FORKARDT

F+

MANUAL CHUCKS
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1. Technical Data

1.1 Introductory Note:

Read these operating instructions before unpacking and using the three-jaw manual chuck, Type F+, and observe the instructions closely. The three-jaw manual chuck, Type F+, may only be used serviced and maintained by persons over 18 years of age who are familiar with the operating instructions.

1.2 Field of Application and Authorised Use:

The three-jaw manual chuck, Type F+, hereinafter referred to as manual chuck, is operated with a chuck key. The force exerted on the chuck key is transmitted via the threaded spindle to the serrated wedge blocks and from there to the base jaws and the top jaws linked to the base jaws with their cross-tenons to generate the gripping force required to hold the workpiece to be machined.

The manual chuck, Type F+, may only be employed for its authorised use. The authorised use is the gripping of workpieces on:

- Lathes and other Rotating machine tools.

The maximum torque, maximum gripping force and maximum spindle speed of the manual chuck must not be exceeded. The permissible spindle speed or the gripping force necessary for a particular machining operation has to be determined in accordance with the relevant technical guidelines and regulations (e.g. VDI 3106 issued by the Association of German Engineers).

Employment for any other purposes does not constitute an authorised use. FORKARDT accepts no liability for injuries or damage resulting from such use.
1.3 Components of the Manual Chuck:

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chuck body</td>
</tr>
<tr>
<td>2</td>
<td>Cover</td>
</tr>
<tr>
<td>3</td>
<td>Thrust ring</td>
</tr>
<tr>
<td>4</td>
<td>Base jaw</td>
</tr>
<tr>
<td>5</td>
<td>Wedge block with thread</td>
</tr>
<tr>
<td>6</td>
<td>Wedge block without thread</td>
</tr>
<tr>
<td>7</td>
<td>Slide block</td>
</tr>
<tr>
<td>8</td>
<td>Spindle</td>
</tr>
<tr>
<td>9</td>
<td>Thrust plate / thrust stud</td>
</tr>
<tr>
<td>10</td>
<td>Threaded plug/supporting wedge</td>
</tr>
<tr>
<td>11</td>
<td>Thrust ring</td>
</tr>
<tr>
<td>12</td>
<td>Retaining stud / supporting screw</td>
</tr>
<tr>
<td>13</td>
<td>Indicator pin</td>
</tr>
<tr>
<td>14</td>
<td>Detent pin</td>
</tr>
<tr>
<td>15</td>
<td>Pressure spring</td>
</tr>
<tr>
<td>16</td>
<td>Pressure spring</td>
</tr>
<tr>
<td>27</td>
<td>Cartridge assembly</td>
</tr>
<tr>
<td>36</td>
<td>Socket head screw</td>
</tr>
<tr>
<td>38</td>
<td>Socket head screw</td>
</tr>
<tr>
<td>39</td>
<td>Funnel-type frease nipple</td>
</tr>
<tr>
<td>40</td>
<td>Circlip</td>
</tr>
<tr>
<td>41</td>
<td>Toothed washer</td>
</tr>
</tbody>
</table>

1.4 Important Data at a Glance:

<table>
<thead>
<tr>
<th>Chuck type F*</th>
<th>125</th>
<th>160</th>
<th>200</th>
<th>250</th>
<th>315</th>
<th>400</th>
<th>500</th>
<th>630</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chuck size</td>
<td>A</td>
<td>125</td>
<td>161</td>
<td>206</td>
<td>255</td>
<td>318</td>
<td>400</td>
<td>500</td>
</tr>
<tr>
<td>Bone</td>
<td>B H7</td>
<td>35</td>
<td>45</td>
<td>55</td>
<td>75</td>
<td>100</td>
<td>130</td>
<td>180</td>
</tr>
<tr>
<td>Spindle mounting</td>
<td>C H6</td>
<td>115</td>
<td>145</td>
<td>185</td>
<td>235</td>
<td>300</td>
<td>380</td>
<td>460</td>
</tr>
<tr>
<td>Jaw mounting</td>
<td>D</td>
<td>F 125</td>
<td>F 160</td>
<td>F 200</td>
<td>F 250</td>
<td>F 315</td>
<td>F 400</td>
<td>F 400</td>
</tr>
<tr>
<td>Ident. No.</td>
<td></td>
<td>164662</td>
<td>164663</td>
<td>164664</td>
<td>164665</td>
<td>164666</td>
<td>164667</td>
<td>164668</td>
</tr>
<tr>
<td>Max. torque M&lt;sub&gt;max&lt;/sub&gt;</td>
<td>Nm</td>
<td>80</td>
<td>120</td>
<td>160</td>
<td>190</td>
<td>210</td>
<td>260</td>
<td>320</td>
</tr>
<tr>
<td>Max. Gripping force F&lt;sub&gt;spmax&lt;/sub&gt;</td>
<td>daN</td>
<td>3700</td>
<td>5900</td>
<td>7600</td>
<td>17500</td>
<td>21500</td>
<td>23400</td>
<td>25000</td>
</tr>
<tr>
<td>Max. Spindle speed n&lt;sub&gt;max&lt;/sub&gt;</td>
<td>min&lt;sup&gt;-1&lt;/sup&gt;</td>
<td>6000</td>
<td>5200</td>
<td>4600</td>
<td>4000</td>
<td>3200</td>
<td>2200</td>
<td>1500</td>
</tr>
<tr>
<td>Moment of inertia J</td>
<td>kgm&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.0075</td>
<td>0.0325</td>
<td>0.1025</td>
<td>0.285</td>
<td>0.8125</td>
<td>2.2</td>
<td>5.5</td>
</tr>
<tr>
<td>Flywheel effect WR&lt;sup&gt;2&lt;/sup&gt;</td>
<td>kpm&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.03</td>
<td>0.13</td>
<td>0.41</td>
<td>1.14</td>
<td>3.25</td>
<td>8.8</td>
<td>22.0</td>
</tr>
<tr>
<td>Weight G (with base jaws)</td>
<td>kg</td>
<td>3.7</td>
<td>8.2</td>
<td>17.7</td>
<td>30.7</td>
<td>59.4</td>
<td>96.4</td>
<td>153.9</td>
</tr>
</tbody>
</table>

Forkardt

1. Technical Data

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Edition: 08 / 97

The Ident. No. Shown applies only to the manual chuck F+ with FGB base jaws.
1. Technical Data

1.5 Chuck Constants:

<table>
<thead>
<tr>
<th>Chuck diam.</th>
<th>125</th>
<th>160</th>
<th>200</th>
<th>250</th>
<th>315</th>
<th>400</th>
<th>500</th>
<th>630</th>
</tr>
</thead>
<tbody>
<tr>
<td>C 1</td>
<td>6500</td>
<td>11100</td>
<td>13100</td>
<td>31100</td>
<td>44200</td>
<td>38400</td>
<td>56200</td>
<td></td>
</tr>
<tr>
<td>C 2</td>
<td>165</td>
<td>260</td>
<td>320</td>
<td>390</td>
<td>440</td>
<td>570</td>
<td>570</td>
<td>820</td>
</tr>
</tbody>
</table>

The chuck constants consider the chuck-specific characteristics. They serve for calculating the clamping force at standstill ($n = 0$) and at operational speed and for the centrifugal force influence at the jaws. See section 6.4.

1.6 Chuck Designation:

<table>
<thead>
<tr>
<th>Chuck designation</th>
<th>Chuck size (outer dia.)</th>
<th>Chuck bore</th>
<th>Spindle mounting</th>
<th>Jaw mounting</th>
<th>Ident. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>F*+</td>
<td>200</td>
<td>52</td>
<td>185</td>
<td>FGB 200</td>
<td>164664</td>
</tr>
</tbody>
</table>

1.7 Tightening Torques for the Chuck Mounting Bolts:

<table>
<thead>
<tr>
<th>Threads to DIN 912</th>
<th>Grade 10.9</th>
<th>Manufactured to DIN 267</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread</td>
<td>M 8</td>
<td>M 10</td>
</tr>
<tr>
<td>Tightening torque</td>
<td>Nm</td>
<td>36</td>
</tr>
<tr>
<td>Max. bolt load</td>
<td>N</td>
<td>24300</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Threads to DIN 7984</th>
<th>Grade 10.9</th>
<th>Manufactured to DIN 267</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread</td>
<td>M 4</td>
<td>M 5</td>
</tr>
<tr>
<td>Tightening torque</td>
<td>Nm</td>
<td>2.8</td>
</tr>
<tr>
<td>Max. bolt load</td>
<td>N</td>
<td>4000</td>
</tr>
</tbody>
</table>

The chuck mounting bolts must be tightened with the torque valves indicated in the tabulation!

1.8 Lubrication Point Drawing:

Grease nipple in threaded plug (12) on manual chuck Type F*+ 125 to Type F*+ 200

Grease nipple on spindle drive (10) on manual chuck Type F*+ 250 to Type F*+ 630

1.9 Information on the Manual Chuck:

On outside diameter of manual chuck: $F_{\text{max}}$, $n_{\text{max}}$, $M_{\text{max}}$, safety instructions

On face of manual chuck: Type of manual chuck, Serial No., Ident. No., FORKARDT emblem
2.0 Safety Instructions:

2.1 General:

This operating manual contains the information required for the correct use of the manual chuck, Type F+. It is directed at technically qualified personnel who have been appropriately trained. Knowledge and the precise following of the safety information and warnings contained in this manual are preconditions for the safe handling, operation and maintenance of the devices described. Only qualified persons in the sense of section 2.2 have the necessary technical expertise to correctly interpret and take notice of safety notes and warnings given in this manual.

**CAUTION !** *It should be noted that no liability will be assumed for damage resulting from failure to heed the instructions contained in this manual!*

2.2 Qualified Personnel:

Interfering with the manual chucks by unqualified persons or failure to follow the safety warnings given in this manual can lead to serious injury or material damage for which FORKARDT takes no responsibility. Only correspondingly qualified personnel may therefore be allowed to work with these manual chucks. Qualified personnel within the meaning of the safety instructions given in this manual are persons who

- have been instructed in the handling of chucking workholding equipment and who are familiar with the contents of this manual referring to the handling of the manual chuck.

- are installation and / or service personnel who have undergone training enabling them to repair / install chucks and workholding equipment and manual chucks.

2.3 Warning Symbols:

The following signs are here both for the personal safety of the Operator and to prevent damage to either the product described or equipment connected to it. Safety instructions and warnings are included to avert danger to the lives and the health of Operators or maintenance personnel, or to avoid material damage.

2.3.1 Danger Symbol:

*This symbol marks all safety instructions in these operating instructions which concern danger to life and limb. Always adhere strictly to the instructions marked with this symbol and take particular care in such situations. The generally applicable safety and accident prevention regulations must also be observed.*

2.3.2 CAUTION ! - Warning:

*This symbol is found at all parts of this manual where particular notice should be taken in order that the guidelines, regulations, instructions and correct work procedures are obeyed and hence damage or destruction of the product can be prevented.*
2.4 General Safety Instructions:

Hazards may arise where the use and handling of rotating manual chucks do not conform to industrial safety requirements. The manual chuck, Type F+, is built to up-to-date technical and safety standards. Despite this, danger can arise from this manual chuck in the event of inappropriate use by untrained personnel or use for unauthorized purposes. The workpiece is an important factor in the interaction between lathe, manual chuck and workpiece and can result in some danger. This danger has to be assessed by the user for the concrete application..

* Only those persons more than 18 years of age who have read the safety instructions and operating manual should use, fit and maintain the manual chuck. These persons must have received special instructions on the implied dangers.

* These operating instructions must be read prior to fitting and using the manual chuck and must be followed exactly!

* Any mode of operation detrimental to the safety of the manual chuck must be avoided.

* The operator is responsible for ensuring that no unauthorised persons work on or with the manual chuck.

* The operator is obliged to report immediately any changes occurring in the manual chuck which are detrimental to safety.

* Intended use - see Section 1.2

* Unauthorized modifications and alterations which affect the safety of the manual chuck are not permitted.

* The user undertakes to use the manual chuck only when it is in perfect operating order.

* The user must ensure, by means of appropriate instructions and checks, that the workplace is kept clean and tidy at all times.

* It is essential that work on the manual chuck (e.g. lubrication, maintenance, servicing) is performed only when the manual chuck is at standstill (n = 0).

* Remove the workpiece from the chuck before carrying out any service work or checks on the manual chuck.

* Remove the chuck key from the square drive of the threaded spindle.

* For safety reasons, use only ORIGINAL FORKARDT assemblies and spare parts. Use of parts from other sources will invalidate our guarantee.

* Before switching on and working with the manual chuck, check that all the guards have been fitted.

* Guard doors may be opened only after the manual chuck has come to a complete standstill. Note instruction plate!

* The local safety and accident prevention regulations in their latest version must be observed at all times when working on and with the manual chuck.
3.1 Instructions:

These operating manual, which has been compiled on the basis of German standard DIN V 8418, must be read, understood and observed by the relevant operating personnel. The figures in brackets ( ) are item numbers which correspond to the numbers used in the relevant assembly drawing or parts list.

This operating manual draws attention to matters of particular significance for the operation of the manual chuck, Type F+. Malfunctions in the manual chuck can be avoided and trouble-free operation ensured only if the operating personnel are familiar with the contents of this operating manual.

* We must point out that we accept no liability for any damage and / or breakdowns resulting from the failure to observe these operating instructions
* If, nevertheless, difficulties are encountered at any time, please contact our customer service department, which will gladly assist you. 
Customer service department, see section 10.3!
* The present operating manual relates to the manual chuck, Type F+.
* We reserve the right to make technical modifications necessitated by the further development and improvement of the manual chuck, Type F+, which may not be reflected in the data and illustrations in this operating manual.

3.2 Copyright:

The copyright on these operating instructions belongs to

FORKARDT DEUTSCHLAND GMBH

This operating manual is intended for use by fitters, operators and supervisors. It contains technical instructions and drawings which may not be reproduced, distributed, exploited for unauthorised purposes in competition or made available to third parties, either as a whole or in part. Furthermore, FORKARDT accepts no liability for the inaccuracy or incompleteness of this manual which is believed to be complete and comprehensive on going to press. If in doubt, contact should be made immediately with FORKARDT.

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Made in Germany

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4. Transport, Storage

4.1 Packing, State of Assembly:

The type of packing is determined partly by the weight of the chuck and the method of transport. The manual chucks are packed dust-tight in either oiled paper or transparent film.

**Manual chucks up to 315 mm diameter:**

- Packed in collapsible cardboard boxes with an appropriate insert to take the chuck or, for longer transport routes, by foaming out the collapsible cardboard box.

**Manual chucks above 400 mm diameter:**

- Packed in wooden crates with appropriate filler material (e.g. chips), together with the accessories, e.g. top jaws and chuck key.

Manual chucks are delivered ready assembled
- adapter flanges or mounting flanges separately.

Pay attention to the symbols (to German standard DIN 55402, Part 1) marked on the packing, e.g.:

![Symbols]

4.2 Care, Storage, Contents of Consignment:

Care must be taken during transport to avoid damage due to knocks or jolts or careless loading or unloading.

Shipping supports appropriate to the duration of the journey have to be provided.

If the power chuck is not fitted immediately on delivery, it must be stored on a pallet in a protected location. During storage, the parts have to be covered properly to protect them from dust and moisture.

All bare metal parts of the power chuck are coated before delivery with a corrosion inhibitor (e.g. Molykote Metalprotector Plus).

On receipt, check the contents of the consignment against the delivery note.

**Any damage incurred in transit and / or any missing parts must be reported immediately by telephone and in writing!**
5. Construction and Mode of Operation

5.1 Manual Chucks:

The gripping force of a manual chuck depends to a significant extent on the principle of the force application, i.e. on how the gripping force is generated and transmitted to the chuck jaws. The most common types of manual chuck in use today are:

a) Independent jaw chucks:

These are workpiece holding chucks of simple design with which workpieces of all forms can be gripped both centrically and eccentrically. Independent jaw chucks are fitted as standard with four jaws which can be adjusted individually by hand, i.e. the chuck jaws are not moved by a central drive. Thanks to this possibility of individual adjustment over practically the whole plate diameter, the workpieces can be mounted and chucked in almost any position.

b) Scroll chucks:

With the scroll chuck, the gripping movement of the chuck jaws is performed centrally by a helically splined disc. The sickle-shaped splines of the base jaws engage in the splines of the disc. This spiral disc is driven by a bevel gear so that the base jaws are moved radially in the guide of the chuck body. The chuck gearing permits a large jaw travel and thus a wide clamping range. The splines of the base jaws which engage in the splines of the disc must have a small radius corresponding to the smallest curvature of the spirals in view of the increasing curvature radius of the scrolls towards the outside. The resulting line contact naturally limits the gripping force, long-term precision and service life of the scroll chuck.

For very many applications, however, this is more than sufficient. With the scroll chuck, the complete scroll has to be traversed in order to replace the chuck jaws. In view of the long travel, this is a very time-consuming operation.

c) Wedge block chucks:

In the wedge block chuck, three linear moving wedge blocks with inclined splines - one of which is driven by a threaded spindle - which are linked by slide blocks and a thrust ring perform the function of the scroll and transmit the gripping forces to the splines of the base jaws. This allows gripping forces to be generated which are not possible with an independent jaw chuck. The high percentage contact areas of the splines produce not only an outstanding and consistent radial concentricity but also a long-term precision of the chuck which cannot be achieved with the line contact of the scroll chuck system. The wedge block principle also creates the preconditions for quick and easy jaw changing.

Just a few turns of the chuck key disengages the splines of the wedge block and the base jaws can be freely moved in their guides.
5.2 Manual Chuck Type F:

In modern production processes, chucks are required which offer not only high gripping forces but also a high long-term precision and minimum wear in order to be able to exploit the capabilities of modern high-performance lathes. The "wedge block chuck" Type F convincingly satisfies all these demands. It is characterised by a large gripping force, high radial concentricity, good long-term precision and quick jaw changing.

The chuck mechanism which is backlash-free under load guarantees the highest precision, irrespective of functional and manufacturing-related dimensional deviations in the individual workpieces.

The gripping force is transmitted purely via generously dimensioned surfaces to guarantee maximum load-bearing capacities and wear resistance. Wedge blocks moving at right-angles to the base jaws release the chuck jaws for moving, turning or changing after a short disengagement stroke.

The main features of the manual chuck Type F are listed below:

- Manual chuck sizes of 125, 160, 200, 250, 315, 400, 500 and 630mm diameter (deviations in the outside diameter are possible in individual cases).
- Hardened chuck body for maximum precision and service life.
- Internal parts of specially selected steels for maximum gripping force.
- Large through hole for bar work.
- Proven F jaw system of unmodified design, thus permitting continued use of many existing sets of chuck jaws.
- Quick jaw changing within seconds.
- Very high repetition precision when using the same sets of jaws again.
- Very high working speeds thanks to low jaw weight.
- Individual jaw mounting for safe handling.
- Can be used on all types of lathe.
- Developed and manufactured under ISO 9001.

The manual chuck Type F can be combined with suitable accessories to produce a modern and high-performance workholding system. Such combinations include:

- One-piece stepped jaws or jaw units consisting of FGB base jaws and FHB hard top jaws.
- KBKTNC roughing jaws with hard jaw inserts SKA (for external chucking) or SKI (for internal chucking).
- FMB soft monoblock jaws or jaw units consisting of FGB base jaws and FWB soft top jaws.
- Special top jaws manufactured to the drawings send to us by you.
- Centering cover for bayonet plate or Camlock attachment to DIN or ASA.
- Adapter flanges for chucks with plain spigot mounting recess.

For effective, safe and efficient work with the manual chuck Type F we also offer:

- Elektronic gripping force meter Type SKM 1200 / 1500 to publication 300 224.10.1E.
- Lubricants for chuck maintenance and to maintain the gripping force to publication 990.01.5D.
- Clamping rings for internal dressing of soft top jaws to publication 990.01.5D.
- Chuck hooks for easy handling of large chucks during mounting / disassembly to publication 990.01.5D.
5.3 Design of the Manual Chuck:

The main components of the manual chuck Type F+ are:

- The one-piece chuck body (1) with plain mounting recess, bore and the corresponding ground slots to take the wedge blocks (5 and 6), with and without thread, and the three jaw guides to take the base jaws (4).
- The thrust ring (3) with the slots to take the slide blocks (9) and the control cam for the indicator pin (15).
- The spring-loaded indicator pin (15, 18) for visual monitoring of the wedge block stroke.
- The three spring-loaded detent pins (16, 17) which are held axially by a circlip (41).
- The three cartridge assemblies (27) which, via the spring-loaded detent pins (16 and 17), prevent the base jaws (4) from being slung out when the chuck rotates.
- The threaded spindle (10) to drive the wedge block (5) which is guided and adjusted backlash-free by the thrust ring (13) and threaded plug / supporting wedge (12) via the thrust plate / thrust stud (11) in the chuck body (1).
- The cover (2) with lubrication grooves which seals the chuck from the outside and is mounted on the chuck body by three socket head screws (38).

On manual chucks F+ 125 to F+ 200, threaded plug (12) - which is held in its position by a retaining stud (14) - contains a funnel-type grease nipple (39) for lubrication of the chuck. On manual chucks F+ 250 to F+ 630, this funnel-type grease nipple is located in the square of the threaded spindle (10) which is adjusted backlash-free via thrust stud (11) and the supporting wedges (12). This backlash-free adjustment is performed by adjusting the supporting screws (14). On manual chucks F+ 500 and F+ 630, the cover (2) is additionally held by three socket head screws (37) inserted from the front of the chuck body.
### 5. Construction and Mode of Operation

#### 5.4 Principal Dimensions of Manual Chuck $F^+$ with Plain Mounting Recess:

![Diagram](image)

F 19 to F 22

<table>
<thead>
<tr>
<th>Chuck type</th>
<th>F+</th>
<th>125</th>
<th>160</th>
<th>200</th>
<th>250</th>
<th>315</th>
<th>400</th>
<th>500</th>
<th>630</th>
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</thead>
<tbody>
<tr>
<td>Chuck size</td>
<td>A</td>
<td>125</td>
<td>161</td>
<td>206</td>
<td>255</td>
<td>318</td>
<td>400</td>
<td>500</td>
<td>630</td>
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<tr>
<td>Bore</td>
<td>B+</td>
<td>35</td>
<td>45</td>
<td>55</td>
<td>75</td>
<td>100</td>
<td>130</td>
<td>180</td>
<td>270</td>
</tr>
<tr>
<td>Register diameter</td>
<td>C</td>
<td>115</td>
<td>145</td>
<td>185</td>
<td>235</td>
<td>300</td>
<td>380</td>
<td>460</td>
<td>580</td>
</tr>
<tr>
<td>Jaw mounting</td>
<td>D</td>
<td>F 125</td>
<td>F 160</td>
<td>F 200</td>
<td>F 250</td>
<td>F 315</td>
<td>F 400</td>
<td>F 400</td>
<td>F 630</td>
</tr>
<tr>
<td>Bore B can be reamed to</td>
<td>B+</td>
<td>35</td>
<td>45</td>
<td>55</td>
<td>75</td>
<td>100</td>
<td>130</td>
<td>180</td>
<td>270</td>
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<tr>
<td>Base jaw length</td>
<td>D</td>
<td>47</td>
<td>56</td>
<td>90</td>
<td>110</td>
<td>125</td>
<td>160</td>
<td>160</td>
<td>230</td>
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<tr>
<td>Register height</td>
<td>F</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
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<tr>
<td>Mounting bolt thread</td>
<td>G</td>
<td>3 x M8</td>
<td>3 x M10</td>
<td>3 x M12</td>
<td>3 x M16</td>
<td>3 x M20</td>
<td>3 x M24</td>
<td>3 x M24</td>
<td>3 x M24</td>
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<tr>
<td>Thread for ring bolt DIN 580</td>
<td>G1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>M16</td>
<td>M16</td>
<td>M16</td>
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<tr>
<td>Chuck width</td>
<td>H</td>
<td>46.5</td>
<td>63</td>
<td>81.3</td>
<td>92</td>
<td>111</td>
<td>118</td>
<td>119</td>
<td>143</td>
</tr>
<tr>
<td>Distance</td>
<td>H1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>55</td>
<td>55</td>
<td>55</td>
</tr>
<tr>
<td>Distance</td>
<td>H2</td>
<td>53.1</td>
<td>69</td>
<td>88</td>
<td>99</td>
<td>119</td>
<td>129</td>
<td>130</td>
<td>155</td>
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<tr>
<td>Thread length</td>
<td>J</td>
<td>11</td>
<td>13</td>
<td>18</td>
<td>27</td>
<td>33</td>
<td>34</td>
<td>34</td>
<td>34</td>
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<tr>
<td>Thread depth</td>
<td>J1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Distance between centers of chuck key</td>
<td>K</td>
<td>33</td>
<td>43</td>
<td>54</td>
<td>67</td>
<td>86</td>
<td>111</td>
<td>153.5</td>
<td>196</td>
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<tr>
<td>Pitch circle diameter</td>
<td>L</td>
<td>100</td>
<td>125</td>
<td>160</td>
<td>200</td>
<td>250</td>
<td>315</td>
<td>235/400</td>
<td>330/27520</td>
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<tr>
<td>Lever length</td>
<td>M</td>
<td>150</td>
<td>200</td>
<td>280</td>
<td>450</td>
<td>500</td>
<td>600</td>
<td>600</td>
<td>710</td>
</tr>
<tr>
<td>Jaw movement</td>
<td>N</td>
<td>4.8</td>
<td>6.3</td>
<td>6.8</td>
<td>7.5</td>
<td>9.6</td>
<td>12</td>
<td>12</td>
<td>14.1</td>
</tr>
<tr>
<td>Distance</td>
<td>O</td>
<td>22.5</td>
<td>31.5</td>
<td>43</td>
<td>47</td>
<td>59</td>
<td>57.5</td>
<td>58.5</td>
<td>72</td>
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<tr>
<td>Distance from lever</td>
<td>P</td>
<td>115</td>
<td>180</td>
<td>210</td>
<td>300</td>
<td>310</td>
<td>360</td>
<td>520</td>
<td>570</td>
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<tr>
<td>Position of base jaw</td>
<td>Rmin</td>
<td>9.2</td>
<td>12.1</td>
<td>13.2</td>
<td>14.8</td>
<td>18.7</td>
<td>24.7</td>
<td>41.6</td>
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<tr>
<td>Rmax</td>
<td>23.6</td>
<td>31.5</td>
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<td>51</td>
<td>68</td>
<td>93.1</td>
<td>135.7</td>
<td>169.8</td>
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<td>Gap</td>
<td>S</td>
<td>-</td>
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<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
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<tr>
<td>Width across flats</td>
<td>SW</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>16</td>
<td>19</td>
<td>19</td>
<td>24</td>
</tr>
<tr>
<td>Pitch of serrations</td>
<td>T</td>
<td>3.6</td>
<td>4.8</td>
<td>4.8</td>
<td>6</td>
<td>7</td>
<td>8.5</td>
<td>8.5</td>
<td>8.5</td>
</tr>
<tr>
<td>Angle $\alpha^\circ$</td>
<td>36' 6&quot;</td>
<td>36' 6&quot;</td>
<td>3&quot;</td>
<td>4'30&quot;</td>
<td>4'30&quot;</td>
<td>4'30&quot;</td>
<td>4'30&quot;</td>
<td>4'30&quot;</td>
<td></td>
</tr>
<tr>
<td>Angle $\beta^\circ$</td>
<td>21'36&quot;</td>
<td>21'36&quot;</td>
<td>18&quot;</td>
<td>19'30&quot;</td>
<td>16'30&quot;</td>
<td>19'30&quot;</td>
<td>14'30&quot;</td>
<td>69'30&quot;</td>
<td></td>
</tr>
<tr>
<td>Groove width</td>
<td>a</td>
<td>5</td>
<td>18</td>
<td>20</td>
<td>20</td>
<td>26</td>
<td>30</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>Groove depth</td>
<td>b</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>8</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Distance</td>
<td>c1</td>
<td>21</td>
<td>19</td>
<td>23</td>
<td>26</td>
<td>30</td>
<td>35</td>
<td>35</td>
<td>52</td>
</tr>
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<td>Distance</td>
<td>c2</td>
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<td>7</td>
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<td>10</td>
<td>14</td>
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<td>15</td>
<td>21</td>
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<tr>
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<td>40</td>
<td>40</td>
<td>54</td>
<td>60</td>
<td>60</td>
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<tr>
<td>Length</td>
<td>e</td>
<td>47</td>
<td>56</td>
<td>67</td>
<td>73</td>
<td>86</td>
<td>103</td>
<td>103</td>
<td>145</td>
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<tr>
<td>Thread</td>
<td>g</td>
<td>M8</td>
<td>M8 x 1</td>
<td>M8 x 1.5</td>
<td>M12 x 1.5</td>
<td>M12 x 1.5</td>
<td>M16 x 1.5</td>
<td>M16 x 1.5</td>
<td>M20</td>
</tr>
<tr>
<td>Jaw width</td>
<td>h</td>
<td>14</td>
<td>20</td>
<td>22</td>
<td>26</td>
<td>32</td>
<td>45</td>
<td>45</td>
<td>65</td>
</tr>
<tr>
<td>Thread depth</td>
<td>j</td>
<td>10</td>
<td>16</td>
<td>20</td>
<td>23</td>
<td>25</td>
<td>30</td>
<td>30</td>
<td>32</td>
</tr>
</tbody>
</table>
5. Construction and Mode of Operation:

5.5 General:

The manual chuck Type F+ is a wedge block chuck which is operated by a chuck key. The heart of the F+ is the wedge block drive of the chuck jaws (base jaw (4) and top jaw (24)). Behind each chuck jaw in the chuck body is a wedge block (5 and 6) which moves laterally. It engages with its angled modular splines with the splines on the rear of the base jaw. When the wedge blocks are moved, the jaws make a pripping movement inwards or outwards, depending on the direction of movement of the wedge blocks.

The exact synchronisation of the three wedge blocks is ensured by the thrust ring (3) located behind the blocks. It has three radial grooves in which the slide blocks (9) engage, each of which is linked to a journal on the rear of the wedge blocks.

One of the three wedge blocks is driven by the threaded spindle (10) mounted in the chuck body. The manual chuck Type F+ is operated by placing the chuck key (20) on the spindle square drive.

An indicator pin (15) in the front face of the chuck indicates the permissible gripping range. When no workpiece is chucked, the useful jaw stroke can be travelled by continuing to turn the chuck key. The end of the jaw stroke is indicated by the indicator pin appearing again (see Figure F 25).

Now turn the chuck key several rotations in clockwise direction until the indicator pin has been retracted flush with the chuck body. In this condition, the splines of the wedge blocks and chuck jaws are engaged and the chuck is ready to grip a workpiece (see Figure F 24).

Workpieces must not be chucked when the indicator pin is protruding out of the chuck body. There is then a danger that the splines of the wedge blocks and chuck jaws are not or not sufficiently engaged or that there is not sufficient reserve jaw stroke for safe and reliable holding of the workpiece.

CAUTION!
5. Construction and Mode of Operation

5.5.2 Function of the Manual Chuck Type F:

The manual chuck, attached to the spindle nose of a lathe, is operated with a chuck key and has the function of generating a gripping force to hold the workpiece to be chucked from the torque applied with the chuck key.

The force applied at the chuck key is transmitted via the threaded spindle to the internal thread of the wedge block and from there via the slide blocks in the thrust ring to the other splined wedge blocks in the chuck body and thus to the base jaws and the top jaws linked to the base jaws with a cross-tenon.

The corresponding gripping force required to hold the workpiece during machining is built up radially on the workpiece via the top jaws.

*It is important here that the torque applied to generate this gripping force is matched to the maximum permissible torque of the manual chuck used and is not exceeded.*

**CAUTION!**

*During gripping with the chuck key, do not use an extension tube as otherwise an excessively high load can be placed on the internal parts of the chuck!*

To install the chuck jaws (base jaw FGB and hard top jaw FHB), back off the splines of the wedge blocks out of the area of the jaw guides by turning the chuck key in counter-clockwise direction. In this position, the indicator pin protrudes several millimetres out of the face of the chuck body (see also Figure 25). If the jaw locks (located behind each base jaw) are now depressed, the chuck jaws can be moved in their guides in the chuck body. A reliable aid to correct positioning of the jaws for engagement in the splines of the wedge blocks is the spring-loaded latch which engages audibly in the splines on the rear of the chuck jaws.

Now turn the chuck key several rotations in clockwise direction until the indicator pin is retracted flush with the chuck body. In this position, the splines of the wedge blocks and chuck jaws are engaged and the chuck is ready to grip a workpiece.

**CAUTION!**

*Remove the chuck key from the square drive of the threaded spindle immediately after completing the chucking procedure. For safety reasons, it must never be left in the chuck!*

If no workpiece is chucked, the useful jaw stroke can be travelled by continuing to turn the chuck key. The end of the jaw stroke is indicated by the indicator pin appearing again.

**CAUTION!**

*Workpieces must not be chucked when the indicator pin is protruding out of the chuck body. There is then a danger that the splines of the wedge blocks and chuck jaws are not or not sufficiently engaged or that there is no sufficient reserve jaw stroke for safe and reliable holding of the workpiece.*

If this instruction should fail to be observed and the chucking mechanism is damaged or if the chuck jaw gearing is damaged as a result of a collision, the jaw locks catch the jaws as they are catapulted outwards within a few millimetres and still inside the chuck body. These jaw locks satisfy the regulations of the German Employers’ Liability Insurance Association and of European standard EN 1550.
For repositioning, turning or changing the chuck jaws, the jaws are moved out as far as possible until the indicator pin is protruding and the chuck key cannot be turned any further. When the jaw lock is now pressed in, the jaw can be repositioned or pulled out.

To adjust the chuck jaws to a particular gripping diameter, the splines of the wedge blocks must be moved out of the area of the jaw guides by turning the chuck key in counterclockwise direction. In this position, the indicator pin protrudes several millimetres out of the face of the chuck body.

Pressing the jaw lock releases the spring-loaded latch on the rear of the chuck jaws can be moved to the required gripping diameter. The correct position of the chuck jaws is indicated by the spring-loaded latch which engages audibly in the splines on the rear of the chuck jaws when the jaw lock is released.

Turning the chuck key in clockwise direction causes the splines of the wedge blocks and chuck jaws to be engaged and the workpiece can be chucked.

If the top jaws are changed from e.g. hard top jaws Type FHB for roughing work to soft top jaws Type FWB for finish-turning, the jaw mounting bolts must be loosened and the top jaw removed completely from the base jaws.

**CAUTION!** Before removing the top jaws from the base jaws, remove any chips or dirt from the chuck bore and base jaws!

**CAUTION!** If machining of the chucked workpiece is interrupted for several hours, the workpiece must be removed from the manual chuck!

As the wedge block splines can be disengaged quickly by turning the chuck key, the chuck jaws can be quickly repositioned for another gripping diameter, turned (e.g. from internal to external chucking) or replaced.

The use of jaw units
- either base jaws (FGB) with hard (FHB) or soft (FWB) top jaws
- or one-piece hard (FStB) or soft (FMB) jaws
with different gripping diameters offers an effective rationalisation possibility with respect to the tooling time of the machine.

For repetitive work using the manual chuck, we therefore recommend different sets of jaw units, i.e. the base jaws and top jaws bolted together are replaced as a unit, thus allowing a large proportion of the set-up time to be saved. Furthermore, the precision of the jaws is maintained if these are always used only on the same chuck.

**CAUTION!** Do not remove top jaws (FHB or FWB) for precision chucking of workpieces from the base jaws as otherwise the precision will be lost!

The manual chucks can, on request, also be designed for short taper mounting to DIN or ASA and supplied with centering cover. In this case the chuck cover (2) is removed from the chuck body by loosening the socket head screws (37, 38) and replaced by the centering cover for bayonet or Camlock mounting.

See also Section 5.13.1, page 22.
5.6 Safety Instructions:

* The torque applied to generate the gripping force must be matched to the maximum permissible torque of the manual chuck used which must not be exceeded.

* During gripping with the chuck key, do not use an extension tube as otherwise an excessively high load can be placed on the internal parts of the chuck!

* Workpieces must not be chucked when the indicator pin is protruding out of the chuck body. There is then a danger that the splines of the wedge blocks and chuck jaws are not or not sufficiently engaged or that there is not sufficient reserve jaw stroke for safe and reliable holding of the workpiece.

* Remove the chuck key from the square drive of the threaded spindle immediately after completing the chucking procedure. For safety reasons, it must never be left in the chuck!

* The lathe spindle may only be started when the gripping force is within the permissible working range of the manual chuck.

* If machining of the chucked workpiece is interrupted for several hours, the workpiece must be removed from the manual chuck!

5.7 Chuck jaws:

5.7.1 General:

The manual chuck forms the link between the lathe and the workpiece to be machined. The lathe spindle torque is transmitted to the workpiece at the transition from the spindle nose - via the manual chuck - and at the connection of manual chuck to workpiece - by the frictional grip of the chuck jaws on the workpiece.

Top jaws are the radially moving elements of the manual chuck which hold the workpiece during the machining. The chuck jaws consist of the base jaws - the connecting link to the part of the manual chuck applying the gripping force to the workpiece - and the top jaw positioned exactly on the base jaw by the engagement of the cross tenons. Depending on the type of machining or the different form and size of the workpieces, soft or hard top jaws are used.

5.7.2 Type Designation of the Chuck Jaws:

<table>
<thead>
<tr>
<th>Basic chuck</th>
<th>F+</th>
<th>125</th>
<th>160</th>
<th>200</th>
<th>250</th>
<th>315</th>
<th>400</th>
<th>500</th>
<th>630</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-piece hard stepped jaws</td>
<td>FSB..</td>
<td>125</td>
<td>160</td>
<td>200</td>
<td>250</td>
<td>315</td>
<td>400</td>
<td>400</td>
<td>-</td>
</tr>
<tr>
<td>Soft monoblock jaws</td>
<td>FMB..</td>
<td>-</td>
<td>160</td>
<td>200</td>
<td>250</td>
<td>315</td>
<td>400</td>
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<td>Base jaw</td>
<td>FGB..</td>
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<td>160</td>
<td>200</td>
<td>250</td>
<td>315</td>
<td>400</td>
<td>400</td>
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<tr>
<td>hard top jaw</td>
<td>- FHB..</td>
<td>-</td>
<td>160</td>
<td>200</td>
<td>250</td>
<td>315</td>
<td>400</td>
<td>400</td>
<td>630</td>
</tr>
<tr>
<td>soft top jaw</td>
<td>- FWB..</td>
<td>125</td>
<td>160</td>
<td>200</td>
<td>250</td>
<td>315</td>
<td>400</td>
<td>400</td>
<td>630</td>
</tr>
</tbody>
</table>
| Roughing jaw                | KBKTNC | Depending on the gripping diameter, see tables on page 26.
5.7.3 One-Piece FStB Hard Stepped Jaws:

One-piece FStB stepped jaws are hardened jaws with serrated gripping surfaces to increase the grip between chuck jaw and workpiece. The gripping surfaces are ground in the chuck whilst the gripping force is being applied. The jaws are used to grip unmachined or rough machined workpieces
Â for medium cuts.

Determine the necessary gripping force Fsp!

5.7.4 Soft FMB Monoblock Jaws:

Soft FMB monoblock jaws are unhardened, rectangular blocks. They are used for gripping previously machined workpieces
Â which must not be damaged on the gripped surface
Â and for light cuts.
Â These jaws are turned to suit the shape of the workpiece whilst the gripping force is being applied and have the advantage that the useful volume is not restricted by any jaw mounting bolts.

Determine the necessary gripping force Fsp!

5.8 Jaw Units:

Jaw units consisting of an FGB base jaw
Â a hard FHB top jaw
Â a soft FWB top jaw or a
Â special chuck jaw
are used for machining the different kinds of workpiece encountered in practice. The FGB base jaw is designed for cross-tenon mounting of the top jaw.

5.8.1 Jaw Unit: FGB and Hard FHB Top Jaw

The FGB - FHB jaw unit is used for gripping unmachined or rough machined workpieces.
Â for medium cuts. They are ground in the chuck whilst the gripping force is being applied in order to increase the concentricity.
Â Hard FHB top jaws are hardened jaws with serrated gripping surfaces to increase the grip between top jaw and workpiece.
Â In order to maintain the chuck concentricity, the top jaw should not be removed from the base jaw.

Determine the necessary gripping force Fsp!
5.8.2 Jaw Unit: FGB and Soft FWB Top Jaw:

The FGB - FWB unit is used for precision gripping of previously machined workpieces which must not be damaged on the gripped surface.

- for light cuts. They are turned or ground to suit the shape of the workpiece in the chuck whilst the gripping force is being applied.
- Soft FWB top jaws are unhardened, rectangular blocks.
- Turned soft FWB top jaws maintain their precision as long as they are not removed from the base jaw.

**Determine the necessary gripping force Fsp!**

5.8.3 Jaw Unit: FGB and Special Chuck Jaw:

In the FGB base jaw and special chuck jaw unit, the base jaw should preferably only be used as the basic jaw.

**Determine the necessary gripping force Fsp!**

With the jaw units

- the greater weight
- the greater height and
- the greater radius of the center of gravity

**must be taken into account when calculating the gripping force Fsp!**

5.9 KBKTNC Roughing Jaws:

These top jaws have hard replaceable serrated inserts (SKA for external chucking, SKI for internal chucking).

This type of jaw is used for gripping blanks, forgings or castings

- for heavy cuts.

**Determine the necessary gripping force Fsp!**
5.10 Grinding Out Top Jaws:

In order to achieve a high concentricity, subsequently supplied hard top jaws (FHB) or one-piece hard stepped jaws (FStB) have to be ground out and marked on the chuck on which they are to be subsequently used for machining the workpieces. In as-delivered condition, they are quite sufficient for gripping any unmachined workpieces where the serrations of the gripping surface are of benefit but a high concentricity is not demanded. For precision gripping on previously machined surfaces, however, unmachined subsequently supplied top jaws should not be used.

When summed, the tolerance-related differences in size of the individual parts involved in driving the individual chuck jaws result in different radial positions of the three jaws. These differences are larger than the permissible concentricity deviation permitted by DIN 6386 and can only be eliminated by grinding out in the chuck. Marking of the jaws with 1, 2 and 3 must also ensure that the same jaw is always installed in the same guide or on the same base jaw. Grinding out of the jaws must always be carried out with the chuck installed ready for operation. For grinding out stepped jaws (FStB) or hard top jaws (FHB) for external chucking, a mandrel must be gripped as close as possible to the surface to be ground (Figure F 35). Grinding is performed whilst the gripping force is being applied. For grinding of gripping surfaces for internal chucking, a correspondingly dimensioned ring must be pushed over the steps of the jaws and gripped with the same force as used for the actual machining work (Figure F 36). The same applies to the grinding out of soft top jaws (FWB) or monoblock jaws (FMB) for machining to a specific gripping diameter. Marking of the jaws with 1, 2 and 3 and the gripping diameter used must also ensure that the same jaw is always installed in the same guide or on the same base jaw.

**CAUTION!**  
Grind out the top jaws whilst the gripping force is being applied!

5.11 Safety Instructions for Top Jaws:

* With top jaws manufactured in your own workshops, ensure that the pitch of the serrations is correct and that no distortion has occurred during hardening.
* Check the strength of top jaws manufactured in your own workshops using the gripping force calculated in Section 6.2.1 of the Operating Manual!
* For high spindle speeds, reduce the weight of soft top jaws and top jaws manufactured in your own workshops as far as - but not at the cost of the jaw strength!
* Apart from the customary calculation of the gripping force, the strength of special chuck jaws must be checked in conjunction with the corresponding chuck! If the dynamic gripping force requires a spindle speed lower than the maximum spindle speed for the manual chuck, mark the special jaws with the maximum permissible spindle speed and the symbol of the manual chuck!
5. Construction and Mode of Operation

* Determine the mass and position of the center of gravity of finished soft top jaws manufactured in your own workshops.

* Check whether the useful actuating force of the manual chuck is sufficient for the intended machining operation. See also specimen calculation in Section 6.4.

* When using special chuck jaws, set the spindle speed limit on the lathe to the maximum permissible speed allowed for those jaws, as otherwise the centrifugal force of the jaws will reduce the gripping force to such an extent that the workpiece is no longer securely held!

* When inserting the workpiece into the manual chuck, always position a top jaw at the bottom in order to avoid the risk of the workpiece becoming jammed between two top jaws. The risk of jamming of workpieces is particularly acute where top jaws with sharp splines are used, with large gripping diameters, with narrow top jaws which do not grip fully round the workpiece and with large opening strokes of the manual chuck.

* When the workpiece is inserted, the travel of the top jaws should be 3 mm or less. Design top jaws in such a way that the jaw travel required to reach the gripping position is not more than 3 mm!

* Check the strength of the chuck mounting bolts when using jaw units. Recalculate the tensile strength (static and dynamic). Use only high quality bolts of grade 10.9 to DIN 267!

* Use only ORIGINAL FORKARDT mounting bolts for fitting top jaws, observing the prescribed bolt grade!

5.12 Tightening Torques for Jaw Mounting Bolts:

<table>
<thead>
<tr>
<th>Bolts to DIN 912</th>
<th>Grade 10.9</th>
<th>Manufactured to DIN 267</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread</td>
<td>M6</td>
<td>M8 x 1</td>
</tr>
<tr>
<td>Tightening torque</td>
<td>Nm 8,3</td>
<td>22</td>
</tr>
<tr>
<td>Max. Bolt load</td>
<td>N 9750</td>
<td>19600</td>
</tr>
</tbody>
</table>
### 5.13 Accessories:

#### 5.13.1 Mounting Flanges, Adapter Flanges and Adapter Plates:

<table>
<thead>
<tr>
<th>Chuck with mounting flange for bayonet plate attachment to DIN 55027, ISO 702 / III, ASA B5.9 Type B</th>
<th>J</th>
<th>Chuck with mounting flange for Camlock attachment to DIN 55029, ISO 702 / II, ASA B5.9 D1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chuck type F+</strong></td>
<td><strong>Spindle nose Size</strong></td>
<td><strong>Mounting flange</strong></td>
</tr>
<tr>
<td>125</td>
<td>3</td>
<td>F125 - J3</td>
</tr>
<tr>
<td>4</td>
<td>F125 - J4</td>
<td>16466204D</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>F125 - J5</td>
</tr>
<tr>
<td>160</td>
<td>4</td>
<td>F160 - J4</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>F160 - J5</td>
</tr>
<tr>
<td>200</td>
<td>6</td>
<td>F200 - J6</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>4</td>
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<td></td>
<td>6</td>
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<td>315</td>
<td>8</td>
<td>F315 - J8</td>
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<tr>
<td>400</td>
<td>11</td>
<td>F400 - J11</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>11</td>
</tr>
<tr>
<td>500</td>
<td>15</td>
<td>F500 - J15</td>
</tr>
<tr>
<td>630</td>
<td>15</td>
<td>F630 - J15</td>
</tr>
</tbody>
</table>

The ident. Nos. Given apply to manual chucks with base jaws but without top!

<table>
<thead>
<tr>
<th>Chuck with plain spigot mounting recess, with adapter flange for spindle nose mounting to DIN 55026 A/B, ISO 702I A1/A2, ASA B5.9 A1/A2</th>
<th>K</th>
<th>Chuck with adapter plate for spindle nose mounting to DIN 55026, ISO 702I</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chuck type F+</strong></td>
<td><strong>Spindle nose Size</strong></td>
<td><strong>Mounting flange</strong></td>
</tr>
<tr>
<td>125</td>
<td>3</td>
<td>F125 - A3</td>
</tr>
<tr>
<td>4</td>
<td>F125 - A4</td>
<td>152205</td>
</tr>
<tr>
<td>5</td>
<td>F160 - A4</td>
<td>152207</td>
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<td>4</td>
<td>F200 - A4</td>
</tr>
<tr>
<td>5</td>
<td>F200 - A5</td>
<td>70417 / 2</td>
</tr>
<tr>
<td>250</td>
<td>5</td>
<td>F250 - A5</td>
</tr>
<tr>
<td>6</td>
<td>F250 - A6</td>
<td>70353 / 2</td>
</tr>
<tr>
<td>315</td>
<td>8</td>
<td>F315 - A5</td>
</tr>
<tr>
<td>8</td>
<td>F315 - A8</td>
<td>70376 / 2</td>
</tr>
<tr>
<td>11</td>
<td>F315 - A11</td>
<td>70375 / 2</td>
</tr>
<tr>
<td>400</td>
<td>15</td>
<td>F400 - A8</td>
</tr>
<tr>
<td>11</td>
<td>F400 - A11</td>
<td>70428 / 2</td>
</tr>
<tr>
<td>500</td>
<td>11</td>
<td>F500 - A8</td>
</tr>
<tr>
<td>11</td>
<td>F500 - A11</td>
<td>70736 / 2</td>
</tr>
<tr>
<td>15</td>
<td>F500 - A15</td>
<td>70791 / 2</td>
</tr>
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<td>630</td>
<td>11</td>
<td>F630 - A11</td>
</tr>
<tr>
<td>15</td>
<td>F630/600-J15</td>
<td>70188 / 2</td>
</tr>
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**Adaptor plate for mounting of manual chuck F+ on spindle noses to DIN 55026 and ISO 702I on request!**

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**Edition: 08 / 97**

**BA No.: 110.50.05.01E**

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**FORKARDT**
### 5.13.2 One-Piece FStB Hard Stepped Jaws:

<table>
<thead>
<tr>
<th>Chuck type F+</th>
<th>max. swing diameter</th>
<th>FSIB jaw type</th>
<th>Nominal dimensions</th>
<th>FStB Nominal dimensions</th>
<th>Ident. No.</th>
<th>External chucking range</th>
<th>Internal chucking range</th>
<th>Center of gravity</th>
<th>Weight kg/jaw</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>148</td>
<td>125</td>
<td>5</td>
<td>14</td>
<td>18</td>
<td>F125</td>
<td>7001050/94</td>
<td>50</td>
<td>43.1 33.5</td>
</tr>
<tr>
<td>160</td>
<td>224</td>
<td>160</td>
<td>7.5</td>
<td>20</td>
<td>24</td>
<td>F160</td>
<td>7001663/3</td>
<td>79</td>
<td>63 45</td>
</tr>
<tr>
<td>200</td>
<td>268</td>
<td>200</td>
<td>10</td>
<td>22</td>
<td>35</td>
<td>F200</td>
<td>7002063/3</td>
<td>94</td>
<td>72 80</td>
</tr>
<tr>
<td>250</td>
<td>335</td>
<td>250</td>
<td>14</td>
<td>26</td>
<td>40</td>
<td>F250</td>
<td>7002583/3</td>
<td>115</td>
<td>79 70</td>
</tr>
<tr>
<td>315</td>
<td>402</td>
<td>315</td>
<td>15</td>
<td>32</td>
<td>46</td>
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<td>7003183/3</td>
<td>129</td>
<td>92.8 81</td>
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<td>400</td>
<td>512</td>
<td>400</td>
<td>20</td>
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<td>7004083/3</td>
<td>167</td>
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<td>500</td>
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<td>20</td>
<td>45</td>
<td>53</td>
<td>F400</td>
<td>7004083/3</td>
<td>167</td>
<td>113.8 93</td>
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</tbody>
</table>

Order example: 1 set of one-piece stepped jaws FStB 200, Ident. No. 70021 / 533

### 5.13.3 Soft FMB Monoblock Jaws:

<table>
<thead>
<tr>
<th>Chuck type F+</th>
<th>max. swing diameter</th>
<th>FMB jaw type</th>
<th>Nominal dimensions</th>
<th>FMB Nominal dimensions</th>
<th>Ident. No.</th>
<th>Center of gravity</th>
<th>Weight kg/jaw</th>
</tr>
</thead>
<tbody>
<tr>
<td>160</td>
<td>220</td>
<td>FMB 160</td>
<td>79</td>
<td>20</td>
<td>24</td>
<td>F160</td>
<td>70016734</td>
</tr>
<tr>
<td>200</td>
<td>264</td>
<td>FMB 200</td>
<td>94</td>
<td>22</td>
<td>35</td>
<td>F200</td>
<td>70021734</td>
</tr>
<tr>
<td>250</td>
<td>395</td>
<td>FMB 250</td>
<td>115</td>
<td>26</td>
<td>40</td>
<td>F250</td>
<td>70026034</td>
</tr>
<tr>
<td>315</td>
<td>390</td>
<td>FMB 315</td>
<td>130</td>
<td>32</td>
<td>46</td>
<td>F315</td>
<td>70033034</td>
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<td>400</td>
<td>520</td>
<td>FMB 400</td>
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<td>F400</td>
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<td>500</td>
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<td>FMB 400</td>
<td>176</td>
<td>45</td>
<td>53</td>
<td>F400</td>
<td>70038034</td>
</tr>
</tbody>
</table>

Order example: 1 set of monoblock jaws FMB 200, Ident. No. 70021 / 734
### 5. Construction and Mode of Operation

#### 5.13.4 Jaw Unit FGB and FHB:

**Principal dimensions of jaw unit FGB and FHB**

<table>
<thead>
<tr>
<th>Chuck type</th>
<th>External chucking</th>
<th>Internal chucking</th>
<th>Distance to center of gravity (for calculation of centrifugal force)</th>
<th>Distance of center of gravity from gripping diameter</th>
<th>Weight of FGB/FHB bolts kg/unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>F+</td>
<td>DA 1</td>
<td>DA 2</td>
<td>DA 3</td>
<td>DA 4</td>
<td>DJ 1</td>
</tr>
<tr>
<td>160</td>
<td>225</td>
<td>5-52</td>
<td>46-96</td>
<td>86-136</td>
<td>112-162</td>
</tr>
<tr>
<td>200</td>
<td>270</td>
<td>7-76</td>
<td>39-110</td>
<td>93-164</td>
<td>121-192</td>
</tr>
<tr>
<td>250</td>
<td>335</td>
<td>7-92</td>
<td>87-172</td>
<td>167-252</td>
<td>89-172</td>
</tr>
<tr>
<td>315</td>
<td>400</td>
<td>13-126</td>
<td>96-211</td>
<td>212-321</td>
<td>89-200</td>
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<tr>
<td>400</td>
<td>525</td>
<td>17-175</td>
<td>136-293</td>
<td>258-416</td>
<td>122-278</td>
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<tr>
<td>500</td>
<td>608</td>
<td>48-259</td>
<td>169-378</td>
<td>291-500</td>
<td>154-362</td>
</tr>
<tr>
<td>630</td>
<td>823</td>
<td>25-323</td>
<td>191-495</td>
<td>357-655</td>
<td>190-486</td>
</tr>
</tbody>
</table>

**Base jaw type F+ 160 to F+ 630**

**Hard top jaw F+ 160 to F+ 200**

**Hard top jaw F+ 250 to F+ 630**

Order example: 1 set of base jaws FGB 200, Ident. No. 700211/504; 1 set of hard top jaws FHB 200, Ident. No. 700215/24
### 5. Construction and Mode of Operation

#### 5.13.5 Jaw Unit FGB and FWB:

**Jaw unit FGB and FWB**

**Principal dimensions of jaw unit FGB and FWB**

<table>
<thead>
<tr>
<th>Chuck type</th>
<th>max. swing diameter</th>
<th>Principal dimensions</th>
<th>Weight FGB, FWB, bolts kg/unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>F+</td>
<td></td>
<td>A1</td>
<td>A2</td>
</tr>
<tr>
<td>125</td>
<td>155</td>
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<td>160</td>
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<td>630</td>
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<td>158.0</td>
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</table>

Order example: 1 set of base jaws FGB 200, Ident. No. 70016/504; 1 set of soft top jaws FWB 200, Ident. No. 70016/525
5. Construction and mode of Operation

5.13.6 Roughing Jaws KBKTNC for External Chucking:

### Chucking Type KBKTNC

<table>
<thead>
<tr>
<th>DIA (mm)</th>
<th>Chucking range</th>
<th>Nominal dimensions</th>
<th>Individual part No.</th>
<th>Principal dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>47-77</td>
<td>195</td>
<td>45465</td>
<td></td>
<td></td>
</tr>
<tr>
<td>68-123</td>
<td>45463</td>
<td>F54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>102-185</td>
<td>45464</td>
<td>F4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>225</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>32-74</td>
<td>260</td>
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<td>13</td>
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<tr>
<td>64-105</td>
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<td></td>
<td></td>
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<tr>
<td>82-150</td>
<td>228</td>
<td>45470</td>
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<td>124-192</td>
<td>266</td>
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<td>45-95</td>
<td>260</td>
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<td>72</td>
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<td>95-168</td>
<td>398</td>
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<td>476</td>
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<tr>
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<td>70-160</td>
<td>615</td>
<td>45488</td>
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<td>115-352</td>
<td>615</td>
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<tr>
<td>236-474</td>
<td>615</td>
<td>45490</td>
<td></td>
<td></td>
</tr>
<tr>
<td>365-550</td>
<td>695</td>
<td>45491</td>
<td></td>
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<tr>
<td>500</td>
<td>70-160</td>
<td>615</td>
<td>45488</td>
<td>37</td>
</tr>
<tr>
<td>115-352</td>
<td>615</td>
<td>45489</td>
<td></td>
<td></td>
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<td>615</td>
<td>45490</td>
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<tr>
<td>365-550</td>
<td>695</td>
<td>45491</td>
<td></td>
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</tr>
</tbody>
</table>

Order example: 1 set of roughing jaws KBKTNC 72-36-40-F250, Ident. No. 45477

5.13.7 Roughing Jaws KBKTNC for Internal Chucking:

### Chucking Type KBKTNC

<table>
<thead>
<tr>
<th>DIA (mm)</th>
<th>Chucking range</th>
<th>Nominal dimensions</th>
<th>Individual part No.</th>
<th>Principal dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>47-77</td>
<td>195</td>
<td>45465</td>
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<tr>
<td>68-123</td>
<td>45463</td>
<td>F54</td>
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<tr>
<td>102-185</td>
<td>45464</td>
<td>F4</td>
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<td>225</td>
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<td></td>
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<tr>
<td>200</td>
<td>32-74</td>
<td>260</td>
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<td>64-105</td>
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<td>82-150</td>
<td>228</td>
<td>45470</td>
<td></td>
<td></td>
</tr>
<tr>
<td>124-192</td>
<td>266</td>
<td>45471</td>
<td></td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>45-95</td>
<td>260</td>
<td>45474</td>
<td>15</td>
</tr>
<tr>
<td>83-120</td>
<td>285</td>
<td>45475</td>
<td></td>
<td></td>
</tr>
<tr>
<td>107-150</td>
<td>328</td>
<td>45476</td>
<td></td>
<td></td>
</tr>
<tr>
<td>155-238</td>
<td>72</td>
<td>45477</td>
<td></td>
<td></td>
</tr>
<tr>
<td>315</td>
<td>50-130</td>
<td>360</td>
<td>45482</td>
<td>9.5</td>
</tr>
<tr>
<td>95-168</td>
<td>398</td>
<td>45483</td>
<td></td>
<td></td>
</tr>
<tr>
<td>167-274</td>
<td>78</td>
<td>45484</td>
<td></td>
<td></td>
</tr>
<tr>
<td>250-364</td>
<td>476</td>
<td>45485</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>72-160</td>
<td>512</td>
<td>45488</td>
<td>37</td>
</tr>
<tr>
<td>115-251</td>
<td>512</td>
<td>45489</td>
<td></td>
<td></td>
</tr>
<tr>
<td>236-372</td>
<td>512</td>
<td>45490</td>
<td></td>
<td></td>
</tr>
<tr>
<td>365-498</td>
<td>638</td>
<td>45491</td>
<td></td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>70-160</td>
<td>615</td>
<td>45488</td>
<td>37</td>
</tr>
<tr>
<td>115-352</td>
<td>615</td>
<td>45489</td>
<td></td>
<td></td>
</tr>
<tr>
<td>236-474</td>
<td>615</td>
<td>45490</td>
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<td></td>
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<td>365-550</td>
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<td></td>
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<td>500</td>
<td>70-160</td>
<td>615</td>
<td>45488</td>
<td>37</td>
</tr>
<tr>
<td>115-352</td>
<td>615</td>
<td>45489</td>
<td></td>
<td></td>
</tr>
<tr>
<td>236-474</td>
<td>615</td>
<td>45490</td>
<td></td>
<td></td>
</tr>
<tr>
<td>365-550</td>
<td>695</td>
<td>45491</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Order example: 1 set of roughing jaws KBKTNC 72-36-40-F250, Ident. No. 45477
### 5. Construction and Mode of Operation

#### 5.13.8 Chuck Handling Hooks:

Manual chucks, independent jaw chucks, and power chucks can be easily and safely fitted to and removed from lathes using the FORKARDT chuck hook. The chuck hook is equipped with a pivoting bush to which the manual chuck is firmly secured.

#### 5.13.9 Clamping Rings MFW:

The MFW clamping rings are used for turning out soft top jaws. Soft top jaws turned out to the workpiece diameter are a precondition for precision machining without damaging the workpiece surface. MFW clamping rings meet all the demands in practice.

Studs are positioned in radial slots which engage with the cylindrical journal in the bolt holes of the soft top jaws. The necessary precision can only be achieved if the jaws are turned out whilst the gripping force is being applied.

### Table: Chuck Handling Hooks

<table>
<thead>
<tr>
<th>Type</th>
<th>F 57</th>
<th>F 58</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual chucks, independent jaw</td>
<td></td>
<td></td>
</tr>
<tr>
<td>chucks and power chucks can be</td>
<td></td>
<td></td>
</tr>
<tr>
<td>easily and safely fitted to and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>removed from lathes using the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FORKARDT chuck hook. The chuck</td>
<td></td>
<td></td>
</tr>
<tr>
<td>hook is equipped with a pivoting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bush to which the manual chuck is</td>
<td></td>
<td></td>
</tr>
<tr>
<td>firmly secured.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table: Clamping Rings MFW

<table>
<thead>
<tr>
<th>Clamping ring for chucks</th>
<th>Clamping ring type (1 set)</th>
<th>Ident. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>F 125</td>
<td>MFW 125</td>
<td>70490</td>
</tr>
<tr>
<td>F 160</td>
<td>MFW 160</td>
<td>70491</td>
</tr>
<tr>
<td>F 200</td>
<td>MFW 200</td>
<td>70492</td>
</tr>
<tr>
<td>F 250</td>
<td>MFW 250</td>
<td>70493</td>
</tr>
<tr>
<td>F 315</td>
<td>MFW 315</td>
<td>70494</td>
</tr>
<tr>
<td>F 400</td>
<td>MFW 400</td>
<td>70495</td>
</tr>
<tr>
<td>F 500</td>
<td>MFW 500</td>
<td>70496</td>
</tr>
<tr>
<td>F 630</td>
<td>MFW 630</td>
<td>70497</td>
</tr>
</tbody>
</table>

Order example: 1 Clamping ring MFW 250, Ident. No. 70768.
5. Construction and Mode of Operation

5.13.10 Jaw Dressing Rings FADR:

A further proven aid for turning out top jaws are the FADR jaw dressing rings. They are supplied as a set, clearly arranged on a perforated plate. One set comprises 36 individual rings with diameters from 20 to 50mm in increments of 2mm and diameters from 50 to 150mm in increments of 5mm. Two studs facilitate the reliable insertion of the smaller rings. The jaw dressing rings are hardened and can be used for turning out all soft top jaws. Reworking of the rings is possible. See also publication 990.01.5D, Accessories for manual and power chucks.

![FADR jaw dressing rings](image)

5.13.11 Torque Amplifier DMV:

The strength of the operator for turning the chuck key is limited for actuating larger manual chucks: With normal lubrication of the manual chuck, around 160 nm for strong and 200 Nm for difficult tightening produce between 10 and 12 Mp gripping force.

On modern lathes surrounded by panellings, long-arm chuck keys can no longer be used. FORKARDT supplies torque amplifiers for such applications.

The torque amplifier is available in two sizes. The force amplification in each case is 4 : 1. The chuck is pretightened using a normal chuck key, then fully tightened using the torque amplifier. High workpiece gripping forces are thus achieved without excessive physical effort and with no danger to the operator’s health.

<table>
<thead>
<tr>
<th>Type</th>
<th>Ident. No.</th>
<th>for chuck size</th>
<th>Torque on output side</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMV 30</td>
<td>45170</td>
<td>F250 to F400</td>
<td>300 Nm</td>
<td>2.6 kg</td>
</tr>
<tr>
<td>Nut for:</td>
<td></td>
<td>F 250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW 14</td>
<td>46694/2</td>
<td>F 315</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW 16</td>
<td>46487/2</td>
<td>F 400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW 19</td>
<td>46738/2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DMV 50</td>
<td>44475</td>
<td>from F400</td>
<td>500 Nm</td>
<td>5.2 kg</td>
</tr>
<tr>
<td>Nut for:</td>
<td></td>
<td>F 400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW 19</td>
<td>43569/2</td>
<td>F 500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW 24</td>
<td>43866/2</td>
<td>F 630</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.13.12 Gripping Force Meter SKM:

Soiling and the washing out of the lubricant film during wet work cause chucks to lose a significant proportion of their efficiency and thus their gripping force. Furthermore, particular attention also has to be paid to the loss of gripping force resulting from the centrifugal forces on the jaws at high spindle speeds. For this reason, FORKARDT offers the gripping force meters SKM 1200 and SKM 1500 for measuring the static gripping force and FORSAVE - D for measuring the dynamic gripping force. The gripping force meters should be used regularly to check whether the available gripping force is still sufficient for the intended machining operation, or whether the chuck requires cleaning and lubricating. Gripping force meters SKM 1200 and SKM 1500, see publication 300224.10.01E. Gripping force meter FORSAVE - D, see publication
6.1 General:

The chuck transmits the spindle torque to the workpiece by means of the frictional grip of the top jaws pressed against the workpiece. The jaw force required to produce this frictional grip is called the gripping force.

The gripping force is affected, directly or indirectly, by various factors:

* The variation in the coefficient of friction between workpiece and top jaw.
* The ratio between gripping diameter and machining diameter.
* The magnitude of the cutting force applied by the tool.
* The distance of the top jaws from the machining point.
* The reduction in the gripping force due to the centrifugal force on the jaws in the case of external chucking.

Rotating workholding equipment is subject to the effect of centrifugal force which increases with the square of the spindle speed. The centrifugal force opposes the gripping force in the case of external chucking, whilst increasing it in the case of internal chucking.

The residual dynamic gripping force of the jaws for holding the workpiece at high spindle speeds depends on the static gripping force, the mass of the top jaws and the radius of their center of gravity.

6.2 Gripping Force:

The max. static gripping force $F_{sp\text{ max}}$ ($= F_{spo}$) quoted in the table in section 1.4 is only achieved under favourable conditions. These are:

* A well maintained manual chuck.
* Optimum lubrication of all sliding surfaces.
* Application of maximum torque on the chuck key.
* Short overhang of the chuck jaws.
* Spindle stationary $n = 0$ (or low spindle speed).

The static gripping force is measured using a static gripping force meter, e.g. SKM 1200 / 1500, see publication 300224.10.01E. The figure given in the table for $F_{sp\text{ max}}$ (see Section 1.4, page 4) can be used for strength calculations, e.g. for the design of special jaws.

6.3 Dynamic Gripping Force $F_{sp}$:

The dynamic gripping force $F_{sp}$ is the total gripping force (in daN) supplied by all the jaws under dynamic conditions and represents the minimum value for the available gripping force under normal operating conditions.

Implied are:

A well maintained condition and
A adequate lubrication of all sliding surfaces
of the manual chuck.

In really good condition, the manual chuck will exceed the calculated value for $F_{sp}$.

The static gripping force is a function of the manual chuck design data, but is not the sole determining factor for the gripping force under dynamic conditions. The top jaws have a significant influence on the performance of a manual chuck. The choice of the top jaws to be used for a particular application depends on the conditions of the specific application. The top jaws influence the gripping force and thus also the spindle speed.

The rated spindle speed (in accordance with standard DIN 6386) for manual chuck Type $F+$ is the spindle speed at which the calculated centrifugal force generated by the heaviest design of jaws belonging to the chuck equals 2/3 of the static gripping force produced by application of the maximum actuating force.
6. Gripping Force

For the Type F+ manual chuck, the rated spindle speed is based on the use of FMB soft monoblock jaws which are flush with the outside diameter of the chuck, see Figure F 64. At the rated spindle speed therefore, 1/3 of the static gripping force is still available for gripping the workpiece.

The centrifugal force generated by the chuck jaws (base jaws and top jaws) during rotation of the manual chuck does not, however, result in a loss of gripping force of the same magnitude. For solid workpieces (i.e. workpieces without bore), the loss of gripping force amounts to approx. 67% of the centrifugal force.

The following formulae apply to the calculation of the gripping force and the actual loss of gripping force DFsp for the manual chuck Type F+:

\[
F_{sp} = F_{spo} \pm DFsp
\]

The available static gripping force \( F_{spo} \) (at spindle speed \( n = 0 \)) is:

\[
F_{spo} = \frac{C_1}{C_2 + a} \times Md
\]

and the loss of gripping force \( DFsp \) at working speed \( n \) is:

\[
DFsp = \pm 0,0008 \times \left( \frac{Ra \times G \times i}{1000} \right) \times n^2
\]

The dynamic gripping force \( F_{sp} \) is then:

\[
F_{sp} = \frac{C_1}{C_2 + a} \times Md \pm 0,0008 \times \left( \frac{Ra \times G \times i}{1000} \right) \times n^2
\]

The total centrifugal moment of the jaws \( Ma \) is calculated as:

\[
Ma = \frac{\frac{3}{2} Dsp \times Y_{AB} \times G \times i}{1000}
\]

Symbols used in the formulae:

\( F_{sp} \) = Dynamic gripping force [daN], the total dynamic gripping force applied by all the jaws

\( C_1, C_2 \) = Chuck constants

\( Md \) = Torque applied with the chuck key [Nm]

\( n \) = Spindle speed [rpm]

\( Ma \) = Total centrifugal moment of the chuck jaws [kgm]

\( Dsp \) = Gripping diameter [mm]

\( Y_{AB} \) = Distance of center of gravity of jaw from gripping diameter [mm]

\( a \) = Jaw overhang [mm]

\( i \) = Number of top jaws

\( G \) = Mass of each top jaw [kg]

\( Ra \) = Distance of center of gravity of jaw from center of chuck [mm]
6. Gripping Force

For each application it is necessary to check that the available dynamic gripping force is adequate. In the case of chuck jaws made from soft FMB monoblock jaws or other special jaws, the actual centrifugal moment must be determined by weighing and by measuring the distance of the center of gravity from the center of the chuck \( \text{Ra} \).

See Figure F 38 →

**When working with high spindle speeds, soft monoblock jaws (FWB or FMB) must be weight-optimised as far as possible** whilst maintaining a short jaw overhang.

Determine the weight and center of gravity of the finished jaws and check whether the remaining dynamic gripping force of the manual chuck is adequate for the machining work to be carried out. See formula 4 on page 30.

*If the calculated dynamic gripping force \( F_{sp} \) proves to be inadequate for the machining work, the spindle speed must be reduced (see formula 8 on page 34) or the weight of the chuck jaws must be reduced (see formula 7 on page 34).*

The permissible spindle speed for the manual chuck with the corresponding jaws or the curve of the dynamic gripping force over spindle speed must be calculated for each application.

6.3.1 Safety Instructions:

* Check that the gripping force of the chuck is adequate for the machining operation under the chosen operating conditions.

* The calculated gripping forces are only achieved with the chuck in a well-maintained condition (the gripping force may be even higher than the calculated value in the case of a freshly lubricated chuck).

* Use light top jaws at high spindle speeds.

* During rotation of the manual chuck, use a dynamic gripping force meter, e.g. FORSAVE D, to measure the dynamic gripping force.

* Determine the loss of gripping force under dynamic conditions at every changeover to ensure that the gripping force is adequate for the intended machining operation.

* If the gripping force measured with the dynamic gripping force meter falls below the specified value, the manual chuck must be lubricated. See also Section 9.2.

* In accordance with the regulations of the factory inspectorate, operation of machinery at high spindle speeds may only be carried out under adequately dimensioned safety guards! The guards must be closed and locked as long as the machine is running!
6.4 Specimen Calculations:

Example 1:

Manual chuck type: 250
Max. torque \( M_{\text{dmax}} \): 190 Nm
Jaws: KBKTNC 72-26-40
Gripping diameter \( D_{\text{sp}} \): 220 mm
Spindle speed \( n \): 3500 min\(^{-1}\)
Chuck constant \( C_1 \): 31100
Chuck constant \( C_2 \): 390
Jaw overhang \( a \): 37 mm
Number of jaws \( i \): 3

How high is the static gripping force \((n = 0)\) and the dynamic gripping force \((n = 3500 \text{ rpm})\) to hold the workpiece?

\[ D_{\text{sp}} = 220 \text{ mm} \]
\[ Y_{\text{AB}} = +3 \text{ mm} \]
Jaw weight \( G = 1.06 \text{ kg/jaw} \)

**Radius of the center of gravity \( R_a \):**

\[ R_a = \frac{D_{\text{sp}}}{2} + Y_{\text{AB}} = \frac{220}{2} + 3 = 113 \text{ mm} \]

**Total centrifugal moment \( M_a \):**

\[ M_a = R_a \times G \times i \times \frac{1000}{1000} = 113 \times 1.06 \times 3 = 0.36 \text{ kgm} \]

**Static gripping force \((n = 0)\):**

\[ F_{\text{spo}} = \frac{C_1}{C_2 + a} \times M_d \]

\[ \frac{31100}{390 + 56.5} \times 190 = 13234 \text{ daN} \]

**Dynamic gripping force \((n = 3500 \text{ rpm})\):**

\[ F_{\text{sp}} = F_{\text{spo}} - 0.0008 \times M_a \times n^2 \]
\[ F_{\text{sp}} = 14518 - 0.0008 \times 0.36 \times 3500^2 \]
\[ F_{\text{sp}} = 14518 - 3552 = 10966 \text{ daN} \]
Example 2:

Manual chuck type: F 250
Max. torque $Md_{max}$: 190 Nm
Jaws: Jaw unit
Gripping diameter: $D_{sp}$ = 220 mm
Spindle speed: $n$ = 3800 rpm
Chuck constant: $C_1$ = 31100
Chuck constant: $C_2$ = 390
Jaw overhang: $a$ = 56.5 mm
Number of jaws: $i$ = 3

How high is the static gripping force ($n = 0$) and the dynamic gripping force ($n = 3800$ rpm) to hold the workpiece?

From the table on page 24 (Section 5.13.4)
$D_{sp}$ = 220mm, gripping stage A4 (167 to 252mm)
Jaw weight $G$ = 1.40 kg / unit

Radius of the center of gravity $Ra$:

$$Ra = \frac{D_{sp}}{2} - Y_{AB} = \frac{220}{2} - 9.07 = 100.93 \text{mm}$$

Total centrifugal moment $Ma$:

$$Ma = \frac{Ra \times G \times i}{1000} = \frac{100.93 \times 1.4 \times 3}{1000} = 0.424 \text{ kgm}$$

Static gripping force ($n = 0$):

$$F_{spo} = \frac{C_1}{C_2 + a} \times Md = \frac{31100}{390 + 56.5} \times 190 = 13234 \text{ daN}$$

Dynamic gripping force ($n = 3800$ rpm):

$$Fsp = F_{spo} - 0.0008 \times Ma \times n^2$$
$$Fsp = 13234 - 0.0008 \times 0.424 \times 3800^2$$
$$Fsp = 13234 - 4909$$
$$Fsp = 8325 \text{ daN}$$
Example 3:

Manual chuck type: F+ 250
Max. torque Mdmax: 190 Nm
Max. required gripping force Fspz at working speed: 6500 daN
Jaws: Base jaw FGB 250 and special top jaw

Gripping diameter Dsp: 220 mm
Spindle speed n: 3800 rpm
Chuck constant C1: 31100
Chuck constant C2: 390
Jaw overhang a: 65 mm
Number of jaws i: 3

Weight of base jaw G1 = 0.74 kg / jaw, distance of center of gravity from chuck center Rs1: 104.5 mm.
Weight of special top jaw G3 = 1.9 kg / jaw, distance of center of gravity from chuck center Rs2: 122 mm.

Radius of the center of gravity Rs:

$$Rs = \frac{G1 \times Rs1 + G2 \times Rs2}{G1 + G2} = \frac{0.74 \times 104.5 + 1.9 \times 122}{0.74 + 1.9} = 117.1 \text{ mm}$$

Total centrifugal moment Ma:

$$Ma = \frac{Rs \times G 	imes i}{1000} = \frac{117.1 \times 2.64 \times 3}{1000} = 0.927 \text{ kgm}$$

Static gripping force (n = 0):

$$F_{spo} = \frac{C1}{C2 + a} \times Md$$

$$31100 \times 190 = 12986 \text{ daN}$$

Dynamic gripping force (n = 3800 rpm):

$$Fsp = F_{spo} - 0.0008 \times Ma \times n^2$$

$$Fsp = 12986 - 0.0008 \times 0.927 \times 3800^2$$

$$Fsp = 12986 - 10830 = 2156 \text{ daN}$$

Calculation of permissible values:

$$Mazul = \frac{(C1 \times Md) - Fspz}{0.0008 \times n^2}$$

$$Mazul = \frac{(31100 \times 190) - 6500}{0.0008 \times 3800^2} = 0.561 \text{ kgm}$$

Since the centrifugal moment Maperm. of the special top jaws is exceeded, the permissible spindle speed must be reduced according to the following formula:

$$n_{zul} = \sqrt{\frac{(C1 \times Md) - Fspz}{0.0008 \times Ma}}$$

$$n_{zul} = \sqrt{\frac{(31100 \times 190) - 6500}{0.0008 \times 0.927}} = 2957 \text{ min}^{-1}$$

The spindle speed must be reduced to 2957 rpm in order to ensure an adequate dynamic gripping force for the machining operation.
6. Gripping Force

6.5 Determination of the Gripping Force Fspz Required for a Specific Application:

The gripping force required for each application has to be determined. If this gripping force cannot be provided by the chuck with the factors of safety given by the guidelines of the German Association of Engineers VDI 3106, then the permissible spindle speed or the permissible chip cross-section has to be determined.

Here is an example:

A solid steel workpiece (i.e. without bore) has to be machined. The gripping diameter dsp=60mm, the turning diameter dz =60mm and the cut requires a tangential cutting force Fs=1200daN at a spindle speed of 2760rpm.

Soft jaws turned to the gripping diameter are used to avoid damaging the workpiece. This gives a gripping coefficient of µsp=0,1.

A safety factor Sz is allowed for the cutting data. The reduction in gripping force Fsp amounts to 2000 daN.

For this example therefore: when taking into account the reduction in gripping force Fsp, the minimum static gripping force required is:

\[ F_{spz} = F_{spz} + F_{sp} = 2000 + 2000 = 4000 \text{ daN}. \]

The “feed thrust Fv” and the “passive force Fp” components do not enter into this formula. They are taken into account in the safety factor Sz. The main variable affecting the gripping force is the tangential cutting force Fs, which can be determined from the chip cross-section and the specific cutting force:

\[ F_s = a \times s \times k_s \]

The gripping force necessary for the machining operation is given by:

\[ F_{spz} = \frac{F_s \times dz}{\mu_{sp} \times dsp} = \frac{a \times s \times k_s \times dz}{\mu_{sp} \times dsp} \quad 1) \]

Where:

- \( \text{la} \) = Overhang of workpiece
- \( \text{a} \) = Depth of cut
- \( \text{s} \) = Feed
- \( \text{Ks} \) = Specific cutting force
- \( \text{dz} \) = Machining diameter
- \( \text{ dsp} \) = Gripping diameter
- \( \mu_{sp} \) = Gripping coefficient
- \( F_s \) = Tangential cutting force (i.e. primary cutting force)

The cutting forces increase as the cutting tool becomes dull. An additional factor of safety Sz=2 is recommended to allow for all uncertainties in the machining process.
The gripping force must be increased to allow for the tilting effect caused by the overhang la.

The tilting force need not be taken into account if the workpiece is supported by a tailstock or if the workpiece does not project beyond the jaws by more than 0.5 \times dsp.

The gripping force required can be found approximately from the formula:

\[
F_{spz} = S_z \times \frac{a \times s \times K_s \times dz}{\mu_{sp} \times dsp} \times (1 + 1.5 \times \frac{la}{dsp})
\]

This equation cannot be applied to stepped workpieces whose gripping diameter is appreciably smaller than the machining diameter.

1) The "feed thrust Fv" and "passive thrust Fp" components are not entered into this formula. They are taken into account with the safety factor, Sz.

The permissible overhang length with given gripping force:

\[
L = 0.25 \times (Dsp \times \frac{Fsp \times \mu_{sp}}{P} - da)
\]

Where:
- \( X = 0.75 \times Dsp \)
- \( Fsp = \) Total gripping force = S jaw forces

Simple safety against the workpiece flying out of the chuck from the cutting force component P is ensured when the friction force \( \mu_{sp} \times Fsp / 3 \) and P are in equilibrium.
6.7 Gripping Force Curve with Hard FHB Top Jaw:

Hard top jaw FHB 160 on F+ 160 as a function of the spindle speed and static gripping force Fspo at max. gripping diameter, gripping stage A4, total centrifugal moment from base jaws and top jaws is 0.105 kgm.

Hard top jaw FHB 200 on F+ 200 as a function of the spindle speed and static gripping force Fspo at max. gripping diameter, gripping stage A4, total centrifugal moment from base jaws and top jaws is 0.192 kgm.

Hard top jaw FHB 250 on F+ 250 as a function of the spindle speed and static gripping force Fspo at max. gripping diameter, gripping stage A4, total centrifugal moment from base jaws and top jaws is 0.491 kgm.

Hard top jaw FHB 315 on F+ 315 as a function of the spindle speed and static gripping force Fspo at max. gripping diameter, gripping stage A4, total centrifugal moment from base jaws and top jaws is 0.883 kgm.

Hard top jaw FHB 400 on F+ 400 as a function of the spindle speed and static gripping force Fspo at max. gripping diameter, gripping stage A4, total centrifugal moment from base jaws and top jaws is 2.579 kgm.

Hard top jaw FHB 500 on F+ 500 as a function of the spindle speed and static gripping force Fspo at max. gripping diameter, gripping stage A4, total centrifugal moment from base jaws and top jaws is 4.882 kgm.
6. Gripping Force

Hard top jaw FHB 630 on F+ 630 as a function of the spindle speed and static gripping force $F_{spo}$ at max. gripping diameter, gripping stage A4, total centrifugal moment from base jaws and top jaws is 10,850 kgm.

Hard top jaw FHB 315 on F+ 315 as a function of the spindle speed and static gripping force $F_{spo}$ at max. gripping diameter, gripping stage A4, total centrifugal moment from base jaws and top jaws is 0.883 kgm.

Example:
The gripping diameter $D_{sp} = 321$mm, the static gripping force $F_{spo} = 120$ kN, spindle speed $n = 1800$ rpm. What is the dynamic gripping force and the gripping force loss at spindle speed $n = 1800$ rpm?
The dynamic gripping force is 9615 daN, the gripping force loss is 2385 daN.

6.8 Gripping Force Curve with Hard FStB Stepped Jaws:

Hard stepped jaw FStB 125 on F+ 125 as a function of the spindle speed and static gripping force $F_{spo}$ at max. gripping diameter, gripping stage A4, total centrifugal moment of all three stepped jaws is 0.018 kgm.

Hard stepped jaw FStB 160 on F+ 160 as a function of the spindle speed and static gripping force $F_{spo}$ at max. gripping diameter, gripping stage A4, total centrifugal moment of all three stepped jaws is 0.078 kgm.
Hard stepped jaw FStB 200 on F+ 200 as a function of the spindle speed and static gripping force Fspo at max. gripping diameter, gripping stage A4, total centrifugal moment of all three stepped jaws is 0.176 kgm.

Hard stepped jaw FStB 250 on F+ 250 as a function of the spindle speed and static gripping force Fspo at max. gripping diameter, gripping stage A4, total centrifugal moment of all three stepped jaws is 0.370 kgm.

Hard stepped jaw FStB 315 on F+ 315 as a function of the spindle speed and static gripping force Fspo at max. gripping diameter, gripping stage A4, total centrifugal moment of all three stepped jaws is 0.733 kgm.

Hard stepped jaw FStB 400 on F+ 400 as a function of the spindle speed and static gripping force Fspo at max. gripping diameter, gripping stage A4, total centrifugal moment of all three stepped jaws is 1.994 kgm.
Hard stepped jaw FStB 500 on F+ 500 as a function of the spindle speed and static gripping force Fspo at max. gripping diameter, gripping stage A4, total centrifugal moment of all three stepped jaws is 4,299 kgm.

Hard stepped jaw FStB 315 on F+ 315 as a function of the spindle speed and static gripping force Fspo at max. gripping diameter, gripping stage A4, total centrifugal moment of all three stepped jaws is 0,733 kgm.

Example:
The gripping diameter Dsp = 321mm, the static gripping force Fspo = 120 kN, spindle speed n = 2000rpm. What is the dynamic gripping force and the gripping force loss at spindle speed n = 2000rpm? The dynamic gripping force is 9540daN, the gripping force loss is 2460daN.

6.9 Gripping Force / Torque Curve:
7.1 Measures before Mounting of the Chuck:

7.1.1 Checking the Spindle Nose for Mounting of the Adapter Flange:

The mounting surfaces on the spindle nose have to be checked with a dial gauge to ensure that high accuracy in respect of radial run-out of the manual chuck is achieved after mounting.

* Radial run-out of register: \( \text{max. 0.005 mm.} \)
* Axial run-out of locating face: \( \text{max. 0.005 mm.} \)
* Check the flatness of the face using a straightedge.
* The surface of the face has to be clean and the holes in it must be deburred.

7.1.2 Checking of the Mounted Adapter Flange:

The manual chuck has a central register. An appropriate adapter flange (see also Section 5.13.1) must be attached to the spindle nose of the lathe for direct mounting of the manual chuck on the machine spindle with short taper to DIN, ISO and ASA standards.

* If the adapter flange is manufactured by the user, it must be finish-turned on the machine spindle and balanced before the manual chuck is mounted.
* Remove any dirt or chips from the machine spindle. Clean the centering collar and locating face of the adapter flange.

* After mounting of the adapter flange, the radial and axial run-out must be checked as described in Section 7.1.1.
* Check the flatness of the face with a straightedge.
* The through-bores for the studs must be countersunk so that the threads cannot be stripped.
* The mounting surfaecer for the manual chuck must not be concave or convex.
* The flange must be in contact over the whole surface!

---

**CAUTION!**

Do not allow the outer rim of the manual chuck to rest on the mounting flange!

Threaded bores must be drilled in the adapter flange for attachment of balancing weights which, depending on the size of the manual chuck to be mounted, should be between M8 and M16 with a thread depth of max. 2d.

The outer diameter of the mounting flange must be relieved so that it is approx. 1mm less than the register diameter for the manual chuck.

See Figure F 99 ➔
7.2 Mounting the Manual Chuck:

Remove any chips from the machine spindle before mounting the manual chuck. Clean the register and locating faces of the adapter flange!

If a mobile hoist which can be moved in all directions is available for mounting of the manual chuck, observe the following points: The working load of the hoist must be at least the weight of the manual chuck!

For weights of the manual chucks, see Section 1.4, page 4.

If using an eyebolt, screw the eyebolt into the threaded bores in the circumference of the chuck body. Attach the chuck to the hoist using a chuck hook and lift the chuck to the height of the spindle nose.

\[ \text{CAUTION} \]

Screw the eyebolt only into the threaded bores in the circumference of the manual chuck body!

See Figure F 100.

Due to their low weight, manual chucks Type \( F \) 125 to 250 have no threaded bores in the circumference of the chuck body. Attach these manual chucks to the hoist using a hoist rope (hemp or wire rope) and lift the chuck to the height of the spindle nose. The hoist rope must satisfy the technical conditions of supply in accordance with DIN 6890!

Mounting Procedure:

- Push the register of the manual chuck onto the centering collar of the adapter flange, ensuring that the mounting bolts are correctly aligned with the threaded bores in the adapter flange!

- Secure the manual chuck to the adapter flange by tightening the mounting bolts using a torque wrench. Before finally tightening the socket head screws in clockwise direction, align the chuck so that after mounting, the run-out at the test faces of the manual chuck does not exceed 0.01mm.
7. Mounting of Chuck

Observe the tightening torques of the chuck mounting bolts, see table!

<table>
<thead>
<tr>
<th>Bolts to DIN 912 Grade 10.9</th>
<th>Manufactured to DIN 267</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread</td>
<td>M 8</td>
</tr>
<tr>
<td>Tightening torque Nm</td>
<td>36</td>
</tr>
<tr>
<td>Max. bolt load N</td>
<td>24300</td>
</tr>
</tbody>
</table>

After mounting the manual chuck on the adapter flange, any remaining imbalance must be corrected by screwing corresponding threaded studs to DIN 914 into the chuck side of the adapter flange. The threaded bores in the body of the manual chuck must not be used for insertion of threaded studs as otherwise the precise dynamic balancing of the manual chuck will be lost.

Check the proper mounting using a dial gauge on the test faces of the manual chuck.

Radial run-out : max. 0,01 mm (guide value)

Axial run-out : max. 0,01 mm (guide value)

If the manual chuck binds without top jaws, the chuck body may be distorted.

In this case, remove the manual chuck from the machine spindle. Check the flatness of the chuck mounting flange and the diameter of the short taper register!

7.3 Balancing of Rotating Parts:

The high spindle speeds necessitate accurate balancing of the rotating parts. Any imbalance in the chuck body will cause free centrifugal forces when the spindle rotates; these centrifugal forces can then cause vibrations which have a negative effect on the product quality. Since the centrifugal forces per unit of weight increase with the square of the rotational speed, the demands on the balancing precision increase as the rotational speed increases. The lathe spindle, the manual chuck and the adapter or mounting flange must therefore be balanced. The manual chuck is dynamically balanced, whereby any imbalance can be corrected by screwing corresponding balancing weights into the chuck body to achieve the balance quality $Q = 2.5$ to VDI 2060. The chuck mounting flanges supplied by us are also balanced.

7.4 Checking the Radial and Axial Run - Out of Manual Chucks:

In accordance with the Technical Conditions of Supply for Manually Actuated Lathe Chucks to DIN 6386 Sheet 3 or DIN 6350, the radial and axial run-out must be checked with internally or externally stepped chuck jaws (FStB bzw. FGB und FHB).

In order to check the radial and axial run-out tolerances, mount the manual chuck on the spindle nose of a lathe or test device according to the instructions of the manufacturer. Pay particular attention to the backlash-free mounting in the register and the flush mounting of the manual chuck.

The test mandrels and test rings must be hardened and ground, whereby the deviations in form must not exceed 3µm and the peak-to-valley roughness must not exceed $Rt = 2µm$.

Grip the test mandrels and test rings in the manual chuck in the normal manner so that they contact the full gripping surface of the chuck jaws. They may only be actuated (for gripping) with the chuck key supplied.
7. Mounting of Chuck

To test the radial run-out, position the dial gauge so that it contacts test mandrels at a distance \( p \) or contact test rings immediately alongside the chuck jaws.

<table>
<thead>
<tr>
<th>Test mandrels</th>
<th>Test 2</th>
<th>Test rings</th>
<th>Axial run-out</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1</td>
<td>Test 2</td>
<td>Test 3</td>
<td>Test 4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chuck size</th>
<th>Test 1</th>
<th>Test rings</th>
<th>Radial run-out</th>
<th>Axial run-out</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>d1</td>
<td>d2</td>
<td>d3</td>
<td>e1</td>
</tr>
<tr>
<td>F+</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>125</td>
<td>18</td>
<td>25</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>160</td>
<td>18</td>
<td>30</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>200</td>
<td>30</td>
<td>40</td>
<td>53</td>
<td>80</td>
</tr>
<tr>
<td>250</td>
<td>30</td>
<td>53</td>
<td>75</td>
<td>80</td>
</tr>
<tr>
<td>315</td>
<td>53</td>
<td>75</td>
<td>100</td>
<td>120</td>
</tr>
<tr>
<td>400</td>
<td>53</td>
<td>100</td>
<td>125</td>
<td>120</td>
</tr>
<tr>
<td>500</td>
<td>75</td>
<td>100</td>
<td>125</td>
<td>160</td>
</tr>
<tr>
<td>630</td>
<td>75</td>
<td>125</td>
<td>160</td>
<td>160</td>
</tr>
</tbody>
</table>

7.5 Mounting the Top Jaws:

The top jaws are secured to the base jaws using corresponding socket head screws. The radial positioning is effected via the cross - tenons of base and top jaws.

Observe the following points:

During mounting of the top jaws on the base jaws, observe the markings 1, 2 or 3 on the base jaws or the corresponding guides in the chuck body!

Mount top jaw 1 on base jaw 1 of the manual chuck!

Tighten the jaw mounting bolts to the specified torque. Tightening torques, see Section 5.12, page 21!

Use only ORIGINAL FORKARDT jaw mounting bolts of the prescribed quality and grade!

To install the chuck jaws, back off the splines of the wedge blocks out of the area of the jaw guides by turning the chuck key in counterclockwise direction.

In this position, the indicator pin protrudes several millimetres out of the face of the chuck body.
7. Mounting of Chuck

Depress the jaw locks to move the chuck jaws in the guides of the chuck body. The correct positioning of the chuck jaws is indicated by the audible engagement of the spring-loaded latch in the splines on the rear of the chuck jaws.

Now turn the chuck key several rotations in clockwise direction until the indicator pin is retracted flush with the chuck body. In this position, the splines of the wedge blocks and chuck jaws are engaged and the chuck is ready to grip a workpiece.

7.6 Preparations for Use of the Chuck:

After the manual chuck has been mounted but before it is used, the following should be carried out in order to ensure trouble-free operation:

* Clear everything from the machine which does not belong to it, such as tools used for mounting the chuck.

* Grease the manual chuck at the grease nipple (on chucks Futter F+ 125 to 200 in the threaded plug, on chucks F+ 250 to 630 in the spindle square drive) with 3 strokes of the grease gun.

* Operate the chuck without gripping a workpiece in order to distribute the grease.

* Check all visible screws and bolts for tightness.

* Check the movement of the jaws.

7.7 Safety Instructions:

**Secure the drive of the lathe spindle to prevent starting when the indicator pin is protruding from the chuck body when the manual chuck is mounted!**

* Workpieces must not be chucked when the indicator pin is protruding out of the chuck body. There is then a danger that the splines of the wedge blocks and chuck jaws are not or not sufficiently engaged or that there is not sufficient reserve jaw stroke for safe and reliable holding of the workpiece.

* Never leave the manual chuck with the wedge blocks disengaged!

* Never force binding chuck jaws into the jaw guide using a hammer!

* Do not unscrew top jaws for precision chucking from the base jaws as otherwise the precision will be lost!

* **grind out subsequently supplied hard top jaws or stepped jaws under gripping pressure on the chuck on which they are to be subsequently used for machining!**

**Actuate the manual chuck with the chuck key only when the chuck is mounted on the spindle.**

**Remove the chuck key from the square drive of the threaded spindle immediately after completing the chucking procedure. For safety reasons, it must never be left in the chuck!**

**Check the radial and axial run-out only with the manual chuck mounted correctly. Do not mount the manual chuck on a mandrel between the centres for testing!**

* Check that all guards and interlocks are in a fully functional condition!
8.1 Instructions:

The initial period of use has a marked effect on the satisfactory performance of the manual chuck. Check the proper mounting of the manual chuck at this stage.

* Mount the top jaws (with cross-tenons) on the chuck and then connect to the base jaws with the jaw mounting bolts. Tighten the jaw mounting bolts to the torque specified in the table on page 21.

When mounting the base jaws, observe the marks 1, 2, 3 on the chuck body (guides) and on the base jaws!

CAUTION!

Fit base jaw 1 in the corresponding guide 1, etc. of the manual chuck!

CAUTION!

Do not overload the manual chuck! The torque applied to generate the gripping force must be matched to the maximum permissible torque of the manual chuck used and must not be exceeded!

CAUTION!

During gripping with the chuck key, do not use an extension tube as otherwise an excessively high load can be placed on the internal parts of the chuck!

* Binding of the manual chuck may be the result of strained base jaws or top jaws. Remove the top jaws and base jaws from the chuck body.

* If the manual chuck binds without top jaws, the chuck body may be distorted. In this case, remove the manual chuck from the machine spindle. Check the flatness of the chuck mounting flange and the diameter of the short taper register!

* Check the jaw travel! Jaw travel, see Section 5.4, page 13.

* Measure the static gripping force Fspmax of the chuck using a static gripping force meter, e.g. SKM 1200 / 1500 and compare with the value specified in the table, Section 1.4, page 4.

8.2 Operation:

Insert and grip the workpiece in the manual chuck. Start the machine and wait for the machine program to enable the spindle rotation.

Do not start the machine spindle until the workpiece has been gripped within the permissible working range of the manual chuck and the indicator pin is flush with the chuck body!

Machine workpieces at high spindle speeds only under the protection of an adequately dimensioned safety guard!

Make sure to fit safety guards and other protective devices!

* The safety guard must be locked as long as the machine spindle is running and should only be opened when the spindle has come to an absolute standstill!

* Operation of the manual chuck must always conform to the local safety and accident prevention regulations!

* Pay attention to abnormal running noises!

* Inspect material specimens!
* The precision of the manual chuck is illustrated during repeated chucking of a workpiece and by its running precision when the workpiece was machined in several consecutive chuckings. If the center of the gripping cross-section deviates from the lathe centerline beyond the specified tolerance, this will result in faulty workpieces and consequently to scrap!

8.3 Unauthorised Use:

**CAUTION!** Any system imbalance observed in the manual chuck must be eliminated immediately!

8.4 Safety Instructions:

* During rotation of the manual chuck, use a dynamic gripping force meter, e.g. FORSAVE D, to measure the dynamic gripping force. See also Section 6.3.
* Determine the loss of gripping force under dynamic conditions at every changeover to ensure that the gripping force is adequate for the intended machining operation. See also Section 6.2.
* If a drop in gripping force is observed, the cutting operation must be stopped immediately and the lathe spindle switched off!
* In order to maintain the gripping force over long production runs, operate the chuck periodically under no-load (without a workpiece). A uniform gripping force of the chuck is assured only if the lubrication films are maintained and the grease is distributed to the loaded parts.
* Release the workpiece from the chuck only after stopping the machine spindle!
* Do not leave the workpiece in the chuck overnight. Remove the workpiece from the chuck!

8.5 Procedure in the Event of Malfunctions:

**CAUTION!** Irrespective of the instructions given below, the manual chuck must always be operated in accordance with the local safety and accident prevention regulations!

We recommend that a lockable switch be fitted which prevents an inadvertent starting of the machine spindle during repairs or in the event of a malfunction.

The table below describes the symptoms, causes and remedial actions to be taken in the event of any malfunctions in the manual chuck. For various reasons (level of knowledge of the operating personnel, etc.), no guarantee can be given for the completeness of the table.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Cause</th>
<th>Remedial action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe vibration of the machine</td>
<td>Imbalance of the mounting flange and possibly the chuck due to incorrect mounting</td>
<td>Check run-out on the reference surfaces of the manual chuck</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Correct system imbalance on the manual chuck immediately</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Possibly rebalance mounting flange</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Readjust spindle bearings</td>
</tr>
<tr>
<td>Insufficient gripping force</td>
<td>Soiling</td>
<td>Clean the manual chuck</td>
</tr>
<tr>
<td></td>
<td>Inadequate lubrication</td>
<td>Check lubrication; if insufficient, dismantle, clean and lubricate the manual chuck.</td>
</tr>
<tr>
<td>Jaw stroke is not achieved</td>
<td>Soiling in the wedge block grooves</td>
<td>Clean the manual chuck</td>
</tr>
</tbody>
</table>
### 8.6 Restarting after a Malfunction:

See Section 8.1 and 8.2.

### 8.7 Before Prolonged Disuse:

* Remove the workpiece from the chuck!

* Clean and grease the chuck!

> **Do not clean the manual chuck with compressed air, because chips and coolant may get into the eyes!**
> **Accident hazard!**

* Coat bright metal parts with a corrosion inhibitor. Observe the safety instructions of the corrosion inhibitor manufacturer!

### 8.8 After Prolonged Disuse:

* Clean corrosion inhibitor from the chuck parts.

* Lubricate the manual chuck. Remove any excess grease which emerges!

* Carry out a no-load operating cycle of the chuck (without workpiece) to distribute the lubricating grease!

* At standstill of the machine spindle, check the static gripping force $F_{spmax}$ with a static gripping force meter, e.g. SKM 1200 / 1500!

* Load the workpiece.

Otherwise proceed as described in Section 7.6 and Section 8.2!
9. Maintenance, Servicing

9.1 Instructions:

Observe the "Safety Instructions" in Section 2 when carrying out checks, maintenance and / or service work on the manual chuck.

* Malfunctions resulting from inadequate or improper maintenance, reconditioning or servicing can be very costly and give rise to long downtimes.

* Careful lubrication is essential for trouble-free operation of the manual chuck.

* The operational reliability and a long service life of the power chuck depend i.a. on proper servicing and maintenance.

* As operating conditions vary, it is not possible to specify in advance how often servicing, inspection for wear or reconditioning are necessary. This must be determined on the basis of the loading conditions and degree of contamination encountered.

<table>
<thead>
<tr>
<th>Hours of Operation / Frequency</th>
<th>Type of Check / Servicing Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>After 24 hours of operation; when new or after reconditioning</td>
<td>Lubrication of the manual chuck</td>
</tr>
<tr>
<td></td>
<td>Check tightness of screws and bolts</td>
</tr>
<tr>
<td>Weekly</td>
<td>Lubrication of the base jaws and threaded spindle</td>
</tr>
<tr>
<td>Weekly</td>
<td>Check the static gripping force Fspmax using a gripping force meter, e.g. SKM 1200 / 1500</td>
</tr>
<tr>
<td>Monthly</td>
<td>Check the base jaws, wedge blocks and splines for wear</td>
</tr>
</tbody>
</table>

9.2 Maintenance, Servicing:

Always stop the machine spindle and secure the lathe against inadvertent starting (with a lockable local switch) before starting maintenance, inspection or other work!

Put up a WARNING signs!

Check the service condition using a static gripping force meter, e.g. SKM 1200 / 1500!

* If the static gripping force Fspmax of the manual chuck specified in Section 1.4, page 4 is no longer achieved even with good lubrication, the chuck must be removed from the machine spindle and then dismantled, cleaned and greased again!

Disengage the splines of the wedge blocks and chuck jaws by turning the chuck key. Depress the spring-loaded latch and remove the chuck jaws from the chuck body.

Screw an eyebolt into the threaded bore in the circumference of the manual chuck. Attach the chuck to the hoist using a chuck hook.
9.3 Dismounting of the Manual Chuck:

Loosen chuck mounting bolts (36) and pull the manual chuck from the centering collar of the adapter flange. Place the manual chuck on a pallet or workbench.

Actuate threaded spindle (10) with the chuck key until indicator pin (15) is flush with the chuck body. Wedge block (5) moves towards the thrust ring (13).

Loosen socket head screws (38) and supporting screws (14, on manual chucks above size F+ 250) and remove cover (2) from the chuck body.

Manual chucks F+ 125 to 200: remove detent pin (14) and unscrew threaded plug (12) with thrust plate (11) from the chuck body. Manual chucks F+ 250 to 630: Screw supporting screw (14) into supporting wedge (12) and remove from the chuck body. Thrust stud (11) moves to the left of the bore of the supporting wedge.

Remove thrust ring (3) from the chuck body. Pull the slide blocks (9) which are vow revealed from the journals of wedge blocks (5, 6) and carefully remove the two wedge blocks (6) without thread from the wedge block guides. Move wedge block (5) to the right with threaded spindle (10) and remove at an angle from the wedge block guide complete with the thrust ring.
Remove indicator pin (15) complete with pressure spring (18) from the chuck body.

* Wash and clean all parts and check for damage. Replace any damaged parts. Grease base jaws, wedge blocks, chuck body (at the guides for the base jaws) with lubricating grease, e.g. PF 5 or PF 6!

* Install the individual parts in the chuck body again in reverse order. Observe the following points:

* When installing the indicator pin (15) with pressure spring (18), insert the pin into the chuck body so that it protrudes from the face and can be secured with a strip of adhesive tape.

Place the two wedge blocks (6) without thread into the middle of the wedge block guides and place slide blocks (9) on the journals of wedge blocks (5, 6). **Insert wedge blocks (5) with threaded spindle (10) and thrust ring (13) into the wedge block guide and bore to take the thrust ring at an angle. Place slide block (9) onto the journal of the slide block and position in the middle.**

**Manual chucks F+ 125 to 200:** Screw threaded plug (12) with thrust plate (11) into the chuck body until the bore for the detent pin (14) is visible in the threaded plug. Install detent pin (14).

**Manual chucks F+ 250 to 630:** Screw supporting screw (14) into supporting wedge (12) and insert into the chuck body. Thrust stud (11) moves to the right towards the threaded spindle.

Screw supporting screw (14) with toothed lock washer (41) into supporting wedge (12) from the face side of the chuck. Insert thrust ring (3), ensuring that the slide blocks engage in the grooves and the tip of the indicator pin engages in the recess of the thrust ring. Remove the adhesive tape from the indicator pin.

During installation of cover (2), pay attention to the exact position of the bore in relation to detent pin (14) or supporting screw (14).

Screw lower detent pin (14) with toothed lock washer (41) into supporting wedge (12) and tighten in such a way that the threaded spindle can be adjusted backlash-free. Screw the upper retaining screw into the supporting wedge and tighten.

Tighten all mounting bolts to the prescribed torque.

**CAUTION!** **Observe the numbering when installing the chuck jaws! Chuck jaw 1 in guide 1 of the chuck body, etc.**
9. Maintenance, Servicing

* Mount the manual chuck on the machine spindle as described in Sections 7.1 and 7.2!
* Tighten the mounting bolts to the torque given in Section 1.7, page 5 using a torque wrench.
* Put the chuck into operation as described in Section 7.6 and Section 8.2!

9.4 Safety Instructions:

* The high spindle speeds customary on modern lathes subject the manual chuck to high loads. When tools collide with the manual chuck, e.g. due to faults in the machine program, the chuck can be damaged.
* After a collision, stop the machine spindle immediately and inspect the manual chuck for damage.
* Remove the chuck from the spindle and do not continue to work with the chuck!
* In addition to visible damage (e.g. to the top jaws and mounting bolts), damage may occur which is not immediately apparent, such as hairline cracks in the chuck body and in the base jaws.
* In such cases, the affected parts of the chuck must be checked for cracks using a suitable non-destructive testing method in order to rule out any danger. Replace all damaged parts!
  
  Suitable test methods are:
  – Dye penetrant test
  – Magnaflux test

* Replace any damaged top jaw mounting bolts only with bolts of the same quality and dimensions, see the table below

<table>
<thead>
<tr>
<th>Threads</th>
<th>M6</th>
<th>M8 x 1</th>
<th>M12 x 1,5</th>
<th>M16 x 1,5</th>
<th>M20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torque</td>
<td>8,3</td>
<td>22</td>
<td>72</td>
<td>180</td>
<td>340</td>
</tr>
<tr>
<td>Bolt load</td>
<td>9750</td>
<td>19600</td>
<td>44000</td>
<td>85500</td>
<td>126000</td>
</tr>
</tbody>
</table>

The jaw mounting bolts must be tightened with the torque value indicated in the tabulation!

9.5 Lubrication:

Foreign matter penetrates into practically every manual chuck during machining. Scale and foundry dust increase the friction between the moving parts and coolant washes away the lubricants. Dirt and fine chips can easily penetrate the chuck when the chuck jaws are wide open and the inner parts of the jaw guides is exposed.

In order to avoid this, profile plugs are inserted into the clean jaw guides with the heat-resistant cover plate facing towards the bore before machining of the workpiece. These plugs only delay the penetration of foreign matter and the chuck must nevertheless be cleaned and lubricated at regular intervals to achieve consistent gripping forces, accuracy and long life.
9. Maintenance, Servicing

**CAUTION!** Careful lubrication is essential for trouble-free operation of the manual chuck.

Lubrication and all work necessary for the lubrication may only be carried out with the machine spindle at standstill!

**CAUTION!** Soiled or poorly lubricated manual chucks suffer an appreciable loss of gripping force!

The manual chuck must be relubricated when the static gripping force $F_{spo}$ of the chuck specified in the table in Section 1.4!

**CAUTION!** Check the static gripping force at regular intervals using a static gripping force meter, e.g. SKM 1200 / 1500!

* Lubricate the manual chuck. 3 strokes of the grease gun are sufficient! For details of the grease gun, see publication 990.01.5D.

* We recommend the following lubricants:
  - PF 5 for all other parts of the manual chuck
  - PF 6 for the wedge blocks, base jaws and the jaw guide.

* Store lubricants only in clean, closed containers under dry and cool conditions!

9.6 Reconditioning:

9.6.1 Instructions:

For the first repair we recommend that you call upon the manufacturer's personnel. Your maintenance personnel then has an opportunity to receive intensive training.

Spare parts should be ordered in accordance with the spare parts lists in Section 10.2 on page 56.

* The lathe must be stopped and prevented from inadvertent starting before any maintenance or reconditioning work is carried out on the manual chuck.

* Remove the chuck jaws from the jaw guides.
  See also description in Section 5.5.1!

* Put up a WARNING sign!

* Only maintenance work coming within the scope of servicing or entailing the replacement of parts subject to wear is described here.
If, for particular reasons, you carry out the replacement of parts yourself, you should keep in stock spare and wear parts supplied by the manufacturer.

If screws or bolts are rendered unserviceable during dismantling, they have to be replaced by screws and bolts of the same grade and design! See tables below.

a) Tightening torques for the chuck mounting bolts:

<table>
<thead>
<tr>
<th>Bolts to DIN 912</th>
<th>Grade 10.9</th>
<th>Manufactured to DIN 267</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread</td>
<td>M 8</td>
<td>M 10</td>
</tr>
<tr>
<td>Tightening torque</td>
<td>Nm</td>
<td>36</td>
</tr>
<tr>
<td>Max. bolt load</td>
<td>N</td>
<td>24300</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bolts to DIN 7984</th>
<th>Grade 10.9</th>
<th>Manufactured to DIN 267</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread</td>
<td>M 4</td>
<td>M 5</td>
</tr>
<tr>
<td>Tightening torque</td>
<td>Nm</td>
<td>2.8</td>
</tr>
<tr>
<td>Max. bolt load</td>
<td>N</td>
<td>4000</td>
</tr>
</tbody>
</table>

The chuck mounting bolts must be tightened with the torque values indicated in the tabulation!

b) Tightening torques for the jaw mounting bolts:

<table>
<thead>
<tr>
<th>Bolts to DIN 912</th>
<th>Grade 10.9</th>
<th>Manufactured to DIN 267</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread</td>
<td>M6</td>
<td>M8 x 1</td>
</tr>
<tr>
<td>Tightening torque</td>
<td>Nm</td>
<td>8.3</td>
</tr>
<tr>
<td>Max. bolt load</td>
<td>N</td>
<td>9750</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bolts to DIN 912</th>
<th>Grade 10.9</th>
<th>Manufactured to DIN 267</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread</td>
<td>M12 x 1,5</td>
<td>M16 x 1,5</td>
</tr>
<tr>
<td>Tightening torque</td>
<td>Nm</td>
<td>72</td>
</tr>
<tr>
<td>Max. bolt load</td>
<td>N</td>
<td>44000</td>
</tr>
</tbody>
</table>

The jaw mounting bolts must be tightened with the torque values indicated in the tabulation!

9.6.2 Replacement of Parts:

As described in Sections 9.2 and 9.3!

Assembly as described in Section 7.2!

The manual chuck has to be put into operation as described in Section 7.6 and Section 8.2!

Observe the safety instructions!
10.1 Spare Parts:

A stock of the most important spare and wear parts on site is an important prerequisite for keeping the manual chuck in running order. Please use the spare parts list when ordering spare parts.

*For safety reasons, use only ORIGINAL - FORKARDT spare parts!*

The use of parts from other sources on our products relieves us from our obligations regarding product liability, in so far as any damage can be attributed directly or indirectly to the use of such parts.

*Our warranty extends only to ORIGINAL spare parts supplied by us!*

*Please note that special production and delivery specifications frequently exist for the parts manufactured or bought by us and that we always supply spare parts that meet the latest technical standards.*

10.2 Spare Parts List Manual Chuck Type F*:

![Diagram of Manual Chuck Type F*]

11
39
12

![Diagram of Manual Chuck Type F*]

10 13 39

![Diagram of Manual Chuck Type F*]

17 40 5,6 9 16

15 18

41 14

12

38

16

36

4

1

2

3

F 02 to F 07
### Manual chuck type

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Designation</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>164662001 164663001 164664001</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>164662002 164663002 164664002</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>164662003 164663003 164664003</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>164662004 164663004 164664004</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>164662005 164663005 164664005</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>164662006 164663006 164664006</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>164662009 164663009 164664009</td>
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<tr>
<td></td>
<td>10</td>
<td>164662010 164663010 164664010</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>164662011 164663011 164664011</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>164662012 164663012 164664012</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>164662013 164663013 164664013</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>164662014 164663014 164664014</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>164662015 164663015 164664015</td>
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<tr>
<td></td>
<td>16</td>
<td>164662016 164663016 164664016</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>164662017 164663017 164664017</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>164662018 164663018 164664018</td>
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<tr>
<td></td>
<td>19</td>
<td></td>
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<tr>
<td></td>
<td>20</td>
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<tr>
<td></td>
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<td></td>
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<td></td>
<td>26</td>
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<tr>
<td></td>
<td>27</td>
<td>180405000 180406000 180407000</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>180408000 180409000 180410000</td>
</tr>
<tr>
<td></td>
<td>29</td>
<td>180412000 180413000 180414000</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>180415000 180416000 180417000</td>
</tr>
<tr>
<td></td>
<td>31</td>
<td>180418000 180419000</td>
</tr>
</tbody>
</table>

The following data should always be specified when ordering spare parts:

- **Quantity**
- **Identification number**
- **Description**
- **Product**
- **Spare parts list number**
- **Serial number**

It is absolutely essential to specify the data marked with an / when ordering spare parts!

**10.3 Address for Spare Parts and Service:**

**FORKARDT**

2155 Traversefield Dr

Traverse City, MI 29686

Telephone: 800-544-3823

Email: sales@forkardt.us

Website: www.forkardt.com
11.1 Tools and Accessories:

The following tools and accessories are supplied with the chuck to facilitate maintenance work:

<table>
<thead>
<tr>
<th>DIN 911 hexagon key for socket head screws</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chuck type F+ ➔ 125 160 200 250 315 400 500 630</td>
</tr>
<tr>
<td>Key - A / F 3, 5, 6 4, 6, 8 6, 10 8, 10, 14 8, 10, 17 8, 14, 19 8, 14, 19 10, 17, 19</td>
</tr>
</tbody>
</table>

Lubricating grease PF 5 and PF 6, grease gun, see tabulation below! Degreasing agent, corrosion inhibitor etc. have to be supplied by you, but can also be ordered from us.

<table>
<thead>
<tr>
<th>Designation</th>
<th>Type</th>
<th>Ident. No.</th>
<th>Content of can</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special grease PF 5</td>
<td>PF 5</td>
<td>101400 / 084</td>
<td>1,0 kg</td>
</tr>
<tr>
<td>Special grease PF 6</td>
<td>PF 6</td>
<td>101400 / 088</td>
<td>1,0 kg</td>
</tr>
<tr>
<td>Lever action grease gun HH 1</td>
<td></td>
<td>101400 / 121</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ring bolt to DIN 580</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chuck type F+ ➔ 315 400 500 630</td>
</tr>
<tr>
<td>Thread M16 M16 M16 M20</td>
</tr>
</tbody>
</table>

11.2 List of Associated Publications:

- Accessories for manual and power chucks 990.01.05E
- Gripping force meter SKM 1200 / 1500 930.10.02E
- Gripping force meter FORSAVE D 620.01.06E
- Jaws for manual and power chucks 700.10.01D
10.4 Forkardt Service Department

**Paid Repair**

The Forkardt service department assesses and repairs all brands currently produced by Forkardt. Customers can send their workholding to the Forkardt plant to receive an assessment for the repairs needed to bring it within original working condition. Any new improvements or revisions to that model will be incorporated into the repair, as if you are receiving a new chuck at a discounted price.

Most estimates are sent within one week of the item arriving at the Forkardt facility. A non-refundable assessment fee may be charged if there are extra ordinary efforts required.

**Paid Service**

Forkardt service technicians can help install or troubleshoot existing workholding set ups. This allows the customer to be trained and also allows the customer to reallocate resources by letting the experts take care of the product.

Technicians can perform on site training for preventative maintenance, disassembly and repair. This leads to improved and safer performance of the product.

Service technicians can also perform balancing on most brands of chucks in the field. This leads to improved performance of the machine, tooling and product.

**Limited Warranty**

Forkardt’s products are warranted for a period of (1) year from date of delivery to be free from defects in material and workmanship.

This warranty does not include, nor does Forkardt assume responsibility for, defects or damage caused by misuse or abuse, alterations, service or repair by others, wear parts or failure to properly maintain the product.

**OEM Serviceable Chucks**

- NA Woodworth
- Forkardt
- SP
- Sheffer
- Logansport
- Buck Chuck
- Tork-Lok
- Teikoku

**Contacts**

- Service Department
  (231-995-8348  jhalligan@forkardt.us)

- Inside Sales
  (231)-995-8348 sales@forkardt.us

**Ship To Address**

2155 Traversefield Dr
Traverse City, MI  49686
DECLARATION OF INCORPORATION

According to EC Machinery Directive EC Directive 2006/42/EC

The manufacturer

FORKARDT GmbH
Lachenhauweg 12
72766 Reutlingen-Mittelstadt

herewith declares the following incomplete machines with the designations:

Type designation: Manual Three Jaw Chuck

Type: F+

• The general health and safety requirements according to Appendix I of the aforementioned directive have been referred to and observed.

• The special technical documents according to Appendix VII B have been prepared.

• The aforementioned special technical documents will be submitted to the responsible authority as required.

• Commissioning is forbidden until it has been verified that the machine in which the aforementioned machines are to be incorporated comply with the specifications of the machinery directive.

• Responsible for the documentation:

Oskar Weinert

Date/Manufacturer's signature: 27.03.14
Place: Erkrath

(Head of Design Mr Weinert)

Declaration of incorporation number: F+.E
OUR HISTORY