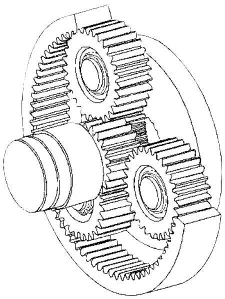
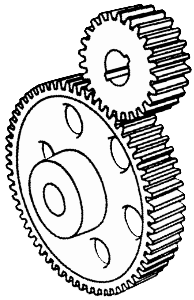
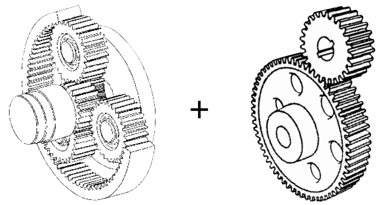
NEMA Size Gearhead Selection



TRUE PLANETARY



SPUR GEAR



HYBRID

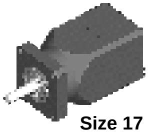
How to choose the type of gearhead depends primarily on the application. Some of the factors to be considered to make proper trade-offs between cost and performance are shown below. The hybrid design of planetary and spur gears are not offered by us but are available on the market, and are included for comparison purposes.

DESIGN FACTORS	GEARHEAD TYPE			
	Planetary	**Low Cost Planetary**	**Spur**	**Hybrid**
Torque Capacity	High	Medium	Low	Medium limited by spur gear pair strength
Load Sharing	Yes	Yes	No	Planetary Section Only
Power to Weight Ratio	High	Medium	Low	Medium
Power to Size Ratio	High	Medium	Low	Medium
Torsional Stiffness	High	Medium	Low	Medium
Backlash	Low 6-10 minutes	Medium 7-14 minutes	High 30 min. max.	Medium
Available Number of Gear Ratios	Low	Low	High	Medium
Cost	High	Meduim	Low	Medium

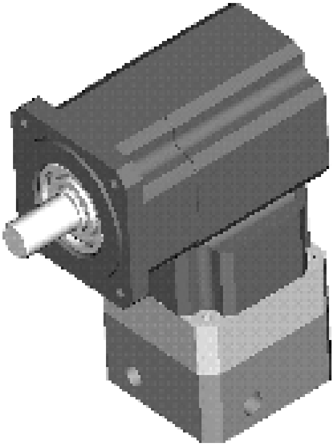
NEMA Size Planetary Gearhead Selection Chart

INCH				
NEMA Size	**Inline Gearheads**	**Right Angle Gearheads**	**Servomotor**	**Stepper Motor**
17	**S9117T-...** (page **1**-6)	—	—	**S9117M-...** (page **1**-41) **HL2100M473010** (page **1**-41)
23	**S9123T-...** (page **1**-8)	**S9123R-R...** (page **1**-10)	**D50R10-024.** (page **1**-32) **D50R11-0243** (page **1**-33)	**S9123M-...HT** (page **1**-45) **S9123M-...** (page **1**-47) **HL2100M473...** (page **1**-49)
34	**S9134T-...** (page **1**-12)	**S9134R-R...** (page **1**-14)	**D50R10-067** (page **1**-34)	**S9134M-...** (page **1**-51) **S9134M-...HT** (page **1**-53) **HL2100M473...** (page **1**-49)
42	**S9142T-...** (page **1**-16)	**S9142R-R...** (page **1**-18)	—	**S9142M-...** (page **1**-55)

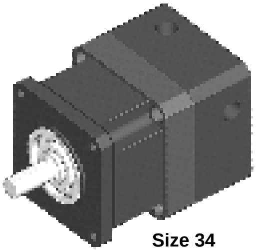
Different motors may require special mounting interfaces.
Please see assembly instructions for each frame size.



Size 17

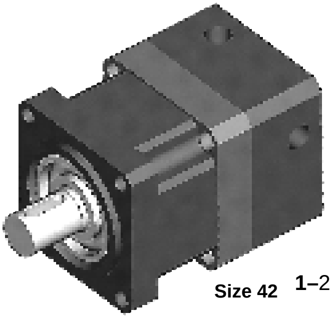


Right Angle Size 42



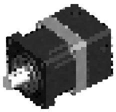
Size 34

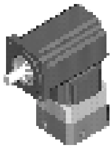
Size 23



Size 42

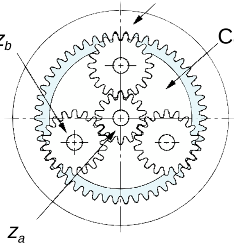
METRIC Size Planetary Gearhead Selection Chart





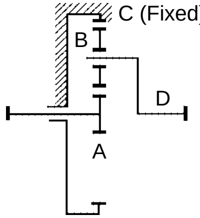
METRIC		
Size	**Inline Gearheads**	**Right Angle Gearheads**
60	**S9160TM...** (page **1**-20)	**S9160RMR...** (page **1**-22)
90	**S9190TM...** (page **1**-24)	**S9190RMR...** (page **1**-26)
115	**S91B5TM...** (page **1**-28)	**S91B5RMR...** (page **1**-30)

Planetary Gear System



The basic form of planetary gear system is shown above. It consists of a sun gear A, planetary gears B, internal gear C and carrier D. In our gearheads the internal gear is fixed, the sun gear is the input pinion, and the output shaft is part of the carrier.

This relationship can be represented schematically as shown on the right. The speed ratio is given by the equation:



$$\text{Gear Ratio} = \frac{1 + \frac{z_a}{z_c}}{\frac{z_a}{z_c}} = \frac{z_a + z_c}{z_a} = \frac{z_c}{z_a} + 1$$

where: z_a = number of teeth in sun gear A, and
z_c = number of teeth in internal gear C.

For the example shown in the above illustration (where $z_a = 14$, $z_b = 18$ and $z_c = 50$), the Gear Ratio is 4.6:1.

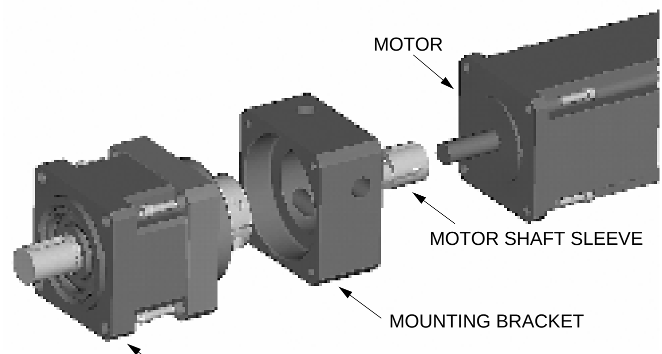
For a double-stage planetary gearhead, the carrier of the first stage becomes the sun gear of the second stage.

The advantages of the planetary gearheads are:

1. The input and output axes are in the same line.
2. The planet gears used in a planetary system share the load, allowing for a much higher torque capacity unit than the comparable size spur gearheads.
3. The unit is compact and inertially balanced.

The disadvantages are:

1. The mechanism is complex.
2. The components require high-precision manufacturing.
3. The cost is considerably more than comparable size spur gearheads.



All of our NEMA and Metric sized gearheads, except NEMA Size 17, are offered using a ready-to-mount system of attaching the motor to the gearhead. The gearhead ratio unit includes a preinstalled pinion and a self-aligning input clamp. This allows the gearhead to maintain concentricity with the motor shaft and eliminates the need to set the pinion.

The procedure for selecting a complete gearhead solution is simple:

Step 1) Select your motor and determine the appropriate frame size for the gearhead.

Step 2) Measure the pilot diameter E, pilot length (from motor), bolt circle, shaft OD and shaft length of your motor.

Step 3) Based on your measurements and frame size selection, go to the page that lists the mounting bracket and sleeve that you require.

Step 4) Choose the reduction ratio and complete the part number.

Example: You have a NEMA 34 motor and you measure the pilot diameter to be 2.875", the pilot length to be .12", the bolt circle to be 3.875", the shaft to be Ø 0.375" and the shaft length to be 1.10". If your required reduction ratio is 30:1, then you would select Mounting Bracket "1" and Sleeve "A". Therefore, the part number you would need to order is S9134T-0301A. (See page 1-12)

Note: *The mounting brackets and motor shaft sleeves listed in this catalog complement 90% of the motors currently available. If your motor does not meet our gearhead specifications, please contact our engineering staff to arrange for a custom mounting bracket or motor shaft sleeve.*

MOUNTING INSTRUCTIONS

A) Using the screws provided, bolt the mounting bracket to the input end of the gearhead ratio unit.

B) Slide the motor shaft sleeve into the input clamp and align the slot in the sleeve with the slot in the clamp.

C) Rotate the clamp to align the mounting bracket access holes with the clamping bolts.

D) Place the motor on a solid work surface with the output shaft pointing up. Slide the assembled gearhead onto the motor shaft.

E) Using a torque wrench, tighten the clamp bolts to the pretorque values listed below.

F) Using the screws provided, bolt the gearhead to the motor.

G) Using an alternating pattern, gradually tighten the clamp bolts until you reach the final tightening torque listed below.

Clamp Bolt Tightening Torques

Gearhead Frame Size	Pretightening Torque		Final Tightening Torque	
	lb. in.	N • m	lb. in.	N • m
NEMA 23	2	0.2	39	4.4
NEMA 34	4	0.4	76	8.5
NEMA 42	16	1.8	316	36
Metric 60	2	0.2	39	4.4
Metric 90	4	0.4	76	8.5
Metric 115	16	1.8	316	36

USEFUL FORMULAS

$$\text{The maximum output HP of Gearhead} = \frac{\text{(Maximum continuous torque) x (Maximum rated output rpm)}}{63025}$$

$$\text{The maximum allowable output HP of the motor} = \frac{\text{The maximum output HP of gearhead}}{\text{0.90 (single stage) or 0.85 (double stage)}}$$

$$\text{Effective inertia} = \frac{\text{load inertia}}{(\text{gear ratio})^2} + \text{gearhead}^{\Delta}\text{ inertia} + \text{pinion}^{\Delta}\text{ inertia}$$

For very fast response, the effective inertia should be one to three times larger than the motor inertia (including the pinion).

For acceptably fast response, the effective inertia should be less than ten times larger than the motor inertia (including the pinion).

$^{\Delta}$Inertia values shown in this catalog include both the gearhead and pinion values.