



BOMBARDIER
AEROSPACE

canadair challenger

NOSE WHEEL STEERING CONTROL SYSTEM
BREAKOUT TEST SET

P/N CCSC3250-01
MOD STATUS E

OPERATING GUIDE

CCSC3250-01-09
rev E.04

02-OCT-98

CAUTION

Before proceeding with testing, technicians *must* familiarize themselves with these procedures and the applicable Canadair Challenger maintenance manual. Damage to equipment or injury to personnel may result.

This test set and operating guide is intended for
GROUND MAINTENANCE USE

NOT FOR IN-FLIGHT USE

Canadair Challenger Breakout Test Sets, part number prefix CCSC or BAS, are computer tested and certified for proper operation before return to service for new, modified, repaired or rental units.

- This test set does not require annual or periodic inspection.

It is recommended that a periodic inspection and recertification, on a cycle established by the owner/user of the test set, be accomplished by Avionics Fabrication, Bombardier Aviation Services, Hartford Service Center to ensure faults and/or malfunctions will not be induced into the aircraft systems by faulty test set components. This is essential if a test set has been loaned or used by another operator/facility before the test set is returned to the owner's tooling storage.

- Technicians should ensure *only* a calibrated/certified multimeter and test equipment is used to make measurements during CC Maintenance Manual directed Functional Tests.
- "TEST" and "SIMULATE" test set functions must not be used to certify an aircraft system in lieu of aircraft component signals as directed by the applicable CCMM procedures
- This test set interfaces with its designated aircraft system for data monitoring and acquisition during GROUND MAINTENANCE and is NOT INTENDED FOR INFLIGHT USE.
- It is the responsibility of the aircraft's owner/operator designated Director/Chief of Maintenance to ensure in-flight use of this test set is in accordance with all applicable regulatory authority rules under which the aircraft is registered and operated
- Connection of the test set to the aircraft system under test during ground maintenance is considered a minor alteration.
- Test set use, in accordance with its operating procedures and Canadair Challenger Maintenance Manuals, does not alter or modify the aircraft system configuration.
- The aircraft system *must* be operationally tested IAW applicable maintenance manual directives after the test set is removed and the system is returned to the normal electrical configuration.

For questions regarding purchase, training, repair or recertification, contact:

BOMBARDIER AVIATION SERVICES
Hartford Service Center
Avionics Fabrication
phone: 860-627-9491, ext 7292
fax: 860-292-7380
email: bill.bowen@learjet.com

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CANADAIR CHALLENGER TEST SET OPERATING GUIDE

The CANADAIR NOSEWHEEL STEERING BREAKOUT TEST SET, p/n CCSC3250-01, provides many features to assist you in fully checking or troubleshooting the Challenger's Electronic Nosewheel Steering System.

The main features of this unit are:

- Ability to monitor all input and outputs of the Nosewheel Steering Electronic Control Module (ECM) while system is in operation.
- Simulation of "weight off wheels" condition to the system.
- Remote re-arming of the system on the Test Set to facilitate faster troubleshooting.
- Constant monitoring of Arm, Weight on Wheels, NWS Fail, and Steering Selector Valve command via indicator lamps.
- Ability to monitor Steering Servo Valve Torque Motor current.

I. ADDITIONAL TOOLING REQUIRED:

The following additional support tooling (or suitable substitutes) may be required, depending on the particular maintenance you are performing. If in doubt, consult the Maintenance Manual.

- A. Nosewheel Steering Protractor, CCSCFX3250-02 or GSE 32-50-02
- B. Digital Multimeter, 3 1/2 digit minimum
- C. Rudder Rig Pin
- D. Proximity Switch Targets

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II. -P R E C A U T I O N S- :

- A. DO NOT connect/disconnect Test Set to/from system with power applied.
- B. CHECK aircraft/Test Set connections for pushed/bent pins BEFORE connecting.
- C. DO NOT arm NWS system with Tow Bar connected to the nose gear. Residual hydraulic pressure in the lines may cause immediate rapid movement.
- D. KEEP UPPER NOSE WHEEL STEERING LINK AREA CLEAR OF EQUIPMENT AND PERSONNEL.
- E. Ensure landing gear ground lock pins are installed.

III. TECHNICAL REFERENCES:

- A. Maint. Manual Chap. 6 for location of Access Panels
- B. Maint. Manual Chap. 7 for jacking of A/C
- C. Maint. Manual Chap. 12 for aircraft power and hydraulics.
- D. Maint. Manual Chap. 27-21 for Rudder Rig Pin installation.
- E. Maint. Manual Chap. 32-50 for Nosewheel Steering System

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IV. TEST SET TECHNICAL SUPPORT:

If you encounter difficulties, require assistance or have questions regarding the use of this unit, contact:

Bombardier Aerospace
Business Aviation Services
Hartford Service Center
Bradley International Airport
Windsor Locks, CT 06096

Tel. 860-627-9491

AVIONICS FABRICATION

or

your Challenger Field Service Representative

V. TEST SET LEGEND:

A. SWITCH FUNCTIONS:

ARM pushbutton Released - Arm signal NORMAL
Depressed - simulates disarming system. If system fails, position steering cuff on nose landing gear to zero degrees, depress and release ARM button. System should re-arm.

WOW pushbutton Released - WOW signal NORMAL.
Depressed - simulates WEIGHT OFF WHEELS

LAMP TEST Released - lamps monitor respective signals.
Depressed - all lamps will illuminate, if the system is ARMED and all lamps are good.

B. FUSE FUNCTION:

STEERING SERVO VALVE TORQUE MOTOR -
Installed - protects STEERING SERVO VALVE drive circuitry inside control unit from excess current.
Removed - allows user to install current meter leads to monitor the current drawn by the STEERING SERVO VALVE Torque Motor.

NOTE: Torque motor current during commanded movement should be equal in both directions of travel.

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VI. SYSTEM TESTING PROCEDURES:

A. INITIAL SYSTEM SETUP

The following setup produces normal system operation. With the Test Set installed in line, monitoring of all available test points is obtained, with no alteration of system operation.

It is recommended to remove the right kidney panel, 114-AR, to allow easier maintenance on the nose strut. Route test set cables from this bay into the avionics bay for ECU connection.

1. Connect Test Set between control unit and aircraft connectors P2GC and P3GC.
2. Jack aircraft (required for funct. test or RVDT align).
3. Disconnect nose gear torque link (scissor brace)(ref. fig. 3). Support upper torque link to simulate nose gear "weight on wheels" condition. A rag or a piece of foam is good for this purpose. Be careful not to change the gap alignment of the centering switch.
4. Ensure that Landing Gear Control, WOW, and Nosewheel Steering circuit breakers are pushed in.
5. Apply aircraft electrical power.
6. Apply aircraft hydraulic power (#3A or B).
7. Place pilot's Nosewheel Steering switch to "ARM" position.
8. Press test set "LAMP TEST" switch and verify all lamps illuminate.
9. Using digital multimeter, on DC volts function, connect negative (BLACK) lead to good airframe ground structure.
10. Measure voltage present on test set for GROUND 1 & 2 test point P3GC-R & P3GC-N. Voltage should be less than .005vdc. Presence of greater voltage indicates poor airframe ground termination. Perform corrective maintenance for the related ground before proceeding.

The system may now be operated from the cockpit normally, and monitored on the Test Set.

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VI. SYSTEM TESTING PROCEDURES cont:

B. WEIGHT OFF WHEELS SIGNAL CHECK

1. Set Test Set and aircraft system configuration as in INITIAL SYSTEM SETUP .
2. Verify proper "ARM" condition - both "CH 1 & 2" green lamps ON.
Check "ARM" test point (P3GC-M) to GROUND 1 (P3GC-R) for 28VDC.
3. Verify WEIGHT-ON-WHEELS condition is not present - both WOW green lamps OFF. Verify 28VDC to GROUND 1 (P3GC-R) is not present on either "WOW" test point (P3GC-H, P3GC-K).
4. Check 6 Rudder (P2GC-V, -b-, E, H, X, & G) and 6 Handwheel (P2GC-J, T, D, W, -c-, & F) test points. Verify 7.650VDC +/- .010 to test set GROUND 1 exists.

Note: This is the ECU internal Zero reference point.
The rudder pot and handwheel pots at center will be aligned to this voltage.

C. CONTROL UNIT POWER SUPPLY CHECK (All voltages +/- 10%)

1. Set Test Set and aircraft system configuration as in Initial System Setup.
2. Verify WEIGHT-ON-WHEELS condition is present - both WOW green lamps ON. (If not present, ensure that WOW targets are in place on all 3 gear and that the landing gear system is operating OK.) Check both WOW test points (P3GC-H, P3GC-K) for 28VDC to GROUND 1 (P3GC-R).
3. Measure between both excitation test points (P2GC-S to P2GC-P) (not to ground) of the RVDT #1 and verify 11.6VAC is present. Check #2 RVDT in the same manner.
4. Measure between both excitation test points (P2GC--a- to P2GC-N) for the STEERING SERVO VALVE and verify 11.6VAC is present.
5. Measure between each negative (-) test point of both handwheel and both rudder pots (4 total test points) to GROUND 1 (P3GC-R) and verify 1.6VDC is present. If not present, ensure "weight on wheels" condition exists.
6. Measure between each positive (+) test point of both handwheel and both rudder pots (4 total test points) to ground and verify 13.6VDC is present. If not present, ensure "weight on wheels" condition exists.

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VI. SYSTEM TESTING PROCEDURES cont:

D. HANDWHEEL DC VOLTAGE OUTPUT CHECK

1. Set Test Set and aircraft system configuration as in Initial System Setup.
2. Verify WEIGHT-ON-WHEELS condition is present - both WOW green lamps ON. (If not present, ensure that WOW targets are in place on all 3 gear and that the landing gear system is operating OK.) Check both WOW test points (P3GC-H, P3GC-K) for 28VDC to GROUND 1 (P3GC-R).

3. With handwheel centered, measure between handwheel #1 signal test point (P2GC-U) and GROUND 1 (P3GC-R) test point. The voltage should be 7.65VDC +/- .010VDC. ~~if voltage is incorrect.~~

~~Loosen the clamping portion of the universal joint attached to the 1/4" shaft of the handwheel pot assembly and rotate the adjustment slot on the bottom of the potentiometer assembly for proper reading (ref. fig. 4, item 3). Retighten the clamp, ensuring the voltage does not change.~~

4. With handwheel centered, measure between handwheel #2 signal test point (P2GC-W) and GROUND 1 (P3GC-R). The voltage should be 7.65VDC +/- .010VDC. If the split in readings between the #1 and #2 handwheel test points exceeds +/- .050 VDC, consult maintenance manual.
5. Recheck steps 1. and 2.

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VI. SYSTEM TESTING PROCEDURES cont:

E. RUDDER POT DC VOLTAGE CHECK

1. Set Test Set and aircraft system configuration as in Initial System Setup.
2. Verify WEIGHT-ON-WHEELS condition is present - both WOW green lamps ON. (If not present, ensure that WOW targets are in place on all 3 gear and that the landing gear system is operating OK.) Check both WOW test points (P3GC-H, P3GC-K) for 28VDC to GROUND 1 (P3GC-R).
3. With hydraulics off, install rudder rig pin in rudder pedal assembly.
4. Measure between rudder #1 signal test point (P2GC-V) and GROUND 1 (P3GC-R). The voltage should be 7.65VDC +/- .010VDC. ~~If the voltage is incorrect:~~

~~Loosen the clamp attached to the 1/4" shaft of the rudder pot assembly and rotate the adjustment slot on the bottom of the potentiometer assembly for proper reading (ref. fig. 5, item 1 and 2). Retighten the clamp, ensuring the voltage does not change.~~

5. Measure between rudder #2 signal test point (P2GC-H) and GROUND 1 (P3GC-R). The voltage should be 7.65VDC +/- .010VDC. If the split in readings between the #1 and #2 rudder test points exceeds +/- .010VDC, consult maintenance manual.
6. Recheck steps 3. and 4..

CANADAIR CHALLENGER TEST SET OPERATING GUIDE

VI. SYSTEM TESTING PROCEDURES cont:

F. RVDT AC VOLTAGE CHECK

1. Set Test Set and aircraft system configuration as in Initial System Setup. -DO NOT apply aircraft hydraulic power.
2. Ensure nose gear strut is fully extended, which forces the strut to mechanically center. Momentarily bring the upper and lower torque links together, with the washer, (ref. fig. 3, item 12) in between, to establish the Nose Gear zero position. Attach nosewheel steering protractor and pointer to nose strut and set to 0 degree reading.
3. Separate the nose gear torque links. Support upper torque link to simulate nose gear "weight on wheels" condition (reference Initial Test Set Setup, VI.A.).

Note: To recheck ZERO degree position between checks, align torque links -with washer installed- between them (ref. fig. 3).

4. Measure the voltage (AC) between both signal test points (P2GC-Z to P2GC-M) for RVDT #1 and record as #1 RVDT output. Measure the voltage between both signal test points (P2GC-J to P2GC-K) for RVDT #2 and record as RVDT #2 output. In each case, the voltage should read 0VAC +/- .050VAC. If not, adjust RVDT as follows (refer to fig. 6):
 - a. Without disconnecting RVDT cannon plug, remove cover (item 1) and lift carefully away from RVDT.
 - b. Loosen, do not remove, 3 cleats (item 6) and rotate RVDT gently (by hand only) to obtain proper voltage. Ensure that reference mark (item 5) stays between E-Z marks (item 8) during the alignment.

Note: If the RVDT is removed for any reason, there is an E-Z red mark on the spline that must be aligned with item 5 E-Z mark when the RVDT is installed.

- c. Alternating, tighten 3 cleats (item 6) monitoring voltage to ensure no change.
- d. Reinstall RVDT cover.

CANADAIR CHALLENGER TEST SET OPERATING GUIDE

VI. SYSTEM TESTING PROCEDURES cont:

F. RVDT AC VOLTAGE CHECK cont:

5. Verify no split in readings between the two outputs. If there is a split, try cleaning the base area of the RVDT mount. Ensure that the cleats do not create side pressure on the RVDT housing as they are tightened.

Note: The maximum allowable split is .100 to .120 VAC. Experience indicates that there is always a slight split between the two outputs. The objective is to reduce the split to the minimum obtainable. As the split rises above the .100 to .120 VAC area, the system begins to produce more unexplained failures. If there is a split, it is best to establish the high reading on OUTPUT #2. Example: #1 RVDT read .095 VAC and #2 RVDT reads .000 VAC. Adjust the RVDT so that #1 RVDT reads .000 VAC and #2 reads .095 VAC. The reason is because of the primary function of each channel; channel #1 is command, channel 2 is monitor.

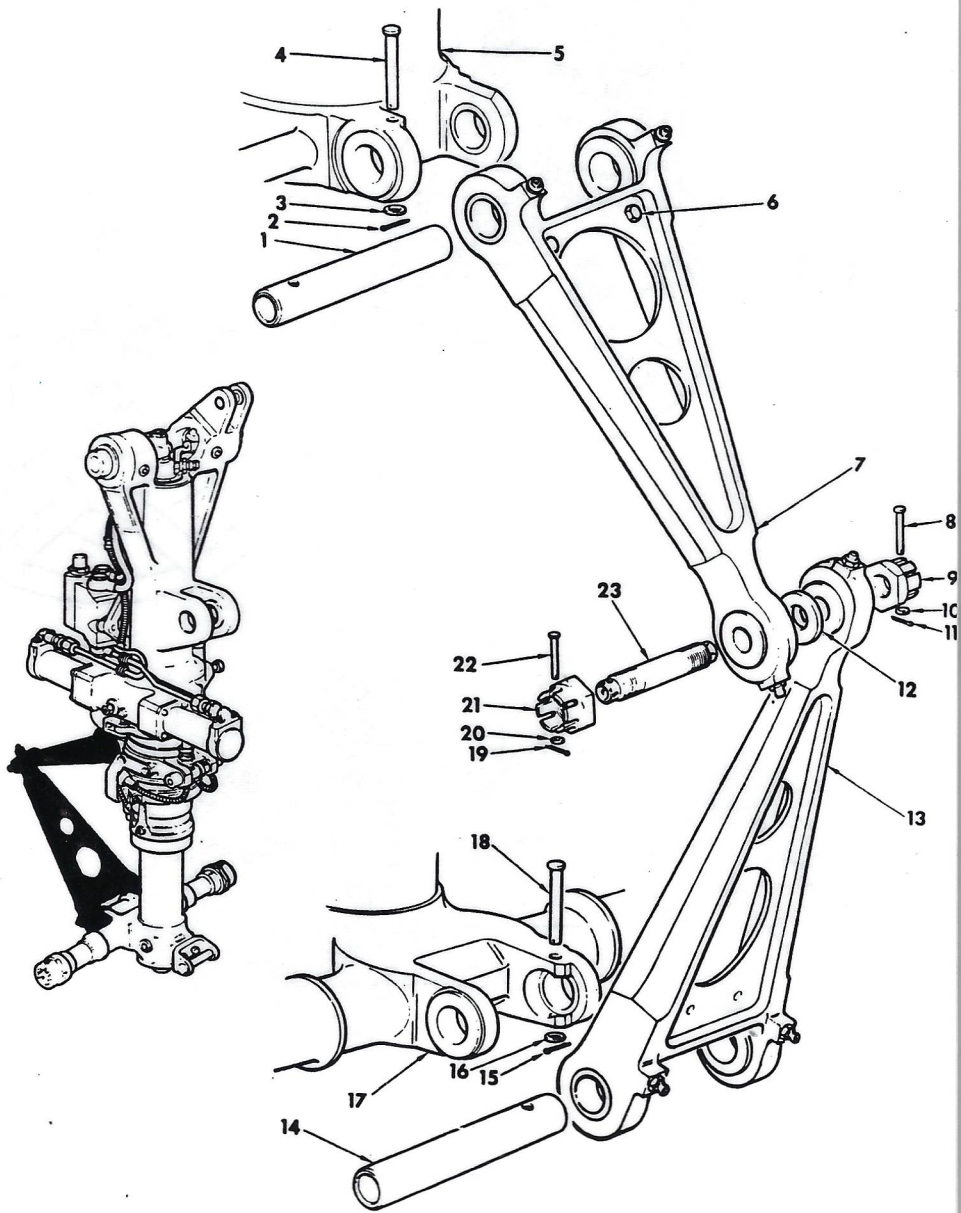
6. When a split is noted, rotate the upper torque link (with no hydraulic power applied) through its full travel in both directions and verify that the split remains relatively constant, or does not exceed the .120 VAC acceptable limit.

Note: When you move the upper torque link full travel, the voltage will vary between 0.0 VAC (at 0 degrees) to approximately 5.8 VAC (at 55 degrees).

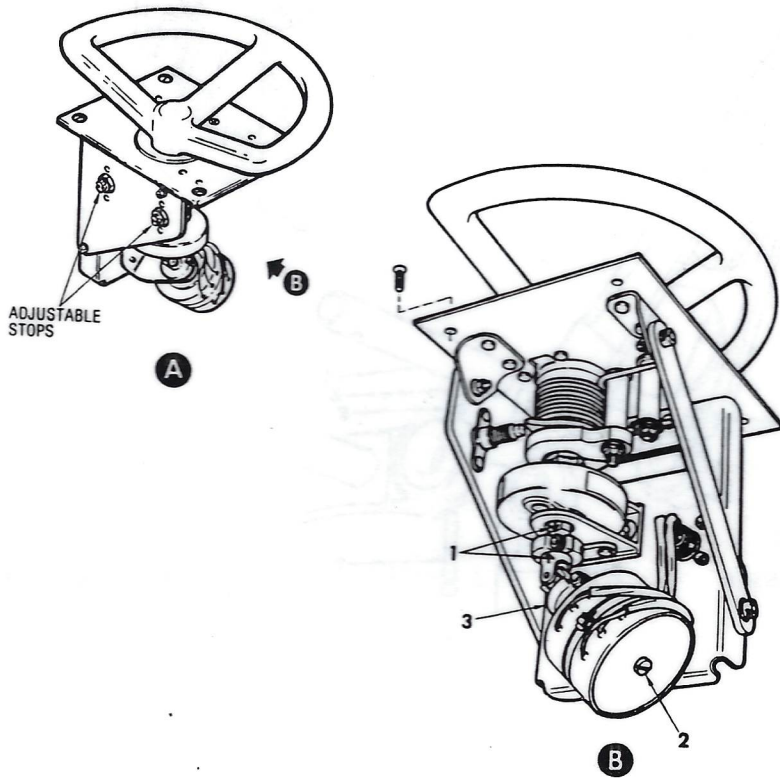
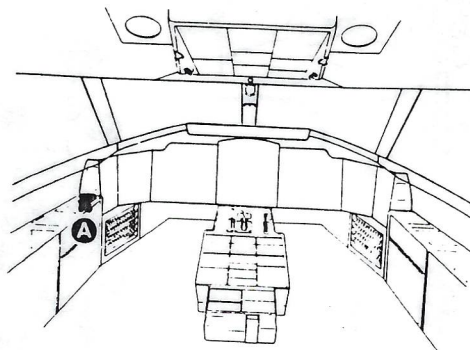
7. Position cockpit NOSE WHEEL STEERING switch to OFF.
8. Turn aircraft electric power OFF.
9. Disconnect test set, reconnect aircraft connectors to NWS ECU.

Perform Nosewheel Steering System OPERATIONAL TEST per Maintenance Manual procedure.

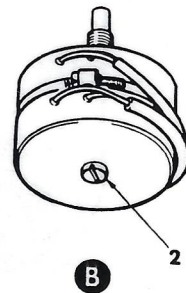
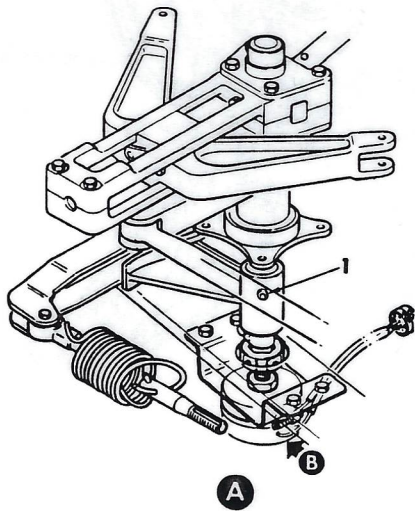
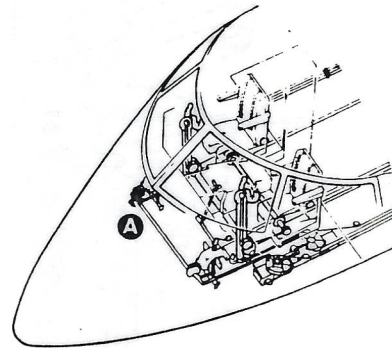
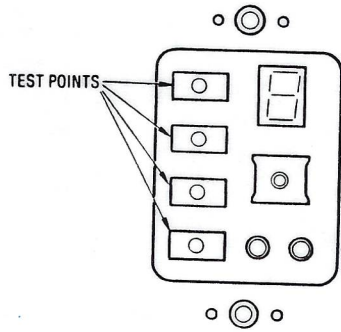
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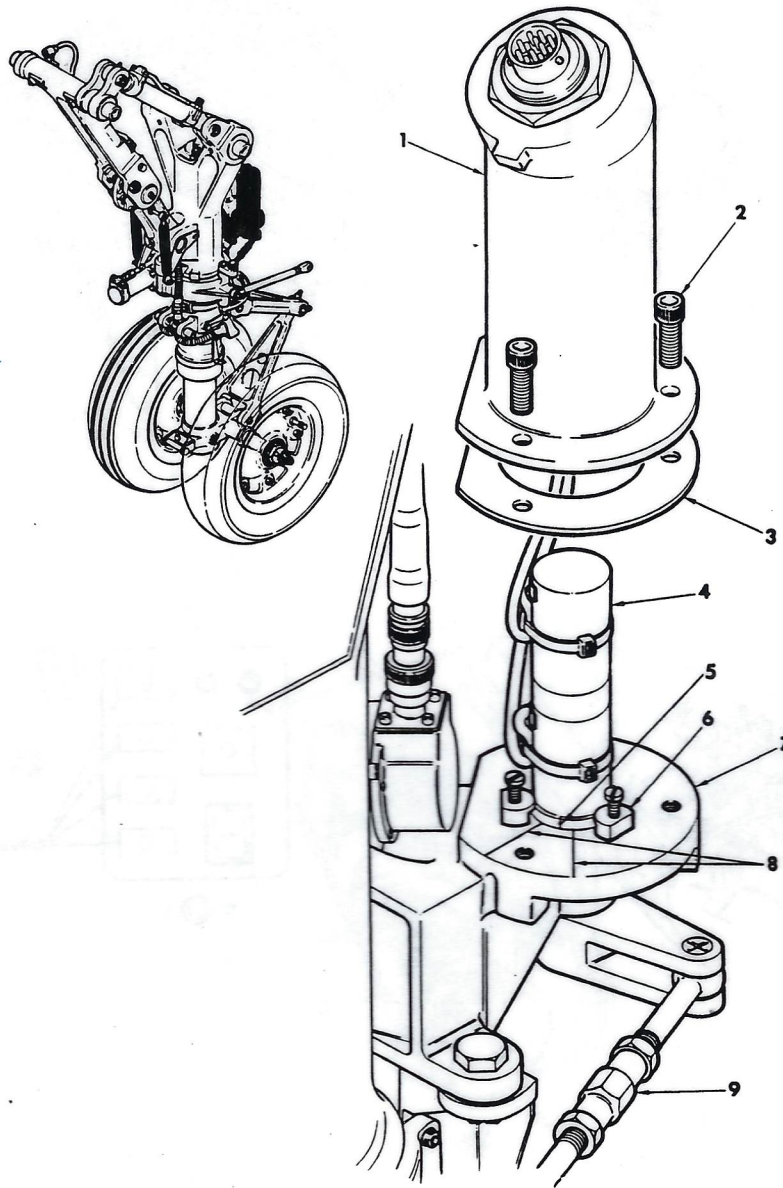
Landing Gear Torque Links - Removal/Installation
FIGURE 3



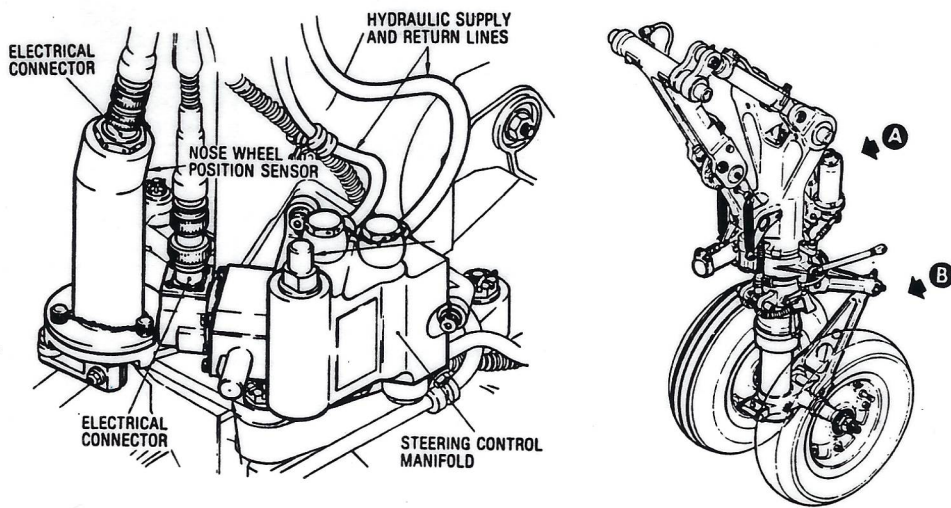
Handwheel Steering Control - Adjustment
FIGURE 4



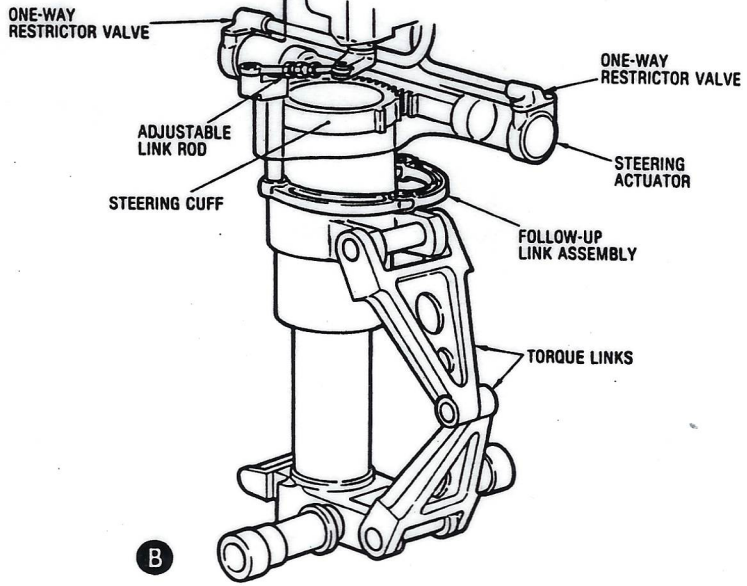
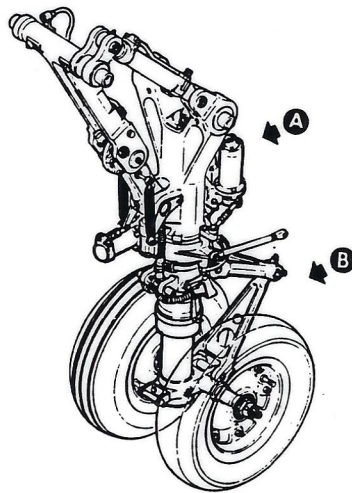
Rudder Pedals Steering Control - Adjustment
FIGURE 5



Nose Wheel Position Sensor - Adjustment
FIGURE 6



A



B

Steering Mechanism - Operational Schematic
 FIGURE 7

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NWS BREAKOUT TEST SET
P/N CCSC3250-01
MOD E 21 SER #

