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This document transmits the Initial Issue of Service Bulletin EV2500-73-0190 and the Initial Issue of the Supplement

Bulletin Initial Issue

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	Pages 1 to 31 of the Service Bulletin	Initial Issue

Supplement Initial Issue

Remove	Incorporate	Reason for change
	Page 1 and 2	Initial Issue

V2500-ENG-73-0190

CHECK THAT ALL PREVIOUS TRANSMITTALS HAVE BEEN INCORPORATED
If any have not been received please advise Publication Services, Rolls-Royce plc, Derby, England

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International Aero Engines

SERVICE BULLETIN

ENGINE - FUEL AND CONTROL - TO PROVIDE A NEW ELECTRONIC ENGINE CONTROL (EEC) WITH D5 SCN14/0 SOFTWARE

1. Planning Information

A. Effectivity

(1) Engine Models Applicable

Boeing MD-90

V2525-D5, V2528-D5

Engine Serial Nos. V20001 thru V20285

B. Concurrent Requirements

There are no concurrent requirements.

C. Reason

(1) Automatic Fan Keep-out Zone.

(a) Problem: Fan blade root damage may result from second flap/third engine order (2F/3E0) stress in V2500 D5 engines.

(b) Evidence: Development engine test has shown that stabilized running in the range of 60% to 66% mechanical N1 speed may give rise to high 2F/3E0 resonance stress with the peak stress amplitude being influenced by the levels of crosswind experienced at the engine intake.

(c) Objective: Provide a fan keep-out zone. Prevent steady state engine fan operation in the region (zone) where 2F/3E0 mechanical resonance can occur. This keep-out zone will only be applied to on-ground (DFGC indicates weight-on-wheels), static operation (less than 0.1 +/- 0.03 Mn). The keep-out zone will not be applied during reverse-thrust operation.

Table 1 EPR mode Keep-out Zone

Inlet Temperature (T2 deg C)	EPR mode lower limit	EPR mode upper limit
-54	1.181	1.259
-35	1.155	1.259
-10	1.131	1.219
20	1.108	1.187

Inlet Temperature (T2 deg C)	EPR mode lower limit	EPR mode upper limit
55	1.088	1.161

NOTE: The design of the keep-out zone in the EPR mode must account for possible engine-to-engine variability, installation effects, engine deterioration and measurement uncertainties. Therefore, in the EPR mode, the keep-out zone limits in terms of N1 are approximately 57.8% to 68.3%.

Table 2 N1 mode Keep-out Zone

Inlet Temperature (T2 deg C)	Unrated N1 mode lower limit (mechanical speed)	Unrated N1 mode upper limit (mechanical speed)
-54	60.0%	63.4%
-35	60.0%	66.0%

The keep-out zone will be implemented as a throttle flat. The following explanation is written in terms of EPR mode operation. The same operational impact applies to the unrated N1 mode.

(i) For increasing (acceleration) throttle movement, engine power will be limited to no more than the low end of the keep-out zone until EPR command exceeds the high end of the zone.

(ii) For decreasing (deceleration) throttle movement, engine power will be limited to no less than the high end of the keep-out zone until EPR command goes below the low end of the zone.

(2) Pb Sensor Operating Temperature Increase.

(a) Problem: The burner pressure (Pb) sensor has been experiencing in-service problems related to water or moisture in the sensor.

(b) Evidence: One possible contributing factor may be that the operating temperature of the Pb sensor is too low for some ambient conditions. The operating temperature influences the water vapor pressure. The water vapor pressure directly affects the amount of water that stays in vapor-state as opposed to condensing in the sensor.

(c) Objective: Raise the temperature at which the heater for the Pb sensor shuts off by 10 deg F (5.6 deg C). For some ambient conditions, this will increase the operating temperature of the sensor and increase the water vapor pressure by about 24%. This will result in approximately 24% more water in vapor-state that will come out of the sensor during decompression rather than potentially condensing in the sensor. The increased operating temperature will not have an affect on the measurement of Pb.

(3) Pb Sensor Heater On At EEC Power-up.

(a) Problem: Field experience has shown that some engines require multiple start attempts if the overnight temperatures were very cold (for example, -35 deg C).

(b) Evidence: Accumulated moisture in the Pb sensor can freeze overnight if the overnight temperature is cold enough. When an engine is started, the software does not allow the Pb sensor heater to be turned on until N2 reaches 6700 rpm. Thus, the frozen water can only be melted by the heat generated by the engine start attempts.

(c) Objective: Allow the software to turn the Pb heater on as soon as the EEC is powered on the ground. This solution also has the added benefit of raising the temperature inside the Pb sensor prior to the engine start, thus reducing the amount of condensation within the sensor.

(4) Reheal of Pb Soft Failures.

(a) Problem: The burner pressure (Pb) sense line is experiencing freezing problems in the field. If the line freezes, the EEC logic detects this problem as a soft failure and accommodates it by using a synthesized Pb. If the line thaws and a valid pressure is available, the EEC logic does not allow the measured Pb to reheal, that is, to be used again. For this discussion, means to clear the latched soft failure and allow the sensed burner pressure to be used again.

(b) Evidence: The original design of the EEC logic did not include the ability to reheal Pb.

(c) Objective: Modify the EEC logic to allow the Pb signal to reheal. The following describes the details of this change:

(i) The Pb signal may reheal at any altitude to allow re-selection of the actual burner pressure signal rather than using a synthesized burner pressure. The burner pressure signal will be allowed to reheal if no hard failures exists and the following has occurred:

(ii) Allow the Pb signal to fail and reheal three times per flight. If the Pb signal fails a fourth time, the signal will not be allowed to reheal.

(iii) A maintenance bit and Class 1 fault (non-dispatchable) will set at first failure as with the current software. These bits will remain set after reheal.

(iv) The EEC recording logic will be changed to allow data gathering to determine the effectiveness of this change:

(1) The burner pressure soft failure will be recorded. (Same as current logic).

(2) All reheal events will be recorded. (These are event recording, not faults).

(3) The reheal event data will be accessible at the bottom of the flight data page through Interactive Mode. The fault code will be displayed as 'PB'. The clear language messages will be displayed as 'PB LINE REHEAL'.

(5) Stator Vane Crosscheck Nuisance Faults.

(a) Problem: Service experience has shown that Delays and Cancellations have been caused by nuisance stator vane (VSV) crosscheck faults (CLM - VSV ACT/HC/EEC). A crosscheck fault occurs when the feedback signal is different between the EEC channels. The faults have been determined to be nuisance faults because most of the time when the actuator is removed for investigation, the vendor cannot find anything wrong with the hardware.

(b) Evidence: The software failure detection logic was reviewed against the hardware specification to verify the failure tolerances are correct. The investigation has shown that the tolerances are acceptable. However, it has been noted that the time to latch a crosscheck failure is 1 second while todays best practices recommend 2 seconds. The short latch time could be a contributor to the nuisance setting of the stator vane crosscheck fault.

(c) Objective: Change the stator vane crosscheck latch time to 2 seconds so that it will be less likely the software will set a nuisance fault.

(6) Reduce 2.5 Bleed Maintenance Burden.

(a) Problem: The 2.5 Bleed crosscheck fault (CLM - 2.5 BLD ACT/HC/EEC) is approved at the engine level for Long Term Dispatch (Time Limited Dispatch Analysis) but is currently conservatively treated as a Short-Term Dispatch fault.

(b) Evidence: Revenue Service experience was desired before downgrading this fault from Short Term Dispatch to Long Term Dispatch.

(c) Objective: Reclassify the 2.5 Bleed crosscheck fault from Short Term Dispatch to Long Term Dispatch.

(7) Reduce Turbine Cooling Air (TCA) Valve Maintenance Burden.

(a) Problem: Many nuisance TCA (feedback) crosscheck faults are being seen in the field. Crosschecks are caused by a disagreement between the two feedback signals to the EEC. The TCA valve is still operating, just the feedback signal is failing. These nuisance crosscheck faults result in the setting of the Class 3 fault indicator. This is a maintenance burden to the field.

The TCA feedback signals are discrete (on/off) indications of valve position. There are microswitches that are an integral part of the valve, that send the position signal back to the EEC. The EEC receives the position signals and then sets a crosscheck fault if they disagree for 30 seconds.

(b) Evidence: Microswitches can be unreliable, especially when located in a hot, hostile area of the engine.

(c) Objective: Change the EEC software to remove TCA crosscheck fault recording and annunciation. The valve out-of-position failure detection logic will remain unchanged. This logic detects all known failure modes of the valve.

(8) Eliminate Misleading No. 4 Bearing Messages.

(a) Problem: Failures of burner pressure (Pb) can propagate into setting all three failures for the No 4 bearing scavenge valve. These faults set the Class 1, no dispatch indication. This results in faults being set that do not point to the root cause of the Class 1 fault. Only the Pb failure needs to be reported. In addition, if the Pb failure is temporary, no fault should be reported.

(b) Evidence: The aircraft Auxiliary Control Unit (ACU) logic uses the EEC ARINC output of Pb to validate the No 4 bearing scavenge valve position. When Pb is failed in the EEC, Pb synthesis is sent out over ARINC with the Sign Status Matrix (SSM) set to No Computed Data (NCD). The ACU cannot validate the No 4 bearing scavenge valve position using Pb synthesis. It therefore transmits the No. 4 bearing word to the EEC with an SSM set to Failure Warning. The EEC then simultaneously defaults (sets) all three No 4 bearing scavenge valve faults.

(c) Objective: Modify the EEC ARINC input logic for the No. 4 bearing word to inhibit all three No 4 bearing faults when Pb is known to be failed. This will prevent a failure of Pb from propagating into setting all three No 4 bearing scavenge valve faults.

(9) Unrated N1 Mode Altitude Lapse Rate.

(a) Problem: If the engine is not shutdown between flights and/or the EEC is not reset after landing, and the EEC were to revert to the unrated N1 mode during the subsequent takeoff, a potential thrust discrepancy up to +3% relative to the desired thrust setting could result on the affected engine. Any discrepancy is washed out by throttle movement and therefore does not affect flight regimes other than takeoff.

(b) Evidence: Current EEC logic assumes the engine will be shutdown and the EEC reset between flights to re-initialize the unrated N1 mode takeoff altitude lapse rate for the subsequent takeoff. The unrated N1 mode takeoff altitude lapse rate is designed to emulate the EPR mode lapse rate.

(c) Objective: Modify the EEC logic to re-initialize the previously calculated N1 takeoff altitude lapse rate upon landing to cover the case where the engine is not shutdown between flights.

(10) Service Bleed EPR Reset Lockup During Takeoff.

(a) Problem: Service bleed EPR resets are applied to the max climb, max continuous, and takeoff ratings. During takeoff, the bleed EPR resets applied to the takeoff rating are locked to protect against potential fluctuations in engine power as a result of cycling bleeds or other problems in the aircraft service bleed system. The bleed EPR resets applied to the max climb and max continuous ratings are not locked during takeoff. For some thrust ratings, at certain flight conditions, there is a potential that the max climb or max continuous rating can influence the takeoff EPR calculation. Thus, with current EEC logic, there is a potential for fluctuations in takeoff thrust due to aircraft bleed system problems.

(b) Evidence: Current logic design does not account for potential overlap which can occur between the takeoff, max continuous, and max climb powersettings, particularly for the upper edges of the take-off envelope, for example, 16000-feet, 0.4 Mn.

(c) Objective: Use the existing takeoff bleed EPR reset locking logic to lock the status of the MCL and MCT bleed EPR resets during takeoff operation.

(11) New Aircraft Wheel Burst Detector Failure Indication.

(a) Problem: Boeing has an aircraft wheel burst detector along the fuel line that is exposed to the aircraft wheel burst (Reference 4), however, there is no direct method to determine if this detector is failed. A method of determining that the aircraft wheel burst detector is failed needs to incorporated into the EEC logic.

(b) Evidence: The detector is wired into the fuel low-level-detection circuit to the Digital Flight Guidance Computer (DFGC). When either a low level of fuel is detected or a wheel burst is detected, the DFGC will send an ARINC bit (L270/23) to the EEC to signal termination of fuel return-to-tank.

(c) Objective: Modify the EEC logic to recognize the detector is failed by monitoring the ARINC bit (L270/23) for inhibit of fuel return-to-tank. If this bit is set continuously for 60 seconds, an event recording will take place. This new event recording will be reviewed at the same interval as that for Class 3 faults.

The new event recording will be:

ASPINW - Fuel return-to-tank for wheel burst detection.

ATA 731342, CLM 52 FUEL DIV RET VAL/EEC@.

Where, @ equals '1' or '2' depending on engine position.

NOTE: When Interactive Mode is used to review the EEC fault memory, the Clear Language Message (CLM) for this fault will be displayed in the LAST LEG REPORT and FAULT REVIEW - FLIGHT menus. However, the CLM is not displayed in the FLIGHT DATA menu. The Boeing troubleshooting manual provides correct procedures for this non-standard display.

(12) P2 / T2 Probe Heat Failure (Class 1) Not Fault Recorded.

(a) Problem: The EEC logic will determine the P2/T2 probe is in an icing condition if the temperature is below 7.2 deg C and the probe heat is commanded on but the feedback indicates it is off. When this happens, a Class 1 indication is set but there is no fault recorded to aid in troubleshooting.

(b) Evidence: The probe icing detection logic does not feed into the probe failure detection logic that drives fault recording.

(c) Objective: Modify the P2/T2 probe failure detection logic to include probe icing as a path to record a failure against the probe. In addition to setting the Class 1 fault indicator, the icing condition will also drive the following existing fault to be recorded:

PTHDIS - P2/T2 probe heater disagree.

ATA 732211, CLM 58 - P2T2 SENS/RELAY BOX/HC@.

Where, @ equals '1' or '2' depending on engine position.

(13) T2 Selection Logic Improvement

(a) Problem: The T2 selection logic was designed to choose the best available T2 input from the four possible sources: left ADC TAT, right ADC TAT, local channel engine T2 probe, and remote channel engine T2 probe. This is not true for all failure scenarios.

(b) Evidence: The logic that handles an engine T2 crosscheck occurring at the same time as an engine T2 to ADC TAT disagreement does not always choose the best available input. Instead, in this case, the logic will always choose the local engine T2.

(c) Objective: Modify the selection logic so that the best available source of T2 is always selected.

(14) Channel Switchover Hardware Nuisance Fault.

(a) Problem: A nuisance fault may be annunciated during the EEC self-tests run during engine spool-down. This may lead to unnecessary EEC removals, as well as delays and cancellations. The fault, ECAM Warning "ENG 1(2) FADEC A(B) FAULT", indicates there is an internal EEC problem. The fault is spurious and cannot be prevented with a procedure change. The ECAM Warning is driven by EEC ARINC Output Label 155 bit 26. The fault that causes the ARINC bit to be set is XSWDOA (Remote channel did not take control when local channel requested a switchover).

(b) Evidence: As part of the normal engine spool-down test the EEC attempts to confirm that the controlling channel is able to give control to the non-controlling channel. If it is unable to do so the EEC will set the fault XSWDOA (remote channel did not take control when local channel attempted a switchover). The intent is that XSWDOA will only be set if the remote/non-controlling channel will not take control because of an internal EEC failure and not because the EEC has detected an external electrical fault in one of the output circuits, for example, detected torque motor or solenoid electrical fault. The EEC channel confirms that the remote channel did not take control due to an external fault by comparing each channel's health before and after the switchover attempt. However, because of a flaw in the logic when comparing the two channel's health, XSWDOA can be set spuriously as a result of an external fault. In order for XSWDOA to be spurious it requires specific multiple fault scenarios, including at least one fault that has different health points above and below idle.

(c) Objective: Modify the EEC self-test logic to avoid this nuisance fault. Modify the logic to correct the way the XSWDOA logic stores and compares channel health points at time of switchover attempt and when determining the cause for the other channel not taking control.

D. Supplemental Information

Substantiation Data

(1) Pratt Whitney Closed Loop Bench (CLB) testing January-April 2004 On versions 29, 30, 31, and 32.

(2) Successful Engine run of D5 Engine Manual Test 10. on 30 April 2004.

(3) D5 SCN14/0 completed software certification process and FAA-DER audits on 21 June 2004.

E. Description

Program the EEC with SCN14/0 software or replace the EEC with a new EEC that has SCN14/0 software.

F. Compliance

Category 4

Accomplish at the first visit of an engine or module to a maintenance base capable of compliance with the accomplishment instructions regardless of the planned maintenance action or the reason for engine removal.

NOTE: Service Bulletin incorporation on engines installed on aircraft may be desirable and should be individually evaluated

G. Approval Data

The part number changes and/or part modifications specified in the Accomplishment Instructions and Material Information sections of this Service Bulletin have been shown to comply with the applicable Federal Aviation Regulations and are FAA-APPROVED for the engine model(s) given.

The compliance statement described in this Service Bulletin have been shown to comply with the applicable Federal Aviation Regulations and are FAA-APPROVED for the Engine Model listed.

H. Manpower

(1) Estimated man - hours to incorporate Part I (for engines installed on aircraft) of this Bulletin when the EEC is sent out for programming.

Remove the EEC (includes install warning notices and opening fan cowls)

0.6

Install the EEC (includes closing fan cowls, removing warning notices, and testing the EEC)

1.3

Total man - hours

1.9

(2) Estimated man - hours to incorporate Part I (for engines installed on aircraft) of this Bulletin when the EEC is programmed on site.

Install warning notices

0.9

Open fan cowls

0.1

Program the EEC

1.0

Close fan cowls

.2

Remove warning notices

0.1

Test the EEC

0.5

Total man - hours

2.0

(3) Estimated man - hours to incorporate Part II (for engines removed from aircraft) when the EEC is sent out for programming.

Remove the EEC

0.4

Install the EEC (includes testing the EEC)

1.0

Total man - hours

1.4

(4) Estimated man - hours to incorporate Part II (for engines removed from aircraft) of this Bulletin when the EEC is programed on site.

Remove the EEC (includes install warning notices and opening fan cowls)

0.6

Program the EEC

1.0

Test the EEC

0.5

Total man - hours

1.5

I. Weight and Balance

(1) Weight Change

None.

(2) Moment Arm

No Effect.

(3) Datum

Engine Front Mount Centerline (Power Plant Station (PPS) 100).

J. Electrical Load Data

This Service Bulletin has no effect on the aircraft electrical load.

K. Software Accomplishment Summary

Not Applicable.

L. References

1. IAE V2500 Service Bulletin V2500-ENG-73-0129 (Engine - Fuel And Control - To Provide A New Electronic Engine Control (EEC) WithThe D5SCN13/NSoftware Configuration).

2. IAE V2500 Service Bulletin V2500-ENG-73-0186 (Engine - Fuel And Control - EEC150-1/EEC150-20 Pressure Burner Sensor Port Screen Deletion (Controlled Service Use Only).

3. Hamilton Sundstrand Service Bulletin EEC-150-20-73-32 (Incorporation of New Software Configuration: D5 SCN14/0).

4. Boeing Service Bulletin MD90-28-009 (FUEL - Return to Tank System - Install Wheel Burst Detector on Fuel Line in Right Wheel Well).

5. Boeing Service Bulletin MD90-73-006 (ENGINE FUEL and CONTROL - Electronic Engine Controller (EEC) - Software Change for V2500-D5 Engines).

6. V2500 Aircraft Maintenance Manual.

7. V2500 Engine Manual (E-V2500-3IA), Chapter/Section 72-00-32.

8. V2500 Engine Illustrated Parts Catalogs (S-V2500-3IA, S-V2500-3IB), Chapter/Section 73-22-34.

9. Internal Reference No. - 04VZ003.

10. ATA Locator - 73-22-00.

M. Other Publications Affected

1. V2500 Engine Illustrated Parts Catalogs (S-V2500-3IA, S-V2500-3IB, Chapter/Section 73-22-34-01-280, to add the new parts.

2. V2500 Engine Manuals (E-V2500-3IA), Chapter/Section 73-22-00 Cleaning, Inspection and Repair, to add the new parts.

N. Interchangeability of Parts

Old and new parts are directly interchangeable.

O. Information in the Appendix

Alternate Accomplishment Instructions (No)

Progression Charts (Yes)

Added Data (No)

Revision to Table of Limits (No)

Inspection Procedures (No)

2. Material Information

A. Material - Price and Availability

1. IAE will provide free of charge the software diskettets required for reprogramming the EEC. Contact your local IAE Customer Support Representative who will coordinate the reprogramming effort with each customer.

2. There is no kit provided to do this Service Bulletin.

3. Part availability information is provided in material data Instructions - Disposition.

B. Industry Support Program

Not Applicable.

C. The material data that follows is for each engine.

NOTE: The prices shown are for estimating purposes only and as such are given in good faith without commercial liability for advanced planning purposes only. Refer to IAE Spares and/or current Price Catalog for current prices.

For V2525-D5, V2528-D5 Engines:

73-22-34

FIG ITEM NO.	NEW PART NO.	QTY	PART TITLE	OLD PART NO.	INSTR DISP
01-280	808050 -4-035 (2A3920)	1	Control, Electronic Engine (150-20 with Pb screen)	808050 -4-033 (2A3356)	(V) (1) (B)
01-280	808050 -4-035 (2A3922)	1	Control, Electronic Engine (150-20 without Pb screen)	808050 -4-033 (2A3904)	(V) (1) (B)

D. Instructions/Disposition Code Statements:

(1) The new part can be obtained through modification by the approved procedure in the Accomplishment Instructions. Obtain the new parts from or return the old parts for modification to one of the approved vendors listed in the Accomplishment Instructions.
(B) The old part will no longer be supplied.
(V) This is the Hamilton Sundstrand part number.

E. Tooling - Price and Availability

The tools and equipment that follow are necessary to program the EEC on site.

The following equipment is required to accomplish this Service Bulletin and will be provided or loaned to the operator for units that are reprogrammed in the field. Units that are returned to Hamilton Sundstrand Support Systems or Maastricht Aachen Airport to incorporate this Service Bulletin will be charged to the operator.

(1) A dedicated (recommendation) IBM compatible computer, with the following minimum requirements:

(a) 80286 processor

(b) 512 Kbytes RAM

(c) 1.44 Mbyte, 3.5 inch floppy disk drive

(d) Dual channel RS-422 asynchronous communication board (HS recommends Model DS202 by Qua Tech Incorporated) with the following setup:

Channel A EEC - COM3 (Base address 2E8, IRQ level 5)

Channel B EEC - COM4 (Base address 3E8, IRQ level 3)

(e) MSDOS operating system (version 3.0 or higher)

NOTE: The IBM computer date/time must be current prior to performing this procedure. In MS DOS systems (as in the Reprogramming Box PC), at the prompt (C:\>), enter 'date' or 'time' and the computer will display the current value. If necessary, type in the correct value, and press the Return key.

(2) Hamilton Sundstrand diskette referenced in Accomplishment Instructions, Table 4. This diskette contains the EEC 150-20/150-40 application code, trims, memory clear utilities, and software loader. The diskette can be obtained from your:

Customer Support Manager

(3) EEC Programming Harness Definition as defined in Accomplishment Instructions, Table 1.

(4) BOOT/BITE switches are defined as:

(a) Single pole, single throw

(b) Closed contact resistance of 50 ohms maximum

(c) Open contact resistance of 100 K ohms minimum

(d) Closed contact current of 20 mA minimum

(e) Open contact voltage of 20 VDC minimum and wired between BOOT DISC and BOOT/BITE RTN and BITE DISC and BOOT/BITE DISC for each channel. Reference Accomplishment Instructions, Table 1 for EEC connector pins.

(5) EEC 150-20/150-40 NAMEPLATE PN 751333-1 or modified nameplate 822815-1.

(6) 28 VDC +/- 0.5 A power supply and associated power cables as defined in Accomplishment Instructions, Table 2.

F. Reidentified Parts

Reidentified Parts Data

New PN	Keyword	Old PN
808050-4-035 (2A3920)	Control, Electronic Engine (150-20 with Pb screen)	808050-4-033 (2A3356) (73-22-34-01-280)
808050-5-035 (2A3922)	Control, Electronic Engine (150-20 without Pb screen)	808050-5-033 (2A3904) (73-22-34-01-280)

G. Other Material Information Data

Not Applicable.

3. Accomplishment Instructions

A. Part I - For engines installed on aircraft

NOTE: Service Bulletin incorporation on engines installed on aircraft may be desirable and should be individually evaluated.

(1) Do this procedure when the EEC is sent out for programming.

(a) Remove the EEC as specified in Reference 6., Aircraft Maintenance Manual, Chapter/Section 73-22-34.

(b) Send your EEC to one of the authorized rework vendors that follows:

NOTE: The Source Demonstration requirements of this rework means that any facility not authorized to accomplish this rework either utilize the Authorized Vendors listed or contact IAE Manager Maintenance Operations to determine if a qualification program can be initiated at their facility.

The designation by IAE of an authorized rework vendor indicates that the vendor has demonstrated the necessary capability to enable it to carry out the rework. However, IAE makes no warranties or representations concerning the qualifications or quality standards of the vendors to carry out the rework, and accepts no responsibility whatsoever for any work that may be carried out by a rework vendor, other than when IAE is listed as the vendor. Authorized rework vendors do not act as agents or representatives of IAE.

(i) Hamilton Sundstrand Corporation, A United Technologies Company, One Hamilton Road, Dock W, Windsor Locks, Ct. 06096-1010, USA

(ii) Hamilton Sundstrand Corporation, A United Technologies Company, Worldwide Repair - Maastricht, Maastrich Airport, Horsterweg, 6191 RX Beek, The Netherlands

(c) Install the EEC as specified in Reference 6., Aircraft Maintenance Manual, Chapter/Section 73-21-34.

(2) Do this procedure when the EEC is programmed on site.

(a) Install warning notices as specified in Reference 6., Aircraft Maintenance Manual, Chapter/Section 73-21-34.

(b) Open the fan cowls as specified in Reference 6., Aircraft Maintenance Manual, Chapter/Section 73-21-34.

(c) Program your EEC on site as specified in Part III of this Service Bulletin.

(d) Close the fan cowls as specified in Reference 6., Aircraft Maintenance Manual, Chapter/Section 73-21-34.

(e) Remove warning notices as specified in Reference 6., Aircraft Maintenance Manual, Chapter/Section 73-21-34.

(f) Test the EEC as specified in Reference 6., Aircraft Maintenance Manual, Chapter/Section 73-21-34.

B. Part II - For engines removed from aircraft

NOTE: Service Bulletin incorporation on engines installed on aircraft may be desirable and should be individually evaluated.

(1) Do this procedure when the EEC is sent out for programming.

(a) Remove the EEC as specified in Reference 7., Engine Manual, Chapter/Section 72-00-32.

(b) Send your EEC to one of the authorized rework vendors that follows:

NOTE: The Source Demonstration requirements of this rework means that any facility not authorized to accomplish this rework either utilize the Authorized Vendors listed or contact IAE Manager Maintenance Operations to determine if a qualification program can be initiated at their facility.

The designation by IAE of an authorized rework vendor indicates that the vendor has demonstrated the necessary capability to enable it to carry out the rework. However, IAE makes no warranties or representations concerning the qualifications or quality standards of the vendors to carry out the rework, and accepts no responsibility whatsoever for any work that may be carried out by a rework vendor, other than when IAE is listed as the vendor. Authorized rework vendors do not act as agents or representatives of IAE.

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(ii) Hamilton Sundstrand Corporation, A United Technologies Company, Worldwide Repair - Maastricht, Maastrich Airport, Horsterweg, 6191 RX Beek, The Netherlands

(c) Install the EEC as specified in Reference, 7., Engine Manual, Chapter/Section 72-00-32.

(2) Do this procedure when the EEC is programmed on site.

(a) Program your EEC on site as specified in Part III of this Service Bulletin.

(b) Test the EEC as specified in Reference 7., Engine Manual, Chapter/Section 72-00-32.

C. Part III - Programming the EEC on site

NOTE: The latest software standard may be loaded directly into any prior approved software standard. It is not required to load all the interim software standards.

Reprogramming assistance is available from your local IAE representative.

Do not turn on aircraft/external supply 28 VDC power until instructed to do so.

Reprogramming the EEC will clear the fault memory. It is recommended that a record of existing EEC faults be obtained before initiating reprogramming.

In the following procedure, statements provided to show text as it appears on the computer screen will be as illustrated follows:

* *

Sample Computer Text

* *

(1) Section 1

(a) Hamilton Sundstrand Electronic Engine Control Model EEC150-20 software is programmed into the EEC using an IBM compatible computer and Hamilton Sundstrand supplied software.

(i) Disassembly of the EEC is not required.

(ii) Data integrity of the Hamilton Sundstrand supplied software is performed as part of the reprogramming procedure.

(iii) A bit-for-bit memory verification test is included as part of the reprogramming procedure.

(iv) No functional, thermal cycle, or vibration testing is required for units reprogrammed in accordance with this Service Bulletin.

(v) The EEC can be programmed at room ambient conditions or while it is installed on the engine.

(2) Section 2

(a) Verify that the model number on the identification plate of the unit is 'EEC 150-20'.

(b) Record the current unit part number and the unit serial number from the nameplate. This information will be input into your computer.

(c) Connect commercial power to all necessary reprogramming equipment.

(d) Remove the harness connector from the EEC connector marked J1 and connect the programming harness connector marked P1 to the EEC connector marked J1. Make sure that the red engagement stripe on the EEC connector J1 is fully covered.

(e) Remove the harness connector from the EEC connector marked J7 and connect the programming harness connector marked P7 to the EEC connector marked J7. Make sure that the red engagement stripe on the EEC connector J7 is fully covered.

(f) If the computer and power supply connections to the cables are permanent, then go to the subsequent section titled: 'Section 3'

(g) Connect the programming harness connector marked CHAUART to the IBM compatible computer UART board connectors for the channel A RS-422 Port (COM3). Make sure that the connectors are properly mated.

NOTE: UART connections can differ for different IBM compatible computers.

It is important to verify that the connectors are correctly installed for correct loader operation. Hamilton Sundstrand recommends labeling the RS-422 COM3 port as CH A UART and COM4 port as CH B UART on the computer to reduce errors.

(h) Connect the programming harness connector marked CH B UART to the IBM compatible computer UART board connectors for the channel B RS-422 Port (COM4). Make sure that the connectors are properly mated.

NOTE: UART connections can differ for different IBM compatible computers.

It is important to verify that the connectors are correctly installed for correct loader operation. Hamilton Sundstrand recommends labeling the RS-422 COM3 port as CHAUART and COM4 port as CHBUART on the computer to reduce errors.

(3) Section 3

(a) If the EEC is powered by aircraft 28 VDC power supply, then go to the subsequent section titled: 'Section 4'

(b) If the computer and power supply connections to the cables are not permanent, connect the opposite end of P3 and P9 cables to the 28VDC power supply.

(c) Remove the harness connector from the EEC connector marked J3 and connect the power supply harness connector marked P3 to the EEC connector marked J3. Ensure that the red engagement stripes on EEC connector J3 are fully covered.

(d) Remove the harness connector from the EEC connector marked J9 and connect the power supply harness connector marked P9 to the EEC connector marked J9. Ensure that the red engagement stripes on EEC connector J9 are fully covered.

(4) Section 4

(a) Locate the BOOT/BITE switches for channel A and channel B. Set the BOOT/BITE switches to the ON (closed) position.

(b) Turn on the 28VDC power supply to the EEC.

(c) Turn on the power to the IBM compatible computer.

NOTE: Make sure that the disk drive 'A' has no disks present prior to power on of the computer.

(d) Wait for the MSDOS prompt 'C:\>' to appear on the IBM compatible computer.

NOTE: The procedure uses disk drive 'A'to identify the location of the floppy drive in the computer system. If your computer is configured with the 3.5inch floppy drive at a different designation, substitute that designation into the procedure.

(e) Obtain the Hamilton Sundstrand reprogramming diskette which is identified in Table 4 of these Accomplishment Instructions and Reference 3. or 4.

(i) Make sure that the write protection tab of the diskette is covering the 'hole'.

NOTE: If necessary, you can remove the stickers from the corner of the disk and move the protecting device to close the hole.

(ii) Insert the diskette into the floppy drive designated as 'A' on the IBM computer.

(f) The display will show the 'C:\>'prompt.

Type 'a:' then press the RETURN key.

NOTE: Some computers have the RETURN key designated ENTER.

(g) The display will show the 'A:\>' prompt.

Type 'LDR15O' then press the RETURN key. This starts the UART programming utility.

NOTE: Several messages will appear including the program identification, version number, time, and the UTC/PandW document property rights notice.

If there is a configuration error on the diskette, the program will display the appropriate error message and abort the programming process. Refer to Table 3 for a summary of error code description and troubleshooting suggestions.

(5) Section 5

(a) The UART programming utility LDR15O will display the following message:

* *

Enter operators name performing download: [ ] >

* *

NOTE: The field between the brackets will always be empty the first time the program is executed on the diskette.

Subsequent execution of the program will display the last name entered.

(i) If the operator is the same, press the RETURN key to continue.

(ii) If a different name is present than the operator or no name is present, the operator should enter his/her name and press the RETURN key.

(b) The LDR150 program will display the following message:

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

WARNING-EEC Fault Memory Will Be Cleared By This Program

If an EEC Fault Dump Is Requested prior to Programming, enter Q to
Quit or C to Continue [Q/C] :>

* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

(i) If a fault dump has already been accomplished or is not required:

Type 'C' then press the RETURN key.

(ii) If a fault dump is required or the operator wishes to terminate the programming procedure:

Type 'Q' then press the RETURN key.

(iii) If the operator selects the quit option, turn off the 28VDC power to the EEC and go to the subsequent section titled: Section 7

(c) The LDR150 program will now prompt with the following message:

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

Enter the 9 character EEC Serial Number: [XXXX-XXXX]>

* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

From the Hamilton Sundstrand nameplate, enter the nine character EEC serial number and press the RETURN key.

NOTE: For the next two steps, if the EEC 150-20 or EEC 150-40 part number on the nameplate between the dashes is a single digit, enter a zero immediately preceding this digit.

Example: PN808050-4-030 would be entered as 808050-04-030.

(d) The LDR150 program will now prompt with the following message:

* *

Enter the 13 character Current EEC HW Part No.: [XXXXXX-XX-XXX]>

* *

From the Hamilton Sundstrand nameplate, enter the 13 character EEC hardware part number and press the RETURN key.

(e) The LDR150 program will now prompt with the following message:

* *

Enter the 13 character SB EEC HW Part No.: [XXXXXX-XX-XXX]>

* *

From Table 4 and References 3. or 4., enter the 13 character EEC hardware part number and press the RETURN key.

(f) The LDR150 program will now prompt with the following message:

* *

Enter Trim Checksum Value for XXXXXX.TRM :

* *

The XXXXXX.TRM designation is the name of the trim file being loaded to the EEC. From Table 4 and Reference 3. or 4., enter the trim checksum value and press the RETURN key.

(g) The LDR150 program will now prompt with the following message:

* *

Do you wish to reenter the above entries [Y/N/Q] :

* *

(i) To proceed with programming process:

Type 'N' then press the RETURN key. Go to the subsequent section titled: Section 6, then continue.

(ii) To correct any errors in the data entered:

Type then press the RETURN key. Then go back to the previous section titled: Section

(iii) To quit the programming process:

Type then press the RETURN key. Turn off the 28VDC power to the EEC then go to the subsequent section titled: ;

(6) Section 6

(a) At this point the screen will be initialized to display the activity of the programming process.

(i) Status messages will scroll across the screen.

NOTE: For a successful reprogramming operation, this step will take the following approximate times:

EEC150-20: 30minutes.

EEC150-40: 10minutes.

(ii) If an error occurs, see Table 3 for a summary of error code description and troubleshooting suggestions.

(b) The LDR150 program will prompt with the following message:

* *

Turn OFF the BITE and BOOT switches to the EEC

then

Turn OFF POWER to the EEC and wait at least 5seconds

then

Turn ON POWER to the EEC

. . . Press the RETURN Key When Ready to Continue

* *

Locate the BOOT/BITE switches on your test equipment, and set the BOOT/BITE switches to the OFF (open) position.

(c) Switch off the 28VDC supply to the EEC, wait 5 seconds, then switch on the 28VDC power supply to the EEC.

(d) On the IBM compatible computer, press the RETURN key.

(e) Wait until the LDR15O program prompts with the following message:

* *

Turn ON the BITE and BOOT switches to the EEC

then

Turn OFF POWER to the EEC and wait at least 5 seconds

then

Turn ON POWER to the EEC

. . . Press the RETURN Key When Ready to Continue

* *

Locate the BOOT/BITE switches on your test equipment, and set the BOOT/BITE switches to the ON (closed) position.

(f) Switch off the 28VDC power supply to the EEC, wait 5seconds, then switch on the 28VDC supply to the EEC.

(g) On the IBM compatible computer, press the RETURN key.

(h) Wait until the LDR15O program prompts with the following message:

* *

Turn OFF POWER to the EEC

. . . Press the RETURN Key When Ready to Continue

* *

Switch off the 28VDC supply to the EEC.

(i) On the IBM compatible computer, press the RETURN key.

(j) The LDR150 program will now display the status of the programming process. Record the name of the log file for hard copy report of the process.

(i) If a successful programming occurred, the following message will be displayed:

* *

****EEC PROGRAMMING SUCCESSFULLY COMPLETED****

Record the log file name VLXXXX.LOG for later printout.

* *

If desired, record the log file name VLXXXX.LOG for later printout

(ii) If programming was unsuccessful, the following message will be displayed:

* *

****DOWNLOAD PROCESS ABORTED - ERROR CODE X

Record the log file name VLXXXX.LOG for later printout.

* *

If desired, record the log file name VLXXXX.LOG for later printout.

The X refers to the type of error that caused the process to abort. Table 3 describes the error codes and action to be taken.

(7) Section 7

(a) Press the RETURN key to terminate the program and return to the MSDOS prompt A:\>.

(b) A paper copy of the log file can be made by the IBM compatible computer if a printer is available. You can do this as follows:

NOTE: You can remove the diskette, write protect the diskette, and move to a system with a printer if no printer is connected to the original system. Complete the following commands to make a paper copy.

(i) At the MSDOS prompt:

Type VLXXXX.LOG.

(ii) Press the RETURN key.

(iii) Wait until the printer is finished before proceeding to the next step.

(iv) Remove the diskette, write protect the diskette.

(c) Disconnect the EEC reprogramming electrical connectors from J1 and J7 and J3/J9, if applicable.

(d) Reconnect the aircraft electrical harness connectors to J1 and J7 and J3/J9, if applicable.

(e) Identify the EEC by the procedure as follows and in Reference 2.

(i) If not already installed, install the software identification plate below the existing nameplate by the procedure specified in HS SB EEC150-20-73-16, Reference 2.

(ii) Use a ballpoint pen or equivalent to put the last three digits of the HS HW new part number from Table 4 in the S/W NO. column of the software identification plate, and the date in the DATE column of the software identification plate.

(iii) Erase (scratch out) the existing HS HW part number and date, if previously marked on the software identification plate.

(iv) Erase (scratch out) the last three digits of the HS HW part number from the nameplate above the software identification plate.

(f) For this reprogramming diskette, make/add a record of accomplishment, listing diskette part number, operator, EEC serial number, and date.

(g) When fleet reprogramming is complete, return reprogramming diskette and record of accomplishment to IAE representative, for return to IAE.

Table 1 EEC Programming Harness Definition

EEC SIGNAL NAME	PROGRAMMING HARNESS CONNECTOR	QUA-TECH CONNECTOR	QUA-TECH SIGNAL NAME
UART IN LINE B CHA	P1-b	PA-2	TXD+
UART IN LINE A CHA	P1-H	PA-7	TXD-
UART OUT LINE A CHA	P1-c	PA-4	RXD+
UART OUT LINE B CHB	P1-J	PA-8	RXD-
BOOT DISK CHA	P1-D	N/A	N/A
BITE DISK CHA	P1-Z	N/A	N/A
BOOT/BITE RTN CHA	P1-m	N/A	N/A
UART IN LINE B CHB	P7-b	PB-2	TXD+
UART IN LINE A CHB	P7-H	PB-7	TXD-
UART OUT LINE A CHB	P7-c	PB-4	RXD+
UART OUT LINE B CHB	P7-J	PB-8	RXD-
BOOT DISC CHB	P7-D	N/A	N/A
BITE DISC CHB	P7-Z	N/A	N/A
BOOT/BITE RTN CHB	P7-m	N/A	N/A

Table 2 Power Supply Connections

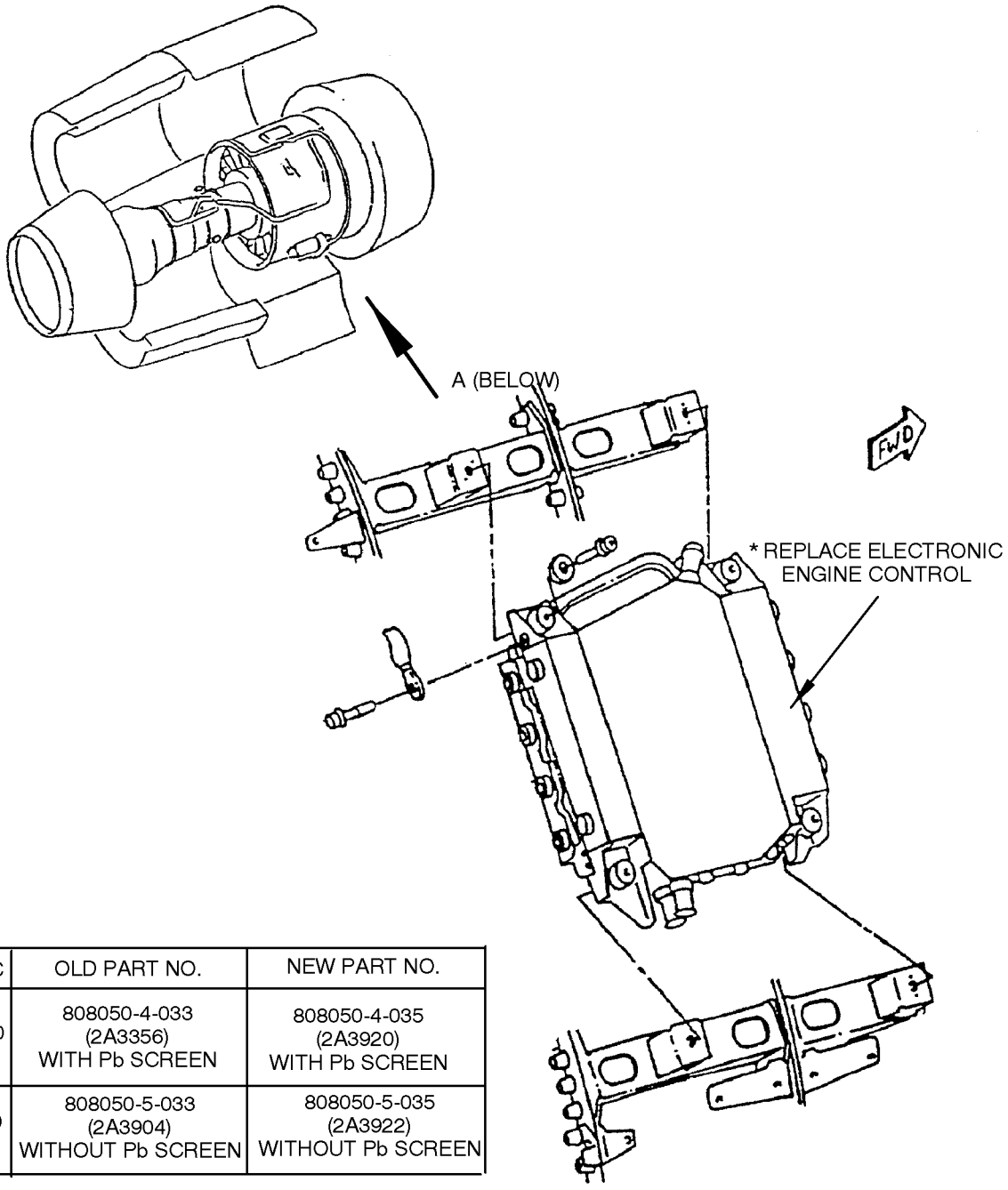
EEC SIGNAL NAME	POWER SUPPLY HARNESS CONNECTOR	POWER SUPPLY
GTP CHA	P3-m	+28VDC
GTP RTN CHA	P3-r	+VDC RTN
GTP CHB	P3-m	+28VDC
GTP RTN CHB	P9-r	+28VDC RTN

Table 3 Error Code Definitions

ERROR CODE	ERROR TYPE	ACTION
E1	EEC VERIFY ERROR-Data verify error in EEC-Compare failed or location could not be programmed.	Try procedure 3 times, if still bad, operator has the option to: return the unit OR successfully reprogram the unit to the prior D5 Sftware Standard, as defined by the corresponding Software Service Bulletin in the Family Tree.
E2	COMMUNICATION ERROR-Communication problem between EEC and IBM compatible computer.	Check BITE, cables, power supply, UART board, and EEC. Retry 3 times.
E3	CONFIGURATION ERROR-Configuration data comparison failed. (Possible Hardware P/N mismatch, EEC compatibility mismatch, Trim Checksum mismatch).	Operator data entered incorrect or incorrect data on existing nameplate. Check data-retry with the correct information.
E4	SYSTEM PROBLEM-Poor operating environment bad disk, or program aborted by operator.	If the process was not terminated by the operator, check that the disk is not write protected, or replace the disk and retry.

Table 4 Reprogramming

D5 SCN14/0	Old P/N	New P/N
Reprogramming Diskette 150-20 (with Pb screen)	n/a	1006699-1
Reprogramming Diskette 150-20 (without Pb Sreen)	n/a	1006699-2
EEC: (with Pb Screen) (HS) HW Part No. 150-20	808050-4-033	808050-4-035
EEC: (without Pb Screen) (HS) HW Part No. 150-20	808050-4-033	808050-5-035
Trim Checksum	n/a	-21405



* EEC	OLD PART NO.	NEW PART NO.
150-20	808050-4-033 (2A3356) WITH Pb SCREEN	808050-4-035 (2A3920) WITH Pb SCREEN
150-20	808050-5-033 (2A3904) WITHOUT Pb SCREEN	808050-5-035 (2A3922) WITHOUT Pb SCREEN

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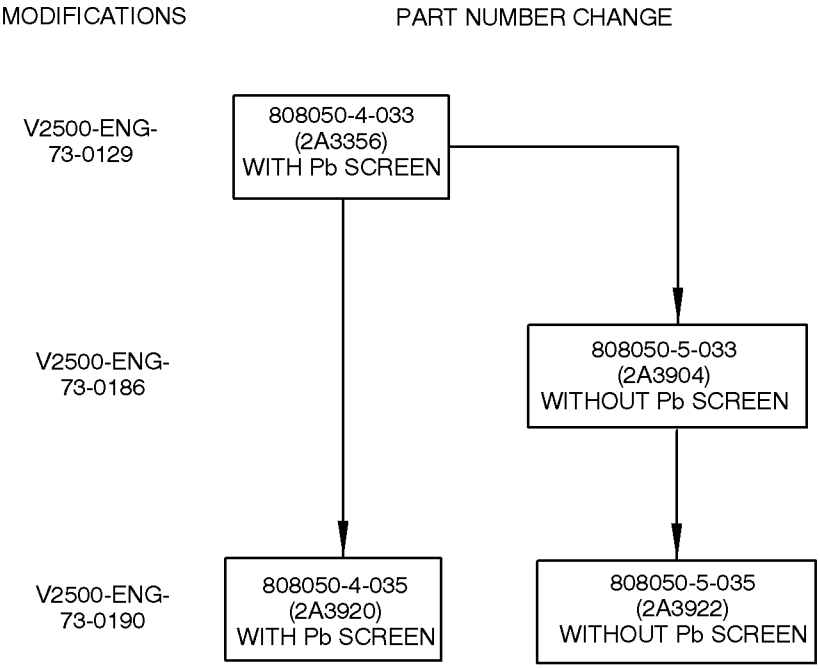
Location of the Electronic Engine Control (EEC)
Figure 1

International Aero Engines

SERVICE BULLETIN

ENGINE – FUEL AND CONTROL – TO PROVIDE A NEW ELECTRONIC ENGINE CONTROL (EEC) WITH D5 SCN14/0 SOFTWARE

Parts Progression To Show the Changed Part in Relation to Other Parts



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Family Tree - Electronic Engine Control (EEC) Ref. Catalog Sequence No. 73-22-34.
Fig. 01 Item 280
Chart A