



GENERATOR & MOTOR SERVICES, LLC.  
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# GMS NEWS

## GMS Provides a Retrofit of a Siemens TLRI Generator Rotor in only 36 Days

### CONTACT GMS

If you want to eliminate tooth-top cracking on your rotors and/or intend to replace retaining rings contact:

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### GMS GENERATOR & EXCITER SERVICES:

- Condition Assessment
- Stator and Rotor Repair
- Exciter Overhaul & Repair
- Positive Pressure Exciter Housing
- Life Extension Programs
- Monitoring and Diagnostics

Visit our web site at

[www.gmsinternational.com](http://www.gmsinternational.com)

In May 2004 GMS concluded a complete retrofit of a Siemens type TLRI generator rotor for an utility located in the southeastern US. This 2 pole, 3600 rpm air cooled generator is rated 148.8 MVA with an 85% power factor. The scope of work included:

- Elimination of tooth-top cracking with a new retaining ring shrink fit design
- Supply and installation of new retaining rings
- Complete field rewind using the original copper
- Design modification and replacement of the J-straps
- Design modification and replacement of the end baffles
- Rotor Balance and Overspeed
- Transportation

GMS was able to complete the required engineering for the development and



Initial Lathe Checks Upon Receipt

implementation of process procedures, design of the retaining ring fit area, new design of the J-straps and end baffles and

complete the rotor modifications listed above in a 36 day time period.

The TLRI generator series includes air-cooled units with nameplate ratings between 50 MVA and 300 MVA. A similar design series, THRI, uses hydrogen cooling with ratings up to 420 MVA. Most TLRI generators are driven by gas turbines and experience a high number of start-stop cycles. Units of this design have failed because of faulty braze joints and cracked J-straps. Loose gas baffles below the retaining ring have also caused operational problems. The Siemens rotor tooth and retaining ring shrink fit design makes the rotor vulnerable for tooth top cracking similar to units manufactured by Westinghouse.

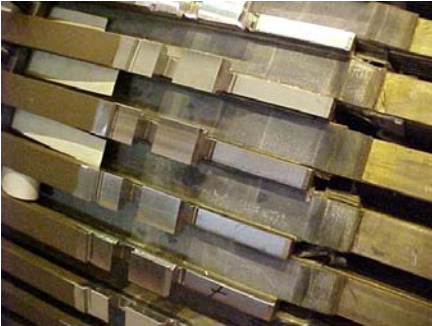
At our customer's direction GMS engineered and solved all the problems with new and improved designs.

Tooth top cracking, a very well known problem in the electric utility industry, was also observed on this type of rotor. It was generally thought that the tooth top cracking problem was only related to one OEM, but it is



Typical Tooth-Top Cracking now recognized that other OEMs have designs that exhibit the same problem.

GMS extensive experience and our well proven and patented tooth-top repair procedure make it possible to effectively implement the required



Typical GMS Tooth-Top Machining engineering and material procurement in a timely manner.

Immediately after the retaining rings were removed, the shrink fit areas of the rotor and retaining rings were machined to a new design. With this new design, tooth top cracking will not be experienced during future operation.

During the rewind of the generator field, over 600 butt joints located in the middle of the coil end-turns were brazed. Prequalified GMS procedures



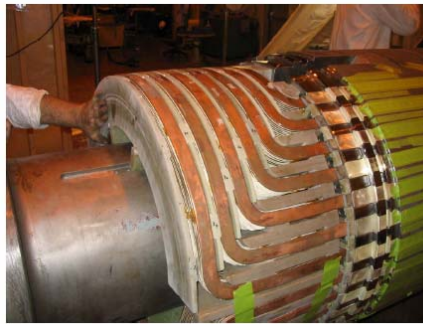
Rotor Rewinding at GMS Facility

along with trained and experienced GMS technicians were used to make each of the butt joints. Each butt joint was induction brazed and inspected.

The J-straps connect the axial leads in the shaft bore with the rotor field

winding. The original J-straps were made from solid copper with a sharp 90° bend. This J-strap configuration fails because of high stresses caused by high current (heating) with insufficient cooling, cyclic operation, friction forces, restrained thermal expansion and stresses induced during manufacturing and installation. GMS provided an enhanced J-strap design with a larger cross-section area utilizing new material that has greater flexibility and strength.

The rotor gas guide baffles and the



GMS End-Winding Blocking end-winding blocking system distribute and direct the cooling gas flow through the end-windings. The baffles have the tendency to move,



OEM Gas Baffles

delaminate and crack. This can cause severe operational problems. The original baffles were replaced with a new material with better fatigue strength and flexibility. The design

was improved and installation clearances optimized. Additionally, the end-winding blocking system was replaced with an improved material and design.

After assembly was completed, mechanical checks and stationary electrical tests were performed. The rotor was then high speed balanced and overspeed tested. The rotor met all requirements at both stand still and



Completed Rotor after GMS Design Improvements

operating speed. The total work scope was completed within 36 days including transportation.

With the work GMS performed on this rotor and with the experience and information collected during this extensive rotor retrofit, GMS has proven its capability to retrofit the TLRI and THRI types of rotors within today's reduced outage schedules.

For more information please contact **Bob Fuller - (412) 829-7500** or via email— [rfuller@gmsinternational.com](mailto:rfuller@gmsinternational.com).

## GMS—Your Choice for Retaining Ring Replacement and Tooth-Top Modifications

GMS currently has in stock 18/18 retaining rings that will fit approximately 80% of the installed US fleet. We have proven technical fixes for the problems being experience with tooth-tops, J-straps, brazed joints and end baffles in the installed fleet. Call us for personal attention on your generator needs.