Modern turbomachinery for oil & gas applications, such as hermetically sealed compressors with integrated electric motor or turboexpander drives, requires the use of magnetic bearing systems. Together with MECOS, MAN Diesel & Turbo provides state-of-the-art magnetic bearing solutions for oil & gas applications.

MECOS has extensive experience with digitally controlled magnetic bearing systems. Our experience with leading OEMs in the oil & gas and other markets (such as semiconductor industry, high-power lasers), enables us to understand today’s requirements and to provide solutions for tomorrow. Whether superior digital control, proven upstream gas technology or user interface, MECOS can provide the perfect magnetic bearing solution.

MECOS Magnetic Bearing Technology for turbomachinery in oil & gas applications

Application Examples

Compressor

Main features of MECOS AMB technology

- Turbomachine control architecture
- Superior system with up to 9 axes from a single cabinet
- Advanced amplifier control
- Stable system under varying conditions
- Fast start, stable operation
- Advanced monitoring capability
- Enables preventive maintenance
- Short response time for first-level troubleshooting
- Software tool for field balancing of completely assembled machines
- Reduces pre-balancing requirements
- Increases quality of balancing
- Fully digital signal processing and control
- Superior PC tools for online measurement and postprocessing
- All sensor parameters are adjusted/optimized by means of the digital controller
- No hardware adaptations necessary
- Maximally reduced commissioning time

Main advantages of MECOS AMB technology

- Massively reduced commissioning time
- No hardware adaptations necessary by means of the digital controller
- All sensor parameters are adjusted/optimized
- Highly efficient service interface
- High dynamic control
- Superior vibration reduction
- Increased quality of balancing
- Improved bearing non-linearity compensation
- Advanced controller functions

Turboexpander

Large-turbine compressors for pipeline and storage application

- Multi-stage compressors
- AMB systems for control of up to 9 axes
- Typical rotor weight between 2 and 3.5 tons
- Rotational speed up to 12,000 rpm

Magnetic bearing solutions for tomorrow. Whether superior digital control, proven upstream gas technology or our experience with leading OEMs in the oil & gas and other markets (such as semiconductors industry, high-power lasers), enables us to understand today’s requirements and to provide solutions for tomorrow. Whether superior digital control, proven upstream gas technology or user interface, MECOS can provide the perfect magnetic bearing solution.

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The MBX10/20 is a high-power, state-of-the-art control system cabinet designed for turbomachines with magnetic bearing systems. With its high supply voltage and advanced digital control architecture, it is the industry’s most dynamic control cabinet in this class.

In the basic configuration, the MBX10/20 controls 5-axis machines. Due to its modular design it can easily be extended to 7- or full 9-axis control and therefore drives turbomachines with up to 4 radials and one thrust bearing.

Advanced controller functions

Fully digital controller

The MBX10/20 features a very powerful, full digital multi-core control system. For high turbulence and critical line applications, the sensor signals are processed fully digitally. As a result, the MBX10/20 is highly insensitive to external electrical disturbances.

To provide the best dynamic, the power amplifiers are also controlled by the digital core which allows for compensation of bearing non-linearity.

Superior vibration reduction

The main source of machine vibration and turboexpander is the residual unbalance of the rotor as well as higher harmonic sensor disturbances, induced e.g. by scratches on the sensor targets. The MBX10/20 offers different control strategies to reduce the level of vibrations resulting from the named sources.

- Adaptive tracking filters minimize synchronous forces due to unbalance (SFICU)
- Unbalance force counteracting control (SFICC) is essential for crossing bending criticals.
- Open-loop output compensation filters are used to cancel out higher harmonic disturbances and to avoid potential amplifier saturation.

Control Cabinet Family MBX10/20

Features of MECOS MBX10/20

- Superior vibration reduction
- Advanced controller functions
- Highly efficient service interface

Highly efficient service interface

The key to short commissioning times and unmatched dynamic identification capabilities, is the service and measurement interface to the MBX10/20. Installed on a remote PC, it allows for multivariable transfer function and signal spectra measurements. Furthermore, these functions allow the system dynamics to be identified, complemented with previous rotordynamic modeling and optimized prior to rotation as well as during commissioning.

These capabilities extend the need for bulky dynamic signal analysis equipment on site. The robustness assessment of the control system according to ISO 14839 is virtually built into the system.

- Supervision of rotor elongation caused by thermal expansion (rotund axial position sensors)
- Monitoring and supervision

Monitoring and supervision

The MBX10/20 features versatile monitoring and supervision capabilities to protect the machine and the control cabinet from excessive load and damage.

- Supervision limit values are set according to customer requirements.
- Advanced trend data logging
- High compressors/turbomachines power densities
- Compact design

- Flexible system interface
- Open-loop runout compensation filter
- Advanced controller functions
- Unbalance force counteracting control (SFICC) is essential for crossing bending criticals.
- Open-loop output compensation filters are used to cancel out higher harmonic disturbances and to avoid potential amplifier saturation.
Magnetic Bearing System

Bearing Components

MECOS offers a very robust magnetic bearing design. Based on our extensive experience with high-volume applications in many different fields, MECOS can provide bearing components in standard, molded or liquid-proof technology.

- FE-optimized magnetic design and minimized eddy currents.
- High-load capacity up to 30 kN radial and 80 kN thrust.
- Validated by force measurements.
- No use of non-ferrous metals in order to increase insensibility to gas residues in pipelines (e.g. glycol).
- Vacuum pressure impregnation (VPI) for use in harsh environments (e.g. sour-gas environment).

Sensors

Reliable sensor technology is fundamental to Active Magnetic Bearing systems. Accurate and highly dynamic sensors are the basis for position control. Measurement of the rotational speed is needed to implement speed-dependent control parameters and supervision limits.

- Inductive or eddy current type.
- 4 sensed channels in one sensor unit (3 displacements, 1 rotation) spare pulse sensor.
- Low noise and high resolution design. Integrated shielding against external magnetic fields.
- Signal quality independent of cable length. Cable lengths of up to 300m and more. No impedance conversion necessary.
- Rugged design scalable in size. Qualified for harsh environments, such as sour-gas environments.

Sour-gas-proven technology

Based on thousands of hours of industrial operational experience with the materials used in our bearings, MECOS can offer active magnetic bearings for wet and sour gas applications.

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MECOS – magnetic bearing technology for turbomachinery in oil & gas applications