Document number RSUK0044

Maintenance Manual

Gyroplane Type MTOsport (UK spec only)

RotorSport UK Ltd
Poplar Farm
Prolley Moor
Wentnor
Bishops Castle
SY9 5EJ

Company Reg No 5486550

Phone: +44 (0) 1588 650769
Fax: +44 (0) 1588 650769
Email: info@rotorsport.org

CAA Approval No: DAI/9917/06

Applicability

Aircraft Registration: **G-**

Aircraft serial no. **RSUK/MTOS/**

Engine type: **Rotax 912 ULS or 914UL**

Engine serial No:

Rotor blade type & diameter: **Autogyro 8,4m (black end cap only)**
or
Autogyro 8m (grey end cap only)
or
Autogyro 8.4m Rotor System II (red cap only) when modified under SB-040 Iss1
or
Autogyro 8.4m RotorSystem II TOPP (blue cap only) when modified under SB-040 Iss2

Propeller type: **HTC 1,73m**
or
Woodcomp SR3000/3 in-flight variable pitch propeller
or
IVO-prop DL3-68 in-flight variable pitch propeller

CONTENTS AND CHECK LIST OF PAGES

SECTION 1

AMENDMENTS TO THE SCHEDULE

1. Where & when necessary RotorSport UK Ltd (hereafter referred to as RSUK) will issue updates to this maintenance standard, and will notify known owners to review the changes via the RSUK website with changes appropriately identified by a strike in the margin.
2. Aircraft operators are responsible for ensuring that amendments to their publication are carried out immediately and in accordance with instructions contained in amendment transmittal letters (where issued).

ISSUE NUMBER	DATE	INSERTED BY	ISSUE NUMBER	DATE	INSERTED BY
Initial			5	12.09.11	
1	26.3.09		6	20.03.12	
2	21.12.09		7	07.04.15	
3	22.12.10		8	28.09.15	
4	12.06.11		9	**21.06.16**	

Issue	Change summary
4	Life limitations added for rotors
5	MC and SBs now on website, RotorsystemII added. MC198 aveoflash and 199 ATR833 referenced. Transponder verification bi-annually recommended. OEM stick grip, pages renumbered and space added. Annual flight test now CFS301.
6	Windscreen crack-stopping added (p52), rudder cable adjustment amended (p64). Transponder verification biennial replaces bi-annual (p58). Fuse values changed under MC-208/SB-054 (p30).
7	Life-limited items (p8), Operational incidents (p12), 1500hr check (p14), Annual flight test (p17,18), braided oil hoses (p26), MC-161 revised electrical system (p34), flight/brake valve (p36), Binx nuts (p45), Teeter bushings (p47), Spinner option (p52), inspection pre-rotator (p53), Reinforcement stay (p53), Trim cylinder kit (p58), new rpm gauges (p68), ATR833 audio in connector (p68), barometric system fittings (p70), AI option (p70), nitrogen filled tyres (p71), rudder distance setting (p76), silicone grease/Copaslip (p73) wheel bearings (p73), tie-down warning (p77), low cable tension warning (p78), low fuel sensor replacement (p88), Rotor head main axis bolts (p83), SB-061 thrust washers (p81), rotor control friction (p82), fuel filter (p87), fuel pumps p(87), new form F023 (p94). All pages republished at Iss7 of 07.04.15.
8	IVO-prop added (Section 9 q). Fuse rating changed (p33), Digital RPM/MAP gauge option (p64). All pages republished Iss8 of 28.09.15.
9	TOPP rotor option added pages 2,5,6,9,40,43,46. Binx nuts photo p45. All pages republished Iss9 of 21.06.16

Document Approval signatures.

The technical content of this document is approved under the authority of the UK CAA

Design Organisation Approval Ref: DAI/9917/06

Signature:	Signature:	Signature:
Gerry Speich Jul 4 2016 9:59 AM	Graham Shaw Jul 4 2016 10:15 AM	Andy Lyons Jul 7 2016 4:42 PM
Position: Engineering Manager	Position: Engineer/Inspector	Position: Head of Airworthiness

List of Effective Pages

Page	Issue	Date	Page	Issue	Date
Page 1	9	21.06.16	Page 53	9	21.06.16
Page 2	9	21.06.16	Page 54	9	21.06.16
Page 3	9	21.06.16	Page 55	9	21.06.16
Page 4	9	21.06.16	Page 56	9	21.06.16
Page 5	9	21.06.16	Page 57	9	21.06.16
Page 6	9	21.06.16	Page 58	9	21.06.16
Page 7	9	21.06.16	Page 59	9	21.06.16
Page 8	9	21.06.16	Page 60	9	21.06.16
Page 9	9	21.06.16	Page 61	9	21.06.16
Page 10	9	21.06.16	Page 62	9	21.06.16
Page 11	9	21.06.16	Page 63	9	21.06.16
Page 12	9	21.06.16	Page 64	9	21.06.16
Page 13	9	21.06.16	Page 65	9	21.06.16
Page 14	9	21.06.16	Page 66	9	21.06.16
Page 15	9	21.06.16	Page 67	9	21.06.16
Page 16	9	21.06.16	Page 68	9	21.06.16
Page 17	9	21.06.16	Page 69	9	21.06.16
Page 18	9	21.06.16	Page 70	9	21.06.16
Page 19	9	21.06.16	Page 71	9	21.06.16
Page 20	9	21.06.16	Page 72	9	21.06.16
Page 21	9	21.06.16	Page 73	9	21.06.16
Page 22	9	21.06.16	Page 74	9	21.06.16
Page 23	9	21.06.16	Page 75	9	21.06.16
Page 24	9	21.06.16	Page 76	9	21.06.16
Page 25	9	21.06.16	Page 77	9	21.06.16
Page 26	9	21.06.16	Page 78	9	21.06.16
Page 27	9	21.06.16	Page 79	9	21.06.16
Page 28	9	21.06.16	Page 80	9	21.06.16
Page 29	9	21.06.16	Page 81	9	21.06.16
Page 30	9	21.06.16	Page 82	9	21.06.16
Page 31	9	21.06.16	Page 83	9	21.06.16
Page 32	9	21.06.16	Page 84	9	21.06.16
Page 33	9	21.06.16	Page 85	9	21.06.16
Page 34	9	21.06.16	Page 86	9	21.06.16
Page 35	9	21.06.16	Page 87	9	21.06.16
Page 36	9	21.06.16	Page 88	9	21.06.16
Page 37	9	21.06.16	Page 89	9	21.06.16
Page 38	9	21.06.16	Page 90	9	21.06.16
Page 39	9	21.06.16	Page 91	9	21.06.16
Page 40	9	21.06.16	Page 92	9	21.06.16
Page 41	9	21.06.16	Page 93	9	21.06.16
Page 42	9	21.06.16	Page 94	9	21.06.16
Page 43	9	21.06.16	Page 95	9	21.06.16
Page 44	9	21.06.16	Page 96	9	21.06.16
Page 45	9	21.06.16	Page 97	9	21.06.16
Page 46	9	21.06.16	Page 98	9	21.06.16
Page 47	9	21.06.16	Page 99	9	21.06.16
Page 48	9	21.06.16	Page 100	9	21.06.16
Page 49	9	21.06.16	Page 101	9	21.06.16
Page 50	9	21.06.16			
Page 51	9	21.06.16			
Page 52	9	21.06.16			

Intentionally Blank

SECTION 2

FOREWORD

1. Applicability

This Schedule is intended for use on the MTOsport Gyroplane only, released on AAN29247.

2. Guidance

This aircraft may be being flown & operated under a CAA Permit to fly, and as such specific rules exist to cover maintenance actions, such as the types of work allowed by owners on Permit aircraft or CAP520 'Light Aircraft Maintenance'. It is the aircraft operators' responsibility to ensure the aircraft is operated within those rules and regulations.

3. Notes

RSUK provides this maintenance schedule so that, to the best of their knowledge, the operator is able to maintain the aircraft in a manner that will preserve its airworthiness. The manufacturer is unable to predict all operating conditions, and as such it is the operator's ongoing responsibility to assess the schedule for applicability to the environment operated within.

Note; check your Permit to Fly – if compliance to this schedule is stated as required, then non-compliance will invalidate the Permit to Fly.

SECTION 3

OWNER/OPERATOR RESPONSIBILITIES

Operators are responsible for the accomplishment of the maintenance prescribed in the schedule.

CERTIFYING PERSONS RESPONSIBILITIES

Certifying persons must use their engineering skill and judgement in determining the depth of inspection needed and other matters that could affect the airworthiness of the gyroplane. In order to claim any alleviation on subsequent inspections, the gyroplane maintenance records must record the extent of previous inspections upon which the alleviation is based.

Certifying persons are responsible for recording in the appropriate log book or worksheet, any defects, deficiencies or additional maintenance required as a result of implementation of the schedule.

GENERAL INSPECTION STANDARDS

The general inspection standards applied to individual task inspections must meet the recommended standards and practices of RSUK.

In the absence of general inspection standards, refer to CAA CAP 562 Civil Aircraft Airworthiness Information and Procedures (CAAIP) or other CAA recommended standards and practices, and/or the LAA Gyroplane Maintenance manual.

Inspections may be carried out without component removal or dismantling unless considered necessary or where required by the schedule.

AIRWORTHINESS LIFE LIMITATIONS (RETIREMENT/SCRAP LIVES)

Airworthiness life limitations shall be those published by the CAA, state of design and RSUK.

Airworthiness life limitations should be recorded in CAP 543 Time Limited Task Record, or an appropriate equivalent.

For safe operation over the specified lifecycle of the aircraft and for liability reasons, the following manufacturer limitations shall apply. In the case where a component has operating hours and calendar time limits the first-reached limit shall apply.

On reaching the manufacturer life limit (MLL) the component SHALL be replaced, regardless of its perceived condition.

Equipment / System	MLL
RotorSystem 1 8.4m blade (MT-series) RSD7040 (black end caps)	700 hours
RotorSystem 1 8.0m blade (MT-series) RSD7139 (grey end caps)	700 hours
Rotorsystem II 8.4m blade BG1793 (red end caps)	2500 hours
Rotorsystem II 8.4m TOPP variant blade BG8946 (blue end caps)	2500 hours
Rotor main bearing	1500 hours

AIRWORTHINESS DIRECTIVES

All applicable Airworthiness Directives or Mandatory Permit Directives issued by the CAA and the state of design must be complied with. Compliance with AD's or MPD's should be recorded in Part C of CAP'S 398, 399 or 400 (logbooks), or an approved equivalent.

AIRWORTHINESS NOTICES

All applicable mandatory CAA Airworthiness Notices must be complied with. Compliance with CAA Airworthiness Notices should be recorded in Part C of CAP'S 396, 399 or 400 (logbooks), or an approved equivalent.

OVERHAUL AND TEST PERIODS

Overhaul and test periods shall be those shown & recommended by RSUK.

The CAA may vary or mandate overhaul and test periods by the issue of an Airworthiness Directive or Airworthiness Notice.

The overhaul and test periods should be recorded in the appropriate aircraft worksheet

SERVICE INFORMATION

Service information (Service Bulletins, Service Letters, etc) published by RSUK should be formally technically assessed by the Owner/Operator and adopted if required to ensure operational safety and reliability, compliance with service information should be recorded in Part C of CAP 398, 399 or 400 (logbooks), or an approved equivalent.

MODIFICATIONS

Approved modifications which have been carried out to the gyroplane, engine, components and radio after original manufacture, must be recorded in the appropriate log book(s).

Any recurring inspection or maintenance task resulting from approved modifications should be recorded in the aircraft worksheets.

DUPLICATE INSPECTIONS

Following initial assembly or any disturbance of a control system or vital point, the procedures outlined in British Civil Airworthiness Requirements (BCAR) Section A/8, Chapter A6-2/B6-2 and A5-3 shall be applied. Certifications must be recorded in the appropriate worksheet, log book or aircraft technical log. In summary, this procedure requires that all and any such changes be cross checked by either a CAA approved Inspector or Certified or CAA Authorised Engineer prior to first flight, and this cross check shall be as thorough as practical – including physical tests if appropriate. In exceptional circumstances the CAA also allow another qualified gyroplane pilot to cross check modifications – this person must sign the logbooks to certify their actions with their pilots licence no.

SCHEDULED MAINTENANCE WORKSHEETS

Worksheets shown in Section 7 must be issued and the tasks certified for all scheduled maintenance checks. These worksheets become part of the maintenance records required to be kept by the operator.

All maintenance carried out in connection with a particular check should be certified on suitably referenced worksheets (an example available from the RSUK website) and included

in the gyroplane records. These worksheets must be cross-referenced in the appropriate log book(s) giving general details of the additional maintenance carried out.

DEFINITIONS

Throughout the schedule the following terms and abbreviations have the stated definitions;

SERVICE/LUBRICATION (SERVICE/LUB):

The term 'Service or Lubrication' requires that a component or system should be serviced and/or replenished as necessary with fuel, oil, grease, water, etc., to the condition specified. The term service may also be used to require filter cleaning or replacement.

INSPECT (INSP):

An ‘Inspection' is a visual check performed externally or internally in suitable lighting conditions from a distance considered necessary to detect unsatisfactory conditions/discrepancies using, where necessary, inspection aids such as mirrors, torches, magnifying glass etc. Surface cleaning and removal of detachable cowlings, panels, covers and fabric may be required to be able to satisfy the inspection requirements.

OPERATIONAL CHECK (OP/C):

An 'Operational Check' is a test used to determine that a system or component or any function thereof is operating normally.

FUNCTIONAL CHECK (F/C):

A 'Functional Check' is a detailed examination of a complete system, sub-system or component to determine if operating parameters are within limits of range of movement, rate of flow, temperature, pressure, revolutions per minute, degrees of travel, etc., as specified in the appropriate maintenance manual. Measured parameters should be recorded.

CHECK (CHK):

A 'Check' is the verification of compliance with the type design organisation's recommendations.

SECTION 4

PERMIT MAINTENANCE RELEASE

This maintenance certification system is specific in accordance with BCAR A3-7.

Owner operators must ensure their airframe and engine logbooks either contain a sticker with the wording ‘Any reference to a Certificate of Release to service in this logbook shall be construed as a PMR’ & ‘The certification at the top of each page in Part A of this logbook is superseded by the following statement; The work recorded below has been completed to my satisfaction and in that respect the aircraft is considered fit for flight’, or have new logbooks containing this information.

For information on who can issue a PMR see CAP553; BCAR Section A, Chapter A3-7, Paragraph 12.5.

On completion of any check required (‘required’=stated in the Permit to Fly) by the schedule, except pilot maintenance (see section 5) and Check A (see section 6), an entry shall be made in Column 6 of CAP398 Aircraft Log Book, CAP399 Engine Log Book or an approved equivalent as Section 4. The certifying person's signature, authority and date must be made in Column 7 against the relevant category (Airframe, Engine, Radio).

The following is an example of an entry acceptable to the CAA, unless already pre printed on the page:

PERMIT MAINTENANCE RELEASE Cross refer to workpack ref; 25 hr/100 hr/Annual Check (delete as appropriate) has been carried out to my satisfaction at total airframe hours…… and in that respect is considered fit for flight Signed……..Authorisation ref…….Date……. Maintenance Schedule Ref. RSUK0044 Issue	Airframe Engine Radio (Annual check only)

A signed PMR does not expire or is superseded by subsequent PMR's, unless relating to a repeat of the same activity. A PMR remains active as long as the activity it relates to remains part of the aircraft.

Pilot Maintenance

A licensed pilot who is the owner or operator of the gyroplane may carry out certain maintenance tasks prescribed in Air Navigation (General) Regulation 16. The issue of a PMR is not required. The pilot must include his pilot's licence number with his signature in the appropriate log book(s). The permitted pilot maintenance is as below;

PERMITTED PILOT MAINTENANCE

This section defines the type and extent of maintenance that may be carried out and certified by a pilot who is the owner of the aircraft and operates under a CAA Permit to Fly. Refer to CAA CAP 733 for more information. Some of the wording is adjusted to suit gyroplane terminology.

1. Replacement of landing gear tyres.
   (Including removal and replacement of wheels, cleaning and servicing of wheel bearings, application of creep marks, removal and refitting of brake units to the extent required for wheel removal and the removal and the renewal of brake pads/linings when special tools are not required. Replenishment of hydraulic brake system fluid level).
2. Replacement of defective safety wiring or split pins excluding those in engine, transmission, flight control and rotor systems (but including those designed to be pilot maintainable and shown in the pilot's handbook, e.g. teeter bolt split pin).
3. Repairs to upholstery and decorative furnishing of the cabin or cockpit interior when repair does not require dismantling of any structures or operating system or interfere with an operating system or affect the structure of the aircraft.
4. Repairs, not requiring welding, to fairings, non-structural cover plates and cowlings.
5. Replacement of safety belts or safety harness.
6. Replacement of seats or seat parts not involving dismantling of any structure of any operating system.
7. Replacement of bulbs, reflectors, glasses, lenses or lights.

8. Replacement of any cowling not requiring removal of the propeller, rotors or disconnection of engine or flight controls.
9. Replacement of unserviceable sparking plugs.
   (Including removal, cleaning, gaping, testing and refitting of all spark plugs).
10. Replacement of batteries.
    (Including maintenance of lead acid batteries)
11. Replacement of wings (rotors) and tail surfaces and controls, the attachments of which are designed to provide for assembly immediately before each flight and dismantling after

each flight.
12. Replacement of main rotor blades that are designed for removal where special tools are not required (as is the case on the MT series).
13. Replacement of VHF communications equipment, only if is not combined with navigation equipment.
14. Manufacture and installation of required cockpit placards and notices.
15. Lubrication of aircraft.
    (Including prior cleaning of hinges)
16. Inspection of engine induction air filter.
    (Including removal, cleaning and refitting (with wirelock)).
17. Inspection of fuel filters.
    (Including removal, cleaning and refitting).
18. Changing of engine oil.
    (Including removal, cleaning/replacement, refitting of oil filter, and wirelock of sump bolt).

Annual Check

The annual check and all associated work must be accomplished under the supervision of an organisation appropriately approved by the CAA (eg RSUK or other CAA Authorised engineer).
Use form F138 from the RSUK website

Inspections after operational incidents
It is essential that in the event of an operational incident a detailed inspection is carried-out as defined below by an A3-7 authorised engineer. Defective components must be replaced. In case one or more of the items marked 'CRITICAL' are found defective or out of tolerance, ground the aircraft and contact RSUK.

1. Suspected hard landing
- In case of a suspected hard landing perform the following checks:
- Inspect nose gear, attachment, fork, linkage and wheel bearing
- Inspect main gear axles
- Examine possible rotor / propeller strike (see 'Rotor / propeller contact with obstacle')
- CRITICAL: Inspect main gear spring spar (attachment ok, no cracks)
- CRITICAL: Inspect fuselage, frame and attachment point for possible deformation or cracks
- CRITICAL: Inspect engine rubber mounts and propeller to frame clearance approx. 5 cm
- CRITICAL: Perform a rotor alignment check

2. Rotor contact with an obstacle
   Rotor contact with obstacle includes any rotor strike of the standing or turning rotor with any obstacle, including propeller and fuselage structures.
   In case of rotor contact with obstacle:
- Perform a rotor alignment check and adjust, if necessary
- Examine damage of aluminium rotor profile:
- Allowed damage: dent with max. depth of 1 mm

- CRITICAL damage: dents(s) with depth >1mm and/or sharp-edged nick(s)

In case the turning rotor hit the stabilizer/rudder, a detailed inspection of the affected components must be performed.

3. Propeller external impact or contact with an obstacle
   Refer to engine manufacturer documentation.

4. Birdstrike
   - Perform detailed inspection of all affected components
   - If rotor blades are affected, proceed according to ‘Rotor contact with obstacle’
   - If propeller is affected, proceed according to ‘Propeller contact with obstacle or external
   - impact’

5. Lightning strike
   A lightning strike may damage the main rotor bearing. Thorough inspection and maintenance after a lightning strike must be performed. Ground aircraft and contact RSUK..

SECTION 5
THE MAINTENANCE CHECK CYCLE

Check title	Content	Period
Check A	Check A	Prior to the first flight of the day
First 25 hour check	25 hour check items (one time check, after new build)	Not exceeding 25 flying hours, or 1 year, whichever is the sooner
100hour/Annual check	25, 100 hour and annual check items	Not exceeding 100 flying hours or 12 months whichever is the sooner (see Notes 5/6) & prior to renewal of Permit to Fly
1500 hour check	Supplemental inspection	When 1500 flight hours reached. Consult RSUK for further information

Use forms F076 25hr Service and F138 100hr Service/Annual Inspection worksheets
For short-term storage (6-12months) use form F146, for long-term storage (>12months) form F141

PERMITTED VARIATIONS (see Notes)

Tasks controlled by flying hours	Maximum Variation
25 hour	+/- 5hrs
100 hour	+/- 10hrs
Tasks controlled by calendar time	**Maximum Variation**
6 months	1 month
Annual	Prior to Permit renewal (see 5. and 6.below)

Tasks controlled by more than one limit
The more restrictive limit shall be applied

Notes

1. Permitted variations may not be applied to applicable airworthiness life limitations, airworthiness directives or overhaul and test periods.
2. Permitted variations for tasks controlled by flying hours should not be understood to be a maintenance planning tool, but as an exceptional means to allow the operator to fly for a limited period of time until the required maintenance is performed.
3. Any application of a permitted variation to the maintenance check cycle period must be recorded in the appropriate log book(s) together with the reason for the variation by a person who is authorised to sign the log book entry for that particular check. Details of the permitted variation must be made visible to the pilot.
4. Permitted variations are not required to be deducted from the next scheduled check.
5. The annual check may be anticipated by a maximum period of 62 days without loss of the continuity of the maintenance check cycle. Thus, for example, where the full 62 days is invoked, the following annual check would become due 14 months after the completion of the annual check that was anticipated. The period by which the annual check was anticipated and the date of the next annual check shall be recorded in the appropriate log book(s).

6. Where the aircraft requires an annual inspection, and was supplied new within that preceding year, it is permissible for the 25hr airframe inspection to be accepted in lieu of the annual inspection, provided the service has been undertaken within the 62 days requirement in note 5.

Intentionally blank

SECTION 6

PILOT'S PRE-FLIGHT CHECK
Pre-flight checks are to be carried out in accordance with the Gyroplane Flight Manual RSUK0043.

CHECK A - PRIOR TO FIRST FLIGHT OF THE DAY
For update control and one source of information, this check is not printed here. Refer to the Pilots Handbook.
For all inspection checks reference must be made to RotorSport UK Ltd, either via the website **www.rotorsport.org** or directly, for the latest schedule.

SECTION 7 - SCHEDULED MAINTENANCE WORKSHEETS
To allow ongoing updates of these service sheets with field service information received, they are located on the RotorSport UK Ltd website www.rotorsport.org.

F076 issue 7, 25hr service worksheet
F138 issue 4, 100hr service/Annual inspection worksheet
F146 issue 3, short-term storage worksheet, or F141 issue 3, long-term storage worksheet

PERMIT RENEWAL
Over and above the annual inspection, the CAA have some specific requirements that must be met/demonstrated during the permit renewal process. These are:

1) Demonstration of compliance with relevant AAN's (29247, downloadable from the CAA website) at applicable issues and with any addendums. See the aircraft Certificate of Conformity for details.

2) Demonstration of compliance with CAA Type Approval data sheet No. -BG-02 @ current Issue (downloadable from CAA website)

3) Demonstration of Compliance with CAP 661 Mandatory Permit Directives - detailing the Revision date/issue and stating relevant MPD's and method of compliance and location/page of certification in log book. Achieved by checking the copy of the latest document on the CAA website, and referencing it on the Annual Inspection worksheet.

4) Demonstration of Compliance with CAP 747 detailing the Revision date/issue and applicable Generic Requirements. Achieved by checking the copy of the latest document on the CAA website, and referencing it on the Annual Inspection worksheet.

5) Demonstration of Compliance with EASA AD's applicable to the Rotax 912/914 engine - claim those for which are covered by mod state and detail those which are not relevant to UL/ULS. Achieved by checking the copy of the latest document on the EASA website, and referencing it on the Annual Inspection worksheet.

6) Demonstration of Last completed Scheduled Maintenance check - reference Maintenance Manual, requirements and significant maintenance tasks/repairs completed. Achieved by showing the signed, completed service worksheets, which must be referenced in the aircraft and engine logbooks together with reference back to the manual used.

7) Flight test report. RotorSport recommend that an annual independent flight test be undertaken in line with the CAA flight test document CFS301, in order to demonstrate that the previous year of the aircrafts life has not caused any flight related deterioration. However, as of 2013, an annual FT is no longer a requirement of the CAA, but at the discretion of the aircraft owner and their A3-7 engineer. If the aircraft is managed by another airworthiness organisation, then the rules of that organisation apply.

8) Permit Flight Release Certificate, if previous Permit expired. Copy required.

9) Aircraft weighing report date and Cof G schedule - copy required if changed since last renewal.
Note! There is no requirement to annually re weigh a gyroplane. If a re-assessment of the aircraft CG is required, please contact RotorSport UK Ltd.

10) Check of Aircraft hours, Engine serial No and Propeller serial number.

11) Pilots Operating handbook Issue No. You will need to show your copy.

12) Modifications and service bulletins/MPDs. The logbook must show any incorporated, both in the white pages and in the back pages showing the mod summary. Service bulletins and MPDs must be shown in either ‘one time requirements’ or ‘Repetitive requirements’ if to be repeated at certain intervals. In the latter case, the repeat checks must have been done.
They must be referenced with either CAA or RSUK mod numbers, and to their worksheets if used to show embodiment – and to be available for review.

A well presented and completed document set as above will make the permit renewal process relatively easy. See the RSUK website for further permit renewal guidance.

Intentionally blank

SECTION 8

ANNUAL FLIGHT TEST

Annual Flight Test Schedule– refer to CAA check flight schedule CFS301 if it is decided that a flight test is needed - or as required by the managing airworthiness organisation.

Intentionally blank

SECTION 9

Aircraft systems description and maintenance methods

General notes;

1. **These instructions are not all encompassing, and should always be used in line with good aircraft engineering practices, and manuals such as AC43.13. Repairs not shown must be approved by either the CAA or RSUK in writing.**
2. **Safety; working on an aircraft brings many hazards. Always wear suitable personal protective equipment such as overalls, safety glasses, safety shoes, gloves etc appropriate for the maintenance task. If possible render the engine inoperable prior to starting work.**
3. **Wherever possible SI units are used**
4. **Always use good quality tools appropriate for the task**
5. **Use of non standard or unauthorised parts or repairs will invalidate the warranty and the Permit to Fly. Parts specifically designed for this aircraft and supplied by RSUK will carry a certificate of conformity, which must be kept with the aircraft records.**
6. **Special tools (none at this time)**
7. **Lubricants. Use engine lubricants only as per Rotax instructions. Bearing grease or moly filled grease is suitable for aircraft lubrication points, preferably water resistant.**
8. **Loctites and sealants. Loctite 243 is used where required.**
9. **General corrosion prevention. Keep the aircraft in a non humid, ventilated area. If humidity is present, protect unplated components such as bolts etc with a proprietary spray such as WD40 or ACF50.**
10. **Help protect our environment by disposing of parts and fluids properly.**
11. **Standard bolt torques are M6 15Nm+/-2Nm, M8 25Nm+/-3Nm, M10 35Nm +/-4Nm, M12 100Nm +/-10Nm. Always assess the joint to be tightened and use engineering judgement – do not overtighten plastic or unsupported tube joints!**
12. **Specific aircraft parts list available separately from RSUK website.**
13. **Remember, maintenance, modification, and bulletin/MPD incorporations must be recorded on suitable worksheets and within the aircraft/engine logbooks – and signed appropriately.**
14. **Refer also to the pilot's handbook as well as the drawings quoted and service parts list, all available from the RSUK website.**
15. **Notes on "nyloc" nuts:**
16. **(i) Ideally a nyloc nut should be used once only. It may be re-used if the thread is undamaged and when fitted to its mating fastener it must only turn with a torque greater than the "Prevailing Torque" listed below (values factored from AC43.13-1B): M6 0.8Nm, M8, 0.8Nm, M10 1.0Nm, M12 1.2Nm**
17. **(ii) Unless specified otherwise the minimum thread protrusion beyond the locking element should be two thread-pitches.**

WARNING! PROPELLERS KILL! WHEN WORKING ON THE AIRCRAFT, UNLESS THERE IS A SPECIFIC REQUIREMENT TO HAVE THE AIRCRAFT LIVE, ENSURE THAT COILS ARE OFF AND KEYSWITCH OFF.

IF POSSIBLE DISCONNECT THE BATTERY, OR REMOVE THE SOLENOID ACTUATOR WIRE FROM THE SOLENOID TO PREVENT POSSIBLE STARTING.

This statement is made here only, to avoid continued repetition. It is the engineer's responsibility to ensure a safe working environment.

Primary and Secondary structure determination:

A primary structural part is one for which the failure would be catastrophic and would prevent continued safe flight and landing.

All other structure can be considered as Secondary, thus failure of a Secondary structural part would not be immediately catastrophic and with due care continued safe flight and/or a safe precautionary landing could still be made.

Because of the simplicity of the aircraft structure some parts have a dual role – such as the airframe. As an example, the core box section airframe is primary structure, but the attachment points to the enclosure are not (they are multiple redundant due to the number of attachments).
The primary structural elements are considered to be:
Airframe box section joining the rotor head to the engine, seats, tail, and undercarriage.
Connection assemblies joining the rotor head to the airframe mast.
The rotor assembly and rotor head
The tail and rudder assy
The rudder and rotor control system
The main undercarriage and nosegear
Whilst other items may have an effect on flight safety, they are considered secondary to the above. The undercarriage is included, as whilst it does not contribute to safe flight, it is difficult to make a safe landing without it - inevitably an aircraft rollover would result, probably destroying the aircraft.

a) Airframe

Basic description

The airframe is made of 1.4301 stainless steel tube and laser cut brackets, jig welded together with 1.4571 wire. After assembly it is cleaned and electropolished.

Assembly methods

None – factory assembled only

Special setup instructions

None – factory assembled only

Repair methods

None. In the event of an accident damaging the airframe, then the only sensible action is to replace the airframe. Do not take risks with the primary structure! Contact the manufacturer for more information, such as key dimensions for checking straightness etc.

It is not permitted to weld the airframe unless via an RSUK approved repair scheme, using Approved welders.

Intentionally blank

b) Engine and controls

Basic description

Refer to RSD7100 and 7099

Engine: The engine is either a Rotax 912 ULS or a 914UL. Both use the standard Rotax white frame engine mounting. Reference must be made to the Rotax service manual supplied with the aircraft and regular checks of the Rotax websites for information on any engineering changes or recommendations.

912ULS engines are fitted with two separate air cleaners, with a vent from the float bowl to the back of the filter. They are wirelocked to the carburettor.
912ULS Carburettor heat system: This engine is fitted with a water jacket warming collar between the each carburettor and the inlet manifold. It is held in place with a grub screw, and is plumbed into the engine water coolant system. It is only effective if the engine is warmed up. See water coolant system drawing RSDS7097.

Materials used: See service parts list

Note engine components, including spark plugs and oil filters, are considered proprietary parts. Provided the parts used are of genuine Rotax origin, they are not required to hold a RSUK certificate of conformity. Parts unique to this application – eg 912ULS air filters – do require a certificate of conformity.

Use of unleaded MOGAS is highly recommended. Leaded fuel contains additives (eg lead) which have a detrimental affect on the engine spark plugs, pistons, and slipper clutch.
Use of leaded fuel changes the service schedule – refer to Rotax maintenance handbook.

Special setup instructions

Follow Rotax handbook instructions.
Each of the four engine mountings consists of two rubber elements, two face washers and one internal sleeve, clamped between the airframe and engine mounting frame with an M10 cap head bolt. The sleeve cannot be visually checked for presence after assembly other than it is not possible to tighten the mounting bolt securely, and that the engine may sag if all four are omitted.

Warning! Ensure all are present! Omitting them may lead to the prop striking the keel!

When refitting an engine, connect the ignition cut off wires early, and ensure they are earthed.

Engine idle setting is 1600rpm. Do not set higher, as extended taxying with a fast idling engine stresses the brakes unnecessarily.

If the engine frame (the white frame) has been removed for any reason, ensure the connection bolts from frame to the engine are re-fitted with Loctite 243 or stronger.

Repair methods

Removal and replacement of the engine is straightforward. The engine may be removed with sub systems (propeller, pre rotator, water cooling and oil hose system less cooler and sump, and exhaust system) still fitted. Or these can be removed.

Assuming these are to remain in place,

1. Disconnect battery, earth lead first.
2. Disconnect starter earth and live leads.
3. Disconnect fuel system from mechanical fuel pump and from electrical pump(s), or in the case of the 914, disconnect the feed and return hoses to the fuel regulator on top of the engine.
4. For 914UL disconnect cable to turbo waste gate.
5. Disconnect voltage regulator
6. Drain oil, and disconnect oil sump and radiator. Ensure suitable receptacles are there to catch waste oil, and block/protect exposed oil orifices.
7. Disconnect choke and throttle cables. Marking the approximate positions will aid re assembly.
8. Take weight of engine on suitable hoist, with straps either securely under the engine, or through the inlet manifolds. Ensure the straps do not crush or foul other items!
9. Disconnect white ignition cables, and airbox temp sensor where fitted. If airbox fitted, loosen clamps to carburettors to allow removal.
10. Disconnect or remove any remaining connections or cables as appropriate – eg 914 pressure sensor and control unit, engine CHT, oil pressure and air hose to pre rotator.
11. Remove carefully the four engine mounting bolts/nuts.
12. The engine can no be moved rearward from the enclosure, and the pre rotator slider will disconnect at the same time.

Repair/replace as required. On refitment reverse the above procedure, taking note of items in the relevant sections below, and setup engine as per Rotax handbook, with engine controls as detailed later.

Before releasing back to service ensure all tools etc are removed, perform a thorough ground test to max power, and a full engine systems audit.

Some of the nuts that retain the engine frame to the aircraft are difficult to get access to and to torque up. Always use new nylocks, and tighten to 35Nm. When tightening ensure the rubber elements are seated correctly.

Engine servicing and repair

Follow the instructions given in the Rotax handbook for the engine, unless specifically shown different in this manual

If SB-033 “Rotax plug-screw wirelocking” has been implemented (MC-144 refers) ensure that both plugs are wire-locked after carrying-out the servicing required by the Rotax schedule.

Basic Description - 914UL Exhaust system:

The silencer is supplied fitted to the engine by Rotax. The aftermuffler is an addition to reduce noise, but may be removed if required.

Materials used

See service parts list

After muffler installation with single band clamp around the silencer.

Special setup instructions
Tighten clamps securely.

Repair methods
This muffler is the service part available for repairs.

Basic description - 912ULS exhaust system:
Refer to RSDS7100.
This comprises a welded up specific assembly for the silencer for this application, and a separate aftermuffler.
Parts of the exhaust system are attached by means of tension springs. It has been found that the original (Rotax) carbon-steel springs are prone to rusting and failure and these may be replaced by stainless-steel springs supplied by RSUK as RSD4487 (Service Bulletin SB-022 refers). Ensure that the safety wire is refitted or replaced.

Materials used See service parts list

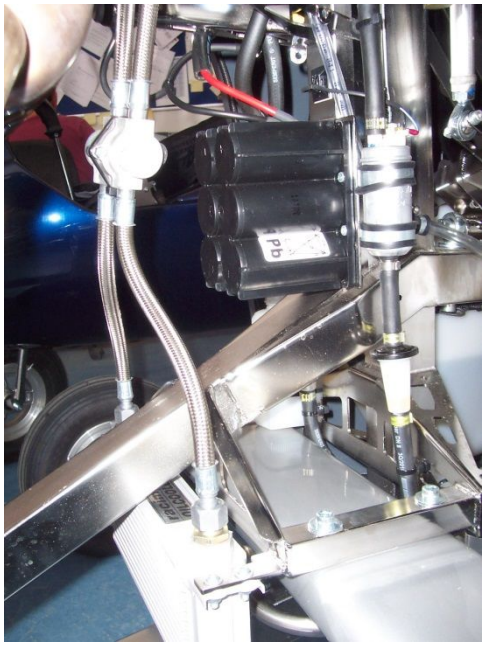
Special setup instructions
Ensure jubilee clips are securely wirelocked to prevent loss in case of failure.
Ensure clamps are tight

Repair methods
Replace items if required.

Basic Description - Oil cooling system:
The oil system is a dry sump type. It comprises an oil tank mounted on the right of the mast, with hoses connecting it to the engine and cooling radiator via a thermostat. Refer to RSDS7001 oil system layout for crimped hoses.
Note that the 914UL engine has one additional hose, from the oil pump to the turbo bearing.
The oil dipstick is contained in the oil tank, accessible via a cap on the top. It is filled here (RSUK stock an easy to use angled funnel), and drained from the wirelocked plug on the tank underside.
Because the oil from the tank will drain back into the engine to a certain degree it is very important to turn the engine over by hand in the normal rotational direct before checking the oil – otherwise the oil may be overfilled, and will then spill out extremely messily when the engine is started. Remove the filler cap, and turn over until a bubbling noise is heard from the tank. Then check the level.

Materials used: Refer to RSDS7001, and spare parts list.
Refill the oil system with oil in accordance with Rotax handbook. RSUK recommend, based on service experience, Shell VSX.
Hoses are Trelleborg Hydro K. This hose is fire resistant and must not be changed for any other type without approval.
Semperit TU10 hose is released to service as an alternative to the original Trelleborg Hydro K under SB-012.
Semperit FUHT hose (which is the recommended RSUK fitment) is released to service as replacement for either of the above hose types under MC-129

Under MC-222 stainless-steel braided/PTFE-lined oil hoses are introduced. These have a better service life at high temperature than orthodox rubber hoses but require different fittings, so are not directly interchangeable, and are supplied only as fully made-up kits. Due to these different fittings the oil thermostat body is also changed. All new parts are visibly different and cannot be mis-matched.



Braided hose construction and new oil thermostat

Special setup instructions:
If the engine suffers a major repair, remove and flush the oil tank. The oil cooler should also be removed and flushed. Take care to refit the tank at the correct height! (see drawing).
After draining the oil system, prime it in accordance with Rotax handbook procedures before starting the engine.
Ensure tank drain plug, rear engine oil hose and oil pump plugs are wirelocked.
When tightening the hoses to the top of the radiator, ensure the nut on top of the radiator is held securely in a spanner to prevent torque from being applied between the nut and the radiator – this connection is not designed to take a torque load, and applying one may lead to oil leakage.

If hoses are removed or replaced, take care to tie wrap securely and as per the drawing. The oil pipes pass close to hot points and edges, and are exposed to vibration. Loose pipes will cause fretting and possible oil loss.
Ensure that the oil thermostat is not rubbing against the battery. Due to variation in hose length, and actual positioning on the aircraft, it is possible that this item may be close to the rear of the battery. In this case a length of hose fitted to the edge nearest the battery is permissible, held on with tie wraps.
The oil thermostat is set at an optimum level to suit anticipated flight conditions, from full power vertical descent on a hot summer day to winter lightweight cruising. As such there are times when the engine oil may not reach temperature. If required the radiator may be blanked off either side with a length of duct tape. Ensure the surface is clean first, and wrap the tape around the radiator such that the ends overlap at least 50mm. Do this first on the water radiator, as the water temperature will also be cool – and if then required on the oil radiator. Remove when the operating conditions allow.
As an alternative to the use of temporary blanking tape on the oil cooler, an insulator may be permanently fitted to the oil thermostat. This prevents radiant heat gain from the exhaust silencer and gives better control of the oil temperature. It may be implemented under MC-156 /SB-036.
If implemented, the security of the insulator pad must be checked at each service interval.

Repair Methods
There is no repair method for the radiator, thermostat, sump, mountings or hoses other than direct replacement. Crimped hose connections may be replaced by clamped connections – see parts shown on the assembly drawing.

Basic description - Water cooling system, 914UL and 912ULS standard
Refer to RSDS7069, RSDS7097 and RSDS 7067
This comprises a Rotax standard radiator mounted on rubber isolators on brackets just in front of the propeller, Hoses from/to the radiator go to the engine water pump and return, and via the T pieces that provide hot water to the carburettor heat jackets.

Materials used: See RSDS7097 Water coolant system layout, and RSDS7067 for radiator system.
Fill with a mix of 50/50 water and EthyleneGlycol antifreeze suitable for aluminium engines. It is highly recommended to use distilled water, as this will limit impurities in the engine.

Special setup instructions.
Follow Rotax instructions for change intervals, and for venting the system whilst refilling – see the engine handbook.
If the radiator is removed, ensure that the rubber mountings are refitted with the safety straps in case of bush failure. The screws retaining the brackets to the engine must be loctited with Loctite 648. This is a very secure loctite, and removal of these bolts may require heat to be applied to the screw head via a suitable small flame torch.
Pay attention to hose routing and tie wraps, to ensure the hose cannot fret or contact hot points – note that the 914 hose on the right of the engine carries a metal section to prevent contact to the exhaust.
Ensure hose clamps are secure and correctly positioned.

There is no thermostat in the water coolant system. This can lead to a long warm up time, and cool running when lightly loaded in cold operating conditions. If required the radiator may be blanked off either side with a length of duct tape. Ensure the surface is clean first, and wrap the tape around the radiator such that the ends overlap at least 50mm. Do one length first, fly and test, then another if needed. Remove when the operating conditions allow.

Repair methods
There is no repair method for the radiator, brackets, mountings or hoses other than direct replacement.

Basic Description – 914UL side scoop radiators
In order to cater for cooling in hot climates a radiator option exists where two scoops are fitted either side of the enclosure over the suspension bow, and two standard radiators fitted behind them This adds 2Kg to the aircraft weight, and two sets are in service in the UK at the time of writing. The air scoops are composite parts. They are retained by rivnuts and/or standard fasteners to the enclosure, and to the airframe. The radiators are mounted inside the scoop to bonded panels. The scoops are non-structural, and minor cosmetic repairs are acceptable.

Materials used: see RSD7120 Dual radiator configuration
Otherwise as single radiator.

Special setup instructions
As single radiator, except that venting the two radiators is not easy. Squeeze the crossover tube between the radiators to blow the bubbles out with one of the top hose disconnected. Ensure the system is able to flow freely with no hose kinks.

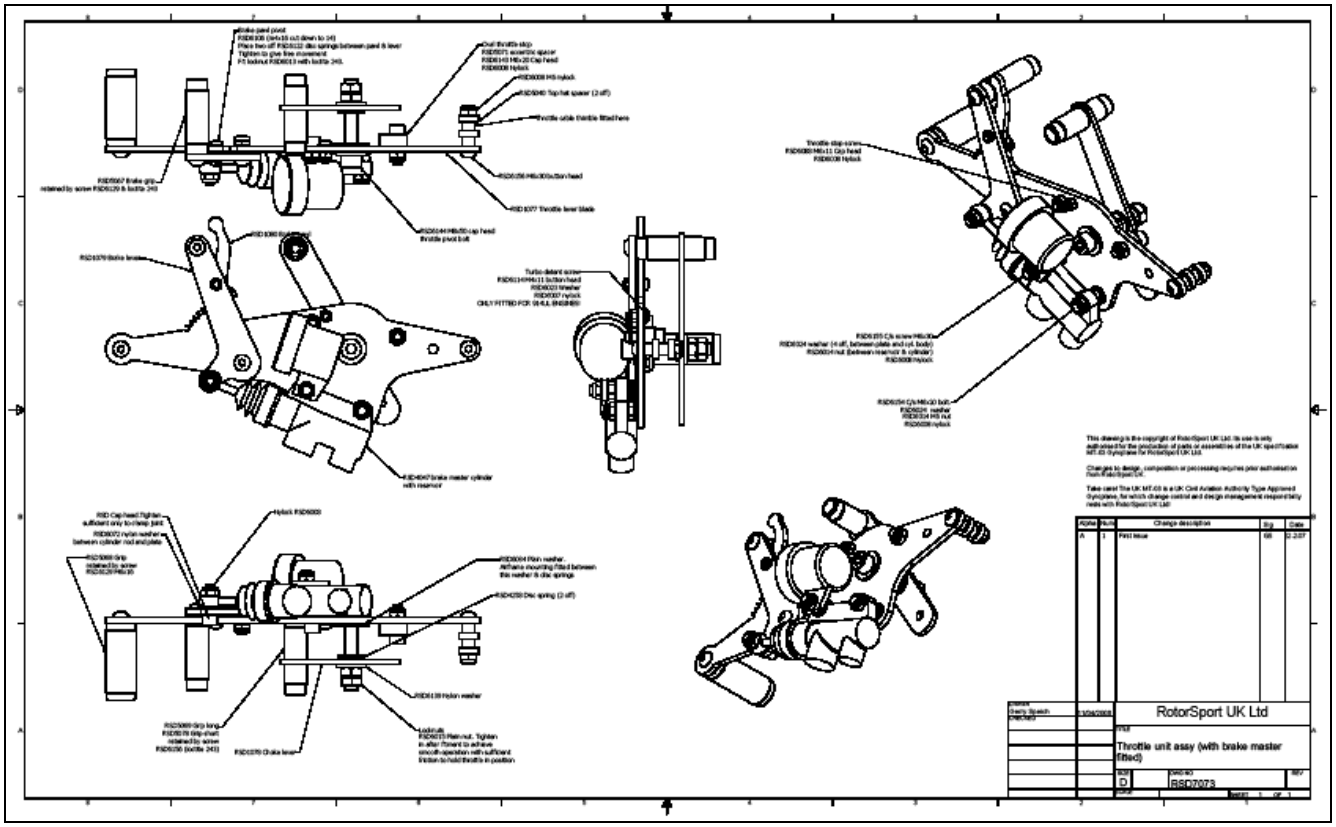
Repair methods

There is no repair method for the radiator, brackets, mountings or hoses other than direct replacement. Air scoops may be painted or minor repairs affected, if removed ensure all fastenings are secure after refitment, and that edge trim is wirelocked.

Basic description - Throttle, turbo (where fitted) and choke controls

The system comprises a throttle body assembly that also carries the brake lever, on a single pivot bolt connected to the airframe. On the same bolt is the choke lever, which if operated is automatically pushed off by the throttle when pushed forward. The connection to the engine is via Bowden cable, two separate cables to the throttles (linked at the throttle body) and one choke cable split to two in a splitter mounted on the mast.

There is an eccentric bush on the throttle body to allow throttle idle adjustment.



Throttle body assy

Materials used See drawing RSD7098

Special setup instructions

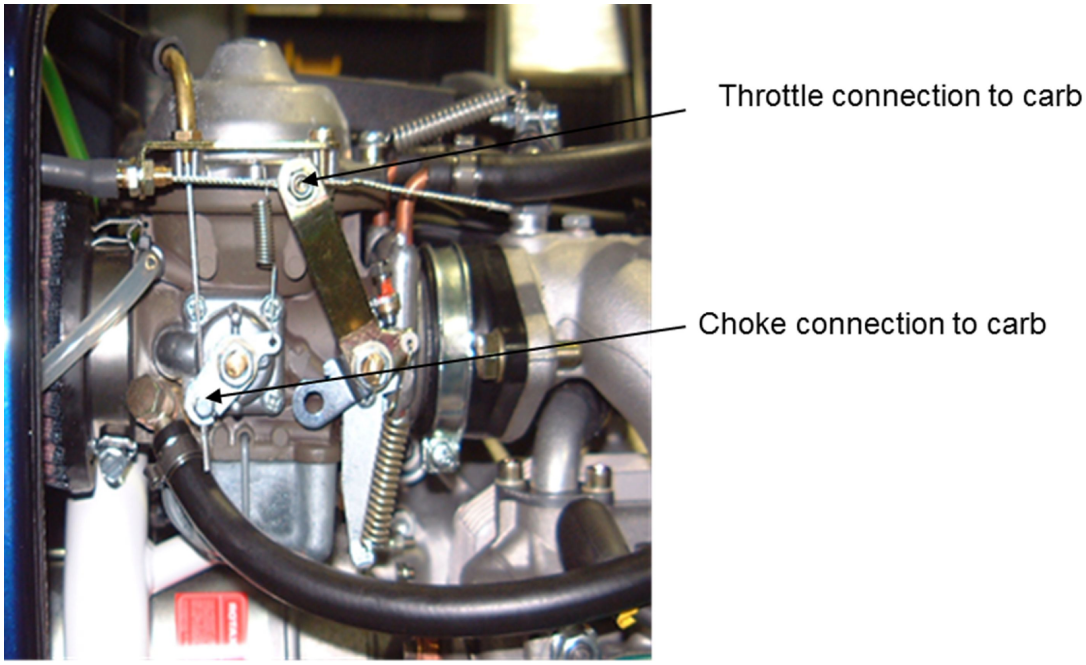
Basic carburettor control setup

Assumption: all cables are in place, and basic setup only is needed. Engine has run.

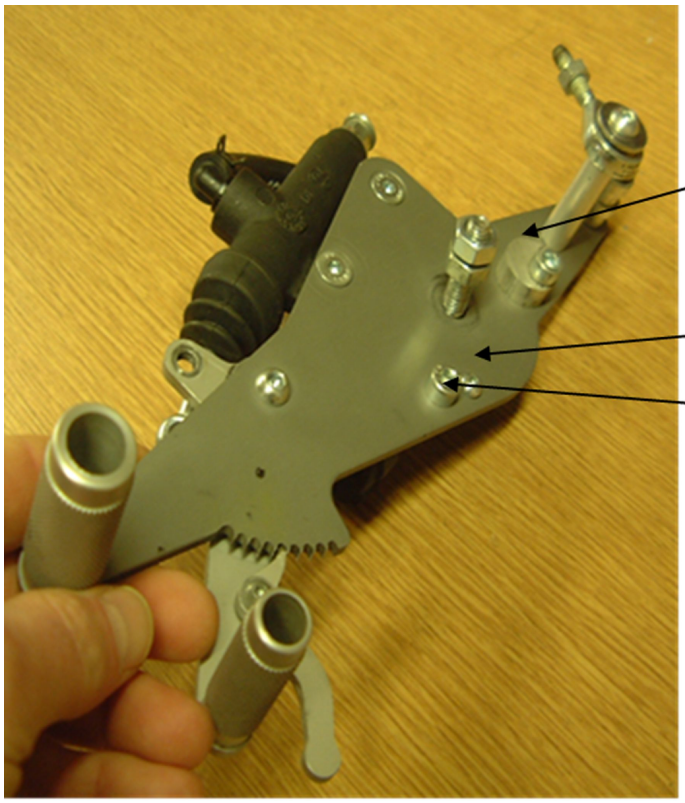
1. Ensure that the carburettor idle stops are screwed back to meet the throttle arm, and that the idle is about 1600rpm.
2. Mark the cable position to the arm.
3. Set the throttle lever to the position shown on P26, about 60mm above the seat. Adjust the idle cam on the throttle lever to stop in this position.
4. Loosen the cables in the carb arms, and allow the lever to return to the throttle stop. Maintain tension and tighten, on both carbs. Adjust as required such that both arms lift simultaneously from the stops.
5. Adjust choke so that the gap between the choke lever and the throttle arm is between 2 to 10mm (choke full on, throttle shut). Adjustment may either be by using the adjuster on the end of the cable on the lever, or by adjusting the connection to the carb choke lever. Ensure that both chokes open as simultaneously as practical, and that both return to closed, and go fully open.

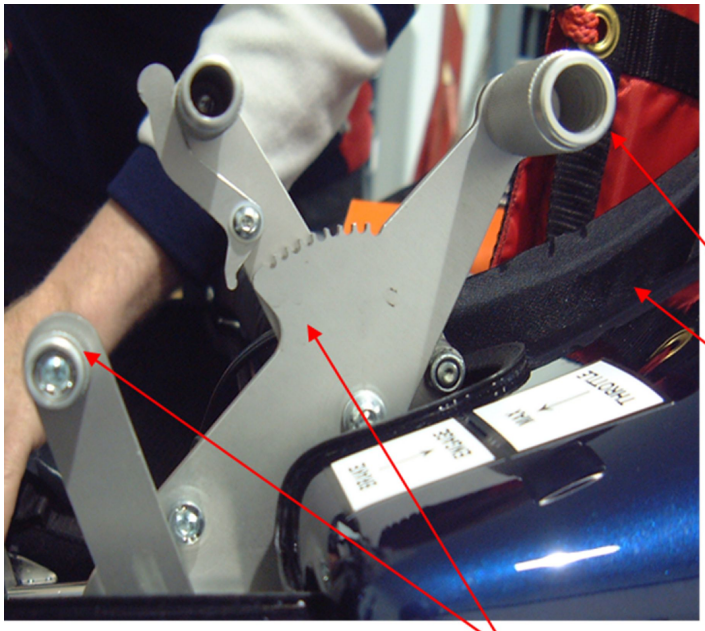
Carb idle and balance setup basics.

1. Fit balance kit either to crossover tube or with nipple to manifold points, with gauges visible to aircraft operator .
2. Ensuring the prop is clear of loose tools or parts, start and warm up engine to 50deg C min.
3. At 2,000rpm confirm carbs are balance. adjust on LH carb ONLY if a 914 or either carb if a 912 by adjusting outer cable length at carburettor. Confirm balanced up to max power, and if needed make the best compromise for balance at 5,000 rpm.
4. Bring engine back to idle, and adjust with cam on cockpit throttle body to achieve 1600 to 1700rpm.
5. Screw in carb throttle stop screws to just touch throttle arms - if too much then balance will be affected (check on gauges).
6. Recheck balance, and if OK stop engine, and remove equipment/return to flight condition.
6. Record idle setting in logbook or worksheet.



Carburettor





Repair methods

Replace worn components. See drgs for reassembly.

The throttle lever and brake ratchet must be replaced (as a pair) if any of the teeth of the throttle lever are visibly deformed or protrude less than 1.5mm (may be assessed with a 1.5mm drill bit placed at the root of the tooth form)

MC-177 introduces an improved assembly (additional bearings), interchangeable with the original

Basic description - Engine electrical system

There are three areas; Ignition system cut off, charging system, and starting system.

(i) The ignition system is cut off by earthing. There are two wires (one for each coil) located in the connector block on top of the engine, as indicated in the Rotax handbook. The gyroplane harness connects into this block with two white wires, and when the switches are OFF, the wires are connected to ground.

WARNING! If these wires are disconnected the engine is LIVE. This will mean that it will not be possible to stop the engine if started, other than via a fuel cutoff! Never turn the engine over without these wires connected.

REMARK: 912ULS engines after S/no. 6.775.360 have redesigned ignition modules which give improved starting but different slow-running characteristics (See RSUK SIL-003). Each new module requires a wire connected to the “cranking” connector of the aircraft’s master-switch. Such an installation (e.g. if new engine fitted) must only be made with prior CAA/RSUK approval – refer to RSUK for further information.

REMARK: Conair Sports Soft Start Module. If the Rotax ignition modules described above are not fitted it is possible to fit this after-market soft-start system under MC-174. See SB-041 for further information

(ii)The charging system is via a Rotax standard regulator, located screwed to the LHS airframe engine mounting. Power is fed from the engine alternator into this unit, and then out to the aircraft systems. See the Rotax engine handbook for more details.

(iii)The starting system is via a Rotax standard solenoid, fed directly from the battery and to the starter motor. The engine is earthed directly to the airframe via a short cable, bolted through the battery earth cable. The solenoid is activated by the keyswitch on the instrument panel.

Materials used See service parts list

Special setup instructions

None

Repair methods

The regulator is not serviceable. The alternator is serviced as per the Rotax maintenance manual, but requires engine removal.

Likely failures are cable end connections. Ensure the cables are secure and connections clean. A generator warning lamp may mean that the connections to the regulator are not clean, so check these first.

Basic Description – general engine repairs

Materials used

See parts list

Special setup instructions

See Rotax handbook

Repair methods

For engine repairs see the Rotax service instructions

c) Electrical

Basic description

This is a 12volt DC system, supplied via the engine alternator.
The storage battery is a “Cyclon” sealed-for-life design and requires no maintenance. It must be changed after 10 years use, or earlier if there is evident difficulty in cranking the engine.

For wiring diagram, see drawing RSDS7110, two sheets

There are two primary looms – the instrument panel, and main cable harness. Other items such as the front stick and the rear seat instructor packs carry a suitable cable loom to connect into the rest.

Materials used

See parts list

Assembly methods

The harness is secured by plastic ties – see drgs for location. The main harness travels on the left of the keel, and the stick on the right.

Repair methods

In line with normal aircraft practice.
Fuses: Automotive type blade fuses are located behind the instrument panel. Access is gained by removing either the left or right lower three screws holding the trim cover to the instrument panel, and locating the fuse block in the loom. Ensure safety tie is fitted across fuses in the block prior to refitting side panel screws. Ensure screws are tight.

Note: Service Bulletin SB-054 (Recommended and applicable to all MTOS before RSUK/MTOS/045) introduces different fuse-ratings to provide better protection of the aircraft’s electrical cables. The revised ratings are shown in comparison with the original fitment below:

Fuse Ident	Function	Original Rating	New Rating	New Part Number
F1	Compressor	20A	15A	RSD4479
F2	Fuel-pump 1	5A	No change	
F3	Fuel-pump 2	5A	No change	
F4	TCU	5A	2A	RSD4710
F5	Cockpit (Instruments & Avionics)	10A	7.5A	RSD4711
	+ Accessory power socket limited to 5A			
F6	Heating 1	15A	No change	
F7	Heating 2	15A	No change	
F8	Lights	20A	15A	RSD4479
	+ Strobe heads 0.35 cable protected by driver unit internal 5A fuse, or optional Aveoflash (LED-nav / strobes) are used in conjunction with LED landing lights and 5A fuse			
F9	Starter Solenoid	5A	No change	
F10	VP Prop	25A	25A*	RSD4481
F11	VP Prop (circuit breaker)	10A	No longer fitted*	
F12	Charging socket	16A	Not fitted to UK aircraft	

*NB: with the introduction of IVO-prop under MC-318 the VP prop fuse is reinstated as 25A.
Propeller function is protected by the end-position control module

Landing Lights: Three types of lamp are available, halogen RSD4163 (option fit, 50W each) and LED RSD4511 (option, 2.5W each), LED RSD4617 (option, 4W each). The lamps are interchangeable and each is retained by a circlip accessible at the nose or by a coil-spring accessible through the baggage hatch

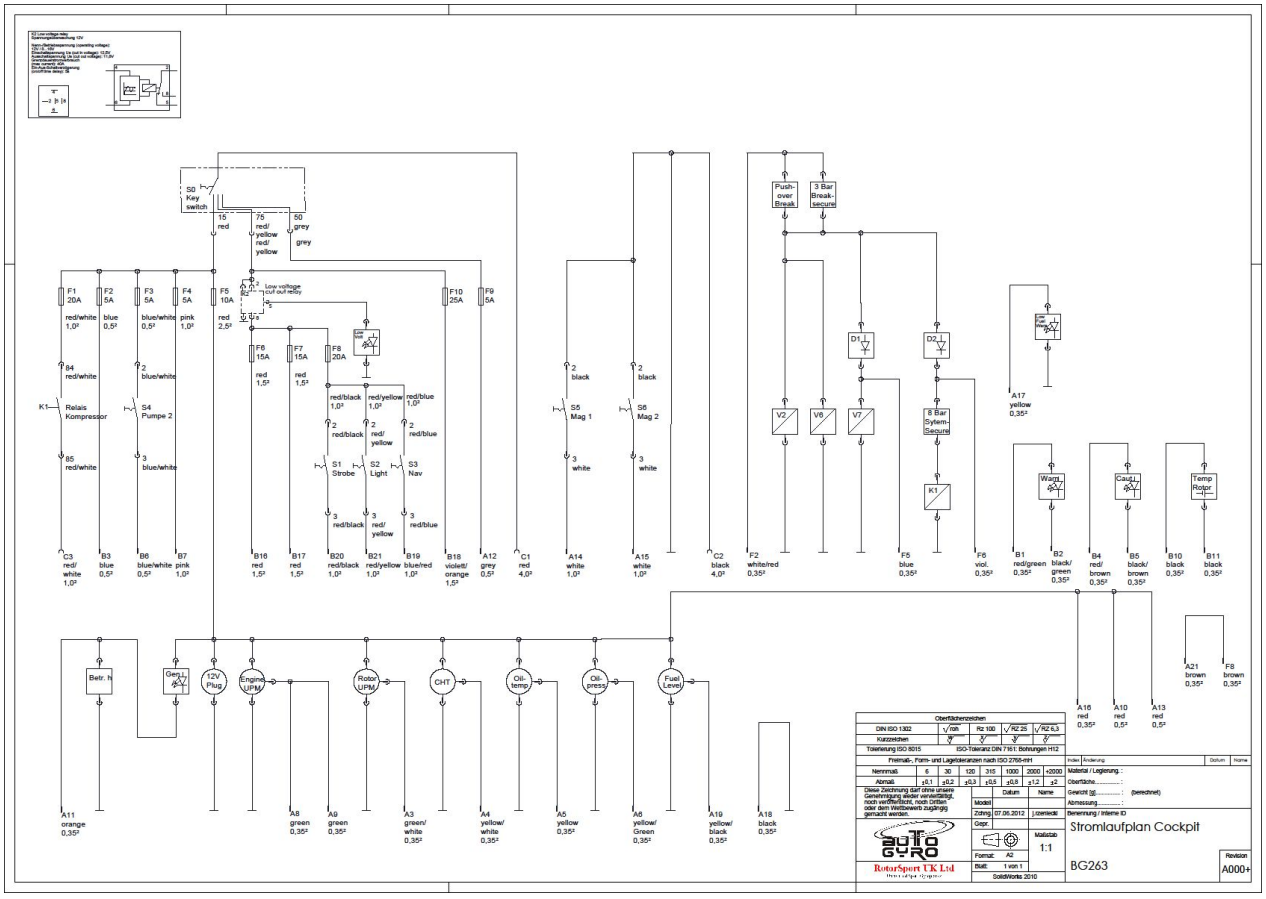
Note. MC-198 releases the Aveoflash strobe units onto the MTOsport, comprising two streamlined LED based strobe heads, with LED nav lights. These are self contained, and link directly into the aircraft wiring harness connection on the mast behind the rear seat. These are NOT approved for night use. When fitted they are to be used only with LED landing lights, and fused with a 5A fuse instead of a 20A fuse.

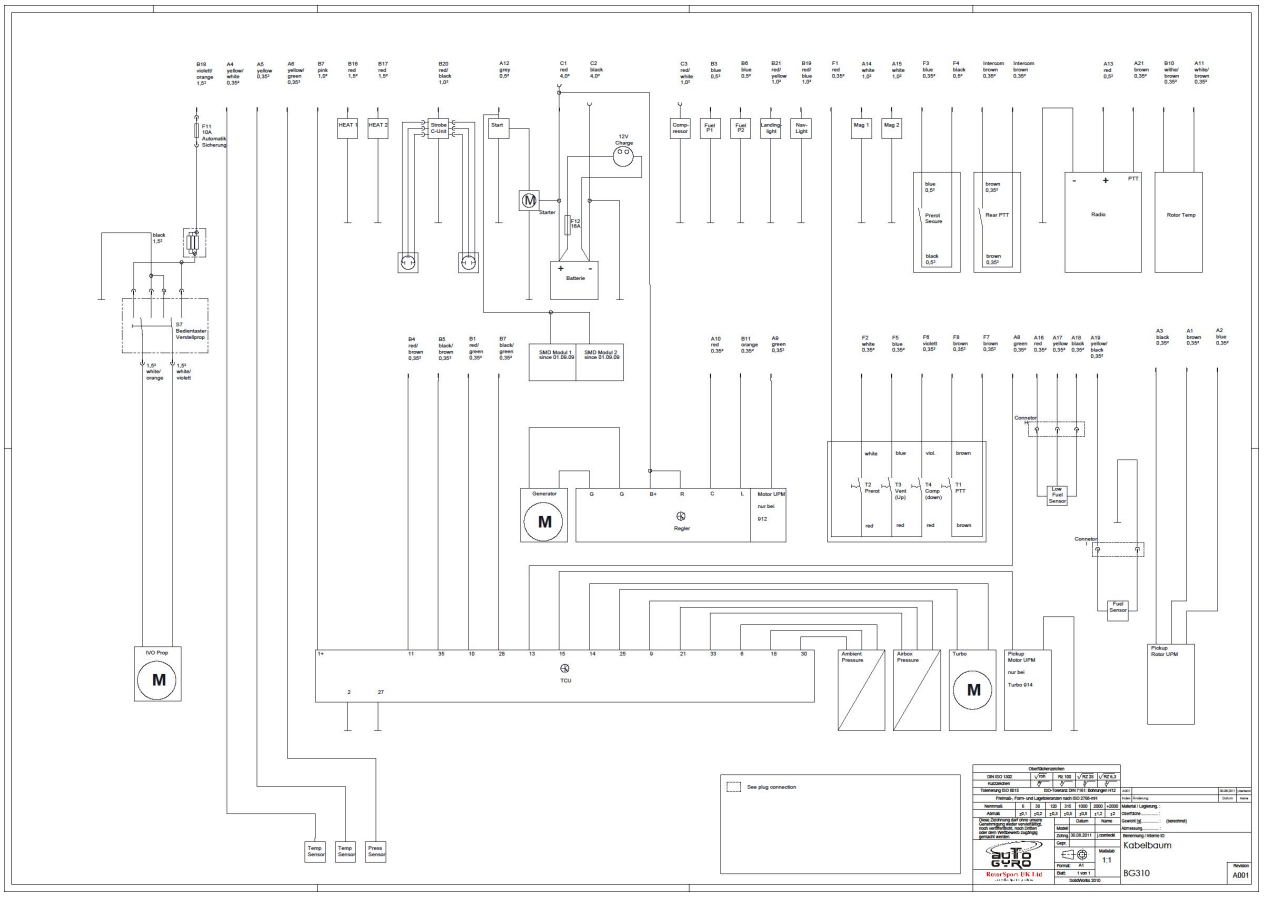
Aveoflash strobe heads. Mounted in the same place as the existing strobe heads, either side of the enclosure rear of the rear seat.

Under modification MC-161 ((applicable to new aircraft from RSUK/MTOS/048) a further level of protection is provided by means of a load-shedding relay. This automatically disconnects non-essential services when the battery terminal voltage falls below a pre-set level (12V) and reconnects when the terminal voltage is above a higher level (nom 12.7V). During the disconnection period the low-volt warning light is illuminated. The non-essential services on MTOsport are strobes, nav lights, landing lights and heated-clothing connectors – these services may not operate when tested on-ground if the battery voltage is low, so either the engine must be started or the (optional) ground-power connection utilised.

With this system installed the “Avcomm” low-fuel/low-volt module is not required.

Revised wiring diagrams BG263 and BG310 are shown below and are available from RSUK in larger format.





d) Pneumatic

Basic description

Refer to RSDS7070.

MTOsport electrically operated pneumatic control system.

Principle of operation. Single electric pump feeds air into system via a water filter and electric and mechanical control valves to three cylinders - a double acting cylinder operating the rotor brake and trim, one single acting cylinder operating the pre rotator engagement, and an additional cylinder that engages the bendix gear. Operation of nose up trim, rotor brake or pre rotator activates pump for pressure, and appropriate valves. Activation of nose down trim releases air via a regulator, and releasing of pre rotator button depressurises engagement air cylinders.

Pumps have a max pressure capability of 10 bar – but are limited via a pressure switch to 8bar, in order to prevent premature pump burnout and system overpressurisation. This is adjustable via the pressure cut off switch, located beside the trim/brake changeover switch. There is a slotted screw on the end between the contacts that is screwed in or out.

Pre rotator operation

Turn mechanical panel valve to 'Flight' Press button on stick when stick is fully forward. Closes circuit to switch V6 & V7 and turns on pump via a solenoid. Release of switch opens circuit, pump stops and valves return to previous position, exhausting the system. If button pressed when not fully forward, or stick pulled back during pre rotation, then a micro switch on base of front stick opens the electrical circuit and the valves and pump return to standby.

This switch should be on when the stick is fully forward. Adjust bracket height to suit.

Valve V6 allows air either to enter the trim/rotor brake circuit OR the pre rotation circuit.

Valve V7 allows air either IN to the pre rotator activation cylinder OR out to exhaust for cylinder.

If there is pressure in the rotor brake system above 3 bar, there is a pressure switch prevents the pre rotator from becoming engaged by cutting out the electrical circuit from the switch to the pump solenoid. This switch is located with the solenoid valve cluster behind the engine gauges, and is adjusted as per the 8bar switch.

Trim operation

Turn mechanical panel valve V1 to 'Flight'. Pull top hat button on the end of the stick towards pilot. Closes electrical circuit to pump solenoid, which pressurises the trim/brake cylinder. Release of switch turns off the pump, leaving the cylinder pressurised. Push the top hat button forwards. Closes the electrical circuit to valve V2, which lets the cylinder exhaust via a regulator.

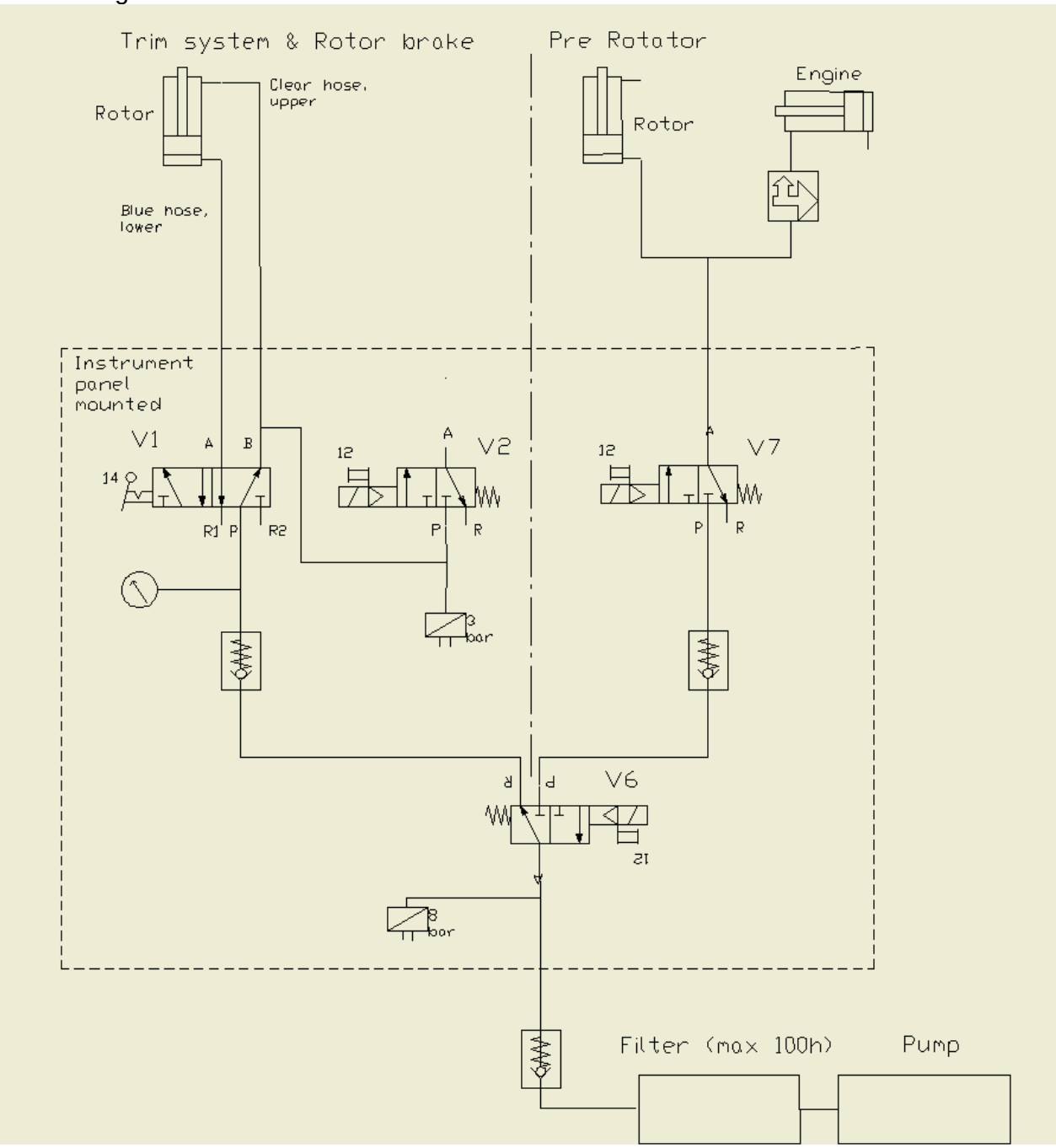
Rotor brake operation

Turn mechanical panel switch V1 to 'Brake'. Pull top hat button on top of switch rearwards. Closes electrical circuit to pump to pressurise trim/brake cylinder, and also opens valve V2 to exhaust air in opposite end of cylinder. Brake can be engaged in full range of stick pitch movement.

Change of flight/brake valve

Under MC-207 (applicable to RSUK/MTOS/040 onwards) a different model of flight/brake selector valve is introduced. Its appearance and function are unchanged but it is fitted with a small additional sub-circuit to manage pilot-air pressure.

Circuit diagram



Materials used (as per parts list)

Assembly methods

Hoses are all push type fitting, push on with wire lock, or with thumbscrew lock

Special setup instructions

Ensure system and air dryer ('filter') are water free. Dryer must be removed and either replaced or dried out every 100hrs. Dried out means plastic pipe connections removed, and placed in an oven at between 75 and 100degC for 2 hrs min. Take care not to burn hands when handling the hot dryer, and leave to cool before refitting.

Ensure the direction of flow arrow on the dryer is correct when re installing. It is recommended to replace the dryer every 500hrs, or when the pump does not easily achieve full pressure. If a

dirty environment, change more frequently. The function of the dryer is to keep the compressed air free of water – water in the pneumatic system will prevent correct operation. It is located behind the instrument panel, either bolted to the trim panel or to the keel.

Functional check after any repair as per below:

Full functional check. In 'Brake' position, engage brake, confirm operation, and that function is acceptable. Pressurise to maximum. Tolerance is 7.5 to 8.5bar. Adjust pressure switch if required, or find the leak
Change to flight – check for 2 to 3 sec max to release air from brake system. If to slow/quick, adjust vent on side of V1 changeover switch
In 'Flight' position check that trim goes on and off in same direction as button (inc rear switch if fitted).
In 'Flight' position, stick forward. Start pre rotator. Ensure cylinders (2) engage, and when the stick is pulled back they disengage. If no disengagement adjust stick microswitch. Note that the head cylinder must engage prior to the engine cylinder. If the head cylinder rises late, adjust the rate at which the engine cylinder engages by adjusting the throttle on the cylinder.
Stick to front, release pre rotator and confirm that pressure is applied to trim and stick comes back slightly.
In 'Brake' position, put 3 bar pressure on and ensure pre rotator does not function. If it does, adjust the cut out pressure switch.
Press the 'Interlock release button' and ensure that pre rotator functions (both cylinders, head and engine) with brake engaged.

Repair methods

Water in the system will hamper valve operation. If water has entered the system, disconnect affected pipes and blow through with dry compressed air. Ensure all valves are thoroughly dried and reconnect. Replace or dry dryer. Confirm full pneumatic system operation, before returning to service.

Possible problems and solution.

Pump does not run in any mode. Check fuse. If fuse OK, check electrical supply to pump. If none, check supply at solenoid. If supply, but no energising of solenoid, check stick loom to main loom connection, and or pressure switches.

Pump runs, but no or little pressure in any mode. Check hose from pump to filter for splits or poor connection. Check filters connections for tightness and hose from filter to instrument panel.

Loss of rotor brake pressure overnight. Normally an air leak, check at the cylinder connection, the changeover switch, & the pressure gauge – and the connections from the panel to the harness.

Pump runs, but the pre rotator fails to engage properly/slow pre rotation and/or the trim system looses pressure. Check the front-most valve on the valve pack for correct function – dirt under the valve face will allow leakage during trim and pre rotation. The valve is easily and quickly changed via the two retaining screws.

Trim pressure loss in flight. Check cylinder and air pipe connections.

No trim pressure release. Blocked valve or no power supply to solenoid valve.

Pre rotator rattles at the rotor head when engaged. Throttle incorrectly set on engine cylinder – back off so that rotor head cylinder is pressurised first.

Note that replacement seal kits are available for the pneumatic cylinders

Intentionally blank

e) Rotor

Basic description

Refer to RSD7040 (8.4m rotor, black end caps), or RSD7139 (8m rotor, grey end caps) or BG1793 RotorSystem II, 8.4m, standard variant (with red end caps) or BG8946 RotorSystem ll, 8.4m TOPP variant (with blue end caps)

The rotor is a pre coned two blade teetering design. Each blade is an extruded section, containing tip weights and end closure plates or caps. The blades are stamped/etched to match the hub assembly to prevent incorrect assembly. The nut torque to clamp the blades to the hub bar is 25Nm.

WARNING! The original rotor blades used on the MTOsport aircraft carry either black end caps or grey end caps. Calidus rotors (orange end caps, 8.4m) are NOT approved for flight on the MTOsport aircraft. RotorSystem ll standard variant (red end caps) has been approved for fitment under MC-175 and RotorSystem ll, 8.4m TOPP variant (blue end caps) approved for fitment under MC-328

Other notable differences: the RotorSystem II hub bar is scalloped, with different lengths of blade to hub bar bolt, and is also heavier than the earlier rotor. Typical weight is 30.5kg (standard variant with red end caps) or 35kg (TOPP variant with blue end caps). The built-in coning angle is also increased from 2deg per side to 2.85deg.

It is very important that the correct rotor is used with the correct type of rotor head tower and teeter stops. The RotorSystemII rotor types will not fit to an earlier rotorhead. An earlier rotor (black or grey end caps) would fit the RotorSystemII rotorhead, but the teeter stops would allow excessive movement, potentially causing rotor to make tail or propeller contact. The tower used with a RotorSystemII rotor is 40mm higher than that used on earlier aircraft.

Materials used (black or grey end cap rotors)

The rotor is supplied as a complete assembly. Spares available are;
End cap inner
End cap outer with rivets
Teeter bolt and bush set
Bolt, plain, 9mm, M8
Bolt, plated, 9mm, M8
Bolt, plated, 9mm, M8 drilled
Washer, 9mm, thin
Washer, 8mm, thin
Nylock nut set of 18
Bolt, drilled, castellated.
M8 Castellated nut
Split pin
Grease nipple

For the RotorSystem II there are 5 different bolt lengths retaining the blade to the hub bar, see diagrams later.

Assembly methods

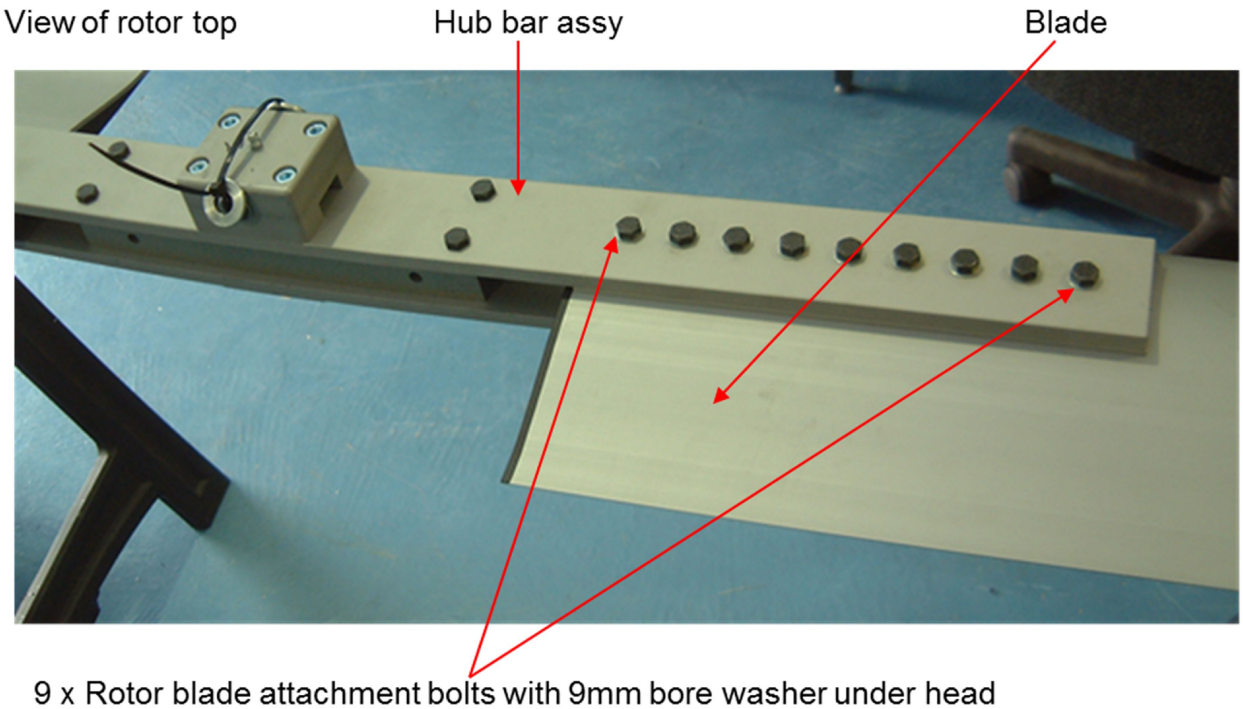
The rotor blades, spacer extrusion and hub are provided with numbers to define the installation direction. By matching these numbers, put the blades into the hub. Fit the 9 bolts fitted with ‘thin’ 9mm washers through the hub and blade assembly from the top, and fit an 8mm ‘thin’ washer and M8 nyloc on the lower surface. The bolts are a close fit – and may need a light tap to push home. Raise or lower the blade with respect to the hub to achieve this. DO NOT hammer them in! For early blade sets (identified by square edges to the hub bar), hand tighten only, and adjust the tracking. Do this with a taut string between the cutouts

in the blade ends. Tap the blades in the hub bar such that the string passes directly over the centre of the grease nipple in the centre block. When satisfactory, tighten all 18 nuts to 25Nm. For later blade sets no tracking adjustment is normally required. Simply tighten all nuts to 25Nm.

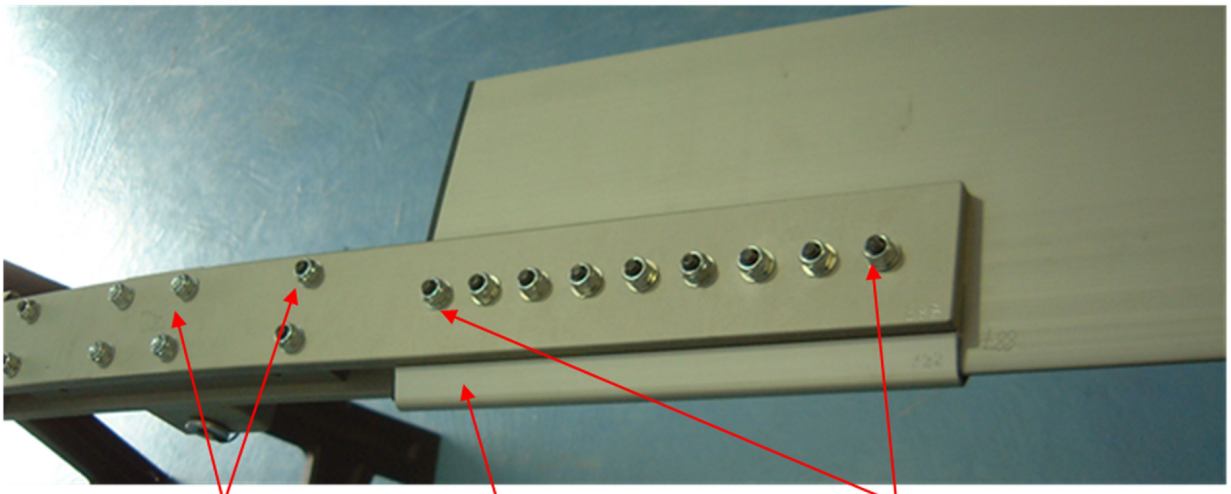
When assembling, or diss-assembling, do not remove or adjust any other nuts/bolts on the hub assembly – the tracking is factory set, and adjusting may change these settings and adversely affect rotor balance.

To fit the rotor to the aircraft proceed as follows:
1. Brake the aircraft securely.
2. Engage the rotor brake with the rotor hub set fore/aft.
3. With the aid of a helper, and some steps (or use the rear seat if tall enough), raise the rotor assembly up into the rotor head.
4. Push through the teeter bolt (making sure the two spacers are greased and in place either side of the hub block) and hand tighten. Note that these may be two different thickness spacers. Fit as dot marked on the rotor and head hub.
5. Tighten the nut to the required torque (hand tight, 1-2Nm, never tight), and fit a split pin through the nut, and secure the pin appropriately.
6. Axial free play is pre set by the bushes provided the nut is not overtightened.
7. Grease the bolt via the grease nipple where fitted.
8. Ensure the rotor teeters to the stops freely.

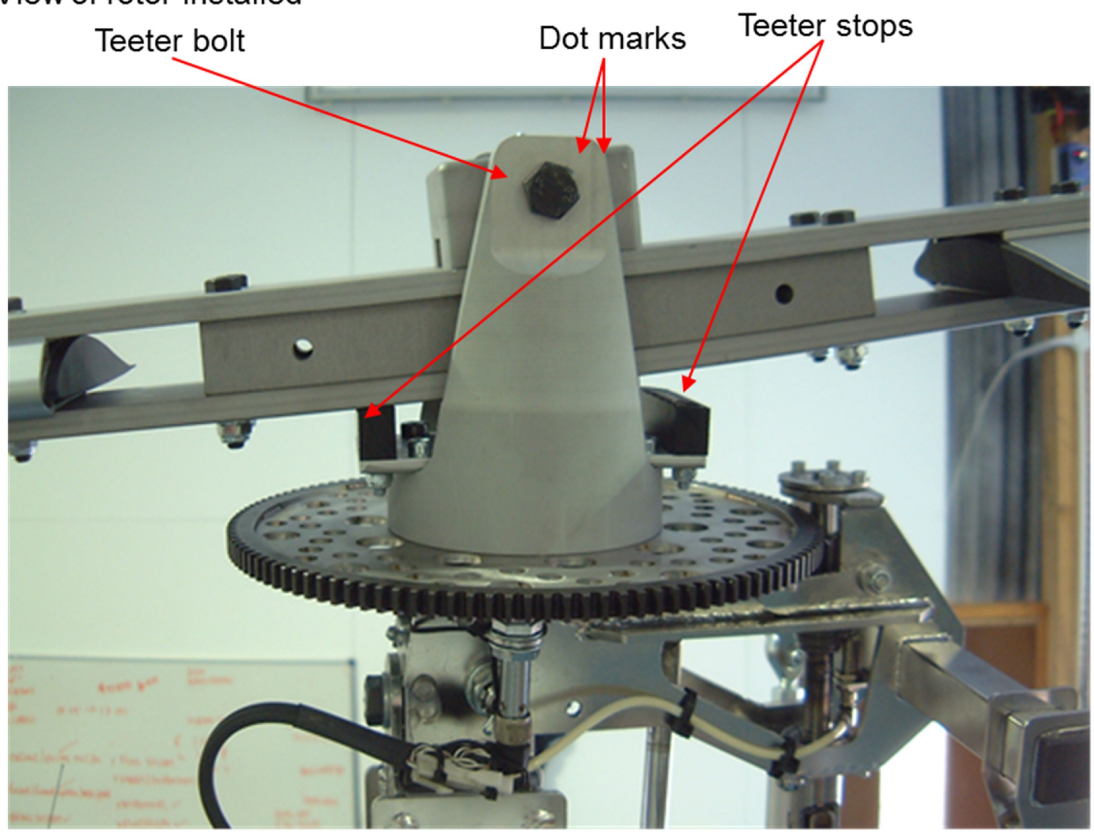
The black or grey end cap rotor system:



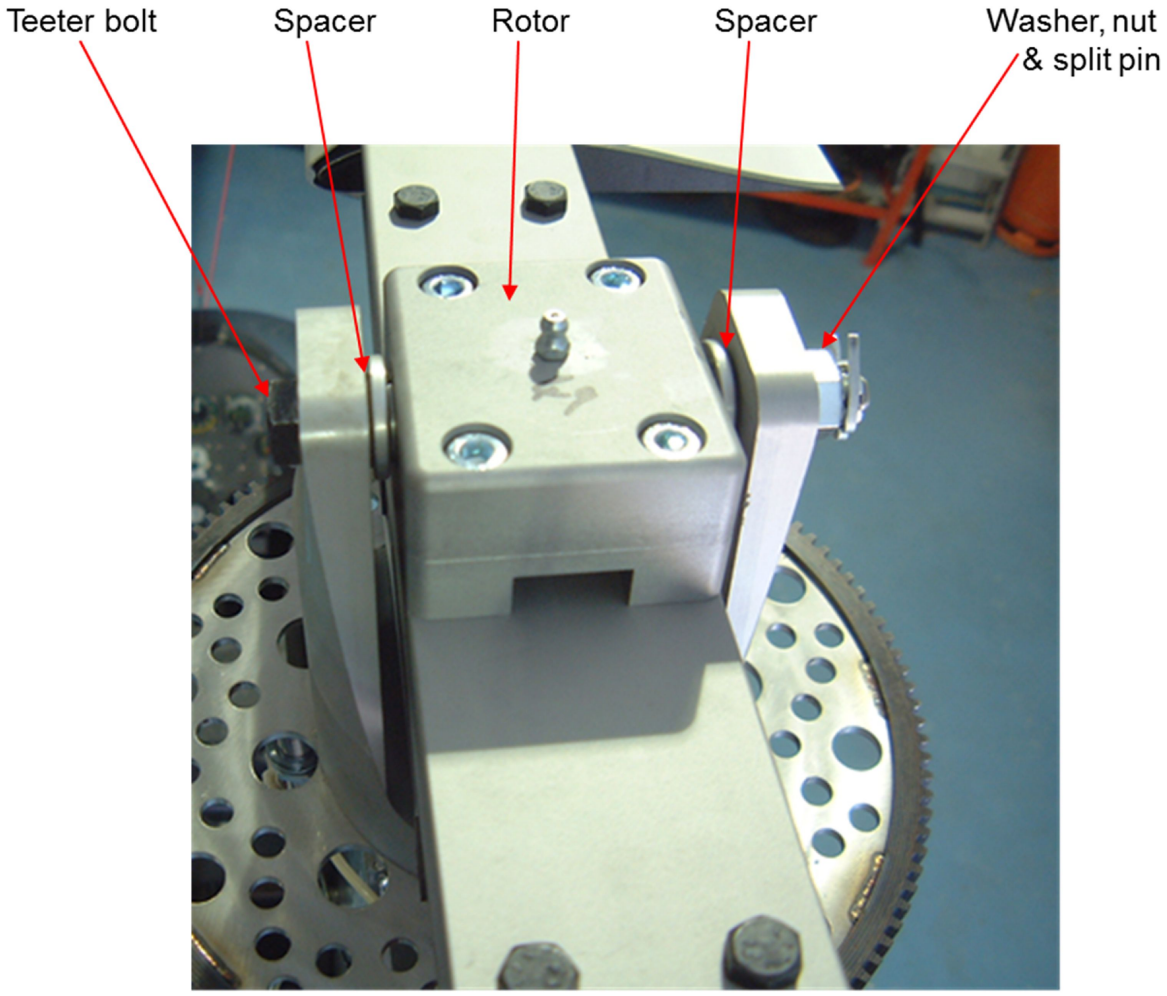
View of rotor bottom



View of rotor installed

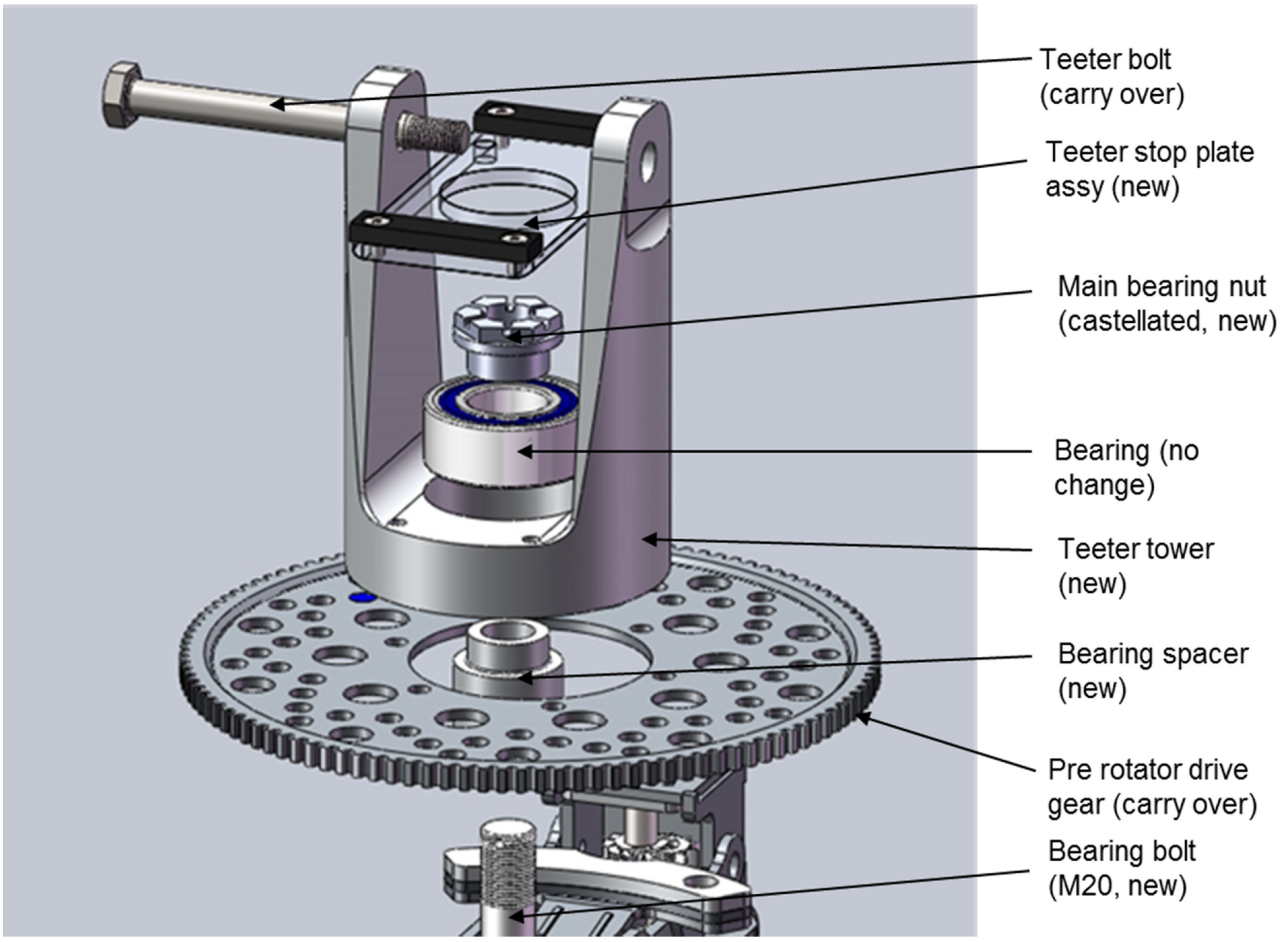


Top view of rotor installed

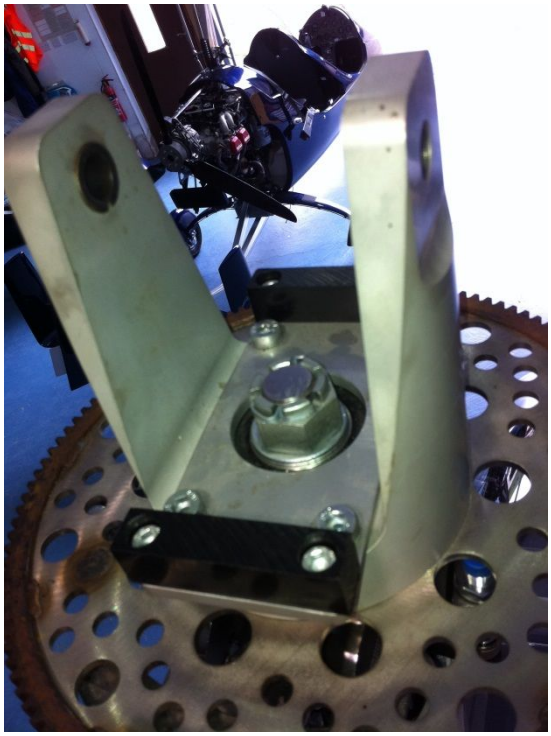


Match parts using dot marks on tower, spacer and hub (normally one dot or two dots), same whether red, black, grey or blue end caps).

Additional views below show the differences between the original and RotorSystem II construction.

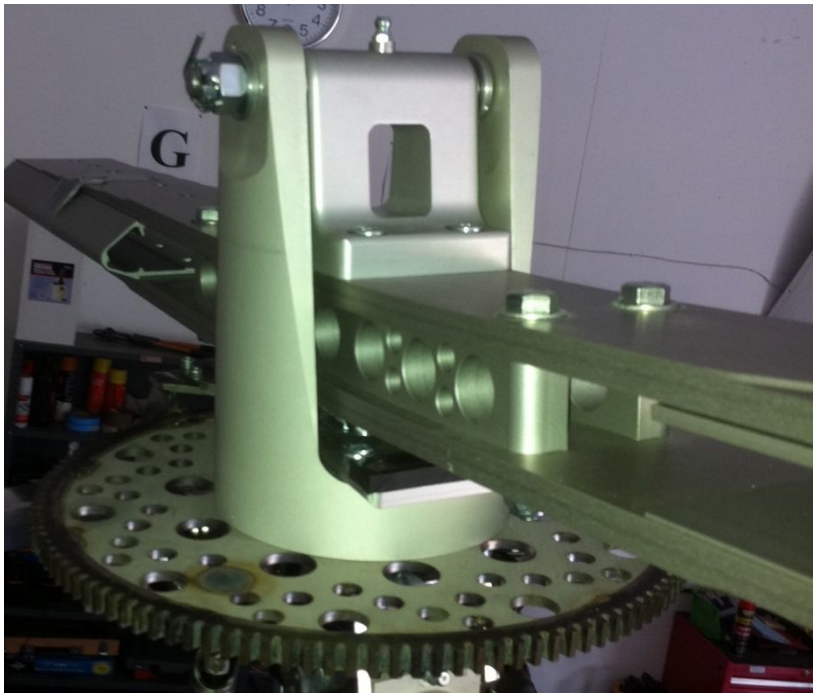


Section view of rotor head with RotorSystem II parts shown.



Old rotor head assy

Rotorsystem II head assy



View of RotorSystem II fitted (rotor blades not installed).

Special setup instructions

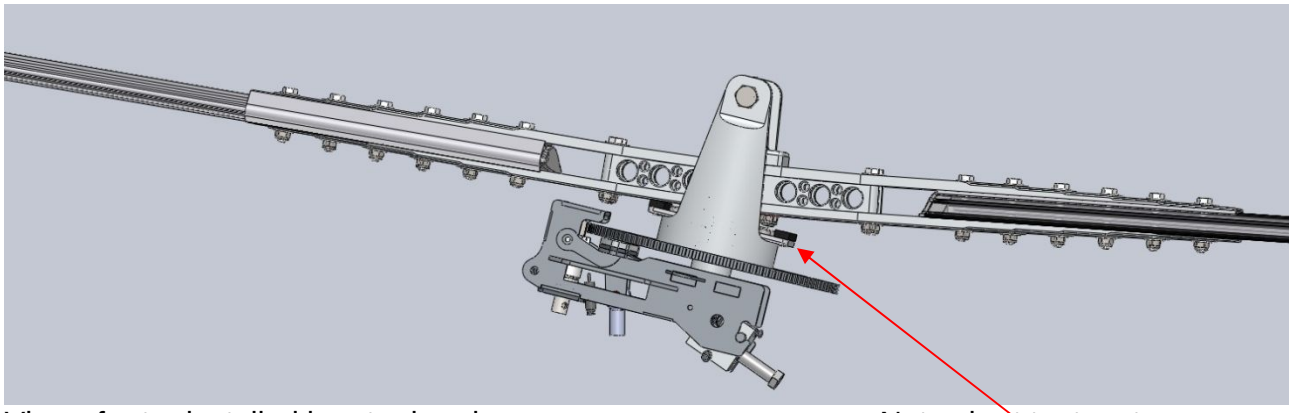
Ensure teeter stops (if adjustable stops are fitted) are correctly set to give approx 2” clearance to the tail with rotor head fully rearwards and blade against the rear stops. Nominal height is 24mm for Aircopter square edge hub bar and 18,8mm for AutoGyro hub bar (black or grey end caps), red end cap is 7mm. Check both sides. Note that non adjustable black plastic ‘soft’ stops are available as an approved modification.

WARNING! Never remove the blade balance bars that are bonded inside the blades, or add extra weights – it is an approved design standard and modification will invalidate the permit to fly – and may have fatal consequences.

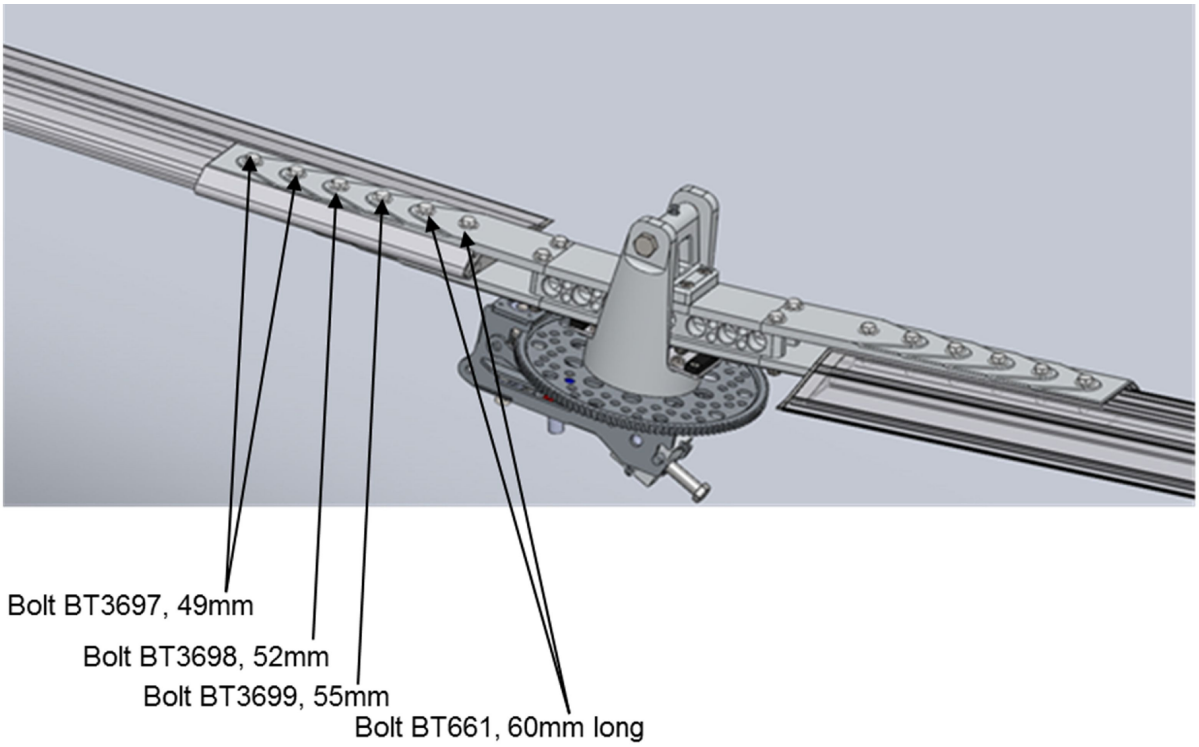
WARNING! - under MC-227 low-profile metal lock-nuts known as “Binx” nuts replace nyloc nuts for attachment of the teeter-block to the hub-bars. These two nut types must not be interchanged. The Binx nuts allow the use of a plain (rather than scalloped) teeter-stop plate which could interfere with nyloc nuts during the teetering action of the rotor. Tightening torque for the Binx nuts is 20Nm compared to 25Nm for orthodox nyloc nuts


Binx low-profile self-locking nuts

The red end cap rotor (RotorSystem II standard) and blue end cap rotor (TOPP variant)



View of rotor installed in rotor head Note short teeter stops



General notes for both rotor systems

WARNING! It is important to fit the correct length bolt in the associated hole! Fitting the wrong length bolt may result in insufficient safety protrusion through the nylock nut, or that the nut jams on the shank of the bolt before the joint is properly tightened.

Repair methods

Nicks and small edge damage can be flattened back with very fine wet ‘n’ dry paper and polished out. Dirt and insect debris should be removed prior to flight – the smoother the rotor surface, the better the performance.

Damage resulting from impacting a fixed object hard, even if not visible to the naked eye, should result in grounding the aircraft for a thorough inspection for mast torque twisting and blade root stress. If in doubt, replace the rotors.

Blade damage above small nicks or minor edge damage, including deep scratches or dents, must always be referred to a qualified inspector or RSUK for advice prior to further flight.

Bending of the trailing edge may result in increased rotor vibration.

Rotor balance. The rotors are factory balanced for good performance. Sometimes they may require in field balancing to improve performance. Before considering this step, ensure that the blades are tracking properly by stringing a line from blade to tip, and ensuring the line passes over the centre of the hub. Slackening and retightening the fastening bolts (blades to hub bar) may give a little movement if needed. Also ensure the rotor parts are all assembled correctly, and serial nos matched.

Balancing requires correct equipment for success.
Vertical plane balance is affected by shims between the hub block and the hub bar.
Tracking is affected by shims under one side between the hub block and hub bar.
Balance across the blades is affected by the thickness of the shim spacers between the hub bar and the rotor tower.
Balance along the blades is affected by adding washers as weights inside the rotor blade.

DO NOT ATTEMPT TO BALANCE ROTORS UNLESS YOU HAVE APPROPRIATE EQUIPMENT, TRAINING AND/OR EXPERIENCE!

NOTE! Wear in the PTFE lined bushes inside the hub block and towers will create rotor vibration, which in turn will create more wear and so on. If more than 0.2mm side play, replace the bushes for best performance (see below). If the teeter bolt is grooved in any way beyond 0.1mm depth, replace the bolt.
Regular greasing and maintenance of this unit will prolong service life.

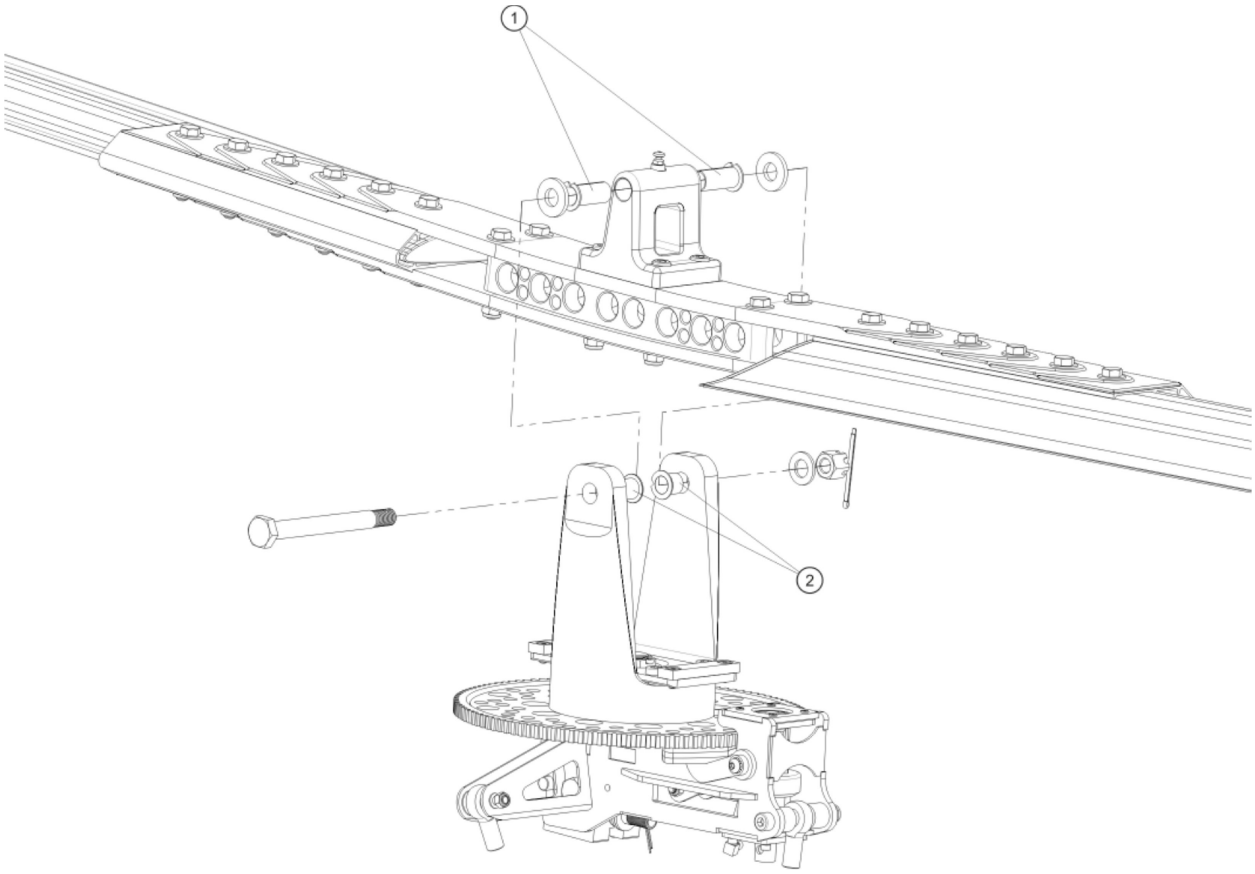
<u>Replacement of teeter bushings</u>

Caution: when disassembling mark all parts so that each and every part is reassembled in exactly the same location and orientation.

Warning: aluminium parts must not become warmer than 140ºC or the material properties will be adversely affected. The use of an oven is recommended.

Remove the bushings (1) from the teeter block – heat the teeter block to 120ºC and press out the bushings. Do not damage the surface of the bore
Remove bushings (2) from the teeter tower – Carefully using a hot-air gun heat the teeter tower to 120ºC and press or push out the bushings. Do not distort the tower arms or bored holes.
Clean the bushing bores and seatings with Amberklene LO30 solvent

Teeter-block - apply a thin layer of Loctite 638 to the bore of the teeter block. Using a clean bench vice press in the first bushing (with the joint facing upwards) until the bushing flange is flush. Clean-off excess Loctite. Repeat for the second bushing.
Teeter tower - apply a thin layer of Loctite 638 to one bore of the teeter tower. Using a M12 bolt, nut and two thick washers pull in the bushing (with the joint facing downwards) until the flange is flush. Clean-off excess Loctite. Repeat for the second bushing.
If necessary to accept the teeter bolt rework the inner diameter of the bushings in the teeter tower with a reamer 13H7. Do not rework the bushings in the teeter block.



Teeter bushings, block and tower. (Calidus head depicted, MTOsport has similar construction)

Intentionally blank

f) HTC Propeller (for Woodcomp SR3000/3 see section p, for IVO-prop see section q)

Basic description

See RSDS7066

The HTC propeller is fitted as standard. This is a 3 bladed composite design with an aluminium 2 piece machined from solid hub. Each blade is a foam filled wet layup component in carbon and glass fibre.

Materials used

1,73m diameter 3 blade HTC composite propeller assembly
Hub assembly (always a pair, and matched marked with numbers)
Blade assy (marked at the root with 'A' or 'B', and a week no./yr of manufacture. If replacing a blade always ensure the A or B is matched to the original, as this denotes the blade weight.
Hub bolt and washer set
Hub to engine bolt and washer set
Engine flange nut set

Assembly methods

Bolt torque (M6 and M8) 15Nm. Take care not to overtighten, and pre coat M8 centre bolt threads with loctite 243. Paint a torque stripe between each M8 centre bolt and the propeller hub.
912ULS Approx blade angle 19.5 deg, 12" from the end of the blade.
914 Turbo Approx blade angle 20.5 deg, 12" from the end of the blade.
Angle measured with respect to the hub face, see photos.
Balance propeller after fitting, unless not disassembled and refitted in original location.

After any blade adjustment, ensure all blades have the same angle to within 0.5deg – recheck after tightening the hub. Max ground rpm should be circa 5,500. Either flight test or ground test to ensure the engine does not rev higher than the Rotax maximum, and adjust to suit. Note that the maximum engine rpm is normally achieved in fast descent flight. If adjustment over 1degree is needed, check engine performance! Note that the 914UL engine carries a datalogger, available for interrogation of engine parameters by service engineers (with appropriate equipment).
ALWAYS recheck all the hub bolt torques after first flight after adjustment

Blade tracking is recommended as no more than 12mm deviation blade to blade, measured at the blade tip, and is reset by slackening the hub bolts and pushing the affected blade forwards or backwards, retightening and rechecking.

Special setup instructions
An RSUK gauge is available to aid blade setting.

Repair methods
Surface damage not tearing through the glass or carbon fibre, or splitting through the mould line (middle of the leading edge along the blade), may be repaired using suitable epoxy resin, or superglue and carbon. The area must be thoroughly cleaned of insect debris and dirt, and abraded to give a good fresh key to bond into. Mix and load the epoxy onto the blade as per the adhesive instructions. Superglue repairs are built up in stages, a small drop of glue followed by a sprinkle of carbon or charcoal (which instantly sets the adhesive). Build up in layers to the height required. Once the adhesive is fully cured, flat back to the original blade profile and polished in for best performance. If the surface is damaged from excess exposure to water (rain) in flight, then use of propeller protection tape fitted to the leading edge may be considered. This must comply with the modification approval MC-090, and may lead to a small performance deterioration. Heat on the tape during fitment will allow easier fitting along the curved edge – see SB-038 for detailed information. If fitted, the integrity of this tape must be examined at each 100hr/Annual inspection. There must be no air-bubbles under the tape, no lifting of any edge, or any deterioration (e.g. splitting) of the tape itself. Should the tape installation be defective it may be replaced (individual blades acceptable). Full instructions are contained in SB-038.

Propeller balance.
A well balanced propeller will significantly improve the engine and ancillary component service life. The Rotax recommended maximum is 0.1ips.
Mass balance weights may either be washers fitted under the propeller fitment bolts, or self-adhesive aluminium wheel balance weights as used on car wheels, fitted inside the propeller hub to a well cleaned, dry surface. If using washers under the prop bolts, use no more than three 2mm washers extra under each standard prop bolt, unless a minimum of 6 full threads of engagement are obtained between the bolt and the flanged nut (measure by checking the depth of the bolt from the flange –nut depth 9mm max). If more washers are required, and/or there is insufficient thread engagement, fit a longer bolt to suit, and ensure no more than 8mm of thread is protruding beyond the nut flange. For aircraft where the propeller has been dynamically balanced on the aircraft prior to despatch (up to MT-03 serial number RSUK/MT-03/050) do not add more than two washers without understanding the cause of the balance change, and consulting RSUK. Otherwise fit no more than 10 x 2mm thick washers.

Spinner option.
Under MC-240 a composite spinner may be fitted to the propeller. The spinner is retained by nine M4 washer-head socket screws (and plastic washers) which attach it to an aluminium backing plate fitted between the propeller flange and the propeller. The spinner must be removed for propeller balancing and after refitment itself balanced by means of self-adhesive weights fitted to the inside surface.

g) Pre rotator (mechanical system)

Basic description

A belt drive takes the power from the propeller disc to a simple drive shaft arrangement to the rotorhead via small universal joints. Engagement to the toothed wheel attached to the rotor head is through an ordinary centrifugal Bendix gear as used on car starter motors. This is engaged by a single air piston which pushes the bendix upwards to that the gears mesh with the starter ring on the head.

The vertical shaft slider is protected by a rubber bellows. This is because jamming of this shaft would interfere with pilot controls. If split, replace. Lubricate slider shafts with regular LM grease, and protect joints from corrosion with chain lube or similar spray-on protective lubricant

Materials used

See service parts list.

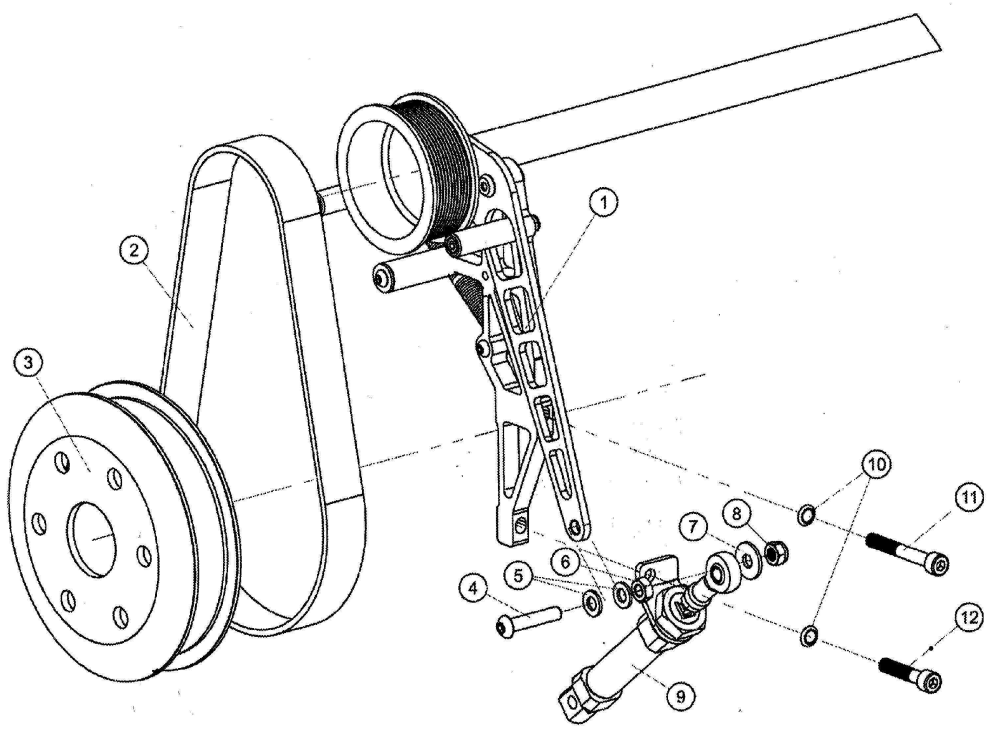
Parts available: Belt, engine pneumatic cylinder with safety wire, Engine side pre rotator assy, propeller drive drum, small drive wheel, gearbox, UJ assies, upper and lower drive shafts, bendix gear, bearings and shaft.

A pre-rotator improvement kit, RSD7181 is offered for fitment under SB-027. This includes a stronger pre-rotator bracket and drive shaft.

A reinforcement stay is offered for fitment under SB-066 (supplied as kit RSD7227).

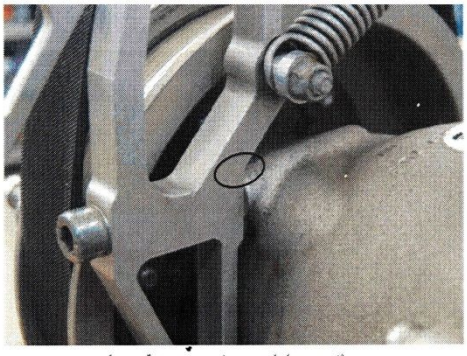
Inspection requirements and Assembly methods

Lower clutch assembly inspection

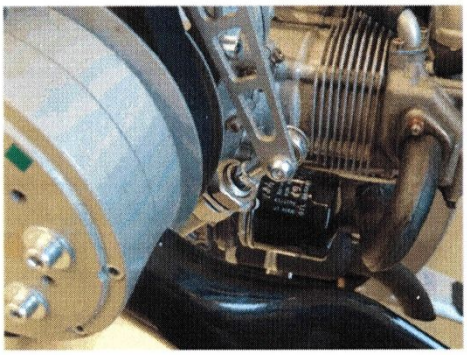


Pre-rotator clutch - belt, pulleys and actuation (lower engagement)

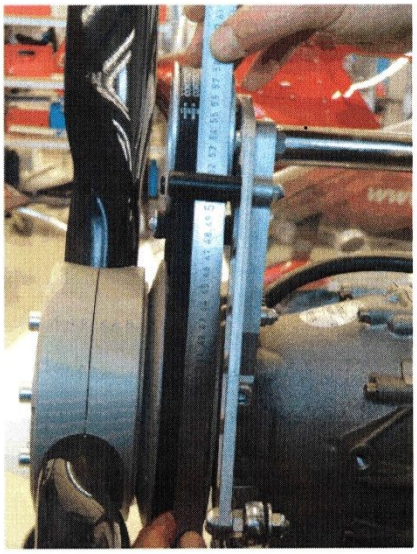
1. Inspect the pre-rotator bracket for cracks in the area butting-up against the mounting bosses of the gearbox casting.
2. Inspect alignment of the upper and lower pulleys using a straight-edge laid against the pulley's flanges
3. Check that there is sufficient slackness in the drive belt with the clutch released. When struck with the palm of the hand from below the lower pulley there must be an audible "click". If in doubt the belt should be replaced. Note: Improper prerotation technique (too high a speed resulting in excessive slip) induces heat which may cause the belt to shrink/distort. As a result the pre-rotator belt is permanently exposed to friction which causes excessive wear, heat and further shrinking and distortion.
4. Check that there is sufficient tension in the drive belt with the clutch engaged. With the engine stopped and the aid of an assistant activate pre-rotation. Check that the pneumatic cylinder is not at its mechanical limit by manually pushing the piston rod further
5. Check that the upper pulley/actuation arm is free moving and returns to the braking position



Area for accurate crack inspection



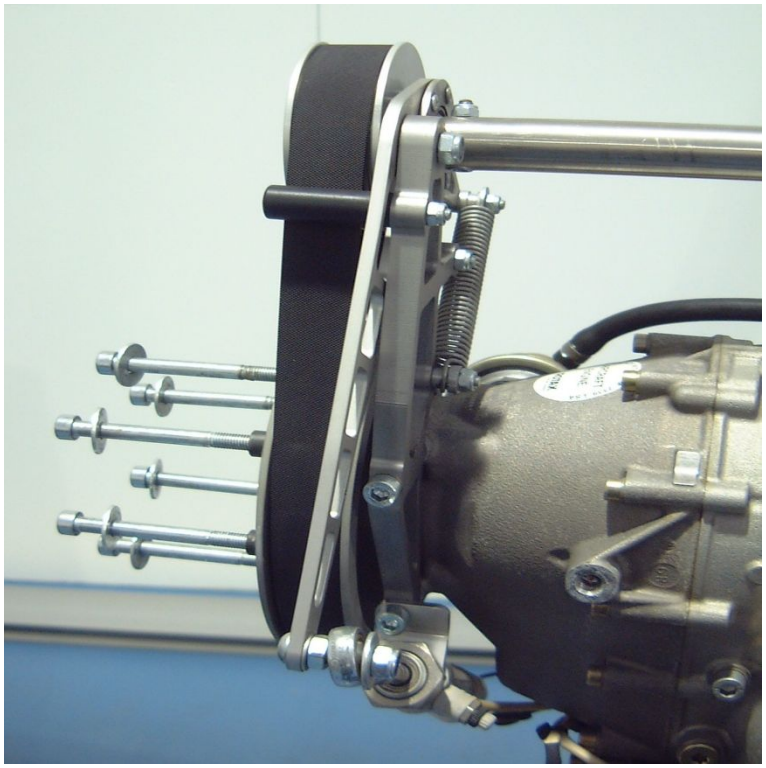
Sufficient travel (piston not in mechanical end stop) when clutch is engaged

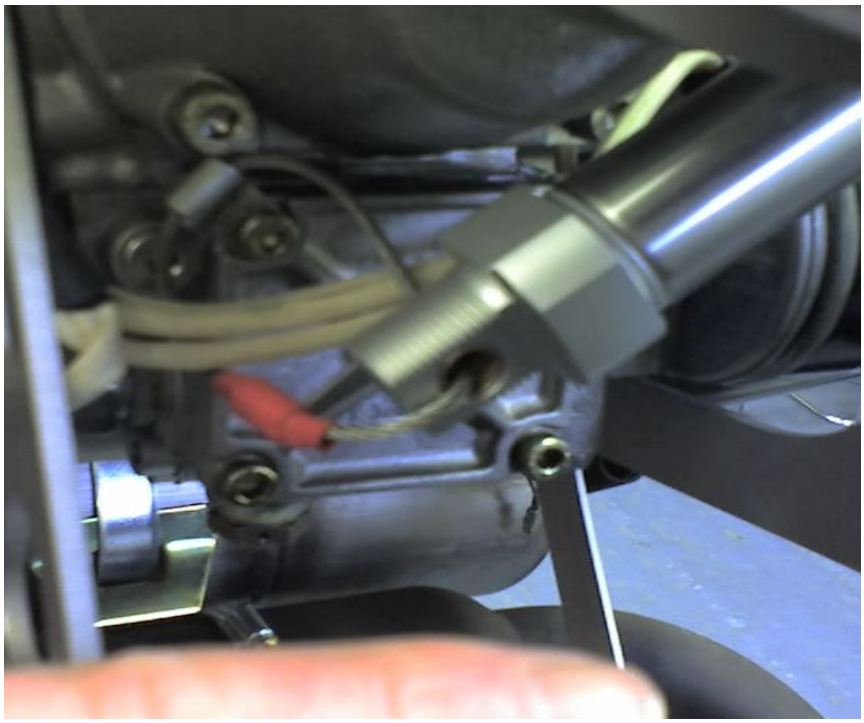


Alignment check with ruler

Inspection items pre-rotator clutch

Assembly methods





Special setup instructions

Only minimally lubricate the bendix with light oil; excess grease or oil may cause the unit to jam.

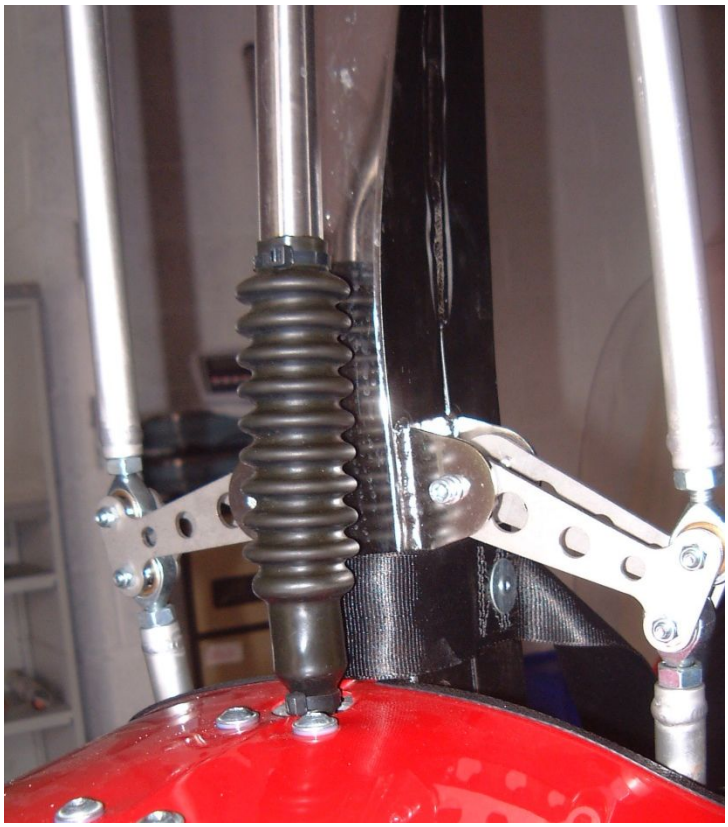
Loctite 243 for all fastenings in the system.

Check for correct pneumatic function after assembly (see test in service sheets). Note that the pre rotator head cylinder must drive the bendix upwards before full engagement at the propeller drive. Adjust the flow valve on the prop cylinder pneumatic valve to achieve this.

The bolt holding the base vertical UJ to the gearbox has a short screw, and reduced thread engagement in the nyloc nut. This is to prevent contact with the seat belt, and the nut must be Loctited (243) during assembly.
When replacing the small drive wheel apply Loctite bearing fit or equivalent between the shaft and the bearing. This is to prevent shaft wear.

Repair methods Refer to drawings RSDS7070 and 7087
To replace the drive belt, remove the propeller (marking the radial position with respect to the engine flange and pre rotator hub first), slip the belt off, and clean the drive wheels. Replace the belt and propeller (Remember; loctite 243 on the propeller bolts). Lightly lubricate the belt with PTFE spray, mould release agent or talcum powder (stops belt grab).

To change the rubber bellows, remove the two plastic ties. Cut off the existing bellows in situ. Ensure the rotor brake is on so that the rotor head is pushed forwards, and remove the bolt connecting the UJ to the gearbox., and lift off. Remove the shaft, clean as required and lubricate with LM grease. Refit and push the replacement boot over the UJ. This can be awkward, and a little grease helps. When in place refit the bolt with loctite 243 and a new nylock. NOTE! The bolt is short on purpose to prevent fouling with the seat belt. Loctite will ensure a safe fit.
Fit a 2mm tie at the bottom of the gaitor, and a 4mm tie at the top – when tightening the top one, extend the bellows with the head forwards, such that when fully back it is not over compressed.



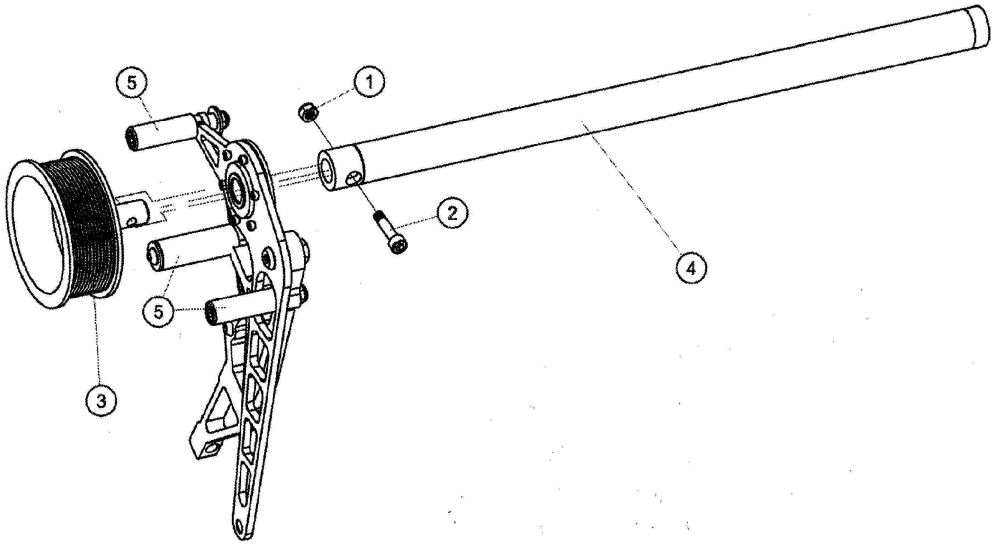
To change the bendix gear shaft or bearings.
Ensure rotor head is braked forwards. This can be done without removing the rotors.
Remove vertical drive shaft UJ bolt, and slip off UJ from the bendix shaft. The retaining strap will stop it falling away. Remove the cap head screws retaining the bottom bearing plate, and

remove the plate, Slide out the bearing and shaft with bendix gear. Replace as required. If needed remove the upper bearing as lower bearing.

When refitting use Loctite 243 on the cap head screws, and lightly lubricate the bendix spiral. Use a new nyloc nut on the UJ bolt.

To change the engine pre rotator, or components. Remove propeller and belt as in changing the belt. Disconnect the drive shaft from the back of the small pre rotator pulley by removing the bolt and nut. Disconnect the bolt connecting the air cylinder to the actuating arm. Remove ancillaries, and disconnect the spring. Remove two mounting bolts and remove bracket and pulley assy from engine. Push the pulley through the bearing, undo the locknut on the back of the pivot bolt, and remove the pivot bolt.

Replace with new parts as required and reassemble.



Pre-rotator clutch - small pulley, bearing and lower drive shaft

Notes on re-assembly: Tighten the pivot bolt (with Loctite 243) up enough for free operation of the pivot arm (remember to put the plastic washer between the bracket and the arm), and then tighten locknut in place. Check when all is tight for free operation.
Remember to fit the small distance washer between the pulley wheel and bearing, and apply bearing fit Loctite 938 between shaft and bearing
Check for free bearing operation before and after assembly.
Check for slider free movement – if needed re grease before reassembly
Apply loctite to bracket to engine bolts and tighten to 25 to 30Nm
Reassemble prop as prop section, and check pre rotator pneumatic function.

h) Rotor brake and trim (mechanical system)

Basic description

A simple pneumatic system using a two way cylinder actuates either the rotor brake by applying upwards pressure to the rotor head, or the trim if in flight by pulling downwards. Because air is compressible, the air in the cylinder acts like a spring, thus being able to be moved in flight. The pneumatic function is covered elsewhere (see system diagram earlier in the manual).

Materials used

See parts list

Assembly methods

Changing the brake pad requires disassembly of the rotor head, and is a recommended activity to be undertaken at a service facility.

Special setup instructions

After any work on the pneumatic system, check for correct system functionality.
Ensure brake pad assembly moves freely after refitment.

Repair methods

The brake pad is a service item.

The trim cylinder may be fitted with a replacement seal kit if found leaking (RSD4484).

1. Install rotor tie-down bag
2. Switch the flight/brake selector to the “Flight” mode and release trim pressure completely. If necessary, switch repeatedly.
3. Disconnect the rod-end bearing from the rotor brake bracket
4. Retract the cylinder and remove the rod-end bearing from the piston rod.
5. Remove the circlip/snap-ring from the end of the cylinder.
6. Tilt the pneumatic cylinder aft and pull out the piston completely. In order to do so, temporarily switch the flight/.brake selector to “Brake” mode and apply a small amount of brake pressure.
7. Remove the old seal rings and discard. Install the new seal rings using the special grease provided.
8. Re-install the piston and re-assemble the pneumatic cylinder. Re-install the circlip/snap-ring.
9. Apply Loctite 243 to the piston rod threads and refit the rod-end bearing
10. Re-connect the rod-end bearing to the rotor brake bracket
11. Inspect for full-and-free movement of the pitch control
12. Arrange duplicate inspection of the work done.

i) Enclosure, seats, harnesses

Basic description

Refer toRSDS7171 (enclosure), RSDS7092 and 7093 (seat belt installations)

Enclosure:

The pilot enclosure is manufactured from GRP (or if ordered specially, carbon fibre). Colour is spray applied and oven cured. Outside colour is to customer order, inside grey, call RSUK for original colour choice. It is fastened to the airframe under the front seat each side, left and right of the rear seat, to the pre rotator gearbox and to the rear of the airframe. The nose gear cover is attached to the inside of the enclosure. The edges are covered by a trim strip to prevent user harm, wirelocked in place – the trim has a metal carrier inside, and if it enters the propeller significant damage will result.

The enclosure is not a structural part of the aircraft in terms of flight, but does have significant value in pilot injury prevention in accidents, and also carries a high proportion of load of the front seat shoulder harness in forward or vertical loading. The fastenings between the front seat back and enclosure, and to the airframe, must not be modified. General fastenings carry rubber washers to allow vibrational movement.

Front seat: GRP, painted front to match enclosure, rear side grey. The rear edge and lower front edge is covered by a trim strip to prevent user harm from fibreglass, and damage to shoulder straps. The seat is retained to the airframe with four bolts through the base, and one either side to the enclosure.

Front seat harness: Retained to the back of the front seat via a single M10 bolt/nut, and to the airframe through holes in the base of the seat via M8 cap head bolts. Note that it is possible to disconnect the shoulder harness from the lap strap – this is for ease of assembly only, and flight is not to be undertaken with the belts disconnected.

Front seat cushions: Either standard cloth or sports type with energy absorbing Dynafoam core (removable for washing). Both are retained by Velcro for easy removal.

Rear seat: GRP, painted black. This seat folds forwards for access behind. It is retained to two hinges on the front edge via two fastenings per hinge. The seat is connected to the mast to stop it moving forward in flight if the harness has been left undone via either an M6 bolt or a thumbnut and rubber connection. The seat hole for the M6 bolt is generous, to prevent mast/airframe flexure damaging the seat. The power supply for the heated clothing regulator and the helmet connection pass thru the seat via a rubber grommet.

Rear seat harness: Wrapped around the back of the mast and retained in place by two rivets. Lap belt bolted to airframe behind the seat with M8 cap head bolts. Trim pieces are fitted where the belt passes the enclosure to prevent fretting.

Rear seat cushions: Either standard cloth or sports type with energy absorbing Dynafoam core (removable for washing, and two layers - 0.5” soft, 1” firm). Both are retained by Velcro. The standard cushions should not be left in for solo flight. If one passes through the propeller it will damage it, possibly severely. The sports seat cushions are restrained by bolts through the back seat, and also through straps on the base cushion.

Materials used

See parts list

Assembly methods
Enclosure: Blind hole fastenings are fitted with Loctite 243. No specific torque, other than tight and secure.
Front seat: Base and side fastenings use nylock nuts. Do not overtighten otherwise you may crush the composite.
Front harness: Shoulder harness attachment has a washer either side of the harness plate, and the bolt head goes toward the pilot. M8 lap belt bolts require Loctite 243. Ensure the regulator cable and helmet connection is tied via a plastic tie to the outside of the left lap belt connecting bracket, and that the edge of the seat hole is protected with trim to prevent cable damage.
Rear harness: Tighten bolts securely.

Special setup instructions
Ensure seat belts are not fraying on any sharp edges, and have a straight run from mounting to mounting, in the line of normal operation.

Repair methods
Seat belts – none. Replace if damaged, worn or frayed.

Paint – contact RSUK for the paint specification used to allow accurate touch up.

GRP parts.
Front seat: small accident damage can be repaired using normal GRP techniques. No repairs permissible to the front seat back, fastenings to frame, or upper edge (safety item, this is the front seat belt shoulder harness mounting) without an approved repair scheme.
Rear seat: this is a non structural part, inasmuch as it is purely for the passenger seat to sit in. The safety harness has no attachment to the seat. Cosmetic repairs accepted.

Windscreens. For views see RSDS7101.
Windscreens are manufactured from 2mm Makrolon. Cleaning can be undertaken with proprietary cleaning agents such as Plexus, or simple soap and water. Never use petrol or such products on the screens! They may shatter or suffer severe surface crazing.
Windscreens are a service item.

Front windscreen. Retained by M4 cap head screws, screwed into rubber mounted captive nuts. Remove the screen by undoing the M4 screws, leaving the sideslip flag screw in place. The screen can be lifted clear. This exposes the captive nuts. If the nut has to be replaced, simply pull it out, and push in a new one. The side slip flag is retained by a single M4 screw, and screws through the screen to the black plastic support block on the inside. This support block in turn is located on the head of a cap head bolt mounted on top of the enclosure which prevents movement once fitted.
Fit the new screen by locating the rubber strop along the lower edge (prevents scuffing, and looks better), and start fastening to the body from the middle outwards. Put the support block in place after 3 or 4 screws, it's easier. Once the lower screen screws are all located, tighten them all down. Then fit the side slip flag – if no screen hole is present, carefully drill a 4mm hole in line with the centre of the support block, and then fit the screw.

Rear windscreen.
Replacement is a straightforward removal of the fasteners, and replacement. Under the edges first and work inwards to the centre screw, and reverse when refitting. Make sure the pilot shoulder harness is in place before fitting outboard screws.

Windscreen repair methods

The only permissible repair to either front or rear windscreen is “stop-drilling” to prevent crack propagation. If there is a crack radiating from one of the screw holes drill a small hole (2.0 to 3.0mm diameter) through the thickness of the screen at the end of the crack. An ordinary steel drill bit may be used provided it is sharp, used with the drill rotating slowly and with a softwood support behind the screen to resist the drilling load. The maximum length of crack is 20mm and it must not reach the edge of the screen.

Landing-light shield (option under MC-124/SB-023)

A lightweight metal shield may be fitted to protect the landing lights located at the front of the luggage locker. This is attached by a single fastener and two Velcro pads. Its security must be checked prior to luggage being loaded through the hatch.

Intentionally blank

j) Instruments

The cockpit layout is represented in fig. below. Differences may occur depending on the equipment fitted. .There may be unused switch or indicator positions on the panel, these may be fitted with blanking plugs

1. Change over switch pneumatics (FLIGHT (TRIM) to BRAKE (ROTOR)
2. Altimeter
3. Airspeed indicator
4. Engine rpm
5. Oil pressure
6. Cylinder Head temperature
7. Oil temperature
8. Ignition switch (one for each coil)
9. Charging (Gen) lamp
10. Main switch
11. Rotor rpm
12. Compass
13. Hour meter
14. Roll trim indicator where fitted
15. Rotor bearing temperature
16. Air pressure gauge for Trim and Rotor Brake
17. Accessory switches
18. Electric fuel pump switch
19. Radio (if fitted)
20. Fuel gauge
21. Rotax engine status lights
22. Pre-rotator & rotor brake interlock release
23. 12v Auxiliary socket
24. Transponder if fitted
25. Low fuel light
26 Low voltage lamp

Note that unused instrument panel holes have blanking plates fitted to allow use at some other time if required.

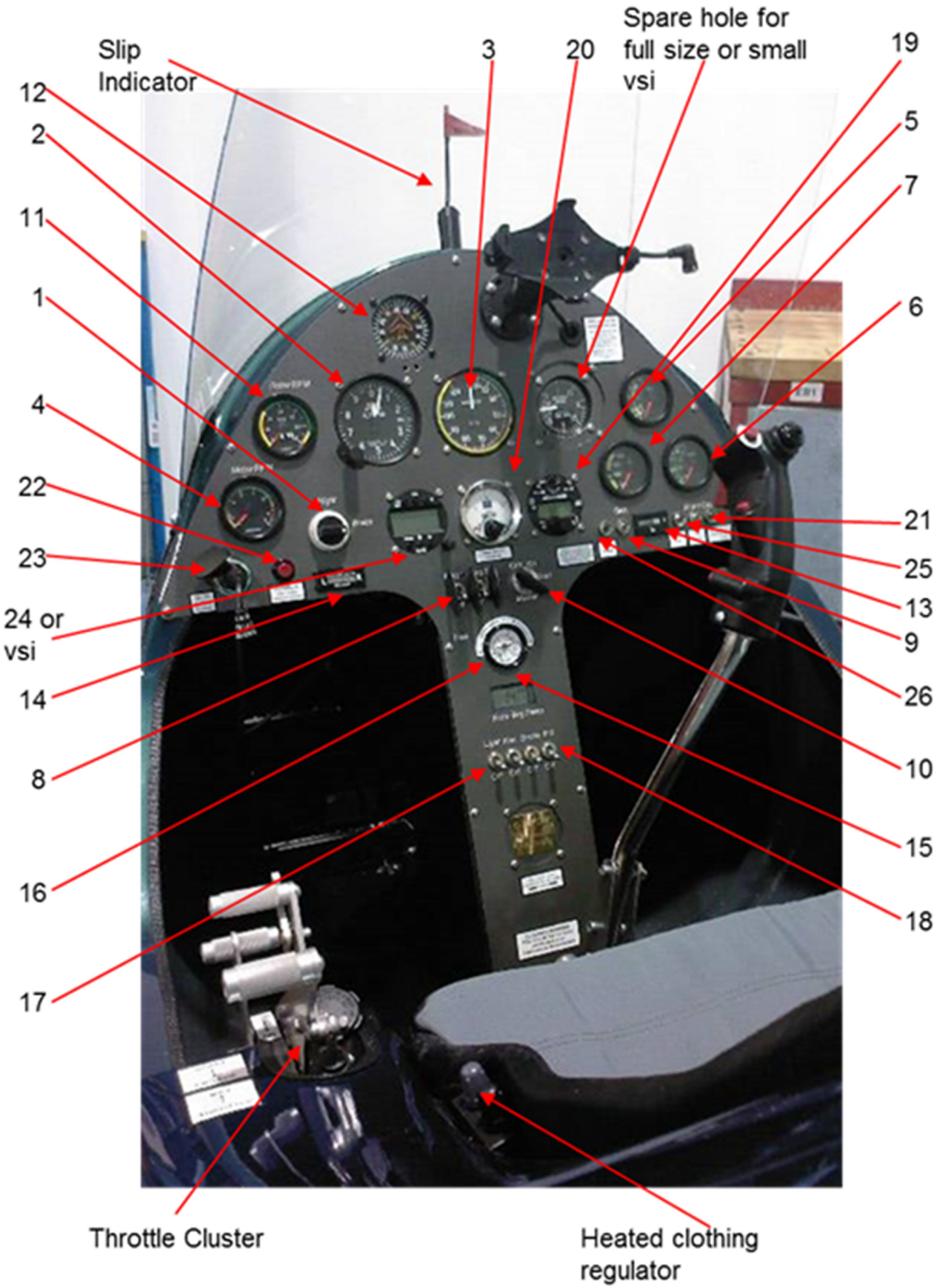
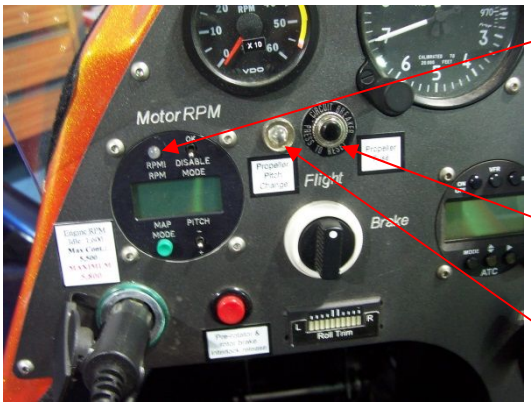
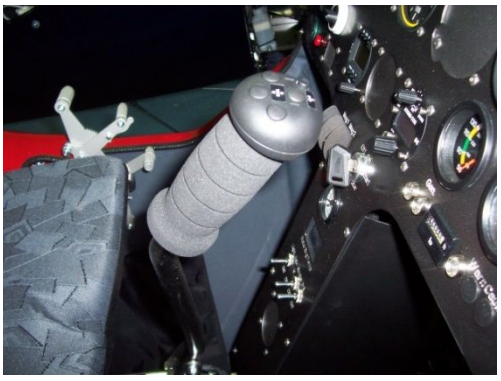


Fig 2, instrument panel (fixed pitch propeller)



View of left side of panel if fitted with Woodcomp propeller and CSC-1 controller

NB: If IVO-prop is fitted under MC-318 a digital combined Engine RPM/MAP gauge may be fitted – see section q) of this AMM.



Alternative stick-grips may be fitted, either as original equipment or replacement for an irrepairably damaged grip. The G205 grip (above) is supplied as a complete, interchangeable stick assembly (M.ST21) under MC-121 approval – please contact RSUK for further information.
The trim pushbuttons on this grip are arranged logically Fwd/Back & L/R.
The pre-rotator button is top-left and the PTT on the front (fwd) face

The OEM stick grip is also supplied as a complete interchangeable stick assembly under MC-162 approval – please contact RSUK for further information

Basic description of instruments

Air Speed Indicator (ASI)

Always located in the centre of the panel. 0 to 140mph. Red line 120mph, green to 50mph. The gauge is connected to a black 4mm airline via a length of silicon hose, which in turn goes to the pitot port at the front of the aircraft. Never blow into the port to test the gauge! The pressure required to operate it is small, and doing so will make the gauge, at best, inaccurate. Where a rear seat ASI is fitted, a 'T' is put into the above airline. Another black line from here takes the pressure to the rear seat ASI. Placarded as per the front seat. For fitment of rear seat instructor kit see instructions with kit.

Altitude.

A standard commercial 0 to 20,000ft altimeter is used.

Engine rpm.

This gauge is unique to RotorSport UK, albeit a modified commercial gauge

Rotor rpm.

This gauge is unique to RotorSport UK, albeit a modified commercial gauge

Oil temp and Pressure

This gauge is unique to RotorSport UK, albeit a modified commercial gauge

Cylinder head temp

This gauge is unique to RotorSport UK, albeit a modified commercial gauge

Fuel level gauge

There are three types of fuel-gauge in service

i) "Fozmula" gauge with integral push-button. This hydrostatic gauge works on pressure sensed at the tank. Due to the non-linear shape of the tank it has not been possible to match the two exactly, but at empty ('E' on the tank) the gauge should read empty when the button is pressed. The gauge is connected to a 4mm pressure line, which travels with the loom to the top of the left fuel tank. It is attached via a normal thumbscrew to the level pipe in the tank. This is screwed into the top of the tank, and is simply a small bore tube.

ii) "Fozmula" hydrostatic gauge with separate pushbutton. Functionally as described above but with smaller scale.

Fozmula integral push-button

Fozmula separate push-button

iii) The third type of gauge is completely electrical, the fuel-level being determined by a float-on-tube arrangement fitted into the top of the left fuel tank. There is no pushbutton and the gauge indicates the fuel level at all times the instrument is powered.

Float-driven (electrical) fuel gauge

Pneumatic pressure
Two types are in use – 0 to 15bar, and in later types, 0 to 10bar. They are acceptable alternatives.
TRT800 or TRT800HMode S transponder (where fitted) from Funkwerk
This device requires careful management – if used it transmits data about the aircraft, so accuracy is important. There are three key parts –
The transponder panel mount unit.
The rear of transponder mounted dongle – this is where the hex code etc is stored – if the main unit goes faulty, it may be replaced without having to reprogram the transponder system.
The antenna, cable and base plate.

Hobbs meter.
Records the engine operational hours.

Temperature sensors
These are independent from the main harness, containing their own battery (LR44).They link directly to their temperature sensors. Where fitted, the airbox sensor is plugged into the rear of the airbox. The rotor brg sensor is pushed into the front of the rotor bearing spacer in the rotor head. This sensor is also held in with hot melt adhesive.

Keyswitch. The keys are all the same across the aircraft.
Ignition switches. Note these always have guards to prevent inadvertent operation.
Vertical speed indicators (VSI). Optional fit, either 2 ¼" or 3 ½" units.
Compass (PAI-700 flat card type). This compass is used because the standard ball type compasses tend to pick up on rotor vibration and oscillate to an extent that is unreadable.

<u>Materials used</u>
See parts list

Assembly methods

All instruments in the panel are fitted with M4 dome head screws, with plain nuts loctited on with 243 – unless specifically supplied with the instruments. The exception is the compass – these are brass, to prevent magnetic effects. There are two levels of screw used – zinc plated and stainless steel. Both are acceptable.

Radio antennas are located in three permissible locations;

Nose, mounted on the bottom of the enclosure. Lynx ¼ wave flexy. 1m cable.

Built into the tail. On a limited number of aircraft. No repairs possible.

Under the enclosure. Lynx ¼ wave flexy, 2m cable. Excellent results when airborne, can get shielded when on the ground due to low height. Can be subject to ground damage so watch for this.

Special setup instructions

ASI should be calibrated as an installed instrument with suitable equipment.

Transponder. Follow the Funkwerk instructions for unit setup. Aircraft hex codes are available from the CAA G-INFO website. After initial setup the unit function must be confirmed using calibrated, proper equipment – transmitting incorrect codes is an offence. A transponder is also a radio transmitter, so should be included on the aircraft radio licence. It is recommended that the transponder is verified biennially (i.e. every two years) to ensure what the pilot thinks it is doing it actually is, and that the codes transmitted are correct.

Transponder installation verification (recommended)

On initial aircraft approval the transponder installation and function was verified in accordance with TGL13. The functional test undertaken is a transponder verification to confirm a) System operation, b) ICAO 24bit address in transmission response and c) Function of system fault detectors (where applicable). Each follow on aircraft has the transponder function verified as part of the release to service for the same features.

Transponder field verification test procedure.

1. Ensure that the correct hexadecimal code has been input by cross checking the code assigned to the aircraft on the CAA G-INFO website to that in the aircraft – follow the Funkwerk setup instructions contained in the Funkwerk handbook 03.2121.010.71e.
2. Ensure the aircraft type code is input (1C) and the aircraft registration without gaps. There are normally three blank spaces at the end of the line. So as an example, the code for G-CLDS is '405F461CGCLDS___'
3. The aircraft has no trigger 'ground' switch for indicating that the wheels are off the ground, so this setup option is left de-activated.
4. Follow the instructions of the verification equipment with regard to setup, and of siting of the equipment antenna with respect to the aircraft antenna.
5. The verification must check and verify items a), b) and c) above together with the reported parameter "Pressure altitude" which must be satisfactorily compared with the aircraft altimeter set at 1013mb. It is preferable to print the test data for evidence of test completion.
6. Aircraft condition during test – Engine off, ignition on, transponder on and in 'ACS' mode. No other equipment is required to be on.
7. Follow the verification equipment instructions for test process.
8. When the verification is complete, record on the aircraft worksheet the serial no and calibration date of the equipment used, the serial no of the transponder, and hexadecimal code confirmed correct.

Radio setup – follow Funkwerk handbook instructions (ATR500 manual Document-No. 01.1251.010.71e or ATR833 manual Document-No. 01.1402.010.71e). Note that the ATR833 was released under MC-199 as option fit for the MTseries, and that the 'D' connection to the harness is different from the ATR500. This radio has "audio in" capability (e.g. warning tones from GPS devices) and a miniature jack socket may be provided for connection, positioned to the left of the avionics equipment.

Repair methods

Note that the pneumatic switches are mounted on the rear of the instrument panel behind the engine gauges. The entire instrument panel may be removed by undoing the screws around the edge (leaving the top centre until last) and then folding it forward (put a piece of waste cardboard under the base edge to prevent damage). The wiring harness is disconnected by pulling the connector plugs apart. The airline fittings are standard types where the collars are compressed into the middle and the lines pulled out. The pressure supply to the ASI and fuel gauges are pulled out. The panel can then be removed. Take care with any pneumatic fittings if removed – some contain one way valves and must be replaced correctly orientated.

WARNING! Once the panel is removed the engine kill switches are deactivated, and if started cannot be stopped easily. Disconnect the battery earth for safety and, where available, fit Safety Plug RSD7191 (available from RSUK)
Refitting is a reverse of the above. The panel must be fully checked for equipment function (pneumatic, electrical, pressure) after replacement!

Only repair instruments in accordance with manufacturer recommendations.
ASI gauge slow to respond: possibly a kinked pipe, especially if OK in the front, and not in the rear. Poor response could be water or other blockage in the pressure feed at or near the nose.
Calibration. The unit cannot be user calibrated. If found to be in error more than 5%, replace.

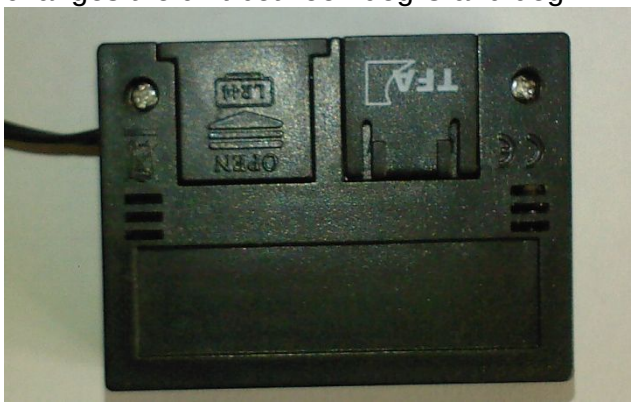
Altimeter. This unit may be adjusted if required to match height indicated to pressure setting. Remove the small screw beside the adjustment knob on the panel. This will allow the knob to be pulled out slightly which will disengage from one scale. Adjust the two scales to suit a calibrated gauge, push back in and replace the screw. Note the adjustment in the aircraft logbook!

RPM and engine gauges. Not user repairable, replace if faulty.
Under modification MC-218 a new design of rpm gauge was introduced (engine rpm and rotor rpm) and may be supplied as spares. They are visually and functionally similar to the earlier gauges but carry-out a full sweep of the gauge face as a self-test feature when powered-up by the aircraft master switch.

Transponder and radio. Neither unit is user serviceable. Return them to Filser via their aftersales program – see the Funkwerke website.
Antennas and cables may be replaced if faulty or broken.

Temperature gauges. These are bonded to the rear face of the panel, so not easy to remove. The battery can be replaced by sliding the small black cover off on the rear of the unit.

View of front, prior to panel fitment. Unit is bonded to panel. Switch should be down – this changes the unit between deg C and deg F



View of rear, showing battery slot for LR44

Compass. Calibrate compass according to the manufacturers instructions, lined with the aircraft keel.

Notes: It is permissible to swop the engine and rotor tacho gauges, provided properly identified with correct placards. This is useful for instructors to give improved visibility from the back seat.

GPS units are permissible to be fitted in line with RSUK approved mounting (Garmin GPSmap and Flymap). Do not fit onto GPS's to the instrument panel due to magnetic interference with the compass! Only fit as per RSUK kit instructions.

Garmin

Flymap

Under modification MC-213 the barometric system fittings (the pitot and if fitted, static lines) are changed to a screwed collet arrangement. If a fitting is removed ensure that the loose collar nut is not lost.

Under modification MC-236 an Artificial Horizon (AI) with PFD-display is available as an optional instrument. It is a useful addition for pilots transitioning from fixed-wing or helicopter operations but its fitment does not permit IFR flight. It is therefore placarded “Day VMC only. Do not rely on this display”
This instrument is connected to the pitot-static system of the aircraft and it is essential that the connections are leakproof. It is electrically powered from the supply bus at the rear of the instrument panel and is protected by a 2A line-fuse. It also has a small GPS antenna which is adhesively affixed to the top of the instrument binnacle. Information on the set-up of the instrument is provided in the User Manual.

Intentionally blank

k) Suspension, wheels and brakes.

Basic description
Refer to RSDS7085 for nose gear, and RSDS7086 for main gear and suspension bow. RSDS7072 for the brakes
The main suspension spar is a GRP moulding (as are the wheel spats)
The brake system and wheels are manufactured by Autogyro Europe
Tyres are 400/100 2 ply (4.80/4.00-8) or heavy duty Heidenau 4.00-8 55M, normally fitted with an inner tube. There is no tail wheel.
Brake pads are service items. Later parts have a wear-groove set at 2mm pad depth.
Nosegear is pivots in bushes bonded inside the keel tube. Friction is controlled by the tightness of the top castellated nut (behind the instrument panel).

Materials used
See parts list
Standard tyres are 400/100 2ply rating tyres, fitted with inner tubes (3.5-8). Heavy duty tyres as above are optional fitment, and are recommended if operating in a stony or school environment. Beware of fitting heavier duty tyres – they are generally much heavier in weight and will further reduce the aircraft payload. A modification Approval must be obtained before using alternative tyres. Knobbly tyres also pick up stones, which can enter the propeller arc.

Assembly methods
See drawings

Special setup instructions
Tyre pressure 1,5 to 2,2bar main, 1,5 to 1.8bar nose
Under modification MC-213 new aircraft are supplied with nitrogen-filled tyres. Nitrogen gas provides certain advantages and owners may wish to consider its use (it is available from a number of UK tyre specialists). To denote nitrogen filling green valve caps must be used.

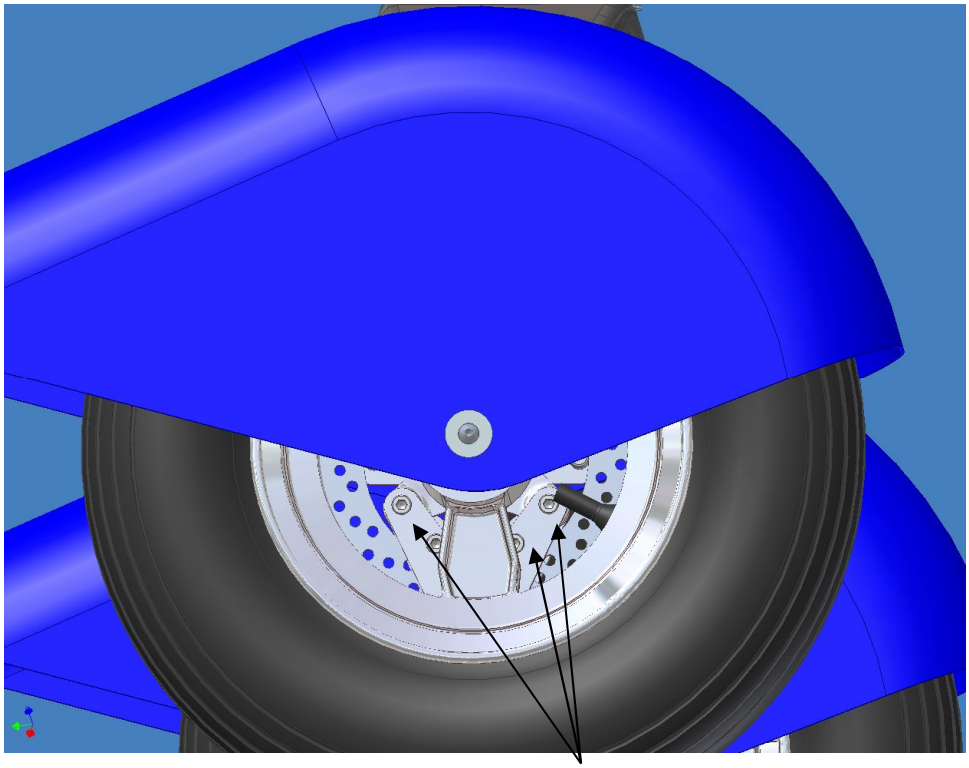
Nosegear centralisation setup. With rudder correctly set with the in flight offset (see below) the nosegear must be set straight ahead.
Nosegear to pedal linkage setup
If the wheels are tubeless, take particular care not to damage the wheel rims when changing tyres. Inner tubes may be fitted if needed.
Residual turning torque for the nose gear (without pedals connected) < 0.2Nm. Tighten nut to achieve this, and fit split pin.

Repair methods
To change the front tyre the wheel must be removed. Tip the aircraft onto its tail, and remove the wheel bolt. The wheel and spacers can be taken off, and the tyre changed using normal techniques. It can be done by hand as the wheel centre groove is very generous. Remove the air, compress the tyre into the wheel centre, and then pull off the rim. When refitting a little soap solution makes it easier for the tyre bead to seat correctly on the rim. Check for the tyre properly seated after fitment, and match mark the rim to the tyre. Use a new nylock nut when refitting the wheel, and check for free rotation.

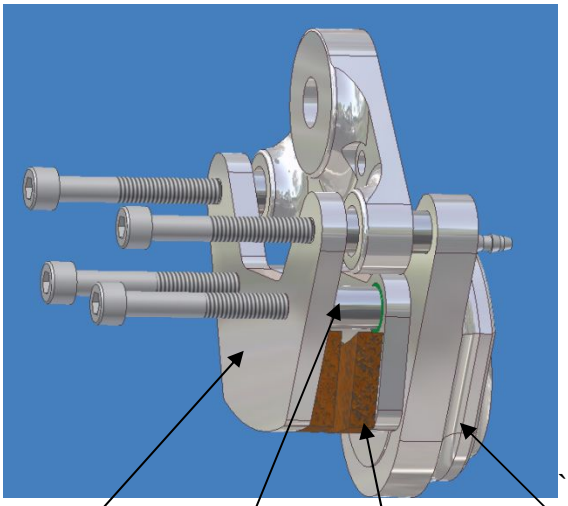
Main wheel tyres can be changed without taking the wheel off if required. Remove the wheel spat (three screws). Jack the aircraft safely under the keel (under the prop, strongest area) and put a ballast bag on the opposite wheel to keep that side on the ground. Make sure the aircraft is chocked and unable to fall off the jack. Remove the tyre air, and remove or replace as nose wheel. When refitting the spat ensure the screws are loctited.

If the wheel has to be removed, either remove the four screws securing the brake disc to the wheel, and then the wheel nut, or remove the four bolts securing the brake pad assembly together and remove.
Warning! When refitting these screws MUST be loctited with 243. If these screws come out in flight then the wheel may not turn on landing!

Brake pad change. Change when 2mm or less remaining. These must be changed as a set for effective operation. There is no need to remove any other item to do this change.
Remove the four cap head bolts holding the assembly together. The calliper will come off to the inside of the wheel, and the two pads off separately. The pads slide on Teflon bushes, on short hardened steel inserts. See picture below



Remove these 4 bolts to remove brake pads



Replace parts as required. When refitting put a thin smear of Vaseline or silicone grease around the piston, and on the bushes. Loctite 243 MUST be put on the bolts, as a loose bolt could enter the wheel and prevent it from turning!

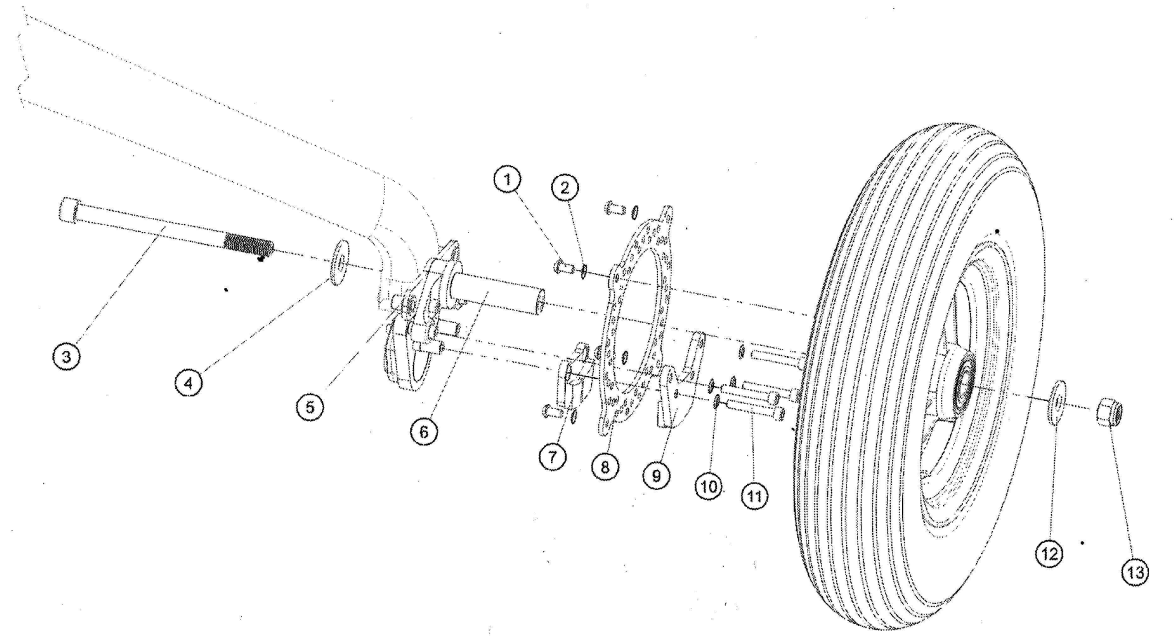
Note: sticking brakes are probably due to one of three causes.

1. The calliper piston is known to sometimes stick in the calliper bore is very dirty, or left with salt corrosion. To repair, remove the calliper from the wheel (but do not disconnect from the hydraulic line) and using the brake lever, push the piston out slowly and carefully until the black O ring is just visible. Clean the piston, and cover with a smear of Vaseline, silicone grease or “Copaslip”. Push it back in, if needed with a G clamp, and re assemble.
2. The brake lever is not returning properly to its stops. Ensure the lever returns – if not check that the rear seat brake cable (if fitted) is adjusted correctly, and that the attachment between the arm and brake cylinder is not too tight (the eyebolt from the arm into the cylinder must be able to move on the bolt)
3. The brake pads are unable to move freely on their bushes, or the bushes are worn. Remove the pads and clean the bushes, or replace the set.

Main-wheel-bearing change:

1. Jack the aircraft as described above and remove the wheel spat.
2. Holding the axle bolt with an allen key remove the wheel nut (13) and washer (12)
3. Unscrew and remove the four bolts (1) with friction washer (2)
4. Remove the wheel from the axle leaving the brake disc and calliper in place
5. Transfer the wheel to the workbench
6. Using a drift tap out the bearings
7. Clean the new bearings and apply Loctite 638 to the outer surface
8. Press the inner bearing into place, install the centre spacer then press the outer bearing into place. Alternatively use a long bolt and nut with suitable washers to pull the two bearings together. In either case ensure that only the bearing outer race is loaded by the assembly tool. The spacer must be held by the two inner races.
9. Replace the wheel on its axle and insert the four bolts (1) using new friction washers to attach the disc to the wheel
10. Tighten the bolts progressively to 10Nm
11. Fit a new nyloc nut (13) with the washer (12) and tighten to 50Nm

12. Check free rotation of wheel, no radial run-out and satisfactory braking function
13. Replace the wheel spat using Loctite 243 on the fasteners
14. Carefully lower the aircraft to the ground.



Main gear, wheel and brake

l) Rudder and rudder control

Basic description

Refer to RSDS7163 rudder controls

The rudder is controlled via tubular linkages between the front and rear pedals (connected via the nosegear), and from the rear pedals to the rudder via a cable. This cable is in three parts, two short lengths connected to each rear pedal, two turnbuckles, and a single length from turnbuckle to turnbuckle around the rudder culisse. The culisse is a plate and bearing assy, which in turn sits on a welded pin on the keel. Each turnbuckle may be covered in shrink wrap sleeve, which protects the passenger or luggage and aircraft from any snagging on split pins or wire locking.

The rudder itself is bolted to the culisse, and does not disturb the cable settings if removed for any reason.

The rear tail assembly and rudder are GRP (or CRP) mouldings. The rudder has a simple top pivot with a 12mm top hat bush and plastic spacer washer between the rudder and pivot plate bolted to the rudder with a steel dome bolt, locked with Loctite 243.

Rudder position and cable tension with respect to the footpedals is adjusted via the turnbuckle in each cable. Cable is supported on pulleys along the airframe. Pedal to pedal alignment is set by the rod ends that connect the pedal pushrods to the pedals and nosegear.

There are three pilot pedal positions – short, medium or long leg. Each has a different pair of rods to connect the pedals to the nose gear, and the pedals are mounted on a short, medium or long extension tube. Each pedal has a nylon sleeve between the pedal and its mounting tube. Each pedal is also retained on that tube by plastic bushes and a split pin. The tube end plug stops infestation.

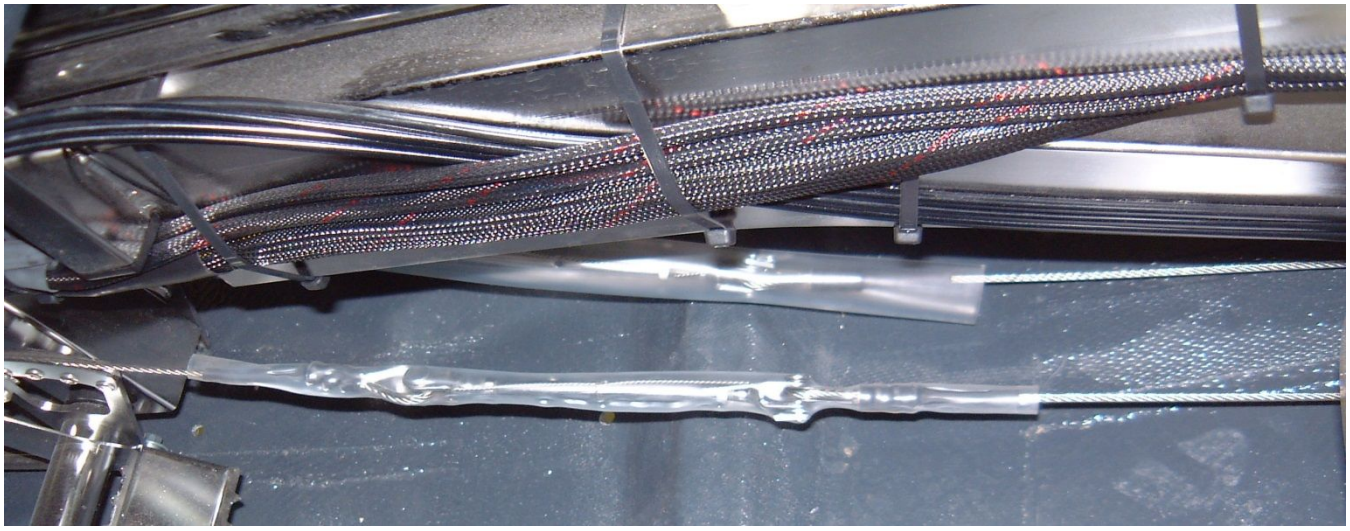
Materials available

See parts list

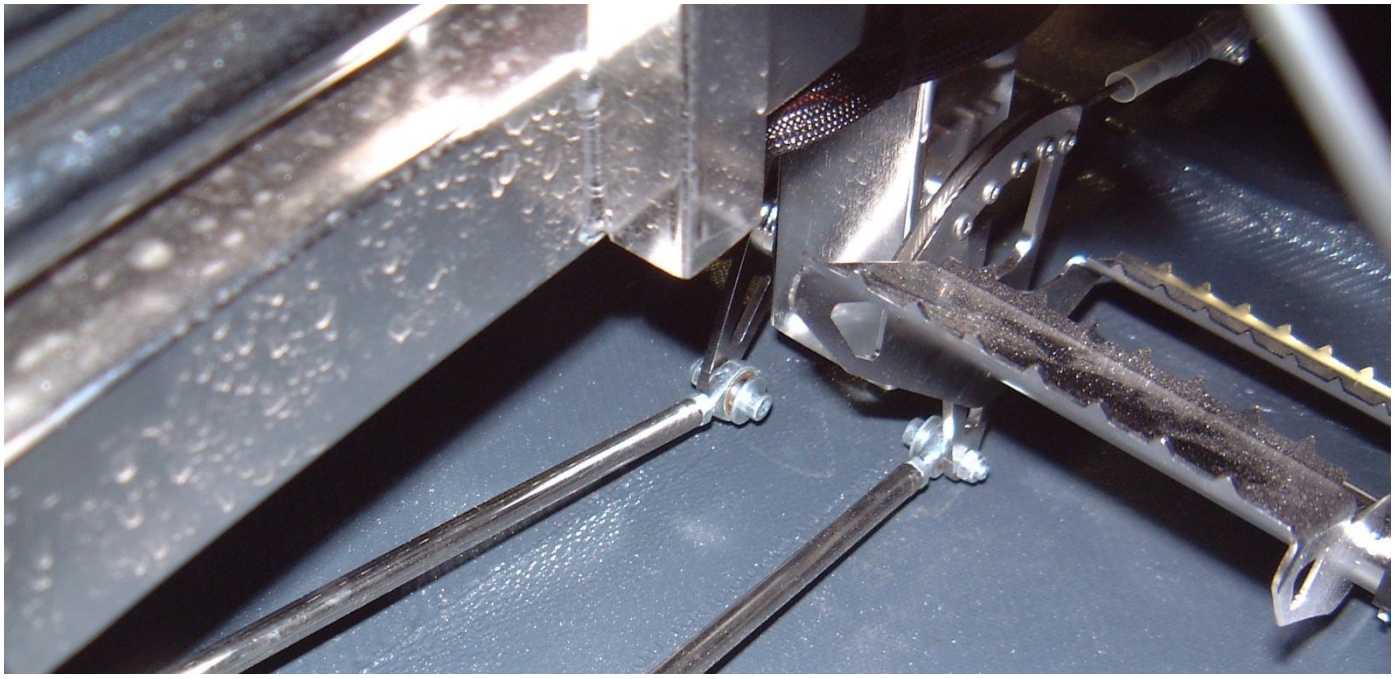
Assembly methods

System setup

1. Clamp a block across either the rear or front pedals so that they are in line.
2. Measure pedal angle to the ground with all wheels on the ground.
3. Adjust if required the non-clamped set of pedals to the angle required, making sure that they are both at the same angle. Do this by removing the bolt connecting a rod end of the rod connecting the pedal to be adjusted, and lengthening or shortening that connection. Take care to ensure plenty of thread remains engaged after adjustment – both ends of the rod have rod ends for adjustment.
4. Front foot pedals in mid position (central) are set 57deg +/-5 relative to adjacent airframe, and within 1 deg to each other.
5. Rear foot pedals in mid position (central) are set 46deg +/-5 relative to adjacent airframe and within 1 deg to each other.
6. Pedal angles may be adjusted to suit individual occupants, but care must be taken to work within these boundaries.
7. At the same time ensure that the nosegear link plate is straight ahead +/-1deg.
8. When satisfactory, tighten locknuts on pushrods, and replace any nylocks used more than three times.
9. With pedals still clamped, check rudder alignment – should be 10degrees right, +/-1 deg. Then check rudder cable tension (see below). Adjust, if required, by adjusting the turnbuckles, and if the tension is already correct, adjust each side the same amount to maintain the same cable tension.
10. Rudder movement should be 27 deg left, 47 deg right, +/-3deg. Check after adjustment.
11. After any cable adjustment re wire lock the turnbuckle and cover with shrink sleeve.



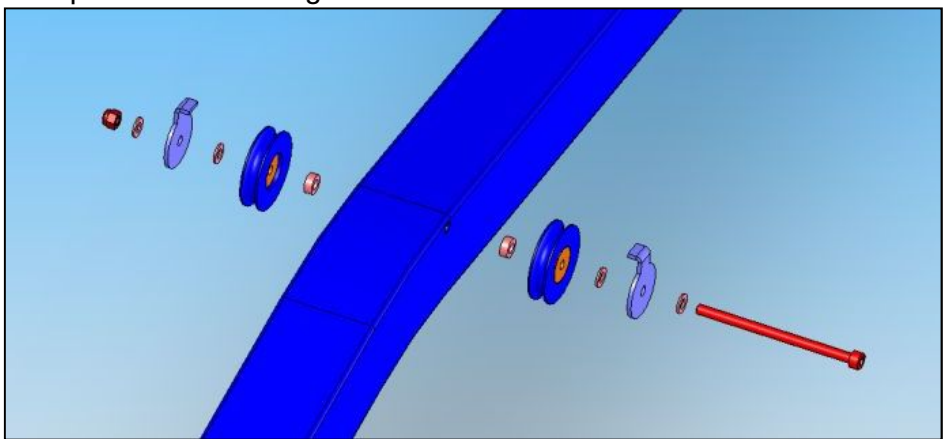
Turnbuckle sleeve, part fitted.



Rod ends connecting rods to rear pedals. Note snubbing washers under bolt cap head

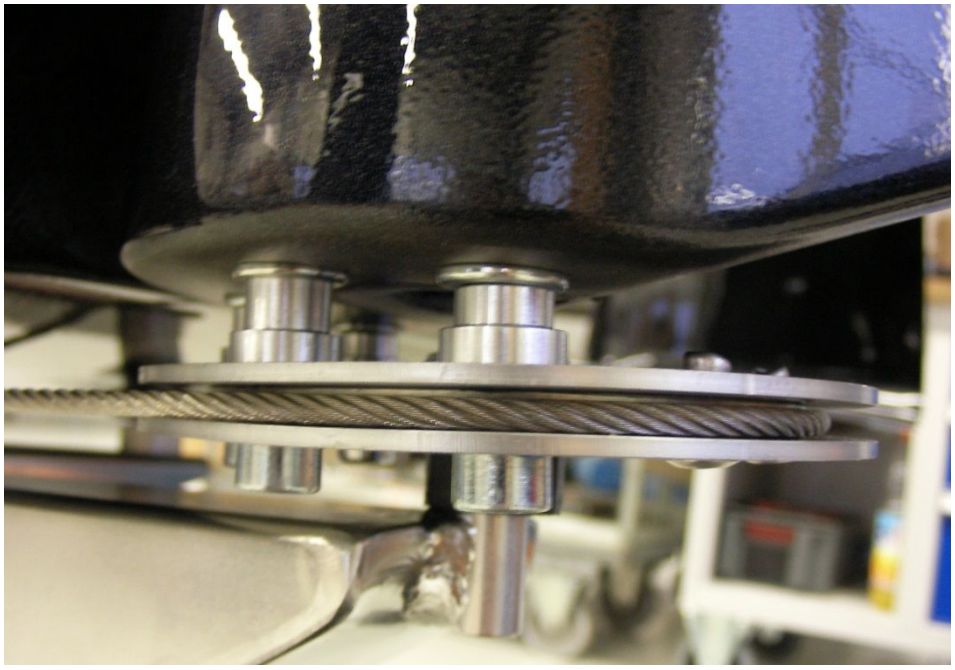
12. As an alternative to angular measurement in (9) above, with the nose wheel set straight and the pedals level the horizontal distance from the aft rudder edge to the trailing edge of the right finlet should be 860 +/- 10mm

Acceptable wire locking of turnbuckle

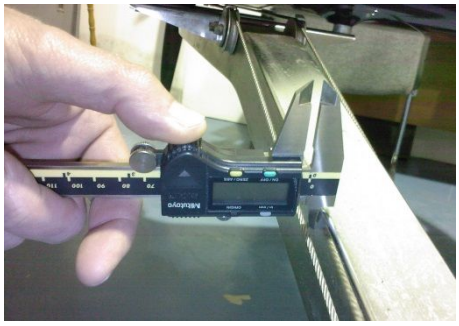


Rudder cable pulley assembly

Warning! When restraining the aircraft for road transport or for engine testing take care that these pulley installations are not damaged by the tie-down straps, and that the cable retainers are sitting above, and not rubbing on, the cables.



View of rudder mounted to culisse

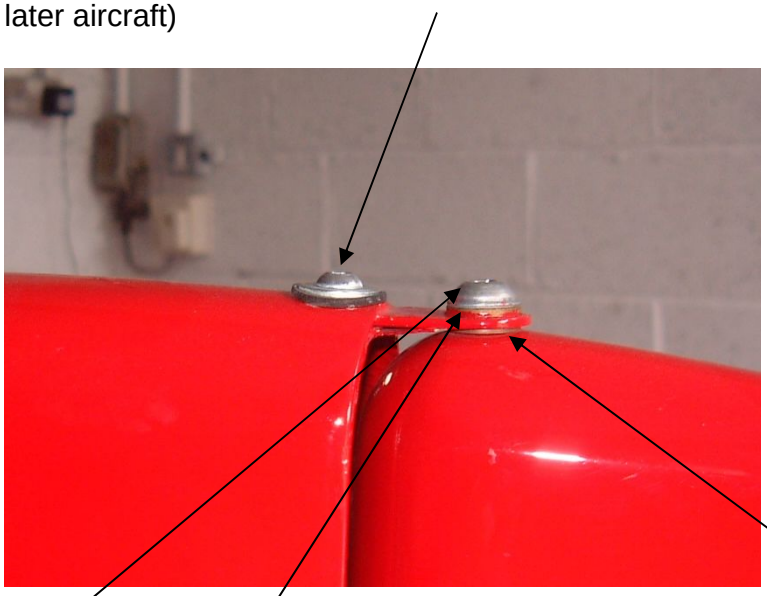


Measure gap between cable and tail boom mid way between pulleys

Apply a tensile load of 2Kg, and re measure gap. Cable should move between 8 and 24mm. Adjust turnbuckles as required.

If an excessively low tension is found inspect the airframe for (especially the keel tube) and the pedal/rudder control linkage for possible damage/deformation.

Top plate is bonded into the tail. This fastener is a failsafe (fastener is bonded inside tail on later aircraft)



M8 screw

Pivot bush
(designed to rotate in bracket, clamped to rudder)

Plastic washer
(fits around bush, and free to rotate)

View of top pivot, installed.

The rudder top bolt torque is 15Nm, with loctite 243, as are the four bottom M6 bolts. There are four spacers between the rudder and the culisse – take care, these are two different heights. The short ones are at the rear. Washers may be placed between the spacers and rudder to allow for height tolerance. The tail is mounted on the airframe via 4 x M6 bolts, 15Nm, with Loctite 243.
Washers may be added between the aluminium spacer and the airframe to centralise the fin assembly with the mast (extra pair of washers on one side of the keel), and raise the tail clear of the rudder cable. Ensure no more than two washer height difference between left and right side of the keel.
Take care that the cable guides are correctly positioned over the pulleys to prevent cables jamming and wearing.

Trim tab.

Trim tab may be positioned either side of the rudder, It is normally bent about 15 to 25deg to the left of the aircraft, and is positioned 100mm from the bottom of the rudder, The tab is supplied with a self adhesive tape – ensure the rudder surface is clean & degreased before fitment.

Repair methods

If the M6 airframe mounting hole in the tail is stripped of its thread, remove the tail and carefully drill and retap to M8. Drill the matching hole in the airframe to 8.5mm. Fit M8x35 cap head screw with washer under the head.

Cable assies; no repairs

Composites; no repairs currently authorised

Paint; touch up and match as per normal automotive repair processes.

m) Rotor head and rotor head control

Basic description
See drgs RSDS7164

All rotor head parts (excepting bolts) are stainless steel or aircraft aluminium as per the airframe.
The roll and pitch stops are set with pins and are not adjustable
Grease nipples are fitted to the rotor, and pitch/roll block.

Materials used
Head bearing spec is SKF3206 A-RS1TN9/MT33. Otherwise see parts list

Assembly methods
Pitch/roll bolts, tighten to 15Nm, then back off such that the head moves freely, and that there is no freeplay. Fit split pin. See drgs for detail.

Under modification MC-209 and service bulletin SB-061 large diameter thrust washers and small diameter shim washers are introduced into the rotor head to reduce stick vibration. There is no additional service requirement but if the gimbal block fasteners are disturbed then correct location of the thrust washers must be verified. SB-061 provides further information.

Rotor bearing nut, tighten to 160Nm+/-20Nm, backed off to next split pin hole.
The head is set so that with the stick in mid position, fully forward, the rotor head is set 1 deg to the left.

Special setup instructions
Ensure that, after all setup, the rotor head is able to reach roll and pitch stops in both directions, and that at the extremes of operation the vertical control rods are still free to rotate.
Ensure that the head rotates freely without any binding or bearing noise. Replace the bearing if any doubt.
Ensure there is no freeplay in the control system by moving the stick(s) with the rotor head held still. If found, locate the cause and rectify.

With the rear control stick in the mid roll, fully forwards position, there should be at least 25mm (-0, +10) clearance to front seat. The stick should not use the front seat as a ‘stop’ in the any position. The rotor head must be able to reach its limit stops in all control positions, and must not use the lower rod ends as limit stops.

NOTE: the bushes within the rod ends on the vertical control tubes are specially relieved type to enable the rod ends to go through the full articulation required. After assembly ensure these are in the correct positions, and check that the rod ends are free on control extremes.
NOTE. The bolts used in the control system are cut down M6 bolts, to ensure the shank is in shear load instead of the bolt threads. NEVER replace these with standard bolts, otherwise the system strength will be degraded.

Repair methods
This is a primary control system – do not take chances!
Bent tubes must be replaced
Teeter bolt or pitch/roll bolts and bushes should be replaced if noticeable wear is found. Noticeable means more than 0.2mm vertically.

Check/adjustment rotor control friction

Periodically the stick load to move the rotor head should be assessed. This will vary depending on the precise fit-out of the gimbal block bearings and the pilot's preference, but should preferably be less than 10N and never exceed 15N when measured at the top of the stick.

There are three configurations of pitch pivot construction:

- The original, unmodified build
- Embodiment of SB-061(MC-209) in which larger thrust washers are installed around the pivot
- Embodiment of SB-060 (MC-210) in which disc-springs provide precompression of the pivot

To carry-out the check the rotor must be removed.
Switch the Flight/Brake selector to "Flight" and release trim pressure completely. If necessary switch repeatedly to deplete the pressure
Attach a force-gauge or spring balance to the top-most area of the control stick and pull aftwards until the stick starts to move. Note the maximum value (breakout force).
To adjust the breakout force shim washers may be added (to increase the force) or removed (to reduce the force). Rotor vibration level will decrease with higher control friction but if the control force is too high the handling qualities will suffer
Obtain a dual signature for any work done.

Check/adjustment: Rotor Head main axis bolt

(A) The first adjustment is to adjust roll tendency. Roll tendency (to bank increasingly left or right) depends on the flight condition, such as mass and altitude, but mainly speed. Due to the turning direction of the rotor the gyroplane has a tendency to roll right at slow speed and roll left at high speed. In a certain speed range the gyroplane shows no roll tendency, i.e. flies straight with no lateral control force required.

1. Fly with medium take-off weight at 70mph, or the desired flight condition for which roll tendency is to be adjusted, and find the “no roll” speed range.
2. After landing measure the lateral position of the rotor head main bolt axis – use a feeler gauge or any other method providing an accuracy of at least 0.5mm.
3 Calculate the new lateral position assuming 0.5mm lateral shift (R or L) per 6mph intended shift in speed range

Note:
R: to correct roll tendency to the right or to adjust the rotor axis for a slower “no roll” speed
L: to correct roll tendency to the left or to adjust the rotor axis for a faster “no roll” speed

4. Remove and discard split pin (1). Undo castle nut (2) and adjust main bolt to new lateral position. Make sure to maintain longitudinal position (backlash of gear) constant. Tighten castle nut with a torque enough to fixate adjustment and recheck position.
5. Tighten castle nut to 160 +/-20Nm and recheck position. If necessary revisit step4. Back-off nut (maintain minimum 140Nm) until split pin can be inserted and formed. Check clearance of split pin against rotating parts.
6. Perform duplicate inspection then test-fly the result. If necessary repeat the adjustment.
7. Inspect the wear pattern and the pre-rotator gear mesh. If in doubt contact RSUK
8. Apply a small amount of axle grease to the ring-gear ensuring that the brake pad is not contaminated

(B) the second adjustment is to adjust the pre-rotator bendix gear pinion engagement with the ring gear. The backlash should be as tight as possible, but also wide enough to allow easy engagement of the bendix gear into the ring-gear in any position.

1. Remove and discard split pin (1). Undo castle nut (2) and adjust main bolt to new longitudinal position. Make sure to maintain lateral position (roll tendency) constant. Tighten castle nut with a torque enough to fixate adjustment and recheck position.

Note:
Fwd: increase pre-rotator backlash (less tight)
Aft: reduce pre-rotator backlash (tighter)

2. Tighten castle nut to 160+/-20Nm and recheck position. If necessary revisit step1. Back-off nut (maintain minimum 140Nm) until split pin can be inserted and formed. Check clearance of split pin against rotating parts
3. Perform duplicate inspection

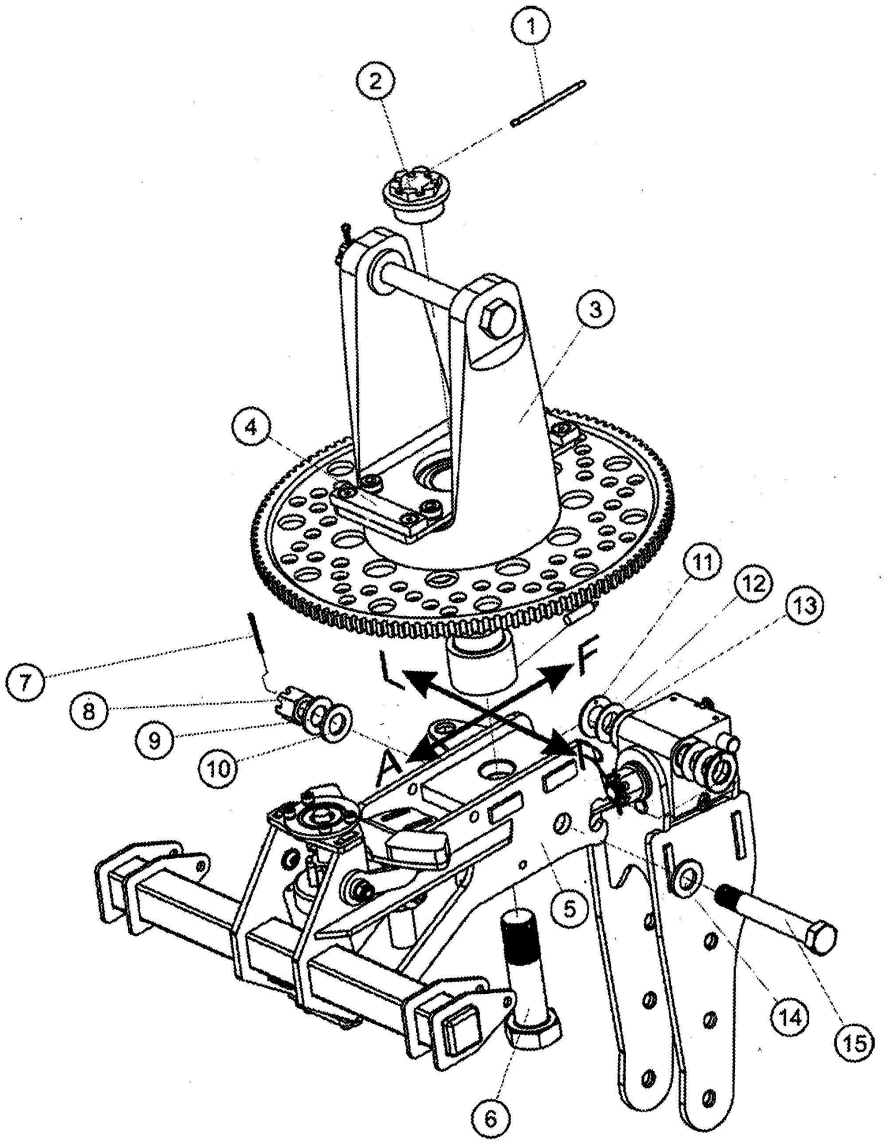


Fig. 1 - Adjustment of rotor head main bolt axis

Note: it should not be necessary to make either of these adjustments more than 0.5mm. If in doubt refer to RSUK

n) Fuel system

Basic description

See fuel system drawings RSDS7160 912ULS and RSDS7161 914UL.

The fuel system is under the rear seat and has a capacity of 35 ltr per tank. The tank is ventilated by a ventilation line above the tank to the rear of the mast. Tank level control is via sight lines on the side of the tanks and a fuel gauge on the instrument panel (see instrument panel). Tanks are marked at zero with 3.4ltr per tank, in line with the MT-03. Tanks are manufactured Polypropylene. Tanks are retained in the aircraft with two straps, holding them tight to the airframe (see photo). They are located axially via welded on upstands on top of the tank that locates in the airframe. These prevent tank forward detachment in an accident. The left tank is always the master tank – feeding the engine, and taking the return feed from the turbo fuel regulator. It also has the fuel level gauge capillary tube fitted from the top (or the sensor tube if an electric fuel gauge is fitted)

The right tank is the header tank, feeding the left via a crossover tube under the keel. This crossover tube also carries a fuel drain.
Each tank is filled via the filler at the top of the tank. These filler caps are retained via a plastic loop to the tank neck, with an additional plastic tie for added security.

Tank fittings: The exit fittings from the tanks carry gauzes to prevent large objects entering the supply system. There are two feed supplies to the engine, comprising a rubber bushing and a push in fitting (with a gauze filter). This allows increased use of fuel tank contents, particularly in a steep nose down descent with low fuel.
Each fuel tank is also fitted with a fuel water check valve. This is fitted with a castellated nut inside the tank, with the castellations facing DOWN so that they embed in the tank when tightened. The unit is also wirelocked to the fuel crossover exit fitting.

Each tank is filled via the filler at the top of the tank. These filler caps are retained via a plastic loop to the tank neck, with an additional plastic tie for added security.

The original fuel hose fitted was Trelleborg Hydro K (which is subject to CAA MPD2010-001), with approved alternative of Semperit TU10 or FUHT. These 8mm hoses are proven to be fire resistant, and are mandatory fit in the engine bay.
Semperit TU10 hose is released to service as an alternative to Hydro K under SB-012. Note that the hose outer diameter is smaller than the equivalent Hydro K, so the hose clips are a size smaller.
Semperit FUHT hose is released to service as replacement for either of the above hose types under MC-129

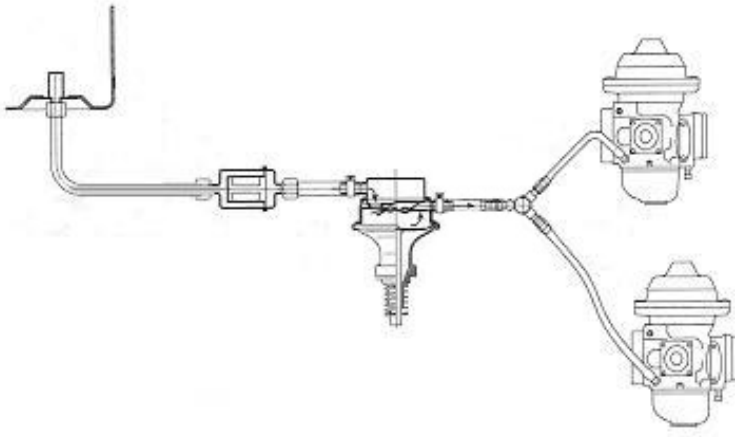
The fuel supply from the tank to the 912ULS mechanical pump is from the front of the tank to the fuel cutoff valve on the left side of the enclosure (where fitted), and then back under the left tank to the filter mounted on the right of the mast (See installation drg). The filter is a mesh type, push fit into the hose. The hose then continues to the mechanical pump, and then to both carburettors.
The fuel supply to the 912ULS backup electrical fuel pump is direct; there is no cut off valve, and the fuel can be shut off by turning the switch off on the panel. The mesh filter is sited directly prior to the pump, with an additional filter after the pump. This latter filter is to prevent pump debris (in the event of pump component break up) entering the carburettors. The feed from here goes directly into the crossover feed between the carburettors.

The 914UL carries two electrical pumps. One is isolated by the panel switch, the other by the keyswitch when turned off. Both carry the same pre filter, and enter one common or two separate post pump filters, feeding into the fuel regulator valve on top of the engine. The tank

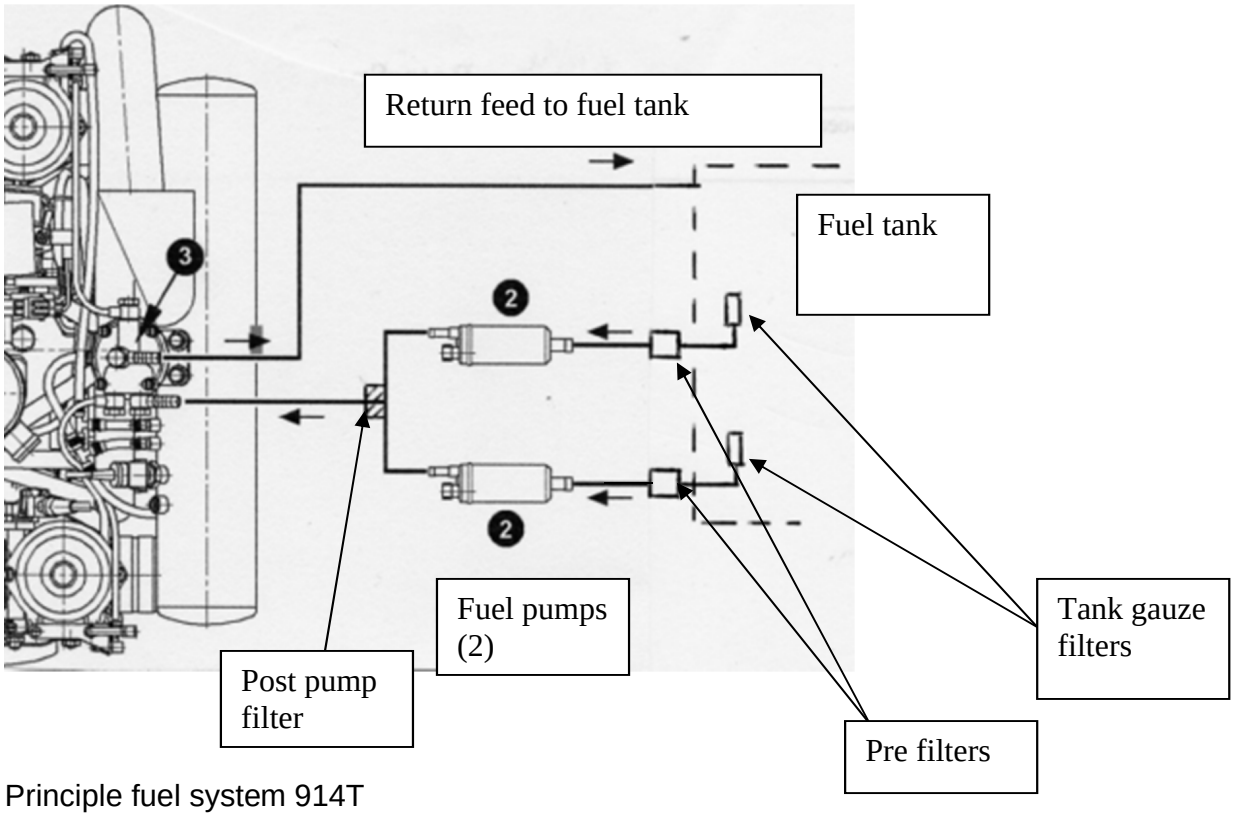
fittings are identical to the 912ULS, and the keyswitch operated pump is fed from the front tank.

The return fuel bypass line from the regulator feed into the top of the left tank via a length of clear hose. The clear hose is there so that fuel can be observed to be flowing. This hose must be Gutasyn or equivalent fuel resistant hose – to comply with CAA MPD1998 019R1.

Principle sketch fuel system 912S mechanical pump



The engine mechanical pump is backed up with an electrical fuel pump.



Principle fuel system 914T

The fuel system also has a low fuel level warning sensor, integrated with a low voltage sensor. The electronics are contained in a grey control box located behind the instrument panel,

supplied by Avcomm. The warning lamps are 6v red leds, and the level sensor is an LED sensor fitted to the rear of the left fuel tank. The height is such that it will switch on at around 5ltrs of fuel.

Materials used
All hoses within firewall area (rear of the battery) were Trelleborg HydroK (which are subject to CAA MPD2010-001). Alternative approved hose is Semperit TU10 or FUHT
See parts list.

Assembly methods
All hoses are connected via snap over or side crimp fittings. See assy drawing.

Special setup instructions
Ensure that the crossover tube drain point is wirelocked after use, and is sealed with the minimum amount of PTFE tape.
Tank fitting connections should not be made with PTFE tape – excess tape can block fittings and cause system malfunction. Use Loctite 5331 on the threads.
Ensure tank straps are pulled tight if disturbed or replaced, without distorting the tanks. Cut off excess.
If the hose runs are disturbed, check after replacement for possibility of fretting against objects that would damage or cut the hoses. Use additional ties as required, with short lengths of hose on the ties to act as distance pieces.

Repair methods
Individual hoses may be replaced from roll stock.
If the nylon mesh filter is replaced because of visible contamination, change the post pump filter at the same time and inspect/clean the built-in strainer of the electric pump(s). If the strainer is damaged it must be replaced.
All fuel filters must be changed every 500hrs/3years (whichever sooner) due to potential algae growth or general deterioration. Mechanical fuel pumps are also life-limited items – see Rotax publications.
Water in the tanks can be drained quickly by draining the crossover tube, or via the individual tank drains. This is, however, a messy method if the fuel system is simply to be drained. In this case it is easiest to disconnect the fuel return hose (on a 914) and use the electrical pump to pump the system out into a suitable receptacle.

Use of unleaded MOGAS is highly recommended. Leaded fuel contains additives (eg lead) which have a detrimental affect on the engine spark plugs, pistons, and slipper clutch.

Fuel filter replacement
1. Before disconnecting any fuel lines temporarily clamp the hoses to prevent fuel spillage
2. Disconnect the filter and replace with new, reconnect the hoses
3. Remake or replace the hose-clips (depending on type)
4. Remove the clamps and check for leaks

Mechanical fuel pump replacement (912ULS)
See the Rotax engine manual

Electric fuel pump replacement (912ULS and 914UL)
1. Ensure that the electrical system is switched-off and protected against unintended activation
2. Temporarily clamp the respective fuel hoses to prevent fuel spillage

3. Unscrew both terminal nuts and disconnect both ring-eye cable terminals. Note that these have different diameters to ensure correct polarisation
4. Disconnect the fuel lines
5. Release the clamp and remove the pump
6. Install the new pump in the clamp and tighten
7. Replace the cable terminals observing polarity. Use securing lacquer on the nuts and threads
8. Reconnect the hoses ensuring no twists or kinks
9. Remake or replace the hose clips (depending on type)
10. Remove the temporary clamps from the fuel hoses
11. Activate the fuel pump and check for leaks

Low-fuel sensor replacement

All UK-registered MTOsport aircraft have the low fuel/low voltage warning system described above. However, under modification MC-146 the aircraft may have been retro-fitted with an alternative low-fuel sensor.

The first sensor used (Honeywell) is a black plastic device. The second sensor (Optomax) is a metal bodied device. Both types are fitted from inside the fuel tank and are retained by an external back-nut. Electrical connections are made by white plastic connector(s).

In 2010 service bulletin SB-028 was published recommending replacement of the Honeywell sensor with the Optomax type – this is now subject to service information letter SIL-013 recommending replacement every two years.

o) Roll trim

Basic description

Roll trim is an option fitment. It comprises a panel mounted indicator fitted horizontally, with placard indicating roll direction, and a servo actuator mounted under the RHS of the front seat. The actuator is connected via a rigging link and a length of bungee to the upper horizontal control tube. The bungee cord is wrapped twice around the tube such that there are four bands, and then knotted. Spare bungee is tie wrapped to the rest.

The servo is retained to the seat support tube via a bracket. This is prevented from moving towards the control tube by the seat bolt.

Operation of the trim is by pushing the top hat switch on top of the stick either right or left. Left movement moves the servo towards the stick, reducing tension on the bungee.

Assembly methods

None specific

Materials used

Bungee cord 6mm

Special setup instructions

Tension the cord to give 1Kg of force to hold the stick central (measured on the hand grip) with the roll on full right trim. Check that on full left trim there is no trim force with stick central.

Ensure that indicator direction matches direction of actuation.

Repair methods

Bungee may be replaced by removing and replacing cord, and re-tensioning as above.

Intentionally blank

p) Woodcomp SR3000/3 propeller and Smart Avionics constant speed controller

Basic description

NOTE! Refer to the propeller manual RSUK0076!

The propeller is an SR3000/3/R/P/CS/C-****RS, specifically designed for the MT series application. This means that there are internal designs that make the product unique, and it must not be replaced by propeller other than the part supplied by RotorSport UK Ltd. The four '*''s indicate a three digit serial number plus the year of manufacture. At the root of each blade is a special self-adhesive label stamped with the propeller serial number, the order of the blade (A, B or C) and the month/year of manufacture.

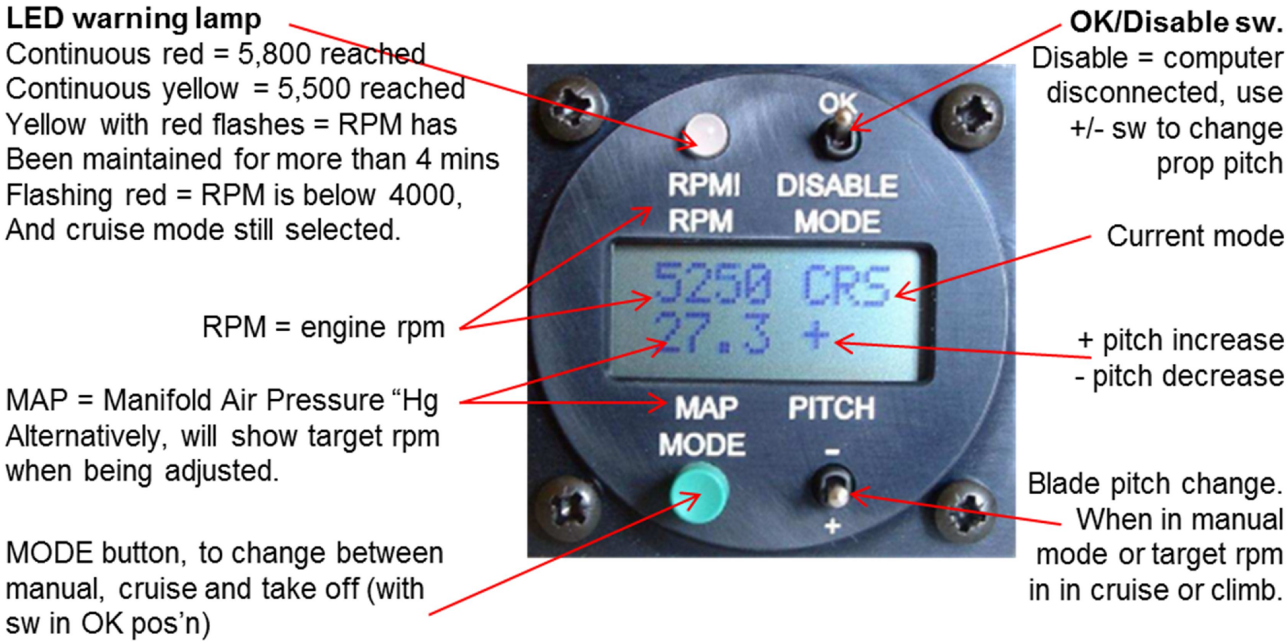
Construction: The blades comprise a wooden core, with layers of carbon fibre on top for protection. The leading edge is protected on the outboard length by a moulded-in section of polyurethane, and on the inboard area by a special tape(replaceable). Each blade has an aluminium hub, which locates the blade into the propeller hub.

The hub is split into two halves for assembly. The blades are located in the hub in bearing bushes, and have worm drive gears on the ends to allow adjustment in flight. The drive to those gears is from a 12v DC motor, via a gearbox.

The motor unit is covered by a spinner, attached to the propeller backplate by 6 screws (loctited with 243)

The hub is retained to the gearbox propeller flange via a unique pre rotator drive wheel.

The flanged nuts normally located in the propeller flange are removed, and replaced with top hat bushes, which locate through the flange and wheel into the rear of the propeller hub. The attachment bolts are pre fitted inside the propeller hub, & slide through the bushes. Nylock nuts retain the bolts, together with a tabbed washer.



The Smart Avionics CSC-1/RS controller is a unique part for this aircraft, pre programmed to suit the application. Do NOT fit any other controller

More information is provided in the CSC-1/RS controller handbook.

Pilots view of controller. This controller replaces the existing engine rpm gauge.

Adjacent to the controller is a single LED, which indicates when power is being supplied to the propeller, and a pop out fuse, which protects the propeller power supply.

By the pilots hand is a rocker switch, which provides the same function as the 'pitch' sw on the controller.

Principles of operation.
The propeller assembly is an in-flight variable pitch design. Pitch of the three blades is adjusted simultaneously via a gear system inside the propeller. The gears are driven by a 12v motor. The motor is supplied with current via two slip rings on the engine face of the propeller assembly.

The blade pitch angle is limited initially via microswitches driven on cams. In the event of a switch failure, or incorrect cam setting, there are end stops in each propeller that prevent excess travel in either direction. These end stops locate in machined stops inside the propeller.
The propeller pitch angle relationship to engine rpm is managed either manually by the pilot, or via the constant speed controller. With the 'mode' sw in disable, the controller function is completely bypassed, such that the pitch angle may be changed by the pilot by either using the rocker switch (optional), or by using the controller 'pitch' sw.
With the controller sw in 'OK', there are three modes available; manual, climb, and cruise. The basic rpm limit settings of the controller are set in the factory, and not user adjustable.
It is not possible to re programme the controller other than at RotorSport UK Ltd or Smart Avionics.
Both the controller and the propeller are fed from the same 25A fuse, with a 10A pop out fuse for the propeller actuation supply, and a 1A fuse for the controller itself.
The propeller will take up to 5seconds to cycle between fully fine and fully coarse.

Assembly methods
The propeller attachment bolts are tightened to 25Nm, and the locking tab washers bent over to prevent rotation.
The controller requires an adjacent placard to identify the engine rpm and manifold pressure (914UL only) limits.

Materials used
No consumable materials.

Special setup instructions

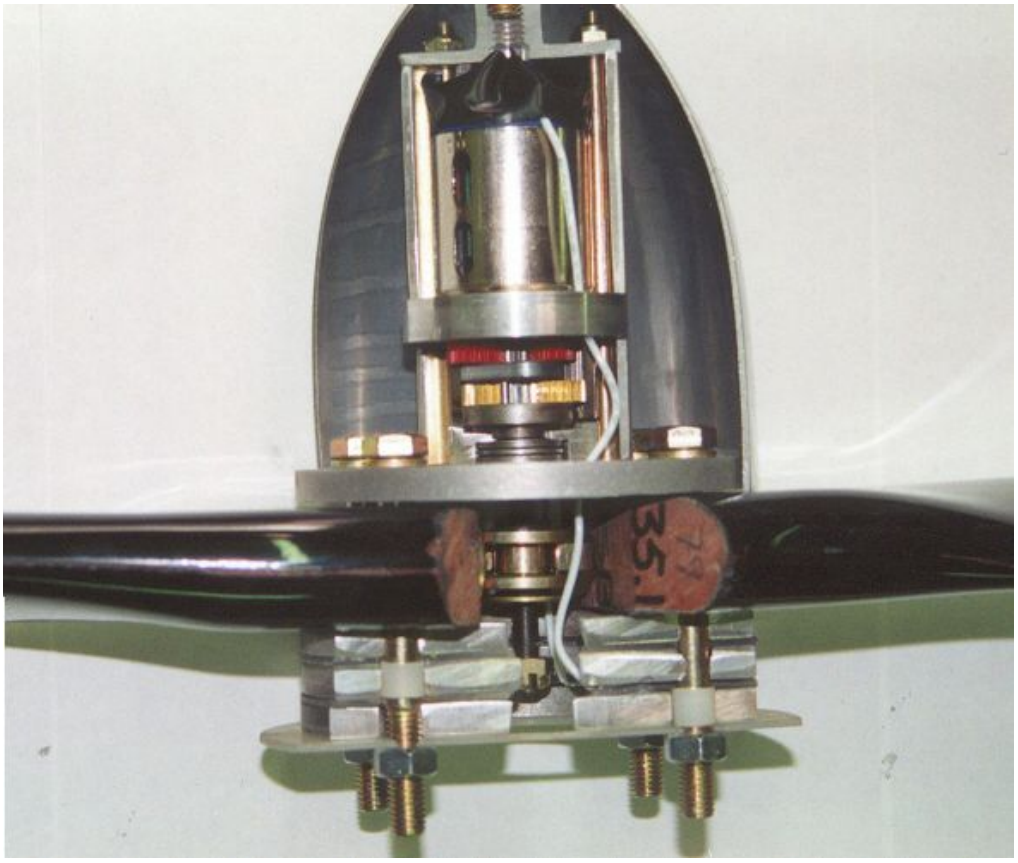
The propeller is electrically actuated via slip rings on the engine face.
WARNING! Cleanliness of this face is important, do NOT apply corrosion preventative substance to the slip rings! It will prevent them from functioning!

When re-assembling the propeller it is very important to ensure the blades are set with the same pitch angle, within 0.5deg of each other.
The screws fastening the brush box to the mounting plate, and the bolts fastening the plate to the gearbox, and the screws retaining the cables to the brush box must be loctited with loctite 243.
The cable crossing the engine is protected with heat resistant sleeving.
After fitment, always check that the propeller pitch direction of operation matches the controller, and that the seat switch (where fitted) also matches the controller – i.e., forward or up is pitch reduction.
The blade electrical pitch limit stop setting must be (+/-1deg)
Fine pitch 13.5 (912ULS) or 15.5 deg (914UL) deg
Coarse pitch 18.5deg in (912ULS) or 20.5deg (914UL).

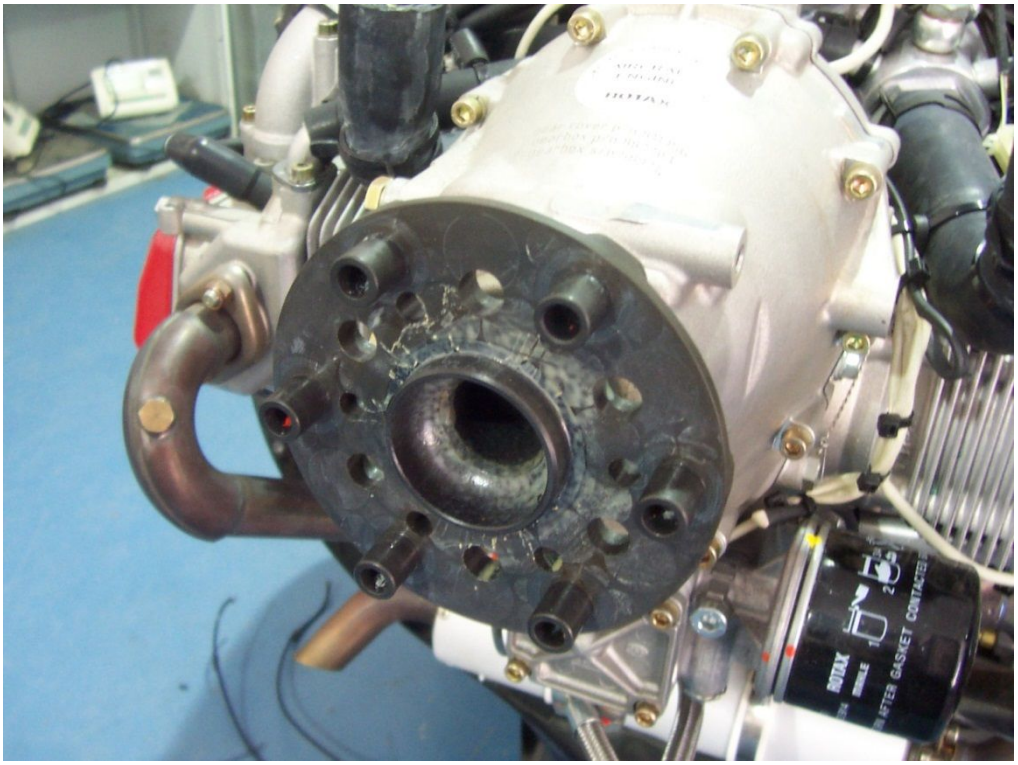
Service and Repair methods
Refer to the Smart Avionics CSC-1 controller handbook for troubleshooting the controller.
Refer to the F106 Woodcomp service sheet, and to the Woodcomp maintenance manual for the methods and techniques of disassembly and re-assembly of the SR3000/3 prop, and of the brush assembly.

q) IVO-prop DL3-68 in-flight variable pitch propeller option

Basic description
NOTE! Refer to the propeller manual RSUK0325!
The propeller is a DL3-68" three-blade, specifically released for the RotorSport application. This means that there are internal designs that make the product unique, and it must not be replaced by a propeller other than the part supplied by RotorSport UK Ltd.
Construction: The blades comprise a resin core, with layers of carbon fibre on top for protection and structural strength. The leading edge is protected on the outboard length by a bonded-on section of stainless-steel foil. Each blade has a substantial flat root area and two 3/8" high-tensile precision bolts are used to attach this to the aluminium hub pieces (the hub is split for assembly). The blades are bolted rigidly to the hub and the change in pitch is effected by twisting each blade along its length (there are no bearing bushes). The twisting torque is produced by a servomotor mounted in the hub and is transmitted through the blade section by an internal torque tube.
The motor unit may be covered by a composite spinner, attached to the propeller backplate by 9 screws (Loctited with 243) and nylon washers
The hub is retained to the Rotax gearbox propeller flange by countersunk M8 socket-head screws and the engine torque is transmitted to the propeller by "torque bushes" in the normal way.

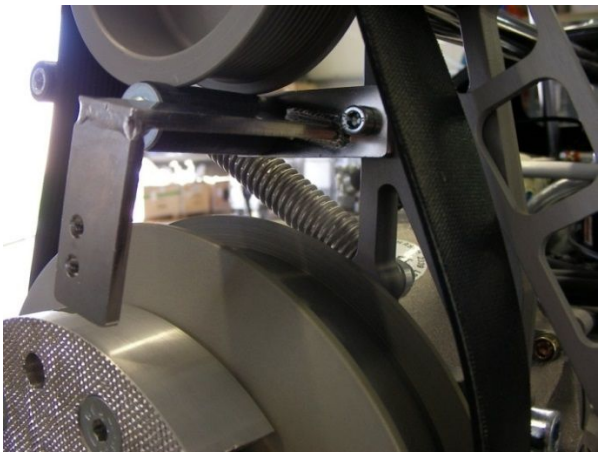


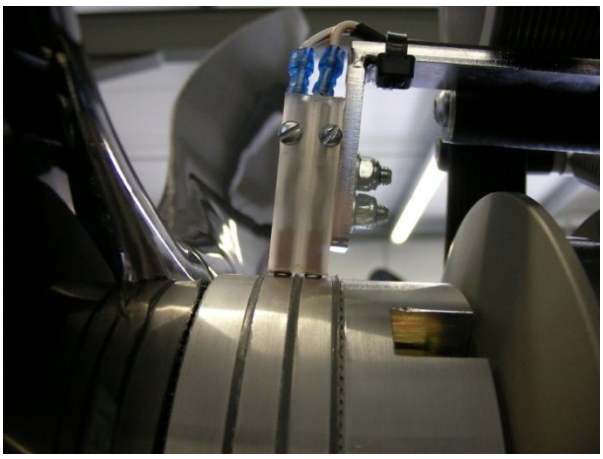
Propeller construction



Propeller mounting flange with Rotax captive nuts fitted

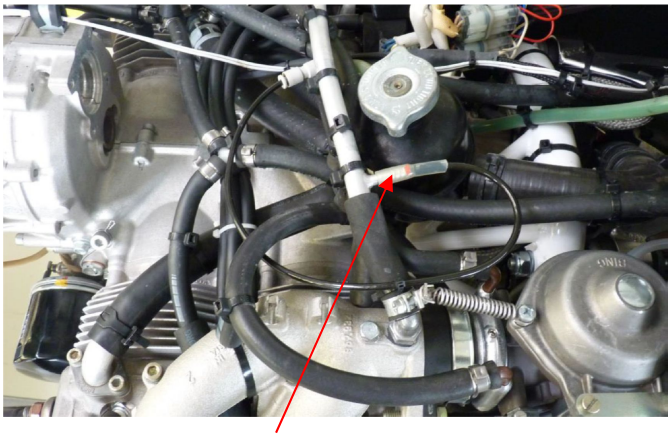
12VDC power is supplied to the propeller by means of two slip-rings in the hub assembly and a brush box mounted on a fabricated bracket at the rear of the engine





Brush protrusion is approximately 0.5mm

The manifold pressure connection is made to a spigot already fitted the carburettor balance pipe on the engine. A 4mm industrial plastic tube is pre-fitted to all aircraft to transfer this pressure from engine to gauge.



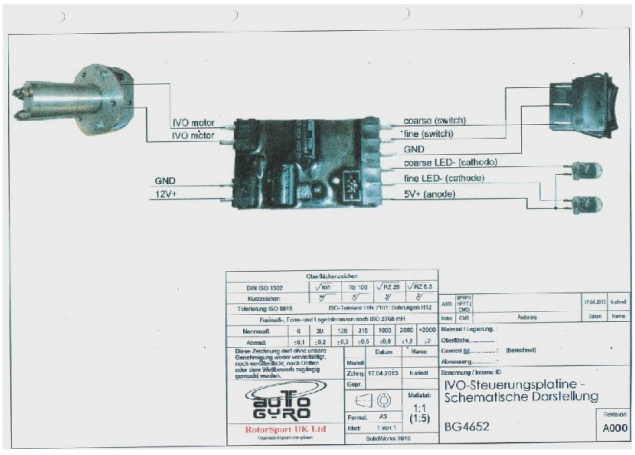
Pressure connection

Control: There is no constant-speed controller fitted to the RSUK IVO-prop installations and pitch adjustment is made manually by means of a rocker-switch mounted on the left fairing of the front seat. There are no micro-switches to limit blade movement so the control system utilises a bespoke circuit-board (the end position controller) which detects the rapid rise in current and disconnects motor power when each pitch limit is reached. Two amber LED indicators mounted adjacent to the engine rpm gauge provide status information:

Both LEDS off	Propeller is not at an end position and no pitch change command active
Upper LED blinking	Propeller changing pitch to FINE
Lower LED blinking	Propeller changing pitch to COARSE
Upper LED steady ON	End position FINE reached and electronic pitch inhibit FINE activated*
Lower LED steady ON	End position COARSE reached and electronic pitch change inhibit COARSE activated*
Both LEDS flashing fast	Actuating motor does not work despite rocker switch activation. Possible defects, e.g. brushes worn, cable break.**

*Electronic pitch change inhibit is deactivated after selecting pitch change in opposite direction for at least 1 second

**Indication can only be reset by switching the master switch temporarily to OFF and then back to ON. In order to avoid pilot distraction, indication of a possible defect is retriggered after another activation of the rocker switch



Both the end-position controller and the propeller are fed from the same 25A fuse mounted in the main fuse holder at the base of the instrument panel.

The propeller will take up to 10seconds to cycle between fully fine and fully coarse.

Principle of operation:
The propeller assembly is an in-flight variable pitch design. Pitch of the three blades is adjusted simultaneously via a cam system inside the propeller. The cams are driven by a 12v motor. The motor is supplied with current via two slip rings in the propeller assembly and a brush-box mounted on a fabricated bracket at the rear of the engine.

The blade pitch angle is limited by thrust washers (selected for each engine type) and the end-position controller removes electrical power from the motor when the thrust washers reach their end-stop.
The propeller pitch angle relationship to engine rpm is managed manually by the pilot with the aid of a manifold pressure gauge. The characteristics of each engine type (912ULS normally aspirated or 914UL turbocharged) are different so the Pilots Handbook RSUK0043 is furnished with a look-up table for use by the pilot.

ROTAX 912 ULS

Power setting	Engine RPM	MAP	Fuel flow [ltr/h]
Max. TOP	5800	27.5	27
Max. MCP	5500	27	26
75% MCP	5000	26	20
65% MCP	4800	26	18
55% MCP	4300	24	14

ROTAX 914 UL

Power setting	Engine RPM	MAP	Fuel flow [ltr/h]
Max. TOP	5800	39.9	33
Max. MCP	5500	35.4	26
75% MCP	5000	31	20
65% MCP	4800	29	17.5
55% MCP	4300	28	12.5

MCP – Maximum Continuous Power
TOP – Take-Off Power
MAP – Manifold Absolute Pressure

NOTE

Above data is valid for standard conditions at sea level. Keep in mind that engine and propeller performance is affected by altitude and temperature. For detailed information refer to the engine manufacturer's and propeller manufacturer's documentation.

Three types of manifold pressure gauge are available:

- Analogue scale with limit placards for 912ULS normally aspirated engine
- Analogue scale with limit placards for 914UL turbocharged engine
- Digital combined engine rpm/manifold pressure gauge.

This replaces the analogue engine rpm gauge to the left of the main instrument panel. It has operational limits pre-programmed into its memory.

Gauge kit for 912ULS

Gauge kit for 914UL

Digital combined gauge

Assembly methods
The propeller-to-gearbox flange attachment bolts (M8 countersunk) are tightened to 25Nm, and are thread-locked with Loctite 243. The propeller main bolts (3/8" hex-head, AN5-36A) with MS21044-N5 nyloc nuts are tightened (and periodically checked) to 40Nm.
Both sets of fasteners are torque-marked (M8 countersunk screw end to propeller flange) and 3/8" hex-nut to bolt thread) – 6-places each.

Materials used
No consumable parts required

Special setup instructions
The propeller is electrically actuated via slip rings on the engine face.
WARNING! Cleanliness of this face is important, do NOT apply corrosion preventative substance to the slip rings! It will prevent them from functioning!

When re-assembling the propeller it is very important to check the blades have the same pitch angle, within 1.5deg of each other.

The screws fastening the brush box to the mounting bracket, the bolts fastening the bracket itself, and the screws retaining the cables to the brush box must be threadlocked with Loctite 243.

After fitment, always check that the propeller pitch direction of operation matches the rocker-switch.

There are no electrical micro-switches to limit the pitch angle as the mechanical limits are determined by thrust washers selected on propeller assembly.
The nominal achieved pitch angles are:

Fine pitch 13.0deg (912ULS) or 14.0deg (914UL).
Coarse pitch 20.0deg (912ULS) or 21.0deg (914UL).

The pitch angle is relative to the propeller hub and is measured just inboard of each propeller tip with the blade leading-edge set horizontal.

Note; fine pitch setting is adjusted to achieve approx. 5600rpm on the ground, and no more than 5750rpm in the climb!

Service and Repair methods
Refer to the F189 IVO-prop service worksheet, and to the IVO-prop maintenance manual RSUK0325 for the methods and techniques of disassembly and re-assembly of the propeller, and of the brush assembly.

Section 10

Modifications approved to date

For the listing of all approved modifications see the RotorSport website owners section where they are all listed, or the Type Approval Data sheet (TADS) from the CAA website.

Service Bulletins issued to date

For the listing of all approved service bulletins see the RotorSport website owners section where they are all listed.

Service Information Letters issued to date

For the listing of all service information letters see the RotorSport website owners section where they are all listed.

If in doubt about any service instruction, or service method, then refer to RSUK on the form F023 below.

This form is supplied to enable the owner/operator/maintainer to request factory support for a repair not documented in the maintenance manual supplied with the aircraft from RotorSport UK Ltd. Depending on the problem identified, a corrective action is investigated and, if needed, CAA involvement and approval obtained prior to repair authorisation.

The information given is stored on a computer, and is only used within RotorSport UK and the CAA for the above purpose.

Return this form to:
RotorSport UK Ltd, Poplar Farm, Prolley Moor, Wentnor, Bishops Castle, Shropshire
Or email info@rotorsport.org, or fax 01588 650769

Aircraft type	Aircraft serial No.
Aircraft Registration No.	Aircraft Engine No.
Logbook Aircraft hours	Logbook Engine hours
Owner/operator name & contact detail	Maintenance organisation identified to carry out repair & contact detail

Repair problem description & cause of problem if known

Name and address of contact person for this request

Sheet of

Signature & date

Telephone:
Email:

Date entered onto CCAR or REPAIR database: CCAR No.: REPAIR No.:	Acknowledgement sent (date) Final reply sent	Job opened by (name & sig) Job closed by: (name, sig & date)

Form F023 issue 4 Part 1 of 2

This form (Part 2 of 2) is the response from RotorSport UK Ltd to a Service Repair and Evaluation/Approval request, which specifies the company authorised repair method. Deviation from this method renders the authorisation ineffective.
Upon completion of the repair the repairer must enter details into the logbook/worksheet with the repair number and sign as normal.
If any problems with carrying out the work authorised, contact RSUK immediately on +44(0)1588 650769, or email info@rotorsport.org.

Repair No. and Issue:	**CCAR No.:** **Mod approval No:**	Repair classification: **MAJOR** or **MINOR**
Aircraft type	**Aircraft serial No.** **First application:**	

Repair problem description & cause of problem if known

Limitations on implementation

Approval statement.
The technical content of this document is approved under the authority of the UK CAA Design Organisation Approval Ref: DAI/9917/06.

Tooling required.

Weight and balance.

Manuals affected.

Previous modifications affecting this SRA.

List of materials required to complete this SRA:

List of components required to complete this SRA:

Interchangeability:

Parts disposition:

Accomplishment instructions/details of the repair:

Reference to other documentation:

Test and inspection records:

Special Tools & Health and Safety requirements, and/or components required for repair:

Quality Inspection requirements after repair:

Flight test requirements after repair:

Documentation completion:

Service repair authorised by: (name, signature, and date of signature)

Quality Control Manager	Engineering Manager	Chief Test Pilot (where an effect on flight performance or safety)	CVE	Head of Airworthiness

Document effectivity date:

Form F023 Issue 4 Part 2 of 2