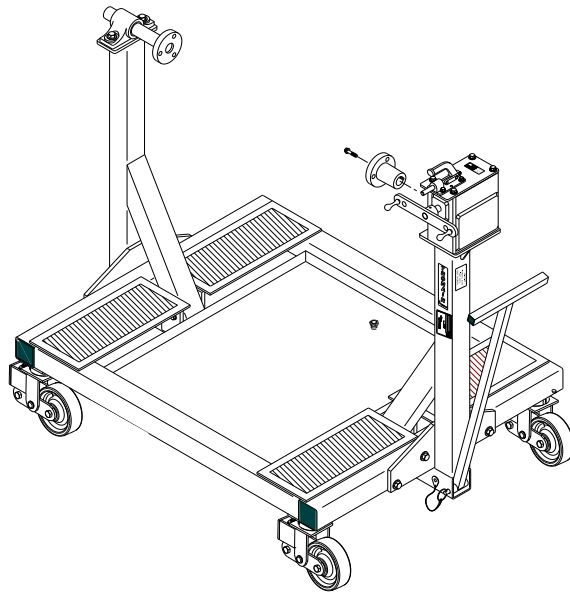




Operation & Service Manual



**Model: 08-2040C0000
Engine Work Stand**



11/2015 – Rev. 03

Includes Illustrated Parts Lists

REVISION	DATE	TEXT AFFECTED
01	07/2015	Original Release
02	10/2015	Major revision
03	11/2015	Modified 3.2.2 Assembly Steps and Parts List

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This product can not be modified without the written approval of Tronair, Inc. Any modifications done without written approval voids all warranties and releases Tronair, Inc., its suppliers, distributors, employees, or financial institutions from any liability from consequences that may occur. Only Tronair OEM replacement parts shall be used.

1.0 PRODUCT INFORMATION

1.1 DESCRIPTION

Engine Work Stand is designed for:

- GARRETT TFE-731-2 through -3B, and like engines
- WILLIAMS FJ-44, and like engines
- PRATT & WHITNEY JT-15D-1 through -1B, -4 through -4D, and like engines
- CESSNA PW615 F engines
- HONDA HJ17100-100-ISE engines

It incorporates the following quality features:

- Heavy steel construction
- Easily maneuverable with handle
- Can be fixed into static position with floor locks
- Oil pan with drain to capture excess fluid
- Rotatable into an infinite number of positions. Positions may be fixed with locking mechanism.
- Non-slip surface on side work platforms

1.2 MODEL & SERIAL NUMBER

Reference nameplate on unit

1.3 MANUFACTURER

TRONAIR, Inc.
1740 Eber Road
Holland, Ohio 43528-9794 USA

Telephone: (419) 866-6301 or 800-426-6301
Fax: (419) 867-0634
E-mail: sales@tronair.com
Website: www.tronair.com

1.4 FUNCTION

The purpose of this stand is to allow mechanics easy access to any part of engine system during engine inspection and maintenance procedures.

2.0 SAFETY INFORMATION

2.1 USAGE AND SAFETY INFORMATION

To insure safe operations please read the following statements and understand their meaning. Also refer to your equipment manufacturer's manual for other important safety information. This manual contains safety precautions which are explained below. Please read carefully.



WARNING! — Warning is used to indicate the presence of a hazard that **can cause severe personal injury, death, or substantial property damage** if the warning notice is ignored.

CAUTION! — Caution is used to indicate the presence of a hazard that **will or can cause minor personal injury or property damage** if the caution notice is ignored.

3.0 PREPARATION PRIOR TO FIRST USE

3.1 SPECIFICATIONS

- Weight: 375 lbs (170 kg)
- Width: 57 ½ in (146 cm)
- Length: 40 in (101.6 cm)
- Engine Centerline Height: 42 in (106.7 cm)

3.2 ASSEMBLY INSTRUCTIONS

3.2.1 General Information

This product should be assembled and/or repaired using good workmanship practices and proper tools. Bolts and elastic stopnuts should be tightened at torque not to exceed industry standards for Grade '5' bolts.

All replacement parts must be the same as or equal to the original parts supplied.

3.2 ASSEMBLY INSTRUCTIONS *(continued)*

3.2.2 Assembly Steps

IDENTIFICATION OF PARTS:

The engine work stand is shipped as one unit, with all parts contained on one pallet. Ensure all parts are present by checking for the following:

- 3 BOXES: 1 For Gear Box Upright
1 For Pillow Block Upright
1 For Hardware (Casters, Floor Lock, Nuts & Bolts)

Engine work stand base will be attached to pallet upside-down with drip pan.

If any damage to the engine stand has occurred during shipping, notify the freight company immediately to file a claim. Also, contact Tronair before assembling.

HARDWARE INCLUDED:

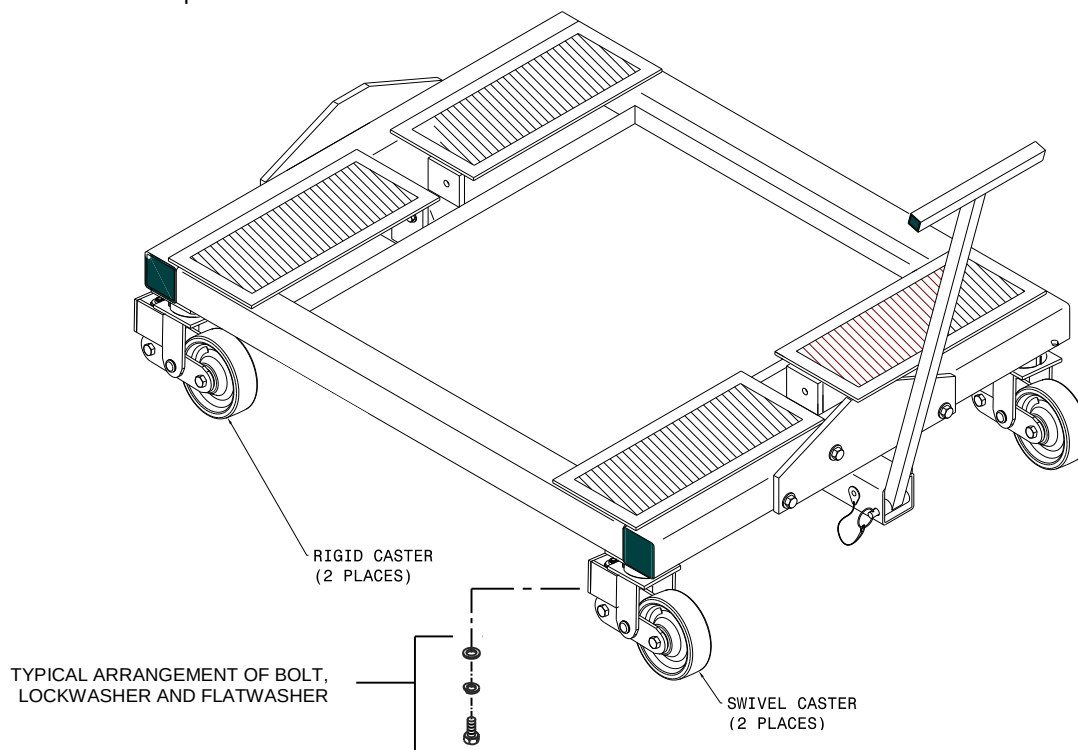
All hardware necessary to assemble this work stand has been provided. Prior to assembly, assure the following hardware is present:

Part Number	Description	Qty
U-1173	Caster, Swivel	2
U-1174	Caster, Rigid	2
G-1100-107506	Bolt, Hex Head, 3/8-24 X 3/4" long	16
G-1100-107550	Bolt, Hex Head, 3/8-24 X 5" long	4
G-1202-1075	Stopnut, 3/8-24 Elastic	4
G-1251-1070R	Lockwasher, 3/8"	16
G-1250-1070N	Flatwasher, 3/8"	16
G-1100-109544	Bolt, Hex Head, 1/2-20 X 4-1/2" long	8
G-1202-1095	Stopnut, 1/2-20 Elastic	8
G-1250-1090N	Flatwasher, 1/2"	16

ENGINE WORK STAND ASSEMBLY:

Caster/Floor Lock To Base Assembly:

1. Attach casters and floor locks to work stand base using (4) 3/8-24 x 3/4" long hex head bolts, (4) 3/8" lockwashers and (4) 3/8" flatwashers per caster and floor lock.



3.2.2 Assembly steps continued on following page.

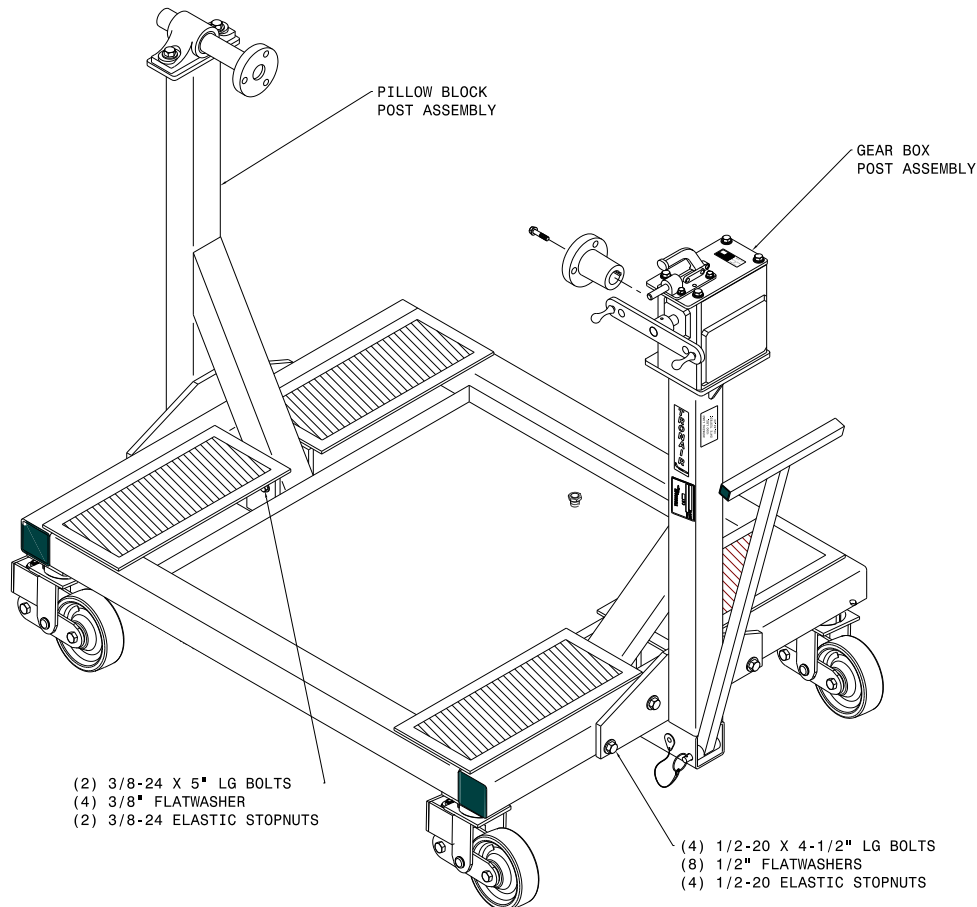
3.2.2 Assembly Steps (continued)

Pillow Block Post Assembly To Base:

1. Attach post assembly to base using (4) 1/2-20 x 4-1/2" long hex head bolts, (8) 1/2" flatwashers and (4) 1/2-20 elastic stopnuts. Use (2) 3/8-24 x 5" long hex head bolts, (4) 3/8" flatwashers and (2) 3/8-24 elastic stopnuts to attach post assembly to base at other location as shown.
2. Torque 1/2-20 bolts to 1100 in-lbs. Torque 3/8-24 bolts to 390 in-lbs.

Gear Box Post Assembly To Base:

1. Attach this post assembly in the same manner as the pillow block post.



3.3 FIELD INSTALLED ENGINE ARM ADAPTER KITS

- K-1795 Adapter Kit for Garrett TFE-731 engine
- K-1796 Adapter Kit for Pratt & Whitney JT-15D engine
- K-2032 Adapter Kit for Williams FJ-44-1, 2, 3 engine
- K-3994 Adapter Kit for Cessna PW615 F engine
- K-4337 Adapter Kit for Honda HJ17100-100-ISE engine

4.0 TRAINING

4.1 TRAINING REQUIREMENTS

The employer of the operator is responsible for providing a training program sufficient for the safe operation of the unit.

4.2 OPERATOR TRAINING

The operator training should provide the required training for safe operation of the unit.

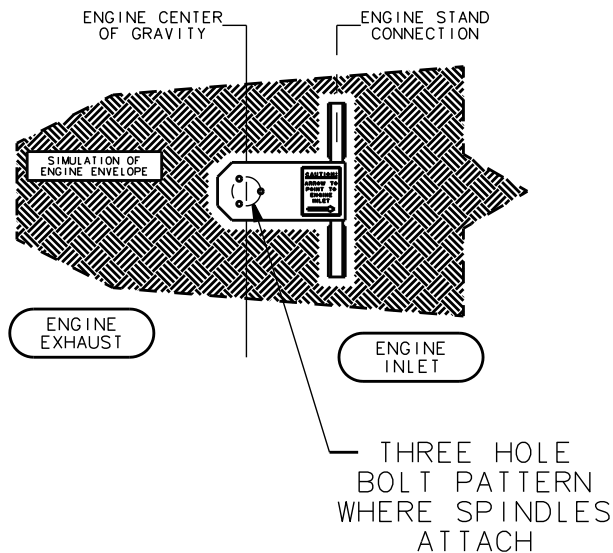
NOTE: Maintenance and Trouble Shooting are to be performed by a skilled and trained technician.

5.0 OPERATING INSTRUCTIONS

1. Remove both engine adapters from Engine Stand by removing three (3) ½ - 20 x 2 inch long bolts from both spindles.
2. Attach engine adapters to engine with engine center of gravity near the center of the three (3) hole bolt pattern where the spindles attach (See **Figure 1**).

Note: The rotating mechanism will turn hard and may cause stand failure if the engine arms are attached backwards.

3. Install engine in Engine Stand and secure attachment arms to stand spindles using three ½ - 20 x 2 inch long bolts and nuts per side. (See **Figure 2**)
4. Engine rotation crank must be pinned in position, rotating mechanism, after engine is placed in desired position to guard against rotation.
5. To remove engine, support engine with sling. While engine is supported by a sling, unfasten engine adapters from spindles via three (3) ½ - 20 x 2 inch long bolts on both sides. Carefully remove engine from work stand. Remove engine adapters from engine and stow when not in use.



ATTACH BOTH ENGINE ADAPTERS TO ENGINE AS SHOWN WITH ARROW POINTING TO THE ENGINE INLET PRIOR TO INSTALLING ENGINE IN STAND

FIGURE 1

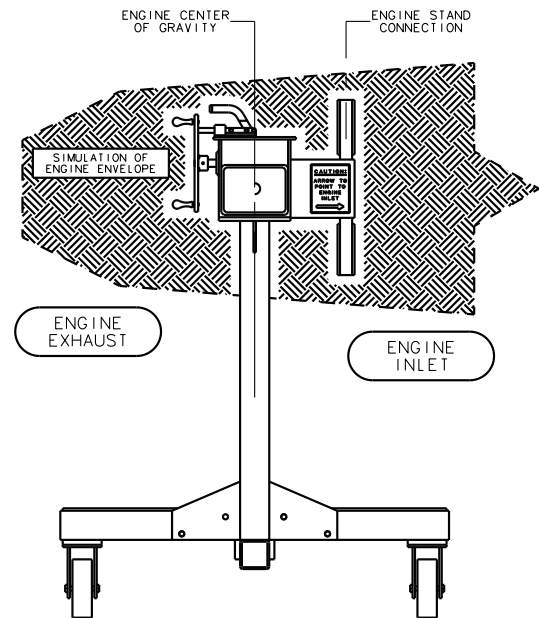


FIGURE 2

6.0 TROUBLE SHOOTING

If gear mechanism works with difficulty, check for the following causes:

- Engine installed backwards
- Lack of lubrication
- Dirt in mechanism
- Worn parts, misalignment of shafts

7.0 MAINTENANCE

1. Lubricate swivel caster bearing race with multi-purpose grease.
2. Lubricate gear box assembly per manufacturer's recommendations.

8.0 PROVISION OF SPARES

8.1 SOURCE OF SPARE PARTS

Spare parts may be obtained from the manufacturer:

TRONAIR, Inc.

1740 Eber Road

Holland, Ohio 43528-9794 USA

Telephone: (419) 866-6301 or 800-426-6301

Fax: (419) 867-0634

E-mail: sales@tronair.com

Website: www.tronair.com

8.2 RECOMMENDED SPARE PARTS LISTS

Reference the following page for Replacement Parts and Kits available.

9.0 IN SERVICE SUPPORT

Contact Tronair, Inc. for technical services and information. See Section 1.3 – Manufacturer.

10.0 GUARANTEES/LIMITATION OF LIABILITY

Tronair products are warranted to be free of manufacturing or material defects for a period of one year after shipment to the original customer. This is solely limited to the repair or replacement of defective components. This warranty does not cover the following items:

- a) Parts required for normal maintenance
- b) Parts covered by a component manufacturers warranty
- c) Replacement parts have a 90-day warranty from date of shipment

If you have a problem that may require service, contact Tronair immediately. Do not attempt to repair or disassemble a product without first contacting Tronair, any action may affect warranty coverage. When you contact Tronair be prepared to provide the following information:

- a) Product Model Number
- b) Product Serial Number
- c) Description of the problem

If warranty coverage is approved, either replacement parts will be sent or the product will have to be returned to Tronair for repairs. If the product is to be returned, a Return Material Authorization (RMA) number will be issued for reference purposes on any shipping documents. Failure to obtain a RMA in advance of returning an item will result in a service fee. A decision on the extent of warranty coverage on returned products is reserved pending inspection at Tronair. Any shipments to Tronair must be shipped freight prepaid. Freight costs on shipments to customers will be paid by Tronair on any warranty claims only. Any unauthorized modification of the Tronair products or use of the Tronair products in violation of cautions and warnings in any manual (including updates) or safety bulletins published or delivered by Tronair will immediately void any warranty, express or implied.

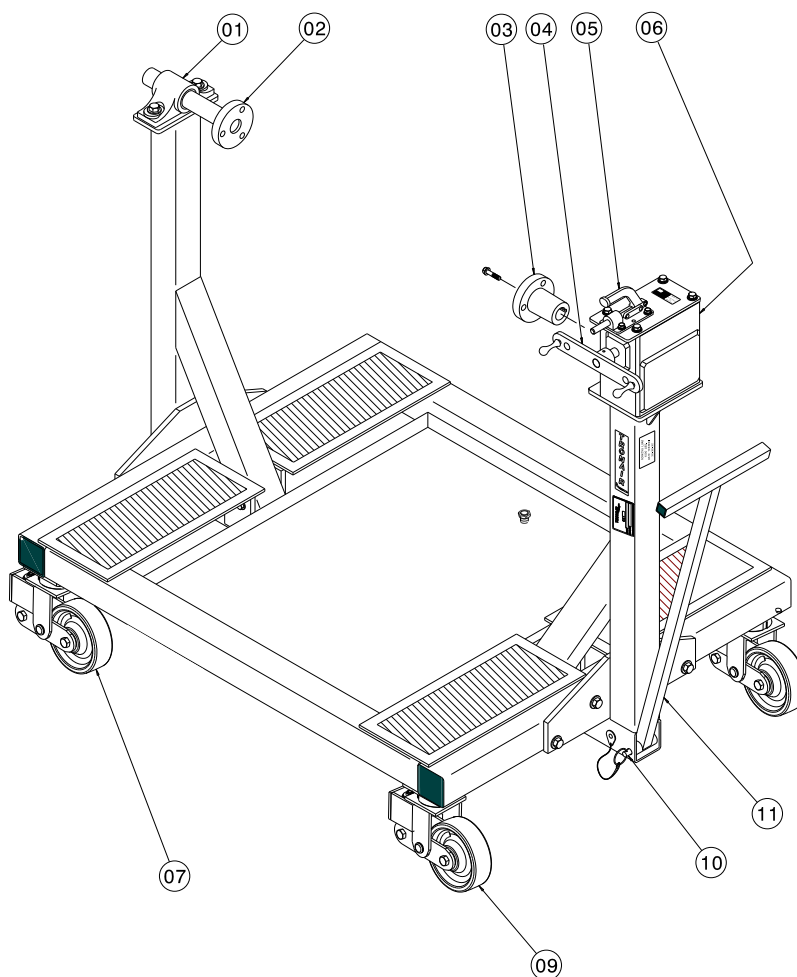
The obligations of Tronair expressly stated herein are in lieu of all other warranties or conditions expressed or implied. **Any unauthorized modification of the Tronair products or use of the Tronair products in violations of cautions and warnings in any manual (including updates) or safety bulletins published or delivered by Tronair will immediately void any warranty, express or implied and Tronair disclaims any and all liability for injury (WITHOUT LIMITATION and including DEATH), loss or damage arising from or relating to such misuse.**

11.0 APPENDICES

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|--------------|--|
| APPENDIX I | Declaration of Conformity |
| APPENDIX II | Worm Gear Speed Reducer Maintenance Instructions |
| APPENDIX III | Rigid Sleeve Bearing Units Service Instructions |

Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
2	Z-2369	Weldment, Slide	1
4	Z-2356-01	Weldment, Handle	1
10	G-1307-0835	Pin, Aerofast Model "C"	1
11	Z-1012-01	Weldment, Handle	1
1	K-4060	Pillow Block, Replacement Kit; consists of:	
		Pillow Block and all Mounting Hardware	1
3	K-2067	Coupling, Replacement Kit; consists of:	
		Gear Box Spindle and 1/4" Square Key	1
5	K-2059	Clamp, Replacement Kit; consists of:	
		Clamp and all Mounting Hardware	1
6	K-2060	Gear Box, Replacement Kit; consists of:	
		Gear Box and all Mounting Hardware	1
7	K-5051	Rigid Caster (Single), Replacement Kit; consists of:	
	(U-1174)	Rigid Caster and all Mounting Hardware	1
9	K-5052	Swivel Caster (Single), Replacement Kit; consists of:	
	(U-1173)	Swivel Caster and all Mounting Hardware	1



APPENDIX I

Declaration of Conformity



DECLARATION of CONFORMITY

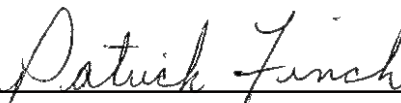
The design, development and manufacture is in accordance with European Community guidelines

ENGINE WORK STAND

Relevant provisions complied with by the machinery:
EN ISO 12100-1

Relevant standards complied with by the machinery:
EN 292-2:1991/A1:1995 (4.1.2.3)
EN 1915-1:2001 (5.20)

Identification of person empowered to sign on behalf of the manufacturer:

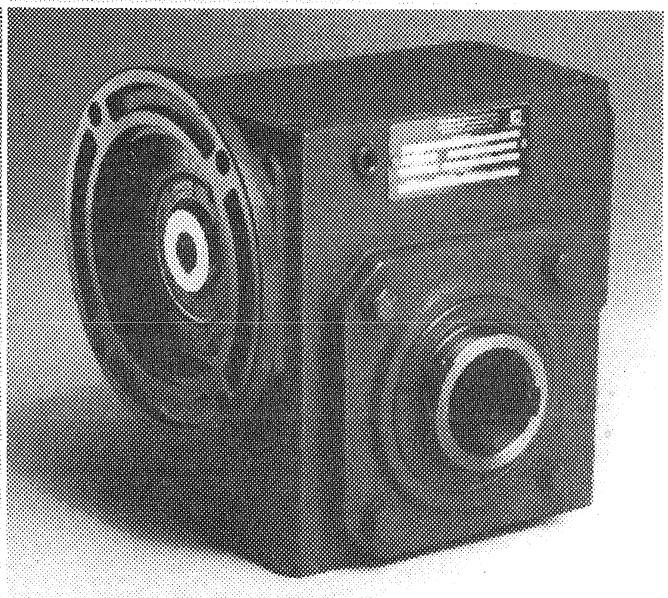
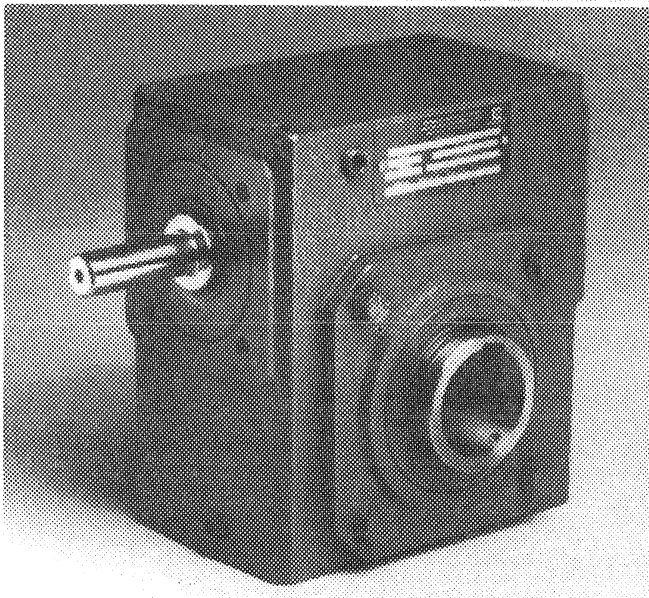
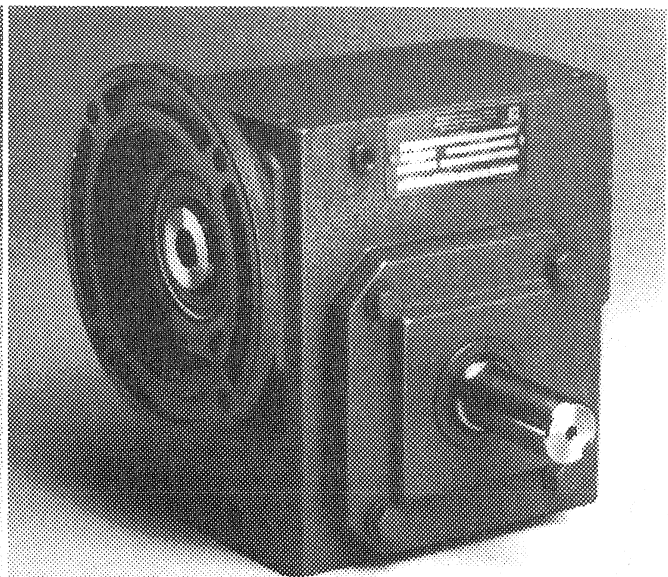
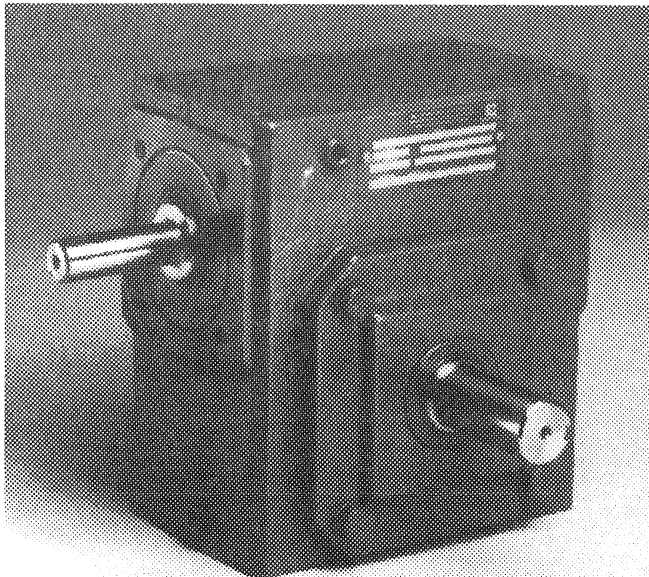

Quality Assurance Representative



APPENDIX II

Worm Gear Speed Reducer Maintenance Instructions

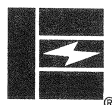
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WORM GEAR SPEED REDUCERS

MAINTENANCE INSTRUCTIONS

CENTER DISTANCES 1.33, 1.54, 1.75, 2.06, 2.37, 2.62, 3.00, and 3.25



EMERSON POWER TRANSMISSION CORP.
620 SOUTH AURORA
ITHACA, NY 14850
PHONE: 607 272-7220

INTRODUCTION

The following instructions apply to Worm Gear Speed Reducers. When ordering parts or requesting information specify all information stamped on the reducer nameplate.

EQUIPMENT REQUIRED

In addition to standard mechanic's tools, the following equipment is required: arbor press, wheel puller, torque wrench, dial indicator, seal driver, bluing, adhesive sealant, snap ring pliers for internal and external rings.

GENERAL INSTRUCTIONS

Housings - Clean external surfaces of reducer before removing seal cages and end covers to prevent dirt from falling into the unit. Record mounting dimensions of accessories for reference when reassembling. If it is necessary to remove the reducer from its operating area, disconnect all connected equipment and lift reducer from its foundation.

Seals - Replacement of all seals is recommended when a unit is disassembled. However, if seals are not to be replaced, protect seal life by wrapping shaft with thin, strong paper coated with oil or grease before removing or replacing seal case assembly. Clean the shaft but do not use any abrasive material on the shaft surface polished by the seal.

CAUTION

If the reducer is painted, extreme care should be taken to mask the shaft extensions and rubber surface of the seals. Paint on the shaft adjacent to the seal or on the seal lip will cause oil leakage.

TO CHANGE OUTPUT SHAFT DIRECTION

To change the hand of a unit from left hand to right hand, or vice versa, the following instructions apply:

1. Remove drain plug and drain oil from unit.
2. Remove end cover and seal cage capscrews; then while supporting output shaft remove end cover and shims from the unit.
3. Remove output shaft and seal cage together from extension side.
NOTE: Keep shims with their respective seal cage and end cover.
4. Reassemble unit per instructions on Page 5, Item 3.

CAPSCREW TIGHTENING TORQUE

Table 1

Capscrew Diameter	$\frac{1}{4}$ -20 UNC	$\frac{5}{16}$ -18 UNC	$\frac{3}{8}$ -16 UNC	$\frac{1}{2}$ -13 UNC
Torque (in. lbs.) Dry	96	204	360	900

UNIT DISASSEMBLY

1. Remove drain plug and drain oil from unit.
2. Low speed shaft (gear shaft) removal:
 - A. Remove end cover and seal cage capscrews.
 - B. With a firm hold on the output extension remove end cover and shims.
 - C. Carefully slide output shaft assembly and seal cage out extension side.
 - D. Slide seal cage off low speed shaft using caution to prevent damage to seal lips.
 - E. Wire or tie the shims to their mating end cover and seal cages. They will be available for reference when assembling the unit.

3. High speed shaft (worm shaft) removal:

- For C-Flange units 1.33 C.D. through 3.25 C.D.:
 - Use a small chisel to make a groove in the stamped steel cover opposite the motor flange. Pry cover off. Remove internal snap ring from housing bore. Remove motor flange. Using a plastic hammer, gently tap on the motor end of the shaft to feed worm shaft assembly through housing and out.
- For Basic units 1.33 C.D. through 3.25 C.D.:
 - Use a small chisel to make a groove in the stamped steel cover opposite the extension. Pry cover off. Remove internal snap ring from housing bore. Using a plastic hammer, gently tap on the extension end of shaft to feed assembly through housing and out. On units with C.D. of 1.33, 1.54, 2.63, and 3.00, front bearing will remain in housing bore. Use soft tool and plastic hammer to tap bearing out extension end of housing from rear. Be sure to tap on outer-race of bearing. If a press is available, pressing this bearing out is preferable.

PARTS SERVICE

1. **Housing** – Clean inside of housing with kerosene or solvent and then dry.
2. **Seal cages and end cover** – Remove dirt from joint faces, wipe clean and dry.
3. **Air vent** – Wash in kerosene, blow clean and dry.
4. **Seals** – To replace seals without dismantling reducer refer to steps C through F below. To replace seals when the entire reducer is dismantled and coupling hubs, sprockets, pulleys, pinions, keys, etc. have been removed the following instructions apply:

NOTE: Replacement of all seals is recommended when a unit is disassembled.

Caution

New seals will leak if the seal lips or if seal's rubbing surface on the shaft has been altered. Protect seal lips at all times. Clean the shaft but do not use any abrasive material on the shaft surface polished by the seal.

- A. Block up seal cages and press or drive out seal.
- B. Remove old sealing compound from seal seat in cage if it is present. If a seal with rubber coating on the outside diameter is used, no sealant is necessary. If no rubber coating is on seal outside diameter, coat seal cage bore with adhesive sealant immediately before assembly.

To prevent possible damage to seal lips, do not reassemble seals until high speed and low speed shafts have been reassembled to the housing. Then see steps E and F below.

- C. See Figures 1 through 4 – To replace seals without dismantling reducer, proceed as follows:

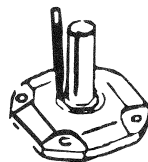


Figure 1

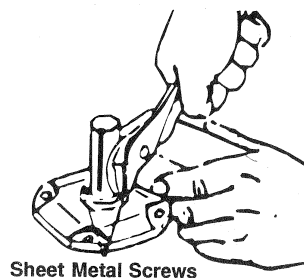


Figure 2

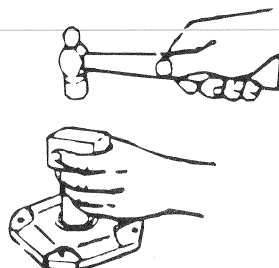


Figure 3

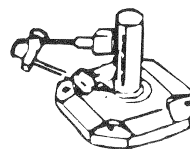


Figure 4

Caution

Do not damage shaft; new seals will leak if seal contacting surface is marred. Use punch and place two or more holes in steel casing of seal, Figure 1. (The steel casing may be rubber coated) Insert sheet metal screws, leaving the heads sufficiently exposed so they can be pried up or grasped with pliers, Figure 2. Do not drill holes because chips may get into the unit.

- D. Work seal loose. Be careful to keep all metal or dirt particles from entering unit. Remove old sealing compound from seal seat if it is present. Also remove burrs and sharp edges from shaft. Clean with rag moistened with solvent. Do not use abrasive material on shaft seal contacting surface.

Caution

- E. **Protect seal lips when handling; seal leakage will result if these are damaged. If a seal with rubber coating on the outside diameter (O.D.) is used, no sealant is necessary. If no rubber coating is on seal O.D., coat seal cage bore with adhesive sealant. Coat seal lips with oil and carefully work seal into position. Before sliding seal into position, protect seal lips from shaft keyway edges by wrapping shaft with thin, strong paper coated with oil. Position garter spring toward the inside of the unit. Place a square face pipe or tube against the seal O.D. and drive or press seal until fully seated as shown in Figure 3. Do not strike seal directly.**
- F. For best performance, seat the seal square with shaft within .005" at 180°. Check with dial indicator as shown in Figure 4, Page 3, or with a straight edge and feelers, or square and feelers. To straighten a cocked seal, place tubing over the seal and tap the tube lightly at a point diametrically opposite the low point on the seal. DO NOT strike seal directly.

5. Bearings –

- A. Wash all bearings in clean kerosene and then dry.
- B. Inspect bearings carefully and replace those that are worn or questionable.
NOTE: Replacement of all bearings is recommended.
- C. Use a wheel puller or press to remove worm shaft bearings. Apply force to inner race only – not to cage or outer race.
- D. Use a wheel puller or press to remove tapered bearing inner races.
- E. To replace tapered bearing inner races and all ball bearings, heat bearings in an oil bath or oven to maximum of 290° F (143° C). Slide high speed shaft bearings onto the oiled shaft until seated against the shoulder or snap ring of the shaft. Slide low speed shaft bearing onto the oiled shaft against the gear spacer.
- F. Thoroughly coat all bearings with lubrication oil.

6. Worm, gear and shaft –

- A. Worm and high speed shaft – since all worms are integral with the high speed shaft, any wear or damage to the worm will necessitate replacing both.
- B. Press shaft out of bronze worm gear. To reassemble gear and low speed shaft, freeze shaft or heat gear. Do not exceed 200° F (93° C). Insert key into the shaft keyway and press shaft into oiled gear bore.
NOTE: It is advisable to replace both the worm and worm gear should either of the assemblies require replacement.

UNIT REASSEMBLY

1. Preliminary

- A. Check to see that all worn parts have been replaced, gear and bearings coated with oil and all parts cleaned. Remove all foreign matter from unit feet. The feet must be flat and square with each other.
- B. Before starting to reassemble reducer, add old shims or replace with new shims of equal thickness.

2. High Speed Shaft (Worm Shaft) Assembly

- For C- Flange units 1.33 C.D. through 3.25 C.D.:
 - Lubricate bearing bores of housing. Press bearing onto end of worm shaft flush to shoulder (or snap ring). Lock bearing onto shaft with external snap ring. Insert shaft assembly from opposite motor end into housing until seated against shoulder in bore. Lock shaft assembly into housing bore with internal snap ring. Coat outside diameter of stamped steel end cover with adhesive sealant and press into input bore opposite motor flange until flush with housing. If endcover is rubber coated, do not use sealant.
- For Basic units with C.D. of 1.75, 2.06, 2.37, and 3.25:
 - Lubricate bearing bores of housing. Subassemble bearings onto worm shaft. Lock rear bearing onto shaft with external snap ring. Insert shaft assembly from opposite extension end into housing until bearing is seated against shoulder in bore. Lock shaft assembly in housing bore with internal snap ring. Coat outside diameter of stamped steel endcover with adhesive sealant and press into input bore opposite extension until flush with housing. If endcover is rubber coated, **DO NOT** use sealant.
- For Basic units with C.D. of 1.33, 1.54, 2.62, and 3.00:
 - Follow above procedure with the following exception:
Subassemble only the rear bearing onto worm shaft. After subassembly is installed into housing, press front bearing into extension side of housing until seated against shoulder or snap ring on worm.

3. Low Speed Shaft (Gear Shaft) Assembly

- A. Determine output shaft direction.
- B. Assemble low speed shaft assembly, seal cage, and end cover with shims on both seal cage and end cover. Torque capscrews to torques listed in Table 1. Rotate the input shaft to seat output bearings.
- C. Moving the shaft back and forth by hand, check axial float with dial indicator as shown in Figure 5. Axial float must be .0005 - .003" with .0005 being the absolute minimum. Do not preload bearings. If the axial float is not as specified, add or subtract required shims under end cover.

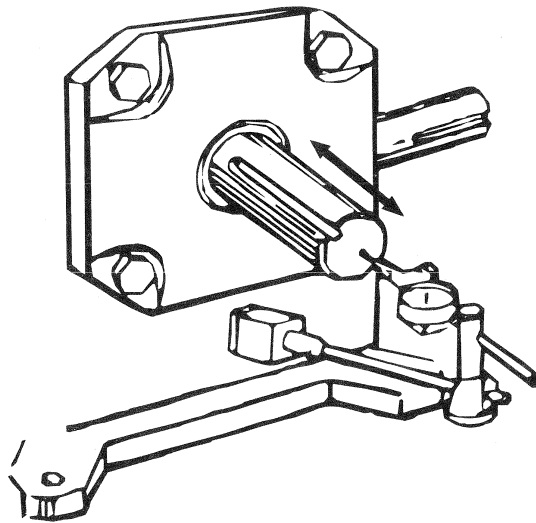
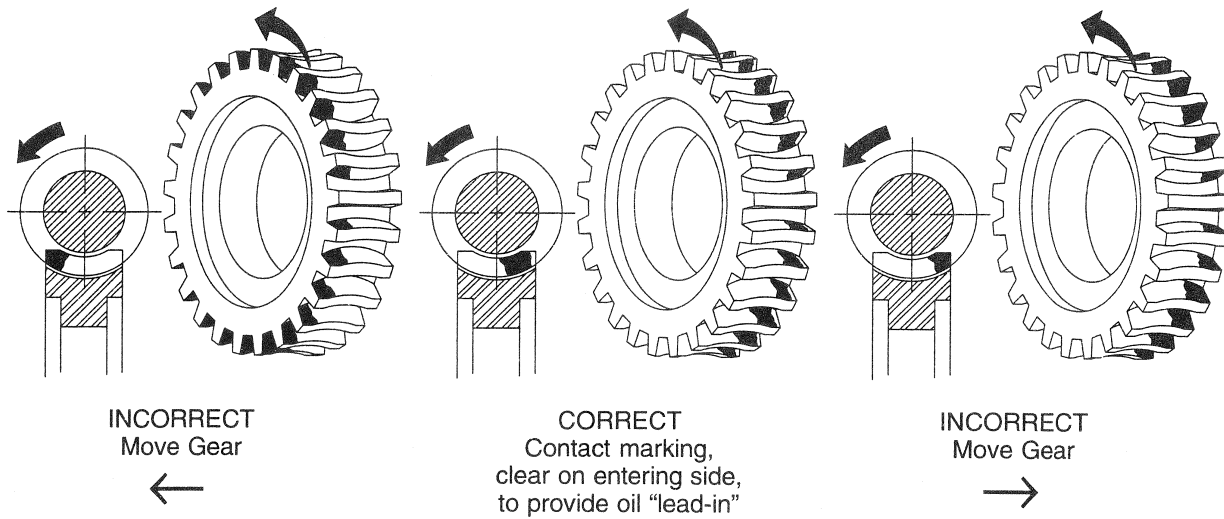


Figure 5 Checking Axial Float

- D. Remove output shaft with seal cage and apply bluing to several teeth on the gear. Worm thread and gear teeth must be clean of oil. Reassemble output shaft and seal cage with output key facing up.
- E. Use a rag to apply hand pressure to the output shaft and rotate the high speed shaft both direction until the gear teeth with bluing have gone through gear mesh several times. Return output shaft to original position. Remove output shaft and seal cage to inspect contact. Compare with Figure 6. If contact is not correct, move assembly in the direction shown in Figure 6 by adding shims to the side to which the arrow points after removing them from the opposite side. Repeat Steps D a E until contact pattern is correct.
- F. Recheck axial float with dial indicator.
- G. When contact pattern is correct, tighten seal cage and end cover capscrews to torques listed in Table 1.

Figure 6 Gear Contact Pattern



4. **Seals** - To reassemble seals to unit, see Parts Service Steps 4E and 4F, Page 4.

5. **Motorized Coupling Adapter**

Certain mounting dimensions should be adhered to when removing motor and coupling assembly for service. When ordering replacement coupling halves (metal gear), specify correct bore diameter. See Table 2 for mounting dimensions.

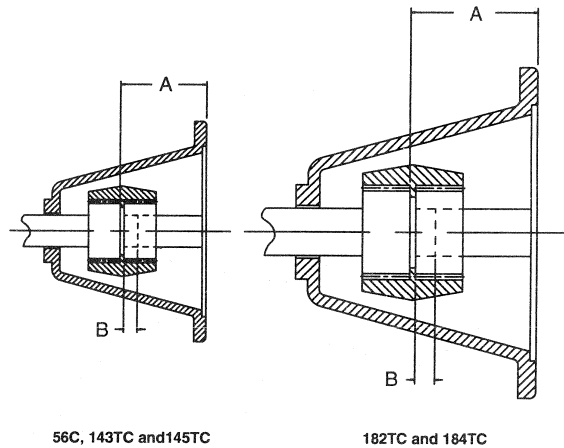


Figure 7 Motorized Coupling Adapter
C.D. 1.33 through 3.25

COUPLING ADAPTER DATA

Table 2

CENTER DISTANCE	56C		140TC		180TC	
	A	B	A	B	A	B
1.33	2.25	.06	2.31	.12	—	—
1.54	2.31	.12	2.38	.19	—	—
1.75	2.25	.06	2.31	.12	—	—
2.06	2.25	.06	2.31	.12	—	—
2.37	2.25	.06	2.31	.12	—	—
2.62	2.25	.06	2.31	.12	3.12	.12
3.00	2.25	.06	2.31	.12	3.12	.12
3.25	2.25	.06	2.31	.12	3.12	.12

6. Final Inspection

- A. Turn gear train over by hand as a final check.
- B. Re-install reducer and accessories.

Caution

**Discard motor key. Use only special key provided with reducer.
Failure to use special key will make assembly impossible.**

- C. Fill reducer with the recommended oil to proper level. See Figure 8 for standard oil levels.
- D. Spin test for three minutes and check for noise, leakage and rapid temperature rise.

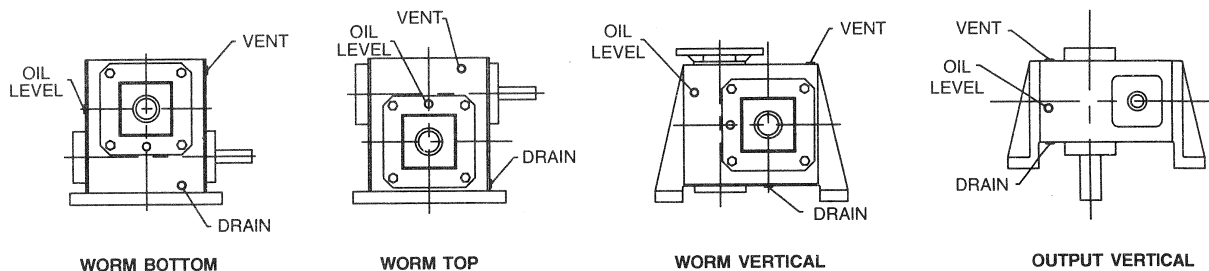


Figure 8 Standard Oil Levels

PREVENTATIVE MAINTENANCE

1. After first week, check all external capscrews and plugs for tightness.
2. Periodically, check oil level when gears are at rest. Add oil if needed. Do not fill above mark indicated by level because leakage and overheating may occur.

STORED AND INACTIVE UNITS

1. All units are shipped with oil that will protect parts against rust for a period of four (4) months in an outdoor shelter or twelve (12) months in a dry building after shipment from the factory. Indoor dry storage is recommended.
2. If a unit is to be stored or is to be inactive after installation beyond the above periods, fill the unit completely with oil.

Caution

Before starting a stored unit or re-starting an inactive unit, the oil level should be returned to the proper value as indicated by the oil level.

LUBRICATION

Normal operating temperature of a worm gear reducer is less than 200°F but during initial break-in the temperature may exceed 200° F. After break-in is completed the temperature will fall below 200° F. If temperature exceeds 200° F for greater than 100 hours consult the factory.

1. Change initial oil fill after 500 hours service or 5 weeks.
2. Change oil every 2500 hours service or 6 months. If severe operating conditions exist, change the oil every 1 to 3 months.
3. **90 WEIGHT OIL AND EP OIL ARE NOT RECOMMENDED.**
4. For ambient temperatures -40° F to 15° F use Mobil SHC634.
5. Units running at slow speeds (less than 100 RPM input) should carry high oil level and in ambient temperatures of 15° to 125° F use an AGMA #8C lubricant.
6. See Table 3 for list of recommended lubrication manufacturers.

Lubrication Manufacturers

The companies and oil shown are typical. Any other make of oil meeting American Gear Manufacturers Association (AGMA) standards #7C and #8C will be satisfactory.

Table 3

Ambient Temperature	15 to 60° F	50 to 125° F
Viscosity Range MM/S at 40°C	414 - 506	612 - 748
ISO Grade	460	680
SAE Gear Lubricant (approx.)	#140	#250
Oil Company Name	AGMA #7C	AGMA #8C
Amoco Oil Co.	Amoco Worm Gear Oil	Amoco Cyl. Oil 680
Atlantic Richfield (ARCO)		Modoc 175
Chevron Oil Co.	Cylinder Oil 460X	Cylinder Oil 680X
Conoco Oil Co.	Inca Oil	
Exxon Oil Cp.	Cyclesstic TK460	Cyclesstic TK680
Fiske Brothers	SPO 277	SPO288
Gulf Oil Co.	Senate 460	Senate 680
Gulf-Canada	Senate 460	Senate 680
Keystone-Penwalt	Keygear K-600	
Mobile Oil Corp.	Mobil 600W Cyl. Oil	Mobil 600W Super Cyl. Oil
Pennzoil	Cyl. Oil #8	Cyl. Oil No. 6
Phillips Petroleum Co.	Hector 460S	Hector 630S
Shell Oil Co.	Valvata Oil J460	Valvata Oil J680
Sohio	Energol DC-600C	Energol DC-600C
Texaco Inc.	Vanguard 460	Honor 680
Union Oil Co. of CA	Steaval B110	Steaval B165

Table 4

OIL CAPACITY (OZ.)				
CENTER DISTANCE	WORM TOP	WORM BOTTOM	WORM VERTICAL	OUTPUT VERTICAL
1.33	4	8	8	4
1.54	6	18	18	14
1.75	8	20	20	12
2.06	12	22	28	18
2.37	16	30	36	26
2.62	26	46	60	40
3.00	46	78	82	72
3.25	56	65	101	66



APPENDIX III

Rigid Sleeve Bearing Units Service Instructions

MAINTENANCE

Bearings must be protected against adverse operating conditions and they must be adequately lubricated. Protective shields should be installed where dirt can fall directly on the bearings. Units should be periodically checked for wear. All split

housing units have shims between base and cap, and as wear develops sufficient shims should be removed to reduce excess clearance between shaft and bearing surface. Inspection of bearing installations at least every six months is recommended. Any unusual noise or vibration change should be immediately investigated.

TABLE 1—Oil selection for rigid sleeve bearings

Ambient Temperature Degrees F ■	Shaft Speed RPM	AGMA Oil Specification Number	SAE Oil Specification Number
▲10 to 40	To 300	2	20
	300 thru 600	1	10
40 thru 160	To 300	4	40
	300 thru 600	3	30

▲Pour point of lubricant must be less than ambient temperature

■Use grease for temperatures below +10°F

TABLE 2—Grease selection for rigid sleeve bearings

Bearing Size Selection in Inch Diameter	Operating Speed, RPM	BEARING TEMPERATURE*		
		20°F to 32°F	32°F to 90°F	90°F to 160°F
		NLGI CONSISTENCY NO.		
Up to 1 in.	Up to 1000	0—1	2—3	3
1 to 2 in.	Up to 500			
2 to 3 in.	Up to 300			
3 to 4 in.	Up to 200			
Over 4 in.	Up to 100			

LUBRICATION

Rigid sleeve bearings can be lubricated by using a grease or oil lubricating device. When grease cups or pressure fittings are used, apply pressure until grease appears at the ends of the unit. When oil cups are used rotate shaft without load until oil appears at the ends of the unit. Inspect bearings frequently when first operated to determine a satisfactory lubrication interval.

Select a grease or oil using Table 1, or Table 2 as a guide to suit the operating conditions.