

**T<sub>2n</sub>** Torque figures are maximum torque at gearbox output based on S1 continuous duty cycle at 20°C ambient temperature at n<sub>1</sub> 1000 min<sup>-1</sup> (r/min).

**T<sub>2b</sub>** is 1.5 x T<sub>2n</sub> Max Acceleration Deceleration Torque (Max <1000 Load Cycles per 60min more than this would require using a factor to lower.)

**T<sub>2not</sub>** is 3 x T<sub>2n</sub> 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 manufacture 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.

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

$$P_1 = \frac{T_1 \times n_1}{9550}$$

$$T_1 = \frac{T_{\text{required}}}{i} \times \frac{100}{\eta_z}$$

$$T_{2n} > T_{\text{required}} \times K_a$$

Application factor  $K_a$

$i [u]$  = Gear Ratio

$n_1$  = Input speed min<sup>-1</sup> (r/min)

$n_2$  = Output speed min<sup>-1</sup> (r/min)

$T_1$  = Input torque (Nm)

$T_{2n}$  = Nominal Output torque (Nm)

$P_1$  = Input Power (kW)

$\eta_z$  = Meshing Efficiency (%)

$T_{\text{required}}$  = 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+

$$T_a = J \times \alpha$$

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

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

$T_a$  = Acceleration torque (Nm)  
 $J$  = Inertia (kg.m<sup>2</sup>)  
 $J_T$  = Total reflected inertia at gearbox input (kg.m<sup>2</sup>)  
 $J_m$  = Reflected inertia of gearbox (kg.m<sup>2</sup>)  
 $J_L$  = Inertia of load (kg.m<sup>2</sup>)  
 $t$  = Acceleration time (sec)  
 $i$  = Ratio  
 $\alpha$  = Angular acceleration (rads/sec<sup>2</sup>)  
 $\omega$  = Angular/Rotational Velocity (rads/sec)  
 $\eta$  = Efficiency (%)

### Example:

Assume a 3:1 ratio, 90% efficient gearbox with a reflected inertia of 0.00052kg.m<sup>2</sup>. 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:

$$500 \text{ rpm} = (360^\circ \times 500) \text{ min}^{-1} = 180000^\circ \text{ min}^{-1}$$

$$180000^\circ \text{ min}^{-1} = (180000^\circ / 60) \text{ s}^{-1} = 3000^\circ \text{ s}^{-1}$$

$$3000^\circ \cdot \text{s}^{-1} = (\pi/180) * 3000 = 52.36 \text{ rad} \cdot \text{s}^{-1}$$

$$\text{So, acceleration} = 52.36/1.5 = 34.91 \text{ rad} \cdot \text{s}^{-2}$$

$$\text{Input torque to accelerate gearbox} = 0.00052 \times 34.91 = 0.01815 \text{ Nm}$$

If a load with inertia  $J_L$  was put on the gearbox output of 0.0062 kg.m<sup>2</sup> the total inertia at the gearbox input would become 0.00053kg.m<sup>2</sup>

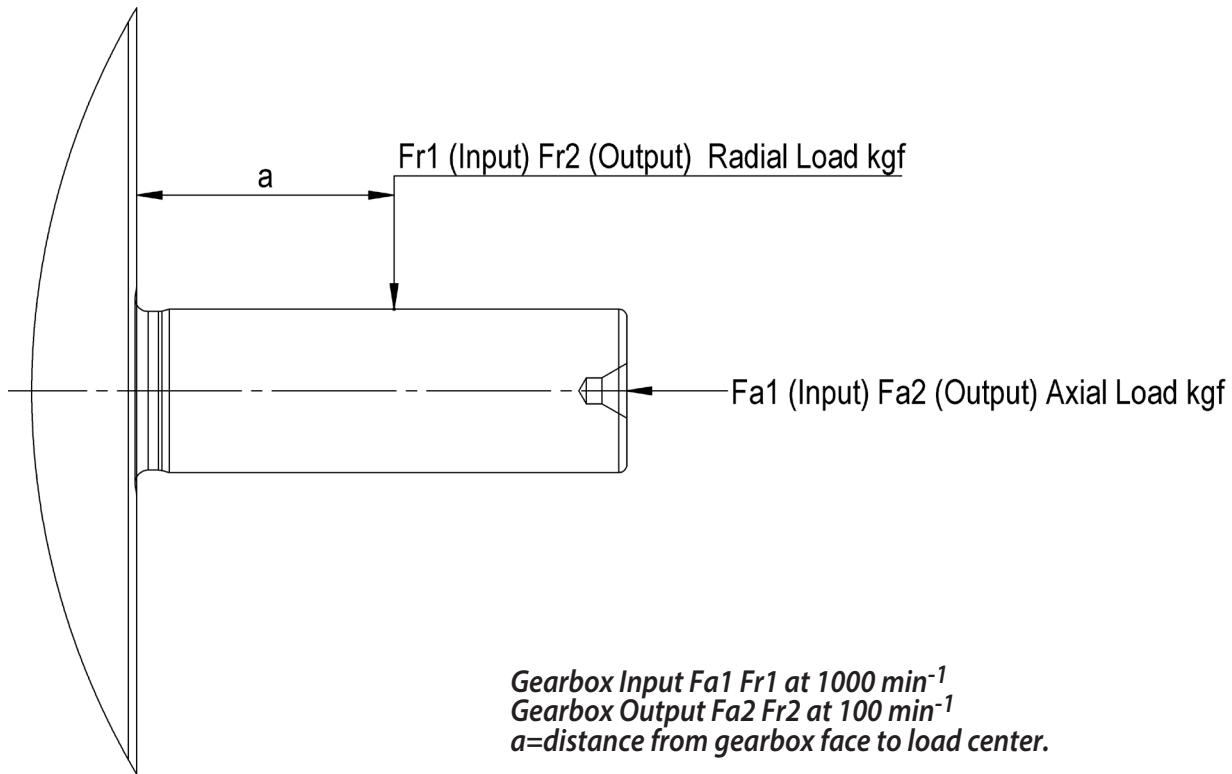
$$\text{New input torque to accelerate gearbox} = 0.00053 \times 34.91 = 0.01850 \text{ Nm}$$

$$\text{Input torque to drive load} = (1/3 \times 100/90) = 0.37037 \text{ Nm}$$

$$\text{Total input torque required at start up} = 0.37037 + 0.01850 = 0.38887 \text{ Nm} \approx 0.39 \text{ Nm}$$

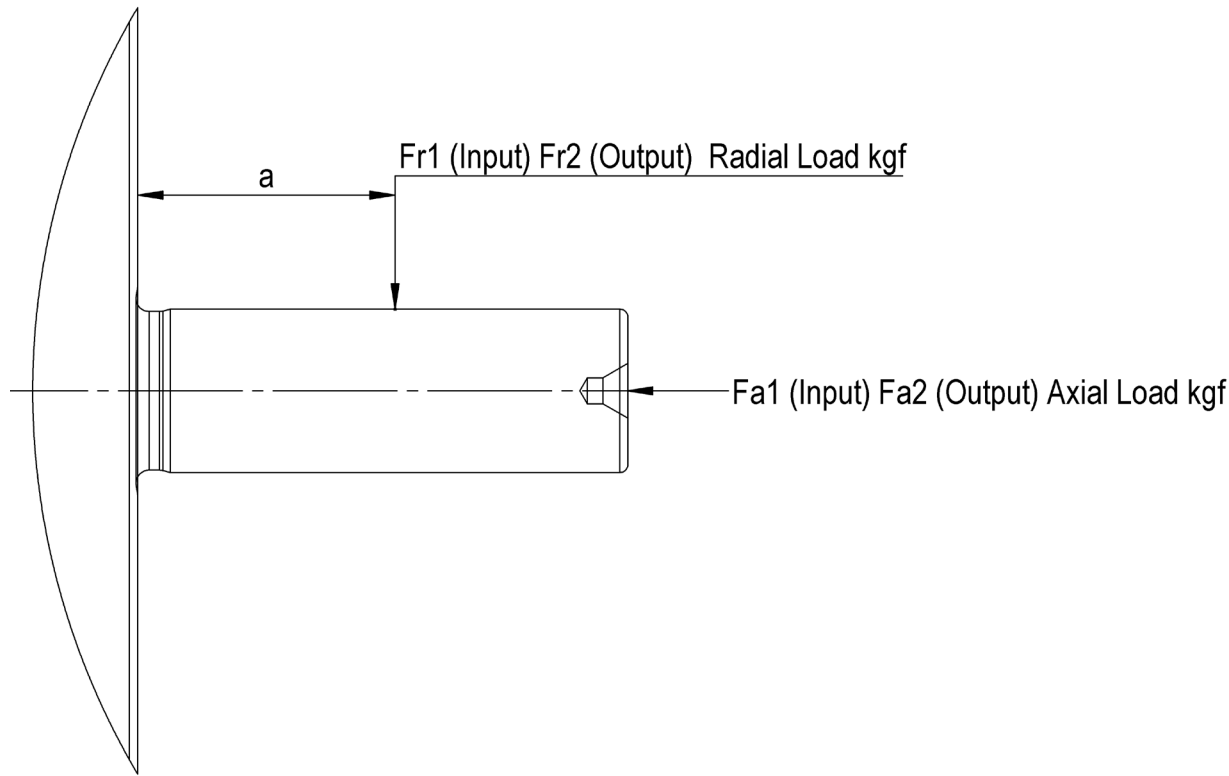
A margin needs to be added to account for inertia of connecting shafts/couplings, motor rotor inertia and friction from bearings and other elements.

1 radian (rad)	= 57.5928°	$1.0 \times 10^{-2} = 0.01$
1 kg m <sup>2</sup>	= 10,000 kg cm <sup>2</sup>	$1.0 \times 10^{-3} = 0.001$
1 kg m <sup>2</sup>	= 1,000,000,000 g mm <sup>2</sup>	$1.0 \times 10^{-4} = 0.0001$
1 m <sup>2</sup>	= 1,000,000 mm <sup>2</sup>	$1.0 \times 10^{-5} = 0.00001$
1 m <sup>2</sup>	= 10,000 cm <sup>2</sup>	$1.0 \times 10^{-6} = 0.000001$
		$1.0 \times 10^{-7} = 0.0000001$



*Gearbox Input Fa1 Fr1 at 1000 min<sup>-1</sup>  
Gearbox Output Fa2 Fr2 at 100 min<sup>-1</sup>  
a=distance from gearbox face to load center.*

		a	Fr2 N	Fa2 N	Fr1 N	Fa1 N
P15	PF15	10	80	30	40	-
P20	PF20	10	120	50	60	-
P30	PF30	12	200	120	80	-
P40	PF/PFN40	15	300	200	80	-
P45	PF45	20	450	300	120	-
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	350	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	40	30	40	30
BLH30	BLHT30	10	80	60	80	60
BLH40	BLHT40	12	120	100	120	100
BLH50	BLHT50	20	200	150	200	150
BLH60	BLHT60	25	300	250	300	250
BLH70	BLHT70	30	500	300	500	300



Gearbox Input Fa1 Fr1 at 1000 min<sup>-1</sup>  
 Gearbox Output Fa2 Fr2 at 100 min<sup>-1</sup>  
 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	60	
FF15		10*	200	200	120	
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	120	100
NH61	NH61	10	120	120	-	-
NT91	NT92	15	200	150	200	150
NH91	NH92	15	200	200	-	-
NT121	NT122	20	250	200	250	200
NH121	NH122	20	250	200	-	-