Manna GENERATORTECH, INC.

GENERATOR ROTOR WINDING SHORTED TURN DETECTION

Air-Gap Flux Probes

Rotor Winding Shorted Turn Analysis Systems

Installation, Testing and Analysis Services

On-Site Training

Shorted turns — Why you need to know!



End-strap elongation has distorted the top turn of the #6 coil resulting in contact with the top turn of the #7 coil (coil-to-coil short).

Generator problems are often solved by process of elimination. Having an accurate assessment of your rotor windings provides an excellent starting point on the path to correctly identifying and solving generator rotor problems.

Rotor winding shorted turns are generally caused by the failure of the insulation between individual windings in generator rotors. The causes of insulation failure include stop-start cycles, line disturbances, contamination, moisture, manufacturer error and damage during retaining ring installation.

The impact of operating with shorted turns ranges from no-problem to abnormal vibration, load limits, higher operating temperatures and forced outages. Generatortech specializes in shorted turn detection and can help plant operators and engineers pinpoint the cause of abnormal vibration, assist in major maintenance decisions and verify the quality of new and rewound rotors.

Shorted turns often develop over time. Regular testing of your rotor windings allows you to actively monitor the field windings, providing valuable information for your predictive maintenance plans.

Generatortech Data Acquisition & Analysis Program



The Industry's Gold Standard

The **Data Acquisition & Analysis Program** is the center of Generatortech's on-line rotor winding shorted turn diagnostic toolset. The software is extremely intuitive and easy-to-use. The analysis algorithms have been fine-tuned by **over two decades of experience** with field winding shorted turns. Generator manufacturers, service companies and power producers throughout the world use the Generatortech **Data Acquisition & Analysis Program** to meet their rotor winding shorted turn detection needs.

The Generatortech Data Acquisition & Analysis Program detects the number and location of turn shorts while a generator is running under normal operating conditions. The program provides automated data recording capabilities as well as manual data capture.

Generatortech offers *free technical support* for all clients who purchase the **Data Acquisition & Analysis Program**. Customers are encouraged to forward their data to Generatortech for expert review.

Shorted Turn Testing Methodology

- A permanent air-gap flux probe is installed on a stator wedge near the turbine end of the generator. The signal cable is routed out of the generator to a termination box or casing gland which has an integral BNC test connection.
- Generatortech's portable or permanently mounted analysis system is connected to the BNC test connection for data acquisition.
- Data is recorded at various loads to maximize shorted turn detection sensitivity for each coil in the rotor winding, thereby eliminating both **false positives** (false turn short indications) and **false negatives** (the failure to identify actual turn shorts).
- The Generatortech **Data Acquisition & Analysis Program** analyzes the recorded data and provides both graphical and quantitative results.
- Data is normally acquired and analyzed at either six-month or yearly intervals, or more frequently if operating conditions give cause for concern that shorted turns have developed since previous testing.



Generatortech Products

Permanent Air-Gap Flux Probes are custom designed and fabricated for each generator. The correct flux probe dimensional and sensitivity parameters are essential for obtaining the highest quality signals to be used for analysis. A variety of available models and construction materials are used to design and build the optimum flux probe for each generator. Generatortech flux probe materials are impervious to the normally harsh environment within the generator and should last for the life of the stator. All probe installation kits come with a NEMA 4 termination box for air-cooled generators or a gas-tight casing gland for hydrogen-cooled generators.



Temporary Air-Gap Flux Probes are available for hydrogen and air cooled machines. Temporary probes are inserted through a stator ventilation slot into the air gap.

BNC Signal Cable Connector

3/16" SS Probe

Portable Analysis System

The Generatortech *Model 9610* has been the data collection and analysis "workhorse" for rotor winding shorted turn detection since the late 1980's. Available with or without a notebook computer, the system comes packaged in a rugged custom-fitted wheeled carrying case for maximum protection and portability. Our newest version of the Generatortech **Data Acquisition & Analysis Program** provides:



Improved graph and data charts.

GENERATORTECH, INC.

- Ability to preload generator setup information for up to 15 units.
- All Charts & Graphs can be created as .JPG files.
- The analysis curve can be displayed while digitizing & acquiring test data.
- Test data can be *auto-saved* at optimum load points for analyzing each separate coil and/or at specified timed intervals.

Permanent Monitoring System

The Generatortech *Model G50* is the latest development for rotor shorted turn detection providing for 24/7 continuous data collection.

Developed from the same, time-tested, Generatortech **Data Acquisition & Analysis Program** which our portable system uses, the Model G50 is rack mounted and designed to simultaneously monitor up to four generators. The G50 system allows test data to be acquired automatically and/or manually.

Flux probes from up to four generators are permanently connected to the G50 system. The system can be configured for access using the Internet or your company's intranet using a secure VPN connection.

No need for your staff to travel to distant power stations for testing. In fact, Generatortech can provide contracted services to be responsible for your regularly scheduled testing and analysis.



Generatortech Services

Generatortech provides the information needed to decide when and if a generator rotor needs repair. Today's competitive electrical power market requires data-driven, cost-effective maintenance decisions. Superior data and analysis are needed to make optimal maintenance decisions. Rely on Generatortech to provide the answers with multiple support and equipment options tailored to accommodate our customer's needs.

Build & Install

- Permanent flux probes •
- Temporary flux probes •

Testing Options

- Generatortech personnel perform on-site testing and analysis which includes formal reporting.
- Generatortech provides rental testing equipment for data acquisition by plant personnel. Data is sent to Generatortech • for analysis and formal report.

Generatortech Data Acquisition & Analysis Program Packages for Round Rotor and Salient Pole Generators

- Purchase a complete Generatortech Data Acquisition & Analysis Program package so your engineers can test and • analyze your generators.
- Purchase the *Model 9610* Data Acquisition & Analysis Program, available with or without a laptop computer. •
- Purchase the *Model G50* Data Acquisition & Analysis Program. Up to four generators are permanently connected to • the consolidated air-gap flux probe signal conditioner. The permanent system allows monitoring via secure VPN Internet connectivity.
- Purchase the *Model G50* Data Acquisition & Analysis Program with Generatortech monitoring option. Generatortech will provide regular testing and shorted turn analysis reporting using a VPN connection to your G50.

Training/Symposiums/Consultations

Generatortech Air-gap Flux Probe and Shorted Turn training classes and symposiums can be scheduled for staff, engineers and management. Generatortech staff are always available for phone consultations.

Compare Testing Methods				
Technique	Location of Turns	Sensitive	Quantitative	Detects Speed/Thermal Dependent Shorts
OFF-LINE TESTS				
Rotor Impedance Test	NO	LOW	NO	Yes-speed, voltage
Pole/Coil/Turn Voltage Drop Test	YES	HIGH	YES	NO
Search Coil Slot Flux Distribution Test	YES	HIGH	NO	NO
ON-LINE TESTS				
V/A Measurements	NO	LOW	NO	maybe
GENERATORTECH FLUX PROBE TEST	YES	HIGH	YES	YES

Established in 1989,

Generatortech, Inc. is the

world leader in the detection

of rotor winding

shorted turns.

Our customer list includes:

- Power generating utilities and cogeneration industries worldwide (over 60 different countries), with units that include both high speed turbines and hydro generators.
- Over 60 nuclear power generators make use of Generatortech equipment.
- Service companies, who use our probes & analysis software for spin pit testing and provide retrofit flux probe installations.

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Original Equipment Manufacturers (OEM) - who install Generatortech equipment in new generators and as retrofit applications during major outages.

www.generatortech.com

View our website for animations, an in-depth discussion of Air-Gap Flux Probe testing and our company history.

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