DESCRIPTION • OPERATION • MAINTENANCE

INSTRUCTIONS

"OW" TRANSFORMER COOLING EQUIPMENT

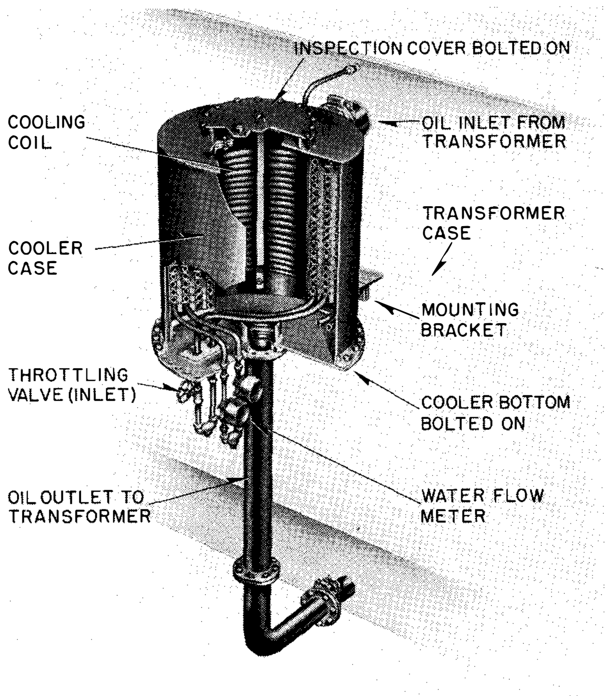

FIG. 1. Cutaway View of "OW" Cooler Individually Mounted on Transformer.

DESCRIPTION

THE OW COOLER is a thermosiphon oil-to-water heat exchanger. Transformer oil flows over the coil by thermosiphon action while the water is forced through the coils from a source supplied by the customer.

OW coolers may be classified as falling into one of two general designs:

1. Individually mounted cylindrical coolers.

The coils used in this cooler are round in shape. These coils are clamped in a rack which in turn is bolted into a round tank. This entire tank assembly is then mounted on the outside of the transformer tank.

2. Integrally mounted rectangular coolers.

The coils used in this cooler are oval in shape. These coils are clamped in a rack which in turn is bolted into a rectangular tank which has one wall common to both it and the main transformer tank.

Regardless of design, the cooling coil is located in the hottest oil so as to provide maximum heat transfer. The coil ends are located in the bottom of the cooler tank, as mounted, allowing complete gravity drain in either design.

The cooling coils are made of seamless copper tubing with an inside diameter of 1.171 inches and an outside diameter of 1.315 inches. The end portions of the coils are made of heavier copper tubing, that is, with an inside diameter of 1.063 inches and an outside diameter of 1.315 inches, to permit the threading of the ends.

There are two fundamental methods of winding cooling coils, as shown in Fig. 3, at "X" and "Y".

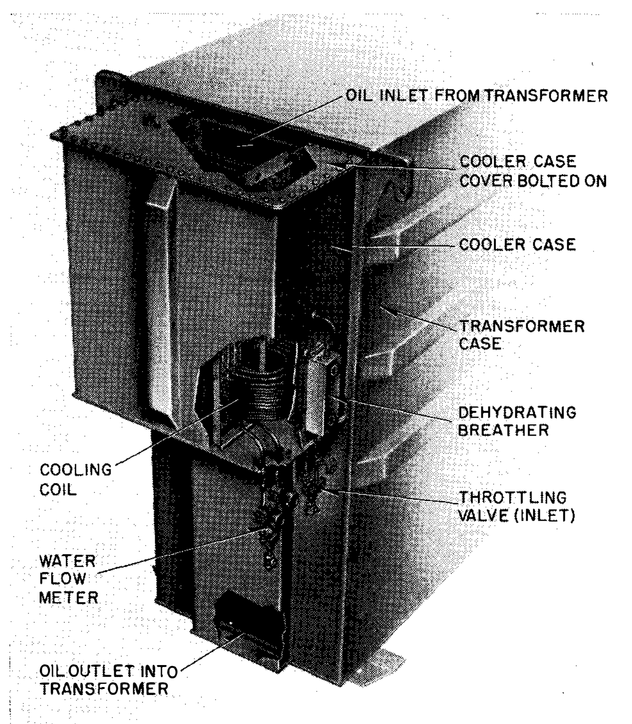

FIG. 2. Cutaway View of "OW" Cooler Integrally Mounted on Transformer.

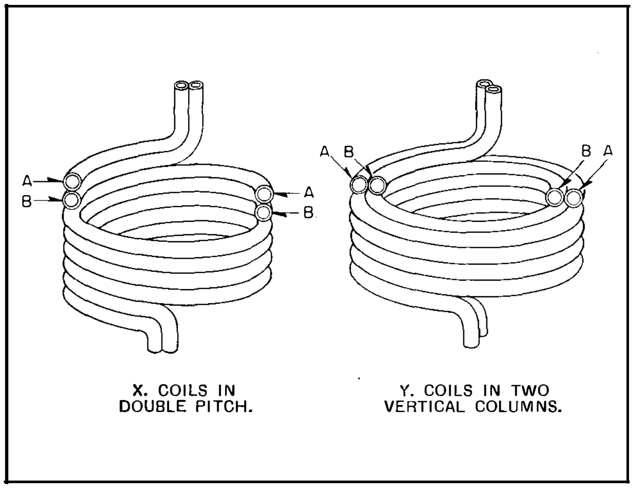

FIG. 3. Showing Two Methods of Winding Cooling Coils.

At "X" is shown two coils combined in a single column, double pitch. This is done to afford a greater slope from one turn of coil "A" to its next turn, giving a greater distance between tubing centers, to provide at least a one percent slope in each water circuit.

At "Y" is shown the other fundamental method, that of combining coils concentrically, in order to increase the cooling area of the coils, within a given height.

These two methods are often combined in order to achieve both the necessary slope and the desired area of cooler tubing. Sufficient tubing area is provided to afford cooling at low water pressures.

Draining. The cooling coils of all externally mounted "OW" coolers are designed for gravity drain with their outlets in the bottom of the tank in which they are located. The coils may be joined to an open or closed discharge system. In the open system the coil sections discharge into a funnel-shaped reducer which has an opening to the atmosphere to permit visual inspection. In the closed system the water leaving the transformer flows through water flow indicators which provide an accurate reading of the water flow in gallons-per-minute.

The conditions necessary for securing gravity draining with a gravity drained coil depends upon whether the external system is open or closed. If the system is open, it can be secured by the use of a three-way cock in the inlet pipe with one passage opening to the atmosphere. With the cock set open to the atmosphere, the water will drain from the coils by gravity because of the slope of the coils. If the system is closed, another three-way cock is necessary in the outflow pipes to permit the water to drain out.

Gravity drained coils will drain when both inflow and outflow pipes are opened to the atmosphere.

Outlets. The end-piece of the cooling coil is threaded to fit the outlet coupling and brazed to produce a leak-proof joint. The coupling assembly is gasketed to make it gas and oil tight and is so designed as to prevent the coil ends and the coupling piece to which it is brazed from twisting and turning during tightening (see Figure 4).

The end of the coupling extending through the tank is threaded 1-inch IPS to allow direct attachment to the external water system.

Water Flow Indicator. The Westinghouse Water Flow Indicator is generally used to indicate the amount of water flowing in the cooling system. The operation of the flow indicator is based upon the differential pressure created by flow of water through a Venturi tube. The flow indicators are generally placed in the outflow pipes, but may be adapted for reading upward flow and therefore can be placed in the inflow pipes. For further information see Instruction Leaflet 46-714-4 on Water Flow Indicators.

INSTALLATION

Installation of Separately Shipped Round Cooling Coil Tank. When the round cooling

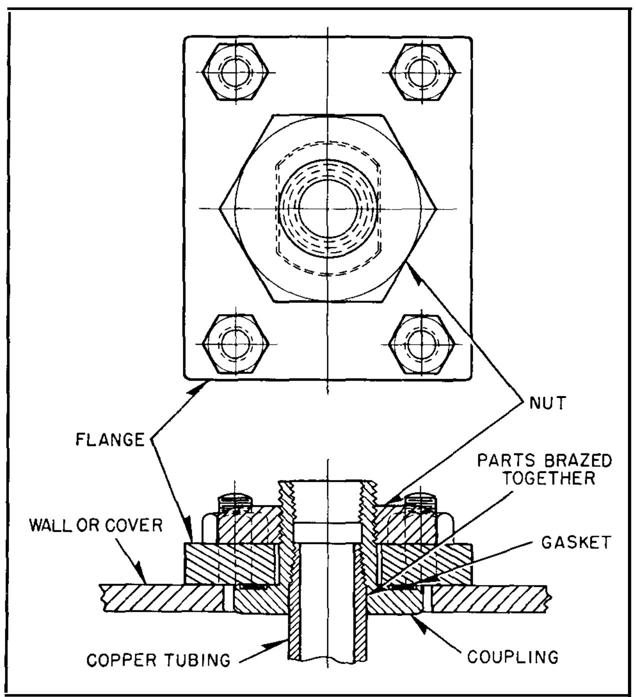

FIG. 4. Section Through Cooling Coil Outlet Flange.

coil is to be shipped separately, the coil is assembled in its tank and the coil tank is fitted to the main transformer tank to insure proper alignment of pipes and brackets. Before shipment, the coil tank is removed and blank flanges are placed over the outlet and inlet to seal the coil tank against moisture.

To install the cooler, the blank flanges must be removed from the coil tank inlet and outlet and from their connections on the main transformer tank. An inspection of the coil tank is necessary to insure that moisture has not entered the oil compartment during shipment. If the compartment is damp, a thorough cleaning and drying is necessary before it is installed, in order to insure against contamination of the main transformer.

When the coil tank is thoroughly dry, the supporting angles of the coil tank are bolted in place against the brackets provided on the main transformer tank. Inlet and outlet connections are made using the gaskets and gasket sealing cement provided.

After the tank has been mounted and all connections made, the inlet and outlet oil valves located on the main transformer tank must be opened. Careful inspection will indicate any oil leaks. When free from leaks, the cooling equipment is ready to be placed in service.

OPERATION

Water Circulation. If there are two or more sets of cooling coils in parallel, adjust the valves of all sections for equal rates of flow. This can be judged approximately by comparing the size of the discharge streams from different sections, or by means of the flow indicators when used in each section. It can be determined best, however, by noting the difference in temperature between ingoing and outgoing water from each section, after the transformer has reached steady temperature conditions under load. A careful measure should be taken of the total amount of water flowing through all sections and the total rate of flow adjusted to that called for on the diagram plate. The rate of flow should be checked from time to time, and if it is found to be diminished, the cause should be looked for and remedied. One common cause of reduction of flow is the clogging of, or scale deposits on, the inside of the cooling coils. The water used should be as free from impurities as possible in order to avoid these deposits. Salt water should never be used in cooling coils.

For low water temperatures, the water rate may be reduced for light loads. When this is done, a careful check must be made on the oil temperature to make sure that it does not exceed 75°C.

Where water-cooled transformers are exposed to low temperatures, the cooling coil connections should be lagged to prevent freezing.

Temperature Readings. Thermometers should be read daily or more often. If, at rated load or less, the oil temperature reaches 75°C. for an oil-immersed water-cooled transformer, it is advisable to check operating conditions.

If the oil temperature in oil-immersed, water-cooled transformers should exceed 75°C. at rated load or less, either the cooling coils need cleaning, an insufficient amount of cooling water is being used, or the temperature of the cooling water is too high. The A.S.A. guide for loading (C 57.32) should be followed in determining the safe loads and temperatures for the transformer.

MAINTENANCE

Care of Water-Cooling Coils in Case of Shut-Down. Whenever a water-cooled transformer is shut down in cold weather, precaution must be taken to prevent freezing of water in the cooling coils. The best method is to blow or drain out the water.

A water-cooled transformer with gravity drained cooling coils may retain a slight amount of water in the coils after they are drained, due to slight misalignment of coils or foundation from a level position. It is recommended that self-draining coils be blown out after draining, as an extra precaution.

Scale in Cooling Coils. Occasionally the quality of water used for cooling purposes is such that it will gradually form a deposit inside the cooling coils. This deposit is a poor heat conductor and will make itself known by increased temperature in the transformer oil and also probably by a decreased flow of water. If the oil in a water-cooled transformer begins to show a higher temperature than it should without apparent reason, the cooling coils should be examined at once for deposit. The deposit may be mostly particles thrown down by dirty water, or it may be a coating or scale that is generally hard to remove. A deposit of dirt can generally be removed by blowing through the coil with steam at a fairly high pressure. In many cases scale can be removed by passing through the coils a ten percent solution of hydrochloric acid. Some kinds of oil will deposit a coating on the outside of the cooling coils and cause an increase in the oil temperature. An inspection will disclose any trouble of this kind. The oil furnished with Westinghouse transformers will not form such a deposit under normal operating conditions.

It is vital to the life of a water-cooled transformer that water be kept flowing continuously through the cooling coils during operation. If the water is shut off, the temperature of the transformer will rise very rapidly and will soon reach the danger point. All Westinghouse water-cooled transformers are equipped with thermometers having alarm contacts. These contacts should be connected to alarm systems that will give warning in case the transformer temperature rises too high.

Testing for Cooling Coil Leaks. Cooling coils are tested for leaks at the factory under a hydrostatic pressure of 500 pounds per square inch. If there is any suspicion that a cooling coil may have been damaged during shipment, it should be tested before being put into service. To do this, connect a pressure pump, valve, and pressure gauge to one end of the coil in the order given. Pump water into the coil, (transformer oil should be used if the coil is already installed) and when full, close up the open end tightly with a cap, being careful to leave no air pocket. Bring the pressure up to about 100 or 150 pounds per square inch by means of the pump and close the valve tightly. If all connections are tight and there are no leaks in the coil, the pressure should hold practically constant for five minutes. If the pressure begins to drop immediately after the valve is closed and keeps dropping steadily, there is a leak somewhere. If there is a minute hole in the coil, the liquid will come through in the form of drops or a very feeble stream. Care should be taken not to mistake a leak in the valve or connections for a leak in the coil.

Another method that may be used is to close up one end of the coil tightly, immerse in water or oil and apply an air pressure of from 20 to 100 pounds per square inch. If there is a leak in the coil, it will be indicated by the appearance of air bubbles on the surface of the liquid.

RENEWAL PARTS

When ordering renewal parts, or writing with reference to any transformer, include the serial number and rating of the transformer as shown on the nameplate. Address all correspondence to the nearest Westinghouse Office.

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