Insulating Liquid Maintenance

Sampling Insulating Liquid

Note: A sample of the liquid should be taken when the unit is warmer than the surrounding air to avoid condensation of moisture on the liquid. Liquid samples must be drawn from the sampling valve located at the bottom of the transformer tank.

Containers used for sampling liquid should be clean and dry large mouth glass bottles.

Do not permit the fluid to splash into the receiving container. Splashing can introduce air and moisture into the fluid. Rinse the bottle three times with the liquid being sampled. Make sure the liquid being sampled is representative of the liquid in the unit.

Test samples should be taken only after the liquid has settled for some time – eight hours for a barrel, up to several days for a large transformer. Cold insulating liquid is much slower in settling. Liquid samples from the transformer should be taken from the sampling valve at the bottom of the tank.

WARNING: Do not lower fluid in tank to a level below the top of the core clamp. Insufficient fluid risks unit failure, which could result in severe personal injury or death to exposed personnel.

When sampling, a metal or non rubber hose must be used because oil leaches the sulfur found in rubber. The presence of sulfur can prove harmful to transformer components.

When drawing samples from the bottom of the transformer or large tank, sufficient liquid must first be drawn off to ensure that the sample will be from the bottom of the tank, and not the liquid stored in the sampling pipe.

Testing Insulating Liquid

For testing the dielectric strength of insulating liquids, follow the procedure specified by the American Society for Testing Materials in ASTM D-877, "Standard Method for Testing Electrical Insulating Oils."

If, at any time, the dielectric strength of the liquid drops below 26 kV, it should be filtered until it tests at 26 kV or better.

Filtering Insulating Liquid

Transformer oil, R-Temp fluid or Envirotemp™ FR3™ fluid can be filtered by means of a filter press. The filter press is effective for removing all types of foreign matter, including finely divided carbon and small amounts of moisture. The purifier equipment consists of a specifically proportioned filter press, a positive volume gear pump, driving motor, combined drip pan and mixing tank, necessary piping, valves, strainer, gauges and a drying oven.

Filtration should be continued until the dielectric test of the insulating liquid is 26 kV or better.

CAUTION: When filtering any insulating fluid, the filtering equipment must be free of contaminants and other liquids. The presence of other liquids may alter the physical and electrical characteristics of the fluid.

Applicable Standards

1. IEEE Std C57.91™-2011 standard, "Guide for Loading Mineral Oil Immersed Transformers."
2. IEEE Std C57.93™-2007 standard "Guide for Installation and Maintenance of Liquid Immersed Power Transformers."
3. IEEE Std C57.106™-2006 standard, "Guide for Acceptance and Maintenance of Insulating Oil in Equipment."
4. ASTM Specification #D 877, "The Standard Method of Testing Electrical Insulating Oils."
5. IEEE Std C57.121™-1998 standard, “Guide for Acceptance and Maintenance of Less Flammable Hydrocarbon Fluid in Transformers.”

R-Temp Fluid-Filled Transformers

Periodic maintenance tests for R-Temp fluid-filled transformers should be performed on essentially the same schedule as would be used for conventional mineral oil-filled transformers of similar application. The same type of sampling techniques should be used. Basic recommended tests for R-Temp fluid-filled transformers are dielectric strength, moisture content, and flash and fire point.

Dielectric Strength

Although the transformer should operate satisfactorily with a fluid dielectric strength of 22 kV, an R-Temp fluid dielectric strength below 25 kV is an indication of excessive contamination. In this case, the R-Temp fluid should be replaced or filtered to remove the moisture or particulate contamination.

The dielectric strength of R-Temp fluid should be tested in accordance with ASTM D 877.

Flash and Fire Points

Relatively small percentages (2-3%) of transformer oil or contaminants may substantially reduce the flash and fire point of R-Temp fluid. If it is suspected that the fluid may have been exposed to contamination, the flash and fire point should be measured in accordance with ASTM D-92. A fire point lower than 300 °C probably indicates some contamination by lower fire point material. If flash or fire points fall below the minimum values required, retrofilling may be required.

Drain and Refill

If it is necessary to drain and refill the transformer, special care should be taken to avoid the entrapment of gas bubbles in the system. Sufficient time should be allowed between refilling and energization of the transformer to be sure that any gas bubbles created during the process have dissipated.

Contact your Cooper Power Systems representative for additional handling guidelines.

PEAK™ and Envirotemp™ FR3™ Fluid-Filled Transformers

Periodic maintenance should be performed on the same schedule as would be used for units of similar application filled with transformer oil. The same type of sampling techniques should be used (ASTM-D923). Basic recommended tests for Envirotemp™ FR3™ fluid are dielectric strength, moisture content and flash and fire points.

Acceptance values should meet or exceed those shown in IEC 61203, "Guide for Maintenance of Transformer Esters in Equipment".

CAUTION: When the insulating fluid temperature is less than –10 ºC (14 ºF), no-load tap changers and energized loadbreak switches should not be operated and the Bay-O-Net fuses should not be used to make or break a load. (Operations at lower temperatures may be possible provided it is certified by the switching device manufacturer for loadbreak operation in Envirotemp™ FR3™ fluid at lower temperatures.)

If the transformer cover or manhole must be removed for internal service, exposure time to ambient air should be minimal. Avoid exposure times greater than 24 hours. Immediately after service is completed, replace the cover or manhole. Then, purge and recharge the headspace with dry nitrogen.

The procedure for recharging the headspace with nitrogen should include the following steps:

1. Fill headspace with dry nitrogen to a pressure of 2-3 psig.
2. Vent headspace to atmospheric pressure.
3. Refill headspace with nitrogen to 2-3 psig.
4. Verify that the unit is hermetically sealed.

If the manhole cover or non-flapper style Bay-O-Net fuses are removed for more than 24 hours, any oxygen absorber packet(s) should be replaced.

Transformer Oil Contamination

Envirotemp™ FR3™ fluid is fully miscible with oil. There is no known detrimental performance impact when Envirotemp™ FR3™ fluid is mixed with mineral oil. Conversely, except for some reduction in flash and fire points, the same is true for oil mixed in with Envirotemp™ FR3™ fluid. More than 7% mineral oil in Envirotemp™ FR3™ fluid is required to drop the fire point to below 300 °C. To maintain its exceptional environmental classification, contamination of Envirotemp™ FR3™ dielectric coolant by any other fluids should be avoided.

Contact your Cooper Power Systems representative for additional handling guidelines.

Spare Parts and Service

We suggest that you keep one spare set of gaskets for the manhole and any gasket-type bushings used. Other renewal parts may be ordered through your local factory representative. When replacing components, including gaskets, on a PEAK transformer ensure they are rated for PEAK level operating temperatures. When ordering parts or requesting service, provide a complete description of the part or the problem and the complete transformer serial number as listed on the nameplate.

One Cooper | www.cooperpower.com | Online

S2101510 February, 2013

COOPER Power Systems

2300 Badger Drive
Waukesha, WI 53188