

PITTS S-1C, S-1S, S-1E, S-1D, S-1T

Issue 2 Pitts S-1T control surface deflections added at section 16.
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1. USA contact

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2. Description

The Pitts Special is a small aerobatic biplane of mixed construction with welded steel tube fuselage and tail surfaces and wooden wings. S-1 variants are single seaters. Of over a hundred Pitts aircraft of all models on the UK register, over sixty are LAA homebuilt examples. A number of different models are found:

- S-1C Single seater. Original homebuilders design built from plans although may incorporate factory kit parts. Shorter fuselage. Shorter span lower wing. Flat-bottomed wing aerofoil section. Ailerons on lower wings only. Virtually all S-1Cs are imports from the USA. Many S-1Cs have been modified to a higher specification, eg spring aluminium undercarriage, four-aileron wings, various engine up to 180 hp, longer span lower wings, longer fuselage frame. MTWA 1050 lb although permitted weight may depend on the specification of individual aeroplane.
- S-1S Single seater. Factory-manufactured certificated aircraft or homebuilt from Pitts factory drawings. Symmetrical wing aerofoil section. May include some kit parts (see S-1E details) and may include modifications as detailed for the S-1E. May include non-factory wing type, eg Sparcraft wing (routed plywood ribs), Falcon wings (square wing tips, revised ailerons), Ultimate wings (build up ribs, square wing tips, revised ailerons). MTWA 1150 lb.
- S-1E Single seater. Built from factory kits. Aircraft primary structure will be identical to a factory-built Pitts S-1S (may differ in minor areas such as canopy, engine cowls, engine specification and propeller). May also include spring aluminium undercarriage legs with attendant modifications to forward fuselage frame. MTWA 1150 lb.
- S-1D Single seater. Homebuilt aircraft. Identical in all respects to homebuilt S-1S except for wings which are identical in planform to the S-1S (equal span upper and lower wings, round tips, four ailerons) but with different aerofoil section (can be identified by having a flatter surface to the underside of the wings). MTWA 1150 lb.
- S-1T Single seater. Can be factory certified aircraft (not applicable to LAA) or homebuilt from factory supplied kits. Similar to S-1S but with revised forward fuselage in order to accommodate 200 hp engine and constant speed propeller. Symmetrical section ailerons. MTWA 1150 lb.

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3. Fast Build Kit 51% Compliance

Not applicable – either built from plans or a slow-build kit.

4. Build Manual

Pitts kits were provided with Build Manuals.

5. Build Inspection

Build inspection schedule 1D (wood/metal Biplane).
Inspector approval codes A-A or A-W. Inspector signing off final inspection also requires 'first flight' endorsement.

6. Maintenance Manual

Pitts aircraft should be maintained in accordance with the airframe and engine manufacturer's maintenance schedule which should be obtained by the owner and made available to the LAA inspector. Maintenance manuals are known to be available from Aviat Aircraft Inc to cover the following models:

Pitts S-1S, which also covers Pitts S-1D and S-1E
Pitts S-2A which also covers Pitts S-2E
Pitts S-2S which also covers Pitts S-2SE
Pitts S-1T

The CAA's Light Aircraft Maintenance Schedule (LAMS) should also be used as a guide. Pitts aircraft are highly aerobatic and almost every Pitts sortie is an aerobatic flight. Inspections should therefore be carried out being particularly vigilant for any defects affecting the structural integrity of the aircraft and for safe and satisfactory working of the flying control system. Full and free movement checks should be carried out with particular care taken to ensure there are never any loose objects left in the aircraft.

7. Flight Manual

Flight Manuals are available from Aviat for the Pitts |S-1T and S-1S (which also covers S-1E and S-1D).

8. Mandatory Permit Directives

None applicable specifically to this aircraft type, but note

MPD: 1998-019-R1 Flexible Fuel Tubing Applies to all aircraft

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9. Airworthiness Directives

All Pitts aircraft ADs are available from the FAAs web site (listed under Sky International Inc). Strictly speaking, these ADs are applicable only to factory-built versions but as home-built versions are essentially the same aircraft it seems sensible to at least consider them, and take advice from Aviat if appropriate.

76.16.08 Loss of Rudder Control – Improper Nicopress Swaging - Cable Slippage

Applies to S-1C aircraft, serial numbers 1-0001 through 1-0043. Within 10 hours.

96.10.12 Crack Inspection and Modification of Control Column.

Applies to all S-1S, and S-1T aircraft. Equally applicable to S-1E and S-1D. Aircraft fitted with a .035-inch wall thickness control column must have the column inspected for cracks every 50 hours until the aircraft is modified by installation of a control column of .058-inch wall thickness in accordance with Aviat SB No 23.

96.12.03 Crack Inspection and Modification of Lower Fuselage Wing attach Fittings.

Applies to all S-1S, S-1T aircraft. The lower fuselage rear wing attach fittings should be inspected for cracks every 50 hours until modified in accordance with Aviat SB No 25.

002.06.93 Inspection and Replacement of Tailplane Support Tube.

Applies to S-1, S-1C, S-1D, S-1E, S-1S, S-1SE and S-1T aircraft not having external tailplane leading edge lower diagonal support tubes fitted. Before further flight, modify the aircraft by replacement of the tube in accordance with the AD (obtain copy from LAA) and Pitts SB No 14.

See also **CAA Emergency AD 002-06-93** - Front tail support tube.

10. LAA Mandatory Modifications

None other than incorporation of all mandatory airworthiness directives as above.

11. Service Bulletins

All Pitts Service Bulletins and Service Letters are available from the Aviat web site (see section 1 above). These include several important inspection items.

12. Standard Options

- Sparcraft wings
- Ultimate wings
- Pitts Spring gear

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13. Special Inspection Points

- **Control-Column Torque-Tube Cracking.** The torque tubes are prone to cracking just behind the tower in which the control column is pivoted. A number of these failures have occurred in the USA and at least one such failure has occurred in the UK. A modification scheme exists to reinforce this area with an additional welded patch, based on Pitts factory Service Letter #5, and aircraft may or may not have this modification incorporated. During inspection, attention should be paid to both the top and bottom of the torque-tube in the area of the stick-pivot. Aircraft with clear-view panels in the under-fuselage skin are easy to inspect by looking in from underneath the aircraft.
- **Control Stick Failure** A number of incidents of stick-failure have been reported caused by either a hole drilled at the point of maximum stress for the PTT wire exit, or internal corrosion caused by water ingress into the stick if no stick-grip is installed.
- **Wing Internal Drag/Anti-Drag Wire/Locating Block Failure** There have been instances of both wire failure (thread failure) and also wire block failure allowing the wing to move slightly forward and aft in flight. A good indication is failure of the wing trailing edge in the area of the failed wire or block.
- **Aileron Hinges – Spar Attachment and Bearing Attachment.** Common summertime problem is loosening of the aileron hinges on the rear-spar due to wood shrinkage. It will be necessary to tighten bolts through the spar to avoid rapid failure of the plywood spar facings. Access will need to be made through the fabric. The rod-end bearings used as aileron hinge pivots can fret and loosen the aluminium rivets that attach them to the hinge brackets, requiring rivet replacement.
- **Engine Shock-Mount Failure.** Due to the high 'g' and gyroscopic loads that the aircraft may be subjected to, failure of the engine shock-mounts can lead to both engine cowl and nosebowl damage. Engine shock-mounts should be regularly inspected for splitting and general condition.
- **Trimmer Failure.** This is generally caused by seizure of the pinch-bolt that attaches the trim-wire to the trimmer horn, which in turn causes fatigue-failure of the wire at the pinch-bolt. Can cause elevator flutter.
- **Aileron Bellcrank Weld Failure.** Careful inspection of the aileron bellcrank arms in the lower wing is recommended as a number of failures in this area have been found in the past.
- **Canopy Loss.** Careful inspection of the canopy rails is recommended to check security of the sliding arrangement. Loss of ball-bearings can cause canopy detachment.
- **Trailing Edge Failure.** See wing internal drag/anti-drag wire/locating block failure.
- **Scraped Lower Wing Tips.** Damage to fabric and paint in the region of the lower wing-tip bows is a sign that the aircraft has been ground-looped. Careful inspection of the rear-spar at the region of the interplane strut is necessary to spot signs of bending failure of the rear-spar.
- **Tailwheel Mounting Bracket Failure.** The tailwheel leaf-spring attachment bracket at the bottom of the stern-post is prone to cracking and ultimately weld failure. Careful inspection of the weld is necessary to prevent failure on landing.
- **Diesel Contamination of Upper Wing Spar Splice** Some Pitts aircraft have an upper centre-section wing tank installed. If used for smoke diesel, then a careful inspection for signs of leakage is required. This is to prevent diesel soakage and contamination of the wood and glued joints in the centre spar-splice.

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- **Streamline Bracing Wire Failure** All streamlined wires, particularly tailplane wires should be inspected carefully for nicks resulting from impact damage from stones and grit which can cause catastrophic failure of the wire.
- **Aileron Spade Failure** Some Pitts aircraft are fitted with aileron spades under the lower wing. The spade surface at the base of the spade arm should be inspected for signs of cracking and evidence of the spade having made contact from the ground, which can cause high loads in the aileron attachments and control circuit.
- **Seat-Pan Failure** The aluminium seat-pan can be prone to cracking from the corners. Total failure of the seat could cause loss of control of the aircraft due to jamming of the control column torque-tube. Seat cushions should be removed and seat-pan inspected.
- **Aluminium Spring-Gear Undercarriage Attachments** Careful inspection of bottom longerons in the area of the undercarriage attachment bolts is advised due to a number of instances of bottom longeron failure.
- **Signs of Overstress** Aerobatic aircraft operate under at high-stress levels and therefore pre and post-flight walk-round inspections are important. Any evidence of slack fabric, loose wires, or airframe movement of any sort should be carefully investigated. Damage is easier to spot on aircraft which are kept clean.
- **Cockpit.** Owners should also consider the general implications of cockpit safety applicable to an aerobatic aeroplane. A few years ago in the UK a Skybolt aircraft (non-LAA) crashed fatally when, its thought, the fire extinguisher came loose in the cockpit during aerobatics and knocked out the pilot.

Imports. Due to the continued availability of Pitts drawings and kits and its popularity as a homebuilder's project world-wide, imported aircraft can vary wildly in their specification, conformity to drawings and quality of workmanship (and welding). It is therefore recommended that a detail survey be carried prior to purchase and import of a homebuilt example from abroad. There is less scope for variation on aircraft constructed solely from factory-produced kits.

Examples of problems previously encountered on previously imported aircraft are as follows:

- ◆ Corrosion in airframe and engine. Beware of aircraft from salty environments (Florida, etc).
- ◆ Wood shrinkage and glue failure. Beware of aircraft from ultra-dry areas (Arizona, etc).
- ◆ Non-standard control systems. Commonly found on earlier aircraft where torque-tubes/control sticks, etc, have been 'adapted' from other aircraft types.
- ◆ Non-standard modifications, e.g. engine mounts, undercarriage springing systems, rear-mounted smoke-tanks, modified ailerons, revised wing attachment brackets, non-standard trimmer systems, non-standard undercarriage attachments, have all been discovered on US imports. Some mods may be safe, but others potentially lethal. Beware!
- ◆ Modified engines. Make sure that the engine modification state is acceptable to LAA Engineering prior to purchase.
- ◆ Weight and balance. Potential sellers of Pitts aircraft tend to be optimistic about the weight of the aircraft they are selling. Make sure that the weight being claimed is accurate. A standard 180 hp electrically-equipped Pitts S-1S will weigh approximately 850 lb dry. Any substantial difference to this value should be investigated prior to purchase.

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- ◆ Signs of accident damage or overstress. As a competition aerobatic aeroplane with demanding ground handling characteristics, great vigilance is required when inspecting imported examples to spot signs of overstressing or accident damage. If in any doubt then fabric may require to be removed to gain access to the structure for inspection.

14. Operating Limitations and Placards

Maximum number of occupants authorised to be carried: One

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:

Aerobatic Limitations

Intentional spinning is permitted

Aerobatic manoeuvres imposing g forces in excess of +6g or -3g are prohibited.

Loading Limitations – Pitts S-1C

Maximum Total Weight Authorised: 1050 Lbs

CG Range: 4.6" forward of datum to 1.0" aft of datum.

Datum is leading edge of lower wing.

Loading Limitations – Pitts S-1S, S-1D, S-1E

Maximum Total Weight Authorised: 1150 Lbs

CG Range: 65.0 inches to 66.0 inches aft of datum at 1150 Lbs.

Forward limit 64.0 aft at 1115 Lbs or less.

Aft limit 67.0 inches aft of datum at 970 Lbs or less. Straight line variation between points given.

Datum Point is: A point 65.06 inches forward of the lower wing leading edge.

Loading Limitations – Pitts S-1T

Maximum Total Weight Authorised: 1150 Lbs

CG Range: 60.37 inches to 62.2 inches aft of datum at 1150 Lbs.

Forward limit 59.35 inches aft at 1115 Lbs or less.

Aft limit 62.48 inches aft of datum at 970 Lbs or less. Straight line variation between points given.

Datum Point is: A point 60.56 inches forward of the lower wing leading edge.

Engine Limitations

Maximum Engine RPM: 2700

Airspeed Limitations

Maximum Indicated Airspeed: 203 mph

Other Limitations

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

Smoking in the aircraft is prohibited.

Additional Placard

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

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

In addition, when certain types of metal propeller are fitted to the Pitts, RPM 'avoid' bands must be stated as quoted on the propeller TCDS regarding the specific engine/propeller combination.

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15. Special Test Flying Issues

Aerobatic flight test schedule in addition to standard schedule

16. Control surface deflections

	<u>S-1S, S-1E and S-1D</u>	<u>S-1T</u>
Ailerons	Up: 25 degrees +/- 2 deg	25 degrees +/-
	Down: 23 degrees +/- 2 deg	25 degrees +/-2 deg
Elevators	Up: 25 degrees +/- 2 deg	25 degrees +/-2 deg
	Down: 25 degrees +/- 2 deg	25 degrees +/- 2 deg
Rudder	Left 30 degrees +/- 2 deg	30 degrees +/-2 deg
	Right 30 degrees +/- 2 deg	30 degrees +/-2 deg
Elevator tab	Up 7.5 degrees +/- 2 deg	7.5 degrees +/-2 deg
	Down 42 degrees +/- 2 deg	42 degrees +/- 2 deg (elevator neutral)

Approved :

F.R. Donaldson
Chief Engineer

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