Gearbox Selection: Ratio, Output Torque and Service Factor

Ratio, output torque and design (catalogue) torque and power of a gear reducer from motor power and speeds, gearbox efficiency and a service factor for the duty.

Method: Gear reducer selection with service factor

Input parameters

Unit system: SI

Parameter	Value	Unit
Motor power	7.5000	kW
Input (motor) speed	1,450.0	rpm
Output speed wanted	50.000	rpm
Gearbox efficiency	94.000	%
Service factor for the load and hours About 1.0 for uniform load and 8–10 h a day, 1.25–1.5 for moderate shock or 24 h duty, 1.75–2 for heavy shock.	1.5000	

Calculated results

Parameter	Value	Unit
Ratio	29.000	
Output torque	1,346.5	N·m
Design (catalogue) torque	2,019.7	N·m
Design power	11.250	kW

Notes for this case

• The ratio is input over output speed; output torque is the motor power, less gearbox losses, divided by the output speed. Catalogue ratings assume uniform load and moderate hours, so the selection torque is multiplied by a service factor for the actual load (uniform, moderate or heavy shock), starts per hour and daily running hours. Also check thermal rating for continuous duty and overhung loads on the shafts.

Formula and method

$$i = \frac{n_1}{n_2}, \quad T_2 = \frac{P\eta}{\omega_2}, \quad T_d = SF \cdot T_2$$

Variables

P	Motor power	W
n_1	Input (motor) speed	rad/s
n_2	Output speed wanted	rad/s
η	Gearbox efficiency	-
SF	Service factor for the load and hours	-
i	Ratio	-
T_2	Output torque	N·m
T_d	Design (catalogue) torque	N·m
P_d	Design power	W

Method and standards

Gearbox selection.

Assumptions and limits

- Steady speeds; service factor from the duty.

References

Gear reducer selection with service factor

Report details

Report reference	FCC-YNKP-WYW9 (the same inputs always give the same reference)
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/mechanical/machine-design/gearbox-service-factor-selection

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.