LAA TYPE ACCEPTANCE DATA SHEET
TADS 048
DRUINE D.31 & D.31A TURBULENT

Issue 1	Initial issue	Dated 08/04/07	FD
Revision A	New format update, addition of Safety Spot article, minor editorial changes.	Dated 29/05/20	MR
Revision B	Addition of operating notes in section 3.5	Dated 04/02/21	JV

This TADS is intended as a summary of available information about the type and should be used during the build, operation and permit revalidation phases to help owners and inspectors. Although it is hoped that this document is as complete as possible, other sources may contain more up to date information, e.g. the manufacturer's website.

Section 1 contains general information about the type.
Section 2 contains information about the type that is **MANDATORY** and must be complied with.
Section 3 contains advisory information that owners and inspectors should review to help them maintain and operate the aircraft in an airworthy and safe condition. If due consideration and circumstances suggest that compliance with the requirements in this section can safely be deferred, is not required or not applicable, then this is a permitted judgement call. This section also provides a useful repository for advisory information gathered through defect reports and experience.

Section 1 - Introduction

1.1 UK contact

Light Aircraft Association, Turweston Aerodrome, Turweston, Nr Brackley, Northants, NN13 5YD

Tel: 01280 846786
Email: engineering@laa.uk.com
Website: http://www.lightaircraftassociation.co.uk/

1.2 Description

The Druine D.31 Turbulent is a small, single seat, low wing aircraft of traditional all-wood construction. The fuselage is a built-up wooden truss covered in birch ply. The one-piece wing is constructed using built-up ribs and a wood/plywood box spar. The wing features wing tip slats. The whole aircraft is fabric covered.

Engine types cleared by LAA for the Turbulent are Ardem or Peacock type VW conversions of up to 1700cc, also a 60 BHP Jabiru 1600 engine is cleared on a single example.

The Druine Turbulent is operated as a SEP ('Group A') aircraft within the UK.

Note that the only propeller(s) approved for an individual aircraft are those listed on the individual aircraft's Operating Limitations document or in the PTL/1 (Propeller Type List) for the type.

Section 2 – Mandatory information for owners, operators and inspectors

At all times, responsibility for the maintenance and airworthiness of an aircraft rests with the owner. A Condition of a Permit to Fly requires that: *"the aircraft shall be maintained in an airworthy condition".*

2.1 Fast Build Kit 51% Compliance

Not applicable – plans built aircraft.

2.2 Build Manual

Turbulent drawings formerly supplied by Rollasons are now available from the LAA. Turbulent drawings are also available from Mme Druine in France but these do not incorporate UK required modifications: Mme Druine, 10, Avenue Aristide, Briand 94100, Saint-Maur, France.

2.3 Build Inspections

Build inspection schedule 1 (Wooden Aircraft).
Inspector approval codes A-A or A-W. Inspector signing off final inspection also requires 'first flight' endorsement.

2.4 Flight Manual

The Rollasons Turbulent Operator's Manual includes pilot's notes for the type.

2.5 Mandatory Permit Directives

None applicable specifically to this aircraft type.

Also check the LAA website for MPDs that are non-type specific (TL2.22).

2.6 LAA Required Modifications (including LAA issued AILs, SBs, etc)

The following are modifications introduced by Rollasons during the 1960s and 70s and incorporated into later issues of the drawings. They are considered mandatory by the LAA.

RAE/45	Modified Aileron Hinges
RAE/51	Windscreen Crash Arch
RAE/67	Safety Straps on Tail plane Bolts
RAE/68	Shoulder Harness Attachment Reenrolments
RAE/88	Attachment of Bulkhead- Engines over 1300cc
RAE/95	Undercarriage Attachment Reinforcements
RAE/96	Wing Inspection Panels

2.7 Additional engine operating limitations to be placarded or shown by instrument markings

Notes:
- Refer to the engine manufacturer's latest documentation for the definitive parameter values and recommended instruments.
- Where an instrument is not fitted, the limit need not be displayed.

With VW: Max CHT: 225°C
Max EGT: 800°C
Max oil temp: 90°C
Min oil pressure: 2.5 kg/cm² @3000 RPM

2.8 Control surface deflections

Ailerons	Up: 4 ½ inches. Neutral should be 1/8 inch down @ root Down: 4 ½ inches. Neutral should be 1/8 inch down @ root
Elevators	Up: 4 7/8 inches ±1/4 inches @ root Down: 4 7/8 inches ±1/4 inches @ root
Rudder	Left: 9.5 inch @ widest chord Right: 9.5 inch @ widest chord

2.9 Operating Limitations and Placards

(Note that the wording on an individual aircraft's Operating Limitations document takes precedence, if different.)

1. Maximum number of occupants authorised to be carried: One

2. The aircraft must be operated in compliance with the following operating limitations, which shall be displayed in the cockpit by means of placards or instrument markings:

2.1 Aerobatic Limitations
Aerobatic manoeuvres are prohibited.
Intentional spinning is prohibited.

2.2 Loading Limitations
Maximum Total Weight Authorised: 620 lbs (700 lbs with D.31A type spar)
CG Range D.31: 12.2 inches to 16.0 inches aft of datum.
CG Range D.31A: 9.0 inches to 16.4 inches aft of datum.
Datum Point is: Leading edge of wing.

2.3 Engine Limitations
Maximum Engine RPM: 3300

2.4 Airspeed Limitations
Maximum Indicated Airspeed D.31 (V_{NE}): 109 kts
Maximum Indicated Airspeed D.31A (V_{NE}): 115 kts

2.5 Other Limitations
The aircraft shall be flown by day and under Visual Flight Rules only.

Smoking in the aircraft is prohibited.

Additional Placards:

"Occupant Warning - This Aircraft has not been Certificated to an International Requirement"

A fireproof identification plate must be fitted to fuselage, engraved or stamped with aircraft's registration letters.

2.10 Maximum permitted empty weight

Fuel tank contents may vary slightly between examples so it is not possible to define a universal maximum empty weight. With full fuel tank, normally the aircraft should be able to carry a pilot weighing 170 lbs without exceeding max permitted gross weight. However, many of the older examples cannot meet this requirement, and historically it has been accepted provided a 170 lbs pilot can carry enough fuel for one hour of flight at cruise power setting without exceeding max gross weight.

Longitudinal levelling datum: Upper fuselage longerons at cockpit.

Section 3 – Advice to owners, operators and inspectors

3.1 Maintenance Manual

The Rollasons Turbulent Operator's Manual includes a special maintenance schedule for the Turbulent. This is available from the LAA (£25.00 Including p&p). LAMS should also be used as a guide to required inspections and this is reflected in the check list in Section 1 of the LAA's Permit renewal application form. Maintenance is typical of wooden/fabric airframes including compliance with CAA CAP 562, leaflet 51-20. Engine maintenance is as appropriate to engine type.

3.2 Standard Options

- The D.31 drawings also show a reinforced wing mainspar intended for a proposed certified Turbulent designated D.31A. Use of the reinforced spar also involves relocation of matching fuselage frame and modification of wing ribs to fit. Use of the reinforced spar permits an increase in max gross weight from 620 lbs to 700 lbs, subject to satisfactory climb performance.
- The drawings also show optional sliding cockpit canopy and wheel spats which are acceptable provided weight allows.
- Most examples are fitted with a fixed tailskid but the castering tailwheel shown as an option on the drawings may also be fitted provided mainwheel brakes are installed.
- Uprated main undercarriage shock-absorber springs are a common modification, details from LAA. These provide more protection of the wingspar from shockload damage in heavy landings.

3.3 Manufacturer's Information (including Service Bulletins, Service Letters, etc)

None known.

3.4 Special Inspection Points

- Drawings have not been updated for many years and may contain dimensional errors. Check dimensions/fit of parts carefully prior to cutting or drilling.
- The Turbulent drawings do not include engine conversion details, see Peacock VW conversion drawings for details.
- Note the Turbulent was designed as a very simple lightweight aircraft. Due to the fitting of additional 'options', e.g. bigger capacity VW engines, wheel spats, canopy, radio etc over the years, the type has a reputation for turning out overweight. This means that many Turbulents cannot be flown within permitted max gross weight except by very light pilots with minimal fuel. Owners MUST avoid the temptation to add extra weight to the Turbulent if they want a satisfactory payload.
- Take care to minimise operating friction in flying controls by careful attention to hinges, cable tensions, lubrication etc. The Turbulent has very light controls and undue friction in the control system will spoil control feel.
- A well-known serious defect with Turbulent aircraft is cracking/compression shake in wing mainspars at undercarriage attachment points or fuselage sides, caused by heavy landing. Any damage in this area is likely to seriously reduce the strength of the wing and the aircraft must be grounded pending major repair.
- Cases have also been reported of the engine mounting studs cracking in the threaded portion which screws in the crankcase.
- 'Wheelbarrow wheels' if fitted to be checked carefully for signs of overstress/failure of hub.
- With VW engine, design of conversion to be agreed with LAA Engineering as there is no standard design of VW conversion. 'Peacock' VW conversion drawings are available from LAA Engineering, but these drawings are now many years old and not all parts called up are still available. Dual ignition system (of an accepted type) required. LAA VW Engine Build checklist to be completed during build-up of engine to record critical measurements. Refer to SPARS section on VW engines. Oil cooler may be required, and careful ducting to achieve adequate cylinder cooling. Compression ratio must be set up (usually no more than 8.0:1) using choice of cylinder base shims if required. With 1834cc conversions, failing to use base shims usually results in excessively high compression ratio and consequent excessively short engine life.
- With VW conversion, if gravity feed is used, check gravity flow from downstream side of carburettor float valve (by removing float chamber bowl or float chamber drain plug) rather than at carburettor fuel inlet. If an automotive carburettor (e.g. Stromberg CD150) is used with gravity feed, the carburettor float valve is often found to provide inadequate or very marginal flow. This is because automotive carburettors are set up for use with a pumped installation not gravity feed. The fuel pressure from a pump allows a carb float jet of only about 1.5 mm diameter to be used, this restricts the flow too much with the much lesser fuel pressure in a typical gravity fed system. This is a common cause of lean running and engine failure. This is cured by fitting a larger diameter jet to the float valve, (typically 2.5 to 3mm diameter) or carefully opening up the existing jet and lapping it in with a household brass polish.
- With VW engine, quality of fit of propeller hub on crankshaft nose is critical to security of propeller mounting in flight.
- Builder interpretation of areas which are sparsely detailed on the drawings, such as canopy hinges, canopy latches, fuel tank, engine controls, exhaust system, cowlings, wheel brakes, cockpit harness, flap system etc. Due to the lack of details on the drawings, inspectors must ensure that these areas are dealt with in accordance with normal light aircraft design practises. Refer to Bingelis's books 'Firewall Forward', 'The Sportplane Builder' and 'Sportplane Construction

Techniques' for examples of standard aviation practises. If in doubt, consult LAA Engineering for advice.

3.5 Operational Issues

- Turbulents are renowned for their delightful handling characteristics but several have been involved in fatal accidents through over-exuberant flying. Due to their low aspect-ratio wing they lose airspeed very rapidly in a steep turn and there have been a number of stall-spin accidents.
- Due to their lightweight structure they are definitely not aerobatic types.
- The mainwheels are well aft, consequently the weight on the tailskid is minimal. Care is required to avoid tipping it onto its nose whilst running up the engine.

Safety Spot reference

Light Aviation September 2018 *Affecting seasonal changes.*

Article discusses the effect of humidity and temperature changes on wooden aircraft structures and best practises.

3.6 Standard Modifications

None

---------- END ----------

Please report any errors or omissions to LAA Engineering: engineering@laa.uk.com