Civil Aviation Authority

SAFETY NOTICE

Number: SN–2021/015

Issued: 8 July 2021

Engine Valve Springs
Rolls-Royce and Packard Merlin (All Marks)

This Safety Notice contains recommendations regarding operational safety.

Recipients must ensure that this Notice is copied to all members of their staff who need to take appropriate action or who may have an interest in the information (including any 'in-house' or contracted maintenance organisations and relevant outside contractors).

Applicability: Rolls-Royce and Packard Merlin series engines (All Marks)	
Aerodromes:	Not primarily affected
Air Traffic:	Not primarily affected
Airspace:	Not primarily affected
Airworthiness:	All BCAR A8-23 / A8-24 / A8-25 Organisations
Flight Operations:	CAP 632 Operators
Licensed/Unlicensed Personnel:	All maintenance engineers in airworthiness organisations operating, servicing, maintaining Rolls-Royce and Packard Merlin series engines (All Marks)

1 Introduction

1.1 A number of ex-military aircraft operating under CAP 632 are fitted with various marks of Rolls-Royce and Packard Merlin piston aero engines for which this Safety Notice concerns, including (but not necessarily limited to) the Supermarine Spitfire, Hawker Hurricane and North American P51 Mustang.

1.2 Several instances of inlet and exhaust valve spring failures have been discovered during routine engine maintenance on Rolls Royce Merlin series engines, including the discovery of a broken inlet valve spring on examination of engine wreckage from a Supermarine Spitfire accident in 2015. The subsequent investigation concluded that an inlet valve spring failure may have led to cylinder valve complications and subsequent engine loss of power. More recent instances of spring failure have been detected during routine engine maintenance, where the removal of cylinder head rocker covers is required for servicing. Broken springs and/or debris have been found, which can potentially lead to engine damage and loss of power.

1.3 An examination and study of a recently found failed inlet valve spring and retaining collet determined that the likely cause was a spring and retaining collet failure due to a high cycle fatigue mechanism propagating from an area of corrosion pitting. The associated collet also subsequently failed due to a high-cycle fatigue mechanism propagating from a corrosion pit or gouge.

1.4 The purpose of this Safety Notice (SN) is to highlight to owners and operators of Ex-Military (CAP 632) aircraft powered by all Rolls Royce/Packard Merlin series engines to carry out inspections of the affected parts at the next scheduled maintenance activities.

2 Recommended Actions to be Taken

2.1 For all Merlin series piston engines, operators should carry out inspection of the affected parts by way of:

1) Removal of engine cowlings as required to gain access to the engine cylinder banks and valve rocker covers to inspect in-situ the following items: All A and B bank inner, plus outer valve springs and spring retaining collets.

2) Visually inspect valve springs and collars for signs of gouging, scoring, surface pitting, corrosion or fractures to the springs and retaining collets.

3) Check for evidence of missing surface protection on the valve springs and retaining collars. This is evidenced by bright bare metal shiny areas due to rubbing or fatigue, and subsequent loss of surface treatment protection. Such areas should be carefully examined for the onset of corrosion or surface pitting.

4) If evidence of gouging, surface pitting or corrosion are found, it is recommended that the component and/or collet should be removed and replaced prior to further flight.

5) If any valve spring or retaining collets are found to be broken or incomplete, and the missing fragments or debris cannot be located, accounted for and removed, it is recommended that the engine is taken out of service for further examination.

6) Subsequent scheduled maintenance tasks involving valve rocker cover removal should include inspection of valve springs and collets for damage and deterioration.

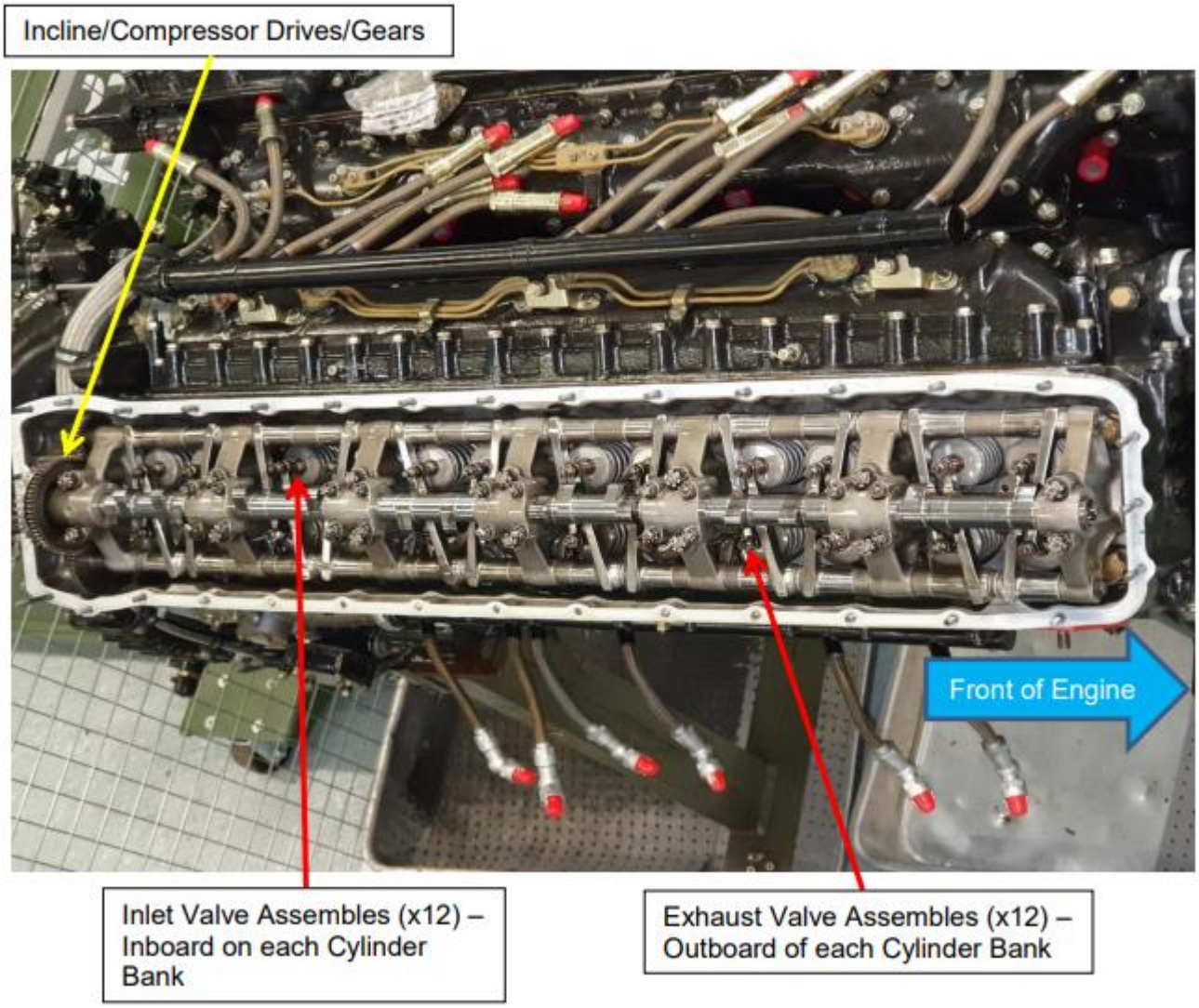

Figure 1: Merlin Engine A&B Bank Components Area of Inspection

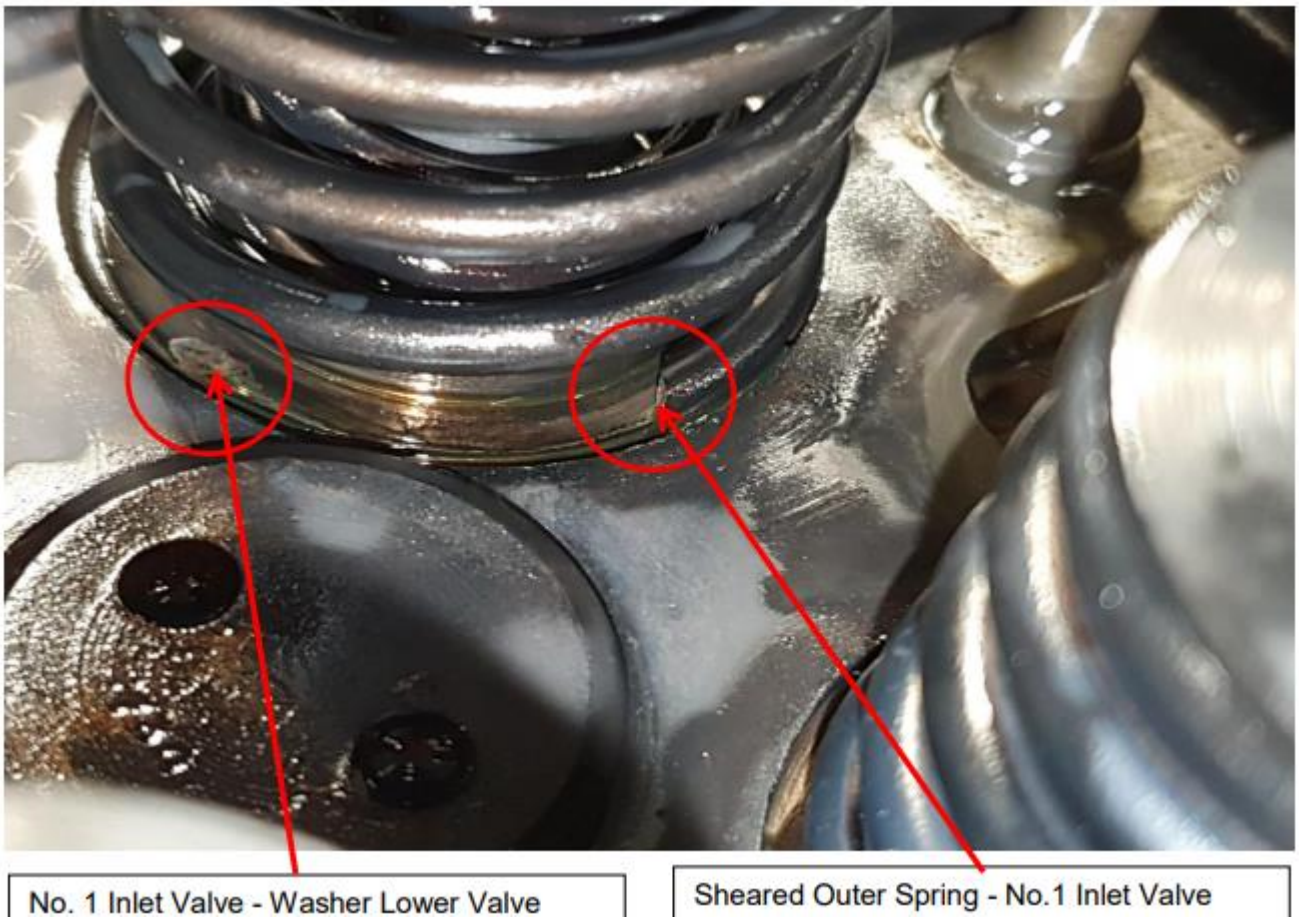

Figure 2: Failed Inlet Valve Outer Spring

3 Reporting Feedback of Inspection Findings

3.1 Any findings of damaged or deteriorated valve springs and associated hardware should be fed back to the UK CAA via the Mandatory Occurrence Reporting (MOR) system.

4 Queries

4.1 Any queries or requests for further guidance as a result of this communication should be addressed to the GA Unit, Safety & Airspace Regulation Group, Civil Aviation Authority, Aviation House, Gatwick Airport South, West Sussex RH6 0YR. Tel: +44 (0)1293 573988 E-mail: GA@caa.co.uk.

5 Cancellation

5.1 This Safety Notice will remain in effect until further notice.

Appendix 1

Rolls Royce Merlin Valve Spring Components