

TEAM MINIMAX 91

Issue 7			
Revision A	New format, change of UK contact's details, update issue number of LAA required modifications. Additional notes transferred from SPARS.	Dated 26/7/10	JV
Revision B	Updated contact details	Dated 30/11/10	JV

Section 1 - Introduction1.1 UK contact

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1.2 Description

The MiniMax 91 is a small single seat microlight aircraft of traditional wooden construction, fabric covered, with an enclosed cockpit. The MiniMax has a strut-braced mid wing, the struts attaching to the ends of the undercarriage axle. There is no undercarriage suspension: all shock absorption being provided by the tyres. The ailerons are full-span and operated by Teleflex cables, as is the one-piece elevator. The rudder is operated by conventional stranded cables which also connect to a steerable tailwheel. The fuel tank is normally mounted in the fuselage.

Normal engine fit is a Rotax 447 with 2.58:1 B-type gearbox but the Mosler MM-CB four stroke and various other small two strokes have also been cleared.

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.

The aircraft was designed by Wayne Ison in the USA in the early 1980's who founded the company TEAM to produce plans and kits. The first example flew in the UK in 1991. For legal reasons the company reformed in 2001 to become Ison Aircraft and then was subsequently sold in 2003 and renamed JDT.

Note that although the majority of MiniMax aircraft are microlights, a few heavyweight examples (both of the original version and the 91 version) have been categorised as 'Group A' aircraft with various modifications (mainly undercarriage reinforcements) to allow them to be flown at a higher gross weight. Increases in gross weight not already approved are no longer permitted due to the change in Section S requirements.

Section 2 – Mandatory information for owners, operators and inspectors2.1 Fast Build Kit 51% Compliance

Not applicable – the MiniMax 91 is either built from plans or a slow-build kit.

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Building instructions are provided with the drawings.

The drawings which define the standard enclosed cockpit MiniMax 91 are figures 1-22 issue '91' plus figures 1-3 headed '#1600 Enclosed Sport' or figs 1 -24 dated 14 Feb 92 headed 1600R Enclosed Sport .

2.3 Build Inspections

Build inspection schedule 1 (wooden aircraft).

Inspector approval codes A-A or A-W or K or M. Inspector signing off final inspection also requires 'first flight' endorsement

2.4 Flight Manual

A separate Flight manual is provided with the plans and is available as a 'pdf' download from the UK contact.

2.5 Mandatory Permit Directives

None applicable specifically to this aircraft type.

Also check the LAA website for MPDs that are non-type specific (e.g. engine and equipment).

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

Mods mandated by LAA, including AILs, SBs, etc, brief description/applicability, including cross-references (e.g. to manufacturer's SBs), and hyperlink to actual document.

LAA-186-001 issue 2	Seat belt attachment
LAA-186-002 issue 2	Firewall
LAA-186-003 issue 2	Turtle deck/roll-over protection
LAA-186-004 issue 2	Locking pin retention
LAA-186-005 issue 2	Flying control system improvements
LAA-186-006	Fuel system improvements
LAA-186-007	Wing forward strut reinforcements (91 version)
LAA-186-008	Undercarriage reinforcement (only required if max gross weight 590 lb)
LAA-186-009 issue 2	Shoulder harness cables

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

With Rotax 447 engine: Max CHT: 260°C (normal 190-230°C) max difference 20°C
 Max EGT: 650°C (normal 460-580°C) max difference 25°C

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2.8 Control surface deflections

Ailerons (original)	Up: 22° Down: 15°
Elevators	Up: 30° Down: 15°
Rudder	Left 30° Right 30°
Flaperons	Max 6° up to 16° down

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 by means of cockpit placards or instrument markings:

2.1 Aerobatic Limitations

The aeroplane is permitted to fly only for non-aerobatic operation. In this context non-aerobatic operation includes:

- i) any manoeuvre necessary for normal flying.
- ii) intentional stalls from level flight.
- iii) steep turns in which the angle of bank does not exceed 60 degrees. Intentional spinning is prohibited.

2.2 Loading Limitations

Maximum Total Weight Authorised: 254 kg (560 lbs)
(may be raised to 268 kg (590 Lbs) if u/c reinforcement mod LAA-186-008 fitted, but subject to minimum rate of climb 250 ft/minute at that weight under standard day conditions. Not applicable to Mosler MMCB powered examples for this reason.

CG Range: Limits 13.0 inches to 16.2 inches aft of the datum point.
Datum Point is: The leading edge of the wing.

2.3 Engine Limitations (Rotax 447)

Maximum Engine RPM: 6800
Maximum Static Engine RPM: 6000 (minimum)

Engine Limitations (Mosler MMCB)

Maximum Engine RPM: 3250

2.4 Airspeed Limitations

Maximum Indicated Airspeed: 100 mph
Maximum indicated airspeed with flaperons drooped: 60 mph (only applies if ailerons are able to be drooped simultaneously to act as flaperons)

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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"

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

As a microlight aircraft, additional microlight weight placard must be fitted as described in TL2.11 regarding empty weight and payload.

2.10 Maximum permitted empty weight

<i>Model</i>	<i>Max gross weight</i>	<i>Max permitted weight</i>
MiniMax 91 (without mod-186-008)	254 kg	168 kg with full fuel
MiniMax 91 (with mod-186-008)	268 kg	182 kg with full fuel

Fuel tank must be sufficient in capacity to allow an hour's flying at max continuous power. With a Rotax 447 this is a minimum of 11 Kg of fuel (3 1/2 imp gallons).

2.11 Noise certification

As a microlight aircraft, a noise certificate must be issued by the CAA specific to each individual aircraft built. A new noise certificate must be obtained following any change in noise output, including change to engine type, reduction gear ratio, propeller type, propeller pitch setting, type of exhaust, exhaust after-muffler or intake silencer.

Section 3 – Advice to owners, operators and inspectors3.1 Maintenance Manual

A maintenance schedule is included in the Flight Manual. For Rotax 447 engine, refer to Rotax two-stroke maintenance schedule.

3.2 Standard Options

Hamer lowered Rotax engine modification, LAA mod 10055.

Streamlined wing struts (only accepted when supplied through Jeremy Harris), LAA mod 10739.

Flaperon system – but range of movement to be not more than 0-16 degrees 'droop' and 0-6 degrees 'reflex'.

Brakes.

Spats.

Wing tips.

TEAM 'open top' cockpit canopy.

Wing tank.

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Note – the welded steel tube alternative undercarriage from TEAM is NOT accepted by the LAA.

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

Nil known.

3.4 Special Inspection Points

- The MiniMax Club newsletters provide important and useful technical items and owners should be members to benefit from such information, making it available to their inspector. Further information, such as rigging and control deflections, can be gathered from the build instructions and drawings.
- If Rotax engine fitted, Rotax 2-stroke installation checklist to be completed (apart from flight test section) as part of final inspection prior to applying for Permit to Fly.
- Following any heavy landing, in particular check 'piano hinges' which attach undercarriage to fuselage for signs of distortion, cracking or movement on the wooden structure. Also vertical wooden spacers inside fuselage where undercarriage mounts, for signs of movement or separation from fuselage sides.
- Following any heavy landing, check that the wooden compression struts and diagonal wooden drag/anti-drag struts inside the wings have not detached from the spars and ribs due to shock loading.
- Following any heavy landing, check tailwheel, tailwheel spring mountings and wooden diagonals in fuselage for signs of detachment or failure, particularly rearmost diagonal in upper frame.
- A reinforcement scheme exists (shown as standard on the later drawings) fitting blocks to the fuselage underside which prevent the top ends of the undercarriage legs migrating inboard in a heavy landing.
- An unusual fabric covering system has been developed for use on the MiniMax which uses Dulux matt vinyl emulsion paint, rolled on, to fill the fabric pores, and a single coat of one-pack polyurethane paint as a topcoat – also applied using a roller. It is not known how well this will protect fabric from damage from UV light in the long term – fabric condition to be monitored for signs of deterioration in strength.
- With prolonged use, cases have been reported of the holes for the wing attachment pins in the fuselage carry-throughs becoming worn. Consult LAA for repair scheme.
- Traditional wood construction is used throughout and is fabric covered (often with Stitts fabric). Inspectors should check all wood and metalwork supplied in the kit carefully for quality. The wood is largely Northern White Pine rather than spruce, but the normal acceptance criteria for spruce still applies. One or two of the detail design features give away the aircraft's microlight status and 'go against the grain' with the traditionalists but nevertheless the MiniMax is now a well proven design.
- Drawings are very clear and few construction problems have been reported. The woodwork can be assembled using T-88 epoxy adhesive as called for by TEAM, or West System epoxy resin 105 with hardener 205/206 in preference to the more traditional Aerolite or Aerodux which are normally the only glues used for wooden aircraft building in the UK.
- If building from plans, check that locally-sourced aluminium extrusions used have a radiused internal corner per normal aeronautical practice, not a sharp corner which causes a stress concentration.

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- The build manual is not detailed regarding engine installation and inspectors should take care to check that standard UK practices have been followed with regard to engine installation, fuel system, etc. Refer to Rotax installation checklist and other engine installation manuals as appropriate.
- LAA recommends that to prevent corrosion, all aluminium parts should be suitably painted and assembly compound used where aluminium parts are bolted in place.
- It is normal for these aircraft not to use rib stitching despite their narrow rib cap strips, the adhesive bond between fabric and rib being nevertheless adequate at the low airspeeds involved.
- Either plastic or metal hubbed main wheels can be fitted, plastic hubs have been known to fail and if fitted these should be treated with caution. They should also be regularly checked for melting in the region of the plain wheel bearing, especially where prolonged taxiing occurs.
- Note this is a very lightweight aircraft and heavy finishes, add-on 'options', etc, must be avoided, otherwise performance and payload will be compromised and the microlight category will not be achieved.
- For microlight versions, the empty weight must be such that the maximum gross weight is not exceeded with full fuel and an 86 kg pilot.
- Longitudinal levelling datum is the upper fuselage longerons at the cockpit position.
- Maintenance is typical of a wooden airframe; refer to CAP562 CAAIPs leaflet 6-11 "Deterioration of wooden aircraft structures".
- The thick plywood engine mounting plate used for Rotax installations should be checked for degradation and wear and replaced when necessary.
- Most examples are fitted with a Rotax 447 engine and many have been installed using a modification devised by John Hamer. This lowers the engine so that the cylinder head no longer pokes up through the top cowling. The gearbox is 'offset up' rather than 'offset down' so that the thrustline is unchanged. Details are available from John Hamer.
- Many builders fit plywood cap strips ½" to ¾" wide to wing ribs to increase fabric bond area and provide a smoother wing profile.
- Other possible trouble spots include the rudder, elevator and rudder pedal hinges: these must be replaced at the first sign of any wear or cracking.

3.5 Special Test Flying Issues

- Rotax two stroke flight test schedule if Rotax two-stroke engine fitted.
- One example of the MiniMax suffered aileron 'buzz' in flight at high speed, a mild form of flutter which was not destructive. This was apparently the result of the inevitable backlash introduced in the control system by the Teleflex type cables coupled with the torsional flexibility of the aileron and the smooth wing/aileron profile causing some sort of airflow problem with this particular aircraft. Fractionally biasing the ailerons so that they were both either slightly 'up' or 'down' solved the problem, the ailerons no longer floating between the limits of backlash in flight. This appears to have been an isolated case but nevertheless high-speed flight should be carried out with particular care until it has been verified that this problem does not crop up again.
- An example of a HiMax (high-wing version of the MiniMax) exhibited neutral directional stability until rudder centring springs and a large fin strake were added. In any TEAM aircraft, check that rudder and tailwheel steering linkage operate freely and self-centre in flight.
- As with any Rotax installation, to ensure future reliability you should go to some trouble to get the engine cooling properly set up, and the propeller pitched to give

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correct rpm whilst also avoiding excessive high EGTs which will quickly seize the engine. Depending on propeller pitch, high EGTs may be suffered at high power settings and high RPM, or during the part-throttle descent at high RPM when running on the 'lean part of the needle'.

- This is a very lightweight 'real' aeroplane with good performance and super-sensitive controls compared to most 3-axis microlights. The rigid undercarriage (no shock absorption) requires a gentle landing technique, and all the usual taildragger skills are essential. Particular care is required on windy days, especially with crosswinds.

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