



# AutoGyro Certification Ltd    Service Bulletin (Permit)

<b>Title: Cavalon Stability and Vibration Reduction upgrade</b>		<b>Release date 05.05.2022</b>
<b>SB-143 Iss1</b>	<b>Related documents</b> Modification: MC-432 engine brace MC-425 teeter tower height change MC-384 mast bushes MC-382 New rotor head with higher pre rotation and Vne CCAR No.: None	<b>Compliance Category:</b>  <b>OPTIONAL</b> <del>or</del> <b>RECOMMENDED</b> <del>or</del> <b>MANDATORY</b>
<b>Applicability</b>		
<b>Aircraft type &amp; model:</b> All UK registered Cavalons	<b>Aircraft serial Nos. affected:</b> All, as applicable	
The maintenance manual to be referenced is this stated or subsequent issue.		RSUK0428 Cavalon USA RSUK0441 Cavalon USA 915iS RSUK0288 Cavalon UK RSUK0426 Cavalon 915iS
<p>This form is the response from AutoGyro Certification Ltd either against a problem found in the product in service requiring a containment or rectification action, or as service information for aircraft modification incorporation. For help, contact RotorSport on 44(0)1588 505060, or email <a href="mailto:compliance@rotorsport.org">compliance@rotorsport.org</a>.</p> <p>The technical content of this document is approved under the authority of the UK CAA Design Organisation Approval Ref: <b>DAI/9917/06</b></p>		

## Documentation (Service Bulletin Completion action)

- a) Entries within the aircraft logbooks, eg CAA BCAR A3-7 Authorised Person to certify that the work is completed by writing 'SB-143 Cavalon S & VR upgrade.' with appropriate description of the embodied part of the modification in the aircraft logbook white pages, and record the action in the pink pages entitled 'Aircraft Modifications'. Both entries must be signed by the Authorised Person together with their Authorisation number.
- b) Completion of the SB worksheet if attached. This must contain a PMR statement, and a final check item that no tools or equipment have been left within the aircraft.
- c) Complete, if required, the Type Approval change application document. (This is required where the SB will affect the type approval limitations, eg airspeed limitation change or MTOW change and enables the owner to request the permit change required)
- d) Any other Permit Maintenance Release to Service form requirements.

Document approval signatures			
<b>Engineering Manager</b>  19 / 05 / 2022	<b>CVE (as required)</b>  <b>Not required, change already approved</b>	<b>Chief Test Pilot (if flight performance or safety effect)</b>  <b>Not required</b>	<b>Head of Airworthiness</b>  DocuSigned by:  87381729FD8946F... Andy Lyons    26th May 2022

# AutoGyro Certification Ltd    Service Bulletin (Permit)

## **Reason and overview of the Service Bulletin (cause of problem if known)**

Through further research and analysis of vibration and flight characteristics of the AutoGyro Cavalon, AutoGyro has developed a series of improvements that are now able to be offered to the market as upgrade kits of varying configurations depending on the modification status of the Cavalon to be upgraded.

The detail is shown in the appended AG-SB-2021-06-C.

Embodiment of these changes permits the aircraft Vne to be increased to 120mph.

## **Manpower estimates**

The estimated man-hours to complete the tasks shown vary depending on the tasks chosen.

## **Compliance: *Optional***

## **Tooling required**

See AutoGyro SB

## **Weight and Balance Effects**

No effect

## **Manuals affected**

Not affected.

## **Previous Modifications that affect the SB**

None

## **Accomplishment instructions (Action required to implement this bulletin):**

1. Follow the requirements of AutoGyro AG-SB-2021-06-C-EN.
2. Note that kit 48156 is not required on any Cavalon released to service via RotorSport UK Ltd or AutoGyro Certification Ltd.
3. Re-weighing is recommended. The location of these changes will have little effect on the aircraft longitudinal CG.
4. The aircraft Vne, where currently 100mph, is increased to 120mph. This means that the ASI fitted must have a full scale indication of 140mph, if this is not the case a new unit must be fitted. The yellow warning line is extended to 120mph, and red line repositioned accordingly. Where an electronic ASI unit is fitted, the warning flags are adjusted as per the manufacturers instructions.
5. The test flight protocol used should be appropriate to the body managing the aircraft; CFS031 from the CAA website, or LAA protocol from the LAA website; or other as required. The test flight should include flight to the new Vne, where this has been extended.

## **Material information (Parts required to be made to implement this service bulletin):**

No parts made during embodiment

## **List of components (with purchasable part nos)**

48157 Complete rotorhead and upper mast replacement with pre rotator gearbox assy and full engine mount & rear brace set.

48158 Teeter tower replacement and full engine mount & rear brace set.

48157 Engine mount and rear brace set

30483 Loctite 243 Blue

30477 Lagermeister WHS2002 Grease

45506 Liqui Moly LM47 MoS2

30476 HHS2000

# AutoGyro Certification Ltd Service Bulletin (Permit)

<b><u>Interchangeability</u></b> Not affected
<b><u>Parts disposition</u></b> a) Disposal requirements – None b) Environmental hazards of parts containing hazardous materials - None c) Scrap requirements (e.g. mutilate scrapped items beyond use) – None.

# AutoGyro Certification Ltd    Service Bulletin (Permit)

Aircraft serial no. Registration	<b>Service Bulletin implementation Worksheet</b>	Date raised:	
		Raised by:	
Purpose – record service bulletin implementation actions.		Document reference: <b>SB-143</b>	
Aircraft Maintenance Manual (AMM) referred to and issue level/date:			
Note; attach SB sheets to this document			
<b>Task</b>	<b>Notes</b>	<b>Eng'r check/date</b>	<b>Inspector check/date</b>
Record actual bulletin kits incorporated			
48157 Complete rotorhead and upper mast replacement with pre rotator gearbox assy and full engine mount & rear brace set.			
48158 Teeter tower replacement and full engine mount & rear brace set.			
48157 Engine mount and rear brace set			
<b>Post installation checks;</b>			
Rotorhead pitch/roll angle check (if changed)			
Rotorhead full control movement			
Teeter block change installation check			
Confirm that the aircraft ASI has been changed to the new Vne of 120mph	Only applicable where the rotorhead has been changed to the latest generation.		
Pre rotator gearbox changed?			
Pre rotator warning led installation and placard			
Rotor rpm limit placard			
Tail plane angle check			
Engine mounting change	Record angle		
Engine thrustline post change			
Engine brace installation			
Tools and loose article removed, and ready for flight			
Aircraft requires test flight and rotor balancing after this work.			
Customer acceptance: Name:	Aircraft hobbs meter reading		
Signature/date:	Confirm logbooks annotated:		
<b>Permit Maintenance Release: The work recorded above has been completed to my satisfaction and in that respect the aircraft is considered fit for flight.</b>			
Engineer/Inspector signature	Date of work		
Name: Authorisation code :	Location where work completed		

# AutoGyro Certification Ltd    Service Bulletin (Permit)

<h2>Permit Change Application</h2>	
The purpose of this document is to provide sufficient information to the CAA to allow a change of the Permit to Fly to incorporate a specific aircraft modification or upgrade.	
Aircraft reg no	Aircraft serial No.
AAN that has been incorporated: None	Service Bulletin number incorporated: SB-143
<p>Owners name and address</p>     <p>Daytime telephone number</p> <p>Email</p>	
Summary of change required:	
<p>Documents to be included with this application:</p> <p>Photocopy of aircraft and/or engine logbook pages with certifying signatures that confirm embodiment of the service bulletin and Permit Maintenance Release certification.</p> <p>Existing CAA Permit to Fly.</p> <p>Application fee as specified in the CAA Scheme of Charges paragraph 6.1</p>	
<p>Send to:</p> <p>CAA Applications and Approvals</p> <p>Aviation House</p> <p>Gatwick Airport South</p> <p>West Sussex</p> <p>England</p> <p>RH6 0YR</p>	

## Service Bulletin

<b>Title: Cavalon Market Upgrade</b>		
<b>AG-SB-2021-06-C-EN</b>	<b>Effective Date:</b> 29.11 2021	<b>Compliance Category:</b>  <b>A - MANDATORY</b> <b>B - RECOMMENDED</b> <b>C - OPTIONAL</b>
<b>Applicability</b>		
<b>Aircraft type &amp; model:</b>  AutoGyro Cavalon	<b>Affected Serial number(s):</b>  All AutoGyro Cavalon 912, 914 & 915iS	
The maintenance manual to be referenced is this stated or subsequent issue.		As per AutoGyro website
<p>This form is the response from AutoGyro GmbH either against a problem found in the product in service requiring a containment or rectification action, or as service information for aircraft modification incorporation. For help, contact <a href="mailto:airworthiness@auto-gyro.com">airworthiness@auto-gyro.com</a>.</p>		



### Documentation (Service Bulletin Completion action)

The accomplishment of this Service Bulletin, or the decision of its rejection, must be properly documented, if such procedure is required by the relevant authority

### Category Codes

A – Mandatory – failure to comply result in a significant reduction of flight safety, injury or death  
 B – Recommended – failure to comply may result in reduced safety margin, injury and/or equipment damage  
 C - Optional – improves operating behavior, reliability and/or maintainability

Re-issued 29.11.2021 to correct an error in the measurement of the thrustline, item 7 page 16

<b>Chief Certification Officer</b>	<b>Chief Technical Officer</b>
 G. Speich Nov 29 2021 11:05 AM 	 M.Sc. Harald Stindl 2022.05.17 06:59:19 +02'00'

**Contact & Info:**  
[airworthiness@auto-gyro.com](mailto:airworthiness@auto-gyro.com)  
[www.auto-gyro.com](http://www.auto-gyro.com)

**AutoGyro GmbH**  
 Dornierstr. 14  
 31137 Hildesheim

## Service Bulletin

### Reason and overview of the Service Bulletin (cause of problem if known)

Through further research and analysis of vibration and flight characteristics of the AutoGyro Cavalon, AutoGyro has developed a series of improvements that are now able to be offered to the market as upgrade kits of varying configurations depending on the modification status of the Cavalon to be upgraded.

These upgrade kits are offered in the following combinations:

1. **48155 - Upgrade kit for existing Cavalons with rotor head II and long keel tube – consisting of:** rotor head III upgrade with teeter tower III.1 (48015); mast II (45983); upgrade set clutch LED (46141); clutch IV (46268); motor support arm (48147); keel tube reinforcement (48163); engine mounting set 65 shore HNBR (48114). *Additional to this, it may be required to order the latest mod state pre-rotator drive shaft (32054). See serial 4. of ‘Accomplishment Instructions’ below.*
2. **48156 – Keel tube I to II.1 upgrade kit for existing Cavalons upgrading from rotor head II to III with short keel tube I (required for upgrade 48155 above) – consisting of:** longer keel tube II.1 (45958) with skid plates; keel tube attachment kit (32085); longer cable rudder II x 2 (34269).
3. **48157 - Upgrade kit for existing Cavalons with rotor head III and teeter tower III – consisting of:** teeter tower III.1 complete (47999); motor support arm (48147); keel tube reinforcement (48163); engine mounting set 65 shore HNBR (48114).
4. **48158 - Upgrade kit for existing Cavalons with rotor head III & teeter tower III.1 – consisting of:** motor support arm (48147); keel tube reinforcement (48163); engine mounting set 65 shore HNBR (48114).

The benefits of these upgrades are as follows:

1. Upgrade from rotor head II to rotor head III - a weight saving of approximately 1.3Kg and the ability of a pre-rotation rpm of 300 (maximum 320), resulting in a shorter take-off distance under comparable weather conditions. Where permissible, the aircraft Vne is increased to 120mph/195km/h/104KIAS
2. Upgrade from teeter tower III to III.1- reduced 2 per revolution vibration.
3. Fitment of engine support arms and 65 shore rubbers – reduced engine induced vibration.
4. Upgrade from short keel tube to long – improved in-flight straight and level stability and required for compatibility with rotor head III upgrade.

It should be noted that although AutoGyro has successfully tested these kits on several aircraft, there may be a small number of aircraft configurations that may require adaptation in some form. In the event of any uncertainty encountered whilst modifying the aircraft, contact AutoGyro Technical Support ([airworthiness@auto-gyro.com](mailto:airworthiness@auto-gyro.com)).

### Manpower estimates

The task may only be performed by an organization or individual entitled and trained to carry out the relevant level of maintenance on AutoGyro aircraft.

Estimated man-hours to complete the tasks as stand-alone items are:

#### Contact & Info:

[airworthiness@auto-gyro.com](mailto:airworthiness@auto-gyro.com)  
[www.auto-gyro.com](http://www.auto-gyro.com)

**AutoGyro GmbH**  
 Dornierstr. 14  
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## Service Bulletin

1. Rotorhead II to III – 4.5 hr
2. Teeter tower III to III.1 – 1.0 hr
3. Engine brace & keel tube reinforcement (including engine mount rubbers) – 2.0 hr
4. Keel tube II.1 – 6.0 hr
5. Rotorbalance and flight check – 3.0 hrs

These hours are an average estimation for planning purposes. The actual hours required may deviate from this depending on modification state and age of the aircraft.

### **Compliance**

*This bulletin is optional and has no compliance timeline.*

### **Customer Support**

Materials and labour hours are not covered by this Service Bulletin.

### **Tooling required**

Standard tools.  
Rotor balancing equipment.  
Any special tooling referred to in relevant job cards.  
32837 blockage pedal lever (optional)  
48006 level mounting plate (optional)

### **Weight and Balance Effects**

Aircraft must be re-weighed and new centre of mass calculated once modifications are embodied, and any country relevant documentation completed.

### **Manuals affected**

POH & AMM AutoGyro is not affected. The latest POH and AMM should be used for the relevant configuration of the aircraft.

### **Previous Modifications that affect the SB**

None

### **Accomplishment instructions (Action required to implement this bulletin):**

All work is to be carried out in accordance with the latest model-relevant AutoGyro Aircraft Maintenance Manual.

Standard torques are to be used where no specific torques are defined in the instruction.

M4:	4Nm
M5:	6Nm
M6:	10Nm
M8:	25Nm
M10:	35Nm

#### **Contact & Info:**

airworthiness@auto-gyro.com  
www.auto-gyro.com

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31137 Hildesheim



## Service Bulletin

**For clarity it is possible to use the zoom function to zoom into all photos.**

### Instructions



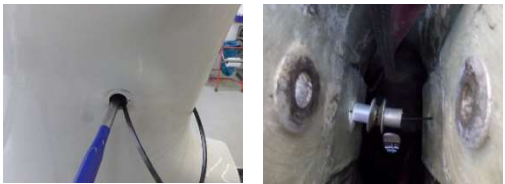

The following sections cover the various upgrades and should be used independently for each relevant module.

Ensure the wheel brake is applied and the ignition is switch off/key removed.

### Rotor Head II to III Upgrade

Note: It is strongly recommended that the following upgrade be carried out by a suitably trained AutoGyro Level III Certified Mechanic

#### *Mast & head replacement*












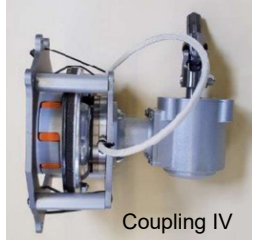
Ser	Description	Illustration
1	Remove the rotor system in accordance with AMM job card 62-11-00 4-1.	
2	Remove the mast fairing in accordance with AMM Job Card 52-00-00 4-1.	
3	Switch the flight/brake switch to flight.(if fitted with the latest generation electrically operated flight-brake switch, the key-switch must be temporarily active to do this) Remove the rotor head and top mast assembly in accordance with AMM job card 62-51-00 4-1.	
4	If the original pre-rotator shaft does not have a bearing retaining collar, it is strongly recommended that a new mod state shaft (32054) be fitted.	 <p>Bearing Retaining Collar</p>
5	It may be necessary to remove material from the composite web between mast rear face/brake-trim cylinder, and pre-rotator drive shaft bearing retaining plate. There must be a minimum of 3mm material visible forward of the forward edge of the drive shaft bearing retaining plate after any re-work.	
6	If the lower bush in the original mast assembly is the rubber variant it will be necessary to remove the old bushes in the fuselage and insert new from the upgrade set. Insert a cable tie around the fuselage mast and through the bushes. Using a suitable punch, carefully drive out the bushes from outside to inside.	
7	Clean and degrease the inside surfaces of the holes and using a suitable tool and bolt, carefully press the 2 new bushes (23901) from the inside into the respective holes left and right of the fuselage mast.	

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## Service Bulletin


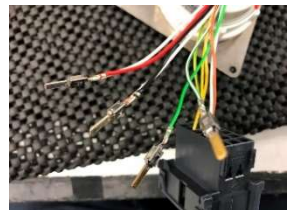

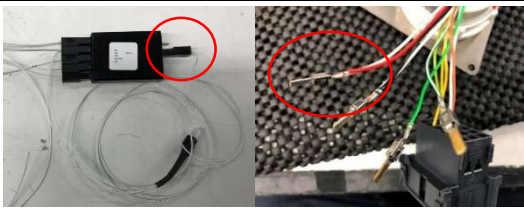

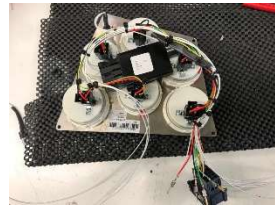
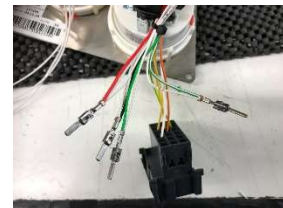
8	Remove the brake/trim cylinder from the original mast and assemble on the new mast using assembly set brake/trim (46078).	 
9	Ensure the spacer is inserted in the lower metal bush and assemble the upper mast II (45983) into the fuselage in accordance with AMM job card 62-51-00 4-1.	 
10	Ensure that the 2 cone washers and thrust washer (with flat section lowermost) are assembled in both forward and rear roll axis of the gimbal with Lagermeister WHS2002 (30477) or equivalent. Assemble the rotor head onto the mast using AMM job cards 62-20-00 8-1, 62-31-00 6-1, 62-32-00 5-1 & 62-51-00 4-1 as reference.	
11	Connect pitch and roll PPCs, brake-trim cylinder and roll trim cylinder using above references, using new nylock nuts. Assemble the pre-rotator upper connecting shaft. Route and connect all pneumatic hoses and electrical harnesses as shown in job card referenced above.  Note: Rotor head III does not have a bearing temperature sensor. The plug can be secured to the harness in a suitable position using cable-ties.	   
12	Assemble the trim spring as shown. It should be assembled so that there is light tension in the spring and rubber when the head is fully to the rear.	
13	Carry out a rotor head angle check for pitch and roll in accordance with AMM job card 62-32-00 6-1. Adjust if required. Carry out full and free movement checks of all pitch & roll flight controls.	<p>Forward: -4° Rear: 20.5° Right: 7.5° Left: 8.75°</p>
<b><i>Pneumatic coupling replacement</i></b>		
14	If the aircraft has a pneumatic coupling II or III fitted (small gearbox) then it requires replacing with pneumatic coupling IV in accordance with AMM job card 63-11-10 4-1. The original mounting cage can be left fitted to the engine. Note: a straight thru-connector connects the pneumatic line to the main harness. There is no longer a requirement for a pressure control valve. The coupling must be replaced in order to achieve the higher pre rotation speeds.	 

**Contact & Info:**

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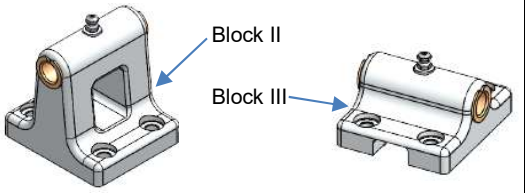
## Service Bulletin

Clutch slip indicator LED installation																																																									
15	Remove the 4 screws securing the left cockpit panel and disconnect the grey 18 pin plug. Remove the panel from the cockpit.																																																								
16	Remove the termination retaining clip from the grey 18 pin plug. Using a suitable de-pinning tool (34136) remove pins 1, 2, 3 and 7 (when present).																																																								
17	Connect the cables from set 46141 to the control unit using cable markings and control unit label as reference.																																																								
18	Crimp a positive lock contact to cable VT/OG from the LED and connect to the control unit. Crimp the RD/BR cable to the red cable of the grey 18 pin plug.																																																								
19	Attach the supplied Velcro to the underside of the control unit.																																																								
20	Affix the control unit to the rear side of the left cockpit panel and route the cables as shown. RD, BK, GN, GN/WH to grey 18 pin plug. LED & WH to the center of the panel along the right side in direction of flight.																																																								
21	Cable pinning positions are shown in the table.	<p>Connection: using harness to cockpit left Plus no. (refine diagram):</p> <table border="1"> <thead> <tr> <th>Pin</th> <th>Color</th> <th>BT</th> <th>Cross section mm² AWG</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>RD</td> <td>13664</td> <td>0,5 #20</td> <td>Cockpit 5V</td> </tr> <tr> <td>2</td> <td>BR</td> <td>13667</td> <td>0,5 #20</td> <td>Sensor GND</td> </tr> <tr> <td>3</td> <td>GN/WH</td> <td>13703</td> <td>0,5 #20</td> <td>Sensor 5V</td> </tr> <tr> <td>4</td> <td>VE/WH</td> <td>125248</td> <td>0,5 #22</td> <td>CHT right rear</td> </tr> <tr> <td>5</td> <td>VE</td> <td>125251</td> <td>0,5 #22</td> <td>CHT temperature</td> </tr> <tr> <td>6</td> <td>VE/WH</td> <td>125249</td> <td>0,5 #22</td> <td>CHT pressure</td> </tr> <tr> <td>7</td> <td>GN</td> <td>133262</td> <td>0,5 #22</td> <td>Engine RPM</td> </tr> <tr> <td>8</td> <td>COOL/VE</td> <td>125249</td> <td>0,5 #22</td> <td>Fuel temp</td> </tr> <tr> <td>9</td> <td>COOL/VE</td> <td>125249</td> <td>0,5 #22</td> <td>CHT left front</td> </tr> <tr> <td>10</td> <td>VE</td> <td>32810</td> <td>0,5 #22</td> <td>Water Temp</td> </tr> </tbody> </table>	Pin	Color	BT	Cross section mm² AWG	Function	1	RD	13664	0,5 #20	Cockpit 5V	2	BR	13667	0,5 #20	Sensor GND	3	GN/WH	13703	0,5 #20	Sensor 5V	4	VE/WH	125248	0,5 #22	CHT right rear	5	VE	125251	0,5 #22	CHT temperature	6	VE/WH	125249	0,5 #22	CHT pressure	7	GN	133262	0,5 #22	Engine RPM	8	COOL/VE	125249	0,5 #22	Fuel temp	9	COOL/VE	125249	0,5 #22	CHT left front	10	VE	32810	0,5 #22	Water Temp
Pin	Color	BT	Cross section mm² AWG	Function																																																					
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9	COOL/VE	125249	0,5 #22	CHT left front																																																					
10	VE	32810	0,5 #22	Water Temp																																																					
22	Using new pins from the set 46141, crimp the respective cables together as stated in the above table and the photo right. Insert the pins into the correct positions in the grey 18 pole plug. Re-fit the retaining clip.																																																								
23	Re-assemble the left panel into its surround in the cockpit. Re-connect the grey 18 pole plug.																																																								

**Service Bulletin**

<p>24</p>	<p>If the center cockpit panel has a free LED position, remove the rubber stopper and assemble the chrome LED socket &amp; mark nut/threads with mechanic paint. Insert the Led into the socket. If no free LED position is available then a 12mm hole will be required to be drilled in the position shown. Apply the “clutch” sticker to the panel below the LED.</p>																
<p>25</p>	<p>Disconnect the purple 21 pin plug behind the cockpit. Using a suitable de-pinning tool, remove the cable from position 14 of the female side.</p>																
<p>26</p>	<p>Remove the pin and crimp the WH cable together with the originally removed cable. Re-insert the pin into position 14 of the socket. Re-connect the socket. Secure the cables suitably behind the cockpit using cable-ties.</p>																
<p>27</p>	<p>Rotor bearing temperature of rotor head III is no longer monitored, therefore the engraving under the cockpit display, and the display itself, should be covered using the cockpit coloured tape supplied in the kit.</p>																
<p><b>Correction of rotor RPM instrument range</b></p>																	
<p>28</p>	<p>Glass cockpit rotor rpm range should be adjusted to reflect the range and limits stated in the POH for rotor head III. Refer to the relevant glass cockpit manufacturers OM.</p>	<p><b>2.5 Rotor Speed Limitations and Instrument Markings</b></p> <table border="1"> <thead> <tr> <th>Rotor Speed</th> <th>Marking</th> <th></th> </tr> </thead> <tbody> <tr> <td>Rotor speed limit</td> <td>Red radial</td> <td>610 RPM</td> </tr> <tr> <td>Rotor speed caution range</td> <td>Yellow arc</td> <td>550 – 610 RPM</td> </tr> <tr> <td>Normal range</td> <td>Green arc</td> <td>200 – 550 RPM</td> </tr> <tr> <td>Maximum pre-rotation speed</td> <td>Yellow radial</td> <td>320RPM</td> </tr> </tbody> </table>	Rotor Speed	Marking		Rotor speed limit	Red radial	610 RPM	Rotor speed caution range	Yellow arc	550 – 610 RPM	Normal range	Green arc	200 – 550 RPM	Maximum pre-rotation speed	Yellow radial	320RPM
Rotor Speed	Marking																
Rotor speed limit	Red radial	610 RPM															
Rotor speed caution range	Yellow arc	550 – 610 RPM															
Normal range	Green arc	200 – 550 RPM															
Maximum pre-rotation speed	Yellow radial	320RPM															
<p>29</p>	<p>Analogue instruments should have the limit markings adjusted or replaced to show a maximum pre-rotation speed of 320rpm. A yellow strip (10564) is supplied in upgrade set 48155. Rotor speed upper limit remains at 610rpm.</p>																

## Service Bulletin

<i>Tail plane angle check</i>		
30	<p>If the keel tube is not to be replaced, carry out a tail plane angle check.</p> <p>Refer to module “<i>Keel Tube I to II Upgrade</i>” serial 29.</p> <p>If it is not possible to attain the correct tail plane angle with the maximum amount of spacers, it is strongly recommended that the keel tube be replaced with the newest version.</p> <p><b>If this is not undertaken it may result in poor flight characteristics of the aircraft.</b></p>	
<i>Functional checks</i>		
31	Carry out a ground run for functional and proof checks of the pre-rotator system and indication.	
<i>Final steps</i>		
32	<p>Replace teeter block II with teeter block III on the rotor system using AMM job card 62-11-00 6-3 as reference.</p>	
33	Re-assemble the rotor system on the aircraft in accordance with AMM job card 62-11-00 4-1.	

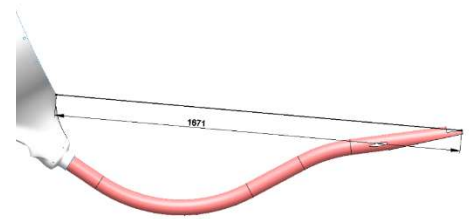
## Service Bulletin

### Keel Tube I to II upgrade

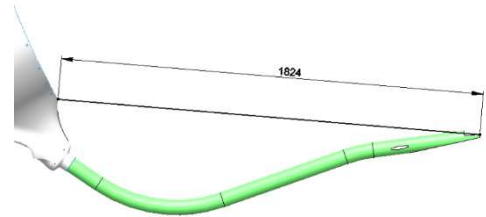
Note: It is strongly recommended that the following upgrade be carried out by a suitably trained AutoGyro Level III Certified Mechanic

#### Removal of rudder and horizontal stabilizer

- 1 If the Cavalon is fitted with keel tube I (short version) it **MUST** be upgraded to keel tube II when upgrading from rotor head II to rotor head III.



Keel tube I – short (1671mm)



Keel tube II – long (1824mm)

- 2 Remove the left and right rudder control cable to rudder bolts  
Note the position of washers and spacer when removing.



- 3 Supporting the rudder, remove the upper bolt, bush and washers.  
Note the position of items for re-fitment.  
Tilt the upper rudder slightly rearwards to clear the attachment bracket of the stabilizer, and slide upwards off of the lower bearing pin.



- 4 Remove the 4 horizontal stabilizer attachment bolts.  
Note positions of spacers and washers.  
Remove the stabilizer from the keel tube.


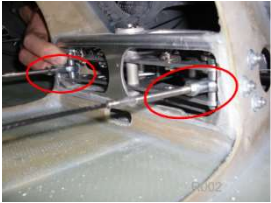
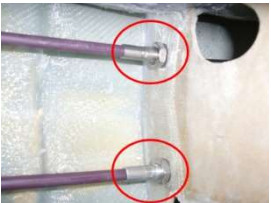


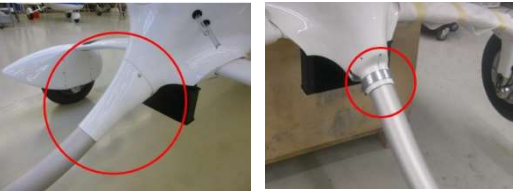



#### Removal of rudder control cables.

- 5 Remove the center console and rear center channel cover in accordance with AMM job card 67-10-00 4-1 to gain access to the rudder control steering yoke and cables.



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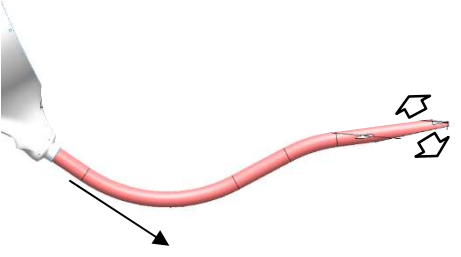


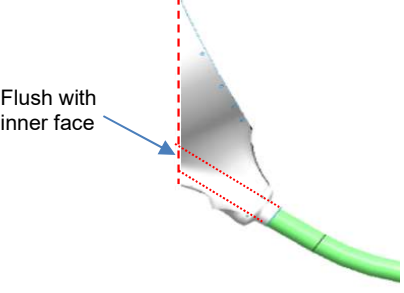



6	Lock the rudder control steering yoke by inserting special tool 'blockage pedal lever' (32837).	
7	Loosen the rudder cable ball-end lock-nuts. Remove the cables from the ball-ends by rotating the cable in its outer housing. Remove the lock-nuts.	
8	Loosen the securing nuts of the rudder cable housing using a slotted 18mm ring spanner (28774). Remove the forward nuts and serrated washers. Draw the cables through the holes in the bulkhead and remove the rear serrated washers and nuts. Remove any cable-ties in the center channel routing and securing the rudder cables.	
9	Remove the safety wire retaining the rudder cable in position at the rear of the keel tube (note routing of wire). Carefully lever the cable end-pressing out of the retaining bracket and draw the cables rearwards through the keel tube.	
<b>Removal of keel tube</b>		
10	Remove the fuel tank drain cover to gain access to the keel tube forward inner cavity.	
11	Remove the keel tube clamp cover and slide rearwards along the keel tube. Loosen the keel tube clamp and slide rearwards along the keel tube.	
12	Remove the upper and lower engine cowlings in accordance with the AMM job card 52-00-00 4-1.	
13	Remove the six securing bolts. Access to the M6 nuts with a 10mm ring spanner can be gained from the cabin side from below between the tanks.	

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14	Using the keel tube end as a lever, rotate the keel tube left and right to break any potential seal of the Paste 20 filler. Pulling rearwards and downwards, remove the keel tube from the fuselage.	
<b>Assembly of new keel tube</b>		
15	Assemble the center and rear skid plates on the replacement keel tube using Loctite 221 on the screws.	
16	Place the keel tube clamp cover, and keel tube clamp onto the new keel tube. Degrease the outside surface of the keel tube using Loctite 7063 at the area where it will insert into the bulkhead and clamp composite areas.	
17	Feed the keel tube through the composite of the clamp. Apply a thin film of locally procured Paste 20 or equivalent (eg. Six10 Thickened Epoxy Adhesive) to the relevant areas of the keel tube at the bulkhead tube and clamp shoulder before inserting into the composite. Gently push the tube into position into the engine bulkhead composite tube. The end of the keel tube should be flush with the forward face of the engine bulkhead. <b>Note: It is important that the next step be carried out IMMEDIATELY, before the epoxy sets.</b>	
18	Place the keel tube clamp in position and tighten lightly to allow some movement in the keel tube. Centralize the keel tube by taking measurements from the lower corner of the cabin door hand recess to rudder pin. Align the keel tube so that the distance between rudder pin and lower corner of the cabin door hand recess is equal on both sides and tighten the clamp to 10Nm. Allow the epoxy to harden overnight (minimum 12 hrs).	
19	Using a 6mm drill and the pre-existing bolt holes in the engine bulkhead composite tube as a template, drill the 6 holes through the keel tube. Secure using the 6 M6x20 bolts and M6 SI nuts (10Nm) ensuring that the ground cable (where fitted) is attached under the head of the forward-most bolt (1).	
20	Position the clamp as shown and tighten to 10Nm. Secure the keel tube clamp cover.	



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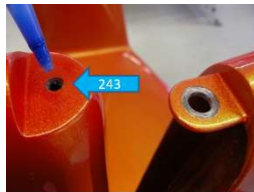



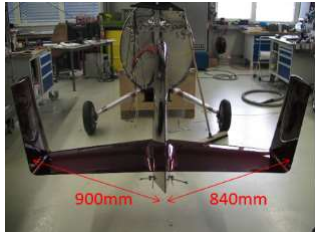

21	<p>Remove the nuts and serrated washers from the rudder pull cables. Feed the cables from the rear through the keel tube forward to the center channel. Secure the cable end housing in place in their respective retainers on the left and right side of the keel tube.</p>	
22	<p>Assemble one of the nuts and serrated washers on each cable end. <b>IMPORTANT: Ensure the cables cross in the body i.e the left cable in the keel tube goes to the right side of the pedal yoke and visa-versa.</b></p>	
23	<p>Assemble the cables in the respective holes in the center channel cross-member. The cable barrel should be central in the frame hole (even number of threads visible either side of the hole). The inner cables pass through the oval holes of the metal center channel frame.</p>	
24	<p>Thread the locknuts 8mm on to the cable ends and screw the cable ends into the ball-ends of the steering yoke until the lock nuts contact the eye-end.</p>	
25	<p>Lock the cables in the keel tube retainers using safety-wire as shown.</p>	
26	<p>Tighten the nuts on the cable ends in the cross-member &amp; mark with safety paint. Tighten the lock-nuts at the yoke attachment (10Nm) &amp; mark with safety paint.</p>	
27	<p>Assemble the tail plane to the keel tube using the same combination of spacers and washers that were previously removed from each mounting point using Loctite blue 243 (10Nm). Ensuring the flooring is horizontal, measure from each trailing edge corner to the ground. The difference should not be greater than 10mm. Add washers to both mountings on the one side to adjust as required.</p>	
28	<p>Check alignment of the tail plane to fuselage. Measure the distance from the lower corner of the cabin door hand recess to the outer forward corner of the tail plane. The distance of the starboard measurement should be 20mm +/-5mm <i>shorter</i> than the port. If this is not the case, loosen the mounting bolts, adjust and re-tighten.</p>	
29	<p>Check the tail plane angle. Place a suitable digital spirit with level mounting plate tool (48006) on the center console and set to zero. Place the spirit level on the leading edge of the vertical fin of the tail plane and measure the angle. The angle should be 82.0° +/- 1.0°.</p>	

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	<p>If this is not the case then a suitable number of U8/20 washers (21853) or 6mm spacer (44257) should be inserted in the relevant position (rear left and right rear, or forward left and right) to achieve this.</p> <p>It may be necessary to use longer M8x40 bolts (20524) to achieve a minimum 8 thread engagement.</p> <p>The maximum number of permissible adjustment is 2 x 6mm spacers and 2 washers.</p> <p>If the correct tail plane angle is still not achievable with the maximum configuration, it is strongly recommended that the keel tube be replaced with the newest keel tube II.1 (45958).</p> <p><b>If this is not undertaken it may result in poor flight characteristics of the aircraft.</b></p>	
30	Once all tail plane adjustments have been completed, ensure the mounting bolts have Loctite blue 243 applied and finally tighten to <b>10Nm only</b> .	
31	Place the original number of nylon spacers over the keel tube pin. Re-assemble the rudder onto the keel tube pin.	
32	Check clearance to the upper mounting bracket. There should be enough clearance to allow the U&/18 washer to be easily slid between the top of the rudder and the mounting bracket. Add/remove nylon spacers on keel tube pin as required to achieve this.	
33	Apply Loctite blue 243 to the thread in the rudder. Assemble the upper rudder attachment. The M6x40 attachment screw should be tightened until there is minimal vertical play. The joint in the bush must be orientated to the front. Lubricate the joint with HHS2000 spray or equivalent. <b>ATTENTION: The screw and bush MUST turn with the rudder.</b>	 
34	Assemble the screw, washer (above the steering plate) spacer, rudder cable ball-end, washer and nut to the rudder, and tighten. Check the tension of each cable (the steering yoke should still be locked in a central position with the pins). Adjust at the ball ends until a tension of 25lbs +/- 5lbs is achieved in each cable.	 
35	Determine position of the rudder with the pedals parallel. Measuring should be carried out from the lower rear tip of the rudder, to the rear edge of the vertical fin of the tail plane, parallel to the ground. Right: 840mm +/- 10mm Left: 900mm +/-10mm Adjust the ball ends until this is achieved, retaining the same tension in the cables.	
36	Remove the yoke centering pins from the yoke.	

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37	Carry out a loose article and tool check in the center channel and re-assemble the center console and rear center channel cover in accordance with AMM job card 67-10-00 4-1. Re-assemble the tank drain cover.	
38	Carry out a full functional test of the rudder control system.	
39	Re-fit the lower and upper engine cowlings in accordance with AMM job card 52-00-00 4-1 if no other modifications are to be carried out.	

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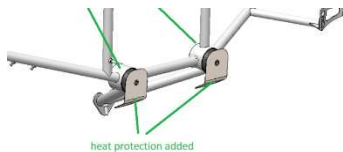



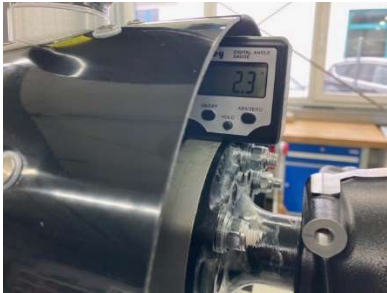
<b>Teeter Tower III to III.1 upgrade</b>		
<b><i>Removal of teeter tower and main crown gear assembly</i></b>		
1	Remove the rotor system in accordance with AMM job card 62-11-00 4-1.	
2	Remove the teeter tower and main crown gear assembly in accordance with AMM job card 62-20-00 8-1.	
3	Remove the 10 countersunk screws from the main crown gear and remove the crown gear from the teeter tower.	
<b><i>Re-assembly of teeter tower and main crown gear</i></b>		
4	Assemble the teeter tower III.1 to the main crown gear using 10 new M6x16 countersunk Torx and Loctite blue 243.	 <span style="border: 1px solid black; padding: 2px;">Teeter Tower III.1</span>
5	Assemble the teeter tower and main crown gear assembly to the rotor head in accordance with AMM job card 62-20-00 8-1.	
6	Re-assemble the rotor system in accordance with AMM job card 62-11-00 4-1. Note: Teeter block III is compatible with both teeter tower III and teeter tower III.1.	

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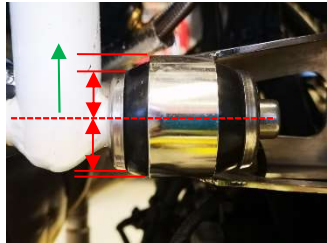
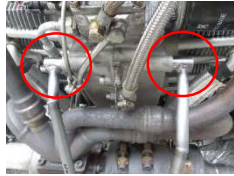
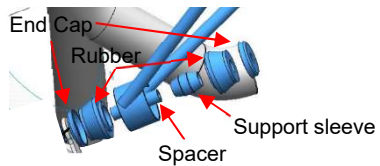



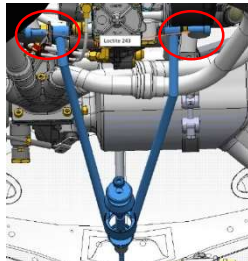
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Engine Mount Set 65 Shore HNBR		
1	Using a suitable sling around the propeller gearbox and crane, raise the rear of the engine so that the engine weight is released from the lower engine mounting bushes.	
2	Note: The engine mounting bushes should be replaced in pairs, either both upper then both lower, or upper and lower left, then upper and lower right.	
3	Remove the relevant mounting bolt and dis-assemble the engine mount rubbers and spacers. Replace the rubbers with the 65 shore HNBR (13813) supplied in the set.	
4	NOTE: The lower engine mounts should be assembled with the heat protection plates (48002) assembled as shown. This may require the next size bolt length fitting from set 48114.	
5	<b>Note: Ensure that the lower left mounting bolt end is not contacting the turbo housing (minimum 2mm clearance).</b> It may be necessary to assemble U10 washers (max 3) under the bolt head to enable this.	
6	<b>FOR THE CAVALON 915iS VARIANT ONLY:</b> The upper left and right engine mount must be assembled with 1 x 9mm spacers (21507) between engine mount and ring mount. Any other existing spacers or washers should be removed prior to re-assembly. It may necessary to use shorter bolts (M10x120).	 <div style="border: 1px solid red; padding: 5px; color: red; width: fit-content; margin-left: 10px;">       Re-assemble with 1 x 9mm spacer only     </div>
7	<b>FOR THE CAVALON 915iS VARIANT ONLY:</b> Check the engine thrust angle. Using 0° at the center console as the reference point, place a suitable digital spirit level on the top of the propeller gearbox spacer or propeller flange face and measure the thrust angle. The angle should be 0° (max 0.5° nose down, 1.0° nose up). If this cannot be achieved then AutoGyro ( <a href="mailto:airworthiness@auto-gyro.com">airworthiness@auto-gyro.com</a> ) should be contacted.	 

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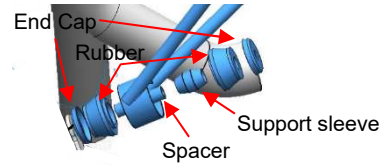


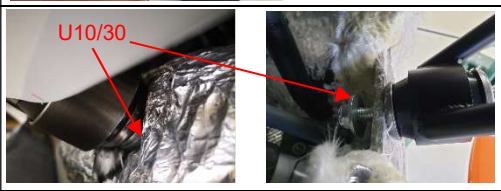

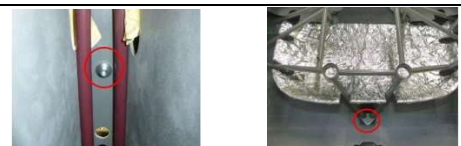
Engine and keel tube support arms - Installation		
<i>Installation of the rear engine support arm</i>		
1	It is assumed that the upper and lower engine cowlings are removed. If not, remove in accordance with AMM job card 52-00-00 4-1.	
2	It is assumed that the sling and crane are still around the propeller gearbox. Decrease the support by lowering the rear of the engine so that approximately 50% of the engine weight is on from the lower engine mounting bushes. The photo shows a loaded mount as an example.	
3	Assemble the rear engine support arm to the sump mounting points. Do not tighten the mounting bolts.	
Rotax 912/914		
4	Remove the right side fire wall.	
5	Assemble the spacer, support sleeve, rubbers and end-washers into the brace and rotate forwards so that the end cap rests on the fuselage.	
6	Mark the position of the forward spacer on the fire protection around its circumference. Move the brace to the rear and cut out any fire protection so that the end-washer sits against the composite of the engine compartment.	
7	Rotate the support arm into position and mark the position of the hole onto the fuselage. There must be a minimum of 15mm material from the center of the hole to the upper edge of the composite. If this is not the case, use U10/30 washers to shim the support arm rearwards to achieve this. Drill a 10.5mm hole in the marked position.	
8	Assemble the support arm to the fuselage with any U10/30 packing washers required as previously noted in step 7 above and tighten. It may be necessary to assemble one or more U10/30 under the nut to compensate for bolt length. NOTE: The bolt is inserted from inside the engine bay to outside.	
9	Remove the support arm upper attachment bolts one at a time, apply Loctite blue 243 and re-assemble then tighten.	

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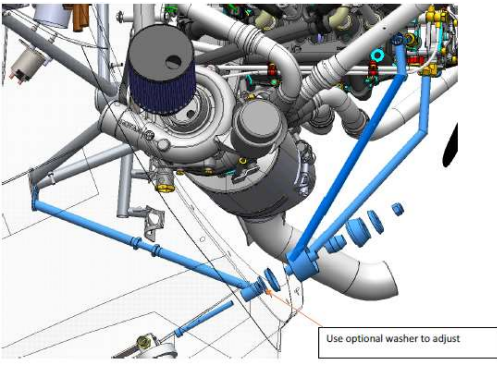
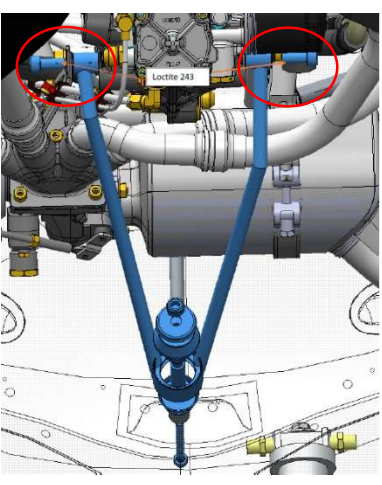
10	Re-assemble the right side fire wall and contour to fit around the engine support arm rubber.	
11	It is strongly recommended that the engine mounting rubbers be replaced as part of this modification. The engine cowlings can therefore be left removed.	
<b>Rotax 915</b>		
12	Assemble the spacer, support sleeve, rubbers and end-washers into the brace and rotate forwards so that the end cap rests on the fuselage.	
13	Mark the position of the forward spacer on the fire protection around its circumference. Move the brace to the rear and cut out any fire protection so that the end-washer sits against the composite of the engine compartment.	
14	Rotate the support arm into position and mark the position of the hole onto the fuselage. There must be a minimum of 15mm material from the center of the hole to the upper edge of the composite. If this is not the case, use U10/30 washers to shim the support arm rearwards to achieve this. Drill a 10.5mm hole in the marked position.	
15	Loosely assemble the support arm to the fuselage with any U10/30 packing washers required as previously noted in the step above.	
16	If the aircraft has the earlier version of the keel tube reinforcement (47487) shown right, it should be removed using steps 18 to 20 as a guide. There should be a M6x35 bolt fitted (step 19), which can be re-used. Once the reinforcement arm is removed, proceed to step 20.	
<b>Installation of the keel tube reinforcement (915iS only)</b>		
17	If the aircraft does not have a keel tube reinforcement fitted, proceed as follows:	
18	Gain access to the lower engine mounting frame bolt by removing the PPC cover and intercom console in the cabin.	
19	Remove the M6x30 bolt and replace with M6x35.	

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20	Position the new adjustable keel tube reinforcement arm (48163) on to the M6x35 bolt and tighten.	
21	<p>Adjust the length of the arm at the center threaded joint so that the lower attachment stub aligns with the assembly hole.</p> <p>The face of the attachment stub must be parallel to the rear face of the fuselage composite.</p> <p>If there is a gap between assembly stub and composite when the faces are parallel, shim with U10/30 washer if required.</p> <p>Insert the bolt through both arm assemblies from inside the engine compartment as shown and secure with the M10 Nyloc nut.</p>	
22	Remove the support arm upper attachment bolts one at a time, apply Loctite blue 243 and re-assemble then tighten.	
23	Re-assemble the intercom console & PPC cover.	
24	<p>It is strongly recommended that the engine mounting rubbers be replaced during this modification.</p> <p>The engine cowlings can therefore be left removed.</p>	



## Service Bulletin

<b>Final procedures</b>	
1	Carry out a loose article and tool check. Carry out a signed duplicate safety inspection of all reconnected control connections by a suitably qualified person
2	Re-assemble any previously removed panels, fairings and cowlings.
3	Carry out rotor balance test flight of the aircraft if either the rotor head II to III upgrade or teeter tower III to III.1 upgrade has been carried out
4	Carry out a full test flight of the aircraft. A test flight protocol (Vorlage04-002cRev4a FTR Cavalon) is available on the web site for AutoGyro mechanics with access to AutoGyro maintenance documentation. Ensure a confirmatory clutch warning LED functional check is carried out during pre-rotation.
5	Ensure a confirmatory clutch warning LED functional check is carried out during pre-rotation. Pre-rotate until the rotor system is rotating consistently, with the engine rpm at approximately 2500rpm. Advance the throttle rapidly and briefly to 4000 engine rpm and ensure the clutch LED illuminates. Return the throttle to 2500 rpm and continue to pre-rotate.
<b><u>Completion of this Service Bulletin must be recorded within the aircraft documentation, in line with the requirements of the country of operation.</u></b>	
<b><u>Material information (Parts required to be made to implement this service bulletin):</u></b>	
Nil	
<b><u>List of components (with purchasable part numbers)</u></b>	
48155 Upgrade pack to reduce vibration RH II 48156 Upgrade Pack Long Tail 48157 Upgrade pack to reduce vibration RH III 48158 Upgrade pack to reduce vibration RH III.1 30487 Loctite 221 Red 30483 Loctite 243 Blue 30477 Lagermeister WHS2002 Grease 45506 Liqui Moly LM47 MoS2 30476 HHS2000	
<b><u>Interchangeability</u></b>	
Not affected	
<b><u>Parts disposition</u></b>	
a) Disposal requirements – Normal waste b) Environmental hazards of parts containing hazardous materials – Nil c) Scrap requirements (e.g. mutilate scrapped items beyond use) – Nil	