

F1 Turbocharger Balancing Rig

Mecelec Design has designed and built a test rig to balance turbochargers for a well known F1 team.

The rig provided a platform to spin the turbo. This included an engine oil feed, cooling water feed, oil scavenge and compressed air feed.

The exhaust gas was simulated by compressed air. It was heated to 140 degrees C and connected to the exhaust turbine of the turbocharger. This spun the turbo at 120,000rpm.

The rig was designed to fit through a standard size door into a 3m x 3m x 3m test cell. Therefore all of the hydraulic cabinets were modular.

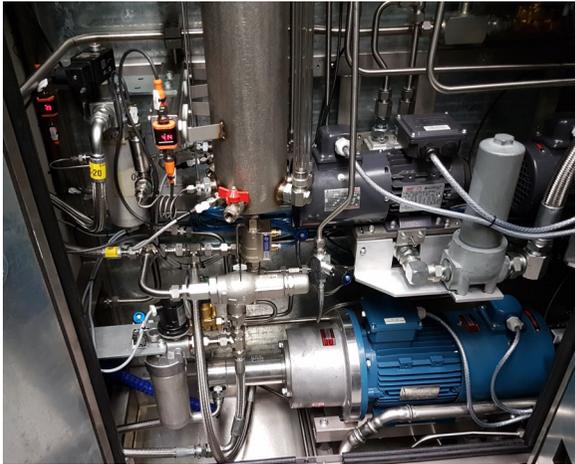
Accelerometers were used to measure vibration and an encoder provided the position in which material needed to be removed from the turbo shaft.

In the interest of cycle time, the UUT was heated and then cooled rapidly to allow the operators to handle it safely.



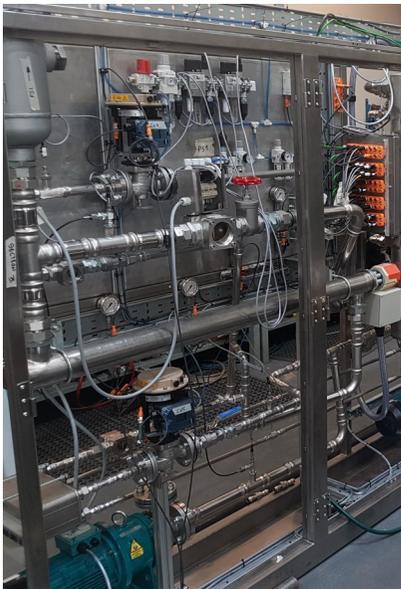
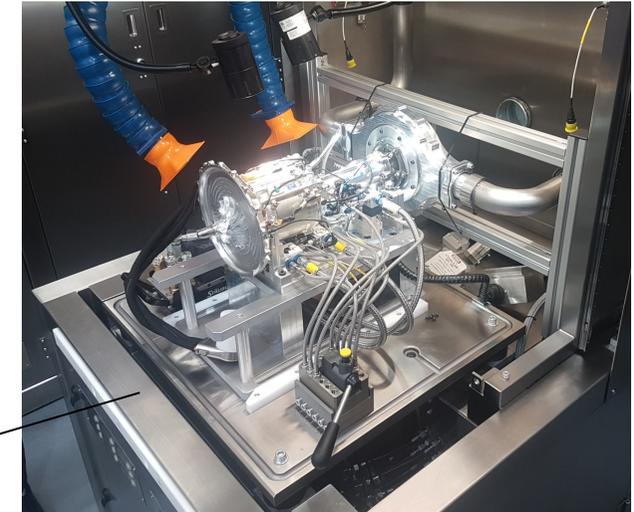
Technical Data

UUT	F1 Turbocharger
Oil Heating Power	40 kW
Water Heating Power	20 kW
Air Heating Power	70 kW
Cooling Power	40 kW
Electrical Supply	3 Phase 415VAC @ 125A
Control System	Siemens PLC, C# PC Software
Operator Interface	Siemens Touchscreen HMI
Cycle Time	30 minutes



The oil conditioning loop provided engine oil to lubricate and cool the turbo. The pressure and temperature was controlled to the same condition as in the engine. An oil scavenge system was used to extract an oil/air mixture from the turbo. The oil/air mixture was separated and both flow rates were measured.

The turbocharger was mounted onto a pallet and slid into the test area. The hydraulic connections were made with quick connect match plates. A dust extraction system was fitted with flexible ducts to remove any grinding dust.



The rig had rapid heating and cooling functionality. This included a 40kW oil heater, 20kW water heater and a 70kW air heater.

A buffer tank of cold water was used to rapidly cool the turbo after the test.



A PLC control system managed all the background processes and a PC control system performed the analytical data processing from the accelerometers. The view to the right shows the oil conditioning loop with live read outs from all the sensors.

