

«MDR-M» - Insulation Monitoring System for Stators of Generators and High-voltage Motors by Partial Discharges

The «MDR-M» monitoring system (Motor and Generator Diagnostics Relay) is used for stator winding insulation condition monitoring of high-voltage turbo and hydro generators, power high-voltage motors.



Stator winding insulation condition

monitoring by «MDR-M» is made on the basis of PD measuring and analyzing in the insulation. Now this way is very sensitive diagnostic method which allows finding defects in the insulation on early development stages.

PD sensors of the «MDR-M» system.

HF frequency sensors of «MDR-M» are used for PD measuring in the stator winding insulation of high-voltage motors. These are high-voltage coupling capacitors produced by different manufactories, or electromagnetic antennas of different types mounted in slot of electric motor stator.

High-voltage coupling capacitors are connected to stator winding voltage has capacity 80 pF, sometimes up to 1000 pF. Measuring coupling capacitors should have high stability and constancy of insulation, especially to pulses overvoltage.

Natural mica insulation has the best operating features, but coupling capacitors of this type has small capacity. Thanks to new insulating materials, coupling capacitors with big capacity can be produced. For PD measurement in the stator insulation it is necessary to connect coupling capacitors to stator winding.

Some coupling capacitors are on the figure. At the left are coupling capacitors with outdoor installation, to the right are coupling capacitors for installation inside of motor stator. They are has shape and dimensions like base insulator and are mounted on their place.



PD sensors and others can be connected to «MDR-M» because there are many demands to producing stator winding monitoring system.

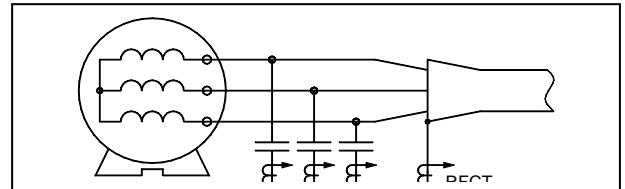
Often high-frequency sensors of transformer «RFCT» are used for noise rejection. Usually these sensors are mounted on grounded supply cables.

Noise rejection.

The most difficult in the PD measurements in the motor stator winding is the noise rejection in the high-voltage

equipment, especially by HF pulses measuring because it has many noises.

The most effective way for noise rejection is the «Time of Arrival» method based on detection and analysis difference in time of pulse arrival from one PD to the several sensors of monitoring system.



The closely this sensor will be to place of discharge location in the insulation, the early on time high-frequency pulse from discharge will be measured by this sensor. Defect location in the insulation can be detected by difference in time of pulse arrival.

If pulse from «RFCT» sensor will arrive firstly to the input of «MDR-M», it means that this pulse is from energy system and it is not arisen in the stator insulation. If pulse from coupling capacitor will arrive firstly to the input of «MDR-M», it means that this pulse is from stator insulation.

The «Time of Arrival» method has very high sensitivity. It allows calculating difference in the distance from sensor to the defect zone in 0.3 m. It gives a possibility for noise rejection and using measuring circuit where 1 «RFCT» sensor is used without three coupling capacitors. «RFCT» is mounted on the grounded shield conductor of connecting high-voltage cable.

Diagnostic features of «MDR-M».

The «MDR-M» system has a set of built-in expert algorithms (the «PD-Expert» system) and allows processing all primary information; the staff gets the reports about monitored electric motor and list of the defects.

Sensors installation circuit in «MDR-M».

4 sensors are installed on the stator of monitored high-voltage electric motor:

- 3 coupling capacitors for the phases of the winding.
- 1 «RFCT» sensor on the conductor of cable grounded.

Measuring device of the «MDR-M» has 3 input channels and 1 additional channel for external noise filtration.

Measuring device of «MDR-M» is mounted near motor in the enclosure. Length of coaxial cables from cables to the sensors shouldn't be more than 50 meters.

Device can operate at the air temperature from -40 up to 60 degrees without heating.

Connecting interface of the «MDR-M» system.

Data transmission to the SCADA system is made by the interface RS-485. Data archive can be copied from the device memory by USB.

The specifications of the «MDR-M»

No	Parameter	Value
1	Quantity of PD channels	3+1
2	Pulses frequency range, MHz	0,5 ÷ 15,0
3	PD pulses amplitude, pC	10 ÷ 100 000
4	Build-in expert system	PD-Expert
5	Device interface	RS-485, USB
6	Device supply voltage, Volt	AC/DC 120 ÷ 260
7	Device dimensions without enclosure, mm	222*170*35
8	Device dimensions in the enclosure, mm	530*400*210