## **Safety Regulation Group**

Applications and Certification Section

17 December 2002

Our Ref 9/97/CtAw/278



## LETTER TO OWNERS/OPERATORS NO 2405 ROLLS-ROYCE AND PACKARD MERLIN SERIES ENGINES CON-ROD BOLTS

Following the outcome of an investigation in 1999 into a Merlin engine failure, the following best practice overhaul recommendations are promulgated to owners/operators and A8-20 organisations. These recommendations should be used in conjunction with the manual instructions at engine overhaul or refurbishment or whenever the con-rod assembly is disturbed:

- 1. For all Merlin marks, big end bolts being used to rebuild crankshaft/con-rod assemblies shall be selected in the following order of preference
  - a. 'New' big-end bolts of the Mod 2990 'rolled thread' standard
  - b. 'Used' big-end bolts of the Mod 2990 'rolled thread' standard
  - c. 'New' big-end bolts of the Mod 2990 'cut thread' standard
  - d. 'Used' big-end bolts of the Mod 2990 'cut thread' standard
- 2. The defined bolt fit limits must be observed and the maximum pre-existing twist on used bolts must be such that twist limits are not exceeded when assembled.
- 3. Ensure that the fork rod bolt 'D' heads are located correctly and fully seated during torque tightening. To ensure that the fork rod bolts remain correctly seated throughout the fitting and torque loading process, positive pressure should be applied to the bolt head with visual confirmation of correct seating of the 'D' head in the trap on the con rod.
- 4. On assembling the big-end bearings, the torque values and the amounts of bolt stretch are to be measured and recorded to ensure that they are within the specified limits in the overhaul manual.
- In accordance with ERM 378/1 and Overhaul manual TSD 293 Addendum sheet 2
  Colloidal Graphite grease Acheson's 'Oildag' or equivalent must be used to
  lubricate the abutment faces and threads of the plain and forked rod nuts during reassembly.
- Reference AP 1590B Vol.II Part 3 Sect. 2 Chap 3 and ERM No 402/1
  - a. Torque tightening requirements for forked rod bolts are:
    - i Tighten to achieve a 'constant torque' and a minimum measured bolt stretch of 0.0075" at a nominal torque value of:
      - 300-400 lb in (25-35 lb ft) for Rolls-Royce manufactured bolts 340-490 lb in (28-40 lb ft) for Packard manufactured bolts
    - ii Nuts may be further tightened to align the castellations with the split-pin holes
    - iii Reject any bolt that gives a 'constant torque' before reaching the minimum nominal torque value quoted above.

continued overleaf



b. Torque tightening requirements for plain rod bolts are:

Tighten to achieve a 'constant torque' and a minimum measured bolt stretch of 0.006" at a nominal torque value of:

660-900 lb in (55-75 lb ft) for Rolls-Royce manufactured bolts 780-1200 lb in (65-100 lb ft) for Packard manufactured bolts

- Nuts may be further tightened to align the castellations with the split-pin holes
- Reject any bolt that gives a 'constant torque' before reaching the minimum nominal torque value quoted above.
- 7. It is permissible for engines to be assembled with a mix of Rolls-Royce and Packard bolts but individual con-rod assemblies must contain only Rolls-Royce or only Packard manufactured bolts, ie the six bolts in any big end assembly must be all Rolls-Royce or all Packard manufacture.
- 8. The bolt twist after assembly, ie the angular shift of split-pin hole relative to centre line of locking feature, shall not exceed 1/16 turn (22°). Where engine overhaul manuals and repair instructions specify higher twist limits the lower figure shall apply.
- 9. In addition to the general requirements of TSD 293 Chap 4 Section 8, when fitting new or used big end bearing shells, carefully inspect for surface degradation and substrate delamination. Reject any bearings with signs of separation of the bronze bearing material from the steel backing. On unused bearings reject any with signs of corrosion, efflorescence or degradation of the lead or lead / indium coating.
- 10. During engine overhaul or refurbishment or where the crankshaft has been removed:
  - a. The crankshaft sludge traps are to be cleared and cleaned of any contents
  - b. All crankshaft and associated bearing oilways are to be flushed and cleaned.

Enquiries regarding this LTO should be referred to Mr C Denis, Propulsion Department - 1E (Telephone No 01293 573641) at the address shown below.

**RJTEW** 

Airworthiness Directive Co-ordinator