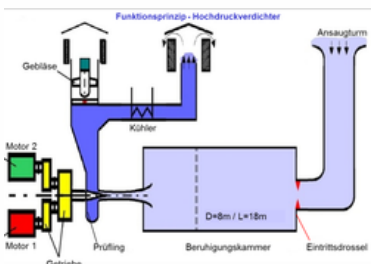


M2VP compressor test rig (Multi-stage 2-shaft compressor test rig)

M2VP - Overview

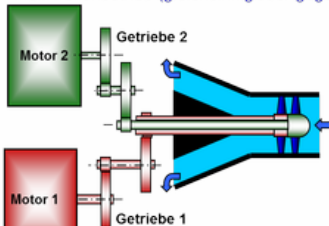


M2VP - Functional principle



M2VP - Shaft arrangement

Betriebsarten: Einzelbetrieb, Koppelbetrieb, Mehrwellenbetrieb (gleichsinnig oder gegenläufig)



Measured values

- Static wall pressures: piezo resistive sensors (PSI system: 8x16 channels)
- Total pressure probes: piezo resistive sensors (PSI system: 8x16 channels)
- Total temperature probes: thermocouples, PT100 (DELPHIN Technology TopMessage system)
- Dynamic values: strain gauges, KULITE sensors (DEWETRON: 128 channels, KULITE)
- Tip clearance measurement (HYTRON: 8 channels)
- Vibration measurement: accelerometers (PCB Piezotronics)
- Boundary layer total pressure rakes (PSI system: 8x16 channels)
- Hot Wire probe
- FRAP probe
- Flow velocities/fluctuations: Laser-2-focus velocimetry L2F
- Flow velocities/fluctuations: Particle Image velocimetry PIV
- Flow velocities/fluctuations: Doppler Global velocimetry DGV

Description of facility

The scope of the compressor research of the institute of propulsion technology ranges from measuring the compressor performance map and detailed flow field measurement up to special applications like e.g. active noise control or counter-rotating prop fans.

For the experimental investigation of axial machines the Multi-stage 2-shaft compressor test rig is available. This test rig allows the investigation of single stage and multi-stage compressors and, furthermore, the measurement of combinations of low and high pressure compressors with different rotating speeds or counters rotating stages.

The propulsion unit consists of two electric motors which act via a gear box

combination on two concentric running shafts of the compressor test rig. The rotating speed of each motor could be regulated independently and continuously from 0 to 2,000 rpm in any direction. By using a simple coupling mechanism of the hollow shaft and the core shaft, both motors can act on one shaft.

The power of each motor is 5MW at the nominal rotational speed; in coupling mode 10MW are available. Depending on the gearbox combination, a rotational speed up to 20,000 rpm can be reached.

The air pipe system of the M2VP permits two different operating modes:

Open circle

This operating mode is useful for compressors with a mean pressure ratio (e.g. multi-stage axial compressors).

Air breathed by the suction tower fills a settling chamber from which the calmed flow is injected by a bell mouth and guided to the test compressor. Behind the test compressor the air passes an outlet throttle and is ejected by a silencer in to the environment. With a nozzle between the suction tower and the settling chamber the inlet pressure can be reduced further, so that compressors which require more than 10 MW can also be investigated.

Open circle with air blower

This operating mode is used for compressors with a small total pressure ratio and a corresponding high mass flow rate (e.g. fans or prop fans).

Analogous to the open circuit, the air passes the test compressor, however, an additional air blower is mounted in the



exit duct in order to overcome the pressure loss due to the wall friction in the air pipe system. In this operating mode mass flow rates up to 160 kg/s are possible.

Technical data

- two electric motors, each of them with 5 MW
- air blower: 1.8 MW
- inlet pressure: 0.65 bar to 1.0 bar
- max compressor diameter 1.0 m
- max compressor rotational speed: 20,000 rpm
- maximum mass flow rate: 160 kg/s

Application

- CRISP: Counter Rotating Integrated Shrouded Propfan, 1 m model of a counter rotating fan with a bypass ratio of more than 20
- UHBR: Ultra High Bypass Ratio Fan, slowly rotating fan with a high bypass ratio
- RIG 250: High pressure compressor with 4 stages and applied casing treatment

Literature / References

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This handout, and cross-references to related measurement techniques and facilities are available at: <http://messtec.dlr.de/link-247-en>.