

**REDEGØRELSE**

|                         |                            |                    |                         |
|-------------------------|----------------------------|--------------------|-------------------------|
| <i>HCLJ 510-2011-17</i> |                            | Registrering:      | OY-NLA                  |
| Luftfartøj:             | Cessna Citation 650        | Flyvning:          | Taxaflyvning, IFR       |
| Motorer:                | 2 – Garrett TFE731-3C-100C | Passagerer:        | 2 – ingen tilskadekomst |
| Besætning:              | 2 – ingen tilskadekomst    | Dato og tidspunkt: | 27.9.2011 kl. 1048 UTC  |
| Sted:                   | Københavns lufthavn, EKCH  |                    |                         |

**Indholdsfortegnelse**

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Luftfartsenheden for Havarikommissionen (HCLJ) modtog melding om hændelsen fra Kontrolcentralen i Københavns lufthavn (EKCH) d. 27. september 2011 kl. 1110 UTC.

**Faktuelle forhold***Flyvningens forløb*

Flyvningen, hvorunder hændelsen indtraf, var en taxaflyvning fra Københavns Lufthavn (EKRK) til Antwerpen (EBAW). Efter starten fra bane 22L og i en højde af ca. 350 fod, hvor flaps blev valgt ind, begyndte luftfartøjet at krænge mod venstre. Efterhånden som flaps kørte ind blev krængningen mere og mere markant. Fartøjschefen prøvede at trimme krængningen væk med ailerontrim, men det havde kun en mindre effekt på krængningen. Han måtte holde kontrollhjulet for aileron (balance klapperne) til fuld højre krængning for at holde luftfartøjets vinger horisontalt. Samtidigt holdt han luftfartøjets flyvefart nede på 190 knob for ikke at udsætte flaps for overspeed, idet han ikke umiddelbart kendte positionen af flaps.

Styrmanden meddelte fartøjschefen, at ”flaps inop” annunciator lyset var tændt, og flaps indikeringen viste at flaps ikke var helt oppe, men ca. 2 grader ude.

Styrmanden informerede kontrolltårnet i EKCH om deres flaps problemer og bad om at returnerer tilbage til EKCH. Luftfartøjet blev radardirigeret ind i et venstre drej i en højde på 2000 fod for en anflyvning til bane 22L. Under drejet blev luftfartøjet af ATC tilbudt at lande på bane 30, som blev accepteret af fartøjschefen, idet flyvningen ville blive kortere og tværvindskomponenten var mindre på denne bane.

Luftfartøjet landede ca. 4 minutter efter starten med Vref 0 flaps på bane 30 uden yderligere problemer.

Efter landingen blev det visuelt konstateret, at de venstre vingeflaps var oppe, mens højre inderste og midterste vinge flaps delvist sad i ca. 20 graders position og yderste flap var kørt helt op.

Hændelsen indtraf i dagslys og under visuelle meteorologiske vejrforhold (VMC).

#### *Oplysninger om personel*

Fartøjschef - mand - 41 år, var indehaver af et dansk udstedt JAR ATPL (A) Airline Transport Pilot Licence med påtegningen C 650 og C 500/550 gyldigt til henholdsvis d. 30.4.2012 og 31.10.2011. Den helbredsmæssige godkendelse (klasse 1) var gyldig indtil d. 25.8.2012

Flyvetidsopgørelse

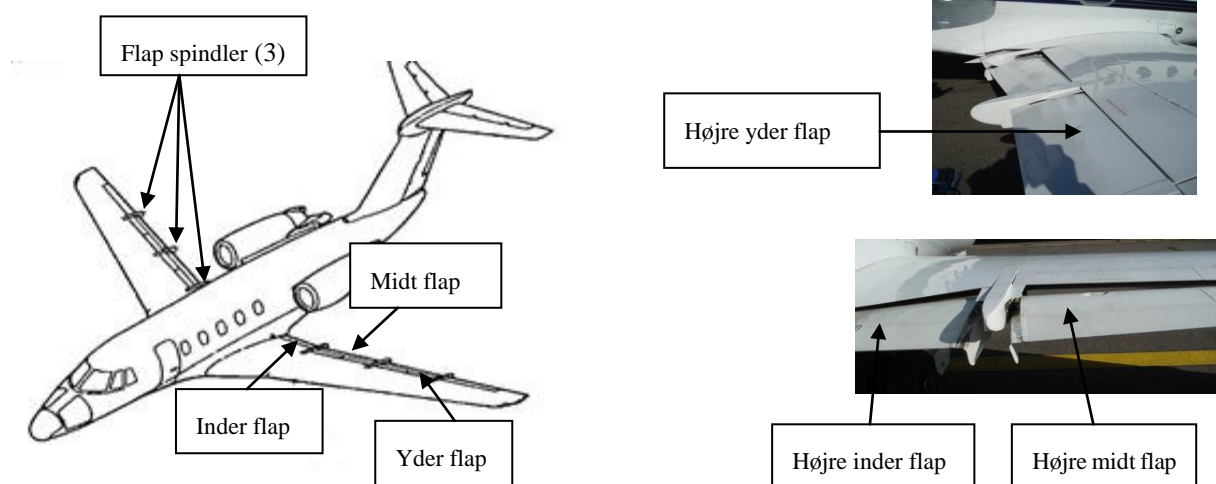
|                    | Sidste 24 timer | Sidste 90 dage | Total |
|--------------------|-----------------|----------------|-------|
| Alle typer:        | 4,5             | 108            | 4001  |
| Denne klasse/type: | 4,5             | 108            | 1201  |
| Antal landinger:   | 4               | 63             |       |

#### *Meteorologiske oplysninger*

Vind: 320° 7kt, > 10 km sigt, temperatur 16 C°, dugpunkt 10 C°, QNH 1028 hPa, Skyer få i 2500 ft.

#### *Beskrivelse af luftfartøjets flapsystem*

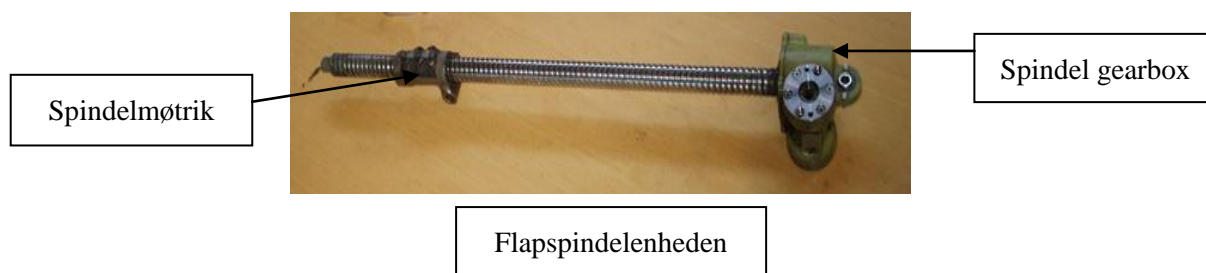
Denne flytype var udstyret med et flaps asymmetrisk system, som skulle stoppe flaps bevægelse, hvis der blev uoverensstemmelse med flap positionen mellem venstre og højre vingeflaps. Følerne (sensorerne) som registrerede uoverensstemmelse mellem venstre og højre flaps var placeret på de yderste flaps. Endvidere var luftfartøjet udstyret med et beskyttelsesystem, en elektrisk overbelastningssikring (current limiter) som skulle stoppe flaps bevægelse, hvis der blev for stor modstand i den mekaniske del af flapssystemet. Den ville samtidig tænde ”flaps inop ” lyset i cockpittet. Ingen af beskyttelsessystemerne havde stoppet flapbevægelsen umiddelbart og derved ikke forhindre at luftfartøjet kom i en kritisk flyvekontrol situation. Da begge yder flaps var oppe, havde det asymmetriske system ikke følt en difference på de øvrige flaps positioner og derfor ikke aktiveret beskyttelsessystemet og standset flaps. Fokus på den tekniske undersøgelse blev derfor koncentreret om, hvorfor den elektriske sikring til flapsmotoren havde aktiveret for sent.



*Teknisk undersøgelse*

Ved undersøgelsen blev det konstateret, at højre inder flap og midter flap var mekaniske fastlåst ca. 20° fra flap op positionen. Højre yder flap var kørt til op position, det samme gjaldt venstre vinges inder - midt -og yder flaps.

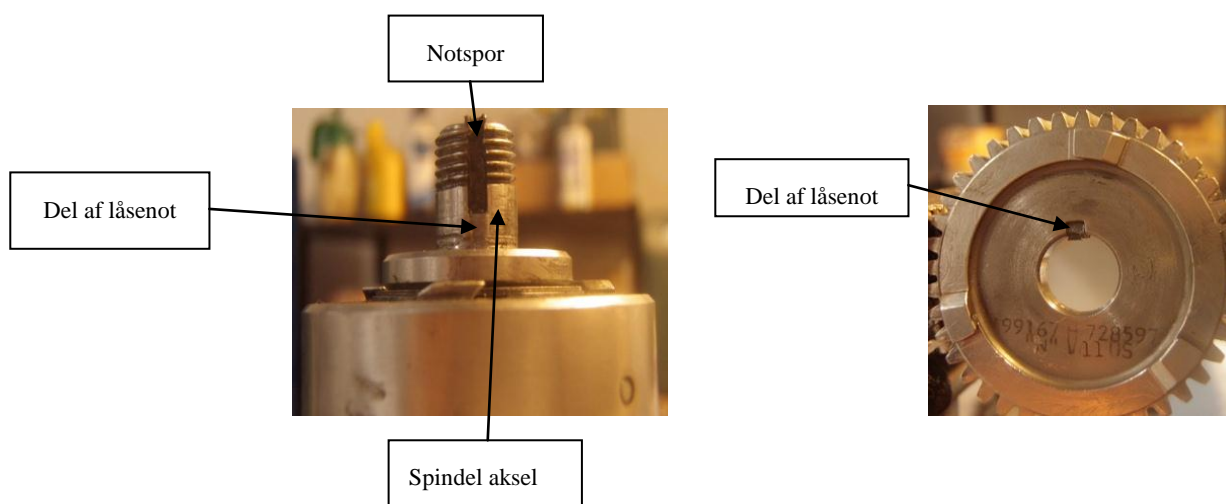
Det blev afdækket at højre flapspindel (ballscrew), som var forbundet med en spindelmøtrik (ballscrew nut) til højre del af højre inder flap og venstre del af højre midt flap ikke kørte når flapsystemet blev aktiveret. Det kunne endvidere konstateres, at flapsystemet kørte let og den mekaniske modstand var indenfor fabrikantens specifikationer.



Flapspindlen var monteret på luftfartøjet i 1998 og havde akkumuleret ca. 3300 flyvninger.

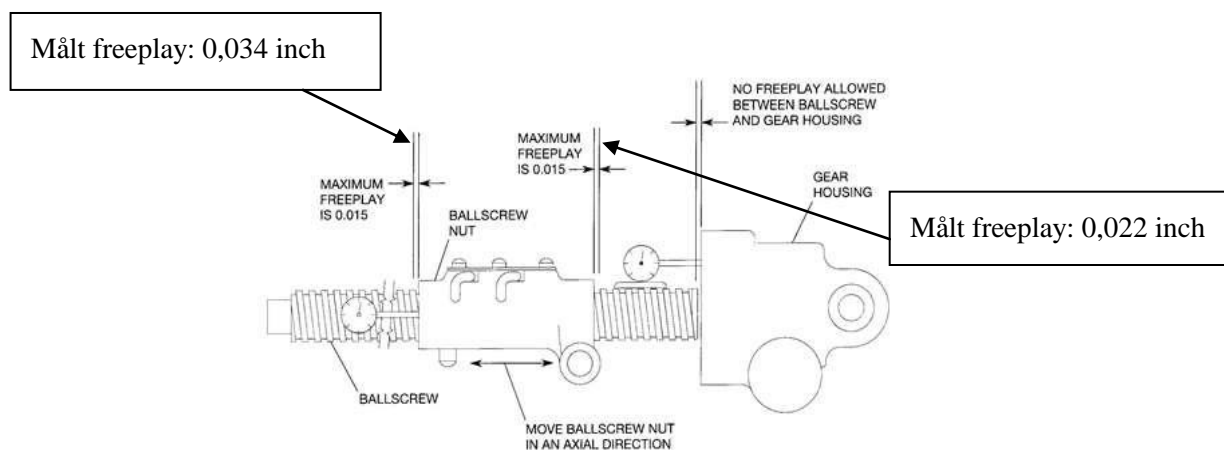
Ved adskillelsen af spindel gearboxen blev det konstateret, at gearboxen var velsmurt og fedtet var af god kvalitet. Det kunne afdækkes at tandhjulet som overførte flapsystemets bevægelse til flap spindelen kunne drejets, uden at spindelen fulgte med.

Tandhjulet blev demonteret fra spindel akselen og det kunne afdækkes at låsenoten som låste tandhjulet med spindel akselen var knækket.



Brudfladen på låsenoten viste tegn på overbelastningsbrud. Da flapsene kunne køre frit uden nævneværdig modstand, blev flapspindlen og flapspindelmøtrikken undersøgt for general slidtage. Det kunne konstateres visuelt, at frigangen (freeplay) var anseelig både aksialt og radially. I flapspindelmøtrikken var der et antal stålkugler som overførte rotationskræfterne fra spindelrotationen i flapspindelmøtrikken til bevægelse af flapsene.

I. H. T. fabrikantens forskrifter var maksimum tilladte aksial freeplay mellem flapspindel og flapspindelmøtrikken 0,015 inch (0,385 mm). Udmålingen af freeplay afdækkede et aksialt freeplay, henholdsvis væk fra gearboxen på 0,022 inch (0,57 mm) og i modsat retning 0,034 inch (0,870 mm). Et radiale freeplay var tilladt, hvis det aksiale freeplay var indenfor fabrikantens begrænsninger (0,385mm). Der blev ikke konstateret freeplay mellem flapspindlen og gearboxen.



### *Inspektioner og vedligeholdelse af flapsystemet*

Dagen før hændelsen havde flapsystemet været fejlmeldt efter en flyvning, hvor ”flap inop” annunciator lyset var tændt og flaps bevægelsen var stoppet ved flap 7° positionen. Operatørens vedligeholdelsesværksted udførte en flaps inspektion i.h.t fabrikantens forskrifter (Maintenance Manual) (se bilag 1), som bl.a. indeholdt en visuel inspektion, check af flap track/flap spindlernes smøretilstand, udmåling af flaps slid tolerancer og funktions check. Current limiteren blev tillige udskiftet, hvilket skulle udføres når denne har været aktiveret.

Der blev ikke afdækket fejl eller slidtage på flapsystemet, som overskred fabrikantens tolerancer og luftfartøjet blev frigivet til videre flyvning.

Mellem værkstedsbesøget og hændelsen havde luftfartøjet fløjet en flyvning fra Ålborg (EKYT) til EKCH uden anmærkninger på flapsystemet.

### **Analyse**

Undersøgelsen af flapsystemet afdækkede at flapspindelen og flapspindelmøtrikkens freeplay var væsentlige over de i fabrikantens foreskrevne begrænsninger. Det er Havarikommissionens vurdering at flapspindelmøtrikken havde sat sig fast i flapspindlen ved begge hændelser. Ved den første hændelse havde current limiteren fungeret korrekt og deaktiverede hele flaps bevægelsen på grund af for stor modstand i flapsystemet. Ved den anden hændelse satte flapsmøtrikken sig fast igen, men forårsagede samtidigt at låsenoten mellem tandhjulet og spindelen i gearboxen blev revet over. Den kortvarige modstand i flapsystemet hvor flapsmøtrikken havde sat sig fast, til at låsenoten blev brudt var ikke nok til at aktivere current limiteren. Current limiteren havde først aktiveret, da højre inder flap kørte skævt op med den inderste flapspindel, så flapsen gik fast i vingestrukturen og flapspererne (flap track)

Havarikommissionen vurderer, at hændelsen indtraf, fordi højre inder og midt flapspindelrotationen blev låst af flapspindelmøtrikken. Som følge af at flapspindelen blev låst og current limiteren ikke frakoblede flapbevægelsen umiddelbart, blev låsenoten brudt i flaps gearboxen. Flapbevægelsen fortsatte frem til at højre inder og midt flap mekanisk blev trukket skævt ind i vingestrukturen, hvor current limiteren afbrød strømmen til flapmotoren.

En flap inspektion blev udført i.h.t fabrikantens Maintenance Manual, en flyvning før hændelsen. Inspektionen blev udført som følge af at flapsystemet var fejlmeldt, fordi flapsene stoppede bevægelsen ved 7°, hvor også flap ”inop” lyset tændte.

### **Konklusion**

Havarikommissionen kan konkludere, at de faktiske afdækkede forhold viste at flapspindlen og flapmøtrikken var slidte ud over fabrikantens specifikationer og dermed ikke var i overensstemmelse med luftfartøjets inspektionsforskrift (Maintenance Manual).

**DC FLAP SYSTEM- INSPECTION/CHECK****Task 27-54-00-720****1. Flap Control System Functional Check**

**NOTE:** Complete this functional check with the aircraft on jacks.

**A. Access**

- (1) Remove panels 173AB, 174AB, 173DB, 174DB and the flap island fairings. Refer to Chapter 6, Access Plates and Panels Identification - Description and Operation.

**B. Tools.**

- (1) External Power - MH32-200K24M or Equivalent
- (2) Hydraulic Service Unit - 05-7012-1200 or Equivalent
- (3) Nose Jack - 02-0526-0110
- (4) Main Jacks - 02-1032-0111
- (5) Jack Pads - 5520151-2
- (6) Simulator, Squat Switch (650-0001 - 0113) - CJMD312-002 or Equivalent
- (7) Simulator, Squat Switch (650-0114 and On) - CJMD312-005 or Equivalent
- (8) Pitot/Static System Tester - Type MB-1 (MIL-T-8076) or Equivalent
- (9) Vernier Inclinator - TB108 or Equivalent
- (10) Digital Voltmeter
- (11) Gearbox Holding Fixture - CJMD327-100
- (12) Torque Wrench (Inch-Pounds)

**C. Operational Check of the Flap System.**

**NOTE:** There are four separate and distinct flap systems on the Model 650, based on serial number effectivity and by the Service Bulletins and/or Modifications that are completed. However the basic steps and intent of the test(s) for the different systems stay the same. This operational check gives a basic check of the system after the flap angle drive gearboxes are installed.

**WARNING: Make sure that all personnel and equipment are clear before you move flaps. This will help to prevent serious injury to personnel or damage to the airplane or equipment.**

- (1) Put the BATT switch to ON and the rotary test switch to the OFF position.
- (2) Engage the FLAP CONTROL, FLP/SPLR IND, and WARN LTS 2 circuit breakers.
  - (a) Preflight Test.
    - 1 Put the airplane rotary test switch to the TRIM/FLAPS position. The FLAPS INOP light must come on for approximately 6 seconds, and then go off.
    - 2 Put the rotary switch to OFF. The FLAPS INOP annunciator must stay off.
  - (b) 7-Degree Extend Position Check.
    - 1 Put the flap control lever to the 7-degree position and the flap panels must extend to the 7-degree position.
 

**NOTE:** Flap position indicator must display 7 degrees, +2.5 or -2.5 degrees (looking straight down the indicator).
  - (c) 20-Degree Extend Position Check.
    - 1 Put the flap control lever to the 20-degree position and the flap panels must extend to the 20-degree position.
 

**NOTE:** Flap position indicator must display 20 degrees, +2.5 or -2.5 degrees (looking straight down the indicator).
  - (d) FULL Position Check
    - 1 Put the flap control lever to the FULL position and the flap panels must extend to the FULL position.
 

**NOTE:** The flap position indicator must display FULL, +2.5 or -2.5 degrees.

**NOTE:** At the full up position, all six flap panels must compress the gap seal on both lower wing surfaces, but not touch the structure. If an adjustment is necessary, refer to Chapter 27, DC Flap System - Adjustment/Test for full flap mechanical rigging procedure.

- D. Examine the Flap Inboard and Outboard Yoke Function.

**WARNING:** Make sure that no hydraulic power is supplied to the airplane, spoiler hold down accumulator is bled and that the AUX HYDRO PWR SWITCH is taped to the OFF position during this check. This will prevent inadvertent lowering of the spoilers/speedbrakes.

**WARNING:** Spoiler hold down will be initiated by auxiliary hydraulic pump automatically switching on when system pressure decays if switch is set to NORM. Whenever maintenance or inspections are to be completed in the area of the spoiler/speedbrake panels, AUX HYD PUMP circuit breaker must be disengaged and spoiler hold down accumulator bled off. Auxiliary pump is connected directly to battery buss, so setting battery switch OFF will not protect against inadvertent operation.

- (1) Examine the Flap Movement and Look for Possible Interference.

**CAUTION:** Make sure that all personnel and equipment are clear of flaps when they are to be retracted or extended.

**NOTE:** Items (a) and (b) may be accomplished simultaneously.

- (a) Examine the Flap Movement and Interference as follows:

- 1 Place battery switch to the BATT position and engage FLAP POWER, FLAP CONTROL, FLP/SPLR IND and WARN LTS 2 circuit breakers.
- 2 Operate Flaps to UP, 7 Degrees, 20 Degrees and FULL positions with pauses between each position. Sequence is not critical as long as transition to each position is observed.
- 3 During each transition observe the flap panels for smooth movement without evidence of binding.
- 4 Examine for interference of outboard and inboard ends of flap panels and fairings with adjacent islands and fairings.
- 5 Examine the leading edge of flap panels for interference with wing trailing edge components during the UP transition.
- 6 Repeat Steps 1.J. (1)(a), 1 through 5 for all panels.

- (2) Examine the Inboard and Outboard Yoke Function.

**NOTE:** The following steps require qualified maintenance personnel with positive communications between them, in the cockpit to the flap system and outside the aircraft to inspect for yoke function and interference during operation.

- (a) Examine the Inboard and Outboard Yoke Function as follows:

- 1 Place battery switch to the BATT position and engage FLAP POWER, FLAP CONTROL, FLP/SPLR IND and WARN LTS 2 circuit breakers.
- 2 Operate flaps to the UP, 7 Degrees, 20 Degrees and FULL positions with pauses between each position. Sequence is not critical as long as transition to each position is observed.
- 3 During each transition, observe inboard and outboard yokes on flap panels for smooth movement and freedom of binding.
- 4 Examine for interference of yokes and adjacent carriage assemblies, flap panel hardware and flap island fairings.
- 5 Repeat Steps (a) 1 through 4 for each set of flap panel yokes.

- E. Examine the Flap Trailing Edge Freeplay.

**NOTE:** The following procedure provides for measurement of the amount of free play at the trailing edge of each flap. This procedure applies to all flaps.

**NOTE:** Flap trailing edge free play or looseness is not necessarily an indication of too much wear or an unsafe condition. The accumulation of normal tolerances in tracks, rollers, bearings and fasteners may result in free play of the trailing edge.

**CAUTION:** Make sure that all personnel and equipment are clear of flaps and flap tracks before moving flaps.

- (1) Complete the flap trailing edge freeplay check as follows:
  - (a) Place the flaps in the 7-degree position.
  - (b) Apply approximately 20 pounds of force up and down at the trailing edge of each flap, with the force applied perpendicular to the flap surface. Refer to Figure 601. Measure the amount of total movement at the trailing edge. Use a rigid stand or a device temporarily mounted to the flap island or wing as a reference point for the measurement. Maximum amount of free play is 0.25 inches (6.35 mm). If the amount of free play is 0.25 inches (6.35 mm), then the flap linkage must be inspected to determine the cause of excessive free play.
  - (c) If flap trailing edge freeplay is excessive;
    - 1 inspect the inner and outer elastomeric bearings for inner or outer race separation.
    - 2 If inner or outer race separation is found, the elastomeric bearings must be replaced.
    - 3 Small cracks in the bearing rubber are permissible.

- (2) Flap Linkage Inspection.

**NOTE:** This procedure gives instructions for inspection of the flap linkage to determine the cause of excessive flap freeplay. This inspection is only required when flap trailing edge freeplay exceeds 0.25 inches (6.35 mm).

- (a) Complete a visual inspection of the following items in the adjacent flap island on each side of a flap exhibiting excessive flap trailing edge freeplay as applicable. Examine the bearing blocks and rollers for wear. There are two bearing blocks or rollers in each carriage. Also examine the carriage slot for wear.
  - 1 Examine for wear of the flap track bearings and looseness between the bearings and the flap track. Move flaps to a position to allow each flap track bearing to be manually rotated (may be a different position for each flap) and look for bearings that require lubrication. Lubricate only those bearings that require lubrication; refer to Chapter 12, Flight Controls - Servicing, for procedures.
- (b) Upon discovery of worn items, replacement is required. If the visual inspection does not reveal any worn items, the applicable actuator(s) must be removed and examined for excessive ballscrew nut freeplay as follows (refer to Figure 602).
  - 1 Put a dial indicator with a magnetic base on the ballscrew with the probe resting against the ballscrew nut. Move the ballscrew nut in an axial (fore and aft) direction without rotating the ballscrew nut. Do not rock the ballscrew nut back and forth, but move it in an axial (for and aft) direction only. The maximum amount of ballscrew nut freeplay is 0.015 inches [REDACTED].
  - 2 Also examine the freeplay between the ballscrew and the gear in the same manner except move the ballscrew in and out of the housing. No freeplay is allowed between the ballscrew and the gear housing.
  - 3 If there is too much freeplay between the ballscrew nut and the ballscrew and/or between the ballscrew and the gear housing, the actuator must be replaced or overhauled in accordance with the applicable Component Maintenance Manual.

F. Flap Approach Switch Check.

- (1) With external power on the airplane, the gear not down, throttles at full power and the flaps lowered below 20 degrees, the gear warning horn must sound. It must not be possible to silence the warning horn with the horn silence switch.

**End Task**

**Task 27-54-00-220**

## 2. Flap Control System Detailed Inspection

- A. Tools.
- (1) External Power - MH32-200K24M or Equivalent
  - (2) Hydraulic Service Unit - 05-7012-1200 or Equivalent
  - (3) Gearbox Holding Fixture - CJMD327-100
  - (4) Torque Wrench (Inch-Pounds)
  - (5) Grease (GHL Type) MIL-PRF-23827 - No Substitute is Allowed.
- B. Inspect Flap Power Drive Unit. Refer to Figure 603.
- (1) Visually inspect the unit for security of installation, cleanliness, corrosion, evidence of overheating, dents or other type of damage
  - (2) Examine the attaching fasteners and pan support for security, cracks and condition.
  - (3) Examine the flex driveshafts for security, cleanliness and damage.
  - (4) Examine the electrical connector and wire bundle for security, cleanliness and damage. Make sure that the wire bundle is correctly routed and clamped with no evidence of chafing or too much strain.
- C. Inspect the Flap Angle Drive Gearboxes (Sundstrand).
- (1) The angle drive gearboxes are connected to the number 1 flap actuators.
  - (2) Visually inspect the gearboxes for security of installation, cleanliness, corrosion, damage and make sure that the safety wire that attaches the fasteners is correct.
- D. Inspect Flap Actuators

**WARNING: During the inspection or lubrication of the flap actuators, make sure that all personnel and equipment are clear of the flaps. Lower the flaps and pull circuit breakers to disable the flap system. Place warning signs/tags as needed to alert personnel not to move the flaps or spoiler/speed brakes while work is in progress.**

**NOTE:** There are eight flap actuators to position the six panels. They are identified (numbered) 1 through 4 from inboard to outboard on the left and right wing trailing edge. The number 1 actuators are located at WS 33.40, number 2 actuators at WS 86.50, number 3 actuators at WS 156.50 and number 4 actuators at WS 226.39. The number 1 and number 3 actuators on each wing have the same part number. The number 2 actuators also are interchangeable. The number 4 actuators are installed in their respective left and right positions.

- (1) Lower the flaps and pull the circuit breaker, install signs/tags to alert personnel not to move flaps or spoiler/speed brakes.
- (2) Visually inspect the flap actuators for security of installation, cleanliness, corrosion, or other damage. Examine the security of all attaching fasteners. Look for cracks, corrosion or other damage.
- (3) Look for chafing on the adjacent structure or components.
- (4) Examine the actuator ballscrews for cleanliness, corrosion, nicks or other damage.
- (5) Reengage flap circuit breakers and remove signs/tags.

- E. Inspect Flap Linkage.

**WARNING: Make sure that all personnel and equipment are clear of flaps and flap tracks before moving.**

**NOTE:** This task requires two maintenance personnel with positive communication between the outside and the cockpit. One person must be inside to run the flaps and one outside to observe flap linkage function.

- (1) Visually inspect all flap linkages for security, correct attachment, function and safety. Examine for cleanliness, corrosion, wear, cracks, evidence of chafing or other damage. Examine for correct safetying of cotter pins.

- (2) Operate the flaps to UP, 7 degrees, 20 degrees and FULL with pauses between while observing the flap linkages for smooth movement and evidence of binding. Sequence is not critical as long as transition to each position is observed.

F. Inspect Flap Carriages.

**NOTE:** This inspection will require repositioning the flaps at different times to examine the flap carriage bearings and rollers.

- (1) Visually inspect the flap carriages for security of installation, cleanliness, corrosion, cracks, wear, loose or failed fasteners or other type of damage.
- (2) Examine the roller bearings for security, cleanliness, corrosion, nicks and evidence of damage.
- (3) Look to make sure that each roller bearing is lubricated by placing the flaps in a position to let each roller to be turned (this may require repositioning flaps several times to let you examine all roller bearings.) Examine for a dry roller bearing by feeling for rough operation and listening for indications that the roller needs lubrication. If special lubrication bolts have not been installed, remove only those roller bearings which require lubrication and lubricate those. Refer to Chapter 12, Flight Controls - Servicing.
- (4) Examine the elastomeric bearing for security of installation.

G. Inspect Flap Yokes and Gimbal Yokes.

- (1) Visually inspect the flap yokes and gimbal yokes for security of installation, cleanliness, corrosion, cracks, wear or other damage. Examine for evidence of chafing on adjacent structure and components. Refer to Figure 604.
- (2) Examine the security and condition of all yoke attach fittings.

H. Lubricate the Flap Angle Drive Gearboxes.

**NOTE:** The lubrication procedures for the angle gearboxes are divided into two sections within this step. The first section applies to the Sundstrand angle drives and the second to the Wadco angle drives. Maintenance personnel must refer to the procedure applicable to their airplane.

- (1) Lubricate Flap Angle Drive Gearbox (Sundstrand). Refer to Figure 606.

**NOTE:** This procedure (using holding fixture) allows lubrication and reinstallation of the angle gearbox without rerigging the system.

**NOTE:** It is very important that the flap system is rendered completely inoperative and stays so while the angle gearboxes are removed from the airplane. Also, use tape (or equivalent) to secure the core of the flex cable drive shaft(s) to it's case so the core does not move. Completion of these steps will allow the gearboxes to be installed as they were removed and prevent the need to do an adjustment/test or a complete the flap system rig. Keep all hardware for reinstallation.

- (a) The angle gear drive boxes are attached to the left and right number 1 flap actuator at WS 32.00.
- (b) Disengage the FLAP CONTROL circuit breaker on the left circuit breaker panel.
- (c) Disconnect the flex drive shaft. Remove the clamps that attach the flex drive shaft in the wheel well. Remove the screws and horse shoe clamp that attach the flex drive shaft to the angle gearbox. Pull the flex drive shaft end from angle gearbox.

**NOTE:** The flex drive cables that attach to the angle drive gearboxes, are held in place with a horse shoe shaped clamp which is secured with two small allen head screws. Use care when loosening the screws to avoid stripping out the hole for the allen wrench. On reassembly, do not over torque these allen head screws.

- (d) Cut the safety wire and remove the three screws and washers that attach the angle gearbox to the actuator.
- (e) Remove the angle gearbox from the airplane. With the angle gearbox removed from the airplane, mount the angle gearbox into the CJMD327-100 holding fixture as follows:

**NOTE:** This will make sure there is the same relationship between the input and output drive sockets after reassembly.

- 1 Loosen setscrew to allow withdrawing 6265071-1 drive from holding fixture.

- 2 Put the angle gearbox to the holding fixture so that the guide pins and square drive socket are mated.
  - 3 Insert 6265071-1 drive shaft through hole in holding fixture and into drive socket angle gearbox.
  - 4 Secure 6265071-1 drive shaft with set screws.
- (f) Remove square drive for actuator and retain.
  - (g) Remove plate and cover housing from angle gearbox.
  - (h) Remove gears from main housing.
 

**NOTE:** Identify gears to make sure reinstallation in the same location and with same orientation as original installation.
  - (i) Use a clean rag or swab (Q-tip) to wipe out as much old grease from the housing as possible. Do not use solvent to clean old lubricant.
  - (j) Visually inspect the interior of the housing, gears, and bearing for damage and wear, if damage or wear is noted, complete the inspections in accordance with the Sundstrand Component Maintenance Manual for fits and tolerances and complete the necessary repairs.
  - (k) Use a grease and a needle type adapter to inject MIL-PRF-23827 grease into the cavities in the head of the angle gearbox which contains gears which are not removed.
  - (l) Add grease to the main housing and pack bearings inside the two smallest gears and the bearings pressed into the main housing and cover housing with grease.
  - (m) Install the gears, bearings, and thrust washers.
 

**NOTE:** Install the largest diameter gear (with square drive hole) first.
  - (n) Completely pack the housing with grease.
  - (o) Install the cover housing and plate and torque the screws to 7.3 to 8.1 inch-pounds (0.82 to 0.92 N-m).
  - (p) Remove angle gearbox from holding fixture and install in airplane.
- (2) Install the angle gearbox. Refer to Figure 605.
    - (a) Mate the square drive with the actuator. Place gearbox to the number 1 actuator, aligning the three gearbox mounting holes with the actuator. Secure with three screws and washers; torque screw 7 to 8 inch-pounds (0.79 to 0.90 N-m) and safety wire.
 

**NOTE:** Before you install the angle gearbox on a new number 1 actuator, make sure that the flex drive horseshoe clamp and two new screws have been removed from the actuator.
    - (b) Mate the flex drive shaft with the gearbox square drive receptacle. Secure the flex drive shaft to the angle gearbox.
    - (c) Secure the flex drive shaft clamps in the wheel well and make sure there is a minimum 12 inch (304.8 mm) bend radius.
    - (d) Engage the flap control circuit breakers and complete the Flap System Operational Check.
  - (3) Lubricate Flap Angle Drive Gearboxes (Wadco only).
 

**NOTE:** It is very important that the flap system is made completely inoperative and stays so while the angle gearboxes are removed from the airplane. Also, use tape (or equivalent) to secure the core of the flex cable drive shaft(s) to it's case so the core does not move. Taking these steps will enable the gearboxes to be installed as they were removed and prevent having to complete an adjustment/test or a complete flap system rig. Keep all hardware for reinstallation.

**CAUTION:** Make sure that the gears, bearings, and grease are not contaminated (during Procedure).

    - (a) Mount unit (angle gearbox) on holding fixture CJMD32-100.
 

**NOTE:** It is not possible or necessary to insert a drive shaft into the hole in the holding fixture.

- (b) Use a 5/64 inch hex L-wrench to break torque on the two WD-8600-08 screws. If not damaged, fully remove and save the screws, or discard if the hex is damaged.

**CAUTION:** Grease-Retained bearings are used in this unit. As the bearing plate is lifted, make sure not to lose any of 21 needle bearings found at the number 5 gear bearing bore. Protect these from falling out by inserting a 10MM or 3/8 Inch diameter pin while the plate is removed. If needle bearings drop out during disassembly, locate and make sure that they are free of foreign matter. Reinstall into bearing cage. Do not use magnet on needle bearings. There must be a total of 21 bearings.

- (c) When the cover and plate is removed, the inside of the gearbox is exposed and the number 2, number 3/4, and number 5 gears are visible. Remove the thrust washer, number 2 gear, and number 3/4 gear cluster and set aside.

- (d) **NOTE:** Do not hammer or beat on bearings. This will cause damage or make the balls weak in the bearing, and make it unserviceable.

Remove the number 5 gear with the square drive hole. This can require lifting unit from holder and pushing gear out with a soft-shouldered pin or shaft. The gear may come out with or without the ball bearing. If without, remove the ball bearing by pushing firmly on inner ring. If the bearing is serviceable, keep it to use for installation.

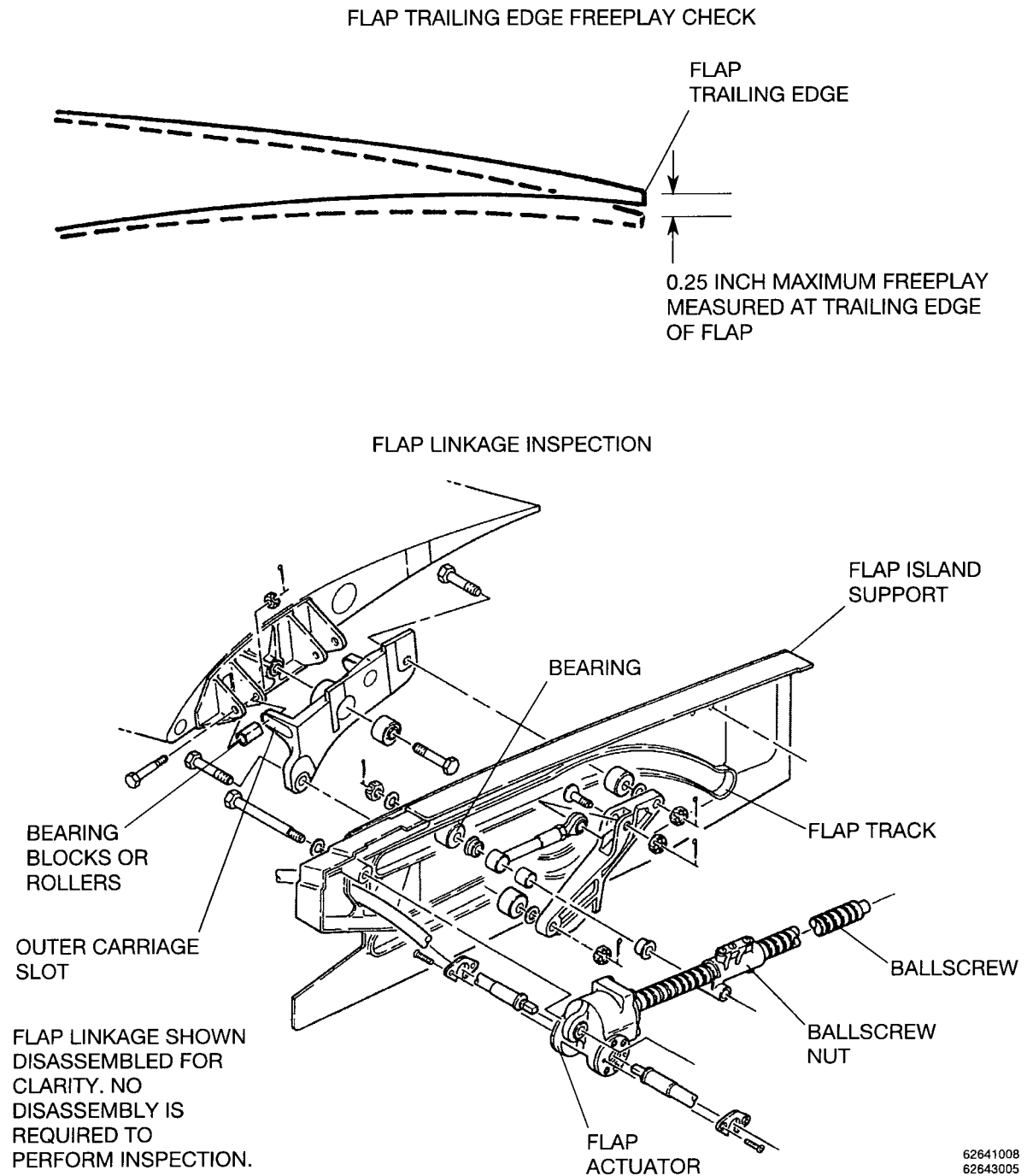
- (e) Clean the gears, thrust washers, and dust cover in solvent. Do not use solvent to clean the bearing plate or ball bearing. If the needles have dislodged from number 5 bearing while cleaning, place back in cage and hold in place by packing with grease.
- (f) Inspect all parts for damage.
- (g) If broken parts are found, the unit must be returned to Wadco for repair.
- (h) For lubrication, use MIL-PRF-23827 grease.
- (i) Lubricate the number 3/4 needle bearing in the housing.
- 1 Pack new grease into the bearing with a small piece of plastic, and push the bearing journal on (the 3/4 gear cluster into bearing).
  - 2 Remove the 3/4 gear cluster and repeat the previous step.
- (j) Install the first thrust washer below number 2 onto the pin on the housing.
- (k) Install the 10 MM ball bearing into the housing bore at the location of number 5 gear.
- (l) Lubricate the gear and bearing. Reassemble housing assembly and reinstall onto main housing with three 5/64 inch screws.
- (m) Pack the housing with new, clean grease up to one-half of the housing depth and into the face gear cavity, while rotating with the drive shaft. As the gear is rotated, make sure that the grease is packed into the opening for the number 1 gear.
- (n) Assemble the number 2 gear with the bearing onto the pin cover with the thrust washer. Make sure that the thrust washer is installed with the same bearing surface facing down as the originally installed.
- (o) Assemble the gear number 5 into the ball bearing, then into the housing, followed by the number 3/4 gear cluster.
- (p) At this point, the unit must be 90% lubricated. If the grease extends above the top of the housing, wipe with shim and clean around the entire edge with a clean rag or wipe, to prevent grease from oozing out after sealing with cover and screws.
- (q) Remove the temporary pin from the needle bearing on the bearing plate, and pack the needle bearing with grease.
- 1 Placing the index finger behind the bearing to stop grease, fill with grease using applicator.
  - 2 While still holding finger behind bearing, press holding pin into bearing to squeeze out unwanted grease.
  - 3 Repeat the previous two steps and remove unwanted grease with a clean rag.
- (r) Reassemble the unit by positioning bearing plate over gears and pin and placing dust cover over plate. Secure with two WD-8600-09 screws. Torque to 10-12 inch-pounds.

- (s) Insert drive shaft on right angle side (number 1 gear) and rotate by hand 5 to 10 turns to distribute grease into number 1 gear head gravity.
- (t) Remove two screws holding cover. If grease is not totally covering gear teeth, add just enough to smooth it over teeth flush to top of outside face of number 2/3 gear cluster, just below shoulder of number 5 gear.
- (u) Replace the bearing plate over the gears and pins and put the dust cover over the plate, securing with two WD-8600-08 screws. Torque to 10-12 inch-pounds.
- (v) Install unit in airplane and complete the Flap System Operational Check.

**End Task**

**Figure 601. Flap Trailing Edge Freeplay Check and Flap Linkage Inspection.**

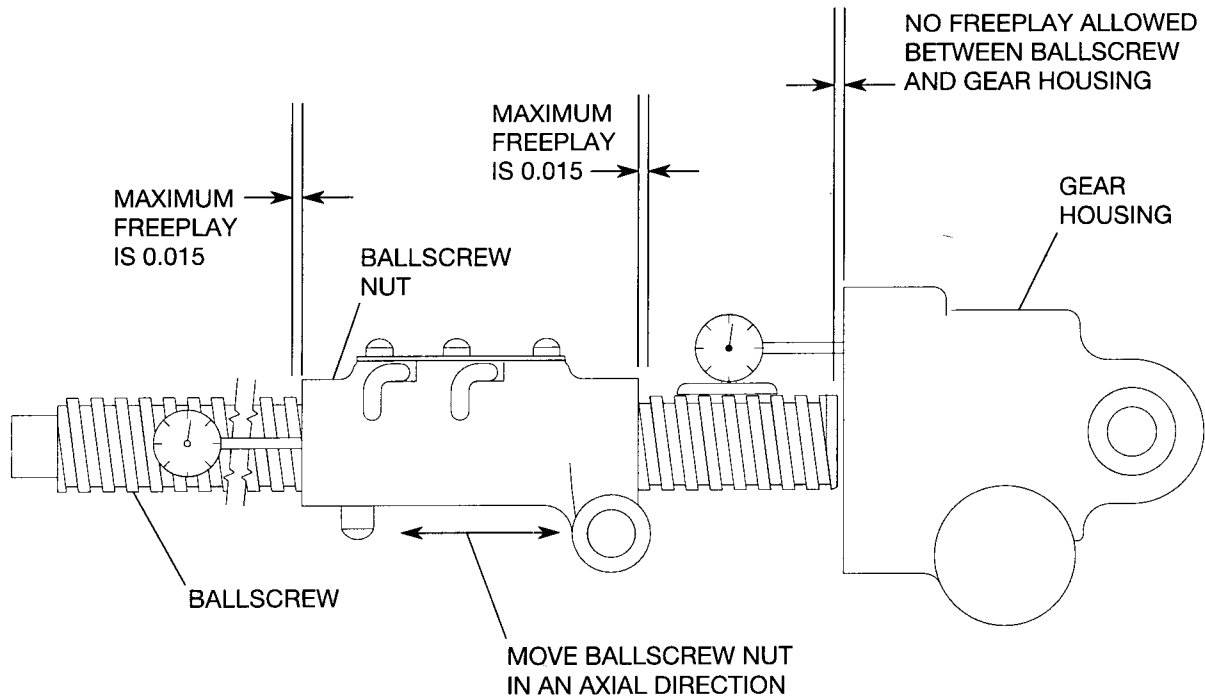
A12198



Sheet 1

**Figure 602. Actuator Freeplay Check**

A12199



**NOTE 1:** USE ONLY HAND PRESSURE TO MOVE BALLSCREW NUT AND BALLSCREW.

**NOTE 2:** RADIAL MOVEMENT OF BALLSCREW NUT IS ACCEPTABLE IF AXIAL FREEPLAY IS WITHIN LIMITS.