

GENERAL INFORMATION

- Maximum input speed ratings are given for lubrication considerations, and should be considered intermittent ratings.
- Maximum unit operating temperature is 180° F. Auxiliary cooling or special lubricants may be necessary depending on the application.
- Output shaft bearing curves illustrate typical B_{10} bearing life based on load and location from geardrive mounting face.
- Speed has a direct inverse effect on bearing life. Torque has an inverse^{10/3} effect on bearing life.
- Backlash: 10 to 30 Arc minutes for double-stage geardrives
- Contact Eskridge for continuous input speeds above 2000 rpm
- Approximate geardrive efficiencies, double-stage reductions: 94% Driving, 90% Backdriving.

INDUSTRIAL DRIVE SELECTION AND APPLICATION

- Geardrive torque ratings given in the catalog are intermittent ratings. Maximum continuous torque ratings are roughly $1/2$ the intermittent rating.
- Applications involving frequent loads near the intermittent rating, reversals, or frequent starts/stops may require de-rating the geardrive to about $1/3$ of intermittent torque rating.
- Continuous ratings of $1/2$ the intermittent rating are based on a service factor of 1, (applications free from shock loads and frequent reversals).
- Average continuous output torque load x Service Factor (from table) should never exceed the Intermittent Rating / 2
- Use the table below for recommended minimum Service Factors

SERVICE FACTOR TABLE:

USAGE	UNIFORM LOADING	MODERATE SHOCK LOADING	HEAVY SHOCK LOADING
Up to 1/2 Hour / Day	0.8	1.0	1.5
1/2 - 3 Hours / Day	1.0	1.3	1.8
3 - 10 Hours / Day	1.3	1.5	2.0
10 - 25 Hours / Day	1.5	1.8	2.3

For example: 35000 in-lb x 1.5 = 52500 in-lb x 2 = 105000 in-lb equivalent load.

Proper selection would be the 120 Series geardrive, which has an intermittent rating of 120000 in-lb.

SWING DRIVE SELECTION AND APPLICATION

- Send completed Application Data Sheet with pinion data, brake data, and other information for a full analysis of your application
- Splined output shafts are preferred over keyed shafts for all pinion applications. Consult Eskridge for available pinions.

MOUNTING REQUIREMENTS

- Mounting surface should be machined flat to within $1/64$ "
- Vertical output down or horizontal mounting is standard. A grease zerk or oil reservoir is recommended for pinion-up applications to ensure proper lubrication of output shaft bearings.

LUBRICATION

- Proper selection and levels of lubrication is essential for satisfactory service. Inadequate lubrication will void all warranties.
- Geardrive units are shipped without lubricant, and should be filled to the proper level before used or tested.
- EP 80/90 GL-5 is the recommended lubricant for most applications. Consult Eskridge before using alternative lubricants, or for sustained operation at ambient temperatures below -20° F, or above 160° F
- Lubrication should be changed after the first 50 hours of operation, and every 500 hours thereafter.
- Published unit weights are dry. Add 0.8 lb to the dry unit weight per pint of EP 80/90.

REFERENCE

ENGLISH GEARDRIVE FORMULAE

Torque (in-lb) = hp x 63025 / rpm
 hp = in-lb x rpm / 63025
 Pitch Dia = Teeth / Diametral Pitch
 Thermal input (Watts) = hp x (1 - eff) x 745.7
 Output TQ = Input TQ x Ratio x Geardrive Efficiency
 Output rpm = Input rpm / Ratio

ENGLISH MOTOR FORMULAE

hp = gpm x psi / 1714
 hp = in-lb x rpm / 63025
 $in^3 = (in-lb \times 6.283) / (psi \times eff)$
 $in-lb = psi \times in^3 \times eff / 6.283$
 $in-lb = hp \times 63025 / rpm$
 $gpm = rpm \times in^3 / 231$
 $rpm = gpm \times 231 / in^3$
 $eff = (in-lb \times 6.283) / (psi \times in^3)$
 $in-lb = gpm \times psi \times eff \times 36.77 / rpm$
 $psi = (in-lb \times 6.283) / (in^3 \times eff)$

CONVERSIONS

SI UNITS TO ENGLISH

kW = 1.341 hp
 bar = 14.5 psi
 $Nm = 8.8496 \text{ in-lb}$
 $daNm = 88.496 \text{ in-lb}$
 $kg-m = 86.796 \text{ in-lb}$
 $L/min = .2642 \text{ gpm}$
 $cm^3 = .061 \text{ in}^3$
 $L = 2.114 \text{ Pints}$
 $C^\circ = (F^\circ - 32) / 1.8$

SI GEARDRIVE FORMULAE

$Nm = kW \times 46326.77 / rpm$
 $kW = Nm \times rpm / 46326.77$
 Thermal input (Watts) = kW x (1 - eff) x 556.08
 Output TQ = Input TQ x Ratio x Geardrive Efficiency
 Output rpm = Input rpm x Ratio

SI MOTOR FORMULAE

$kW = L/min \times bar / 70148.25$
 $kW = Nm \times rpm / 46326.77$
 $cm^3 = (Nm \times 170.7) / (bar \times x \text{ eff})$
 $Nm = bar \times cm^3 \times \text{eff} / 170.7$
 $Nm = kW \times 46326.77 / rpm$
 $L/min = rpm \times cm^3 / 125.25$
 $rpm = L/min \times 125.25 / cm^3$
 $eff = (Nm \times 170.7) / (bar \times cm^3)$
 $Nm = (L/min \times bar \times \text{eff}) / (rpm \times 1.514)$
 $bar = (Nm \times 170.7) / (cm^3 \times \text{eff})$

For more information regarding Planetary Geardrives and other innovative products, feel free to contact us at:


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APPLICATION INFORMATION AVAILABLE:

Output torque load	74,000 in-lb
Output shaft speed	15 rpm
Shaft side (radial) loads and location, or pinion data	15,000 lb sideload located 4.5" from geardrive mounting face
Estimated duty cycles	3 hours / day with moderate shock loading
System hydraulic pressure and flow	2500 psi @ 15 gpm
Minimum B ₁₀ bearing life required	5000 hours

STEP 1

Determine initial geardrive selection using Service Factor table:

- Multiply Output torque by Service Factor 74,000 in-lb x 1.3 = 96,200 in-lb
- Multiply result x 2 for gearbox minimum 'Intermittent Rating' 96,200 x 2 = 192,400 in-lb
- The proper selection is the 250 Series, since this value exceeds the 150 Series 'Intermittent Rating'

STEP 2

Determine output shaft bearing life from catalog bearing curve for Model 250 geardrive:

- From the catalog bearing curve, allowable radial load at 4.5" from mounting face is 23,000 lb.
- From formula, Hours of B₁₀ bearing life = $3000 (10 / 15 \text{ rpm}) \times (30,000 / 15,000)^{10/3} = 20,158 \text{ hours B}_{10}$ bearing life

STEP 3

Choose a ratio and calculate required motor torque*:

- Output - The following relationships can be calculated using the Model 250 ratios available:
- Input (motor) torque = output torque load / (gear reduction x geardrive efficiency (from technical data sheet))
- Input speed required = output speed x ratio

	<u>RATIO</u>	<u>EFFICIENCY</u>	<u>MOTOR TORQUE</u>	<u>MOTOR SPEED</u>
	20.25	94%	3888 in-lb	304 rpm
	25.88	94%	3042 in-lb	388 rpm
	29.58	94%	2661 in-lb	444 rpm
*	37.80	94%	2083 in-lb	567 rpm
	40.25	94%	1956 in-lb	604 rpm
	51.43	94%	1531 in-lb	771 rpm

STEP 4

Approximate motor displacement:

- Choose a motor within the speed range, and use the formula: $\text{in}^3 \text{ displacement} = \text{in-lb} \times 6.283 / (\text{psi} \times \text{motor efficiency})$.
 $\text{Motor displacement} = 2083 \text{ in-lb} \times 6.283 / (2500 \text{ psi} \times 90\% \text{ estimated motor efficiency}) = 5.82 \text{ in}^3$
- A check of available motors reveals that 6.1 in³ is the closest available selection in this case
- Determine required flow rate for application requirements using the formula: $\text{gpm} = \text{rpm} \times \text{in}^3 / 231$
 $\text{Flow required} = 567 \text{ rpm} \times 6.7 \text{ in}^3 / 231 = 14.97 \text{ gpm}$
- Check the catalog efficiency and calculate pressure required for desired torque: $\text{psi} = \text{in-lb} \times 6.283 / (\text{in}^3 \times \text{efficiency})$
 $\text{Pressure required} = 2083 \text{ in-lb} \times 6.283 / (6.1 \text{ in}^3 \times 90\% \text{ motor catalog efficiency}) = 2384 \text{ psi}$

STEP 5

Check backdriving resistance and brake selection

- Some applications can generate severe backdriving torque loads, which may be increased by the added resistance of the hydraulic system.
- The hydraulic system should be designed to allow pressure relief when the possibility of overloading the geardrive exists.
- Effective output torque load = input torque resistance x ratio / backdriving efficiencies (from technical data sheet)
- Input torque resistance = brake torque load available + torque load generated by motor backdriving.
- Assuming we select a 4800 in-lb brake for our application, and we have a hydraulic relief valve set at 3000 psi:
 $\text{Output torque load} = (4800 + 2600 \text{ in-lb (Backdriving torque) (from motor catalog) pumping}) \times 37.8 \text{ ratio} / .9$
 $\text{geardrive backdriving efficiency} = 310,800 \text{ in-lb}$
- From this example we know that we must modify our hydraulic circuit or reduce the brake torque rating to prevent exceeding our geardrive 'Intermittent Rating'.





Geardrive Selection

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Application Data Sheet

Prepared By: _____

Company: _____

Address: _____

Phone / Fax: _____

● TYPE OF EQUIPMENT

Maximum Output Torque Load _____ % Operation _____

Average Output Torque Load _____ % Operation _____

One-Time Test Load _____ If required

Output rpm _____

Horsepower _____ Torque (in-lb) x rpm / 63025

Hours Usage Per Day _____

Estimated Hours Per Year _____

B₁₀ Bearing Life Required _____

Other Considerations _____ (Shock Loads/Reversals/Braking)

Service Factor _____ (From Table on Page 40)

● TYPE OF APPLICATION

A. SWING DRIVE (Pinion Output) _____

Output Gear Type ____ Full Depth ____ AGMA Stub ____ Fellows

Number of Teeth _____ Diametral Pitch _____

Gear Face Width _____ Pitch Diameter _____

Distance, Gearbox Mount to Center of Load _____

B. INDUSTRIAL AND OTHER

____ Shaft Mount (Torque Arm)

____ Flange Mount (Piloted)

Type of Driven Equipment _____

Estimated Shaft Side Load _____

Estimated Shaft Thrust Load _____

● TYPE OF INPUT

• PTO ____ 540 rpm ____ 1000 rpm

• ELECTRIC MOTOR (Consult Factory)

• HYDRAULIC MOTOR

Model _____ SAE Mounting: _____

Displacement _____ Output Shaft: _____

Operating Pressure _____ Maximum Pressure _____

Hydraulic System Type _____ (Open/Closed Loop, etc) _____

● BRAKE REQUIRED

____ Yes ____ No

Brake Model _____ Brake Torque Rating _____ (Minimum) (Nominal) (Maximum)

NOTE: BRAKE HOLDING TORQUE x RATIO SHOULD NOT EXCEED GEARBOX INTERMITTENT RATING



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