
SERVICE INFORMATION LETTER

SERVICE INFORMATION LETTER NO. 0150

Revision 2

DATE: February 18, 2025

1. SUBJECT: Lower Swashplate Assembly, P/N 28-16101-101
2. MODEL: F-28A, F-28C, F-28C-2, F-28C-2R, 280, and 280C
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 a former lower swashplate assembly used in production. Enstrom subsequently reviewed the design of that lower swashplate assembly and had incorporated a number of improvements, which then was identified lower swashplate assembly, P/N 28-16101-939. The current lower swashplate assembly is now identified as P/N 28-16101-101. 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 (SIL) provides maintenance instructions and parts information for maintaining the latest design lower swashplate assembly, P/N 28-16101-101, or a lower swashplate equipped with the Lower Swashplate Modification Kit, P/N 28-01053-5.

Revision 2 of this SIL adds the F-28C variants, removes the F-28F, 280F, and 280FX models (information has been incorporated into the F-28F/280F Series Maintenance Manual), and updates part number information.

NOTE: Enstrom will no longer supply spare/repair parts for lower swashplate assemblies other than P/N 28-16101-101.

5. COMPLIANCE:

Use the following procedures for maintaining a Lower Swashplate Assembly, P/N 28-16101-101 or a lower swashplate assembly equipped with the Lower Swashplate Modification kit, P/N 28-01053-5.

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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-lb/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-lb/6.8 Nm. Do not remove the cotter pin from the nut during the check and stop the torque check if 60 in-lb/6.8 Nm is reached without the tie rod assembly rotating. Any rotation of the tie rod with less than 60 in-lb/6.8 Nm of torque is unacceptable.

3. If neither looseness nor loss of torque is evident, the swashplate is in serviceable condition.
4. If any 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.

5.3 LOWER SWASHPLATE DISASSEMBLY:

NOTE: Refer to Illustrated Parts Catalog (IPC) Figure 8-1 for part identification.

NOTE: Regarding IPC Figure 8-1, item (80) (Universal Housing (Lower)): The applicable part numbers for item (80) are provided in the table; however, the label "80" is inadvertently omitted in the illustration (at the time of this revision release).

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1. Install tool T-0016 in the end of the tie rod (230). Place a wrench on the tool T-0016 to prevent the tie rod from rotating and remove the cotter pin (130), nut (150), light washer (110), washer (160), DU washer (170), and shims (180) from the tie rod.
2. Tap the tie rod out of the bushings (190) using an aluminum drift. Separate the lower universal housing (80) from the upper universal housing (220). Remove the spacers (240) from inside the bushings (190) in the housing.
3. Remove the shims (180) and the DU washer (170) from the tie rod (230).
4. Temporarily install the tie rod (230) in the universal shaft (210) to prevent it from rotating and remove the cotter pins (130), nuts (150), washers (160), DU washers (170), and shims (180) from both ends of the shaft (210).
5. Tap the end of the universal shaft (210) with an aluminum drift to remove the shaft and sleeve (200) from the lower universal housing (80).
6. Tap the opposite sleeve (200) to remove it from the lower universal housing (80).
7. Tap the sleeves (200) from the upper universal housing (220) using an aluminum drift.
8. Hold the bolt (10) with a wrench and remove the cotter pin (140), nut (120), and washer (100).
9. If applicable, back out the set screw (90) in the lower universal housing (80).

CAUTION: A VARIATION OF THE LOWER UNIVERSAL HOUSING HAS A SET SCREW PLUG THAT MUST BE LOOSENED TO ALLOW REMOVAL OF THE BOLT (10).

10. Pull the bolt (10) and bearing assembly (30) and (20) from the lower universal housing (80).
11. Press the bolt (10) from the bearing (30) and remove slinger (60) and spacer (50).
12. Remove the retaining ring (40) and grease fitting (70) from the housing (20).
13. Heat the housing (20) to approximately 250°F/121°C and remove the bearing (30) from the housing.

WARNING: USE EXTREME CAUTION WHEN REMOVING OR INSTALLING HEATED PARTS AND ASSEMBLIES TO PREVENT INJURING PERSONNEL.

WARNING: USE PROTECTIVE GLOVES WHEN HANDLING HEATED PARTS.

14. Press the DU bushings (190) from the sleeves (200).

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5.4 LOWER SWASHPLATE DETAILED PARTS INSPECTION:

1. Inspect the detail parts of the lower swashplate assembly in accordance with Table 1 of this SIL.
2. Replace unserviceable parts as required and reassembly the lower swashplate in accordance with Paragraph 5.5.

5.5 LOWER SWASHPLATE ASSEMBLY:

WARNING: USE EXTREME CAUTION WHEN REMOVING OR INSTALLING HEATED PARTS AND ASSEMBLIES TO PREVENT INJURING PERSONNEL.

WARNING: USE PROTECTIVE GLOVES WHEN HANDLING HEATED PARTS.

1. Heat the bearing housing (20) to approximately 250°F/121°C.
2. Apply a small amount of Loctite 277 to the O.D. of the bearing (30) and install the bearing (30) with the open side toward the “closed end” of the bearing housing (20). Allow the housing assembly to cool.

NOTE: Install the housing assembly onto the lower swashplate assembly with the retaining ring away from the swashplate.

3. Install the retaining ring (40) and grease fitting in the housing (70).

NOTE: Install the bolt with the head on the same side as the retaining ring.

4. Support the inner race of the bearing (30) and press the bolt (10) into the bearing (30).
5. Install the spacer (50) with the narrow side of the spacer against the inner race of the bearing (30).
6. Install the slinger (60) on the bolt (10).
7. Lubricate (MIL-PRF-81322) the bolt (10) and install into the lower universal housing (80). Install the washer (100) and nut (120). Torque the nut to 200 in-lb/22.7-29.5 Nm and install a cotter pin (140). Apply VC3 Vibra-Tite over the end of the bolt, nut, and cotter pin.
8. If applicable, apply a small amount of Loctite 277 to set screw (90) and install set screw into the lower universal housing (80).

NOTE: A variation of the lower universal housing (80) has a set screw plug (90) that must be installed upon reassembly.

9. Install the DU bushings (190) into the sleeves (200) (4 places).

NOTE: Lubricate (Tri-Flow brand or equivalent light viscosity lubricant) DU washers and bushings.

10. Check the fit of the universal shaft (210) and the tie rod (230) in the bushings (190). 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).

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

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WARNING: USE PROTECTIVE GLOVES WHEN HANDLING HEATED PARTS.

11. Lubricate (MIL-PRF-81322) the O.D. of two of the sleeves (200) and the bores of the ears on the lower universal housing (80).
12. Install one of the sleeves (200) into the lower universal housing (80) using tool T-0100-1.
13. Install the universal shaft (210) into the lower universal housing (80) through the ear without the sleeve and then install a sleeve (200) into the lower universal housing using T-0100-1. The shaft should rotate freely in the bushings (190).
14. Shim the universal shaft using the following procedure:

NOTE: Lubricate (Tri-Flow brand or equivalent light viscosity lubricant) DU washers and bushings.

- A. Using a felt tip marker, place a mark on one of the ears on the lower universal housing and install a 0.020 in/0.5 mm shim (180) on the end of the universal shaft (210). The mark indicates a 0.020 in/0.5 mm shim is installed.
- B. Install a DU washer (170) on the shaft (210) with the Teflon (grey) side of the washer against the sleeve (200).
- C. Install a washer (160) on the shaft (210) with the pin towards the DU washer (170).

- D. Install the tie rod (230) into the universal shaft (210) to prevent the shaft from rotating and install a nut (150). Ensure the DU washer is properly seated on the retention pin on the washer (160). Torque the nut to 110-150 in-lb/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.
- E. Install a .020 in/.5 mm shim (180), DU washer (170), washer (160), and nut (150) on the opposite end of the universal shaft. Ensure the DU washer (170) is properly seated on the retention pin on the washer (160). Torque the nut to 110-150 in-lb/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.
- F. Tap each end of the universal shaft (210) with an aluminum drift and hammer to seat the stack up.
- G. 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 in/7.5 cm arm. The preload should be 1.5-2.0 lb/0.68-0.91 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 0.005 in/0.13 mm maximum difference in shims is allowed from end to end to obtain proper preload.

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

WARNING: USE EXTREME CAUTION WHEN REMOVING OR INSTALLING HEATED PARTS AND ASSEMBLIES TO PREVENT INJURING PERSONNEL.

WARNING: USE PROTECTIVE GLOVES WHEN HANDLING HEATED PARTS.

CAUTION: ENSURE THAT THE SPACERS (240) ARE THE CORRECT LENGTH (SEE TABLE 1, INSPECTION REQUIREMENTS) IF SHIMMING DOES NOT ACHIEVE REQUIRED PRELOAD.

15. Lubricate (MIL-PRF-81322) the O.D. of the two remaining sleeves (200) and the bores of the ears on the upper universal housing (220). Using tool T-0100-1, install the sleeves into the upper universal housing.
16. Install a DU washer (170) onto the tie rod (230). Ensure the Teflon (grey) surface is facing inboard and the DU washer is properly seated on the retention pin. Install a spacer (240) and then a 0.020"/0.5 mm shim (180) onto the tie rod (230).

NOTE: Lubricate (Tri-Flow brand or equivalent light viscosity lubricant) DU washers and bushings.

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17. Place the upper universal housing (220) over the lower universal housing (80) and align the proper openings.
18. Insert the tie rod (230) 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.
19. Install the remaining spacer (240) onto the tie rod.
20. Install a 0.020 in/0.5 mm shim, DU washer (170), washer (160), light washer (110), and nut (150) on the tie rod (230). Ensure the DU washer is properly seated on the retention pin on the washer. Using tool T-0016 to secure the tie rod, torque the nut to 110-150 in-lb/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.
21. Tap each end of the tie rod (230) with an aluminum drift and hammer to seat the stack up.
22. 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.
23. 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 ± 0.25 lb/0.11 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 0.005 in/0.13 mm maximum difference in shims is allowed from end to end to obtain proper preload.

CAUTION: ENSURE THAT THE SPACERS (240) ARE THE CORRECT LENGTH (SEE TABLE 1, INSPECTION REQUIREMENTS) IF SHIMMING DOES NOT ACHIEVE REQUIRED PRELOAD.

24. Install the cotter pins (130) when the preload is set.

5.6 LOWER SWASHPLATE INSTALLATION:

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

5.7 PARTS

1. Refer to the F-28/280 Series IPC Figure 8-1 for the lower swashplate assembly.
2. Consumables (procured locally):

Lubricant, Grease	MIL-PRF-81322
Lubricant, Light Viscosity	Tri-Flow
Threadlocker, Flexible	VC-3 Vibra-Tite (or equivalent)
Threadlocker, High Strength	Loctite 277 (or equivalent)

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 INSPECTIONS:

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

Table 1 - Inspection Requirements – Lower Swashplate Assembly

Inspection Requirements

P/N	IPC Fig. 8-1 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits*	Repair or Action
28-16123-1, -11	10	Bolt	Bearing surface Dia. .4723 to .4726	-.0002	Not Repairable	Replace Bolt
			Threads (crossed or missing)	None allowed	Not repairable	Replace Bolt
ECD009-11	30	Bearing	O.D. 1.2593 to 1.2598	No Tolerance Allowed	Not Repairable	Replace Bearing
			I.D. .4721 to .4724	No Tolerance Allowed None allowed	Not Repairable	Replace Bearing
			Ratcheting or roughness		Not Repairable	Replace Bearing
28-16361-1	20	Bearing Assembly	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
			Bore size I.D. 1.2598 to 1.2604	+.0002	Not Repairable	Replace Housing
			Cracks	None Allowed	Not Repairable	Replace Housing
28-16228-1	50	Spacer	Nicks and gouges	None Allowed	≤ .003 deep	Polish out smooth
28-16387-1	60	Slinger	Check for bends in outer edges	.005	Not Repairable	Replace Slinger

Table 1 - Inspection Requirements – Lower Swashplate Assembly

Inspection Requirements

P/N	IPC Fig. 8-1 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits*	Repair or Action
28-16119-3, -5	80	Housing	Bushing bores Dia. .7500 to .7505 (-3) .7495 to .7500 (-5)	+.0005	Not Repairable	Replace Housing
			Center bolt bore Dia. .4370 to .4380 (-3) .4376 to .4380 (-5) (no galling allowed in this bore)	None Allowed	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
			Cracks	None Allowed	Not Repairable	Replace Housing
28-16227-3	160	Washer	Nicks and gouges	None Allowed	Not Repairable	Replace Washer
28-16263-5	170	DU Washer	Thickness .0585 to .0605	-.008	Not Repairable	Replace DU Washer
08DU08	190	DU Bearing	**I.D. .4992 to .5019	+.0025	Not Repairable	Replace DU Bearing
28-16226-5	200	Sleeve	O.D. .7503 to .7508	-.0003	Not Repairable	Replace Sleeve
			I.D. .5937 to .5941	+.0002	Not Repairable	Replace Sleeve

Table 1 - Inspection Requirements – Lower Swashplate Assembly

Inspection Requirements						
P/N	IPC Fig. 8-1 Item #	Part Name	Inspection*	Serviceable Limits*	Repair Limits*	Repair or Action
28-16223-19	210	Universal Shaft	O.D. .4991 to .4995	-.0003	Not Repairable	Replace Shaft
			Tie Rod Bore .3750 to .3752	+.0005	Not Repairable	Replace Shaft
			Concentricity	.0015 FIM	Not Repairable	Replace Shaft
			Threads (crossed or missing)	None Allowed	Not Repairable	Replace Shaft
28-16116-1, -11	220	Housing	Bushing bores Dia. .7500 to .7505	+.0005	Not Repairable	Replace Housing
			Cracks	None Allowed	Not Repairable	Replace Housing
28-16224-5	230	Tie Rod	O.D. .3746 to .3749	-.0003	Not Repairable	Replace Tie Rod
			Concentricity	.002 FIM	Not Repairable	Replace Tie Rod
			Threads (crossed or missing)	None Allowed	Not Repairable	Replace Tie Rod
28-16225-19	240	Spacer	O.D. .4991 to .4995	-.0003	Not Repairable	Replace Spacer
			†Length 1.037 to 1.036	-.001	Not Repairable	Replace Spacer

* All dimensions are in inches.

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

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