

Franke Whitepaper



Bearing assemblies with Torque-Drive

Highly dynamic and efficient



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1. Introduction

Movement through direct drive

1.1. Definition direct drive

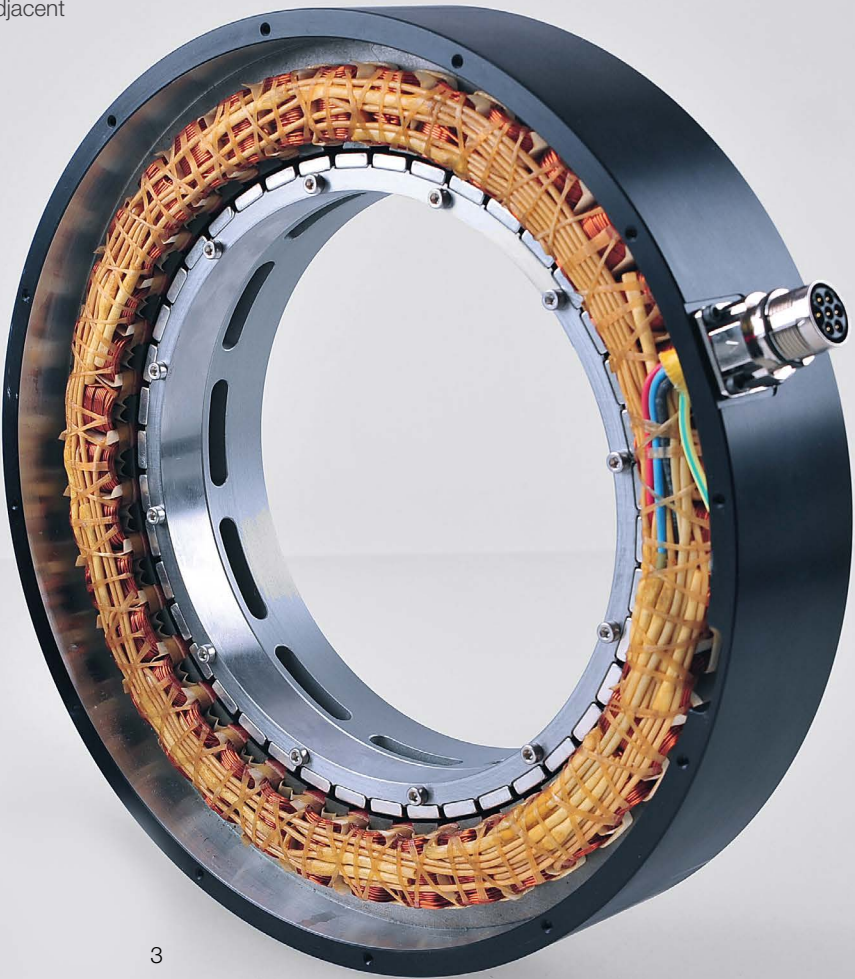
In a direct drive, the motor and driven component are directly connected. There is no need for intermediate elements for power transmission such as gears, shafts or belts. Changes in motor speed have a direct effect on the driven component in rotary applications. Direct drives are suitable for rotary and linear movements. This info sheet is intended to deal with the use in rotary applications.

1.2. Components: bearing assembly with direct drive

In a bearing assembly with direct drive, all components are integrated into the bearing housing. Essentially these are:

- Ball bearing consisting of raceways, rolling elements and cage
- Rotor with magnets
- Stator with winding coils
- Enclosing housing with connector for motor cable and threaded holes for mounting the adjacent construction.
- Measuring systems

Only the control system is required externally. Further drive elements are not necessary.



2. Comparison: Conventional drives vs. direct drive



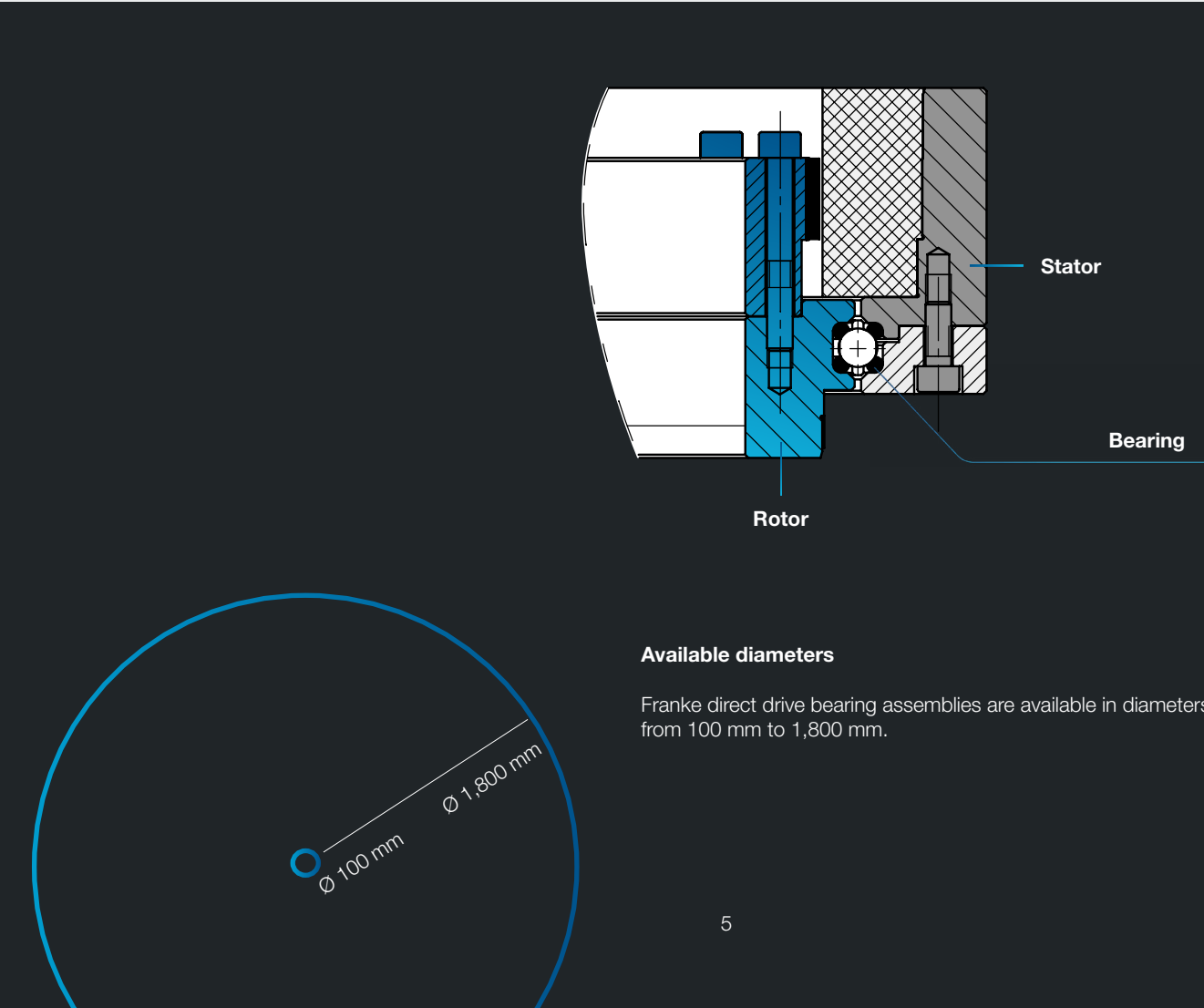
Features	Worm gear	Pinion drive	Toothed belt	Direct drive
Rotation speed	+	++	++	+++
Installation space	+	++	++	+++
Torque	+++	++	+	+++
Maintenance	+	+	+	+++
Wear / Durability	+	+	+	+++
Cleanliness	+	+	++	+++
Precision	+++	++	+	+++
Costs	+	++	+++	+

3. Functionality of direct drive (Torque-Motor)

Torque motors are integrated directly into bearing assemblies. The customer receives a completely ready-to-install system. Due to the direct control, it is not only possible to generate a rotary motion, but also to position extremely precisely or to execute defined cycle steps.

Bearing assemblies with integrated direct drives are characterized by maximum energy efficiency. The moving masses are significantly lower and power loss due to factors such as friction and backlash is minimized.

The coils of the torque motor are integrated in the stator and the magnets are mounted on the rotor.

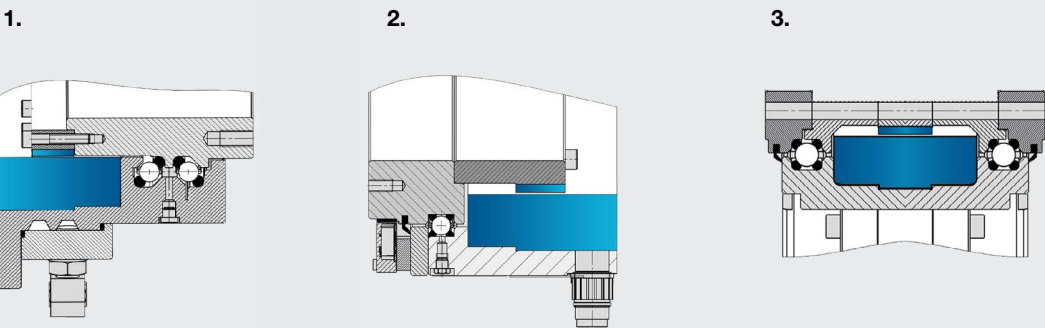


4. Design example: bearing assemblies with direct drive

When using a wire race bearing for the bearing arrangement, the basic advantages inherent in the principle of the wire race bearing system come into play:

- free design of the enclosing housing parts
- free choice of materials for the housing parts (e.g. steel, stainless steel, aluminum, plastic)

Examples of integration of bearing and drive in a common housing:



- 1. Franke-Torque with water cooling, KKØ 300mm
- 2. Franke-Torque in steel version, KKØ 150mm
- 3. Franke-Torque in aluminum version, KKØ 350mm



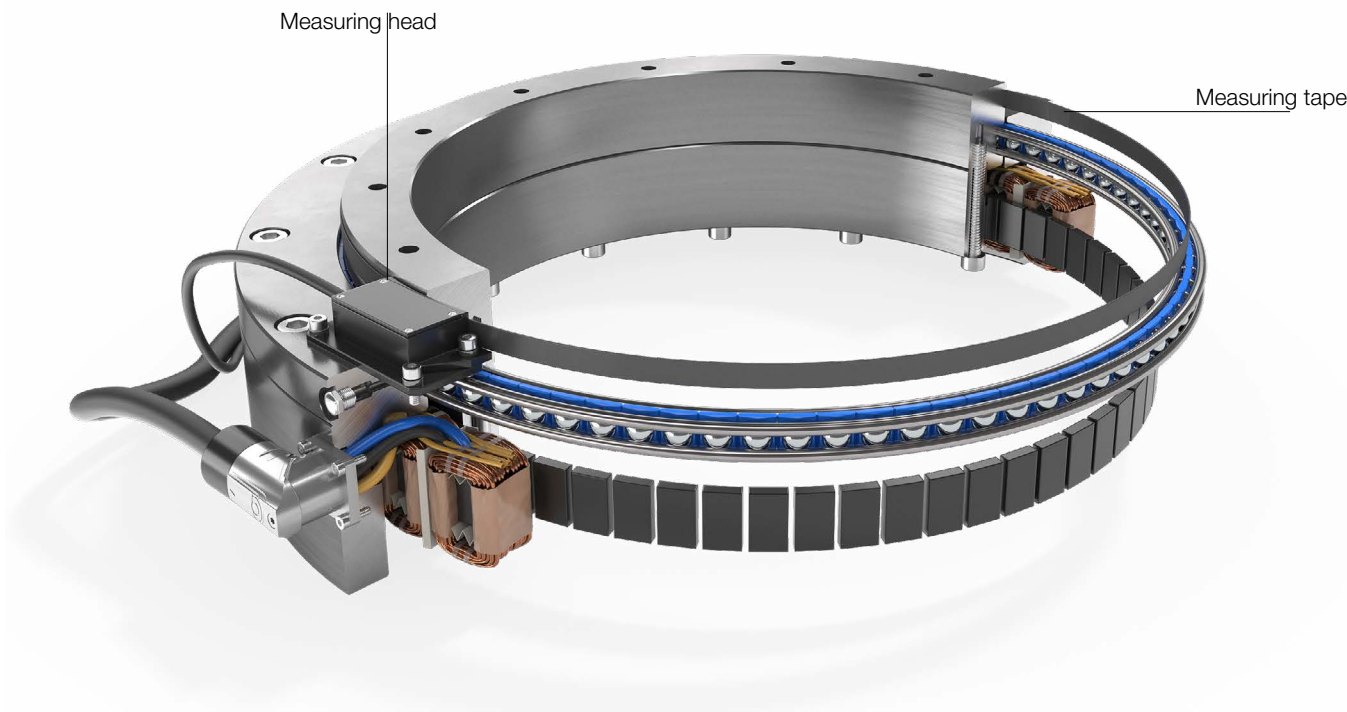
5. Measuring systems: As individual as your application

All available measuring systems usable

All measuring systems available on the market can be integrated into the bearing assembly. Very robust inductive measuring systems are used as standard. They are available as incremental or absolute systems in various accuracy classes. The following interfaces are available:

- Inkrementelle Systeme: TTL, 1Vss,
- Absolute Systeme: EnDat 22; Fanuc, BiSS, SSI – 1Vpp.

The (closed) measuring tape is attached directly to the rotor and the measuring head is screwed to the stator. It is also conceivable to attach a measuring system to the continuing construction. For larger quantities, any diameter is available.



6. Against gravity: Bearing assemblies with segmented direct drive

In a groundbreaking technological development, Franke presents itself as a pioneer in the field of advanced bearing technologies with the bearing assembly with segment motor. This innovative solution integrates a wire race bearing with a motorized direct drive that overcomes the traditional limitations of vertical bearing applications.

Characteristics: Precise design for maximum performance

The bearing assembly with segment motor is characterized by a unique structure. The integrated motor, whose stator windings only cover the upper half of the bearing, enables an impressive performance of up to 300 revolutions per minute. This innovative design ensures an optimal balance between power and weight, resulting in exceptional performance.

Special feature: Overcoming gravity - an evolution in storage technology

The key feature of the segmented bearing is the electromagnetic force of the stator acting upwards on one side. This reduces the force of gravity acting on the rotor, which relieves the integrated bearing of the weight of the rotor. The result is a relieved mode of operation and thus a considerably longer service life compared to conventional roller bearings.

Suitable applications: Highly dynamic rotary movements

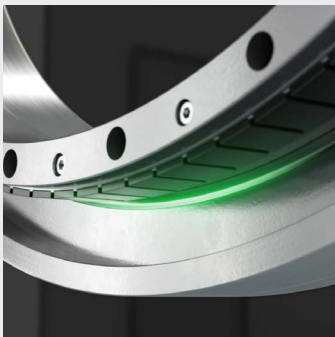
Bearing assemblies with segment motors are used in devices and machines in which rolling bearings are used vertically at high speeds. Examples include processing machines and computer tomographs. The precise and low-load operation makes them ideal for scenarios in which the highest demands are placed on performance.

Advantages: Longer service life and contribution to sustainability

The advantages of this innovative bearing solution are manifold. In addition to the impressive service life and extended maintenance intervals, slewing rings with segment motors make a significant contribution to sustainable design. By reducing wear and optimizing operation, they help to conserve resources and minimize the ecological impact.

Running performances of up to one billion revolutions are possible without any problems. The total cost of ownership more than makes up for the slightly higher purchase price.

The fusion of innovation and technical excellence in bearing assemblies with segment motors redefines the standards in the bearing industry. This development not only promises efficiency and precision, but also paves the way for a more sustainable future in industrial manufacturing.



Technical data:

Max. Speed:	300 rpm
Noise development at	
300 rpm	66,7 dBA
200 rpm	61,4 dBA

Service life due to virtually load-free running:
1 billion revolutions

The video on YouTube:



7. Application examples: Performance for many industries

Bearing assemblies with direct drives are suitable for numerous applications in many industries. Advantages result from the high performance of the direct drives in the areas of energy efficiency, dynamics and precision.

The use of integrated wire race bearings enables further advantages such as weight savings, robustness and high center clearance to be realized.



1. Computer tomograph

Bearing assemblies with direct drive ensure high precision in the main bearing of computer tomographs.



2. Filling line

The bearing assembly with direct drive is made of stainless steel and fitted with special seals. This gives the complete system consisting of bearing and drive the best possible protection against environmental influences and cleaning agents. Since no gears need to be lubricated, the drive is particularly clean.



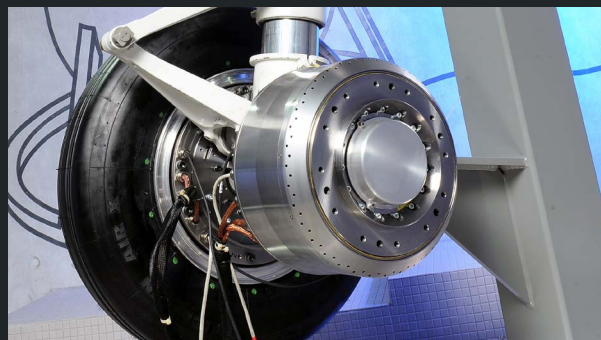
3. Measurement of pipeline tubes

Due to its large center clearance, the bearing assembly with Direkt drive allows ideal placement of the measuring optics. No further elements are required to drive the bearing.



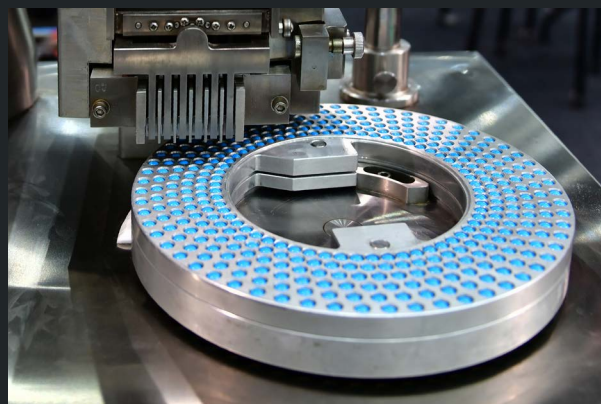
4. Radar antenna on telescopic boom

Bearing Assemblies with direct drive are suitable for applications where high performance and low space requirements are important criteria. The integration of the drive into the bearing housing means that wear-prone assemblies for transmitting drive power, such as toothed belts, pinions or gears, can be dispensed with. This reduces maintenance costs, increases efficiency and improves both the speed range and positioning accuracy.



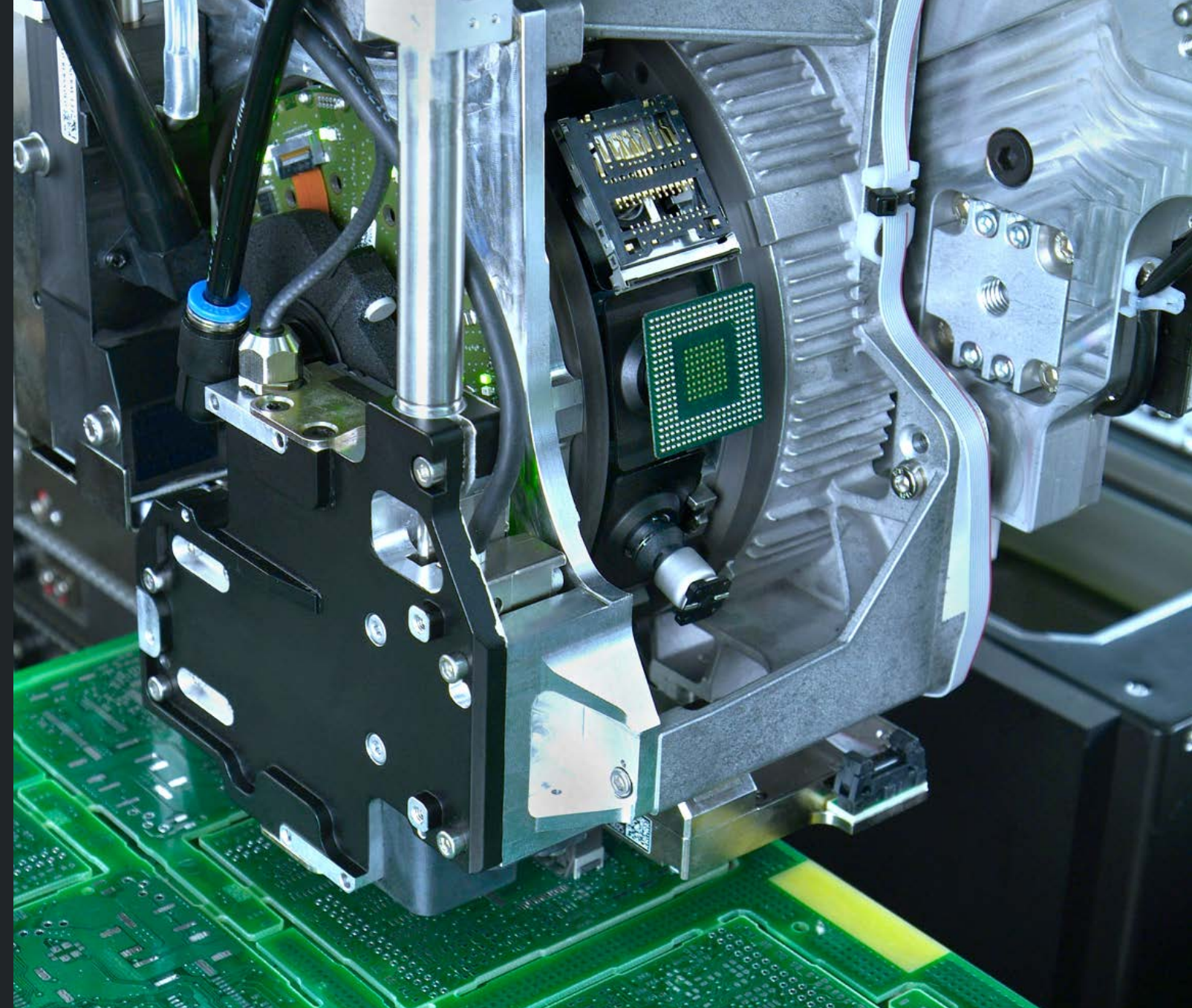
5. Wheel hub with direct drive

Customer-specific bearing for direct integration into the customer's design. Absorption of forces from all directions including tilting moments. Installation space designed in cooperation. Joint assembly of the rolling bearing prototype at Franke.



6. Filling line

The bearing assembly with direct drive is made of stainless steel and fitted with special seals. As a result, the complete system consisting of bearing and drive is optimally protected against environmental influences and cleaning agents. As no gear wheels need to be lubricated, the drive is particularly clean.



7. Assembly of printed circuit boards

Rolling bearings for a high-performance placement head for PCB production with a cycle frequency of 18 start/stop movements per second and up to 120 million revolutions within five years. The service life is set at ten years. The bearing must be preloaded without play in all directions at 70 °C so that the components can be precisely assembled.

FAQ

Design / Operating conditions

1. What diameters are feasible?

Diameters from 100 to 1800mm are possible.

2. What operating temperatures are permissible?

Up to approx. 120° C.

Motorization

3. How is thermal overload prevented?

Various sensors are available for integration: PTC (PTC thermistor) / KTY (temperature sensor) / triplet switch (bimetallic switch).

4. What is the advantage of water cooling?

The nominal torque is doubled. This reduces the size.

5. How does the motor react in the event of a power failure?

Motor and bearing assembly run out slowly. Optional: Brake system for quick stop or controller with safety function.

6. How are the cables of the motor assembled?

The cables are assembled with and without connectors according to the customer's requirements.

7. What IP protection class can be achieved?

Due to the nature of the bearings, a protection class of IP41 can be achieved.

8. Are NFPA / UL standards met?

It is possible to equip the insulation system of the motor with UL listed materials.

9. What documentation is supplied?

General information, safety instructions, connection diagrams and installation and maintenance instructions.

Controller / measuring system

10. Which controllers can be used?

Any controller can be used, e.g. Elmo, BoschRexroth, Kollmorgen, Siemens, Keba...

11. Which measuring systems are suitable?

Any measuring system can be used.

12. How are the measuring systems attached?

The measuring tape is attached directly to the rotor and the measuring head to the stator. Alternatively, it is possible to attach the measuring system to the continuing construction.

13. What are the limitations of measuring systems

Since the measuring tape is a closed ring, only certain diameters are available here, which must be taken into account in the design. For larger quantities, any diameter is feasible - but with one-time additional costs.



„If you have any questions about our LTD type bearing assemblies, I will be happy to help you.“

Dipl.-Ing. (BA) Peter Niemeyer, team leader constructikon and development
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