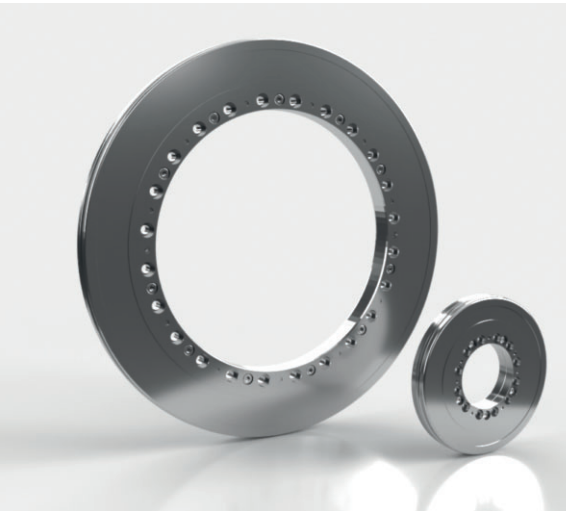
Operating instructions

RotoClamp Outside



XS/XSA
S/SA
N/NA
XL/XLA

ENGLISH

RotoClamp Outside

Operating instructions

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Contact

For further information please turn to:

HEMA Maschinen- und Apparateschutz GmbH,
Am Klinggraben 2
63500 Seligenstadt, Germany
Phone: +49 (0)6182-773-0
Fax: +49 (0)6182-773-35
E-mail: info@hema-group.com
Web: www.hema-group.com

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CONTENTS

1. Important information

These operating instructions describe how to use the RotoClamp Outside properly. Warranty claims are valid only when these instructions have been observed. It is therefore imperative that you please read these instructions before using the safety clamp.

- It is imperative that you observe the thresholds (e.g. for pressures, forces, torques, and temperatures) and tolerance ranges for the clamping pair specified in these instructions.
- Make sure that the supplied compressed air has been properly treated. Once selected, the medium's composition must be maintained over the whole service life.
- Consider the prevailing operating conditions.
- Observe the rules and regulations issued by the professional associations and the technical safety inspectorate TÜV, and the pertinent national, international, and European terms and conditions.
- Before installing for the first time, please remove all transport locks and guards like paper, foil, etc. Each of these materials must be introduced to the legally prescribed disposal cycle (recycling containers).
- The product may be installed and commissioned only be qualified, specialised personnel in accordance with these operating instructions.

Symbols used

⚠ Warning
☛ Note

2. General description

- The clamping elements of the RotoClamp Outside series open pneumatically and generate their clamping force via a spring accumulator at 0 bar. Optionally, the clamping force can be boosted with the additional air function (booster).
- The clamping elements of the RotoClamp Outside Active series close pneumatically and generate their clamping force via the deformation of a prestressed spring at the operating pressure.
- The clamping force is exerted by the frictional contact between the vertically applied surfaces between the clamp's external diameter and the shaft's internal diameter.

RotoClamp Outside Standard

- Disengaging - When compressed air at 4 bar (+0.5/-0.3 bar) or 6 bar (+0.5/-0.3 bar) is applied to the internal spring diaphragm chamber (OPEN), and air is drawn out of the external spring diaphragm chamber (CLOSE), the diaphragm deflects, reducing the distance between the two radial contacting surfaces on the spring's internal and external diameters. In this state, the clamping element is open.-
- Clamping - When air is drawn out of the internal spring diaphragm chamber (OPEN) and supplied to the external spring diaphragm chamber (CLOSE), the diaphragm relaxes and presses against the radial contacting surfaces on the spring's internal and external diameters. The clamping element deforms at the clamped surface. In this state, the clamping element is closed.

- Clamping with additional air (booster) - Optionally, the clamping force can be boosted when the external spring diaphragm chamber (CLOSE) is pressurised additionally with compressed air at 4 bar (+0.5/-0.3 bar) or 6 bar (+0.5/-0.3 bar). In this state the clamping element is closed.

RotoClamp Outside Active (clamping with air)

- Disengaging - In the installed state, the spring diaphragm is bent, reducing the distance between the two radial contacting surfaces on the spring's internal and external diameters. In this state, the clamping element is open.
- Clamping - When air is drawn out of the internal spring diaphragm chamber (OPEN) and the external spring diaphragm chamber (CLOSE) is pressurised with compressed air at 4 bar (-0.3 bar) to 6 bar (+0.5 bar), the diaphragm deflects and presses against the radial contacting surfaces of the spring's internal and external diameters.
  The clamping element deforms at the clamped surface. In this state, the clamping element is closed.

3. MODEL VARIANTS

- RotoClamp Outside is available in the model versions XS, S, N, XL as a standard or active version (clamping with air), and for a working pressure of 4 bar (+0.5/-0.3 bar) or 6 bar (+0.5/-0.3 bar).
- Rotoclamp Outside is also possible and available in customised special sizes.
- RotoClamp Outside is also possible as a special version with other operating pressures from 4 to 6 bar (+0.5/-0.3 bar).

4. CONTROLS AND CONNECTIONS

- Fastening options depending on version:
  - through holes in the RotoClamp Outside's housing
  - female thread in the RotoClamp Outside's housing (option)
  The fastening screws must be able to take the max retaining torques.
- Compressed air connections »OPEN« and »CLOSE« on both sides of the housing:
  - M3 / M5 connections on RotoClamp Outside XS types
  - M5 connections on RotoClamp Outside S types
  - G1/8" connections on RotoClamp Outside N and XL types
- IMPORTANT: On the RotoClampOutside Standard without additional air (booster) mode, the connection »CLOSE« must always be open for drawing out air.
- Plugs for sealing the unused connections (red) are included in delivery.
- IMPORTANT: Unused air connections must be sealed tightly.

5. Use

- The clamping elements of the RotoClamp Outside series are designed to clamp rotating elements during machining operations and are manufactured for the fits specified in the technical documentation/catalogues.
- The task and functional characteristic of HEMA clamping systems are to retain and clamp components in the one position.
- RotoClamp Outside is designed to be used indoors and confined spaces with dry atmosphere.

6. Improper use / warnings

- RotoClamp clamping systems are not designed to secure suspended loads when machines or machine parts are being manufactured, transported, assembled, installed, commissioned, used, cleaned, subjected to troubleshooting, shut down, disassembled, or disposed of in personal danger areas without redundant safety systems
- RotoClamp clamping systems cannot be used as bearings for supporting shafts and axles.
- RotoClamp clamping systems cannot be used as brakes.
- RotoClamp clamping systems cannot be used as axial clamps.

7. Residual risks

RotoClamp clamping systems are not fitted with a second safety circuit. When the system is actuated intentionally or by accident, the RotoClamp opens and therefore releases its retaining force - and the retained mass - on the shaft. As a consequence, during all operating modes and lifecycle phases without a redundant system, there are mechanical dangers in the form of:

- crushing, cutting, shearing, abrasion, or puncturing during installation from:
  - unsecured connected structures, disruptions in the compressed air supply (e.g. pressure fluctuations)
  - human error (e.g. inadequate experience or qualifications, stress, fatigue, "convenient shortcuts")
- failure to observe the information and warning signs during installation and commissioning
- wrong use of the RotoClamp Outside (see Section 6)
- impacts, abrasion, cutting as a consequence of inadequate compressed air connections or loose compressed air lines or fastening screws

8. Warranty

- The design peculiar to the RotoClamp Outside requires that the tolerance range (dimensional, shape, and positional tolerances) between the shaft and clamp lie within the thresholds defined in the annexed tables. A discrepancy can cause damage to the housing or diaphragm in continuous operation. Failure to observe the tolerance ranges will lead to the loss of warranty.
- Rigidity of the surrounding structure - The clamping process always generates outwardly

directed radial forces that are transferred to the surrounding structure via all of the fastening screws and that prevent the RotoClamp from expanding.

- All of the provided screw points must be used. In particular for the booster function, the radial forces may affect the geometrical precision of the plane contact between the contacting surfaces and the shaft when the surrounding structure exhibits inadequate rigidity. A change in geometry often leads to asymmetrical loads inside the RotoClamp and therefore to undesired deformations during this fast, dynamic clamping process. Detrimental effects on the spring diaphragms' service life can therefore not be ruled out. The geometrical precision of the plane contact on the shaft must also remain less than 0.02 mm during the clamping process, and the RotoClamp's radial expansion must be less than 0.01 mm at the internal diameter.
- Operating conditions - Ambient temperature min 10°C and max 45°C, pneumatic operating pressure 4 bar (+0.5/-0.3 bar), 6 bar (+0.5/-0.3 bar), mainly operation with dry, filtered air (particles: Class 4, condensate: Class 4, oil content: Class 3) according ISO 8753-1:2010.
- RotoClamp Outside Standard »4 bar« versions may be operated with 4 bar (+0.5/-0.3 bar) only, »6 bar« versions with 6 bar (+0.5/-0.3 bar) only. Too high an operating pressure causes damage to the spring diaphragms and sealing problems. Too low an operating pressure causes opening problems.
- Rotoclamp Outside Active versions are appropriate for a operating pressure range of: XL types: 4 bar (-0.3 bar), all other types from 4 bar (-0.3 bar) up to 6 bar (+0.5 bar).
- Safety clamping systems of the RotoClamp Outside Standard type come with a warranty of twelve months following delivery, but not in excess of one million clamping cycles (no emergency or braking clampings). When submitting a warranty claim, the customer must present suitable verification of the actual number of clampings.
- Safety clamping systems of the RotoClamp Outside Active type come with a warranty of twelve months following delivery, but not in excess of 500,000 clamping cycles (no braking clampings). When submitting a warranty claim, the customer must present suitable verification of the actual number of clampings.
- Before leaving the factory, the RotoClamp Outside clamping elements are machined with external cylindrical grinders to their respective external size based on the defined plane contact.
- Only completely assembled RotoClamp Outside units are covered by the warranty. Removing, dismantling, or remachining the RotoClamp Outside without prior consent issued in writing by HEMA reduces the operating safety and renders the warranty void.
- The specified retaining torques are obtained when the shaft and clamp are dry and unlubricated. The use of greasy lubricants may cause a considerable reduction in retaining torque (> 50%) or failure of the clamping element.
- Before mounting the RotoClamp, the clamping area should be cleaned of sealing compounds and oils using a solvent (such as Weicon Reiniger »S«).
- The additional air (booster) function cannot be activated for a passive component until it has been installed. Activating the clamping function on active components is also critical. Activating without resistance may cause damage to the housing and gaskets.
- The clamping elements are used properly only when they are used in full compliance

with the technical specifications. Any other use will exempt HEMA Maschinen- und Apparateschutz GmbH from providing any other services.

9. Transport/storage/intermediate storage

- The clamping elements are transported in the prestressed state without locks.
- The clamping elements should be placed in storage or interim storage in the preserved state and in the packaging selected by HEMA.
- The clamping elements are made of materials that can corrode when treated incorrectly. Warranty claims on these grounds will not be acknowledged.
- Before mounting the RotoClamp, the clamping area should be cleaned of sealing compounds and oils using a solvent (such as Weicon Reiniger »S«).

10. Type designation

- The engraved type designation can be found on the top panel of the RotoClamp housing. With all standard parts, this side is not plane ground and does not serve as a plane contact.

The engraved type designation serves to identify and track the clamping element. The clamping element's serial number (SN) is important. It is unique for every clamping element and therefore absolutely essential for tracking purposes. So never obliterate the type engraving with chemical and/mechanical means. The type designation must be legible at all times. Removing or obliterating the type designation renders all warranty claims void. The type designation describes the type and the size.

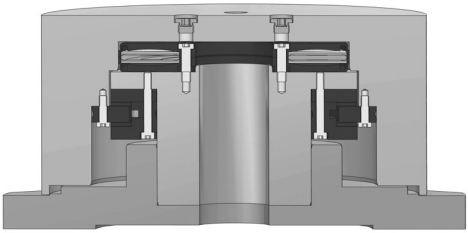
- HEMA clamping systems function in accordance with the specifications and performance data and undergo a full, individual final inspection with retaining torque measurement. The components receive an individual marking and are documented internally.

11. Installation notes

- Check that the type designation on the RotoClamp Outside agrees with the RotoClamp variant you want to install. Handle the RotoClamp so that it cannot sustain damage. This will reduce the operating safety and render the warranty void.

- Make sure that the installation is free of torsion and the max loads in the catalogue cannot be exceeded. Screws of property class 12.9 must be used to secure the RotoClamp Outside.
- When using screws of strength class 12.9, the machine manufacturer must take measures to prevent hydrogen embrittlement.
- In order to prevent an independent loosening or loosening of the fixing screws, the screws are installed with a medium-strength threadlocker.
- Tighten the fastening screws with the prescribed torque (see Section 18).

12. INSTALLED STATE



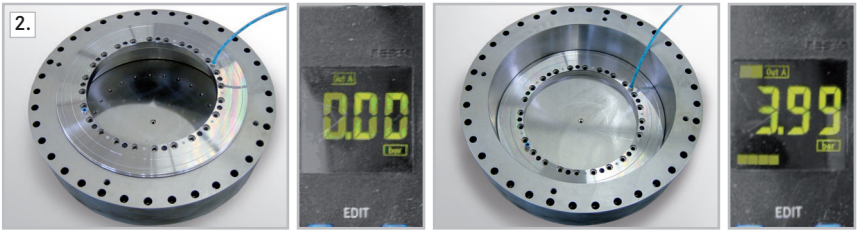
View: RotoClamp Outside in mounting position (recommendation)

13. INSTALLING THE ROTOCLAMP OUTSIDE

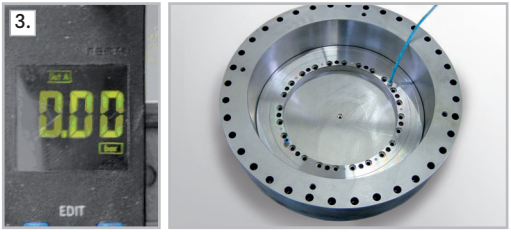
- Make sure that the fastening and clamping surfaces are clean and plane. Before mounting the RotoClamp, the clamping area should be cleaned of sealing com pound and oils using a solvent (such as Weicon Reiniger »S«).
- Attach the pneumatic lines.
- The RotoClamp Outside Standard must be pressurised at the »OPEN« connection and opened with compressed air at 4 bar (+0.5 bar) or 6 bar (+0.5 bar). Then it can be inserted into the housing.
- Afterwards the RotoClamp Outside is aligned to the planned contacting position and screwed in place with a reduced tightening torque.
- After installing the RotoClamp Outside, reduce the air pressure to 0 bar until the RotoClamp Outside has centred within the housing. This step should be repeated at different angular positions of the rotating part.
- Reliable centring requires a radial clearance of about 1 mm at the RotoClamp Outside's internal diameter. The internal and external diameters are not concentric.
- The RotoClamp Outside Standard has only one defined plane contacting side opposite the engraved side.
- Once the RotoClamp Outside has centred at the planned position, the fastening screws are fully tightened with the defined tightening torque (Table 1, page 18) applied crosswise over two to three circuits.

Step by step procedure for installing the RotoClamp Outside:

- Remove the red plugs from the connections »OPEN« and »CLOSE«.
- Should the **air connection be from the side opposite the engraving**, then please first start with **„steps for changed air supply“** (page 11), then continue as described.
- Please make sure that all RotoClamp Outside units are screwed with their plane ground housing sides (the opposite sides without the serial number) to the planned, treated contacting surface on the machine.
- Connect compressed air to the »OPEN« connection, and set the rated pressure to 4 bar (+0.5 bar) or 6 bar (+0.5 bar), depending on the version ordered.
- When installing the RotoClamp, a maximum operating pressure of 4.5 bar or 6.5 bar is recommended for 4 and 6 bar models respectively.

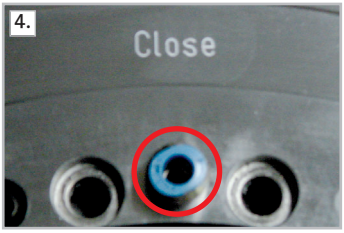


- Please bear in mind that the RotoClamp Outside Standard **cannot be installed without operating pressure**. The RotoClamp Outside Standard **can be installed only with operating pressure** at 4 bar (+0.5 bar) or 6 bar (+0.5 bar).
- Position and align the RotoClamp Outside Standard until plane, then turn in the screws of property class 12.9, and tighten by hand until they sit correctly. Please note that 12.9 screws must be used without fail. See Table 1, page 18 for tightening torques.

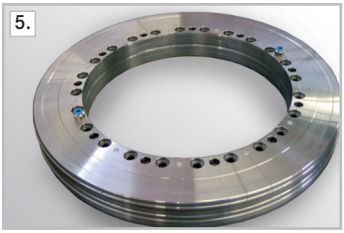


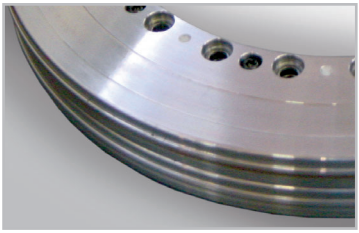
- Remove the pressure: the system centres itself. Now tighten the screws with the calculated torque.

- Proceeding crosswise over several circuits with defined end values, e.g. first 20 Nm, then 50 Nm, then 70 Nm.
- Apply the operating pressure, and check that the shaft can rotate freely. If necessary, repeat the steps for installation.



- IMPORTANT: RotoClamp Outside with additional air option (booster) - Connect compressed air to the »CLOSE« connection, and examine tightness and correct functioning after full installation.



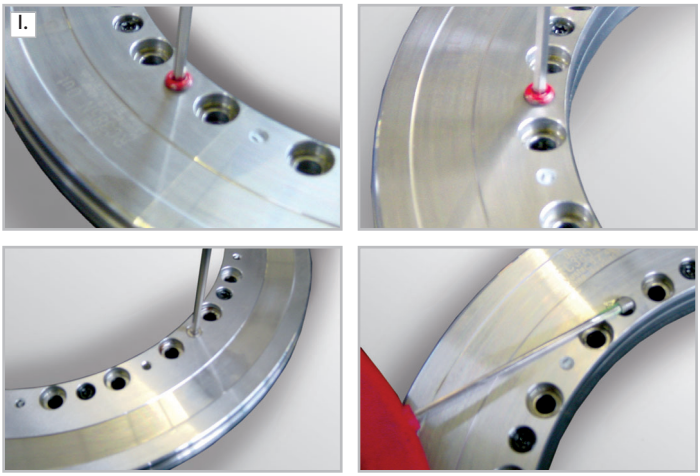


- Tandem variants (two RotoClamps) are installed analogously to the above description with consideration to the air passage, the tightening torques, and their sequence.

Additional steps for changed air supply

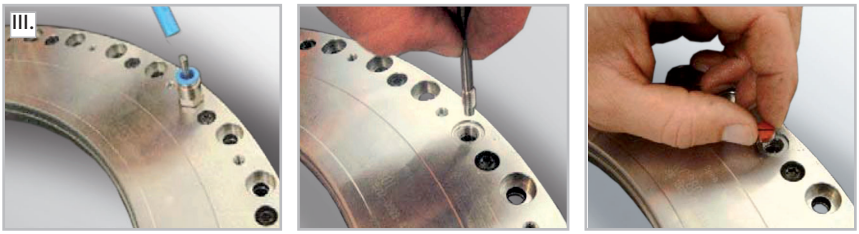
IMPORTANT: The following additional steps are necessary only when a changed air supply is needed from the opposite side of the engraving. In this case, please order separately the parts set (see page 13 for details).

- Examine the installation kit for the RotoClamp Outside, and keep it ready. Remove the red storage protection caps from the »OPEN« and »CLOSE« connections on the RotoClamp Outside.
- N, XL series - Remove the setscrew with flat point (DIN EN 24766 M6 x 8) from the »OPEN« connection on the engraved side and the unpainted G1/8" screw plug from the »CLOSE« connection on the nonengraved side of the RotoClamp Outside
  XS / S series - Remove the M3 / M5 screw plugs from the »OPEN« and »CLOSE« connections on the nonengraved side.

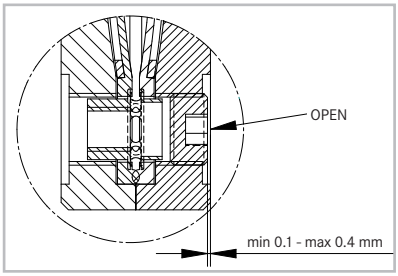


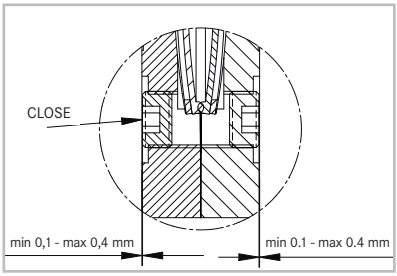
- Using the installation kit when installing for the first time and removing.

- From the engraved side, screw in the installation pin at the »OPEN« connection, and if necessary seal the thread. Screw a straight pneumatic connection (G1/8" thread) into the »OPEN« connection (engraved side), and afterwards insert a suitable hose.
- Pressurise the RotoClamp Outside with operating pressure (4 or 6 bar). Insert O rings at the »OPEN« and »CLOSE« connections between the RotoClamp Outside's plane contact and the attachment area. Install the RotoClamp at the desired position (towards the observer), then shut off the air supply.
  Afterwards, remove the pneumatic connection and the installation pin.



- Seal the »OPEN« and »CLOSE« connection with the protective screws marked red. All screw plugs should be inserted to a depth of 0.1–0.4 mm under the plane surface. Otherwise, there may be leakage and functional problems. The compressed air can now be supplied from the plane side.
  IMPORTANT The work depicted in this example is on a RotoClamp Inside.





To remove the RotoClamp, follow these steps in reverse order. Continue the installation then with step 1, page 10.

Installation materials accessory kit, not included in delivery, please order separately by fax +49(0)6182 773-35 or E-Mail to bestellung@hema-group.com:

Installation kit for S types
article no.: 10028159
installation pin
(St 37-2 as per drawing): 1 pce
O ring (70 Shore, 4 x 1.5): 2 pcs
plug screw (M5 x 4): 3 pcs

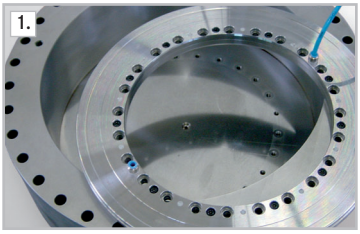
Installation kit for N and XL types
article no.: 10026841
installation pin
(St 37-2 as per drawing): 1 pce
O ring (70 Shore, 12 x 1.5): 2 pcs
plug screw (G1/8" x 5): 3 pcs

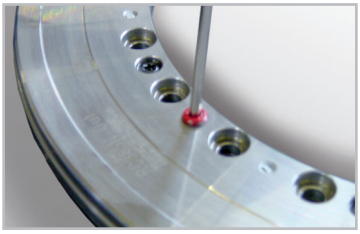
Installation kit for XS types
Installation kit for XS types with M3 on request

14. Installing the RotoClamp Outside Active

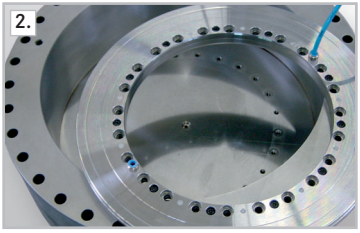
- Make sure that the fastening and clamping surfaces are clean and plane.
- RotoClamp Outside Active is open without compressed air and can therefore be inserted into the housing without compressed air.
- Afterwards the RotoClamp Outside Active is aligned to the planned contacting position and screwed in place with a reduced torque.
- Make the compressed air connections.
- After installing the RotoClamp Outside Active, raise the air pressure to 4 bar (+0.5/-0.3 bar) or 6 bar (+0.5/-0.3 bar) (»CLOSE« connection) until the RotoClamp centres itself on the shaft. This step should be repeated at different angular positions of the rotating part.
- Reliable centring requires a radial clearance of about 1 mm at the RotoClamp Outside's internal diameter. The internal and external diameters are not concentric. The RotoClamp Outside Active has only one defined plane contacting side opposite the engraved side.
- Once the RotoClamp Outside Active has centred at the planned position, the fastening screws are fully tightened with the defined tightening torque (Table 1, page 18) applied crosswise over two to three circuits.

Step by step procedure for installing the RotoClamp Outside Active (clamping with air / booster)

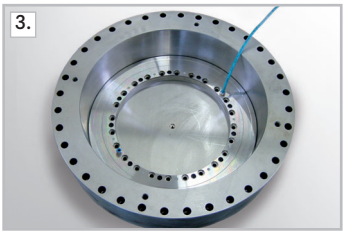




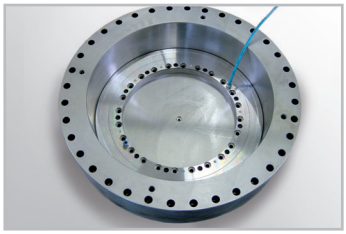
- Remove the red plugs from the connections »OPEN« and »CLOSE«.
  Please make sure that all RotoClamp Outside Active units are screwed with their plane ground housing sides (the opposite sides without the serial number) to the planned, treated contacting surface on the machine.



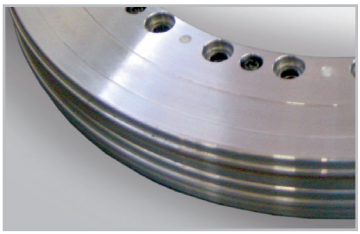
- Note: The RotoClamp Outside Activ can be **installed only without operating pressure**.



- Position and align the RotoClamp Outside Active until plane, then turn in the screws (property class 12.9), and tighten by hand until they sit correctly. Please note that 12.9 screws must be used without fail.



- Apply the pressure: the system centres itself. Now tighten the screws with the calculated torque, proceeding crosswise over several circuits with defined end values (e.g. first 20 Nm, then 50 Nm, then 70 Nm).
- Remove the operating pressure, and check that the shaft can rotate freely. If necessary, repeat the steps for installation.



- Tandem variants (two RotoClamps) are installed analogously to the above description with consideration to the air passage, the tightening torques, and their sequence.

15. Final examinations and information

- Examine the clamping gap between the housing and the RotoClamp Outside. The tolerance ranges defined for the sizes XS, S, N, and XL can be taken from the annexed tables.
- Should you not obtain the clamping clearance needed for proper functioning and long service life, remove the RotoClamp Outside and examine all of the relevant measurements.
- In cases of doubt, consult HEMA.
- Bear in mind that the RotoClamp Outside's mating (contacting) surfaces must be plane machined. Also, the RotoClamp Outside is plane ground on the defined plane contacting side.
- The external diameter of all RotoClampOutside units is machined with external cylindrical grinders when they are installed, open, and pressurised at the defined system pressure. The overall running precision is safeguarded only with respect to the defined plane contacting side and in the open state.
- Incorrectly installed RotoClamp Outside units cannot function reliably.
- Never install two RotoClamp Outside units in tandem on your own authority without first consulting HEMA. The systems must be matched to each other, and the contacting and reference surfaces machined accordingly before installation.
  Note the air passage on stacked clamps. HEMA must deliver stacked clamp solutions in the preassembled state. The plane ground side and plane contacting surface must be examined carefully.
  Please make sure that the operating pressure remains constant in the system. Pressure fluctuations (drops) during operation can cause irreparable damage to the system.
- After connecting the system, execute about 500 test cycles to verify correct functioning and eliminate any effects caused by transport. Examine the system for air noise or other irregularities.
- For the optimal mating, the contact surfaces may also be run in (slid) within 0.75 angular degrees ≙ 2700 seconds of arc) at a max feed rate of 0.01 rpm (≙ 3.6°/min) under the defined conditions.
- The installed metal-rubber connectors are subject to ageing that may cause leakage during the service life.

16. RotoClamp Outside features

- The precision of the clamping surface is machined to the specified dimensions with external cylindrical grinders. The clamping surface's overall running tolerance to the screw-on surface (plane contact) is less than 0.020 mm.
- The width of the theoretical clamping surface is approx 7 mm. Based on the function and the radial clearances, clamping may be expected to take effect in the 2–4 mm range.
- During operations with additional air, the max compressive stresses at the RotoClamp Outside's clamping lip are as high as 180 N/mm². Please bear this in mind when designing the shaft. HEMA always recommend that the shaft should be process hardened (HRc 58 +4, Eht 0.8 mm, Ra = 0.4).

- The link must be rigid if it is to transfer the high clamping torques.
- The geometrical precision of the plane contact on the shaft must also remain less than 0.02 mm during the clamping process. The RotoClamp's radial expansion must be less than 0.01 mm at the external diameter.
- Transferable torque (example) – With M8 12.9 screws, each pretightened at 30,700 N, a coefficient of friction μ of 0.1, and a radius of 100 mm, each screw can transfer a torque of 307 Nm. Please make sure that your system exhibits adequate torsional stability.
- The circularity and concentricity of the clamped component when installed should be less than 10 μm.
- Your design should take into account the clamps' alignment and installation.
- In principle, RotoClamp components can also function properly when there are slight leaks in the system. Possible leaks when the clamp is opened, also with a pressure loss in excess of 2.5 bar/min, are offset by the replenishing pneumatic system, and the defined opening dimension is still reached. Possible leaks during additional air booster operations (CLOSE), also with a pressure loss in excess of 2.5 bar/min, are offset by the replenishing pneumatic system, and the defined retaining torque is still reached.
  The internal HEMA acceptance test allows a max pressure loss of 0.5 bar/min for OPEN and CLOSE, based on the operating pressure.
- Contact and fretting corrosion between the shaft and clamping surface can be minimised only with suitable measures on the shaft.
- B10 values / B10d values: The HEMA RotoClamp Outside Standard safety components are used to clamp rotating machine components at standstill. The holding and clamping in one position is the feature and the task of the HEMA clamping elements. In accordance with the intended function and in compliance with the instructions and data defined for the project planning, application and installation in accordance with the operating instructions and the applicable technical rules, these components have a safety function defined by the spring accumulator at 0 bar opening pressure. Taking into account all known information and data, this safety function has hitherto been obtained in all known intended applications, regardless of the number of cycles and the service life.

17. Tightening torques for screws

These apply to screw head supports of steel. On connecting structures of softer materials (e. g. aluminium), the tightening torque for the screws (property class 12.9) must be determined separately on the basis of the max transferred forces and max surface pressure under the screw bearing surface.

Recommended tightening torque Property classes for srews ISO 4762, 12.9	Nm
M4	5.4
M5	10.7
M6	18.3
M8	44.1
M10	86.9
M12	151.0

Table 1 (with reference to VOI 2230, not binding)

NOTE: Only screws of property class 12.9 may be used. Other property classes may have adverse effects on the clamping force and behaviour

18. Commissioning

- Install the pneumatic valve (e.g. 3/2 or 5/3 way valve open at centre position, min rated size G1/8“) near the clamping element, and connect a 6 or 8 mm hose.
- IMPORTANT! The longer the line and the smaller the cross section, the longer the response times.
- High speed or fast ventilation valves can reduce considerably the response times of the RotoClamp Outside!
- Once it has been installed properly, the RotoClamp Outside must be examined for its standby properties:
  - The clamping process must be tested with an attempt at manual turning.
  - When the clamping element is pressurised, all pneumatic connections must be examined for leakage.
  - All fastening screws must be examined for their prescribed tightening torque.
- Owing to the paired fits configured at the factory, readjustments are not required after proper installation. Start a test run.

19. Maintenance and care

- Never use greasy or lubricant auxiliaries: these can reduce the clamping torques.
- Approved cleaning agents are all media, including lubricant solvents, that do not attack the materials.
- Remove dirt and oil residue at the open air connection on the RotoClampOutside without additional air mode.
- Check that there is a uniform gap between the shaft and the open RotoClamp Outside.

20. CE MARKING CE

In the delivered state, the clamping and braking elements RotoClamp Outside XS, S, N, XL fulfil the requirements under the Machinery Directive 2006/42/EC and are marked with the CE symbol.

21. EC DECLARATION OF CONFORMITY

In accordance with the Machinery Directive 2006/42/EC of 17 May 2006, Annex II A

We hereby declare that the design and type of the structurally identical safety components named in the following and the version we market comply with the fundamental safety and health requirements in the Machinery Directive 2006/42/EC. This declaration becomes void when any change is made without our consent to these safety components.

Manufacturer HEMA Maschinen- und Apparateschutz GmbH
Am Klinggraben 2, 63500 Seligenstadt, Germany
Phone: +49(0)6182/773-0, Fax: +49(0)6182/773-35
www.hema-group.com

Description of the machine
Function: Clamping of stationary shafts and axles
Type/model: RotoClamp Outside and Outside XS, S, N, XL

Applied harmonized standards, in particular:

- DIN EN ISO 12100: 2011-03
  Safety of machinery - General principles of design - Risk assessment and risk reduction
  German version EN ISO 20100: 20100
- DIN EN ISO 12100: 2013-08
  Safety of machinery - General principles of design - Risk assessment and risk reduction,
  Corrigendum to DIN EN ISO 20100: 2011-03
  German version EN ISO 20100: 20100
- DIN EN ISO 13849-1: 2016-06
  Safety-related parts of control systems, Part 1: General principles of design
  German Version he Fassung EN ISO 13849-1: 2015
- DIN EN ISO 13849-2: 2013-02: Safety-related parts of control systems,
  Part 2: Validation
  German Version EN ISO 13849-1: 2015

Other technical standards and specifications applied:

- DIN ISO 8573-1 2010-04 Compressed air - Part 1: Impurities and purity classes

HEMA Maschinen- und Apparateschutz GmbH

Steffen Walter
Managing Director

Philipp Sendelbach
CE authorized person

Am Klinggraben 2, 63500 Seligenstadt
Seligenstadt, 1 April 2021

22. Causes of faults – solutions

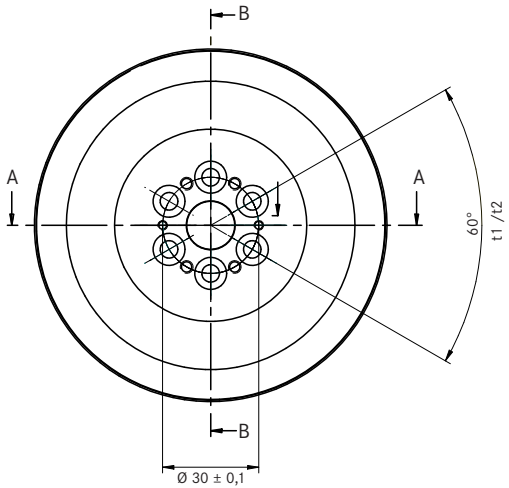
Malfunction	Possible cause	Remedy
Clamp not opening	Too little supplied air	Valve too small, line from valve to clamping element too long, or maintenance unit too small
	Too little exhaust air	Connections and holes for the exhaust air too small or clogged (on RotoClamp connections »CLOSE«)
	Too low a pressure	Pressure in upstream pressure reducer too low
	Storage and transport temperature outside of specifications	Temperatures under 10 °C can affect the rubber diaphragm. This then becomes hard and unsusceptible, and may leak temporarily
	Diaphragm error	Check RotoClamp tightness and function, call HEMA services
Response times too long	Too little supplied air	Valve too small, line from valve to clamping element too long, or maintenance unit too small; lines leak
	Too little exhaust air	Connections and holes for the exhaust air too small or clogged (on RotoClamp hole under the clamping body)
	Storage and transport temperature outside of specifications	Temperatures under 10 °C can affect the rubber diaphragm. This then becomes hard and unsusceptible, and may leak temporarily
Loud rattling	Undefined spring movement	Check RotoClamp tightness and function, call HEMA services
High temperatures at clamped area	Clamping friction caused by heavy soiling	Clean clamping surfaces (see »Maintenance and care«)
	Switching errors in controller (valve for clamping elements switches too early or late)	Adjust controller. Use valves with faster switching times
Loud air and purging noise	Diaphragm error	Check RotoClamp tightness and function, call HEMA services
	Storage and transport temperature outside of specifications	Temperatures under 10 °C can affect the rubber diaphragm. This then becomes hard and unsusceptible, and may leak temporarily
	Housing parts leak	Check RotoClamp tightness and function, call HEMA services
Clamping force inadequate	Dirt or grease on clamping surface	Remove any soiling; check paired materials with HEMA services
	Check the plane contact between RotoClamp and screw-on surface	Plane grind the contacting surfaces on surfaces on the opposite side
	Check tightening torques; make sure forces are transferred correctly via screws	Check screws and tightening torques, and the order in which the screws are tightened
	Shaft diameter too small	Make sure the shaft has correct diameter
M6x4 screw plug in the air cage cannot be removed	Hardened thread sealant	Request additional document »Loosening the screw plug« (email to info@hema-group.com)

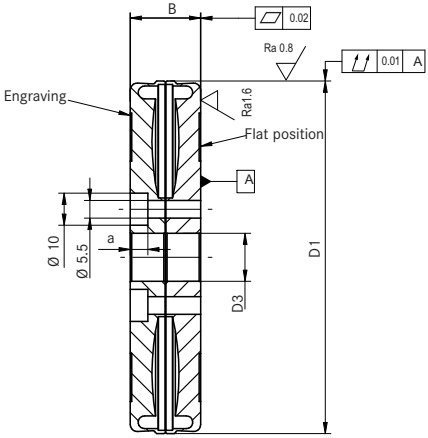
23. ROTOCLAMP OUTSIDE XS

Specifications and drawing

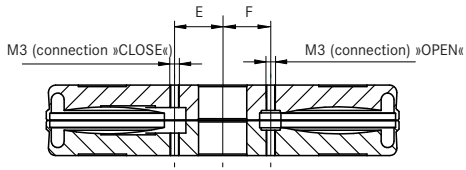
Size	D1 opened rated pressure Pn = 4 bar or 6 bar	Required shaft diameter	D2	D3	B	E	F	n Number of fixing screws	a	t1	t2	Elastic holding torque Pn = 6 bar at 0 bar	Elastic holding torque Pn = 6 bar Booster at 6 bar	Elastic holding torque Pn = 4 bar at 0 bar	Elastic holding torque Pn = 4 bar Booster at 4 bar	Mass max.	Air re-quire-ment per stroke max.
Unit	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	Quantity	[mm]	[°]	[°]	[Nm]	[Nm]	[Nm]	[Nm]	[kg]	[mL]
Tolerance	-0.02/-0.03	+0.01/+0.025	±0.1		+0.4												
Roundness	0,01	0,01															
Surface finish	R_a 0.8 µm	R_a 0.8 µm															
RCO 110 XS	110	110	30	15	22	15	15	6xM5	5,5	60	60	125	230	90	150	1.5	20

Specifications valid for RotoClamp Outside XS Standard. Retaining torques for tandem versions: factor 1.8.
Subject to modifications. Errors excepted. Only the written order confirmation is valid.





Profile B-B



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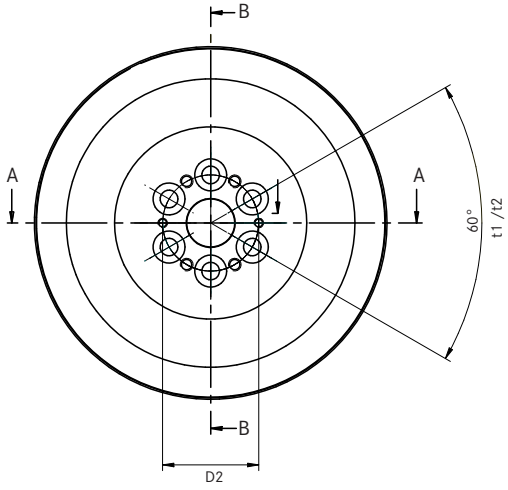
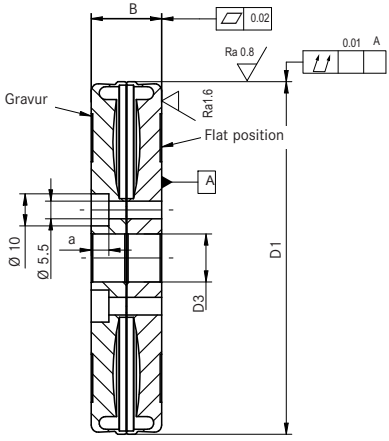
24. RotoClamp Outside XSA

Specifications and drawing

Size	D1 opened rated pressure Pn = 0 bar	Required shaft diameter	D2	D3	B	E	F	n Number of fixing screws	a	t1	t2	Elastic holding torque Pn = 6 bar at 6 bar	Elastic holding torque Pn = 4 bar at 4 bar	Mass max.	Air requirement per stroke max.
Unit	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	Quantity	[mm]	[°]	[°]	[Nm]	[Nm]	[kg]	[mL]
Tolerance	-0.02/-0.03	+0.01/+0.025	±0.1		+0.4										
Roundness	0.01	0.01													
Surface finish	R_a 0.8 µm	R_a 0.8 µm													
RCO 110 XSA	110	110	30	15	22	15	15	6x M5	5.5	60	60	125	90	1.5	20

Specifications valid for RotoClamp Outside XS Active. Retaining torques for tandem versions: factor 1.8.
Subject to modifications. Errors excepted. Only the written order confirmation is valid.





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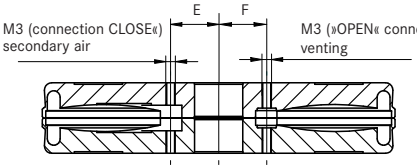


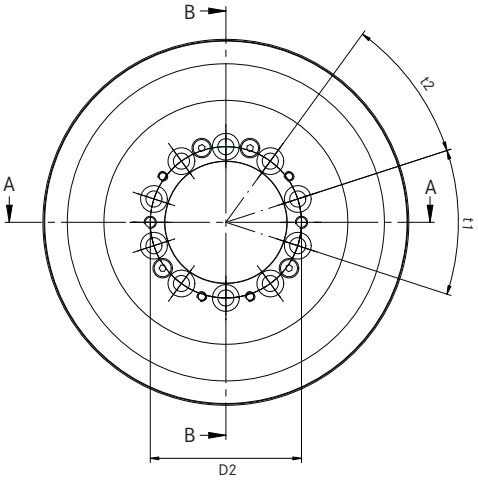
Profile A-A

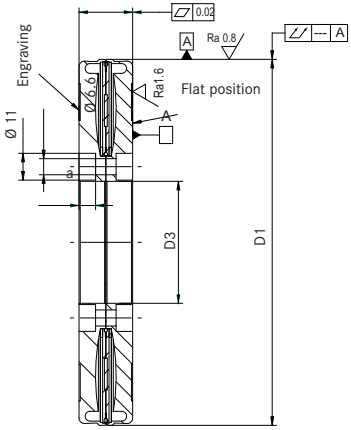
25. RotoClamp Outside S

Specifications and drawing

Size	D1 opened rated pressure Pn = 4 bar oder 6 bar	Required shaft diameter	D2	D3	B	E	F	n Number of fixing screws	a	t1	t2	Elastic holding torque Pn = 6 bar at 0 bar	Elastic holding torque Pn = 6 bar Booster at 6 bar	Elastic holding torque Pn = 4 bar at 0 bar	Elastic-Halte-moment Pn = 4 bar Booster at 4 bar	Mass max.	Air re-quire-ment per stroke max.
Unit	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	Quantity	[mm]	[°]	[°]	[Nm]	[Nm]	[Nm]	[Nm]	[kg]	[mL]
Tolerance	-0.035/-0.05	+0.01/+0.025	±0.1		+0.4												
Roundness	0,01	0,01															
Surface finish	R_a 0.8 µm	R_a 0.8 µm															
RCO 150 S	150	150	62	50	22	31	31	10xM6	6.8	36	36	250	460	170	320	2	20
RCO 170 S	170	170	82	20	22	41	41	12xM6	6.8	30	30	360	600	250	450	2.2	25

Specifications valid for RotoClamp Outside S Standard. Retaining torques for tandem versions: factor 1.8.
Subject to modifications. Errors excepted. Only the written order confirmation is valid.





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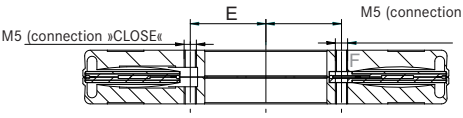


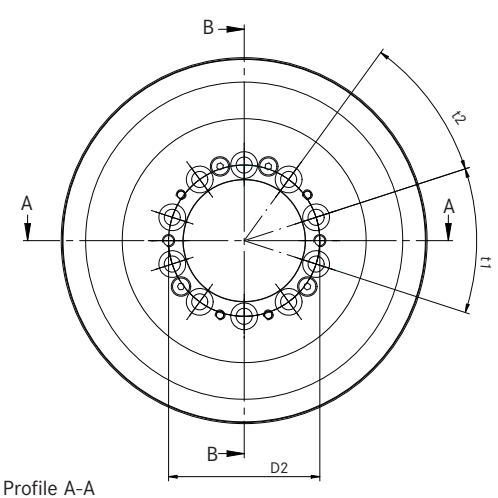
Profile A-A

26. ROTOCLAMP OUTSIDE SA

Specifications and drawing

Size	D1 opened rated pressure Pn = 0 bar	Required shaft diameter	D2	D3	B	E	F	n Number of fixing screws	a	t1	t2	Elastic holding torque Pn = 6 bar bei 6 bar	Elastic holding torque Pn = 4 bar bei 4 bar	Mass max.	Air requirement per stroke max.
Unit	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	Quantity	[mm]	[°]	[°]	[Nm]	[Nm]	[kg]	[mL]
Tolerance	-0.035/-0.05	+0.01/+0.025	±0.1		+0.4										
Roundness	0.01	0.01													
Surface finish	R_a 0.8 µm	R_a 0.8 µm													
RCO 150 SA	150	150	62	50	22	31	31	10x M6	6.8	36	36	250	170	2	20
RCO 170 SA	170	170	82	70	22	41	41	12x M6	6.8	30	30	360	250	2.2	25

Specifications valid for RotoClamp Outside S Active. Retaining torques for tandem versions: factor 1.8.
Subject to modifications. Errors excepted. Only the written order confirmation is valid.



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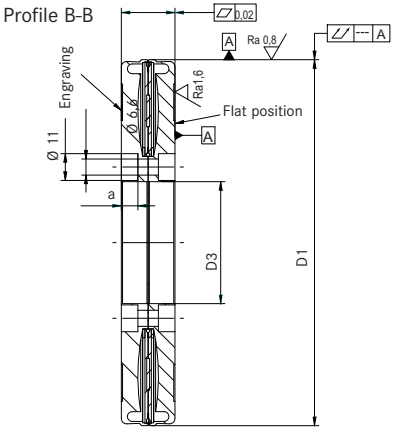
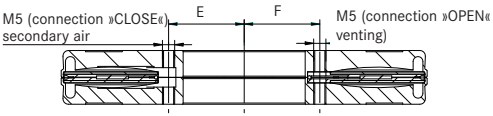


Profile A-A

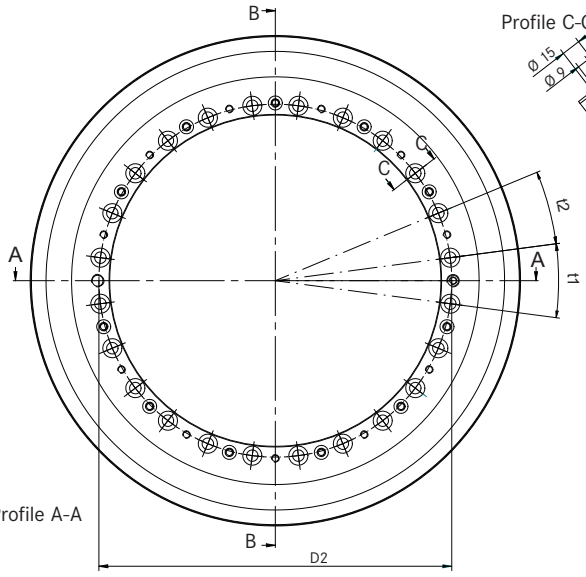


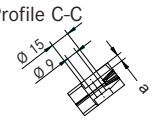
27. ROTOCLAMP OUTSIDE N

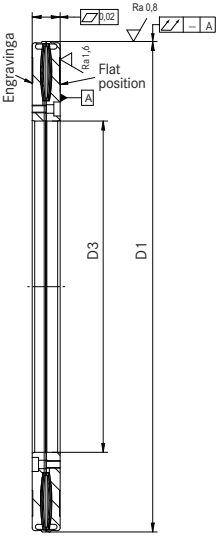
Specifications and drawing

Size	D1 opened rated pressure Pn = 4 bar oder 6 bar	Required shaft diameter	D2	D3	B	E	F	n Number of fixing screws	a	t1	t2	Elastic holding torque Pn = 6 bar at 0 bar	Elastic holding torque Pn = 6 bar Booster at 6 bar	Elastic holding torque Pn = 4 bar at 0 bar	Elastic holding torque Pn = 4 bar Booster at 4 bar	Mass max.	Air re-quire-ment per stroke max.
Unit	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	Quantity	[mm]	[°]	[°]	[Nm]	[Nm]	[Nm]	[Nm]	[kg]	[mL]
Tolerance	-0.045/-0.06	+0.01/+0.03	±0.1		+0.4												
Roundness	0.015	0.015															
Surface finish	R_a 0.8 µm	R_a 0.8 µm															
RCO 195 N	195	195	87	70	22	44.5	44.5	10xM8	5.5	36	36	456	819	328	573	3.1	60
RCO 255 N	255	255	147	130	22	74.5	74.5	16xM8	5.5	22.5	22.5	1080	1944	756	1361	4.5	80
RCO 315 N	315	315	207	190	22	104.5	104.5	18xM8	5.5	20	20	1887	3468	1321	2428	6,1	100
RCO 385 N	385	385	277	260	22	139.5	139.5	24xM8	5.5	15	15	3100	5500	2100	3800	7	120

Specifications valid for RotoClamp Outside N Standard. Retaining torques for tandem versions: factor 1.8.
Subject to modifications. Errors excepted. Only the written order confirmation is valid.





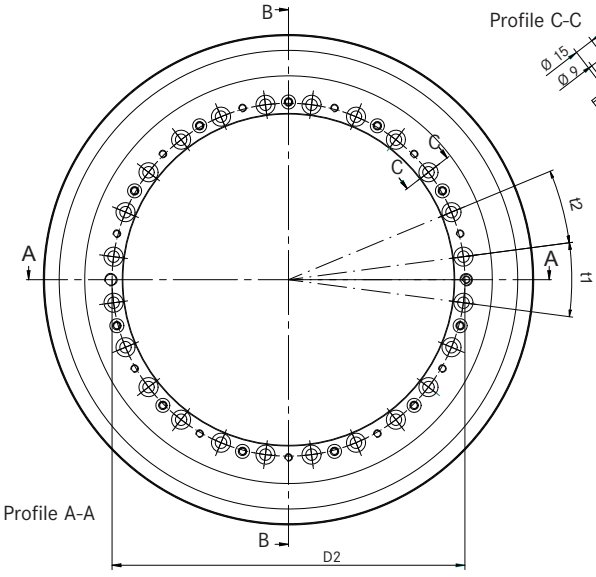


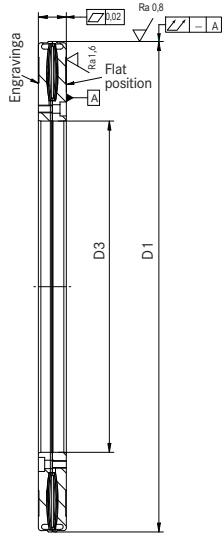
28. RotoClamp Outside NA

Specifications and drawing

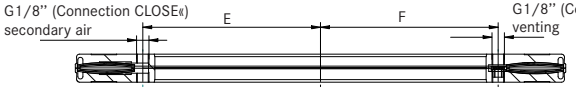
Size	D1 opened rated pressure Pn = 0 bar	Required shaft diameter	D2	D3	B	E	F	n Number of fixing screws	a	t1	t2	Elastic holding torque Pn = 6 bar at 6 bar	Elastic holding torque Pn = 4 bar at 4 bar	Masse max.	Air re-quire-ment per stroke max.
Unit	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	Quantity	[mm]	[°]	[°]	[Nm]	[Nm]	[kg]	[mL]
Tolerance	-0.04/-0.055	+0.01/+0.03	±0.1		+0.4										
Roundness	0.015	0.015													
Surface finish	R_a 0.8 µm	R_a 0.8 µm													
RCO 195 NA	195	195	87	70	22	44.5	44.5	10xM8	5.5	36	36	460	330	3.1	60
RCO 255 NA	255	255	147	130	22	74.5	74.5	16xM8	5.5	22.5	22.5	1080	760	4.5	80
RCO 315 NA	315	315	207	190	22	104.5	104.5	18xM8	5.5	20	20	1880	1320	6.1	100
RCO 385 NA	385	385	277	260	22	139.5	139.5	24xM8	5.5	15	15	3100	2100	7	120

Specifications valid for RotoClamp Outside N Actice. Retaining torques for tandem versions: factor 1.8.
Subject to modifications. Errors excepted. Only the written order confirmation is valid.





Profile B-B

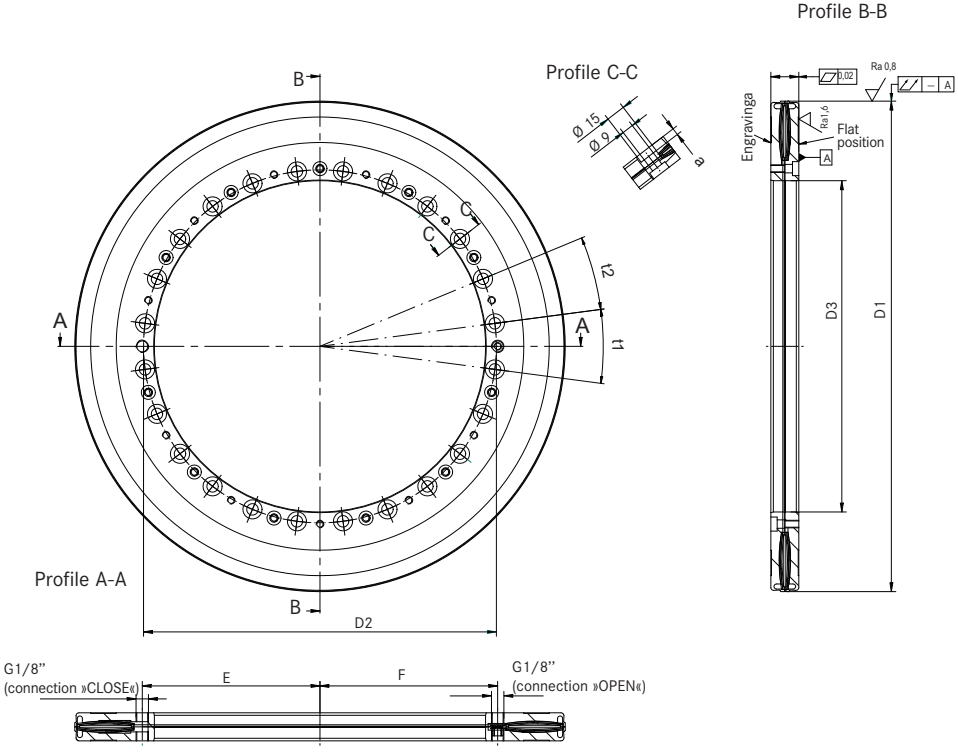


29. ROTOCLAMP OUTSIDE XL

Specifications and drawing

Size	D1 opened rated pressure Pn = 4 bar	Required shaft diameter	D2	D3	B	E	F	n Number of fixing screws	a	t1	t2	Elastic holding torque Pn = 4 bar at 0 bar	Elastic holding torque Pn = 4 bar Booster at 4 bar	Mass max.	Air requirement per stroke max.
Unit	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	Quantity	[mm]	[°]	[°]	[Nm]	[Nm]	[kg]	[mL]
Tolerance	-0.04/-0.055	+0.01+-0.03	±0.1		+0.4							∞			
Roundness	0.02	0.02													
Surface finish	R_a 0.8 µm	R_a 0.8 µm													
RCO 520 XL	520	520	365	340	30	182.5	182.5	24xM10	8	15	15	3900	6500	22	300

Specifications valid for RotoClamp Outside XL Standard. Retaining torques for tandem versions: factor 1.8.
Subject to modifications. Errors excepted. Only the written order confirmation is valid.



30. RotoClamp Outside XLA

Specifications and drawing

Size	D1 opened rated pressure Pn = 0 bar	Required shaft diameter	D2	D3	B	E	F	n Number of fixing screws	a	t1	t2	Elastic holding torque Pn = 4 bar at 4 bar	Mass max.	Air requirement per stroke max.
Unit	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	Quantity	[mm]	[°]	[°]	[Nm]	[kg]	[mL]
Tolerance	-0.04/-0.055	+0.01/+0.03	±0.1		+0.4									
Roundness	0.02	0.02												
Surface finish	R_a 0.8 µm	R_a 0.8 µm												
RCO 520 XLA	520	520	365	340	30	182.5	182.5	24x M10	8	15	15	3900	22	300

Specifications valid for RotoClamp Outside XL Active. Retaining torques for tandem versions: factor 1.8.
Subject to modifications. Errors excepted. Only the written order confirmation is valid.