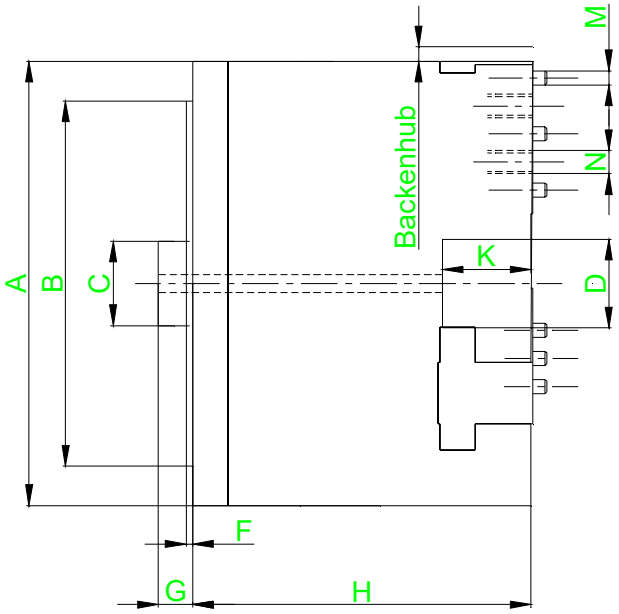
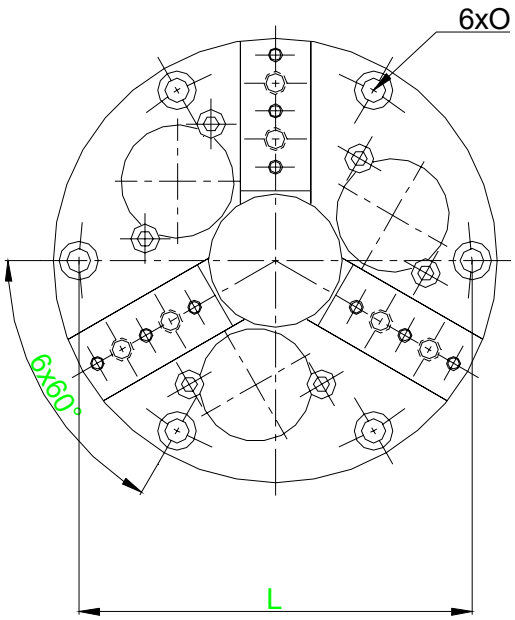
Air precision chucks
Operating manual





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(05/17)

Index

1. Introduction

Thank you very much for the purchase of a MicroCentric air precision chuck. We wish you a good success on your work with it. Please read the operation manual carefully before you start the work with this product. The consideration of this manual will help you to avoid accidents, breakdowns and damages.

Clamping systems are the most important components of tool machines, when you have to produce high precision parts with high accuracy and concentricity. Our products have several advantages and are in usage for different application, e.g. turning, grinding and milling.

Please call our sales- and service engineers if you would like to get additional information.

2. General

2.1 Features of air precision chucks

MicroCentric air precision chucks are designed according to the actual stand of technique and correspond to the requirements of modern clamping systems:

- Accuracy < 1,5 µm
- Sizes from 75 to 400 mm
- Clamping force up to 2.385 daN
- Steplessly adjustable clamping force, you can clamp thin walled parts without deformation
- Chucks and vices available
- Built in air cylinder
- Useable for inside and outside clamping
- Chuck has a through bore as standard to bring coolant through the spindle directly to the workpiece
- Quick change top jaw system
- Compatible to MicroCentric diaphragm chucks
- Special chuck (e.g. sealed with a rubber cover or high speed versions)

2.2 Security notices

Please read and pay attention to the following security notices very carefully:

1. All applications of the air precision chuck must be according to this operating manual.

2. Do not touch the chuck while it is rotating.

3. While closing the top jaws please pay attention, that there are no objects between the top jaws and the workpiece.

4. The spindle adapter must be manufactured in the right way. During mounting the chuck onto the machine, spindle nose, spindle adapter and the chuck must be clean. Further all mounting bolts have to tighten strong enough.

5. Periodically you should verify, that all mounting bolts on the chuck resp. the spindle adapter are still fixed and if the air supply tubes are fixed without an air pressure lost.

6. The supplied air must be without humidity or pollution. Please never exceed the maximum air pressure of the chuck of 6 bar. The minimum air pressure is 0,5 bar.

7. On automatically loaded machines there should be a control, if the chuck will get into the right position while clamping the workpiece. One possibility is to check the axial movement of the air tube. Also is thinkable, that the chuck has a built in air control sense.

8. Please let us know first and immediately in every cases, when the chuck works abnormally or it has no function. Our well educated service engineers will support you well and solve your problems.

9. On the usage of our clamping systems the valid instructions and laws to avoid accidents must be observed.

3. System description

3.1 Chuck assembly

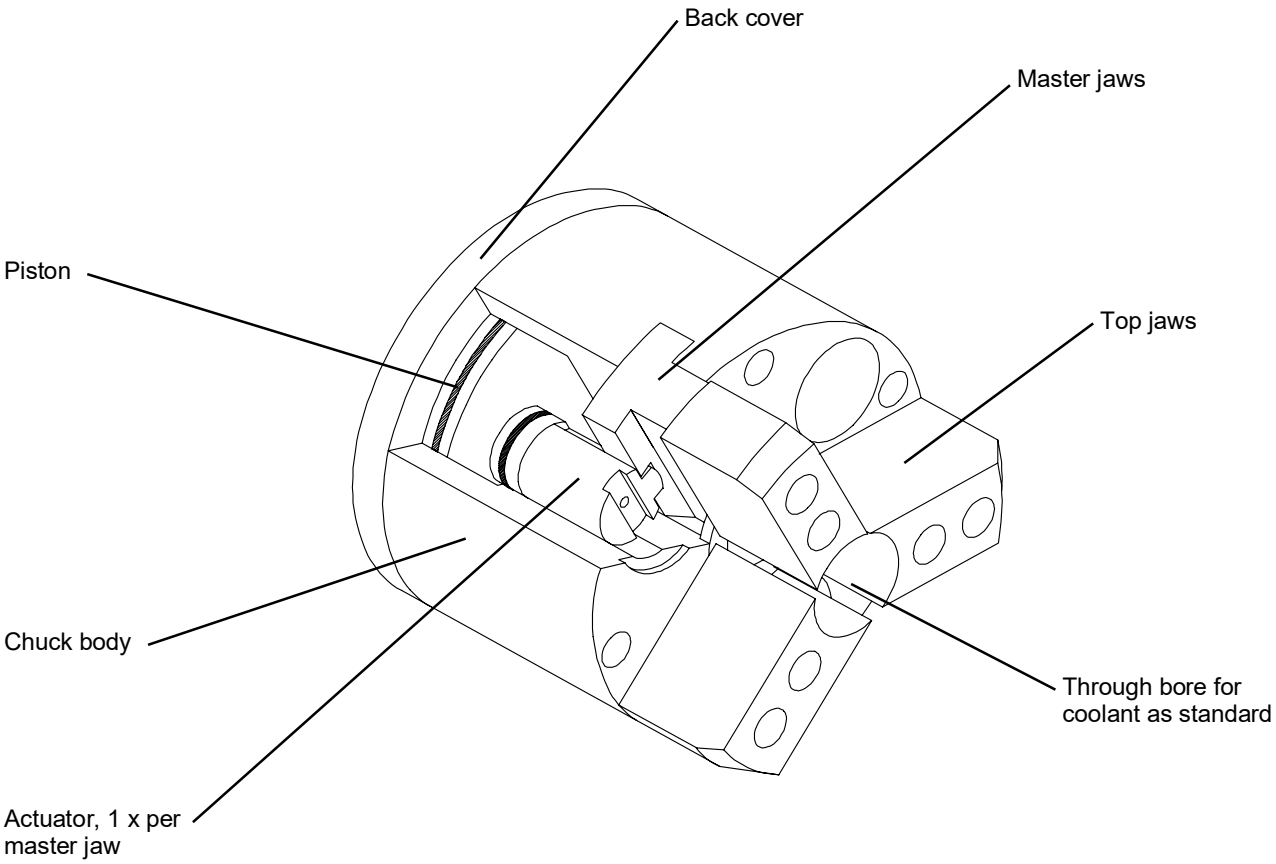

Fig. 1.1

3.2 Function principle

The piston makes a forward movement through air pressure. On the piston are actuators (1 x per master jaw) fixed. These actuators have an oblique plain milled in, which engage in slots of the master jaws. Through that the axial movement of the piston is transfered to a radial movement of the jaws. The chuck closes on the outside clamping through that motion. The chuck opens through a backward movement of the piston. The clamping force on this chuck can be adjusted very fine through a change of the pneumatic pressure.

On the inside clamping the function will be done reverse.

3.3 Rotating applications

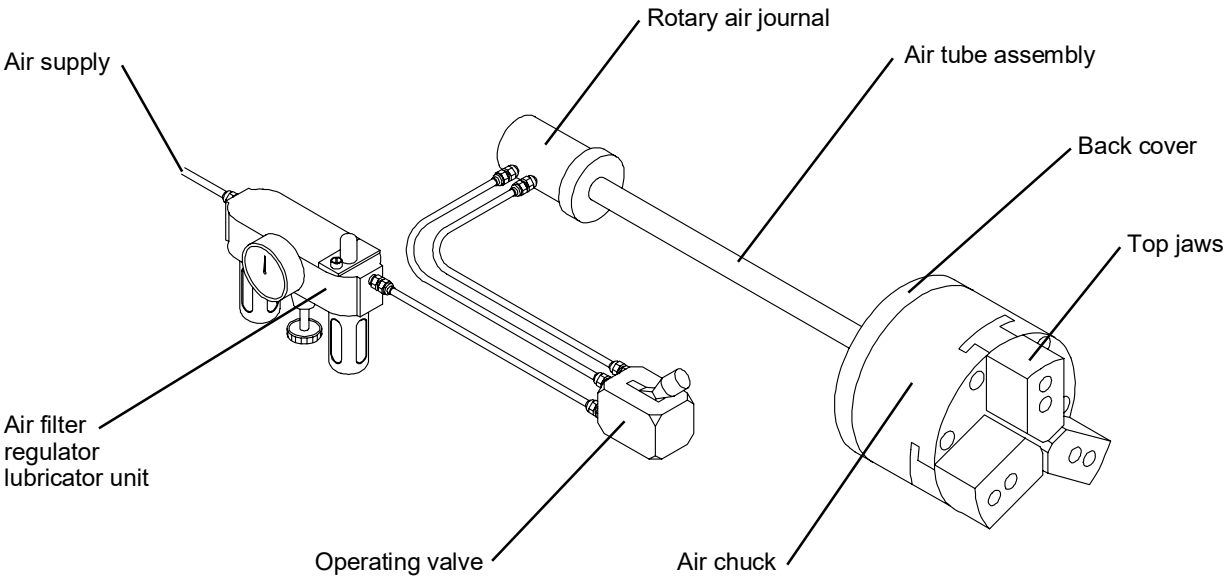

Fig. 1.2

3.4 Non rotating applications

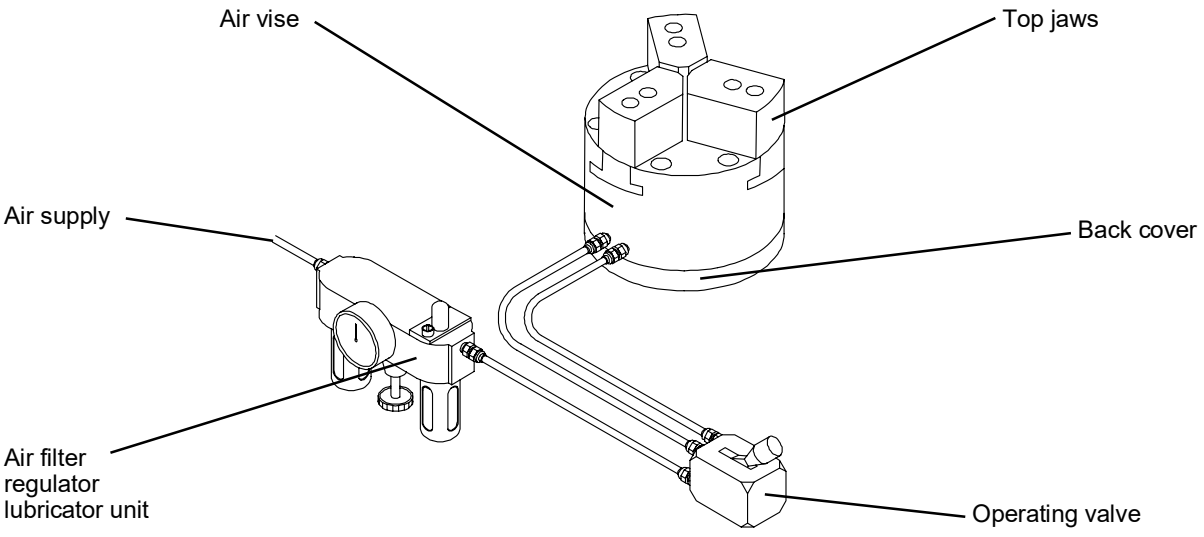

Fig. 1.3

3.5 Mounting of chucks (rotary)

Attention:
All bolts must be fixed with the in Appendix A listed torque.

1. For the installation of MicroCentric chucks a suitable spindle adapter is required. When you manufacture the spindle adapter by yourself, please take the necessary dimensions out of the DIN-ISO-norms resp. our data sheets. The spindle adapter should get a suitable recess with enough clearance to the pilot diameter of the chuck. The lateral runout may not exceed 2,5 µm. Through the clearance between the recess and the pilot diameter it is possible to adjust a radial runout. The spindle adapter must have a through bore for the air tube assembly. Please bring in 6 holes and threads into the spindle adapter for mounting the chuck onto the adapter plate.

2. Make sure that mounting surfaces of chuck, adapter plate and spindle nose are free from nicks or pollution. Please tighten all mounting bolts alternately and equally. It is recommended to use bolts with solidity class 12.9.

3. First fix the spindle adapter onto the machine spindle with handforce. Adjust the adapter by taking out a radial runout. Tighten the mounting screws equally.

4. Mount the chuck onto the spindle adapter, adjust it at the outside diameter radially and tighten the screws over cross equally.

5. The split bushing is for the support of the air tube at the rear of the machine spindle. Machine a short step on the bushing for a slip fit in the inside of the spindle. Then insert the split bushing into the spindle and tighten set screw to lock bushing in place. The clearance from the air tube to the bore of the bushing should be appr. 0,1 mm.

6. Install the air tube by threading it into the manifold of the air chuck. Tighten air tube by hand, using the black knurled ring. During actuating the air tube on some chuck types (e.g. 4-360-3) moves back and forth. Make certain your air tube is of sufficient length. Knurled ring must not strike the split bushing at rear of spindle, as this can damage your chuck resp. air tube.

7. Connect control valve, air hoses, and air filter-regulator-lubrication unit carefully as illustrated in fig. 1.2. The usage of an air filter-regulator-lubrication unit is an absolute must, cause otherwise the chuck could be damaged. To actuate the chuck any valve can be used, which observe the valid instructions and laws to avoid accidents. MicroCentric offers corresponding hand-valves, foot-valves and pneumatic control units. Now the chuck should work with low air pressure.

3.6 Mounting of NR-chucks (stationary)

1. For the installation of MicroCentric NR-chucks a suitable base plate is required. Please bring in 6 holes and threads into the base plate for mounting the chuck onto the plate. Please tighten all mounting bolts alternately and equally. It is recommended to use bolts with solidity class 12.9.

2. First fix the base plate onto the machine table with handforce. Adjust the plate if necessary and tighten the mounting screws equally.

3. Mount the NR-chuck onto the base plate and adjust the chuck if necessary. Tighten the mounting screws equally.

4. Connect control valve, air hoses, and air filter-regulator-lubrication unit carefully as illustrated in fig. 1.3. The usage of an air filter-regulator-lubrication unit is an absolute must, cause otherwise the NR-chuck could be damaged. To actuate the chuck any valve can be used, which observe the valid instructions and laws to avoid accidents. MicroCentric offers corresponding hand-valves, foot-valves and pneumatic control units. The NR-chuck should work with low air pressure now.

4. Top jaws

4.1 Design of top jaws

Top jaw design is one of the most important criteria in the overall performance, accuracy, and efficiency of a workholding system.

To achieve utmost accuracy as well as the best possible holding capability, the following should be considered when designing top jaws:

1. Workpieces must have a good finished diameter with a good roundness for precise holding.

2. Use a clamping force as low as possible, especially on thin walled workpieces. Please think about, that each dimension and shape-deviations of workpieces influence the clamping situation.

3. Grip the workpiece as close to the face of the chuck as possible.

4. Clamping surfaces of top jaws and workpieces must be absolutely clean and free of burrs.

5. For external grip applications lighten the top jaws as much as possible to minimize the effects of centrifugal force. It is important to reduce the weight at the largest radius. Refer to Figure 2.1.

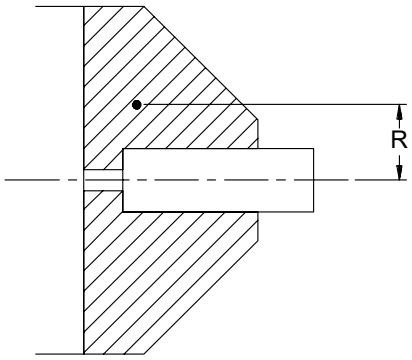

Fig. 2.1

6. In the area of axial location the workpiece must have a correct manufactured angle to the clamping diameter (see Fig. 2.2). The edge of the clamping diameter in the top jaws should get a little groove.

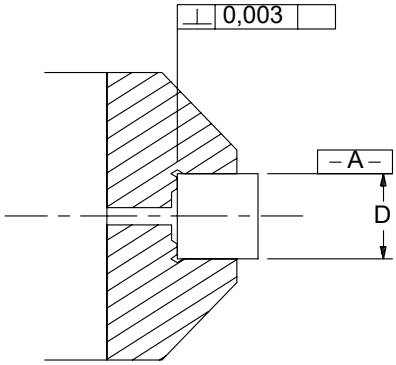

Fig. 2.2

7. Workpieces with no shoulder support must be held on a length twice their diameter. Refer to figure 2.2.

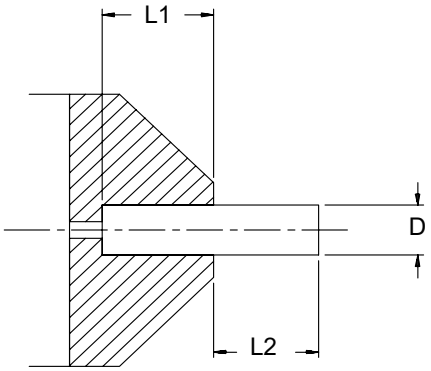

Fig. 2.3

8. Long workpieces should not extend from the top jaws more than 1,5 times (L2) the length being gripped (L1). Otherwise we recommend to use a tailstock. Please see Fig. 2.3.

9. For outside clamping situations the finished diameter of top jaws should be machined equal to or little greater than the largest workpiece diameter in your lot, when you require a very high accuracy (one-line contact occurs). For higher clamping forces the top jaws should be machined a little smaller than your workpiece diameter, so that you will get a two-line clamping situation. Please see Fig. 2.4 und 2.5.

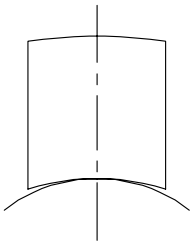

Fig. 2.4

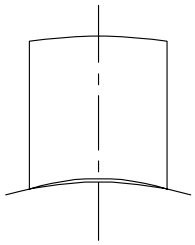

Fig. 2.5

10. For inside clamping situations the finished diameter of top jaws should be machined equal or a little smaller than the largest workpiece diameter in your lot, when you require a very high accuracy (one-line contact occurs). For higher clamping forces the top jaws should be machined a little greater than your workpiece diameter, so that you will get a two-line clamping situation. Please see Fig. 2.6 und 2.7.

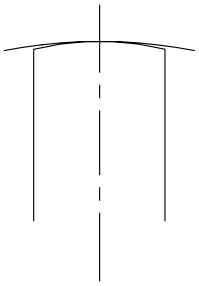

Fig. 2.6

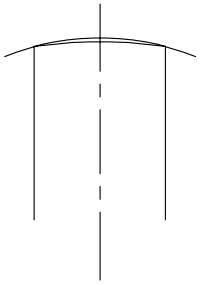

Fig. 2.7

11. The clamping diameter is exactly equal to the workpiece diameter, when you clamp the workpieces in the area of the mounting holes. Otherwise your will get a two-line clamping situation with a loss of accuracy. (see Fig. 2.8).

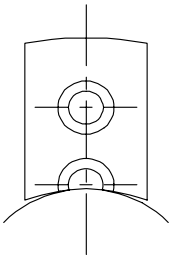

Fig. 2.8

12. Top jaws must be machined on the chuck under load during their preparation and at actual air pressure to be used in production. So you will get the best accuracy.

4.2 Machining of top jaws

1. Top jaws should sit strong enough in the pins in the master jaws. First fix the top jaws with handforce and clamp the loading pin resp. loading ring several times. When you are sure, that the top jaws are sitting in the right position, tighten the screws under load equally.

2. For the machining of top jaws it is necessary to load the jaws in the same direction as they are used in production. The top jaws must be machined under load during their preparation and at actual air pressure to be used in production.

3. Determine in which position of jaw stroke the top jaws should be machined. With a small jaw stroke it is easier to get a high accuracy. If you will load the workpieces automatically you should machine the top jaws with an opening stroke of 0,5 mm at least.

4. Adjust air pressure to the required clamping force.

5. Open the chuck fully and insert a suitable loading pin resp. loading ring (Refer figure 2.9 to 2.12).

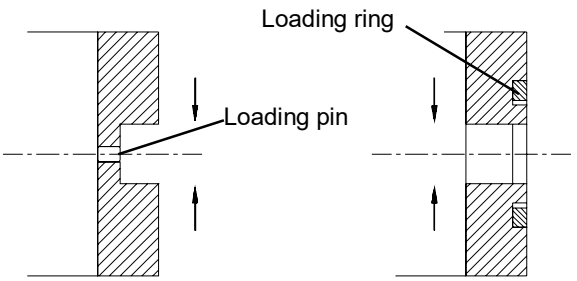

Fig. 2.9

Fig. 2.10

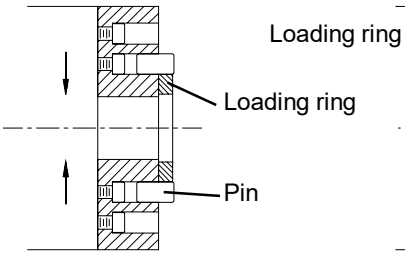

Fig. 2.11

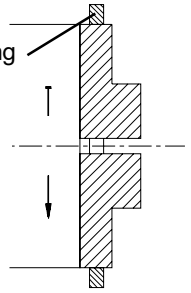

Fig. 2.12

5.1 Figure 2.9 illustrates the loading in a step bore for outside clamping. A loading pin will be clamped in the small diameter to machine the greater one. For the re-machining loading pins with different diameters are useful.

5.2 Figure 2.10 shows an other method for the machining of top jaws for outside clamping. A loading ring is used for through bores. For the re-machining loading rings with different diameters are useful.

5.3 Figure 2.11 shows a version with pins, which are mounted in the screw bores of the top jaws. With these pins a loading ring is clamped. This method can be used for through bores as well, but this method should be used only exceptionally.

5.4 In Figure 2.12 you see a sample for an inside clamping. A loading ring is fixed on the outside diameter of top jaws. For the re-machining loading rings with different inside diameters are useful.

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6. Close the chuck and machine the clamping diameter into the top jaws.

7. After finishing the clamping diameter open the chuck and remove the loading pin resp. loading ring.

8. Load workpiece and close the chuck. Verify without spindle rotation, if the workpiece is clamped without a possibility of distortion.

9. Start spindle rotation and stop it. Verify, if the workpiece is still clamped in the right position without distortion.

10. Start the production of your workpieces.

Additional notices:

Top jaws can be machined on a simultaneous chuck (jaw turning fixture). To achieve the best repeatability top jaws must be finish machined under load during their preparation on the chuck.

After changeover of top jaws the clamping diameter should be reworked.

When a chuck is changed completely with the clamping set, after remounting of chucks the radial and lateral runout must be adjusted carefully. It is useful to adjust the chuck with a master workpiece.

4.3 QC (quick change) top jaws

1. On QC top jaws it is necessary for a good changeover accuracy, that you mount the top jaws always in the same sequence with a constant torque.

2. Mount top jaws in the sequence no. 1, no. 2 and no. 3 onto the chuck and tighten them with handforce. It is recommended to use bolts with solidity class 12.9.

3. Tighten the top jaws with the in appendix A listed torque equally. Hereby fasten first the inner screw of each top jaw and second the outer screw.

5. Chuck care and maintenance

5.1 General notices

The lifetime of your MicroCentric chuck can be increased significant through careful and periodical care. The following notices should help you certainly:

1. Lubricate the chuck at regular intervals as determined by actual operating conditions. We recommend a lubrication interval each shift on automatically loading machines. The absolute minimum for lubrication is once a week. You should never exceed this lubrication interval.

2. Do never exceed the maximum air pressure. The chuck could be damaged. As a general rule: The closest repeatability is attained at low to middle air pressures. Please adjust the air pressure in all applications so low as possible.

3. Disassemble the chuck at regular intervals, as determined by actual operating conditions, at least once a year but possibly as often as every few months, for cleaning, replacement of O-Rings, and to determine effectiveness of lubrication schedule.

4. Protect the chuck and air tube when the system is not on your machine. Please clean it and protect the system against dust and humidity (corrosion). Think always, that the chuck should work in the µm-area.

5.2 Lubrication

To lubricate the chuck, each chuck has 3 grease nipples at the front side or the outside diameter. Squeeze several times (2-3 strokes) with the grease gun, while you open and close the chuck.

Caution: Press not to much oil in the chuck!

5.3 Chuck disassembly

Caution: These chucks are precision tools. All components are manufactured for a proper fit to other parts. It is necessary, that all parts are reassembled at the same position where they are removed first.

1. Place the chuck face down and remove back cover. Make note of the letter stamped on the face of the piston. It must align with jaw slot no. 1 when reassembling.

2. Remove manifold-piston assembly. If the chuck is in good working order this can be easily done by threading the air tube into the manifold and pulling upward. However, if the slides are binding and the chuck does not operate freely, it will be necessary to remove the 3 actuator covers on the face of the chuck and with a nylon plug, alternately tap each actuator until the assembly is free.

   Attention: Do not disassemble the 3 actuators from the piston, as they are positioned and pinned in place.

3. Remove master jaws.

4. Clean all parts with mineral spirits or a stoddard solvent and blow dry with light air pressure.

5.4 Chuck assembly

1. All sliding surfaces should be liberally coated with lubricating oil.

2. Slide master jaws into their respective T-slots, note numbers engraved on jaws and T-slots.

3. Insert manifold-piston assembly, aligning the letter stamped on the face of piston with jaw slot no. 1. Slide piston forward.

4. Engage actuators into slot in master jaw. Slide piston completely forward.

5. Mount the back cover.

6. Chuck should operate freely at an air pressure of 0,5 bar.

Attention: Chucks in need of repair should be returned to our address for skilled fitting to restore original performance and accuracy.

6. Trouble shooting guide

	Problems	Possible Causes
1.	Not enough jaw force	A,B,C,D,E
2.	The jaws move to slowly	A,B,C,D,E
3.	Not enough jaw force at high spindle speed	A,B,D,F,I
4.	Excessive vibration	H
5.	Excessive body runout	J
6.	Chuck does not repeat	B,D,E,F,G
7.	Chuck jaws do not have full travel	B,D,E,K
8.	Air leaks from chuck or through operating valves	L,M

Possible causes and solutions:

A. Air pressure is too low. Check setting air on the air regulator.

B. Poor lubrication. It may be necessary to disassemble the chuck for a thorough cleaning and lubrication, particularly if the chuck has not been lubricated at frequent regular intervals.

C. Restricted air flow. First check the air tube hoses if they are sealed. Further verify the right mounting and adjustment of the air filter-regulator-lubrication unit and the air regulator. All air tube hoses could have a restricted air flow.

D. Improper assembly of chuck. If the chuck has been dismounted recently, make sure that all parts of the chuck have been cleaned carefully and installed correctly.

E. Master jaw binding in chuck body. Remove top jaws. If binding action is no longer present examine for foreign material trapped between master jaw and top jaw. If binding action is still present after removing top jaws, disassemble chuck and examine for galled sliding surfaces. Consult us for repair information.

F. Poor preparation or design of top jaws. Top jaws must be machined under load and actual pressure to be used during operation. Reduce top jaw weight as much as possible to minimize the effects of centrifugal force. Please see our proposal in this manual.

G. The top jaws are not tight enough. Tighten equally.

H. Unequal weight distribution. Counterbalance as required.

I. Reduce of jaw force through too high centrifugal force. On spindle speeds over 2.500 r.p.m it is necessary to pay attention to the centrifugal force. Reduce the jaw weight, increase the air pressure or reduce the spindle speed if possible.

J. Improper system mounting. Please check the spindle adapter and the spindle nose for damages and pollution. Verify if the mounting bolts are not too long. Tighten the mounting bolts equally and alternately.

K. The air tube is too short. Please look for possible causes at the rear side of machine spindle.

L. Verify the O-Rings. If necessary renew the seals.

M. The air tube is not mounted correctly with the teflon washer. If the teflon washer is damaged, it is necessary to renew this part.

Appendix A: Torque for mounting bolts

Bolt size	Torque at bolts 8.8	Torque at bolts 12.9
M 5	6,0 Nm	10,4 Nm
M 6	10,4 Nm	17,9 Nm
M 8	25,3 Nm	43,6 Nm
M 10	51,0 Nm	88,0 Nm
M 12	87,0 Nm	150,0 Nm
M 14	139,0 Nm	239,0 Nm

Notices