

Precision Planetary Gearboxes PS Series

Overview

Description

The Helical Planetary Gearboxes incorporate design solutions to provide superior performance for the most demanding high performance applications.

The PS gearboxes incorporate dual angular contact bearings providing higher radial load capacities while maintaining high input speeds. The construction comprise among others, needle bearings to ensure a longer lifetime. An optimized gearing geometry provides the basis for the universal mounting position. Common mounting kits promote quicker deliveries and ease of mounting to any servo motor.

Mounting to any servo motor is as easy as A-B-C (adapter, bushing, collet).



Features

- **High radial load capacity:**
Angular contact output bearings
- **Increased service life:**
Needle bearings
- **Life time lubrication**
- **Mounting Kits:**
Quicker deliveries and easier mounting
- **High nominal torque and low backlash:**
Helical planetary gearing
- **High wear resistance:**
Plasma Nitriding heat treating

Technical Characteristics - Overview

| Series | Unit | PS |
|----------------------------|----------------------|-------------------|
| Gear geometry | | Helical Planetary |
| Type | | In-Line |
| Frame sizes | [mm] | 60, 90, 115, 142 |
| Maximum input speed | [min ⁻¹] | up to 6000 |
| Nominal torque | [Nm] | 27...430 |
| Max. Radial force | [N] | 10 000 |
| Life | [h] | 20 000 |
| Backlash | [arcmin] | up to <3 |

Technical Characteristics

| Parameter | Unit | Ratio ⁽⁸⁾ | PS60 | PS90 | PS115 | PS142 |
|---|----------------------|--|------------------------------|------|-------|-------|
| Nominal output torque ⁽¹⁾ $T_{nom r}$ | [Nm] | 3 , 15, 30 | 27 | 76 | 172 | 300 |
| | | 4, 5 , 7, 20 , 25, 40, 50 , 70 | 37 | 110 | 230 | 430 |
| | | 10 , 100 | 32 | 93 | 205 | 310 |
| Maximum acceleration torque $T_{acc r}$ | [Nm] | 3 , 15, 30 | 34 | 105 | 225 | 450 |
| | | 4, 5 , 7, 20 , 25, 40, 50 , 70 | 48 | 123 | 285 | 645 |
| | | 10 , 100 | 37 | 112 | 240 | 465 |
| Emergency stop output torque ⁽²⁾ $T_{em r}$ | [Nm] | 3 , 15, 30 | 80 | 260 | 600 | 1100 |
| | | 4, 5 , 7, 20 , 25, 40, 50 , 70 | 70 | 230 | 500 | 970 |
| | | 10 , 100 | 60 | 200 | 430 | 830 |
| Nominal drive speed $N_{nom r}$ | [min ⁻¹] | 3 | 3000 | 2500 | 2000 | 1500 |
| | | 4, 5 | 3500 | 3000 | 2500 | 2000 |
| | | 7, 10 , 15 | 4000 | 3500 | 3000 | 2500 |
| | | 20 , 25, 30 | 4500 | 4000 | 3500 | 3000 |
| | | 40, 50 | 4800 | 4400 | 3800 | 3200 |
| | | 70, 100 | 5200 | 4800 | 4200 | 3600 |
| Maximum input speed $N_{max r}$ ⁽³⁾ | [min ⁻¹] | 3...100 | 6000 | 5500 | 4500 | 4000 |
| Maximum radial force $P_{r max}$ ⁽⁴⁾ | [N] | | 1650 | 4800 | 7500 | 10000 |
| Maximum axial load $P_{a max}$ ⁽⁵⁾ | [N] | | 2100 | 3600 | 6800 | 8800 |
| Life | [h] | | 20000 (lifetime lubrication) | | | |
| Backlash - standard ⁽⁶⁾ | [arcmin] | 3...10 (1 step) | <6 | <6 | <4 | <4 |
| | | 15...100 (2 step) | <8 | <8 | <6 | <6 |
| Backlash - reduced ⁽⁶⁾ | [arcmin] | 3...10 (1 step) | <4 | <4 | <3 | <3 |
| | | 15...100 (2 step) | <6 | <6 | <5 | <5 |
| Efficiency at nominal torque | % | 3...10 | 97 | 97 | 97 | 97 |
| | | 15...100 | 94 | 94 | 94 | 94 |
| Noise level at 3000 min⁻¹ ⁽⁷⁾ | [db] | 3...100 | <62 | <62 | <65 | <66 |
| Torsional rigidity | [Nm/arcmin] | 3...100 | 3 | 12 | 27 | 50 |
| Operating temperature | [°C] | 3...100 | -20...90 | | | |
| Lubrication | | 3...100 | Lifetime lubrication | | | |
| Orientation | | 3...100 | any | | | |
| Direction of Rotation | | 3...100 | same as input | | | |
| Enclosure rating | | | IP65 | | | |
| Rotor inertia | | | see page 20 | | | |
| Weight | [kg] | 3...10 | 1.3 | 3.0 | 7.0 | 14.0 |
| | | 15...100 | 1.7 | 5.0 | 10.0 | 20.0 |

⁽¹⁾ At nominal speed $N_{nom r}$.

⁽²⁾ Maximum of 1000 stops.

⁽³⁾ Cycle mode.

⁽⁴⁾ Max. radial load applied to the center of the shaft at 100 min⁻¹

⁽⁵⁾ Max. axial load at 100 min⁻¹.

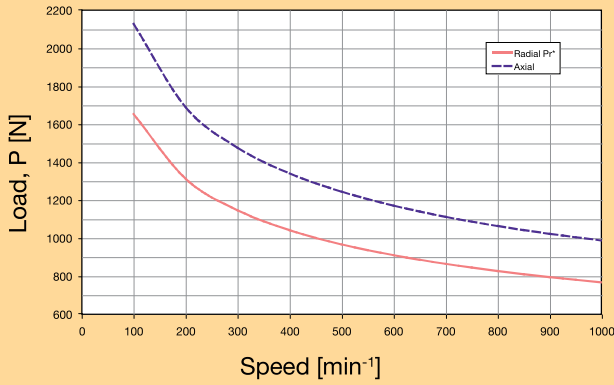
⁽⁶⁾ Measured at 2 % of rated torque.

⁽⁷⁾ Measure at 1 m.

⁽⁸⁾ Gearboxes in bold print - ratios with standard reversing play are on stock. (for PS60 to PS115 only)

Load on Input Shaft

PS60

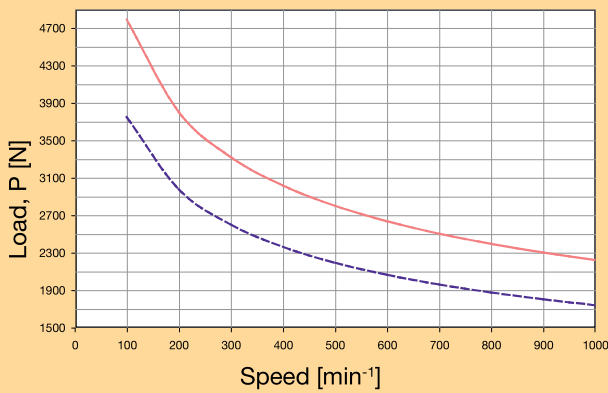


— Radial Pr*
- - Axial

Formulas to calculate radial load (Prx) at any distance "X" from the gearbox mounting surface:

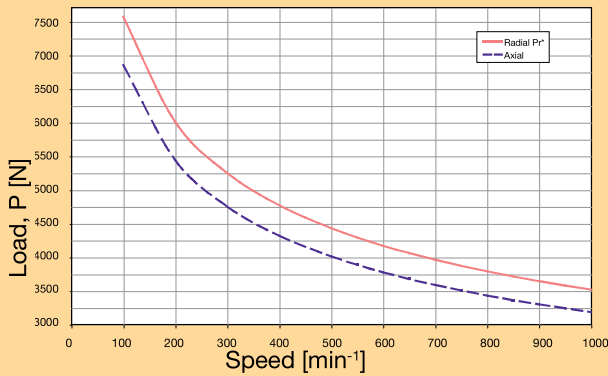
$$Pr_x = Pr * 75 \text{ mm} / (49 \text{ mm} + X)$$

PS90



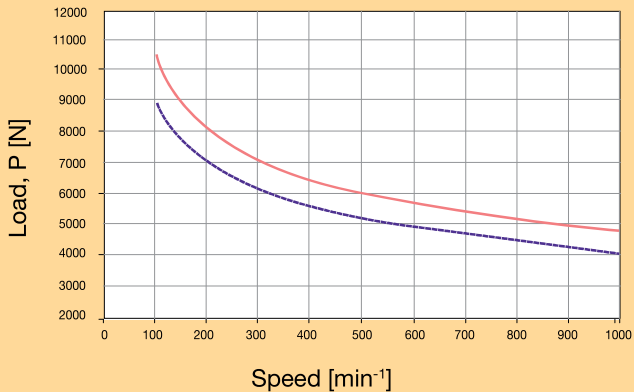
$$Pr_x = Pr * 96 \text{ mm} / (62 \text{ mm} + X)$$

PS115



$$Pr_x = Pr * 124 \text{ mm} / (81 \text{ mm} + X)$$

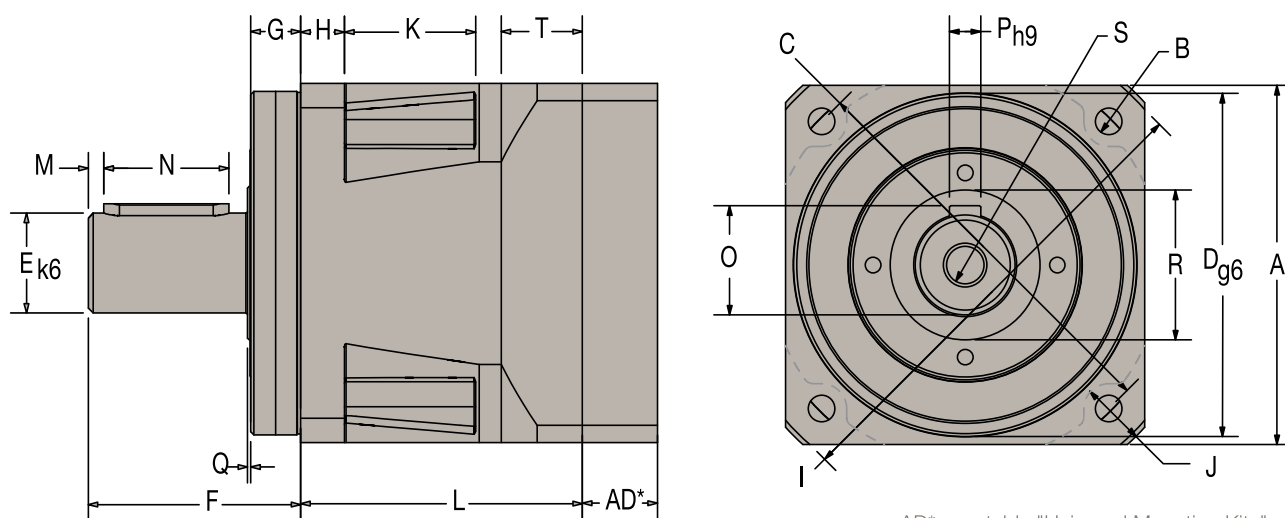
PS142



$$Pr_x = Pr * 156 \text{ mm} / (93 + X)$$

* Radial load applied to center of the shaft.

Dimensions



AD*: see table "Universal Mounting Kits"

| Frame size | All dimensions in mm | PS60 | PS90 | PS115 | PS142 |
|------------|--------------------------------|------|-------|--------|--------|
| A | Flange cross section | 62 | 90 | 115 | 142 |
| B | Fixing bore | 5.5 | 6.5 | 8.5 | 11.0 |
| C | Bolt circle | 70 | 100 | 130 | 165 |
| D | Motor pilot Ø | 50 | 80 | 110 | 130 |
| E | Drive shaftØ | 16 | 22 | 32 | 40 |
| F | Drive shaft length | 40 | 52 | 68 | 102 |
| G | Motor pilot depth | 11 | 15 | 16 | 20 |
| H | Flange width | 8 | 10 | 14 | 15 |
| I | Ø Housing | 80 | 116 | 152 | 185 |
| J | Housing recess | 5 | 6.5 | 7.5 | 10.0 |
| K | Recess length | 24 | 33 | 42 | 45 |
| L1 | Length single stage | 59.8 | 69.5 | 90.2 | 103.7 |
| L2 | Length double stage | 94.8 | 113 | 143.4 | 170.7 |
| M | Distance from shaft end | 2 | 3 | 5 | 5 |
| N | Keyway length | 25 | 32 | 40 | 63 |
| O | Key height | 18 | 24.5 | 35 | 43 |
| P | Keyway width | 5 | 6 | 10 | 12 |
| Q | Collar height | 1 | 1 | 1.5 | 2.5 |
| R | Collar Ø | 22 | 35 | 50 | 78 |
| S | Center bore (shaft end) | M5x8 | M8x16 | M12x25 | M16x32 |
| T | Width of flange on output side | 20.5 | 20 | 26 | 31 |

Universal Mounting Kits

Adapter length "AD" dimension

| Frame size | Motor shaft length [mm] | Gearbox adapter length [mm] |
|------------|----------------------------|--------------------------------|
| 60 | 16...35 | 16.5 |
| | 35.1...41 | 22.5 |
| 90 | 20...40 | 20 |
| | 40.1...48 | 28.5 |
| 115 | 22...50 | 24 |
| | 50.1...61 | 35 |
| 142 | 26...62 | 30 |
| | 62.1...82 | 50 |

PS: Rotor Inertia

All rotor inertias refer to the gearbox input

| Ratio | Unit | PS60 | PS90 | PS115 | PS142 |
|---------------------|----------------------|------|------|-------|-------|
| 3 | [kgmm ²] | 25 | 97 | 340 | 1480 |
| 4 | [kgmm ²] | 17 | 67 | 220 | 980 |
| 5 | [kgmm ²] | 15 | 51 | 170 | 700 |
| 7 | [kgmm ²] | 14 | 41 | 130 | 530 |
| 10 | [kgmm ²] | 14 | 37 | 110 | 440 |
| 15 | [kgmm ²] | 15 | 52 | 170 | 640 |
| 20 | [kgmm ²] | 15 | 51 | 170 | 640 |
| 25 | [kgmm ²] | 15 | 51 | 170 | 640 |
| 30, 40, 50, 70, 100 | [kgmm ²] | 13 | 37 | 110 | 420 |

Adapter Flange / Motor - Dimensions (Gear Unit Input Side)

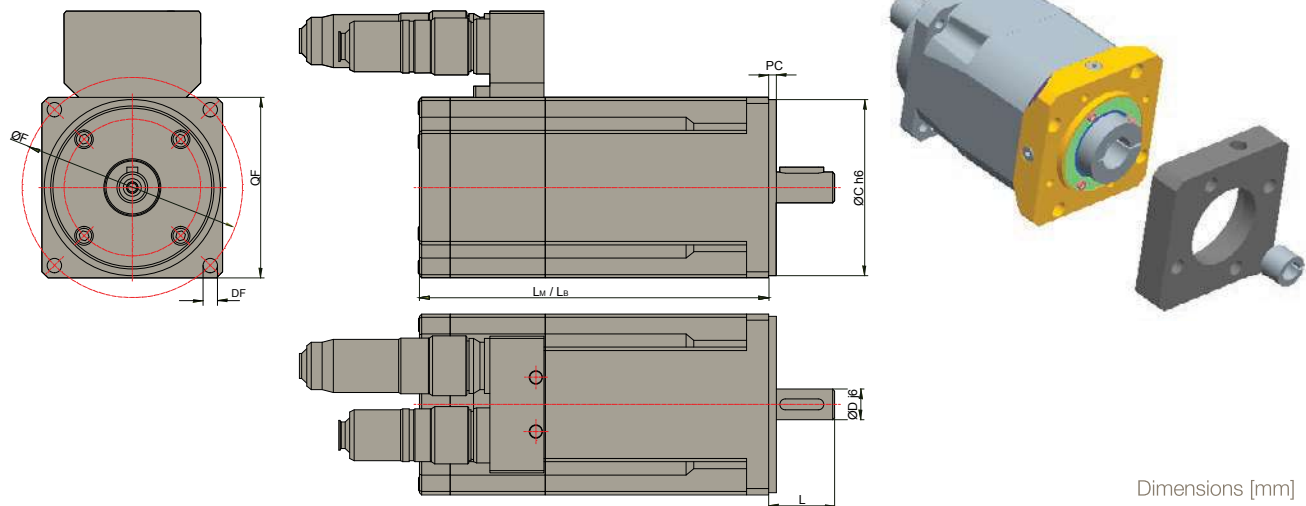
| Motor ⁽¹⁾ | Flange Type | Motor flange | Flange depth | Bolt circle Ø | Bore Ø | Pilot Ø | Pilot depth | Shaft Ø | Shaft length | Adapter flange | | |
|----------------------|-------------|--------------|--------------|---------------|--------|---------|-------------|---------|--------------|----------------|------------------|---------------------------|
| | | QF | PC | F | DF | C | S | D | L | Order No. | Fastening thread | AD ⁽²⁾ (short) |
| SM_60,###,##,5,11,S | B5 | 70 | 7 | 75 | 6 | 60 | 2.5 | 11 | 23 | MU60-001 | M5 | 16.5 |
| M_70,###,##,5,11,S | B5 | 70 | 7 | 75 | 6 | 60 | 2.5 | 11 | 23 | MU60-001 | M5 | 16.5 |
| NX320 | | 56 | 8.5 | 75 | 5.5 | 60 | 2.5 | 11 | 23 | MU60-001 | M5 | 16.5 |
| M_56,###,##,5,9,S | B5 | 56 | 6.5 | 63 | 5.5 | 40 | 2.5 | 9 | 20 | MU60-003 | M5 | 16.5 |
| SM_60,###,##,8,9,S | B5 | 60 | 7 | 63 | 5.5 | 40 | 2.5 | 9 | 20 | MU60-003 | M5 | 16.5 |
| SY56# | Nema23 | 56.5 | 4.83 | 66.67 | 5.3 | 38.1 | 1.6 | 6.35 | 25.4 | MU60-005 | M5 | 16.5 |
| M_56,###,##,5,11,S | B5 | 56 | 6.5 | 63 | 5.5 | 40 | 2.5 | 11 | 23 | MU60-254 | M5 | 16.5 |
| NX205/210 | | 56 | 7.2-18 | 63 | 5.5 | 40 | 2.5 | 11 | 25 | MU60-254 | M5 | 16.5 |
| NX110 | | 42.5 | 6 | 50 | 3.2 | 30 | 2.5 | 9 | 25 | MU60-255 | M3 | 16.5 |
| SM_82,###,##,8,14,S | B8 | 82 | 10 | 100 | 6.5 | 80 | 3.5 | 14 | 30 | MU60-321 | M6 | 16.5 |
| SM_82,###,##,8,14,S | B8 | 82 | 10 | 100 | 6.5 | 80 | 3.5 | 14 | 30 | MU90-001 | M6 | 20 |
| SM_82,###,##,8,19,S | B8 | 82 | 10 | 100 | 6.5 | 80 | 3.5 | 19 | 40 | MU90-085 | M6 | 20 |
| NX420/430 | | 91.5 | 10.5 | 100 | 7 | 80 | 3 | 19 | 40 | MU90-085 | M6 | 20 |
| M_105,###,##,5,19,S | B5 | 105 | 10 | 115 | 9.5 | 95 | 3.5 | 19 | 40 | MU90-088 | M9 | 20 |
| SM_100,###,##,5,19,S | B5 | 100 | 10 | 115 | 9 | 95 | 3.5 | 19 | 40 | MU90-088 | M8 | 20 |
| SM_115,###,##,8,19,S | B8 | 115 | 10 | 130 | 9 | 95 | 3.5 | 19 | 40 | MU90-345 | M8 | 20 |
| M_105,###,##,5,24,S | B5 | 105 | 10 | 115 | 9.5 | 95 | 3.5 | 24 | 50 | MU115-005 | M8 | 24 |
| SM_100,###,##,5,24,S | B5 | 100 | 10 | 115 | 9 | 95 | 3.5 | 24 | 50 | MU115-005 | M8 | 24 |
| SM_115,###,##,8,19,S | B8 | 115 | 10 | 130 | 9 | 95 | 3.5 | 19 | 40 | MU115-006 | M8 | 24 |
| M_105,###,##,6,24,S | B6 | 105 | 10 | 130 | 9 | 110 | 3.5 | 24 | 50 | MU115-010 | M8 | 24 |
| SM_115,###,##,7,24,S | B7 | 130 | 10 | 130 | 9 | 110 | 3.5 | 24 | 50 | MU115-010 | M8 | 24 |
| NX620/630 | | 121 | 10.5 | 130 | 9 | 110 | 3.5 | 24 | 50 | MU115-010 | M8 | 24 |
| SM_82,###,##,8,14,S | B8 | 82 | 10 | 100 | 6.5 | 80 | 3.5 | 14 | 30 | MU115-015 | M6 | 24 |
| SM_115,###,##,5,24,S | B5 | 145 | 10 | 165 | 11 | 130 | 3.5 | 24 | 50 | MU115-026 | M10 | 24 |
| SM_142,###,##,5,24,S | B5 | 145 | 10 | 165 | 11 | 130 | 3.5 | 24 | 50 | MU115-026 | M10 | 24 |
| SM_82,###,##,5,19,S | B5 | 100 | 10 | 115 | 9 | 95 | 3.5 | 19 | 40 | MU115-039 | M8 | 24 |
| SM_100,###,##,5,19,S | B5 | 100 | 10 | 115 | 9 | 95 | 3.5 | 19 | 40 | MU115-039 | M8 | 24 |
| SM_82,###,##,8,19,S | B8 | 82 | 10 | 100 | 6.5 | 80 | 3.5 | 19 | 40 | MU115-089 | M6 | 24 |
| SM_115,###,##,8,24,S | B8 | 115 | 10 | 130 | 9 | 95 | 3.5 | 24 | 50 | MU115-257 | M8 | 24 |
| M_105,###,##,9,24,S | B9 | 96 | 10 | 100 | 7 | 80 | 3.5 | 24 | 50 | MU115-269 | M6 | 24 |
| SM_170,###,##, ,38,S | B5 | 170 | 8 | 215 | 14 | 180 | 4 | 38 | 80 | MU142-40410 | M12 | 53 |
| MH205,###,##, ,38,S | B5 | 205 | 8 | 215 | 14 | 180 | 4 | 38 | 80 | MU142-40410 | M12 | 53 |

For motors not shown in the list please contact Parker

⁽¹⁾ MB/SMB: for drives TPDM, SLVDN,

MH/SMH: for drives Compax3, PSD

⁽²⁾ AD: Adapter length (please refer to the "dimensions" chapter)



Gearbox Sizing

Parker has prepared the following procedure to provide a quick method for selecting a gearbox.

1) Application parameters:

- Acceleration time (t_{acc})
- Continuous run time (t_{cont})
- Deceleration time (t_{dec})
- Dwell time (t_{dwell})
- Acceleration torque (T_{acc})
- Continuous torque (T_{cont})
- Deceleration torque (T_{dec})

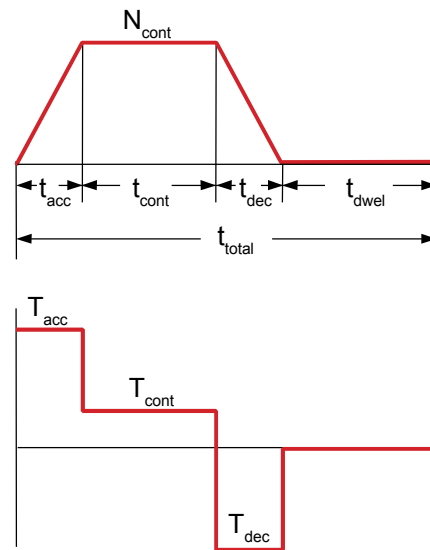
- Application speed (N_{cont})
- Transmission ratio (i)
- Gearbox nominal torque ($T_{nom r}$)
- Max. permissible acceleration torque ($T_{acc r}$)
- Percentage of acceleration torque vs. continuous cycle time (t_{total})
- Max. input speed ($N_{max r}$)

2) Duty cycle:

$$\text{Duty cycle} = \frac{t_{acc} + t_{cont} + t_{dec}}{t_{total}} \times 100 \%$$

If duty cycle is <60 % and ($t_{acc} + t_{cont} + t_{dec}$) is less than 20 minutes, the motion is considered to be intermittent.

If duty cycle is <60 % and ($t_{acc} + t_{cont} + t_{dec}$) is more than 20 minutes, the motion is considered to be continuous.



3) For Cycle mode applies:

Determine T_{acc} % of ($T_{acc} + T_{cont} + T_{dec}$):

$$\frac{T_{acc}}{T_{acc} + T_{cont} + T_{dec}} \times 100\%$$

Define the ratio: T_{cont} / T_{acc}

Use the table to select the load factor K.

Compare Accel/Decel torque to the maximum permissible accel torque of the gearbox $T_{acc r}$: $T_{acc} < T_{acc r} \times K$, if not, please select a more suitable gearbox.

Compare the required maximum speed to the maximum rated speed of the gearbox.
 $N_{max} < N_{max r / i}$ (i-gearbox ratio)

Table: Load Factor K

| T_{acc} % | $0 < T_{cont} / T_{acc} < 0.25$ | $0.25 < T_{cont} / T_{acc} < 0.5$ |
|-------------|---------------------------------|-----------------------------------|
| 10-15 | 1.0 | 1.0 |
| 15-20 | 1.0 | 0.95 |
| 20-25 | 0.94 | 0.89 |
| 25-30 | 0.88 | 0.84 |
| 30-35 | 0.81 | 0.79 |
| 35-40 | 0.76 | 0.75 |
| 40-45 | 0.71 | 0.70 |
| 45-50 | 0.66 | 0.66 |

4) For continuous operation applies:

$$T_{nom} < T_{nom r}$$

$$N_{nom} < N_{nom r} / i$$

5) Check the Emergency Stop Torque Rating.

6) Verify Radial and Axial Shaft Load of the Application for the selected Gearbox.

Order Code

PS Gearboxes

| | | | | | | | | | |
|---------------|----|----|---|-----|---|---|---|---|----------|
| | 1 | 2 | | 3 | | 4 | 5 | | 6 |
| Order example | PS | 60 | - | 003 | - | S | 2 | / | MU60-088 |

1 Gearbox type

- **PS** Gearbox for in-line mounting

2

- **60** Flange 60
- **90** Flange 90
- **115** Flange 115
- **142** Flange 142

3 Ratio

| | | |
|------------|-----|---|
| 003 | 3 | ● |
| 004 | 4 | |
| 005 | 5 | ● |
| 007 | 7 | |
| 010 | 10 | ● |
| 015 | 15 | |
| 020 | 20 | ● |
| 025 | 25 | |
| 030 | 30 | |
| 040 | 40 | |
| 050 | 50 | ● |
| 070 | 70 | |
| 100 | 100 | |

4 Reverse play / orientation

- **S** Standard
- **L** Reduced

5 Series

- **2** Gen 2 Gearboxes

● On stock, short delivery times

PS gearboxes generally come with a keyway

6 Adapter flange / Motor assignment

| | |
|--------------------|--|
| ● MU60-001 | SMH60,###,##,5,11,S MH70,###,##,5,11,S NX3 |
| ● MU60-003 | MH56,###,##,5,9,S SMH60,###,##,8,9,S |
| MU60-005 | SY56 |
| ● MU60-254 | MH56,###,##,5,11,S NX2 |
| ● MU60-255 | NX1 |
| ● MU60-321 | SMH,###,##,8,14,S |
| ● MU90-001 | SMH82,###,##,8,14,S |
| ● MU90-085 | SMH82,###,##,8,19,S NX4 |
| ● MU90-088 | MH105,###,##,5,19,S SMH100,###,##,5,19,S |
| MU90-345 | SMH115,###,##,8,19,S |
| ● MU115-005 | MH105,###,##,5,24,S SMH100,###,##,5,24,S |
| ● MU115-006 | SMH115,###,##,8,19,S |
| ● MU115-010 | MH105,###,##,6,24,S SMH115,###,##,7,24,S NX6 |
| MU115-015 | SMH82,###,##,8,14,S |
| ● MU115-026 | SMH115,###,##,5,24,S SMH142,###,##,5,24,S |
| ● MU115-039 | SMH82,###,##,5,19,S SMH100,###,##,5,19,S |
| ● MU115-089 | SMH82,###,##,8,19,S |
| MU115-257 | SMH115,###,##,8,24,S |
| ● MU115-269 | MH105,###,##,9,24,S |
| MU142-40410 | SM_170,###,##,38,S MH205,###,##,38,S |
| MUxxx-yyy | Additional motors |