

Turbocharger Test Rig

The turbocharger is the small part. The gas that drives it is not.

IT IS REALLY A HOT GAS STAND

To test a turbocharger you must reproduce what an engine's exhaust does to it: a controlled mass flow at a controlled temperature and pressure, held steady while the machine's own operating point moves underneath it. Most of the rig, most of the cost and nearly all of the control difficulty sit upstream of the unit under test. The specification that matters is therefore the GAS SUPPLY ENVELOPE, not the size of unit the rig can physically accept - and a rig bought on the latter often cannot reach the corner of the map that mattered.

THE BEARING SYSTEM IS THE PRODUCT

Beyond 100,000 rpm the rotor floats on oil films whose thickness, stiffness and damping are set by oil supply pressure and temperature, and the critical speeds sit inside the operating range rather than outside it. Oil is therefore a controlled test variable - conditioned, measured and logged with the performance data - rather than a service that is plumbed in. Rigs that treat it as a utility produce results that cannot be compared with one another.

THE MAP IS THE DELIVERABLE

Nobody buys the fact that it ran. They buy a compressor map and a turbine map: pressure ratio against corrected mass flow along constant-speed lines, with efficiency islands, bounded by surge and choke. Corrected quantities depend directly on inlet measurement accuracy, and the left-hand boundary can only be found by approaching surge - deliberately and repeatedly - which sets the instrumentation rates, the control response and much of the safety design.

CONTAINMENT IS A DESIGN CASE

A wheel bursting at full speed releases a great deal of energy as fragments, and on a rig that is an expected event rather than a remote one, because a rig exists to run units to and past their limits. The enclosure is sized by credible burst energy, with remote operation, nobody in the cell while it runs, and interlocks that make presence impossible rather than merely against the rules.

THE MACHINE

- Hot gas supply - air, burner, mass flow and turbine inlet control
- Test section and mounting - adapters, ducting, quick unit changes
- Oil conditioning - pressure, temperature, filtration, flow
- Instrumentation, control and containment - mapping and interlocked access

VARIANTS

Hot gas stand for development · Cold-flow / compressor-only bench · Endurance and thermal cycling rig · Production acceptance stand

SCOPE

Ours: rig design and integration, hot gas supply and control, test section, mounting and ducting, oil conditioning, instrumentation and data acquisition, automation and mapping integration, burst containment and the safety case, installation, commissioning, correlation, training and AMC. Bought-in certified: burners, compressors and blowers, transducers and analysers, control hardware. The customer's: the turbochargers to be tested, the operating envelope and the test programme.

STATUS

Engineered to order. Equipment of this class has been quoted against a turbocharger test rig requirement for a defence vehicle manufacturer; no delivered turbocharger test rig is claimed.