

## SAFETY REGULATION GROUP

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Our ref 9/33/7225/A24050  
8 June 1994

FOR THE ATTENTION OF MR G BLACK

Aero Vintage Ltd  
New House  
Northiam  
Near Rye  
East Sussex  
TN31 6JL

Dear Sirs

**HAWKER DEMON G-BTVE**

I apologise for the delay in response to your letter dated 26 April 1994, and subsequent fax.

With reference to your application for the substitution of 301S21 for S88C in the production spars for the above aircraft. We are prepared to accept this material substitution in this application subject to the following conditions:

1. The steel manufacturer provides a Certificate of Conformity.
2. The steel is to be ordered, manufactured, tested and certified to the requirements of BS 1449 part 2. Any existing stocks supplied to BS 5770 shall be further tested to the full requirements of BS 1449 part 2.
3. After cold rolling to improve the mechanical properties of the strip, tensile tests should be undertaken on each batch of material (batch defined as every complete single production roll of strip used).
4. The tensile property criteria for acceptance of the cold rolled material should be as follows and the 0.2% proof stress should be quoted:
  - i) Ultimate tensile stress 1100 to 1300 MPa
  - ii) 0.1% proof minimum 620 MPa
  - iii) Elongation at failure min 15% (20 to 25 % expected)
5. Test certificates given by the steel stockists/processors should clearly define the material supplied and the material standard to which it has been tested.

I hope the above has been helpful to you.

Yours faithfully

A handwritten signature in black ink, appearing to read 'AC Love', written over the typed name.

AC Love  
Design Surveyor  
Aircraft Projects Department



AIRWORTHINESS APPROVAL NOTE NO: 24050

APPLICANT: HM Davies  
AIRCRAFT TYPE: Hawker Demon  
REGISTRATION NO: G-BTVE CONSTRUCTOR'S NO: K 8203  
OPERATOR: -  
INSTALLER: Aero Vintage Ltd  
DESIGN ORGANISATION: -  
CERTIFICATE CATEGORY: Permit to Fly  
MODIFICATION NO: -  
MODIFICATION TITLE: To Approve Hawker Demon Registered G-BTVE for the Issue of a Permit to Fly

1. Introduction

This aircraft was built as one of a batch of 37 by Boulton Paul Aircraft Ltd at Wolverhampton in 1937. Various historical records show that it had seen service with the RAF but no records for this particular aircraft are available and its in-service time is unknown. The aircraft was eventually purchased by Guy Black.

Skysport Engineering Ltd have performed extensive restoration work on the aircraft. The restoration is based on the main fuselage of a Demon. It will display military markings and appropriate permission from the MoD has been obtained for this.

The purpose of this AAN is to approve this aeroplane for the issue of a Permit to Fly.

2. Description

The Hawker Demon is a two seat biplane designed as a fighter and powered by a Rolls-Royce Kestrel 12 cylinder Vee water cooled engine driving a Watts 2 bladed wooden propeller. Further descriptive information may be found in the publications referred below.

3. Approval Basis

The basis of original service acceptance of this type is not known. The aircraft is of simple conventional design and as a complete set of maintenance/overhaul manuals was available for the aircraft and engine, the aircraft will be accepted for a Permit to Fly on its own merits as a *Simple Type*. Compliance with appropriate Airworthiness Notices will be required and any new work will be assessed against the requirements of BCAR Section K.

**APPLICANT  
CERTIFICATION AND APPROVALS DEPARTMENT**

AD166/2  
300304



INVESTOR IN PEOPLE

#### 4. Compliance With Requirements - Technical Investigation

The design standard of the Demon aircraft is defined in AP 1461 Vol 1. The design of the main aircraft components is as follows:

<b>Drawing Number</b>	<b>Description</b>
D39160	Fuselage
D41604 & D 41449	fuselage fairing & under fairing
B 38487	Top Main plane
A 38607	Centre Section
C 18554-5	Aileron
C 17540	Tail plane
C17575	Fin
C17451	Elevator
C 26691	Rudder
D 30249	Undercarriage

Technical investigation comprised a review of existing documentation and a brief evaluation aimed at identifying hazardous features (BCAR Section A3-7 para 3.1 d).

#### 4.1 Modification State

##### 4.1.1 Manufacturers Modifications

Not all the original Demon information was available, so Skysport have cross referenced with Hawker Hind information relating to modification required for airworthiness, and their letter dated 3 October 2006 confirms manufacturers modifications embodied as follows:

<b>Mod. No.</b>	<b>Description</b>
Demon/294	Engine. Kestrel II S replaced with Kestrel V DR
Demon/437	Oil Cooler. 7 element Potts cooler replaced with 9 element Potts cooler.
Demon/456	Folded plate flying wire shackles replaced with solid shackles.
Demon/464	Fuel pressure gauge added to system.
Demon/471	Bearings, oil impregnated added in place of ball or roller bearings in rudder and elevator hinges.
Demon/473	Main fuel tank. Add stiffening channel for support bracket at joint C (rear mounting)
Demon/494	Add P6 compass and re-route ASI tubing.
Demon/496	Add fuel drain pipes to air intake pipes.
Demon/499	Add stiffener channel to front of pilot's seat
Demon/512	Add stop plate to throttle quadrant
Demon/515	Add stop for rudder bar adjuster screw
Demon/524	Add stabilisers to centre section incidence wires
Demon/544	Add fuel trap to boost gauge pipe line.
Demon/571	Add rubbing strip to cross strut "NN" for tailplane adjusting gear cables
Demon/577	Add radiator indicator cable guard
Demon/578	Add strengthened locking quadrant for pilot's seat
Demon/604	Engine mount. Port and starboard 'rear foot' to joint 'Y' struts, gauge increased from 20 SWG to 17 SWG.

##### 4.1.2 Applicants Modifications

The applicant has carried out the following:

- i) Firewall - asbestos and stainless steel sheet has been applied to the original firewall located between the cockpit and the engine.
- ii) Wing spar and boom replacement material
- iii) tailplane spar and boom replacement material
- iv) T50 tube replaced with premium selected T45 tube
- v) Stainless steel DTD 166 plate superseded by S524 plate
- vi) Interplane strut ends replaced with later type (Hind & Australian Demon)
- vii) Bottom of tailplane struts replaced with machined fitting

(Cond't)

- viii) Seat harness – Made to original standard but with nylon webbing, both pilot and passenger are four point harnesses.
- ix) Engine pre-oiler piping from a connection on the left hand engine bearer to rear of each cam.

#### 4.2 Structural Rebuild

Details of the work that has been done during the restoration is outlined below.

##### 4.2.1 Fuselage

The drawing for the fuselage could not be located and a Hind fuselage drawing reference D59048 has been used instead. As the fuselage of the Demon is very similar to the Hind, with the exception of the crosstube at the turret, this is acceptable. Build standard has omitted the Fraser-Nash turret and gun shield which were a retro-fit after original manufacture – the standard fit Scarfe ring has been fitted.

##### 4.2.2 Mainplane

The original material required for manufacture of the wing spars, high tensile carbon steel S88C, is no longer available. The alternative material DTD 54A was used for naval versions. This is also no longer available so 301S21 was used. This is acceptable to the CAA based on following conditions.

Finger/fish plates connecting bracing struts in mainplane and fuselage were originally manufacturing from DTD 166 S54 was used as an alternative and accepted by CAA, skysport letter dated 03 October 2006 refers.

This is accepted subject to the following conditions:

- i. A Certificate of Conformity is provided by the manufacturer.
- ii. The steel is manufactured, tested and certified to the requirements of BS 1449 Part 2.
- iii. After cold rolling to improve the mechanical properties of the strip, tensile tests must be performed on each batch of the material.
- iv. Test Certificates given by the steel stockists/processors should clearly define the material supplied and the material standard to which it has been tested.

##### 4.2.3 Empennage

Replacement material for the spar booms have been employed similar to those of the wing spars. Otherwise original components have been employed.

##### 4.2.4 Undercarriage

This has been scratch built to original drawings and pattern, with items originally forged from S6 or S11 replaced with machined items of S1 or S154, S93 and S97. Source bar stock affects material strength, but appropriate sizes were used, but this has been accomplished to a standard satisfactory to the CAA.

#### 4.2.5 Powerplant

The engine kestrel V has a single stage, single speed, mechanically driven supercharger, with twin carburettors. Overhaul by Vintech at Gransden completed on 6 September 2008. Time since original overhaul was 294:30 and time between overhauls is 400 hours. Vintech's log book certificate No 969 shows the engine modifications embodied.

Starting - hand cranked.

Water Cooling - liquid cooled radiator, which is counterbalanced for lowering into the airstream.

Oil Cooling - The original 7 element oil cooler has been replaced with a 9 element oil cooler of similar design mounted below engine nacelle, fixed in original position in the airflow.

Engine limitations are specified under Section 9 below. Information specific to the Demon is not available so in many cases information applicable to the Hind (which is also powered by a Kestrel V) has been employed.

#### 4.2.6 Propeller

The Watts B411 2 bladed wooden propeller (pitch 11.47 ft diameter 10.83 ft) has been made by Clark Industries of Ontario, Canada to drawing Z 2071/4. Certificate of conformity is available.

#### 4.2.7 Systems

Fuel is carried in two tanks, a 18 gal gravity tank in the top wing and a 58 gal main tank (as defined in Drawing 56214). A supply cock enables selection of either tank. Fuel supply is via an engine driven pump only.

The guns were originally (hydraulic pulse) constantesco operated but no hydraulic, pneumatic or oxygen systems are fitted, and the guns which are located in either side of the cockpit have been disabled.

Four point harnesses were made for the pilot and the passenger, both as original except that they employ modern nylon webbing in lieu of the original.

There is no functioning electrical system and no radio is fitted.

#### 4.2.8 Equipment

During the Major overhaul from 1992 to 2009 all aircraft instruments were removed and overhauled. A fuel flow indication system has been introduced.

### 5 Weight and Balance

No weight or cg limitations were available specific to the Demon, so on the basis of its high degree of similarity, Hind limitations have been employed in lieu. A new weight and balance schedule has been compiled from weighing report reference 09 MY4835 dated 08 May 2009. The weight was determined to be 3424lb and the centre of gravity was at -10.84 ins. The datum being the leading edge of the lower wing at the root.

Balance weights to be installed on external ballast bar (up to X6, 17lb weights) as established by weight and balance schedule, allowing for single occupant/pilot operation to bring aircraft into C of G range.

6. Flight Test

The aircraft has been flown by the CAA or otherwise approved test pilot to FTS 233 and in order to assess handling aspects. FTR based on CAA FTR233 was flown by S Goldspink dated 24 July 2009 and confirms that the aircraft is acceptable for the issue of a Permit to Fly although as no spin testing was carried out the aircraft is not ready for aerobatic clearance. The applicant may pursue this later under an Addendum to this AAN.

7. Manuals

Skysport Engineering Ltd have provided "Pilot's Notes for: Hawker Demon- G-BTVE (K8203)" as pilot's notes together with "BRIEF & INITIAL COCKPIT SETTINGS". These documents are to be employed.

8. Noise

Noise certification is not currently required for an aircraft operating on a Permit to Fly.

9. Limitations/Concessions

Maximum number of occupants authorised to be carried 2. Minimum Flight Crew. The following limitations have been established for this aircraft and are included in the Permit to Fly. Those marked with an asterisk(\*) must be highlighted in the cockpit by placards or appropriate instrument markings.

- |      |   |                   |
|------|---|-------------------|
| (1)  | Maximum weight authorised   | 4464 lb (2025 kg) |
| (2)  | C of G limits 6" in to 1 in Forward of Datum (lower wing root at fuselage side)   |                   |
| (3)  | <b>Airspeed Limitations</b>   |                   |
| *    | Maximum indicated Airspeed VNE  | 240 mph IAS       |
|      | [nb Permit to Test is to show Vne as 266 mph IAS, which will then become Vdf following flight test with Vne then planned to be 240mph.] |                   |
| (4)  | <b>Engine Limitations</b>   |                   |
| *    | Maximum Engine RPM (5 minutes Max)  | 2900 rpm          |
| *    | Normal Operating Engine RPM   | 2500 rpm          |
|      | Minimum height for full throttle  | 11000 ft          |
| *    | Boost:  |                   |
|      | Maximum for take-off  | + 6 psi           |
|      | Max for level / climbing flight   | +1.5 psi          |
| *    | Oil pressure  |                   |
|      | Normal  | 65-75 psi         |
|      | Minimum in flight   | 40 psi            |
| *    | Oil Temperature   |                   |
|      | Minimum for Take-off  | 15°C              |
|      | Maximum   | 80°C              |
|      | Inlet maximum   | 80°C              |
|      | Outlet maximum  | 115°C             |
| *    | Water temperature   |                   |
|      | Minimum for take-off  | 65°C              |
|      | Maximum   | 94°C              |
|      | Fuel Pressure   |                   |
|      | Minimum   | 2 psi             |
|      | Maximum   | 4 psi             |
| (5)  | <b>Aerobatic Limitations</b>  |                   |
|      | Aerobatics are prohibited.  |                   |
| *(6) | Intentional spinning is prohibited.   |                   |
| *(7) | Smoking prohibited.   |                   |

10. Approval Statement

This aircraft is approved for the issue of a Permit to Fly provided that it is operated in accordance with the Manuals referred in section 7 above together with the limitations referred in section 9 above, and that it is maintained in a satisfactory and airworthy condition in accordance with Demon Maintenance Schedule MS/02335/P or any other schedule approved by the CAA.

11. Inspection Statement

This aircraft has been inspected and found to conform to the requirements of this AAN, and to be in a satisfactory and airworthy condition.

12.0 Maintenance

The aircraft has undergone an Annual Inspection in accordance with Military Schedule. All life limited inspections have been checked for compliance and found satisfactory. The applicant has sufficient technical information and manuals for the continued maintenance of this aircraft.

A.C. Love



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For the Civil Aviation Authority

Date 29 July 2009

**APPROVAL BY EASA NOT REQUIRED – EC Regulation 216/2008 Annex II**