

StandardAero

Technical Brief – TPE331 Engine Testing

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Situational Analysis - Arguably the most important element of any engine maintenance, repair or overhaul event is the testing that is required after the work has been completed. A certificate of airworthiness (FAA Form 8130) is issued to every turboprop engine following any kind of maintenance. This is required by the FAA. There is an OEM document called a "DSC" that is issued with each engine certification. DSC data can be obtained from either a dynamometer test cell or a propeller stand. All North American TPE331 engine MRO facilities, other than Honeywell and StandardAero, use propeller stands to test recently repaired or overhauled engines.

Dynamometer vs. Propeller Engine Test Stands - All Honeywell TPE331 post overhaul engine testing is performed in accordance with Honeywell Overhaul Manual Testing Instructions (OHM). The OHM's Propeller Stand Test Instructions state the following limitation: "...only for calm day testing." A calm day is defined as no gusts with maximum 5 knot wind velocity.

That statement is given because engine operation becomes excessively unstable. The Propeller Stand is an unstable environment in zero wind velocity but becomes excessively so as wind velocity increases or when wind gusts are present.

Just like Honeywell, StandardAero has chosen to operate dynamometer test cells to avoid all the problems associated with Propeller Stands. Take a look at the list of Propeller Test Stand problems:

- Instability can artificially cause performance rejects; increased maintenance costs could result from a performance test reject. Which also means an engine's performance could be accepted based upon choices the service provider makes concerning data integrity.
- Propeller Stand recompensation program uses a conservative T4 (TIT) calculation method which translates to engine performance rejects and increased maintenance cost.
- Torque indication system calibration becomes more difficult and has greater chance for error.
- Negative Torque System (NTS) function cannot be fully verified until the check flight; have you ever experienced a NTS problem during in-flight engine shut down? It can be an interesting ride.
- Fluid and bleed air leak detection is very difficult.
- Vibration monitoring is influenced by the propeller and test stand vibration modes, hence the OHM allows for higher acceptable vibration levels on the Propeller Stand.
- Engine testing is limited to calm days; delivery commitments can be difficult; rain and cold weather influence engine operation and technician related function.
- Propeller noise and technician safety issues can influence end product quality.



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TPE331 Engine Testing in a Dynamometer Test Cell has three benefits over Propeller Test Stands:

- 1** - Engine operational stability on a dynamometer test cell provides data accuracy not obtainable on a prop stand. Obviously the engine manufacturer knows a stable test environment is required for TPE331 testing, they use dynamometer test cells.
- 2** - The Negative Torque Sensing (NTS) system is critical to safety of flight. The function of the negative torque sensing system is to limit the torque the engine can extract from the propeller during wind-milling and thereby prevent large drag forces on the airplane. The NTS system causes a movement of the propeller blades automatically toward their feathered position should the engine suddenly lose power while in flight. The NTS system is an emergency backup system in the event of sudden engine failure.

Although the engine manufacturer provides a method of testing the NTS system on a propeller stand, that gives an indication only that the system is probably functioning correctly. Therefore, using a propeller stand, Negative Torque System (NTS) function cannot be fully verified until the check flight. A dynamometer however, measures actual NTS system operating points to ensure that the system is operating within Honeywell's tolerances.

- 3** - A dynamometer test cell uses mass airflow measurements and a more accurate turbine inlet temperature calculation methodology to provide more accurate performance test results.

There is one advantage to operating a Propeller Stand: lower cost for the MRO service provider to implement and operate. StandardAero offers competitive pricing while providing OEM Quality testing. Why choose a service provider that uses a Propeller Stand?

