ENGINE - FUEL AND CONTROL - TO PROVIDE A NEW ELECTRONIC ENGINE CONTROL (EEC) WITH THE SCN11B SOFTWARE CONFIGURATION - CATEGORY CODE 4 - MOD.ENG-73-0079

1. Planning Information

A. Effectivity

(1) Aircraft: McDonnell Douglas MD-90

(2) Engine: V2525-D5 Engines before Serial No.V20050
V2528-D5 Engines before Serial No.V20050

This Service Bulletin must be incorporated at the same time as V2500-ENG-71-0175.

B. Reason

(1) Condition

(a) 1.0 WING TANK FUEL TEMPERATURE SPLIT: Disagreements between left and right wing tank fuel temperatures, in excess of 10 deg.C., have been observed during MD-90 production flight testing and revenue service operation. As a result of these temperature splits, both EECs log the "wing tank fuel temperature cross-check" fault message and inhibit fuel return to tank.

(b) 2.0 FUEL TEMPERATURE RAISED IDLE: A fuel temperature raised idle schedule is selected in response to abnormally high fuel temperatures or a failure of the fuel temperature thermocouple. (1) Selection of this raised idle schedule on the ground results in an idle level requiring substantial performance penalties, making aircraft operation difficult or impractical. (2) For cold day operation with the current level of fuel temperature raised idle, a landing field length penalty contribution results from the unnecessarily high idle level present prior to aircraft touchdown. (3) The selection of the raised idle schedule can exist for up to 20 minutes without an 'EEC Fault" indiction to the crew.

(c) 3.0 SELECTION OF DFGC BUSSES DURING TAKEOFF: EPR synchronization can be activated during takeoff, after the takeoff power setting has been "frozen". This can occur in the absence of any true component failure and can result in a left engine EPR engine EPR downtrim of up to 0.04.

(d) 4.0 REVISION TO PIP EPR MODIFIER TABLE: The MD-90 flight test data shows non-conservative discrepancy in takeoff thrust relative to the published Airplane Flight Manual (AFM). This descrepancy is presently addressed via takeoff field length penalties.

(e) 5.0 GROUND STARTING ENHANCEMENTS FOR HIGH ALTITUDE/LOW STARTER AIR PRESSURE: V2500 engine ground autostarts at high altitudes or with low starter air supply have not been 100% successful.

(f) 6.0 LOSS OF AIRCRAFT POWER - NUISANCE FAULT ANNUNCIATIONS: Nuisance annunciations of the OAP messages 'ENG SYSTEM FAIL' and 'REVERSER FAULT' have been observed during flight test and in revenue service.

(g) 7.0 NUISANCE 'REVERSER FAULT' MESSAGE - LOSS OF AIRCRAFT 28 VDC POWER: The reverser No Dispatch bit (OAP message 'REVERSER FAULT') is set by a loss of aircraft 28 VDC power which lasts less than 5 seconds. The requirement is to set the fault only if the power is lost for 5 seconds or more.

(h) 8.0 NUISANCE 'REVERSER FAULT' MESSAGE - IN-RANGE CROSS-CHANNEL TRA DISAGREEMENT: Nuisance annunciations of the Reverser No-Dispatch OAP message 'REVERSER FAULT' have been observed during MD-90 flight test and revenue service, due to in-range cross-channel disagreement of the Throttle Resolver Angle (TRA) inputs, when the reverse thrust lever is at the stow/deploy position (-4.5 degrees TRA).

(i) 9.0 BOWED-ROTOR AUTO-CRANKING PROVISIONS/REDUCED ON-GROUND STARTER CUTOUT SPEED: (1) Field experience with the V2500-A1 engine has identified the potential for engine clearance degradation between rotating and static parts following engine restart of a previously shutdown engine. (2) Improvement to starter life can be obtained by lowering the on-ground starter cut-out (SCO) speed.

(j) 10.0 ACC DUAL F/B FAILURE ANNUNCIATION: The Class II, time-limited dispatch bit (label 350/Bit 29, 'EEC FAULT'), does not include all feedback failure conditions that result in the active clearance control (ACC) actuator being failsafed (i.e., HPT valve closed and LPT valve partially open).

(k) 11.0 CDX MODIFIER RANGE REVISION: The V2500-D5 EIS engines to date have been shipped with an average EPR modifier plug class of 10. The present EPR modifier plug class structure is 4 to 11. As a result, the ability to properly CDX future engines may be at risk due to potential limitations in the current EPR modifier plug class structure.

(l) 12.0 NUISANCE 'REVERSER FAULT' MESSAGE - RAPID THROTTLE MOVEMENT: Nuisance annunciations of the Reverser No-Dispatch OAP message 'REVERSER FAULT' have been observed during MD-90 flight test in response to rapid reverse thrust lever movement about the stow/deploy position.

(m) 13.0 FLIGHT CREW ANNUNCIATIONS FOR DISPATCHABLE FAULT CONDITIONS WITH OPERATIONAL IMPACT: Presently, the occurrence of an 'EEC FAULT' OAP message, without interrogation of the EEC maintenance memory to determine if the originating fault carries any special flight crew procedures, requires the flight crew to assume that all such conditions exist for dispatch. This requires substantial performance and fuel burn penalties be imposed for subsequent flights. In addition to restricting takeoff weight, this can result in dispatch delays.

(n) 14.0 FIX FOR NUISANCE DFGC FAULT MAINTENANCE RECORDINGS: Presently, depowering of the DFGC on the ground by the crew of self-testing can result in the CLM 'DFGC1,2/HC/EEC1,2' in response to the loss of DFGC data.

(o) 15.0 FIX FOR NUISANCE 'GAT INHIBITED' MESSAGE MAINTENANCE RECORDINGS: Nuisance "GAT INHIBITED' maintenance messages are frequently being recorded by the EEC and thus requiring disposition by the operator.

(p) 16.0 NUISANCE 'HMS-VSCF OVTMP W/RECIRC1, 2' MAINTENANCE MESSAGE: If the VSCF oil temperature is over the maintenance limit at the time the engine is shutdown a nuisance annunciation of Flip Mode, 'HMS-VSCF OVTMP W/RECIRC1, 2', will occur. This fault is recorded in EEROM and is intended to indicate a heat management system fault. The requirement is for an overtemperature condition to exist for 2 minutes before setting the fault flag.

(q) 17.0 THRUST REVERSER INTERLOCK FAULT ANNUNCIATION: Present EEC logic can set and annunciate failures associated with the T/R Interlock Relay circuit.

(r) 18.0 WEIGHT-ON-NOSEGEAR ARINC INPUT FAILED TO 'ON-GROUND': An erroneous DFGC weight-on-nosegear ARINC input (WOWP) can be sent to the EEC indicating "on-ground" while the aircraft is in the air. This can adversely affect a number of EEC functions, including the scheduling of the heat management system raised idle, the scheduling of minimum allowable N1 for icing protection, and the scheduling of the 7A high compressor bleed valve for surge margin protection.

(s) 19.0 NUISANCE FAULT RECORDING OF 'WEIGHT-ON-NOSEGEAR FAILED TO ON-GROUND': The flag which indicates the weight-on-nosegear signal is failed to the "on-ground" state while the aircraft is in the air (as determined by Mach number) can be fault recorded inappropriately. The fault is inappropriately recorded when the weight-on-nosegear signal indicates "on-ground" while Mach number is not available to determine the aircraft is in the air.

(2) Background

(a) 1.0 WING TANK FUEL TEMPERATURE SPLIT: The EEC heat management system control logic can allow differential heat rejection rates, via the fuel return to tank system, to the left and right wing tanks, during normal operational conditions or as a result of failures. Differential rejection rates can result in 10 deg C wing tank fuel temperature splits, which cause the EECs to inhibit return to tank flow and log the cross-check maintenance fault. Significant left to right wing tank fuel temperature differentials have been observed with one engine controlling to mode 1 and the other controlling to mode 4.

(b) 2.0 FUEL TEMPERATURE RAISED IDLE: (1) The EEC tolerance time for detections of fuel temperature thermocouple failures is too short. This allows for unnecessary illuminations of 'EEC FAULT' on the OAP, selections of the fuel temperature raised idle, and inhibiting of fuel return-to-tank. (2) For inflight use the schedule is unnecessarily high. (3) Current logic allows the selection of the raised idle schedule for up to 20 minutes without an 'EEC FAULT' indication to the crew.

(c) 3.0 SELECTION OF DFGC BUSSES DURING TAKEOFF: The DFGC bus selection logic does not preclude automatic bus transitions during takeoff. An automatic bus transition to the pilot selected DFGC during takeoff can lead to the above described problem.

(d) 4.0 REVISION TO PIP EPR MODIFIER TABLE: The original EPR Takeoff ratings do not provide the anticipated MD-90 aircraft performance, at all conditions as specified in the AFM.

(e) 5.0 GROUND STARTING ENHANCEMENTS FOR HIGH ALTITUDE/LOW STARTER AIR PRESSURE: There are two reasons the starts have not been successful: light up stall and insufficient engine starting acceleration torque caused by low starter air pressure and non-optimized ground start fuel scheduling.

(f) 6.0 LOSS OF AIRCRAFT POWER - NUISANCE FAULT ANNUNCIATIONS: Re-configuration of the aircraft electrical system can result in the EEC losing aircraft power and generating nuisance OAP and associated Clear Language Messages (CLM). Flight crews occasionally turn off the emergency power (EMER PWR) switch while an engine is spooling down after shutdown, removing aircraft power to the EEC's. Additionally, certain aircraft procedures require that the EMER PWR switch be turned off, briefly, and then returned to ARM or ON. If the flight crew leaves the switch OFF for 5 or more seconds per these procedures, while the engines are running, unnecessary annunciations of 'ENG SYSTEM FAIL' and 'REVERSER FAULT' will be generated.

(g) 7.0 NUISANCE 'REVERSER FAULT' MESSAGE - LOSS OF AIRCRAFT 28 VDC POWER: Combinational latched faults, which include loss of aircraft 28 VDC, are part of the Reverser No Dispatch fault

(h) 8.0 NUISANCE 'REVERSER FAULT' MESSAGE - WITH IN-RANGE CROSS-CHANNEL TRA DISAGREEMENT: This problem occurs when the channel A and channel B TRA inputs are within the allowed cross-check tolerance band and straddle the -4.5 degree stow/deploy position.

(i) 9.0 BOWED-ROTOR AUTO-CRANKING PROVISIONS/REDUCED ON-GROUND STARTER CUTOUT SPEED: (1) Thermal differentials developing after shut-down of a hot engine can produce significant "bowing" of the rotor spool which, coupled with resulting amplification of the natural spool whirl on the subsequent engine start, can result in rubbing, leading to clearance degradation and a corresponding loss in engine performance. (2) Current SCO speed is set unnecessarily high.

(j) 10.0 ACC DUAL F/B FAILURE ANNUNCIATION: The original intent of the design, which is to cover all cases where the EEC can't control the ACC loop, is not met with the current implementation.

(k) 11.0 CDX MODIFIER RANGE REVISION: EIS engines have a different thrust/EPR relationship then the flight test engines used to define the present EPR modifier plug class structure.

(l) 12.0 NUISANCE 'REVERSER FAULT' MESSAGE - RAPID THROTTLE MOVEMENT: The EEC logic does not account for the mechanical lag of the thrust reverser system which can result in the erroneous indication of an auto-restow or auto-redeploy condition.

(m) 13.0 FLIGHT CREW ANNUNCIATIONS FOR DISPATCHABLE FAULT CONDITIONS WITH OPERATIONAL IMPACT: The occurrence of any Short-Term-Dispatch fault is annunciated by the single 'EEC FAULT' OAP message.

(n) 14.0 FIX FOR NUISANCE DFGC FAULT MAINTENANCE RECORDINGS: The EEC presently records these faults in response to the loss of DFGC data whether the loss occurs inflight or on the ground.

(o) 15.0 FIX FOR NUISANCE 'GAT INHIBITED' MESSAGE MAINTENANCE RECORDINGS: Current EEC logic records the 'GAT INHIBITED' message into maintenance memory whenever the N1 mode is selected on the ground, whether or not the selection is associated with an attempt to run the ground actuator test (GAT).

(p) 16.0 NUISANCE 'HMS-VSCF OVTMP W/RECIRC1, 2" MAINTENANCE MESSAGE: The logic implementation can be defeated by the EEC reset which occurs at shutdown.

(q) THRUST REVERSER INTERLOCK FAULT ANNUNCIATION: The decision to remove the T/R Interlock function from the MD-90 was made too late to disable the associated logic in the EEC without impacting A/C certification. This necessitated installation of unnecessary wiring and relays on each aircraft to preclude nuisance maintenance messages and inappropriate 'EEC FAULT' annunciations.

(r) 18.0 WEIGHT-ON-NOSEGEAR ARINC INPUT FAILED TO 'ON-GROUND': Certain aircraft failure modes can lead to the DFGC sending the EEC a valid but erroneous weight-on-nosegear signal indication"on-ground" while the aircraft is in the air.

(s) 19.0 NUISANCE FAULT RECORDING OF 'WEIGHT -ON-NOSEGEAR FAILED TO ON-GROUND': The software was coded incorrectly.

(3) Objective

(a) 1.0 WING TANK FUEL TEMPERATURE SPLIT: Incorporate a discrete trim in the EEC heat management logic to inhibit mode 4 selection and to set mode 1 maximum allowable spill flow whenever return to tank is allowed. Additionally, the Air Cooled Oil Cooler (ACOC) valve will be scheduled closed, for a minimum of 2 minutes, following a transition from a spill inhibit condition to mode 1 (spill allowed). This latter change is required to preclude the potential for increased ACOC valve usage following an inhibit condition during which the engine fuel temperature approaches the controlling limit.

(b) 2.0 FUEL TEMPERATURE RAISED IDLE: Revise the EEC logic to: (1) increase the tolerance time for detecting fuel temperature thermocouple failures from 5 to 30 seconds, (2) inhibit the selection of the raised idle schedule on the ground, (3) limit the authority of the raised idle schedule inflight based on corrected N2 as a function of altitude and (4) revise the conditions for annunciating a fuel-temperature-over-limit situation from "> 110 deg C for 20 minutes to "> 120 deg C for 5 minutes."

(c) 3.0 SELECTION OF DFGC BUSSES DURING TAKEOFF: Modify the DFGC bus selection logic to inhibit automatic bus transitions during takeoff operation.

(d) 4.0 REVISION TO PIP EPR MODIFIER TABLE: Modify the PIP EPR modifier table to provide additional thrust during takeoff to significantly reduce this descrepancy. The AFM will be revised to eliminate the remainder of the discrepancy.

(e) 5.0 GROUND STARTING ENHANCEMENTS FOR HIGH ALTITUDE/LOW STARTER AIR PRESSURE: Optimize ground start fuel scheduling by making minimum fuel flow a function of altitude to reduce it to 240 PPH at high altitude, provisioning for an optimized ground autostart fuel and ignition on speed schedule as a function of altitude, adjusting the autostart ground ignition speed timer to 35 seconds and introducing a raised N2dot acceleration schedule for ground starting to ensure light up at lower altitudes occurs on the Wf/Pb starting schedule. These changes are applied to ground starts only based on the current Ground/Flight starting logic, thus assuring no impact to the air starting characteristics or certification.

(f) 6.0 LOSS OF AIRCRAFT POWER - NUISANCE FAULT ANNUNCIATIONS: Modify the logic in the EEC to not generate the 'ENG SYSTEM FAIL' and 'REVERSER FAULT' OAP messages, in response to the loss of aircraft 28 VDC power, unless the power loss lasts for 15 or more seconds while the FUEL Switch or the START Switch is ON. The logic is also modified so as to not generate the 'A/C 28 V POWER/EEC' CLM in response to the loss of aircraft 28 VDC power, unless the power loss occurs while either the FUEL Switch or the START Switch is ON.

(g) 7.0 NUISANCE 'REVERSER FAULT' MESSAGE - LOSS OF AIRCRAFT 28 VDC POWER: Replace the combinational latched faults, which include loss of aircraft 28 VDC, with their individual components, leaving out the aircraft 28 VDC fault.

(h) 8.0 NUISANCE 'REVERSER FAULT' MESSAGE - WITH IN RANGE CROSS CHANNEL TRA DISAGREEMENT: Modify the EEC logic to exclude nuisance OAP 'REVERSER FAULT' EEC ARINC Label 270/Bit 19) messages from being set and the associated faults from being recorded.

(i) 9.0 BOWED ROTOR AUTO-CRANKING PROVISIONS/REDUCED ON-GROUND STARTER CUTOUT SPEED: (1) Modify the starting logic for autostarts to make the provision by trim to motor the engine on the starter for 50 seconds, after opening the starter valve, before initiating fuel flow. This provision will not be activated in SCN11B (2) Provide a separate trim to starter cutout (SCO) speed to allow reduction in the SCO speed, to avoid impacting in-flight starting certification. Lower the on-ground SCO speed, from the current 42.6% to 40.1% N2, to enhance starter life.

(j) 10.0 ACC DUAL F/B FAILURE ANNUNCIATION: Modify the Class II logic to include dual channel active clearance control feedback failures.

(k) 11.0 CDX MODIFIER RANGE REVISION: To provide CDX capability beyond the present maximum class of 11, CDX EPR modifier range will be revised by removing classes 4 and 5 and adding classes 12 and 13.

(l) 12.0 NUISANCE 'REVERSER FAULT' MESSAGE - RAPID THROTTLE MOVEMENT: Modify the logic to inhibit the detection of an auto-redeploy or auto-restow condition for 0.7 seconds after a throttle movement. The change will not impede the detection of real inadvertent deploy/stow events or impact the control response time to an event.

(m) 13.0 FLIGHT CREW ANNUNCIATIONS FOR DISPATCHABLE FAULT CONDITIONS WITH OPERATIONAL IMPACT: Modify the EEC logic to provide five new OAP messages to annunciate the occurrence of any Short Term Dispatch engine fault condition which requires the crew to perform special procedure, per the MD-90 MMEL. These fault conditions are: (1) Fuel Temperature Exceeds Maximum Limit or Fuel Temperature Input Fail-safed, (2) Air Oil Cooler Valve Fail-safed or Failed Open, (3) Active Clearance Control System Fail-safed, or Actuator Track Check, (4) 2.5 Bleed Valve Stuck Open and (5) ARINC Nosegear Signal Failed to On-ground.

(n) 14.0 FIX FOR NUISANCE DFGC FAULT MAINTENANCE RECORDINGS: Modify the logic to not record any failure of the DFGC data bus which occurs on the ground and does not persist into flight operation.

(o) 15.0 FIX FOR NUISANCE 'GAT INHIBITED' MESSAGE MAINTENANCE RECORDINGS: The maintenance messages 'GAT INHIBITED1, 2' are being deleted from the EEC. The remaining 'GAT STARTED1, 2', 'GAT PASSED1, 2', 'GAT FAILED1, 2' AND 'GAT ABORTED1, 2' messages are sufficient to support operation of the test, and to identify problems as necessary.

(p) 16.0 NUISANCE 'HMS VSCF OVTMP W RECIRC1, 2' MAINTENANCE MESSAGE: Modify the logic implementation such that it can not be defeated by an EEC reset.

(q) 17.0 THRUST REVERSER INTERLOCK FAULT ANNUNCIATION: Modify the EEC logic, as necessary, to preclude the setting of failures in the T/R Interlock Relay circuit, thus eliminating the need to install additional wiring and relays on each aircraft.

(r) 18.0 WEIGHT-ON-NOSEGEAR ARINC INPUT FAILED TO 'ON-GROUND': Modify the EEC ARINC input processing logic to detect, accommodate, and annunciate the failure of the weight-on-nosegear signal to the "on-ground" state. MN will be used to determine on-ground/in-flight status for this fault condition. The failure will be annunciated by recording the fault and setting the Class II short term dispatch bit.

(s) 19.0 NUISANCE FAULT RECORDING OF 'WEIGHT-ON-NOSEGEAR FAILED TO ON-GROUND': Code the software as originally intended.

(4) Substantiation

The flight simulation and flight testing of the SCN11B version 025 software logic was accomplished at McDonnell Douglas.

(5) Effects of Bulletin on Workshop Procedures:

Removal/Installation	Not affected
Disassembly/Assembly	Not affected
Cleaning	Not affected
Inspection/Check	Not affected
Repair	Not affected
Testing	Not affected

(6) Supplemental Information

None.

C. Description

(1) Provide a new Electronic Engine Control (EEC) incorporating D5SCN11B, version 025 and 025 Trims. This software version provides code changes to address either requirement changes or revenue service identified problems, from D5SCN11.

Part I - If the Electronic Engine Control is sent to one of the addresses listed in Paragraph 2. B., Accomplishment Instructions

(a) A new EEC can be obtained from the supplier referenced in Part I of this Service Bulletin. The removed part is returned, programmed, identified with the new part number and installed again.

Part II - If IAE is requested to assist to coordinate the reprogramming of the Electronic Engine Control

(b) The EEC can be programmed on the engine, by the procedure given in Part II of this Service Bulletin, and identified with the new part number.

D. Approval

Incorporation of this Service Bulletin must be accomplished only in conjunction with Douglas Aircraft Company Service Bulletin MD90 73-001 which has received exclusive FAA approval for MD-90 Series Aircraft.

E. Compliance

Category Code 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.

F. Manpower

Estimated Manhours to incorporate the full intent of Part I of this Bulletin:

Venue	Estimated Manhours
(1) In Service	TOTAL: 1 hour 16 minutes
(a) To gain access	
(i) Install warning notices ..	5 minutes
(ii) Open the fan cowls	7 minutes
(iii) Remove the EEC	23 minutes
TOTAL	35 minutes
(b) To return to flyable status	
(i) Install the EEC	28 minutes
(ii) Close the fan cowls ..	8 minutes
(iii) Remove the warning notices	5 minutes
TOTAL	41 minutes

Estimated Manhours to incorporate the full intent of Part II of this Bulletin:

Venue	Estimated Manhours
(1) In Service	TOTAL: 1 hour 25 minutes
(a) To gain access	
(i) Install warning notices ..	5 minutes
(ii) Open the fan cowls	7 minutes
(iii) Program the EEC	1 hour
TOTAL	1 hour 12 minutes
(b) To return to flyable status	
(i) Close the fan cowls ..	8 minutes
(ii) Remove the warning notices	5 minutes

TOTAL 13 minutes

(2) At overhaul .. .. .. Not Applicable

G. Material - Price and Availability

(1) Modification Kit not required.

(2) This Service Bulletin will be done at no cost to the operator.

H. Tooling - Price and Availability

The tools and equipment that follow are necessary to do the procedure given in Part II of this Service Bulletin.

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

(a) 80286 processor

(b) 512 Kbytes RAM

(c) 1.44 Mbyte, 3.5" 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 5)

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

NOTE: The IBM computer date/time must be current prior to performing this procedure.

(2) Hamilton Standard diskette called out in Reference (1). This diskette contains the EEC150-20: application code, trims, memory clear utilities, and software loader.

(c) 1.44 Mbyte, 3.5" 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 5)

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

NOTE: The IBM computer date/time must be current prior to performing this procedure.

2) Hamilton Standard diskette called out in Reference (1). This diskette contains the EEC150-20: application code, trims, memory clear utilities, and software loader.

EEC SIGNAL NAME	EEC 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
Communication Connections

ted0001059

Communication Connections
Table 1

(3) EEC150-20 communication cables as defined in Table 1.

(4) EEC150-20 Nameplate PN 751333-1.

I. Weight and Balance

(1) Weight change	.. .. ..	None
(2) Moment arm	.. .. ..	No effect
(3) Datum	.. .. ..	Engine front mount Centerline (Powerplant station P.P.S.100)

J. Electrical Load Data

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

K. Reference

(1) Internal Reference No.

95VZ005

(2) Other References

Hamilton Standard Service Bulletin EEC-150-20-73-11.

IAE Service Bulletin:

V2500-ENG-71-0175 (Engine - EEC Harness - Provide a New Harness That Eliminates The Thrust Reverser Interlock Circuit Wiring Provisions).

MD-90 Aircraft Maintenance Manual, Chapter/Section 73-21-34.

V2500-D5 Engine Illustrated Parts Catalog (S-V2500-3IA)

L. Other Publications Affected

(1) The V2500-D5 Engine Illustrated Parts Catalog, Chapter/Section 73-22-34, Figure 1, to add the new parts.

2. Accomplishment Instructions

Part I - If the Electronic Engine Control is sent to one of the addresses listed in Paragraph 2. B., Accomplishment Instructions

A. The Source Demonstration requirements of this rework means that any facility not authorized to accomplish this rework either utilize the Authorized Vendors listed below or contact IAE Technical Services to determine if a qualification program can be initiated at their facility.

IAE-INTERNATIONAL AERO ENGINES AG
Corporate Center II
628 Hebron Ave.
Glastonbury, CT 06033-2595 USA
ATTN: Director Technical Services

B. Authorized Rework Vendors for this bulletin are listed below.

Hamilton Support Systems
Customer Service Center
97 Newberry Road
East Windsor, CT 06088 USA

or

Pratt & Whitney Overhaul/Repair Center Europe (PWORCE)
Maastricht Airport
P.O. Box 269
6190 AG BEEK
The Netherlands

C. 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.

D. Removal Instructions

(1) Remove the 808050-04-025 (2A3130), Electronic Engine Control by the approved procedure given in Reference (3), Chapter/Section 73-21-34, Removal/Installation. Refer to Figure 1.

E. Rework Instructions

(1) Do a modification of the 808050-04-025 (2A3130) Electronic Engine Control (See Reference (4), Chapter/Section 73-22-34, Fig/Item No.01-280) and reidentify by the procedures given in Reference (1).

Procedure	Supplementary Information
(a) Send the Electronic Engine Control to the approved vendor to be modified. See paragraph 2.B.	See Figure 1.

F. Installation Instructions

(1) Install the 808050-4-029 (2A3189), Electronic Engine Control (1 off) by the approved procedure given in Reference (3), Chapter/Section 73-21-34, Removal/Installation. See Figure 1.

G. Recording Instructions

(1) A record of accomplishment is necessary.

Part II - If IAE is requested to assist or coordinate the reprogramming of the Electronic Engine Control

NOTE: This procedure can be used by trained personnel to support fleet operation of the IAE V2500 engine. RSS approval is not required for closed box reprogramming.

A. Isolate aircraft electrical system and gain access to the EEC by doing the pre-requisite procedures given in steps 3. A., B. and C., Reference (3), Chapter/Section 73-21-34, Removal/Installation.

NOTE: Only turn back-on aircraft 28VDC when instructed to in the following procedure.

B. General

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

(a) Disassembly of the EEC is not required.

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

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

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

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

(2) The tools specified in Paragraph 1. H. are necessary to accomplish this procedure.

C. Do the steps that follow to reprogram the Electronic Engine Control (EEC) without removing it from the engine.

(1) Verify that the model number on the identification plate of the unit is "EEC150-20".

(2) Record the current unit part number and the unit serial number from the nameplate. Thus information will input into your computer.

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

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

(5) Remove the harness connector from the EEC connector marked J7 and connect the programming harness connector marked P7 to the EEC connector marked J7.

(a) Make sure that the red engagement stripe on the EEC connector J7 is fully covered.

(6) If the computer and power supply connections to the cables are permanent, skip to step C. (12).

(7) 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 these connectors are properly mated.

(8) Connect the programming harness 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.

NOTE: It is important to verify that the connectors are correctly installed for correct loader operation. Hamilton Standard recommends labeling the RS-422 COM3 port as "ch. a uart" and COM4 port as "ch. b uart"on the computer to reduce errors.

(9) Intentionally left blank.

(10) Intentionally left blank.

(11) Interntionally left blank.

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

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

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

(15) 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.

(16) Obtain the Hamilton Standard reprogramming diskette which is given in Reference (1).

(a) Make sure that the write protection tab of the diskette is covering the "hole".

(b) Insert the diskette into the floppy drive designated as "A" on the IBM compatible computer.

(17) The display will show the "C:\>" Type a: then press the RETURN key.

NOTE: Some computers have the RETURN key designated ENTER.

(18) The display will show the "A:\>" prompt.

(a) Type LDR150 then press the RETURN key. This starts the UART programming utility.

1 Several messages will appear includding the program identification, version number, time and the UTC/P&W document property rights notice.

2 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.

(19) The UART programming utility LDR150, will display the following message: "Enter operator's name performing download:[ ]>"

(a) The field between the brackets will always be empty the first time the programe is executed on the diskette.

(b) Subsequent execution of the program will display the last name entered.

1 If the operator is the same, press the RETURN key to continue.

2 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.

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

WARNING - EEC Fault Memory Will Be Cleared By This Program. If an EEC Fault Dump Is Required Prior to Programming, enter Q to Quit or C to Continue [Q/C]:

(a) If a fault dump has already been accomplished or is not required, type C, then press the RETURN key.

(b) If a fault dump is required or the operator wishes to terminate the programming procedure, type Q then press the RETURN key.

(c) If the operator selects the quit option, turn off the 28VDC power to the EEC and go to step C. (36).

(21) The LDR150 program will now prompt with the following message: "Enter the 9 character EEC Serial Number : [XXXX-XXXX]>". From the Hamilton Standard nameplate, enter the nine character EEC serial number and press the RETURN key.

(22) 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 Standard nameplate, enter the 13 character EEC Hardware Part Number and press the RETURN key.

(23) The LDR150 program will now prompt with the following message: "Enter the 13 character EEC HW Part No.: [XXXXXX-XX-XXX]>". From Reference (1), the Service Bulletin, enter the 13 character EEC Hardware Part Number and press the RETURN key.

(24) The LDR150 program will now prompt with the following message: "Enter Trim Checksum Value for "xxxxxx.xxx:>". The xxxxxx.xxx designation is the name of the Trim File being loaded to the EEC. From Reference (1), the Service Bulletin, enter the trim checksum value and press the RETURN key.

(25) The LDR program will now prompt with the following message: "Do you wish to reenter the above entries [Y/N/Q]:".

(a) To proceed with programming process, type N, then press the RETURN key. Continue with step C. (25).

(b) To correct any errors in the data entered, type Y, then press RETURN. Continue with step C. (19).

(c) To quit the programming process, type Q, then press RETURN. Turn off the 28 VDC power to the EEC and continue with step C. (36).

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

(a) Status messages will scroll across the screen.

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

(27) The LRD150 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.

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

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

(30) 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.

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

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

(33) 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 aircraft supply to the EEC.

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

(35) 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.

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

****EEC REPROGRAMMING SUCCESSFULLY COMPLETED***
Record the log file name "VLXXXX.LOG" for later printout.

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

(b) If the 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 1 describes the error codes and action to be taken.

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

(37) 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 commands listed below to make a paper copy.

(a) At the MSDOS prompt, type PRINT VLXXX.LOG.

(b) Press the RETURN key.

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

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

(38) Disconnect the EEC reprogramming electrical connectors from J1 and J7.

(39) Reconnect the aircraft electrical harness connectors to J1 and J7.

(40) Identify the Electronic Engine Control by the procedure specified in Reference (1).

(41) Close-up the engine and remove the remaining notices by doing the post-requisite procedures given in steps 4. I., J. and K., Reference (3), Chapter/Section 73-21-34 Removal/Installation, and the Recording Instructions given in Part I, Paragraph G.

(42) Do the post-installation test specified in Reference (3) as shown for the electronic control system.

EEC SIGNAL NAME	EEC 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

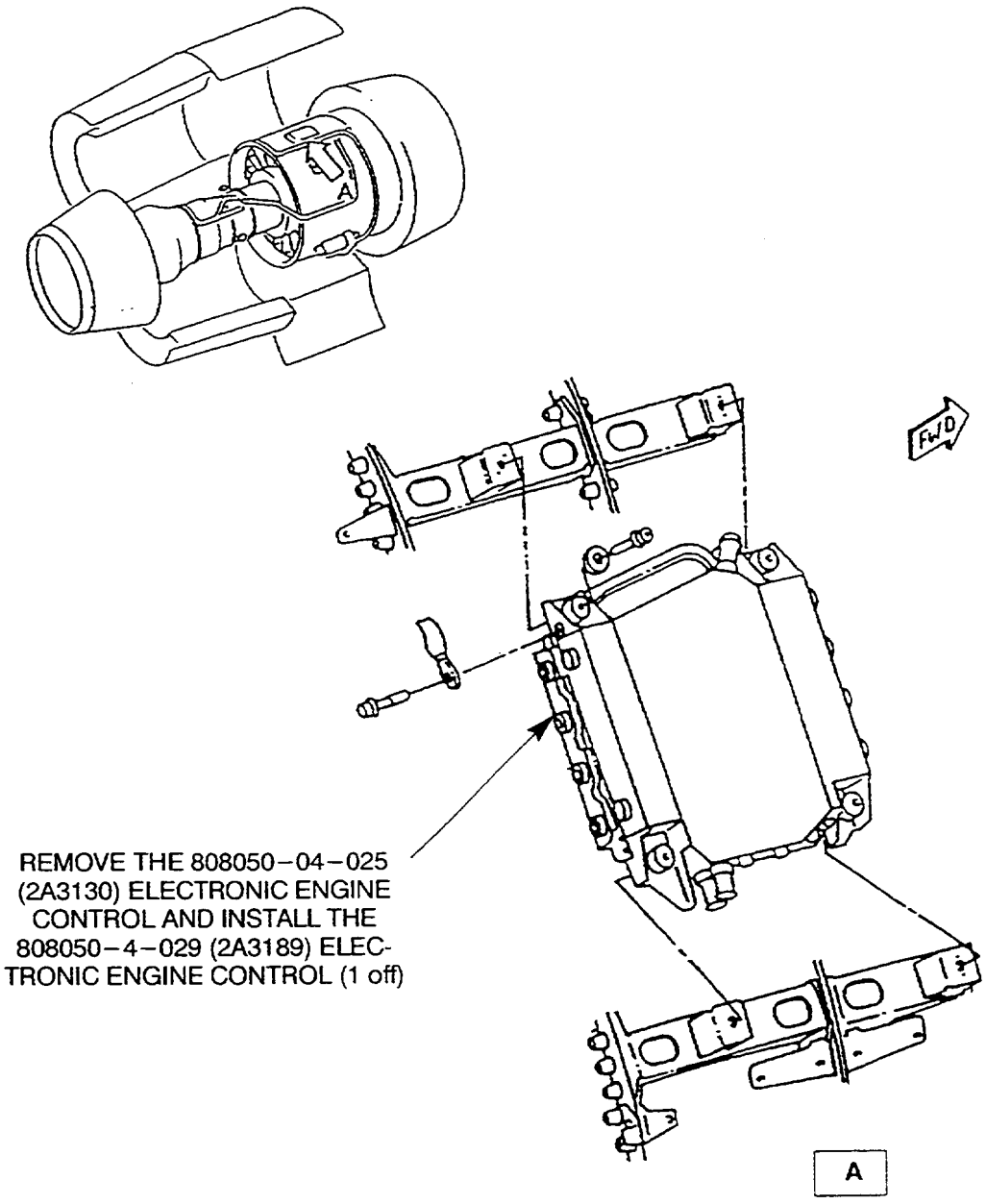
Table 2
Power Supply Connections

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 return EEC unit
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 id not write protected, or replace disk and retry.

Table 3
Error Code Definitions

ded0001060

Tables 2 and 3 Power Supply Connections and Error Code Definitions



Location of Electronic Engine Control (EEC)
Fig.1

3. Material Information

A. Kits associated with this Bulletin:

None.

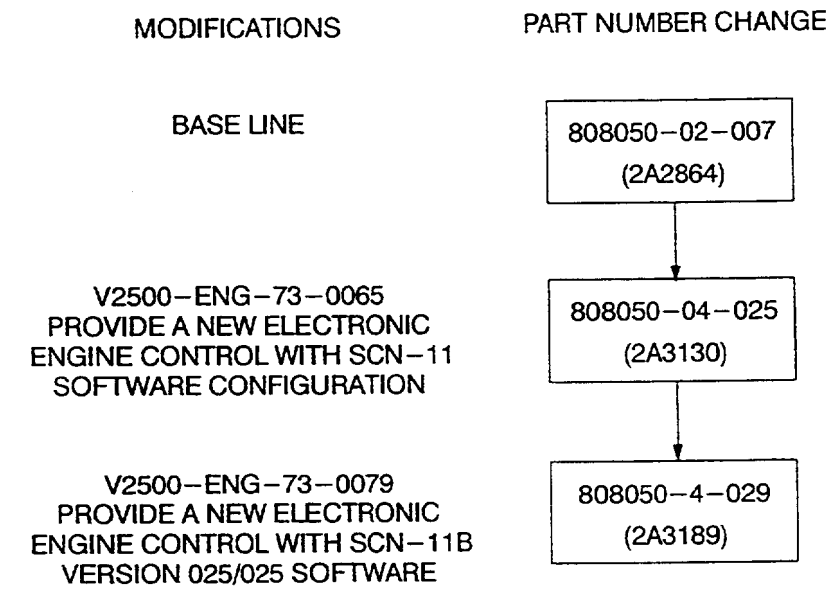
B. Parts affected by this Bulletin:

New Part No. (ATA No.)	Qty.	Est'd Unit Price ($)	Keyword	Old Part No. (IPC No.)	Instructions/ Disposition
808050-4-029 (2A3189) (73-22-34)	1		Control, Electronic Engine	808050-04-025 (2A3130) (01-280)	(A) (B)

C. Instruction/Disposition Code Statements:

(A) New part is currently available.
(B) The Old part will no longer be available.

NOTE: The estimated 1995 unit prices shown are provided for planning purposes only and do not constitute a firm quotation. Consult the IAE Price Catalog or contact IAE's Spare Parts Sales Department for information concerning firm prices.



Family Tree - Electronic Engine Control (EEC) Catalog Sequence No. 73-22-34, Fig 01, Item 280
Fig.2

UNITED TECHNOLOGIES
HAMILTON STANDARD

SERVICE BULLETIN

Engine Fuel and Control – EEC150–20 Electronic Engine Control – Incorporation of Douglas SCN11B Software Configuration

cannot add to QI 73 as IAE SB is still a draft

HSS FAA Repair Station License Number – SI3R842L
PWORCE FAA Repair Station License Number – CW5Y794M

Revision	Date	Pages Affected
1	Mar 6/96	1,12,14,15

1. Planning Information

A. Effectivity

Hamilton Standard EEC150–20 Electronic Engine Controls Part Number

808050–4–XXX

NOTE: Following incorporation of this service bulletin, the EEC150–20 can be installed on MD–90 aircraft that use the IAE V2500–D5 engine.
XXX – Identifies all available software configurations.

B. Reason

The purpose of this Service Bulletin is to allow the IAE V2500–D5 engine operators install Douglas SCN11B software in the EEC150–20.

(1) PROBLEM:

(a) WING TANK FUEL TEMPERATURE SPLIT
Disagreements between left and right wing tank fuel temperatures, in excess of 10 degC., have been observed during MD–90 production flight testing and revenue service operation. As a result of these temperature splits, both EECs log the "wing tank fuel temperature cross–check" fault message and inhibit fuel return to tank.

(b) FUEL TEMPERATURE RAISED IDLE

A fuel temperature raised idle schedule is selected in response to abnormally high fuel temperatures or a failure of the fuel temperature thermocouple. (1) Selection of this raised idle schedule on the ground results in an idle level requiring substantial performance penalties, making aircraft operation difficult or impractical. (2) For cold day operation with the current level of fuel temperature raised idle, a landing field length penalty contribution results from the unnecessarily high idle level present prior to aircraft touchdown. (3) The selection of the raised idle schedule can exist for up to 20 minutes without an 'EEC FAULT' indication to the crew.

(c) SELECTION OF DFGC BUSSES DURING TAKEOFF

EPR synchronization can be activated during takeoff, after the takeoff power setting has been "frozen". This can occur in the absence of any true component failure and can result in a left engine EPR downtrim of up to 0.04.

(d) REVISION TO PIP EPR MODIFIER TABLE

The MD–90 flight test data shows a non–conservative discrepancy in takeoff thrust relative to the published Airplane Flight Manual (AFM). This discrepancy is presently addressed via takeoff field length penalties.

(e) GROUND STARTING ENHANCEMENTS FOR HIGH ALTITUDE/LOW STARTER AIR PRESSURE

V2500 engine ground autostarts at high altitudes or with low starter air supply have not been 100% successful.

(f) LOSS OF AIRCRAFT POWER – NUISANCE FAULT ANNUNCIATIONS

Nuisance annunciations of the OAP messages 'ENG SYSTEM FAIL' and 'REVERSER FAULT' have been observed during flight test and in revenue service.

(g) NUISANCE 'REVERSER FAULT' MESSAGE – LOSS OF AIRCRAFT 28 VDC POWER

The Reverser No Dispatch bit (OAP message 'REVERSER FAULT') is set by a loss of aircraft 28 VDC power which lasts less than 5 seconds. The requirement is to set the fault only if the power is lost for 5 seconds or more.

(h) NUISANCE 'REVERSER FAULT' MESSAGE - WITH IN-RANGE CROSS-CHANNEL TRA DISAGREEMENT

Nuisance annunciations of the Reverser No-Dispatch OAP message 'REVERSER FAULT' have been observed during MD-90 flight test and revenue service, due to in-range cross-channel disagreement of the Throttle Resolver Angle (TRA) inputs, when the reverse thrust lever is at the stow/deploy position (-4.5 degrees TRA).

(i) BOWED-ROTOR AUTO-CRANKING PROVISIONS/REDUCED ON-GROUND STARTER CUTOUT SPEED

(1) Field experience with the V2500-A1 engine has identified the potential for engine clearance degradation between rotating and static parts following engine restart of a previously shutdown engine. (2) Improvement to starter life can be obtained by lowering the on-ground starter cut-out (SCO) speed.

(j) ACC DUAL F/B FAILURE ANNUNCIATION

The Class II, time-limited dispatch bit (Label 350/Bit 29, 'EEC FAULT'), does not included all feedback failure conditions that result in the active clearance control (ACC) actuator being failsafed (i.e., HPT valve closed and LPT valve partially open).

(k) CDX MODIFIER RANGE REVISION

The V2500-D5 EIS engines to date have been shipped with an average EPR modifier plug class of 10. The present EPR modifier plug class structure is 4 to 11. As a result,the ability to properly CDX future engines may be at risk due to potential limitations in the current EPR modifier plug class structure.

(l) NUISANCE 'REVERSER FAULT' MESSAGE - RAPID THROTTLE MOVEMENT

Nuisance annunciations of the Reverser No-Dispatch OAP message 'REVERSER FAULT' have been observed during MD-90 flight test in response to rapid reverse thrust lever movement about the stow/deploy position.

(m) FLIGHT CREW ANNUNCIATIONS FOR DISPATCHABLE FAULT CONDITIONS WITH OPERATIONAL IMPACT

Presently, the occurrence of an 'EEC FAULT' OAP message, without interrogation of the EEC maintenance memory to determine if the originating fault carries any special flight crew procedures, requires the flight crew to assume that all such conditions exist for dispatch. This requires substantial performance and fuel burn penalties be imposed for subsequent flights. In addition to restricting takeoff weight, this can result in dispatch delays.

(n) FIX FOR NUISANCE DFGC FAULT MAINTENANCE RECORDINGS
Presently, depowering of the DFGC on the ground by the crew or DFGC self-testing can result in the CLM 'DFGC1,2/HC/EEC1,2' in response to the loss of DFGC data.

(o) FIX FOR NUISANCE 'GAT INHIBITED' MESSAGE MAINTENANCE RECORDINGS
Nuisance 'GAT INHIBITED' maintenance messages are frequently being recorded by the EEC and thus requiring disposition by the operator.

(p) NUISANCE 'HMS-VSCF OVTMP W/RECIRC1, 2' MAINTENANCE MESSAGE
If the VSCF oil temperature is over the maintenance limit at the time the engine is shutdown a nuisance annunciation of Flip Mode, 'HMS-VSCF OVTMP W/RECIR1, 2', will occur. This fault is recorded in EEROM and is a Class II fault which is intended to indicate a heat management system fault. The requirement is for an overtemperature condition to exist for 2 minutes before setting the fault flag.

(q) THRUST REVERSER INTERLOCK FAULT ANNUNCIATION
Present EEC logic can set and annunciate failures associated with the T/R Interlock Relay circuit.

(r) WEIGHT-ON-NOSEGEAR ARINC INPUT FAILED TO 'ON-GROUND'
An erroneous DFGC weight-on-nosegear ARINC input (WOWP) can be sent to the EEC indicating "on-ground" while the aircraft is in the air. This can adversely affect a number of EEC functions, including the scheduling of the heat management system raised idle, the scheduling of minimum allowable N1 for icing protection, and the scheduling of the 7A high compressor bleed valve for surge margin protection.

(s) NUISANCE FAULT RECORDING OF 'WEIGHT-ON-NOSEGEAR FAILED TO ON GROUND'
The flag which indicates the weight-on-nosegear signal is failed to the "on-ground" state while the aircraft is in the air (as determined by MACH Number) can be fault recorded inappropriately. The fault is inappropriately recorded when the weight-on-nosegear signal indicates "on-ground" while MACH number is not available to determine the aircraft is in the air.

(2) CAUSE:

(a) WING TANK FUEL TEMPERATURE SPLIT
The EEC heat management system control logic can allow differential heat rejection rates, via the fuel return to tank system, to the left and right wing tanks, during normal operational conditions or as a result of failures. Differential rejection rates can result in 10 degC wing tank fuel temperature splits, which cause the EECs to inhibit return to tank flow and log the cross-check maintenance fault. Significant left to right wing tank fuel temperature differentials have been observed with one engine controlling to mode 1 and the other controlling to mode 4.

(b) FUEL TEMPERATURE RAISED IDLE
(1) The EEC tolerance time for detections of fuel temperature thermocouple failures is too short. This allows for unnecessary illuminations of 'EEC FAULT' on the OAP, selections of the fuel temperature raised idle, and inhibiting of fuel return-to-tank. (2) For inflight use the schedule is unnecessarily high. (3) Current logic allows the selection of the raised idle schedule for up to 20 minutes without an 'EEC FAULT' indication to the crew.

(c) SELECTION OF DFGC BUSSES DURING TAKEOFF
The DFGC bus selection logic does not preclude automatic bus transitions during takeoff. An automatic bus transition to the pilot selected DFGC during takeoff can lead to the above described problem.

(d) REVISION TO PIP EPR MODIFIER TABLE
The original EPR Takeoff ratings do not provide the anticipated MD-90 aircraft performance, at all conditions, as specified in the AFM.

(e) GROUND STARTING ENHANCEMENTS FOR HIGH ALTITUDE/LOW STARTER AIR PRESSURE
There are two reasons the starts have not been successful: light up stall and insufficient engine starting acceleration torque caused by low starter air pressure and non-optimized ground start fuel scheduling.

(f) LOSS OF AIRCRAFT POWER - NUISANCE FAULT ANNUNCIATIONS

Re-configuration of the aircraft electrical system can result in the EEC losing aircraft power and generating nuisance OAP and associated Clear Language Messages (CLM). Flight crews occasionally turn off the the emergency power (EMER PWR) switch while an engine is spooling down after shutdown, removing aircraft power to the EEC's. Additionally, certain aircraft procedures require that the EMER PWR switch be turned off, briefly, and then returned to ARM or ON. If the flight crew leaves the switch OFF for 5 or more seconds per these procedures, while the engines are running, unnecessary annunciations of 'ENG SYSTEM FAIL' and 'REVERSER FAULT' will be generated.

(g) NUISANCE 'REVERSER FAULT' MESSAGE - LOSS OF AIRCRAFT 28 VDC POWER

Combinational latched faults, which include loss of aircraft 28 VDC, are part of the Reverser No Dispatch fault.

(h) NUISANCE 'REVERSER FAULT' MESSAGE - WITH IN-RANGE CROSS-CHANNEL TRA DISAGREEMENT

This problem occurs when the channel A and channel B TRA inputs are within the allowed cross-check tolerance band and straddle the -4.5 degree stow/deploy position.

(i) BOWED-ROTOR AUTO-CRANKING PROVISIONS/REDUCED ON-GROUND STARTER CUTOUT SPEED

(1) Thermal differentials developing after shut-down of a hot engine can produce significant "bowing" of the rotor spool which, coupled with resulting amplification of the natural spool whirl on the subsequent engine start, can result in rubbing, leading to clearance degradation and a corresponding loss in engine performance. (2) Current SCO speed is set unnecessarily high.

(j) ACC DUAL F/B FAILURE ANNUNCIATION

The original intent of the design, which is to cover all cases where the EEC can't control the ACC loop, is not met with the current implementation.

(k) CDX MODIFIER RANGE REVISION

EIS engines have a different thrust/EPR relationship than the flight test engines used to define the present EPR modifier plug class structure.

(l) NUISANCE 'REVERSER FAULT' MESSAGE - RAPID THROTTLE MOVEMENT
The EEC logic does not account for the mechanical lag of the thrust reverser system which can result in the erroneous indication of an auto-restow or auto-redeploy condition.

(m) FLIGHT CREW ANNUNCIATIONS FOR DISPATCHABLE FAULT CONDITIONS WITH OPERATIONAL IMPACT
The occurrence of any Short-Term-Dispatch fault is annunciated by the single 'EEC FAULT' OAP message.

(n) FIX FOR NUISANCE DFGC FAULT MAINTENANCE RECORDINGS
The EEC presently records these faults in response to the loss of DFGC data whether the loss occurs inflight or on the ground.

(o) FIX FOR NUISANCE 'GAT INHIBITED' MESSAGE MAINTENANCE RECORDINGS
Current EEC logic records the 'GAT INHIBITED' message into maintenance memory whenever the N1 mode is selected on the ground, whether or not the selection is associated with an attempt to run the ground actuator test (GAT).

(p) NUISANCE 'HMS-VSCF OVTMP W/RECIRC1, 2' MAINTENANCE MESSAGE
The logic implementation can be defeated by the EEC reset which occurs at shutdown.

(q) THRUST REVERSER INTERLOCK FAULT ANNUNCIATION
The decision to remove the T/R Interlock function from the MD-90 was made too late to disable the associated logic in the EEC without impacting A/C certification. This necessitated installation of unnecessary wiring and relays on each aircraft to preclude nuisance maintenance messages and inappropriate 'EEC FAULT' annunciations.

(r) WEIGHT-ON-NOSEGEAR ARINC INPUT FAILED TO 'ON-GROUND'
Certain aircraft failure modes can lead to the DFGC sending the EEC a valid but erroneous weight-on-nosegear signal indicating "on-ground" while the aircraft is in the air.

(s) NUISANCE FAULT RECORDING OF 'WEIGHT-ON-NOSEGEAR FAILED TO ON GROUND'
The software was coded incorrectly.

(3) SOLUTION:

(a) WING TANK FUEL TEMPERATURE SPLIT
Incorporate a discrete trim in the EEC heat management logic to inhibit mode 4 selection and to set mode 1 maximum allowable spill flow whenever return to tank is allowed. Additionally, the Air Cooled Oil Cooler (ACOC) valve will be scheduled closed, for a minimum of 2 minutes, following a transition from a spill inhibit condition to mode 1 (spill allowed). This latter change is required to preclude the potential for increased ACOC valve usage following an inhibit condition during which the engine fuel temperature approaches the controlling limit.

(b) FUEL TEMPERATURE RAISED IDLE
Revise the EEC logic to: (1) increase the tolerance time for detecting fuel temperature thermocouple failures from 5 to 30 seconds, (2) inhibit the selection of the raised idle schedule on the ground, (3) limit the authority of the raised idle schedule inflight based on corrected N2 as a function of altitude and (4) revise the conditions for annunciating a fuel-temperature-over-limit situation from "> 110 deg C for 20 minutes" to "> 120 deg C for 5 minutes."

(c) SELECTION OF DFGC BUSSES DURING TAKEOFF
Modify the DFGC bus selection logic to inhibit automatic bus transitions during takeoff operation.

(d) REVISION TO PIP EPR MODIFIER TABLE
Modify the PIP EPR modifier table to provide additional thrust during takeoff to significantly reduce this discrepancy. The AFM will be revised to eliminate the remainder of the discrepancy.

(e) GROUND STARTING ENHANCEMENTS FOR HIGH ALTITUDE/LOW STARTER AIR PRESSURE
Optimize ground start fuel scheduling by making minimum fuelflow a function of altitude to reduce it to 240 PPH at high altitudes, provisioning for an optimized ground autostart fuel and ignition on speed schedule as a function of altitude,adjusting the autostart ground ignition speed timer to 35 seconds and introducing a raised N2dot acceleration schedule for ground starting to ensure light up at lower altitudes occurs on the Wf/Pb starting schedule. These changes are applied to ground starts only based on the current Ground/Flight starting logic, thus assuring no impact to the air starting characteristics or certification.

(f) LOSS OF AIRCRAFT POWER - NUISANCE FAULT ANNUNCIATIONS
Modify the logic in the EEC to not generate the 'ENG SYSTEM FAIL' and 'REVERSER FAULT' OAP messages, in response to the loss of aircraft 28 VDC power, unless the power loss lasts for 15 or more seconds while the FUEL Switch or the START Switch is ON. The logic is also modified so as to not generate the 'A/C 28 V POWER/EEC' CLM in response tothe loss of aircraft 28 VDC power, unless the power loss occurs while either the FUEL Switch or the START Switch is ON.

(g) NUISANCE 'REVERSER FAULT' MESSAGE - LOSS OF AIRCRAFT 28 VDC POWER
Replace the combinational latched faults, which include loss of aircraft 28 VDC, with their individual components, leaving out the aircraft 28 VDC fault.

(h) NUISANCE 'REVERSER FAULT' MESSAGE - WITH IN-RANGE CROSS-CHANNEL TRA DISAGREEMENT
Modify the EEC logic to exclude nuisance OAP 'REVERSER FAULT' (EEC ARINC Label 270/Bit 19) messages from being set and the associated faults from being recorded.

(i) BOWED-ROTOR AUTO-CRANKING PROVISIONS/REDUCED ON-GROUND STARTER CUTOUT SPEED
(1) Modify the starting logic for autostarts to make the provision by trim to motor the engine on the starter for 50 seconds, after opening the starter valve, before initiating fuel flow. This provision will not be activated in SCN 11A. (2) Provide a separate trim to starter cutout (SCO) speed to allow reduction in the SCO speed for ground starting, without changing in-flight SCO speed, to avoid impacting in-flight starting certification. Lower the on-ground SCO speed, from the current 42.6% to 40.1% N2, to enhance starter life.

(j) ACC DUAL F/B FAILURE ANNUNCIATION
Modify the Class II logic to include dual channel active clearance control feedback failures.

(k) CDX MODIFIER RANGE REVISION
To provide CDX capability beyond the present maximum class of 11, the CDX EPR modifier range will be revised by removing classes 4 and 5 and adding classes 12 and 13.

(l) NUISANCE 'REVERSER FAULT' MESSAGE - RAPID THROTTLE MOVEMENT
Modify the logic to inhibit the detection of an auto-redeploy or auto-restow condition for 0.7 seconds after a throttle movement. The change will not impede the detection of real inadvertent deploy/stow events or impact the control response time to an event.

(m) FLIGHT CREW ANNUNCIATIONS FOR DISPATCHABLE FAULT CONDITIONS WITH OPERATIONAL IMPACT
Modify the EEC logic to provide five new OAP messages to annunciate the occurrence of any Short Term Dispatch engine fault condition which requires the crew to perform special procedure, per the MD-90 MMEL. These fault conditions are: (1) Fuel Temperature Exceeds Maximum Limit or Fuel Temperature Input Failsafed, (2) Air Oil Cooler Valve Failsafed or Failed Open, (3) Active Clearance Control System Failsafed, or Actuator Track Check, (4) 2.5 Bleed Valve Stuck Open and (5) ARINC Nosegear Signal Failed to On-ground.

(n) FIX FOR NUISANCE DFGC FAULT MAINTENANCE RECORDINGS
Modify the logic to not record any failure of the DFGC data bus which occurs on the ground and does not persist into flight operation.

(o) FIX FOR NUISANCE 'GAT INHIBITED' MESSAGE MAINTENANCE RECORDINGS
The maintenance messages 'GAT INHIBITED1,2' are being deleted from the EEC. The remaining 'GAT STARTED1,2', GAT PASSED1,2', 'GAT FAILED1,2' and 'GAT ABORTED1,2' messages are sufficient to support operation of the test, and to identify problems, as necessary.

(p) NUISANCE 'HMS-VSCF OVTMP W/RECIRC1, 2' MAINTENANCE MESSAGE
Modify the logic implementation such that it can not be defeated be an EEC reset.

(q) THRUST REVERSER INTERLOCK FAULT ANNUNCIATION
Modify the EEC logic, as necessary, to preclude the setting of failures in the T/R Interlock Relay circuit, thus eliminating the need to install additional wiring and relays on each aircraft.

(r) WEIGHT–ON–NOSEGEAR ARINC INPUT FAILED TO 'ON–GROUND'
Modify the EEC ARINC input processing logic to detect, accommodate, and annunciate the failure of the weight–on–nosegear signal to the "on–ground" state. MN will be used to determine on–ground/in–flight status for this fault condition. The failure will be annunciated by recording the fault and setting the Class II short term dispatch bit.

(s) NUISANCE FAULT RECORDING OF 'WEIGHT–ON–NOSEGEAR FAILED TO ON GROUND'
Code the software as originally intended.

C. Description

You do not open the EEC150–20 to install the revised software. The EEC150–20 is reprogrammed with Douglas SCN11B software and re–identified with the new part number. A functional test of the EEC150–20 is not required.

D. Compliance

Category 4 – Accomplish on a planned basis when an installed EEC150–20 is at a maintenance base capable of compliance with the Accomplishment Instructions regardless of other planned maintenance.

E. Approval

The part number changes and/or part modifications given in Paragraphs 2 and 3 of this service bulletin obey the applicable Federal Aviation Regulations and are FAA–approved for the EEC150–20 Electronic Engine Control.

F. Manpower

Approximately 1 man–hour is necessary to do these Service Bulletin procedures.

G. Material – Cost and Availability

(1) IAE funds this program. The hard copy, no–charge purchase order to perform this service bulletin must refer to the HS service bulletin number EEC150–20–73–11 and the IAE Service Bulletin Number V2500–ENG–73–0079.

This service bulletin will be done at no charge to the operator if the EEC150–20 is sent to one of these addresses:

(a) United Technologies Corporation
Hamilton Standard Division
Attention: Hamilton Support Systems
Electronics Service Center
97 Newberrry Road
East Windsor, CT 06088
U.S.A. (FAA Repair License No: SI3R842L)

(b) Pratt & Whitney
Overhaul and Repair Center – Europe (PWORCE)
P.O. Box 269
6190 AG BEEK
Maastricht Airport
The Netherlands (FAA Repair License No: CW5Y749M)

(2) You can do these Service Bulletin procedures at your own location at your own cost and expense using the "Alternate Reprogramming Method" described in the accomplishment instructions. If you do these Service Bulletin procedures with the "Alternate Reprogramming Method", you need to obtain the software diskette used to reprogram the EEC. Refer to Material Information to order the Reprogramming Diskette.

(3) One Reprogramming Diskette can be used to modify approximately 40 EEC150–20 units. The Software Loader Utility used to reprogram the EEC creates a log file on the Reprogramming Diskette. When the log file is filled or when your fleet of EEC's is modified, return the Reprogramming Diskette to Hamilton Standard. Contact your local Hamilton Standard Field Support Representative if you need assistance to return the Reprogramming Diskette.

(4) The new parts required to accomplish this Service Bulletin are listed in Section 3, Material Information.

H. Tooling

NOTE: The following tools and equipment are necessary to perform the "Alternate Reprogramming Method" procedures:

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

(a) 80286 processor

(b) 512 Kbytes RAM

(c) 1.44Mbyte, 3.5" floppy disk drive

(d) Dual channel RS–422 aysnchronous 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 5)

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

NOTE: THE IBM COMPUTER DATE/TIME MUST BE CURRENT PRIOR TO PERFORMING THIS PROCEDURE.

(2) Hamilton Standard diskette called out in the Service Bulletin which is being incorporated. This diskette contains the EEC150–20: application code, trims, memory clear utilities, and software loader.

(3) EEC150–20 commuication cables as defined in Table 1.

(4) 28VDC, 5.0 +/– 0.5A power supply and associated power cables as defined in Table 2.

I. Weight and Balance

None

J. Electrical Load Data

Not Affected

K. References

E9137 Standard Electronic Practices Manual
Components Maintenance Manual CMM 73–28–01
IAE Service Bulletin Number V2500–ENG–73–0079
Hamilton Standard Service Bulletin EEC150–20–73–11

L. Other Publications Affected

Illustrated Parts Catalog 73–28–01

2. Accomplishment Instructions

NOTE: Refer to the E9137 Standard Practices Manual to do the procedures unless otherwise noted.

NOTE: The "Alternate Reprogramming Method" procedures may be used whenever the EEC electrical connectors are disconnected from the aircraft. If the EEC is reprogrammed using 28VDC power from the aircraft, refer to the engine/aircraft procedures.

A. If you use the "Alternate Reprogramming Method" skip to step 2.B. Otherwise refer to CMM 73–28–01, section 200 (ATLAS) to reprogram the EEC150–20. Use the program, version number, and engine trims shown below.

	Channel A	Channel B
Application Program:	Y812396	Y812397
Application Version Number:	025	025
Engine Trim Program:	Y812398	Y812398
Engine Trim Version Number:	025	025

If you do not use the "Alternate Reprogramming Method" of programming, skip to step 2.AM

B. If you use the "Alternate Reprogramming Method", verify that the model number on the identification plate of the unit is "EEC150–20".

C. Record the current unit part number and the unit serial number from the nameplate. This information will be input into the computer.

D. Plug–in all necessary equipment, but do not turn the equipment on.

E. Connect the programming harness connector marked P1 to the EEC connector marked J1. Ensure that the red engagement stripe on the EEC connector J1 is fully covered.

F. Connect the programming harness connector marked P7 to the EEC connector marked J7. Ensure that the red engagement stripe on the EEC connector J7 is fully covered. If the computer and power supply connections to the cables are permanent, skip to step 2.J.

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). Ensure that these connectors are properly mated.

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). Ensure that these connectors are properly mated.

NOTE: UART CONNECTIONS CAN DIFFER FOR DIFFERENT IBM COMPATIBLE COMPUTERS.

NOTE: It is important to verify that the connectors are correctly installed for correct loader operation. HS recommends labeling the RS–422 COM3 port as "ch. a uart" and COM4 port as "ch. b uart" on the computer to reduce errors.

I. Connect the opposite end of P3 and P9 cables to the 28VDC supply.

J. 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.

K. 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.

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

M. Turn on the 28 VDC power supply to the EEC .

N. Turn on the power to the IBM compatible computer.

O. 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.

P. Obtain the Hamilton Standard reprogramming diskette P/N 819191–3. Ensure that the write protection tab of the diskette is covering the "hole". Insert the diskette into the floppy drive designated as "A" on the IBM compatible computer.

Q. The display will show the "**C:\>**". Type **a:** then press the **RETURN** key (note: some computers have the **RETURN** key designated as **ENTER**).

R. The display will show the "**A:\>**" prompt. Type **LDR150** then press the **RETURN** key. This starts the UART programming utility. Several messages will appear including the program identification, version number, time and the UTC/P&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. See Table 3 for a summary of error code description and troubleshooting suggestions.

S. The UART programming utility **LDR150**, will display the following message: **"Enter operator's name performing download : [ ] >"**. 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. If the operator is the same, press the **RETURN** key to continue. If a different name is present than the operator's or no name is present, the operator should enter his/her name and press the **RETURN** key.

T. The LDR150 program will display the following message:

WARNING – EEC Fault Memory Will Be Cleared By This Program.
If an EEC Fault Dump Is Required Prior to Programming,
enter Q to Quit or C to Continue [Q/C] :

If a fault dump has already been accomplished or is not required, type **C**, then press the **RETURN** key.

If a fault dump is required, or the operator wishes to terminate the programming procedure, type **Q**, then press the **RETURN** key. If the operator selects the quit option, turn off the 28VDC power to the EEC and go to step 2.AI.

U. The LDR150 program will now prompt with the following message: **"Enter the 9 character EEC Serial Number : [XXXX–XXXX] > "**. From the Hamilton Standard nameplate, enter the nine character EEC serial number and press the **RETURN** key.

NOTE: For steps 2.V and 2.W, if the EEC150–20 part number on the nameplate between the dashes is a single digit, enter a zero immediately preceeding this digit.
Example: P/N 808050–4–025 would be entered as 808050–04–025.

V. 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 Standard nameplate, enter the 13 character EEC Hardware Part Number and press the **RETURN** key.

W. The LDR150 program will now prompt with the following message: **"Enter the 13 character SB EEC HW Part No. : [XXXXXX–XX–XXX] > "**. From the Service Bulletin, enter the new 13 character EEC Hardware Part Number and press the **RETURN** key.

X. The LDR150 program will now prompt with the following message: **"Enter Trim Checksum Value for "xxxxxx.xxx" : >** ". The xxxxxx.xxx designation is the name of the Trim File being loaded to the EEC. Enter the trim checksum value **13565** and press the **RETURN** key.

Y. The LDR150 program will now prompt with the following message: **"Do you wish to reenter the above entries [Y/N/Q] : "**.

(1) To proceed with programming process, type **N**, then press the **RETURN** key. Continue with step 2.Z.

(2) To correct any errors in the data entered, type **Y,** then press **RETURN**. Continue with step 2.S.

(3) To quit the programming process, type **Q**, then press **RETURN**. Turn off the 28VDC power to the EEC and continue with step 2.AJ.

Z. At this point the screen will be initialized to display the activity of the programming process. Status messages will scroll across the screen. If an error occurs, see Table 3 for a summary of error code description and troubleshooting suggestions.

AA. 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.

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

AC. On the IBM compatible computer, press the **RETURN** key.

AD. 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.

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

AF. On the IBM compatible computer, press the **RETURN** key.

AG. 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 28 VDC power supply to the EEC .

AH. On the IBM compatible computer, press the **RETURN** key.

AI. 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.

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

****** EEC REPROGRAMMING SUCCESSFULLY COMPLETED *****

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

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

(2) If the 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 1 describes the error codes and action to be taken.

AJ. Press the **RETURN** key to terminate the program and return to the MSDOS prompt "**A:\>**".

AK. If a printer is available, a paper copy of the log file can be generated by the IBM compatible computer. To do this, at the MSDOS prompt, type **PRINT VLXXXX.LOG**, then press the **RETURN** key. Wait until the printer is finished before proceeding with the next step. If the printer is not available remove the diskette and move it to a system that has a printer and type the preceeding command for a paper copy.

AL. Disconnect the EEC electrical connectors from the J1, J3, J7 and J9 connectors.

AM. Change the Hamilton Standard Part Number to show that this Service Bulletin is included into the end-assembly configuration. Put the information shown below on a new unit identification plate. EEC150-20 units reprogrammed at one of the addresses shown in paragraph 1.G.1 will be sent back with their assemblies re-identified as shown.

(a) Put the new end-assembly part number in the "PART NO." area of the new identification plate:

PART NUMBER BEFORE THIS SERVICE BULLETIN	PART NUMBER AFTER THIS SERVICE BULLETIN
808050-4-XXX	808050-4-029

(b) Put the new IAE part number in the "CI NO." area of the new identification plate.

EEC150-20 END-ASSEMBLY	NEW IAE PART NUMBER
808050-4-029	2A3189

Table 1. COMMUNICATION CONNECTIONS

EEC SIGNAL NAME	EEC CONNECTOR	QUA-TECH CONNECOR	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 2. POWER SUPPLY CONNECTIONS

EEC SIGNAL NAME	EEC 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 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 return EEC unit
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 compatability 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 disk and retry.

3. Material Information

A. This Service Bulletin change will use the parts in the list for each EEC150-20 that incorporates this service bulletin.

B. Any parts that usually are discarded when you disassemble the EEC150-20 are not in the list.

C. In the list of parts for this change, MSQ is the "Minimum Sales Quantity". The parts that have an entry in this area of the list are supplied only in this quantity, or a multiplication of this quantity.

D. In the list of parts for this change, the "Key Word" is a one-word name for the part.

E. In the list of parts for this change, the "Instruction Codes" tell you what to do with the parts. A short list under the list of parts tells you about the instruction codes that are used in the list.

F. The prices that are shown are estimates for one part. When you buy the parts, the prices may be different. Send requests for parts to:

Mail: Hamilton Standard Customer Support Service Center
Attention: Spare Parts Sales
471 Lakeshore Parkway
Rock Hill, SC 29730
Attn: Spare Parts Sales

Facsimile: 803-325-2849

Purchase orders for parts must refer to the HS Service Bulletin Number EEC150-20-73-11, the IAE Service Bulletin Number V2500-ENG-73-0079.

G. New Parts Required

New PN	Qty	MSQ	Estimated Price	Key Word	PN Before this SB	Instruc-tion Code
751333-1	1	20	1.80	Plate	-	A
819191-3	1	1	$ 0.00	Diskette	-	B,C

Instruction Code A. The "New PN" is the same as the "PN before this SB".

Instruction Code B. One Reprogramming Diskette can modify approximately 40 EEC150-20 units. You should order the proper quantity of diskettes to modify your fleet of EEC150-20 units.

Instruction Code C. The Reprogramming Diskette is provided to you at No Charge.

Hamilton Standard Service Bulletin EEC150-20-73-11
Hamilton Standard Internal Reference Numbers EC238017, EC239550
IAE Service Bulletin Number V2500-ENG-73-0079
IAE Internal Reference Number 95VZ005