dertec®

Designed to Perform

Stainless Steel
Helical Gearboxes.

FR

FR series helical gearboxes are being developed to achieve high torque, low energy use and less surface heat.
The high efficiency of the drive reduces the energy consumption.
The case hardened gears ensure a long lifetime and smooth running.
The smart use of 2 stage or 3 stage gearing in the same housing offers a complete spectrum of ratio’s to be selected.
The footprint and shaft sizes are similar to common used standards in the market.

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 AISI 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 AISI 304 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.

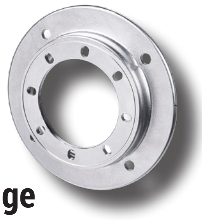
Laser engraved tag plate

To avoid dirt traps under the commonly used motor identification tag plate,
all our motors and gearboxes are being equipped with a laser engraved tag plate.
Besides for the food safety this also prevents against possible lost of information because of taking away the tag plate or loosing the tag plate 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 3,41 : 1 to 199,81 : 1
- IEC motor adaption versions (AM)
- Integrated motor versions (B5T)
- standard solid shaft 25, 30 & 35mm
- Optional output flanges available
- Stainless steel AISI 316
- Duplex stainless steel AISI 2205 output shaft
- Interchangeable with euro sizes
- Designed and produced in the Netherlands



Flange

Product Characteristics

Output flange	
FR38	SS 085 FL 120
	SS 085 FL 140
	SS 085 FL 160
	SS 085 FL 200
FR48	SS 095 FL 140
	SS 095 FL 160
	SS 095 FL 200
FR68	SS 115 FL 200
	SS 115 FL 250

FR 38	
Ratio's	From 3.41 : 1
	to 134,82 : 1
Standard shaft	25 mm
Torque	Max. 200 Nm
Power	Max. 3,0 kW

FR 48	
Ratio's	From 3,83 : 1
	to 176,88 : 1
Standard shaft	30 mm
Torque	Max. 300 Nm
Power	Max. 4,0 kW

FR 68	
Ratio's	From 4,29 : 1
	to 199,81 : 1
Standard shaft	35 mm
Torque	Max. 600 Nm
Power	Max. 7,5 kW

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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

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.

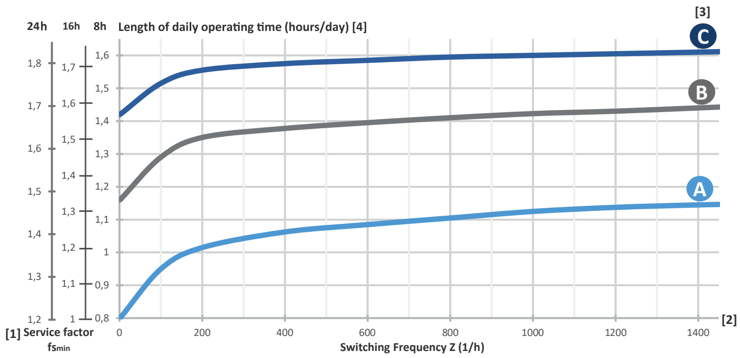
C: Heavy shock load, mass acceleration factor of **$f_a \leq 10$**.Examples of applications: Mixers for heavy materials, shears, presses, centrifuges, rotating supports, winches and lifts for heavy materials, heavy application elevators, grinding lathes, stone mills, bucket elevators, drilling machines,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

Service factor graph

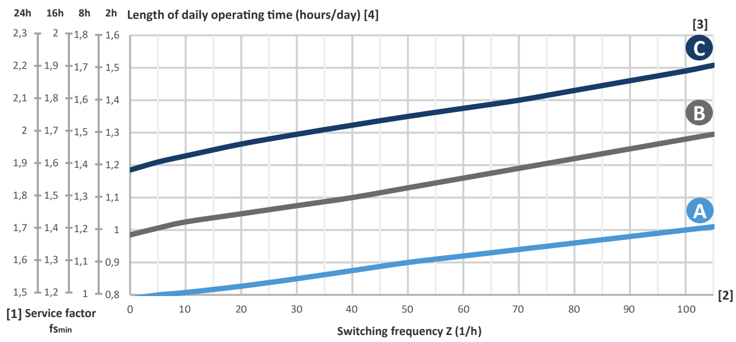
The determined Minimum **[1]** service factor is based on **[2]** switching frequency, **[3]** load classification and **[4]** length of daily operating time.

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:



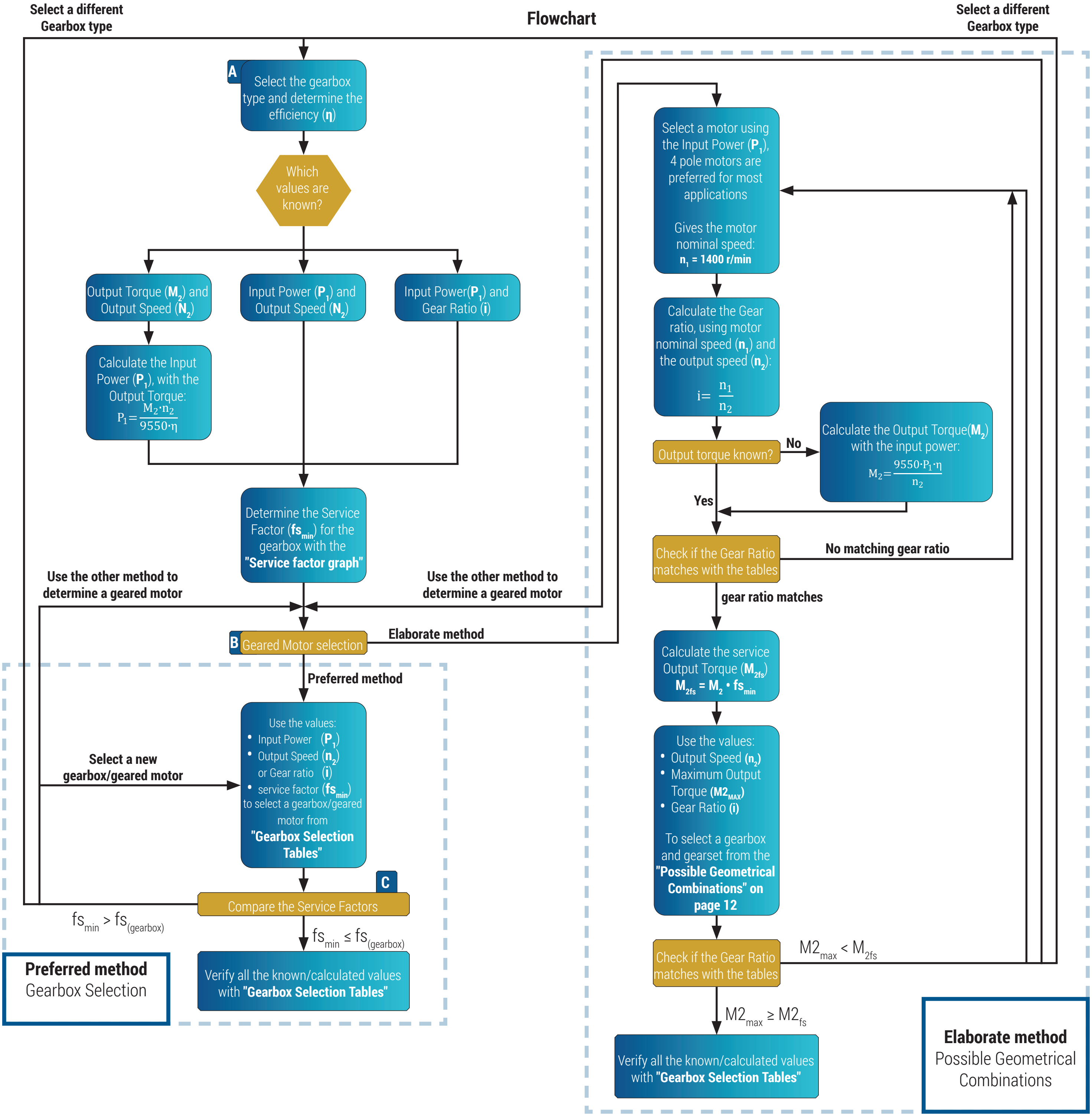
Service factor for low Switching frequency (Z), used mostly for worm- and helical worm gearboxes:



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**



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 factor (**fs_{min}**) can be determined.

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

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"** $\mathbf{fs}_{min} \leq \mathbf{fs}_{gearbox}$.

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

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

Verify the results
If the service factor $\mathbf{fs}_{min}$ 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.

Example 1: Preferred method

Known parameters:

> This example uses a different gearbox type but is generally applicable

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?

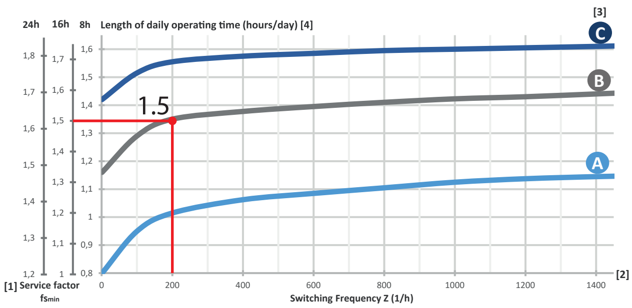
- Output torque- and speed
- ~~Input power- and speed~~
- ~~Input power and gear ratio~~

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.

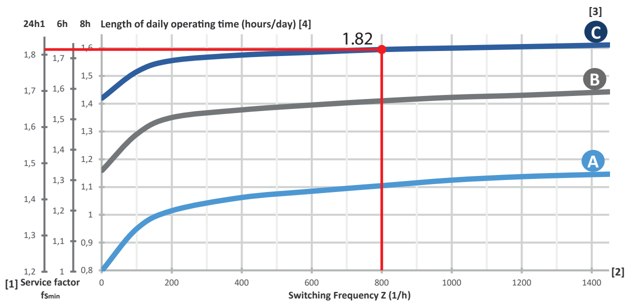
Which values are known?

- ~~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

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

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

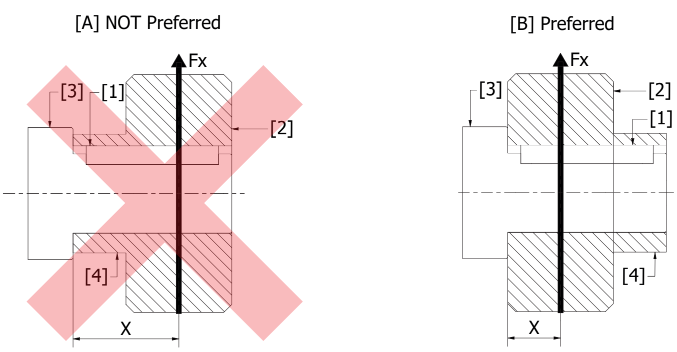
The rated bearing service life L_{10h} (in hours, according to **ISO 281**) is used to calculate the estimated bearing life in hours. For special operating conditions the modified service life should be used.

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

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

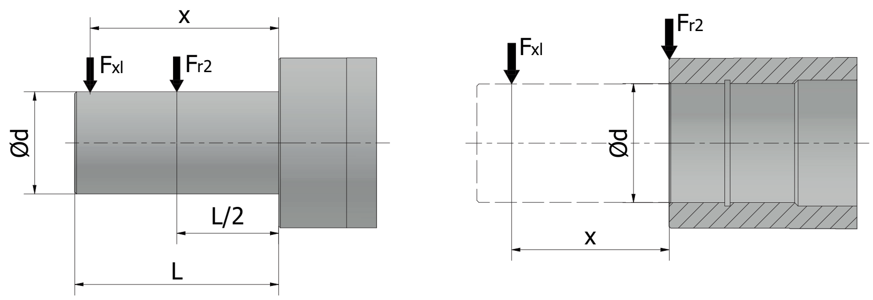
The preferred way of mounting the overhung load for sprockets, gears and other transmissions is with the hub **[4]** at the end of the shaft **[3]** and the sprocket/gear **[2]** against the shoulder, see **[B]** in the figure below. This method ensures a better load distribution on the end of the shaft.



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

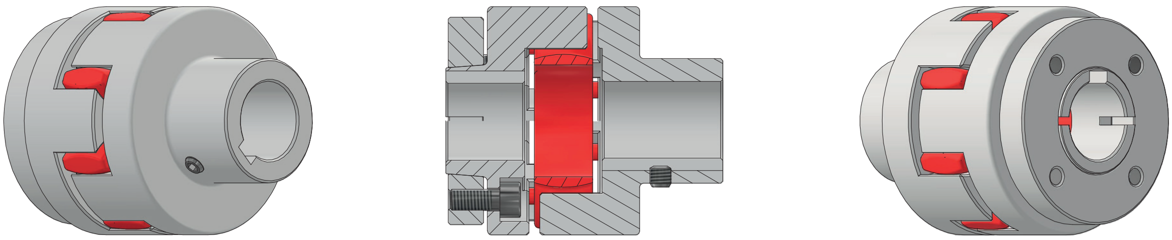
FRC	a [mm]	b [mm]	Ød [mm]	L [mm]
FRC 01	103	83	20	40
FRC 02	116,5	91,5	25	50

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.

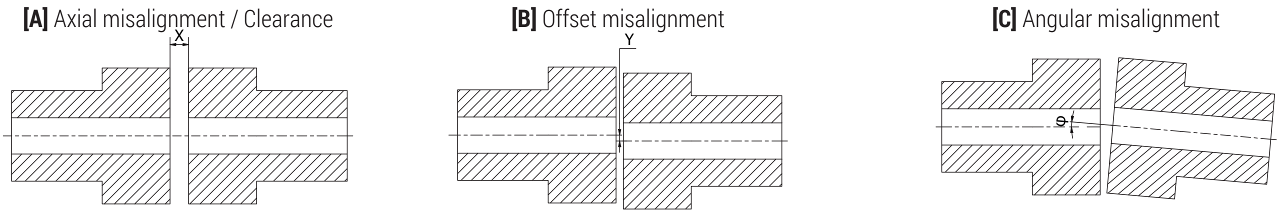
Note: A coupling slightly increases the temperature of the shafts, due to friction and slightly decreases the efficiency of the gearbox.

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] 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. Xmin ≤ X ≤ Xmax , where Xmin > 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.

Possible Geometrical Combinations

Possible Geometrical Combinations

FR 38 (3 Stage)
Maximum Torque = 200 Nm @ N1 = 1400 r/min

n2 [Min-1]	M2max [Nm]	Fr2 [N]	i	η%	AM / B5T1	AM / B5T1	AM / B5T1	AM / B5T1	AM / B5T1
					IEC63	IEC71	IEC80	IEC90	IEC100
10	200	4950	134,82	94%	V	V			
11	200	4950	123,66	94%	V	V			
13	200	4950	105,28	94%	V	V	V		
15	200	4950	90,77	94%	V	V	V	V	
17	200	4950	84,61	94%	V	V	V	V	
19	200	4950	73,96	94%	V	V	V	V	V
20	200	4950	69,33	94%	V	V	V	V	
23	200	4950	61,18	94%	V	V	V	V	V
25	200	4950	55,76	94%	V	V	V		
29	200	4950	48,08	94%	V	V	V	V	
31	200	4950	44,81	94%	V	V	V	V	
36	200	4760	39,17	94%	V	V	V	V	V
38	200	4540	36,72	94%	V	V	V	V	
43	200	4120	32,4	94%	V	V	V	V	V
49	200	3740	28,73	94%	V	V	V	V	V
57	200	3240	24,42	94%	V	V	V	V	V

FR 38 (2 Stage)
Maximum Torque = 200 Nm @ N1 = 1400 r/min

n2 [Min-1]	M2max [Nm]	Fr2 [N]	i	η%	AM / B5T1	AM / B5T1	AM / B5T1	AM / B5T1	AM / B5T1
					IEC63	IEC71	IEC80	IEC90	IEC100
49	200	3690	28,32	96%	V	V			
54	185	3860	26,03	96%	V	V			
63	200	2970	22,27	96%	V	V	V		
73	200	2570	19,31	96%	V	V	V	V	
78	200	2390	18,05	96%	V	V	V	V	
90	200	2010	15,6	96%	V	V	V	V	V
106	190	1880	13,25	96%	V	V	V	V	V
118	183	1810	11,83	96%	V	V	V	V	V
138	170	1820	10,11	96%	V	V	V	V	V
148	167	1760	9,47	96%	V	V	V	V	V
176	156	1720	7,97	96%	V	V	V	V	V
210	144	1000	6,67	96%	V	V	V	V	V
247	142	760	5,67	96%	V	V	V	V	V
277	135	790	5,06	96%	V	V	V	V	V
324	126	820	4,32	96%	V	V	V	V	V
346	122	850	4,05	96%	V	V	V	V	V
411	112	900	3,41	96%	V	V	V	V	V

FR48 (3 Stage)
Maximum Torque = 300 Nm @ N1 = 1400 r/min

n2 [Min-1]	M2max [Nm]	Fr2 [N]	i	η%	IEC63	IEC71	IEC80	IEC90	IEC100	IEC112	IEC132
					AM / B5T2	AM / B5T2	AM / B5T2	AM / B5T2	AM / B5T2	AM / B5T2	AM / B5T2
7,9	300	5420	176,88	94%	V	V					
8,6	300	5420	162,94	94%	V	V					
10	300	5420	139,99	94%	V	V	V				
11	300	5420	121,87	94%	V	V	V	V			
12	300	5420	114,17	94%	V	V	V	V			
14	300	5420	100,86	94%	V	V	V	V			
15	300	5420	93,68	94%	V	V	V	V			
16	300	5420	84,9	94%	V	V	V	V			
18	300	5420	76,23	94%	V	V	V	V			
20	300	5420	68,54	94%	V	V	V	V			
22	300	5420	64,21	94%	V	V	V	V			
25	300	5420	56,73	94%	V	V	V	V	V		
27	300	5350	52,69	94%	V	V	V	V			
29	300	5150	47,75	94%	V	V	V	V	V		
33	300	4930	42,87	94%	V	V	V	V	V		
38	300	4630	36,93	94%	V	V	V	V	V		
40	300	4520	34,73	94%	V	V	V	V	V		
47	300	4240	29,88	94%	V	V	V	V	V		
52	300	4050	26,7	94%			V	V	V		
59	300	3840	23,59	94%			V	V	V		

FR48 (Stage 2)
Maximum Torque = 300 Nm @ N1 = 1400 r/min

n2 [Min-1]	M2max [Nm]	Fr2 [N]	i	η%	IEC63	IEC71	IEC80	IEC90	IEC100	IEC112	IEC132
					AM / B5T2	AM / B5T2	AM / B5T2	AM / B5T2	AM / B5T2	AM / B5T2	AM / B5T2
41	240	4690	33,79	96%	V	V					
45	220	4610	31,12	96%	V	V				V	V
52	300	4050	26,74	96%	V	V	V			V	V
60	300	3820	23,28	96%	V	V	V	V		V	V
64	300	3710	21,81	96%	V	V	V	V		V	V
73	295	3530	19,27	96%	V	V	V	V	V		
78	290	3390	17,89	96%	V	V	V	V			
86	275	3350	16,22	96%	V	V	V	V	V	V	
96	265	3230	14,56	96%	V	V	V	V	V	V	
112	250	3080	12,54	96%	V	V	V	V	V	V	V
119	245	3020	11,79	96%	V	V	V	V	V	V	V
138	230	2890	10,15	96%	V	V	V	V	V	V	V
154	220	2780	9,07	96%			V	V	V	V	V
175	205	2690	8,01	96%			V	V	V	V	V
180	163	2720	7,76	96%	V	V	V	V	V	V	
201	159	2620	6,96	96%	V	V	V	V	V	V	
233	156	2470	6,00	96%	V	V	V	V	V	V	V
248	155	2410	5,64	96%	V	V	V	V	V	V	V
289	150	2280	4,85	96%	V	V	V	V	V	V	V
323	146	2190	4,34	96%	V	V	V	V	V	V	V
366	144	2090	3,83	96%	V	V	V	V	V	V	V

FR 68 (3 Stage)
Maximum Torque = 600 Nm @ N1 = 1400 r/min

n2 [Min-1]	M2max [Nm]	Fr2 [N]	i	η%	AM / B5T2 IEC63	AM / B5T2 IEC71	AM / B5T2 IEC80	AM / B5T2 IEC90	AM / B5T2 IEC100	AM / B5T2 IEC112	AM / B5T2 IEC132
7	600	7560	199,81	94%	V	V					
7,6	600	7560	184,07	94%	V	V					
8,9	600	7560	158,14	94%	V	V	V				
10	600	7560	137,67	94%	V	V	V	V			
11	600	7560	128,97	94%	V	V	V	V			
12	600	7560	113,94	94%	V	V	V	V	V		
13	600	7560	105,83	94%	V	V	V	V			
15	600	7560	95,91	94%	V	V	V	V	V	V	
16	600	7560	86,11	94%	V	V	V	V	V	V	
19	600	7560	74,17	94%	V	V	V	V	V	V	V
20	600	7560	69,75	94%	V	V	V	V	V	V	V
23	600	7560	61,26	94%	V	V	V	V	V		
25	600	7560	56,89	94%	V	V	V	V			
27	600	7560	51,56	94%	V	V	V	V	V	V	
30	600	7560	46,29	94%	V	V	V	V	V	V	
35	580	7790	39,88	94%	V	V	V	V	V	V	V
37	570	7900	37,5	94%	V	V	V	V	V	V	V
43	540	8210	32,27	94%	V	V	V	V	V	V	V
49	520	8400	28,83	94%			V	V	V	V	V

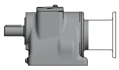
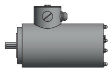
FR 68 (2 Stage)
Maximum Torque = 600 Nm @ N1 = 1400 r/min

n2 [Min-1]	M2max [Nm]	Fr2 [N]	i	η%	AM / B5T2 IEC63	AM / B5T2 IEC71	AM / B5T2 IEC80	AM / B5T2 IEC90	AM / B5T2 IEC100	AM / B5T2 IEC112	AM / B5T2 IEC132
50	540	8210	28,13	96%	V	V	V	V			
52	540	8210	26,72	96%	V	V	V	V			
60	560	8010	23,44	96%	V	V	V	V	V		
70	600	7560	19,89	96%	V	V	V	V	V	V	
78	590	7330	17,95	96%	V	V	V	V	V	V	
89	560	7130	15,79	96%	V	V	V	V	V	V	V
94	550	6980	14,91	96%	V	V	V	V	V	V	V
110	520	6650	12,7	96%	V	V	V	V	V	V	V
121	500	6500	11,54	96%			V	V	V	V	V
140	470	6220	10,00	96%			V	V	V	V	V
161	440	5960	8,7	96%				V	V	V	V
180	380	5830	7,79	96%	V	V	V	V	V	V	V
190	370	5790	7,36	96%	V	V	V	V	V	V	V
223	330	5590	6,27	96%	V	V	V	V	V	V	V
246	310	5450	5,7	96%			V	V	V	V	V
284	290	5210	4,93	96%			V	V	V	V	V
326	270	5000	4,29	96%				V	V	V	V

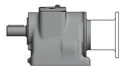
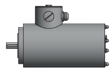
Gearbox Selection Tables

Gearbox Selection Tables

0,12 - 0,18 kW

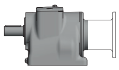
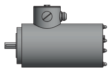
P1 [kW]	n2 [Min-1]	M2 [Nm]	i	Fr2 [N]	fs (gear-box)		
0,12	6,9	166	199,81	10300	3,60	FR 68 AM63 FR68 B5T2	631-4 B5 631-4 B5T2
	7,5	153	184,07	10400	3,90		
0,18	9,8	176	134,82	5230	1,15	FR 38 AM63 FR38 B5T1	632-4 B5 632-4 B5T1
	11	161	123,66	5370	1,25		
	13	137	105,28	5580	1,45		
	15	118	90,77	5710	1,70		
	16	110	84,61	5760	1,80		
	18	96	73,96	5840	2,10		
	19	90	69,33	5870	2,20		
	22	80	61,18	5920	2,50		
	24	73	55,76	5940	2,80		
	27	63	48,08	5960	3,20		
	9,6	179	90,77	5190	1,10	FR 38 AM71 FR38 B5T1	711-6 B5 711-6 B5T1
	10	167	84,61	5310	1,20		
	7,5	230	176,88	5740	1,30	FR48 AM63 FR48 B5T2	632-4 B5 632-4 B5T2
	8,1	210	162,94	5810	1,40		
	9,4	182	139,99	5910	1,65		
	11	159	121,87	5980	1,90		
	12	149	114,17	6000	2,00		
	13	131	100,86	6040	2,30		
	14	122	93,68	6060	2,50		
	16	111	84,90	6080	2,70		
	17	99	76,23	6100	3,00		
	6,6	260	199,81	10100	2,30	FR68 AM63 FR68 B5T2	632-4 B5 632-4 B5T2
	7,2	240	184,07	10100	2,50		
	8,3	205	158,14	10200	2,90		
	9,6	179	137,67	10300	3,40		
	10	168	128,97	10300	3,60		
	12	148	113,94	10400	4,00		
	12	138	105,83	10400	4,40		

0,18 - 0,25 kW

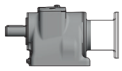
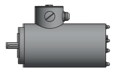
P1 [kW]	n2 [Min-1]	M2 [Nm]	i	Fr2 [N]	fs (gear-box)		
0,18	4,4	395	199 ,81	9370	1,50	FR68 AM71 FR68 B5T2	711-6 B5 711-6 B5T2
	4,7	365	184,07	9560	1,65		
	5,5	310	158,14	9830	1,90		
	6,3	270	137,67	10000	2,20		
	6,8	255	128,97	10100	2,40		
	7,6	225	113,94	10200	2,70		
	8,2	210	105,83	10200	2,90		
	9,1	190	95,91	10300	3,20		
	10	170	86,11	10300	3,50		
	12	147	74,17	10400	4,10		
	12	138	69,75	10400	4,40		
0,25	12	193	105,28	5030	1,05	FR38 AM71 FR38 B5T1	711-4 B5 711-4 B5T1
	14	167	90,77	5320	1,20		
	15	155	84,61	5420	1,30		
	18	136	73,96	5590	1,45		
	19	127	69,33	5650	1,55		
	21	112	61,18	5750	1,80		
	23	102	55,76	5800	1,95		
	27	88	48,08	5870	2,30		
	29	82	44,81	5760	2,40		
	33	72	39,17	5540	2,80		
	35	67	36,72	5430	3,00		
	40	60	32,40	5230	3,40		
	8	300	162,94	5420	1,00	FR48 AM71 FR48 B5T2	711-4 B5 711-4 B5T2
	9,3	255	139,99	5630	1,15		
	11	225	121,87	5770	1,35		
	11	210	114,17	5820	1,45		
	13	185	100,86	5900	1,60		
	14	172	93,68	5940	1,75		
	15	156	84,90	5980	1,90		
	17	140	76,23	6020	2,10		
	19	126	68,54	6050	2,40		
	20	118	64,21	6070	2,50		
	23	104	56,73	6090	2,90		
	25	97	52,69	6100	3,10		
	27	88	47,75	6080	3,40		
	6,5	365	199,81	9540	1,65	FR68 AM71 FR68 B5T2	711-4 B5 711-4 B5T2
	7,1	340	184,07	9700	1,80		
	8,2	290	158,14	9930	2,10		
	9,4	255	137,67	10100	2,40		
	10	235	128,97	10100	2,50		
	11	210	113,94	10200	2,90		
	12	194	105,83	10300	3,10		
	14	176	95,91	10300	3,40		
	15	158	86,11	10400	3,80		

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

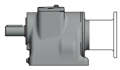
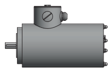
P1 [kW]	n2 [Min-1]	M2 [Nm]	i	Fr2 [N]	fs (gear-box)		
0,25	4,4	540	199,81	8190	1,10	FR68 AM71 FR68 B5T2	712-6 B5 712-6 B5T2
	4,8	500	184,07	8590	1,20		
	5,6	430	158,14	9140	1,40		
	6,4	375	137,67	9500	1,60		
	6,8	350	128,97	9630	1,70		
	7,7	310	113,94	9840	1,95		
	8,3	285	105,83	9940	2,10		
	4,3	555	158,14	8060	1,10	FR68 AM80 FR68 B5T2	802-8 B14a 802-8 B5T2
	4,9	485	137,67	8730	1,25		
	5,3	455	128,97	8970	1,35		
	6,0	400	113,94	9340	1,50		
0,37	19	189	73,96	5070	1,05	FR38 AM71 FR38 B5T1	712-4 B5 712-4 B5T1
	20	178	69,33	5210	1,15		
	23	157	61,18	5410	1,30		
	25	143	55,76	5530	1,40		
	29	123	48,08	5590	1,60		
	31	115	44,81	5480	1,75		
	35	100	39,17	5290	2,00		
	38	94	36,72	5190	2,10		
	43	83	32,40	5010	2,40		
	48	74	28,73	4850	2,70		
	57	63	24,42	4620	3,20		
	49	73	28,32	4830	2,80		
	53	67	26,03	4710	2,80		
	62	57	22,27	4500	3,50		
	71	49	19,31	4320	4,10		
	76	46	18,05	4230	4,30		
	88	40	15,60	4050	5,00		
	104	34	13,25	3850	5,60		
	117	30	11,83	3720	6,00		
	12	290	114,17	5460	1,05	FR48 AM71 FR48 B5T2	712-4 B5 712-4 B5T1
	14	260	100,86	5630	1,15		
	15	240	93,68	5700	1,25		
	16	215	84,90	5790	1,40		
	18	195	76,23	5870	1,55		
	20	176	68,54	5930	1,70		
	21	164	64,21	5960	1,80		
	24	145	56,73	6010	2,10		
	26	135	52,69	5990	2,20		
	29	122	47,75	5820	2,50		
	32	110	42,87	5650	2,70		
	37	95	36,93	5410	3,20		
	40	89	34,73	5310	3,40		
	41	87	33,79	5270	2,80		
	44	80	31,12	5150	2,80		
	52	69	26,74	4920	4,40		
	59	60	23,28	4720	5,00		
	63	56	21,81	4620	5,40		

0,37 - 0,55 kW

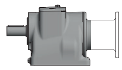
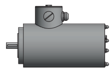
P1 [kW]	n2 [Min-1]	M2 [Nm]	i	Fr2 [N]	fs (gear-box)		
0,37	6,9	510	199,81	8480	1,15	FR68 AM71 FR68 B5T2	712-4 B5 712-4 B5T2
	7,5	470	184,07	8820	1,25		
	8,7	405	158,14	9310	1,50		
	10	355	137,67	9620	1,70		
	11	330	128,97	9740	1,80		
	12	290	113,94	9920	2,10		
	13	270	105,83	10000	2,20		
	14	245	95,91	10100	2,40		
	16	220	86,11	10200	2,70		
	19	190	74,17	10300	3,20		
	20	179	69,75	10300	3,40		
	23	157	61,26	10400	3,80		
	24	146	56,89	10400	4,10		
	6,5	540	137,67	8210	1,10	FR68 AM80 FR68 B5T2	801-6 B14a 801-6 B5T2
	7	505	128,97	8530	1,20		
	7,9	445	113,94	9010	1,35		
0,55	28	186	48,08	5120	1,10	FR38 AM80 FR38 B5T1	801-4 B14a 801-4 B5T1
	30	173	44,81	5230	1,15		
	35	151	39,17	5070	1,30		
	37	142	36,72	4990	1,40		
	42	125	32,40	4840	1,60		
	47	111	28,73	4700	1,80		
	56	94	24,42	4500	2,10		
	61	86	22,27	4390	2,30		
	70	75	19,31	4220	2,70		
	75	70	18,05	4140	2,90		
	87	60	15,60	3970	3,30		
	103	51	13,25	3790	3,70		
	115	46	11,83	3670	4,00		
	18	295	76,23	5450	1,00	FR48 AM80 FR48 B5T2	801-4 B14a 801-4 B5T2
	20	265	68,54	5600	1,15		
	21	250	64,21	5670	1,20		
	24	220	56,73	5790	1,35		
	26	205	52,69	5770	1,45		
	28	184	47,75	5630	1,65		
	32	166	42,87	5470	1,80		
	37	143	36,93	5260	2,10		
	39	134	34,73	5180	2,20		
	46	115	29,88	4970	2,60		
	51	103	26,74	4820	2,90		
	58	90	23,28	4630	3,30		
	62	84	21,81	4550	3,60		

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

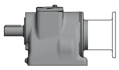
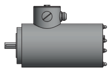
P1 [kW]	n2 [Min-1]	M2 [Nm]	i	Fr2 [N]	fs (gear-box)		
0,55	8,6	610	158,14	7430	1,00	FR68 AM80 FR68 B5T2	801-4 B14a 801-4 B5T2
	9,9	530	137,67	8290	1,15		
	11	500	128,97	8600	1,20		
	12	440	113,94	9060	1,35		
	13	410	105,83	9280	1,45		
	14	370	95,91	9520	1,60		
	16	335	86,11	9730	1,80		
	18	285	74,17	9940	2,10		
	20	270	69,75	10000	2,20		
	22	235	61,26	10100	2,50		
	24	220	56,89	10200	2,70		
0,75	35	205	39,17	4720	1,00	FR38 AM80 FR38 B5T1	802-4 B14a 802-4 B5T1
	38	191	36,72	4740	1,05		
	43	168	32,40	4610	1,20		
	48	149	28,73	4490	1,35		
	57	127	24,42	4320	1,60		
	62	116	22,27	4230	1,75		
	71	100	19,31	4080	2,00		
	76	94	18,05	4010	2,10		
	88	81	15,60	3850	2,50		
	104	69	13,25	3690	2,80		
	117	61	11,83	3570	3,00		
	137	53	10,11	3420	3,20		
	146	49	9,47	3360	3,40		
	24	295	56,73	5450	1,00	FR48 AM80 FR48 B5T2	802-4 B14a 802-4 B5T1
	26	275	52,69	5480	1,10		
	29	250	47,75	5370	1,20		
	32	225	42,87	5240	1,35		
	37	192	36,93	5060	1,55		
	40	180	34,73	4980	1,65		
	46	155	29,88	4800	1,95		
	52	139	26,70	4660	2,20		
	58	122	23,59	4510	2,50		
	52	139	26,74	4660	2,20		
	59	121	23,28	4490	2,50		
	63	113	21,81	4420	2,70		
	72	100	19,27	4270	3,00		
	77	93	17,89	4180	3,10		
	85	84	16,22	4070	3,30		
	12	590	113,94	7660	1,00	FR68 AM80 FR68 B5T2	802-4 B14a 802-4 B5T2
	13	550	105,83	8120	1,10		
	14	500	95,91	8600	1,20		
	16	445	86,11	9010	1,35		
	19	385	74,17	9430	1,55		
	20	360	69,75	9570	1,65		
	23	320	61,26	9800	1,90		
	24	295	56,89	9910	2,00		
	27	270	51,56	10000	2,20		
	30	240	46,29	10100	2,50		

1,1 kW

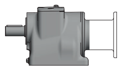
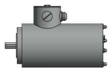
P1 [kW]	n2 [Min-1]	M2 [Nm]	i	Fr2 [N]	fs (gear-box)		
1,1	57	183	24,42	3720	1,10	FR38 AM90 FR38 B5T1	90S-4 B14a 90S-4 B5T1
	73	145	19,31	3840	1,40		
	78	135	18,05	3790	1,50		
	90	117	15,60	3660	1,70		
	106	99	13,25	3520	1,90		
	118	89	11,83	3430	2,10		
	139	76	10,11	3290	2,20		
	148	71	9,47	3230	2,40		
	176	60	7,97	3090	2,60		
	210	50	6,67	2920	2,90		
	247	43	5,67	2790	3,30		
	277	38	5,06	2700	3,60		
	38	275	36,93	4720	1,10	FR48 AM90 FR48 B5T2	90S-4 B14a 90S-4 B5T2
	40	260	34,73	4660	1,15		
	47	225	29,88	4520	1,35		
	52	200	26,70	4410	1,50		
	59	177	23,59	4290	1,70		
	60	175	23,28	4270	1,70		
	64	164	21,81	4210	1,85		
	73	145	19,27	4080	2,00		
	78	134	17,89	4010	2,20		
	86	122	16,22	3910	2,30		
	96	109	14,56	3800	2,40		
	112	94	12,54	3650	2,70		
	119	89	11,79	3590	2,80		
	138	76	10,15	3450	3,00		
	154	68	9,07	3340	3,20		
	19	555	74,17	8040	1,10	FR68 AM90 FR68 B5T2	90S-4 B14a 90S-4 B5T2
	20	525	69,75	8370	1,15		
	23	460	61,26	8920	1,30		
	25	425	56,89	9160	1,40		
	27	385	51,56	9420	1,55		
	30	345	46,29	9650	1,75		
	35	300	39,88	9890	1,95		
	37	280	37,50	9970	2,00		
	43	240	32,27	10100	2,20		
	49	215	28,83	10200	2,40		
	50	210	28,13	10200	2,60		
	52	200	26,72	10100	2,70		
	60	176	23,44	9730	3,20		
	70	149	19,89	9270	4,00		

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

1,5 kW

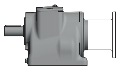
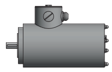
P1 [kW]	n2 [Min-1]	M2 [Nm]	i	Fr2 [N]	fs (gear-box)		
1,5	73	196	19,31	2660	1,00	FR38 AM90 FR38 B5T1	90L-4 B14a 90L-4 B5T1
	78	183	18,05	2840	1,10		
	90	159	15,60	3160	1,25		
	106	135	13,25	3350	1,40		
	119	120	11,83	3270	1,50		
	140	103	10,11	3160	1,65		
	149	96	9,47	3110	1,75		
	177	81	7,97	2980	1,95		
	211	68	6,67	2820	2,10		
	249	58	5,67	2710	2,50		
	279	51	5,06	2630	2,60		
	326	44	4,32	2520	2,90		
	348	41	4,05	2470	3,00		
	414	35	3,41	2360	3,20		
	47	305	29,88	4220	1,00	FR48 AM90 FR48 B5T2	90L-4 B14a 90L-4 B5T2
	53	270	26,70	4140	1,10		
	60	240	23,59	4050	1,25		
	61	235	23,28	4040	1,25		
	65	220	21,81	3990	1,35		
	73	196	19,27	3890	1,50		
	79	182	17,89	3830	1,60		
	87	165	16,22	3740	1,65		
	97	148	14,56	3650	1,80		
	112	127	12,54	3520	1,95		
	120	120	11,79	3470	2,10		
	139	103	10,15	3340	2,20		
	155	92	9,07	3240	2,40		
	176	81	8,01	3140	2,50		
	182	79	7,76	3060	2,10		
	203	71	6,96	2980	2,30		
	235	61	6,00	2860	2,60		
	250	57	5,64	2810	2,70		
	291	49	4,85	2700	3,00		
	325	44	4,34	2610	3,30		
	368	39	3,83	2520	3,70		
	25	580	56,89	7810	1,05	FR68 AM90 FR68 B5T2	90L-4 B14a 90L-4 B5T2
	27	525	51,56	8370	1,15		
	30	470	46,29	8830	1,30		
	35	405	39,88	9300	1,45		
	38	380	37,50	9460	1,50		
	44	330	32,27	9750	1,65		
	49	295	28,83	9920	1,80		
	50	285	28,13	9950	1,90		
	53	270	26,72	9850	2,00		
	60	240	23,44	9500	2,40		
	71	200	19,89	9070	3,00		
	79	182	17,95	8810	3,20		

2,2 kW

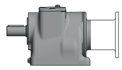
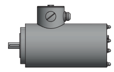
P1 [kW]	n2 [Min-1]	M2 [Nm]	i	Fr2 [N]	fs (gear-box)		
2,2	119	176	11,83	1990	1,05	FR38 AM100 FR38 B5T1	100L1-4 B14a 100L1-4 B5T1
	140	151	10,11	2360	1,15		
	149	141	9,47	2480	1,20		
	177	119	7,97	2750	1,30		
	211	99	6,67	2470	1,45		
	249	84	5,67	2570	1,70		
	279	75	5,06	2500	1,80		
	326	64	4,32	2410	1,95		
	348	60	4,05	2370	2,00		
	414	51	3,41	2270	2,20		
	73	285	19,27	3550	1,05	FR48 AM100 FR48 B5T2	100L1-4 B14a 100L1-4 B5T2
	87	240	16,22	3460	1,15		
	97	215	14,56	3400	1,20		
	112	187	12,54	3310	1,35		
	120	176	11,79	3270	1,40		
	139	151	10,15	3160	1,50		
	155	135	9,07	3090	1,65		
	176	119	8,01	3000	1,70		
	182	116	7,76	2910	1,40		
	203	104	6,96	2840	1,55		
	235	89	6,00	2740	1,75		
	250	84	5,64	2700	1,85		
	291	72	4,85	2600	2,10		
	325	65	4,34	2530	2,30		
	368	57	3,83	2440	2,50		
	35	595	39,88	7630	1,00	FR68 AM100 FR68 B5T2	100L1-4 B14a 100L1-4 B5T2
	38	560	37,50	8020	1,00		
	44	480	32,27	8750	1,10		
	49	430	28,83	9140	1,20		
	60	350	23,44	9140	1,60		
	71	295	19,89	8760	2,00		
	79	270	17,95	8530	2,20		
	89	235	15,79	8240	2,40		
	95	220	14,91	8110	2,50		
	111	189	12,70	7760	2,80		
	122	172	11,54	7560	2,90		
	141	149	10,00	7250	3,20		
	162	130	8,70	6960	3,40		
	181	116	7,79	6760	3,30		

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

3 - 4 kW

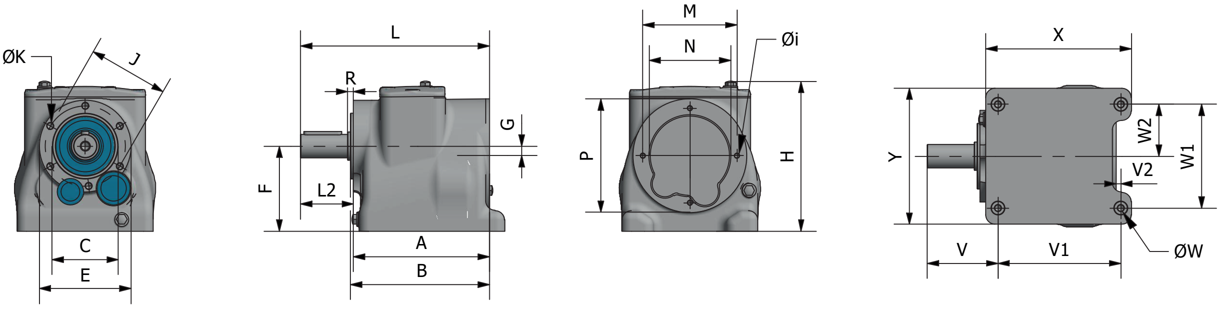
P1 [kW]	n2 [Min-1]	M2 [Nm]	i	Fr2 [N]	fs (gear-box)		
3,0	210	137	6,67	1250	1,05	FR38 AM100 FR38 B5T1	100L2-4 B14a 100L2-4 B5T1
	247	116	5,67	1630	1,25		
	277	104	5,06	1830	1,30		
	324	88	4,32	2070	1,45		
	346	83	4,05	2140	1,45		
	411	70	3,41	2180	1,60		
	119	240	11,79	3040	1,00	FR48 AM100 FR48 B5T2	100L2-4 B14a 100L2-4 B5T2
	138	210	10,15	2970	1,10		
	154	186	9,07	2910	1,20		
	175	164	8,01	2840	1,25		
	181	159	7,76	2740	1,05		
	201	143	6,96	2680	1,10		
	233	123	6,00	2610	1,25		
	248	115	5,64	2580	1,35		
	288	99	4,85	2490	1,50		
	323	89	4,34	2430	1,65		
	365	78	3,83	2360	1,85		
	60	480	23,44	8730	1,15	FR68 AM100 FR68 B5T2	100L2-4 B14a 100L2-4 B5T2
	70	405	19,89	8420	1,45		
	78	365	17,95	8230	1,60		
	89	325	15,79	7980	1,75		
	94	305	14,91	7860	1,80		
	110	260	12,70	7550	2,00		
	121	235	11,54	7360	2,10		
	140	205	10,00	7090	2,30		
4,0	252	152	5,64	2410	1,00	FR48 AM112 FR48 B5T2	112M-4 B14a 112M-4 B5T2
	293	131	4,85	2350	1,15		
	327	117	4,34	2300	1,25		
	371	103	3,83	2250	1,40		
	71	535	19,89	7960	1,10	FR68 AM112 FR68 B5T2	112M-4 B14a 112M-4 B5T2
	79	485	17,95	7800	1,20		
	90	425	15,79	7600	1,30		
	95	400	14,91	7510	1,35		
	112	340	12,70	7240	1,50		
	123	310	11,54	7080	1,60		
	142	270	10,00	6840	1,75		
	163	235	8,70	6600	1,90		
	182	210	7,79	6440	1,80		
	193	198	7,36	6340	1,85		
	227	169	6,27	6070	1,95		
	249	153	5,70	5920	2,00		
	288	133	4,93	5680	2,20		
	331	116	4,29	5460	2,30		

5,5 - 7,5 kW

P1 [kW]	n2 [Min-1]	M2 [Nm]	i	Fr2 [N]	fs (gear-box)		
5,5	373	141	3,83	2080	1,00	FR48 AM132 FR48 B5T2	132S-4 B14a 132S-4 B5T2
	96	550	14,91	6900	1,00	FR68 AM132 FR68 B5T2	132S-4 B14a 132S-4 B5T2
	113	465	12,70	6810	1,10		
	124	425	11,54	6690	1,20		
	143	365	10,00	6500	1,30		
	164	320	8,70	6310	1,40		
	183	285	7,79	6180	1,35		
	194	270	7,36	6100	1,35		
	228	230	6,27	5860	1,45		
	251	210	5,70	5720	1,50		
	290	181	4,93	5510	1,60		
	333	158	4,29	5310	1,70		
7,5	164	435	8,70	5930	1,00	FR68 AM132 FR68 B5T2	132M-4 B14a 132M-4 B5T2
	194	370	7,36	5720	1,00		
	228	315	6,27	5600	1,05		
	251	285	5,70	5480	1,10		
	290	245	4,93	5300	1,15		
	333	215	4,29	5130	1,25		

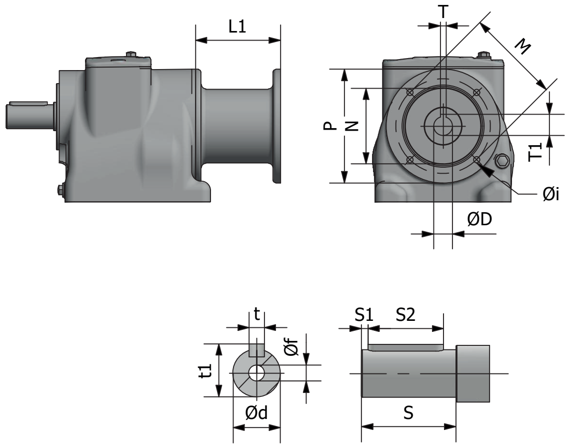
General Dimensions

General dimensions



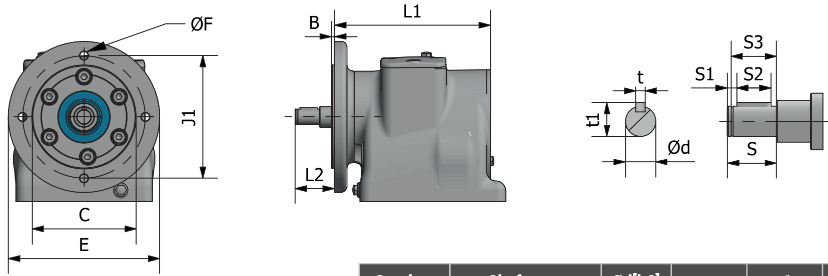
Gearbox	A	B	C	E	F	G	H	Øi	J	ØK	L	L2	M	N	P	R	V	V1	V2	ØW	W1	W2	X	Y
FR38 B5T1	144	147	70	97	90	10	158	M6	85	6x M8	200	56	100	80	120	6	75	130	5	M8	110	55	154	144
FR48 B5T2	169	172	80	110	115	14	196	M8	95	6x M8	235	66	130	110	160	6	90	165	20	M12	135	67,5	192	175
FR68 B5T2	201	204	95	140	130	20,7	224	M8	115	8x M8	277	76	130	110	160	6	100	195	18	M12	150	75	215	229

AM Flange



Gearbox	Flange type	ØD [H7/h6]	Øi	L1	M	N	P	T	T1
FR38 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
	AM100	28			130	110	160		31,3
	AM112	28			130	110	160		
FR48 B5T2	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
	AM100	28			130	110	160		31,3
	AM112	28			130	110	160		
FR68 B5T2	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
	AM100	28			130	110	160		31,3
	AM112	28			130	110	160		
	AM132	38	11	126	165	130	200	10	41,3

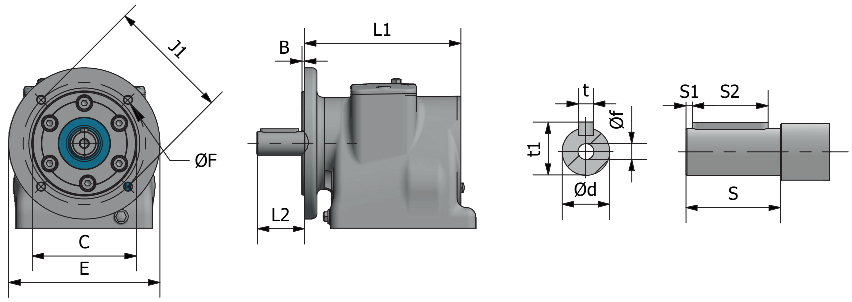
B5T Flange



Gearbox	Flange	B	C	E	ØF	J1	L1
FR38	SS 085 FL 160 B5T2	3	110	160	9	130	165
	SS 085 FL 200 B5T3	3	130	200	11	165	165

Gearbox	Shaft type	Ød[h6]	t	t1	S	S1	S2	S3	L2
FR38	SA 10 B5T2	10	2	10,8	18,5	3,5	12	17	41,5
	SA 12 B5T2	12	3	13,2	20,5		14	19	
	SA 14 B5T2	14		15,2	22,5	5,5		21	
	SA 16 B5T2	16	4	17,5	26	5	18	24	44
	SA 18 B5T2	18		19,5	29		20	27,2	
	SA 22 B5T2	22	5	24	36	6	25	34,2	
	SA 10 B5T3	10	2	10,8	18,5	3,5	12	17	47,5
	SA 12 B5T3	12	3	13,2	20,5		14	19	
	SA 14 B5T3	14		15,2	22,5	5,5		21	49,5
	SA 16 B5T3	16	4	17,5	26	5	18	24	52
	SA 18 B5T3	18		19,5	29		20	27,2	53
	SA 22 B5T3	22	5	24	36	6	25	34,2	56

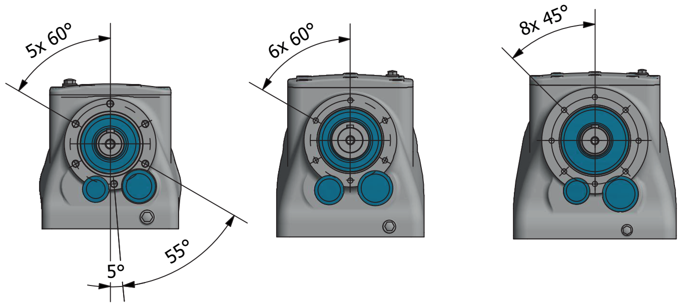
Output flanges



Gearbox	Flange	B	C	E	ØF	J1	L1	L2
FR38	SS 085 FL 120	3	80	120	6,6	100	165	50
	SS 085 FL 140		95	140	9	115		
	SS 085 FL 160		110	160		130		
	SS 085 FL 200		130	200	11	165		
FR48	SS 095 FL 140	3	95	140	9	115	190	60
	SS 095 FL 160		110	160		130		
	SS 095 FL 200		130	200	11	165		
FR68	SS 115 FL 200	3,5	130	200	11	165	229	70
	SS 115 FL 250		180	250	13,5	215	229	

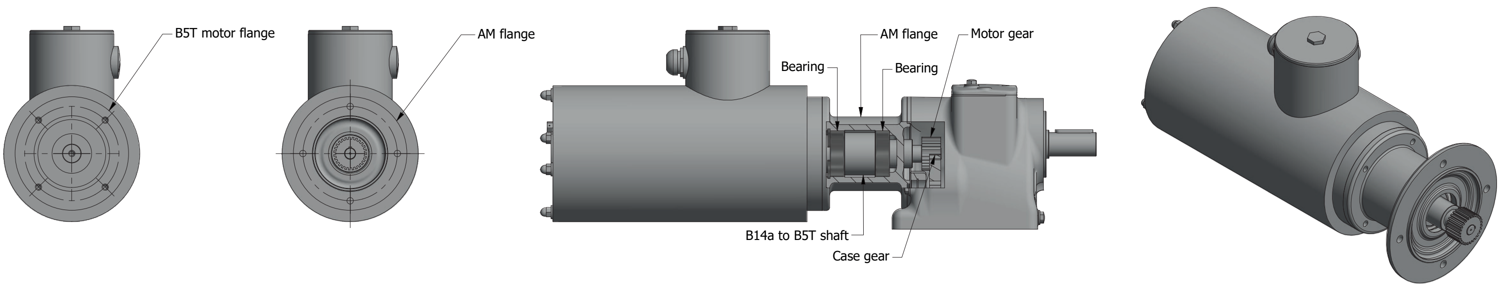
Gearbox	Ød[h6]	Øf	t	t1	S	S1	S2
FR38	25	M10	8	28	50	5	40
FR48	30	M10	8	33	60	4	50
FR68	35	M10	10	38	70	8,5	56

Hole overview

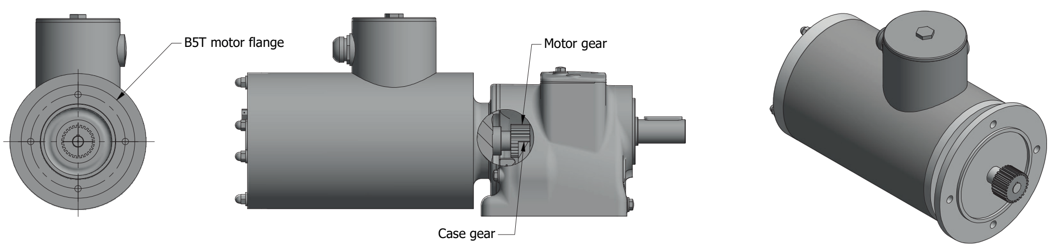


Difference between B5T and B14a

B14a motor with AM - flange

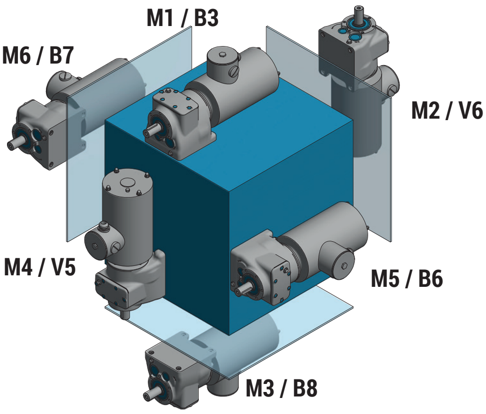


B5 motor

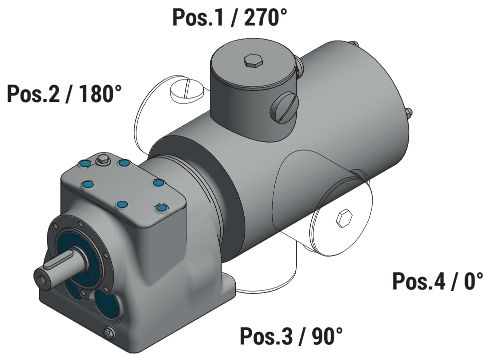


Extra information

Mounting Positions



Terminal Box Positions



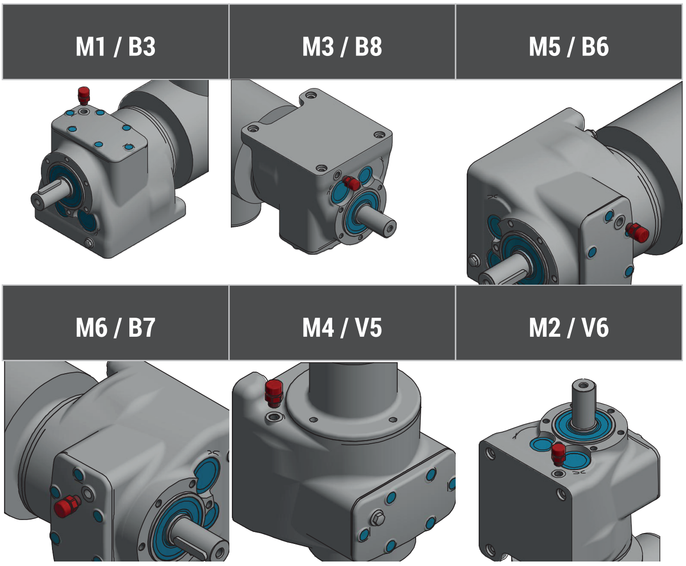
Lubrication Quantity

Oil Quantity in ML	Mounting Position					
Gearbox	M1 (B3)	M3 (B8)	M6 (B7)	M5 (B6)	M4 (V5)	M2 (V6)
FR 38 B5T1 / AM..	1000	1000	1000	1000	1200	1000
FR 48 B5T2 / AM..	2000	1800	1900	1400	2300	2400
FR 68 B5T2 / AM..	3250	2900	3000	2700	3600	3300

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

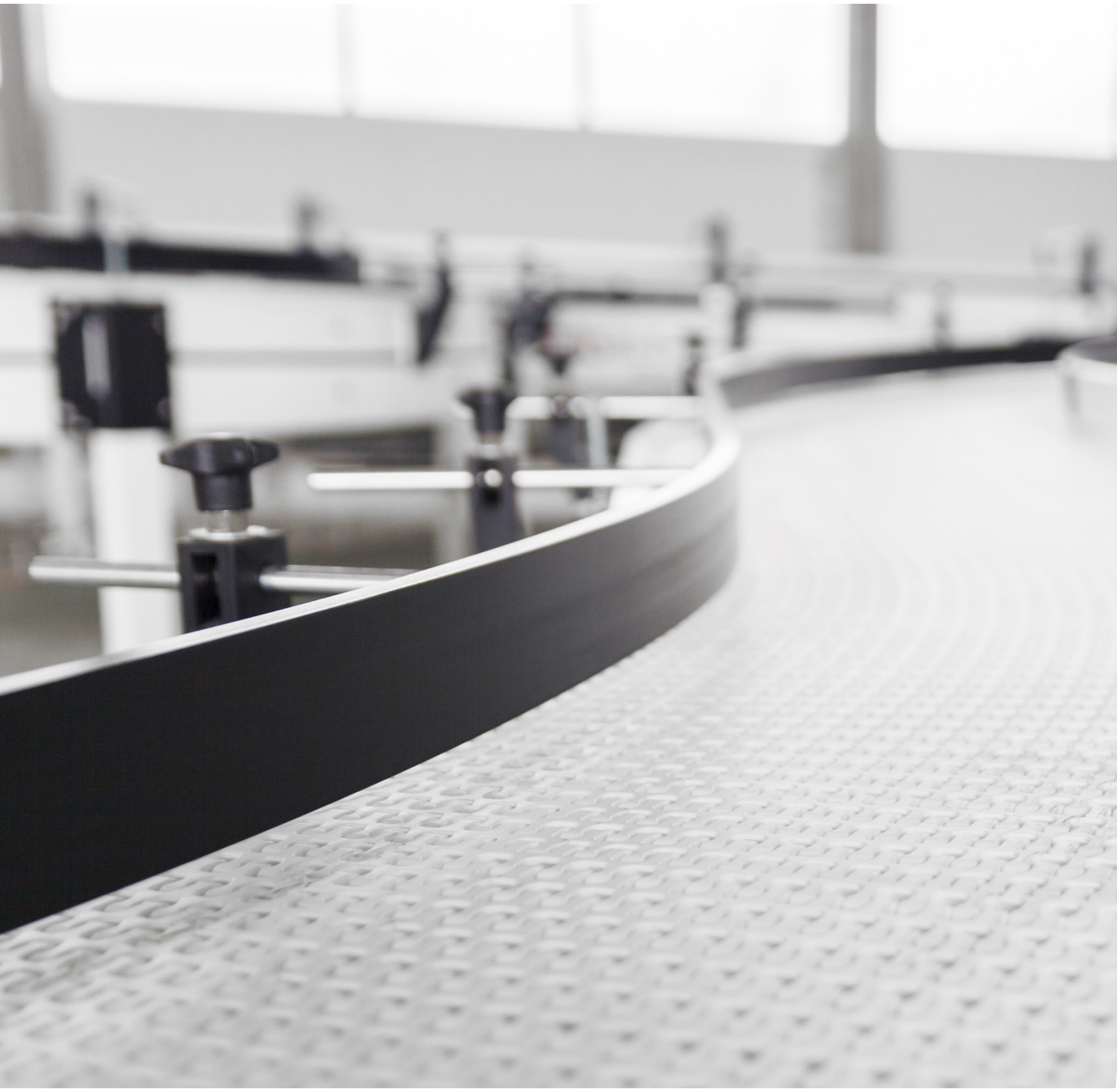
B5T weight

Gearbox	Weight
FR 38 B5T1	9,0 kg
FR 48 B5T2	15 kg
FR 68 B5T2	22,5 kg

General weight

Gearbox	Weight
FR 38 AM..	12,5 kg
FR 48 AM..	19 kg
FR 68 AM..	27 kg

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



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FR Documentation - 1.0
3/3/2022

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Note: Unless otherwise stated all sizes are in millimeters