The values given in the load table are based on uniform, smooth servo-operation. Since, in practice, the applications are very diverse, it is essential to consider the given conditions by using the appropriate factors S, K_A and b_B (see symbols). The maximum oil-sump temperature of 80° C should not be exceeded.

Formulas for Determining Power and Torque Data:

$$a = \frac{\nu}{t_b} \quad [m/s^2]$$

$$F_u = m \cdot g + m \cdot a \quad \text{(for lifting axle)} \quad [N]$$

$$F_u = m \cdot g \cdot \mu + m \cdot a \quad \text{(for driving axle)} \quad [N]$$

$$T_{2req.} = \frac{F_u \cdot d}{2000} \quad [Nm]$$

$$n_2 = \frac{\nu}{d \cdot \pi} \cdot 60000 \quad \text{(rpm)} \quad [rpm]$$

$$i_{gear} = \frac{n_1}{n_2}$$

$$T_{2perm.} = \frac{T_{2table}}{K_A \cdot S \cdot b_B} \quad [Nm]$$

Condition $T_{2perm.} > T_{2req.}$ must be fulfilled.

$$P_{1req.} = \frac{T_{2req.} \cdot n_2}{9550 \cdot \eta} \quad [kW]$$

Load Factor K_A

Drive	Type of load from the machines to be driven		
	uniform	medium shocks	heavy shocks
uniform	1.00	1.25	1.75
light shocks	1.25	1.50	2.00
medium shocks	1.50	1.75	2.25

Operating Time Factor b_B

Operating time	4–8 h	8–12 h	>12 h
Operating time factor	1.00	1.20	1.35

Safety Coefficient S

The Safety Coefficient should be allowed for according to experience (S = 1.1 to 1.4).

Symbols

a	=	Acceleration or Retardation	(m/s^2)
b_B	=	Operating Time Factor	
d	=	Pinion Pitch-Circle Diameter	(mm)
g	=	Acceleration Due to Gravity	($9.81 m/s^2$)
m	=	Mass	(kg)
n_1	=	Gearbox Input rpm	(rpm)
n_2	=	Gearbox Output rpm	(rpm)
t_b	=	Acceleration Time	(s)
i	=	Gear Ratios	(--)
ν	=	Travelling/Lifting Speed	(m/s)
F_u	=	Peripheral Force at the Pinion	(N)
K_A	=	Load Factor	(--)
P_1	=	Gearbox Input Power	(kW)
S	=	Safety Coefficient	(--)
T_2	=	Gearbox Output Torque	(Nm)
η	=	Gearbox Efficiency	(--)
μ	=	Coefficient of Friction	(--)
π	=	3.1459	

Calculating Example

Values Given

○ Travelling Operation	⊗ Lifting Operation			
Mass to be Moved	m	=	300	kg
Speed	v	=	1.08	m/s
Acceleration Time	t_b	=	0.27	s
Acceleration Due to Gravity	g	=	9.81	m/s²
Coefficient of Friction	μ	=	—	
Pitch-Circle Dia. of Pinion	d	=	63.66	mm
Load Factor	K_A	=	1.25	
Operation Time Factor	b_B	=	1.2	
Safety Coefficient	S	=	1.2	
Motor rpm	n_1	=	3000	rpm
Motor Type				
Motor Manutacturer				

Calculation Process — Results

$a = \frac{v}{t_b}$ $a = \frac{1.08}{0.27}$ = 4 m/s²

$F_u = m \cdot g + m \cdot a$ $F_u = 300 \cdot 9.81 + 300 \cdot 4$ = 4,143 N

$F_u = m \cdot g \cdot \mu + m \cdot a$ only Travelling Operation

$T_{2erf.} = \frac{F_u \cdot d}{2000}$ $T_{2erf.} = \frac{4143 \cdot 63.66}{2000}$ = 132 Nm

$n_2 = \frac{v}{d \cdot \pi} \cdot 60{,}000$ $n_2 = \frac{1.08}{63.66 \cdot \pi} \cdot 60000$ = 324 rpm

$i_{Getr.} = \frac{n_1}{n_2}$ $i_{Getr.} = \frac{3000}{325}$ ≅ 9.25

Permissible Gear Torque T_{2table} see page GB-13
assumed 58_5_09 with T_2=280 Nm at 3,000 rpm

$T_{2zul.} = \frac{T_{2Table}}{K_A \cdot S \cdot b_B}$ $T_{2zul.} = \frac{280}{1.25 \cdot 1.2 \cdot 1.2}$ = 155 Nm

Condition

$T_{2zul.} > T_{2erf}$ = 155 Nm > 132 Nm = fulfilled

$P_{1erf} = \frac{T_{2erf} \cdot n_2}{9550 \cdot \eta}$ $P_{1erf} = \frac{132 \cdot 324}{9550 \cdot 0.90}$ = 4.98 KW

Your Calculation

Values Given

○ Travelling Operation	○ Lifting Operation			
Mass to be Moved	m	=	_____	kg
Speed	v	=	_____	m/s
Acceleration Time	t_b	=	_____	s
Acceleration Due to Gravity	g	=	9.81	m/s²
Coefficient of Friction	μ	=	_____	
Pitch-Circle Dia. of Pinion	d	=	_____	mm
Load Factor	K_A	=	_____	
Operation Time Factor	b_B	=	_____	
Safety Coefficient	S	=	_____	
Motor rpm	n_1	=	_____	rpm
Motor Type			_____	
Motor Manutacturer			_____	

Calculation Process — Results

$a = \frac{v}{t_b}$ a = _____ = _____ m/s²

$F_u = m \cdot g + m \cdot a$ F_u = _____ = _____ N

$F_u = m \cdot g \cdot \mu + m \cdot a$ F_u = _____ = _____ N

$T_{2erf.} = \frac{F_u \cdot d}{2000}$ $T_{2erf.}$ = _____ = _____ Nm

$n_2 = \frac{v}{d \cdot \pi} \cdot 60000$ n_2 = _____ · 60000 = _____ rpm

$i_{Getr.} = \frac{n_1}{n_2}$ $i_{Getr.}$ = _____ ≅ _____

Permissible Gear Torque T2table see page ...

$T_{2zul.} = \frac{T_{2Table}}{K_A \cdot S \cdot b_B}$ $T_{2zul.}$ = _____ = _____ Nm

Condition

$T_{2zul.} > T_{2erf}$ = Nm > Nm = fulfilled

$P_{1erf} = \frac{T_{2erf} \cdot n_2}{9550 \cdot \eta}$ P_{1erf} = _____ = _____ KW

Result: Gear 58_5_09 Page GB-6