PART III

HANDLING

LIST OF CHAPTERS

PART III—HANDLING

Chapter 1—PREPARATION FOR FLIGHT

(Completely revised by A.L.1)

CONTENTS

1. External checks

(a) Ensure that the hydraulic accumulators are exhausted, then carry out a general check of the aircraft exterior. The following specific checks must be made: —

Undercarriage locks ...	Removed
Control surface locks ...	Removed (see sub-para. (b))
Hydraulic accumulators ...	1350 $^{+50}_{-0}$ PSI at + 5°C.
Hydraulic ground/flight cock	Wired in FLIGHT position
Pressure head	Cover removed
Static vents	Plugs removed
External power	Disconnected

(*b*) In high wind conditions it may be necessary to leave the external rudder locks in for taxying, and in winds above 35 kts. the aileron locks should also be fitted. If the aileron locks are left in for taxying, the flaps must be fully up before the locks are fitted and the flap selector must be locked up by its locking pin until the pre-take-off checks.

WARNING: The flaps will be damaged if the aileron trimmer or the flap selector is operated whilst the aileron locks are in. The rudder trimmer must not be operated whilst the rudder lock is in.

2. Internal checks

(*a*) On entering the aircraft confirm or set:

MASTER SAFETY switch	OFF
Hatch SAFETY switches (2)	OFF
Ejection seats (crew check)	
Safety pin	In face screen firing handle
Emergency oxygen ...	Static line connected

Emergency oxygen bottle	Safety pin removed
Auto harness release ...	Static line secure
Auto parachute release ...	Static line secure
Parachute barometric release	Cap in place
Drogue gun	Static line connected, safety pin removed
Drogue shackle	Secure
Intercomm. leads ...	Connected
Top latch	Locked
Safety harness and leg restraint cords ...	Secure
Canopy JETTISON switch	OFF and guarded
Hatch JETTISON switches	OFF and guarded
Bomb JETTISON switch ...	OFF
FUEL TANK JETTISON button	Guarded
Undercarriage SAFE/LIVE switch	SAFE
Undercarriage DOWN button	In
Battery isolating switch ...	ON—check voltage and U/c lights—then OFF
Hydraulic hand pump ...	In position, check operation
Pilot's Notes	Stowed
Fire extinguisher	Stowed
Crash axe	Stowed
First-aid kit	Stowed
Asbestos gloves	Stowed
Signal pistol and cartridges	Secure and stowed
Drying crystals	Serviceable (blue)
Generator switches ...	ON
No. 4 and 5 inverters ...	OFF
Radar	OFF
Electrical control panel ...	All circuit breakers closed

NOTE: The hydraulic pump handle must be in position at all times except when the folding seat is occupied when it should be in position for taxying, take-off and landing only.

(*b*) *Cockpit checks*

When strapped in (see Pt. I, Chap. 9, Para. 18 for procedure) adjust the rudder pedals and seat for comfort, check oxygen and RT connections made, then check:—

External power *or* battery isolating switch	ON
Intercomm. (crew check) ...	ON and NORMAL

DC volts	23 volts min. on load
Internal lights	Set
Emergency lights	Checked and off
External lights	Checked off/as required
Bomb door safety pin ...	Stowed
*Flap safety pin	Stowed
UC safety clip ,(if fitted) ...	Stowed
Ejection seat pins	Out and stowed (crew check)
*External control locks ...	Out
*Flying controls	Full and free movement

*Except when aileron/rudder locks left in for taxying.

Port console

Bomb doors emergency lever	Wired SHUT (up)
Tip tanks jettison button ...	Guard flap down
Heaters and air drier	All switches OFF Pressure head ON
Bomb doors selector ...	OPEN
Bomb safety switch if fitted	OFF
Bomb jettison switch ...	OFF
Snatch unit	Wire locked
MASTER SAFETY switch	OFF
Fuel pump isolation switches	NORMAL (down)
Throttles and HP cocks ...	Checked, shut, friction set
IFF switches	OFF
Internal demister	OFF (clockwise)

Port front panel

Undercarriage

Emergency selector ...	Wired in
DOWN button	In
Emergency override ...	Horizontal
Indicator	3 greens, changeover and screens checked
Master switch	SAFE
Flaps	UP and indicating UP

Engine starting panel

Oxygen (crew check)

Contents	Sufficient
ON/OFF switch ...	Wired ON
Selector	100% (17D), NORMAL (17E)

Pressure	Checked (200-400 PSI)
Connections, indicators ...	Checked and indicating
Emergency flow	Checked
Master start and ignition switches	OFF
VHF	OFF, selected No. ..... Box. Volume as required
Comp-D. Gyro switch ...	COMPASS
Cabin press. warning switch	ON

Flight instruments panel

Flight instruments	Undamaged
Altimeter	Set Zero
G. Mk. 4B compass ...	Align with standby
Turn-and-slip emergency supply	Checked and OFF (if fitted)

Engine instruments panel

Generator warning lights ...	On
Recuperator switches (if fitted)	OFF
Engine instruments ...	Undamaged
Fuel pressure warning lights	On
Fuel contents	Checked ..... lb.
LP pumps	Checked singly
Overload tank (if fitted) ...	Check pumps, leave OFF

Miscellaneous

UHF (if fitted)	OFF
Engine air switches ...	OFF
Cabin heat control	COLD (pre-mod. 5) HOT (post-mod. 5)
Door jettison handle	Strapped up
Airbrakes	IN
External power (if used) ...	Disconnected
Battery isol. switch ...	ON
DC volts	23 volts min.
Starboard equipment hatch	Locked—key stowed

PORT FRONT PANEL

Undercarriage emergency selector	Wired in
Undercarriage selector ...	DOWN button in, UP button override horizontal
Undercarriage position indicator	Three green lights, check changeover and day/screen.
Undercarriage master switch	SAFE (down)
Flap selector	UP

FLIGHT INSTRUMENTS PANEL

Instruments	Undamaged
Altimeter	Set to zero
Turn-and-slip emergency supply	Test, leave OFF
MK. 4B compass	Align with standby compass

ENGINE INSTRUMENTS PANEL

Instruments	Undamaged
Generator warning lights ...	On, day/night screens open.
Fuel gauges	Contents
Fuel pressure warning lights	On, day/night screen open
LP cocks and pumps ...	*Unmodified aircraft* Operation of each cock and pump aurally and against fuel pressure warning lights and leave OFF.

LP cocks and pumps (continued)	*Bomber Command Mod.* 32, *Pt.* 1 *aircraft* Operation of each pump aurally and against fuel pressure warning lights and leave OFF.
	Bomber Command Mod. 90 *aircraft* Operation of each cock and pump aurally and against the fuel pressure warning lights—leave the cocks ON and the pumps OFF.
Overload tank (if fitted) ...	If to be used, check pumps aurally and leave OFF.

ENGINE STARTING PANEL

Master start and ignition switches	OFF
VHF	Both sets OFF, selector switch to approach, volume full
MK. 4B compass changeover switch	COMP.

MISCELLANEOUS INSTRUMENT PANEL

Cabin pressure warning horn override switch	ON
Cabin heat and pressure control	*Pre-Mod.* 5. Operation of mixing valve and leave COLD.
	Post-Mod. 5. Engine air switches OFF. Operation of mixing valve and leave HOT.

Hydraulic pressure gauge(s)	Brake pressure 1,500 PSI minimum
Entrance door	Open, jettison handle strapped up.
Airbrakes	IN

Have the external power supply disconnected (if used) and the starboard lower equipment hatch locked.

Battery isolation switch ...	ON—check voltage 22 volts minimum

PART III—HANDLING

Chapter 2—STARTING, TAXYING AND TAKE-OFF

CONTENTS

1. Starting the engines

◀Confirm or set:

Entrance door	Open
Brakes	On (1,500 PSI min.)
Throttles and HP cocks ...	Closed
Port master start switch ...	ON
Emergency instrument supply	Indicator white
T-and-S and AH flags ...	Not showing
Starboard master start switch	ON
Emergency instrument supply	Indicator black
Ignition switches	ON
LP pumps	No. 3 tank ON
Fuel pressure warning lights	Out
Clear with groundcrew ...	

Start port engine

HP cock	ON, starter button pressed
*RPM	Normal
*Fire warning light	Out
*Oil pressure	Normal (3 PSI min.)
*JPT	Normal (500°C max.)
*Generator warning light(s)	Out. (Once idling RPM (2,700 ± 100) is reached, set RPM at 5,000 and check AC 115V, DC 28V) ▶

◀Bomb doors ... ... CLOSED, hydraulic pressure (2,400-2,500 PSI)

Clear with ground crew ...

Start starboard engine

HP cock ... ... ON, starter button pressed

Check starred items above, then throttle back the port engine to 2,750 RPM; check that the generator warning light comes ON, then increase RPM on the starboard engine to 5,000 RPM. Check generator warning light out, DC volts 28, AC volts 115, Emerg. inst. supp. indicator black. ▶

2. Failure to start

(*a*) If an engine fails to accelerate to idling RPM or a cartridge fails to fire, the HP cock must be closed immediately and the master starting and ignition switches set to OFF before any further action is taken.

(*b*) If, after a cartridge has fired, the pressure relief valve blows (indicated by clouds of black smoke in the engine air intake) or the starter fails to accelerate the engine to more than 1,000 RPM no further attempt may be made with that starter, which is to be removed as suspect.

(*c*) If a cartridge fails to fire, at least 1 minute must elapse before the starter breech cap is removed. If a second cartridge fails to fire, have the electrical system checked.

(*d*) After a failure to start, if the HP cock is closed without delay, there should be no necessity to " blow through " the engine. If in doubt and provided that the engine has accelerated to more than 1,000 RPM in the previous attempt any excess fuel may be removed by firing a further cartridge as follows: —

Master starting switch	ON
Ignition switch	OFF
HP cock	OFF
LP pumps	OFF
Starter button	Press

◀3. Checks before taxying

NOTE: If control locks are left in for taxying delay the checks of the flaps, aileron trim and rudder trim until the pre-take-off checks.

▶

◀Voltmeter	28V with 5,000 RPM set; check generator warning light goes out at 3,300 RPM
Phase failure indicator ...	Needle in white sector
Entrance door	Closed, check handle
Radios	VHF on, UHF on, test
Flaps	Checked and UP
Airbrakes	Checked and IN
Hydraulic pressures ...	2,400-2,500 PSI
Aileron trim	Checked and neutral
Rudder trim	Checked and neutral
Tailplane actuator ...	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 independently. Then operate the tailplane over the full range and return to neutral; then half a division up and down and return to neutral
Mk. 4B compass	Annunciating on ..... Standby .....
Altimeter	QFE ..... mbs. .....ft.
LP pumps	Checked singly
Recuperator (if fitted) ...	ON
Radios	Checked ▶

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

4. Taxying

(*a*) Check the operation of the brakes, which are powerful, as soon as possible. Reduce speed when turning or manoeuvring and do not turn with one wheel locked.

(*b*) Check serviceability of flight instruments during turns.

(*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 rudder pedals to obtain differential braking.

(*d*) At aft CG's avoid high speed taxying, owing to the tendency for the nose to lift.

(*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 RPM to maintain JPTS within the limits.

(*g*) Fuel consumption while taxying is about 32 lb. per minute.

◀5. Checks before take-off

NOTE: If control locks have been used for taxying do not pressurise the cabin until the locks have been placed in the aircraft and the entrance door closed. Test controls for full and correct movement and check the operation of the flaps, aileron trimmer and rudder trimmer.

RPM	One engine set at 5,000 RPM
Trimmers	All neutral
Throttles and HP cocks ...	Friction adjusted
Airbrakes	IN
Flaps	UP indicating UP
Bomb doors	Closed
Fuel	
Pump isol. switches ...	NORMAL (down)
HP cocks	ON
Contents	Sufficient (..... lb.)
LP pumps	All ON, except overload tank (if fitted)
Recuperator switches, if fitted	ON
Fuel pressure warning lights	OUT
Cock and pump circuit breakers	All made
Instruments	
Heaters	All ON
Sandwich drier and internal demister	OFF
DC and AC volts	Checked
Emergency inst. supply	Indicator black
Artificial horizon ...	Erect, button out, free
Altimeters	Zero set ..... mbs, compare
Turn-and-slip indicator ...	Checked ▶

◀ G Mk. 4B compass	...	Annunciating, Heading ..... Standby .....
JPTS and oil pressures	...	Checked
Fire warning lights	...	Out
Oxygen (crew check)	...	Contents, connected, flowing
Engine air switches	...	ON
Mixing valve ...	...	HOT (pre-mod. 5); as required (post-mod. 5)
Hatches	...	DV panel closed; door locked. Jettison handle up and strapped
UC master switch ...	...	LIVE
MASTER SAFETY switch		ON
Hatch SAFETY switch	...	ON
Ejection seat pins ...	...	Confirmed out (crew check)
Harnesses	...	Tight and locked
Flying controls ...	...	Full and free movement ▶

6. Take-off

(*a*) Align the aircraft on the runway and apply the brakes. Open up the engines to 7,000 RPM and check for poor throttle and JPT synchronisation, an indication of swirl vane malfunction. If an engine is suspect, increase power; throttle and JPT desynchronisation will be more evident and the suspect engine will show a tendency to over-speed. 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.

(*b*) During the take-off, check the tendency for the nosewheel to rise early, and hold it on the runway until 5 knots before unstick speed. At this point move the control column steadily backwards and fly the aircraft off at the correct unstick speed. If the nosewheel 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*)
30,000	100
35,000	109
40,000	117
45,000	125

(*c*) When comfortably airborne apply the wheelbrakes momentarily 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.

(*d*) The aircraft accelerates rapidly with an increasing nose-up change of trim.

(e) If a climb to altitude is intended, throttle the engine to 7,600 RPM and climb at 330 knots (see Part III, Chap. 3, para. 1). For circuit practice it is recommended that the speed be kept below 220 knots. For the climb to circuit height 7,000 RPM is ample.

(*f*) *Safety speed*

The safety speed depends on the configuration and disposition of weight away from the centre line of the aircraft. The safety speed with full tip tanks is 140 knots. (See Pt. IV, Ch. 1, for action to be taken in the event of engine failure on take-off).

◀(*g*) *Abandoned take-off*)

The aircraft is cleared for engagement with the Mk. 5 or Mk. 6 arrester barrier. If take-off is abandoned and it becomes necessary to engage an arrester barrier, proceed as follows:—

(i) Make RT call "Barrier" and close HP cocks.

(ii) Make an early decision on whether to jettison or retain wing tip tanks.

(iii) Retain the canopy and navigator's hatch.

(iv) Aim to engage between the verticals and, if possible, in the centre of the net.

(v) Duck head forward and release brakes just before entry.

(vi) After entry use steady wheel braking.

(vii) Apply parking brake when aircraft comes to rest (to prevent roll back).

(viii) If circumstances permit, switch off all master switches, battery isolating switch, LP cock/pumps, and make aircraft "safe for parking" before leaving the aircraft.▶

engine. If in doubt and provided that the engine has accelerated to more than 1,000 RPM in the previous attempt any excess fuel may be removed by firing a further cartridge as follows:—

Master starting switch	ON
Ignition switch	OFF
HP cock	OFF
LP pumps	OFF
Starter button	Press

3. Checks before taxying

Voltmeter	28 volts, increase RPM as required
Phase failure indicator (if fitted)	Needle in white sector
Entrance door	Closed and secure
Engine air switches ...	ON
Cabin heat control ...	As required, but see Pt. I, Chap. 8, para. 3.
VHF	ON and test
Fuel	Check LP pumps individually against fuel pressure warning lights
Hydraulic system	Gauge(s) pressure 2,000-2,500 PSI. Ensure aileron locks out and then check operation of flaps and airbrakes.
Aileron and rudder trimmers	Ensure rudder lock out then operate over full range and return to neutral.

Tailplane actuator ...	...	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 independently. Then operate the tailplane over the full range and return to neutral; then half a division up and down and return to neutral. Test for override.

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

Pressure head heater	...	As required
Vent valve heater ...	...	As required
Instruments ...	...	MK.4B compass annunciating and synchronised with navigator's. Compare with standby compass. AH erect, button out.

NOTE: 1. In high wind conditions (25 kts. or over) it is advisable to leave the rudder locks 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. The electrical load is high while carrying out checks on the trimmers and the tailplane actuator. If necessary, increase the RPM to maintain generator output at 28 volts while the checks are being carried out.

4. Taxying

(a) Check the operation of the brakes, which are powerful, as soon as possible. Reduce speed when turning or manoeuvring and do not turn with one wheel locked.

(b) Check serviceability of flight instruments during turns.

(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 rudder pedals to obtain differential braking.

(d) At aft CG's avoid high speed taxying, owing to the tendency for the nose to lift.
(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 RPM to maintain JPTs within the limits.
(g) Fuel consumption while taxying is about 32 lb. per minute.

5. Checks before take-off

Trimmers	All neutral
Throttles and HP cocks ...	Friction nuts tight
Airbrakes	IN
Flaps	UP and indicated UP
Bomb doors	Closed
Fuel	Pump isol. switches—NORMAL. HP cocks—ON
	Contents
	LP pumps—all ON
	Fuel pressure warning lights out. LP pump and cock circuit breakers—all closed
Instruments	DC volts
	Phase failure indicator (if fitted)—needle in white sector
	EMERGENCY INST. SUPPLY indicator black.
	AH erect, button out.
	Altimeter set, check with navigator
	Turn-and-slip indicator.
	MK.4B compass annunciating and synchronised with navigator's.

	Check with standby compass.
	JPT's and oil pressure.
	Fire warning lights.
Oxygen	Contents, connected and flowing; emergency connected-check with crew
Hatches	DV panel closed, entrance door jettison handle up and strapped.
Heaters	Pressure head, DV panel and vent valve heaters ON.
	Canopy interspace air drier ON. Canopy internal demister OFF.
Cabin heating/Pressurisation	Engine air switches ON, mixing valve as required.
Master safety switches ...	ON, check with crew.
Ejection seat pin	Out, check with crew.
Undercarriage master switch	LIVE
Harness	Tight and locked, check with crew.
Flying controls	Full and correct movement.

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 controls for full and correct movement and check the operation of the flaps and trimmers as required.

6. Take-off

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

(b) During the take-off, check the tendency for the nosewheel to rise early, and hold it on the runway until 5 knots

before unstick speed. At this point move the control column steadily backwards and fly the aircraft off at the correct unstick speed. If the nosewheel 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)*
30.000	100
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40,000	117
45,000	125

(c) When comfortably airborne apply the wheelbrakes momentarily 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.

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

(e) If a climb to altitude is intended, throttle the engine to 7,600 RPM and climb at 330 knots (see Part III, Chap. 3, para. 1). For circuit practice it is recommended that the speed be kept below 220 knots. For the climb to circuit height 7,000 RPM is ample.

(f) *Safety speed*

(i) The safety speed depends on the configuration and disposition of weight away from the centre line of the aircraft. The safety speed with full tip tanks is 140 knots. (see Pt. IV, Ch. 1, for action to be taken in the event of engine failure on take-off).

PART III

HANDLING

CHAPTER 3—HANDLING IN FLIGHT

CONTENTS

1. Climbing

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

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

(c) The canopy internal demister must not be on during a climb.

(d) *Climbing checks*

Make the following checks at 10,000 feet intervals on the climb, and periodically thereafter:—

Oxygen contents, flow and connections, check with crew.
DC voltage, generator warning lights and EMERGENCY INST. SUPPLY indicator black.
Phase failure needle (if fitted) in white sector.
RPM, JPT's and oil pressures.
Cabin altimeter.

2. Engine handling in flight

(a) *Engine acceleration*

(i) Operate the throttles smoothly at all times and avoid slam accelerations.

(ii) At all times during flight avoid using engine RPM lower than 4,500. Acceleration to full power from 4,500 RPM can be obtained within 5 seconds; accelerations from below this figure take considerably longer and care must be taken when opening up again otherwise it is possible to stall the compressor, particularly when the speed is low and the aircraft is sinking.

(b) RPM *surge at altitude*

(i) While the ACU is designed to operate up to 5,000 ft. its action and, therefore, engine acceleration, deteriorates progressively with altitude, and care is required when increasing power at high altitudes, especially for the early stages of throttle opening at low IAS. Too rapid throttle opening may cause surge which may lead to severe overheating or flame-out. If surge occurs, the throttle must be closed and speed increased before another attempt is made to open up the engine(s) using a slower throttle movement.

(ii) When using maximum RPM at low forward speed in extremely cold air at high altitudes, there is a risk of surge followed by flame-out, this risk varying according to the modification standard of the compressor. Avon Mod. 542 increases the angle of the compressor 10th stage blades to improve the surge characteristics. The risk can be obviated by flying at reduced RPM according to variations in indicated air temperature and altitude as follows:—

Altitude correction factor (*all Avon* MK. 1 *engines*)
Reduce RPM from 7,800 by 15 RPM for each 1,000 feet above 30,000 feet.

Indicated air temperature correction factor (*without Avon Mod.* 542):
Reduce RPM from 7,800 by 20 RPM for each 1°C. below −50°C. IAT.

Indicated air temperature correction factor (*with Avon Mod.* 542):

Reduce RPM from 7,800 by 20 RPM for each 1°C. below −70°C. IAT.

NOTE: If the aircraft is flying above 30,000 feet but the indicated air temperature is higher (warmer) than the above limit, the temperature correction factor may be used in the same ratio and subtracted from the altitude correction factor, thus maintaining optimum conditions but not exceeding 7,800 RPM.

1. *Example Pre-Mod.* 542

Altitude 40,000 feet ...	Reduce RPM from 7,800 to 7,650.
Indicated air temperature −55°C.	Reduce RPM by a further 100 to 7,550.

2. *Example Post-Mod.* 542

Altitude 45,000 feet ...	Reduce RPM from 7,800 to 7,575.
Indicated air temperature −60°C.	Increase RPM by 200 to 7,775.

(*c*) *Use of* HP *pumps isolating valves*

(i) Failure of the HP pump servo control system will cause a sudden drop in engine RPM. If a sudden drop occurs in flight first establish that this is not due to booster-pump failure or to icing. If neither of these is the cause, close the throttle and select ISOL (up) on the appropriate isolating valve switch. If the engine then idles normally an attempt may be made to accelerate it. If it fails to idle normally close the HP cock and relight the engine normally as recommended in Pt. III, Ch. 5, para. 3, leaving the isolating switch set to ISOL. Having relit, if both pumps are serviceable, maximum RPM should be obtained but if one HP pump has failed, only 60 per cent engine power will be available at sea level, rising progressively with

altitude until at approximately 12,000 ft. 100% power will be available.

(ii) With the HP pump isolating switch to ISOL, considerable care must be exercised when the engine is opened up from idling RPM. If the throttle is handled coarsely at engine speeds below 5,000 RPM, the engine is prone to over-fuelling and excessively high JPT, resulting in a possible engine fire. While opening the throttle keep a check on the RPM and JPT. If the JPT rises rapidly and reaches the maximum, the RPM meanwhile remaining constant, close the throttle immediately and then open up again using a slower throttle movement. In the event of having to go round again with the HP pumps servo system isolated, it should be remembered that only 60 per cent of take-off thrust will be obtainable at low altitude if one pump has failed.

◀(*d*) *Engine handling in icing conditions*

(i) As there is no provision for anti-icing protection of the airframe or engine, if possible avoid flying in icing conditions. If icing conditions are met in flight, climb or descend out of the icing region immediately. Throttle handling in icing conditions must receive the utmost care and RPM below 5,800 or between 6,000 and 7,000 must be avoided; i.e. the engine is more prone to surge in the swirl vane operating range with the bleed valves closed, and also when below 5,800 RPM.

(ii) To climb out of icing use 7,600 RPM and climb at 250 knots. Do not move the throttles unless it is essential, and then only very smoothly. If it is necessary to accelerate the engine from 5,800 to the higher RPM range (above 7,000) move the throttles smoothly and without hesitation through the range 6,000-7,000 RPM.

(iii) To descend out of icing conditions, throttle back to and maintain 5,800 RPM and descend at 250 knots with airbrakes OUT until clear of icing. If icing conditions pertain below 2,000 feet, RPM must not be allowed to fall below 5,800 until finally committed to a landing.

(iv) If an engine surges in icing conditions, throttle it back and if height permits, make a rapid descent below freezing level. The engine may then be slowly opened up to 5,800 RPM and left for five minutes, after which an at-▶

◀ tempt may be made to accelerate it further. If the JPT rises rapidly, the engine must be throttled back again immediately and a further period of five minutes allowed for it to de-ice.

(v) If flame-out occurs, the engine may be re-lit after closing the throttle. If height permits, descend below freezing level before accelerating the engine from idling to 5,800 RPM. Great care must be taken when opening the throttle; when clear of icing conditions, RPM must be kept at 5,800 for five minutes, after which an attempt may be made to accelerate it further. ▶

(*e*) *Engine handling on descent*
Maintain a minimum engine RPM of 4,500 on the descent. For descent in icing conditions, see sub-para. (d) (iii) above.

(*f*) *Throttle movement in low temperatures*
In low temperatures the throttles may be found difficult to move due to grease stiffening. If this occurs, move the throttles rapidly once or twice over the full range of movement before starting the engines.

3. General flying

(*a*) *Controls*

The controls are well harmonised 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 IAS. The ailerons are light and effective with very good response at speeds from the stall to high mach numbers but at speeds above 0·83M their effectiveness decreases suddenly. The elevators are powerful and elevator forces are light becoming heavier at high speeds resulting in poor 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 speeds. 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.

(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*)

(i) *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 trim switch must always be operated and released simultaneously.

(ii) *Testing in flight*

Checks must be made periodically in flight to ensure that the switches are functioning correctly by operating each switch independently. 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 of the double circuit will no longer exist and the possibility of a runaway is increased. For this reason speed must 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 of 250 knots and landed as soon as possible.

(*d*) *Limited tailplane travel*

If the tailplane runs away to a fully nose-down trim position ◀(with Mod. 2107 embodied) the aircraft will be in trim▶ longitudinally at a speed of between 425 and 450 knots. (See Part I, Chap. 5, para. 2(c)).

(*e*) *Airbrakes*

At high airspeeds the airbrakes are effective, but below about 300 knots their effectiveness decreases until at

approach speeds their effect is negligible. At high mach numbers their use causes increased buffeting with little deceleration.

(f) *Change 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	Slight nose-up
Bomb doors closed ...	Slight nose-down

(g) *Buffeting*

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

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

4. Flying at reduced airspeed

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

5. Flying in conditions of severe turbulence

(a) Investigation into cases of flame-out at high altitude, caused by turbulence, indicate that an engine RMP of 7,000 gives the best protection against flame-out. It has been established that it is also essential to maintain an adequate forward speed. In addition to maintaining the recommended speeds at altitude, in order to prevent flame-out, it is also essential to maintain the recommended speeds at low altitudes for structural reasons.

(b) When flying in conditions of severe turbulence the recommended speed ranges are as follows:—

Below 10,000 feet ...	250 to 300 knots
Between 10,000 feet and 25,000 feet	270 to 300 knots
Between 25,000 feet and 30,000 feet	270 knots
Above 30,000 feet ...	.72 mach.

(c) At lighter weights, with 7,000 RPM set, surplus speed above that recommended may be used for a gentle climb out of the turbulent area but under no circumstances should the normal climbing RPM be set. At heavier weights if the recommended speed cannot be maintained at 7,000 RPM a gradual reduction in height, if practicable, should be accepted.

6. Stalling

(a) The appropriate stalling speeds in knots are:—

	32,000 *lb.* *No wing-tip tanks*	42,000 *lb.* *With wing-tip tanks*
Power off		
Undercarriage and flaps up	85—90	105—110
Undercarriage and flaps down	75	
Power on (Typical approach conditions)		
Undercarriage and flaps down	75	

NOTE: The power-off stalling speeds quoted above apply with the engines throttled back. When practising stalling maintain an engine speed of not less than 4,500 RPM 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 intital 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) When wing tip tanks are fitted the stalling characteristics are generally similar but occur about 5 knots earlier. In addition the pre-stall buffeting is more marked and is accompanied by slight aileron snatch felt as trembling in the aileron control; the snatching becomes marked if aileron is used to raise a dropped wing.

(d) At any time when G is applied ample warning of the approach of a 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.

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

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

7. High speed flight

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

2. The high mach number characeristics 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.

(a) *Below* 15,000 *feet*

The speed limitation clean is 450 *knots or* 0.75M *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 will 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 IAS or mach number limitation reduce speed as soon as possible until the oscillation ceases. If speed is inadvertently increased above 450 knots, a marked vibration may develop. If this occurs, speed must be reduced immediately. The airbrakes are effective at high IAS, but their use is accompanied by noticeable buffeting.

(b) *Between* 15,000 *and* 25,000 *feet*

The speed limitation clean is 0.79M. *The speed limitation with wing tip tanks is* 365 *knots or* 0.79M. As speed is increased buffeting commences at about 0.77M and increases in strength as speed rises. If the limitation of 0.79M is exceeded there is a tendency for lateral unsteadiness to develop.

(c) *Above* 25,000 *feet*

The speed limitation clean is the speed at which a nose-up change of trim occurs, i.e. about 0.84M. *The speed limitation with wing tip tanks is* 0.80M.

(i) Up to about 35,000 feet warning of the approach of severe compressibility effects is given by a nose-up change of trim which occurs at about 0.84M to 0.85M. Below this speed the first symptoms are given by slight buffeting which

commences at about 0.78M to 0.80M. At about 0.81M the buffeting increases in intensity and at 0.83M a slight nose-down change of trim occurs followed by a nose-up change at about 0.85M. 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 the tendency for one wing, generally the starboard, to drop slowly at about 0.84M. This tendency occurs at slightly lower speeds, between 0.82M and 0.83M, at about 45,000 feet. Below these speeds the symptoms are much the same as in sub-para. (i).

(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 over-stressing 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 CG 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 refer 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 RPM 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. 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 limiting speeds.

8. Descent

(a) *Rapid descent*

The recommended technique in making a rapid descent is to close the throttles, extend the airbrakes and descend at 0.79M above 40,000 ft. and 0.75M below, until a coincident speed of 400 knots without wing tip tanks, or 365 knots with tanks, is reached, maintaining the appropriate speed thereafter. This will give a rate of descent of 5,000 feet per min. down to 30,000 ft. increasing to 10,000 feet per min. or more at lower altitudes.

(b) *Normal descent*

For a normal descent, throttle fully back, put airbrakes out and descend at 0.75M until a coincident speed of 250 knots is reached, maintaining that speed thereafter.

(c) *Descent in icing conditions*

To descend out of icing conditions, throttle back to and maintain 5,800 RPM and descend at 250 knots with airbrakes out until clear of icing conditions. If icing conditions persist below 2,000 feet, RPM must not be allowed to fall below 5,800 until finally committed to a landing.

(d) *Altimeter error*

The barometric altimeters are subect 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 final approach after rapid descent.

(e) *Use of canopy internal demister*

To obtain maximum efficiency from the internal demisting system, start demisting 10 minutes before the descent. The internal demister should not be on at any other time than that required for the descent.

PART III—HANDLING

Chapter 4—CIRCUIT AND LANDING PROCEDURES

Contents

1. Approach and landing

(*a*) *Checks before landing*

Before joining the circuit or commencing descent check:

Mk. 4B compass	Magnetic
Canopy internal demister ...	As required
Fuel contents	Sufficient
LP pumps	..... ON (min. 2 per engine)
LP cock and pump circuit breakers	All made
Bomb doors	Closed
Threshold speed	Calculated as ..... knots
Altimeter	QFE set as required on descent

After joining the circuit reduce speed to below 190 knots and check:—

Airbrakes	IN
Undercarriage (below 190 Kts)	DOWN, 3 green lights
Fuel contents	Sufficient
LP pumps	.....ON (min. 2 per engine)
Fuel press. warning lights ...	Out
Harness (crew check) ...	Tight and locked
Brakes	Checked and off (2,000 PSI min.) ▶

(*b*) Approach speeds are shown on the graph on the page opposite. 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 a decision to land has been made, the RPM must be kept above 4,500 and an exaggerated nose up attitude must be avoided. The recommended engine handling technique is to maintain power within a practical margin whilst aiming to cross the runway threshold at the correct speed; only then should the throttles be fully closed. At high AUW there is a marked tendency to undershoot if the throttles are closed prematurely, even at approach speeds higher than those recommended. ▶

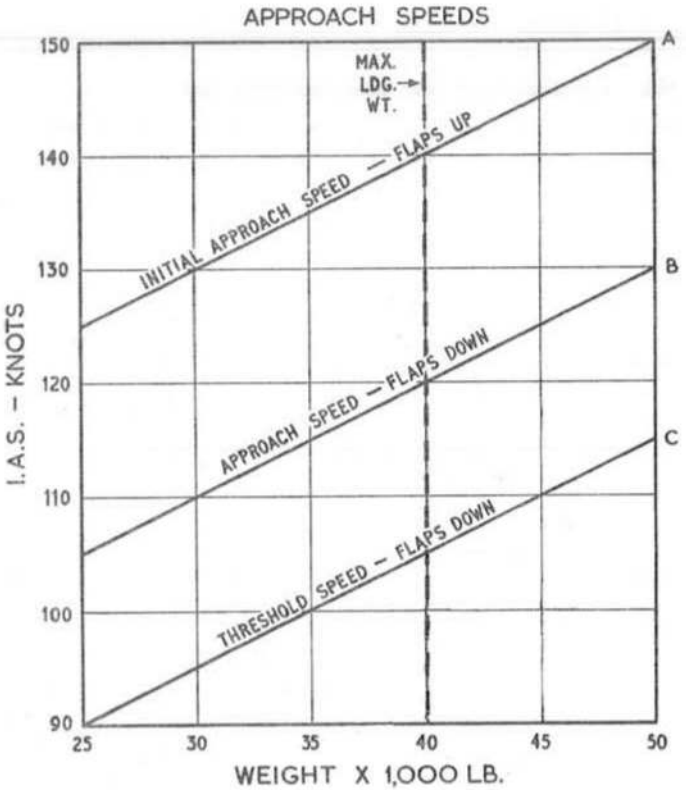
(*d*) If landing at a CG forward of 21 inches, the threshold speed must be increased by 5 knots above the normal speed for the weight. This can only happen if the fuel drill is not correctly followed or the fuel system has not functioned properly. In cases of doubt as to the position of the CG ascertain the extent of control in the landing configuration at a safe height and determine the approach speed accordingly.

2. Flapless landing

(*a*) A slight increase in drag and thus a steeper angle of approach may be obtained by carrying out the final approach and landing with the bomb doors open. This, however, is not advisable in the case of hydraulic failure as the reserve of hydraulic fluid may be prejudiced. It is advisable to reduce weight as much as possible.

(*b*) Turn on the final approach at 125 knots. The approach, which should be longer than that for normal landing, will be very flat. Throttle back early, aiming to cross the threshold at 10 knots above the normal speed for the weight. Lower the nosewheel onto the runway immediately after touch-down and apply the brakes as much as possible without locking the wheels.

(*c*) On a 2,000 yard runway a flapless landing may be carried out comfortably, following a correctly executed approach, at maximum normal landing weight (40,000 lb.). At weights above 40,000 lb., if the runway is wet, use a 3,000 yard runway if possible.



APPROXIMATE ALL-UP WEIGHTS (lb.)

Crew only	23,000
Full fuselage tanks	34,000
Full fuel including tip tanks	38,000
2,400 lb. remaining	25,500

NOTE: No armament is included in these weights.

3. 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 speed by 5 to 10 knots.

◀4. Landing with one wing tip tank full

If one wing tip tank does not feed and the other is empty, determine, at a safe height, the lowest speed for *adequate* control, i.e. the speed at which rolling manoeuvres can be executed safely in both directions with undercarriage and flaps down. The approach speed should not be allowed to fall below the speed for *adequate* control plus 5 knots.

5. Braking

Braking efficiency will be improved, especially on wet runways and/or at low weights if the control column is moved rearwards as braking commences, thus transferring weight onto the main wheels. When the nosewheel has lowered onto the runway the brakes can be used, dependent on runway conditions as follows:— ▶

(i) *Dry surfaces*

The brakes may be applied continuously but caution must be exercised while the speed is high to avoid locking the wheels. Pressure may be increased as speed falls off but, unless the shortest possible run is required, more gentle use of the brakes is recommended. If a slip or skid is felt, or if difficulty is experienced in keeping straight, release the brakes momentarily.

(ii) *Wet surfaces*

Retardation may be drastically reduced and will depend directly upon the degree of wetness of the runway surface. Generally, under wet conditions it is recommended that light intermittent braking action be commenced as soon as the aircraft is firmly on the ground and the wheels have had time to spin up. The brake pressure may then be progressively increased and can be held continuously as the speed falls off. If a slip or skid is suspected the pressure should be released momentarily and re-applied gradually.

(iii) *Flooded or icy runways*
Whenever possible these conditions should be avoided due to the certainty of the drastic reduction in braking effectiveness on flooded or icy surfaces. However, if a landing has to be made, extreme caution is required. The brakes must be used most carefully, as excessive application of continuous pressure can lead to wheel locking and subsequent tyre damage.

(*b*) 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 less than ten minute intervals and if, while taxying after such landings, heavy differential use of the brakes is made, double the time interval.

(*c*) If, when the aircraft has stopped after landing, the brakes are observed to be smoking or on fire, do not shut down the engines until fire appliances are available. This is a precaution to prevent the dumped fuel igniting underneath the aircraft. If, however, fire appliances are not readily available, the engines may be shut down (except on aircraft with B.C. Mod. 32) by switching off the LP pumps and cocks, leaving the HP cocks open. If this method is used it must be reported so that the fuel system may be primed before the next start.

6. Instrument approach

(*a*) The following speeds, flap, undercarriage and approximate power settings, are recommended for use during instrument approaches. The figures apply specifically to an aircraft without wing tip tanks at about 30,000 lb. AUW. The effect of empty wing tip tanks on the RPM required will be very small.

TWO ENGINES

	RPM	U/C	Flap	Airspeed (knots)
Pattern	6,200	Down	Up	150
Final	6,200	Down	Up	150
Glide path	6,200	Down	Down	125 reducing to threshold speed

ONE ENGINE—ALL CONDITIONS

	RPM	U/C	Flap	Airspeed (knots)
Pattern	6,300	Up	Up	145—150
Final	6,300	Up	Up	145—150
Glide path	6,300	Down	Up	140 (min.)
Decision height	6,300	Down	Down	Reducing to threshold speed

NOTE: 1. When the glide path is intercepted and flap is lowered, to achieve 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 full nose-down trim applied a residual push force will remain until the speed is below approximately 125 knots.

2. On a single engine instrument approach, delay flap selection until it is certain that the runway threshold can be reached without increasing power.

◀(*b*) *Instrument approach in icing conditions*

Instrument approaches should be avoided when icing conditions pertain at and below the pattern height; a diversion to an airfield clear of icing should be made whenever this is possible. Should an instrument approach in icing conditions be unavoidable, the following technique is recommended.

TWO ENGINES—ICING CONDITIONS

30,000 lb. AUW	RPM	UC	FLAPS	AIR BRAKES	AIRSPEED (KNOTS)
Pattern	5,800	Up	Up	Out	Approx. 170
Final	5,800	Up	Up	Out	Approx. 170
Glide path	5,800	Down	Up	As reqd.	Approx. 160
Decision height	5,800	Down	Down	In	Reducing to threshold speed

NOTE: 1. The decision height is the flap lowering height at which the pilot considers he is certain of reaching the runway without increasing RPM. If the decision height is below 500 ft. a higher than normal speed at the threshold may be unavoidable.

2. The use of airbrakes and bomb doors will assist in reducing the pattern and glide path speeds to acceptable limits.

3. Do not reduce RPM below 5,800 until certain of reaching the runway.

4. In the event of an overshoot, move the throttles smoothly and without hesitation through the range 6,000-7,000 RPM and climb away at 7,600 RPM. ▶

7. Overshooting

(*a*) If possible retain a minimum of 1,250 lb. of fuel in No. 2 tank which allows five minutes flying for this eventuality.

(*b*) Open the throttles smoothly to 7,000 RPM and check that symmetrical power is being obtained; raise the undercarriage and flaps and increase power. If the thrust at 7,000 RPM 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 properly 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 RPM and allowance made for some difference in response from each engine.

(ii) Keep the nosewheel on the runway until the engines have reached 7,000 RPM.

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

◀8. Checks after landing

If the control locks are to be used for taxying, first complete the following checks, then insert the flap lever locking pin before having the locks fitted. Thereafter, do not operate the rudder or aileron trimmers or the flaps.

Parking brake ... ... On (2,000 PSI min.)
One generator on line ... RPM 5,000, check 28 volts ▶

◀Undercarriage master switch SAFE
MASTER SAFETY switch OFF
Hatch SAFETY switches OFF
Flaps ... ... UP
Heaters and air drier (if used) OFF
Pressure head heater ... ON
Canopy demister ... ... OFF
Trimmers ... ... All neutral
Unrequired radios ... OFF
LP pumps ... ... No. ..... tanks ON
Engine air switches ... OFF, temperature control HOT (Post-Mod. 5), COLD (Pre-mod. 5)
DV panel ... ... Open momentarily
Radar and inverters ... OFF
Hydraulic pressure(s) ... 2,400-2,500 PSI

NOTE: After parking for a "running change" the ejection seat pins must be inserted before the changeover.

9. Shut down procedure

Parking brake ... ... On, (2,000 PSI min).
Tailplane ... ... Full nose down, one blip up
Port HP cock ... ... Closed
Bomb doors ... ... OPEN (below 500 RPM)
Hydraulic pressures ... 2,400-2,500 PSI
Starboard HP cock ... Closed
Master start and ign. switches ... ... OFF
LP pumps ... ... OFF
All radios ... ... OFF
DV panel ... ... Closed
Flap and bomb door pins ... IN
UC safety clip (if fitted) ... IN

Safe for parking :—

Ejection seat pins ... IN (crew check)
MASTER SAFETY switch ... ... Confirmed OFF
Hatch SAFETY switches OFF ▶

◀External lights	... ...	OFF (if applicable)
Internal lights	... ...	OFF (if applicable)
Parking brake	... ...	Off, when chocks in position
Pressure head heater	...	OFF
Intercomm.	... ...	OFF
Battery isol. switch	...	OFF ▶

PART III—HANDLING

Chapter 5—ASYMMETRIC FLYING

Contents

1. Stopping an engine in flight

◀When closing down an engine in flight deliberately:—

(*a*) Transfer radar, if required, to No. 4 inverter.

(*b*) Close down No. 5 inverter.

(*c*) Switch off the appropriate generator and engine air switch.

(*d*) Close the throttle and shut the HP cock. ▶

2. 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 RPM 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) electrical load must be reduced as in para. 1 above. When using only one generator use the tailplane trimmer as little as possible.

3. Relighting an engine in flight

(*a*) If an engine flames out, an immediate relight may be attempted by pressing the relight button for 5 seconds and then releasing it, leaving the throttle and HP cock at their set positions. A successful relight will be indicated by the RPM stabilising and then commencing to rise. Ensure, by

throttling back if necessary, that the maximum JPT 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*) For normal relighting, the following heights and windmilling RPM are the recommended maxima for relighting, depending on the modification state of the engines.

(i) Pre-Avon Mod. 857—20,000 feet—1,200 RPM.

(ii) Post-Avon Mod. 857—25,000 feet—no RPM restriction.

(*c*) Relighting is practicable up to approximately 5,000 feet above the recommended heights, but a reduction in height and windmilling RPM makes relighting progressively more certain. If relighting is attempted above 25,000 feet (Avon Mod. 857) reduce the windmilling RPM to 1,200 or less.

(*d*) The following relighting drill applies to both pre and post-Avon Mod. 857 engines:—

(i) When at or below the appropriate altitude reduce speed until the windmilling RPM are at or below the recommended figure.

(ii) Ensure that the throttle and HP cock are closed.

(iii) Isolating valve switch as required (see Pt. III, Ch. 3, para. 2(*c*)).

(iv) Ensure that at least one LP pump switch is on and that the fuel pressure warning light is out.

(v) Check that the master starting and ignition switches are on.

(vi) Press the relight pushbutton, and open the HP cock (see (*e*) below).

(vii) When the RPM start rising, release the relight button.

(viii) When the RPM have stabilised, the engine may be opened up slowly to the desired figure.

◀(ix) Switch on the generator and engine air switch. ▶

(*e*) The engine will normally light up as soon as the HP cock is open. If it fails to do so within a few seconds, close the HP cock, re-check height, speed and cockpit drill. If at the

maximum height for relighting, a further attempt may be made after descending to a lower altitude; in any case allow an interval of about two minutes for the engine to dry out before attempting a further relight. The maximum time for continuous use of the relight button is 30 seconds.

4. Relighting in icing conditions

If an engine flames-out when flying in icing conditions an immediate relight as described in para. 3(a) may be attempted; if this fails and conditions permit, the normal relight drill should be carried out. If this also fails any further attempts to relight may cause damage to the engine.

5. Asymmetric landing and overshoot

(a) *Landing*

(i) Maintain a speed of at least ~~150~~ 140 knots while positioning the aircraft with the flaps up. Lower the undercarriage at the normal position on the circuit. Maintain 140 knots until the final decision to land is made at 600 feet AGL or above, then lower the flaps and reduce speed to cross the threshold at the speed recommended for a normal landing.

(ii) When icing conditions obtain down to aerodrome level the RPM must be maintained at 5,800 for as long as possible. It is recommneded therefore that, in these conditions, the undercarriage is not selected down until it is necessary to descend on the final approach.

(b) *Overshoot*

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

(ii) Carefully increase power on the live engine, taking care to maintain directional control, and raise the undercarriage. Allow the speed to build up to 150 knots and commence the climb at this speed. Restrict the RPM on the live engine to 7,600; however, it may be found that an RPM setting below this figure will be sufficient for the climb. Power on the live engine must be increased very carefully, especially if the RPM required to climb away is high, otherwise control may be lost. Rapid increases in power can result in marked yaw and loss of height.