6.3 Dimensional drawings

In this chapter you can find the dimensions of the geared motors.

There is a dimensional drawing for every possible shaft/housing design, each with the tables for gear unit dimensions, motor dimensions and geared motor dimensions.

Dimensions can exceed the specifications of ISO 2768-mK due to casting tolerances or accumulation of individual tolerances.

We reserve the right to make dimensional changes due to ongoing technical development.

You can download 3D models of our standard drives at https://configurator.stoeber.de/en-US/.

Combination options and the dimensions of forced ventilated geared motors can also be found at https://configurator.stoeber.de/en-US/.

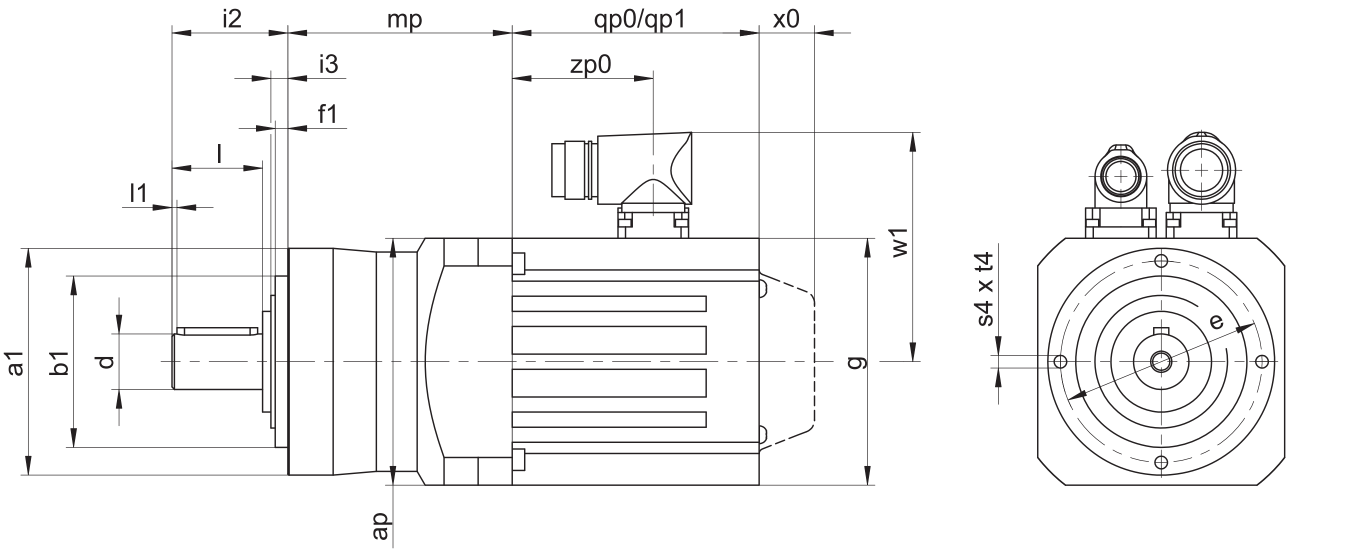
Tolerances

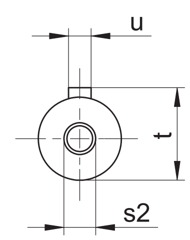
Solid shaft	Tolerance
Fit	ISO k6
Feather keys	DIN 6885-1, high form A
Balancing	With half feather key

Centering holes in solid shafts in accordance with DIN 332-2, DR shape

Thread size	M4	M5	M6	M8	M10	M12	M16	M20	M24
Thread depth [mm]	10	12.5	16	19	22	28	36	42	50

6.3.1 P shaft design (solid shaft with feather key)





qp0 Applies to motors without brake.

x0 EZ2: Applies only to motors with brake and encoders using an optical or inductive measuring method
EZ3 – EZ8: Applies to encoders using an optical measuring method

qp1 Applies to motors with brake.

w1 Different for the One Cable Solution (OCS), see the chapter [▸ 17.4]

Dimensions of gear units

Type	Øa1	Øb1	Ød	Øe	f1	i2	i3	l	l1	s2	s4	t	t4	u
PE221	50	35_{h6}	12_{k6}	44	4	24.5	5.0	18	2	M4	M4	13.5	8	A4×4×14
PE222	50	35_{h6}	12_{k6}	44	4	24.5	5.0	18	2	M4	M4	13.5	8	A4×4×14
PE321	70	52_{h6}	16_{k6}	62	5	36.0	6.0	28	2	M5	M5	18.0	10	A5×5×22
PE322	70	52_{h6}	16_{k6}	62	5	36.0	6.0	28	2	M5	M5	18.0	10	A5×5×22
PE421	90	68_{h6}	22_{k6}	80	5	46.0	6.5	36	2	M8	M6	24.5	12	A6×6×32
PE422	90	68_{h6}	22_{k6}	80	5	46.0	6.5	36	2	M8	M6	24.5	12	A6×6×32
PE521	120	90_{h6}	32_{k6}	108	6	70.0	8.0	58	4	M12	M8	35.0	16	A10×8×50
PE522	120	90_{h6}	32_{k6}	108	6	70.0	8.0	58	4	M12	M8	35.0	16	A10×8×50

Dimensions of motors

Type	□g	qp0	qp1	w1	x0	zp0
EZ202U	55	141	150.0	47.0	25	86.0
EZ203U	55	159	168.0	47.0	25	104.0
EZ301U	72	90	130.0	55.5	21	54.5
EZ302U	72	112	152.0	55.5	21	76.5
EZ303U	72	134	174.0	55.5	21	98.5
EZ401U	98	98	146.5	91.0	22	56.0
EZ402U	98	123	171.5	91.0	22	81.0
EZ404U	98	173	221.5	91.0	22	131.0
EZ501U	115	93	147.5	100.0	22	58.5
EZ502U	115	118	172.5	100.0	22	83.5
EZ503U	115	143	197.5	100.0	22	108.5
EZ505U	115	193	247.5	100.0	22	158.5
EZ701U	145	102	161.0	115.0	22	64.0
EZ702U	145	127	186.0	115.0	22	89.0
EZ703U	145	152	211.0	115.0	22	114.0
EZ705U	145	207	266.0	134.0	22	165.0

Dimensions of geared motors

Type	EZ2		EZ3		EZ4		EZ5		EZ7	
	ap	mp	ap	mp	ap	mp	ap	mp	ap	mp
PE221	□55	59.5	□72	73.0	–	–	–	–	–	–
PE222	□55	91.5	–	–	–	–	–	–	–	–
PE321	–	–	□72	86.5	□98	83.0	–	–	–	–
PE322	⌀75	106.5	⌀75	120.0	–	–	–	–	–	–
PE421	–	–	–	–	□98	89.0	□115	91.5	–	–
PE422	–	–	⌀100	129.0	⌀100	125.5	–	–	–	–
PE521	–	–	–	–	–	–	⌀120	110.0	□145	113.0
PE522	–	–	–	–	⌀120	152.0	⌀120	151.5	–	–

6.4 Type designation

In this chapter, you can find an explanation of the type designation with the associated options.

Additional ordering information not included in the type designation can be found at the end of the chapter.

Example code

PE	4	2	2	S	P	S	S	0200	EZ401U

Explanation

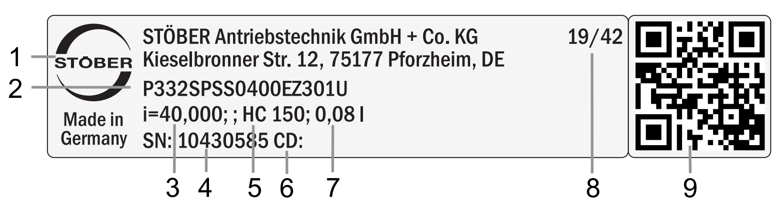
Code	Designation	Design
PE	Type	Planetary gear unit
4	Size	4 (example)
2	Generation	Generation 2
1	Stages	Single-stage
2		Two-stage
S	Housing	Standard
P	Shaft	Solid shaft with feather key
S	Bearing	Standard bearing
S	Backlash	Standard
0200	Transmission ratio (i x 10)	i = 20 (example)
EZ401U	Motor	EZ synchronous servo motor

To complete the type designation, also specify the following in your order:

- A detailed type designation of the motor, see the chapter [▷ 17]

6.4.1 Nameplate

An example geared motor nameplate is explained in the figure below.



Code	Designation
1	Name of manufacturer
2	Type designation
3	Gear ratio of the gear unit
4	Serial number of the gear unit
5	Lubricant specification
6	Customer-specific data
7	Lubricant fill volume
8	Date of manufacture (year/calendar week)
9	QR code (link to product information)

6.4.1.1 Supporting documents

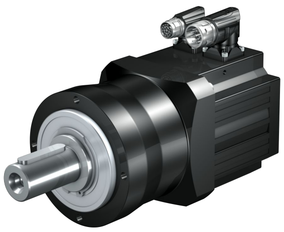
You can view or download supporting documents for the product by reading off the serial number on the nameplate of the product and entering it at the following address online:
https://id.stober.com

Alternatively, you can use a suitable mobile device to scan in the QR code on the nameplate of the product in order to be linked to the supporting documents.

6.5 Product description

6.5.1 Input options

EZ synchronous servo motor



Catalog ID 442437_en

LM Lean motor

Catalog ID 443016_en

The corresponding catalogs can be found at http://www.stoeber.de/en/downloads/

Enter the ID of the catalog in the Search term field.

6.5.2 Installation conditions

The specified torques and forces only apply when gear units are fastened on the machine side using screws of strength class 10.9. In addition, the gear housings must be adjusted at the pilot. The machine-side fit must be H7.

6.5.3 Lubricants

STOBER fills the gear units with the amount and type of lubricant specified on the nameplate.

You will receive lubricants for use in the food industry upon request.

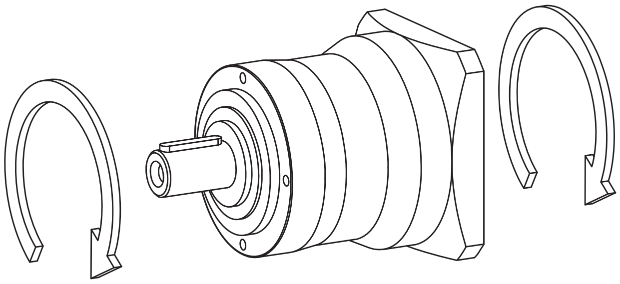
6.5.4 Other product features

Feature	Value
Max. permitted gear unit temperature (on the surface of the gear unit)	≤ 80 °C
Paint	Black RAL 9005
Explosion-proof design in accordance with (ATEX) Directive 2014/34/EU (optional)	Not available
Efficiency:	
η_{get} single-stage	97%
η_{get} two-stage	95%
Protection class:[1]	
Gear unit	IP64
Motor	IP56, optionally IP66

[1] Observe the protection class of all the components.

6.5.5 Direction of rotation

The input and output rotate in the same direction.



6.6 Project configuration

Project your drives using our SERVOsoft designing software. Download SERVOsoft for free at https://www.stoeber.de/en/ServoSoft.

It is the most convenient and reliable method of drive selection, as the entire torque/speed curve of the application is displayed and evaluated here in the curve of the geared motor.

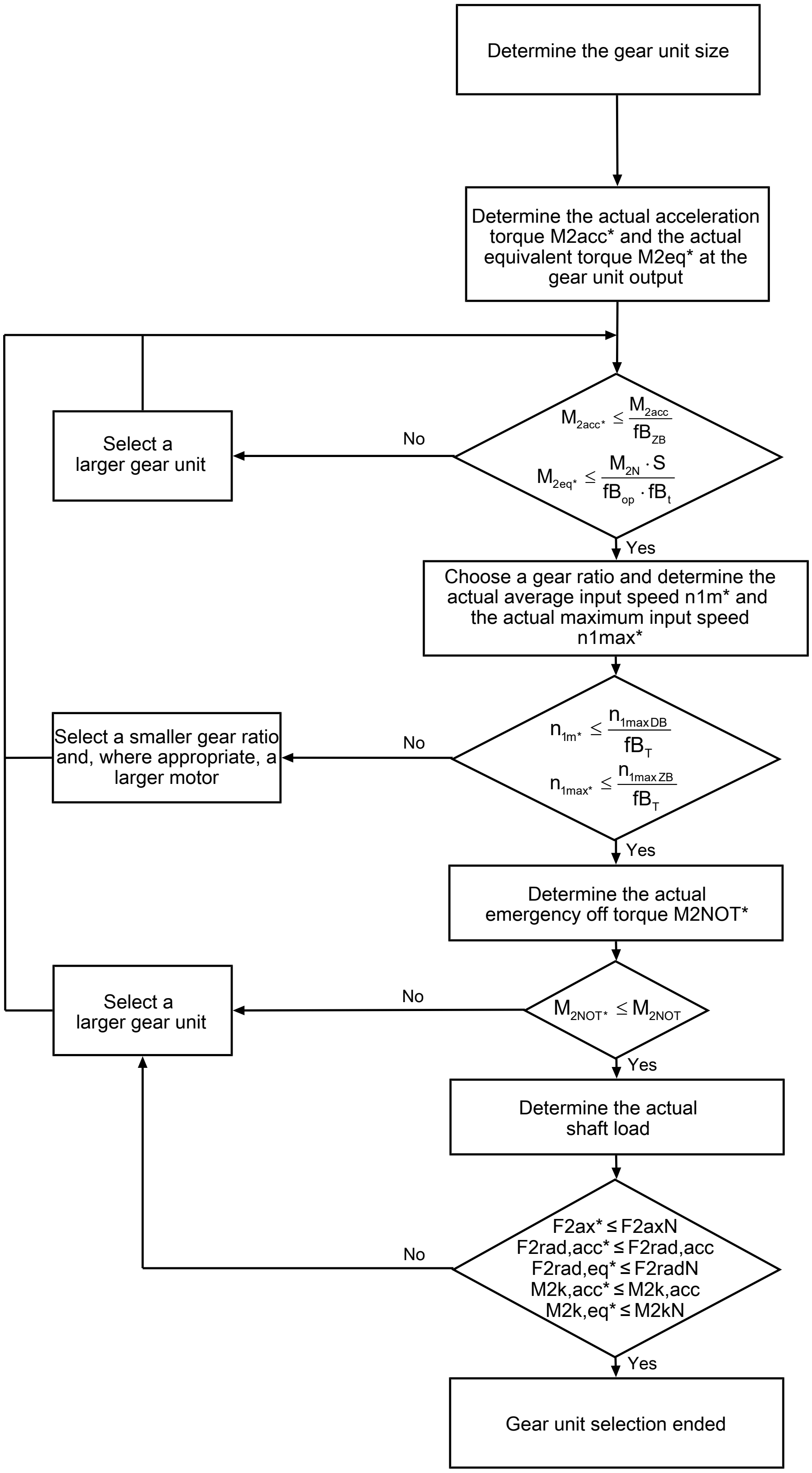
In this chapter, only limit values for specific operating points can be taken into consideration for manual drive selection.

An explanation of the formula symbols can be found in Chapter [▸ 20.1].

The formula symbols for values actually present in the application are marked with *.

6.6.1 Drive selection

Drive selection for gear units

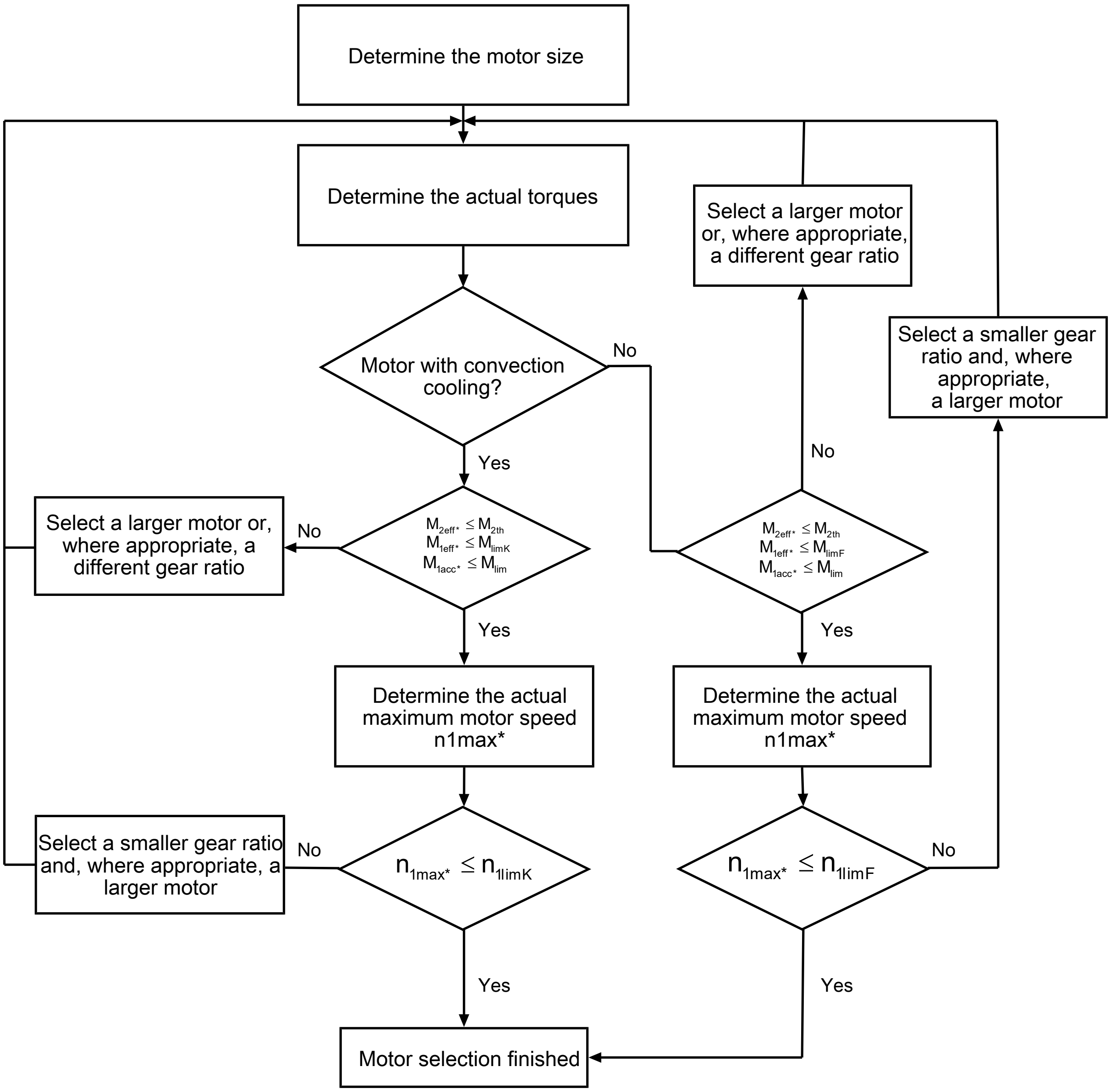


Calculate the forces and tilting torques in the chapter Permitted shaft loads.

Refer to the selection tables for the values for i, n_{1maxDB}, n_{1maxZB}, M_{2acc}, M_{2NOT}, M_{2N} and S.

The values for fB_T, fB_{op}, fB_t and fB_{ZB} can be found in the corresponding tables in this chapter.

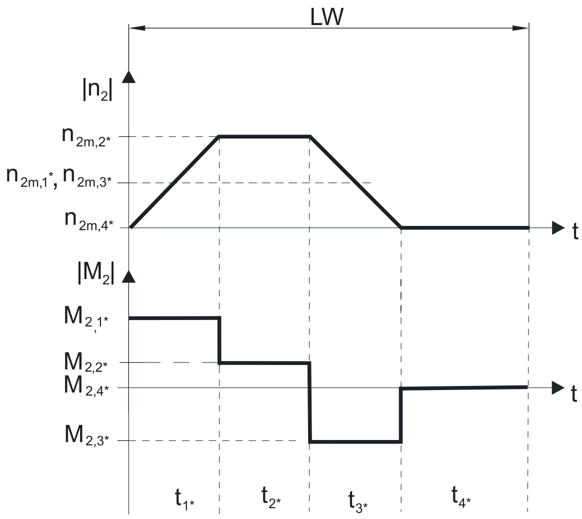
Drive selection for motors



The value for M_{lim}, M_{limK}, M_{limF}, n_{1limK} and n_{1limF} can be found in the motor characteristic curve in the chapter [▹ 17.3]. Note the size, nominal speed n_N and cooling type of the motor.

Example of cyclic operation

The following calculations are based on a representation of the power taken from the output based in accordance with the following example:



Calculation of the actual maximum acceleration torques

$$M_{2acc*} = J_{tot} \cdot \frac{\Delta n_2}{9{,}55 \cdot \Delta t} + M_{L*}$$

$$M_{1acc*} = \frac{M_{2acc*}}{i \cdot \eta_{get}} + J_1 \cdot \frac{\Delta n_1}{9{,}55 \cdot \Delta t}$$

Calculation of the actual average input speed

$$n_{1m*} = n_{2m*} \cdot i$$

$$n_{2m*} = \frac{|n_{2m,1*}| \cdot t_{1*} + \ldots + |n_{2m,n*}| \cdot t_{n*}}{t_{1*} + \ldots + t_{n*}}$$

If t_{1*} + ... + $t_{3*} \geq 6$ min, calculate n_{2m*} without the rest phase t_{4*}.

The values for the ratio i can be found in the selection tables.

Calculation of the actual effective torque

$$M_{2eff*} = \sqrt{\frac{t_{1*} \cdot M_{2,1*}^2 + \ldots + t_{n*} \cdot M_{2,n*}^2}{t_{1*} + \ldots + t_{n*}}}$$

Calculation of the actual emergency-off torque

$$M_{2NOT*} = J_{tot} \cdot \frac{\Delta n_2}{9.55 \cdot \Delta t} + M_{L*}$$

Calculation of the actual equivalent torque

$$M_{2eq*} = \sqrt[3]{\frac{|n_{2m,1*}| \cdot t_{1*} \cdot |M_{2,1*}^3| + \ldots + |n_{2m,n*}| \cdot t_{n*} \cdot |M_{2,n*}^3|}{|n_{2m,1*}| \cdot t_{1*} + \ldots + |n_{2m,n*}| \cdot t_{n*}}}$$

Calculation of the thermal limit torque

Calculate the thermal limit torque M_{2th} for a duty cycle ED_{10} > 50% and the actual average input speed n_{1m*}. (At $K_{mot,th} \leq 0$ you must reduce the average input speed n_{1m*} accordingly or select another geared motor size.)

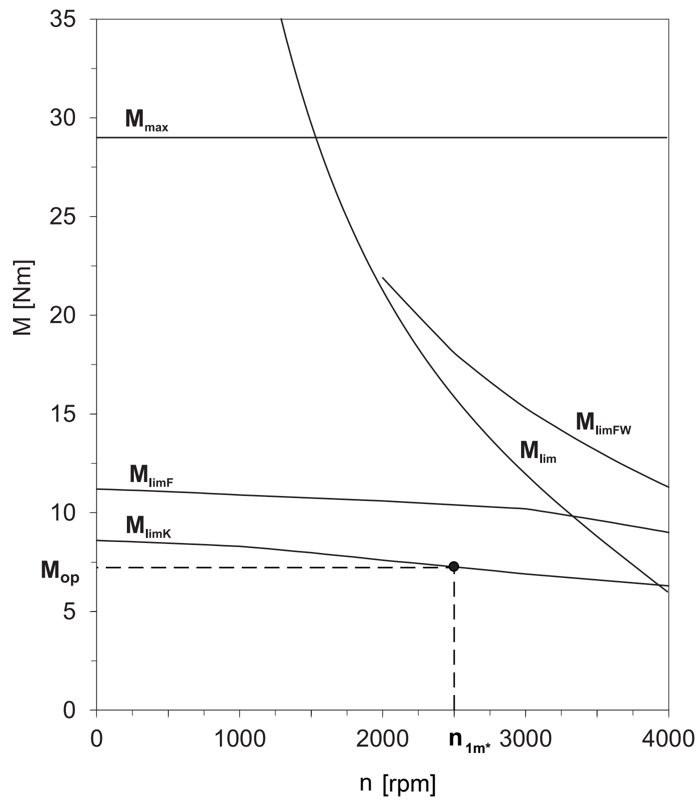
$$M_{2th} = M_{op} \cdot i \cdot K_{mot,th}$$

$$K_{mot,th} = 0{,}95 - \frac{a_{th}}{1000} \cdot fB_T \cdot \left(\frac{n_{1m*}}{1000}\right)^3$$

Refer to the selection tables for the values of i and a_{th}.

The values for fB_T can be found in the corresponding table in this chapter.

The value for the torque of the motor at operating point M_{op} with the determined average input speed n_{1m*} can be found in the motor characteristic curve in the chapter [▹ 17.3]. Note the size, nominal speed n_N and cooling type of the motor. The figure below shows an example of reading the torque M_{op} of a motor with convection cooling at the operating point.



Operating factors

Operating mode	fB_{op}
Uniform continuous operation	1.00
Cyclic operation	1.00
Reversing load cyclic operation	1.00

Run time	fB_t
Daily runtime ≤ 8 h	1.00
Daily runtime ≤ 16 h	1.15
Daily runtime ≤ 24 h	1.20

Cyclic operation	fB_{ZB}
≤ 1000 load changes/hour (LW/h)	1.00
> 1000 load changes/hour (LW/h)	1.15

Temperature		fB_T
Motor cooling	**Surrounding temperature**	
Motor with forced ventilation	≤ 20 °C	0.9
	≤ 30 °C	1.0
	≤ 40 °C	1.15
Motor with convection cooling	≤ 20 °C	1.0
	≤ 30 °C	1.1
	≤ 40 °C	1.25

Notes

- The maximum permitted gear unit temperature (see the "Other product features" chapter) must not be exceeded. Doing so may result in damage to the geared motor.
- For braking from full speed (for example when the power fails or when setting up the machine), note the permitted gear unit torques (M_{2acc}, M_{2NOT}) in the selection tables.

6.6.2 Permitted shaft loads for the output shaft

The values specified in the tables apply to the permitted shaft loads:

- For shaft dimensions in accordance with the catalog
- For output speeds $n_{2m*} \leq 100$ rpm ($F^{2axN} = F_{2ax100}$; $F_{2radN} = F_{2rad100}$; $M_{2kN} = M_{2k100}$)
- Only if radial forces on the gear unit are stabilized by its pilots (housing, flange shaft)

Permitted shaft loads for standard bearing S

Type	z_2 [mm]	F_{2ax100} [N]	$F_{2rad100}$ [N]	$F_{2rad,acc}$ [N]	M_{2k100} [Nm]	$M_{2k,acc}$ [Nm]
PE2	8.0	400	800	800	13	13
PE3	11.0	800	1600	1600	40	40
PE4	13.0	1900	2400	2400	73	73
PE5	16.0	4000	4600	4600	206	206

For other output speeds, download diagrams at https://configurator.stoeber.de/en-US/.

The following applies to output speeds n_{2m*} > 100 rpm:

$$F_{2axN} = \frac{F_{2ax100}}{\sqrt[3]{\frac{n_{2m*}}{100\text{ rpm}}}} \qquad F_{2radN} = \frac{F_{2rad100}}{\sqrt[3]{\frac{n_{2m*}}{100\text{ rpm}}}} \qquad M_{2kN} = \frac{M_{2k100}}{\sqrt[3]{\frac{n_{2m*}}{100\text{ rpm}}}}$$

The values for F_{2ax100}, $F_{2rad100}$ and M_{2k100} can be found in the table "Permitted shaft loads" in this chapter.

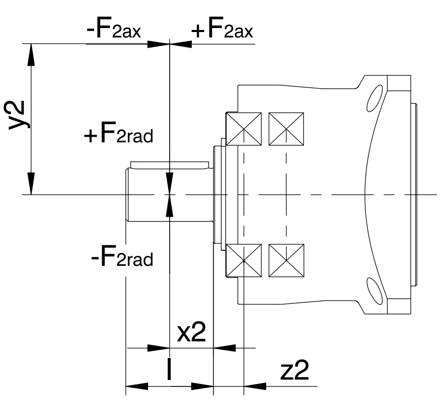


Fig. 1: Force application points

The specified values for $F_{2rad100}$ and $F_{2rad,acc}$ refer to an application of force at the center of the output shaft: $x_2 = l/2$.

Shaft dimensions can be found in the "Dimensional drawings" chapter.

The following applies to other force application points:

$$M_{2k,acc*} = \frac{2 \cdot F_{2ax*} \cdot y_2 + F_{2rad,acc*} \cdot (x_2 + z_2)}{1000}$$

For applications with multiple axial and/or radial forces, you must add the forces as vectors.

In the event of EMERGENCY OFF operation (max. 1000 load changes), you can multiply the permitted forces and torques for F_{2ax100}, $F_{2rad100}$ and M_{2k100} by a factor of two.

Also note the calculation for equivalent values:

$$M_{2k,eq*} = \sqrt[3]{\frac{|n_{2m,1*}| \cdot t_{1*} \cdot |M_{2k,acc,1*}|^3 + \ldots + |n_{2m,n*}| \cdot t_{n*} \cdot |M_{2k,acc,n*}|^3}{|n_{2m,1*}| \cdot t_{1*} + \ldots + |n_{2m,n*}| \cdot t_{n*}}}$$

$$F_{2rad,eq*} = \sqrt[3]{\frac{|n_{2m,1*}| \cdot t_{1*} \cdot |F_{2rad,acc,1*}|^3 + \ldots + |n_{2m,n*}| \cdot t_{n*} \cdot |F_{2rad,acc,n*}|^3}{|n_{2m,1*}| \cdot t_{1*} + \ldots + |n_{2m,n*}| \cdot t_{n*}}}$$

The following apply to the bearing service life L_{10h} ($ED_{10} \leq 40\%$):

$L_{10h} > 10000$ h with $1 < M_{2kN}/M_{2k*} < 1.25$

$L_{10h} > 20000$ h with $1.25 < M_{2kN}/M_{2k*} < 1.5$

$L_{10h} > 30000$ h with $1.5 < M_{2kN}/M_{2k*}$

For different duty cycles:

$$L_{10h} > L_{10h(ED_{10}=40\%)} \cdot \frac{40\%}{ED_{10}}$$

6.6.3 Radial shaft seal rings

Leak-proofness

Our gear units are equipped with high-quality radial shaft seal rings and checked for leaks. However, a leak cannot be fully ruled out over the length of use of a gear unit. If you use a gear unit with goods incompatible with the lubricant, you must take measures to prevent direct contact with the gear unit lubricant in case of a leak.

6.7 Additional documentation

Additional documentation related to the product can be found at http://www.stoeber.de/en/downloads/

Enter the ID of the documentation in the Search term field.

Documentation	ID
Operating manual for PE22 – PE52 planetary gear units and planetary geared motors	443252_en