HEATING/COOLING COILS

CONTENTS PAGE

1. GENERAL

1.01 This section describes the operations and procedures followed for maintaining coils used in refrigeration systems.

1.02 Whenever this section is reissued, the reason(s) for reissue will be given in this paragraph.

2. DESCRIPTION

2.01 In air conditioning systems, coils are the primary means of transferring heat energy to and/or from air. The name or term ***coils*** describes the original heat transfer method whereby piping was simply ***coiled*** into a configuration to fit a space and over which air could drift or be blown so that the air which contacted the coil surface may be heated or cooled as appropriate to the application.

2.02 Modern extended surface coils consist of several metallic tubes which pass perpendicular through closely spaced metallic plate fins. The number of tubes and rows, plus spacing of fins, are determined by the design engineer.

2.03 Some coils are fabricated by spirally wrapping a thin strip of metal around each tube to make the fin, after which the individually wrapped tubes are cut to length and assembled in a metal frame or casing.

2.04 The quantity of heat energy transferred between air and coil surface will depend upon several factors.

(a) Temperature difference (TD) between air and media within tubes

(b) Coil-air contact time

(c) Coil-air contact surface

(d) Coil surface cleanliness (external and/or internal).

3. COIL TYPES

3.01 This discussion will cover coils of the following types:

(a) Water coils

(b) Refrigerant coils

(c) Steam coils.

A. Water Coils

3.02 Water coils are used for either cooling or heating and should be installed so that the coldest water will encounter the coldest air for cooling. In the case of heating, the hottest water should encounter the hottest air. This method of installation is commonly referred to as "counter flow." (See Fig. 1.)

3.03 As air flows through a coil, its temperature approaches the temperature of the water and the water approaches the temperature of the air. "Counter flow" installation provides a more efficient heat transfer by providing the highest possible temperature difference within the coil.

3.04 Water coils are provided with external supply and return pipe headers which conduct water to and from the tube circuits. The tubes are secured and welded or soldered to headers.

3.05 Header outlet connection should, if possible, be installed at the high point of the coil to permit passage of air. Many water coils are provided with a small pipe connection at the high point of the headers for purging of air collected at the tube circuits at the top. When air is trapped in the upper tubes, heat transfer cannot take place. Purge (vent) valves should be connected to the small pipe connection at the top of each coil header.

3.06 The prevention of freezing of water inside coil tubes requires careful design and control attention since it is impossible to completely drain water from all passageways of a coil. Stopping of fans by freezestats will not assure that the coil will not freeze since outside air dampers are seldom completely airtight. Building stack effect (multifloor building) or moderate to strong surface wind can cause cold air to enter air conditioning unit plenums, freezing water coils even while the fan is stopped.

3.07 Where severe cold weather is encountered, water coils should be protected by preheat coils before the water coil, application of heat in the air plenum chambers to maintain a safe temperature, or the operation of the pump serving the water coil, or a combination of these. Stack effect is a major problem in buildings exceeding three floors, and special attention should be given to chilled water coils installed at the low levels of a multifloor building.

3.08 Freezing occurs at the return bends and at the intermediate tube support points where fins have been removed. Return bends may be repaired, but ruptures at the intermediate tube support sheets are all but impossible to repair, especially in a water coil of more than four rows.

B. Refrigerant Coils

3.09 Refrigerant coils, as discussed here, will be limited to direct expansion (DX) type using common refrigerants such as R-12 and R-22.

3.10 These coils are similar in construction to water coils with the main difference being the means of distributing the refrigerant through the coil.

3.11 A direct expansion coil performs its cooling function by boiling or evaporating the refrigerant inside the coil tubes, while removing the necessary heat of vaporization of the refrigerant from air passing over the outside of the tube and fins. The purpose of the fins is to increase the heat transfer surface of the tubes. The refrigerant is fed into each tube circuit through a small tube from the refrigerant distributor. As the cold or low pressure refrigerant passes through the tube circuits, it completely evaporates and is conducted into the tube headers and then to the compressor.

3.12 The air passing over the coils is capable of evaporating only so much refrigerant, depending of course on its volume and temperature. The refrigerant flow must, therefore, be controlled to allow enough to cool the air but not so much that liquid refrigerant is pumped back to the compressor.

3.13 The amount of refrigerant flow is controlled by the expansion valve location directly ahead of the distributor. This valve is selected and adjusted so that the vapor leaving the coil header is approximately 10 to 15°F warmer than the boiling temperature of the refrigerant which is governed by the pressure in the coil. The pressure is affected by the amount of liquid the air can evaporate and the suction action of the compressor.

3.14 Systems employing DX coils are generally designed to operate at 40-degree suction temperature in the coil. This temperature corresponds to 37 pounds per square inch for Refrigerant 12 and 69 pounds per square inch for Refrigerant 22. If the suction pressure falls as a result of a reduced cooling load and the compressor is not equipped with an automatic unloading capability to compensate for the reduced cooling load, the suction temperature will drop and continue down until the water condensed on the outside of the tubes and on the fins will freeze. Freezing on the coil will reduce air flow which will further lower the suction temperature which in turn freezes all the condensed moisture. If left long enough, the entire face of the coil will ice up and completely stop air flow. Several problems can cause this, such as broken fan belt, extreme shortage of refrigerant, very dirty filters, clogged coils, and fire dampers shut.

3.15 Refrigerant coils should be inspected periodically for leaks. These are generally accompanied with an oil spot around the leak. However, by the time the oil spot is noticeable, a considerable amount of refrigerant may have already escaped and will show up as a lack of refrigerant in the system.

C. Steam Coils

3.16 Steam coils are made in two types—a standard coil for general use and a so-called nonfreeze coil. (See Fig. 2.) These coils are made similar to the other coils with tubes passing through a series of fins.

3.17 Nonfreeze steam coils are a little more elaborate in their construction. Each tube in the coil is provided with an inner tube. This inner tube is perforated and connected to the steam header. The steam is forced through the inner tube perforations against the outer tube which is embedded in the fins. The condensate then runs back through the outer tube to the condensate header. The even distribution of the steam through the perforated inner tube is supposed to provide enough heat to the condensate to prevent it from freezing. This is only possible as long as enough steam is being supplied.

3.18 Steam coils will freeze in the same manner as water coils. Condensate at the bottom of the coil is the same as the water coil.

4. CLEANING COILS

4.01 Periodic cleaning of coils should be programmed. (See Section 770-200-000.)

4.02 The appearance of the coil should never be used to determine the condition of a coil. This should be verified by the face velocity and static pressure drop through the coil comparing the same with the conditions when new or from the original design.

4.03 Cleaning should be done by using adequate air pressure, detergent and hot water, steam, or one of the commerically marketed products designed for this use.

4.04 The use of solvents will require that the duct be blocked at the unit in order to prevent fumes being distributed throughout the building. It is recommended that the detergent and water method be used if possible.

4.05 The excess detergent should be allowed to escape through the condensate drain. Thoroughly rinse the coil with clear water after cleaning and before restarting the fan. Petroleum based solvents should not be allowed to enter sanitary sewerage systems where prohibited by local codes.

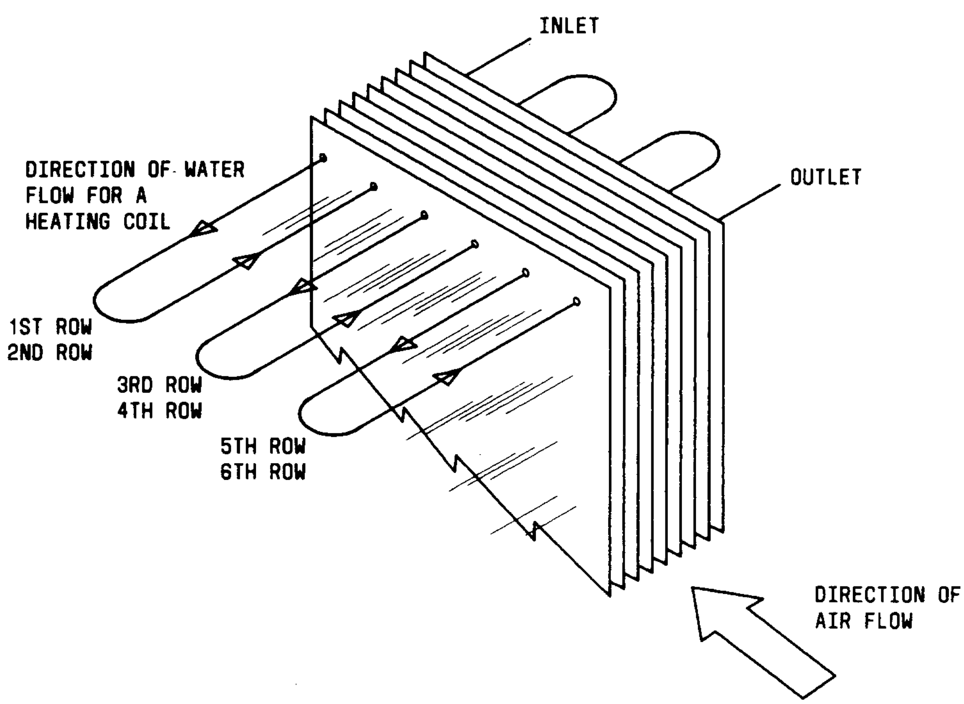

Fig. 1—Cutaway View of 6 Row Coil

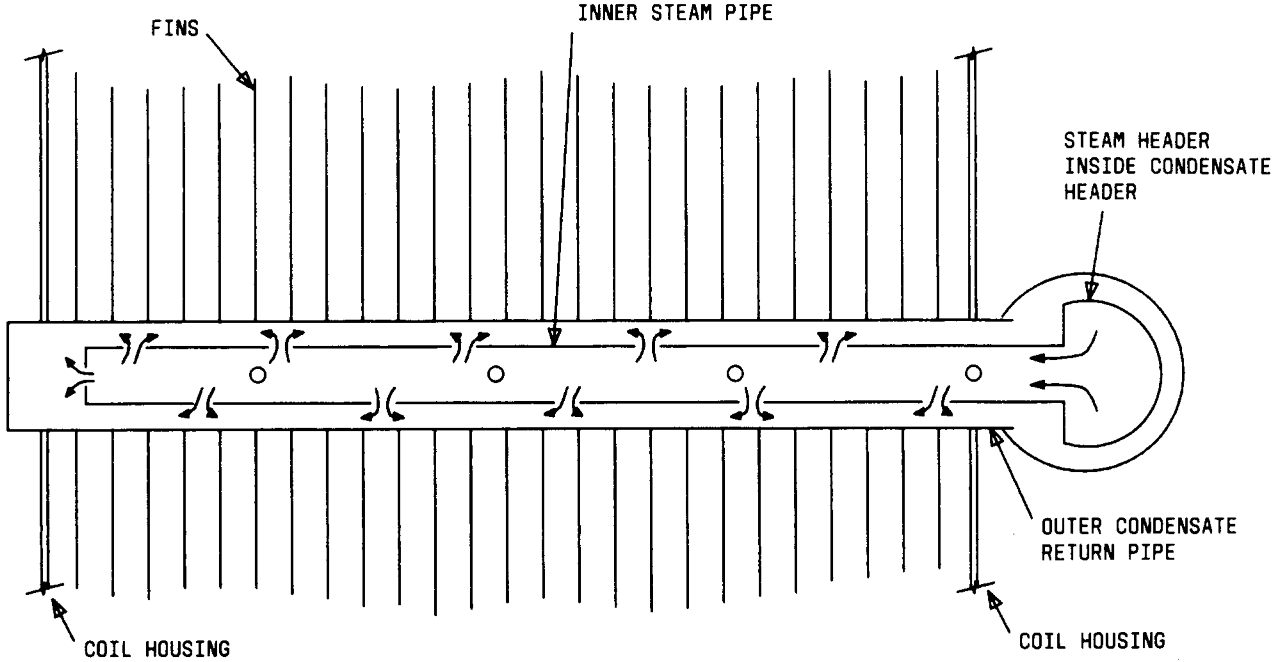

Fig. 2—Nonfreeze or Double Tube Steam Coil