Gearbox Technical

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# General Specifications

**$T_{2n}$** Torque figures are maximum torque at gearbox output based on S1 continuous duty cycle at 20ºc ambient temperature at $n_1$ 1000 min$^{-1}$ (r/min).

**$T_{2b}$** is 1.5 x T2n Max Acceleration Deceleration Torque (Max <1000 Load Cycles per 60min more than this would require using a factor to lower.)

**$T_{2not}$** is 3 x T2n Emergency Stop Torque (Max 1000 Cycles in lifetime of unit)

S4/S5 Cyclic operation at ED <60% or EZ <20min

ED = Duty % out of total cycle. If ED60% would be 40% at zero speed 60% at speed.

TC = Time in min at speed in cycle.

Max operating temp of gearbox with grease approx 60°c while at speed.

Max operating temp of gearbox with oil approx 80°c while at speed.

IEC 60034-1

If your design goes higher than the torque for the unit, please select a larger unit.

We can maufacture specials and to design using our KISSsoft® & Gleason GEMS® design suites.

Figures are to be used for guidance only and are to help with initial selection. You will need to assess duty, cycles and confirm gearbox suitability with your own calculations & trial in application.

**Keyways and Bores -**

Bores are toleranced to H7 ISO 286 as standard unless stated. Keyways Js9 for DIN 6885 keys normally h9 with sliding fit.

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

$$P_1 = \frac{T_1 \, x \, n_1}{9550}$$

$$T_1 = \frac{T_{required}}{i} \, x \, \frac{100}{\eta z}$$

$T_{2n} > T_{required} \, x \, K_a$

*Application factor $K_a$*

$i$ [u] = *Gear Ratio*
$n_1$ = *Input speed min$^{-1}$ (r/min)*
$n_2$ = *Output speed min$^{-1}$ (r/min)*
$T_1$ = *Input torque (Nm)*
$T_{2n}$ = *Nominal Output torque (Nm)*
$P_1$ = *Input Power (kW)*
$\eta z$ = *Meshing Efficiency (%)*
$T_{required}$ = *Torque to drive application (Nm)*

*DIN 3990 ISO 6336 Application factor $K_a$*

| Working characteristics of driving machine | Working characteristics of driven machine: Uniform | Light Shocks | Moderate Shocks | Heavy Shocks |
|---|---|---|---|---|
| Uniform | 1.00 | 1.25 | 1.50 | 1.75 |
| Light Shocks | 1.10 | 1.35 | 1.60 | 1.85 |
| Moderate Shocks | 1.25 | 1.50 | 1.75 | 2.00 |
| Heavy Shocks | 1.50 | 1.75 | 2.00 | 2.25+ |

# Inertia

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$T_a = J \times \alpha$

$\alpha = \frac{\omega_2 - \omega_1}{t}$

$J_T = J_m + \frac{J_L}{i^2 \times \eta}$

$T_a$ = *Acceleration torque (Nm)*
$J$ = *Inertia (kg.m²)*
$J_T$ = *Total reflected inertia at gearbox input (kg.m²)*
$J_m$ = *Reflected inertia of gearbox (kg.m²)*
$J_L$ = *Inertia of load (kg.m²)*
$t$ = *Acceleration time (sec)*
$i$ = *Ratio*
$\alpha$ = *Angular acceleration (rads/sec²)*
$\omega$ = *Angular/Rotational Velocity (rads/sec)*
$\eta$ = *Efficiency (%)*

**Example:**
Assume a 3:1 ratio, 90% efficient gearbox with a reflected inertia of 0.00052kg•m².
Torque required at output to drive load is 1Nm

If we were to accelerate the gearbox from rest to 500 rpm in 1.5 seconds the acceleration would be as follows:
500 rpm = (360 ° x 500 ) $min^{-1}$ = 180000° $min^{-1}$
180000° $min^{-1}$ = (180000 ° / 60) $s^{-1}$ = 3000° $s^{-1}$
3000 °•$s^{-1}$ = ($\pi$/180) * 3000 = 52.36 rad•$s^{-1}$
So, acceleration = 52.36/1.5 = 34.91 rad•$s^{-2}$

Input torque to accelerate gearbox = 0.00052 x 34.91 = 0.01815Nm

If a load with inertia $J_L$ was put on the gearbox output of 0.0062 kg.m² the total inertia at the gearbox input would become 0.00053kg.m²

| | | |
|---|---|---|
| New input torque to accelerate gearbox | = 0.00053 x 34.91 | = 0.01850Nm |
| Input torque to drive load | = (1/3 x 100/90) | = 0.37037Nm |
| Total input torque required at start up | = 0.37037 + 0.01850 | = 0.38887Nm ≈ 0.39Nm |

A margin needs to be added to account for inertia of connecting shafts/couplings, motor rotor inertia and friction from bearings and other elements.

| | | |
|---|---|---|
| 1 radian (rad) | = 57.5928° | $1.0 \times 10^{-2} = 0.01$ |
| 1 kg m² | = 10,000 kg cm² | $1.0 \times 10^{-3} = 0.001$ |
| 1 kg m² | = 1,000,000,000 g mm² | $1.0 \times 10^{-4} = 0.0001$ |
| 1 m² | = 1,000,000 mm² | $1.0 \times 10^{-5} = 0.00001$ |
| 1 m² | = 10,000 cm² | $1.0 \times 10^{-6} = 0.000001$ |
| | | $1.0 \times 10^{-7} = 0.0000001$ |


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# Bearing Loads

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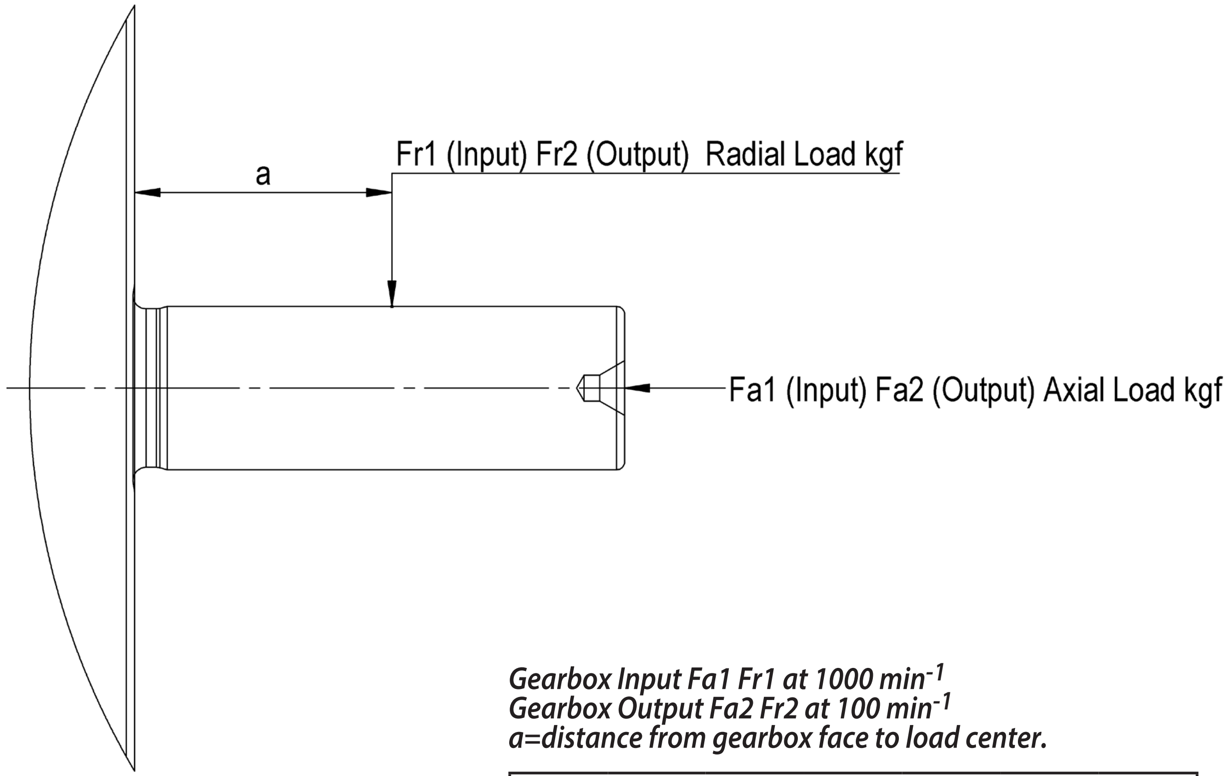


*Gearbox Input Fa1 Fr1 at 1000 min$^{-1}$*
*Gearbox Output Fa2 Fr2 at 100 min$^{-1}$*
*a=distance from gearbox face to load center.*

| | | a | Fr2 N | Fa2 N | Fr1 N | Fa1 N |
|---|---|---|---|---|---|---|
| P15 | PF15 | 10 | 80 | 30 | 10 | - |
| P20 | PF20 | 10 | 120 | 50 | 20 | - |
| P30 | PF30 | 12 | 200 | 120 | 30 | - |
| P40 | PF/PFN40 | 15 | 300 | 200 | 50 | - |
| P45 | PF45 | 20 | 450 | 300 | 60 | - |
| P55 | PF55 | 20 | 600 | 400 | 140 | - |
| P60 | PF60 | 25 | 700 | 500 | 160 | - |
| P70 | PF70 | 30 | 800 | 600 | 200 | - |
| P80 | | 150 | 2000 | 5000 | 250 | - |
| P85 | | 150 | 3500 | 7000 | 900 | - |
| | | | | | | |
| HRHC28 | | 20 | 600 | 400 | 200 | 100 |
| | | | | | | |
| PP35 | | 12 | 120 | 100 | 60 | |
| PP50 | | 20 | 300 | 200 | 100 | |
| PP60 | | 25 | 450 | 300 | 150 | |
| | | | | | | |
| E15 | | 6 | 150 | 100 | 150 | 100 |
| E20 | | 6 | 150 | 100 | 150 | 100 |
| E30 | | 10 | 200 | 150 | 200 | 150 |
| E40 | | 12 | 400 | 300 | 400 | 300 |
| E50 | | 20 | 600 | 400 | 600 | 400 |
| E60 | | 25 | 800 | 500 | 800 | 500 |
| E70 | | 30 | 1100 | 600 | 1100 | 600 |
| | | | | | | |
| BLH20 | BLHT20 | 6 | 10 | 5 | 10 | - |
| BLH30 | BLHT30 | 10 | 30 | 20 | 30 | - |
| BLH40 | BLHT40 | 12 | 60 | 50 | 60 | 50 |
| BLH50 | BLHT50 | 20 | 200 | 100 | 200 | 100 |
| BLH60 | BLHT60 | 25 | 300 | 150 | 300 | 150 |
| BLH70 | BLHT70 | 30 | 500 | 200 | 500 | 200 |
| | | | | | | |



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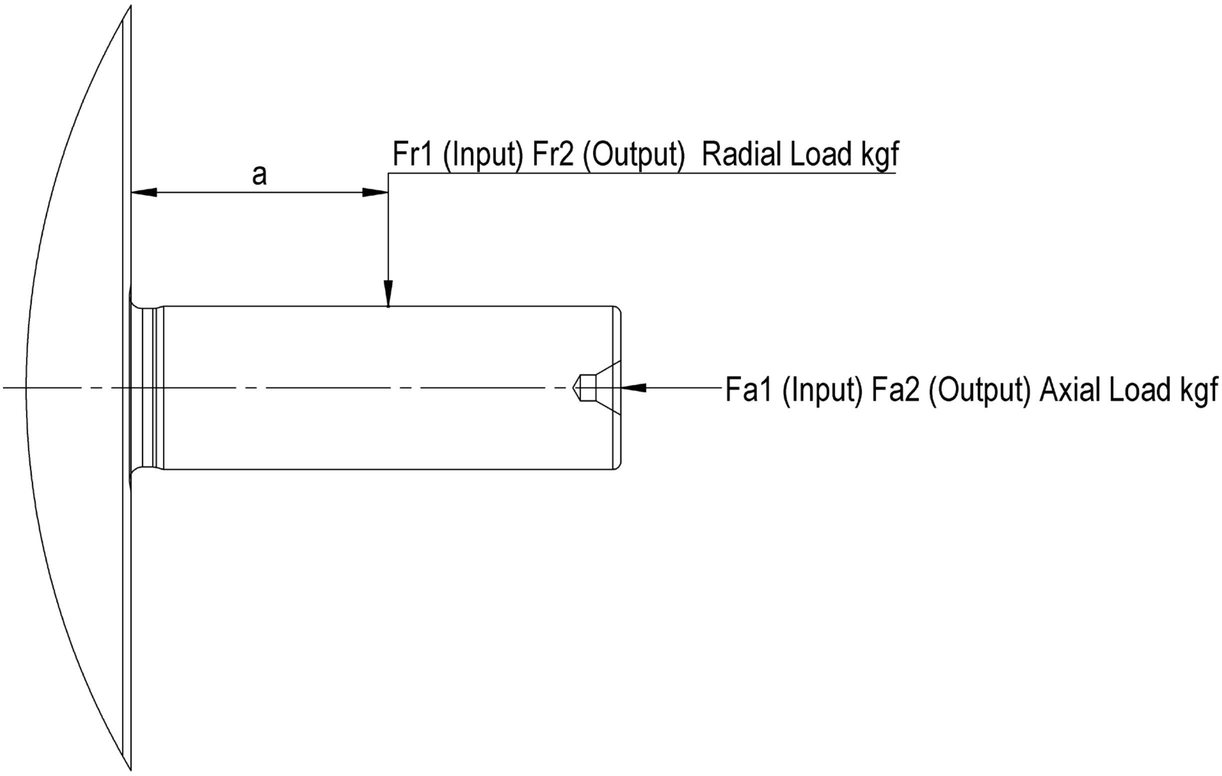
# Bearing Loads




*Gearbox Input Fa1 Fr1 at 1000 min$^{-1}$*
*Gearbox Output Fa2 Fr2 at 100 min$^{-1}$*
*a=distance from gearbox face to load center.*
** = see product page for where a is from.*

| | | a | Fr2 N | Fa2 N | Fr1 N | Fa1 N |
|---|---|---|---|---|---|---|
| RGB125 | | 50 | 1000 | 500 | - | - |
| | | | | | | |
| EHD04 | | 10 | 200 | 150 | - | - |
| EDH06 | | 10 | 250 | 150 | - | - |
| EHD08 | | 12 | 300 | 200 | - | - |
| EHD12 | | 20 | 600 | 600 | - | - |
| EHD16 | | 30 | 1000 | 1000 | - | - |
| | | | | | | |
| FF10 | | 8* | 100 | 100 | 20 | |
| FF15 | | 10* | 200 | 200 | 60 | |
| FF20 | FFS20 | 15* | 400 | 300 | 160 | |
| FF30 | FF30 | 20* | 600 | 400 | 200 | |
| FF40 | FFS40 | 30 | 800 | 500 | 300 | |
| FF50 | FFS50 | 40 | 1000 | 600 | 400 | |
| | | | | | | |
| J51 J52 | J53 | 6 | 10 | 10 | 10 | 10 |
| XJ51 | XJ53 | 6 | 10 | 10 | - | - |
| J64 | J66 | 6 | 20 | 20 | 20 | 20 |
| XJ64 | XJ64 | 6 | 20 | 20 | - | - |
| | | | | | | |
| NT61 | NT63 | 10 | 120 | 100 | 60 | 50 |
| NH61 | NH61 | 10 | 120 | 120 | - | - |
| NT91 | NT92 | 15 | 200 | 150 | 200 | 100 |
| NH91 | NH92 | 15 | 200 | 200 | - | - |
| NT121 | NT122 | 20 | 250 | 200 | 250 | 150 |
| NH121 | NH122 | 20 | 250 | 200 | - | - |
| | | | | | | |

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