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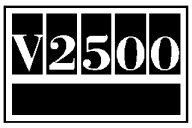


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DATER Jun.30/03

# V2500-A5 SERIES PROPULSION SYSTEM SERVICE BULLETIN



This document transmits Revision 1 to Service Bulletin EV2500-73-0184

Document History

| Service Bulletin Revision Status | Supplement Revision Status |
|---|---|
| Initial Issue Apr.4/03 | |

Bulletin Revision 1

| Remove | Incorporate | Reason for change |
|---|---|---|
| All pages of the Service Bulletin | Pages 1 to 30 of the Service Bulletin | To revise Effectivity. |
| All pages of Appendix 1 | Page 1 and 2 of Appendix 1 | To revise Effectivity. |

V2500-ENG-73-0184



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

LIST OF EFFECTIVE PAGES

The effective pages to this Service Bulletin following incorporation of Revision 1 are as follows:

| Page | | Revision Number | Revision Date |
|---|---|---|---|
| | Bulletin | | |
| R | 1 | 1 | Jun.30/03 |
| R | 2 | 1 | Jun.30/03 |
| R | 3 | 1 | Jun.30/03 |
| R | 4 | 1 | Jun.30/03 |
| R | 5 | 1 | Jun.30/03 |
| R | 6 | 1 | Jun.30/03 |
| R | 7 | 1 | Jun.30/03 |
| R | 8 | 1 | Jun.30/03 |
| R | 9 | 1 | Jun.30/03 |
| R | 10 | 1 | Jun.30/03 |
| R | 11 | 1 | Jun.30/03 |
| R | 12 | 1 | Jun.30/03 |
| R | 13 | 1 | Jun.30/03 |
| R | 14 | 1 | Jun.30/03 |
| R | 15 | 1 | Jun.30/03 |
| R | 16 | 1 | Jun.30/03 |
| R | 17 | 1 | Jun.30/03 |
| R | 18 | 1 | Jun.30/03 |
| R | 19 | 1 | Jun.30/03 |
| R | 20 | 1 | Jun.30/03 |
| R | 21 | 1 | Jun.30/03 |
| R | 22 | 1 | Jun.30/03 |
| R | 23 | 1 | Jun.30/03 |
| R | 24 | 1 | Jun.30/03 |
| R | 25 | 1 | Jun.30/03 |
| R | 26 | 1 | Jun.30/03 |
| R | 27 | 1 | Jun.30/03 |
| R | 28 | 1 | Jun.30/03 |
| R | 29 | 1 | Jun.30/03 |
| R | 30 | 1 | Jun.30/03 |
| | Appendix 1 | | |
| R | 1 | 1 | Jun.30/03 |
| R | 2 | 1 | Jun.30/03 |

# ENGINE - FUEL AND CONTROL - TO PROVIDE A NEW ELECTRONIC ENGINE CONTROL (EEC) WITH A5 SCN17/V SOFTWARE



## 1. Planning Information

### A. Effectivity Data

(1) For Airbus A319

Engine Models Applicable

V2522-A5, V2524-A5, V2527M-A5 Engine Serial Nos V10001 thru V11419, V11421 thru V11424, V11426 thru V11433, V11435 thru V11438, V11440 thru V11454,
R V11456, V11475, V11482

(2) For Airbus A320

Engine Models Applicable

V2527-A5, V2527E-A5 Engine Serial Nos V10001 thru V11419, V11421 thru V11424, V11426 thru V11433, V11435 thru V11438, V11440 thru V11454,
R V11456, V11475, V11482

(3) For Airbus A321

Engine Models Applicable

V2530-A5, V2533-A5* Engine Serial Nos V10001 thru V11419, V11421 thru V11424, V11426 thru V11433, V11435 thru V11438, V11440 thru V11454,
R V11456, V11475, V11482

NOTE: * V2533-A5 Base Line Serial Number is V10198.

CAUTION: SCN17/V INCLUDES CHANGES SUCH AS THE INCREASED MCT RATING AND THE FAN FLUTTER KEEP-OUT ZONE WHICH, FOR A GIVEN THROTTLE SETTING (IN CERTAIN SITUATIONS), COULD RESULT IN A DIFFERENCE IN POWER SETTING ACROSS WING THAT COULD BE NOTICEABLE BY THE COCKPIT CREW IF SCN17/V WAS INSTALLED ON ONE ENGINE AND INTERMIXED WITH A PRIOR SOFTWARE VERSION ON THE OTHER ENGINE. AS A RESULT, SCN17/V AND PRIOR SOFTWARE VERSIONS ARE NOT INTERMIXABLE.

### B. Concurrent Requirements

There are no concurrent requirements.

C. Reason

(1) Derated Takeoff.

NOTE: Other modifications must be accomplished at an aircraft level to activate the derated take-off option. See Airbus Service Bulletin Reference 5., for more details.

(a) Problem: Airbus intends to provide, at the aircraft level, the ability to perform fixed derated takeoffs for the A319, A320, and A321 aircraft. The EEC does not currently have this feature.

(b) Background: This feature is a new requirement.

(c) Objective: Incorporate new logic to provide the capability for up to 6 fixed levels of derated takeoff for approximately 4%, 8%, 12%, 16%, 20% and 24% thrust derate relative to the maximum takeoff rating. A large thrust derate, 16%, 20%, or 24%, may actually be less thrust than the max climb rating for some of the lower thrust ratings (for example, A319/22 and A319/24). If this condition occurs, the max climb rating is lowered to the derated thrust level so that it will not limit the takeoff thrust. The lowered climb rating will be gradually increased to its normal level between 0.3 and 0.4 Mach.

(2) Flex Takeoff.

(a) Problem: The current flex takeoff mode is limited by the max climb rating.

(b) Background: The flex mode allows the possibility to request a takeoff thrust that is lower than the max climb rating.

(c) Objective: Lower the max climb rating. The max climb rating will be lowered to the flex takeoff thrust level so that it will not limit the takeoff thrust. The lowered climb rating will be gradually increased to its normal level between 0.3 and 0.4 Mach.

(3) Max Continuous Rating Increase.

(a) Problem: The Maximum Continuous EPR rating does not provide the desired thrust in certain areas of the flight envelope.

(b) Background: New requirements have been established which require the rating be changed.

(c) Objective: Incorporate higher Max Continuous EPR power-settings for the A321 V2533 and V2530 ratings. The increased Max Continuous thrust levels are limited to lower (5,000-ft and below) altitudes, lower (0.4-mach and below) Mach numbers and hot (ISA+30 deg C and greater) day conditions.

Incorporate higher Max Continuous EPR power-settings for the A320 V2527E and V2527 ratings. The higher Max Continuous thrust levels are the same as the current V2533 and V2530 ratings for 8,000-ft pressure altitude and above. There is no increase below 5,000-ft except for hot day, low Mach number conditions (ISA+40 deg C and greater, 0.4-mach and below).

For A320 ratings only, the transition from Max Continuous to Max Climb rating is extended from 20,000-ft to 25,000-ft pressure altitude. The new transition is 100% washed out at 27,000-ft pressure.

(4) Fan Flutter Keep-out Zone.

(a) Problem: There have been incidents of fan blade root damage confirmed in service operation of the A5 engine.

(b) Background: It is suspected that the root damage has been caused by high cycle fatigue stresses resulting from fan 'stall ' flutter and/or second flap/third engine order (2F3E0) mechanical resonance.

(c) Objective: Provide a logic concept similar to the V2500-A1 SCN14/S fan keep-out zone. Restrict steady state engine fan operation in the region (zone) where fan flutter/2F3E0 mechanical resonance can occur. This keep-out zone will only be applied to on-ground, static operation (less than 0.07 MN). The keep-out zone will not be applied during unrated N1 mode operation and during reverse operation.

The keep out zone is defined as follows:

The lower limit of the keep-out zone is a function of inlet temperature to minimize the impact on engine operation due to both aerodynamic and mechanical resonance concerns at lower speeds. The following table defines the lower limit:

| Inlet Temperature (T2 deg C) | EPR mode lower limit | Rated N1 mode lower limit (zone is expressed in corrected speed) |
|---|---|---|
| -62. | 1.184 | 70.0% |
| -20. | 1.135 | 63.9% |
| 15. | 1.108 | 59.9% |
| 60. | 1.086 | 55.7% |

The upper limit of the keep-out zone is:

1.215 EPR EPR mode operation.

72.0% N1C2 Rated N1 mode operation (zone is expressed in corrected speed).

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 rated N1 mode.

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.

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.

(5) Cockpit Stall Annunciation.

(a) Problem: Not all stalls are currently annunciated on the flight deck. SCN17/V provides flight deck annunciation for all FADEC detected stalls to allow the crew to correlate audible indications and to facilitate appropriate troubleshooting prior to next flight.

(b) Background: When an engine stall occurs, the EEC responds to recover the engine from the stall. If the duration of the stall exceeds 2 seconds, a Class 1 fault will be recorded and annunciated in the cockpit. However, most stalls recover within 2 seconds and are therefore not annunciated in the cockpit. All stall events, of any duration, are recorded as Class 3 faults.

(c) Objective: Modify the EEC logic such that for every engine stall, of any duration, a Class 1 fault will be recorded and annunciated in the cockpit. The current Class 3 fault logic will no longer be recorded.

(6) Throttle Resolver Angle Failure Accommodation - Fault accommodation for a crosscheck on the ground during a takeoff run.

(a) Problem: Recent thrust control malfunction discussions have defined that no single failure on ground should lead to uncommanded forward thrust above 50% of max takeoff when the pilot requests idle or reverse. The crosscheck (comparison of EEC Channel A to Channel B TRA inputs) fault accommodation logic when the throttle is in a takeoff position may not meet this requirement during a takeoff run.

(b) Background: The current crosscheck fault accommodation logic for takeoff requires that the larger (the one closer to max takeoff) TRA be used for power setting. This is the case even if one TRA signal indicates idle at the time the crosscheck is detected.

(c) Objective: Modify the crosscheck fault accommodation logic for takeoff such that the larger is selected if both TRA are above the idle flat. If one TRA signal is at idle or in reverse, forward idle shall be selected. The fault accommodation can switch between selecting idle and selecting the larger TRA based on the input conditions as long as the throttle is still in a takeoff configuration.

(7) Throttle Resolver Angle Failure Accommodation - Fault accommodation for a dual failure in flight.

(a) Problem: For certain situations, Airbus has identified that the best accommodation logic for a dual signal loss in flight is to select max climb. The current EEC logic does not meet this new requirement.

(b) Background: For certain situations, the current accommodation logic for a dual signal loss in flight is to select max continuous. Selecting max continuous causes obtrusive flashing of the Flight Mode Annunciator on the Primary Flight Display in the cockpit.

(c) Objective: Modify the fault accommodation logic to select max climb instead of max continuous. This change will prevent the flashing of the Flight Mode Annunciator on the Primary Flight Display in the cockpit.

(8) Throttle Resolver Angle Failure Accommodation - Fault accommodation for a crosscheck in flight with TRA at or below max continuous.

(a) Problem: For certain situations, Airbus has identified that the best accommodation logic for a crosscheck in flight with TRA at or below max continuous is to select the higher TRA but limited to max climb. The current EEC logic does not meet this new requirement.

(b) Background: For certain situations, the current accommodation logic for a crosscheck in flight with TRA at or below max continuous is to select the higher TRA but limited to max continuous. Selecting max continuous causes obtrusive flashing of the Flight Mode Annunciator on the Primary Flight Display in the cockpit.

(c) Objective: Modify the fault accommodation logic to select the higher TRA but limit to max climb instead of max continuous. This change will prevent the flashing of the Flight Mode Annunciator on the Primary Flight Display in the cockpit.

(9) Cockpit Fuel Flow Display (engine shutdown).

(a) Problem: A new requirement has been established that the EEC logic for fuel flow cockpit display at engine shutdown be driven only by the closure of the high-pressure shutoff valve. The current EEC logic does not meet this new requirement.

(b) Background: When fuel is commanded off, the current design masks the fuel flow display for 15 seconds once the N2 speed is below idle, by transmitting the ARINC output for fuel flow with an SSM = No Computed Data. The cockpit Display Management Computer displays amber 'XX' for the 15 seconds.

(c) Objective: Modify the logic to transmit a value of zero, with an SSM = Normal, whenever the high-pressure shutoff valve indicates the fuel is off and the N2 speed is below idle.

(10) 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) Background: 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.

(11) Master Lever Position on ARINC.

(a) Problem: A new requirement has been established for an EEC ARINC indication of the master lever position.

(b) Background: This is a new requirement.

(c) Objective: Output the selected master lever position on ARINC Output Label 272 bit 11. The bit shall be set equal to one (1) when the selected master lever position is OFF.

(12) Fuel Back-to-Tank Inhibit on Selection of Master Lever Off.

(a) Problem: Recent flight-testing has shown instances of Auxiliary Power Unit (APU) shutdown (flameout) during engine windmill starts.

(b) Background: The APU shutdowns are attributable to a fuel pressure pulse entering the aircraft fuel system from the engine. When the engine is shutdown by the Master Lever, while the engine is spooling down, the Heat Management System (HMS) continues to command spill back-to-tank. This can drain fuel from the engine system and result in total or partial evacuation of the system between the Low Pressure Fuel (LP) Pump and Low Pressure Fuel (LP) Valve.

During subsequent re-light, the LP Valve is commanded open and the aircraft fuel-pumps force fuel back into the engine. The surge of fuel entering the evacuated system comes to an abrupt stop as it reaches the LP Pump and the resultant reflected shockwave propagates back down the system as a pressure pulse towards the APU. On reaching the APU, the pulse causes a combustor flameout and under-speed shutdown

(c) Objective: Modify the HMS logic to inhibit spill-back-to-tank when Master Lever is off and until the engine is at idle. The action of inhibiting spill during engine shutdown will have no effect on the engine HMS because during shutdown, the LP Valve is closed and hence there is no cool fuel being fed into the engine. For the period where the engine has re-lit and is below idle, the absence of spill back-to-tank will have no detrimental effect on the engine as cooling is still provided by the Air Modulating Valve if necessary.

(13) Flex Takeoff Determination.

(a) Problem: Several cases of asymmetric EPR during flex takeoff have been reported from the field. In some of the cases, it was recorded that the flex takeoff mode was not entered by the system on one engine leading to a case where one engine was operating at max continuous power and the other engine operating at flex takeoff power.

(b) Background: The source of the problems reported from the field is not completely understood. However, during the investigation of the problems, one possible cause has been identified which can be addressed with an EEC software change. This change will prevent the EEC software from contributing to the problems being experienced in the field.

The EEC software is designed so that each channel independently determines the total ambient temperature (TAT). Each channel determines TAT by selecting the best signal from the Air Data T2 and the engine T2 probe input. Note that each EEC channel receives its own T2 reading from the dual-channel engine T2 probe. If the engine T2 probe channels differ by a small amount and they disagree with the Air Data T2; it is possible that the TAT determined by the EEC will be different between EEC channels

If the TAT's determined by each EEC channel are different and the requested flex temperature is between the two TAT's, then one channel will go into flex mode and the other will not. If the controlling channel has the higher TAT, it would provide max continuous power when the throttle is moved to the max continuous detent. The non-controlling channel would note that flex temperature is higher than its TAT and annunciate flex mode on ARINC, but does not provide thrust control. The aircraft looks for either EEC channel to annunciate flex mode on ARINC. If the other engine on the aircraft has the controlling channel in flex mode, then both EEC's would annunciate flex mode but only one engine would be in that mode

(c) Objective: Modify the logic such that if one channel of the EEC selects flex mode, the other channel will select flex mode. This change will ensure that both EEC channels are always in the same thrust mode. Note that in order for both EEC channels to enter flex mode, flex temperature must be received by both EEC channels.

(14) Centralized Maintenance System (CMS) Menu Mode.

(a) Problem: This is not a current problem, but is being introduced to prevent any potential future problem. The EEC must enter Menu Mode every time when requested. To do so, the EIU must receive ARINC Label 270 from the EEC. If the transmit interval of ARINC Label 270 is less than 200 msec while attempting to enter Menu Mode, then the communication between the EEC and the Engine Interface Unit (EIU) may not be established and the system may not enter Menu Mode.

(b) Background: This is a new requirement. Recent testing of the communication protocol between the EEC and the EIU has defined this requirement.

(c) Objective: Change the logic to prevent possible problems while entering Menu Mode. Modify the logic that controls ARINC transmission while entering Menu Mode to insure that Label 270 is transmitted at an update rate of 200 msec. This change does not affect Normal Mode operation.

(15) Removal of redundant fault from fault recording.

(a) Problem: Two Scheduled Maintenance faults, FDLNG and FDRNG, which are set in the EEC150-40 only, are redundant to other recorded faults.

(b) Background: These faults cause other recorded faults to be set.

(c) Objective: Remove the redundant faults from fault recording.

Specifically, the following Scheduled Maintenance faults will be removed:

- FDLNG - Local F/D converter no good

- FDRNG - Remote F/D converter no good

- ATA 732234, CLM 1 - EEC@

The removed faults are covered by the following existing faults:

- P2IFA - P2 interface fail flag.

- P5IFA - P5 interface fail flag.

- PAMIFA - PAM interface fail flag.

- PBIFA - PB interface fail flag.

- PMXIFA - PMX interface fail flag.

All of these faults are associated to ATA 732234, CLM 1 - EEC@, where, @ equals '1 ' or '2 ' depending on engine position.

D. Supplemental Information

Substantiation Data

(1) Airbus Iron Bird testing in May - June 2002 (version 53) and October 2002 (version 54).

(2) Pratt Whitney Closed Loop Bench (CLB). Testing for Flight Test April-June (version 53) and September-October 2002 (version 54).

(3) Simulation analysis of Fan Keep-out Zone to insure no interaction with Maximum Flex/Fixed Derated Takeoff and Derated On-Ground engine operation.

Maximum continuous rating enhancements were analyzed relative to the current peak levels of Rotor speeds and EGT to maintain current notional N1 and N2 Speed Redline Margins and EGT Redline Margin. No change in Redlines.

(4) Engine test on X804/24B (version 53) in July 2002 to check-out Fan Keep-Out Zone.

(5) Successful Airbus flight test on EEC150-20 and EEC150-40 in July 2002 (version 53) and October 2002 (version 54).

(6) Successful pilot lot run of engine TIS in October 2002 (version 54).

E. Description

Program the EEC with SCN17/V software or replace the EEC with a new EEC that has SCN17/V 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

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

| Description | Estimated Man-hours |
|---|---|
| Remove the EEC (includes installing warning notices and opening fan cowls) | .6 |
| Install the EEC (includes closing fan cowls, removing warning notices, and testing the EEC) | 1.3 |
| Total man-hours | 1.9 |

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

| Description | Estimated Man-hours |
|---|---|
| Install warning notices | .1 |
| Open fan cowls | .1 |
| Program the EEC | 1.0 |
| Close fan cowls | .2 |
| Remove the warning notices | .1 |
| Test the EEC | .5 |

| Description | Estimated Man-hours |
|---|---|
| Total man-hours | 2.0 |

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

| Description | Estimated Man-hours |
|---|---|
| Remove the EEC | .4 |
| Install the EEC (includes testing the EEC) | 1.0 |
| Total man-hours | 1.4 |

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

| Description | Estimated Man-hours |
|---|---|
| Program the EEC | 1.0 |
| Test the EEC | .5 |
| Total man-hours | 1.5 |

I. Weight and Balance

| | |
|---|---|
| Weight Change | None |
| Moment | No Effect |
| 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-73-0170 (Engine - Fuel And Control - To Provide A New A5 SCN16/U Electronic Engine Control (EEC)).

2. Hamilton Sundstrand Service Bulletin EEC-150-20-73-16 (Install Software Identification Plate).

3. Hamilton Sundstrand Service Bulletin EEC-150-20-73-27 (Incorporation of New Software Configuration: A5 SCN17/V).

4. Hamilton Sundstrand Service Bulletin EEC-150-40-73-10 Incorporation of New Software Configuration: A5 SCN17/V).

5. Airbus Service Bulletin A320-73-1075 and Aircraft Modification No. 32656.

6. V2500 Aircraft Maintenance Manual.

7. V2500 Engine Manual (E-V2500-1IA), Chapter/Section 72-00-32.

8. V2500 Engine Illustrated Parts Catalogs (S-V2500-2IA, S-V2500-2IB, S-V2500-5IA, S-V2500-5IB, S-V2500-6IA, S-V2500-6IB, S-V2500-7IA, and S-V2500-71B), Chapter/Section 73-22-34.

R 9. Internal Reference No. - 00VZ017, 00VZ017-02, 00VZ017-03.

10. ATA Locator - 73-22-00.

M. Interchangeability of Parts

Old and new part are not directly interchangeable. New part can only be replaced with latest standard.

N. Information in the Appendix

Alternate Accomplishment Instructions (No)

Progression Charts (Yes)

Added Data (Yes)

Revision to Table of Limits (No)

Inspection Procedures (No)

2. Material Information

A. Material - Price and Availability

1. Part prices were not available at the time of Service Bulletin publication. Contact IAE's Spare Parts Sales Department for firm quotations.

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.

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

For V2522-A5, V2524-A5, V2527-A5, V2527E-A5, V2527M-A5, V2530-A5, V2533-A5 Engines:

| New PN | Qty | Estimate of Unit Price ($) | Keyword | Old PN | Instructions - Disposition |
|---|---|---|---|---|---|
| 808050-4-056 (2A3840) | 1 | * | Control, Electronic Engine (150-20) > | 808050-4-044 (2A3505) (73-22-34-01-280) | (V) (1)(A)(B) |
| | | | OR > | | |
| 824972-2-010 (2A3839) | 1 | * | Control, Electronic Engine (150-40) | 824972-2-008 (2A3504) (73-22-34-01-280) | (V) (1)(A)(B) |

E. Instructions/Disposition Code Statements:

(1) The new part can be obtained through modification by the approved procedure in the Accomplishment Instructions. Purchase the new parts from or return the old parts for modification to one of the approved vendors listed in the Accomplishment Instructions.
(A) The new part will be available approximately April, 2003.
(B) The old part will no longer be supplied.
(V) This is the Hamilton Sundstrand part number.

F. 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 at no charge 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 150-20 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 Kohms minimum

(d) Closed contact current of 20 mA minimum

(e) Open contact voltage of 20VDC 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 +/- 0.5A power supply and associated power cables as defined in Accomplishment Instructions, Table 2.

G. Reidentified Parts

Reidentified Parts Data

| New PN | Keyword | Old PN |
|---|---|---|
| 808050-4-056 (2A3840) | Control, Electronic Engine (150-20) | 808050-4-044 (2A3505) |
| 824972-2-010 (2A3839) | Control, Electronic Engine (150-40) | 824972-2-008 (2A3504) |

H. 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 73-22-34.

CAUTION: SCN17/V INCLUDES CHANGES SUCH AS THE INCREASED MCT RATING AND THE FAN FLUTTER KEEP-OUT ZONE WHICH, FOR A GIVEN THROTTLE SETTING (IN CERTAIN SITUATIONS), COULD RESULT IN A DIFFERENCE IN POWER SETTING ACROSS WING THAT COULD BE NOTICEABLE BY THE COCKPIT CREW IF SCN17/V WAS INSTALLED ON ONE ENGINE AND INTERMIXED WITH A PRIOR SOFTWARE VERSION ON THE OTHER ENGINE. AS A RESULT, SCN17/V AND PRIOR SOFTWARE VERSIONS ARE NOT INTERMIXABLE.

(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 73-22-34.

(b) Open the fan cowls as specified in Reference 6., Aircraft Maintenance Manual, Chapter/Section 73-22-34.

CAUTION: SCN17/V INCLUDES CHANGES SUCH AS THE INCREASED MCT RATING AND THE FAN FLUTTER KEEP-OUT ZONE WHICH, FOR A GIVEN THROTTLE SETTING (IN CERTAIN SITUATIONS), COULD RESULT IN A DIFFERENCE IN POWER SETTING ACROSS WING THAT COULD BE NOTICEABLE BY THE COCKPIT CREW IF SCN17/V WAS INSTALLED ON ONE ENGINE AND INTERMIXED WITH A PRIOR SOFTWARE VERSION ON THE OTHER ENGINE. AS A RESULT, SCN17/V AND PRIOR SOFTWARE VERSIONS ARE NOT INTERMIXABLE.

(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 73-22-34.

(e) Remove warning notices as specified in Reference 6., Aircraft Maintenance Manual, Chapter/Section 73-22-34.

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

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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One Hamilton Road

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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 7., Engine Manual, Chapter/Section 72-00-32.

CAUTION: SCN17/V INCLUDES CHANGES SUCH AS THE INCREASED MCT RATING AND THE FAN FLUTTER KEEP-OUT ZONE WHICH, FOR A GIVEN THROTTLE SETTING (IN CERTAIN SITUATIONS), COULD RESULT IN A DIFFERENCE IN POWER SETTING ACROSS WING THAT COULD BE NOTICEABLE BY THE COCKPIT CREW IF SCN17/V WAS INSTALLED ON ONE ENGINE AND INTERMIXED WITH A PRIOR SOFTWARE VERSION ON THE OTHER ENGINE. AS A RESULT, SCN17/V AND PRIOR SOFTWARE VERSIONS ARE NOT INTERMIXABLE.

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

CAUTION: SCN17/V INCLUDES CHANGES SUCH AS THE INCREASED MCT RATING AND THE FAN FLUTTER KEEP-OUT ZONE WHICH, FOR A GIVEN THROTTLE SETTING (IN CERTAIN SITUATIONS), COULD RESULT IN A DIFFERENCE IN POWER SETTING ACROSS WING THAT COULD BE NOTICEABLE BY THE COCKPIT CREW IF SCN17/V WAS INSTALLED ON ONE ENGINE AND INTERMIXED WITH A PRIOR SOFTWARE VERSION ON THE OTHER ENGINE. AS A RESULT, SCN17/V AND PRIOR SOFTWARE VERSIONS ARE NOT INTERMIXABLE.

(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 28VDC 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:

R

```
Sample computer text
```

(1) Section 1

(a) Hamilton Sundstrand Electronic Engine Control Model EEC150-20 or 150-40 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' or 'EEC 150-40'.

(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 CH A UART 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 CH A UART and COM4 port as CH B UART on the computer to reduce errors.

(3) Section 3

(a) If the EEC is powered by aircraft 28VDC 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 3.5 inch 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/P and W 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:

R

```
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:

R
```
WARNING-EEC Fault Memory Will Be Cleared By This Pro-
gram. 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:

R
```
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: PN 808050-4-030 would be entered as 808050-04-030.

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

R
```
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.

R

R

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

R `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:

R `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:

R `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 'Y', then press the RETURN key. Then go back to the previous section titled: 'Section 5'

(iii) To quit the programming process:

Type 'Q', then press the RETURN key. Turn off the 28VDC power to the EEC then go to the subsequent section titled: 'Section 7'

(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:

EEC 150-20: 30 minutes.

EEC 150-40: 10 minutes.

(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 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 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 LDR150 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 5 seconds, then switch on the 28VDC supply to the EEC.

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

(h) Wait until the LDR150 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:

R ****EEC PROGRAMMING SUCCESSFULLY COMPLETED****
R 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:

R ****DOWNLOAD PROCESS ABORTED - ERROR CODE 'X'
R 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.

| 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 CHA | P1–J | PA–8 | RXD– |
| BOOT DISC CHA | P1–D | N/A | N/A |
| BITE DISC 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 1
Programming Harness Definition

Power Supply Connections

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

Table 2
Power Supply Connections

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PROGRAMMING HARNESS DEFINITION AND POWER SUPPLY CONNECTIONS
Tables 1 and 2

| 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 A5 Software 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 3
Error Code Definitions

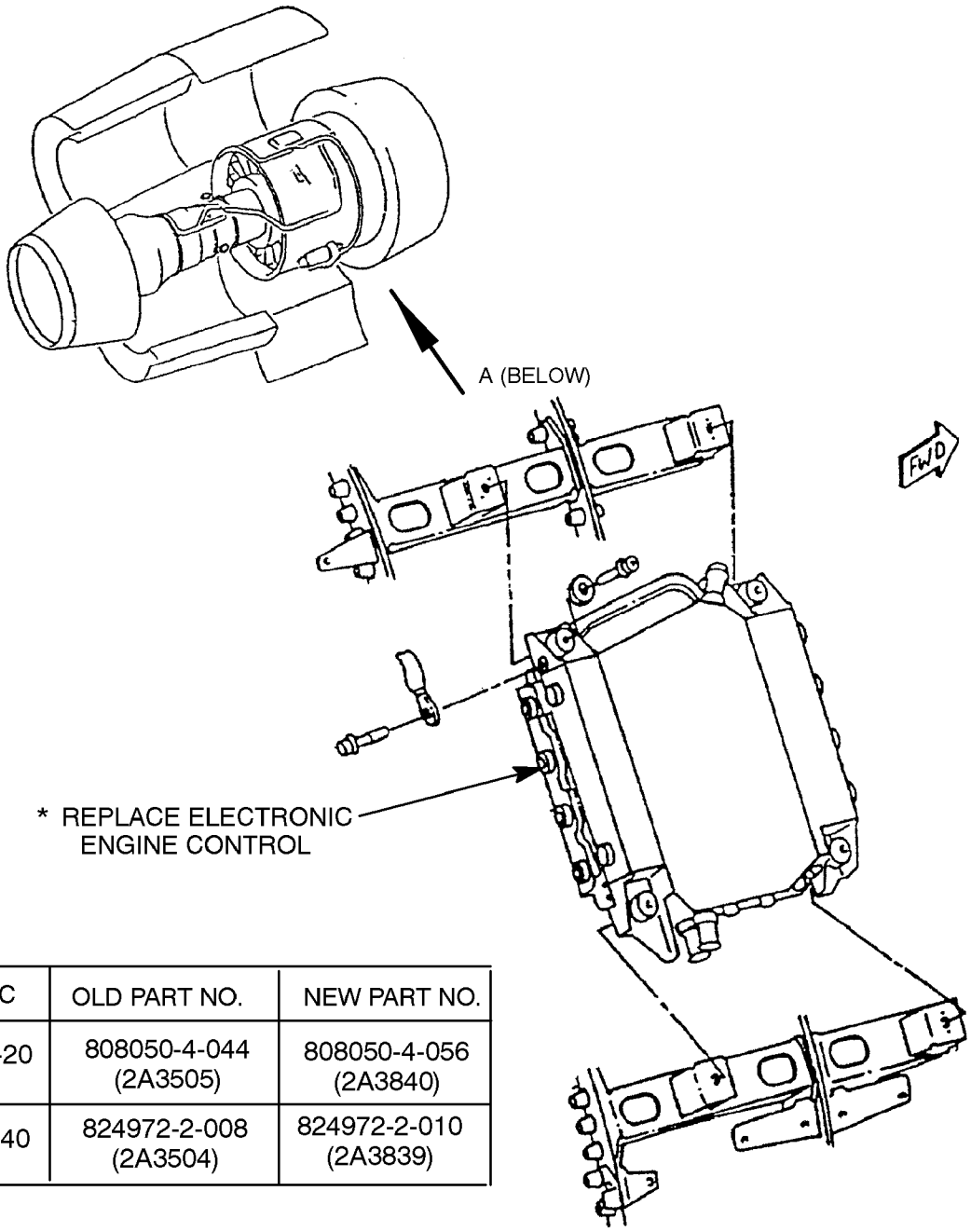
| A5 SCN17/V | | |
|---|---|---|
| | Old P/N | A5 SCN17/V New P/N |
| Reprogramming Diskette<br>150-20<br>150-40 | <br><br>n/a | <br>819191-37<br>819191-36 |
| EEC: (HS) HW Part No.<br>150-20<br>150-40 | <br>808050-4-044<br>824972-2-008 | <br>808050-4-056<br>824972-2-010 |
| EEC: IAE P/N<br>150-20<br>150-40 | <br>2A3505<br>2A3504 | <br>2A3840<br>2A3839 |
| Trim Checksum | n/a | 10104 |

Table 4
Reprogramming Input Reference Table





ERROR CODE DEFINITIONS AND REPROGRAMMING INPUT REFERENCES
Tables 3 and 4




| * EEC | OLD PART NO. | NEW PART NO. |
|---|---|---|
| 150-20 | 808050-4-044 (2A3505) | 808050-4-056 (2A3840) |
| 150-40 | 824972-2-008 (2A3504) | 824972-2-010 (2A3839) |

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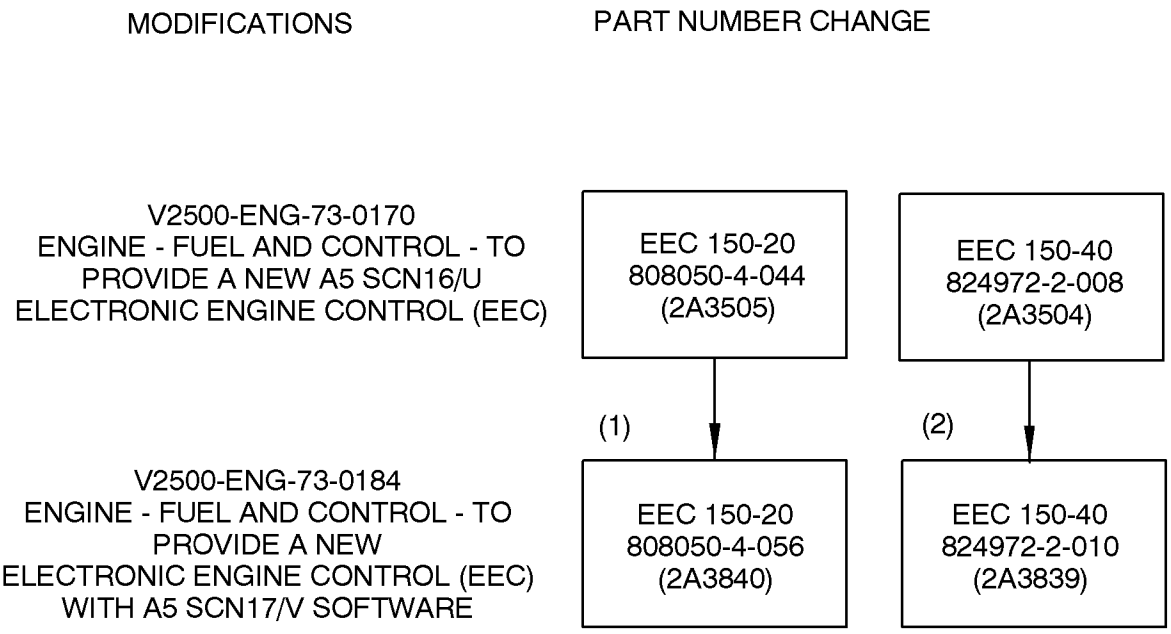
LOCATION OF THE ELECTRONIC ENGINE CONTROL (EEC)
Figure 1

## APPENDIX 1

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

Added Data

Number values shown in parenteheses adjacent to U.S. values are International System of units (SI) equivalents.




(1) See Reference 3. for the Hamilton Sundstrand Service Bulletin

(2) See Reference 4. for the Hamilton Sundstrand Service Bulletin

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.

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FAMILY TREE - ELECTRONIC ENGINE CONTROL (EEC) REF. CATALOG SEQUENCE NO. 73-22-34.
FIG. 01 ITEM 280
Figure 2