

MITIGATION OF GENERATOR ROTOR TOOTH TOP CRACKING

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Fatigue cracks can develop at the small radius under the top of the coil slot teeth and, in some cases, at the snap ring groove under the retaining ring shrink-fit region due to stress concentrators and an alternating stress produced by start-stop operation. The alternating stress develops from the compressive stress due to the shrink-fit at standstill or turning gear operation, and from the tensile stress due to coil load at running conditions. These cyclic alternating stresses produced from start-stop operations will eventually initiate and propagate fatigue cracks. The initiation of cracks is dependent on the magnitude of the alternating stress, and on the number of start-stop cycles. In severe cases fatigue cracks can initiate in as few as 400 start-stop cycles.

It is obvious then that for a given number of start-stop cycles, reducing the magnitude of the alternating stress can extend the tooth top life. This is the basis for the ReGENco "Short Ring Modification". A "Long Ring Modification" is only required if a substantial portion of the tooth top is badly cracked. Otherwise small cracks can be removed as part of the "Short Ring Modification".

The ReGENco "Short Ring Modification" is a highly engineered analysis of the OEM's design using finite element stress analysis and fatigue analysis to obtain a higher fatigue life approaching 10,000 start-stop cycles. The modification essentially consists of two parts:

- 1) Reduce the compressive stress on the tooth top radius from the retaining ring shrink-fit, and make the fit uniform across the contact surface.
- 2) Reduce the coil and wedge load on the tooth top radius to the lowest possible value. The tooth top radius is subjected to tensile stress at running speed and overspeed as the centrifugal load of the coils pushes against the wedge, which in turn push against the tooth top. Since fatigue cracks initiate and grow faster from tensile stress than compressive stress, elimination of the tensile stress is very beneficial.

ReGENco also has a "Long Ring Modification" that can be applied as a last resort when the teeth are badly cracked. This modification requires that the cracked teeth be machined off and that the snap ring groove be relocated to a new inboard location. The remainder of this modification is similar to the "Short Ring Modification". This modification will also provide a long fatigue life.