Maintenance Manual

Gyroplane Type Calidus (UK spec only)

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CAA Approval No: DAI/9917/06

Applicability

Aircraft Registration:	**G-**
Aircraft serial no.	**RSUK/CALS/**
Engine type:	**Rotax 912ULS & 914UL**
Engine serial No:	
Rotor blade type & diameter:	**Autogyro 8,4m rotor system (orange cap only)** **or** **Autogyro 8.4m RotorSystemII (red cap only) when modified under SB-039** **or** **Autogyro 8.4m RotorSystemII TOPP (blue cap only)** **NB: all types have silver spacers (clamp profiles)**
Propeller type:	**HTC 1,73m with or without spinner.** **or** **IVO-prop DL3-68 in-flight variable pitch propeller**

Calidus gyroplane, fitted with semi enclosed canopy

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			4	13.03.12	
1	14.01.11		5	01.07.13	
2	08.06.11		6	10.06.14	
3	12.9.11		7	12.04.16	

Issue	Change summary
5	Life limitations table (p10), Inspection after operational incident (p13-14), Supplemental inspection (p15), Flight test requirement (p17, 18). Inspection of rubber bushings (p28), oil hoses (p36), MC-255 ref added (p37), further information 914UL (p61), warning on Binx nuts (p77), thrust washers (p78), teeter bushings (p79), Improved pre-rotator gearbox and clutch series II/III (p84), Trim cylinder seal kit (p86), Flymap 3 AHARS (p95-96), Baro fittings (p97), AI option (p97). different rpm gauges (p102), ATR833 audio socket (p101), MC263 ref added, (p102), nitrogen-filled tyres (p106), nosegear rubber replacement (p106), new nosewheel (p106), push-pull cables (p120), base control unit (p121), rotor head main bolt adjustment (p122), fuel sensor two years (p127), Fuel filters life limited (p128).. Form F023 updated. All pages republished at Iss5 01.07.13.
6	Life limited parts revised (p9), Section 10 now IVO-prop VP propeller (p136-142). Modifications, service bulletins, etc. now Section 11 (p143)
7	TOPP rotor option added p2, p5,p6-7,p9, p68, p117 All pages republished at Iss7 12.04.16

Signature:	Signature:	Signature:
Graham Shaw Apr 27 2016 9:06 AM Position: Eng. Manager	Gerry Speich Apr 26 2016 2:06 PM Position: Head of Engineering	Andy Lyons Apr 28 2016 6:29 PM Position: Head of Airworthiness

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SECTION 2

FOREWORD

1. Applicability

This Schedule is intended for use on the CALIDUS Gyroplane only, released on AAN29266.

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 Calidus blade BG1448 (orange end caps)	700 hours
Rotorsystem II 8.4m BG1793 (red end caps)	2500 hours (fixed)
Rotorsystem II 8.4m BG8946 (blue end caps)	2500 hours – see below This (fatigue) life limit of 2,500hrs assumes 2.8 (500Kg MTOW) ground-air-ground cycles per flight hour on average over the 2,500hr life. Operational use in excess of these values will reduce the safe life of the rotor accordingly. GAG cycles should be recorded in the aircraft logbook.
Rotor main bearing	1500 hours

NB: as the publication of this table will have retrospective requirements on some aircraft, the affected component(s) must be replaced no later than the next Annual Check

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.

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. RSUK0061 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, gapping, 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 Calidus).
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 (e.g. RSUK or other CAA Authorised engineer).
Use form F115 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 the case where the turning rotor has hit the tail or rudder, a detailed inspection of the affected components must be undertaken.

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 is required. 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
100 hour check	100 hour check items	Not exceeding 100 flying hours
Annual check	As 100hr check items.	Not exceeding 12 months from previous 100hr or annual check (see Note 5)
1500 hour check	Supplemental inspection	When 1500 flight hours reached. Consult RSUK for further information

Use forms F114 25hr Service and F115 100hr Service/Annual Inspection Worksheets

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.

SECTION 6

PILOT'S PRE-FLIGHT CHECK
Pre-flight checks are to be carried out in accordance with the Gyroplane Pilots Handbook RSUK0060.

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.

F114 issue 3, 25hr service worksheet
F115 issue 4, 100hr or Annual worksheet
F156 issue 2 Short term storage and return to service
F157 issue 2 Long term storage and return to service
F189 issue 1 IVO-prop 25hr or 100hr/Annual service 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 (29266, 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-04 @ 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 – as of 2013 no longer required by the CAA, but at the discretion of the aircraft owner and their A3-7 engineer. Note that if the aircraft is managed under the LAA permit renewal scheme, a flight test may still be required.

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

9) Aircraft weighing report date and C of 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) Logbooks, modifications and service bulletins/MPDs. The aircraft and engine logbooks will be inspected (as will the VP-propeller log book if such a prop is fitted), and MUST be complete and up to date. In addition, they must show any modifications 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.

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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.

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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**
   RSD7197.Coil earthing lead, used to earth the ignition coils should the instrument panel be removed.
7. **Propeller setting tool available, part no RSD4536 (914) and RSD4537 (912)**
8. **Lubricants. Use engine lubricants only as per Rotax instructions. Shell LM Bearing grease RSD4530 or equivalent is suitable for aircraft grease lubrication points.**
9. **Loctites and sealants. See individual sections.**
10. **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.**
11. **Help protect our environment by disposing of parts and fluids properly.**
12. **Standard bolt torques are M5 10Nm +/-2Nm, 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!**
13. **Specific aircraft parts list available separately from RSUK website.**
14. **Remember, maintenance, modification, and bulletin/MPD incorporations must be recorded on suitable worksheets and within the aircraft/engine logbooks – and signed appropriately.**
15. **Refer also to the pilots handbook as well as the drawings quoted and service parts list, all available from the RSUK website.**
16. **Notes on "nyloc" nuts:**
    (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
    (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 composite body of the aircraft is primary structure, but the attachment points to the airframe 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 rear of the body, engine, 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.

<u>General aircraft testing and requirements post maintenance.</u>

1. Aircraft operation. Any engine service will require the operation of the engine, as will any maintenance action requiring adjustment of an engine control or subsystem, or affected system such as removal of the instrument panel. Safely operating an aircraft, even for a ground run, requires training, and should only be undertaken with a pilot or suitably experienced person in the pilot seat. Operation must never be undertaken in a confined space, and always in the open with the propeller wash pointing away from any buildings or anything of value.
   Ensure there are no loose materials in the vicinity that could be sucked into the propeller, leading to expensive damage.
   Ensure the aircraft is chocked to prevent a runaway.
   Ensure there are no persons (especially children) or animals in the vicinity of the aircraft. Any persons required to be present (eg support staff) MUST be suitably trained or briefed of the danger they are in.
2. This aircraft is equipped with a pitot and static port system. For safe aircraft operation it is very important that these systems are correctly fitted and checked if disturbed. Any maintenance operation which removes the instrument panel or instrument connected to this system must be properly verified for function prior to flight, as per Pitot System Integrity Test under Standard system checks.
3. Any maintenance action which requires a flight test (eg fitment of an alternative design of propeller) will result in the requirement for a Permit Flight Release Certificate (PFRC) to be issued. This is a simple document, and is not included within the logbooks. It must be retained with the aircraft records.

Aircraft access for maintenance and inspection

The aircraft is fully enclosed; which means access to the 'workings' is restricted unless access panels are removed.

There are several areas of access.

1. Cabin area. The general cabin area is accessed via the lever on the RHS of the canopy. This will allow the canopy to be opened, allowing access from the right side. If required the canopy can be removed (see canopy section in POH RSUK0060).
   a) Access to the stick bases is achieved by pulling the gaitor from the base of the stick (held in place by Velcro). Refitment is by reattaching the gaitor to the Velcro all around the gaitor.
   b) Access to the control sticks is by removing the composite cover (see photo below) retained by M4 screws. Replacement is by reattaching. There is no loctite required.

Cover, held in place with M4 screws

   c) Access to fuses is directly on the instrument panel. No tools are required, and the fuse circuit is shown on the right of the panel.
   d) Access to the rear of the instrument panel is achieved by removing the 6xM4 screws retaining the panel to the aircraft on the panel front face. The panel may be easily fully removed by disconnecting the harness plugs and hoses, but after re installation a full functional check of all gauges MUST be completed.
2. Engine bay.
   a) Access to the oil dipstick is via the cover on the right side of the engine cowl, by undoing the 3 push and turn camlock fasteners (Use pozidrive end of aircraft water drain tool). This allows access to the standard Rotax oil tank and dipstick. Ensure the filler cap is properly secured before refitting the cover and checking the three fasteners are secured in place.
   b) Access to the top of the engine is achieved by undoing the camlock pozidrive push and turn fasteners attaching the top cowl to the other cowls. Wriggle them free, and lift off the cowl. Reattachment is the reverse. Ensure all screws are securely locked!
   c) Access to the lower engine requires the removal of the upper cowl, and then removal of the lower engine cowl, secured by M4 fastenings. Note also that the battery charging point (where fitted to the left canopy) will require disconnection from the harness. When refitting

ensure the positive is attached to the MIDDLE terminal. The cowl attachment screws have a nylon washer between the screw head and the cowl, and must be securely tightened..

d) Access to the battery, fuel filters etc is achieved by loosening and moving the left (master) fuel tank out of the way. This is done by loosening the attachment straps, and detaching the filler neck from the tank. When refitting the tank ensure the straps are tightened to 4Nm of tightening force and earthing strap re-attached.

3. Mast

a) The upper engine cowl must first be removed, and any joining screws between the mast fairing and the lower engine cowls. The rear mast fairing is retained to the front by M4 screws. Remove these to allow the rear fairing to the pulled off rearwards. The front fairing may then be pulled off forwards. Reattachment is the reverse, with screws securely tightened.

Standard system checks

Pitot and static ports.

The airspeed indicator pitot is a metal nozzle located at the nose of the aircraft.

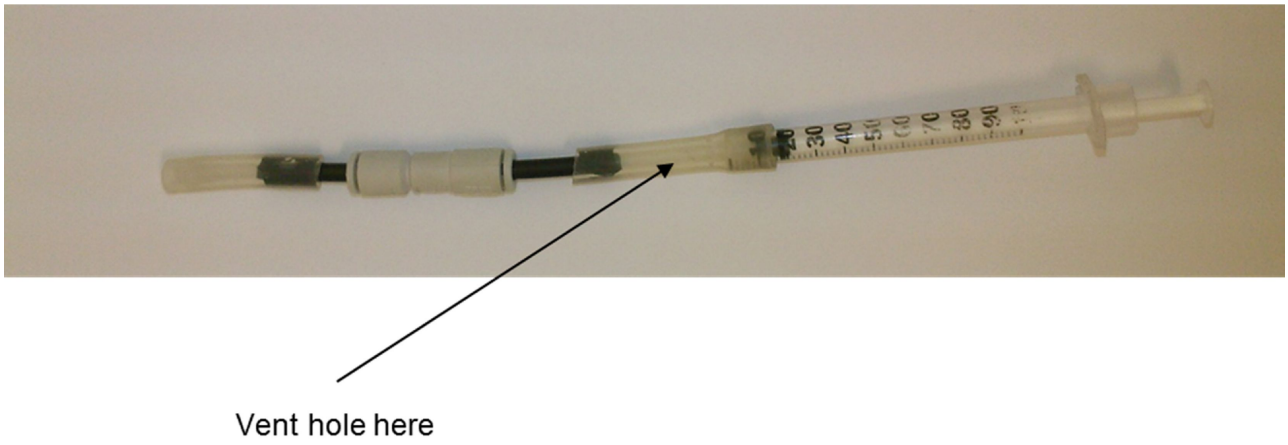
The static ports are located either side of the fuselage, roughly 2/3rds of the length along, and marked by white rings and black letters saying ‘Static port – do not block!’ The static port connects to the ASI, Altimeter and VSI where fitted.

The integrity of this system is important, because a) a system leak could result in an under reading ASI, leading to unintended flight speeds beyond Vne, or behind the power curve, and b) incorrect static port balancing will lead to altimeter and ASI errors

A full system check is undertaken using a Barfield type apparatus (by following the instructions with the test set) which will give a full system calibration. Alternatively a simple system integrity test can be achieved using two 1ml syringes connected to the pitot and static ports, with the second static port blocked. A full system calibration is normally undertaken in the event of a problem found during the simple integrity test, or in the event of a system rebuild or overhaul.

Pitot system integrity test

Check the ASI function and the integrity of the pitot-tube to ASI connection by use of field test kit RSD7179. This consists of a modified Becton Dickinson D U-100 Insulin hypodermic (or equivalent, and the needle is removed) and a short section of 6mm silicone tube containing a one way valve.



Unit fitted to Calidus

1. The hypodermic scale is calibrated 0-100 units, this range being equivalent to 1ml of fluid. For both single and dual ASI installations withdraw the plunger to deliver 100 units.

2. Push the silicone tube onto the pitot nozzle at the front of the aircraft.

3. With a finger over the syringe vent hole, slowly depress the plunger to the end-of-stroke, and release.

4. Examine the ASI which should be reading around 70mph. The actual value is not critical and is dependent on the length of pipework installed.

Specifically check that there is no decay of the indicated reading over a period of 10 seconds, this confirms that the system has no leaks.
After the test gently ease the tube off the end of the pitot nozzle. Check that the indicators have returned to zero.

Static port integrity:

With the above test in progress (ie the system pressurised and showing 70mph), block one static port with the bung from test set RSD7180. Set the altimeter to 1013Mb

1. Attach the 1ml syringe with rubber bung to the second port with the syringe fully open.
2. Close the syringe. The Vertical speed Indicator, if fitted, will show an ascent. The ASI will show a reduction in speed. The Altimeter will show a reduction in height. The amount of change will depend on the amount of equipment fitted, ie the length of airline being pressurised
3. Leave the system pressurise for 10seconds, there show be no noticeable decay.
4. Withdraw the static port syringe and then the static port bung, and the needles must return to their pretest positions.
5. Complete remainder of pitot test sequence.

If the needle positions decay, then there is a leak. Locate, repair, and retest.

Pneumatic system check:

1) Turn on aircraft keyswitch.
2) With changeover switch in the 'Brake' position, engage brake by depressing brake button on control stick, confirm pump and brake operation, and that function is acceptable. Repeat for rear stick where fitted, if necessary release brake pressure by switching the changeover valve from Brake to Flight and back again.
3) Pressurise to maximum (nominal reading 8bar +/-.5bar on instrument panel pressure gauge) Change to 'Flight' – check for 2 to 3 sec max to release air from brake system.
4) In 'Flight' position check that trim goes on and off in same direction as button (inc rear stick switch if fitted), and is indicated so on the instrument panel pressure gauge.
5) In 'Flight' position, stick forward, canopy latched shut or interlock bypassed with a magnet taped to the canopy unlocked sensor. Depress pre rotator activation button on stick. Ensure cylinder engages by viewing bendix gear rising in the rotor head, and when the stick is pulled back it disengages.
6) Stick to front, release pre rotator and confirm that pump stops
7) In 'Brake' position, put 3 bar pressure on and ensure pre rotator does not function. Two bar or more pressure may be needed in the system whilst switching to Brake to enable the changeover valve to function
8) Press the 'Interlock release button' and ensure that pre rotator functions (bendix moves) with brake engaged.
9) Unlock canopy or remove magnet over the unlocked sensor (panel warning light comes on). Depress the pre rotator button. The pump should start, but there must be no bendix movement at the rotor head.
10) Press roll left, and then roll right trim buttons. Ensure the indicator on the instrument panel moves in the same direction (to the right with right trim, left with left trim), and the stick is pulled into the same direction. Centre trim indicator, which must return the stick to the middle (ie the stick requires a small force to push for roll left or roll right).
11) Engage rotor brake to maximum pressure, and leave the system pressurised. Monitor for 1 hour minimum, and overnight if possible, for leaks, and address as necessary. Turn off the keyswitch before leaving the aircraft.

Instrument panel function test.

NOTE! The aircraft core functions (eg fuel pumps and engine gauges) have a protection system, such that if the alternator is unable to provide sufficient energy for all aircraft operations, then non essential functions will shut down! This may mean that when the aircraft is turned on the available voltage may be too low to allow these functions to work, so the aircraft may have to be started up first. These functions are; Landing lights, strobes, navigation lights.

1. Aux socket. Aux socket only works if the keyswitch is on, and is limited to 5amps maximum. Centre is positive, outside negative. Can be checked for polarity with a standard electrical meter, or for function by plugging in auxiliary equipment such as a GPS and check for the charging function.
2. Engine gauges. Can only really be checked for normal function by starting the engine and monitoring the gauge response. If a gauge is suspect, see the instrument panel section for checks.
3. Fuel gauge. Ensure gauge level indication is comparable to the fuel tank
4. Low fuel warning lamp. Function can be checked by disconnecting the cable to the sensor. The lamp will come on. Remember to reconnect.
5. Landing lights; turn on and off and check function
6. Navigation lamps: turn on and off and check function
7. Backup fuel pump: turn on and off, and listen for function

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.

Side view of airframe

Assembly methods

None – factory assembled only

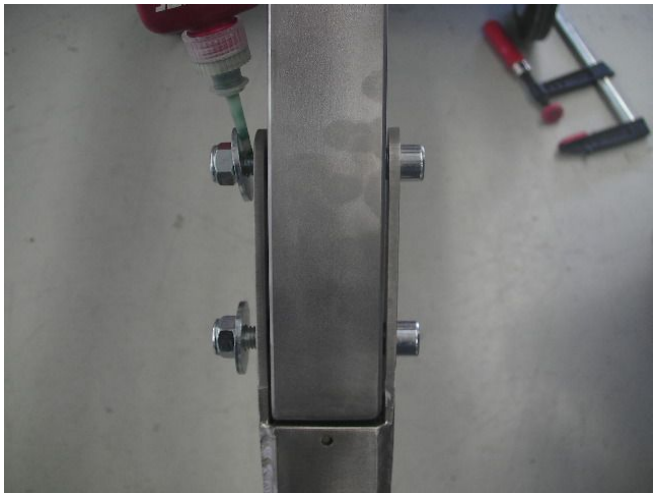
Rubbing strip, fitted beneath the lowest point of the rear keel. This is located by countersunk screws, loctited to the keel with loctite 243.

Assembly of upper mast to lower mast. This connection comprises the fitment of four elastomeric bushes located in the bottom half of the mast, clamped between the side plates of the top half of the mast.

The bushes (steel inner and outer sleeves with rubber between) are assembled by lining the inside of the holes in the mast with loctite 638 and then pressing the bushes in with a G clamp. Ensure the outside sleeves are flush with the outside of the mast.

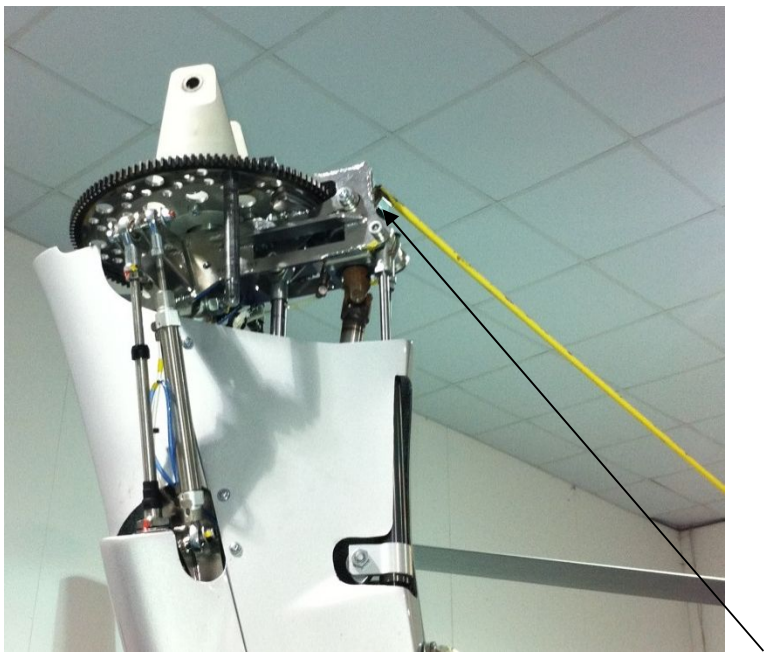
Shims are used between the bushes and the upper mast side plates to achieve a flush fit and straight mast assembly

When fitting the bolts to retain the upper and lowers masts together Loctite 2701 must be applied to the threads. Always use new nyloc nuts!



Special setup instructions
None – factory assembled only

Repair methods
None. In the event of an accident damaging the airframe, then the only 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.
The key check criteria for damage is the distance between the top of the mast and the top of the keel, easily converted to a distance from the rear of the rotor bridge to the top of the tail for ease of checking an assembled aircraft. This dimension, 2150mm should be +/-30mm. A dimension less than this may indicate a very hard tail landing.

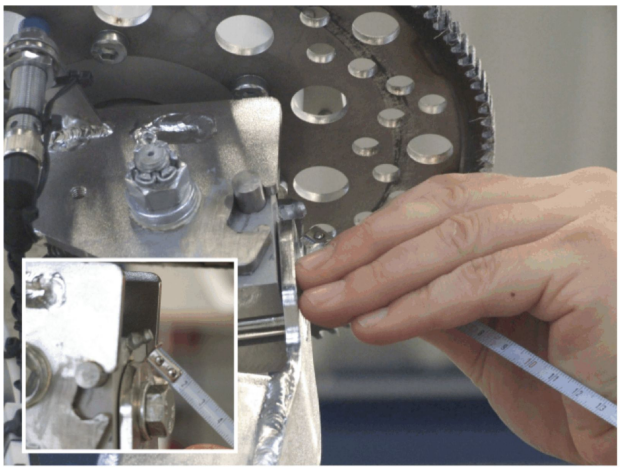


It is not permitted to weld the airframe unless via an RSUK approved repair scheme, using A8-10 Approved welders.

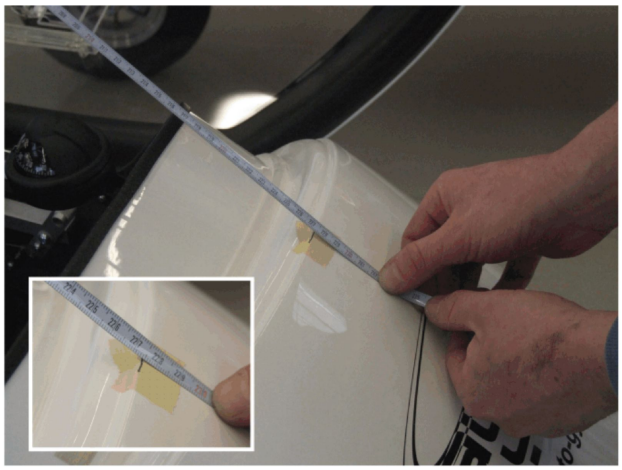
Inspection: Mast mounting bushings

A similar measurement to the above permits assessment of the condition of the mast (rubber) mounting bushings. The required dimension is the diagonal from the front of the rotor head to the lip of the canopy aperture on the centre-line of the aircraft.

1. With a neutral mast position (no force applied) take the measurement.
2. Repeat the measurement with 150N force applied to the ring-gear horizontally in the flight direction. If the difference exceeds 5mm contact RSUK.
3. If advised by RSUK repeat the measurement with 150N applied to the ring-gear horizontally against flight direction.

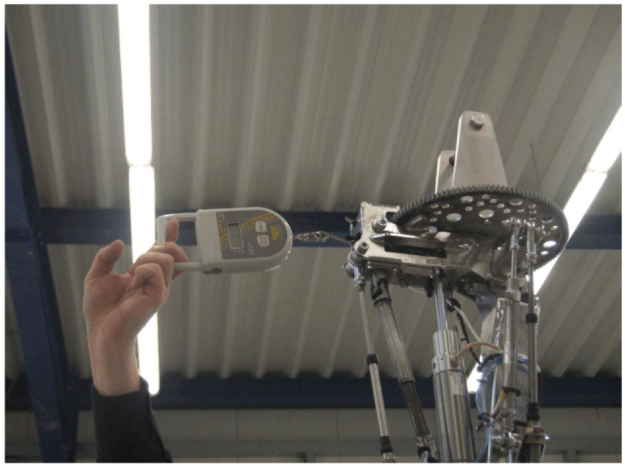


Mast reference point



Fuselage reference point

Force applied in flight direction



Force applied against flight direction

b) Engine and controls

Basic description

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. The air cleaners are not wirelocked to the carburettors.
Neither the 914UL or the 912ULS engine variants carry any anti ice system, due to the carburettor air intakes being fed warmed air from the engine radiator.

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, fuel 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 radically reduces the service intervals and changes the service requirements – 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.
Note that the two upper nuts are fitted with Nyloc lock-nuts and the two lower bolts are fitted with all-metal lock-nuts.

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. Otherwise an inadvertent engine start will be very difficult to stop.

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

If the engine bearer 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 and torqued to 35Nm. Paint strip the bolt head to the bearer to be able to see any movement in service.

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,

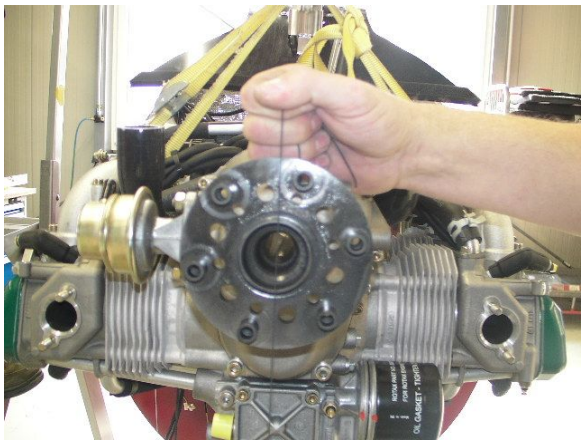
1. Remove all engine cowls.
2. Disconnect battery, earth lead first.
3. Drain and remove fuel tanks.
4. Disconnect engine earth and live leads.
5. Disconnect fuel system from mechanical fuel pump and from electrical pump(s), or in the case of the 914, disconnect the feed and return hoses to the fuel regulator on top of the engine.
6. For 914UL disconnect cable to turbo waste gate or remove whole servo unit from bulkhead.
7. Disconnect voltage regulator connector, and remove the two pins that are part of the main wiring harness
8. Drain oil, and disconnect oil sump and radiator. Ensure suitable receptacles are there to catch waste oil, and block/protect exposed oil orifices.
9. Disconnect choke and throttle cables. Marking the approximate positions will aid re assembly.
10. 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!
11. Disconnect white ignition cables, and airbox temp sensor where fitted. .
12. 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 clutch.
13. Remove carefully the four engine mounting bolts/nuts.
14. The engine can now 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 lock-nuts, and tighten to 35Nm. When tightening ensure the rubber elements are seated correctly.

During installation check for thrustline offset to the keel, by dropping a plumb line from the centre of the gearbox flange to the keel. It should be 10 to 15mm to the left. Adjust position with M10 washers between the engine frame and mountings (see photo). Use longer screws as required for minimum two threads protruding through the nyloc nut.

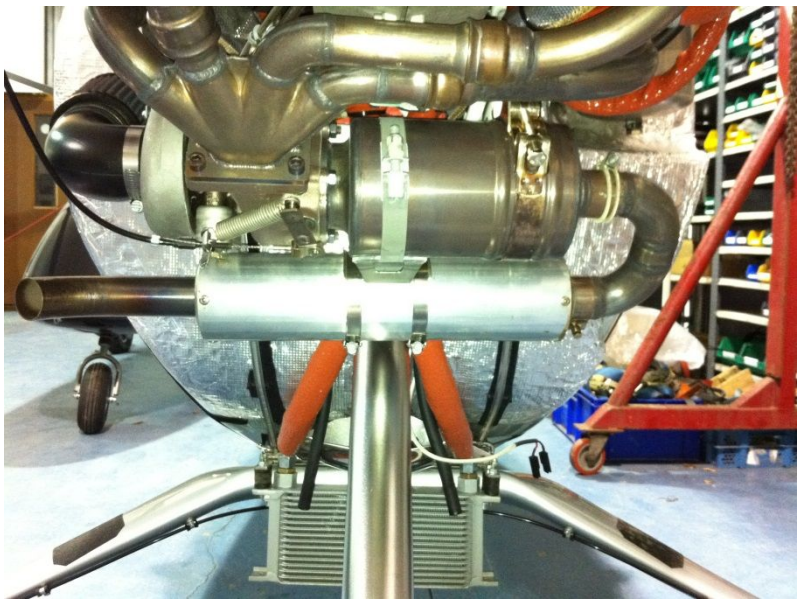


<u>Engine servicing and repair</u>

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

If the magnetic drain plug or the adjacent M8 plug screw are removed 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 exhaust noise.


914UL silencer and aftermuffler installation

Materials used
See service parts list

Special setup instructions
Tighten muffler clamps securely.
MC-193/SB-043 introduces silicone strips under the band-clamps. Ensure that these are centrally positioned and wirelock the clamps to the adjacent stand-off bracket after tightening

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

Basic description - 912ULS exhaust system:
This comprises a welded up specific assembly for the silencer for this application, and a separate aftermuffler, uniquely manufactured for RSUK. Aircraft S/No 001, 002, 003 and 011 have an axial after-muffler attached to the keel.

912ULS silencer & axial after muffler assy
Springs are secured by cables for safety.

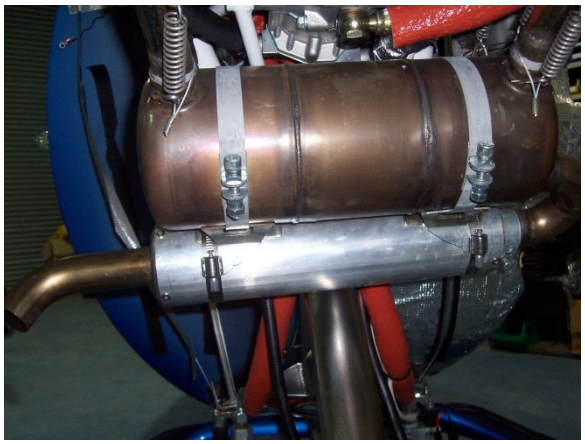
912ULS exhaust system with
axial after-muffler

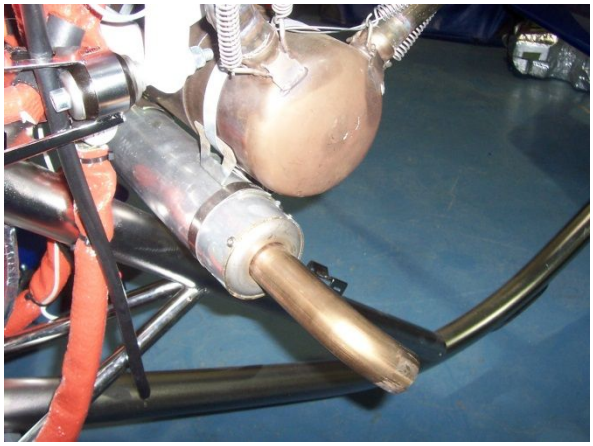
Materials used See service parts list

Special setup instructions
Ensure swivel coupling are free to move, and correctly fastened.
Ensure muffler clamps are tight and wire-locked.

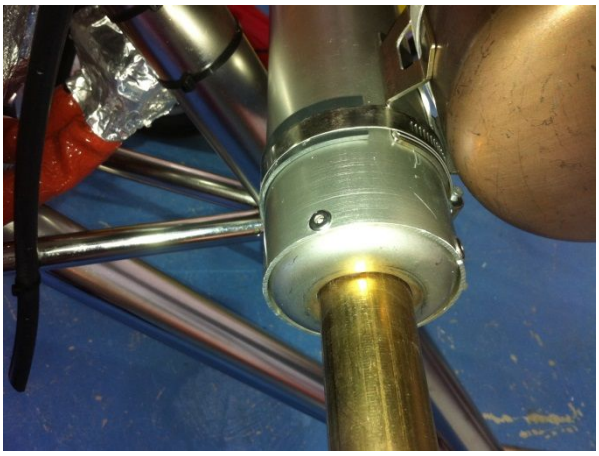
Repair methods
Replace items if required.

Aircraft S/No 004 onwards (except 011 – see above) have a transverse after-muffler retained by two band-clamps (MC-160).
There may be a silicone strip RSD4627 under each band-clamp (MC-193/SB-043). Wire-lock the clamps to the adjacent stand-off bracket after tightening.





912ULS engine with transverse after-muffler installation under MC-160



Silicone strip fitted under band-clamps (MC-193 / SB043)

Basic Description - Oil cooling system:

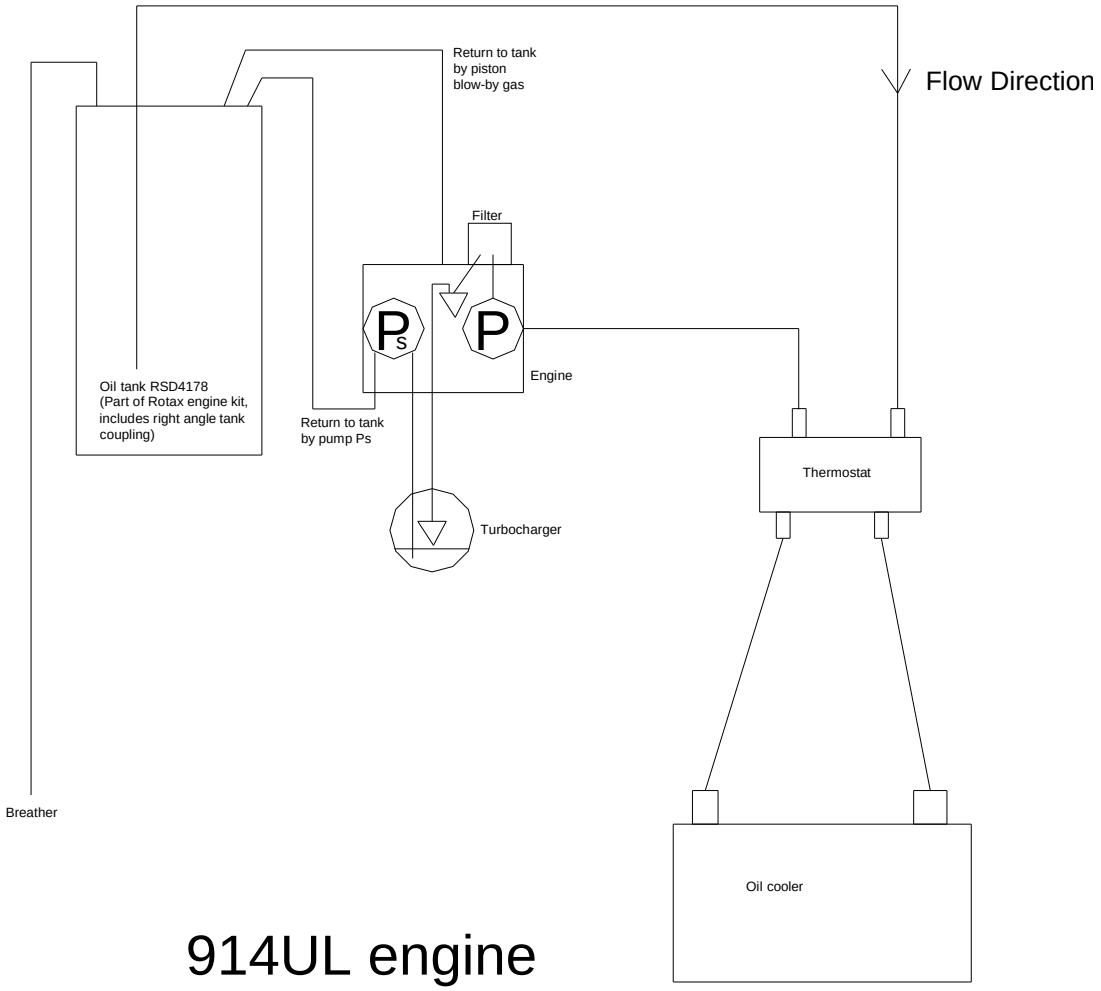
The oil system is a dry sump type. It comprises an oil tank mounted on the right of the aircraft, with hoses connecting it to the engine and cooling radiator via a thermostat. Note that the 914UL engine has one additional hose, from the oil pump to the turbo bearing.

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.

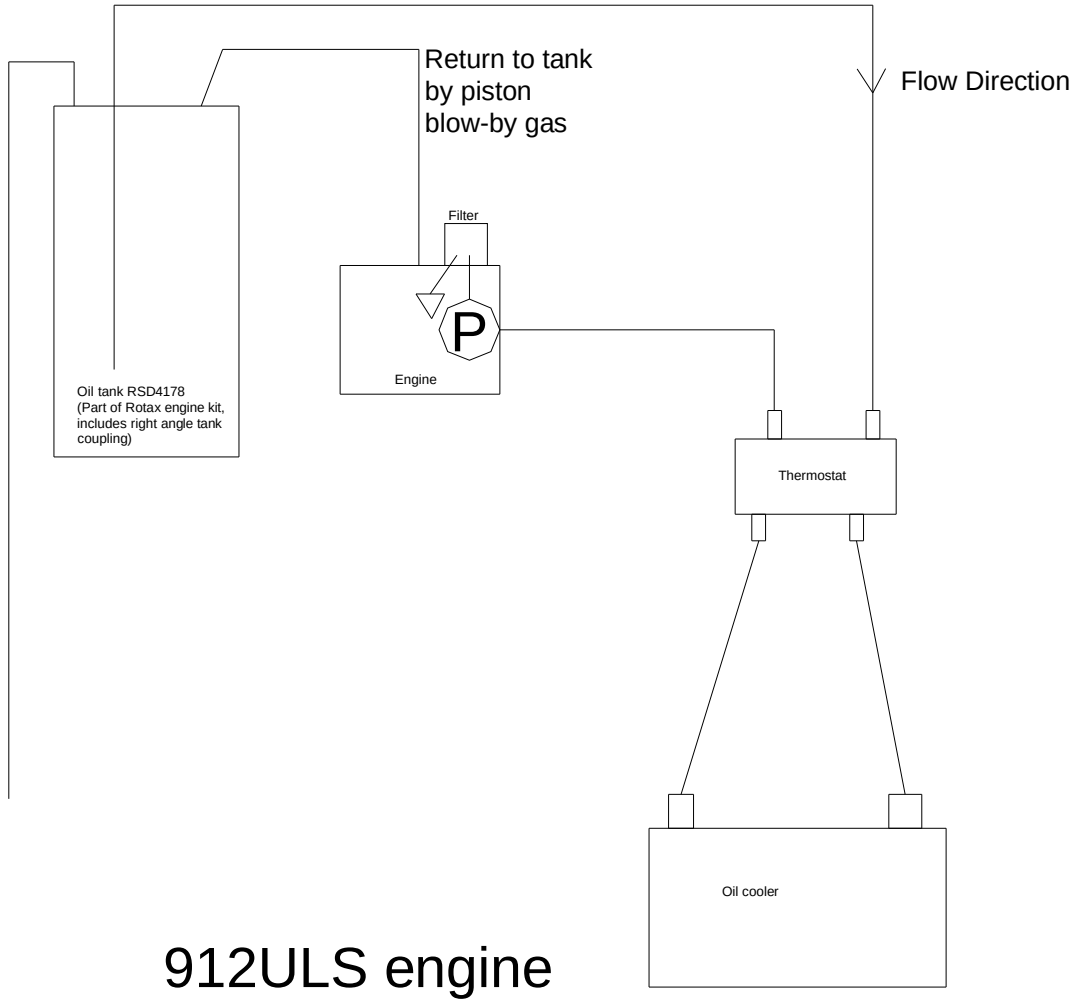
Because the oil from the tank will drain back into the engine to a certain degree it is very important to turn the engine over by hand in the normal rotational direction before checking the oil – otherwise the oil may be overfilled, and will then spill out extremely messily when the engine is started. Remove the filler cap, and turn over until a bubbling noise is heard from the tank. Then check the level.

Note that access to the oil tank with the cowls in place is via the access panel, retained by 3x camlock type fasteners (use aircraft fuel/water drain tool). Ensure these are properly refitted if removed!

Oil system schematics below.



914UL engine



912ULS engine

Materials used: Refer spare parts list.
Refill the oil system with oil in accordance with Rotax handbook. RSUK recommend, based on service experience, Shell VSX.
Hoses are Semperit FUHT. This hose is fire resistant and must not be changed for any other type without approval.

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. Due to these different fittings the oil thermostat body is also changed. All new parts are visibly different and cannot be mis-matched.

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 with clean oil. Take care to refit the tank at the correct height! (see photo below of the oil tank fitted to its mounting).

There are two types of oil tank mounting, a saddle-clamp arrangement (as shown below) and a similar but lighter mounting using a band-clamp (implemented from S/No 005 under MC-150)

Photo showing oil tank. Note top is flush with the bracket. Bracket is detachable to allow easy removal of the fuel tank. Drain plug is on the bottom.

After draining the oil system, prime it in accordance with Rotax handbook procedures before starting the engine.

Note! Under MC-255 the oil temp sensor is fitted to the oil tank, not to the engine. This means that the oil temp shown in the cockpit is the real temperature as it leaves the engine, not after it has been through the thermostat. The sensor is the standard Rotax part, relocated.

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 as removed and as per photos. The oil pipes pass close to hot points and edges, and are exposed to vibration. Loose pipes will cause fretting and possible oil loss.
Note! A length of Velcro (soft side) is fitted to the top of the oil cooler to prevent the engine cowls from wearing away the top surface of the cooler, and must be replaced if found missing or excessively worn.

914UL left side hoses. Note that hose must be securely fixed to the engine.

Left side, 912ULS engine. Take care that hoses are tied from the exhaust.

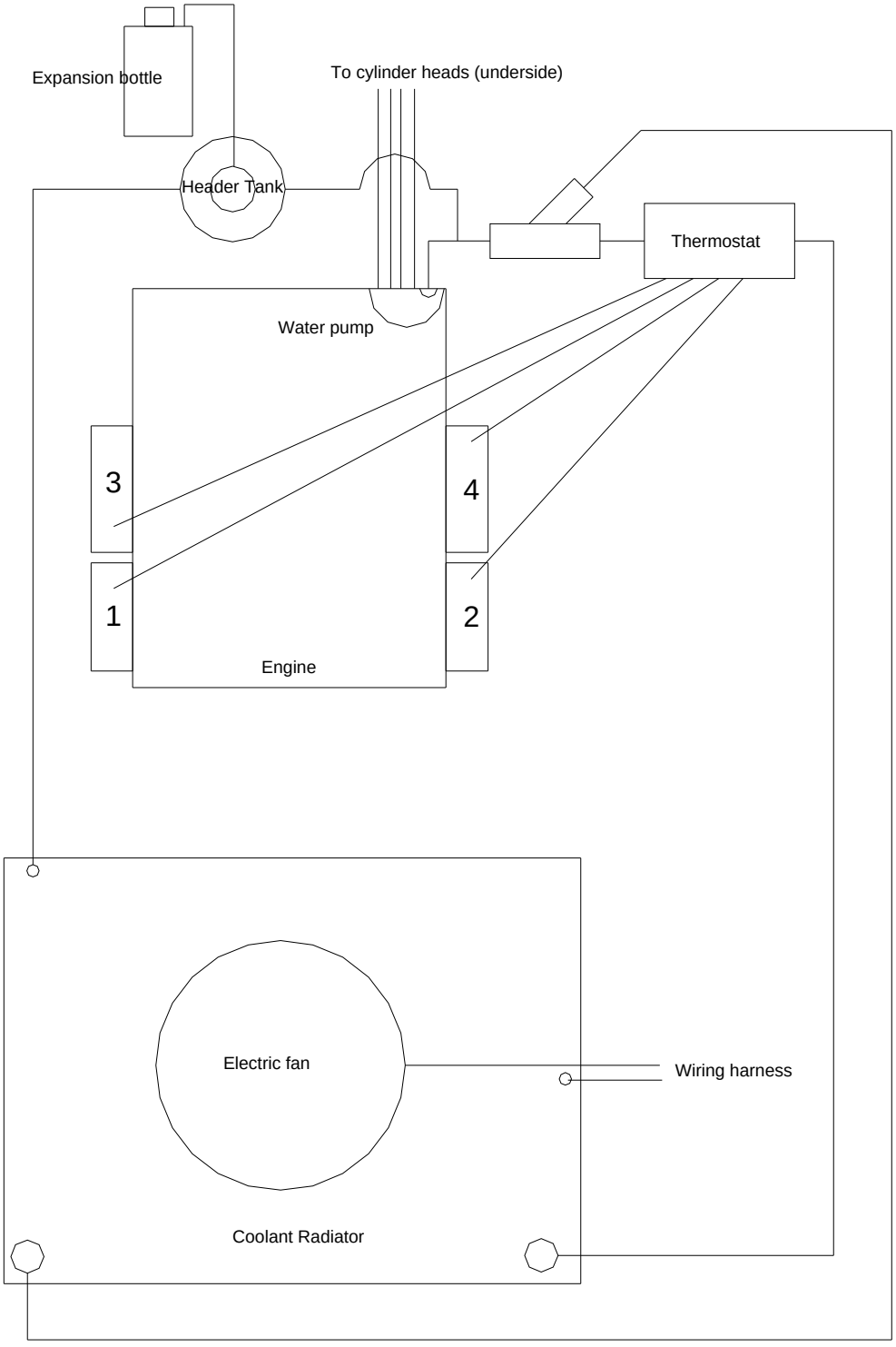
The water and oil thermostats are set at an optimum level to suit anticipated flight conditions, from full power vertical descent on a hot summer day to winter lightweight cruising.

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

Intentionally blank

Basic description - Water cooling system, 914UL and 912ULS standard

This comprises a radiator mounted on top of the engine, with electric cooling fan bonded to the upper side. The system is as shown below in the system schematic. It includes a thermostat to enable the system to heat up faster and to regulate the engine temperature.



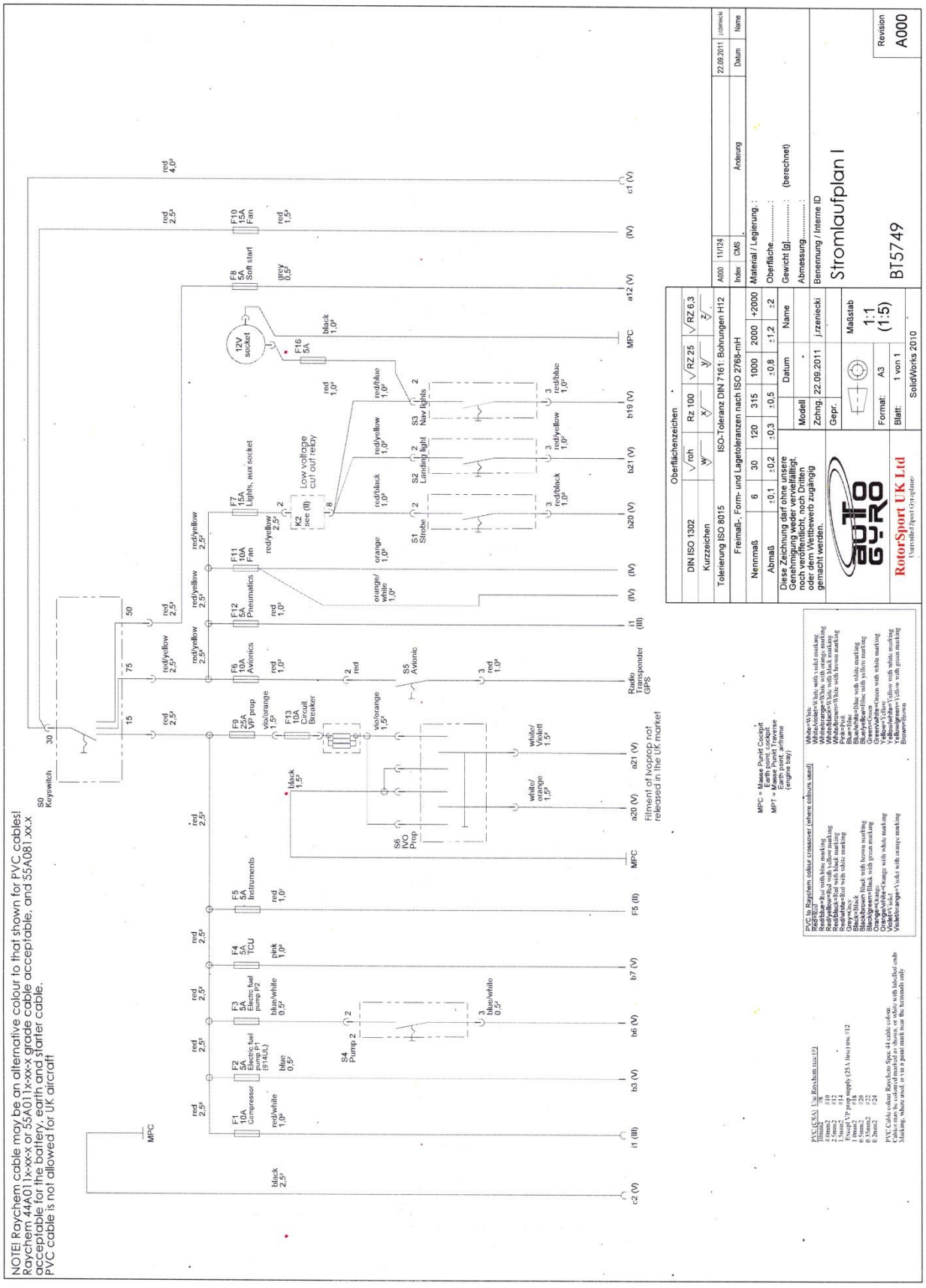
Materials used: See parts list.

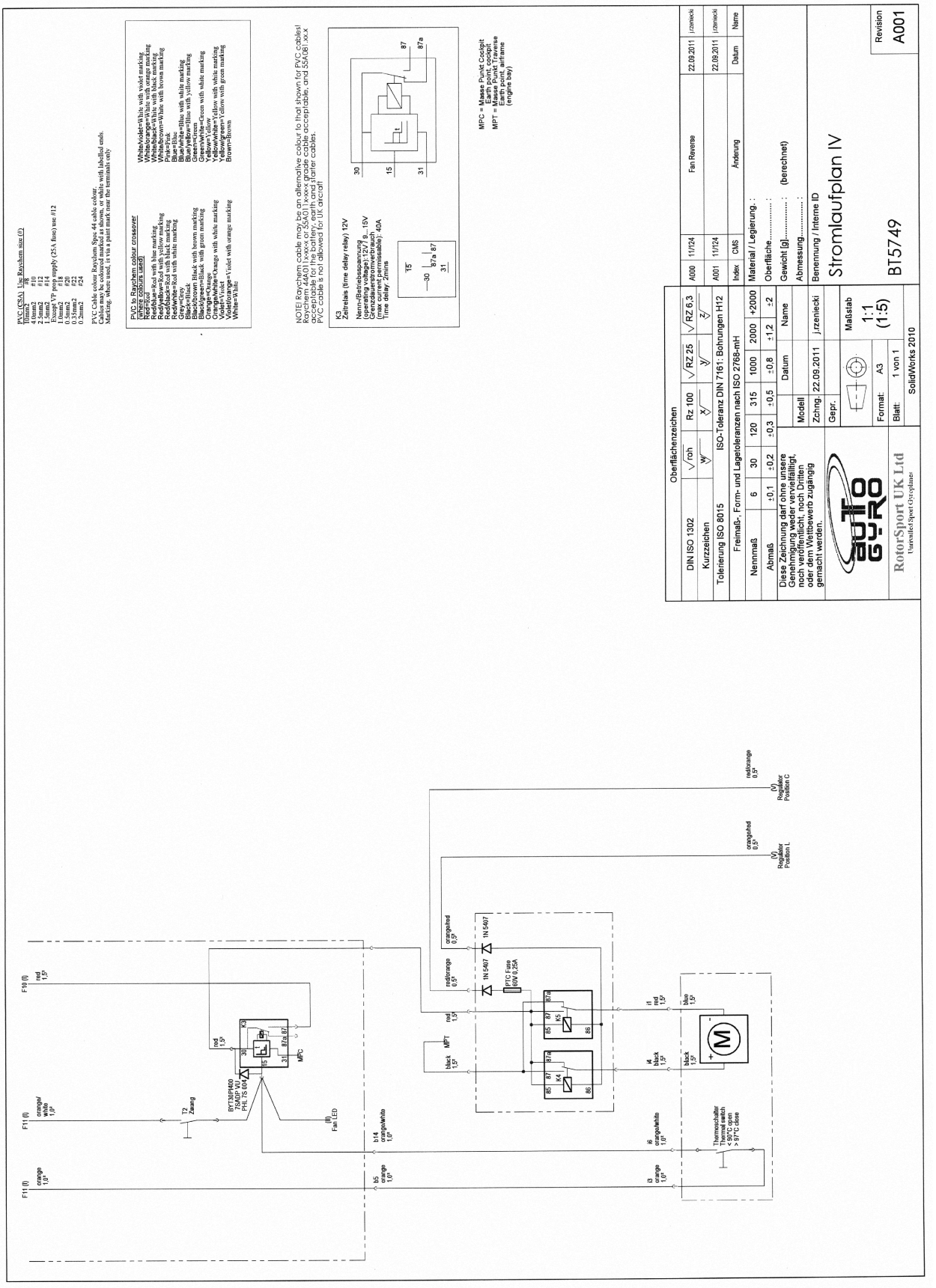
Fill with a mix of 50/50 water and EthyleneGlycol antifreeze RSD4535 suitable for aluminium engines. It is highly recommended to use distilled water, as this will limit impurities and corrosion in the engine waterways.

Special setup instructions.
Follow Rotax instructions for change intervals, and for venting the system whilst refilling – see the engine handbook.
The screws retaining the radiator brackets to the engine must be loctited with Loctite 243. Pay attention to hose routing and tie wraps, to ensure the hose cannot fret or contact hot points.
Ensure hose clamps are secure and correctly positioned.

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

Basic description – Water-cooling system with reverse air-flow arrangement (MC-194 and/or SB-044 embodied)
In order to provide improved ground-cooling when operating in hot environmental conditions MC-194/SB-044 introduces an arrangement whereby the cooling air provided by the electric fan is reversed on-ground but unchanged in-flight. The reverse cooling is initiated by the pilot manually selecting fan operation after landing/shutdown (but before turning the keyswitch off) and runs automatically for a 5-6minute period thereafter (even with master-switch off). Fan reversal is achieved by a dual relay installation (fitted near to the coolant radiator on the engine) which is inhibited from operation when the engine is running.
There is no change to the coolant system schematic shown above, but the electrical system is changed to that shown by the two sheets from BT5749 below:





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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. The choke lever is mounted on the same basic tube, just forward of the throttle body. The choke lever is left free to return to open under the return spring pressure, ensuring it is open for flight. Further, it blocks the throttle lever if left closed. 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 above the left fuel tank.
There is an eccentric bush on the throttle body to allow throttle idle adjustment.

Materials used See parts list

Special setup instructions
NOTE! For a 914UL engine first read, understand, and follow setup information contained in the appropriate Rotax manual
Basic carburettor control setup
Assumption: all cables are in place, and basic setup only is needed. Engine has run and warmed up to 50deg min (CHT and oil).
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 in the photo 3 below, about 60mm above the body edge. 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 cable so that the lever is at approx 30deg to the mounting tube it is fitted to (see photo 3). 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. Balance kits are available from RSUK (RSD4534) or Rotax distributor.
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 1,600rpm.
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.
7. After setting run the engine up, and set idle and carb balance. If using that form record settings there, if not, record idle setting in logbook or worksheet.

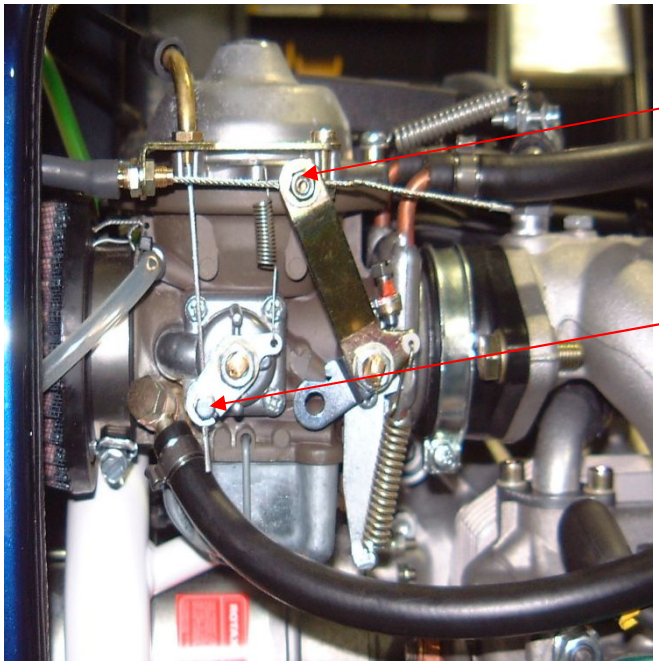


Photo 1

Carburettor. Ensure cables clamp nuts are securely tightened, approx 3Nm

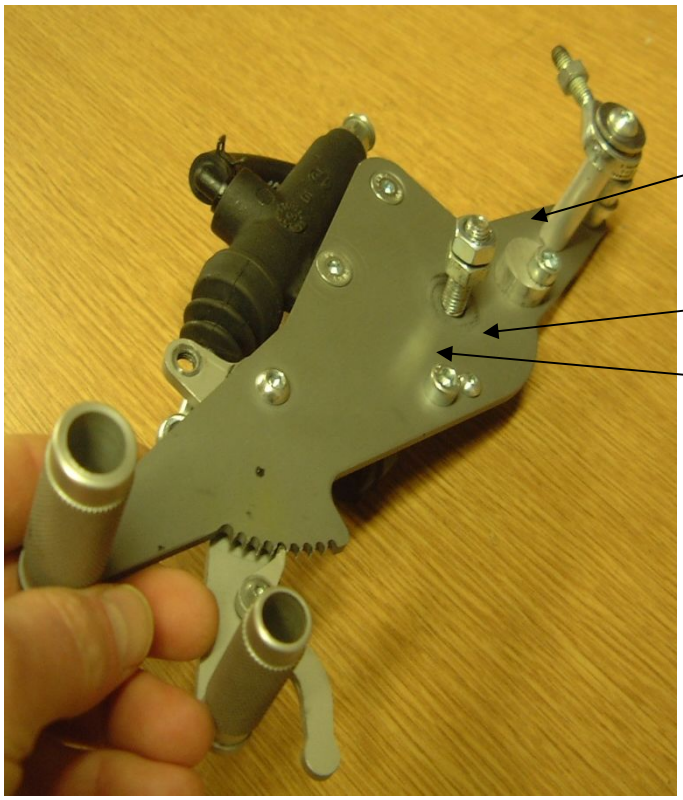


Photo 2

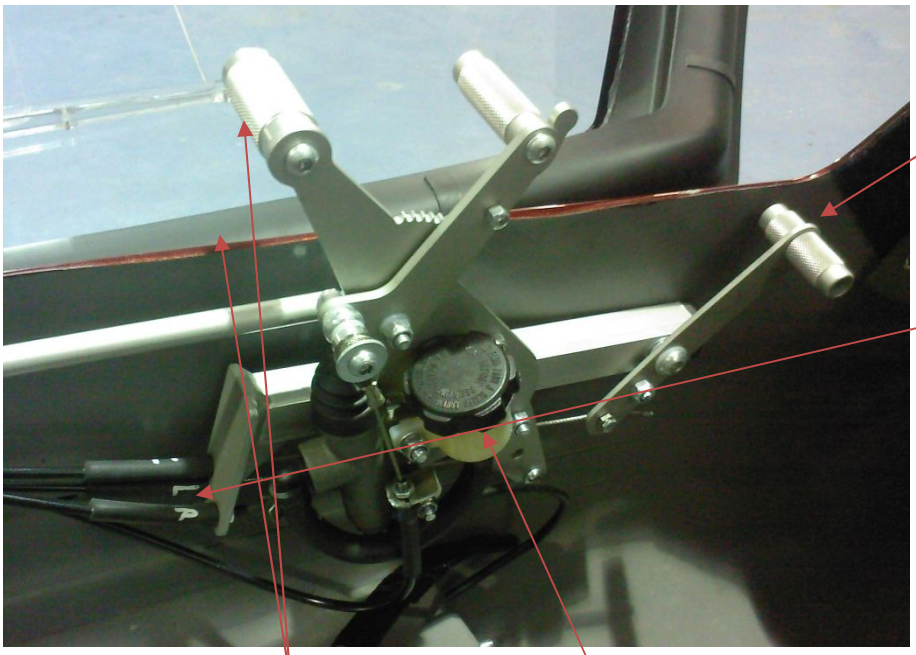


Photo 3

Photo 4

Optional rear seat throttle, fitted with optional main wheel brake lever.

Repair methods

Replace worn components.

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)

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 the leads from the coils. 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.

(ii) (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) (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

Intentionally blank

c) Electrical

Basic description

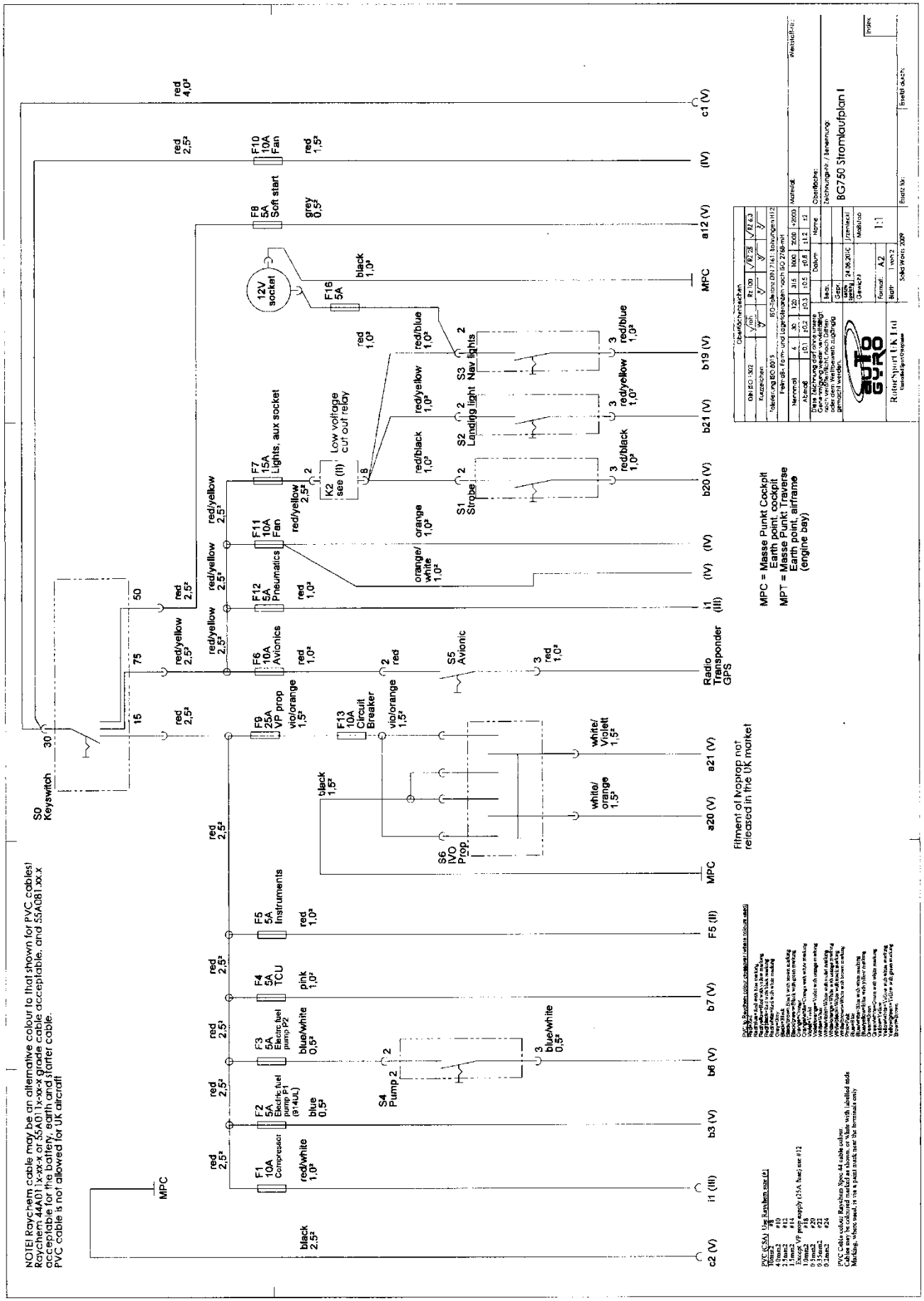
This is a 12volt DC system, supplied via the engine alternator. The main cable tree runs between the engine and the instrument panel, via the top left side of the enclosure. Connectors used are proprietary AMP style items, from the automobile industry. The tree also contains pneumatic hoses for air supply and management. The instrument panel may be detached from the main cable tree by detaching the connectors, allowing full removal for table works and access to pedal assemblies etc.

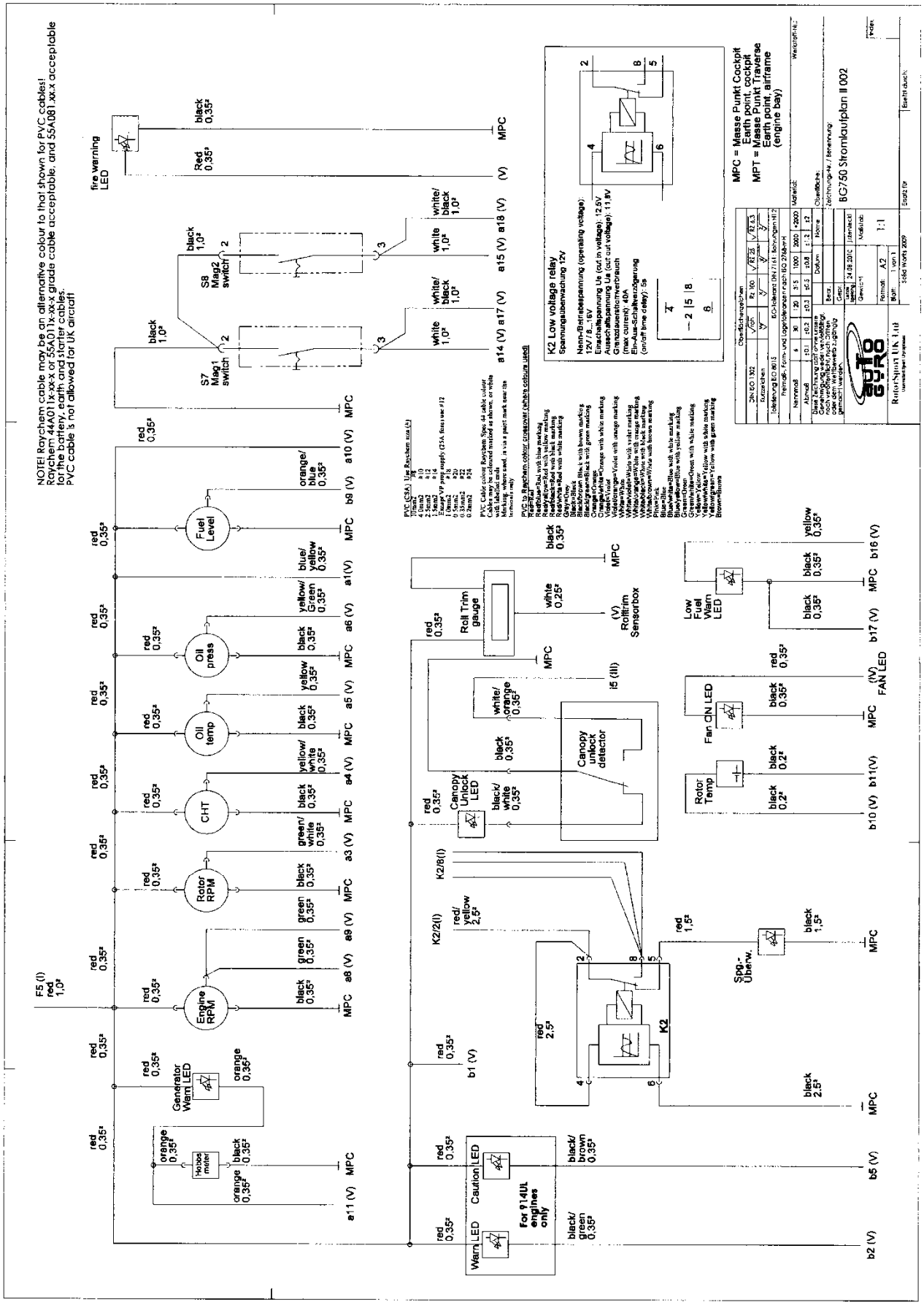
Note that the cable harness to the landing lights also carries the pitot tube for the nozzle, and is attached to the upper surface of the body to ensure any water entering the pitot nozzle naturally drains out.

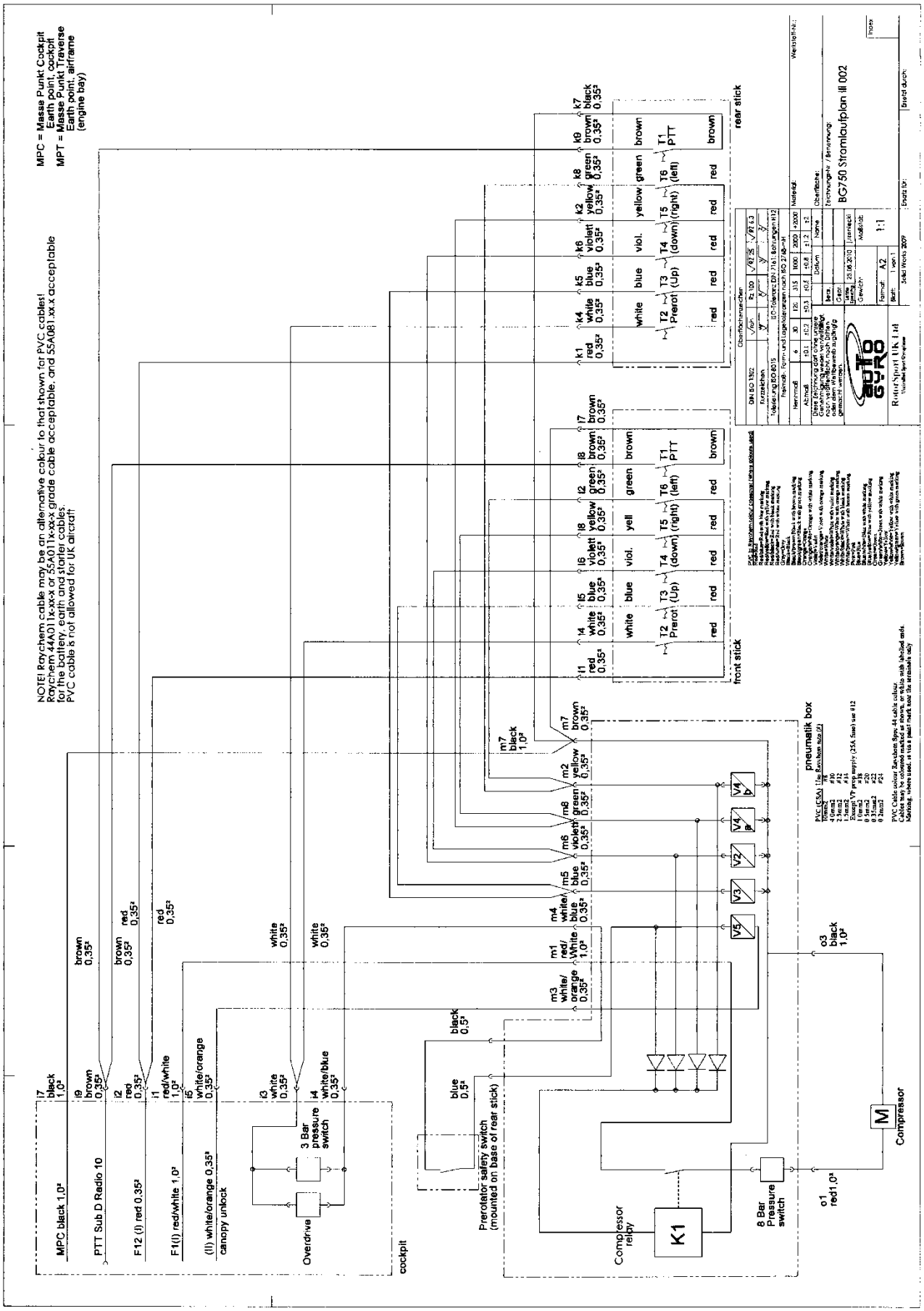
There are secondary harnesses that connect to the primary cable tree. The front and rear sticks are plug and play into the centre cable tree. The radio harness (different between the ATR500 and ATR833) are unique items that connect to the main tree. The strobe sets connect to the main tree (two different options, AVEOflash or Skyflash).

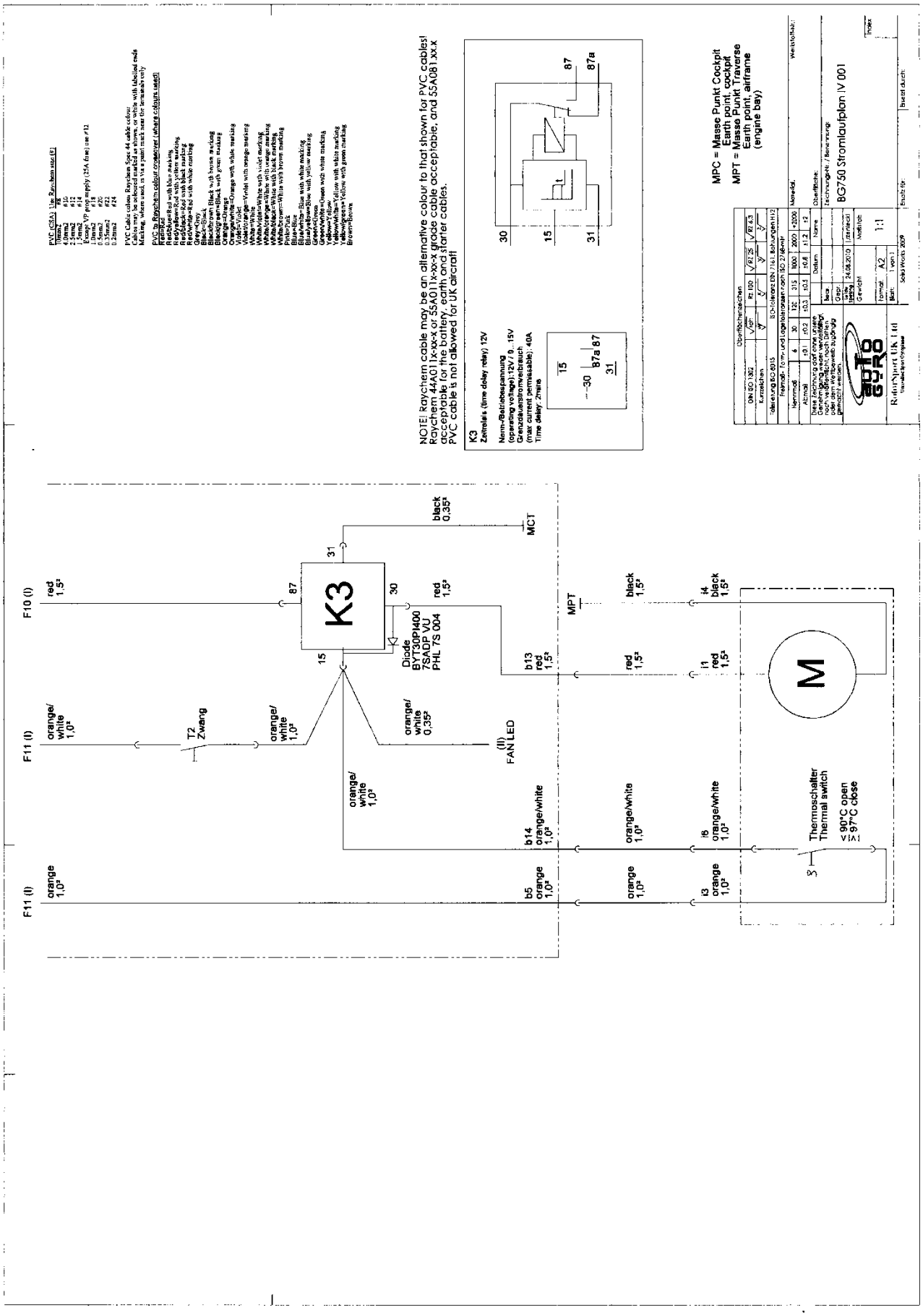
Wiring diagrams are below. Note that larger scale copies are available from the RotorSport website.

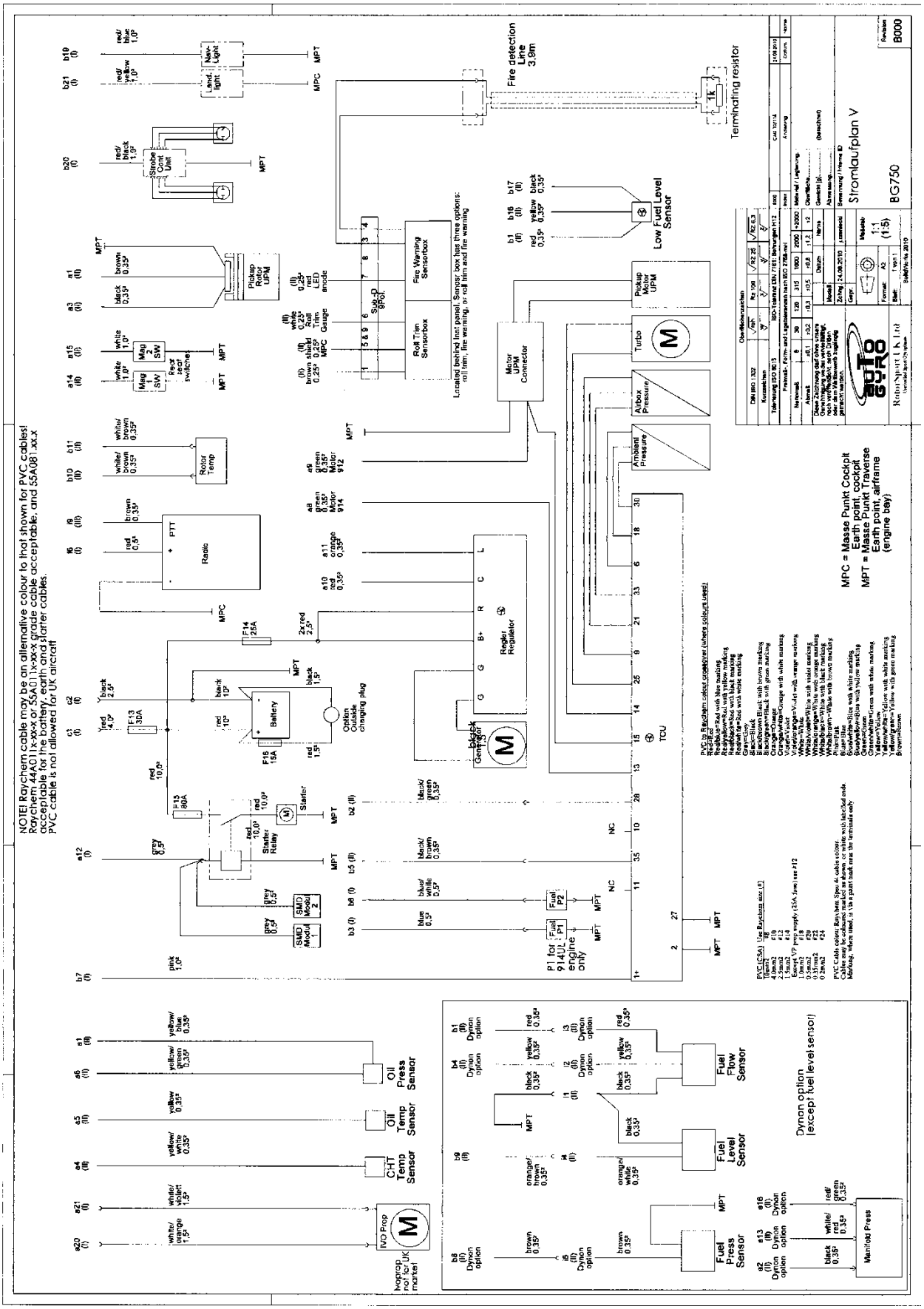
Note: For electrical changes introduced by embodiment of MC-194/SB-044 (Reversed airflow ground cooling system) see description of the Water Cooling System earlier in this document









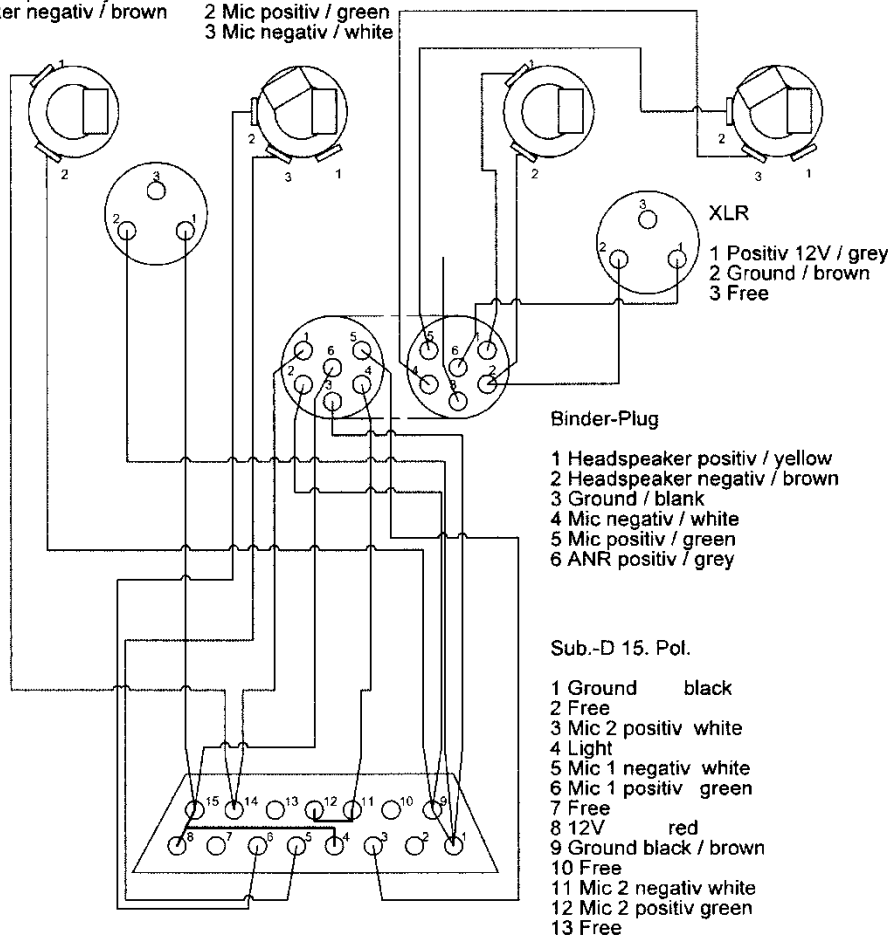


Headset Plug 6,3mm

1 Headspeaker positiv / yellow
2 Headspeaker negativ / brown

Mic Plug 5,3mm

1 Free
2 Mic positiv / green
3 Mic negativ / white



XLR

1 Positiv 12V / grey
2 Ground / brown
3 Free

Binder-Plug

1 Headspeaker positiv / yellow
2 Headspeaker negativ / brown
3 Ground / blank
4 Mic negativ / white
5 Mic positiv / green
6 ANR positiv / grey

Sub.-D 15. Pol.

1 Ground black
2 Free
3 Mic 2 positiv white
4 Light
5 Mic 1 negativ white
6 Mic 1 positiv green
7 Free
8 12V red
9 Ground black / brown
10 Free
11 Mic 2 negativ white
12 Mic 2 positiv green
13 Free
14 Headset positiv yellow
15 Positiv red /grey

Oberflächenzeichen				
DIN ISO 1302	√roh	Rz 100	√RZ 25	√RZ 6,3
Kurzzeichen	W	X	Y	Z

Tolerierung ISO 8015 — ISO-Toleranz DIN 7161: Bohrungen H12

Freimaß-, Form- und Lagetoleranzen nach ISO 2768-mH

Nennmaß	6	30	120	315	1000	2000	+2000
Abmaß	±0,1	±0,2	±0,3	±0,5	±0,8	±1,2	±2

Index	Änderung	Datum	Name

Material / Legierung. :
Oberfläche..... :
Gewicht [g]..... : (berechnet)
Abmessung..... :

	Datum	Name
Modell		
Zchng.	01.02.2010	vaultadmin
Gepr.		

Maßstab 1:1 (1:5)
Format: A4
Blatt: 1 von 1
SolidWorks 2010

Benennung / Interne ID

Kabelbaum Intercom Cockpit

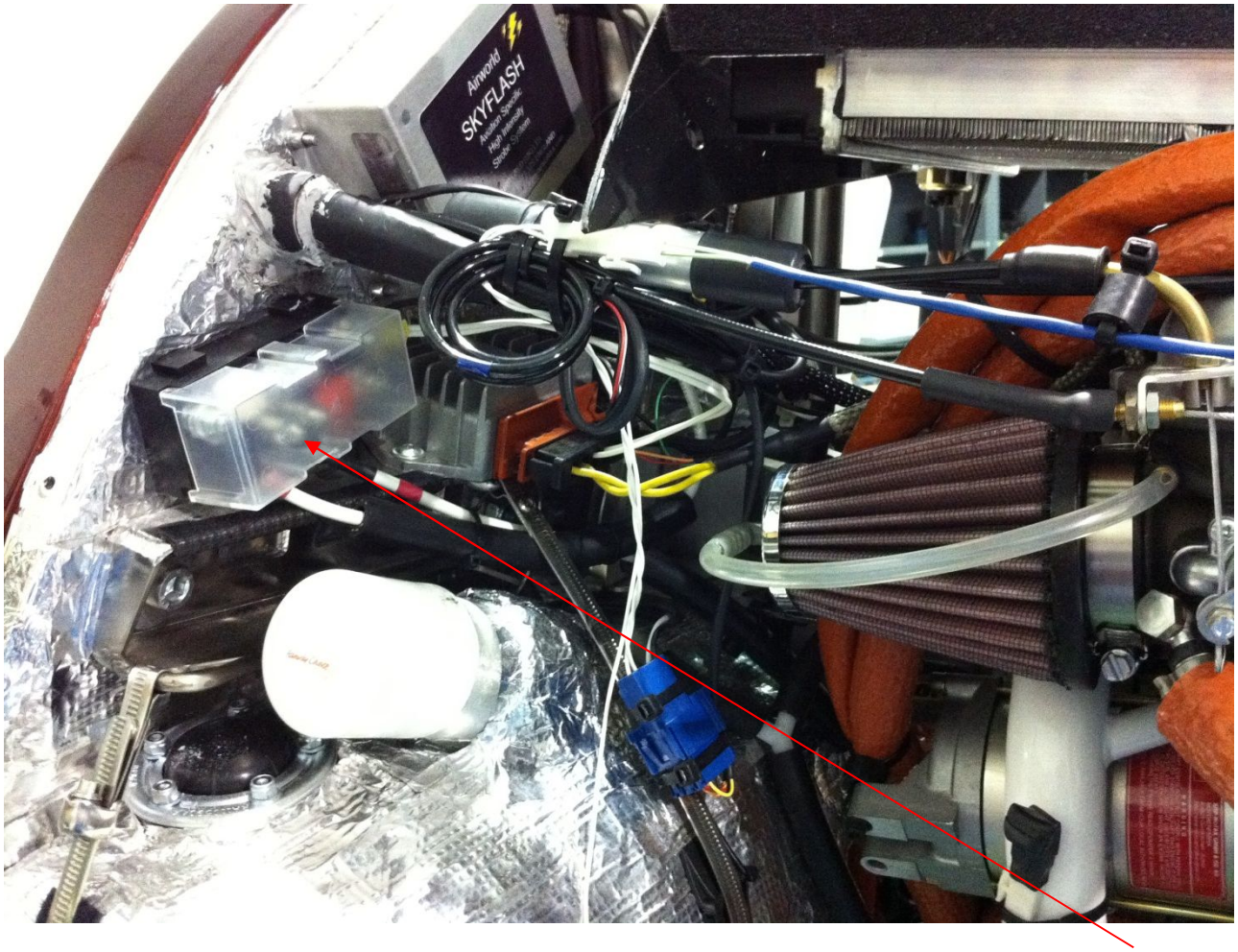
BG753

Revision A000+

RotorSport UK Ltd
Unrivalled Sport Gyroplanes

Materials used
See parts list

Assembly methods
The primary harness runs inside the left side of the enclosure, from the instr. Panel into the engine bay. It is sealed with Intumescent mastic where entering the engine bay to prevent rubbing and gaseous entry.



Fuse box may be located here or the airframe, subject to options fitted and space available.

The fuel tank filler is shown covered with a loose cap – good practice to prevent unwanted items falling into the tank.

Secondary harnesses run as follows:
Sticks – down the centre channel adjacent to the stick control system
Rear cockpit instructor switches, and rear cockpit intercom – inside the left of the body.

Repair methods
In line with normal aircraft practice (such as AC43 or relevant CAAIPs).
Cable. The use of PVC cable is NOT permitted in this aircraft. The Calidus aircraft is fitted with Raychem type 44 cable and or type 55 cable.

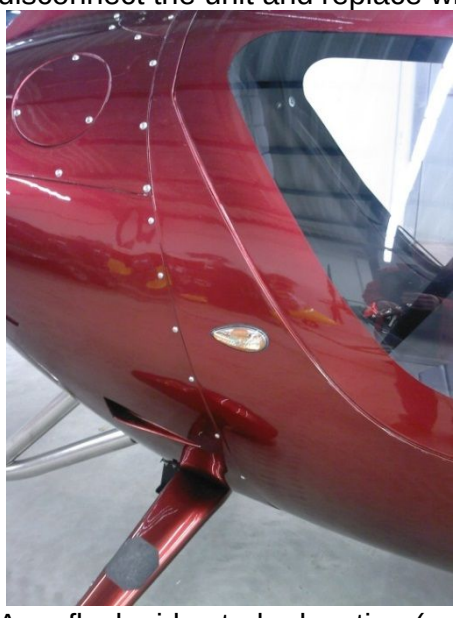
Fuses: Automotive type blade fuses are located on the left lower front of the instrument panel, and named on the right lower side. Note that in-line fuses are fitted to the battery charge circuit, and to the GPS units where fitted (within the equipment supply cable).

Fuse description	Rating	Protects	Fuse type	Location
Main incoming supply to cockpit	30A	Main positive supply is fed to the starter solenoid from the battery. The supply continues then through the 30amp fuse to the cabin.	Bolt in strip type, MTA S.p.A. “Midival” range	Engine bay fuse box, above left fuel tank, on rear face of enclosure or engine bearer.
Compressor	10A	Fuse only supplies the pneumatic compressor	Automotive	Inst. Panel
Primary Fuel pump	5A	Fuel pump	Automotive	Inst. Panel
Secondary fuel pump	5A	Fuel pump	Automotive	Inst. Panel
914UL TCU	5A	Engine control unit	Automotive	Inst. Panel
Cockpit	5A	All electrical gauges (rotor and engine rpm, oil pressure, water and oil temps, fuel gauge) and warning lamps	Automotive	Inst. panel
Avionics	10A	Radio, Transponder and GPS units	Automotive	Inst. panel
Landing lights	15A	Strobes, landing lights, nav lights and aux socket. NOTE! Aux socket fitted with additional 5amp in line fuse.	Automotive	Inst. panel
Start	5A	Starter relay and SMD module	Automotive	Inst. panel
IVO-prop Variable pitch propeller (where fitted)	25A	Main supply to prop controller (approved under MC-276/SB-083)	Automotive	Inst. panel
Fan	5A	Thermostat control of fan via relay	Automotive	Inst. Panel
Fan	10A (or 15A see below)	Power supply to fan via relay	Automotive	Inst. Panel

Trim	5A	Supplies power to the stick controls for operating the pneumatic solenoid valves and the compressor relay	Automotive	Inst. panel
Rotax regulator	25A	Charging circuit from regulator to battery/aircraft supply	Automotive 25A fuse, located between the 30A fuse and the cockpit supply	Engine bay fuse box, above left fuel tank, on rear face of enclosure or engine bearer.
Starter	80A (or 100A, see below)	Primary supply from battery to starter-solenoid /starter and from starter solenoid to main fuse	Midivale 80Amp fuse, published time at 80A, asymptotic, 13secs at 150A. Fuse mounted after the solenoid.	Engine bay fuse box, above left fuel tank, on rear face of enclosure or engine bearer.
External battery charge point (where fitted)	15A	Cable from short circuit when fitting or removing the cowls	Automotive glass fuse	Near battery
Flymap L (where fitted)	5A	GPS only	Automotive glass fuse	Power supply lead to GPS unit behind instr. Panel
Garmin GPSmap (where fitted)	1.5A	GPS only	Automotive glass fuse	Power supply lead to GPS unit behind instr. Panel
Avmap EKP IV (where fitted)	2A	GPS only	Automotive glass fuse	Power supply lead to GPS unit behind instr. Panel

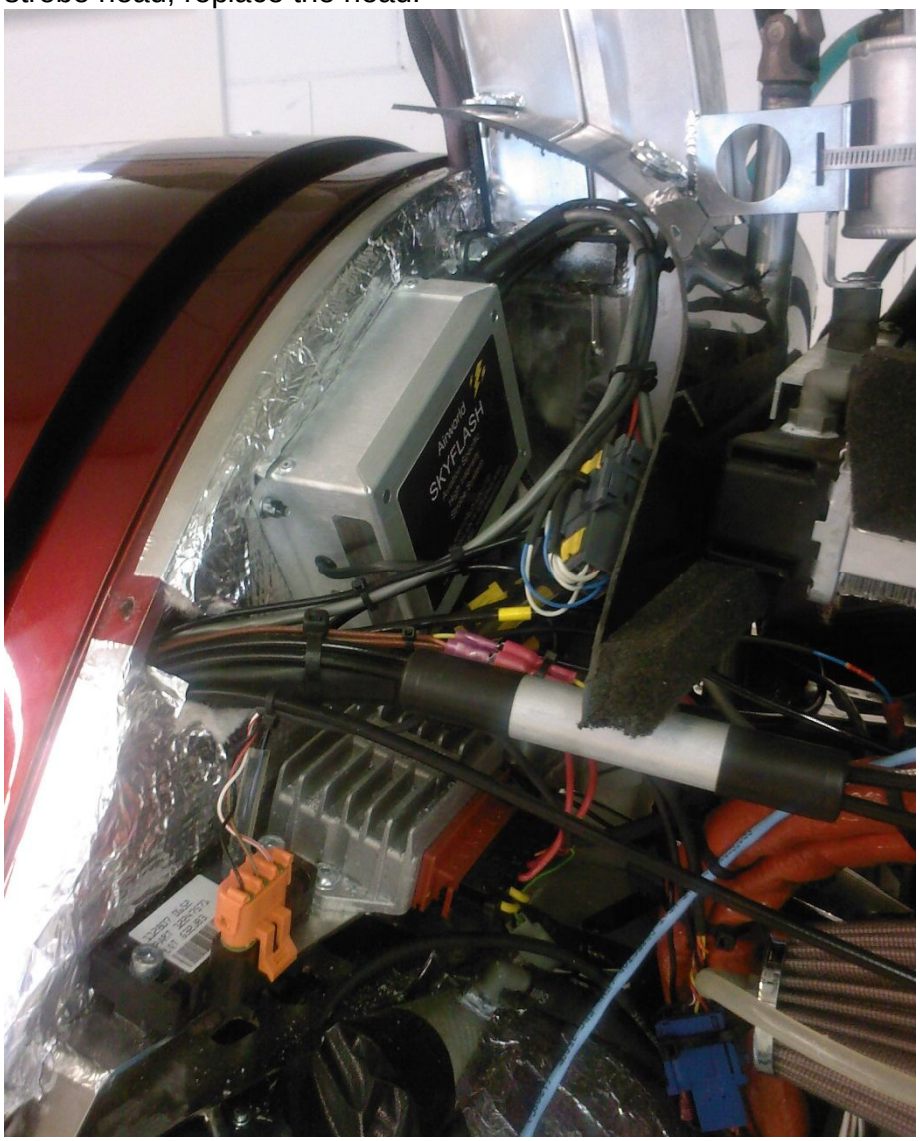
MC-192 / SB-042 allows replacement of the 80A starter fuse with a 100A fuse of the same type. This prevents starter fuse failure when operating in cold environmental conditions.
Embodiment of MC-194 / SB-044 (Ground cooling) requires replacement of the Fan fuse F10 with a 15A fuse of the same type

Strobe systems.
The AVEOflash system has no control box, as the control is all mounted within the heads them selves. The units may contain navigation lights and positioned either side of the aircraft, and/or a white rear facing strobe mounted on the rear of the mast. In the event of failure, disconnect the unit and replace with new.



Aveoflash side strobe location (same for Skyflash)

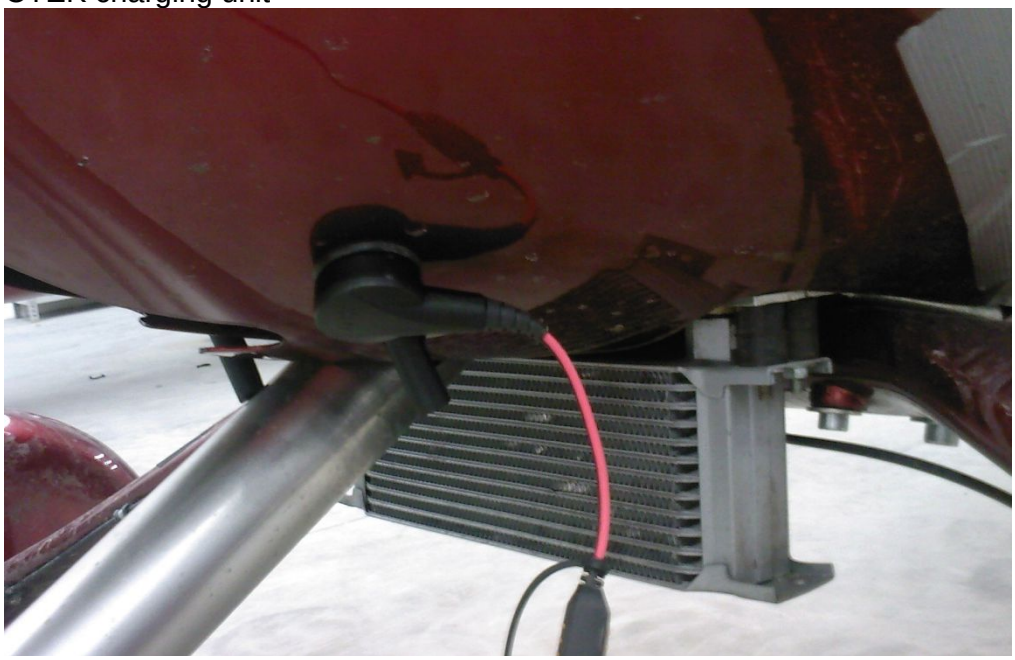
The Skyflash system relies on a control to generate the strobe pulse. The navigation lights (if fitted) are powered independently. In the event of a strobe flash failure first check whether the control box or the head is faulty by swopping the head supply cables over at the control box. If the problem transfers from one head to another, replace the box. If the problem stays with the strobe head, replace the head.



Skyflash control box location

Battery charging. The aircraft is fitted with an SBS8 battery, located centrally between the fuel tanks. Access to the battery for replacement requires the removal of one fuel tank.
An optional charging point is available under the right side of the lower engine fairing, protected with a 15A in line fuse adjacent to the battery. The charging lead is magnetically held in place, and when connected to a CTEK charger as shown below. This unit is ideally matched to the battery requirements.

CTEK charging unit



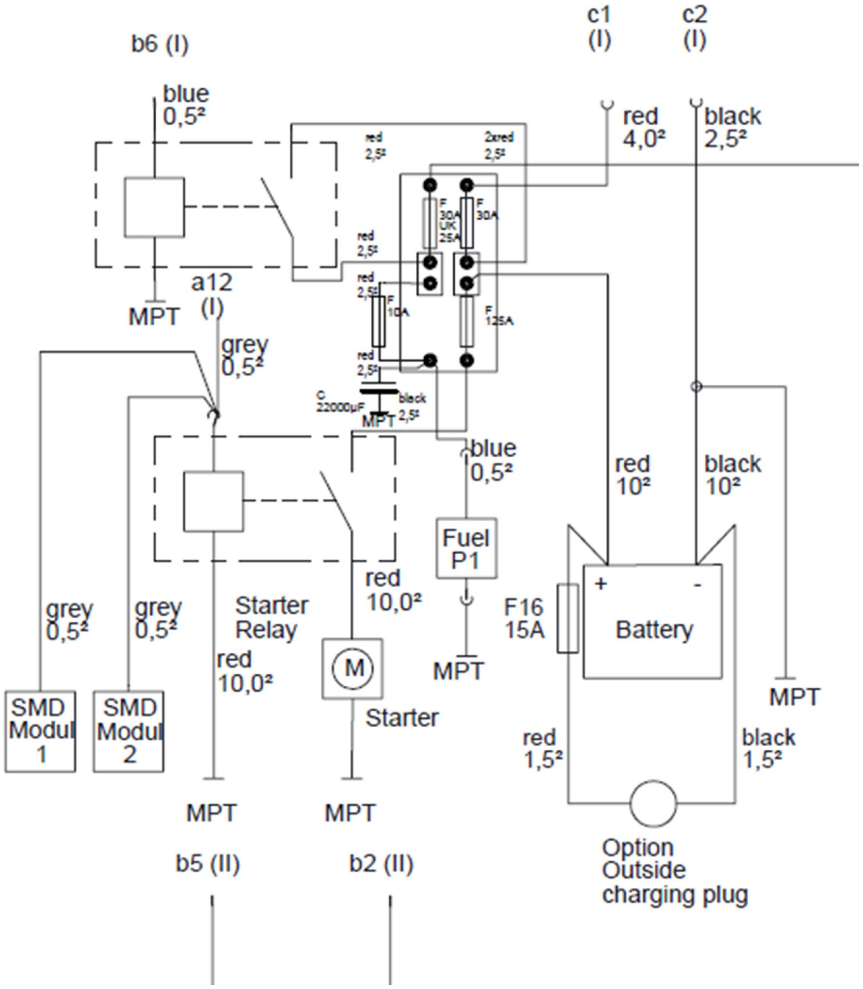
Charging point location with lead attached.

FURTHER INFORMATION (914UL)

Under MC-264/SB-073 a protection relay is introduced to provide continued electrical supply to the P1 fuel pump in certain failure conditions.

No power in the cabin indicates either the main circuit fuse has failed, or that the battery has failed and the pump protection relay has opened. In this case the P1 primary fuel pump remains powered by the regulator directly, maintaining fuel supply to the engine. The turbo control unit is not powered in this instance, and will remain in whatever position it was in when power was lost – so mixture and manifold pressure control will be lost. The pilot must take care to only use the minimum power required to land safely to prevent engine damage.

In this case the primary fuel pump will continue to run until the engine alternator stops providing electrical energy. If required, fuel supply can be shut off via the fuel cock located behind the seats.



Extract from Calidus wiring diagram BT5749 Stromlaufplan V now at Issue A002, showing new relay, capacitor and fuse at top-left.
Note that for UK aircraft a 100A fuse replaces that shown as 125A.

d) **Pneumatic**

Basic description

Refer to pneumatic diagram (choose with or without roll trim, shown at the end of the section).
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 bearing cylinder operating the pre rotator clutch 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.
The pump has a max pressure capability of 10 bar – but is 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 under the rear seat in the valve box. There is a slotted screw on the end between the contacts that is screwed in or out. It is factory set, and paint marked. Adjustment is not normally required
Additionally there is an optional cylinder for the roll trim. This is located on the left side of the rotor head. The roll left and roll right buttons on the control stick change which side of the cylinder is pressurised, and which exhausted.

Note that the rate of fill and exhaust of the system will control the rate of trim change.

Trim indication.

Pitch trim is indicated on the analogue dial gauge on the panel. This simply records the pressure in the pitch trim cylinder. Pressure increase is nose up trim, decrease is nose down.
Roll trim is indicated on the LED bargraph mounted on the instrument panel. This is a differential pressure indicator – indicating the difference in pressure between the two sides of the roll trim cylinder, and is set such that equal pressure will give a mid display reading. The signal generator for the LED scale is located under the rear seat, and is not user repairable.

Pre rotator operation

Turn mechanical panel valve to 'Flight'. Press button on stick when stick is fully forward. Closes circuit to switch V5 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 rear 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 microswitch position to suit.
Valve V5 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 which 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 valve cluster behind the instrument panel, and is adjusted as per the 8bar switch (but is factory set and paint marked, and does not normally require adjustment).

Pitch Trim operation

Turn mechanical panel valve V1 to 'Flight'. Press rear trim button on the end of the stick nearest the pilot. Release of switch turns off the pump and closes the valve, leaving the cylinder pressurised. Push the top hat button forwards. Closes the electrical circuit to valve V3, which lets the cylinder exhaust via a regulator.

Roll Trim operation

Press left roll trim button on top of stick. Closes electrical circuit to pump solenoid, which pressurises the trim cylinder, and opens valve V4 to allow air to enter the one side of the

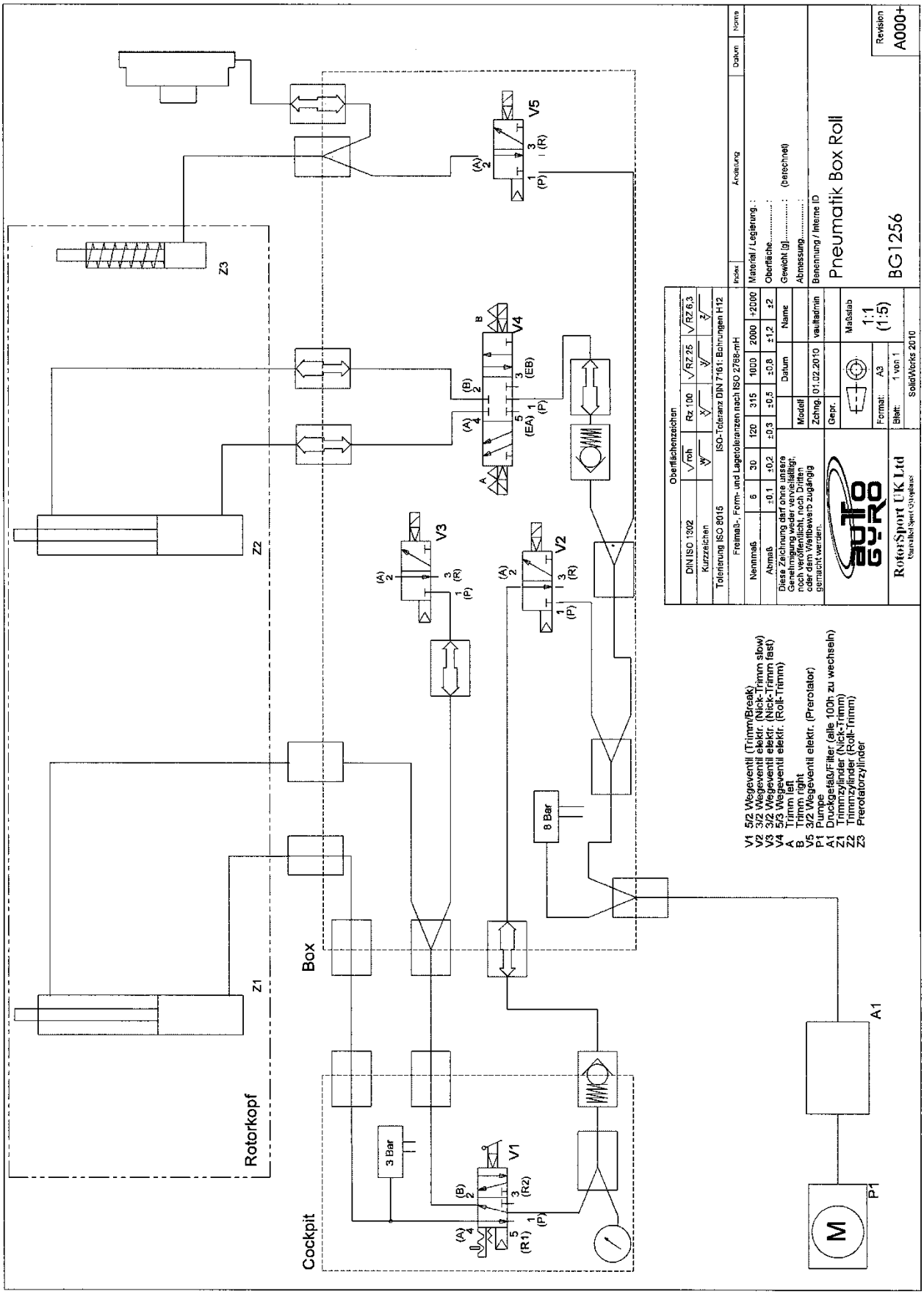
cylinder, and allows the other side to vent via a regulator. Releasing the button closes the valve. The same happens in the opposite direction when pressing the right roll trim button.

Rotor brake operation

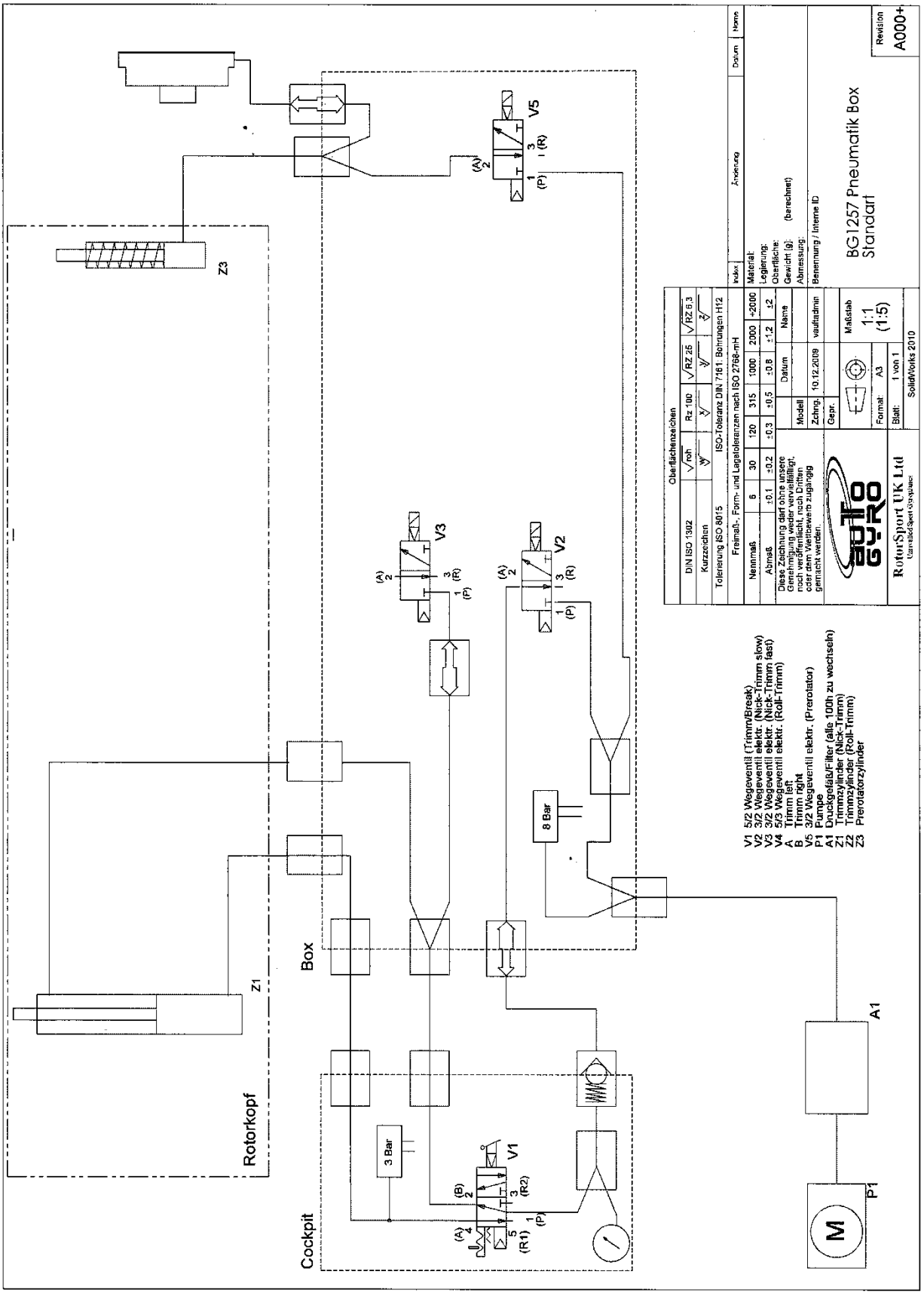
Turn mechanical panel switch V1 to 'Brake'. Press front trim button on top of switch. Closes electrical circuit to pump to pressurise trim/brake cylinder. Brake can be engaged in full range of stick pitch movement.

Equipment location: the box containing all pneumatic valves, vents, throttles etc, and the pump, is located under the central panel under the rear seat. The roll trim differential pressure sensor is located under on the keel box section in front of the nosegear, and supplies its signal electrically to the roll trim indicator.

Pneumatic circuit diagrams are shown below:



Circuit diagram with roll trim



Pneumatic circuit without roll trim.

Materials used (as per parts list)
Assembly methods
Hoses are all push type fitting, push on with collet lock, or with thumbscrew lock

Special setup instructions
Ensure system and air dryer ('filter') are water free. Dryer (located under the rear seat) 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 under the rear seat.

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 cylinder engages (check that the bendix rises), and when the stick is pulled back it disengages. If no disengagement adjust stick microswitch. Note that the head cylinder must engage prior to the engine clutch.
Stick to front, release pre rotator and confirm that pressure is applied to trim and stick comes back slightly – and that pressure gauge shows around 2 to 3 bar. Apply right roll trim, note that indicator moves right and pressure moves stick to the right. Repeat to the left, then return to centre by centering the bar indicator. When centered the stick should be centered with very little to move left or right. When at extreme left or right travel the last indicator led should flash slowly to indicate it is at the end of the travel.
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 (bendix rises) 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 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. Check also that the panel led for the canopy unlocked sensor is not lit – this sensor isolates the power supply to the solenoid valve, preventing pre-rotation unless the canopy is locked shut.
Trim pressure loss in flight. Check cylinder and air pipe connections, and trim cylinder for leakage.
No trim pressure release. Blocked valve or no power supply to solenoid valve.
Pre rotator rattles at the rotor head when engaged. Flow regulator incorrectly set on engine cylinder – back off so that rotor head cylinder is pressurised first.
Trim sensitivity high, and unequal between left and right – flow regulators poorly set. Adjust.
NOTE! The pneumatic system (electrical valves, relay etc) is housed in a box under the rear seat. It is recommended this is returned to RSUK for servicing should malfunction occur.
The pump is also located under the rear seat.

Note that replacement seal kits (RSD4532, Pitch trim and brake, RSD4533 roll trim) are available for the pneumatic cylinders. Fit as per instructions in seal kit.

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e) Rotor (8.4m rotor, orange end caps, or RotorSystem II, 8.4m, red end caps), or RotorSystem II, 8.4m TOPP variant (blue end caps)

Basic description

The rotor is a pre coned two blade teetering design. Each blade is an extruded section, containing tip weights and end 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 rotor blades used on the Calidus aircraft carry either orange end caps (approved for flight to 90mph) or red end caps (approved for flight to 120mph under AAN29266 addendum 1), or blue end caps (approved for flight to 120mph under MC-328).

MT rotors (black end caps, 8.4m, and grey end caps, 8,0m) are NOT approved for flight on the Calidus aircraft.

Orange end cap rotors were fitted as new to aircraft serial 001 to 017, red end cap rotors or blue end-cap rotors are used thereafter. Aircraft serial 001 to 018 may be upgraded to use RotorSystem II under SB-039, and orange end cap rotors may be upgraded to BG1793 red end cap standard under SB-050. Rotorsystem II TOPP variant rotors (blue end caps) may be fitted (optionally) to an aircraft on which SB-039 has already been embodied

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 (RSII)– 35kg (TOPP). 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 RotorSystem II rotor will not fit to an earlier rotorhead. An earlier rotor (orange end caps) would fit the RotorSystem II rotorhead, but the teeter stops would allow excessive movement, potentially causing rotor to make tail or propeller contact. The tower used with a RotorSystem II rotor is 40mm higher than that used on earlier aircraft.

Materials used (orange 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
Washer, 9mm, thin
Washer, 8mm, thin
Nylock nut set of 12 x M8
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 six (per blade) 9mm shank bolts fitted with ‘thin’ 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! Tighten all M8 nuts to 25Nm.

When assembling, or dis-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, a suitable step put onto the rear seat can help), 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.
8. Ensure the rotor teeters to the stops freely.

Removal of the rotors is the reverse of the above, noting;
1. Ensure the rotor and parking brakes are fully on before starting the process.
2. Remove the rear seat cushion and place a suitably strong box in its place to stand on whilst lifting the rotor into position.

Ensure the relationship markings between the spacers, rotor and rotor head is marked, to ensure correct reassembly.

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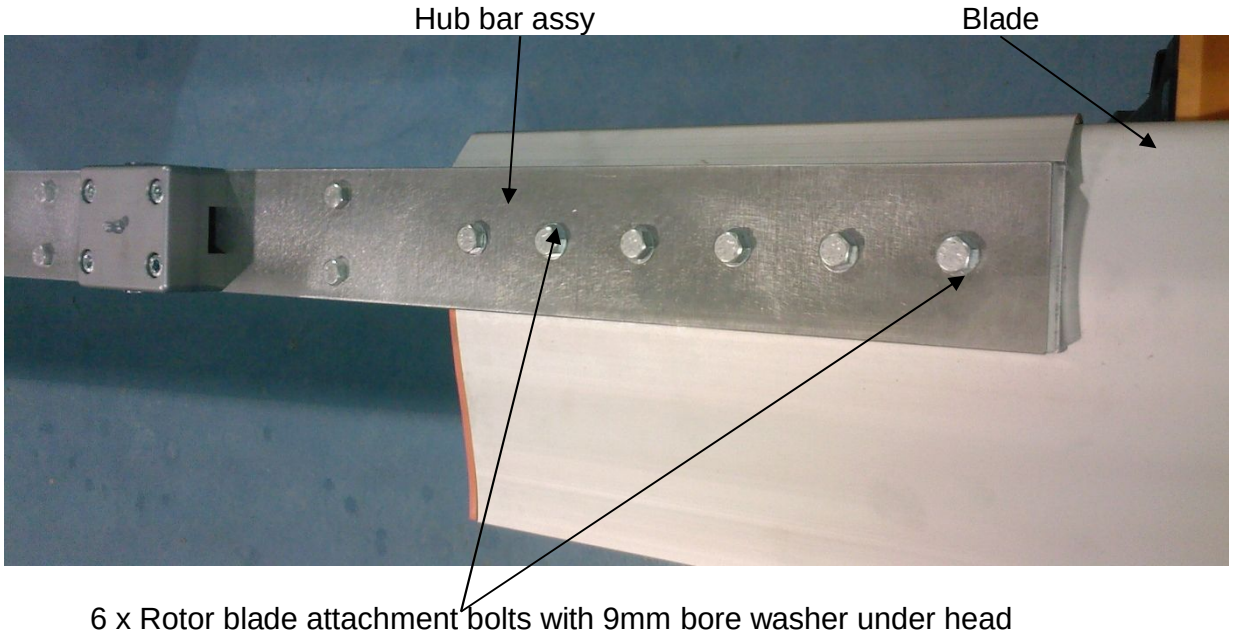
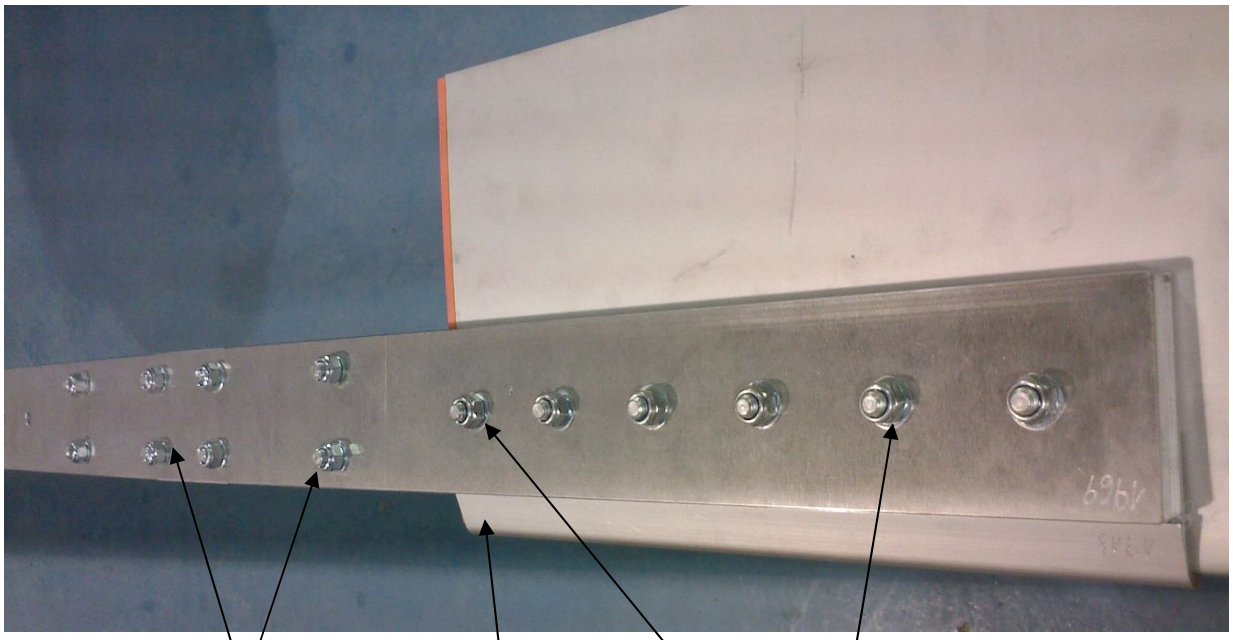
The Orange end cap rotor system:

View of rotor top



6 x Rotor blade attachment bolts with 9mm bore washer under head
These bolts are all the same length

View of rotor bottom

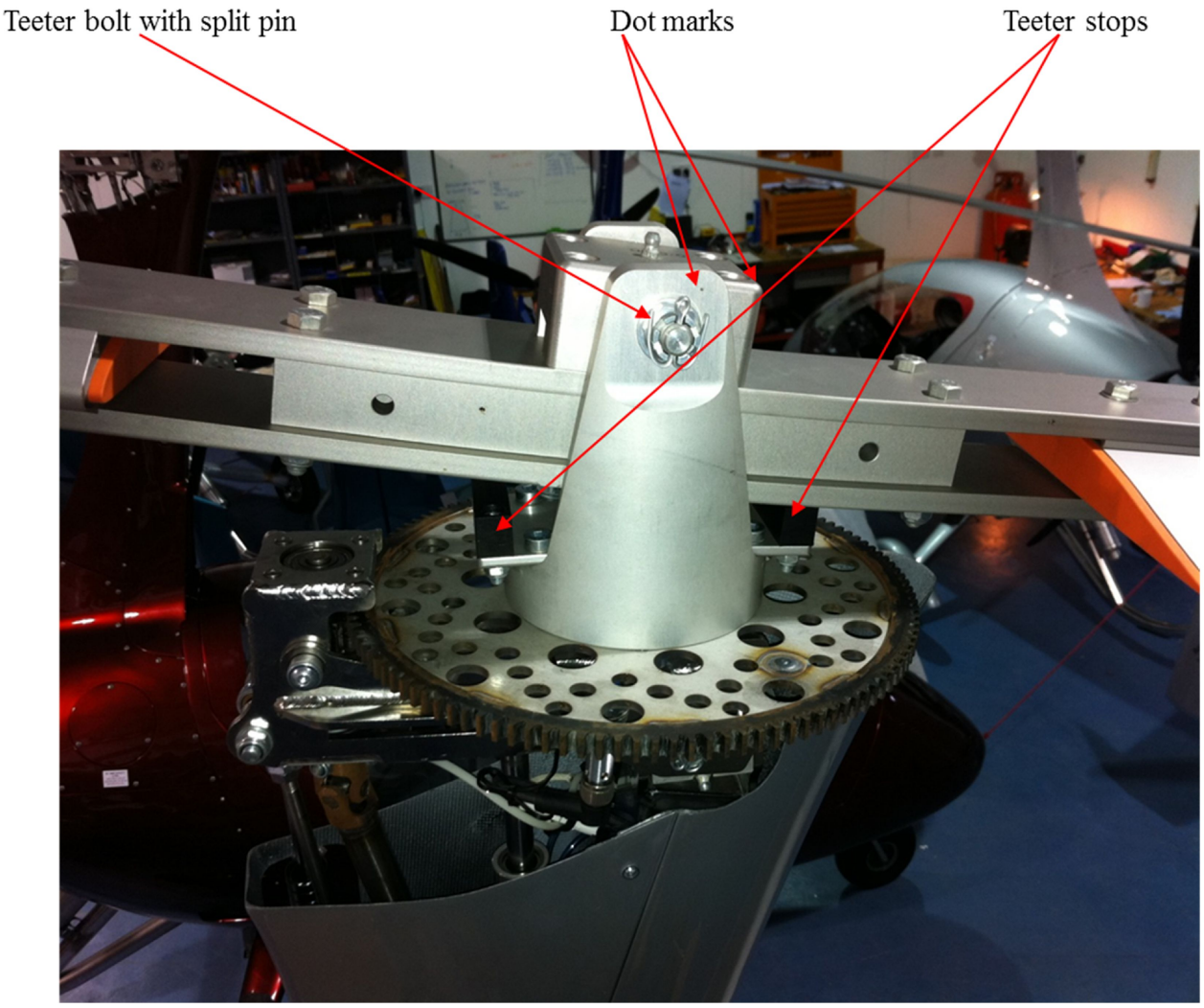


Do not adjust these 8 nuts/bolts

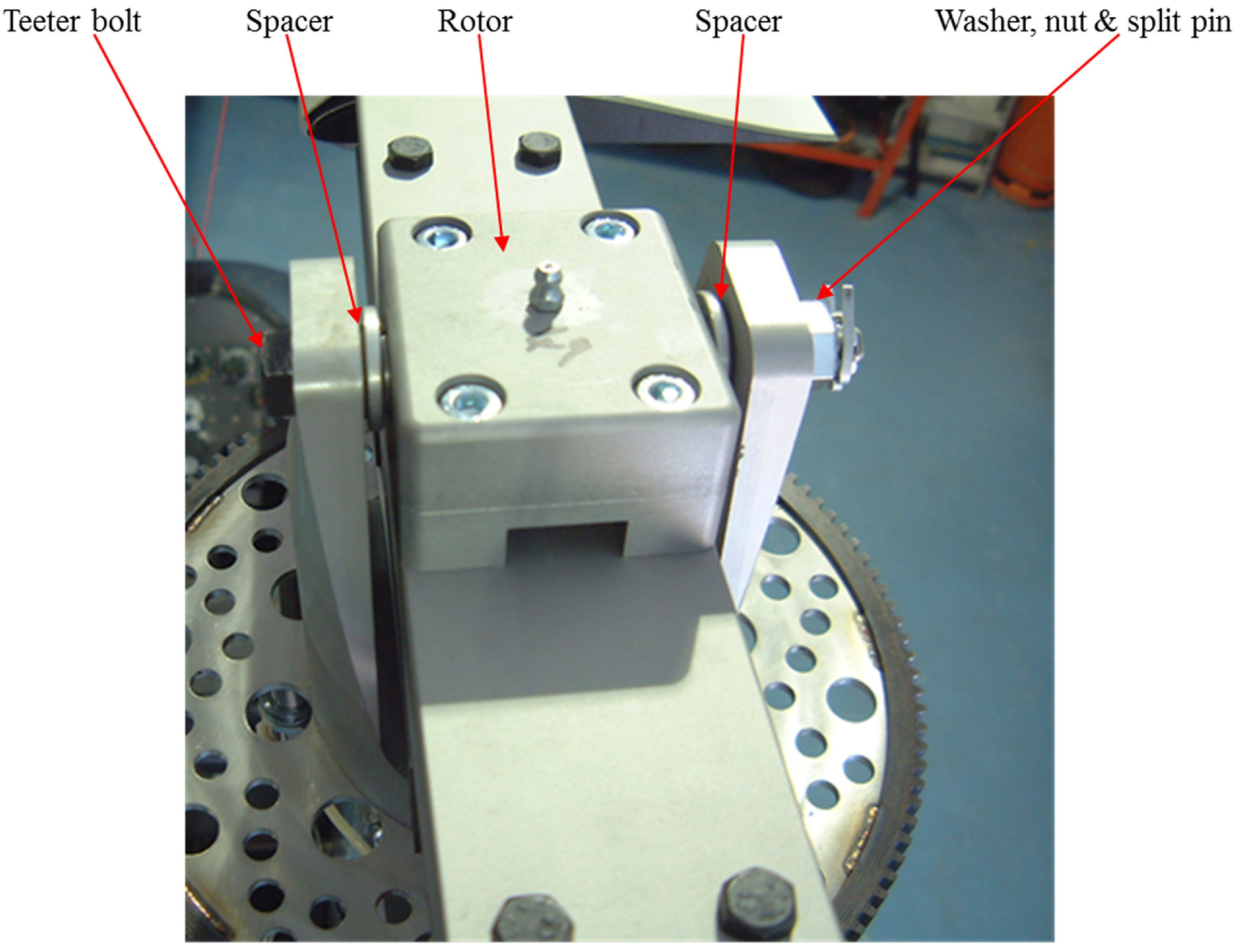
Spacer extrusion

M8 Nylock nuts, 8mm thin washer under head

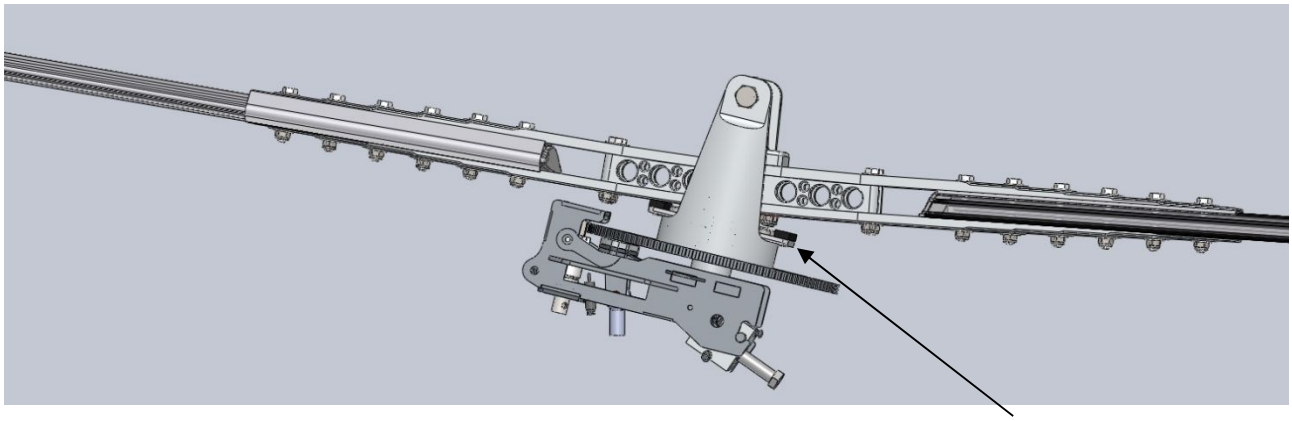
View of rotor installed



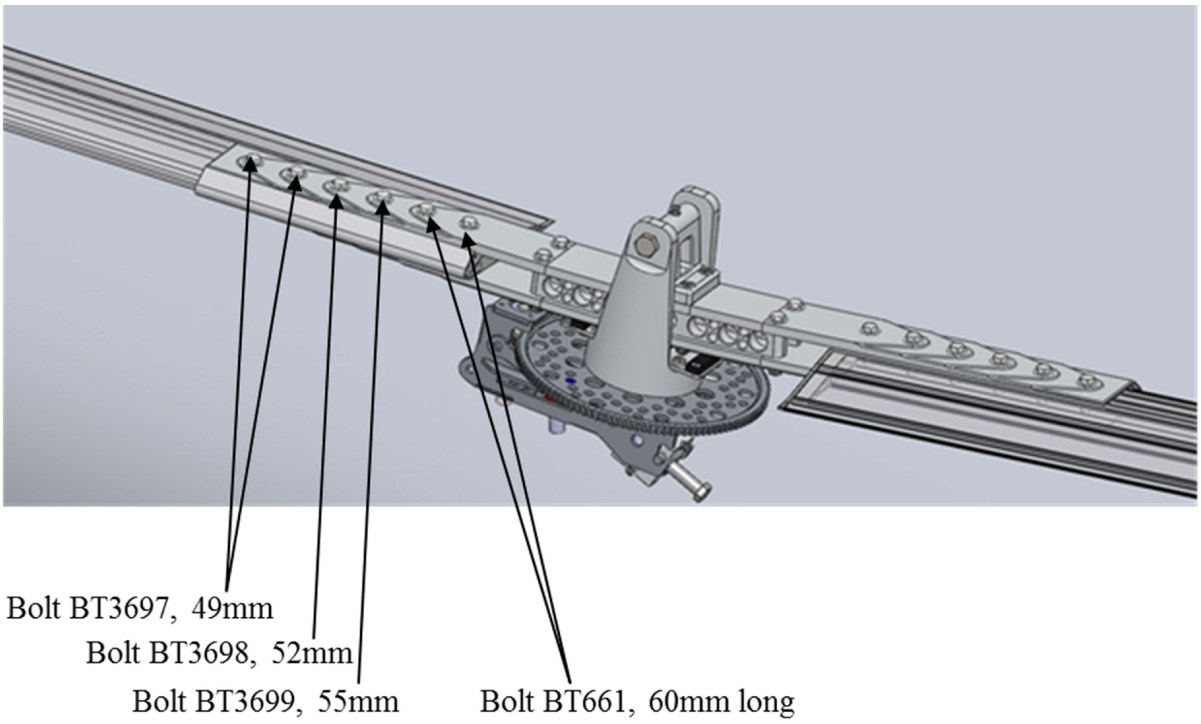
Top view of rotor installed



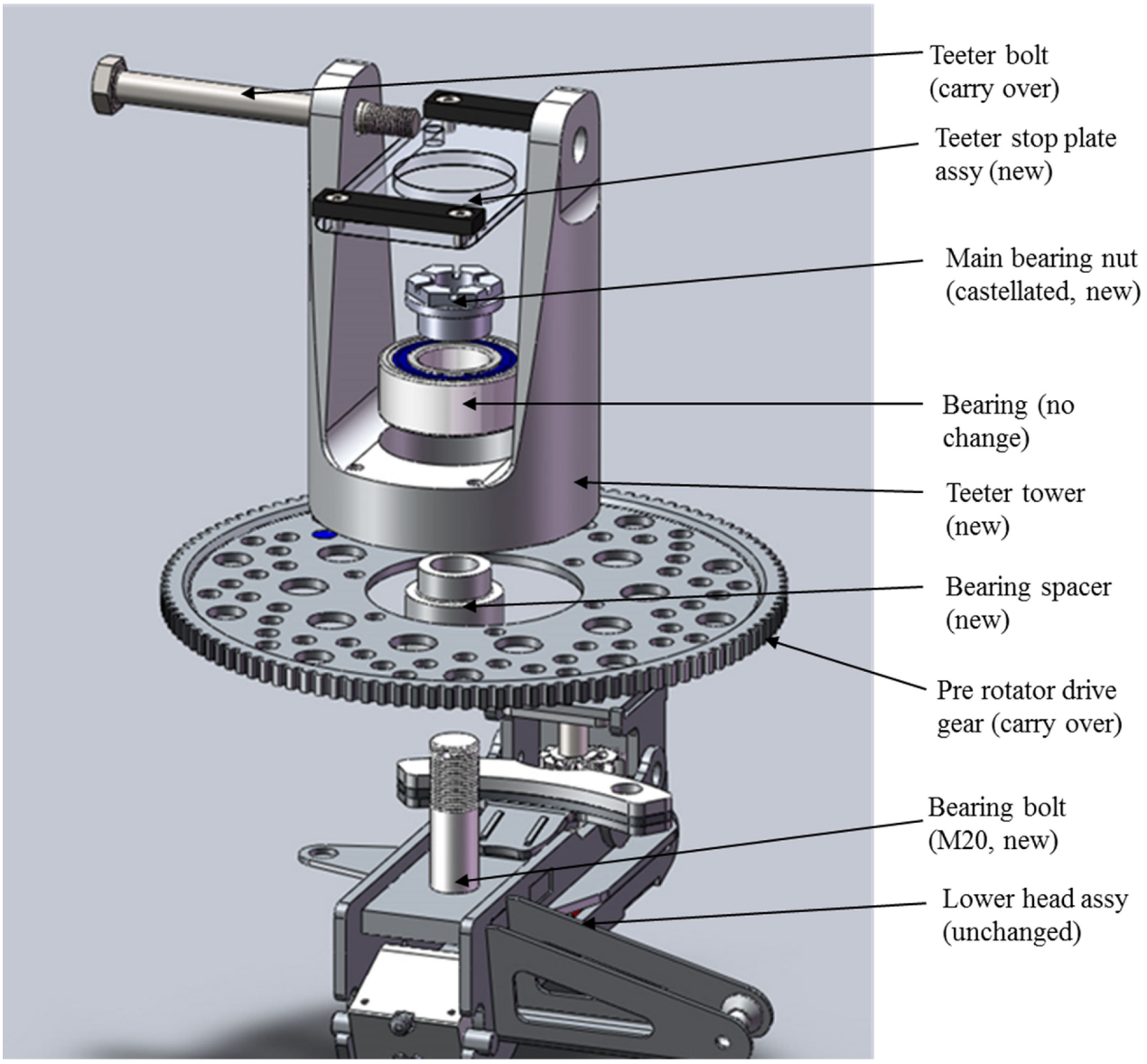
The red end cap rotor system (RotorSystem II)



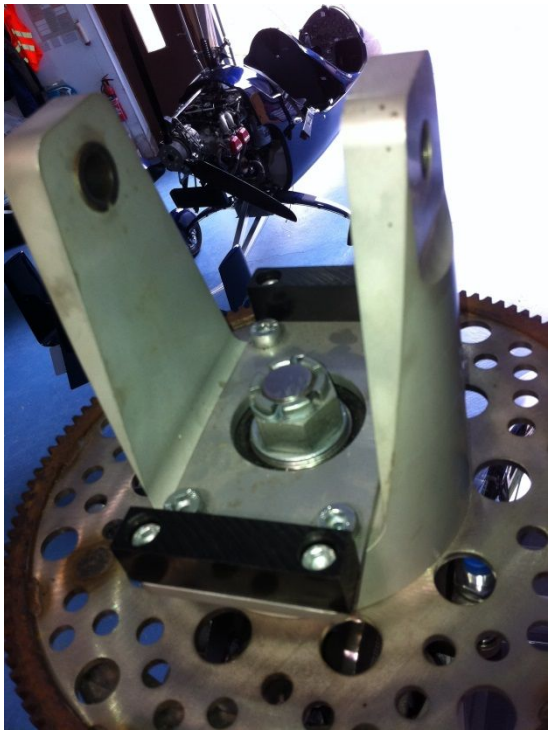
View of rotor installed in rotor head Note short teeter stops



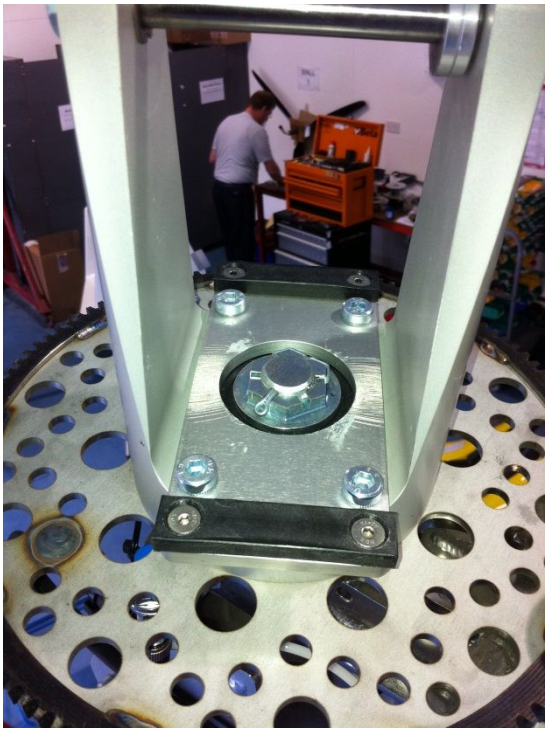
WARNING! It is important to fit the correct length bolt in the associated hole! Fitting the wrong length bolt may result in insufficient safety protrusion through the nylock nut, or that the nut jams on the shank of the bolt before the joint is properly tightened.



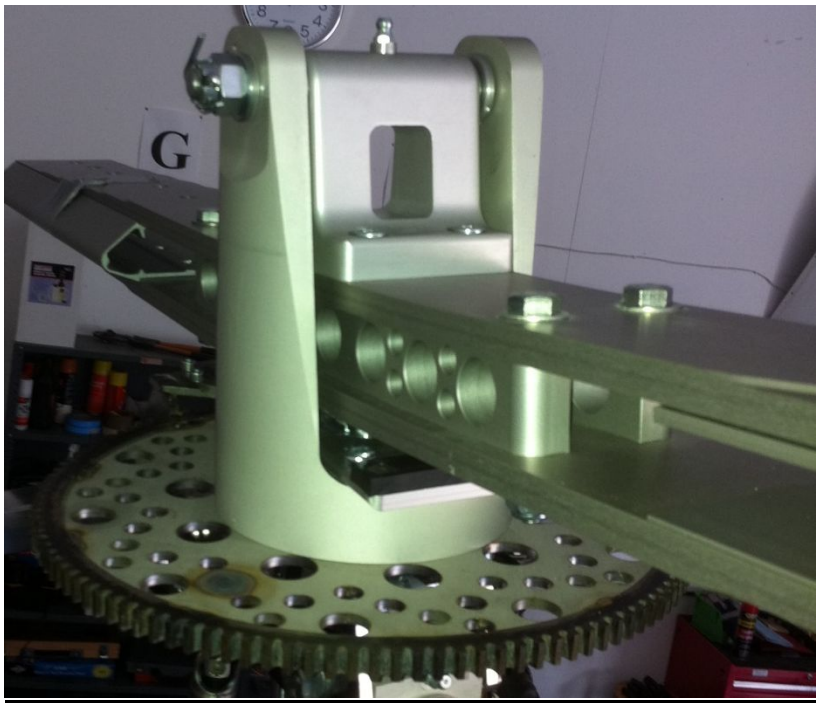
Section view of Calidus rotor head with RotorSystem II parts shown.



Old rotor head assy



Rotorsystem II head assy



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

General notes for both rotors systems

Special setup instructions

Orange end cap teeter stop (the black plastic blocks) height is 18,8mm, red end cap is 7mm. Check both sides, short height blocks may allow tail to rotor contact, long blocks will limit rotor teeter in flight.

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

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 with soap and water– 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 tip 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.

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.

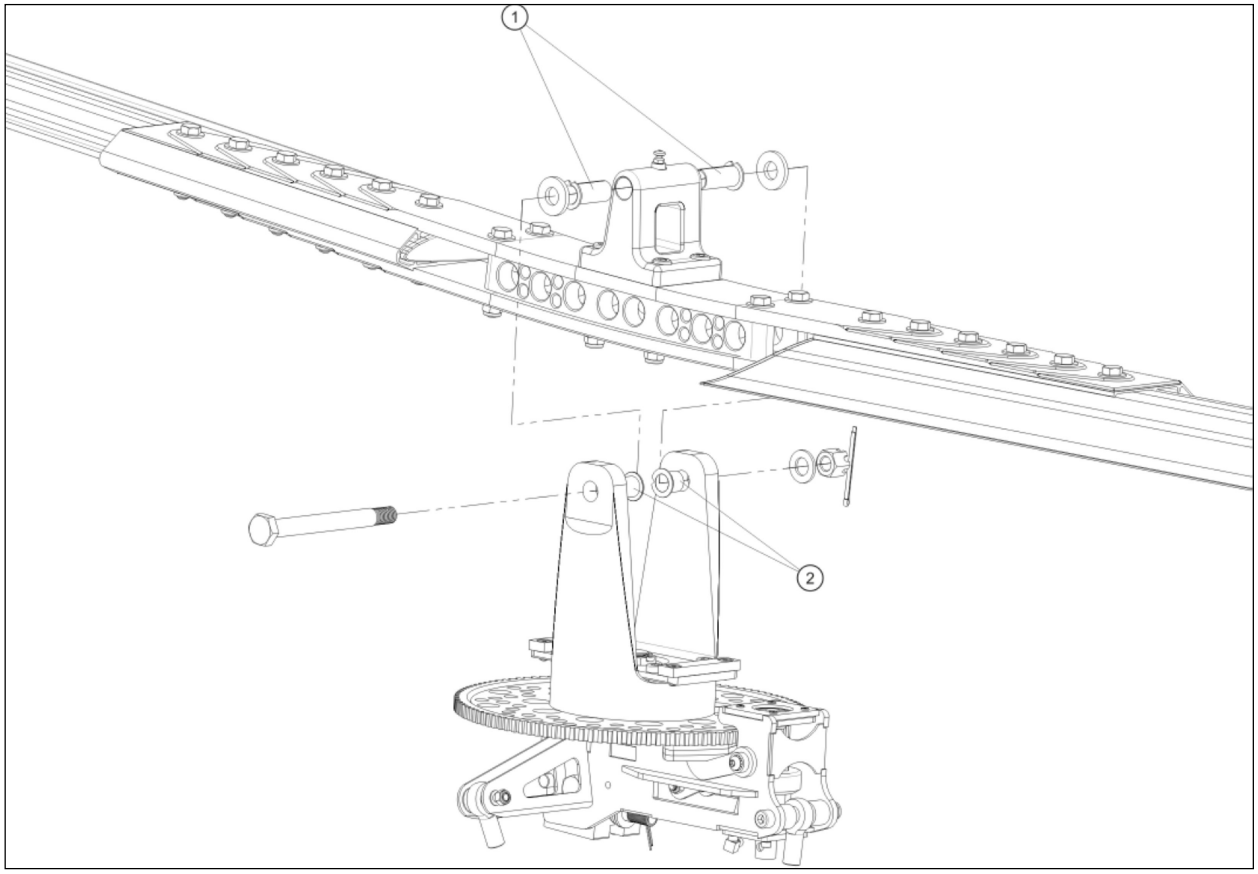
Replacement of teeter bushings

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 160ºC or the material properties will be adversely affected. The use of a suitably instrumented 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

f) HTC Propeller Basic description

See RSDS7066

The HTC propeller is fitted as standard. This is a 3 bladed composite design with an aluminium 2 piece hub machined from solid. Each blade is a foam filled wet layup component in carbon and glass fibre. There is a 50mm spacer fitted between the propeller and the engine gearbox flange. Between the spacer and the propeller are fitted 6 torque bushes, to transmit the engine torque from the spacer to the propeller. Similarly, there are 6 (Rotax manufactured) flanged nuts fitted to the gearbox flange, into which the propeller bolts are tightened. These carry the torque to the spacer. The function of the six propeller bolts is to clamp the hub to the gearbox flange. In use, they should carry no torque, and if the propeller balance is correct, very little tensile cyclic loading – as the driving force is onto the gearbox flange.

An optional spinner assembly may be fitted. This comprises a composite spinner, an aluminium CNC machined mounting plate, and 9 M4 screws to hold the spinner to the plate (with plastic washers under the heads).

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
Spacer and bush set
Spinner backing plate
Spinner

Assembly methods

Bolt torque (M6 and M8) 15Nm. Take care not to overtighten, and pre coat M8 centre bolt threads with loctite 243. Apply paint stripe between the protruding bolts theads and gearbox flange to allow visual check of bolt security. Minimum protrusion 1 thread for marking.

Spinner screws. Use loctite 243 and tighten securely. Ensure a nylon washer is fitted to each screw.

912ULS Approx blade angle 20.5 deg, 12” from the end of the blade.

914 Turbo Approx blade angle 22.0 deg, 12” from the end of the blade.

Angle measured with respect to the hub face, see photos. Special tool available, part no RSD4536 (914) and RSD4537 (912)

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 5,400, but do not adjust the propeller blade angle to achieve this value - flight test to ensure the engine does not rev higher than the Rotax maximum, and, if then required, adjust to suit. Note that the prop is pitched to not exceed 5,800 in level flight at 120mph. 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, and if fitting a new prop or blades, check the bolt torques after the first 25hrs, to compensate for the blades settling into the hub. Failure to do so may lead to cracking of the gelcoat around the blade to hub attachment.

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 out of balance force on the propeller shaft 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 aircraft release to service 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.

g) Pre rotator (mechanical system)

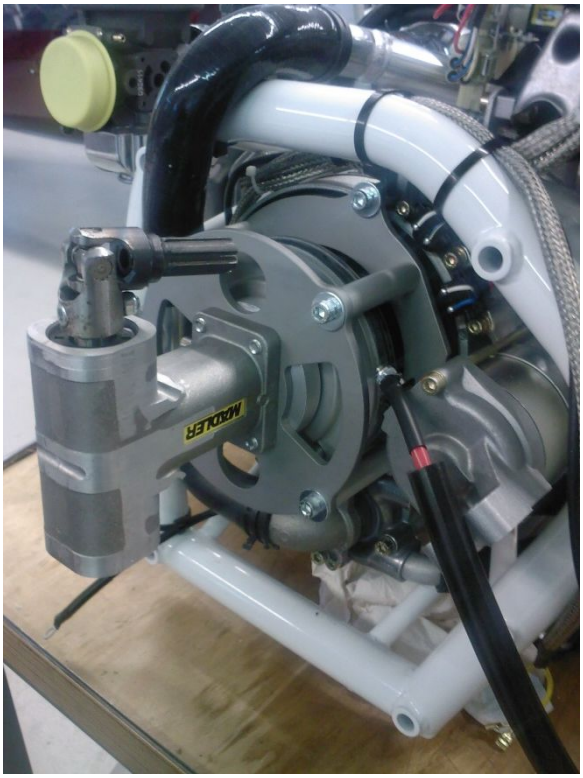
Basic description

A pneumatic clutch is driven from the front end of the engine crankshaft. This drives a right angle gearbox, which then transmits the torque to the rotor head through three universal joints and two sliders. 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 the mast fairing. Jamming of this shaft would interfere with pilot controls, must be kept well lubricated with regular LM grease (RSD4530), and protect joints from corrosion with chain lube, Waxoyl or similar spray-on protective lubricant.
The system is engaged by the pilot pressing the pre rotator button on the control stick with engine rpm low – around 1800rpm. This turns on the air pump, and switches the valves to allow air to flow into the engine clutch and the bendix cylinder. The bendix is pushed up first, to ensure a smooth engagement, and the engine rpm is kept around 1800 until the pre rotator clutch is not slipping, when it can be increased further to maximum rotor speed of around 280rpm. Recommended maximum rpm for grass use is 250. Operation above 250rpm will shorten the pre rotator gearbox life.

Materials used

See service parts list.

Parts available: engine pneumatic clutch assy, clutch disc and spring, gearbox, UJ assies, upper, middle and lower drive shafts, bendix gear, bearings and shaft.



Views of the “Maedler” pre rotator gearbox

Assembly methods
Screws are loctited to the engine casing. The gearbox and clutch unit is a service part.

Special setup instructions
Only minimally lubricate the bendix with light oil (such as 3-in-1 oil, RSD4531); 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 clutch pneumatic valve to achieve this.

MC-166 introduced upper drive-shaft components with flats, shorter screws and better tolerancing to provide improved operating clearances. The bendix drive shaft is now toleranced to avoid the need for shim-washer selection.

Repair methods

To change the bendix gear shaft or bearings.
Ensure rotor head is braked forwards. This can be done without removing the rotors.
Remove mast covers and upper engine cover. Remove vertical drive shaft UJ bolt, and slip off UJ from the bendix shaft. 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 bearings are noisy or showing signs of dryness or lumpiness, replace. If needed remove the upper bearing as lower bearing, excepting that the bearing plate is retained with stainless pop rivets. Drill out the rivets and replace with new from the service pack.

When refitting, secure the cap head screws with loctite 243, and lightly lubricate the bendix spiral.

To change the engine pre rotator, or components.
Remove all engine and mast cowls
Replace with new parts as required and reassemble.

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, and check pre rotator pneumatic function.

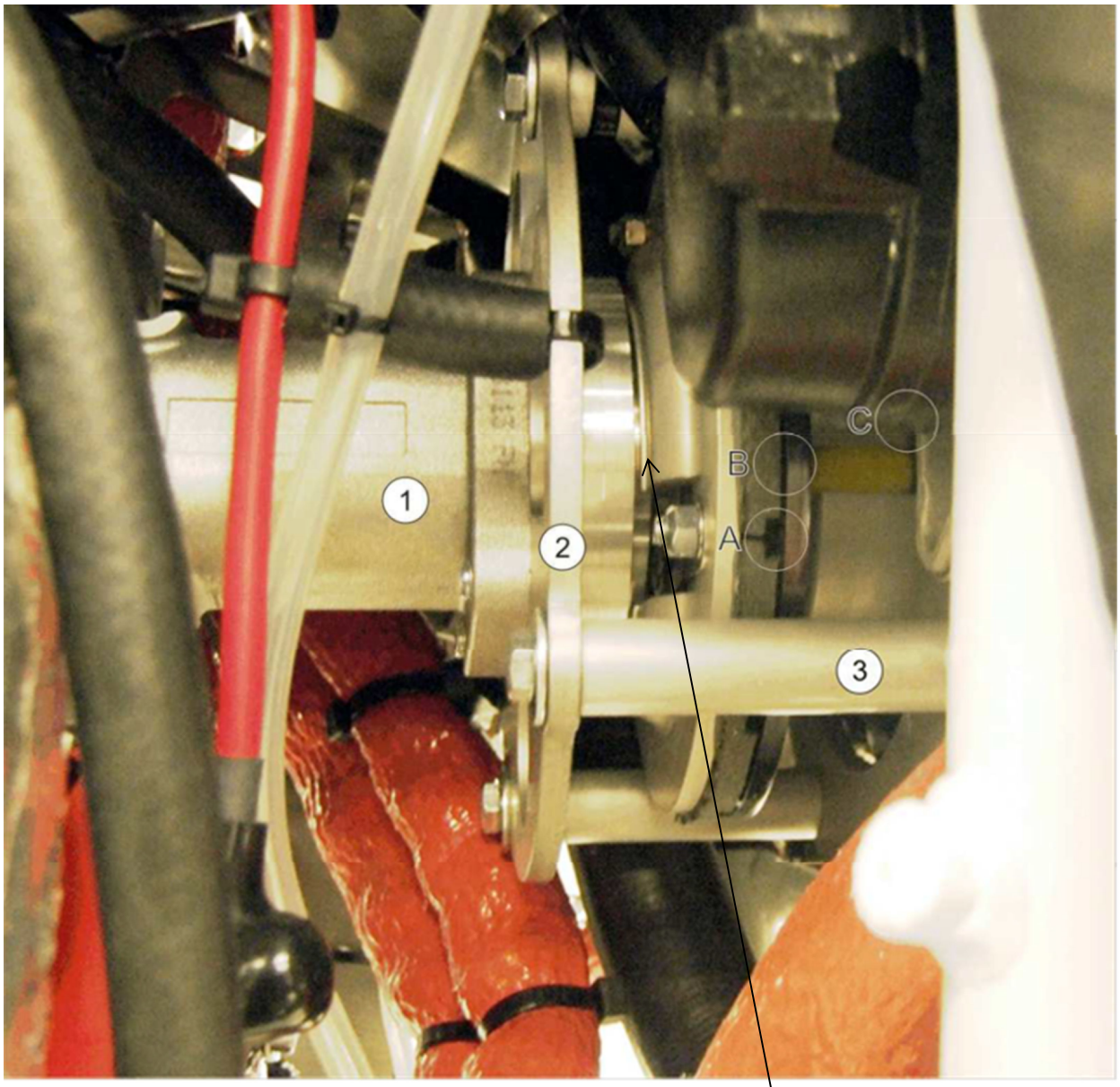
Improved pre-rotator gearbox and clutch (series II/III)
Under MC-212 an improved gearbox (with pressure regulator) was introduced. The gearbox has a 1.5:1 reduction ratio (which results in more progressive rotor acceleration with increased engine rpm) and a pressure regulator to better control engagement of the pneumatic clutch. Pre-rotation technique is slightly different – see Pilots Handbook RSUK0060.
Embodiment of MC-212 can be recognised by the use of a black rather than red button on the interlock release push-button.
MC-259 introduced a clutch brake to prevent freewheeling of the pre rotator mechanism when the clutch is disengaged. If the shaft spins freely it is either not fitted, or not working.

Inspection and replacement of pre-rotator clutch series II/III
In order to access this item located in the very centre of the aircraft the cowlings and fuel tanks must be removed as described earlier in this document (Section 9 “Aircraft access for maintenance and inspection” and section n) Fuel system

Inspection

1. To check the wear state of the clutch lining the wear mark must be visible – see highlight A in photo below. The depth grove must be visible (3mm when new).
2. Measure the clearance between the clutch lining and the clutch plate – see photo below highlight B. The clearance must be between 1.0 and 1.5mm. If less than 1.0mm or more than 1.5mm contact RSUK
3. Measure the clearance between the inner drive star disc and the outer drive star claws – see highlight C in photo below. The clearance must be between 1.0 and 1.5mm.. If less than 1.0mm or more than 1.5mm contact RSUK.

Normal pressure regulator setting is between 6.5 and 7bar



1-gearbox, 2-backing or mounting plate, 3-spacer. Clutch brake fitted here

Removal

1. Disconnect the pneumatic hose at the quick-release coupling
2. Cut open and discard cable ties as required
3. Unscrew and remove 4 xM6 bolts and remove the pneumatic clutch with attach ring. Do not separate attach ring from clutch, let the adapter frame remain on the engine.
4. Remove the pneumatic clutch by pulling apart the sliding shaft coupling

Installation

1. Insert the sliding shaft coupling and position the pneumatic clutch with attach ring on the adapter frame
2. Using Loctite 243 replace the 4 x M6 bolts and tighten to 10Nm
3. Check that the vertical pre-rotator drive can easily be turned by hand.
4. Reconnect the pneumatic hose at the quick-release coupling
5. Using the normal pre-rotation technique but with the engine off, perform functional check and monitor the clutch actuation

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).

Assembly methods

Changing the brake pad does not require disassembly of the rotor head. The pad is held in place by two countersunk screws, loctited in place. These are accessible through the top of the pre-rotator disc. Note that the screw length is short, so that if they come out they cannot jam into the rotor disc. Never use longer screws!

Special setup instructions

After any work on the pneumatic system, check for correct system functionality (see general aircraft system testing). The brake does not prevent the rotor from being rotated when applied, but the rotor should be stiff to turn by hand, using the rotor tip to turn.
Ensure brake pad assembly moves freely after refitment.

Repair methods

The brake pad is a service item part no C.RKE01. Fit as ‘Assembly methods’.

The trim cylinder may be fitted with a replacement seal kit if found leaking (RSD4532).

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.

Intentionally blank

i) Enclosure, seats, harnesses

Basic description

Enclosure:

The pilot enclosure is manufactured from GRP & CRP. 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 behind the rear seat each side, left and right of the rear seat, to the main airframe. The nose gear and pedals are mounted in the enclosure, such that the enclosure is a structural element. The occupant seats are also built into the enclosure, with storage areas under. The storage lids hinge outwards using tape and velcro as a hinge. If worn this must be replaced.

The back of the front seat is adjustable both in terms of angle, by adjusting the straps at either side, or by position, by removing the four countersunk screws that hold it to the enclosure, moving the whole seat back fore or aft, and re-attaching it. There is no loctite on these screws!

NOTE! As standard the aircraft is equipped without any rear seat pilot equipment. If fitted with a rear seat stick, travel limiting screws MUST be fitted to the front seat back angle adjustment straps (see pilots handbook).

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

Seat harnesses: The rear seat upper and lower harnesses attach directly to the aircraft airframe. The front seat shoulder harness attaches to the airframe with the rear seat lap straps, and the front seat lap strap connects to the composite structure. The left front seat shoulder harness carries a link, to allow easy access for the passenger.

Canopy. Two versions of the canopy are available, either a fully enclosed version or one with cutouts either side for summer ventilation. Both canopies may be fitted with a painted on sunshade.

The enclosed canopy carries a left side emergency access hatch (also known as a DV (Direct Vision) window) to allow the pilot either to see to land or for hand access for cleaning. On the right side are two airscoops for ventilation – when opened forward air can be forced into the cabin, when opened rearwards, cabin pressure is reduced and ventilated. The canopies are interchangeable, but a changeover requires a permit maintenance release. For instructions see the pilots handbook RSUK0060.

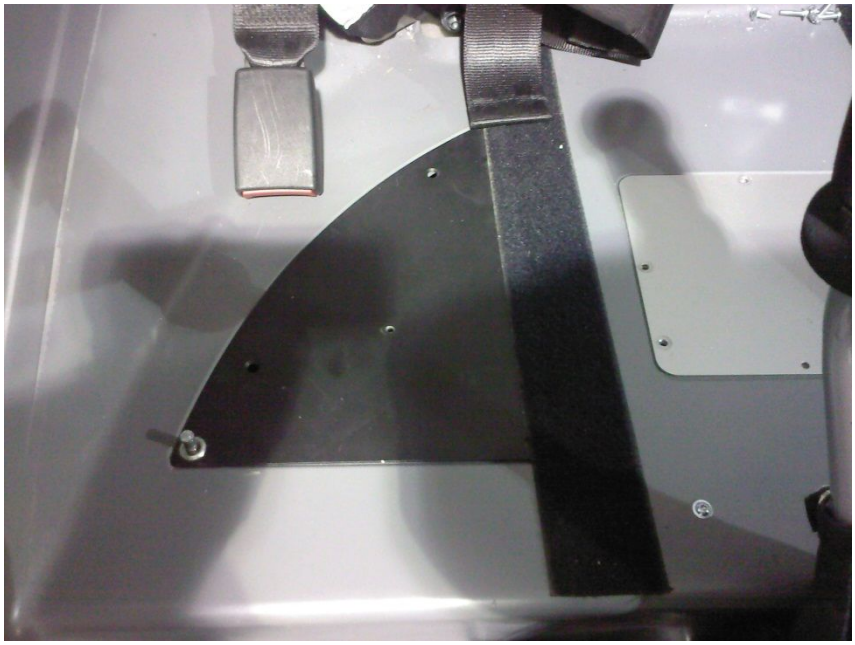
Cabin ventilation is also provided by an air vent between the pilot and instrument panel, fed from a NACA scoop on the enclosure underside.

Cabin heat is provided from a port over the passengers right shoulder. The air is taken from below the water cooling radiator, so does not pass through or close by any producer of CO or other gases. Volume of air is controlled by a butterfly valve, in turn adjusted by a cable from the instrument panel. The butterfly valve is stainless steel, and is part of the engine bay firewall. It must close properly when the knob is pushed into the panel.

From embodiment of MC-205 (applicable to RSUK/CALS/019 onwards) there two types of DV window supplied. They are identical in size and function but the mounting holes are in different locations. Should spare parts be required the different types can be recognised by the embossed name “Mecaplex” or “Weiss”

Adjustment positions for back of the front seat

Left hand front seat locker



Right hand locker located under the passenger seat. The centre aluminium panel houses the pneumatic pump and circuitry.

Assembly methods
Enclosure fitment to body
Canopy fitment to body – see RSUK0060

Seat fitment

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.
Where the rear seat instructor stick is fitted, the stick must not touch the rear of the front seat. Check that the strap limit stops are correctly fitted to prevent the contact.

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: Other than paint repairs or minor damage repair, no repairs are allowed without an approved repair scheme.

Canopy.
Windscreens are manufactured from 3mm (closed canopy) or 4mm (open canopy) Plexiglass. Cleaning can be undertaken with proprietary cleaning agents such as Plexus, or simple soap and water. Never use petrols or such products on the screens! They may shatter or suffer severe surface crazing.
Closed canopies have a Direct Vision (DV) window in the left-hand side, Two type are used, being visually similar and functionally identical. However, individual parts will not interchange – refer to RSUK if spares are required.

j) Instruments

The arrangement of the control elements and instrumentation in the cockpit is represented in the photos in fig. 2. Differences may occur depending on the equipment fitted – standard analogue, then with various GPS panel options. See table for warning lamp functions.

1. Change over switch pneumatics (TRIM to ROTOR BRAKE)
2. Altimeter
3. Airspeed indicator
4. Engine rpm
5. Oil pressure
6. Cylinder Head temperature
7. Oil temperature
8. Ignition coil switch (one for each coil)
9. Charging (Gen) lamp, lit when not charging
10. Main keyswitch
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 (P2)
19. Radio (if fitted)
20. Fuel gauge
21. Rotax engine status lights (914UL only)
22. Pre-rotator & rotor brake interlock release
23. 12v 5A max Auxiliary socket
24. Transponder if fitted
25. Low fuel light
26. Low voltage warning lamp (when lit)
27. Fire warning lamp
28. Push-Pull knob for heater control
29. Dynon Warning lamp (parameter breech)
30. Fuse bank (see right side for circuit name)
31. GPS
32. Headset connectors (with pwr supply)
33. Fan over-ride
34. Variable pitch rocker switch (not UK use)
35. Variable pitch prop circuit breaker
36. Fan –on warning (when lit)
37. Canopy unlocked warning lamp
38. Avionics switch (turns on radio, transponder, GPS)

Note, items 29, 34, 35 not yet released in the UK market. Note also that the different sized GPS units require that some items, such as warning lamps, may be located in alternative places on the instrument panel.

Switch functions
Keyswitch. First stop supplies power to the instrument panel and equipment. Second stop will engage starter motor. An interlock prevents re engagement of the starter without cycling the switch to ‘off’ first.
Avionics. On supplies power to the radio, transponder and GPS (where fitted)
Lights. On supplies power to the landing lights (where fitted)
Nav. On supplies power to the navigation lights (where fitted)
Strobes. On supplies power to the strobe lights (where fitted)
Mag switches. When off this earths the cable to the engine ignition coils, preventing engine start.
Fan button. With the keyswitch on, depressing this will start the engine cooling fan. The fan will run for a set period and then stop automatically.
Change over switch (Brake to Flight). Changes the air supply to the trim/brake cylinder to either allow the rotor brake or the in flight pitch trim to be applied.
Pre-rotator & rotor brake interlock release. Depressing this button will temporarily allow the use of the pre rotator to drive the rotors to a centered position with the rotor brake applied.

Note re Rotor bearing temp indicator. The purpose of this is to advise the pilot of an unusual rise in temperature of the bearing. In general use it may be used to indicate the outside air temperature in the region of the rotor head.

Warning lamp description and function		
Item no	Marking	Function/description
9	Gen (red)	When lit, indicates the alternator is not charging the battery. When off, indicates the alternator is charging the battery. May be seen to flicker gently in low light conditions. This is normal and acceptable.
21a	Rotax Warn (red)	Lights for 1-2secs when turned on, then goes out. When lit continuously: Boost pressure exceeded. Possible serious effect on engine, make a precautionary landing and investigate. Blinking: Turbo has been engaged for more than 5minutes. Refer to the Rotax operators manual
21b	Rotax Caution (red)	Lights for 1-2secs when turned on, then goes out. When blinking, indicates the Turbo Control Unit or associated equipment may have failed. Flight remains safe, although there may be a reduction in power available, investigate on landing. Refer to the Rotax operators manual
25	Low Fuel (red)	When lit it indicates that the low level led sensor in the fuel tank is no longer immersed in fuel. This is around 5ltrs remaining. Plan an expedited landing if lit
26	Low Volt (red)	When lit indicates that the battery voltage has dropped below 11.8v, and that the load shedding relay has disconnected the 12v socket, strobes, and landing lamps. Placard on panel advises operator to reduce electrical load, or make a precautionary landing
27	Fire warning when lit (red)	Pulse red three times on system start up. Flashes red rapidly when the engine bay fire warning cable melts. Solid red indicates system fault. When flashing red make immediate precautionary landing
37	Canopy unlocked when lit (red)	Lights when the canopy lever is unlocked. Goes out when locked. Function is from a reed switch mounted under the locked canopy latch, operated by a magnet bonded into the latch.
36	Fan (amber)	When lit warns the pilot that the electrical engine cooling fan is running. Normally it runs for an occasional short time only, or when the engine is not getting enough cooling air. This uses up to 8Amps, so constant running indicates poor cooling and excess electrical energy usage.

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

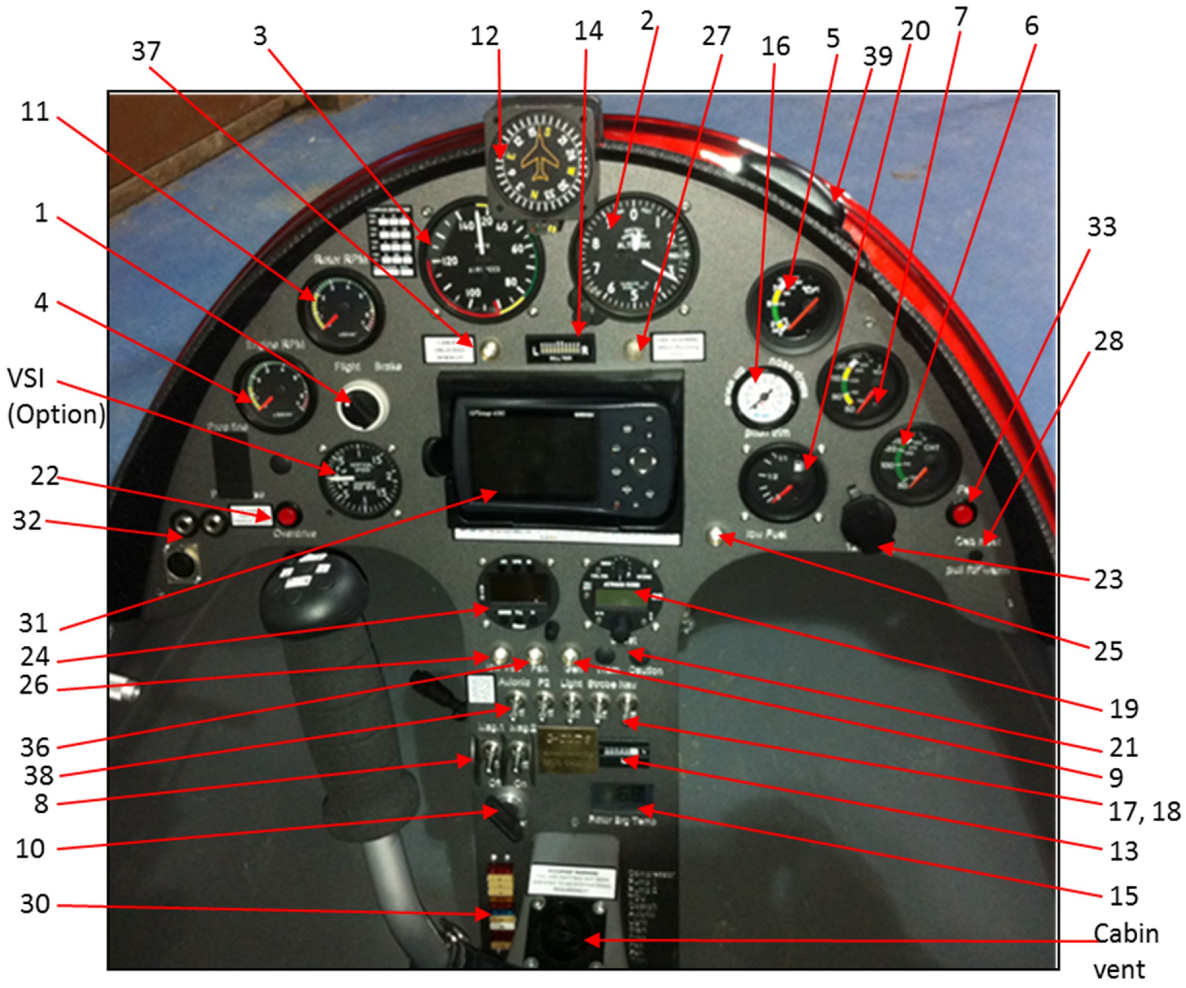


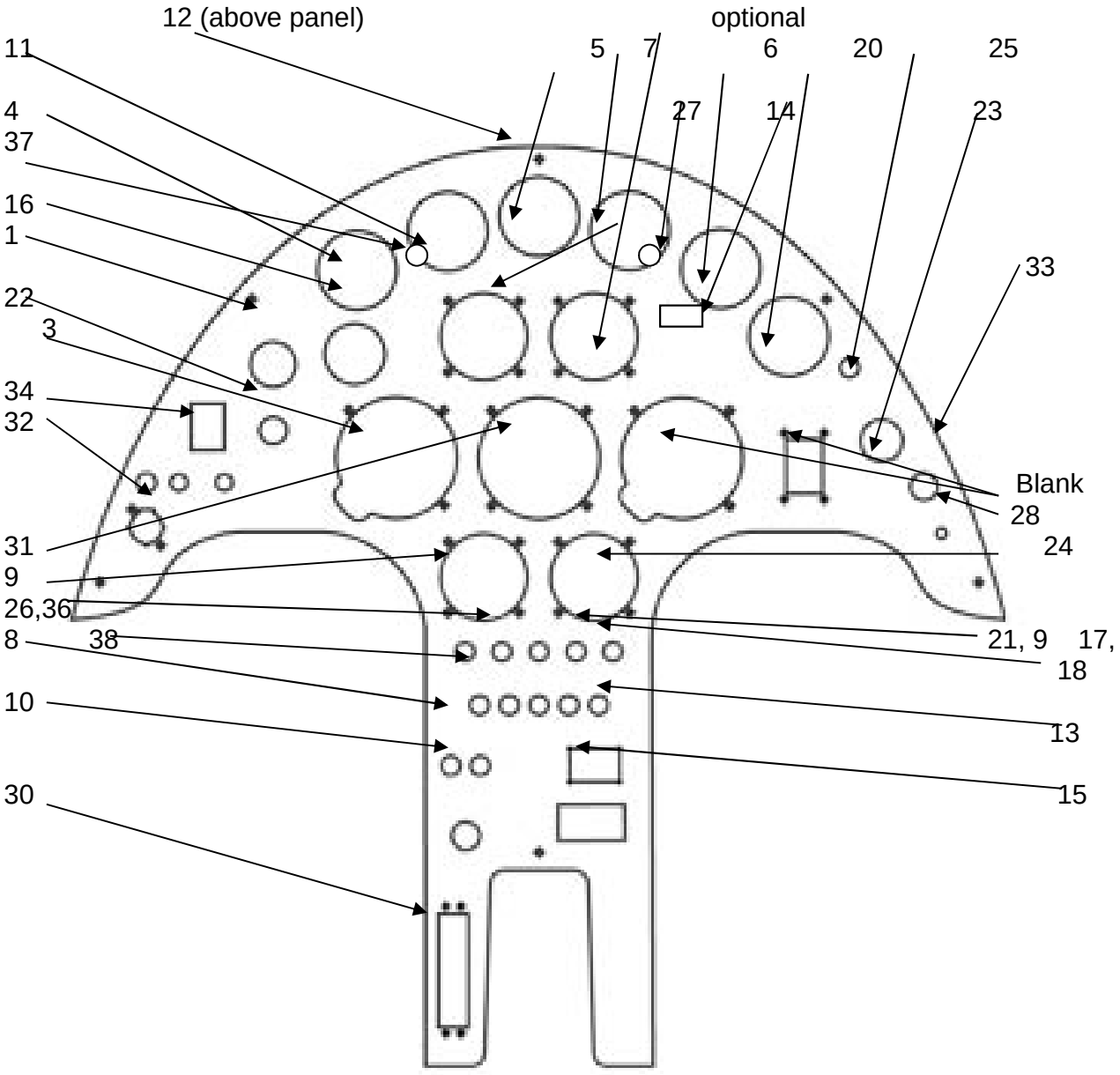
Fig 2, instrument panel, with Garmin GPS.

WARNING! GPS options.

(i) The GPS units supplied with the aircraft require regular updating of the map displays and potentially, the software included. It is the operators responsibility to ensure the equipment is correctly updated prior to flight, and to understand that the GPS system is NOT a primary navigational aid. The GPS system has not been approved to any airworthiness standard!

(ii) Only GPS units approved by RSUK/CAA may be permanently or semi-permanently fitted to the aircraft. Those presently approved are:

- under AAN29266 - Garmin 496, FlymapL, Avmap EKP IV
- under MC-180 – Flymap F7
- under MC-181 – Airbox Foresight
- Under MC-206 – addition of Attitude and Heading Reference System (AHRS) module to the Flymap L.



Analogue panel – standard

Flymap L Instrument panel option.
Note that the fitment of an AHRS module does not change the panel layout – with the exception that a placard stating 'Day VMC only. Do not rely on this display' must be affixed adjacent to the Flymap display.

The AHRS module allows the Flymap L to display flight information such as airspeed, heading, vertical speed, and aircraft attitude. The information shown is dependent on the device setup (refer to the Flymap AHRS manual (from Stauff Systec GmbH, manual ref 500-408)) and must always be considered secondary to the primary dial type flight instruments, and never relied upon for flight safety.

The device is bonded to the aircraft keel forward of the nose gear.
It requires a pitot and static connection, made into the existing 4mm airlines. This enables the Flymap display to be cross calibrated at the same time as the primary aircraft ASI (see the
AHRS manual for calibration instructions). The connection to the
Flymap is via the harness supplied with the AHRS module.
The power supply to the module is taken from the same fused supply line as the FlymapL module itself – it does not have its own fuse.

Insert picture (above) shows the AHRS module with T piece into the pitot system above and harness connection at the rear (the two silver units are the rear of the landing lights).

A similar installation is approved under MC-224 for fitment of the Airbox Foresight 3 GPS with AHRS module

View of AVmap panel.

View of panel with GPS area in middle of panel for customer GPS mounting.
Note that any aircraft modification – mounting holes, hard wiring to aircraft systems etc, requires CAA approval. It is the operators responsibility to ensure any equipment located in this area does not limit forward stick travel and is properly secure for flight.

Under modification MC-213 the barometric system fittings (the pitot and 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.

Two types of stick-grip are in use:

The original “G205” grip has recessed pushbuttons in the top moulding and a soft-foam grip section:

The alternative “OEM” stick grip is available (fitted as a complete interchangeable stick assembly) under MC-162 approval – please contact RSUK for further information

OEM stick-grip installed in MTOS

The instructor pack consists of stick (either type of grip may be fitted), throttle and brake, pedals and kill switches. There is a significant weight for this equipment, and it should only be fitted and carried if it is to be used. If fitted, the stick may be removed by the aircraft operator as required, with appropriate logbook entry.
There is no extra instrumentation in the rear cockpit, the instructor must rely on seeing the pilots instruments.

Optional rear seat instructor pack, fitted with two engine kill switches, headset jackplug sockets and headset power supply. Standard fit is jackplug sockets only.
From S/no 015 this control panel is fitted into a binnacle faired-into the interior skin (MC-154)

Basic description

Air Speed Indicator (ASI)
0 to 140mph. Red line 90mph (if orange rotor cap system) or 120mph (if RotorSystem II red rotor caps), 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! Use the test procedure defined at the start of Section 9. The ASI is also connected to the static port line.
Altitude.
A standard commercial 0 to 20,000ft altimeter is used. This is connected to the static port line. For standard panels a 3 1/8” gauge is used.
Engine rpm.
This gauge is unique to RotorSport UK.
Rotor rpm.
This gauge is unique to RotorSport UK. Operation may be checked by spinning the rotor. Only works with the keyswitch on.
Oil Temp gauge.
This gauge is unique to RotorSport UK. May be checked by connection to a slave sensor immersed in water of known temperature (eg boiling =100degC).
Oil Pressure gauge
This gauge is unique to RotorSport UK, albeit a modified commercial gauge. Check by direct coupling to a pressure gauge and pump.
Cylinder head temp
This gauge is unique to RotorSport UK, albeit a modified commercial gauge. May be checked by connection to a slave sensor immersed in water of known temperature (eg boiling =100degC).
Fuel level
This is an electrical fuel sensor system, based on a float around a tube type design fitted inside the left fuel tank. It is not field serviceable.
Pneumatic pressure, 0 to 10bar.

Standard commercial air pressure gauge. Used to indicate trim pressure in flight, or rotor brake pressure when on the ground.
Roll trim indicator.
LED scale used to display trim cylinder differential pressure.

TRT800H Mode 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 transponder module goes faulty, it may be replaced without having to reprogram the transponder system.
The antenna, cable and base plate is mounted under either the left or right front seat, accessed via the under seat pockets.

Refer to the Funkwerk installation manual Doc no 03.2123.010.71e.
Ensure that during Maintenance testing of altitude reporting transponders should be suitably screened to minimise the risk of nuisance traffic or collision resolution advisories in operating aircraft.

Hobbs meter.
Records the engine operational hours.

Bearing Temperature indicator
This is independent from the main harness, containing its own battery (LR44), and directly linked to the rotor bearing temperature sensors. The rotor brg sensor is pushed into the front of the rotor bearing spacer in the rotor head, and is retained with hot melt adhesive. Function may be checked using a slave sensor plugged into the head harness connection point, immersed in water of known temp (eg boiling =100degC) or by reference to ambient temperature versus gauge indication

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, and required to be connected to the static port system.
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. The compass may be panel mounted or remote mounted as required to suit aircraft magnetic fields. Normal fitment is above the instrument panel.

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

<u>Assembly methods</u>
All instruments in the panel are fitted with M4 stainless steel dome head screws, with plain nuts loctited on with 243 – unless specifically supplied with the instruments.
The radio antennas is mounted on the bottom of the enclosure to the left or right centre section, opposing the transponder antenna. . This is a Lynx ¼ wave flexy with 2m cable and ground plane.. Excellent results when airborne, can get shielded when on the ground due to low height.

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 required 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.
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). The latter 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.

Trouble shooting and Repair methods
Note: instrument panel is easily and quickly removed by taking out the 6 x M4 screws around the outside of the panel, and detaching the loom and airline connections. When refitting always recheck the pitot and static system for correct connections and operation! See standard tests.

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 pitot and static 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 RSD7197 (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. 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.

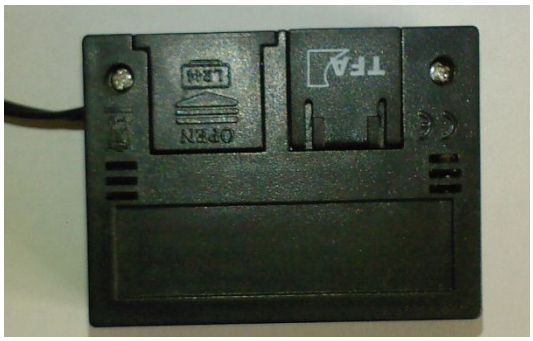
Altimeter. This unit may be adjusted if required to match height indicated to pressure setting. Remove the small screw beside the adjustment knob on the panel. This will allow the knob to be pulled out slightly which will disengage from one scale. Adjust the two scales to suit a calibrated gauge, push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

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 Funkwerk via their aftersales program – see the Funkwerke website.
Antennas and cables may be replaced if faulty or broken.

Bearing temperature indicator. This is 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. This is not mandatory flight equipment, and battery replacement is undertaken when the indication becomes difficult to read or annually (see maintenance schedule).

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 LR 44 (SR44 battery recommended for longer life)

Under modification MC-263 a 1.5v power supply was built into the wiring harness fed from the keyswitch, obviating the need to change the battery.

Compass. Calibrate compass according to the manufacturers instructions, lined with the aircraft keel. – see Appendix A.

GPS units are permissible to be fitted in line with RSUK approved mounting (Garmin GPSmap, Flymap), or via RSUK service bulletins. Be careful when fitting device's to the instrument panel due to magnetic interference with the compass!

k) Suspension, wheels and brakes

Basic description

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 pivots in bushes bonded inside the pilot enclosure. Friction is controlled by the tightness of the top castellated nut (behind the instrument panel).

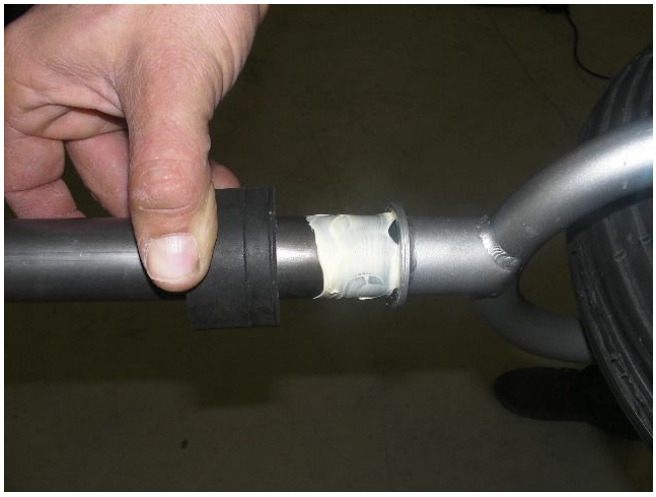
Materials used

See parts list
Mainwheels:
The above tyre is used for its light weight (1.085Kg) and low replacement cost. Approved heavy duty alternative is the Heidenau 4.00-8 55M tyre, which weigh 2.04Kg each. Other tyre options require specific approval. Knobbled tyres are not recommended due to their ability to pick up stones and flick them into the propeller arc.
Nosewheel:

Assembly methods

The nose wheel carries a Veloce 400-4tyre with inner tube. The wheel must be removed to change or repair the tyre.

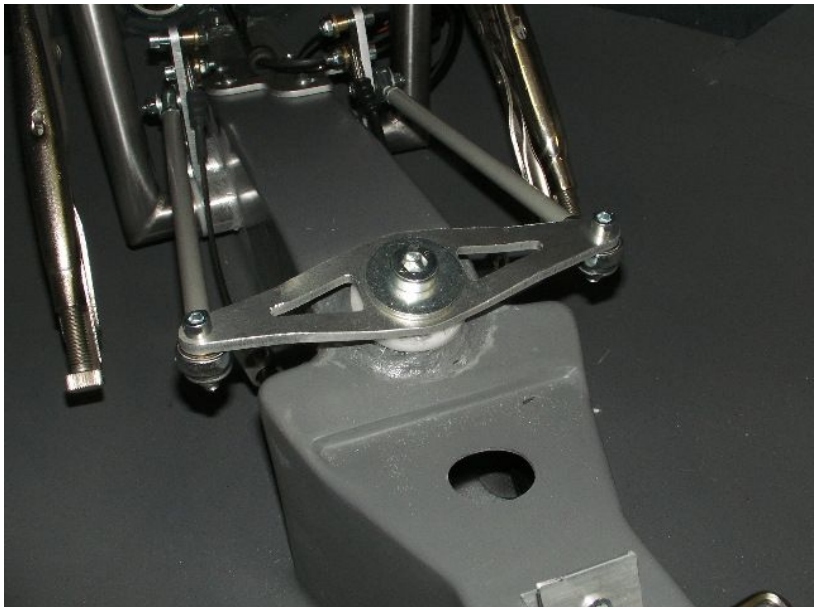
Top nosegear bush. Both upper and lower bushes are retained with Epoxy resin, and the pair of bushes reamed as required to suit the nosegear forks.



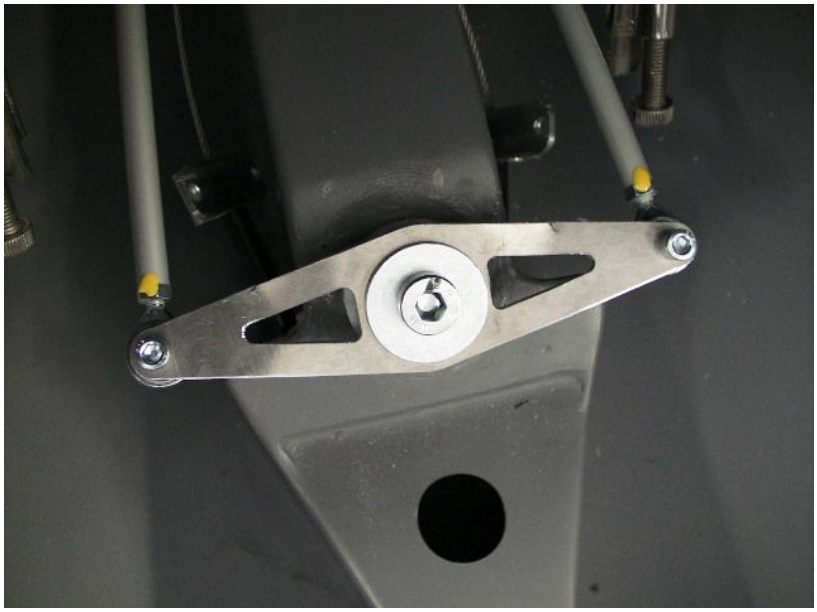
Suspension rubber for nosefork. Note grease under (W2000 or equiv axle grease)

Nosewheel in place. Lubricate fork axis with W2000 grease or equiv during assy.

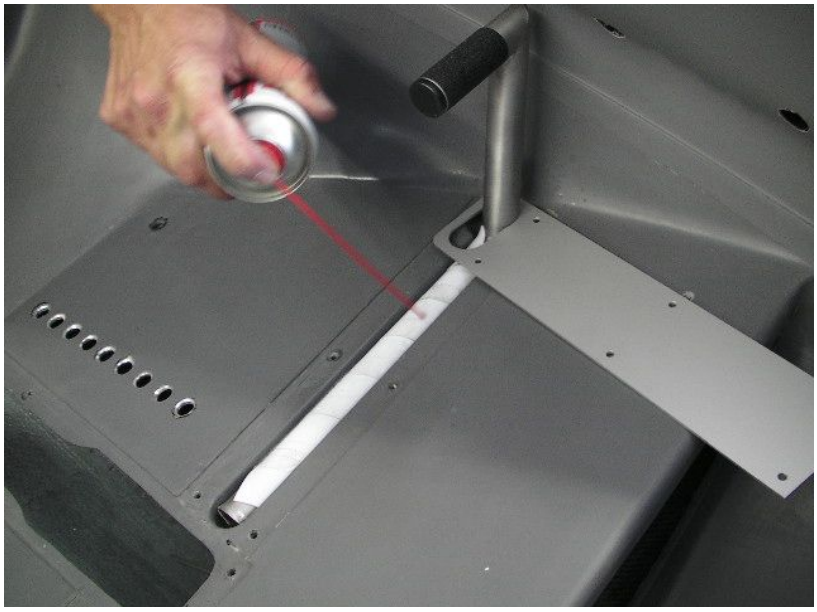
Top of fork tube has a square drive welded in which locates into the connecting plate. Note O ring fitted around shaft.



Connecting plate fitted. Loctite screw with 243.



With the pedal bars aligned to each other by clamping a short bar between them, adjust the push rod lengths to give a 1 deg wheel offset to the left (Means the left rod is approx 6mm longer than the right rod. Tighten and paint id the nut to the connecting rod, ensuring at least 7mm of the rod end thread is inside the connecting rod.
The rudder cables are designed to pivot freely on their brass bushes. These are retained by loctite 243 to the attachment bolts. For added security the four bolts also carry a 2x16split pin retaining the threaded bush.



Rear seat pedal assy. Lubricate the ptfe liner during assembly with light oil such as '3 in 1', RSD4531.

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 are used.

Under MC-243 an alternative construction of nose-wheel is introduced, interchangeable with the original.

Residual turning torque for the nose gear forks (without pedals connected) < 0.2Nm. If too tight, ream out plastic bushes to suit.

The tyres are fitted as standard with inner tubes

Repair methods

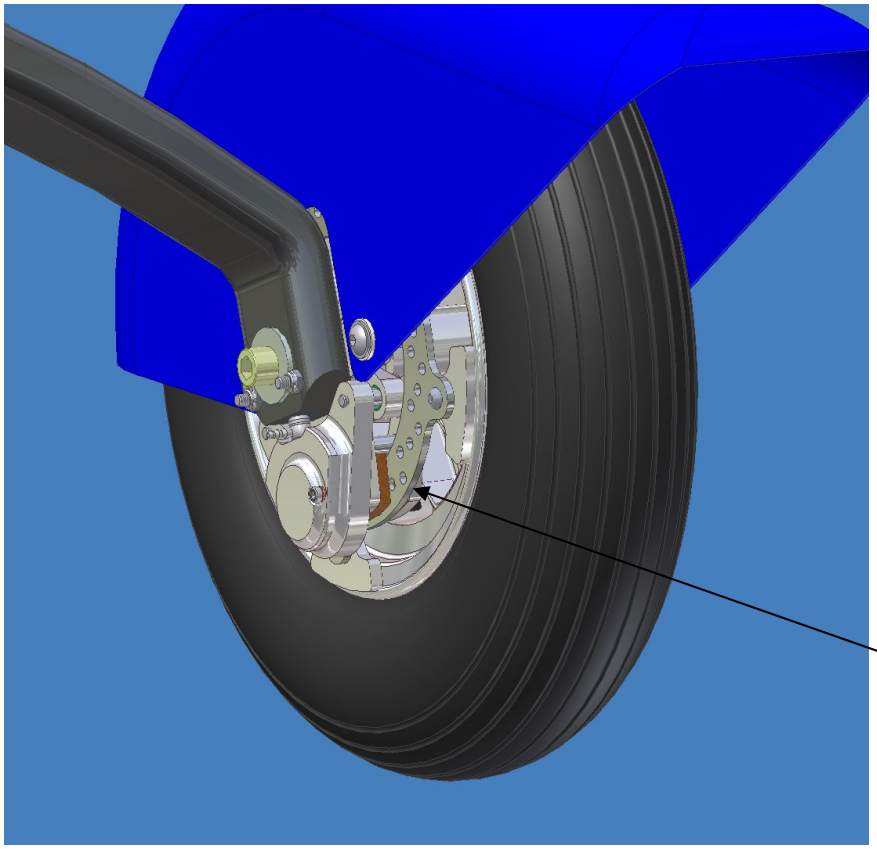
To change the front tyre the wheel must be removed. Stand the aircraft on its tail, and put a 20Kg sandbag on the keel to make sure it stays there. Remove the axle bolt, and drop the wheel out with any spacers. The wheel is a split rim design such that by removing the bolts holding the wheel together the two halves will come away. Before undoing these bolts, deflate the tyre (if inflated), and push the tyre off the wheel rims. Replace/ repair as required, and refit to rim, lubricating the tyre bead with tyre soap. Take care when connecting the two halves together not to trap the inner tube, as this will result in a puncture. Tighten bolts to 10to 15Nm, inflate tyre, and matchmark rim to tyre. Use a new nylock nut when refitting the wheel, and check for free rotation.

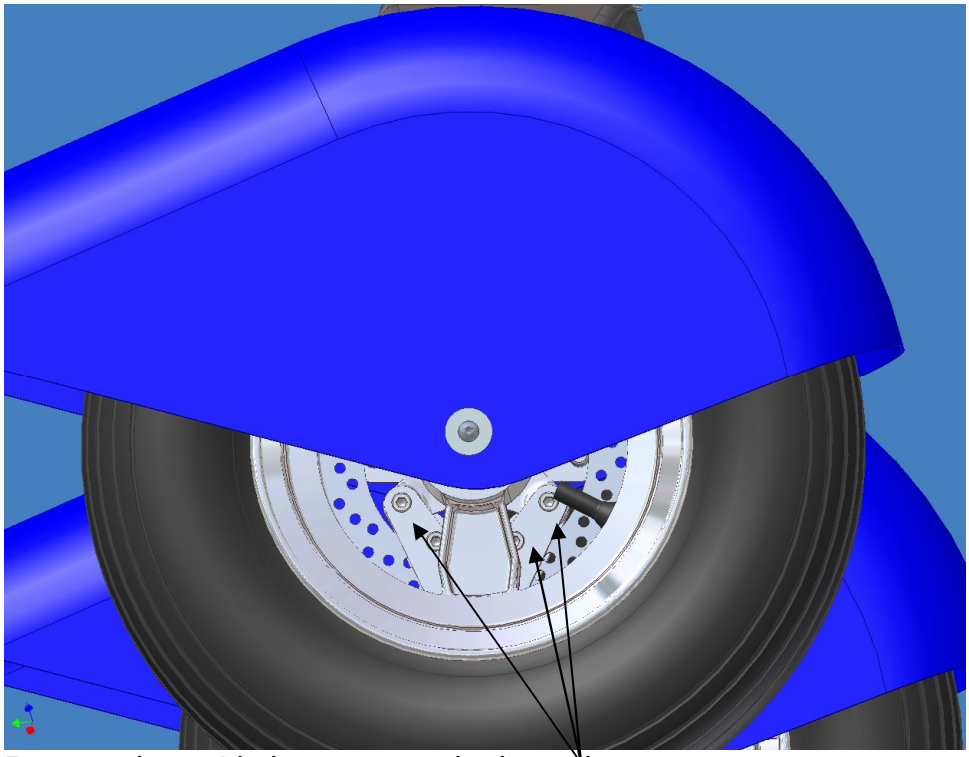
Note there are no 'heavy duty' options for the nose wheel tyre.

To change the nosegear rubber damper the nose should be lifted as described above and the central allen bolt retaining the connecting plate removed, together with the washer and O-ring. The fork and wheel will drop clear of the aircraft allowing the rubber element to be replaced. Reassembly is the reverse, ensuring that the new rubber is lubricated on fitment and the O-ring replaced with new. The angled fork should face forwards and the allen bolt tightened to 40Nm with Loctite 243 on the threads.

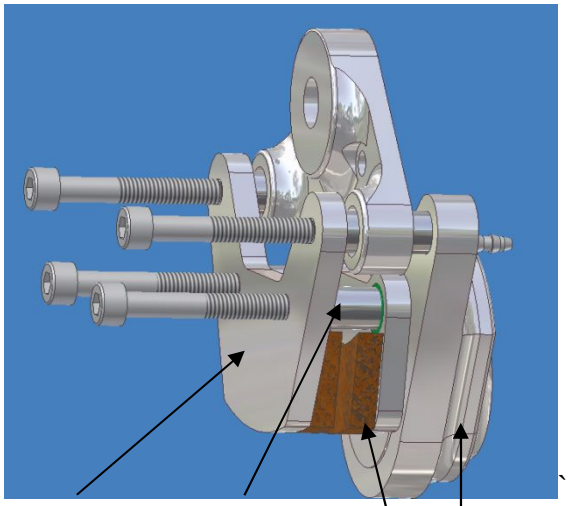
The mainwheels are cast aluminium, and care should be taken when handling to avoid damage. The standard tyres can be changed easily in situ, once the three bolts securing the wheel spat have been removed. Then raise the aircraft via a trolley jack under the lowest part of the keel, with a sandbag or similar on the opposite wheel to hold it on the ground. Make sure the aircraft is chocked and unable to fall off the jack. Jack only so that the wheel is clear of the ground by a small amount, maybe 10mm. With the wheel brakes on, the wheel won't turn, and any air can be let out of the inner tube. Push the tyre off the wheel rim, such that the beads go into the centre of the wheel. The opposite side can then be pulled over the edge of the rim, and the tyre removed. Replace it or the inner tube as required. When refitting, a little tyre soap will make the tyre easier to fit, and easier to ride up onto the wheel rim when pressurised. Pressurise to 3bar max to seat properly, and if the bead is not seated evenly, remove the pressure and try again. Once satisfied that the tyre is seated properly on both sides, mark the tyre to wheel relationship with a paint mark so that if the wheel turns with respect to the tyre it can be seen (to avoid the inner tube valve being pulled out). Note that it is much harder to remove the heavy duty tyres. For these it is recommended that the brake disc securing screws are removed, then the nut retaining the wheel in place, and the wheel removed to a suitable tyre shop for repair. On refitting, it is recommended that a new wheel M12 nylock nut is fitted, and note that the brake disc screws and spat screws must be retained with loctite 243 and torqued to 10Nm.

Brake pad change. Change when 2mm or less remaining (check via wear slot in the middle of the pad, if no slot left the pads should be changed). 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 aircraft side of the wheel, and the two pads off separately, either side of the disc. The pads slide on Teflon bushes, on short hardened steel inserts. See picture below





Remove these 4 bolts to remove brake pads



Outer pad Bush Inner pad Calliper with piston

Replace parts as required. When refitting there is put a thin smear of Vaseline or 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!
Take care to keep the pad surfaces free of grease!

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

1. The calliper piston is known to sometimes stick in the calliper bore if 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 or silicone grease. 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.

l) Rudder and rudder control

Basic description

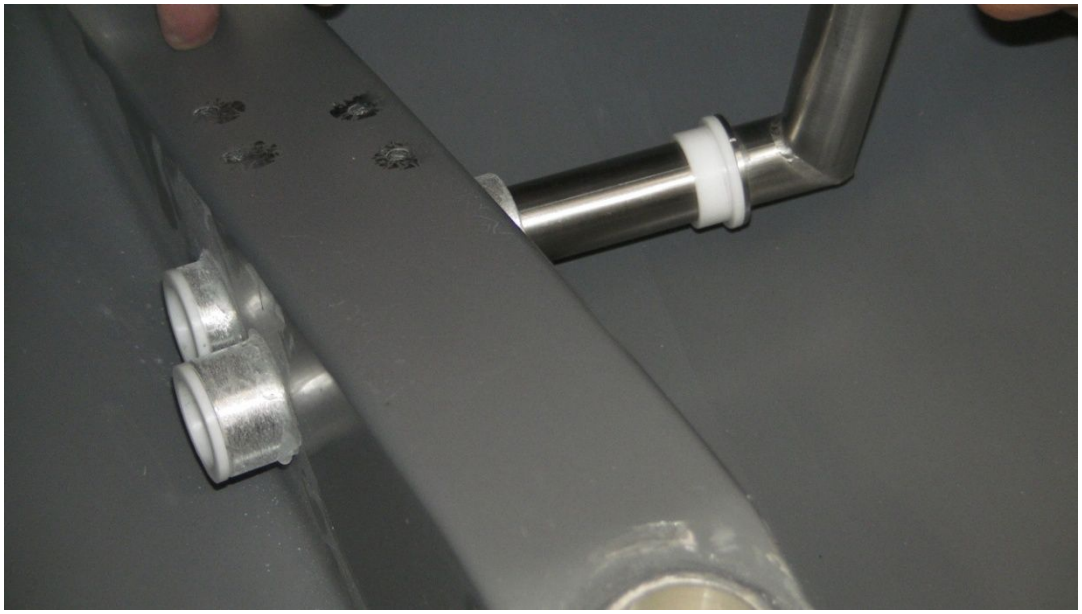
The rudder is controlled via cables between the front pedals and the rudder turnbuckle (one cable per pedal, two different lengths). The front and rear pedals are connected by another cable, one per side via a cable. Between the rudder arm and the cable is a turnbuckle, one per cable, wire locked. The rudder arm, or culisse, is a plate and bearing assy, which in turn sits on a welded pin on the keel.

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

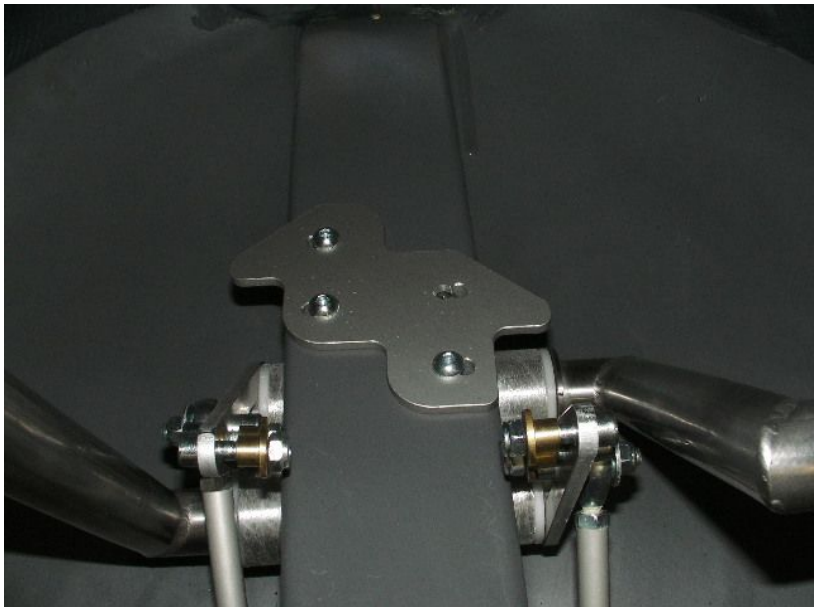
The rear tail assembly and rudder are GRP (or CRP) mouldings. The rudder has a simple top pivot with a 10mm top hat bush and plastic spacer washer between the rudder and pivot plate bolted to the rudder with a steel dome bolt, locked with Loctite 243.

Rudder position and cable tension with respect to the footpedals is adjusted via the turnbuckle in each cable. Pedal to pedal alignment is set by the length of the cables, and alignment to the nosegear by adjusting the rod ends that connect the pedal pushrods between them.

The pedal position is not adjustable. Each pedal has a nylon sleeve between the pedal and its mounting tube.



View of pedal assemblies during fitment. Bushes are retained with Loctite



Pedal limit stop plate. Screws retained by loctite 243.

View of complete pedal assy

Pedal limit stop is when the link plate touches this stop plate

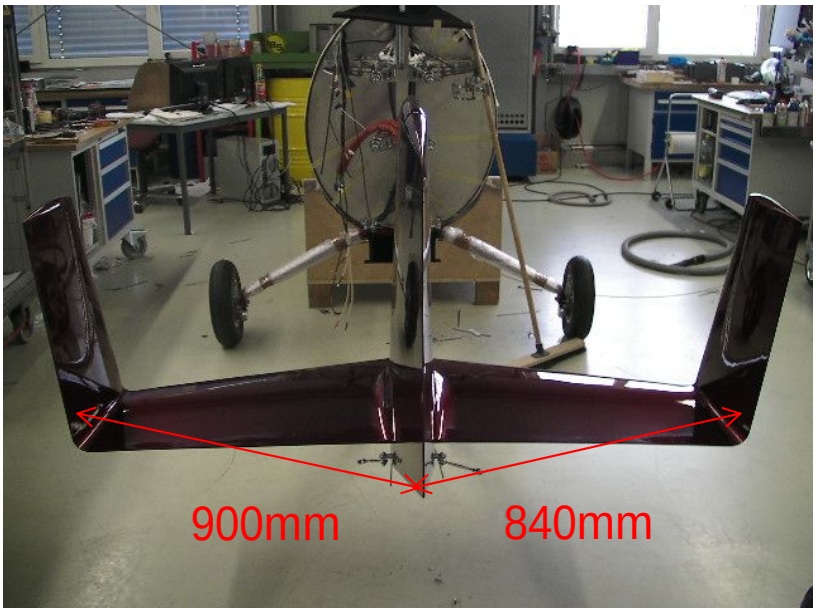
Cable to rudder attachments. Bushes are loctited to the retaining screws, and then split pinned in place for double security. The upper cable goes to the rudder, the lower to the rear seat pedals where fitted.

Materials available
See parts list

Assembly methods
System setup

1. Clamp a block across the front pedals so that they are in line.
2. Attach the push rods to the nosegear and adjust so that the nosewheel points 2degrees left.
3. Rear foot pedals in mid position (central) are set 38deg +/-5 to the ground (or perpendicular to the composite base they stand on), and within 1 deg to each other.

4. When satisfactory, tighten locknuts on pushrods, and replace nylocks with new. Paint mark rod ends.
5. Attach cables to rudder. Adjust turnbuckle tension to achieve a load to move the pilot pedals of between 5 and 6Kg in mid position, and so that with pedals locked straight ahead the rudder offset is as below.

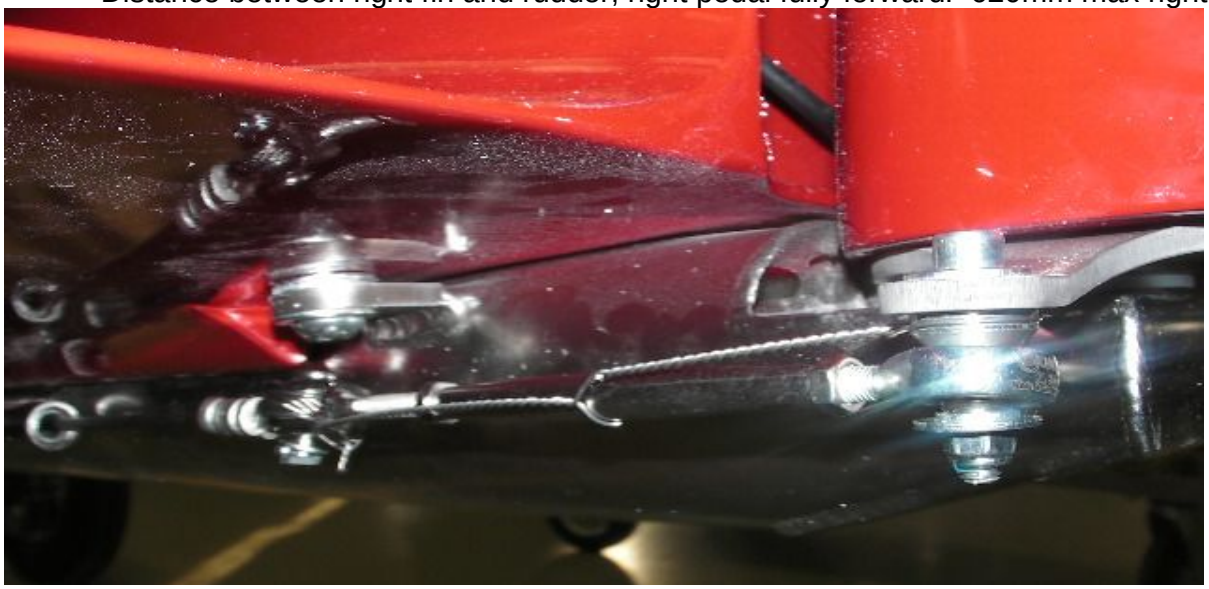


6. Rudder movement
   Distance between left fin and rudder, left pedal fully forward: 700mm max
   Distance between right fin and rudder, right pedal fully forward: 620mm max right
   Adjustment of the links between the pedal link plates and the nosegear adjusts the distance between the link plates and the end stops.
7. After any cable adjustment re wire lock the turnbuckle.
8. Rudder backlash
   If the cable-system is correctly adjusted there will be minimal backlash in the rudder movement. To assess this place the aircraft on a level smooth surface with the nosewheel and rudder at the central position. Hold the rudder between finger and thumb at a position just below the trim-tab and gently (i.e. typical force about 1Kgf) move the rudder left and right so that any backlash may be felt. The backlash should not be more than +/- 5mm.

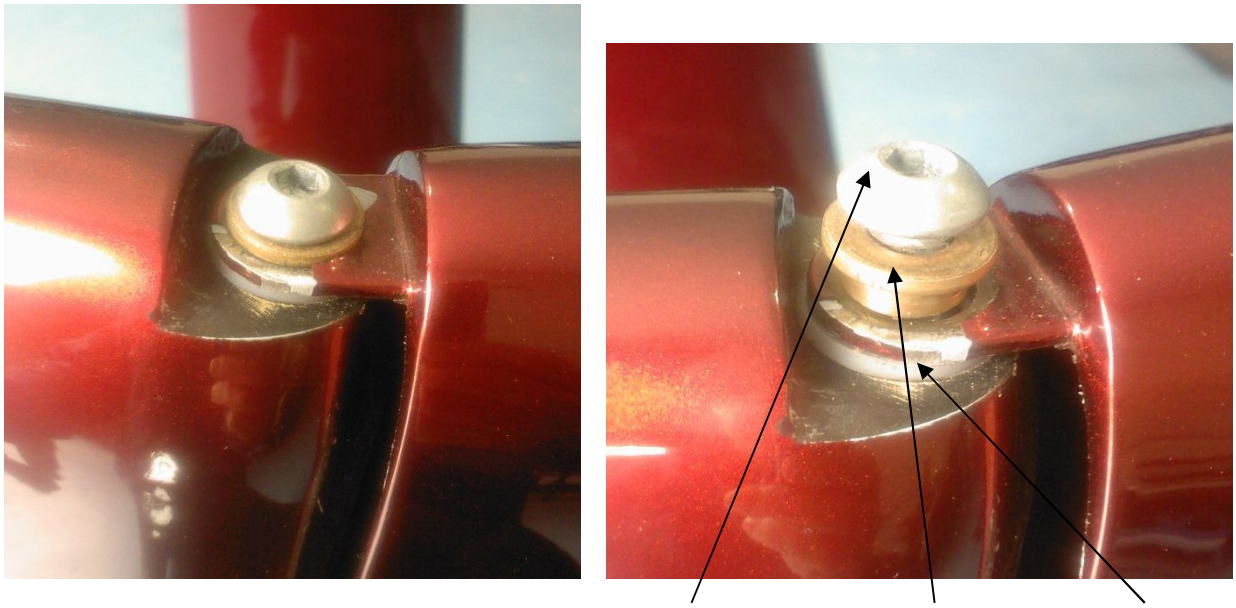
Turnbuckle. Note wire locking fitted between turnbuckle pivot and the pinned end.

Also shows view of rudder mounted to culisse. Note how the wire locking is located into the groove on the spacer between the rod end and the rudder culisse

Distance between left fin and rudder, left pedal fully forward: 700mm max
Distance between right fin and rudder, right pedal fully forward: 620mm max right



Acceptable wire locking of turnbuckle

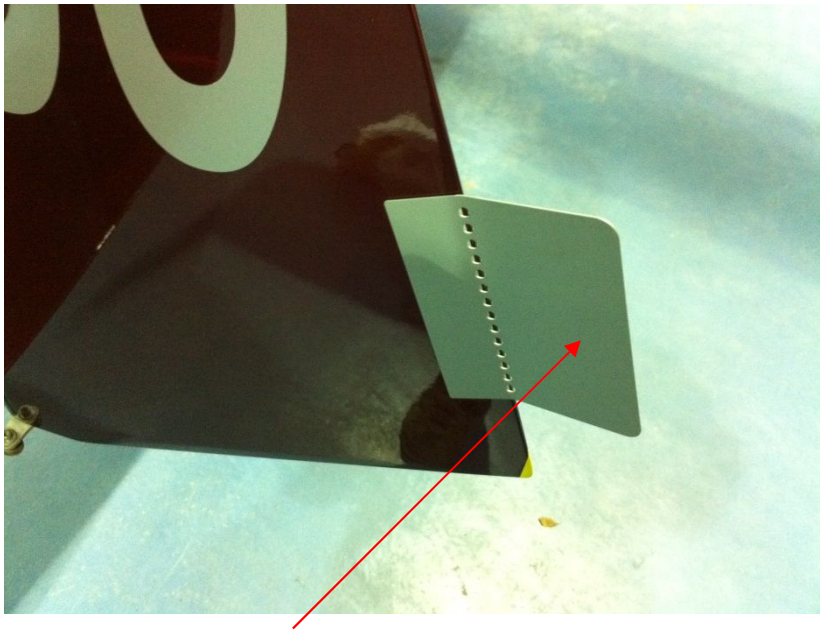


MTseries rudder top bearing, as fitted to Calidus 001 and as an authorised repair if the top rudder insert has been cross threaded.

View of M6 top pivot, installed, production standard

The rudder top bolt torque is 15Nm, secured with loctite 243, as are the four bottom M6 bolts. 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, secured 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.

Note that the rudder is fitted with a trim tab. This is normally biased approx 14deg to the left, and may be adjusted by the operator to trim the aircraft for straight flight at a desired speed, feet off the pedals. Adjusting it to the left will biase the rudder to the right and vice versa.

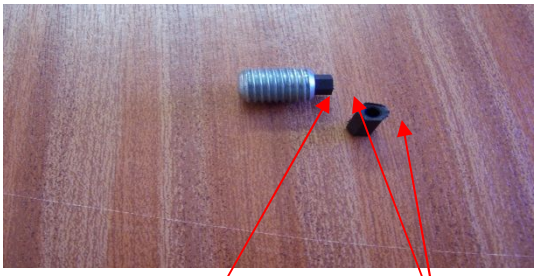


Trim tab fitted to the rudder

The trim tab must be adjusted progressively, in no more than 5degree increments between flight evaluations. A bias greater than 35degrees should not be required. If in doubt refer to RSUK.

Repair methods
No repairs to aircraft attachment points.
Cable assies; No repairs permitted other than replacement
Composites; no repairs currently authorised
Paint; touch up and match as per normal automotive repair processes.
Top rudder bolt: acceptable rework to replace bolt with M8. Use RSUK service repair kit.
Trim tab replacement – use a sharp blade between the tab and the rudder to part the foam adhesive strip. Peel away the old tab, & remove the adhesive from the rudder. Ensure the surface is clean and affix the new tab – noting that the line of holes is aligned with the edge of the rudder, and the base of the tab is 90+/-10mm from the bottom of the rudder.

Embodiment of Service Bulletin SB-048 (approved under MC-189) fits a replaceable nylon bush in the threaded insert where each rudder-cable exits the keel-tube. These bushes reduce wear on the rudder-cables. The bushes are retained by a fillet of epoxy resin RSD4232, which engages in the female threads of the keel-tube and a groove in the nylon bush. Disrupting this adhesive with hand-tools enables the bush to be withdrawn and replaced. The bushes are split to allow removal/replacement over the installed cable. Replace when the visible wear groove is 0.7mm deep.



Threaded insert Bushes

Adhesive fillet

m) Rotor head and rotor head control

Basic description
Roll angle: +/-8 deg nom (set 1 deg left)
Pitch angle: -4 stick forward +20deg stick back

The roll and pitch stops are set with pins and are not adjustable
Grease nipples are fitted to the rotor, and pitch/roll block.

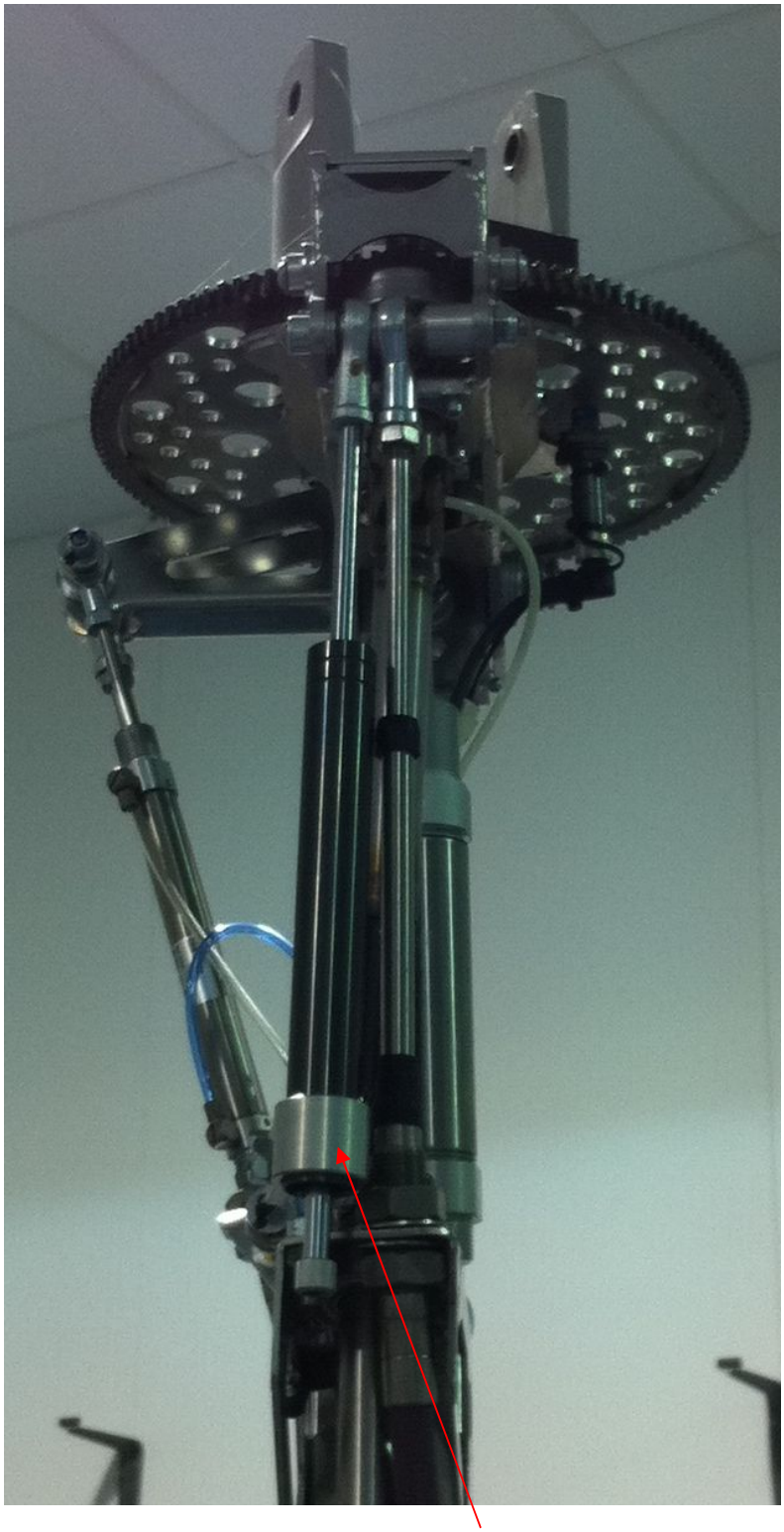
Materials used
Head bearing spec is SKF3206 A-RS1TN9/MT33. Otherwise see parts list

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.

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.

Side views of the rotor head

The damper shown above is always fitted with the orange end-cap rotor system but is optional with RotorSystemII (red end-caps) and Rotorsystem II TOPP variant (blue end caps)



Rotor head rear face Damper

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, and seat strap stops in place, there should be at least 5mm (-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.

Repair methods

This is a primary control system – do not take chances!
Bent tubes or kinked cables 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 (see also section (e) Rotor - above).

Check/adjustment: Flight control push-pull cables

1. Inspect the upper attachment points of the pitch and roll push-pull cables. Check firm installation, safety lacquer intact and condition of rubber seal.

2. Inspect the lower attachment point of the pitch control push-pull cable. Check firm installation, safety lacquer intact and condition of rubber seal.

3. Inspect the lower attachment point of the roll push-pull cable (visible at the bottom aft end of the composite body). Check firm installation, safety lacquer intact and condition of rubber seal.

4. Check free play of the pitch control push-pull cable. In order to do so, temporarily insert into the rotor head stop the shaft of a drill or similar (see photo below) and apply a minimum of 8 bar brake pressure. Measure the free play of the control stick pitch movement as depicted below. If free play exceeds 8mm contact RSUK.

5. Remove the temporary stop, return the flight/brake switch to the "flight" condition and check full-and-free movement of the control stick is restored. The brake pressure may then be restored.

Check: Base control unit attachment

1. Check fasteners for corrosion and condition/presence of drain holes in the fabrication visible at the bottom aft end of the composite body. If no drain holes present contact RSUK.

2. Inspect the base control link and rod-end bearing. Replace if corroded. Signs of corrosion can be detected when looking from the top and at the nut – see photo below

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 feller 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

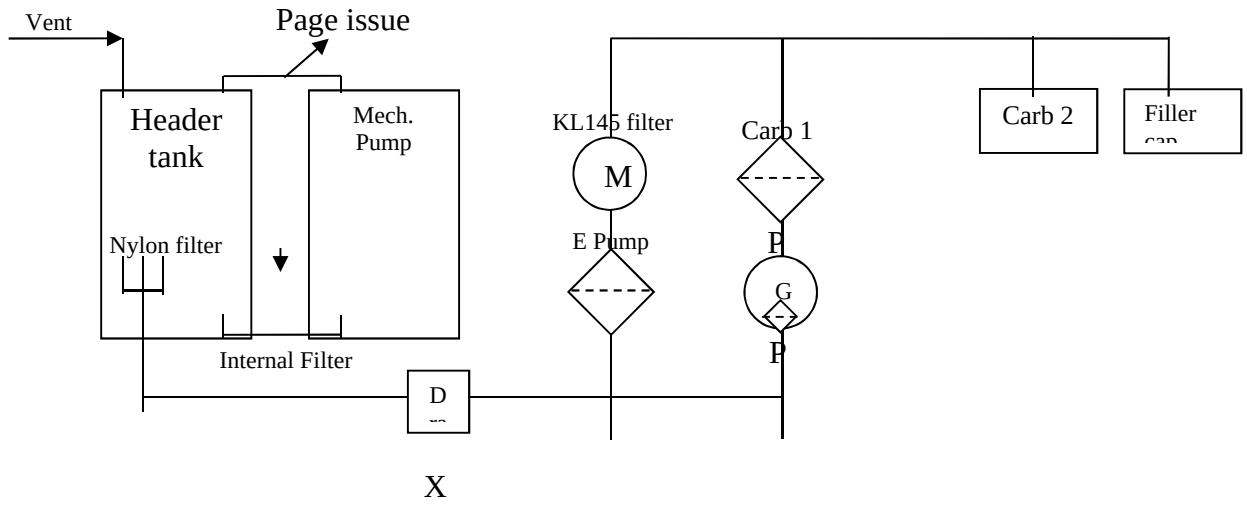
Rotor head bridge, bearing and teeter tower

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

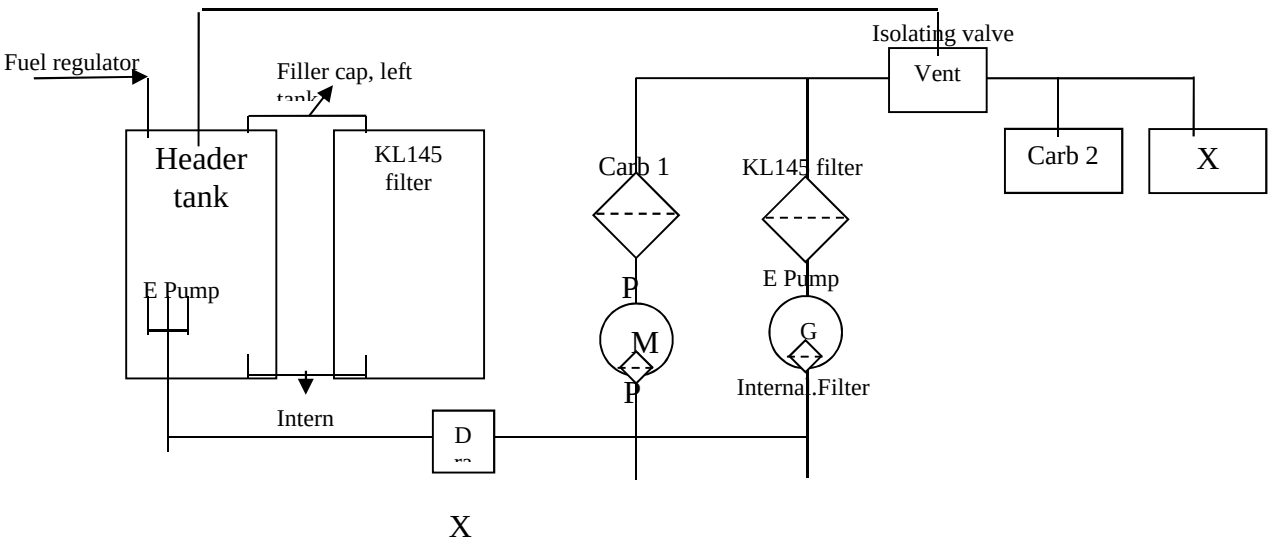
n) Fuel system

Basic description

Principles of the fuel system, Rotax 912 ULS:



Principles of the fuel system, Rotax 914 UL:



The fuel system is entirely contained outside the pilot cabin, and inside the engine compartment. A single, 39ltr (38.4 usable), fuel tank is mounted on the left side of the aircraft. The Main tank is filled via a filler cap located on the side of the aircraft (earthed to the airframe), and is made as a glass fibre moulded part, with a fuel proof coating on the inside. The tank is covered in a fireproof covering which must not be removed unless for replacement. A second, optional, 36ltr (35.4 usable) tank is fitted to the right side. This tank is considered a header tank, and is connected to the main tank via a large bore balance pipe. Into this balance pipe is fitted a water drain valve, which may also be removed to act as a system drain point.

Fuel is drawn from the tank via a push in fitting with a coarse mesh gauze filter. The fuel hose (Semperit FUHT hose only) then takes the fuel to a shut off valve mounted on the face of the enclosure. This is operated by an extension rod inside the cockpit, and is protected by a flip up

cover. ‘OFF’ is when the tap is at 90deg to the cover, and the cover does not close properly. From here the fuel travels as follows:
912ULS: the fuel line splits to provide a feed through a nylon filter into the mechanical fuel pump and to the carburettors, and also to the backup electric fuel pump into a metalclad filter and then to the carburettors. The electrical fuel pump only operates with the keyswitch on and switch P2 switched on.
914UL: The fuel line splits into the pair of electric fuel pumps, independent metalclad fuel filters, and then to the fuel regulator. The return hose from the regulator feeds into the top of the left main tank.
Tank venting is provided by a hose from the top of each tank, joined together and venting to the bottom of the engine enclosure.
The fuel take off point in the left tank will always leave around 0.3~0.5ltrs left in the each tank (this is the ‘zero’ contents marker) and is not significantly dependent on flight attitude. The fuel crossover tube is at the same level, so draining the tank sump is undertaken by simply removing the water check valve on the bottom of the crossover tube. Wirelock on refitment!

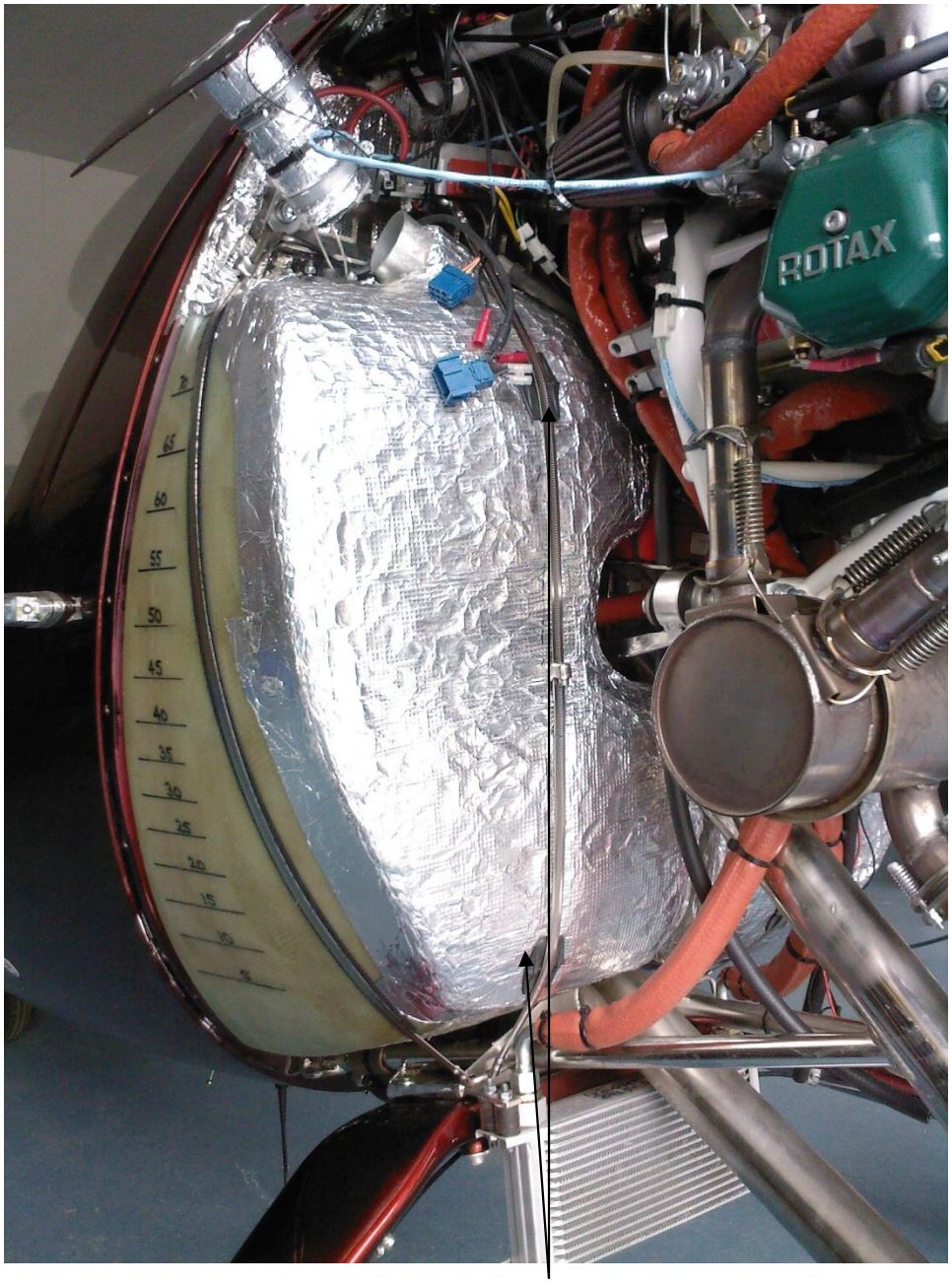
Fuel tank crossover tube with drain fitted.

The fuel tanks are retained to the enclosure via metal bands, tightened to a tensioning torque of at least 4Nm.

There are two options for the fuel cap – lockable or standard. Both caps are retained by a safety wire to the aircraft.

View of connection between tank and filler neck from under the cowl. Note the earth lead to the filler neck (hose is shown not covered in the fireproof sleeving)

Right tank, installed



Left fuel tank, fitted. Note load spreaders

The fuel hoses in the engine bay are additionally protected by a red fireproof sleeve.

For both engine variants the backup electrical fuel pump is activated by the P2 switch, and is only normally used for take off and landing.

The return fuel bypass line from the regulator feed into the top of the left tank
There is NO clear fuel hose in either the 914UL or 912ULS installation.
As standard there is fitted a fuel gauge and a low fuel warning lamp. The gauges system cannot be field calibrated. Correct indication can be ascertained by checking that tank markings match gauge indication – eg full =fuel indicated, empty=empty indicated etc.
The low fuel warning lamp system consist of a panel mounted LED and an LED sensor mounted inside the left tank. The LED sensor gives an off or on signal that either lights or doesn't light the lamp. This LED sensor is now subject to service information letter SIL-013 recommending replacement every two years.

Materials used

All hoses within firewall area (rear of the battery) are Semperit FUHT , fire resistant hose. Further, this hose is covered with a red fireproof sheathing. This sheathing must be in place under the engine cowls.
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, to a minimum torque of 4Nm and with two load spreaders on the rearmost pair of straps..
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.

Warning! Do not fill fuel tanks more than 2cm from the filler neck, as fuel is normally cold when filling, and will expand as it warms up – and will then overflow causing a fire and safety hazard!

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.
Normally all fuel filters must be changed every 200hrs/2years (whichever sooner) due to potential algae growth or general deterioration. Fuel pumps are also life-limited items – see list earlier in this document.
Water in the tanks can be drained quickly by draining the crossover tube. 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) or fuel supply hose (912ULS or 914UL) 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.

Intentionally blank

o) Fire warning system

Basic description & principle of operation

The system comprises the following elements:

a. Single colour red led warning lamp
b. Diagnostic box
c. Harness connection to engine bay
d. 'Protectowire' linear heat detector fitted around the engine bay.

The Protectowire consist of two wires individually encased in a wax-like coating, inside an insulating sleeve. The wires are terminated with a ballast resistor, sealed inside a hot melted cap.

The diagnostic box checks for circuit continuity and correct resistance on start up (when the keyswitch is turned on). The warning lamp will pulse red three times first, then go off. If the protectowire shorts to earth, shorts to power, or goes open circuit, the lamp will show solid red – indicating a system fault mode. The warning lamp will flash red if the protectowire is short circuited, indicating that the wax-type coating has melted and the two wires have come into contact with each other.

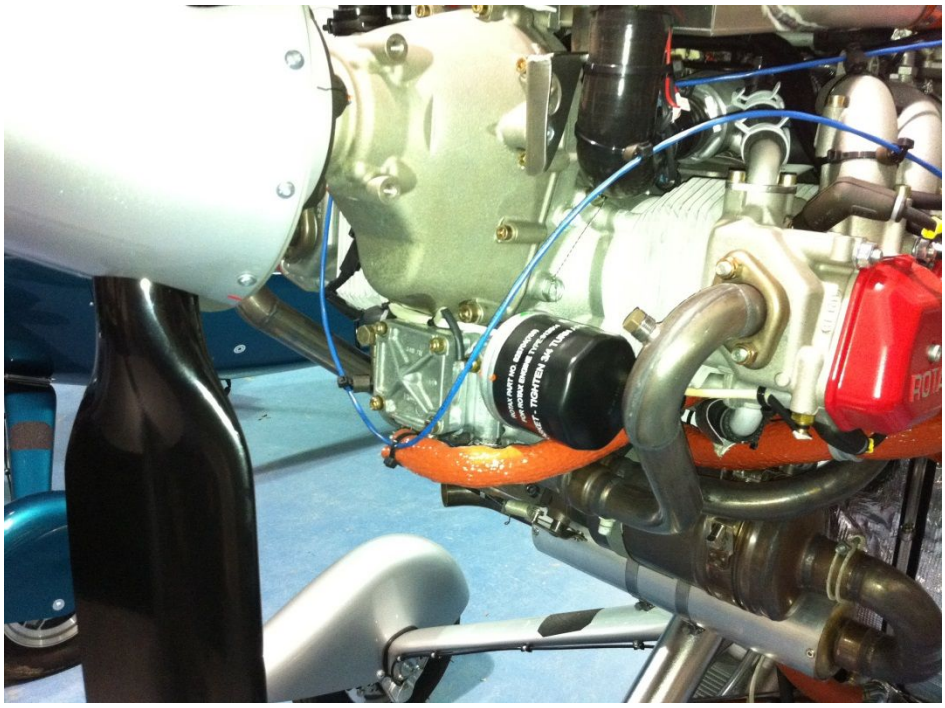
Note that the temperature that the coating will melt is set at 180degC.

Once the protectowire has shown a fire warning the lamp will continue to flash red (in an irregular manner to alert the pilot) until power is taken off, and the protectowire is disconnected.

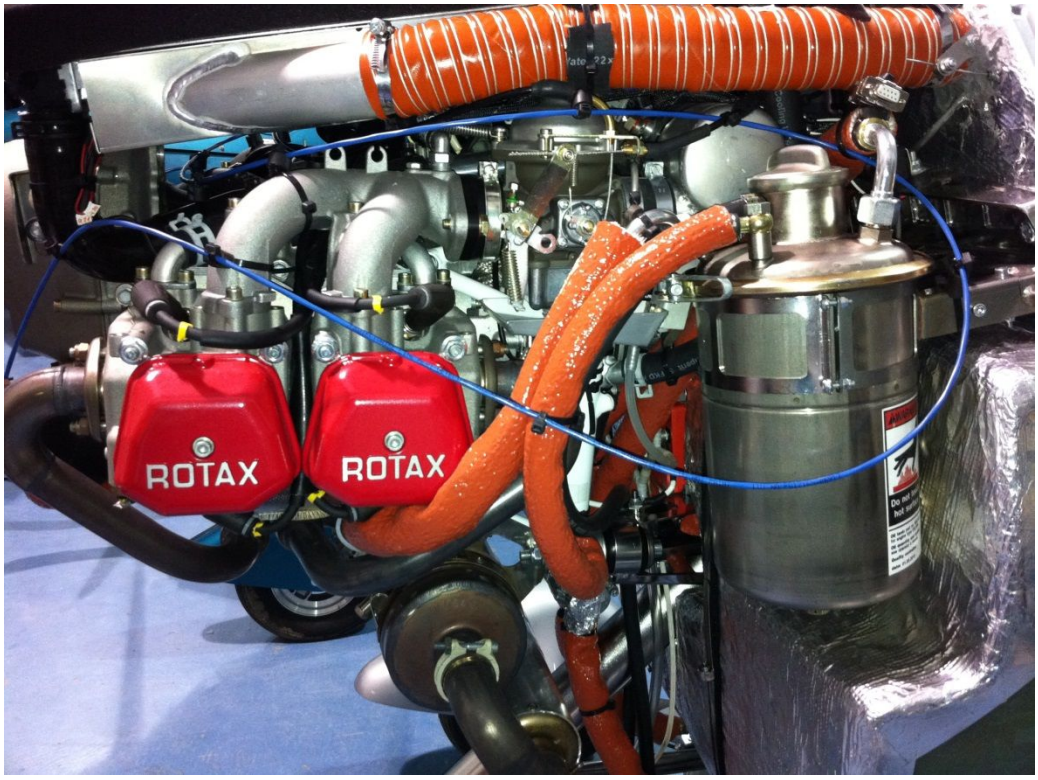
Assembly methods;

The Protectowire cable is connected to the harness via a two pin plug next to the diagnostic box – the connection cable is not allowed in the engine bay. The Diagnostic box is connected via a D connector. The LED is available a replacement part. It is important that the blue protectowire is correctly positioned in the engine bay, to prevent false fire warnings. See photos below.

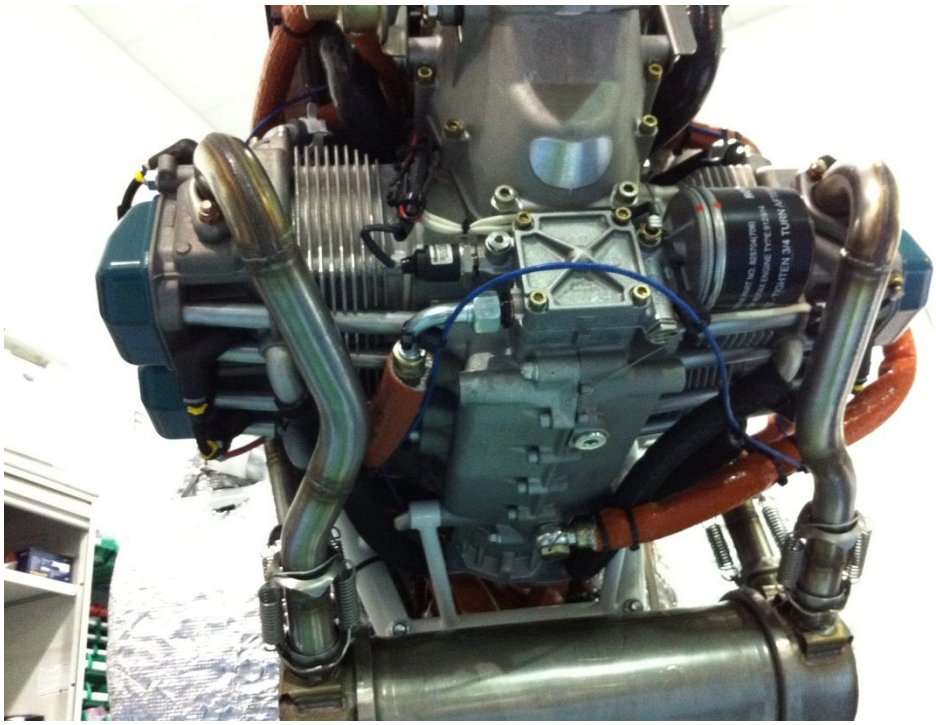
Left engine installation, 914UL

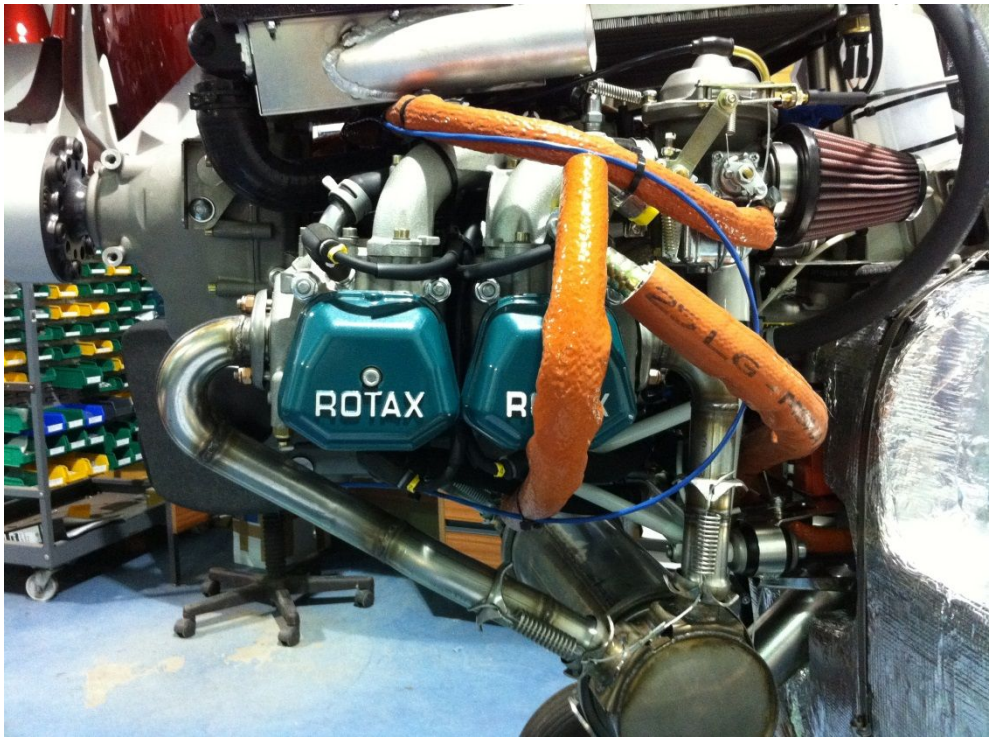


914UL engine rear wire installation

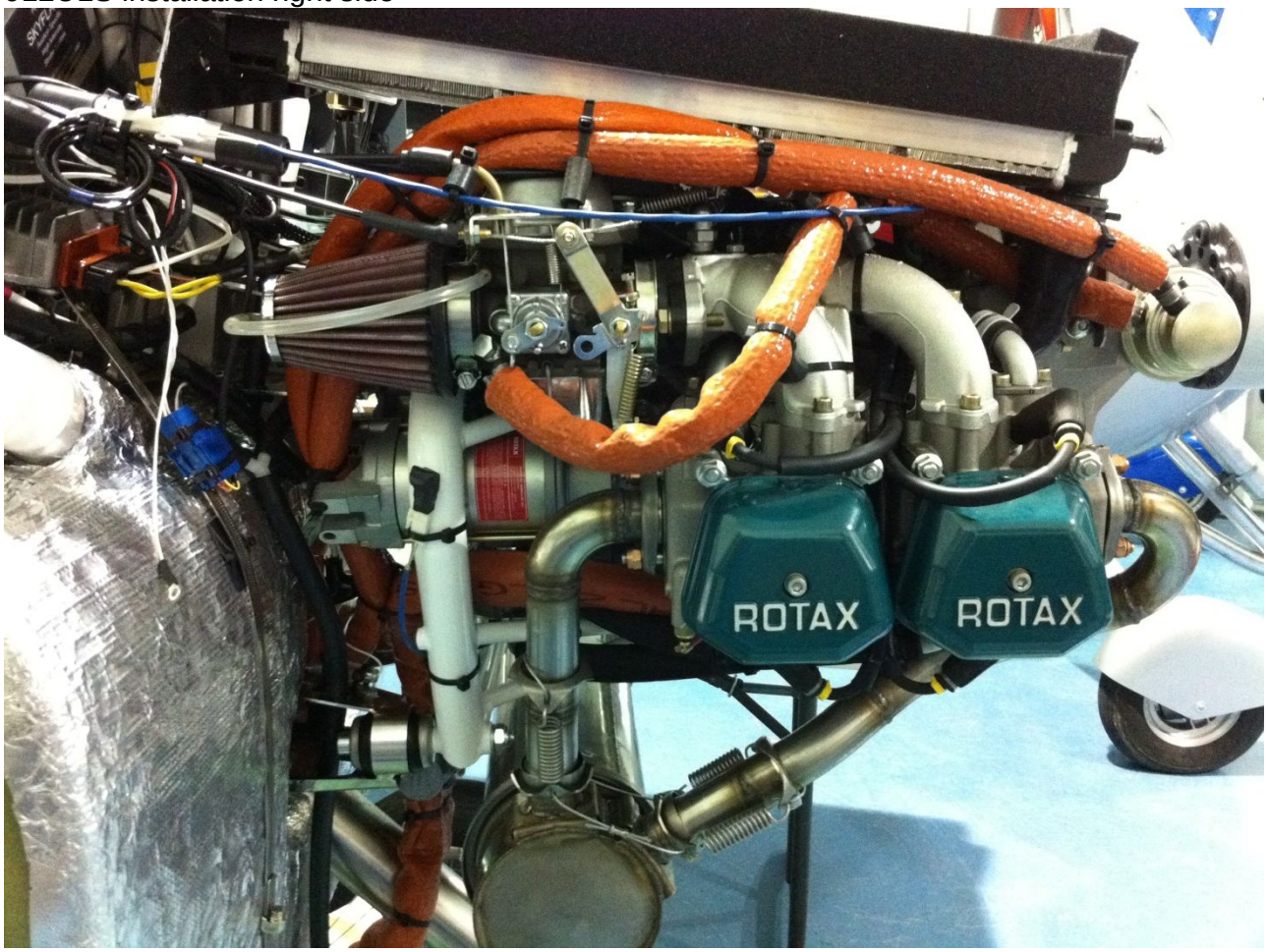


914UL engine right side installation


912ULS installation under engine rear



912ULS installation right side



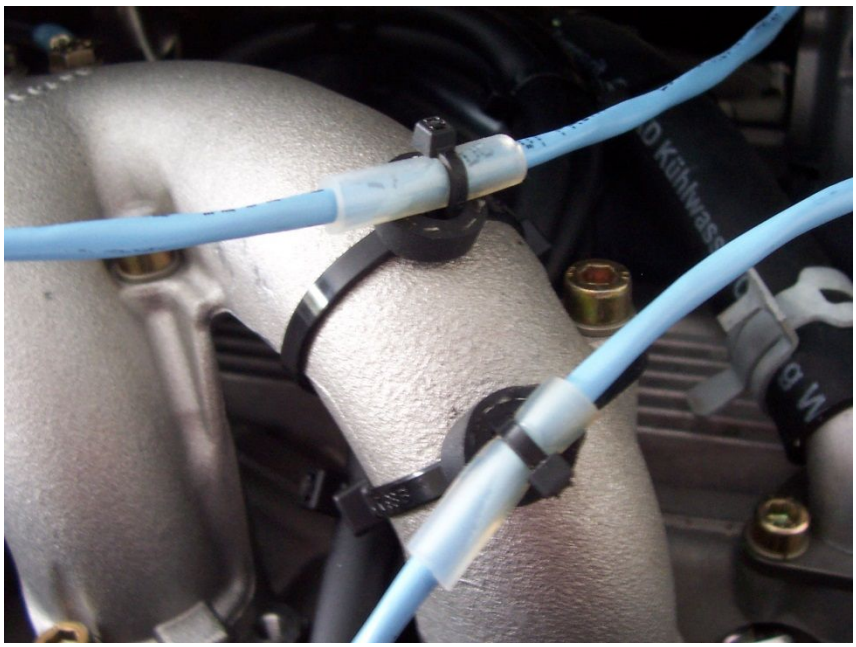
912ULS installation, left side.

Materials: see parts list.

Special set up and test.
There are no special setup requirements.
After installation, the system must be tested. Turn the keyswitch on. The led must pulse red, then go off.
The diagnostic box may be tested as follows:
The two white leads take the signal from the Protectowire.

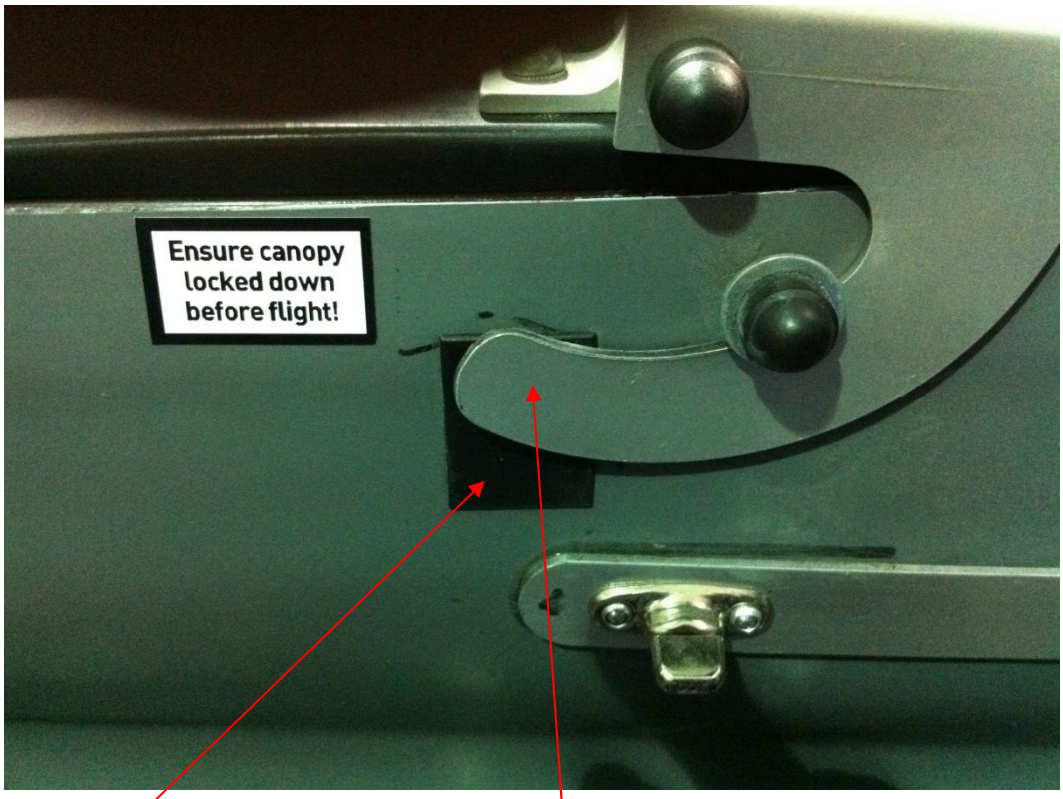
1. Disconnect the Protectowire circuit. The led must go solid red.
2. Short circuit across the wiring loom connector to the Protectowire. The LED must flash red (FIRE). Reconnect the lead. Turn off the keyswitch and then back on again to reset the system.
3. Using a probe lead, short one Protectowire to earth, and then to power. The LED must indicate solid red. Remove the lead. The system returns to monitoring.

Service and repair.
The system is designed as plug and play, not for repair. If a component has failed, it should be replaced with new.
If a fire warning has been given due to the Protectowire shorting (either due to an overheat, actual fire, or cable damage), then the cable must be replaced.
MC-196/SB-046 introduces small protection sleeves of silicone rubber to prevent the Protectowire from being crushed by the cable-ties used to route and restrain it.
These sleeves are slid onto the Protectowire, and the restraining cable ties wrapped over them (see photo).
Do not pull the ties tight; overtightening results in cable deformation when hot, and a false fire warning!



p) Canopy unlocked warning

This device is designed to prevent take off with the canopy unlocked. It consists of a magnetically activated two pole reed switch mounted behind the inner canopy handle (when locked). A small magnet is bonded into the inner hidden face of the handle. When the magnet is not present over the switch, the switch passes an earth to the red panel mounted 'Canopy Open' LED so that it indicates canopy unlocked. At the same time it isolates the earth to the valve that allows air to pass to the rotor pre rotator.



Reed switch sensor Magnet is on the reverse of this face

When the magnet is over the switch (canopy down and locked), then the reed switch changes poles and isolated the led (turning it off) and acts as the earth for the pneumatic valve that allows air to pass to the pre rotator.

q) Canopy repairs

Canopy cracks may be repaired as described below provided they are clear of the forward field-of- view of the pilot. They must only be repaired with Acrifix 192 adhesive/filler (available from RSUK or other outlets)

1. Prevent the crack developing further by drilling a "stop-hole" 1 to 2mm diameter at the extreme end of the crack.. Use a drill suitable for plexiglass (drill point angle 30degrees)
2. Using a suitable powered hand-tool (e.g. Dremel) mill a V-shaped slot into the outer surface of the canopy. The slot should have an inclusive angle 10 to 15degrees and should be progressively deepened until it penetrates the canopy section with a slot 0.5 to 1.0mm wide on the inside surface. If either end of the crack will be made unstable by this slot a suitable jury-rig support should be made using adhesive cloth tape ("gaffer tape") and soft-wood before making the cut..

3. Thoroughly clean the slot of all swarf, dust and other residues using a scraper, vacuum cleaner, soft bristle brush then a lint-free cloth (or cotton-bud) dampened with Ambersil LO30. This step is important, as any debris will weaken the finished repair.
4. Seal one side of the slot with suitable scotch tape to prevent adhesive leakage during the bonding/filling process.
5. Using an appropriate dosing device (e.g. nozzle or syringe) progressively fill the slot with Acrifix 192. Build-up to give an adhesive bead proud of the surface and take care to avoid introducing any air bubbles into the bead (Bubbles are permitted, but visually detrimental) .
6. Allow the adhesive to cure in ambient light conditions for 12 hours at room temperature. Do not place in bright sunshine or tension changes may cause cracks or crazing the adhesive.
7. When the adhesive has hardened both sides of the bead must be flatted-back to be flush with the adjacent surface using “wet-and-dry” abrasive paper on a suitable shape of softwood block. It is not necessary to minimise the size of this block, indeed a small block may result in a shallow groove in the plexiglass. A block 50-70mm wide would be typical if space permits. The abrasive paper should be used wet (ordinary water) and made progressively finer in grade: 800, then 1500, then 2400, then 3200, then up to 6000 as needed.
8. Thoroughly clean the abraded area of any residue then polish with a suitable powered hand-tool fitted with a stitched polishing mop and “jewellers rouge” or similar proprietary polishing compound.
9. Finally polish with a soft cloth and “Plexus” plastics polish (available from RSUK).
10. If repaired correctly the crack will disappear and there will be little optical disturbance.

SECTION 10 – IVO-PROP IN-FLIGHT VARIABLE PITCH PROPELLER OPTION

Basic description

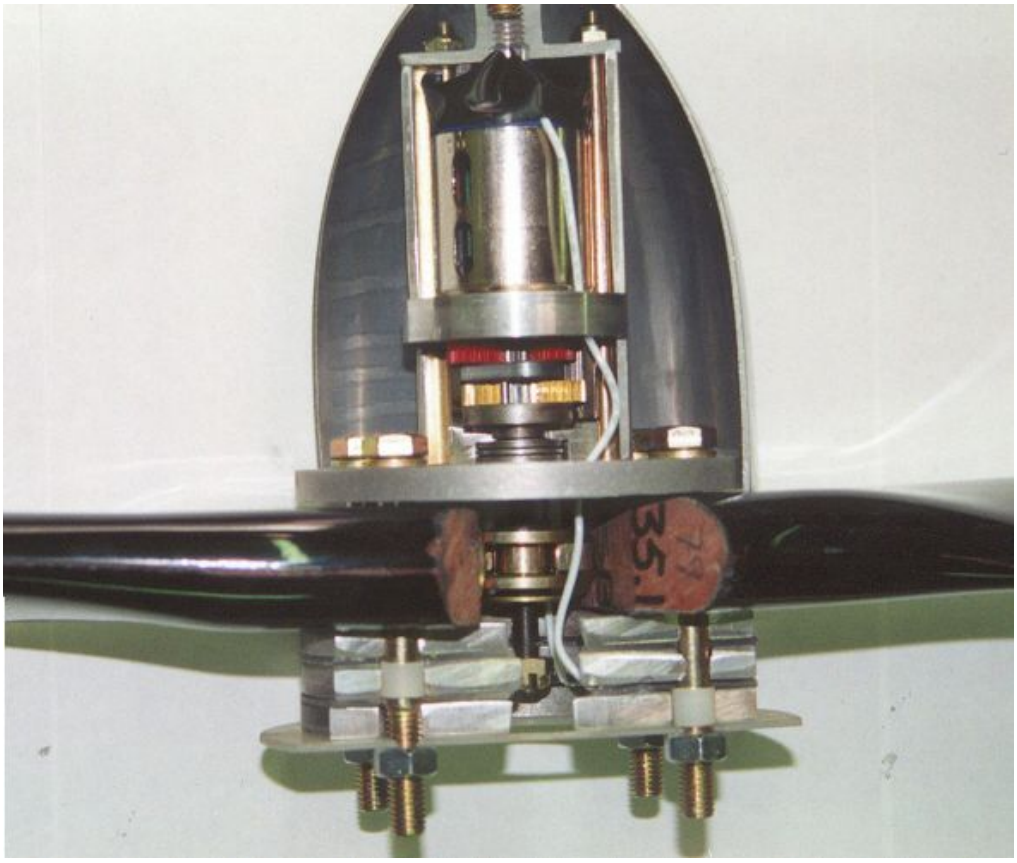
NOTE! Refer to the propeller manual RSUK0325!

The propeller is a DL3-68" three-blade, specifically designed 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 is covered by a composite spinner, attached to the propeller backplate by 9 screws (Loctited with 243) and nylon washers

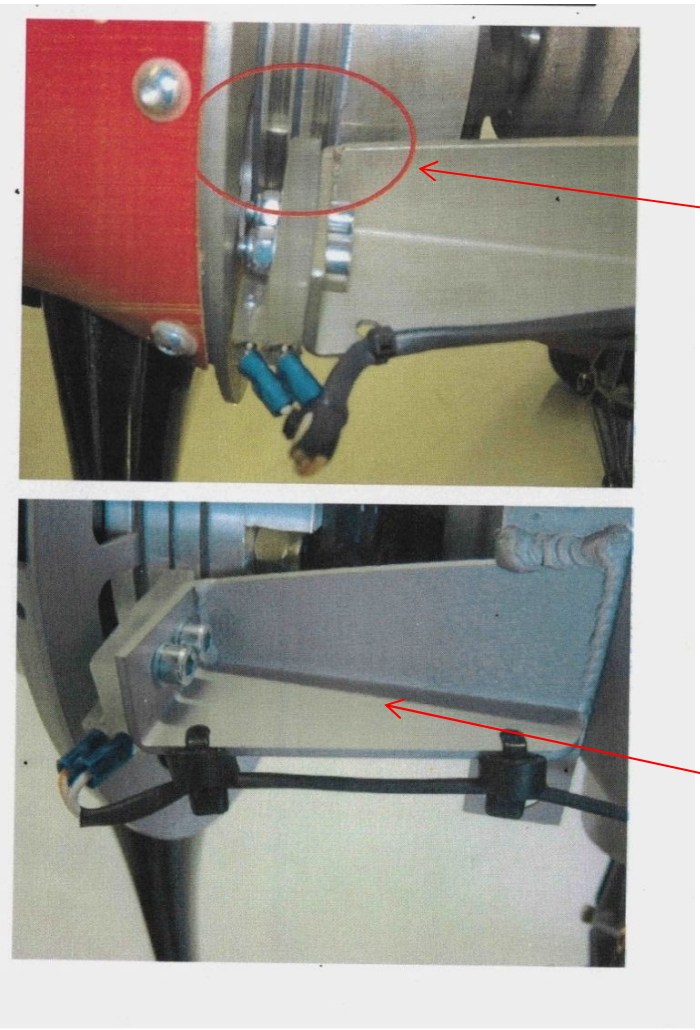
The hub is retained to the Rotax gearbox propeller flange by countersunk M8 socket-head screws and the engine torque is transmitted to the propeller by "torque bushes" in the normal way.



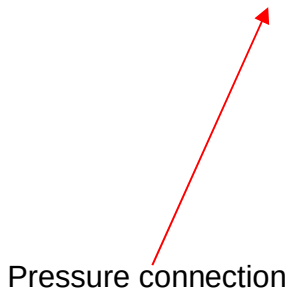
Propeller construction

Propeller mounting flange with “torque-bushes”

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.



The 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.



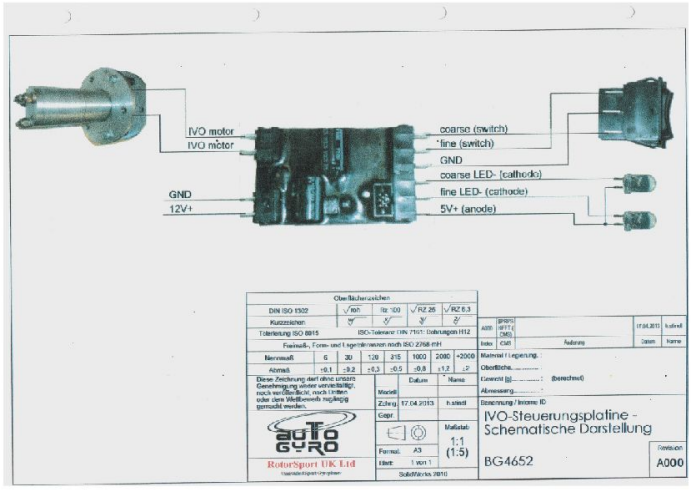
Pressure connection

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 of the instrument panel. 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 rocker switch 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 RSUK0060 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

These may be fitted in a the main instrument panel or in a small sub-panel to the lower left of the main instrument panel

- 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

Engine rpm gauge

Sub-panel location

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 to the gearbox, and the screws retaining the cables to the brush box must be threadlocked 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 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

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 11

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 are 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 are 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 gerry@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 gerry@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

Appendix A Compass calibration