International Aero Engines
NON-MODIFICATION SERVICE BULLETIN

Date: May 23/2003

ENGINE – HP COMPRESSOR, STAGE 6 ROTOR PATH - DUAL METCO 313 ENGINED AIRCRAFT - FLEET MANAGEMENT ACTIONS – NON-MODIFICATION SERVICE BULLETIN

V2500-D5 SERIES PROPULSION SYSTEM NON-MODIFICATION SERVICE BULLETIN

This document transmits Revision 1 of Non-Modification Service Bulletin V2500-ENG-72-0448

Document History

Service Bulletin Revision Status

Initial Issue	Jan. 2/2003

Bulletin Revision 1

Remove	Incorporate	Reason for change
All pages	Pages 1 to 12 of the Service Bulletin	To add transmittal pages and page dates.

List of Effective Pages

The effective pages to this Service Bulletin are as follows:

Page	Revision Number	Revision Date
Bulletin		
1	Revision 1	May 23/2003
2	Revision 1	May 23/2003
3	Revision 1	May 23/2003
4	Revision 1	May 23/2003
5	Revision 1	May 23/2003
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1. Planning Information

A. Effectivity

(1) Boeing MD 90 aircraft

B. Concurrent Requirements

None

C. Reason

The purpose of this Non-Modification Service Bulletin is to highlight individual operators where action is required to mitigate the risk of dual engine significant events caused by Metco 313 HPC stage 6 rotor path lining loss.

Due to continued in-service events caused by the loss of Metco 313, action is required in specific operations. The degree of action has been established for two categories – A and B. Operators in categories A & B are recommended to act according to section E.

The categories are defined using several sources of data including:

a) Fleet-wide and regional risk analyses

b) Calendar life risk analysis

c) Service (operator) Experience

Further information about the risk categorisation of fleets is provided in SIL165 issue 4 (Ref. c).

Category A Operators

Operators within this group (see table 1 below) have a history of Metco 313 loss either in-service or during shop visits (no in-service disruption may have been observed). They have also been identified by risk analyses as being more likely to suffer from Metco 313 loss. For these operators, action is ultimately required to ensure that aircraft have only one Metco 313 engine per aircraft.

Table 1 – Category A Operators

Delta Airlines	China Northern Airlines

Category B: Operators

All other D5 operators with Dual Metco 313 engine aircraft.

D. Compliance

Comply within the stated timescales (below)

Table 2 – Category A operators: Compliance timescales

Operator	Inspect for blade damage Within	De-pair engines within
Delta Airlines	1 Month from 31 Jan 2003 or Next A-Check	0 – 6 Months from 31 Jan 2003
China Northern Airlines	1 Month from transmittal date or Next A-Check	0 – 6 Months from transmittal date

The compliance times for the Category A Operators are derived from the risk analyses.

These times are a maximum, and operators should aim to de-pair aircraft at a minimum rate of 1 per month.

Category B Operators

All Operators that have aircraft with dual Metco 313 engines (but are not listed in Category A) are to inspect for airfoil damage (Ref – g, h, i) and Metco liner condition in accordance with Appendix 1. This inspection should be conducted within one month of receipt of this bulletin, or next A-Check (whichever is sooner).

NOTE: If any engines from a category B operator are found to be outside the inspection criteria, a change to category A of that operator is recommended.

NOTE: The intent of this Service Bulletin is to help minimize the occurrence of multiple-engine in flight shutdown, power loss, or other anomaly due to maintenance error. Therefore, IAE recommends that operators avoid performing maintenance on multiple engines installed on the same aircraft at the same time if at all possible. IAE, however, recognises that some situations may be unavoidable. If it is not possible to avoid maintenance on more than one engine at the same time, IAE recommends that different maintenance teams service each engine. Maintenance guidelines should be revised, where possible, to promote this recommendation.

E. Action

1. All Category A Operators (See Appendix 2)

1.1 To reduce the risk of dual engine significant events and to assist with prioritising aircraft during the de-pairing program, operators are to confirm by borescope inspection (Ref – g, h, i) that each engine per dual-engine aircraft does not have HPC stage 6 blade damage outside of AMM limits. This action is to be taken within a compliance time commensurate with that allowed for de-pair as in table 2, above.

NOTE: Engines in category A that have been successfully inspected in the past 3 months are exempt from action 1.1.

1.2 De-pair all Metco 313 engines installed on a single aircraft within compliance times given in table 2

1.3 Operators should not fit a Metco 313 engine to an aircraft if the other engine also has Metco 313 incorporated.

2. All Category B Operators

Perform the following procedure within the timescales shown above

Either:

2.1 De-pair all Metco 313 engines installed on a single aircraft within 6 months at a minimum rate of 1 aircraft per month.

Or;

2.2 For those aircraft that have dual Metco 313 engine installations, inspect as follows; (See Appendix 3)

a. Perform a borescope inspection of the stage 6 blades only in accordance with Ref. g, h, i

b. Perform an inspection of the HPC stage 6 rotor path lining in accordance with the Procedure and Acceptance limits detailed in Appendix 1.

c. If the first engine of any one aircraft inspected is acceptable, then the second engine does not need to be inspected.

d. If the first engine of any one aircraft inspected is not acceptable due to metco 313 rotor path disbond at stage 6, that operator fleet will move into Cat A and comply with the Cat.A actions

e. In the event of d), details of compliance times for individual operators will be provided by IAE.
NOTE: If a change to Cat.A is required, all Metco313 engines will require inspection and de-pair as per Cat.A actions.

NOTE: If the borescope reveals any damage to the rotor blades, then AMM limits should be applied. Ref. Appendix 4 of this SB.

NOTE: All inspection results should be reported to IAE Technical Services via the Local Customer Support Representative.

NOTE: Borescope inspections should not be performed on both engines of one aircraft during any single period of maintenance activity.

2.3 Operators should not fit a Metco 313 engine to an aircraft if the other engine also has Metco 313 incorporated.

F. Approval

The Compliance Statement at 1 D 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 models listed.

G. Manpower

Estimated man-hours to embody the inspection task of this Service Bulletin:

In Service	Est. Manhours
To gain access	1 hour
To embody	2 hours
To close up	0.5 hour
Total	3.5 hours

H. References

ATA Locator 72-00-02

a. SB: ENG-72-0235 ENGINE - HP COMPRESSOR - NEW STAGES 6, 7 AND 8 ROTOR PATH RINGS WITH IMPROVED ABRADABLE LININGS

b. SB: ENG-72-0369 MODIFICATION SERVICE BULLETIN - ENGINE - HP COMPRESSOR RING CASES - INTRODUCTION OF HP COMPRESSOR STAGE 6, 7 AND 8 ROTOR PATHS WITH REVISED ABRADABLE LINING

c. SIL165 issue 4

d. Internal Reference No. – 02VR902

Boeing AMM Task 72-00-02-290-801 - Inspection of HP Compressor

e. …3) Job Set up… B – Open, safety and tag Circuit Breakers

f.		C – Open upper and lower thrust reversers
g.		E – Remove borescope access port cover C
h.		H – Install the borescope probe
i.	…4) Procedure…	A (1) (e) – Tip damage and discolouration (Note: increased limits for stage 6 apply – Reference Appendix 4)
j.		D (2) – Install the borescope access port cover C
k.	…5) Close Up…	B – Remove tags and safeties and Close Circuit Breakers
l.		C – Close upper and lower thrust reversers

2. Material Information

None

3. Accomplishment Instructions

A. Tools and Equipment

The standard of borescope equipment should be at least equivalent to the following specification

Part No	Description
IV6-C6	Borescope probe (flexible tip)
V66 120DN	Borescope tip (120 degrees near focus)

B. Pre-Requisite Actions

1) Put a warning in the cockpit to tell persons not to start the engine.

2) Make sure that the engine has been shut down not less than 60 minutes before you do this procedure

3) Open, safety and tag all necessary circuit breakers IAW ref e (AMM subtask 72-00-02-865-001).

4) Open upper and lower thrust reversers IAW ref f (AMM task 78-32-00-010-801).

C. Borescope Inspection

1) Perform an inspection of the HPC stage 6 rotor path lining or stage 6 blades as required by Para E. Action, in accordance with the Procedure and Acceptance limits detailed in Appendix 1.

D. Close Up Actions

1) Perform Ref j. – Install the borescope access port cover C.

2) Perform Ref k - Remove tags and safeties and Close Circuit Breakers

3) Make sure area tidy. Perform Ref l. – Close upper and lower thrust reversers

4) Remove warning notice(s)

APPENDIX 1

1) Inspection Procedure

A. Inspect the HPC stage 6 rotor path abradable lining through Port C.

B. Ref g – Remove borescope port covers

C. Ref h – Install borescope probe

D. For the best viewing of the stage 6 rotor path lining, a flexible borescope is recommended. However, it is acceptable to use a rigid borescope. Port C is positioned between the stage 5 VSVs to provide a view of the trailing edge of the stage 5 blades and the leading edge of the stage 6 blades and stage 6 rotor path. Depending on the borescope equipment used, it will be possible to view an arc between 15° and 60° either side of the borescope port.

E. Inspect HPC stage 6 blades in accordance with Ref i.

2) Stage 6 Rotor Path Acceptance Limits

A. Lining material sound and grey in colour or with light surface deposits, white in colour (Refer to Fig 1) – Acceptable.

B. Missing topcoat not exposing basecoat. Remaining topcoat sound, without blistering or flaking (Refer to Fig 2) – Acceptable.

C. Missing topcoat not exposing basecoat (Refer to Fig 3). Any areas of missing top coat up to 1 in^2 (645 mm^2) each – Acceptable. Any areas of missing topcoat more than 1 in^2 (645 mm^2) each – Unacceptable.

D. Surface craze cracks with no missing material or lifting (Refer to Fig 4) - Accept. Large, open cracks – Unacceptable.

E. Surface corrosion resulting in topcoat, lifting, blistering, bulging or swelling (Refer to Fig 5) – Unacceptable.

F. Lifting/delamination. If there is evidence of delamination between the topcoat and bondcoat interface (Refer to Fig 6) – up to 1” (25 mm) circumferentially – Acceptable. More than 1” (25 mm) circumferentially – Unacceptable.

Fig 1 – Uniformly sound topcoat surface

Fig 2 – Missing topcoat not exposing basecoat

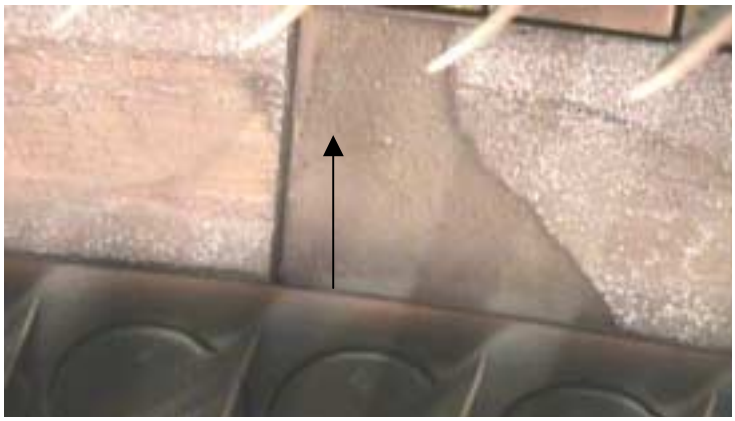


Fig 3 – Missing topcoat exposing basecoat

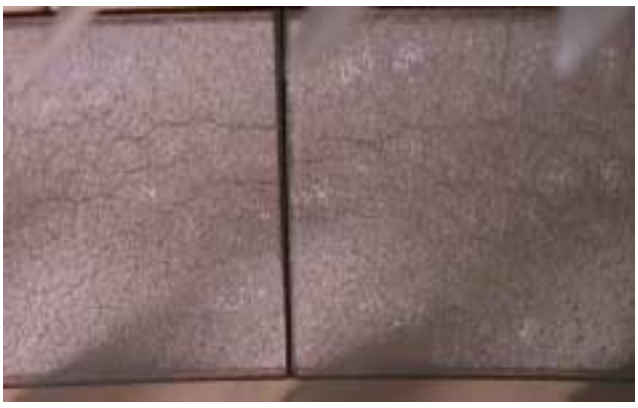


Fig 4 – Cracking of topcoat surface

Figs 5 & 5a – Examples of corrosion related pitting, lifting, flaking or blistering of topcoat surface

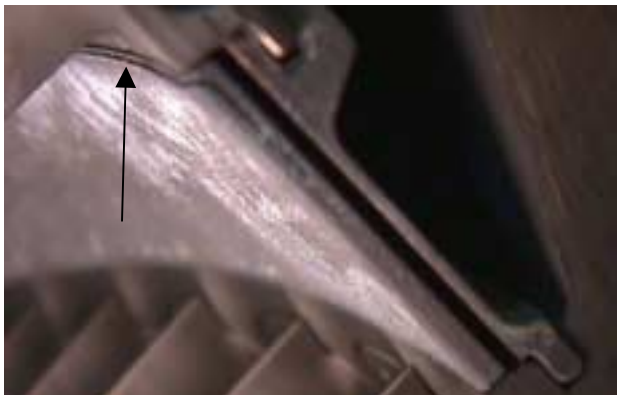
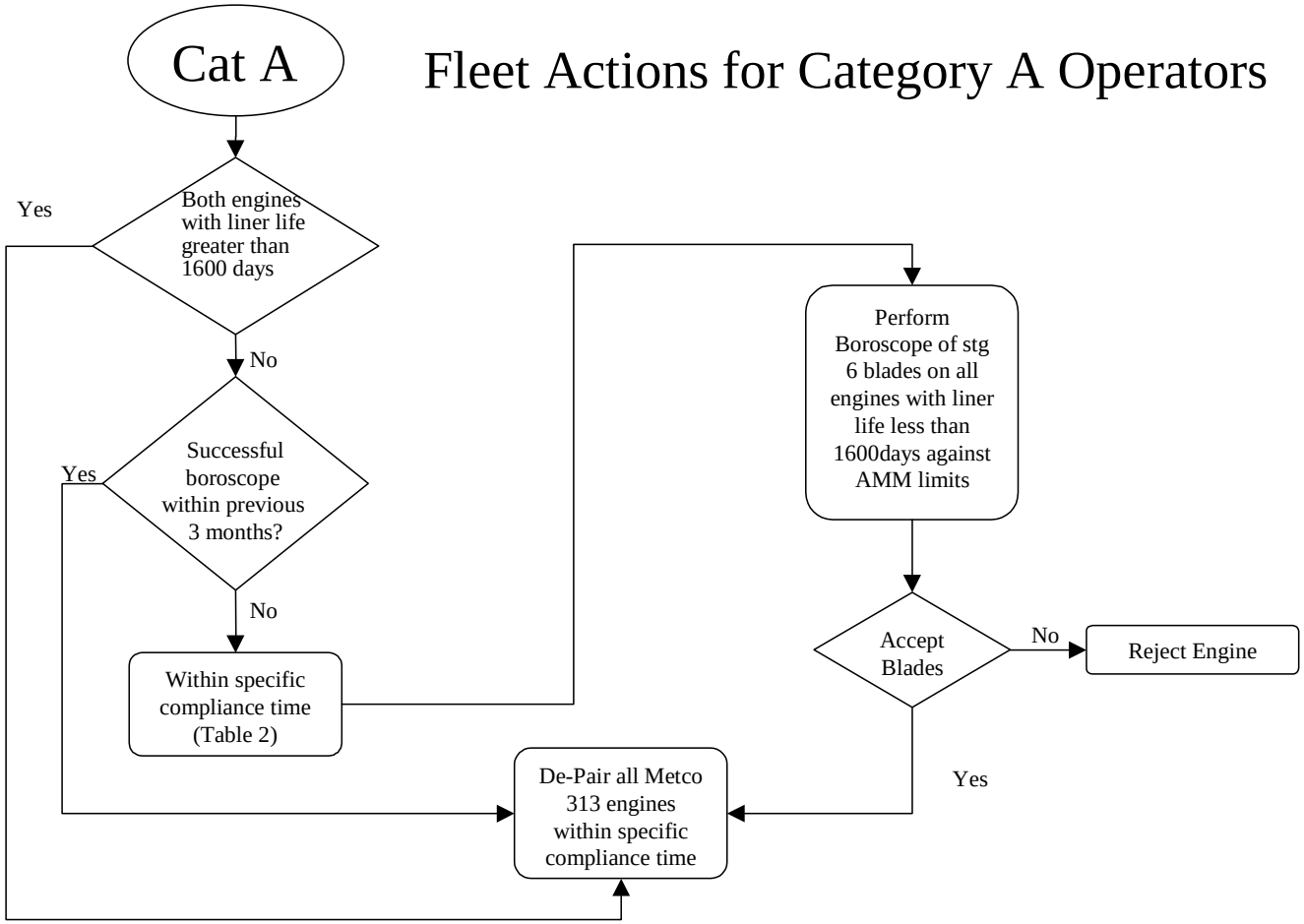


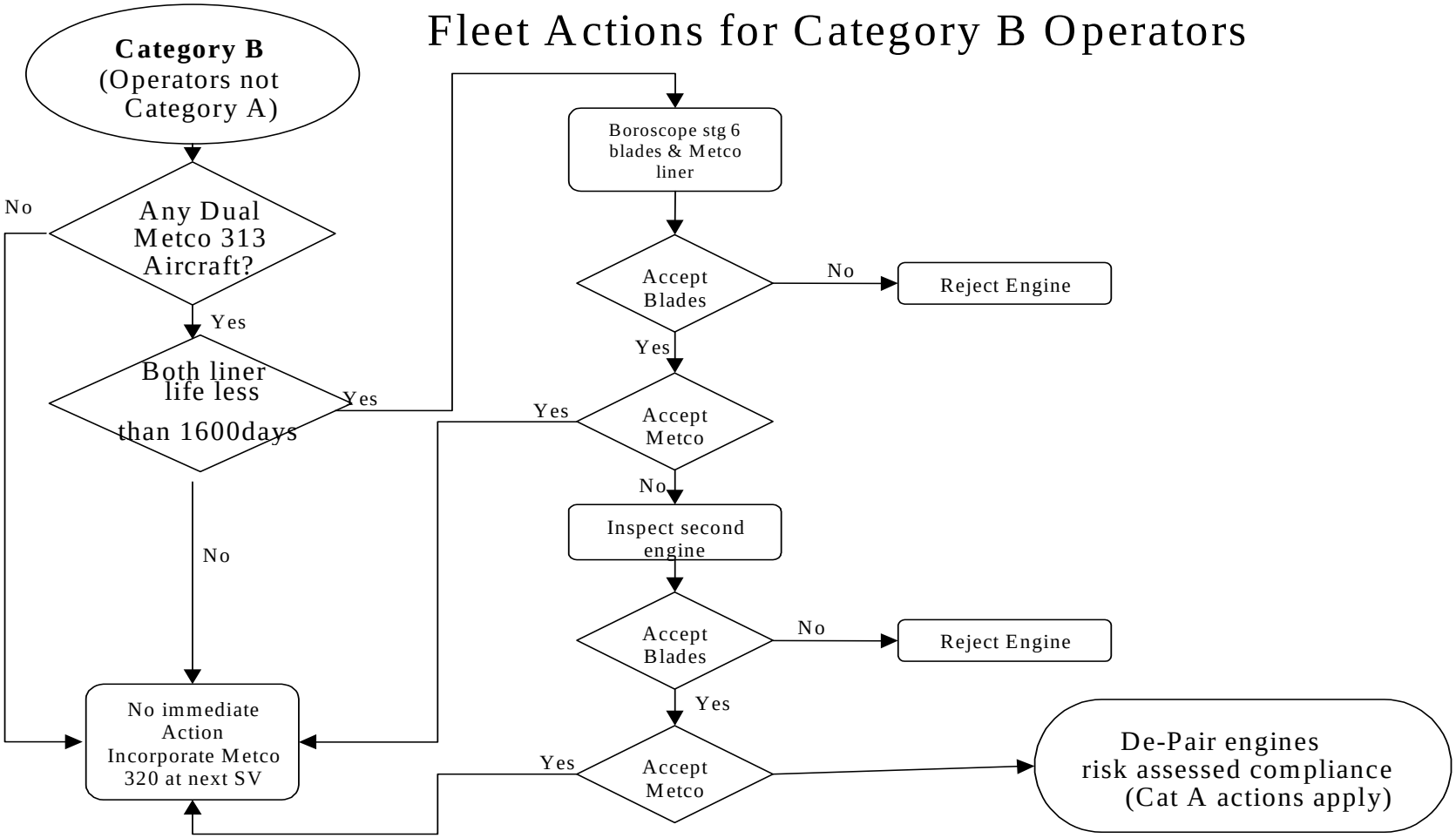
Fig 6– Delamination of topcoat/bondcoat interface

Appendix 2



Appendix 3

Fleet Actions for Category B Operators



APPENDIX 4

The inspection limits for HPC blade tip damage have been increased. The increase in damage applies to the stage 6 blades only and allows for tip curl up to 20% aerofoil height or 20% aerofoil chord. A limit on the number of blades exhibiting tip curl damage has been imposed which reduces with increasing %age tip curl.

The amendment has been created to reflect in-service experience based on a number of previously accepted OTCs for HPC stage 6 aerofoil tip curl associated with corrosion of the Metco 313 stage 6 rotor path liner.

It is expected that by fleet inspection, stage 6 tip curl exceeding 5% aerofoil height and 5% aerofoil chord may be found. As the inspection is due to fleet management policy and not as a result of operability problems, there is a need to increase allowable tip curl limits to recognize that damage to a certain level given in the amendment below is acceptable from an engine operability standpoint.

The following is to be added to Boeing AMM Subtask 72-00-02-290-001: -

Engines with stage 6 tip curl between 15 and 20 percent of Dim X or Dim Y (whichever percentage is greater) – Accept up to 1 blade.

Engines with stage 6 tip curl between 10 and 15 percent of Dim X or Dim Y (whichever percentage is greater) – Accept up to 5 blades.

Engines with stage 6 tip curl between 5 and 10 percent of Dim X or Dim Y (whichever percentage is greater) – Accept up to 10 blades.

Notes: - A total of ten blades are acceptable exceeding 5 percent of Dim X or Dim Y, subject to the limits above.

More than any of the above – Reject engine within 10 flights if inspection was scheduled. Reject engine immediately if inspection was for HPC troubleshooting.

Engines with any blades with more than 10 percent of Dim X or Dim Y require repeat inspection at next Aircraft A Check

All tip curls must be free from cracks, tears, nicks and creases.