

Contributions to the Development of Turbochargers



Contents



- Whole Vehicle / Road Test
- Entire Engine/ Bench Test
- Integration of Turbocharger (Structural)
- Development of Exhaust Gas Systems
- Development of Turbochargers
- Development of Impeller / Components
- Matrix of Competence

Whole Vehicle / Road Test

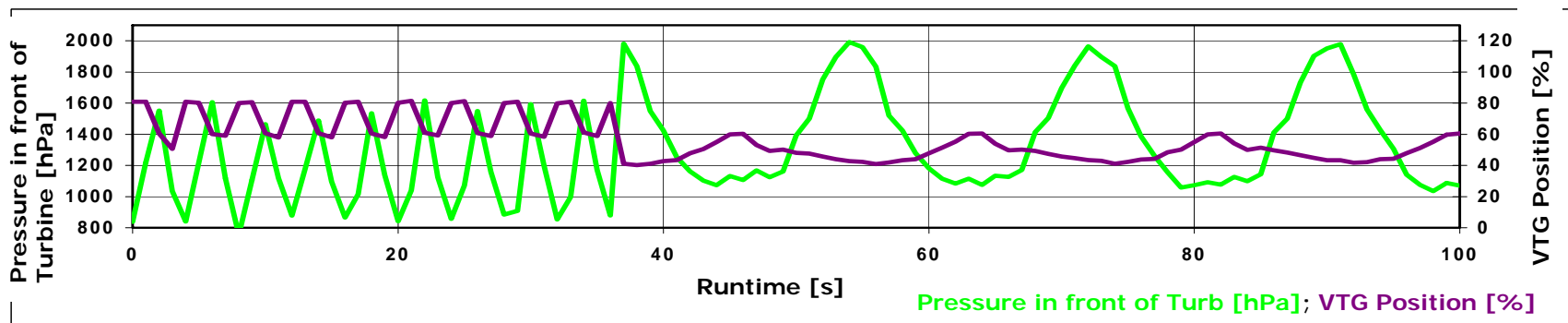
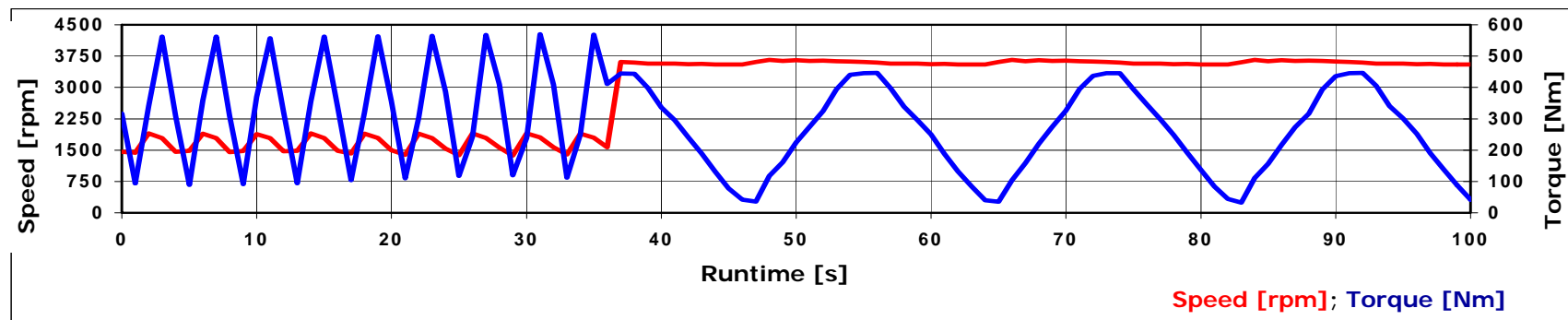
Data Logging for Whole Vehicle

KST has been performing road tests on test tracks and public roads:

- Durability testing
- Mobile data logging (e.g. evaluation of load spectrums for bench testing)

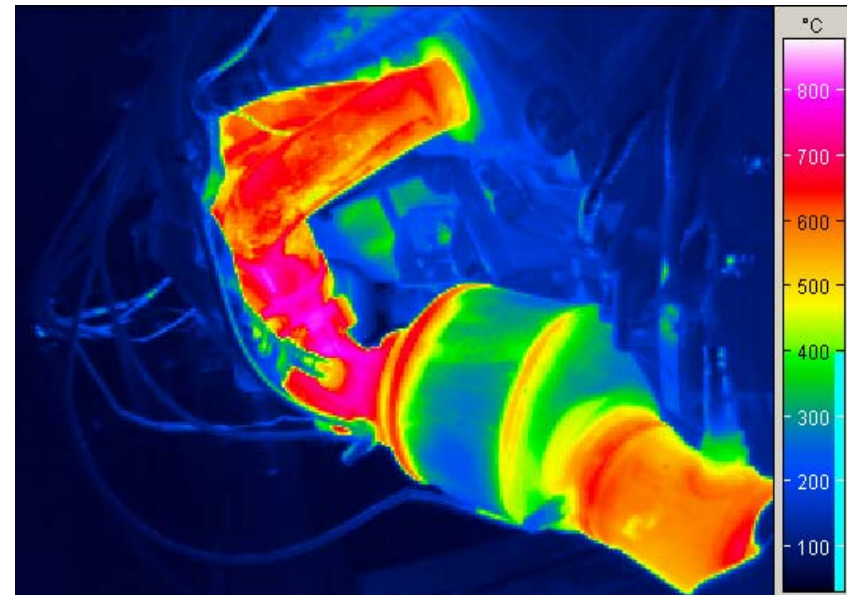
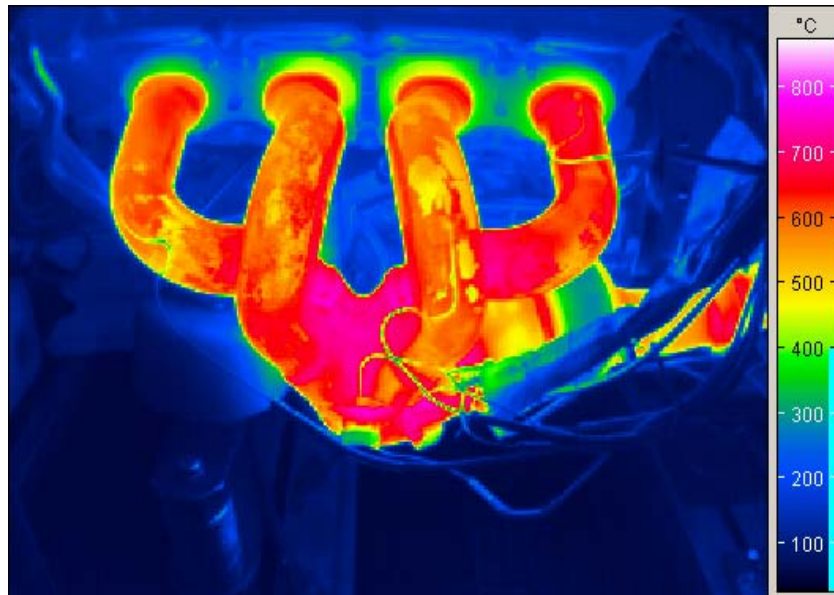


Various Load Cases for Engine / Turbocharger



Measuring grid: 100 ms

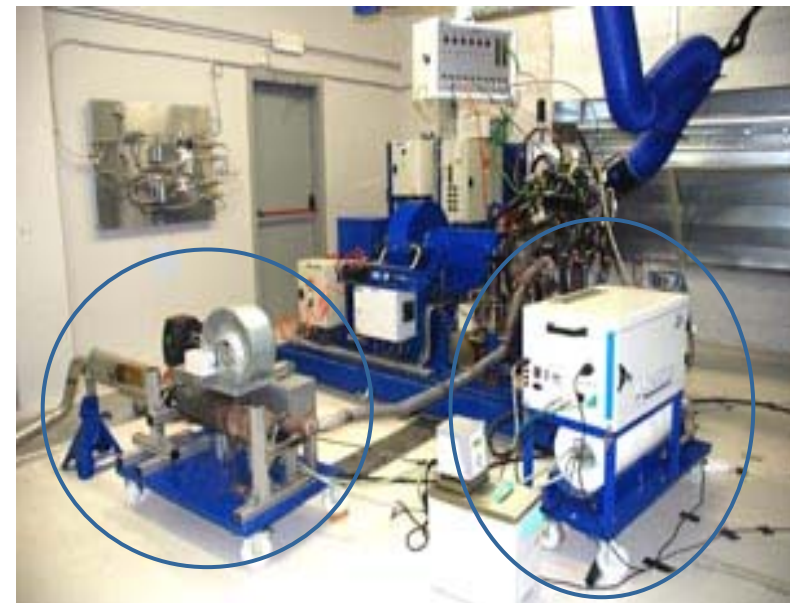
Thermal Imaging of Exhaust Gas Components



Temperatures at Nominal Output

Oil Consumption / Oil Dilution

- Real-time data logging of oil consumption and oil dilution (RNT with tracer)
- Oil consumption (e.g. at turbocharger) separately measureable (bandwidth from 0.1 to > 140 g/h)

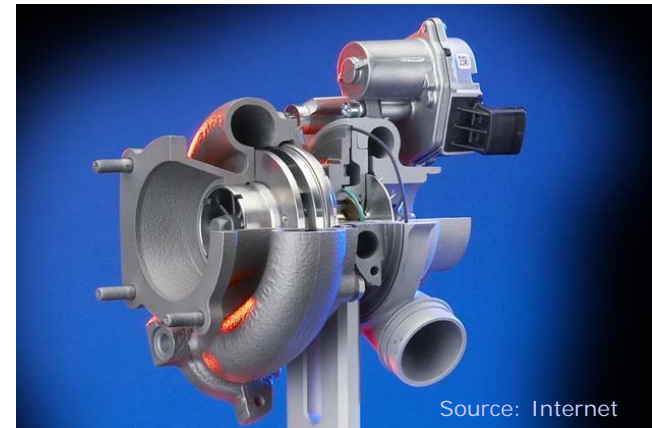


Oil Consumption

Oil Dilution

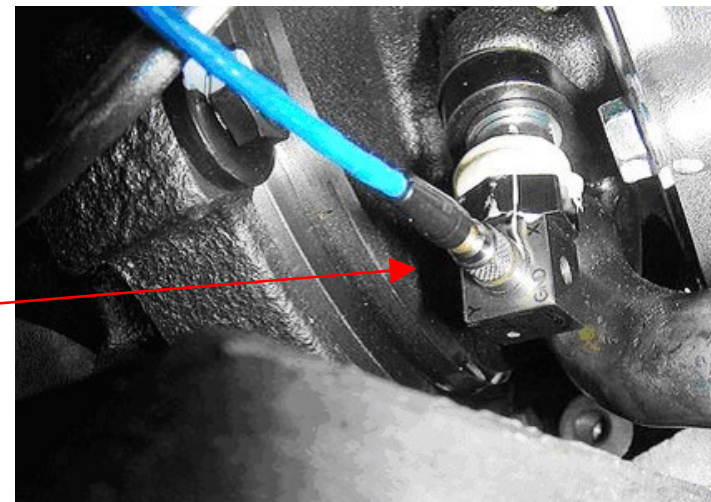
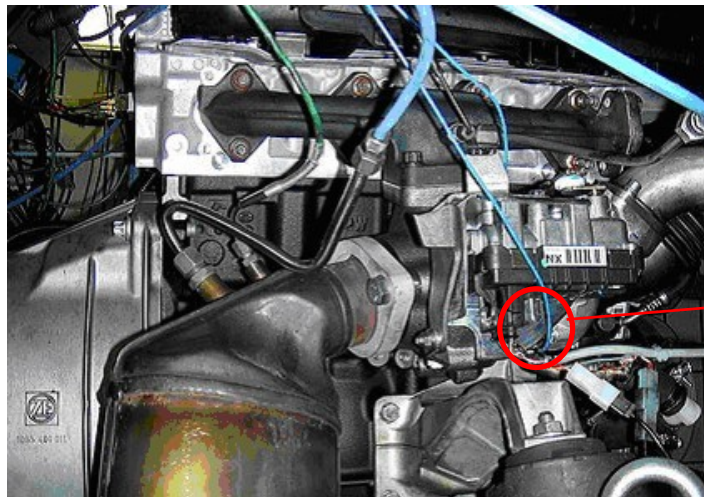
Experimental Structure-Dynamic Analysis

- Modal analysis
- Analysis for structural integrity of assemblies and components
- Dynamic simulation testing
- Lifetime and wear testing

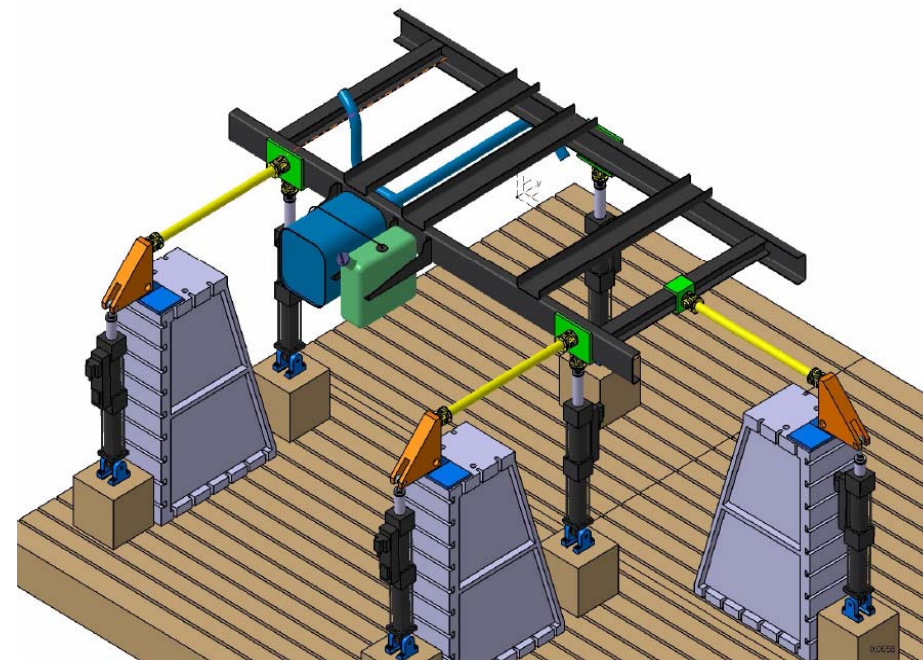


Vibration Analysis

Measurement system Müller-BBM,
(max. 160 channels, also applicable to vehicle)



- Structure-dynamic analysis
- analysis for structural integrity of assemblies and components
- Dynamic simulation testing
- Lifetime and wear testing
- Optional: Hot gas testing with upstream burner



6-axis LCF Test for Exhaust Systems on Utility Vehicle Frame

Flow Lab

- Adjustment of exhaust mass flow rate and exhaust gas back pressure
- Optimization of geometry of flow
- Spatial twist and tumble measurement
- Maximum mass flow rate: 400 kg/h

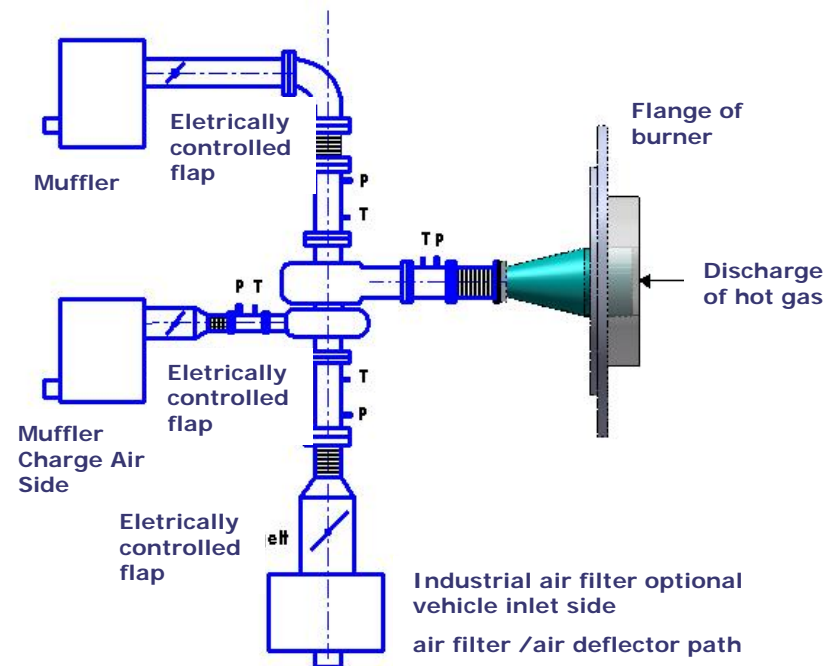


Tippelmann Test Bench

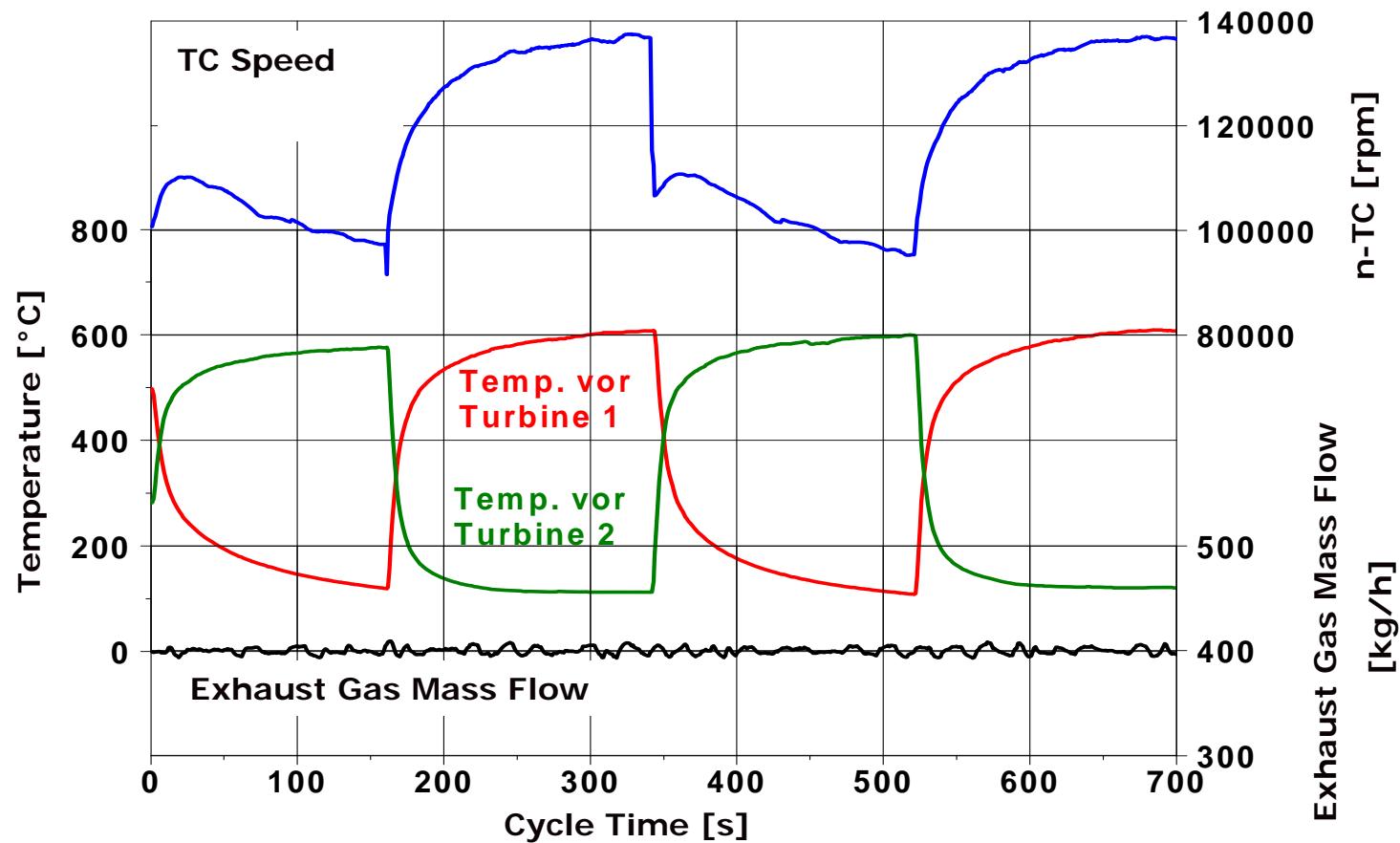
Engine-Independent Testing of Function and Lifecycle: Hot Gas Generator Test Benches / Shaker Test Benches

Gas temperature : Max. 1200 °C
Operating supplement : Natural Gas
Exhaust gas mass flow rate : Up to 1200 kg/h
Exhaust gas back pressure : Max. 500 kPa

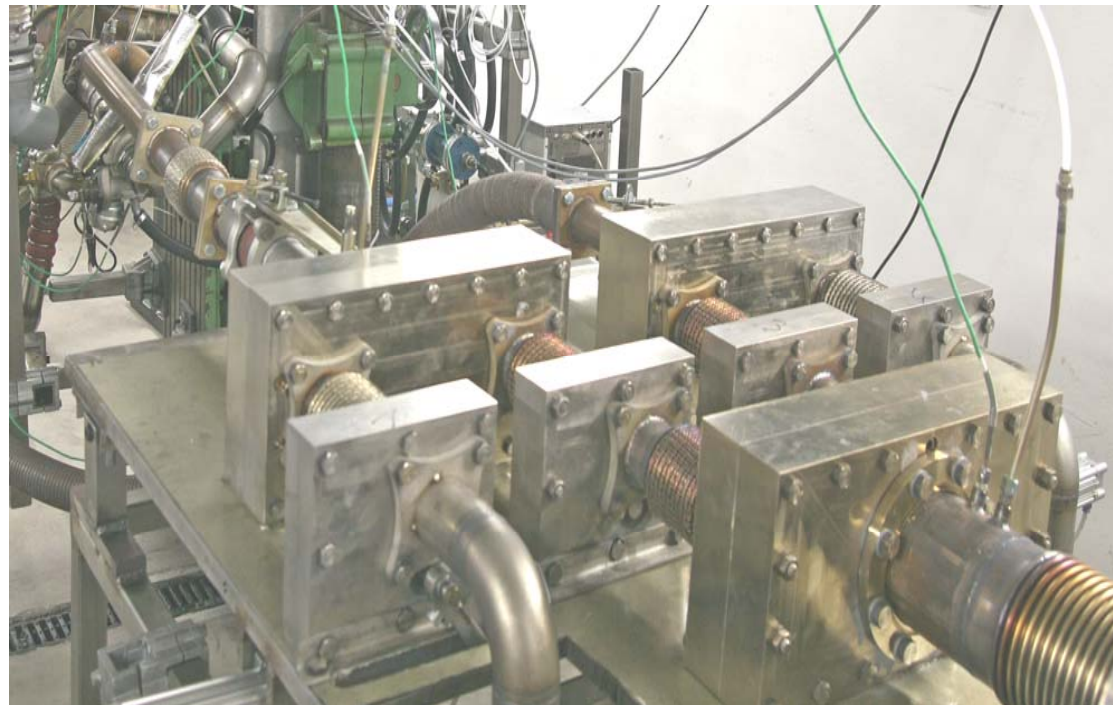
Truck Application via siamesed two gas generators



Development of TC: Thermo Shock cycle 2,0 Ltr. Passenger Car-Diesel



Gas Flow Valve Configuration for Mass-flow Setting at the Hot Gas Generator Test Bench/Thermal Shock



Spin Test Benches

Simulation of operating loads on rotor-dynamic components (e.g. flywheels, TC impellers, rotors of electric engines, wheel hub motors) with spin test benches:

- Lifetime analysis
(also under extreme conditions in terms of temperature stress)
- Rotor-dynamic analysis
- Burst and overspeed testing



Development of Impeller / Components

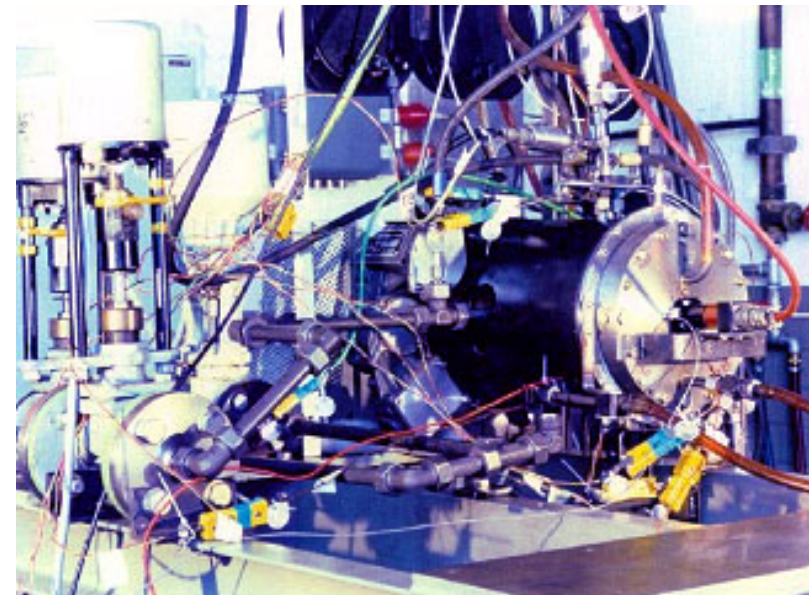


Spin Test Benches

Test Bench	BSI 1	BSI 2	BSI 3	Schenck BI 1U	Schenck BI 2U
Diameter of Chamber	1600 mm	1600 mm	1500 mm	200 mm	250 mm
Axial Length	900 mm	900 mm	700 mm	200 mm	200 mm
Maximum Weight of Sample	4000 kg	4000 kg	450 kg	10 kg	50 kg
Speed Range	0 – 40000 rpm	0 – 40000 rpm	0 – 65000 rpm	0 - 16000 rpm	5000 – 120000 rpm
Control System	Computer-Controlled, Programmable	Computer-Controlled, Programmable	Computer-Controlled, Programmable	Computer-Controlled	Computer-Controlled
Vibration Monitor	2 – Channel	2 – Channel	2 – Channel		
Heating System	3 x 10 kW	3 x 10 kW		1 x 3 kW	1 x 10 kW
Maximum Temperature	800 °C	800 °C	800 °C	150 °C	600 °C
Transfer of Data	Telemetry	Telemetry	Telemetry		
Temperature Measurement	Optical Pyrometer	Optical Pyrometer	Optical Pyrometer		Optical Pyrometer
Data Logging	32 Channel	32 Channel	32 Channel	2 Channel	

Lifetime Testing of Turbocharger Bearings

- Speed : up to 50000 rpm
Oil pressure : up to 5 bar
Oil temperature : up to 130 °C
(circute quantity adjustable)
- Radial and axial force via
pneumatic actuation < 12 kN
(air pressure up to 6 bar)



Matrix of Competence

Bandwidth of development:
 Passenger car, truck and
 heavy-duty engines

	Spin Test Bench	Structural Test Bench	Hot Gas Generator Test Bench	Engine Test Bench
Passenger Car	Existing Competence	Existing Competence	Existing Competence	Existing Competence
Truck	Existing Competence	Existing Competence	Build Up of Competence	Existing Competence
Heavy Duty	Existing Competence	Existing Competence	Existing Competence	Existing Competence

Competence of KST
 Competence of GEVA

Locations



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