(iv) If the recommended r.p.m. figures are not maintained and icing is moderate to severe, flame-out may result. If this occurs, an immediate relight on one engine (see para. 120 (a)) may be attempted; if this fails, and conditions permit, the normal relighting drill should be carried out. It should be noted that if icing conditions persist down to ground level, it may not be possible to obtain a relight due to ice formation in the engine.

95. **Starter loading**

(a) After checking that the MASTER STARTING switches are off, unlock and open the starter fairings. Each breech cap is then unscrewed and the spent cartridge removed by unscrewing the cap after releasing the locking ratchet by pressing on the spring-loaded stud in the cap. The cartridge case is removed from the cap by depressing the two buttons in the base. A new cartridge is fitted so that the extractor claws grip the base. The cartridge is then inserted into the barrel and the cap screwed home finger-tight only. If screwed too tight it may be difficult to unscrew subsequently and the starter may be damaged.

(b) On no account may any work be carried out on the starter while the engine is turning.

NOTE.—Until modified starter fairings are available, do not fly the aircraft with live cartridges fitted if engine anti-icing is to be used.

PART IV

HANDLING

STARTING, TAXYING AND TAKE-OFF

96. **Safety check**

Before commencing the external checks carry out the following safety check.

All ejection seats	Safety pins in position
Master jettison switch	OFF
Canopy and hatch jettison switches	OFF
Battery isolating switch	OFF
Undercarriage safety switch	Down
Wing clearing safety switch (B.(I)6)	Off
Armament safety plug (B.(I)6)	Removed

97. **External checks**

Systematically check the outside of the aircraft for signs of damage and for the security of panels, filler caps, doors and hatches. The engine intakes must be free from obstruction, the starter fairings secure, the fuel drain pipes protruding and undamaged and the jet pipes free from distortion. The pressure head cover and static vent plugs must be removed. The following specific checks must also be made.

Hydraulic accumulators	Min. pressure 1,350 lb./sq. in.
Hydraulic ground/flight cock	Wired in FLIGHT position

98. **Internal checks**

(a) On entering the aircraft check:—

Pilot's Notes	Stowed
Fire extinguisher	Stowed
Crash axe	Stowed
First aid kit	Stowed
Asbestos gloves	Stowed
Signal pistol	In mounting
Generator switches (4 and 5) (if fitted)	ON
Pilot's services, No. 1 and 2 generator fields, and armament services (B.(I)6) circuit-breakers (3)	Closed
No. 4 and No. 5 inverters (2)	OFF
All radar (1)	Off
Circuit-breakers below rear face of electrical control panel	Closed
L.P. cock and pump circuit-breakers (6, 7, 8 and 9)	Closed
Nose station oxygen regulator	As required
Oxygen wander lead	In clip, blanking plug fitted
Hydraulic handpump handle	In position, check operation of pump against brake gauge

NOTE.—The hydraulic hand pump handle must be left in position at all times in flight except when the folding seat is occupied.

Canopy drying crystals	Serviceable
Intercomm. lead connections	Check all positions

Crew check

Ejection seat drogue wire	Connected
Automatic parachute release static line	Secure
Automatic harness release static line	Secure
Parachute barometric release	Cap in place
Emergency oxygen supply static line	Connected
Emergency oxygen bottle safety pin	Remove
Ejection seat safety pin	Remove and stow

(b) *Cockpit checks*

When strapped in have the rudder lock removed, take out the flap and bomb door pins, adjust the rudder pedals and seat for comfort, thigh guard up. Check oxygen and R/T connections made, set the internal lights as required and then check clockwise round the cockpit starting on the port side.

Battery isolating switch (fig. 2)	ON (OFF if external battery is used) Check voltage on D.C. voltmeter (see para. 91 (a) (ii))
Intercomm. switches (fig. 2)	ON/NORMAL—Check with crew
Bomb door emergency lever (16)	Wired shut (up)
Bomb jettison switch (12)	Safe (to rear)
Bomb door switch (11)	SHUT
Engine anti-icing switches (41)	OFF
External light switches (at 39)	As required
Control column snatch unit lever (40)	Guard flap flat

Crew check

Oxygen regulator (15) and contents gauges (92)	Check contents Oxygen selected ON Air inlet switch 100% oxygen Indicator responding to breathing, remote indicator (if fitted) responding Test mask fit by pushing the emergency switch fully in, in the central position Flick emergency switch to left and right and note pressure increase at mask
Wing clearing switch (B.(I)6) (36)	Off
H.P. cocks (34)	~~ON~~ OFF
Throttles (29)	Closed
Friction nuts (32 and 33)	As required
Canopy jettison switch (31)	OFF

Take-off panel (fig. 2):—

Fuel cocks	All ON (check aurally) Integral tank transfer cocks NORMAL
Heaters	Pressure head, D.V. panel, canopy demist, and vent valve switches all OFF
U/C safety switch	OFF (down)
Canopy demist (internal) (22)	OFF
Undercarriage emergency handle (24)	In and wire-locked
Undercarriage UP button override (28)	Horizontal
Undercarriage position indicator (27)	Three green lights check change-over switch and day/night screen
Flaps (26 and 23)	UP and indicating UP

Master starting switches (85)	OFF
Ignition switches (83 and 90)	OFF
Mk. 4B compass selector (77)	COMP

Flight instrument panel:—

Instruments	Undamaged. Set airfield height on altimeter
Turn and slip indicator emergency switch (81)	Test function, switch OFF
Emergency lamps (52)	Test and OFF
Engine instruments	Undamaged
Fuel pressure warning lights (73 and 71)	On
Fuel contents gauges	Check contents
L.P. pumps (75, 73, 70 and 69)	Check singly against fuel pressure warning lights, and aurally—leave OFF
Fire warning lights (60)	Check function by separate pushbutton (Mod. 1778)
Cabin heat control (67)	Check function, leave HOT
Engine air switches (68)	OFF
Cabin pressure warning horn over-ride switch (63)	ON
Brake and hydraulic pressure gauges (66 and 65)	Minimum pressure 1,350 lb./sq. in.
Generator warning lights (88)	On
Entrance door	Open—jettison handle (93) strapped up
Airbrakes selector switch	IN
Wheelbrakes	On

99. Starting the engines

(a) Confirm or set:—

Entrance door	Open
Brakes	On
Throttles	Closed
~~H.P. cocks~~	~~ON~~
L.P. cocks	ON
L.P. pumps	Integrals only ON
Fuel pressure warning lights	Out
Port master starting switch	ON
No. 2 inverter failure indicator	White
Phase failure indicator (if fitted)	Indicator needle in white sector
Starboard master starting switch	ON
No. 2 inverter failure indicator	Black
Phase failure indicator (if fitted)	Indicator needle in white sector
Ignition switches	ON

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(b) For each engine in turn, port first (see para. 100 (b)), open the H.P. cock and press the starter button firmly.

(c) When the cartridge fires the engine is rapidly accelerated to 1,500 to 1,800 r.p.m. and the r.p.m. will then drop slightly. As the engine lights up the r.p.m. will increase slowly to the idling figure of 2,750 ± 100 r.p.m.

(d) *Failure of an engine to start*

(i) If an engine fails to accelerate to idling r.p.m. close the H.P. cock immediately. When the engine has stopped rotating the starter can be reloaded, after setting the master starting switch OFF. If the starter has been loaded with three cartridges, the H.P. cock can be re-opened and the new cartridge fired as soon as the starter button has re-set.

(ii) If a cartridge fails to fire, carry out the same procedure as in (i) above except that a minimum time of 30

seconds must elapse before reloading or firing a second cartridge. If a second cartridge fails to fire have the electrical circuit checked.

WARNING.—When charged, the capacitor in the high energy ignition unit possesses a lethal voltage. The unit must be isolated and at least one minute allowed before any adjustments may be made near the unit.

(iii) After failure to start, if the H.P. cock is closed without delay there should be no necessity to "blow through" the engine. If in doubt, excess fuel may be removed by firing another cartridge as follows:—

Master starting switch	ON
Ignition switch	OFF
H.P. cock	Closed

If an internal fire is suspected the L.P. cocks and pumps for that engine must also be put off.

(iv) When the engines are running, have the starter battery, if used, removed and the starboard equipment bay door closed.

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100. Checks after starting

(a) *Immediate*

Fire warning light	Out
Oil pressure	10 lb./sq. in. minimum
J.p.ts.	530° C. maximum
R.p.m.	2,750 ± 100

(b) When the port engine has started, complete the checks at (a) above and then operate a hydraulic service. Subsequently, note that the hydraulic pressure builds up again to 2,200–2,700 lb./sq. in. Then start the starboard engine and check it as at (a) above before completing the checks at (c) below.

(c) *Subsequent*

Electrics	Generator warning lights out. D.C. voltmeter 28 volts.
Anti-icing	As required
Entrance door	Closed-jettison handle safe
V.H.F.	Both sets ON
Hydraulic system	Operation of bomb doors, flaps and airbrakes. Leave shut, up and in. Pressure including brakes, 2,200 lb./sq. in. minimum.
NOTE.—Ensure that aileron locks are out.	

Instruments	Mk. 4B compass annunciating and synchronised with navigator's. Compare with standby compass. Erect artificial horizon if necessary
Air-conditioning	Engine air switches ON. Mixing valve as required but see para. 92 (a) (ii)
Aileron and rudder trimmers (see NOTES 1 and 2)	Ensure rudder lock out then operate over full range and return to neutral
Tailplane actuator (B.6) (see NOTE 2)	Test for a "live" circuit by ensuring that the tailplane does not move when either the cut-in switch or the tail-trim switch is operated separately. Then operate the tailplane over its full range and return to T.O. or neutral: then half division UP and DOWN and return to T.O. or neutral.

WARNING.—The aircraft must not be flown if the circuit is proved to be "live" when either the cut-in switch or the tail-trim switch is operated separately or if the tailplane operation is faulty.

B.(I) 6	Test for a "live" circuit by ensuring that the tailplane does not move when the cut-in switch is operated, *i.e.*, flap up. Keep the flap raised and check the tailplane operation as for the B.6.

WARNING.—The aircraft must not be flown if a "live" circuit exists or if the tailplane operation is faulty.

NOTE.—1. In high wind conditions it is advisable to leave the rudder lock in position for taxying to prevent damage to the rudder stops. The rudder trimmer must not be operated when the control lock is fitted.

2. While carrying out checks on the trimmers and tailplane actuator, increase r.p.m., if necessary, to maintain generator output at 28 volts, thus relieving any load on the battery.

101. Taxying

(a) *Checks before taxying:—*

Radio	Tested
Instruments	Serviceability
Pressure head heater	As required
Vent valve heater	As required

(b) Check the operation of the brakes, which are powerful, as soon as possible.

(c) Rudder and control column loads can be high when taxying in strong winds. If the rudder lock has been left in for taxying, apply only sufficient pressure at the rudders to obtain differential braking.

(d) At aft C.G.'s, particularly on B.(I)6 aircraft, avoid high speed taxying, owing to the tendency for the nose to rear.

(e) Under high cross-wind conditions the engines may stall during acceleration. In these conditions take care when opening the throttles.

(f) If it is necessary at any time to stand tail into wind run the engines at sufficient r.p.m. to maintain j.p.t.'s within the limits.

(g) Fuel consumption while taxying is about 30–40 lb. per minute.

102. Take-off

(a) *Checks before take-off:—*

Take-off panel	All switches up
Trimmers	Tailplane to T.O. or neutral Rudder and aileron neutral
Throttles	Friction nut tight
Airbrakes	IN
Anti-icing	As required
Fuel	Contents H.P. cocks ON, friction nuts tight L.P. pumps—all ON Integral transfer cocks NORMAL L.P. cocks—All ON Circuit-breakers for all L.P. cocks and pumps closed Fuel pressure warning lights out
Flaps	Selected and indicating UP
Bomb/flare doors	Closed

Instruments	Instrument supply indicator black Artificial horizon erected, button out Altimeter set Mk. 4B compass annunciating and synchronised with navigator's — check with standby compass Turn and slip indicator D.C. and A.C. voltage J.p.t.'s and oil pressures
Oxygen	Contents, connected and flowing; emergency connected—check with crew
Hatches	D.V. panel closed, entrance door jettison handle up and strapped, normal handle locked
Heating	Engine air switches ON, mixing valve as required
Harness	Tight and locked—check with crew
Flying controls	Full and correct movement
Armament safety plug (B.(I)6)	In

NOTE.—If control locks have been used for taxying do not pressurise the cabin until the control locks have been placed in the aircraft and the entrance door closed. Test the controls for full and correct movement and check the operation of the flaps and trimmers as required.

(b) Align the aircraft on the runway and apply the brakes. Open up the engines to 7,000 r.p.m. and check for poor throttle and j.p.t. synchronisation, an indication of swirl vane malfunction. If an engine is suspect, increase power; throttle and j.p.t. desynchronisation will be more evident and the suspect engine will show a tendency to overspeed. If these symptoms are present abandon the take-off and have the cause investigated. If the above check is satisfactory release the brakes and open the throttles fully.

(c) During the take-off, check the tendency for the nosewheel to rise early in the take-off run and hold it on to the runway until five knots before the unstick speed. At this point move the control column steadily backwards and fly the aircraft off at the correct unstick speed. If the nose-wheel is not held on the runway the take-off run is greatly prolonged and in extreme cases acceleration will be very poor.

Take-off weight (lb.)	Unstick speed (knots)
35,000	110
40,000	115
45,000	125
50,000	135
55,000	140

(d) When comfortably airborne apply the wheel brakes and retract the undercarriage. There is little change of trim, but take care not to exceed 190 knots before the wheels are locked up, particularly at light weights when acceleration is rapid. If 190 knots is reached before the doors are closed, it is possible that they may not close at all. There is no visual indication that the doors are open, but buffeting will be felt. Should this happen reduce speed to about 170 knots to allow the doors to close.

(e) The aircraft accelerates rapidly with an increasing nose up change of trim.

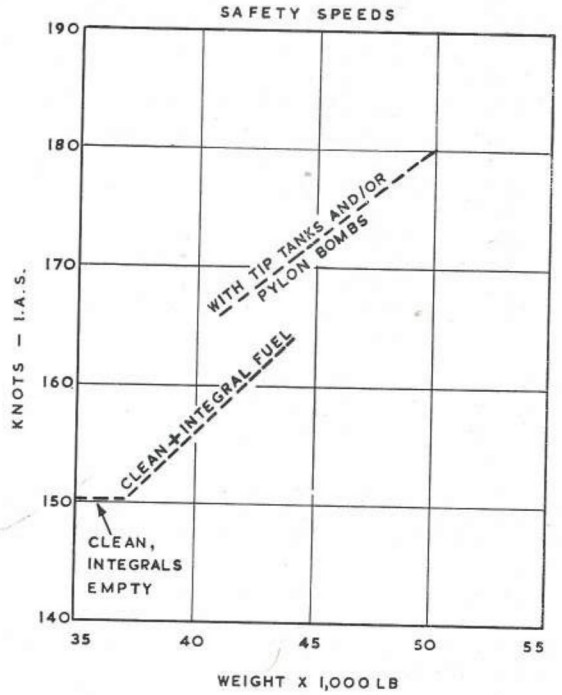
(f) If a climb to altitude is intended throttle the engines to 7,750 r.p.m. and climb at 330 knots (see para. 104 (a)). For circuit practice it is recommended that the speed be kept below 220 knots. For the climb to circuit height 7,000 r.p.m. is ample.

HANDLING IN FLIGHT

103. **Safety speeds**

(a) The safety speed depends on the configuration and disposition of weight away from the centre line of the aircraft and it is shown on the chart below. Failure of one engine will cause very pronounced roll and yaw towards the failed engine. At higher weights the rate of descent is very high if

corrective action is at all delayed and it is difficult to recover unless the safety speed has been reached.



NOTE.—The weights shown above do not include ammunition (B.(I)6) or internal stores since their carriage does not affect safety speed. Therefore, if ammunition or internal stores are carried, their weight must be subtracted from the all-up weight of the aircraft when determining safety speed.

(b) At take-off weights up to 50,000 lb. with external stores (B.(I)6), if safety speed has not been reached when an engine fails, jettison the tip tanks and pylon bombs immediately.

(c) At take-off weights above 50,000 lb. with external stores, the tip tanks and pylon bombs must be jettisoned immediately an engine fails, whether or not safety speed has been reached.

104. **Climbing**

(a) The recommended climbing speed is 330 knots until 0.72 M. is reached at about 20,000 feet. Thereafter maintain 0.72 M. until the desired altitude is reached.

(b) R.p.m. tend to increase with altitude and must be restrained by careful throttling. At high altitudes the precise setting of desired r.p.m. is not easy. Jet pipe temperatures remain roughly constant up to about 30,000 feet, above which they may increase slightly at constant r.p.m.

105. **General flying**

(a) *Controls*

The controls are well harmonized and smooth in operation at all altitudes. The rudder is light and sensitive for small deflections but quickly becomes heavier with increase of movement; use it with care at high I.A.S. The ailerons are light and effective, with very good response at speeds from the stall to high mach numbers, but at speeds above 0.83 M. their effectiveness decreases suddenly. The elevators are powerful and elevator forces are light becoming heavier at high speeds resulting in poorer elevator response at higher mach numbers although still remaining effective.

(b) *Trimmers*

(i) Tailplane incidence control is powerful at all speeds and becomes very sensitive at high airspeeds. The rudder trimmer is powerful and quick in operation; it requires care in its use. The aileron trimmer is the least powerful of the trimmers and slowest in operation.

(ii) Lateral trim is sensitive to asymmetric thrust and rudder trim; a deliberate yawing of the aircraft produces a pronounced rolling motion in the direction of the yaw. It may be stopped by clamping the rudder and moving the ailerons to regain lateral level.

(c) *Use of the tail trim and cut-in switches (B.6)*

(i) *Testing in flight.* Checks must be made periodically in flight to ensure that the switches are functioning correctly by operating each switch separately. If the tailplane moves when the trim switch alone is operated, the flight may be completed and the trimmer still used, but it should be remembered that the

safety factor of the double system will no longer exist and the possibility of a runaway is increased. For this reason speed must then be restricted to a maximum of 250 knots. If the tailplane moves when the cut-in switch alone is operated, the switch must be released immediately; on no account may any further attempt be made to trim in either direction, and the aircraft must be restricted to a maximum speed of 250 knots and landed as soon as possible.

(ii) *Operation in flight*. Tailplane runaway can only occur if there is a double failure. If the cut-in switch is held on, in anticipation of trimming, the safety factor provided by the double circuit is removed. Therefore, except when testing the circuits, the cut-in switch and the trim switch must always be operated and released simultaneously.

(d) *Use of tail trim and cut-in switches* (*B.(I)6*)

(i) *Testing in flight*. As it is not possible to operate the trim circuit without "making" the cut-in circuit, there is no object in trying to test the systems in flight.

(ii) *Operation in flight*. Tailplane runaway can only occur if there is a double failure. By raising the cut-in switch flap in anticipation of trimming the safety factor provided by the double circuit is removed; therefore, the flap must not be raised in anticipation of trimming and it must be released as soon as trimming is completed. If on raising the flap, and before operating the tail trim switch, the tailplane moves, the flap must be released immediately. No further attempt to trim must be made and the aircraft must be restricted to a maximum speed of 250 knots and landed as soon as possible.

(e) *Limited tailplane travel*

If the tailplane runs away to the fully nose-down trim position when Mod. 2125 is embodied, the aircraft will be in trim longitudinally at a speed of between 425 and 450 knots (see para. 33 (c)).

(f) *Airbrakes*

At high I.A.S. the airbrakes are effective, even when in the MID position, but below about 300 knots their effectiveness decreases until at approach speed their effect is

negligible. At high mach numbers their use causes increased buffeting with little deceleration.

(g) *Changes of trim*

Undercarriage down	Slight nose-up	
Undercarriage up	Little change	
Flaps down	Strong nose-up	
Flaps up	Strong nose-down	
Airbrakes out	Little change except for nose-down at high mach numbers	
Airbrakes in	Little change	
Bomb doors open or closed	No change	
Flare doors open	Nose-up	B.(I)6
Flare doors closed	Nose-down	B.(I)6
Dropping pylon bombs	No change	B.(I)6

(h) *Buffeting*

(i) When lowering flaps fully slight buffeting occurs which decreases as speed is reduced.

(ii) When bomb or flare doors are opened at high airspeeds and mach numbers marked buffeting occurs. Buffeting is correspondingly less with lower air speeds and mach numbers.

(j) *Flying at reduced airspeed*

Reduce speed to approximately 150 knots and keep the flaps up.

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(k) *Flying in conditions of severe turbulence*
When flying in conditions of severe turbulence the recommended speed is 240 knots up to 35,000 feet and, in addition, to avoid the possibility of engine flame-out, it is recommended that the r.p.m. on one or both engines be reduced to 7,000.

(l) *Asymmetric bomb-load* (*B.(I)6*)

The handling characteristics with one pylon bomb only are unaltered.

106. Stalling

(a) The approximate stalling speeds in knots are

	32,000 lb.	*42,000 lb.*	*55,000 lb. with tip tanks*
Power off			
Undercarriage and flaps up	85–90	105–110	125
Undercarriage and flaps fully down	75		
Power on			
Undercarriage and flaps fully down	75		

NOTE.—The "power-off" stalling speeds quoted above apply with the engines throttled right back. When practicing stalling, maintain an engine speed of not less than 4,500 r.p.m. to avoid the possibility of stalling the compressor.

(b) Warning of the approach to the stall is given by slight buffeting which starts some 10 to 15 knots above the stall and becomes moderate as the stall is reached. Just before the stall either wing may drop gently; aileron is effective enough to raise the wing but finally as the stall occurs the nose and either wing drop gently together. Recovery from the stall is straightforward on releasing backward pressure on the stick, although in the initial stage of the ensuing dive slight buffeting may again be encountered and care is required to avoid inducing a further stall through too harsh a recovery to normal flight. If corrective action is taken at any time up to the stall, little or no height is lost; if it is taken after the stall has occurred recovery can be effected in about 1,000 feet.

(c) With wing tip tanks fitted, the stalling characteristics are generally similar, but occur about 5 knots earlier. In addition, the pre-stall buffet is more marked and is accompanied by slight aileron snatch, felt as a trembling in the aileron control; the snatching becomes marked if aileron is used to raise a dropped wing.

(d) If underwing stores are fitted the wing drop is sharp, the ailerons become much less effective, and rudder control will be required to correct the roll. If corrective action is

delayed, the roll and pitch down can be severe and recovery may take 1,500–2,000 feet.

(e) At any time when G is applied ample warning of the approach of the stall is given by buffeting which increases down to the stall proper, at which there is a tendency for either wing to drop. Recovery is immediate upon releasing the pull force on the control column.

(f) At high altitudes, and at high weights at low altitudes, aileron snatching in the pre-stall buffet becomes marked.

(g) Because of the great care necessary in engine handling at high altitude (see para. 93 (c)), practice stalling at heights above 25,000 feet is not recommended.

107. High speed flight

NOTE.—1. The limitations are laid down for structural reasons and must not be exceeded.

2. The high mach number characteristics may vary slightly from aircraft to aircraft: they also depend, particularly at high altitude, on the angle of dive (rate of increase of airspeed), on G and on the condition of the aircraft.

3. With wing tip tanks fitted, the compressibility effects described below will occur at slightly lower mach numbers and even lower if they are badly fitted. If complete loss of control occurs recovery may be more difficult.

4. On the B.(I)6 with the gunpack fitted the handling characteristics are similar to those with the aircraft clean.

(a) *Below 15,000 feet*

The speed limitation clean or with pylon bombs is 450 knots or 0.75 M. whichever is the lower.

The speed limitation with tip tanks is 365 knots.

The aircraft is easily capable of exceeding its airspeed limitation, even in level flight. As speed increases there may be a slight change of longitudinal trim, and, at the maximum speed or mach number, slight intermittent buffeting may occur. If a rapid longitudinal oscillation develops at or near the I.A.S. or mach number limitation, reduce speed

as soon as possible until the oscillation ceases. The airbrakes are effective at high I.A.S. but their use is accompanied by noticeable buffeting especially when OUT is used.

(b) *Between 15,000 and 25,000 feet.*
The speed limitation clean or with pylon bombs is 0.79 M.
The speed limitation with wing tip tanks is 365 knots or 0.79 M.
As speed is increased buffeting commences at about 0.77 M. and increases in strength as the speed rises. If the limitation of 0.79 M. is exceeded there is a tendency for lateral unsteadiness to develop.

(c) *Above 25,000 feet*
The speed limitation clean or with pylon bombs is the speed at which a nose-up change of trim occurs, i.e. about 0.84 M.
The speed limitation with wing tip tanks is 0.8 M.

(i) Up to about 35,000 ft. warning of the approach of severe compressibility effects is given by a nose-up change of trim which occurs at about 0.84 M. to 0.85 M. Below this speed the first symptoms are given by slight buffeting which commences at about 0.78 M. to 0.8 M. At about 0.81 M. the buffeting increases in intensity and at 0.83 M. a slight nose-down change of trim occurs, followed by a nose-up change at about 0.85 M. The lateral trim becomes sensitive at these speeds and lateral unsteadiness may be encountered.

(ii) Above 35,000 feet warning of the approach of severe compressibility effects is given by lateral unsteadiness and a tendency for one wing, generally the starboard, to drop slowly at about 0.84 M. This tendency occurs at slightly lower speeds, between 0.82 M. and 0.83 M., at about 45,000 feet. On the B.(I)6 the wing heaviness is preceded by aileron snatch if pylon bombs are fitted. Below these speeds the symptoms are much the same as in (i) above.

(iii) Above 35,000 feet, if the aircraft is accelerated past the speed at which there is a wing drop, aileron snatching and a loss of aileron effectiveness usually occurs, making it difficult to restore lateral level. At the same time elevator effectiveness falls off markedly and severe buffeting sets in. Should control be lost, great care must be taken to avoid overstressing the aircraft during subsequent recovery at the lower altitudes when the airspeed may be high. Avoid the use

of the tail trimmer during recovery if possible, but if it has to be used, extreme care must be taken.

(iv) The behaviour under compressibility will vary between aircraft and is also likely to vary on individual aircraft depending on the C.G. position and the external condition of the aircraft. Although the wing drop case above is given as being the most critical from the point of view of possible temporary loss of control, other effects such as strong nose-up or nose-down changes of trim, lateral rocking and directional instability may be apparent and are equally critical. As soon as compressibility effects become marked, particularly at the highest altitudes, speed must be reduced, as the consequences of increasing the speed still further are unpredictable and may be serious. The remarks in this paragraph apply both to the clean aircraft and when wing tip tanks are fitted.

(v) Recovery from mild compressibility conditions is best made by throttling back to not less than 6,500 r.p.m. and easing the aircraft out of the dive, care being taken to avoid high G which will aggravate matters.

(vi) If loss of control is experienced the engines must be throttled right back and the airbrakes extended to the MID position: on no account may the OUT position be used. About 10,000 feet may be lost before the mach number has fallen to a figure at which control can be regained. During recovery, G loads must be kept low. Avoid the use of the tail trimmer during recovery if possible, but if it has to be used, extreme care must be taken.

(vii) At all heights, if the engine power is high, only a shallow dive is needed to reach the limiting speeds.

108. **Descent**

(a) *Rapid descent*
The recommended technique in making a rapid descent is to close the throttles, extend the airbrakes fully and descend at 0.75 M. until a coincident speed of 400 knots without tip tanks or 365 knots with tip tanks is reached, maintaining the appropriate speed thereafter.

(b) *Descent in icing conditions*

If icing conditions require the use of the engine anti-icing system, maintain engine r.p.m. at 6,100 and descend at the same mach number and speeds as in (a) above.

(c) *Altimeter error*

The altimeters are subject to error during rapid descents from high altitude. Tests indicate that these errors may be up to 200 feet, the altimeter reading high. Therefore special care is required on the final approach after a rapid descent.

CIRCUIT PROCEDURE AND LANDING

109. **Approach and landing**

(a) *Checks before landing*

Before joining the circuit check:—

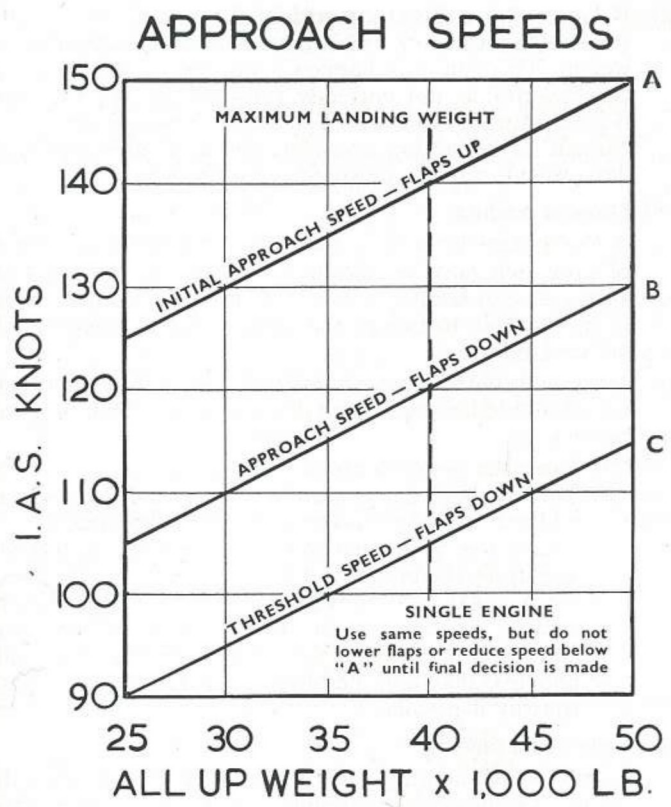
Fuel	Contents. L.P. cock and pump switches of tanks with fuel remaining ON and circuit-breakers closed.

After joining the circuit reduce speed to 170 knots and check:—

Airbrakes	IN.
Undercarriage	DOWN, three green lights.
Bomb or flare doors	Closed.
Harness	Tight and locked—check with crew.
Brakes	Operation and off, pressure 2,200 lb./sq. in. (minimum).

(b) Approach speeds are shown on the chart on page 89. On the crosswind leg keep the speed at A, turn on to the final approach, lower flaps and reduce speed to B. When the decision to land has been made reduce speed progressively to cross the threshold at C.

(c) Until the decision to land has been made, the r.p.m. must be kept above 4,500 and an exaggerated nose-up attitude avoided. On throttling back the thrust and speed reduce slowly. To ensure that the touchdown is made with the least amount of residual thrust throttle back on reaching the runway threshold.



APPROXIMATE ALL-UP WEIGHTS (lb.)

	B.6	B.(I)6
Crew only	**24,500**	**26,000**
Full fuselage tanks	**35,500**	**37,000**
Full fuselage and integrals	**42,500**	**44,000**
Full fuselage and tip tanks	**39,500**	**41,000**
Full fuel including tips	**46,500**	**48,000**
300 gallons remaining	**27,000**	**28,500**

NOTE.—No bombs or ammunition are included in these weights.

(d) If landing at a C.G. forward of 21 inches, increase the threshold speed by 10 knots above the normal speed for the weight. This can only happen if bombs are hung up and the fuel drill is not correctly followed or has not functioned properly. In cases of doubt ascertain the extent of control in the landing configuration at a safe height and determine the approach speed accordingly.

110. **Flapless landing**

(a) A slight increase in drag and thus a slightly steeper angle of approach may be obtained by carrying out the final approach and landing with the bomb or flare doors open. It is advisable to reduce the weight as much as possible before landing.

(b) Turn on to the final approach at 140 knots. The approach, which should be longer than that for a normal landing, will be very flat.

(i) Open the bomb doors.
(ii) Throttle back early, aiming to cross the threshold at 10 knots above the normal speed for the weight.
(iii) Lower the nosewheel immediately after touchdown and apply the brakes fully.
(iv) On a 2,000 yard runway a flapless landing may be carried out comfortably following a correctly executed approach, at weights up to 40,000 lb. At weights above 35,000 lb. if the runway is wet, use a 3,000 yard runway if possible.

111. **Cross-wind landing**

A cross-wind landing presents no special difficulty; the "crab" technique is recommended. If the cross-wind is gusting above 15 knots increase the threshold speeds by 5 to 10 knots.

112. **Landing with one wing tip tank full**

If one wing tip tank does not feed and the other one is empty, a safe landing is possible provided that the speed is kept about 5 knots above the minimum for adequate control, which should be checked at a safe height, and that weather and runway conditions are suitable (see also para. 126).

113. **Braking**

(a) When the nose wheel has lowered on to the runway the brakes can be used continuously and the maxaret units will prevent wheel-locking. The landing run can be cut to less

than half normal by using continuous full brake, but as this procedure causes rapid brake wear do not adopt it as a normal practice.

(b) The aircraft must be firmly on the ground before applying the brakes. If the aircraft is allowed to touch down with the brakes on, the maxaret units will not operate and the wheels will lock. However, if once having started turning the wheels should stop because of a skid or a bounce, they will not lock unless the skid or bounce continues for more than four seconds.

(c) Make every effort to avoid overheating the brakes, by using the brakes judiciously according to the length of the runway. Do not make landings involving heavy braking at intervals of less than ten minutes and if, while taxying after such landings, heavy differential use of the brakes is made, double the time interval.

(d) When landing in overload conditions, i.e. above 40,000 lb., great care must be taken when braking, as severe overheating to the point of causing fire in the brake drums may occur. Use aerodynamic braking until the air speed falls below 90 knots.

114. **Instrument approach**

The following speeds, flap and approximate power settings, are recommended for use during instrument approaches.

	R.p.m.	U/c.	Flap	I.A.S. (knots)
ALL UP WEIGHT 30,000 LB.				
Pattern	6,300	Down	Up	140
Final	6,300	Down	Up	140
Glide path	6,300	Down	Down	115 reducing to 100
ALL UP WEIGHT 40,000 LB.				
Pattern	6,600	Down	Up	150–160
Final	6,600	Down	Up	150–160
Glide path	6,500	Down	Down	150 reducing to 110
ALL UP WEIGHT 40,000 LB. ONE ENGINE				
Pattern	6,700	Up	Up	160
Final	6,700	Up	Up	160
Glide path	6,700	Down	Up	150
Glide path, 3 miles ..	6,700	Down	Down	reducing to 120

NOTE.—When the glide path is intercepted and flap is lowered, the rate of descent tends to be reduced. To maintain the desired rate of descent push the control column forward against the trim until the flaps are fully down and the aircraft is trimmed into the descent. With Mod. 2125 embodied and full nose down trim applied, a residual push force will remain until the speed is below approximately 125 knots.

115. **Overshooting**

(a) If possible retain a minimum of 1,250 lb. of fuel, which allows five minutes' flying, for this eventuality.

(b) Open the throttles smoothly to 7,000 r.p.m. and check that symmetrical power is being obtained, raise the undercarriage and flaps and increase power. If the thrust at 7,000 r.p.m. is not symmetrical, due to swirl vane malfunctioning, the thrust of the serviceable engine must be increased only within the limits of rudder control. Check that the tailplane actuator is functioning correctly before raising the flaps. There is a strong nose-down change of trim during the last half of the flap travel; anticipate this by progressive application of nose-up trim as the flaps retract. The aircraft will accelerate quickly and any tendency to sink is easily held.

(c) Practice "roller" landings are not recommended because of the possibility of compressor stall and engine surge while opening up from the fully throttled position, especially in cross-wind conditions. If in emergency it becomes necessary to go round again from the runway, observe the following precautions:

(i) When opening the throttles particular care must be taken up to 4,500 r.p.m. and allowance made for some difference in response from each engine.

(ii) Keep the nose-wheel on the runway until the engines have reached 7,000 r.p.m.

(iii) Check at 7,000 r.p.m. that symmetrical thrust is being obtained before opening the throttles further.

116. **Checks after landing**

U/C SAFETY SWITCH	Down
Canopy and hatch jettison master switch	OFF
Brakes	2,200–2,700 lb./sq. in.
Flaps	UP
All radar	Off
L.P. cocks and pumps	One for each engine ON, remainder OFF
Pressure head heater	OFF
Vent valve heater	OFF
Canopy de-misters	OFF
D.V. panel heater	OFF
Engine air switches	OFF
Mixing valve	HOT
D.V. panel	Open (to relieve residual cabin pressure)
Anti-icing	OFF
Trimmers	All neutral
Armament safety plug (B.(I)6)	Removed
External lights	As required

NOTE.—At night cockpit lighting and taxy lamps as required.

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117. **Shut-down procedure**

(a) Before stopping the engines, trim the tailplane to fully nose-down and then give one " blip " up on the tail trim switch to ease tension on the tailplane micro-switch spring. This will prevent ingress of moisture to the actuator jack.

(b) Stop the engines, port first, by closing the H.P. cocks. When the port engine has stopped, operate a hydraulic service and, subsequently, note that the hydraulic pressure builds up again to 2,200–2,700 lb. sq. in. before stopping the starboard engine.

(c) *Checks after stopping the engines*

Brakes	Off when chocks in position
Bomb flare doors	Open, locking pin in
Master starting and ignition switches	OFF
All electrical services	Off
L.P. cocks and pumps	OFF
Flap lever locking pin	In
Rudder lock	In
Battery isolating switch	OFF
Ejection seats	Safety pins in

ASYMMETRIC FLYING

118. Stopping an engine in flight

When closing down an engine in flight deliberately, first stop No. 5 inverter and switch off the appropriate generator. Then stop the engine by closing the throttle and then shutting the H.P. cock: keep at least one L.P. cock ON and switch off the appropriate engine air switch.

119. Flying on one engine

(a) The aircraft has a good single-engine performance and the rudder trimmer is powerful enough to trim out all foot loads at normal cruising speeds. On one engine, at 7,400 r.p.m. a speed of about 330 knots will be maintained in level flight below 5,000 feet.

(b) When flying on one engine (or if a generator fails) some electric load must be shed to conserve the aircraft battery. It will normally be sufficient merely to stop No. 5 inverter. If it is desired to use the Gee receiver or Rebecca, No. 4 inverter may be started after switching off all non-essential electrical loads. When using only one generator use the tailplane actuator as little as possible.

120. Relighting an engine in flight

(a) If an engine flames out, an *immediate* relight may be attempted by pressing the relight button for 2 seconds and then releasing it, leaving the throttle and H.P. cock at their set positions. A successful relight will be indicated by the r.p.m. stabilising and then commencing to rise. Ensure that the maximum j.p.t., by throttling back if necessary, is not exceeded. The likelihood of obtaining an immediate relight is increased if the height and airspeed are below the permitted maxima for relighting given at (b) below.

(b) Normal relighting is practicable at heights up to 35,000 feet and at speeds up to 200 knots. Relighting becomes progressively more certain with reduction of altitude and airspeed; therefore attempting relighting above 35,000 feet is not recommended. Below 25,000 feet relighting may be attempted at any speed.

(c) Ensure that the H.P. cock is closed, and then:—

(i) Above 25,000 feet reduce speed to 200 knots or less until the windmilling r.p.m. are 1,000–1,200.

(ii) Ensure that at least one L.P. cock and one pump are on and that the fuel pressure warning light is out.

(iii) Check the master starting switch ON.

(iv) Close the throttle fully.

(v) Press the relight button whilst opening the H.P. cock. (See also (d) below.)

(vi) When the r.p.m. start rising, release the relight button.

(vii) When the r.p.m. have stabilised, the engine may be opened up smoothly to the desired r.p.m.

(d) If the engine r.p.m. fail to build up within 30 seconds of pressing the relight button, release the relight button and close the H.P. cock immediately. Another attempt may be made to relight the engine after allowing a period of two minutes for the engine to dry out and, if the height is critical, after descending to a lower altitude.

121. Asymmetric landing and overshoot

(a) *Landing*

Maintain a speed of at least 150 knots while positioning the aircraft with the flaps up. Lower the undercarriage in the normal position on the circuit. Maintain speed A given on the approach speed chart until the final decision to land is made at 600 feet A.G.L. or above, then lower the flaps and reduce speed to cross the threshold at the speed recommended for a normal landing.

(b) *Overshoot*

(i) An overshoot can be done comfortably provided that the speed is at least that given in line A on the approach speed graph.

(ii) Raise the undercarriage and carefully increase power on the live engine, taking care to maintain directional control. Allow the speed to build up to 180 knots and climb away at this speed. *Unless power is increased carefully control will be lost.* Rapid increases in power can result in marked yaw and loss of height.