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1. Introduction

Thank you very much for the purchase of a MicroCentric diaphragm 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 applications, 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 diaphragm chucks

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

- Stepless adjustable clamping force, also changeable while the chuck is rotating
- Accuracy < 2 µm
- Accuracy after changeover of the clamping diameter < 3 µm
- Maintenance and lubrication free
- Long lifetime
- Sealed against pollution
- Stability against centrifugal force
- Clamping force up to 6.230 daN
- Compatible to MicroCentric jaw chucks
- Chuck has a through bore as standard to bring coolant through the spindle directly to the workpiece
- Part stops could be mounted very easily
- Pull down action

2.2 Security notices

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

1. All applications of the diaphragm chuck must be according to this operation 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. On air operated chucks the supplied air must be without humidity or pollution. Please never exceed the maximum air pressure of the chuck of 8 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 resp. the drawtube. 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 abnormal 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 (air operated chuck)

Through a forward movement of the piston, the chuck will be opened on outside clamping. The chuck close through the re-deformation of the diaphragm and if necessary it will be supported by a pneumatic or a drawtube operation of the piston. The clamping force on this chuck can be adjusted very fine.

On the inside clamping the function will be done reverse.

3.2 Function principle
3.3 Rotating applications (air operated chuck)

3.4 Non rotating applications
3.5 Mounting of chucks (rotary)

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

A. General
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 resp. the drawtube. 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.

B. Chuck MBS-L with pneumatic operation via an air tube:
1. 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.

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

3. 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.

4. Install the air tube by threading it into the manifold of the diaphragm chuck.

5. 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.

C. Chuck MBS-Z with power operation via drawtube:
1. Bring the drawtube with the cylinder into the front position. Mount the drawtube connector onto the drawtube and tighten it carefully.

2. Fix the spindle adapter onto the machine spindle with handforce. Adjust the adapter by taking out a radial runout. Tighten the mounting screws equally.

3. Mount the connection bolt onto the drawtube connector.

4. Move the drawtube with low force to the rear position.

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

6. Move the drawtube with the cylinder into the front position with low force again. Bring an actuating washer with the vault side in direction of the diaphragm onto the seat of the connection bolt.
7. Mount the diaphragm with 6 bolts on the chuck body, so that the diaphragm has a distance of 2-3 mm to the chuck body. Consider to the position pin of the diaphragm and the correct size of the actuating washer on the connection bolt. Simultaneously mount the actuating bolt with a second actuating washer (vault side in direction to the diaphragm) and fix it.

8. Move the drawtube with low force backwards. Fix the diaphragm with the 6 mounting bolts equally in the chuck body. The chuck should work with low drawtube forces now.

D. Chuck MBS-B with pneumatic operation via the spindle (backported):

1. 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.

2. Mount the chuck onto the spindle adapter, adjust it at the outside diameter radially and tighten the screws over cross equally. Pay attention on the correct positions of the air passages an their seals.

3. For the pneumatic control of the chuck please read the instruction B.5. Please contact your machine supplier if you need additional information of the pneumatic of your machine. The chuck should work with low air pressure now.

3.6 Mounting of NR-chucks MBS-N

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 chuck onto the base plate and adjust the NR-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 chuck could be damaged. To actuate the NR-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.
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.

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

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 and 2.5.
4.2 Machining of top jaws

1. Top jaws should sit strong enough on the diaphragm. First fix the top jaws with handforce. Then tighten the screws 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. This can be in neutral position or through change of air pressure resp. drawtube force in both directions. 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 / drawtube force of cylinder to the required clamping force. Following is valid: As greater the air pressure resp. the drawtube force is as greater is the jaw stroke. On usage of a control unit BE-2 the air pressure (and jaw stroke) for opening the chuck can be adjusted separately from the air pressure for closing the chuck.

5. Open the chuck fully and insert a suitable loading pin resp. loading ring (Refer figure 2.8 to 2.11).

5.1 Figure 2.8 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 2.9 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 2.10 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 2.11 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.

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. 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.

After changeover of a complete clamping set (diaphragm/top jaws/part stop) the system has an accuracy less than 3 µm without any adjustment of the chuck.

4.3 Diaphragm changeover

Dismounting of diaphragm:

1. For the changeover of diaphragms the drawtube resp. the piston of pneumatic chucks must be moved backwards. Loose and remove the 6 mounting bolts from the diaphragm.

2. Move the drawtube resp. the piston with the lowest force as possible to the front.

3. Mount 2 bolts into the both squeeze off threads in the diaphragm. Simultaneously when you screw in these bolts, loose the actuating bolt.

4. The diaphragm can be removed from the chuck body. Please pay attention, that you do not lose the actuating washers.

Mounting of diaphragm:

1. The drawtube resp. the piston of pneumatic chucks must be moved frontwards. Bring an actuating washer with the vault side in direction to the diaphragm. Simultaneously when you screw in these bolts, loose the actuating bolt.

2. Mount the diaphragm with 6 bolts on the chuck body, so that the diaphragm has a distance of 2-3 mm to the chuck body. Consider to the position pin of the diaphragm and the correct size of the actuating washer on the connection bolt. Simultaneously mount the actuating bolt with a second actuating washer (vault side in direction to the diaphragm) and fix it.

3. Move the drawtube with low force backwards. Fix the diaphragm with the 6 mounting bolts equally in the chuck body.
5. Part stops and other accessories

5.1 Part stop with part stop spider

One locating pin ASM or 3 locating pins ASH in the corresponding length are mounted onto the part stop spider ASS.

1. Locating pin ASM
The pin will be mounted and fixed in the centre of the part stop spider. On high accurate applications the pin must be ground on the location surface.

2. Locating pins ASH
On usage of locating pins ASH the part stop spider must get 3 holes and threads in the corresponding bolt circle. Our standard bolts D=6 have thread M4 and bolts D=10 have thread M6.

The bolts will be mounted and tightened into the part stop spider. On high accurate applications the pins must be ground on the location surface, so that all bolts have exactly the same length.

If necessary the top jaws must be milled resp. drilled, so that the pins have enough space in the clamping set.

5.2 Part stop with a part stop plate

As an option a part stop plate ATR can be mounted into the chuck body, when a part stop spider is not useful on technical reasons.

On usage of the part stop plate locating pins are towering sealed through the diaphragm.

For the built in the part stop plate must get 3 holes with threads in the corresponding bolt circle. The diaphragm must get 3 holes in same bolt circle. Our standard bolts D=6 have thread M4 and bolts D=10 have thread M6.
The lifetime of your MicroCentric chuck can be increased significantly through careful and periodical care. The following notices should help you certainly:

1. You do not have to lubricate the chuck periodically.

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. 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 \( \mu m \)-area.

4. When your machine is working with coolant emulsion or dry, please protect the chuck against corrosion while the chuck stands still for a couple of days (e.g. during holidays).

5. The chuck may not be dismounted from uneducated employments. When the chuck is dismounted without our agreement, we can not guarantee further for the function and the security of the chuck system.

6. Please call us in all cases, where the chuck is working abnormally or if it has no function. Our service engineers will support you to remove faults from your clamping system.

5.3 Coolant union nozzle

Our diaphragm chucks have as standard a small through bore to bring coolant through the chuck. For the exact output of coolant to the workpiece, different nozzles are available. The nozzle can be mounted very easily on the chucks front side.

Available are nozzles with straight, 30°, 60° und 90° operation direction.

On usage of a coolant union nozzle it will be fixed on the chucks actuating bolt.

The airtube assembly Model 50 has a third passage built in. On mounting a coolant union RU-10 on the rear side of the air tube the third passage can be used to bring coolant through the machine spindle.

5.4 Different forces on chuck actuating

On some circumstances it is useful to actuate the diaphragm chuck with different air pressures or drawtube forces for opening and closing of the chuck.

You will have this case, if the diaphragm will be finished under preforce and for the closing action should be used only a little air pressure, e.g. for the machining of fragile or thin-walled workpieces. Possible is the actuating with different air pressures by using a second pressure regulator behind the operation valve.

Very useful is the using of our control unit BE-2 for these cases.
7. Trouble shooting guide

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

Possible causes and solutions:

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

B. 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.

C. 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.

D. Damage. Please check all moveable components if they are crashed, molten or damaged. When you can not find out the problem, you should contact us for a rework of the diaphragm chuck.

E. 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.

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

G. Unequal weight distribution. Counterbalance as required.

H. 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.

I. 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.

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

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

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

M. The external cylinder is not working unobjectionable. Please check the cylinder.

N. The drawtube connector is machined with faults. Please contact us for the right dimensions and use a new connector on demand.
### Appendix A: Torque for mounting bolts

<table>
<thead>
<tr>
<th>Bolt size</th>
<th>Torque at bolts 8.8</th>
<th>Torque at bolts 12.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 5</td>
<td>6,0 Nm</td>
<td>10,4 Nm</td>
</tr>
<tr>
<td>M 6</td>
<td>10,4 Nm</td>
<td>17,9 Nm</td>
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<tr>
<td>M 8</td>
<td>25,3 Nm</td>
<td>43,6 Nm</td>
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<td>M 10</td>
<td>51,0 Nm</td>
<td>88,0 Nm</td>
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<tr>
<td>M 12</td>
<td>87,0 Nm</td>
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<tr>
<td>M 14</td>
<td>139,0 Nm</td>
<td>239,0 Nm</td>
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