



SERVICE INSTRUCTION M20-112 (Rev. A)

Date: December 19, 2007

- SUBJECT:** TO ADVISE OWNERS OF THE RETROFIT KIT 940164-501 FOR DUKES ACTUATOR PART NUMBERS: 4196-00-1 AND DIRECT REPLACEMENT FOR DUKES1057-00-5G. THE RETROFIT KIT 940164-503 FOR THE ITT ACTUATOR P/N's LA11C2110 (MAC 950227-501) and ITT actuators LA11C2114, LA11C2115.
- MODELS/ SN AFFECTED:** DUKES 4196-00-1C (MAC 950158-503) - M20C, M20E, M20F, M20G (OPTIONAL)
 DUKES 4196-00-1C (MAC 950158-503) - M20C (690001 THRU 20-0041)
 DUKES 4196-00-1C (MAC 950158-503) - M20E (690001 THRU 21-0060)
 DUKES 4196-00-1C (MAC 950158-503) - M20F (690001 THRU 22-0068)
 DUKES 4196-00-1C (MAC 950158-503) - M20G (690001 THRU 700006)
 DUKES 1057-00-5G - M20J (24-0001 THRU 24-0083, 24-0085 THRU 24-0377) (DIRECT REPLACEMENT)
 ITT LA11C2110 (MAC 950227-501) M20C (20-0042 THRU 20-0046, 20-1147 THRU 20-1258)
 ITT LA11C2110 (MAC 950227-501) M20E (21-0051 THRU 21-0060, 21-1161 THRU 21-1180)
 ITT LA11C2110 (MAC 950227-501) M20F (22-0069 THRU 22-0078, 22-1179 THRU 22-1439)
 ITT LA11C2114 and LA11C2115
- TIME OF COMPLIANCE:** OPTIONAL RETROFIT KIT - Compliance to this Service Instruction M20-112 revises 200 hour inspection of the gears specified in service Bulletin M20-190B. The inspection interval is now per instructions as outlined in Mooney Service and Maintenance Manual for M20J serial numbers 24-0001 thru 24-0377. (reference MAC M20J service maintenance manual section 5-20-06) actuator gear inspection is now: After 500 hours of operation and then every 200 hours thereafter.
- INTRODUCTION:** This Retrofit kit converts 20:1 gear ratio Dukes 4196 and ITT LA11C2110, LA11C2114 and LA11C2115 actuators into 40:1 gear ratio, equivalent to Dukes 1057 actuator. The 40:1 ratio gear will slow landing gear retraction time from 3 seconds to 6 seconds. Increased service life is the benefit of 40:1 over gears 20:1 gears.
- INSTRUCTIONS:** READ ENTIRE PROCEDURE BEFORE BEGINNING.

GEAR RETROFIT PROCEDURE:

1. Disassemble and replace removed components with like components from Actuator Parts Kit as instructed in the following steps. (See Figures 1, 2, 3, 4)
2. Separate motor/gear housing by removing the two nuts/washers/bolts from the brackets holding motor/gearbox assembly to the jackscrew/gearbox assembly. (See Figure 1)
3. Break lockwire and remove bolts and washers from gear housing end plate.
4. Remove end plate from gear housing.
5. Remove bushing 940024-001 from end plate. (ITT actuators Only)
6. While restraining screw assembly from turning, remove hexagon nut from threaded end of screw assembly (nut is staked two places).
7. Remove locking key and worm gear from threaded end of screw assembly.
8. Remove worm, by pushing up from bottom of the keyed shaft.
9. Remove bushing 940024-003 from shaft and gear housing assembly (ITT) or remove seal AF0100-EO from shaft and rear housing assembly (Dukes).

10. Install new parts from Retrofit kit in reverse order:
 - 940164-501 kit – Dukes 4196-00-1 (MAC 950158-503)
 - 940164-503 kit – ITT LA11C2110 (MAC 950227-501) and LA11C2114, LA11C2115
11. Install new bushing 940024-003 into housing (ITT) or apply Loctite™ 641 to new lower seal AF0100-EO (Dukes) and install into housing assembly, metal side inward until flush with housing (See Figure 2).

- CAUTION -

Loctite™ must not contact rubber portion of seal AF0100-EO.

12. If gear housing bearing and retainer were removed for replacement, Install bearing retainer in gear housing against bearing assembly and tighten retainer to 25 inch-pound torque.
13. Apply Loctite™ 641 to bearing A200900 and swedge new worm gear shaft 560268-001 to bearing A200900.
14. Lubricate and install new worm gear 560267-001 and bearing A200900 with 3 cc minimum of grease. Use only MIL-PRF-23827 grease (AEROSHELL Grease #7) with 10% by volume molybdenum disulfide added.
15. Check worm gear so it engages with center of worm without binding or catching. Use laminated shim washer(s) 560195-001 provided in kit to properly align worm gear. These shims are made laminated to a .010” total thickness (made from 5 pieces of .002” material) and can be separated by using a utility knife to achieve proper thickness for alignment. (see Figure 3)
16. Apply Loctite™ #242 to MS21083C7 hex nut, while holding screw assembly against turning, torque nut to 200 - 212 inch-pounds. Stake nut two places, equally spaced.
17. Install retainer nut (ITT) or plug cap (Dukes) on worm housing, and stake to lock in place
18. Install end plate on gear housing, and secure with bolts and washers. Torque bolts to 15 inch-pounds.
19. Install MS20995NC32 lockwire between all bolts in pairs, and between retainer and closest bolt, in accordance with MS33540. Stake retainer 4 places (Dukes).
20. Attach 940024-011 Placard to Actuator Gear Housing. Remove 940024-009 Placard if attached to Actuator. (See Figure 4)
21. Install Rubber Coupling B100-06 by inserting either shaft firmly into two of the serviceable coupling slots.
22. Position the motor/gearbox portion into place; carefully inserting the other shaft, 90° opposite the first shaft, into the other slots in the coupling. Position and secure the two bolts/washers/nuts to the bracket (in reverse order of removal) to re-assemble the components.
23. Install actuator into aircraft, reference MAC Service and Maintenance Chapter 5.
24. Test the overhauled actuator as follows:
25. Use aircraft electrical system, or DC input power of 13+ volts (obtained by batteries augmented by a charger).
26. Extend and retract the actuator against an 800 pound peak end opposing load (or aircraft landing gear if installed). Operating time shall be 9 seconds maximum, and current drain shall be 25 amperes maximum, at a stroke of 3.0 inches. (Available stroke is 4.61 ± 0.03 inches.)
27. Operate the unit through at least 3 manual landing gear emergency extensions. The manual crank shall operate smoothly with no binding or kick back.

28. With no load applied to the actuator, slowly increase voltage, starting from zero volts DC, to the actuator brake until the brake pulls in. Pull in voltage shall not exceed 9.0 volts DC. (applies to ITT actuator motors equipped with brake)
29. Since the actuator was removed from the aircraft it will be necessary to check landing gear rigging and operation per the applicable MAC Service and Maintenance manual.
30. When all operations are found to be satisfactory per MAC Service and Maintenance manual re-install the belly skins, enter compliance note into log book and return aircraft to service.

WARRANTY: This modification is not warranty reimbursable.

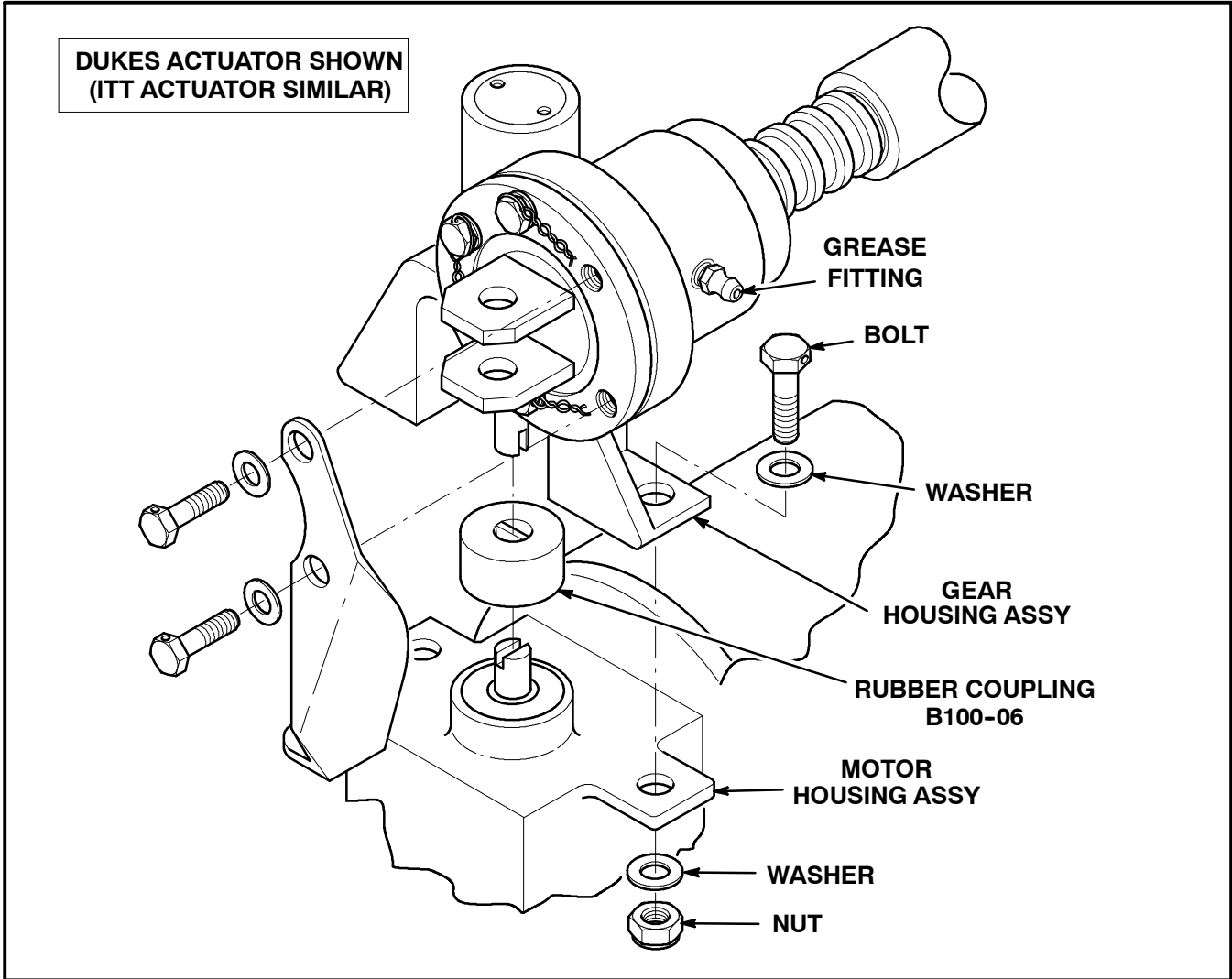
REFERENCE DATA: Refer to Mooney Airplane Company Service Manuals (applicable A/C) Chapter 5 for maintenance and service data. Refer to MAC SI M20-089-001 and SB M20-190B

PARTS LIST: Kit P/N: **SI20-112-001 - Dukes Landing Gear Actuators**

<u>Item</u>	<u>P/N</u>	<u>Description</u>	<u>QTY</u>
1.	940164-501	Actuator Repair Kit for Dukes (4196-00-1C) 40:1 ratio	1
.....	560267-001	Worm Gear 40:1	1
.....	560268-001	Worm 40:1	1
.....	A200900	Bearing	1
.....	MS21083C7	Nut	1
.....	560195-001	Shims, Laminated	2
.....	AF0100-EO	Seal	1
.....	B100-06	Rubber Coupling	1
.....	MS28775-128	O-Ring, Gasket	1
.....	AEROSHELL #7 MDP	Lubricant (Aeroshell NO.7 MIL-G-23827)	AR
.....	MOLYBDNENUM	Molybdenum Disulfide per AMS 7866	AR
.....	940024-011	Decal (Lubricant)	1
2.	SI M20-112	Paper Copy of Service Instruction SI M20-112	1

Kit P/N: **SI20-112-003 - ITT Landing Gear Actuators**

<u>Item</u>	<u>P/N</u>	<u>Description</u>	<u>QTY</u>
1.	940164-503	Actuator Repair Kit for ITT (LA11C2110, 2114, 2115) 40:1 ratio	1
.....	560267-001	Worm Gear 40:1	1
.....	560268-001	Worm 40:1	1
.....	A200900	Bearing	1
.....	MS21083C7	Nut	1
.....	560195-001	Shims, Laminated	2
.....	MS28775-128	O-Ring, Gasket	1
.....	AEROSHELL #7 MDP	Lubricant (Aeroshell NO.7 MIL-G-23827)	AR
.....	MOLYBDNENUM	Molybdenum Disulfide per AMS 7866	AR
.....	940024-011	Decal (Lubricant)	1
.....	940024-001	Bushing (End Cap)	1
.....	940024-003	Bushing (Worm Housing)	1
2.	SI M20-112	Paper Copy of Service Instruction SI M20-112	1



**FIGURE 1 - SEPARATING DUKES ACTUATOR GEAR AND MOTOR HOUSING
(4196-00-1C - SHOWN)**

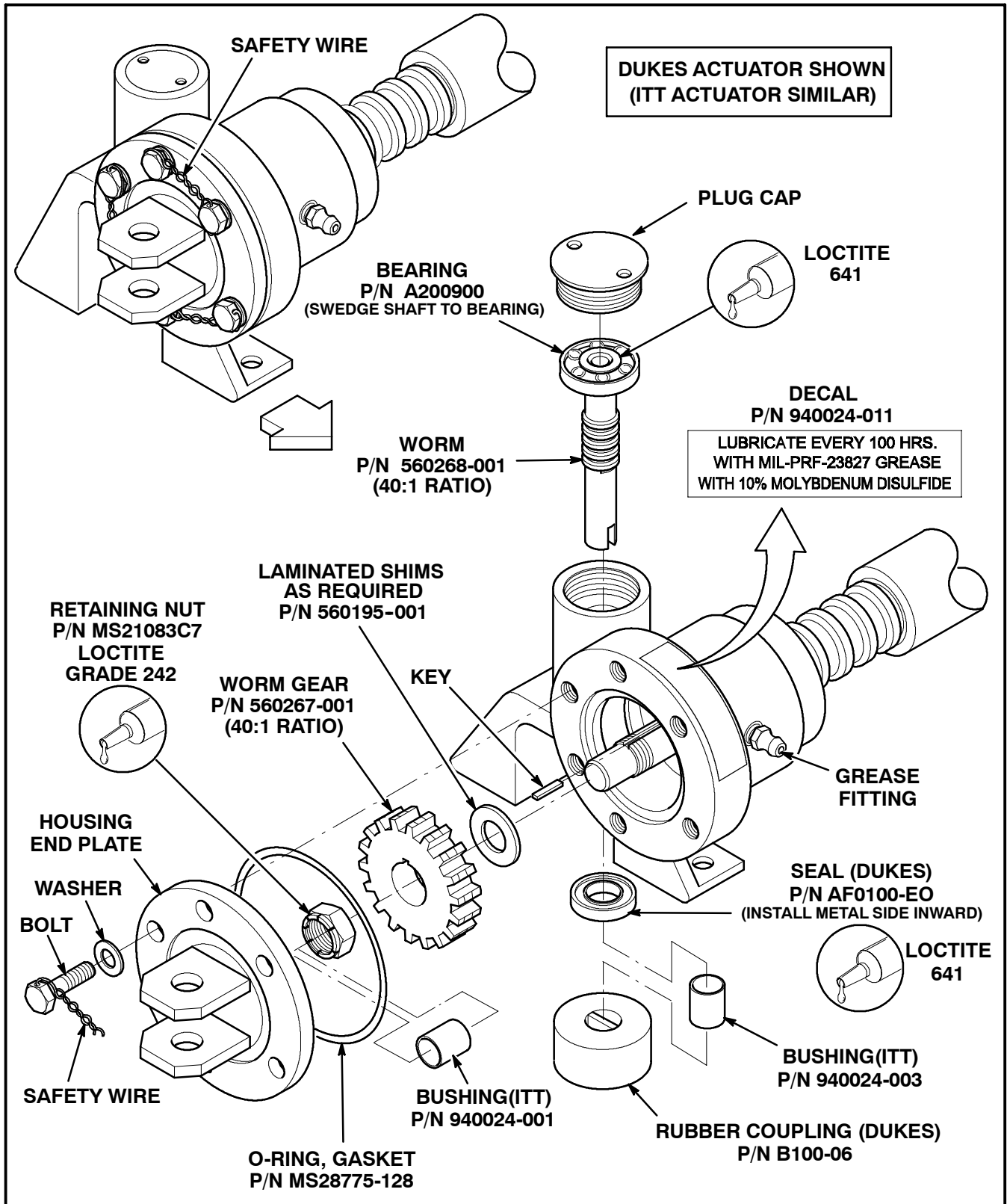


FIGURE 2 - DUKES ACTUATOR EXPLODED VIEW (4196-00-1C - SHOWN)

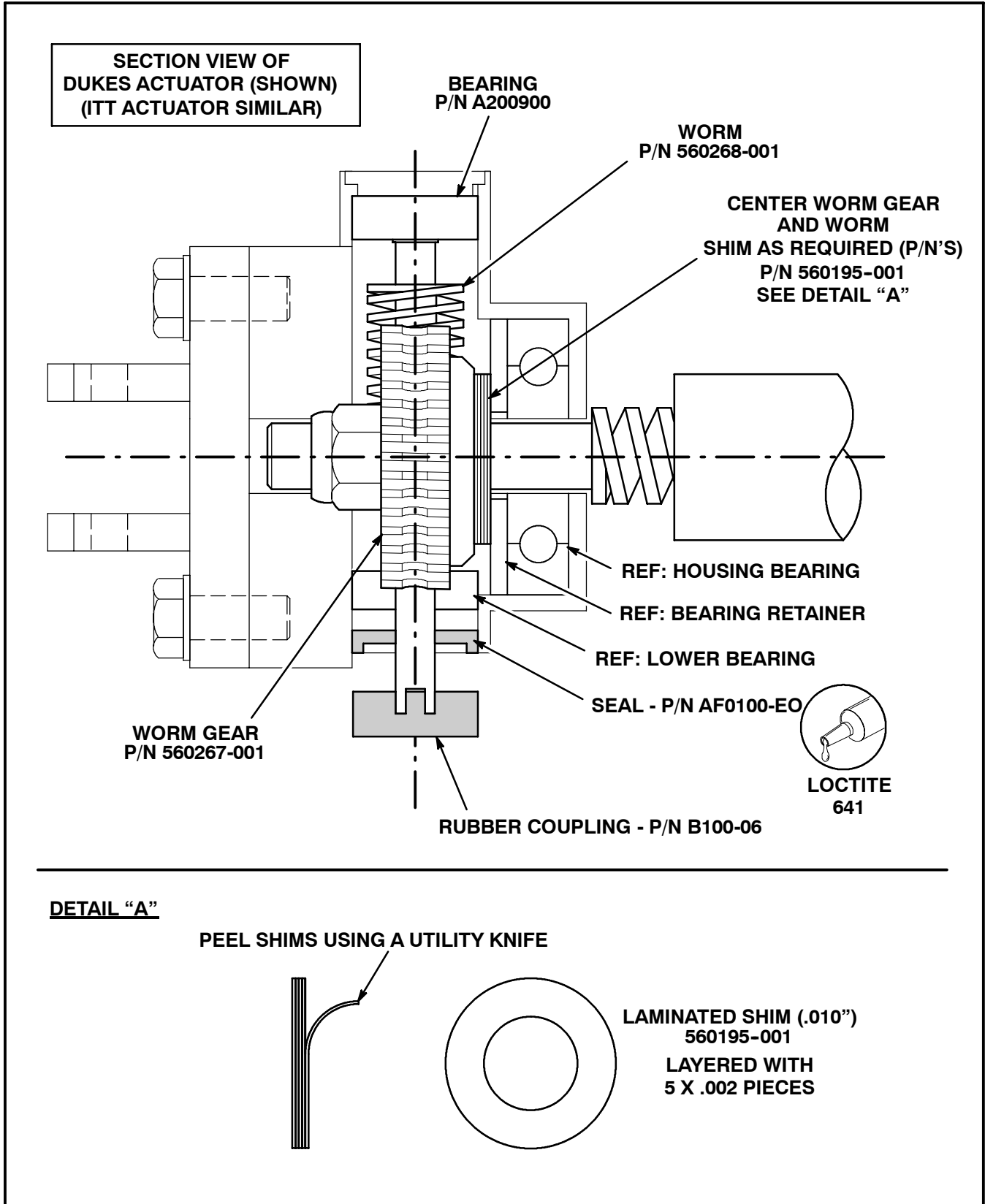


FIGURE 3 - DUKES ACTUATOR - SECTION VIEW (4196-00-1C - SHOWN)

REMOVE:

**LUBRICATE EVERY 100 HRS.
WITH MIL-G-23827 GREASE**

940024-009

ADD:

**LUBRICATE EVERY 100 HRS.
WITH MIL-PRF-23827 GREASE
WITH 10% MOLYBDENUM DISULFIDE**

940024-011

FIGURE 4 - ACTUATOR PLACARDS

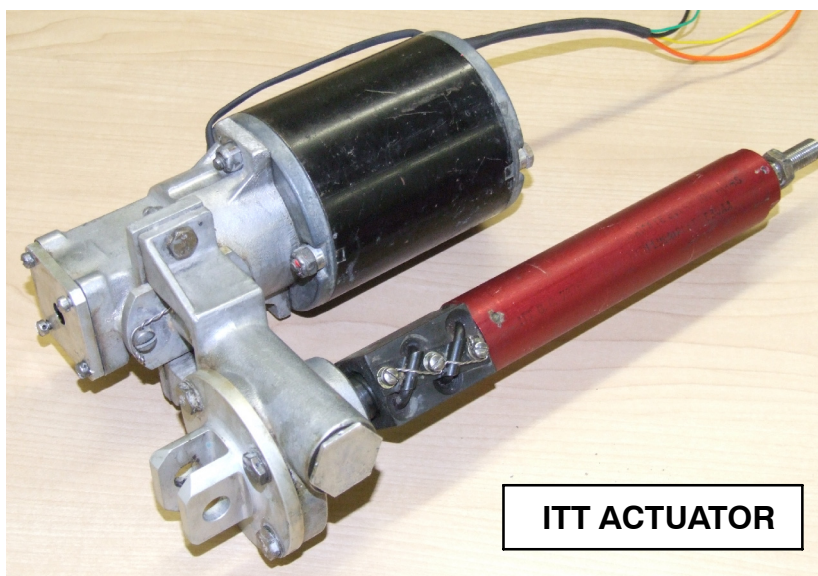
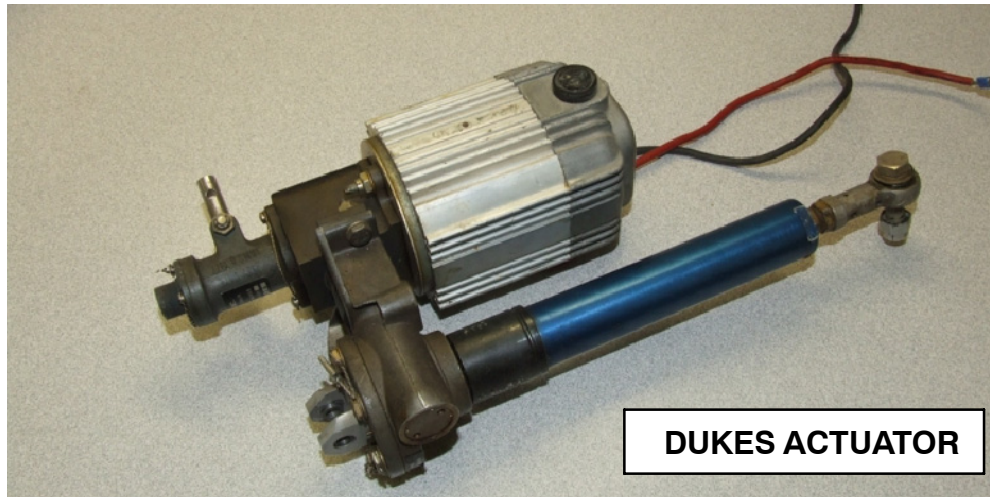


FIGURE 5 - DUKE AND ITT ACTUATORS