



SB 147 Cable life issue 2.

SERVICE BULLETIN NUMBER 147, issue 2.

TITLE Rigging cables with roll-swaged end terminals.
CLASSIFICATION P&M Aviation have classified this service bulletin as essential. The CAA have mandated it by means of MPD 2017-004-E.
COMPLIANCE Inspection before further flight, replacement of out of life cables within 25 hours.
APPLICABILITY Lower side, lower front and lower rear rigging cables with roll-swaged terminal ends fitted to the aircraft types below.

- [BM4](#) Gemini Flash
- [BM10](#) Pegasus Flash
- [BM14](#) Gemini Flash 2
- [BM16](#) Scorcher
- [BM17](#) Pegasus Flash 2
- [BM23](#) Gemini Flash 2 Alpha
- [BM43](#) Mainair Mercury
- [BM47](#) Mainair Blade
- [BM51](#) Mainair Blade 912
- [BM54](#) Mainair Rapier
- [BM60](#) Mainair Blade 912S
- [BM70](#) Quik GT450
- [BM77](#) QuikR
- [BM80](#) Quik GTR
- [BM81](#) PulsR

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REVISION HISTORY

Issue	Date	Changes
1	15/5/17	Initial issue
2	30/11/17	750 hours revised to 800 in line with P&M recommended inspection schedule for wings. Duplicate inspection text changed to BMAA SIGMA protocol.



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1. INTRODUCTION

A P&M GT450 in a flying school had a partial failure of a lower side rigging cable (Part No. YQD-045) when recovering from a spiral manoeuvre, within the limits of the flight envelope. These cables are arranged in pairs, to give a backup load path. The second cable carried the load and the aircraft landed safely. This is the only P&M production lower side cable failure we have been aware of since 1984. See fig 1. for cable definitions. The partial failure was at the edge of the roll-swaged terminal end shown in fig 2. The alternative cable terminations using Nicopress sleeves and thimbles allow more progressive flexing of the cable. See fig 3.

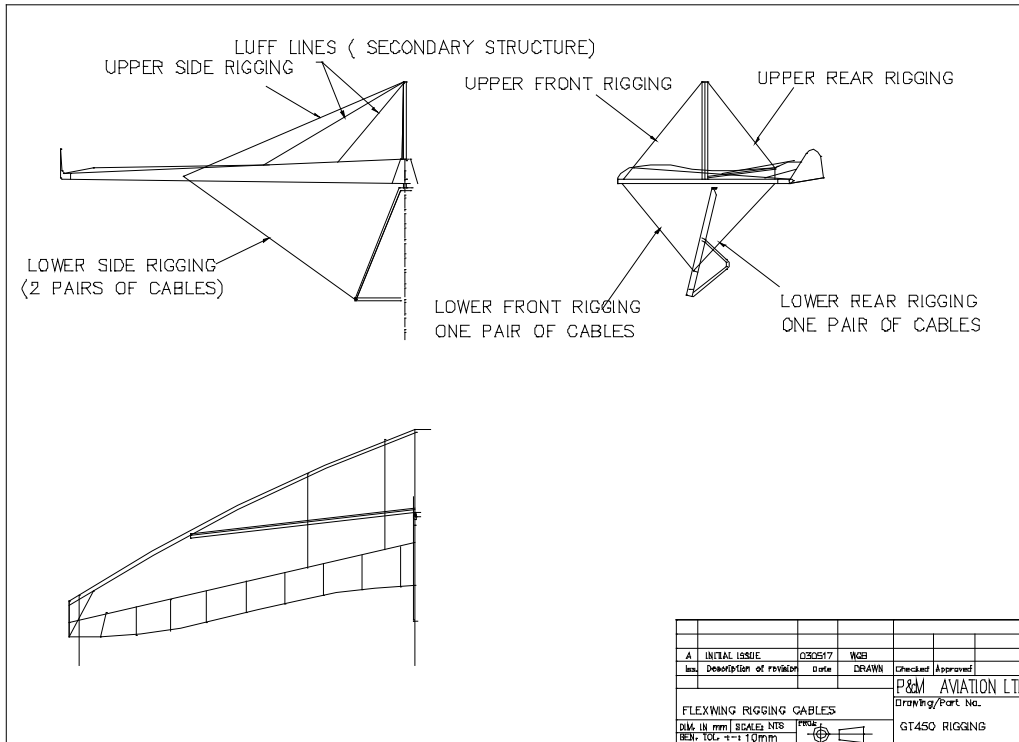
The incident GT450 lower side rigging cables had been in use for 1050 hours and 9 years. The aircraft had been subject to an accident and rebuilt once in its life. It was also operated quite near the coast where it has been considered that sea air Chlorides could have affected the material. There were corrosion pits in the S316 stainless steel material which accelerate fatigue failures. CLSCC (Chloride Stress Corrosion Cracking) is known to affect stainless steel.

The cable fitting was at the bottom end of the cable, where solutions can wick down it and collect. The strand failures were caused by bending and tensile fatigue because of cracks propagating from scratches and corrosion pits on the surface. See figs 4 & 5.

All the remaining cables had broken strands at the edge of the roll-swaged terminals. Some of these strands had been failed for some time, as shown by discolouration of the failure surfaces. The cable is 7 cores of 7 strands construction.

The central core, being straight, can pick up more tensile load than the others and can fail before the outer ones. The broken strands are hard to spot, especially in the inner core of the cable and so it has been considered necessary to put a replacement life on structural cables with roll-swaged terminals.

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MASTER IN COLOUR

Fig 1. Structural airframe cables



Fig 2. Overall general arrangement of the GT450 lower side rigging cables with roll-swaged terminal ends. The arrow shows the point of partial failure. The attachment bolt at the control frame knuckle should be just loose enough to allow each cable to align with the load. Note the plating on the bolt head is shiny in this example.

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Fig 3. A thimble and Nicopress sleeve type fitting. The blue plastic shroud can be pulled back for inspection of the sleeve.



Fig 4. Magnification of edge of the roll-swaged terminal of the partially failed cable. Note dirty surfaces of old failures and corrosion marks especially in the central area, which is hard to inspect externally. Several strands had been broken for some time before the failure.



Fig 5. Failed cable strands showing wear grooves and corrosion pits.



Fig 6. The corroded bolt (Part No. FBA5-21A) that held the partially failed side cable to the control frame.

As can be seen from Fig 6, this bolt displays clear evidence of corrosion and pitting. This is indicative of the general environment in which the aircraft has been operated. This also MAY be indicative of the probability of corrosion occurring within the cable itself. The corrosion on the bolt head is not uncommon for such fittings that are exposed to a salty atmosphere over a long period of time. A clean and bright bolt may well indicate corrosion of the cable is less likely to be an issue.

All Mainair aircraft manuals already have a recommended replacement 250hrs on lower side cables + major inspection on all other rigging cables every 250hrs/3yrs. The Pegasus Quasar 2 manual also recommends replacement at 500hrs on side cables (Nicopress swage). These recommendations remain unaffected by this service bulletin. All cables, especially the lower side rigging, must be checked to be undamaged and free of kinks as part of the Daily Inspection, especially at the edge of roll-swaged terminals.

The application of bending loads on the cable end connections must be avoided, e.g. the aircraft should NOT be manoeuvred on the ground by pulling or pushing on the cables. If the rigged aircraft needs to be picketed down, then wherever possible avoid using tiedowns to the lower side cables but rather use a suitable strap through the cross boom inspection panel (where they exist) and over the tubing. Great care must also be taken when packing the wing to ensure that the lower side cables are not subject to bending in the vicinity of the roll-swaged fittings i.e. they must always remain unkinked.

2. ACTION

This Service Bulletin only relates to the lower side cables, lower front cables and lower rear cables that use roll-swaged fittings as the lower cables are subject to the most fatigue loading cycles and so are the most susceptible to failure due to bending and tensile fatigue. Only Mainair aircraft use roll-swaged fittings on the lower front cables.

For applicable cables with more than 800 flying hours or 7 years of service, whichever comes first, before further flight, visually inspect at the edge of the roll-swaged terminal(s) using a magnifying glass with a power of at least 3x. Inspect closely for damage i.e. broken strands, corrosion, mechanical damage or slippage. If any damage is found, replace the affected cable before further flight. If no damage is found, replace the cable within 25 flying hours.



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For applicable cables with less than 800 flying hours and less than 7 years of service, within 25 flying hours, visually inspect at the edge of the roll-swaged terminal(s) using a magnifying glass with a power of at least 3x. Inspect closely for damage i.e. broken strands, corrosion, mechanical damage or slippage. If any damage is found, replace the affected cable before further flight. If no damage is found, replace the cable at 800 flying hours or 7 years of service, whichever comes first.

Warning - Do NOT bend the cable in an effort to find broken strands. Do NOT attempt to unwind the lay of the cable to see the inner core. Both these actions are most likely to cause additional damage!

A flowchart of the process to be followed is shown in Appendix 1.

Instructions for replacement of cables and associated fasteners can be downloaded from P&M Aviation website under the “manuals” section, see http://www.pmaviation.co.uk/manuals_new.php

When fitting replacement cables, new nyloc nuts must be used or new split pins, if castle nuts are fitted. Note the cables must be free enough to rotate allowing self-alignment under load.

Out of life cables, or any damaged cables within the service life, MUST be returned to the factory with a note from which aircraft they come from, the number operating hours and the calendar age.

3. DOCUMENTATION

Removal and replacement of any airframe structural cable requires a duplicate inspection, one of which can be by an owner/operator. The second inspection must be by a person the owner considers qualified to inspect the work done.

The aircraft technical log must be signed “Service bulletin SB147 (roll-swaged cables) carried out” by the owner/operator and the qualified person.

4. INVESTIGATION OF CABLES RETURNED TO DATE

Investigation into cables returned from 13 aircraft so far would indicate: -

- That a cable may look perfect from a visual inspection but can have multiple broken core strands that are not visible to the naked eye.
- Rolling the cable and listening for clicks to indicate broken strands does not always work. It has been found that cables with multiple core strand failures have been rolled without evidence of any clicking. Therefore, this cannot be considered a viable or reliable test process.
- Of the thirty-seven cables tested to-date, ten cables had broken strands within the core with a corresponding reduction in cable strength (the worst case being 57% of new strength).
- Given the dangerous state of some of the returned cables, it is highly probable that this Service Bulletin has prevented serious incidents/accidents.



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The hours flown and age of the failed cables range from 280 to 650 hours and 8 to 29 years. On the basis of the evidence gained so far, there can be no justification for relaxing the existing parameters.

5. CONTINUED AIRWORTHINESS

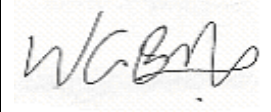
At each permit revalidation and as per the appropriate maintenance manual, all roll-swaged cables are to be checked that they are within the flying hours life, uninked and in good condition. They must be inspected by magnifying glass, especially at the edges of terminals.

All lower side, lower front and lower rear rigging cables with roll-swaged terminal ends must be replaced within 800 hours operation or 7 years age, whichever comes first.


Replacement GT450 lower side rigging cables are now being provided as a kit featuring thimble and sleeve type ends and a longer control frame knuckle bolt (minor modification M313).

Note - for cables with thimble and Nicopress sleeve type ends, replacement at 800 hours/7 years is recommended *but not mandatory*, provided detailed inspection is carried out at each permit revalidation.

ISSUED BY W.G.Brooks

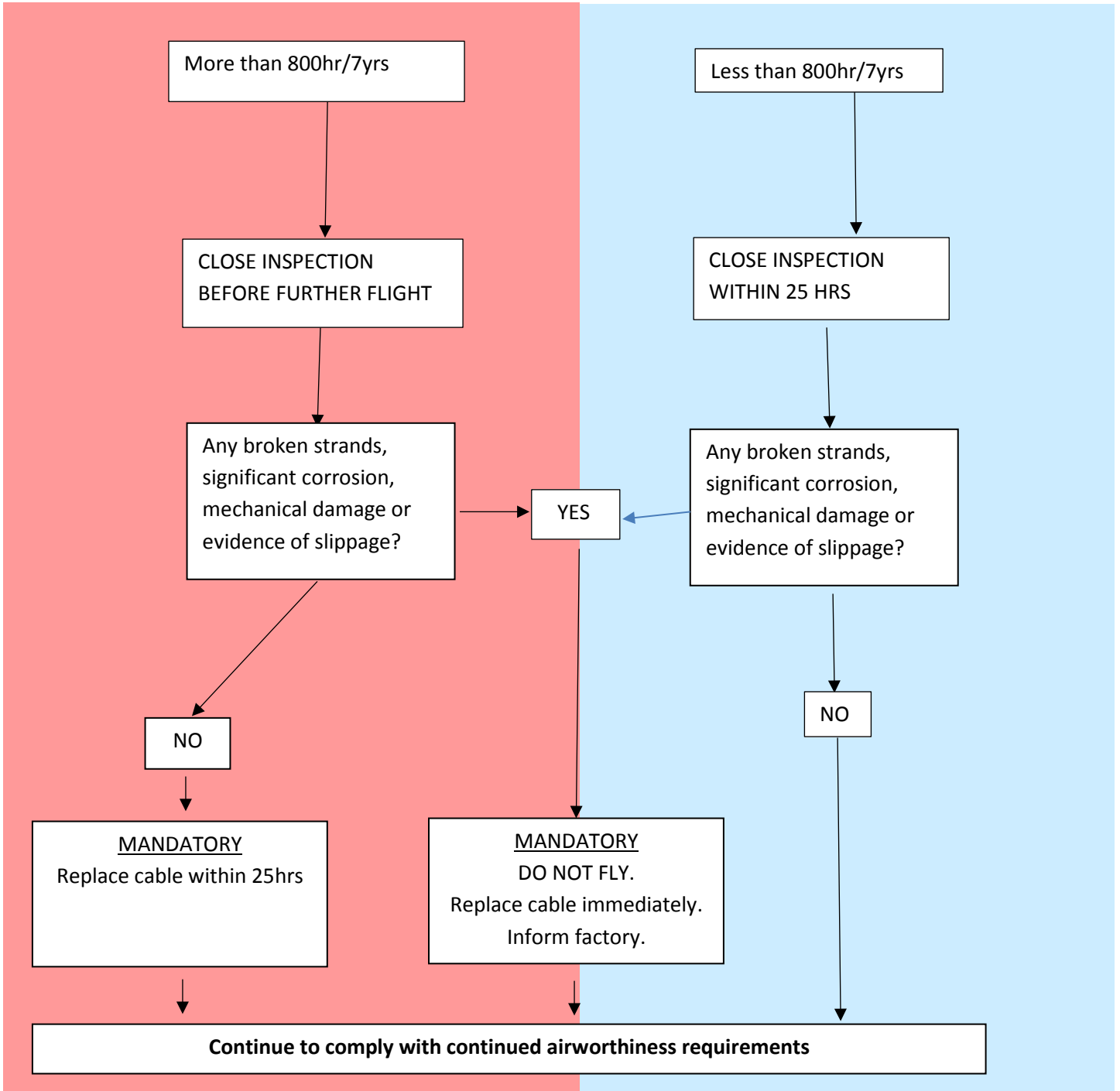
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APPENDIX 1

ACTION - FOR LOWER RIGGING CABLES WITH ROLL-SWAGED TERMINAL ENDS ONLY



RECURRING ACTION

MANDATORY - REPLACE LOWER RIGGING CABLES WITH ROLL-SWAGED TERMINAL ENDS AT 800HRS/7 YEARS