

Centrifugal compressor test rig

SRV - Overview



SRV - Impeller and diffuser



SRV - Technical data

Technische Daten (Maximalwerte)

Drehzahl:	60000 1/min
Umfangsgeschwindigkeit:	700m/s
Stufendruckverhältnis:	9:1
Massenstrom:	3,5kg/s
Raddurchmesser:	250mm
Stufendurchmesser:	600mm
Antriebsleistung	
Gleichstromantrieb:	1500kW
Getriebe:	1:30

Measured values

- Total pressures and total temperatures in front of and behind the stage
- Mass flow measurement with a standard Venturi tube
- Measurement of the rotational speed by trigger signals
- Static pressure taps in the compressor casing along the outer contour over the impeller
- Three-hole probes
- Total pressure probes
- Kulite-probes
- Static pressures of the compressor and the oil system are measured with a PSI-system
- Electric sensor signals like PT 100, Fe-CuNi thermocouple, trigger signals and so on are measured with a DELPHIN TopMessage data acquisition system
- 4-channel tip clearance measurement with a HYTRON system
- Laser-2-focus velocimetry L2F
- Particle image velocimetry PIV
- Doppler global velocimetry DGV

Description of facility

At the centrifugal compressor test rig, single fast-rotating high-loaded centrifugal compressors are investigated. In addition to measuring the compressor performance map, detailed flow field measurements are made in order to analyze the three dimensional flow field within the rotor and the diffuser by using conventional probes and several optical measuring methods like L2F, PIV and DGV. Only optical techniques are applicable within the rotating component. These partly new developed measuring methods have been tested under extreme conditions. To get detailed knowledge and information about noise generation mechanism and noise characteristics of centrifugal compressors, acoustic measurements are taken which need

special installations on the suction side like a semi-anechoic channel and a rotary channel equipped with an array of microphones.

The air flow to the compressor passes a filter, a Venturi tube and a flow straightener. In the impeller the air gets, due to the high rotating speed, a very high kinetic energy, which is transformed in the following diffuser into pressure energy. Using a continuously variable throttle at the pressure side, different desired pressure ratios and mass flow rates can be adjusted. In the following cooler the flow with a temperature of 300 degree Celsius will be cooled down before exhausting through a silencer into the environment.

Mechanically, the impeller is driven by two separately excited DC motors which are coupled by a gear box and a pneumatic coupling. Mounting a second gear box and a second coupling on the other side of the motor, it is possible to drive two compressors on this test rig.

Application

Centrifugal compressor development

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-250-en>.

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