

ON-LINE MOLECULAR SIEVE DRYING FOR POWER TRANSFORMERS

DESCRIPTION

On-line molecular sieve will continuously remove water from the oil and from the paper insulation in a power transformer while it is fully operational.. On-line molecular sieve shall improve the dielectric strength of the oil, and increase reliability. Plumbed into the oil 'circuit' of a transformer, the circulation pump will pump the oil across the molecular bed, which, through chemical bond, will attract water particles contained within the oil. By constantly reducing the level of water contained within the oil, water contained within the solid insulation, where over 95% of the water is trapped, will migrate into the oil to maintain the natural water equilibrium. In this way water gradually moves from the solid insulation, to the oil, and then trapped by the molecular sieve.

A 10 micron particulate filter will at the same time remove extraneous matter, such as fibers, which can become ionised, being attracted to areas of high electrical stress and causing a flashover

On-line molecular sieve shall be non-invasive, gradual process, that will over a period of time, reduce the water contained within the solid insulation.

MODELS, SIZING, AND PERFORMANCE

On-line Transformer Drying Unit shall be equipped with three cylinder designed for oil capacity greater than 10,000 litres. It shall come with stainless steel particulate filter and a 13" pre-filter for heavily sludged transformers.

On-line Transformer Drying Unit shall have the capacity to remove approximately 10 litres of water from a transformer before saturation. Design flow rate of the pumped oil shall be nominally 90 litres per hour to give maximum adsorption through the molecular bed.

OPERATION AND MAINTENANCE (Cylinder Saturation)

On-line Transformer Drying Unit shall operate in an external location on a continuous basis with the transformer on-line. It is constructed of stainless steel. The pump is a totally immersed canned rotor type, designed for continuous operation. Electrical connection box shall have a rating of IP45 and equipped with stainless steel cover offering total environmental protection for the pump. The pump seals shall be all nitrile making it compatible with all transformer oils.

Ambient temperature may be a consideration, and if it is likely to fall and be sustained to a degree where the temperature of the TRANSEC unit remains below minus 10° then a thermal cut off relay can be added to protect the pump motor.

On-line Transformer Drying Unit shall be designed that the oil sampling valves can accept a Vaisala water in oil probe and gives a number of options to take the ppm reading and temperature at these two points. (see 9.0 MONITORING).

-> CL3AM ONLY Two Vaisala MMT 162 probes shall be mounted at the input and at the output to the On-line Transformer Drying Unit. These probes will give an output signal to SCADA which can be read on the control computer giving real time temperature and water activity which is converted to ppm. (see monitoring). There shall also be a local display mounted within the monitor enclosure

-> CL3AM ONLY The MMT 162 probe leads are terminated in the Monitor enclosure, where the LCD display gives the local reading. SCADA connections are made using two analogue channel outputs for current and voltage giving readings for temperature and water in oil in ppm. The probes are fitted into stainless steel tee fittings which introduce the sensing head directly into the oil flow.

-> CL3AM ONLY PUMP & SUPPLY MONITORING

The continuous operation of the pump and the integrity of the incoming LV supply is monitored via the LEM monitor.

The LEM monitor is a C/T through which the live core of the cable which supplies the pump passes. If current above a pre-set threshold is present then the incoming 240V 50Hz supply is healthy, and the pump is operating. If either of these fails an alarm will trigger in the form of a volts free relay change of state. This can then be brought out hard wired to control, or connected to a remote monitoring facility.

REGENERATION

On-line Transformer Drying Unit shall allow cylinder exchange method where new or recycled cylinders can replace the existing ones. This shall be done through quick fit couplers on top and bottom of

each cylinder, and removing each cylinder in turn. The couplers shall self-seal, so there no oil shall be lost.

On-line Transformer Drying Unit shall allow particulate filter to be changed.

A Method statement to be observed for the cylinder change process shall be available and supplied.

Each cylinder shall have a unique serial number which shall be referenced in a database to its original starting weight when newly supplied.

INSTALLATION

On-line Transformer Drying Unit shall allow to be installed on the side of the transformer tank or installed with a stand alone frame, possibly supported by a bund wall or channel struts on some convenient point on the transformer.

Installation with flexible pipes shall be possible.

The support frame attached to the On-line molecular sieve frame shall allows the assembly to be bolted down onto a plinth.

On-line Transformer Drying Unit may be installed with the transformer live. Method and equipment shall be supplied to prevent intrusion of air in the system.

On-line Transformer Drying Unit shall operate under an isolated 240V 50 Hz supply, protected with 6 amps fuses. Nominal operational current shall be bellow 1.5 amps. An isolator switch on the frame of the device shall be available to enable local control of the pump.

On-line Transformer Drying Unit can be mounted on a substation wall, with the pipes routed at high and low level to the take off valves.

The input to On-line Transformer Drying Unit shall be from the low level take off valve on the transformer tank or cooling circuit. The output from the On-line Transformer Drying Unit is to the high level take off valve on the transformer tank or cooling circuit, but the return must be below the oil level in the conservator, it must not be allowed to return into the air space above the oil level.

A high level bleed pipe shall be supplied to be fitted in the oil line adjacent to the top take off valve, so that when the air is purged from the pipework it is bleed to atmosphere from the highest point of the system before returning to the transformer.

COMMISSIONING

On-line Transformer Drying Unit will be full of oil to IEC 60296 unless otherwise advised. Method details of the commissioning process shall be available on request.

GAS ADSORPTION (DGA)

On-line Transformer Drying Unit shall use zeolite with a 'pore' size of 3 Å. Key gases within the transformer shall not be adsorbed by the zeolite. Small quantities of hydrogen may be adsorbed. No special provision shall be required to read or understand the DGA when taken on a transformer that has a On-line Transformer Drying Unit fitted.

ROUTINE & TYPE TESTING.

Each On-line Transformer Drying Unit supplied shall be individually tested for leaks on the test rig. The oil temperature shall be elevated to 60°C and a pressure equal to 2 bar applied for 30 minutes with the pump turned off. All joints and interfaces shall be inspected. Test results are noted and a certificate of conformity is signed and issued against that frame number and cylinder serial numbers.

MONITORING

OIL FLOW OR PUMP MONITOR

To monitor the continuous flow of oil through the On-line Transformer Drying Unit two options shall exist

A current transformer through which the live core of the cable which supplies the pump passes shall be available to monitor the current through 240V 50Hz supply. Shall the pump not be drawing any current an alarm will trigger in the form of a volts free relay change of state.

Alternatively a Flow-Mon flow monitor can replace the visual flow indicator. This will monitor the rate of oil through the On-line Transformer Drying Unit, and if it falls below a set flow rate (user adjustable) then an alarm will be triggered as above.

WATER IN OIL PPM & TEMPERATURE

On-line Transformer Drying Unit shall allow installation of two Vaisala MMT162 probes at input and output and use a M170 hand held to plug in and interrogate the probes. This offers an economic and practical solution to monitoring the saturation level of the cylinders, and gives a trending pattern to the water in oil ppm level in the transformer tank.

ADSORPTION MATERIALS & PERFORMANCE:

Zeolite - Crystalline Aluminosilicate with binders (CAS-No. 1318-02-1; EINES-No 215-283-8)
3 Angstrom bead size. Non-flammable and bio-degradable.

Weight of beads per cylinder - 13 kgs

Oil Volume per cylinder - 12 litres

Oil Type - New un-inhibited naphthenic to IEC 60296 (3)

Adsorption capacity of water per cylinder - Maximum 30% of bead weight (3.5 litres – approx 10 to 11 litres total for 3 cylinders per cycle)

MATERIALS IN CONSTRUCTION

Cylinders: 304 grade stainless steel all welded construction with quick fit couplers for ease of removal.

Frame: 304 grade stainless steel all welded construction.

Pump: Caned Rotor sealed circulation pump running at average 60l/hr -25°C to 110°C

Pipework: 15mm x 1mm wall Stainless Steel seamless tube with all welded joint construction wherever possible.

FITTINGS

Stainless Steel ¼ turn ball valves, flow indicator, de-aerator, non return valves etc. Lockable air bleed valve, accessible at ground level on 6mm diam. copper– up to 5 m capillary tube Non- return valve, ½” BSP, brass body construction.

-> CL3AM ONLY MONITORS

Vaisala MMT 162 probes at input and output for SCADA signal for oil temperature and ppm water in oil, with local LCD display.

LEM monitor for incoming LV supply and pump integrity.

INSTALLATION

Mounted on transformer

MATERIALS

2 x 1.5m length of 15mm stainless steel pipe

2 x Flange Adaptors – 15mm pipe to take off valve flange size.

4 x ½” BSP M x 15mm SS male stud couplings.

3 x ½” BSP M SS hex nipples

TYPE TESTING

Random unit selected for test once every 12 months.

System pressurised to 3 bar for 1 hour at 110°C (pump not running) to prove leak free.

ROUTINE TEST

Every production unit.

Each individual cylinder is tested under 4 bar pressure prior to TRANSEC unit assembly

Each unit is tested pressurised to 2 bar for 30 minutes at 60°C to prove leak free.