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AgustaWestland Products

SERVICE BULLETIN

RECOMMENDED

N° 109EP-183

DATE: August 2, 2024

REV. : /

TITLE

ATA 64 – TAIL ROTOR DUPLEX BEARING SUPPORT IMPROVEMENT

REVISION LOG

First Issue

1. PLANNING INFORMATION

A. EFFECTIVITY

All A109E helicopters.

B. COMPLIANCE

Within and not later than 48 (fourty-eight) months after the issue of this Service Bulletin.

C. CONCURRENT REQUIREMENTS

N.A.

D. REASON

This Service Bulletin is issued in order to provide the necessary instruction to improve the tail rotor installation with the new design of the retaining system of the duplex bearing.

LH issued this SB for the following reason:

Helicopter Reliability/Maintainability	
Product Improvement	✓
Obsolescence	
Customization	
Product/Capability Enhancement	

E. DESCRIPTION

Leonardo Helicopter has developed this Service Bulletin in order to perform the replacement of the support bearing sleeve assy.

F. APPROVAL

The technical content of this Service Bulletin is approved under the authority of DOA nr. EASA.21.J.005. For helicopters registered under other Aviation Authorities, before applying the Service Bulletin, applicable Aviation Authority approval must be checked within Leonardo Helicopters customer portal.

EASA states mandatory compliance with inspections, modifications or technical directives and related time of compliance by means of relevant Airworthiness Directives.

If an aircraft listed in the effectivity embodies a modification or repair not LH certified and affecting the content of this Service Bulletin, it is responsibility of the Owner/Operator to obtain a formal approval by Aviation Authority having jurisdiction on the aircraft, for any adaptation necessary before incorporation of the present Service Bulletin.

G. MANPOWER

To comply with this Service Bulletin, approximately 10 (ten) MMH are deemed necessary.

MMH are based on hands-on time and can change with helicopter configuration, personnel and facilities available. MMH are not comprehensive of the overall hours necessary to get access to work areas and to remove all the equipment that interferes with the application of the prescribed instructions.

H. WEIGHT AND BALANCE

Negligible.

I. REFERENCES

I.1 PUBLICATIONS

Following Data Modules refer to MM:

DATA MODULE		DESCRIPTION	PART
DM01	00-20-1	Helicopter safety	-
DM02	64-31-6	Pitch change mechanism-Removal/installation	-

I.2 ACRONYMS & ABBREVIATIONS

AMDI	Aircraft Material Data Information
AR	As Required
DM	Data Module
DOA	Design Organization Approval
EASA	European Union Aviation Safety Agency
IPC	Illustrated Parts Catalog
LH	Left Hand
MM	Maintenance Manual
MMH	Maintenance Man Hours
N.A.	Not Applicable
P/N	Part Number
PTUM	Pictorial Tools Usage Manual

RH	Right Hand
SB	Service Bulletin
S/N	Serial Number

I.3 ANNEX

Annex A – Removal/installation (Sleeve assy P/N 109G6430A03)

Annex B – Torque wrenches – Operation

Annex C – Threaded fasteners – Tighten procedure

J. PUBLICATIONS AFFECTED

A109E Maintenance Manual

CSPP-A-CSPP-00-X Common Standard Practices Publication

K. SOFTWARE ACCOMPLISHMENT SUMMARY

N.A.

2. MATERIAL INFORMATION

A. REQUIRED MATERIALS

A.1 PARTS

#	P/N	ALTERNATIVE P/N	DESCRIPTION	Q.TY	LVL	NOTE	LOG P/N
1	109G6430A03-101		Support bearing sleeve assy	1	.	(1)	
2	109G6430A03-105		Support bearing sleeve assy	1	.	(2)	
3	109G6430A04-101		Flange	1	.		709-099L1
4	109G6430A05-101		Peeling shim	1	.		709-099L1
5	AW021TB03H004		Bolt	6	.		709-099L1
6	MS21299C3K		Countersunk washer	6	.		709-099L1
7	NAS1149C0332R		Washer	6	.		709-099L1

Refer also to IPC for the spares materials required to comply with the MM DMs referenced in the accomplishment instructions.

Refer also to Annex A for the spares materials required to comply with this Service Bulletin.

A.2 CONSUMABLES

The following consumable materials, or equivalent, are necessary to accomplish this Service Bulletin:

#	SPEC./LH CODE NUMBER	DESCRIPTION	Q.TY	NOTE	PART
8	MS20995C32	Lockwire	AR	(3)	-

Refer also to AMDI for the consumable materials required to comply with the MM Paragraphs referenced in the accomplishment instructions.

Refer also to Annex A for the consumable materials required to comply with this Service Bulletin.

A.3 LOGISTIC MATRIX

In order to apply this Service Bulletin, the following Logistic P/N can be ordered in accordance with the applicable notes:

LOGISTIC P/N	Q.TY (PER HELO)	NOTE	PART
709-099L1	1	-	-
109G6430A03-101	1	(1)	-
109G6430A03-105	1	(2)	-

NOTES

(1) Applicable to A109E helicopters that install duplex bearing P/N 109-0133-05-103 or P/N 109-0133-05-107.

(2) Applicable to A109E helicopters that install duplex bearing P/N 109-0133-05-101 or P/N 109-0133-05-105.

(3) Item to be procured as local supply.

B. SPECIAL TOOLS

Refer to PTUM for the special tools required to comply with the MM DM referenced in the accomplishment instructions.

Refer also to Annex A for the special tools required to comply with this Service Bulletin.

C. INDUSTRY SUPPORT INFORMATION

Owners/Operators who comply with the instructions of this Service Bulletin no later than the applicable date in the “Compliance” section will be eligible to receive REQUIRED MATERIALS on free of charge basis, except for Consumable Materials and Special Tools. NOTE: Customers who fail to comply with the instructions in this Service Bulletin before the compliance date are not eligible for the aforementioned special policy. Please Issue relevant MMIR form to your Warranty Administration Dpt.

3. ACCOMPLISHMENT INSTRUCTIONS

GENERAL NOTES

a) Place an identification tag on all components that are re-usable, including the attaching hardware that has been removed to gain access to the modification area and adequately protect them until their later re-use.

b) Exposed thread surface and nut must be protected using a layer of tectyl according to MIL-C-16173 grade I.

c) All lengths are in mm.

1. In accordance with MM DM 00-20-1, prepare the helicopter on ground for a safe maintenance. Disconnect the battery, all electrical power sources and/or the external power supply.
2. In accordance with the applicable steps of MM DM 64-31-6, disassembly the housing and slider group. Discard the tail rotor support bearing sleeve assy P/N 109-0130-94-XXX (any dash installed) and the locking nut P/N 109-0130-97-XXX (any dash installed).
3. In accordance with Annex A, Annex B and Annex C, re-assembly the housing and slider group with the new support bearing sleeve assy P/N 109G6430A03-101 or P/N 109G6430A03-105, the new flange P/N 109G6430A04-101 and the new peeling shim P/N 109G6430A05-101.
4. Return the helicopter to flight configuration and record for compliance with this Service Bulletin on the helicopter logbook.
5. Gain access to My Communications section on Leonardo Customer Portal and compile the “Service - Technical Bulletin Application”.
   As an alternative, send the attached compliance form to the following mail box:
   engineering.support.lhd@leonardo.com
   and (for North, Central and South America) also to:
   AWPC.Engineering.Support@leonardocompany.us

ANNEX A

REMOVAL/INSTALLATION (SLEEVE ASSY P/N 109G6430A03)

Annex A

64-31-6C. Removal/installation (Sleeve assy P/N 109G6430A03)
(Fig 64-35)

A. Input Conditions

(1) Required conditions:

- Helicopter safe for maintenance (Chap 00)
- Access panels P5 and P12 removed
- Tail rotor hub and blade assembly removed (Sect 64-00).

(2) Support equipment:

- Tool, T/R pitch change slider ring nut removal/installation (LSE NO 49)
- Tool, T/R pitch change housing ring nut removal/installation (LSE NO 130)
- Tool, T/R pitch change housing duplex bearing removal (LSE NO 131)
- Tool, T/R pitch change housing duplex bearing installation (LSE NO 132)
- Tool, T/R pitch change slider installation (LSE NO 133)
- Tool, T/R pitch change slider removal (LSE NO 101)
- Syringe (Local supply)
- Heating gun (Local supply)
- Feeler gage (Local supply)
- Depth micrometer gage (Local supply)
- Refrigerator (Local supply)
- Plastic scraper (Local supply)

(3) Consumable materials:

WARNING: THE CONSUMABLE MATERIALS THE NOMENCLATURE OF WHICH IS PREFIXED BY "(D)" ARE DANGEROUS MATERIALS.
BEFORE USE, MAKE SURE TO KNOW THE SAFETY PRECAUTIONS AND FIRST AID INSTRUCTIONS PRINTED ON:
- THE LABEL ON THE CONTAINER THE MATERIAL WAS SUPPLIED IN
- THE MATERIAL SAFETY DATA SHEET
- THE LOCAL SAFETY REGULATIONS.
ALSO MAKE SURE THAT THE APPLICABLE FIRST AID MATERIALS ARE AVAILABLE.

- Abrasive paper (C055)
- (D) Sealing compound (C029)
- Safety wire (C014)
- (D) Primer (C446)
- Safety wire (C013)
- (D) Grease (C594)
- Cloth, soft lint-free (C011)
- (D) Solvent, cleaning (C023)
- (D) Oil (C139)
- (D) Primer (C237)
- Sealant (C501)
- (D) Corrosion preventive compound (C509)
- (D) Corrosion inhibiting compound (C505)
- (D) Corrosion preventive compound (C587)
- (D) Cleaning solvent (C287)
- (D) Corrosion inhibitor (C288)

(4) Other recommendations:

WARNING: THIS INSTALLATION INCLUDES VITAL POINTS (VP). DURING THE PROCEDURE, YOU MUST OBEY THE LOCAL REGULATIONS APPLICABLE TO THE VITAL POINTS.

CAUTION: MAKE SURE THAT YOU DO NOT MIX GREASES OF DIFFERENT BRANDS ALTHOUGH THE SPECIFICATIONS ARE THE SAME. REFER TO THE HELICOPTER LOG BOOK TO PREVENT MIXTURE OF UNWANTED GREASES.

CAUTION: THIS COMPONENT INCLUDES CRITICAL PARTS. EXAMINE THE COMPONENT FOR SIGNS OF STRUCTURAL DAMAGE, BEFORE YOU INSTALL IT ON THE HELICOPTER. REFER TO SECT 20-40.

B. Removal Procedure.

(1) Disconnect tail rotor pitch control tube (59) from torque shaft control lever (49) by removing attaching hardware. Discard cotter pin.

(2) Disconnect FWD half scissor (30) from sleeve (25) and AFT half scissor (35) from slider (23) by removing attaching parts. Discard cotter pins.

(3) Detach AFT half scissor (35) from FWD half scissor (30) by removing attaching parts. Discard cotter pin.

(4) Cut lockwire from forward boot (26) and withdraw sleeve (25) from gearbox shaft. Remove forward boot (26) from sleeve (25).

NOTE: Mark position of pitch control links (20) to reconnect in same position during reassembly of slider.

CAUTION: REMOVE THE PITCH CONTROL LINK (20) IN THE SEQUENCE AS FOLLOWS FOR NOT DAMAGE THE LINK.

(5) Remove pitch control link (20) from slider arm (23), by removing parts; the bolt (21), the washer (22), damper washer (60), the other washer (22), the nut (38) and discard the cotter pin (38A) remove pitch control link (20).

(6) Remove and discard cotter pin (70), remove the nut (66), the flat surface cup washer (67), the spacer (68) (if installed), the washer (69) and disconnect the pitch control link (20) from the blade (71).

(7) Remove links (10) by removing attaching parts. Discard cotter pins.

(8) Cut lockwire from aft boot (39).

(9) Withdraw housing (15), together with assembled parts, from gearbox shaft.

(10) Disassemble housing (15) and slider assembly (23) as follows:

(a) Put the housing and slider group (1, Figure 64-36) on an applicable work table.

(b) Lock the Base (Part of LSE NO 49) (2) in an applicable vice.

(c) Put the housing and slider group (1) on the base (2).

(d) Move the braces (3) of the slider against the pins (4) of the base (2).

(e) Open the two clawed tabs on the lock ring (5). Then remove it from the housing and slider group (1).

(f) Remove the ring nut (7) with the Wrench (Part of LSE NO 49) (6).

(g) Remove the housing-slider assembly (8) from the base (2).

(h) Put the housing-slider assembly (8) on the Support (Part of LSE 101) (9).

CAUTION: WHEN YOU DO THE STEP B.(10)(I) THAT FOLLOWS, MAKE SURE THAT THE PIN (12) AND THE DUPLEX BEARING (22) ARE CORRECTLY ALIGNED. THIS IS TO PREVENT DUPLEX BEARING DAMAGE.

(i) Push the slider group (10) out of the housing group (11). To do this, use the Pin (Part of LSE NO 101) (12) and an applicable arbor press.

(j) Remove the slider group (10) from the support (9).

(k) Remove the sealant from the housing group (11), between the housing-bearing assembly (18) and the flange (14) with the Plastic scraper (Local supply) (See Detail A).

(l) Cut the safety wire from the six bolts (15).

(m) Remove these parts that attach the flange (14) with the peeling shim (13) to the housing-bearing assembly (18):

- The six bolts (15)
- The six countersunk washers (16)
- The six washers (17).

(n) Remove the flange (14) with the peeling shim (13) from the housing-bearing assembly (18).

(o) Put the Bushing (Part of LSE NO 131) (20) in its position on the Pin (Part of LSE NO 131) (21).
(p) Put the housing-bearing assembly (18) on the pin (21) above the bushing (20).

WARNING: BE CAREFUL WHEN YOU USE HEAT. HOT PARTS CAN CAUSE INJURY TO THE PERSONS. ALWAYS USE APPLICABLE PROTECTIVE CLOTHING.

(q) Lightly increase the temperature of the external surface of the housing-bearing assembly (18) with the Heating gun (Local supply). This will help you to remove the duplex bearing (22) from the bearing support sleeve (23). Make sure that the temperature must not be more than 90 °C.
(r) Push the duplex bearing (22) out of the bearing support sleeve (23). To do this, use the Barrel (Part of LSE NO 131) (19) and an applicable arbor press.

(11) Remove boot (39, Fig 64-35).
(12) Remove attaching parts of levers (5 and 49), then remove levers and shims (8) and extract pivot (9) from lugs on gearbox.
(13) Disconnect pitch control lever (40) from link (46) by removing attaching parts. Remove lever (40). Discard cotter pin.
(14) Disconnect link (46) from lugs on gearbox by removing attaching parts. Remove link (46). Discard cotter pin.

C. Installation Procedure.

CAUTION: INSTALL THE FWD HALF-SCISSOR (30, FIG 64-35) AND AFT HALF-SCISSOR (35, FIG 64-35) IN THE CORRECT LOCATION AND ORIENTATION AS SHOWN IN DETAIL C1 OF FIG 64-35.

NOTE: During the installation of the self-locking bolts or the self-locking nuts, when the locking is engaged, with the torque wrench (Local supply), make sure that the locking torque necessary to move the bolts or nuts, before contact with the washer, is between the minimum breakaway torque and the maximum locking torque. If you do not get his value, discard the bolts and/or nuts.

(1) Position torque shaft (9, Fig 64-35) in 90-degree gearbox lugs.
(2) Install laminated shims (8) and levers (5 and 49) on torque shaft (9). Do not torque attaching parts.

NOTE: If any of the following items: 90-degree gearbox case, torque shaft (9) levers (5 and 49) laminated shims (8) have been replaced, proceed as follows:

(a) Position torque shaft (9) in 90-degree gearbox lugs.
(b) Position levers (5 and 49) on torque shaft (9) without shims and secure temporarily in position.
(c) Measure the total gap between one lever and the adjacent lug with a feeler gauge. Half of the gap is dimension of each laminated shim (8).
(d) Remove levers (5 and 49) from torque shaft (9).
(e) Fit laminated shims (8) on torque shaft (9) then reinstall levers (5 and 49) and secure. Do not torque nuts (3 and 51) at this time.
(f) Check for free rotation of pivot. If shim thickness is unsatisfactory, modify the shims the same amount on either side to obtain an axial play between 0,03 and 0,08 mm between 90° gearbox lugs bearings and levers (5 and 49) when installed.

NOTE: Before installing the boot in the housing and slider group deform the boot metallic rim to an oval shape with a maximum diameter of 43 thru 44 mm (1.693 thru 1.732 in) as shown in DETAIL D of figure 64-35. This is to help a tighter fit in the seat. Put the inboard boot in its position in the housing and slider group.

(3) Position aft boot (39) on gearbox shaft.
(4) Reassemble housing (15) and slider assembly (23) as follows:

CAUTION: BEFORE YOU ASSEMBLE THE HOUSING AND SLIDER GROUP (1, FIG. 64-37) PUT THE COMPONENT THAT FOLLOW AND THE RELATED ATTACHING PARTS ON AN APPLICABLE WORK TABLE.
CAREFULLY EXAMINE THE COMPONENT AND THE RELATED ATTACHING PARTS FOR CORROSION, NICKS AND DAMAGE, WEAR AND FRETTING. IF YOU FIND THAT THE

COMPONENT IS DAMAGED, REPLACE IT:
- THE DUPLEX BEARING (11)
- THE BEARING SUPPORT SLEEVE (8).

(a) Divide the two parts of the duplex bearing (11).

NOTE: Do step C.(4)(b) thru step C.(4)(d) only for removed bearings. New bearings are supplied already lubricated and must not be filled with grease.

(b) Fill the Syringe (Local supply) with the Grease (C594).
(c) Before you install the bearing (12), fill it with 3.5 cc (0.21 in3) of grease with the syringe from the side opposite to the boot. Refer to Detail A of Fig. 64-37.
(d) Do step C.(4)(c) again on the bearing (13).
(e) Put the bearing (12) against the bearing (13) with the boot sides externally and the internal and external V-marks aligned to show an arrow. See Detail A, Fig. 64-37.
(f) Install the duplex bearing (11) into the bearing support sleeve (8) in the way that follows:
1. Apply a thin layer of Primer (C446) on the mating surfaces between the duplex bearing (11) and bearing support sleeve (8).
2. Put the bearing support sleeve (8) on the Base (Part of LSE NO 132) (14).

WARNING: BE CAREFUL WHEN YOU USE HEAT. HOT PARTS CAN CAUSE INJURY TO THE PERSONS. ALWAYS USE APPLICABLE PROTECTIVE CLOTHING.

3. Heat the bearing support sleeve (8) to a temperature between 60 and 70 °C with the Heating gun (Local supply) . This will help you to install the duplex bearing (11) into the bearing support sleeve. Make sure that the temperature is not more than 90 °C (heating gun set to a temperature of 90 °C).

NOTE: As an alternative to heating the bearing support sleeve (8); you can cool down the duplex bearing (11) with the Refrigerator (Local supply) to a temperature between -18 and -40 °C for 30 minutes. Do not touch the cold duplex bearing with bare hands to prevent injury.

4. Push the duplex bearing (11) into the bearing support sleeve (8). To do this, use the Pin (Part of LSE NO 132) (15) and an applicable arbor press.
5. Make sure there is no clearance between the two bearings (12 and 13) and between the outer ring of duplex bearing (11) and the shoulder of the bearing support sleeve (8). To do this, use the applicable Feeler gage (Local supply).
6. Remove the housing-bearing assembly (16) from the base (14).

NOTE: Before you continue, make sure that all the components are at ambient temperature.

(g) Install the flange (6) with the peeling shim (7) into the housing-bearing assembly (16). Obey the instructions that follow:
1. Clean the flange (6), the mating surfaces of the housing-bearing assembly (16) and the six bolts (3) with the Cloth, soft lint-free (C011) and the Solvent, cleaning (C023).
2. Dry the parts that you cleaned with a clean Cloth, soft lint-free (C011).
3. Temporarily put the flange (6) in its correct position on the housing-bearing assembly (16) against the duplex bearing (11). Do not apply pressure on the bearing.
4. Measure the gap between the flange (6) and the housing-bearing assembly (16) in the six tabs. Refer to Detail B of Fig. 64-37. Calculate the average value (dimension S) and then record it. **(VP)**
5. Adjust the thickness "S7" of the peeling shim (7) with this formula: **(VP)** S7 = S - 0,17 thu 0,22 mm (0.007 thru 0.009 in).
6. Install the peeling shim (7) and the flange (6) in the housing-bearing assembly (16).

CAUTION: MAKE SURE THAT THERE ARE NO BURRS DURING PEELING SHIMS INSTALLATION (7) ADJUSTMENT. IF YOU FIND BURRS REMOVE WITH ABRASIVE PAPER (C055).

NOTE: Make sure that the six countersunk washers are correctly installed as shown in Detail B of Fig. 64-37. **(VP)**

7. Install these parts that attach the flange (6) with the peeling shim (7) to the bearing support sleeve (8): (**VP**)
   - The six washers (5)
   - The six countersunk washers (4)
   - The six bolts (3).

NOTE 1: During the installation of the six bolts (3) in the insert of the bearing support sleeve (8), when the locking is engaged, with the torque wrench (Local supply), make sure that the locking torque necessary to move the bolts, before contact with the washers (4) and (5), is between 0.22 Nm (1.95 lbf in) and 2.03 Nm (17.97 lbf in). if you do not get this value, discard the bolts and / or inserts. (**VP**)

NOTE 2: In case you have to replace the inserts, contact the TC holder.

8. Torque the bolts (3) to the Final torque (Locking torque + Seating torque). Refer to the torque values that follow and to Annex 1 for the torque instructions. (**VP**):
   - Locking torque: 2.03 N m (17.97 lbf in) maximum
   - Breakaway torque: 0.22 N m (1.95 lbf in) minimum
   - Seating torque: 4.30 thru 4.52 N m (38.05 thru 40 lbf in)
9. Remove the housing-bearing assembly (16) from the base (14).
10. Make sure that the duplex bearing (11) turns freely. (**VP**)
11. Refer to Detail B of Fig. 64-37:
    (a) Measure and record the dimension L.
    (b) Make sure that the dimension you find is between 23.75 to 24.0 mm (0.935 to 0.945 in).
    (c) If you find that the dimension is not in the given limits, remove the duplex bearing (11). Then, do step C.(4)(f) and step C.(4)(g) again.
12. Refer to Detail C of Fig. 64-37:
    (a) Measure and record the dimension M.
    (b) Calculate and record the dimension N with this formula: N = M - L.
13. Safety the six bolts (3) with the new Wire, safety (C014) . Refer also to CSPP-A-20-40-00-03A-712AD. (**VP**)

(h) Apply a thin layer of Oil (C139) on the internal surface of the duplex bearing (11).
(i) Put the Bushing (Part of LSE NO 133) (18) in its position on the Pin (Part of LSE NO 133) (19).
(j) Put the housing group (16) on the pin (19) above the bushing (18).
(k) Put the slider (2) on the pin (19).

NOTE 1: To help you install the slider (2), heat the housing group (16) in an oven preheated to a temperature of 50 °C for 15 to 30 minutes.

NOTE 2: As an alternative to heating the housing group (16); you can cool down the slider (2) with the Refrigerator (Local supply) to a temperature between -18 and -40 °C for 30 minutes. Do not touch the cold slider with bare hands to prevent injury.

(l) Push the slider (2) into the housing group (16). To do this, use the Barrel (Part of LSE NO 133) (17) and an applicable arbor.
(m) Remove the housing-slider assembly (20) from the pin (19).

NOTE: Before you continue, make sure that all the components are at ambient temperature.

(n) Make sure there is no clearance between the inner rings of the two bearings (12 and 13) and the shoulder of the slider (2). To do this, use the applicable Feeler gage (Local supply).
(o) Refer to Detail D of Fig. 64-37:
   1. Measure and record the dimension N. To do this, use an applicable Depth micrometer gage (Local supply).
   2. Make sure that the dimension N measured agrees with the dimension calculated at step C.(4)(g)(11)b.
   3. If you find that the dimension N does not agree, remove the duplex bearing (11). Then, do step C.(4)(f) thru step C.(4)(o) again.

(p) Lock the Base (Part of LSE NO 49) (22) in an applicable vice.
(q) Put the housing-slider assembly (20) on the base (22).
(r) Move the braces (23) of the slider against the pins (24) of the base (22). Refer to Detail E of Fig. 64-37.
(s) Clean the threads of the ring nut (9) and the slider (2) with the Cloth, soft lint-free (C011) and the Solvent, cleaning (C023) . **(VP)**
(t) Dry the threads of the ring nut (9) and slider (2) with a clean Cloth, soft lint-free (C011) . **(VP)**
(u) Apply a layer of Primer (C237) on the threads of the ring nut (9).
(v) Apply a layer of Primer (C237) on the threads of the slider (2).
(w) Apply four drops of Adhesive (C029) on the threads of the ring nut (9). Put them in four equally spaced positions (90 degrees apart). **(VP)**
(x) Install the ring nut (9) with the Wrench (Part of LSE NO 49) (21).
(y) Torque the ring nut (9) to 49 thru 59 N m (36 thru 43 lbf ft). **(VP)**
(z) Remove the housing and slider group (1) from the base (22).
(aa) Install the new Lock ring (10).
(bb) Bend the clawed tabs of the lock ring (10) on the ring nut (9). Make sure that the two clawed tabs of the lock ring (10) are correctly engaged.
(cc) Seal the gap between the flange (6) and the housing-bearing assembly (16) with Sealant (C501) as shown in Detail B of Fig. 64-37.
(dd) Let the sealing compound cure. For sealing compound cure cycle, refer to 09-A-00-50-00-85A-074C-D.
(ee) Clean the head of the six bolts (3) with a soft Lint-free cloth (C011) and the Cleaning solvent (C287).
(ff) Apply the Corrosion inhibitor (C288) to the head of the six bolts (3).
(gg) Paint a slippage mark between the head of the six bolts (3) and flange (6), refer to CSPP-A-20-40-00-05A-691A-D.

(5) Connect pitch control lever (40, Fig. 64-35) and links (10) to housing (15).
(6) Torque the bolts (14) to the Final torque (Locking torque + Seating torque). Refer to the torque values that follow and to Annex 1 for the torque instructions. **(VP)**:
- Locking torque: 3.39 N m (30 lbf in) maximum
- Breakaway torque: 0.39 N m (3.45 lbf in) minimum
- Seating torque: 3.40 thru 4.52 N m (30 thru 40 lbf in)

(7) Install cotter pins and apply the Corrosion inhibiting compound (C505) or Corrosion inhibiting compound (C587) to the shank and under head of the bolt (14).

NOTE 1: It is possible to install the bumper washers (40A) between housing (15) and links (10) between lever (40) and housing (15). Before you torque nuts (11), make sure that the spherical bearings of the control lever (40) and link (10) touch the lug of the housing (15) and not the bumper washers (40A). **(VP)**

NOTE 2: Install the two spacers (13 and 15A) against spherical bearing of pitch control lever (40) and link (10). Install the two small washers (12) between the larger one (15A) and the nut (11). To obtain proper torque, replacement of one smaller washer AN960C416 with an AN960C416L washer is permitted. **(VP)**

NOTE 3: During the installation, if the total clearance between the pitch control lever (40) and the housing (15) is more than 0,3 mm, install one washer (65) P/N AN960PD416L (superseded by P/N NAS1149D0416K) on one attachment point bolt (14).

(8) Deleted.
(9) Deleted.
(10) Deleted.
(11) Deleted.
(12) Deleted.

NOTE: Deleted.

(13) Deleted.
(14) Deleted.
(15) Deleted.

(16) Deleted.
(17) Deleted.
(18) Put the connecting link (46) in position on the lever (40) and the fitting (61).
(19) Put the four washers (46A) and the two shims (46B) in their position between the connecting link (46), the lever (40) and the fitting (61).
(20) Apply the Corrosion inhibiting compound (C505) or Corrosion inhibiting compound (C587) to the shank and under head of the bolt (58). Secure the connecting link to fitting (61) using the bolt (58), washers (57, 56) and nut (55).
(21) Measure clearance between the link (46) and the fitting (61); if the clearance is more than 0.05 mm (0.002 in), adjust thickness of shim (46B).

NOTE: Shims (46B) can be installed on the top side or either on the bottom side of link (46).

(22) Torque the bolt (58) to the Final torque (Locking torque + Seating torque). Refer to the torque values that follow and to Annex 1 for the torque instructions. (**VP**):
- Locking torque: 3.39 N m (30 lbf in) maximum
- Breakaway torque: 0.39 N m (3.45 lbf in) minimum
- Seating torque: 3.40 thru 4.52 N m (30 thru 40 lbf in)

(23) Install the cotter pin.
(24) Apply the Corrosion inhibiting compound (C505) or Corrosion inhibiting compound (C587) to the shank and under head of the bolt (44), then secure the connecting link to lever (40) using the bolt (44), washers (42, 43) and nut (41).
(25) Measure clearance between the link (46) and the lever (40); if the clearance is more than 0.05 mm (0.002 in), adjust thickness of shim (46B).
(26) Torque the bolt (44) to the Final torque (Locking torque + Seating torque). Refer to the torque values that follow and to Annex 1 for the torque instructions. (**VP**):
- Locking torque: 3.39 N m (30 lbf in) maximum
- Breakaway torque: 0.39 N m (3.45 lbf in) minimum
- Seating torque: 3.40 thru 4.52 N m (30 thru 40 lbf in)

(27) Install the cotter pin.
(28) Install the assembly on 90-degree gearbox output shaft. Lockwire boot aft (39) with safety wire (C013).
(29) Connect links (10) to levers (5 and 49). Verify that bolts can turn and slide freely in seats, otherwise reposition lever (49) and/or lever (5) until this requirement is satisfied.
(30) Torque the bolt (45) to the Final torque (Locking torque + Seating torque). Refer to the torque values that follow and to Annex 1 for the torque instructions. (**VP**):
- Locking torque: 3.39 N m (30 lbf in) maximum
- Breakaway torque: 0.39 N m (3.45 lbf in) minimum
- Seating torque: 3.40 thru 4.52 N m (30 thru 40 lbf in)

(31) Install the cotter pin.

NOTE: Install larger washer under bolt head and small washer under nut.

(32) Torque the bolts (7 and 47) to the Final torque (Locking torque + Seating torque). Refer to the torque values that follow and to Annex 1 for the torque instructions. (**VP**):
- Locking torque: 3.39 N m (30 lbf in) maximum
- Breakaway torque: 0.39 N m (3.45 lbf in) minimum
- Seating torque: 5.65 thru 7.91 N m (50 thru 70 lbf in)

(33) Install the cotter pin.
(34) Apply the Corrosion inhibiting compound (C505) or Corrosion inhibiting compound (C587) to the shank and under head of the bolt (45).

CAUTION: CHECK THAT LEVERS (5 AND 49) ARE ALIGNED TO EACH OTHER, AND THAT BEARING (18) IS NOT PRELOADED.

(35) Connect the free arm of torque shaft control lever (49) to tail rotor control tube (59) with the bolt (52), the washer (53) and the nut (54).
(36) Torque the bolt (52) to the Final torque (Locking torque + Seating torque). Refer to the torque values that follow and to Annex 1 for the torque instructions. (**VP**):
- Locking torque: 3.39 N m (30 lbf in) maximum
- Breakaway torque: 0.39 N m (3.45 lbf in) minimum
- Seating torque: 3.40 thru 4.52 N m (30 thru 40 lbf in)

(37) Install the cotter pin.
(38) Apply the Corrosion inhibiting compound (C505) or Corrosion inhibiting compound (C587) to the shank and under head of the bolts (52).
(39) Connect pitch control links (20) to slider (23) following markings made at removal. Install between links and slider damper washers (60) with bolt (21), washers (22) and nut (38).
(40) Torque the bolt (21) to the Final torque (Locking torque + Seating torque). Refer to the torque values that follow and to Annex 1 for the torque instructions. (**VP**):
- Locking torque: 3.39 N m (30 lbf in) maximum
- Breakaway torque: 0.39 N m (3.45 lbf in) minimum
- Seating torque: 3.40 thru 4.52 N m (30 thru 40 lbf in)

(41) Install the cotter pin.
(42) Install forward boot (26) on sleeve (25).
(43) Install sleeve (25) on gearbox shaft. Lockwire forward boot (26) as required using Safety wire (C014).
(44) Apply the Corrosion inhibiting compound (C505) or Corrosion inhibiting compound (C587) to the shank of the bolts (32).

NOTE: Make sure that the head of the bolt (32) points in the direction of the rotation of the tail rotor.

(45) Connect the FWD half-scissor (30) to the sleeve (26) with the bolt (32), washers (29 and 31) and nut (28). Fully tighten all components. Do not torque nut.
(46) Manually determine the axial play between FWD half-scissor (30) and sleeve (26) along bolt axis in the way that follows:
(a) Turn the FWD half-scissor (30) back and forth, from "a" to "b" as Shown in Fig 64-29B Detail A, until you get the position of minimum play. Stop the FWD half-scissor (30, Fig. 64-35) in this position. (**VP**):
(b) Torque the nut (28) until you get to the cotter pin hole on the bolt (32) with no axial play between components. FWD half-scissor must move freely with no binding. Slight friction is permitted. (**VP**):
(c) If you find too much binding / friction, replace the nut (32) with a new one and do again Step C.(36)(a) and Step C.(36)(b). (**VP**):
(d) If with the new nut (32) you still get too much binding / friction, add a washer (31A) P/N NAS1149F0416P under nut and do again Step C.(36)(a) and Step C.(36)(b). (**VP**):
(e) If you still get too much binding / friction, contact the TC holder.
(47) Connect the AFT half-scissor (35) to the FWD half-scissor (30) with the bolt (76), washers (77 and 78) and nut (79). Fully tighten all components. Do not torque nut. (**VP**):
(a) Before install the bolt (76) that connect the FWD half-scissor and AFT half-scissor apply the Corrosion inhibiting compound (C505) or Corrosion inhibiting compound (C587).
(48) Manually determine the axial play between AFT half-scissors (35) and FWD half-scissors (30) along bolt axis in the way that follows:
(a) Turn the AFT half-scissors (35) back and forth, from "a" to "b" as Shown in Fig 64-29B Detail B, until you get the position of minimum play. Stop the AFT half-scissors (35) in this position. (**VP**):
(b) Torque the nut (79) until you get to the cotter pin hole on the bolt (76) with no axial play between components. AFT half-scissor must move freely with no binding. Slight friction is permitted. (**VP**):
(c) If you find too much binding / friction, replace the nut (79) with a new one and do again Step C.(38)(a) and Step C.(38)(b). (**VP**):
(d) If with the new nut (79) you still get too much binding / friction, add a washer (78A) P/N NAS1149F0416P under nut and do again Step C.(38)(a) and Step C.(38)(b). (**VP**):
(e) If you still get too much binding / friction, contact the TC holder.

(49) Apply the Corrosion inhibiting compound (C505) or Corrosion inhibiting compound (C587) to the shank of the bolts (76).

NOTE: Make sure that the head of the bolt (37) points in the direction of the rotation of the tail rotor.

(50) Connect the AFT half-scissor (35) to the slider (23) with the bolt (37), washers (36 and 34) and nut (33). Fully tighten all components. Do not torque nut.
(51) Manually determine the axial play between AFT half-scissor (35) and the slider (23) along bolt axis in the way that follows:
  (a) Move the slider (23) back and forth until you get the position of minimum play. Stop the sleeve in this position. (**VP**):
  (b) Torque the nut (33) until you get to the cotter pin hole on the bolt (37) with no axial play between components. (**VP**):
  (c) If you find too much binding / friction, replace the nut (33) with a new one and do again Step 41(a) and Step 41(b). (**VP**):
  (d) If with the new nut (33) you still get too much binding / friction, add a washer (34A) P/N NAS1149F0416P under nut and do again Step C.(41)(a) and Step C.(41)(b). (**VP**):
  (e) If you still get too much binding / friction, contact the TC holder.
(52) Install the new Cotter pins on nuts (28, 33 and 79).
(53) Apply the Corrosion preventive compound (C509) to the parts that follow:
  (a) The heads of the bolts (32 and 37)
  (b) The washers (31) and (34), the nuts (28) and (33) and the cotter pins.
(54) Apply the Corrosion inhibiting compound (C505) or Corrosion inhibiting compound (C587) to the shank and under head of the bolts (32) and (37).
(55) Connect the pitch control link (20) to the blade (71) with the washer (69), the spacer (68) (if installed), the flat surface cup washer (67) and the nut (66).
(56) Torque the nut (66) to the Final torque (Locking torque + Seating torque). Refer to the torque values that follow and to Annex 1 for the torque instructions. (**VP**):
  - Locking torque: 9.04 N m (80 lbf in) maximum
  - Breakaway torque: 1.07 N m (9.47 lbf in) minimum
  - Seating torque: 7.91 thru 10.17 N m (70 thru 90 lbf in)
(57) Install the cotter pin.

NOTE: Ensure that bolt (32 and 37) heads are facing tail rotor sense of rotation.

D. Follow-On Maintenance Required:
- Install tail rotor hub and blade assembly (Sect 64-00)
- Install access panels P5 and P12.

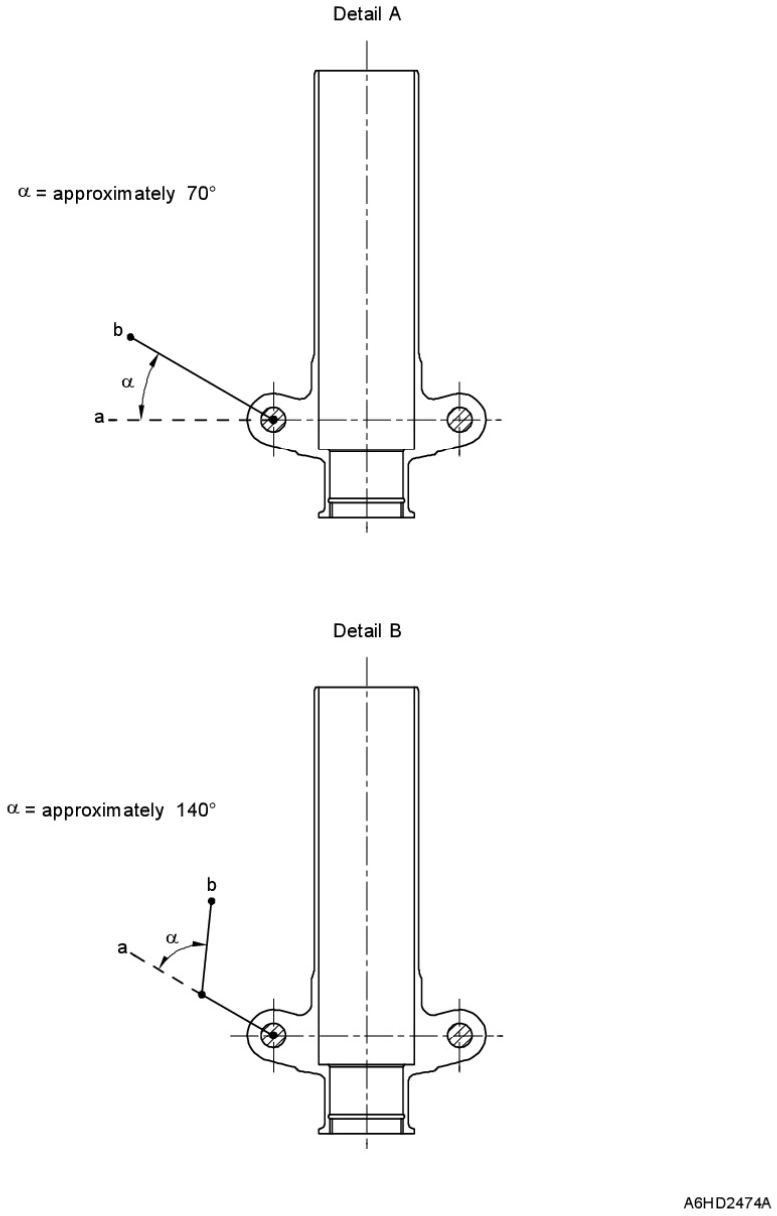


Figure 64-29B. Half scissors play check

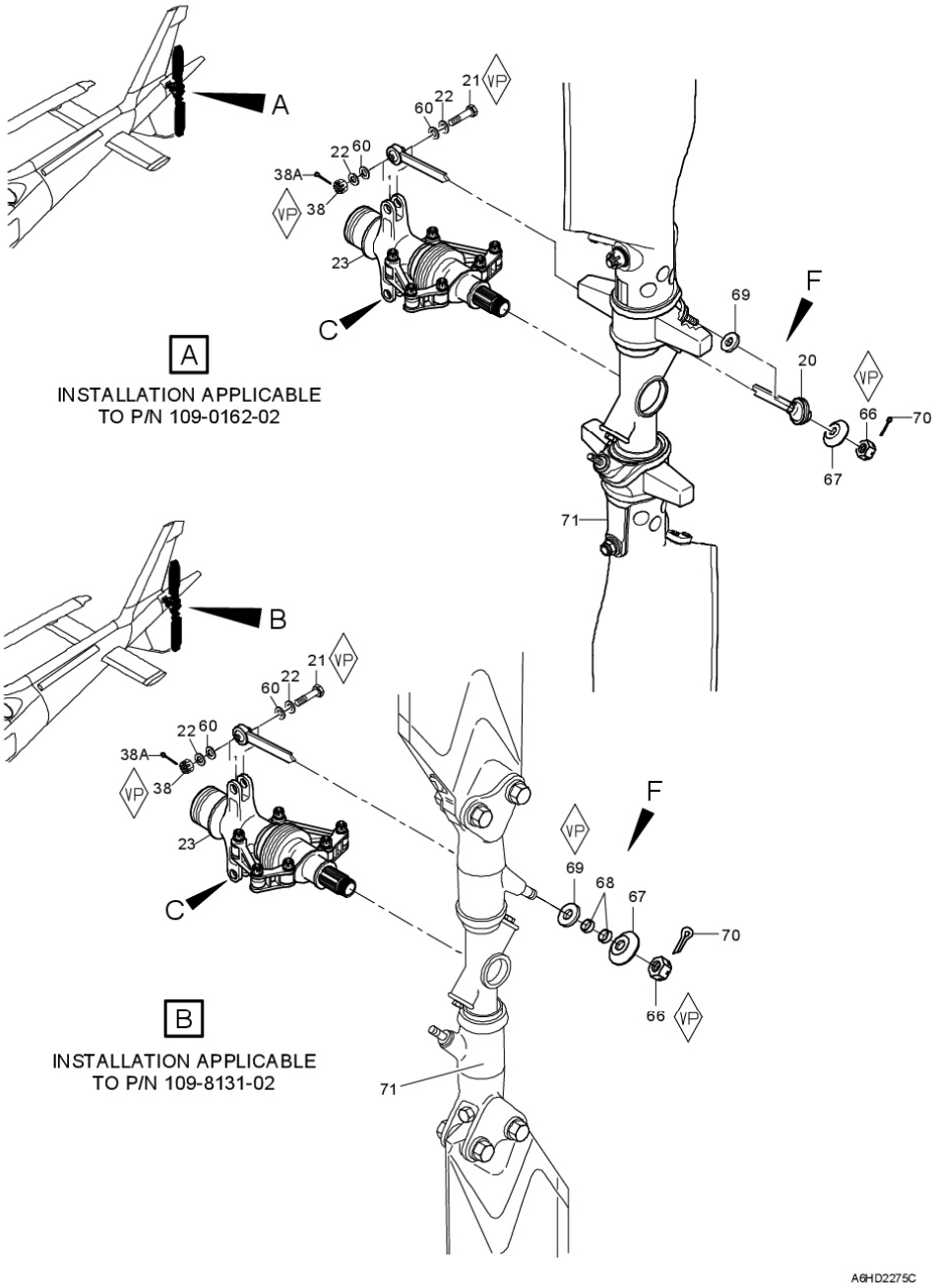


Figure 64-35 (sheet 1 of 5). Pitch change mechanism (Sleeve assy P/N 109G6430A03)

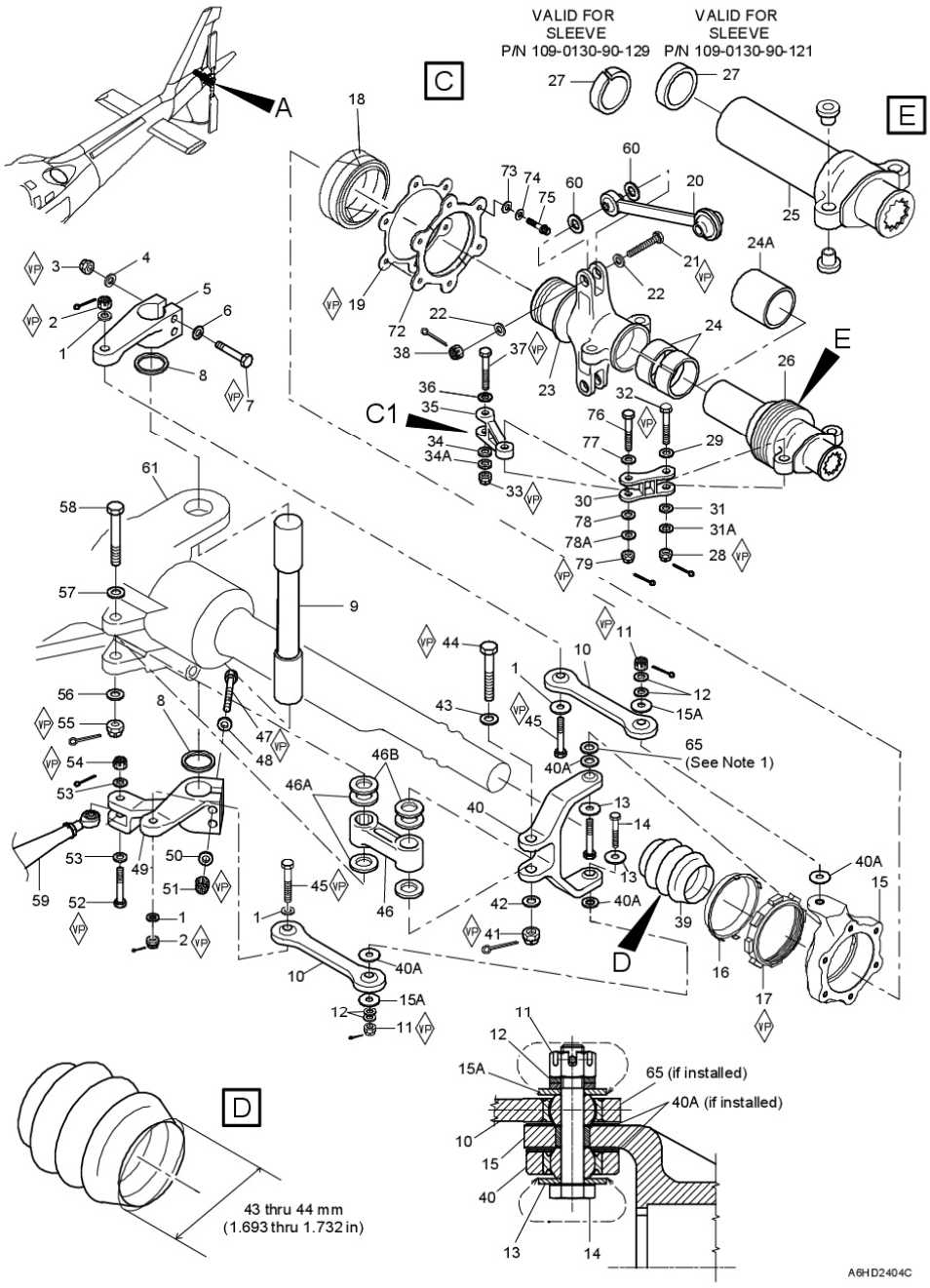


Figure 64-35 (sheet 2 of 5). Pitch change mechanism (Sleeve assy P/N 109G6430A03)

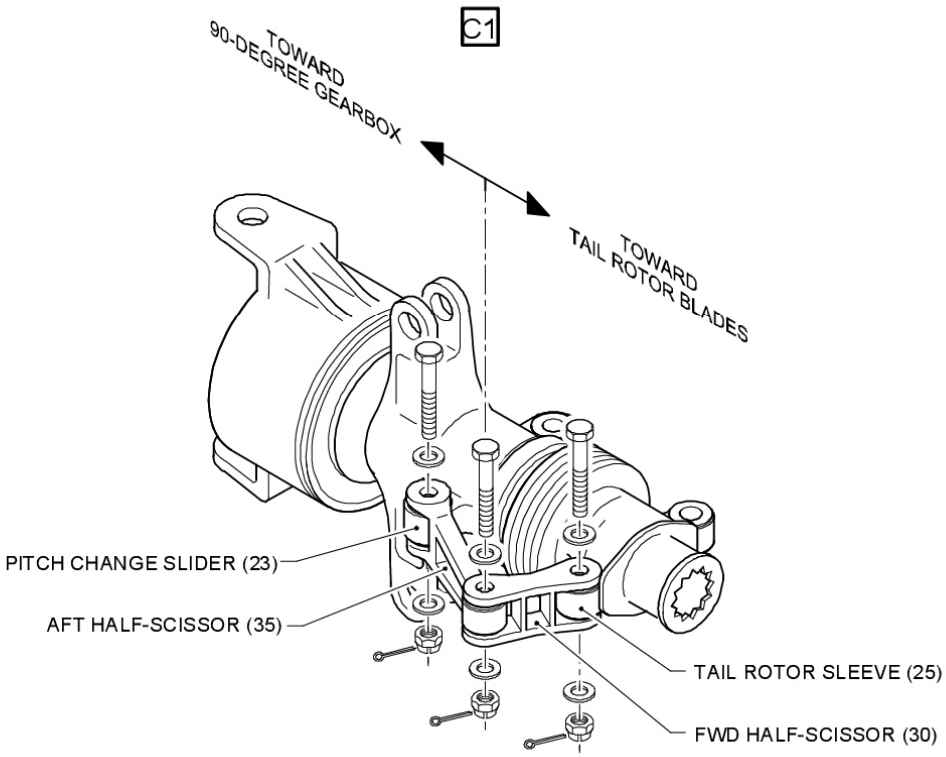


Figure 64-35 (sheet 3 of 5). Pitch change mechanism (Sleeve assy P/N 109G6430A03)

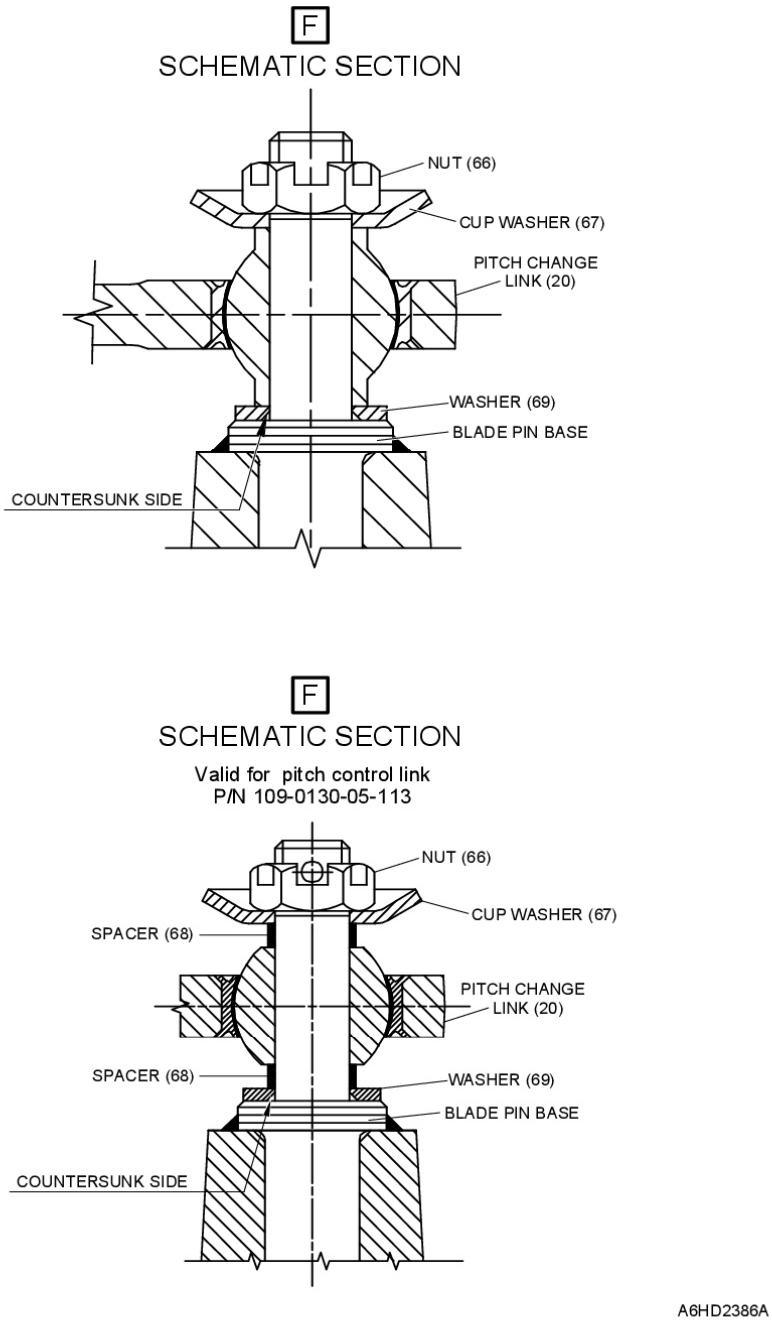


Figure 64-35 (sheet 4 of 5). Pitch change mechanism (Sleeve assy P/N 109G6430A03)

1. Washer
2. Nut
3. Nut
4. Washer
5. Lever
6. Washer
7. Bolt
8. Shim
9. Torque shaft
10. Link
11. Nut
12. Washer
13. Spacer
14. Bolt
15. Housing
15A. Spacer
16. Lock ring
17. Ring nut
18. Duplex bearing
19. Ring nut
20. Pitch control link
21. Bolt
22. Washer
23. Slider
24. Bushing (*)
24A. Bushing (**)
25. Sleeve
26. Forward boot
27. Bushing
28. Nut
29. Washer
30. FWD half scissor
31. Washer
31A. Washer (select on fit)
32. Bolt (*)
33. Nut
34. Washer
34A. Washer (select on fit)
35. AFT half scissor
36. Washer
37. Bolt (*)
38. Nut
38A. Cotter pin
39. AFT boot
40. Lever
40A. Bumper washer
41. Nut
42. Washer
43. Washer
44. Bolt
45. Bolt
46. Link
46A. Washer
46B. Shim
47. Bolt
48. Washer
49. Torque shaft control lever
50. Washer
51. Nut
52. Bolt
53. Washer
54. Nut
55. Nut
56. Washer
57. Washer
58. Bolt
59. Tail rotor pitch control tube (ref)
60. Washer, damper
61. T/R gearbox fitting
62. Shim
63. Bushing (**)
64. Shim
65. Washer
66. Nut
67. Flat surface cup washer
68. Spacer (if installed)
69. Washer
70. Cotter pin
71. Hub and blade assy
72. Flange
73. Washer
74. Washer
75. Bolt
76. Bolt
77. Washer
78. Washer
78A. Washer (select on fit)
79. Nut

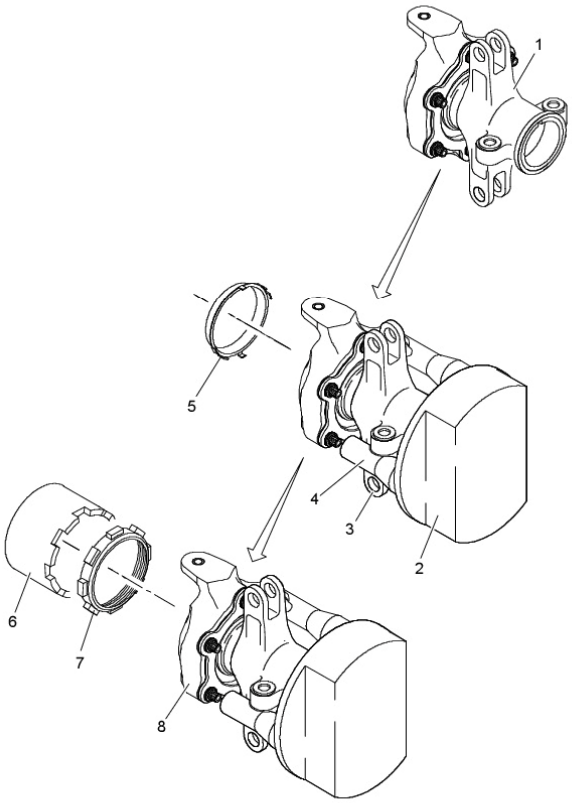
(*) Used with slider P/N 109-0130-91-105.

(**) Used with slider P/N 109-0130-91-117/-119.

NOTE 1:

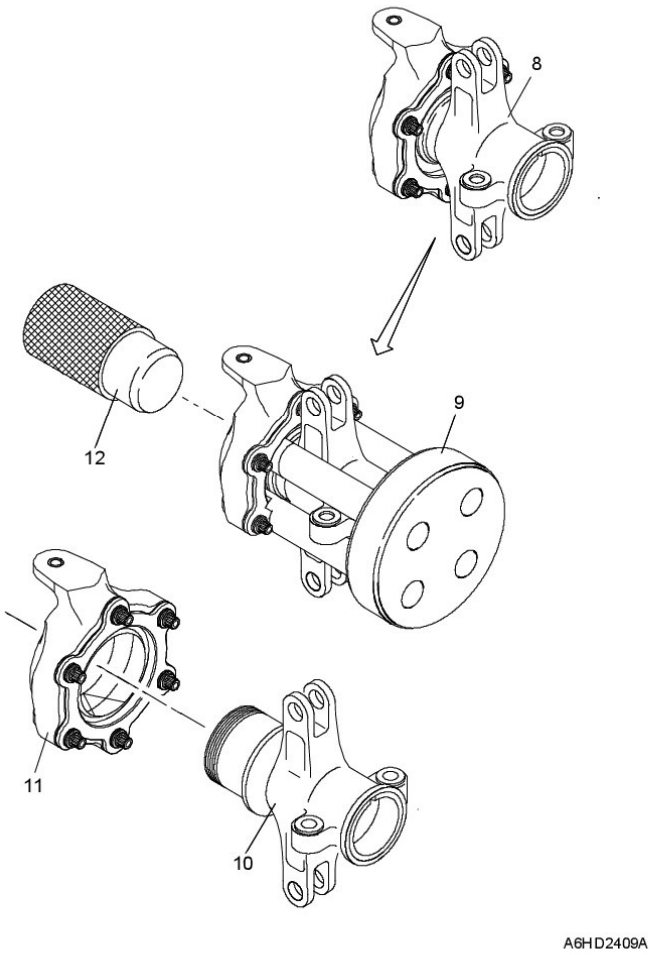
Washer (65) is shown in this location but, if necessary, can be installed on opposite bolt (14).

Figure 64-35 (sheet 5 of 5). Pitch change mechanism (Sleeve assy P/N 109G6430A03)



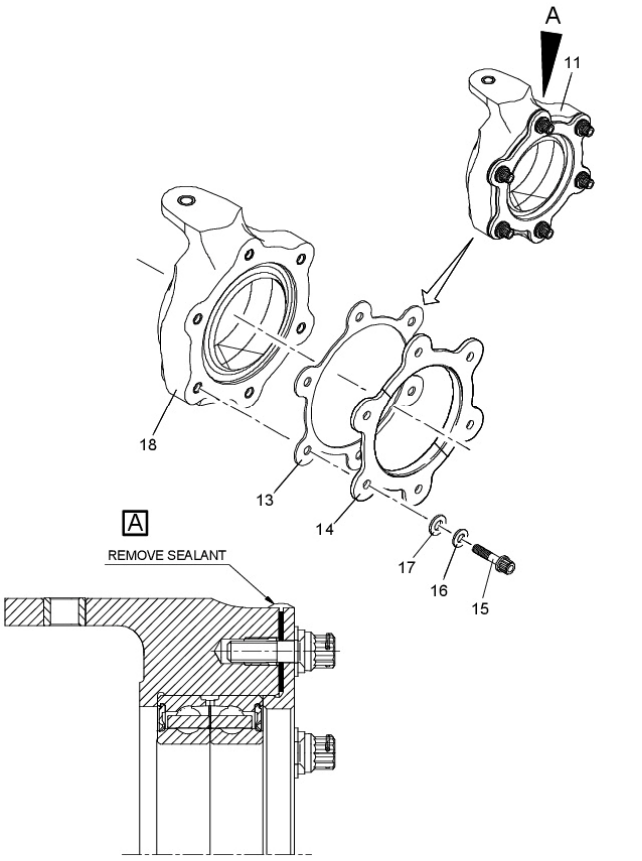
1. Slider group
2. Base
3. Brace
4. Pin
5. Lock ring
6. Wrench
7. Ring nut
8. Housing-slider assembly
9. Support

Figure 64-36 (sheet 1 of 4). Housing and slider group - Disassemble procedure (Sleeve assy P/N 109G6430A03)



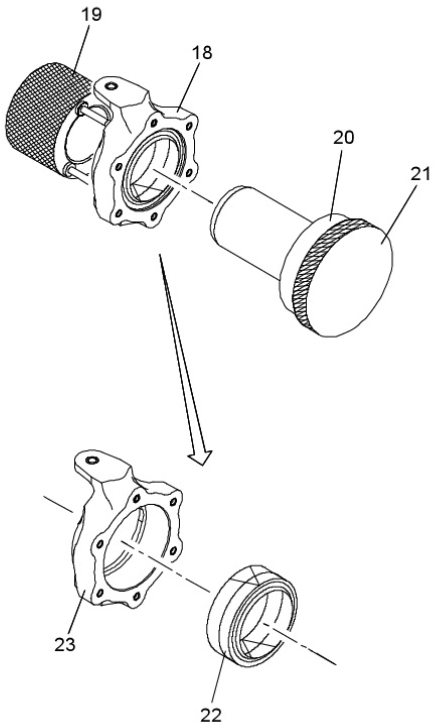
8. Housing-slider assembly
9. Support
10. Slider group
11. Housing group
12. Pin

Figure 64-36 (sheet 2 of 4). Housing and slider group - Disassemble procedure (Sleeve assy P/N 109G6430A03)



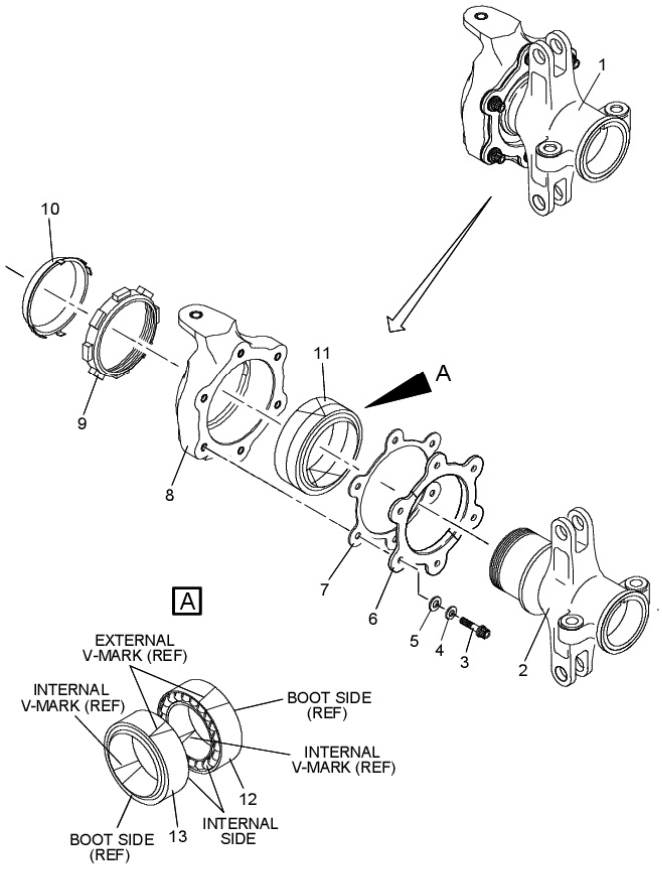
11. Housing group
12. Pin
13. Peeling shim
14. Flange
15. Bolt
16. Washer
17. Washer
18. Housing-bearing assembly

Figure 64-36 (sheet 3 of 4). Housing and slider group - Disassemble procedure (Sleeve assy P/N 109G6430A03)



18. Housing-bearing assembly
19. Barrel
20. Bushing
21. Pin
22. Duplex bearing
23. Bearing support sleeve

Figure 64-36 (sheet 4 of 4). Housing and slider group - Disassemble procedure (Sleeve assy P/N 109G6430A03)



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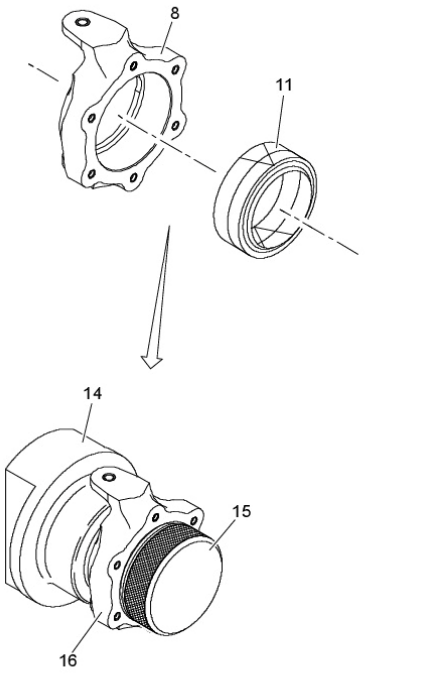
1. Slider group	6. Flange	11. Duplex bearing
2. Slider	7. Peeling shim	12. Bearing
3. Bolt	8. Bearing support sleeve	13. Bearing
4. Countersunk washer	9. Ring nut	
5. Washer	10. Lock ring	

Figure 64-37 (sheet 1 of 5). Housing and slider group - Assemble procedure (Sleeve assy P/N 109G6430A03)



14. Base
15. Pin
16. Housing-bearing assembly

Figure 64-37 (sheet 2 of 5). Housing and slider group - Assemble procedure (Sleeve assy P/N 109G6430A03)

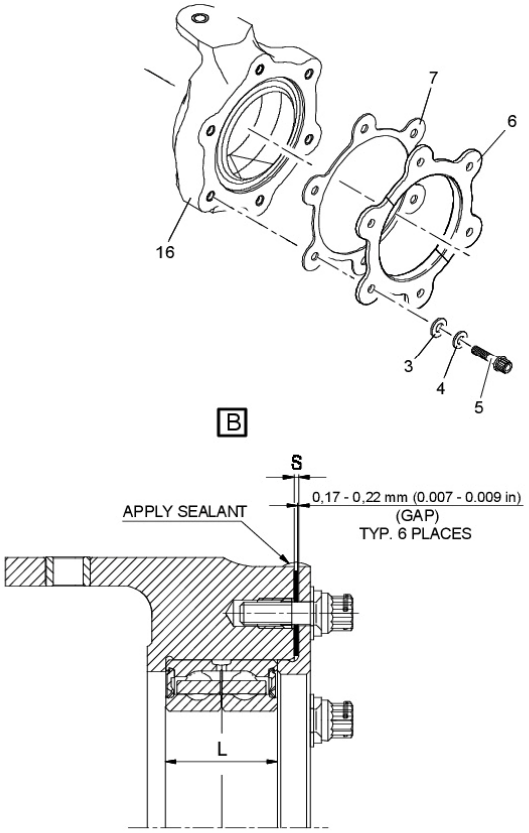
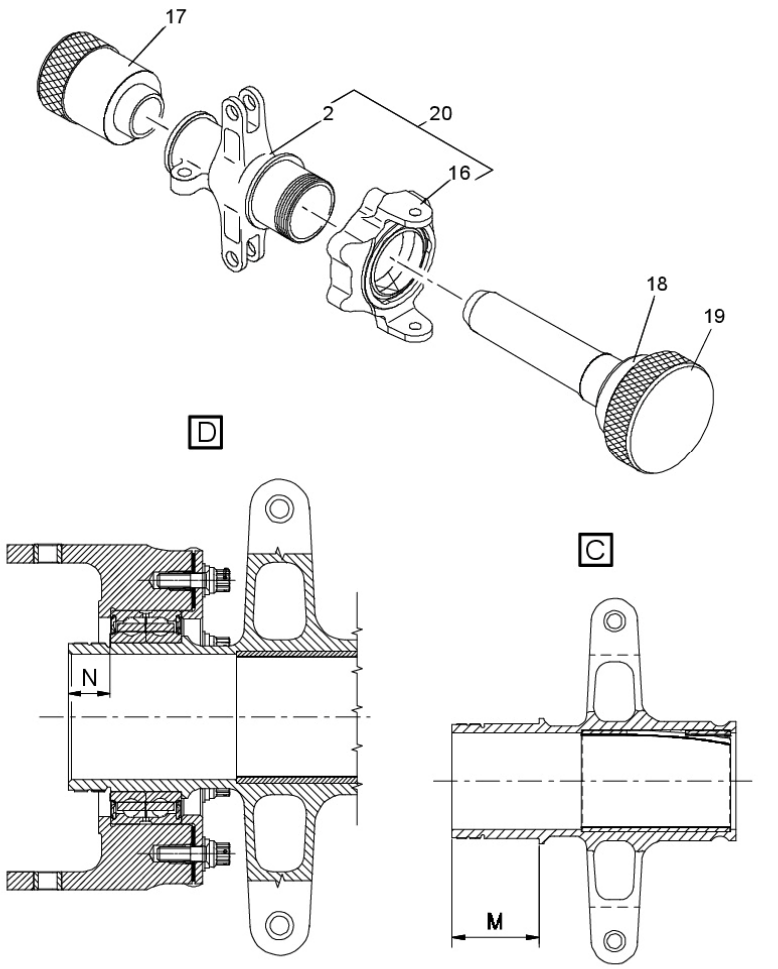
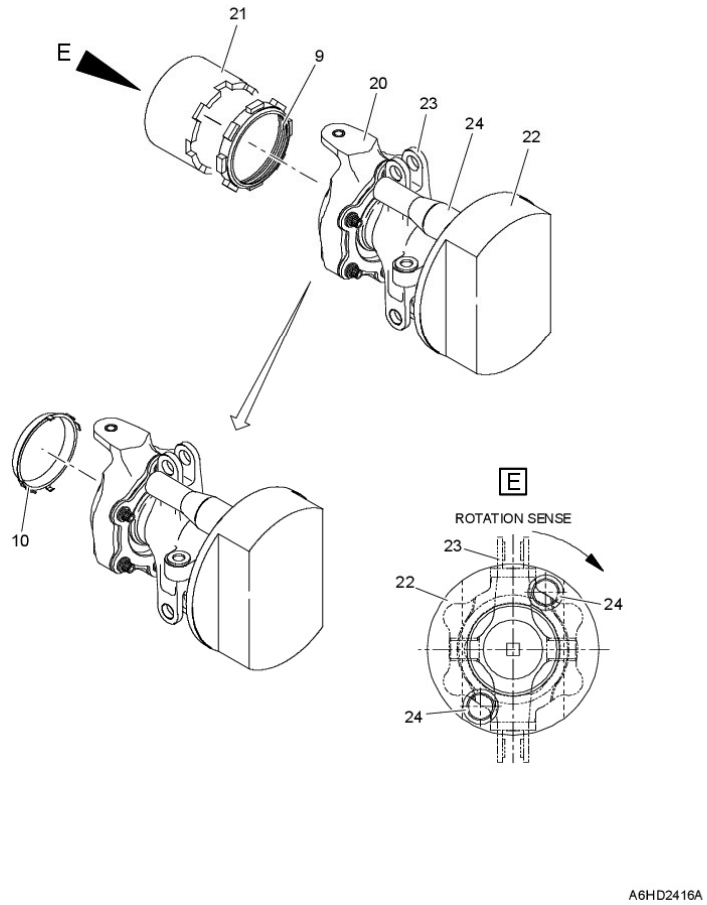


Figure 64-37 (sheet 3 of 5). Housing and slider group - Assemble procedure (Sleeve assy P/N 109G6430A03)



17. Barrel
18. Bushing
19. Pin
20. Housing-slider assembly

Figure 64-37 (sheet 4 of 5). Housing and slider group - Assemble procedure (Sleeve assy P/N 109G6430A03)



20. Housing-slider assembly
21. Wrench
22. Base
23. Brace
24. Pin

Figure 64-37 (sheet 5 of 5). Housing and slider group - Assemble procedure (Sleeve assy P/N 109G6430A03)

ANNEX B

TORQUE WRENCHES – OPERATION

Annex B

Torque wrenches – Operation

Table of contents

List of tables

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References

Table 1 References

Data Module	Title
CSPP-A-20-40-00-02A-711A-D	Threaded fasteners – Tighten procedure – **See Annex C**

Description

1. Use of torque wrench to torque threaded fasteners

1.1. Torque wrench with concentric-type adapter

Refer to Fig 1.

1.2. Torque wrench with non-concentric-type adapter

Refer to Fig 2.

With a non-concentric-type adapter, the point of application of the force has effects on the torque applied to the fastener. Refer to Fig 3 for proper and improper application of the force and their effects.

2. Use of wrench-arc to torque threaded fasteners

2.1. Preliminary instructions

There are four basic procedures to tighten at different degrees: 15°, 30°, 60° and 120°, 90° and 180°. There is also an alternate procedure for the 15° wrench-arc position.

Before you tighten the nut, make sure that all the threads an all the sealing and mating surfaces are clean and free of nicks, burrs and scratches.

Before you start the torque procedure, make sure that the nut is seated tight and not torqued.

The procedures that follow are intended to be done with an open-end wrench with 15° offset angled heads. As alternative, you can use a torque angle gauges adapter to measure the arc.

The nut is tight when:

— You feel a great increase of resistance (more than the run-on torque)

— The parts are properly coupled

— There is no looseness between the mating parts.

2.2. 15° wrench-arc tighten procedure (preferred method)

Refer to Sheet 1 of Fig 4 (View A).

1. Tighten the nut with the open-end wrench.
2. Put the wrench on the nut and set a line of sight in relation to the handle of the wrench.
3. Turn the wrench until the flats of the nut (engaged by the wrench) align with the line of sight set in the Para 1.1.

2.3. 15° wrench-arc tighten procedure (alternate method)

Refer to Sheet 1 of Fig 4 (View B).

1. Tighten the nut with the open-end wrench.
2. Put the wrench on the nut and set a line of sight in relation to the flats of the nut engaged by the wrench.
3. Turn the wrench until the handle align with the line of sight set in the Para 1.1.

2.4. 30° wrench-arc tighten procedure

Refer to Sheet 2 of Fig 4 (View C).

1. Tighten the nut with the open-end wrench.
2. Put the wrench on the nut and set a line of sight in relation to the handle of the wrench.
3. Put the wrench in the opposite position on the same flats of the nut.
4. Turn the wrench until the handle align with the line of sight set in the Para 1.1.

2.5. 60° and 120° wrench-arc tighten procedure

Refer to Sheet 3 of Fig 4 (View D).

1. Tighten the coupling nut with the open-end wrench.
2. Use the corners of the coupling nut with reference to the flats of the union to set a reference point.
3. For 60° wrench-arc, turn the wrench until the first flat of the coupling nut aligns with the reference point.
4. For 120° wrench-arc, turn the wrench until the second flat of the coupling nut aligns with the reference point.

2.6. 90° and 180° wrench-arc tighten procedure

Refer to Sheet 4 of Fig 4 (View E and View F).

1. Tighten the coupling nut with the open-end wrench.
2. For 90° wrench-arc, turn the wrench until the handle is perpendicular to its starting position.
3. For 180° wrench-arc, turn the wrench until the handle points in the opposite direction.

3. Torque instructions

This procedure is applicable to all the fasteners with the locking, breakaway and seating torque values indicated.

If it is not differently specified, you must apply the torque to the nut.

“Self-locking” fasteners: set the torque wrench to the FINAL TORQUE value. The measured LOCKING TORQUE value must be between the given MAXIMUM LOCKING TORQUE and MINIMUM BREAKAWAY TORQUE values.

“Non self-locking” fasteners: set the torque wrench to the SEATING TORQUE value indicated.

3.1. Torque definitions

LOCKING TORQUE value: is the torque necessary to move the nut or bolt along its threaded length after it engages the related locking element, but before it is in contact with the parts that it must assemble.

BREAKAWAY TORQUE value: is the torque necessary to loosen the nut or bolt from its non-loaded position with the locking element engaged.

SEATING TORQUE value: is the torque that sets up the required tensile load in the bolt and locks the parts that must be assembled together.

FINAL TORQUE value: it is the sum of the measured LOCKING TORQUE value and the SEATING TORQUE value.

3.2. Torque procedure

After you assemble the fasteners, do the torque procedure as follows:

1. Make sure that:
   - All the threads of the nut or bolt engage with the related locking element
   - The fasteners are not fully in contact with the parts that you must assemble.

Note

Para 2 and Para 3 are applicable to "self-locking" fasteners. For "non self-locking fasteners skip to Para 4.

2. With the torque wrench, find and record the LOCKING TORQUE value at which you tightened the nut or bolt. Make sure that the measured value is less than the maximum applicable LOCKING TORQUE value, otherwise discard the nut or bolt.

3. With the torque wrench, loosen the nut or bolt to find the measured BREAKAWAY TORQUE value. Make sure that the measured value is more than the minimum applicable BREAKAWAY TORQUE value, otherwise discard the nut or bolt.

4. Calculate the SEATING TORQUE value as the torque that sets up the required tensile load in the bolt and locks the parts that must be assembled together. The SEATING TORQUE value is indicated in the maintenance procedures otherwise, if not specified, please refer to standard torque value written in CSPP-A-20-40-00-02A-711A-D.

5. With the torque wrench, torque the nut or bolt to the FINAL TORQUE value. Calculate the FINAL TORQUE as the sum of the SEATING TORQUE plus the LOCKING TORQUE evaluated above. For standard (“non self-locking”) fasteners the FINAL TORQUE value is equal to the SEATING TORQUE value.

6. Safety the nut or bolt as indicated.

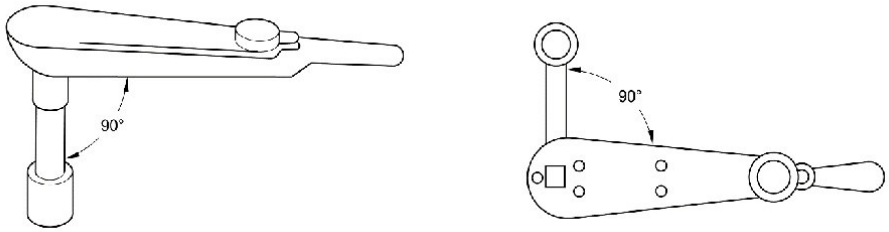

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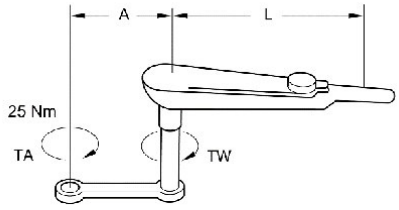
Figure 1 – Torque wrench with concentric-type adapter.

FORMULA TO OBTAIN CORRECT INDICATED TORQUE VALUE WITH NON CONCENTRIC ADAPTER

$$TW = \frac{(TA) \times (L)}{(L) \pm (A)}$$

TW = INDICATED TORQUE VALUE ON TORQUE WRENCH
TA = ACTUAL TORQUE VALUE APPLIED TO FASTENER
L = LEVER LENGTH
A = ADAPTER LENGTH

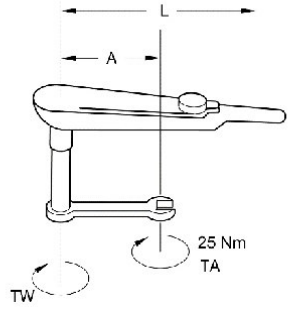
DIMENSIONS
A = 0.05 m
B = 0.04 m
L = 0.30 m



$$TW = \frac{25 \times 0.30}{0.30 + 0.05} = 21.4 \text{ Nm}$$

RESULTS : FASTENER TORQUED TO 25 Nm WHEN WRENCH INDICATES 21.4 Nm

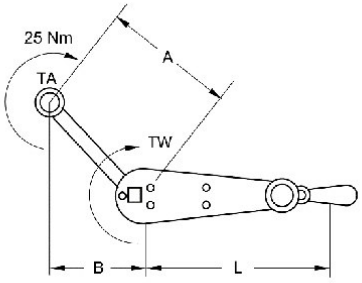
EXAMPLE 1



$$TW = \frac{25 \times 0.30}{0.30 - 0.05} = 30 \text{ Nm}$$

RESULTS : FASTENER TORQUED TO 25 Nm WHEN WRENCH INDICATES 30 Nm

EXAMPLE 2



$$TW = \frac{25 \times 0.30}{0.30 + 0.04} = 22 \text{ Nm}$$

RESULTS : FASTENER TORQUED TO 25 Nm WHEN WRENCH INDICATES 22 Nm

EXAMPLE 3

ICN-CSPP-A-204000-G-00001-00044-A-001-01

Figure 2 – Torque wrench with non-concentric-type adapter.

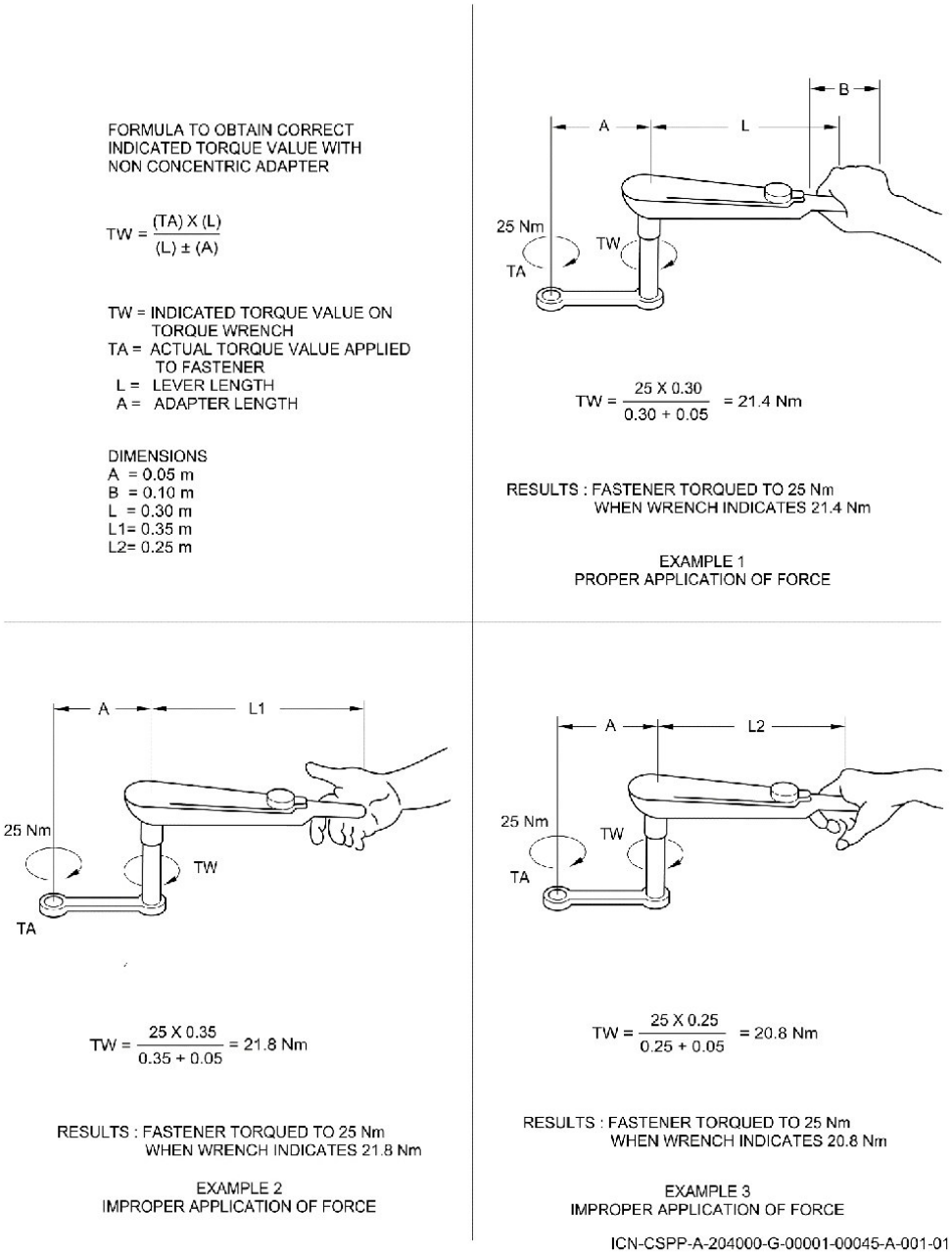


Figure 3 – Torque wrench with non-concentric-type adapter — Effect of force application point.

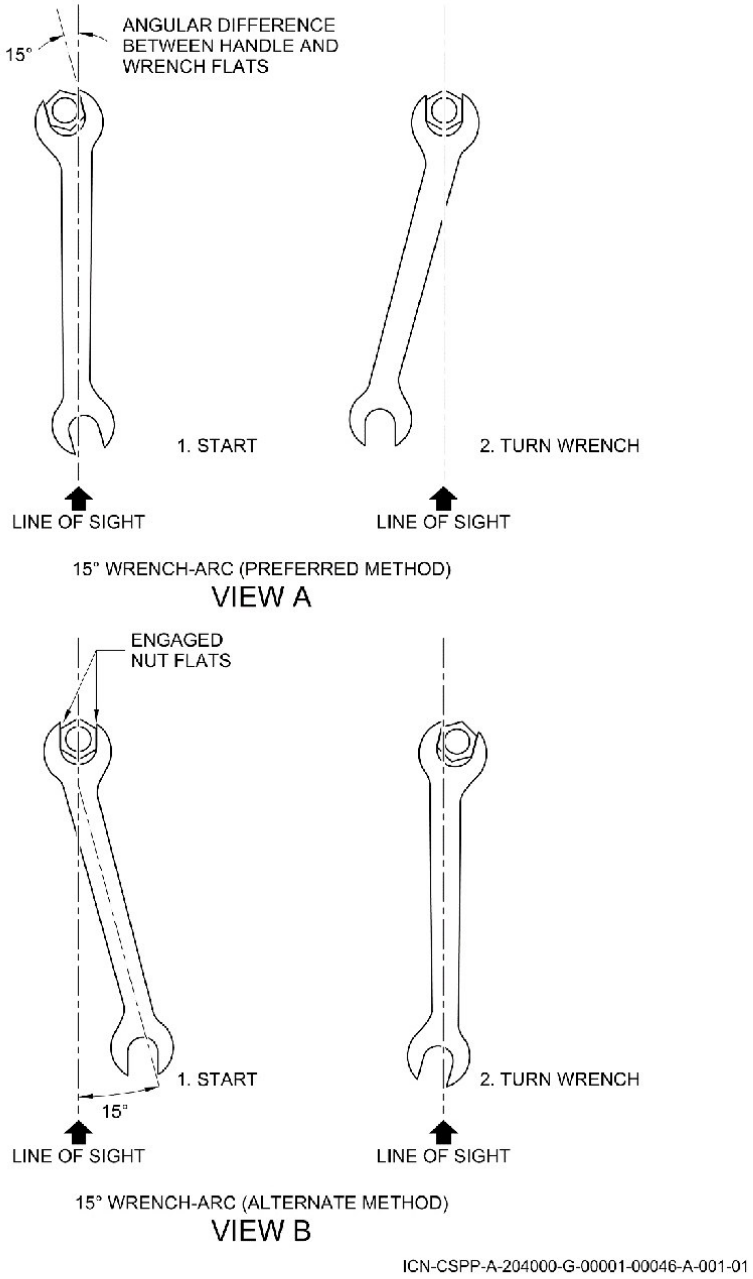


Figure 4 – Wrench-arc method (Sheet 1 of 4).

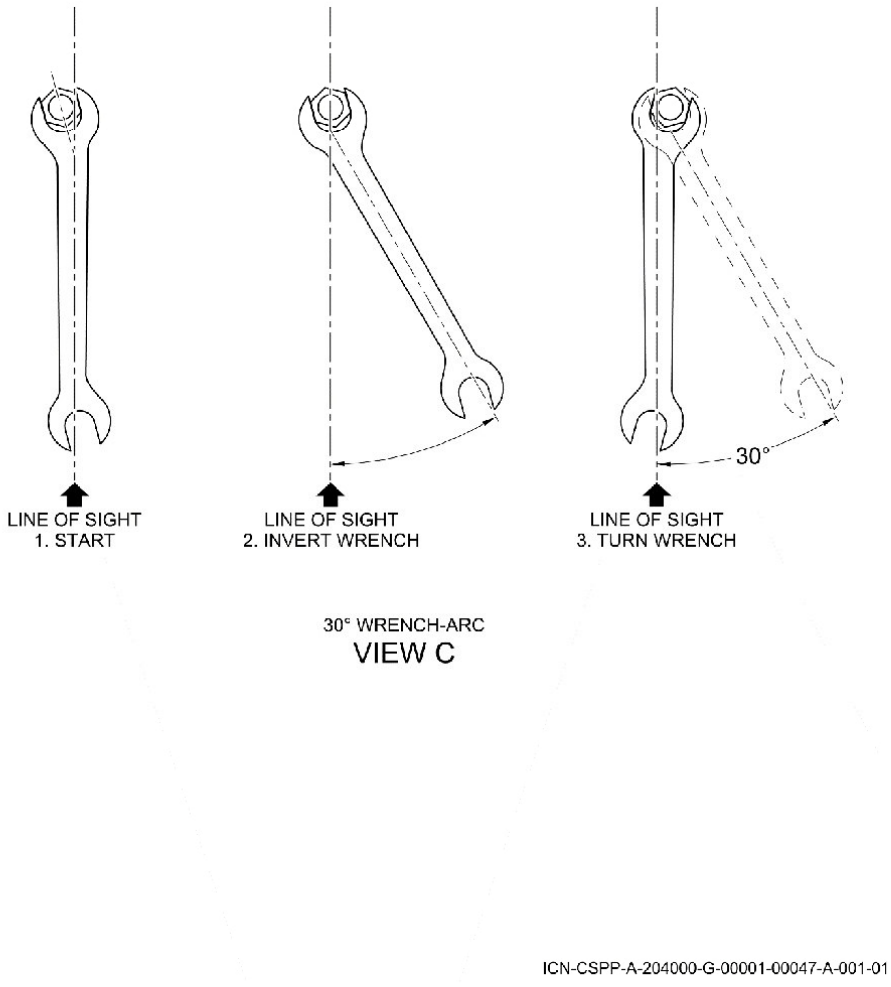


Figure 4 – Wrench-arc method (Sheet 2 of 4).

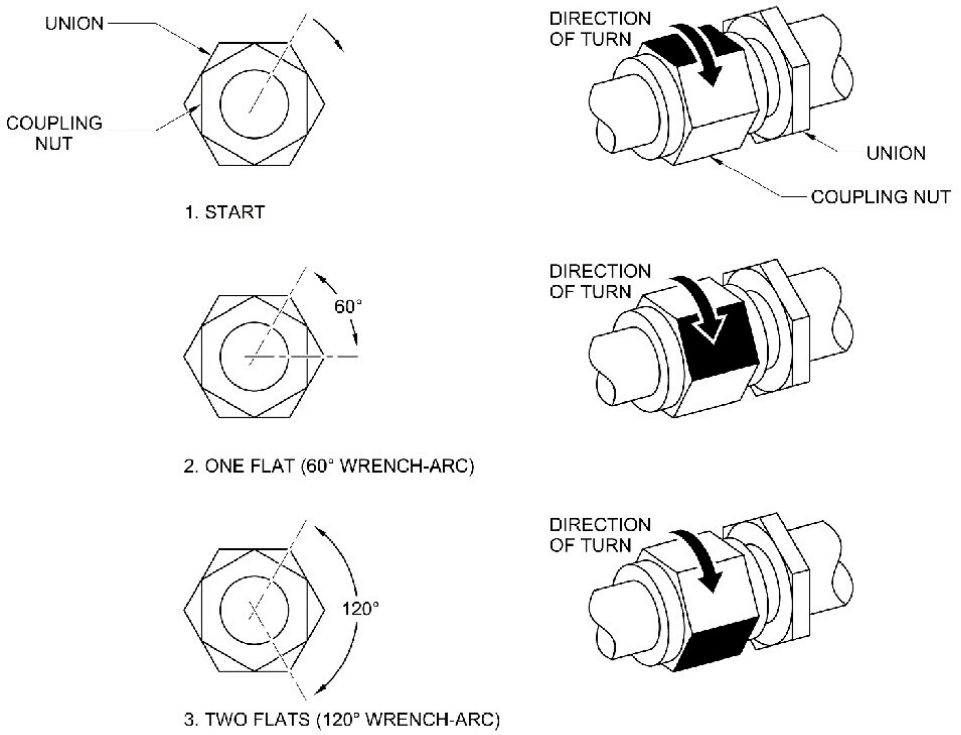
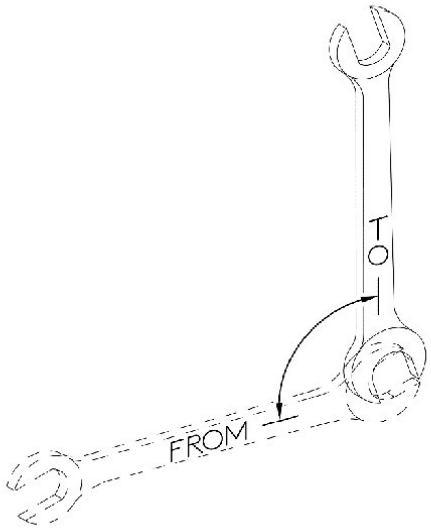
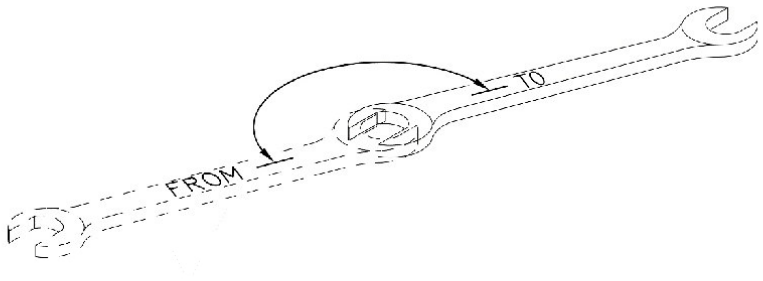


Figure 4 – Wrench-arc method (Sheet 3 of 4).



90° WRENCH-ARC
VIEW E



180° WRENCH-ARC
VIEW F

ICN-CSPP-A-204000-G-00001-00049-A-001-01

Figure 4 – Wrench-arc method (Sheet 4 of 4).

ANNEX C

THREADED FASTENERS – TIGHTEN PROCEDURE

Annex C

Threaded fasteners – Tighten procedure

Table of contents

List of tables

List of figures

References

Table 1 References

Data Module	Title
CSPP-A-20-40-00-01A-100A-D	Torque wrenches – Operation
CSPP-A-20-40-00-05A-691A-D	Assembled parts (Slippage Marks) – Marking

Description

1. Tighten procedures

1.1. General torque informations

This data module supplies the instructions for tighten procedure of threaded fasteners. When a special or a standard torque is necessary for a threaded fastener, the torque value is specified in the applicable procedure. Use the standard torque you find in this data module, when the procedure does not show the torque value.

For the threaded fasteners of critical installations and of flight control system installation, the related procedure must indicate the Seating Torque or the Final Torque together with the Maximum Installation Torque and Minimum Breakaway Torque, if applicable. Refer to Table 2 for the torque definition.

Note

In the installation procedure, if not specified, the indicated torque is the Seating Torque. The Final Torque must be calculated as the sum of measured Installation Torque plus the Seating Torque indicated.

Table 2 Torque definition

Torque definition	Description
Seating Torque	The torque that creates the necessary tensile force in the threaded fastener and attaches the assembled parts.
Installation Torque (or Locking Torque,or Run Down Torque,or Frictional Lock,or Tare Torque)	The torque necessary to move the nut or bolt along a threaded length after the locking device is engaged and/or any residual torque, before you apply the Seating Torque.
Break Out Torque	The torque necessary to "unseat" or move a fastener, in the opposite direction to tightening, after that the Final Torque is applied.
Breakaway Torque	The minimum torque necessary to loosen the nut by a quarter turn from a non-torqued position with the locking device engaged.
Final Torque	The sum of the Installation Torque plus Seating Torque that gives the necessary attach force.
Maximum Final Torque	The Final Torque plus 5% (if not differently specified in the related installation procedure).
Minimum Final Torque	The Final Torque minus 5% (if not differently specified in the related installation procedure).

2. General assembly and maintenance information

2.1. General data

In the threaded connections, the nuts are usually tightened, not the bolt head. In some installations, not easily accessible or when the anchor or the barrel nuts are installed, it can be necessary to apply an increased final torque corresponding to the bolt shank friction torque. Bolt shank friction must be measured with a torque wrench fitted with an indicator (indicator type torque-wrench). The procedure indicates the tightening of the bolt-head, if the nuts cannot be tightened, refer to Para 2.1.1 for the related instructions.

When not specified differently in the related procedure the torque must be applied at increments in the sequence that follows:

— Torque to 70% Final Torque

— Loosen 1½ turns

— Torque to 100% Final Torque

— Torque again to 100% Final Torque until there are no more movement.

Before assembly, fastener threads shall be cleaned of any temporary protective treatment and tightened in a dry (non lubricated) or wet (lubricated) condition.

If not specified differently, dry assembly is chosen.

If applicable, any remaining sealant must be removed after final assembly.

For critical installations, when a threaded connection is part of a critical Assembly, the Vital Point (VP) is indicated in procedure in the torque-application step.

2.1.1. Tightening of bolts from heads

Bolts that have special torque values and are tightened on the head, must have the torque limit increased by the amount corresponding to the bolt shank friction torque.

Bolt shank friction must be measured with a torque wrench fitted with an indicator (indicator type torque-wrench).

2.2. Use of torque wrenches

Refer to data module CSPP-A-20-40-00-01A-100A-D in Annex B.

2.3. Nuts secured with cotter pin

When you tighten the nuts which are secured with a cotter pin, apply the necessary Final Torque in the limits indicated in the applicable torque-value table (when, in the procedure, the Seating Torque is indicated, the Final Torque must be calculated as the sum of the measured Installation Torque plus the Seating Torque):

— When you tighten the nuts, stop the torque load above the Minimum torque value and, if possible, install the cotter pin. If not possible, apply additional torque to get the next cotter-pin hole. Make sure that the torque value is not more than the Maximum torque value indicated.

— It is not permitted to install the cotter pin with the Final Torque more than the Maximum Final torque value, or over-tighten the nut and then loosen it.

— If the nut and cotter pin hole cannot be correctly positioned along the bolt axis by applying the required torque value, the nut shall be removed.

Note

For the flight control system installation, when the torque value is not indicated, refer to the torque values indicated in Para 3 or contact the Design Authority.

2.4. Self-locking nuts

It is not permitted to install self-locking nuts or special double lock-nuts more than one time without the measurement of the Maximum installation torque and Minimum breakaway torque indicated in the related procedure or the applicable torque-value tables. If the indicated torque values cannot be get, the nut must be discarded and replaced.

Self-locking nuts must be assembled without the application of jointing compound or lubrication (dry condition), if not specified differently in the applicable procedure.

2.5. Thread safety limits

After you get the torque value that is 70% final torque, remove the counter-acting wrench and continue to tighten the bolt. If the bolt turns together the nut, check that the bolt is out of the thread safety limits. If necessary, contact the Design Authority.

After the Final torque is applied correctly, the end of the bolt must be not less than the dimension of 1½ full thread pitches from the nut.

2.6. Grip length control

Note

The information given in the paragraphs that follow do not apply to the threaded fasteners of the components of a critical installation with a Vital Point (VP) where the torque check is indicated.

The information that follow apply to the threaded fasteners of all the components of the helicopter if not indicated differently.

2.6.1. General

Because of accumulated tolerance buildups between the structure and the fasteners, grip length adjustment of the bolt or screw is necessary where the grip lengths for standard bolts and screws are used. This adjustment must be done with change of the grip-length of the bolt or screw and/or with the use of flat washers, refer to the data that follow.

2.6.2. Bolts and screws

The standard grip length of bolts and screws can be increased or decreased of only one grip length and only for the reasons that follow:

— To prevent the threads in the structural bearing area. The shanks of structural fasteners must be seated with no threads in the structural bearing area. Do this when the sheet or the fitting adjacent to the nut has a thickness of 2.4 mm (0.094 in) or less. Where the sheet or the fitting adjacent to the nut has a thickness more than 2.4 mm (0.094 in), a maximum of one and half threads (including thread run out) is permitted. Make sure that these threads are not more than 25 % of the total thickness of the structural bearing area.

— To prevent nuts go to the bottom of the bolt or screw shank. The nut threads which engage on the first incomplete thread adjacent to the bolt shank (in a grip oriented fastener), are considered to be bottomed and are not permitted.

— To prevent wrong thread engagement. Full nut thread engagement is required and at least a full turn or chamfer plus a thread pitch of the bolt or screw shall extend from the nut. Bolts and screws with plain ends shall extend through the nut for a minimum length equivalent to two thread pitches.

Note

The grip length adjustment is not permitted where the thread protrusion cannot be seen (studs, fully threaded bolts, or bolts or screws used with inserts, nut plate or barrel nuts).

2.6.3. Washers

Additional washers (NAS1149) of the same alloy as those specified in the related engineering drawing can be used when necessary for the correct installation of nut and cotter pin. Not more than total three washers can be used, two under the nut (for the correct grip length adjustment) and one under the bolt or screw head (for the surface protection), if not specified differently in the related engineering drawing.

If the drawing does not specify the washers position, they can be installed under the item that turns (bolt or screw head or the nut) during tighten operation. The only exception is where one washer is required as material protection under the bolt or screw head.

Note

The replacement of washers (NAS1149) to joints where special washers are installed (chamfered, concave, dissimilar metal, keyed or lock washers) is not permitted.

2.7. V-band clamps installation

For the installation and tightening of V-band clamps refer to the instruction that follow:

- Install the clamp starting to match the v profile between clamp and flanges in the opposite sector of the clamp T-bolt
- Manually wrap the clamp on the flanges
- Measure the Breakaway Torque of the clamp nut
- Set the measured torque as the Installation torque and tighten the nut up to the surface of the clamp boss
- Tap all over the circumference of the clamp using a soft plastic hammer
- Torque again the nut with the same torque value
- Do again the operation until the clamp bolt no longer turns
- Set the wrench to the Final Torque and complete the tightening procedure
- Apply the slippage mark, refer to CSPP-A-20-40-00-05A-691A-D.

Note

The Final torque value is supplied by the clamp manufacturer.

2.8. Vital points

CAUTION

Fasteners of critical installations and flight control installation are flagged with VP (Vital Point).

For the check of the torque value of the threaded fasteners used in Vital Points (VP), these indications are given for the related procedure:

— The maximum Installation Torque and the minimum Breakaway Torque must be measured before the Final Torque is applied. If torque values indicated in procedure cannot be get, the nut or bolt must be replaced.

— To check that the Final Torque is correctly applied to all fasteners of the assembly, at the first application, the current Final Torque must be recorded in the Maintenance history record.

— A Dual inspection must be done. The dual inspection is done before the secondary locking is applied (safety wire, cotter pins, etch)

— The completion of dual inspection must be recorded in the Maintenance history record.

The Maintenance history record includes these data:

— The completion of torque tightening to the necessary torque values,

— The records of dual inspection

— The secondary locking

— The application of slippage marks.

Note

The Grip length control adjustment is not applicable on Vital points. If, in a Vital Point (VP), you find the one of the conditions described in Para 2.6, contact the Design Authority.

3. Torque values for threaded fasteners

3.1. General

The torque values for the threaded fasteners are given in the tables of Fig 1.

The torque values given in the tables are applicable to bolts and screws with different minimum ultimate tensile strengths. Refer to Para 3.2.

Fasteners listed in higher tensile strength categories (sheets 2 thru 5 of Fig 1) may be used in conjunction with fasteners listed in lower tensile strength categories. In those cases the lower category torque range applies, regardless of bolt tensile or nut strength relationship.

3.2. Recommended torque ranges

The torque ranges specified in sheet 1 of Fig 1 are recommended for the indicated nuts on bolts and screws with a minimum ultimate tensile strength of 860 MPa (125000 lbf/in^2).

The torque ranges specified in sheet 2 of Fig 1 are recommended for the indicated nuts on bolts, screws and ring-locked or interference studs with a minimum ultimate tensile strength of 860 MPa (125000 lbf/in^2).

The torque ranges specified in sheet 3 of Fig 1 are recommended for the indicated nuts on bolts and screws with a minimum ultimate tensile strength of 1100 MPa (160000 lbf/in^2).

The torque ranges specified in sheet 4 of Fig 1 are recommended for the indicated nuts on bolts and screws with a minimum ultimate tensile strength of 1240 MPa (180000 lbf/in^2).

The torque ranges specified in sheet 5 of Fig 1 are recommended for the indicated nuts on bolts and screws with a minimum ultimate tensile strength of 1515 MPa (220000 lbf/in^2).

The torque ranges specified in sheet 6 of Fig 1 are recommended for steel and corrosion resisting steel nuts on bolts and screws with a minimum ultimate tensile strength less than 860 MPa (1250000 lbf/in^2).

4. Torque values for studs

The recommended torque values for studs installed with interference are given in the table of Fig 2.

For the torque values of nuts on studs, refer to the table on sheet 2 of Fig 1.

5. Torque values for clamps

The recommended torque range for worm gear clamps on oil, fuel or coolant hose is 2.3 thru 3.3 N m (20 thru 30 lbf in).

The recommended torque range for .1900-32 thread size bolt or screw mounting loop clamps is 1.36 thru 1.69 N m (12 thru 15 lbf in).

6. Torque values for electrical connectors

The installation torque for the connection of mating threaded back accessories shall be obtained by tightening the coupling nut or accessory 1/8 turn past the point of finger tight.

7. Torque values for honeycomb panel inserts

For all bolts coupled with threaded inserts installed on honeycomb panels, refer to the table on Sheet 2 of Fig 1.

8. Torque values for coarse threads

The recommended torque values for coarse threads are given in the table of Fig 3.

9. Index of threaded fasteners

The Table 3 gives the index of the threaded fasteners.

The index lets you find a fasteners in the recommended torque value table when its part number is known.

Table 3 Index of threaded fasteners

Torque definition	Description
48FLW (SPS)	Fig. 1 (sheet 4 of 6)
A106A	Fig. 1 (sheet 1 of 6)
A135A (1)	Fig. 1 (sheet 4 of 6)
A136A (1)	Fig. 1 (sheet 4 of 6)
A258A	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
A389A	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
A407A	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
A423A	Fig. 1 (sheet 2 of 6)
A427A	Fig. 1 (sheet 3 of 6)

Torque definition	Description
A428A	Fig. 1 (sheet 2 of 6)
A436A	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
AN173 thru AN186	Fig. 1 (sheet 1 of 6)
AN173 thru AN186	Fig. 1 (sheet 2 of 6)
AN21 thru 27 (NAS M21 thru 27)	Fig. 1 (sheet 2 of 6)
AN21 thru AN37 (NAS M21 thru 37)	Fig. 1 (sheet 1 of 6)
AN256 (NAS M256)	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
AN3 thru AN20 (NAS M3 thru 20)	Fig. 1 (sheet 1 of 6) - Fig. 1 (sheet 2 of 6)
AN310 (NAS M310)	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
AN315 (NAS M315)	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
AN316 (NAS M316)	Fig. 1 (sheet 2 of 6)
AN320 (NAS M320)	Fig. 1 (sheet 2 of 6)
AN42 thru 49 (NAS M42 thru 49)	Fig. 1 (sheet 2 of 6)
AN42 thru AN49 (NAS M42 thru 49)	Fig. 1 (sheet 1 of 6)
AN502	Fig. 1 (sheet 1 of 6) - Fig. 1 (sheet 2 of 6)
AN525 (NAS M525)	Fig. 1 (sheet 1 of 6) - Fig. 1 (sheet 2 of 6)
EB (ESNA)	Fig. 1 (sheet 4 of 6)
FN22M (SPS)	Fig. 1 (sheet 5 of 6)
LH3393 (ESNA)	Fig. 1 (sheet 5 of 6)
LH3830 (ESNA)	Fig. 1 (sheet 4 of 6)
LH6422t (ESNA)	Fig. 1 (sheet 5 of 6)
LH6520	Fig. 1 (sheet 5 of 6)
LHEB220 (ESNA)	Fig. 1 (sheet 5 of 6)
M87714/1	Fig. 1 (sheet 3 of 6)
M87714/2	Fig. 1 (sheet 3 of 6)
M87714/3	Fig. 1 (sheet 3 of 6)
MA14182 (NAS M14182)	Fig. 1 (sheet 5 of 6)
MS14144 (NAS M14144)	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
MS14145 (NAS M14145)	Fig. 1 (sheet 2 of 6)
MS14156 (NAS M14156)	Fig. 1 (sheet 4 of 6)
MS14157 (NAS M14157)	Fig. 1 (sheet 4 of 6)
MS14163	Fig. 1 (sheet 5 of 6)
MS14164 (NAS M14164)	Fig. 1 (sheet 5 of 6)
MS14181 (NAS M14181)	Fig. 1 (sheet 5 of 6)
MS17825	Fig. 1 (sheet 1 of 6)

Torque definition	Description
MS17826	Fig. 1 (sheet 1 of 6)
MS20004 thru 24 (NAS M20004 thru 24)	Fig. 1 (sheet 3 of 6)
MS20033 thru 20046 (NAS M20033 thru 20046)	Fig. 1 (sheet 2 of 6)
MS20073 (NAS M20073)	Fig. 1 (sheet 1 of 6) - Fig. 1 (sheet 2 of 6)
MS20500	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
MS21025 (NAS M21025)	Fig. 1 (sheet 2 of 6)
MS21042 (NAS M21042)	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6) - Fig. 1 (sheet 4 of 6)
MS21043 (NAS M21043)	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
MS21044 (NAS M21044)	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
MS21047 thru 49 (NAS M21047 thru 49)	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
MS21051 thru 56 (NAS M21051 thru 56)	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
MS21058 thru 62 (NAS M21058 thru 62)	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
MS21069 thru 76 (NAS M21069 thru 76)	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
MS21080 (NAS M21080)	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
MS21083 (NAS M21083)	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
MS21084 (NAS M21084)	Fig. 1 (sheet 5 of 6)
MS21086 (NAS M21086)	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
MS21091	Fig. 1 (sheet 1 of 6) - Fig. 1 (sheet 2 of 6)
MS21133 (NAS M21133)	Fig. 1 (sheet 4 of 6)
MS21134 (NAS M21134)	Fig. 1 (sheet 4 of 6)
MS21225 (NAS M21225)	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
MS21250 (NAS M21250)	Fig. 1 (sheet 4 of 6)
MS21297 (NAS M21297)	Fig. 1 (sheet 5 of 6)
MS24694 (NAS M24694)	Fig. 1 (sheet 1 of 6) - Fig. 1 (sheet 2 of 6)
MS27039 (NAS M27039)	Fig. 1 (sheet 1 of 6) - Fig. 1 (sheet 2 of 6)
MS27576 (NAS M27576)	Fig. 1 (sheet 3 of 6)
MS9088	Fig. 1 (sheet 1 of 6) - Fig. 1 (sheet 2 of 6)
NAS1003 thru 10020	Fig. 1 (sheet 2 of 6)
NAS1021	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
NAS1022	Fig. 1 (sheet 2 of 6)
NAS1023	Fig. 1 (sheet 2 of 6)
NAS1031	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
NAS1033	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
NAS1067	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
NAS1068	Fig. 1 (sheet 2 of 6)

Torque definition	Description
NAS1101	Fig. 1 (sheet 3 of 6)
NAS1102	Fig. 1 (sheet 3 of 6)
NAS1103 thru 1120	Fig. 1 (sheet 3 of 6)
NAS1121 thru 1128	Fig. 1 (sheet 3 of 6)
NAS1131 thru 1138	Fig. 1 (sheet 3 of 6)
NAS1141 thru 1148	Fig. 1 (sheet 3 of 6)
NAS1151 thru 1158	Fig. 1 (sheet 3 of 6)
NAS1161 thru 1168	Fig. 1 (sheet 3 of 6)
NAS1171 thru 1178	Fig. 1 (sheet 3 of 6)
NAS1181 thru 1188	Fig. 1 (sheet 3 of 6)
NAS1189	Fig. 1 (sheet 3 of 6)
NAS1190	Fig. 1 (sheet 3 of 6)
NAS1191	Fig. 1 (sheet 3 of 6)
NAS1202 thru 1210	Fig. 1 (sheet 3 of 6)
NAS1218	Fig. 1 (sheet 3 of 6)
NAS1223 thru 1235	Fig. 1 (sheet 3 of 6)
NAS1266 thru 1270	Fig. 1 (sheet 3 of 6)
NAS1291	Fig. 1 (sheet 3 of 6) - Fig. 1 (sheet 4 of 6)
NAS1297	Fig. 1 (sheet 1 of 6) - Fig. 1 (sheet 2 of 6)
NAS1303 thru 1320	Fig. 1 (sheet 3 of 6)
NAS1351	Fig. 1 (sheet 3 of 6)
NAS1352	Fig. 1 (sheet 3 of 6)
NAS1402 thru 1406	Fig. 1 (sheet 3 of 6)
NAS144 thru 158	Fig. 1 (sheet 3 of 6)
NAS1473	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
NAS1474	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
NAS1580	Fig. 1 (sheet 3 of 6)
NAS1758	Fig. 1 (sheet 5 of 6)
NAS1766	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
NAS1770	Fig. 1 (sheet 3 of 6)
NAS1771	Fig. 1 (sheet 3 of 6)
NAS1773	Fig. 1 (sheet 3 of 6)
NAS1778	Fig. 1 (sheet 3 of 6)
NAS1789	Fig. 1 (sheet 2 of 6)
NAS1791	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)

Torque definition	Description
NAS1792	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
NAS1793	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
NAS1801	Fig. 1 (sheet 3 of 6)
NAS1802	Fig. 1 (sheet 3 of 6)
NAS1804	Fig. 1 (sheet 4 of 6)
NAS1805	Fig. 1 (sheet 3 of 6) - Fig. 1 (sheet 4 of 6) - Fig. 1 (sheet 5 of 6)
NAS1870	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
NAS1972 thru 1980	Fig. 1 (sheet 4 of 6)
NAS2803 thru 2810	Fig. 1 (sheet 4 of 6)
NAS333 thru 340	Fig. 1 (sheet 3 of 6)
NAS428	Fig. 1 (sheet 1 of 6) - Fig. 1 (sheet 2 of 6)
NAS464	Fig. 1 (sheet 3 of 6)
NAS509	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
NAS517	Fig. 1 (sheet 3 of 6)
NAS577	Fig. 1 (sheet 3 of 6) - Fig. 1 (sheet 4 of 6)
NAS583 thru 590	Fig. 1 (sheet 3 of 6)
NAS6203 thru 6220	Fig. 1 (sheet 3 of 6)
NAS623	Fig. 1 (sheet 3 of 6)
NAS624 thru 644	Fig. 1 (sheet 4 of 6)
NAS6303 thru 6320	Fig. 1 (sheet 3 of 6)
NAS6402 thru 6420	Fig. 1 (sheet 3 of 6)
NAS6603 thru 6620	Fig. 1 (sheet 3 of 6)
NAS6703 thru 6720	Fig. 1 (sheet 3 of 6)
NAS673 thru 678	Fig. 1 (sheet 3 of 6)
NAS679	Fig. 1 (sheet 2 of 6) - Fig. 1 (sheet 3 of 6)
NAS6803 thru 6820	Fig. 1 (sheet 3 of 6)
NAS7103 thru 7116	Fig. 1 (sheet 3 of 6)
NAS7203 thru 7216	Fig. 1 (sheet 3 of 6)
NAS7303 thru 7316	Fig. 1 (sheet 3 of 6)
NAS7500 thru 7516	Fig. 1 (sheet 3 of 6)
NAS8100 thru 8106	Fig. 1 (sheet 3 of 6)
NAS8200 thru 8206	Fig. 1 (sheet 3 of 6)
NAS8702 thru 8716	Fig. 1 (sheet 3 of 6)
NAS9101 thru 9106	Fig. 1 (sheet 3 of 6)
NAS9201 thru 9206	Fig. 1 (sheet 3 of 6)

THREAD	TORQUE RANGE - N m (lbf in - lbf ft *)	
	SHEAR	TENSION
	BOLTS AND SCREWS	
	AN173 thru AN186 MS9088 AN3 thru AN20 (NASM3 thru 20) AN42 thru AN49 (NASM42 thru 49) MS20073 (NASM20073) MS27039 (NASM27039) NAS1297	AN502 MS21091 AN21 thru AN37 (NASM21 thru 37) AN525 (NASM525) MS24694(NASM24694) NAS428
	NUTS	
	A106A MS17826	MS17825
.1900-32 (10-32)	0.79 - 1.36 (7 -12)	1.36 - 1.69 (12 -15)
.2500-28 (1/4-28)	2.8 - 3.9 (25 - 35)	3.4 - 4.5 (30 - 40)
.3125-24 (5/16-24)	5.6 - 7.9 (50 - 70)	6.8 - 9.6 (60 - 85)
.3750-24 (3/8-24)	7.9 - 10.2 (70 - 90)	10.7 - 12.4 (95 - 110)
.4375-20 (7/16-20)	12.4 - 17.0 (110 - 150)	30.5 - 33.9 (270 - 300)
.5000-20 (1/2-20)	17.0 - 22.6 (150 -200)	32.5 - 46.1 (24 - 34*)
.5625-18(9/16-18)	22.6 - 33.9 (200 - 300)	54 - 68 (40 - 50*)
.6250-18 (5/6-18)	33.9 - 47.5 (300 - 420)	75 - 88 (55 -65*)
.7500-16 (3/4-16)	61 - 84 (45 - 62*)	146 - 169 (108 - 125*)
.8750-14 (7/8-14)	107 - 130 (79 -96*)	169 - 203 (125 - 150*)
1.0000-12 (1-12)	169 - 203 (125 - 150*)	248 - 373 (183 - 275*)
1.1250-12 (1-1/8-18)	282 - 396 (208 -292*)	339 - 475 (250 - 350*)
1.2500-12 (1-1/4-12)	396 - 509 (292 - 375*)	610 - 746 (450 - 550*)

Refer to para. 2-1.

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Figure 1 – Torque values for threaded fasteners (Sheet 1 of 6).

THREAD	TORQUE RANGE - N m (lbf in - lbf ft *)	
	SHEAR	TENSION
	BOLTS, SCREWS AND ALL THREADED STUDS	
	A428 MS9088 AN21 thru 27 (NASM21 thru 37) MS20033 thru 20046 (NASM20033 thru 20046) MS27039 (NASM27039) NAS1297	AN173 thru AN186 MS21091 AN42 thru 49 (NASM42 thru 49) MS20073 (NASM20073) NAS428 AN502 AN3 thru 20 (NASM3 thru 20) AN525 (NASM525) MS24694 (NASM24694) NAS1003 thru 10020
	NUTS	
	A423A AN316 (NASM316) AN320 (NASM320) MS141545 (NASM14125) MS21025 (NASM21025) MS21083 (NASM21083) NAS1022 NAS1068 NAS1789	A258A A407A MS20500 AN310 (NASM310 MS14144 (NASM14144) MS21043 (NASM21043) MS21047 thru 49 (NASM21047 thru 49) MS21058 thru 62 (NASM21058 thru 62) MS21080 (NASM21080) MS21086 (NASM21086) NAS509 NAS1021 NAS1031 NAS1067 NAS1474 NAS1791 NAS1793 A389A A436A AN256 (NASM256) AN315(NASM315) MS21042 (NASM21042) MS21044 (NASM21044) MS21051 thru 56 (NASM21051 thru 56) MS21069 thru 76 (NASM21069 thru 76) MS21083 (NASM21083) MS21225 (NASM21225) NAS679 NAS1023 NAS1033 NAS1473 NAS1766 NAS1792 NAS1870
.1900-32 (10-32)	1.35 - 1.69 (12 - 15)	2.3 - 2.8 (20 - 25)
.2500-28 (1/4-28)	3.4 - 4.5 (30 - 40)	5.6 - 7.9 (50 - 70)
.3125-24 (5/16-24)	6.8 - 9.6 (60 - 85)	11.3 - 15.8 (100 - 140)
.3750-24 (3/8-24)	10.7 - 12.4 (95 - 110)	18.1 - 21.5 (160 - 190)
.4375-20 (7/16-20)	30.5 - 33.9 (270 - 300)	50 - 57 (37 - 42*)
.5000-20 (1/2-20)	32.5 - 46.1 (24 - 34*)	54 - 79 (40 - 58*)
.5625-18 (9/16-18)	54 - 68 (40 - 50*)	89 - 112 (60 - 83*)
.6250-18 (5/8-18)	75 - 88 (55 - 65*)	123 - 146 (91 - 108*)
.7500-16 (3/4-16)	146 - 169 (108 -125*)	259 - 282 (191 - 208*)
.8750-14 (7/8-14)	169 - 203 (125 - 150*)	282 - 339 (208 - 250*)
1.0000-12 (1-12)	248 - 373 (183 - 275*)	418 - 621 (308 - 458*)
1.1250-12 (1-1/8-18)	339 - 475 (250 - 350*)	564 - 791 (416 - 583*)
1.2500-12 (1-1/4-12)	610 - 746 (450 - 550*)	1017 - 1242 (750 - 916*)

Refer to para. 2-1.

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Figure 1 – Torque values for threaded fasteners (Sheet 2 of 6).

THREAD	TORQUE RANGE - N m (lbf in - lbf ft *)	
	SHEAR	TENSION
	BOLTS, SCREWS AND ALL THREADED STUDS	
	A427A MS20004 thru 24 (NASM2004 thru 2024) NAS464 NAS673 thru 678 NAS1121 thru 1128 NAS1161 thru 1168 NAS1190 NAS1223 thru 1235 NAS1352 NAS1802 NAS6603 thru 6620 NAS7203 thru 7216 NAS8200 thru 8206 M87714/1 MS27576 (NASM27576) NAS517 NAS1101 NAS1131 thru 1138 NAS1171 thru 1178 NAS1191 NAS1266 thru 1270 NAS1402 thru 1406 NAS6203 thru 6220 NAS6703 thru 6720 NAS7303 thru 7316 NAS8702 thru 8716 M87714/2 NAS144 thru 158 NAS583 thru 590 NAS1102 NAS1141 thru 1148 NAS1181 thru 1188 NAS1202 thru 1210 NAS1303 thru 1320 NAS1580 NAS6303 thru 6320 NAS6803 thru 6820 NAS7500 thru 7516 NAS9101 thru 9106 M87714/3 NAS333 thru 340 NAS623 NAS1103 thru 1120 NAS1151 thru 1158 NAS1189 NAS1218 NAS1351 NAS1801 NAS6403 thru 6420 NAS7103 thru 7116 NAS8100 thru 8106 NAS9201 thru 9206	
	NUTS	
	A258A A436A AN310 NASM310) MS21043 (NASM21043) MS21051 thru 56 (NASM21051 thru 21056) MS21080 (NASM21080) MS21225 (NASM21225) NAS1021 NAS1067 NAS1766 NAS1793 A389A MS20500 AN315 (NASM315) MS21044 (NASM21044) MS21058 thru 62 (NASM21058 thru 21062) MS21083 (NASM21083) NAS509 NAS1031 NAS1473 NAS1791 NAS1870 A407A AN256 (NASM256) MS14144 (NASM14144) MS21047 thru 49 (NASM21047 thru 21049) MS21069 thru 76 (NASM21069 thru 21076) MS21086 (NASM21086) NAS679 NAS1033 NAS1474 NAS1792	MS21042 (NASM21042) NAS577 NAS1291 NAS1770 NAS1771 NAS1772 NAS1773 NAS1778 NAS1805
.1900-32 (10-32)	2.3 - 2.8 (20 - 25)	3.4 - 4.5 (30 - 40)
.2500-28 (1/4-28)	5.6 - 7.9 (50 - 70)	8.5 - 10.7 (75 - 95)
.3125-24 (5/16-24)	11.3 - 15.8 (100 - 140)	13.6 - 18.1 (120 - 160)
.3750-24 (3/8-24)	18.1 - 21.5 (160 - 190)	34 - 38 (25 - 28*)
.4375-20 (7/16-20)	50 - 57 (27 - 42*)	53 - 58 (39 - 43*)
.5000-20 (1/2-20)	54 - 79 (40 - 58*)	72 - 96 (53 - 71*)
.5625-18 (9/16-18)	89 - 112 (66 - 83*)	112 - 136 (83 - 100*)
.6250-18 (5/8-18)	123 - 146 (91 - 108*)	157 - 180 (16 - 133*)
.7500-16 (3/4-16)	259 - 282 (191 - 208*)	271 - 293 (200 - 216*)
.8750-14 (7/8-14)	282 - 339 (208 - 250*)	452 - 509 (333 - 375*)
1.0000-12 (1-12)	418 - 621 (307 - 458*)	587 - 791 (433 - 583*)
1.1250-12 (1-1/8-18)	564 - 791 (416 - 583*)	937 - 1164 (691 - 858*)
1.2500-12 (1-1/4-12)	1017 - 1242 (750 - 916*)	1955 - 2181 (1441 - 1608*)

Refer to para. 2-1.

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Figure 1 – Torque values for threaded fasteners (Sheet 3 of 6).

THREAD	TORQUE RANGE - N m (lbf in - lbf ft *)	
	SHEAR	TENSION
	BOLTS AND SCREWS	
	A136A[1] MS14157 (NASM14157) MS21250 (NASM21250) NAS1972 thru 1980	MS21134 (NASM21134) NAS624 thru 644 NAS2803 thru 2810
	NUTS	
	A135A[1] MS21042 (NASM21042) NAS577 NAS1291	MS14156 (NASM14156) MS21133 (NASM21133) NAS1804 NAS1805 EB (ESNA) LH3830 (ESNA) 48FLW (SPS)
.1900-32 (10-32)	2.5 - 3.2 (22 - 28)	3.8 - 5.1 (34 - 45)
.2500-28 (1/4-28)	6.3 - 8.9 (56 - 79)	9.5 - 12.1 (84 - 107)
.3125-24 (5/16-24)	12.6 - 17.8 (111 - 157)	15.2 - 20.3 (134 - 180)
.3750-24 (3/8-24)	20.3 - 24.2 (180 - 214)	38.0 - 43.4 (336 - 384*)
.4375-20 (7/16-20)	57 - 64 (505 - 566*)	60 - 65 (531 - 575*)
.5000-20 (1/2-20)	61 - 73 (45 - 54*)	81 - 108 (60 - 80*)
.5625-18 (9/16-18)	100 - 126 (74 - 93*)	126 - 152 (93 - 112*)
.6250-18 (5/8-18)	138 - 165 (102 - 122*)	176 - 203 (130 - 150*)
.7500-16 (3/4-16)	292 - 317 (215 - 234*)	305 - 330 (225 - 243*)
.8750-14 (7/8-14)	317 - 381 (234 - 281*)	509 - 572 (375 - 422*)
1.0000-12 (1-12)	496 - 698 (346 - 515*)	661 - 890 (487 - 656*)
1.1250-12 (1-1/8-18)	635 - 890 (468 - 656*)	1054 - 1309 (777 - 965*)
1.2500-12 (1-1/4-12)	1145 - 1397 (844 - 1030*)	2199 - 2454 (1621 - 1809*)

Refer to para. 2-1.
[1] Use A135A with A136A

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Figure 1 – Torque values for threaded fasteners (Sheet 4 of 6).

THREAD	TORQUE RANGE - N m (lbf in - lbf ft *)	
	SHEAR	TENSION
	BOLTS AND SCREWS	
	MS14163 MS14181 (NASM14181) MS21297 (NASM21297)	
	NUTS	
	LH6520 NAS1805	MS14164 (NASM14164) MS14182 (NASM14182) MS21084 (NASM21084) NAS1758 FN22 M (SPS) LH3393 (ESNA) LH6422 (ESNA) LHEB220 (ESNA)
.1900-32 (10-32)	3.2 -3.8 (28 - 34)	4.6 - 6.2 (41 - 55)
.2500-28 (1/4-28)	7.8 - 10.8 (69 - 95)	11.6 - 14.8 (103 - 131)
.3125-24 (5/16-24)	15.6 - 21.7 (138 - 192)	18.6 - 24.9 (165 - 220)
.3750-24 (3/8-24)	24.9 - 29.5 (220 - 261)	46.1 - 51.5 (408 - 456)
.4375-20 (7/16-20)	69 - 79 (51 - 58*)	73 - 80 (54 - 59*)
.5000-20 (1/2-20)	75 - 108 (55 - 80*)	99 - 132 (73 - 98*)
.5625-18 (9/16-18)	123 - 155 (91 - 114*)	155 - 187 (114 - 138*)
.6250-18 (5/8-18)	170 - 201 (125 - 148*)	217 - 248 (160 - 183*)
.7500-16 (3/4-16)	357 - 388 (263 - 285*)	373 - 403 (275 - 297*)
.8750-14 (7/8-14)	388 - 467 (286 - 344*)	621 - 700 (458 - 516*)
1.0000-12 (1-12)	575 - 854 (424 - 630*)	807 - 1088 (595 - 802*)
1.1250-12 (1-1/8-18)	776 - 1088 (572 - 802*)	1287 - 1601 (950 - 1181*)
1.2500-12 (1-1/4-12)	1398 - 1709 (1031 - 1260*)	2687 - 2999 (1962 - 2218*)

Refer to para. 2-1.

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Figure 1 – Torque values for threaded fasteners (Sheet 5 of 6).

THREAD	TORQUE RANGE N m (lbf in)
.1900-32 (10-32)	0.45 - 0.68 (4.0 -6.0)
.2500-28 (1/4-28)	1.1 - 1.7 (10.0 - 15.0)
.3125-24 (5/16-24)	2.4 - 3.5 (21 - 31)
.3750-24 (3/8-24)	3.8 - 4.5 (34 - 40)
.4375-20 (7/16-20)	11.0 - 12.2 (97 - 108)
.5000-20 (1/2-20)	11.6 - 16.6 (103 -147)

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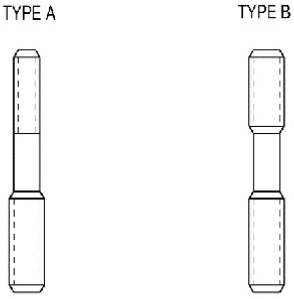
Figure 1 – Torque values for threaded fasteners (Sheet 6 of 6).



THREAD		TORQUE RANGE - N m (lbf in - lbf ft *)	
NUT END [1]	STUD END	TYPE A	TYPE B
.1900-32 (10-32)	.1900-24 (10-24)	--------	3.4 - 4.5 (30.1 - 39.8)
	.2500-20 (1/4-20)	3.4 - 4.5 (30.1 - 39.8)	3.4 - 4.5 (30.1 - 39.8)
.2500-28 (1/4-28)	.2500-20 (1/4-20)	5.6 - 10.7 (50 - 95)	5.6 - 7.9 (50 - 70)
	.3125-18 (5/16-18)	5.6 - 12.4 (50 - 110)	5.6 - 9.0 (50 - 80)
.3125-24 (5/16-24)	.3125-18 (5/16-18)	11.3 - 25.4 (100 - 225)	11.3 - 14.7 (100 - 130)
	.3750-16 (3/8-16)	11.3 - 27.1 (100 - 240)	11.3 - 18.1 (100 - 160)
.3750-24 (3/8-24)	.3750-16 (3/8-16)	19.8 - 42.4 (175 - 375)	19.8 - 28.2 (175 - 250)
	.4375-14 (7/16-14)	19.8 - 53.7 (175 - 475)	19.8 - 36.7 (175 - 325)
.4375-20 (7/16-20)	.4375-14 (7/16-14)	27.1 -73.2 (240 - 648)	28.2 - 45.2 (249 - 400)
	.5000-13 (1/2-13)	27.1 - 81.4 (240 - 720)	28.2 - 59.3 (249 -525)
.5000-20 (1/2-20)	.5000-13 (1/2-13)	44.8 - 112.6 (33 - 83*)	44.8 - 78.7 (33 - 58*)
	.5625-12 (9/16-12)	44.8 - 128.9 (33 - 95*)	44.8 - 95.0 (33 - 70*)
.5625-18 (9/16-18)	.5625-12 (9/16-12)	67.8 - 162.8 (50 - 120*)	55.6 - 118.0 (41 - 87*)
	.6250-11 (5/8-11)	67.8 - 185.8 (50 - 137*)	67.8 - 128.9 (50 - 95*)
06250-18 (5/8-18)	.6250-11 (5/8-11)	101.7 - 225.2 (75 -166*)	78.7 - 157.3 (58 - 116*)
	.6875-11 (1-1/16-11)	101.7 - 271.3 (75 - 200*)	101.7 - 191.3 (75 - 141*)

[1] To torque the nuts see Fig. 1

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Figure 2 – Torque values for studs.

THREAD	TORQUE RANGE - Nm (lbf in - lbf ft*)
.1900 - 24 (10 - 24)	1,36 - 1,69 (12.1 - 15.0)
.2500 - 20 (1/4 - 20)	2,9 - 3,3 (25 - 30)
.3125 - 18 (5/16 - 18)	5.5 - 6.2 (48 - 55)
.3750 - 16 (3/8 - 16)	10.8 - 12.4 (95 - 110)
.4375 - 14 (7/16 - 14)	15.9 - 17.5 (140 - 155)
.5000 - 13 (1/2 - 13)	27.2 - 32.7 (240 - 290)
.5625 - 12 (9/16- 12)	33.9 - 47.4 (300 - 420)
.6250 - 11 (5/8 - 11)	47.5 - 61 (420 - 540)
.7500 - 10 (3/4 - 10)	80 - 107 (58 - 79*)
.8750 - 9 (7/8 - 9)	147 - 203 (108 - 150*)
1.0000 - 8 (1 - 8)	249 - 338 (184 - 250*)
1.1250 - 7 (1 - 1/ 8 - 7)	337 - 451 (275 - 333*)
1.2500 - 7 (1 - 1/ 4 - 7)	452 - 564 (333 - 416*)
NUTS	All threaded nuts, inserts and tapped holes
BOLTS AND SCEWS	All

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Figure 3 – Torque values for studs.

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Customer Name and Address:	Telephone:
	Fax:
	B.T. Compliance Date:

Helicopter Model	S/N	Total Number	Total Hours	T.S.O.

Remarks:

Information:

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