Document number RSUK0325

Maintenance Manual
for
IVO-prop variable pitch propeller

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CAA Approval No: DAI/9917/06

Applicability

Propeller type: **IVO-prop DL3-68**

Propeller serial no.

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

Aircraft: **Calidus, Cavalon, MTOsport, MT-03**

Calidus fitted with IVO-prop variable pitch propeller

CONTENTS AND CHECK LIST OF PAGES

SECTION 1
AMENDMENTS TO THE SCHEDULE

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

ISSUE NUMBER	DATE	INSERTED BY	ISSUE NUMBER	DATE	INSERTED BY
Initial			4		
1	19.05.14		5		
2	08.06.15		6		
3			7		

Issue	Change summary
1	First issue
2	Additional applicability to Cavalon, MTOsport, MT-03 Re-formatted for clarity (all pages re-issued)

Signature: Graham Shaw Jun 22 2015 11:00 AM Position: Eng. Manager	Signature: Gerry Speich Jun 17 2015 8:28 AM Position: Head of Engineering	Signature: Andy Lyons Jun 22 2015 10:10 PM Position: Head of Airworthiness

List Of Effective Pages

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SECTION 2

FOREWORD

1. Applicability

This Schedule is intended for use on the RSUK version of the IVO-prop DL3-68 only, as released under addenda to AAN29345 (Cavalon), AAN29266 (Calidus), AAN29247 (MTOsport), AAN29134 (MT-03)

2. Guidance

This aircraft which this propeller is fitted to 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 or propeller. In order to claim any alleviation on subsequent inspections, the gyroplane and propeller 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 the appropriate propeller worksheet and/or the propeller logbook CAP388.

There are no life limited parts on this DL3-68 propeller

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 propeller 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 (propeller) (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 CAP 543 Time Limited Task Record, or an appropriate equivalent.

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

All maintenance carried out in connection with a particular check should be certified on suitably referenced worksheets (an example available from the RSUK website) and included in the gyroplane records. These worksheets must be cross-referenced in the appropriate log book(s) giving general details of the additional maintenance carried out.

DEFINITIONS

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

SERVICE/LUBRICATION (SERVICE/LUB):

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

INSPECT (INSP):

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

OPERATIONAL CHECK (OP/C):

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

FUNCTIONAL CHECK (F/C):

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

CHECK (CHK):

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

SECTION 4

PERMIT MAINTENANCE RELEASE

This maintenance certification system is specific in accordance with BCAR A3-7.
Owner operators must ensure their airframe and engine logbooks either contain a sticker with the wording ‘Any reference to a Certificate of Release to service in this logbook shall be construed as a PMR’ & ‘The certification at the top of each page in Part A of this logbook is superseded by the following statement; The work recorded below has been completed to my satisfaction and in that respect the aircraft is considered fit for flight’, or have new logbooks containing this information.

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

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.

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, CAP400 Propeller logbook 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 propeller hours*……. and in that respect is considered fit for flight Signed……...Authorisation ref…….Date……. Maintenance Schedule Ref. RSUK0325 Issue……	Airframe Engine Propeller

*Note: as a variable pitch propeller, the DL3-68 has its own log-book

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.

1. Removal and replacement of the propeller spinner.
2. Replacement of slip ring brushes.
3. Blade repairs (see section 7.0 for limitations)
4. Replacement of propeller leading edge tape.

Annual Check

The annual check and all associated work must be accomplished under the supervision of an organisation appropriately approved by the CAA (eg RSUK or other CAA Authorised engineer).
Use form F189 from the RSUK website

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	25, 100 hour and annual check items	Not exceeding 12 months (see Note 5) & prior to renewal of Permit to Fly

Use form F189 inspection/service records for the propeller only

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. 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).

SECTION 6

PILOT'S PRE-FLIGHT CHECK

Pre-flight checks are to be carried out in accordance with the relevant Gyroplane Pilots Handbook for which this specific propeller is released.

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.
F189 issue 1, 25hr/100hr or Annual service worksheet

SECTION 8 - ANNUAL INSPECTION

F189 issue issue 1, 25hr/100hr or Annual Service worksheet

SECTION 9 - Propeller 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 an Approved Certificate, which must be kept with the aircraft records.**
6. **Special tools (none at this time)**
7. **Lubricants. Use only as per instructions.**
8. **Loctites and sealants. As per instructions.**
9. **General corrosion prevention. Keep the aircraft in a non humid, ventilated area. If humidity is present, protect unplated components such as bolts etc with a proprietary spray such as WD40 or ACF50.**
10. **Help protect our environment by disposing of parts and fluids properly.**
11. **Standard bolt torques are M6 15Nm+/-2Nm, M8 25Nm+/-3Nm, M10 35Nm +/-4Nm, M12 100Nm +/-10Nm. Always assess the joint to be tightened and use engineering judgement – do not overtighten plastic or unsupported tube joints!**
12. **Remember, maintenance, modification, and bulletin/MPD incorporations must be recorded on suitable worksheets and within the aircraft/engine logbooks – and signed appropriately.**
13. **Refer also to the Pilots Handbook as well as the drawings quoted and service parts list, all available from the RSUK website.**

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.

1. Component identification

1.1 The hub
The hub consists of a number of circular parts that, when bolted together with the propeller blades, mount the propeller assembly to the engine and provide integral slip-rings for transfer of electrical power. These parts are not serial-numbered.

1.2 The blades
At the base of each blade root there an exposed resin area that is marked with indelible felt-tip pen with the following data:

Blade set serial number (e.g. 519.1)
Blade weight
Date of manufacture

Each blade is embossed with a position number (1,2,3) to enable precise replacement if removed.

1.3 Part numbers

C.xxnn = Calidus bill-of.materials
M.xxnn = MTOsport bill of materials (also MT-03 applicability)
V.xxnn = Cavalon bill of materials

Propeller, complete (and itemised)	BG535 (C.KU37, V.KU503, M.KU38)
Propeller mounting kit	BG967 (C.MO14, V.MO09) BG 504 (M.MO23) or BG5312 (M.MO48 A2) including brush bracket BG968
End position controller (including LED indicators)	BG7627 (C.EL301) BG4759 (V.EL301) BG4762 (M.EL302
Spinner	BG1184 (C.KU43) BG2743 (V.KU214) BG1316 (M.KU53)
Spinner attach kit (including backing plate)	BG1483 (C.MO26, V.MO07, MO029) BG5320 (M.MO50 A2)

Manifold pressure gauge kit .BG1420 (S.EL44) for 912ULS, or BG1419 (C.EL43) for 914UL or RSD4806 (combined digital pressure gauge/engine rpm gauge programmed for either engine type)

Propeller internal part nos (for spares)

Parts list to V.KU503 - IVOPROP Medium, Electric In – Flight adjustable (IVOPROP Medium Electric

Reg-No.	ID	Qty.	Name	Distr.	Reference No.
V.KU503	BG535		IVOPROP Medium, Electric In – Flight adjustable		
			IVOPROP Medium, Electric In – Flight adjustable		
└V.KU503.02	BG3384	1	IVO Antrieb montiert		
			IVO drive mounted		
└V.KU503.02.02	BT1486	1	Ivo Prop komplett	116	DL 368 E R41N / 912 S
			Ivo Propeller complete		
└V.KU503.02.03	BT9559	2	IVO Begrenzungsscheiben	115	Bestandteil von BT1486
			IVO Limit washer		
└V.KU503.02.04	BT9560	2	IVO Gummischeiben	115	Bestandteil von BT1486
			IVO rubber washer		
└V.KU503.02.05	BT9561	1	IVO Schneckenantrieb Mitnehmer	115	Bestandteil von BT1486
			IVO screw drive carrier		
└V.KU503.02.06	BT9562	1	IVO Schneckenantrieb	115	Bestandteil von BT1486
			IVO Screw drive		
└V.KU503.02.07	BT9563	1	IVO Hauptplatte	115	Bestandteil von BT1486
			IVO mainplate		
└V.KU503.02.08	BT9564	2	IVO Gehäuserohr	115	Bestandteil von BT1486
			IVO gear housing		
└V.KU503.02.09	BT9565	2	IVO Gehäuseschrauben	115	Bestandteil von BT1486
			IVO gear housing screws		
└V.KU503.02.10	BT9566	3	IVO Gehäusemutter	115	Bestandteil von BT1486
			IVO housing nut		
└V.KU503.02.11	BT9567	1	IVO Gehäuse U-Scheibe	115	Bestandteil von BT1486
			IVO housing washer		
└V.KU503.02.12	BT3117	1	Ivoprop Ersatzmotor	115	Bestandteil von BT1486
			Ivoprop spare motor		
└V.KU503.02.12	BT3117	1	Ivoprop Ersatzmotor	116	MOTOR MEDIUM
			Ivoprop spare motor		
└V.KU503.02.13	BT9568	1	IVO Halteplatte Motor	115	Bestandteil von BT1486
			IVO attachment plate engine		
└V.KU503.02.14	BT9569	1	IVO Abdeckplatte	115	Bestandteil von BT1486
			IVO Coverplate		
└V.KU503.02.15	BT9570	1	IVO Planetengetriebe	115	Bestandteil von BT1486
			IVO planetary gear		
└V.KU503.03	BG3385	1	Propellerblattsatz Ivo Prop		
			Prop blade set Ivo prop		
└V.KU503.03.01	BT5812	1	Propellerblattsatz Ivo Prop	116	DL368 set 3 blades only
			Prop blade Ivo prop		
└V.KU503.03.01	BT5812	1	Propellerblattsatz Ivo Prop	115	Bestandteil von BT1486 bzw, BT8975
			Prop blade Ivo prop		
└V.KU503.06	BT5901	2	Ivo Kontakteplatte	115	Bestandteil von BT1486
			Ivo contact plate		
└V.KU503.07	BT7044	1	Ivo Frontplatte	115	Bestandteil von BT1486
			Ivo front plate		
└V.KU503.08	BT7045	1	Ivo Rückenplatte	115	Bestandteil von BT1486
			Ivo backplate		

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V.KU503.09	BT7046	3	Ivo Isolatoren Ivo insulators	115	Bestandteil von BT1486
└V.KU503.10	BT7047	5	Ivo Shimmscheiben Pitchbereich Ivo adjusting shim	115	Bestandteil von BT1486
└V.KU503.12	BT7049	1	Ivo Kohlehalter Ivo carbon brush holder	115	Bestandteil von BT1486
└V.KU503.13	BT7098	6	Ivo U-Scheibe Ivo washer	115	Bestandteil von BT1486 bzw. BT8975
└V.KU503.14	BT7099	6	Ivo Mutter Ivo nut	115	Bestandteil von BT1486 bzw. BT8975
└V.KU503.16	BT8930	6	IVO Sechskantschraube IVO Hex head screw	115	Bestandteil von BT1486 bzw. BT8975
└V.KU503.17	BT8931	1	Anleitung Manual	115	Bestandteil von BT1486

2 . Performance data

The following data are presented for information only and are in accordance with the design and structural parameters of the propeller at its current stage of development.
Max. engine power output: 100HP (Rotax 912ULS) or 115 HP (Rotax 914UL)
Max. propeller RPM: 2650 rpm
Range of operating temperatures: -25degC - +50degC
Number of blades: 3
Diameter : 1727 mm (68inches)
The rate of pitch change from one end position to another (under aerodynamic load) 10sec nominal
Propeller mass: 8kg
One half of the hub assembly acts as a spacer for installation of the propeller and it is placed between the propeller and the propeller flange of the engine, to which it is secured by the countersunk fixing bolts.

3. Design, structure and instructions for operation

The propeller consists of the following main structural assemblies:

- Blades
- Hub (multiple pieces)
- Adjusting mechanism
- Spinner

3.1 Blades
The propeller blades are made of resin covered by carbon/graphite composite.


Set of three blades bolted together for transport

The root part of the blade is a robust flat section which is clamped between the two hub halves by means of two 3/8” precision hex-head bolts and nyloc nuts which, aided by deep knurling on the hub-halves, restrain the axial and radial forces.
For use in situations where greater blade wear is likely (sand airfield surfaces, float planes etc.) the leading edges have bonded-on (replaceable) stainless steel foil protection for maximum resistance against water and foreign objects.
The blade finish is black resin.

3.2. Hub
The material of hub is aluminium alloy. The hub consists of two primary parts and is backed-up by a series of aluminium/nylon spacers to provide a slip-ring set. The hub fwd half is mounted directly to the engine’s propeller flange by means of M8 countersunk socket screws screwed into standard Rotax flange nuts (mounted in the same PCD as the HTC propeller) and the remainder of the hub assembly attached to this by 3/8” precision hexagon bolts and nyloc nuts.


Hub fwd half

3.3. Adjustment in flight

3.3.1. General description

The DL3-68 is an electrical in flight adjustable propeller. Blade adjustment is carried out by means of an electrical servomotor, which is controlled manually from the cockpit by means of a rocker switch (mounted on the left of the pilot). 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 each Pilots Handbook 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.

3.3.2 Propeller blade pitch stops

The propeller is manufactured with physical machined pitch stops (contacted by thrust-washers selected on propeller assembly to suit engine type), in order to prevent the propeller being run too fine or too coarse. 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

WARNING! On no account may these thrust washers be changed, they are selected to allow the aircraft to meet the performance and safety requirements of BCAR Section T.

The pitch limit stop setting results in the following nominal pitch angles (+/-1deg)

Fine pitch 13.0deg (912ULS) or 14.0deg (914UL) deg
Coarse pitch 20.0deg in (912ULS) or 21deg (914UL).

During first assembly on an aircraft the fine pitch limit stop shims are adjusted to achieve 5600rpm on the ground, with the aircraft tied to a suitable fixed object.

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.

Checking the system of stops and LED indicators.

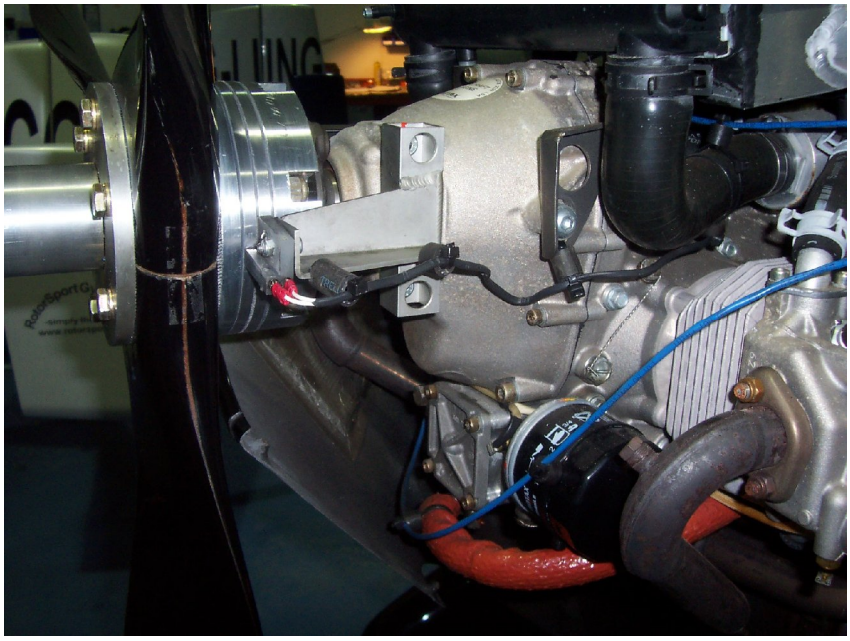
When carrying out pre-flight checks the system of propeller blade angle stops and the respective LED indicators should always be checked (see status table above). With the engine not running, the propeller should be adjusted from the one end position to other. If the propeller adjustment stops in each end position in a normal manner and with correct LED indication then the system is in order.

3.4. Spinner
The spinner diameter is 220mm.
Spinner material: Composite, painted to match the aircraft.
The whole spinner is fixed to the propeller backing plate by 9 steel screws, loctited with Loctite 243.
The spinner backing plate is used for final balancing of the complete propeller, by means of balancing weights glued inside the lower disk and held there by centrifugal force.

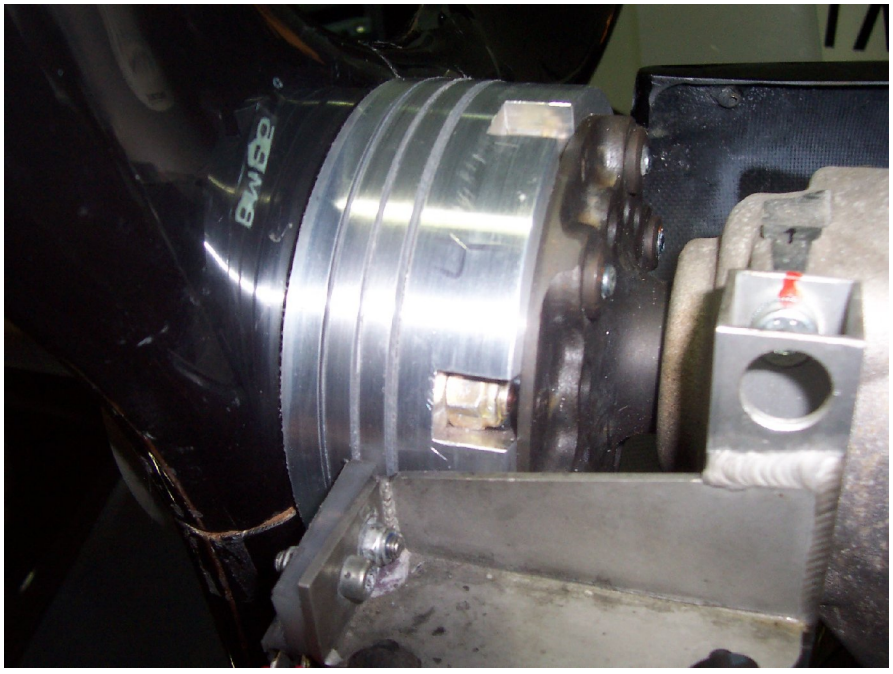
When a spinner is fitted the last aluminium spacer forming part of the propeller hub is furnished with a locating spigot to locate (and trap) the spinner backing plate.

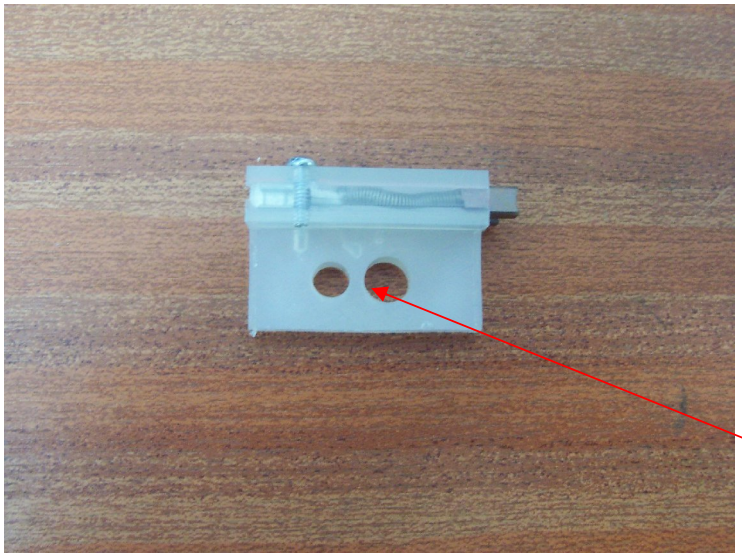
3.5 Brushgear

The attachment of the fabricated mounting bracket and carbon brush box on the Rotax engine is shown in the picture below. The bracket is mounted by means of 2 bolts, which screw into existing threaded bosses holes on the Rotax engine with Loctite 243.

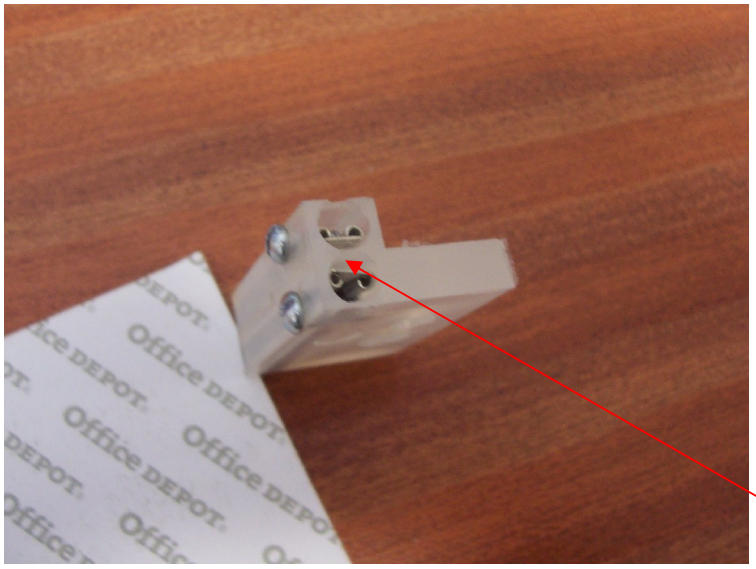


The IVO-supplied plastic brush box assembly (housing, springs, brushes, 3/16” connectors, retaining screws) is attached to the fabricated bracket by means of socket-head screws that enable a limited amount of angular and linear adjustment. The brush-box is set so that the each brush is central on its slip-ring and protruding about 0.5mm from the plastic housing.

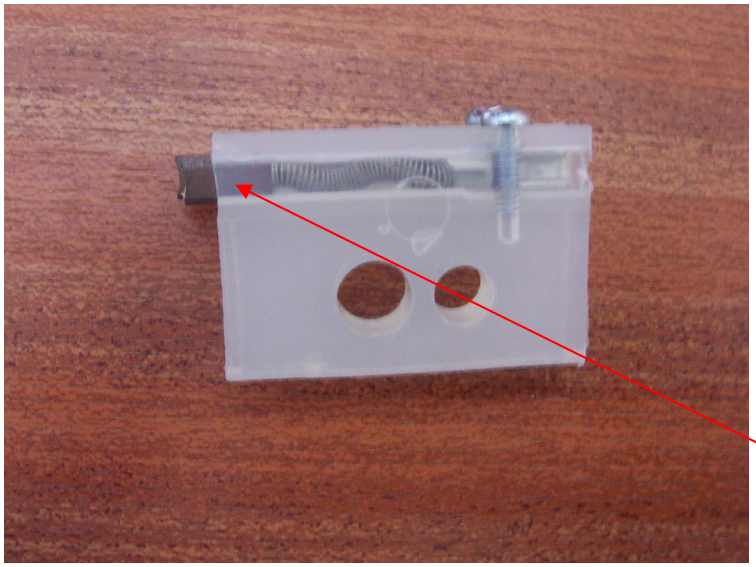




Carrier mounting/adjustment holes



Captive 3/16” “Faston” terminals



Brush length 10mm when new

4. Installation on Aircraft

4.1 Propeller installation and removal
The propeller's fwd hub-half is mounted on the engine flange using 6 off M8 countersunk socket head screws (torque 25Nm with Loctite 243) and the remainder of the propeller assembly is attached to this by means of six 3/8" precision hex-head bolts and nyloc nuts (torque 40Nm). When fully assembled with the fasteners tightened to the correct torque, paint stripes must be applied between the M8 c/sunk screw threads/the propeller flange and the 3/8" hex-nut/bolt ends (6-places each).

When removing or refitting the propeller it is necessary to be careful not to damage the carbon brushes, which supply the electric power to the propeller. Therefore remove the mounting bolts retaining the brush box bracket to the engine – this will improve access to the propeller retaining nuts too. Remember to use Loctite 243 on the threads when refitting! If a new engine first fit the Rotax flange nuts through the propeller flange, if the IVO-prop is replacing an HTC propeller then these will already be in place.

Engine gearbox flange with Rotax flange nuts fitted

<u>Propeller assembly</u>

Place the steel thrust washers on the actuator motor's lead-screw as shown in the photograph, selecting for engine fitment:

• 912: 2 x out of C.KU37 rear (total 2.5mm)

• 3 x out of C.KU37 front (total 5.7mm)

or

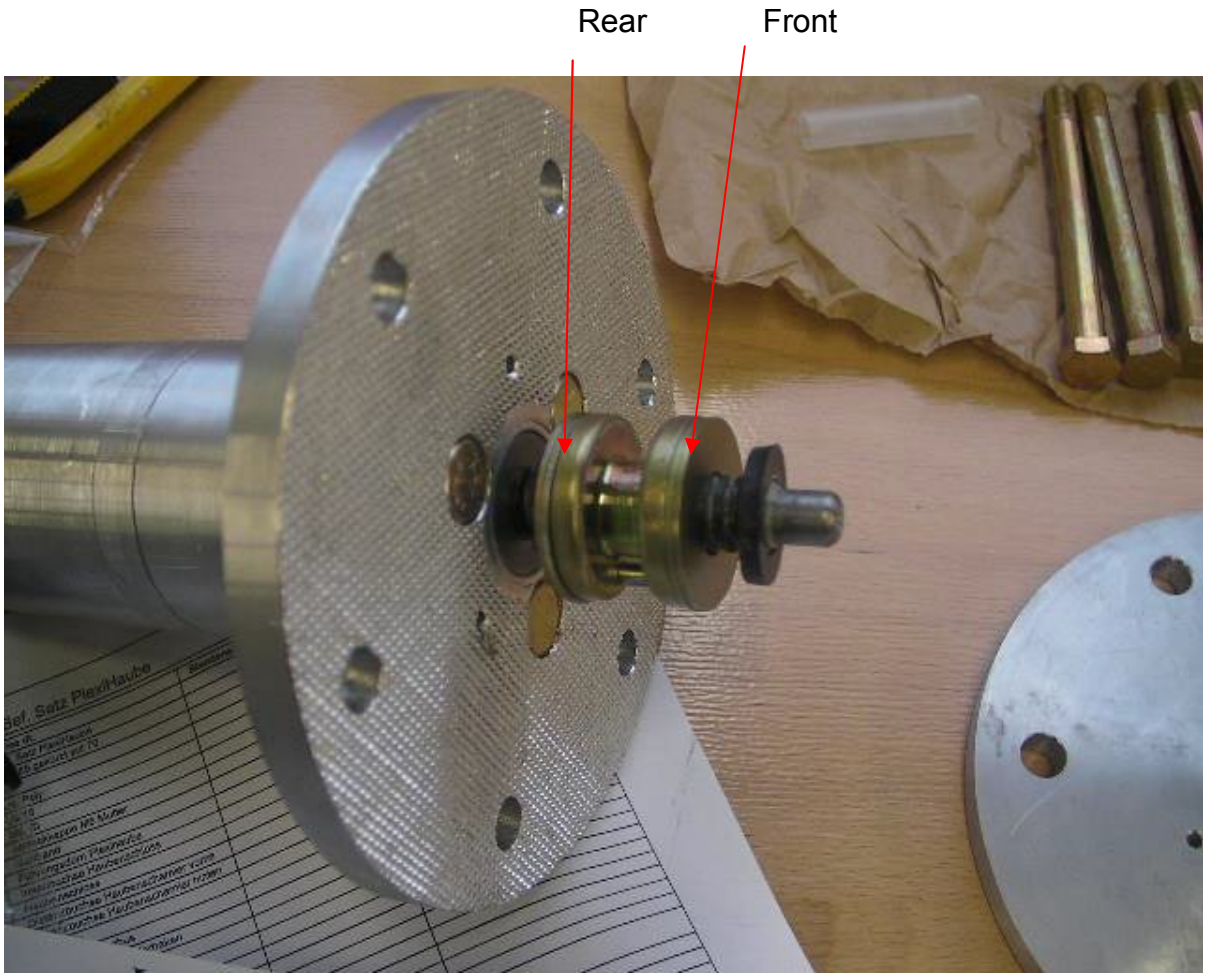
• 914: 1 x out of C.MO14 rear (total 0.8mm)

• 4 x out of C.MO14 front (total 4.2mm)

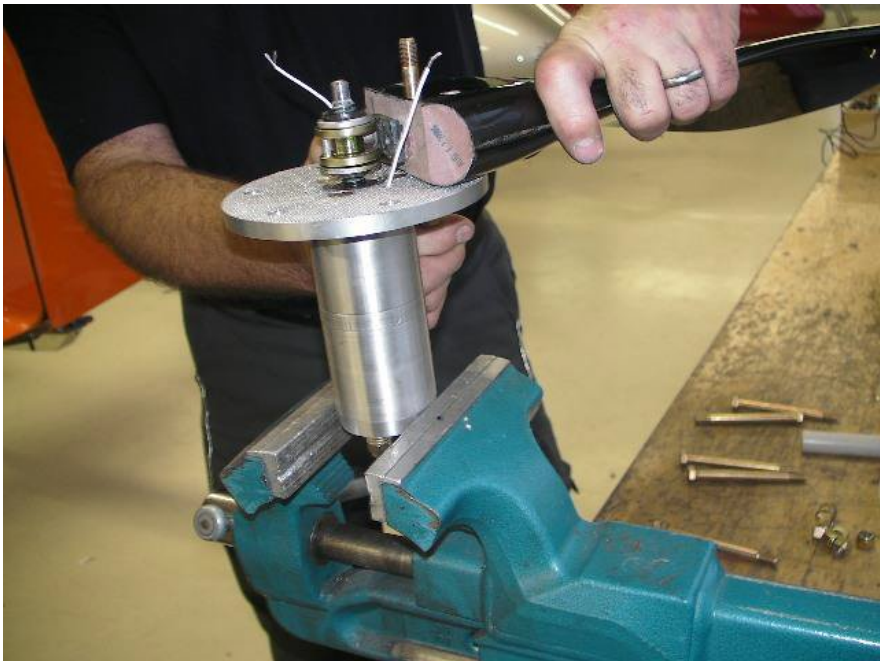
NOTE!

- The front shim washers may be increased or decreased in order to achieve 5600rpm maximum whilst the aircraft is suitably restrained on the ground at full power.
- The rear shim washers are set to achieve a minimum climb rate of 250fpm at maximum take-off weight.

Ensure that the two rubber cushion washers are in place.

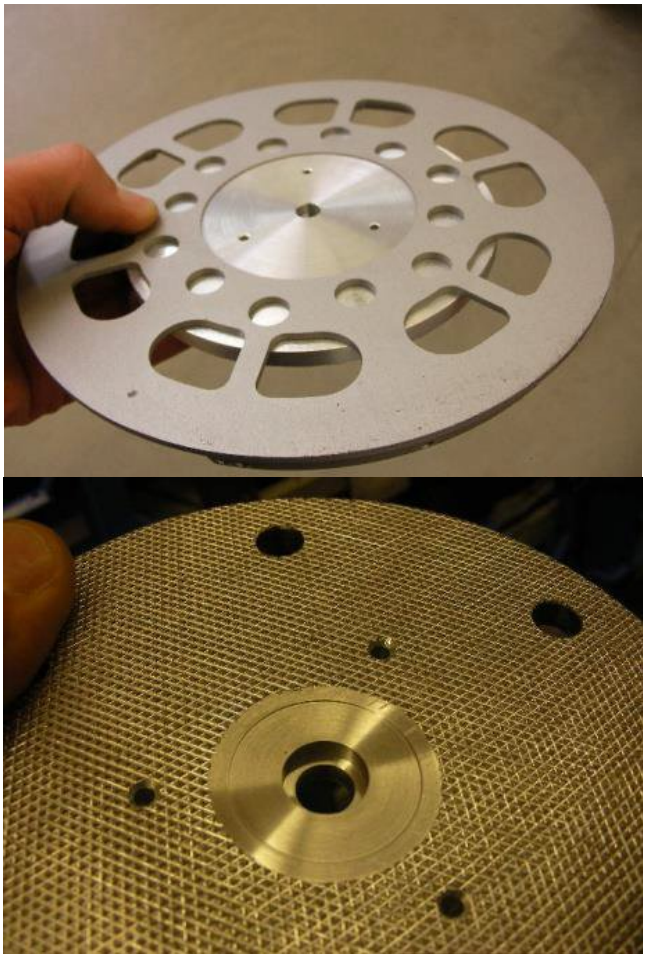


Clamp the actuator motor vertically in a vice (use soft-jaws) and using the 3/8” AN bolts and washers fit the three blades. Ensure that the two cables are free.



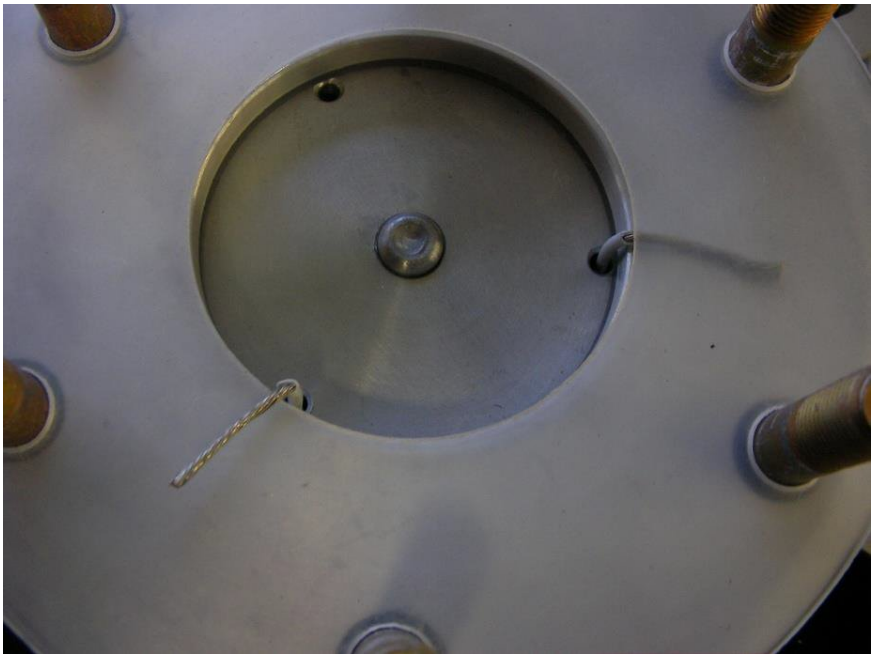
Fit the knurled clamping plate over the six protruding bolts, carefully pulling the two cables through the plate.

If a spinner is to be fitted use the alternate knurled clamping plate and spinner backing plate, ensuring that the blade cut outs align with the propeller blades..



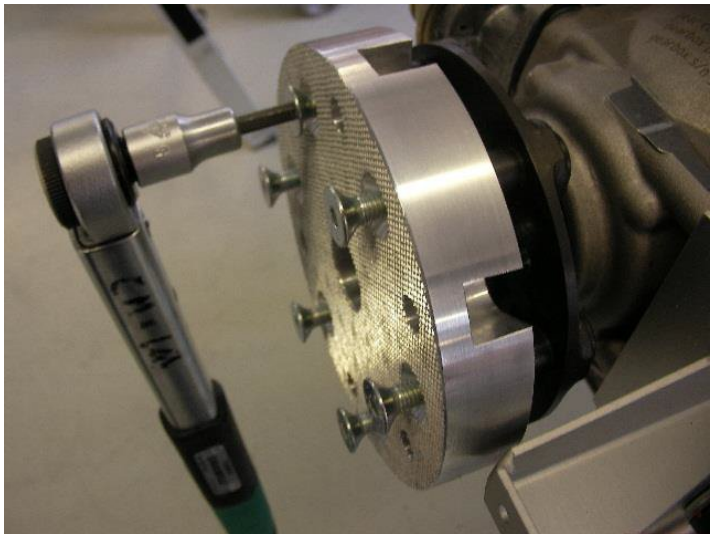
Assemble the insulators and spacing plates in the order shown below

Fold over each of the cables so that one electrical cable connects to each plate:
NB: there is no solder or welding, electrical contact is made by the clamping pressure.

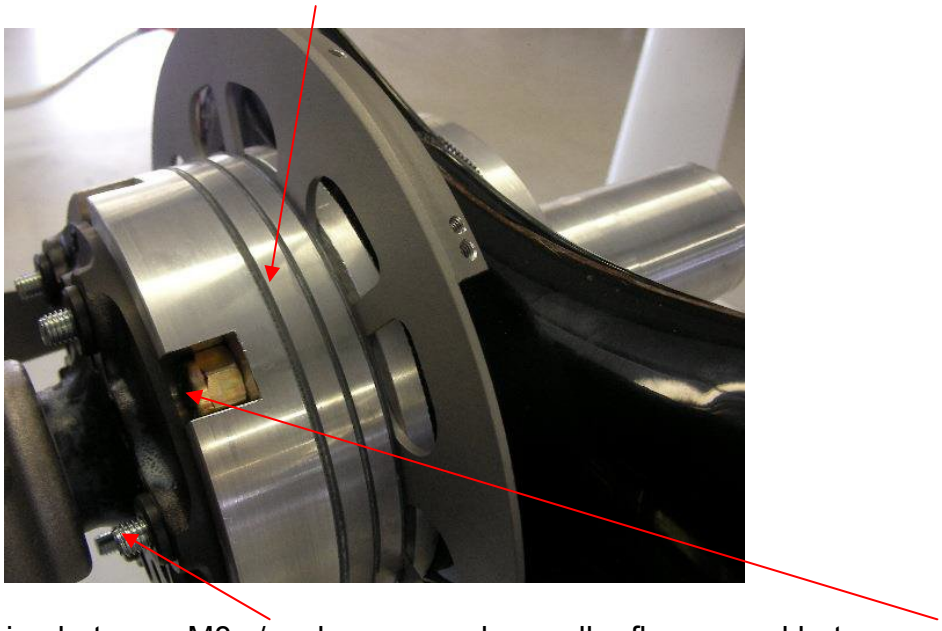


Make sure that the insulator bushes are in the correct position, if they have moved out push them back into place with tool C.WZ3020

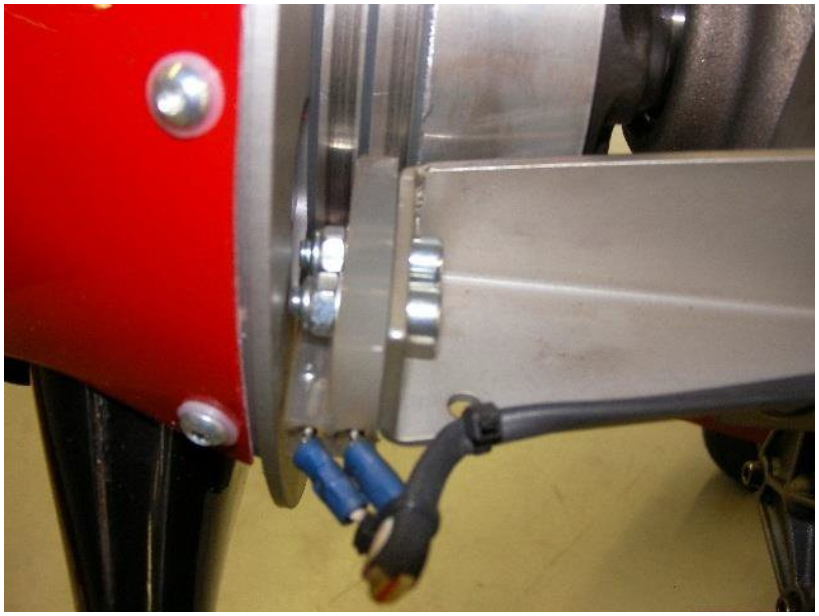
Install the adaptor plate on the engine using the M8 countersunk socket screws, Loctite 243 and torque (progressively) to 25Nm



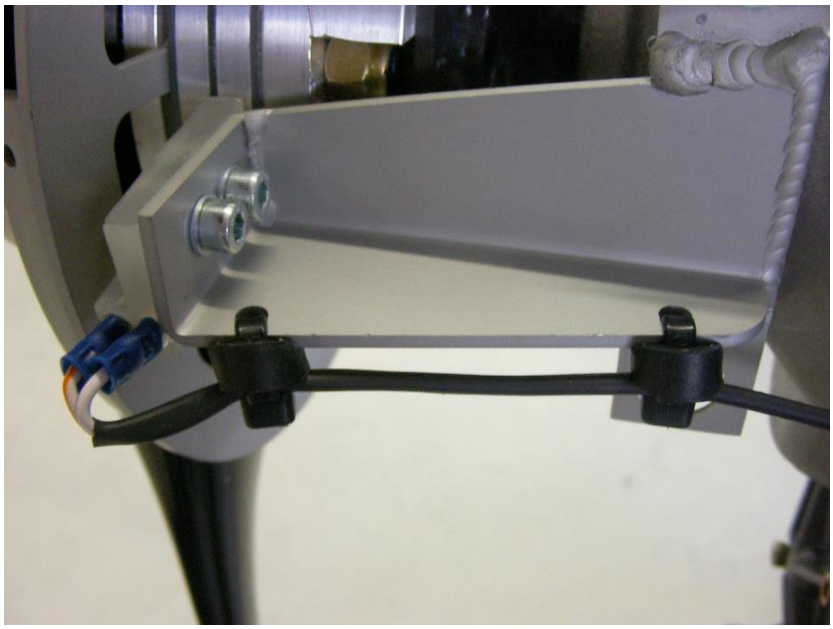
Attach the whole prop unit to the adaptor plate using the 3/8 AN5 hex-head bolts and nyloc nuts positioned in the recesses. Tighten the main prop bolts (progressively) to 40Nm. Note: Before fully tightening the bolts assess whether the nyloc nuts are “in safety” (i.e. minimum two visible threads protruding). If not so, then replace the six bolts with longer items RSD6401)
When everything is correctly located and the bolts tightened use a scalpel to trim any protruding insulator flush with the outer diameter of the aluminium spacers



Paint stripe between M8 c/sunk screw and propeller flange, and between nut and bolt end, 6pls ea.
Check that there is clearance between the ends of the bolts and the propeller flange. If there is no clearance, use the next size shorter bolt, or renew the plastic isolators, which compress during use and tightening.
Install the brush holder as shown. Make sure that the brush housing has 0.5mm clearance to the contact discs/spacers



Identify the two spare cables tied-back above the engine and using 3/16” crimp terminals connect the two cables to the brush terminals.
Use cable ties and spacers (made from scrap fuel hose) to secure the cable as shown.



Ensure that the carbon brush housing is adjusted such that the brushes run in the centre of the rings, and the brushes are free moving axially in the housing with about 0.5mm static protrusion. Turn the propeller, to check that the carbon brushes seat properly in the centres of the slip rings, and make contact with their entire surfaces.
When refitting the brush box, align such that the brushes are centred on the slip rings, and running with the brush axis perpendicular to the ring. The brushes must have freedom of movement in and out as the propeller turns – check this. The screws holding the brush box to the bracket have some adjustment.

The brush box bracket-to-engine bolts must be threadlocked with Loctite 243.
When new the brush length is 10mm. if worn to less than 4mm, replace. Note that the brushes must slide freely within the brush box, remove and clean them as required.

Removal of the propeller is the reversal of this process.
Loctite 243 should be used with the nyloc nuts but always renew nyloc nuts when the residual torque of the nut's locking element is less than 1Nm

4.3. Checking the installation
After installation and before starting the engine check the propeller functions:
1. Switch on the aircraft master switch.
2. Check the sense and function of the rocker switch on the instrument panel and the function of the LED indicators signalling propeller movement and its end positions.
3. With the aid of an assistant visually check that all propeller blades move simultaneously
4. Return the propeller to the full-fine position in anticipation of engine start
5. Carry out an engine test on the ground. During the engine ground test there must not occur any excessive vibration or unusual noise.
With engine speed 3000rpm adjust the propeller to full-coarse and verify that:

- there is a noticeable drop in engine rpm
- the manifold pressure gauge operates in accordance with table 3.3.1 above.

Return the propeller to full-fine and verify that the engine returns to the pre-set rpm

WARNING NOTICE

When making the engine ground test with the aircraft stationary, never adjust to the max. coarse angle on the propeller when the engine runs at maximum power (full throttle). This may produce stall flutter on the propeller with subsequent damage.

5 Periodic inspections and overhauls

5.1 Periodic inspections
Periodic inspections have to be carried out by the propeller producer or by an authorised person at the following time intervals: Use form F189 (initial 25hr and 100hr) for details of requirements

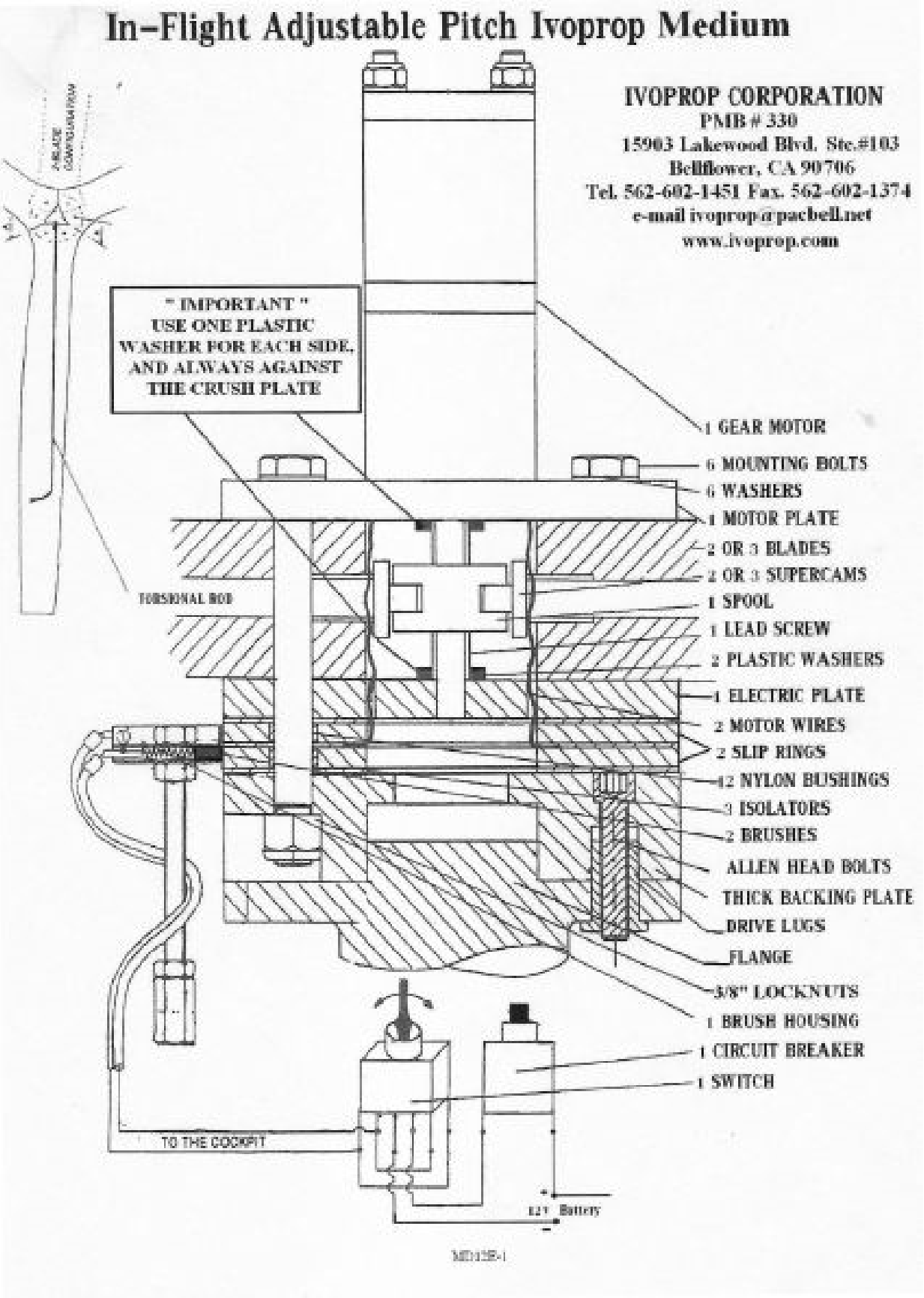
First 25 hours	On the aircraft	A3-7, LAA, or other	Authorised Engineer
100 hours	On the aircraft	A3-7, LAA, or other	Authorised Engineer
Annually (or coincident with 100hr interval)		A3-7, LAA, or other	Authorised Engineer

NOTE!
A record of these periodic inspections of the propeller must be kept in the propeller logbook.

5.2 Special inspections
In case of significant (see section 7.0 for owner repair limits) blade damage, impact of a significant foreign object on the propeller, or if propeller over-speeding by more than 200 rpm has occurred, it will be necessary to transport the propeller to RSUK for damage assessment and frequency vibration of the blades to be carried out.
NOTE!
A record of any special inspection must be made in the propeller logbook.
5.3 Overhaul

The period to overhaul is “on condition” as determined by the 100hr/Annual inspections.
Only an authorised person or RSUK may carry out propeller overhaul.
To remove propeller:
1. Remove spinner by removing the 9 retaining screws.
2. Remove and fix out of the way the brush box assy.
3. Progressively release and remove the 6-off hex bolts
4. Carefully extract the propeller, remembering it weighs around 8Kg.
5. Place propeller on a suitable workbench to allow disassembly.

Dis-assembly and subsequent re-assembly is described in the IVO-prop document MD12E that is embedded in this report RSUK0325 below.



Ivoprop Corp.

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Tel. 562-602-14351 Fax. 562-602-1374
e-mail ivoprop@pacbell.net
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Ivoprop Pitch-Change Design And How It Works
Medium Propeller

The IVOPROP operates on a COMPLETELY NEW AND UNIQUE adjustable pitch system that allows for substantially less hardware and rotating mass than any other ground pitch adjustable prop. The unique pitch adjustment design operates on the principle of twisting the blades through the chrom-moly alloy steel torsional rod cast inside the blade. The outer end of the torsional rod is firmly anchored inside the outer blade section. The round torsional rod is capable of rotating inside the blade, except for the outer end.
Both Ground and In-Flight Adjustable System utilize the same carbon / graphite fiber blades with stainless steel leading edges. The blades are capable of pitch change from 30" to 90"

The In Flight Adjustable Pitch Ivoprop

The ability to change the pitch in flight is as significant for the airplane pilot as for the driver of a car to shift gears in the transmission, this results in substantial savings in fuel, engine wear and noise.

- Pilot controls the pitch through the toggle switch mounted in the cockpit. Pressing the toggle switch one way sends electric current through the graphite brushes to the slip rings and finally to the electric motor.
- Depressing the toggle switch the other way reverses the polarity of the current and the rotation of electric motor. The pitch change operation is similar to the power windows in an automobile. As long as you hold the switch in one direction- the pitch changes in that direction and you observe the result on your RPM meter.
- Torque from the electric motor is multiplied in a 3 stage planetary gear drive, which turns the lead screw.
- Lead screw is supported by a thrust bearing and converts it's rotary motion into axial movement of the spool.
- The spool is linked to the supercams, which turn the torsional rods. Torsional rods transmit the movement from the center of the prop to the outside section of the blade. This causes the blade to twist therefore changing the pitch in the same manner as the ground adjustable pitch system.
- Total time required for full range of adjustment is about 10 seconds.
- Movement of the spool can be restricted each way by inserting washers on the lead screw. This limits maximum and minimum pitch and prevents engine over-revving.
- Older models Ivoprop ground adjustable props can be convert to In-Flight Adjustable System by means of retrofit kit.
- In-Flight adjustable hub comes assembled with instructions on how to use it.

MD12E-2

Ivoprop Medium Assembly

- Mount the Adaptor on the flange. Use Allen head bolts and blue loctite or lock nuts. **Torque 8mm bolts to 200 inch x LBS, 3/8" bolts to 30ft x LBS.**
- Insert the mounting bolt with the washer through the motor plate in one of the bolt holes closets to the two motor wires.
- Insert one blade on the mounting bolt. Flat airfoil side towards the electric motor for pusher. Curved airfoil side towards electric motor for tractor.
- Rotate the blades so that the supercam goes into the groove in the spool.
- Insert second bolt with washer through the motor plate and blade.
- Insert electric plate (The one without nylon bushings on the boltholes)
- Run the motor wires through the holes in the electric plate.
- Insert isolator.
- Insert slip ring on the bolts. Do not push out the nylon bushings.
- Bend one motor wire in right angle radially outward on the slip ring.
- Insert second isolator.
- Bend second motor wire the same way like the first one on the isolator.
- Insert second slip ring
- Insert third isolator
- Bolt prop loosely on the thick plate.
- Insert remaining blade (s) between plates and torque mounting bolts to **30 ft. x lbs.**
- Mount the brush housing "somehow" next to the flange so that brushes will contact slip rings. The mount must be rigid. There should also be a small clearance between brush housing and slip rings.
- Brushes should point directly towards the center of the prop.
- Install switch and circuit breaker in the cockpit in a place where you can easily reach but not accidentally activate.
- Attach 3/16" connectors to the brush housing.
- Attach battery connectors to the battery. Circuit breaker wire belongs to the positive pole.
- Write next to the switch direction of the pitch change. By interchanging brush connectors you can change the direction of pitch change.

Example:

Pitch up	Pitch down
R.P.M. down	R.P.M. up
Cruse	Climb

- Caution: Brushes are brittle- Do not break them.
- If you wish to use the spinner. The spinner backing plate shall be inserted between the electric plate and the isolator.

MD12E-3

WARNINGS:

MARK THE PROP POSITION IN RELATION TO THE REDUCTION FLANGE.
THERE ARE MULTIPLE POSITIONS TO MOUNT THE 3 BLADE PROP. THIS MAKES A GREAT DIFFERENCE IN HOW THE PROP AND ENGINE VIBRATE TOGETHER AND EACH POSITION CREATES A TOTALLY NEW SITUATION.

THE KNURLED PLATES ARE INSTALLED SO THAT THE KNURLING FINISH ON EACH PLATE IS IN CONTACT WITH THE BLADES.

THE KNURLED PATTERN IS 60 DEGREES SYMMETRICAL, SO IF YOU REINSTALL THE BLADES BETWEEN CRUSH PLATES LATER IN A DIFFERENT POSITION, THE IMPRINT ON THE BLADES SHOULD MATCH THE KNURLED PATTERN. HOWEVER (BECAUSE OF MANUFACTURING TOLERANCES) TO GET THE BEST MATCH YOU NEED TO NUMBER THE BLADES AND PLATES AND ALWAYS PUT THE BLADES BACK IN THE SAME PLACE.

IF YOU GET A NEW BLADE OR BLADES START A PROGRESSIVE TORQUE SCHEDULE OVER AGAIN

6. Maintenance
In normal operation the propeller does not require any special maintenance.
In case of propeller contamination wash its surface with a cloth dipped in warm water with addition of household detergent.
WARNING!
No other cleaning means or solvents are allowed.

7. Repairs (by owners)
Surface damage not tearing through the glass or carbon fibre, and not exceeding 10mm in length or width, 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 stainless-steel prop tape is damaged, replace it with a new service strip of tape. Ensure the original tape and any adhesive debris is removed first, and that the surface is clean and dry before adhering the new tape in place. Try to get it in exactly the same position as the original, to maintain propeller balance. All other work, unless specifically allowed under CAP733, must be completed by a CAA authorised person
Sealing the edge of the tape with cyanoacrylate adhesive helps ensure the tape stays attached to the blade longer.
WARNING! The edge of the stainless steel strips are VERY sharp. Handle with care to avoid damage to skin.

8. Problems and their elimination.
The following problems may occur during the propeller operation:
Possible problem cause and rectification
Vibration in flight or on the ground: Static imbalance of the propeller
Check on the ground that the balance weights inside the spinner back plate are not missing and that there are no missing broken parts of the blades, which could cause the imbalance.
A well balanced propeller will significantly improve the engine and ancillary component service life. The Rotax recommended maximum is 0.1ips.
Mass balance weights used should be self adhesive aluminium wheel balance weights as used on car wheels, fitted inside the propeller spinner backing disc hub to a well cleaned, dry, surface.

Aerodynamic imbalance of the propeller
Check on the ground, with engine out of operation, if all three blades are adjusting simultaneously and smoothly. These defects can be rectified by a service agent.

The propeller does not adjust the blades and the panel lamp stays off.
Broken, worn or wrong contact of carbon brushes. Replace or adjust the brushes.
Check according to the diagram if there is proper electrical connection of propeller and of electrical joints.

9. Transport and storage

9.1 Storage

9.1.1 Manner of storage

If removed from the aircraft, the propeller can be stored horizontally or vertically, but only in such a way that it is supported by the six M8 fixing bolts attaching it to the pad. In either case the ends of the blades must not support the propeller.

WARNING!

It is forbidden to store the propeller in such a manner, that it is put on the ends of two blades and supported by the wall. During such long term storage distortion of the blades will occur.

9.1.2. Climatic conditions

Normal room temperature and relative humidity up to 80%.

Section 10
Modifications approved to date

Mod No.	Description	Use and comments

Service Bulletins issued to date

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

This form is Part 1 of 2. This is the customer request form, Part 2 is the reply

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, SY9 5EJ. 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)

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