



Civil Aviation Authority

MANDATORY PERMIT DIRECTIVE



Number: 2020-002

Issue date: 23 March 2020

In accordance with Article 41(1) of The Air Navigation Order 2016, as amended, the following action required by this Mandatory Permit Directive (MPD) is mandatory for applicable aircraft registered in the United Kingdom operating on a UK CAA Permit to Fly.	
Type Approval Holder's Name: Rolls-Royce	Type/Model Designation(s): Merlin Engine, Packard Merlin Engine
Title:	Camshaft Bracket, Retaining Studs
Manufacturer:	Rolls-Royce
Applicability:	Merlin Engine (all variants, including Packard Merlin)
Reason:	<p>A recent MOR detailed the failure of a camshaft in a Packard Merlin 266 engine. Investigation revealed that the camshaft had failed in the region of the number 6 Camshaft Bracket. The outboard nut on the rear Camshaft (no. 7) Bracket was no longer present on its stud and the nuts' safety locking wire had failed adjacent to each retaining nut. The rear Camshaft Bracket was thus no longer adequately restrained by its studs. The Bracket was removed, and it was found that the thread in the cylinder head for the inboard stud had stripped and the stud was entirely free. The outboard stud was not fully secure in the cylinder head and could be unscrewed by hand a number of turns.</p> <p>The cause of this failure was attributed to studs which whilst appearing to be of the correct modification standard, did not appear to have the correct interference fit in the cylinder head.</p> <p>Note: The Bracket retaining studs require a specific interference fit for each modification standard. This area of the engine has been subject of at least 5 modification actions.</p> <p>A review of previous accident data revealed that a similar failure had occurred in an engine fitted to a Hawker Hurricane in 1991 which ultimately resulted in the loss of the aircraft. The camshaft had failed in a similar position and the No. 7 pedestal was loose. This accident resulted in all the operator's engines being updated to the latest modification standard.</p>
Effective Date:	25 March 2020

Compliance/ Action:	<p>Within 10 flying hours or 2 months from the effective date of this MPD, whichever occurs first:</p> <p>a) Confirm the modification status of the no. 7 (i.e. rearmost) Camshaft Bracket and retaining stud arrangement from the aircraft records for each bank [Note: they may be of differing standards]. If this information is not available from the records, it should be sought from the engine's last overhauler.</p> <p>b) Obtain confirmation from the overhauler of the associated torque figure(s) for the modification status in question.</p> <p>c) Conduct a stud location integrity check by:</p> <p>i) cleaning the area of the No.7 (rearmost) Camshaft Brackets;</p> <p>ii) noting the condition of the Bracket retention nut locking means;</p> <p>iii) removing the locking wire or split pins on the two retaining stud nuts;</p> <p>iv) marking each nut position against the Bracket Cap (to allow judgement of having overcome static friction during step v);</p> <p>v) using an 'indicating' (as opposed to a pre-set) torque wrench slowly apply torque to each nut until there is movement of the nut or the stud, being particularly careful not to exceed the figure specified for the particular modification standard. If movement occurs at lower than the specified figure, the figure achieved should be noted in an MOR and the engine withdrawn from service pending discussion and resolution with the approved engine overhauler. If the movement occurs at the specified figure, or if no movement is detected up to the specified figure, the peak figure achieved when untightening the nuts should be recorded. If this is significantly* higher than that specified for the particular modification standard, the figure should be recorded in an MOR and the engine should be withdrawn from service pending discussion and resolution with the approved engine overhauler. If not, the nuts should be removed, cleaned and re-lubricated before being re-fitted using the specified torque for the particular modification standard.</p> <p>*[Note: 'Significantly' here means more than that expected to overcome static friction. If in doubt, discuss with your overhauler].</p> <p>vi) If any related anomalies are found relating to stud or Bracket condition or security, an MOR should be submitted and a discussion held with the approved engine overhauler.</p> <p>d) Note: The method of re-locking the stud nuts should be determined in consultation with your chosen overhauler.</p>
	<p>Compliance with this MPD shall be recorded in the aircraft/engine logbooks and future planned inspections should be included in the aircraft maintenance programme.</p>
Reference Publications:	<p>Retro Track & Air Ltd. Technical Instruction TI 4100 Issue 1 or subsequent 'Merlin Rear Camshaft Bracket Holding-Down Torque Guide' or approved OEM data.</p>

Remarks:	<ol style="list-style-type: none">1. This MPD was originally published as Proposed MPD 20-01 and closed for consultation on 13 March 2020.2. Enquiries regarding this Mandatory Permit Directive should be referred to: 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
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