



March 6, 2000

TO: Recipients of Enstrom Helicopter Service Directive Bulletins.

SUBJECT: REVISION OF SERVICE INFORMATION LETTER NO. 0150

This letter transmits Revision 1 to Service Information Letter No. 0150. This is a COMPLETE revision. Replace the previous issue with this edition.

This revision provides additional information about the maintenance and inspection procedures for the current lower swashplate assembly, P/N 28-16101-939. It also adds spare/repair part information for the lower swashplate assembly.

NOTE

Enstrom will only provide spare/repair parts support for the current design (P/N 28-16101-939) of the lower swashplate assembly.

NOTE

Enstrom is pleased to offer special pricing on the "-939" overhaul and upgrade kit, P/N 28-01053-5, for a period of six (6) months from the issue date of this Service Information Letter. Please contact your local dealer, service center, or Enstrom Customer Service for pricing information.

TECHNICAL PUBLICATIONS
ENSTROM HELICOPTER CORPORATION



SERVICE INFORMATION LETTER

SERVICE INFORMATION LETTER NO. 0150

Revision 1

Page 1 of 15

DATE: March 6, 2000

1. SUBJECT: New Lower Swashplate Assembly, P/N 28-16101-939
2. MODEL: F-28A, F-28C, F-28F, 280, 280C, 280F, and 280FX
3. EFFECTIVITY: All serial numbers
4. BACKGROUND:

The original release of this Service Information Letter provided maintenance instructions and parts information for the lower swashplate assembly, P/N 28-16101-927, which was the current lower swashplate assembly used in production. Enstrom has subsequently reviewed the design of this lower swashplate assembly and has incorporated a number of improvements. As a result, the lower swashplate assembly has been re-identified as P/N 28-16101-939. This lower swashplate assembly is eligible for installation on all models of the F-28/280 series aircraft and is available as an exchange unit. A modification kit (Lower Swashplate Modification Kit, P/N 28-01053-5) is available to upgrade older configurations.

This Service Information Letter provides maintenance instructions and parts information for maintaining the new design lower swashplate assembly, P/N 28-16101-939, or a lower swashplate equipped with the Lower Swashplate Modification Kit, P/N 28-01053-5.

NOTE

Enstrom will no longer supply spare/repair parts for lower swashplate assemblies other than P/N 28-16101-939.

5. COMPLIANCE:

Use the following procedures for maintaining a Lower Swashplate Assembly, P/N 28-16101-939 or a lower swashplate assembly equipped with the Lower Swashplate Modification Kit, P/N 28-01053-5.

March 6, 2000

5.1. LOWER SWASHPLATE PERIODIC INSPECTION:

NOTE

Use the following inspection procedure during 100 hour/annual inspections.

1. Remove both side panel cowls if not previously removed for the 100 hour/annual inspection.
2. With the aid of an assistant, remove the collective friction and move the collective up and down throughout the range and wiggle the cyclic stick (movement of the collective and cyclic stick does not have to occur simultaneously). Observe and *carefully* feel the lower swashplate assembly for any looseness (e.g. vertical play at the universal joint or end play along the universal shaft and tie rod axes). Any looseness is most noticeable with a collective control reversal and/or reversal of the cyclic controls. NOTE: Vertical looseness may also be evident at the collective stick as a sudden change in stick force or may exhibit itself as a clinking sound. Using a 9/16 inch crows foot and torque wrench set to 60 in-lbs/6.8 Nm, check that the torque required to rotate the tie rod assembly at the nut on the end of the tie rod assembly is more than 60 in-lbs/6.8 Nm. Do not remove the cotter pin from the nut during the check and stop the torque check if 60 in-lbs/6.8 Nm is reached without the tie rod assembly rotating. Any rotation of the tie rod with less than 60 in. lbs./6.8 Nm of torque is unacceptable.
3. If neither visible looseness nor loss of torque is evident, the swashplate assembly is in serviceable condition.
4. If any visible vertical looseness or loss of torque is found, remove the lower swashplate assembly from the aircraft. Disassemble the lower swashplate assembly in accordance with paragraph 5.3 and inspect the detail parts in accordance with paragraph 5.4.

NOTE

Do not completely disassemble the lower swashplate assembly unless required due to a fault with the cyclic pivot bearing assembly (Paragraph 5.3, Steps 9 through 11).

5.2. LOWER SWASHPLATE REMOVAL:

1. Use the procedure in the maintenance manual applicable for the model aircraft for removing the lower swashplate assembly.

March 6, 2000

5.3. LOWER SWASHPLATE DISASSEMBLY:

NOTE

Refer to Figures 1,2 and 3 for part identification.

1. Install tool T-0016 in the end of the tie rod. Place a wrench on the tool T-0016 to prevent the tie rod from rotating and remove the cotter pin, nut, washer assembly, DU washer, and shims from the tie rod.
2. Tap the tie rod out of the bushings using an aluminum drift. Separate the lower universal housing and shims from the upper universal housing. Remove the spacers from inside the sleeves in the housing.
3. Remove the DU washer from the tie rod.
4. Temporarily install the tie rod in the universal shaft to prevent it from rotating and remove the cotter pins, nuts, washer assemblies, DU washers, and shims from both ends of the universal shaft.
5. Tap the end of the universal shaft with tool T-0100-1 or an aluminum drift to remove the shaft and sleeve from the lower universal housing.
6. Tap the opposite sleeve to remove it from the lower universal housing.
7. Tap the sleeves from the upper universal housing using an aluminum drift.
8. If required, remove the DU bushings from the sleeves.
9. Holding the bolt with a wrench, remove the cotter pin, nut, and washer. Remove the bolt and bearing assembly from the lower universal housing.
10. Press the bolt from the bearing assembly and remove the slinger and spacer.

WARNING

Use caution when removing or installing heated parts to prevent injury to personnel.

WARNING

Use protective gloves when handling heated parts.

March 6, 2000

11. Remove the retaining ring and grease fitting from the bearing housing. Heat the housing to approximately 250°F/121°C and press the bearing from the housing.

5.4. LOWER SWASHPLATE DETAILED PARTS INSPECTION:

1. Inspect the detail parts of the lower swashplate assembly in accordance with Table 1 of this Service Information Letter.

2. Replace unserviceable parts as required and reassemble the lower swashplate in accordance with paragraph 5.5.

5.5. LOWER SWASHPLATE ASSEMBLY:

WARNING

Use caution when removing or installing heated parts to prevent injury to personnel.

WARNING

Use protective gloves when handling heated parts.

1. Heat the bearing housing to approximately 250°F/121°C and install the bearing (Item 3, Figure 3) with the open side toward the “closed end” of the bearing housing.

2. After the housing has cooled, install the retaining ring and grease fitting.

3. Support the inner race of the bearing and press the bolt into the bearing with the head of the shaft on the retaining ring side.

4. Install the spacer on the bolt with the bevel towards the bearing and install the slinger.

5. Lubricate the bolt with a 50/50 mix of STP® and 30 wt. oil and install the bolt and bearing assembly into the lower universal housing. Install the washer and nut. Torque the nut to 200-260 in-lbs./22.7-29.5 Nm and install the cotter pin.

6. Install the DU bushings into the sleeves.

7. Check the fit of the universal shaft and the tie rod in the bushings. The universal shaft and tie rod should move freely in the bushings. If required, use an expandable reamer and lightly ream the bushings so that the shaft and tie rod move freely in the bushings. Do not ream the bushings so they have free play (loose fit).

March 6, 2000

NOTE

The lower universal housing may be heated with a heat gun to allow easier installation of the sleeves. Do not exceed 250°F/121°C and allow the parts to cool before shimming.

WARNING

Use caution when removing or installing heated parts to prevent injury to personnel.

WARNING

Use protective gloves when handling heated parts.

8. Lubricate the O.D. of two (2) of the sleeves and the bores of the ears on the lower universal housing with a 50/50 mix of STP® and 30 wt. oil.
9. Install one of the sleeves into the lower universal housing using tool T-0100-1 or T-0101-1.

CAUTION

Ensure that the correct Universal Shaft, P/N 28-16223-19, is used when assembling the lower swashplate assembly (The length of the bushing surface is 1.289" ± .001"/32.74 mm ± .03 mm). Failure to install the correct universal shaft can result in premature wear of the tie rod and universal shaft.

10. Install the universal shaft into the lower universal housing through the ear without the sleeve and then install a sleeve into the lower universal housing using T-0101-1. The shaft should rotate freely in the bushings.
11. Shim the universal shaft using the following procedure:
 1. Using a felt tip marker, place a mark on one of the ears on the lower universal housing and install a .020" shim on the end of the universal shaft. The mark indicates a .020" shim is installed.
 2. Install a DU washer on the shaft with the Teflon (grey) side of the washer against the sleeve.
 3. Install a washer assembly on the shaft with the pin towards the DU washer.

March 6, 2000

4. Install the tie rod into the universal shaft to prevent the shaft from rotating and install a nut, P/N AN320-6. Ensure the DU washer is properly seated on the retention pin on the washer assembly. Torque the nut to 110-150 in-lbs./12.5-17.0 Nm and check that the cotter pin hole is aligned. This may require installing different nuts until the proper torque and cotter pin hole alignment is achieved. Do not back the nut off for cotter pin alignment.

5. Install a .020" shim, DU washer, washer assembly, and nut on the opposite end of the universal shaft. Ensure the DU washer is properly seated on the retention pin on the washer assembly. Torque the nut to 110-150 in-lbs./12.5-17.0 Nm and check that the cotter pin hole is aligned. This may require installing different nuts until the proper torque and cotter pin hole alignment is achieved.

6. Tap each end of the universal shaft with an aluminum drift and hammer to seat the stack up and recheck the torque on the nuts.

7. Insert the tie rod or an appropriate size bolt in the tie rod bore of the universal shaft and check the preload with a spring scale at a 3 inch/7.5 cm arm. The preload should be 2.5-3.0 pounds/1.14-1.36 kg. If too loose, fewer shims are required. If too tight, more shims are required. Ideal shimming of the assembly is to have equal amounts of shims on each end of the universal shaft; however, a .005" maximum difference in shims is allowed from end to end to obtain proper preload.

NOTE

The upper universal housing may be heated with a heat gun to allow easier installation of the sleeves. Do not exceed 250°F/121°C and allow the parts to cool before shimming.

WARNING

Use caution when removing or installing heated parts to prevent injury to personnel.

WARNING

Use protective gloves when handling heated parts.

12. Lubricate the O.D. of the two (2) remaining sleeves and the bores of the ears on the upper universal housing with a 50/50 mix of STP® and 30 wt. oil. Using tool T-0101-1, install the sleeves into the upper universal housing.

March 6, 2000

CAUTION

Ensure that the Spacers, P/N 28-16225-19, used on the tie rod are the correct length (Refer to Table 1 of this SIL). Failure to install the correct length spacers can result in premature wear of the tie rod and universal shaft.

13. Install a DU washer onto the tie rod. Ensure the Teflon (grey) surface is facing inboard and the DU washer is properly seated on the retention pin. Install a spacer and then a .020" shim onto the tie rod.
14. Place the upper universal housing over the lower universal housing and align the proper openings.
15. Insert the tie rod through the sleeve in the upper housing that is in line with the dog leg ears of the lower housing, the universal shaft, and the opposite sleeve in the upper housing.
16. Install the remaining spacer onto the tie rod.
17. Install a .020" shim, DU washer, washer assembly, and nut on the tie rod. Ensure the DU washer is properly seated on the retention pin on the washer assembly. Using tool T-0016 to secure the tie rod, torque the nut to 110-150 in-lbs./12.5-17.0 Nm and check that the cotter pin hole is aligned. This may require installing different nuts until the proper torque and cotter pin hole alignment is achieved.
18. Tap each end of the tie rod with an aluminum drift and hammer to seat the stack up and recheck the torque on the nut.
19. Install the lower swashplate assembly on tool, T-0134 (Plate Assembly), a spare bell housing, P/N 28-16112-1, clamped in a vise, or on the upper swashplate assembly.
20. Insert a bolt through one of the ears on the cyclic bearing housing and check the preload of the tie rod axis. The preload on the tie rod axis should be the same as the universal shaft preload $\pm .25$ pounds/.11 kg. If too loose, fewer shims are required. If too tight, more shims are required. Ideal shimming of the assembly is to have equal amounts of shims on each end of the tie rod; however, a .005" maximum difference in shims is allowed from end to end to obtain proper preload.
21. Install the cotter pins when the preload is set.

March 6, 2000

5.6. LOWER SWASHPLATE INSTALLATION:

1. Use the procedure in the maintenance manual applicable for the model aircraft for installing the lower swashplate assembly.

5.7. PARTS:

1. Refer to Figure 3 and Table 2 for the illustrated parts list for the lower swashplate assembly.

6. SPECIAL TOOLS:

T-0016, Lower Swashplate Gimble Tool
T-0100-1, Swashplate Bushing Installation Tool
T-0101-1, Swashplate Bushing Removal Tool
T-0134, Assembly Plate

7. MAN-HOURS: Not applicable

8. WARRANTY: Not applicable

9. WEIGHT CHANGE: None

10. LOG BOOK ENTRY: As required for maintenance actions

11. REPETITIVE INSPECTION:

Inspect the lower swashplate assembly at the 100 hour/annual inspection in accordance with paragraph 5.1.

March 6, 2000

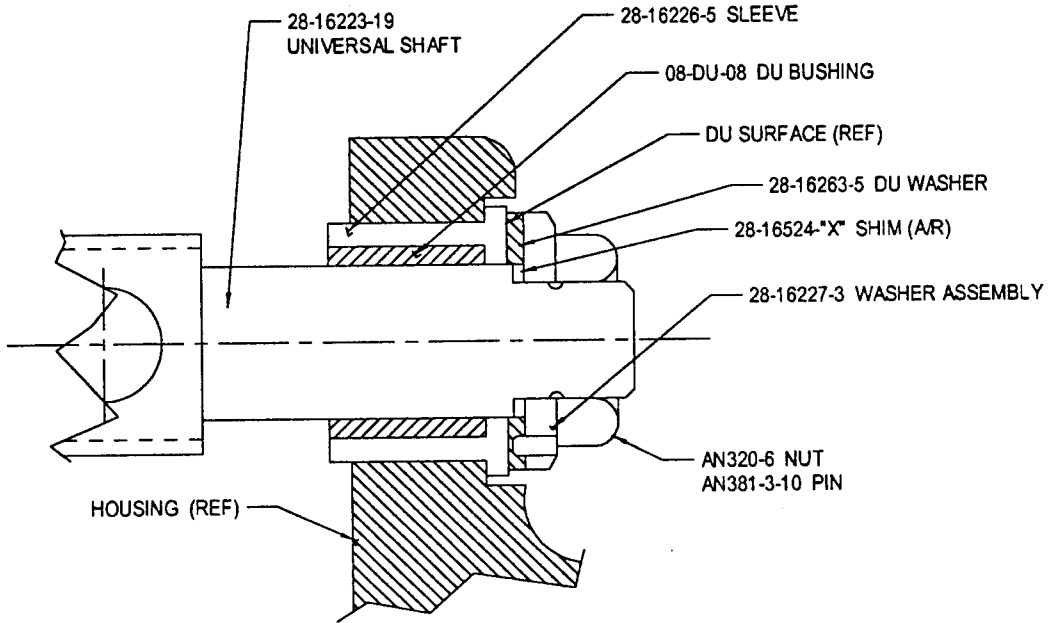


FIGURE 1 - UNIVERSAL SHAFT TO LOWER HOUSING

(TYPICAL BOTH ENDS)

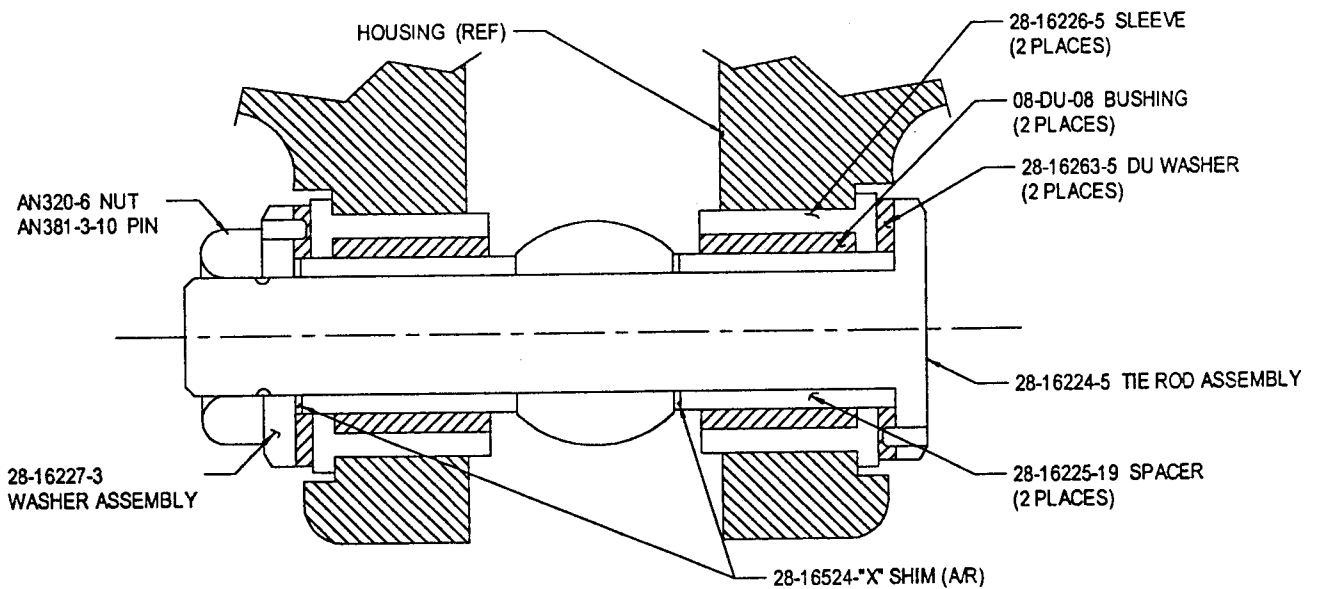


FIGURE 2 - TIE ROD TO UPPER HOUSING

March 6, 2000

Table 1 - Lower Swashplate Assembly

Inspection Requirements						
P/N	Figure 3 Item #	Part Name	Inspection**	Serviceable Limits**	Repair Limits	Repair or Action
28-16123-1	1	Bolt	Bearing surface Dia. .4723 to .4726	-.0002	Not Repairable	Replace Shaft
			Threads (crossed or missing)	None Allowed	Not Repairable	Replace Shaft
ECD-009-11	3	Bearing	O.D. 1.2595 to 1.2598	No Tolerance Allowed	Not Repairable	Replace Bearing
			I.D. .4722 to .4724	No Tolerance Allowed	Not Repairable	Replace Bearing
			Ratcheting or roughness	None Allowed	Not Repairable	Replace Bearing
28-16361-1	4	Housing	Bearing bore Dia. 1.2604 to 1.2598	+.0005	Not Repairable	Replace Housing
			Bolt holes in pivot ears for elongation	None Allowed	Not Repairable	Replace Housing
			Surface nicks or scratches	None Allowed	≤ .010 deep	Blend and polish out smooth

March 6, 2000

Table 1 - Lower Swashplate Assembly

Inspection Requirements						
P/N	Figure 3 Item #	Part Name	Inspection**	Serviceable Limits**	Repair Limits	Repair or Action
28-16361-1	4	Housing (Cont'd)	Cracks	None Allowed	Not Repairable	Replace Housing
28-16228-1	6	Spacer	Nicks or galling on the I.D.	None Allowed	≤ .003 deep	Polish out smooth
28-16387-1	7	Slinger	Bends on outer edge			Repair/Replace as Required
28-16119-3	8	Housing	Bushing bores Dia. .7500 to .7505	+ .0005	Not Repairable	Replace Housing
			Center bolt bore Dia. .4375 (no galling allowed in this bore)	+ .0005	Not Repairable	Replace Housing
			Large bolt bore Dia. in the pivot ears .375 to .376	+ .0005	Not Repairable	Replace Housing
			Small bolt bore Dia. in the pivot ears .250 to .251	+ .0005	Not Repairable	Replace Housing

March 6, 2000

Table 1 - Lower Swashplate Assembly

Inspection Requirements						
P/N	Figure 3 Item #	Part Name	Inspection**	Serviceable Limits**	Repair Limits	Repair or Action
28-16119-3	8	Housing (Cont'd)	Cracks	None Allowed	Not Repairable	Replace Housing
28-16227-3	12	Washer Assy.	Nicks and gouges	None Allowed	Not Repairable	Replace Spacer
28-16263-5	13	DU Washer	Thickness .0585 to .0605	-.008	Not Repairable	Replace Washer
08-DU-08	14	DU Bushing	*I.D. .4992 to .5019	+.0025	Not Repairable	Replace Bushing
28-16226-5	15	Sleeve	O.D. .7503 to .7508	-.0003	Not Repairable	Replace Sleeve
28-16223-19	16	Shaft, Universal	I.D. .5937 to .5941	+.0002	Not Repairable	Replace Sleeve
			O.D. .4991 to .4995	-.0003	Not Repairable	Replace Shaft
			Concentricity	.0015 FIM	Not Repairable	Replace Shaft
			Tie Rod Bore .3750 to .3752	+.0005	Not Repairable	Replace Shaft
			Threads (crossed or missing)	None Allowed	Not Repairable	Replace Shaft

March 6, 2000

Table 1 - Lower Swashplate Assembly

P/N	Figure 3 Item #	Part Name	Inspection Requirements			Repair or Action
			Inspection**	Serviceable Limits**	Repair Limits	
28-16224-5	17	Tie Rod	O.D. .3748 to .3750	-.0005	Not Repairable	Replace Tie Rod
			Concentricity	.002 FIM	Not Repairable	Replace Tie Rod
			Threads (crossed or missing)	None Allowed	Not Repairable	Replace Tie Rod
28-16116-1	18	Housing	Bushing bores Dia. .7500 to .7505	+.0005	Not Repairable	Replace Housing
			Cracks	None Allowed	Not Repairable	Replace Housing
28-16225-19	19	Spacer	O.D. .4991 to .4995	-.0003	Not Repairable	Replace Spacer
			Length† 1.037 to 1.036	-.001	Not Repairable	Replace Spacer

* Inspect the DU Bushing I.D. with the bushing installed in the sleeve, P/N 28-16226-5.

** All dimensions are inches.

† Measure length at several locations to check for uneven wear.

March 6, 2000

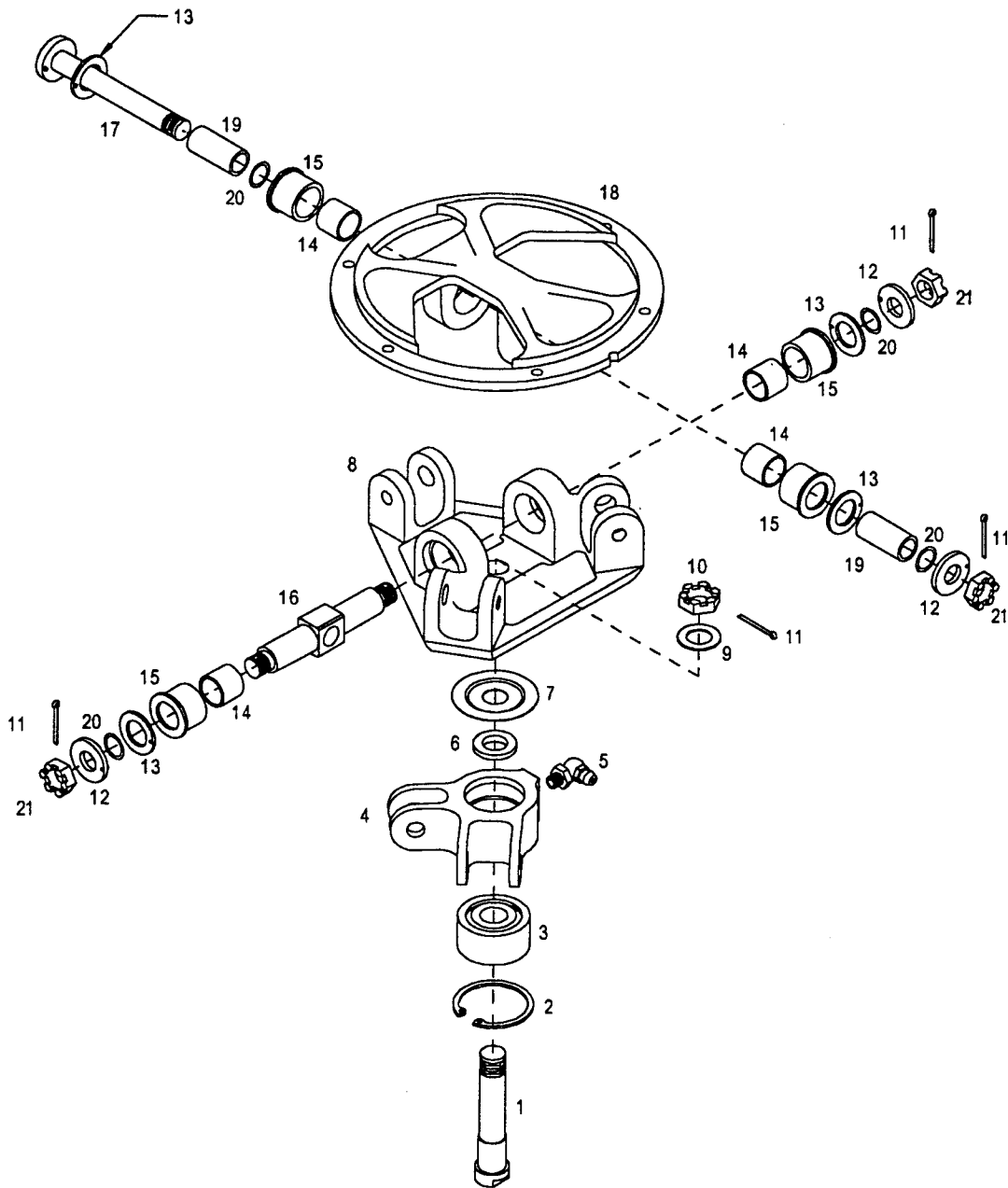


FIGURE 3 - LOWER SWASHPLATE ASSEMBLY

March 6, 2000

Table 2 - Lower Swashplate Assembly Parts Breakdown

FIGURE 3 ITEM #	PART NUMBER	DESCRIPTION	UNITS PER ASSY
-	28-16101-939	. Lower Swashplate Assembly	1
1	28-16123-1	.. Bolt	1
2	N5002-125-PP	.. Retaining Ring	1
3	ECD-009-11	.. Bearing	1
4	28-16361-1	.. Bearing Housing	1
5	1637-B	.. Lube Fitting	1
6	28-16228-1	.. Spacer	1
7	28-16387-1	.. Slinger	1
8	28-16119-3	.. Housing, Lower Universal	1
9	AN960-716L	.. Washer	1
10	F12NE4717-070	.. Nut	1
11	AN381-3-16	.. Cotter Pin	4
12	28-16227-3	.. Washer Assembly	3
13	28-16263-5	.. DU Washer	4
14	08-DU-08	.. DU Bushing	4
15	28-16226-5	.. Sleeve	4
16	28-16223-19	.. Shaft, Universal	1
17	28-16224-5	.. Tie Rod Assembly	1
18	28-16116-1	.. Housing, Upper Universal	1
19	28-16225-19	.. Spacer	2
20	28-16524-3	.. Shim, .020 in.	AR
20	28-16524-4	.. Shim, .015 in.	AR
20	28-16524-5	.. Shim, .005 in.	AR
20	28-16524-6	.. Shim, .003 in.	AR
20	28-16524-7	.. Shim, .002 in.	AR
20	28-16524-8	.. Shim, .001 in.	AR
21	AN320-6	.. Nut	3
-	28-01053-5	. Lower Swashplate Modification Kit	Kit