1.0 APPLICATION

These instructions are for Unifin fixed tube sheet design ONW type Natural Convection Transformer Oil Coolers with either standard or single tube or Leak Detector Double Tube construction. These heat exchangers are designed to meet the cooling requirements for transformer oils and have the following features:

a) Long life and dependable service.
b) Ease of maintenance with a minimum of service.
c) Safe design, minimizing the hazard of water leaks into the oil stream.
d) Compact and sturdy construction.

2.0 HEAT EXCHANGER CONSTRUCTION

Leak Detector Type

Tubes Unifin oil coolers have a double concentric tube construction. The internal tube (water-side) is made of either CuNi or Stainless Steel metal and the outer tube (oil side) is made of copper with integral aluminum fins over the copper outer tube. The outer tube is fluted on the inside diameter to provide space for either fluid to flow out the length of the tube to atmosphere, should a leak occur in either tube.

Tube Sheets There are double tube sheets at each end of the cooler separated by an air space. The outer tube is rolled into the oil-side tube sheet of steel and the inner tube is rolled into the water-side tube sheet. This construction allows any leaks which might occur in the water-side or oil-side system to drain into the atmosphere rather than leak from one fluid to the other.

Standard Type Unifin standard coolers utilize the same basic construction as the leak detector type except that a single-wall tube construction is used in place of the double leak detecting tube. Double tube sheet construction is maintained but the tubes are rolled into the oil-side tube sheet as well as the water-side tube header. 90/10 Cupro-Nickel tubes are normally supplied but other materials are available.

Shell The shell is fabricated from carbon steel pipe.

Water Boxes The water boxes are of welded steel construction with a bolted gasketed cover at each end for access to the tubes for cleaning. Water boxes of fabricated 90/10 CuNi or Stainless Steel are available.

3.0 ASSEMBLY

The entire cooler is assembled with welded joints to eliminate gasketing. The only gaskets required are the water headers. Vents and drains are provided. Zinc anodes to reduce galvanic corrosion on the water side can be provided as optional extra accessories. These are normally fitted to the vent and drain openings. Replacement plugs and holders are available from Unifin.

4.0 FACTORY TESTS

The oil-side of the cooler is tested hydrostatically at 15 PSIG with transformer oil. The water-side of the cooler is tested at 150 PSIG water.

5.0 INSTALLATION

Unifin ONW coolers must be mounted in a horizontal position as high as practical on the transformer tank. Coolers are supplied with flat face flanges as standard, but other types may be supplied if required. It is important that flanges on oil piping line up accurately with cooler flanges to ensure tight joints. To provide thermosyphon head the centre of the cooler tubes must be a minimum of 5 feet steel (1.5 m) above the centre of the transformer windings.

It is important that no air is trapped in the oil-side compartment of the heat exchanger when filling with oil. Filling with vacuum is recommended to eliminate air.

If filling with air in the tank remove the top oil vent plug and allow oil to enter the system by opening the lower valve. replace the plugs when oil starts to flow through the openings.

6.0 WATER RATE

The water rate stamped on the instruction plate or specified in the exchanger data sheet is the nominal rate for the cooler giving the most efficient operation. If the heat load is reduced or water is cooler than the design conditions, the water rate may be reduced. To reduce sludging and silt accumulation the tube side water speed should not be lower than 2 feet per second.

If the water contains some silt a high water flow should be used for 24 hours on a monthly basis to flush out loose sediment.

7.0 TEMPERATURE READINGS (Transformer Coolers)

A record of the top oil temperature should be maintained. Readings should be taken regularly. For transformers with a varied load cycle, temperatures should always be read at the conclusion of a peak load cycle. The temperature of the entire water to the cooler should be recorded at the same time. The difference of these readings is the top oil rise and is a measure of the heat exchanger's efficiency.
If the load cycle remains constant and the top oil rise shows a gradual increase, it is an indication of either a decrease in water quantity or cooler fouling necessitating cleaning.

8.0 MAINTENANCE

Cleaning the inside of cooler tubes:

Cooler tubes may be cleaned by removing the water box covers and using a fiber brush with a solution of water and detergent. A high pressure water stream will usually remove sludge and sediment. Wire brush will remove soft scale for flushing with water. Rubber or felt plugs forced through the tubes are also useful for removing sludge. Replace gaskets that have deteriorated through age, or which have been damaged during removal.

9.0 CLEANING THE OIL COMPARTMENT

Under normal operating conditions the oil will not leave a deposit in the heat exchanger, and it should not be necessary to clean the oil compartment. If, due to poor operating procedure, the oil has deteriorated to the point of sludging flush the tube bundle with clean oil.

10.0 TESTING FOR HEAT EXCHANGER LEAKS

If there is any suspicion that the heat exchanger has 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 the vent in the water compartment. Pump water into the heat exchanger tube side until full. Bring pressure up to 100 PSIG and close valve. Pressure should remain constant after shutting the valve.

The oil side compartment may be tested by closing the valves in the oil circuit and applying pressure. Clean the outside of the cooler thoroughly, and dust all joints with chalk. An oil leak will discolor the chalk. Traces of oil on the outside of the leak detector tubing in the space between the tube sheets will sometimes be noted. These usually are not leaks but slight films left as a result of the double tube fabrication process. An oil leak into a leak detector tube will cause oil to drip from the groove and can be detected quite easily.

11.0 MAINTENANCE TO LEAKING TUBES

11.1 If tubes become loose in the tube sheets, they can be tightened with proper rolling expanders.

11.2 It is recommended that tube rolling be done only by mechanics with previous experience and proven skill. The mechanic should be very careful in using the expander. Excessive rolling thins and work hardens the tubes and may result in permanent damage.

CAUTION:

Do not expand the tubes that are not found leaking and do not expand the tube past the tube sheet.

11.3 If the tube is leaking on the water side, it can be plugged at each end by driving in a tapered plug or brass or other non-corrosive material. (Plugs are available from Unifin.)

Coolers are normally designed with excess surface to allow for dirt accumulation. By adopting a more frequent cleaning schedule this margin could be reduced to permit plugging of tubes that have failed. By this means up to 5% of the tubes could be plugged before a cooler would need to be replaced.

These instructions are intended only for general use. If any difficulties are encountered with these coils in particular installations, it is recommended that Unifin International, Inc., London, Ontario, Canada be contacted for specific instructions or consultation before attempting to remedy the situation concerned.

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