

Why do I need a high speed balance?

By: Joseph Rauter, PE

A high speed balance:

- Guarantees smooth operation of the rotor at rated speed
- The rotor vibration is observed through the entire speed range to over-speed
- All balance weight planes across the rotor body are accessible
- Mechanical integrity is verified with over-speed
- On generators, it allows for electrical testing at operating speed, therefore speed related electrical faults can be detected

Why not low speed balance?

Power plant size generator rotors operate above the first and second bending modes and for long, slender rotors above the third or higher modes. Generator rotors are “flexible” rotors. Most turbine rotors are “quasi-flexible”, meaning they operate above the first bending mode and sometimes the second. Flexible and quasi-flexible rotors exhibit dynamic response as they run through their bending critical speeds. The magnitude of the response is related to the unbalance present and the location of the unbalance. Low speed balancing cannot replicate operational speed conditions. Balance weights need to be placed taking bending mode shapes into account. The effect of balance weight placement is dramatically more effective when weights can be placed in relation to the bending mode shape. Once a generator rotor is installed in the stator, for example, it is impossible to install weights into the body. In the balance bunker, the entire rotor is accessible and weights can be placed in the body to correct vibration at specific critical speeds. Placement of weights in the body of the rotor has the added advantage that we are better able to keep balancing planes at the ends of the rotor open for trim balancing or future balance corrections on site.

Which rotors are candidates for evaluation and high speed balance?

- Rotors that have had their journals, couplings or fits machined.
- Rotors that required changes to their centers of rotation.
- Rotors that have been balanced multiple times over a long operating period or have a history of vibration problems.
- Rotors experiencing changed operating vibration resulting from:
 - Loss of mass due to rubbing or other mechanical means
 - Permanent bowing or deformation due to rubs or water induction
 - Cracking
 - Thermal instability
- Turbine rotors that have been rebladed without blades of like weight positioned 180 degrees opposite

one another.

- Turbine rotors that have had blades weld repaired or foxhole rivet repaired – for verification of mechanical integrity.
- Generator rotors that have been completely rewound.
- Generator rotors that have had significant disassembly including removal of retaining rings and at least some of the coils.

Even after a high speed balance, situations arise during installation of a rotor into a shaft train that would create an unbalance.

- Coupling misalignment introduced when installing a balanced rotor will produce an unbalance condition that affects the vibration behavior of the assembled machine.
- Coupling face or locating fit runouts on mating rotor couplings will introduce misalignment when the face and rim are used to align the rotors and the couplings are pulled together.
- Correction of coupling face, rim and fit runout by machining will aid in achieving good alignment conditions, however the coupling bolt hole bolt-circle must also be considered. Correction of a coupling without correcting the coupling bolt hole positions will introduce an unbalance.
- A rotor balanced to correct for a past vibration problem must consider prior balance weight placements in adjacent rotors. Balance weights placed to correct for the prior operating conditions will become an unbalance for the newly corrected and balanced rotor.

Why choose ReGENco for a high speed balance?



Our balance team has more than thirty years experience in balancing, dynamic analysis, and diagnosis of vibration problems. As ReGENco, we have balanced 53 rotors in the last two years, including five generator rotors in the 92,000 to 120,000 pound weight range and five turbine rotors. We have served twenty-two different customers. Twelve of those customers have trusted us with repeat business, with seven allowing us to balance three or more of their rotors.