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-A1/A5/D5 SERIES PROPULSION SYSTEM NON-MODIFICATION SERVICE BULLETIN

This document transmits the Initial Issue of Non-Modification Service Bulletin V2500-ENG-72-0638.

Non-Modification Service Bulletin Initial Issue

Remove	Incorporate	Reason for change
	Pages 1 to 141 of the Non-Modification Service Bulletin.	Initial Issue.

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Transmittal - Page 1 of 1

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

NON-MODIFICATION SERVICE BULLETIN - ENGINE - HIGH PRESSURE (HP) COMPRESSOR - STAGE 3 TO 8 COMPRESSOR DRUM - ULTRASONIC INSPECTION PROCEDURE (USI)

1. Planning Information

A. Effectivity Data

(1) Airbus A319

(a) All V2522-A5, V2524-A5, V2527M-A5 Engines.

(2) Airbus A320

(a) All V2500-A1 Engines.

(b) All V2527-A5, V2527E-A5 Engines.

(3) Airbus A321

(a) All V2530-A5, V2533-A5 Engines.

(4) Boeing MD-90

(a) All V2525-D5, V2528-D5 Engines.

B. Concurrent Requirements

None.

C. Reason

(1) Condition:

Crack indications have been found on the High Pressure (HP) compressor stage 3-8 drum assembly during overhaul.

(2) Background:

Crack indications were highlighted during an Engine Manual crack inspection of the stage 7-8 disc internal cavity.

(3) Objective:

To do an ultrasonic inspection procedure of the HP compressor stage 8 disc.

(4) Substantiation:

Crack indications have been found on the HP compressor stage 3-8 drum assembly during overhaul. An ultrasonic inspection was developed and has shown the capability of detecting cracks in service.

(5) Effects of Bulletin on:

(a) Removal/Installation:

Not affected.

(b) Disassembly/Assembly:

Not affected.

(c) Cleaning:

Not affected.

(d) Inspection/Check:

Not affected.

(e) Repair:

Not affected.

(f) Testing:

Not affected.

(6) Supplemental Information

None.

D. Description

This Non-Modification Service Bulletin instructs ultrasonic inspection procedures of the HP compressor stage 8 disc that can be carried out "In Service" or "At Overhaul/ Shop Visit".

(1) The procedures are to inspect the internal stage 8 disc for cracks, on the outer diameter adjacent to the stage 7-8 EB weld land and on the inner diameter at the inner radius position.

(2) A shear wave ultrasonic inspection probe is positioned 0,15 mm above the surface of the ceramic lining of the stage 7-8 outer diameter. This gap is achieved by fitting a clamp with a cam to the probe manipulator.

(3) Engines affected are listed in paragraph 1.A. Effectivity.

NOTE: For the individual engine location (In-Service (INSTRUCTION I) or At Overhaul (INSTRUCTION II)) and individual engine mark (V2500-A1 (PART A), V2500-A5 (PART B) or V2500-D5 (PART C)) it is only required to refer to the applicable pages.

NOTE: The Accomplishment Instruction of this Service Bulletin is divided into two INSTRUCTIONs as follows:

INSTRUCTION I - Applicable for engines "In Service".

INSTRUCTION I of this Service Bulletin is divided into three PARTs as follows:

PART A - Applicable for V2500-A1 engines.
(Procedure instructed on pages from 8 to 24)

PART B - Applicable for V2500-A5 engines.
(Procedure instructed on pages from 25 to 43)

PART C - Applicable for V2500-D5 engines.
(Procedure instructed on pages from 44 to 61)

INSTRUCTION II - Applicable for engines "At Overhaul/Shop Visit".

INSTRUCTION II of this Service Bulletin is divided into three PARTs as follows:

PART A - Applicable for V2500-A1 engines.
(Procedure instructed on pages from 62 to 75)

PART B - Applicable for V2500-A5 engines.
(Procedure instructed on pages from 76 to 92)

PART C - Applicable for V2500-D5 engines.
(Procedure instructed on pages from 93 to 109)

E. Compliance

Category 8

Accomplishment based upon operators decision.

F. Approval

The compliance statement and the procedures described in this Non-Modification Service Bulletin have been shown to comply with the applicable Federal Aviation Regulations and are FAA-APPROVED for the engine models listed.

G. Manpower

Estimated man-hours to carry out this Non-Modification Service Bulletin in full:

(1) In Service

(a) Engines without heat shield retainers installed:

3 Hours

(b) Engines with heat shield retainers installed:

7 hours

(2) At Overhaul

(a) Engines without heat shield retainers installed:

3 Hours

(b) Engines with heat shield retainers installed:

6 hours

NOTE: The ultrasonic inspection defined in this NMSB must only be performed by personnel qualified to ultrasonic inspection level 2 or higher in accordance with EN4179 and/or NAS410 or alternative standards/ guidelines accepted by the applicable National Aviation Authority.

H. Weight and Balance

(1) Weight Change

None.

(2) Moment Arm

No effect.

(3) Datum

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

I. Electrical Load Data

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

J. Software Accomplishment Summary

Not Applicable.

K. References

(1) Aircraft Maintenance Manual (AMM) Chapters 36-11-10, 70-30-00, 70-35-03, 70-35-26, 71-00-00, 71-00-02, 71-13-00, 72-00-00, 72-00-02, 75-32-51, 78-30-00 and 78-32-00.

(2) IAE V2500 Engine Manual (E-V2500-1IA), Chapters 72-00-40 and 72-41-11.

(3) IAE V2500 Engine Manual (E-V2500-3IA), Chapters 72-00-40 and 72-41-11.

(4) IAE V2500 Standard Practices and Processes Manual (SPP-V2500-1IA), Chapter 70-23-05.

(5) Overhaul Processes and Consumables Index.

(6) Non-Modification Service Bulletin V2500-ENG-72-0615

NON-MODIFICATION SERVICE BULLETIN - ENGINE - HIGH PRESSURE (HP) COMPRESSOR - STAGE 3 TO 8 COMPRESSOR DRUM - STRESS CORROSION CRACKING

(7) Airworthiness Directive - AD 2012-09-09.

(8) SEN5088 Issue 1. "Significant shop findings on HPC 3-8 drum".

(9) SEN5088 Issue 2. "Significant shop findings on HPC 3-8 drum".

(10) SEN5088 Issue 3. "Significant shop findings on HPC 3-8 drum".

(11) SIL 277 Issue 1. "HPC 3-8 Drum USI clarification".

(12) Internal Reference No. EC 12VR785.

L. Other Publications Affected

None.

M. Interchangeability of Parts

Not applicable.

2. Material Information

A. Material - Price and Availability

None.

B. Industry Support Program

Not applicable.

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

This Non-Modification Service Bulletin is for inspection only.

D. Instructions/Disposition Code Statements:

Parts Modification Conditions

Not applicable.

Spare Parts Availability

Not applicable.

Cleaning, Inspection and Repair Information

Inspection procedure (Refer to paragraph 3. Accomplishment Instructions).

E. Tooling - Price and Availability

The tooling to comply with the inspections will be provided to operators on free of charge (FOC) loan basis. To receive the FOC tooling, please follow the ordering procedure outlined below:

(1) Submit a zero charge PO to IAE Spares (GPIAESPRTLG@IAEV2500.com) with kit tool number and, if applicable, drilling guide tool number to address requested.

(2) Shipping and customs costs are the responsibility of the operator

Return of kits after use must use the following procedure:

(3) Submit an e-mail request to GPIAESPRTLG@IAEV2500.com. Return details will be provided by e-mail.

(4) Upon issuance of a MRA all return details of the kit will be provided.

Contact your CFD with any questions.

F. Re-identified Parts

Not Applicable.

G. Other Material Information Data

Not Applicable.

3. Accomplishment Instructions

INSTRUCTION I - APPLICABLE FOR ENGINES "IN SERVICE"

Part A - Applicable for V2500-A1 engines

A. General

Use the new inspection kit IAE2R19882 or the old inspection kit IAE2R19864 to carry out an ultrasonic inspection on the outer diameter of the HP compressor stage 8 disc adjacent to the stage 7-8 EB weld land.

NOTE: In order to reduce the potential for multiple-engine in-flight shutdown, power loss, or other anomaly due to maintenance error, IAE recommends that Operators avoid performing maintenance on multiple engines installed on the same aircraft at the same time. If it is not possible to avoid maintenance on more than one engine of an aircraft at the same time, IAE recommends that additional controls are applied in order to ensure that maintenance tasks have been completed as defined.

WARNING: YOU MUST BE CAREFUL WHEN YOU DO WORK ON THE ENGINE PARTS AFTER THE ENGINE IS STOPPED. THE ENGINE PARTS CAN STAY HOT FOR MORE THAN ONE HOUR.

WARNING: DO NOT TOUCH HOT PARTS WITHOUT APPLICABLE GLOVES. HOT PARTS CAN CAUSE AN INJURY.

(1) Obey all the WARNINGS and CAUTIONS in the procedures that are referred to.

(2) Consumable Materials

(a) Refer to the table that follows:

MATERIAL NO.	DESIGNATION
V01-201	Distilled or De-ionised water
V10-058	Penetrating Oil

For the details of the consumable materials given in the table above, refer to the Aircraft Maintenance Manual (AMM) TASK 70-30-00-918-010.

(3) Tools and Equipment

(a) Refer to the table that follows:

ITEM	DESCRIPTION	TOOL NUMBER
(a)	Inspection kit contains the outer diameter location inspection kit of item (b) in this table and the inner diameter location inspection kit of item (b) of the table in section 3.K.(3)(a) of this Non-Modification Service Bulletin. OR	IAE2R19882
(b)	Outer diameter location inspection kit *(contains items (c) to (g)	IAE2R19864
(c)	Ultrasonic probe manipulator assembly	IAE2R19865
(d)	Couplant feed manipulator	IAE2R19867
(e)	Couplant feed system	IAE2R19807
(f)	Working standard	IAE2R19854
(g)	MCX/BNC lead	IAE2R19755
(h)	Ultrasonic flaw detector, frequency selectable in the 5.0 MHz range with audible/visual electronic alarm gate	Not supplied
(i)	4 to 6 mm flexible borescope kit with image capture capability	Not supplied
(j)	Turning tool (if applicable)	Not supplied
(k)	Bolts (2 off)	AS48516 or 4W0170 not supplied
(l)	Washers to fit item (k)	Not supplied

NOTE: 1. The lead for the ultrasonic probe is supplied with a BNC connector installed. An adaptor may be required if alternative equipment is used.

2. The compressor can be turned manually, but an electronic turning tool is recommended to perform the inspection.

3. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

B. Get access to the HP compressor stage 7 bleed valve aperture that is installed on the left side of the engine

(1) Open the applicable fan cowl doors (Refer to the Aircraft Maintenance Manual, Chapter 71-13-00).

(2) Deactivate the thrust reverser Hydraulic Control Unit (HCU) (Refer to the Aircraft Maintenance Manual, Chapter 78-30-00).

(3) Open the applicable half of the thrust reverser (Refer to the Aircraft Maintenance Manual, Chapter 78-32-00).

C. Remove the HP stage 7 bleed valve air duct from the left side of the engine

(1) Remove the HP stage 7 bleed valve air duct together with the HP compressor stage 7 bleed valve (Refer to Figure 1)

(a) Allow the engine to cool for at least 2 hours with the cowl doors open.

(b) Apply the approved penetrating oil CoMat 10-058 before the removal of threaded parts. Let the parts soak at least 15 minutes.

(c) Seal all openings to prevent contamination from unwanted materials.

(d) Remove the coupling that attaches the IP bleed check valve to the HP7 bleed valve/cabin air duct (Refer to the Aircraft Maintenance Manual, TASK 36-11-41-00-010).

(e) Carefully overcome the initial torque of each bolt of the flange to the duct.

(f) Carefully loosen each bolt of the flange to the duct. If excessive resistance is encountered, apply more penetrating oil and allow the bolts to soak for at least 15 minutes before proceeding.

NOTE: Ensure the proper size tool for the bolt head and do not force the bolt excessively during the removal process.

(g) Remove the 12 bolts (75-00-49, 02-252), with the bracket (75-00-49, 01-235 and the bracket (75-00-49, 01-240).

(h) Remove the HP stage 7 bleed valve air duct (75-00-49, 01-250) from the flange.

(i) If a bolt was broken during the removal process, perform the following steps:

(i) Remove broken bolts and/or studs by mechanical removal methods.

(ii) Drill a hole into the end of the broken bolt and/or stud. Refer to the tool manufacturer's instructions for the correct size drill.

(iii) Put an extraction tool in to remove the broken bolt.

(iv) Tap the threads if necessary to clean or chase the threads.

(v) Examine the threads for damage or an oversize condition.

(j) If required, replace any inserts per Aircraft Maintenance Manual TASK 70-35-26-300-010.

D. Install the turning tool and the borescope

(1) Install the turning tool to the accessory gearbox in accordance with the manufacturer's operating instructions. Install the V2500 A1 software module on the control unit, set the HP compressor rotation speed to the slowest (10 minutes per revolution). Set the HP compressor stage to HPC8 and engage continuous rotation mode. (Refer to the Aircraft Maintenance Manual, TASK 72-00-00-480-010).

OR

(2) Install the hand turning tool to the accessory gearbox (Refer to the Aircraft Maintenance Manual, TASK 72-00-00-860-010).

(3) Access the liner through the HP compressor Stage 7C bleed valve manifold aperture on the left side of the engine (Refer to Figures 2 and 7).

(4) Visually examine the ceramic liner for any missing material (Refer to Figures 7 and 8).

(a) Insert the flexible borescope and position between the stage seven stator vanes to look down on the surface of the stage seven liner (Refer to Figure 7).

NOTE: Make sure the borescope is clear of the stage 8 rotor blades and use the turning tool to rotate the compressor one full revolution.

(5) Inspect the stage 7-8 stator for ceramic liner loss in accordance with Aircraft Maintenance Manual (AMM), TASK 72-00-00-200-016.

(a) If the condition of the ceramic liner is not acceptable as per AMM, remove the engine in accordance with the AMM or before the drum reaches the applicable USI threshold (Refer to paragraph 1.E. Compliance of Non-Modification Service Bulletin V2500-ENG-72-0615), whatever comes first.

(b) If the condition of the ceramic liner is acceptable as per AMM, perform a borescope check on the full circumference if the ceramic liner meets the requirements to be inspected with the ultrasonic equipment.

NOTE: The USI probe must run on the surface of the ceramic liner, not on the surface of the bondcoat underneath the ceramic liner as this can damage/break the probe. A wear line on the liner may be visible at the trailing edge of the stators, this is the approximate seating position of the ultrasonic probe and particular attention should be given to this area around the circumference of the drum (Refer to Figure 7).

(c) Liner loss underneath the path of the probe can damage/break the probe. Lifting of the probe from the surface of the liner to avoid liner loss areas greater in size than the probe head is not acceptable. If ceramic liner loss is found beyond the requirements necessary to perform an ultrasonic inspection, remove the engine before the drum reaches the applicable USI threshold (Refer to paragraph 1.E. Compliance of Non-Modification Service Bulletin V2500-ENG-72-0615).

(6) Inspect the stage 7-8 stator ceramic liner for staining and/or axial cracking (Refer to Figure 8).

(a) If staining and /or cracking is found in the specific area as shown in Figure 8, reject the Engine before next flight.

NOTE: Only findings located at the trailing edge of the vane contact area are relevant, findings in other areas can be disregarded.

The main direction of crack progression, is axial on the ceramic liner.

(b) If no staining and /or cracking is found, proceed with paragraph 3.E.

E. Calibrate the ultrasonic equipment

Range	28 mm (nominal)
Material velocity	3100 m/s
Delay	0.00 micro seconds
Frequency	Selectable in the 5.0 MHz range
Damping	50 Ohms
Rectify	Full
Pulser	Single crystal
Gate position	3.5 - 7.0 timebase position

NOTE: 1. The nominal settings above are for a USN 52 or equivalent flaw detector to achieve approximate signal timebase positions. Alternative instruments may require different settings.

2. For calibration purposes the couplant feed manipulator should be detached as described in F.(4) thru (7) in REVERSE order.

3. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

(1) Attach the lead to the manipulator/flaw detector, apply the distilled or de-ionised water and position the probe (IAE2R19865) on to the working standard (IAE2R19854) (Refer to Figure 9).

(2) Position the probe on the working standard with the flat face on the working standard and the probe mounting screw facing the working standard. The 0.04 in. long by 0.02 in. deep (1,0 mm l by 0,5 mm) EDM target is located in the center of the base of the working standard (Refer to Figure 9).

NOTE: 1. If calibration is carried out with the working standard in contact with a secondary surface, excessive couplant on the working surface and EDM target surface, may allow transfer of sound into the secondary surface. This can result in a weak signal and incorrect calibration.

2. During calibration make sure that the probe is flat down on the two contact faces of the working standards. Failure to do so can result in incorrect calibration.

3. Make sure that the probe is positioned correctly on the working standard and the reflected signal is not from the corner of the block.

(3) With the probe positioned on the working standard (Refer to Figure 9), identify the response from the EDM target at half skip distance. Maximize the signal response to achieve 70 percent Full Screen Height (FSH) and adjust the range control to position the EDM target signal at five on the timebase. (Refer to Figure 10).

(4) Position the gate between the 3.5 and 7.0 divisions on the timebase and set the alarm threshold level at 40 percent FSH.

F. Install the manipulator and ultrasonic probe (IAE2R19865) into the engine

CAUTION: DUE TO THE SIMILARITY BETWEEN THE INNER AND OUTER DIAMETER INSPECTION TOOLS, CARE MUST BE TAKEN TO ENSURE THE CORRECT PROBE AND WORKING STANDARD HAVE BEEN SELECTED FOR THE RELEVANT INSPECTION.

(1) Position the distilled or de-ionised water container at a suitable position on the engine. Make sure the container is supported above the probe position. Attach the end of the water supply tube to the connector on the rear of the manipulator. Open the valve on the water container and make sure that water flows from the probe face with no sign of air bubbles. When water flows from the probe, close the valve on the water container.

(2) Before installing the manipulator/probe into the engine, make sure all parts are secure. Make sure the attachment bolt for the ultrasonic probe is secure, the spring is not bent and the cable is not damaged. Make sure the water tube is removed from the manipulator assembly to allow the probe to be inserted into the engine.

NOTE: Figure 11 shows the component parts of the probe assembly. Figure 11 shows the fully assembled probe and couplant feed tube correctly assembled.

CAUTION: DO NOT APPLY FORCE TO THE MANIPULATOR OR DAMAGE MAY OCCUR TO THE PROBE AND ENGINE.

(3) Use CoMat 10-058 to lightly oil the threads of the mounting bolts. Position the probe manipulator arm to the forward side of the HP compressor bleed valve port with the manipulator lock plate closed. Make sure that the probe arm is installed to the correct bleed valve aperture (Refer to Figure 11). Install the probe into the HP compressor case until it contacts the ceramic liner. Slide the manipulator mount plate up to the flange of the bleed valve. Hold the mount plate in contact with the flange of the bleed valve and install the bolts by hand. Make sure the probe manipulator assembly is free to move and tighten the bolts.

NOTE: When correctly installed, the probe manipulator assembly should be able to slide freely in the mount plate and be able to make contact with the liner.

(4) Open the manipulator lock plate and carefully install the couplant manipulator into the same aperture and above the probe manipulator.

(5) Make sure that the couplant arm is correctly installed into the mount plate groove and close the lock plate.

(6) Retract the tension spring lock plate until it can be installed over the couplant arm mount boss (Refer to Figure 11).

(7) Make sure the probe and couplant arms are contacting the ceramic liner and tighten the spring clamp.

(8) Connect the couplant feed system to the couplant feed manipulator.

NOTE: Figure 11 shows the ultrasonic probe manipulator assembly correctly installed on the engine.

Make sure that the couplant feed manipulator is not mounted forward of the probe, this will prevent reliable contact with the liner. When the couplant feed tube and probe manipulator are correctly aligned, the assembly is correctly installed.

G. Inspect the disc

(1) Open the water couplant valve and turn the HP compressor in a CLOCKWISE direction until the probe is positioned between the two locking nuts of the stage 7 locking blades (Refer to Figure 17). Apply light inward pressure and make sure the probe is coupled with the liner by watching the flaw detector timebase response. Withdraw the probe manipulator assembly slightly and watch the change in timebase display when the probe is not coupled. Return the probe to the coupled position.

NOTE: Water levels in the container must be monitored throughout the inspection. If the container is found to be empty during the inspection, the container must be refilled and the inspection repeated.

(2) When the probe is coupled, zero the turning tool counter number datum and begin the inspection. If the HP compressor is being turned manually, use a borescope to locate a datum feature that can be used to confirm a complete rotation of the drum. This will ensure that the HP compressor is inspected for one full rotation (360 degrees).

If the HP compressor is rotated with the electronic turning tool, zero the turning tool blade counter prior to starting the rotation.

NOTE: There are 93 stage 7 rotor blades and 89 stage 8 rotor blades.

NOTE: 1. During inspection monitor the distilled or de-ionised water level, replenish as necessary.

(3) The flaw detector should be monitored for signals that move along the timebase in the gated area. Any ultrasonic responses that break the alarm gate, will cause the engine to be rejected (Refer to Figure 10).

NOTE: Ultrasonic background structural noise (grass level) must be monitored to ensure correct ultrasonic coupling. Any loss of background noise must be investigated and if necessary the drum re-inspected.

(4) Cracks that have developed on the inner surface of the disc will appear (maximize) within the gate on the timebase at half skip distance (Refer to Figure 10).

(5) Inspect the full circumference of the disc.

(6) If turning tool is used, record the amplitude and timebase position indications over the threshold. Record the degree position on the accomplishment proforma contained in Non-Modification Service Bulletin V2500-ENG-72-0615.

CAUTION: LIFT THE PROBE CLEAR OF THE CERAMIC LINER BEFORE YOU REVERSE THE DIRECTION OF THE HP COMPRESSOR, TO PREVENT DAMAGE TO THE PROBE.

(7) If the probe 'picks up' or 'chatters' when the HP compressor is rotated in a clockwise direction, Rotate the HP compressor in a counterclockwise direction and repeat the inspection.

NOTE: 1. It is expected that there may be differences in signals when the HP compressor is rotated in different directions. This is because the direction of rotation changes the way the probe sits on the liner. Additionally, the water comes in from one direction only, which affects the function of the couplant, It is recommended not to change the direction of rotation during an inspection pass.

2. The results of the borescope inspection for liner cracks or staining determine further engine serviceability.

H. Remove the probe manipulator assembly from the engine

(1) After the inspection is complete, close the water valve and remove the water supply tube from the couplant manipulator assembly. Slacken the manipulator lock plate screw and spring clamp screw, remove the couplant manipulator assembly from the bleed valve aperture.

CAUTION: DO NOT USE EXCESSIVE FORCE TO REMOVE THE PROBE MANIPULATOR ASSEMBLY FROM THE ENGINE.

(2) Close the lock plate and remove the flange mount bolts. Carefully remove the probe manipulator assembly from the engine.

(3) Make sure all parts of the probe manipulator assembly are present and undamaged.

I. Make a check of the ultrasonic equipment calibration

(1) Make a check of the calibration of the ultrasonic equipment after the inspection is completed. Carry out the check in accordance with paragraph 3.E. (1) to (3). If the calibration is under sensitive by more than 3dB, re-calibrate the ultrasonic equipment and carry out an inspection of the disc again.

J. Accept and reject criteria

(1) For the accept and reject criteria, refer to Non-Modification Service Bulletin V2500-ENG-72-0615.

K. General

Use the new inspection kit IAE2R19882 or the old inspection kit IAE2R19869 to carry out an ultrasonic inspection on the inner diameter of the HP compressor stage 8 disc adjacent to the 7-8 EB weld land.

NOTE: In order to reduce the potential for multiple-engine in-flight shutdown, power loss, or other anomaly due to maintenance error, IAE recommends that Operators avoid performing maintenance on multiple engines installed on the same aircraft at the same time. If it is not possible to avoid maintenance on more than one engine of an aircraft at the same time, IAE recommends that additional controls are applied in order to ensure that maintenance tasks have been completed as defined.

WARNING: YOU MUST BE CAREFUL WHEN YOU DO WORK ON THE ENGINE PARTS AFTER THE ENGINE IS STOPPED. THE ENGINE PARTS CAN STAY HOT FOR MORE THAN ONE HOUR.

WARNING: DO NOT TOUCH HOT PARTS WITHOUT APPLICABLE GLOVES. HOT PARTS CAN CAUSE AN INJURY.

(1) Obey all the WARNINGS and CAUTIONS in the procedures that are referred to.

(2) Consumable Materials

(a) Refer to the table that follows:

MATERIAL NO.	DESIGNATION
V01-201	Distilled or De-ionised water
V10-058	Penetrating Oil

For the details of the consumable materials given in the table above, refer to the Aircraft Maintenance Manual, TASK 70-30-00-918-010.

(3) Tools and Equipment

(a) Refer to the table that follows:

ITEM	DESCRIPTION	TOOL NUMBER
(a)	Inspection kit contains the inner diameter location inspection kit of item (b) in this table and the outer diameter location inspection kit of item (b) of the table in section 3.A.(3)(a) of this Non-Modification Service Bulletin. OR	IAE2R19882
(b)	Inner diameter location inspection kit *(contains items (c) to (g)	IAE2R19869
(c)	Ultrasonic probe manipulator assembly	IAE2R19870
(d)	Couplant feed manipulator	IAE2R19871
(e)	Couplant feed system	IAE2R19807
(f)	Working standard	IAE2R19860

(g)	MCX/BNC lead	IAE2R19755
(h)	Ultrasonic flaw detector, frequency selectable in the 5.0 MHz range with audible/visual electronic alarm gate	Not supplied
(i)	4 to 6 mm flexible borescope kit with image capture capability	Not supplied
(j)	Turning tool (if applicable)	Not supplied
(k)	Bolts (2 off)	AS48516 or 4W0170 not supplied
(l)	Washers to fit item (k)	Not supplied

NOTE: 1. The lead for the ultrasonic probe is supplied with a BNC connector installed. An adaptor may be required if alternative equipment is used.

2. The compressor can be turned manually, but an electronic turning tool is recommended to perform the inspection.

3. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

L. Calibrate the ultrasonic equipment

Range	59 mm (nominal)
Material velocity	3100 m/s
Delay	0.00 micro seconds
Frequency	Selectable in the 5.0 MHz range
Damping	50 Ohms
Rectify	Fullwave
Pulser	Single crystal
Gate position	3.0 - 8.0 timebase position

NOTE: 1. The nominal settings above are for a USN 52 or equivalent flaw detector to achieve signal timebase positions. Alternative instruments may require different settings.

2. For calibration purposes the couplant feed manipulator should be detached as described in M.(4) thru (7) in REVERSE order.

3. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

(1) Attach the lead to the manipulator/flaw detector, apply the distilled or de-ionised water and position the probe (IAE2R19870) on to the working standard (IAE2R19860) (Refer to Figure 9).

(2) Position the probe on the working standard with the flat face on the working standard and the probe mounting screw facing the working standard. Make sure the attachment bolt for the ultrasonic probe is secure, the spring is not bent and the cable is not damaged.

NOTE: 1. If calibration is carried out with the working standard in contact with a secondary surface, excessive couplant on the working surface and EDM target surface, may allow transfer of sound into the secondary surface. This can result in a weak signal and incorrect calibration.

2. During calibration make sure that the probe is flat down on the two contact faces of the working standards. Failure to do so can result in incorrect calibration.

3. Make sure that the probe is positioned correctly on the working standard and the reflected signal is not from the corner of the block.

(3) With the probe positioned on the working standard (Refer to Figure 9), identify the response from the EDM target at half skip distance. Maximize the signal response to achieve 70 percent Full Screen Height (FSH) and adjust the range control to position the EDM target signal at five on the timebase. (Refer to Figure 10).

(4) Position the gate between the 3.0 and 8.0 divisions on the timebase.

For HP compressor drums of Ti6 material set the alarm threshold level at 30 percent FSH (Refer to Figure 10).

For HP compressor drums of Ti5 material set the alarm threshold level at 55 percent FSH (Refer to Figure 10).

NOTE: For any uncertainty on the 3-8 drum material, refer to the Compliance 1.E. of Non-Modification Service Bulletin V2500-ENG-72-0615.

M. Install the manipulator and ultrasonic probe (IAE2R19870) into the engine

CAUTION: DUE TO THE SIMILARITY BETWEEN THE INNER AND OUTER DIAMETER INSPECTION TOOLS, CARE MUST BE TAKEN TO ENSURE THE CORRECT PROBE AND WORKING STANDARD HAVE BEEN SELECTED FOR THE RELEVANT INSPECTION.

(1) Position the distilled or de-ionised water container at a suitable position on the engine. Make sure the container is supported above the probe position. Attach the end of the water supply tube to the connector on the rear of the manipulator. Open the valve on the water container and make sure that water flows from the probe face with no sign of air bubbles. When water flows from the probe, close the valve on the water container.

(2) Before installing the manipulator/probe into the engine, make sure all parts are secure. Make sure the attachment bolt for the ultrasonic probe is secure, the spring is not bent and the cable is not damaged. Make sure the water tube is removed from the manipulator assembly to allow the probe to be inserted into the engine.

NOTE: Figure 11 shows the component parts of the probe assembly. Figure 11 shows the fully assembled probe and couplant feed tube correctly assembled.

CAUTION: DO NOT APPLY FORCE TO THE MANIPULATOR OR DAMAGE MAY OCCUR TO THE PROBE AND ENGINE.

(3) Use CoMat 10-058 to lightly oil the threads of the mounting bolts. Position the probe manipulator arm to the forward side of the HP compressor bleed valve port with the manipulator lock plate closed. Make sure that the probe arm is installed to the correct bleed valve aperture (Refer to Figure 11). Install the probe into the HP compressor case until it contacts the ceramic liner. Slide the manipulator mount plate up to the flange of the bleed valve. Hold the mount plate in contact with the flange of the bleed valve and install the bolts by hand. Make sure the probe manipulator assembly is free to move and tighten the bolts.

NOTE: When correctly installed, the probe manipulator assembly should be able to slide freely in the mount plate and be able to make contact with the liner.

(4) Open the manipulator lock plate and carefully install the couplant manipulator into the same aperture and above the probe manipulator.

(5) Make sure that the couplant arm is correctly installed into the mount plate groove and close the lock plate.

(6) Retract the tension spring lock plate until it can be installed over the couplant arm mount boss (Refer to Figure 11).

(7) Make sure the probe and couplant arms are contacting the ceramic liner and tighten the spring clamp.

(8) Connect the couplant feed system to the couplant feed manipulator.

NOTE: Figure 11 shows the ultrasonic probe manipulator assembly correctly installed on the engine.

Make sure that the couplant feed manipulator is not mounted forward of the probe, this will prevent reliable contact with the liner. When the couplant feed tube and probe manipulator are correctly aligned, the assembly is correctly installed.

N. Inspect the disc

(1) Open the water couplant valve and turn the HP compressor in a CLOCKWISE direction until the probe is positioned between the two locking nuts of the stage 7 locking blades (Refer to Figure 17). Apply light inward pressure and make sure the probe is coupled with the liner by watching the flaw detector timebase response. Withdraw the probe manipulator assembly slightly and watch the change in timebase display when the probe is not coupled. Return the probe to the coupled position.

NOTE: Water levels in the container must be monitored through the inspection. If the container is found to be empty during the inspection, the container must be refilled and the inspection repeated.

(2) When the probe is coupled, zero the turning tool counter number datum and begin the inspection. If the HP compressor is being turned manually, use a borescope to locate a datum feature that can be used to confirm a complete rotation of the drum. This will ensure that the HP compressor is inspected for one full rotation (360 degrees).

If the HP compressor is rotated with the electronic turning tool, zero the turning tool blade counter prior to starting the rotation.

NOTE: There are 93 stage 7 rotor blades and 89 stage 8 rotor blades.

NOTE: 1. The flaw detector timebase signals must be constantly monitored during the inspection, as no back-wall or geometry signals appear on the timebase and loss of coupling could occur at any time.

2. During inspection monitor the distilled or de-ionised water level, replenish as necessary

(3) The flaw detector should be monitored for signals that move along the timebase in the gated area. Any ultrasonic responses that break the alarm gate, will cause the engine to be rejected (Refer to Figure 15).

NOTE: Ultrasonic background structural noise (grass level) must be monitored to ensure correct ultrasonic coupling. Any loss of background noise must be investigated and if necessary the drum re-inspected.

(4) Cracks that have developed on the inner surface of the disc will appear (maximize) within the gate on the timebase at half skip distance. (Refer to Figure 15).

(5) Inspect the full circumference of the disc, if the ceramic liner allows.

(6) If turning tool is used, record the amplitude and timebase position indications over the threshold. Record the degree position on the accomplishment proforma contained in Non-Modification Service Bulletin V2500-ENG-72-0615.

CAUTION: LIFT THE PROBE CLEAR OF THE CERAMIC LINER BEFORE YOU REVERSE THE DIRECTION OF THE HP COMPRESSOR, TO PREVENT DAMAGE TO THE PROBE.

(7) If the probe 'picks up' or 'chatters' when the HP compressor is rotated in a clockwise direction, Rotate the HP compressor in a counterclockwise direction and repeat the inspection.

NOTE: 1. It is expected that there may be differences in signals when the HP compressor is rotated in different directions. This is because the direction of rotation changes the way the probe sits on the liner. Additionally, the water comes in from one direction only, which affects the function of the couplant, It is recommended not to change the direction of rotation during an inspection pass.

2. The results of the borescope inspection for liner cracks or staining determine further engine serviceability.

O. Remove the probe manipulator assembly from the engine

(1) After the inspection is complete, close the water valve and remove the water supply tube from the couplant manipulator assembly. Slacken the manipulator lock plate screw and spring clamp screw, remove the couplant manipulator assembly from the bleed valve aperture.

CAUTION: DO NOT USE EXCESSIVE FORCE TO REMOVE THE PROBE MANIPULATOR ASSEMBLY FROM THE ENGINE.

(2) Close the lock plate and remove the flange mount bolts. Carefully remove the probe manipulator assembly from the engine.

(3) Make sure all parts of the probe manipulator assembly are present and undamaged.

P. Make a check of the ultrasonic equipment calibration

(1) Make a check of the calibration of the ultrasonic equipment after the inspection is completed. Carry out the check in accordance with paragraph 3.L. (1) to (3). If the calibration is under sensitive by more than 3dB, re-calibrate the ultrasonic equipment and carry out an inspection of the disc again.

(2) If the calibration is satisfactory, disconnect the turning tool and remove it from the engine

(a) Remove the turning tool from the accessory gearbox in accordance with the manufacturer's operating instructions (Refer to the Aircraft Maintenance Manual, TASK 72-00-00-080-010).

OR

(b) Remove the hand turning tool from the accessory gearbox (Refer to the Aircraft Maintenance Manual, TASK 72-00-00-860-010).

NOTE: 1. All equipment including the probe manipulator assembly water supply tube and the water bottle should be thoroughly drained and dried before storing, to prevent corrosion.

2. Due to the similarity between the inner and outer diameter inspection kits, care must be taken to ensure the correct probes and working standards are replaced in the correct storage cases. Part numbers of the individual tools are marked on the case labels and on the tools.

Q. Accept and reject criteria

(1) For the accept and reject criteria, refer to Non-Modification Service Bulletin V2500-ENG-72-0615.

R. Install the HP stage 7 bleed valve air duct on the left side of the engine.

(1) Install the HP stage 7 bleed valve air duct together with the HP compressor stage 7 bleed valve

(a) Lubricate all threads and abutment faces of nuts and bolts with CoMat 10-077 (approved engine oil) and CoMat 10-094 (anti seize compound).

(b) Hold the HP stage 7 bleed valve air duct (75-00-49, 01-250) in the correct position on the HP compressor case and align the bolt holes.

(c) Install the 12 bolts (75-00-49, 01-252), with the bracket (75-00-49, 01-235) and the bracket (75-00-49, 01-240).

(d) Torque the twelve bolts (75-00-49, 01-252) to 85 to 105 lbf in. (10 to 12 Nm).

(e) Install the 'v' clamp (36-11-41, 01-100).

(f) Torque the coupling nut on 'v' clamp (36-11-14, 01-100) to 75 to 85 lbf in. (8,5 to 9,6 Nm). Use a soft faced hammer and tap around the outside of the coupling.

(g) Torque the coupling nut again. Use the above procedure three more times.

S. Make sure that the work area is clean and clear of tools, equipment and other unwanted materials.

T. Close the access to the HP compressor stage 7 bleed valve aperture that is installed on the left side of the engine

(1) Close both halves of the thrust reverser (Refer to the Aircraft Maintenance Manual, Chapter 78-32-00).

(2) Activate the thrust reverser Hydraulic Control Unit (HCU) (Refer to the Aircraft Maintenance Manual, Chapter 78-30-00).

(3) Do a idle leak check (Refer to the Aircraft Maintenance Manual, Chapter 71-00-00).

(4) Close the fan cowl doors (Refer to the Aircraft Maintenance Manual, Chapter 71-13-00).

U. Recording Instructions

(1) Record the incorporation of Non-Modification Service Bulletin V2500-ENG-72-0638 in the applicable engine records.

Part B - Applicable for V2500-A5 engines

V. General

Use the new inspection kit IAE2R19878 or the old inspection kit IAE2R19851 to carry out an ultrasonic inspection on the outer diameter of the HP compressor stage 8 disc adjacent to the stage 7-8 EB weld land.

NOTE: In order to reduce the potential for multiple-engine in-flight shutdown, power loss, or other anomaly due to maintenance error, IAE recommends that Operators avoid performing maintenance on multiple engines installed on the same aircraft at the same time. If it is not possible to avoid maintenance on more than one engine of an aircraft at the same time, IAE recommends that additional controls are applied in order to ensure that maintenance tasks have been completed as defined.

WARNING: YOU MUST BE CAREFUL WHEN YOU DO WORK ON THE ENGINE PARTS AFTER THE ENGINE IS STOPPED. THE ENGINE PARTS CAN STAY HOT FOR MORE THAN ONE HOUR.

WARNING: DO NOT TOUCH HOT PARTS WITHOUT APPLICABLE GLOVES. HOT PARTS CAN CAUSE AN INJURY.

(1) Obey all the WARNINGS and CAUTIONS in the procedures that are referred to.

(2) Consumable Materials

(a) Refer to the table that follows:

MATERIAL NO.	DESIGNATION
V01-201	Distilled or De-ionised water
V10-058	Penetrating Oil
V06-064	Fluorescent Penetrant
V05-020	Waterproof Abrasive Paper
V05-021	Waterproof Abrasive Paper
V05-074	Aluminum Oxide Abrasive Paper

For the details of the consumable materials given in the table above, refer to the Aircraft Maintenance Manual TASK 70-30-00-910-801.

(3) Tools and Equipment

(a) For inspection of the outer diameter location:

ITEM	DESCRIPTION	TOOL NUMBER
(a)	Inspection kit contains the outer diameter location inspection kit of item (b) in this table and the inner diameter location inspection kit of item (b) of the table in section 3.AF.(3)(a) of this Non-Modification Service Bulletin. OR	IAE2R19878
(b)	Outer diameter location inspection kit *(contains items (c) to (f)	IAE2R19851
(c)	Ultrasonic probe manipulator assembly contains 45 degree shear wave ultrasonic inspection probe	IAE2R19852 or IAE2R19879
(d)	Couplant feed system	IAE2R19807
(e)	Outer diameter location working standard	IAE2R19854
(f)	MCX/BNC lead	IAE2R19755
(g)	Ultrasonic flaw detector, frequency selectable in the 5.0 MHz range with audible/visual electronic alarm gate	Not supplied
(h)	Distilled or De-ionised water	Not supplied
(i)	Turning tool (if applicable)	Not supplied
(j)	4 to 6 mm flexible borescope kit with image capture capability	Not supplied
(k)	8 mm NC-centralising drill bit (90 degree cutting angle, HSCO material, TiN coated)	Generic, eg Forum # 4211506022 or equivalent - Not supplied
(l)	Outer diameter location drilling guide tool	IAE1R19877 or IAE1R19861
(m)	Bolts (2 off)	AS48516 or 4W0170 not supplied
(n)	Washers to fit item (m)	Not supplied
(o)	Vacuum cleaner and hose	Not supplied
(p)	Cloth	Not supplied
(q)	Hand-held electric drill	Not supplied
(r)	Penetrating oil	Not supplied
(s)	Portable hand grinding equipment	Not supplied
(t)	Clamp	IAE2R19912

NOTE: 1. The lead for the ultrasonic probe is supplied with a BNC connector installed. An adaptor may be required if alternative equipment is used.

2. The compressor can be turned manually, but an electronic turning tool is recommended to perform the inspection.

3. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

4. Drilling guide tool IAE1R19861 can be reworked to IAE1R19877, for details contact your local IAE Representative.

5. The outer diameter drilling guide tool number is identical to the inner diameter location drilling guide tool number.

W. Get access to the HP compressor stage 7 bleed valve aperture that is installed on the left side of the engine

(1) Open the applicable cowl doors (Refer to the Aircraft Maintenance Manual, Chapter 71-13-00).

(2) Deactivate the thrust reverser Hydraulic Control Unit (HCU) (Refer to the Aircraft Maintenance Manual, Chapter 78-30-00).

(3) Open the applicable half of the thrust reverser (Refer to the Aircraft Maintenance Manual, Chapter 78-32-00).

X. Remove the HP stage 7 bleed valve air duct from the left side of the engine.

(1) Remove the HP stage 7 bleed valve air duct together with the HP compressor stage 7 bleed valve (Refer to Figure 1)

(a) Allow the engine to cool for at least two hours with the cowl doors open.

(b) Apply the approved penetrating oil CoMat 10-058 before the removal of threaded parts. Let the parts soak at least 15 minutes.

(c) Seal all openings to prevent contamination from unwanted materials.

(d) Remove the coupling that attaches the IP bleed check valve to the HP7 bleed valve/cabin air duct (Refer to the Aircraft Maintenance Manual, Chapter 36-11-41).

(e) Carefully overcome the initial torque of each bolt of the flange to the duct.

(f) Carefully loosen each bolt of the flange to the duct. If excessive resistance is encountered, apply more penetrating oil and allow the bolts to soak for at least 15 minutes before proceeding.

NOTE: Make sure you use the correct size tool for the bolt head and do not force the bolt excessively during the removal process.

(g) Repeat step (f) until all bolts have been removed successfully.

(h) Remove the duct.

(i) If a bolt was broken during the removal process, perform the steps that follow:

(i) Remove broken bolts and/or studs by mechanical removal methods.

(ii) Drill a hole into the end of the broken bolt and/or stud. Refer to the tool manufacturer's instructions for the correct size of drill.

(iii) Put an extraction tool into the drilled hole and lock into position.

(iv) Turn the extraction tool to remove the broken bolt.

(v) Tap the threads if necessary to clean or chase the threads.

(vi) Examine the threads for damage or an oversize condition.

(j) If required, replace any inserts (Refer to the Aircraft Maintenance Manual, Chapter 70-35-26).

(2) When using the new inspection kit, IAE2R19879 on engines with Pre SB 72-0263 standard HPC Rear Outer Cases (P/N, 6A4154 and 6A5495) the bleed port flange may obstruct access of the drill and inspection probe. If this occurs perform the rework that follows:

(a) Prepare inner free area of the bleed port by placing a clean cloth such that no cutting debris can fall into the engine.

(b) Blend to create a recess in the rear outer case port flange.

Remove minimum amount of material possible to enable access, do not exceed the given limits. Use abrasive stones and papers to create the recess ensuring a smooth finish and blend into adjacent areas is achieved. Ensure all burrs and sharp edges are removed and the surface finish is comparable to adjacent areas.

Use V05-020, V05-021 and/or V05-074 abrasive papers and portable hand grinding equipment. Refer to Figure 4.

CAUTION: NOTE THE MAXIMUM BLEND LIMITS DEFINED IN FIGURE 4 AND ENSURE THEY ARE NOT EXCEEDED AS THIS CAN LEAD TO THE ENGINE BEING REJECTED UPON INSPECTION.

(c) Locally clean and fluorescent penetrant inspect the blended area. Refer to SPP TASK 70-23-05-230-010. Use CoMat V06-064 penetrant with a brush. If cracks are found, reject the engine.

CAUTION: ENSURE THE ENGINE IS SUFFICIENTLY PROTECTED WITH THE CLOTH PLACED IN STEP. (A) SO THAT NO SOLVENT OR PENETRANT CAN FALL INTO THE ENGINE.

(d) Remove the cloth protecting the engine and wipe away any visible debris. If available, use a vacuum cleaner and hose to remove any further debris.

(e) Inspect the case flange to ensure the blend limits were not exceeded. If the limits are exceeded, reject the engine.

(3) For engines which have HP compressor heat shield retainers (pre V2500-ENG-72-0296) or heat shield retainers with heat shields (pre V2500-ENG-72-0477), perform the rework that follows for probe access

(a) Prepare inner free area of the bleed port by placing a clean cloth such that no cutting debris can fall into the engine.

(b) Attach the drilling guide tool IAE1R19861 or IAE1R19877 to one end of the slotted hole with two bolts (AS48516) and two washers as shown in Figure 3.

(c) Insert an 8,00 mm (0.315 in.) drill bit into the drilling guide tool and drill a hole until the second wall of the heat shield retainer is penetrated (Figure 5 thru Figure 7).

(d) Remove the drill, loosen the bolts and slide the guide tool to the other end of the slotted hole and repeat step (c).

(e) Repeat steps (c) and (d) between the previously drilled two holes, until the entire opening is created as shown in Figure 5 thru Figure 7.

(f) Deburr and remove high material around the corners of the opening using mechanical tools until the probe can be inserted easily.

(g) Remove the cloth and wipe away any visible debris. If available, use a vacuum cleaner and hose to remove any further debris.

Y. Install the HP system turning tool

(1) Install the turning tool to the accessory gearbox in accordance with the manufacturer's operating instructions (Olympus tool quoted). Install the V2500 A5 software module on the control unit, set the HP compressor rotation speed to the slowest (10 minutes per revolution). Set the HP compressor stage to HPC8 and engage continuous rotation mode. (Refer to the Aircraft Maintenance Manual, TASK 72-00-00-480-010).

OR

(2) Install the hand turning tool to the accessory gearbox (Refer to the Aircraft Maintenance Manual, TASK 72-00-00-860-010).

(3) Inspect the stage 7-8 stator ceramic liner for staining and/or axial cracking (Refer to Figure 8).

(a) If staining and /or cracking is found in the specific area as shown in Figure 8, reject the Engine before next flight.

NOTE: Only findings located at the trailing edge of the vane contact area are relevant, findings in other areas can be disregarded.

The main direction of crack progression will be axial on the ceramic liner.

If liner loss was identified during the inspection for staining/cracking and the HP compressor is rotated manually, the rotation must be carried out carefully and slowly over these areas. Temporarily reverse the rotation of the HP compressor and re-inspect these areas for indications before continuing the inspection.

(b) If no staining and /or cracking is found, proceed with paragraph 3.Z.

Z. Calibrate the ultrasonic equipment

Range	28 mm (nominal)
Material velocity	3100 m/s
Delay	0.00 micro seconds
Frequency	Selectable in the 5.0 MHz range
Damping	50 Ohms
Rectify	Full
Pulser	Single crystal
Gate position	3.5 - 7.0 time base position

NOTE: 1. The nominal settings above are for a USN 52 or equivalent flaw detector to achieve approximate signal timebase positions. Alternative instruments may require different settings.

2. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

(1) Fit the clamp (IAE2R19912) to the manipulator shaft (Tool No. on the upper surface), refer to Figure 11. Use the Allen key and secure loosely.

NOTE: The clamp (IAE2R19912) must be able to slide on the manipulator at this stage.

(2) Attach the lead to the manipulator/flaw detector, apply the distilled or de-ionised water and position the probe (IAE2R19852) on to the working standard (Refer to Figure 9).

(3) With the flat face of the probe seated on the rear face of the working standard and the chamfered corners outward facing, position the probe on the working standard (Refer to Figure 9). The 1.0 mm long by 0.50 mm deep EDM notch is located in the center of the base of the working standard.

NOTE: 1. If calibration is carried out with the working standard in contact with a secondary surface, excessive couplant on the working surface and EDM target surface, may allow transfer of sound into the secondary surface. This can result in a weak signal and incorrect calibration.

2. During calibration make sure that the probe is flat down on the two contact faces of the working standards. Failure to do so can result in incorrect calibration.

3. Make sure that the probe is positioned correctly on the working standard and the reflected signal is not from the corner of the block.

(4) With the probe positioned on the working standard (Refer to Figure 9), identify the response from the EDM target at half skip distance. Maximize the signal response to achieve 70 percent Full Screen Height (FSH) and adjust the range control to position the EDM target signal at five on the timebase. (Refer to Figure 10).

(5) Position the gate between the 3.5 and 7.0 divisions on the time base and set the alarm threshold level at 40 percent FSH.

AA. Install the manipulator (IAE2R19852 or IAE2R19879) and ultrasonic probe into the engine

CAUTION: DUE TO THE SIMILARITY BETWEEN THE INNER AND OUTER DIAMETER INSPECTION TOOLS, CARE MUST BE TAKEN TO ENSURE THE CORRECT PROBE AND WORKING STANDARD HAVE BEEN SELECTED FOR THE RELEVANT INSPECTION.

(1) Position the distilled or de-ionised water container at a suitable position on the engine. Make sure the container is supported above the probe position. Attach the end of the water supply tube to the connector on the rear of the manipulator. Open the valve on the water container and make sure that water flows from the probe face with no sign of air bubbles. When water flows from the probe, close the valve on the water container.

(2) Before installing the manipulator/probe into the engine, make sure all parts are secure. Make sure the attachment bolt for the ultrasonic probe is secure, the spring is not bent and the cable is not damaged. Make sure that the clamp (IAE2R19912) has been attached correctly (Tool No. on upper surface), it is important that it is free to move on the manipulator at this stage. Make sure the water tube is removed from the manipulator assembly to allow the probe to be inserted into the engine.

NOTE: 1. Two standards of bleed air slots may be found on engines. The current modification standard has longer elongated slots (Refer to Figure 16) however a number of engines have an earlier modification standard with smaller square slots. The gaps between the stator platforms are identical; however, the larger slot allows more freedom to allow the probe to fit easily into the gap between the stators. Installing the probe into the smaller slot is more difficult due to the smaller space available; in this case, the probe face initially contacts the corner of the lower stator platform (Refer to Figure 16).

2. To install the probe to the smaller slot, first angle the head of the probe upwards a few degrees by gently rotating the probe head on the attachment bolt. Holding the manipulator as low as possible during entry, will allow the probe to slide upwards as it enters the slot avoiding the corner of the stator. When installed, the manipulator assembly should be pushed on to the liner to ensure contact and to center the probe.

3. During withdrawal, the probe will contact the inner surface of the stator platform preventing withdrawal. By applying gentle pressure to the manipulator, and again adjusting the probe head angle, whilst the probe is still in the engine, the probe will be able to be withdrawn. Excessive force must not be used during removal.

(3) Use CoMat 10-058 to lightly oil the threads of the mounting bolts. Offer the probe to the forward side of the HP compressor bleed valve port (Refer to Figure 2) through the bleed slot adjacent to the flat-headed D bolt. Carefully allow the probe to enter the HP compressor casing until it contacts the ceramic liner. Carefully slide the manipulator mounting plate up to the bleed valve flange. Manually screw the bolts into the bolt holes ensuring the mounting plate remains in contact with the bleed valve flange and the probe manipulator assembly is free to move. Tighten the bolts alternately whilst checking the probe manipulator assembly remains free to move.

NOTE: Do not force the manipulator or damage may occur to the probe and engine.

If the probe is difficult to insert, more material should be removed from the first and second walls of the heatshield retainer.

(4) When correctly installed, the probe manipulator assembly should be able to slide freely in the mounting block and allow the probe to make contact with the liner. Figure 11 shows the manipulator assembly correctly installed to the engine.

NOTE: The clamp (IAE2R19912) must be able to slide on the manipulator allowing the probe to reach the liner of the drum.

If areas of liner loss in the probe path have been identified during the borescope inspection, ensure the probe is seated on the liner surface during the probe "SET" operation. If total liner loss (360°) in the probe path has been identified, the "SET" operation must be carried out on the drum surface. Care must be taken, as any remaining patches of liner will damage the probe.

(5) Rotate the cam until the flat marked "SET" is uppermost (viewed from the cable end of the manipulator) and firmly push the probe onto the drum liner. With the probe contacting the liner surface, slide the clamp against the mounting block ensuring the lower flat on the cam is firmly seated on the mounting block surface. Tighten the clamp screw with the Allen key. The probe is now locked in position, touching the surface with "SET" displayed on the cam.

CAUTION: DO NOT TURN THE HP COMPRESSOR UNTIL CLAMP IS ADJUSTED (INDICATION 'INSPECT' IS SHOWN). THIS CAN CAUSE DAMAGE TO THE PROBE.

(6) Rotate the cam on the clamp (IAE2R19912) until the flat side marked 'INSPECT' is up (view from the cable entry side of the manipulator). Ensure that the ultrasonic probe has been lifted away from the drum liner surface.

NOTE: Manufacturing tolerances within the manipulator can result in a slight contact of the probe with the drum and is acceptable.

AB.Inspect the disc

(1) If the HP compressor is rotated manually, use a borescope to identify a datum feature on the liner or the center position between the two lock nuts on the stage 7 blades (Refer to Figure 17). The borescope must be installed during the inspection to view the datum point. This will ensure that the HP compressor is inspected for one full rotation (360 degrees).

If the HP compressor is rotated with the electronic turning tool, zero the turning tool blade counter prior to starting the rotation.

NOTE: There are 93 stage 7 rotor blades and 84 stage 8 rotor blades.

(2) Open the water couplant valve fully and rotate the HP compressor in an ANTI CLOCKWISE direction to begin the inspection and inspect the full circumference of the disc (Refer to Figure 11).

NOTE: 1. Ultrasonic background structural noise (grass level) must be monitored to ensure correct ultrasonic coupling. Any loss of background noise must be investigated and if necessary the drum re-inspected.

2. The flaw detector must be monitored for signals that move along the timebase in the gated area. Any ultrasonic response that break the alarm gate (40 percent) will cause the engine to be rejected (Refer to Figure 15).

3. Water levels in the container must be monitored during the inspection. If the container is found to be empty during the inspection, the container must be re-filled and the inspection repeated. With the probe operating off the surface of the liner and therefore less restriction to couplant flow, the water container can empty quicker than previously and must be monitored.

4. If liner loss was identified during the inspection for staining/cracking and the HP compressor is rotated manually, the rotation must be carried out carefully and slowly over these areas. Temporarily reverse the rotation of the HP compressor and re-inspect these areas for indications before continuing the inspection.

AC. Remove the probe manipulator assembly from the engine

(1) After completion of the inspection, close the water valve and remove the water supply tube from the manipulator. Undo the bolts and carefully ease the manipulator from the bleed valve port.

CAUTION: DO NOT USE EXCESSIVE FORCE TO REMOVE THE PROBE MANIPULATOR ASSEMBLY FROM THE ENGINE.

(2) Make sure all parts of the probe manipulator assembly are present and undamaged and loosen the clamp.

AD. Make a check of the ultrasonic equipment calibration

(1) Make a check of the calibration of the ultrasonic equipment after the inspection is completed. Carry out the check in accordance with paragraph 3.Z. (2) to (5). If the calibration is under sensitive by more than 3dB, re-calibrate the ultrasonic equipment and carry out an inspection of the disc again.

AE.Accept and reject criteria

(1) For the accept and reject criteria, refer to Non-Modification Service Bulletin V2500-ENG-72-0615.

AF.General

Use the new inspection kit IAE2R19878 or the old inspection kit IAE2R19858 to carry out an ultrasonic inspection on the inner diameter of the HP compressor stage 8 disc adjacent to the stage 7-8 EB weld land.

NOTE: In order to reduce the potential for multiple-engine in-flight shutdown, power loss, or other anomaly due to maintenance error, IAE recommends that Operators avoid performing maintenance on multiple engines installed on the same aircraft at the same time. If it is not possible to avoid maintenance on more than one engine of an aircraft at the same time, IAE recommends that additional controls are applied in order to ensure that maintenance tasks have been completed as defined.

WARNING: YOU MUST BE CAREFUL WHEN YOU DO WORK ON THE ENGINE PARTS AFTER THE ENGINE IS STOPPED. THE ENGINE PARTS CAN STAY HOT FOR MORE THAN ONE HOUR.

WARNING: DO NOT TOUCH HOT PARTS WITHOUT APPLICABLE GLOVES. HOT PARTS CAN CAUSE AN INJURY.

(1) Obey all the WARNINGS and CAUTIONS in the procedures that are referred to.

(2) Consumable Materials

(a) Refer to the table that follows:

MATERIAL NO.	DESIGNATION
V01-201	Distilled or De-ionised water
V10-058	Penetrating Oil

For the details of the consumable materials given in the table above, refer to the Aircraft Maintenance Manual (AMM) TASK 70-30-00-918-010.

(3) Tools and Equipment

(a) Refer to the table that follows:

ITEM	DESCRIPTION	TOOL NUMBER
(a)	Inspection kit contains the inner diameter location inspection kit of item (b) in this table and the outer diameter location inspection kit of item (b) of the table in section 3.V.(3)(a) of this Non-Modification Service Bulletin. OR	IAE2R19878

(b)	Inner diameter location inspection kit *(contains items (c) to (f)	IAE2R19858
(c)	Ultrasonic probe manipulator assembly contains 45 degree shear wave ultrasonic inspection probe	IAE2R19859 or IAE2R19880
(d)	Couplant feed system	IAE2R19807
(e)	Inner diameter location working standard	IAE2R19860
(f)	MCX/BNC lead	IAE2R19755
(g)	Ultrasonic flaw detector, frequency selectable in the 5.0 MHz range with audible/visual electronic alarm gate	Not supplied
(h)	Distilled or De-ionised water	Not supplied
(i)	Turning tool (if applicable)	Not supplied
(j)	4 to 6 mm flexible borescope kit with image capture capability	Not supplied
(k)	8 mm NC-centralising drill bit (90 degree cutting angle, HSCO material TiN coated)	Generic, eg Forum # 4211506022 or equivalent - Not supplied
(l)	Inner diameter location drilling guide tool	IAE1R19877 or IAE1R19861
(m)	Bolts (2 off)	AS48516 or 4W0170 not supplied
(n)	Washers to fit item (m)	Not supplied
(o)	Vacuum cleaner and hose	Not supplied
(p)	Cloth	Not supplied
(q)	Hand-held electric drill	Not supplied
(r)	Penetrating oil	Not supplied
(s)	Portable hand grinding equipment	Not supplied
(t)	Clamp	IAE2R19912

NOTE: 1. The lead for the ultrasonic probe is supplied with a BNC connector installed. An adaptor may be required if alternative equipment is used.

2. The compressor can be turned manually, but an electronic turning tool is recommended to perform the inspection.

3. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

AG.Calibrate the ultrasonic equipment

Range	59mm (nominal)
Material velocity	3100 m/s
Delay	0.00 micro seconds
Frequency	Selectable in the 5.0 MHz range
Damping	50 Ohms

Rectify	Full wave
Pulser	Single crystal
Gate position	3.0 - 8.0 timebase position

NOTE: 1. The nominal settings above are for a USN 52 or equivalent flaw detector to achieve approximate signal timebase positions. Alternative instruments may require different settings.

2. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

(1) Fit the clamp (IAE2R19912) to the manipulator shaft (Tool No. on the upper surface), refer to Figure 11. Use the Allen key and secure loosely.

NOTE: The clamp (IAE2R19912) must be able to slide on the manipulator at this stage.

(2) Attach the lead to the manipulator/flaw detector, apply the distilled or de-ionised water and position the probe (IAE2R19859 or IAE2R19880) on to the working standard (IAE2R19860) (Refer to Figure 9).

(3) With the flat face of the probe seated on the rear face of the working standard and the chamfered corners outward facing, position the probe on the working standard approximately 10.00 mm from the end as shown (Refer to Figure 9). The EDM target is located on the lower rear edge of the working standard.

NOTE: 1. If calibration is carried out with the working standard in contact with a secondary surface, excessive couplant on the working surface and EDM target surface, may allow transfer of sound into the secondary surface. This can result in a weak signal and incorrect calibration.

2. During calibration make sure that the probe is flat down on the two contact faces of the working standards. Failure to do so can result in incorrect calibration.

3. Make sure that the probe is positioned correctly on the working standard and the reflected signal is not from the corner of the block.

(4) With the probe positioned on the working standard (Refer to Figure 9), identify the response from the EDM target at half skip distance. Maximize the signal response to achieve 70 percent Full Screen Height (FSH) and adjust the range control to position the EDM target signal at five on the timebase. (Refer to Figure 10).

(5) Position the gate between the 3.0 and 8.0 divisions on the timebase.

For HP compressor drums of Ti6 material set the alarm threshold level at 30 percent FSH (Refer to Figure 10).

For HP compressor drums of Ti5 material set the alarm threshold level at 55 percent FSH (Refer to Figure 10).

NOTE: For any uncertainty on the 3-8 drum material, refer to the Compliance 1.E. of Non-Modification Service Bulletin V2500-ENG-72-0615.

AH. Install the manipulator and ultrasonic probe (IAE2R19859 or IAE2R19880) into the engine

CAUTION: DUE TO THE SIMILARITY BETWEEN THE INNER AND OUTER DIAMETER INSPECTION TOOLS, CARE MUST BE TAKEN TO ENSURE THE CORRECT PROBE AND WORKING STANDARD HAVE BEEN SELECTED FOR THE RELEVANT INSPECTION.

(1) Position the distilled or de-ionised water container at a suitable position on the engine. Make sure the container is supported above the probe position. Attach the end of the water supply tube to the connector on the rear of the manipulator. Open the valve on the water container and make sure that water flows from the probe face with no sign of air bubbles. When water flows from the probe, close the valve on the water container.

(2) Before installing the manipulator/probe into the engine, make sure all parts are secure. Make sure the attachment bolt for the ultrasonic probe is secure, the spring is not bent and the cable is not damaged. Make sure that the clamp (IAE2R19912) has been attached correctly (Tool No. on upper surface), it is important that it is free to move on the manipulator at this stage. Make sure the water tube is removed from the manipulator assembly to allow the probe to be inserted into the engine.

NOTE: 1. Two standards of bleed air slots may be found on engines. The current modification standard has longer elongated slots (Refer to Figure 16) however a number of engines have an earlier modification standard with smaller square slots. The gaps between the stator platforms are identical; however, the larger slot allows more freedom to allow the probe to fit easily into the gap between the stators. Installing the probe into the smaller slot is more difficult due to the smaller space available; in this case, the probe face initially contacts the corner of the lower stator platform (Refer to Figure 16).

2. To install the probe to the smaller slot, first angle the head of the probe upwards a few degrees by gently rotating the probe head on the attachment bolt. Holding the manipulator as low as possible during entry, will allow the probe to slide upwards as it enters the slot avoiding the corner of the stator. When installed, the manipulator assembly should be pushed on to the liner to ensure contact and to center the probe.

3. During withdrawal, the probe will contact the inner surface of the stator platform preventing withdrawal. By applying gentle pressure to the manipulator, and again adjusting the probe head angle, whilst the probe is still in the engine, the probe will be able to be withdrawn. Excessive force must not be used during removal.

(3) Use CoMat 10-058 to lightly oil the threads of the mounting bolts. Offer the probe to the forward side of the HP compressor bleed valve port (Refer to Figure 2) through the bleed slot adjacent to the flat-headed D bolt. Carefully allow the probe to enter the HP compressor casing until it contacts the ceramic liner. Carefully slide the manipulator mounting plate up to the bleed valve flange. Manually screw the bolts into the bolt holes ensuring the mounting plate remains in contact with the bleed valve flange and the probe manipulator assembly is free to move. Tighten the bolts alternately whilst checking the probe manipulator assembly remains free to move.

NOTE: Do not force the manipulator or damage may occur to the probe and engine.

If the probe is difficult to insert, more material should be removed from the first and second walls of the heatshield retainer.

(4) When correctly installed, the probe manipulator assembly should be able to slide freely in the mounting block and allow the probe to make contact with the liner. Figure 11 shows the manipulator assembly correctly installed to the engine.

NOTE: The clamp (IAE2R19912) must be able to slide on the manipulator allowing the probe to reach the liner of the drum.

If areas of liner loss in the probe path have been identified during the borescope inspection, ensure the probe is seated on the liner surface during the probe "SET" operation. If total liner loss (360°) in the probe path has been identified, the "SET" operation must be carried out on the drum surface. Care must be taken, as any remaining patches of liner will damage the probe.

(5) Rotate the cam until the flat marked "SET" is uppermost (viewed from the cable end of the manipulator) and firmly push the probe onto the drum liner. With the probe contacting the liner surface, slide the clamp against the mounting block ensuring the lower flat on the cam is firmly seated on the mounting block surface. Tighten the clamp screw with the Allen key. The probe is now locked in position, touching the surface with "SET" displayed on the cam.

CAUTION: DO NOT TURN THE HP COMPRESSOR UNTIL CLAMP IS ADJUSTED (INDICATION 'INSPECT' IS SHOWN). THIS CAN CAUSE DAMAGE TO THE PROBE.

(6) Rotate the cam on the clamp (IAE2R19912) until the flat side marked 'INSPECT' is up (view from the cable entry side of the manipulator). Ensure that the ultrasonic probe has been lifted away from the drum liner surface.

NOTE: Manufacturing tolerances within the manipulator can result in a slight contact of the probe with the drum and is acceptable.

AI.Inspect the disc

(1) If the HP compressor is rotated manually, use a borescope to identify a datum feature on the liner or the center position between the two lock nuts on the stage 7 blades (Refer to Figure 17). The borescope must be installed during the inspection to view the datum point. This will ensure that the HP compressor is inspected for one full rotation (360 degrees).

If the HP compressor is rotated with the electronic turning tool, zero the turning tool blade counter prior to starting the rotation.

NOTE: There are 93 stage 7 rotor blades and 84 stage 8 rotor blades.

(2) Open the water couplant valve fully and rotate the HP compressor in an ANTI CLOCKWISE direction to begin the inspection and inspect the full circumference of the disc (Refer to Figure 11).

NOTE: 1. Ultrasonic background structural noise (grass level) must be monitored to ensure correct ultrasonic coupling. Any loss of background noise must be investigated and if necessary the drum re-inspected.

2. The flaw detector must be monitored for signals that move along the timebase in the gated area. Any ultrasonic response that break the alarm gate (30 percent or 55 percent) will cause the engine to be rejected (Refer to Figure 15).

3. Water levels in the container must be monitored during the inspection. If the container is found to be empty during the inspection, the container must be re-filled and the inspection repeated. With the probe operating off the surface of the liner and therefore less restriction to couplant flow, the water container can empty quicker than previously and must be monitored.

4. If liner loss was identified during the inspection for staining/cracking and the HP compressor is rotated manually, the rotation must be carried out carefully and slowly over these areas. Temporarily reverse the rotation of the HP compressor and re-inspect these areas for indications before continuing the inspection.

AJ.Remove the probe manipulator assembly from the engine

(1) On completion of the inspection, close the water valve and remove the water supply tube from the manipulator. Undo the bolts and carefully ease the manipulator from the bleed valve port.

CAUTION: DO NOT USE EXCESSIVE FORCE TO REMOVE THE PROBE MANIPULATOR ASSEMBLY FROM THE ENGINE.

(2) Make sure all parts of the probe manipulator assembly are present and undamaged and loosen the clamp.

AK.Make a check of the ultrasonic equipment calibration

(1) Make a check of the calibration of the ultrasonic equipment after the inspection is completed. Carry out the check in accordance with paragraph 3.AG. (2) to (5). If the calibration is under sensitive by more than 3dB, re-calibrate the ultrasonic equipment and carry out an inspection of the disc again.

(2) If the calibration is satisfactory, disconnect the turning tool and remove it from the engine

(a) Remove the turning tool from the accessory gearbox in accordance with the manufacturer's operating instructions (Refer to the Aircraft Maintenance Manual, TASK 72-00-00-080-010).

OR

(b) Remove the hand turning tool from the accessory gearbox (Refer to the Aircraft Maintenance Manual, TASK 72-00-00-860-010).

NOTE: 1. All equipment including the probe manipulator assembly water supply tube and the water bottle should be thoroughly drained and dried before storing, to prevent corrosion.

2. Due to the similarity between the inner and outer diameter inspection kits, care must be taken to ensure the correct probes and working standards are replaced in the correct storage cases. Part numbers of the individual tools are marked on the case labels and on the tools.

AL.Accept and reject criteria

(1) For the accept and reject criteria, refer to Non-Modification Service Bulletin V2500-ENG-72-0615.

AM.Install the HP stage 7 bleed valve air duct on the left side of the engine.

(1) Install the HP stage 7 bleed valve air duct together with the HP compressor stage 7 bleed valve

(a) Lubricate all threads and abutment faces of nuts and bolts with CoMat 10-077 (approved engine oil) and CoMat 10-094 (anti seize compound).

(b) Hold the HP stage 7 bleed valve air duct (75-00-49, 01-250) in the correct position on the HP compressor case and align the bolt holes.

(c) Install the 12 bolts (75-00-49, 01-252), with the bracket (75-00-49, 01-235) and the bracket (75-00-49, 01-240).

(d) Torque the twelve bolts (75-00-49, 01-252) to 85 to 105 lbf in. (10 to 12 Nm).

(e) Install the 'v' clamp (36-11-41, 01-100).

(f) Torque the coupling nut on 'v' clamp (36-11-14, 01-100) to 75 to 85 lbf in. (8,5 to 9,6 Nm). Use a soft faced hammer and tap around the outside of the coupling.

(g) Torque the coupling nut again. Use the above procedure three more times.

AN.Make sure that the work area is clean and clear of tools, equipment and other unwanted materials.

AO.Close the access to the HP compressor stage 7 bleed valve aperture that is installed on the left side of the engine

(1) Close both halves of the thrust reverser (Refer to the Aircraft Maintenance Manual, Chapter 78-32-00).

(2) Activate the thrust reverser Hydraulic Control Unit (HCU) (Refer to the Aircraft Maintenance Manual, Chapter 78-30-00).

(3) Do an idle leak check (Refer to the Aircraft Maintenance Manual, Chapter 71-00-00).

(4) Close the fan cowl doors (Refer to the Aircraft Maintenance Manual, Chapter 71-13-00).

AP.Recording Instructions

(1) A record of accomplishment is required. Complete a separate Accomplishment Proforma for outer and inner diameter contained in Non-Modification Service Bulletin V2500-ENG-72-0615.

(2) Record the incorporation of Non-Modification Service Bulletin V2500-ENG-72-0638 in the applicable engine records.

(3) If the heatshield rework was performed make a note of this in the engine records.

Part C - Applicable for V2500-D5 engines

AQ.General

Use inspection kit IAE2R19873 to carry out an ultrasonic inspection on the outer diameter of the HP compressor stage 8 disc adjacent to the stage 7-8 EB weld land.

NOTE: In order to reduce the potential for multiple-engine in-flight shutdown, power loss, or other anomaly due to maintenance error, IAE recommends that Operators avoid performing maintenance on multiple engines installed on the same aircraft at the same time. If it is not possible to avoid maintenance on more than one engine of an aircraft at the same time, IAE recommends that additional controls are applied in order to ensure that maintenance tasks have been completed as defined.

WARNING: YOU MUST BE CAREFUL WHEN YOU DO WORK ON THE ENGINE PARTS AFTER THE ENGINE IS STOPPED. THE ENGINE PARTS CAN STAY HOT FOR MORE THAN ONE HOUR.

WARNING: DO NOT TOUCH HOT PARTS WITHOUT APPLICABLE GLOVES. HOT PARTS CAN CAUSE AN INJURY.

(1) Obey all the WARNINGS and CAUTIONS in the procedures that are referred to.

(2) Consumable Materials

(a) Refer to the table that follows:

MATERIAL NO.	DESIGNATION
V01-201	Distilled or De-ionised water
V10-058	Penetrating Oil
V06-064	Fluorescent Penetrant
V05-020	Waterproof Abrasive Paper
V05-021	Waterproof Abrasive Paper
V05-074	Aluminum Oxide Abrasive Paper

For the details of the consumable materials given in the table above, refer to the Aircraft Maintenance Manual (AMM) TASK 70-30-00-910-801.

(3) Tools and Equipment

(a) For inspection of the outer diameter location:

ITEM	DESCRIPTION	TOOL NUMBER
(a)	Inspection kit contains the outer diameter location inspection items (b) to (e) listed in this table and the inner diameter location inspection items (b) to (e) listed in the table in section 3.BA.(3)(a) of this Non-Modification Service Bulletin	IAE2R19873
(b)	Ultrasonic probe manipulator assembly contains 45 degree shear wave ultrasonic inspection probe	IAE2R19874
(c)	Couplant feed system	IAE2R19807
(d)	Outer diameter location working standard	IAE2R19854
(e)	MCX/BNC lead	IAE2R19755
(f)	Ultrasonic flaw detector, frequency selectable in the 5.0 MHz range with audible/visual electronic alarm gate	Not supplied
(g)	Distilled or De-ionised water	Not supplied
(h)	Turning tool (if applicable)	Not supplied
(i)	4 to 6 mm flexible borescope kit with image capture capability	Not supplied
(j)	8 mm NC-centralising drill bit (90 degree cutting angle, HSCO material, TiN coated)	Generic, eg Forum # 4211506022 or equivalent - Not supplied
(k)	Outer diameter location drilling guide tool	IAE1R19881
(l)	Bolts (2 off)	AS48516 or 4W0170 not supplied
(m)	Washers to fit item (l)	Not supplied
(n)	Vacuum cleaner and hose	Not supplied
(o)	Cloth	Not supplied
(p)	Hand-held electric drill	Not supplied
(q)	Penetrating oil	Not supplied
(r)	Portable hand grinding equipment	Not supplied
(s)	Clamp	IAE2R19912

NOTE: 1. The lead for the ultrasonic probe is supplied with a BNC connector installed. An adaptor may be required if alternative equipment is used.

2. The compressor can be turned manually, but an electronic turning tool is recommended to perform the inspection.

3. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

4. The outer diameter drilling guide tool number is identical to the inner diameter location drilling guide tool number.

AR. Get access to the HP compressor stage 7 bleed valve aperture that is installed on the left upper side of the engine

(1) Open the applicable cowl doors (Refer to the Aircraft Maintenance Manual, Chapter 71-13-00).

AS. Remove the HP stage 7A bleed valve air duct from the left side of the engine.

(1) Remove the HP stage 7A bleed valve air duct together with the HP compressor stage 7A bleed valve (Refer to Figure 1)

(a) Allow the engine to cool for at least two hours with the cowl doors open.

(b) Apply the approved penetrating oil CoMat 10-058 before the removal of threaded parts. Let the parts soak at least 15 minutes.

(c) Seal all openings to prevent contamination from unwanted materials.

(d) Carefully overcome the initial torque of each bolt of the flange to the duct.

(e) Carefully loosen each bolt of the flange to the duct. If excessive resistance is encountered, apply more penetrating oil and allow the bolts to soak for at least 15 minutes before proceeding.

NOTE: Make sure you use the correct size tool for the bolt head and do not force the bolt excessively during the removal process.

(f) Repeat step (e) until all bolts have been removed successfully.

(g) Remove the duct.

(h) If a bolt was broken during the removal process, perform the steps that follow:

(i) Remove broken bolts and/or studs by mechanical removal methods.

(ii) Drill a hole into the end of the broken bolt and/or stud. Refer to the tool manufacturer's instructions for the correct size of drill.

(iii) Put an extraction tool into the drilled hole and lock into position.

(iv) Turn the extraction tool to remove the broken bolt.

(v) Tap the threads if necessary to clean or chase the threads.

(vi) Examine the threads for damage or an oversize condition.

(i) If required, replace any inserts (Refer to the Aircraft Maintenance Manual, TASK 70-35-26-300-801).

(2) For engines which have HP compressor heat shield retainers (pre V2500-ENG-72-0296) or heat shield retainers with heat shields (pre V2500-ENG-72-0477), perform the rework that follows for probe access

(a) Prepare inner free area of the bleed port by placing a clean cloth such that no cutting debris can fall into the engine.

(b) Attach the drilling guide tool IAE1R19881 to one end of the slotted hole with two bolts and two washers as shown in Figure 3.

(c) Insert an 8,00 mm (0.315 in.) drill bit into the drilling guide tool and check whether the drill can reach the heat shield retainer without making contact with the rear outer case bleed port flange.

NOTE: On Pre/Post Service Bulletin V2500-ENG-72-0177 standard rear outer cases (P/N 6A4407 and 6A5497) the bleed port flange can prevent the drill from reaching the heat shield retainer.

(i) If the drill cannot pass the rear outer case flange, go to Step. (d).

(ii) If the drill passes without touching the rear outer case port flange, go to Step. (k).

(d) Remove the drill, loosen the bolts and remove the drilling guide tools.

(e) Blend to create a recess in the rear outer case port flange to enable drill access to the heat shield retainer.

Remove minimum amount of material possible to enable access, do not exceed the given limits. Use abrasive stones and papers to create the recess ensuring a smooth finish and blend into adjacent areas is achieved. Ensure all burrs and sharp edges are removed and the surface finish is comparable to adjacent areas.

Use V05-020, V05-021 and/or V05-074 abrasive papers and portable hand grinding equipment. Refer to Figure 4.

CAUTION: NOTE THE MAXIMUM BLEND LIMITS DEFINED IN FIGURE 4 AND ENSURE THEY ARE NOT EXCEEDED AS THIS CAN LEAD TO THE ENGINE BEING REJECTED UPON INSPECTION.

(f) Locally clean and fluorescent penetrant inspect the blended area. Refer to SPP TASK 70-23-05-230-801. Use CoMat V06-064 penetrant with a brush. If cracks are found, reject the engine.

CAUTION: ENSURE THE ENGINE IS SUFFICIENTLY PROTECTED WITH THE CLOTH PLACED IN STEP. (A) SO THAT NO SOLVENT OR PENETRANT CAN FALL INTO THE ENGINE.

(g) Remove the cloth protecting the engine and wipe away any visible debris. If available, use a vacuum cleaner and hose to remove any further debris.

(h) Inspect the case flange to ensure the blend limits were not exceeded. If the limits are exceeded, reject the engine.

(i) Prepare inner free area of the bleed port by placing a clean cloth such that no cutting debris can fall into the engine.

(j) Attach the drilling guide tool IAE1R19881 to one end of the slotted hole with two bolts (AS48516) and two washers as shown in Figure 3.

(k) Insert an 8,00 mm (0,315 in.) drill bit into the drilling guide tool and drill a hole until the second wall of the heat shield retainer is penetrated (Figure 3 thru Figure 4).

(l) Remove the drill, loosen the bolts and slide the guide tool to the other end of the slotted hole and repeat step (k).

(m) Repeat steps (k) and (l) between the previously drilled two holes, until the entire opening is created as shown in Figure 5.

(n) Deburr and remove high material around the corners of the opening until the probe can be inserted easily. Refer to SPP TASK 70-35-03-300-501.

(o) Remove the cloth and wipe away any visible debris. If available, use a vacuum cleaner and hose to remove any further debris.

AT.Install the HP system turning tool

(1) Install the turning tool (IAE2R18853) to the accessory gearbox in accordance with the manufacturer's operating instructions (Olympus tool quoted). Install the V2500-D5 software module on the control unit, set the HP compressor rotation speed to the slowest (10 minutes per revolution). Set the HP compressor stage to HPC8 and engage continuous rotation mode. (Refer to the Aircraft Maintenance Manual, TASK 72-00-02-290-801).

OR

(2) Install the hand turning tool to the accessory gearbox (Refer to the Aircraft Maintenance Manual, TASK 72-00-00-810-801).

(3) Inspect the stage 7-8 stator ceramic liner for staining and/or axial cracking (Refer to Figure 8).

(a) If staining and /or cracking is found in the specific area as shown in Figure 8, reject the Engine before next flight.

NOTE: Only findings located at the trailing edge of the vane contact area are relevant, findings in other areas can be disregarded.

The main direction of crack progression will be axial on the ceramic liner.

If liner loss was identified during the inspection for staining/cracking and the HP compressor is rotated manually, the rotation must be carried out carefully and slowly over these areas. Temporarily reverse the rotation of the HP compressor and re-inspect these areas for indications before continuing the inspection.

(b) If no staining and /or cracking is found, proceed with paragraph 3.AU.

AU.Calibrate the ultrasonic equipment

Range	28 mm (nominal)
Material velocity	3100 m/s
Delay	0.00 micro seconds
Frequency	Selectable in the 5.0 MHz range
Damping	50 Ohms
Rectify	Full
Pulser	Single crystal
Gate position	3.5 - 7.0 time base position

NOTE: 1. The nominal settings above are for a USN 52 or equivalent flaw detector to achieve signal timebase positions. Alternative instruments can require different settings.

2. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

(1) Fit the clamp (IAE2R19912) to the manipulator shaft (Tool No. on the upper surface), refer to Figure 11. Use the Allen key and secure loosely.

NOTE: The clamp (IAE2R19912) must be able to slide on the manipulator at this stage.

(2) Attach the lead to the manipulator/flaw detector, apply the distilled or de-ionised water and position the probe (IAE2R19874) on to the working standard (IAE2R19854) (Refer to Figure 9).

(3) With the flat face of the probe seated on the rear face of the working standard and the chamfered corners outward facing, position the probe on the working standard (Refer to Figure 9). The 1.0 mm long by 0.50 mm deep EDM notch is located in the center of the base of the working standard.

NOTE: 1. If calibration is carried out with the working standard in contact with a secondary surface, excessive couplant on the working surface and EDM target surface, can allow transfer of sound into the secondary surface. This can result in a weak signal and incorrect calibration.

2. During calibration make sure that the probe is flat down on the two contact faces of the working standards. Failure to do so can result in incorrect calibration.

3. Make sure that the probe is positioned correctly on the working standard and the reflected signal is not from the corner of the block.

(4) With the probe positioned on the working standard (Refer to Figure 9), identify the response from the EDM target at half skip distance. Maximise the signal response to achieve 70 percent Full Screen Height (FSH) and adjust the range control to position the EDM target signal at five on the timebase. (Refer to Figure 10).

(5) Position the gate between the 3.5 and 7.0 divisions on the time base and set the alarm threshold level at 40 percent FSH.

AV. Install the manipulator (IAE2R19874) and ultrasonic probe into the engine

CAUTION: DUE TO THE SIMILARITY BETWEEN THE INNER AND OUTER DIAMETER INSPECTION TOOLS, CARE MUST BE TAKEN TO ENSURE THE CORRECT PROBE AND WORKING STANDARD HAVE BEEN SELECTED FOR THE RELEVANT INSPECTION.

(1) Position the distilled or de-ionised water container at a suitable position on the engine. Make sure the container is supported above the probe position. Attach the end of the water supply tube to the connector on the rear of the manipulator. Open the valve on the water container and make sure that water flows from the probe face with no sign of air bubbles. When water flows from the probe, close the valve on the water container.

(2) Before installing the manipulator/probe into the engine, make sure all parts are secure. Make sure the attachment bolt for the ultrasonic probe is secure, the spring is not bent and the cable is not damaged. Make sure that the clamp (IAE2R19912) has been attached correctly (Tool No. on upper surface), it is important that it is free to move on the manipulator at this stage. Make sure the water tube is removed from the manipulator assembly to allow the probe to be inserted into the engine.

NOTE: 1. Two standards of bleed air slots may be found on engines. The current modification standard has longer elongated slots (Refer to Figure 16) however a number of engines have an earlier modification standard with smaller square slots. The gaps between the stator platforms are identical; however, the larger slot allows more freedom to allow the probe to fit easily into the gap between the stators. Installing the probe into the smaller slot is more difficult due to the smaller space available; in this case, the probe face initially contacts the corner of the lower stator platform (Refer to Figure 16).

2. To install the probe to the smaller slot, first angle the head of the probe upwards a few degrees by gently rotating the probe head on the attachment bolt. Holding the manipulator as low as possible during entry, will allow the probe to slide upwards as it enters the slot avoiding the corner of the stator. When installed, the manipulator assembly should be pushed on to the liner to ensure contact and to center the probe.

3. During withdrawal, the probe will contact the inner surface of the stator platform preventing withdrawal. By applying gentle pressure to the manipulator, and again adjusting the probe head angle, whilst the probe is still in the engine, the probe will be able to be withdrawn. Excessive force must not be used during removal.

(3) Use CoMat 10-058 to lightly oil the threads of the mounting bolts. Offer the probe to the forward side of the HP compressor bleed valve port (Refer to Figure 2) through the bleed slot adjacent to the flat-headed D bolt. Carefully allow the probe to enter the HP compressor casing until it contacts the ceramic liner. Carefully slide the manipulator mounting plate up to the bleed valve flange. Manually screw the bolts into the bolt holes ensuring the mounting plate remains in contact with the bleed valve flange and the probe manipulator assembly is free to move. Tighten the bolts alternately whilst checking the probe manipulator assembly remains free to move.

NOTE: Do not force the manipulator or damage may occur to the probe and engine.

If the probe is difficult to insert, more material should be removed from the first and second walls of the heatshield retainer.

(4) When correctly installed, the probe manipulator assembly should be able to slide freely in the mounting block and allow the probe to make contact with the liner. Figure 11 shows the manipulator assembly correctly installed to the engine.

NOTE: The clamp (IAE2R19912) must be able to slide on the manipulator allowing the probe to reach the liner of the drum.

If areas of liner loss in the probe path have been identified during the borescope inspection, ensure the probe is seated on the liner surface during the probe "SET" operation. If total liner loss (360°) in the probe path has been identified, the "SET" operation must be carried out on the drum surface. Care must be taken, as any remaining patches of liner will damage the probe.

(5) Rotate the cam until the flat marked "SET" is uppermost (viewed from the cable end of the manipulator) and firmly push the probe onto the drum liner. With the probe contacting the liner surface, slide the clamp against the mounting block ensuring the lower flat on the cam is firmly seated on the mounting block surface. Tighten the clamp screw with the Allen key. The probe is now locked in position, touching the surface with "SET" displayed on the cam.

CAUTION: DO NOT TURN THE HP COMPRESSOR UNTIL CLAMP IS ADJUSTED (INDICATION 'INSPECT' IS SHOWN). THIS CAN CAUSE DAMAGE TO THE PROBE.

(6) Rotate the cam on the clamp (IAE2R19912) until the flat side marked 'INSPECT' is up (view from the cable entry side of the manipulator). Ensure that the ultrasonic probe has been lifted away from the drum liner surface.

NOTE: Manufacturing tolerances within the manipulator can result in a slight contact of the probe with the drum and is acceptable.

AW.Inspect the disc

(1) If the HP compressor is rotated manually, use a borescope to identify a datum feature on the liner or the center position between the two lock nuts on the stage 7 blades (Refer to Figure 17). The borescope must be installed during the inspection to view the datum point. This will ensure that the HP compressor is inspected for one full rotation (360 degrees).

If the HP compressor is rotated with the electronic turning tool, zero the turning tool blade counter prior to starting the rotation.

NOTE: There are 93 stage 7 rotor blades and 84 stage 8 rotor blades.

(2) Open the water couplant valve fully and rotate the HP compressor in an ANTI CLOCKWISE direction to begin the inspection and inspect the full circumference of the disc (Refer to Figure 11).

NOTE: 1. Ultrasonic background structural noise (grass level) must be monitored to ensure correct ultrasonic coupling. Any loss of background noise must be investigated and if necessary the drum re-inspected.

2. The flaw detector must be monitored for signals that move along the timebase in the gated area. Any ultrasonic response that break the alarm gate (40 percent) will cause the engine to be rejected (Refer to Figure 15).

3. Water levels in the container must be monitored during the inspection. If the container is found to be empty during the inspection, the container must be re-filled and the inspection repeated. With the probe operating off the surface of the liner and therefore less restriction to couplant flow, the water container can empty quicker than previously and must be monitored.

4. If liner loss was identified during the inspection for staining/cracking and the HP compressor is rotated manually, the rotation must be carried out carefully and slowly over these areas. Temporarily reverse the rotation of the HP compressor and re-inspect these areas for indications before continuing the inspection.

AX. Remove the probe manipulator assembly from the engine

(1) On completion of the inspection, close the water valve and remove the water supply tube from the manipulator. Undo the bolts and carefully ease the manipulator from the bleed valve port.

NOTE: Remove with care. The socket of the spanner can fall into the engine.

CAUTION: DO NOT USE EXCESSIVE FORCE TO REMOVE THE PROBE MANIPULATOR ASSEMBLY FROM THE ENGINE.

(2) Carefully remove the probe manipulator assembly from the engine.

(3) Make sure all parts of the probe manipulator assembly are present and undamaged and loosen the clamp.

AY.Make a check of the ultrasonic equipment calibration

(1) Make a check of the calibration of the ultrasonic equipment after the inspection is completed. Carry out the check in accordance with paragraph 3.AU. (1) to (4). If the calibration is under sensitive by more than 3dB, re-calibrate the ultrasonic equipment and carry out an inspection of the disc again.

AZ.Accept and reject criteria

(1) For the accept and reject criteria, refer to Non-Modification Service Bulletin V2500-72-0615.

BA.General

Use inspection kit IAE2R19873 to carry out an ultrasonic inspection on the inner diameter of the HP compressor stage 8 disc adjacent to the stage 7-8 EB weld land.

NOTE: In order to reduce the potential for multiple-engine in-flight shutdown, power loss, or other anomaly due to maintenance error, IAE recommends that Operators avoid performing maintenance on multiple engines installed on the same aircraft at the same time. If it is not possible to avoid maintenance on more than one engine of an aircraft at the same time, IAE recommends that additional controls are applied in order to ensure that maintenance tasks have been completed as defined.

WARNING: YOU MUST BE CAREFUL WHEN YOU DO WORK ON THE ENGINE PARTS AFTER THE ENGINE IS STOPPED. THE ENGINE PARTS CAN STAY HOT FOR MORE THAN ONE HOUR.

WARNING: DO NOT TOUCH HOT PARTS WITHOUT APPLICABLE GLOVES. HOT PARTS CAN CAUSE AN INJURY.

(1) Obey all the WARNINGS and CAUTIONS in the procedures that are referred to.

(2) Consumable Materials

(a) Refer to the table that follows:

MATERIAL NO.	DESIGNATION
V01-201	Distilled or De-ionised water
V10-058	Penetrating Oil

For the details of the consumable materials given in the table above, refer to the Aircraft Maintenance Manual (AMM) TASK 70-30-00-910-801.

(3) Tools and Equipment

(a) Refer to the table that follows:

ITEM	DESCRIPTION	TOOL NUMBER
(a)	Inspection kit contains the inner diameter location inspection items (b) to (e) listed in this table and the outer diameter location inspection items (b) to (e) listed in the table in section 3.AQ.(3)(a) of this Non-Modification Service Bulletin	IAE2R19873
(b)	Ultrasonic probe manipulator assembly contains 45 degree shear wave ultrasonic inspection probe	IAE2R19876
(c)	Couplant feed system	IAE2R19807
(d)	Inner diameter location working standard	IAE2R19860
(e)	MCX/BNC lead	IAE2R19755
(f)	Ultrasonic flaw detector, frequency selectable in the 5.0 MHz range with audible/visual electronic alarm gate	Not supplied
(g)	Distilled or De-ionised water	Not supplied
(h)	Turning tool (if applicable)	Not supplied
(i)	4 to 6 mm flexible borescope kit with image capture capability	Not supplied
(j)	8 mm NC-centralising drill bit (90 degree cutting angle, HSCO material TiN coated)	Generic, eg Forum # 4211506022 or equivalent - Not supplied
(k)	Inner diameter location drilling guide tool	IAE1R19881
(l)	Bolts (2 off)	AS48516 or 4W0170 not supplied
(m)	Washers to fit item (j)	Not supplied
(n)	Vacuum cleaner and hose	Not supplied
(o)	Cloth	Not supplied
(p)	Hand-held electric drill	Not supplied
(q)	Penetrating oil	Not supplied
(r)	Portable hand grinding equipment	Not supplied
(s)	Clamp	IAE2R19912

NOTE: 1. The lead for the ultrasonic probe is supplied with a BNC connector installed. An adaptor may be required if alternative equipment is used.

2. The compressor can be turned manually, but an electronic turning tool is recommended to perform the inspection.

3. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

BB.Calibrate the ultrasonic equipment

Range	59mm (nominal)
Material velocity	3100 m/s
Delay	0.00 micro seconds
Frequency	Selectable in the 5.0 MHz range
Damping	50 Ohms
Rectify	Full
Pulser	Single crystal
Gate position	3.0 - 8.0 timebase position

NOTE: 1. The nominal settings above are for a USN 52 or equivalent flaw detector to achieve signal timebase positions. Alternative instruments can require different settings.

2. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

(1) Fit the clamp (IAE2R19912) to the manipulator shaft (Tool No. on the upper surface), refer to Figure 11. Use the Allen key and secure loosely.

NOTE: The clamp (IAE2R19912) must be able to slide on the manipulator at this stage.

(2) Attach the lead to the manipulator/flaw detector, apply the water couplant and position the probe (IAE2R19876) on to the working standard (IAE2R19860) (Refer to Figure 9).

(3) With the flat face of the probe seated on the rear face of the working standard and the chamfered corners outward facing, position the probe on the working standard approximately 10.00 mm from the end as shown (Refer to Figure 9). The EDM target is located on the lower rear edge of the working standard.

NOTE: 1. If calibration is carried out with the working standard in contact with a secondary surface, excessive couplant on the base of the working standard i.e. on the surface with EDM target, may allow transfer of sound through the base of the working standard into the secondary surface. This can result in a weak signal and incorrect calibration.

2. During calibration make sure that the probe is flat down on the two contact faces of the working standards. Failure to do so can result in incorrect calibration.

3. Make sure that the probe is positioned correctly on the working standard and the reflected signal is not from the corner of the block.

(4) With the probe positioned on the working standard (Refer to Figure 9), identify the response from the EDM target at half skip distance. Maximise the signal response to achieve 70 percent Full Screen Height (FSH) and adjust the range control to position the EDM target signal at five on the timebase. (Refer to Figure 10).

(5) Position the gate between the 3.0 and 8.0 divisions on the timebase.

For HP compressor drums of Ti6 material set the alarm threshold level at 30 percent FSH (Refer to Figure 10).

For HP compressor drums of Ti5 material set the alarm threshold level at 55 percent FSH (Refer to Figure 10).

NOTE: For any uncertainty on the 3-8 drum material, refer to the Compliance 1.E. of Non-Modification Service Bulletin V2500-ENG-72-0615.

BC. Install the manipulator and ultrasonic probe (IAE2R19876) into the engine

CAUTION: DUE TO THE SIMILARITY BETWEEN THE INNER AND OUTER DIAMETER INSPECTION TOOLS, CARE MUST BE TAKEN TO ENSURE THE CORRECT PROBE AND WORKING STANDARD HAVE BEEN SELECTED FOR THE RELEVANT INSPECTION.

(1) Position the distilled or de-ionised water container at a suitable position on the engine. Make sure the container is supported above the probe position. Attach the end of the water supply tube to the connector on the rear of the manipulator. Open the valve on the water container and make sure that water flows from the probe face with no sign of air bubbles. When water flows from the probe, close the valve on the water container.

(2) Before installing the manipulator/probe into the engine, make sure all parts are secure. Make sure the attachment bolt for the ultrasonic probe is secure, the spring is not bent and the cable is not damaged. Make sure that the clamp (IAE2R19912) has been attached correctly (Tool No. on upper surface), it is important that it is free to move on the manipulator at this stage. Make sure the water tube is removed from the manipulator assembly to allow the probe to be inserted into the engine.

NOTE: 1. Two standards of bleed air slots may be found on engines. The current modification standard has longer elongated slots (Refer to Figure 16) however a number of engines have an earlier modification standard with smaller square slots. The gaps between the stator platforms are identical; however, the larger slot allows more freedom to allow the probe to fit easily into the gap between the stators. Installing the probe into the smaller slot is more difficult due to the smaller space available; in this case, the probe face initially contacts the corner of the lower stator platform (Refer to Figure 16).

2. To install the probe to the smaller slot, first angle the head of the probe upwards a few degrees by gently rotating the probe head on the attachment bolt. Holding the manipulator as low as possible during entry, will allow the probe to slide upwards as it enters the slot avoiding the corner of the stator. When installed, the manipulator assembly should be pushed on to the liner to ensure contact and to center the probe.

3. During withdrawal, the probe will contact the inner surface of the stator platform preventing withdrawal. By applying gentle pressure to the manipulator, and again adjusting the probe head angle, whilst the probe is still in the engine, the probe will be able to be withdrawn. Excessive force must not be used during removal.

(3) Use CoMat 10-058 to lightly oil the threads of the mounting bolts. Offer the probe to the forward side of the HP compressor bleed valve port (Refer to Figure 2) through the bleed slot adjacent to the flat-headed D bolt. Carefully allow the probe to enter the HP compressor casing until it contacts the ceramic liner. Carefully slide the manipulator mounting plate up to the bleed valve flange. Manually screw the bolts into the bolt holes ensuring the mounting plate remains in contact with the bleed valve flange and the probe manipulator assembly is free to move. Tighten the bolts alternately whilst checking the probe manipulator assembly remains free to move.

NOTE: Do not force the manipulator or damage may occur to the probe and engine.

If the probe is difficult to insert, more material should be removed from the first and second walls of the heatshield retainer.

(4) When correctly installed, the probe manipulator assembly should be able to slide freely in the mounting block and allow the probe to make contact with the liner. Figure 11 shows the manipulator assembly correctly installed to the engine.

NOTE: The clamp (IAE2R19912) must be able to slide on the manipulator allowing the probe to reach the liner of the drum.

If areas of liner loss in the probe path have been identified during the borescope inspection, ensure the probe is seated on the liner surface during the probe "SET" operation. If total liner loss (360°) in the probe path has been identified, the "SET" operation must be carried out on the drum surface. Care must be taken, as any remaining patches of liner will damage the probe.

(5) Rotate the cam until the flat marked "SET" is uppermost (viewed from the cable end of the manipulator) and firmly push the probe onto the drum liner. With the probe contacting the liner surface, slide the clamp against the mounting block ensuring the lower flat on the cam is firmly seated on the mounting block surface. Tighten the clamp screw with the Allen key. The probe is now locked in position, touching the surface with "SET" displayed on the cam.

CAUTION: DO NOT TURN THE HP COMPRESSOR UNTIL CLAMP IS ADJUSTED (INDICATION 'INSPECT' IS SHOWN). THIS CAN CAUSE DAMAGE TO THE PROBE.

(6) Rotate the cam on the clamp (IAE2R19912) until the flat side marked 'INSPECT' is up (view from the cable entry side of the manipulator). Ensure that the ultrasonic probe has been lifted away from the drum liner surface.

NOTE: Manufacturing tolerances within the manipulator can result in a slight contact of the probe with the drum and is acceptable.

BD.Inspect the disc

(1) If the HP compressor is rotated manually, use a borescope to identify a datum feature on the liner or the center position between the two lock nuts on the stage 7 blades (Refer to Figure 17). The borescope must be installed during the inspection to view the datum point. This will ensure that the HP compressor is inspected for one full rotation (360 degrees).

If the HP compressor is rotated with the electronic turning tool, zero the turning tool blade counter prior to starting the rotation.

NOTE: There are 93 stage 7 rotor blades and 84 stage 8 rotor blades.

(2) Open the water couplant valve fully and rotate the HP compressor in an ANTI CLOCKWISE direction to begin the inspection and inspect the full circumference of the disc (Refer to Figure 11).

NOTE: 1. Ultrasonic background structural noise (grass level) must be monitored to ensure correct ultrasonic coupling. Any loss of background noise must be investigated and if necessary the drum re-inspected.

2. The flaw detector must be monitored for signals that move along the timebase in the gated area. Any ultrasonic response that break the alarm gate (30 percent or 55 percent) will cause the engine to be rejected (Refer to Figure 15).

3. Water levels in the container must be monitored during the inspection. If the container is found to be empty during the inspection, the container must be re-filled and the inspection repeated. With the probe operating off the surface of the liner and therefore less restriction to couplant flow, the water container can empty quicker than previously and must be monitored.

4. If liner loss was identified during the inspection for staining/cracking and the HP compressor is rotated manually, the rotation must be carried out carefully and slowly over these areas. Temporarily reverse the rotation of the HP compressor and re-inspect these areas for indications before continuing the inspection.

BE.Remove the probe manipulator assembly from the engine

(1) After completion of the inspection, close the water valve and remove the water supply tube from the manipulator. Undo the bolts and carefully ease the manipulator from the bleed valve port.

NOTE: Remove with care. The socket of the spanner can fall into the engine.

CAUTION: DO NOT USE EXCESSIVE FORCE TO REMOVE THE PROBE MANIPULATOR ASSEMBLY FROM THE ENGINE.

(2) Make sure all parts of the probe manipulator assembly are present and undamaged.

BF.Make a check of the ultrasonic equipment calibration

(1) Make a check of the calibration of the ultrasonic equipment after the inspection is completed. Carry out the check in accordance with paragraph 3.BB. (1) to (4). If the calibration is under sensitive by more than 3dB, re-calibrate the ultrasonic equipment and carry out an inspection of the disc again.

(2) If the calibration is satisfactory, disconnect the turning tool and remove it from the engine

(a) Remove the turning tool from the accessory gearbox in accordance with the manufacturer's operating instructions (Refer to the Aircraft Maintenance Manual, TASK 72-00-02-290-802) OR

(b) Remove the hand turning tool from the accessory gearbox (Refer to the Aircraft Maintenance Manual, TASK 72-00-00-810-801).

NOTE: 1. All equipment including the probe manipulator assembly water supply tube and the water bottle should be thoroughly drained and dried before storing, to prevent corrosion.

2. Due to the similarity between the inner and outer diameter inspection kits, care must be taken to ensure the correct probes and working standards are replaced in the correct storage cases. Part numbers of the individual tools are marked on the case labels and on the tools.

BG. Accept and reject criteria

(1) For the accept and reject criteria, refer to Non-Modification Service Bulletin V2500-ENG-72-0615.

BH. Install the HP stage 7A bleed valve air duct on the upper left side of the engine.

(1) Install the HP stage 7A bleed valve air duct together with the HP compressor stage 7A bleed valve

(a) Lubricate all threads and abutment faces of nuts and bolts with CoMat 10-077 (approved engine oil) and CoMat 10-094 (anti seize compound).

(b) Put the duct in position on the HP compressor case (with the angle duct to the top) and align the bolt holes.

(c) Install the 12 bolts together with the bracket. Torque the bolts to 85 to 105 lbf in. (10 to 12 Nm).

BI. Make sure that the work area is clean and clear of tools, equipment and other unwanted materials.

BJ. Close the access to the HP compressor stage 7A bleed valve aperture that is installed on the left side of the engine

(1) Close the cowl doors (Refer to the Aircraft Maintenance Manual, Chapter 71-13-00).

(2) Do a idle leak check (Refer to the Aircraft Maintenance Manual, Chapter 71-00-00).

BK. Recording Instructions

(1) A record of accomplishment is required. Complete a separate Accomplishment Proforma for outer and inner diameter contained in Non-Modification Service Bulletin V2500-ENG-72-0615.

(2) Record the incorporation of Non-Modification Service Bulletin V2500-ENG-72-0638 in the applicable engine records.

(3) If the heatshield rework was performed make a note of this in the engine records.

INSTRUCTION II - APPLICABLE FOR ENGINES "AT OVERHAUL/SHOP VISIT"

Part A - Applicable for V2500-A1 Engines

BL.General

Use the new inspection kit IAE2R19882 or the old inspection kit IAE2R19864 to carry out an ultrasonic inspection on the outer diameter of the HP compressor stage 8 disc adjacent to the stage 7-8 EB weld land.

(1) Obey all the WARNINGS and CAUTIONS in the procedures that are referred to.

(2) Consumable Materials

(a) Refer to the table that follows:

MATERIAL NO.	DESIGNATION
01-201	Distilled or De-ionised water
10-058	Penetrating Oil

For the details of the consumable materials given in the table above, refer to the Overhaul Processes and Consumables Index.

(3) Tools and Equipment

(a) Refer to the table that follows:

ITEM	DESCRIPTION	TOOL NUMBER
(a)	Inspection kit contains the outer diameter location inspection kit of item (b) in this table and the inner diameter location inspection kit of item (b) of the table in section 3.BV.(3)(a) of this Non-Modification Service Bulletin) OR	IAE2R19882
(b)	Outer diameter location inspection kit *(contains items (c) to (g)	IAE2R19864
(c)	Ultrasonic probe manipulator assembly	IAE2R19865
(d)	Couplant feed manipulator	IAE2R19867
(e)	Couplant feed system	IAE2R19807
(f)	Working standard	IAE2R19854
(g)	MCX/BNC lead	IAE2R19755
(h)	Ultrasonic flaw detector, frequency selectable in the 5.0 MHz range with audible/visual electronic alarm gate	Not supplied
(i)	4 to 6 mm flexible borescope kit with image capture capability	Not supplied
(j)	Turning tool (if applicable)	Not supplied
(k)	Bolts (2 off)	AS48516 or 4W0170 not supplied

(l)	Washers to fit item (k)	Not supplied

NOTE: 1. The lead for the ultrasonic probe is supplied with a BNC connector installed. An adaptor may be required if alternative equipment is used.

2. The compressor can be turned manually, but an electronic turning tool is recommended to perform the inspection.

3. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

BM. Get access to the HP compressor stage 7 bleed valve aperture that is installed on the left side of the engine.

BN. Remove the stage 7 air off-take duct from the left side of the engine (Refer to the Engine Manual, Chapter 72-00-40 and to Figure 1 of this Service Bulletin).

B0. Install the turning tool and the borescope

(1) Install the turning tool to the accessory gearbox in accordance with the manufacturer's operating instructions. Install the V2500 A1 software module on the control unit, set the HP compressor rotation speed to the slowest (10 minutes per revolution). Set the HP compressor stage to HPC8 and engage continuous rotation mode.

OR

(2) Install the hand turning tool to the accessory gearbox.

(3) Inspect the stage 7-8 stator for ceramic liner loss in accordance with Engine Manual (EM), TASK 72-00-00-200-002-A00/B00.

(a) If the condition of the ceramic liner is not acceptable as per EM, remove the engine in accordance with the EM or before the drum reaches the applicable USI threshold (Refer to paragraph 1.E. Compliance of Non-Modification Service Bulletin V2500-ENG-72-0615), whatever comes first.

(b) If the condition of the ceramic liner is acceptable as per EM, perform a borescope check on the full circumference if the ceramic liner meets the requirements to be inspected with the ultrasonic equipment.

NOTE: The USI probe must run on the surface of the ceramic liner, not on the surface of the bondcoat underneath the ceramic liner as this can damage/break the probe. A wear line on the liner may be visible at the trailing edge of the stators, this is the approximate seating position of the ultrasonic probe and particular attention should be given to this area around the circumference of the drum (Refer to Figure 7).

(c) Liner loss underneath the path of the probe can damage/break the probe. Lifting of the probe from the surface of the liner to avoid liner loss areas greater in size than the probe head is not acceptable. If ceramic liner loss is found beyond the requirements necessary to perform an ultrasonic inspection, remove the engine before the drum reaches the applicable USI threshold (Refer to paragraph 1.E. Compliance of Non-Modification Service Bulletin V2500-ENG-72-0615).

(4) Inspect the stage 7-8 stator ceramic liner for staining and/or axial cracking (Refer to Figure 8).

(a) If staining and /or cracking is found in the specific area as shown in Figure 8, reject the Engine before next flight.

NOTE: Only findings located at the trailing edge of the vane contact area are relevant, findings in other areas can be disregarded.

The main direction of crack progression, is axial on the ceramic liner.

(b) If no staining and /or cracking is found, proceed with paragraph 3.BP.

BP.Calibrate the ultrasonic equipment

Range	28 mm (nominal)
Material velocity	3100 m/s
Delay	0.00 micro seconds
Frequency	Selectable in the 5.0 MHz range
Damping	50 Ohms
Rectify	Full
Pulser	Single crystal
Gate position	3.5 - 7.0 timebase position

NOTE: 1. The nominal settings above are for a USN 52 or equivalent flaw detector to achieve approximate signal timebase positions. Alternative instruments may require different settings.

2. For calibration purposes the couplant feed manipulator should be detached as described in BQ. (4) thru (7) in REVERSE order.

3. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

(1) Attach the lead to the manipulator/flaw detector, apply the distilled or de-ionised water and position the probe (IAE2R19865) on to the working standard (IAE2R19854) (Refer to Figure 9).

(2) Position the probe on the working standard with the flat face on the working standard and the probe mounting screw facing the working standard. Make sure attachment bolt for the ultrasonic probe is secure, the spring is not bent and the cable is not damaged. The 0.04 in. long by 0.02 in. deep (1,0 mm l by 0,5 mm) EDM target is located in the center of the base of the working standard (Refer to Figure 10).

NOTE: 1. If calibration is carried out with the working standard in contact with a secondary surface, excessive couplant on the working surface and EDM target surface, may allow transfer of sound into the secondary surface. This can result in a weak signal and incorrect calibration.

2. During calibration make sure that the probe is fully flat down on the two contact faces of the working standard. Failure to do so can result in incorrect calibration.

3. Make sure that the probe is positioned correctly on the working standard and the reflected signal is not from the corner of the block.

(3) With the probe positioned on the working standard (Refer to Figure 9), identify the response from the EDM target at half skip distance. Maximize the signal response to achieve 70 percent Full Screen Height (FSH) and adjust the range control to position the EDM target signal at five on the timebase (Refer to Figure 10).

(4) Position the gate between the 3.5 and 7.0 divisions on the timebase and set the alarm threshold level at 40 percent FSH.

BQ.Install the manipulator and ultrasonic probe (IAE2R19865) into the engine

CAUTION: DUE TO THE SIMILARITY BETWEEN THE INNER AND OUTER DIAMETER INSPECTION TOOLS, CARE MUST BE TAKEN TO ENSURE THE CORRECT PROBE AND WORKING STANDARD HAVE BEEN SELECTED FOR THE RELEVANT INSPECTION.

(1) Position the distilled or de-ionised water container at a suitable position on the engine. Make sure the container is supported above the probe position. Attach the end of the water supply tube to the connector on the rear of the manipulator. Open the valve on the water container and make sure that water flows from the probe face with no sign of air bubbles. When water flows from the probe, close the valve on the water container.

(2) Before installing the manipulator/probe into the engine, make sure all parts are secure. Make sure the attachment bolt for the ultrasonic probe is secure, the spring is not bent and the cable is not damaged. Make sure the water tube is removed from the manipulator assembly to allow the probe to be inserted into the engine.

NOTE: Figure 11 shows the component parts of the probe assembly. Figure 11 shows the fully assembled probe and couplant feed tube correctly assembled.

CAUTION: DO NOT APPLY FORCE TO THE MANIPULATOR OR DAMAGE MAY OCCUR TO THE PROBE AND ENGINE.

(3) Use CoMat 10-058 to lightly oil the threads of the mounting bolts. Position the probe manipulator arm to the forward side of the HP compressor bleed valve port with the manipulator lock plate closed. Make sure that the probe arm is installed to the correct bleed valve aperture (Refer to Figure 11). Install the probe into the HP compressor case until it contacts the ceramic liner. Slide the manipulator mount plate up to the flange of the bleed valve. Hold the mount plate in contact with the flange of the bleed valve and install the bolts by hand. Make sure the probe manipulator assembly is free to move and tighten the bolts.

NOTE: When correctly installed, the probe manipulator assembly should be able to slide freely in the mount plate and be able to make contact with the liner.

(4) Open the manipulator lock plate and carefully install the couplant manipulator into the same aperture and above the probe manipulator.

(5) Make sure that the probe and couplant arms are contacting the ceramic liner and tighten the spring clamp.

(6) Retract the tension spring lock plate until it can be installed over the couplant arm mount boss (Refer to Figure 11).

(7) Make sure the probe and couplant arms are exactly aligned and tighten the spring clamp.

(8) Connect the couplant feed system to the couplant feed manipulator

NOTE: Figure 11 shows the ultrasonic probe manipulator assembly correctly installed on the engine.

Make sure that the couplant feed manipulator is not mounted forward of the probe, this will prevent reliable contact with the liner. When the couplant feed tube and probe manipulator are correctly aligned, the assembly is correctly installed.

BR.Inspect the disc

(1) Open the water couplant valve to fully open and turn the HP compressor in a CLOCKWISE direction until the probe is positioned between the two locking nuts of the stage 7 locking blades (Refer to Figure 17). Apply light inward pressure and make sure the probe is coupled with the liner by watching the flaw detector timebase response. Withdraw the probe manipulator assembly slightly and watch the change in timebase display when the probe is not coupled. Return the probe to the coupled position.

NOTE: Water levels in the container must be monitored through the inspection. If the container is found to be empty during the inspection, the container must be refilled and the inspection repeated.

(2) When the probe is coupled, zero the turning tool counter number datum and begin the inspection. If the HP compressor is being turned manually, use a borescope to locate a datum feature that can be used to confirm a complete rotation of the drum. This will ensure that the HP compressor is inspected for one full rotation (360 degrees).

If the HP compressor is rotated with the electronic turning tool, zero the turning tool blade counter prior to starting the rotation.

NOTE: There are 93 stage 7 rotor blades and 89 stage 8 rotor blades.

NOTE: 1. During inspection monitor the distilled or de-ionised water level, replenish as necessary.

(3) The flaw detector should be monitored for signals that move along the timebase in the gated area. Any ultrasonic responses that break the alarm gate, will cause the engine to be rejected (Refer to Figure 10).

(4) Cracks that have developed on the inner surface of the disc will appear (maximize) within the gate on the timebase at half skip distance (Refer to Figure 10).

(5) Inspect the full circumference of the disc.

(6) If turning tool is used, record the amplitude and timebase position indications over the threshold. Record the degree position on the accomplishment proforma contained in Non-Modification Service Bulletin V2500-ENG-72-0615.

CAUTION: LIFT THE PROBE CLEAR OF THE CERAMIC LINER BEFORE YOU REVERSE THE DIRECTION OF THE HP COMPRESSOR, TO PREVENT DAMAGE TO THE PROBE.

(7) If the probe 'picks up' or 'chatters' when the HP compressor is rotated in a clockwise direction, Rotate the HP compressor in a counterclockwise direction and repeat the inspection.

NOTE: 1. It is expected that there may be differences in signals when the HP compressor is rotated in different directions. This is because the direction of rotation changes the way the probe sits on the liner. Additionally, the water comes in from one direction only, which affects the function of the couplant, It is recommended not to change the direction of rotation during an inspection pass.

2. The results of the borescope inspection for liner cracks or staining determine further engine serviceability.

BS. Remove the probe manipulator assembly from the engine

(1) After the inspection is complete, close the water valve and remove the water supply tube from the couplant manipulator assembly. Slacken the manipulator lock plate screw, remove the couplant manipulator assembly, remove the couplant manipulator assembly from the bleed valve aperture.

CAUTION: DO NOT USE EXCESSIVE FORCE TO REMOVE THE PROBE MANIPULATOR ASSEMBLY FROM THE ENGINE.

(2) Close the lock plate and remove the flange mount bolts. Carefully remove the probe manipulator assembly from the engine.

(3) Make sure all parts of the probe manipulator assembly are present and undamaged.

BT. Make a check of the ultrasonic equipment calibration

(1) Make a check of the calibration of the ultrasonic equipment after the inspection is completed. Carry out the check in accordance with paragraph 3.BP. (1) to (4). If the calibration is under sensitive by more than 3dB, re-calibrate the ultrasonic equipment and carry out an inspection of the disc again.

BU. Accept and reject criteria

(1) For the accept and reject criteria, refer to Non-Modification Service Bulletin V2500-ENG-72-0615.

BV.General

Use the new inspection kit IAE2R19882 or the old inspection kit IAE2R19869 to carry out an ultrasonic inspection on the inner diameter of the HP compressor stage 8 disc adjacent to the 7-8 EB weld land.

(1) Obey all the WARNINGS and CAUTIONS in the procedures that are referred to.

(2) Consumable Materials

(a) Refer to the table that follows:

MATERIAL NO.	DESIGNATION
01-201	Distilled or De-ionised water
10-058	Penetrating Oil

For the details of the consumable materials given in the table above, refer to the Overhaul Processes and Consumables Index.

(3) Tools and Equipment

(a) Refer to the table that follows:

ITEM	DESCRIPTION	TOOL NUMBER
(a)	Inspection kit contains the inner diameter location inspection kit of item (b) in this table and the outer diameter location inspection kit of item (b) of the table in section 3.BL.(3)(a) of this Non-Modification Service Bulletin. OR	IAE2R19882
(b)	Inspection kit *(contains items (c) to (g)	IAE2R19869
(c)	Ultrasonic probe manipulator assembly	IAE2R19870
(d)	Couplant feed manipulator	IAE2R19871
(e)	Couplant feed system	IAE2R19807
(f)	Working standard	IAE2R19860
(g)	MCX/BNC lead	IAE2R19755
(h)	Ultrasonic flaw detector, frequency selectable in the 5.0 MHz range with audible/visual electronic alarm gate	Not supplied
(i)	4 to 6 mm flexible borescope kit with image capture capability	Not supplied
(j)	Turning tool (if applicable)	Not supplied
(k)	Bolts (2 off)	AS48516 or 4W0170 not supplied

(l)	Washers to fit item (k)	Not supplied

NOTE: 1. The lead for the ultrasonic probe is supplied with a BNC connector installed. An adaptor may be required if alternative equipment is used.

2. The compressor can be turned manually, but an electronic turning tool is recommended to perform the inspection.

3. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

BW.Calibrate the ultrasonic equipment

Range	59 mm (nominal)
Material velocity	3100 m/s
Delay	0.00 micro seconds
Frequency	Selectable in the 5.0 MHz range
Damping	50 Ohms
Rectify	Full wave
Pulser	Single crystal
Gate position	3.0 - 8.0 timebase position

NOTE: 1. The nominal settings above are for a USN 52 or equivalent flaw detector to achieve signal timebase positions. Alternative instruments may require different settings.

2. For calibration purposes the couplant feed manipulator should be detached as described in BP.(4) thru (7) in REVERSE order.

3. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

(1) Attach the lead to the manipulator/flaw detector, apply the distilled or de-ionised water and position the probe (IAE2R19870) on to the working standard (IAE2R19860) (Refer to Figure 9).

(2) Position the probe on the working standard with the flat face on the working standard and the probe mounting screw facing the working standard. Make sure the attachment bolt for the ultrasonic probe is secure, the spring is not bent and the cable is not damaged.

NOTE: 1. If calibration is carried out with the working standard in contact with a secondary surface, excessive couplant on the working surface and EDM target surface, may allow transfer of sound into the secondary surface. This can result in a weak signal and incorrect calibration.

2. During calibration make sure that the probe is flat down on the two contact faces of the working standard. Failure to do so can result in incorrect calibration.

3. Make sure the probe is positioned correctly on the working standard and the reflected signal is not from the corner of the block.

(3) With the probe positioned on the working standard (Refer to Figure 9), identify the response from the EDM target at half skip distance. Maximize the signal response to achieve 70 percent Full Screen Height (FSH) and adjust the range control to position the EDM target signal at five on the timebase. (Refer to Figure 10).

(4) Position the gate between the 3.0 and 8.0 divisions on the timebase.

For HP compressor drums of Ti6 material set the alarm threshold level at 30 percent FSH (Refer to Figure 10).

For HP compressor drums of Ti5 material set the alarm threshold level at 55 percent FSH (Refer to Figure 10).

NOTE: For any uncertainty on the 3-8 drum material, refer to the Compliance 1.E. of Non-Modification Service Bulletin V2500-ENG-72-0615.

BX. Install the manipulator and ultrasonic probe (IAE2R19870) into the engine

CAUTION: DUE TO THE SIMILARITY BETWEEN THE INNER AND OUTER DIAMETER INSPECTION TOOLS, CARE MUST BE TAKEN TO ENSURE THE CORRECT PROBE AND WORKING STANDARD HAVE BEEN SELECTED FOR THE RELEVANT INSPECTION.

(1) Position the distilled or de-ionised water container at a suitable position on the engine. Make sure the container is supported above the probe position. Attach the end of the water supply tube to the connector on the rear of the manipulator. Open the valve on the water container and make sure that water flows from the probe face with no sign of air bubbles. When water flows from the probe, close the valve on the water container.

(2) Before installing the manipulator/probe into the engine, make sure all parts are secure. Make sure the attachment bolt for the ultrasonic probe is secure, the spring is not bent and the cable is not damaged. Make sure the water tube is removed from the manipulator assembly to allow the probe to be inserted into the engine.

NOTE: Figure 11 shows the component parts of the probe assembly. Figure 11 shows the fully assembled probe and couplant feed tube correctly assembled.

CAUTION: DO NOT APPLY FORCE TO THE MANIPULATOR OR DAMAGE MAY OCCUR TO THE PROBE AND ENGINE.

(3) Use CoMat 10-058 to lightly oil the threads of the mounting bolts. Position the probe manipulator arm to the forward side of the HP compressor bleed valve port with the manipulator lock plate closed. Make sure that the probe arm is installed to the correct bleed valve aperture (Refer to Figure 2). Install the probe into the HP compressor case until it contacts the ceramic liner. Slide the manipulator mount plate up to the flange of the bleed valve. Hold the mount plate in contact with the flange of the bleed valve and install the bolts by hand. Make sure the probe manipulator assembly is free to move and tighten the bolts.

NOTE: When correctly installed, the probe manipulator assembly should be able to slide freely in the mount plate and be able to make contact with the liner.

(4) Open the manipulator lock plate and carefully install the couplant manipulator into the same aperture and above the probe manipulator.

(5) Make sure that the couplant arm is correctly installed into the mount plate groove and close the lock plate.

(6) Retract the tension spring lock plate until it can be installed over the couplant arm mount boss (Refer to Figure 11).

(7) Make sure the probe and couplant arms are contacting the ceramic lining and tighten the spring clamp.

(8) Connect the couplant feed system to the couplant feed manipulator.

NOTE: Figure 11 shows the ultrasonic probe manipulator assembly correctly installed on the engine.

Make sure that the couplant feed manipulator is not mounted forward of the probe, this will prevent reliable contact with the liner. When the couplant feed tube and probe manipulator are correctly aligned, the assembly is correctly installed.

BY.Inspect the disc

(1) Open the water couplant valve to fully open and turn the HP compressor in a clockwise direction until the probe is positioned between the two locking nuts of the stage 7 locking blades (Refer to Figure 17). Apply light inward pressure and make sure the probe is coupled with the liner by watching the flaw detector timebase response. Withdraw the probe manipulator assembly slightly and watch the change in timebase display when the probe is not coupled. Return the probe to the coupled position.

(2) When the probe is coupled, zero the turning tool counter number datum and begin the inspection. If the HP compressor is being turned manually, use a borescope to locate a datum feature that can be used to confirm a complete rotation of the drum. This will ensure that the HP compressor is inspected for one full rotation (360 degrees).

If the HP compressor is rotated with the electronic turning tool, zero the turning tool blade counter prior to starting the rotation.

NOTE: There are 93 stage 7 rotor blades and 89 stage 8 rotor blades.

NOTE: 1. The flaw detector timebase signals must be constantly monitored during the inspection, as no back-wall or geometry signals appear on the timebase and loss of coupling could occur at any time.

2. During inspection monitor the distilled or de-ionised water level, replenish as necessary.

(3) The flaw detector should be monitored for signals that move along the timebase in the gated area. Any ultrasonic responses that break the alarm gate, will cause the engine to be rejected (Refer to Figure 15).

(4) Cracks that have developed on the inner surface of the disc will appear (maximize) within the gate on the timebase at half skip distance (Refer to Figure 15).

(5) Inspect the full circumference of the disc, if the ceramic liner allows.

(6) If turning tool is used, record the amplitude and timebase position indications over the threshold. Record the degree position on the accomplishment proforma contained in Non-Modification Service Bulletin V2500-ENG-72-0615.

CAUTION: LIFT THE PROBE CLEAR OF THE CERAMIC LINER BEFORE YOU REVERSE THE DIRECTION OF THE HP COMPRESSOR, TO PREVENT DAMAGE TO THE PROBE.

(7) If the probe 'picks up' or 'chatters' when the HP compressor is rotated in a clockwise direction, Rotate the HP compressor in a counterclockwise direction and repeat the inspection.

NOTE: 1. It is expected that there may be differences in signals when the HP compressor is rotated in different directions. This is because the direction of rotation changes the way the probe sits on the liner. Additionally, the water comes in from one direction only, which affects the function of the couplant, It is recommended not to change the direction of rotation during an inspection pass.

2. The results of the borescope inspection for liner cracks or staining determine further engine serviceability.

BZ.Remove the probe manipulator assembly from the engine

(1) After the inspection is complete, close the water valve and remove the water supply tube from the couplant manipulator assembly. Slacken the manipulator lock plate screw and spring clamp screw, remove the couplant manipulator assembly from the bleed valve aperture.

CAUTION: DO NOT USE EXCESSIVE FORCE TO REMOVE THE PROBE MANIPULATOR ASSEMBLY FROM THE ENGINE.

(2) Close the lock plate and remove the flange mount bolts. Carefully remove the probe manipulator assembly from the engine.

(3) Make sure all parts of the probe manipulator assembly are present and undamaged.

CA.Make a check of the ultrasonic equipment calibration

(1) Make a check of the calibration of the ultrasonic equipment after the inspection is completed. Carry out the check in accordance with paragraph 3.BW. (1) to (3). If the calibration is under sensitive by more than 3dB, re-calibrate the ultrasonic equipment and carry out an inspection of the disc again.

(2) If the calibration is satisfactory, disconnect the turning tool and remove from the engine

(a) Remove the turning tool from the accessory gearbox in accordance with the manufacturer's operating instructions.

OR

(b) Remove the hand turning tool from the accessory gearbox.

NOTE: 1. All equipment including the probe manipulator assembly water supply tube and the water bottle should be thoroughly drained and dried before storing, to prevent corrosion.

2. Due to the similarity between the inner and outer diameter inspection kits, care must be taken to ensure the correct probes and working standards are replaced in the correct storage cases. Part numbers of the individual tools are marked on the case labels and on the tools.

CB.Accept and reject criteria

(1) For the accept and reject criteria, refer to Non-Modification Service Bulletin V2500-ENG-72-0615.

CC. Install the stage 7 air off-take duct on the left side of the engine (Refer to the Engine Manual, Chapter 72-00-40).

CD. Make sure that the work area is clean and clear of tools, equipment and other unwanted materials.

CE. Recording Instructions

(1) A record of accomplishment is required. Complete a separate Accomplishment Proforma for outer and inner diameter contained in Non-Modification Service Bulletin V2500-ENG-72-0615.

(2) Record the incorporation of Non-Modification Service Bulletin V2500-ENG-72-0638 in the applicable engine records.

Part B - Applicable for V2500-A5 Engines

CF.General

Use the new inspection kit IAE2R19878 or the old inspection kit IAE2R19851 to carry out an ultrasonic inspection on the outer diameter of the HP compressor stage 8 disc adjacent to the stage 7-8 EB weld land.

(1) Obey all the WARNINGS and CAUTIONS in the procedures that are referred to.

(2) Consumable Materials

(a) Refer to the table that follows:

MATERIAL NO.	DESIGNATION
CoMat 01-201	Distilled or De-ionised water
CoMat 10-058	Penetrating Oil
CoMat 06-064	Fluorescent Penetrant
CoMat 05-020	Waterproof Abrasive Paper
CoMat 05-021	Waterproof Abrasive Paper
CoMat 05-074	Aluminum Oxide Abrasive Paper

For the details of the consumable materials given in the table above, refer to the Overhaul Processes and Consumables Index (PCI).

TASK identified by SPP TASK are in the Standard Practices Manual.

TASKs identified by EM TASK are in the Engine Manual.

(3) Tools and Equipment

(a) For inspection of the outer diameter location:

ITEM	DESCRIPTION	TOOL NUMBER
(a)	Inspection kit contains outer diameter inspection kit of item (b) in this table and the inner diameter inspection kit of item (b) of the table in section 3.CP.(3)(a) of this Non-Modification Service Bulletin. OR	IAE2R19878
(b)	Outer diameter location inspection kit *(contains items (c) to (f)	IAE2R19851
(c)	Ultrasonic probe manipulator assembly contains 45 degree shear wave ultrasonic inspection probe	IAE2R19852 or IAE2R19879
(d)	Couplant feed system	IAE2R19807
(e)	Outer diameter location working standard	IAE2R19854
(f)	MCX/BNC lead	IAE2R19755
(g)	Ultrasonic flaw detector, frequency selectable in the 5.0 MHz range with audible/visual electronic alarm gate	Not supplied

(h)	Distilled or De-ionised water	Not supplied
(i)	Turning tool (if applicable)	Not supplied
(j)	4 to 6 mm flexible borescope kit with image capture capability	Not supplied
(k)	8 mm NC-centralising drill bit (90 degree cutting angle, HSCO material, TiN coated)	Generic, eg Forum # 4211506022 or equivalent - Not supplied
(l)	Outer diameter location drilling guide tool	IAE1R19877 or IAE1R19861
(m)	Bolts (2 off)	AS48516 or 4W0170 not supplied
(n)	Washers to fit item (m)	Not supplied
(o)	Vacuum cleaner and hose	Not supplied
(p)	Cloth	Not supplied
(q)	Hand-held electric drill	Not supplied
(r)	Penetrating oil	Not supplied
(s)	Portable hand grinding equipment	Not supplied
(t)	Clamp	IAE2R19912

NOTE: 1. The lead for the ultrasonic probe is supplied with a BNC connector installed. An adaptor may be required if alternative equipment is used.

2. The compressor can be turned manually, but an electronic turning tool is recommended to perform the inspection.

3. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

4. Drilling guide tool IAE1R9861 can be reworked to IAE1R19877, for details contact your local IAE Representative.

5. The outer diameter drilling guide tool number is identical to the inner diameter location drilling guide tool number.

CG. Get access to the HP compressor stage 7 bleed valve aperture that is installed on the left side of the engine.

CH. Remove the HP stage 7 bleed valve air duct from the left side of the engine.

(1) Remove the HP stage 7 bleed valve air duct together with the HP compressor stage 7 bleed valve (Refer to the Engine Manual, Chapter 72-00-40 and to Figure 1)

(a) Apply the approved penetrating oil CoMat 10-058 before the removal of threaded parts. Let the parts soak at least 15 minutes.

(b) Seal all openings to prevent contamination from unwanted materials.

(c) Remove the coupling that attaches the IP bleed check valve to the HP7 bleed valve/cabin air duct (Refer to the Engine Manual, Chapter 71-00-02).

(d) Carefully overcome the initial torque of each bolt of the flange to the duct.

(e) Carefully loosen each bolt of the flange to the duct. If excessive resistance is encountered, apply more penetrating oil and allow the bolts to soak for at least 15 minutes before proceeding.

NOTE: Make sure you use the correct size tool for the bolt head and do not force the bolt excessively during the removal process.

(f) Repeat step (e) until all bolts have been removed successfully.

(g) Remove the duct.

(h) If a bolt was broken during the removal process, perform the steps that follow:

(i) Remove broken bolts and/or studs by mechanical removal methods.

(ii) Drill a hole into the end of the broken bolt and/or stud. Refer to the tool manufacturer's instructions for the correct size of drill.

(iii) Put an extraction tool into the drilled hole and lock into position.

(iv) Turn the extraction tool to remove the broken bolt.

(v) Tap the threads if necessary to clean or chase the threads.

(vi) Examine the threads for damage or an oversize condition.

(i) If required, replace any inserts (Refer to the Engine Manual, Chapter 70-35-26).

(2) When using the new inspection kit, IAE2R19879 on engines with Pre SB 72-0263 standard HPC Rear Outer Cases (P/N, 6A4154 and 6A5495) the bleed port flange may obstruct access of the drill and inspection probe. If this occurs perform the rework that follows:

(a) Prepare inner free area of the bleed port by placing a clean cloth such that no cutting debris can fall into the engine.

(b) Blend to create a recess in the rear outer case port flange.

Remove minimum amount of material possible to enable access, do not exceed the given limits. Use abrasive stones and papers to create the recess ensuring a smooth finish and blend into adjacent areas is achieved. Ensure all burrs and sharp edges are removed and the surface finish is comparable to adjacent areas.

Use CoMat 05-020, CoMat V05-021 and/or CoMat V05-074 abrasive papers and portable hand grinding equipment. Refer to Figure 4.

CAUTION: NOTE THE MAXIMUM BLEND LIMITS DEFINED IN FIGURE 4 AND ENSURE THEY ARE NOT EXCEEDED AS THIS CAN LEAD TO THE ENGINE BEING REJECTED UPON INSPECTION.

(c) Locally clean and fluorescent penetrant inspect the blended area. Refer to SPP TASK 70-23-05-230-501. Use CoMat 06-064 penetrant with a brush. If cracks are found, reject the case.

CAUTION: ENSURE THE ENGINE IS SUFFICIENTLY PROTECTED WITH THE CLOTH PLACED IN STEP. (A) SO THAT NO SOLVENT OR PENETRANT CAN FALL INTO THE ENGINE.

(d) Remove the cloth protecting the engine and wipe away any visible debris. If available, use a vacuum cleaner and hose to remove any further debris.

(e) Inspect the case flange to ensure the blend limits were not exceeded. If the limits are exceeded, reject the case.

(3) For engines which have HP compressor heat shield retainers (pre V2500-ENG-72-0296) or heat shield retainers with heat shields (pre V2500-ENG-72-0477), perform the rework that follows for probe access

(a) Prepare inner free area of the bleed port by placing a clean cloth such that no cutting debris can fall into the engine.

(b) Attach the drilling guide tool IAE1R19877 or IAE1R19861 to one end of the slotted hole with two bolts (AS48516) and two washers as shown in Figure 3.

(c) Insert an 8,00 mm (0.315 in.) drill bit into the drilling guide tool and drill a hole until the second wall of the heat shield retainer is penetrated (Figure 4 thru Figure 7).

(d) Remove the drill, loosen the bolts and slide the guide tool to the other end of the slotted hole and repeat step (c).

(e) Repeat steps (c) and (d) between the previously drilled two holes, until the entire opening is created as shown in Figure 5 thru Figure 7.

(f) Deburr and remove high material around the corners of the opening using mechanical tools until the probe can be inserted easily. Refer to SPP TASK 70-35-03-300-501.

(g) Remove the cloth and wipe away any visible debris. If available, use a vacuum cleaner and hose to remove any further debris.

CI.Install the HP system turning tool

(1) Install the turning tool to the accessory gearbox in accordance with the manufacturer's operating instructions (Olympus tool quoted). Install the V2500 A5 software module on the control unit, set the HP compressor rotation speed to the slowest (10 minutes per revolution). Set the HP compressor stage to HPC8 and engage continuous rotation mode. (Refer to the Engine Manual, TASK 72-00-00-200-002).

OR

(2) Install the hand turning tool to the accessory gearbox.

(3) Inspect the stage 7-8 stator ceramic liner for staining and/or axial cracking (Refer to Figure 8).

(a) If staining and /or cracking is found in the specific areas as shown in Figure 8, reject the Engine before next flight.

NOTE: Only findings located at the trailing edge of the vane contact area are relevant, findings in other areas can be disregarded.

The main direction of crack progression will be axial on the ceramic liner.

If liner loss was identified during the inspection for staining/cracking and the HP compressor is rotated manually, the rotation must be carried out carefully and slowly over these areas. Temporarily reverse the rotation of the HP compressor and re-inspect these areas for indications before continuing the inspection.

(b) If no staining and /or cracking is found, proceed with paragraph 3.CJ.

CJ.Calibrate the ultrasonic equipment

Range	28 mm (nominal)
Material velocity	3100 m/s
Delay	0.00 micro seconds
Frequency	Selectable in the 5.0 MHz range
Damping	50 Ohms
Rectify	Full wave
Pulser	Single crystal

Gate position	3.5 - 7.0 time base position

NOTE: 1. The nominal settings above are for a USN 52 or equivalent flaw detector to achieve approximate signal timebase positions. Alternative instruments may require different settings.

2. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

(1) Fit the clamp (IAE2R19912) to the manipulator shaft (Tool No. on the upper surface), refer to Figure 11. Use the Allen key and secure loosely.

NOTE: The clamp (IAE2R19912) must be able to slide on the manipulator at this stage.

(2) Attach the lead to the manipulator/flaw detector, apply the distilled or de-ionised water and position the probe (IAE2R19852) on to the working standard (Refer to Figure 9).

(3) With the flat face of the probe seated on the rear face of the working standard and the chamfered corners outward facing, position the probe on the working standard (Refer to Figure 9). The 1.0 mm long by 0.50 mm deep EDM notch is located in the center of the base of the working standard.

NOTE: 1. If calibration is carried out with the working standard in contact with a secondary surface, excessive couplant on the working surface and EDM target surface, may allow transfer of sound into the secondary surface. This can result in a weak signal and incorrect calibration.

2. During calibration make sure that the probe is flat down on the two contact faces of the working standards. Failure to do so can result in incorrect calibration.

3. Make sure that the probe is positioned correctly on the working standard and the reflected signal is not from the corner of the block.

(4) With the probe positioned on the working standard (Refer to Figure 9), identify the response from the EDM target at half skip distance. Maximize the signal response to achieve 70 percent Full Screen Height (FSH) and adjust the range control to position the EDM target signal at five on the timebase. (Refer to Figure 10).

(5) Position the gate between the 3.5 and 7.0 divisions on the time base and set the alarm threshold level at 40 percent FSH.

CK.Install the manipulator (IAE2R19852 or IAE2R19879) and ultrasonic probe into

the engine

CAUTION: DUE TO THE SIMILARITY BETWEEN THE INNER AND OUTER DIAMETER INSPECTION TOOLS, CARE MUST BE TAKEN TO ENSURE THE CORRECT PROBE AND WORKING STANDARD HAVE BEEN SELECTED FOR THE RELEVANT INSPECTION.

(1) Position the distilled or de-ionised water container at a suitable position on the engine. Make sure the container is supported above the probe position. Attach the end of the water supply tube to the connector on the rear of the manipulator. Open the valve on the water container and make sure that water flows from the probe face with no sign of air bubbles. When water flows from the probe, close the valve on the water container.

(2) Before installing the manipulator/probe into the engine, make sure all parts are secure. Make sure the attachment bolt for the ultrasonic probe is secure, the spring is not bent and the cable is not damaged. Make sure that the clamp (IAE2R19912) has been attached correctly (Tool No. on upper surface), it is important that it is free to move on the manipulator at this stage. Make sure the water tube is removed from the manipulator assembly to allow the probe to be inserted into the engine.

NOTE: 1. Two standards of bleed air slots may be found on engines. The current modification standard has longer elongated slots (Refer to Figure 16) however a number of engines have an earlier modification standard with smaller square slots. The gaps between the stator platforms are identical; however, the larger slot allows more freedom to allow the probe to fit easily into the gap between the stators. Installing the probe into the smaller slot is more difficult due to the smaller space available; in this case, the probe face initially contacts the corner of the lower stator platform (Refer to Figure 16).

2. To install the probe to the smaller slot, first angle the head of the probe upwards a few degrees by gently rotating the probe head on the attachment bolt. Holding the manipulator as low as possible during entry, will allow the probe to slide upwards as it enters the slot avoiding the corner of the stator. When installed, the manipulator assembly should be pushed on to the liner to ensure contact and to center the probe.

3. During withdrawal, the probe will contact the inner surface of the stator platform preventing withdrawal. By applying gentle pressure to the manipulator, and again adjusting the probe head angle, whilst the probe is still in the engine, the probe will be able to be withdrawn. Excessive force must not be used during removal.

(3) Use CoMat 10-058 to lightly oil the threads of the mounting bolts. Offer the probe to the forward side of the HP compressor bleed valve port (Refer to Figure 2) through the bleed slot adjacent to the flat-headed D bolt. Carefully allow the probe to enter the HP compressor casing until it contacts the ceramic liner. Carefully slide the manipulator mounting plate up to the bleed valve flange. Manually screw the bolts into the bolt holes ensuring the mounting plate remains in contact with the bleed valve flange and the probe manipulator assembly is free to move. Tighten the bolts alternately whilst checking the probe manipulator assembly remains free to move.

NOTE: Do not force the manipulator or damage may occur to the probe and engine.

If the probe is difficult to insert, more material should be removed from the first and second walls of the heatshield retainer.

(4) When correctly installed, the probe manipulator assembly should be able to slide freely in the mounting block and allow the probe to make contact with the liner. Figure 11 shows the manipulator assembly correctly installed to the engine.

NOTE: The clamp (IAE2R19912) must be able to slide on the manipulator allowing the probe to reach the liner of the drum.

If areas of liner loss in the probe path have been identified during the borescope inspection, ensure the probe is seated on the liner surface during the probe "SET" operation. If total liner loss (360°) in the probe path has been identified, the "SET" operation must be carried out on the drum surface. Care must be taken, as any remaining patches of liner will damage the probe.

(5) Rotate the cam until the flat marked "SET" is uppermost (viewed from the cable end of the manipulator) and firmly push the probe onto the drum liner. With the probe contacting the liner surface, slide the clamp against the mounting block ensuring the lower flat on the cam is firmly seated on the mounting block surface. Tighten the clamp screw with the Allen key. The probe is now locked in position, touching the surface with "SET" displayed on the cam.

CAUTION: DO NOT TURN THE HP COMPRESSOR UNTIL CLAMP IS ADJUSTED (INDICATION 'INSPECT' IS SHOWN). THIS CAN CAUSE DAMAGE TO THE PROBE.

(6) Rotate the cam on the clamp (IAE2R19912) until the flat side marked 'INSPECT' is up (view from the cable entry side of the manipulator). Ensure that the ultrasonic probe has been lifted away from the drum liner surface.

NOTE: Manufacturing tolerances within the manipulator can result in a slight contact of the probe with the drum and is acceptable.

CL.Inspect the disc

(1) If the HP compressor is rotated manually, use a borescope to identify a datum feature on the liner or the center position between the two lock nuts on the stage 7 blades (Refer to Figure 17). The borescope must be installed during the inspection to view the datum point. This will ensure that the HP compressor is inspected for one full rotation (360 degrees).

If the HP compressor is rotated with the electronic turning tool, zero the turning tool blade counter prior to starting the rotation.

NOTE: There are 93 stage 7 rotor blades and 84 stage 8 rotor blades.

(2) Open the water couplant valve fully and rotate the HP compressor in an ANTI CLOCKWISE direction to begin the inspection and inspect the full circumference of the disc (Refer to Figure 11).

NOTE: 1. The flaw detector must be monitored for signals that move along the timebase in the gated area. Any ultrasonic response that break the alarm gate (40 percent) will cause the engine to be rejected (Refer to Figure 15).

2. Water levels in the container must be monitored during the inspection. If the container is found to be empty during the inspection, the container must be re-filled and the inspection repeated.

3. If liner loss was identified during the inspection for staining/cracking and the HP compressor is rotated manually, the rotation must be carried out carefully and slowly over these areas. Temporarily reverse the rotation of the HP compressor and re-inspect these areas for indications before continuing the inspection.

CM.Remove the probe manipulator assembly from the engine

(1) After completion of the inspection, close the water valve and remove the water supply tube from the manipulator. Undo the bolts and carefully ease the manipulator from the bleed valve port.

CAUTION: DO NOT USE EXCESSIVE FORCE TO REMOVE THE PROBE MANIPULATOR ASSEMBLY FROM THE ENGINE.

(2) Make sure all parts of the probe manipulator assembly are present and undamaged and loosen the clamp.

CN.Make a check of the ultrasonic equipment calibration

(1) Make a check of the calibration of the ultrasonic equipment after the inspection is completed. Carry out the check in accordance with paragraph 3.CJ. (1) to (4). If the calibration is under sensitive by more than 3dB, re-calibrate the ultrasonic equipment and carry out an inspection of the disc again.

CO.Accept and reject criteria

(1) For the accept and reject criteria, refer to Non-Modification Service Bulletin V2500-ENG-72-0615.

CP.General

Use the new inspection kit IAE2R19878 or the old inspection kit IAE2R19858 to carry out an ultrasonic inspection on the inner diameter of the HP compressor stage 8 disc adjacent to the stage 7-8 EB weld land.

(1) Obey all the WARNINGS and CAUTIONS in the procedures that are referred to.

(2) Consumable Materials

(a) Refer to the table that follows:

MATERIAL NO.	DESIGNATION
CoMat 01-201	Distilled or De-ionised water
CoMat 10-058	Penetrating Oil

For the details of the consumable materials given in the table above, refer to the Overhaul Processes and Consumables Index.

(3) Tools and Equipment

(a) Refer to the table that follows:

ITEM	DESCRIPTION	TOOL NUMBER
(a)	Inspection kit contains inner diameter inspection kit of item (b) in this table and the outer diameter inspection kit of item (b) of the table in section 3.CF.(3)(a) of this Non-Modification Service Bulletin. OR	IAE2R19878
(b)	Inner diameter location inspection kit *(contains items (c) to (f)	IAE2R19858
(c)	Ultrasonic probe manipulator assembly contains 45 degree shear wave ultrasonic inspection probe	IAE2R19859 or IAE2R19880
(d)	Couplant feed system	IAE2R19807
(e)	Inner diameter location working standard	IAE2R19860
(f)	MCX/BNC lead	IAE2R19755

(g)	Ultrasonic flaw detector, frequency selectable in the 5.0 MHz range with audible/visual electronic alarm gate	Not supplied
(h)	Distilled or De-ionised water	Not supplied
(i)	Turning tool (if applicable)	Not supplied
(j)	4 to 6 mm flexible borescope kit with image capture capability	Not supplied
(k)	8 mm NC-centralising drill bit (90 degree cutting angle, HSCO material TiN coated)	Generic, eg Forum # 4211506022 or equivalent - Not supplied
(l)	Inner diameter location drilling guide tool	IAE1R19877 or IAE1R19861
(m)	Bolts (2 off)	AS48516 or 4W0170 not supplied
(n)	Washers to fit item (m)	Not supplied
(o)	Vacuum cleaner and hose	Not supplied
(p)	Cloth	Not supplied
(q)	Hand-held electric drill	Not supplied
(r)	Penetrating oil	Not supplied
(s)	Portable hand grinding equipment	Not supplied
(t)	Clamp	IAE2R19912

NOTE: 1. The lead for the ultrasonic probe is supplied with a BNC connector installed. An adaptor may be required if alternative equipment is used.

2. The compressor can be turned manually, but an electronic turning tool is recommended to perform the inspection.

3. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

CQ.Calibrate the ultrasonic equipment

Range	59mm (nominal)
Material velocity	3100 m/s
Delay	0.00 micro seconds
Frequency	Selectable in the 5.0 MHz range
Damping	50 Ohms
Rectify	Full wave
Pulser	Single crystal
Gate position	3.0 - 8.0 timebase position

NOTE: 1. The nominal settings above are for a USN 52 or equivalent flaw detector to achieve approximate signal timebase positions. Alternative instruments may require different settings.

2. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

(1) Fit the clamp (IAE2R19912) to the manipulator shaft (Tool No. on the upper surface), refer to Figure 11. Use the Allen key and secure loosely.

NOTE: The clamp (IAE2R19912) must be able to slide on the manipulator at this stage.

(2) Attach the lead to the manipulator/flaw detector, apply the water couplant and position the probe on to the working standard (Refer to Figure 9).

(3) With the flat face of the probe seated on the rear face of the working standard and the chamfered corners outward facing, position the probe on the working standard approximately 10.00 mm from the end as shown (Refer to Figure 9). The EDM target is located on the lower rear edge of the working standard.

NOTE: 1. If calibration is carried out with the working standard in contact with a secondary surface, excessive couplant on the working surface and EDM target surface, may allow transfer of sound into the secondary surface. This can result in a weak signal and incorrect calibration.

2. During calibration make sure that the probe is flat down on the two contact faces of the working standards. Failure to do so can result in incorrect calibration.

3. Make sure that the probe is positioned correctly on the working standard and the reflected signal is not from the corner of the block.

(4) With the probe positioned on the working standard (Refer to Figure 9), identify the response from the EDM target at half skip distance. Maximize the signal response to achieve 70 percent Full Screen Height (FSH) and adjust the range control to position the EDM target signal at five on the timebase. (Refer to Figure 10).

(5) Position the gate between the 3.0 and 8.0 divisions on the timebase.

For HP compressor drums of Ti6 material set the alarm threshold level at 30 percent FSH (Refer to Figure 10).

For HP compressor drums of Ti5 material set the alarm threshold level at 55 percent FSH (Refer to Figure 10).

NOTE: For any uncertainty on the 3-8 drum material, refer to the Compliance 1.E. of Non-Modification Service Bulletin V2500-ENG-72-0615.

CR.Install the manipulator and ultrasonic probe (IAE2R19859 or IAE2R19880) into the engine

CAUTION: DUE TO THE SIMILARITY BETWEEN THE INNER AND OUTER DIAMETER INSPECTION TOOLS, CARE MUST BE TAKEN TO ENSURE THE CORRECT PROBE AND WORKING STANDARD HAVE BEEN SELECTED FOR THE RELEVANT INSPECTION.

(1) Position the distilled or de-ionised water container at a suitable position on the engine. Make sure the container is supported above the probe position. Attach the end of the water supply tube to the connector on the rear of the manipulator. Open the valve on the water container and make sure that water flows from the probe face with no sign of air bubbles. When water flows from the probe, close the valve on the water container.

(2) Before installing the manipulator/probe into the engine, make sure all parts are secure. Make sure the attachment bolt for the ultrasonic probe is secure, the spring is not bent and the cable is not damaged. Make sure that the clamp (IAE2R19912) has been attached correctly (Tool No. on upper surface), it is important that it is free to move on the manipulator at this stage. Make sure the water tube is removed from the manipulator assembly to allow the probe to be inserted into the engine.

NOTE: 1. Two standards of bleed air slots may be found on engines. The current modification standard has longer elongated slots (Refer to Figure 16) however a number of engines have an earlier modification standard with smaller square slots. The gaps between the stator platforms are identical; however, the larger slot allows more freedom to allow the probe to fit easily into the gap between the stators. Installing the probe into the smaller slot is more difficult due to the smaller space available; in this case, the probe face initially contacts the corner of the lower stator platform (Refer to Figure 16).

2. To install the probe to the smaller slot, first angle the head of the probe upwards a few degrees by gently rotating the probe head on the attachment bolt. Holding the manipulator as low as possible during entry, will allow the probe to slide upwards as it enters the slot avoiding the corner of the stator. When installed, the manipulator assembly should be pushed on to the liner to ensure contact and to center the probe.

3. During withdrawal, the probe will contact the inner surface of the stator platform preventing withdrawal. By applying gentle pressure to the manipulator, and again adjusting the probe head angle, whilst the probe is still in the engine, the probe will be able to be withdrawn. Excessive force must not be used during removal.

(3) Use CoMat 10-058 to lightly oil the threads of the mounting bolts. Offer the probe to the forward side of the HP compressor bleed valve port (Refer to Figure 2) through the bleed slot adjacent to the flat-headed D bolt. Carefully allow the probe to enter the HP compressor casing until it contacts the ceramic liner. Carefully slide the manipulator mounting plate up to the bleed valve flange. Manually screw the bolts into the bolt holes ensuring the mounting plate remains in contact with the bleed valve flange and the probe manipulator assembly is free to move. Tighten the bolts alternately whilst checking the probe manipulator assembly remains free to move.

NOTE: Do not force the manipulator or damage may occur to the probe and engine.

If the probe is difficult to insert, more material should be removed from the first and second walls of the heatshield retainer.

(4) When correctly installed, the probe manipulator assembly should be able to slide freely in the mounting block and allow the probe to make contact with the liner. Figure 11 shows the manipulator assembly correctly installed to the engine.

NOTE: The clamp (IAE2R19912) must be able to slide on the manipulator allowing the probe to reach the liner of the drum.

If areas of liner loss in the probe path have been identified during the borescope inspection, ensure the probe is seated on the liner surface during the probe "SET" operation. If total liner loss (360°) in the probe path has been identified, the "SET" operation must be carried out on the drum surface. Care must be taken, as any remaining patches of liner will damage the probe.

(5) Rotate the cam until the flat marked "SET" is uppermost (viewed from the cable end of the manipulator) and firmly push the probe onto the drum liner. With the probe contacting the liner surface, slide the clamp against the mounting block ensuring the lower flat on the cam is firmly seated on the mounting block surface. Tighten the clamp screw with the Allen key. The probe is now locked in position, touching the surface with "SET" displayed on the cam.

CAUTION: DO NOT TURN THE HP COMPRESSOR UNTIL CLAMP IS ADJUSTED (INDICATION 'INSPECT' IS SHOWN). THIS CAN CAUSE DAMAGE TO THE PROBE.

(6) Rotate the cam on the clamp (IAE2R19912) until the flat side marked 'INSPECT' is up (view from the cable entry side of the manipulator). Ensure that the ultrasonic probe has been lifted away from the drum liner surface.

NOTE: Manufacturing tolerances within the manipulator can result in a slight contact of the probe with the drum and is acceptable.

CS.Inspect the disc

(1) If the HP compressor is rotated manually, use a borescope to identify a datum feature on the liner or the center position between the two lock nuts on the stage 7 blades (Refer to Figure 17). The borescope must be installed during the inspection to view the datum point. This will ensure that the HP compressor is inspected for one full rotation (360 degrees).

If the HP compressor is rotated with the electronic turning tool, zero the turning tool blade counter prior to starting the rotation.

NOTE: There are 93 stage 7 rotor blades and 84 stage 8 rotor blades.

(2) Open the water couplant valve fully and rotate the HP compressor in an ANTI CLOCKWISE direction to begin the inspection and inspect the full circumference of the disc (Refer to Figure 11).

NOTE: 1. The flaw detector must be monitored for signals that move along the timebase in the gated area. Any ultrasonic response that break the alarm gate (30 percent or 55 percent) will cause the engine to be rejected (Refer to Figure 15).

2. Water levels in the container must be monitored during the inspection. If the container is found to be empty during the inspection, the container must be re-filled and the inspection repeated.

3. If liner loss was identified during the inspection for staining/cracking and the HP compressor is rotated manually, the rotation must be carried out carefully and slowly over these areas. Temporarily reverse the rotation of the HP compressor and re-inspect these areas for indications before continuing the inspection.

CT.Remove the probe manipulator assembly from the engine

(1) On completion of the inspection, close the water valve and remove the water supply tube from the manipulator. Undo the bolts and carefully ease the manipulator from the bleed valve port.

CAUTION: DO NOT USE EXCESSIVE FORCE TO REMOVE THE PROBE MANIPULATOR ASSEMBLY FROM THE ENGINE.

(2) Make sure all parts of the probe manipulator assembly are present and undamaged.

CU.Make a check of the ultrasonic equipment calibration

(1) Make a check of the calibration of the ultrasonic equipment after the inspection is completed. Carry out the check in accordance with paragraph 3.CQ. (2) to (5). If the calibration is under sensitive by more than 3dB, re-calibrate the ultrasonic equipment and carry out an inspection of the disc again.

(2) If the calibration is satisfactory, disconnect the turning tool and remove it from the engine

(a) Remove the turning tool from the accessory gearbox in accordance with the manufacturer's operating instructions (Refer to the Engine Manual, Chapter 72-00-00).

OR

(b) Remove the hand turning tool from the accessory gearbox.

NOTE: 1. All equipment including the probe manipulator assembly water supply tube and the water bottle should be thoroughly drained and dried before storing, to prevent corrosion.

2. Due to the similarity between the inner and outer diameter inspection kits, care must be taken to ensure the correct probes and working standards are replaced in the correct storage cases. Part numbers of the individual tools are marked on the case labels and on the tools.

CV.Accept and reject criteria

(1) For the accept and reject criteria, refer to Non-Modification Service Bulletin V2500-ENG-72-0615.

CW.Install the HP stage 7 bleed valve air duct on the left side of the engine.

(1) Install the HP stage 7 bleed valve air duct together with the HP compressor stage 7 bleed valve (Refer to the Engine Manual, Chapter 72-00-40)

CX.Make sure that the work area is clean and clear of tools, equipment and other unwanted materials.

CY.Recording Instructions

(1) A record of accomplishment is required. Complete a separate Accomplishment Proforma for outer and inner diameter contained in Non-Modification Service Bulletin V2500-ENG-72-0615.

(2) Record the incorporation of Non-Modification Service Bulletin V2500-ENG-72-0638 in the applicable engine records.

(3) If the heatshield rework was performed make a note of this in the engine records.

Part C - Applicable for V2500-D5 Engines

CZ.General

Use inspection kit IAE2R19873 to carry out an ultrasonic inspection on the outer diameter of the HP compressor stage 8 disc adjacent to the stage 7-8 EB weld land.

(1) Obey all the WARNINGS and CAUTIONS in the procedures that are referred to.

(2) Consumable Materials

(a) Refer to the table that follows:

MATERIAL NO.	DESIGNATION
CoMat 01-201	Distilled or De-ionised water
CoMat 10-058	Penetrating Oil
CoMat 06-064	Fluorescent Penetrant
CoMat 05-020	Waterproof Abrasive Paper
CoMat 05-021	Waterproof Abrasive Paper
CoMat 05-074	Aluminum Oxide Abrasive Paper

For the details of the consumable materials given in the table above, refer to the Overhaul Processes and Consumables Index (PCI).

TASKs identified by SPP TASK are in the Standard Practices Manual.

TASKs identified by EM TASK are in the Engine Manual.

(3) Tools and Equipment

(a) For inspection of the outer diameter location:

ITEM	DESCRIPTION	TOOL NUMBER
(a)	Inspection kit contains the outer diameter location inspection items (b) to (e) listed in this table and the inner diameter location inspection items (b) to (e) listed in the table in section 3.DJ.(3)(a) of this Non-Modification Service Bulletin	IAE2R19873
(b)	Ultrasonic probe manipulator assembly contains 45 degree shear wave ultrasonic inspection probe	IAE2R19874
(c)	Couplant feed system	IAE2R19807
(d)	Outer diameter location working standard	IAE2R19854
(e)	MCX/BNC lead	IAE2R19755
(f)	Ultrasonic flaw detector, frequency selectable in the 5.0 MHz range with audible/visual electronic alarm gate	Not supplied
(g)	Distilled or De-ionised water	Not supplied
(h)	Turning tool (if applicable)	Not supplied

(i)	4 to 6 mm flexible borescope kit with image capture capability	Not supplied
(j)	8 mm NC-centralising drill bit (90 degree cutting angle, HSCO material, TiN coated)	Generic, eg Forum # 4211506022 or equivalent - Not supplied
(k)	Outer diameter location drilling guide tool	IAE1R19881
(l)	Bolts (2 off)	AS48516 or 4W0170 not supplied
(m)	Washers to fit item (l)	Not supplied
(n)	Vacuum cleaner and hose	Not supplied
(o)	Cloth	Not supplied
(p)	Hand-held electric drill	Not supplied
(q)	Penetrating oil	Not supplied
(r)	Portable hand grinding equipment	Not supplied
(t)	Clamp	IAE2R19912

NOTE: 1. The lead for the ultrasonic probe is supplied with a BNC connector installed. An adaptor may be required if alternative equipment is used.

2. The compressor can be turned manually, but an electronic turning tool is recommended to perform the inspection.

3. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

4. The outer diameter drilling guide tool number is identical to the inner diameter location drilling guide tool number.

DA. Get access to the HP compressor stage 7A bleed valve aperture that is installed on the upper left side of the engine.

DB. Remove the HP stage 7 bleed valve air duct from the upper left side of the engine

(1) Remove the HP stage 7A bleed valve air duct together with the HP compressor stage 7A bleed valve (Refer to Figure 1 and to the Engine Manual, Chapter 72-00-40)

(a) Apply the approved penetrating oil CoMat 10-058 before the removal of threaded parts. Let the parts soak at least 15 minutes.

(b) Seal all openings to prevent contamination from unwanted materials.

(c) Carefully overcome the initial torque of each bolt of the flange to the duct.

(d) Carefully loosen each bolt of the flange to the duct. If excessive resistance is encountered, apply more penetrating oil and allow the bolts to soak for at least 15 minutes before proceeding.

NOTE: Make sure you use the correct size tool for the bolt head and do not force the bolt excessively during the removal process.

(e) Repeat step (d) until all bolts have been removed successfully.

(f) Remove the duct.

(g) If a bolt was broken during the removal process, perform the steps that follow:

(i) Remove broken bolts and/or studs by mechanical removal methods.

(ii) Drill a hole into the end of the broken bolt and/or stud. Refer to the tool manufacturer's instructions for the correct size of drill.

(iii) Put an extraction tool into the drilled hole and lock into position.

(iv) Turn the extraction tool to remove the broken bolt.

(v) Tap the threads if necessary to clean or chase the threads.

(vi) Examine the threads for damage or an oversize condition.

(h) If required, replace any inserts (Refer to the Engine Manual, Chapter 70-35-26).

(2) For engines which have HP compressor heat shield retainers (pre V2500-ENG-72-0296) or heat shield retainers with heat shields (pre V2500-ENG-72-0477), perform the rework that follows for probe access

(a) Prepare inner free area of the bleed port by placing a clean cloth such that no cutting debris can fall into the engine.

(b) Attach the drilling guide tool IAE1R19881 to one end of the slotted hole with two bolts and two washers as shown in Figure 3.

(c) Insert an 8,00 mm (0.315 in.) drill bit into the drilling guide tool and check whether the drill can reach the heat shield retainer without making contact with the rear outer case bleed port flange

NOTE: On Pre/Post Service Bulletin V2500-ENG-72-0177 standard rear outer cases (P/N 6A4407 and 6A5497) the bleed port flange can prevent the drill from reaching the heat shield retainer.

(i) If the drill cannot pass the rear outer case port flange, go to Step. (d).

(ii) If the drill passes without touching the rear outer case port flange, go to Step. (k).

(d) Remove the drill, loosen the bolts and remove the drilling guide tool.

(e) Blend to create a recess in the rear outer case port flange to enable drill access to the heat shield retainer.

Remove minimum amount of material possible to enable access, do not exceed the given limits. Use abrasive stones and papers to create the recess ensuring a smooth finish and blend into adjacent areas is achieved. Ensure all burrs and sharp edges are removed and the surface finish is comparable to adjacent areas.

Refer to SPP TASK 70-35-03-300-501. Use CoMat 05-020, CoMat 05-021 and/or CoMat 05-074 abrasive papers and portable hand grinding equipment. Refer to Figure 4.

CAUTION: NOTE THE MAXIMUM BLEND LIMITS DEFINED IN FIGURE 4 AND ENSURE THEY ARE NOT EXCEEDED AS THIS CAN LEAD TO THE CASE BEING REJECTED UPON INSPECTION.

(f) Locally clean and fluorescent penetrant inspect the blended area. Refer to SPP TASK 70-23-05-230-501. Use CoMat 06-064 penetrant with a brush. If cracks are found, reject the case.

CAUTION: ENSURE THE ENGINE IS SUFFICIENTLY PROTECTED WITH THE CLOTH PLACED IN STEP. (A) SO THAT NO SOLVENT OR PENETRANT CAN FALL INTO THE ENGINE.

(g) Remove the cloth protecting the engine and wipe away any visible debris. If available, use a vacuum cleaner and hose to remove any further debris.

(h) Inspect the flange to ensure the blend limits were not exceeded. If limits are exceeded reject the case.

(i) Prepare inner free area of the bleed port by placing a clean cloth such that no cutting debris can fall into the engine.

(j) Attach the drilling guide tool IAE1R19881 to one end of the slotted hole with two bolts (AS48516) and two washers as shown in Figure 3.

(k) Insert an 8,00 mm (0.315 in.) drill bit into the drilling guide tool and drill a hole until the second wall of the heat shield retainer is penetrated (Figure 3 thru Figure 7).

(l) Remove the drill, loosen the bolts and slide the guide tool to the other end of the slotted hole and repeat step (k).

(m) Repeat steps (k) and (l) between the previously drilled two holes, until the entire opening is created as shown in Figure 5 thru Figure 6.

(n) Deburr and remove high material around the corners of the opening using mechanical tools until the probe can be inserted easily. Refer to SPP TASK 70-35-03-300-501.

(o) Remove the cloth and wipe away any visible debris. If available, use a vacuum cleaner and hose to remove any further debris.

DC.Install the HP system turning tool

(1) Install the turning tool (IAE2R18853) to the accessory gearbox in accordance with the manufacturer's operating instructions (Olympus tool quoted). Install the V2500-D5 software module on the control unit, set the HP compressor rotation speed to the slowest (10 minutes per revolution). Set the HP compressor stage to HPC8 and engage continuous rotation mode. (Refer to the Engine Manual, TASK 72-00-00-200-002).

OR

(2) Install the hand turning tool to the accessory gearbox.

(3) Inspect the stage 7-8 stator ceramic liner for staining and/or axial cracking (Refer to Figure 8).

(a) If staining and /or cracking is found in the specific area as shown in Figure 8, reject the Engine before next flight.

NOTE: Only findings located at the trailing edge of the vane contact area are relevant, findings in other areas can be disregarded.

The main direction of crack progression will be axial on the ceramic liner.

If liner loss was identified during the inspection for staining/cracking and the HP compressor is rotated manually, the rotation must be carried out carefully and slowly over these areas. Temporarily reverse the rotation of the HP compressor and re-inspect these areas for indications before continuing the inspection.

(b) If no staining and /or cracking is found, proceed with paragraph 3.DD.

DD.Calibrate the ultrasonic equipment

Range	28 mm (nominal)
Material velocity	3100 m/s
Delay	0.00 micro seconds
Frequency	Selectable in the 5.0 MHz range
Damping	50 Ohms
Rectify	Full
Pulser	Single crystal
Gate position	3.5 - 7.0 timebase position

NOTE: 1. The nominal settings above are for a USN 52 or equivalent flaw detector to achieve signal timebase positions. Alternative instruments may require different settings.

2. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

(1) Fit the clamp (IAE2R19912) to the manipulator shaft (Tool No. on the upper surface), refer to Figure 11. Use the Allen key and secure loosely.

NOTE: The clamp (IAE2R19912) must be able to slide on the manipulator at this stage.

(2) Attach the lead to the manipulator/flaw detector, apply the distilled or de-ionised water and position the probe (IAE2R19874) on to the working standard (Refer to Figure 9).

(3) With the flat face of the probe seated on the rear face of the working standard and the chamfered corners outward facing, position the probe on the working standard (Refer to Figure 9). The 1.0 mm long by 0.50 mm deep EDM notch is located in the center of the base of the working standard.

NOTE: 1. If calibration is carried out with the working standard in contact with a secondary surface, excessive couplant on the working surface and EDM target surface, may allow transfer of sound into the secondary surface. This can result in a weak signal and incorrect calibration.

2. During calibration make sure that the probe is flat down on the two contact faces of the working standards. Failure to do so can result in incorrect calibration.

3. Make sure that the probe is positioned correctly on the working standard and the reflected signal is not from the corner of the block.

(4) With the probe positioned on the working standard (Refer to Figure 9), identify the response from the EDM target at half skip distance. Maximise the signal response to achieve 70 percent Full Screen Height (FSH) and adjust the range control to position the EDM target signal at five on the timebase. (Refer to Figure 10).

(5) Position the gate between the 3.5 and 7.0 divisions on the time base and set the alarm threshold level at 40 percent FSH.

DE.Install the manipulator (IAE2R19874) and ultrasonic probe into the engine

CAUTION: DUE TO THE SIMILARITY BETWEEN THE INNER AND OUTER DIAMETER INSPECTION TOOLS, CARE MUST BE TAKEN TO ENSURE THE CORRECT PROBE AND WORKING STANDARD HAVE BEEN SELECTED FOR THE RELEVANT INSPECTION.

(1) Position the distilled or de-ionised water container at a suitable position on the engine. Make sure the container is supported above the probe position. Attach the end of the water supply tube to the connector on the rear of the manipulator. Open the valve on the water container and make sure that water flows from the probe face with no sign of air bubbles. When water flows from the probe, close the valve on the water container.

(2) Before installing the manipulator/probe into the engine, make sure all parts are secure. Make sure the attachment bolt for the ultrasonic probe is secure, the spring is not bent and the cable is not damaged. Make sure that the clamp (IAE2R19912) has been attached correctly (Tool No. on upper surface), it is important that it is free to move on the manipulator at this stage. Make sure the water tube is removed from the manipulator assembly to allow the probe to be inserted into the engine.

NOTE: 1. Two standards of bleed air slots may be found on engines. The current modification standard has longer elongated slots (Refer to Figure 16) however a number of engines have an earlier modification standard with smaller square slots. The gaps between the stator platforms are identical; however, the larger slot allows more freedom to allow the probe to fit easily into the gap between the stators. Installing the probe into the smaller slot is more difficult due to the smaller space available; in this case, the probe face initially contacts the corner of the lower stator platform (Refer to Figure 16).

2. To install the probe to the smaller slot, first angle the head of the probe upwards a few degrees by gently rotating the probe head on the attachment bolt. Holding the manipulator as low as possible during entry, will allow the probe to slide upwards as it enters the slot avoiding the corner of the stator. When installed, the manipulator assembly should be pushed on to the liner to ensure contact and to center the probe.

3. During withdrawal, the probe will contact the inner surface of the stator platform preventing withdrawal. By applying gentle pressure to the manipulator, and again adjusting the probe head angle, whilst the probe is still in the engine, the probe will be able to be withdrawn. Excessive force must not be used during removal.

(3) Use CoMat 10-058 to lightly oil the threads of the mounting bolts. Offer the probe to the forward side of the HP compressor bleed valve port (Refer to Figure 2) through the bleed slot adjacent to the flat-headed D bolt. Carefully allow the probe to enter the HP compressor casing until it contacts the ceramic liner. Carefully slide the manipulator mounting plate up to the bleed valve flange. Manually screw the bolts into the bolt holes ensuring the mounting plate remains in contact with the bleed valve flange and the probe manipulator assembly is free to move. Tighten the bolts alternately whilst checking the probe manipulator assembly remains free to move.

NOTE: Do not force the manipulator or damage may occur to the probe and engine.

If the probe is difficult to insert, more material should be removed from the first and second walls of the heatshield retainer.

(4) When correctly installed, the probe manipulator assembly should be able to slide freely in the mounting block and allow the probe to make contact with the liner. Figure 11 shows the manipulator assembly correctly installed to the engine.

NOTE: The clamp (IAE2R19912) must be able to slide on the manipulator allowing the probe to reach the liner of the drum.

If areas of liner loss in the probe path have been identified during the borescope inspection, ensure the probe is seated on the liner surface during the probe "SET" operation. If total liner loss (360°) in the probe path has been identified, the "SET" operation must be carried out on the drum surface. Care must be taken, as any remaining patches of liner will damage the probe.

(5) Rotate the cam until the flat marked "SET" is uppermost (viewed from the cable end of the manipulator) and firmly push the probe onto the drum liner. With the probe contacting the liner surface, slide the clamp against the mounting block ensuring the lower flat on the cam is firmly seated on the mounting block surface. Tighten the clamp screw with the Allen key. The probe is now locked in position, touching the surface with "SET" displayed on the cam.

CAUTION: DO NOT TURN THE HP COMPRESSOR UNTIL CLAMP IS ADJUSTED (INDICATION 'INSPECT' IS SHOWN). THIS CAN CAUSE DAMAGE TO THE PROBE.

(6) Rotate the cam on the clamp (IAE2R19912) until the flat side marked 'INSPECT' is up (view from the cable entry side of the manipulator). Ensure that the ultrasonic probe has been lifted away from the drum liner surface.

NOTE: Manufacturing tolerances within the manipulator can result in a slight contact of the probe with the drum and is acceptable.

DF.Inspect the disc

(1) If the HP compressor is rotated manually, use a borescope to identify a datum feature on the liner or the center position between the two lock nuts on the stage 7 blades (Refer to Figure 17). The borescope must be installed during the inspection to view the datum point. This will ensure that the HP compressor is inspected for one full rotation (360 degrees).

If the HP compressor is rotated with the electronic turning tool, zero the turning tool blade counter prior to starting the rotation.

NOTE: There are 93 stage 7 rotor blades and 84 stage 8 rotor blades.

(2) Open the water couplant valve fully and rotate the HP compressor in an ANTI CLOCKWISE direction to begin the inspection and inspect the full circumference of the disc (Refer to Figure 11).

NOTE: 1. The flaw detector must be monitored for signals that move along the timebase in the gated area. Any ultrasonic response that break the alarm gate (40 percent) will cause the engine to be rejected (Refer to Figure 15).

2. Water levels in the container must be monitored during the inspection. If the container is found to be empty during the inspection, the container must be re-filled and the inspection repeated.

3. If liner loss was identified during the inspection for staining/cracking and the HP compressor is rotated manually, the rotation must be carried out carefully and slowly over these areas. Temporarily reverse the rotation of the HP compressor and re-inspect these areas for indications before continuing the inspection.

DG.Remove the probe manipulator assembly from the engine

(1) After completion of the inspection, close the water valve and remove the water supply tube from the manipulator. Undo the bolts and carefully ease the manipulator from the bleed valve port.

NOTE: Remove with care. The socket of the spanner can fall into the engine.

CAUTION: DO NOT USE EXCESSIVE FORCE TO REMOVE THE PROBE MANIPULATOR ASSEMBLY FROM THE ENGINE.

(2) Make sure all parts of the probe manipulator assembly are present and undamaged.

DH.Make a check of the ultrasonic equipment calibration

(1) Make a check of the calibration of the ultrasonic equipment after the inspection is completed. Carry out the check in accordance with paragraph 3.DD. (1) to (4). If the calibration is under sensitive by more than 3dB, re-calibrate the ultrasonic equipment and carry out an inspection of the disc again.

DI.Accept and reject criteria

(1) For the accept and reject criteria, refer to Non-Modification Service Bulletin V2500-ENG-72-0615.

DJ.General

Use inspection kit IAE2R19873 to carry out an ultrasonic inspection on the inner diameter of the HP compressor stage 8 disc adjacent to the stage 7-8 EB weld land.

(1) Obey all the WARNINGS and CAUTIONS in the procedures that are referred to.

(2) Consumable Materials

(a) Refer to the table that follows:

MATERIAL NO.	DESIGNATION
CoMat 01-201	Distilled or De-ionised water

CoMat 10-058	Penetrating Oil

For the details of the consumable materials given in the table above, refer to the Overhaul Processes and Consumables Index.

(3) Tools and Equipment

(a) Refer to the table that follows:

ITEM	DESCRIPTION	TOOL NUMBER
(a)	Inspection kit contains the inner diameter location inspection items (b) to (e) listed in this table and the outer diameter location inspection items (b) to (e) listed in the table in section 3.CZ.(3)(a) of this Non-Modification Service Bulletin	IAE2R19873
(b)	Ultrasonic probe manipulator assembly contains 45 degree shear wave ultrasonic inspection probe	IAE2R19876
(c)	Couplant feed system	IAE2R19807
(d)	Inner diameter location working standard	IAE2R19860
(e)	MCX/BNC lead	IAE2R19755
(f)	Ultrasonic flaw detector, frequency selectable in the 5.0 MHz range with audible/visual electronic alarm gate	Not supplied
(g)	Distilled or De-ionised water	Not supplied
(h)	Turning tool (if applicable)	Not supplied
(i)	4 to 6 mm flexible borescope kit with image capture capability	Not supplied
(j)	8 mm NC-centralising drill bit (90 degree cutting angle, HSCO material TiN coated)	Generic, eg Forum # 4211506022 or equivalent - Not supplied
(k)	Inner diameter location drilling guide tool	IAE1R19881
(l)	Bolts (2 off)	AS48516 or 4W0170 not supplied
(m)	Washers to fit item (j)	Not supplied
(n)	Vacuum cleaner and hose	Not supplied
(o)	Cloth	Not supplied
(p)	Hand-held electric drill	Not supplied
(q)	Penetrating oil	Not supplied
(r)	Portable hand grinding equipment	Not supplied
(s)	Clamp	IAE2R19912

NOTE: 1. The lead for the ultrasonic probe is supplied with a BNC connector installed. An adaptor may be required if alternative equipment is used.

2. The compressor can be turned manually, but an electronic turning tool is recommended to perform the inspection.

3. Care should be taken to keep the two working standards IAE2R19854 and IAE2R19860 separate.

DK.Calibrate the ultrasonic equipment

Range	59mm (nominal)
Material velocity	3100 m/s
Delay	0.00 micro seconds
Frequency	Selectable in the 5.0 MHz range
Damping	50 Ohms
Rectify	Full
Pulser	Single crystal
Gate position	3.0 - 8.0 timebase position

NOTE: The nominal settings above are for a USN 52 or equivalent flaw detector to achieve approximate signal timebase positions. Alternative instruments may require different settings.

(1) Fit the clamp (IAE2R19912) to the manipulator shaft (Tool No. on the upper surface), refer to Figure 11. Use the Allen key and secure loosely.

NOTE: The clamp (IAE2R19912) must be able to slide on the manipulator at this stage.

(2) Attach the lead to the manipulator/flaw detector, apply the water couplant and position the probe on to the working standard (Refer to Figure 9).

(3) With the flat face of the probe seated on the rear face of the working standard and the chamfered corners outward facing, position the probe on the working standard approximately 10.00 mm from the end as shown (Refer to Figure 9). The EDM target is located on the lower rear edge of the working standard.

NOTE: 1. If calibration is carried out with the working standard in contact with a secondary surface, excessive couplant on the base of the working standard i.e. on the surface with EDM target, may allow transfer of sound through the base of the working standard into the secondary surface. This can result in a weak signal and incorrect calibration.

2. During calibration make sure that the probe is flat down on the two contact faces of the working standards. Failure to do so can result in incorrect calibration.

3. Make sure that the probe is positioned correctly on the working standard and the reflected signal is not from the corner of the block.

(4) With the probe positioned on the working standard (Refer to Figure 9), identify the response from the EDM target at half skip distance. Maximise the signal response to achieve 70 percent Full Screen Height (FSH) and adjust the range control to position the EDM target signal at five on the timebase. (Refer to Figure 10).

(5) Position the gate between the 3.0 and 8.0 divisions on the timebase.

For HP compressor drums of Ti6 material set the alarm threshold level at 30 percent FSH (Refer to Figure 10).

For HP compressor drums of Ti5 material set the alarm threshold level at 55 percent FSH (Refer to Figure 10).

NOTE: For any uncertainty on the 3-8 drum material, refer to the Compliance 1.E. of Non-Modification Service Bulletin V2500-ENG-72-0615.

DL. Install the manipulator and ultrasonic probe (IAE2R19876) into the engine

CAUTION: DUE TO THE SIMILARITY BETWEEN THE INNER AND OUTER DIAMETER INSPECTION TOOLS, CARE MUST BE TAKEN TO ENSURE THE CORRECT PROBE AND WORKING STANDARD HAVE BEEN SELECTED FOR THE RELEVANT INSPECTION.

(1) Position the distilled or de-ionised water container at a suitable position on the engine. Make sure the container is supported above the probe position. Attach the end of the water supply tube to the connector on the rear of the manipulator. Open the valve on the water container and make sure that water flows from the probe face with no sign of air bubbles. When water flows from the probe, close the valve on the water container.

(2) Before installing the manipulator/probe into the engine, make sure all parts are secure. Make sure the attachment bolt for the ultrasonic probe is secure, the spring is not bent and the cable is not damaged. Make sure that the clamp (IAE2R19912) has been attached correctly (Tool No. on upper surface), it is important that it is free to move on the manipulator at this stage. Make sure the water tube is removed from the manipulator assembly to allow the probe to be inserted into the engine.

NOTE: 1. Two standards of bleed air slots may be found on engines. The current modification standard has longer elongated slots (Refer to Figure 16) however a number of engines have an earlier modification standard with smaller square slots. The gaps between the stator platforms are identical; however, the larger slot allows more freedom to allow the probe to fit easily into the gap between the stators. Installing the probe into the smaller slot is more difficult due to the smaller space available; in this case, the probe face initially contacts the corner of the lower stator platform (Refer to Figure 16).

2. To install the probe to the smaller slot, first angle the head of the probe upwards a few degrees by gently rotating the probe head on the attachment bolt. Holding the manipulator as low as possible during entry, will allow the probe to slide upwards as it enters the slot avoiding the corner of the stator. When installed, the manipulator assembly should be pushed on to the liner to ensure contact and to center the probe.

3. During withdrawal, the probe will contact the inner surface of the stator platform preventing withdrawal. By applying gentle pressure to the manipulator, and again adjusting the probe head angle, whilst the probe is still in the engine, the probe will be able to be withdrawn. Excessive force must not be used during removal.

(3) Use CoMat 10-058 to lightly oil the threads of the mounting bolts. Offer the probe to the forward side of the HP compressor bleed valve port (Refer to Figure 2) through the bleed slot adjacent to the flat-headed D bolt. Carefully allow the probe to enter the HP compressor casing until it contacts the ceramic liner. Carefully slide the manipulator mounting plate up to the bleed valve flange. Manually screw the bolts into the bolt holes ensuring the mounting plate remains in contact with the bleed valve flange and the probe manipulator assembly is free to move. Tighten the bolts alternately whilst checking the probe manipulator assembly remains free to move.

NOTE: Do not force the manipulator or damage may occur to the probe and engine.

If the probe is difficult to insert, more material should be removed from the first and second walls of the heatshield retainer.

(4) When correctly installed, the probe manipulator assembly should be able to slide freely in the mounting block and allow the probe to make contact with the liner. Figure 11 shows the manipulator assembly correctly installed to the engine.

NOTE: The clamp (IAE2R19912) must be able to slide on the manipulator allowing the probe to reach the liner of the drum.

If areas of liner loss in the probe path have been identified during the borescope inspection, ensure the probe is seated on the liner surface during the probe "SET" operation. If total liner loss (360°) in the probe path has been identified, the "SET" operation must be carried out on the drum surface. Care must be taken, as any remaining patches of liner will damage the probe.

(5) Rotate the cam until the flat marked "SET" is uppermost (viewed from the cable end of the manipulator) and firmly push the probe onto the drum liner. With the probe contacting the liner surface, slide the clamp against the mounting block ensuring the lower flat on the cam is firmly seated on the mounting block surface. Tighten the clamp screw with the Allen key. The probe is now locked in position, touching the surface with "SET" displayed on the cam.

CAUTION: DO NOT TURN THE HP COMPRESSOR UNTIL CLAMP IS ADJUSTED (INDICATION 'INSPECT' IS SHOWN). THIS CAN CAUSE DAMAGE TO THE PROBE.

(6) Rotate the cam on the clamp (IAE2R19912) until the flat side marked 'INSPECT' is up (view from the cable entry side of the manipulator). Ensure that the ultrasonic probe has been lifted away from the drum liner surface.

NOTE: Manufacturing tolerances within the manipulator can result in a slight contact of the probe with the drum and is acceptable.

DM.Inspect the disc

(1) If the HP compressor is rotated manually, use a borescope to identify a datum feature on the liner or the center position between the two lock nuts on the stage 7 blades (Refer to Figure 17). The borescope must be installed during the inspection to view the datum point. This will ensure that the HP compressor is inspected for one full rotation (360 degrees).

If the HP compressor is rotated with the electronic turning tool, zero the turning tool blade counter prior to starting the rotation.

NOTE: There are 93 stage 7 rotor blades and 84 stage 8 rotor blades.

(2) Open the water couplant valve fully and rotate the HP compressor in an ANTI CLOCKWISE direction to begin the inspection and inspect the full circumference of the disc (Refer to Figure 11).

NOTE: 1. The flaw detector must be monitored for signals that move along the timebase in the gated area. Any ultrasonic response that break the alarm gate (30 percent or 55 percent) will cause the engine to be rejected (Refer to Figure 15).

2. Water levels in the container must be monitored during the inspection. If the container is found to be empty during the inspection, the container must be re-filled and the inspection repeated.

3. If liner loss was identified during the inspection for staining/cracking and the HP compressor is rotated manually, the rotation must be carried out carefully and slowly over these areas. Temporarily reverse the rotation of the HP compressor and re-inspect these areas for indications before continuing the inspection.

DN.Remove the probe manipulator assembly from the engine

(1) On completion of the inspection, close the water valve and remove the water supply tube from the manipulator. Undo the bolts and carefully ease the manipulator from the bleed valve port.

NOTE: Remove with care. The socket of the spanner can fall into the engine.

CAUTION: DO NOT USE EXCESSIVE FORCE TO REMOVE THE PROBE MANIPULATOR ASSEMBLY FROM THE ENGINE.

(2) Carefully remove the probe manipulator assembly from the engine.

(3) Make sure all parts of the probe manipulator assembly are present and undamaged.

DO.Make a check of the ultrasonic equipment calibration

(1) Make a check of the calibration of the ultrasonic equipment after the inspection is completed. Carry out the check in accordance with paragraph 3.DK. (2) to (5). If the calibration is under sensitive by more than 3dB, re-calibrate the ultrasonic equipment and carry out an inspection of the disc again.

(2) If the calibration is satisfactory, disconnect the turning tool and remove it from the engine

(a) Remove the turning tool from the accessory gearbox in accordance with the manufacturer's operating instructions (Refer to the Engine Manual, Chapter 72-00-00).

(b) Remove the hand turning tool from the accessory gearbox.

NOTE: 1. All equipment including the probe manipulator assembly water supply tube and the water bottle should be thoroughly drained and dried before storing, to prevent corrosion.

2. Due to the similarity between the inner and outer diameter inspection kits, care must be taken to ensure the correct probes and working standards are replaced in the correct storage cases. Part numbers of the individual tools are marked on the case labels and on the tools.

DP.Accept and reject criteria

(1) For the accept and reject criteria, refer to Non-Modification Service Bulletin V2500-ENG-72-0615.

DQ.Install the HP stage 7A bleed valve air duct on the left side of the engine.

(1) Install the HP stage 7A bleed valve air duct together with the HP compressor stage 7A bleed valve (Refer to the Engine Manual, Chapter 72-00-40)

(a) Lubricate all threads and abutment faces of nuts and bolts with CoMat 10-077 (approved engine oil) and CoMat 10-094 (anti seize compound).

(b) Put the duct in position on the HP compressor case (with the angle duct to the top) and align the bolt holes.

(c) Install the 12 bolts together with the bracket. Torque the bolts to 85 to 105 lbf in. (10 to 12 Nm).

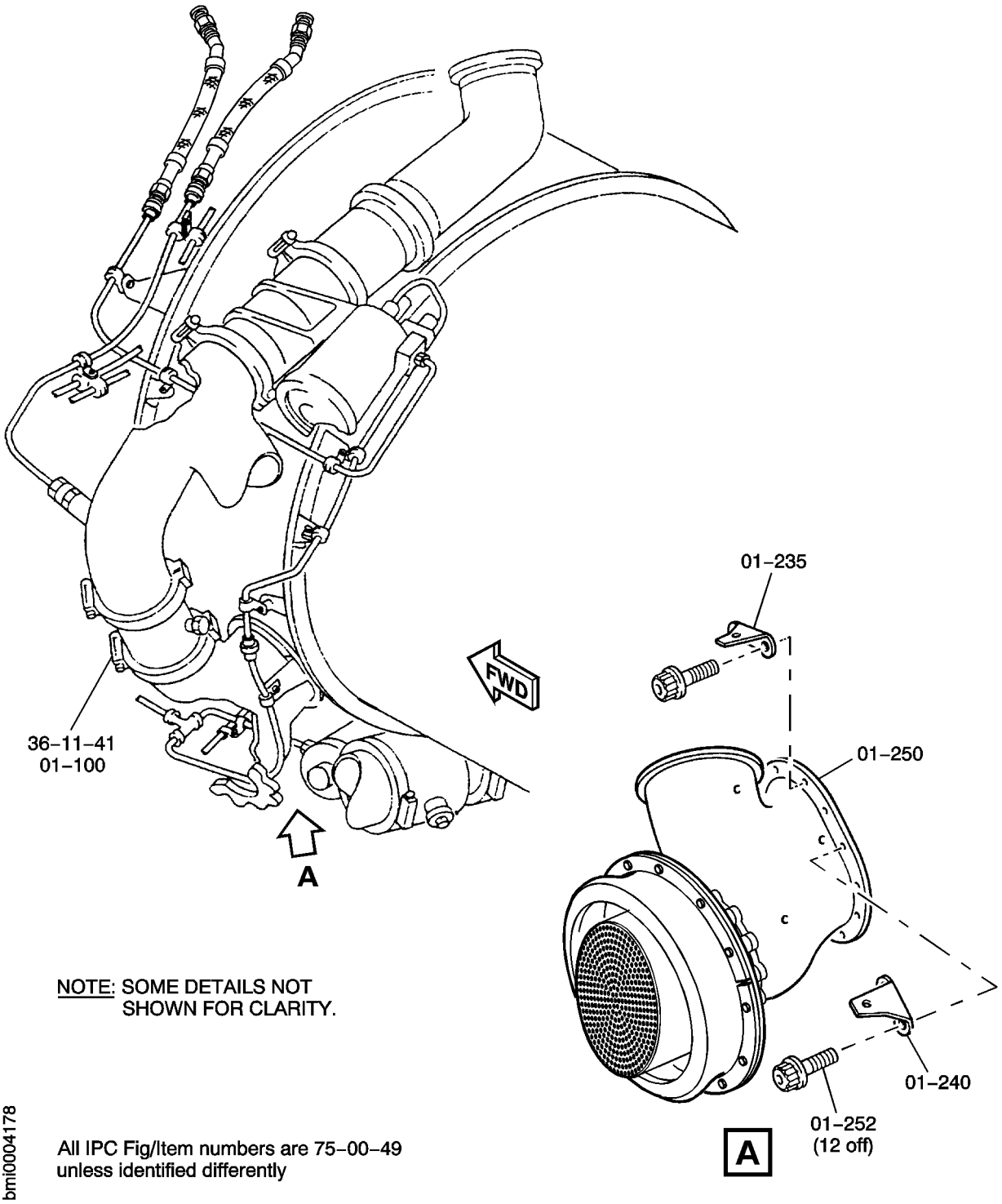
DR.Make sure that the work area is clean and clear of tools, equipment and other unwanted materials.

DS.Recording Instructions

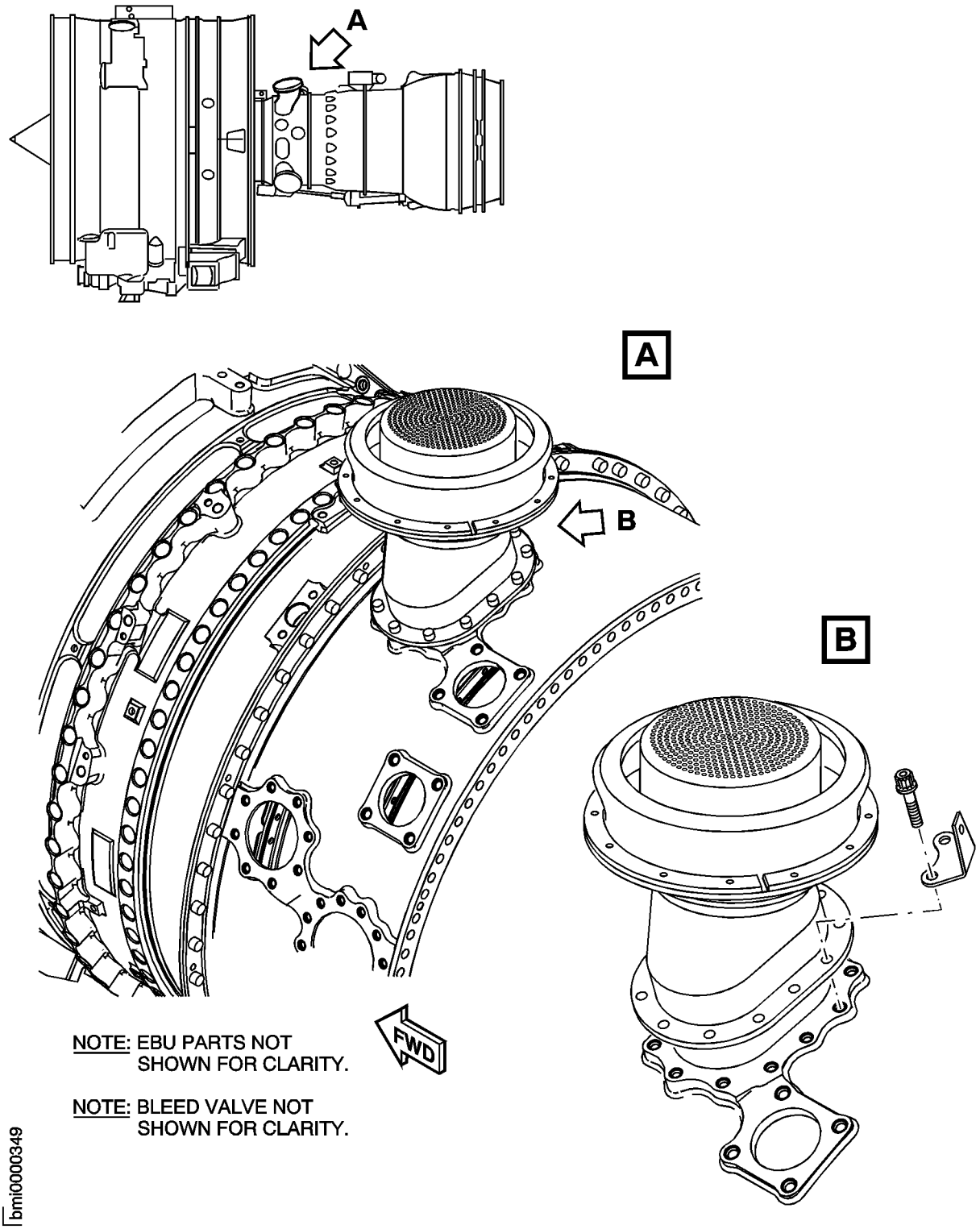
(1) A record of accomplishment is required. Complete a separate Accomplishment Proforma for outer and inner diameter contained in Non-Modification Service Bulletin V2500-ENG-72-0615.

(2) Record the incorporation of Non-Modification Service Bulletin V2500-ENG-72-0638 in the applicable engine records.

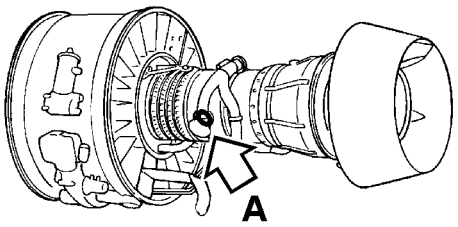
(3) If the heatshield and/or casing rework was performed make a note of this in the engine records.

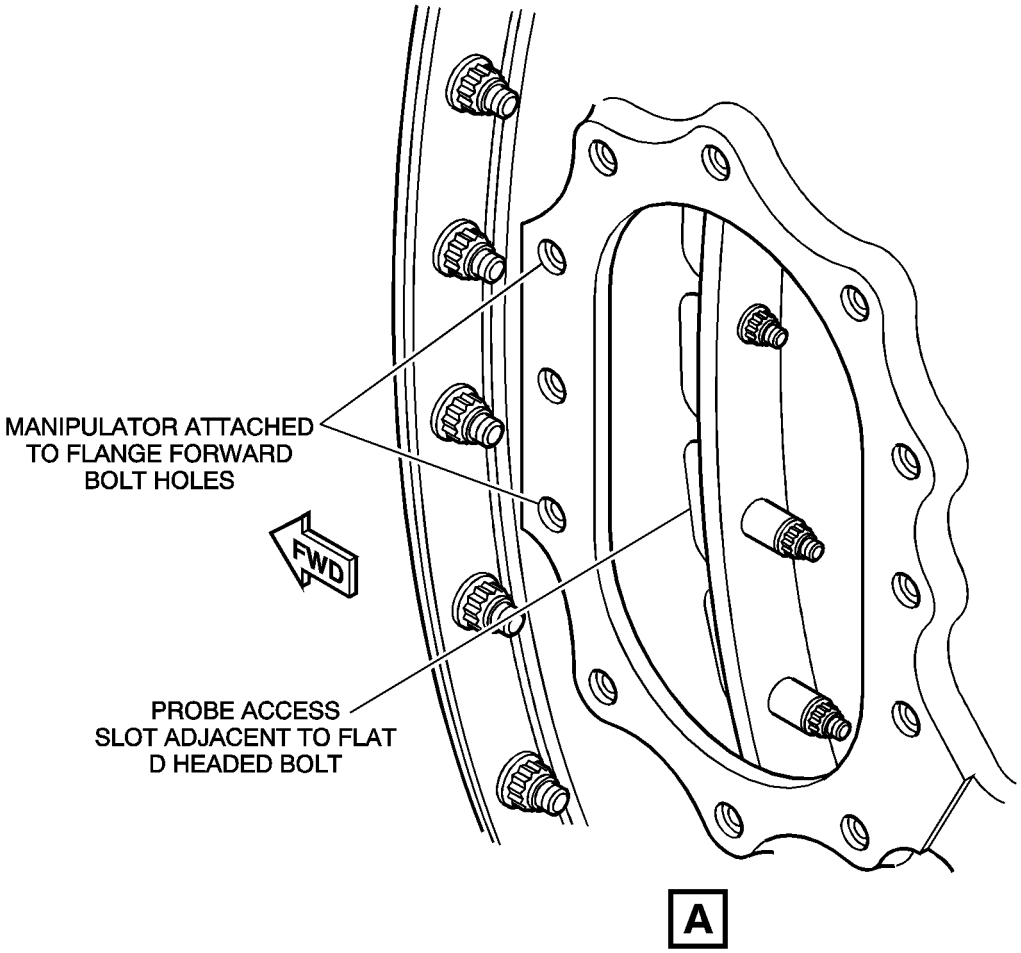


HP Compressor Bleed Valve and Support Duct A1/A5
Figure 1 (Sheet 1 of 2)



HP Compressor Bleed Valve and Support Duct D5
Figure 1 (Sheet 2 of 2)





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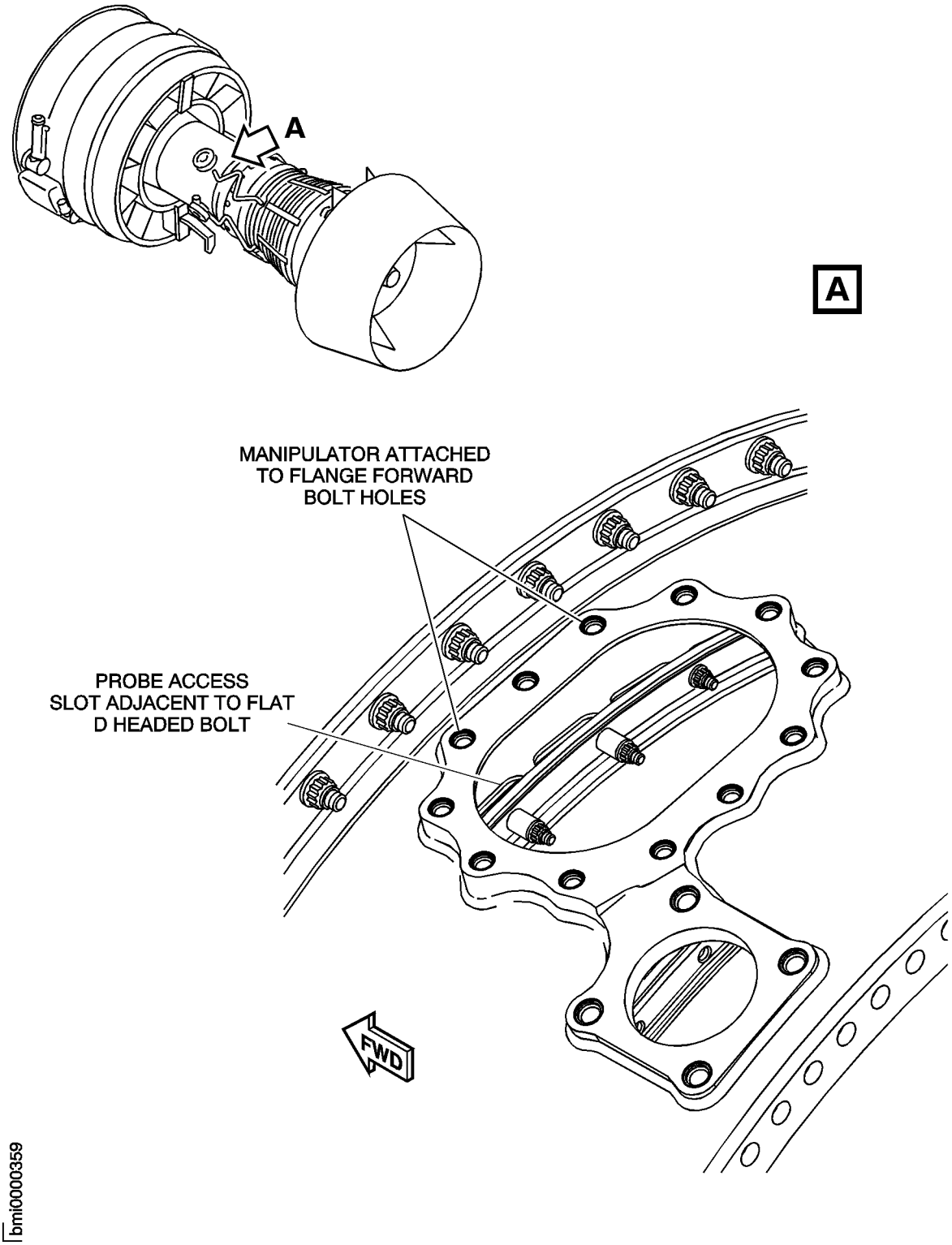
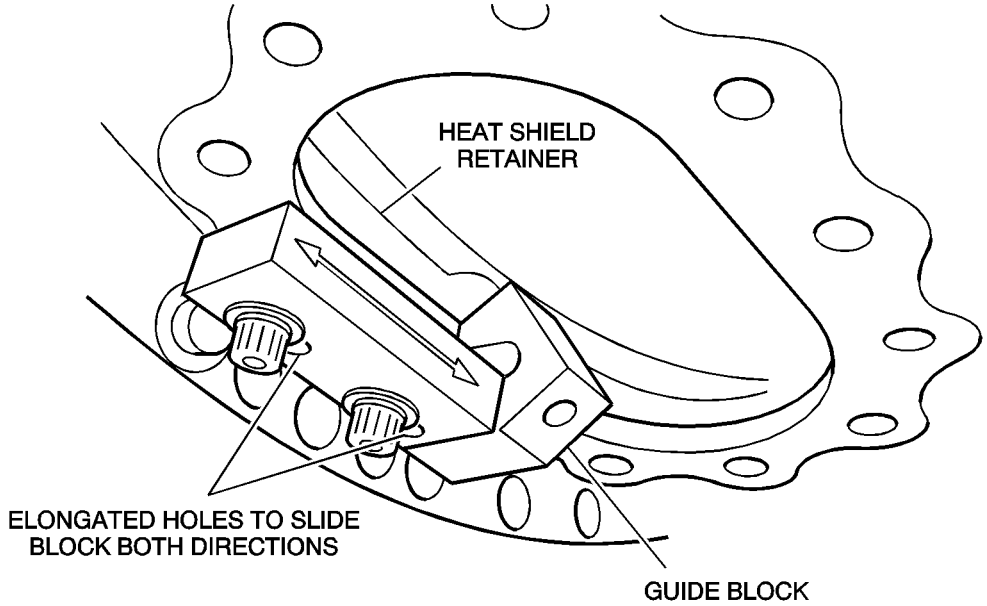
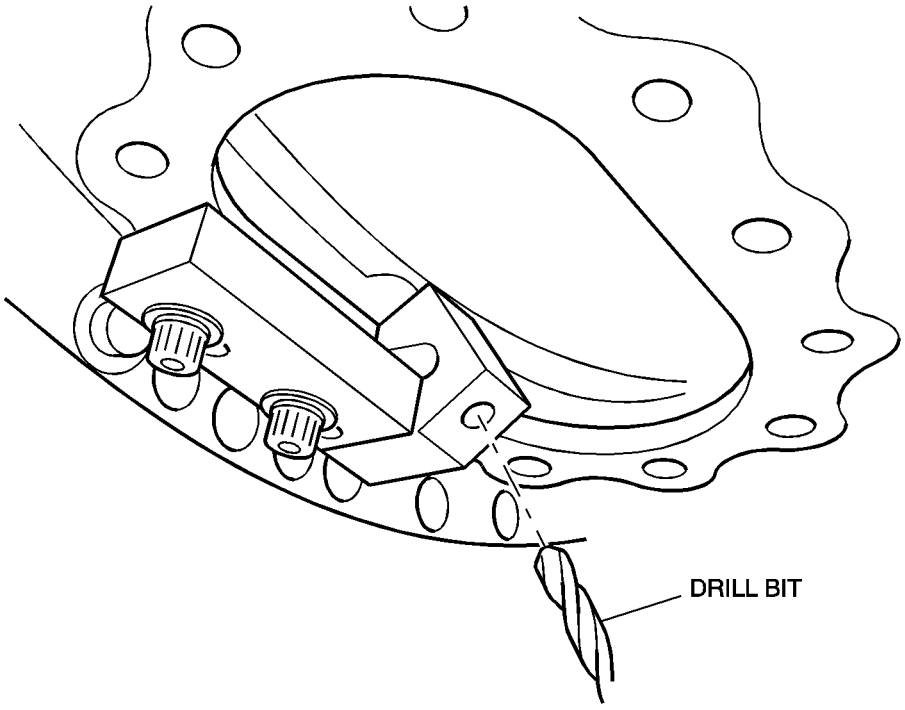
View of Bleed Valve Port Access Point and Manipulator Attachment Bolt Holes A1/A5
Figure 2 (Sheet 1 of 2)



View of Bleed Valve Port Access Point and Manipulator Attachment Bolt Holes D5
Figure 2 (Sheet 2 of 2)



VIEW OF ATTACHED DRILLING GUIDE TOOL



VIEW OF ATTACHED DRILLING GUIDE TOOL, DRILL INSERTION

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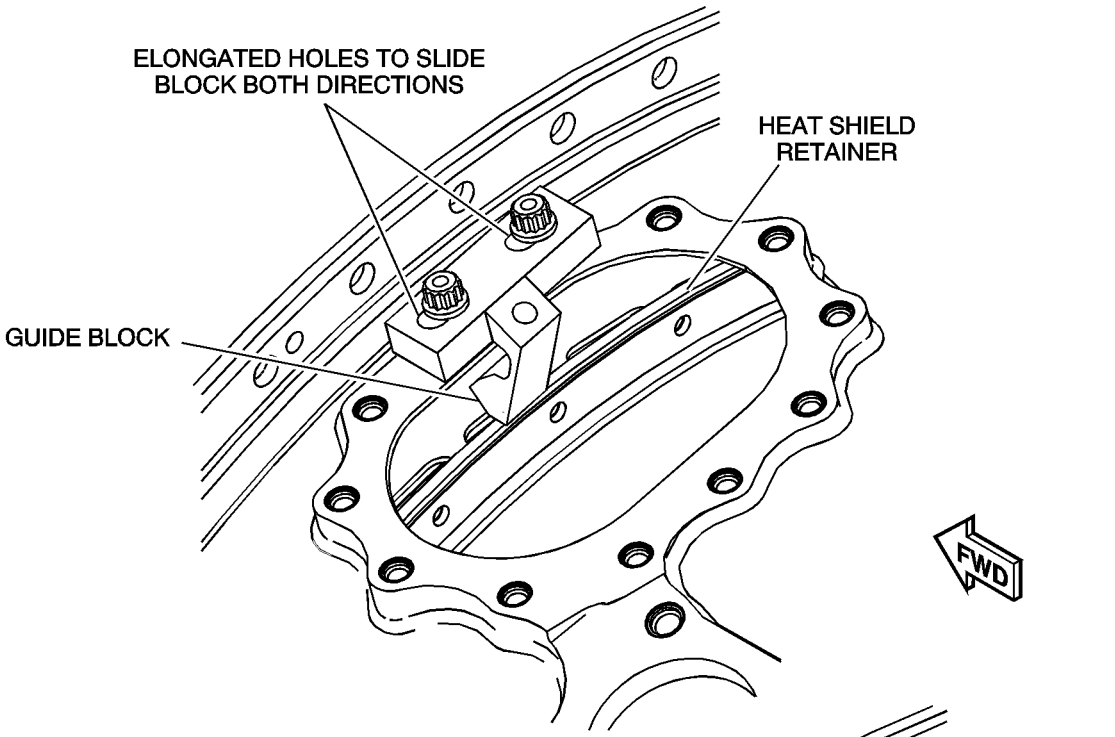
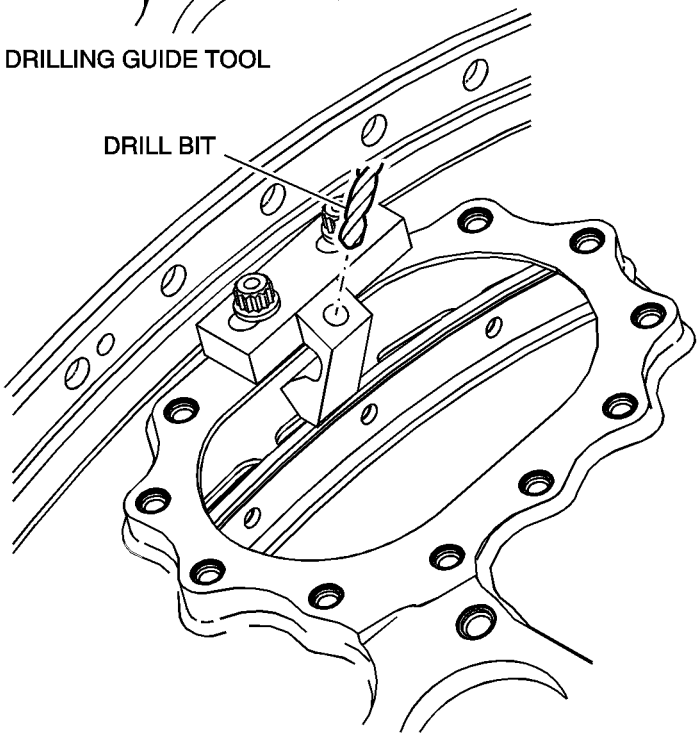
View of Attached Drilling Guide Tool and Drill Insertion A5
Figure 3 (Sheet 1 of 2)



VIEW OF ATTACHED DRILLING GUIDE TOOL



VIEW OF ATTACHED DRILLING GUIDE TOOL, DRILL INSERTION

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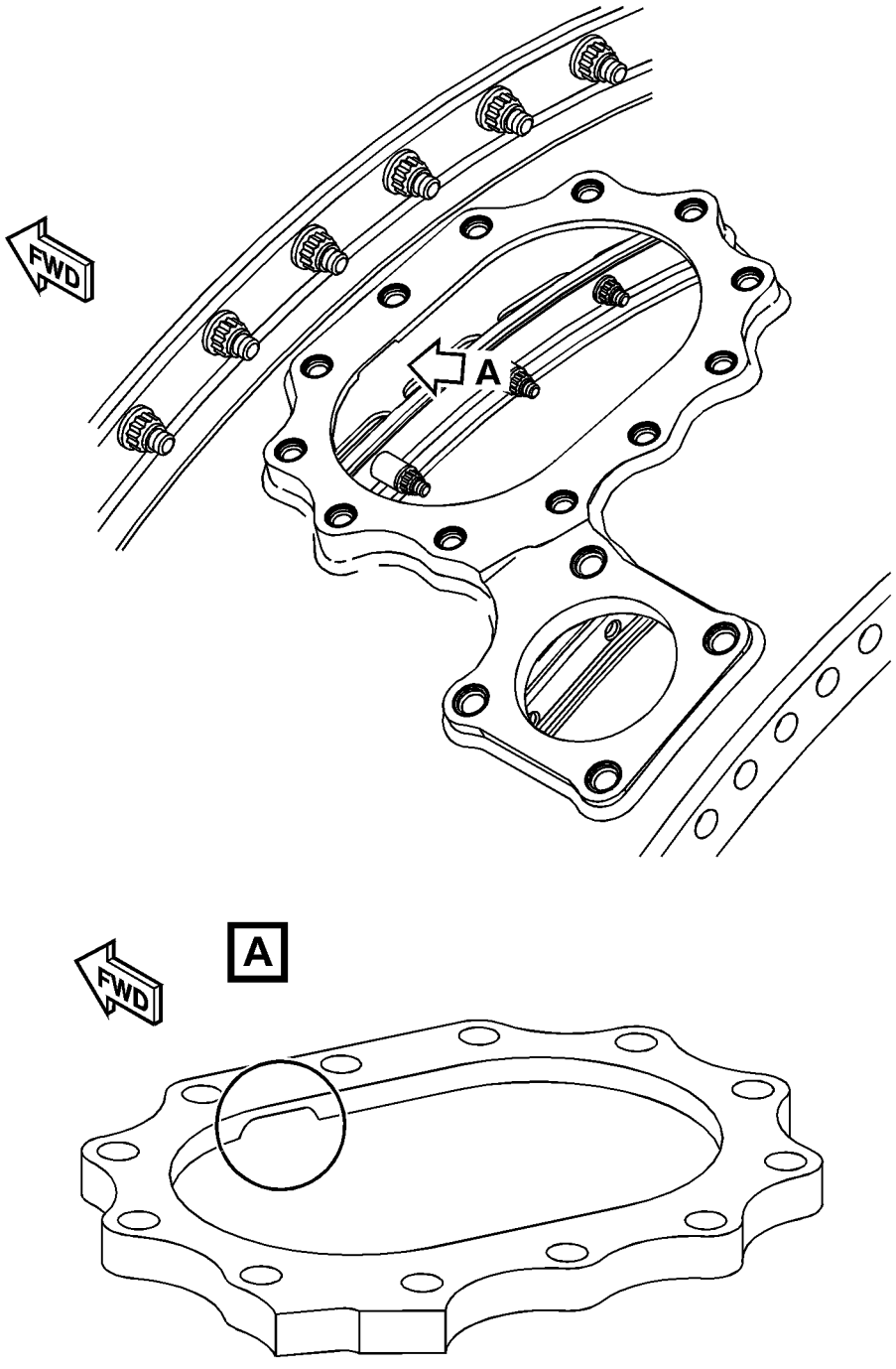
View of Attached Drilling Guide Tool and Drill Insertion D5
Figure 3 (Sheet 2 of 2)



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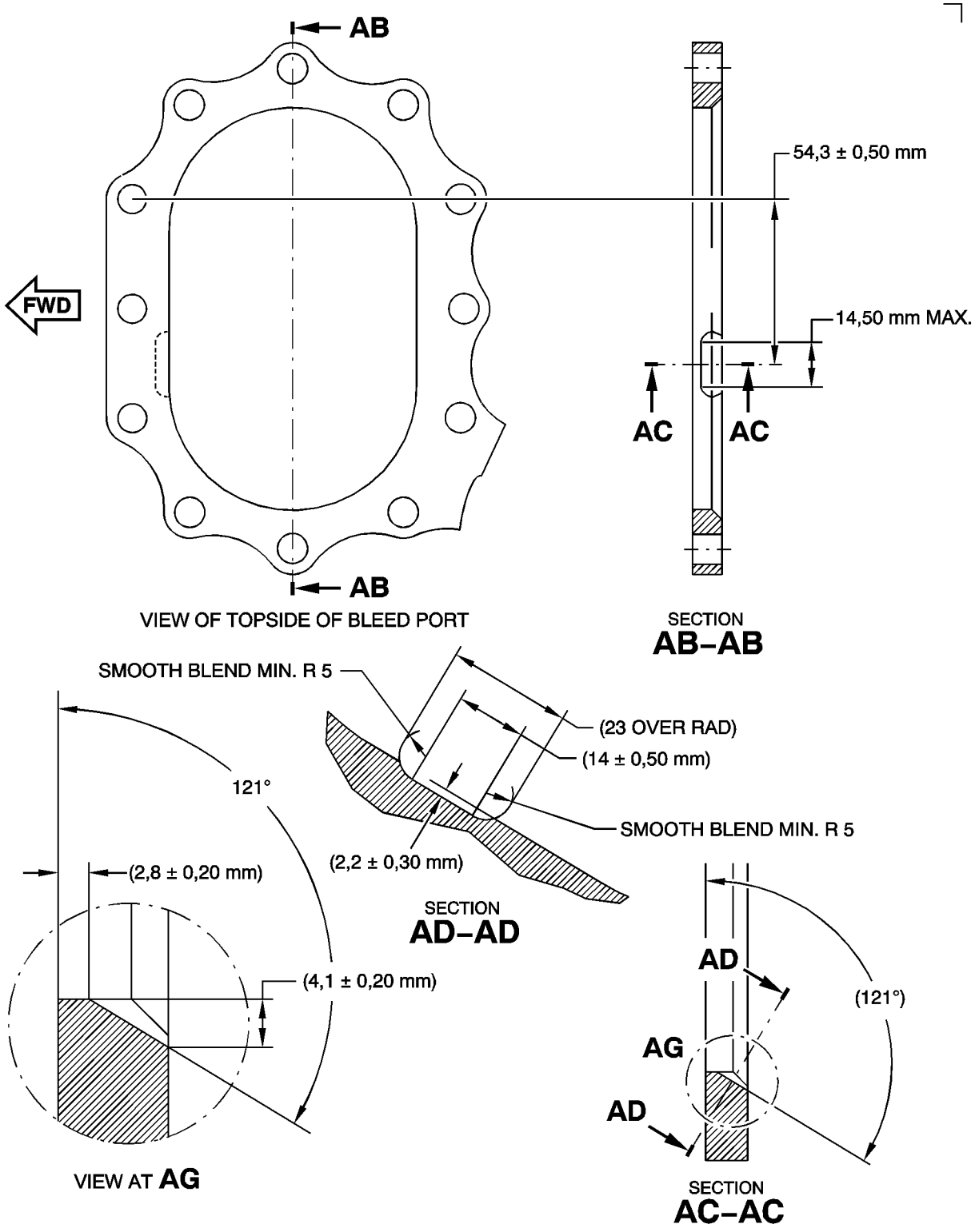
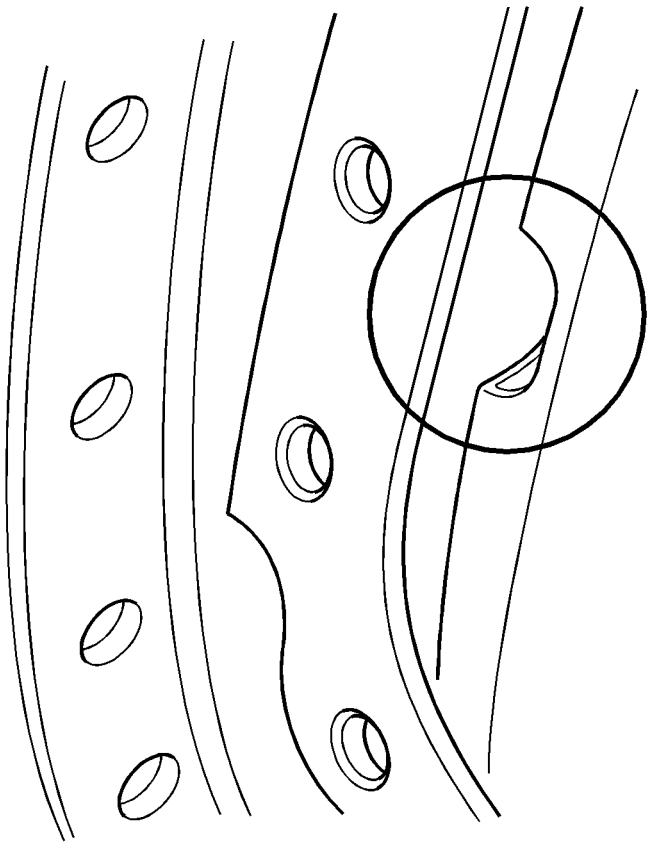
View of Rear Outer Case Bleed Port Flange Showing Dressed Recess A5/D5
Figure 4 (Sheet 1 of 2)



Detailed View of Rear Outer Case Bleed Port Flange Showing Recess Dressing Limits
A5/D5
Figure 4 (Sheet 2 of 2)



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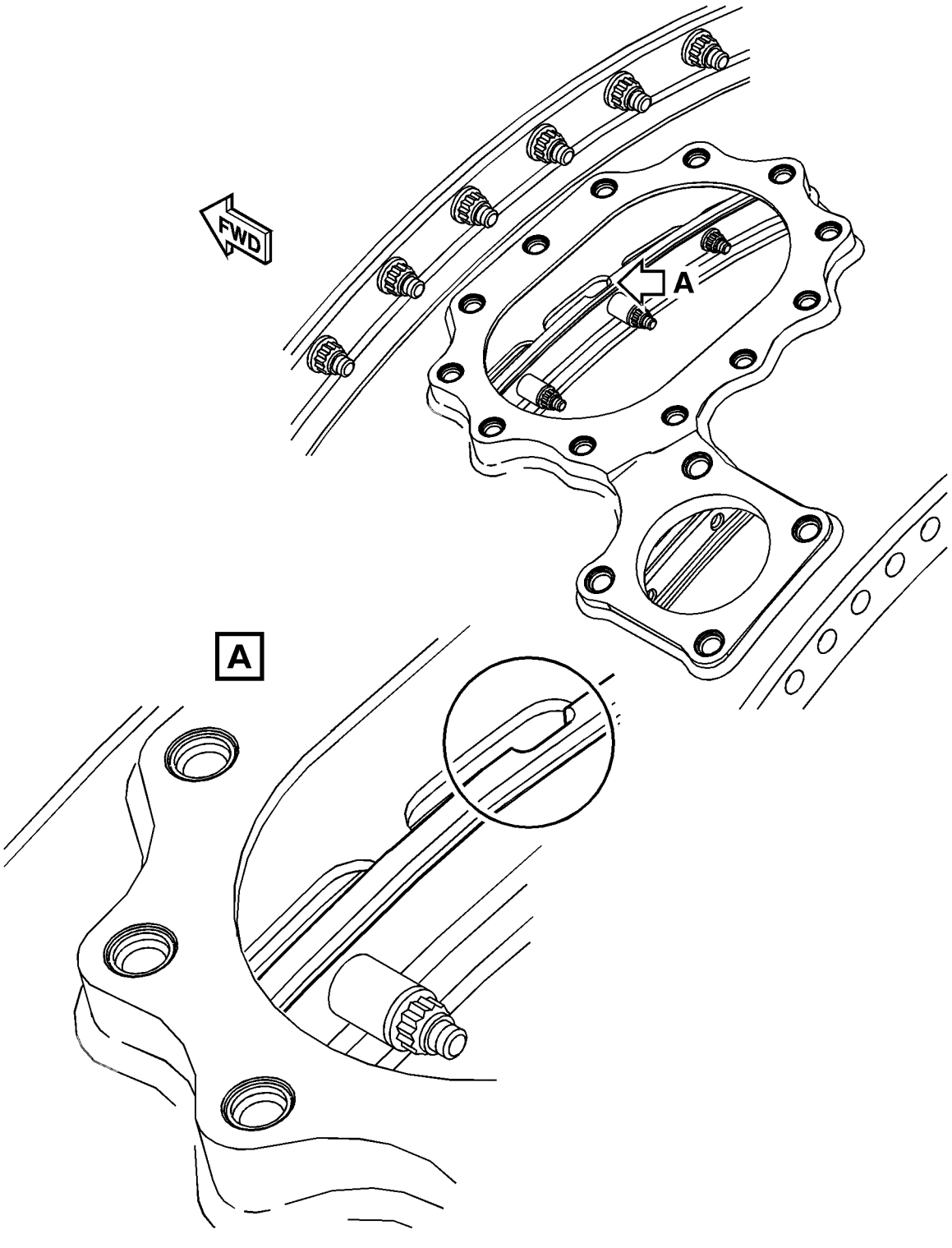
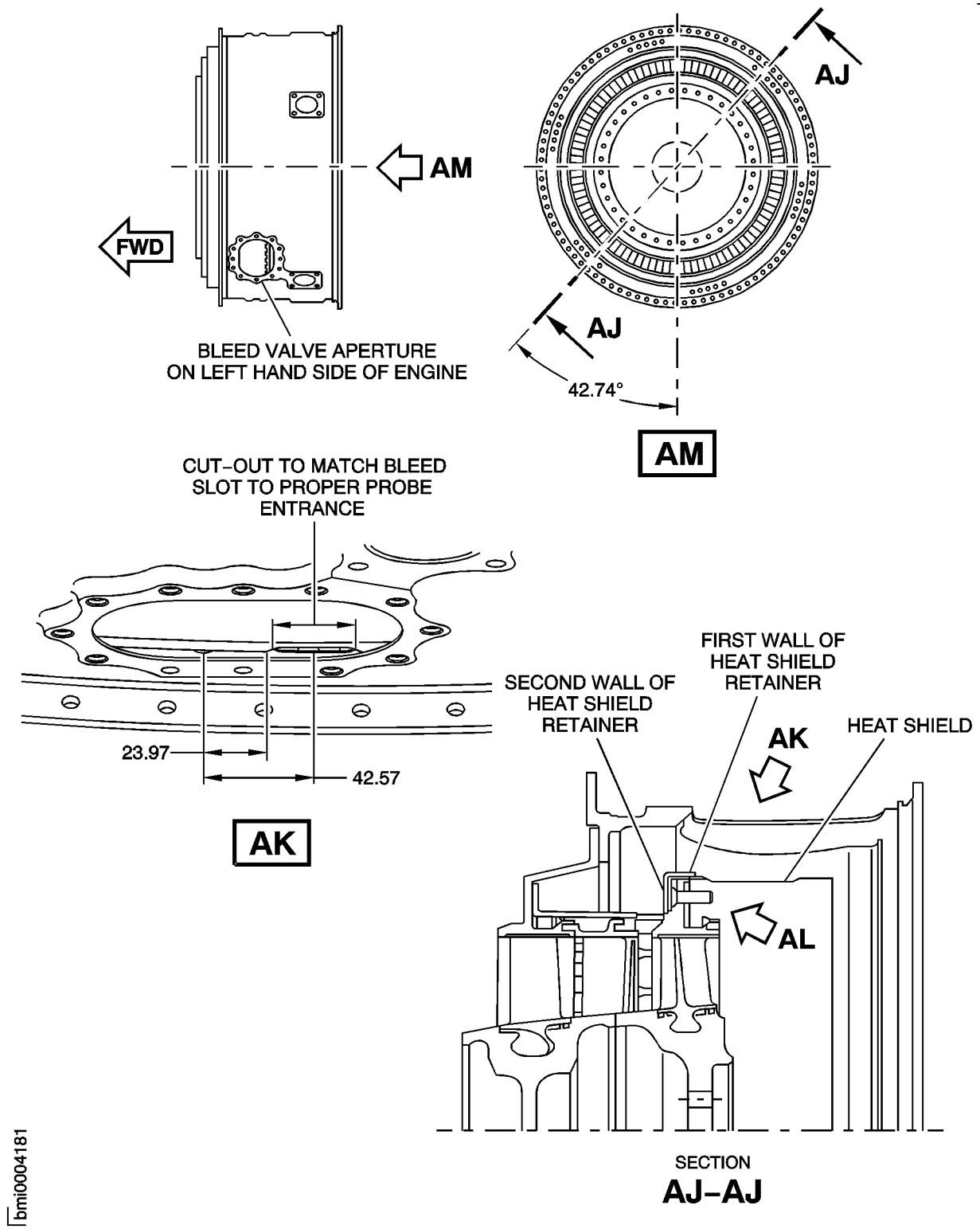
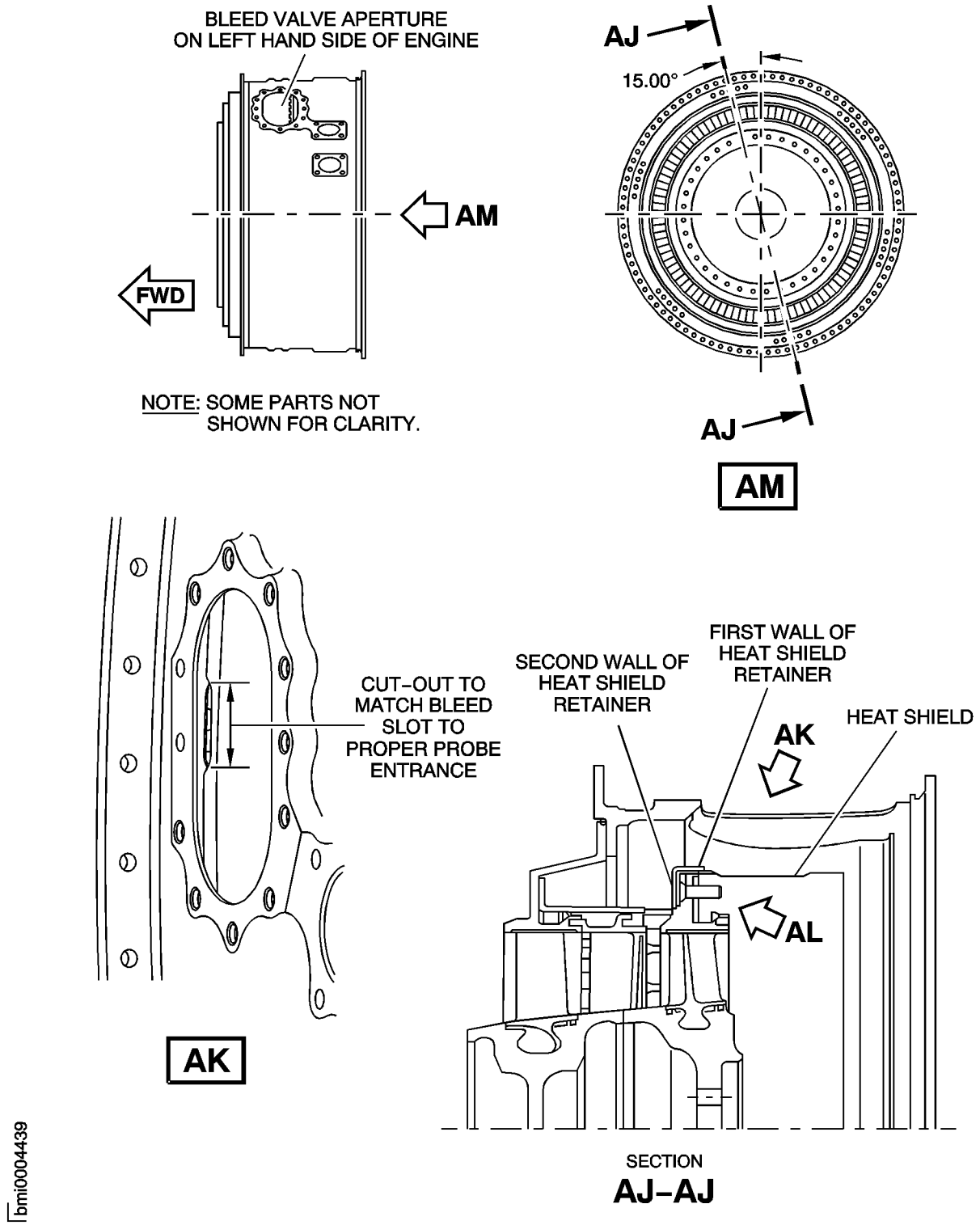
View of Finished Rework Opening A5
Figure 5 (Sheet 1 of 2)



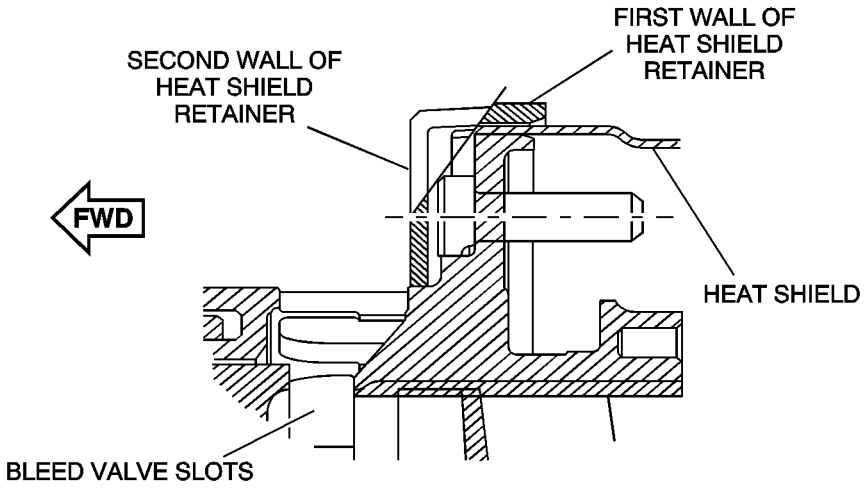
View of finished Rework Opening D5
Figure 5 (Sheet 2 of 2)



Diagrammatic Views for Rework A5
Figure 6 (Sheet 1 of 2)



Diagrammatic Views for Rework D5
Figure 6 (Sheet 2 of 2)



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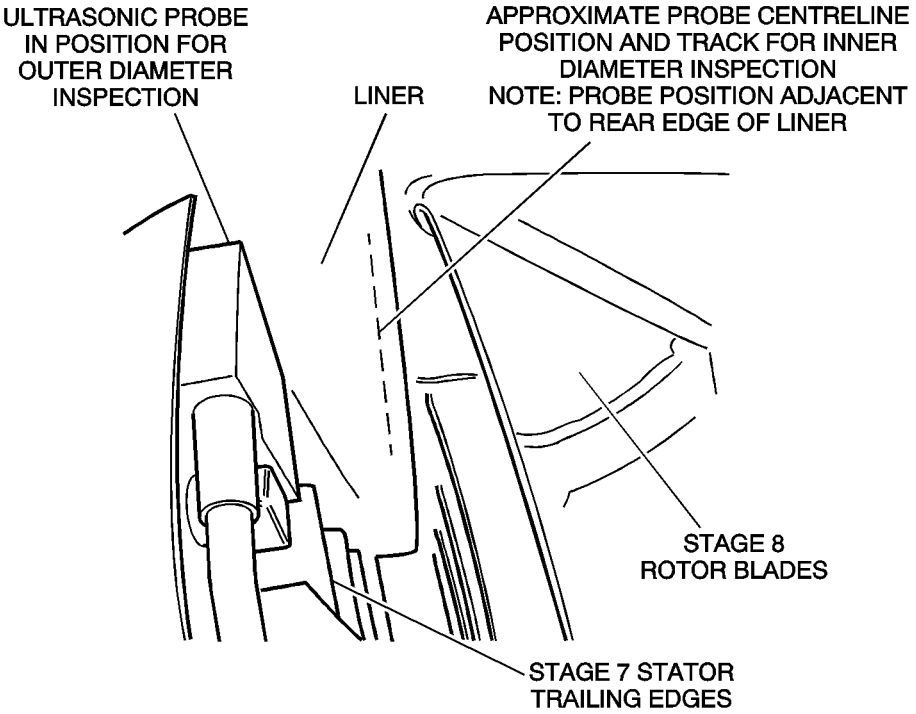
DIAGRAMMATIC VIEWS FOR REWORK



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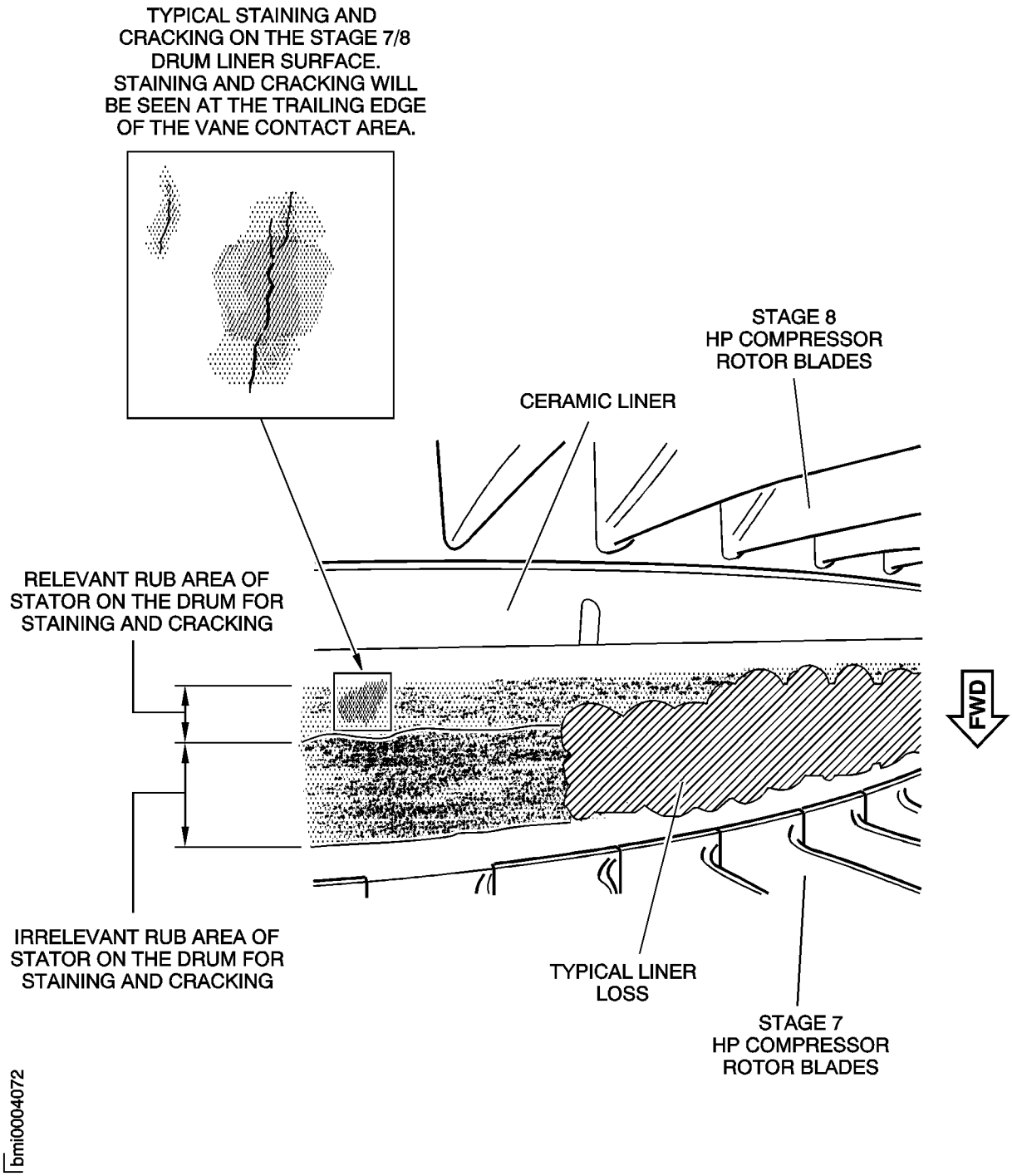
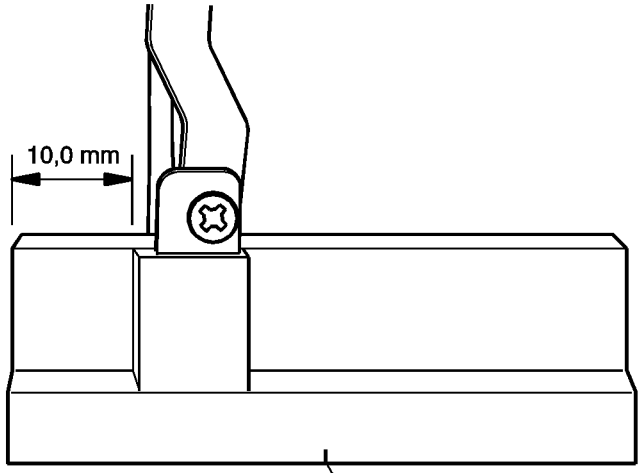
BORESCOPE VIEW SHOWING THE LINER, STAGE 7 STATOR VANES
AND STAGE 8 ROTOR BLADES

Borescope View Showing the liner, Stage 7 Stator Vanes and Stage 8 Rotor Blades
A5/D5
Figure 7

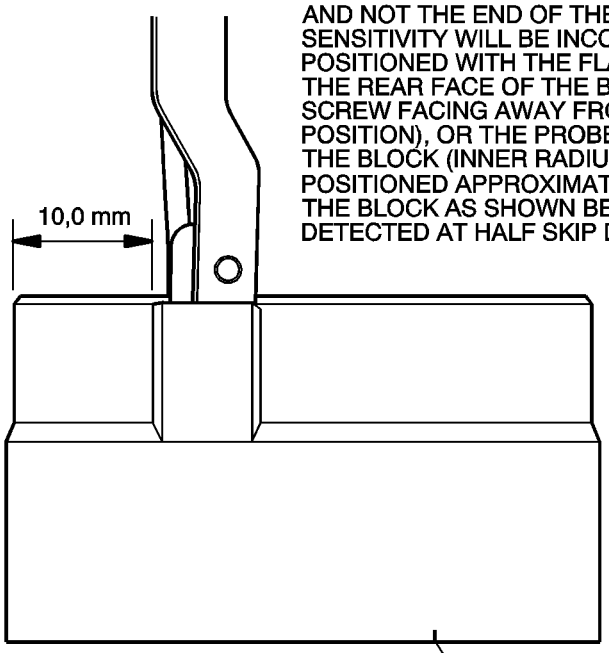


Typical Damage to the Ceramic Liner A1/A5/D5
Figure 8



OUTER DIAMETER POSITION

ULTRASONIC PROBE POSITIONED ON WORKING STANDARD. MAKE SURE CALIBRATION IS CARRIED OUT ON THE EDM NOTCH AND NOT THE END OF THE BLOCK OR THE INSPECTION SENSITIVITY WILL BE INCORRECT. THE PROBE SHOULD BE POSITIONED WITH THE FLAT FACE OF THE PROBE AGAINST THE REAR FACE OF THE BLOCK AND THE PROBE MOUNTING SCREW FACING AWAY FROM THE BLOCK (OUTER DIAMETER POSITION), OR THE PROBE MOUNTING SCREW FACING INTO THE BLOCK (INNER RADIUS POSITION). WITH THE PROBE POSITIONED APPROXIMATELY 10,0 mm FROM THE END OF THE BLOCK AS SHOWN BELOW, THE EDM TARGET WILL BE DETECTED AT HALF SKIP DISTANCE.



INNER DIAMETER POSITION

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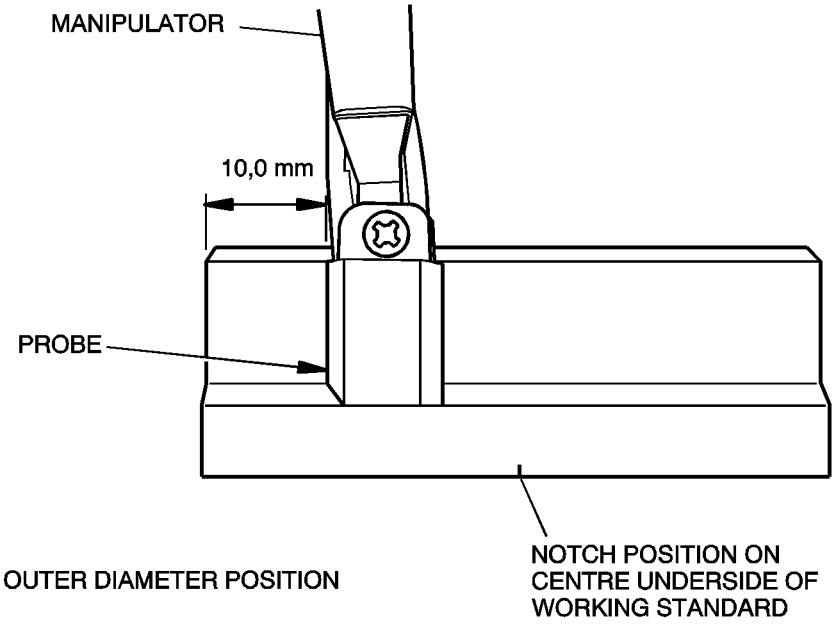
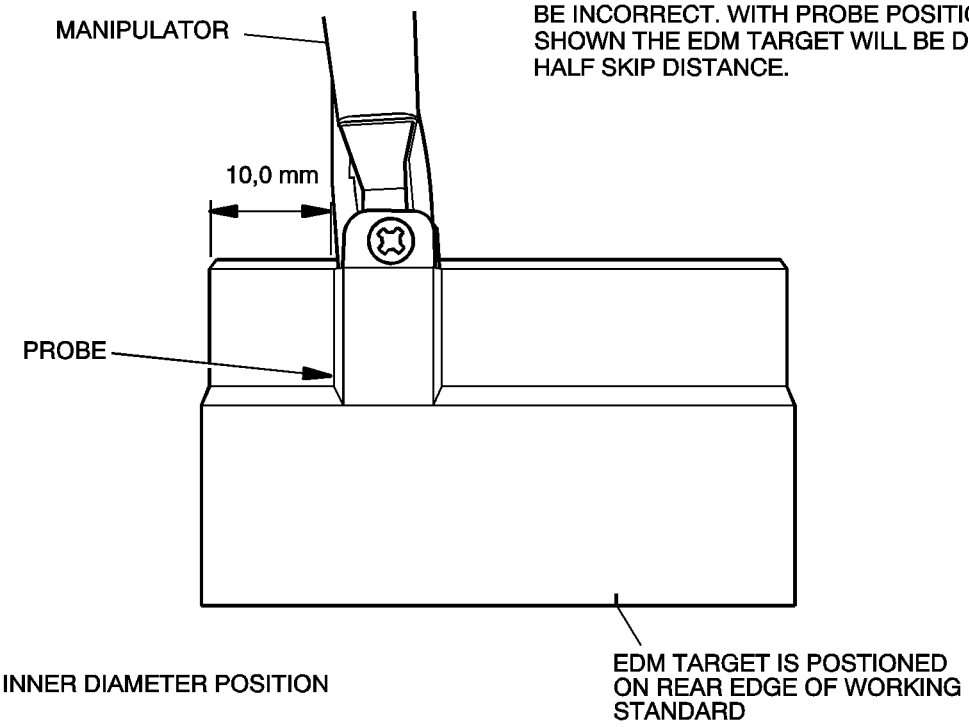
Ultrasonic Probe Positioned on Working Standard A1
Figure 9 (Sheet 1 of 2)



ULTRASONIC PROBE POSITIONED ON WORKING STANDARD. MAKE SURE CALIBRATION IS CARRIED OUT ON THE EDM NOTCH AND NOT THE END OF THE BLOCK OR THE INSPECTION SENSITIVITY WILL BE INCORRECT. WITH PROBE POSITIONED AS SHOWN THE EDM TARGET WILL BE DETECTED AT HALF SKIP DISTANCE.



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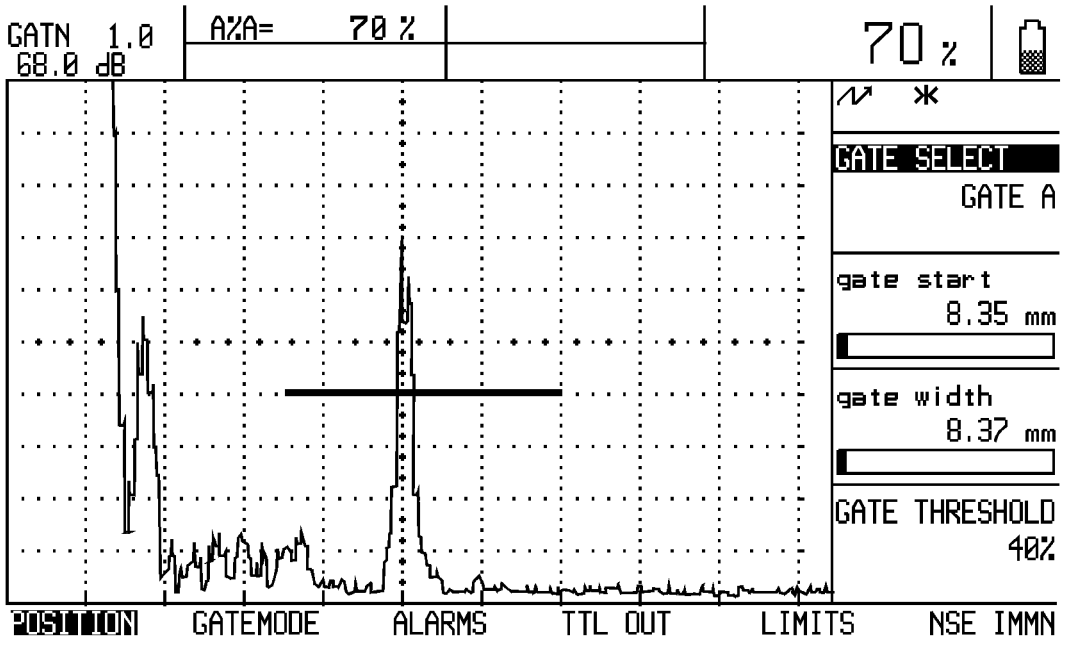
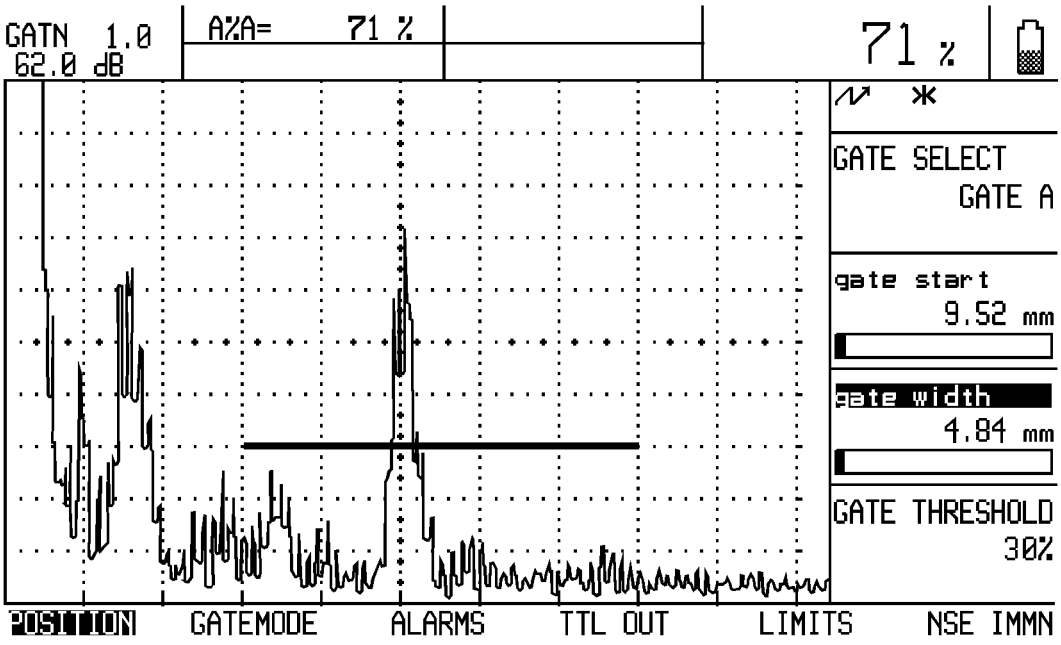
Ultrasonic Probe Positioned on Working Standard A5/D5
Figure 9 (Sheet 2 of 2)



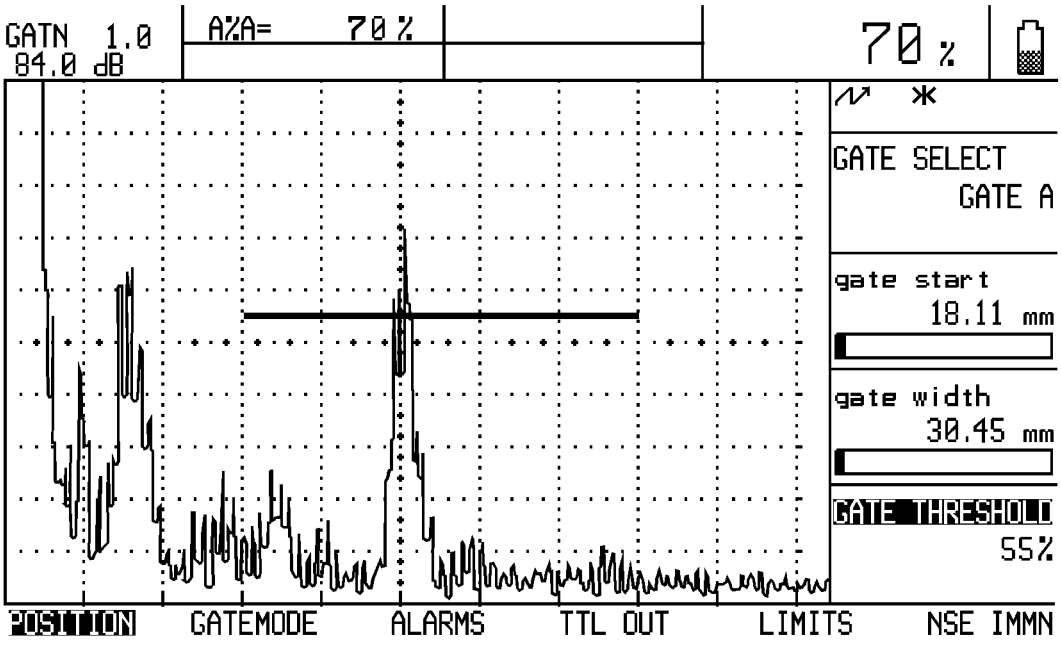
OUTER DIAMETER STAGE 7-8 EB WELD LAND

bmi0004421

Signal from EDM Target on Working Standard at Half Skip Distance A1/A5/D5
Figure 10 (Sheet 1 of 2)



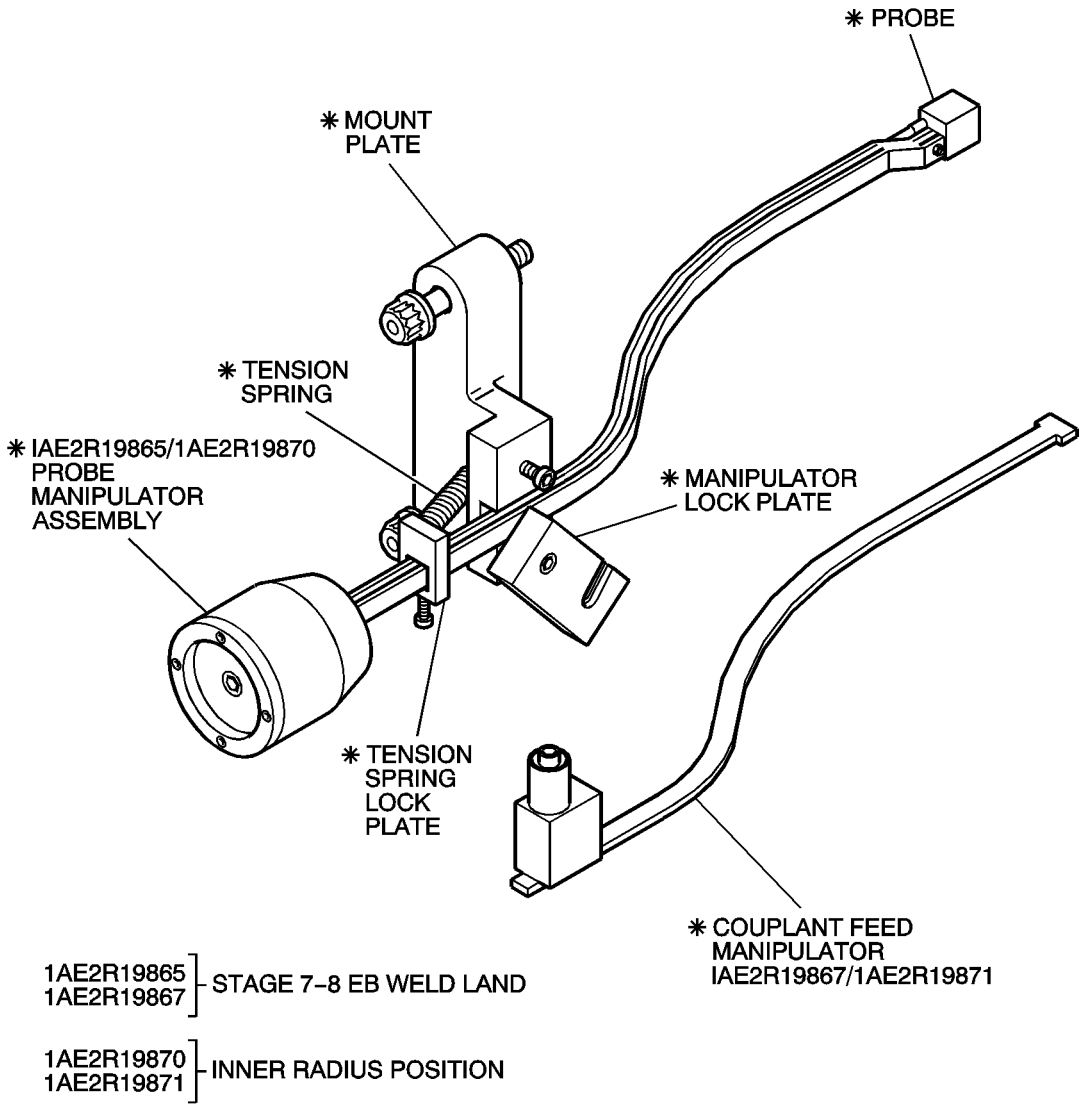
INNER RADIUS POSITION
FOR HP COMPRESSOR DRUMS OF Ti6 DRUM MATERIAL



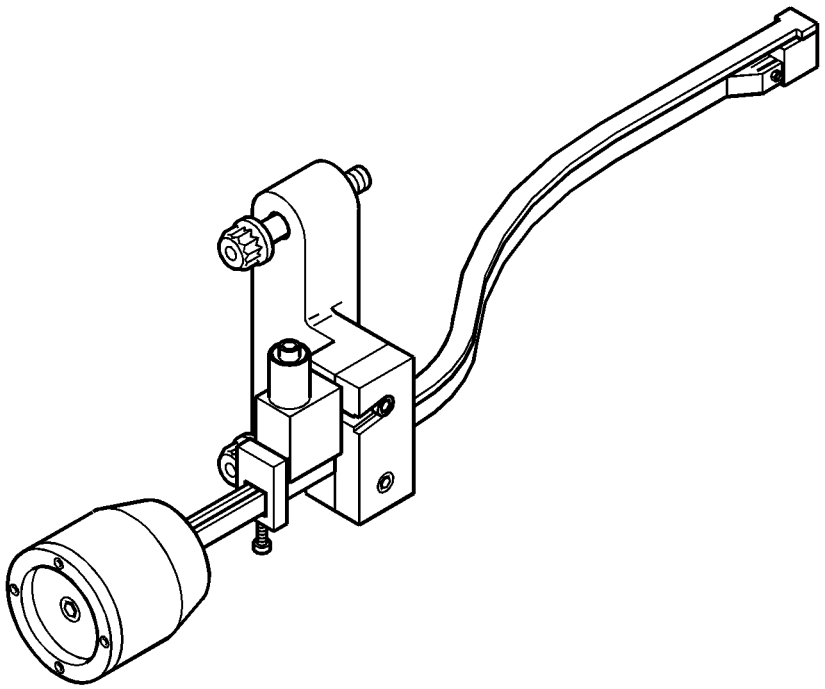
INNER RADIUS POSITION
FOR HP COMPRESSOR DRUMS OF Ti5 DRUM MATERIAL

bmi0004075

Signal from EDM Target on Working Standard at Half Skip Distance A1/A5/D5
Figure 10 (Sheet 2 of 2)



Components Parts of the Ultrasonic Probe Manipulator Assembly A1
Figure 11 (Sheet 1 of 7)



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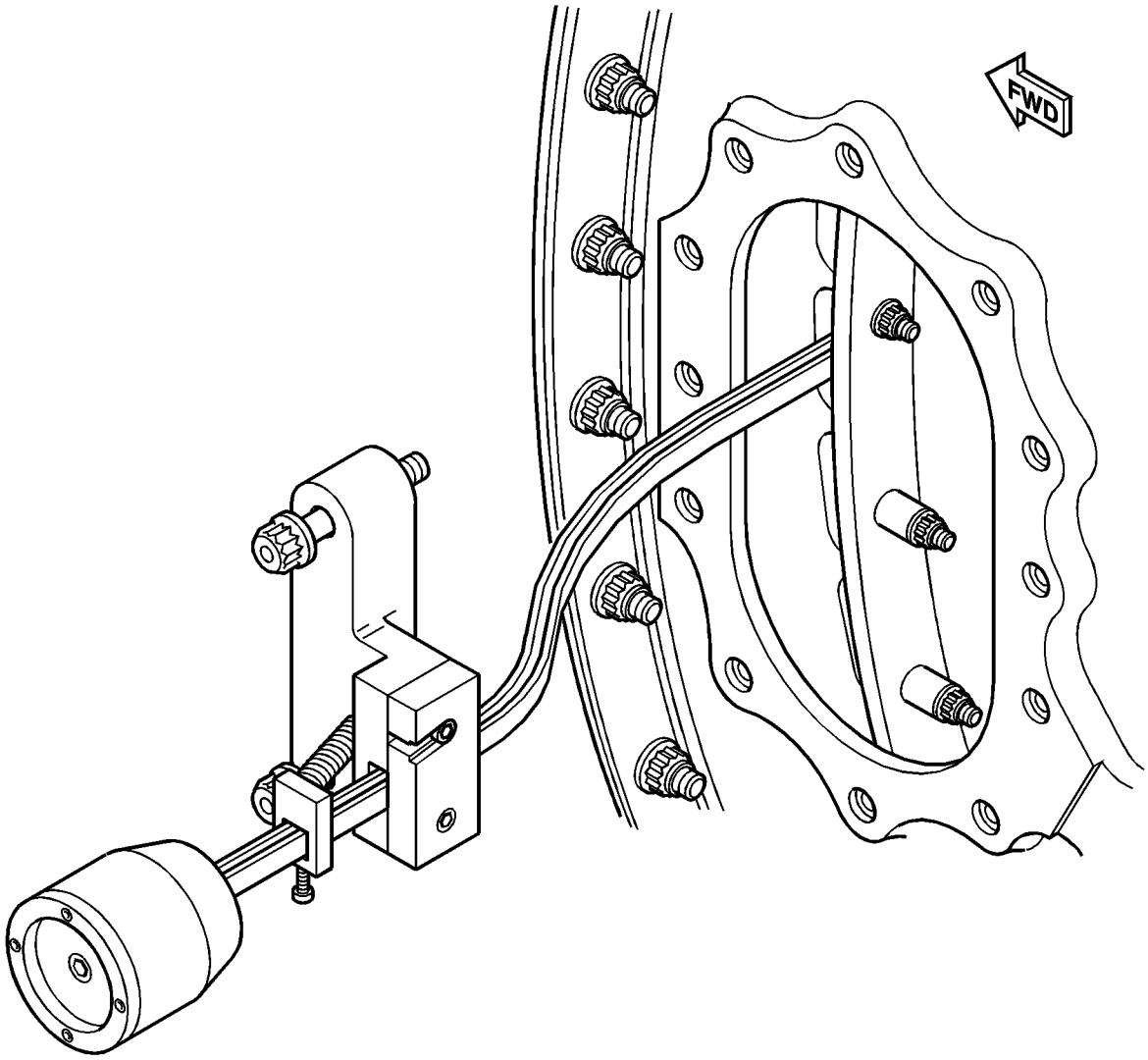
Fully Assembled Probe and Couplant Manipulator Assembly A1
Figure 11 (Sheet 2 of 7)



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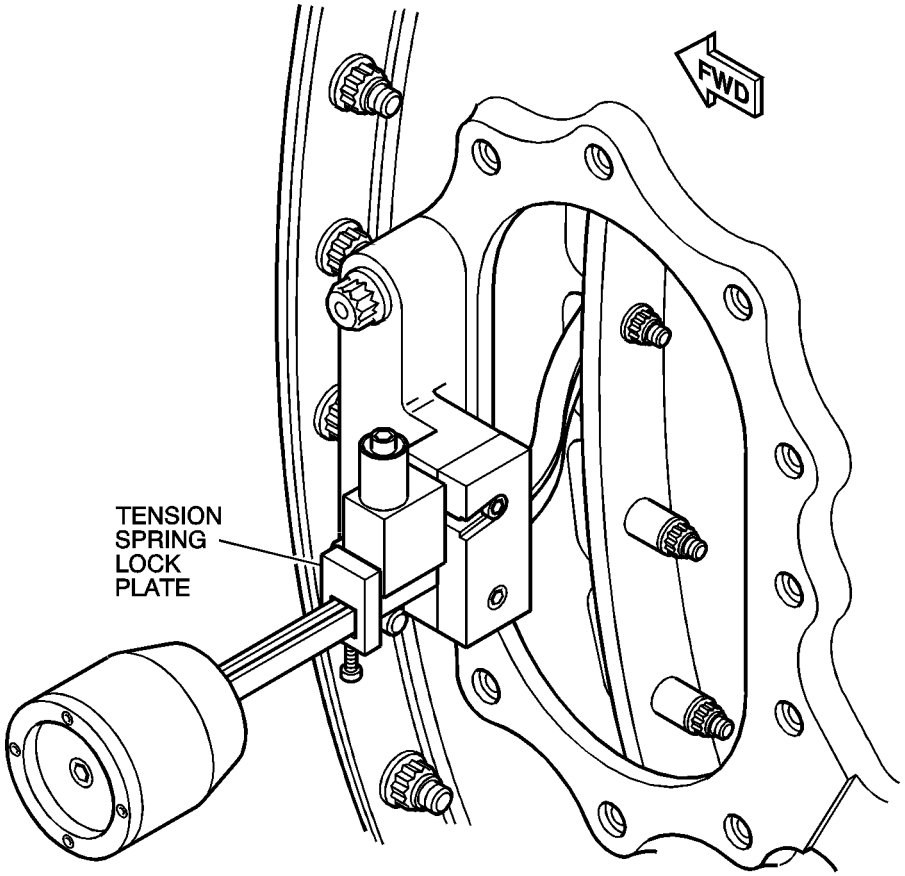
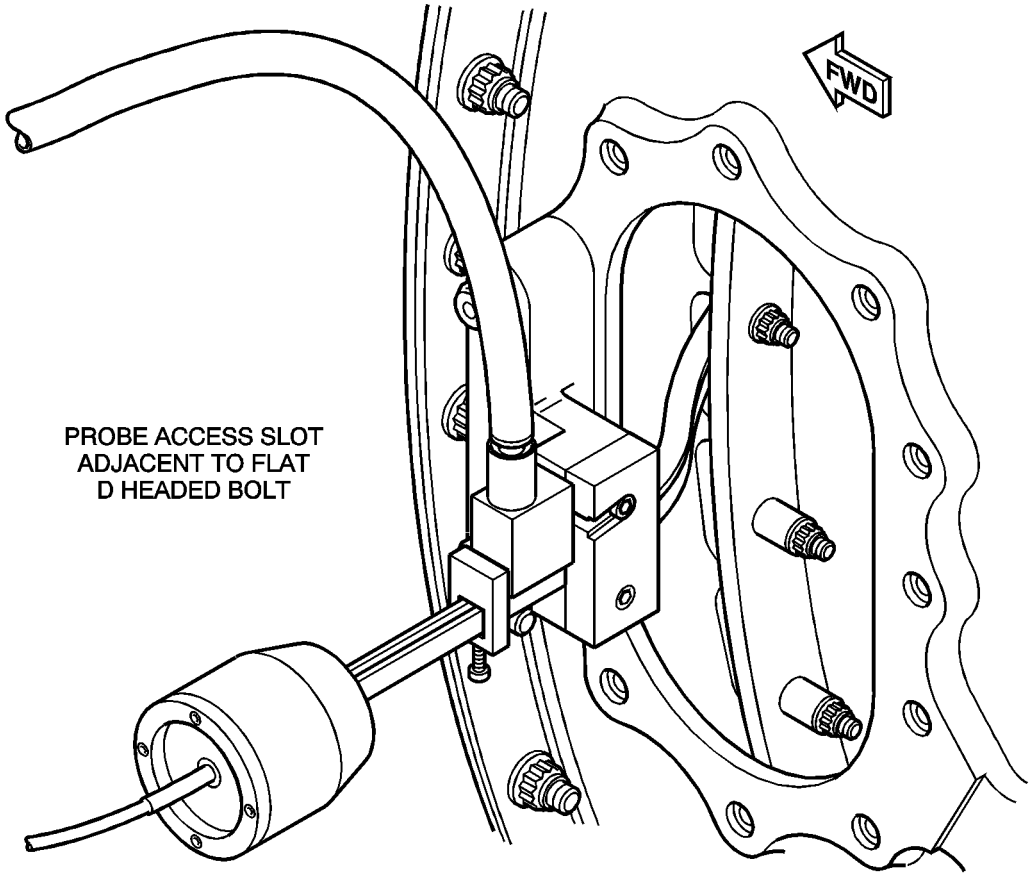
Install the Ultrasonic Probe Manipulator to the Engine A1
Figure 11 (Sheet 3 of 7)



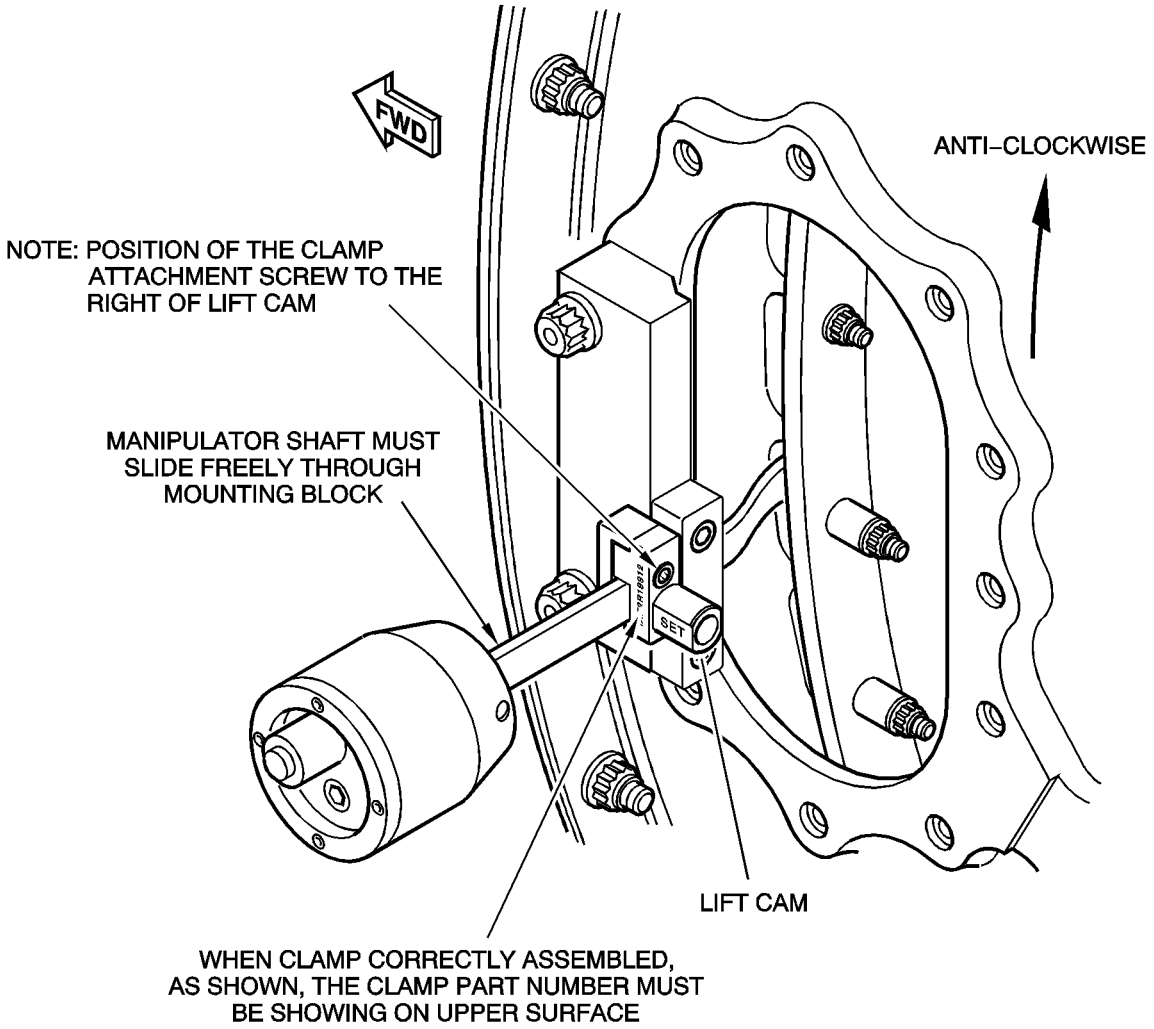
bmi0004069

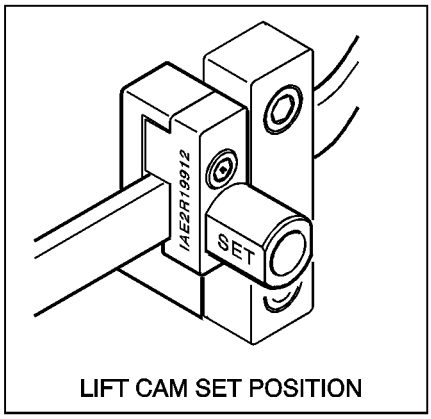
Install the Tension Spring Lock Plate A1
Figure 11 (Sheet 4 of 7)



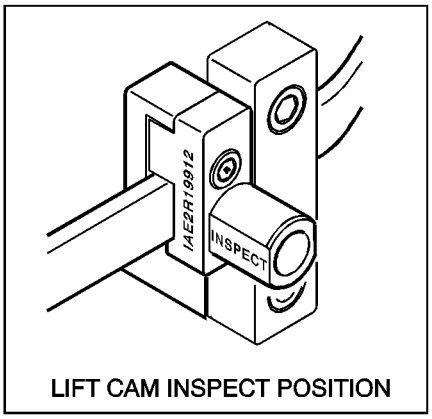
bmi0004070

Ultrasonic Probe Manipulator Installed to the Bleed Valve Aperture A1
Figure 11 (Sheet 5 of 7)





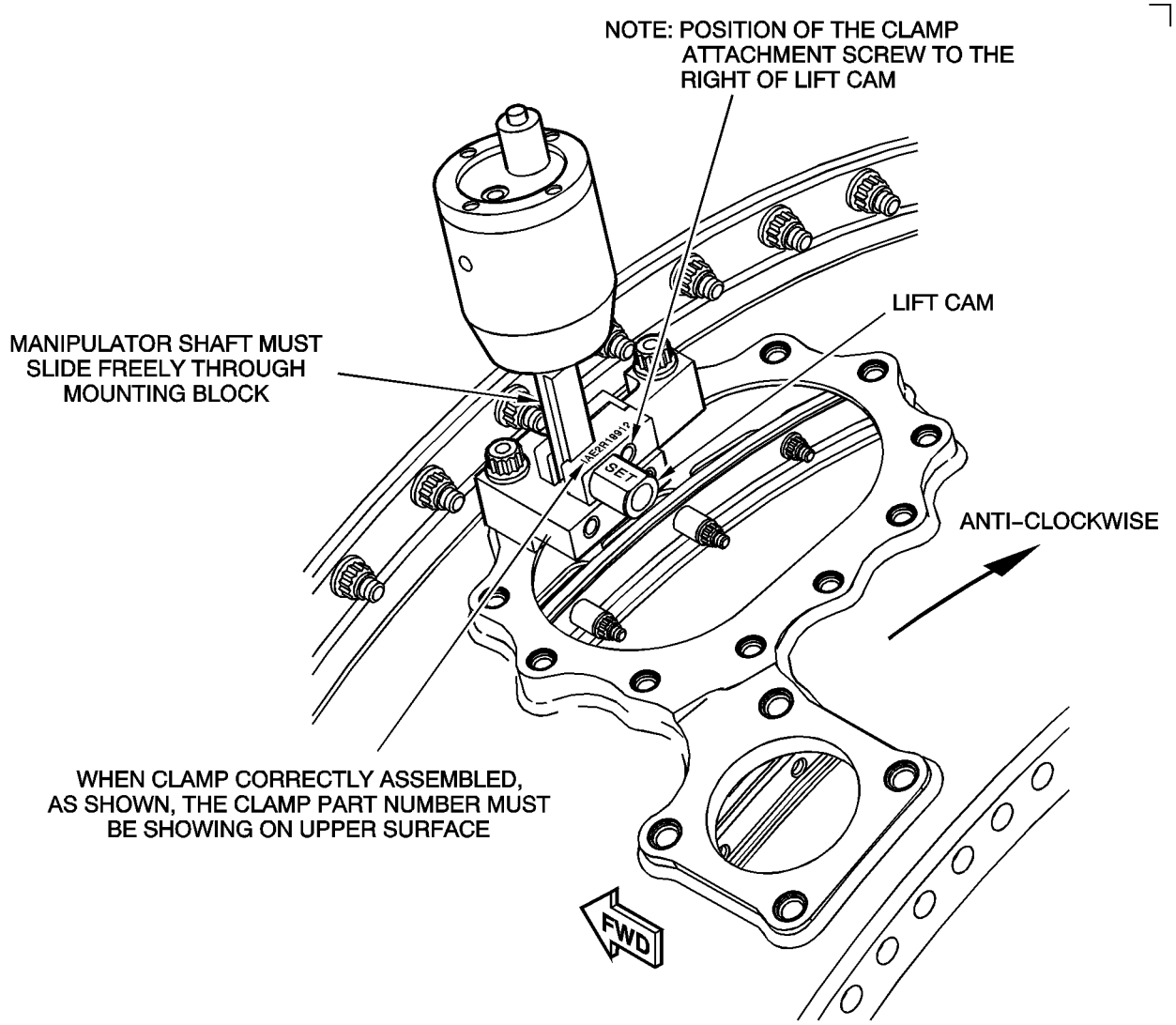
LIFT CAM SET POSITION

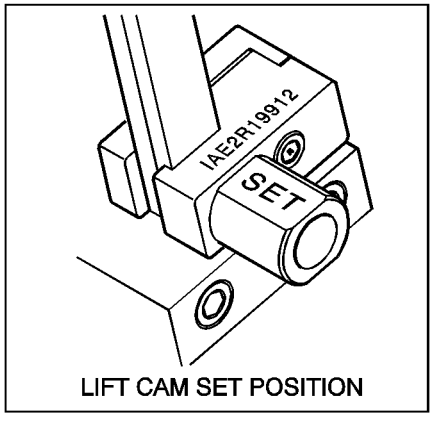


LIFT CAM INSPECT POSITION

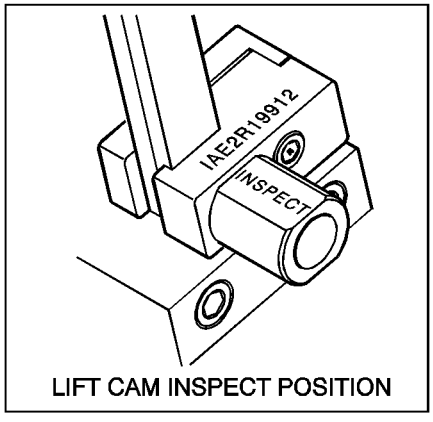
bmi0004190

Ultrasonic Probe Manipulator Installed to the bleed Valve Aperture A5
Figure 11 (Sheet 6 of 7)





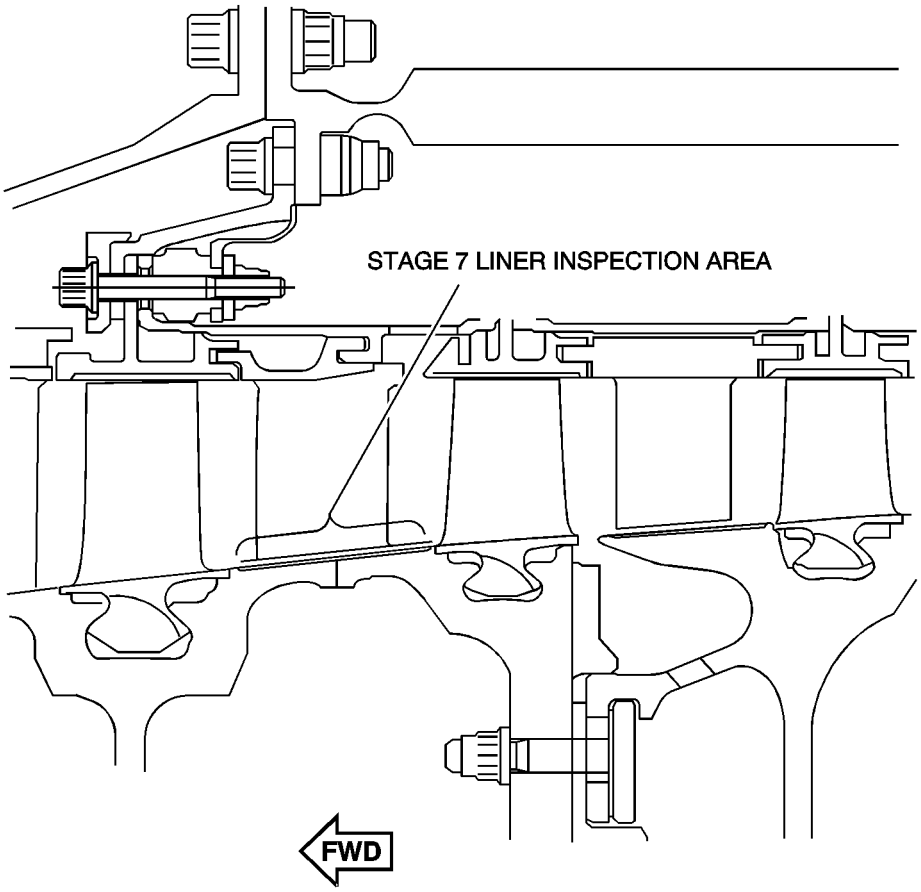
LIFT CAM SET POSITION



LIFT CAM INSPECT POSITION

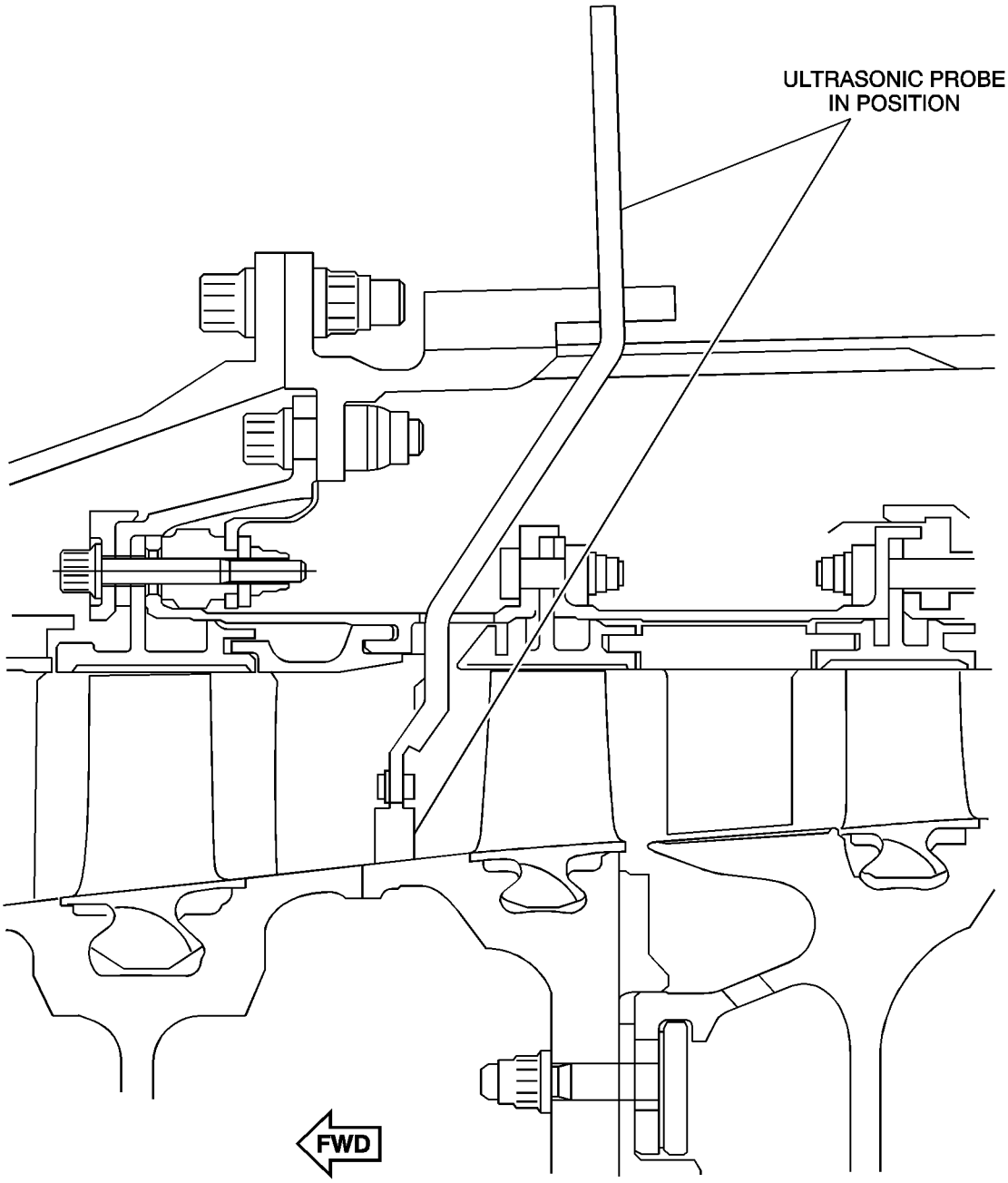
bmi0000360

Ultrasonic Probe Manipulator Installed to the bleed Valve Aperture D5
Figure 11 (Sheet 7 of 7)

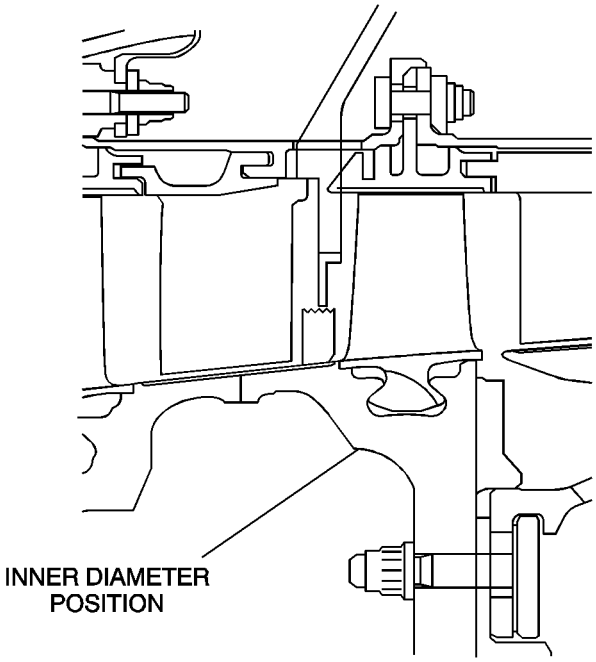


bmi0004184

HP Compressor Section A1/A5/D5
Figure 12

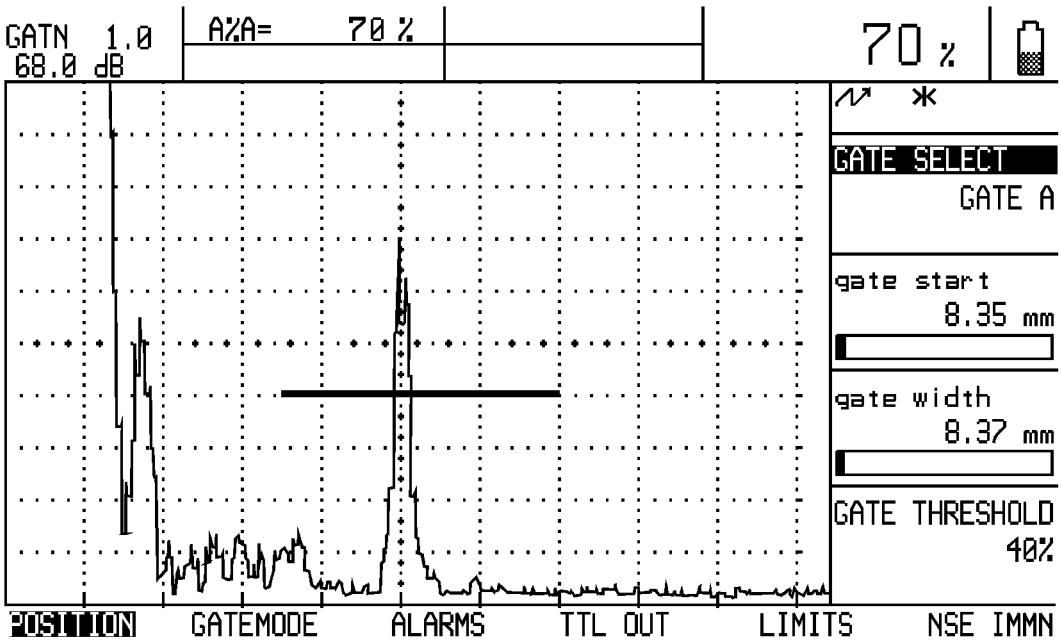


HP Compressor Outer Diameter Probe in Position A1/A5/D5
Figure 13



bmi0004191

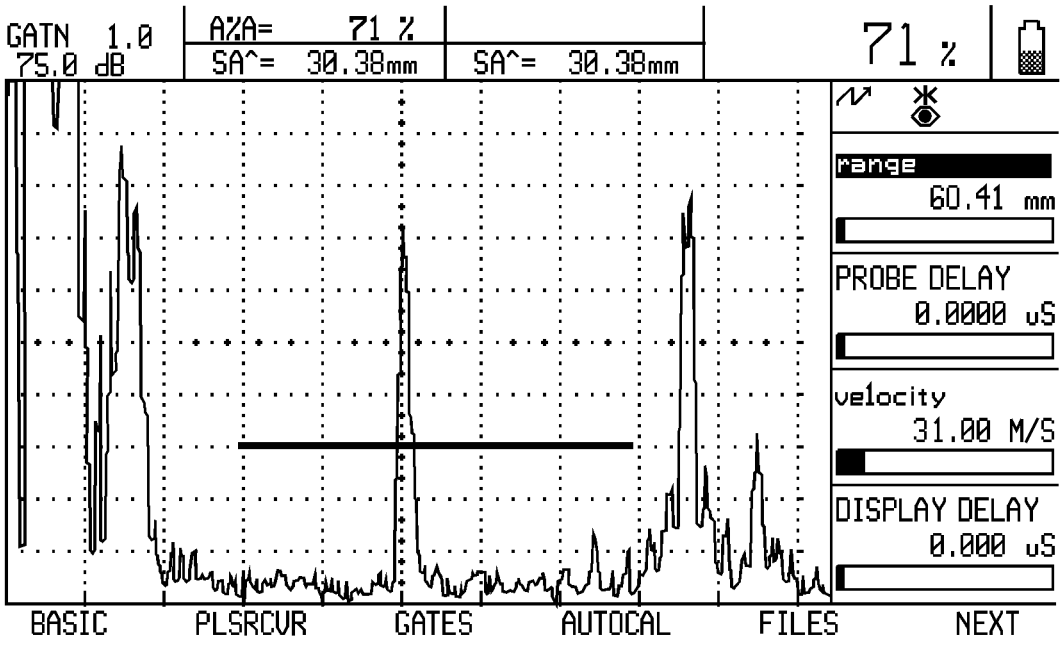
HP Compressor Section Inner Diameter Probe in Position A5
Figure 14



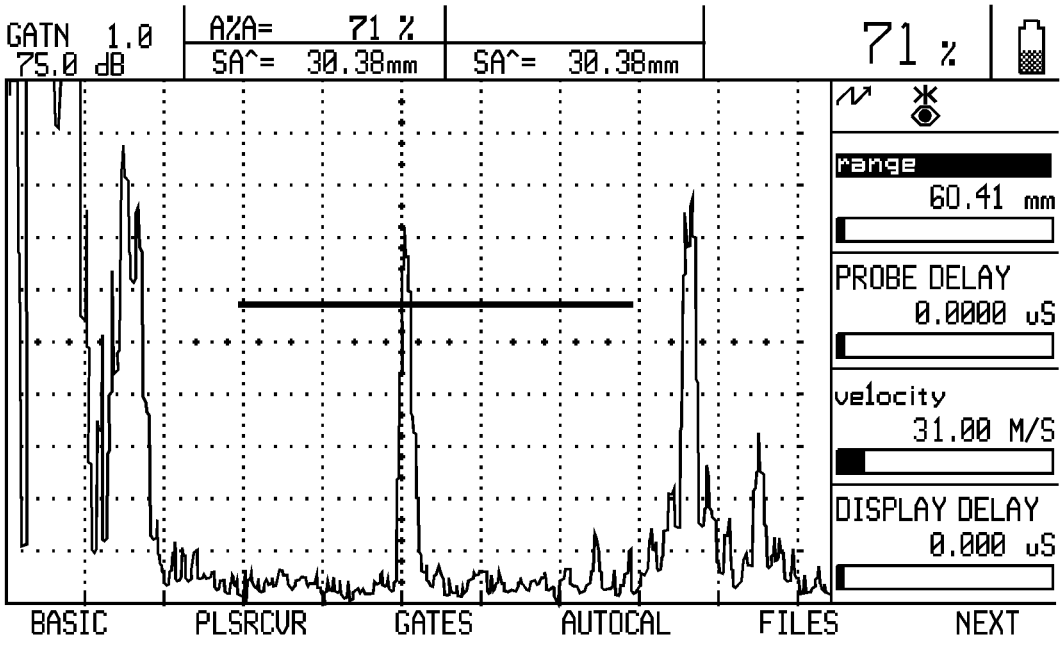
OUTER DIAMETER STAGE 7-8 EB WELD LAND

bmi0004193

Signal from Typical Crack on Disc at Half Skip Distance A1/A5/D5
Figure 15 (Sheet 1 of 2)



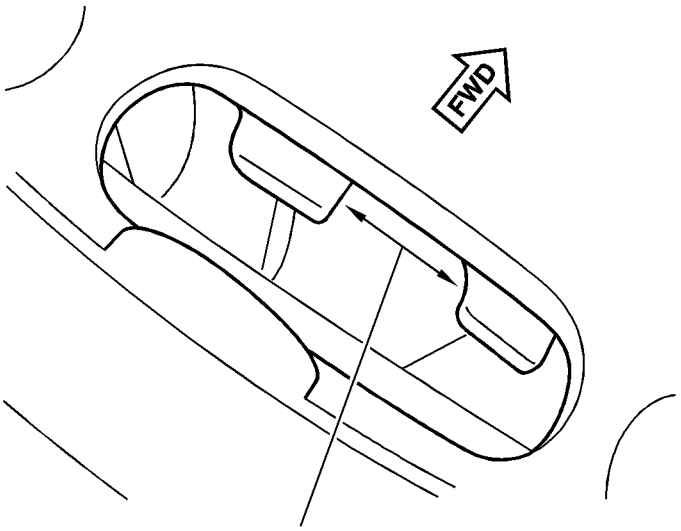
INNER RADIUS POSITION
FOR HP COMPRESSOR DRUMS OF Ti6 DRUM MATERIAL



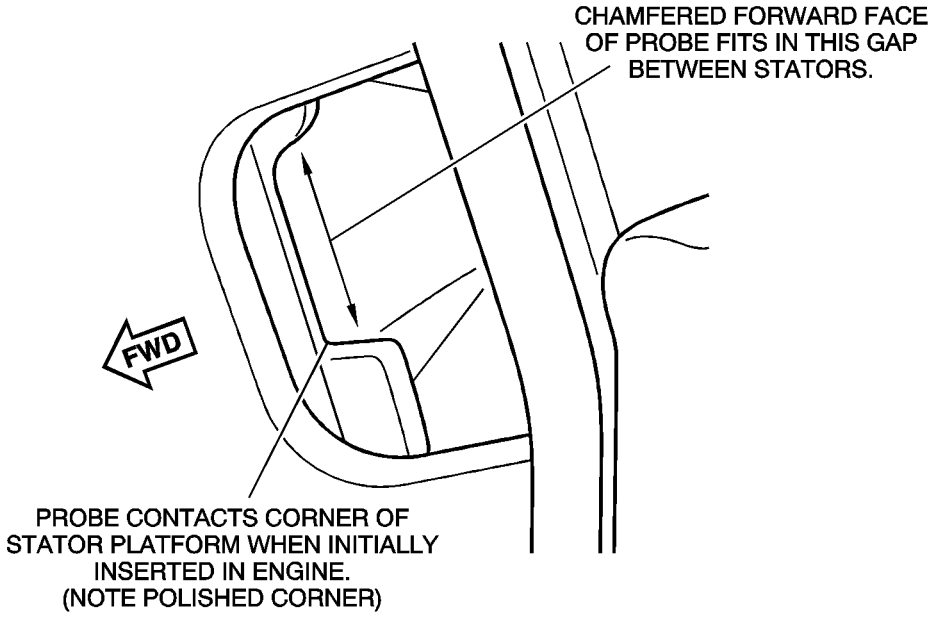
INNER RADIUS POSITION
FOR HP COMPRESSOR DRUMS OF Ti5 DRUM MATERIAL

bmi0004197

Signal from Typical Crack on Disc at Half Skip Distance A1/A5/D5
Figure 15 (Sheet 2 of 2)



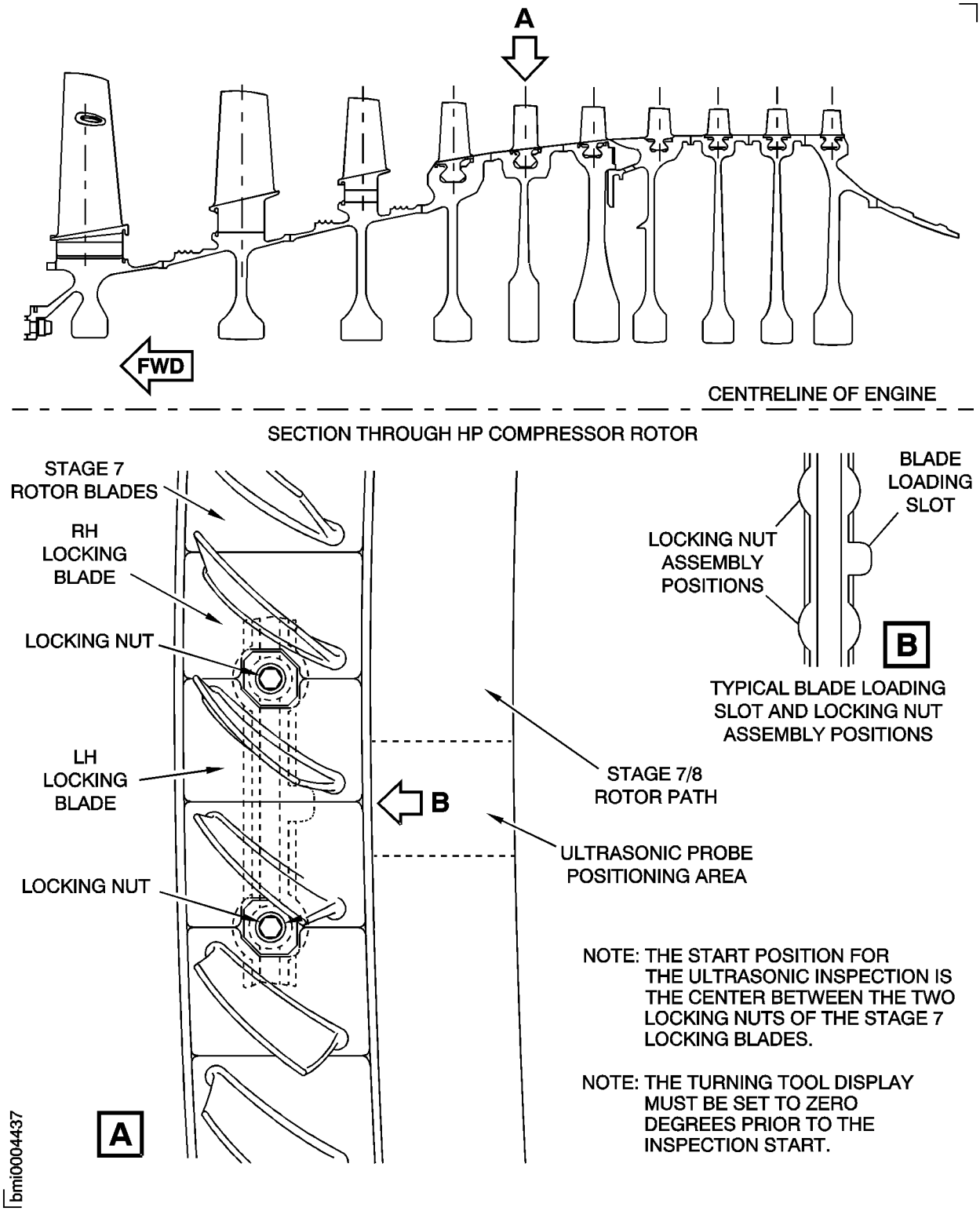
LARGER ELONGATED BLEED AIR SLOT SHOWN



SMALL SQUARE BLEED AIR SLOT

bmi0004427

Typical Bleed Air Slot A5/D5
Figure 16



Ultrasonic Start Position
Figure 17

SERVICE BULLETIN FEEDBACK FORM

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- General quality rating of this Service Bulletin	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
- Quality rating of the Accomplishment Instructions	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
- Quality rating of the Illustration	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
- Is this Service Bulletin easy to understand ?	☐ Yes ☐ No

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Planning Information Section:		Material Information Section:	Accomplishment Instruction Section:
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☐ 1.C.	☐ 1.K.	☐ 2.C.	☐ Removal/Installation
☐ 1.D.	☐ 1.L.	☐ 2.D.	☐ Inspection
☐ 1.E.	☐ 1.M.	☐ 2.E.	☐ Test
☐ 1.F.	☐ 1.N.	☐ 2.F.	☐ Close the Access
☐ 1.G.	☐ 1.O.		☐ Log Book Entry
☐ 1.H	☐ 1.P.		

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