Generating Timely Repair Solutions
**Introduction**

**AGT Services** has over 200 years of combined, proven OEM engineering, design, and hands-on experience; and is known in the industry for its schedule conscious, cost-effective solutions with respect to generator testing and repairs.

**AGT Services** specializes in providing time saving (value-added) testing and repair solutions, coupled with expert restorations and expedited delivery of custom components to repair any steam turbine or gas turbine driven generator.

**AGT Services** can provide on-site or off-site services and manufacture replacement parts for any make or model of generator in the power generation industry. Our newly expanded 35,000 square foot service facility is equipped with the latest innovations for the testing and repair of generators, readily stocked with the most critical replacement materials, and tooled to undertake any emergency generator stator or field need. Equipped with 75 ton crane capacity and easily accessible to the NY State Thruway, our service shop is capable of servicing almost any size generator.

**Testing Services**

**AGT Services** maintains its own fleet of calibrated generator testing equipment. In emergency situations, most equipment can be shipped, counter-to-counter, to arrive with the Generator Specialist. Comprehensive generator testing and immediate interpretation and analysis of results is our commitment to you.

- Hi Potential Testing (D-C & A-C)
- Winding Resistance Testing
- Insulation Resistance Testing
- Stator Water Cooling System (Pressure/Vacuum Decay) Testing
- Helium Tracer Gas Testing
- Capacitance Mapping
- Stator Wedge Surveys (Manual & Automated)
- EL CID Testing
- Stator Core Loop Testing
- Core Tightness Evaluation
- Doble Testing
- End Winding Stability/ “Bump” Testing
- RSO (Repetitive Surge Oscilloscope) Rotor Shorted Turn Analyzer

**Repair Services**

**AGT Services** employs some of the most experienced OEM-trained winders in the industry. Our typical winder experience ranges from wedging five MW stators to rewinding 1100 MW water-cooled units.

**Stator:**
- Rewedges (Full/Partial)
- Rewinds (Full/Partial)
- End Winding Repairs
- Water-Cooled Leak Repairs/ Clip Replacement
- Bar Vibration Abrasion Repairs
- Stator Core Restacking/Repairs
- Through Bolt Replacement/Building Bolt Tightening
- High Voltage Bushing Change-Outs
- Stand-Off Insulator Change-Outs
- Belly-Band Installation

**Rotor Services:**
- Retaining Ring Removal/Replacement
- Winding Elongation/Coil Distortion Repairs
- Partial/Full Rewinds
- Main Lead Replacements
- Rotor Dovetail Cracking Repairs/Maintenance
- Collector Ring Replacements and Resurfacing
- Brushless Exciter Evaluation/Repairs

**CAPABILITIES**
Rewind and Short Cycle Liquid Cooled Stator

Rewind development programs. In 1997, Bill went through the GE Generator Specialist program and relocated to the western US; responsible for performing test and inspections, as well as managing major generator outages, including rewinds (field and stator). In 2000, he joined Generator Manufacturing, responsible for the manufacturing of generator stators, and later transitioned into a quality role supporting the generator stator wind and core stack operations. Bill’s last position, while at GE, was that of Generator Methods Engineer for Field Services organization, where he led the development of comprehensive, state-of-the-art technical reference materials, data evaluation tools, and data collection forms.

Mike has more than 30 years experience in the power generation industry with a focus on engineering innovative repair solutions and training. A graduate of General Electric’s respected Field Engineering Program, Mike spent four years in GE’s Generator Availability Engineering unit where he analyzed equipment failures, devised unique repairs, directed major rebuild projects, and trained generator specialists to the highest standards. Mike’s resume also includes a stint with the New York Power Authority as director of plant-wide repairs and improvements at the Fitzpatrick Nuclear Plant. Upon returning to GE, he worked in Generator Design Engineering, helping to integrate the design and manufacturing groups. He went on to manage GE’s ASD Generator Service Organization, the Generator Manufacturing Quality Assurance programs, and the PGS Generator Services group. In 1995, Mike joined Mechanical Dynamics & Analysis (MD&A) as Manager of Generator Special Projects. In 2000, Mike founded AGT Services with his longtime colleague Jim Taillon.

Vinny began his career, in the power industry, with GE in 1989, as a Project Engineer in Generator Rebuild & Maintenance. Highlights include receiving the GE Product Service Engineering Award in 1995 and was the project manager of the second nuclear GE generator replacement on a Westinghouse turbine. After 5 years in that arena, Vinny moved on to hold numerous management positions in Generator Manufacturing which included: Field Wind and Parts; Final Assembly and Test Operation; and finally Stator Wind, Stack, and Clean during a two-year “bubble” production period, from 2001 to 2002. Before joining AGT Services, Vinny was Quality Manager for GE-Schenectady Steam Turbine and Generator Operations, GE-Mexico Bucket Operation, and GE-Bangor Maine ST-GT Operations.

Chuck is a graduate of the GE Generator Specialist program, the program he would later manage; training many of the generator specialists working today. He began his career with a focus on directing large liquid-cooled and conventional generator rewinds, becoming an expert on short-cycle rewind methodology. A promotion to Program Manager in GE’s New Product Introduction group produced many new generator innovations designed to dramatically reduce rewind cycles. His contributions to reducing rewind cycles in liquid-cooled and conventionally cooled generators earned Chuck industry-wide recognition, including the GE Corporate Service Engineer of the Year Award in 1998. He also holds several patents, including a device for automated stripping of stator bar insulation; specialized tooling in induction brazing technology; and specialized material development for high-potential testing of large generators.

Bill began his career in the power generation industry, with GE in 1990, as an engineer in Generator Rebuild & Maintenance. Initial responsibilities included coordinating and implementing field modifications and design enhancements to Air-Cooled Package Power generators. Later responsibilities included: Lead engineer responsible for GE TIL-1098, and Program Manager for the Advanced Stator Rewind and Short Cycle Liquid Cooled Stator Rewind development programs. In 1997, Bill went through the GE Generator Specialist program and relocated to the western US; responsible for performing test and inspections, as well as managing major generator outages, including rewinds (field and stator). In 2000, he joined Generator Manufacturing, responsible for the manufacturing of generator stators, and later transitioned into a quality role supporting the generator stator wind and core stack operations. Bill’s last position, while at GE, was that of Generator Methods Engineer for Field Services organization, where he led the development of comprehensive, state-of-the-art technical reference materials, data evaluation tools, and data collection forms.
Jamie Clark
SALES MANAGER
BSME

Jamie earned his BSME from Florida Tech in 1996 and began his mechanical engineering career with GE in 1997 where he was responsible for design of generator auxiliary systems ranging from hydrogen cooling and seal oil systems design for conventionally cooled machines, to stator water cooling systems for larger fossil and nuclear generator applications. From 2000 to 2007, Jamie took on the role of North American Sales Manager for Environment One’s Utility Systems business, responsible for the Application Engineering and Consultative Sales for EOne’s product line throughout N. America and the Caribbean. Jamie returned to GE in 2007 as Technical Leader for Steam Turbine and Generator Accessory Systems’ New Product Introduction team, responsible for leading the design and execution of new accessory systems and plant configurations.

Nick Rebich
Generator Specialist, BSEE

Nick joined the AGTServices team in 2002, after leading Providence R.E.E.S., an aftermarket generator and repair manufacturer, as president. Prior experience includes 15 years with American Electric Power. His area of expertise is generator and excitation testing. He has replaced and upgraded generators and exciters during scheduled maintenance outages, and resolved many online failures. Nick has extensive testing, inspection and repair experience on General Electric and Westinghouse generators, as well as thorough design experience of stator winding assemblies and support members. He is an active member and former chairman of the Columbus, Ohio, section of IEEE.

Tracy Stephenson
Generator Specialist, BSEET

Tracy joined the team with extensive testing, inspection and repair experience on General Electric and Westinghouse generators. A graduate of the GE Generator Specialist program, Tracy began his career as a generator Field Service Engineer out of the Houston, TX service shop. He also directed repair programs for customer outages with TAB Services, a gas turbine consulting engineering firm. Later, Tracy joined MD&A as a generator engineer, where he supervised two liquid-cooled stator rewinds.

Terry Benson
Generator Specialist

Terry has 33 years experience in the power generation industry which began in 1973 as a generator winder for GE in Atlanta, GA. He attended GE Generator Specialist program and upon graduating he was promoted to Generator Specialist. In 1986, he was promoted to Project Manager and held that position until 1999 when he received yet another promotion to Service Manager.

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R. (Terry) Benson
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James Taillon
Consultant Generator Specialist, AAME

Jim’s forty year career in the power generation industry began in General Electric’s Materials and Processes Lab. He went on to work in generator engineering, streamlining the factory process for stator core stacking and developing monitoring equipment. Over the years he extended his technical expertise by training field support personnel, writing process instructions for field and stator repairs, and training field engineers. His resume also includes working for ASD where he managed the support team providing technical and marketing assistance to 19 GE Service Shops throughout the United States. In 1988, Jim joined Mechanical Dynamics & Analysis (MD&A) where he held several progressively more responsible positions, including Generator Field Engineer and Manager of Generating Engineering.
AGTServices’ Team

RICHARD BUECHNER
Generator Specialist

Rick has 36 years experience in the power generation industry which began in 1973 as a generator factory winder for General Electric in Schenectady NY. In 1996, Rick left General Electric and joined Mechanical Dynamics & Analysis (MD&A) where he attended their Generator Specialist Training Program and Stator Leak Testing & Repair program. His area of expertise is generator stator rewrinds and repairs, both conventional and water cooled. Rick joined AGT Services in 2000 and has performed many Tests and Inspections and has managed several stator rewrinds and extensive repair projects.

KURT CARLONE
Generator Specialist

Kurt has 16 years experience in the power generation industry which began in 1993 as a generator winder and was later promoted to Lead Winder for Mechanical Dynamics & Analysis (MD&A). At MD&A, Kurt attended their Stator Leak Testing and Repair Program and became specialized in various stator leak repair which included; cast/porosity leak repairs, clip replacement, and epoxy injection. In 2000, Kurt left MD&A and joined AGT Services. He attended the AGT Services Generator Specialist Program in 2002, and his area of expertise is generator field rewrinds and repairs, on all OEM’s designs. Kurt has also performed many Tests and Inspections and has managed stator rewrinds and high voltage bushing replacements.

DAVID MCCULLEN
Generator Specialist

David has 20 years experience in the power generation industry. From 1982 to 1986 David was a member of the United States Marine Corp where he specialized in electrical equipment repairs. In 1993, David joined Mechanical Dynamics & Analysis (MD&A). At MD&A, David attended their Stator Leak Testing and Repair Program and became specialized in various stator leak repair which included; cast/porosity leak repairs, clip replacement, and epoxy injection. In 2004, Dave left MD&A and joined AGT Services. His area of expertise is generator high voltage bushing and standoff insulator replacements. Dave has also performed many Tests and Inspections and has managed several stator and field repair projects.

PAUL JENSEN
Generator Specialist

Paul has 36 years experience in the power generation industry which began in 1973 as a generator winder for GE Service Shop in North Bergen, NJ. In 1998, Paul attended and graduated from the GE Generator Specialist Program. He became specialized in short-cycle stator liquid cooled rewrinds both for fossil and nuclear utilities. Paul has managed over 20 stator liquid cooled and rewrinds and been involved in several epoxy injection and clip/porosity repairs. He left General Electric in 2008, and joined AGTServices as a Generator Specialist. His area of expertise includes generator stator rewrinds and repairs, both conventional and water cooled, test and inspections, and field repair projects.
Generator Stator Rewind

Full & Partial Stator Rewinds

AGT Services can provide an Engineering Skill Set from years of experience of our Field Service Generator Specialist and our Senior Staff, many who have worked for various OEM's.

Background:

AGT Services has developed installation techniques and procedures from a variety of experiences on several different makes and models in size and condition, working in various locations and surroundings around the world.

Recommendations for Rewind Project Scope:

- Inspection of original winding / end basket configuration, evaluate upgrades of existing configuration, if any, and dimensions of existing winding for manufacturing new coils (stator bars).
- Remove existing coils & assess condition of core.
- Stator core preparation, including cleaning, repairs to interlaminar insulation, testing and repainting (Some scopes may include a core restack. In other cases, age of the unit or testing results may indicate problems requiring core replacement.)
- Installation of upgraded end winding support system.
- Installation of stator coils utilizing class F or higher insulation components, RTDs and wedging and blocking systems, and testing of individual coils or groups of coils at specified points in the installation.
- Braze, tape, and cap series / phase connections.
- Testing of the completed winding.
- “Bump test” end winding to ensure no detrimental resonance frequency present.
- Painting and turn over to reassembly team.
Full & Partial Field Rewinds

AGTServices can provide all the tools & materials along with our experienced technicians, to successfully rewind your generator field.

Background:

The AGTServices Repair Facility can handle fields from as small as 5MW to 900MW with our newly installed 75 Ton Crane Capacity and 35,000 square feet of shop space. AGTServices has a full time staff of generator specialists and winders who are capable of performing partial or full field rewinds, either in our facility or the owner’s plant location.

AGTServices Field Services Offerings:

- Full and partial field rewinds.
- Retaining ring change outs using state-of-the-art induction heating.
- New retaining ring forgings and machining.
- Field coil repairs to address elongation, foreshortening and top turn isolation.
- Main lead replacements.
- Copper dust inspections and corrections
- Bore copper inspection, repairs, and replacement.
- NDE of body wedges, forging and retaining rings using magnetic particle and dye penetrant.
- Main lead (terminal) stud and collector terminal stud hydrogen seal testing and replacement.
- Collector ring inspection, replacements, and machining / grinding.
- Removal, inspection, cleaning, and replacement of copper turns.
- Testing including Insulation Resistance, Hi Pot, AC Impedance, Winding Resistance, pole balance and RSO Shorted Turn Analyzer testing.
High Voltage Bushings

Background:
The primary function of a high voltage bushing (HVB) is to conduct electric current from the stator winding of a hydrogen pressurized generator through the outer steel wrapper to bus connections external to the generator. The HVB isolates stator winding voltage from the generator frame and provides a gas-tight connection for the transfer of electrical energy.

Problems:
Degradation of gasket sealing components, conductor insulation, or porcelain insulator cracking can lead to HVB failure and adversely impact generator reliability and availability. Deterioration of these critical components is a process directly related to operational service conditions, concerning such factors as mechanical and electrical stresses on the HVB, heating and cooling cycles, and vibration.

HVB REPLACEMENT
AGTServices’ has the capability and experience to change out leaking, degraded, and failed high voltage bushings. A typical HVB replacement performed by AGTServices will involve the following:

- Removal of connection insulation.
- Removal of old HVB’s.
- Inspection of all mating services.
- Pre-installation pressure & electrical testing of HVB’s (New or Refurbished) - optional.
- Replace all mating surface gaskets.
- Installation of replacement HVB’s.
- Final Electrical testing (can include Hi Pot and Doble).
- Re-insulating connections.

HVB Manufacturing
AGTServices’ has the capability to manufacture new replacement high voltage bushings. The ability to replace porcelain HVB’s & SOI’s particularly distinguishes AGTServices from the competition.

AGTServices’ Experience & Performance:
- Over 125 New Manufactured Replacement bushings to date.
- Standard Sizes available in stock 6-8 Weeks turnaround on new High Voltage Bushings.
- Expedited Cycle available upon request.
- Upgraded sealing design of porcelain-to-flange interface.
**HVB Refurbishment**

**Options:**

Another option is removal of the HVB from the generator, followed by a complete refurbishment of the existing HVB. AGTServices offers this option to reduce cycle time to return a refurbished HVB to minimize unit down time. A typical HVB refurbishment performed by AGTServices will involve the following:

- Complete disassembly.
- Assessment & evaluation of all components.
- Replace all gasket seals with VITON.
- Inspection / Re-insulation of the copper conductor.
- Inspection / Replacement (if required) of porcelain insulator.
- Cleaning of all components to “as new” condition.
- Silver plating connection ends.
- Reassembly.
- Pressure testing.
- Electrical testing including Hi Pot and Doble (as desired).
- Pack & Ship.

**AGTServices’ HVB Experience:**

- Over 150 bushings refurbished to date.
- 3-4 weeks standard cycle on refurbished HVB.
- Expedited cycle available upon request.
- Significant cycle reduction on replacement HVB with available stock parts.
- Ability to restore / supply / repair both standard and non standard OEM components.

**MANUFACTURING OF REPLACEMENT STAND-OFF INSULATORS**

- Manufactured in AGTServices Facility for Quality Assurance.
- Standard sizes available in stock.
- Strictly Porcelain insulator.
Generator Stator Rewedge

*Stator Wedges are a critical component of the stator slot support system.*

Several wedge design (slot support systems) and wedge materials have been used over the past 30 years. Most OEM's have a specified wedge material that meets their specific design requirements. These materials have evolved with new technology, the most important material properties for stator wedges include:

- Dimensional Stability at High Temperatures
- Flexural Strength
- Compressive Strength
- Impact Strength
- Abrasiveness

Stator wedge performance for reliability is predominately determined by the material selection, wedge design, and proper installation techniques.

**Recommendations for Rewedge Projects:**

- Review the current slot support system – wedge design & wedge material
- Wedge Tightness Test results previously taken compared to the current results:
  1. Length of time in service.
  2. Wedge tightness changes since past tests.
  3. Effectiveness of any previous rewedges to determine the integrity of the wedges, in terms of rewedge life cycle & severity of wedge tightness problems.
- Procure materials (can be performed in parallel with rewedge).
- Determine slot support system needed based on type of wedge system & material specifications.
- Let AGTServices do the rest

**Summary:**

- Wedge tightness test evaluates the integrity of the slot support system.
- Determine if a new wedge system is needed.
- Ensure the right wedge design & materials are used.
- Ensure proper installation techniques are used.
- AGTServices has the capability & knowledge to perform all the recommendations listed above.
Exciter Rectifier Refurbishment

Recommendations:

Alterrex™ excitation systems have been known to be the cause of field ground alarms and stator cooling water leakage. An OEM Technical Information Letter was issued for the maintenance of these rectifier cubicles in order to ensure these faults do not occur. If this maintenance is not performed, copper oxides from the stator winding can begin to build up in the Teflon tubes of the rectifier, resulting in a potential creepage path to ground. Another known issue concerns the Teflon cooling hoses of the fuse block heat sinks. In many cases, leaks are found where the Teflon hose is assembled to the female part of the fitting, where the fitting is brazed to the fuse block heat sink. Another common leak source occurs in the copper tubing and fittings that feed and return water flow to the rectifier cubicle.

AGT Services Recommended options:

Option 1: Refurbishment of the rectifier banks

Option 2: Replace Water Cooled with Air Cooled ProTec Air Bridge 2000™

AGT Services has extensive experience in both applications.

Option 1:

- Rectifier refurbishment begins with a visual inspection & pressure test of the assembly. The cubicles are then disassembled and cleaned.
- The fuse block heat sinks are modified, the Teflon hoses & fittings replaced with high reliability mechanical Swagelok fittings, the existing Teflon tubes and O-rings are replaced with new Teflon and viton O-rings.
- All remaining copper deposits are removed by flushing the heat sinks at final assembly.
- A one hour pressure test is the final test to ensure the unit is leak free.

Cycle time to rebuild and reinstall three rectifier cubicle banks is ~3 weeks.

Summary - Experience and Recommendations:

- 300 Units with Compact Alterrex
- 30-35 Years of Operation
- Several Units experienced Leaks and Cu Deposition
- Replace Teflon Hoses and Tubes at next Major Outage
- Maintain Leak Free rectifiers & improve unit reliability

Option 2:

Replacing the water cooled bridges with the ProTec AIR BRIDGE 2000™ eliminates all water-cooled bridge problems, to learn more about the AIR BRIDGE 2000™ please visit protec’s website at www.protecservicesinc.com

- Eliminates corrosion, pipe blockages and water leaks, copper tracking, erosion and isolation valve failures to save on maintenance costs.
- Allows for the option of reusing existing switches to eliminate unnecessary replacement.
Generator Field Dovetail Maintenance

Background:
Fretting and cracking in large generator rotor forging dovetails is an industry-wide issue that has surfaced in generators manufactured by various OEM’s. This phenomenon has been studied for nearly three decades, with corrective action dating back to 1981. The fretting / cracking occurs in the #1 coil slots, understood to be caused by steel wedge interaction with the rotor slot dovetail. Susceptible rotors have a long body length in comparison to its diameter. In most cases, the affected rotors have been in service 25+ years or have had a rigorous start-stop cycling life.

Recommendations:
Industry-accepted practice recommends removing the retaining rings along with the wedges in the #1 coil slots. After wedge removal, an eddy current inspection of the dovetails is performed to identify any fretting / cracking. AGT Services offers a more cost-effective solution consisting of ultrasonic testing (UT) with the wedges in and retaining rings in place using angle beam technology. However, if indications are found in UT testing, AGT Services concurs with the industry-accepted / proven approach; remove all fretting / cracking with minimal localized grinding to prevent further crack propagation. The steel wedges in the critical two-thirds of the rotor should be modified and replaced with a softer material (aluminum) to reduce the probability of future fretting, as well as provide some protection from negative sequence events.
## Repair Options:

*Any or all of the following repair options can be applied:*

<table>
<thead>
<tr>
<th>OPTIONS</th>
<th>COMMENTS</th>
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<tbody>
<tr>
<td>1. UT dovetails from OD of forging with retaining rings assembled.</td>
<td>New technology developed by several NDT companies. Can identify indication of approximately .020&quot; in depth &amp; larger.</td>
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</tbody>
</table>
| 2. Remove at least one retaining ring Eddy current NDT evaluation of dovetails. LP NDT evaluation of wedges. | Industry accepted technology.  
- Eddy current identifies minute indications in forging dovetails.  
- Visual & LP provides adequate evaluation of wedges. |
- Minimal localized material removal / polishing / blending / retesting. |
- Minimal localized material removal / polishing / blending / retesting. |
| 5. Existing wedge modifications to reduce probability of additional fretting & damage due to negative sequence current events. | Industry accepted technology for more than a decade.  
1. Install undercut in critical fillet area of wedge to remove heat affected material  
   - Reduce stress concentration factor.  
2. Radius ends of wedges to create clearance to forging at wedge interface.  
   - Avoids risk of performing major machining work on forging.  
   - Create clearance to forging in the event of negative sequence event. |
| 6. Replace magnetic steel wedges with modified (see option #5) aluminum wedges to reduce probability of additional fretting & damage due to negative sequence current events. | Industry accepted technology for more than a decade.  
- In service experience shows that softer wedge material significantly reduces risk of fretting - as seen in slots with existing aluminum wedges.  
- Includes wedge modifications per option #5 (above). |
Stator End Winding Dusting

Background:
Since 2001, many owners have reported seeing dusting in the stator end winding. This dusting was found primarily on units undergoing their first inspection following commissioning. Dusting, also called “greasing” if oil is present, is the result of mechanical abrasion of components in the stator end winding. Failure to correct the loose components could result in more costly future maintenance or forced outage of the generator.

Root Causes of End Winding Dusting:
• Block & tying methods / materials.
• Bonding of blocks and ties.
• Lack of resin cure.
• Thermal expansion irregularities.
• End winding resonant / instability conditions.

AGT Services is offering an inspection and repair program for addressing end winding dusting. A methodical approach for corrective action is outlined in this memorandum. It covers both the inspection process and the repair methods depending on the severity of the dusting.

Stator Winding & End Winding Support System:
Generator stator windings and end winding support systems can be subject to rapid deterioration as a result of mechanical or electromechanical phenomena. Adequate inspection programs are imperative, to minimize necessary corrective action or repair efforts.

Causes of Winding & End Winding Deterioration:

Contamination: Oil from the seals and bearings, is known to coat the generator stator winding. If large quantities of oil are present, a significant increase in the rate of deterioration will occur. Oil substantially reduces the friction and bonding between parts of the end winding support system and can lead to gross looseness of the windings.

Design: The stator end windings are designed to survive the same general kinds of operating duty as the slot portion of the winding; normal operating electromagnetic forces, thermal effects, and fault forces.

Operating Forces: Normal running forces in the winding are low but can cause progressive deterioration. To prevent this, a zero clearance assembly is required and good bonding of contacting parts is essential.

Movement: Relative motion between components in the end winding can lead to insulation wear. This motion can be initiated by high forces in the end winding either as a result of a fault, series of faults, or as a result of a severe thermal excursion.

Resonant Frequencies: Windings are designed and tested so as to not have natural frequencies in the range of the electromagnetic forces. Careful attention has to be paid to the vibration characteristics of the winding and components to ensure that there are no resonant conditions.
near the operating frequencies. If mechanical bonds become broken or support ties become loose, the natural frequency of associated components may be shifted to an undesirable range.

**Insulation System:** The electrical grading system is also vulnerable to being damaged by excessive motion of the winding or by wear from loose components. Breaks in the continuity of the system can potentially initiate conditions for corona activity.

**Inspection and Test Process:**

1. Thorough visual inspection of the entire end winding area.
   - All ties and blocking on the bars and connection rings should be examined for signs of looseness, dusting, and/or greasing.
   - Any signs of dusting should be recorded for evaluation.

2. Impact testing, known as “bump” testing, verifies the condition of the end windings with respect to resonant frequencies.

3. Develop repair plan for areas of concern from visual inspection and Bump Test for each unit, on a case-by-case basis.

**REPAIR RECOMMENDATIONS:**

Repairs can be as simple as coating some/all of the ties (bar and blocking) with wicking epoxy, or as detailed as removing all of the end winding blocking and re-installing with air-cure resin saturated felt and tying with air-cure resin saturated glass roving.

**End Winding Stiffening Treatment:**
Consists of the following:

- Thoroughly clean apply coating of wicking epoxy to accessible areas of end windings; including but not limited to:
  - Bar-to-bar blocking.
  - Bar ties.

**Series Loop Blocking Installation:**
Consists of installing blocking (textolite G-11 block sandwiched between Dacron felt saturated in air-cure resin) between all series loop connections. If series loop blocks are currently installed and not performing, it is recommended to remove them, clean up the series loop caps, and reinstall them using air-cure resins for greater durability. Upon completion of this repair, an additional Bump Test is performed to validate successful series loop repairs.

**AGT SERVICES EXPERIENCE:**

- OEM Factory experience in the manufacturing of hundreds of units that may experience these issues.
- Numerous (25+) Units to date with proven end winding dusting repairs implemented.
Specializing in providing time saving testing and repair solutions, coupled with expert reverse engineering & expedited delivery of custom components to repair any steam, gas, fossil, or nuclear generator.