

TECHNICAL BULLETIN
Bell Helicopter **TEXTRON**
A Subsidiary of Textron Inc.

NO 407-00-24
DATE 03-17-00
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DATE
REV.

MODELS AFFECTED: 407

SUBJECT: **ENGINE START CIRCUIT, ADDITION OF PULL UP RESISTOR TO IMPROVE FADEC START MODE LOGIC**

HELICOPTERS AFFECTED: 407, Serial Numbers 53000 through 53267.

[Helicopters Serial Numbers 53268 and subsequent will have the intent of this bulletin completed before delivery.]

COMPLIANCE: Recommended at the next annual inspection.

DESCRIPTION:

Bell Helicopter has found that the start circuit wiring gives an open circuit to the Start Mode discrete (Starter V-bit) of the Electronic Control Unit (ECU). This causes the Starter V-bit discrete of the ECU to be in a continuous "True" state. This makes the ECU think that the start switch is being held in the "START" position.

Because of this, both the 60 second timer to initiate the start and the 60 second timer to achieve lightoff are activated as soon as the pilot positions the throttle above 9° Power Lever Angle (PLA). The intended system design is that the 60 second timer to achieve lightoff should not initiate until the start switch is engaged. In the present situation, with the ECU seeing the start switch as always engaged, this could cause the following situations to occur.

- The time allowed to achieve lightoff after the pilot engages the start switch can be reduced by the time delay between advancing the throttle and the time the start switch is pressed.

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Therefore, it is possible for a start to latch and then unlatch before lightoff, if the lightoff does not occur within 60 seconds after advancing the throttle above 9° PLA, even though only a few seconds have elapsed since engaging the start switch.

- If the throttle is advanced above 9° PLA while the engine is shut down and then returned to the Closed position, the constant true state of the Starter V-bit causes the ECU to interpret this as a start which was initiated and then aborted by the pilot.

If the residual MGT is greater than 150° C and the pilot engages the start switch with the throttle Closed, the ECU will allow the starter to latch until the MGT is reduced to below 150° C or until the lightoff timer times out.

- Normally, prior to starting, returning the throttle to the Closed position reinitializes the timers. However, if the throttle is advanced above 9° PLA with MGT greater than 150° C, and the lightoff timer has not yet timed out, the action of the throttle going to cutoff will not reset the timer.

Therefore, a pilot could cycle the throttle, thinking the timer has been reset for another 60 seconds only to have a start unlatch a few seconds after activating the start switch.

To correct these conditions, Bell Helicopter has added a 10 kilohm pull-up resistor into the start circuit. The resistor ensures that the Starter V-bit discrete of the ECU will only be in a "True" state when the start switch is engaged. This Technical Bulletin provides the approval and information to install the resistor.

APPROVAL:

The engineering design aspects of this Technical Bulletin are Transport Canada approved.

MANPOWER:

Approximately 3.0 man-hours are necessary to complete this Bulletin. The man-hours are based on hands-on time and can change due to the personnel and facilities available.

WARRANTY:

Owners/operators of 407 helicopters who comply with the instructions outlined in this bulletin are eligible for a special 100% warranty credit toward the purchase of the kit contained in the "Required Material" section of this bulletin.

To receive this credit:

- Customers must order the replacement parts from an approved BHTI supply source.
- Comply with the instructions outlined in this bulletin no later than September 30, 2001.
- Send a completed Malfunction Report (MR) to BHT warranty Administration. A copy of the invoice referencing parts used to accomplish this bulletin must be attached to the Malfunction Report.

- NOTE -

Customers who fail to comply with the instructions in this bulletin prior to September 30, 2001 are not eligible for the special warranty credit provisions listed above.

MATERIAL:

Required Material:

The material that follows is necessary to complete this Bulletin and can be procured as kit P/N CT-407-00-24 through your Bell Helicopter Textron Supply Center.

<u>PART NUMBER</u>	<u>NOMENCLATURE</u>	<u>QUANTITY</u>
110-182A103TAR	Resistor Assembly	1
M81714/60-22-05	Module	1 (NOTE)
MS27488-22	Sealing Plug	16
140-039-22	Wire (M22759/41-22-9)	3 feet (91.44 cm)
M39029/22-192	Contact	1

Note: M39029/22-191 contacts are supplied with this module.

The wires that follow are required and should be made locally. Use the 140-039-22 wire listed above.

<u>WIRE NUMBER</u>	<u>WIRE SPECIFICATION</u>	<u>WIRE LENGTH</u>
K8D22	M22759/41-22-9	13 inches (33.02 cm)
K20A22	M22759/41-22-9	17 inches (43.18 cm)

Consumable Material:

<u>PART NUMBER</u>	<u>NOMENCLATURE</u>	<u>REF. NO.</u>
MILT43435TY IV FIN C	LACING CORD	EC-052 (NOTE 1)

NOTE 1:

“EC” designation is called out in the Electrical Standard Practices Manual.

SPECIAL TOOLS:

The tools that follow, or equivalent, are required to complete the procedures specified in this bulletin. The tools can be procured through your Bell Helicopter Textron Supply Center.

<u>PART NUMBER</u>	<u>NOMENCLATURE</u>	<u>QUANTITY</u>
M22520/7-01	Tool Frame	1
M22520/7-11	Positioner	1
M22520/7-12	Positioner	1
M81969/16-04	Insertion/Extraction Tool	1
M81969/16-01 or M81969/14-10	Insertion/Extraction Tool	1
M6106/31-001	Relay Extraction Tool	2
M6106/32-001	Relay Base Extraction Tool	1
M81714/69-01 (Deutsch CTJ-R06)	Module Removal Tool	1

WEIGHT AND BALANCE:

Not affected.

ELECTRICAL LOAD DATA:

Not affected.

REFERENCES:

BHT-407-MM, Volume 10, Rev. 7, 01 May 1998:

Chapter 96, Electrical.

Chapter 98, Wiring Diagrams.

BHT-ELEC-SPM, Electrical Standard Practices Manual, 15 November 1996.

PUBLICATIONS AFFECTED:

BHT-407-MM, Volume 10, Rev.7, 01 May 1998:

Chapter 96, Electrical.

Chapter 98, Wiring Diagrams.

BHT-407-IPB, Rev. 3, 16 December 1996:

Chapter 96, Electrical.

ACCOMPLISHMENT INSTRUCTIONS:

1. Remove the electrical power from helicopter.

- NOTE -

For the locations where the FADEC Start Relay 1K3 and Terminal Blocks 4TB2 and 8TB3 are installed, refer to the 407 Maintenance Manual, Chapter 96, Figure 96-10 (Sheet 3) on Page 65.

2. Get access to the FADEC/Start Relay 1K3 and Terminal Blocks 4TB2 and 8TB3 (Figure 1).

- NOTE -

Refer to the Bell Helicopter Electrical Standard Practices Manual (BHT-ELEC-SPM) for information and procedures common to electrical installations.

3. To prepare for the installation of electrical contacts, strip the ends of the locally fabricated wires K8D22 and K20A22. Refer to the procedures in Section 4-00-00 of the Bell Helicopter Electrical Standard Practices Manual (BHT-ELEC-SPM).

- NOTE -

Contacts M39029/22-191 are supplied with the module M81714/60-22-05.

4. Use the tool frame M22520/7-01 with the positioner M22520/7-11 set to position 4, and crimp the two contacts, M39029/22-191, on the locally fabricated wire K8D22.
5. Use the insertion tool M81969/16-04 to insert one end of the wire K8D22 into position "P" on the uninstalled module M81714/60-22-05. Refer to Figure 1 and to BHT-ELEC-SPM, Section 5-00-00.
6. Use the tool frame M22520/7-01, with the positioner M22520/7-11 set to position 4, to crimp the contact, M39029/22-191 on the locally fabricated wire K20A22.
7. Use the insertion tool M81969/16-04 to insert wire K20A22 into position "Y" of the uninstalled module M81714/60-22-05. Refer to Figure 1 and to the BHT-ELEC-SPM, Section 5-00-00.
8. Use the tool frame M22520/7-01 with the positioner M22520/7-12 set to position 4, and crimp the contact M39029/22-192 on the other end of locally fabricated wire K20A22. Refer to BHT-ELEC-SPM, Section 5-00-00.
9. Use insertion tool M81969/16-04 to insert the contacts of the resistor 110-182A103TAR (reference designator 8R8), into positions "N and T" of the uninstalled module M81714/60-22-05 (Figure 1). Install the 16 sealing plugs MS27488-22 into all the remaining open positions of module M81714/60-22-05.

- NOTE -

When you remove the FADEC/Start Relay 1K3, make a note of the installed orientation of the relay in the base. When you remove the FADEC/Start Relay base 1XK3 from the mounting rail, make a note of the installed and locked position of the base in the mounting rail.

- NOTE -

For more data on removal of the FADEC/start relay and base, refer to 407 Maintenance Manual, Chapter 96, Paragraph 96-75 and Figure 96-31.

10. Use the two extraction tools M6106/31-001 (QTY - 2) to remove the FADEC/start relay 1K3.
11. Use the relay base extraction tool M6106/32-001 to remove the FADEC/start relay base 1XK3.

- NOTE -

To install the module to the rail, the module letters "A,B,C,D" will face aft when installed. If the module must be removed from the rail, use tool M81714/69-01.

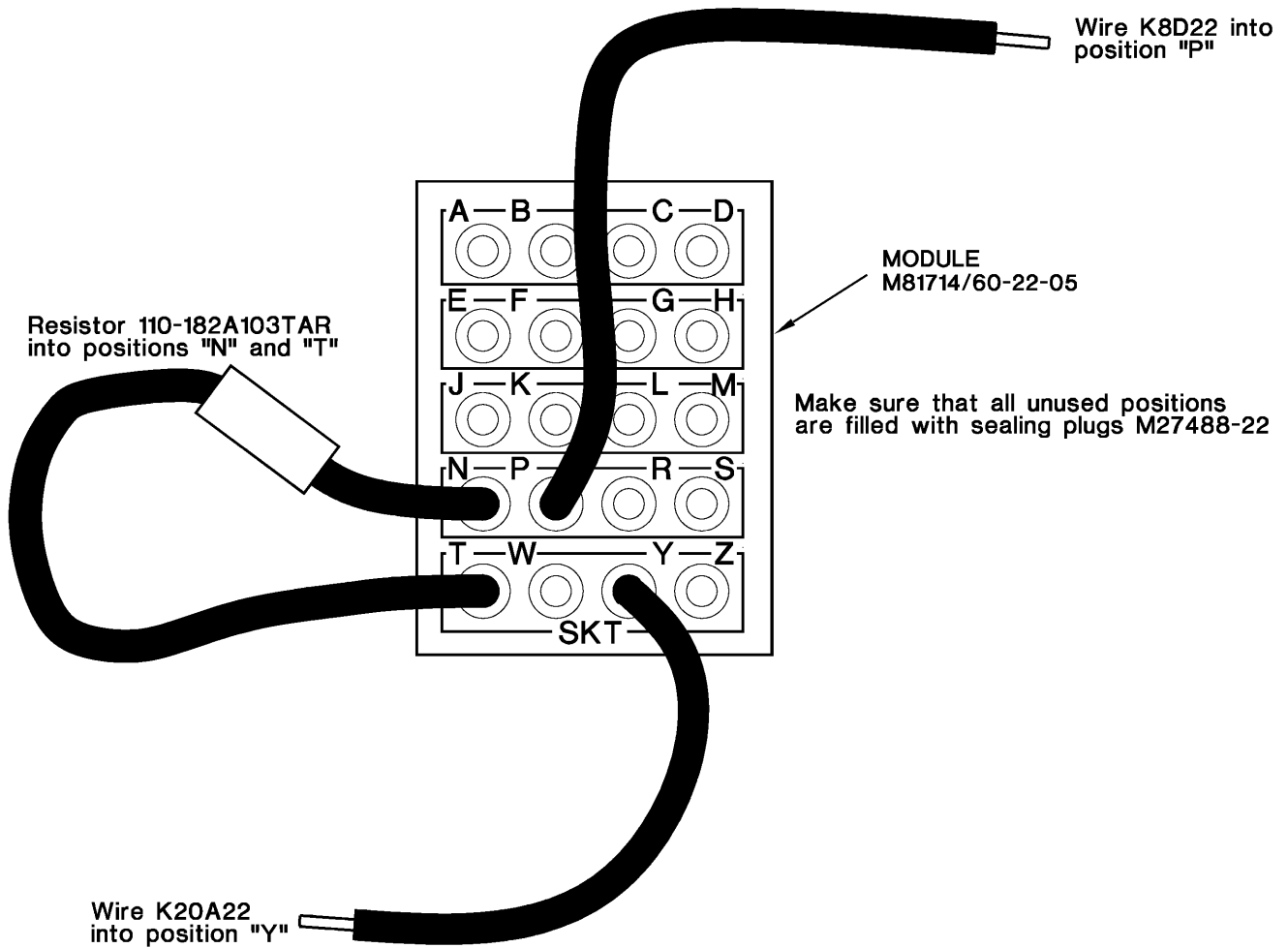
12. Use finger pressure to install module M81714/60-22-05 with the installed wires K8D22, K20A22 and resistor 110-182A103TAR (reference designator 8R8), into position "S" of 8TB3.
13. Put the wire K20A22 along the existing harness to the FADEC/start relay base 1XK3.
14. Use the insertion tool M81969/16-01 or M81969/14-10, to install the contact of wire K20A22 into position "A3" of FADEC/start relay base 1XK3 (Figure 2).
15. Use finger pressure to install the FADEC/start relay base 1XK3 to the mounting rail.

- NOTE -

For more data on the installation of the FADEC/start relay base and relay, refer to 407 Maintenance Manual, Chapter 96, Paragraph 96-76 and Figure 96-31.

16. Use finger pressure to install the FADEC/Start Relay 1K3 to the relay base 1XK3.
17. Put the wire K8D22 along the existing harness to terminal block 4TB2 position "LP". Use the insertion tool M81969/16-04 to install the contact of wire K8D22 into position "LP" of Terminal block 4TB2 (Figure 2).

18. As an alternative procedure to do Step 17, module "L" can first be removed from terminal block 4TB2.
 - a. Use the tool M81714/69-01 to remove module "L".
 - b. After you install the wire K8D22 into module position "P", install module into 4TB2 position "L" with finger pressure (Figure 2).
19. Make sure the wires K8D22 and K20A22 are installed correctly and securely held to wire bundles with lacing cord (EC-052). Ensure resistor 110-182A103TAR (reference designator 8R8) is left in free air and supported so that no interference occurs. Refer to BHT-ELEC-SPM, Section 6-00-00.
20. Install the access panel over terminal blocks and relays.
21. Make an entry in the helicopter historical records to show that you have completed this bulletin.
22. Make an entry in the Record of Technical Bulletins in the Maintenance Manual and the Illustrated Parts Breakdown to show that you have done this bulletin.
23. Prepare the helicopter for flight.

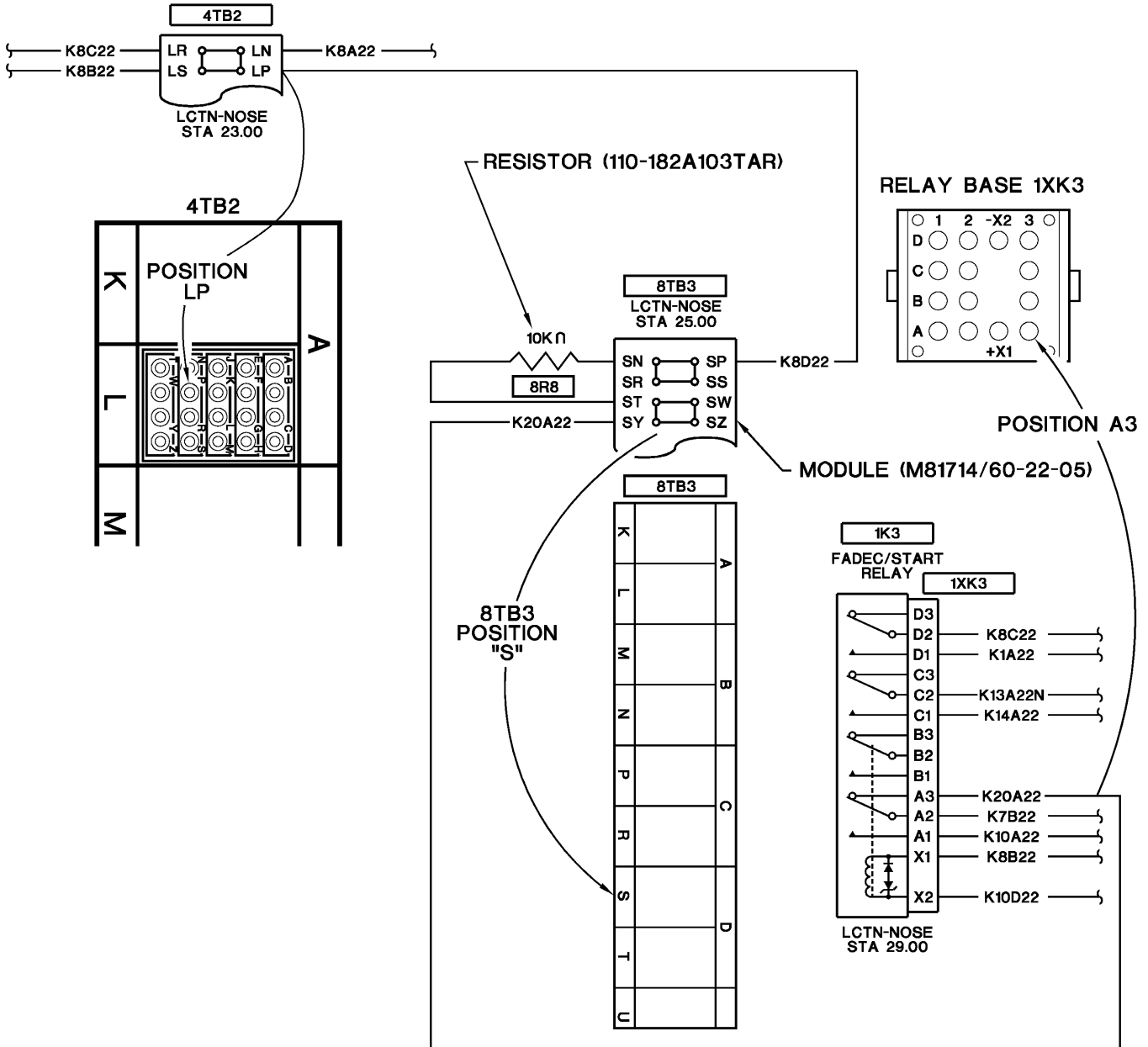


NOTE

Refer to Accomplishment Instructions, and install wires K8D22, K20A22 and resistor 110-182A103TAR (reference designator 8R8) into module M81714/60-22-05 before you install the module into terminal block 8TB3.

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Figure 1. Wire and Resistor – Installation on Module



NOTE

To provide clarity, other existing modules in 4TB2 and 8TB3 have not been shown.

Figure 2. Wiring Detail – Post T.B.