

The logo for ZZ ANTRIEBE features the letters 'ZZ' in a bold, blue, sans-serif font. To the right of 'ZZ' is a stylized blue graphic consisting of two curved lines that suggest a gear or a mechanical component. To the right of this graphic, the word 'ANTRIEBE' is written in a blue, sans-serif font, all in uppercase letters.

**ZZ** ANTRIEBE

The text 'Screw Jack Units' is displayed in a white, bold, sans-serif font against a solid blue background. The text is positioned in the lower right corner of the page. The background of the entire page is a close-up photograph of a screw jack unit, showing a large metal screw and a blue plastic housing. The image is partially obscured by a large, semi-transparent white circle that overlaps the logo and the text.

**Screw Jack Units**





**Sales and Delivery Terms:**

Our "General Conditions for the Supply of Gear Units and Drive Elements" shall apply. All dimensions and illustrations are without obligation. We reserve the right to effect changes and modifications to the construction, sizes, weights, technical specifications, etc. without prior notice.

Valid 05/2005.

## Our Production Program



### ZZ Bevel Gear Units

up to 7000 Nm nominal torque  
or 500 kW power. ZZ-Servoline®  
series for high-dynamic drives



### ZZ Screw Jack Units

with trapezoidal or ball screw spindle  
for loading up to 1000 kN



### ZZ Indexing Units

as globoid, cylinder- or radial  
cam gear units with pendular  
or stepping function



### ZZ Spiral Bevel Gears

with - Palloid gear tooth system  
- Cyclo-palloid gear tooth system  
- HPG-S gear tooth system



### ZZ Cams

As - Globoid cams  
- Axial cams  
- Radial cams



### ZZ Special Gear Units

For versatile use in many  
different types of application

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#### 4 Standard Types

Axial movement of the threaded spindle (translatory spindle movement, no rotation of the spindle)

- Basic model (HG)
- Basic model with anti-rotation lock (HV)

Axial movement of the screw-nut (rotating spindle, no translatory spindle movement)

- Screw-nut model (HL)
- Screw-nut model (HLL) with integrated counter bearing (size H210 upwards)

These 4 Standard types are available with options:

- with single trapezoidal thread spindle (multiple trapezoidal thread spindle by request)
- with restricted play between nut and spindle
- with safety nut for basic model and screw-nut model
- with ball groove threaded spindle (by request)

#### 10 Sizes

Gear size	H 5	H 10	H 25	H 50	H 100	H 210	H 350	H 500	H 750	H 1000
Max. loading [kN]	5	10	25	50	100	210	350	500	750	1000
Max. spindle length [mm]	2500	2500	4000	5000	7500	8000	9000	9000	9000	9000
	Longer lengths, by request									

( 1 t ≈ 10 kN, 1 kN ≈ 100 kg )

#### Gear ratio's

Each size is supplied with two gear ratio's as standard:

- 1mm lift for each revolution of the drive shaft
- 0.25 mm lift for each revolution of the drive shaft
- other variations of gear ratio's are available by request.

#### Drive shaft

ZZ lifting spindle drives are supplied with double-ended drive shafts, as standard. Models with single-ended drive shafts are available after presentation of the installation position (p. 39).

#### In-line arrangement of several lifting spindle drives

If more than 2 lifting spindle drives are connected one after the other and driven by one motor, there is a possibility that the worm shaft nearest to the motor will be overloaded, since this shaft must carry the sum of the driving torque of all individual lifting spindles. This form of application requires testing, separately (table, p. 6).

#### Accessories

Various accessories (pp. 46-49) supplement the program:

- End plate, rod-end bearing, yoke, connecting shaft, toe plates, gaiter, protection tube, pillow-block bearing, coupling, additional spindle bearing assemblies, cardan adapter, end switch, counter bearing plate, extension lock, swivel element, swing-nut, corrosion-resistant components, nuts for trapezoidal threads maintenance-free dry running, etc.
- In composite gear systems, suitable bevel gear drives from the ZZ-series program

#### Service life / Durability

The loading values given in the performance tables, are based on a service life (real running time), of at least 800 operating hours with proper operation and correct maintenance.

#### Custom-made models

Special customised lifting spindle drives can also be designed and manufactured for special applications.

### Advantages of ZZ lifting spindle drives

- Practice-oriented gear construction
- Suitable for pressure and tensile loads
- High accuracy of repeatability
- Proven construction with long service life and a minimum of wear
- Minimum backlash (play) due to the high quality of individual components
- Gears can be used for grease and oil lubrication (size H25 upwards)
- Cube-shaped housing for a variety of screw-fittings and add-on possibilities
- Synchronous movement with several gears
- Minimum maintenance requirement
- Extensive range of accessories
- Combination with bevel gear units, joint shafts, motors to produce complete lifting systems
- Short delivery times by keeping standard items in stock
- User-oriented planning and design

Basic model HG



Screw-nut model HL

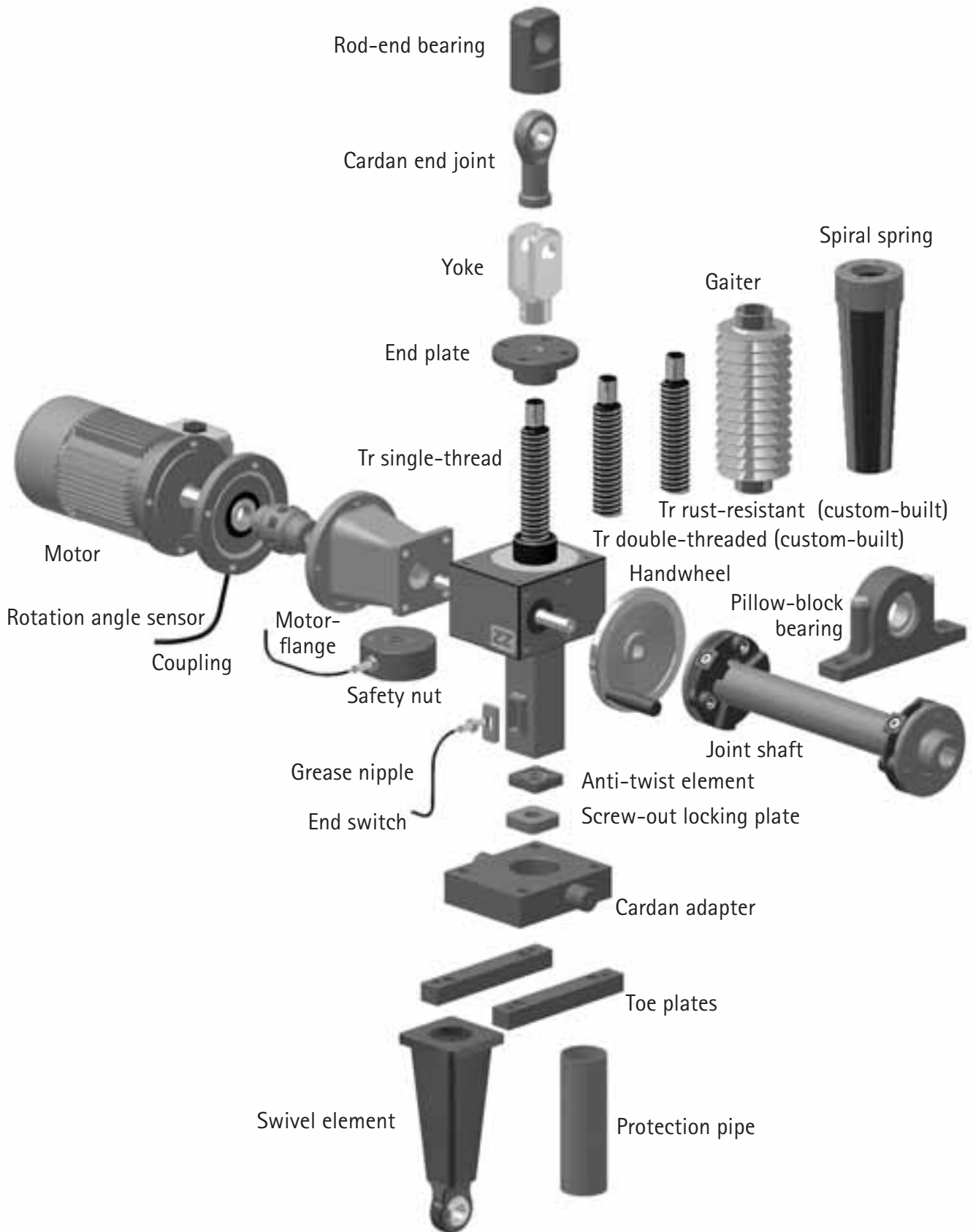


Basic model with  
Anti-twist element HV



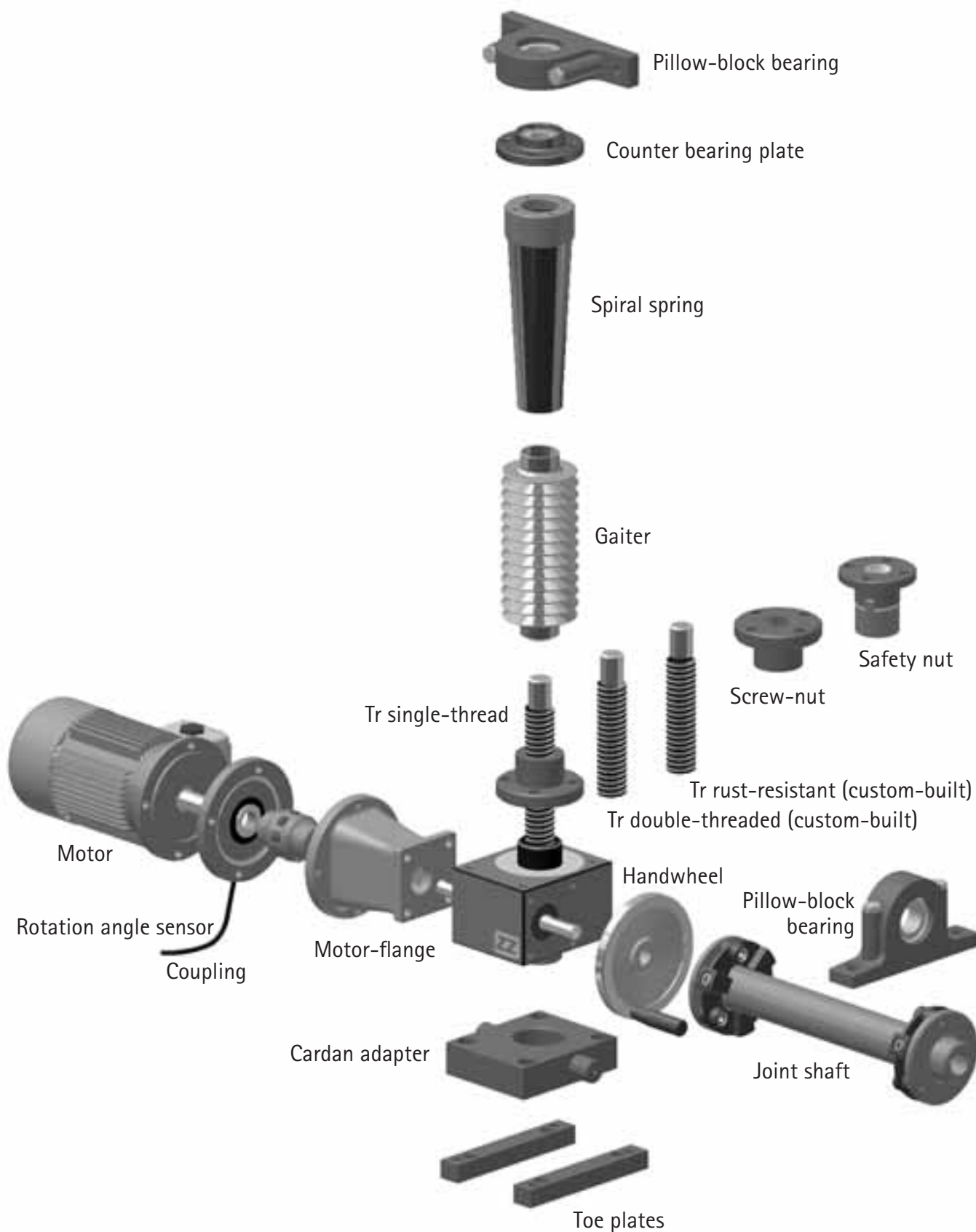
Basic model HG  
with Swivel element





# System Components

## Screw-nut model HL



Size		Unit	HM 5	HM 10	HA 25	HA 50	HA 100
Maximum static load		kN	5	10	25	50	100
Trapezoidal threaded spindle	DIN 103	-	Tr 18x4	Tr 20x4	Tr 30x6	Tr 40x7	Tr 55x9
	Thread pitch	°	4.55	4.05	4.05	3.49	3.25
Permissible spindle length, at compression stress and maximum load	Euler-1	mm	140	130	180	250	410
	Euler-2	mm	290	270	370	500	820
	Euler-3	mm	410	380	510	720	1180
	Euler-4	mm	580	540	740	1000	1650
Overall efficiency Ratio N (standard values)	Calculated	%	30	30	28	28	24
	Speed and lubricant dependent	%	26...36	24...34	24...33	23...31	19...28
Overall efficiency Ratio L (standard values)	Calculated	%	20	20	20	18	17
	Speed and lubricant dependent	%	19...24	18...23	17...22	14...20	14...19
Spindle efficiency	Friction angle = 6° (steel/bronze)	%	42	40	39	36	34
	Speed and lubricant dependent	%	32...45	30...42	30...40	26...39	25...38
Ratio N	Ratio N	-	4:1	4:1	6:1	7:1	9:1
	Lift / rev.	mm/rev.	1 mm				
Ratio L	Ratio L	-	16:1	16:1	24:1	28:1	36:1
	Lift / rev	mm/rev.	0,25 mm				
Idle torque	N	Nm	0.1	0.25	0.3	0.7	1.5
	L	Nm	0.08	0.15	0.22	0.5	0.9
Distance betw. axes, worm gear		mm	25	32	45	63	71
Thread pitch, worm gear	N	°	32.74	28.81	24.62	26.57	10.89
	L	°	9.13	7.83	6.54	7.13	5.04
Efficiency, worm gear Speed-dependent (n = 500-2000 rpm)	N	%	83...87	83...87	82...86	83...87	72...77
	L	%	62...68	61...67	57...64	60...66	53...59
Spindle torque at max. lifting capacity		Nm	8	16	60	155	410
Max. torque at drive shaft (with in-line gear connection)		Nm	27	57	118	205	430
Mass (weight)	Gear (without spindle)	kg	1.2	2.1	6.5	17	35
	Spindle	kg / m	1.6	2	4.5	8.2	15.7
Moment of inertia of spindle, referred to gear input shaft	N	kgcm <sup>2</sup> / m	0.03	0.05	0.12	0.28	0.63
	L	kgcm <sup>2</sup> / m	0.002	0.003	0.007	0.018	0.039
Moment of inertia of gear (w.o. spindle), referred to its input shaft	N	kgcm <sup>2</sup>	0.12	0.42	0.72	2.4	10
	L	kgcm <sup>2</sup>	0.1	0.32	0.55	1.6	3.6
Housing material		-	Aluminium -alloy		EN-GJS-400-15 (GGG-40)		
Gear lubrication		-	Grease		Oil or grease		

# Performance Features

## Screw Jack Unit

HZ 210 – HZ 1000



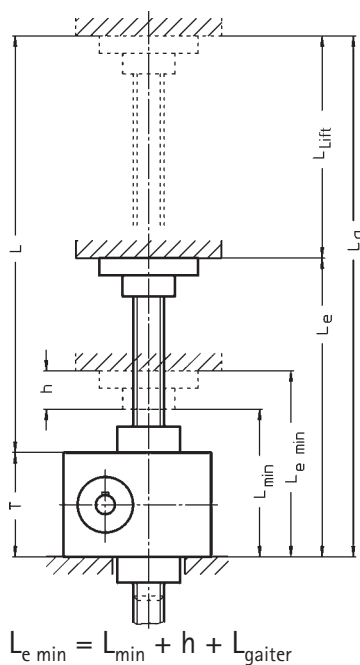
Size		Unit	HZ 210	HZ 350	HZ 500	HZ 750	HZ 1000	
Maximum static load		kN	210	350	500	750	1000	
Trapezoidal threaded spindle	DIN 103	-	Tr 80x10	Tr 100x10	Tr 120x14	Tr 140x16	Tr 160x18	
	Thread pitch	°	2.43	1.92	2.26	2.21	2.17	
Permissible spindle length, at compression stress and maximum load	Euler-1	mm	650	850	960	1200	1400	
	Euler-2	mm	1350	1700	1950	2400	2750	
	Euler-3	mm	1900	2450	2750	3450	3900	
	Euler-4	mm	2700	3400	3800	4800	5500	
Overall efficiency Ratio N (standard values)	Calculated	%	21	18	18	18	18	
	Speed and lubricant dependent	%	16...24	13...21	12...20	13...21	13...21	
Overall efficiency Ratio L (standard values)	Calculated	%	14	11	11	11	11	
	Speed and lubricant dependent	%	12...16	10...13	10...13	10...12	10...12	
Spindle efficiency	Friction angle = 6° (steel/bronze)	%	28	23	26	26	25	
	Speed and lubricant dependent	%	20...30	15...25	18...28	18...28	17...27	
Ratio N	Ratio N	-	10:1	10:1	14:1	16:1	18:1	
	Lift / rev.	mm/rev.	1 mm					
Ratio L	Ratio L	-	40:1	40:1	56:1	64:1	72:1	
	Lift / rev	mm/rev.	0,25 mm					
Idle torque	N	Nm	2.4	3.1	3.8	7.1	10	
	L	Nm	1.7	2.1	2.7	4.3	6	
Distance betw. axes, worm gear		mm	80	100	135	170	200	
Thread pitch, worm gear	N	°	16.70	13.13	10.71	11.31	11.31	
	L	°	6.18	5.71	4.97	5.14	4.68	
Efficiency, worm gear Speed-dependent (n = 500-2000 rpm)	N	%	78...83	76...80	73...78	74...79	74...79	
	L	%	57...63	57...63	54...60	55...61	53...59	
Spindle torque at max. lifting capacity		Nm	1170	2310	4100	7142	10840	
Max. torque at drive shaft (with in-line gear connection)		Nm	520	720	1290	1930	2370	
Mass (weight)	Gear (without spindle)	kg	50	75	150	250	320	
	Spindle	kg / m	34.7	55.6	78.7	107.6	140.6	
Moment of inertia of spindle, referred to gear input shaft	N	kgcm <sup>2</sup> / m	2.44	6.23	6.34	9.06	12.28	
	L	kgcm <sup>2</sup> / m	0.152	0.389	0.396	0.566	0.768	
Moment of inertia of gear (w.o. spindle), referred to its input shaft	N	kgcm <sup>2</sup>	13	48	115	165	280	
	L	kgcm <sup>2</sup>	6	16	45	75	115	
Housing material		-	EN-GJS-600-3 (GGG-60)				S355J2G3 (St52-3)	
Gear lubrication		-	Oil or grease				Grease	

### Basic Models

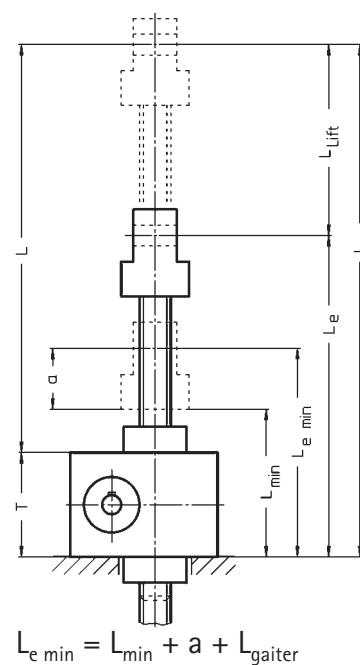
- $L_a$  = Upper end-point of the working lift: → the threaded spindle is extended to a maximum
- $L_e$  = Lower end-point of the working lift: → the threaded spindle is partly or completely, retracted
- $L_{e\ min}$  = Minimum dimension with a fully retracted threaded spindle. In an assembly according to the outline drawings below, this measurement must be present for the threaded spindle that is intended to be used.
- $L_{gaiter}$  = Block length of the gaiter; this is approximately 18% of the lift  
For lifting spindle drives without a gaiter,  $L_{gaiter}$  is set to 0 (zero)
- $L_{Lift}$  = Lift in mm
- $L$  = free unsupported length

For all other dimensions refer to the tables of measurements that commence on page 40.  
The following should be stated with any enquiries or orders: Measurement  $L_a$  and the head style of the threaded spindle (with thread - with end plate - with rod-end bearing)

Basic model HG with end plate



Basic model HG with rod-end bearing



$L_{min}$  from measurements table, page 40

$h$  from measurements table, page 46

$a$  from measurements table, page 46

$$L_{gaiter} = 0,18 \times L_{Lift} \text{ (without gaiter: } L_{gaiter} = 0)$$

$$L_e \geq L_{e\ min}$$

(e.g. for  $L_e$  select the next higher standard size or the next larger "even measure")

$$L_a = L_e + L_{Lift}$$

$$L = L_a - T$$

with  $T$  from measurements table, page 40

The assembly dimensions can also be determined from scaled drawings.

# Calculation of Assembly Dimensions and Lift

## Screw-nut model HL



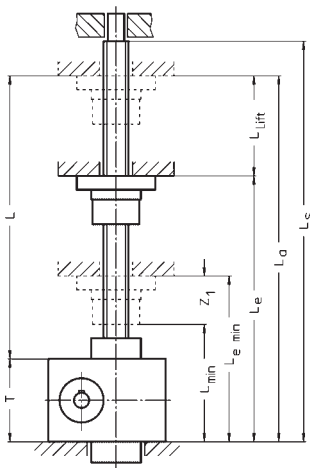
### Screw-nut model

- $L_a$  = Upper end-point of the working lift: → the screw-nut is extended to a maximum
- $L_e$  = Lower end-point of the working lift: → the screw-nut is partly or completely, retracted
- $L_{e\ min}$  = Minimum dimension with a fully retracted screw-nut. In an assembly according to the outline drawings below, this measurement must be present for the lifting spindle drive that is intended to be used.
- $L_{gaiter}$  = Block length of the gaiter; this is approximately 18% of the lift  
For lifting spindle drives without a gaiter,  $L_{gaiter}$  is set to 0 (zero)
- $L_{Lift}$  = Lift in mm
- $L$  = free unsupported length
- $L_s$  = Lower edge of the housing to the end of the spindle (without journals)

For all other dimensions refer to the tables of measurements that commence on page 44.  
The following should be stated with any enquiries or orders: Measurement  $L_a$  (position of the screw-nut flange) and finish of the free end of the threaded spindle (with or without bearing)

### Screw-nut model HL

#### Screw-nut flange uppermost



$$L_{e\ min} = L_{min} + Z_1 + L_{gaiter}$$

$L_{min}$  from measurements table, page 44

$Z_1$  from measurements table, page 44

$$L_{gaiter} = 0,18 \times L_{Lift}$$

$$L_{gaiter} = 0,3 \times L_{Lift}$$

$$L_{gaiter} = 0$$

$$L_e \geq L_{e\ min}$$

$Z_3$  from measurements table, page 44

(with one gaiter)  
(with two gaiters)  
(without gaiter)

(e.g. for  $L_e$  select the next higher standard size or the next larger "even measure")

$$L_a = L_e + L_{Lift}$$

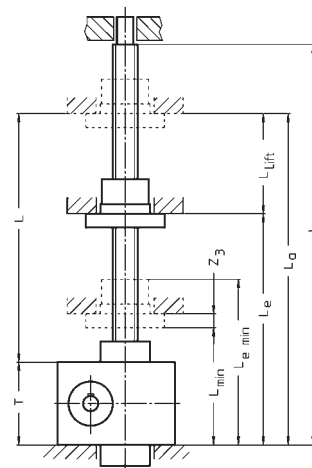
$$L = L_a - T$$

with  $T$  from measurements table, page 44

The assembly dimensions can also be determined from scaled drawings.

### Screw-nut model HL

#### Screw-nut flange underneath



$$L_{e\ min} = L_{min} + Z_3 + L_{gaiter}$$

The complete design of a ZZ lifting spindle drive requires the following steps:

- Specifying the loading on each screw jack unit
- Specifying the assembly size
- Checking:
  - Buckling
  - Lifting speed
  - Moment of torsion
  - Lateral force
- Determining:
  - Operational factors
  - Drive power
  - Driving torque

All necessary steps are described below in more detail. By following these steps in designing a system, the most suitable form of a screw jack unit for a specific application will be established.

Supplementary design information and notes, will be found in:

VBG14, BGV14, BGR260, VBG70, BGV C1, GUV 16.15.3, EN1570, EN280, EN1756, EN1493, and many others.

### Sequence of calculation steps for ZZ lifting spindle drives

1. Given: Loading, Assembly and Operation
2. From the loading, the size of the installation required is assessed (Size tables, page 2) and for the assembly the clear length of spindle "L" is calculated (see illustrations and equations, pages 8 and 9).
3. For pressure loading, the buckling state according to Euler is defined, referring to the examples on page 13.
4. For pressure loading, from tables 1 to 4 (pp. 14 to 21), the gear size required (depending on the buckling state), the clear length of spindle "L" and the loading "F", are selected.  
For tensile loading, the gear size is determined according to the maximum load.
5. With the clear length of spindle "L" and the assembly situation (buckling state), the critical revolution speed  $n_{kr}$ , for the selected gear size, is taken from "Chart A" (p. 22) and using the equation for  $n_k$ , the maximum spindle revolution speed  $n_k$  is calculated.  
The maximum spindle revolution speed  $n_{pv}$  is taken from "Chart B" (p. 22) corresponding to the axial loading F for the selected gear size. The smaller of the two speeds represents the maximum permissible spindle revolution speed.
6. Taking the maximum permissible spindle revolution speed into account, a spindle speed for the selected gear size is determined from table 5 (p.23) and for this, the speed of the drive and lifting speed is determined.
7. For this drive speed and the given axial loading "F", the required driving power and driving torque is taken from tables 6 to 15 (pp. 24 to 33).
8. If lateral forces "FS" are acting on the threaded spindle, they must be checked with the values in the table on page 36 (for tensile loading) or with pressure loading, with the values in the charts on pages 36 and 37.
9. The moment of torsion can be taken from the charts (page 38), for each lifting spindle drive according to the loading.
10. Depending on the method of use and application, various operating conditions must be taken into account (working time, temperature, etc. – pages 11 and 12), to guarantee correct functioning and service life.

## Specifying the Size – Reference Values

The powers and torque values given in the selection tables, apply to correctly run-in (after about 24 hours of operating) and lubricated gears, including proper installation by a qualified engineer, with the following operational performance:

- Smooth operation of the drive machine (prime mover)
- Daily operation of 8 hours
- A maximum of 10 starts per hour
- Running time RT 20% / h or RT 30% / 10min for gear sizes H5 ... H350
- Running time RT 15% / h or RT 20% / 10min for gear sizes H500, H750
- Running time RT 10% / h or RT 15% / 10min for gear sizes H1000
- Ambient temperature of 20°C

If there are any deviations in the operating conditions, these must be corrected by applying an operational factor. In such a case, the available drive power and driving torque must be multiplied by the operational factor.

$$P_{1\text{ req}}(m) = P_{1\text{ avail}} \times f_B \times f_A \quad \text{oder} \quad T_{1\text{ req}}(m) = T_{1\text{ avail}} \times f_B \times f_A$$

$$P_{1\text{ req}}(t) = P_{1\text{ avail}} \times f_{RT} \times f_T \quad \text{oder} \quad T_{1\text{ req}}(t) = T_{1\text{ avail}} \times f_{RT} \times f_T$$

$P_{1\text{ req}}(m), T_{1\text{ req}}(m)$  = Drive power and driving torque required, considering the mechanical effects

$P_{1\text{ req}}(t), T_{1\text{ req}}(t)$  = Drive power and driving torque required, considering the thermal effects

$P_{1\text{ avail}}, T_{1\text{ avail}}$  = Available drive power and driving torque of the prime mover

The selection of gear size orientates towards the largest of the two calculated values.

For a correct selection of the gears, the following applies:

$$P_{1\text{ req}} = \frac{P_1}{S_F} \quad T_{1\text{ req}} = \frac{T_1}{S_F}$$

$P_1, T_1$  = Permissible drive power and driving torque according to the selection tables

$S_F$  = Safety factor

The safety factor  $S_F$  should be determined from experience and any regulations that are valid at the time.

Reference value: - without endangering personnel  $S_F = 1,0 \dots 1,5$

- with personal danger  $S_F \geq 2$

## Operational factor, $f_B$ according to NIEMANN

Degree of shocks of prime mover	Type of prime mover								
	Electromotor On-time [h] / day			Turbine, hydraulic motor On-time [h] / day			Single-cylinder piston machine Laufzeit [h] / day		
	upto 2	upto 8	8 +	upto 2	upto 8	8 +	upto 2	upto 8	8 +
I	0.8	1.0	1.25	1.0	1.25	1.5	1.25	1.5	1.75
II	1.0	1.25	1.5	1.25	1.5	1.75	1.5	1.75	2.0
III	1.5	1.75	2.0	1.75	2.0	2.25	2.0	2.25	2.5

Degree of mechanical shock

I Uniform – light shocks → permissible mass acceleration factor  $\leq 0,2$

II Irregular – medium shocks → permissible mass acceleration factor  $\leq 3$

III Severely irregular – intense shocks → permissible mass acceleration factor  $\leq 10$

## Mass acceleration factor $f_j$

$$\text{Mass acceleration factor } f_j = \frac{J_{\text{ex.red}}}{J_{\text{mot}}}$$

- $J_{\text{ex.red}}$  = Mass moment of inertia of the machine and gears reduced to the drive motor
- $J_{\text{mot}}$  = Mass moment of inertia of the motor including the brake and ventilator  
(see Degree of mechanical shock, p. 11)

## Start-up factor $f_{\text{su}}$

Starts per hour	≤ 10	10 - 60	> 60
$f_{\text{su}}$	1.0	1.1	1.2

## Running time factor $f_{\text{RT}}$

RT [%]		10	15	20	25	30	40	50	60	80	100
$f_{\text{RT}}$	Ref. time 60 min.	0.55	0.8	1.0	1.2	1.35	1.65	1.9	2.1	2.3	2.5
	Ref. time 30 min	0.45	0.65	0.85	1.0	1.2	1.45	1.7	1.9	2.2	2.5
	Ref. time 10 min	0.4	0.55	0.7	0.85	1.0	1.3	1.6	1.8	2.1	2.5

## Determining the running time

$$\text{RT} [\%] = \frac{t_o}{t_o + t_d} \times 100$$

$$t_o = \text{On time [s]} \quad t_d = \text{Downtime [s]}$$

## Ambient temperature factor $f_T$

$T_{\text{am}}$ [°C]	< 10	20	30	40	50	60	70
$f_T$	0.85	1	1.2	1.5	2	3	6

$T_{\text{am}}$  = Ambient temperature [°C]

**Caution:** The operating temperature should not exceed 80°C.

For screw jack units with a rotating spindle (HL - model), heat is generated by the power loss between spindle and nut. This heat must be dissipated over the surface of spindle, end plate and nut.

When operating with a gaiter or a spiral spring cover, because of the restricted escape of warm air, the running time should be limited to approximately 75% of the permissible running time. To keep the power loss as low as possible, attention must be paid to good lubrication and a free run of the nut (no skew, sticking, sluggishness).

By using a larger spindle diameter or a double-threaded spindle together with a reduction of the lifting speed and / or the running time, a reduction in the power loss is also possible. If these measures do not suffice, then an additional cooling system should be provided.

A loading limit on the lifting spindle drive with pressure loading, represents the buckling of the threaded spindle. The maximum permissible pressure loads in relation to the end restraint conditions and the clear length of spindle "L" are listed in the following tables. The values in the tables apply to the basic model (HG) as well as to the screw-nut model (HL). The buckling load has been determined according to EULER; it does not apply for a pendant form of the threaded spindle.

The maximum permissible pressure loading can be taken from tables 1-4 for each loading condition.

These were determined in each case, using the given buckling safety factor  $v_k$ .

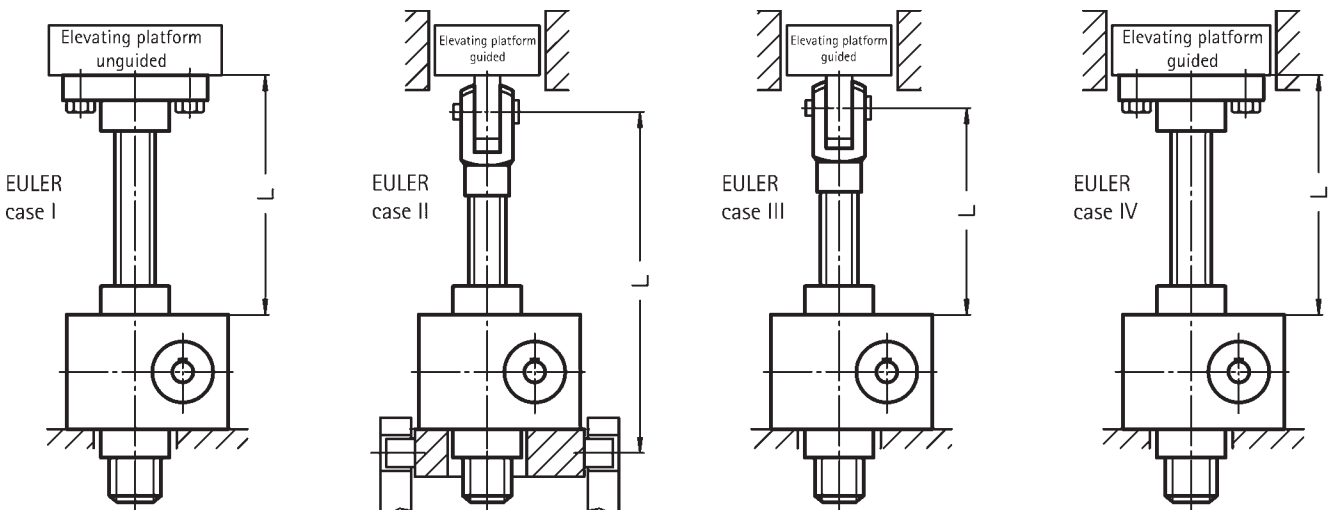
If this buckling safety factor appears too high or too low for various application conditions, then the loading  $F'$  is determined for the Safety factor  $v_k'$  required:

$$F' = F \times \frac{v_k}{v_k'}$$

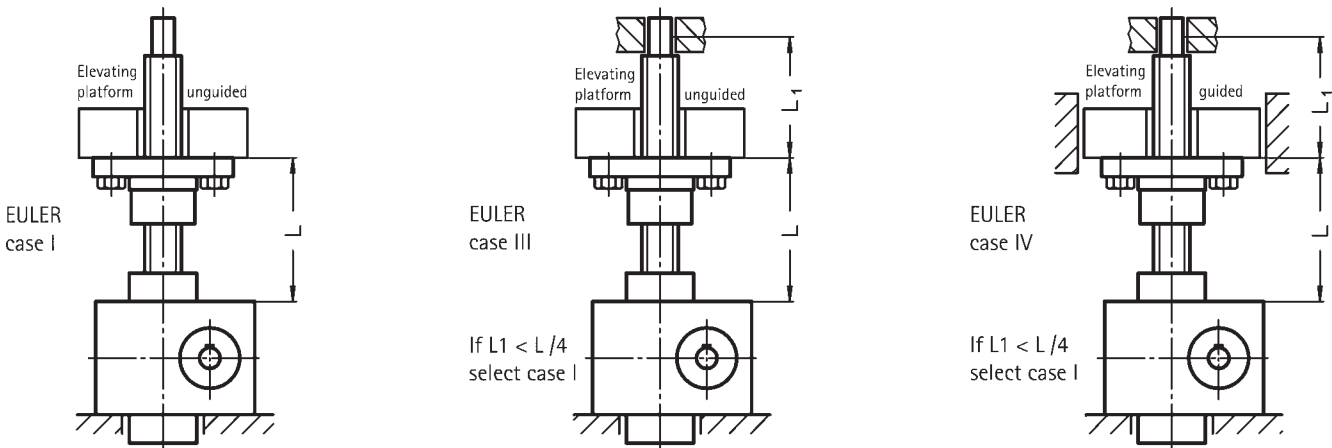
However, it should be borne in mind here that the maximum permissible loading must not be exceeded (see Sizes table, page 2).

A few examples of assembly, together with the appropriate Euler conditions, are shown below to explain the loading conditions.

## Basic model, HG

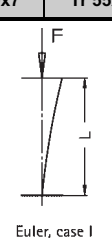


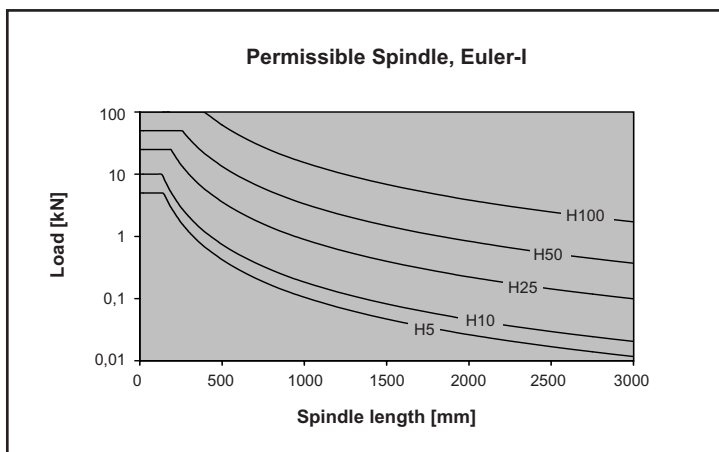
## Screw-nut model HL



1000 kg = 1 t ≈ 10 kN

Buckling safety  $v \approx 8$  for H5, H10, H25, H50  
 $v \approx 6$  for H100

Spindle length [mm]	Spindle loading [kN]				
	H5	H10	H25	H50	H100
	Tr 18x4	Tr 20x4	Tr 30x6	Tr 40x7	Tr 55x9
100	5	10	25		
110	5	10	25		
120	5	10	25		
130	5	10	25		
140	5	9.5	25		
150	4.7	8.3	25		
160	4.1	7.3	25		
170	3.6	6.5	25	50	100
180	3.2	5.8	25	50	100
190	2.9	5.2	25	50	100
200	2.6	4.7	23	50	100
220	2.2	3.9	19	50	100
240	1.8	3.2	16	50	100
260	1.6	2.8	13	50	100
280	1.3	2.4	12	44	100
300	1.2	2.1	10	39	100
350	0.86	1.5	7.4	28	100
400	0.66	1.2	5.7	22	99
500	0.42	0.75	3.6	14	64
600	0.29	0.52	2.5	9.7	44
700	0.21	0.38	1.8	7.1	32
800	0.16	0.29	1.4	5.4	25
900	0.13	0.23	1.1	4.3	20
1000	0.11	0.19	0.91	3.5	16
1200	0.07	0.13	0.63	2.4	11
1400	0.05	0.10	0.46	1.8	8.1
1600	0.04	0.07	0.35	1.4	6.2
1800	-	0.06	0.28	1.1	4.9
2000	-	0.05	0.23	0.87	4.0
2200	-	-	0.19	0.72	3.3
2400	-	-	0.16	0.60	2.8
2600	-	-	0.13	0.52	2.4
2800	-	-	-	0.44	2.0
3000	-	-	-	0.39	1.8



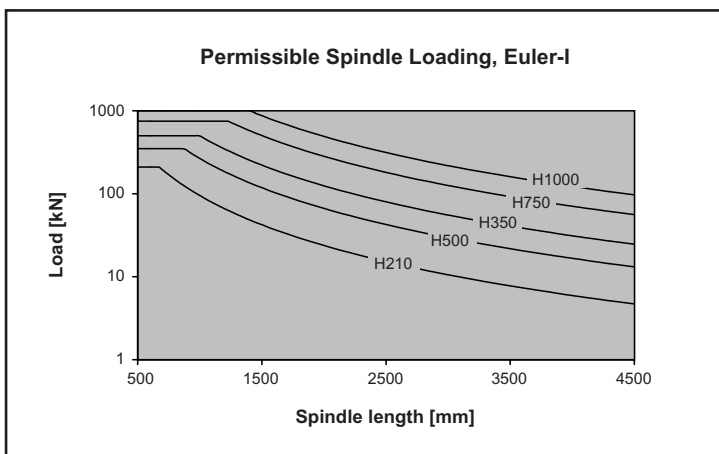
# Permissible Spindle Loading (Euler case I)

Table 1 (cont'd)

1000 kg = 1 t ≈ 10 kN

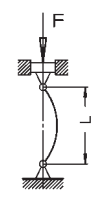
Buckling safety  $\nu \approx 6$  for H210, H350, H500  
 $\nu \approx 5$  for H750, H1000

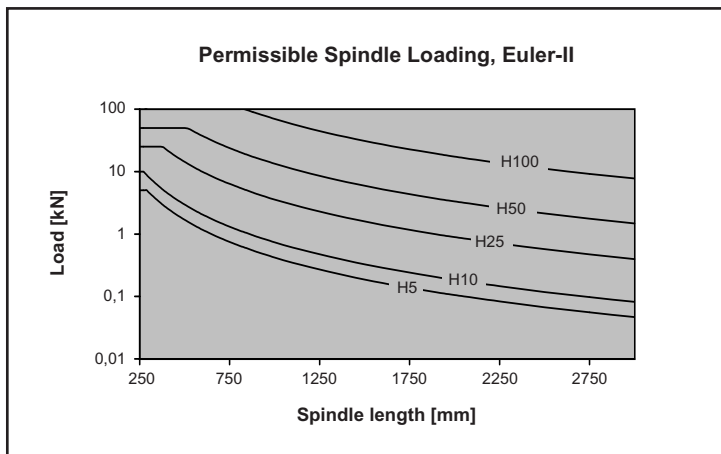
Spindle length [mm]	Spindle loading [kN]				
	H210	H350	H500	H750	H1000
	Tr 80x10	Tr 100x10	Tr 120x14	Tr 140x16	Tr 160x18
500	210	350	500		
600	210	350	500		
700	186	350	500		
800	142	350	500		
900	112	329	500		
1000	91	266	499		
1100	75	220	412		
1200	63	185	346	750	1000
1300	54	158	295	669	1000
1400	46	136	254	577	1000
1500	40	118	222	503	873
1600	36	104	195	442	768
1700	32	92	173	391	680
1800	28	82	154	349	606
1900	25	74	138	313	544
2000	23	67	125	283	491
2100	21	60	113	257	446
2200	19	55	103	234	406
2300	17	50	94	214	371
2400	16	46	87	196	341
2500	15	43	80	181	314
2600	13	39	74	167	291
2700	12	37	68	155	270
2800	12	34	64	144	251
2900	11	32	59	135	234
3000	10	30	55	126	218
3200	8.9	26	49	110	192
3400	7.9	23	43	98	170
3600	7.0	21	38	87	152
3800	6.3	18	35	78	136
4000	5.7	17	31	71	123
4300	4.9	14	27	61	106
4600	4.3	13	24	53	93
5000	3.6	11	20	45	79



1000 kg = 1 t ≈ 10 kN

Buckling safety  $v \approx 8$  for H5, H10, H25, H50  
 $v \approx 6$  for H100

Spindle length [mm]	Spindle loading [kN]				
	H5	H10	H25	H50	H100
	Tr 18x4	Tr 20x4	Tr 30x6	Tr 40x7	Tr 55x9
150	5	10	25	 <p>Euler, case II</p>	
175	5	10	25		
200	5	10	25		
250	5	10	25		
300	4.7	8.3	25		
350	3.4	6.1	25		
400	2.6	4.7	23		
450	2.1	3.7	18	50	100
500	1.7	3.0	14	50	100
550	1.4	2.5	12	46	100
600	1.2	2.1	10	39	100
650	1.0	1.8	8.6	33	100
700	0.86	1.5	7.4	28	100
750	0.75	1.3	6.4	25	100
800	0.66	1.2	5.7	22	99
900	0.52	0.92	4.5	17	79
1000	0.42	0.75	3.6	14	64
1100	0.35	0.62	3.0	12	53
1200	0.29	0.52	2.5	9.7	44
1300	0.25	0.44	2.1	8.2	38
1400	0.21	0.38	1.8	7.1	32
1500	0.19	0.33	1.6	6.2	28
1600	0.16	0.29	1.4	5.4	25
1700	0.15	0.26	1.3	4.8	22
1800	0.13	0.23	1.1	4.3	20
1900	0.12	0.21	1.0	3.9	18
2000	0.11	0.19	0.91	3.5	16
2200	0.09	0.15	0.75	2.9	13
2400	0.07	0.13	0.63	2.4	11
2600	0.06	0.11	0.54	2.1	9.4
2800	0.05	0.10	0.46	1.8	8.1
3000	0.05	0.08	0.40	1.5	7.1
3250	0.04	0.07	0.34	1.3	6.0
3500	0.03	0.06	0.30	1.1	5.2



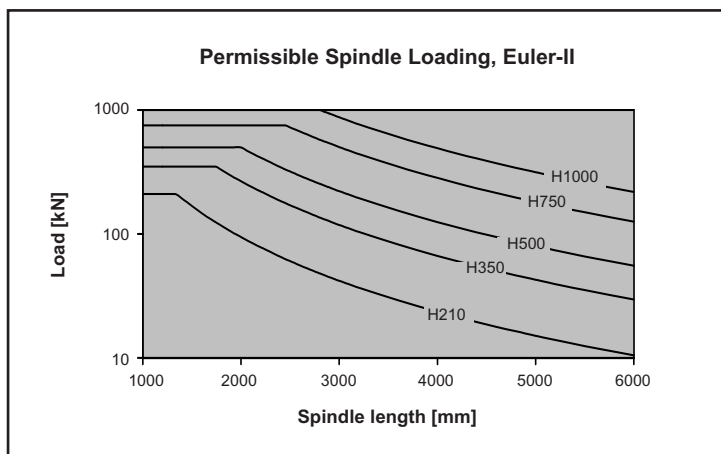
# Permissible Spindle Loading (Euler case II)

Table 2 (cont'd)

1000 kg = 1 t ≈ 10 kN

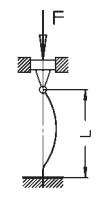
Buckling safety  $\nu \approx 6$  for H210, H350, H500  
 $\nu \approx 5$  for H750, H1000

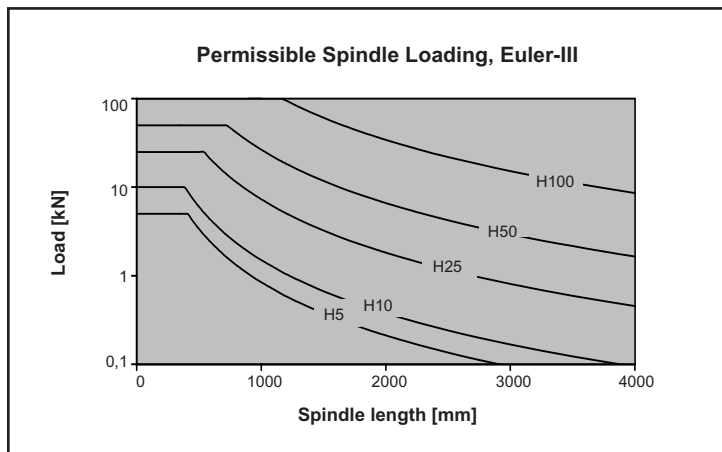
Spindle length [mm]	Spindle loading [kN]				
	H210	H350	H500	H750	H1000
	Tr 80x10	Tr 100x10	Tr 120x14	Tr 140x16	Tr 160x18
1000	210	350	500	<p>Euler, case II</p>	
1100	210	350	500		
1200	210	350	500		
1300	210	350	500		
1400	196	350	500		
1500	171	350	500		
1600	150	350	500		
1700	133	350	500	750	1000
1800	119	329	500	750	1000
1900	106	295	500	750	1000
2000	96	266	499	750	1000
2100	87	241	452	705	1000
2200	79	220	412	642	1000
2300	73	201	377	587	1000
2400	67	185	346	539	1000
2500	61	170	319	497	1000
2600	57	158	295	460	1000
2700	53	146	274	426	1000
2800	49	136	254	396	989
2900	46	127	237	369	922
3000	43	118	222	345	861
3200	38	104	195	303	757
3400	33	92	173	269	670
3600	30	82	154	240	598
3800	27	74	138	215	537
4000	24	67	125	194	484
4200	22	60	113	176	439
4400	20	55	103	160	400
4600	18	50	94	147	366
4800	17	46	87	135	336
5000	15	43	80	124	310
5250	14	39	72	113	281
5500	13	35	66	103	256
6000	11	30	55	86	215



1000 kg = 1 t ≈ 10 kN

Buckling safety  $v \approx 8$  for H5, H10, H25, H50  
 $v \approx 6$  for H100

Spindle length [mm]	Spindle loading [kN]				
	H5	H10	H25	H50	H100
	Tr 18x4	Tr 20x4	Tr 30x6	Tr 40x7	Tr 55x9
200	5.00	10	25	 <p>Euler, case III</p>	
400	5.00	9.4	25		
420	4.8	8.5	25		
440	4.4	7.8	25		
460	4.0	7.1	25		
480	3.7	6.5	25		
500	3.4	6.0	25		
550	2.8	5.0	24	50	100
600	2.3	4.2	20	50	100
700	1.7	3.1	15	50	100
800	1.3	2.4	11	41	100
900	1.0	1.9	9.0	33	100
1000	0.85	1.5	7.3	26	100
1100	0.70	1.2	6.0	22	100
1200	0.59	1.0	5.1	18	95
1300	0.50	0.89	4.3	16	81
1400	0.43	0.77	3.7	14	70
1500	0.38	0.67	3.2	12	61
1600	0.33	0.59	2.8	10	54
1700	0.29	0.52	2.5	9.2	47
1800	0.26	0.46	2.2	8.2	42
1900	0.23	0.42	2.0	7.3	38
2000	0.21	0.38	1.8	6.6	34
2100	0.19	0.34	1.7	6.0	31
2200	0.17	0.31	1.5	5.5	28
2400	0.15	0.26	1.3	4.6	24
2600	0.13	0.22	1.1	3.9	20
2800	0.11	0.19	0.93	3.4	17
3000	0.09	0.17	0.81	2.9	15
3200	0.08	0.15	0.71	2.6	13
3400	0.07	0.13	0.63	2.3	12
3600	0.07	0.12	0.56	2.0	11
3800	0.06	0.10	0.50	1.8	9.5
4000	0.05	0.09	0.46	1.7	8.6



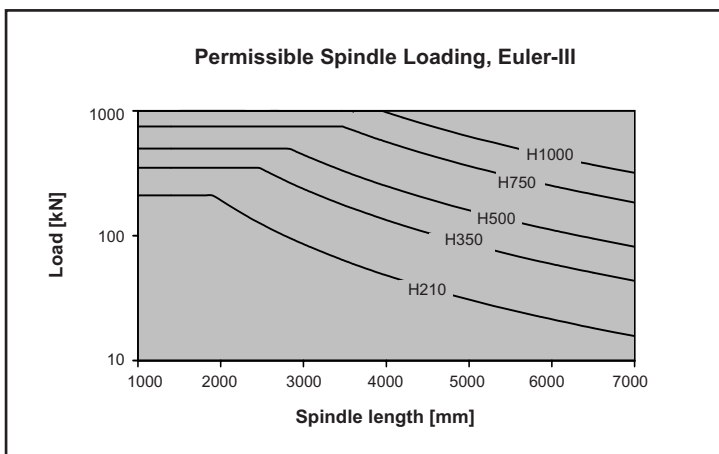
# Permissible Spindle Loading (Euler case III)

Table 3 (cont'd)

1000 kg = 1 t ≈ 10 kN

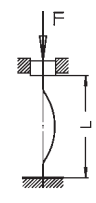
Buckling safety  $v \approx 6$  for H210, H350, H500  
 $v \approx 5$  for H750, H1000

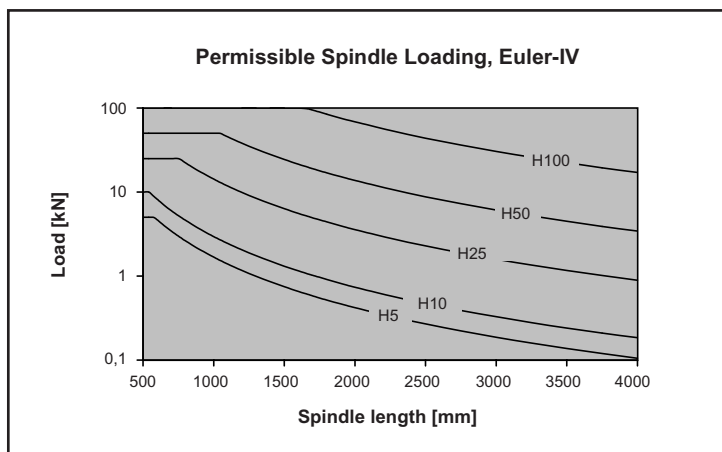
Spindle length [mm]	Spindle loading [kN]				
	H210	H350	H500	H750	H1000
	Tr 80x10	Tr 100x10	Tr 120x14	Tr 140x16	Tr 160x18
1400	210	350	500	<p>Euler, case III</p>	
1500	210	350	500		
1600	210	350	500		
1700	210	350	500		
1800	210	350	500		
1900	210	350	500		
2000	192	350	500		
2100	175	350	500	750	1000
2200	159	350	500	750	1000
2300	146	350	500	750	1000
2400	134	350	500	750	1000
2500	123	342	500	750	1000
2600	114	316	500	750	1000
2700	106	293	500	750	1000
2800	98	272	500	750	1000
2900	92	254	475	750	1000
3000	86	237	444	750	1000
3200	75	209	390	750	1000
3400	67	185	346	750	1000
3600	59	165	308	697	1000
3800	53	148	277	626	1000
4000	48	133	250	565	971
4200	44	121	227	512	881
4400	40	110	206	467	802
4600	36	101	189	427	734
4800	33	93	174	392	674
5000	31	85	160	362	621
5200	28	79	148	334	574
5400	26	73	137	310	533
5600	25	68	127	288	495
5800	23	63	119	269	462
6000	21	59	111	251	431
6500	18	51	95	214	368
7000	16	44	82	184	317



1000 kg = 1 t ≈ 10 kN

Buckling safety  $v \approx 8$  for H5, H10, H25, H50  
 $v \approx 6$  for H100

Spindle length [mm]	Spindle loading [kN]				
	H5	H10	H25	H50	H100
	Tr 18x4	Tr 20x4	Tr 30x6	Tr 40x7	Tr 55x9
500	5	10	25	 <p>Euler, case IV</p>	
520	5	10	25		
540	5	10	25		
560	5	9.4	25		
580	5	8.8	25		
600	4.7	8.2	25		
650	4.0	7.0	25	50	100
700	3.4	6.0	25	50	100
750	3.0	5.2	25	50	100
800	2.6	4.6	22	50	100
850	2.3	4.1	20	50	100
900	2.1	3.6	18	50	100
950	1.9	3.3	16	50	100
1000	1.7	2.9	14	50	100
1100	1.4	2.4	12	45	100
1200	1.2	2.0	9.9	38	100
1300	1.0	1.7	8.4	32	100
1400	0.86	1.5	7.3	28	100
1500	0.75	1.3	6.3	24	100
1600	0.66	1.2	5.6	21	99
1700	0.58	1.0	4.9	19	88
1800	0.52	0.91	4.4	17	79
1900	0.47	0.82	4.0	15	71
2000	0.42	0.74	3.6	14	64
2200	0.35	0.61	2.9	11	53
2400	0.29	0.51	2.5	9.5	44
2600	0.25	0.44	2.1	8.1	38
2800	0.21	0.38	1.8	7.0	32
3000	0.19	0.33	1.6	6.1	28
3200	0.16	0.29	1.4	5.4	25
3400	0.15	0.26	1.2	4.8	22
3600	0.13	0.23	1.1	4.2	20
3800	0.12	0.20	1.0	3.8	18
4000	0.11	0.18	0.9	3.4	16

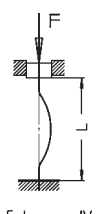


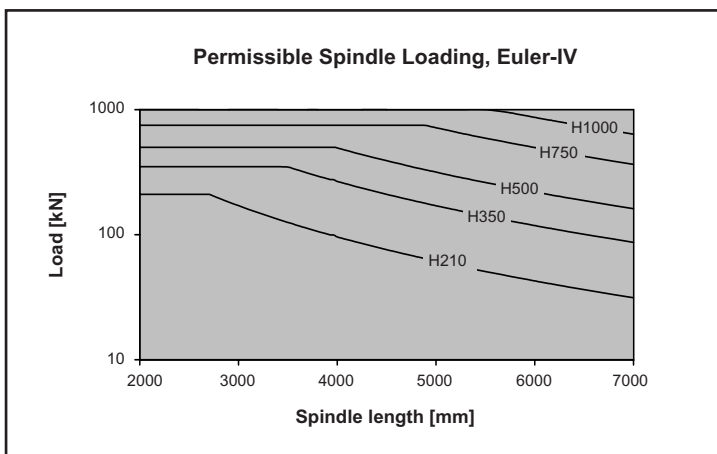
# Permissible Spindle Loading (Euler case IV)

Table 4 (cont'd)

1000 kg = 1 t ≈ 10 kN

Buckling safety  $v \approx 6$  for H210, H350, H500  
 $v \approx 5$  for H750, H1000

Spindle length [mm]	Spindle loading [kN]				
	H210	H350	H500	H750	H1000
	Tr 80x10	Tr 100x10	Tr 120x14	Tr 140x16	Tr 160x18
2000	210	350	500	 <p>Euler, case IV</p>	
2100	210	350	500		
2200	210	350	500		
2300	210	350	500		
2400	210	350	500		
2500	210	350	500		
2600	210	350	500		
2700	210	350	500	750	1000
2800	196	350	500	750	1000
2900	183	350	500	750	1000
3000	171	350	500	750	1000
3100	160	350	500	750	1000
3200	150	350	500	750	1000
3300	141	350	500	750	1000
3400	133	350	500	750	1000
3500	125	348	500	750	1000
3600	119	329	500	750	1000
3700	112	311	500	750	1000
3800	106	295	500	750	1000
3900	101	280	500	750	1000
4000	96	266	494	750	1000
4200	87	241	448	750	1000
4400	79	220	408	750	1000
4600	73	201	374	750	1000
4800	67	185	343	750	1000
5000	61	170	316	724	1000
5200	57	158	292	669	1000
5400	53	146	271	621	1000
5600	49	136	252	577	992
5800	46	127	235	538	925
6000	43	118	220	503	864
6250	39	109	202	463	796
6500	36	101	187	428	736
7000	31	87	161	369	635



The revolution speed of the threaded spindle is determined by the two speeds,  $n_{kr}$  and  $n_{pv}$ . The speed  $n_{kr}$  takes the length of the spindle into account; for  $n_{pv}$ , the specific loading and the running, or sliding speed are the decisive factors. The lower of these two speeds, gives the maximum permissible revolution speed of the threaded spindle,  $n_{perm}$ .

$$n_{perm} \leq n_k \quad n_{perm} \leq n_{pv}$$

- Higher speeds require lifting drives with ball screw spindles.

Chart A

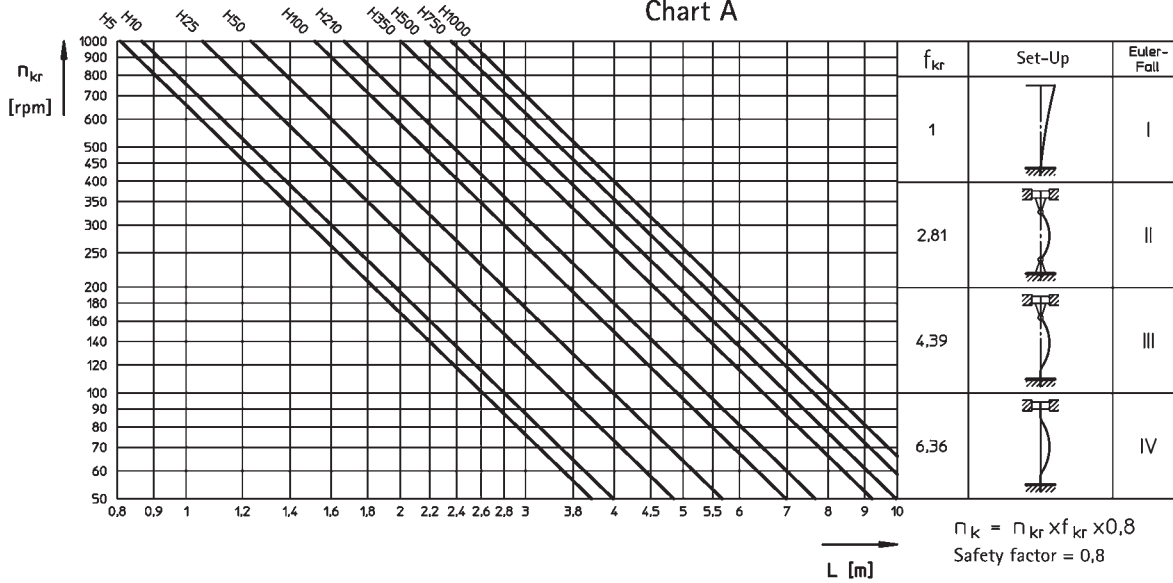
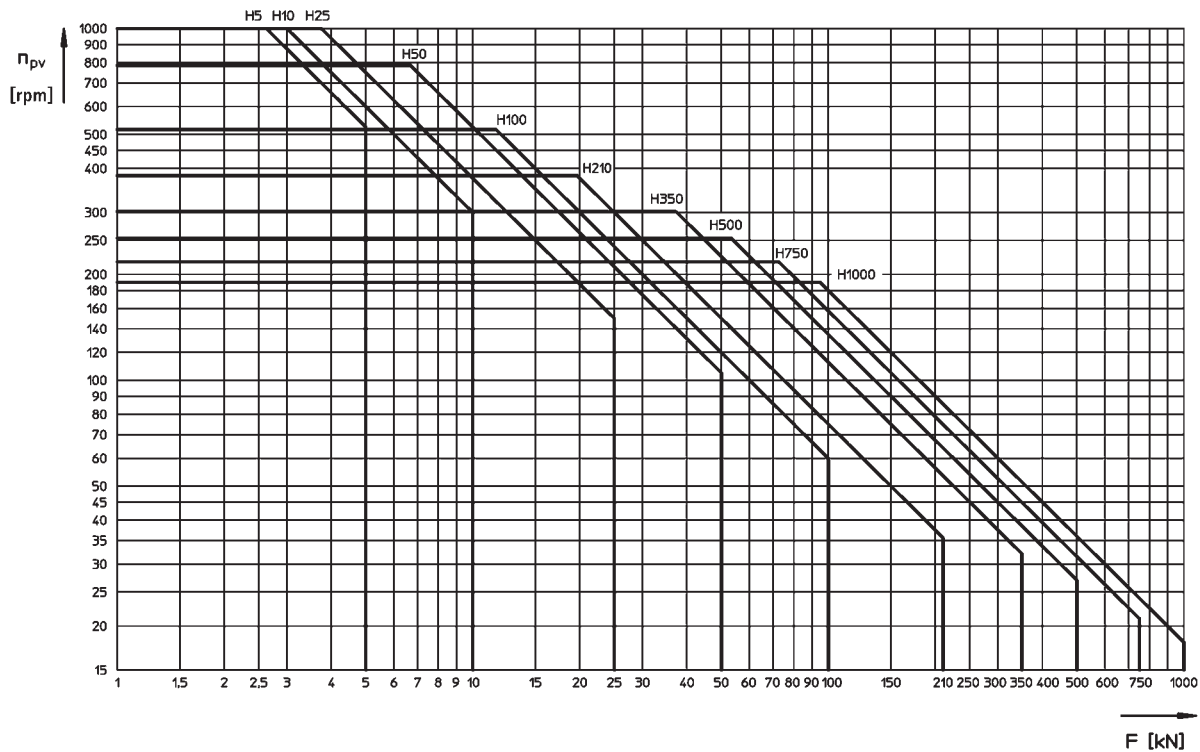


Chart B



- The values for  $n_{pv}$  are standard values.
- Higher speeds are possible, but will considerably increase wear.

# Lifting Speed – Drive Speed – Threaded Spindle Revolution Speed

Table 5



When a lifting speed can be realised with two standard gear ratio's, then the ratio with  $i = 1 \text{ mm lift / revolution of the drive}$  is the preferred value due to the higher degree of efficiency.

Lifting speed		Drive speed [min <sup>-1</sup> ]		Spindle revs. Speed [min <sup>-1</sup> ]									
[m/min]	[mm/s]	<u>1mm lift</u> 1 rev. Drive	<u>0.25mm</u> 1 rev. Drive	H5	H10	H25	H50	H100	H210	H350	H500	H750	H1000
0.025	0.417	25	100	6.25	6.25	4.17	3.57	2.78	2.50	2.50	1.79	1.56	1.39
0.050	0.833	50	200	12.50	12.50	8.33	7.14	5.56	5.00	5.00	3.57	3.13	2.78
0.075	1.250	75	300	18.75	18.75	12.50	10.71	8.33	7.50	7.50	5.36	4.69	4.17
0.100	1.667	100	400	25.00	25.00	16.67	14.29	11.11	10.00	10.00	7.14	6.25	5.56
0.125	2.083	125	<b>500</b>	31.25	31.25	20.83	17.86	13.89	12.50	12.50	8.93	7.81	6.94
0.150	2.500	150	<b>600</b>	37.50	37.50	25.00	21.43	16.67	15.00	15.00	10.71	9.38	8.33
0.175	2.917	175	700	43.75	43.75	29.17	25.00	19.44	17.50	17.50	12.50	10.94	9.72
0.200	3.333	200	800	50.00	50.00	33.33	28.57	22.22	20.00	20.00	14.29	12.50	11.11
0.225	3.750	225	900	56.25	56.25	37.50	32.14	25.00	22.50	22.50	16.07	14.06	12.50
0.250	4.167	250	<b>1000</b>	62.50	62.50	41.67	35.71	27.78	25.00	25.00	17.86	15.63	13.89
0.275	4.583	275	1100	68.75	68.75	45.83	39.29	30.56	27.50	27.50	19.64	17.19	15.28
0.300	5.000	300	1200	75.00	75.00	50.00	42.86	33.33	30.00	30.00	21.43	18.75	16.67
0.325	5.417	325	1300	81.25	81.25	54.17	46.43	36.11	32.50	32.50	23.21	20.31	18.06
0.350	5.833	350	1400	87.50	87.50	58.33	50.00	38.89	35.00	35.00	25.00	21.88	19.44
0.375	6.250	375	<b>1500</b>	93.75	93.75	62.50	53.57	41.67	37.50	37.50	26.79	23.44	20.83
0.400	6.667	400	1600	100.00	100.00	66.67	57.14	44.44	40.00	40.00	28.57	25.00	22.22
0.425	7.083	425	1700	106.25	106.25	70.83	60.71	47.22	42.50	42.50	30.36	26.56	23.61
0.450	7.500	450	1800	112.50	112.50	75.00	64.29	50.00	45.00	45.00	32.14	28.13	25.00
0.475	7.917	475	1900	118.75	118.75	79.17	67.86	52.78	47.50	47.50	33.93	29.69	26.39
0.500	8.333	<b>500</b>	2000	125.00	125.00	83.33	71.43	55.56	50.00	50.00	35.71	31.25	27.78
0.550	9.167	550	2200	137.50	137.50	91.67	78.57	61.11	55.00	55.00	39.29	34.38	30.56
0.600	10.000	<b>600</b>	2400	150.00	150.00	100.00	85.71	66.67	60.00	60.00	42.86	37.50	33.33
0.650	10.833	650	2600	162.50	162.50	108.33	92.86	72.22	65.00	65.00	46.43	40.63	36.11
0.700	11.667	700	2800	175.00	175.00	116.67	100.00	77.78	70.00	70.00	50.00	43.75	38.89
0.750	12.500	<b>750</b>	<b>3000</b>	187.50	187.50	125.00	107.14	83.33	75.00	75.00	53.57	46.88	41.67
0.800	13.333	800	3200	200.00	200.00	133.33	114.29	88.89	80.00	80.00	57.14	50.00	44.44
0.850	14.167	850	3400	212.50	212.50	141.67	121.43	94.44	85.00	85.00	60.71	53.13	47.22
0.900	15.000	900	3600	225.00	225.00	150.00	128.57	100.00	90.00	90.00	64.29	56.25	50.00
0.950	15.833	950	-	237.50	237.50	158.33	135.71	105.56	95.00	95.00	67.86	59.38	52.78
1.000	16.667	<b>1000</b>	-	250.00	250.00	166.67	142.86	111.11	100.00	100.00	71.43	62.50	55.56
1.100	18.333	1100	-	275.00	275.00	183.33	157.14	122.22	110.00	110.00	78.57	68.75	61.11
1.200	20.000	1200	-	300.00	300.00	200.00	171.43	133.33	120.00	120.00	85.71	75.00	66.67
1.300	21.667	1300	-	325.00	325.00	216.67	185.71	144.44	130.00	130.00	92.86	81.25	72.22
1.400	23.333	1400	-	350.00	350.00	233.33	200.00	155.56	140.00	140.00	100.00	87.50	77.78
1.500	25.000	<b>1500</b>	-	375.00	375.00	250.00	214.29	166.67	150.00	150.00	107.14	93.75	83.33
1.600	26.667	1600	-	400.00	400.00	266.67	228.57	177.78	160.00	160.00	114.29	100.00	88.89
1.700	28.333	1700	-	425.00	425.00	283.33	242.86	188.89	170.00	170.00	121.43	106.25	94.44
1.800	30.000	1800	-	450.00	450.00	300.00	257.14	200.00	180.00	180.00	128.57	112.50	100.00
1.900	31.667	1900	-	475.00	475.00	316.67	271.43	211.11	190.00	190.00	135.71	118.75	105.56
2.000	33.333	2000	-	500.00	500.00	333.33	285.71	222.22	200.00	200.00	142.86	125.00	111.11
2.200	36.667	2200	-	550.00	550.00	366.67	314.29	244.44	220.00	220.00	157.14	137.50	122.22
2.400	40.000	2400	-	600.00	600.00	400.00	342.86	266.67	240.00	240.00	171.43	150.00	133.33
2.600	43.333	2600	-	650.00	650.00	433.33	371.43	288.89	260.00	260.00	185.71	162.50	144.44
2.800	46.667	2800	-	700.00	700.00	466.67	400.00	311.11	280.00	280.00	200.00	175.00	155.56
3.000	50.000	<b>3000</b>	-	750.00	750.00	500.00	428.57	333.33	300.00	300.00	214.29	187.50	166.67
3.200	53.333	3200	-	800.00	800.00	533.33	457.14	355.56	320.00	320.00	228.57	200.00	177.78
3.400	56.667	3400	-	850.00	850.00	566.67	485.71	377.78	340.00	340.00	242.86	212.50	188.89
3.600	60.000	3600	-	900.00	900.00	600.00	514.29	400.00	360.00	360.00	257.14	225.00	200.00

The maximum permissible revolution speed of the threaded spindle in use is dependent on length and load, and is specified by the speed limit  $n_{perm} = f(n_{kr}, n_{pv})$  according to the charts "A" and "B" on page 22.

Driving torque  $T_1$  [Nm]  
Drive power  $P_1$  [kW]

medium efficiency:  $i = 4:1 \quad \eta \approx 30\%$   
 $i = 16:1 \quad \eta \approx 20\%$

Drive speed	Lifting speed		Ratio	Loading [kN]															
				5		4.5		4		3.5		3		2.5		2		1	
[rpm]	[m/min]	[mm/s]	$i_s$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$
3000	3.00	50.00	4 : 1	2.19	0.69	1.98	0.62	1.77	0.56	1.56	0.49	1.35	0.43	1.15	0.36	0.94	0.29	0.52	0.16
	0.750	12.50	16 : 1	0.88	0.28	0.80	0.25	0.72	0.23	0.64	0.20	0.56	0.18	0.48	0.15	0.40	0.13	0.24	0.08
2800	2.80	46.67	4 : 1	2.22	0.65	2.01	0.59	1.80	0.53	1.58	0.46	1.37	0.40	1.16	0.34	0.95	0.28	0.52	0.15
	0.700	11.67	16 : 1	0.90	0.26	0.82	0.24	0.74	0.22	0.65	0.19	0.57	0.17	0.49	0.14	0.41	0.12	0.24	0.07
2500	2.50	41.67	4 : 1	2.27	0.59	2.05	0.54	1.83	0.48	1.62	0.42	1.40	0.37	1.18	0.31	0.97	0.25	0.53	0.14
	0.625	10.42	16 : 1	0.93	0.24	0.84	0.22	0.76	0.20	0.67	0.18	0.59	0.15	0.50	0.13	0.42	0.11	0.25	0.07
2200	2.20	36.67	4 : 1	2.32	0.53	2.10	0.48	1.88	0.43	1.65	0.38	1.43	0.33	1.21	0.28	0.99	0.23	0.54	0.13
	0.550	9.17	16 : 1	0.94	0.22	0.85	0.20	0.77	0.18	0.68	0.16	0.59	0.14	0.51	0.12	0.42	0.10	0.25	0.06
2000	2.00	33.33	4 : 1	2.36	0.50	2.14	0.45	1.91	0.40	1.68	0.35	1.46	0.31	1.23	0.26	1.01	0.21	0.55	0.12
	0.500	8.33	16 : 1	0.94	0.20	0.86	0.18	0.77	0.16	0.68	0.14	0.60	0.12	0.51	0.11	0.42	0.09	0.25	0.05
1800	1.80	30.00	4 : 1	2.41	0.45	2.18	0.41	1.95	0.37	1.72	0.32	1.49	0.28	1.26	0.24	1.03	0.19	0.56	0.11
	0.450	7.50	16 : 1	0.95	0.18	0.86	0.16	0.77	0.15	0.69	0.13	0.60	0.11	0.51	0.10	0.43	0.08	0.25	0.05
1500	1.50	25.00	4 : 1	2.50	0.39	2.26	0.36	2.02	0.32	1.78	0.28	1.54	0.24	1.30	0.20	1.06	0.17	0.58	0.09
	0.375	6.25	16 : 1	0.96	0.15	0.87	0.14	0.78	0.12	0.69	0.11	0.61	0.10	0.52	0.08	0.43	0.07	0.26	0.04
1200	1.20	20.00	4 : 1	2.63	0.33	2.37	0.30	2.12	0.27	1.87	0.23	1.62	0.20	1.36	0.17	1.11	0.14	0.61	0.08
	0.300	5.00	16 : 1	0.97	0.12	0.88	0.11	0.79	0.10	0.70	0.09	0.61	0.08	0.53	0.07	0.44	0.05	0.26	0.03
1000	1.00	16.67	4 : 1	2.73	0.29	2.47	0.26	2.21	0.23	1.94	0.20	1.68	0.18	1.42	0.15	1.15	0.12	0.63	0.07
	0.250	4.17	16 : 1	0.98	0.10	0.89	0.09	0.80	0.08	0.71	0.07	0.62	0.07	0.53	0.06	0.44	0.05	0.26	0.03
800	0.80	13.33	4 : 1	2.88	0.24	2.60	0.22	2.32	0.19	2.05	0.17	1.77	0.15	1.49	0.12	1.21	0.10	0.66	0.05
	0.200	3.33	16 : 1	1.00	0.08	0.91	0.08	0.82	0.07	0.72	0.06	0.63	0.05	0.54	0.05	0.45	0.04	0.26	0.02
700	0.70	11.67	4 : 1	2.97	0.22	2.69	0.20	2.40	0.18	2.11	0.15	1.82	0.13	1.54	0.11	1.25	0.09	0.67	0.05
	0.175	2.92	16 : 1	1.01	0.07	0.92	0.07	0.82	0.06	0.73	0.05	0.64	0.05	0.54	0.04	0.45	0.03	0.27	0.02
500	0.50	8.33	4 : 1	3.10	0.16	2.80	0.15	2.50	0.13	2.20	0.12	1.90	0.10	1.60	0.08	1.30	0.07	0.70	0.04
	0.125	2.08	16 : 1	1.04	0.05	0.94	0.05	0.85	0.04	0.75	0.04	0.65	0.03	0.56	0.03	0.46	0.02	0.27	0.01
300	0.30	5.00	4 : 1	3.17	0.10	2.86	0.09	2.56	0.08	2.25	0.07	1.94	0.06	1.63	0.05	1.33	0.04	0.71	0.02
	0.075	1.25	16 : 1	1.09	0.03	0.99	0.03	0.89	0.03	0.78	0.02	0.68	0.02	0.58	0.02	0.48	0.02	0.28	0.01
200	0.20	3.33	4 : 1	3.23	0.07	2.92	0.06	2.61	0.05	2.29	0.05	1.98	0.04	1.67	0.03	1.35	0.03	0.73	0.02
	0.050	0.83	16 : 1	1.13	0.02	1.03	0.02	0.92	0.02	0.82	0.02	0.71	0.01	0.61	0.01	0.50	0.01	0.29	0.01
100	0.10	1.67	4 : 1	3.38	0.04	3.05	0.03	2.72	0.03	2.39	0.03	2.07	0.02	1.74	0.02	1.41	0.01	0.76	0.01
	0.025	0.42	16 : 1	1.23	0.01	1.12	0.01	1.00	0.01	0.89	0.01	0.77	0.01	0.66	0.01	0.54	0.01	0.31	0.01

The calculation values apply for a running time of 20% per hour.

The values of torque and power stated are nominal values.

Starting from standstill requires a momentary torque of 2-3 times the nominal value.

This requirement is usually available with three-phase motors.

# Driving Torque/Drive Power

Table 7

Tr 20 x 4

# H10



Driving torque  $T_1$  [Nm]  
 Drive power  $P_1$  [kW]

medium efficiency:  $i = 4:1 \quad \eta \approx 30\%$   
 $i = 16:1 \quad \eta \approx 20\%$

Drive speed	Lifting speed		Ratio	Loading [kN]															
				10		9		8		7		6		5		4		3	
[rpm]	[m/min]	[mm/s]	$i_s$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$
3000	3.00	50.00	4 : 1	4.6	1.46	4.2	1.32	3.8	1.18	3.3	1.04	2.9	0.90	2.4	0.77	2.0	0.63	1.6	0.49
	0.750	12.50	16 : 1	1.9	0.59	1.7	0.53	1.5	0.48	1.4	0.43	1.2	0.37	1.0	0.32	0.8	0.26	0.7	0.21
2800	2.80	46.67	4 : 1	4.7	1.38	4.2	1.25	3.8	1.11	3.4	0.98	2.9	0.85	2.5	0.72	2.0	0.59	1.6	0.46
	0.700	11.67	16 : 1	1.9	0.56	1.7	0.51	1.6	0.46	1.4	0.40	1.2	0.35	1.0	0.30	0.9	0.25	0.7	0.20
2500	2.50	41.67	4 : 1	4.8	1.25	4.3	1.14	3.9	1.02	3.4	0.90	3.0	0.78	2.5	0.66	2.1	0.54	1.6	0.42
	0.625	10.42	16 : 1	2.0	0.51	1.8	0.47	1.6	0.42	1.4	0.37	1.2	0.32	1.1	0.28	0.9	0.23	0.7	0.18
2200	2.20	36.67	4 : 1	4.9	1.13	4.4	1.02	4.0	0.92	3.5	0.81	3.0	0.70	2.6	0.59	2.1	0.49	1.6	0.38
	0.550	9.17	16 : 1	2.0	0.47	1.8	0.42	1.7	0.38	1.5	0.34	1.3	0.29	1.1	0.25	0.9	0.21	0.7	0.16
2000	2.00	33.33	4 : 1	5.0	1.05	4.5	0.95	4.0	0.85	3.6	0.75	3.1	0.65	2.6	0.55	2.1	0.45	1.7	0.35
	0.500	8.33	16 : 1	2.0	0.43	1.9	0.39	1.7	0.35	1.5	0.31	1.3	0.27	1.1	0.23	0.9	0.19	0.7	0.15
1800	1.80	30.00	4 : 1	5.1	0.96	4.6	0.87	4.1	0.78	3.6	0.69	3.2	0.60	2.7	0.50	2.2	0.41	1.7	0.32
	0.450	7.50	16 : 1	2.1	0.39	1.9	0.35	1.7	0.32	1.5	0.28	1.3	0.24	1.1	0.21	0.9	0.17	0.7	0.14
1500	1.50	25.00	4 : 1	5.3	0.83	4.8	0.75	4.3	0.67	3.8	0.59	3.3	0.52	2.8	0.44	2.3	0.36	1.8	0.28
	0.375	6.25	16 : 1	2.1	0.33	1.9	0.30	1.7	0.27	1.5	0.24	1.3	0.21	1.1	0.18	0.9	0.14	0.7	0.11
1200	1.20	20.00	4 : 1	5.6	0.70	5.0	0.63	4.5	0.56	4.0	0.50	3.4	0.43	2.9	0.36	2.4	0.30	1.8	0.23
	0.300	5.00	16 : 1	2.1	0.27	1.9	0.24	1.7	0.22	1.5	0.19	1.3	0.17	1.1	0.14	0.9	0.12	0.7	0.09
1000	1.00	16.67	4 : 1	5.8	0.61	5.2	0.55	4.7	0.49	4.1	0.43	3.6	0.37	3.0	0.32	2.5	0.26	1.9	0.20
	0.250	4.17	16 : 1	2.1	0.22	1.9	0.20	1.7	0.18	1.5	0.16	1.3	0.14	1.1	0.12	0.9	0.10	0.7	0.08
800	0.80	13.33	4 : 1	6.1	0.51	5.5	0.46	4.9	0.41	4.3	0.36	3.8	0.31	3.2	0.27	2.6	0.22	2.0	0.17
	0.200	3.33	16 : 1	2.2	0.18	2.0	0.17	1.8	0.15	1.6	0.13	1.4	0.11	1.2	0.10	1.0	0.08	0.8	0.06
700	0.70	11.67	4 : 1	6.3	0.46	5.7	0.42	5.1	0.37	4.5	0.33	3.9	0.28	3.3	0.24	2.7	0.20	2.1	0.15
	0.175	2.92	16 : 1	2.2	0.16	2.0	0.15	1.8	0.13	1.6	0.12	1.4	0.10	1.2	0.09	1.0	0.07	0.8	0.06
500	0.50	8.33	4 : 1	6.7	0.35	6.1	0.32	5.4	0.28	4.8	0.25	4.1	0.22	3.5	0.18	2.8	0.15	2.2	0.11
	0.125	2.08	16 : 1	2.3	0.12	2.0	0.11	1.8	0.10	1.6	0.09	1.4	0.07	1.2	0.06	1.0	0.05	0.8	0.04
300	0.30	5.00	4 : 1	6.9	0.22	6.2	0.19	5.5	0.17	4.9	0.15	4.2	0.13	3.6	0.11	2.9	0.09	2.2	0.07
	0.075	1.25	16 : 1	2.4	0.07	2.1	0.07	1.9	0.06	1.7	0.05	1.5	0.05	1.3	0.04	1.0	0.03	0.8	0.03
200	0.20	3.33	4 : 1	7.0	0.15	6.3	0.13	5.7	0.12	5.0	0.10	4.3	0.09	3.6	0.08	3.0	0.06	2.3	0.05
	0.050	0.83	16 : 1	2.5	0.05	2.2	0.05	2.0	0.04	1.8	0.04	1.5	0.03	1.3	0.03	1.1	0.02	0.8	0.02
100	0.10	1.67	4 : 1	7.3	0.08	6.6	0.07	5.9	0.06	5.2	0.05	4.5	0.05	3.8	0.04	3.1	0.03	2.4	0.02
	0.025	0.42	16 : 1	2.7	0.03	2.4	0.03	2.2	0.02	1.9	0.02	1.7	0.02	1.4	0.01	1.2	0.01	0.9	0.01

The calculation values apply for a running time of 20% per hour.

The values of torque and power stated are nominal values.

Starting from standstill requires a momentary torque of 2-3 times the nominal value.

This requirement is usually available with three-phase motors.

Driving torque  $T_1$  [Nm]  
Drive power  $P_1$  [kW]

medium efficiency:  $i = 6:1 \quad \eta \approx 28\%$   
 $i = 24:1 \quad \eta \approx 20\%$

Drive speed	Lifting speed		Ratio	Loading [kN]															
				25		22.5		20		17.5		15		10		7.5		5	
[rpm]	[m/min]	[mm/s]	$i_s$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$
3000	3.00	50.00	6 : 1	12.2	3.8	11.0	3.4	9.8	3.1	8.6	2.7	7.4	2.3	5.0	1.6	3.9	1.2	2.7	0.84
	0.750	12.50	24 : 1	5.0	1.6	4.5	1.4	4.1	1.3	3.6	1.1	3.1	0.97	2.1	0.7	1.7	0.52	1.2	0.37
2800	2.80	46.67	6 : 1	12.3	3.6	11.1	3.3	9.9	2.9	8.7	2.6	7.5	2.2	5.1	1.5	3.9	1.1	2.7	0.79
	0.700	11.67	24 : 1	5.0	1.5	4.6	1.3	4.1	1.2	3.6	1.1	3.1	0.91	2.1	0.63	1.7	0.49	1.2	0.35
2500	2.50	41.67	6 : 1	12.6	3.3	11.4	3.0	10.1	2.7	8.9	2.3	7.7	2.0	5.2	1.4	4.0	1.0	2.8	0.72
	0.625	10.42	24 : 1	5.1	1.3	4.6	1.2	4.1	1.1	3.6	0.95	3.1	0.82	2.2	0.57	1.7	0.44	1.2	0.31
2200	2.20	36.67	6 : 1	13.0	3.0	11.7	2.7	10.4	2.4	9.2	2.1	7.9	1.8	5.4	1.2	4.1	0.94	2.8	0.65
	0.550	9.17	24 : 1	5.1	1.2	4.6	1.1	4.1	0.95	3.6	0.84	3.2	0.73	2.2	0.50	1.7	0.39	1.2	0.28
2000	2.00	33.33	6 : 1	13.2	2.8	11.9	2.5	10.6	2.2	9.3	2.0	8.1	1.7	5.5	1.1	4.2	0.87	2.9	0.60
	0.500	8.33	24 : 1	5.1	1.1	4.7	0.97	4.2	0.87	3.7	0.77	3.2	0.66	2.2	0.46	1.7	0.36	1.2	0.25
1800	1.80	30.00	6 : 1	13.5	2.5	12.2	2.3	10.9	2.1	9.6	1.8	8.2	1.6	5.6	1.1	4.3	0.80	2.9	0.56
	0.450	7.50	24 : 1	5.2	0.98	4.7	0.88	4.2	0.79	3.7	0.70	3.2	0.60	2.2	0.42	1.7	0.32	1.2	0.23
1500	1.50	25.00	6 : 1	14.1	2.2	12.7	2.0	11.3	1.8	10.0	1.6	8.6	1.3	5.8	0.91	4.4	0.70	3.1	0.48
	0.375	6.25	24 : 1	5.2	0.82	4.7	0.74	4.2	0.67	3.7	0.59	3.2	0.51	2.2	0.35	1.7	0.27	1.2	0.19
1200	1.20	20.00	6 : 1	14.8	1.9	13.4	1.7	11.9	1.5	10.5	1.3	9.0	1.1	6.1	0.77	4.7	0.59	3.2	0.40
	0.300	5.00	24 : 1	5.3	0.67	4.8	0.61	4.3	0.5	3.8	0.48	3.3	0.41	2.3	0.28	1.8	0.22	1.2	0.16
1000	1.00	16.67	6 : 1	15.5	1.6	14.0	1.5	12.5	1.3	11.0	1.1	9.4	0.99	6.4	0.67	4.9	0.51	3.3	0.35
	0.250	4.17	24 : 1	5.4	0.57	4.9	0.51	4.4	0.5	3.8	0.40	3.3	0.35	2.3	0.24	1.8	0.19	1.3	0.13
800	0.80	13.33	6 : 1	16.4	1.4	14.8	1.2	13.1	1.1	11.5	0.97	9.9	0.83	6.7	0.56	5.1	0.43	3.5	0.29
	0.200	3.33	24 : 1	5.5	0.46	5.0	0.42	4.4	0.37	3.9	0.33	3.4	0.28	2.3	0.20	1.8	0.15	1.3	0.11
700	0.70	11.67	6 : 1	16.4	1.2	14.8	1.1	13.2	0.97	11.6	0.85	10.0	0.73	6.8	0.49	5.1	0.38	3.5	0.26
	0.175	2.92	24 : 1	5.6	0.41	5.0	0.37	4.5	0.33	4.0	0.29	3.4	0.25	2.4	0.17	1.8	0.13	1.3	0.09
500	0.50	8.33	6 : 1	16.6	0.87	15.0	0.79	13.4	0.70	11.7	0.61	10.1	0.53	6.8	0.36	5.2	0.27	3.6	0.19
	0.125	2.08	24 : 1	5.7	0.30	5.2	0.27	4.6	0.24	4.1	0.21	3.5	0.18	2.4	0.13	1.9	0.10	1.3	0.07
300	0.30	5.00	6 : 1	17.0	0.53	15.3	0.48	13.7	0.43	12.0	0.38	10.3	0.32	7.0	0.22	5.3	0.17	3.6	0.11
	0.075	1.25	24 : 1	6.0	0.19	5.5	0.17	4.9	0.15	4.3	0.13	3.7	0.12	2.5	0.08	2.0	0.06	1.4	0.04
200	0.20	3.33	6 : 1	17.4	0.36	15.6	0.33	13.9	0.29	12.2	0.26	10.5	0.22	7.1	0.15	5.4	0.11	3.7	0.08
	0.050	0.83	24 : 1	6.3	0.13	5.7	0.12	5.1	0.11	4.5	0.09	3.9	0.08	2.7	0.06	2.0	0.04	1.4	0.03
100	0.10	1.67	6 : 1	18.1	0.19	16.3	0.17	14.5	0.15	12.7	0.13	11.0	0.11	7.4	0.08	5.6	0.06	3.9	0.04
	0.025	0.42	24 : 1	6.9	0.07	6.2	0.07	5.6	0.06	4.9	0.05	4.2	0.04	2.9	0.03	2.2	0.02	1.6	0.02

The calculation values apply for a running time of 20% RT / h.

The values of torque and power stated are nominal values.

Starting from standstill requires a momentary torque of 2-3 times the nominal value.

This requirement is usually available with three-phase motors.

# Driving Torque/Drive Power

Table 9

Tr 40 x 7

# H50



Driving torque  $T_1$  [Nm]  
 Drive power  $P_1$  [kW]

medium efficiency:  $i = 7:1 \quad \eta \approx 28\%$   
 $i = 28:1 \quad \eta \approx 18\%$

Drive speed	Lifting speed		Ratio	Loading [kN]															
				50		45		40		35		30		25		20		15	
[rpm]	[m/min]	[mm/s]	$i_s$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$
3000	3.00	50.00	7 : 1	24.0	7.5	21.6	6.8	19.3	6.1	17.0	5.3	14.7	4.6	12.3	3.9	10.0	3.1	7.7	2.4
	0.750	12.50	28 : 1	9.8	3.1	8.8	2.8	7.9	2.5	7.0	2.2	6.1	1.9	5.1	1.6	4.2	1.3	3.3	1.0
2800	2.80	46.67	7 : 1	24.3	7.1	21.9	6.4	19.6	5.7	17.2	5.0	14.8	4.4	12.5	3.7	10.1	3.0	7.8	2.3
	0.700	11.67	28 : 1	9.9	2.9	9.0	2.6	8.1	2.4	7.1	2.1	6.2	1.8	5.2	1.5	4.3	1.3	3.3	0.98
2500	2.50	41.67	7 : 1	24.8	6.5	22.4	5.9	20.0	5.2	17.6	4.6	15.2	4.0	12.8	3.3	10.3	2.7	7.9	2.1
	0.625	10.42	28 : 1	10.3	2.7	9.3	2.4	8.3	2.2	7.3	1.9	6.4	1.7	5.4	1.4	4.4	1.2	3.4	0.90
2200	2.20	36.67	7 : 1	25.4	5.9	23.0	5.3	20.5	4.7	18.0	4.2	15.5	3.6	13.1	3.0	10.6	2.4	8.1	1.9
	0.550	9.17	28 : 1	10.6	2.4	9.6	2.2	8.6	2.0	7.6	1.7	6.6	1.5	5.6	1.3	4.5	1.0	3.5	0.81
2000	2.00	33.33	7 : 1	25.9	5.4	23.4	4.9	20.9	4.4	18.4	3.8	15.8	3.3	13.3	2.8	10.8	2.3	8.3	1.7
	0.500	8.33	28 : 1	10.9	2.3	9.9	2.1	8.8	1.8	7.8	1.6	6.7	1.4	5.7	1.2	4.7	0.98	3.6	0.76
1800	1.80	30.00	7 : 1	26.5	5.0	23.9	4.5	21.3	4.0	18.8	3.5	16.2	3.1	13.6	2.6	11.0	2.1	8.4	1.6
	0.450	7.50	28 : 1	11.1	2.1	10.1	1.9	9.0	1.7	7.9	1.5	6.9	1.3	5.8	1.1	4.8	0.90	3.7	0.70
1500	1.50	25.00	7 : 1	27.6	4.3	24.9	3.9	22.2	3.5	19.5	3.1	16.8	2.6	14.1	2.2	11.4	1.8	8.8	1.4
	0.375	6.25	28 : 1	11.3	1.8	10.2	1.6	9.1	1.4	8.0	1.3	7.0	1.1	5.9	0.92	4.8	0.75	3.7	0.59
1200	1.20	20.00	7 : 1	29.0	3.6	26.1	3.3	23.3	2.9	20.5	2.6	17.7	2.2	14.8	1.9	12.0	1.5	9.2	1.2
	0.300	5.00	28 : 1	11.4	1.4	10.3	1.3	9.2	1.2	8.1	1.02	7.0	0.89	6.0	0.75	4.9	0.61	3.8	0.47
1000	1.00	16.67	7 : 1	30.2	3.2	27.2	2.9	24.3	2.5	21.3	2.2	18.4	1.9	15.4	1.6	12.5	1.3	9.5	1.0
	0.250	4.17	28 : 1	11.6	1.2	10.5	1.1	9.3	1.0	8.2	0.86	7.1	0.75	6.0	0.63	4.9	0.52	3.8	0.40
800	0.80	13.33	7 : 1	31.8	2.7	28.7	2.4	25.6	2.1	22.5	1.9	19.4	1.6	16.3	1.4	13.2	1.1	10.0	0.84
	0.200	3.33	28 : 1	11.7	0.98	10.6	0.89	9.5	0.80	8.4	0.70	7.2	0.61	6.1	0.51	5.0	0.42	3.9	0.32
700	0.70	11.67	7 : 1	32.9	2.4	29.7	2.2	26.5	1.9	23.2	1.7	20.0	1.5	16.8	1.2	13.6	1.00	10.4	0.76
	0.175	2.92	28 : 1	11.9	0.87	10.7	0.79	9.6	0.70	8.5	0.62	7.3	0.54	6.2	0.45	5.0	0.37	3.9	0.29
500	0.50	8.33	7 : 1	35.9	1.9	32.4	1.7	28.8	1.5	25.3	1.3	21.8	1.1	18.3	0.96	14.8	0.77	11.3	0.59
	0.125	2.08	28 : 1	12.2	0.64	11.0	0.58	9.9	0.52	8.7	0.45	7.5	0.39	6.3	0.33	5.2	0.27	4.0	0.21
300	0.30	5.00	7 : 1	37.2	1.2	33.5	1.1	29.9	0.94	26.2	0.82	22.6	0.71	18.9	0.59	15.3	0.48	11.6	0.37
	0.075	1.25	28 : 1	12.8	0.40	11.5	0.36	10.3	0.32	9.1	0.29	7.9	0.25	6.6	0.21	5.4	0.17	4.2	0.13
200	0.20	3.33	7 : 1	37.9	0.79	34.1	0.72	30.4	0.64	26.7	0.56	23.0	0.48	19.3	0.40	15.6	0.33	11.8	0.25
	0.050	0.83	28 : 1	13.3	0.28	12.0	0.25	10.8	0.23	9.5	0.20	8.2	0.17	6.9	0.14	5.6	0.12	4.3	0.09
100	0.10	1.67	7 : 1	39.3	0.41	35.4	0.37	31.6	0.33	27.7	0.29	23.9	0.25	20.0	0.21	16.1	0.17	12.3	0.13
	0.025	0.42	28 : 1	10.2	0.11	9.2	0.10	8.2	0.09	7.3	0.08	6.3	0.07	5.3	0.06	4.4	0.05	3.4	0.04

The calculation values apply for a running time of 20% RT / h.

The values of torque and power stated are nominal values.

Starting from standstill requires a momentary torque of 2-3 times the nominal value.

This requirement is usually available with three-phase motors.

Driving torque  $T_1$  [Nm]  
Drive power  $P_1$  [kW]

medium efficiency:  $i = 9:1 \quad \eta \approx 24\%$   
 $i = 36:1 \quad \eta \approx 17\%$

Drive speed	Lifting speed		Ratio	Loading [kN]															
				100		95		90		85		80		70		60		50	
[rpm]	[m/min]	[mm/s]	$i_s$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$
1500	1.50	25.00	9 : 1					56.3	8.8	53.2	8.4	50.2	7.9	44.1	6.9	38.0	6.0	31.9	5.0
	0.375	6.25	36 : 1			24.5	3.9	23.3	3.7	22.1	3.5	20.8	3.3	18.3	2.9	15.8	2.5	13.3	2.1
1400	1.40	23.33	9 : 1			60.3	8.8	57.2	8.4	54.1	7.9	51.0	7.5	44.8	6.6	38.6	5.7	32.4	4.8
	0.350	5.83	36 : 1	25.9	3.8	24.7	3.6	23.4	3.4	22.2	3.2	20.9	3.1	18.4	2.7	15.9	2.3	13.4	2.0
1300	1.30	21.67	9 : 1			61.4	8.4	58.2	7.9	55.1	7.5	51.9	7.1	45.6	6.2	39.3	5.4	33.0	4.5
	0.325	5.42	36 : 1	26.1	3.5	24.8	3.4	23.5	3.2	22.3	3.0	21.0	2.9	18.5	2.5	16.0	2.2	13.5	1.8
1200	1.20	20.00	9 : 1			62.6	7.9	59.4	7.5	56.1	7.1	52.9	6.7	46.5	5.8	40.1	5.0	33.6	4.2
	0.300	5.00	36 : 1	26.2	3.3	25.0	3.1	23.7	3.0	22.4	2.8	21.2	2.7	18.6	2.3	16.1	2.0	13.6	1.7
1100	1.10	18.33	9 : 1	67.2	7.7	63.9	7.4	60.6	7.0	57.3	6.6	54.1	6.2	47.5	5.5	40.9	4.7	34.3	4.0
	0.275	4.58	36 : 1	26.4	3.0	25.1	2.9	23.9	2.7	22.6	2.6	21.3	2.5	18.8	2.2	16.2	1.9	13.7	1.6
1000	1.00	16.67	9 : 1	68.8	7.2	65.5	6.9	62.1	6.5	58.7	6.1	55.4	5.8	48.6	5.1	41.9	4.4	35.2	3.7
	0.250	4.17	36 : 1	26.6	2.8	25.3	2.7	24.1	2.5	22.8	2.4	21.5	2.2	18.9	2.0	16.3	1.7	13.8	1.4
900	0.90	15.00	9 : 1	70.7	6.7	67.2	6.3	63.8	6.0	60.3	5.7	56.9	5.4	49.9	4.7	43.0	4.1	36.1	3.4
	0.225	3.75	36 : 1	26.9	2.5	25.6	2.4	24.3	2.3	23.0	2.2	21.7	2.0	19.1	1.8	16.5	1.6	13.9	1.3
800	0.80	13.33	9 : 1	72.9	6.1	69.3	5.8	65.7	5.5	62.2	5.2	58.6	4.9	51.5	4.3	44.3	3.7	37.2	3.1
	0.200	3.33	36 : 1	27.1	2.3	25.8	2.2	24.5	2.1	23.2	1.9	21.9	1.8	19.3	1.6	16.6	1.4	14.0	1.2
700	0.70	11.67	9 : 1	75.5	5.5	71.8	5.3	68.1	5.0	64.4	4.7	60.7	4.5	53.3	3.9	45.9	3.4	38.5	2.8
	0.175	2.92	36 : 1	27.5	2.0	26.1	1.9	24.8	1.8	23.5	1.7	22.2	1.6	19.5	1.4	16.8	1.2	14.2	1.0
600	0.60	10.00	9 : 1	78.8	4.9	74.9	4.7	71.0	4.5	67.2	4.2	63.3	4.0	55.6	3.5	47.9	3.0	40.1	2.5
	0.150	2.50	36 : 1	27.9	1.8	26.5	1.7	25.2	1.6	23.8	1.5	22.5	1.4	19.8	1.2	17.1	1.1	14.4	0.90
500	0.50	8.33	9 : 1	82.9	4.3	78.8	4.1	74.8	3.9	70.7	3.7	66.6	3.5	58.5	3.1	50.3	2.6	42.2	2.2
	0.125	2.08	36 : 1	28.4	1.5	27.0	1.4	25.6	1.3	24.3	1.3	22.9	1.2	20.1	1.1	17.4	0.91	14.6	0.77
400	0.40	6.67	9 : 1	86.8	3.6	82.5	3.5	78.2	3.3	74.0	3.1	69.7	2.9	61.2	2.6	52.7	2.2	44.1	1.8
	0.100	1.67	36 : 1	29.0	1.2	27.6	1.2	26.2	1.1	24.8	1.04	23.4	0.98	20.6	0.86	17.8	0.75	15.0	0.63
300	0.30	5.00	9 : 1	88.3	2.8	84.0	2.6	79.6	2.5	75.3	2.4	70.9	2.2	62.3	2.0	53.6	1.7	44.9	1.4
	0.075	1.25	36 : 1	30.0	0.94	28.5	0.90	27.1	0.85	25.6	0.80	24.2	0.8	21.3	0.67	18.4	0.58	15.4	0.49
200	0.20	3.33	9 : 1	90.7	1.9	86.3	1.8	81.8	1.7	77.4	1.6	72.9	1.5	64.0	1.3	55.0	1.2	46.1	0.97
	0.050	0.83	36 : 1	31.5	0.66	30.0	0.63	28.4	0.60	26.9	0.56	25.4	0.53	22.3	0.47	19.3	0.40	16.2	0.34
100	0.10	1.67	9 : 1	95.9	1.00	91.2	0.95	86.5	0.91	81.7	0.86	77.0	0.81	67.6	0.71	58.1	0.61	48.7	0.51
	0.025	0.42	36 : 1	34.6	0.36	33.0	0.35	31.3	0.33	29.6	0.31	27.9	0.29	24.5	0.26	21.1	0.22	17.8	0.19

The calculation values apply for a running time of 20% RT / h or 10% RT / h (greyed boxes).

The values of torque and power stated are nominal values.

Starting from standstill requires a momentary torque of 2-3 times the nominal value.

This requirement is usually available with three-phase motors.

# Driving Torque/Drive Power

Table 11

Tr 80 x 7

# H210



Driving torque  $T_1$  [Nm]  
 Drive power  $P_1$  [kW]

medium efficiency:  $i = 10:1 \quad \eta \approx 21\%$   
 $i = 40:1 \quad \eta \approx 14\%$

Drive speed	Lifting speed		Ratio	Loading [kN]															
				210		180		160		140		120		100		75		50	
[rpm]	[m/min]	[mm/s]	$i_s$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$
1500	1.50	25.00	10 : 1					108	17	95	15	82	13	69	11	52	8.2	35	5.6
	0.375	6.25	40 : 1					47	7.4	41	6.5	36	5.6	27	4.2	23	3.6	16	2.5
1400	1.40	23.33	10 : 1					110	16	97	14	83	12	70	10	53	7.7	36	5.3
	0.350	5.83	40 : 1					48	7.0	42	6.2	36	5.3	31	4.5	23	3.4	16	2.4
1300	1.30	21.67	10 : 1			126	17	112	15	98	13	85	12	71	9.7	54	7.3	37	5.0
	0.325	5.42	40 : 1					49	6.7	43	5.9	37	5.1	31	4.3	24	3.3	17	2.2
1200	1.20	20.00	10 : 1			128	16	114	14	100	13	86	11	72	9.1	55	6.9	37	4.7
	0.300	5.00	40 : 1					49	6.2	43	5.5	37	4.7	32	4.0	24	3.0	17	2.1
1100	1.10	18.33	10 : 1			131	15	117	13	102	12	88	10	74	8.5	56	6.4	38	4.4
	0.275	4.58	40 : 1					50	5.7	44	5.0	38	4.3	32	3.7	24	2.8	17	1.9
1000	1.00	16.67	10 : 1			134	14	119	13	105	11	90	9.4	76	7.9	57	6.0	39	4.1
	0.250	4.17	40 : 1					50	5.2	44	4.6	38	4.0	32	3.3	24	2.6	17	1.8
900	0.90	15.00	10 : 1			138	13	123	12	108	10	93	8.7	78	7.3	59	5.5	40	3.8
	0.225	3.75	40 : 1					50	4.8	44	4.2	38	3.6	32	3.0	25	2.3	17	1.6
800	0.80	13.33	10 : 1	165	14	142	12	126	11	111	9.3	95	8.0	80	6.7	61	5.1	41	3.4
	0.200	3.33	40 : 1					51	4.3	45	3.8	39	3.2	32	2.7	25	2.1	17	1.4
700	0.70	11.67	10 : 1	171	13	147	11	131	10	115	8.4	99	7.2	83	6.1	63	4.6	43	3.1
	0.175	2.92	40 : 1			58	4.2	52	3.8	45	3.3	39	2.9	33	2.4	25	1.8	17	1.3
600	0.60	10.00	10 : 1	179	11	153	10	137	8.6	120	7.5	103	6.5	86	5.4	65	4.1	44	2.8
	0.150	2.50	40 : 1			59	3.7	52	3.3	46	2.9	40	2.5	33	2.1	25	1.6	17	1.1
500	0.50	8.33	10 : 1	188	10	161	8.4	144	7.5	126	6.6	108	5.7	91	4.7	69	3.6	47	2.4
	0.125	2.08	40 : 1	69	3.6	59	3.1	53	2.8	47	2.4	40	2.1	34	1.8	26	1.3	18	0.93
400	0.40	6.67	10 : 1	200	8.4	172	7.2	153	6.4	134	5.6	116	4.8	97	4.0	73	3.1	50	2.1
	0.100	1.67	40 : 1	71	3.0	61	2.5	54	2.3	48	2.0	41	1.7	35	1.4	26	1.1	18	0.76
300	0.30	5.00	10 : 1	214	6.7	184	5.8	164	5.1	143	4.5	123	3.9	103	3.2	78	2.4	53	1.7
	0.075	1.25	40 : 1	73	2.3	63	2.0	56	1.8	49	1.5	42	1.3	36	1.1	27	0.85	19	0.58
200	0.20	3.33	10 : 1	219	4.6	188	3.9	167	3.5	147	3.1	126	2.6	105	2.2	80	1.7	54	1.1
	0.050	0.83	40 : 1	76	1.6	65	1.4	58	1.2	51	1.1	44	0.93	37	0.78	28	0.59	19	0.41
100	0.10	1.67	10 : 1	229	2.4	196	2.1	175	1.8	153	1.6	132	1.4	110	1.2	83	0.87	56	0.59
	0.025	0.42	40 : 1	83	0.87	72	0.75	64	0.67	56	0.59	48	0.51	41	0.42	31	0.32	21	0.22

The calculation values apply for a running time of 20% RT / h or 5% RT / h (greyed boxes)

The values of torque and power stated are nominal values.

Starting from standstill requires a momentary torque of 2-3 times the nominal value.

This requirement is usually available with three-phase motors.

Driving torque  $T_1$  [Nm]  
Drive power  $P_1$  [kW]

medium efficiency:  $i = 10:1 \quad \eta \approx 18\%$   
 $i = 40:1 \quad \eta \approx 11\%$

Drive speed	Lifting speed		Ratio	Loading [kN]															
				350		300		250		200		180		150		120		80	
[rpm]	[m/min]	[mm/s]	$i_s$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$
1500	1.50	25.00	10:1							155	24	140	22	117	18	94	15	64	10.1
	0.375	6.25	40:1			99	16	83	13	67	10	60	9	51	7.9	41	6.4	28	4.4
1400	1.40	23.33	10:1					197	29	158	23	142	21	119	17	96	14	65	9.5
	0.350	5.83	40:1			101	15	85	12	68	10	62	9	52	7.6	42	6.1	29	4.2
1300	1.30	21.67	10:1					200	27	161	22	145	20	121	17	98	13	66	9.0
	0.325	5.42	40:1	121	16	104	14	87	12	70	10	63	9	53	7.2	43	5.8	29	4.0
1200	1.20	20.00	10:1					204	26	164	21	148	19	124	16	100	13	68	8.5
	0.300	5.00	40:1	124	16	106	13	89	11	72	9	65	8.1	54	6.8	44	5.5	30	3.8
1100	1.10	18.33	10:1					209	24	168	19	151	17	127	15	102	12	69	7.9
	0.275	4.58	40:1	127	15	109	13	92	11	74	8	67	7.7	56	6.4	45	5.2	31	3.5
1000	1.00	16.67	10:1					214	22	172	18	155	16	130	14	104	10.9	71	7.4
	0.250	4.17	40:1	131	14	112	12	94	10	76	8	68	7.1	57	6.0	46	4.8	31	3.3
900	0.90	15.00	10:1					220	21	177	17	159	15	133	13	107	10.1	73	6.8
	0.225	3.75	40:1	132	12	113	11	95	9	76	7.2	69	6.5	58	5.4	47	4.4	32	3.0
800	0.80	13.33	10:1			272	23	227	19	182	15	164	14	138	12	111	9.3	75	6.3
	0.200	3.33	40:1	133	11	114	10	95	8	77	6.4	69	5.8	58	4.9	47	3.9	32	2.7
700	0.70	11.67	10:1			282	21	236	17	189	14	171	12	143	10	115	8.4	78	5.7
	0.175	2.92	40:1	134	10	115	8.5	97	7.1	78	5.7	70	5.1	59	4.3	47	3.5	32	2.4
600	0.60	10.00	10:1			295	19	246	15	197	12	178	11	149	9.4	120	7.5	81	5.1
	0.150	2.50	40:1	136	9	117	7.3	98	6	79	4.9	71	4.5	60	3.7	48	3.0	33	2.1
500	0.50	8.33	10:1	362	19	310	16	259	14	208	11	187	10	157	8.2	126	6.6	85	4.5
	0.125	2.08	40:1	138	7.2	119	6.2	99	5.2	80	4.2	72	3.8	60	3.2	49	2.6	33	1.7
400	0.40	6.67	10:1	386	16	332	14	277	12	222	9.3	200	8.4	167	7.0	134	5.6	91	3.8
	0.100	1.67	40:1	141	5.9	121	5.1	101	4.3	82	3.4	74	3.1	62	2.6	50	2.1	34	1.4
300	0.30	5.00	10:1	422	13	362	11	302	9	242	7.6	219	6.9	183	5.7	147	4.6	99	3.1
	0.075	1.25	40:1	145	4.6	125	3.9	104	3.3	84	2.6	76	2.4	64	2.0	51	1.6	35	1.1
200	0.20	3.33	10:1	450	9.4	386	8.1	322	6.7	258	5.4	233	4.9	195	4.1	156	3.3	105	2.2
	0.050	0.83	40:1	152	3.2	131	2.7	109	2.3	88	1.8	79	1.7	66	1.4	54	1.1	36	0.76
100	0.10	1.67	10:1	472	4.9	405	4.2	338	3.5	271	2.8	244	2.6	204	2.1	164	1.7	110	1.15
	0.025	0.42	40:1	166	1.7	143	1.5	119	1.2	96	1.0	86	0.9	72	0.76	58	0.61	40	0.41

The calculation values apply for a running time of 20% RT / h or 5% RT / h (greyed boxes).

The values of torque and power stated are nominal values.

Starting from standstill requires a momentary torque of 2-3 times the nominal value.

This requirement is usually available with three-phase motors.

# Driving Torque/Drive Power

Table 13

Tr 120 x 14

# H500



Driving torque  $T_1$  [Nm]  
 Drive power  $P_1$  [kW]

medium efficiency:  $i = 14:1 \quad \eta \approx 18\%$   
 $i = 56:1 \quad \eta \approx 11\%$

Drive speed	Lifting speed		Ratio	Loading [kN]															
				500		450		400		350		300		250		200		100	
[rpm]	[m/min]	[mm/s]	$i_s$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$
1500	1.50	25.00	14 :1	363	57	327	51	291	46	255	40	219	34	183	29	147	23	76	12
	0.375	6.25	56 :1											79	12	64	10	33	5.2
1400	1.40	23.33	14 :1	369	54	332	49	296	43	259	38	223	33	186	27	150	22	77	11
	0.350	5.83	56 :1											81	12	65	9.6	34	5.0
1300	1.30	21.67	14 :1	376	51	338	46	301	41	264	36	227	31	190	26	153	21	78	11
	0.325	5.42	56 :1									99	13	83	11	67	9.1	35	4.7
1200	1.20	20.00	14 :1	383	48	345	43	307	39	269	34	231	29	194	24	156	20	80	10.0
	0.300	5.00	56 :1									101	13	85	11	68	8.6	36	4.5
1100	1.10	18.33	14 :1	392	45	353	41	314	36	275	32	237	27	198	23	159	18	81	9.4
	0.275	4.58	56 :1									102	12	85	10	69	7.9	36	4.1
1000	1.00	16.67	14 :1	402	42	362	38	322	34	282	30	243	25	203	21	163	17	83	8.7
	0.250	4.17	56 :1									103	11	86	9.0	69	7.3	36	3.8
900	0.90	15.00	14 :1	413	39	372	35	331	31	290	27	249	23	208	20	167	16	86	8.1
	0.225	3.75	56 :1									104	9.8	87	8.2	70	6.6	36	3.4
800	0.80	13.33	14 :1	426	36	384	32	342	29	299	25	257	22	215	18	173	14	88	7.4
	0.200	3.33	56 :1									105	8.8	88	7.3	71	5.9	37	3.1
700	0.70	11.67	14 :1	442	32	398	29	354	26	311	23	267	20	223	16	179	13	91	6.7
	0.175	2.92	56 :1							123	9.0	106	7.8	89	6.5	71	5.2	37	2.7
600	0.60	10.00	14 :1	462	29	416	26	370	23	324	20	278	17	233	15	187	12	95	6.0
	0.150	2.50	56 :1							125	7.8	107	6.7	90	5.6	72	4.5	38	2.4
500	0.50	8.33	14 :1	487	25	438	23	390	20	342	18	293	15	245	13	197	10	100	5.3
	0.125	2.08	56 :1							127	6.6	109	5.7	91	4.8	74	3.9	38	2.0
400	0.40	6.67	14 :1	520	22	468	20	417	17	365	15	313	13	262	11	210	8.8	107	4.5
	0.100	1.67	56 :1							130	5.4	111	4.7	93	3.9	75	3.1	39	1.6
300	0.30	5.00	14 :1	567	18	511	16	455	14	398	13	342	11	286	9.0	229	7.2	116	3.7
	0.075	1.25	56 :1					152	4.8	134	4.2	115	3.6	96	3.0	77	2.4	40	1.3
200	0.20	3.33	14 :1	582	12	524	11	466	10	408	9	351	7.3	293	6.1	235	4.9	119	2.5
	0.050	0.83	56 :1					159	3.3	140	2.9	120	2.5	101	2.1	81	1.7	42	0.88
100	0.10	1.67	14 :1	612	6.4	551	5.8	490	5.1	430	4.5	369	3.9	308	3.2	247	2.6	125	1.3
	0.025	0.42	56 :1			196	2.1	175	1.8	153	1.6	132	1.4	110	1.2	89	0.93	46	0.48

The calculation values apply for a running time of 15% RT / h or 5% RT / h (greyed boxes).

The values of torque and power stated are nominal values.

Starting from standstill requires a momentary torque of 2-3 times the nominal value.

This requirement is usually available with three-phase motors.

Driving torque  $T_1$  [Nm]  
Drive power  $P_1$  [kW]

medium efficiency:  $i = 16:1 \quad \eta \approx 18\%$   
 $i = 64:1 \quad \eta \approx 11\%$

Drive speed	Lifting speed		Ratio	Loading [kN]															
				750		700		650		600		500		400		300		200	
[rpm]	[m/min]	[mm/s]	$i_s$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$
1200	1.20	20.00	16 : 1	576	72	538	68	500	63	462	58	386	49	310	39	235	29	159	20
	0.300	5.00	64 : 1													103	13	70	8.8
1100	1.10	18.33	16 : 1	589	68	550	63	511	59	472	54	395	45	317	37	240	28	162	19
	0.275	4.58	64 : 1													103	12	70	8.1
1000	1.00	16.67	16 : 1	603	63	563	59	524	55	484	51	404	42	325	34	246	26	166	17
	0.250	4.17	64 : 1													104	11	71	7.4
900	0.90	15.00	16 : 1	620	58	579	55	538	51	497	47	416	39	334	31	252	24	171	16
	0.225	3.75	64 : 1											139	13	105	10	71	6.7
800	0.80	13.33	16 : 1	640	54	597	50	555	47	513	43	429	36	344	29	260	22	176	15
	0.200	3.33	64 : 1											140	12	106	8.9	72	6.0
700	0.70	11.67	16 : 1	663	49	619	45	576	42	532	39	444	33	357	26	270	20	182	13
	0.175	2.92	64 : 1											141	10	107	7.9	73	5.3
600	0.60	10.00	16 : 1	692	43	647	41	601	38	555	35	464	29	372	23	281	18	190	12
	0.150	2.50	64 : 1									178	11	143	9.0	109	6.8	74	4.6
500	0.50	8.33	16 : 1	729	38	681	36	633	33	585	31	488	26	392	21	296	15	200	10
	0.125	2.08	64 : 1									181	9	146	7.6	110	5.8	75	3.9
400	0.40	6.67	16 : 1	779	33	727	30	676	28	624	26	521	22	419	18	316	13	213	8.9
	0.100	1.67	64 : 1									185	7.7	149	6.2	113	4.7	76	3.2
300	0.30	5.00	16 : 1	850	27	794	25	738	23	682	21	569	18	457	14	344	11	232	7.3
	0.075	1.25	64 : 1							227	7.1	190	6.0	153	4.8	116	3.6	79	2.5
250	0.25	4.17	16 : 1	862	23	805	21	748	20	691	18	577	15	463	12	349	9.1	235	6.1
	0.063	1.04	64 : 1							232	6.1	194	5.1	156	4.1	118	3.1	80	2.1
200	0.20	3.33	16 : 1	874	18	816	17	758	16	700	15	585	12	469	9.8	354	7.4	238	5.0
	0.050	0.83	64 : 1					257	5.4	238	5.0	199	4.2	160	3.3	121	2.5	82	1.7
150	0.15	2.50	16 : 1	895	14	836	13	777	12	718	11	599	9.3	481	7.5	362	5.6	244	3.8
	0.038	0.62	64 : 1					269	4.2	248	3.8	208	3.2	167	2.6	126	2.0	86	1.3
100	0.10	1.67	16 : 1	917	9.6	856	9.0	795	8.3	735	7.7	613	6.4	492	5.2	371	3.9	250	2.6
	0.025	0.42	64 : 1			302	3.2	281	2.9	259	2.7	217	2.3	174	1.8	132	1.4	89	0.9
50	0.05	0.83	16 : 1	1002	5.2	936	4.9	869	4.6	803	4.2	670	3.5	538	2.8	405	2.1	272	1.4
	0.013	0.21	64 : 1	377	2.0	352	1.8	328	1.7	303	1.6	253	1.3	203	1.1	153	0.8	104	0.5

The calculation values apply for a running time of 15% RT / h or 5% RT / h (greyed boxes).

The values of torque and power stated are nominal values.

Starting from standstill requires a momentary torque of 2-3 times the nominal value.

This requirement is usually available with three-phase motors.

# Driving Torque/Drive Power

Table 15

Tr 160 x 18

# H1000



Driving torque  $T_1$  [Nm]  
 Drive power  $P_1$  [kW]

medium efficiency:  $i = 18:1 \quad \eta \approx 18\%$   
 $i = 72:1 \quad \eta \approx 11\%$

Drive speed	Lifting speed		Ratio	Loading [kN]															
				1000		900		800		700		600		500		400		300	
[rpm]	[m/min]	[mm/s]	$i_s$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$	$T_1$	$P_1$
1200	1.20	20.00	18 : 1			696	87	619	78	543	68	467	59	391	49	315	40	239	30
	0.300	5.00	72 : 1													141	18	107	13.5
1100	1.10	18.33	18 : 1			711	82	633	73	555	64	477	55	399	46	321	37	244	28
	0.275	4.58	72 : 1													143	16	109	12.5
1000	1.00	16.67	18 : 1			728	76	649	68	569	60	489	51	409	43	329	34	249	26
	0.250	4.17	72 : 1													144	15	109	11.5
900	0.90	15.00	18 : 1	831	78	748	71	666	63	584	55	502	47	420	40	338	32	256	24
	0.225	3.75	72 : 1													145	14	110	10.4
800	0.80	13.33	18 : 1	857	72	772	65	687	58	603	50	518	43	433	36	349	29	264	22
	0.200	3.33	72 : 1											181	15	146	12.3	111	9.3
700	0.70	11.67	18 : 1	888	65	800	59	713	52	625	46	537	39	449	33	361	26	273	20
	0.175	2.92	72 : 1											183	13	148	10.8	112	8.2
600	0.60	10.00	18 : 1	927	58	835	52	743	47	652	41	560	35	468	29	377	24	285	18
	0.150	2.50	72 : 1											186	11.7	150	9.4	114	7.2
500	0.50	8.33	18 : 1	976	51	879	46	783	41	686	36	590	31	493	26	396	21	300	16
	0.125	2.08	72 : 1									226	12	189	9.9	152	8.0	116	6.1
400	0.40	6.67	18 : 1	1042	44	939	39	836	35	732	31	629	26	526	22	423	18	320	13
	0.100	1.67	72 : 1									230	9.6	193	8.1	156	6.5	118	5.0
300	0.30	5.00	18 : 1	1137	36	1025	32	912	29	799	25	686	22	574	18	461	14	348	11
	0.075	1.25	72 : 1									237	7.5	199	6.2	160	5.0	122	3.8
250	0.25	4.17	18 : 1	1155	30	1040	27	926	24	811	21	697	18	582	15	468	12	353	9.2
	0.063	1.04	72 : 1									243	6.3	203	5.3	164	4.3	124	3.2
200	0.20	3.33	18 : 1	1173	25	1056	22	940	20	824	17	708	15	591	12	475	9.9	359	7.5
	0.050	0.83	72 : 1							288	6.0	248	5.2	208	4.4	167	3.5	127	2.7
150	0.15	2.50	18 : 1	1200	19	1081	17	962	15	843	13	724	11	605	9.4	486	7.6	367	5.7
	0.038	0.62	72 : 1					344	5.3	302	4.7	260	4.0	217	3.4	175	2.7	133	2.1
100	0.10	1.67	18 : 1	1228	13	1106	12	984	10	863	9.0	741	7.8	619	6.5	497	5.2	375	3.9
	0.025	0.42	72 : 1			403	4.2	359	3.8	315	3.3	271	2.8	227	2.4	183	1.9	138	1.4
50	0.05	0.83	18 : 1	1339	7.0	1206	6.3	1073	5.6	940	4.9	807	4.2	674	3.5	541	2.8	409	2.1
	0.013	0.21	72 : 1	524	2.7	472	2.5	420	2.2	368	1.9	317	1.7	265	1.4	213	1.1	161	0.8

The calculation values apply for a running time of 10% RT / h or 5% RT / h (greyed boxes).

The values of torque and power stated are nominal values.

Starting from standstill requires a momentary torque of 2-3 times the nominal value.

This requirement is usually available with three-phase motors.

In addition to the spindle efficiency, the overall efficiency of lifting spindle drives is also dependent on external assembly and operating conditions (tilting, contamination, poor lubrication, etc.), that are difficult to evaluate, numerically.

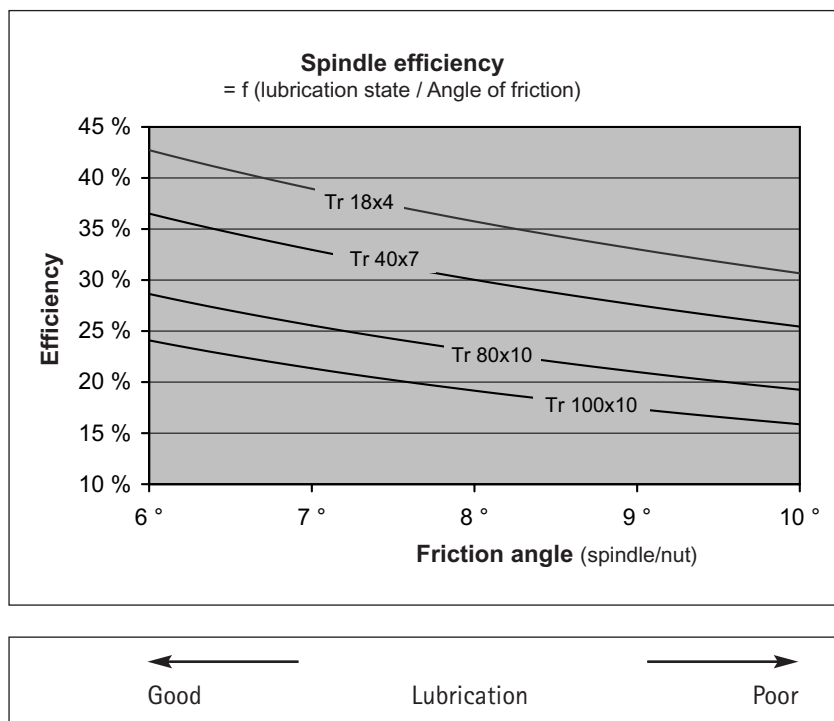
The efficiency of spindle and worm drives is determined by way of the lead angle and friction angle, whereby the friction angle apart from the material pair (steel/bronze), is also determined by the existing tribologic conditions, the surface finish of the components and the degree of the running-in conditions. A deciding factor for the overall efficiency of the gearing is the spindle efficiency, that exhibits different functional responses for lifting and lowering operations (page 35).

If the lifting spindle gear becomes distorted during use, or the lubrication necessary for the threaded spindle has been neglected, the power loss is considerably increased. It is then possible that the given lifting powers are not sufficient for nominal operation therefore, corresponding increases in the drive power should be taken into account during the planning stage.

As a basis for calculation, a friction angle of  $\rho \approx 6^\circ$  applies (sliding friction number  $\mu = 0.1$ ) for a lubricated material pair steel/bronze. If the surface of the spindle is dirty or damaged, the coefficient of friction becomes larger. With poor lubrication (dry running), the angle of friction  $\rho$  of the function pairing spindle/screw-nut deteriorates up to  $10^\circ$  ( $\mu = 0,17$ ) or more, that results in a worsening of the efficiency of the spindle and thus, the gearing also, by approximately 30% compared to the normal operation.

Coeff. of friction	Friction angle
0,07	4 °
0,09	5 °
0,10	6 °
0,12	7 °
0,14	8 °
0,16	9 °
0,17	10 °

Chart: Trapezoidal thread Angle of friction / Efficiency



The chart shows the lifting efficiency for various sizes of spindle, as a function of the angle of friction. The efficiency of the spindle is also improved by better tribologic conditions, higher lifting speeds and peripheral speeds in the operation of spindle/nut. In a practical application, the operational efficiency of the gear can vary enormously. Considering the above facts, an exact quotation for efficiency of the spindle and the overall gearing, cannot be given.

### Self-locking

Basically, self-locking gears always have a low efficiency. Screw jack units have thread lead angles between  $1.92^\circ$  and  $4.55^\circ$  and considering the following properties and operating conditions, can be regarded as self-locking. With Screw jack units a differentiation is made between the lifting and the lowering efficiency, whereby for the self-locking only the lowering efficiency of the trapezoidal thread is the deciding factor.

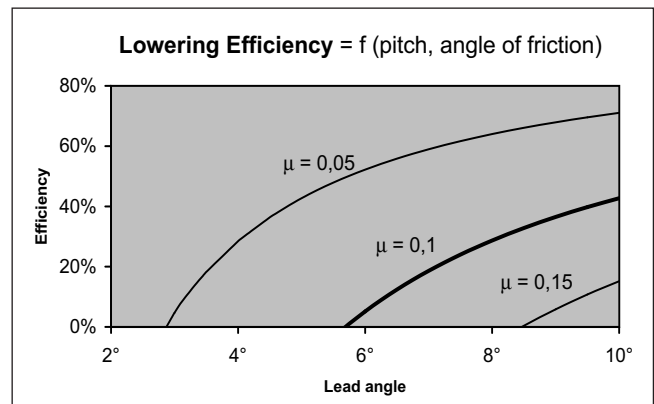
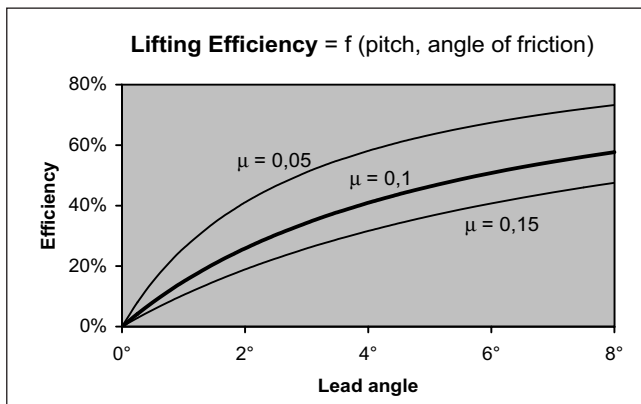
**Static self-locking** or self-locking from standstill, is the condition if the start-up efficiency is less than 50%. The condition of starting from standstill with the spindle under load, is not numerically plausible since the lowering efficiency of the spindle is less than 0%. In practice however, this self-locking can be cancelled by external vibrations or shocks, which means that the drive can start with a loaded spindle. The friction of the material used for the gear-pair has a deciding influence on the self-locking of the thread. Since the frictional conditions cannot be determined exactly (there are a few assumptions to be made for establishing the coefficient of friction), it is not possible to specify any explicit limit where the conditions for the self-locking are satisfied. It is preferable therefore, to assess transitional areas and the various obstructing features.

**Non-self-locking** is the classification in practical applications that use a spindle thread pitch  $> 4.5^\circ$ , since then, the condition thread lead angle  $<$  angle of friction is satisfied only by a limit value.

**Conditional self-locking** is applied to applications with a thread lead angle between  $2.5^\circ$  and  $4.5^\circ$ . Here, from a geometric point of view, self-locking is present but it can be influenced by vibrations, mechanical shocks or optimum sliding conditions. In case of doubt, a motor brake should be installed at the input side.

**Dynamic self-locking** or self-locking during movement, requires (from experience), a thread lead angle  $< 2.5^\circ$ . This feature is present in lifting spindle gears larger than size H350.

The following lifting and lowering efficiencies are given for various lead angles and coefficients of friction:



Use of the screw jack unit with the requirements of self-locking:

Gear / Trapezoidal Threaded Spindle			Self-locking			
Gear size	Trapezoidal thread	Thread pitch $\gamma$	No self-locking	conditional at standstill	at standstill	during movement
H 5	Tr 18x4	$4.55^\circ$	•			
H 10	Tr 20x4	$4.05^\circ$		•		
H 25	Tr 30x6	$4.05^\circ$		•		
H 50	Tr 40x7	$3.49^\circ$		•		
H 100	Tr 55x9	$3.25^\circ$		•		
H 210	Tr 80x10	$2.43^\circ$			•	
H 350	Tr 100x10	$1.92^\circ$			•	•
H 500	Tr 120x14	$2.26^\circ$			•	•
H 750	Tr 140x16	$2.21^\circ$			•	•
H 1000	Tr 160x18	$2.17^\circ$			•	•



**Lateral Force  $F_s$**

The permissible lateral force,  $F_s$  is dependent on the axial load,  $F$  and the clear length of spindle,  $L$ .

Tensile load:

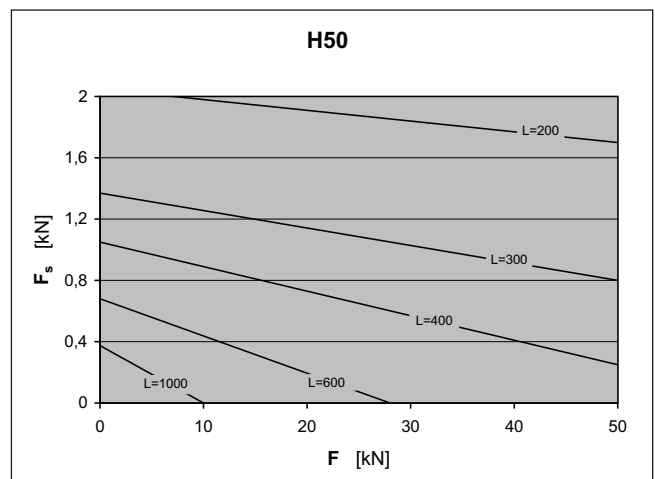
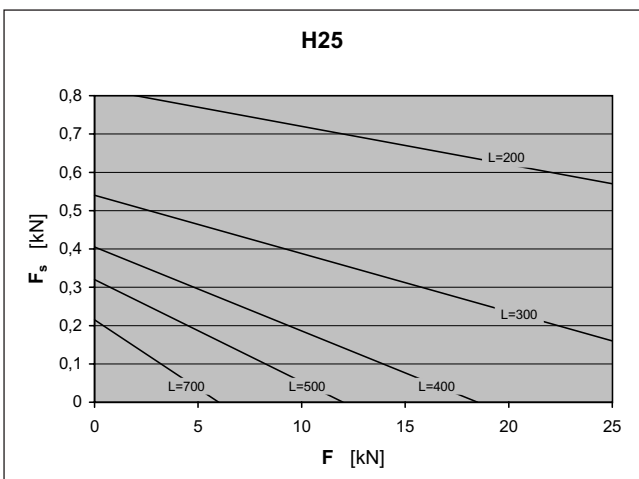
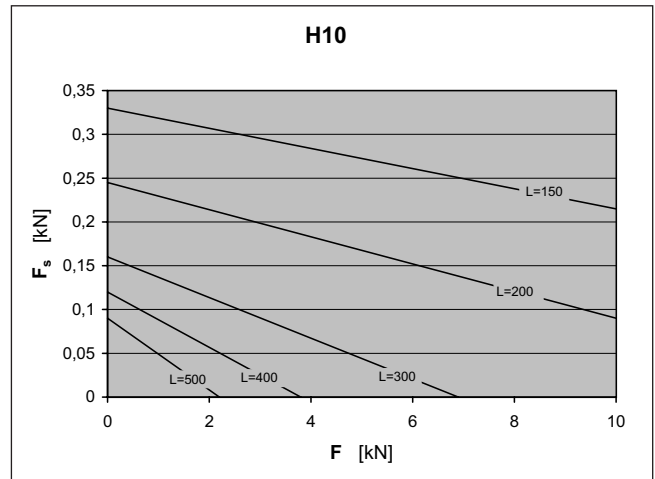
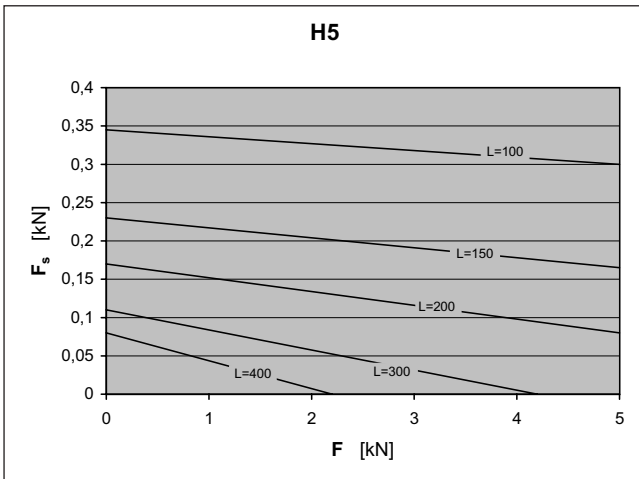
- the following applies when traction is applied to the elevating spindle:

Gear	H5	H10	H25	H50	H100	H210	H350	H500	H750	H1000
$T_{s_{max}}$ [Nm]	35	50	200	400	2000	3500	10000	17000	26000	40000

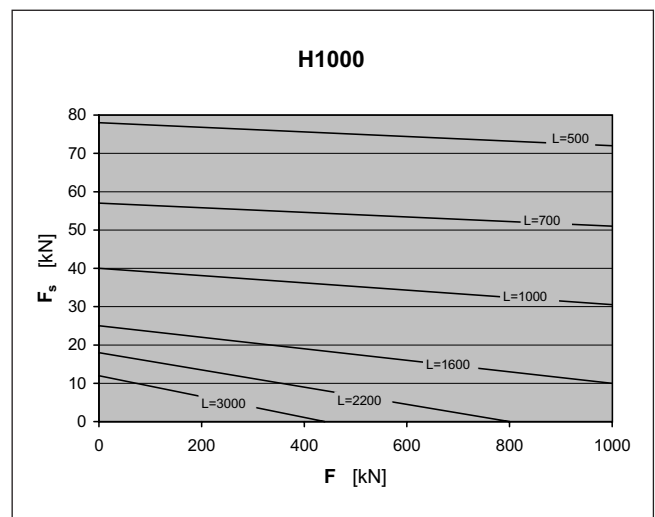
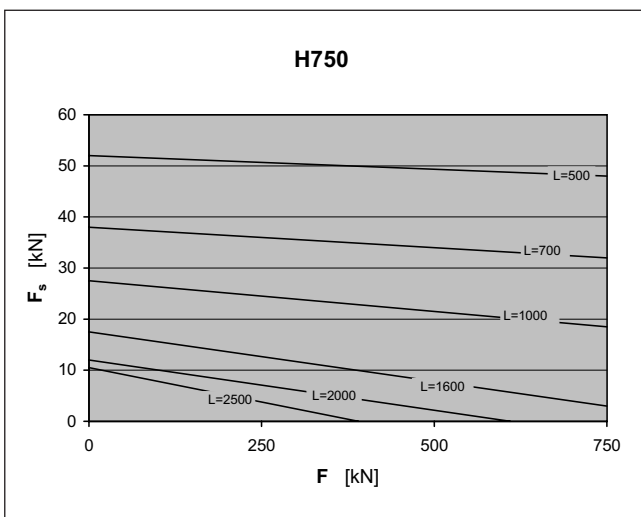
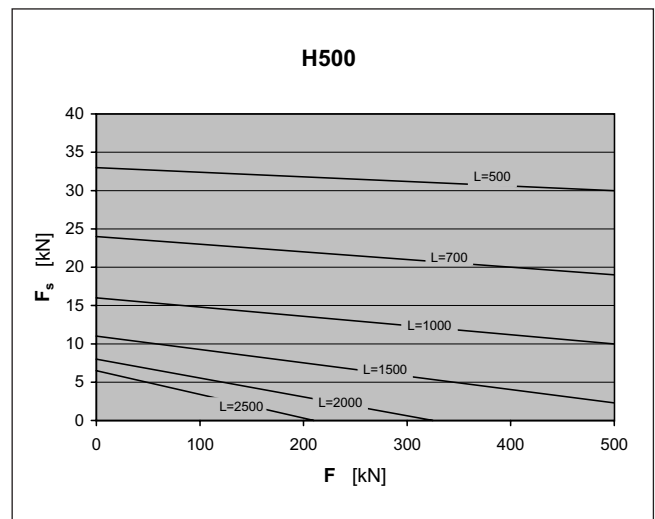
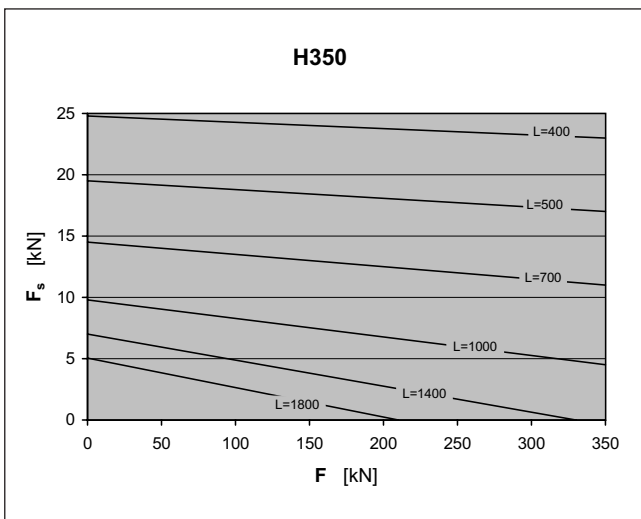
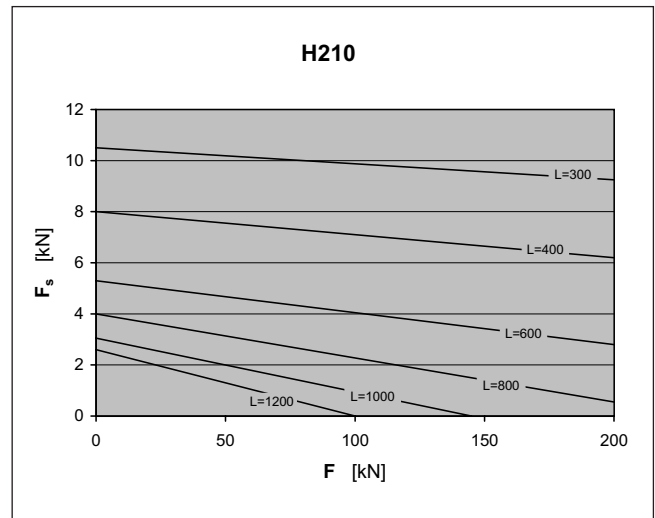
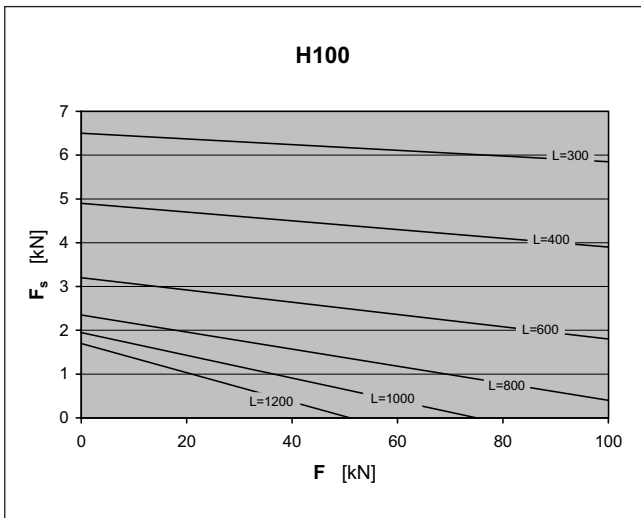
Considering a specific application, the product of the variables  $F_s$  [N] and  $L$  [m] must not exceed the value of  $T_{s_{max}}$  [Nm].

Compression stress:

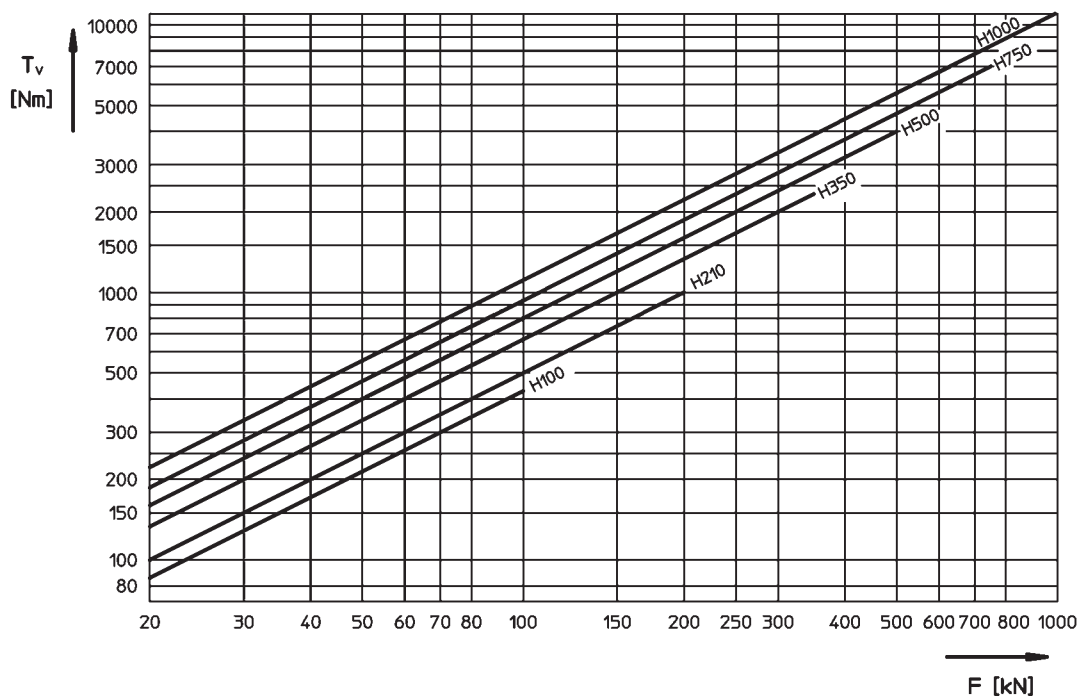
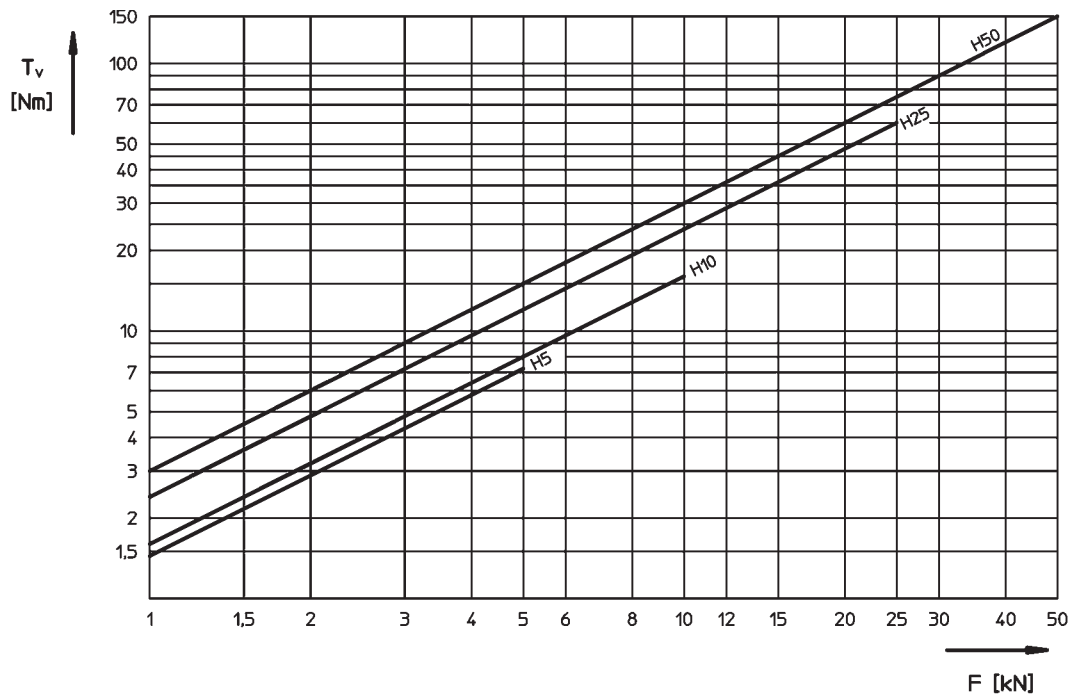
- If the elevating spindle is subjected to compressive stress, the following charts apply for permanent loading. Safety factors of 3...4 have been taken into account.
- During any movement processes, the lateral force should not exceed a maximum of 50% of the values given in the charts (permanent loading).
- For taking up lateral forces, screw-nut lifting gears should always incorporate a "built-in counter bearing".



# Charts for Permissible Lateral Force, $F_s$



The occurrence of moment of torsion  $T_v$ , is dependent on the loading,  $F$ . In screw jack units of the basic model HG, the elevating spindle (in the screw-nut model HL, the nut) must be protected against twisting movements that are produced when lifting and the moments of torsion that occur under load. These moments of torsion must be taken up by the linkage between lifting spindle drive and load as well as by the guideways. Thus, for example, an axial movement of the screw-nut is started only by "holding" the nut tight on the rotating spindle. The forces and moments necessary for this, are obtained by a suitable anti-twist element. In gears with an integrated anti-twist element, these moments of torsion do not require separate consideration; the reaction forces are absorbed in the construction of the gear. In all other applications, the system installation must support these moments of torsion.



### Weight – Lubricant Quantities (Guidance values)

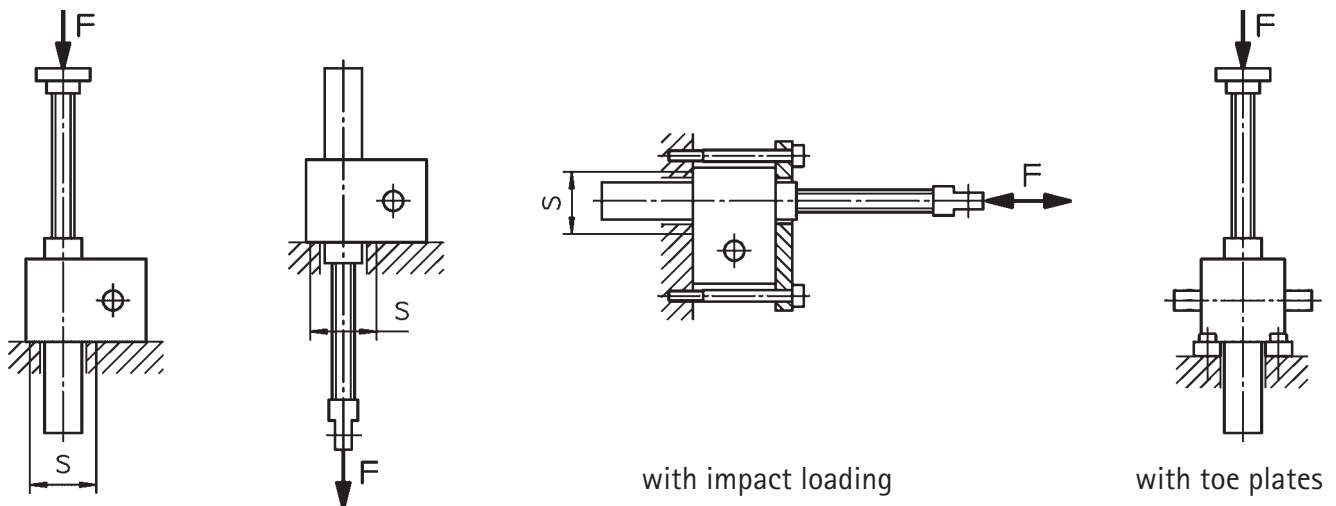
Lifting spindle drive	Unit	H5	H10	H25	H50	H100	H210	H350	H500	H750	H1000
Mass Screw jack unit (without spindle)	[kg]	1.2	2.1	6.5	17	35	50	75	150	250	320
Mass Trapez. thread per 1000 mm length	[kg/m]	1.6	2.0	4.5	8.2	15.7	34.7	55.6	78.7	107.6	140.6
Grease quantity per gear filling	[cm <sup>3</sup> ]	50	80	180	450	900	1600	2800	5500	8000	15000

→ Types of oil and viscosities, according to the table on page 61

### Assembly

ZZ - lifting spindle drives can basically, be fitted at either of the two plane sides that are at a right-angle to the axis of the elevating spindle (side "D" or "A").

The method of fixing should be selected so that the loaded side of the gear is supported by the range of diameter S. Smaller clearance holes S should be tried as these offer a better load support for the gearing.

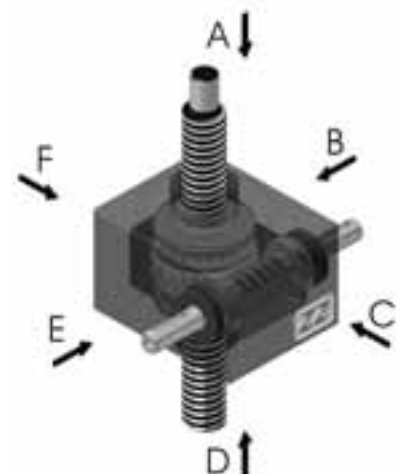


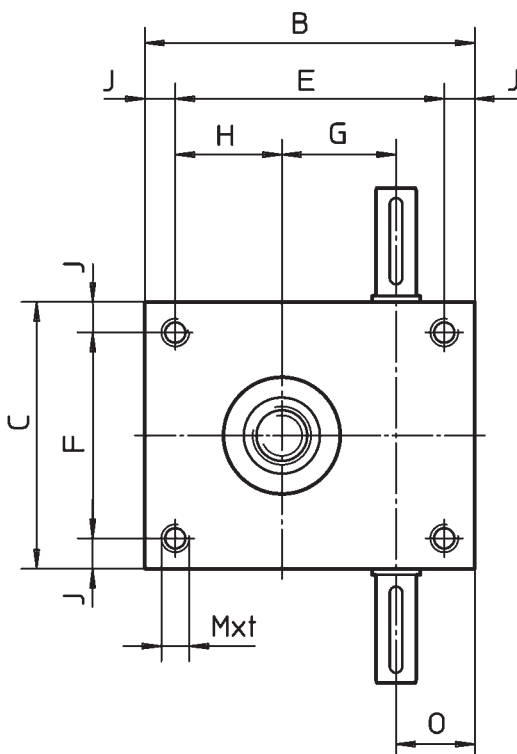
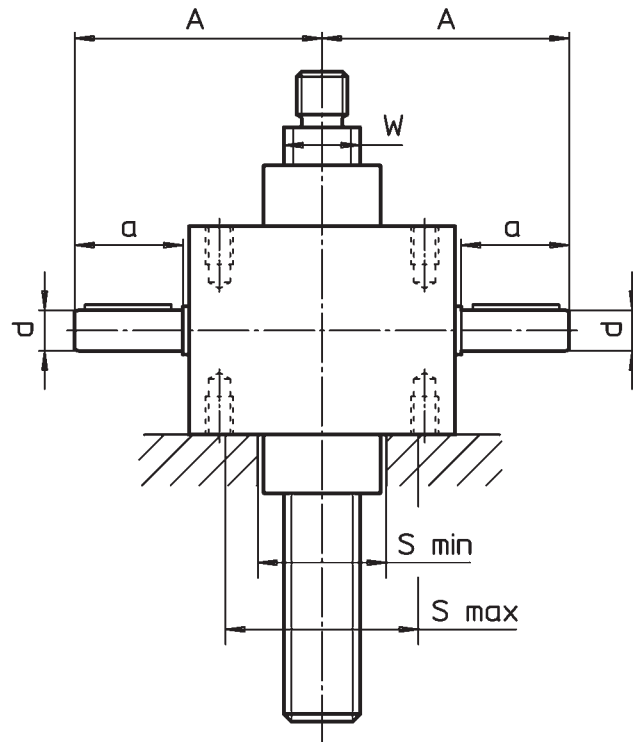
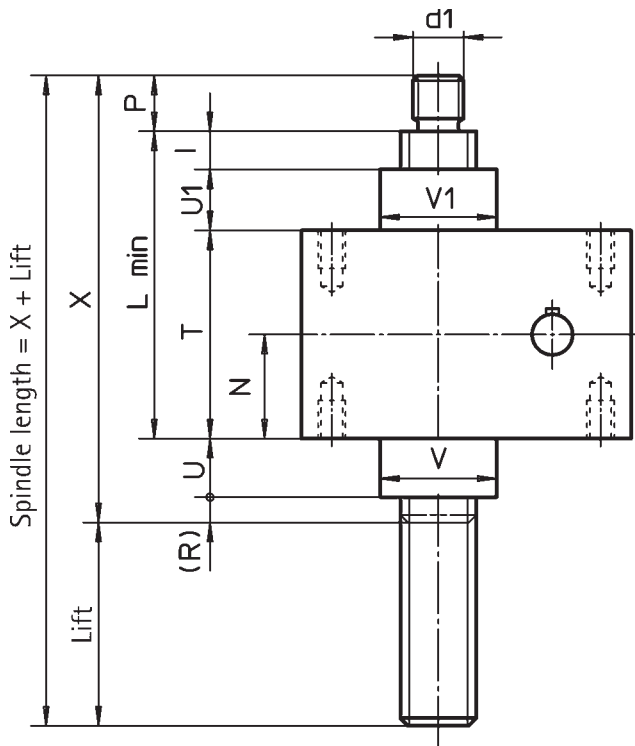
All variants of screw jack units can be mounted on toe plates.

### Description of the gearing surfaces

With a single-sided worm shaft and when including toe plates or a motor flange, the relevant side must be quoted when placing an order.

- single-sided worm shaft fitting (sides B, E)
- single-sided motor fitting (sides B, E)
- Addition of toe plates (sides A, D)
- Housing fixing (sides A, D)





S min = minimum clearance hole  
- for screw jack units without protection tube

S max = maximum permissible clearance hole  
- because of the minimum mounting surface for the housing

Keyway dimensions, to DIN 6885/1  
Shaft with centre bore, to DIN 332-D

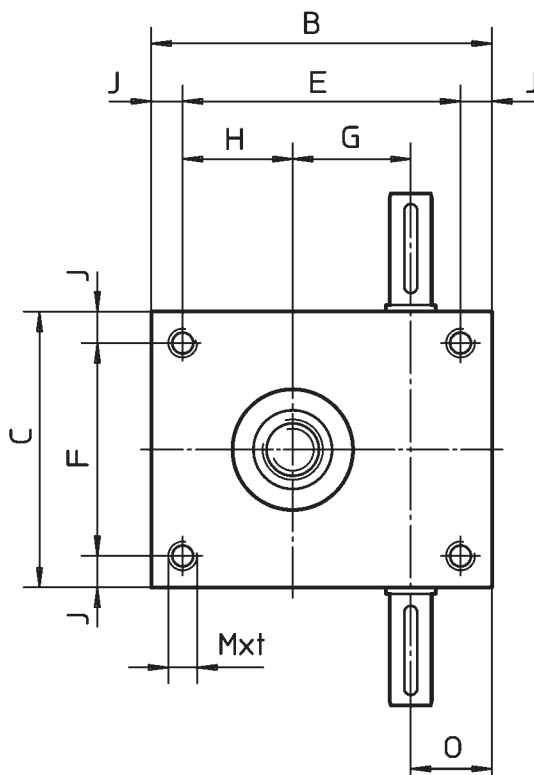
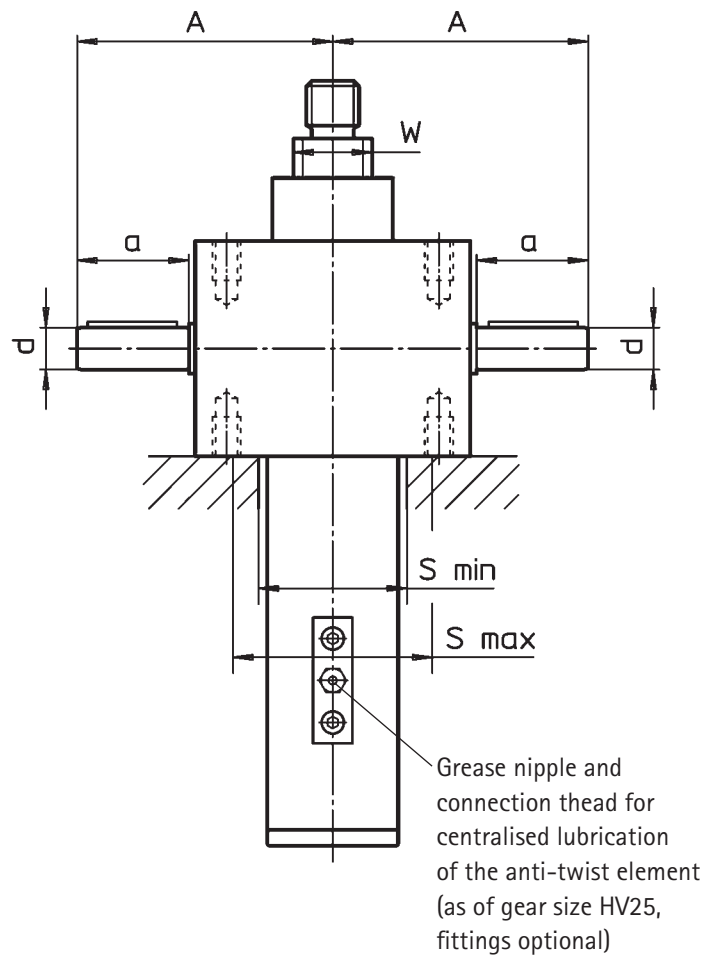
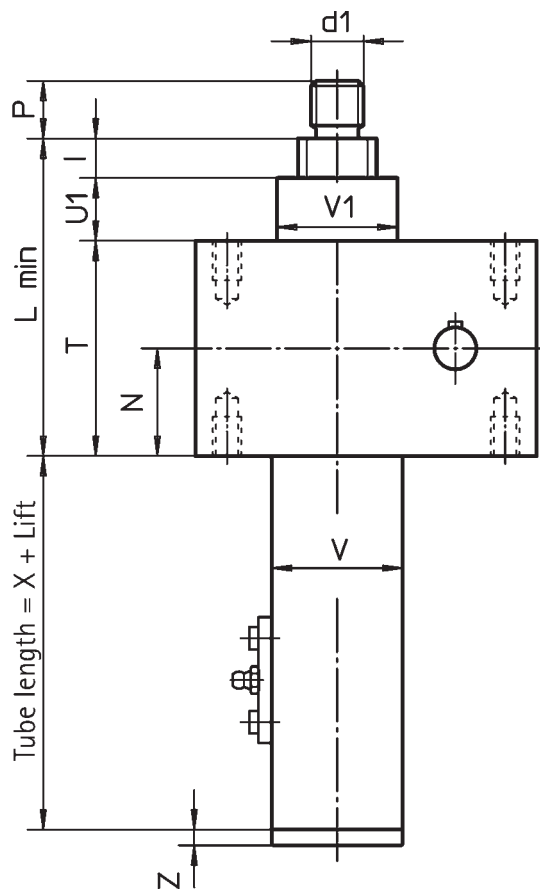
Dimensions and presentation, without obligation,  
Amendments are possible without prior notice.

# Table of Dimensions of ZZ Screw Jack Units

Basic Model HG



Dims.	Gear Size									
	HGM	HGM	HGA	HGA	HGA	HGZ	HGZ	HGZ	HGZ	HGZ
	5	10	25	50	100	210	350	500	750	1000
<b>a</b>	22.5	25.5	43	45	65	60	65	80	85	105
$\varnothing d_{k6}$	10	14	16	20	25	32	38	48	55	60
<b>d1</b>	M12	M14	M20	M30	M36	M52	M72x6	M100x6	M110x6	M120x6
<b>A</b>	60	70	97.5	120	150	175	190	250	285	335
<b>B</b>	80	100	130	180	200	250	290	370	450	510
<b>C</b>	72	85	105	145	165	220	244	330	390	450
<b>E</b>	60	78	106	150	166	200	230	300	360	410
<b>F</b>	52	63	81	115	131	170	184	260	300	350
<b>G</b>	25	32	45	63	71	80	100	135	170	200
<b>H</b>	21	29	42	63	66	85	97	120	140	165
<b>I</b>	4	7	15	15	15	20	20	30	30	30
<b>J</b>	10	11	12	15	17	25	30	35	45	50
<b>L<sub>min</sub></b>	78	100	121	164	218	225	275	330	322	410
<b>Mxt</b>	M8x12	M8x13	M10x16	M12x20	M20x32	M24x35	M30x50	M30x50	M42x55	M42x65
<b>N</b>	32	37	41	58	80	80	100	120	125	150
<b>O</b>	24	28	31	39	46	60	63	80	95	95
<b>P</b>	19	20	22	29	48	50	70	80	90	100
<b>R</b>	ca.10	ca.10	ca.10	ca.10	ca.10	ca.10	ca.10	ca.10	ca.20	ca.20
$\varnothing S_{min}$	31	40	47	61	86	112	142	175	235	235
$\varnothing S_{max}$	45	55	95	120	150	200	230	290	340	410
<b>T</b>	62	75	82	116	160	160	200	240	250	300
<b>U</b>	12	18	23	30	40	45	55	60	42	80
<b>U1</b>	12	18	24	33	43	45	55	60	42	80
$\varnothing V$	30	39	46	60	85	110	140	170	230	230
$\varnothing V1$	30	39	46	60	85	140	170	170	230	230
<b>W</b>	Tr18x4	Tr20x4	Tr30x6	Tr40x7	Tr55x9	Tr80x10	Tr100x10	Tr120x14	Tr140x16	Tr160x18
<b>X</b>	120	150	175	235	315	330	410	480	480	610



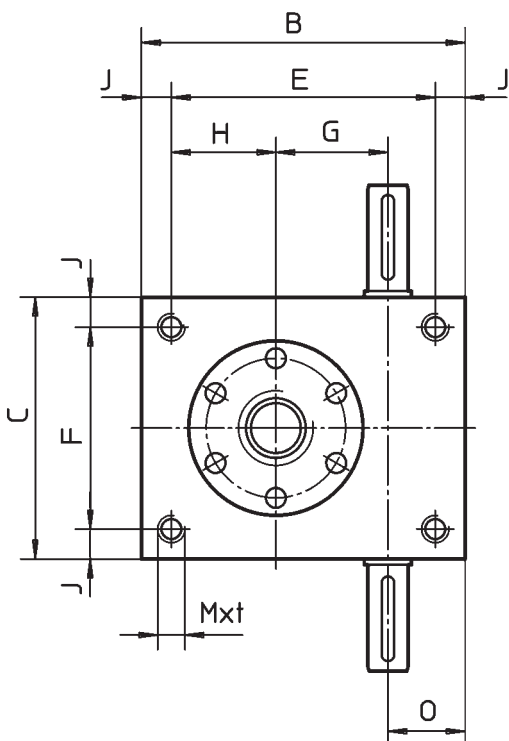
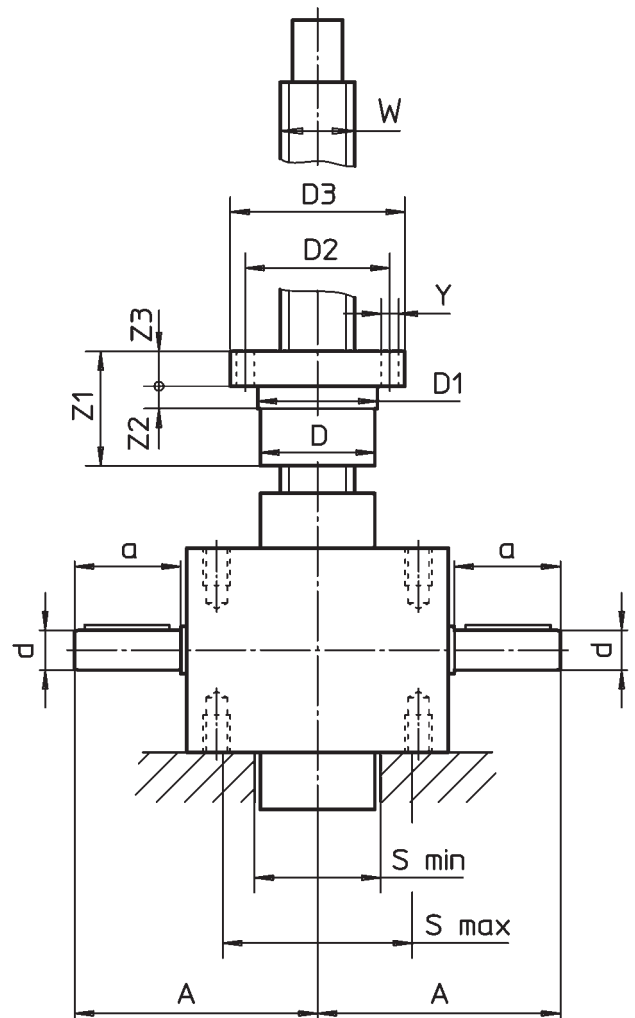
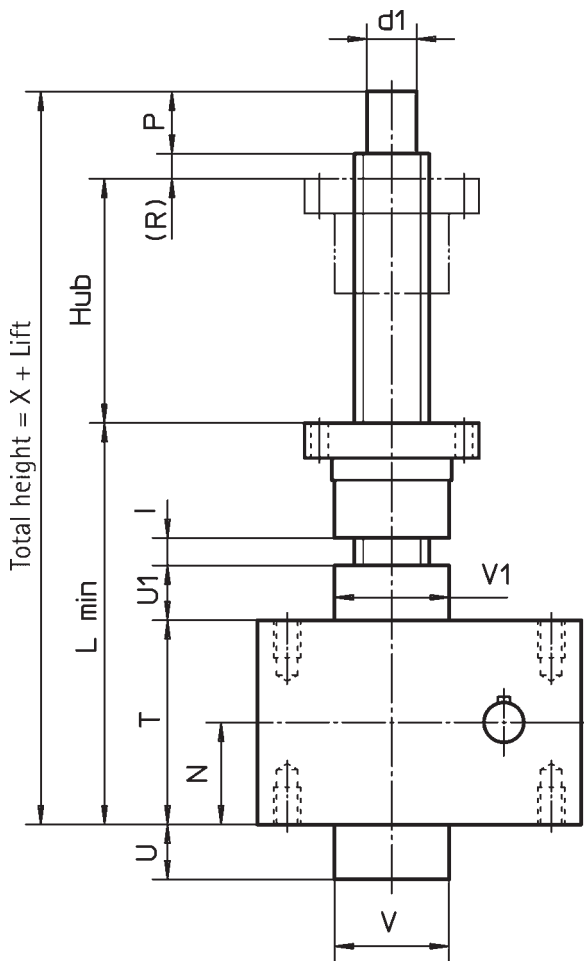
$S_{min}$  = minimum clearance hole  
 - for feed-through opening  $\square S_{min}$   
 - for clearance hole  $\varnothing S_{min}$   
 $S_{max}$  = maximum permissible clearance hole  
 - because of the minimum bearing surface for the housing

Keyway dimensions, to DIN 6885/1  
 Shaft with centre bore, to DIN 332-D

Dimensions and presentation, without obligation,  
 Amendments are possible without prior notice.

Table of Dimensions of ZZ Screw Jack Units  
with Anti-twist Element HV

Dims.	Gear Size									
	HVM	HVM	HVA	HVA	HVA	HVZ	HVZ	HVZ	HVZ	HVZ
	5	10	25	50	100	210	350	500	750	1000
<b>a</b>	22.5	25.5	43	45	65	60	65	80	85	105
$\varnothing d_{k6}$	10	14	16	20	25	32	38	48	55	60
<b>d1</b>	M12	M14	M20	M30	M36	M52	M72x6	M100x6	M110x6	M120x6
<b>A</b>	60	70	97.5	120	150	175	190	250	285	335
<b>B</b>	80	100	130	180	200	250	290	370	450	510
<b>C</b>	72	85	105	145	165	220	244	330	390	450
<b>E</b>	60	78	106	150	166	200	230	300	360	410
<b>F</b>	52	63	81	115	131	170	184	260	300	350
<b>G</b>	25	32	45	63	71	80	100	135	170	200
<b>H</b>	21	29	42	63	66	85	97	120	140	165
<b>I</b>	4	7	15	15	15	20	20	30	30	30
<b>J</b>	10	11	12	15	17	25	30	35	45	50
<b>L<sub>min</sub></b>	78	100	116	159	213	225	275	320	320	410
<b>Mxt</b>	M8x12	M8x13	M10x16	M12x20	M20x32	M24x35	M30x50	M30x50	M42x55	M42x65
<b>N</b>	32	37	41	58	80	80	100	120	125	150
<b>O</b>	24	28	31	39	46	60	63	80	95	95
<b>P</b>	19	20	22	29	48	50	70	80	90	100
$\square S_{min}$	33	43	58	80	100	126	156	176	272	236
$\varnothing S_{min}$	33	43	70	98	126	152	194	226	272	310
$\varnothing S_{max}$	45	55	95	120	150	200	230	290	340	410
<b>T</b>	62	75	82	116	160	160	200	240	250	300
<b>U1</b>	12	18	24	33	43	45	55	60	42	80
<b>V</b>	$\varnothing 32$	$\varnothing 42$	$\varnothing 50$	$\varnothing 70$	$\varnothing 90$	$\varnothing 110$	$\varnothing 140$	$\varnothing 160$	$\varnothing 200$	$\varnothing 220$
$\varnothing V1$	30	39	46	60	85	110	170	170	230	230
<b>W</b>	Tr18x4	Tr20x4	Tr30x6	Tr40x7	Tr55x9	Tr80x10	Tr100x10	Tr120x14	Tr140x16	Tr160x18
<b>X</b>	21	30	95	100	120	120	125	150	150	200
<b>Z</b>	5	5	5	5	5	5	5	5	5	5



$S_{min}$  = minimum clearance hole  
 - for screw jack units without protection tube  
 $S_{max}$  = maximum permissible clearance hole  
 - because of the minimum bearing surface for the housing

Keyway dimensions, to DIN 6885/1  
 Shaft with centre bore, to DIN 332-D

Dimensions and presentation, without obligation, amendments are possible without prior notice.

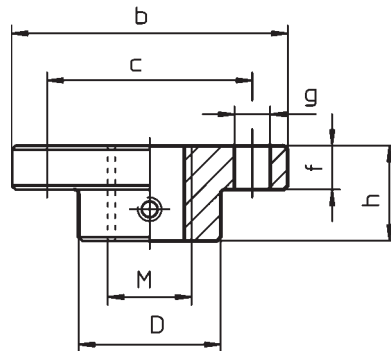
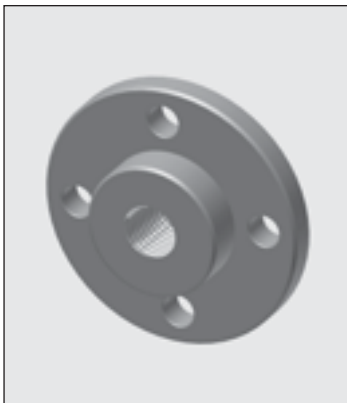
# Table of Dimensions of ZZ Screw Jack Units

Screw-nut Model HL



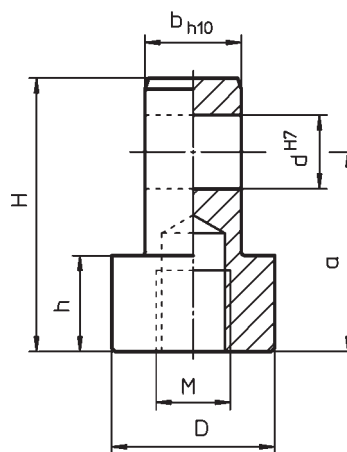
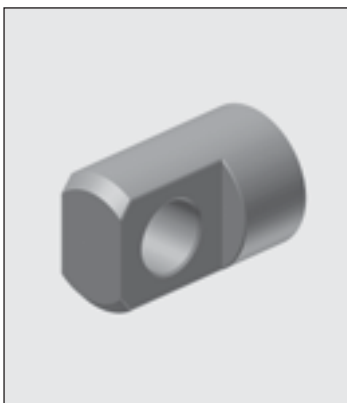
Dims.	Gear Size									
	HLM	HLM	HLA	HLA	HLA	HLZ	HLZ	HLZ	HLZ	HLZ
	5	10	25	50	100	210	350	500	750	1000
<b>a</b>	22.5	25.5	43	45	65	60	65	80	85	105
<b>Ød<sub>k6</sub></b>	10	14	16	20	25	32	38	48	55	60
<b>Ød1<sub>j7</sub></b>	12	15	20	25	40	55	75	100	110	120
<b>A</b>	60	70	97.5	120	150	175	190	250	285	335
<b>B</b>	80	100	130	180	200	250	290	370	450	510
<b>C</b>	72	85	105	145	165	220	244	330	390	450
<b>ØD</b>	28	32	38	63	72	108	138	168	198	228
<b>ØD1<sub>h9</sub></b>	28	32	38	63	72	110	140	170	200	230
<b>ØD2</b>	38	45	50	78	90	155	200	240	270	320
<b>ØD3</b>	48	55	62	95	110	200	250	300	330	390
<b>E</b>	60	78	106	150	166	200	230	300	360	410
<b>F</b>	52	63	81	115	131	170	184	260	300	350
<b>G</b>	25	32	45	63	71	80	100	135	170	200
<b>H</b>	21	29	42	63	66	85	97	120	140	165
<b>I</b>	12	15	15	15	15	20	20	30	30	30
<b>J</b>	10	11	12	15	17	25	30	35	45	50
<b>L<sub>min</sub></b>	130	152	166	231	305	325	425	510	565	650
<b>M x t</b>	M8x12	M8x13	M10x16	M12x20	M20x32	M24x35	M30x50	M30x50	M42x55	M42x65
<b>N</b>	32	37	41	58	80	80	100	120	125	150
<b>O</b>	24	28	31	39	46	60	63	80	95	95
<b>P</b>	15	20	25	30	45	70	100	120	150	200
<b>R</b>	ca.12	ca.15	ca.15	ca.15	ca.15	ca.15	ca.15	ca.15	ca.15	ca.15
<b>ØS<sub>min</sub></b>	31	40	-	-	-	105	145	175	210	240
<b>ØS<sub>max</sub></b>	45	55	95	120	150	200	230	290	340	410
<b>T</b>	62	75	82	116	160	160	200	240	250	300
<b>U</b>	12	18	-	-	-	40	25	45	55	65
<b>U1</b>	12	18	23	30	40	45	55	60	75	80
<b>ØV</b>	30	39	-	-	-	100	140	170	200	230
<b>ØV1</b>	30	39	46	60	85	110	140	170	200	230
<b>W</b>	Tr18x4	Tr20x4	Tr30x6	Tr40x7	Tr55x9	Tr80x10	Tr100x10	Tr120x14	Tr140x16	Tr160x18
<b>X</b>	157	187	205	270	370	410	540	645	730	865
<b>ØY</b>	6x Ø6	6x Ø7	6x Ø7	6x Ø9	6x Ø11	4x Ø26	6x Ø26	6x Ø33	8x Ø33	8x Ø39
<b>Z1</b>	44	44	46	70	90	100	150	180	210	240
<b>Z2</b>	7	7	7	7	7	7	7	7	7	7
<b>Z3</b>	12	12	14	16	20	25	30	35	40	50

**End plate**



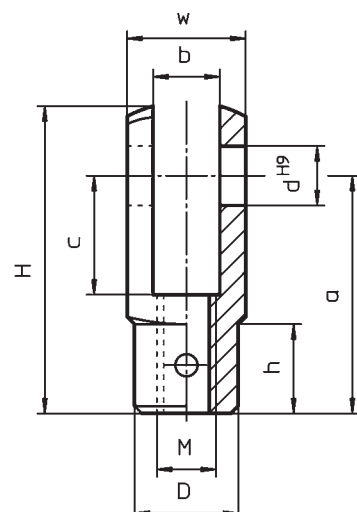
Dims.	Gear Size									
	HM 5	HM 10	HA 25	HA 50	HA 100	HZ 210	HZ 350	HZ 500	HZ 750	HZ 1000
Øb	65	80	90	110	150	200	250	300	330	390
Øc	48	60	67	85	117	155	200	240	270	320
ØD	29.3	38.7	46	60	85	110	140	170	200	230
M	M12	M14	M20	M30	M36	M52	M72 x6	M100 x6	M110 x6	M120 x6
Øg	4x Ø9	4x Ø11	4x Ø11	4x Ø13	4x Ø17	4x Ø26	6x Ø26	6x Ø33	8x Ø33	8x Ø39
h	20	21	23	30	50	52	72	82	92	105
f	7	8	10	15	20	25	30	35	40	50

**Rod-end bearing**



Dims.	Gear Size									
	HM 5	HM 10	HA 25	HA 50	HA 100	HZ 210	HZ 350	HZ 500	HZ 750	HZ 1000
H	50	60	100	125	145	150	240	300	340	380
ØD	36	36	46	60	85	110	140	170	200	230
b <sub>h10</sub>	16	20	30	35	40	75	110	120	140	160
h	20	20	40	50	65	50	90	100	140	140
a	35	40	75	90	108	100	165	200	240	260
Ød <sup>H7</sup>	12	14	20	30	35	60	80	100	120	140
M	M12	M14	M20	M30	M36	M52	M72 x6	M100 x6	M110 x6	M120 x6

**Yoke**



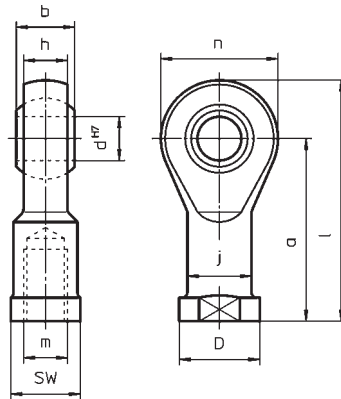
Dims.	Gear Size				
	HM 5	HM 10	HA 25	HA 50	HA 100
M	M12	M14	M20	M30	M36
H	61	72	105	160	188
w	24	28	40	60	70
b	12	14	20	30	36
c	24	28	40	60	72
a	48	56	80	120	144
ØD	20	24.5	34	52	60
Ød <sup>H9</sup>	12	14	20	30	35
h	18	22	30	42	54

## ZZ Accessories

Cardan end joint • Counter bearing plate • Protection tube



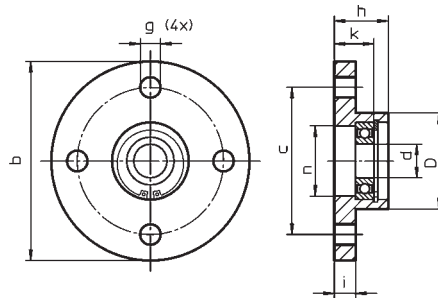
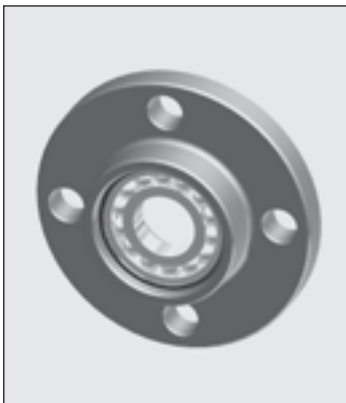
### Cardan end joint



Dims.	Gear Size				
	HM 5	HM 10	HA 25	HA 50	HA 100
a	50	57	77	110	125
b	16	19	25	37	43
h	12	13.5	18	25	28
l	66	75	102	145	165
m	M12	M14	M20	M30	M36
n	32	36	50	70	80
Ød <sup>H7</sup>	12	14	20	30	35
Øj	17.5	20	27.5	40	46
ØD	22	25	34	50	58
SW	19	22	32	41	50

Used only for gears with anti-twist element

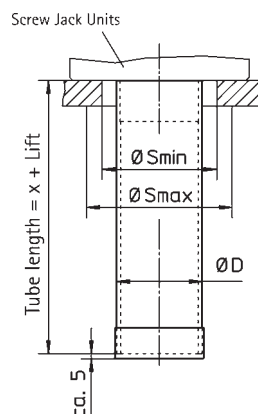
### Counter bearing plate



Dims.	Gear Size				
	HM 5	HM 10	HA 25	HA 50	HA 100
Øb	65	80	90	110	150
Øc	48	60	67	85	117
Øg	9	11	11	13	17
ØD	30	39	46	60	85
Ød	12	15	20	25	40
Øn	20	28	32	42	60
i	7	8	10	15	20
h	20	21	23	30	50
k	13	17	19	22	35
bearing	61901.2RS	6002.2RS	61904.2RS	6005.2RS	6008.2RS

The counter bearing plate guides the clear end of the spindle in the screw-nut model, increases the buckling load of the spindle and improves the smooth running. The antifriction bearing is sealed.

### Protection tubes from PVC and steel for basic model HG



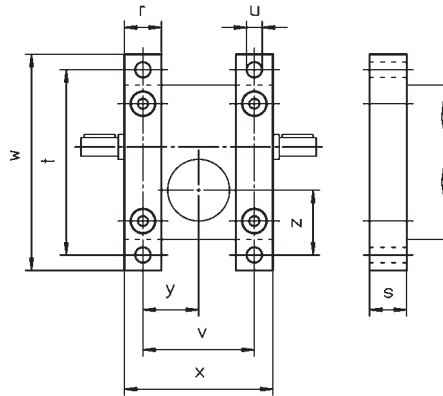
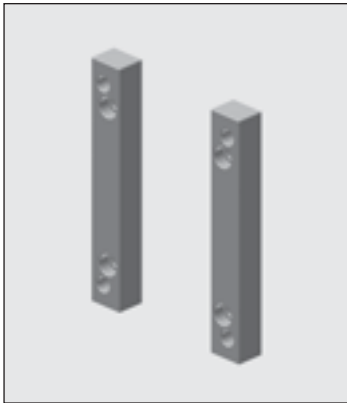
#### PVC protection tube

Dims.	HGM 5	HGM 10	HGA 25	HGA 50	HGA 100	HGZ 210	HGZ 350	HGZ 500	HGZ 750	HGZ 1000
	ØD	-	-	50	75	110	125	160	180	-
ØS <sub>min</sub>	-	-	85	110	140	140	175	185	-	-
ØS <sub>max</sub>	-	-	95	120	150	200	230	290	-	-
X	-	-	50	55	65	75	85	100	-	-

#### Steel protection tube

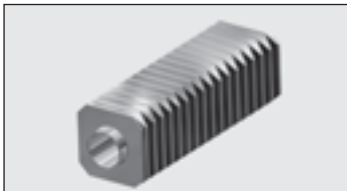
Dims.	HGM 5	HGM 10	HGA 25	HGA 50	HGA 100	HGZ 210	HGZ 350	HGZ 500	HGZ 750	HGZ 1000
	ØD	32	42	50	65	90	115	145	180	200
ØS <sub>min</sub>	35	45	60	75	100	130	160	195	235	260
ØS <sub>max</sub>	45	55	95	120	150	200	230	290	340	410
X	21	30	50	55	65	75	85	100	90	130

**Toe plate**

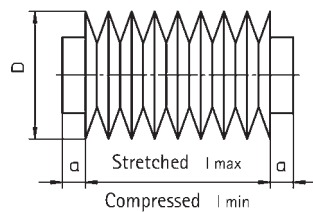


Dims.	Gear Size									
	HM 5	HM 10	HA 25	HA 50	HA 100	HZ 210	HZ 350	HZ 500	HZ 750	HZ 1000
r	20	20	30	30	40	50	70	70	90	90
Øu	8.5	8.5	11	13.5	22	26	33	33	45	45
s	16	16	20	20	35	50	50	70	90	90
x	72	83	111	145	171	220	270	330	390	440
v	52	63	81	115	131	170	210	260	300	350
w	120	140	170	230	270	355	415	550	650	710
t	100	120	150	204	236	310	360	470	560	620
y	26	31.5	40.5	57.5	65.5	85	105	130	150	175
z	41	50	64	90	101	140	162	205	240	270

**Gaiter**



Gaiter with elasticised cuff at each end



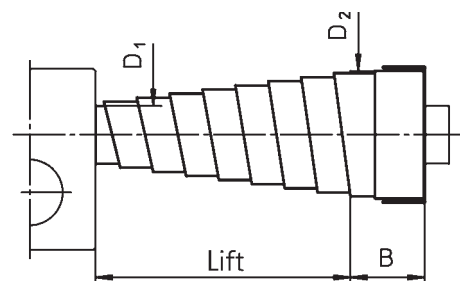
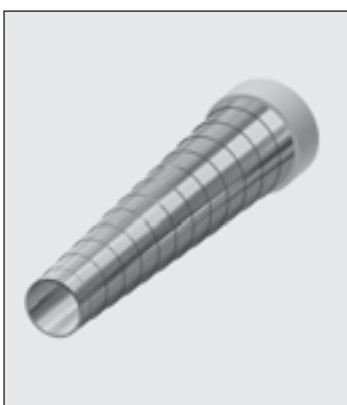
- for  $l_{max} > 1000$  Gaiter with stretch limiter
- for horizontal fitting:  
 $l_{max} > 400$  Gaiter with supporting rings

The gaiter protects the spindle from the effects of dirt and dust.

Material: Laminated ribbed foil and fabric, PVC coated, watertight

Dims.	Gear Size									
	HM 5	HM 10	HA 25	HA 50	HA 100	HZ 210	HZ 350	HZ 500	HZ 750	HZ 1000
a	15	15	15	15	15	20	20	20	20	20
ØD <sub>max</sub>	80	80	100	125	150	190	190	210	260	295
l <sub>min</sub>	approx. 18% of l <sub>max</sub>									

**Spiral spring cover**



Spiral spring covers protect the spindle from dust and damage from large and sharp-edged particles.

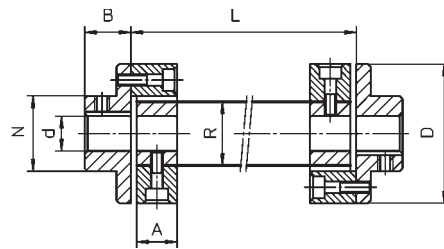
For a vertical fitting, it is recommended that the larger diameter is uppermost; for horizontal fitting, in the direction of the flow of dirt. The correct size of the spiral spring with the necessary centralising flanges ( $D_1$ ,  $D_2$ ) is specified in planning the system.

Measurement "B" = minimum height of spiral spring when fully compressed.

## ZZ Accessories

Joint shaft • Pillow-block bearing • Cardan adapter

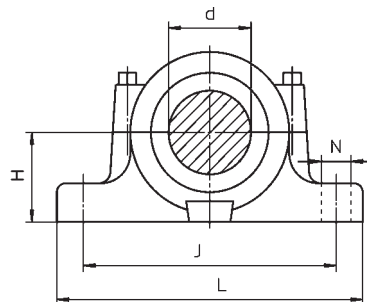
### Joint shaft, structural X – G



Gear Size	X-G1	X-G2	X-G4	X-G8	X-G16	X-G25	X-G30
$T_N$ [Nm]	10	30	60	120	240	370	550
A	18	24	25	30	35	40	50
$\varnothing d_{min}$	8	10	12	12	15	15	20
$\varnothing d_{max}$	25	38	45	55	70	85	100
$\varnothing D$	56	85	100	120	150	170	200
L	Length depends on application						
B	24	28	30	42	50	55	66
$\varnothing N$	36	55	65	80	100	115	140
$\varnothing R$	30	40	45	60	70	85	100

The joint shafts with the structural shape X-G, are torsionally rigid and allow an angular misalignment independent of the speed and without any axial displacement, the gear sections can be radially installed or removed. The lengths and sizes of the jointing shafts are specified by ZZ and are supplied ready for installation. Depending on the length and installation conditions, pillow block bearings are also supplied. To ensure true and smooth running, the shafts and pillow block bearings must be in exact axial alignment.

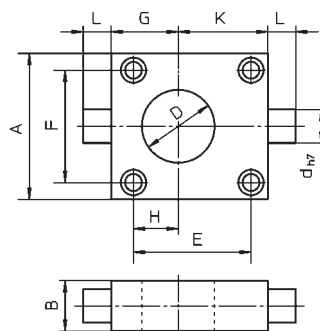
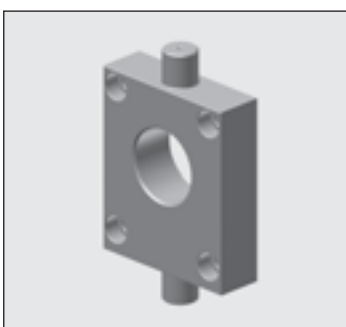
### Pillow block bearings



Bearing ID No.	Shaft $\varnothing$	$\varnothing d$	H	J	L	N
SNA 507	30	30	50	150	185	13
SNA 509	40	40	60	170	205	15
SNA 510	45	45	60	170	205	15
SNA 513	60	60	80	230	275	18
SNA 516	70	70	95	260	315	22
SNA 519	85	85	112	290	345	22
SNA 522	100	100	125	350	410	26

The 2-section housings of grey cast iron with the given bearing units, are supplied ready for installation. With multiple bearing units on long joint shafts, only one pillow block bearing may be installed as a fixed bearing. All other bearing units must be in the form of movable bearings, to prevent any distortions of the joint shaft.

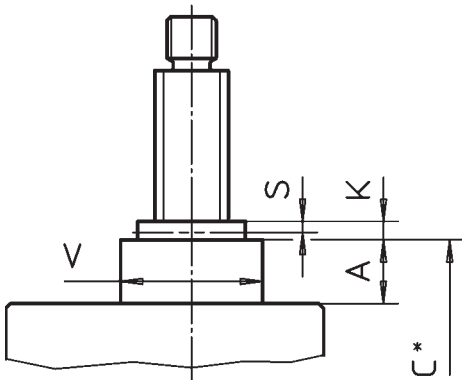
### Cardan adapter



Dims.	Gear size							
	HM 5	HM 10	HA 25	HA 50	HA 100	HZ 210	HZ 350	HZ 500
B	20	25	30	40	50	80	90	100
$\varnothing d_{h7}$	15	20	25	35	45	70	80	90
D	34	43	85	110	140	155	195	225
H	21	29	42	63	66	85	97	120
E	60	78	106	150	166	200	230	300
F	52	63	81	115	131	170	184	260
A	72	85	105	145	165	220	244	330
G	31	40	54	78	83	110	127	155
K	49	60	76	102	117	140	163	215
L	15	20	20	30	35	50	60	75

The cardan adapter allows swivel movements of the lifting spindle gear about one axis. Bearing assemblies with double-cardan are possible, but require detailed planning.

### Safety nut HG, HV

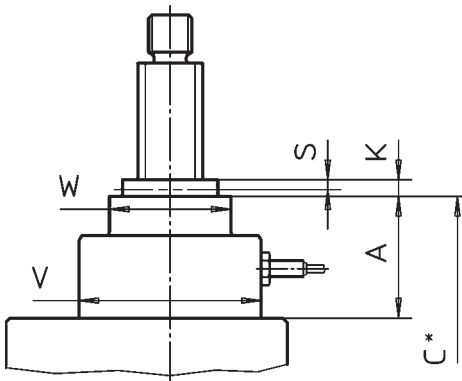


Dims.	Gear Size		
	HA 25	HA 50	HA 100
A	24	33	43
K	2 ±0,5	2,5 ±0,6	3 ±0,75
C *	106	149	203
ØV	46	60	85
S	1,2	1,4	1,8

S - permissible depth of wear

\* Measurement C referred to base of gearing (screw-on surface)

### Safety nut HG, HV with end-switch

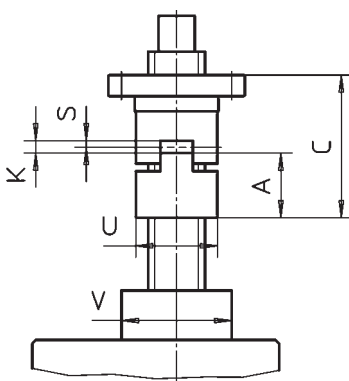


Dims.	Gear Size		
	HA 25	HA 50	HA 100
A	49,5	61	81,5
K	2 ±0,5	2,5 ±0,6	3 ±0,75
C *	ca. 131,5	ca. 177	ca. 241,5
ØW	46	60	85
ØV	84	112	137
S	1,2	1,4	1,8

S - permissible depth of wear

\* Measurement C referred to base of gearing (screw-on surface)

### Safety nut HL



Dims.	Gear Size		
	HA 25	HA 50	HA 100
A	26,5	37,5	49,5
K	2 ±0,5	2,5 ±0,6	3 ±0,75
C	69 ±0,5	103,5 ±0,6	134 ±0,75
ØU	38	50	70
ØV	46	60	85
S	1,2	1,4	1,8

S - permissible depth of wear

K - distance, as manufactured when delivered

- On delivery, the adjustment setting is engraved on the safety nut

### Principle of the ZZ [safety nut] in HG, HV and HL Drives

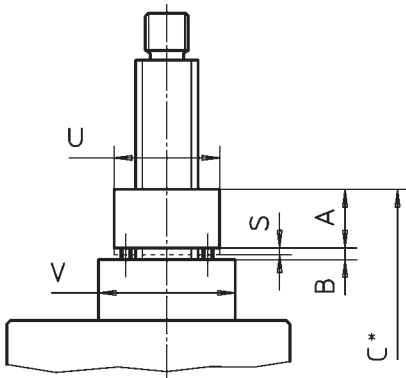
The rotating nut is free of any load during normal operation, but in an emergency, for example when the support nut is worn out, the rotating nut assumes the function of the load-bearing elevating spindle nut. This prevents an unintentional slip-through of the spindle (HG, HV) or the screw nut (HL). Any continued operation after this transfer of function is no longer permissible. However, the system can be driven back to the maintenance position for repair work to be completed.

A check is kept on the wear by the distance K. As soon as dimension K changes by the distance S (limit of wear), the wormwheel (or spindle nut) should be replaced.

## Furthur Accessories for ZZ Screw Jack Units

Safety nut for HG, HV, HL. Gear sizes HZ210 to HZ1000

### Safety nut HG, HV

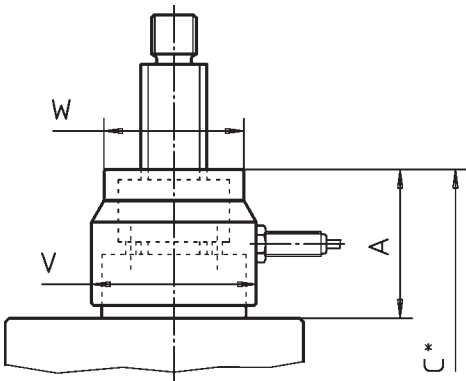


Dims.	Gear Size				
	HZ 210	HZ 350	HZ 500	HZ 750	HZ 1000
A	55	75	95	115	135
B	6	6	8	9	10
C *	264	363	403	416	525
ØV	140	170	170	230	230
ØU	110	140	165	195	225
S	2	2	2,8	3,2	3,6

S - permissible depth of wear

\* Measurement C referred to base of gearing (screw-on surface)

### Safety nut HG, HV with End Switch

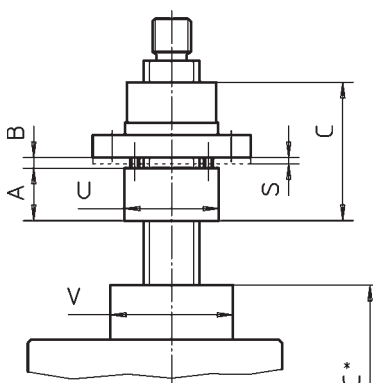


Dims.	Gear Size				
	HZ 210	HZ 350	HZ 500	HZ 750	HZ 1000
A	115	145	145	-	-
C *	275	345	385	-	-
ØW	140	170	200	-	-
ØV	158	188	217	-	-
S	2	2	2,8	3,2	3,6

S - permissible depth of wear

\* Measurement C referred to base of gearing (screw-on surface)

### Safety nut HL



Dims.	Gear Size				
	HZ 210	HZ 350	HZ 500	HZ 750	HZ 1000
A	55	75	95	115	135
B	6	6	8	9	10
C	159	229	283	334	385
C *	205	255	300	325	380
ØU	110	140	165	195	225
90	110	140	170	200	230
S	2	2	2,8	3,2	3,6

S - permissible depth of wear

K - distance, as manufactured when delivered

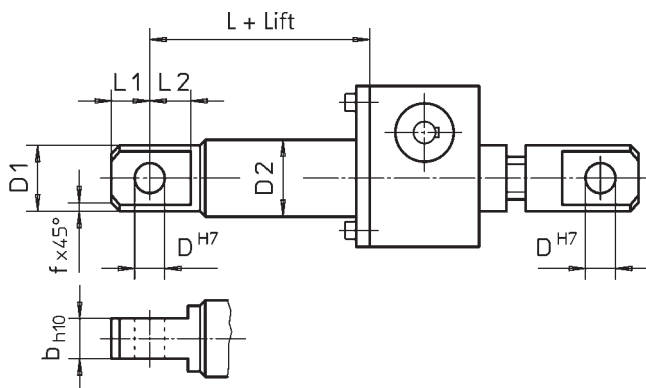
- On delivery, the adjustment setting is engraved on the safety nut

### Principle of the ZZ safety nut in HG, HV and HL Drives

The rotating nut is free of any load during normal operation, but in an emergency, for example when the support nut is worn out, the rotating nut assumes the function of the load-bearing elevating spindle nut. This prevents an unintentional slip-through of the spindle (HG, HV) or the screw nut (HL). Any continued operation after this transfer of function is no longer permissible. However, the system can be driven back to the maintenance position for repair work to be completed.

A check is kept on the wear by the distance K. As soon as dimension K changes by the distance S (limit of wear), the wormwheel (or spindle nut) should be replaced.

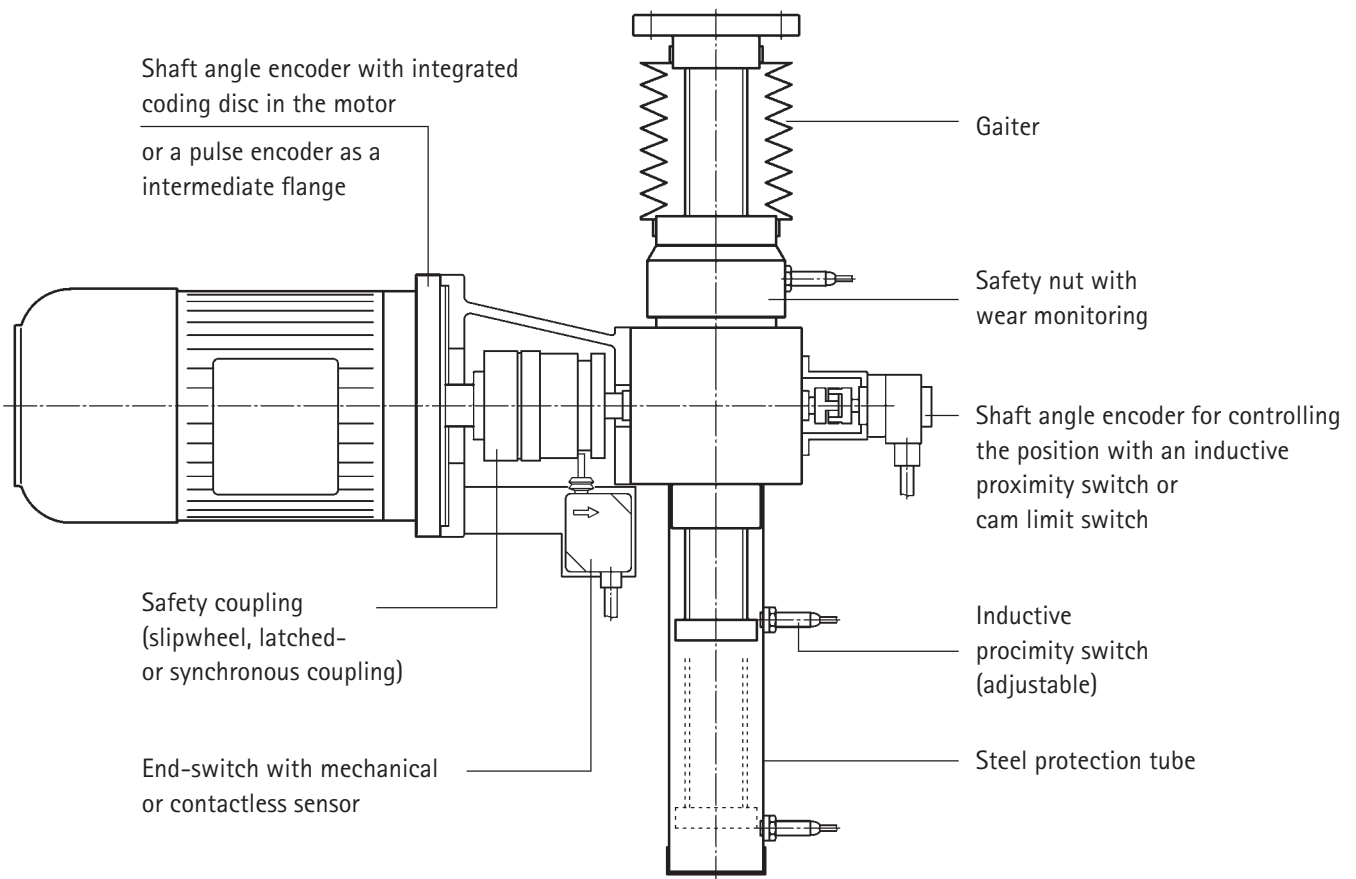
**Screw Jack Unit HG with Swivel element**



Dims.	Gear Size				
	HM 5	HM 10	HA 25	HA 50	HA 100
Ø D <sup>H7</sup>	12	14	20	30	35
Ø D1	36	43	53	68	85
Ø D2	38	48.5	57	73	102
L	75	95	105	120	150
L1	15	20	25	35	40
L2	18	25	30	40	50
f	2.5	3	3.5	4	5
b <sub>h10</sub>	16	20	30	35	40

This swivel element can be used with standard screw jack units, if any swivel or tilting movement is present in the lifting movement. Here, the screw jack mounted on the swivel element, and the end of the spindle, extended with a rod-end bearing, are each mounted in a turning knuckle.

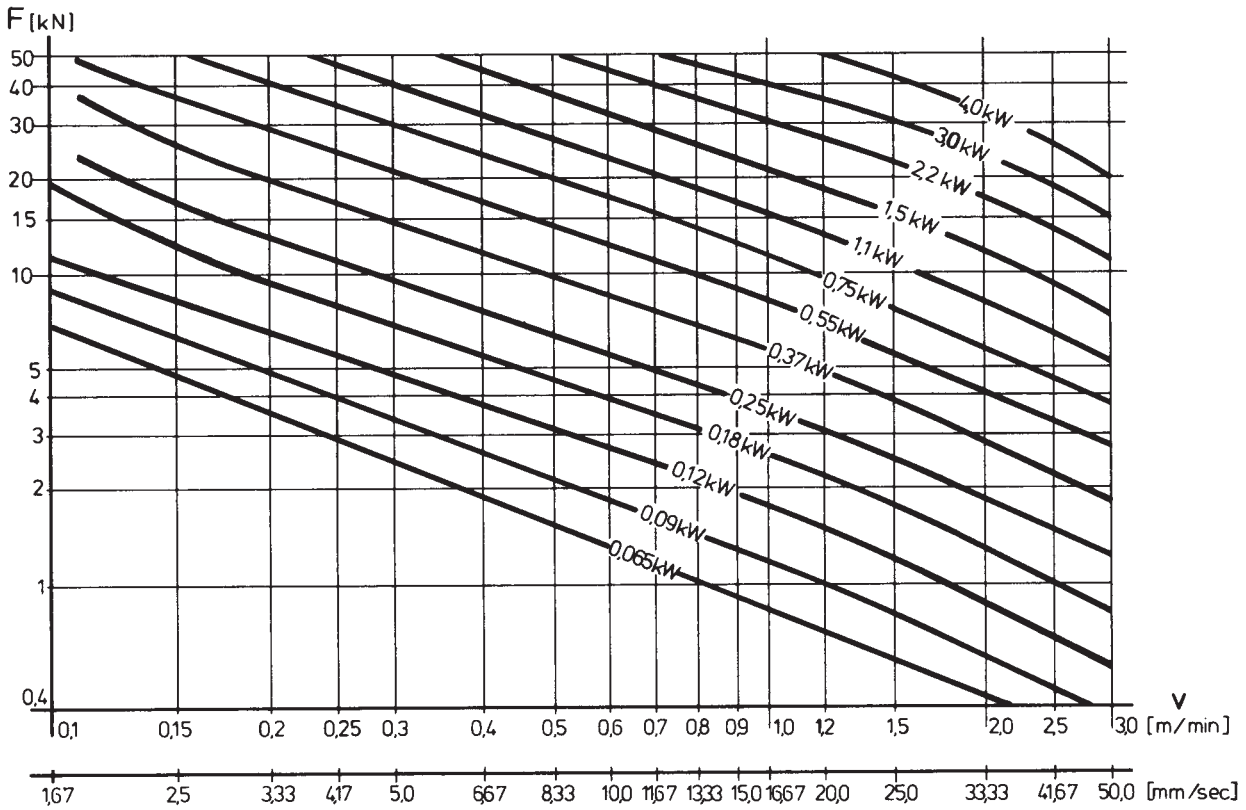
**Monitoring Devices**



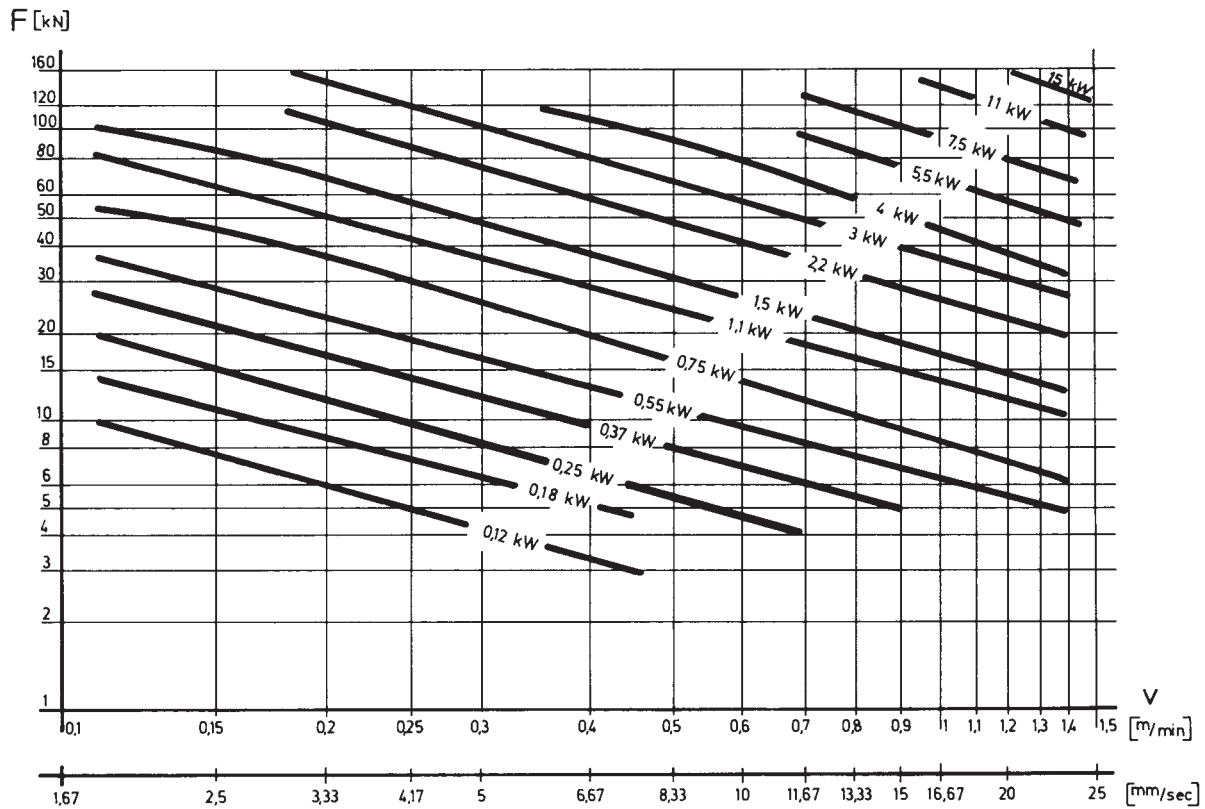
The more important monitoring devices are:

- Wear monitoring, spindle/nut
- Monitoring the current lift position
- End-positions check of lifting movement
- Spindle run-out limiter
- Torque check at input side
- Overload protection

Power Characteristics for Screw Jack Units FH5 to FH50



Power Characteristics for Screw Jack Units FH100 and FH210



- The table shows the permissible loading on the gear, for various motor ratings.
- Values printed in **bold face** show that the load limit of the gear has been reached.
- The motor-screw jack unit combinations marked in **grey** boxes, indicate that they require a special motor flange, or technical clarification.
- For standard combinations, the drawings on page 56 and the table on page 57 apply.

Motor				Lifting speed		Lift per rev. [mm]	Permissible load [kN]					
P <sub>M</sub> [kW]	Size	[rpm]	T <sub>N</sub> [Nm]	[m/min]	[mm/s]		HM5	HM10	HA25	HA50	HA100	HZ210
0.12	80 S/12	440	2.6	0.11	1.83	0.25	<b>5</b>	<b>10</b>	13.1	11.8	11.1	9.2
	71 S/8	670	1.71	0.17	2.79	0.25	<b>5</b>	8.6	8.6	7.7	-	-
	63 L/6	890	1.29	0.22	3.71	0.25	<b>5</b>	6.5	6.5	<b>5.8</b>	-	-
	63 S/4	1340	0.86	0.34	5.58	0.25	4.3	4.3	4.3	<b>3.9</b>	-	-
	80 S/12	440	2.6	0.44	7.33	1	<b>4.9</b>	3.3	3.3	2.9	2.8	-
	71 S/8	670	1.71	0.67	11.17	1	3.2	2.1	2.1	1.9	-	-
	56 L/2	2800	0.41	0.70	11.67	0.25	<b>2.1</b>	<b>2.1</b>	<b>2.1</b>	-	-	-
	63 L/6	890	1.29	0.89	14.83	1	2.4	1.6	1.6	<b>1.5</b>	-	-
	63 S/4	1340	0.86	1.34	22.33	1	1.6	1.1	1.1	<b>1.0</b>	-	-
56 L/2	2800	0.41	2.80	46.67	1	0.8	0.5	-	-	-	-	
0.18	80 L/12	420	4.1	0.11	1.75	0.25	<b>5</b>	<b>10</b>	20.6	18.5	17.5	<b>14.4</b>
	71 L/8	675	2.55	0.17	2.81	0.25	<b>5</b>	<b>10</b>	12.8	11.5	-	<b>9.0</b>
	71 S/6	910	1.89	0.23	3.79	0.25	<b>5</b>	9.5	9.5	8.5	-	-
	63 L/4	1350	1.27	0.34	5.63	0.25	<b>5</b>	6.4	6.4	<b>5.8</b>	-	-
	80 L/12	420	4.1	0.42	7.00	1	<b>5</b>	5.1	5.1	4.6	4.4	-
	71 L/8	675	2.55	0.68	11.25	1	4.8	3.2	3.2	2.9	-	-
	63 S/2	2790	0.62	0.70	11.63	0.25	3.1	3.1	3.1	<b>2.8</b>	-	-
	71 S/6	910	1.89	0.91	15.17	1	3.6	2.4	2.4	2.1	-	-
	63 L/4	1350	1.27	1.35	22.50	1	2.4	1.6	1.6	<b>1.4</b>	-	-
63 S/2	2790	0.62	2.79	46.50	1	1.2	0.8	0.8	-	-	0.5	
0.25	90 L/12	420	5.7	0.11	1.75	0.25	<b>5</b>	<b>10</b>	25.0	25.7	24.3	20.0
	80 S/8	680	3.5	0.17	2.83	0.25	<b>5</b>	<b>10</b>	17.6	15.9	15.0	12.4
	71 L/6	925	2.6	0.23	3.85	0.25	<b>5</b>	<b>10</b>	13.0	11.7	11.0	9.1
	71 S/4	1390	1.72	0.35	5.79	0.25	<b>5</b>	8.6	8.6	7.8	7.3	-
	90 L/12	420	5.7	0.42	7.00	1	<b>5</b>	7.1	7.1	6.4	6.1	-
	80 S/8	680	3.5	0.68	11.33	1	<b>5</b>	4.4	4.4	4.0	3.8	-
	63 L/2	2800	0.85	0.70	11.67	0.25	4.3	4.3	4.3	<b>3.9</b>	-	-
	71 L/6	925	2.6	0.93	15.42	1	4.9	3.2	3.2	2.9	2.8	-
	71 S/4	1390	1.72	1.39	23.17	1	3.2	2.2	2.2	1.9	1.8	-
63 L/2	2800	0.85	2.80	46.67	1	1.6	1.1	1.1	<b>1.0</b>	-	-	
0.37	100 L/12	430	8.2	0.11	1.79	0.25	-	-	<b>25</b>	37.2	35.1	28.9
	80 L/8	680	5.2	0.17	2.83	0.25	<b>5</b>	<b>10</b>	<b>25</b>	23.5	22.2	18.3
	80 S/6	920	3.85	0.23	3.83	0.25	<b>5</b>	<b>10</b>	19.3	17.4	16.4	13.5
	71 L/4	1390	2.55	0.35	5.79	0.25	<b>5</b>	<b>10</b>	12.8	11.5	10.9	8.9
	100 L/12	430	8.2	0.43	7.17	1	<b>5</b>	<b>10</b>	10.3	9.3	8.8	7.2
	80 L/8	680	5.2	0.68	11.33	1	<b>5</b>	6.5	6.5	5.9	5.6	-
	71 S/2	2790	1.27	0.70	11.63	0.25	<b>5</b>	6.4	6.4	5.7	-	-
	80 S/6	920	3.85	0.92	15.33	1	<b>5</b>	4.8	4.8	4.3	4.1	-
	71 L/4	1390	2.55	1.39	23.17	1	4.8	3.2	3.2	2.9	2.7	-
71 S/2	2790	1.27	2.79	46.50	1	2.4	1.6	1.6	1.4	-	-	
0.55	100 L/12a	450	11.7	0.11	1.88	0.25	-	-	<b>25</b>	50.0	49.9	41.1
	90 L/8	670	7.8	0.17	2.79	0.25	-	<b>10</b>	<b>25</b>	35.5	33.5	27.6
	80 L/6	910	5.8	0.23	3.79	0.25	<b>5</b>	<b>10</b>	29.0	26.1	24.7	20.3
	80 S/4	1380	3.8	0.35	5.75	0.25	<b>5</b>	<b>10</b>	19.1	17.2	16.3	13.4
	100 L/12a	450	11.7	0.45	7.50	1	<b>5</b>	<b>10</b>	14.7	13.2	12.5	10.3
	90 L/8	670	7.8	0.67	11.17	1	<b>5</b>	<b>10</b>	9.9	8.9	8.4	-
	71 L/2	2810	1.87	0.70	11.71	0.25	<b>5</b>	9.4	9.4	8.5	-	-
	80 L/6	910	5.8	0.91	15.17	1	<b>5</b>	7.3	7.3	6.5	6.2	-
	80 S/4	1380	3.8	1.38	23.00	1	<b>5</b>	4.8	4.8	4.3	4.1	-
71 L/2	2810	1.87	2.81	46.83	1	3.5	2.3	2.3	2.1	-	-	

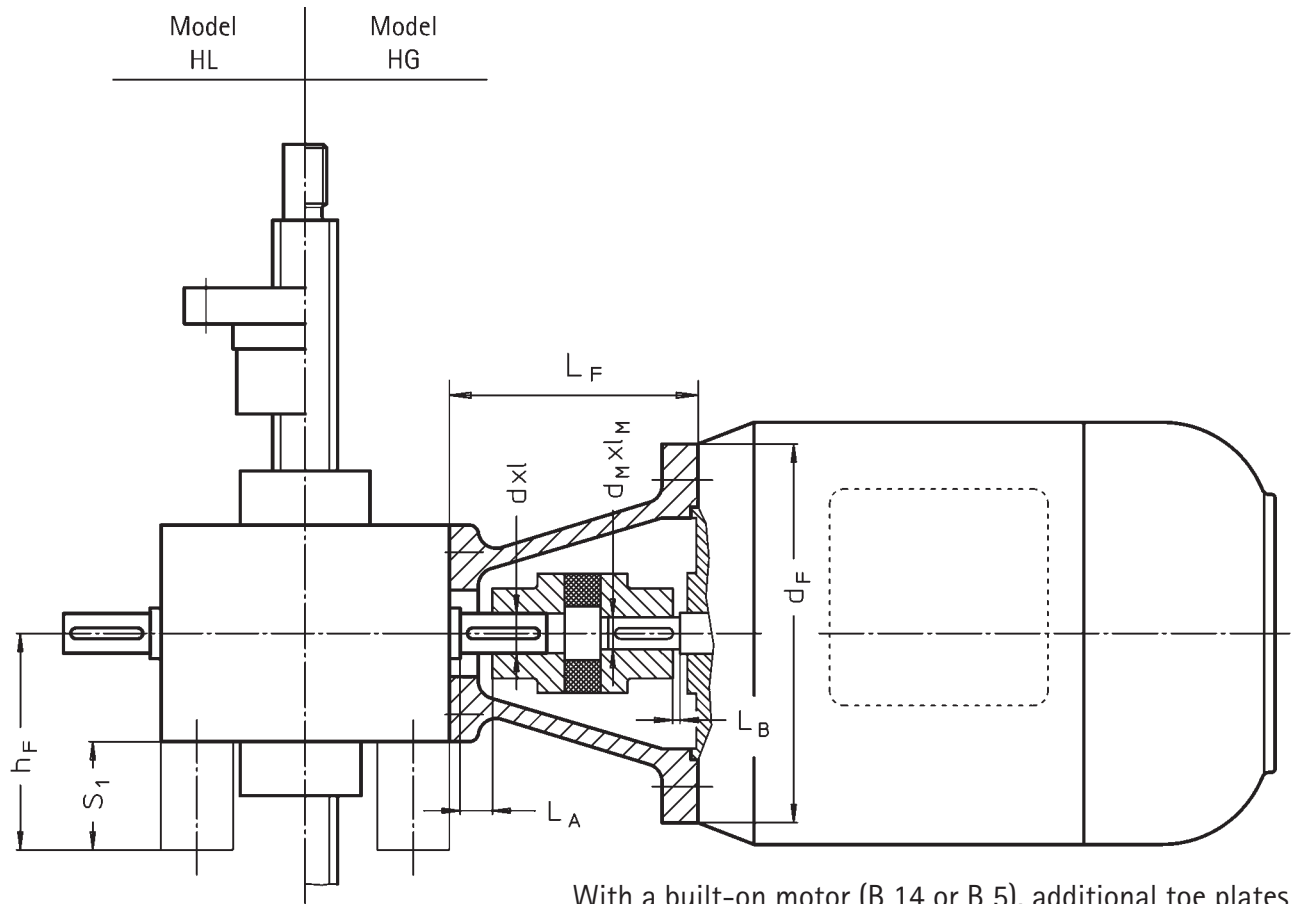
# Performance Specification

Screw Jack Unit (HM5 to HZ210) / Motor (0,75 to 4,0 kW)

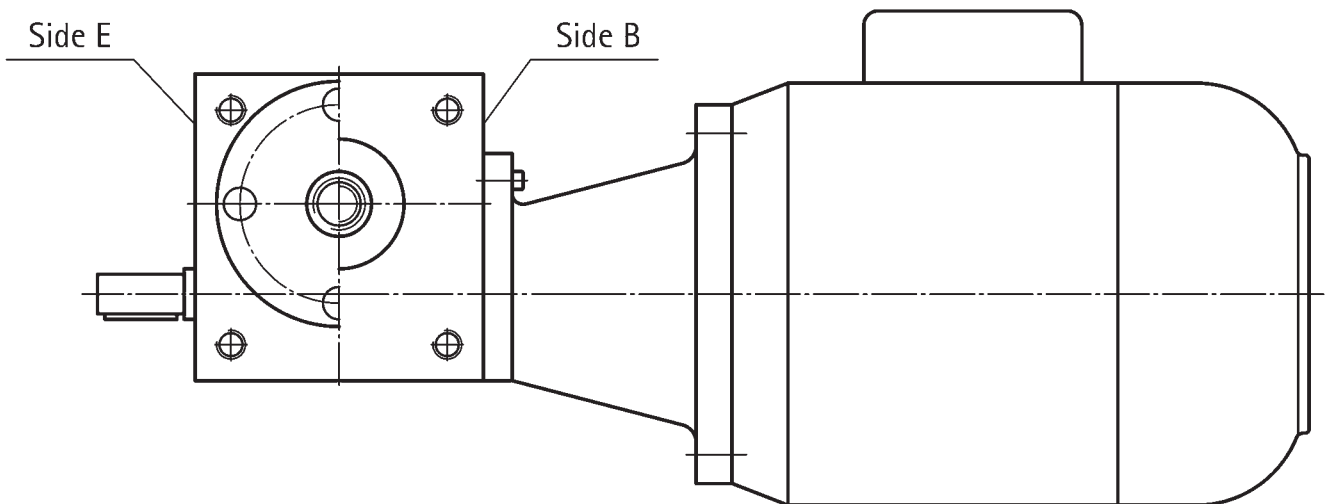


- The table shows the permissible loading on the gear, for various motor ratings.
- Values printed in **bold face** show that the load limit of the gear has been reached.
- The motor-screw jack unit combinations marked in **grey boxes**, indicate that they require a special motor flange, or technical clarification.
- For standard combinations, the drawings on page 56 and the table on page 57 apply.

Motor			Lifting speed		Lift per rev. [mm]	Permissible load [kN]						
P <sub>M</sub> [kW]	Size	[rpm]	T <sub>N</sub> [Nm]	[m/min]		[mm/s]	HM5	HM10	HA25	HA50	HA100	HZ210
0.75	112 M/12	440	16.3	0.11	1.83	0.25	-	-	<b>25</b>	<b>50</b>	69.5	57.3
	100 L/8	690	10.4	0.17	2.88	0.25	-	-	<b>25</b>	<b>50</b>	44.3	36.5
	90 S/6	915	7.8	0.23	3.81	0.25	-	<b>10</b>	<b>25</b>	35.4	33.4	27.5
	80 L/4	1390	5.2	0.35	5.79	0.25	<b>5</b>	<b>10</b>	<b>25</b>	23.3	22.0	18.1
	112 M/12	440	16.3	0.44	7.33	1	<b>5</b>	<b>10</b>	<b>25</b>	28.6	24.5	21.5
	100 L/8	690	10.4	0.69	11.50	1	<b>5</b>	<b>10</b>	18.3	18.3	15.7	13.7
	80 S/2	2780	2.6	0.70	11.58	0.25	<b>5</b>	<b>10</b>	12.9	11.7	-	-
	90 S/6	915	7.8	0.92	15.25	1	<b>5</b>	<b>10</b>	13.8	13.8	11.8	10.3
1.1	80 L/4	1390	5.2	1.39	23.17	1	<b>5</b>	9.7	9.1	9.1	7.8	6.8
	80 S/2	2780	2.6	2.78	46.33	1	4.9	4.9	4.5	4.5	-	-
	132 S/12	460	23	0.12	1.92	0.25	-	-	<b>25</b>	<b>50</b>	97.6	80.3
	100 L/8a	690	15.2	0.17	2.88	0.25	-	-	<b>25</b>	<b>50</b>	65.0	53.6
	90 L/6	910	11.5	0.23	3.79	0.25	-	-	<b>25</b>	<b>50</b>	49.3	40.6
	90 S/4	1400	7.5	0.35	5.83	0.25	-	<b>10</b>	<b>25</b>	33.9	32.1	26.4
	132 S/12	460	23	0.46	7.67	1	<b>5</b>	<b>10</b>	<b>25</b>	40.2	34.4	30.1
	100 L/8a	690	15.2	0.69	11.50	1	<b>5</b>	<b>10</b>	<b>25</b>	26.8	23.0	20.1
1.5	80 L/2	2810	3.7	0.70	11.71	0.25	<b>5</b>	<b>10</b>	18.8	16.9	-	-
	90 L/6	910	11.5	0.91	15.17	1	<b>5</b>	<b>10</b>	20.3	20.3	17.4	15.2
	90 S/4	1400	7.5	1.40	23.33	1	<b>5</b>	<b>10</b>	13.2	13.2	11.3	9.9
	80 L/2	2810	3.7	2.81	46.83	1	<b>5</b>	7.0	6.6	6.6	-	-
	132 M/12	455	31.5	0.11	1.90	0.25	-	-	<b>25</b>	<b>50</b>	135	111
	112 M/8	710	20	0.18	2.96	0.25	-	-	<b>25</b>	<b>50</b>	86.2	71.0
	100 L/6	950	15.1	0.24	3.96	0.25	-	-	<b>25</b>	<b>50</b>	64.4	53.1
	90 L/4	1410	10.2	0.35	5.88	0.25	-	-	<b>25</b>	46.0	43.4	35.7
2.2	132 M/12	455	31.5	0.46	7.58	1	-	<b>10</b>	<b>25</b>	<b>50</b>	47.5	41.5
	112 M/8	710	20	0.71	11.83	1	<b>5</b>	<b>10</b>	<b>25</b>	35.5	30.4	26.6
	90 S/2	2850	5	0.71	11.88	0.25	<b>5</b>	<b>10</b>	<b>25</b>	22.7	-	-
	100 L/6	950	15.1	0.95	15.83	1	<b>5</b>	<b>10</b>	<b>25</b>	26.5	22.7	19.9
	90 L/4	1410	10.2	1.41	23.50	1	<b>5</b>	<b>10</b>	17.9	17.9	15.3	13.4
	90 S/2	2850	5	2.85	47.50	1	<b>5</b>	9.5	8.8	8.8	-	-
	132 S/8	710	29.5	0.18	2.96	0.25	-	-	<b>25</b>	<b>50</b>	<b>100</b>	104
	112 M/6	950	22	0.24	3.96	0.25	-	-	<b>25</b>	<b>50</b>	<b>100</b>	77.8
3	100 L/4	1420	14.8	0.36	5.92	0.25	-	-	<b>25</b>	<b>50</b>	63.2	52.1
	160 MK/12	470	44.5	0.47	7.83	1	-	<b>10</b>	<b>25</b>	<b>50</b>	67.4	59.0
	90 L/2	2835	7.4	0.71	11.81	0.25	<b>5</b>	<b>10</b>	<b>25</b>	33.5	31.7	-
	132 S/8	710	29.5	0.71	11.83	1	<b>5</b>	<b>10</b>	<b>25</b>	<b>50</b>	44.6	39.0
	112 M/6	950	22	0.95	15.83	1	<b>5</b>	<b>10</b>	<b>25</b>	38.9	33.3	29.2
	100 L/4	1420	14.8	1.42	23.67	1	<b>5</b>	<b>10</b>	<b>25</b>	26.0	22.3	19.5
	90 L/2	2835	7.4	2.84	47.25	1	<b>5</b>	<b>10</b>	13.0	13.0	-	-
	132 M/8	710	40.5	0.18	2.96	0.25	-	-	<b>25</b>	<b>50</b>	<b>100</b>	142
4	132 S/6	955	30	0.24	3.98	0.25	-	-	<b>25</b>	<b>50</b>	<b>100</b>	106
	100 L/4a	1420	20	0.36	5.92	0.25	-	-	<b>25</b>	<b>50</b>	86.2	71.0
	160 M/12	470	61	0.47	7.83	1	-	-	<b>25</b>	<b>50</b>	91.9	80.4
	100 L/2	2850	10.1	0.71	11.88	0.25	-	-	<b>25</b>	45.5	-	-
	132 M/8	710	40.5	0.71	11.83	1	-	<b>10</b>	<b>25</b>	<b>50</b>	60.8	53.2
	132 S/6	955	30	0.96	15.92	1	<b>5</b>	<b>10</b>	<b>25</b>	<b>50</b>	45.2	39.6
	100 L/4a	1420	20	1.42	23.67	1	<b>5</b>	<b>10</b>	<b>25</b>	35.5	30.4	26.6
	100 L/2	2850	10.1	2.85	47.50	1	<b>5</b>	<b>10</b>	17.7	17.7	-	-
4	112 M/4	1420	27	0.36	5.92	0.25	-	-	<b>25</b>	<b>50</b>	<b>100</b>	94.6
	160 L/12	475	80	0.48	7.92	1	-	-	<b>25</b>	<b>50</b>	<b>100</b>	106.1
	132 M/8a	710	54	0.71	11.83	1	-	<b>10</b>	<b>25</b>	<b>50</b>	81.1	71.0
	132 M/6	955	40	0.96	15.92	1	-	<b>10</b>	<b>25</b>	<b>50</b>	60.3	52.8
	112 M/4	1420	27	1.42	23.67	1	<b>5</b>	<b>10</b>	<b>25</b>	47.3	40.6	35.5
112 M/2	2900	13.2	2.90	48.33	1	<b>5</b>	<b>10</b>	<b>25</b>	23.2	-	-	



With a built-on motor (B 14 or B 5), additional toe plates (dimensions, page 48) are a help for a better installation of gear (motor floor clearance).



- In the standard arrangement, the motor is mounted on side "B" (page 39).

# Measurements Table for ZZ Screw Jack Units with built-on Motor



## Main measurements for screw jack units with flange, coupling and motor

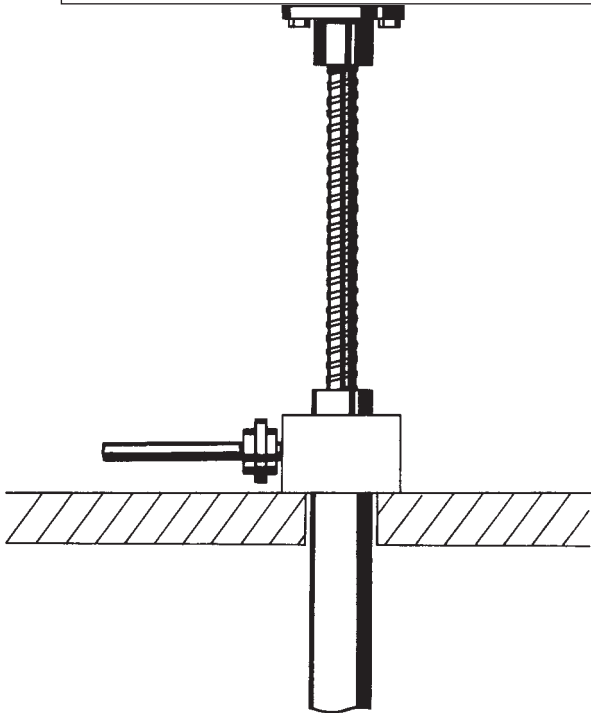
Gear size	Motor size	Coupling	Gear dimensions							
			d <sub>F</sub>	d x l	d <sub>M</sub> x l <sub>M</sub>	L <sub>F</sub>	L <sub>A</sub>	L <sub>B</sub>	h <sub>F</sub>	S <sub>1</sub>
FHM 5	63 B14	KU-14 AI-D	90	10x22,5	11x23	53	5	11.5	82	50
	71 B14		105		14x30	60	5	18.5	82	50
FHM 10	63 B14	KU-19 AI-D	90	14x25,5	11x23	90	12	10	77	40
	71 B14		120		14x30	90	8.5	13.5	77	40
	80 B14		120		19x40	90	8.5	13.5	97	60
	90S B14		120		24x50	102	8.5	25.5	97	60
FHA 25	63 B14	KU-24 AI-D	120	16x43	11x23	105	20	5	81	40
	71 B14		140		14x30	105	20	5	81	40
	80 B14		120		19x40	105	15	10	101	60
	90 B14		140		24x50	105	10	15	101	60
	100 B14		160		28x60	118	8	30	101	60
FHA 50	71 B14	KU-24 AI-D	140	20x45	14x30	102	21.5	0	98	40
	80 B14		120		19x40	102	11.5	10	98	40
	90 B14		140		24x50	122	21.5	20	98	40
	90 B14		160		24x50	122	21.5	20	98	40
	100 B14		160		28x60	122	11.5	30	118	60
	112 B14		160		28x60	122	11.5	30	118	60
FHA 100	90 B14	KU-28 AI-D	160	25x65	24x50	140	19	18.5	130	50
	100 B14		160		24x50	140	22.5	25	130	50
	112 B14		160		24x50	140	22.5	25	130	50
	132 B14		160		38x80	160	22.5	45	140	60
FHZ 210	100 B14	KU-28 AI-D	250	32x60	28x60	143	20	25	130	50
	112 B14		250		28x60	143	20	25	130	50
	132 B5		250		38x80	170	45	27	140	60



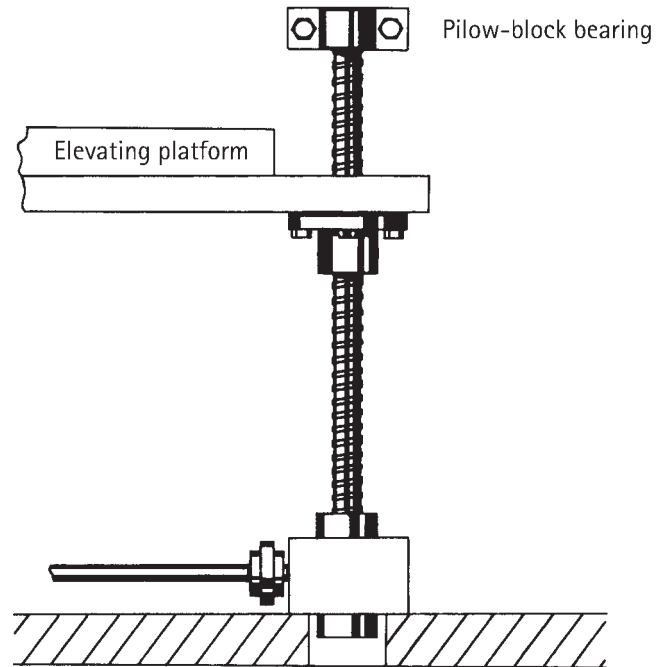
Model example: Screw jack unit with motor flange, coupling and 3-phase motor

**Screw Jack Unit, Basic Model HG**  
 • Axial movable elevating spindle with protection tube, without anti-twist element

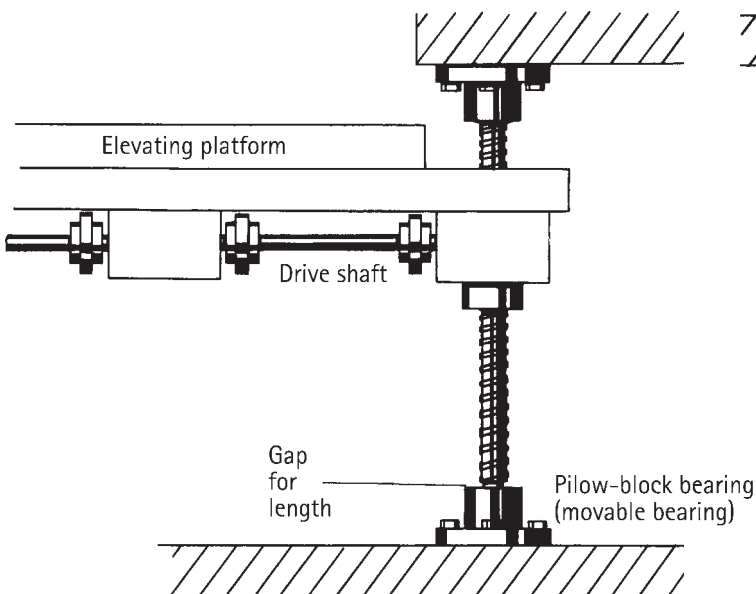
Elevating platform, protected against twisting by a guideway



**Screw Jack Unit, Screw-nut Model HL**  
 • Rotating spindle, nut moves axially



**Screw Jack Unit, Basic Model HG**  
 • Spindle pendant, fixed; gear moves axially, without protection tube



## Cover

The elevating spindle must be protected against damage and dirt and liquids must not be allowed to penetrate the gears. Therefore, the use of a cover for the elevating spindle is strongly recommended, in the form of a gaiter.

The length of the compressed gaiter is approximately 18% of the elevating movement (lift). With horizontal gear installations, a longer gaiter must incorporate extra support on the spindle.

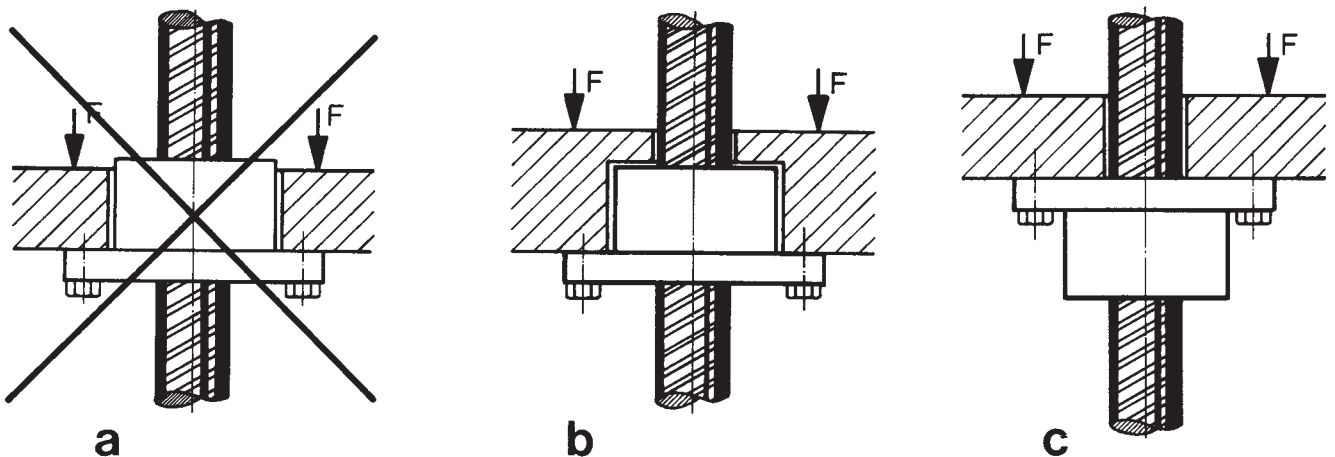
## Elevating movement limit

Both end positions of the elevating movement must be protected by end switches.

We recommend that the gear be protected against excessive extension of the spindle or screw-nut, by way of a run-out limiter fitted at the factory.

## Screw nut installation

For reasons of safety, we recommend that when installing the screw-nut, constructive measures are taken to ensure that any possible overloading during operation does not cause the flange to be broken.

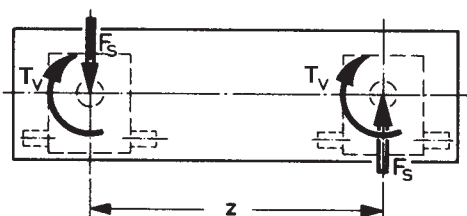


## Lateral forces

The effects of lateral forces on the spindle should be avoided. However, if lateral forces do occur, the screw-nut model HL should always be ordered with an integrated counter bearing (model HL210, onwards). The clear end of the spindle must be supported by a movable bearing.

Lateral forces can also result if the moments of torsion of several lifting spindle gears (due to their layout), produces an interaction.

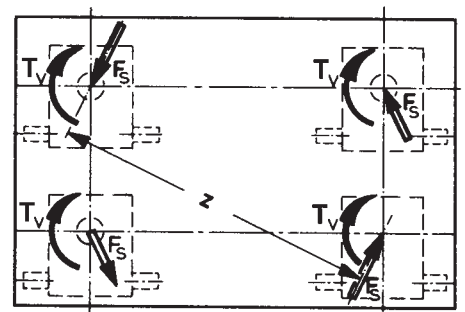
## With 2 screw jack units

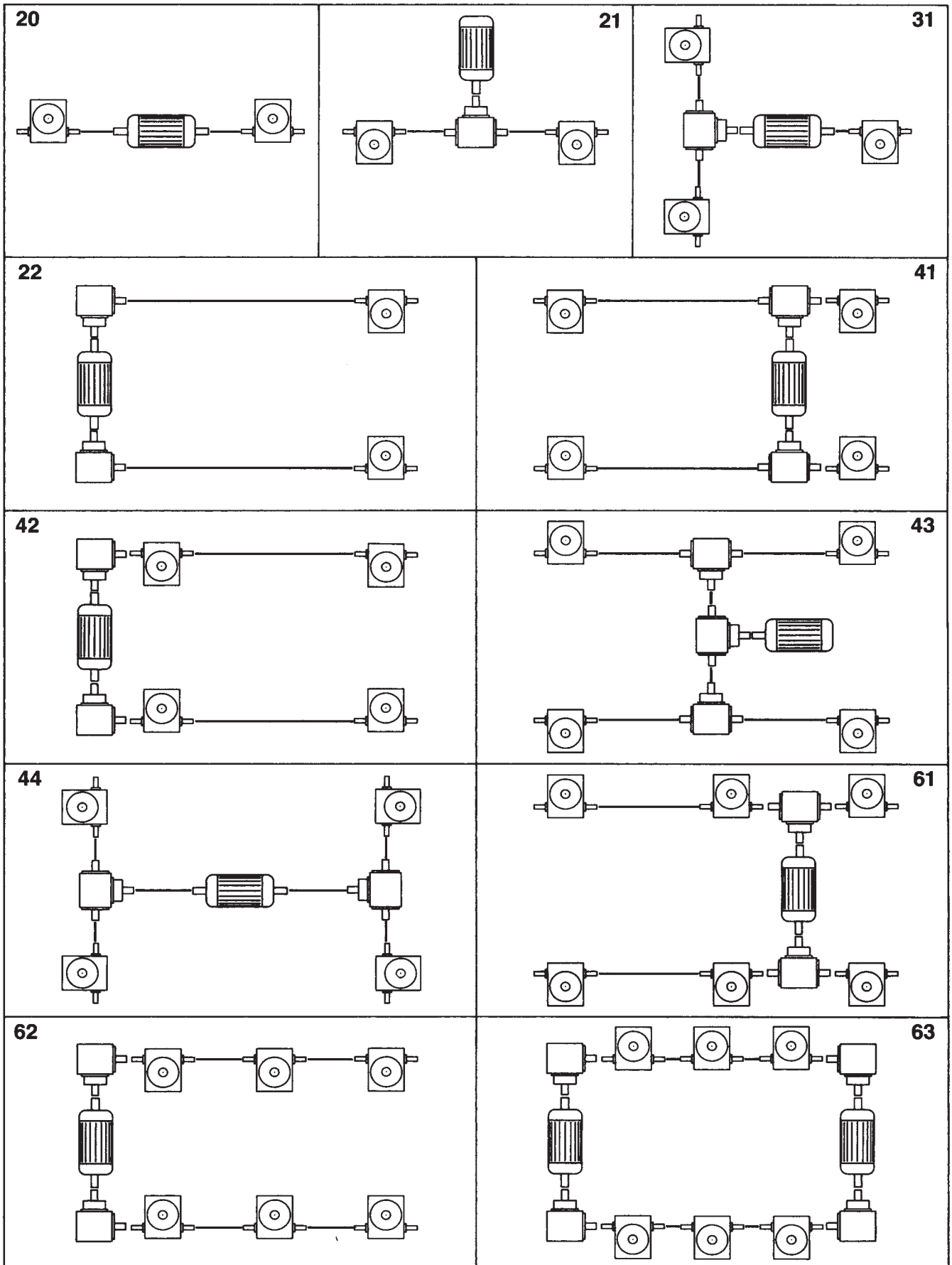


$$F_s = \frac{2 \cdot T_v}{z}$$

$$F_s = \frac{2 \cdot T_v}{z}$$

## With 4 screw jack units





# End-play of the Spindle

## Selection of Lubricant

### End-play of the spindle

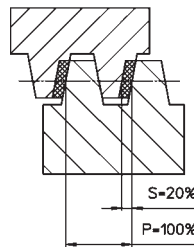
During operation, the lifting spindle drive is subject to wear (depending on the load and lifting speed) and this results in an end-play of the spindle. The amount of wear must be monitored.

When the end-play of the spindle reaches the limit value, as given in the following table, the gear must be inspected and repaired as necessary. The bronze nut (screw-nut or wormwheel) and possibly the elevating spindle, must be replaced. It is appropriate that this reconditioning work is carried out in the factory.

Gear	HM5	HM10	HA25	HA50	HA100	HZ210	HZ350	HZ500	HZ750	HZ1000
Max. spindle end-play, when new [mm]	0,20	0,20	0,25	0,26	0,30	0,31	0,31	0,38	0,40	0,43
Max. spindle end-play, incl. wear [mm]	1,00	1,00	1,45	1,66	2,10	2,31	2,31	3,18	3,60	4,03
Maximum permissible wear [mm]	0,80	0,80	1,20	1,40	1,80	2,00	2,00	2,80	3,20	3,60

### Caution

With interacting axial loading, the permissible wear distance is halved!



P = Pitch of thread  
 S = Maximum wear approx. 20% of the spindle thread pitch

### Lubrication

- Screw jack units of size HM5 and HM10, contain a grease filling as standard (polyglycole base, consistency class NLGI 00).
- Screw jack units of sizes 25 upwards (HA25 to HZ1000), can be filled with grease or oil – selection depends on the speeds and operating durations in the particular application
- Permissible operating temperature is in the range -15°C to +80°C

### Selection of oil type and viscosity

(typical lubricant quantities, see page 39)

Factor Distance betw. axes x Speed	Viscosity - Ambient temperature - Type of lubricant							
	Mineral oil		Polyglycole oil			PAO/HC oil		
G [mm] x n <sub>1</sub> [rpm]	+10°C	-20°C	+ 30°C	-10°C	-30°C	+30°C	-15°C	-40°C
	+50°C	+20°C	+100°C	+40°C	+20°C	+80°C	+40°C	-10°C
< 100 000	VG 680	VG 220	VG 680	VG 460	VG 220	VG 680	VG 460	VG 150
> 100 000	VG 460	VG 220	VG 460	VG 460	VG 220	VG 460	VG 460	VG 150

G = Distance between axes of worm gear pair [mm] (see Table of Dimensions, pp. 40-45).

n<sub>1</sub> = Average drive speed of the worm shaft [rpm].

- With ambient temperatures below -30°C and above 60°C, special attention must be paid to materials, lubricants and sealing compounds.
- Use in low temperatures considerably increases the drive power required; this must be borne in mind during the planning phase.

### Caution !

- Polyglycole lubricants are not compatible with other quality lubricants.
- The spindle has been greased with high-performance grease, consistency class NLGI 2 DIN 51818.

Numerical-value equations for calculating and converting values of:

- Load, F [kN],
- Input power, P<sub>1</sub> [kW]
- Input torque, T<sub>1</sub> [Nm]
- Input speed, n<sub>1</sub> [rpm]
- Lifting speed, v [ m/min] or [mm/s]
- Spindle thread pitch, S [mm]
- Spindle speed, n<sub>sp</sub> [rpm]
- Efficiency, η [%]
- Gear ratio, i [1]

$$P_1 \text{ [kW]} = \frac{F \text{ [kN]} \cdot v \text{ [mm/s]}}{10 \cdot \eta \text{ [%]}}$$

$$F \text{ [kN]} = \frac{10 \cdot P_1 \text{ [kW]} \cdot \eta \text{ [%]}}{v \text{ [mm/s]}}$$

$$P_1 \text{ [kW]} = \frac{F \text{ [kN]} \cdot v \text{ [m/min]}}{0,6 \cdot \eta \text{ [%]}}$$

$$v \text{ [mm/s]} = \frac{n_{sp} \text{ [U/min]} \cdot S \text{ [mm]}}{60}$$

$$T_1 \text{ [Nm]} = \frac{9549 \cdot P_1 \text{ [kW]}}{n_1 \text{ [rpm]}}$$

$$v \text{ [m/min]} = \frac{n_1 \text{ [U/min]} \cdot S \text{ [mm]}}{i \cdot 1000}$$

$$\eta \text{ [%]} = \frac{F \text{ [kN]} \cdot v \text{ [mm/s]}}{10 \cdot P_1 \text{ [kW]}}$$

$$\left[ \frac{\text{m}}{\text{min}} \right] = 16,67 \cdot \left[ \frac{\text{mm}}{\text{s}} \right]$$

Conversion of permissible load to other Euler cases, with the same spindle length

EULER -1	EULER -2	EULER -3	EULER -4
<b>1</b>	4	8	16
0,25	<b>1</b>	2	4
0,125	0,5	<b>1</b>	2
0,063	0,25	0,5	<b>1</b>

- The permissible load is dependent on the relevant end restraint conditions of the spindle (Euler-case)
- Example:
  - Euler-4 can handle 16-times the load, compared to Euler-1, (with the same length of spindle)
  - With the same spindle length, Euler-2 must not handle more than 50% of the load compared to Euler-3

Conversion of permissible spindle lengths to other Euler cases, with the same load

EULER -1	EULER -2	EULER -3	EULER -4
<b>1</b>	2	2,8	4
0,5	<b>1</b>	1,4	2
0,35	0,7	<b>1</b>	1,4
0,25	0,5	0,7	<b>1</b>

- The permissible spindle length is dependent on end restraint conditions of the spindle (Euler-case)
- Example:
  - With Euler-4, the spindle may only be 4-times as long compared to Euler-1
  - With Euler-2, the spindle may only be 0.7-times as long compared to Euler-3

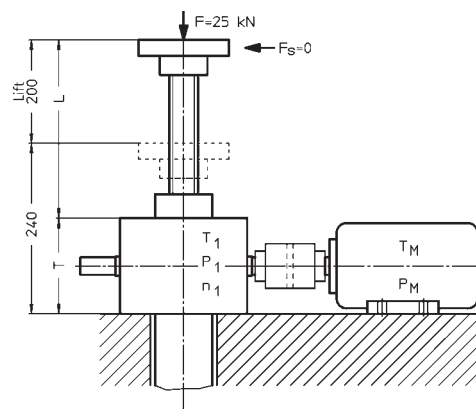
## Example of a Gear Assembly

### Given:

Loading,  $F = 25 \text{ kN}$   
 Arrangement, according to sketch  
 Lifting speed,  $v = 1.5 \text{ m/min}$   
 Lifting spindle drive as basic model

### Wanted:

Gear size HG  
 Ratio  
 Driving torque  
 Drive power



**Solution:** Corresponding to the calculation sequence, page 10.

1. Required: Lifting spindle drive, basic model with end plate, elevating spindle without guideway, load  $F = 25 \text{ kN}$ .
2. For  $F = 25 \text{ kN}$  from table page 2:  $\rightarrow$  A lifting spindle drive HGA 25 or larger (HGA50 or HGA 100) is required.  
 Clear spindle length  $L$  according to formula on page 8 (see Table of Dimensions, pp. 40 – 45).

		HGA 25	HGA 50	HGA 100
$L_{e \text{ min}} = L_{\text{min}} + h$ (without gaiter)	$L_{\text{min}}$ $h$	121 23	164 30	218 50
	$L_{e \text{ min}}$ $L_e$ from sketch	144 240	194 240	268 240

With HGA 100,  $L_{e \text{ min}}$  is larger than the installation space available

$$L_a = L_e + L_{\text{Lift}} = 240 + 200 = 440 \text{ mm}$$

		HGA 25	HGA 50
$L = L_a - T$	$L_a$	440	440
	$T$ (from Dims. Table, pp 40-41)	82	116
	$L =$	358	324

3. Buckling (page 13), Euler case-I (spindle without guideway), load according to table 1 on page 14
  4. From table 1  
 for HGA 25 with  $L = 358 \rightarrow F = 7.4 \text{ kN}$  for  $L = 350$   
 for HGA 50 with  $L = 324 \rightarrow F = 28 \text{ kN}$  for  $L = 350$   
 Thus, for  $F = 25 \text{ kN}$ , an HGA 25 is not sufficient  $\rightarrow$  selected model, HGA 50
  5. From chart "A" for  $L = 330 \text{ mm} = 0.33 \text{ m}$  (non-critical length)  $\rightarrow n_{kr} > 1000 \text{ rpm}$   
 with  $n_k = n_{kr} \cdot f_{kr} \cdot 0.8 = 1000 \cdot 1 \cdot 0.8 \rightarrow n_k = 800 \text{ rpm}$  (page 22)  
 From chart "B" for 25 kN and gear size HGA50  $\rightarrow n_{pv} = 210 \text{ rpm}$   
 $n_{\text{perm}}$  is the lower of the two speeds  $n_k$  bzw.  $n_{pv} \rightarrow n_{\text{perm}} = 210 \text{ rpm}$
  6. From table 5 on page 23 : Spindle speed  $n_{sp} < n_{\text{perm}}$   $\rightarrow$  for  $n_{sp} = 210 \text{ rpm}$ , size HGA 50  
 Ratio 1mm lift /drive rev.  $\rightarrow v = 1.5 \text{ m/min} \rightarrow$  Drive speed  $n_1 = 1500 \text{ rpm}$
  7. From table 9 for 1500 rpm and  $F = 25 \text{ kN} \rightarrow T_1 = 14.1 \text{ Nm} \rightarrow P_1 = 2.2 \text{ kW}$
  8. Other loading or moments (torque) need not be considered, since lateral forces  $F_S \sim 0$
  9. Moment of torsion,  $T_v$  from chart on page 38 for  $F = 25 \text{ kN}$  with HGA 50  $\rightarrow T_v = 80 \text{ Nm}$   
 $\rightarrow$  this moment must be directly absorbed by the gear or by some other anti-twist element in the installation.
- $\rightarrow$  **Ordered:** Lifting spindle drive HV50 (with anti-twist element, since there is no guideway planned for the load),  $i = 7:1$ ,  $L_a = 440 \text{ mm}$ , elevating movement 200, with end plate, coupling, motor.

# Enquiry Form

## ZZ-Antriebe GmbH

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Company \_\_\_\_\_  
Dept. \_\_\_\_\_  
Addr. \_\_\_\_\_  
Tel. \_\_\_\_\_  
FAX \_\_\_\_\_  
E-mail \_\_\_\_\_  
Date \_\_\_\_\_

Enquiry concerning lifting spindle gears / Lifting systems

Contact requested

Please send catalogue

- Bevel gear units       Screw-jack units       Indexing gears  
 Spiral bevel gear units       Cam units       Complete program

**Load details**

Direction of loading       Compression  
 Tensile loading  
 Compression and tensile

Type of loading       Unguided load       Euler, case -1  
 Guided load       Euler, case-2       Euler, case-3       Euler, case-4

Total lifting force      static \_\_\_\_\_ kN      dynamic \_\_\_\_\_ kN  
 Lifting force per drive      static \_\_\_\_\_ kN      dynamic \_\_\_\_\_ kN  
 Lifting speed      \_\_\_\_\_  m/min       mm/s

**Installation position**

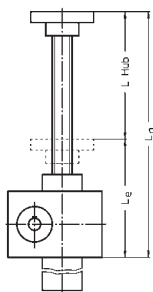
- Vertical       Spindle uppermost       Spindle downwards  
 Horizontal  
 Slope angle \_\_\_\_\_ °      (With sketch)  
 Side D       Side A      (see Catalogue page 39)

**Fixture**

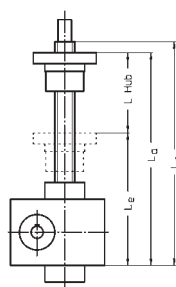
Number of cycles (↓↑) \_\_\_\_\_  per day       per shift       per hour       Monthly

**Installation data**

$L_s$  max. \_\_\_\_\_ mm      Lift. \_\_\_\_\_ mm  
 $L_e$  \_\_\_\_\_ mm       $L_s$  \_\_\_\_\_ mm  
 Ratio       1 mm Lift / 1 rev. drive       0.25 mm Lift / 1 rev. drive



- Basic model HG  
 Anti-twist (requirement of installation)  
 Lifting spindle drive with anti-twist element



- Screw-nut HL  
 with integrated counter bearing with any considerable lateral forces  
 Movable bearing on clear end of spindle

**Accessories**

- End plate       Gaiter       Couplings       Motor flange  
 Rod-end bearing       Protection tube       Joining shaft       Counter bearing plate  
 Yoke       Spiral spring       Pillow-block bearing       ZZ-Bevel gear units  
 Toe plates       Cardan end joint       Cardan adapter       \_\_\_\_\_

**Additional details**

Special loading:      Lateral forces       \_\_\_\_\_  
    Mechanical shocks/ Vibrations       \_\_\_\_\_  
 Ambient conditions      Temperature      \_\_\_\_\_ °C to \_\_\_\_\_ °C  
    Dust       \_\_\_\_\_  
    Humidity       \_\_\_\_\_ Spindle rust-free:    Yes     No

Miscellaneous: \_\_\_\_\_



**Sales and Delivery Terms:**

Our "General Conditions for the Supply of Gear Units and Drive Elements" shall apply. All dimensions and illustrations are without obligation. We reserve the right to effect changes and modifications to the construction, sizes, weights, technical specifications, etc. without prior notice.

Valid 05/2005.

## Our Production Program



### ZZ Bevel Gear Units

up to 7000 Nm nominal torque  
or 500 kW power. ZZ-Servoline®  
series for high-dynamic drives



### ZZ Screw Jack Units

with trapezoidal or ball screw spindle  
for loading up to 1000 kN



### ZZ Indexing Units

as globoid, cylinder- or radial  
cam gear units with pendular  
or stepping function



### ZZ Spiral Bevel Gears

with - Palloid gear tooth system  
- Cyclo-palloid gear tooth system  
- HPG-S gear tooth system



### ZZ Cams

As - Globoid cams  
- Axial cams  
- Radial cams



### ZZ Special Gear Units

For versatile use in many  
different types of application