

PART 2

FLIGHT TESTS

44. Engine Check

Open up initially against brakes and check r.p.m. at which aircraft rolls, which should be not less than 6,800 r.p.m., then continue to full throttle and check J.P.T. oil pressure and r.p.m. (*See Engine Limitations—Appendix II.*)

45. Take-off Run

During take-off run a reduction in indicated r.p.m. is usually caused by an acceleration effect on the engine speed indicator and, with the present Manufacturing Limits, may amount to 100 r.p.m. below the static ground full throttle figure. As speed builds up to initial climb speed this error is cumulative with the high I.A.S. effect (*mentioned in para. 47(o)*) so that at the start of the climb the r.p.m. may be almost 150 below the static ground figure. These errors should resolve progressively as the climb continues. Check for any abnormal behaviour during the take-off run. If there is any marked vibration after leaving the ground it will probably be due to the nosewheel; if this is excessive the nosewheel should be rebalanced or changed. If blue smoke enters the cabin through the demisting pipes—the oil level of the C.A.U. should be checked after flight.

46. When Airborne

- (a) Note operation of undercarriage and indicators.
- (b) Check that tailplane trim at 'Zero' is satisfactory for take-off and note the amount of retrimming necessary on the rudder control to obtain trimmed climb at 5,000 feet and climbing speed. The tailplane setting for trimmed climb at these conditions may vary from 1.5 deg. to 2.0 deg. nose down, but should not be outside the limits particularly in the nose down sense, otherwise sufficient trim may not be available to cover the complete range of C. of G. and flight conditions. The tailplane trim setting can be affected by aileron rigging and a large nose down setting may indicate the presence of a small amount of aileron upfloat, and/or incorrect elevator datum setting. If the tailplane setting is outside the above limits these points should be checked.

PART 2

47. First Flight

(a) Initial Climb to 50,000 feet

(i) *F.C.U. Functioning*

Carry out a climb from 2,000 feet to 40,000 feet starting at 7,300 r.p.m. The over-all B.P.C. creep can vary from plus 350 to minus 100 at 40,000 feet. There are no arbitrary limits to these figures, and as long as max. r.p.m. are obtained at height, and engine handling is satisfactory, they are acceptable.

(ii) *Governor Functioning*

At 40,000 feet open the throttle fully and continue to 50,000 feet, checking the governed r.p.m. Positive creep should not exceed 150 r.p.m. from the basic ground setting. This climb should be made with the T.T.C. switch off, manually controlling at 685 deg. C. Checks on the governed r.p.m. should be made at 42,000, 45,000, 48,000 and 50,000 feet.

(iii) *Top Temperature Controller Check*

On the Avon Mk. 207 engine (*governed at 8,000 r.p.m.*) the J.P.T. may not reach the point at which the T.T.C. is required to operate, even allowing for positive governor creep of 150 r.p.m. from sea level to 50,000 feet.

However, in order to check T.T.C. datum and functioning it is permissible to select engine anti-icing ON at full throttle.

The J.P.T. will rise to approximately 700 deg. and then, if the T.T.C. is operating correctly, will fall to the J.P.T. controller preset datum (*see Engine Limitations — Appendix II*) as fuel flow is reduced, with a corresponding fall in r.p.m.

Select T.T.C. OFF; r.p.m. should rise again at once to the previous limit maintained by the governor, and throttle back to remain within the J.P.T. limit. Then select anti-icing OFF.

If the T.T.C. is again switched on, interference caused by the time delay switch and lasting for 30 seconds will be heard in the pilot's headphones. This provides a further check that the circuit is live.

Normally the controlling temperature will be reached in the latter stages of the climb to 50,000 feet and the functioning of the controller may then be checked without the use of the anti-icing switch.

47. First Flight (*Contd.*)(a) Initial Climb to 50,000 feet (*Contd.*)

During the initial climb to 50,000 feet, record the following figures at take-off, 2,000 feet, 20,000 feet, 30,000 feet, 40,000 feet, 42,000 feet, 45,000 feet, 48,000 feet and 50,000 feet :—

R.P.M., J.P.T., Oil Pressure,
Trim Settings, Cabin Altitude
and Fuel State.

(b) Cabin Pressurisation and Conditioning

The climb should be started with the rheostat in the 'Fully Warm' position, and the manual control set to AUTO. Later in flight the manual control should be moved to HOTTER and COLDER, and the rheostat operated to extremes and the effect on cabin temperature assessed. Check the 'Flood Flow' operation as convenient.

The following points should be checked on the pressurisation :—

- (i) Cabin altitude on the climb is within limits given in Fig. 4.
- (ii) There should be no hunting in cabin pressure during the climb.
- (iii) When speed is reduced at altitude check that cabin altitude remains within limits.

(c) Initial High M.N. Test

Carry out shallow dive and note that the Mach. No. characteristics correspond with the description contained in Pilot's Notes. Note any variation from standard. Check ailerons during dive and note any abnormal behaviour.

(d) Cruise at 40,000 feet

Carry out a cruise at 40,000 feet using 7,200 r.p.m. During cruise check flying controls for response, compass, gunsight, radio, D.M.E. (*if fitted*), cabin conditioning and de-misting, pressurisation, lighting, etc.

There should be no sticking, or tendency to self select on flying controls.

PART 2

47. First Flight (*Contd.*)

(e) Turns at 40,000 feet

Check handling in turns and high speed stall behaviour. The I.A.S. at 0.9 I.M.N. should be 275—278 knots at this altitude. An acceleration of about 2.5 'g' indicated should normally be obtained at this altitude when the pre-stall buffet commences.

(f) Engine Handling at 40,000 feet

At 150 knots, open the throttle moderately and progressively from idling to full throttle. Note time to accelerate; this should be within 8—12 seconds and should normally be about 10 seconds. Idling r.p.m. at this altitude and speed should be between 5,100—5,500 r.p.m. Note also that cabin height remains within limits at 150 knots at idling r.p.m.

(g) Flaps

Lower landing flaps to 40 deg. at approximately 300 knots I.A.S. and below 0.9 I.M.N. Check there is no marked lateral trim change on extension and retraction, and the 'nose down' trim change is normal. Check handling during simulated instrument descent, and watch for any hunting of flaps, etc.

(h) Handling with Flying Controls in Manual

At 250 knots I.A.S. select ailerons and elevator to 'Manual'. Check reselection to 'Power' on aircraft without 'by-pass' boosters. Check handling in 'Manual' with 40 deg. flap, and with undercarriage and flaps fully down. Raise flaps and undercarriage simulating overshoot and reselect controls to 'Power'.

Note . . .

Full details are given in 'Hunter Power Controls—Notes for Pilots'.

(j) Stalls at 25,000 feet

At approximately 6,000 r.p.m., lower flaps and undercarriage at 25,000 feet and reduce speed. Note undercarriage lowering and raising time (*10 secs. down, 8 secs. up*).

Stalling speeds are given in Fig. 3. Buffet will commence some 10—15 knots before the stall and becomes moderately intense as speed is reduced. There should be no tendency for wing drop to occur before the stall, and no directional breakaway.

During undercarriage lowering check that hydraulic pressure does not drop below 1,000 p.s.i. and that undercarriage lights operate satisfactorily.

47. First Flight (Contd.)

(k) Cabin Depressurising

At 15,000 feet, between 350—400 knots I.A.S. depressurise and note the following items :—

- (i) Cabin altimeter readings before and after depressurising.
- (ii) The operation of the cabin pressure warning light.
- (iii) The time taken to restore cabin pressure.

(l) Trim Settings

At 10,000 feet at 300 knots I.A.S. with the ailerons selected to 'Manual', trim the aircraft laterally and directionally.

Check settings on trim indicators; call for reset if necessary.

Reselect ailerons to 'Power'. The trim in power on the aileron spring feel unit should not normally be altered.

Note . . .

An entry should be made in the aircraft Servicing Form to show the tab angle carried with the trimmer set at 'Zero'.

High I.A.S. Flying

(m) Longitudinal Trim Check

With flying tail selected OUT, trim aircraft longitudinally at 1,500 feet, 250 knots, I.A.S. and switch elevator to 'Manual', checking for any change of trim. Switch back to 'Power' and repeat at 50 knot increments up to 550 knots or to the I.A.S. at which the trim change exceeds 20 lb. nose up or 10 lb. nose down. *Care should be taken when carrying out this check.*

A longitudinal trim change may occur even when the elevator has the correct nominal setting with the elevator geometrically trailing (*i.e.*, zero deflection relative to tailplane). To overcome this, it is permissible to adjust the datum of the elevator spring feel unit so that the stick free position of the elevator coincides with the mean aerodynamic trail position of the elevator.

If the trim change from 'Power' to 'Manual' is nose down, the elevator should be floated down to eliminate the change. A satisfactory setting can only be obtained by trial and error flight checks. Present production flight testing results indicate that a maximum deviation from geometric trail angle of ± 1 deg. of elevator angle should allow a sufficient range of adjustment.

Note . . .

The final setting of the elevator spring feel unit datum is to be entered in the airframe Log Book.

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47. First Flight (Contd.)

(n) Elevator Damping Check

Trim aircraft at 1,500 feet, 200/300 knots, using the main tailplane trimmer, and select elevator control to 'Manual'. Increase I.A.S. and maintain level flight. The 'stick jerking' checks for elevator damping should be commenced at 450 knots and continued at 5 knot intervals to 550 knots, or to the I.A.S. at which any vibration is not immediately damped, whichever is achieved first. If the damping appears marginal at 550 knots at 1,500 feet, a check should be made to ensure that any vibration which can be induced below 0.85 I.M.N., between 1,500 feet and 10,000 feet is immediately damped. If any vibration is not immediately damped within these limits of altitude and I.M.N. the symptoms should be reported to the Manufacturers.

If a serious case of vibration should occur which cannot be damped quickly enough by this method, the elevator should be switched back to 'Power'. The vibration should cease immediately but the control column may give a kick in either direction if the tailplane trim settings for 'Power' and 'Manual' are not in agreement.

Note . . .

The following 'stick jerking' technique has been found to be satisfactory :—

At the same time as the right hand is released from the control column, a sharp blow should be delivered to the top of the hand grip using the outside edge of the left hand. The blow should be crisp and any tendency to follow through should be avoided.

(o) Maximum I.A.S.

On completion of damping checks increase speed to 620 knots and check behaviour is normal and that adequate tailplane trim is available. Check A.S.I.—M.N. effects and for any marked directional trim changes. Such changes are often due to excessive clearance or mal-alignment of tailplane fairings. Operate the air brake at maximum conditions.

At stabilised full throttle conditions at high forward speed there is a fuel pump governor effect which may reduce engine speed by up to 100 r.p.m.

It should be noted that while speed is increasing there is a cumulative drop from the indicator effect (*mentioned in para. 45*) which may give an r.p.m. drop exceeding 100 until the speed stabilises.

47. First Flight (*Contd.*)**(p) Air Brake**

The air brake should be tested at a M.N. in excess of 1.0 and at maximum I.A.S. In neither case should there be any hunting of the flap causing a pitching oscillation. Hydraulic pressure should be steady. The opening time should not be greater than 3 to 4 seconds and changes of trim should be as detailed in Pilot's Notes.

In this connection it should be remembered that the change of trim at high M.N. is dependent in degree upon the tailplane incidence setting.

Changes of trim and the degree of buffet are critically affected by the angular opening of the brake and in the event of a persistent nose down effect at high I.A.S. or extensive buffet causing strong fore and aft stick oscillation at high M.N. the degree of opening should be checked.

The magnetic indicator should only show *white* with the brake *extended*.

To check the automatic closing of the air brake when lowering the undercarriage, wheels should be selected 'down' with the air brake 'out' when joining the circuit.

(q) Undercarriage Warning Light

Check the setting of this light, which should come on at circuit height and speed at approximately 5,500 r.p.m. when throttling back with wheels retracted. If incorrect, mark the throttle quadrant with the throttle lever set to 5,500 r.p.m., to assist subsequent adjustment.

(r) Landing

Stream the tail parachute on touch down and check its satisfactory deployment from the deceleration experienced.

Check for any abnormal delay between operation of the switch and the parachute streaming.

Then check for main oleo judder by severely braking to low speeds. Sufficient brake should be applied, on one landing, when the aircraft is firmly on the ground and the brake pressure gauge checked to ensure that the Maxaret units are operating.

Note . . .

At high speed in the initial landing run, full pressure will not be indicated on the triple pressure gauge and, depending on runway conditions, there may be a varying amount of needle fluctuation. A subsequent tyre inspection should not show irregular wear, flats or mal-alignment of creep marks.

Jettison the parachute after clearing the runway.

PART 2

47. First Flight (Contd.)

(s) Accumulator Checks

After switching 'Off' the engine and chocking wheels, exhaust the remaining hydraulic pressure in the main system by lowering flaps, then without delay check accumulators as follows :—

(i) Ailerons

Check by full lateral movements of the control column that $2\frac{1}{2}$ complete cycles are available before the magnetic indicator indicates reversion to 'Manual'.

(ii) Elevator

Check by full fore and aft movements of the control column that $1\frac{1}{2}$ complete cycles are available before the magnetic indicator indicates reversion to 'Manual'.

The audio warning may be checked by leaving the radio on during this operation, when the audio warning and hydraulic pressure warning light should operate as the pressure falls below 600 p.s.i. At the same time the audio warning cut-out switch (*starboard instrument panel*) may be checked.

(iii) Brakes

By fully applying and releasing brakes, check that a minimum of 35 applications are available before the accumulator discharges to the basic zero pressure of 750 p.s.i.

48. Second Flight

(a) Combat Climb to 50,000 feet

Carry out combat climb timed from wheels rolling to 50,000 feet, taking the following readings at take-off, 20,000 feet, 30,000 feet, 40,000 feet, 45,000 feet, 48,000 feet and 50,000 feet :—

Time, R.P.M., J.P.T., Oil Pressure,
Tailplane Trim, Cabin Altitude
and Fuel State.

48. Second Flight (*Contd.*)(a) Combat Climb to 50,000 feet (*Contd.*)

Since the engine is nominally rated at a J.P.T. very close to the maximum operational limit, it is to be expected that during climbs to altitude the engine r.p.m. will be reduced by the top temperature controller.

The degree of r.p.m. throttling at normal climbing speeds depends on five factors :—

- (i) The basic r.p.m. setting of the engine governor.
- (ii) The basic temperature (J.P.T.) of the particular engine.
- (iii) The degree of J.P.T. creep.
- (iv) The ambient air temperature during the climb.
- (v) The actual setting of the J.P.T. controller.

Fig. 8 shows for an engine on the maximum production acceptance limit of jet pipe temperatures, the engine speeds to be expected during a full throttle climb to altitude for a range of ambient air temperatures, and with the controller set at 685 deg. C.

After correcting J.P.T. and R.P.M. for instrument errors (*including tilt error*) the indicated r.p.m. may be 50 below those shown on the curve.

Note . . .

There should be no power surging or irregular engine speed fluctuation while climbing on the governed r.p.m.

(b) **Transonic Dives**

Carry out sonic dives noting characteristics and control behaviour. Check that air brake (1) and fuel transfer (2) magnetic indicators do not show *white* during dive or recovery. The cabin pressure warning light may come on in very steep dives or if the throttle is closed during the dive.

Delay the recovery of at least one dive until about 20,000 feet.

(c) **Engine Anti-Icing Check**

At any convenient time during the flight set 7,200 r.p.m. and switch anti-icing ON. Check that the indicator shows 'OPEN' and that the r.p.m. and j.p.t. increase slightly. Switch engine anti-icing OFF, check that the indicator shows 'SHUT' and check engine response.

PART 2

48. Second Flight (*Contd.*)

(d) Level at 10,000 feet

At 300 knots I.A.S. at 10,000 feet check directional and lateral trim (*manual ailerons—these were set on first flight*).

Increase power to full throttle and carry out level at 10,000 feet until stabilised.

Note the following:—

I.A.S., Mach. No., R.P.M., J.P.T., Oil Pressure, Tailplane Trim, Fuel State.

Check also for directional trim changes while accelerating to maximum level conditions.

(e) General Handling

Carry out aerobatics, including inverted flight, as convenient.

(f) Fuel System

Throughout the flights, check that fuel transfers correctly and that port and starboard fuel contents remain within 80 lb. of each other. Check booster pumps by selecting individually.

At 10,000 feet, with both pumps 'On', invert aircraft using 7,300 r.p.m. and fly level for 10 seconds. Check the engine functions correctly and the low pressure fuel warning light does *not* come 'On'.

Note . . .

If the inversion has to be repeated, allow at least 15 seconds for the booster pumps to re-charge the fuel recuperators before making repeat inversion.

(g) Oil System

Note some oil pressure available whilst inverted and that it recovers to the previous value when normal flight is resumed.

(h) G Suit

This equipment should be worn and the system tested at some convenient period during the flight.



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