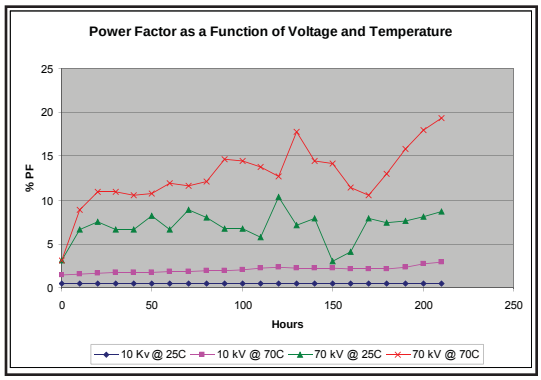
OEM Bushing Health and Winding Module

Electrical Diagnostic Innovations, Inc.

BUSHING HEALTH WINDING MODULE (BHWM)

Bushings represent one of the highest failure components on large power transformers. It has become apparent that defects in a bushing can occur very quickly and periodic testing of bushings in these cases is ineffective. This combined with the fact that many defects do not show up at offline testing voltages (10kV) and some defects are temperature sensitive as shown in the graph.



Significant changes in bushing power factor are shown when higher temperature and higher voltages are present when compared to normal 10 kV test levels at 25^0C.

During a system short circuit, extremely high mechanical stresses are generated in the transformer coil assembly. During normal operation windings will become loose, especially at colder temperatures. These high stresses may cause winding deformation and future major insulation failure. Timely detection of a deformed winding may avoid a major failure. The winding distortion is monitored by estimating the change in transformer leakage inductance.

The (BHWM) is designed to monitor both the C1 Capacitance and Power Factor of each individual bushing and distortion of the windings. Power factor functionality is based on the common “Sum of Currents Method” algorithms. The BHWM also has unique features unlike any other bushing monitor that is available today.

Unique Features

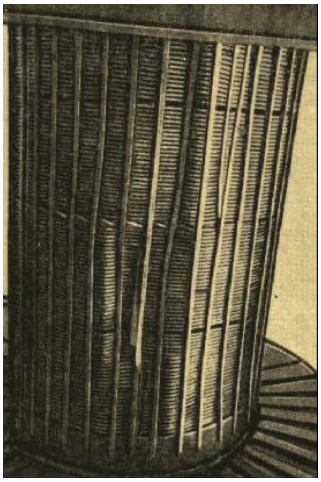
- Calculates and reports Capacitance and Power Factor of each bushing.
- Reports both the magnitude of the sum of currents (severity of the defect) and vector (provides the ability to determine which bushing has the defect).
- Accepts operating dynamic parameters such as top oil temperature and load current directly from the OEM Transformer Monitoring System via RS485 Port (ModBus).
- Automatic behavior learning upon commissioning with Load and Temperature. Alarms when behavior is outside thresholds.
- Bushing sensor design provides the ability to perform on-line Partial Discharge measurements on the transformer.
- Bushing Sensors have Surge Protection, Open Circuit Protection and Fail Safe circuitry built into the body of each sensor.

Electrical Diagnostic Innovations, Inc
14109 54th Ave North - Plymouth, MN 55446
www.elec-di.com e-mail: edi@elec-di.com
612-963-0974

Improving Plant and Equipment Reliability Through Innovation and Service

Electrical Diagnostic Innovations, Inc.

Specifications

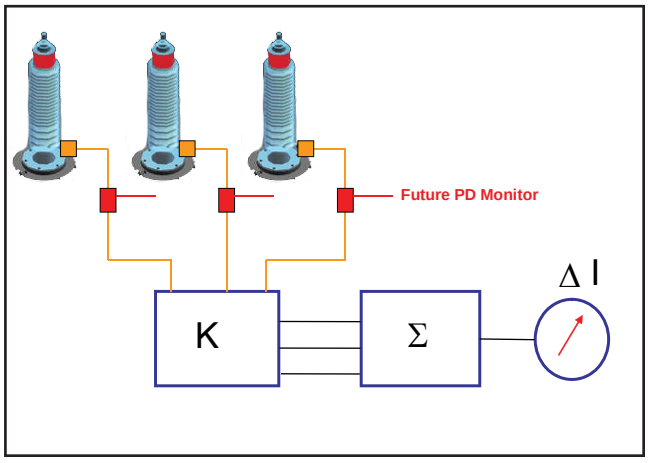


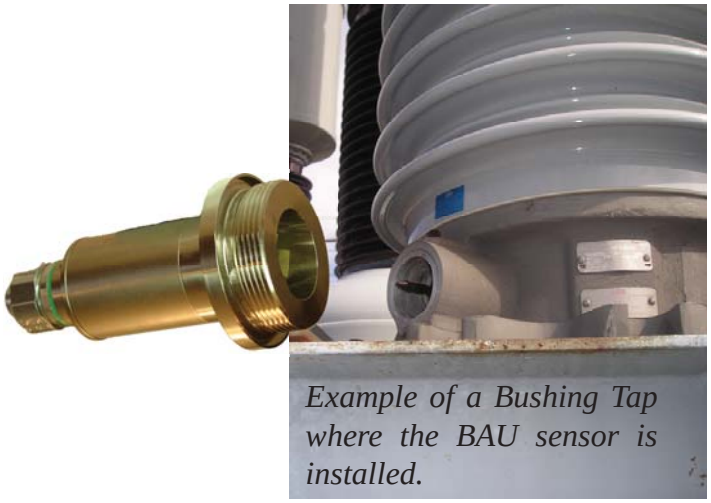
Winding Distortion caused by a through fault on a loose winding.

- Operating Temperature Range: - 30^{0}C to + 70^{0}C
- Bushing Voltage: 20 to 800 kV
- Number of Bushing Sets: 2
- Three load current inputs for winding distortion
- Power Requirements: + 5 VDC (Power Supply Optional)
- Self Test and Calibration: Performed prior to each measurement
- Measurement Schedule: Based on time of day or time interval
- Communications: USB and RS485 ModBus RTU
- Bushing Sensors: Installs in test tap on base of each bushing (See BAU Brochure)
- Three LED's indicate Status (Error and Measuring, Warning Alarm, High Alarm
- Optional Display / Keypad available

How Bushing Monitoring Works

The current flowing through the bushing taps are a function of the C1 capacitance and the dielectric losses (Power Factor) of each bushing. By summing the currents from a bushing set, a signal proportional to the health of the bushings is provided. The system consists of four main components: Sensors installed in the bushing capacitance and/or voltage tap, Balancing Unit (K), Summation Unit (Σ) and a Null Meter which represents the sum of the three currents. During the commissioning of the system, the balancing unit is adjusted until the null meter is set to null. Therefore, if the capacitance and/or the power factor of a bushing changes, the null meter will no longer be null. The magnitude of the output represents the severity of the problem and the vector output indicates which bushing is deteriorating and whether it is the power factor and/or capacitance changing.





Example of a Bushing Tap where the BAU sensor is installed.

Electrical Diagnostic Innovations, Inc
14109 54th Ave North - Plymouth, MN 55446
www.elec-di.com e-mail: edi@elec-di.com
612-963-0974

Improving Plant and Equipment Reliability Through Innovation and Service