

BALANCING SYSTEMS

ELECTROMECHANICAL BALANCING HEADS




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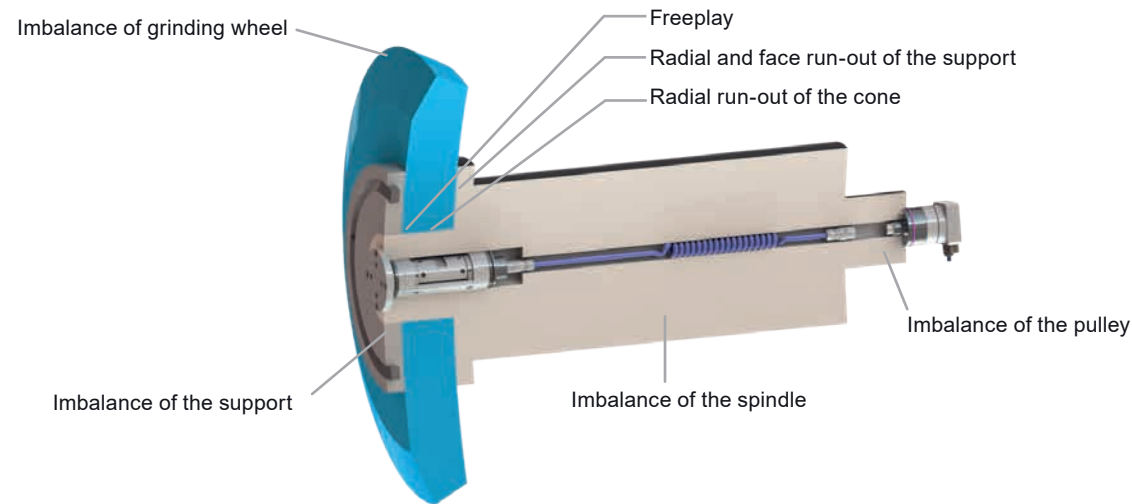
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Why it is so important to balance the grinding wheel...

Our balancing systems are based on a precision mechanical balancing head and a well-established balancing strategy. The use of balancing systems ensures that unbalances are detected early and dealt with in time. This provides our customers a constantly high level of workpiece quality and a long machine and tool life.



Optimally balanced grinding wheels and drive elements are essential for consistently high workpiece quality and increased service life of the grinding wheel and the life of the grinding spindle. Setup times will be minimized.

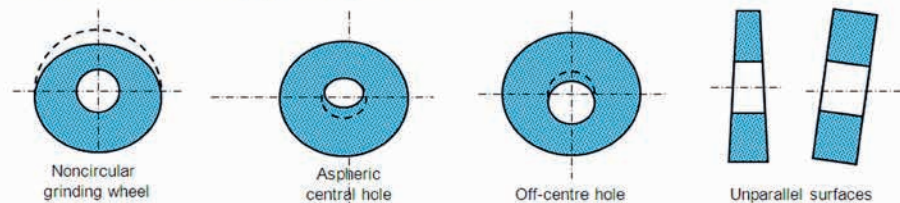
Quality

Each body fixed on a rotating axis has imbalances that manifest themselves as vibrations or oscillation and noise.

Imbalance occurs when material is not distributed symmetrically about the axis of rotating bodies. Especially at high speeds this results in increased vibration and wear. The imbalance can be either static or dynamic in form. In most cases, both forms occur simultaneously.

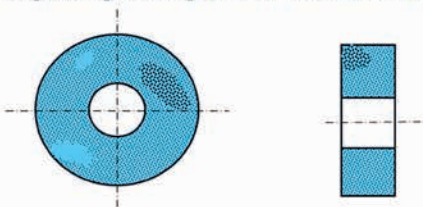
Imperfections in grinding wheel geometry

unbalances caused by grinding wheel



Grinding wheel heterogeneity

irregular grinding wheel structure/density distribution



Balancing methods

As the spindle runs up and the grinding wheel rotates, an imbalance is generated that causes the grinding wheel to vibrate. Even small imbalances in the wheel or in the clamping device generate large centrifugal forces at high circumferential speeds.

The vibrations are detected by the accelerometer, recognised and processed by the balancing system. The wheel is balanced by adjusting the positions of the integral masses (manually or electromechanically in the balancing head) - as a counterweight to the imbalance.

The balancing process will be repeated as soon as a new unbalance is detected by the vibration sensor (set limit) or the grinding wheel is changed / renewed.

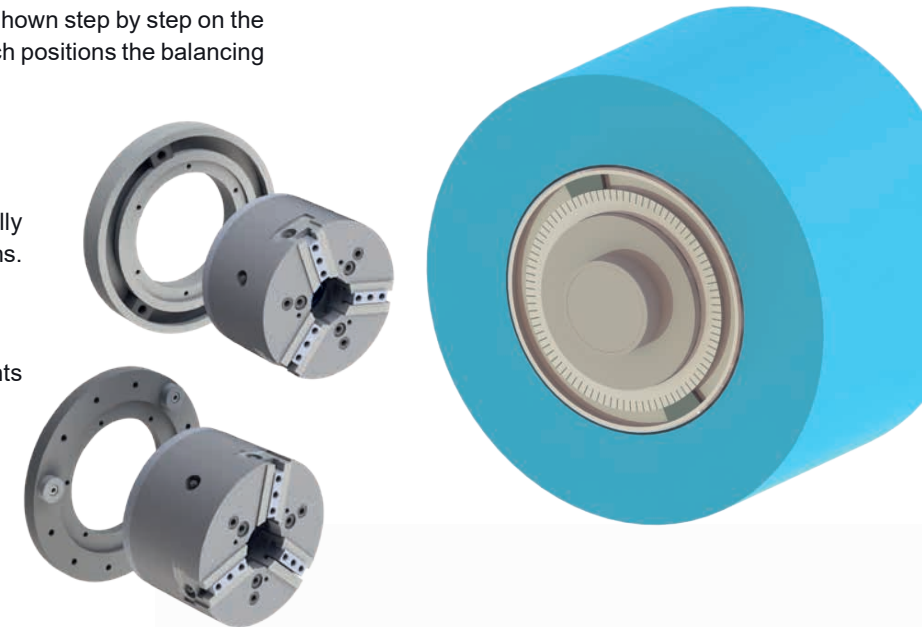
During **manual balancing (pre-balancing)**, the imbalance of the wheel is measured while the machine is running. The user is shown step by step on the software interface what needs to be done, e.g. to which positions the balancing weights are to be moved or attached.

Spread angle method:

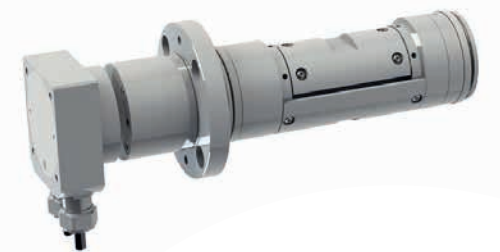
Imbalance is compensated for by shifting two equally heavy weights (sliding blocks) to the calculated positions.

Fixed position method:

Imbalance is compensated by adding defined weights (e.g. screws) at specific positions.



Specially developed for use on precision machine tools, the balancing devices measure the size and position of the imbalance in one plane or in two planes and compensate for them with high precision between grinding cycles. The electromechanically adjustable balancing masses (Balancing heads) are supplied by contactless energy transmission and the balancing takes place **fully automatically** at operating speed.



With **hydro balancing systems**, the imbalance is compensated by injecting emulsion or oil into the three or four balancing chambers of the expansion tank (container) or directly into chambers that are integrated in the grinding wheel flange. This enables quick and precise balancing to be achieved.

The hydro tank can be adapted to the respective machine in a wide variety of customer-specific designs and is therefore ideal for retrofitting older machines that previously had no integrated automatic balancing system.



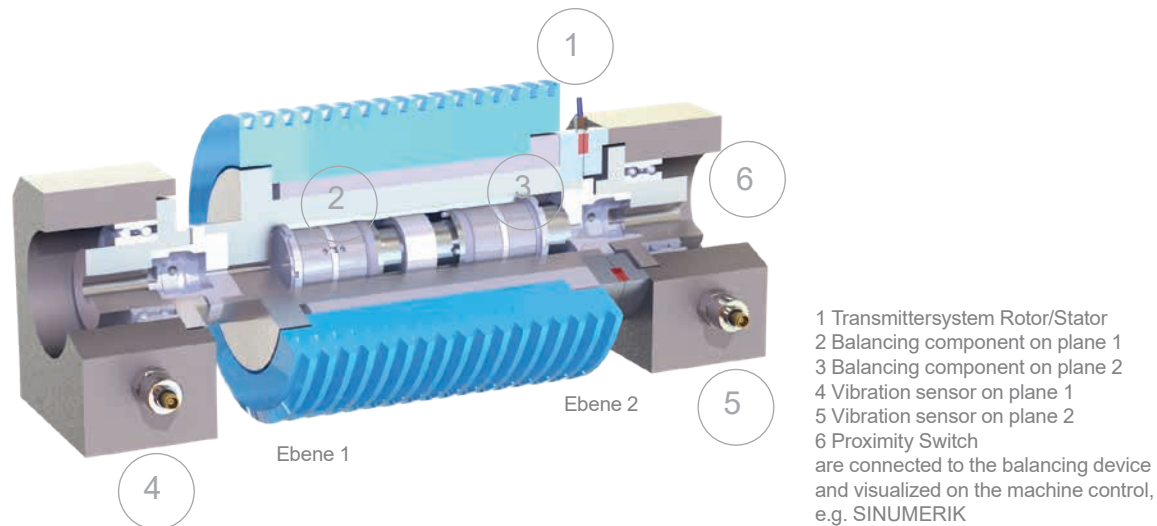
Automatic balancing systems

The mechanical balancing system for the detection, counterbalancing and compensation of imbalance consists of a balancing head, a highly precise acceleration pick-up and the electronic module. Depending on the design of the balancing head it is possible to integrate an Acoustic Emission sensor. So the extension of the system by an Acoustic Emission Module is easily made due to the modular design. This further optimizes the overall performance.

By moving the compensation masses on the balancing head, the system recognizes whether the masses are moving in the right direction and thus cancel the imbalance.

In automatic mode, the electronics process the weights fully automatically until the switch-off threshold is reached or the disc is completely balanced (trial & error process)

While for the deterministic type balancing process, the angular position of the masses in a deterministic balancing head is known by virtue of its internal encoders. The angular position of the imbalance is also known so the masses can be driven directly to a calculated position for optimal compensation. This also results in a much faster balancing cycle. The masses can be moved both at standstill or while the head is rotating.

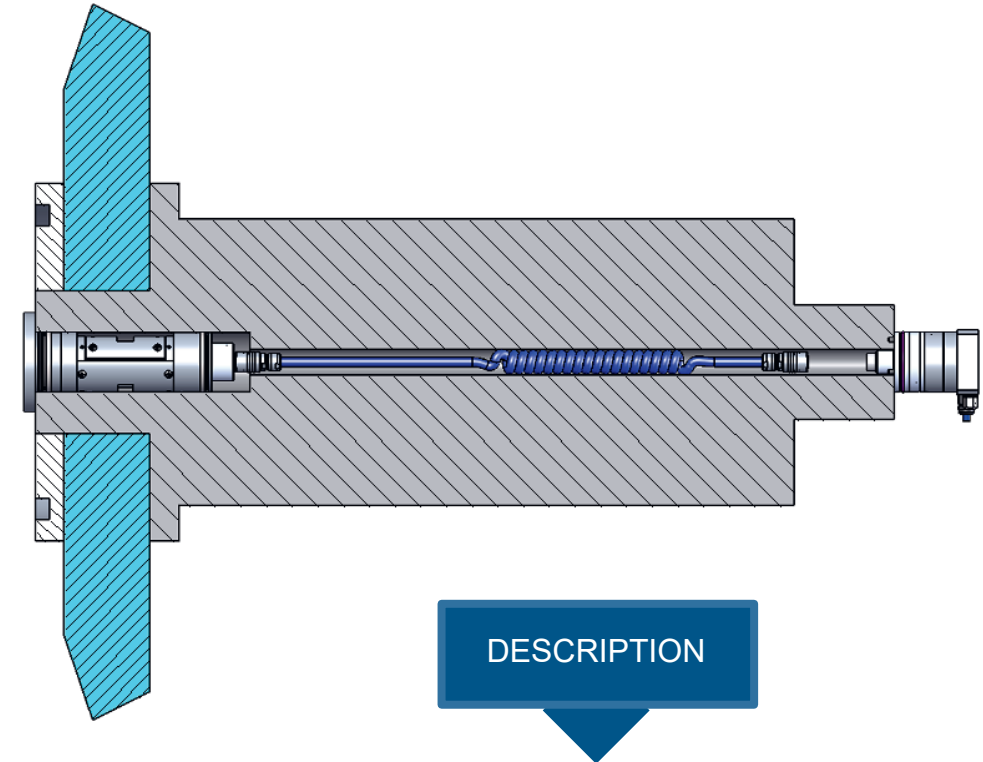


the constant unbalance monitoring and continuous balancing or rebalancing leads to:

- + improved workpiece surfaces (without chattermarks)
- + reduced spindle bearing wear
- + prevents material fatigue and failure of important parts
- + shortened machine and spindle downtime
- + lower grinding wheel erosion
- + and less dressing operations
- + Machine and user are better protected

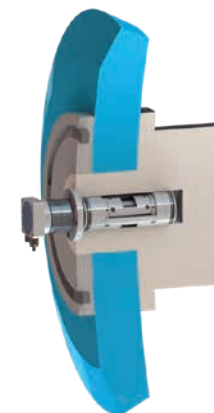


Benefits



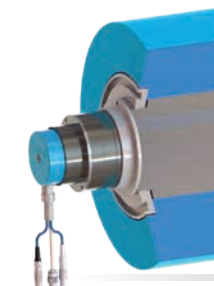
DESCRIPTION

The electronics enable detection, evaluation and monitoring of the imbalance on the spindles or grinding wheels. Fast and precise compensation is performed by a contactless balancing system - fully automated and at operating speed.



Integrated Balancing heads (ST - spindle type): for mounting and operation inside the spindle. They are usually used on high specification machines operating at higher speed that demand lower levels of vibration.

Balancing heads are available with a range of diameters, lengths and capacities to suit most spindles and wheels and can be fitted with an acoustic sensor to check the grinding and dressing process. Furthermore flange or expansion self-locking systems are available to lock them to the spindle.



Flange mounting (FT - flange type): installed on the grinding wheel flange, outside of the spindle. They are usually used on simple and economical grinding machines, without the automatic grinding wheel change. They are very easy to install and therefore ideal for retrofitting and can be fitted with an acoustic sensor to check the grinding and dressing process.



Electromechanical balancing heads - integrated heads (ST - spindle type)

The balancing heads for installation in the spindle are provided with contactless transmission and a built-in acoustic emission sensor.

Balancing heads with coplanar masses (as opposed to adjacent masses) are generally used in high speed spindles with CBN wheels.

The coplanar design of the balancing heads serves to reduce the moment imbalance due to the avoidance of two different centers of gravity. All versions contain a broadband acoustic sensor. They are available either with a rotor connection via a spiral cable or with a built-in transmission system.

USE

Applications:

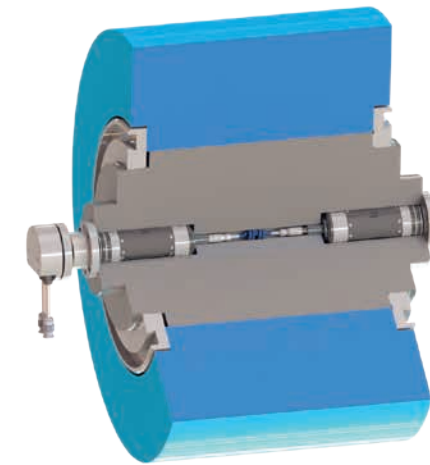
For all grinding machines with a frontal spindle bearing

Advantages:

- Balancing head in the centre of imbalance
- RPMs up to 30,000 1/min
- Minimum interference
- No maintenance
- AE sensor can be integrated
- Non-contact power transmission

Contactless transmission

The contactless transmission could be on spindle end or directly mounted on the balancer in front of the spindle. The contactless transmission is maintenance free and it is possible to integrated rpm-sensor and Acoustic Emission Sensor.



When using 2-plane automatic balancing, the unbalance is measured and corrected on two levels, thus reducing the dynamic imbalance.

TECH SPECS

| Type | outside Ø [mm] | capacity max. [gcm] | max. rpm |
|-------|----------------|---------------------|----------|
| ST 24 | 24 | 25 | 24000 |
| ST 28 | 28 | 50 | 20000 |
| ST 30 | 30 | 80 | 30000 |
| ST 32 | 32 | 100 | 19000 |
| ST 38 | 38 | 400 | 20000 |
| ST 42 | 42 | 640 | 15000 |
| ST 50 | 50 | 1300 | 10000 |
| ST 55 | 55 | 1500 | 8500 |
| ST 60 | 60 | 2200 | 7500 |
| ST 70 | 70 | 3300 | 6000 |
| ST 81 | 81 | 8500 | 1400 |

Mounting

Two options are available for fixing the balancers in the spindle. The first uses a flange type mount



ST-Balancing head integrated in a HSK-Shaft with ring-transmission

and the second employs an expanding collar to clamp within the spindle bore. The multitude possibilities of flange design allow to fix the balancer convenient in customer made spindle bore.

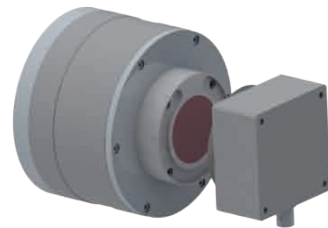
Electromechanical balancing heads - Flange mounted (FT- flange type)

TECH SPECS

| Type | outside Ø [mm] | capacity max. [gcm] | max. RPM | | |
|-------|-------------------|------------------------|----------------------|--------------------------------|---------------------------------|
| | | | Retraction (FTR)* | contactless transmission ** | attached transmission (AT)** |
| FT 50 | 50 | 320 | - | 12000 | - |
| FT 70 | 70 | 550 | - | 11000 | 10000 |
| FT 80 | 80 | 800 | 4000 | 10000 | 10000 |
| FT102 | 102 | 2.300 | 3000 | 5500 | 5500 |
| FT122 | 122 | 4.400 | 2000 | 4000 | 4000 |
| FT142 | 142 | 7.400 | 1700 | 2000 | 2000 |

* FTR balancing heads for use with P1dWB, P1, P7 and Blü Systems

** This transmission with working only with DS5000 and DS6000 Systems.



"Retraction" -

Retractable contacts (FTR)

The contacts which transmit power to the balancing head are normally open and are only closed during the balancing cycle. The retractable contacts provide maintenance free performance, and a long life. No option for Acoustic Sensor.

Non-Contact Power Transmission (C or CT / CG)

Contactless transmission is maintenance free. Integrated rpm and Acoustic Emission sensor options are available.

Attached transmitter (AT)

The attached transmitter is directly connected to the balancer. The signal transmission will be contactless. Easy to mount and with acoustic emission sensor and integrated RPM sensor possible.



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VERSIONS

The versions available, of balancing heads with external and internal spindle installation, meet the most disparate application requirements:

Balancing heads with retractable contact (FT R):

The motors are driven with retractable brushes which are closed only during the balancing cycle. The balancing head consists of a single component and therefore does not require any support for the stator.

Balancing heads with contactless transmission (FT C):

Heads with contactless transmission consist of two parts (stator and rotor). Power for the motors is transferred between stator and rotor by electromagnetic induction. Signals for managing the balancing cycle i.e. controlling motor movement and direction are transmitted via contactless optical link between stator and rotor.

These heads also feature a neutral position cycle that places the masses diametrically opposite each other - this is useful after a grinding wheel change and minimises the influence of the balancing head on the overall balance.

Balancing heads with contactless transmission and built-in acoustic emission sensor (FT CG):

These heads combine the characteristics and functions of the contactless balancing heads with a wide band acoustic sensor operating close to the grinding wheel. The sensor can be used to detect contact between wheel and workpiece for grinding monitoring and between wheel and dresser for wheel dressing.

Costs are reduced with shorter cycle times, improved wheel wear and collision detection.

Balancing heads with connected transmitter (FT AT):

Heads with connected stator combine the functionality of contactless transmission with a mechanically linked rotor and stator. Therefore, as with the retractable contacts type, no support is required for the stator.

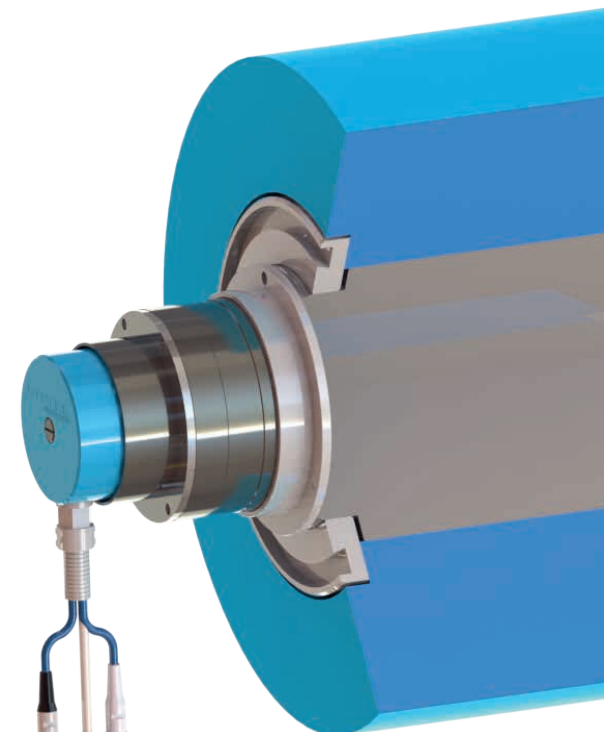
BENEFITS

Applications:

For all grinding machines without automatic quick change

Advantages:

- Suitable for retrofitting
- RPMs up to 12,000 1/min
- Easy to assemble
- Compact design
- No maintenance
- AE sensor can be integrated



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Manual balancing system for rotary tables on machine tools

Unbalance is on machine tools the most common source of vibrations. Balancing of the tool holder and the spindle is of great benefit.

While „Pre-balancing“ (manual balancing) the imbalance is determined by an accelerometer on the machine and balanced by attaching or moving predefined masses in the workpiece holder according to calculated positions.

For the calculation, the system suggests the optimum balancing weight to be used out of a table of freely programmable weights. With the spread angle method, the compensation takes place by shifting the weights on a 360° scale.

With the fixed position method the P6001FD algorithm is used to determine the best positions out of a maximum of 24 in which to fix two or three weights. The electronics also offers a continuous monitoring of the vibration of rotating elements.

The functions are displayed, operated and set on the machine control, a Windows PC or via the customer-specific software interface. Profibus, Profinet and serial interfaces are available for the control signals.

The P6001FD module was especially designed for the use on machine tools rotating at low RPM.

Filtered-RPM-imbalance monitoring for RPM range 80-6000 1/min

Continuous imbalance monitoring

Intelligent and customizable graphical user interface

ProfiBUS, ProfiNET and static I/Os communication channels

Visualization through Ethernet connection

Simple software integration

Simple factory reset function in case of servicing (series setup)

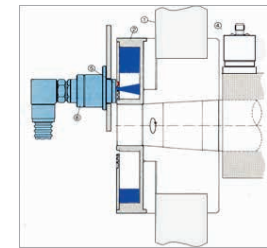
Individual adjustable user levels

Advantages

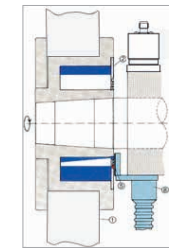
The hydro-balancing system can be used on any grinding machine.

The imbalance is compensated for by injecting coolant or oil into 3 or 4 balancing chambers, which are integrated into a balancing container or directly into the grinding wheel flange.

The balancing container can be delivered in various designs depending on the specifications of customers' machines. This makes it very easy to retrofit the system on older machines having no existing integrated automatic balancing system till now.



Hydro-Tank mounted on wheel flange



Hydro-Tank integrated in wheel flange

BENEFITS

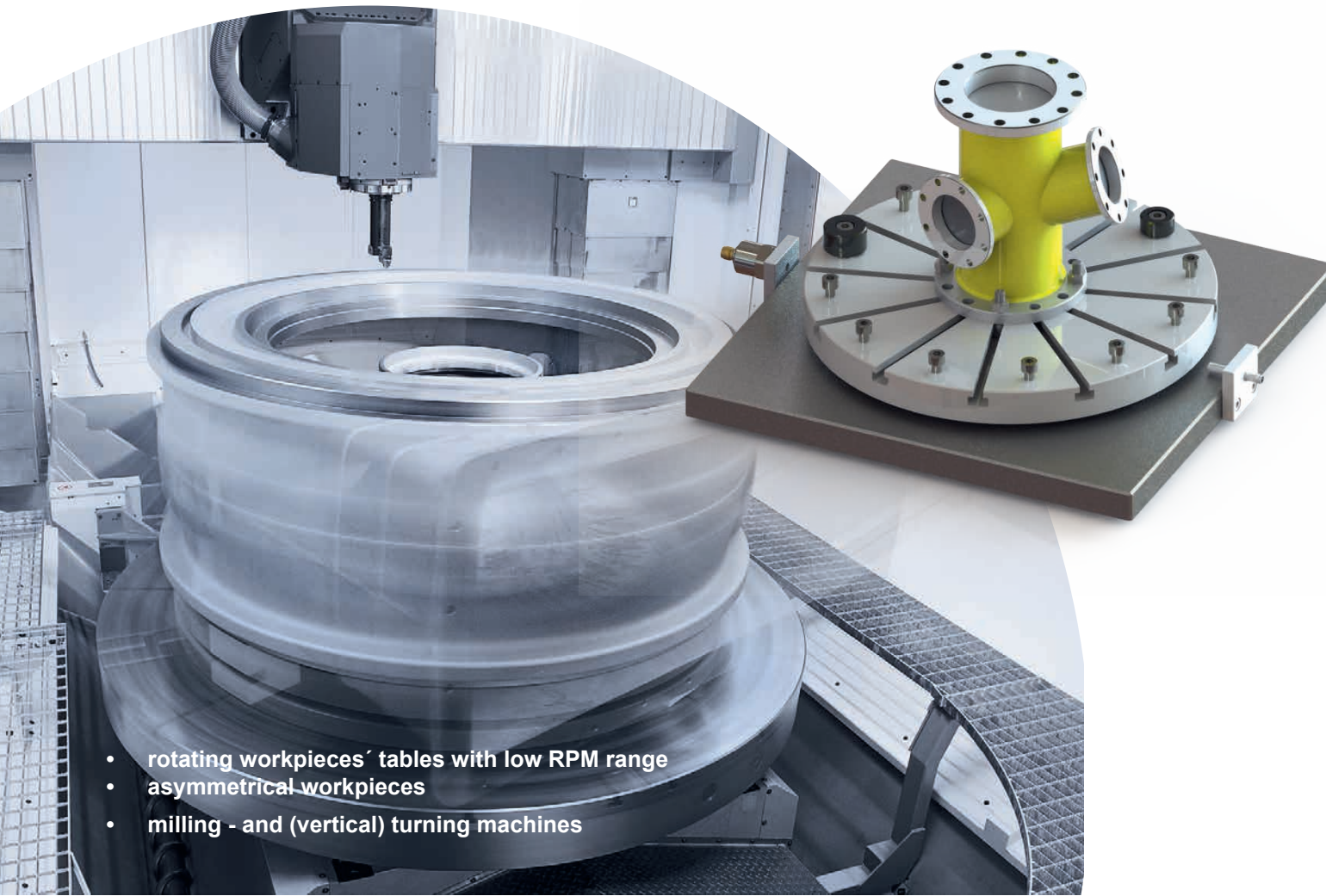
Application:

- wheel, nozzle unit mounted in protective cover
- Balancing container mounted behind the grinding wheel, nozzle unit mounted on spindle housing
- Balancing chambers integrated into grinding wheel flange, nozzle unit mounted on wheel housing or protective cover
- For all grinding machines with automatic grinding wheel change
- For spindles where a standard balancing head cannot be mounted

Advantages:

- Simple to retrofit
- Flexible design
- RPMs up to 20,000 1/min

Hydro-Balancing System



- rotating workpieces' tables with low RPM range
- asymmetrical workpieces
- milling - and (vertical) turning machines