FORKARDT

FNC
POWER CHUCKS

OPERATING INSTRUCTIONS

FORKARDT

Contents

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1. Technical Data 3
1.1 Field of Application/Authorized Use 3
1.2 Components/Technical Specifications 4
1.3 Chuck Constants 4
1.4 Mounting Bolt Tightening Torques 5
1.5 Lubricating Point Drawing 5
2. Safety Instructions 6
2.1 Qualified Personnel 6
2.2 Warning Symbols 6
2.3 General Safety Instructions 7
3. General Information 8
4. Transport & Storage 9
5. Operation & Design 10
5.1 Features & Benefits 10
5.2 Design 11
5.3 Principle Dimensions 12
5.4 Mode of Operation 13
5.5 Gripping jaws 14
5.5.1 Designation of the Top Jaws 15
5.5.2 Jaw Bolt Tightening Torques 15
5.5.3 Safety Instructions for Top Jaws 17
5.6 Accessories 18
5.6.1 Chuck Mounting Plates 18
5.6.2 FStB One Piece Hard Stepped Jaws 19
5.6.3 Soft FMB Monoblock Jaws 19
5.6.4 Jaw Unit FGB and FHB 20
5.6.5 Jaw Unit FGB and FWB 21
5.7 Technical Safety Requirements 22
6. Gripping Force 23
6.1 General 23
6.2 Static Gripping Force Fspo 23
6.3 Dynamic Gripping Force Fsp 24
6.4 Safety Instructions 26
6.5 Calculation Examples 27
6.6 Gripping Force Fspz 29
6.7 Permissible Overhang Length 30
6.8 Nomograms for Calculation 31
7. Mounting of Chuck 35
7.1 Work to be Performed Prior to Mounting 35
7.1.1 Check Spindle Nose 35
7.1.2 Checking Mounting Flange 35
7.1.3 Fitting and Alignment of the Draw Tube 36
7.1.4 Balancing of Rotating Parts 37
7.2 Mounting of the Power Chuck 37
7.2.1 Chuck Mounting Bolt Tightening Torque 38
7.3 Mounting of the Top Jaws 39
7.4 Preparations for Use of the Power Chuck 39
8. Chuck Operation 41
8.1 Instructions 41
8.2 Operation 41
8.3 Safety Instructions 42
8.4 Procedure in the Event of Malfunctions 42
8.5 Troubleshooting 43
8.6 Restarting after a Malfunction 43
8.7 Before Prolonged Disuse 43
8.8 After Prolonged Disuse 43
9. Maintenance 44
9.1 Maintenance Instructions 44
9.2 Safety Instructions 47
9.3 Lubrication 48
9.4 Reconditioning 49
10. Spare Parts & Service 50
10.1 Spare Parts 50
10.2 Tools and Accessories 50
10.3 Spare Parts Lists 51
11. Manufacturer's Declaration 52

Please read these safety instructions and the operating manual carefully prior to operating the chuck.

Failure to follow safety and operating instructions may result in injury to the operator or damage to the machine. Only qualified persons who have read these safety instructions and operating manual should use, install or maintain this chuck.

1.1 Field of Application and Authorized Use:

The type FNC three jaw power chuck, called power chuck hereafter, is actuated by a rotating cylinder. The axial actuating force exerted by the cylinder must be matched to the power chuck. The type FNC power chuck may only be employed for authorized purposes.

The authorized use for the power chuck is the gripping of workpieces on:

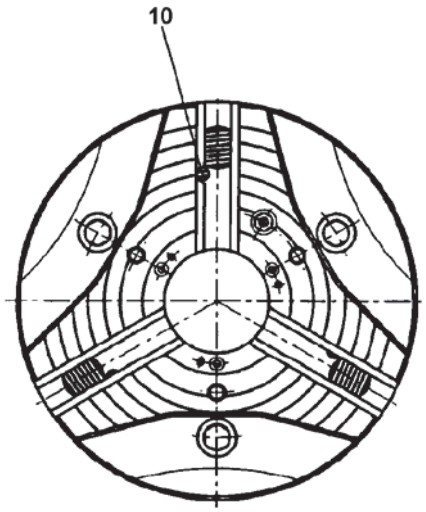
1) Lathes (rotating) or

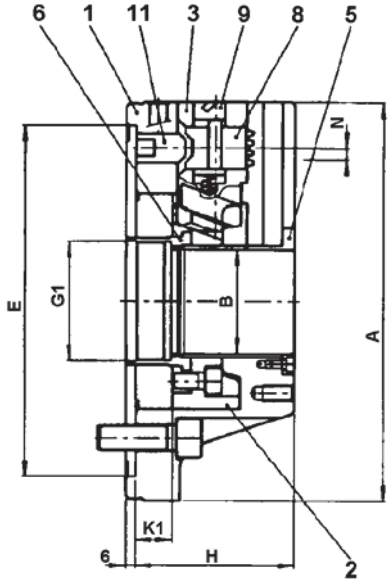
2) machine tools (static).

Do ***not*** exceed the maximum axial actuating force, the maximum gripping force or the maximum spindle speed. The permissible spindle speed or the gripping force necessary for any particular machining operations is determined in accordance with the relevant technical guidelines and regulations (e.g. VDI 3106 issued
by the Association of German Egineers).

Authorized use also implies observance of the manufacturer's instructions concerning use, installation, and maintenance. FORKARDT accepts no liability for improper use of the power chuck.

1.2 Components and Technical Specifications





Part No.	Designation
1	Chuck Body
2	Chuck Piston
3	Transmission Jaw
5	Protective Bushing
6	Drawtube Connector
8	Engaging Plunger
9	Eccentric Locking Pin
11	Detent
12	Safety Catch

Chuck Type FNC		175-42	200-45	250-65	250-72	315-65	315-82	400-85	400-92	500-125	630-125
Outer Diameter	A	180	206	250	257	315	315	400	400	500	630
Bore Diameter	B	42	45	65	72	65	82	85	92	125	125
Spindle Mounting Style	C	Z 5	Z 6	Z 8	Z 8	Z 8	Z 11	Z 11	Z 11	Z 15	Z 15
Jaw Mounting	D	F160	F 200	F 250	F 250	F 250	F 250	F 315	F 315	F 400	F400
Draw Tube Thread	G1	M50x2	M52x2	M75x2	M80x2	M75x2	M92x2	M95x2	M100x2	M135x2	M135x2
Width	H	78	83	100	100	100	100	127	127	138	138
Piston Stroke	K1	20	20	23	23	23	23	28	28	33	33
Jaw Movement	N	7.2	7.2	8.3	8.3	8.3	8.3	10	10	12	12
Part Number		159570 1	59571 1	59424	159427 1	59573	159572	159574	159575	159577	159578
Max. Actuating Force Fmax	daN	3000	4500	6000	6000	6000	6000	10000	10000	12000	12000
Max. Gripping Force Fspo	daN	5500	8400	12000	12000	12000	12000	19500	19500	24000	24000
Max. Spindle Speed N Max RPM		6300	5500	4700	4500	4000	4000	3300	3300	2200	1700
Rated Spindle Speed nR RPM		5000	4700	3900	3900	3100	3100	2700	2700	1700	1400
Polar Moment Of Inertia J	kgm²	0.04	0.09	0.2	0.2	0.5	0.5	1.5	1.5	4.0	11.0
Flywheel Effect Gd²	kgm²	0.16	0.35	0.78	0.78	1.96	1.96	5.88	5.88	15.7	43.2
Weight G	kg	11	15	22	24	37	37	68	68	115	200

1.3 Chuck Constants:

The chuck constants are based on the specific characteristics of the chuck. 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.

Chuck Size	175-42	200-45	250-65	250-72	315-65	315-82	400-85	400-92	500-125	630-125
C 1	390	412	620	580	820	780	960	940	1200	1760
C 2	213	221	310	290	410	390	490	482	600	880
C 3	0.065	0.09	0.18	0.187	0.33	0.33	0.73	0.73	1.66	2.80

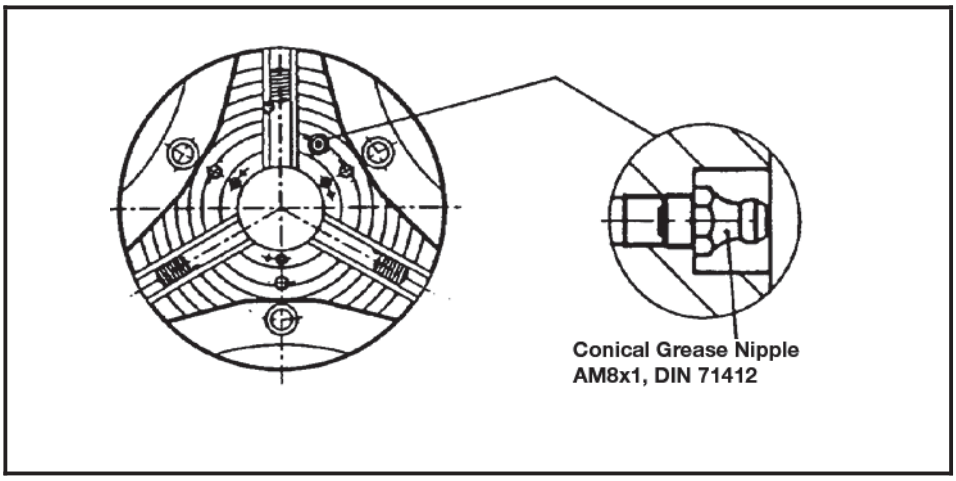
1.4 Tightening Torques for the Chuck Mounting Bolts:

Bolts to DIN 912		Grade 10.9			Manufactured to DIN 267					
Thread		M4	M5	M6	M8	M10	M12	M16	M20	M24
Tightening Torque	Nm	4.4	8.7	15	36	72	125	200	400	500
Max. Bolt Load	N	5800	9400	13200	24300	38700	56500	69100	108900	115000

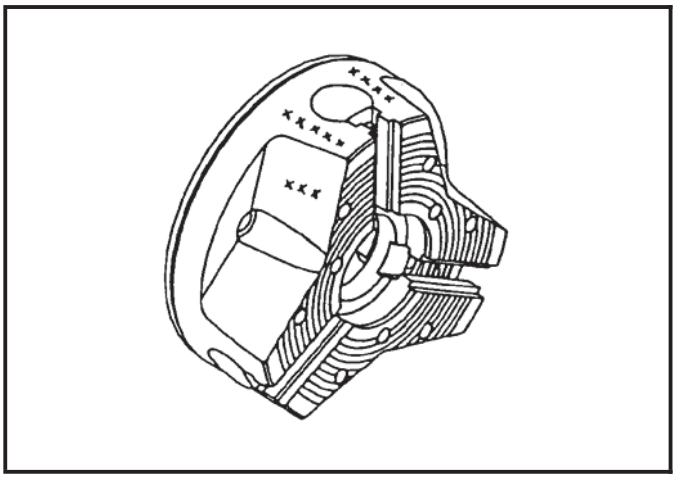
Bolts To Din 912	Grade 8.8	Manufactured To Din 267			
Thread		M6	M8	M10	M12
Tightening Torque	Nm	10	25	49	85
Max. Bolt Load	N	9000	16400	26000	37800

The chuck mounting bolts must be tightened with the torque indicated in the tables above.

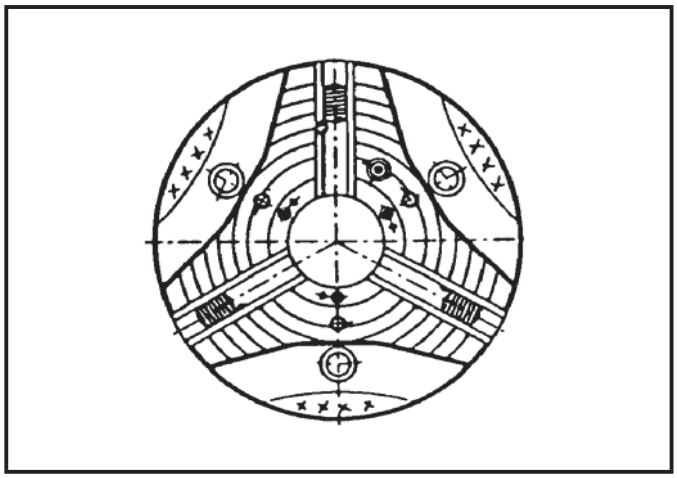
1.5 Lubricating Point Drawing:



Information Noted on Power Chuck:



On outer diameter of chuck: Fmax, nmax and max permissible weight of each jaw



On front face of chuck: Type of power chuck, Serial No., Part no., Forkardt emblem

General:

This instruction manual contains the information required for the correct use of the Type FNC power chucks. 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 as described below have the necessary technical expertise to correctly interpret and take notice of safety notes and warnings given in this manual.

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

2.1 Qualified Personnel:

Interfering with the power 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 power 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 power chuck**.**
- are installation and / or service personnel who have undergone training enabling them to repair / install chucks and workholding equipment and power chucks**.**

2.2 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.

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.

Caution Symbol:

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.

2.3 General Safety Instructions:

Hazards may arise where the use and handling of power chucks do not conform to industrial safety requirements. The Type FNC power chuck is built to current technical and safety standards.
Despite this, danger can arise from this power 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, power chuck and workpiece*** and can result in some danger. This danger must be assessed by the user.

- ***Only those persons more than 18 years of age who have read the safety instructions and operating manual should use, install and maintain the power chuck. These persons must have received special instructions on the implied dangers.***
- ***These operating instructions must be read prior to fitting and using the power chuck and have to be followed exactly.***
- ***Avoid any mode of operation detrimental to the safety of the power chuck.***
- ***Operators should ensure that no unauthorized persons use the power chuck.***
- ***The operator should report anything affecting the safety of the power chuck to a supervisor.***
- ***For authorized use see Section 1.1***
- ***Do not make unauthorized modifications to the power chuck since such steps could affect its safety.***
- ***Only use the power chuck when it is in good condition.***
- ***Failure to keep the workplace clean may create dangerous operating conditions.***
- ***Conduct maintenance work (e.g. lubrication, servicing) on the chuck only when it is at standstill (n = 0).***
- ***Release pressure in the actuating cylinder before servicing or inspecting the power chuck.***
- ***Use only units and spare parts produced by FORKARDT. Use of unauthorized spare parts invalidates FORKARDT'S warranty.***
- ***Before working with the power chuck, be sure to fit all guards properly.***
- ***Open guard doors only after the power chuck has stopped.***
- ***Note instruction plate.***
- ***Follow all local safety and accident prevention regulations when operating the power chuck.***

Instructions:

These operating instructions, which have been compiled on the basis of German standard DIN V 8418, must be read, understood and observed by the relevant operating personnel. These operating instructions draw attention to matters of particular significance for the operation of the Type FNC power chuck. Malfunctions in the power chuck can be avoided and trouble free operation ensured only if the operating personnel are familiar with the contents of these operating instructions.

- 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 difficulties are encountered at any time, please contact our customer service department, which will gladly assist you.
- These operating instructions refer to the Type FNC power chuck.
- The information and descriptions in these operating instructions are subject to technical modifications deemed to be necessary for improvements to the Type FNC power chuck.

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This manual is intended for installation, operating and maintenance personnel. It contains regulations and drawings of a technical nature which may be neither wholly nor partially reproduced or distributed to other parties or used for competitive aims without prior written authorization from **FORKARDT.** 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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Germany

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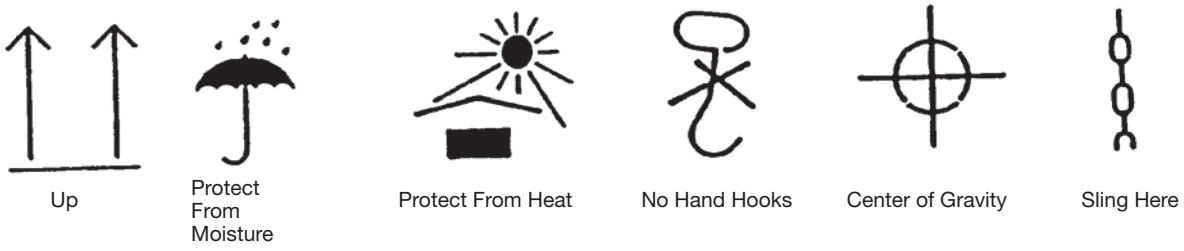
Packing, State of Assembly:

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

Power chucks up to 315 mm diameter are packed in collapsible cardboard boxes with suitable supporting inserts.

Power chucks from 400 mm diameter onwards are packed in wooden boxes with appropriate stuffing, (e.g. chips) with inclusion of accessories such as top jaws and mounting keys.

Power chucks are supplied fully assembled, - but with the mounting flange separate. Attention must be paid to the symbols (to German standard DIN 55402 part 1) displayed on the packing and other materials.



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 must be provided.

If the power chuck is not installed immediately on delivery, it must be stored on a pallet in a protected location. During storage, the parts must 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 to Forkardt immediately.

5.1 Features & Benefits

The type FNC power chuck is a wedge hook chuck with quick-change jaw system. It is suitable for all CNC lathes on which small or medium sized batches are machined where there is frequent jaw changeover. The key features of the type FNC power chuck are as follows:

- Sizes range from 175 mm to 630 mm, with larger sizes available.
- Specially heat treated, one-piece chuck body provides high strength and rigidness.
- Compact design
- Cutouts in chuck body reduce weight allowing for increased speeds
- Low moment of inertia
- Piston with trapezoidal wedge hooks allows for high gripping forces
- Piston does not disengage
- Transmission jaws remain in chuck body engaged with the piston during jaw changeover
- Gripping jaws are disengaged individually by hand
- Small diameters can be gripped externally
- The key for the eccentric locking pin can only be withdrawn when the pin has locked the engaging plunger into engagement with the chuck jaw
- The well proven F chuck jaw system is used so that jaws can be exchanged with exising F+ style chucks

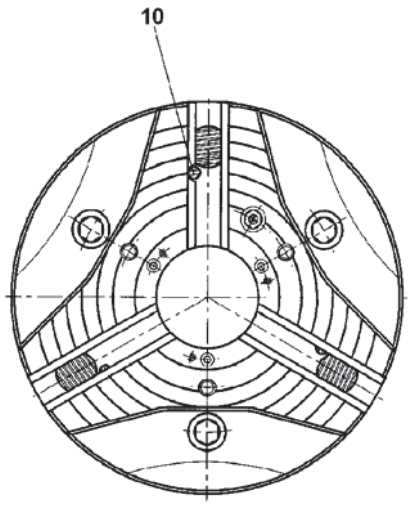
Chuck Designation:

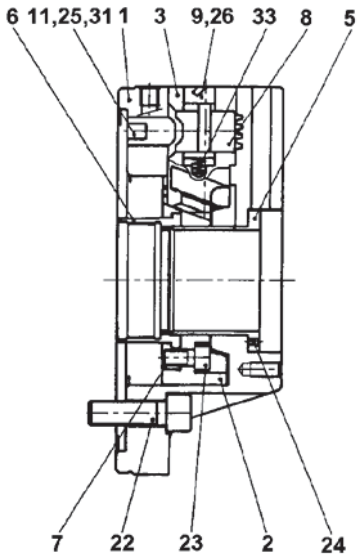
FNC	250	65	Z 8	159424
Chuck Designation	Chuck Size (Outer Dia.)	Chuck Bore	Mounting Style	Part Number

5.2 Design

The type FNC power chuck consists of the following main components:

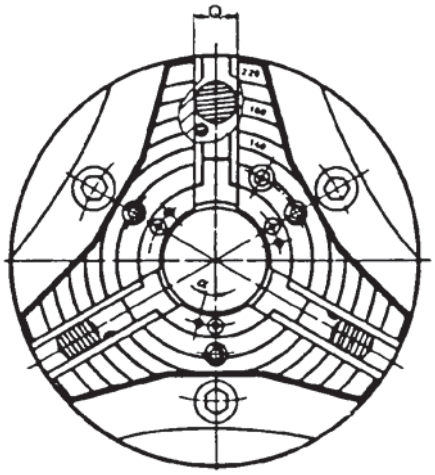
- One-piece chuck body (1) with plain mounting recess
- Piston (2) with the draw tube connector (6)
- Three transmission jaws (3) with integral engaging plunger (8) and spring loaded eccentric locking pin (9)
- Protective bushing (5) that guards against ingress of dirt and chips into the guides for the transmission jaws and the chuck piston.
- The draw tube connector (6) attached to the piston (2) by means of a ring (7) and the screws (23), with angular location by a detent pin (20).
- The safety catches (11) in the chuck body that prevent the transmission jaws (3) from flying out during machining and keep the engaging plungers (8) in engagement.
- The chuck jaws that are latched in by a spring loaded detent (10) in the transmission jaws. This detent also locates the jaws correctly relative to the engagement plunger.

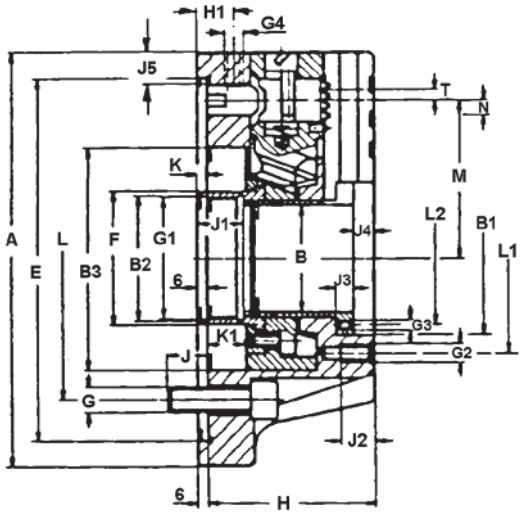




Part No.	Description
1	Chuck Body
2	Chuck Piston
3	Transmission Jaw
5	Protective Bushing
6	Draw Tube Connector
7	Ring
8	Engaging Plunger
9	Eccentric Locking Pin
11	Detent
22	Safety Catch
23	Socket-Head Cap Screw
24	Socket-Head Cap Screw
25	Socket-Head Cap Screw
26	Socket-Head Cap Screw
31	Pin
33	Washer/Compression Spring

5.3 Principle Dimensions





Chuck Type FNC		175-42	200-45	250-65	250-72	315-65	315-82	400-85	400-92	500-125	630-125
Outer Diameter	A	180	206	250	257	315	315	400	400	500	630
Chuck Bore	B + 0.1	42	45	65	72	65	82	85	92	125	125
Spindle Mounting Style	C	Z 5	Z 6	Z 8	Z 8	Z 8	Z 11	Z 11	Z 11	Z 15	Z 15
Jaw Mounting	D	F160	F 200	F 250	F 250	F 250	F 250	F 315	F 315	F 400	F400
IPart Number		159570	159571	159424	159427	159573	159572	159574	159575	159577	159578
	B1	65	-	-	-	-	-	-	-	-	-
	B2 H7	51	53	76	81	76	94	96	102	136	136
	B3	90	106	135	140	135	150	192	192	230	230
Register Diameter	E H6	140	170	220	220	220	300	300	300	380	380
	F	54	57	80	85	80	98	102	110	142	142
Screw Size	G	M10	M12	M16	M16	M16	M20	M20	M20	M24	M24
	G1	M50x2	M52x2	M75x2	M80x2	M75x2	M92x2	M95x2	M100x2	M135x2	M135x2
	G2	M6	M8	M10	M10	M10	M10	M12	M12	M16	M16
	G3	M4	M4	M5	M5	M5	M5	M6	M6	M6	M6
	G4	M8	M10	M12	M12	M12	M12	M16	M16	M16	M20
Chuck Width	H ±0.1	78	83	100	100	100	100	127	127	138	138
	H1	17	18	20	20	20	20	22.5	22.5	30	30
	J	15	18	24	24	24	24	30	30	36	36
	J1	22	22	28	28	28	28	28	28	28	28
	J2	11	16	20	20	20	20	20	20	22	22
	J3	6	6	8	8	8	8	8	8	8	8
	J4	13	-	-	-	-	-	-	-	-	-
	J5	16	20	22	22	20	20	30	30	32	32
	Min. K	6	6	6	6	6	6	6	6	6	6
	Max. K	26	26	29	29	29	29	34	34	39	39
Piston Stroke	K1	20	20	23	23	23	23	28	28	33	33
Pitch Circle Diameter	L	104.8	133.4	171.4	171.4	171.4	235	235	235	330.2	330.2
	L1	76	90	115	115	115	125	160	160	200	200
	L2	54	59	79	87	79	96	110	110	145	145
	Max. M	68	77.6	96	99.5	96	108	135	135	158	201
Jaw Movement	N	7.2	7.2	8.3	8.3	8.3	8.3	10	10	12	12
	Q	20	22	26	26	26	26	32	32	45	45
Pitch Of The Mounting Serration	T	4.8	4.8	6	6	6	6	7	7	8.5	8.5
		20°	17°30'	15°	15°	15°	15°	15°	15°	15°	15°

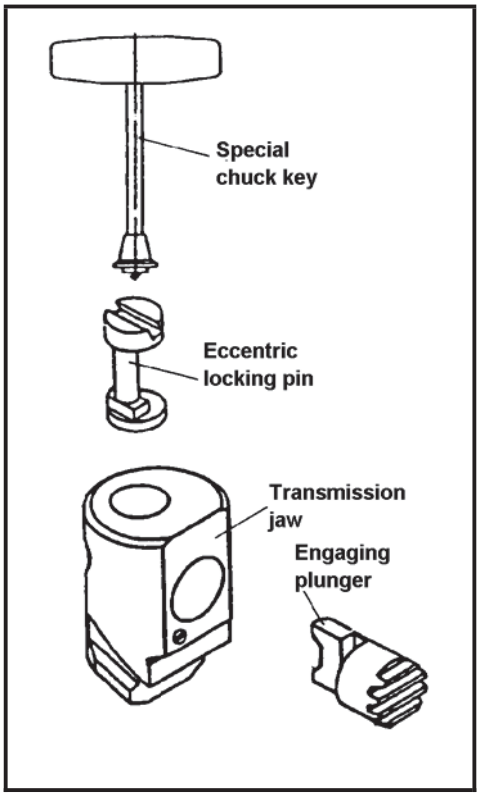
5.4 Mode of Operation:

The power chuck is actuated by a standard hydraulic cylinder with stroke monitor, either utilizing the machine hydraulics or a separately supplied hydraulic power pack.

The pressure at the actuating cylinder must be set so that the maximum actuat-ing force of the power chuck is not exceeded.

The power chuck attached to the spindle nose of a lathe is actuated by a rotating hydraulic cylinder; its function is to generate a gripping force to hold the workpiece to be machined from the axial force generated by the actuating cylinder.

The power chuck is actuated by an axial movement of the cylinder piston - transmitted by a draw tube (partly open center or open center chucking) - to the chuck piston and is transmitted by the surfaces of the wedge hook mechanism in the chuck piston to the correspondingly shaped wedge guides in the master jaws which engage during the gripping process. The serrated engaging plunger must be disengaged axially from the gripping jaw



- for setting the gripping jaws to another gripping diameter or vice versa
- for changing the gripping jaws, for instance from hard roughing jaws to soft finishing jaws

CAUTION

Note change of direction of jaw movement.

- by pressing the eccentric locking pin with the special chuck key and turning it anticlockwise. This releases the gripping jaw.

CAUTION

Remove chips and dirt from the bore of the the chuck and the gripping jaws before removing the jaws.

A tensile force on the chuck piston causes the jaws to move inwards (external chucking of the work-piece), compressive force on the chuck piston causes the jaws to move outwards (internal chucking of hollow workpieces). The gripping stroke is monitored by limit switches mounted radially on the actuating cylinder.
If the gripping jaws are set to a particular gripping diameter (gripping diameters are engraved on the front of the power chuck) or the jaws are changed from external to internal chucking,

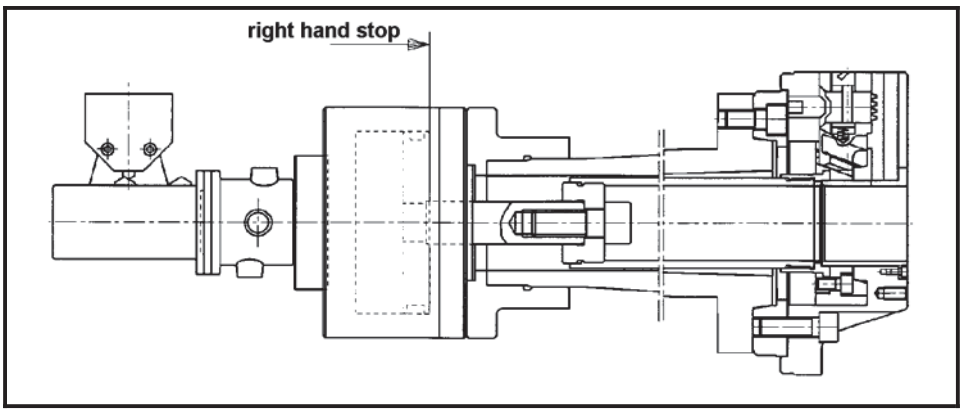
CAUTION ***Note change of direction of jaw movement.***

care must be taken that the gripping jaws have engaged. Gripping jaws are locked by turning the chuck key clockwise and the chuck key is released.

Gripping jaws can only be locked and unlocked when the power chuck has been opened and

- ***with the chuck piston in the foremost position and***
- ***with the actuating cylinder piston in the extreme right hand position.***

CAUTION ***Unlock chuck jaws only with the special chuck key. Do not use any other devices as this may cause an accident.***



CAUTION ***The gripping jaws cannot be unlocked while moving.***

5.5 Gripping jaws:

The power chuck is the connecting element between lathe and the workpiece to be turned. The power produced by the lathe is transmitted to the spindle nose by the power chuck and to the transfer point between power chuck and workpiece by the positive driving of the closed gripping jaws. Gripping jaws are radially moving elements of the power chuck which grip the workpiece during machining. The gripping jaws consist of the transmission jaws which connect tothe powerproviding part of the power chuck and the gripping jaw (top jaw) which is positively attached (by cross - tenons) to the transmission jaw (master jaw) and can thus be exactly positioned.
The jaws are interchangeable to suit the application.

5.5.1 Designation of the Top Jaws:

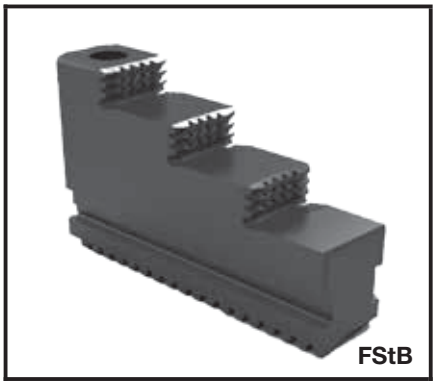
The table below indicates the suitable jaws in accordance to the power chuck type.

Basic Chuck Type	FNC	175	200	250	315	400	500	630
One - Piece Hard Stepped Jaws	FStB	160	200	250	250	315	400	400
Soft Monoblock Jaws	FMB	160	200	250	250	315	400	400
Base Jaw	FGB	160	200	250	250	315	400	400
Hard Top Jaw	FHB	160	200	250	250	315	400	400
Soft Top Jaw	FWB	160	200	250	250	315	400	400

5.5.2 Tightening Torques of the Jaw Mounting Bolts:

Bolts to DIN 912		Grade 10.9	Manufactured to DIN 267	
Thread		M 8 x 1	M 12 x 1.5	M 16 x 1.5
Tightening Torque	Nm	28	90	115
Max. Bolt Load	N	26600	60000	116000

One Piece FStB Hard Stepped Jaws:

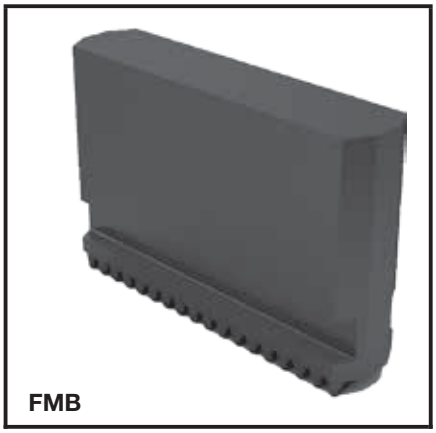

FStB

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 while gripping force is applied. The jaws are used to grip unmachined or rough machined work-pieces

- for medium cuts.

Determine the necessary gripping force Fsp

Soft FMB Monoblock Jaws:


FMB

Soft FMB monoblock jaws are unhardened, rectangular blocks. They are used for gripping previously machined workpieces

- which must not be damaged on the gripped surface and
- for light cuts.

These jaws are turned to suit the shape of the workpiece while gripping force is applied and have the advantage that the useful gripping surface is not restricted by jaw mounting bolts.

Determine the necessary gripping force Fsp

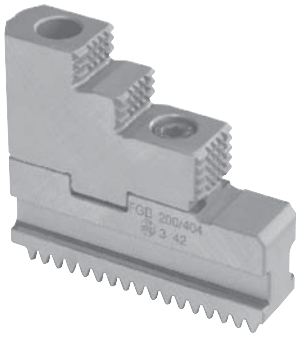
Jaw Units:

Jaw assemblies consist of the FGB base jaw and

- a FHB hard top jaw or
- a FWB soft top jaw
- or a special gripping jaw.

These assemblies are used to machine various types of workpieces. The FGB base jaw is designed for DIN standard cross - tenon mounting of the top jaw.

The FGB - FHB jaw unit is used for gripping unmachined or rough machined workpieces for medium cuts. They are ground in the chuck whilst the gripping force is being applied in order to increase the concentricity.



FGB-FHB

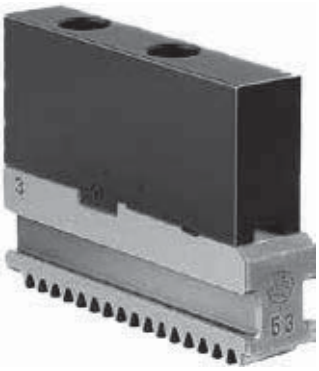
Hard FHB top jaws are hardened jaws with serrated gripping surfaces to increase the grip between top jaws and work-piece. In order to maintain the chuck concentricity, the top jaw should not be removed from the base jaw. They should be used as a set.

Determine the necessary gripping force Fsp

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 under gripping force.

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.



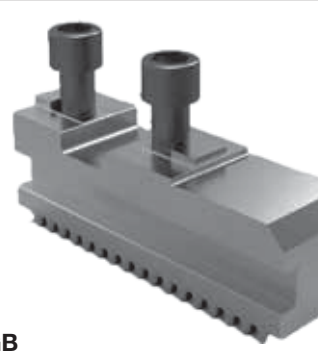
FGB-FWB

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



FGB

5.5.3 Safety Instructions for Top Jaws:

When machining top jaws, it is important to ensure proper serration pitch and to check that no distortion has taken place during hardening. Recalculate the strength after machining. For details see section 6.

When working at high speeds, reduce the weight of soft top jaws or machined hard jaws as much as possible, but not at the cost of strength. In addition to the normal grip force calculation, the strength of special top jaws must be recalculated in combination with the corresponding power chuck.

If the calculation and measurement of the dynamic gripping force for the permissible speed produces a value lower than the maximum speed of the chuck, the special top jaws must be marked with the permissable speed and the chuck designation. Calculate the weight and position of the center of gravity of top jaws prior to operation.

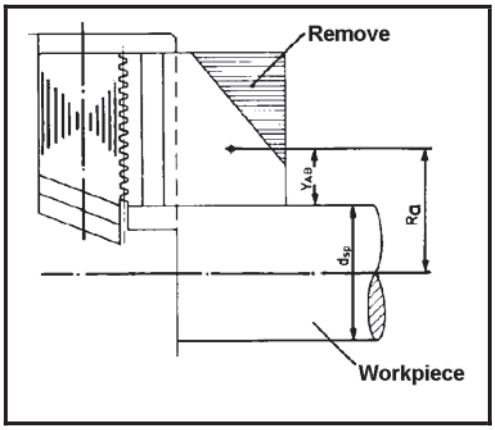
Check whether useful gripping force of the chuck is sufficient for the intended machining operations. See calculation example in section 6.

Set the lathe to the permissible speed determined for the top jaws. If the chuck is operated at a higher speed than the jaws allow, the gripping force will be reduced and the workpiece could eject from the chuck.

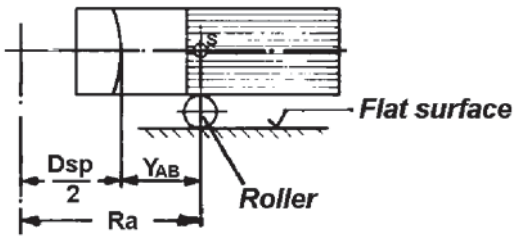
When the workpiece is inserted, the jaw travel should be 4 mm or less. Design top jaws so that the jaw travel required to reach the grip position does not exceed 4 mm.

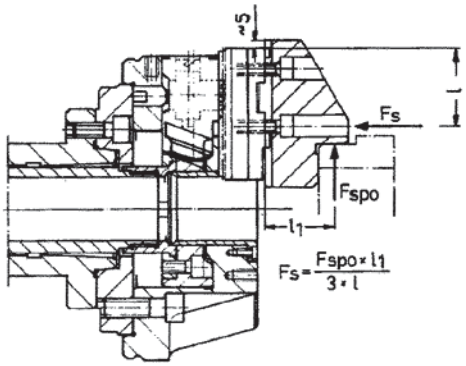
Check the strength of the jaw mounting bolts. Recalculate both the static and dynamic tensile strength. Use only high grade bolts of 10.9 to DIN 267. It is best to use the jaw bolts provided with the chuck.

For ID chucking the jaw bolts should be as close to the outside as possible. For OD chucking, they should be as close to the inside as possible.



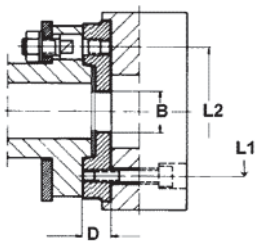
Determination of the center of gravity



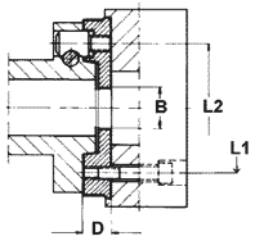


5.6 Accessories

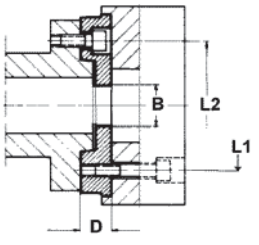
5.6.1 Mounting Flanges, Adaptor Flanges and Adaptor Plates:



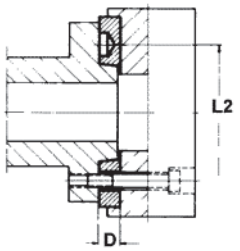
Mounting Flange J



Mounting Flange D



Adaptor Flange K



Adaptor Plate K

Chuck With Mounting Flange for Bayonet Plate Attachment J on Spindle Noses to DIN 55027, DIN 55027, ISO 702 / Iii

Chuck With Mounting Flange for Camlock Attachment D on Spindle Noses To DIN 55029, ISO 702 / Ii, ASA B 5.9 D1

Chuck Type Fnc	Spindle Nose Size	Mounting Flange Type	Part No.	Dimensions				Studs And Collar Nuts			Mounting Flange Type	Part No.	Dimensions				Camlock Studs		
				B	D	L1	L2	FN	Part No.	Qty.			B	D	L1	L2	FN	Part No.	Qty.
175	4	FF140-J4	74085	50	18	104.8	85	322	70504	3	FF140-D4	74118	50	28	104.8	82.6	286	70511	3
	5	FF140-J5	74086	50	24	104.8	104.8	322	70505	4	FF140-D5	74119	50	30	104.8	104.8	287	70512	6
200	5	FF170-J5	74089	60	24	133.4	104.8	322	70505	4	FF170-D5	74122	60	30	133.4	104.8	287	70512	6
	6	FF170-J6	74090	65	28	133.4	133.4	322	70506	4	FF170-D6	74123	65	35	133.4	133.4	288	70513	6
250	5	FF220-J6	74096	80	28	171.4	133.4	322	70506	4	FF220-D6	74129	80	35	171.4	133.4	288	70513	6
	6	FF220-J8	74097	80	32	171.4	171.4	322	70507	4	FF220-D8	74130	80	40	171.4	171.4	289	70514	6
315	6	FF220-J6	74096	80	28	171.4	133.4	322	70506	4	FF220-D6	74129	80	35	171.4	133.4	288	70513	6
	8	FF220-J8	74097	80	32	171.4	171.4	322	70507	4	FF220-D8	74130	80	40	171.4	171.4	289	70514	6
400	8	FF300-J8	74103	90	32	235	171.4	322	70507	4	FF300-D8	74136	90	40	235	171.4	289	70514	6
	11	FF300-J11	74104	90	35	235	235	322	70508	6	FF300-D11	74137	90	45	235	235	290	70515	6
500	11	FF380-J11	74107	120	35	330.2	235	322	70508	6	FF380-D11	74140	120	45	330.2	235	290	70516	6
	15	FF380-J15	74108	120	42	330.2	330.2	324	70517	6	FF380-D15	74141	120	50	330.2	330.2	291	70516	6
630	11	FF380-J11	74107	120	35	330.2	235	322	70508	6	FF380-D11	74140	120	45	330.2	235	290	70516	6
	15	FF380-J15	74108	120	42	330.2	330.2	324	70517	6	FF380-D15	74141	120	50	330.2	330.2	291	70516	6

Order example: 1 mounting flange typ FF 170 - J5, Ident. No. 74089; 1 set stud bolts and collar nuts size 5, Ident. No. 70505.

Chuck With Plain Spigot Mounting Recess, With Adapter Flange for Spindle Nose K Mounting to DIN 55021 A/B, DIN 55026 A/B, ISO 702/I A1/A2, ASA B5.9 A1/A2

Chuck Type FNC	Spindle Nose Size	Adapter Flange Type	Part No.	Dimensions				Corresponding Bolts Din 912 10.9
				B	D	L1	L2	
175	4	ZWF140-K4	74053	50	18	104.8	85	3xM10x20
175	4	ZWF140-K4	44757	50	18	104.8	82.6	3xM10x20
200	5	ZWF170-K5	74056	60	24	133.4	104.8	4xM10x25
250	6	ZWF220-K6	74060	80	28	171.4	133.4	4xM12x30
315	6	ZWF220-K6	74060	80	28	171.4	133.4	4xM12x30
400	8	ZWF300-K8	74065	90	32	235	171.4	4xM16x35
500	11	ZWF380-K11	74068	120	35	330.2	235	6xM20x40
630	11	ZWF380-K11	74068	120	35	330.2	235	6xM20x40

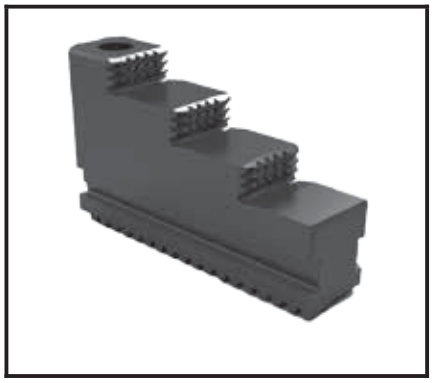
DIN 55021 pitch circle diameter 85 DIN 55026 pitch circle diameter 82.6

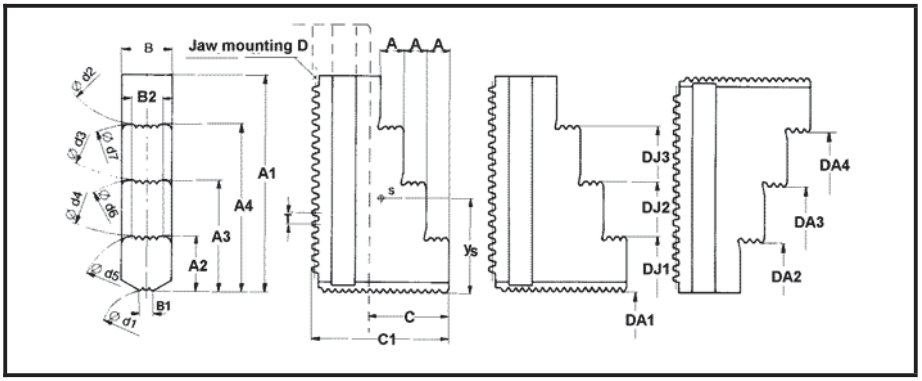
Chuck With Adapter Plate for Spindle Nose K Mounting to DIN 55021 A, DIN 55026 A, ISO 702/I A2, ASA B5.9 A2

Chuck Type FNC	Spindle Nose Size	Adapter Plate Type	Part No.	Dimensions		
				D	L2	L
-	-	-	-	-	-	-
175	5	ZWS140-K5	74035	14	104.8	10
200	6	ZWS170-K6	74036	15	133.4	15
250	8	ZWS220-K8	74038	17	171.4	15
315	8	ZWS220-K8	74038	17	171.4	15
400	11	ZWS300-K11	74040	19	235	20
500	15	ZWS380-K15	74042	21	330.2	20
630	15	ZWS380-K15	74042	21	330.2	20

The length of the chuck mounting bolts has to be increased by the amount L when these adapter plates are used.

5.6.2 FStB One Piece Hard Stepped Jaws:



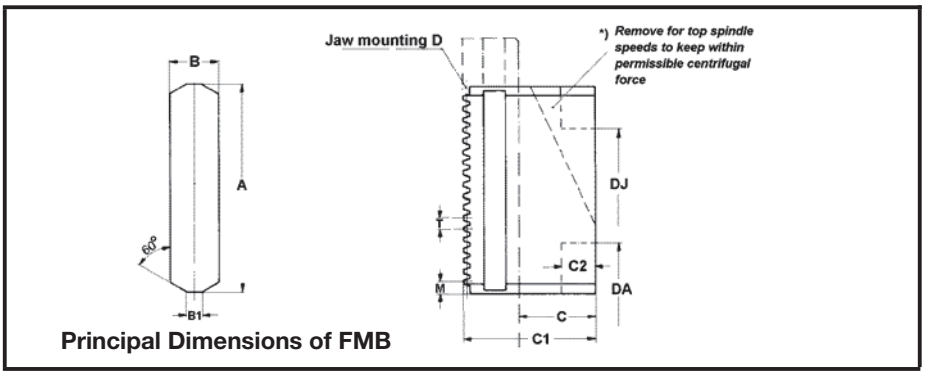


Chuck	Max Swing Dia.	Jaw Type	Nominal Dimensions				Part No.	Nominal Dimensions					External Chucking Range				Internal Chucking Range			Center of Gravity Ys	Weight per Jaw (kg)
			A	B	C	D		A1	A2	A3	A4	C1	DA 1	DA 2	DA 3	DA4	DJ 1	DJ 2	DJ 3		
175-42	234	160	7.5	20	24	F160	70016533	79	23	43	63	45	8-65	59-108	99-148	138-188	63-112	102-152	142-192	35.5	0.35
200-45	273	200	10	22	35	F200	70021533	94	24	48	72	60	8-76	69-128	116-176	164-224	65-124	113-173	160-220	41	0.615
250-65	346	250	14	26	40	F250	70026533	115	39.7	-	79.9	70	10-101	96-181	-	175-261	96-182	-	176-262	53	1.09
250-72	346	250	14	26	40	F250	70026533	115	39.7	-	79.9	70	10-101	96-181	-	175-261	96-182	-	176-262	53	1.09
315-65	377	250	14	26	40	F250	70026533	115	39.7	-	79.9	70	10-101	96-181	-	175-261	96-182	-	176-262	53	1.09
315-82	377	250	14	26	40	F250	70026533	115	39.7	-	79.9	70	10-101	96-181	-	175-261	96-182	-	176-262	53	1.09
400-85	462	315	15	32	46	F315	70033533	129	37.5	-	92.8	81	40-202	106-276	-	216-386	109-278	-	218-88	59	1.77
400-92	462	315	15	32	46	F315	70033533	129	37.5	-	92.8	81	40-202	106-276	-	216-386	109-278	-	218-88	59	1.77
500-125	586	400	20	45	52	F400	70038533	167	52.2	-	113.8	93	40-236	150-357	-	272-480	152-367	-	274-480	75.5	3.60
630-125	586	400	20	45	52	F400	70038533	167	52.2	-	113.8	93	40-236	150-357	-	272-480	152-367	-	274-480	75.5	3.60

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

5.6.3 Soft FMB Monoblock Jaws:

Soft FMB Monoblock Jaw



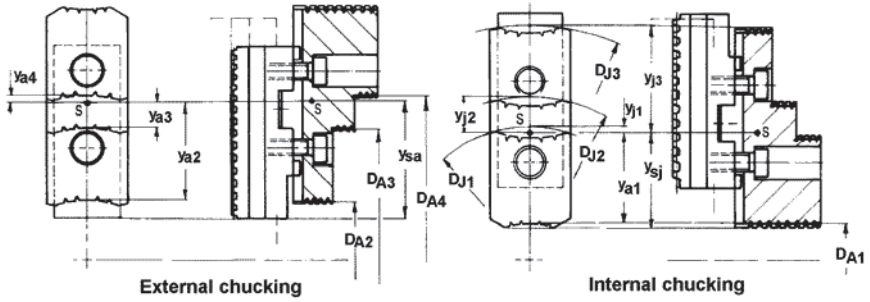
Principal Dimensions of FMB

Chuck	Max Swing Dia.	Jaw Type	Nominal Dimensions				Part No.	Nominal Dimensions				Weight per Jaw (kg)
			A	B	C	D		B1	C1	M	T	
175-42	224	FMB 160	79	20	24	F 160	70016734	7	45	3.2	4.84	0.47
200-45	264	FMB 200	94	22	35	F 200	70021734	7	60	5.4	4.89	0.84
250-65	325	FMB 250	115	26	40	F 250	70026034	10	70	6.2	6.03	1.41
250-72	325	FMB 250	115	26	40	F 250	70026034	10	70	6.2	6.03	1.41
315-65	373	FMB 250	115	26	40	F 250	70026034	10	70	6.2	6.03	1.41
315-82	373	FMB 250	115	26	40	F 250	70026034	10	70	6.2	6.03	1.41
400-85	455	FMB 315	130	32	46	F 315	70033034	12	81	8.7	7.04	2.21
400-92	455	FMB 315	130	32	46	F 315	70033034	12	81	8.7	7.04	2.21
500-125	586	FMB 400	76	45	52	F 400	70038034	22	93	11.0	8.55	5.15
630-125	690	FMB 400	76	45	52	F 400	70038034	22	93	11.0	8.55	5.15

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

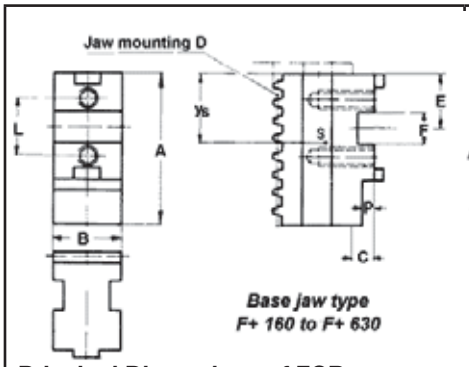
5.6.4 Jaw Unit FGB and FHB:

Jaw Unit FGB and FHB

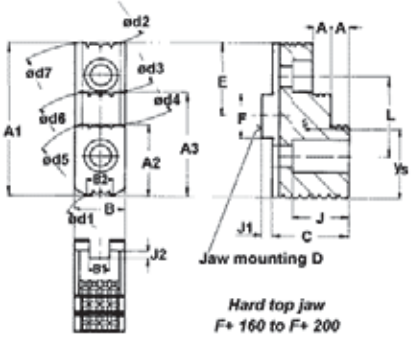


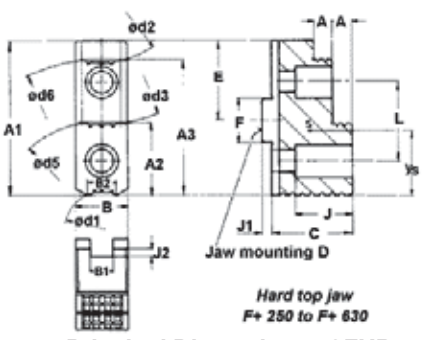
Principal Dimensions of Jaw Unit FGB and FHB

Chuck Size	Max Swing Dia.	External Chucking				Internal Chucking			Distance to Center of Gravity		Distance to Center of Gravity from Gripping Dia. (For Calculation of Centrifugal Force)							Weight Jaw Unit with Bolts
		DA 1	DA 2	DA 3	DA 4	DJ 1	DJ 2	DJ 3	Y sa	Y sj	Ya1	Ya2	Ya3	Ya4	Yj1	Yj2	Yj3	
175-42	234	8-65	59-108	99-149	125-175	76-125	100-151	142-192	45.1	33.9	33.65	28.52	8.21	4.73	3.63	9.15	29.47	0.46
200-45	273	8-76	69-128	122-182	150-210	79-138	107-166	160-220	53.7	40.3	40.1	31.22	4.4	9.56	8.57	5.22	32.02	0.74
250-65	346	10-101	-	96-182	176-262	98-182	177-262	-	66.5	48.5	48.0	-	30.93	9.07	7.0	32.52	-	1.40
250-72	346	10-101	-	96-182	176-262	98-182	177-262	-	66.5	48.5	48.0	-	30.93	9.07	7.0	32.52	-	1.40
315-65	378	10-137	-	96-218	176-298	98-218	177-298	-	66.5	48.5	48.0	-	30.93	9.07	7.0	32.52	-	1.40
315-82	378	10-137	-	96-218	176-298	98-218	177-298	-	66.5	48.5	48.0	-	30.93	9.07	7.0	32.52	-	1.40
400-85	462	40-202	-	120-275	230-386	109-278	219-388	-	74.7	55.3	54.0	-	36.7	18.3	16.3	38.20	-	2.07
400-92	462	40-202	-	120-275	230-386	109-278	219-388	-	74.7	55.3	54.0	-	36.7	18.3	16.3	38.20	-	2.07
500-125	586	40-236	-	147-359	289-481	152-341	274-464	-	95.7	69.3	68.0	-	43.16	17.84	16.8	43.70	-	4.52
630-125	686	110-339	-	147-461	289-583	152-443	274-566	-	95.7	69.3	68.0	-	43.16	17.84	19.2	43.70	-	4.52



Principal Dimensions of FGB



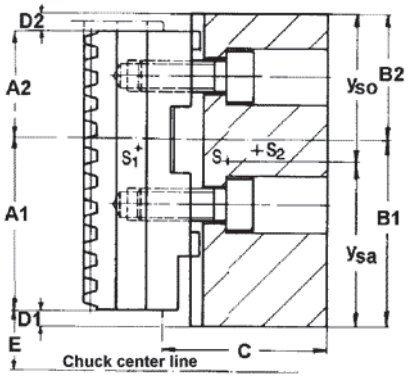


Principal Dimensions of FHB

Chuck Size	Base Jaw									Hard Top Jaw														
	FGB Type	Nominal Dimensions				Part No..	Dimensions		Weight Kg/Jaw	Type FHB	Nominal Dimensions				Part No.	Nominal Dimensions									Weight kg/Jaw
		A	B	C	D		F	L			A	B	C	D		A1	A2	A3	B1	E	F H6	J1	J2	L	
175-42	160	74	20	6	F160	70016504	18	32	0.215	160	7.5	20	32.5	F160	70016524	63	29.5	42.5	8	30	18	4.5	3	32	0.217
200-45	200	90	22	7	F200	70021504	20	40	0.370	200	10	22	38	F200	70021524	72	31	45	10	35	20	5	3.5	40	0.34
250-65	250	110	26	7	F250	70026404	20	40	0.585	250	14	32	50	F250	70026524	90	40	80.3	12	49	20	5	3.5	40	0.74
250-72	250	110	26	7	F250	70026404	20	40	0.585	250	14	32	50	F250	70026524	90	40	80.3	12	49	20	5	3.5	40	0.74
315-65	250	110	26	7	F250	70026404	20	40	0.585	250	14	32	50	F250	70026524	90	40	80.3	12	49	20	5	3.5	40	0.74
315-82	250	110	26	7	F250	70026404	20	40	0.585	250	14	32	50	F250	70026524	90	40	80.3	12	49	20	5	3.5	40	0.74
400-85	315	125	32	8	F315	70033404	26	54	0.945	315	15	36	56	F315	70033524	104	37.5	92.8	12	56	26	6	3.5	54	2.24
400-92	315	125	32	8	F315	70033404	26	54	0.945	315	15	36	56	F315	70033524	104	37.5	92.8	12	56	26	6	3.5	54	2.24
500-125	400	160	45	10	F400	70038404	30	60	2.100	400	20	45	75	F400	70038524	130	52.3	113.8	18	73	30	7	4.5	60	2.24
630-125	400	160	45	10	F400	70038/404	30	60	2.100	400	20	45	75	F400	70038/524	130	52.3	113.8	18	73	30	7	4.5	60	2.24

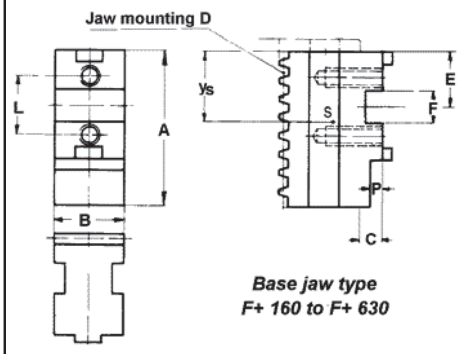
5.6.5 Jaw Unit FGB and FWB:

Jaw Unit FGB and FWB



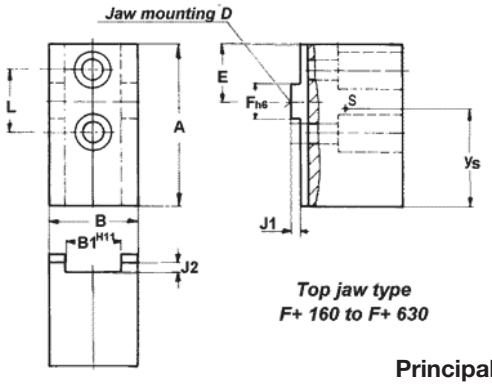
Principal Dimensions of Jaw Unit FGB and FWB

Chuck Size	Max Swing Dia.	Principal Dimensions											Weight Both Jaws & Bolts
		A1	A2	B1	B2	C	D1	D2	Emin	Emax	Ysa	Yso	
175-42	240	46	28	51	34	41.5	4	7	12	38	43.35	41.65	0.645
200-45	290	57	33	61	44	49	4	11	11	42.5	51.6	53.4	1.060
250-65	356	74	38	79	46	57	5	10	14.5	56	56.5	63.1	2.005
250-72	356	74	38	79	46	57	5	10	14.5	56	56.5	63.1	2.005
315-65	392	74	38	79	46	57	5	10	14.5	74	56.5	63.1	2.005
315-82	392	74	38	79	46	57	5	10	14.5	74	56.5	63.1	2.005
400-85	472	82	43	87	58	64	5	15	16	94	71.8	73.2	3.065
400-92	472	82	43	87	58	64	5	15	16	94	71.8	73.2	3.065
500-125	605	110	50	115	65	85	5	15	18.5	125	86.45	93.55	6.450
630-125	706	110	50	115	65	85	5	15	18.5	176.5	86.45	93.55	6.450



Base jaw type
F+ 160 to F+ 630

Principal Dimensions of Jaw FGB



Top jaw type
F+ 160 to F+ 630

Principal Dimensions of Jaw FWB

Chuck Size	Base Jaw									Soft Top Jaw												
	Jaw Style FGB	Nominal Dimensions				Part No.	Dimensions		Weight kg/Jaw	Jaw Style FWB	Nominal Dimensions				Part No	Dimensions						Weight kg/Jaw
		A	B	C	D		F	L			A	B	C	D		B1	E	F	J1	J2	L	
175-42	160	74	20	6	F160	180567	18	32	0.215	160	85	20	35.5	F	508	8	34	18	4.5	3	32	0.40
200-45	200	80	22	7	F200	180577	20	40	0.37	200	105	22	42	F200	70021525	10	44	20	5	3.5	40	0.66
250-65	250	110	26	7	F250	180588	20	40	0.585	250	125	32	50	F250	70026425	12	46	20	5	3.5	40	1.34
250-72	250	110	26	7	F250	180588	20	40	0.585	250	125	32	50	F250	70026425	12	46	20	5	3.5	40	1.34
315-65	250	110	26	7	F250	180588	20	40	0.585	250	125	32	50	F250	70026425	12	46	20	5	3.5	40	1.34
315-82	250	110	26	7	F250	180588	20	40	0.585	250	125	32	50	F250	70026425	12	46	20	5	3.5	40	1.34
400-85	315	125	32	8	F315	180596	26	54	0.945	315	145	36	56	F315	70033425	12	58	26	6	3.5	54	2.04
400-92	315	125	32	8	F315	180596	26	54	0.945	315	145	36	56	F315	70033425	12	58	26	6	3.5	54	2.04
500-125	400	160	45	10	F400	180606	30	60	2.1	400	180	45	75	F400	70038425	18	65	30	7	4.5	60	4.16
630-125	400	160	45	10	F400	180606	30	60	2.1	400	180	45	75	F400	70038425	18	65	30	7	4.5	60	4.16

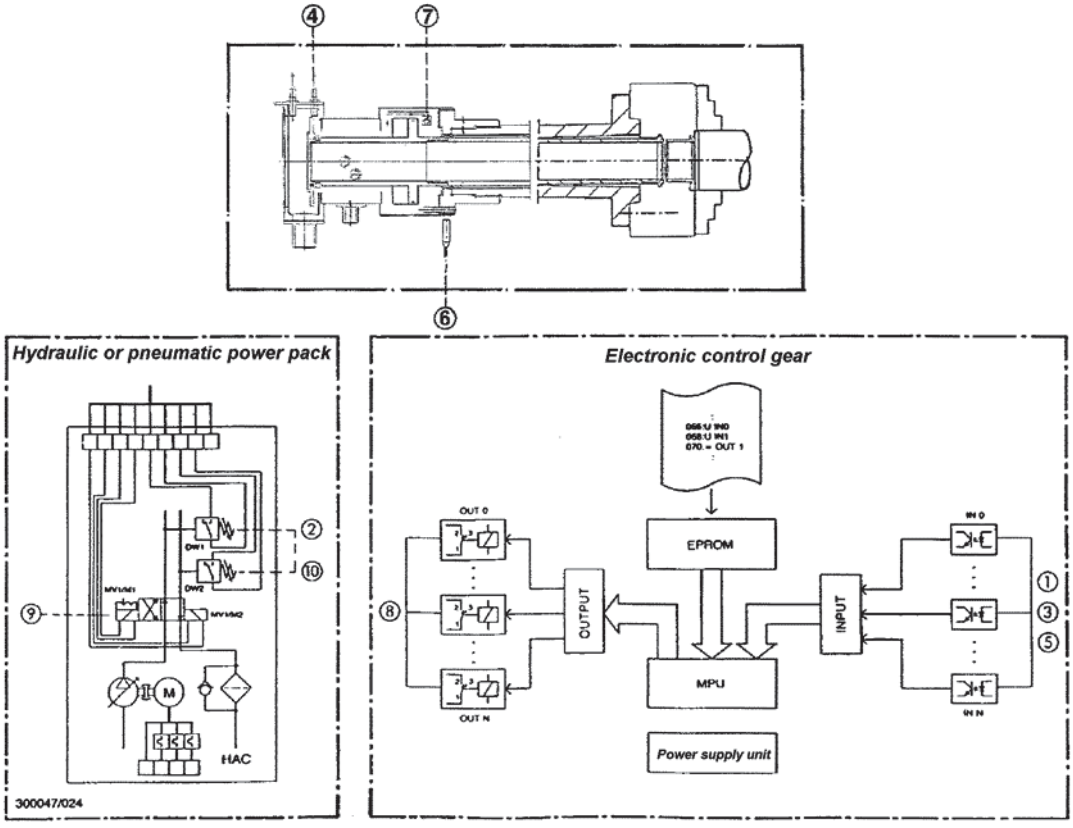
Order example: 1 set soft top jaws FWB 200, Ident. No. 70021/525; 1 set base jaws FGB 200, Ident. No. 180577

5.7 Technical Safety Requirements for Power Operated Workholding Equipment:

The technical requirements for the operation of power - operated workholding equipment are defined in safety regulations as well as in the DIN (German Standard Institute), VDE (Association of German Electrical Engineers) and VDI (Associ-ation of German Engineers) guidelines. The individual safety requirements must to be satisfied by appropriate measures, as shown in the adjacent table.

Safety requirement :	Satisfied by:	Corresponding Diagram Location
The machine spindle may only start when the full chucking pressure has built up in the actuating cylinder.	Pressure switch in the pressure lines	1 & 2
The machine spindle may only start when gripping has taken place within the permissible range of jaw movement.	Monitoring of actuating cylinder stroke by electric limit switches	3 & 4
The grip can only be released when the machine spindle has stopped.	Machine spindle rotation monitor	5 & 6
In the event of failure of the hydraulic power supply the workpiece has to remain gripped until the spindle comes to rest.	Pilot operated check valves in actuating cylinder	7
Electric power failure and subsequent restoration of the power supply must not result in any change of the control gear status.	Impulse actuated directional valve with detents in end positions	8 & 9
In the event of failure of the hydraulic power supply a signal for the automatic or manual stopping of the spindle has to be given.	Pressure switch in pressure lines	10

Safety Interlocks For Power Operated Workholding Equipment:



6.1 General:

The chuck transmits the spindle torque to the workpiece by means of the frictional grip of the jaws (master jaws and top jaws). The force applying the jaws to the workpiece 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 gripping jaw
- The ratio between gripping diameter and diameter being machined
- The magnitude of the cutting force applied by the tool
- The overhang of the gripping jaws at the gripping point
- The reduction in the gripping force due to the centrifugal force acting on the jaws in the case of external chucking

Rotating workholding equipment is subject to centrifugal forces that increase with the square of the speed of rotation. The centrifugal force opposes the gripping force in the case of external chucking and increases it in the case of internal chucking. The residual dynamic gripping force at high spindle speeds depends on the static gripping force, the mass of the chuck jaws and the radius of their center of gravity.

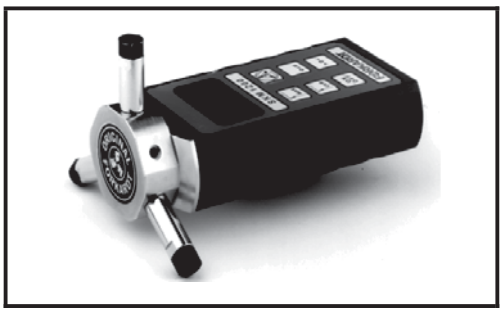
6.2 Static Gripping Force Fspo:

The maximum static gripping force, Fspo, shown in the table in section 1.4 is only achieved under favorable conditions. These are:

- A well maintained power chuck.
- Optimum lubrication of all sliding surfaces.
- Application of maximum actuating force.
- Short overhang of top jaws.
- Spindle static n = 0 (or low spindle speed).

The static gripping force is measured with a static gripping force meter, e.g. SKM 1200 / 1500, see publication 930.10.02E.

The figure given in Section 1.4, page 4 for Fspo can be used for stress calculations, e.g. for the design of special jaws.



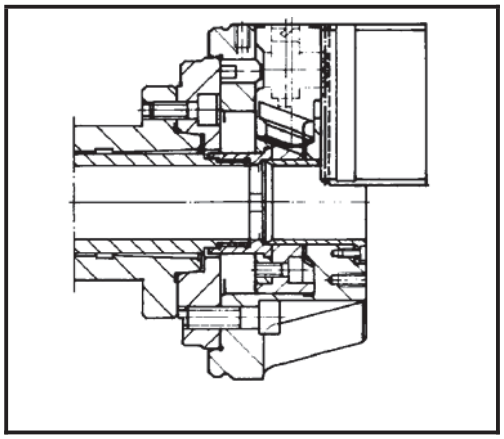
6.3 Dynamic Gripping Force Fsp:

The dynamic gripping force Fsp is the total force (daN) supplied by all of the jaws under dynamic conditions and represents the minimum value of the available gripping force under normal operating conditions. Implied are:

- well maintained condition and
- adequate lubrication of all sliding surfaces of the power chuck.

In really good condition, power chucks will exceed the calculated value of Fsp.

The static gripping force is a function of the chuck design data, but does not solely determine the gripping force un-der dynamiy conditions. The gripping jaws appreciably ef-fect the performances of a chuck. They have to be selected to suit the specific application. The gripping jaws effect the dynamic gripping force and hence the maximum permissi-ble spindle speed. The rated spindle speed quoted in ac-cordance with German standard DIN 6386 for the type FNC power chuck is the spindle speed at which the calcu-lated centrifugal force generated by the heaviest design of jaws belonging to the chuck equals 2/3 of the static grip-ping force produced by application of the maximum actuat-ing force.



For the type FNC power chuck, the rated spindle speed is based on use of FMB monoblock jaws that are flush with the outer diameter of the chuck. See figure above. At the rated spindle speed 1/3 of the static gripping force is still available for gripping the workpiece.The maximum permissible weight per jaw for this condition is given on the chuck body. The centrifugal force generated by the jaws (transmission and gripping jaws) during rotation of the power chuck however does not result in a loss of gripping force of the same magnitude due to the chuck stiffness and the workpiece elasticity.

For solid workpieces (i.e. without bore), for instance, the loss of gripping force amounts to approx. 63% of the centrigugal force. The dynamic gripping force and the actual loss of gripping force ### Fsp for the Type FNC power chuck can be calculated from the following formulae:

$$\mathbf{Fsp = Fspo \pm Fsp}$$

whereby the available static gripping force Fspo (gripping force at spindle speed n = 0) is:

$$\mathbf{Fspo} = \frac{C1}{\mathbf{2+}} \times \mathbf{Fax}$$

and the loss of gripping force ### Fsp due to the jaws:

$$\mathbf{Fsp = \pm\ 0{,}0007 \times (C_3 + Ma) \times n^2}$$

+ for internal chucking
- for external chucking

The dynamic gripping force Fsp is thus:

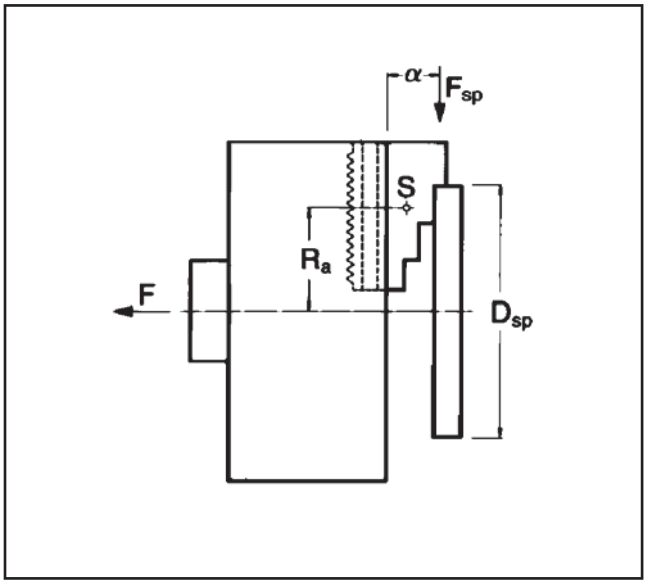
$$\mathbf{Fsp} = \frac{C1}{\mathbf{2+}} \times \mathbf{Fax \pm\ 0{,}0007 \times (C_3 + Ma) \times n^2}$$

The total centrifugal moment can be calculated as:

$$\mathbf{Ma} = \frac{\frac{Dsp}{2} \pm Y_{AB}\ xGxi}{1000}$$

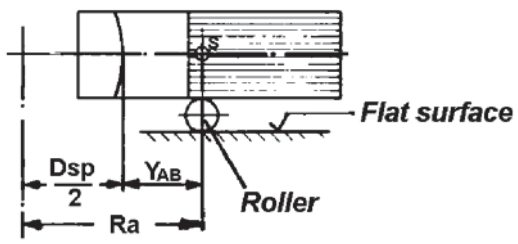
where:

Fsp = Dynamic gripping force [daN], the total dynamic gripping force applied by the jaws
C1, C2, C3 = Chuck constants
Fax = Maximum actuating force [daN]
n = Spindle speed [RPM]
Ma = Total centrifugal moment of the jaws [kgm]
Dsp = Gripping diameter [mm]
YAB = Distance of center of gravity of top jaw from gripping diameter [mm]
a = Jaw overhang [mm]
i = Number of jaws
G = Mass of each jaw [kg]
Ra = Distance of centre of gravity of jaw from center of chuck [mm]



For each application it is necessary to check that the available dynamic gripping force is adequate. In the case of gripping jaws made from soft FMB monoblock jaws or other special jaws, the actual moment must be established by weighing and by determining the distance of the centerof gravity, **Ra**, from the center of the chuck.
See Adjacent Figure

Determination of the Center of Gravity



The weight of soft gripping jaws for high spindle speeds must be reduced as much as possible and the overhang of the jaws should be kept short.

The weight and position of the center of gravity of the finished jaws must be determined and it must be verified that the residual dynamic gripping force of the power chuck is adequate for the intended machining operation. **See Fsp formula page 25.**

If the calculated dynamic gripping force Fsp proves to be inadequate for the machining operation, then the spindle speed or the weight of top jaws must be reduced.

The permissible spindle speed for the power chuck equipped with appropriate jaws or the variation of gripping force with speed must be calculated for each application.

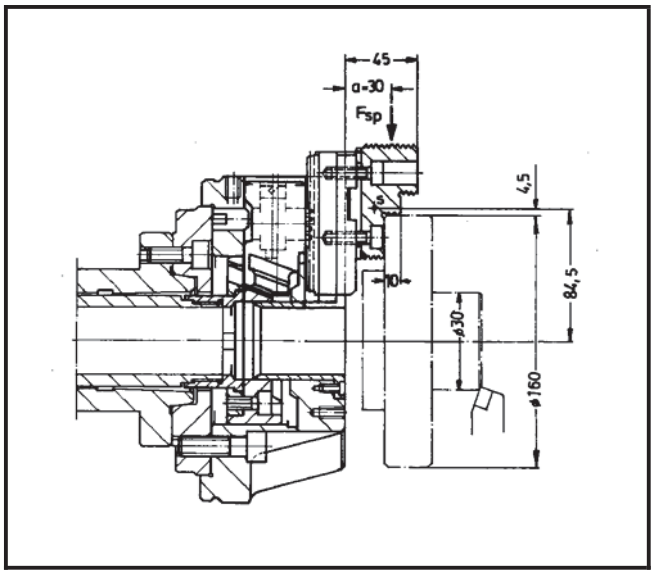
6.4 Safety Instructions:

- ***Check that the gripping force of the chuck is adequate for the machining operation under the chosen operating conditions.***
- ***Maintain the chuck properly to attain the calculated values of the gripping force (the actual gripping force can be higher in the case of a freshly lubricated chuck).***
- ***Use light top jaws at high spindle speeds.***
- ***During rotation of the power chuck, use a dynamic gripping force meter, e.g. to determine 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 desired operation.***
- ***If the gripping force falls below the specified value, lubricate the power chuck.***
- ***See also Section 9***
- ***Operating machinery at high spindle speeds requires use of adequate interlocked***
- ***guards for protection. Do not open guards during machine operation.***

6.5 Calculation Examples

Example 1:

Type of Power Chuck		FNC 200 - 45
Max. Actuating Force	Fax	4500 daN
Jaws		Jaw unit FGB/ FHB 200
Gripping Diameter	Dsp	160 mm
Spindle Speed	n	4000 RPM
Chuck Constant	C1	412
Chuck Constant	C2	221
Chuck Constant	C3	0.09
Jaw Overhang	a	30 mm
Number of Jaws	i	3



The static gripping force (n = 0) and the dynamic gripping force (n = 4000 RPM) must be found.

From table on page 21 (Section 5.6.5):
Dsp = 160 mm, step A3 (122 - 182 mm)
Jaw weight G = 0.74 kg / jaw assembly

Radius of the center of gravity Ra:

$$Ra = \frac{Dsp}{2} + Y_{AB} = \frac{160}{2} + 4.5 = 84.5\ mm$$

Total moment Ma of jaws about center of chuck:

$$Ma = \frac{Ra\ x\ G\ x\ i}{1000} = \frac{84.5x0.74x3}{1000} = 0.188\ kgm$$

Static gripping force (n = 0):

$$Fspo = \frac{C1}{C2 + a}\ x\ Fax = \frac{412}{1000}\ x\ 4500 = 7386\ daN$$

Dynamic gripping force (n = 4000 RPM):

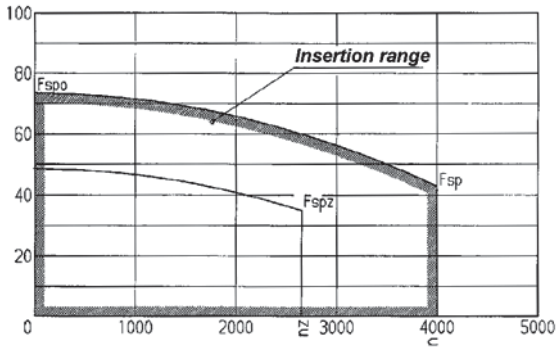
$$Fsp = \frac{C1}{C2 + a}\ x\ Fax - 0.0007\ x\ (C3 + Ma) x\ n^2$$

$$Fsp = \frac{412}{221 + 30}\ x\ 4500 - 0.0007\ x\ (0.09 + 0.188) x\ 4000^2$$

$$Fsp = 7386 - 3114 = 4272\ daN$$

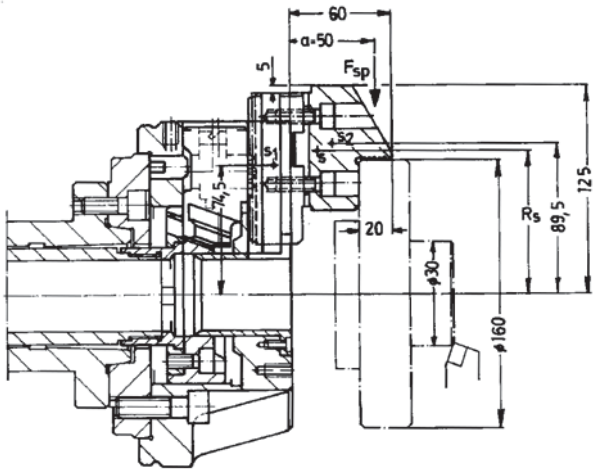
Example: Material 42 CrMo 4V

la = 60mm Dsp = 160mm v = 250m / min
a = 10mm sp = 0.20 nz = 2652 RPM
s = 0.63 Sz = 2 Fspz = 3500 daN
dz = 30mm Ks = 1919 N / mm



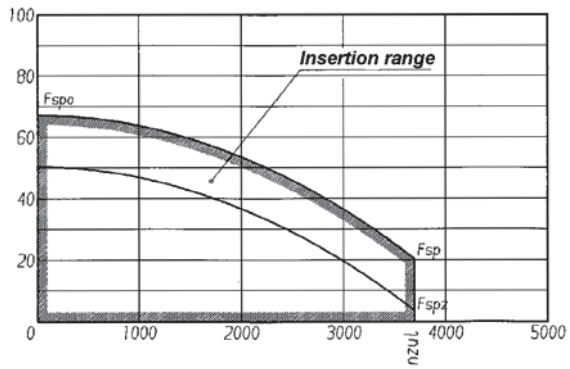
Example 2:

Type of Power Chuck		FNC 200 - 45
Max. Actuating Force	Fax	4500 daN
Required Grip Force at Operating Spindle Speed		2000 daN
Jaws		FGB 200/Special Top Jaw
Gripping Diameter	Dsp	160 mm
Spindle speed	n	4000 r.p.m.
Chuck constant	C 1	412
Chuck constant	C 2	221
Chuck constant	C 3	0,09
Jaw overhang	a	50 mm Number of jaws i 3
Weight of FGB 200	G1	0.37 kg / jaw.
Center of Gravity from Center of Chuck	Rs1	125 - 5 - 45.5 = 74.5 mm.
Weight of Special Jaw	G2	0.23 kg / jaw.
Center of Gravity from Center of Chuck	Rs2	89.5 mm.



Example: Material 42 CrMo 4V

la = 60mm Dsp = 160mm v = 250m / min
a = 2mm μsp = 0.35 nz = 3700 RPM
s = 0.25 Sz = 2 Fspz = 330 daN
dz = 30mm Ks = 2249 N/mm²



Weight of jaw unit G:

$$G = G1 + G2 = 0.37 + 1.23 = 1.6\ kg/jaw$$

Distance of center of gravity Rs from center of chuck:

$$Rs = \frac{G_1 \times R_{s1} + G_2 \times R_{s2}}{G_1 + G_2} = \frac{0.37 \times 74.5 + 1.23 \times 89.5}{0.37 + 1.23} = 86.03mm$$

Total moment Ma of jaws about center of chuck:

$$Ma = \frac{Ra \times G \times i}{1000} = \frac{86.03 \times 1.6 \times 3}{1000} = 0.413\ kgm$$

Static gripping force (n = 0):

$$Fspo = \frac{C1}{C2+a} \times Fax = \frac{412}{221+50} \times 4500 = 6841\ daN$$

Dynamic gripping force (n = 4000 RPM):

$$Fsp = \frac{C1}{C2+a} \times Fax - 0.0007 \times (C3 + Ma) \times n^2$$

$$Fsp = \frac{412}{221+50} \times 4500 - 0.0007 \times (0.09 + 0.413) \times 4000^2$$

$$Fsp = 6841 - 5622 = 1219\ daN$$

Calculation of permissible values:

$$Ma_{zul} = \frac{\frac{C1}{C2+a} \times Fax - Fspz}{0.0007 \times n^2} - C3$$

$$Ma_{zul} = \frac{\frac{412}{221+50} \times (4500 - 2000)}{0.0007 \times 4000^2} - 0.09 = 0.342\ kgm$$

As the permissible moment Ma_{zul} of the special jaw assembly is exceeded, the maximum permissible spindle speed must be calculated from the formula below.

$$n_{zul} = \sqrt{\frac{\frac{C1}{C2+a} \times (Fax - Fspz)}{0.0007 \times Mc}}$$

$$Mc = Ma + C3$$

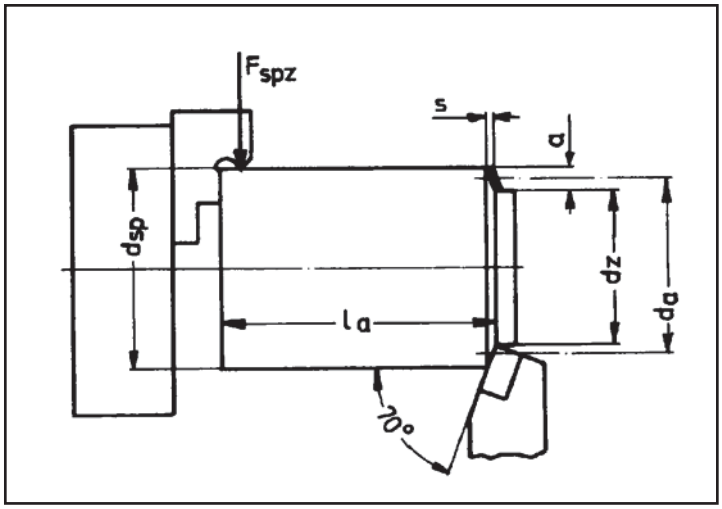
$$Mc = 0.413 + 0.09 = 0.503\ kgm$$

$$n_{zul} = \sqrt{\frac{\frac{412}{221+50} \times (4500 - 2000)}{0.0007 \times 0.503}} = 3281\ RPM$$

The spindle speed must be reduced to 3281 RPM in order to ensure an adequate dynamic gripping force for the machining operation

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

The gripping force required for each application must be determined. If this gripping force cannot be determined within the required guidelines, then the permissible spindle speed or the permissible chip cross-section must be determined.



ex.

A solid steel workpiece (i.e. without bore) is to be machined.

- *Gripping Diameter dsp=60mm*
- *Turning Diameter dz =60mm*

and the cut requires a

- *Tangential Cutting Force Fs=1200daN at*
- *Spindle Speed of 2760 RPM*

Soft jaws turned to the gripping diameter are used to avoid damaging the workpiece. This gives a

- *Gripping Coefficient of sp=0.1*

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

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

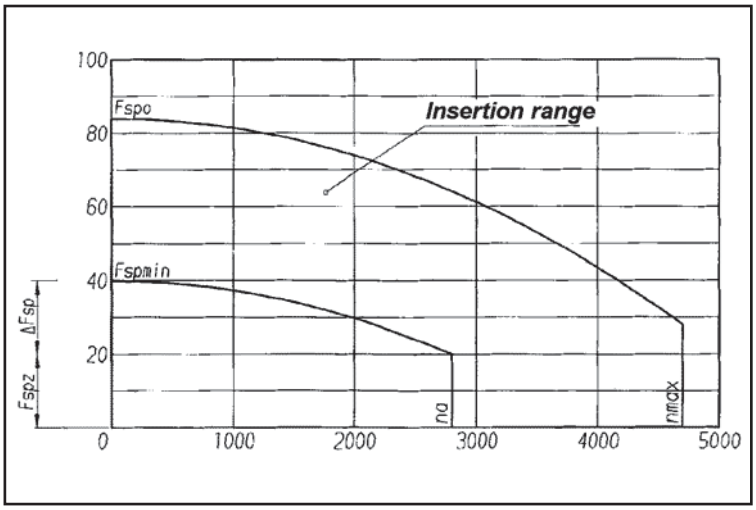
Fspmin=Fspz+ Fsp=2000+2000=4000daN

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 spe-cific cutting force:

Fs = a x s x ks

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

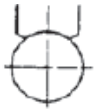
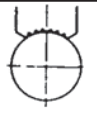
$$Fspz = \frac{Fs \times dz}{\mu sp \times dsp} = \frac{a \times s \times ks \times dz}{\mu sp \times dsp}$$



Where:

la	= Overhang of Workpiece
a	= Depth of Cut
s	= Feed
KS	= Specific Cutting Force
dz	= Machining Diameter
dsp	= Gripping Diameter
µsp	= Gripping Coefficient
Fs	= Tangential (Primary) Cutting Force

The cutting forces increase as the cutting tool becomes dull. An additional safety factor of Sz = 2 is recommended to allow for all uncertainties in the machining process.

Type of Jaws	Workpiece Material	Finish of Gripped Workpiece Surface ▼▼▼	▼▼, ▼	~
 Finishing Jaws	Steel	0.1	0.15	-1)
	Aluminum	0.1	0.14	-
	Brass	0.09	0.14	-
	Cast Iron	0.08	0.12	-
 Block Pattern Jaws	Steel	0.12	0.20	0.32
	Aluminum	0.11	0.19	0.30
	Brass	0.11	0.18	0.27
	Cast Iron	0.10	0.16	0.26

1) Avoid, smooth jaws are only suitable for gripping machined surfaces

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 x dsp.

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

$$Fspz = Sz \times \frac{a \times s \times Ks \times dz}{\mu sp \times dsp} \times (1 + 1.5 \times \frac{la}{dsp})$$

Tilting Factor $(1 + 1.5 \times \frac{la}{dsp})$

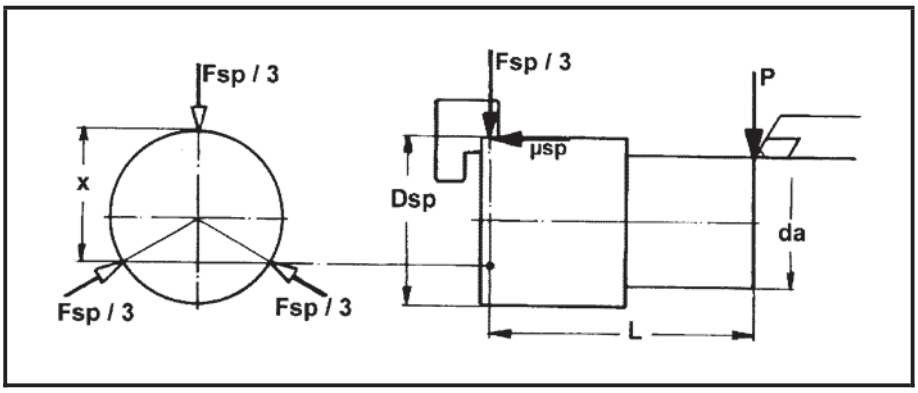
This equation cannot be applied to stepped workpieces whose gripping diameter is appreciably smaller than the machining diameter.

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.

Specific cutting force Ks (N / mm)at feed s and tool cutting edge angle of 70° (source: König and Essel)

Material No.	Material	Tensile strength N / mm	at v= m/min	Feed s (mm)					
				0.16	0.25	0.40	0.63	1.00	1.60
1.0401	C15G	373	100	2482	2189	1918	1687	1481	1298
1.0501	C35G	490	100	2577	2237	1927	1668	1441	1241
1.0532	St50-2	559	100	2561	2248	1959	1716	1499	1307
1.0632	St70-2	824	100	2877	2492	2142	1851	1595	1371
1.0711	9S20	373	100	1609	1553	1497	1444	1393	1342
1.1181	Ck35V	622	100	2574	2266	1982	1741	1527	1335
1.1191	Ck45V	765	100	2524	2253	1999	1781	1584	1405
1.1221	Ck60V	873	100	2548	2296	2058	1851	1662	1490
1.3505	100Cr6G	624	100	2904	2558	2239	1968	1726	1510
1.4113	X6CrMo17G	505	100	2378	2107	1854	1638	1445	1272
1.4305	X12CrNiS18.8	638	350	2596	2192	1835	1545	1296	1085
1.5752	14NiCr14BF	658	100	2249	2012	1790	1598	1424	1266
1.5919	15CrNi6	510	100	2271	2051	1842	1661	1494	1342
1.5920	18CrNi8G	578	100	2360	2095	1847	1636	1446	1276
1.7131	16MnCr5G	510	100	2641	2244	1891	1603	1354	1141
1.7147	20MnCr5G	568	100	2452	2174	1915	1694	1495	1317
1.7225	42CrMo4V	1138	100	2428	2249	2075	1919	1773	1635
1.8515	31CrMo12V	1060	100	2678	2419	2173	1960	1764	1585
1.8519	31CrMoV9V	931	100	2507	2265	2036	1836	1653	1485
3.1354	AlCuMg2	15Hv10	200	953	849	752	668	593	525
--	G-AlMg4SiMn	260	200	829	729	636	558	--	--
3.3561.01	G-AlMg5	75HV10	200	886	797	713	641	574	514
0.6020	GG-20	178HB	200	1687	1444	1227	1047	892	757
0.6030	GG-30	206HB	100	1919	1595	1313	1088	899	740
0.7050	GGG 50	194HB	200	1840	1606	1392	1213	1053	913

6.7 Permissible Overhang Length:



Where:
X = 0.75 Dsp
Fsp = Total Gripping Force
= ∑ Jaw Forces

Simple safety against the workpiece flying out of the chuck from the cutting force component, P, is ensured when the friction force, sp x Fsp / 3, and P are in equilibrium.

1) P x L = sp x Fsp / 3 x X = 0.25 x Fsp x Dsp x sp

Grip force required to prevent tilting out of the chuck:

$$Fsp_1 = P \times \frac{4 \times L}{Dsp \times \mu sp}$$

$$Pmax = Fsp \times \frac{Dsp \times \mu sp}{4 \times L}$$

Grip force required for driving:

$$Fsp_2 = P \times \frac{da}{Dsp \times \mu sp}$$

Grip force required:

$$Fsp = S \times \frac{P}{\mu sp} \times \frac{(da + 4 \times L)}{Dsp}$$

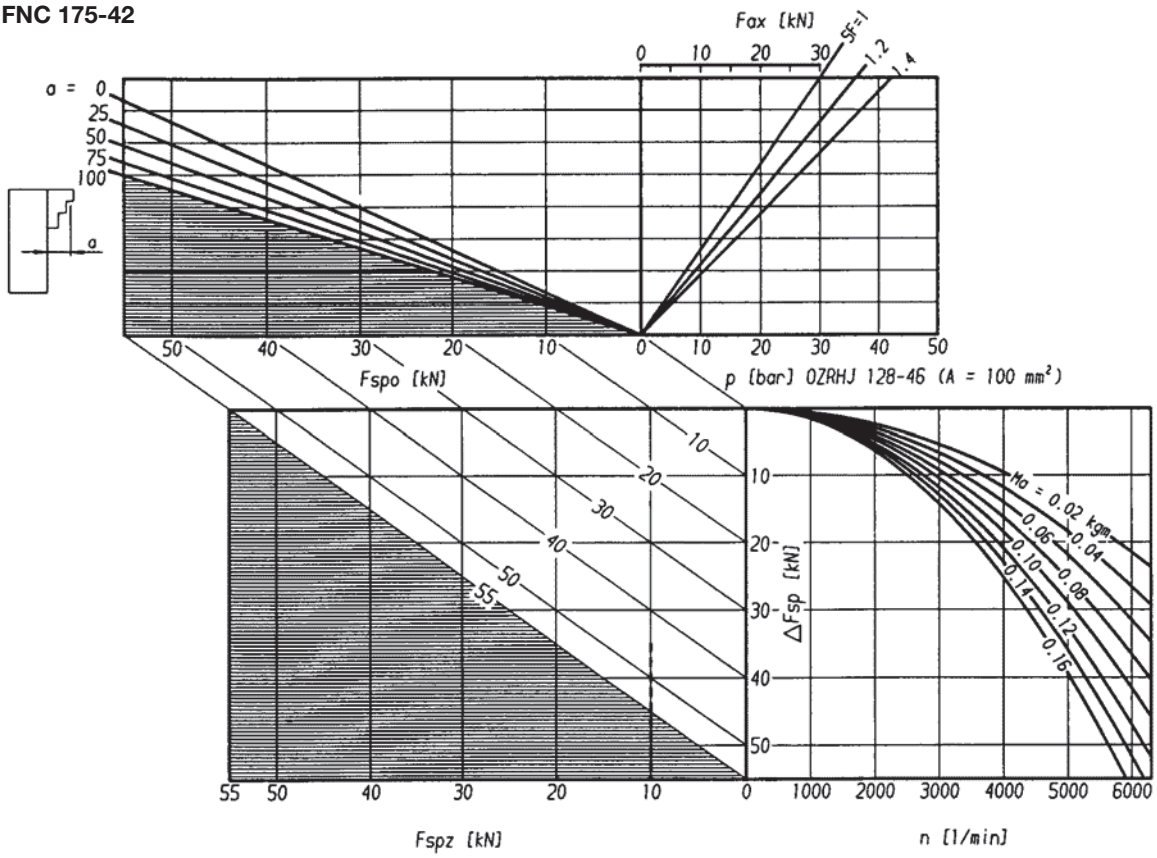
S = Safety factor

Permissible overhang length with given grip force:

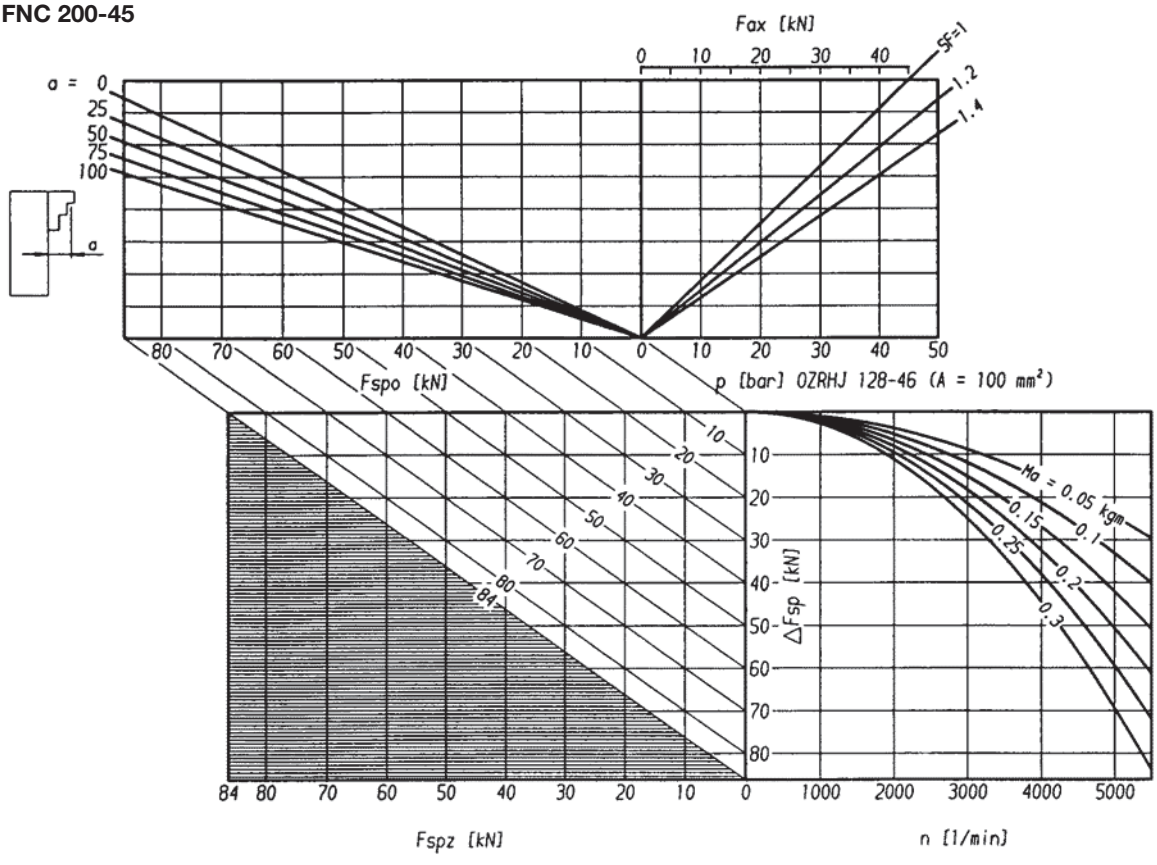
$$L = 0.25 \times (Dsp \times \frac{Fsp \times \mu sp}{P \times S} - da)$$

6.8 Nomograms for Calculation:

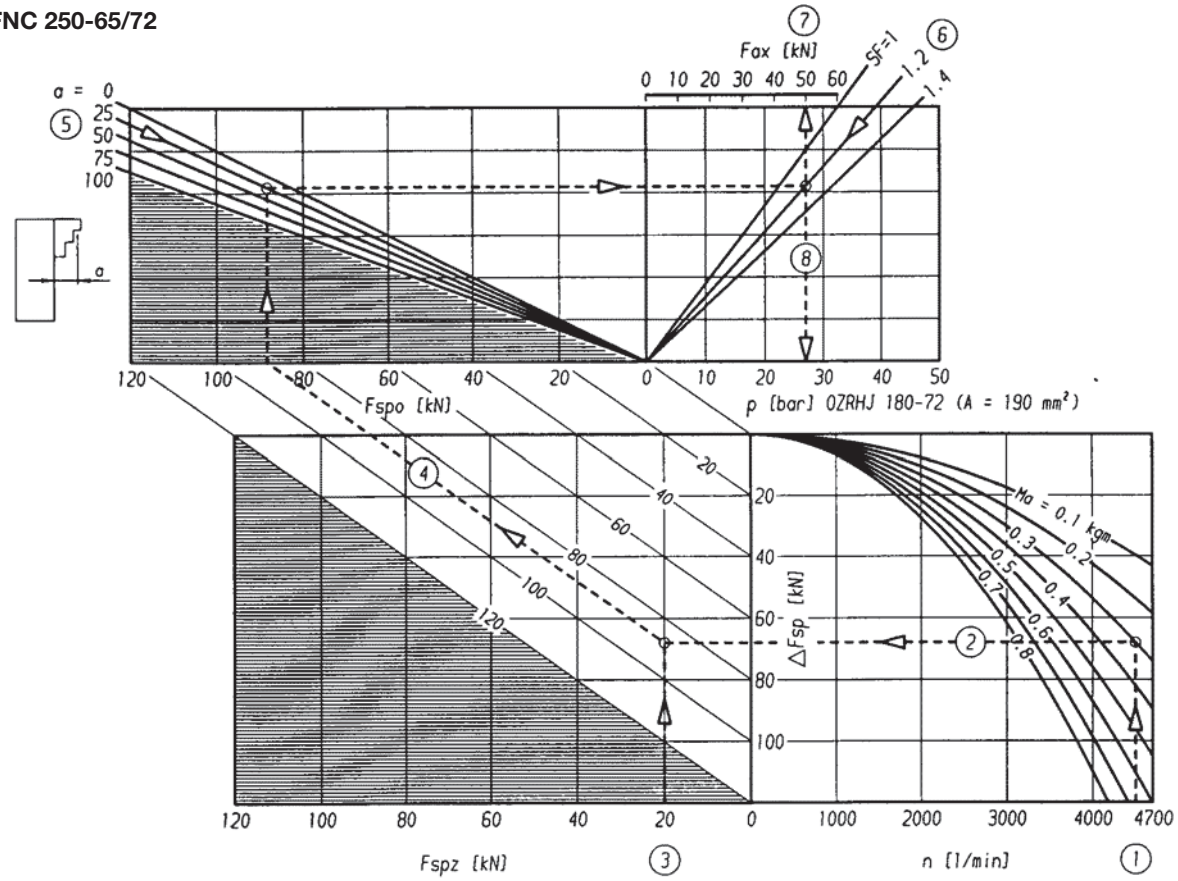
FNC 175-42



FNC 200-45



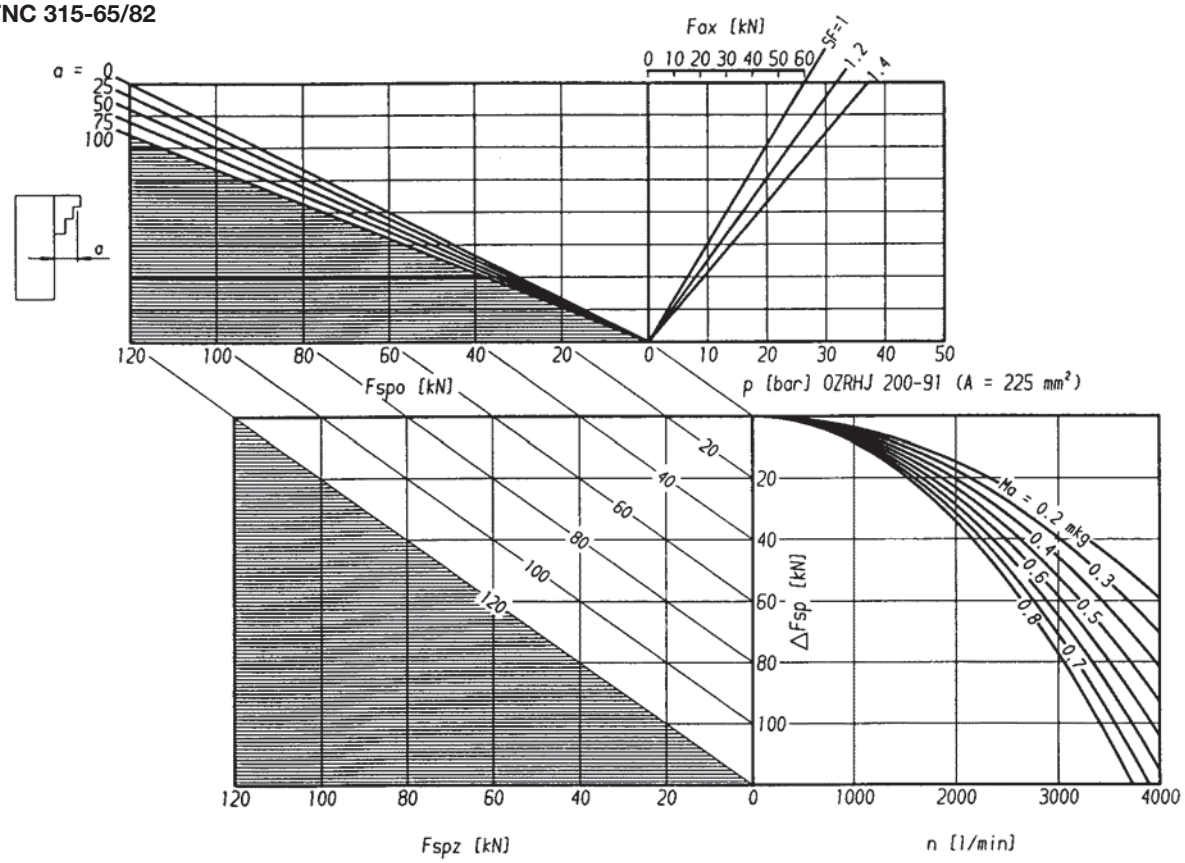
FNC 250-65/72



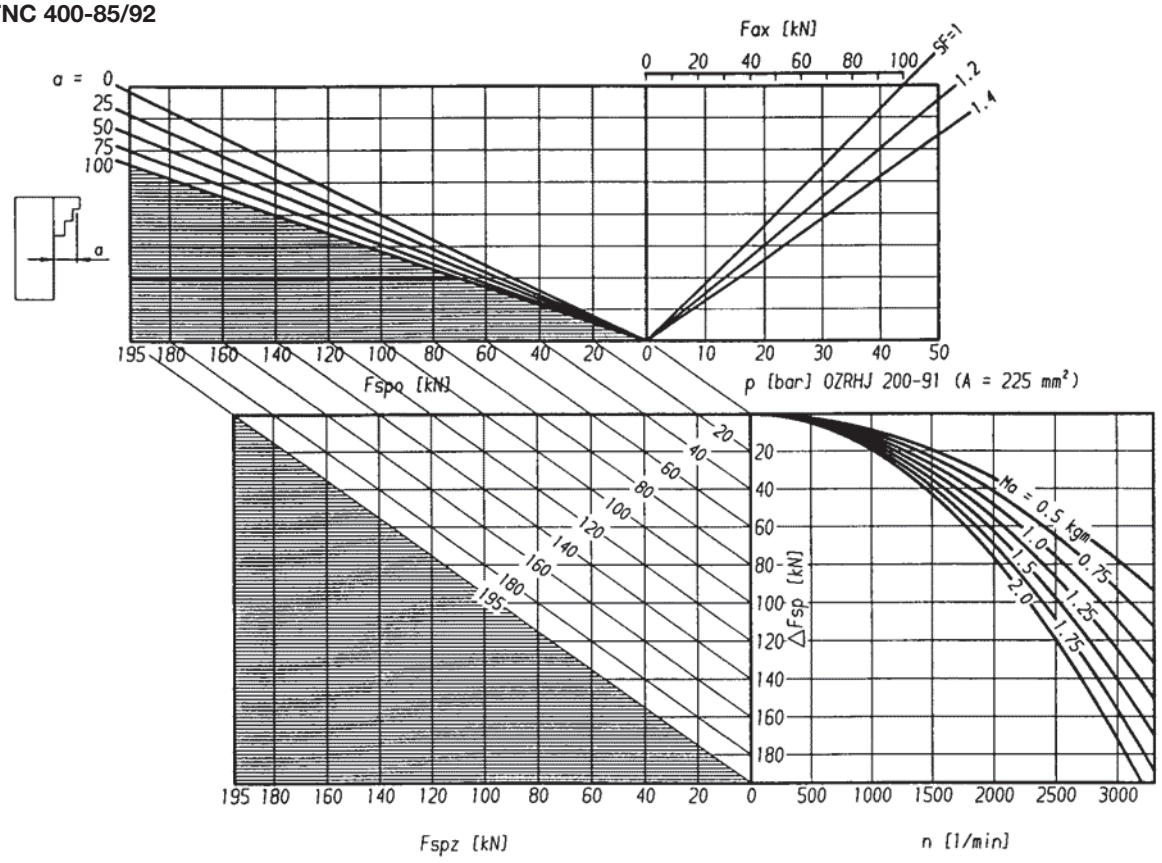
Example:

1.	n	: 4500	RPM	Spindle Speed
2.	Ma	: 0.3	kgm	Moment of jaws about center of chuck
3.	Fspz operation	: 2000	daN	Required residul dynamic gripping force for the machining See also Section 6.4
4.	Fspo	: 8800	daN	Static Gripping Force (n = 0)
5.	a	: 25	mm	Jaw Overhang
6.	Sf	: 1.2		Lubrication factor Sf = 1.0 lubrication in good condition Sf = 1.2 lubrication in medium condition Sf = 1.4 lubrication in bad condition
7.	Fax	: 5000	daN	Actuating Force
8.	p	: 28	bar	Cylinder Pressure

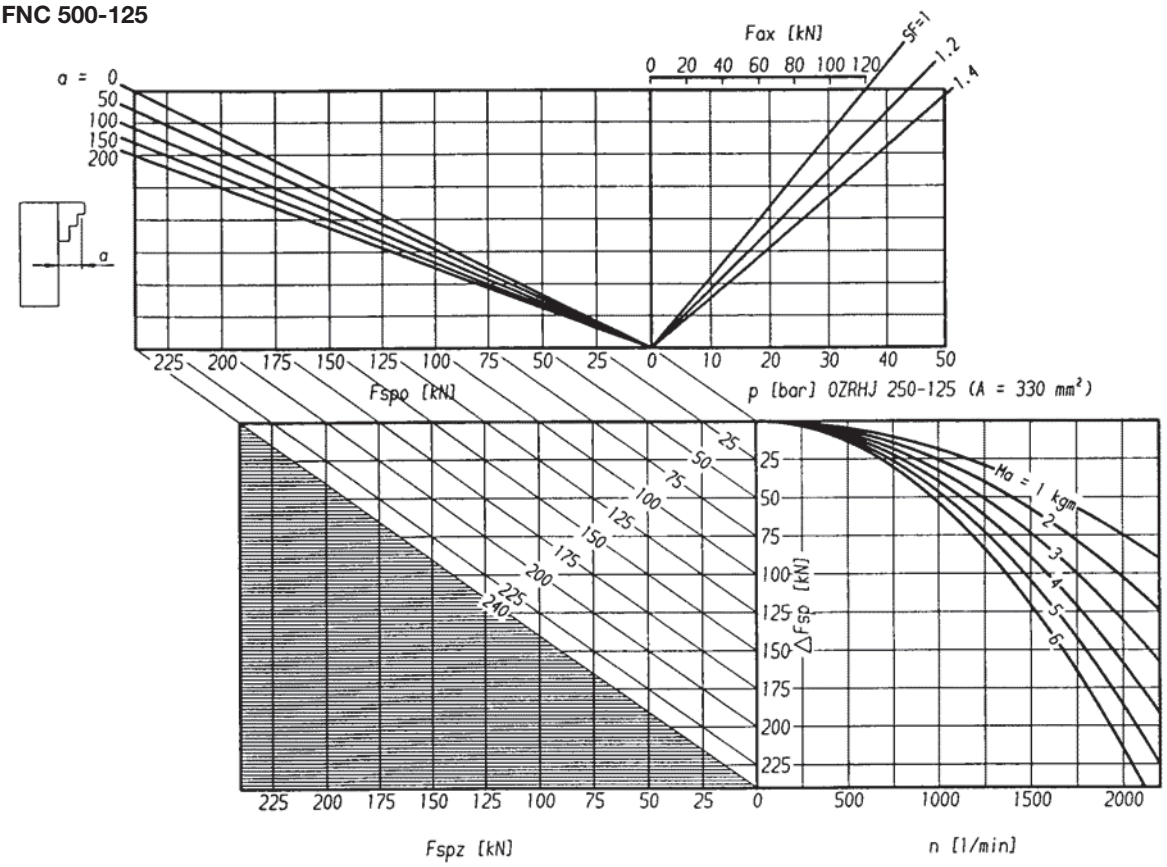
FNC 315-65/82



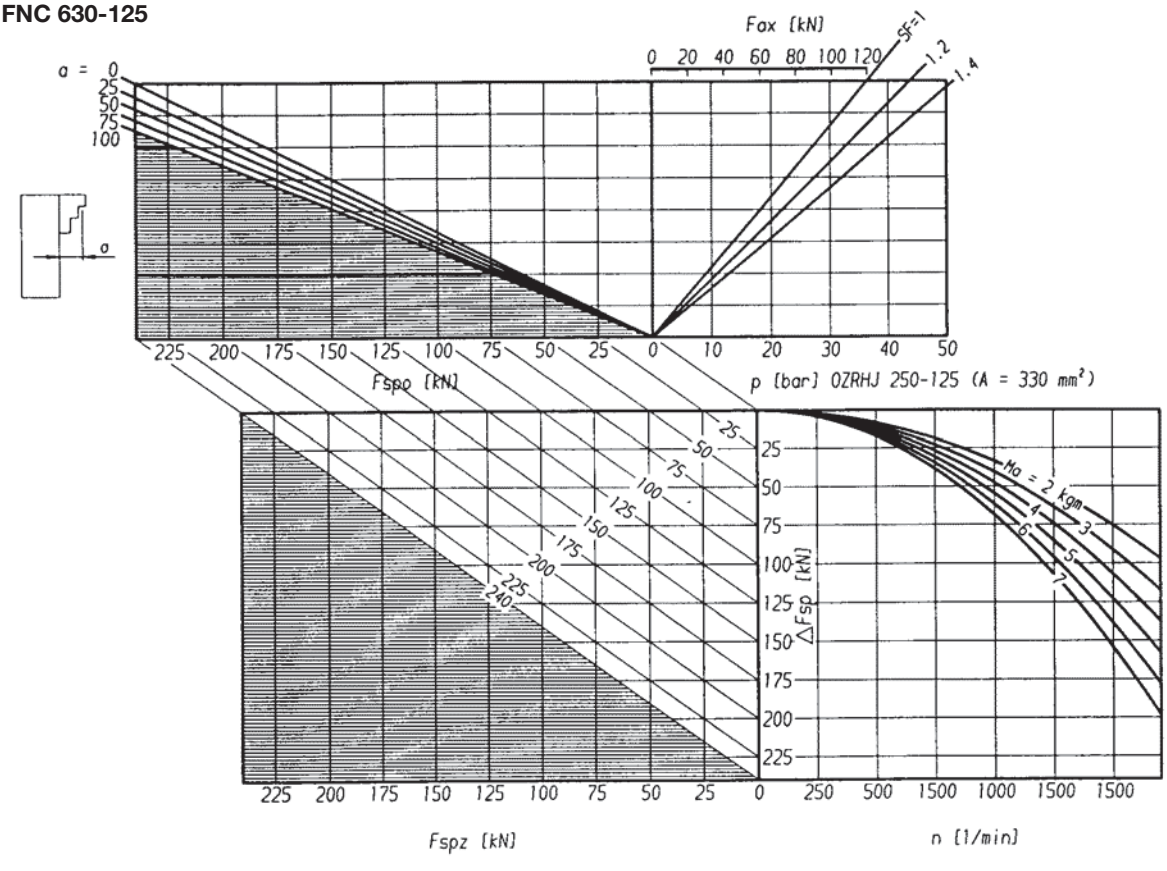
FNC 400-85/92



FNC 500-125

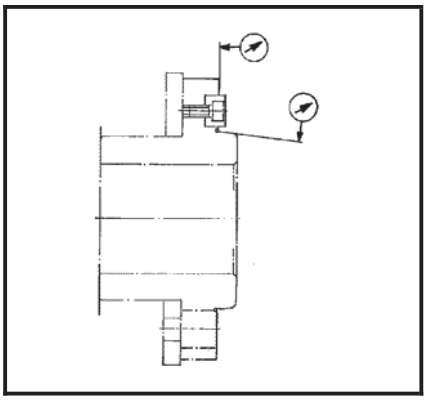


FNC 630-125



7.1 Work to be Perfomed Prior to Chuck Mounting:

7.1.1 Check Spindle Nose:



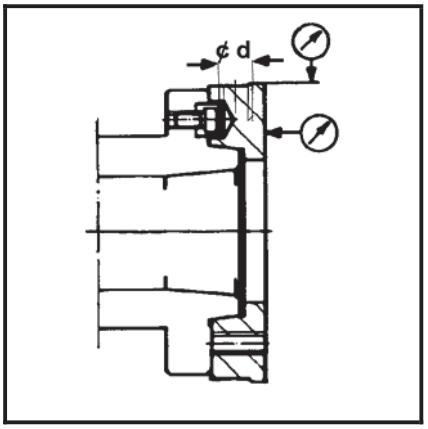
The mounting surfaces of the spindle nose must be checked with a dial gauge to ensure that high accuracy in radial run-out of the power chuck is achieved.

Radial run-out of register: **max. 0.005 mm**

Axial run-out of locating face: **max. 0.005 mm**

The flatness of the face must be checked with a straight-edge and must be clean with all holes deburred.

7.1.2 Checking Mounting Flange



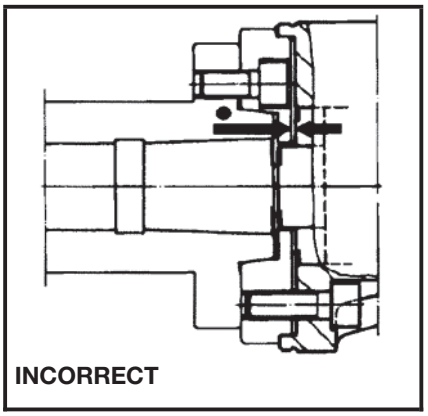
The power chuck has a central register. An appropriate mounting flange (see also Section 5.6.1) is attached to the spindle nose for direct mounting of the power chuck.

If the adapter flange is manufactured by the user, it must be finish-turned on the machine spindle and balanced before the power chuck is mounted.

After fitting of the mounting flange, the radial and axial run-out must be checked as described above.

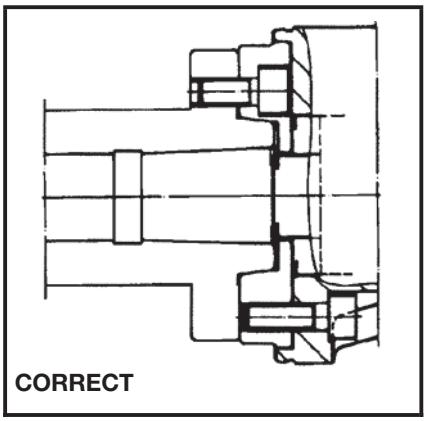
Check the flatness of the face with a straightedge. The tapped holes for the mounting bolts must be counter-sunk, so that the thread is not stripped. The mounting surface for the power chuck must not be concave or convex.

The flange must be in contact over the whole surface.



Do not allow the outer rim of the power chuck to rest on the mounting flange.

The outer diameter of the mounting flange must be relieved so that it is approximately 1 mm less than the register diameter for the power chuck.
Threaded bores must be drilled in the mounting flange for attachment of balancing weights which, depending on the size of the chuck, should be between M8 and M16 with a max thread depth of 2d. See Figures to the right.



7.1.3 Fitting and Alignment of the Draw Tube:

The actuating cylinder and the power chuck are connected by a draw tube in the case of partial open center chucking with an open center chuck, for example for bar work. Particular attention has to be paid to the following points when fitting a draw tube:

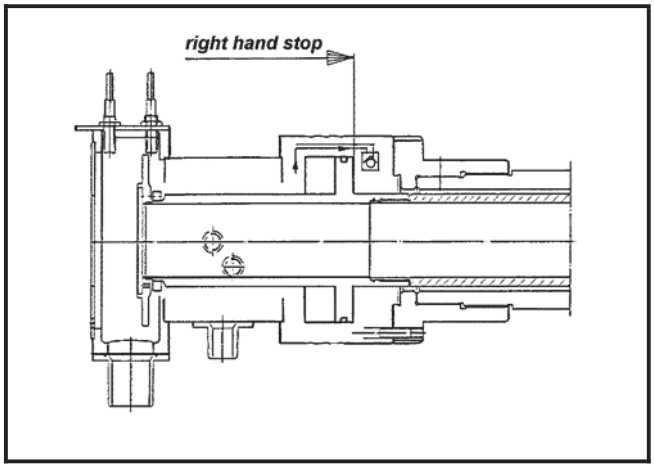
- The draw tube dimensions have to be adequate for the loads imposed.
- Manufacture the draw tube from a material with a tensile strength of at least 45kp / mm², e.g. St 35 BK.
- The draw tube must be turned all over to avoid imbalance.
- The draw tube must be ***balanced dynamically*** in two planes, so that the residual imbalance in each plane is not equivalent to more than a mass of ***5g*** at the outer diameter.

CAUTION

Make sure that the draw tube is in alignment. The draw tube is in alignment when both threads are concentric.

Skews threads are not permissible.

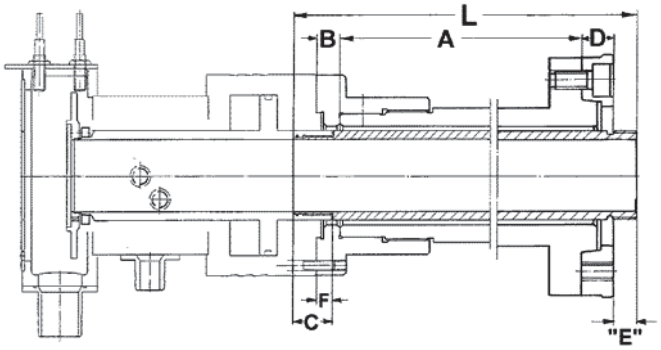
The extreme r.h. position of the chuck piston must always be determined by the actuating cylinder and not by the power chuck itself. The piston of the actuating cylinder therefore must be moved into the extreme r.h. position before mounting the power chuck.



A : Draw Tube for Open Center Chucking

Screw the draw tube into the thread of the actuating cylinder. The length of the draw tube must be arranged so that the setting dimension **E** is obtained in the position shown.

Secure the draw tube in the piston rod of the actuating cylinder with ***Loctite 242.***



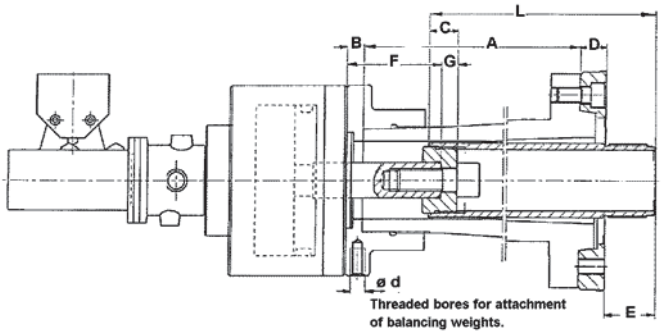
Draw Tube Length L = A + B + C + D +E - F

B : Draw Tube For Partial Open Center Chucking

Bolt an adapter with mounting recess to the end of the actuating cylinder piston rod and screw the draw tube into the thread of the adaptor.

The length of the draw tube has to be arranged so that the setting dimen-sion **" E "** is obtained in the position shown.

Secure the draw tube on the adapter by means of ***Loctite 290.***



Draw Tube Length L = A + B + C + D + E - (F + G)

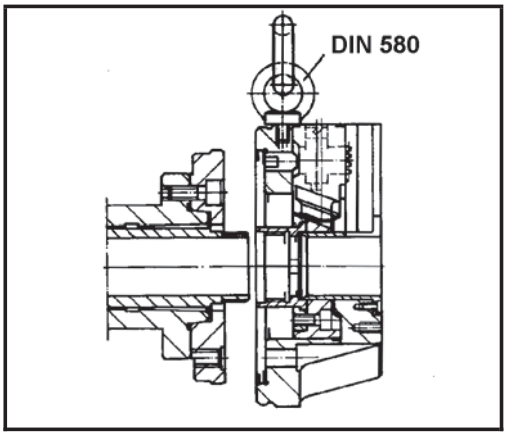
Chuck Size	175-42	200-45	250-65	250-72	315-65	315-82	400-85	400-92	500-125	630-125
Setting dimensions E - 0.3 mm	16	16	22	22	22	22	22	22	22	22

7.1.4 Balancing of Rotating Parts:

The high spindle speeds necessitate accurate balancing of the rotating parts. An imbalance in the chuck body will cause free centrifugal forces when the spindle rotates; these centrifigal forces can 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 spindle speed, the demands on the precision of balancing increase with increasing speed of the parts. For this reason, the lathe spindle, the actuating cylinder, the power chuck, the cylinder flange, the chuck mounting flange or adapter plate and the draw tube must be balanced.
The power chuck is balanced dynamically, whereby any imbalance is corrected by screwing balancing weights into the chuck body and the balance quality, Q = 2.5, in accordance with VDI 2060 is observed.
Cylinder flanges, chuck mounting flanges, drawtube if supplied by FORKARDT are also balanced.
The actuating cylinder is balanced dynamically in two planes, whereby any imbalance is corrected by threading balancing weights into the cover and the cylinder body of the actuating cylinder and the balance quality, Q =2.5, in accordance with VDI 2060 is observed.

7.2 Mounting of the Power Chuck:

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



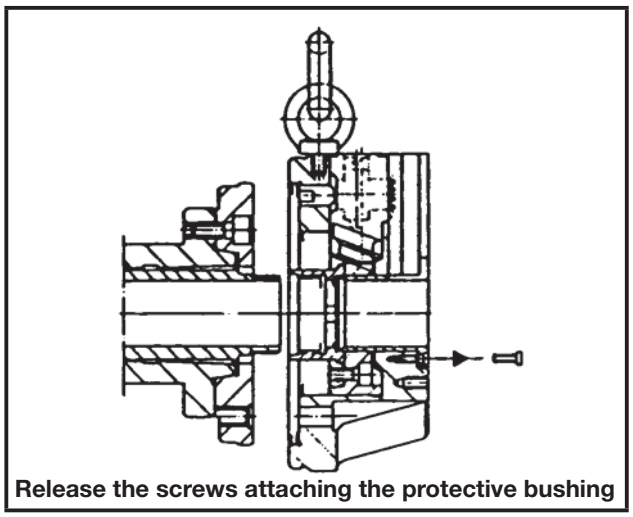
Screw an eyebolt into the tapped hole on the circumference of the chuck and lift the chuck to the height of the spindle nose by means of a hook and a hoist.

CAUTION

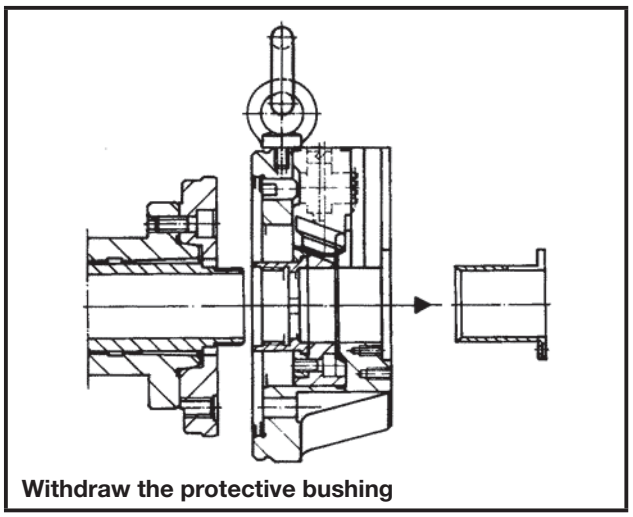
To sling the chuck, only use an eyebolt screwed into the tapped hole on the edge of the chuck.

See Figure to the Left

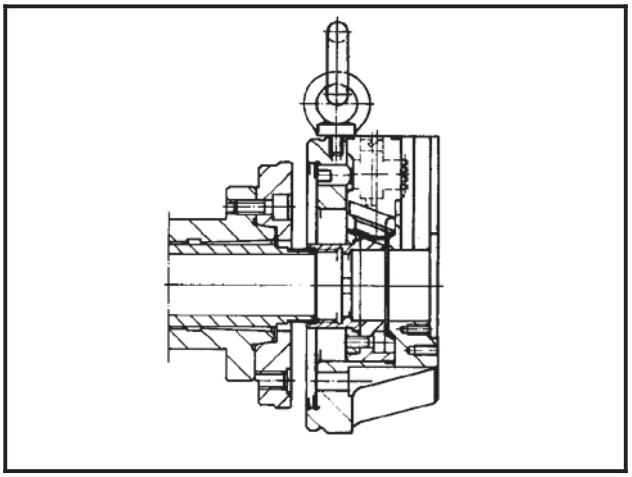
If a mobile hoist which can be moved in all directions is available for mounting the power chuck, observe the following points: The working load of the hoist must be at least the weight of the power chuck. For weights of the power chucks, see Section 1.4, page 4.



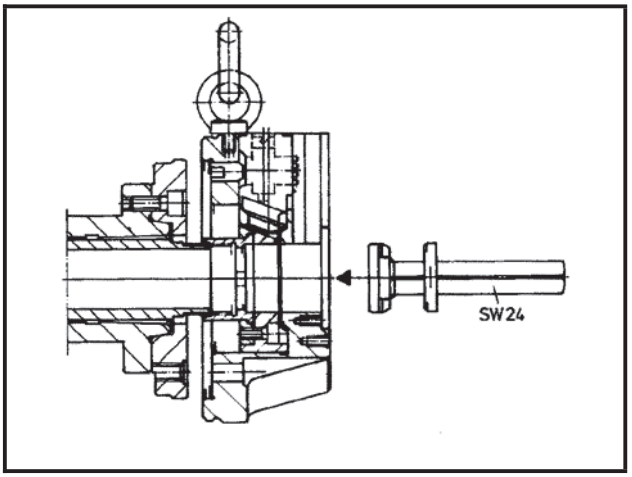
Release the screws attaching the protective bushing



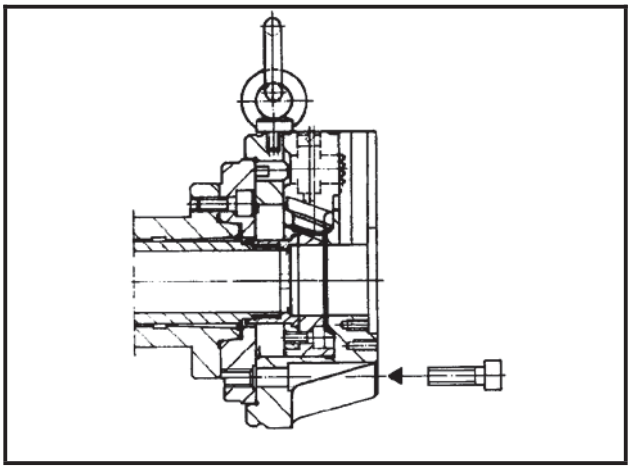
Withdraw the protective bushing



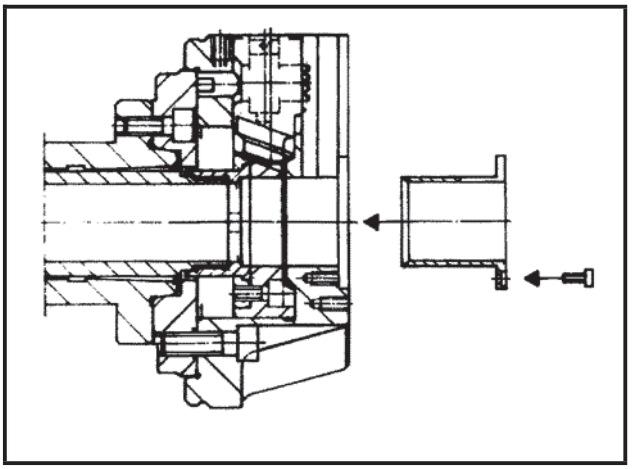
Mount the chuck centrally on the mounting flange.



Use the wrench provided to screw the draw tube connector onto the draw tube until the draw tube is tight against the bottom of the draw tube connector.



Attach the power chuck to the mounting flange by means of the mounting bolts tightened with a torque wrench.



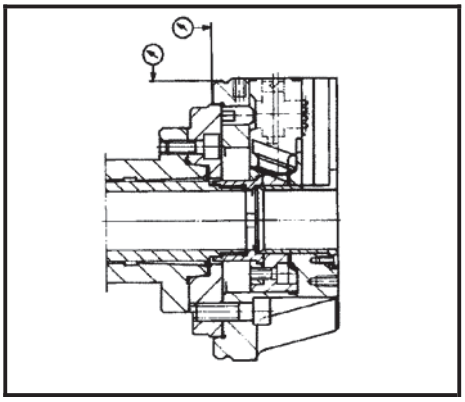
Insert and attach the protective bushing.

7.2.1 Chuck Mounting Bolt Tightening Torque

Bolts to DIN 912		Grade 10.9				Manufactured to DIN 267				
Thread		M4	M5	M6	M8	M10	M12	M16	M20	M24
Tightening Torque	Nm	4.4	8.7	15	36	72	125	200	400	500
Max. Bolt Load	N	5800	9400	13200	24300	38700	56500	69100	108900	115000

Bolts to DIN 912	Grade 8.8	Manufactured to DIN 267			
Thread		M6	M8	M10	M12
Tightening Torque	Nm	10	25	49	85
Max. Bolt Load	N	9000	16400	26000	37800

After mounting the complete power chuck system, check for imbalance and compensate any remaining imbalance by screwing in corresponding threaded studs to DIN 914 on the cylinder side into thread d of the cylinder flange. The thread on the cylinder body of the actuating cylinder or on the body of the power chuck must not be used for this purpose as the exact dynamic balancing of the actuating cylinder or power chuck will be lost.



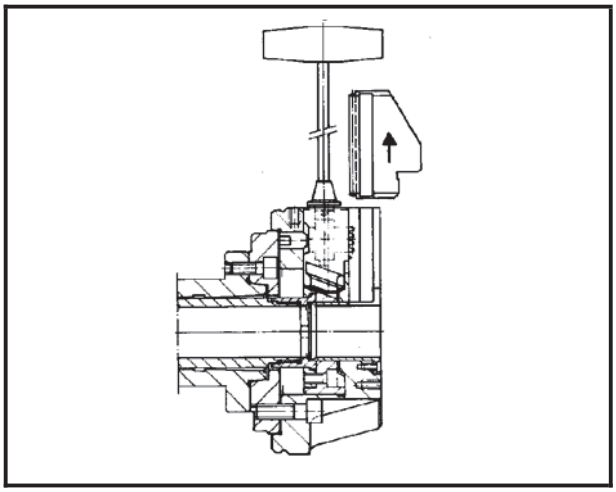
Check the proper mounting using a dial gauge on the test faces of the power chuck.

Radial run-out : max. 0.01 mm (guide value)
Axial run-out : max. 0.01 mm (guide value)

The chuck body may be distorted if the chuck without gripping jaws does not operate freely. In that case, remove the chuck from the spindle of the machine and check the flatness of the chuck mounting flange and the diameter of the taper register.

7.3 Mounting of the Top Jaws:

To install the gripping jaws, the serrated engaging plunger must be disengaged axially from the transmission jaw by pressing the eccentric locking pin with the special chuck key and turning it anti-clockwise. Move the gripping jaws in the guides of the chuck body. Care must be taken that the gripping jaws have engaged.
Gripping jaws are locked by turning the chuck key clockwise and the chuck key is released thereby.



Gripping jaws can only be locked and unlocked when the power chuck has been opened and
- ***with the chuck piston in the foremost position and***
- ***with the actuating cylinder piston in the extreme right hand position.***

Unlock chuck jaws only with the special chuck key. Do not use any other devices.

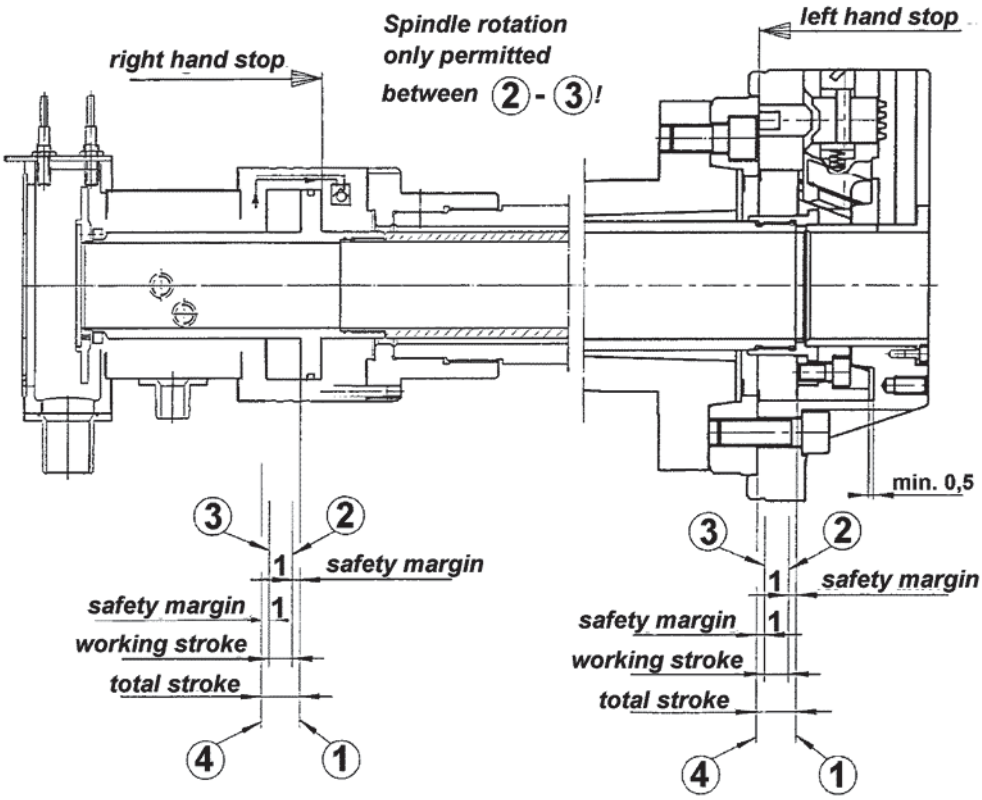
7.4 Preparations for Use of the Power Chuck:

After the chuck has been mounted but before it is used, the following steps must be taken to ensure trouble-free operation:
- Clean everything from the machine that does not belong to it, such as tools for mounting the chuck.
- Grease the power chuck at the grease nipples (AM 8 x 1, DIN 71412) on the front face of the chuck, 5 strokes of the grease gun are sufficient.
- Thoroughly remove any excess grease which may be pressed out of the jaw guides
- Carry out a no-load operating cycle (without workpiece) of the chuck to distribute the grease.
- Check all visible screws and bolts for tightness
- Check the movement of the jaws.

7.5 Safety Instructions:

Safety regulations specify that not only a ***pressure monitor*** but also a ***stroke monitor*** is provided for the actuating cylinder. The stroke monitor must ensure that spindle and feed drives cannot be started, or are necessarily stopped, if the power chuck has been opened or the actuating cylinder has reached the end of its stroke.

- ***Use limit switches to VDE 0113 / 12 with mechanically operated positive-acting NC contacts to monitor the actuating cylinder stroke. If other control elements, e.g. proximity limit switches, are used instead of the safety limit switches, the same degree of safety must be assured.***



- ***Use a s a f e t y m a r g i n of one (1) mm. in each direction when setting the limit switch actuators to the permissible stroke. Stroke of the chuck piston of the power chuck see Section 1.4, page 4.***
- ***Check the proper function of the electric stroke monitor on the actuating cylinder. The limit switches must be reliably tripped before the corresponding end positions are reached.***
- ***Do not allow the machine spindle to start when the power chuck is completely open or completely closed - this will make the safety limit switches stop the lathe in the extreme positions.***
- ***Test the entire control system.***
- ***Check the operation of the associated equipment (e.g. the pressure reducing valve with integral pressure monitor).***
- ***Make sure that the guards and their interlocks are safe. The purpose of the inter- locks is that the machine spindle is stopped in the event of pressure failure.***

8.1 Instructions:

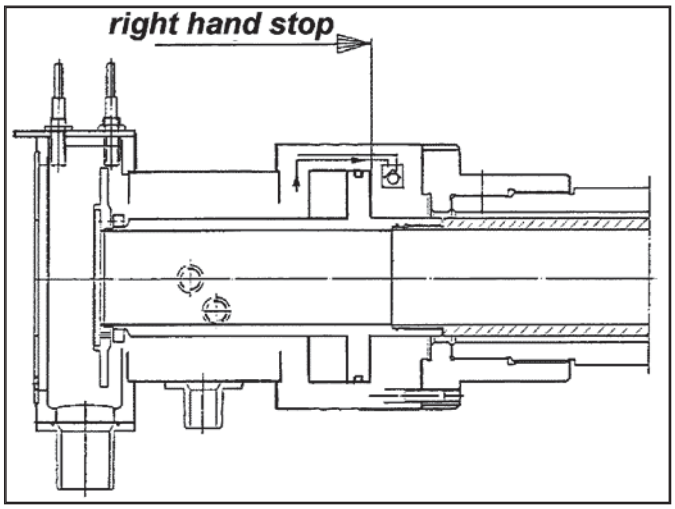
The initial period of use has a marked effect on the satisfactory performance of the power chuck. The mounting of the power chuck should be checked at this stage.

- Fit gripping jaws concentrically and engage them with the transmission jaws, using the special chuck key.
- When mounting the transmission jaws, observe the marks 1, 2, 3 on the chuck body (guides) and on the transmission jaws.

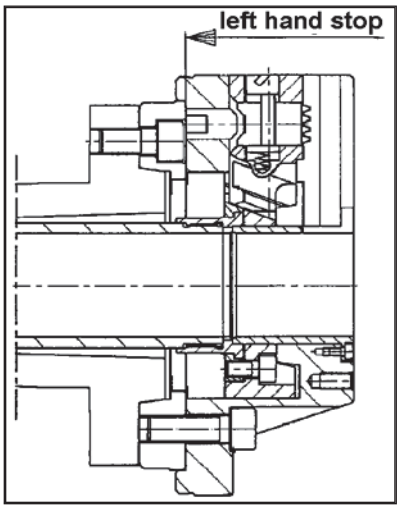
Fit transmission jaw 1 in the corresponding guide 1, etc. of the power chuck.

Do not overload the power chuck. Set the pressure at the actuating cylinder so that the maximum permissible actuating force specified in Section 1.2 is not exceeded.

- The power chuck must open and close at approx. 1/10 of the permissible actuating force.
- If the power chuck does not operate freely, distortet transmission jaws may be the cause.
- remove gripping jaws and check the serrations of the engaging plunger.
- If the power chuck binds without top jaws, the chuck body may be strained. Check the flatness of the chuck mounting flange.
- Check the jaw movement and chuck piston stroke. Jaw movement and chuck piston stroke, see section 1.4.
- Measure the gripping force,Fspo, with a static gripping force measuring device, e.g. SKM 1200/ 1500, and compare with the value specified in the table, see section 1.4.



The stop of the cylinder piston is on the right, always in the actuating cylinder - not in the power chuck.



The extent of movement of the chuck piston towards the left must be limited by the chuck body or its mounting flange.

8.2 Operation:

Do not start the machine spindle until the actuating cylinder has built up sufficient pressure and the workpiece has been gripped within the permissible working range.

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

Make sure to fit safety devices and close safety guard.

- ***Machine workpieces at high spindle speeds only under the protection of an adequately dimensioned safety guard.***
- ***Make sure to fit safety devices and close safety guard.***

Operation of the power chuck must always comply with the local safety and accident prevention regulations. Reference is expressly made to the specific accident prevention regulations of the local industrial safety authority.

- ***Listen for any abnormal noises whilst the chuck is running.***
- ***Check sample workpieces.***

The precision of the power 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.

In the event of system imbalance at the actuating cylinder or power chuck, eliminate the imbalance immediately.

8.3 Safety Instructions:

- ***The operating gripping force must be measured with the power chuck rotating using a dynamic gripping force measuring device. See also Section 6.3.***
- ***Measure the dynamic gripping force after every tool change and ensure that the gripping force is sufficient for the intended machining operation. See also Section 6.2.***
- ***In the event of a loss of chucking power, stop the machining operation and the machine spindle immediately.***
- ***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 as the chuck releases the workpiece after the power chucking system has been switched off.***

8.4 Procedure in the Event of Malfunctions:

Irrespective of the instructions given below, the power 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 following table lists the symtoms, causes and the measures to be taken into the event of any malfunctions of the power chuck. We can not guarantee for the exhaustiveness of this list due to wide range of influencing factors (level of knowledge of the operating personnel, etc.).

8.5 Troubleshooting

Symptom	Cause	Remedial Action
Severe vibration of the machine	Out-of-balance forces due to the mounting flange or cylinder flange and possibly the chuck or the actuating cylinder due to incorrect mounting	Check run-out on the reference surfaces of the power chuck Correct imbalance on power chuck or actuating cylinder immediately. Rebalance mounting flange or cylinder flange, if necessary Readjust spindle bearings
Inadequate gripping force	Soiling Inadequate lubrication	Clean power chuck Check lubrication. If lubrication is not sufficient, dismantle, clean and lubricate the power chuck.
Full movement of the jaws is not attained	Draw tube of wrong length Loose draw tube connector	Check setting dimension „ E ”
No gripping force	Distortion of gripping jaws due to height displacement of cross - tenons	Inspect locating faces Possibly use of jaws from a different manufacturer
Gripping jaw cannot be engaged	Dirt on the serrations of the engaging plunger and the gripping jaws	Clean Possibly difference in pitch with self-manufactured top jaws
Excessive radial run - out using ground gripping jaws	Gripping jaws or possibly transmission jaws fitted in wrong order	Check and interchange if applicable

8.6 Restarting after a Malfunction:

See Section 8.1 and Section 8.2.

8.7 Before Prolonged Disuse:

- ***Move the piston of the actuating cylinder to the right.***
- ***Remove the workpiece from the power chuck.***
- ***Clean and grease the power chuck.***

Do not clean the power chuck with compressed air because chips and coolant may get in the eyes.

- ***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 power chuck. Remove any excess grease which emerges.***
- ***Operate the chuck without gripping a workpiece to distribute the lubricating grease.***
- ***At standstill of the machine spindle, check the static gripping force, Fspo, with a static gripping force meter, e.g. SKM 1200 / 1500.***
- ***Grip a workpiece.***

Otherwise proceed as described in Section 7.3 and Section 8.2.

9.1 Maintenance Instructions:

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

The operational reliability and a long service life of the power chuck depend 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. However, we have provided some basic guidelines below.

Hours of Operation / Frequency	Type of Check / Servicing Instructions
After 24 hours of operation; when new or after reconditioning	Lubricate the power chuck Check tightness of screws and bolts
Weekly	Lubrication of transmission jaws, chuck piston and serrations of engaging plunger
Weekly	Check the Fspo with a gripping force measuring device, e.g. SKM 1200 / 1500
Monthly	Check wedge hook of the chuck piston and the master jaws for wear

Always stop the machine spindle and properly lock out the lathe before maintaining or inspecting the machine. Move the piston of the actuating cylinder to the extreme r.h. position.

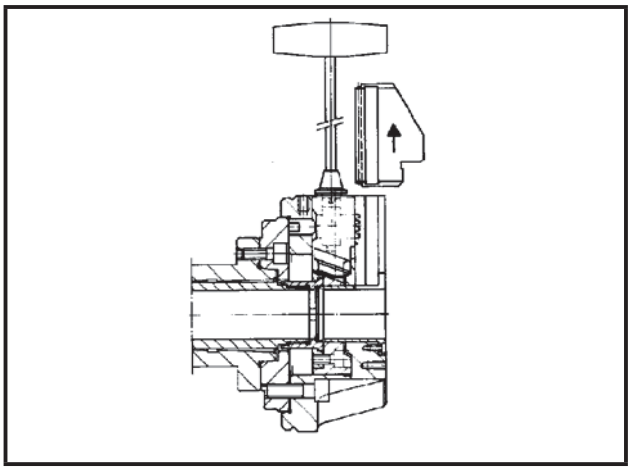
Depressurize hydraulic lines of the hydraulic actuating cylinder.

Follow all lock-out procedures.

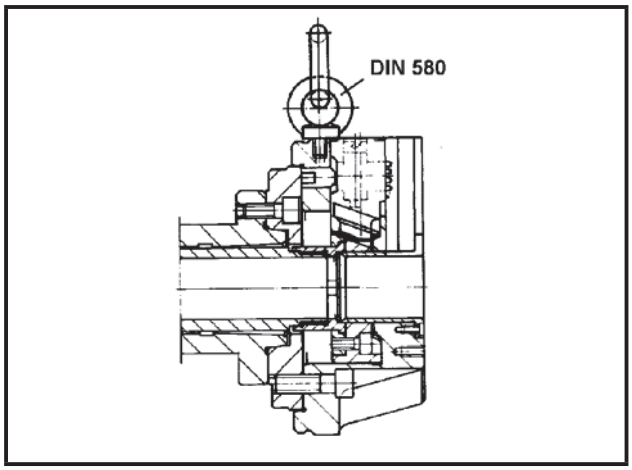
CAUTION

Check the maintenance condition with a static gripping force measuring device, e.g. SKM 1200 / 1500.

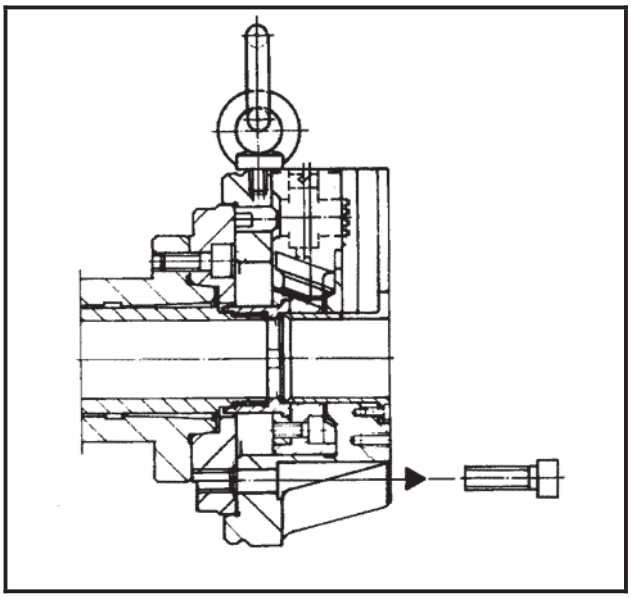
If the static gripping force Fspo of the chuck specified in Section 1.4 and 6.2.1 is no longer achieved even with good lubrication, the power chuck must be removed from the machine spindle and then dismantled, cleaned and greased again.



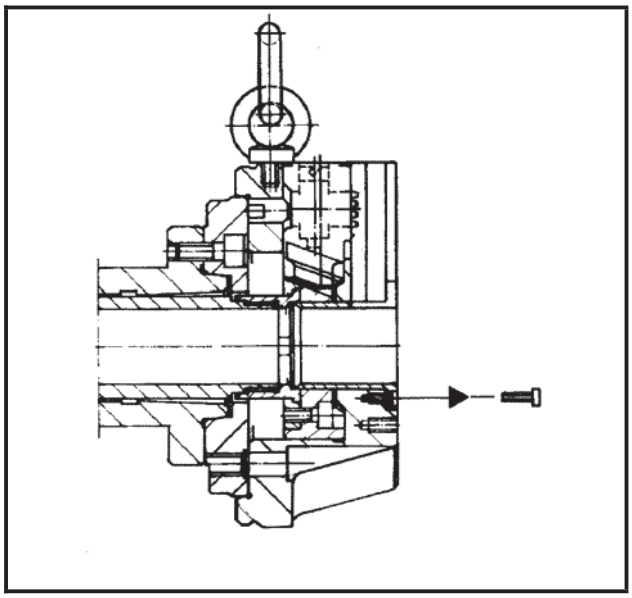
Remove gripping jaws by disengaging them from the transmission jaws.



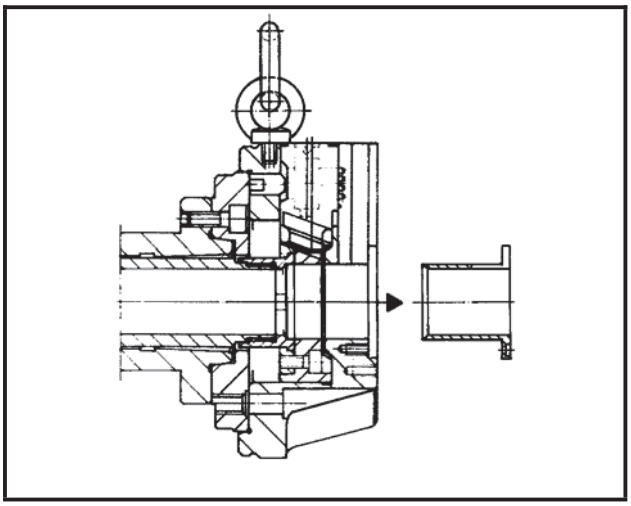
Screw eyebolt into tapped hole on the circumference of the chuck and lift chuck by means of a hook and hoist.



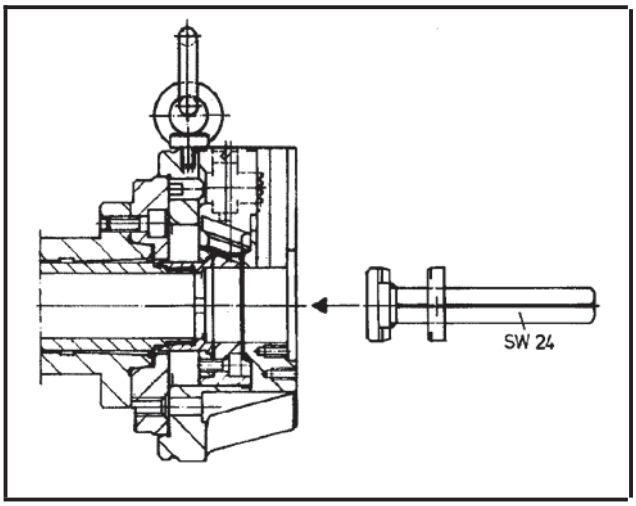
Release chuck mounting bolts (22).



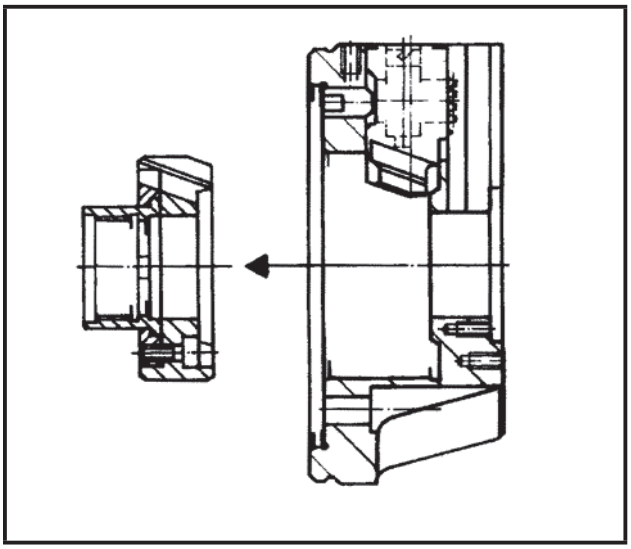
Release screws (24) for attaching the protective bushing.



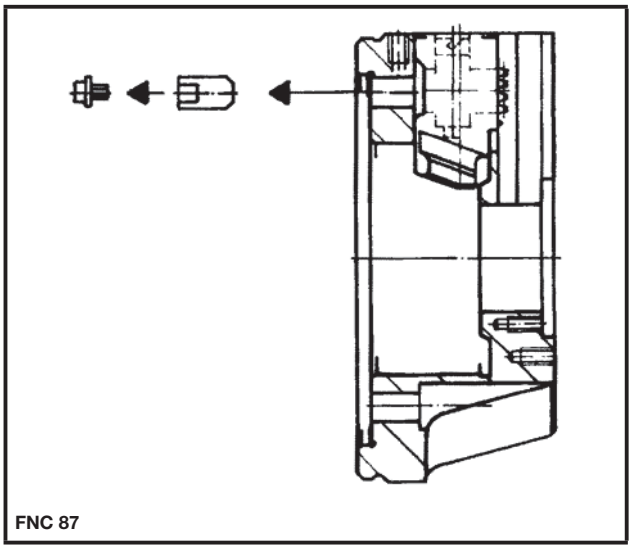
Withdraw protective bushing (5).



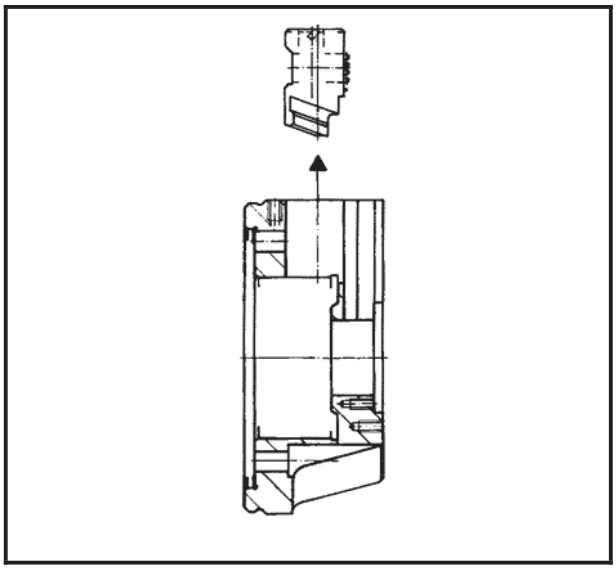
Unscrew the power chuck draw tube connector (6) from the draw tube by means of the included special wrench and withdraw the power chuck from the machine spindle.



Remove the complete chuck piston.

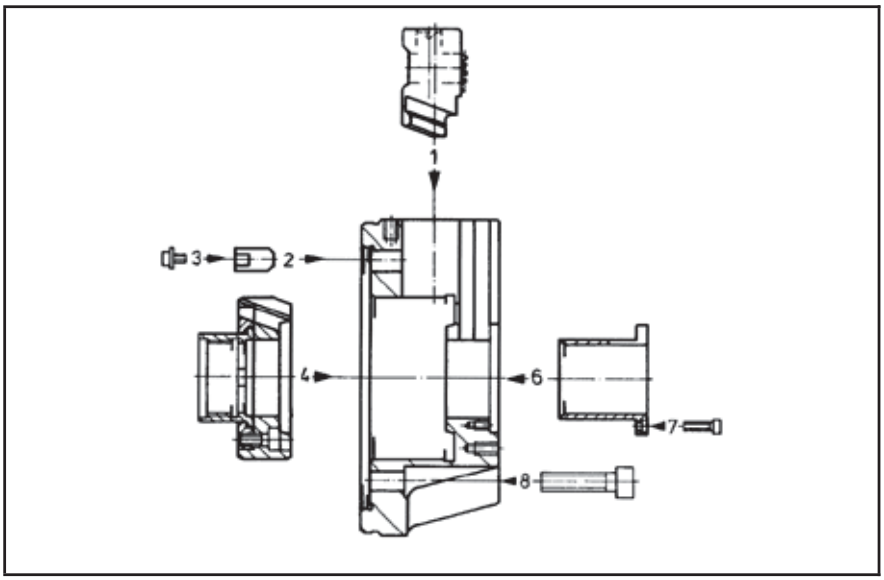


Release screws (25) and remove the safety catches (11).



Remove transmission jaws (3) from the chuck body (1).

Inspect all parts for damage, wash out and clean. Replace any defective parts. Grease chuck piston, transmission jaws, chuck body (at the guides of the chuck piston and the transmission jaws) and the serrations of the engaging plunger with lubricating grease, e.g. PF 6.



Install the individual parts in the chuck body in the sequence indicated.

CAUTION

When installing the transmission jaws, observe the marks on the trans-mission jaws. Install transmission jaw 1 into guide 1 of the power chuck, etc.

CAUTION

Install chuck piston with wedge hook guide 1 in transmission jaw 1, etc.

Install the power chuck on the machine spindle as described in Sections 7.
Tighten the mounting bolts to the torque specified in Section 1.
Put the chuck into operation as described in Section 7 and 8.

9.2 Safety Instructions:

- ***The high spindle speeds customary on modern lathes subject the power chuck to high loads. When tools collide with the 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 chuck for damage.***
- ***Remove the chuck from the spindle and do not continue to work with the chuck.***
- ***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 as noted in the chart below.

Bolts to DIN 912	Grade 10.9	Manufactured to DIN 267		
Thread		M 8 x 1.0	M 12 x 1.5	M 16 x 1.5
Tightening Torque	Nm	28	90	115
Max. Bolt Load	N	26600	60000	116000

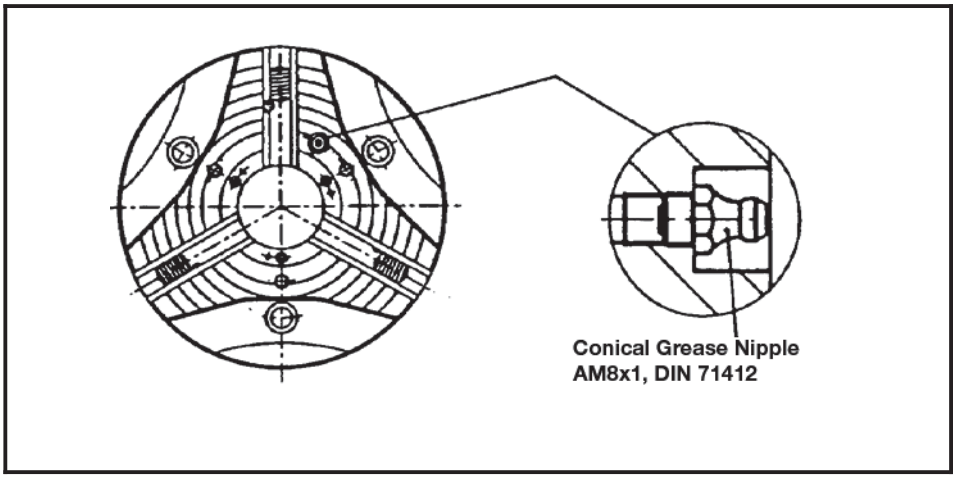
The jaw mounting bolts must be tightened with the torque value indicated in the table above.

9.3 Lubrication:

Foreign matter can penetrate the chuck during machining; scale and foundry dust increase the friction between moving parts and coolant washes away the lubricants. The protective bushing can only delay such contamination. The power chuck therefore must be cleaned and lubricated regularly to achieve consistent gripping forces, accuracy and long service life.

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

Lubrication and all work necessary for the lubrication must be carried out only with the machine spindle at a standstill.



9.3.1 Tightening torques for the chuck mounting bolts:

Bolts to DIN 912		Grade 10.9			Manufactured to DIN 267					
Thread		M4	M5	M6	M8	M10	M12	M16	M20	M24
Tightening Torque	Nm	4.4	8.7	15	36	72	125	200	400	500
Max. Bolt Load	N	5800	9400	13200	24300	38700	56500	69100	108900	115000

Bolts to DIN 912	Grade 8.8	Manufactured to DIN 267			
Thread		M6	M8	M10	M12
Tightening Torque	Nm	10	25	49	85
Max. Bolt Load	N	9000	16400	26000	37800

The chuck mounting bolts must be tightened with the torque values indicated in the table.

9.3.2 Tightening torques for the jaw mounting bolts:

Bolts to DIN 912	Grade 10.9	Manufactured to DIN 267		
Thread		M 8 x 1	M 12 x 1.5	M 16 x 1.5
Tightening Torque	Nm	28	90	115
Max. Bolt Boad	N	26600	60000	116000

The jaw mounting bolts must be tightened with the torque values indicated in the table.

Soiled or poorly lubricated power chucks have a considerably reduced gripping force.

The power chuck must be relubricated when the static gripping force Fspo with the machine spindle at a standstill no longer achieves the values in the table in Section 1

Measure the gripping force with the machine spindle at a standstill using a static gripping force measuring device, e.g. SKM 1200 / 1500, at regular intervals.

- Lubricate the power chuck. Five (5) strokes of the grease gun are sufficient.
- We recommend the following lubricants:
  PF 5 for all the other parts of the power chuck
  PF 6 for the wedge hooks of the master jaws, the chuck piston and the piston guide.
- Store lubricants only in clean, closed containers under dry and cool conditions.

9.4 Reconditioning:

For the first repair we recommend that you call upon Forkardt's service department. Your maintenance personnel then has an opportunity to receive intensive training. Reconditioning or repair by the user requires personnel with considerable experience. It is essential that work is carried out carefully, as it concerns a unit that effects safety. Should you choose to perform the repairs yourself, spare parts should be ordered in accordance with the spare parts lists in Section 10.2.

The lathe must be stopped and properly locked out before any maintenance is carried out on the chuck.

Remove the gripping jaws (top jaws) from the transmission jaws (master jaws) . Extend the piston of the actuating cylinder to the extreme r.h. position.

Release the pressure in the hydraulic pipes and hoses leading to the actuating cylinder.

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 spare and wear parts supplied by the manufacturer in stock.
If screws or bolts are rendered unserviceable during dismantling, they have to be replaced by screws and bolts of the same grade and type.

10.1 Spare Parts:

In order to keep the chuck in running order and to avoid costly down time, it is important to plan ahead to keep spare parts on site.

Please use the spare parts list when ordering spare parts.

For safety reasons and to ensure optimal chuck performance, use only ORIGINAL - FORKARDT spare parts.

The use of parts from other sources on our products relieves Forkardt of 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 Forkardt. Please note that special specifications frequently exist for parts supplied by Forkardt and spare parts always meet the latest technical standards.

The following data should be specified when ordering spare parts:

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

It is absolutely essential to specify the model and serial number from the face of the chuck when ordering spare parts.

10.2 Tools and Accessories:

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

Special Key For Locking And Unlocking The Transmission Jaws										
Chuck Size	175-42	200-54	250-72	250-72	315-65	315-82	400-85	400-92	500-125	630-125
Part Number of Key	15957016	15957016	15942416	15942416	15942416	15942416	15957416	15957416	15957416	15957416

Wrench For Draw Tube Connector In The Chuck Piston										
Chuck Size	175-42	200-54	250-72	250-72	315-65	315-82	400-85	400-92	500-125	630-125
Part Number of Wrench	15278859	15278823	1527882	1527882	1527882	1527883	1527888	15278847	1527889	1527889

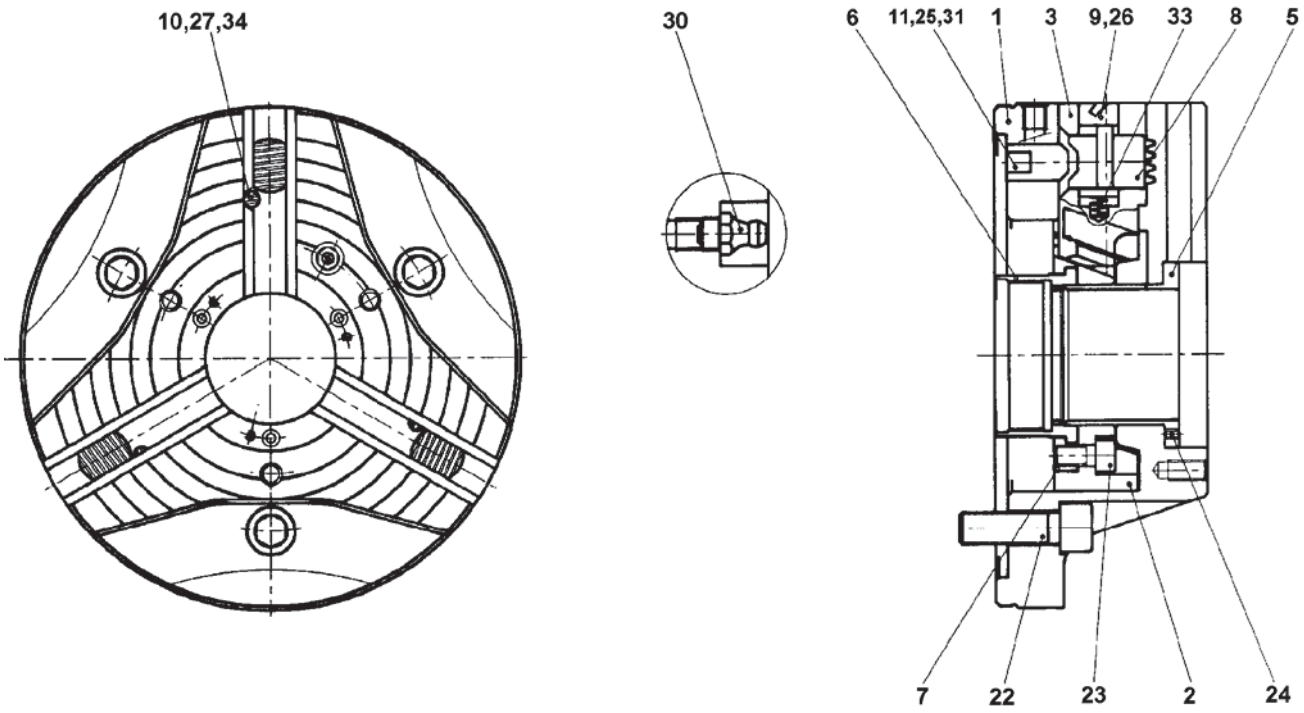
Din 911 Hexagon Key For Socket Head Screws										
Chuck Size	175-42	200-54	250-72	250-72	315-65	315-82	400-85	400-92	500-125	630-125
Key - A / F	3	3	4	4	4	4	4	4	5	5
Key - A / F	8	10	14	14	14	14	17	17	19	19

Lubricating grease PF 5 and PF 6, grease gun, see table below.

Din 580 Eyebolt For Mounting Of Power Chuck										
Chuck Size	175-42	200-54	250-72	250-72	315-65	315-82	400-85	400-92	500-125	630-125
Eyebolt	M8	M10	M12	M12	M12	M12	M16	M16	M16	M20

Designation	Type	Ident. No.	Content of can
Special Grease	PF 5	101400 084	1.0 kg
Special Grease	PF 6	101400 088	1.0 kg
Lever Action Grease Gun	HH 1	101400 121	

10.3 Spare Parts Lists



Qty	Description	Part No.	Chuck Size									
			175-42	200-54	250-65	250-72	315-65	315-82	400-85	400-92	500-125	630-125
1	Chuck Body	1	1595701	1595711	1594241	1594271	1595731	1595721	1595741	1595741	1595771	1595781
1	Chuck Piston	2	1595702	1595712	1594242	1594272	1594242	1595722	1595742	1595752	1595772	1595772
3	Transmission Jaw	3	1595703	1595713	1594243	1594243	1595733	1595723	1595743	1595743	1595773	1595783
1	Protective Bushing	5	1595705	1595715	1594245	1594275	1594245	1595725	1595745	1595755	1595775	1595775
1	Draw Tube Connector	6	1595706	1595716	1594246	1594276	1594246	1595726	1595746	1595756	1595776	1595776
1	Ring	7	1595707	1595717	1594247	1594277	1594247	1595727	1595747	1595757	1595777	1595777
3	Engaging Plunger	8	1595708	1595718	1594248	1594248	1594248	1594248	1595748	1595748	1595778	1595778
3	Eccentric Locking Pin	9	1595709	1595719	1594279	1594279	1595739	1595729	1595749	1595749	1595779	1595789
3	Detent	10	15957010	15957110	15942410	15942410	15942410	15942410	15957410	15957410	15957710	15957710
3	Safety Catch	11	15957011	15957111	15942411	15942411	15942411	15942411	15957411	15957411	15957711	15957811
1	Compression Spring	19	FN 268	FN 268	FN 268	FN 268	FN 268	FN 268	FN 268	FN 268	FN 268	FN 268

Qty	Description	Part No.	Chuck Size									
			175-42	200-54	250-65	250-72	315-65	315-82	400-85	400-92	500-125	630-125
1	Detent Pin	20	FN 256	FN 256	FN 256	FN 256	FN 256	FN 256	FN 256	FN 256	FN 256	FN 256
3	Socket Head Screw DIN 912 10.9	22	M10x80	M12x40	M16x50	M16x100	M16x50	M16x50	M20x60	M20x60	M24x70	M24x130
6	Socket Head Screw DIN 912 8.8	23	M6x16	M8x20	M10x20	M10x20	M10x20	M10x20	M12x30	M12x30	M12x25	M12x25
3	Socket Head Screw DIN 912 10.9	24	M4x8	M4x8	M5x8	M5x8	M5x8	M5x8	M6x12*	M6x12*	M6x15*	M6x12*
3	Socket Head Screw DIN 912 10.9	25	M4x8	M4x8	M5x8	M5x8	M5x8	M5x8	M6x12	M6x12	M6x12	M8x15
3	Pin DIN 6325	26	5m6x15	5m6x16	5m6x18	5m6x18	5m6x18	5m6x18	6m6x22	6m6x22	6m6x26	6m6x26
3	Pin DIN 6325	27	2.5x28	2.5x28	4m6x36	4m6x36	4m6x36	4m6x36	4m6x40	4m6x40	4m6x60	4m6x60
3	Conical Grease Nippel DIN 71412	30	AM8x1	AM8x1	AM8x1	AM8x1	AM8x1	AM8x1	AM8x1	AM8x1	AM8x1	AM8x1
3	Washer DIN 7349	31	4.3	4.3	5.3	5.3	5.3	5.3	6.4	6.4	6.4	8.4
3	Compression Spring	33	1x6.3x14.5	1x6.3x14.5	D-165C	D-165C	D-165C	D-165C	D-180S	D-180S	D-165	D-165
3	Compression Spring	34	0.63x3.2x11	0.63x3.2x11	D-142AC	D-142AC	D-142AC D	D-142AC	D-145C	D-145C	D-145D	D-145D
6	**Socket Head Screw DIN 912 10.9**	**48**	**M8x1.0**	**M8x1.0**	**M12x1.5**	**M12x1.5**	**M12x1.5**	**M12x1.5**	**M12x1.5**	**M12x1.5**	**M16x1.5**	**M16x1.5**

*Socket head screw DIN 7984

MANUFACTURERS DECLARATION

We herewith declare that all items listed hereon are intended to be incorporated onto a machine.
It is essential to ensure that the machine designated to accomodate these products is conform to the European Machine Directive.

Description:	Three Jaw Power Chuck
Type:	FNC
Harmonized Within Standard Specifications:	DIN EN 292 - 1, DIN EN 292 - 2, DIN EN 414, DIN EN 418, DIN EN 457, DIN EN 60 204 -
Specific National Standard & Specifications	Requirement of the Industrial Safety Authority BG Eisen und Metall II, No. GS - EM Nr.I / 2 - 50.

Date / Authorization: **16.04.2008**

..... **(**Manager of Design: Mr. Hildebrandt)

This declaration becomes invalid in case parts of the product are changed or dismantled without our special acceptance.

Manufacturers Declaration No.: FNC E

As we are constantly engaged in improving our products, the dimensions and data given in this manual cannot always correspond to latest design features and are subject to alteration without notice.

FORKARDT®

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First-class
Experienced.

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