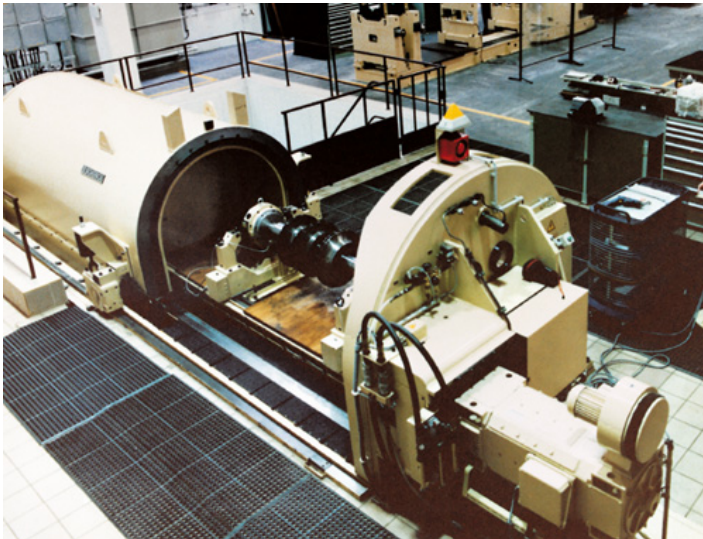


## DH 2 - DH 13 High Speed Balancing and Overspeed Test Facility



For more than 40 years Schenck RoTec has been engaged in the development and design of special high-speed balancing machines for heavy turbine and generator rotors as well as for high-speed compressors of steam and gas turbines.

Constant exchange of experience between Schenck RoTec and renowned manufacturers of electrical and turbo machinery have led to the development of the special DH bearing pedestals for balancing machines. These are equipped with isotropically supported bearings, providing equal stiffness in all bearing plane radial directions, and are suitable for use at extremely high balancing and test speeds.

DH bearing pedestals are designed for the following applications:

- Low speed balancing
- Checking of rotor balance at high speeds (operational speed)
- Dynamic straightening of flexible rotors
- Testing of material strength by operating rotors at overspeed
- Rotor investigation in operational bearings.

All these tasks can be performed in a single rotor set up. The most important features of these high-speed balancing systems are shown on the next page.

Rigid bearing supports – Additional stiffness

Rigid bearing supports provide for greater stability, particularly at high speeds. A supplementary, remote controlled change-over facility enables the stiffness of the bearing pedestals to be varied, thus enabling rotor resonance frequencies to be passed through safely, and minimizing the risk of damaging the rotor or the balancing facility.

Balancing and overspeed testing under vacuum

Due to the high windage effect of bladed rotors at high speeds and the associated power and temperature problems, balancing and overspeed testing takes place under vacuum conditions with a residual pressure of approx. 0.5 - 2 mbar.

Explosion proof enclosure

To protect the surroundings from the dangers resulting from a total or partial explosion of the rotor, a variety of different solutions can be recommended:

Longstanding experience has shown that a walk-in tunnel design is most suitable, especially for medium or large facilities. For rotors weighing up to 8 t, with outer diameters up to 1.7 m, an axially sliding vacuum chamber with integrated burst protection can be used. The movable part of the chamber is equipped with several steel liners, which act as burst protection. If the specimen bursts, the burst energy is absorbed by deformation elements in the foundation. A compact design enables the facility to be installed on the shop floor.

Drive system

For high-speed balancing, overspeed testing and dynamic straightening of flexible rotors, either a three-phase servo motor with frequency converter or an infinitely variable DC motor with thyristor control can be used.

## DH 2 - DH 13 High Speed Balancing and Overspeed Test Facility

Depending on the required speed range, a suitable transmission gear has to be installed. A so-called intermediate shaft constitutes the connection between the gear and the over-speed testing chamber. Rotors are coupled to this intermediate shaft by means of precision drive shafts.

Oil supply, vacuum and monitoring systems  
To operate a high-speed balancing facility, a number of auxiliary systems are required, such as:

- Oil supply systems for oil supply to the rotor bearings, the turbo gear and the intermediate shaft of the drive train;
- Vacuum units for evacuation of the overspeed chamber;
- Emergency oil supply.

### Measuring systems

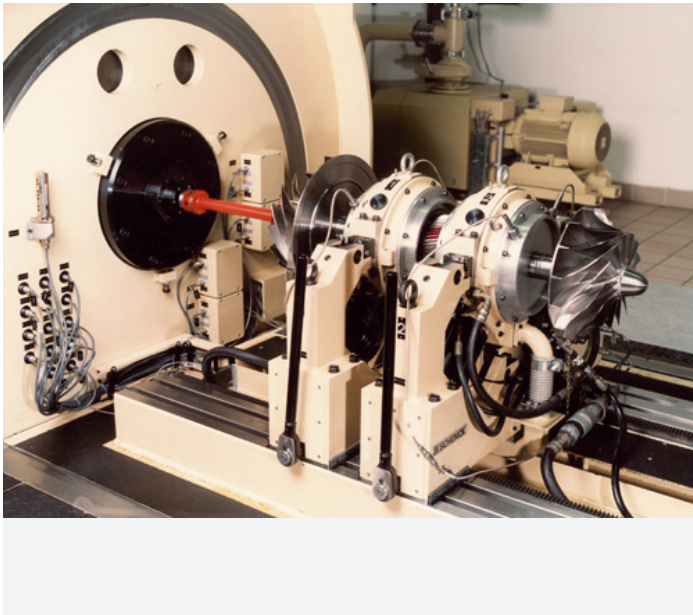
Today the balancing of flexible rotors can be performed with the help of our new measuring system CABFLEX++ Windows NT based. This new measuring system has been designed to process multi-channel frequency selective measuring values very quickly and efficiently. In addition to the correction weights calculated on the basis of the influence coefficient method, we offer different evaluations, like Bode and Nyquist diagrams. Further software options are: shaft orbit, shop verification, runout profile, vibration analysis package, bending line and prognosis. Network compatibility and the possibility to graph the rotor bending line near to natural frequency makes our software package complete.

For the measuring of the shaft vibration, no-contact sensors are used to analyze the rotor behavior in the sleeve bearings, in addition to the moving-coil sensors for unbalance measurement. In addition it is also possible to calculate exactly the extent of rotor deflections at relevant points, such as overhanging parts of the shaft or in the center of the rotor.

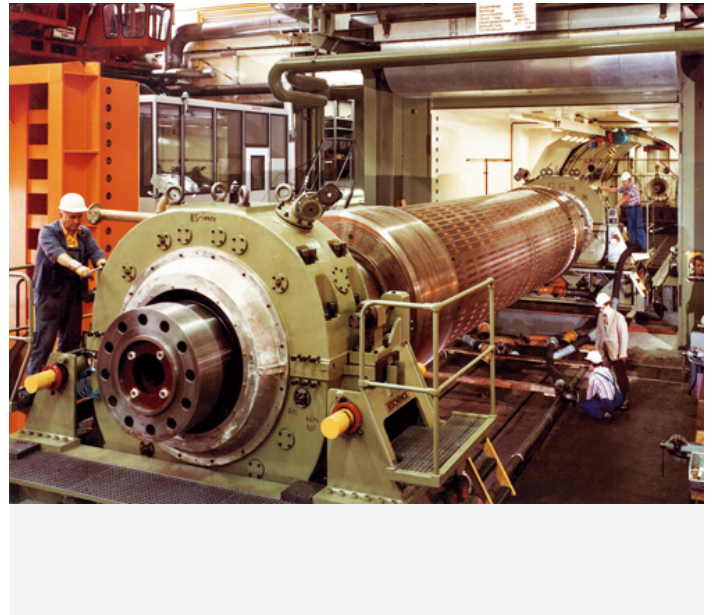
### Facility planning and design

Schenck RoTec is also able to provide the overall planning of the complete facility and supply parts which do not specifically belong to our product range, for instance, electrical drive unit, turbo gear, oil supply or vacuum systems. We are therefore in a position to deliver the complete mechanical engineering of a balancing and overspeed test facility from a single source. For the civil engineering and the vacuum-tight steel liners we are able to offer the complete engineering at extremely reasonable cost (see page 186, Engineering).

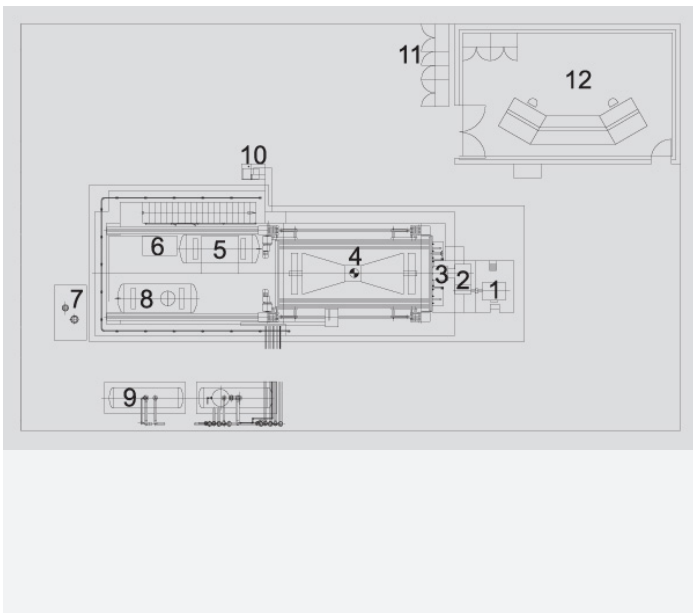
## DH 2 - DH 13 High Speed Balancing and Overspeed Test Facility



For better utilization of overspeed test facilities, several bearing pedestal sizes may be used in one facility. Here, a compressor is shown being balanced in an overspeed test facility size DH 4, using DH 2 bearing pedestals, at test speeds up to 50000 min<sup>-1</sup>.



Mounting of a large generator on DH bearing pedestals



1 Electric drive  
2 Gearbox  
3 Intermediate shaft  
4 Vacuum tunnel  
5 Oil station for vacuum operation  
6 Pump station for lubricating oil  
7 Vacuum pump station  
8 Oil station for atmospheric operation  
9 Emergency oil tank (approx. 10 m above floor)  
10 High-pressure oil station  
11 Switch cabinets  
12 Monitoring room

Plan view (non-binding example. Dimensions depend on the relevant version)

## DH 2 - DH 13 High Speed Balancing and Overspeed Test Facility

Technical data at a glance		DH 2	DH 3	DH 30	DH 4
Rotor weight (max.)	[t]	0,16	0,32	0,63	1,25
Diameter (max.)	[mm]	900	900	900	900
Speed (max.)	[min <sup>-1</sup> ]	1,500 to 63,000 depending on drive	1,500 to 63,000 depending on drive	1,500 to 63,000 depending on drive	1,500 to 63,000 depending on drive
Drive power	[kW]	55 to 8,000 depending on drive	55 to 8,000 depending on drive	55 to 8,000 depending on drive	55 to 8,000 depending on drive
Technical data at a glance		DH 5	DH 50	DH 6	DH 7
Rotor weight (max.)	[t]	2,5	4,5	8	12,5
Diameter (max.)	[mm]	1100	1300	1700	1700
Speed (max.)	[min <sup>-1</sup> ]	1,500 to 63,000 depending on drive	1,500 to 63,000 depending on drive	1,500 to 63,000 depending on drive	1,500 to 63,000 depending on drive
Drive power	[kW]	55 to 8,000 depending on drive	55 to 8,000 depending on drive	55 to 8,000 depending on drive	55 to 8,000 depending on drive
Technical data at a glance		DH70	DH 8	DH 9	DH 90
Rotor weight (max.)	[t]	20	32	50	80
Diameter (max.)	[mm]	2250	2800	3300	4000
Speed (max.)	[min <sup>-1</sup> ]	1,500 to 63,000 depending on drive	1,500 to 63,000 depending on drive	1,500 to 63,000 depending on drive	1,500 to 63,000 depending on drive
Drive power	[kW]	55 to 8,000 depending on drive	55 to 8,000 depending on drive	55 to 8,000 depending on drive	55 to 8,000 depending on drive
Technical data at a glance		DH 10	DH 11	DH 12	DH 13
Rotor weight (max.)	[t]	125	200	320	500
Diameter (max.)	[mm]	4400	4700	5100	5500
Speed (max.)	[min <sup>-1</sup> ]	1,500 to 63,000 depending on drive	1,500 to 63,000 depending on drive	1,500 to 63,000 depending on drive	1,500 to 63,000 depending on drive
Drive power	[kW]	55 to 8,000 depending on drive	55 to 8,000 depending on drive	55 to 8,000 depending on drive	55 to 8,000 depending on drive