P U B L I C A T I O N T R A N S M I T T A L

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V2500-A5/D5 SERIES PROPULSION SYSTEM NON-MODIFICATION SERVICE BULLETIN

This document transmits the Revision 5 of Non-Modification Service Bulletin V2500-ENG-72-0505.

Document History

Non-Modification Service Bulletin Revision Status

Initial Issue	Jul.29/05
Revision 1	Aug. 3/05
Revision 2	Feb 1/06
Revision 3	Mar.16/07
Revision 4	Nov.26/07

Non-Modification Service Bulletin Revision 5

Remove	Incorporate	Reason for change
All pages of the Non-Modification Service Bulletin.	Pages 1 to 20 of the Non-Modification Service Bulletin.	To change the inspection requirements. Minor editorial changes.

CHECK THAT ALL PREVIOUS TRANSMITTALS HAVE BEEN INCORPORATED
If any have not been received please advise IAE International Aero Engines AG

International Aero Engines

SERVICE BULLETIN

ENGINE - HIGH PRESSURE (HP) COMPRESSOR STAGE 4 ROTOR BLADES - ULTRASONIC INSPECTION OF SERVICE BULLETIN V2500-ENG-72-0295 STANDARD BLADE ROOTS - NON-MODIFICATION SERVICE BULLETIN

1. Planning Information

A. Effectivity Data

(1) Airbus A319

R V2522-A5, V2524-A5, V2527M-A5 Engines (A5 Standard)

R (a) High Pressure (HP) Compressor - Stage 4 blade, P/N 6A7635.

(2) Airbus A320

R V2527-A5, V2527E-A5 Engines (A5 Standard)

R (a) High Pressure (HP) Compressor - Stage 4 blade, P/N 6A7635.

(3) Airbus A321

R V2530-A5, V2533-A5 Engines (A5 Standard)

R (a) High Pressure (HP) Compressor - Stage 4 blade, P/N 6A7635.

(4) Boeing MD-90

R V2525-D5, V2528-D5 Engines

R (a) High Pressure (HP) Compressor - Stage 4 blade, P/N 6A7635.

R NOTE: Only engines with High Pressure (HP) Compressor - Stage 4 blades, P/N
R 6A7635 introduced with Service Bulletin V2500-ENG-72-0295 are affected.

B. Concurrent Requirements

None.

C. Reason

(1) Condition

The purpose of this Non-Modification Service Bulletin is to introduce an inspection for cracking of SB72-0295 standard Stage 4 HPC rotor blade roots.

Cracking has been found in the root of SB72-0295 standard Stage 4 HPC rotor blade roots. The cracking initiates from the trailing edge of the blade root at the top edge of bedding position. There have been a number of occasions where this cracking has propagated sufficiently for the remainder of the blade to be released causing in-flight shut down or aborted take-off events.

The previous method of inspecting Pre-SB72-0295 standard blades cannot be
R used to inspect SB72-0295 standard blades. This inspection utilises a specially designed ultrasonic probe that can be inserted into the engine through the borescope access port at stage 4.

D. Description

This Non-Modification Service Bulletin is divided into two parts:

PART 1 - Details an ultrasonic inspection procedure that can be used
R for engines at overhaul, when it is not planned to inspect the rotor 4 blades at piece part level.

PART 2 - Details an equivalent level of inspection that can be used for engines at overhaul where the stage 4 HPC rotor blades have been removed from the engine.

E. Compliance

Category 4

R Accomplish at every visit of an engine in a maintenance base capable of
R compliance with the accomplishment instructions regardless of the planned
R maintenance action.

R NOTE: If the HP Compressor is not planned to be disassembled or the stage 4
R blades are not planned to be removed from the rotor, section 3.A. (Part
R 1) of the NMSB should be accomplished at a suitable point in the shop
R visit. If the stage 4 blades are planned to be removed from the rotor,
R section 3.B. (Part 2) should be accomplished.

R NOTE: The ultrasonic inspection must only be performed by suitably qualified
R persons who have received specialist training to the appropriate
R national standard (EN4179, NAS 410 or equivalent) at level 2 or higher.
R The specific training for this NMSB must be performed by IAE instructors
R or by holders of an IAE certificate of training for this inspection.

F. Approval

The compliance statement at 1.D. and the procedures in Section 3. of this Non-Modification Service Bulletin comply with the Federal Aviation Regulations
R and are FAA-APPROVED for the engine models listed.

G. Manpower

Estimated man-hours to embody this Service Bulletin in full:

(1) In Service

R Not applicable.

R (2) At Overhaul/Shop Visit

R Applicable (hours not affected).

NOTE: The parts affected by this Service Bulletin are accessible at overhaul.

H. Tools and Equipment

(1) Part 1

NOTE: Items (b) and (e) are to be supplied on loan from IAE.

(a) Ultrasonic flaw detector, frequency selectable in the 5-10 MHz range.

(b) Turning tool and borescope inspection kit - IAE tool number IAE2R19544 (equivalent Olympus part number 2100765) is recommended by IAE. Alternatively use a 6 mm rigid 45 to 115 degree swing prism borescope, and hand turning tool (references 8 and 9).

(c) Rigging Pin - IAE tool number IAE 1R18254.

(d) Ultrasonic probe inspection kit - IAE tool number IAE2R19802.

The kit contains the following:

(i) IAE2R19803 - Manipulator and probe

(ii) IAE2R19807 - Water feed bottle and tubing

(iii) IAE2R19753 - Borescope hole adaptor

(iv) IAE2R19806 - Calibration jig

(v) IAE2R19804 - Working standard (notched)

(vi) IAE2R19805 - Working standard (un-notched)

(e) De-ionised/De-mineralised water.

NOTE: 1. Only de-ionised or de-mineralised water must be used for the ultrasonic inspections. Any additives may alter the USI probe operational capability.

2. The ultrasonic probe lead is supplied with a BNC connector fitted; an adaptor may be required if alternative equipment is to be used with different front panel connectors.

3. The calibration jig and probe manipulator are matched as a kit and must not be separated. This tool is not user adjustable. If the tool cannot be calibrated before and after inspection it must be returned to IAE for rectification.

(2) Part 2

Refer to the Engine Manual, 72-41-15, for tools and equipment necessary to inspect the stage 4 rotor blades.

I. References

(1) IAE V2500 Service Bulletin:

V2500-SB-ENG-72-0295.

Engine - HP Compressor Blades - Introduction of a Redesigned Stage 4 Blade Assembly.

(2) V2500-A1/A5 Engine Manual (EM), Chapter Section 72-41-15, Inspection/Check.

(3) V2500-D5 Engine Manual (EM), Chapter Section 72-41-15.

(4) V2500-ALL Engine Manual (EM), Chapter Section 72-41-15-300-012. Repair the Airfoil of the HP Compressor Rotor Blade - Stage 4 - By Weld, Repair 012 (VRS6050).

R (5) Internal Reference No. EC 05VR821D.

2. Material Information

R A. Material - Price and Availability

R Not applicable.

3. Accomplishment Instructions

A. Part I - ultrasonic inspection of stage 4 blades at overhaul where the HP Compressor stage 4 blades will not be removed.

R Consumable Materials

R	CoMat 01-003	Inhibited and stabilised trichloroethane
R	CoMat 01-076	Methyl Ethyl Ketone
R	CoMat 04-004	Jointing compound
R	CoMat 10-070	Anti-seize compound
R	CoMat 10-072	Anti-seize compound

(1) Calibration of Ultrasonic Flaw Detector

NOTE: Nominal setting for USN 52 flaw detector to achieve approximate signal timebase positions:

Material Velocity	3100m/s
Delay	0.00 microsec
Range	25 mm
Frequency	10 MHz range
Pulser	Single crystal

The blades are located in the correct inspection position in the calibration jig by releasing the clamp and allowing the blade holder to move between two fixed stops. The blade to be inspected should be positioned against the relevant stop and the clamp locked. (See Figure 3).

(a) Fit the manipulator to the calibration jig, connect the probe lead to the flaw detector and manipulator. Position the un-notched blade in the inspection position and lock the clamp. Position the de-ionised water container on a convenient support ensuring the bottle is positioned slightly higher than the probe. Attach the end of the water supply tube to the connector on the rear of the manipulator and open the valve on the bottle ensuring water is flowing from the probe.

NOTE: Ultragel couplant or similar gel type couplants must not be used, as they will cause the small water couplant pipe in the probe to become blocked.

(b) Operate the cam on the manipulator (See Figure 4) to position the ultrasonic probe on the platform of the un-notched blade and apply slight inwards pressure on the manipulator to seat the probe on to the blade platform. Observe the signal from the blade root corner. Re-seat the probe several times to allow couplant to flow under the probe face.

(c) With zero delay selected, adjust the range control to position the signal at eight divisions on the timebase and adjust the signal amplitude to 100 percent Full Screen Height (FSH).

(d) Operate the cam and fully retract the manipulator into the retracted (safe) position.

(e) Adjust the calibration jig to position the notched blade in the inspection position and lock the clamp. Operate the cam on the manipulator to position the ultrasonic probe on the blade platform and re-seat the probe several times to allow couplant to flow under the probe face.

(f) The signal from the notch should appear at approximately 6.5 on the timebase. Adjust the amplitude of the notch signal to 100 percent FSH (See Figure 5).

(g) Adjust the monitor gate width to extend between 6.1 and 7 divisions on the timebase ensuring the spurious signal at 6 on the timebase does not trigger the gate. Select any audible or visual alarm to trigger at 40 percent screen height.

(h) Repeat paragraph (b) and check amplitude of signal from a good blade.

(i) Operate the cam and fully retract the manipulator into the retracted (safe) position and remove the manipulator from the jig.

(2) Installation of Turning Tool and Borescope Inspection Kit

(a) Fit the turning tool to the engine gearbox in accordance with the manufacturer's operating instructions. Ensure the V2500 software module is fitted to the control unit, the HPC rotation speed is set at 10 Minutes Per Rev (MPR), the correct HPC stage has been selected (HPC4 38 blades) and the instrument is set to operate in jog mode.

NOTE: It is easier to carry out this inspection when using the electronic turning tool in the IAE2R544 borescope inspection kit.

CAUTION: BEFORE INSERTING THE BORESCOPE, THE VSV'S WILL HAVE TO BE MANUALLY OPERATED TO THE FULLY OPEN POSITION AND THE RIGGING PIN INSERTED; FAILURE TO DO THIS WILL RESULT IN DAMAGE TO THE ENGINE AND THE BORESCOPE. IT IS IMPORTANT THAT THE VSV'S ARE FULLY OPEN AS THE VSV TRAILING EDGE IS TO BE USED AS VISUAL DATUM POINT FOR INITIAL POSITIONING OF THE HPC ROTOR.

(b) Attach the borescope hole adaptor to the HPC stage 4 borescope port B (See Figure 1).

(c) Use an applicable wrench on the flats of the crankshaft and move the VSV system to the high speed position (ram retracted). Install the rigging pin (IAE1R18254) through the rig pin hole in the crankshaft front bearing housing and the crankshaft.

(d) Attach the video camera and lens to the borescope and connect the
R monitor to the camera in accordance with the manufacturers` instructions.

NOTE: To allow borescope access, the P clip securing the pipe/loom immediately in front of the borescope port may have to be removed to allow slight movement of the pipe (See Figure 1).

(e) Insert the borescope into the engine through the borescope hole adaptor (See Figure 1). The borescope should be inserted with the viewing lens pointing to the rear and will be fully inserted when the shaft rotation collar contacts the rear edge of the fan case.

(f) Ensure the camera and borescope are correctly adjusted and looking rearwards through the open stage 3 VSV's on to the stage 4 blade platforms. The VSV trailing edges and blade platforms should now be visible on the monitor (See Figure 2).

CAUTION: IF THE ROTOR HAS TO BE TURNED BY HAND, THE ELECTRONIC COUNTER ON THE TURNING TOOL WILL BE UNAVAILABLE. THEREFORE, TO AVOID MISSING A BLADE, IT IS IMPORTANT THAT THE BLADES ARE COUNTED MANUALLY.

(g) Viewing the monitor and using the engine turning tool in jog mode, take up the backlash in the engine gearbox. It may take several seconds before the rotor begins to move. Rotate the HPC rotor at least two blades to ensure that the rotor is moving smoothly. If the HPC rotor does not rotate smoothly it may have to be turned by hand.

(3) Removal Instruction for the HPC Tooling Port Blank

(a) Remove the blank

Remove the two bolts (72-41-31, 01-122) that attach the blank (72-41-31, 01-120) to the compressor case at the four o'clock position, to the rear of the stage 3 unison ring. Remove the blank

NOTE: The HPC tooling port (See Figure 1) is a redundant borescope port (old port B).

(b) Clean the Borescope Access Ports

WARNING: 1. WHEN YOU USE COMAT 01-003 INHIBITED AND STABILISED TRICHLORETHANE YOU MUST USE THE NECESSARY PROTECTIVE CLOTHING. DO NOT GET THE SOLVENT ON YOUR SKIN OR IN YOUR EYES. YOU MUST NOT SMOKE WHEN YOU USE THE SOLVENT AS THE VAPOUR CHANGES AND BECOMES TOXIC.

2. WHEN YOU USE COMAT 01-076 METHYL ETHYL KETONE YOU MUST MAKE SURE THERE IS SUFFICIENT VENTILATION. YOU MUST USE THE CORRECT PROTECTIVE CLOTHING. YOU MUST NOT SMOKE. DO NOT PUT THE SOLVENT NEAR A SOURCE OF HEAT.

CAUTION: DO NOT LET JOINT COMPOUND GET IN TO THE ENGINE THROUGH THE ACCESS PORTS.

(c) Remove the used jointing compound from the access ports.

Use a non-metallic scraper and a lint free cloth made moist with CoMat 01-003 inhibited and stabilised trichloroethane or CoMat 01-076 methyl
R ethyl ketone. Remove the entire jointing compound from around the access ports.

(4) Installation of the Manipulator and Ultrasonic Probe into the Engine

(a) Position the de-ionised water container on a convenient point on the engine ensuring the bottle is supported slightly higher than the probe. Attach the end of the water supply tube to the connector on the rear of the manipulator and open the valve on the bottle ensuring water is flowing freely with no signs of air bubbles. If water flow from the probe has been confirmed close the valve.

(b) Before inserting the manipulator/probe into the engine, check the ultrasonic probe is attached securely to the end of the manipulator segments.

R CAUTION: THE MANIPULATOR ATTACHMENT BOLTS ARE FITTED RADIALLY TO THE HPC CASE , NOT HORIZONTALLY, AND SHOULD BE HAND TIGHTENED AS FAR AS POSSIBLE TO PREVENT CROSS THREADING AND POSSIBLE DAMAGE TO THE
R BOLT THREADS OR CASING INSERTS. A WRENCH SHOULD BE USED ONLY TO FINALLY LIGHTLY SECURE THE BOLTS.

(c) Ensure the manipulator is in the safe retracted position (See Figure 4) and offer the probe to the HPC tooling port (See Figure 1). Carefully allow the probe and segments to enter the HPC casing and lightly secure the manipulator to the tooling boss with the captive bolts. A location collar on the mounting boss ensures the manipulator can only be bolted to the engine in the correct orientation.

NOTE: The HPC tooling port (See Figure 1) is a redundant borescope port (old port B). Detailed instructions for the removal and the installation of the relevant blank are given in paragraph 3.3.

(d) Check the monitor and ensure that the manipulator and probe have been installed in the retracted (safe) position and the probe is clear of the rotor path, the probe should be visible on the monitor.

(5) Inspection

CAUTION: 1. ENSURE THE MANIPULATOR IS IN THE RETRACTED (SAFE) POSITION BEFORE OPERATING THE TURNING TOOL.

2. VIEW MONITOR AND ENSURE COUPLANT IS FLOWING FROM PROBE FACE.

(a) The rotor is in the correct position for initial insertion of the probe, when the edge of the blade platform is approximately in line with the VSV trailing edge (See Figure 2). From this point the rotor may have to be moved a further one to two millimeters in the direction of the arrow (See Figure 2), until the back echo signal from the blade root can be maximized.

(b) Operate the cam manipulator to position the ultrasonic probe on to the blade platform. Adjust the position of the rotor as necessary, ensuring the probe has been temporarily retracted to the safe position during rotation, re-apply the probe and maximize the signal from the blade root corner. The signal will be displayed at the eight-division mark on the timebase (See Figure 6). Re-seat the probe several times to allow couplant to flow under the probe and monitor grass levels to ensure correct coupling and positioning (See Figure 6).

CAUTION: ENSURE THE MANIPULATOR IS IN THE RETRACTED (SAFE) POSITION BEFORE OPERATING TURNING TOOL

(c) Assuming a satisfactory back wall signal has been maximized from the blade root corner, a feature on the blade should be used as a datum point to assist positioning of subsequent blades. This can be established by marking the screen with tape and a marker pen, aligning the airfoil or platform edge of the blade as a visual datum. The next blade to be inspected can now be positioned accurately on the datum mark. Also, note the digital display number on the turning tool, as this will assist in blade counting.

(d) Fully retract the manipulator to place the probe into the safe position, view the monitor and operate the turning tool to rotate the HPC rotor to correctly position the next blade to be inspected. The digital readout should be used as a guide to assist positioning the blade e.g. if the first blade was inspected at 6.1 the next blade would be 7.1, the next 8.1 etc.

(e) Annotate the accomplishment chart after each blade has been inspected.

(f) Repeat paragraph 5(a) to 5(e) on all remaining blades.

(6) Removal of Manipulator and Probe from the Engine

CAUTION: EXCESSIVE FORCE MUST NOT BE USED TO REMOVE THE MANIPULATOR; THE ULTRASONIC PROBE IS SLIGHTLY LARGER THAN THE MANIPULATOR SEGMENTS AND MAY GET TRAPPED ON THE TOOLING PORT INNER EDGE DURING REMOVAL. REMOVE PROBE WITHOUT ROTATING THE MANIPULATOR.

(a) On completion of the inspection, close the water valve, operate the cam and fully retract the manipulator into the safe position. Undo the cam and fully retract the manipulator into the safe position. Undo the couplant tube and the probe lead from the rear of the manipulator. Undo the bolts and carefully ease the manipulator segments and probe from the engine and check security of all parts.

(7) Installation of the Tooling Port Blank

(a) Apply a thin layer of CoMat 04-004 jointing compound to the mating faces of the access ports and the access port blanks with a stiff bristle brush. Do not apply jointing compound nearer than 0.12 to 0.16 in. (3 to 4 mm) to the access port.

(b) Let the jointing compound dry for at least 10 minutes.

(c) Apply CoMat 10-072 anti-seize compound or CoMat 10-70 anti-seize compound to the two bolts (72-41-31, 01-122) which hold the borescope access port blank B to the compressor case.

(d) Attach the access port blank (72-41-31, 01-120) to the compressor case with the two bolts (72-41-31, 01-122). Torque the bolts to 85 to 105 lbf in. (10 to 12 Nm).

(e) Remove unwanted jointing compound from around the access ports.

(8) Ultrasonic Equipment Re-Calibration Using Jig

(a) Check the probe and flaw detector calibration on the jig after completion of the inspection. If the calibration is under sensitive by more than 3dB, re-calibrate and re-inspect all blades inspected since last calibration.

(9) Reject/Acceptance Criteria

(a) Observe the flaw detector screen. If the blade root corner geometry signal is evident at the eight-division mark on the timebase with no signal in the gated area, accept the blade.

NOTE: The blade root corner geometry signal should be a minimum of 100 percent FSH. If this is not achievable the blade should be repositioned to place the probe in the optimum inspection position and the blade re-inspected. If this does not bring the blade root corner geometry signal to 100 percent FSH the probe should be re-calibrated. If the geometry signal continues not to be at a minimum of 100 percent FSH the probe should be declared unserviceable.

CAUTION: INCORRECT POSITIONING OF THE PROBE ON THE BLADE PLATFORM WILL RESULT IN EXCESSIVE GRASS LEVELS IN THE GATE AND POSSIBLE FALSE
R INDICATIONS. THEREFORE , BEFORE REJECTING A BLADE, ENSURE PROBE HAS BEEN CORRECTLY POSITIONED BY COMPARING THE PREVIOUS BLADE RESPONSE (SEE FIGURE 6) AND DATUM POINT AND RE-INSPECTING THE BLADE.

(b) Signals in the gated area i.e. between timebase positions 6.1 and 7 in excess of 40 percent FSH which cannot be attributed to geometry signals, shall be cause for rejection of the blade.

(c) If a rejected blade is found, reject the engine

(i) Reject the whole set of rotor 4 blades if one or more in the set are found to be cracked.

NOTE: If blades pass EM piece part inspection they may still have fatigue damage present that is too small to be detected.

(10) Return the Engine to a Serviceable Condition

(a) Carefully remove the borescope from the engine.

(b) Disconnect the turning tool from the front face of the gearbox - refer to the manufacturer's instructions.

(c) Remove the rigging pin from the VSV operating crank. Use a suitable spanner on the wrench flats of the crankshaft and move the VSV's to the closed position.

(d) Disconnect the borescope Hole Adaptor IAE2R19753 from borescope access port B.

R B. Part 2 - Crack test inspection of the stage 4 blades at overhaul.

(1) Clean the parts

Refer to the Engine Manual, 72-41-15, TASK 72-41-15-100-002 for the procedure necessary to clean the parts.

R (2) Examine the parts for cracks

R Refer to the Engine Manual, 72-41-15, TASK 72-41-15-200-002-C00, SUBTASK
R 72-41-15-230-124-002 for the procedure necessary to perform a FPI
R inspection on the parts.

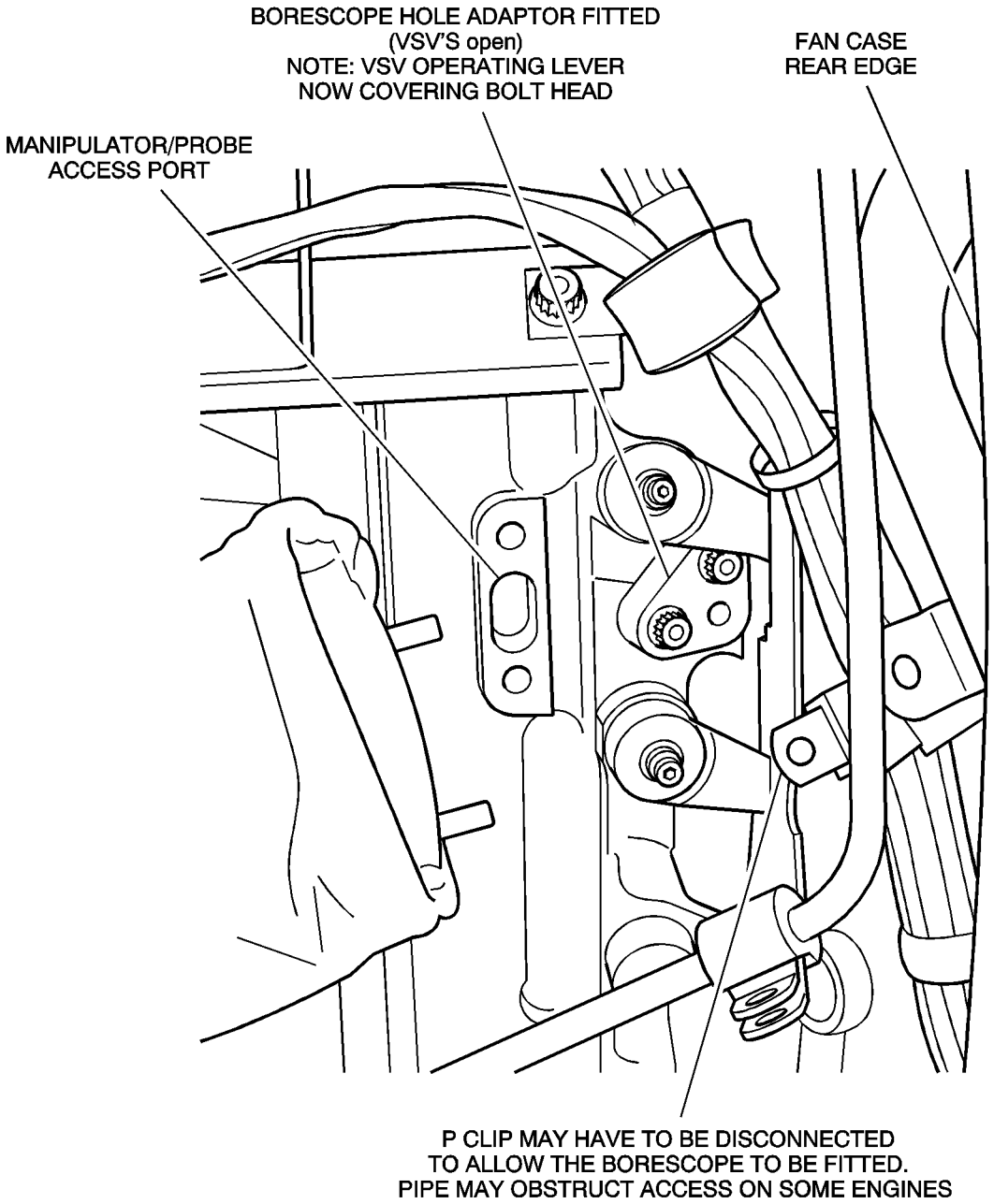
(a) Reject the whole set of rotor 4 blades if one or more in the set are found to be cracked.

R NOTE: If any blades are found cracked, the other blades in the set may still have fatigue damage present that is too small to be detected.

C. Record of Accomplishment

(1) A record of accomplishment is necessary.

(2) When the accomplishment instructions are completed, tell the IAE representative that this Non-Modification Service Bulletin has been accomplished, the inspection record sheet (Figure 7) can be used for this purpose.



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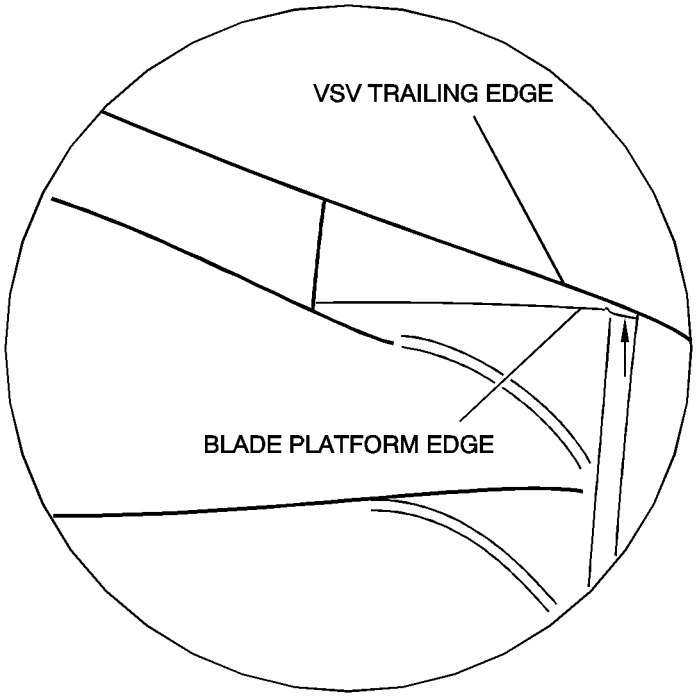
View of HPC Stage 4 Borescope and Ultrasonic Access Ports
Figure 1



VIEW SHOWS BLADE IN POSITION FOR INITIAL INSERTION OF THE PROBE. THE ROTOR MAY HAVE TO BE MOVED A FURTHER 1 TO 2 MILLIMETRES IN THE DIRECTION OF THE ARROW UNTIL THE BACK ECHO SIGNAL FROM THE BLADE ROOT CORNER CAN BE MAXIMISED.

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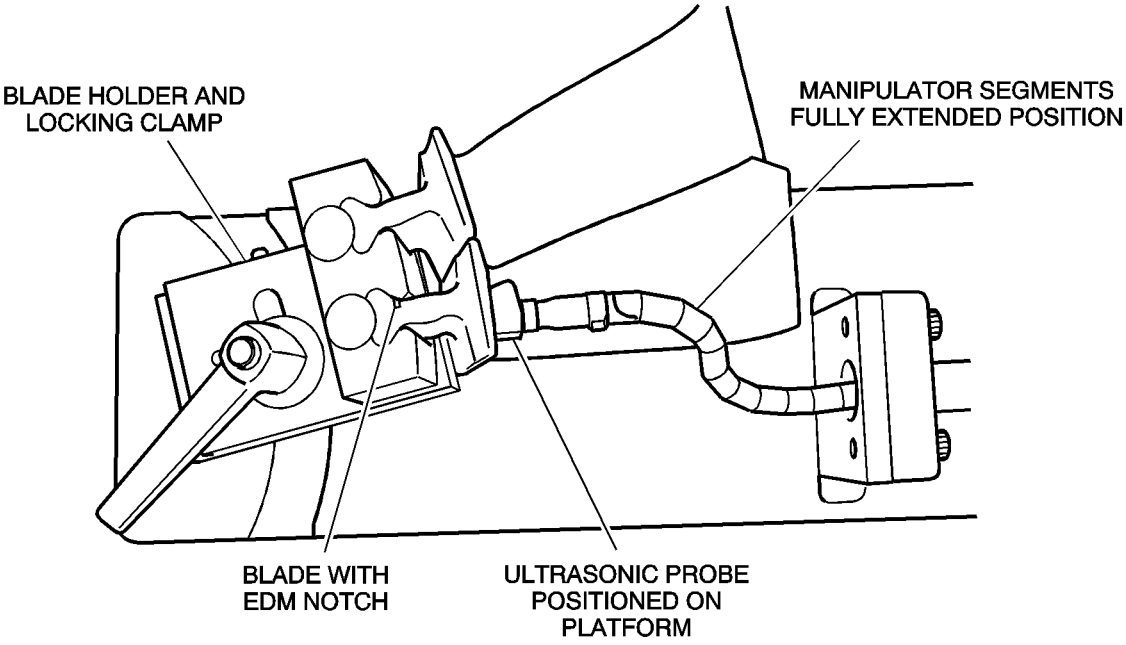
Borescope View of HPC Stage 4 blade in position
Figure 2



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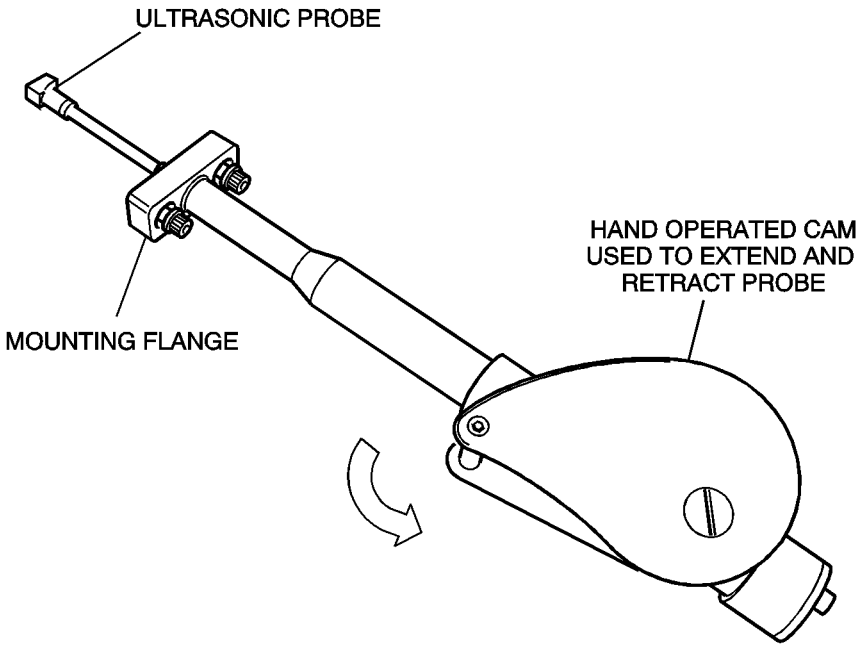
Calibration Jig with Manipulator Installed
Figure 3



NOTE: OPERATE CAM IN DIRECTION
OF ARROW TO EXTEND.

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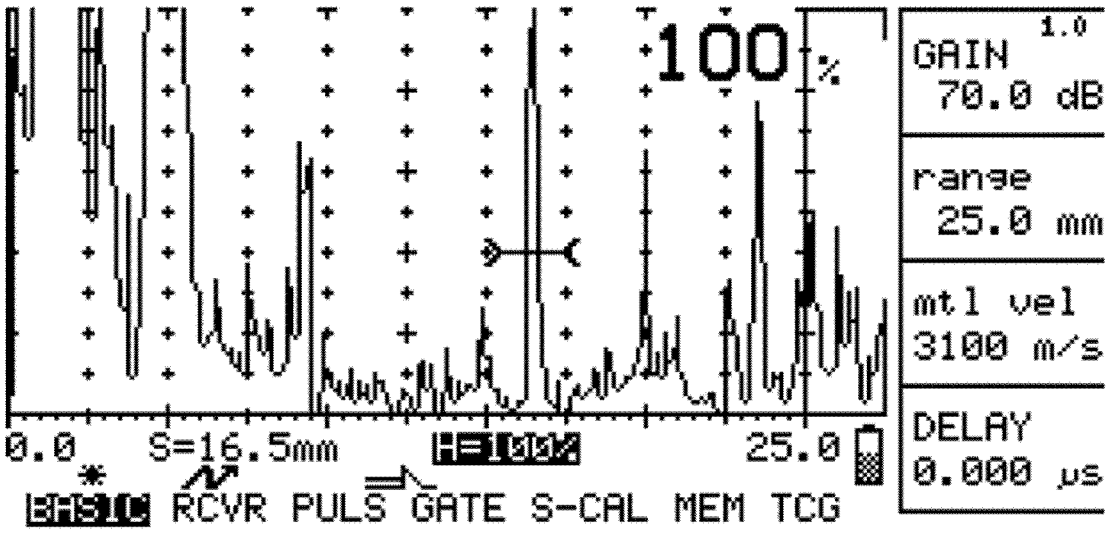
Manipulator in Retracted (Safe) Position
Figure 4



NOTE: Reduced blade root corner signal at 8 on timebase
Spurious signals at 6, 9 and 9.5 on timebase.

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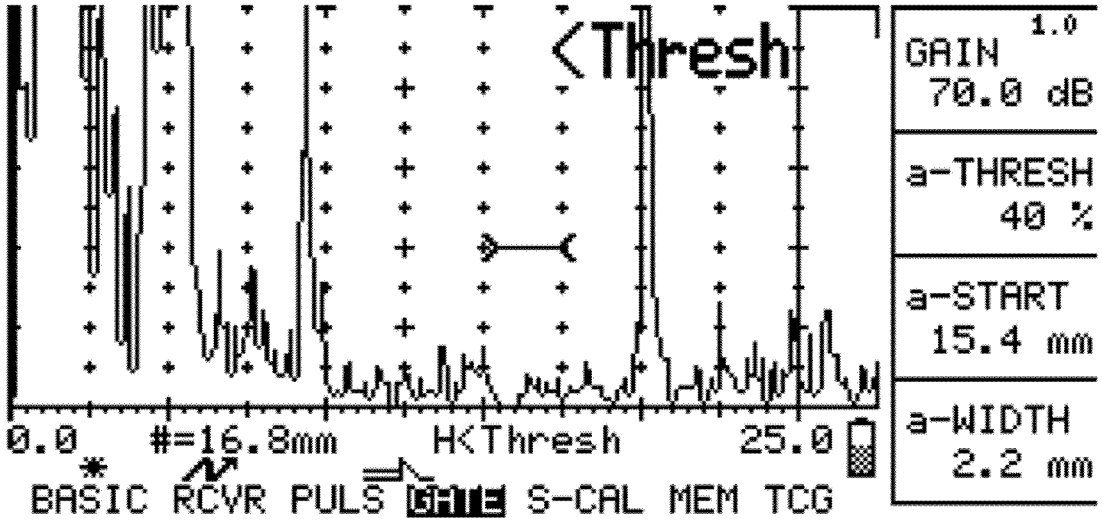
Signal from EDM Notched Blade Set to Calibration Level of 100% FSH
Figure 5



WITH BLADE CORRECTLY POSITIONED, SIGNAL SHOULD
BE GREATER THAN FULL SCREEN HEIGHT

NOTE: The blade root corner geometry signal must be a minimum of 100% FSH.
If this in not achievable the HPC rotor must be repositioned to place the
probe/blade in the optimum inspection and the blade re-inspected

bmi0004417

Signal Obtained from Blade Root Corner - Good Blade

V2500 HPC STAGE 4 BLADE ACCOMPLISHMENT CHART

ULTRASONIC INSPECTION OF BLADE ROOT

Aircraft No. / Engine position:	
Engine serial No:	
Date:	
Inspector:	

Blade No.			Blade No.		
	Pass	Fail		Pass	Fail
1			20		
2			21		
3			22		
4			23		
5			24		
6			25		
7			26		
8			27		
9			28		
10			29		
11			30		
12			31		
13			32		
14			33		
15			34		
16			35		
17			36		
18			37		
19			38		

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Inspection Record Sheet
Figure 7