BRITISH MICROLIGHT AIRCRAFT ASSOCIATION

TECHNICAL INFORMATION LEAFLET

NO: 108 **ISSUE 3** **FEB 2011**

STANDARD MINOR MODIFICATION – CARBURETTOR HEATERS

1. Introduction

Effective carburettor heating provides a significant safety benefit for aircraft flying in conditions conducive to carburettor icing. Such conditions are all too common in the UK all year round: see the CAA's General Aviation Safety Sense leaflet no. 14, Piston Engine Icing, for more details. Safety Sense leaflets are available on the CAA's website: www.caa.co.uk.

This leaflet only covers the fitment of carburettor heaters that apply heat directly to the carburettor body; it specifically does not cover carburettor heaters that heat the air being supplied to (or supply heated air to) the engine. This latter type can adversely affect engine power, and so must be applied for as a one-off modification using form BMAA/AW/002. In addition, this leaflet only covers an explicit set of carburettor heaters that have previously been approved by the BMAA as one-off modifications: see table 1. Note that this should not be taken as a guarantee of the effectiveness of the listed devices, only that these carburettor heaters, when properly installed, do not adversely affect the safety of the aircraft.

CH code	manufacturer	description	type	comments	nominal weight [g]
CH1.1	Skydrive	2 stroke single carb	coolant		180
CH1.2	Skydrive	2 stroke twin carb	coolant	532 & 582/90	290
CH1.3	Skydrive	2 stroke twin carb	coolant	582/99 & 618	350
CH1.4	Skydrive	912 mk2 & mk3	coolant		650
CH2.1	ST Aviation Services	IceEliminator™	electrical		70+

Table 1 – current list of kits approved for use with this leaflet

This leaflet can be used to fit carburettor heaters that are electrically powered or plumbed into the engine's cooling system. This leaflet can be used to fit carburettor heaters to both flexwing and 3-axis microlight aircraft.

2. Electrical Carburettor Heaters

2.1 Applicability

The current version of this TIL is only applicable to carburettor heat systems that are supplied by the aircraft's DC electrical system. Some electric carburettor heater types are only intended to be supplied by the aircraft's AC electrical system. Currently this TIL does not cover fitment of such types.

2.2 Power Supply

Before installing an electrical carburettor heat system, the aircraft's electrical system must be analysed to ensure that it can cope with the additional load of the proposed carburettor heat system. The maximum continuous current draw on the system (without carburettor heat) must be calculated or measured. The sum of the maximum continuous current draw on the system and the maximum current rating of the carburettor heat system must not exceed 60% of the maximum current available from the aircraft's generator.

When calculating the current draw on the system, in the absence of any other source of information, the typical maximum current values in table 2 may be used for common load types. Maximum electrical power outputs of common engine types are listed in table 3.

Note: Fuji-Robin documentation does not quote the maximum current, but maximum current at 5500 RPM. For these engines the maximum current ratings of the auxiliary power sockets must not exceed 75% of the 5500 RPM value.

2.3 Installation

The carburettor heater(s) must be installed according to the manufacturer's instructions using the hardware provided (or recommended by the manufacturer).

2.4 Switches

The carburettor heater(s) must be able to be easily switched off in flight by the pilot in case of fire or other electrical problem. It is not acceptable to use the aircraft's master switch alone to meet this requirement. This is because prolonged use of carburettor heat with the engine off is not advised due to a potential fire risk.

Each switch's current rating must be at least 4 times the maximum continuous current of the carburettor heater. Switches must be clearly placarded as to their sense (on/off) and function (for example 'carb heat'), and must be orientated down for off. In the case of a multi-element carburettor heat system where the aircraft operator wishes to switch the elements independently, this may be achieved using either multiple switches or a single multi-throw switch. In this latter case the switch must still be orientated down for fully off.

2.5 Cabling

Cables must be adequately rated for the maximum current of the carburettor heat system; multi-strand cable must be used; solid-core cable is unacceptable. Cables must be securely attached to the airframe at intervals of 150 mm (6 inches) or less. Cables that bridge between the airframe and engine must be long enough, and flexible enough, to allow for relative movement between the two.

2.6 Circuit Protection

The carburettor heat circuit must be protected by a fuse or circuit breaker of rating specified by the manufacturer.

2.7 Post-Installation Testing

Correct installation must be confirmed by checking that the carburettor and/or carburettor heater becomes warm to the touch after it is turned on. Also, unless there is an ammeter connected in series with the element(s) to show current being drawn, a positive check of the operation of the heater (for example by touch) must be performed before each flight.

load type	maximum current [A]
digital engine instruments	1.0
GPS	0.5
transceiver (max 5W transmit)	1.0
transponder	2.5

Table 2 – typical maximum current values for common load types

engine	maximum power [W]	maximum current [A]
Fuji-Robin* EC34PM/EC44PM	75	6
Hirth 2706	250	21
HKS 700E	210	17
Jabiru 2200	120	10
Rotax 2-stroke (447 and larger)	170	14
Rotax 912/914	250	21
Verner 133M	160	13

Table 3 – maximum electrical power outputs of engines in common use
*Fuji-Robin engines @5500 RPM

3. Coolant Carburettor Heaters

3.1 Installation

The carburettor heater(s) must be installed according to the manufacturer's instructions using the hardware provided (or recommended by the manufacturer).

3.2 Plumbing

All additional plumbing must be routed ensuring that:

- Hoses are long enough, and flexible enough, to allow for the vibration and relative movement of their attachment points. In particular, carburettors are generally not rigidly attached to the inlet manifold, and significant movement of the carburettor relative to the rest of the engine must be allowed for;
- Hoses are short enough and/or supported adequately to avoid excessive movement of the hose when subjected to vibration and flight loads. Also note that long supply hoses will reduce the effectiveness of the carburettor heat system;
- Hoses cannot rub against each other or other parts of the engine/airframe. Adjacent hoses can either be secured to each other using a cable tie to eliminate relative movement, or, each hose can be protected by attaching a cable tie (so that the cable ties touch each other, not the hoses).

3.3 Post-Installation Testing

Correct installation must be confirmed by checking that the carburettor and/or carburettor heater is warm to the touch after the aircraft has first been ground run up to a normal operating temperature. Following this test the installation must be checked to ensure that there are no leaks and nothing has loosened or moved.

4. Common Installation Notes

4.1 Engine Package Size

The installation of a carburettor heat system will, in general, increase the size of the engine package. This is due to the size of the carburettor heater itself, additional wiring or plumbing, and, in the case of some carburettor heater kits, a change in the position of the carburettors relative to the engine. It is important that this dimensional change does not unacceptably reduce the clearance between the engine and any other part of the airframe: the installation should not reduce any clearance between the engine and any other part of the airframe, including cowlings, below 25 mm.

4.2 Weight and Balance

The last weight and balance report must be checked to ensure that the additional weight of the installation will not put the aircraft overweight: the empty weight of the aircraft must not exceed the maximum zero fuel weight (Max ZFW) give in section 5i of the TADS / HADS.

For 3-axis control aircraft the inspector must calculate, from the known weight and position of the carburettor heat system parts, the empty CG change. This must not, in any condition, make the aircraft go outside the permitted CG limits. If a weight and CG report is not held for the

aircraft, one must be prepared, or the BMAA contacted for the file copy. An amended weight and balance entry must be made in the aircraft logbook.

5. What to do once you have fitted your carburettor heater(s)

In conjunction with your inspector, fill in the form on pages 6 and 7 of this TIL, and return it to the BMAA. The BMAA will return this form to you, with the full modification approval number shown at the bottom of the page. This mod number must then be entered in the aircraft logbook.

It is acceptable to send in the form with your permit renewal form.

Aircraft must be wholly owned by BMAA members. A BMAA Ownership Trustee Grid should be submitted with this form for syndicate, group and company owned aircraft.

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STANDARD MINOR MODIFICATION – CARBURETTOR HEATERS

BMAA – STANDARD MINOR MODIFICATION CHECKLIST: TIL 108

Reg: G-_ _ _ _	Aircraft type:	Serial No:
Owners name:		Owners BMAA No:
[1] *BMAA Aircraft Ownership Trustee Grid required for syndicate/group/company owned aircraft*		
Carburettor Heater CH Code: (see table 1):	Installation weight: g	

Installation Details – Electrical Carburettor Heaters

Max Continuous Current Draw (prior to installation)	A
Calculated or Measured?	
Max Continuous Current Draw (post installation)	A
Aircraft Generator Max Current (Fuji-Robin: 5500 rpm value)	A

Safety Checks – Electrical Carburettor Heaters

CHECK	ACTION	COMMENTS	INSPECTOR'S INITIALS
1 Power Availability			
1.1	Max current draw not > 60% max current from aircraft generator (Fuji-Robin: not > 75% of 5500 rpm value)		
2 Installation			
2.1	Installation carried out to manufacturer's instructions		
2.2	Carb' heat can easily be turned off by pilot in flight		
2.3	All cables and other components rated > max continuous current		
2.4	Carb' heat circuit(s) fused - fuse rating placarded and correct fuse installed		
2.5	Multi-strand cable used - adequate cable flexibility		
2.6	Cables and other components properly secured		
3 Switches			
3.1	Switch(es) easily accessible by pilot in flight		
3.2	Switch(es) rated > 4 times max continuous current		
3.3	Function of switch(es) clearly placarded		
3.4	Switch(es) down for off and placarded as such		
3.5	Holes only in instrument panel - panel not load bearing		
4 Post-installation testing			
4.1	Carb' heater(s) warm to the touch		

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Safety Checks – Coolant Carburettor Heaters

CHECK	ACTION	COMMENTS	INSPECTOR'S INITIALS
5 Installation			
5.1	Installation carried out to manufacturer's instructions		
5.2	Hoses long enough – sufficient flexibility		
5.3	Hoses properly secured		
5.4	Hoses protected against rubbing		
6 Post-installation testing			
6.1	Carb' heater(s) warm to the touch (after ground run to normal operating temperature)		
6.2	Installation secure – no leaks		

Common Safety Checks

7 Engine package			
7.1	Adequate clearance between engine and airframe - no clearance reduced below 25 mm		
8 Weight & CG			
8.1	Additional weight will not put aircraft over-weight		
8.2	With additional weight aircraft cannot go outside CG limits (3-axis control only)		
8.3	Amended weight and balance entry in aircraft logbook		

OWNER'S DECLARATION		
I declare that the foregoing information is correct to the best of my knowledge and I will not change the installation design once approved.		
Signed:	Name.	Date:

INSPECTOR'S DECLARATION		
I declare that the foregoing information is correct and the installation is fit to be flown.		
Signed:	BMAA Inspector #: BMAA Member #:	Date:

This form must be sent with payment as per BMAA Online Shop (www.bmaa.org), and BMAA Aircraft Ownership Trustee Grid (if applicable) to*:- technical.office@bmaa.org

BMAA Office Approval: **(signed)** **(Name)**

Mod No.: G-_ _ _ _ / TIL108 / 20 _ _ /_ _ _ _ _ **(Date)**

**Whilst waiting for this form to be returned by the BMAA the aircraft may be flown for upto one calendar month from the Inspection date above. Once this form is returned to you signed please enter the full modification approval number above in your aircraft logbook and retain this sheet with your aircraft records.*