Bulletin #88-PG09
March 2001

Neptune / Orion / Saturn / Titan Owners' Manual

Rexnord

TABLE OF CONTENTS

Neptune / Orion / Saturn / Titan—Owners' Manual

Bulletin #88-PG09
March 2001

Section 1.0
Introduction

The following instructions apply to Neptune, Saturn, and Titan **Planetgear™** Speed Reducers. To assure long life and performance of the **Planetgear** speed reducers, the following practices should be followed.

1.1 BASIC OPERATION AND DESIGN

The **Planetgear** unit is a concentric shaft speed reducer that uses a simple planetary design, which utilizes a sun gear as the input, a ring gear as the fixed element, and a planetary carrier as the output. Power is transmitted from the reducer input shaft, through a splined connection to the input gear (sun gear) of the first reduction. The input gear drives the planet gears, which in turn drive the planetary carrier assembly. This carrier assembly is then connected to the next reduction sun gear or to the output shaft through a splined connection. Each carrier represents a single reduction. The reducer output shaft rotates in the same direction as the input shaft, regardless of the number of reductions. **Reference Figure 1.2** for a detailed representation.

All gearing has been made of a high grade alloy steel and case hardened for maximum life. Three to four points of contact, with a minimum of six to eight gear teeth engaged allow for a smooth transmission of power during normal operation and under extreme spike loads. Self contained input and output shaft assemblies use a double row of tapered roller bearings mounted to a steel alloy shaft to provide high overhung and thrust load capacity. This feature also keeps all external shaft forces isolated from the gearing. Included in both shaft assemblies are two seals with a grease purgeable cavity between them. This design prevents contamination from entering the gear reducer under extreme conditions. The input shaft assembly also has the ability to add a backstop option to eliminate reducer counter rotation when the input driver is shut off.

1.2 SECTIONAL VIEW AND COMPONENT IDENTIFICATION

Reference Figure 1.2

1.3 NAMEPLATE INFORMATION

Note location of serial number and model number on nameplate. When contacting the factory, have the **serial number** available, as this unique number fully describes the reducer and allows for the most efficient and accurate exchange of information. **Reference Figure 1.3** for name plate illustration.

Operation of the reducer shall not differ from the application data warranted on the nameplate. Any deviations from this data requires submittal of new application information along with all nameplate data to the factory or service center for approval. All data changes require a revised nameplate.

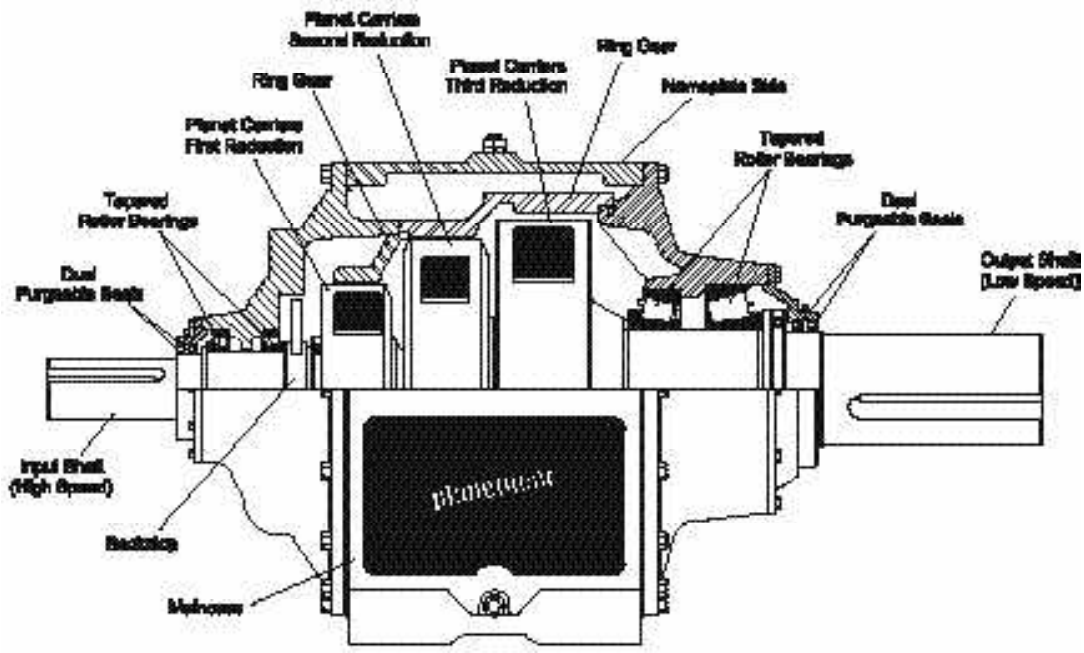


Figure 1.2—Sectional View of a Planetgear Speed Reducer

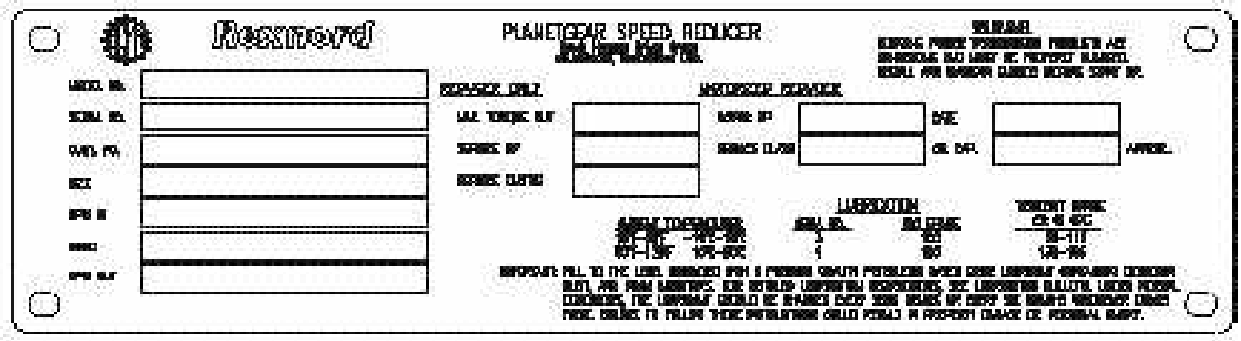


Figure 1.3—Reducer Nameplate

Section 2.0
Installation

2.1 HANDLING OF REDUCER

Disconnect all mounting bolts from the reducer before lifting. Use a double rope sling of ample strength, wrapped around the input and the output shafts when lifting the speed reducer; **reference Figure 2.1. Reference Table 1 (page 22)** for reducer weights. Be sure the reducer is properly secured and balanced to prevent shifting during suspension.

⚠ WARNING
To avoid personal injury or product damage, never attempt to lift the reducer with an eyebolt threaded into the top of the reducer maincase.

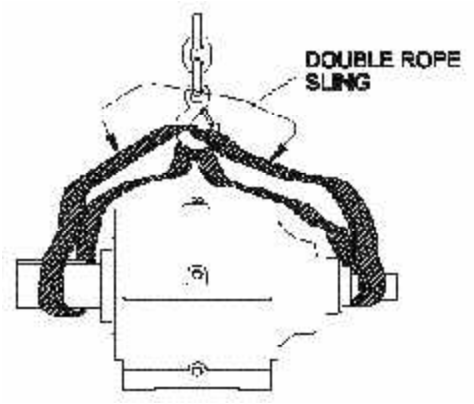


Figure 2.1—Reducer Handling

2.2 REDUCER MOUNTING

It is essential that the speed reducer be securely bolted to a solid, level, and vibration free foundation.

If the reducer mounting surface is not horizontal, refer to **Table 3 (page 22)** for **Maximum Allowable Tilts for Standard Reducers**.

NOTE: If the reducer is tilted, the oil requirements may change.

Bolts should be of the correct size to fit mounting holes. They should be SAE Grade 5 or equivalent. Fasteners shall be torqued according to **Table 2 (page 22)**. The use of a rigid structural steel baseplate is strongly recommended as a foundation. If a concrete foundation is used, grout structural steel mounting pads into the concrete rather than grouting the reducer directly into the concrete. Allow the concrete to cure before torquing the reducer mounting bolts down.

Align the reducer with driven equipment by placing broad flat shims underneath all mounting pads of the reducer. Start at the low speed end and level across the length and width of the reducer. **Check with a feeler gauge to make certain there is no clearance and that all pads are supported to prevent distortion of housing when reducer is bolted down.** After the reducer has been aligned with the driven equipment and bolted down, align prime mover to the reducer input shaft. **If the reducer is received coupled to a motor, it has been aligned properly at the factory. However, because alignment may have been disturbed during shipment, it is best to check alignment and then realign if necessary.** The reliability and long life of the reducer requires careful installation of accessories and accurate alignment of the connecting shafts. Check final alignment of motor shaft, coupling, and reducer shaft after reducer is in final working position.

2.3 MOUNTING OF TRANSMISSION ACCESSORIES

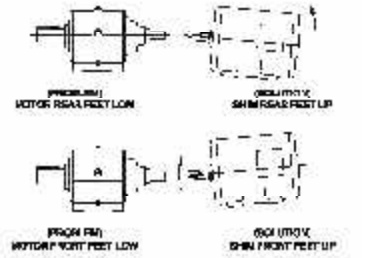
⚠ WARNING
When the Planetgear speed reducer is connected to a motor or driven equipment through the use of couplings, sprockets, gears or belt drives, all rotating parts must be properly guarded with guarding that conforms to OSHA requirements to prevent personal injury or property damage.

2.3.1a MOTORS (STANDARD UNITS)

When direct coupling motors to the **Planetgear** reducer, follow the four step process shown below to achieve proper motor to reducer alignment. Refer to coupling manufacture specifications to determine required alignment accuracy. **Note: Steps 1 to 4 may have to be repeated several times to achieve manufacturers required accuracies.**

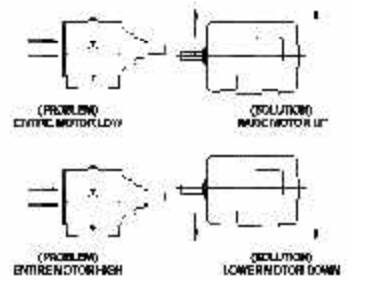
STEP #1 (side view plane)

Correct for ***angular*** misalignment in the ***side view plane***.



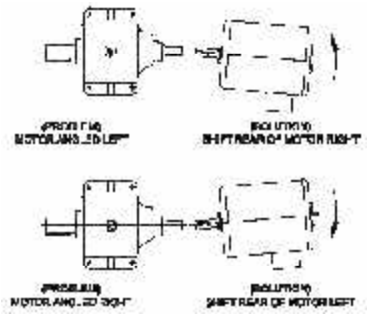
STEP #2 (side view plane)

Correct for ***parallel*** misalignment in the ***side view plane***.



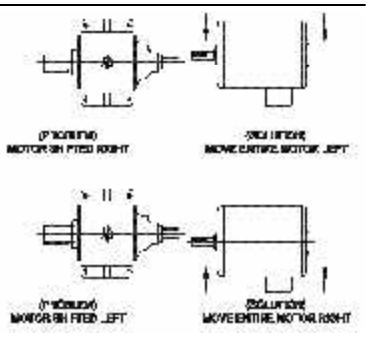
STEP #3 (top view plane)

Correct for ***angular*** misalignment in the ***top view plane***.



STEP #4 (top view plane)

Correct for ***parallel*** misalignment in the ***top view plane***.



2.3.1b MOTORS (C-FACE UNITS & IEC MOTOR FLANGE UNITS) - Neptune & Orion Quad/Quint Only)

1. Mount the reducer C-face or IEC Motor Flange Coupling coupling onto the motor shaft with the appropriate size key. The motor shaft to coupling fit should be snug and may require light tapping **(Note: Warming up the coupling and applying an Anti-seize compound to the motor shaft is helpful). Note: A loose fit coupling should be avoided and a heavy fit could damage motor bearings if the coupling is pressed onto the motor shaft with extreme force.**

> **⚠ CAUTION**
> **Never turn down the motor shaft diameter to allow for easy coupling installation, as this will cause coupling movement and wear during operation.**

2.a. **C-FACE:** For **Neptune and Orion quadruple and quintuple reduction** speed reducers, locate the coupling 0.500 to 0.625 inches from the motor face **(Hint: Standard keystock is helpful for this purpose**). Refer to the illustration in **Figure 2.3.1.b.**

2.b. **IEC MOTOR FLANGE COUPLING:** Locate the coupling 13.0 to 15.0mm from the motor face. Refer to the illustration in Figure **2.3.1.c.**

3. Tighten the coupling set screws; one located over the key and the other located at 90° (degrees). After tightening the set screws, the gap between the motor face and the coupling should be measured again to insure that the tolerance has been maintained. If the tolerance is not within the specification, loosen the set screws and repeat steps 2 and 3.

4. Mount the motor with coupling to the reducer. Align the internal spline end of the coupling with the external spline end of the reducer input

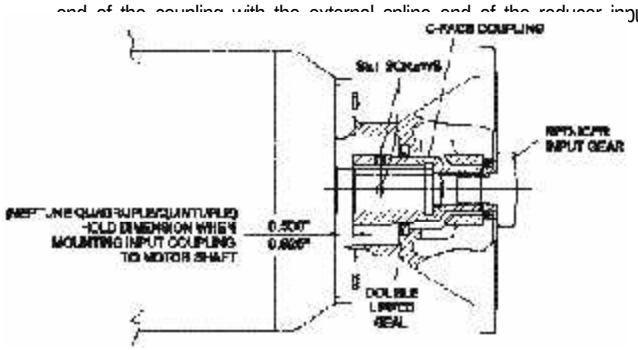


Figure 2.3.1b C-Face Cross Section

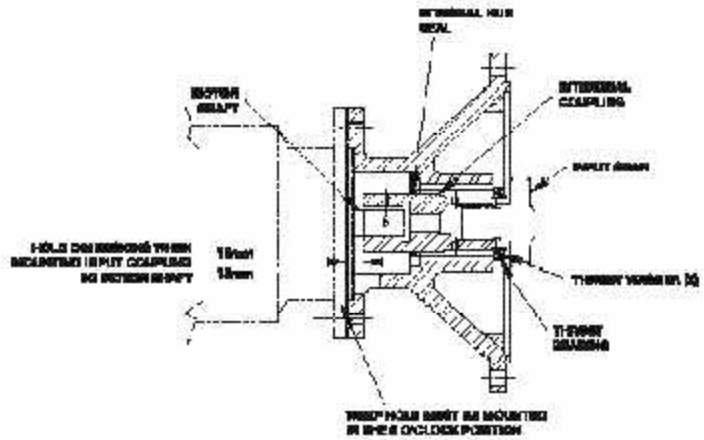


Figure 2.3.1c IEC Cross Section

> **⚠ CAUTION**
> **Be careful not to roll the seal when installing or removing the coupling and motor. This could result in oil leakage during operation.**

5. Align the mounting holes of the motor with the mounting holes of the reducer, and fasten, **reference Table 2 (page 22)** for recommended bolt torques.

2.3.2 COUPLINGS

Mount the reducer coupling hub on the input shaft and the motor coupling hub on the motor shaft as instructed in the manual shipped with the coupling. If the coupling is not a **Rexnord® Omega™**, refer to the manufacturers literature for installation instructions. If Planetgear does not mount the motor, the couplings are mounted for shipment only. Coupling bolts and coupling instructions are packed inside the coupling elements. Note: Prior to the installation of the element, check both coupling hubs for the required parallel and angular alignment; **Reference Figure 2.3.2**.

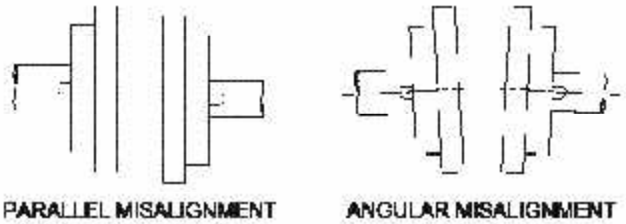


Figure 2.3.2 Parallel and Angular Misalignment

2.3.3 SPROCKETS OR SHEAVES

Prior to installing sprockets or sheaves, review the manufacturers requirements for chain or belt tension and required alignment. When mounting the sprocket or sheave to the shaft, locate it as close as possible to the reducer. This will minimize the overhung load and prolong bearing life.

When using a **Planetgear** motor mount accessory, the belt tension can be changed by varying the height of the motor mount plate. This can be done by adjusting the four threaded support bolts. **Reference Figure 2.3.3**.

NOTE: Mount sheaves and belts as close to the reducer as possible to avoid undue overhung loading on the bearings.

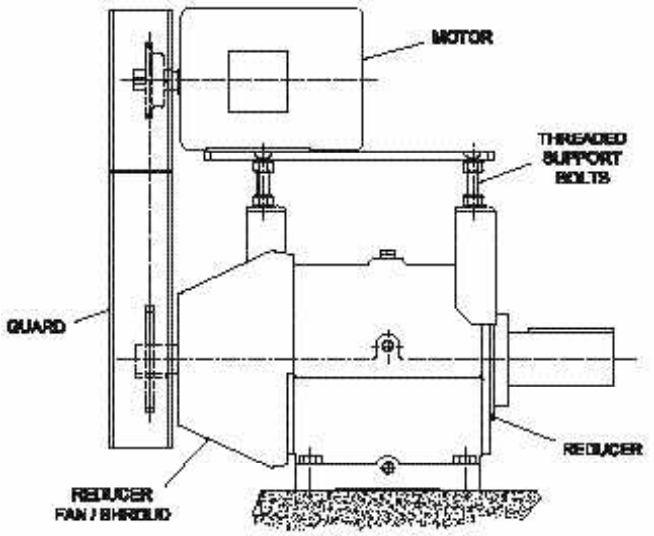


Figure 2.3.3—Planetgear Top Motor Mount

Section 3.0
Lubrication

⚠ IMPORTANT
Read and carry out all instructions on nameplate and review all warning tags and caution tags.

LUBRICATION CHANGES

OIL

For normal conditions, **change oil every six months or 2,500 hours**, whichever comes first. If operating under abnormal conditions such as high temperature, severe duty, moisture or particle contamination, oil may need to be changed more frequently. **Reference Section 5.0** for maintenance.

NOTE: Most lubricant suppliers can test oil from the unit periodically and recommend economical oil change schedules. Oil samples should be taken from the oil level hole, not the drain hole.

GREASE

All reducers are furnished with grease purgeable seals, thus minimizing entry of water or abrasive dust into the reducer. The reducers are shipped with the grease cavity filled with No.2 grease (equivalent to K2K grease). For normal conditions, change grease every six months or 2,500 hours, whichever comes first. Under extreme conditions, grease may need to be changed more frequently. **Reference Section 5.0** for maintenance.

OPERATING TEMPERATURE

Determine the minimum and maximum ambient temperatures that the **Planetgear** reducer will be subject to during operation. If the speed reducer operates in an environment where the temperature fluctuations are predictable, choose an oil viscosity that is recommended for that given temperature. I.E. for cold weather operation, use an oil that will circulate freely at all times. The pour point of the oil should be 9°F (5°C) less than the minimum external temperature during reducer operation. During hot weather, use a higher viscosity oil that will not thin out and lose its lubricating qualities.

If the speed reducer operates under extreme conditions or is exposed to large temperature fluctuations, the use of a synthetic oil is recommended. Contact lubrication supplier for recommendations.

NOTE: The synthetic lubricant should conform to the requirements of ANSI / AGMA 9005-D94.

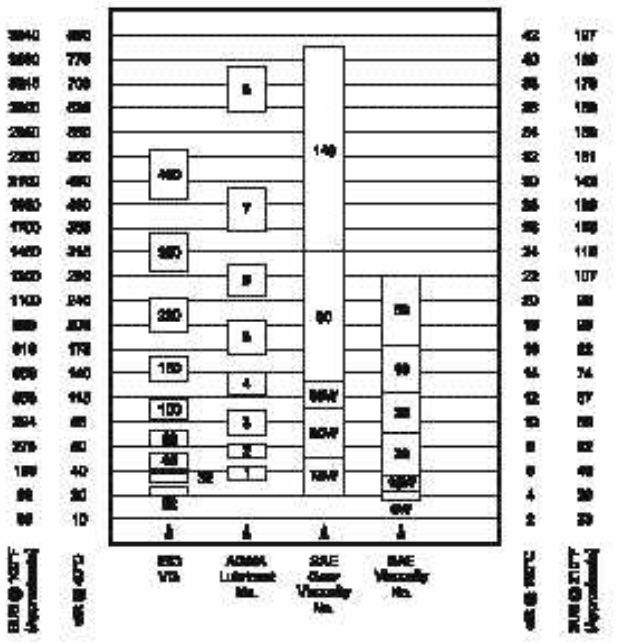
⚠ CAUTION
Special measures should be taken to protect drives operating in direct sunlight at ambient temperatures over 100°F (38°C). This protection can consist of a canopy over the drive or reflective paint on the drive. If neither is possible, a heat exchanger or other cooling device may be required to prevent the reducer sump temperature from exceeding the allowable maximum oil temperature of 200°F (93°C). Temperatures in excess of 120°F (49°C) feel hot to the human hand. Planetgear reducers can be operated with reducer sump oil temperatures of up to 200°F (93°C).

LUBRICATION GRADE SELECTION

After the determination of the ambient temperature is made, reference the nameplate or the **Ambient Temperature Table** (next column) to determine the proper AGMA or ISO grade lubricant for those temperature conditions, and select an appropriate oil. SAE oils apply to gear lubricants only. Automotive oils are not recommended. All reducers are splash lubricated by gear rotation with even distribution to all gear meshes and bearings.

Ambient Temp.	Viscosity @ 40°C Centistokes	AGMA Grade #	ISO Grade #
-10°C to 15°C 15°F to 60°F	90 - 110	3	100
10°C to 50°C 50°F to 125°F	135 - 165	4	150

Comparative Viscosity Classifications



Petroleum Based R&O Gear Oils

Maximum operating temperature of lubricants: 200°F (93°C)
AGMA 3: 15°F - 60°F AGMA 4: 50°F - 125°F

Manufacturer	AGMA Viscosity Grade 3	AGMA Viscosity Grade 4
	Lubricant	Lubricant
Amco Oil Co.	American Ind. Oil #100	American Ind. Oil #150
Chevron U.S.A. Inc.	AW Machine Oil 100	AW Machine Oil 150
Cities Service Co. Conco Inc.	Citgo Pacemaker 100 Dectol R&O Oil 100	Citgo Pacemaker 150 Dectol R&O Oil 150
Exxon Company, U.S.A.	Teresstic 100	Teresstic 150
Gulf Oil Corp.	Harmony 100	Harmony 150 D
Gulf Canada Limited	Harmony 66	Harmony 77
Imperial Oil Ltd. Mobil Oil Corp.	Teresso 100 DTE Heavy	Teresso 150 DTE Extra Heavy
Phillips Petroleum Co.	Magnus Oil 100	Magnus Oil 150
Shell Oil Co. Shell Canada Limited	Morlina 100 Tellus 100	Morlina 150 Tellus 150
Standard Oil Co. (Ohio) Texaco Inc.	Industron 66 Regal Oil R&O 100	Industron 80 Regal Oil R&O 150
Texas Canada Inc.	Regal R&O 100	Regal R&O 150
Union Oil Co. of Calif. (East) Union Oil Co. of Calif. (West)	Unax RX 100 Turbine Oil 100	Unax RX 150 Turbine Oil 150

LUBRICATION QUANTITY

From the nameplate or the oil capacity chart below, determine the quantity of oil needed to operate the reducer.

Reducer Series	Reduction Type					
	S/D/T gal	S/D/T liters	Quad gal	Quad liters	Quint gal	Quint liters
Neptune	7.8 (14.0)	29.5 (53.0)	8.5 (15.5)	32.2 (58.7)	8.3 (15.3)	31.4 (57.9)
Orion	12.0 (see nameplate)	45.4 (see nameplate)	see nameplate	see nameplate	see nameplate	see nameplate
Saturn	13.0 (22.0)	49.2 (83.3)	15.0 (25.0)	56.8 (94.6)	14.8 (24.8)	56.0 (93.9)
Titan	15.5 *	58.7 *	17.5	66.2	17.2	65.1

( ) - Oil capacity for vertically oriented reducers.
S=single D=double T=triple Quad=quadruple Quint=Quintuple
* Double & Triple only

Section 4.0
Start-up

⚠ WARNING

Never operate the speed reducer at speeds and/or loads that exceed the limits specified on the nameplate. Exceeding these limits may result in personal injury or machinery damage. Check to insure that all rotating equipment is properly guarded according to OSHA standards.

⚠ CAUTION

All speed reducers are shipped without oil. Be sure to fill the unit to the proper level prior to start-up.

⚠ CAUTION

When starting up new equipment, proceed cautiously.

4.1 PRE START-UP CHECKLIST

① **Has the reducer been filled with the proper oil type and to the correct oil level?**

② Are all mounting bolts high strength ANSI B18.2.1Grade 5 or ISO 898/1 Grade 8.8 and tightened according to torque specifications in **Table 2 (page 22)?**

③ Are all input and output shaft couplings, sprockets, pinions, etc. mounted with full engagement and keys in place**?**

④ Have couplings and reducer seals been properly greased**?**

⑤ Are coupling connections properly aligned and fastened**?**

⑥ Have all pipe plugs (oil fill, oil level, and oil drain) been inserted and properly tightened**?**

⑦ Have all electrical connections been made**?**

⑧ Does the motor shaft rotate in the proper direction**?**

⑨ Are all guards in place and properly secured**?**

4.2 INITIAL START-UP

It is recommended that all **Planetgear** speed reducers be run-in for a period of time before introduction to full service. This will allow the gearing to mate properly prior to being exposed to any high load conditions. The following procedure is recommended for initial start-up.

4.2.1 PRIME MOVER

The prime mover should be set up to maximize the amount of time necessary to get to the rated speed. This will avoid any instantaneous gear loads that could exceed the rating of the speed reducer or other components.

4.2.2 REDUCER ROTATION

If the reducer is equipped with an internal backstop, an arrow located on the top of the maincase will indicate the direction of rotation during operation. Make sure the motor shaft will rotate in that direction. If necessary, reverse the leads on the motor so that the proper motor direction is attained.

4.2.3 START-UP

Start the reducer under as light a load as possible. As the unit is brought up to normal operating speed, check for unusual noises, excessive vibration, or excessive heat and oil leakage. If any of these conditions exist, shut down the unit immediately and determine the cause of the problem. Refer to **Section 9.0 Troubleshooting (page 21)** for assistance.

4.3 POST START-UP CHECKLIST

① After approximately forty hours of use, check all foundation and mounting bolts and tighten as required. **Note: Always recheck alignment after tightening**.

② The oil used in the initial start-up of a new reducer should be completely drained and replaced after 500 hours of use. A thorough cleaning of the gear case using a flushing oil should be performed to remove any foreign matter during the first oil change.

Section 5.0
Maintenance

⚠ WARNING

DO NOT PERFORM ANY MAINTENANCE PROCEDURES WHILE REDUCER IS IN OPERATION. DOING SO MAY RESULT IN PERSONAL INJURY OR PROPERTY DAMAGE. TO INSURE SAFETY DURING MAINTENANCE, ACTIVATE ALL ELECTRICAL AND/OR MECHANICAL LOCKOUTS.

NOTE: ALL EXTERNAL PLUMBING (PIPE NIPPLE, PIPE PLUGS, FITTINGS) ARE STANDARD NPT (NATIONAL PIPE THREAD) CONNECTIONS.

5.1 FILLING OIL

1. Chose correct oil type; **reference Section 3.0**.
2. Determine correct oil quantity; **reference Nameplate or Section 3.0**.

NOTE: Special applications may have different oil quantity requirements. Refer to the nameplate for specific oil quantity.

3. Remove oil fill plug (vent plug) and one of the two oil level plugs; **reference Figure 5.1**.

NOTE: Reference Section 7.0 for Vertical Service Instructions (page 19).

4. Fill reducer at oil fill port.
5. Reducer oil capacity is reached when oil starts to pour out of the bottom of the level port. Allow several minutes for oil to settle, then recheck oil level. Add oil if necessary.

NOTE: Oil should be checked or added when reducer is at ambient temperature.

⚠ CAUTION

Underfilling reducer may cause product damage. Overfilling reducer may cause excessive oil temperatures.

6. Replace oil level plug, sealing it in the process using thread sealant.
7. Replace oil fill plug (vent plug).
8. Start up reducer under a no load condition. Run reducer for a few minutes.
9. Stop reducer and recheck oil at the oil level port. If necessary, add oil.

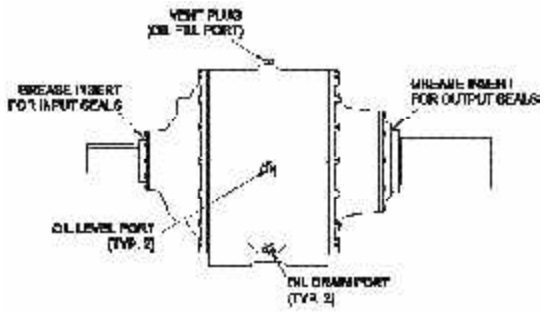


Figure 5.1—Reducer Oil Ports, Vent Plug, and Grease Insert Locations

5.2 DRAINING OIL

1. Clean external surfaces to avoid contaminants from entering unit when plugs are removed.
2. Remove oil fill plug (vent plug) for ventilation; **reference Figure 5.1.**

⚠ CAUTION

Care should be taken when removing the vent plug. If vent has been clogged, the possibility of pressurized air inside the reducer may exist . Once threads are free to hand rotate, place a heavy cloth over the vent plug and rotate counter-clockwise until removed.

3. With the proper size oil drain pan (reference oil quantity on nameplate) in place, remove one of the drain plugs.

⚠ CAUTION

Oil may be hot. Do not drain until oil is at ambient or a safe temperature.

4. After oil is removed, replace oil drain plug, sealing it in the process using thread sealant.
5. **Reference Section 5.1** for filling reducer with oil.

5.3 ADDING GREASE TO REDUCER SEALS

1. Clean grease inserts, **reference Figure 5.1** for location.
2. Using a high temperature No. 2 grease. Attach grease gun to grease insert and pump grease into seal carrier.
3. Stop greasing when a sufficient amount of grease purges out of seal carrier next to shaft.

NOTE: Grease should purge from outboard seal onto shaft, if this does not occur, refer to Section 6.2 to check for proper seal installation.

4. Clean purged grease from reducer.

5.4 REPLACING SEALS IN SERVICE

Reference Section 6.2 for procedure.

Section 6.0
Disassembly and Assembly Instructions

The following instructions are for the Neptune, Orion, Saturn, and Titan speed reducers. This is a guide for disassembly, parts replacement, and reassembly. Note, one drawing is used to represent the entire line of reducers and therefore may not agree in every detail. To expedite service, when ordering parts or requesting information, supply the following information: **model number, reducer size, ratio, serial number, HP, motor RPM, and the build date** from the reducer nameplate. No ratio change should be made without first consulting a **Planetgear** representative. All bearings and seals used on standard **Planetgear** speed reducers are listed in **Table 4 and Table 5 (page 23)**.

REQUIRED EQUIPMENT

Standard mechanic's tools: arbor press or hydraulic press, torque wrench, dial indicator with magnetic base, and hoist.

⚠ CAUTION

Always take the necessary safety precautions when working with an arbor press, hydraulic press or with any hand tools.

6.1 TAKING REDUCER OUT OF SERVICE

NOTE: If only replacing seals, the reducer need not be pulled from service.

⚠ WARNING

DO NOT PERFORM ANY MAINTENANCE PROCEDURES WHILE REDUCER IS IN OPERATION. DOING SO MAY RESULT IN PERSONAL INJURY OR PROPERTY DAMAGE. TO INSURE SAFETY DURING MAINTENANCE, ACTIVATE ALL ELECTRICAL AND/OR MECHANICAL LOCKOUTS.

1. Disconnect all attached equipment.
2. Remove all reducer mounting bolts.
3. Lift reducer using the double rope sling method explained in **Section 2.1**.
4. Drain oil from reducer, **reference Section 5.2** for procedure.

NOTE: Care should be taken to protect the shafts from damage. Damaged shaft may cause problems when reinstalling couplings, sprockets, or sheaves.

6.2 REPLACING SEALS

6.2.1 REMOVING SEAL CARRIER

NOTE: If only replacing seals, the reducer need not be pulled from service. Seals are housed in a seal carrier which can be removed from the reducer at the installation location.

NOTE: If unit is equipped with a fan and shroud, remove fan and shroud.

1. Clean shaft extension.
2. Drain oil from reducer before removing seal carrier; **reference Section 5.2**.
3. Remove bolts attaching seal carrier to input or output housing (Note location of grease fitting for reinstallation).
4. Using a **flat blade** and a hammer, break the seal between the seal carrier assembly and the input or output housing; **reference Figure 6.2.1**.

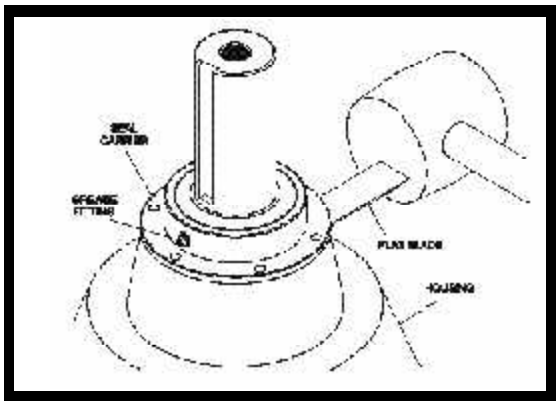


Figure 6.2.1—Separation of Seal Carrier From Hub

5. Remove seal carrier.
6. After seal carrier is removed, protect the input or output bearings from contamination by wrapping a clean cloth (or equivalent) around the exposed area.

⚠ CAUTION

When removing seal carrier, care should be taken not to damage or contaminate the bearings. Damaged bearings may reduce bearing life.

6.2.2 REMOVING SEALS FROM SEAL CARRIER

1. Remove seal carrier from the input or output housing; **reference Section 6.2.1 Removing Seal Carrier**.
2. With a set of blocks or equivalent, support the seal carrier up so the seals can be pushed out; **reference Figure 6.2.2, next page**.
3. With an arbor press or a hydraulic press, carefully push seals out of seal carrier using a metal tube or a circular disc.

NOTE: Take care not to scratch or gouge the inside diameter of the seal carrier or the surface that mates to the input or output housing. Damage to these areas may result in oil leakage during operation.

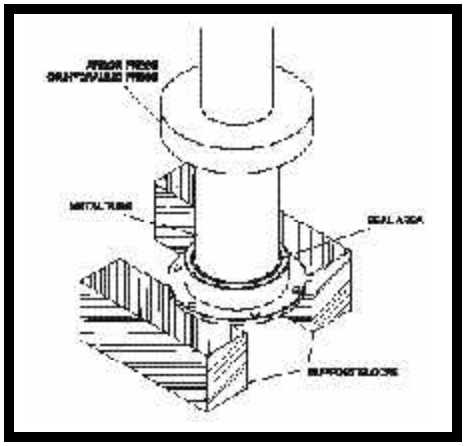


Figure 6.2.2—Removal of Seals from Seal Carrier

NOTE: For Neptune and Orion input and Saturn output, push seals out from the inboard side of the seal carrier.

6.2.3 INSTALLING NEW SEALS (Saturn and Titan Input -Neptune, Orion, and Titan Output Seal Carriers)

1. Remove seal carrier from the input or output housing; **reference Section 6.2.1**.
2. Remove seals from seal carrier; **reference Section 6.2.2**.
3. Clean all machined surfaces on the seal carrier and the machined surface that the seal carrier seats to on the input or output housing.
4. Place seal carrier outboard side face down on a flat surface. Set the double lipped seal on seal carrier so that the opening (garter spring side) faces the inboard side; **reference Figure 6.2.3.1A**.

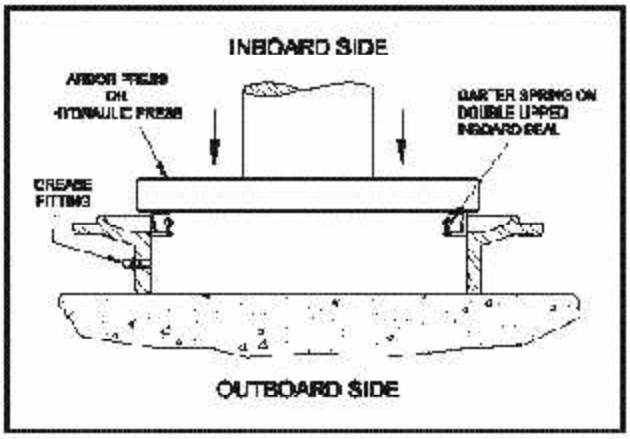


Figure 6.2.3.1A—Placement of Inboard Seal for Installation

5. With an arbor press or a hydraulic press, carefully push seal into seal carrier flush with end of chamfer; **reference Figure 6.2.3.1B, next column**.

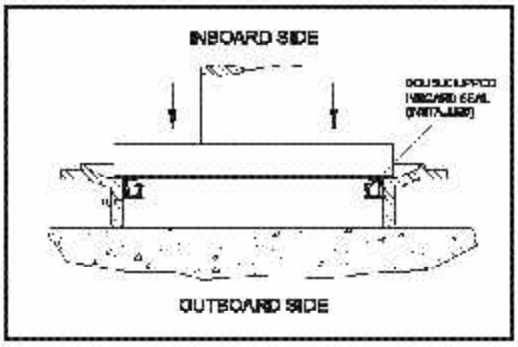


Figure 6.2.3.1B—Installation of Inboard Seal

NOTE: Be sure to push seal in squarely. Any misalignment might damage seal and result in oil leakage.

6. Place seal carrier inboard side face down on a flat surface. Set the single lipped seal on the seal carrier so that the opening (garter spring side) faces the outboard side; **reference Figure 6.2.3.2A**.

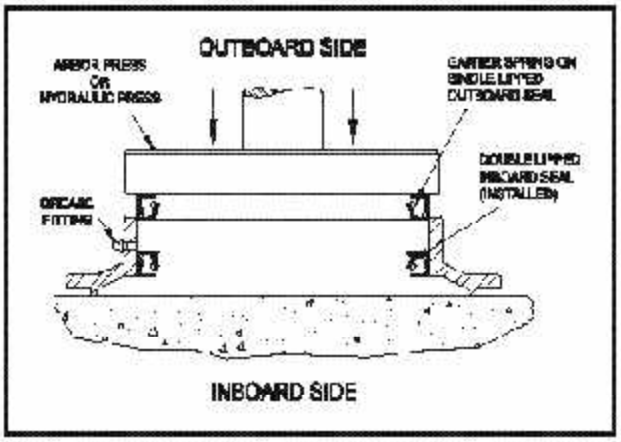


Figure 6.2.3.2A—Placement of Outboard Seal for Installation

7. With an arbor press or a hydraulic press, carefully push seal into seal carrier until the seal seats flush to the outboard face of the seal carrier; **reference Figure 6.2.3.2B**.

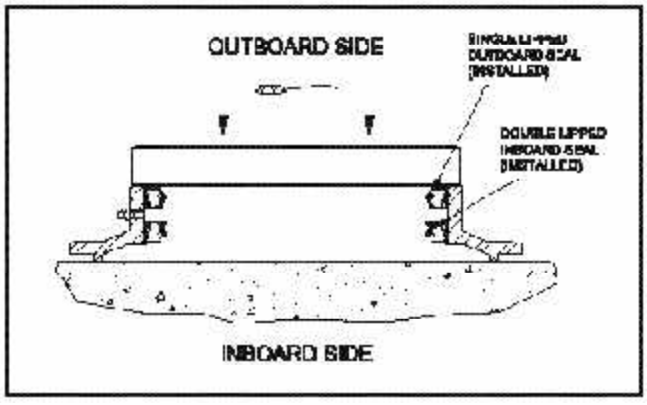


Figure 6.2.3.2B—Installation of Outboard Seal

NOTE: Be sure to push seal in squarely. Any misalignment might damage seal and result in oil leakage.

6.2.4 INSTALLING NEW SEALS (Neptune and Orion Input and Saturn Ouput Seal Carriers)

1. Remove seal carrier from the input housing; **reference Section 6.2.1**.
2. Remove seals from seal carrier; **reference Section 6.2.2**.
3. Clean the inside diameter of the seal carrier as well as the surface that mates to the input housing.
4. Place seal carrier inboard side face down on a flat surface. Set the double lipped seal on seal carrier so that the opening on the seal where the garter spring is located faces the inboard side; **reference Figure 6.2.4.1A**.

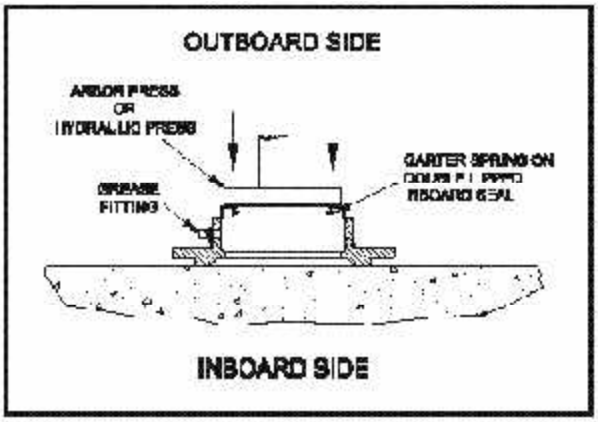


Figure 6.2.4.1A—Placement of Inboard Seal for Installation

5. With an arbor press or a hydraulic press, carefully push seal into seal carrier until the seal seats flush to the shelf of the seal carrier; **reference Figure 6.2.4.1B**.

NOTE: Be sure to push seal in squarely. Any misalignment might damage seal and result in oil leakage.

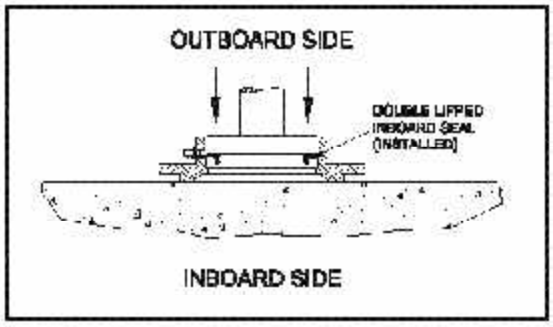


Figure 6.2.4.1B—Installation of Inboard Seal

6. Set the single lipped seal on the seal carrier so that the opening on the seal where the garter spring is located faces the outboard side; **reference Figure 6.2.4.2A, next column**.
7. With an arbor press or a hydraulic press, carefully push seal into seal carrier until the seal seats flush to the outboard face of the seal carrier; **reference Figure 6.2.4.2B**.

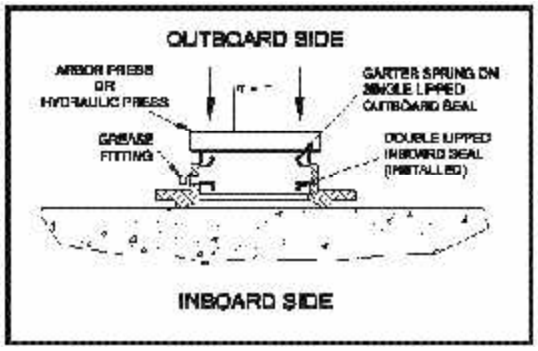


Figure 6.2.4.2A—Placement of Outboard Seal for Installation

NOTE: Be sure to push seal in squarely. Any misalignment might damage seal and result in oil leakage.

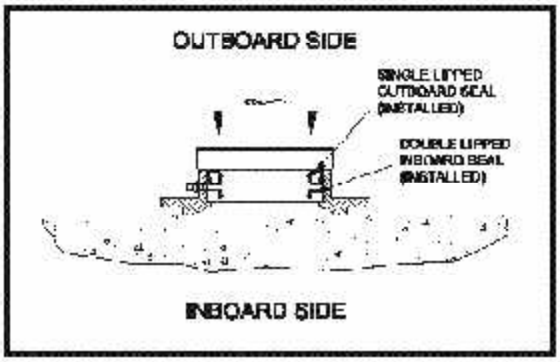


Figure 6.2.4.2B—Installation of Outboard Seal

6.2.5 INSTALLING SEAL CARRIER - INPUT/OUTPUT SHAFT ASSEMBLY

1. Clean the machined surfaces where the seal carrier and the input or output housing mate.

NOTE: Scraping of surfaces with a putty knife may be required.

2. Apply a bead of sealant around the inboard lip of the seal carrier and/or around the face of the input or output **housing inside the bolt hole circle**.

NOTE: Use Loctite 515 gasket eliminator, or equivalent as a sealant.

3. Slip the seal carrier over the shaft.

⚠ CAUTION
Extreme care must be taken to not roll the lip of the seal or cut the seal on the keyway.

4. When the seal carrier is piloted on the shaft pilot, seat the seal carrier by slowly pressing down on the flange; **reference Figure 6.2.5**.

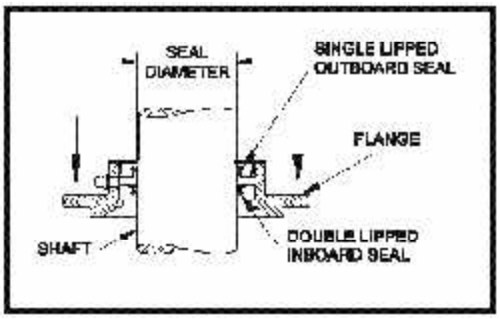


Figure 6.2.5—Placement of Seal Carrier Assembly onto Shaft

NOTE: Orientate the seal carrier grease fitting to the position best suited to your application. Reducers built by Planetgear are assembled with the grease fitting oriented in-line with an oil port in the input or output shaft housings and are normally in the 12 o'clock position.

5. Bolt seal carrier to input or output housing, reference **Table 2 (page 22)** for bolt torques.
6. Add grease to seal carrier; **reference Section 5.3**.
7. Add oil to reducer; **reference Section 5.1**.

7. Remove assembly by lifting it straight up away from the maincase. An eye bolt can be used in the threaded end of the shaft to lift the assembly; **reference Figure 6.3.1. DO NOT LIFT ENTIRE REDUCER BY THE THREADED HOLE ON EITHER SHAFT.**

NOTE: Place all removed parts on a clean dry surface to avoid contact with contaminants.

⚠ CAUTION
Do not lift input or ouput shaft assembly by hand. The assemblies are heavy and lifting by hand can cause serious injury.

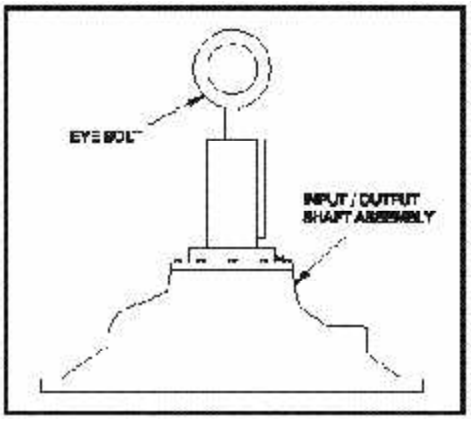


Figure 6.3.1—Proper Lifting of Input or Output Shaft Assemblies

6.3 REPLACING BEARINGS - INPUT/OUTPUT SHAFT ASSEMBLIES

6.3.1 REMOVING INPUT OR OUTPUT SHAFT ASSEMBLIES TO REPLACE BEARINGS

1. Take reducer out of service; **reference Section 6.1**.
2. Clean all external surfaces to prevent contaminants from entering unit when disassembled.
3. Drain oil from unit; **reference Section 5.2**.
4. If unit is equipped with a fan and shroud, remove fan and shroud.

NOTE: For better results, mount reducer in the vertical position with the assembly to be removed facing up.

5. Remove the twelve (12) 1/2" bolts that attaches assembly to the maincase.
6. With a 1/2" bolt, drive the bolt into one of the four 1/2-13 UNC threaded holes. This will break the seal between the housing and the maincase allowing the removal of the assembly.

NOTE: Special care should be taken when removing the output assembly. All gearing is stabilized at the output assembly. Removing output assembly first may result in difficulties during reducer reassembly. It is recommended that the input assembly be removed first, then the gear train, and finally the output assembly (reference Section 6.5 for additional information).

6.3.2 DISASSEMBLING INPUT OR OUTPUT SHAFT ASSEMBLIES TO REPLACE BEARINGS (Saturn & Titan Input and Orion & Titan Output)

1. Remove endbell from reducer; **reference Section 6.3.1**.
2. Remove seal carrier from endbell; **reference Section 6.2.1**.
3. Support hub to expose the inboard side of the endbell; **reference**

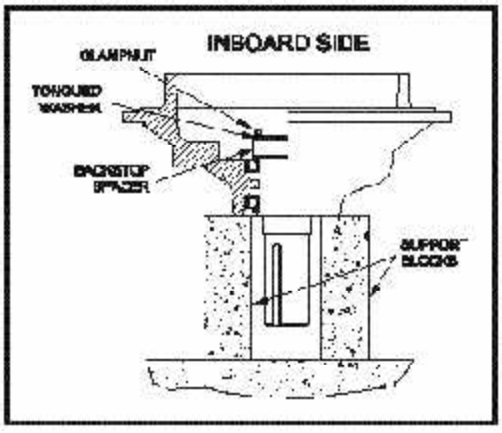


Figure 6.3.2.1A—Saturn/Titan Input Shaft Assembly

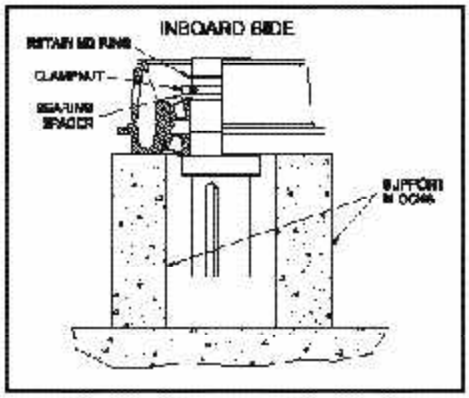


Figure 6.3.2.1B—Titan Output Shaft Assembly

Figure 6.3.2.1A and Figure 6.3.2.1B, next page.

NOTE: Allow space between the shaft extension and the working surface.

4. **ORION & TITAN OUTPUT ONLY** - Remove external retaining ring. **Store in clean spot.**
5. Loosen socket head cap screw on clampnut.
6. Remove clampnut from shaft. **Store in clean spot.**

NOTE: A wedge can be used to spread the clampnut in order to ease removal.

7. Remove tongued washer from shaft. **Store in clean spot.**
8. **SATURN AND TITAN INPUT ASSEMBLIES ONLY** - Remove backstop or backstop spacer from shaft. **Store in clean spot.**
9. With an arbor press or a hydraulic press, press on the inboard end of the shaft to break free the inboard bearing cone.
10. At this time, the shaft will be free and can be separated from the housing. The inboard bearing cone will be free to remove and discard.

⚠ CAUTION
The input and output shafts are heavy.

11. To remove the outboard bearing from the shaft, one of two procedures can be used. 1.) Support the shaft by the bearing cone with the inboard end of the shaft facing up. With an arbor press or hydraulic press, press down on the inboard end of the shaft; **reference Figure 6.3.2.2**. 2.) With a hammer and punch, carefully strike the bearing cone towards the inboard end of the shaft; **reference Figure 6.3.2.3, next column**.

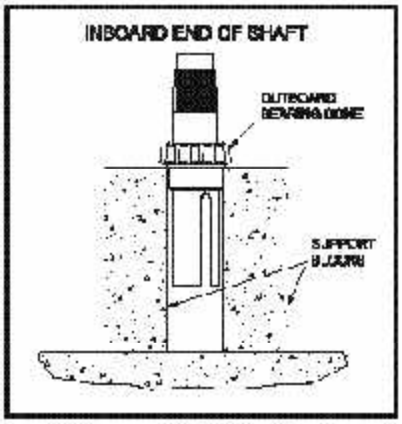


Figure 6.3.2.2—Removal of Outboard Bearing Cone (Option #1)

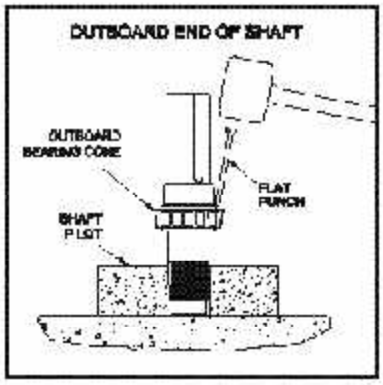


Figure 6.3.2.3—Removal of Outboard Bearing Cone (Option #2)

NOTE: Take care not to damage the shaft bearing surface or seal surface.

12. With a hammer and punch, tap out the inboard and outboard bearing cups from the housing.

NOTE: Take care not to damage the bearing surface of the housing.

6.3.3 <u>DISASSEMBLING INPUT OR OUTPUT SHAFT ASSEMBLIES TO REPLACE BEARINGS</u> (Neptune Input and Neptune & Saturn Output)

1. Remove endbell from reducer; **reference Section 6.3.1**.
2. Remove seal carrier from endbell; **reference Section 6.2.1**.
3. Support hub to expose the outboard side of the endbell; **reference Figure 6.3.3.1A and Figure 6.3.3.1B, next page**.

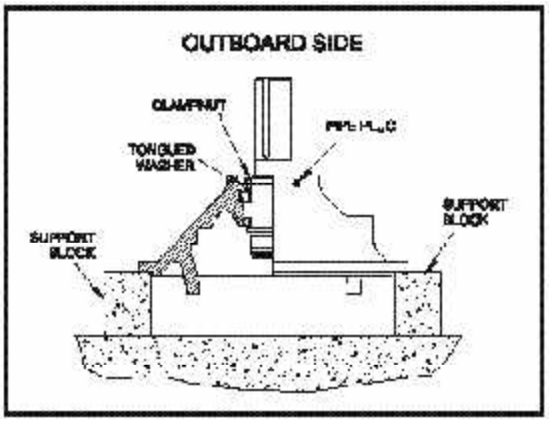


Figure 6.3.3.1A—Neptune Input Shaft Assembly

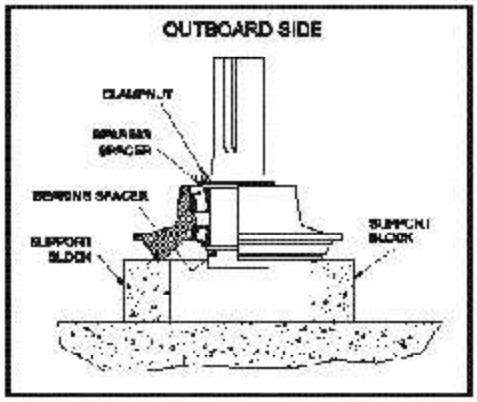


Figure 6.3.3.1B—Neptune/Saturn Output Shaft Assembly

NOTE: Allow space between the shaft extension and the working surface.

4. **NEPTUNE INPUT ONLY** - Remove pipe plug on housing near outboard end to allow access to socket head cap screw on clampnut
5. Loosen socket head cap screw on clampnut.
6. Remove clampnut from shaft. **Store in clean spot.**

NOTE: A wedge can be used to spread the clampnut in order to ease removal.

7. Remove tongued washer from shaft. **Store in clean spot.**
8. With an arbor press or a hydraulic press, press on the outboard end of the shaft to break free the outboard bearing cone.
9. At this time, the shaft will be free and can be separated from the housing. The outboard bearing cone will be free to remove and discard.

⚠CAUTION
The input and output shafts are heavy.

10. To remove the inboard bearing from the shaft, one of two procedures can be used. 1.) Support the shaft by the bearing cone with the outboard end of the shaft facing up. With an arbor press or hydraulic press, press down on the inboard end of the shaft; **reference Figure 6.3.3.2**. 2.) With a hammer and punch, carefully strike the bearing cone towards the outboard end of the shaft; **reference Figure 6.3.3.3, next column**.

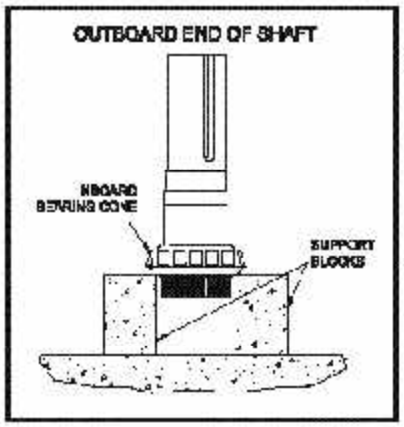


Figure 6.3.3.2—Removal of Outboard Bearing Cone (Option #1)

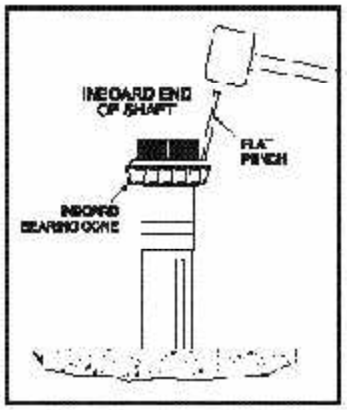


Figure 6.3.3.3—Removal of Outboard Bearing Cone (Option #2)

NOTE: Take care not to damage the shaft bearing surface or seal surface.

NOTE: For Neptune input, if assembly has a backstop, removing it may ease assembly later.

11. With a hammer and punch, tap out the inboard and outboard bearing cups from the housing.

NOTE: Take care not to damage the bearing surface of the housing.

6.3.4 INSTALLING BEARING CUPS INTO INPUT OR OUTPUT HOUSINGS

1. Clean machined surfaces on housing where bearing cups are located.

NOTE: If high spots or burrs occurs after disassembly, use discretion to remove them. Bearing cup has to be seated perfectly to insure proper bearing alignment.

2. Place bearing cup squarely on the bearing bore. With an arbor press or a hydraulic press and flat disc push bearing cup into housing until seated.

NOTE: This procedure applies to both inboard and outboard bearing cup. Be sure to push cups in evenly. Any misalignment may result in a damaged housing or bearing cup.

NOTE: Take care not to scratch or gauge bearing surface. Any damage done may result in premature damage of the bearings.

3. With a 0.001" or 0.040 mm feeler gage, make sure that there is no gap between the housing and the bearing cups to insure proper cup seating; **reference Figure 6.3.4, next page**.

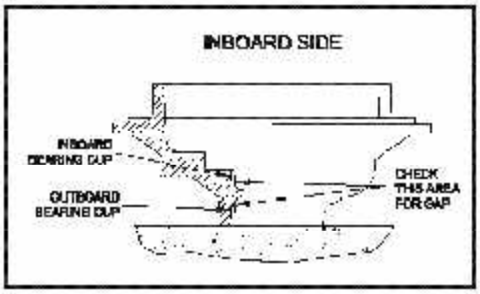


Figure 6.3.4—Installation of Inboard and Outboard Bearing Cups

NOTE: Any gap between hub and bearing cups can result in excessive axial bearing clearance or bearing misalignment and ultimately result in premature bearing damage.

6.3.5 ASSEMBLING INPUT OR OUTPUT SHAFT ASSEMBLIES (Saturn/ Titan Input and Titan Output)

1. Clean bearing surface on shaft.

> **⚠ CAUTION**
> **Assembly may become top heavy. Pilot assembly so that it will not fall over.**

2. Make sure bearing cups are clean and installed properly in housing; **reference Section 6.3.3**.

3. Set shaft on end with the spline end of the shaft facing up.

4. Place the outboard bearing cone squarely on the inboard end of the shaft with the smaller diameter of the bearing facing inboard; **reference Figure 6.3.5.1**.

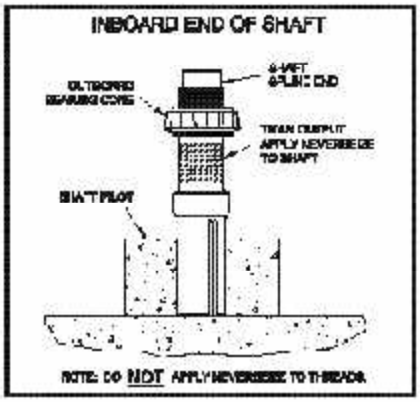


Figure 6.3.5.1—Placement of Outboard Bearing Cone on Shaft

NOTE: For Titan output assembly, the use of Neverseize around the shaft is allowed to ease assembly. DO NOT put Nerverseize on threaded part of shaft.

5. With an arbor press or a hydraulic press carefully push bearing cone until it bottoms on shaft shoulder.

NOTE: DO NOT push on bearing rollers or bearing cage; reference Figure 6.3.5.2 for location.

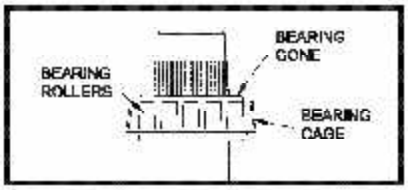


Figure 6.3.5.2—Location of Bearing Cage and Roller Bearing

6. With a 0.001" or 0.040 mm feeler gage, make sure that there is no gap between the shaft shoulder and the bearing cone to insure proper cone seating; **reference Figure 6.3.5.3**.

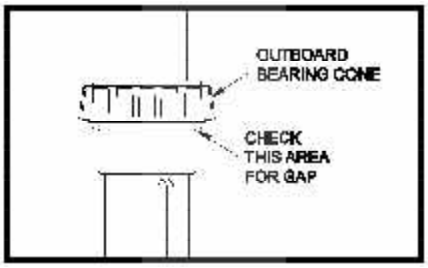


Figure 6.3.5.3—Checking for Zero Clearance with Feeler Gauge

NOTE: Any gap between shaft and bearing cone can result in excessive axial bearing clearance or bearing misalignment and ultimately result in premature bearing damage.

7. Carefully set the housing, outboard side face down, onto the outboard bearings.

NOTE: It is helpful to use a crane to lift hub onto shaft; reference Figure 6.3.5.4.

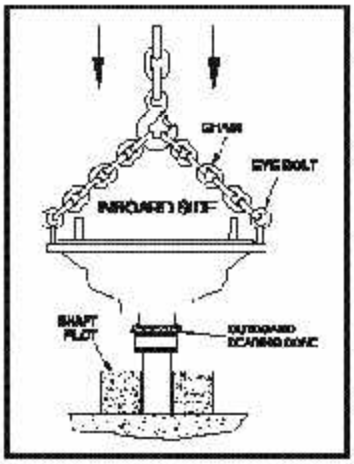


Figure 6.3.5.4—Placing Housing onto Shaft Assembly

8. While rotating the housing on bearings, apply clean oil to the bearings.

9. Place the inboard bearing cone squarely on the inboard end of the shaft with the smaller diameter of the bearing facing the outboard; **reference Figure 6.3.5.5, next page**.

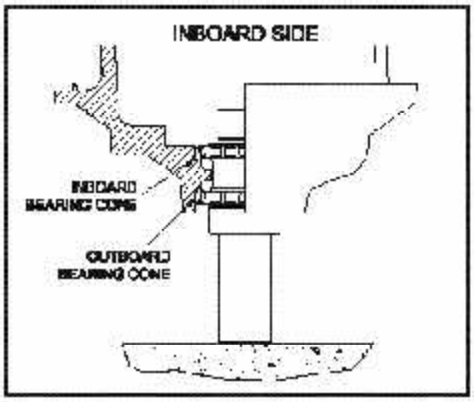


Figure 6.3.5.5—Placing Inboard Bearing Cone onto Shaft

10. With an arbor press or a hydraulic press carefully push bearing cone. When bearings begin to approach the bearing cup, apply clean oil to inboard bearings.

NOTE: DO NOT push on bearing rollers or bearing cage; reference Figure 6.3.5.2.

11. Press inboard bearing until it touches the surface of the bearing cup.

NOTE: Do not over push bearings into cup. This might cause the bearings to Brinell the cup.

NOTE: An indication when the inboard bearing is fully seated is when the hub will not rotate on the shaft freely.

12. **INPUT ONLY** - Clean and place the backstop or backstop spacer onto the shaft.

NOTE: The desired rotation of the reducer is determined by viewing thru the output shaft side. Reference Figure 6.3.5.6 for orientation of the backstop after being assembled onto the input shaft.

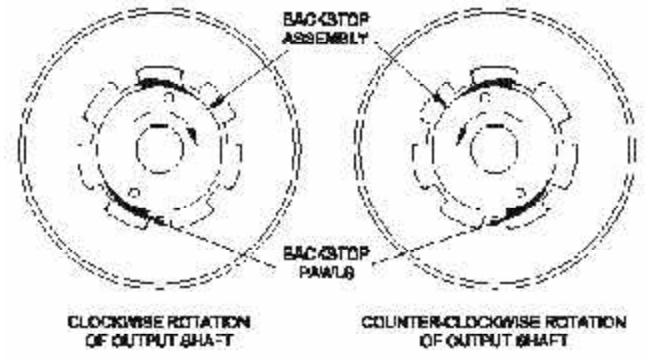


Figure 6.3.5.6—Backstop on Input Assembly

13. Clean and place the tongued washer onto the shaft.
14. Clean clampnut. Place it with the grooved side down (or groove towards bearings) and thread on clampnut until it is unable to rotate.
15. Mark the location of the clampnut.
16. Loosen clampnut approximately 3/4" (19mm) from original mark.
17. Tighten socket head cap screw on clampnut; **reference Table 2**
18. Support hub and affix to work table with the shaft not touching the table; **reference Figure 6.4.1 (page 16)**.
19. With an arbor press or a hydraulic press, push on the inboard end of the shaft to relieve the bearings.

NOTE: A popping noise will sound when bearings are relieved. If the noise does not occur , an alternative way to determine if the bearings have been relieved is if the housing rotates freely on the bearings.

20. **Reference Axial Bearing Clearance, Section 6.4 for proper bearing endplay.**

6.3.6 <u>ASSEMBLING INPUT OR OUTPUT SHAFT ASSEMBLIES</u> (Neptune Input and Neptune/Saturn Output)

1. Clean bearing surface on shaft.

> **⚠ CAUTION**
> **Assembly may become top heavy. Pilot assembly so that it will not fall over.**

2. Make sure bearing cups are clean and installed properly in housing**; reference Section 6.3.3**.
3. Set shaft on end so that shaft is resting on spline end.
4. **NEPTUNE AND SATURN OUTPUT ONLY** - Clean and place bearing spacer onto shaft.
5. Place the inboard bearing cone squarely on the outboard end of the shaft with the smaller diameter of the bearing facing outboard; **reference Figure 6.3.6.1**.

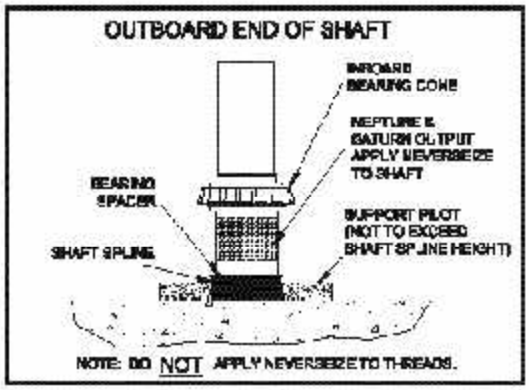


Figure 6.3.6.1—Placement of Inboard Bearing Cone on Shaft

6. With an arbor press or a hydraulic press carefully push bearing cone until it bottoms on shaft shoulder or bearing spacer.

NOTE: DO NOT push on bearing rollers or bearing cage; reference Figure 6.3.6.2 for location, next page.

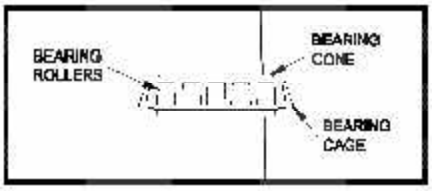


Figure 6.3.6.2—Location of Bearing Cage and Roller Bearing

7. With a 0.001" or 0.040 mm feeler gage, make sure that there is no gap between the shaft shoulder or bearing spacer, and the bearing cone to insure proper cone seating; **reference Figure 6.3.6.3**.

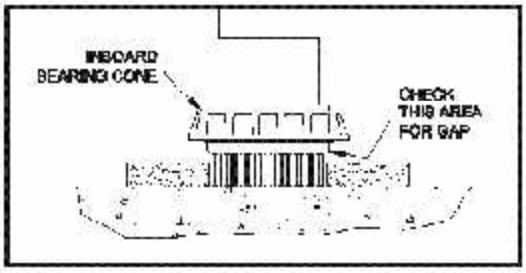


Figure 6.3.6.3—Checking for Zero Clearance with Feeler Gauge

NOTE: Any gap between shaft and bearing cone can result excessive axial bearing clearance or bearing misalignment and ultimately result in premature bearing damage.

8. Carefully set the housing, outboard side face up, onto the inboard bearings.

NOTE: It is helpful to use a crane to lift hub onto shaft; reference Figure 6.3.6.4.

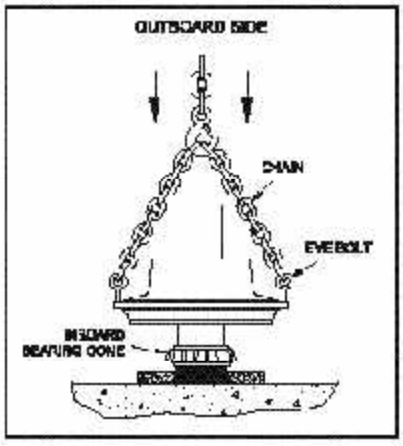


Figure 6.3.6.4—Placing Housing onto Shaft Assembly

9. While rotating the housing on bearings, apply clean oil to the bearings.

10. Place the outboard bearing cone squarely on the outboard end of the shaft with the smaller diameter of the bearing facing the inboard; **reference Figure 6.3.6.5, next column**.

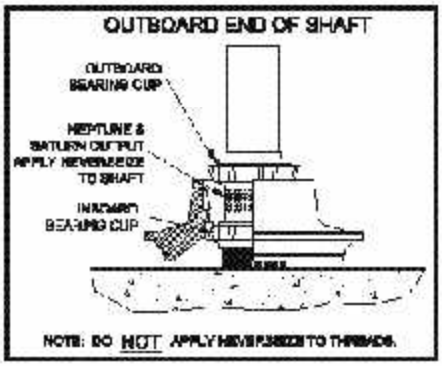


Figure 6.3.6.5—Placing Outboard Bearing Cone onto Shaft

11. With an arbor press or a hydraulic press carefully push bearing cone. When bearings begin to approach the bearing cup, apply clean oil to outboard bearings.

NOTE: DO NOT push on bearing rollers or bearing cage; reference Figure 6.3.6.2.

12. Press outboard bearing until it touches the surface of the bearing cup.

NOTE: Do not over push bearings into cup. This might cause the bearings to Brinell the cup.

NOTE: An indication when the outboard bearing is fully seated is when the hub will not rotate on the shaft freely.

13. Clean and place the tongued washer onto the shaft.

14. Clean clampnut. Place it with the grooved side down (or groove towards bearings) and thread on clampnut until it is unable to rotate.

15. Mark the location of the clampnut.

16. Loosen clampnut approximately 3/4" (19 mm) from original mark.

17. Tighten socket head cap screw on clampnut; **reference Table 2**

18. Support hub and affix to work table with the shaft not touching the table; **reference Figure 6.4.1, next page**.

19. With an arbor press or a hydraulic press, push on the inboard end of the shaft to relieve the bearings.

NOTE: A popping noise will sound when bearings are relieved. If the noise does not occur , an alternative way to determine if the bearings have been relieved is if the housing rotates freely on the bearings.

20. Reference Axial Bearing Clearance, Section 6.4 for proper bearing endplay.

21. NEPTUNE INPUT ONLY - After setting the axial bearing clearance, replace pipe plug on housing near outboard end sealing it in the process with thread sealant.

6.4 SETTING PROPER AXIAL BEARING CLEARANCES ON INPUT OR OUTPUT SHAFT ASSEMBLIES

6.4.1 MEASURING AXIAL CLEARANCE ON INPUT AND OUTPUT ASSEMBLIES

1. Support housing to allow the shaft to rotate freely; **reference Figure 6.4.1**.

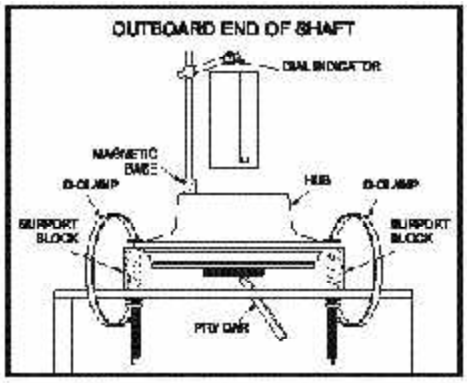


Figure 6.4.1—Setting Axial Bearing Clearance

NOTE: If necessary, the axial bearing clearance can be measured by orientating the larger assemblies outboard side down. The dial indicator should then be placed on the inboard end of the shaft while prying upwards on the outboard end of the shaft.

NOTE: Axial clearance should be checked while seal carrier is removed.

2. Affix the hub to the support table with C-Clamps or bolting to table; **reference Figure 6.4.1**.
3. While exerting downward force by hand on the end of the shaft, rotate shaft 6 to 10 times to align the bearing rollers.
4. Use a dial indicator with a magnetic base to take measurements.

NOTE: Use a dial indicator that has a balanced dial with 0.0001" (or 0.01 mm) graduations.

5. Affix the magnetic base of the dial indicator to a flat area of the housing; **reference Figure 6.4.1**.
6. Place the stem of the dial indicator perpendicular to the end of the shaft.

NOTE: Place stem of dial indicator as close to the center of the shaft as possible.

7. Record the reading of the dial indicator when the indicator has engaged the shaft.
8. With a pry bar, push the inboard end of the shaft up; **reference Figure 6.4.1**.

NOTE: Use a constant swift force when pushing on the pry bar. Excessive force not required. DO NOT rotate shaft while pushing on shaft. The object is to lift the shaft only.

9. Record reading of the dial indicator. Take the difference between the two readings. The difference is the axial bearing clearance.

NOTE: 0.001" to 0.004" (0.025 to 0.102 mm) axial bearing clearance is recom-mended. Do steps 3 thru 9 several times to insure an accurate measurement has been made.

10. See **Sections 6.4.2 and 6.4.3** for adjusting for too much or too little axial bearing clearance.

6.4.2 ADJUSTING FOR TOO MUCH AXIAL BEARING CLEARANCE

NOTE: If axial bearing clearance is too excessive, it might be necessary to remove the clampnut and other hardware, and press the bearing again. Reference Section 6.3.5 - steps 11 to 20, or Section 6.3.6 - steps 12 to 21.

1. Loosen socket head cap screw on clampnut.
2. Mark the position of the clampnut.
3. Rotate clampnut 1/16" to 1/8" (1.5 to 3.1 mm) in the clockwise direction from mark to tighten clampnut.

NOTE: The measurement given is an estimate.

4. Follow procedures in **Section 6.4.1** to determine new axial bearing clearance.
5. Repeat first 5 steps if axial bearing clearance is found to be still too much.

6.4.3 ADJUSTING FOR TOO LITTLE AXIAL BEARING CLEARANCE

1. Loosen socket head cap screw on clampnut.
2. Mark the position of the clampnut.
3. Rotate clampnut 1/16" to 1/8" (1.5 to 3.1 mm) in the counter clockwise direction from mark to loosen clampnut.

NOTE: The measurement given is an estimate.

4. With a hydraulic press, push on the clampnut end of shaft to increase the bearing axial clearance.
5. Follow procedures in **Section 6.4.1** to determine new axial bearing clearance.
6. Repeat first 6 steps if axial bearing clearance is found to be still too little.

6.4.4 FINAL TIGHTENING OF LOCK SCREW ON CLAMPNUT

1. Tighten torque socket head cap screw on clampnut to value below.

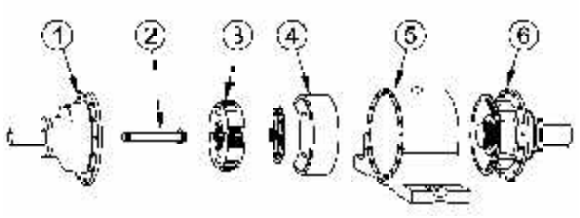
	Cap Screw Torque (Ft-lb)	
Series	**Input**	**Output**
Neptune	15	54
Orion	15	54
Saturn	14	54
Titan	14	54

6.5 GEAR TRAIN DISASSEMBLY

Place gears in a clean dry place in the order of disassembly. Exploded view drawings of a specific gear train may be requested from the factory by specifying the reducer serial number, model number, size, ratio, and rating. To order replacement components, please give the previouly stated information about the reducer and the items needed. Reference the follwing sketches for general exploded view drawings.

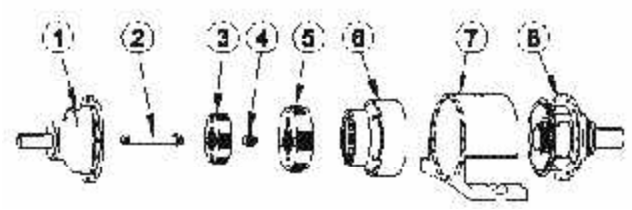
NOTE: All the gearing is stabilized at the output assembly. Removing output assembly first may result in a difficult time reassembling reducer. It is recommended that the input assembly be removed first, then the gear train, and finally the output assembly.

Single Reduction disassembly—Remove input assembly (**1**) from maincase (**5**). Remove input gear (**2**), ring gear (**4**), and last stage carrier (**3**). Remove output assembly (**6**) from maincase.



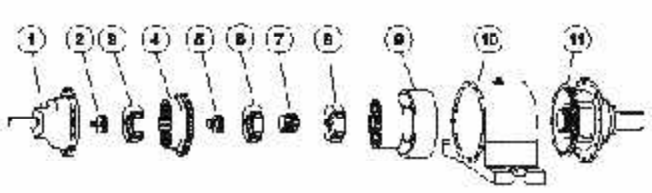
SINGLE REDUCTION

Double Reduction disassembly—Remove input assembly (**1**) from maincase (**7**). Remove input gear (**2**), ring gear (**6**), first stage carrier (**3**), last stage sun gear (**4**), and last stage carrier (**5**). Remove output assembly (**8**) from maincase.



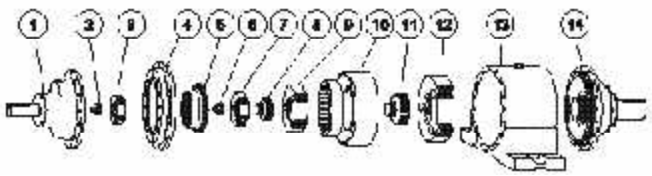
DOUBLE REDUCTION

Triple Reduction disassembly—Remove input assembly (**1**) from maincase (**10**). Remove input gear (**2**), first stage carrier (**3**), triple ring gear (**4**), ring gear (**9**), second stage sun gear (**5**), second stage carrier (**6**), last stage sun gear (**7**), and last stage carrier (**8**). Remove output assembly (**11**) from maincase.



TRIPLE REDUCTION

Quadruple Reduction disassembly—Remove input assembly (**1**) from maincase (**13**). Remove input gear (**2**), first stage carrier (**3**), quad adapter (**4**), quad ring gear (**5**), second stage sun gear (**6**), second stage carrier (**7**), ring gear (**10**), third stage sun gear (**8**), third stage carrier (**9**), last stage sun gear (**11**), and last stage carrier (**12**). Remove output assembly (**14**) from maincase.



QUADRUPLE REDUCTION

6.6 GEAR TRAIN ASSEMBLY

The gear train can be assembled in the reverse order of disassembly. **Reference Section 6.5**.

NOTE: It is recommended that the output sub-assembly be installed first, then the gear treain and finally the input sub-assembly. Unit shoud be assembled in the vertical position, with input shaft up.

6.7 FAN AND SHROUD INSTALLATION

6.7.1 SHROUD CLIP INSTALLATION

Remove mounting bolts from input sub-assembly / maincase in the following locations and install shroud clips; **reference Figure 6.7.1A**.

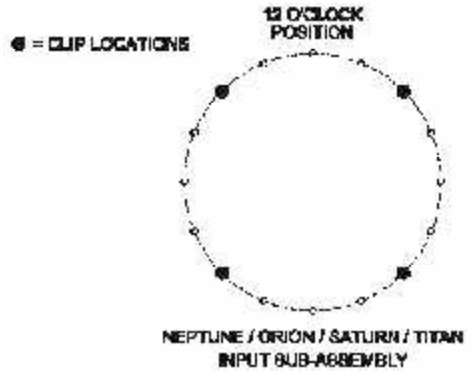


Figure 6.7.1A—Location of Shroud Clips

Align shroud clip with center of reducer; **reference Figure 6.7.1B,** and tighten bolts to torque requirements of **Table 2 (page 22)** .

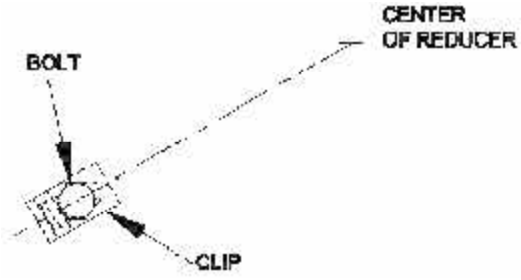


Figure 6.7.1B—Location of Shroud Clips

6.7.2 FAN INSTALLATION

From **Figure 6.7.2**, determine the distance from the end of the input shaft to the front edge of the fan.

REDUCER SIZE	NA Inch Shaft	NA Metric Shaft
NEPTUNE	4.00	102
ORION	4.00	102
SATURN	4.69	119
TITAN	4.69	119

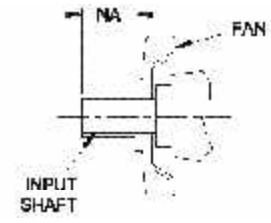


Figure 6.7.2—Dimensions for Location of Fan

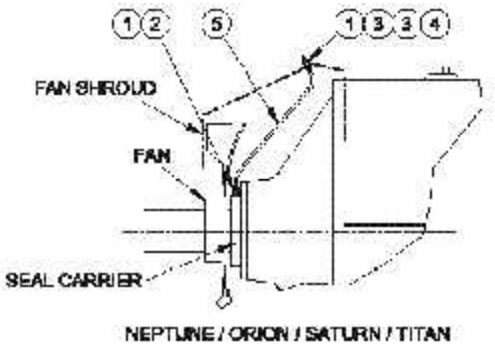
With key in place, position the fan on the input shaft to the determined **"NA"** distance.

Locate the set screw which is 90° from the keyway to the spotting hole on the shaft.

Tighten set screws (2). **Reference Table 2 (page 22)** for torque requirements.

6.7.3 REMOTE GREASE LINE INSTALLATION

NOTE: ALL EXTERNAL PLUMBING (PIPE NIPPLE, PIPE PLUGS, FITTINGS) ARE STANDARD NPT (NATIONAL PIPE THREAD) CONNECTIONS.



ITEM	DESCRIPTION
1	1/8" NPT x 1/4" O.D. TUBE STRAIGHT QD. BRASS FTG.
2	1/4"-28 MALE x 1/8" NPT FEMALE ADAPTER
3	3/8" STEEL WASHER
4	1/8" NPT GREASE FITTING
5	1/4" O.D. TUBE [9" (230mm) NEPTUNE AND 12" (300 mm) SATURN / TITAN]

Per preceding drawing, install grease fitting hardware (items 1 & 2) at seal carrier (if not already installed) and fill grease tube (item 5). Note, fill grease tube prior to installation.

Assemble grease fitting hardware (items 1, 3, &4) into predrilled 7/16 (11 mm) diameter hole in fan shroud (if not already installed).

The grease line (item 5) will be inserted into the grease fitting hardware in the fan shroud when the shroud is assembled to the speed reducer.

6.7.4 FAN SHROUD INSTALLATION

Position the fan shroud so that it fits tight over the shroud clips. Check to insure that when the input shaft is rotated, the fan does not interfere with the shroud. Gently bend the shroud clips to position the shroud.

NOTE: the fan shroud should be predrilled for the shroud clips and the remote grease line (RGL).

Insert RGL grease tube into shroud grease fitting hardware.

Using bolts and washers that were removed originally during disassembly, fasten the shroud to the shroud clips. Once fastened rotate input shaft to insure no interference with fan.

Section 7.0
Vertical Service

NOTE: ALL EXTERNAL PLUMBING (PIPE NIPPLE, PIPE PLUGS, FITTINGS) ARE STANDARD NPT (NATIONAL PIPE THREAD) CONNECTIONS.

Vertical service can be input shaft up on the Neptune and Saturn reducers only. Standard reducers are not designed for vertical applications. **Modifications are made at the factory to convert a standard reducer for vertical service. Contact factory with any other applications.**

Planetgear speed reducers used in a vertical orientation or most inclined orientations require an oil reservoir lubrication system. Any mounting orientation other than horizontal must be stated at order placement so **Planetgear** can determine the requirement for a reservoir kit.

The reservoir kit works by providing an adequate head of oil to lubricate the uppermost bearing while allowing for oil expansion. A plastic tube acts as a purge line to eliminate trapped air below the seals.

⚠ CAUTION
Failure to use a properly installed reservoir kit will cause premature speed reducer damage.

Assemble components as shown in **Figure 7.1a** and **Table 7.1b**. It is difficult to determine all potential field installation interference points. If necessary please substitute different pipe fittings as required. In doing so, **it is important that the bottom of the reservoir is at or above the uppermost bearing**. Holes have been drilled by the factory to facilitate both right hand or left hand oil reservoir mounting. Apply pipe sealant to all threaded connections during assembly.

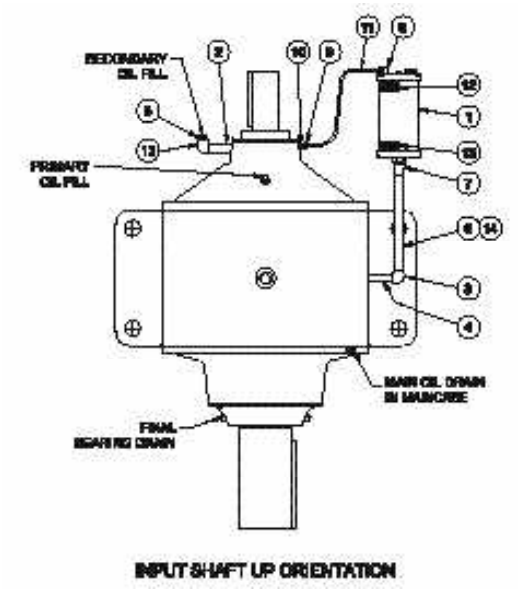


Figure 7.1a Vertical Service Shaft Orientations

NEPTUNE	SATURN	ITEM	DESCRIPTION
1	---	14	1/2" NPT x 10" LG. PIPE NIPPLE (250 mm)
1	1	13	3/8" NPT x 90° PIPE ELBOW
2	2	12	OIL LEVEL DECAL
1	1	11	1/4" O.D. PLASTIC TUBE x 24" LG. (600 mm)
1	1	10	3/8" NPT x 1/8" HEX. REDUCING BUSHING
1	1	9	1/8" NPT x 1/4" O.D. TUBE STRAIGHT BRASS FITTING
1	1	8	1/8" NPT x 1/4" O.D. TUBE 90° BRASS FITTING
1	1	7	1/2" NPT PIPE COUPLING
---	1	6	1/2" NPT x 12" LG. PIPE NIPPLE (300 mm)
1	1	5	3/8" SQ. HD. PIPE PLUG
1	1	4	1/2" NPT x 3" LG. PIPE NIPPLE (75 mm)
1	1	3	1/2" NPT x 90° PIPE ELBOW
1	1	2	3/8" NPT x 3" LG. PIPE NIPPLE (75 mm)
1	1	1	RESERVOIR 1/2 GALLON (1.89 L)

Table 7.1b Vertical Service (Standard Reducers)

FILLING REDUCER WITH OIL

The speed reducer should be completely filled with oil prior to start-up.

NOTE: When replacing oil plug, seal it in the process using thread sealant.

1. Begin by filling the reducer thru the primary oil fill until full; **reference Figure 7.1a**.
2. Plug primary oil fill and fill thru secondary oil fill until full.
3. Plug secondary oil fill and fill reservoir until proper oil level is reached.
4. Start reducer under a no-load condition.

NOTE: During start-up and initially after, it is important to monitor the oil level, as any remaining trapped air may need to purge out. Add oil as needed if this occurs.

DRAINING OIL

⚠ CAUTION
Oil may be hot. Do not drain oil until oil is at ambient or a safe temperature.

NOTE: When replacing oil plug, seal it in the process using thread sealant.

1. Begin by draining oil from main oil drain in maincase; **reference Figure 7.1a**.
2. Plug main oil drain and drain oil from final bearing drain.

Section 8.0
Storage Procedures

8.1 SPARE PARTS STORAGE

1. On receipt of spare parts, unpack and spray or dip the parts in a rust preventative such as **Mobilarma 524**, or equivalent.
2. Place parts on a wood pallet in a dry place. Cover loosely with plastic, DO NOT wrap or store parts in news print as it is corrosive.
3. Re-spray parts every six months. Spray parts every three months if high humidity exists.
4. If rust develops, remove rust with a medium grit emery cloth and re-spray with rust preventative.
5. When ready to install parts, make sure all parts rotate freely. Clean all grime from the parts before installation.

8.2 STORED AND INACTIVE REDUCERS

1. **Preparation For Storage**
   - **A.** If a reducer is to be stored or is inactive after installation, fill the reducer with the correct type and amount of lubricant. Add a rust inhibitor such as **Mobil Vaprotec Concentrate** to the lubricant. Seal the reducer completely; replace the vent plug with a solid pipe plug to keep rust inhibiting atmosphere sealed inside.
   - **B.** After approximately three months, rotate the input shaft such that the output shaft rotates a full 360°(degrees). This will insure that all internal parts will remain coated and will also keep the bearings from becoming lacquered. Noncompliance with this procedure may cause bearing damage during start-up.
   - **C.** Every six months inspect the stored or inactive reducer and add rust inhibitor if necessary. Dry, indoor storage is recommended.

2. **Preparation For Start-up**
   Rotate shafts until the bearings move freely. This is to assure that the bearings have not become lacquered. Reducer may be operated without draining the lubricant described in **Section 8.2-A**.

8.3 LONG TERM STORAGE

Reducer can be ordered from the factory for long term storage. Field preparation for long-term storage is described **Section 8.2**.

Section 9.0
Troubleshooting

This troubleshooting guide will handle questions encountered in regards to **Planetgear** speed reducers.

EXCESSIVE TEMPERATURE [more than 200°F (93°C)]	
POSSIBLE CAUSES:	**POSSIBLE SOLUTIONS:**
OVERLOAD	• Compare actual reducer load with rated load on the nameplate. If the HP or torque is greater, or the speed is slower than stated on the nameplate, the reducer is probably overloaded. Contact a Rex Planetgear Representative; may require a speed change or a larger unit.
TIGHT OR DEFECTIVE BEARINGS	• Inspect bearings for excessive wear or discoloration due to heat. If either is present, replace the bearings. Refer to Section 6.0 for replacing bearings.
EXCESSIVE AMBIENT TEMPERATURE	• Provide ventilation for the reducer. • Paint white if reducer is in direct sun light. • If conditions are extreme, contact a Rex Planetgear Representative for assistance.
IMPROPER OIL, OIL LEVEL, OLD OR CONTAMINATED OIL	• Make sure lubricant is correct for reducer. A mistake frequently made is to use automotive oil. This is incorrect and will frequently cause the reducer to overheat. • Check the oil level in the reducer. Too much as well as too little oil can cause the reducer to overheat. • Check to see that oil has not lost its' lubricating property. If oil viscosity is too low, this will result in high oil temperatures.
PLUGGED SHROUD	• Make sure area immediately in front of fan shroud is clear.
OVERSPEED	• Reduce input speed to reduce oil temperature. If reducer input speed is above the stated value on the nameplate, this would raise oil temperature due to increase in internal windage.
RESTRICTED VENT PLUG	• Remove and clean vent plug. • Replace vent plug.

BEARING DAMAGE	
POSSIBLE CAUSES:	**POSSIBLE SOLUTIONS:**
IMPROPER ADJUSTMENT	• Adjust bearing to proper axial bearing clearance as instructed in Section 6.0.
LACK OF LUBRICATION, IMPROPER LUBRICATION, OLD OR CONTAMINATED OIL	• Replace damaged bearings as instructed in Section 6.0. Note: Check hub and shaft for potential damage or heat distress.
EXCESSIVE OVERHUNG LOAD	• Reduce overhung load. Move the sprocket or sheave closer to the bearings or increase the diameter of both the driven and the driver.

BEARING NOISE	
POSSIBLE CAUSES:	**POSSIBLE SOLUTIONS:**
DEFECTIVE BEARING	• Inspect and replace bearings if necessary. Reference Section 6.0.
IMPROPER BEARING ADJUSTMENT	• Adjust bearing endplay. Reference Section 6.0.
WRONG OR INSUFFICIENT LUBRICATION	• Make sure that enough oil of the correct grade is used. Reference Section 3.0.

LEAKAGE	
POSSIBLE CAUSES:	**POSSIBLE SOLUTIONS:**
DAMAGED OR WORN SEALS	• Replace seals. Reference Section 6.0.
BEARINGS OUT OF ADJUSTMENT	• Reset bearings. Reference Section 6.0.
EXCESSIVE TEMPERATURE, CAUSING BRITTLE SEALS	• Isolate reducer from source of extreme temperature. • Install high temperature seals.
ABRASIVE OR CORROSIVE ATMOSPHERE	• Isolate reducer seal area from environment. • Re-grease frequently.
RESTRICTED VENT PLUG	• Remove and clean vent plug. • Replace vent plug.
SPLIT-LINE LEAKAGE	• Make sure fasteners are torqued correctly. Reference Table 2. • Remove suspect hub. Visually inspect mating surfaces for rises or dings. File smooth (do not allow file shavings to enter gearing or bearings) apply gaske eliminator and replace hub.

DAMAGE OF FASTENERS	
POSSIBLE CAUSES:	**POSSIBLE SOLUTIONS:**
FAILURE OF FASTENERS	• Make sure fasteners are torqued correctly. Reference Table 2. • Make sure the correct grade of fastener is used. All reducer fasteners should be ANSI B18.2.1 Grade 5 or ISO 898/1 Grade 8.8 or greater. • Check length of fastener.
FASTENER LOOSENING	• Make sure fasteners are torqued correctly. Reference Table 2. • For highly vibratory environments, loctite fasteners and torque, or use studs and double nut.

Section 10.0
Tables

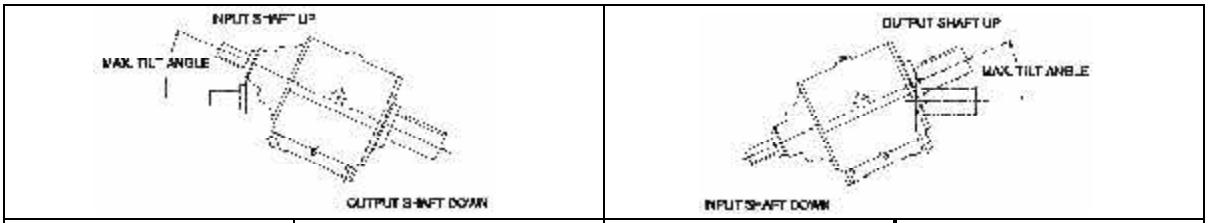
TABLE 1 AVERAGE WEIGHTS lbs (Kg)					
REDUCER SERIES	REDUCER ONLY	REDUCER[1] W/ TOP MOTOR MOUNT	REDUCER[1] W/ SLIDEBASE	REDUCER[1] W/ BASEPLATE	REDUCER[1] W/ SCOOP
Neptune	923 (419)	1066 (484)	1141 (518)	1526 (692)	1095 (497)
Orion	1266 (595)	1434 (652)	1525 (693)	1973 (897)	1485 (675)
Saturn	1512 (685)	1706 (774)	1812 (822)	2323 (1054)	1779 (807)
Titan	2000 (907)	2215 (1005)	2329 (1057)	3180 (1442)	2267 (1028)

[1]Does not include motor weights

TABLE 2 TORQUE REQUIREMENTS FOR DRY FASTENERS (INCH)															
SAE	DIA	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
GENERAL PURPOSE GRADE 2	TORQUE (ft. lbs.)	6	12	21	34	52	75	104	178	184	265	380	530	700	930
HIGH STRENGTH GRADE 5	TORQUE (ft. lbs.)	9	18	33	53	80	116	160	285	460	690	850	1200	1570	2080
ALLOY STEEL GRADE 8	TORQUE (ft. lbs.)	13	26	47	74	114	164	225	400	650	970	1370	1940	2540	3370
TORQUE REQUIREMENTS FOR DRY FASTENERS (METRIC)															
GRADE	NOMINAL DIA. STANDARD PITCH	M5	M6	M7	M8	M10	M12	M14	M16	M18	M20	M22	M24	M27	M30
8.8	TORQUE (Nm)	6.15	10.5	17.5	26	51	89	141	215	295	420	570	725	1070	1450
10.9	TORQUE (Nm)	8.65	15	25	36	72	125	198	305	420	590	800	1020	1510	2050
12.9	TORQUE (Nm)	10.4	18	29	43	87	150	240	365	500	710	960	1220	1810	2450

- The torques shown produce a clamp load of 80% of proof load. They assume clean, dry threads with a torque coefficient of 0.2, and a coefficient of friction of 0.14.
- Plated threads. need only 3/4 torque shown.
- Well lubricated threads need only 1/2 torque shown.
- Source: Rexnord Engineering Specification: GES8-19, 04/10/79

TABLE 3
MAXIMUM ALLOWABLE TILTS FOR STANDARD REDUCERS



REDUCER SERIES	MAX. REDUCER TILT (DEGREES) HIGH SPEED SHAFT UP	REDUCER SERIES	MAX. REDUCER TILT (DEGREES) LOW SPEED SHAFT UP
NEPTUNE (s,d,t)	0°	NEPTUNE (s,d,t)	8°
NEPTUNE (quad)	0°	NEPTUNE (quad)	8°
ORION (s,d,t)	0°	ORION (s,d,t)	12°
ORION (quad)	0°	ORION (quad)	12°
SATURN (s,d,t)	0°	SATURN (s,d,t)	11°
SATURN (quad)	0°	SATURN (quad)	11°
TITAN (s,d,t)	0°	TITAN (s,d,t)	10°
TITAN (quad)	0°	TITAN (quad)	10°

Note: If any reducer application exceeds maximum allowable tilt, consult a **Planetgear** representative for possible modifications.

Section 11.0
Tables: Replacement Seals and Bearings

TABLE 4
BEARINGS FOR STANDARD SPEED REDUCERS
(ALL BEARINGS ARE "TIMKEN" UNLESS NOTED OTHERWISE)

REDUCER SERIES	INPUT BEARINGS		OUTPUT BEARINGS	
	INBOARD CUP / CONE	OUTBOARD CUP / CONE	INBOARD CUP / CONE	OUTBOARD CUP / CONE
Neptune (s,d,t)	34478 / 34300	42620 / 42687	74850 / 74500	95925 / 95500
Neptune (quad)	362A / 368A	3720 / 3780	74850 / 74500	95925 / 95500
Neptune (quint)	18720 / 18790	LM104911 / LM104949	74850 / 74500	95925 / 95500
Orion (s,d,t)	34478 / 34300	42620 / 42687	99100 / 99600	99100 / 99600
Orion (quad)	362A / 368A	3720 / 3780	99100 / 99600	99100 / 99600
Orion (quint)	18720 / 18790	LM104911 / LM104949	99100 / 99600	99100 / 99600
Saturn (s,d,t)	42584 / 42375	42584 / 42375	99100 / 99600	107105 / EE107060
Saturn (quad)	34478 / 34300	42620 / 42687	99100 / 99600	107105 / EE107060
Saturn (quint)	362A / 368A	3720 / 3780	99100 / 99600	107105 / EE107060
Titan (s,d,t)	42584 / 42375	42584 / 42375	94113 / 94700	93125 / 93708
Titan (quad)	LB14710 / LB14749	42620 / 42687	94113 / 94700	93125 / 93708
Titan (quint)	362A / 368A	3720 / 3780	94113 / 94700	93125 / 93708

TABLE 5
SEALS FOR STANDARD SPEED REDUCERS
(ALL SEALS ARE "CHICAGO RAWHIDE" UNLESS NOTED OTHERWISE)

REDUCER SERIES	INPUT SEALS				OUTPUT SEALS			
	NITRILE		VITON		NITRILE		VITON	
	INBOARD	OUTBOARD	INBOARD	OUTBOARD	INBOARD	OUTBOARD	INBOARD	OUTBOARD
Neptune (s,d,t)	CR26220	CR26209	CR26204	CR26208	417534	457585	--	--
Neptune (quad)	24898	24910	24899	24914	417534	457585	--	--
Neptune (quint)	24898	24910	24899	24914	417534	457585	--	--
Orion (s,d,t)	CR26220	CR26209	CR26204	CR26208	CR70053	CR70052	CR70054	CR534998
Orion (quad)	24898	24910	24899	24914	CR70053	CR70052	CR70054	CR534998
Orion (quint)	24898	24910	24899	24914	CR70053	CR70052	CR70054	CR534998
Saturn (s,d,t)	--	--	N416556V	N455195V	N416666	CR57521	N416666V	CR57523
Saturn (quad)	CR26220	CR26209	CR26204	CR26208	N416666	CR57521	N416666V	CR57523
Saturn (quint)	24898	24910	24899	24914	N416666	CR57521	N416666V	CR57523
Titan (s,d,t)	--	--	N416556V	N455195V	N415489	N455489	N415489V	N455489H
Titan (quad)	CR26220	CR26209	CR26204	CR26208	N415489	N455489	N415489V	N455489H
Titan (quint)	24898	24910	24899	24914	N415489	N455489	N415489V	N455489H

N = National Seal

Section 12.0
Maintenance Log

REDUCER SERIAL NUMBER _____

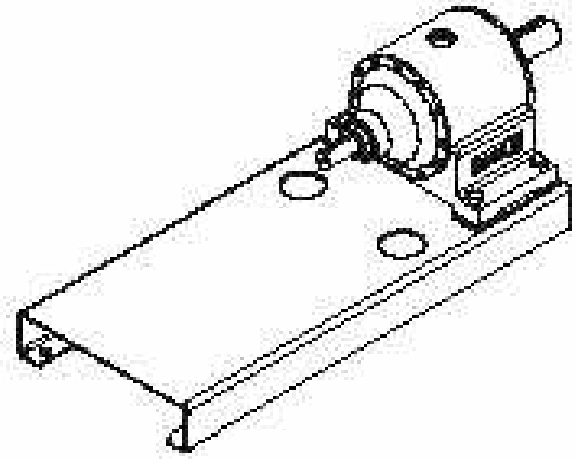
DATE INSTALLED _____

DATE	MAINTENANCE PERFORMED

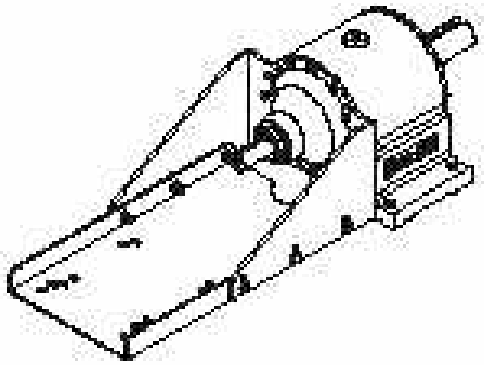
NOTES

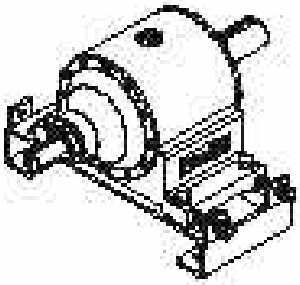
Contact a Planetgear sales representative or refer to Planetgear catalog for detailed information on accessories.

Reducer with Baseplate

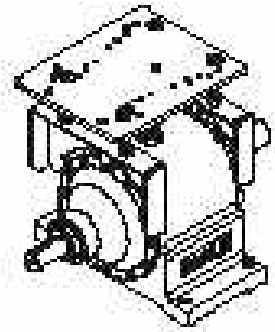


Reducer with Scoop Motor Mount





Reducer with Slidebase



Reducer with Top Motor Mount