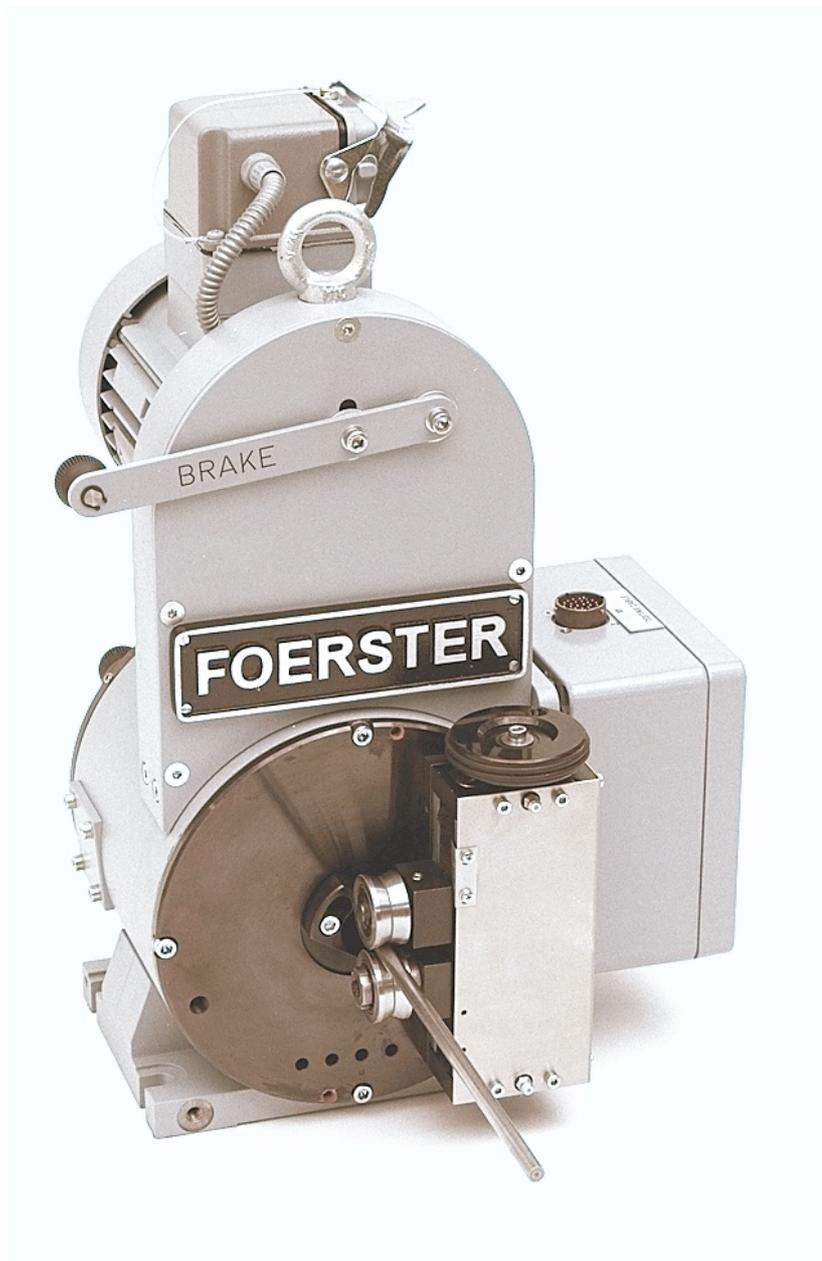


CIRCOGRAPH®
Sensor system Ro 20 P 6.460

Operating Instructions



FOREWORD

These operating instructions were written to be read, understood and complied with in full by those persons responsible for operating the machine.

The complete operating instructions consist of the following sections:

- 1 Safety**
- 2 Description**
- 3 Installation**
- 4 Operation**
- 5 Maintenance**

Machine faults can only be avoided and fault-free operation of the machine can only be guaranteed through knowledge of the operating instructions.

It is therefore particularly important that all responsible persons are familiar with and understand the full operating instructions.

Our service department or one of our representatives would be pleased to receive suggestions about how to further improve these operating instructions. Any questions not covered by these instructions will also be dealt with quickly and comprehensively.



Copyright

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In Laisen 70, D-72766 Reutlingen



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1 SAFETY

1.1 Dangers posed by this machine

The CIRCOGRAPH sensor system Ro 20 P features protective safety devices. It has been subjected to a safety test and safety acceptance test. In the event of operating errors or misuse, the machine may pose dangers and risks to

- the life and limb of the operator,
- the machine and other operator's valuables and
- efficient operation of the machine

All persons involved in installation, commissioning, operation, servicing and maintenance of the machine must

- be appropriately qualified and
- must strictly follow the information provided in these operating instructions.

Your safety is at stake!

1.2 Safety information and tips

The following symbols are used in these operating instructions:



DANGER!

This warns against dangers to persons. These sections provide you with information on what to do and what not to do in order to prevent personal injury.



WARNING!

These sections indicate possible damage to the test system. They provide information on what to do and what not to do in order to prevent damage to property.



NOTE!

These sections provide tips for the user on how to use the system better and also provide other useful information.



1.3 Use as intended

1.3 Use as intended

The CIRCOGRAPH sensor system Ro 20 P is suitable only for non-destructive testing of **round material**.

Diameter range **2 mm to 20 mm, continuously adjustable!**

Larger diameters may not be admitted into the sensor system under any circumstances.

Material with a cross-section which is anything other than round may not be admitted into the sensor system under any circumstances.

The sensor system may be operated only in conjunction with a suitable conveying mechanism and a lifting table.

On no account may you convert or modify the sensor system arbitrarily, for reasons relating to safety.



DANGER!

Masses rotating at high speed pose a serious danger to your life if the machine is operated incorrectly. Never touch the rotating sensor components.



NOTE!

The information on operation, servicing and maintenance prescribed in these operating instructions must be followed strictly.

1.4 Dangers posed by accessories

Transport mechanisms, lifting table and external control equipment must not render the protective safety devices of the CIRCOGRAPH sensor system Ro 20 P inoperable.

1.5 Emissions

The maximum A-weighted equivalent sound pressure level lies at 82 dB(A) in a distance of 1 m from the machine's surface and at 1.6 m above basement, measured in axial direction of the ventilator. The values at the workstations of the personell are resp. lower, also when using rotating speeds less than 18.000 rpm.



1.6 Danger sources

The CIRCOGRAPH sensor system Ro 20 P operates with a rotating test system and an attached roller guide system during operation. A person coming into contact with the roller guide or the rotating test system may suffer very serious injuries.

Switch off the drives before you put your hands into or touch the sensor system. Wait for all motions to cease.

Before carrying out servicing and cleaning work, switch off the drive for the sensor system and conveying mechanisms and disconnect the power supply (secure the master switch in position OFF).

Never remove protective safety devices or render them inoperable by making modifications to the system.

1.7 Workstations

The workstation is located on the electronic equipment cabinet or on the operating panel of the CIRCOGRAPH sensor system Ro 20 P.

Do not carry out any work or tamper in any other way with the sensor system when it is rotating.

1.8 Authorized operators

Only authorized personnel may work on the CIRCOGRAPH sensor system Ro 20 P. Please comply with the minimum legal age!

The operator is responsible for the safety of third parties in the work area.

The scopes of authority for the various activities on the sensor system must be clearly defined and complied with. Untrained personnel pose a safety risk!

The operator must make

- the operating instructions available to the machine operator and
- sure that the machine operator has read and understood them

1.9 Personal safety equipment

No personal safety equipment is required.



1.10 Safety measures at the installation location

The CIRCOGRAPH sensor system Ro 20 P must be installed stably on a machine foundation provided for it and must be firmly anchored to the foundation. If this is not done, this will pose a potentially lethal risk.

**NOTE!**

Ensure that the area surrounding the workstation is always clean and unobstructed by issuing appropriate in-company instructions and conducting inspections.

1.11 Protective safety devices

The CIRCOGRAPH sensor system is shut down

- when opening the housing (safety switch on the rotor cover)
- with the switch on the operating panel or on the electronic equipment cabinet
- with the EMERGENCY-STOP switch on the operating panel (EMERGENCY-STOP has to be linked with motor control)

The protective safety devices

- are installed to ensure the safety of the operating staff
- may not be modified, removed or bypassed by making modifications to the sensor system under any circumstances.

1.12 Behavior in the event of an emergency

In an emergency, please immediately press the red EMERGENCY-STOP switch. Have authorized personnel remedy the cause of the fault immediately.



DECLARATION of CONFORMITY

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GERMANY www.foerstergroup.de

Responsibility for documentation: Dr. Juergen Schroeder

Product: CIRCOGRAPH DS Ro20

Type: 6.460.01-1001

Serial No.: 00309 and higher

We declare, that this product complies with the requirements of following European Directives and corresponding Standards:

European Directive 2006/42/EC: Safety of machinery
European Standards EN 12100-1, -2, EN 14121-1, EN 60204-1

European Directive 2006/95/EC: Safety of electrical apparatus
European Standard EN 61010-1

European Directive 2004/108/EC: Electromagnetic Compatibility
European Standard EN 61326-1

This declaration relates exclusively to the machinery in the state in which it was placed on the market, and excludes components which are added and/or operations carried out subsequently by the final user.

Reutlingen, December 29, 2009

Dr. Juergen Schroeder
General Manager - Division Test Systems

Notes:

**2 Description****2.1 Application**

Nondestructive testing of ferromagnetic, austenitic and nonferromagnetic round materials (wires, bars and tubes) for surface flaws in conjunction with the CIRCOGRAPH® DS 6.430 (two channel with Clearance Compensation) or CIRCOGRAPH® CP 6.412 (one-channel without Clearance Compensation) testing and evaluation electronic equipment and a suitable mechanical handling system

- Diameter range of testing material 2 to 20 mm
- Preferably continuous testing, also separate piece testing
- Surface free of scale, wherever possible bright
- Testing mode without physical contact at rotational speeds upto 18.000 rpm
- End condition free of projecting burrs
- Max. test material temperature +80 °C
- Testheads with tracking width 1,5 / 2,5 und 5 mm [BS]
Typ N as standard,
Typ DF for encreased clearance (prefered for FE material)
- Quickcange nozzeles inside and outside
- Blower facilitiy for cooling and maintaining cleanliness
- Precision guiding unit

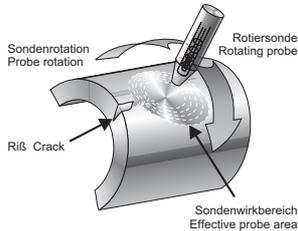
Testing capacity

- surface flaw testing, preferably longitudinal flaws
- flaw detectability for bright material surface from flaw depth of approx. 30 µm
- testing speed of up to 3 m/s for gapless testing (rotational speed = 18,000 rpm, two test heads with 5 mm track width)



2.2 Mode of operation

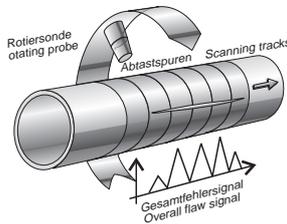
2.2 Mode of operation



Signal generation during rotary testing

The sensor system Ro 20 operates on the basis of the eddy-current principle in accordance with EN 12 084. Rotating systems are used to detect longitudinal surface defects. Probes rotate at high speed and without physical contact around the test piece. By feeding the material the probes scan the surface in helical paths.

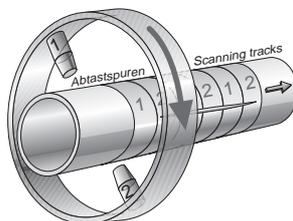
Due to the locally high resolution of the probes and the transverse movement across the crack by each revolution, this is the most sensitive method for detecting longitudinal defects.



Test tracks and flaw signals of a rotating probe

Any time a probe crosses a crack, it generates a signal. Thus, the rotating system generates a high number of consecutive signals that reliably indicate a flaw of a some length.

The testing speed result in the number of rotating pin probes, integrated in the Ro 20 (2 or 1 pin probes), the track width of all pin probes and the rotating speed (rpm). The helical path of all probes must be side by side to guarantee a fully gapless scan.



Test tracks of two rotating probes offset by 180°

The signals recorded by the probes are transferred from the sensor system to the test electronics for evaluation.

The primary power supply and the secondary signal of the probes are transmitted by rotating inductive transmitters without physical contact.

Two types of motor controls are available:
MOC E (economy version) with one constant rational speed at 9000 rpm and manual brake system.
MOC EV with variable rotational speeds up to 18000 rpm and electrical brake system.



Fig. 2/4 Test equipment configuration, CIRCGRAPH CP (top), CIRCGRAPH DS (bottom)



2.3 Construction

CIRCOGRAPH DS or DEFECTOMAT CP test electronics and the connection cables are required for a complete test system, besides the sensor system which scans the test material and generates the eddy-current signal.

Separate Leaflets:
"CIRCOGRAPH DS System 6.430", Order-No. 163 852 1 and
"CIRCOGRAPH CP 6.412", Order-No. 152 266 3 will inform You about the according test electronics.

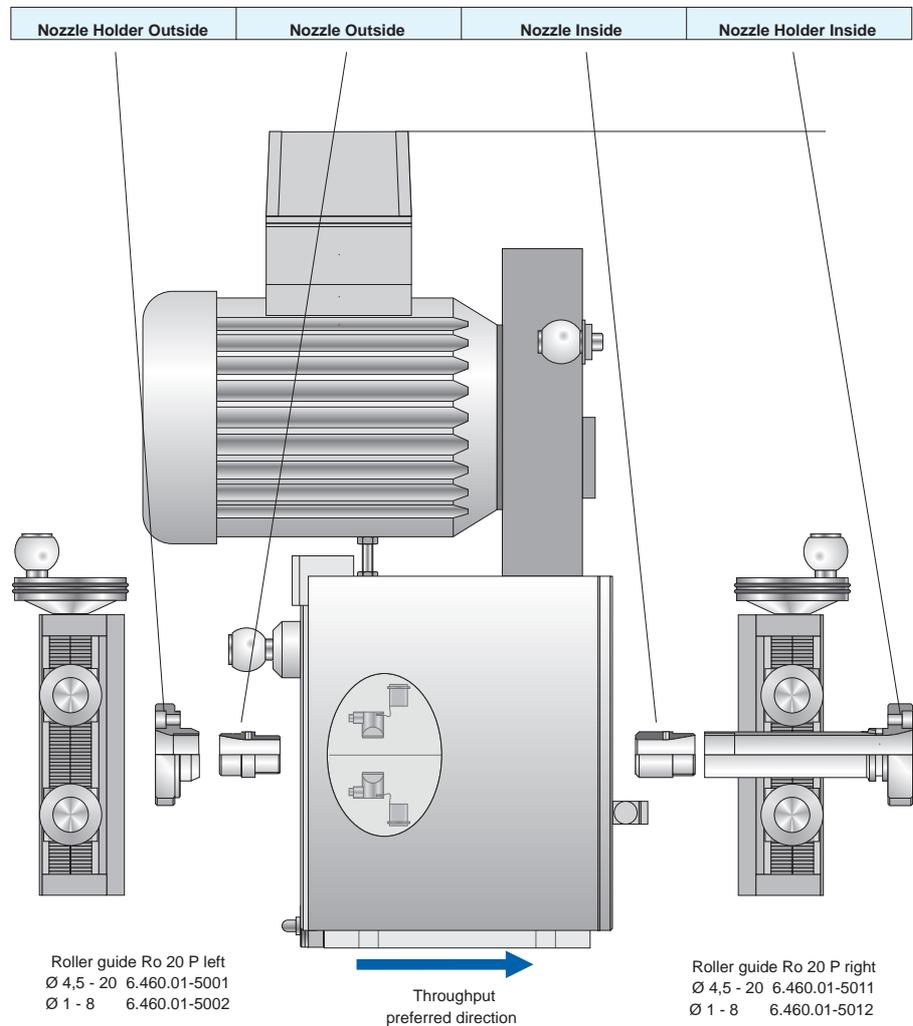


Fig. 2/5 CIRCOGRAPH sensor system Ro 20 P

The compact CIRCOGRAPH CP test electronics is recommended in the following cases

- no clearance compensation is required
- a reasonably priced solution is needed



In order to withstand the rough conditions of use, the Ro 20 P has been designed to be dust-protected, robust and reliable by means of complex constructional measures such as labyrinth seals and dirt deflectors.

The chamber surrounding the test zone serves the purpose of contact and burst protection as well as dust collection. This chamber is provided with a connection facility for a suction connector for an external extraction system (to be provided by customer).

The Ro 20 P sensor system consists of the following compulsory components:

- rotating head Ro 20 P
- test heads, track width 1.5 – 2.5 – 5 mm
- protective nozzles

The following options are available for adaptation to particular material conditions:

- roller guides, right, left or on both sides
- precision guide, can be used for 2 to 20 mm



2.3 Construction

2.3.1 Test Heads

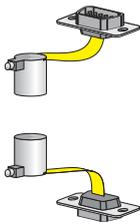
The test heads are both the heart of the sensor system and its most critical components.



Rotating disc with test heads

They consist of an eddy-current probe with field, measuring and clearance windings which are installed in a precise mechanical holder and are connected by means of a highly flexible special cable with a connection plug.

Due to the high centrifugal forces (acceleration up to 10,000 g!) and the rough environmental conditions at the testing location, the test heads are completely cast and can be replaced as a complete part only.



Test heads

As already mentioned in the 'Mode of operation' section, there is a mathematical relationship between the number and track width of the test heads, the rotational speed and the testing speed.

The following table shows these relationships and gives typical examples for a practical selection:

Maximum testing speed [m/s]	Decreasing sensitivity to short flaws	Track width BS [mm]	Test head type	
0,45 / 0,9	↓	1,5	N	6.460.01-2015
			DF	6.460.03-2015
0,75 / 1,5		2,5	N	6.460.01-2025
			DF	6.460.03-2025
1,5 / 3,0		5,0	N	6.460.01-2050
			DF	6.460.03-2050
n = 9.000 U/min / n = 18.000 U/min				

2.3.2 Rotating Head Ro 20 P

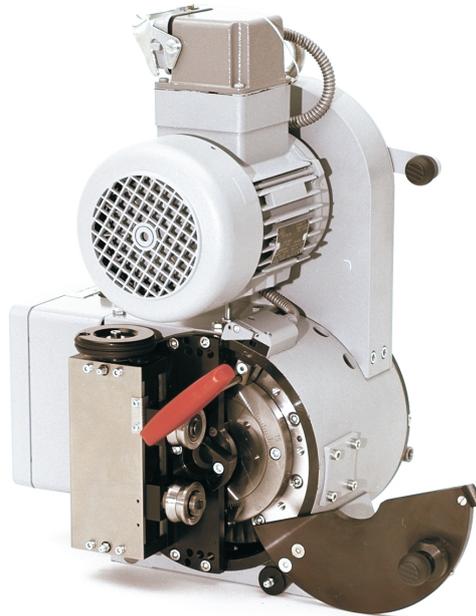


Fig. 2/6 Rotating head Ro 20 P

The rotating head is the main component of the sensor system. It consists of:

- rotor
- transmitter
- drive
- housing
- rotating head electronics

The test direction can be selected as right or left (viewed in the throughput direction).

In order to withstand the rough conditions of use, the Ro 20 P has been designed to be dust-protected, robust and reliable by means of complex constructional measures such as labyrinth seals and dirt deflectors.

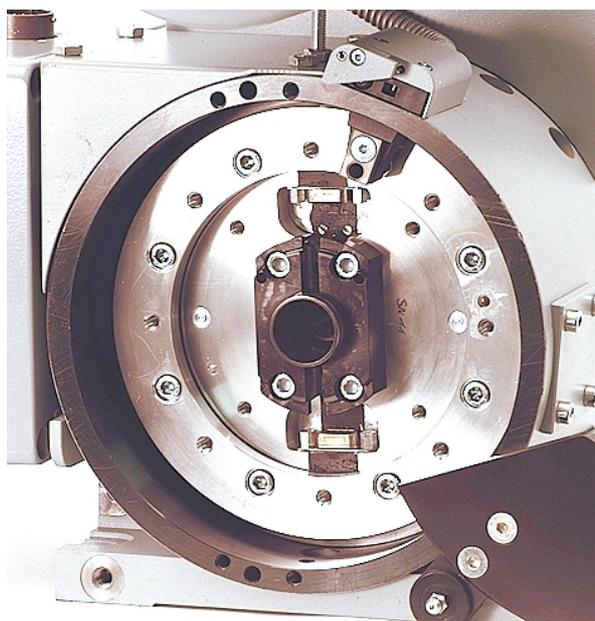


Fig. 2/7 Rotating disc with test heads
View through the opened adjustment side, housing flange and cover of rotating disc removed

Rotor

The rotor consists of a hollow shaft, a rotor disc and the movable part of the sensor.

The rotor is driven by the motor by means of a high-power profile flat belt. It is supported in the housing by two high-speed bearings.

The high-precision rotating disc for holding the test heads is fitted on the front side.

A pivot-mounted spiral disc with an actuating gear and automatic blocking facility is fitted in the rotating disc for precise and simultaneous test head diameter adjustment.



Sensor

Wear-resistant rotating sensor in disc-type construction with a field sensor, two measuring channels and a clearance channel.

Consisting of a rotor and stator, it **transmits** the field current for the rotating probes from the stator to the rotor and, in the opposite direction, **transmits** the test signal to the test electronics for evaluation.

Rotating head electronics

The rotating head electronics amplifies the probe signals and the field current. It is installed in a robust box on the connection side of the bearing housing to permit ease of maintenance. The cable to the test electronics is connected using MIL plug connectors.

The drive motor is connected directly using a Harting plug connector.

Drive

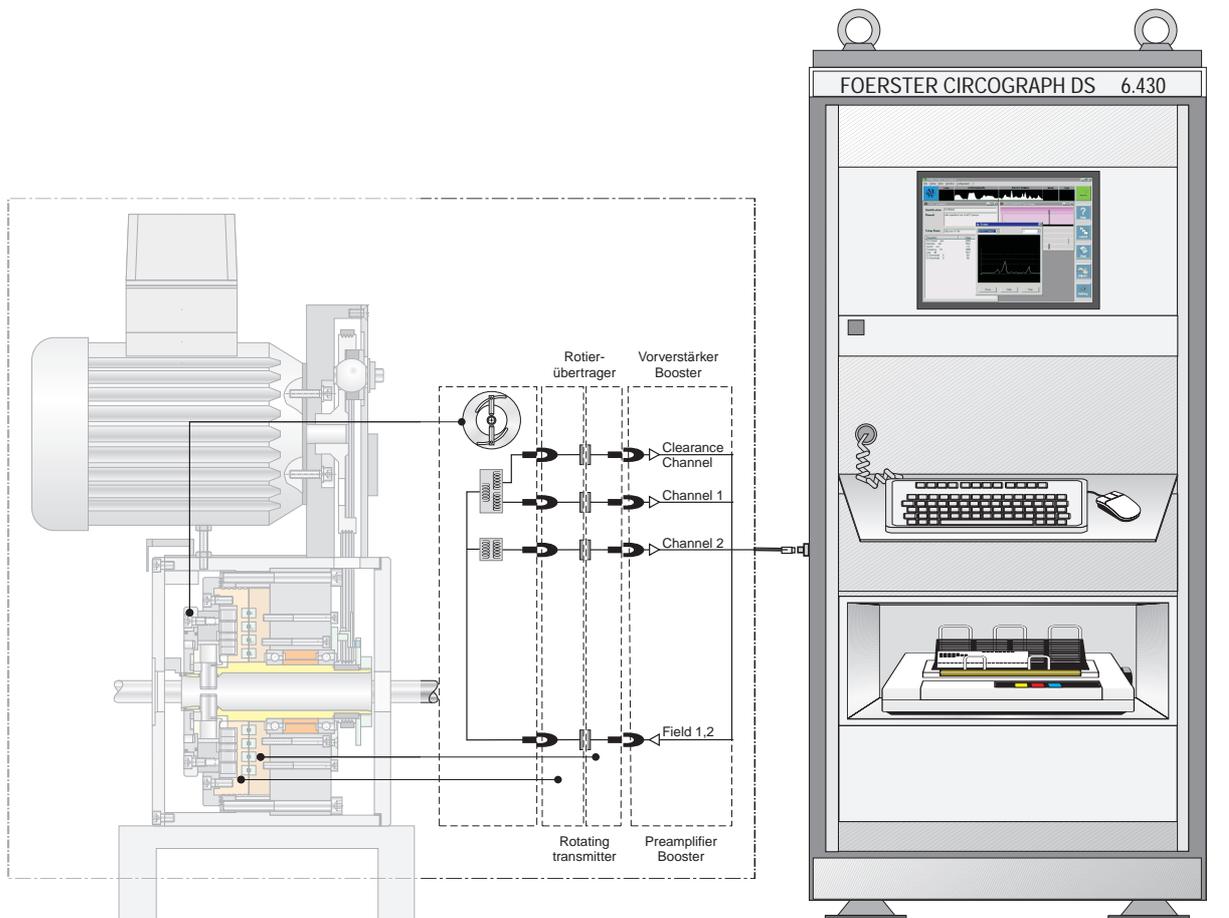


Fig. 2/8 Signal path



Indestructible 3-phase drive with a cage motor in conformance with standards.

External motor control for power supply to the drive.

The following versions are available:

- MOC E motor control
 - fixed rotational speed of 9,000 rpm at 50 Hz mains supply.
 - reasonably priced version, recommended for testing speeds at which a rotational speed of 9,000 rpm is sufficient for gapless testing (cf. Test Head selection table, page 2/6).

- MOC EV motor control
 - variable rotational speed of up to max. 18,000 rpm
 - with frequency converter
 - minimized bearing wear through adaptation of rotational speed to testing speed
 - suitable for applications with changing testing speeds.

Both motor controls supply the required voltages and currents and contain the necessary switching and safety devices (contactors, motor protection switches, protective circuits).



2.3 Construction

Diameter adjustment

Diameter adjustment is carried out manually with a tool. The linear scale is located on the rotor. The diameter can be adjusted with an accuracy of 0.1 mm.

Protective nozzles standard

The protective nozzles have a dual function:

They protect the test heads from damage, particularly during entry and exit of the test material, provided that the straightness conditions and the end properties are observed.

Protective nozzles are available in nominal sizes of 2.0 to 21 mm.

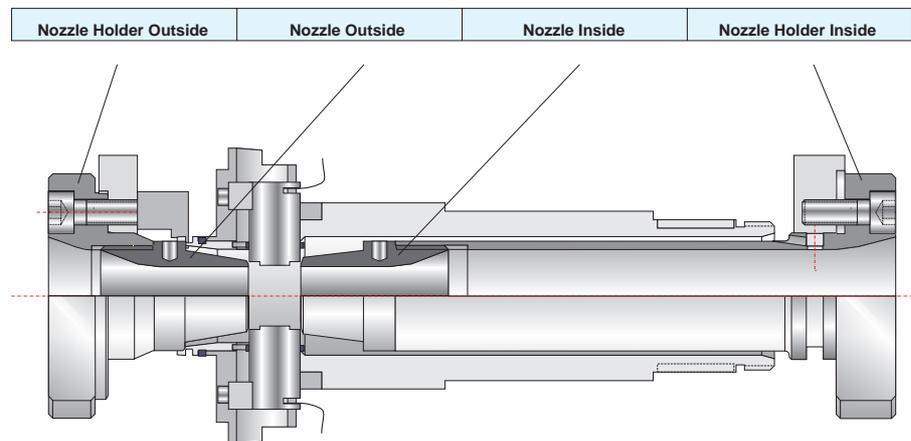


Fig. 2/9 Protective nozzles, schematic guide with nominal size 2 to 16 mm, nozzle holder with change nozzles

They **limit the maximum eccentricity** of the test material within the zone to be tested to a narrow dimension within which the clearance compensation can fully compensate the sensitivity fluctuations.

Entry and exit nozzles must always be used in pairs with the same nominal value.

Protective nozzles can be ordered from INSTITUT DR. FOERSTER or can be manufactured by the customer on the basis of drawings.

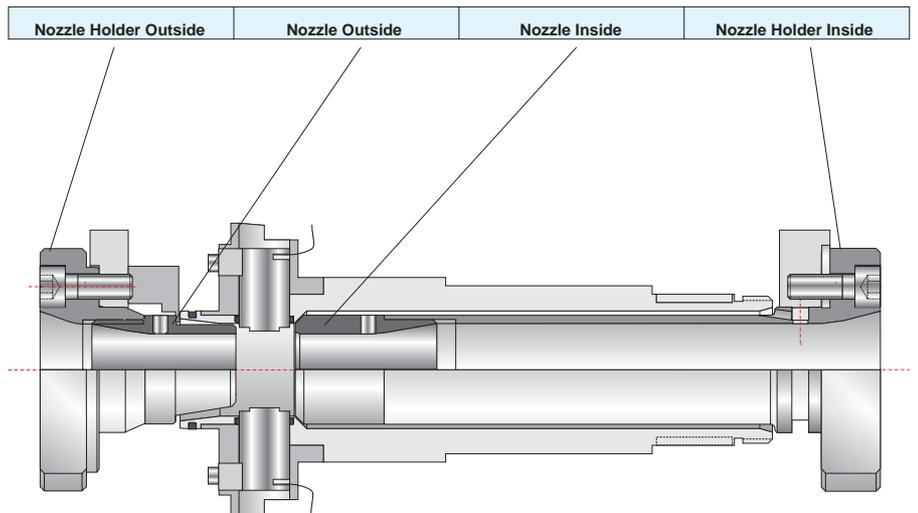


Fig. 2/10 Protective nozzles, schematic diagram with nominal size > 16 mm, nozzle holder with change nozzles



WARNING!

Operation without protective nozzles is not permitted for damage and safety reasons.



2.3 Construction

Precision guide

This option is recommended in addition to the protective nozzle function if short parts, thin bars or copper pipes are to be tested.

Additional narrow-tolerance guide cores in the entry and exit areas, near to the test heads, improve guidance and reduce test material vibrations during throughput.

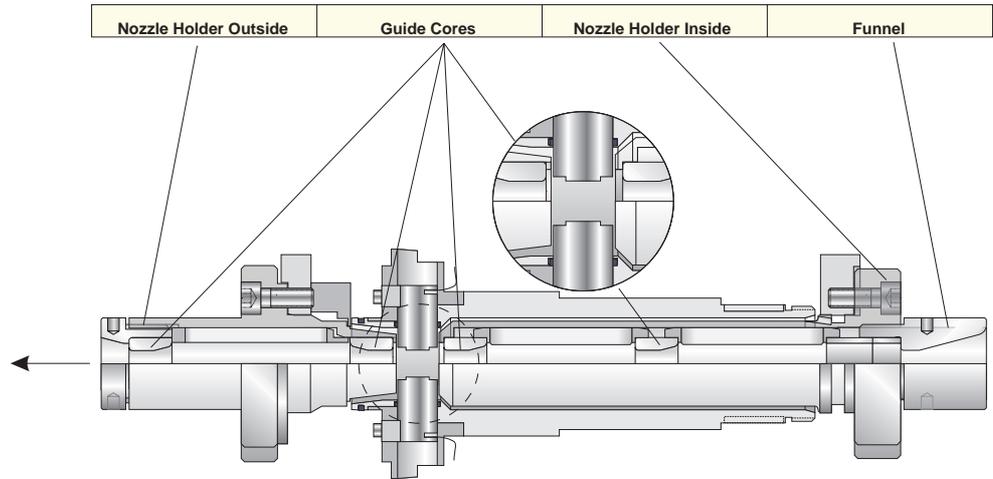


Fig. 2/11 Precision guide e.g. for copper pipes or bars, schematic diagram with guide cores, throughput right to left

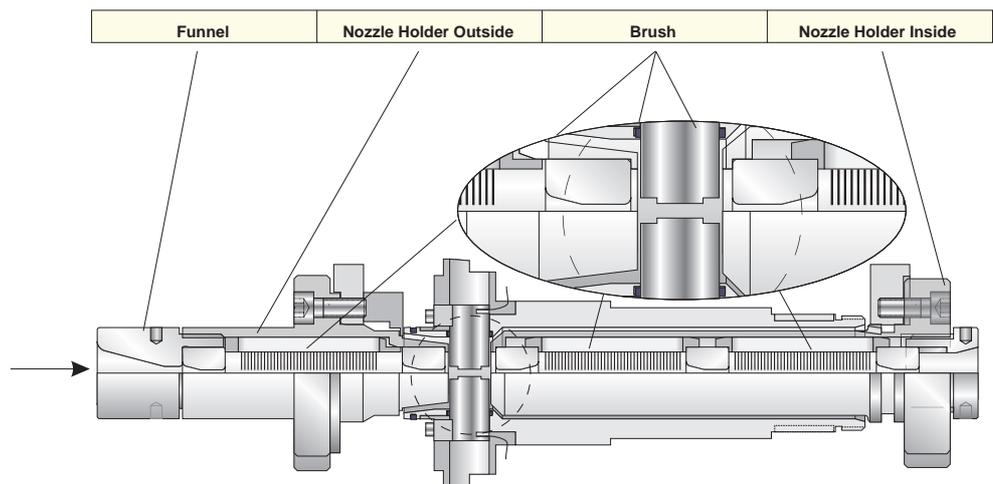


Fig. 2/12 Precision guide e.g. for bars, schematic diagram with brush guidance for small dimensions, throughput left to right

Roller guide

The roller guides have two advantages:

In set-up mode, a calibration piece with reference flaws can be held centrally outside the test line and the test electronics can be adjusted simply, since the rotating probes periodically scan the test flaw and display the signal quasi-statically.

In testing mode, the roller guides improve centricity, especially for smaller dimensions, and damp vibrations. They are always required if the drivers for material transport cannot be set up directly in front of and behind the sensor system.

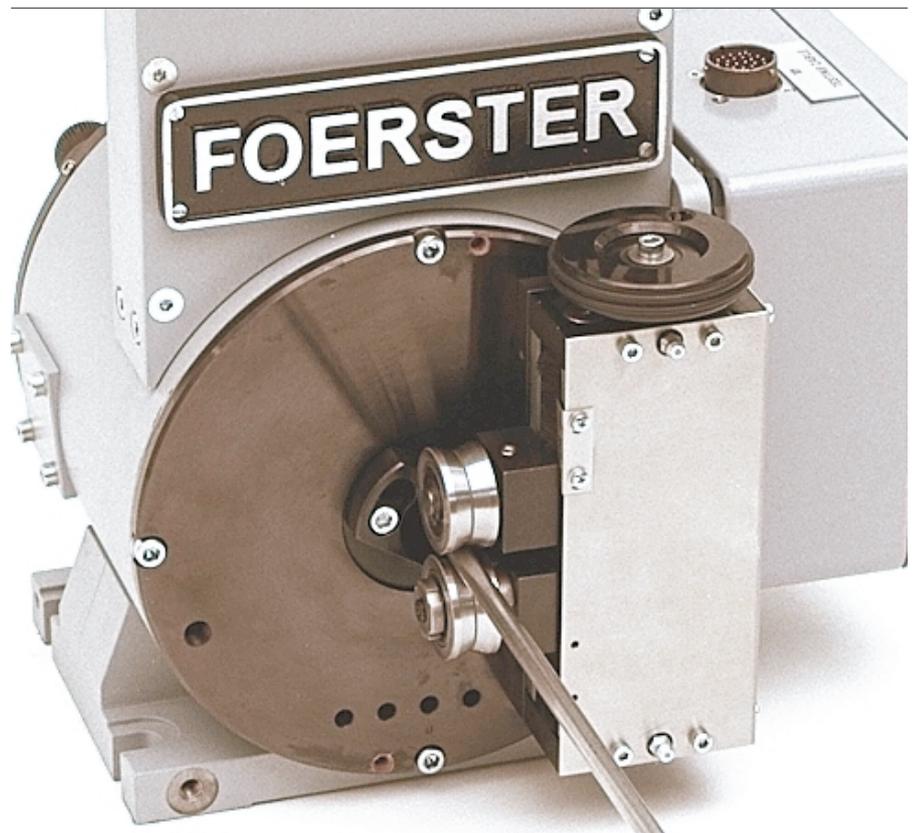


Fig. 2/13 Ro 20 P with roller guide

**2.4 Technical data****Ro 20 P**

Test material diameter range	2 to 20 mm, continuously adjustable	
Revolution speed		
MOC E motor control	9,000 rpm	
MOC EV motor control	up to 18,000 rpm	
Type of test	without physical contact	
Test heads (TH)	two TH offset by 180° adjustable according to a scale, with one probe each	
Probe track width	5 mm, 2.5 mm, 1.5 mm	
Test speed	9,000 rpm	$v_{\max} = 1.5 \text{ m/s}$
for gapless testing (5 mm track width)	18,000 rpm	$v_{\max} = 3.0 \text{ m/s}$
Dimensions	see dimension drawing	
Mass	approximately 50 kg	
Drive		
Three-phase motor	$n_o = 2,850 \text{ rpm}$	$P = 0.55 \text{ kW}$
Power supply	3 x 400 V three-phase, different supply voltage adapted via an isolating transformer	
Useful bearing life (depending on operating conditions)	operating hours	typically
Grease lubrication (Standard)	9,000 rpm	app. 5,000 h
	18,000 rpm	app. 3,500 h
Oil air lubrication (Option)	9,000 rpm	app. 7,000 h
	18,000 rpm	app. 5,000 h

Roller guide (option)

Standard	Ø 4.5 to 20 mm
Additional	Ø 2 to 8 mm
Mass	approximately 3.2 kg
Dimensions	See dimension drawing

**Oil air lubrication (option)**

Compressed air connection	4 to 6 bar
ISO class oil viscosity	VG 32 (up to VG 100)
Lubrication unit dimensions (fitted on base plate, W x H x D)	400 x 388 x 152 mm

2.5 Operating, storage and transport conditions**Operation**

Temperature range	
sensor	+5° C to +80° C
rotating system	+5° C to +45° C
Relative humidity	
sensor	95 %, casually condensation permissible
rotating system	85 %, condensation not permissible
Degree of protection EN (60 529)	
sensor	IP 65
rotating system	IP 43

Storage and transport

Storage, transport and handling may be carried out in original packaging only. The packages must be protected from moisture.

Observe instructions on the packaging (e.g. fragile, store in a dry place, this way up, etc.)

Storage conditions

- storage in unopened original packaging
- in closed rooms
- temperature range -20° C to +70° C
- max. relative humidity 95 %, condensation not permissible
- maximum storage duration approx. 12 months (extension possible after intermediate check by FOERSTER employee)



2.6

Dimension sheet

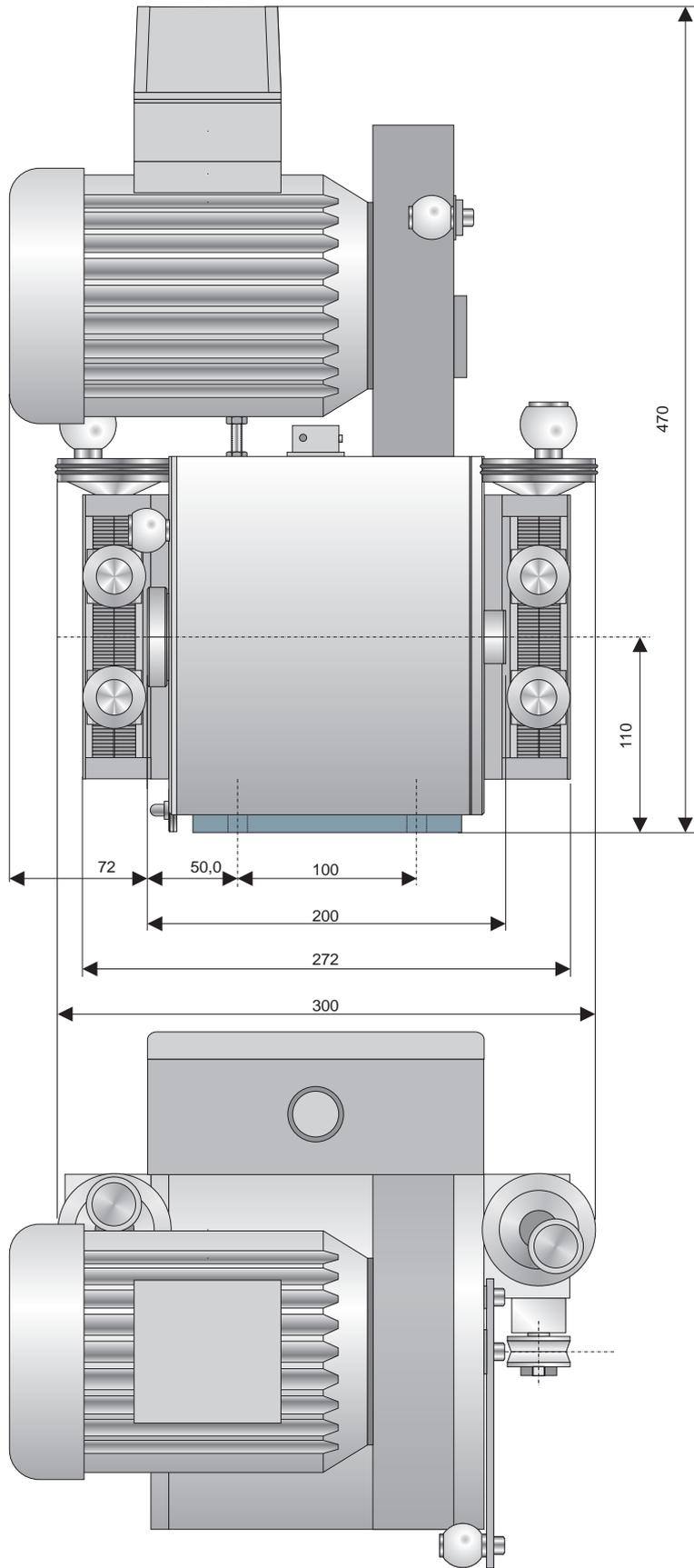


Fig. 14 Dimension drawing 1

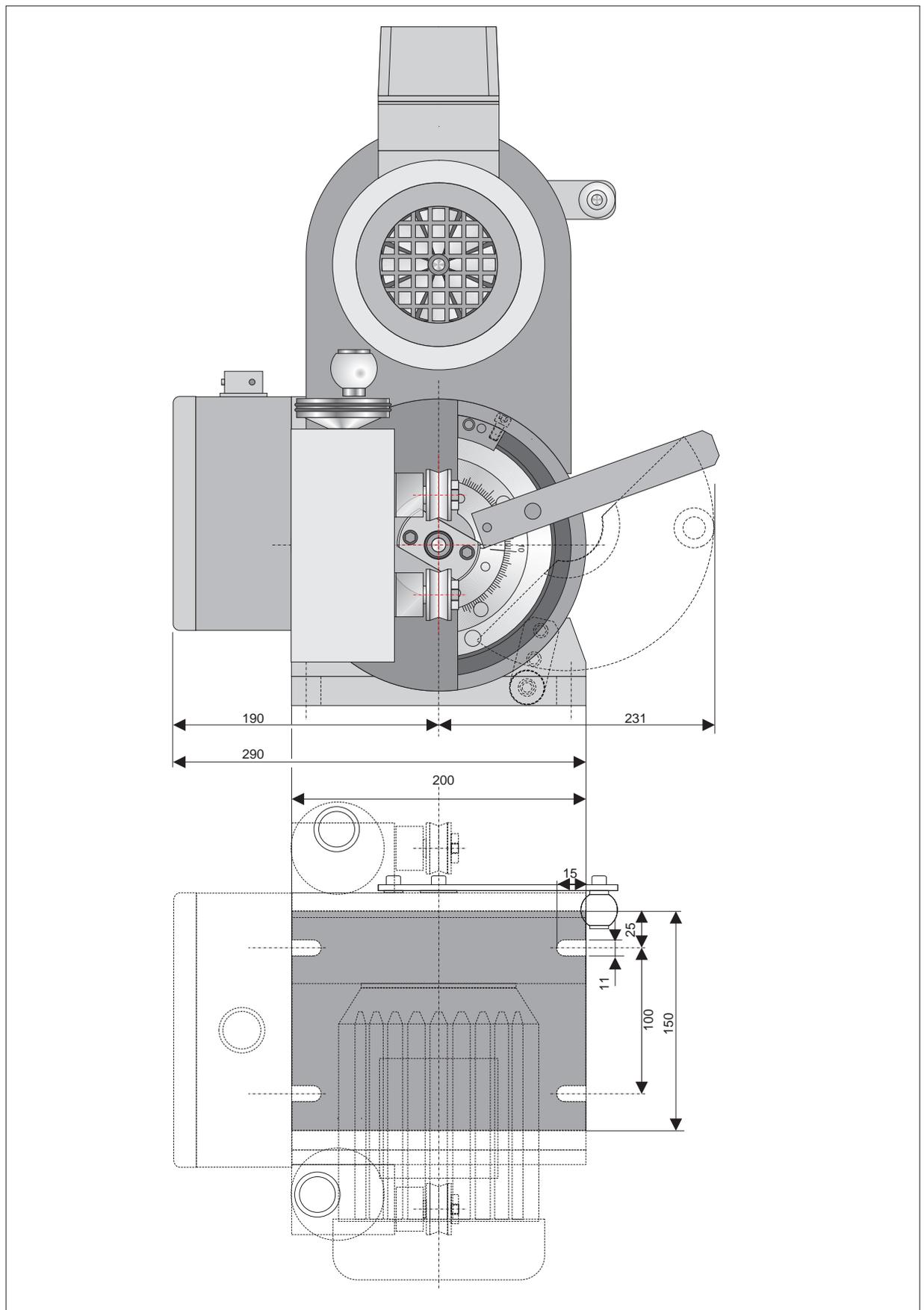


Fig. 15 Dimension drawing 2

**2.7 Standard Components**

Designation	Part-No.	Order-No.
ROTATING HEAD RO 20	6.460.01-1001	1373900
ROTATING HEAD RO 20, OIL AIR LUBRICATION	6.460.01-1031	1638378
TEST CABLE DS 10M, CIRCOGRAPH-DS	6.460.01-9921	1650785
TEST CABLE 10M, FOR USING WITH CP	6.460.01-9925	1655078
MOTOR CABLE 10M	6.460.01-9931	1638343
EARTHING CABLE 10M	1.175 -0061	1554034
TEST HEAD N, BS=1.5	6.460.01-2001	1597388
TEST HEAD N, BS=2.5	6.460.01-2011	1597361
TEST HEAD N, BS=5	6.460.01-2021	1597345
NOZZLE HOLDER INSIDE, NOM.SIZE 2-21	6.460.01-1001-20	1539833
NOZZLE HOLDER OUTSIDE, NOM.SIZE 2-21	6.460.01-1001-25	1575562
NOZZLE, 2-16 NOM.SIZE S.ORDER	6.460.01-3251	1594770
PRECISIONS GUIDE, NOM.SIZE 2-12	6.460.01-5301	1641557
PRECISIONS GUIDE, PREC. NOM.SIZE >12-21	6.460.01-5310	1651587
DRAWING CORE, NOM.SIZE 2-4	6.460.01-5301-0200	1641697
DRAWING CORE, NOM.SIZE >4-12	2.850.31-5301-0400	1651790
NOZZLE SET, PRAEZ. >12-20 NOM.SIZE S. WA	6.460.01-5301-1200	1652745
SET OF TOOLS	6.460.01-1001-10	1540653
ROLLER GUIDE, LEFT NOM.SIZE 4.5-20	6.460.01-5001	1533860
ROLLER GUIDE, RIGHT NOM.SIZE 4.5-20	6.460.01-5011	1533878
ROLLER SET, NOM.SIZE 1-8	6.460.01-5020	1655060
OIL AIR LUBRICATION	6.460.01-7501	1650963
MOTOR CONTROL, MOC E	6.430.01-3010	1638254
MOTOR CONTROL, MOC EV	6.430.01-3020	1638262
OPERATING INSTRUCTIONS GER., SENSOR SYSTEM RO 20	6.460 UA06/DE	1638351
OPERATING INSTRUCTIONS ENGL., SENSOR SYSTEM RO 20	6.460 UA06/EN	1638360



3. INSTALLATION

3.1 Setup and Connection



NOTE!

The sensor system must be mounted on a horizontally shiftable lifting table in order to be able to change the dimensions or to carry out service work outside of the test line.

Requirements of the lifting table:

- It must be designed accordingly for the weight and function of the sensor system
 - adequate load-bearing capacity
 - low-vibration design
 - able to be fixed in test position
- With precise vertical adjustment facility
- Able to be withdrawn from the testing position to maintenance position and able to be removed reproducibly back to test position; withdrawing travel at least 700 mm
- The mounting surface for the sensor system must be completely horizontal at every elevation (this must be checked with a precision spirit level)
- Cable skid for protecting the cables against damage when traversing the lifting table

The two horizontal end positions of the lifting table (maintenance position/test position) should each be monitored with a limit switch. The limit switches must be gated with the roller conveyor control system in such a way that the roller conveyor can be switched on only if the table is fixed on one of the end positions.

In addition, it must be ensured that the table can be moved out and in or vertically adjusted only if the roller conveyor is switched off.

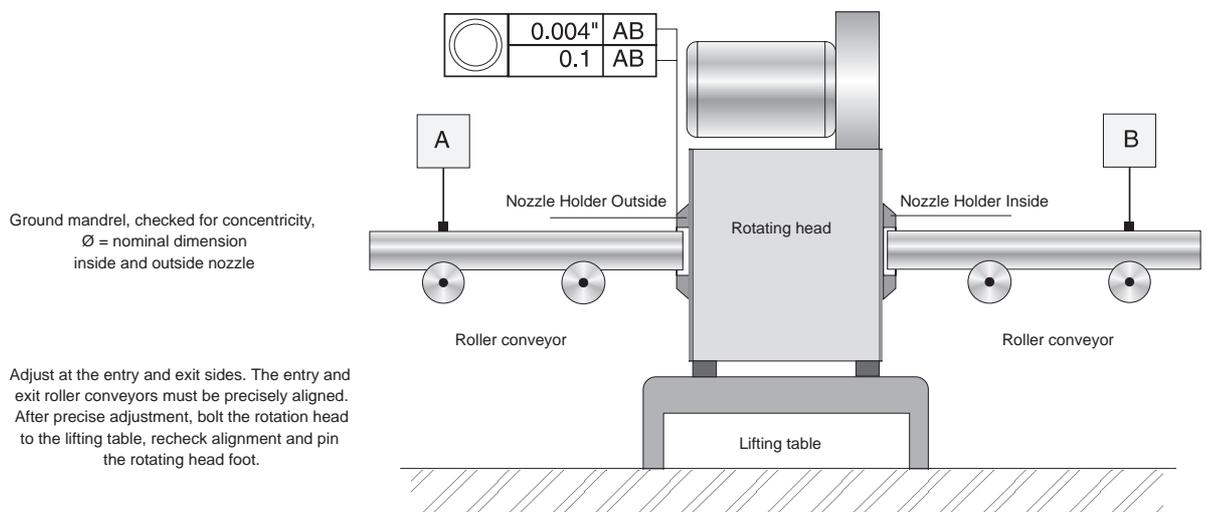


Fig. 3/1 Aligning the sensor system on the lifting table



3.1 Setup and Connection

Electrical connections

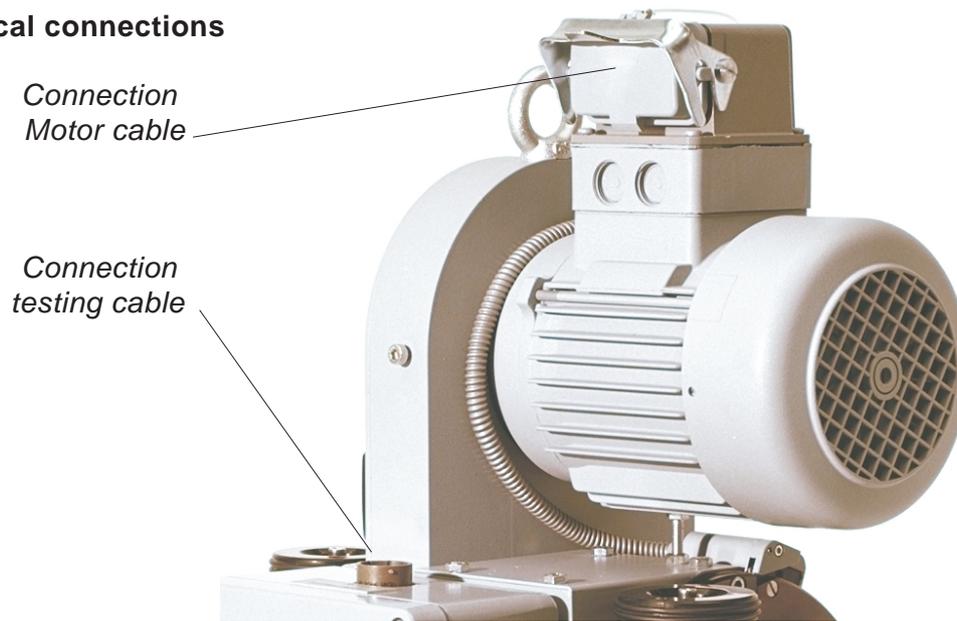


Fig. 3/2 Rotating head, connections

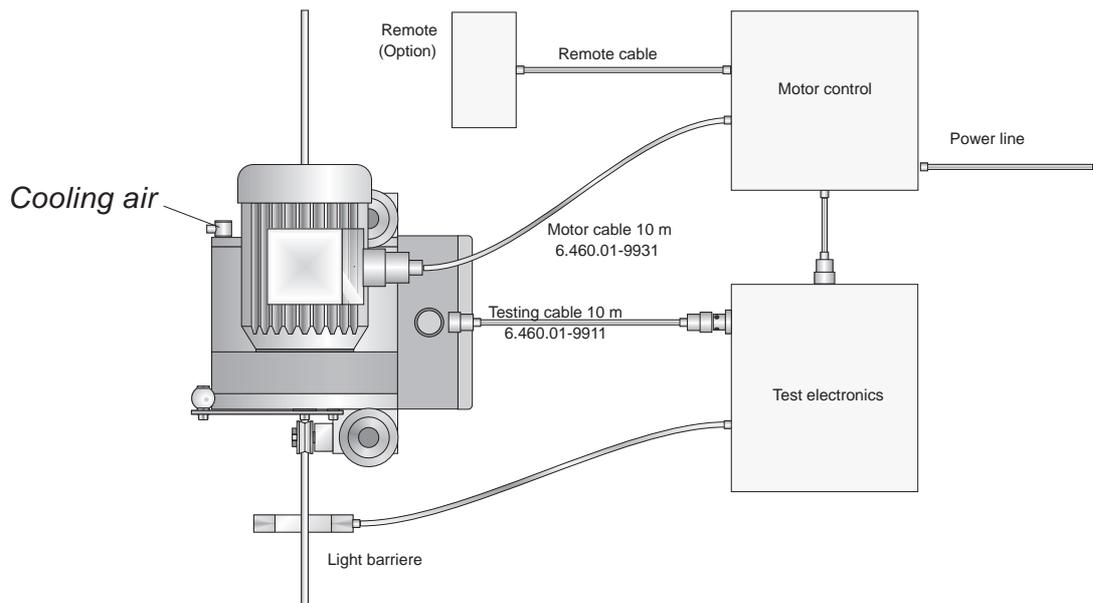


Fig. 3/3 Connection 2-channel Rotating head to CIRCOGRAPH DS electronic unit



NOTE!

For rotating speed > 9,000 rpm install cooling air with 1 bar to increase life time of bearings.

Protective conductor connection (PE) according to EN 61010 (VDE 0411)

Connect the protective conductor terminal of the electronic cabinet and the other system components, e. g. control cabinets, motor control, rotating heads with the next main protective conductor terminal 16 mm². A green/yellow lead with 16 mm² Cu is to be used for that.



4. OPERATION

4.1 Dimension change

The following steps must be carried out during conversion

- I Set test head to new nominal value of protective nozzles
- II Insert suitable protective nozzles
- III Set roller guides to test diameter
- IV Center sensor system in the test line

Preparation

- Select protective nozzles for new test piece measurement
- Prepare tools for dimension change



WARNING!

Do not intervene manually in the sensor system when the rotating unit is running:

Danger of injury!

Switch off drive before carrying out any work!
Wait for machine standstill!

Deceleration times from max. rotational speed 18,000 rpm:
approx. 120 seconds (with manual braking).

Dimension change procedure

- switch off sensor system drive
- move sensor system out of the test line
- open both roller guides
- remove external and internal nozzle
- clean nozzle mount carefully
- adjust test heads to the new nominal diameter of the protective nozzles
- install nozzles
- check setting (observe smooth running of rotor)
- move rotating head into test line
- insert test material



4.2 Selection and installation of the protective nozzles

4.2.1 Selection of the protective nozzles

Function of the protective nozzles

- guarantee protection from damage during entry, even for test pieces with larger diameters, impermissible curvatures or deformed fronts or ends
- in addition during operation without roller guides: guide the test material with low eccentricity

On the basis of empirical values, the relationship between test material and protective nozzle diameter for obtaining good test results has been set out as follows:

D mm	DD mm
2 - 4	D + 0,1
> 4 - 10	D + 0,15 ... 0,2
> 10 - 14	D + 0,2 ... 0,3
> 14 - 20	D + 0,3 ... 0,4

Table 4/1 Target nozzle grading for
D = nominal diameter of test material
DD = nominal size of protective nozzles

The FOERSTER standard protective nozzle range is based on the grading recommendation above.

The protective nozzles can be selected more precisely depending on the test diameter if the quality of guidance is sufficiently precise. This can improve the test results.



Standard Nozzle

Important! Do not slide the test material in and out without nozzle - risk of major damage. Operate only with protective nozzles!				
	Nozzle Outside Drawing No.	Nozzle Inside Drawing No.	Nominal dimension mm	Step mm
Standard	6.460.01-3211		2,0 to 16,0	s. Table 4/1

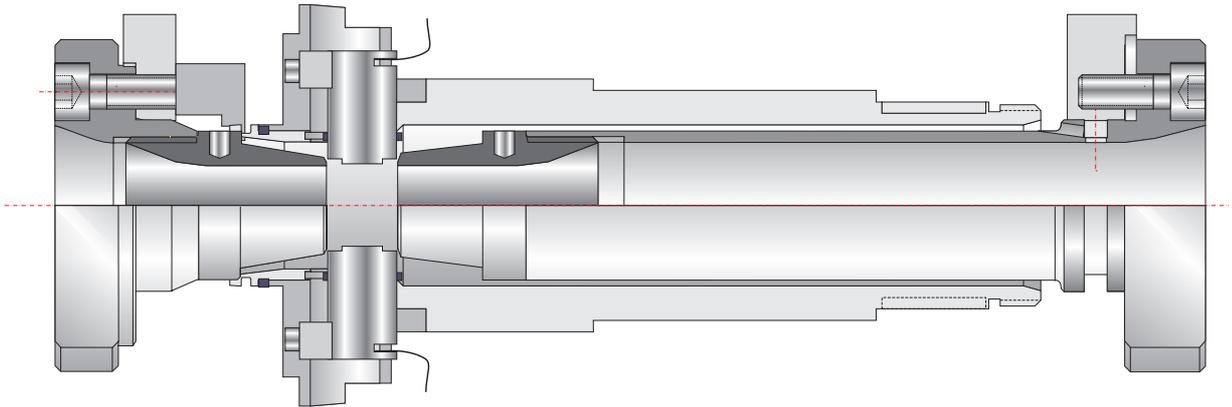


Fig. 4/1 Protective nozzle, schematic diagram, NM 2 bis 16 mm, nozzle holder with exchangeable nozzles

Important! Do not slide the test material in and out without nozzle - risk of major damage. Operate only with protective nozzles!				
	Nozzle Outside Drawing No.	Nozzle Inside Drawing No.	Nominal dimension mm	Step mm
Standard	6.460.01-3241	6.460.01-3231	16,1 to 20,0	s. Table 4/1

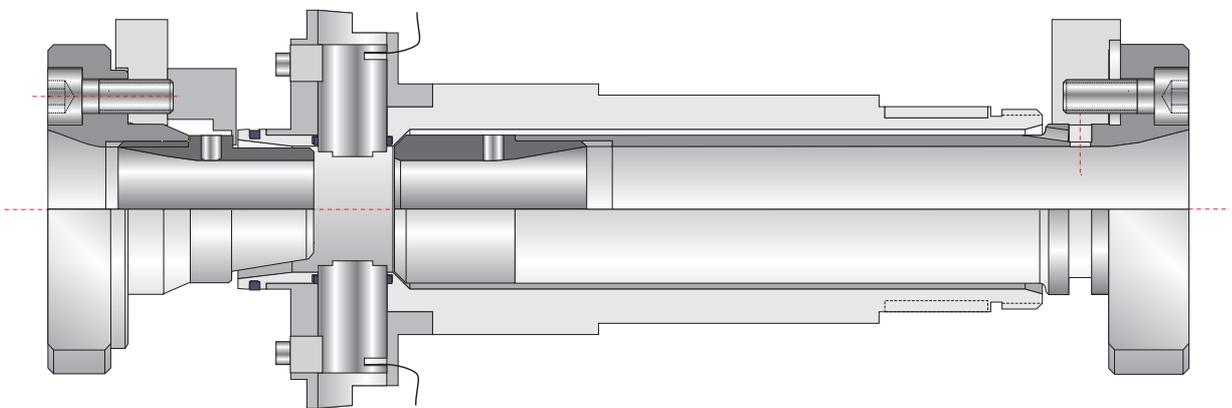


Fig. 4/2 Protective nozzle, schematic diagram, NM > 16 mm, nozzle holder with exchangeable nozzles



4.2 Selection and installation of the protective nozzles

Precision guide

Important! Do not slide the test material in and out without nozzle - risk of major damage. Operate only with protective nozzles!				
	Nozzle Outside Drawing No.	Nozzle Inside Drawing No.	Nominal dimension mm	Step mm
Precision	Guide cores 2.850.31-5301-0020 2.850.31-5301-0021 etc. to 2.850.31-5301-0119 2.850.31-5301-0120		2,0 2,1 11,9 12,0	ref. Table 4/1
	6.460.01-3242	6.460.01-3232	12,1 12,2 19,9 20,0	
	4 different funnels for assembly in the precision guide entry			Ø 2 - 4 mm Ø 4 - 6 mm Ø 6 - 8 mm Ø 8 - 10 mm

Caution:
Always make sure that adaptation is exact!
Incorrect adaptation is a safety risk and can lead to damage!

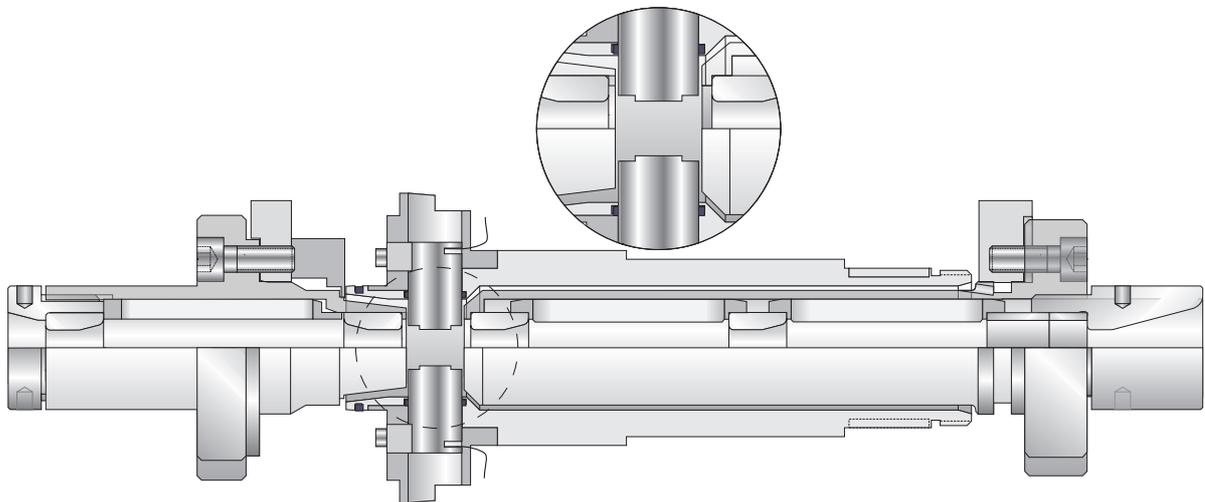


Fig. 4/3 Precision guide e.g. for copper pipes or bars, schematic diagram, throughput right to left



4.2.2 Required tools

▪ Hexagon screwdriver, straight a/f 5 x 200 mm T-handle	016 851 6
▪ Hexagon socket head wrench 5 x 100 mm	014 002 3
▪ Hexagon screwdriver, straight a/f 4 mm spherical head	012 013 8
▪ Hexagon screwdriver, straight a/f 3 x 100 mm T-handle	014 030 4
▪ Hexagon screwdriver, straight a/f 5 x 100 mm T-handle	014 002 3
▪ Hook spanner 25 to 28 mm	003 147 0
▪ Wrench	154 215 0
▪ Adjusting pliers, shape B	030 189 2
▪ Pin puller	137 215 7
▪ 2 winged screws	001 297 1
▪ Roll-up tool bag type 170 144	030 484 0



4.3 Changing nominal diameter

4.3 Changing nominal diameter

4.3.1 Preparation

- select new protective nozzles according to Chapter 4.2
- switch off drive and wait for standstill
- move test material out of the sensor system
- move sensor system out of the test line
- open rotor cover

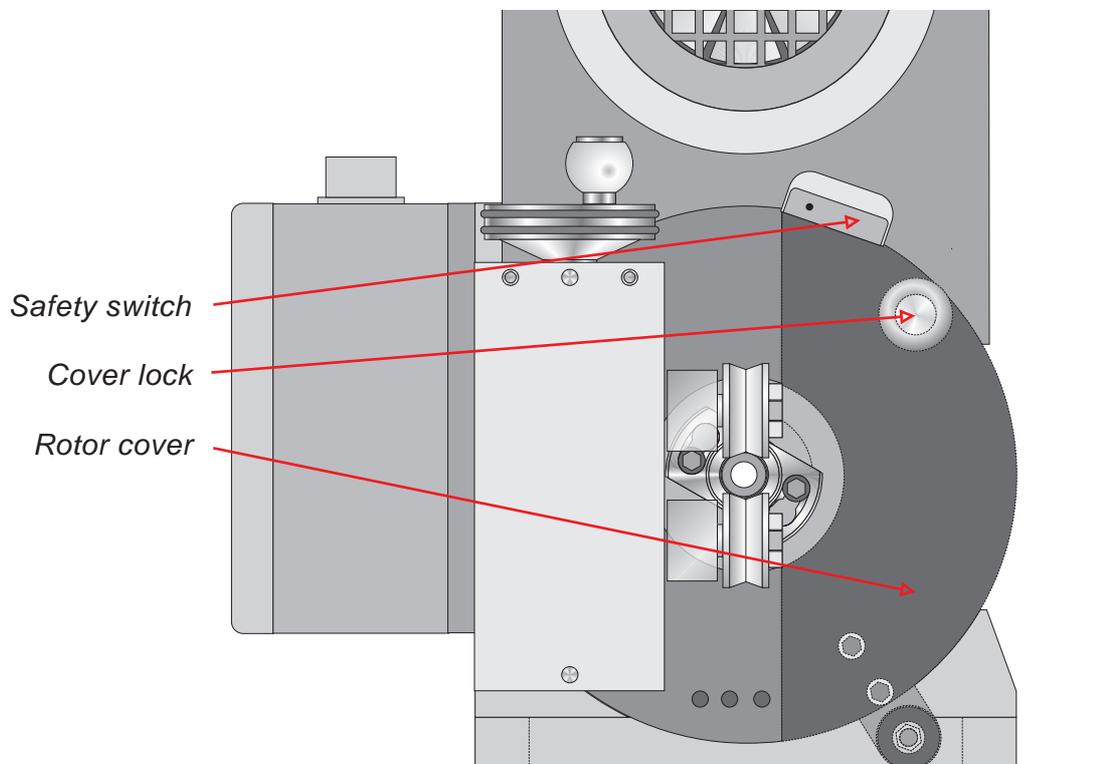


Fig. 4/4 Adjustment side with rotor cover



WARNING!

For safety reasons, a safety switch interrupts the power supply of the drive as soon as the door of the drive cover is opened.

Do not change the function of the safety switch under any circumstances!



4.3.2 Removing nozzle holder

Adjustment side

- open roller guides with hand wheel until the nozzle holder is accessible
- undo fastening of outside nozzle holder
- turn outside nozzle holder anti-clockwise
- Outside nozzle holder

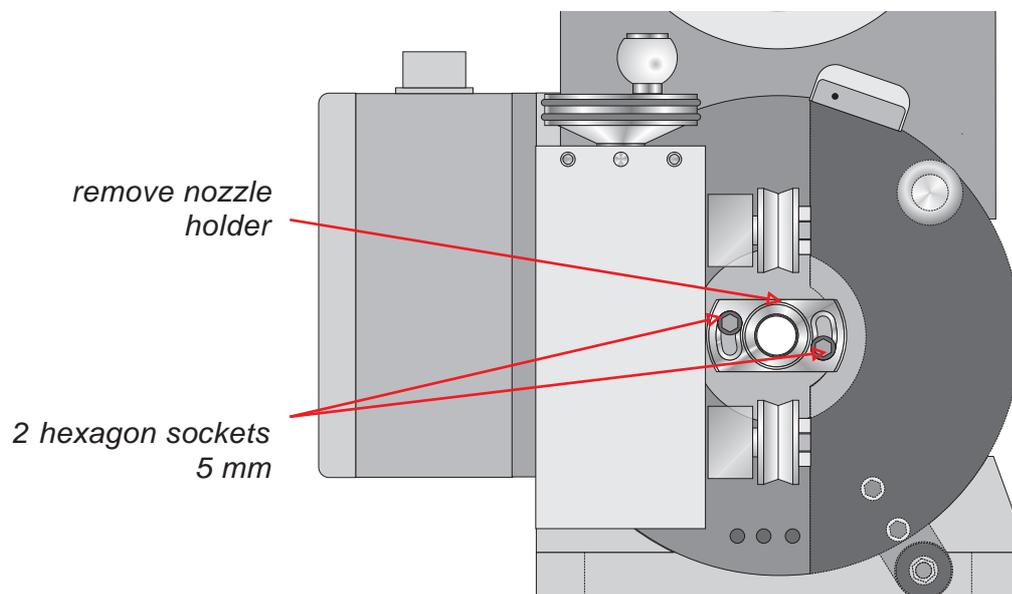


Fig. 4/5 Adjustment side, nozzle holder in removal position

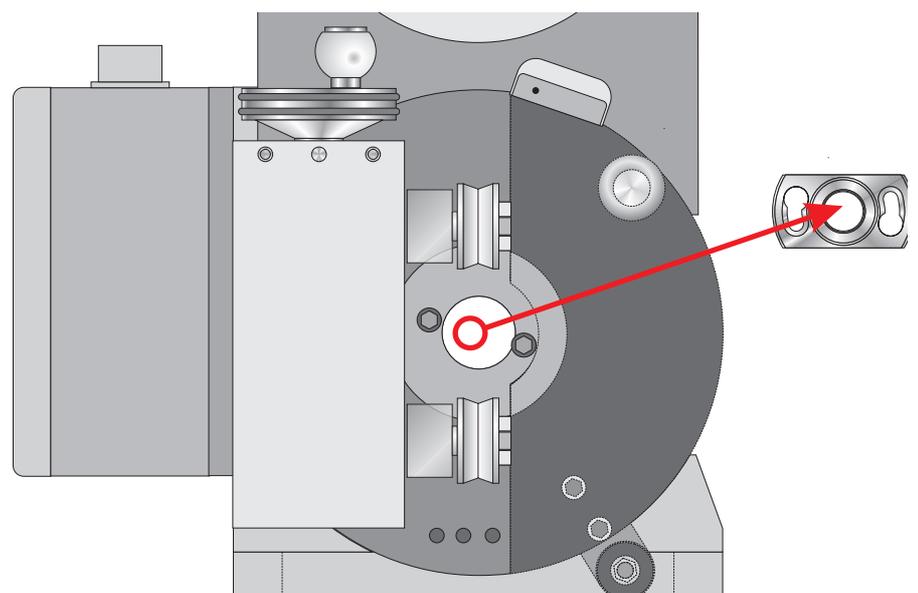


Fig. 4/6 Adjustment side, nozzle holder removed



4.3 Changing nominal diameter

Drive side

- open roller guides with hand wheel until the nozzle holder is accessible
- undo fastening of inside nozzle holder
- turn inside nozzle holder anti-clockwise
- remove inside nozzle holder

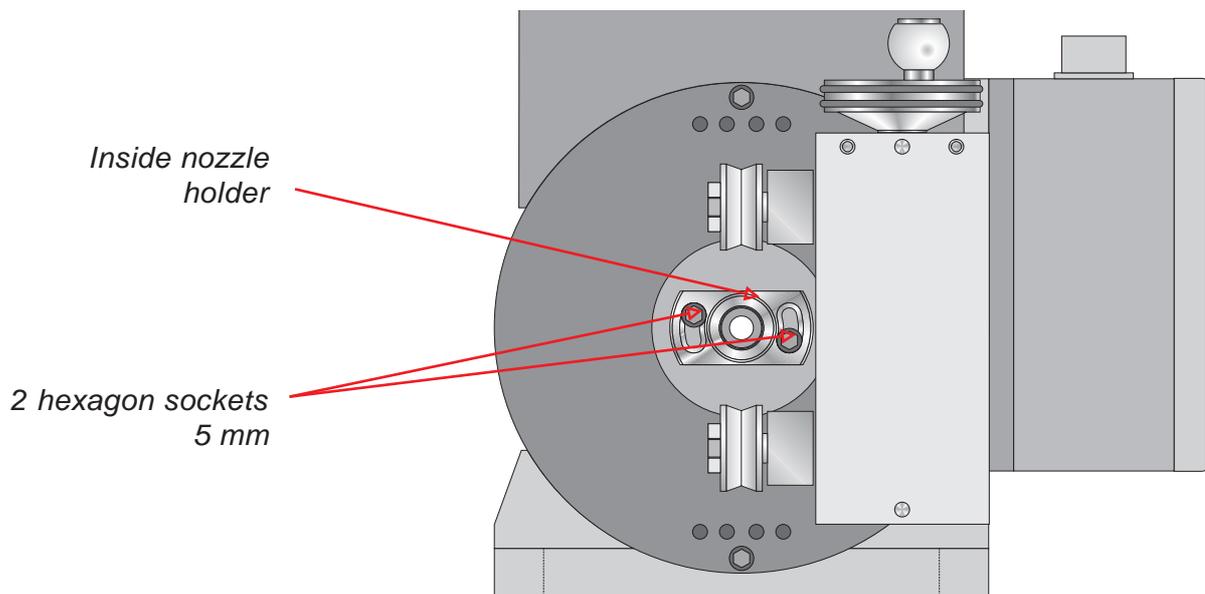


Fig. 4/7 Drive side, nozzle holder in removal position

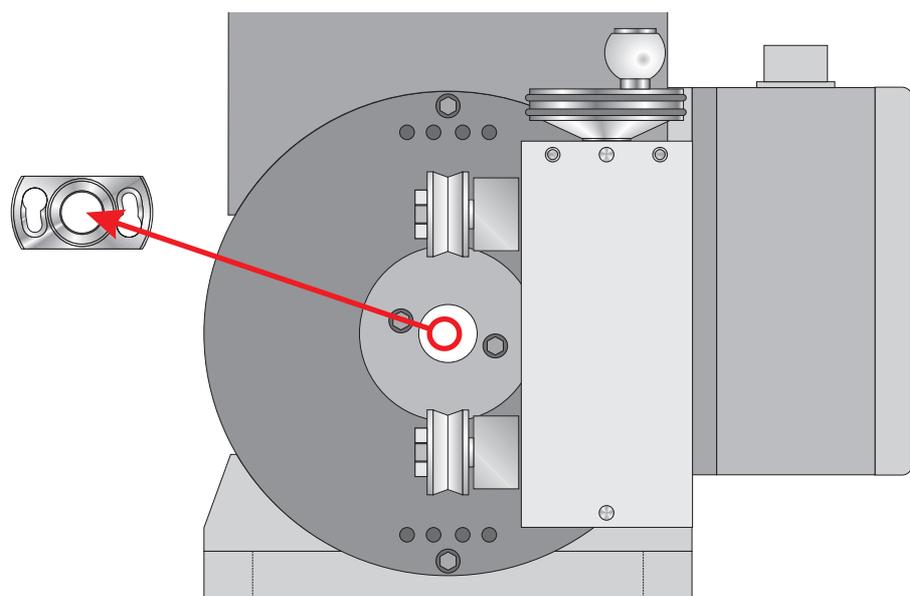


Fig. 4/8 Drive side, nozzle holder removed



4.3.3 Changing nozzles

- unscrew the nozzles from the nozzle holder using two hook spanners



CAUTION!

If the nozzle holder is fixed in a vice, clamp on the surfaces only!

- Outside nozzle holder
- Outside protective nozzle
- Hook spanner
- Inside protective nozzle
- Inside nozzle holder

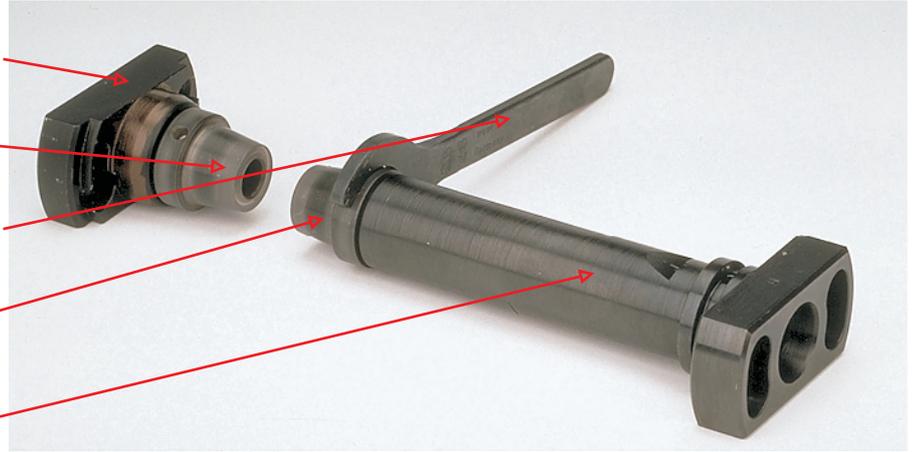


Fig. 4/9 Nozzle holders, nozzles and hook spanners

- screw in new protective nozzles
- fix nozzles using hook spanners
- check end position! Danger of collision with test head!



NOTE!

Use only nozzle pairs with the same nominal diameter!



WARNING!

Adjust the test heads to the nominal diameter of the protective nozzles before inserting the nozzle holders! Inserting the nozzle holders into a test head arrangement that is too narrow can cause damage to the test heads and/or nozzles.



4.3 Changing nominal diameter

4.3.4 Adjusting probe clearance

The test heads are adjusted to the nominal diameter (clear opening) of the protective nozzles.

The adjustment scale is calibrated in such a manner that a safety distance of 0.2 mm is maintained between the protective nozzle and test head when adjusting to the nominal diameter over the entire adjustment range.

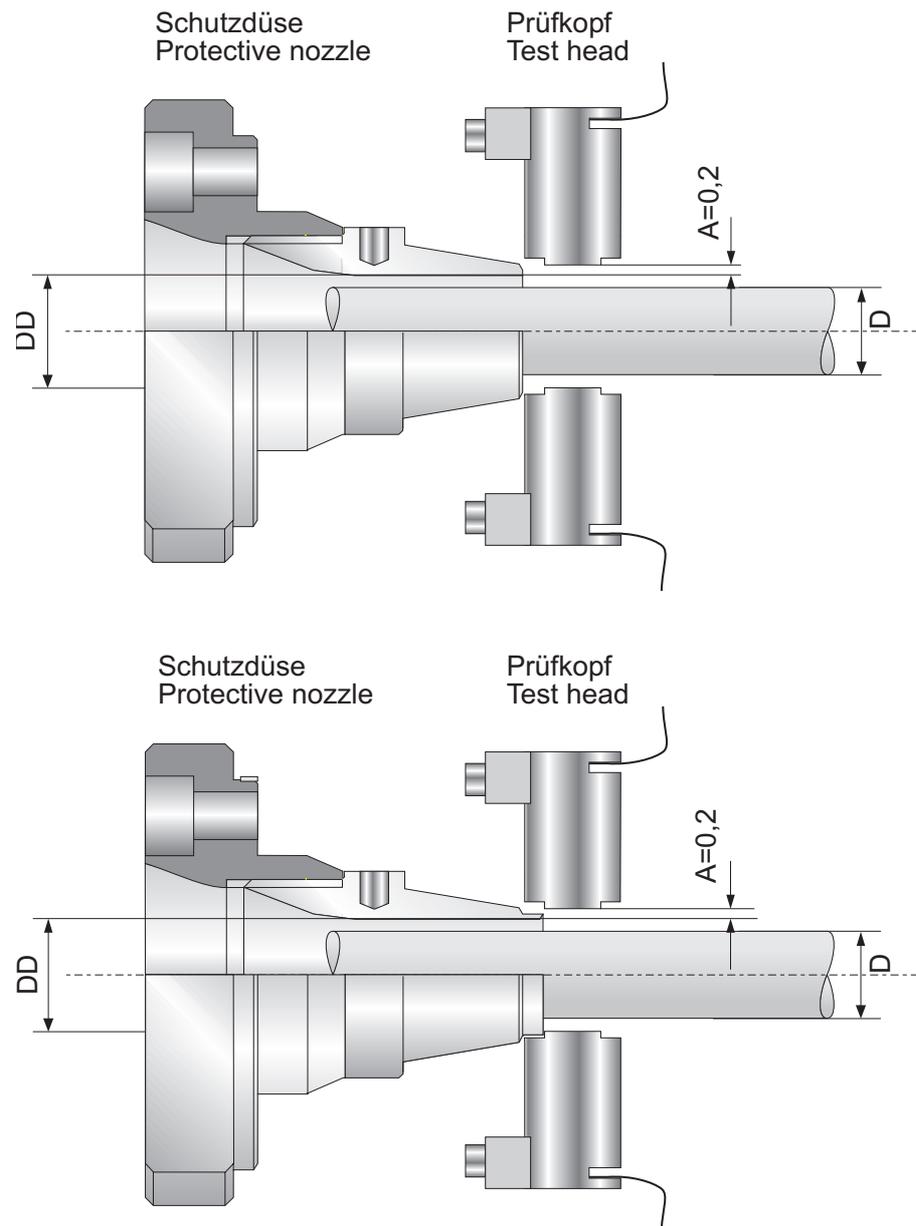


Fig. 4/10 Definition of the settings on the test head
above: standard nozzle; below: special nozzle for test heads N
 D test piece diameter
 DD nominal diameter
 A safety distance between protective nozzle and test head



- Open rotor cover
To do this, pull ball handle and swivel out locking plate

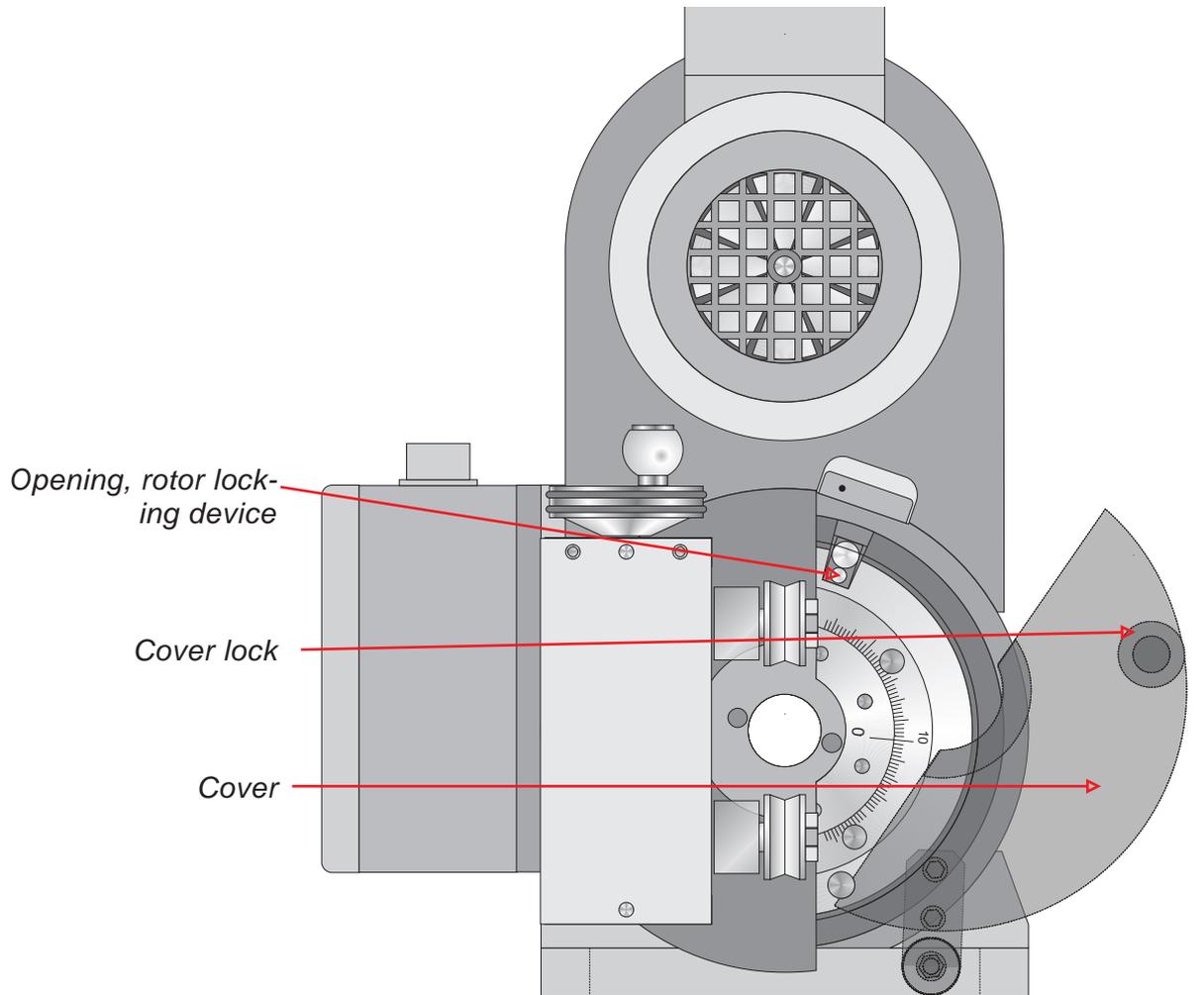


Fig. 4/11 Adjustment side, rotor cover and rotor locking device



4.3 Changing nominal diameter

- Insert wrench 154 215 0 in the graduated disc (with pointer)
- Insert 5 mm socket spanner into the opening of the rotor locking device and fix rotor in position

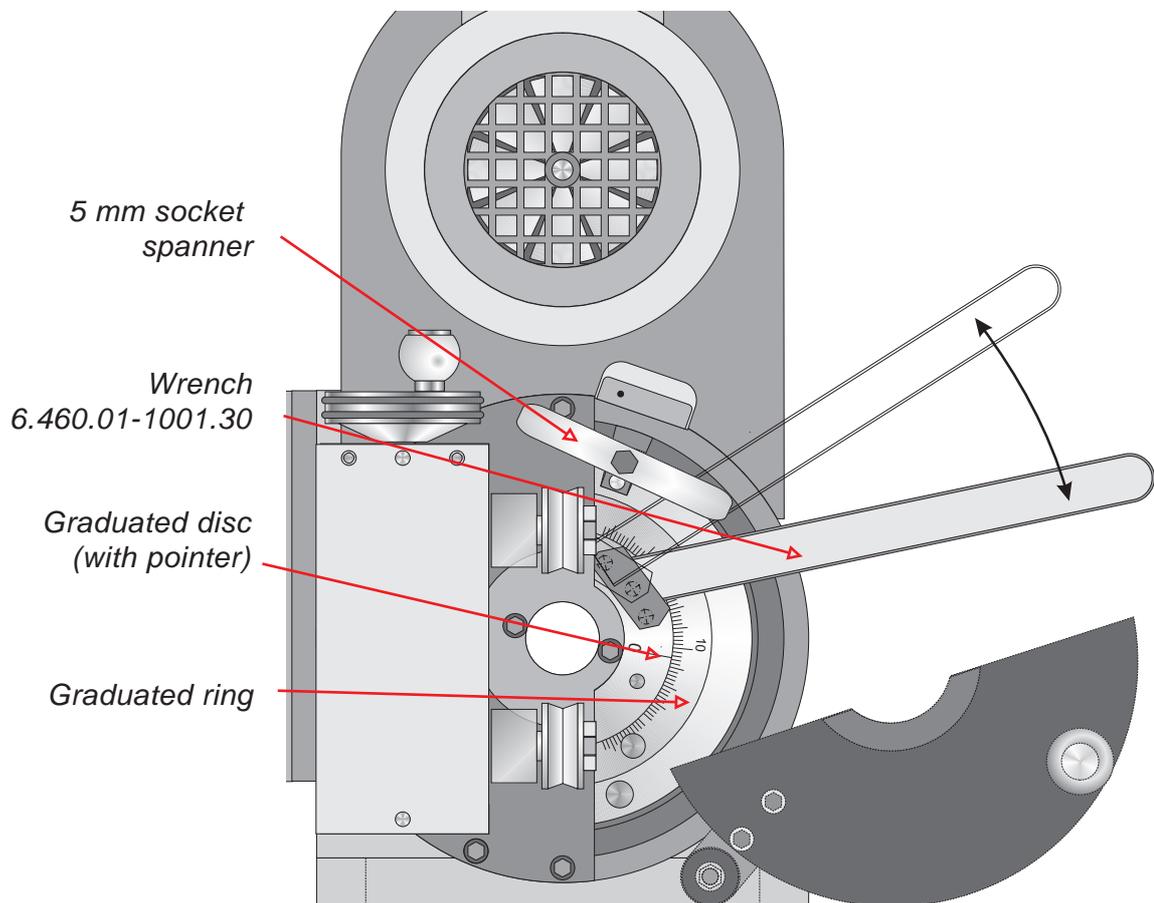


Fig. 4/12 Adjustment side, tools inserted for nominal dimension adjustment



NOTE!

The setting ring for nominal dimension adjustment is self-locking!

- use the wrench to set the graduated disc (with pointer) to the new nominal dimension. In the case of angle limitation, reposition the 5 mm socket spanner.
- remove wrench and socket spanner
- close cover
- insert outside and inside nozzle holders
- fix nozzle holders



4.3.5 Adjusting roller guide

- open roller guide in accordance with material diameter
- insert test material
- adjust roller guide so that the rollers just touch the test material



NOTE!

The test piece must run centrally through the sensor system, if necessary adjust the table to the height of the test axis and lock.

4.4 Rotational speed preselection

The following rotational speeds are available depending on the type of motor control:

- MOC E motor control
 - fixed rotational speed of 9,000 rpm at 50 Hz mains supply.
- MOC EV motor control
 - variable rotational speed of up to max. 18,000 rpm (with frequency converter)

Both motor controls supply the required voltages and currents and contain the necessary switching and safety devices (contactors, motor protection switches, protective circuits).



4.5 Switching on motor

4.5 Switching on motor



NOTE!

Check the diameter and height settings of the sensor system before switching on.

The operating elements used to switch on the rotating head drive are located on the motor control.

The motor control is installed in a separate housing.

Acceleration time: approx. 30 sec

Braking time:

The braking time until standstill can be reduced to a few seconds by actuating the hand brake.

The rotating head must run quietly and without loud noises when no test material is present.

Whistling noises when starting or braking indicate that the belt needs to be retensioned.



NOTE!

Switch off the drive immediately if grinding noises are heard.

Possible causes:

Incorrect test head replacement parts inserted

Incorrect nozzles inserted

Nozzle or holders not securely fitted

Nozzle not fitted in end position



5. Maintenance

5.1 Maintenance schedule



WARNING:

Do not touch or tamper with the sensor system, with the rotating unit operating!

Risk of serious injury!

Always switch off the drive and wait for the machine to stop before performing work of any kind!



Deceleration times:

without braking approx. 7 minutes

with braking approx. 120 seconds

(Values are valid for maximum rotational speed 18,000 rpm)

Important! Parts which are worn or damaged must be replaced immediately.				
	when changing dimensions	each shift	each week	each month
Roller guide		clean, check track rollers for wear and damage	oil joints oil spindle oil hinges	
Nozzles	Remove, check thoroughly and visually for damage	clean, check for wear and damage		
Rotating parts		clean	clean, check for wear and damage	
Testing heads	clean, check for wear and damage	clean, check for wear and damage		
Belt				check tension check for wear and damage
Synchronization light barrier (separated from rotating head!)				clean

Table 5/1 Maintenance schedule



5.2 Cleaning

**WARNING!**

Do not use cold cleaner!

Isopropyl alcohol or denatured ethyl alcohol are recommended as cleaning agents.

- make sure the areas around the rotating parts are clean!
- remove abrasion and dirt with an industrial vacuum cleaner. Clean rotating disc and test heads with alcohol.
- clean test piece sensor (external) with a soft cloth
- lightly oil bright metallic parts after cleaning
- open housing cover to clean inner chamber
- do not blow compressed air into open chamber!

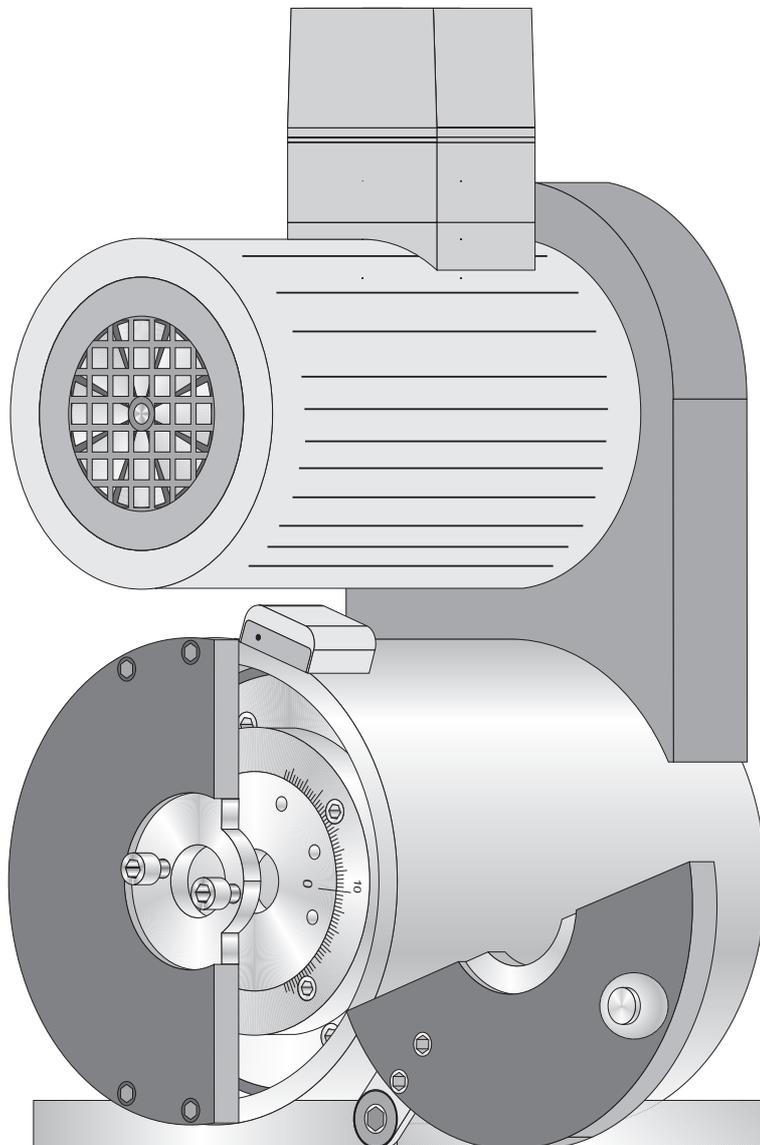


Fig. 5/1 Cleaning chamber



5.3 Removing test heads



NOTE!

Make sure the plug contacts are clean!

- swivel cover outwards
- set test heads to maximum diameter
- remove lid on front side
- undo four M6 x 10 DIN 912 hexagon socket screws
- remove lid

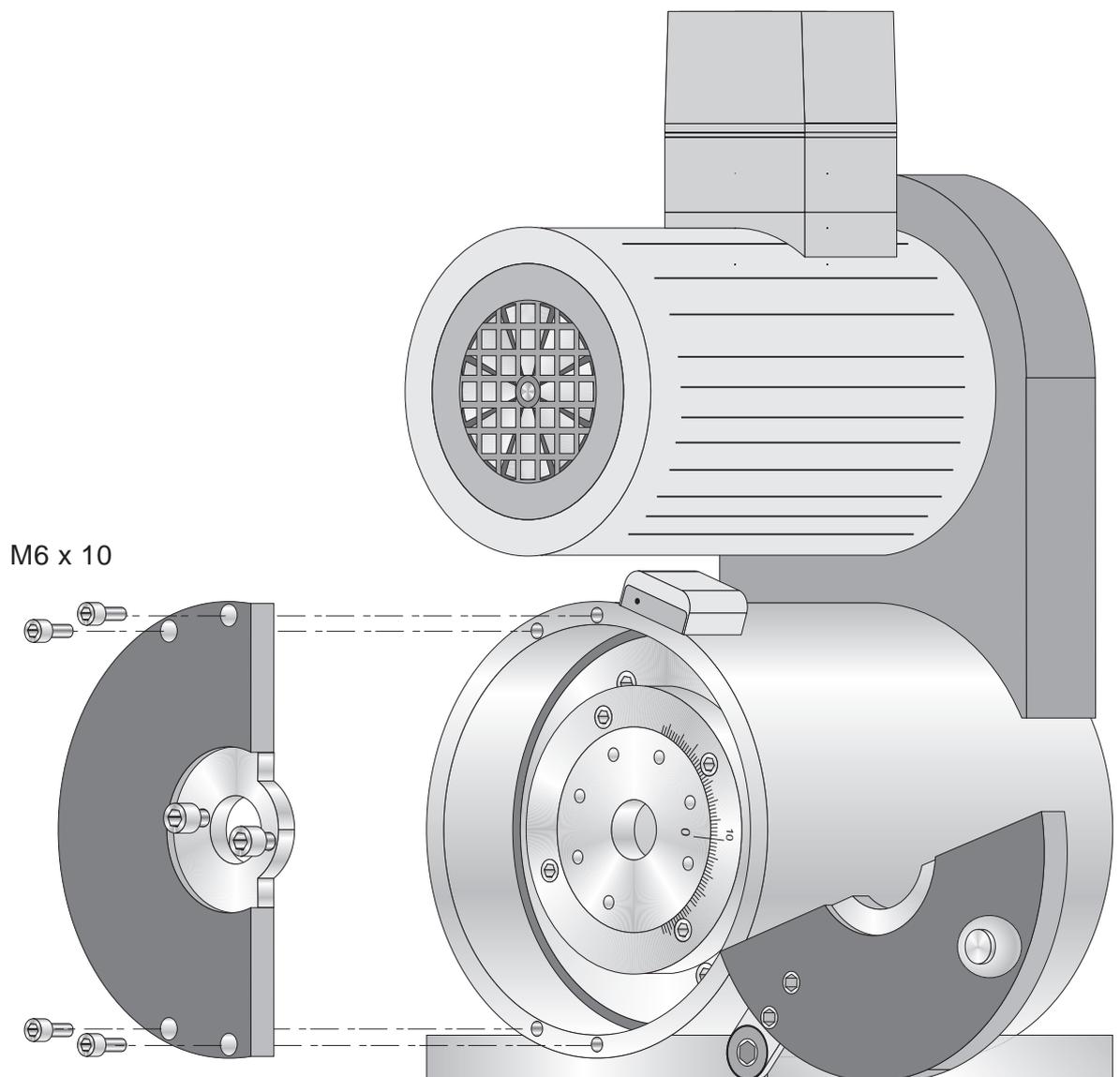


Fig. 5/2 Removing lid on front side



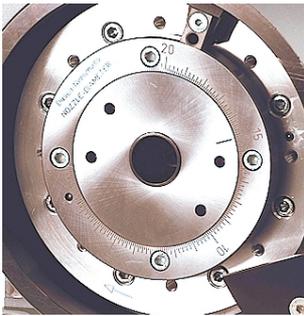
5.3 Removing test heads

- remove graduated ring and spiral disc
- undo four M6 x 16 DIN 912 hexagon socket screws
- remove graduated ring, if necessary press off with two M8 screws
- remove spiral disc



WARNING!

The spiral disc is loose once the graduated disc has been removed!



M6 x 16

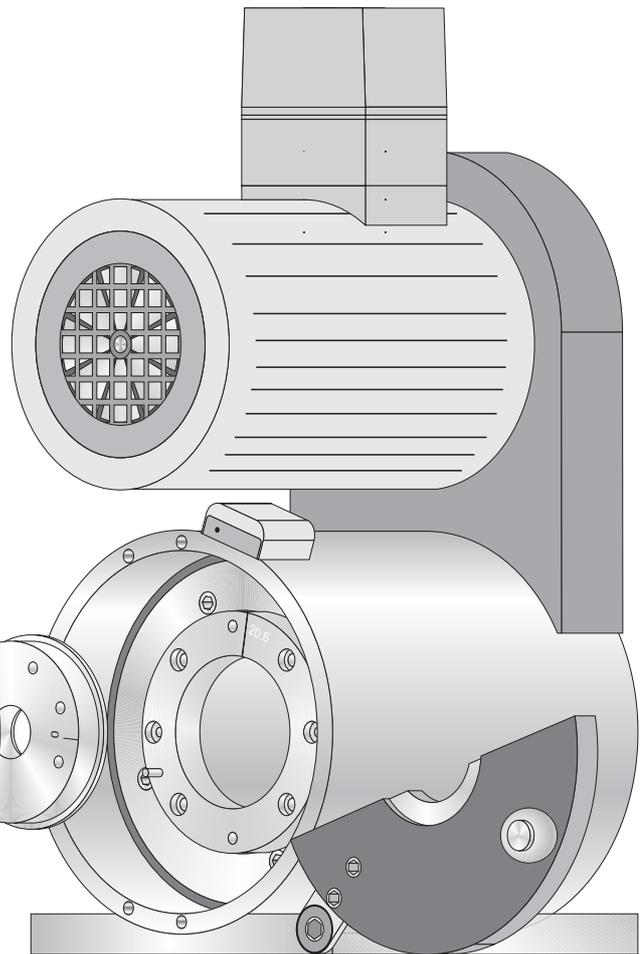
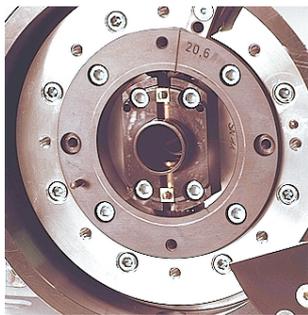


Fig. 5/3 Removing graduated ring and spiral disc



- remove ring
- undo four M6 x 16 DIN 912 hexagon socket screws
- press off ring with two M6 screws



M6 x 16

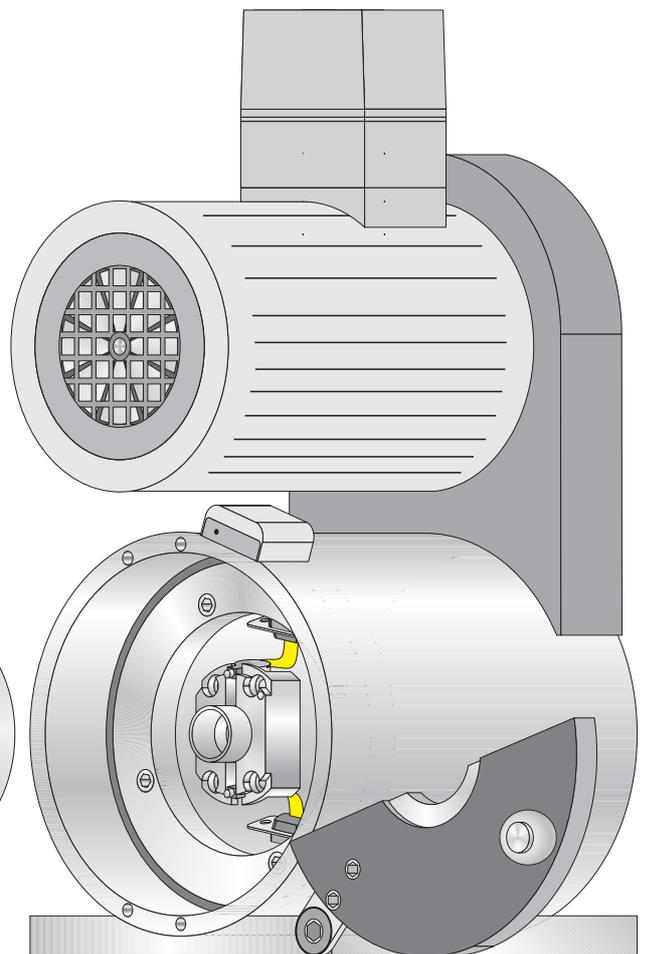
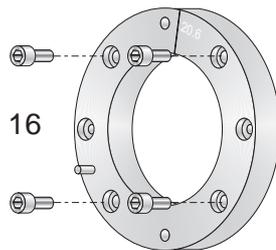


Fig. 5/4 Removing ring



5.3 Removing test heads

- take out test heads
 - undo the plug connection of the test head cable using pliers
 - push the test head outwards in a radial direction and remove
-
- clean test heads (grease lightly if necessary)

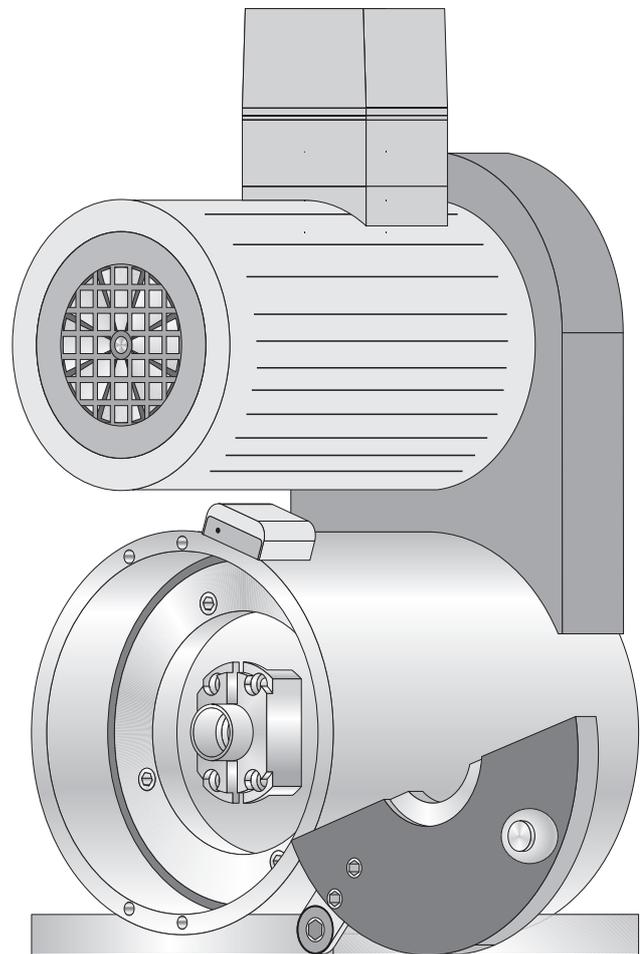
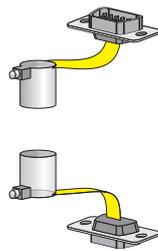


Fig. 5/5 Remove test heads



5.3.1 Installing test heads



CAUTION!

Use test heads in pairs with the same specifications. The type number is found on the upper side of the test heads.

- clean all parts, especially the contact surfaces
- insert test heads into the holders
- insert the plug connection of the test head cable using pliers; fastening screws are not necessary!
- push in test heads on external diameter to a flush position
- insert ring (pay attention to position of pin) and secure with four hexagon socket screws M6 x 16 DIN 912
- place spiral disc in position 20.6, push in by turning gently, do not grease O-rings!
- check the mobility of both test heads by manually adjusting the spiral disc
- fit graduated ring (pay attention to position of pin) and secure with four hexagon socket screws M6 x 16 DIN 912
- fit lid (pay attention to position of pin) and secure with four hexagon socket screws M6 x 10 DIN 912

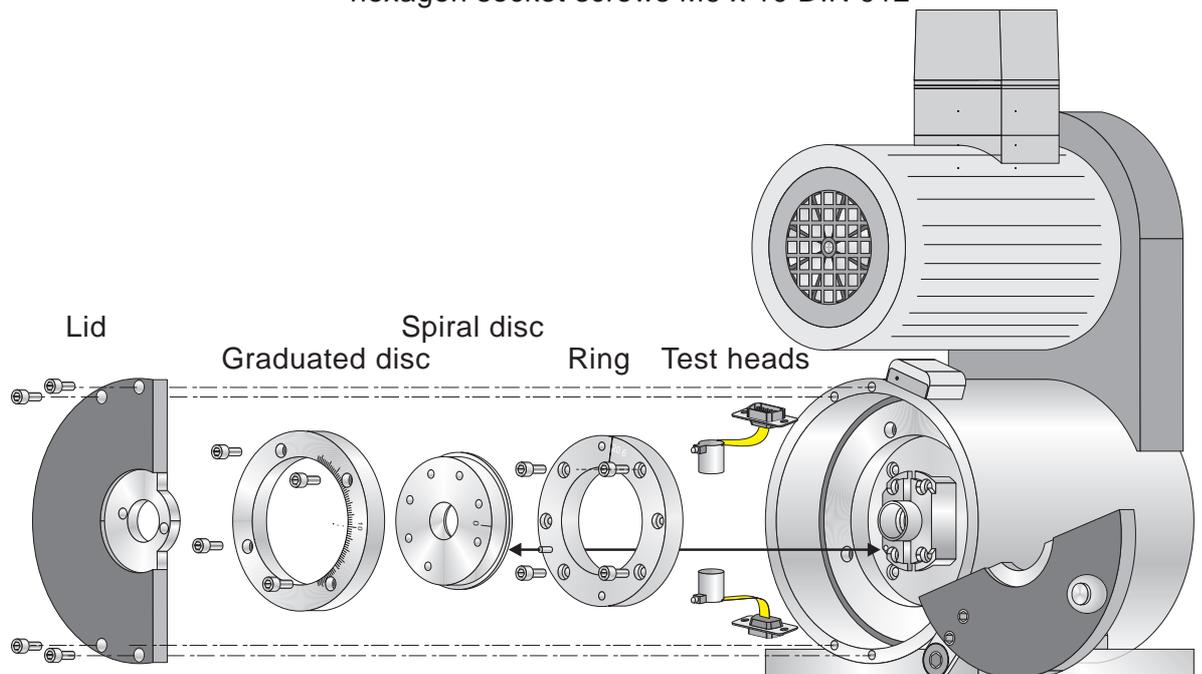


Fig. 5/6 Sequence of components



5.4 List of parts subject to wear

5.4 List of parts subject to wear

Item-Nr	Designation	Order-Nor. Part-No.	Quantity installed	Quantity recommended on stock
1	Rotierkopf	137 276 9 6.460.01		
1.1	Riemen	017 936 1 Poly-V 280; J4 Firma Flender	1	1
1.2	Spezialunterleg-ring Nylite Siegel D = 6	017 927 2 950060.00 Firma Kerb-Konus	8	25
1.3	O-Ring	003 385 5 Simmerit	1	2
1.4	O-Ring	004 543 8 Simmerit	1	2
1.5	O-Ring	009 627 0 Simmerit	1	2
1,6	O-Ring	004 532 2 Simmerit	1	2
1.7	O-Ring	000 577 0 Simmerit	2	4
1.8	Spindellager	032 718 2	2	2
2	Prüfkopf, alternativ:			
2.1	Prüfkopf N Spurbreite 2 x 1.5	166 079 9 6.460.01-2015	2	4
2.2	Prüfkopf N Spurbreite 2 x 2.5	166 080 2 6.460.01-2025	2	4
2.3	Prüfkopf N Spurbreite 2 x 5	166 081 0 6.460.01-2050	2	4
2.4	Prüfkopf DF Spurbreite 2 x 1.5	166 082 9 6.460.03-2015	2	4
2.5	Prüfkopf DF Spurbreite 2 x 2.5	166 083 7 6.460.03-2025	2	4
2.6	Prüfkopf DF Spurbreite 2 x 5	166 084 5 6.460.03-2050	2	4
3	Rollenführung links	153 386 0 6.460.01-5001	1	
3	Rollenführung rechts	153 387 8 6.460.01-5011	1	
3.1	Rolle	153 706 7 6.460.01-5001-0008	4	8
3.2	Rillenkugellager	007 801 8 6000-2RS1 SKF	8	8
3.3	O-Ring	011 984 9 Simrit 72 NBR/872 Firma Freudenberg	2	2
3.4	O-Ring	008 087 0 Simrit 72NBR/872 Firma Freudenberg	4	4
4	Düse	6.460.01-3211	2	4
5	Düse innen	6.460.01-3231	1	2
6	Düse außen	6.460.01-3241	1	2



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