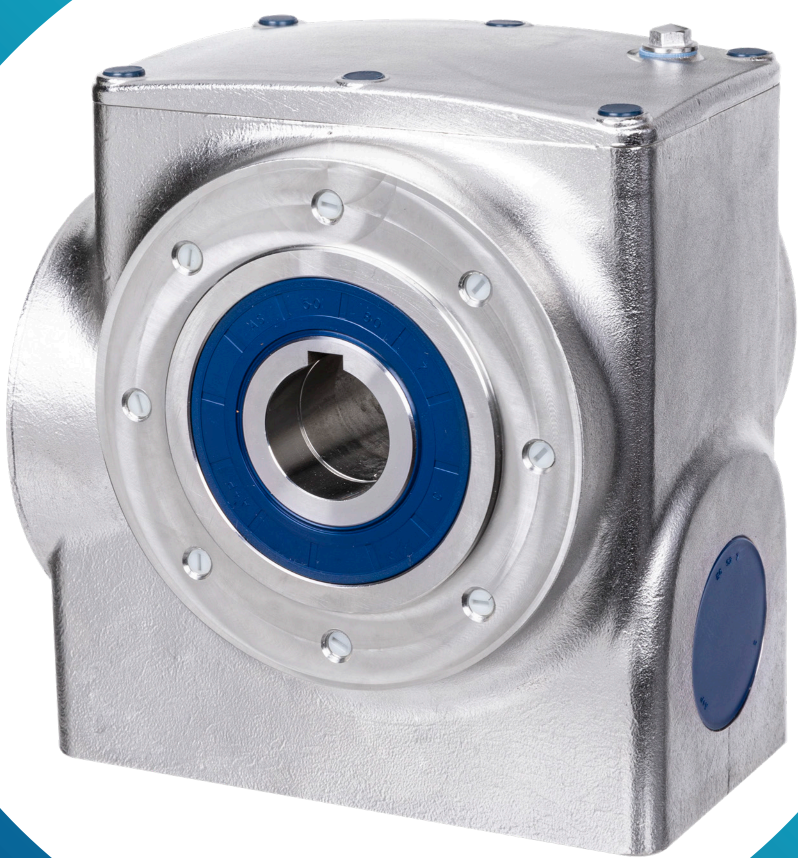
dertec®

Designed to Perform

Stainless Steel
Helical Worm Gearboxes.

FS(A)



Dertec FSA Helical wormgear bevel gearboxes have been specifically developed with a view to hygiene and cleanability, With a design that aims to minimize build-up of dirt and a shape that contributes to less accumulation and adhesion of contaminants and therefore simplifies cleaning.
Use of stainless steel also contributes to the reduced use of strong chemical cleaning agents, which benefits the surface water quality.

Dertec FSA series helical worm gears provide, by using a primary gear stage, relatively higher torque and improved efficiency over gearboxes based only on a worm gear. The improved efficiency of the drive reduces energy consumption.
Dertec FSA serie is a robust version helical wormgearbox which traditionally is frequently used in the food industry.
The FSA serie is like the Dertec FKA, FR and FFA series interchangeable with cast iron drives with EURO dimensions.
The combination of bronze worm gears, hardened ground worm and grounded hardened gears in the primary gearstage ensure a long life and smooth running.
Dertec FSA series is available in 4 sizes with standard hollow shaft diameters of 20, 25, 30, 35, 40 and 45 mm.
The FSA serie is suitable for IEC motor mounting or equipped with an integrated stainless steel electric motor.
The maximum transmission ratio is 217.41: 1 and the maximum secondary torque is 520 Nm.

Main Features

Made of high quality carefully electro polished Stainless Steel AISI 316 (mirror Polished on request). The smooth design gives the gearbox a nice appearance, ready to suit all kinds of stainless steel machinery for the food industry.

Hardened shaft

All hollow shafts are produced in Duplex Stainless Steel 2205. The special PNS surface treatment ensures enough hardness to collaborate with our Special High Temperature Resistant Blue Shaft Seals. The PNS treatment increases the lifetime of shaft / seal cooperation and helps to reduce wear on the shaft surface.
By this, the gearbox obtains a longer drip free operation compared to standard shaft / seal combinations made of SS304 with NBR or FKM. The use of above combination offers all the positive characteristics of stainless steel and the surface hardness of a hardened shaft.

Blue shaft seals

Our high performance engineered shaft seals have a blue colour.
It is a well overthought feature for food industry applications.
It might be clear that the colour “blue” is a not existing organic colour.
In the context of food safety it is a common use to embed blue colours as these are very visible and easily to be recognised by vision scanning systems.

Foodgrade lubrication

All gearboxes are standard equipped with NSH H1 certified Synthetic Foodgrade lubrication.
On request it can be supplied with a Halal, Kosher or Nut Free certification.

Laser engraved tagplate

To avoid dirt traps under the commonly used motor identification tagplate, all our motors and gearboxes are being equipped with a laser engraved tagplate.
Besides for the food safety this also prevents against possible lost of information because of taking away the tagplate or loosing the tagplate from the driveparts.

As a part of our standard procedure every drive is tested in our production facility in the Netherlands to ensure correct functioning.

General specifications

- Standard ratio’s 22.5 : 1 to 217,41 : 1
- IEC motor adaption versions (AM)
- Integrated motor versions (B5T..)
- Standard hollow shafts 20, 25, 30, 35, 40, 45 mm
- Extra hygienic optional shaft covers. (open and closed version)
- Easy clean torque arm with built in elastic element to reduce mis alignment.
- Higher efficiency than a standard wormgearbox
- Optional output flanges available
- Stainless Steel AISI316
- Duplex stainless steel 2205 output shaft
- Interchangeable with euro sizes
- Designed and produced in the Netherlands

Product Characteristics

FS(A) 38	
Ratio's	From 22.5 : 1
	To 157.43 : 1
Standard shaft	20 mm
Torque	Max. 92 Nm
Power	Max. 0.55 kW

FS(A) 48	
Ratio's	From 23.2 : 1
	To 201 : 1
Standard shaft	20 mm
Torque	Max. 170 Nm
Power	Max. 1.1 kW

FS(A) 58	
Ratio's	From 23.2 : 1
	To 201 : 1
Standard shaft	30 & 35 mm
Torque	Max. 292 Nm
Power	Max. 1.5 kW

FS(A) 68	
Ratio's	From 26.93 : 1
	To 217.41 : 1
Standard shaft	40 & 45 mm
Torque	Max. 520 Nm
Power	Max. 3.0 kW

Output Flanges	
FSA 38	SS 085 FL 125
FSA 48	SS 095 FL 160
FSA 58	SS 115 FL 200
FSA 68	SS 130 FL 250

Easy Clean Open Cover	
FSA 38	SS 085 CO 20
FSA 48	SS 095 CO 25
FSA 58	SS 115 CO 30
FSA 68	SS 130 CO 45

Easy Clean Closed Cover	
FSA 38	SS 085 CC
FSA 48	SS 095 CC
FSA 58	SS 115 CC
FSA 68	SS 130 CC

Torque Arms	
FSA 38	SS 085 MS L100
	SS 085 MS L110S
FSA 48	SS 095 MS L130S
	SS 095 MS L150
FSA 58	SS 115 MS L160S
	SS 115 MS L200
FSA 68	SS 130 MS L200

Table of content

Table of Content

Project planning

Basic Parameters

Power P

The input power can be found in the **"Gearbox Selection Tables"** , it represents the amount of kilowatts [kW] that can be safely transmitted into the gearbox.

$$P_1 = \frac{P_2}{\eta}$$

P_1 = Input power (kW)
P_2 = Output power (kW)
η = Gearbox efficiency (%)

Rotation speed *n* and gear ratio *i*

The gear ratio can be calculated with the input and output speed

$$i = \frac{n_1}{n_2}$$

i = Gear ratio
n_1 = Input speed in (rpm)
n_2 = Output speed in (rpm)

Torque *M*

The output torque can be calculated with the input power, the efficiency and the output speed.

$$M_2 = \frac{9550 \cdot P_1 \cdot \eta}{n_2}$$

$$M_{2max} \geq M_2 \cdot fs_{gearbox}$$

M_2 = Output torque (Nm)
M_{2max} = Maximum output torque (Nm)
P_1 = Input power (kW)
n_2 = Output speed (rpm)
η = Gearbox efficiency (%)
$fs_{gearbox}$ = Service factor (see in the tables at)

Mass acceleration factor f_a

The mass acceleration factor is calculated with all the external mass moments of inertia and the mass moment of inertia from the motor.

$$f_a = \frac{J_c}{J_m}$$

f_a = Mass acceleration factor
J_c = All external mass moments of inertia [kg m^2]
J_m = Mass moment of inertia on the motor end [kg m^2]

⚠ **If the mass acceleration factor $f_a \geq 10$, please contact us.**

Efficiency of gearboxes *η*

The efficiency of gearboxes is mainly determined by the gear type, the gear ratio and the bearing friction. The efficiency of the gears at start-up and at sub-optimal operating speed is always lower than when the gears are running at the optimal operating speed. The gear shape of worm- and helical worm gearboxes causes more friction, thus a lower total efficiency. As a result of the higher friction, the temperature of worm gearboxes might also be higher than gearboxes with other gear types.

The efficiency of the different gear types can be found in the **"Possible Geometrical Combinations".**

For an approximate approach the following values can be used for the efficiency of gears at their (optimal) operational speed, beware these are generalized and can be different depending on the factors as discussed before.
For bevel-, helical- and parallel shaft gears the efficiency is in-between 94% (3-stage) and 96% (2-stage).
The efficiency of hypoid bevel gears is 90% (3-stage) and 92% (2-stage). For worm- and helical worm gears the efficiency depends on the gear ratio, incoming rotational speed and the temperature of the worm gearbox, the efficiency of the gears is between 40% and 90%.

To ensure the efficiency of the gears is optimal it is recommended but not limited to: Regularly change oil, use the optimal mounting position and use the gearbox at the optimal operating speed.
Choosing the right size gearbox for the application is recommended to achieve a better efficiency, at speeds below- and over the optimal operating speed the efficiency is lower than at optimal speeds and conditions.

Service factor fs_{min} and $fs_{gearbox}$

The service factor is a method to determine the effects of the driven machine or other application on the gearbox, with a sufficient level of accuracy for most applications. The minimal service factor **(fs_{min})** for a machine can be determined using the **"Service factor graph"**. This minimum service factor is only an approximation, for the service factor for each gearbox, see the **"Gearbox Selection Tables"**.

⚠ **The minimal service factor (fs_{min}) should always be lower than or equal to the actual service factor of the gearbox ($fs_{gearbox}$).**

$$fs_{min} \leq fs_{gearbox}$$

fs_{min} = Minimal determined service factor **"Service factor graph"**
$fs_{gearbox}$ = Actual service factor for the gearbox **"Gearbox Selection Tables"**

⚠ **The service factor for each gearbox ($fs_{gearbox}$) is the critical service factor, and should always be equal to or higher than the minimum service factor (fs_{min}) !**

Switching frequency

The switching frequency determines how often an application switches per hour.
The switching consists of: **turning on/off, changing of speeds, changing of loads and braking**

z = Switching frequency [1/h]

Load classification

There are three load classifications to be considered, they depend on the mass acceleration factor.
The mass acceleration factor can be calculated, see **"Mass acceleration factor f_a"**

f_a = Mass acceleration factor

The load classifications are split in three groups with each examples of the common applications for each load classification.

A: Uniform load, a mass acceleration factor of **$f_a \leq 0,3$**
Examples of applications: Screw feeders for light materials, fans, assembly lines, conveyer belts for light materials, small mixers, light application elevators, cleaning machines, fillers, control machines.

B: Moderate shock load, mass acceleration of **$f_a \leq 3$**
Examples of applications: Winding devices, woodworking machine feeders, medium application elevators, balancers, medium mixers, conveyer belts for heavy materials, winches, sliding doors, fertilizer scrapers, packing machines, concrete mixers, crane mechanisms, milling cutters, folding machines, gear pumps.

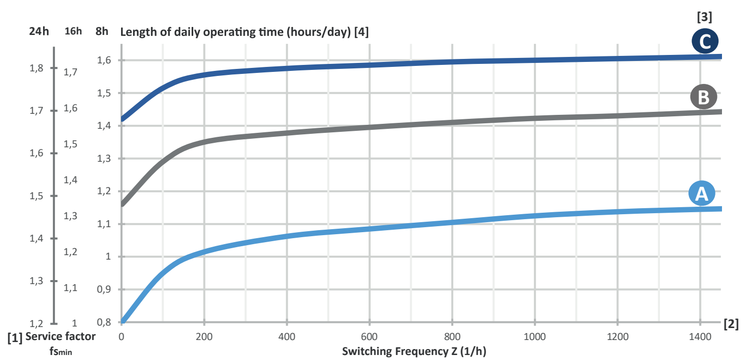
C: Heavy shock load, mass acceleration factor of **$f_a \leq 10$**.Examples of applications: Mixers for heavy materials, shears, presses, centrifuges, rotating supports, winches and lifts for heavy materials, heavy application elevators, grinding lathes, stone mills, bucket elevators, drilling machines, hammer mills, cam presses, folding machines, turntables, tumbling barrels, vibrators, shredders.

Service factor graph

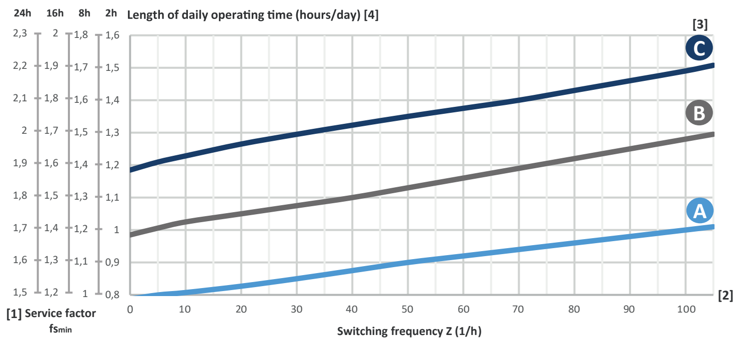
The determined Minimum **[1]** service factor is based on **[2]** switching frequency, **[3]** load classification and **[4]** length of daily operating time.

To get the expected service life from the gearbox, $fs_{min} \leq fs_{gearbox}$
see the "Gearbox Selection Tables" for the gearbox service factor

Service factor for a high Switching frequency [Z], used for all gearboxes:



Service factor for low Switching frequency (Z), used mostly for worm- and helical worm gearboxes:

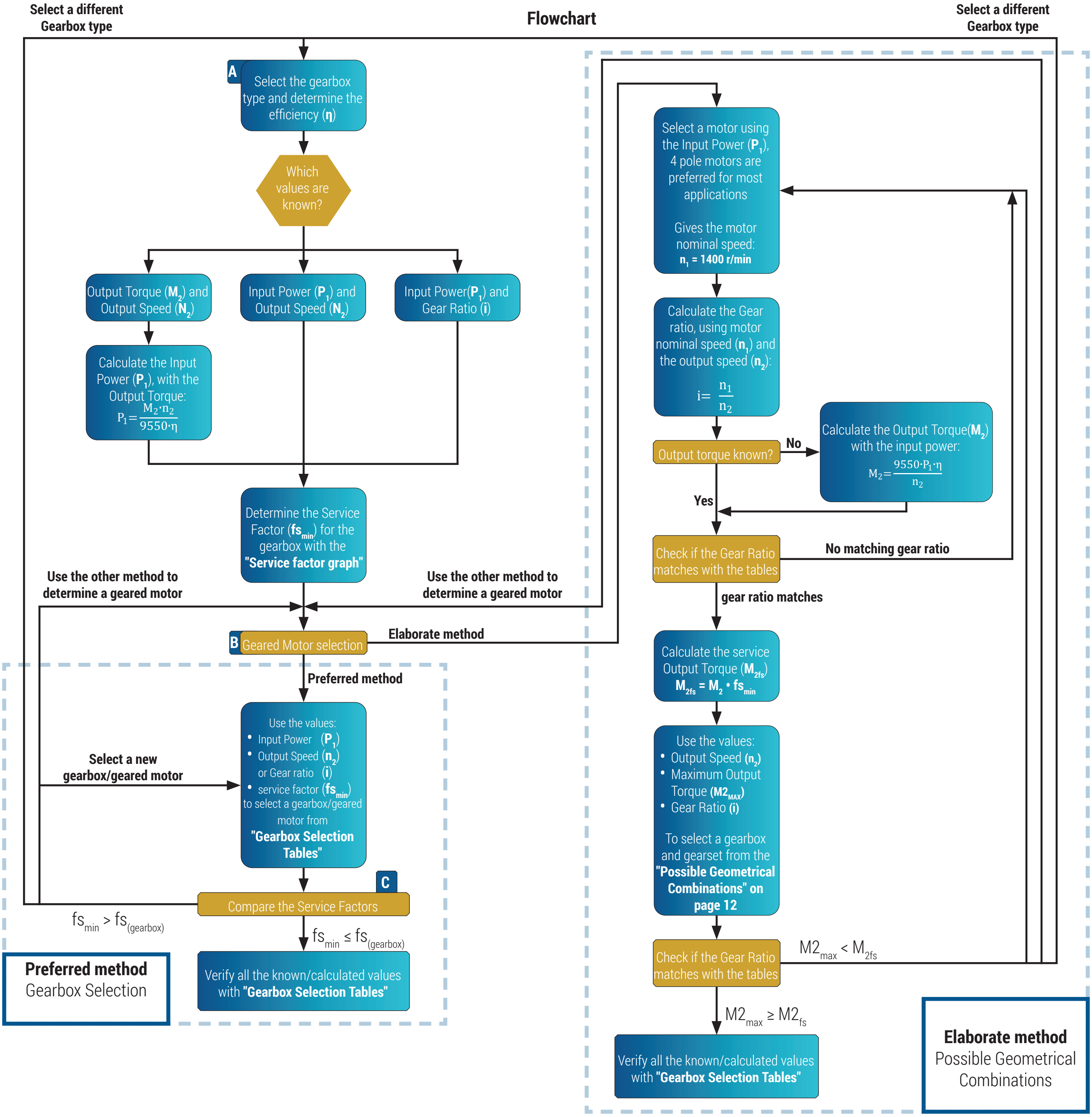


For worm gearboxes the ambient temperature has more influence on the service factor, the service factor should be adjusted as following:

Ambient temperature:
=30~40˚C, f_s•1,1 ~ 1,2
=40~50˚C, f_s•1,3 ~ 1,4
=50~60˚C, f_s•1,5 ~ 1,6

Project Planning

Flowchart



A

Gearbox types by gear type:

- Worm gear
- Helical worm gear
- Helical bevel gear
- Hypoid bevel gear
- Parallel shaft gear
- (Compact) Helical gear

B

Geared motor selection, there are 2 methods of selecting a geared motor:

- The elaborate method is used to select a geared motor based on calculations.
- The preferred method is based on a quick and accurate decision with our tables.

C

The service factor, is a value to determine the effect of a driven machine on the gearbox. With **"Gearbox Selection Tables"** the minimum expected service(fs_{min}) factor can be determined.

The gearboxes themselves have a maximum service factor that varies per gearbox ($fs_{gearbox}$), always make sure that: $fs_{min} \leq fs_{(gearbox)}$

To get the expected service life from the gearbox.

Explanation of the flowchart

Gearbox selection type
To select a gearbox the values for efficiency and the service factor are needed. These can be predicted by choosing the type of gearbox, **"Possible Geometrical Combinations"**

Which values are known?
There are three sets of values that can be known and which can be used to select the right gearbox and geared motor.
These three sets of values are:

- **Output torque and speed**
- **Input power and speed**
- **Input power and gear ratio**

For only knowing the output torque- and speed it is necessary to determine the input power with the following equation:

$$P_1 = \frac{M_2 \cdot n_2}{9550 \cdot \eta}$$

P_1	Input power [kW]
M_2	Output torque [Nm]
η	Gearbox efficiency [%]
n_2	Rotational speed [rpm]

Determine the service factor
Use the **"Service factor graph"** to determine the service factor.

Select a geared motor
There are two methods to select a gearbox and a geared motor:

The preferred method: This method is accurate and quick, this method only needs a basic calculation in when the input power is unknown.

The elaborate method: This method gives more insight and a more hands on approach in the selection process for a gearbox and geared motor. There are a few calculations that have to be done in this method.

⚠ **If both methods don't give the correct results it can be possible that the gearbox and or motor are not correct for this application!**

Preferred method:

Use the "Gearbox Selection Tables"
Use the Input power, output speed or gear ratio and the service factor to select the gearbox/geared motor.

⚠ **Note: that the output torque is sufficiticated to your application**

Check the service factor
Check if the determined service factor $\mathbf{fs_{min}}$ is smaller or equal to the service factor from the **"Gearbox Selection Tables"** $\mathbf{fs_{min} \leq fs_{gearbox}}$.

If $\mathbf{fs_{min} > fs_{gearbox}}$ a different gearbox/geared motor should be selected if that is not possible then it is advised to check the other gearbox types..

If $\mathbf{fs_{min} \leq fs_{gearbox}}$ go to the next step and verify the results.

Verify the results
If the service $\mathbf{fs_{min}}$ and $\mathbf{fs_{gearbox}}$ gives a valid result, verify the rest of the results with the tables from **"Gearbox Selection Tables"**.

Elaborate method:

Select a motor
Select a motor from in the **(Motor documentation)**.
4-pole motors are preferred for most applications. The given nominal motor speed of a 4-pole motor is **n_1=1400 rpm**.

Calculate the gear ratio
If the gear ratio is known, the output speed **n_2** needs to be calculated.

$$n_2 = \frac{n_1}{i}$$

With the nominal speed from the selected motor and known output speed the gear ratio can be calculated.

$$i = \frac{n_1}{n_2}$$

i = Gear ratio [-]
n_1 = Gearbox input speed [rpm] (equal to motor speed)
n_2 = Gearbox output speed [rpm]

Check if the output torque is known
If the output torque is known go to the next step.
If the output torque is unknown use the following calculation to determine the output torque:

$$P_1 = \frac{M_2 \cdot n_2}{9550 \cdot \eta}$$

P_1 = Input power [kW]
M_2 = Output torque [Nm]
η = Gearbox efficiency [%]
n_2 = Rotational speed [rpm]

Check the gear ratio
With the known or calculated gear ratio and the **"Possible Geometrical Combinations"**, the gear ratio can be checked.
If the needed gear ratio is not in the list a different motor or gearbox should be selected.

Calculate the service output torque
With the determined service factor and the output torque, calculate the service output torque.

$$M_{2fs} = M_2 \cdot fs_{min}$$

M_{2fs} = Service output torque [Nm]
M_2 = Output torque [Nm]
fs_{min} = Service Factor

Use the Possible Geometrical Combinations tables
Use the Output speed, Service output torque and gear ratio to determine a gearbox and gearset with the tables from the **"Possible Geometrical Combinations"**.

Check the maximum output torque
Check if the maximum output torque in these tables matches the calculated service output torque. If the maximum torque is lower than the calculated service torque: **$M_{2max} < M_{2fs}$** it is advised to select a different motor or gearbox.

If **$M_{2max} \geq M_{2fs}$** go to the next step and verify the results.

Verify the results
If the maximum output torque matches the tables and gives a valid result, then verify the values from the tables with the calculated values and make a selection for the gearbox/geared motor.

This example uses a different gearbox type but is generally applicable

Example 1: Preferred method

Known parameters:

M_2 Nominal output torque [Nm] = **110 Nm**
n_2 Rotational speed [rpm] = **29 rpm**

Moderate shock load, operational **16 hours a day**, Switching frequency of **200 times per hour.**

Gearbox selection type

A hypoid bevel gearbox is selected. The estimated efficiency ***η≈90% to 94%***. For a more accurate efficiency look it up in the **"Possible Geometrical Combinations"**.

When in doubt use the lowest estimated efficiency.

Which values are known?

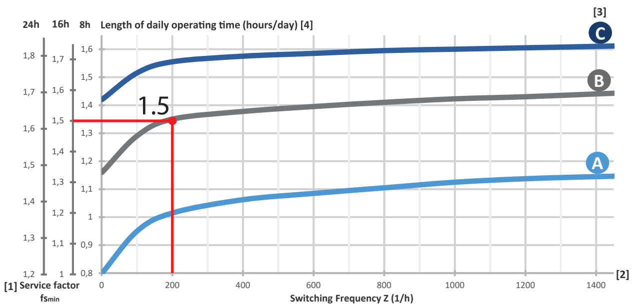
- Output torque- and speed
- ~~Input power- and speed~~
- ~~Input power and gear ratio~~

M_2 = **110Nm**
n_2 = **29 rpm**

Looking up the output speed and output torque in the **"Possible Geometrical Combinations" on page 15** tables gives an efficiency of: **η≈92%**
With the output torque- and speed it is necessary to determine the input power with the following equation:

$$P_1 = \frac{M_2 \cdot n_2}{9550 \cdot \eta} = \frac{110 \cdot 29}{9550 \cdot 0{,}92} = 0{,}363 \text{ kW}$$

Determine the safety factor



Select the *'Elaborate method'* or the *'Preferred method'*

Preferred method is chosen.

P_{1n} [kW]	n_2 min⁻¹	M_{2n} [Nm]	i	F_{r2} [N]	fs		
0.37	23	140	60.50	3430	1.40	FK38B IEC71	712-4 B14a
	29	113	48.71	3190	1.80		
	36	91	39.29	2970	2.00		
	46	70	30.31	2720	2.80		
	57	57	24.44	2530	3.20		
	69	47	20.25	2380	3.20		
	95	34	14.67	2130	3.20		

Check the service factor

fs_{min}=**1,5**
$fs_{(gearbox)}$=**1,8**

Check if the following is true

$fs_{min} \leq fs_{gearbox}$
Yes, because **1,5 < 1,8**

Verify the results

Needed Torque: **110 Nm**, available torque in selected gearbox: **113 Nm**
Needed output speed: **29 rpm**, available output speed in selected gearbox: **29 rpm**
Calculated Input power: **0,363 kW**, available input power in selected gearbox: **0.37 kW**

Service factor: $fs_{min} \leq fs(gearbox)$ = **1,5<1,8**
So the choice of gearbox/geared motor is: **FK38B IEC71 / 712-4 B14a.**

It is recommended to select a gearbox or geared motor that fits the application. Choosing a gearbox or geared motor that is too light or too heavy can cause damage (to the machine) and shorten the expected service life of the gearbox/geared motor!

This example uses a different gearbox type but is generally applicable

Example 2: Eleborate method

Known parameters:

P1 Input power [kW] = **0.55kW** **i** gear ratio = **30:1**
Heavy shock load, operational **24 hours a day**, switching frequency of **800 times per hour.**

Gearbox selection type
A hypoid bevel gearbox is selected. The estimated efficiency ***η≈90% to 94%***. For a more accurate efficiency look it up in the **"Possible Geometrical Combinations"**

When in doubt use the lowest estimated efficiency.

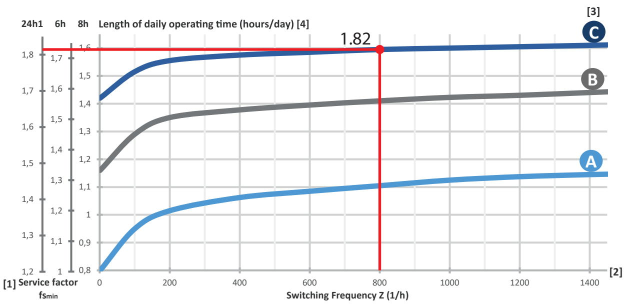
Which values are known?

- ~~Output torque and speed~~
- ~~Input power and speed~~
- Input power and gear ratio

P_1 = **0.55 kW**
i = **30:1**

Looking up the output speed and output torque in the **"Possible Geometrical Combinations"** tables gives an efficiency of: **η≈94%**

Determine the safety factor



Select the elaborate or the Simple method
Elaborate method is chosen

Select a motor
Check the **"Possible Geometrical Combinations"**, which motor is preferred. In this example an IEC80 B14a motor is preferred.

The choice of motor is based on a 4-pole motor, which means an input speed of 1400 rpm.
However it is possible to choose from a wide range of motors.

Calculate the output speed

i = 30:1
n_1 = 1400 rpm

$$i = \frac{n_1}{n_2} \rightarrow n_2 = \frac{n_1}{i} \rightarrow \frac{1400\ \text{rpm}}{30} = 46{,}67\ \text{rpm}$$

Check of the output torque is known
The output torque is not known yet, so it needs to be calculated with the known values.

$$M = \frac{9550 \cdot P \cdot \eta}{2} = \frac{9550 \cdot 0{,}55 \cdot 0{,}90}{46{,}67\ rpm} \quad 101{,}3\ Nm$$

Check the gear ratio
To check the gear ratio, look in the **"Possible Geometrical Combinations"** tables for the preferred gearbox. As seen below, the gear ratio and output speed match with this gearbox. The preferred motor is also possible with this gearbox type.

FK 28 B

Maximum torque = 130 Nm @ N1= 1400 rpm

n_2 [min⁻¹]	M_{2max} [Nm]	F_{r2} [N]	i		η%	IEC 63 B5	IEC 71 B14a	IEC 80 B14a	IEC 90 B14a
35	130	2610	40	40.09	94	✓	✓	✓	
48	130	2350	30	29.33	94	✓	✓	✓	
59	130	2200	25	24.07	94	✓	✓	✓	✓

Calculate the service output torque
Use the determined service factor and the calculated output torque.

$M_{2fs} = M_2 \cdot fs_{min} \rightarrow 101{,}3\ Nm \cdot 1{,}82 = 184{,}37\ Nm$

Use the Possible Geometrical Combinations tables

FK 28 B

*Maximum torque = **130 Nm** @ N1= 1400 rpm*

n_2 [Min⁻¹]	M_{2max} [Nm]	F_{r2} [N]	i		η%	IEC 63 B5	IEC 71 B14a	IEC 80 B14a	IEC 90 B14a
35	130	2610	40	40.09	94	✓	✓	✓	
48	130	2350	30	29.33	94	✓	✓	✓	
59	130	2200	25	24.07	94	✓	✓	✓	✓

Check the maximum output torque
With the known values and the selected gearbox, we can determine that the following values apply:

n_2 = 48 rpm ≈ 46.67 rpm [calculated]
I = 30 = 30 [known]
M2fs = 101,3 Nm [calculated]

So the determined gearbox has enough output torque for the application 130 Nm, but when we look at the service output torque, it is not recommended to choose this gearbox with this service factor and service output torque.

M_{2fs} = 184,37 Nm [calculated]
$M_{2max} < M_{2fs} \rightarrow$ 130 Nm < 184,37 Nm

It is recommended to choose another gearbox, the easiest way to do this is to look for a bigger gearbox within the same gearbox type.

Selecting a new gearbox
It is recommended to match the calculated results as before, but look for a higher maximum torque. Try to select a maximum torque that still matches the application, it is not recommended to select a gearbox with more maximum torque than the application needs.

FK 38 B

*Maximum torque = **200 Nm** @ N1= 1400 rpm*

n_2 [Min⁻¹]	M_{2max} [Nm]	F_{r2} [N]	i		η%	IEC 63 B5	IEC 71 B14a	IEC 80 B14a	IEC 90 B14a
36	200	2970	40	39.29	94	✓	✓	✓	✓
47	200	2720	30	30.31	94	✓	✓	✓	✓
58	200	25030	25	24.44	94		✓	✓	✓

Verify the results
With the table for the FK38B gearbox, we can determine the following.

n_2 = 47 rpm ≈ 46.67 rpm [calculated]
i = 30 = 30 = [known]
M_2 = 101,3 Nm [calculated]
M_{2fs} = 184,37 Nm [calculated]

Check if the maximum output torque is higher than the service output torque.

$M_{2max} > M_{2fs} \rightarrow$ 200 Nm > 184,37 Nm

So this gearbox can be used for the application, because the service output torque is lower than the maximum output torque.

The recommended gearbox with motor is:
For a gearbox, a **FK38B** with a true gear ratio of **30,31** and for a motor, the **IEC80 B14a** is possible.

It is recommended to select a gearbox or geared motor that fits the application. Choosing a gearbox or geared motor that is too light or too heavy can cause damage (to the machine) and shorten the expected service life of the gearbox/geared motor

Overhung and axial loads

Determing overhung loads

Each transmission element has a transmission element factor f_z , this factor is different for each element.

In order to properly use transmission elements, always make sure that they are aligned properly on the shaft of the gearbox and or the shaft of the machine or other application. It is important to check that the transmission element is mounted properly before use, the element might cause problems in dynamic situations if this isn't checked

$$F_r = \frac{M \cdot 2000}{d_0} \cdot fz$$

F_r = overhung load [N]
M = Torque [Nm]
d_0 = Mean diameter of the mounted element [mm]
F_z = Element factor [see table above]

Transmission elements	Transmission elements Factor Fz	Comments
Gears	1.00	≥ 17 Teeth
	1.15	< 17 Teeth
Chain sprockets	1.00	≥ 20 Teeth
	1.25	< 20 Teeth
	1.40	< 13 Teeth
Narrow V-belt Pulleys	1.75	Influence of the tensile force
Flat Belt Pulleys	2.50	Influence of the tensile force
Toothed Belt Pulleys	2.50	Influence of the tensile force

Rated bearing service life

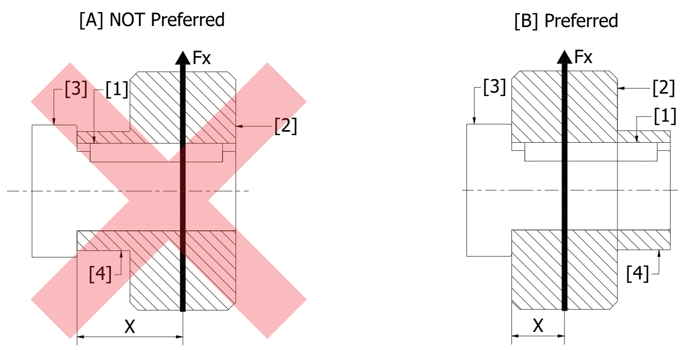
The rated bearing service life L_{10h} (in hours, according to **ISO 281**) is used to calculate the estimated bearing life in hours. For special operating conditions the modified service life should be used.

$$L_{10h} = \frac{10^6}{60 \cdot n_2} \cdot \left(\frac{C}{F_r}\right)$$

L_{10h} = Rated service life [hour]
C = Basic dynamic load rating, bearing [kN]
F_r = Equivalent dynamic load, bearing [kN]
ρ = Exponent for the life equation, ρ=3 for ball bearings, ρ=10/3 for roller bearings
n_2 = Gearbox output speed [rpm]

Preferred mounting for overhung loads

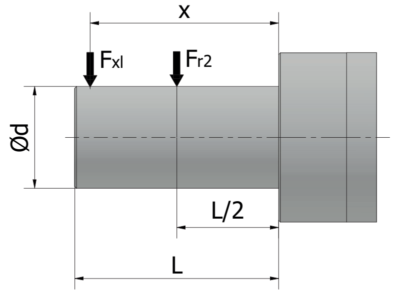
The preferred way of mounting the overhung load for sprockets, gears and other transmissions is with the hub **[4]** at the end of the shaft **[3]** and the sprocket/gear **[2]** against the shoulder, see **[B]** in the figure below. This method ensures a better load distribution on the end of the shaft.

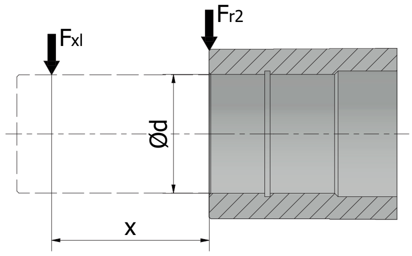


nr.	Part Name
[1]	Key
[2]	Sprocket / Gear
[3]	Solid shaft
[4]	Hub
[Fx]	Radial Force on the Sprocket / Gear
[X]	Distance to center of mass and force

Overhung load conversion for off-centre force applications

The rated bearing life is the basis for determining the permissible overhung load. The permissible overhung loads for foot mounted gearboxes with solid shafts can be calculated with the following calculation.





$$F_{xL} = F_{r2} \cdot \frac{a}{b+x}$$

F_{xL} = Permitted overhung load based on bearing service life[N]
F_{r2} = Permitted overhung load (x=L/2) for foot mounted gearboxes according to the selection tables [N]
F_{r2max} = Maximum permitted overhung load (x=L/2) for foot mounted gearboxes according to the sellection tables [N]
x = Distance from the shaft shoulder to the applied force [mm]
a,b ød, L = Gear unit constant for overhung load conversions [mm]

The values in table are for the foot mounted gearboxes with solid shaft only, the measurements are for the standard shafts.

FV	a [mm]	b [mm]	Ød [mm]	L [mm]	Fr2 max [N]
FV 030	65	50	14	30	1830
FV 040	84	64	18	40	3490
FV 050	101	76	25	50	4840
FV 063	120	95	25	50	6270
FV 075	131	101	28	60	7380
FV 090	162	122	35	80	8180

FKA	a [mm]	b [mm]	Ød [mm]	L [mm]
FKA 38	123,5	98,5	25	50
FKA 48	153,5	123,5	30	60
FKA 68	181,3	141,3	40	80
FKA 78	215,8	165,8	50	100
FKA 88	252	192	60	120

FFA	a [mm]	b [mm]	Ød [mm]	L [mm]
FFA 38	123,5	98,5	25	50
FFA 48	153,5	123,5	30	60
FFA 68	181,3	141,3	40	80
FFA 78	215,8	165,8	50	100

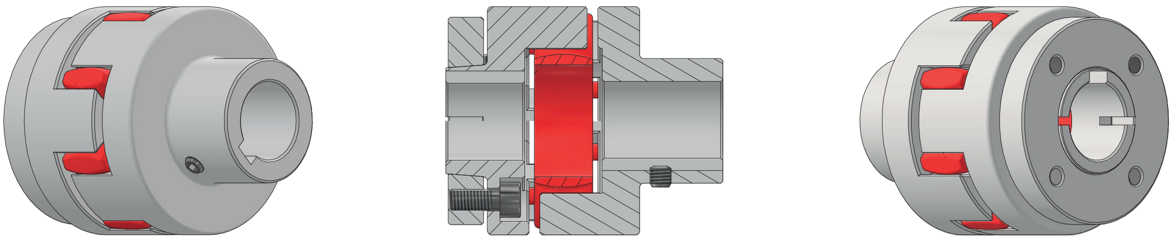
FRC	a [mm]	b [mm]	Ød [mm]	L [mm]
FRC 01	103	83	20	40
FRC 02	116,5	91,5	25	50

FK	a [mm]	b [mm]	Ød [mm]	L [mm]
FK 28 B/C	104	78	25	50
FK 38 B/C	118	93	25	50
FK 48 B/C	131	101	28	60
FK 58 B/C	159	119	35	80

FS(A)	a [mm]	b [mm]	Ød [mm]	L [mm]
FS(A) 38	118,5	98,5	20	40
FS(A) 48	130	105	25	50
FS(A) 58	150	120	30	60
FS(A) 68	184	149	35	70

FR	a [mm]	b [mm]	Ød [mm]	L [mm]
FR 38	118	93	25	50
FR 48	137	107	30	60
FR 68	168,5	133,5	35	70

The use of couplings



Example of a flexible coupling

Couplings are usually needed when a gearbox is rigidly mounted to a machine or other application. A coupling offers some room for misalignment that may be present or develop during use of the gearbox.

Not all misalignments can be statically determined, some may develop during dynamic processes are only present during use of the gearbox

Couplings give room for these misalignments and ensure the service life of the bearings inside of the gearbox, by offering a bit more room for error when there are misalignments.
There are different types of couplings that can be used in such applications, one example is a flexible coupling ***,see: example of a flexible coupling***.
Flexible couplings often have three parts, one for the shaft of the machine or application,
one for the shaft of the gearbox and a part that gives flexibility. The flexible part is often made of rubber or another kind of polymer.

Note: A coupling slightly increases the temperature of the shafts, due to friction and slightly decreases the efficiency of the gearbox.

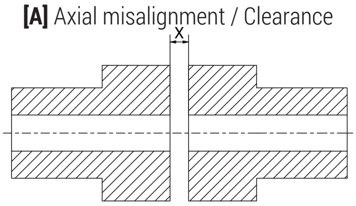
Mounting of couplings

To properly mount the couplings and prevent excessive wear on the gearbox, it is necessary to mount the couplings correctly.
To mount a coupling properly please pay attention to the following types of misalignment.

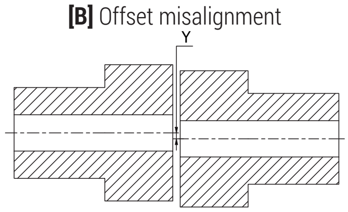
Note: The amount of allowable misalignment is often specified in the coupling datasheet, from the coupling manufacturer

Never mount couplings onto the shaft by hitting them with a hammer, this can cause damage to the gearbox bearings and can reduce the gearbox service life

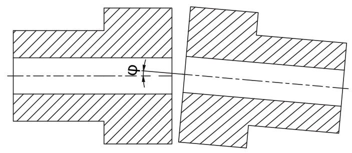
[A] Axial misalignment / Clearance



[B] Offset misalignment



[C] Angular misalignment



[A] Horizontal misalignment/Clearance:
Make sure that the horizontal misalignment/clearance [X] does not exceed the minimum and maximum clearance. This value is dependant on the type of coupling, material of the coupling and bore/shaft diameter and length. $X_{min} \leq X \leq X_{max}$, where $X_{min} > 0$.

Note: For the allowable clearance see the coupling manufacturers data sheet.

[B] Axial misalignment:
Make sure that the axial misalignment [Y] is as close to 0 as possible, in general axial misalignment will cause wear when the misalignment is too big.

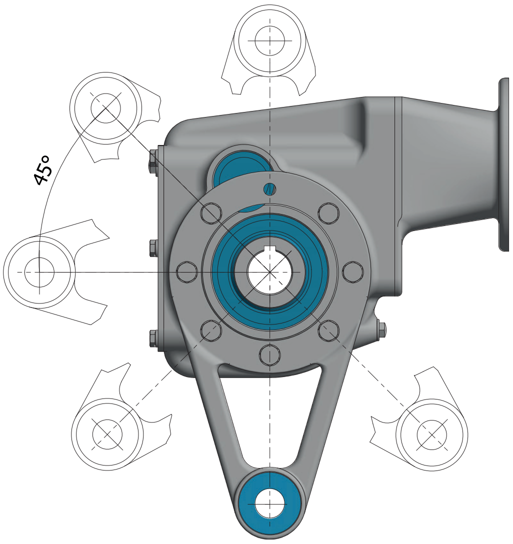
[C] Angular misalignment:
Make sure the angular misalignment [φ] is as close to 0 (degrees) as possible, excessive angular misalignment will cause damage.

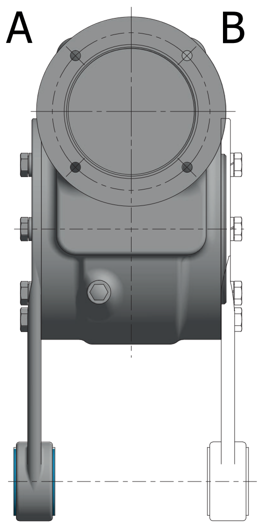
Couplings allow small misalignments, but excessive misalignment and couplings that aren't mounted properly can still cause damage to the gearbox and or machine or other applications.

Torque arm

A torque arm is an attachment for a gearbox that prevents the gearbox from spinning with the driven shaft. When a gearbox is mounted directly on the output shaft without any external support it is always necessary to use a torque arm.

Depending on the gearbox type and size, torque arms can be mounted in a multitude of different positions on the output sides of the gearbox, see the figure below for an example of the different positions.

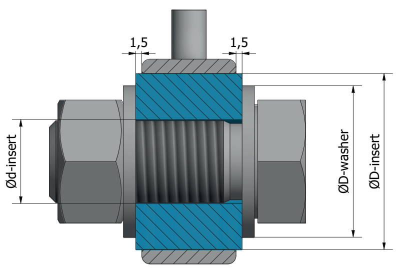


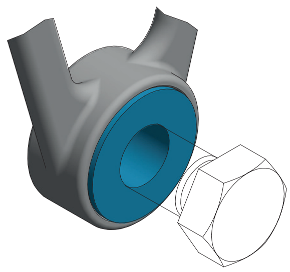


When mounting the torque arm pay attention to the following:

- A torque arm is used to prevent the gearbox from turning with the driven shaft, the torque arm does not prevent movement.
- It is important that the gearbox is allowed some movement when using a torque arm, to ensure that the gearbox bearings don't wear excessively.
- Also make sure the gearbox has enough clearance around it, so that nothing can get in contact with the gearbox immediately.
- It is always recommended to mount the torque arm on the gearbox side closest to the machine, this lowers the probability and the effect of misalignment.
- Avoid mounting the torque arm to a separate frame, this could cause misalignment. Mounting to the machine/application is always preferred.
- Always make sure the torque arm in properly mounted to the gearbox, and all available mounting holes are used.
- When using a torque arm pay attention when mounting the torque arm to a "fixed" position. The torque arm should have enough room to move freely and should not be mounted too tight.
- When attaching the torque arm to a "fixed" position with a bolt, make sure that the bolt is hand tightened and that the rubber insert is not tightened too firm.
- Make sure when using a bolt to hold the torque arm in place, that the washer is smaller than the rubber insert (see figure below).
- If the rubber insert moves out of place, the alignment is not done properly. This does not mean that the torque arm is not tightened properly.

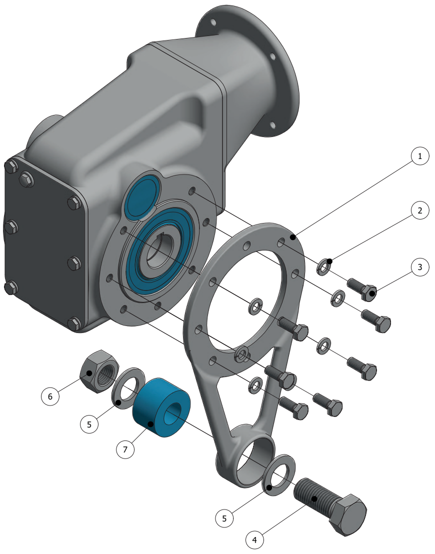
	ø D-ring [mm]	ø D-insert [mm]	ø d-insert
MSB 2510	<25	25	10
MSB 4320	<43	43	20





Mounting the torque arm

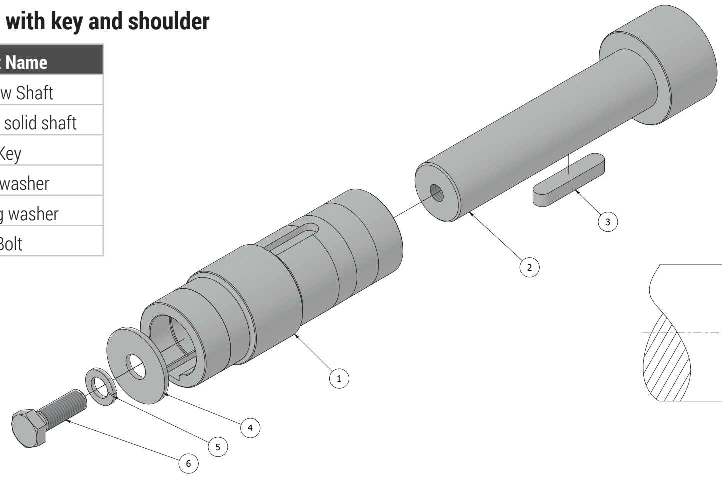
To mount the torque arm, mount the **[1]**torque arm to the gearbox and bolt it down with **[2]** spring washer and **[3]** bolts of the right size. Attach the holding **[4]**bolt with a **[5]** washer, through the hole of the **[7]**rubber insert. Add another **[5]**washer on the opposite side of the **[7]**rubber insert and attach the **[6]** nut hand tight to the holding **[4]**bolt.



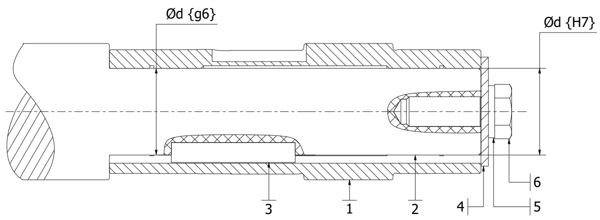
nr.	Part Name
1	Torque arm
2	Spring washer
3	Bolt
4	Bolt
5	Washer
6	Nut
7	Rubber insert

Hollow shaft with key and shoulder

nr.	Part Name
1	Hollow Shaft
2	Machine solid shaft
3	Key
4	Flat washer
5	Spring washer
6	Bolt

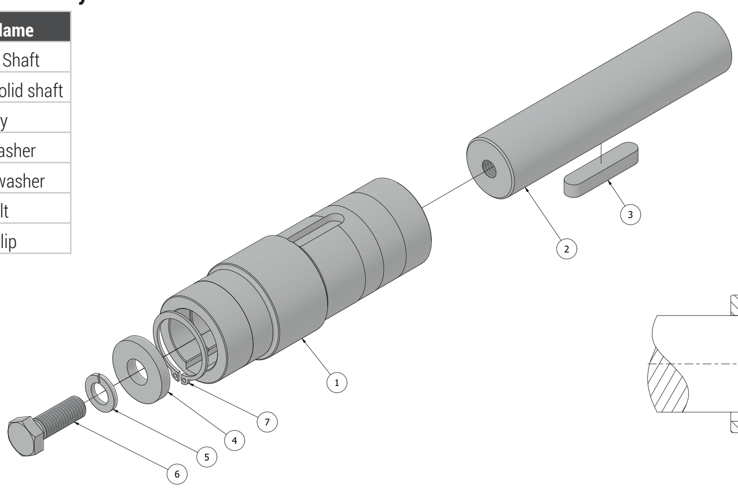


A machine shaft with a key and shoulder is usually held in place with a bolt, a lock washer and a flat washer on the outside of the hollow shaft.

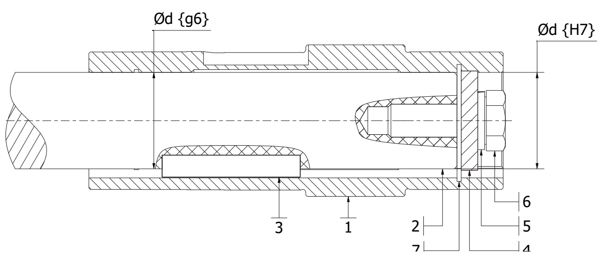


Hollow shaft with key without shoulder

nr.	Part Name
1	Hollow Shaft
2	Machine solid shaft
3	Key
4	Flat washer
5	Spring washer
6	Bolt
7	Circlip



A machine shaft with a key and without shoulder is usually held in place with a bolt, lock washer, a thick flat washer and a circlip on the inside of the hollow shaft.

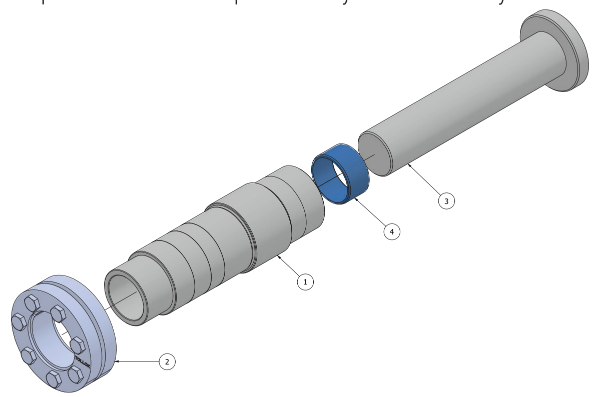


Hollow shaft with a shrink disk

For some applications a shrink disk is preferred, this is a disk that is installed on a longer hollow shaft, which clamps down onto is shaft. This friction holds the machine shaft inside the hollow shaft in place. Because of the friction fit, the machine shaft does not need to have a key in it.

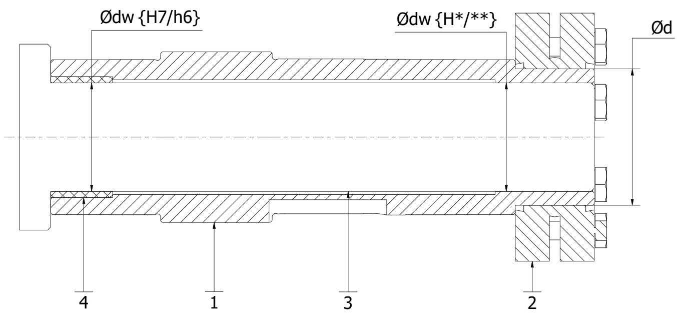
The benefit of a shrink disk is that it provides a way for easy removal of the shaft. Because it is a friction fit, no contact corrosion forms between the shafts, Also it provides an extra fail safe when the machine locks up. The gearbox will not be damaged because the shrink disk will slip when to much torque is applied. A shrink disk provides fast and simple assembly and disassembly. The downside to a shrink disk is that it takes up more space.

nr.	Part Name
1	Hollow Shaft SD
2	Shrinkdisk
3	Machine solid shaft
4	Spacer tube



Shrink disk specifications and installation

The measurements for the machine shaft diameter and the tolerances are shown in the table below. Here the amount of screws and screw type with the tightening torque are also shown.

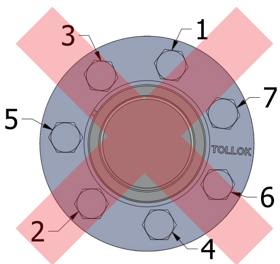


Ød [mm]	Ødw size [mm]	Ødw {H*/**} tolerance	Tightening screws [N° X Type]	Tightening torque [Nm]
14	11-12	H6/j6	4 x M5	4
16	13-14		5 x M5	
24	19-21		6 x M5	
30	24-26		7 x M5	
>30	24-26	H6/h6		
36	28-31		5 x M6	12
44	32-36		7 x M6	
50	38-42		8 x M6	
>50	38-42	H6/g6		
55	42-48			
62	48-52		10 x M6	
68	50-55			
75	55-65		7 x M8	30
80	60-75			
>80	60-75	H7/g9		

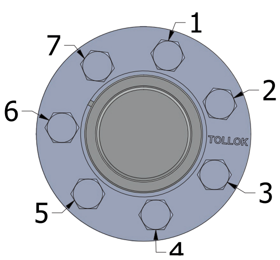
In order to ensure the shrinkdisk is used correctly the following has to be taken into account:

- When the shrink disk is untightened, make sure the screws don't get loosened all the way, this could cause them to fall out.
- When tightening the shrink disk do this in the correct order according to **[B]** with the right amount of torque as shown in the table. If tightening is not done properly situation **[E]** unequally tightening can occur.

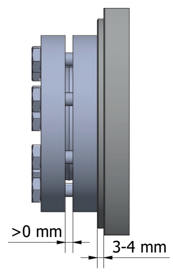
[A] Incorrect tightening order



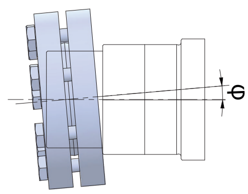
[B] Correct tightening order



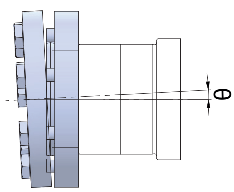
[C] Minumum and maximum clearance



[D] Angular misalignment



[E] Unequally tightened



Possible Geometrical Combinations

FS(A) 38

Maximum Torque = 92 Nm @ N1 = 1400r/min

n2 [Min-1]	M2max [Nm]			Fr2 [N]	i	η%			AM B5T1	AM B5T1	AM B5T1
	2 pole	4 pole	6 pole			2 pole	4 pole	6 pole	IEC63/IEC71	IEC80	IEC90
8,9	82	92	92	3000	157,43	57%	53%	50%	V		
9,7	80	92	92	3000	144,40	57%	54%	51%	V		
11	78	91	92	3000	122,94	58%	55%	52%	V	V	
13	76	88	92	3000	106,00	59%	56%	53%	V	V	V
14	75	87	92	3000	98,80	59%	56%	54%	V	V	V
16	72	86	92	3000	86,36	60%	57%	55%	V	V	V
17	72	85	92	3000	80,96	60%	58%	55%	V	V	V
20	70	84	91	3000	71,44	61%	59%	56%	V	V	V
22	67	82	89	3000	63,33	61%	60%	57%	V	V	V
25	72	81	91	3000	55,93	76%	73%	71%	V	V	V
26	53	80	87	3000	53,83	59%	61%	58%		V	V
27	72	81	90	3000	51,30	76%	74%	72%	V		
32	70	81	87	3000	43,68	77%	75%	73%	V	V	V
37	68	79	86	3000	37,66	78%	76%	74%	V	V	V
40	66	78	84	3000	35,10	78%	76%	74%	V	V	V
46	64	76	82	2870	30,68	78%	76%	75%	V	V	V
49	64	75	82	2800	28,76	78%	77%	75%	V	V	V
55	62	74	81	2660	25,38	79%	77%	76%	V	V	V
62	57	73	79	2530	22,50	79%	78%	76%	V	V	V

FS(A) 48

Maximum Torque = 170 Nm @ N1 = 1400 r/min

n2 [Min-1]	M2max [Nm]			Fr2 [N]	i	η%			AM B5T1	AM B5T1	AM B5T1	AM B5T1
	2 pole	4 pole	6 pole			2 pole	4 pole	6 pole	IEC63/IEC71	IEC80	IEC90	IEC100
7,0	150	170	185	5340	201,00	59%	55%	51%	V			
7,6	150	170	183	5340	184,80	59%	56%	51%	V			
8,9	150	170	180	5340	158,12	60%	57%	52%	V	V		
10	150	168	178	5350	137,05	61%	58%	53%	V	V	V	
11	150	168	176	5350	128,10	62%	58%	54%	V	V	V	
13	150	168	174	5350	110,73	63%	59%	55%	V	V	V	V
15	146	168	172	5350	94,08	63%	60%	56%	V	V	V	V
17	130	167	171	5360	84,00	63%	61%	57%	V	V	V	V
20	107	167	171	5360	71,75	63%	62%	58%	V	V	V	V
20	140	155	180	5370	69,39	78%	75%	71%	V			
21	99	167	171	5360	67,20	62%	63%	58%	V	V	V	V
22	140	155	180	5370	63,80	78%	75%	72%	V			V
25	75	165	171	5320	56,61	60%	64%	60%			V	V
26	140	155	176	5150	54,59	79%	76%	73%	V	V		
30	140	155	175	4850	47,32	80%	77%	73%	V	V	V	
32	140	155	175	4710	44,22	80%	77%	74%	V	V	V	
37	139	155	173	4430	38,23	80%	78%	75%	V	V	V	V
43	117	155	171	4120	32,48	80%	79%	75%	V	V	V	V
48	104	155	171	3920	29,00	80%	79%	76%	V	V	V	V
57	87	155	171	3650	24,77	80%	80%	77%	V	V	V	V
60	79	152	171	3570	23,20	79%	80%	77%	V	V	V	V

FS(A) 58

Maximum Torque = 295 Nm @ N1 = 1400 r/min

n2 [Min-1]	M2max [Nm] 2 pole	M2max [Nm] 4 pole	M2max [Nm] 6 pole	Fr2 [N]	i	η% 2 pole	η% 4 pole	η% 6 pole	AM B5T1 IEC63/IEC71	AM B5T1 IEC80	AM B5T1 IEC90	AM B5T1 IEC100
7,0	270	295	300	7130	201,00	62%	58%	55%	V			
7,6	270	295	300	7130	184,80	63%	58%	55%	V			
8,9	270	295	295	7130	158,12	64%	60%	56%	V	V		
10	270	295	295	7130	137,05	65%	61%	57%	V	V	V	
11	270	295	295	7130	128,10	65%	61%	58%	V	V	V	
13	255	295	295	7130	110,73	66%	62%	59%	V	V	V	V
15	225	295	295	7130	94,08	67%	63%	60%	V	V	V	V
17	200	295	295	7130	84,00	67%	64%	61%	V	V	V	V
20	174	290	295	7170	71,75	67%	65%	62%	V	V	V	V
20	220	245	270	7520	69,39	80%	76%	74%	V			
21	164	285	295	7220	67,20	67%	65%	63%	V	V	V	V
22	220	245	270	7520	63,80	80%	77%	75%	V			
25	138	264	300	7370	56,61	67%	67%	64%			V	V
26	220	245	270	7520	54,59	81%	78%	75%	V	V		
30	220	245	270	7520	47,32	81%	79%	76%	V	V	V	
32	220	245	270	7520	44,22	81%	79%	77%	V	V	V	
37	205	245	270	7320	38,23	82%	80%	77%	V	V	V	V
43	180	245	270	6840	32,48	82%	80%	78%	V	V	V	V
48	162	245	270	6520	29,00	82%	81%	79%	V	V	V	V
57	139	245	270	6100	24,77	82%	81%	80%	V	V	V	V
60	131	245	270	5930	23,20	82%	82%	80%	V	V	V	V

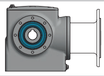
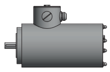
FS(A) 68

Maximum Torque = 520 Nm @ N1 = 1400 r/min

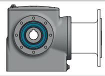
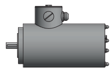
n2 [Min-1]	M2max [Nm] 2 pole	M2max [Nm] 4 pole	M2max [Nm] 6 pole	Fr2 [N]	i	η% 2 pole	η% 4 pole	η% 6 pole	AM B5T1 IEC63/IEC71	AM B5T1 IEC80	AM B5T1 IEC90	AM B5T1 IEC100	AM B5T1 IEC112	AM B5T1 IEC132
6,4	465	520	560	8680	217,41	65%	61%	58%	V	V				
7,4	465	520	560	8680	190,11	66%	62%	59%	V	V	V			
7,8	465	520	555	8680	180,60	66%	62%	59%	V	V	V			
8,8	465	520	555	8680	158,45	67%	63%	60%	V	V	V	V		
10	465	520	550	8680	134,40	68%	64%	61%	V	V	V	V	V	
12	465	520	550	8680	121,33	68%	65%	62%	V	V	V	V	V	
13	465	520	550	8680	106,75	69%	66%	63%	V	V	V	V	V	V
14	465	520	550	8680	100,80	69%	66%	63%	V	V	V	V	V	V
16	400	520	550	8680	85,83	70%	67%	64%	V	V	V	V	V	V
18	365	520	550	8680	78,00	70%	68%	65%			V	V	V	V
19	435	480	525	9020	75,06	81%	79%	76%	V	V				
21	315	520	550	8680	67,57	69%	69%	66%				V	V	V
21	435	480	525	9020	65,63	82%	79%	77%	V	V	V			
22	435	480	525	9020	62,35	82%	79%	77%	V	V	V			
24	270	500	550	8850	58,80	69%	69%	67%					V	V
26	435	480	525	8670	54,70	83%	80%	78%	V	V	V	V		
30	435	480	525	8060	46,40	83%	81%	79%	V	V	V	V	V	
33	430	480	525	7690	41,89	83%	81%	79%	V	V	V	V	V	
38	380	480	525	7250	36,85	84%	82%	80%	V	V	V	V	V	V
40	365	480	525	7060	34,80	84%	82%	80%	V	V	V	V	V	V
47	310	480	525	6540	29,63	84%	83%	81%	V	V	V	V	V	V
52	280	480	525	6240	26,93	84%	83%	81%		V	V	V	V	V

Gearbox Selection Tables

0,12 - 0,18 kW

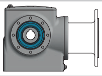
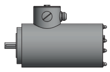
P1 [kW]	n2 [Min-1]	M2 [Nm]	i	Fr2 [N]	fs (gear-box)		
0,12	8,8	74	157,43	3000	1,25	FS(A)38 AM63 FS(A)38 B5T1	631-4 B5 631-4 B5T1
	9,6	68	144,4	3000	1,35		
	11	60	122,94	3000	1,55		
	13	52	106	3000	1,7		
	14	49	98,8	3000	1,75		
	16	44	86,36	3000	1,95		
	17	41	80,96	3000	2,1		
	19	37	71,44	3000	2,3		
	22	33	63,33	3000	2,5		
	25	35	55,93	3000	2,3		
	27	33	51,3	3000	2,5		
	32	28	43,68	3000	2,9		
	37	25	37,66	3000	3,2		
	39	23	35,1	3000	3,4		
	45	20	30,68	3000	3,7		
	48	19	28,76	3000	3,9		
	54	17	25,38	3000	4,4		
	61	15	22,5	3000	4,8		
	6,9	95	201	5680	1,8	FS(A)48 AM63 FS(A)48 B5T1	631-4 B5 631-4 B5T1
	7,5	89	184,8	5700	1,9		
	8,7	77	158,12	5740	2,2		
	10	68	137,05	5780	2,5		
	11	64	128,1	5790	2,6		
	12	57	110,73	5810	3		
0,18	11	93	122,94	3000	1	FS(A)38 AM63 FS(A)38 B5T1	632-4 B5 632-4 B5T1
	12	82	106	3000	1,1		
	13	77	98,8	3000	1,15		
	15	68	86,36	3000	1,25		
	16	64	80,96	3000	1,3		
	18	58	71,44	3000	1,45		
	21	52	63,33	3000	1,6		
	24	55	55,93	3000	1,45		
	26	51	51,3	3000	1,6		
	30	44	43,68	3000	1,85		
	35	38	37,66	3000	2,1		
	38	36	35,1	3000	2,2		
	43	32	30,68	3000	2,4		
	46	30	28,76	3000	2,5		
	52	27	25,38	3000	2,8		
	59	24	22,5	3000	3,1		

0,18 - 0,25 kW

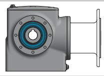
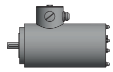
P1 [kW]	n2 [Min-1]	M2 [Nm]	i	Fr2 [N]	fs (gear-box)		
0,18	6,6	149	201	5440	1,15	FS(A)48 AM63 FS(A)48 B5T1	632-4 B5 632-4 B5T1
	7,1	138	184,8	5490	1,25		
	8,3	121	158,12	5570	1,4		
	9,6	107	137,05	5630	1,6		
	10	100	128,1	5660	1,65		
	12	88	110,73	5700	1,9		
	14	77	94,08	5750	2,2		
	16	69	84	5770	2,4		
	18	60	71,75	5800	2,8		
	19	69	69,39	5750	2,2		
	5,5	173	158,12	5320	1	FS(A)48 AM71 FS(A)48 B5T1	711-6 B5 711-6 B5T1
	6,4	153	137,05	5420	1,1		
	6,8	144	128,1	5470	1,2		
	6,6	154	201	8010	1,9	FS(A)58 AM63 FS(A)58 B5T1	632-4 B5 632-4 B5T1
	7,1	143	184,8	8050	2,1		
	8,3	125	158,12	8120	2,4		
	9,6	110	137,05	8160	2,7		
	4,3	220	201	7670	1,35	FS(A)58 AM71 FS(A)58 B5T1	711-6 B5 711-6 B5T1
	4,7	205	184,8	7760	1,45		
	5,5	180	158,12	7900	1,65		
	6,4	159	137,05	7990	1,85		
	4	255	217,41	10300	2,2	FS(A)68 AM71 FS(A)68 B5T2	711-6 B5 711-6 B5T2
	4,6	225	190,11	10400	2,5		
	4,8	215	180,6	10400	2,6		
0,25	18	81	71,44	3000	1,05	FS(A)38 AM71 FS(A)38 B5T1	711-4 B5 711-4 B5T1
	21	73	63,33	3000	1,1		
	23	78	55,93	3000	1,05		
	25	72	51,3	3000	1,15		
	30	62	43,68	3000	1,3		
	35	54	37,66	3000	1,45		
	37	51	35,1	3000	1,55		
	42	45	30,68	3000	1,7		
	45	42	28,76	3000	1,8		
	51	37	25,38	3000	2		
	58	33	22,5	3000	2,2		
	8,2	170	158,12	5340	1	FS(A)48 AM71 FS(A)48 B5T1	711-4 B14a 711-4 B5T1
	9,5	150	137,05	5440	1,1		
	10	141	128,1	5480	1,2		
	12	124	110,73	5560	1,35		
	14	108	94,08	5630	1,55		
	15	98	84	5670	1,7		
	18	85	71,75	5720	1,95		
	19	97	69,39	5640	1,6		
	19	80	67,2	5740	2,1		
	20	90	63,8	5670	1,7		
	24	78	54,59	5720	2		
	27	68	47,32	5760	2,3		

P_{1n} = Rated Motor Power [kW]
n_2 = Output Speed [Min^{-1}]
M_{2n} = Rated Output torque [Nm]
M_{2max} = Maximum permissible output torque [Nm]
F_{r2} = Permitted Overhung Load Output Side [N]
i = Gear unit Ratio
η% = Transmission Efficiency %
fs = Service Factor

0,25 -0,37 kW

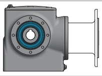
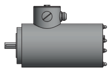
P1 [kW]	n2 [Min-1]	M2 [Nm]	i	Fr2 [N]	fs (gear-box)		
0,25	6,5	215	201	7700	1,35	FS(A)58 AM71 FS(A)58 B5T1	711-4 B5 711-4 B5T1
	7	200	184,8	7790	1,45		
	8,2	176	158,12	7920	1,7		
	9,5	155	137,05	8010	1,9		
	10	146	128,1	8040	2		
	12	129	110,73	8110	2,3		
	14	111	94,08	8160	2,7		
	15	101	84	8190	2,9		
	4,4	305	201	7050	1	FS(A)58 AM71 FS(A)58 B5T1	712-6 B5 712-6 B5T1
	4,8	285	184,8	7230	1,05		
	5,6	245	158,12	7510	1,2		
	6,4	220	137,05	7690	1,35		
	6,9	205	128,1	7760	1,45		
	6	245	217,41	10300	2,1	FS(A)68 AM71 FS(A)68 B5T2	711-4 B5 711-4 B5T2
	6,8	220	190,11	10400	2,4		
	7,2	210	180,6	10500	2,5		
	8,2	187	158,45	10500	2,8		
	9,7	161	134,4	10600	3,2		
	11	147	121,33	10600	3,5		
	12	131	106,75	10700	4		
	4	350	217,41	9890	1,6	FS(A)68 AM71 FS(A)68 B5T2	712-6 B5 712-6 B5T2
	4,6	310	190,11	10100	1,8		
	4,9	295	180,6	10100	1,9		
	5,5	265	158,45	10300	2,1		
	3,1	435	217,41	9350	1,3	FS(A)68 AM80 FS(A)68 B5T2	802-8 B14a 802-8 B5T2
	3,6	390	190,11	9670	1,45		
	3,8	370	180,6	9770	1,5		
	4,3	330	158,45	9980	1,7		
0,37	37	76	37,66	3000	1,05	FS(A)38 AM71 FS(A)38 B5T1	712-4 B5 712-4 B5T1
	39	71	35,1	3000	1,1		
	45	63	30,68	3000	1,2		
	48	59	28,76	3000	1,3		
	54	52	25,38	2940	1,4		
	61	47	22,5	2870	1,55		
	15	151	94,08	5430	1,1	FS(A)48 AM71 FS(A)48 B5T1	712-4 B5 712-4 B5T1
	16	137	84	5500	1,2		
	19	119	71,75	5580	1,4		
	20	136	69,39	5460	1,15		
	21	112	67,2	5610	1,5		
	22	126	63,8	5510	1,25		
	25	109	54,59	5590	1,4		
	29	96	47,32	5410	1,6		
	31	90	44,22	5330	1,75		
	36	78	38,23	5140	2		
	42	67	32,48	4930	2,3		
	48	60	29	4790	2,6		
	56	52	24,77	4590	3		
	59	49	23,2	4510	3,1		

0,37 -0,55 kW

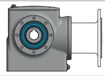
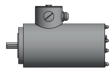
P1 [kW]	n2 [Min-1]	M2 [Nm]	i	Fr2 [N]	fs (gear-box)		
0,37	7,5	285	184,8	7230	1,05	FS(A)58 AM71 FS(A)58 B5T1	712-4 B5 712-4 B5T1
	8,7	245	158,12	7510	1,2		
	10	220	137,05	7690	1,35		
	11	205	128,1	7770	1,45		
	12	180	110,73	7900	1,65		
	15	156	94,08	8000	1,9		
	16	141	84	8060	2,1		
	19	122	71,75	8130	2,4		
	20	139	69,39	8070	1,75		
	21	115	67,2	8150	2,5		
	22	128	63,8	8110	1,9		
	7	300	128,1	7100	1	FS(A)58 AM80 FS(A)58 B5T1	801-6 B14a 801-6 B5T1
	8,1	265	110,73	7390	1,1		
	9,6	230	94,08	7630	1,3		
	11	205	84	7760	1,45		
	6,4	345	217,41	9900	1,5	FS(A)68 AM71 FS(A)68 B5T2	712-4 B5 712-4 B5T2
	7,3	310	190,11	10100	1,7		
	7,6	295	180,6	10200	1,75		
	8,7	260	158,45	10300	2		
	10	225	134,4	10400	2,3		
	11	205	121,33	10500	2,5		
	4,1	505	217,41	8810	1,1	FS(A)68 AM80 FS(A)68 B5T2	801-6 B14a 801-6 B5T2
	4,7	450	190,11	9260	1,25		
	5	430	180,6	9400	1,3		
	5,7	380	158,45	9700	1,45		
0,55	60	70	22,5	2600	1,05	FS(A)38 AM FS(A)38 B5T1	801-4B14a 801-4 B5T1
	20	169	67,2	5350	1	FS(A)48 AM80 FS(A)48 B5T1	801-4 B14a 801-4 B5T1
	29	144	47,32	5010	1,1		
	31	135	44,22	4950	1,15		
	36	118	38,23	4810	1,3		
	42	101	32,48	4650	1,55		
	47	91	29	4540	1,7		
	55	78	24,77	4380	2		
	59	74	23,2	4310	2,1		
	12	270	110,73	7320	1,1	FS(A)58 AM80 FS(A)58 B5T1	801-4 B14a 801-4 B5T1
	14	235	94,08	7590	1,25		
	16	210	84	7730	1,4		
	19	184	71,75	7880	1,55		
	20	174	67,2	7930	1,65		
	25	167	54,59	7960	1,45		
	29	146	47,32	8040	1,7		
	31	137	44,22	8080	1,8		
	36	120	38,23	8130	2,1		
	42	103	32,48	7970	2,4		
	47	92	29	7730	2,7		
	55	79	24,77	7390	3,1		
	59	75	23,2	7250	3,3		

P_{1n} = Rated Motor Power [kW]
n_2 = Output Speed [Min^{-1}]
M_{2n} = Rated Output torque [Nm]
M_{2max} = Maximum permissible output torque [Nm]
F_{r2} = Permitted Overhung Load Output Side [N]
i = Gear unit Ratio
η% = Transmission Efficiency %
fs = Service Factor

0,55 - 0,75 kW

P1 [kW]	n2 [Min-1]	M2 [Nm]	i	Fr2 [N]	fs (gear-box)		
0,55	13	265	71,75	7360	1,1	FS(A)58 AM80 FS(A)58 B5T1	802-6 B14a 802-6 B5T1
	13	250	67,2	7470	1,15		
	16	245	54,59	7520	1,1		
	19	215	47,32	7710	1,25		
	20	200	44,22	7790	1,35		
	24	176	38,23	7920	1,55		
	6,3	520	217,41	8660	1	FS(A)68 AM80 FS(A)68 B5T2	801-4 B14a 801-4 B5T2
	7,2	465	190,11	9150	1,1		
	7,5	445	180,6	9300	1,15		
	8,6	395	158,45	9620	1,3		
	10	340	134,4	9930	1,55		
	11	310	121,33	10100	1,65		
	13	275	106,75	10200	1,85		
	13	265	100,8	10300	1,95		
	16	230	85,83	10400	2,3		
	18	230	75,06	10400	2,1		
	21	205	65,63	10500	2,4		
0,75	36	159	38,23	4420	1	FS(A)48 AM80 FS(A)48 B5T1	802-4 B14a 802-4 B5T1
	42	136	32,48	4310	1,15		
	48	122	29	4230	1,25		
	56	106	24,77	4110	1,45		
	59	99	23,2	4060	1,55		
	16	285	84	7210	1,05	FS(A)58 AM80 FS(A)58 B5T1	802-4 B14a 802-4 B5T1
	19	250	71,75	7500	1,15		
	21	235	67,2	7590	1,2		
	25	225	54,59	7650	1,1		
	29	197	47,32	7810	1,25		
	31	185	44,22	7870	1,35		
	36	161	38,23	7980	1,5		
	42	138	32,48	7670	1,8		
	48	124	29	7450	2		
	56	107	24,77	7150	2,3		
	59	100	23,2	7030	2,5		
	16	295	56,61	7140	1	FS(A)58 AM90 FS(A)58 B5T1	90S-6 B14a 90S-6 B5T1
	20	275	44,22	7300	1		
	8,7	530	158,45	8570	1	FS(A)68 AM80 FS(A)68 B5T2	802-4 B14a 802-4 B5T2
	10	460	134,4	9180	1,15		
	11	420	121,33	9470	1,25		
	13	375	106,75	9750	1,4		
	14	355	100,8	9860	1,45		
	16	305	85,83	10100	1,7		
	18	310	75,06	10100	1,55		
	21	275	65,63	10200	1,75		
	22	260	62,35	10300	1,85		
	25	230	54,7	10300	2,1		
	30	198	46,4	9840	2,4		

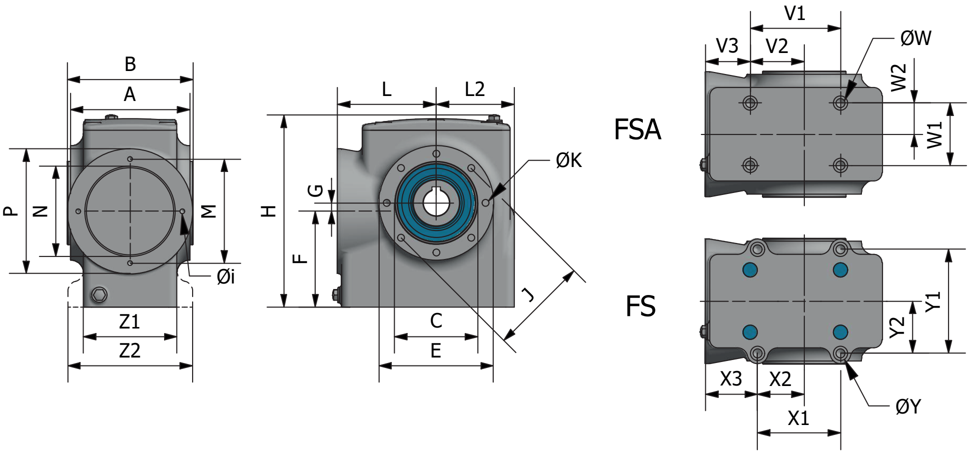
1,1 - 2,2 - 3 kW

P1 [kW]	n2 [Min-1]	M2 [Nm]	i	Fr2 [N]	fs (gear-box)		
1,1	57	153	24,77	3670	1	FS(A)48 AM90 FS(A)48 B5T1	90S-4 B14a 90S-4 B5T1
	60	143	23,2	3640	1,05		
	37	235	38,23	7410	1,05	FS(A)58 AM90 FS(A)58 B5T1	90S-4 B14a 90S-4 B5T1
	43	200	32,48	7170	1,25		
	48	179	29	7000	1,35		
	57	154	24,77	6760	1,6		
	60	145	23,2	6660	1,7		
	14	515	100,8	8740	1	FS(A)68 AM90 FS(A)68 B5T2	90S-4 B14a 90S-4 B5T2
	16	445	85,83	9300	1,15		
	18	405	78	9550	1,3		
	21	400	65,63	9610	1,2		
	22	380	62,35	9720	1,25		
	26	335	54,7	9560	1,45		
	30	285	46,4	9240	1,65		
	33	260	41,89	9040	1,85		
	38	230	36,85	8780	2,1		
	40	220	34,8	8660	2,2		
	47	187	29,63	8330	2,6		
	49	245	29	6520	1	FS(A)58 AM90 FS(A)58 B5T1	90L-4 B14a 90L-4 B5T1
	57	210	24,77	6340	1,15		
	61	196	23,2	6270	1,25		
	26	455	54,7	8810	1,05	FS(A)68 AM90 FS(A)68 B5T2	90L-4 B14a 90L-4 B5T2
	30	390	46,4	8590	1,25		
	34	355	41,89	8450	1,35		
	38	310	36,85	8250	1,55		
	41	295	34,8	8160	1,6		
	48	255	29,63	7900	1,9		
	52	230	26,93	7740	2,1		
2,2	38	460	36,85	7360	1,05	FS(A)68 AM100 FS(A)68 B5T2	100L1-4 B14a 100L1-4 B5T2
	41	435	34,8	7320	1,1		
	48	370	29,63	7180	1,3		
	52	340	26,93	7080	1,4		
3	52	465	26,93	6330	1,05	FS(A)68 AM FS(A)68 B5T2	100L2-4 B14a 100L2-4B5T2

P_{1n} = Rated Motor Power [kW]
n_2 = Output Speed [Min^{-1}]
M_{2n} = Rated Output torque [Nm]
M_{2max} = Maximum permissible output torque [Nm]
F_{r2} = Permitted Overhung Load Output Side [N]
i = Gear unit Ratio
η% = Transmission Efficiency %
fs = Service Factor

General Dimensions

General dimensions

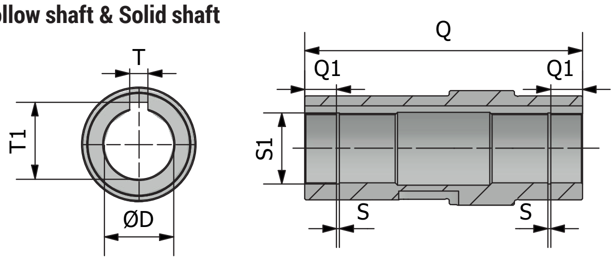


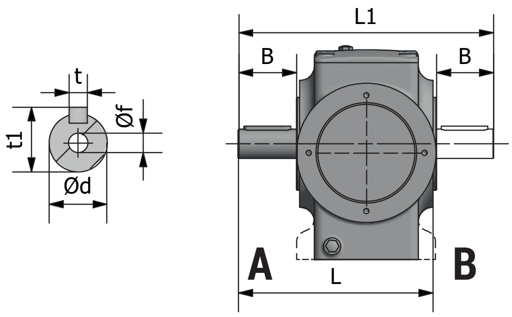
Gearbox	X1	X2	X3	ØY	Y1	Y2
FS 38	52	28	63	M8	90	45
FS 48	50	45	80	M10	100	50
FS 58	52	55	100	M10	110	55
FS 68	66	70	130	M12	130	65

Gearbox	V1	V2	V3	ØW	W1	W2
FSA 38	50	30	60	M8	72	36
FSA 48	43	52	87	M10	60	30
FSA 58	48,5	58,5	117	M10	60	30
FSA 68	55,5	80,5	152	M12	88	44

Geabox	A	B	C	E	F	G	H	Øi	J	ØK	L	L2	M	N	P	Z1	Z2
FS(A) 38 B5T1	114	120	70	100	80	0	146	M6	85	4X M8	80	63	100	80	120	85	110
FS(A) 48 B5T1	115	121	85	110	92,11	7,89	185	M6	95	8X M8	95	75	100	80	120	90	120
FS(A) 58 B5T1	144	150	95	140	92	20	201	M6	115	8X M8	107	80	100	80	120	100	130
FS(A) 68 B5T2	160	166	110	160	118	22	242	M8	130	8X M10	136	98	130	110	160	120	160

Hollow shaft & Solid shaft





Hollow shaft

Gearbox	ØD[H7/h6]	T	T1	Q	Q1	S	S1
FS(A) 38	20	6	22,8	120	13,9	1,1	21
FS(A) 48	25	8	28,3	121	13,7	1,3	26,2
	30		33,3				31,4
FS(A) 58	30	8	33,3	150	16,7	1,3	31,4
	35	10	38,3			1,6	37
FS(A) 68	40	12	43,3	166	20	1,85	42,5
	45	14	48,8				47,5

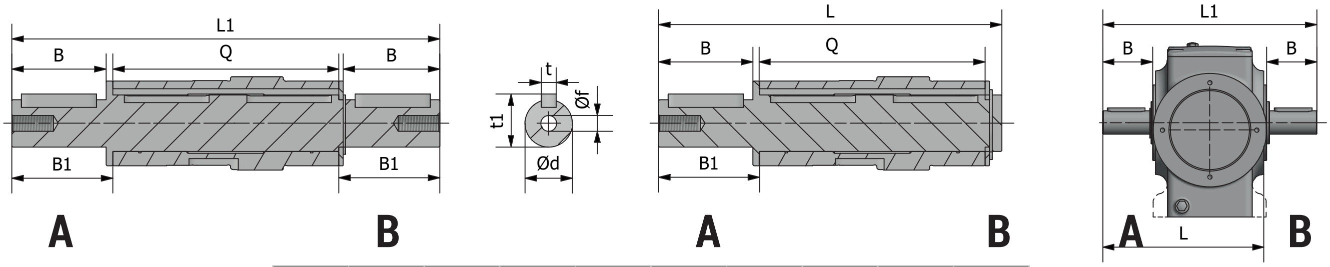
Different solid shaft dimensions possible on request

Solid shaft

Gearbox	Ød[g6]	Øf	t	t1	L	L1	B
FS(A) 38	20	M6	6	22,5	160	200	40
FS(A) 48	25	M10	8	28	171	221	50
FS(A) 58	30	M10	8	33	210	270	60
FS(A) 68	35	M12	10	38	336	306	70

Different solid shaft dimensions possible on request

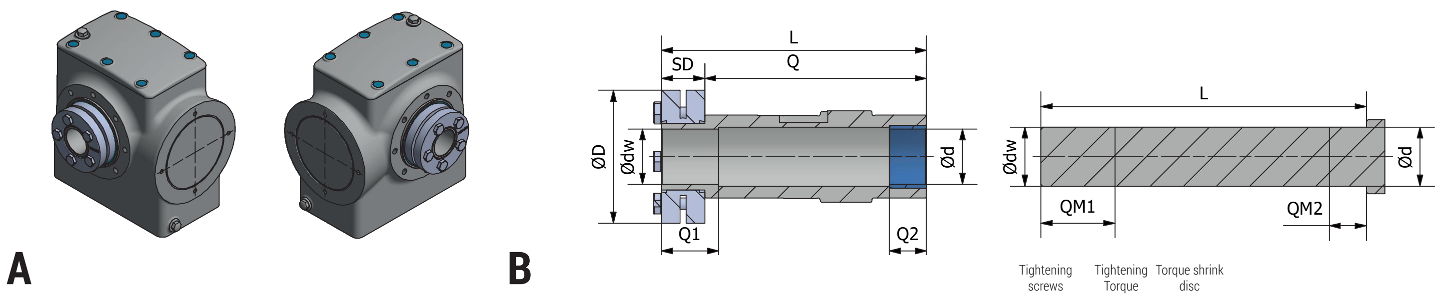
Solid input shaft



Gearbox	Ød[h6]	Øf	t	t1	L	L1	Q	B	B1
FS(A) 38	20	M6	6	22,5	170	207	120	40	43
FS(A) 48	25	M10	8	28	182	228	121	50	53
FS(A) 58	30	M10	8	33	220	277	150	60	63
FS(A) 68	35	M12	10	38	250	315	166	70	73

Different solid input shaft dimensions possible on request

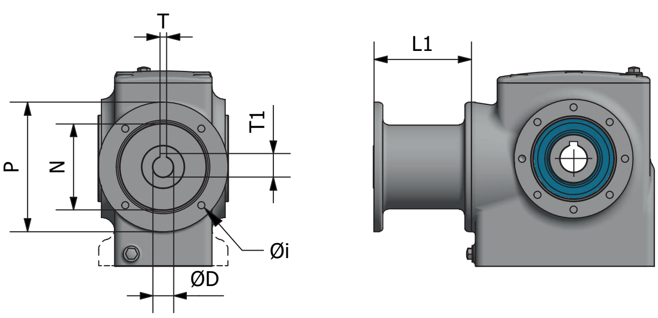
Shrink disk



Gearbox	Ød[H7/h6]	Ødw[H6/*]	ØD	L	SD	Q	Q1	Q2	G1	G2	Tightening screws N° x Type	Tightening Torque Ms [Nm]	Torque shrink disc Mt [Nm]
FS(A) 38	20	20 [*j6]	50	115,5	19,5	92	24	20	29	25	6 x M5	4	210
FS(A) 48	30	30 [*h6]	72	143,5	23,5	120	31	20	36	25	5 x M6	12	570
FS(A) 58	35	35 [*h6]	80	175,5	25,5	150	32	20	37	25	7 x M6	12	780
FS(A) 68	40	40 [*h6]	90	206,5	27,5	179	38	20	43	25	8 x M6	12	1160

Different shrinkdisk dimensions possible on request
From 18 mm to 30 mm H6/j6
From 30 mm to 50 mm H6/h6

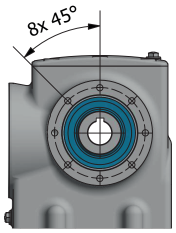
AM flange



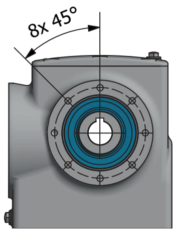
Gearbox	AM flange	ØD [H7/h6]	Øi	L1	M	N	P	T	T1
FS(A)38 B5T1	AM63	11	9	90	115	95	140	4	12,8
	AM71	14			130	110	160	5	16,3
	AM80	19	7		100	80	120	6	21,8
FS(A)48 B5T1	AM63	11	9	90	115	95	140	4	12,8
	AM71	14			130	110	160	5	16,3
	AM80	19	7		100	80	120	6	21,8
	AM90	24	9		115	95	140	8	27,3
FS(A)58 B5T1	AM63	11	9	90	115	95	140	4	12,8
	AM71	14			130	110	160	5	16,3
	AM80	19	7		100	80	120	6	21,8
	AM90	24	9		115	95	140	8	27,3
FS(A)58 B5T2	AM71	14	9	90	130	110	160	5	16,3
	AM80	19	7		100	80	120	6	21,8
	AM90	24	9		115	95	140	8	27,3
	AM100	28			130	110	160		31,3

Hole overview

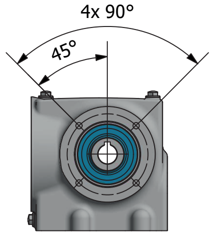
FS 48, 58, 68



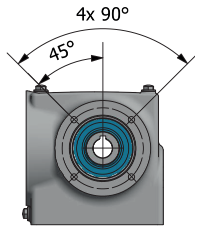
FSA 48, 58, 68



FS 38



FSA 38

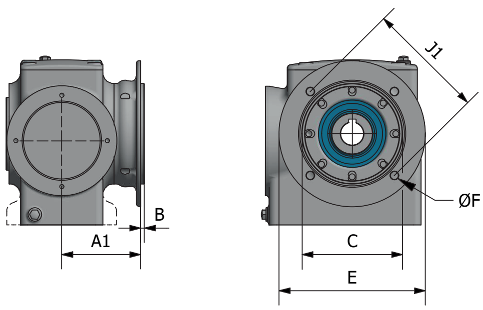


Open & Closed cover

Gearbox	Closed cover	A1
FS(A) 38	SS 085 CC	77,5
FS(A) 48	SS 095 CC	83,5
FS(A) 58	SS 115 CC	100
FS(A) 68	SS 130 CC	108

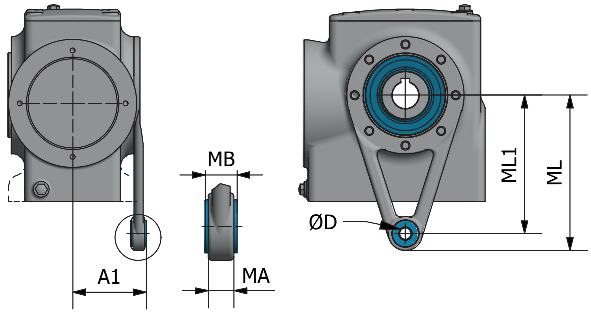
Gearbox	Open cover	A2	ØD
FS(A) 38	SS 095 CO30	74,1	20
FS(A) 48	SS 115 CO35	79,5	25
FS(A) 58	SS 130 CO40	100	30
FS(A) 68	SS140 CO50	107,5	35

Output flanges



Gearbox	Flangetype	A1	B	C	E	ØF	J1
FS(A) 38	SS 085 FL125	103,5	2	70	125	11	85
FS(A) 48	SS 095 FL160	86,5	4	110	160	9	130
FS(A) 58	SS 115 FL200	100	3,5	130	200	11	165
FS(A) 68	SS 130 FL250	106,5	4	180	250	13,5	215

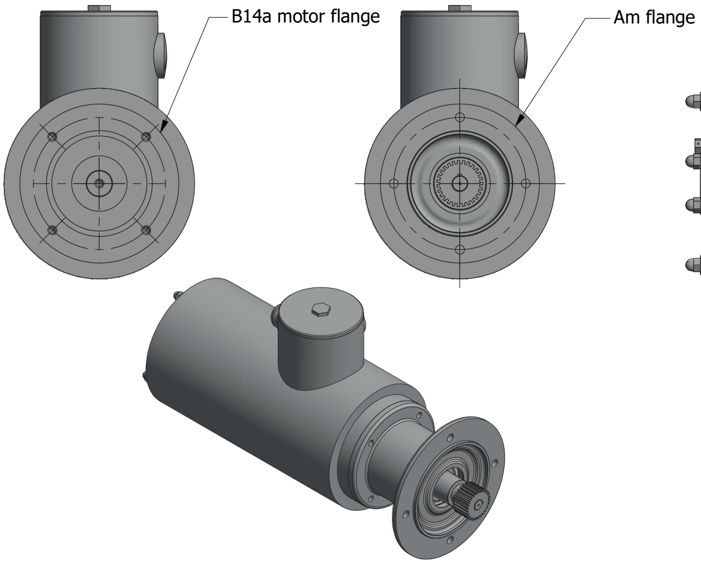
Torque arm

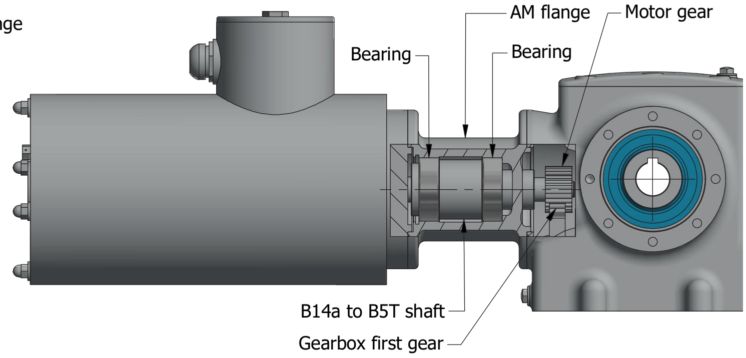


Gearbox	Torque arm	A1	MA	MB	ØD	ML	ML1
FS(A) 38	SS 085 MS L100	69	12	15	10,5	116	100
	SS 085 MS L110S	69	12	15	10,5	126	110
FS(A) 48	SS 095 MS L130S	69,4	12	15	10,5	146	130
	SS 095 MS L150	69,4	12	15	10,5	166	150
FS(A) 58	SS 115 MS L160S	89,4	23	26	20,5	185	160
	SS 115 MS L200	89,4	23	26	20,5	225	200
FS(A) 68	SS 130 MS L200	98,6	23	26	20,5	225	200

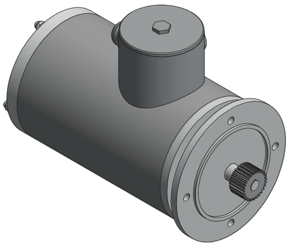
Difference between B5T and B14a

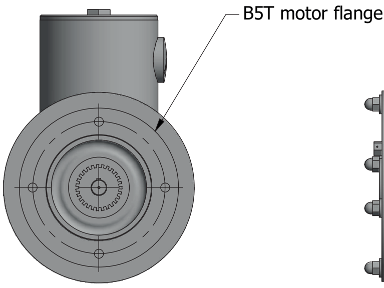
B14a motor with AM - flange

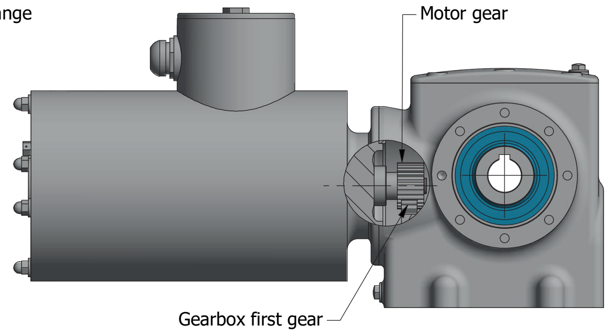




B5 motor

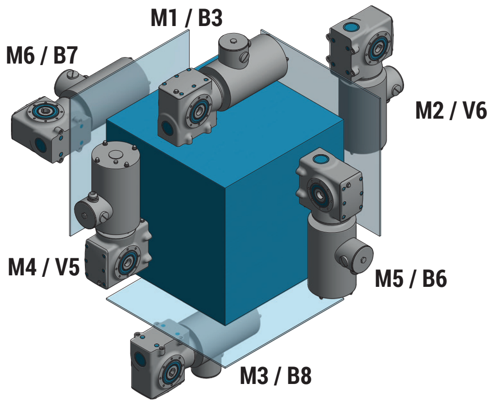




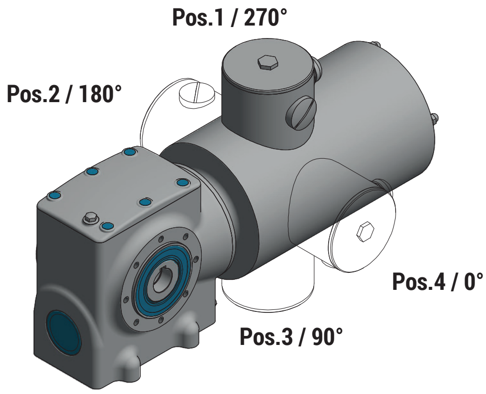


Extra information

Mounting Positions



Terminal Box Positions



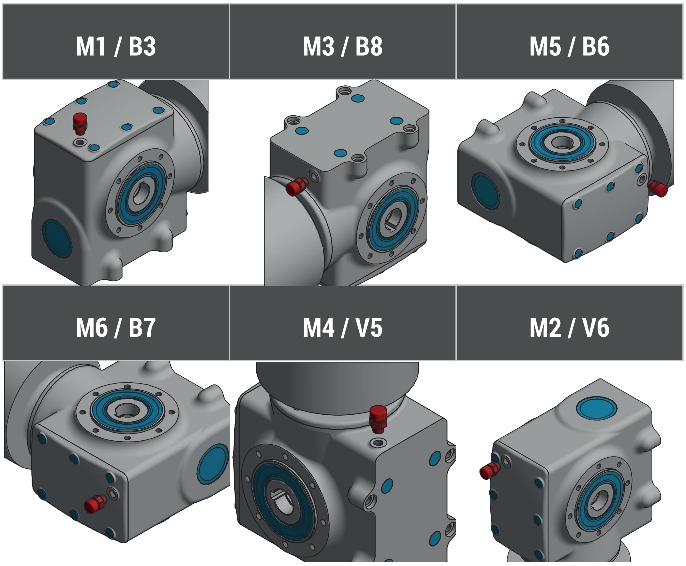
Lubrication Quantity

Oil Quantity in ML	Mounting Position					
Gearbox	M1 (B3)	M3 (B8)	M6 (B7)	M5 (B6)	M4 (V5)	M2 (V6)
FS(A) 38 B5T1 & AM..	400	800	500	500	800	500
FS(A) 48 B5T1 & AM..	750	1200	750	750	1300	900
FS(A) 58 B5T1 & AM..	1300	1800	1300	1300	2050	1400
FS(A) 68 B5T1 & AM..	2500	3200	2200	2200	3500	2500

Lubrication Type

Lubrication brand	Lubrication type	
Matrix	Foodmax 460	Standard
Castrol	Optileb GT 460	Alternative
Bechem	Berusynth 460H1	Alternative
Shell	Casida Fluid GL460	Alternative
Mobil	SHC Cibus 460	Alternative

Debreather Positions



Weight

B5T Weight

Gearbox	Weight
FS(A) 38 B5T1	7.5 kg
FS(A) 48 B5T1	10.5 kg
FS(A) 58 B5T1	14.5 kg
FS(A) 68 B5T2	22.5 kg

AM Weight

Gearbox	Weight
FS(A) 38 AM..	11 kg
FS(A) 48 AM..	14 kg
FS(A) 58 AM..	18 kg
FS(A) 68 AM..	27 kg

Given values are an average and may vary depending on oil quantity.

Dertec
Einsteinpark 1
2171 TX Sassenheim
The Netherlands

T +31 71 409 2 409
E info@dertec.com

FS(A) Documentation - 1.0
3/2/2022

www.dertec.com