Geardrive Selection

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

CONVERSIONS

SI UNITS TO ENGLISH

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

SI GEARDRIVE FORMULAE

Nm = kW x 46326.77 / rpm
kW = Nm x 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 x bar / 70148.25
kW = Nm x rpm / 46326.77
cm^3 = (Nm x 170.7) / (bar x eff)
Nm = bar x cm^3 x eff / 170.7
Nm = kW x 46326.77 / rpm
L/min = rpm x cm^3 / 125.25
rpm = *L*/min x 125.25 / cm^3
eff = (Nm x 170.7) / (bar x cm^3)
Nm = (*L*/min x bar x eff) / (rpm x 1.514)
bar = (Nm x 170.7) / (cm^3 x eff)

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

Ouput 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 B_{10} bearing life = 3000 (10 / 15 rpm) x (30,000 / 15,000) $^{10/3}$ = 20,158 hours B_{10} bearing life

STEP 3

Choose a ratio and calclate 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

	RATIO	EFFICIENCY	MOTOR TORQUE	MOTOR SPEED
	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: In^3 displacement = in-lb x 6.283 / (psi x motor efficiency).
  Motor displacement = 2083 in-lb x 6.283 / (2500 psi x 90% estimated motor efficiency) = 5.82 in^3
- A check of available motors reveals that 6.1 in^3 is the closest available selection in this case
- Determine required flow rate for application requirements using the formula: gpm = rpm x in^3 / 231
  Flow required = 567 rpm x 6.7 in^3 / 231 = 14.97 gpm
- Check the catalog efficiency and calculate pressure required for desired torque: psi = in-lb x 6.283 / (in^3 x efficiency)
  Pressure required = 2083 in-lb x 6.283 / (6.1 in^3 x 90% motor catalog efficiency) = 2384 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: Output torque load = (4800 + 2600 in-lb (Backdriving torque) (from motor catalog) pumping) x 37.8 ratio / .9 geardrive backdriving efficiency = 310,800 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'.

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APPLICATION DATA SHEET

Note: Use your TAB key to navigate the form.

Let our technical sales personnel specify the Eskridge product you need. Simply fill out as much information as you know below. Blanks are fine. Any questions, just call us at (913) 782-1238.

Contact Information

Name: _____ E-mail: _____
Company: _____ Phone: _____
Street Address: _____ Fax: _____
City, State, Zip: _____

Type of Equipment

Maximum Output Torque Load (% operation): _____ Horsepower - Formula below: (Torque (in-lb) x RPM/ 63025): _____
Average Output Torque Load (% operation): _____ Hours Usage Per Day: _____
One-Time Test Load (if required): _____ Estimated Hours Per Year: _____
Output RPM: _____ B_{10} Bearing Life Required: _____
Other Considerations (Shock Loads / Reversals / Braking): _____

Type of Application

A. Swing Drive (Pinion Output)

Output Shaft Orientation: ☐ Horizontal ☐ Up ☐ Down
Output Gear Type: ☐ Full Depth ☐ Fellows ☐ AGMA Stub

Number of Teeth: _____ Gear Face Width: _____
Diametral Pitch: _____ Pitch Diameter: _____
Distance, Gear Drive Mount to Center of Load: _____

B. Industrial and Other

Output Shaft Orientation: ☐ Horizontal ☐ Up ☐ Down
Mount Type: ☐ Shaft Mount (Torque Arm) ☐ Flange Mount (Piloted)

Type of Input

Input Type (PTO, Electric Motor, Hydraulic Motor): _____ Output Shaft: _____
Model: _____ Operating Pressure: _____
SAE Mounting: _____ Maximum Pressure: _____
Displacement: _____ Hydraulic System Type: _____

Brake Required

☐ YES ☐ NO
Brake Model: _____ Torque Rating: _____

E-mail or fax completed sheet to Eskridge – Sales@EskridgeInc.com, (913) 782-1238. Contact Technical Sales at 913-782-1238 with questions.