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

International Aero Engines

400 MAIN STREET, MAIL STOP 121-10
EAST HARTFORD, CT 06108, USA.
TELEPHONE:- 860 565 5515
FAX:- 860 565 0600

P.O. BOX 31, DERBY
TELEGRAMS - 'ROYCAR' DERBY
TELEX - 37645
TELEPHONE:- 44 (0) 1332 242424
FAX:- 44 (0) 1332 249936

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V2500 D5 SERIES PROPULSION SYSTEM NON-MODIFICATION SERVICE BULLETIN

This document transmits Revision 2 to Service Bulletin EV2500-72-0499

Document History

Service Bulletin Revision Status		Supplement Revision Status
Initial Issue	Jun.14/05	
Revision 1	Feb.28/06	

Bulletin Revision 2

Remove	Incorporate	Reason for change
Pages 1 to 6 of the Service Bulletin	Pages 1 to 18 of the Service Bulletin	To introduce acceptance and fly-on limits for the borescope inspection of the HP compressor stage 6 and 7 stator vanes and the HP compressor stages 6 to 8 rotor blades.

LIST OF EFFECTIVE PAGES

The effective pages to this Service Bulletin following incorporation of Revision 2 are as follows:

	Page	Revision Number	Revision Date
	Bulletin		
R	1	2	Jan.12/07
R	2	2	Jan.12/07
R	3	2	Jan.12/07
R	4	2	Jan.12/07
R	5	2	Jan.12/07
R	6	2	Jan.12/07
R	7	2	Jan.12/07
R	8	2	Jan.12/07
R	9	2	Jan.12/07
R	10	2	Jan.12/07
R	11	2	Jan.12/07
R	12	2	Jan.12/07
R	13	2	Jan.12/07
R	14	2	Jan.12/07
R	15	2	Jan.12/07
R	16	2	Jan.12/07
R	17	2	Jan.12/07
R	18	2	Jan.12/07

International Aero Engines

SERVICE BULLETIN

ENGINE – HP COMPRESSOR – BORESCOPE INSPECTION OF STAGES 6 TO 8 ROTOR BLADES AND STAGES 6 TO 7 STATOR VANES – NON-MODIFICATION SERVICE BULLETIN

1. Planning Information

A. Effectivity

In-service engines

MD90

V2528-D5 engines operated by Saudi Arabian Airlines (SVA).

B. Reason

R (1) Reason for Revision 2

R Revision 2 of this Non-Modification Service Bulletin (NMSB) introduces R acceptance and fly-on limits for the borescope inspection of the High R Pressure (HP) compressor stages 6 and 7 stator vanes and the HP compressor R stages 6 to 8 rotor blades for engines which are operated in desert R environments.

(2) Problem

R Sand erosion, primarily of the stage 6 stator vanes and stage 7 stator R vanes, on the SVA D5 fleet has led to in-flight shut-down events.

R The inspection of the stages 6 to 8 rotor blade tips will indicate whether R the rotor blades have suffered from tip erosion which could lead into engine performance deterioration and subsequent unscheduled engine removals.

R The inspection of the stages 6 and 7 stator vanes will focus on the R thickness and condition of the trailing edge. Sand erosion causes a thinning of the aerofoil near the vane platform. This will lead to a R jagged trailing edge and cracking of the aerofoil.

C. Description

This Non-Modification Service Bulletin has been divided into two parts:

Part 1 – Details the in-service borescope inspection of engines incorporating R Service Bulletin V2500-ENG-72-0433 and operating in a desert environment.

Part 2 – Details the in-service borescope inspection of engines not R incorporating Service Bulletin V2500-ENG-72-0433 and operating in a desert environment.

R It can be substantiated that damage found on the HP compressor stages 6 to 8
R rotor blades and HP compressor stages 6 and 7 stator vanes within the limits
R described in Section 3. Accomplishment Instructions has negligible effect on
R the subject rotor blade and vane stress levels and the engine performance.

D. Compliance

Category 3

R (1) Part 1 - Engines which have already incorporated Service Bulletin
R V2500-ENG-72-0433 (Ref.(2))

R The inspection procedure described in Section 3. Accomplishment
R Instructions is recommended when the life in desert environment of any
R rotor blade of stages 6 to 8 or any stator vane of stages 6 and 7 reaches
R 3000 cycles from new. The inspection should be repeated every 500 cycles
unless otherwise instructed in the accomplishment instructions.

R (2) Part 2 - Engines pre-Service Bulletin V2500-ENG-72-0433 and engines which
R have only partially incorporated Service Bulletin V2500-ENG-72-0433
(Ref.(2))

R The inspection procedure described in Section 3. Accomplishment
R Instructions is recommended when the life in desert environment of any
R rotor blade of stages 6 to 8 or any stator vane of stages 6 and 7 reaches
R 2300 cycles from new. The inspection should be repeated every 500 cycles
unless otherwise instructed in the accomplishment instructions.

E. Approval

The compliance statement at 1.D. Compliance and the procedures in Section 3. Accomplishment Instructions of this Non-Modification Service Bulletin comply with the Federal Aviation Regulations and are FAA-approved for the engine model listed.

F. References

(1) MD90 Aircraft Maintenance Manual (AMM), Chapter 72-00-02-290-801,
R Borescope Inspection of the HP compressor.

(2) SB V2500-ENG-72-0433 - ENGINE - HP COMPRESSOR BLADES AND VANES -
INTRODUCTION OF STAGE 6, 7 AND 8 BLADES AND STAGE 8 STATOR VANES WITH
R EROSION RESISTANT COATINGS

R (3) Internal Reference No. - 05VR740A, 05VR740B, 05VR740C.

G. Concurrent Requirements

None.

H. Manpower

Estimate of man-hours necessary to embody this NMSB in full:

(1) In service

Estimated Man-hours

(a) To gain access

1 hour

(b) To embody

R 3,5 hours

(c) To close up

30 minutes

(d) Total

R 5 hours

(2) At overhaul

Not affected.

2. Material Information

None.

3. Accomplishment Instructions

CAUTION: IN ORDER TO REDUCE THE POTENTIAL FOR MULTIPLE ENGINE IN-FLIGHT SHUT DOWN, POWER LOSS, OR OTHER ANOMALIES 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 AT THE SAME TIME, IAE RECOMMENDS THAT ADDITIONAL CONTROLS BE APPLIED IN ORDER TO ENSURE THAT MAINTENANCE TASKS HAVE BEEN COMPLETED AS DEFINED.

A. Tools and Equipment

(1) 6mm flexible borescope with a tip viewing angle of at least 100 degrees. Borescope length should be at least 2.5m.

R (2) Video recording equipment.

R B. Borescope Inspection of Stage 6 Rotor Blade

(1) Insert the borescope through access port cover C (AMM reference: Figure 601/72-00-02-990-801).

R (2) In addition to the AMM requirements, inspect each rotor blade in turn for
R tip erosion, according to the limits shown below in step (3).

R (3) Tip erosion

R (a) Repeat borescope inspection within 500 cycles if the chordal extent of
R the erosion is less than 25 percent of the remaining chord (Refer to
R Figures 10 and 11).

R (b) Repeat borescope inspection within 125 cycles if the chordal extent of
R the erosion is greater than 25 percent but less than 50 percent of the
R remaining chord (Refer to Figure 12).

R (c) Reject the engine within 10 cycles if chordal extent of the erosion is
R greater than 50 percent of the remaing chord.

R NOTE: The condition of the stage 6 rotor blades should be recorded on the
R Inspection Feed Back Form (Figure 1).

R C. Borescope Inspection of Stage 6 Stator Vane

R (1) Insert the flexible borescope through access port D between stage 7 stator
R and stage 8 rotor (AMM reference: Figure 601/72-00-02-990-801). Insert the
R flexible borescope between stage 7 stator and stage 7 rotor until the
R trailing edge of the stage 6 stator is visible.

R (2) Insert the flexible borescope towards the trailing edge of stage 6 stator
R and then around the circumferential i.e. 360 deg until the entry point is
R visible. The convex surface of the trailing edge of the stage 6 stator
R vane should be visible.

R (3) Inspect the trailing edge on the convex surface of the stage 6 stator vane
R for nicks or tears, cracks, loss of material and thinning of trailing edge
R according to the limits listed in step (5). Upon satisfactory inspection
R of the first stage 6 stator vane, withdraw the flexible borescope
R circumferentially until the next stage 6 stator vane trailing edge can be
R inspected.

R (4) Repeat the procedure for the whole set of stage 6 stator vanes (84 off).

R NOTE: Each stage 6 stator vane has to be counted in order to make sure
R that the whole set is inspected.

R NOTE: The condition of the stage 6 stator vanes should be recorded on the
R Inspection Feed Back Form (Figure 2).

R (5) Damage from vane platform to 1/3 vane height

R (a) Nicks, tears or dents on individual airfoils (Refer to Figure 6)

R A	Not more than 0.016 in. (0,4 mm) in radial or axial dimension and not in the area of T/E material loss	Repeat borescope inspection within 500 cycles.
R B	More than A, but not more than 0.024 in. (0,6 mm) in radial or axial dimension and not in the area of T/E material loss	Repeat borescope inspection within 250 cycles.
R C	More than B but not more than 0.036 in. (0,92 mm) in radial or axial dimension and not in the area of T/E material loss	Repeat borescope inspection within 125 cycles.
R D	More than C, but not more than 0.039 in. (1 mm) in radial or axial dimension	Reject within 10 cycles.
R E	More than D	Reject.

R

R (b) Cracks

A	Not more than 0.039 in. (1 mm) in length	Reject within 10 cycles.
B	More than A	Reject.

R (c) Loss of material from trailing edge with or without a jagged trailing edge profile (Refer to Figures 7 and 8)

A	Not more than 0.006 in. (0,15 mm) in axial depth	Repeat borescope inspection within 500 cycles.
B	More than A, but not more than 0.016 in. (0,4 mm) in axial depth	Repeat borescope inspection within 250 cycles.
C	More than B, but not more than 0.035 in. (0,9 mm) in axial depth	Repeat borescope inspection within 125 cycles.
D	More than C, but not more than 0.079 in. (2 mm) in axial depth	Reject the engine within 10 cycles.
E	More than D	Reject.

R (d) Sharp, thin trailing edge that remains straight (Refer to Figure 9)

R - Repeat borescope inspection within 500 cycles.

R D. Borescope Inspection of Stage 7 Rotor Blade

R (1) Insert the flexible borescope through access port D (AMM reference: Figure 601/72-00-02-990-801).

(2) Carry out borescope inspection in accordance with AMM TASK 72-00-02-290-801.

R (3) In addition to the AMM requirements, inspect each rotor blade in turn for tip erosion, according to the limits shown below

R (a) Repeat borescope inspection within 500 cycles if the chordal extent of the erosion is less than 25 percent of the remaining chord (Refer to Figures 10 and 11).

R (b) Repeat borescope inspection within 125 cycles if the chordal extent of the erosion is greater than 25 percent but less than 50 percent of the remaining chord (Refer to Figure 12).

R (c) Reject the engine within 10 cycles if chordal extent of the erosion is greater than 50 percent of the remaining chord.

R NOTE: The condition of the stage 7 rotor blades should be recorded on the Inspection Feed Back Form (Figure 3).

R E. Borescope Inspection of Stage 7 Stator Vane

R (1) Insert the flexible borescope through access port D until the borescope port is visible again to ensure an inspection of all vanes i.e. 360 deg.
R until the entry port is visible (AMM reference: Figure 601/72-00-02-990-801).

R (2) Start pulling out the flexible borescope to examine the trailing edge of each vane in turn for nicks or tears, cracks, loss of material and
R thinning of trailing edge according to the limits shown in step (3) below.

R NOTE: Each stage 7 stator vane has to be counted in order to make sure
R that the whole set is inspected.

R NOTE: The condition of the stage 7 stator vanes should be recorded on the
R Inspection Feed Back Form (Figure 4).

(3) Damage from vane platform to 1/3 vane height

R (a) Nicks, tears or dents on individual airfoils (Refer to Figure 6)

R A	Not more than 0.016 in. (0,4 mm) in radial or axial dimension and not in the area of T/E material loss	Repeat borescope inspection within 500 cycles.
R B	More than A, but not more than 0.022 in. (0,55 mm) in radial or axial dimension and not in the area of T/E material loss	Repeat borescope inspection within 250 cycles.
R C	More than B but not more than 0.028 in. (0,7 mm) in. radial or axial dimension and not in the area of T/E material loss	Repeat borescope inspection within 125 cycles.
R D	More than C, but not more than 0.039 in. (1 mm) in radial or axial dimension	Reject within 10 cycles.
R E	More than D	Reject.

R

(b) Cracks

A	Not more than 0.039 in. (1 mm) in length	Reject within 10 cycles.
B	More than A	Reject.

(c) Loss of material from trailing edge with or without a jagged T/E profile (Refer to Figures 7 and 8)

A	Not more than 0.006 in. (0,15 mm) in axial depth	Repeat borescope inspection within 500 cycles.
B	More than A, but not more than 0.016 in. (0,4 mm) in axial depth	Repeat borescope inspection within 250 cycles.
C	More than B, but not more than 0.035 in. (0,9 mm) in axial depth	Repeat borescope inspection within 125 cycles.
D	More than C, but not more than 0.079 in. (2 mm) in axial depth	Reject the engine within 10 cycles.
E	More than D	Reject.

(d) Sharp, thin trailing edge that remains straight (Refer to Figure 9)

- Repeat borescope inspection within 500 cycles.

F. Borescope Inspection of Stage 8 Rotor Blade

(1) Insert the flexible borescope through access port cover E (AMM reference: Figure 601/72-00-02-990-801).

(2) Carry out borescope inspection in accordance with AMM TASK 72-00-02-290-801.

(3) In addition to the AMM requirements, inspect each rotor blade in turn for tip erosion, according to the limits shown below in step (4).

(4) Tip Erosion

(a) Repeat borescope inspection within 500 cycles if the chordal extent of the erosion is less than 25 percent of the remaining chord (Refer to Figures 10 and 11).

(b) Repeat borescope inspection within 125 cycles if the chordal extent of the erosion is greater than 25 percent but less than 50 percent of the remaining chord (Refer to Figure 12).

R (c) Reject the engine within 10 cycles if chordal extent of the erosion is
R greater than 50 percent of the remaining chord.

R NOTE: The condition of the stage 8 rotor blades should be recorded on the
R Inspection Feed Back Form (Figure 5).

R G. Digital images or a video

R (1) Digital images or a video shall be made for any findings, which lead into
R a repeat borescope inspection.

R H. Recording Instructions

R (1) A record of accomplishment is necessary.

R (2) Inform the IAE local office that this Non-Modification Service Bulletin
R has been accomplished by sending the feedback form (Pages 10-14 of this
R Non-Modification Service Bulletin).

R (3) Send the feedback forms (Pages 10-14 of this Non-Modification Service
R Bulletin) to IAE Technical Services to the following fax number: +49 (0)
R 33708 6 3313.

DATE: _____ INSPECTED BY: _____

ENGINE DETAILS

ENGINE NUMBER: _____ AIRCRAFT AND POSITION: _____

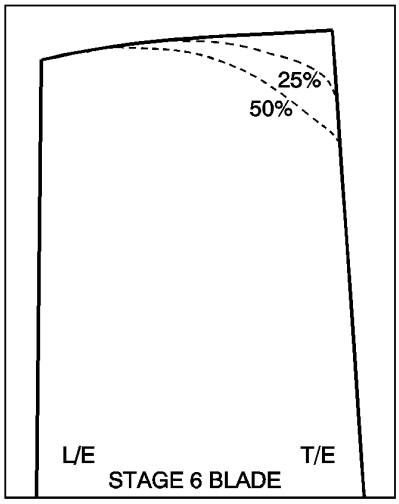
HOURS: _____ CYCLES: _____

INSPECTION DETAILS

EROSION ON WORST BLADE

(INDICATE EXTENT OF EROSION ON THE OUTLINE.)

COMMENTS:



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Stage 6 Rotor Blade Inspection Feed Back Form
Figure 1

DATE: _____ INSPECTED BY: _____

SIGNATURE: _____

ENGINE DETAILS

ENGINE NUMBER: _____ AIRCRAFT AND POSITION: _____

HOURS: _____ CYCLES: _____

INSPECTION DETAILS

VANE NO.	PASS	REPEAT AT 'X' CYCLES	VANE NO.	PASS	REPEAT AT 'X' CYCLES	VANE NO.	PASS	REPEAT AT 'X' CYCLES
1			29			57		
2			30			58		
3			31			59		
4			32			60		
5			33			61		
6			34			62		
7			35			63		
8			36			64		
9			37			65		
10			38			66		
11			39			67		
12			40			68		
13			41			69		
14			42			70		
15			43			71		
16			44			72		
17			45			73		
18			46			74		
19			47			75		
20			48			76		
21			49			77		
22			50			78		
23			51			79		
24			52			80		
25			53			81		
26			54			82		
27			55			83		
28			56			84		

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Stage 6 Stator Vane Inspection Feed Back Form
Figure 2

DATE: _____ INSPECTED BY: _____

ENGINE DETAILS

ENGINE NUMBER: _____ AIRCRAFT AND POSITION: _____

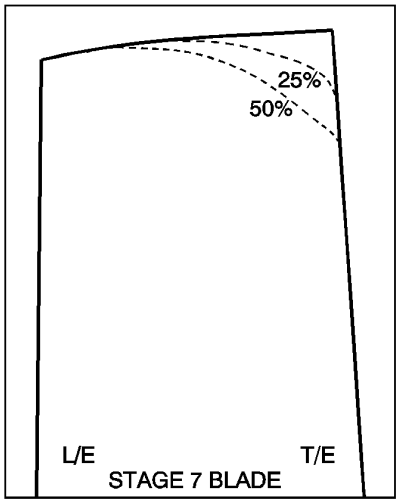
HOURS: _____ CYCLES: _____

INSPECTION DETAILS

EROSION ON WORST BLADE

(INDICATE EXTENT OF EROSION ON THE OUTLINE.)

COMMENTS:



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Stage 7 Rotor Blade Inspection Feed Back Form
Figure 3

DATE: _____ INSPECTED BY: _____

SIGNATURE: _____

ENGINE DETAILS

ENGINE NUMBER: _____ AIRCRAFT AND POSITION: _____

HOURS: _____ CYCLES: _____

INSPECTION DETAILS

VANE NO.	PASS	REPEAT AT 'X' CYCLES	VANE NO.	PASS	REPEAT AT 'X' CYCLES	VANE NO.	PASS	REPEAT AT 'X' CYCLES
1			31			61		
2			32			62		
3			33			63		
4			34			64		
5			35			65		
6			36			66		
7			37			67		
8			38			68		
9			39			69		
10			40			70		
11			41			71		
12			42			72		
13			43			73		
14			44			74		
15			45			75		
16			46			76		
17			47			77		
18			48			78		
19			49			79		
20			50			80		
21			51			81		
22			52			82		
23			53			83		
24			54			84		
25			55			85		
26			56			86		
27			57			87		
28			58			88		
29			59					
30			60					

bmi0000125

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R Stage 7 Stator Vane Inspection Feed Back Form
R Figure 4

DATE: _____ INSPECTED BY: _____

ENGINE DETAILS

ENGINE NUMBER: _____ AIRCRAFT AND POSITION: _____

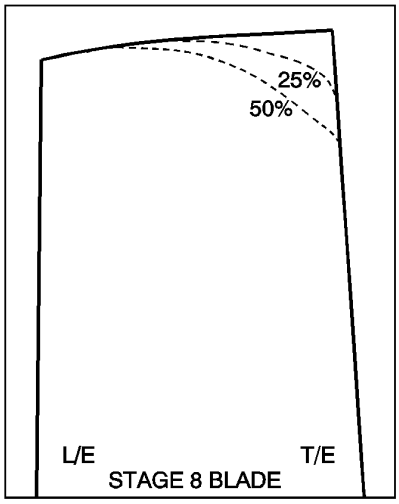
HOURS: _____ CYCLES: _____

INSPECTION DETAILS

EROSION ON WORST BLADE

(INDICATE EXTENT OF EROSION ON THE OUTLINE.)

COMMENTS:



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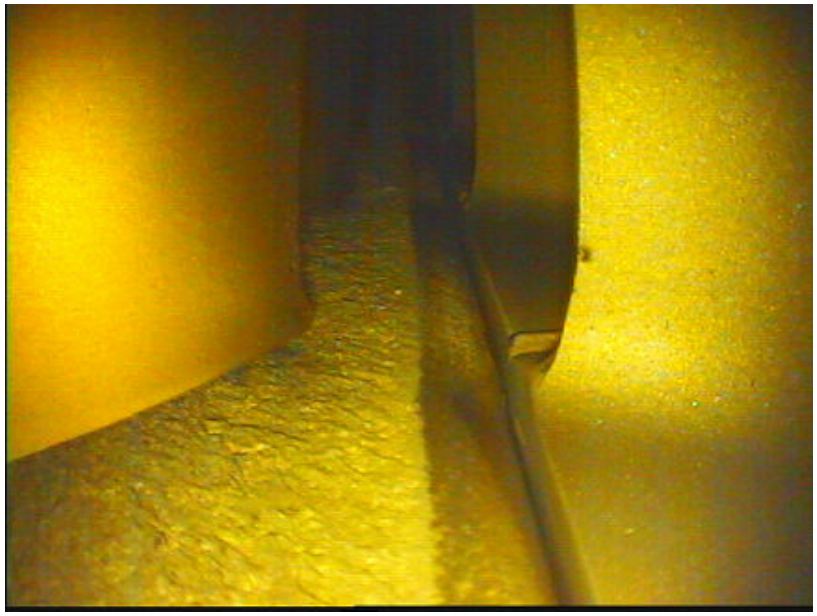
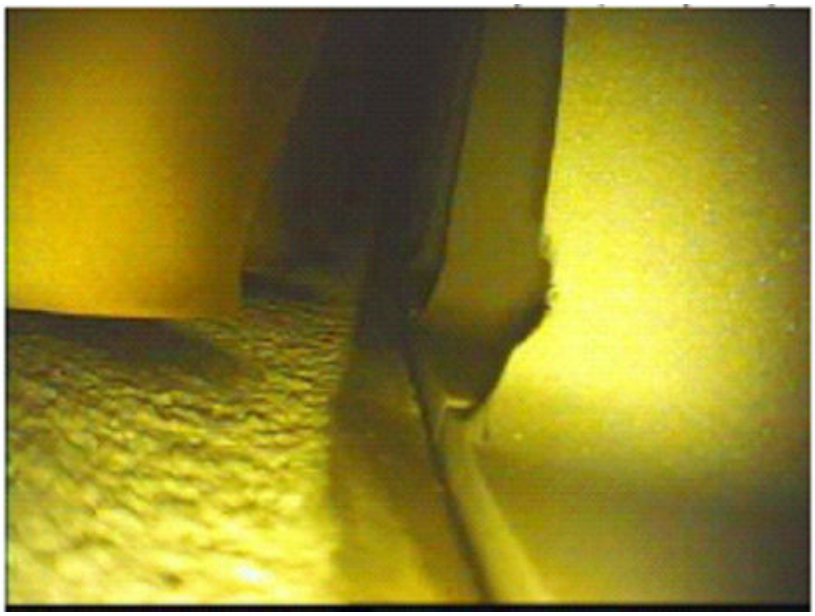
Stage 8 Rotor Blade Inspection Feed Back Form
Figure 5

R Example of borescope pictures



R HPC stage 6 stator vane with nick at the T/E, dimension of the nick
R 0.014 in. (0,36 mm), no material removal allowed
R Figure 6

R HPC stage 6 stator vane; smooth loss of material without a jagged T/E
R Figure 7

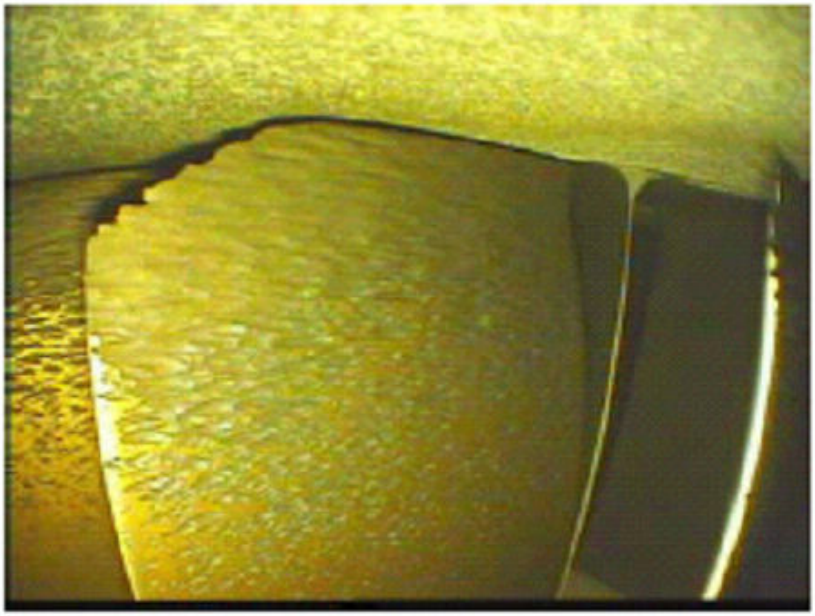


R HPC stage 6 stator vane; loss of material with a jagged T/E profile
R Figure 8

R HPC stage 7 stator vane with a thin T/E which remains straight
R Figure 9

R HPC stage 6 rotor blade without blade tip erosion
R Figure 10

R HPC stage 7 rotor blade with tip erosion not more than 25 percent
R Figure 11



R HPC stage 7 rotor blade with blade tip erosion with more than 25 percent
R but not more than 50 percent
R Figure 12