

Seal Dynamics

13780 McCormick Drive
Tampa, Florida 33626

Installation Instructions

NLG Steering Actuator Bushing Replacement Bombardier Model CL-600-2B19

Report Number: SD3122015INSTL

Revision: A, Dated 06/29/2020

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Log of Revisions

Revision

A

Description

Removed AC665 B2-6OZ and
Replaced With MIL-PRF-81733

Date

06/29/2020

Approval

Scott Sanford

Digitally signed by Scott
Sanford
Date: 2020.06.29 15:01:27
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1.0 Scope

This report provides Work Instructions for the installation or replacement of Seal Dynamics Nose Landing Gear (NLG) steering actuator self-lubricating bushings on Bombardier CL-600-2B19 Aircraft. Information contained herein was derived from the successful fleet experience installing similar self-lubricating bushings by Air Wisconsin. These self-lubricating bushings are manufactured by Kamatics and include Karon B liners which eliminate greasing requirements. Malfunctions of NLG steering RVDT's have been reported and found to be related to grease ingress and utilization of the Seal Dynamics NLG steering actuator self-lubricating bushings eliminates greasing requirements.

2.0 General Description

Seal Dynamics NLG steering actuator self-lubricating bushings part number 16117-13SD and 16117-15SD are direct replacements for Messier-Dowty bushings part number 16117-13 and 16117-15 respectively. Installation eligibility is Bombardier CL-600-2B19 Aircraft. Installation can be accomplished during normally scheduled "C" Checks, during line maintenance or during NLG overhaul resulting in dressed NLG assemblies not installed on an aircraft. Procedures specified herein are specific to Seal Dynamics Nose Landing Gear (NLG) steering actuator self-lubricating bushings superseding the bushing repair (replacement) procedures provided by Messier-Dowty CMM 32-20-04.

3.0 Distribution

This document is an integral part of the PMA data package for the installation of Seal Dynamics NLG steering actuator self-lubricating bushings part number 16117-13SD and 16117-15SD replacing Messier-Dowty NLG steering actuator bushings part number 16117-13 and 16117-15. Seal Dynamics will furnish at least one complete copy of this document to the aircraft operator at the time of the PMA issuance. Seal Dynamics will authorize the aircraft operator to make this document available to any person required to comply with any of the items contained in this document.

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4.0 Reference Documents

Except where a specific issue is indicated, the current issue of the listed references shall be considered part of these installation instructions to the extent specified herein.

Document Number	Title
16117CRJ-NLGKIT	CRJ-NLG Bushing Replacement Kit Drawing
16117-13SD	Bushing Drawing
16117-15SD	Bushing Drawing
16117-13SDTP	Installation / Removal Tool (Plug) Drawing
16117-13SDTC	Installation / Removal Tool (Cup) Drawing
16117-15SDTP	Installation / Removal Tool (Plug) Drawing
16117-15SDTC	Installation / Removal Tool (Cup) Drawing
SD3122015PLCD	Placard Drawing
SD3122015SICA	Supplemental Instructions for Continued Airworthiness

5.0 AMM References

Document Number	Title
FIM 32-60-00	Position and Warning Fault Isolation
TASK 07-11-01-582-802	Jacking of the Aircraft from the Nose
TASK 10-11-00-400-801	Installation of the Nose Landing Gear Lockpin
TASK 10-11-00-400-802	Installation of the Main Landing Gear Lockpins
TASK 12-00-06-863-803	Pressurize Hydraulic System No. 3
TASK 12-00-06-863-804	Release Hydraulic Pressure - System No. 3
TASK 20-10-00-910-809	Standard Maintenance Practices for Electrical Wiring Interconnection System (EWIS)
TASK 29-10-00-870-803	Bleed Hydraulic System No. 3
TASK 32-50-00-740-801	BITE Test of the Steering System
TASK 32-51-00-710-801	Operational Test of the Nosewheel Steering
TASK 32-51-05-820-801	Rigging of the RVDTs with the use of the Maintenance Diagnostic Computer (MDC) Aircraft on Jack
TASK 32-51-20-000-801	Removal of the Left and Right Feedback RVDTs
TASK 32-52-10-000-801	Removal of the Steering - Actuator Swivel Valve
TASK 32-61-05-220-801	Clearance Check of the Landing Gear Proximity Sensors

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6.0 Materials

P/N or Specification	Description	QTY
M83461-1-219	Packing Preform	2
NAS1601-010	Packing Preform	8
M8791-1-010	Retainer	16
M83461/1-024	Packing	4
MIL-PRF-81733	Sealant (Examples: 3M AC665 B, P/S 870 B)	As Required
AC350B1-2-2-5OZ (3M)	Sealant	As Required
16117-13SD	Bushing	2
16117-15SD	Bushing	2
16117-13SD-060 **	Bushing (Oversize)	2
16117-15SD-060 **	Bushing (Oversize)	2
SD3122015PLCD	Placard	1
2PB19	Zerk Cap	4
(Local Supply)	Dry Ice	As Required
(Local Supply)	Alcohol	As Required
(Local Supply) *	Vaseline	As Required
49504 (Loctite 495) *	Super Glue	As Required
DC404532 *	Molykote	As Required
(Local Supply) *	MEK	As Required
MS20995C-032 *	Lockwire	As Required
MS20995C-032 *	Lockwire	As Required
Royco 33 *	Grease	As Required
LD4 Skydrol or Hyjet *	Hydraulic Fluid	As Required
RTV730 *	Sealant	As Required

* = Normal Shop stock items

** = Oversize Bushings will not be used if unless required

7.0 Tools and Equipment

Item	Description
CAT5643-3B	Torque Wrench Adaptor (Messier/Dowty)
16117-13SDTP	Installation / Removal Tool (Plug)
16117-13SDTC	Installation / Removal Tool (Cup)
16117-15SDTP	Installation / Removal Tool (Plug)
16117-15SDTC	Installation / Removal Tool (Cup)
C - Clamp	5" (Optional 4" or 6")
Fluke (VOM) or Equivalent	Multi-Meter

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8.0 Work Instructions

ITEM	WORK INSTRUCTIONS			MECH	INSP	
PREPARATION						
1	WARNING: Obey all safety precautions and general maintenance practices according to Canadair Regional Jet Aircraft Maintenance Manual.			XX	XX	
2	Follow all precautions and maintain standards for EWIS. Apply proper EWIS practices and housekeeping. Reference AMM Task 20-10-00-910-809, Standard Practices for Electrical Wiring Interconnection System (EWIS).			XX	XX	
3	The following is a list of AMM references. Obtain copies if / as needed:			XX	XX	
	32-51-20-000-801	32-52-10-000-801	32-61-05-220-801			
	32-51-00-710-801					
4	Park aircraft with nose wheels on grease plates.			XX	XX	
5	Install safety lockpins at the nose landing gear and at the main landing gear (Ref. TASK10-11-00-400-801 and TASK 10-11-00-400-802).				XX	
6	Release the hydraulic pressure from system No. 3 (Ref. TASK 12-00-06-863-804).				XX	
7	Open, Safety and Tag the circuit breakers that follow:				XX	
	CP PANEL	CB NO.	NAME			ZONE
	CBP-1	F6	PROX SENS LGC/D1			221
	CBP-1	F7	PROX SENS WOW 1			221
	CBP-1	F8	NOSE STEER			221
	CBP-2	F8	NOSE STEER			222
	CBP-2	F9	PROX SENS WOW 2			222
	CBP2	P2	PROX SENS LGC/D1			222
	CBP-2	P3	PROX SENS LGC/D2 WOW 1 +2			222
	CBP-4	B13	PROX SENS LGC/D2			222
	CBP-1	A2	HYD PUMP 3B			221
	CBP-1	G11	HYD SYS AC PUMP CONT 3B			221
	CBP-2	A2	HYD PUMP 3A			222
	CBP-2	G15	HYD SYS AC PUMP CONT 3A			222

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ITEM	WORK INSTRUCTIONS	MECH	INSP
8	Reference Figure 1. Remove both RVDT's as follows: • Disconnect the electrical connectors from the RVDTs (1). • Remove and discard the lockwire from the bolts (2). • Loosen the captive bolts (2). • Carefully cut the sealant around the base of the RVDT (1). If necessary, turn the RVDT to break the remaining sealant. <u>CAUTION:</u> MAKE SURE THAT ALL OF THE SEALING COMPOUND AROUND THE RVDT BASE IS REMOVED BEFORE YOU REMOVE THE RVDT. DO NOT USE A TOOL SUCH AS A SCREWDRIVER TO LIFT THE EDGE OF THE RVDT WHEN YOU REMOVE IT. YOU WILL BEND THE RVDT SHAFT. • Lift the RVDT (1) straight up to prevent damage to the RVDT shaft and remove the RVDT from the steering sleeve/actuator assembly. • Remove and discard the preformed packing (4). • Clean the sealant from the steering sleeve and the base of the RVDT (1). • Clean all grease from the RVDT body and shaft.		XX

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ITEM	WORK INSTRUCTIONS	MECH	INSP
9	Reference Figure 2A and 2B. Remove the steering actuator swivel valves (1) as follows: • Put a hydraulic fluid container below the work area and protect the tires from hydraulic fluid. • Cut and discard the lockwire from the bolts (2) that attach the pipes to the support block. Remove the nuts (3), the bolts (2), and the washers (4). • Remove the plate and the proximity sensor harness from the support block. • Carefully flex the support block at each split and remove the support block from the pipes. • Cut and discard the lockwire from the cap screws (5) and remove the cap screws and the washers (6). • Carefully pull the pipes from the swivel valve (1). • Cut and discard the lockwire from the bolts (7) and remove the bolts and the washers (8). • Carefully remove the swivel valve (1) from the steering actuator. • Remove and discard the retainers (9) and the preformed packings (10) from the hydraulic pipes and from the quills of the swivel valve (1). • Install plugs and caps on the pipes and open hydraulic ports.		XX

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ITEM	WORK INSTRUCTIONS	MECH	INSP
10	Reference Figure 3. Lower the steering plate (9) as follows: • Remove the lockwire from the bolts (11) on the proximity sensor bracket. • Remove the bolts (11) and the washers (12) that attach the proximity sensor bracket to the steering plate (9). • Loosen the locking nut assembly (8) on the steering sleeve as follows: ➢ Remove and discard the lockwire from the two bolts (5). ➢ Remove the two bolts (5), with the two washers (6), and the locking key (7). ➢ Use the locknut wrench (Messier-Dowty part number CAT5643-3B) and loosen the locking nut assembly (8). <u>NOTE:</u> If required, disconnect the upper and lower torque links to get access to the locking nut assembly (8). <u>NOTE:</u> Steering plate (9) may separate from the steering sleeve and can be lowered down the length of the strut. • Support the steering actuator with string to prevent it from hanging on the shaft.		XX

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ITEM	WORK INSTRUCTIONS	MECH	INSP
11	Reference Figure 4B. Remove Steering Plate Bushings (2 each) as follows: - Using Bushing Installation / Removal Tool (Plug) Part Number 16117-13SDTP and Bushing Installation / Removal Tool (Cup) Part Number 16117-13SDTC and a 5" "C" clamp (4" or 6" if 5" not available), press original bushings upward and out of steering plate. <u>CAUTION:</u> DO NOT USE ABRASIVE MATERIAL TO CLEAN THE INNER AREA OF THE NLG BUSHING HOLES. DAMAGE TO CADMIUM PLATING WILL RESULT. - Clean Steering Plate bushing bores with MEK or Isopropyl Alcohol and wipe dry.		XX
12	Reference Figure 4A. Measure Steering Plate Bore and determine replacement bushing size as follows: - Clean Steering Plate bores with MEK or Isopropyl Alcohol and wipe dry. - With appropriate micrometer, measure inside diameter of steering plate bores. - If bore diameters are greater than 1.6708" diameter: Use .060" oversized replacement bushing 16117-13SD-060 and machine bushing bore diameters to corresponding bore diameter as shown per the table in figure 4A. - If bore diameters have not been oversized beyond 1.6708" diameter, proceed to block 13.		XX

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ITEM	WORK INSTRUCTIONS	MECH	INSP
13	Reference Figure 4B. Install Steering Plate Bushings (2 each) as follows: - Place new steering plate bushings 16117-13SD or (16117-13SD-060, machined to fit) in a bath of dry ice and alcohol mixture. - Apply Molykote DX to steering plate bore. Ensure metal face is fully covered. - Mix MIL-PRF-81733 sealant according to package instructions. <u>WARNING:</u> USE TONGS, PADDED PLIERS, INSULATED GLOVES OR SUITABLE CLOTH PROTECTION WHEN REMOVING THE BUSHINGS FROM THE DRY ICE. INJURY TO SKIN MAY RESULT. - Remove bushing from dry ice and apply MIL-PRF-81733 sealant to flange face that will contact top of the steering plate. Ensure full coverage is applied. - Insert new bushings 16117-13SD or (16117-13SD-060, machined to fit) in place on the steering plate. Fully seat bushing flange against the steering plate using Bushing Installation / Removal Tool (Plug) Part Number 16117-13SDTP and Bushing Installation / Removal Tool (Cup) Part Number 16117-13SDTC if necessary. Ensure bushings are fully seated. - Remove excess Molykote DX from the face of steering plate. - Apply small bead of MIL-PRF-81733 sealant to fillet area of bushings to steering plate.		XX

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ITEM	WORK INSTRUCTIONS	MECH	INSP
14	Reference Figure 4D. Remove Steering Sleeve Bushings (2 each) as follows: - Using Bushing Installation / Removal Tool (Plug) Part Number 16117-15SDTP and Bushing Installation / Removal Tool (Cup) Part Number 16117-15SDTC and a 5" "C" clamp (4" or 6" if 5" not available), press original bushings downward and out of the steering sleeve. <u>CAUTION:</u> DO NOT USE ABRASIVE MATERIAL TO CLEAN THE INNER AREA OF THE NLG BUSHING HOLES. DAMAGE TO CADMIUM PLATING WILL RESULT. - Clean Steering Sleeve bushing bores with MEK or Isopropyl alcohol and wipe dry.		XX
15	Reference Figure 4C. Measure Steering Sleeve Bore and determine replacement bushing size as follows: - Clean Steering Sleeve bores with MEK or Isopropyl Alcohol and wipe dry. - With appropriate micrometer, measure inside diameter of steering sleeve bores. - If bore diameters are greater than 1.4007" diameter: Use .060" oversized replacement bushing 16117-15SD-060 and machine bushing bore diameters to corresponding bore diameter as shown per the table in figure 4C. - If bore diameters have not been oversized beyond 1.4007" diameter, proceed to block 16.		XX

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ITEM	WORK INSTRUCTIONS	MECH	INSP
16	Reference Figure 4D. Install Steering Sleeve Bushings (2 each) as follows: - Place new steering plate bushings 16117-15SD or (16117-15SD-060, machined to fit) in a bath of dry ice and alcohol mixture. - Apply Molykote DX to bushing holes. Ensure metal face is fully covered. - Mix MIL-PRF-81733 sealant according to package instructions. <u>WARNING:</u> USE TONGS, PADDED PLIERS, INSULATED GLOVES OR SUITABLE CLOTH PROTECTION WHEN REMOVING THE BUSHINGS FROM THE DRY ICE. INJURY TO SKIN MAY RESULT. - Remove bushing from dry ice and apply MIL-PRF-81733 sealant to flange face that will contact bottom of the steering sleeve. Ensure full coverage is applied. - Insert new bushings 16117-15SD or (16117-15SD-060, machined to fit) in place on the steering sleeve. Fully seat bushing flange against the steering sleeve using Bushing Installation / Removal Tool (Plug) Part Number 16117-15SDTP and Bushing Installation / Removal Tool (Cup) Part Number 16117-15SDTC if necessary. Ensure bushings are fully seated. - Remove excess Molykote DX from the face of steering sleeve. - Apply small bead of MIL-PRF-81733 sealant to fillet area of bushings to steering sleeve.		XX

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ITEM	WORK INSTRUCTIONS	MECH	INSP
17	Reference Figure 3. Install Steering Plate and Actuators as follows: <u>NOTE:</u> Do not apply grease to the steering actuator bushings at the steering sleeve and steering plate. • Move the steering plate (9) up and carefully install the two steering actuators (10) in it. Make sure that the steering actuator (10) to be installed in this procedure is installed correctly in the steering sleeve. • Remove string support the steering actuators. • Tighten the locking nut assembly (8) by hand. • Use the locknut wrench (Messier-Dowty part number CAT5643-3B) and adjust the locking nut assembly (8) to get a gap of between 0.004 and 0.010 in. (0.10 and 0.25 mm). Make sure that the locking key (7) will align with one of the related detents in the steering plate (9) when it is installed on the locking nut assembly (8). <u>NOTE:</u> The gap is measured between the locking nut assembly (8) and the steering plate (9). Make sure that the steering plate (9) and the steering collar assembly are fully against the steering sleeve. • Install the locking key (7) on the locking nut assembly (8) with the washers (6) and the bolts (5). • Safety the bolts (5) with MS20995C-032 lockwire. • Seal the joints between the main fitting, the steering plate (9), locking nut assembly (8), and the locking key (7), with MIL-PRF-81733 sealant. • If they were disconnected in the removal task, connect the NLG upper and lower torque links. Make sure that the quick-disconnect handles on the NLG torque links engage correctly. <u>NOTE:</u> If necessary, manually turn the NLG so that the steering collar lug is not under the steering sleeve.		XX

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18	Reference Figure 2A and 2B. Install the Steering Actuator Swivel valves as follows: NOTE: The left and right swivel valves are not interchangeable. The installation procedure for the left and right swivel valve are the same. • Remove the plugs and caps from the pipes and hydraulic ports. • Clean the mounting surfaces of the steering actuator, the pipes, and the swivel valve (1) with a lint free cloth and an MEK or Isopropyl Alcohol. • Lubricate the retainers (9) and the preformed packings (10) with clean hydraulic fluid. • On each pipe stem and on each quill of the swivel valve (1), install a preformed packing (10) and two retainers (9) with a retainer on each side of the packing (10). • Turn the shaft of the swivel valve (1) and align the punch mark, (found on the bottom–exterior of the swivel valve), so that it is adjacent to the inboard anti–rotation lug on the swivel valve body and also aligned to the aircraft center–line. • Position the swivel valve (1) below the actuator and align the lugs of the swivel valve with the lubrication extension on the steering plate. • Install the swivel valve (1) to the steering actuator. Make sure that the lugs of the swivel valve engage the lubrication extension on the steering plate. • Install the bolts (7) with the washers (8). • Torque the bolts (7) to 25–30 pound–inches (2.8–3.4 N·m) and safety wire MS20995C-020 lockwire. • Carefully install the pipes in the swivel valve (1). • Install the cap screws (5) with the washers (6). • Torque the cap screws (5) to 15–20 pound–inches (1.7–2.2 N·m) and safety with MS20995C-020 lockwire. • Flex the support block at each split and install it on the pipes. • Install the proximity sensor harness in the support block and install the plate. • Attach the support block and the plate to the landing gear bracket with the bolts (2), the washers (4), and the nuts (3). • Torque the nuts (3) to 25–30 pound–inches (2.8–3.4 N·m). • Safety wire the bolts (2) with MS20995C-032 lockwire.		XX

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19	Reference Figure 3. Install the Proximity Sensor Bracket and bolts as follows: NOTE: Adjustment and inspection of the NLG sensor bracket and sensors will be performed in later steps. • Install bracket with bolts (11) and washers (12) • Safety wire the two bolts with MS20995C-032 lockwire.		XX
20	Reference Figure 9. Install Red Zerk Caps on steering plate and steering sleeve grease Zerk Fittings as follows: • Apply one drop of super glue P/N 49504 to steering plate and steering sleeve grease Zerks aft of the grease hole. • Install red cap PN 2PB19 on Zerks firmly.		XX
21	Reference Figure 9. Apply grease (Royco 33 or equivalent) to Steering actuator Rod End fittings.		XX

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22	Reference Figure 1. Install both RVDT's as follows: - Remove the used sealant from the steering sleeve and the base of the RVDT (1). NOTE: Be careful when you clean the sealant from the steering sleeve. Do not get the used sealant in the hole of the steering actuator. - Lubricate the preformed packing (4) with Vaseline and put the preformed packing (4) on the steering sleeve. CAUTION: DO NOT MIX DIFFERENT TYPES OR BRAND NAMES OF GREASE. THE GREASES CAN BE INCOMPATIBLE, EVEN IF APPROVED UNDER THE SAME SPECIFICATIONS. IT IS RECOMMENDED TO FULLY PURGE AND CLEAN THE USED GREASE BEFORE FILLING WITH ANOTHER MANUFACTURER PRODUCT OR TYPE. IF YOU DO NOT DO THIS, YOU CAN CAUSE CONTAMINATION OF THE SYSTEM AND/OR DAMAGE TO THE EQUIPMENT. - Apply a light coat of grease, Royco 33, to the splines of the RVDT and to the internal splines of the steering actuator. - Align the red-tip spline on the RVDT shaft with the electrical zero (E-Z) mark on the base of the RVDT (1) to a tolerance of ± 0.5 degree. - Position the RVDT (1) over the steering sleeve/actuator assembly. Make sure that the red-tip spline stays aligned with the E-Z mark. - Align the red-tip spline on the RVDT shaft with the red line on the actuator interface area. - Engage the shaft of the RVDT (1) with the internal splines of the steering actuator. Do not push the RVDT completely down on the steering sleeve/actuator assembly. (Continued in Step 23)		XX

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23	Reference Figure 1. Install both RVDT's as follows: (Continued from step 22) - With the RVDT and the steering actuator splines engaged, turn the RVDT (1) until the bolts (2) will align with the holes in the steering sleeve. - Push the RVDT (1) completely down on the steering sleeve/actuator assembly and install the bolts (2) with the washers (3) in their related holes in the steering sleeve. - Tighten the bolts (2) until they are almost tight and you can turn the RVDT for adjustment. - Remove the protective caps and connect the electrical connector to the RVDT receptacle.		XX																																																				
24	Remove tags and close the following circuit breakers <table border="1"> <thead> <tr> <th>CB PANEL</th><th>CB NO.</th><th>NAME</th><th>ZONE</th></tr> </thead> <tbody> <tr> <td>CBP-1</td><td>F6</td><td>PROX SENS LGC/D1</td><td>221</td></tr> <tr> <td>CBP-1</td><td>F7</td><td>PROX SENS WOW 1</td><td>221</td></tr> <tr> <td>CBP-1</td><td>F8</td><td>NOSE STEER</td><td>221</td></tr> <tr> <td>CBP-2</td><td>F8</td><td>NOSE STEER</td><td>222</td></tr> <tr> <td>CBP-2</td><td>F9</td><td>PROX SENS WOW 2</td><td>222</td></tr> <tr> <td>CBP2</td><td>P2</td><td>PROX SENS LGC/D1</td><td>222</td></tr> <tr> <td>CBP-2</td><td>P3</td><td>PROX SENS LGC/D2 WOW 1 +2</td><td>222</td></tr> <tr> <td>CBP-4</td><td>B13</td><td>PROX SENS LGC/D2</td><td>222</td></tr> <tr> <td>CBP-1</td><td>A2</td><td>HYD PUMP 3B</td><td>221</td></tr> <tr> <td>CBP-1</td><td>G11</td><td>HYD SYS AC PUMP CONT 3B</td><td>221</td></tr> <tr> <td>CBP-2</td><td>A2</td><td>HYD PUMP 3A</td><td>222</td></tr> <tr> <td>CBP-2</td><td>G15</td><td>HYD SYS AC PUMP CONT 3A</td><td>222</td></tr> </tbody> </table>	CB PANEL	CB NO.	NAME	ZONE	CBP-1	F6	PROX SENS LGC/D1	221	CBP-1	F7	PROX SENS WOW 1	221	CBP-1	F8	NOSE STEER	221	CBP-2	F8	NOSE STEER	222	CBP-2	F9	PROX SENS WOW 2	222	CBP2	P2	PROX SENS LGC/D1	222	CBP-2	P3	PROX SENS LGC/D2 WOW 1 +2	222	CBP-4	B13	PROX SENS LGC/D2	222	CBP-1	A2	HYD PUMP 3B	221	CBP-1	G11	HYD SYS AC PUMP CONT 3B	221	CBP-2	A2	HYD PUMP 3A	222	CBP-2	G15	HYD SYS AC PUMP CONT 3A	222		XX
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25	Bleed the Hydraulic System No. 3. Reference Task 29-10-00-870-803.		XX																																																				
26	Place aircraft NLG on jacks per AMM 07-11-01-582-802.		XX																																																				

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ITEM	WORK INSTRUCTIONS	MECH	INSP
27	Reference Figure 5. Perform NLG WOFW sensor and NLG Centered/Extended to target clearance check as follows: <u>WARNING:</u> HOLD THE TOP TORQUE LINK WHEN YOU RELEASE THE QUICK DISCONNECT PINS. THE TOP TORQUE LINK IS SPRING LOADED AND WILL MOVE UP QUICKLY. THIS CAN CAUSE INJURIES TO PERSONS AND/OR DAMAGE TO THE EQUIPMENT. • Disconnect the upper and lower torque links of the NLG. Move the upper torque link so the proximity sensor (1) is in line with the target center (2). • With a feeler gauge, measure the clearance between the sensing surface of the proximity sensor(s) (1) and its related target (2). • Make sure both sensor-to-target clearances are between 0.045 and 0.055 in. (1.14 and 1.40 mm). • If the clearance between the sensing surface of the proximity sensor (1) and its target (2) is not correct, adjust the proximity sensor (1). • If necessary, adjust the clearance between the sensing surface of the applicable proximity sensor (1) and target (2) as follows: ➤ Remove and discard the lockwire from the two nuts (3) and (4). ➤ Loosen the two nuts (3) and (4). Make sure that the proximity sensor (1) moves freely through the installation bracket (5). ➤ Adjust the clearance between the sensing surface to the value listed above by alternately loosening and tightening the nuts (3) and (4) until you get the correct sensor-to-target clearance. ➤ Make sure that the tab on the keywasher (6) correctly engages the hole in the installation bracket (5). <u>NOTE:</u> Each turn of the nuts increases or decreases the sensor-to-target clearance by 0.042 inch (1.07 mm). ➤ Tighten the two nuts (3) and (4). Make sure that the sensor-to-target clearance has not changed. ➤ Torque the nuts (3) and (4) to 110–120 pound-inches (12.43–13.56 N·m). ➤ Safety the nuts (3) and (4) with MS20995C-032 lockwire.		XX

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ITEM	WORK INSTRUCTIONS	MECH	INSP
28	Reference Figure 6. Perform NLG Centered/Extended sensor to target clearance check (centering target) as follows: • Connect the upper and lower torque links of the NLG. • Make sure the NLG Centered target offset is 0.163-0.183" (4.14-4.65 mm). • If the offset is not correct, calculate the distance that the target needs to move (forward or aft) to get the correct sensor offset and then do the steps that follow: ➤ Remove the sealant from around the edge of the laminated shim (7). ➤ Remove and discard the three cotter pins (8) from the three bolts (9). ➤ Remove the three nuts (10), and the three washers (11) from the three bolts (9). ➤ Remove the three bolts (9) and the washers (11) that attach the target bracket and the laminated shims (7) to the upper torque link. ➤ If the offset was less than 0.0163 inch (4.14 mm) remove laminations (equal to the amount calculated) until you get the correct offset. NOTE: The shim (7) is laminated. Each layer is 0.003 inch (0.0762 mm) thick. ➤ If the sensor offset was more than 0.0183 inch (4.65 mm) do the steps that follow: ✓ Measure the thickness of the shim (7) that was removed. Add the calculated amount that is required to get the correct sensor offset. This dimension is the correct shim thickness required to get the correct sensor offset. ✓ Measure the thickness of a new shim (7). Remove laminations from the new shim (7) until you get the correct shim thickness (that was calculated in the previous step). (Continued in step 29)		XX

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ITEM	WORK INSTRUCTIONS	MECH	INSP
29	Reference Figure 6. Perform NLG Centered/Extended sensor to target clearance check (centering target) as follows: (Continued from step 28) ➤ Attach the target bracket and the laminated shim (7) to the center web of the upper torque link again with the three bolts (9) and the three washers (11). ➤ Make sure that the bolts (9) are installed so that they point aft. NOTE: If laminations were removed from the laminated shim (7), a maximum of two more washers (11) are permitted on each bolt (9) to install the nut (10) correctly. • Install the three washers (11) and the three nuts (10) on the three bolts (9). • Tighten the three nuts (9). Make sure that the sensor-to-target clearance and the sensor offset are correct. Adjust the nuts (3) and (4) or the thickness of the shim (7) again if necessary. • If the sensor to target clearance and the sensor offset are correct, torque the three nuts (9) to 20–30 pound-inches (2.3–3.4 N·m). Make sure that the sensor-to-target clearance and the sensor offset have not changed. • Install the three cotter pins (8) in the three bolts (9). • Seal all of the edges of the laminated shim (7) with AC350B1-2-2-5oz sealant. • Torque the nuts (3) and (4) to 110–120 lbf·in (12.43–13.56 N·m). Make sure that the sensor-to-target clearance has not changed. • Safety the nuts (3) and (4) together with MS20995C-032 lockwire.		XX
30	Document using an appropriate form that inspection of Proximity Sensor Bracket, Sensor Installation, WOFW and NLG Centering Sensor have been performed. • Documentation to include a statement the NLG Steering Actuator Self-Lubricating Bushings have been installed per Installation Instructions SD3122015INSTL thru Step 30 has been completed.	XX	

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ITEM	WORK INSTRUCTIONS	MECH	INSP
31	Remove aircraft from the NLG jacks per AMM 07-11-01-582-802.		XX
32	Perform a Power Up test of the Proximity Sensor System as follows: • Set the engine indication and crew alerting system (EICAS) primary display to its primary page. Set the EICAS secondary display to the status page. • Make sure that the indications that follow do not come into view on the primary page: ➤ WOW INPUT ➤ WOW OUTPUT • Make sure that the caution lights on the glareshield do not come on. • Make sure that the indications that follow do not come into view on the status page: ➤ WOW OUTPUT FAIL ➤ PROX SYST FAULT • If an indication comes into view on the EICAS, do the Fault Isolation procedure for the position and warning system (Ref. FIM 32-60-00).		XX

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ITEM	WORK INSTRUCTIONS	MECH	INSP
33	Reference Figure 7 and 8. Adjust the RVDT's as follows: • Make sure that hydraulic system No. 3 is not pressurized. • On the pilots side panel, place the N/W STRG switch is in the OFF position. • Make sure that the steering handwheel-control-unit (HCU) on the pilot's side console is in the centered (neutral) position and that the rudder pedals are in the neutral position. • Disconnect the NLG torque links if connected. • Install the rudder-pedal-centering rigging pins to put the rudder pedals at the neutral position. If the rudder system is correctly centered, you will be able to install the rigging pins easily. • Install the NLG steering rigging pin in the NLG. If the steering system is correctly centered, you will be able to install the steering rigging pin easily. NOTE: The rigging pin is installed through the steering sleeve and the steering collar on the left side of the NLG behind the steering actuator. • Connect the external ac power to the aircraft and power the aircraft buses. • Pressurize hydraulic system No. 3 • Put the N/W STRG switch on the pilot's side panel to the ARMED position. NOTE: Ignore the amber STEERING INOP message if it is shown on the primary page of the engine indication and crew alerting system (EICAS). • Put the RIG/OPR switch on the front panel of the NWS system ECU to the RIG position. • Make sure that the Maintenance Display Code "A" is seen on the seven-segment maintenance display of the ECU after a short time. NOTE: When the maintenance Display Code "A" is shown, the ECU is in RIGGING MODE. In this mode, the solenoid selector valve (SSV) is disabled to allow steering system components to be rigged. (Continued in step 34)		XX

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ITEM	WORK INSTRUCTIONS	MECH	INSP
34	Reference Figure 7 and 8. Adjust the RVDT's as follows: (Continued from step 33) • Open the access cover on the front of the ECU. NOTE: To adjust the left feedback RVDT, connect the leads of the DVM to the L FDBK (positive) and the COMMON (negative) jack points on the ECU. NOTE: To adjust the right feedback RVDT, connect the leads of the DVM to the R FDBK (positive) and the COMMON (negative) jack points on the ECU. • With the applicable NWS system feedback RVDT at the electrical-null position, read the value of the voltage indication on the DVM. If the voltage indication for the left feedback RVDT is -1.796 ± 0.044 VDC (or $+1.796 \pm 0.044$ VDC for the right feedback RVDT), the adjustment of the applicable feedback RVDT will not be required. NOTE: Although the maximum voltage tolerance allowed for correct operation of the NWS system is ± 0.044 VDC, it is recommended that you adjust the applicable feedback RVDT to within a maximum tolerance of ± 0.020 VDC if the voltage indication is at or near the maximum allowed. • If the voltage indication for the feedback RVDT is not within the ± 0.044 VDC voltage tolerance given in the above step, adjust the left (right) feedback RVDT as follows: ➤ Loosen the three captive screws on the RVDTs. ➤ While another technician monitors the DVM, turn the applicable feedback RVDT until a voltage value of -1.796 ± 0.020 VDC for the left feedback RVDT (or $+1.796 \pm 0.020$ VDC for the right feedback RVDT) is read on the DVM. • Tighten the captive screws in the feedback RVDT to 15–20 pound-inches (1.695–2.26 N·m). Make sure that the voltage values have not changed. • Put the RIG/OPR switch on the front panel of the ECU to the OPR position. (Continued in step 35)		XX

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ITEM	WORK INSTRUCTIONS	MECH	INSP
35	Reference Figure 7 and 8. Adjust the RVDT's as follows: (Continued from step 34) NOTE: For this step only, ignore the amber STEERING INOP message if it is shown on the EICAS primary page. - Put the N/W STRG switch on the pilot's side panel in the OFF position. - If the adjustment of the applicable feedback RVDT is satisfactory, do the steps that follow to correctly update the NWS system ECU with the current calibration values for the feedback RVDTs. NOTE: This step will prevent feedback RVDT nuisance faults. If the NWS system ECU is not updated with the current calibration values of the NWS system RVDTs, it is possible that a nuisance STEERING INOP indication will be seen on the primary page of the EICAS together with the Maintenance Display Code "E" on the seven-segment maintenance display of the ECU. - Put the N/W STRG switch on the pilot's side panel in the ARMED position. - Put the OPR/RIG switch on the front of the NWS ECU to the RIG position. ➤ Make sure that the Maintenance Display Code "A" is seen on the seven-segment maintenance display of the ECU. - Put the OPR/RIG switch on the front of the NWS ECU to the OPR position. ➤ Make sure that the Maintenance Display Code "C" is seen on the seven-segment maintenance display of the ECU. When the Maintenance Display Code "C" is shown, the ECU has completed a rigging sequence satisfactorily and the calibration values of the NWS system RVDTs are correct. NOTE: All of the steering system RVDTs must be in the electrical-null position for this indication to be shown. The ECU is now in OPERATING MODE. In this mode, the SSV is still disabled. The ECU will not return to GROUND MODE until electrical power is cycled with the N/W STRG switch. (Continued in step 36)		XX

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ITEM	WORK INSTRUCTIONS	MECH	INSP
36	Reference Figure 7 and 8. Adjust the RVDT's as follows: (Continued from step 35) NOTE: If the Maintenance Display Code "E" is shown on the seven-segment maintenance display of the ECU, (by itself or as part of a Code Sequence), you will need to do the BITE test of the steering system (Ref. TASK 32-50-00-740-801). - Do the steps that follow to put the NWS system ECU in GROUND MODE. - Cycle the N/W STRG switch on the pilot's side panel to the OFF position and then back to the ARMED position. Make sure that the amber STEERING INOP message is not shown on the EICAS primary page and that the Maintenance Display Code "C" has changed to a full size "0". NOTE: When the full size Maintenance Display Code "0" is shown, the ECU is in GROUND MODE. In this mode, the ECU will respond to steering command inputs and will provide control signals to the electrohydraulic servo valve (EHSV) and the SSV. The ECU is in GROUND MODE When: - both of the NLG WoffW proximity sensors are FAR (WOW) - the NLG downlock proximity sensors are NEAR (down and locked) - and there are no failures in the steering system. - Put the N/W STRG switch on the pilot's side panel to the OFF position. - Remove the NLG steering rigging pin from the NLG. - Do the steps that follow to make sure that the NWS system feedback RVDTs are calibrated correctly at the full left (counter-clockwise (CCW) rotation) position and at the full right (clockwise (CW) rotation) position: NOTE: Make sure that the amber STEERING INOP message is not shown on the primary page of the EICAS. If the nosewheel steering fails during this test, do the BITE test of the steering system (Ref. TASK 32-50-00-740-801). (Continued in step 37)		XX

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ITEM	WORK INSTRUCTIONS	MECH	INSP
37	Reference Figure 7 and 8. Adjust the RVDT's as follows: (Continued from step 36) NOTE: If you cannot get the correct voltage values for the feedback RVDTs, do a check of the steering HCU for correct calibration. - Put the N/W STRG switch to the ARMED position. - Slowly turn the pilot's HCU fully to the left (CCW) until it is lightly against its internal stop. Make sure that the upper torque link moves to the right of the aircraft center-line. NOTE: The upper torque link will move approximately 70 degrees to the right of the aircraft center-line. - Read the value of the voltage indication on the DVM. The voltage indication for the left feedback RVDT must be -1.9075 ± 0.1095 VDC. The voltage indication for the right feedback RVDT must be -2.3955 ± 0.1155 VDC. - Slowly turn the pilot's HCU fully to the right (CW) until it is lightly against its internal stop. ➤ Make sure that the upper torque link moves to the left of the aircraft center-line. - Read the value of the voltage indication on the DVM. The voltage indication for the left feedback RVDT must be -1.9075 ± 0.1095 VDC. The voltage indication for the right feedback RVDT must be -2.3955 ± 0.1155 VDC. - Slowly turn the pilot's HCU fully to the right (CW) until it is lightly against its internal stop. Make sure that the upper torque link moves to the left of the aircraft center-line. NOTE: The upper torque link will move approximately 70 degrees to the left of the aircraft center-line. - Read the value of the voltage indication on the DVM. The voltage indication for the left feedback RVDT must be $+2.3955 \pm 0.1155$ VDC. The voltage indication for the right feedback RVDT must be $+1.9075 \pm 0.1095$ VDC. (6) Let the HCU return to the center (neutral) position. - Make sure that the electrical-null voltage value of -1.796 ± 0.044 VDC for the left feedback RVDT (or $+1.796 \pm 0.044$ VDC for the right feedback RVDT) is read on the DVM. (Continued in step 38)		XX

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ITEM	WORK INSTRUCTIONS	MECH	INSP
38	Reference Figure 7 and 8. Adjust the RVDT's as follows: (Continued from step 37) • Slowly cycle the HCU fully left and right two times and then let the HCU return to its center (neutral) position. Make sure that the electrical-null voltage values have not changed. • Release the hydraulic pressure from system No. 3. • Remove the rudder-pedal-centering rigging pins from the rudder pedal levers. • Pressurize hydraulic system No. 3. (Ref. TASK 12-00-06-863-803). • Make sure that the upper torque link stays at the center position and that the electrical-null voltage values for the center (neutral) position have not changed. NOTE: If the electrical-null voltage values have changed, do a check of the adjustment of the rudder-pedal-input RVDT (Ref. TASK 32-51-05-820-801). • Put the N/W STRG switch on the pilot's side panel to the OFF position. • Release the hydraulic pressure from system No. 3 • Disconnect the DVM from the ECU and close the access cover on the front of the ECU. • Apply a bead of AC350B1-2-2-5OZ sealant to the outer perimeter of the RVDT base and the related area of the steering sleeve mating surface. • Safety wire the RVDT's with MS20995C-032 lockwire.		XX

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ITEM	WORK INSTRUCTIONS	MECH	INSP
39	Reference Figure 7: Perform operational check of the NWS system as follows: • If connected, disconnect the nose-landing-gear (NLG) torque links. Move the upper torque link to align the holes in the steering sleeve and the steering collar for the NLG steering rigging pin. • On the pilot's side panel, make sure that the N/W STRG switch is in the OFF position. • Make sure that the steering handwheel-control-unit (HCU) is in the centered (neutral) position and that rudder pedals are in the neutral position. • Pressurize hydraulic system No. 3. NOTE: If the nosewheel steering fails during this test and the amber STEERING INOP message is seen on the primary page of the engine indication and crew alerting system (EICAS), do a BITE test of the steering system (Ref. TASK 32-50-00-740-801) to determine the defective steering system component(s). • Put the N/W STRG switch on the pilot's side panel to the ARMED position. • Make sure that the amber STEERING INOP message is not shown on the EICAS primary page. • On the pilot's side console, move the steering HCU fully to the left and to the right through its full range of travel. Make sure that the steering collar moves fully to the left and to the right through their full range of travel related to the direction of the HCU movement. NOTE: The steering system will turn approximately 70 degrees to the left and 70 degrees to the right. • Let the HCU return to the centered (neutral) position. Make sure that the steering collar goes back to centered (straight ahead) position and that the amber STEERING INOP message is not shown on the EICAS primary page. (Continued in step 40)		XX

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ITEM	WORK INSTRUCTIONS	MECH	INSP
40	Reference Figure 7: Perform operational check of the NWS system as follows: (Continued from step 39) - Do a test of the operation of the NWS system with rudder pedal command inputs as follows: NOTE: If the nose wheel steering fails during this test and the amber STEERING INOP message is seen on the primary page of the engine indication and crew alerting system (EICAS), do a BITE test of the steering system (Ref. TASK 32-50-00-740-801) to determine the defective steering system component(s). - Push the left and the right rudder pedals through their full range of travel. Make sure that the steering collar moves fully to the left and to the right through their full range of travel related to the direction of the rudder pedal movement. NOTE: The steering system will turn 5.3 to 7.3 degrees to the left and 5.3 to 7.3 degrees to the right. - Let the rudder pedals return to the centered (neutral) position. Make sure that the steering collar goes back to centered (straight ahead) position and that the amber STEERING INOP message is not shown on the EICAS primary page. - Check for leaks from the NLG Steering Actuator Swivel Valves and hydraulic tubing. Correct leaks as required. - Put the N/W STRG switch on the pilot's side panel in the OFF position. - Release the hydraulic pressure from system No. 3. - Connect the NLG torque links. Make sure that the quick-disconnect handles are correctly engaged.		XX

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ITEM	WORK INSTRUCTIONS	MECH	INSP
41	Reference Figure 9: Install Placard on NLG Steering Sleeve as follows: • Clean NLG steering sleeve upper left arm pocket area with MEK or Isopropyl alcohol. Wipe dry with clean cloth. • Install placard P/N SD3122015PLCD on left steering sleeve arm in its pocket, see Figure 9.		XX
42	Discard all removed lockwire, O-rings, retainers, and original bushings.		XX
FINAL / CLOSE UP			
43	Make sure that all work areas are clean and clear of tools and miscellaneous items or equipment.		XX
44	Complete applicable Job Card or Maintenance Work Card stating that the Work Instructions per NLG Steering Actuator Self-Lubricating Bushing Installation Instructions SD3122015INSTL have been accomplished.		XX
45	On completion of the Work Instructions, enter the information below: A/C Fleet #: _____ Date: _____ A/C Total Hours: _____ A/C Total Cycles: _____ Supervisor / Crew Chief: _____	XX	XX

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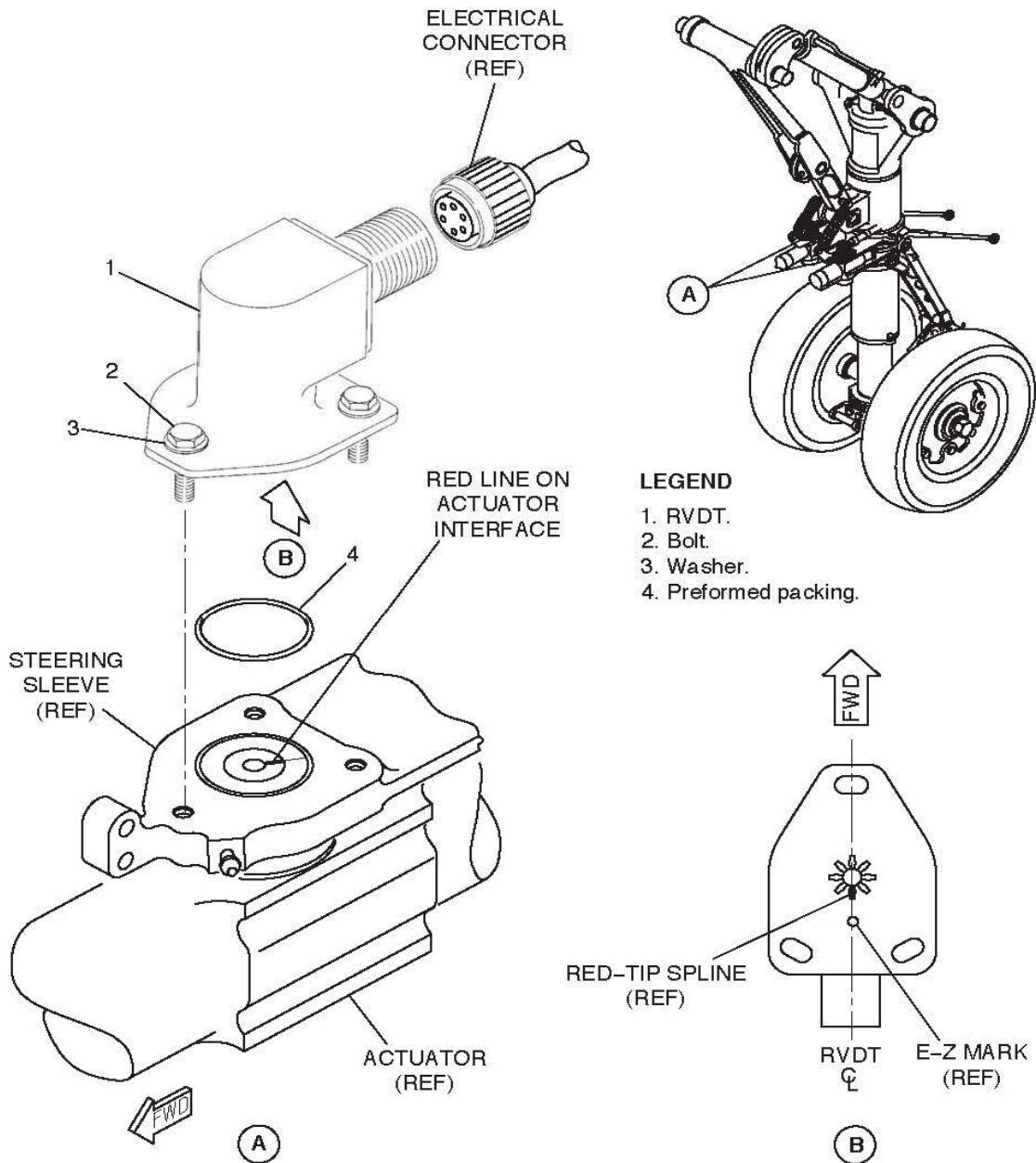


Figure 1

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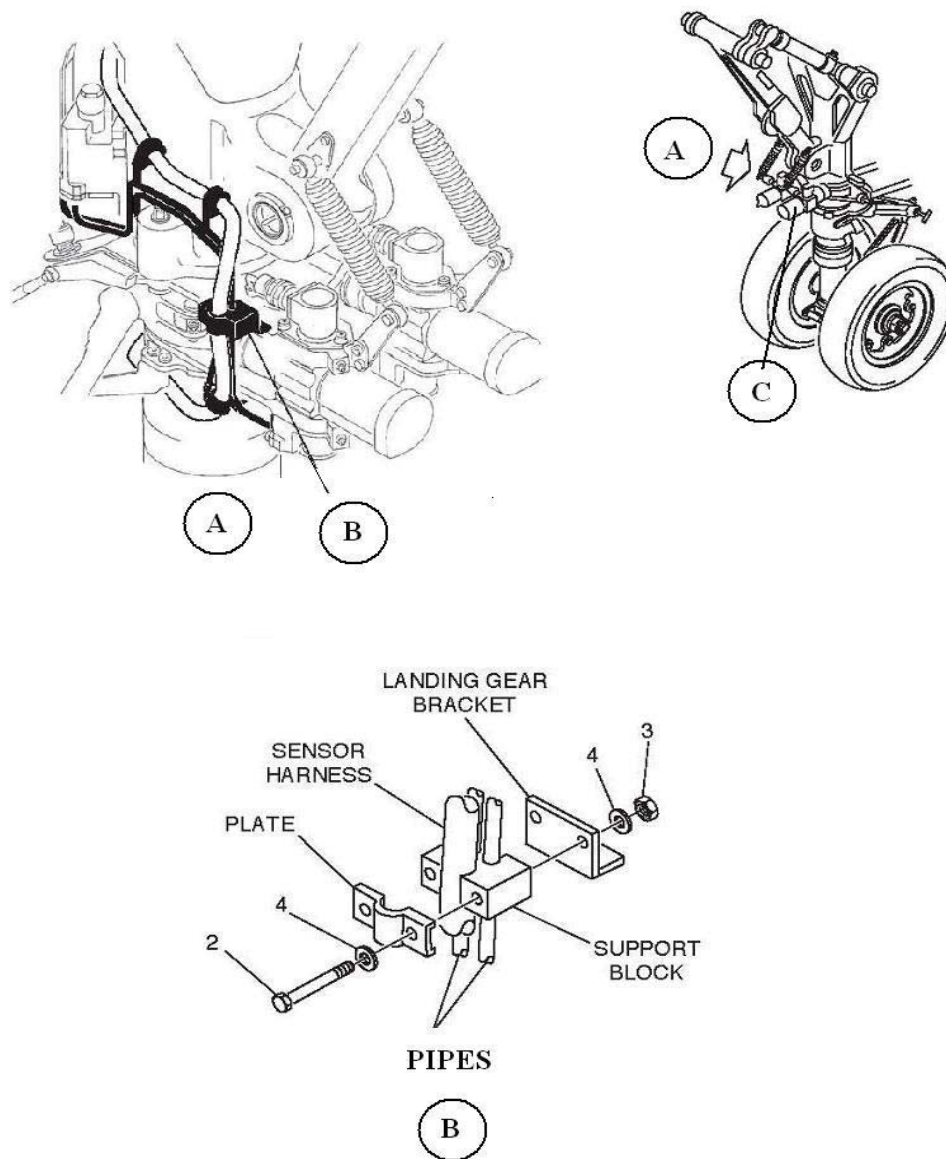


Figure 2A

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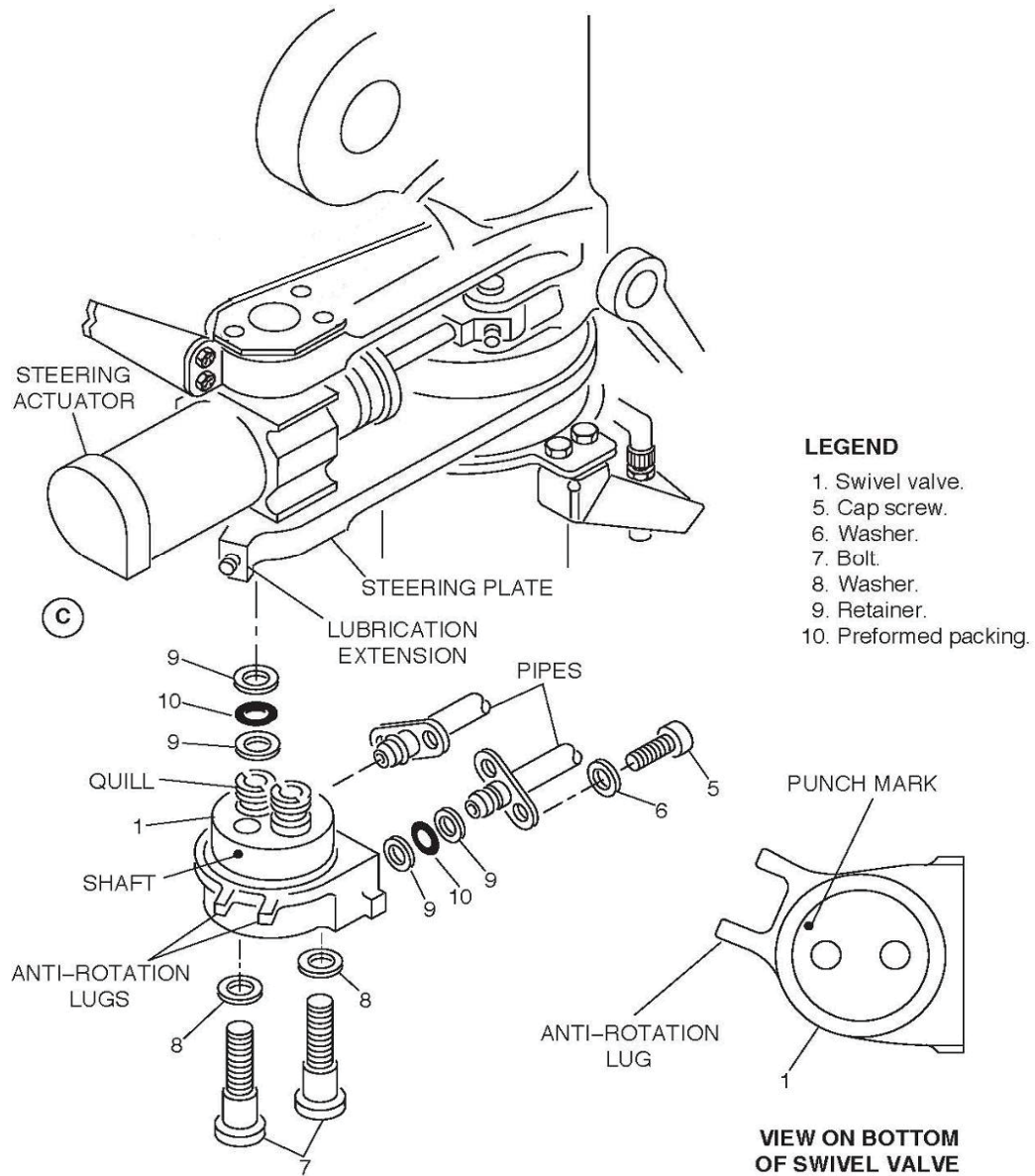


Figure 2B

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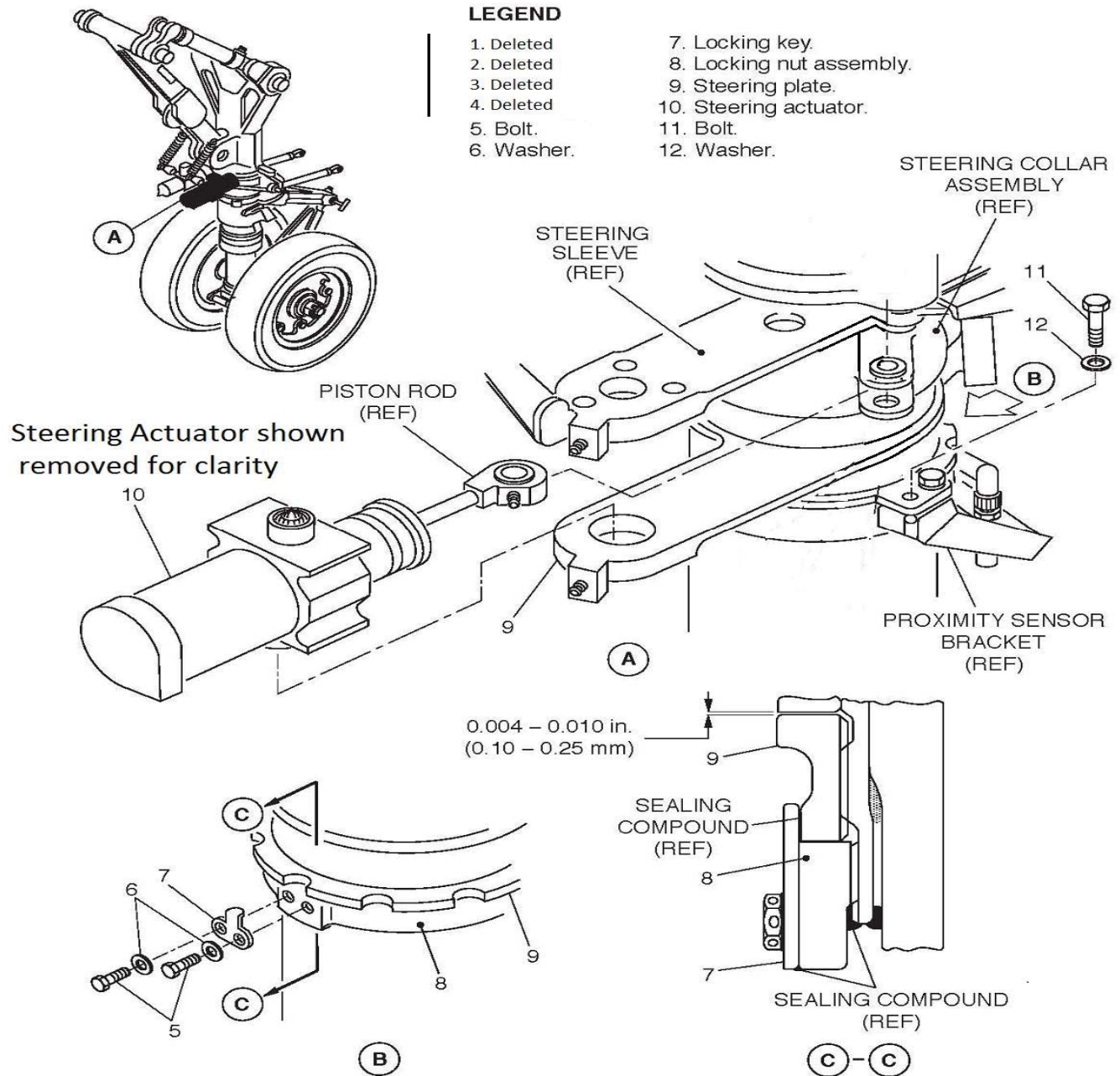
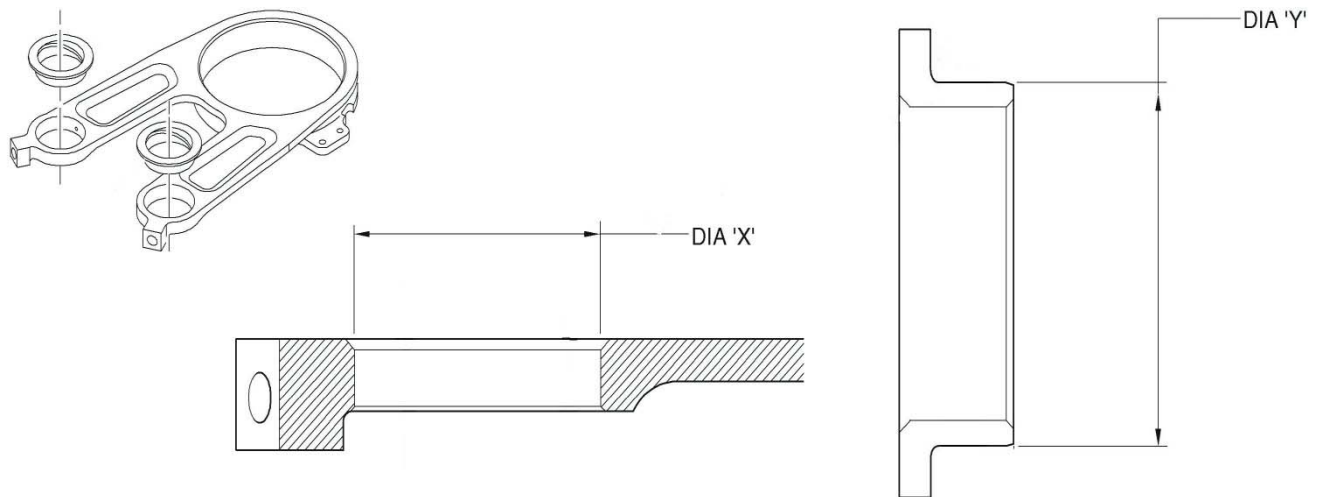


Figure 3

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16117-13SD Bushing Original and Oversize dimensions

	BORE - DIAMETER 'X'	BUSHING - DIAMETER 'Y'
Original	1.6700 - 1.6708	1.6716 - 1.6725
	1.6750 - 1.6758	1.6766 - 1.6775
	1.6800 - 1.6808	1.6816 - 1.6825
	1.6850 - 1.6858	1.6866 - 1.6875
	1.6900 - 1.6908	1.6916 - 1.6925
	1.7000 - 1.7008	1.7016 - 1.7025
	1.7100 - 1.7108	1.7116 - 1.7125
	1.7200 - 1.7208	1.7216 - 1.7225
.060 Oversize	1.7300 - 1.7308	1.7316 - 1.7325

Figure 4A

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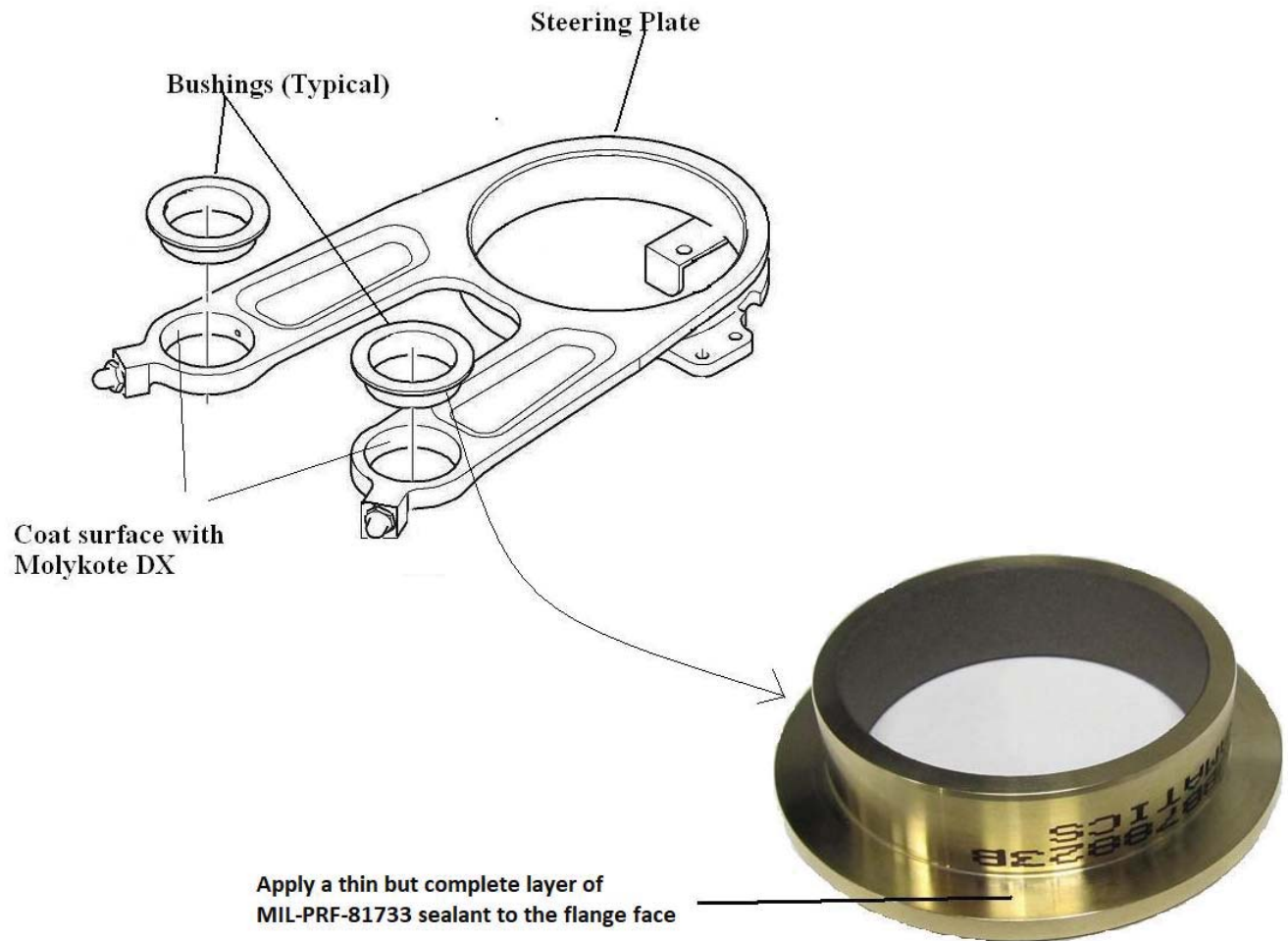
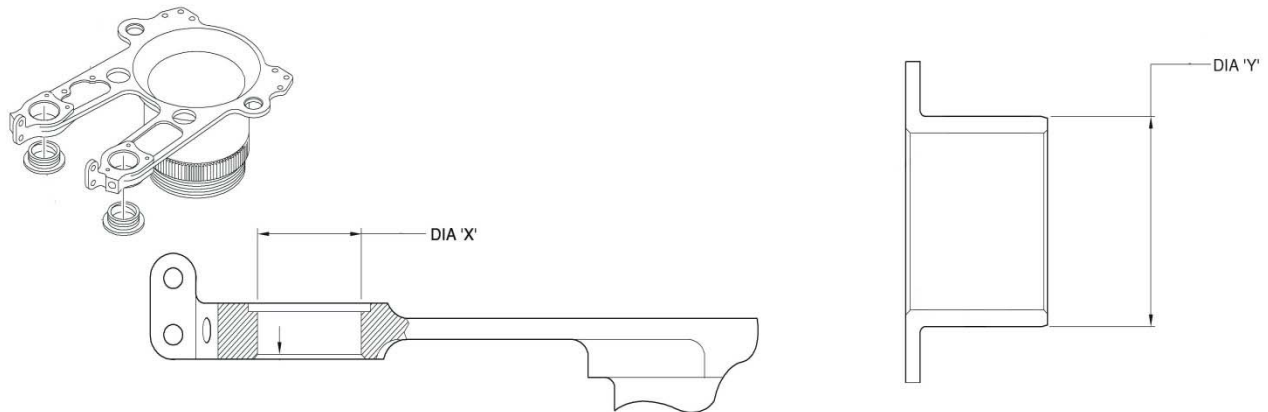


Figure 4B

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16117-15SD Bushing Original and Oversize dimensions

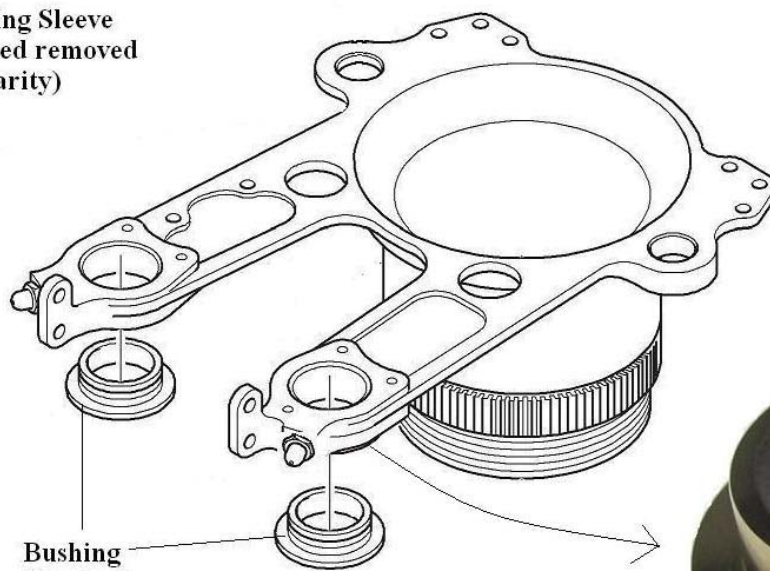
	BORE - DIAMETER 'X'	BUSHING - DIAMETER 'Y'
Original	1.4000 - 1.4007	1.4014 - 1.4023
	1.4050 - 1.4057	1.4064 - 1.4073
	1.4100 - 1.4107	1.4114 - 1.4123
	1.4150 - 1.4157	1.4164 - 1.4173
	1.4200 - 1.4207	1.4214 - 1.4223
	1.4300 - 1.4307	1.4314 - 1.4323
	1.4400 - 1.4407	1.4414 - 1.4423
	1.4500 - 1.4507	1.4514 - 1.4523
.060 Oversize	1.4600 - 1.4607	1.4614 - 1.4623

Figure 4C

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Steering Sleeve
(showed removed
for clarity)



Bushing
(Typical)

Apply a thin but complete layer of
MIL-PRF-81733 sealant to the flange face



Figure 4D

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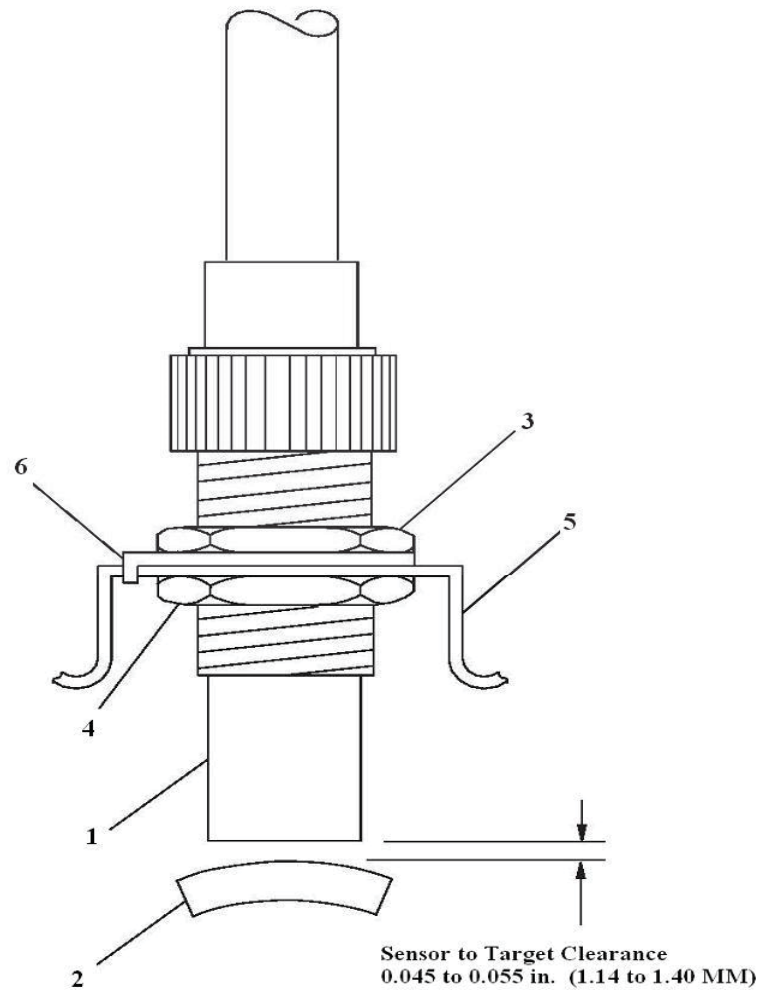
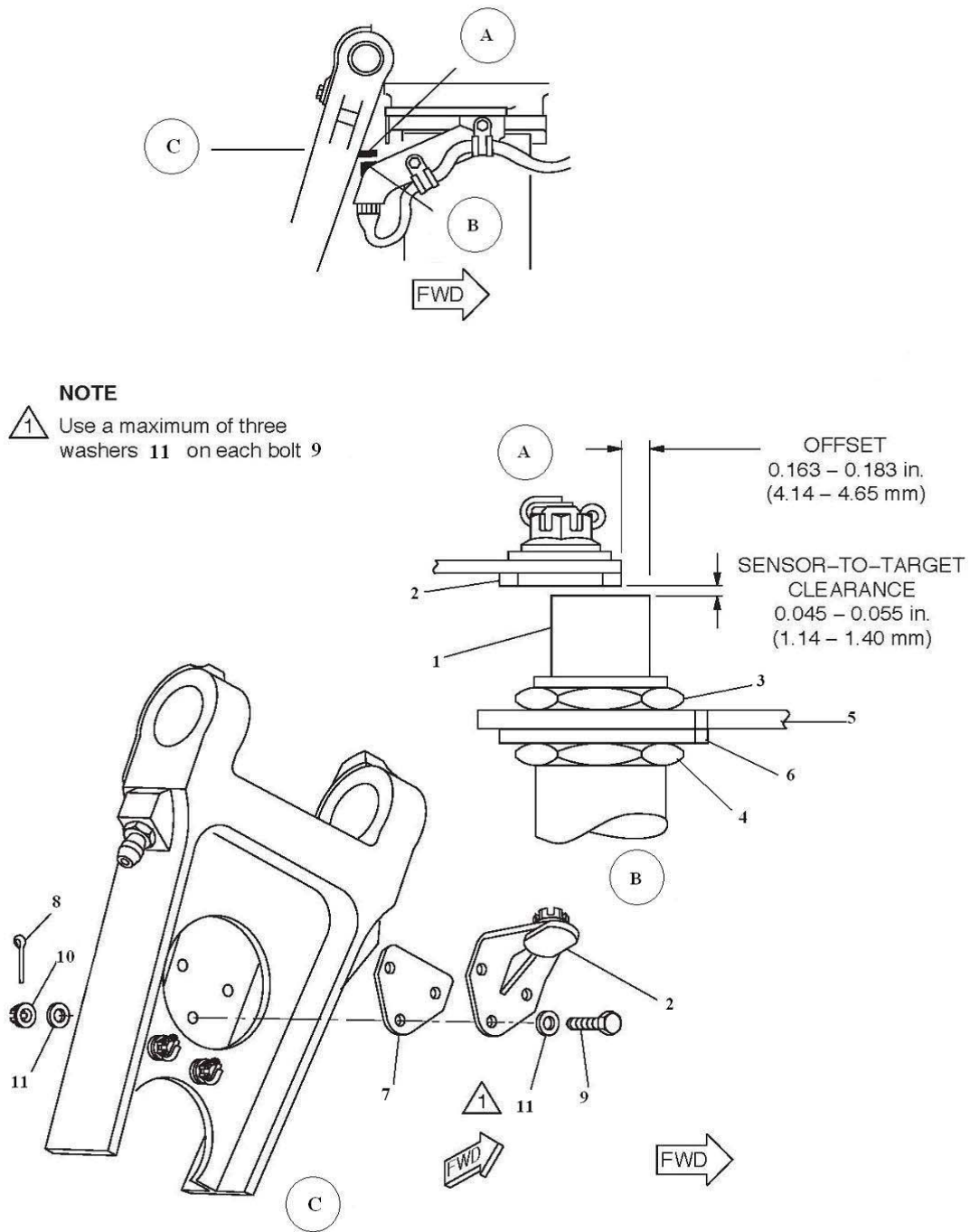


Figure 5

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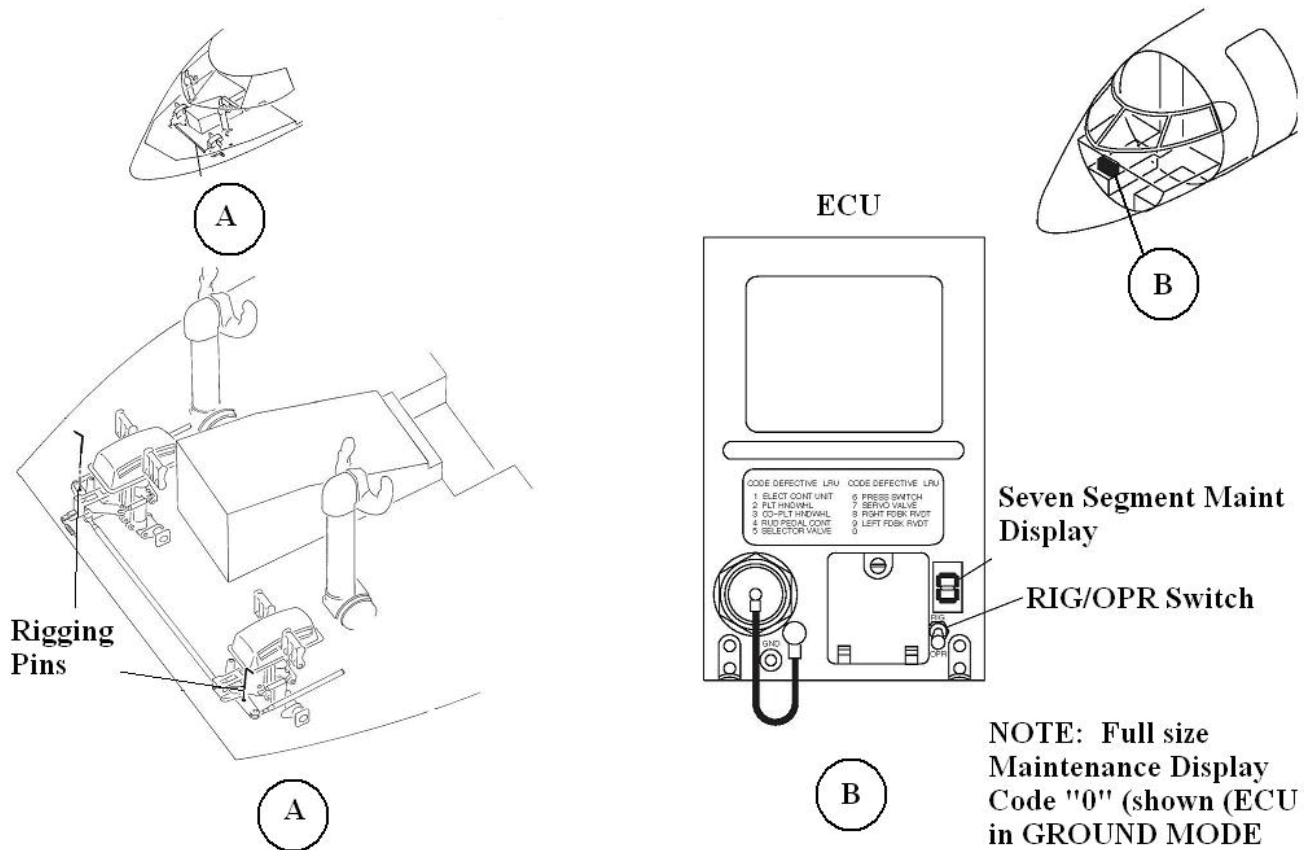


Figure 7

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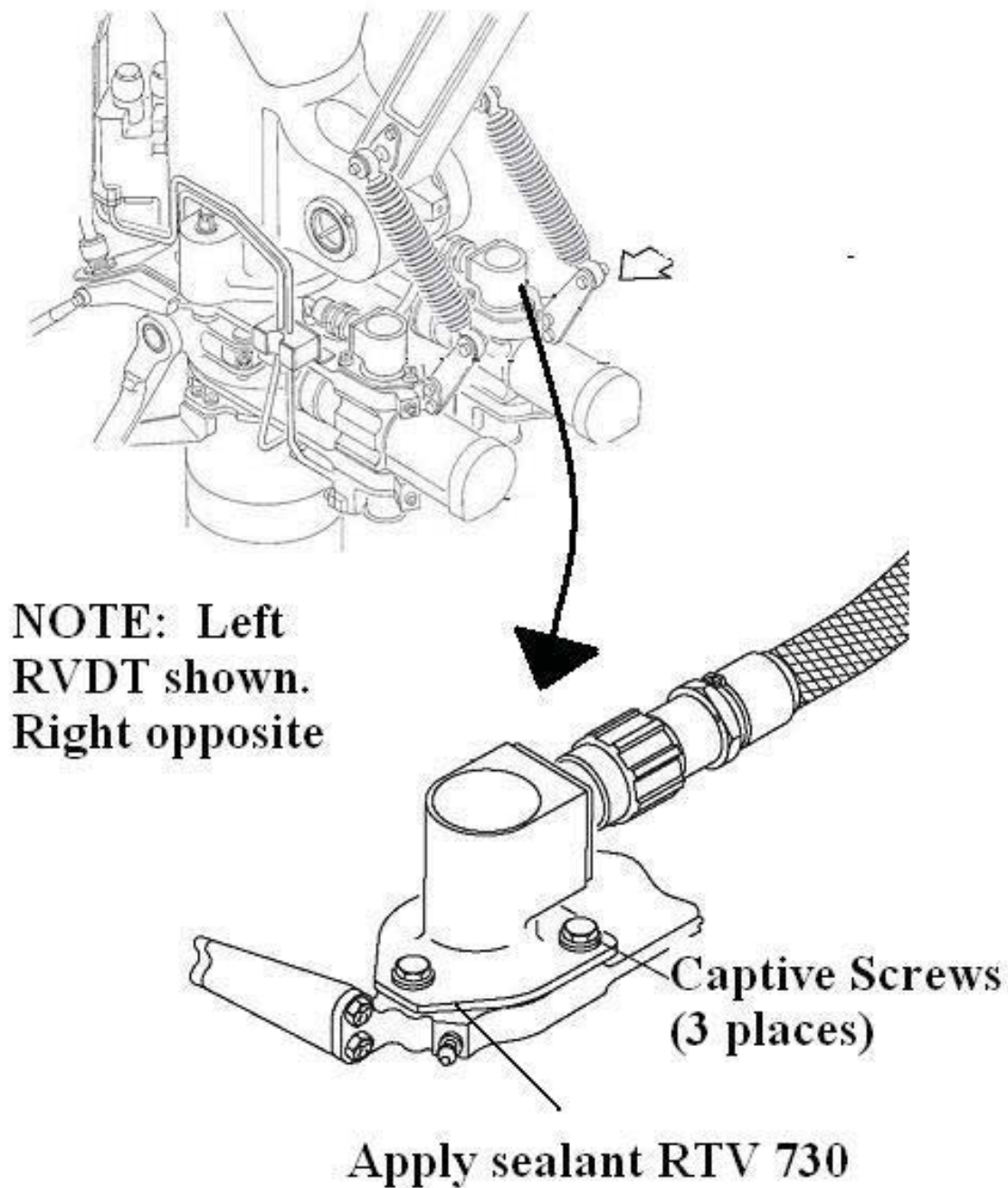


Figure 8

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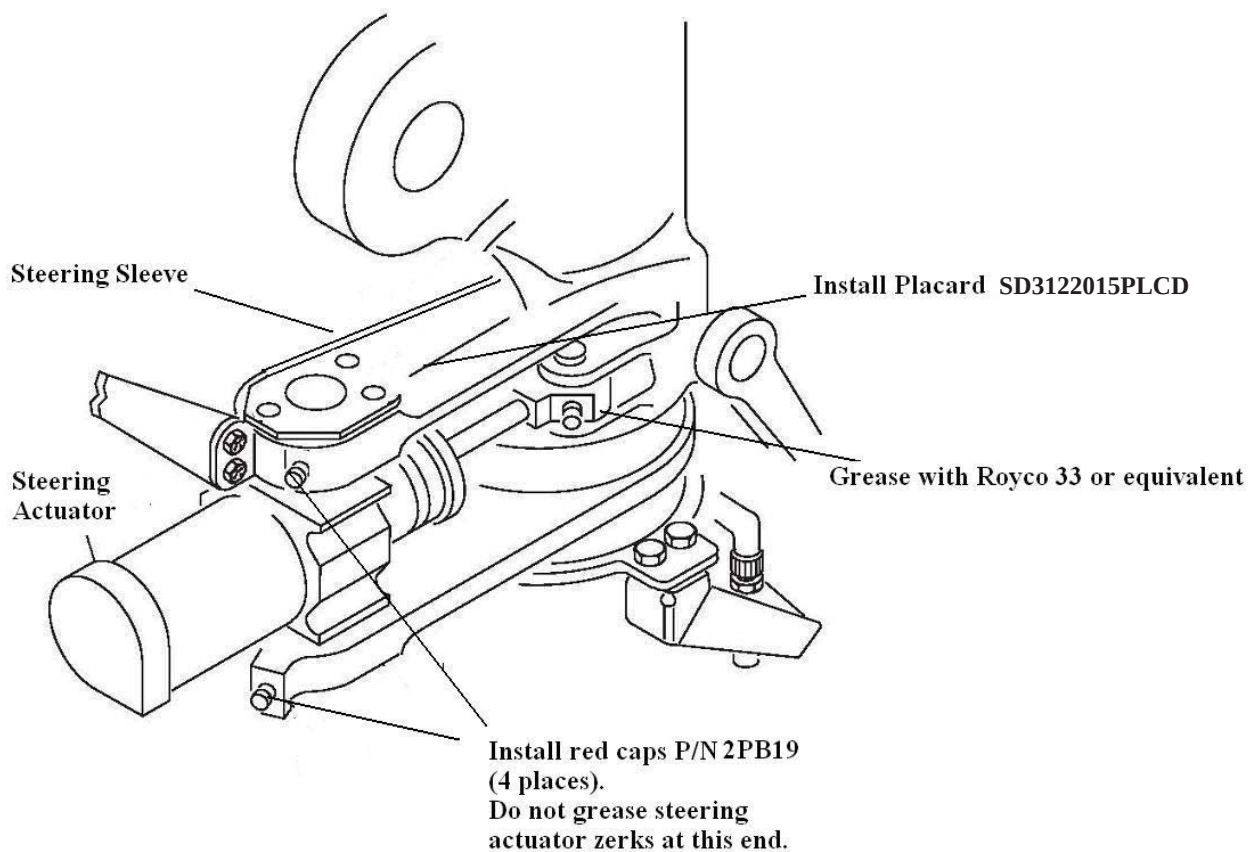


Figure 9

Seal Dynamics

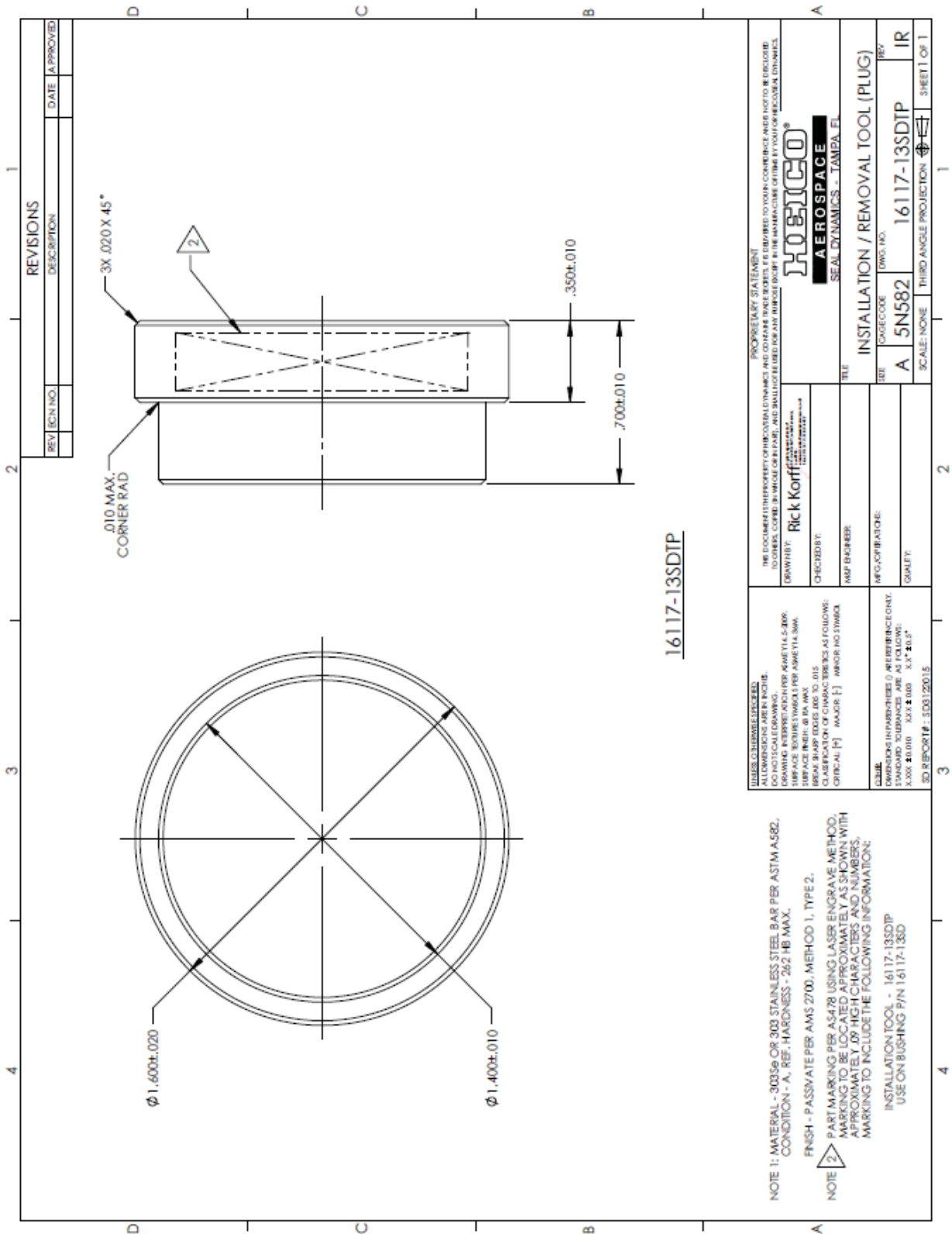
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APPENDIX A

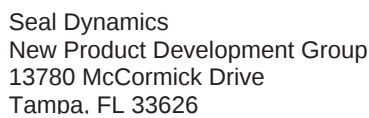
Bushing Installation / Removal Tool Drawings

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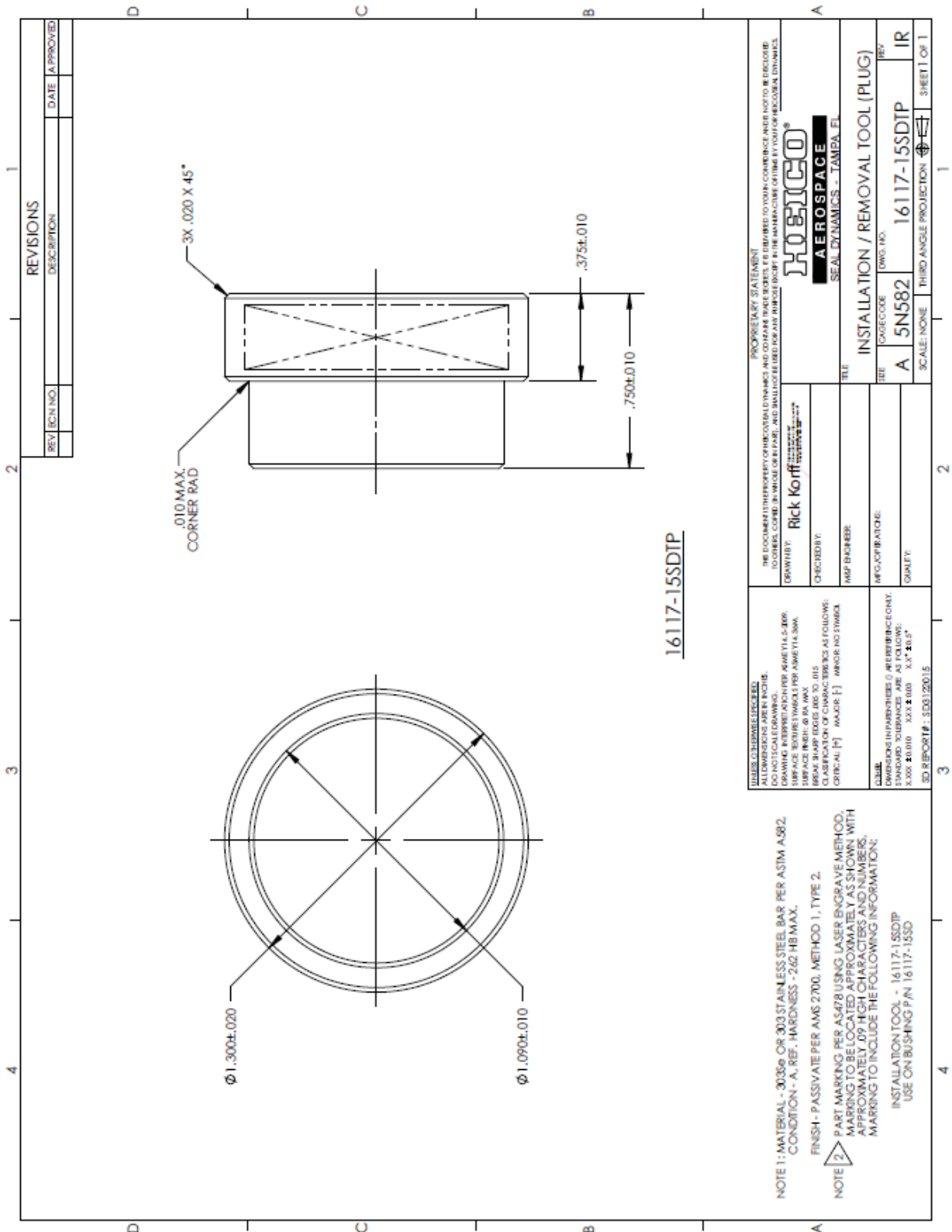


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