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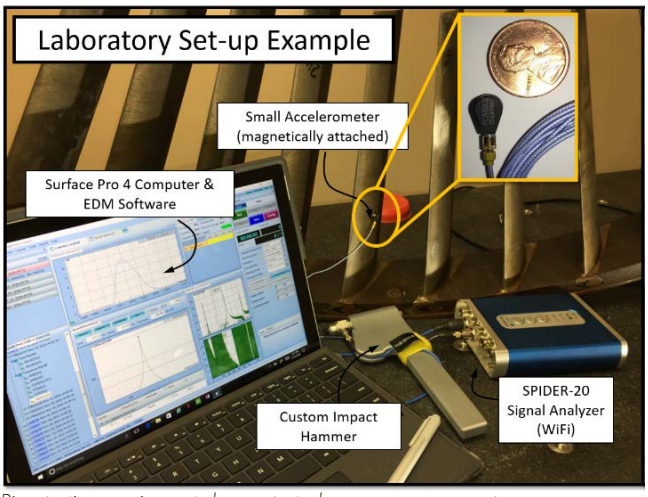
Compressor Stator Vane Ping Testing and Analysis



Ping testing equipment demonstrated on a vane segment.

- Identify and quantify stator vane lock-up via measured quality factor (Q)
- Q measurements can be helpful for prioritizing stator vane replacement schedules, tracking the progression of stator lock-up over time, documenting pre/post stator replacement lock-up, and building a comparable results database
- Optional training sessions on performing tests in-house

Key Research Question

As combustion turbine (CT) fleets age, oxidation and debris accumulates within the stator vane assembly connections causing tightening that eventually leads to lock-up of the stator vanes. Lock-up reduces damping and can contribute to excessive stator vane vibratory response. If stator vane vibrations are large enough, the stator leading edge tips can collide with adjacent rotor blades (called blade clashing). In addition to causing stator vane leading-edge damage, high strains associated with large vibrations can also lead to fatigue. Vane pinging tests can quantify vane lock-up through a Quality Factor (Q); however, little data has been collected to determine more in-depth understanding of limits on reduced damping.

The main focus of this project is to cultivate a Q database to gain more insights on vane health by integrating Q values and engine operating parameters into a report card type rating.

Objective

Underdamping - an important characteristic when it comes to large amplitude response to vibration - is thought to be an important contributor to blade clashing. Related to vane lock-up, or underdamped conditions, rotating stall is believed to be the key driver. The rotating stall intensity can be driven by ambient conditions, inlet guide vane (IGV) angles, and other operating parameters.

OEM's recommend CT owners replace existing stator assemblies with new ones that incorporate new coatings on vanes, reduced vane counts on segments, and corrosion resistant materials into the stator assembly.

As such, CT owners are faced with replacing affected parts to restore stator damping; however, CT owners can benefit from a procedure for measuring and trending stator damping among their fleet(s). Damping measurements can be helpful for *prioritizing stator vane replacement schedules*, *tracking the progression of stator lock-up over time*, *documenting pre/post stator replacement lock-up*, and *building a comparable results database*. The damping measurements (related to Q) are acquired through the EPRI-developed Pinging Protocol.

Approach and Research Value

This project is structured to support utilities in their continuing assessment of engine component health. Activities include two main elements: (i) perform ping tests on stator vanes using the EPRI Pinging Protocol, and (ii) assess unit condition through physical unit observations, measured Q values, and operational history. The latter assessment will allow for scoring of units to determine vane blade risk factors. Overall, this information will be compared to all tested units to better refine scoring data.

Deliverables

Deliverables from this project include a CT data analysis report including engine operating parameters and measured Q factor to determine potential risk factors.

The non-proprietary results of this work will be incorporated into Program P79 and made available to the public, for purchase or otherwise. Information that would identify companies and operating plants will be held as confidential to EPRI and the participating company.

Price of Project

Project cost is scope-based and depends on the location and number of units to test and analyze. Costs are estimated to range from $20,000 to $40,000 for the first unit, and $7,500 to $10,000 for additional units tested during the same visit.

Optional training on using the pinging test equipment can be included for an additional $15,000.

Project Schedule

The project will commence upon initiation by the first funder and will continue for a minimum of two years, subject to funding availability. A minimum period of performance of one year is anticipated for each funder.

Who Should Join

Power generators who own or operate gas turbine simple-cycle or combined-cycle plants, and who are interested in unit clashing and/or blade liberations could benefit from participation in the project.

Contact Information

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com).

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Product ID: 3002011796 Project ID: 1-109878 September 2017

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