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A.L.207, Dec.77

SECTION 2

GROUND HANDLING AND PREPARATION FOR FLIGHT

LIST OF CHAPTERS OVERLEAF

SECTION 2

GROUND HANDLING AND PREPARATION FOR FLIGHT

LIST OF CHAPTERS

Note:- *A list of contents appears at the beginning of each chapter*

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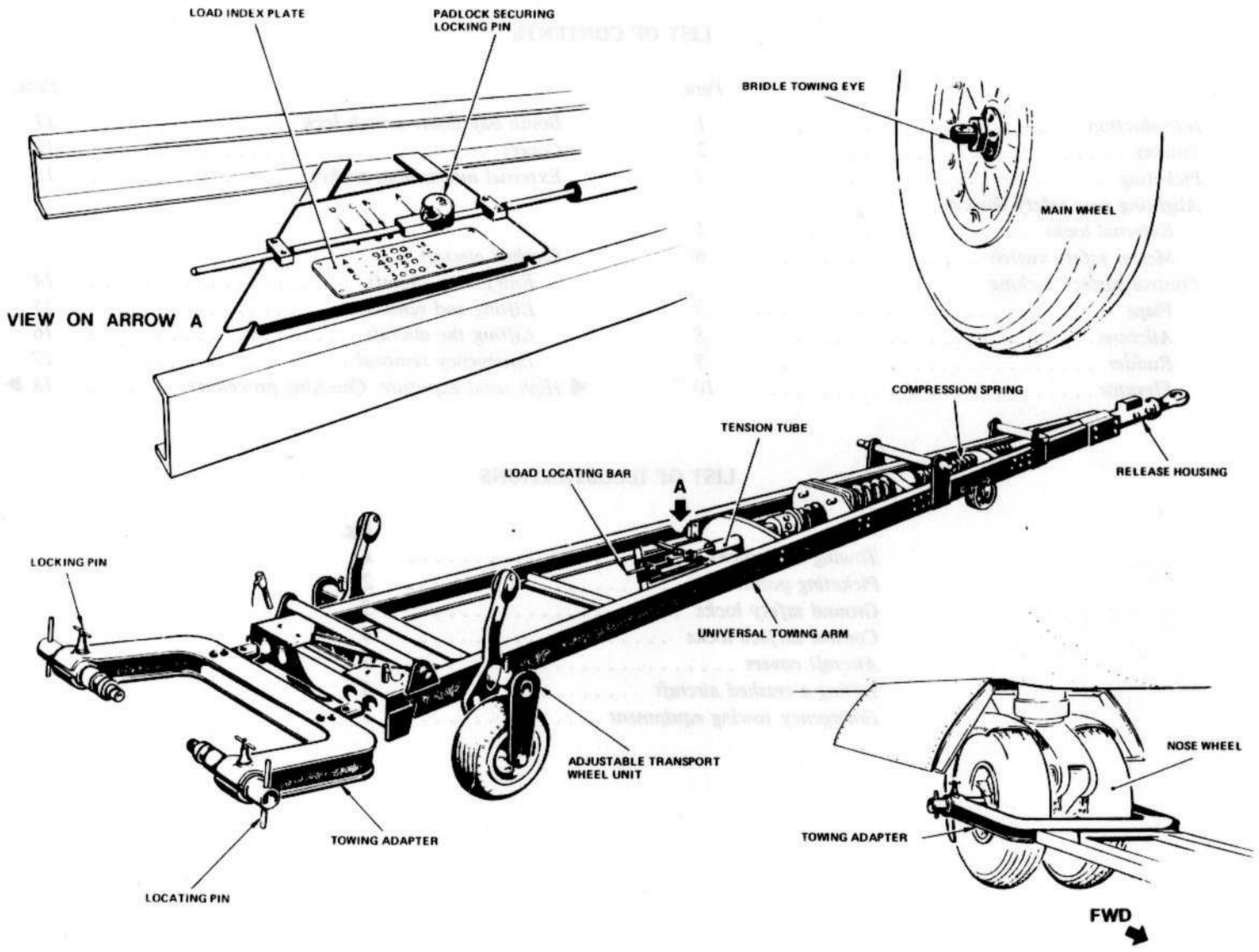


FIG.1. TOWING EQUIPMENT

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

Introduction

1. Information on the general handling of the aircraft on the ground is given in this chapter. The equipment necessary for ground handling is listed in Chapter 4 of this section.

Towing *(fig.1)*

2. Normal towing is from the nose-wheel axle, the towing gear consisting of a towing arm *(Chap.4, Table 2)* adapted to suit the axle by fitting an adapter *(Chap.4, Table 1)*. A release mechanism is incorporated in the towing arm to prevent damage to the nose undercarriage in the event of an overload during towing. With the locking pin inserted at the correct position (A, on the load index plate on the towing arm) the release mechanism operates at a pull-off load of 9200 lb. The towing equipment is fully described in A.P.119K-0704-15F6A (towing arm) and A.P.119K-0710-15F (towing bridle). The aircraft may, if necessary, be towed either forward or backward from the main wheel axles by attaching a 50 ft towing bridle to the towing eyes on the axles; when towing from the main wheels the aircraft is steered with a steering arm attached to the nose-wheel axle. During all towing operations, the cockpit must be occupied by a tradesman qualified to operate the brakes as necessary.

Note . . .

The wheel brake system hydraulic pressure must not be permitted to fall below 2200 lb/in² during aircraft towing.

Picketing *(fig.2)*

3. The aircraft must, where possible, be picketed facing into wind. Chocks must be positioned fore-and-aft of each wheel, securely chained and tensioned at all times until the aircraft is being prepared for flight, the aircrew have entered and effective wheel braking has been applied. The following additional safety precautions must be observed:-

(1) For wind speeds greater than 25 knots:-

(a) Fit the rudder lock *(para.9)*.

(b) Fit the elevator lock *(para.10)*.

(2) For wind speeds greater than 35 knots additionally:-

(a) Fit the aileron locks *(para.8)*.

(b) If the aircraft is more than 10 deg out of alignment, nose into wind, fit the nose picket.

(3) Wind speeds between 50 knots and 80 knots additionally:-

(a) Fit nose-wheel picket.

(b) Fit main-wheel pickets.

(c) Fit the secondary pickets.

CAUTION

Design requirements do not cater for the aircraft structure to be capable of withstanding loads from picketing at wind speeds in excess of 80 knots.

4. The main points of anchorage are at the nose undercarriage, where a lashing is placed over the stay link lugs on the shock-absorber strut, and at each main undercarriage unit, where a lashing is coupled to a detachable ring-bolt, screwed, from outboard, into the upper hinge-pin of the torque linkage; these points are closed by cover plates in the undercarriage fairings, when not in use. Three secondary points are also provided, one in the underside of each main plane, where screwed holes for detachable

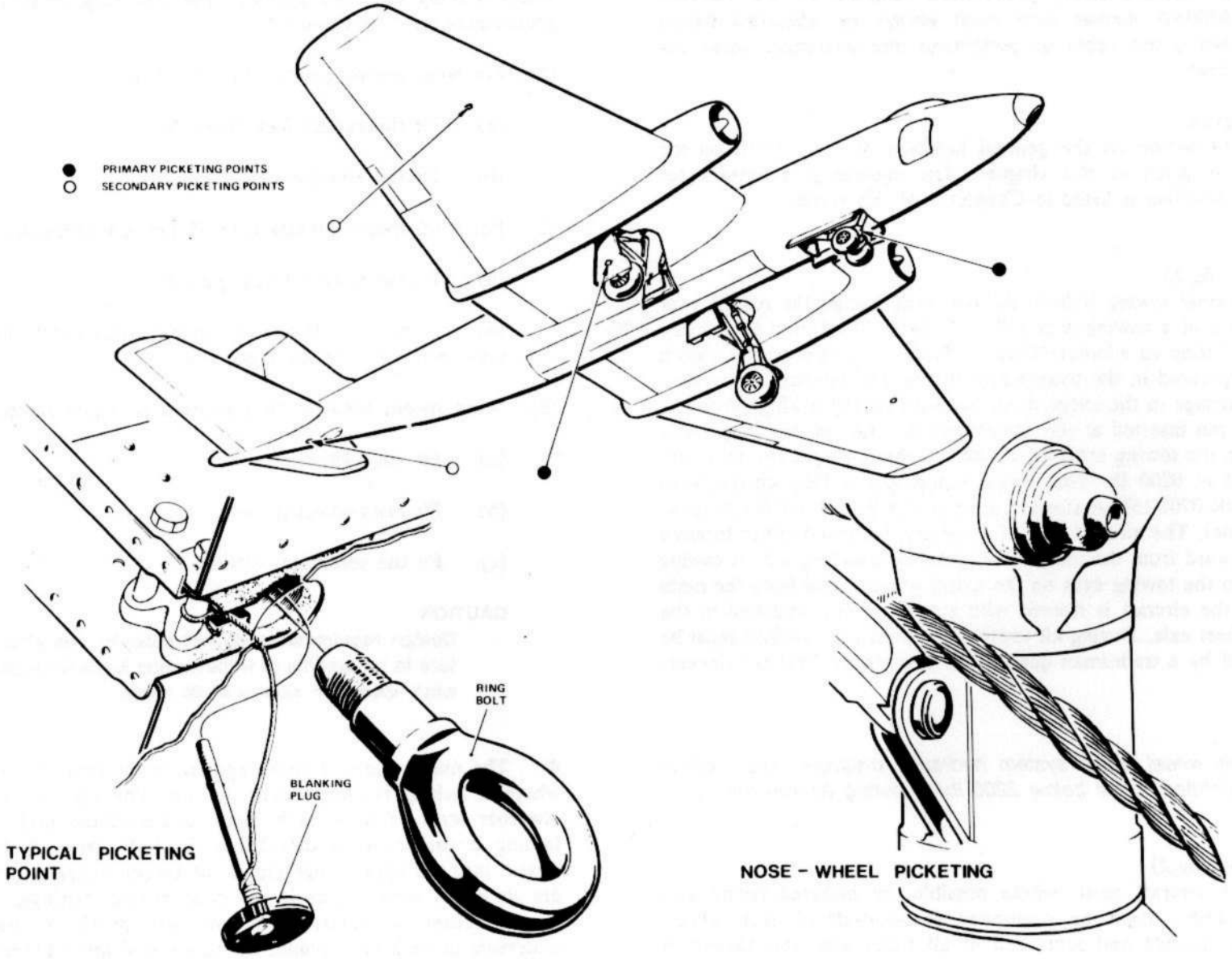


FIG. 2. PICKETING POINTS

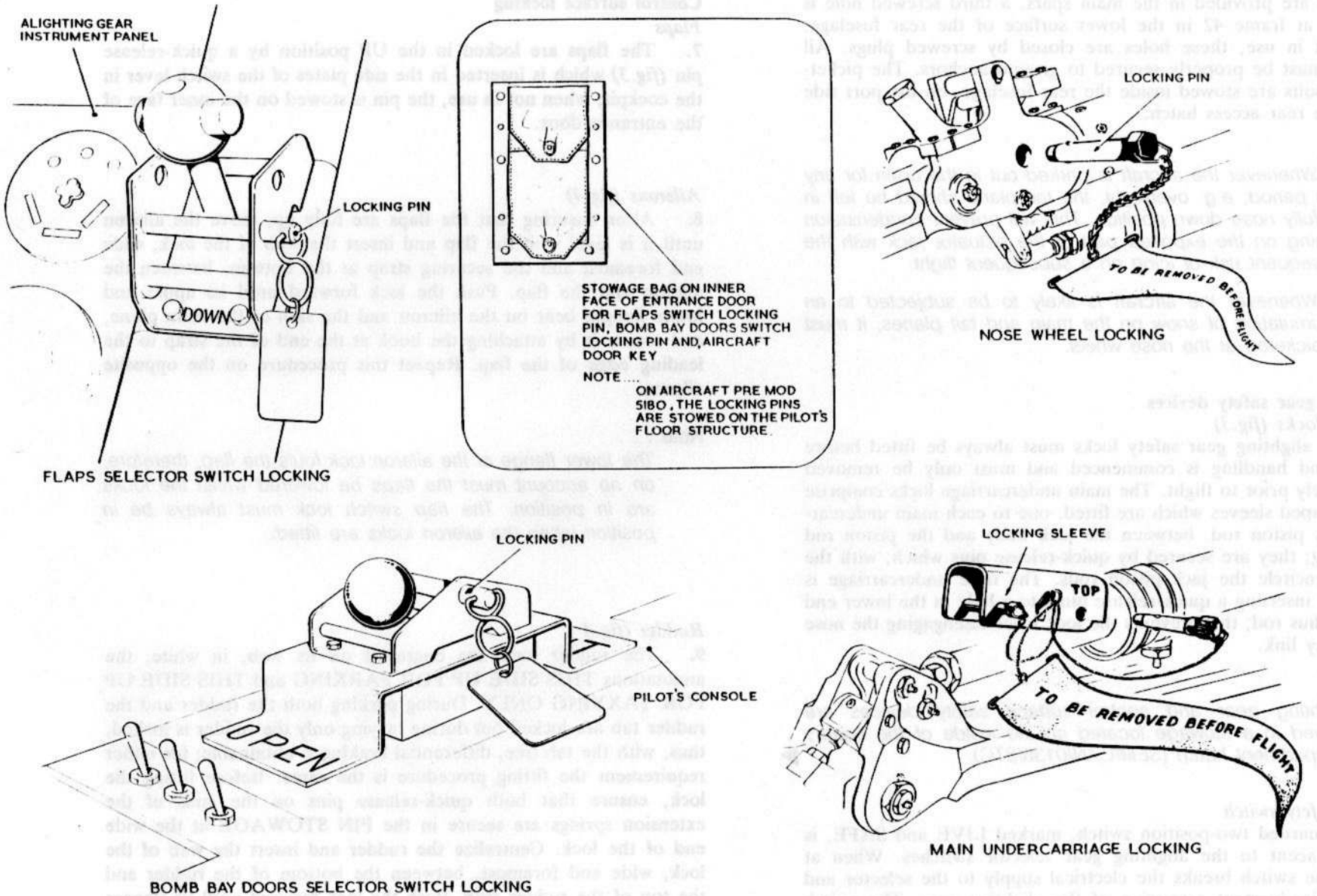


FIG. 3. GROUND SAFETY LOCKS

ring-bolts are provided in the main spars, a third screwed hole is provided at frame 42 in the lower surface of the rear fuselage; when not in use, these holes are closed by screwed plugs. All lashings must be properly secured to ground anchors. The picketing ring-bolts are stowed inside the rear fuselage, on the port side above the rear access hatch.

Note . . .

1. Whenever the aircraft is parked out in the open for any long period, e.g. overnight, the tail plane should be left in the fully nose down position. This will prevent condensation forming on the exposed part of the actuator jack with the consequent risk of icing on a subsequent flight.

2. Whenever the aircraft is likely to be subjected to an accumulation of snow on the main and tail planes, it must be picketed at the nose wheel.

Alighting gear safety devices

External locks (fig.3)

5. The alighting gear safety locks must always be fitted before any ground handling is commenced and must only be removed immediately prior to flight. The main undercarriage locks comprise two U-shaped sleeves which are fitted, one to each main undercarriage jack piston rod, between the jack body and the piston rod end fitting; they are secured by quick-release pins which, with the sleeves, encircle the jack piston rods. The nose undercarriage is locked by inserting a quick-release pin into a hole in the lower end of the radius rod; this prevents the lock lever disengaging the nose of the stay link.

◀ Note . . .

Alighting gear and control surface safety devices are stowed in a stowage located on the inside of the battery compartment hatch (SEM/CAN/0136/STC). ▶

Master safety switch

6. A guarded two-position switch, marked LIVE and SAFE, is fitted adjacent to the alighting gear selector switches. When at SAFE, the switch breaks the electrical supply to the selector and prevents inadvertent retraction of the alighting gear. The switch must be in the SAFE position at all times whilst the aircraft is on the ground, except during alighting gear retraction tests with the aircraft jacked and trestled.

Control surface locking

Flaps

7. The flaps are locked in the UP position by a quick-release pin *(fig.3)* which is inserted in the side plates of the switch lever in the cockpit; when not in use, the pin is stowed on the inner face of the entrance door.

Ailerons (fig.4)

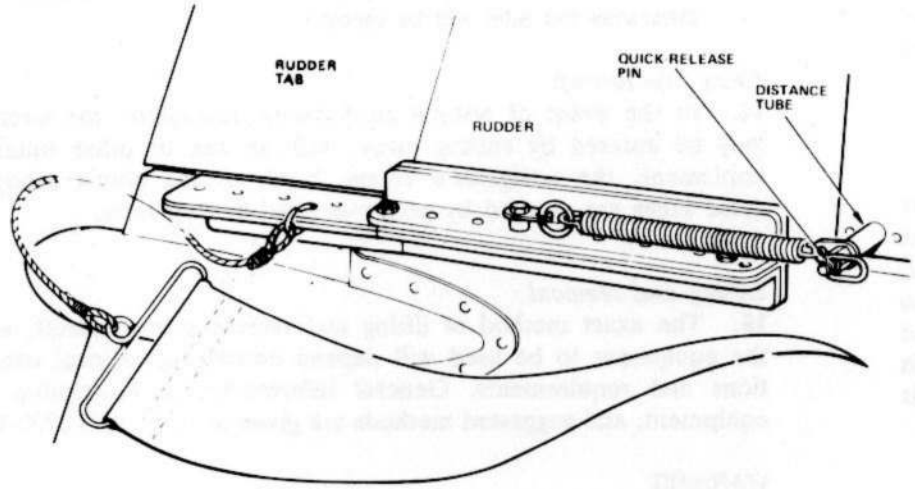
8. After ensuring that the flaps are fully up, move the aileron until it is level with the flap and insert the web of the lock, wide end foremost and the securing strap at the bottom, between the aileron and the flap. Push the lock forward until its upper and lower flanges bear on the aileron and the skin of the main plane, and secure it by attaching the hook at the end of the strap to the leading edge of the flap. Repeat this procedure on the opposite aileron.

Note . . .

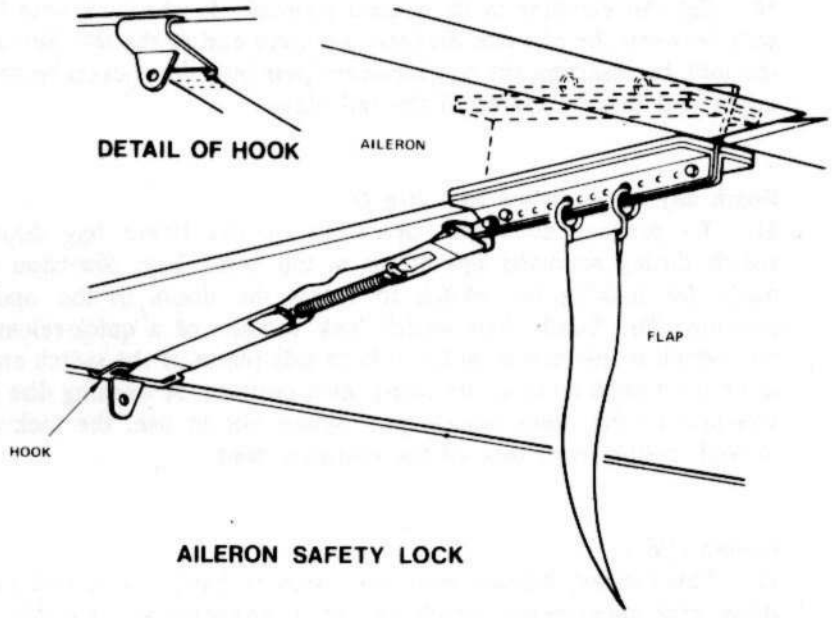
The lower flange of the aileron lock fouls the flap, therefore, on no account must the flaps be lowered whilst the locks are in position. The flap switch lock must always be in position when the aileron locks are fitted.

Rudder (fig.4)

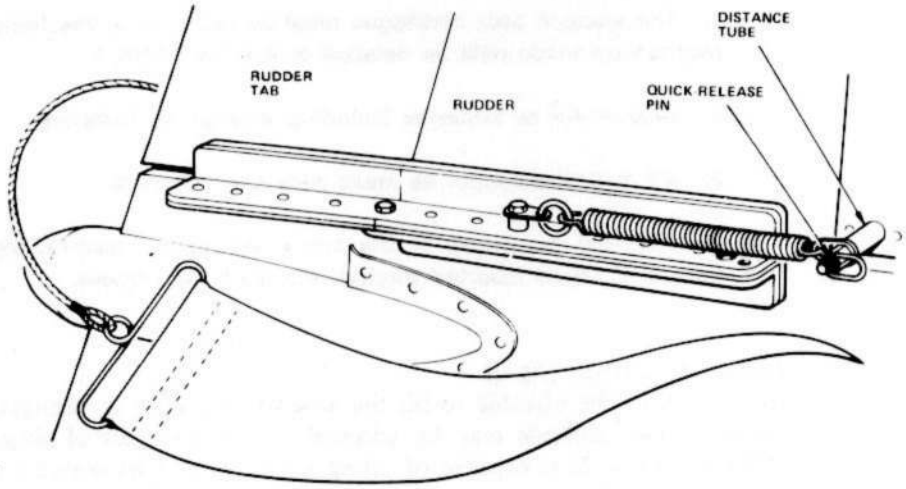
9. The rudder lock has engraved on its web, in white, the annotations THIS SIDE UP FOR PARKING and THIS SIDE UP FOR TAXYING ONLY. During parking both the rudder and the rudder tab are locked but during taxying only the rudder is locked, thus, with the tab free, differential braking is obtainable; for either requirement the fitting procedure is the same. Before fitting the lock, ensure that both quick-release pins on the ends of the extension springs are secure in the PIN STOWAGE at the wide end of the lock. Centralize the rudder and insert the web of the lock, wide end foremost, between the bottom of the rudder and the top of the rudder stub. Push the lock forward until its flanges bear on both sides of the rudder and stub, remove the starboard quick-release pin from the PIN STOWAGE and insert it into the hole in the starboard side of the rudder.



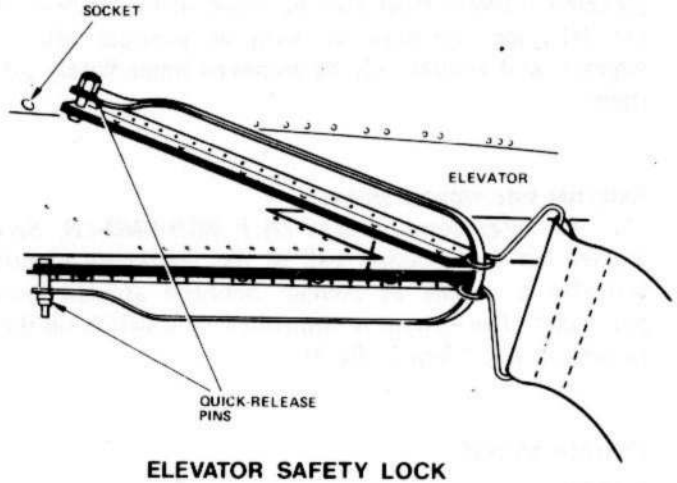
RUDDER SAFETY LOCK - TAXYING



AILERON SAFETY LOCK



RUDDER SAFETY LOCK - PARKING



ELEVATOR SAFETY LOCK

FIG. 4. CONTROL SURFACE LOCKS

Elevator (fig.4)

10. Set the elevator in its neutral position, fit the lock with its web between the elevator and the outboard end of the tab. Secure the lock by inserting the quick-release pins into the sockets on the upper and lower surfaces of the tail plane.

Bomb bay doors switch lock *(fig.3)*

11. To prevent accidental operation of the bomb bay doors switch during servicing operations in the bomb bay, provision is made for locking the switch to retain the doors in the open position. The bomb door switch lock consists of a quick-release pin, which is inserted in holes in both side plates of the switch and locks the switch lever in the doors open position. A warning disc is attached to the quick-release pin. When not in use, the lock is stowed on the inner face of the entrance door.

Covers *(fig.5)*

12. The canopy, wheels, nose and pressure head covers and the static vent plugs must always be fitted whenever the aircraft is picketed. Covers must also be fitted to the engine air intakes and the jet pipe openings as soon as possible after stopping the engines, and should only be removed immediately prior to starting them.

External intercomm. socket

13. An intercomm. socket *(A.P.101B-0402-1B, Sect.6, Chap.1)*, located on the inboard wall of the starboard alighting gear bay, provides a means of contact between ground crew and cabin personnel. The system is controlled by a switch on the pilot's radio panel *(Sect.1, Chap.1, fig.3)*.

Crashed aircraft

WARNING

Before attempting to cut away the hatch of aircraft having single-lever ejection facilities for the rear crew members, it is essential to look through the navigator's window to see if either crew member has attempted to eject. If the sear has been withdrawn from the ejection gun ensure that the secondary firing cable, connecting the safety catch in the restrictor of the breech firing unit to the hatch, is not disturbed otherwise the seat will be ejected.

Entry into aircraft

14. In the event of normal entry being impossible, the aircraft may be entered by cutting away, with an axe or other suitable implement, the navigator's escape hatch or the pilot's canopy; these areas are marked by yellow-painted broken lines.

Lifting and removal

15. The exact method of lifting and removing the aircraft, and the equipment to be used will depend entirely upon local conditions and requirements. General information, a description of equipment, and suggested methods are given in A.P.119Q-0200-16.

WARNING

Before the commencement of lifting operations, refer to the current regulations relating to crashed aircraft, and take the following precautions:-

1. The ejection seat cartridges must be removed or the firing mechanism made safe as detailed in A.P.109A-0001-1.

2. Disconnect all batteries including emergency batteries.

3. All explosives must be made safe and removed.

4. The fuel remaining in the tanks should be removed by means of hoses inserted through the filler cap orifices.

Lifting the aircraft (fig.6)

16. Should it be possible to lift the aircraft by cranes or gantries, the following methods may be adopted. A complete set of slings *(Chap.4, Table 1)* is capable of lifting an aircraft at its maximum all up weight. If, owing to crane limitations, this weight is beyond the combined capacity of the cranes available, the weight of the aircraft must be reduced accordingly.

(1) Remove the top cowling, service panel, and bottom cowling from each engine.

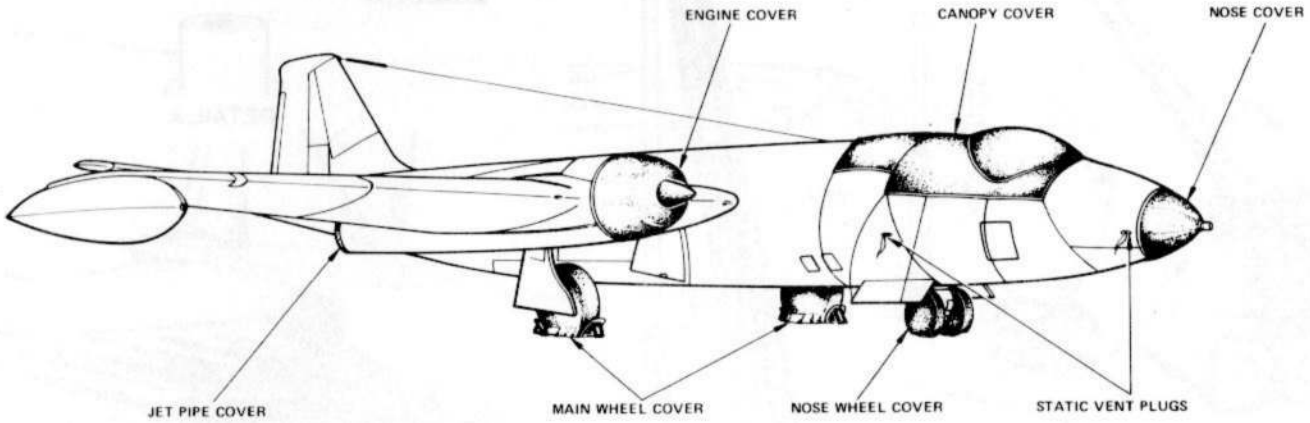


FIG. 5. AIRCRAFT COVERS

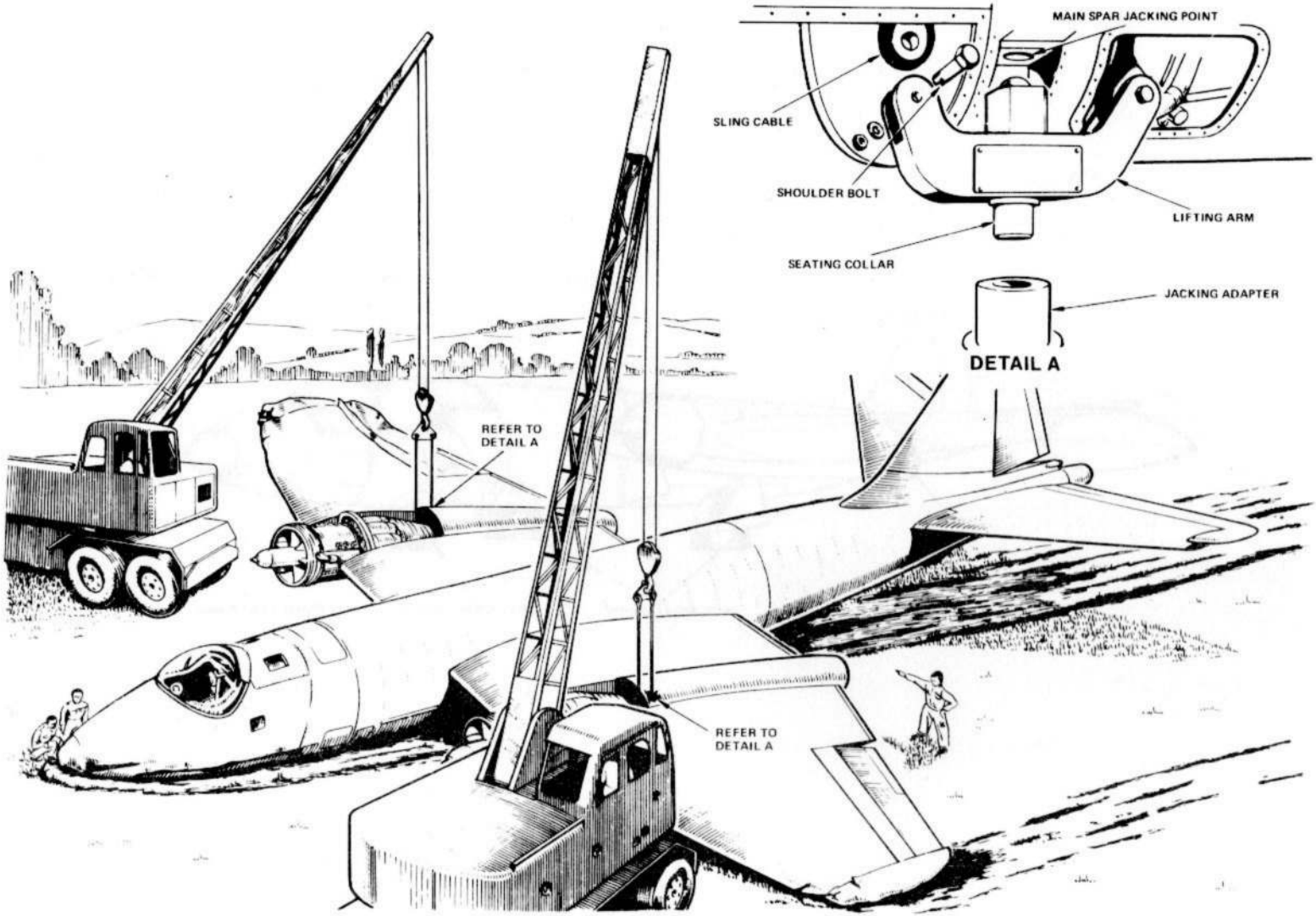


FIG. 6. LIFTING A CRASHED AIRCRAFT

(2) Open the main spar jacking point access panel and remove the detachable panel immediately aft of this point.

(3) Cut through the top jet pipe cowl on the outboard side aft of the main spar to provide access for the sling cable.

(4) Position the cranes at each outer wing leading edge immediately outboard of the engines. Ensure that the cranes are positioned on good solid ground, or suitably supported by sleepers, etc.

(5) Anchor the tail of the aircraft to prevent swinging but allowing enough slack in the line for lifting.

(6) Lower the slings with one cable each side of the engine firewall until the cable ends protrude beneath the engine cowlings.

(7) Attach the lifting arms to the cables *(detail A)* with the shoulder bolts Part No.EA3.88.317, ¾ in. Whitworth hexagon nuts and special washers Part No.EA3.88.319 and raise the slings until the spherical head on the lifting arm engages in the main spar jacking point.

(8) Raise the aircraft and position a 10-ton hydraulic jack and Mk.1 trestle *(Chap.4, Table 2)*, suitably supported on a firm foundation, with a Mk.48 adapter head *(Chap.4, Table 2)* beneath each main plane jacking point.

(9) Lower the aircraft until the seating collar on the lifting arm is engaged with the jack adapter.

(10) Retaining tension on the slings, trestle the fuselage as instructed in Sect.2, Chap.4.

Emergency removal

17. One method of removing crashed aircraft from runways is as follows:-

(1) *Equipment required (fig.7)*

(a) Two locally manufactured crow bars. Make from steel bar, 1½ in. dia. Ref.No.30A/9610622.

(b) Four locally manufactured stop plates. Make from 6 s.w.g. steel sheet Ref.No.30A/9610795.

(c) Four quick-release pins Ref.No.27FT/1200982.

◀ (d) Two soft towing bridles (Ref.No.4GB/4409987) fitted with one ¾ in. shackle (Ref.No.28Y/1057116) and shackle pin (Ref.No. 28Y/9508299) on each end. ▶

(e) Sledge hammer Ref.No.1B/9104699.

(f) Suitable towing/winching vehicles.

(2) *Preparation (fig.7)*

(a) Place the point of a crow bar on the inboard front corner of the main spar access panel and, using a sledge hammer, drive the crow bar through the top panel.

(b) When the crow bar has penetrated the upper access panel and entered the main plane, thread a towing bridle shackle and stop plate over it, and fit a quick-release pin.

(c) Locate the point of the bridle attachment bar on the inner surface of the lower access panel and force the bar through the main plane until the upper quick-release pin prevents further penetration.

(d) Thread the other shackle end of the towing bridle, and the stop plate over the protruding lower end of the crow bar, and secure with a quick-release pin.

(e) Repeat this operation on the opposite main plane.

(3) *Removal*

Connect the towing bridles to a suitable vehicle and tow/winch clear.

◀ **CAUTION**

To minimise the risk of damage to flying controls caused by high winds, control locks must be fitted whenever the aircraft is parked in the open.

Note . . .

Control locks may not necessarily prevent high winds from damaging the control systems and surfaces.

High wind exposure. Checking procedure

18. Aircraft which have been exposed to wind speeds in excess of 25 knots must be examined before the next flight in accordance with the following procedure.

(a) Examine all control locks. Ensure they are still correctly fitted and the controls still correctly locked.

(b) Remove the locks. Examine the locks for signs of strain or damage.

Any defects found during the checks (a) or (b) will render the aircraft unserviceable. Continue to check the relevant control systems as follows.

(c) Ensure free operation of the controls over the full range of movement.

(d) Examine the control surfaces primary limit stops and their attachment brackets. Ensure there are no fractures, distortion or signs of strain.

Any defects found during checks (c) or (d) will require a detailed investigation of the flying control systems. Continue to check the relevant control systems as follows. ▶

◀ **19.** Commence in the cockpit. Examine the control column and rudder pedals. Then work outward along the main planes and rearward along the fuselage, carefully examining the following points of the flying controls system.

(a) Pivot pins and fulcrum bolts. Check for excessive wear, distortion and signs of stress.

(b) Rivets and bolts which secure brackets and fairleads. Check for looseness, distortion and signs of shear.

(c) Secondary limit stops and their attachment brackets. Check for fractures, distortion and signs of strain.

(d) Control rods.
Check for fractures, distortion and signs of strain.

(e) Control surface fairings.
Check for damage resulting from harsh or excessive movements.

(f) Control surfaces. Examine. Especially in the vicinity of the hinge brackets.
Check for damage and distortion.

(g) Controls actuating arms and levers.
Check for fractures, rivet failure and signs of distortion. ▶

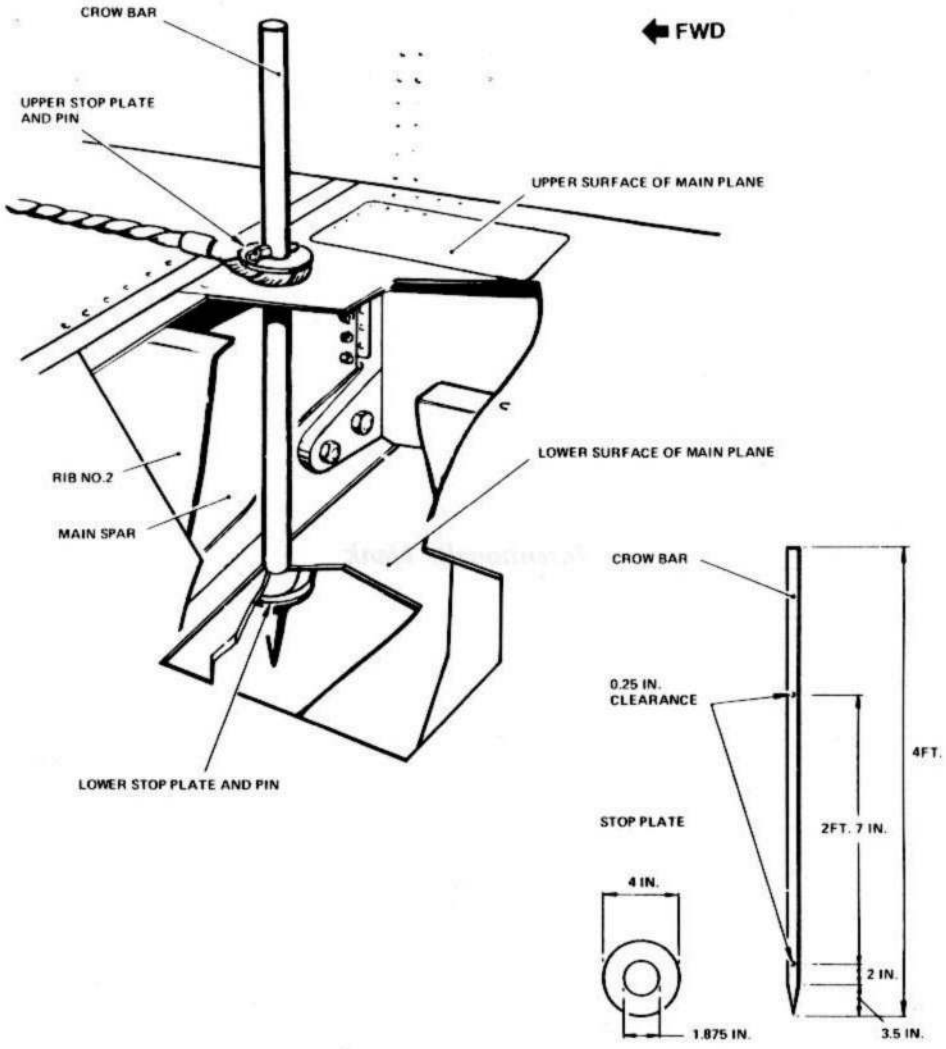


FIG. 7. EMERGENCY TOWING EQUIPMENT

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WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

Introduction

1. This chapter gives information on the general preparation of the aircraft for flight. Access to the fuel tank and other replenishing points is illustrated in fig.2.

Refuelling

2. Fuel tank filler caps are located in the top surface of the fuselage; the wing-tip tanks have filler caps in their upper surface and the filler cap for the auxiliary fuel tank is on the top, front end, of the tank. Observe the precautions in para.3.

Refuelling/defuelling precautions

3. It is essential that the following precautions are observed when refuelling or defuelling the aircraft.

(1) Verify the correct type of fuel to be used.

(2) Prior to removing the filler caps, ensure that the fuel hose and refueller are correctly earthed.

(3) On no account should No.1 tank be drained whilst fuel remains in No.2 and/or No.3 tanks, without supporting the fuselage at frame 42.

During refuelling operations fill No.1 tank first; during defuelling, No.1 tank must always be drained last.

(4) The tanks must be filled only from a refueller fitted with a Streamline filter.

Checking the tank contents

4. The main fuel tanks are fitted with capacitor-type fuel contents guages which indicate correct readings irrespective of the attitude of the aircraft; dipsticks are not required. The gauge indicators register the tank contents when the battery isolating switch is switched on or when an external electrical supply is connected.

Checking the accessory gearbox oil level

5. The accessory gearbox oil dipstick is located on the top of the gearbox, and is accessible after removing a panel in the main plane *(Sect.2, Chap.4)*. If the oil level is lower than the FULL mark on the dipstick, the gearbox should be replenished through the filler-cap adjacent to the dipstick with oil as specified in Leading Particulars.

Note. . .

The gearbox and sump oil has a deleterious effect on paint, rubber, electric cables etc., care must be taken to avoid spilling it on such parts.

Refilling the oil sumps

6. The oil sump filler caps *(fig.2)* are accessible through removable panels *(Chap.4)*. Refer to Leading Particulars for the correct type of oil. To refill or top-up:-

After the system has been emptied.

◀ (1) *No.1 engine*

(a) With the aircraft standing on level ground, fill the sump to approximately 1½ inches below the seal face of the sump filler neck.

(b) Run the engine for 2 minutes at idling rev/min to circulate the oil.

(c) After stopping the engine, allow sufficient time to elapse for the oil in the system to drain back into the sump (approximately 10 minutes), after which, top up to the level as in (1)(a).

(2) *No.2 engine* ▶

(a) With the aircraft standing on level ground, fill the sump

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to approximately ½ inch below the seal face of the sump filler neck.

(b) Repeat (1)(b).

(c) After stopping the engine, allow sufficient time to elapse for the oil in the system to drain back into the sump (approximately 10 minutes), after which, top up the level as in (2)(a).

Intermediate topping up

(3) The levels referred to in (1)(a) and (2)(a) are to be rigidly observed.

Checking the cold-air unit oil level (post Mod.5 or 2523)

7. The combined oil filler and dipstick is located on the top of the cold-air unit and is accessible after removing a panel on the port inner wing *(Chap.4)*. If the oil level is lower than the FULL mark on the dipstick, top-up with oil OEP-71.

Note. . .

Pour oil slowly into the filler neck allowing a few minutes for it to settle before checking the dipstick. The oil level is critical, do not overfill.

Topping up the hydraulic fluid reservoir

8. An elliptical panel in the upper surface of the fuselage, aft of the crew escape hatch, provides access to the hydraulic reservoir filler cap. The reservoir should be topped up to the maximum possible level with fluid as specified in Leading Particulars; a drainpipe is provided for fluid spilt through overfilling. It is important that hydraulic pressure is exhausted from the main accumulator by operating the flaps or the bomb-bay doors until no further movement can be obtained, and from the brakes accumulator by operating the wheel brakes.

WARNING

Before operating the flap selector, ensure that aileron locks are not fitted. Refer to the note in Chap.1 of this Section.

9. Before topping-up the reservoir ensure that the pressures shown on the accumulator pressure gauges *(para.10 and 11)* agree with those given in Leading Particulars, when the respective system is exhausted. If the pressure shown is in excess of the given figure it is an indication that fluid is still contained in the respective accumulator. If the pressure is below the given figure the accumulator must be recharged *(para.10 and 11)*. Also before filling, ensure that the alighting gear is down, the bomb-bay doors open and the air brakes in. The flaps may be in either the fully up, or fully down positions.

Hydraulic accumulator inflation

10. The hydraulic accumulator inflation point is adjacent to the hydraulic accumulator in the starboard undercarriage well, together with its pressure gauge. The correct inflation pressure when the accumulator is exhausted is given in Leading Particulars.

Brakes accumulator inflation

11. The brakes accumulator inflation point is at the forward end of the bomb bay, together with its pressure gauge. The correct inflation pressure when the accumulator is exhausted is given in Leading Particulars.

Oxygen system

12. The oxygen charging valve is located on the rear face of frame 12. It is accessible through the battery access door on the port side of the fuselage. The procedure for charging the system is fully described in A.P.107D-0001-1.

Battery isolating switch

13. As a number of electrical circuits are without switches and fed directly from the main positive supply, an isolating switch is fitted to prevent battery drain when the aircraft is on the ground with the engines stopped. The switch is located on the electrical control panel, and must be switched OFF immediately after stopping the engines.

External electrical supply socket

14. The external electrical supply socket is located on the main

Electrical panel on the starboard side of the fuselage; access is through a door in the lower side of the fuselage, aft of the entrance door.

Canopy de-misting

15. Windows provided in the air-drier tubes fitted to the canopy, the nose and the forward observation window, permit visual inspection of the contents of the 'tell-tale' compartments. The dessicant used in the air-driers is silica gel, which should be changed when it becomes pink.

Note . . .

Silica gel is blue when dry.

Alighting gear inflation

16. The inflation pressure of the main undercarriage shock-absorber struts may be checked by measuring the strut extensions and checking these measurements against the graph in fig.4. The initial inflation pressure with the strut fully extended should be 545 ± 25 lb/in^2.

17. The nose undercarriage is liquid sprung and is not inflated with air, consequently graphs are not provided for checking its condition. The shock-absorber must be charged to 1500 ± 0.0 lb/in^2 with hydraulic fluid as specified in Leading Particulars, and with the nose wheel clear of the ground for optimum efficiency. After charging, and when the shock-absorber has settled down the extension *(dimension X in fig.1)* should be noted for the most common CG configuration and all-up weight. The serviceability of the unit may be subsequently checked by using this dimension as a norm. Any abnormal variance is to be investigated by jacking up the nose and checking the pressure *(Sect.3, Chap.5B)*.

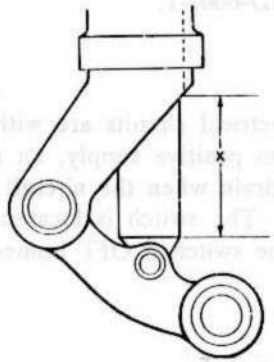

Fig.1 Nose undercarriage shock-absorber extension

Note . . .

The dimension X will vary from aircraft to aircraft and according to the type of shock-absorber unit fitted.

Tyre pressures

18. The tyre pressures are given in A.P.101B-0400-5A3.

◀ To obviate the risk of auto-ignition, dry nitrogen should be used to inflate the undercarriage wheel tyres. The occasional 'topping-up' of pressure may be accomplished using dry air if nitrogen is not available. In an emergency dry air may be used to inflate the tyres but this must be rectified at the earliest opportunity. ▶

Positioning the aircraft for ground running

19. The aircraft must be headed into wind for all ground running, to prevent the hot gases entering the air-intakes and causing overheating. Before starting an engine, care must be taken to ensure that the aircraft is well clear of buildings and other aircraft; these, if less than 100 yards behind the aircraft, are liable to be damaged by the stream of hot gases or by loose objects thrown up by the air stream from the jet pipe. The ground in the immediate vicinity of the front of the aircraft must be kept clear of loose objects which may otherwise be drawn into the engine. All personnel should keep well clear of the air intakes, at least five yards, and safety guards *(Chap.4, Table 1)* must be fitted to the air intakes. The aircraft must never be positioned on tarmac for ground running, if possible, position it on concrete, but if a concrete base is not available, it may be positioned on grass.

Reloading the engine starter

20. The engines are started by single-breech turbo-starters positioned in the air-intakes of both engines; the procedure for reloading the starter is given in fig.3.

WARNING

If a cartridge does not fire when the starter control is operated, an interval of three to four minutes should be allowed before the breech cap is removed to investigate the fault.

Reloading interval

21. When the starter is cold two shots may be fired without restrictions on the reloading interval, but thereafter a cooling period of ten minutes must be allowed after firing a shot, before reloading.

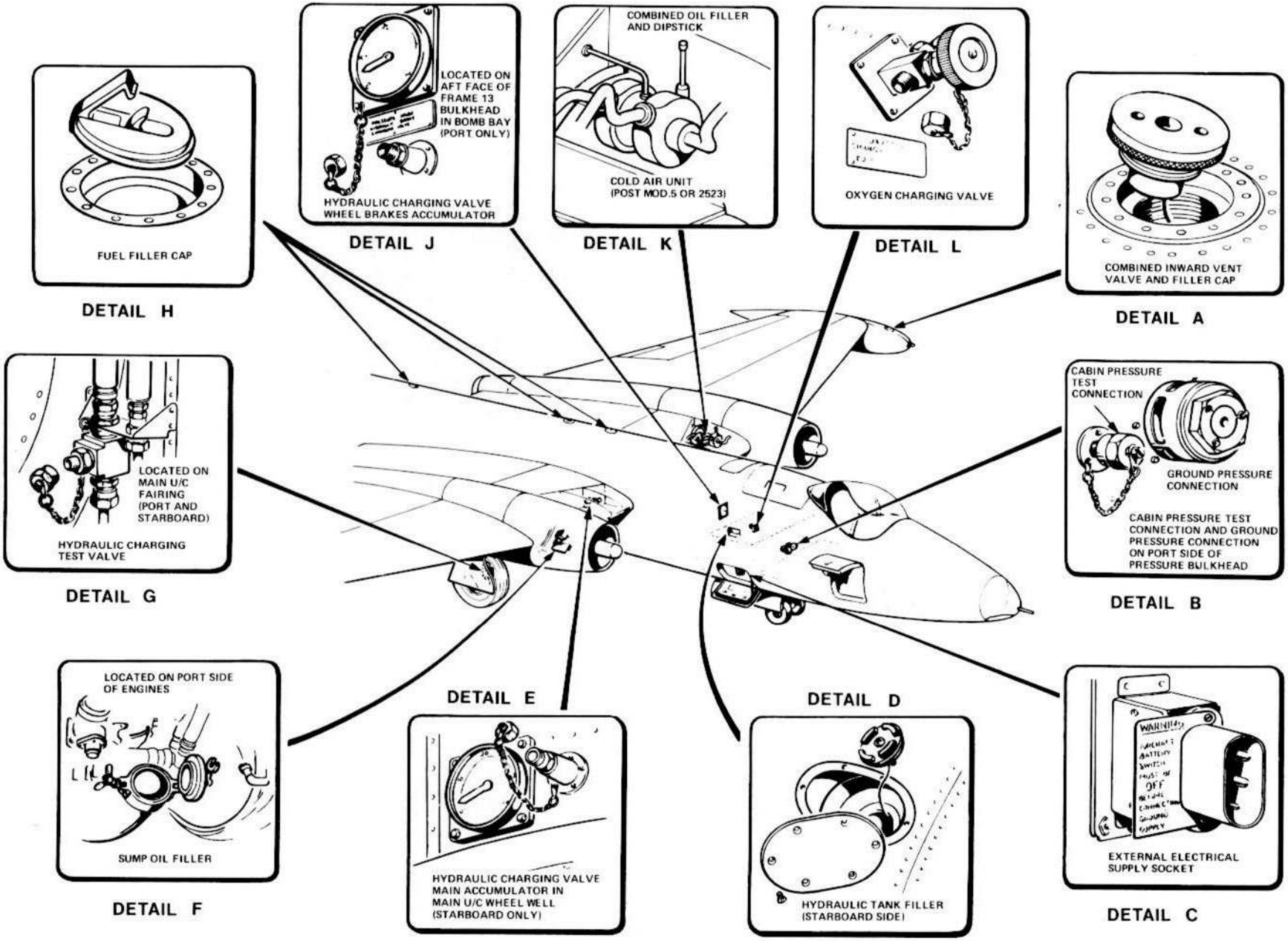

FIG. 2. SERVICING POINTS

◀ COLD AIR UNIT ADDED ▶

UK RESTRICTED

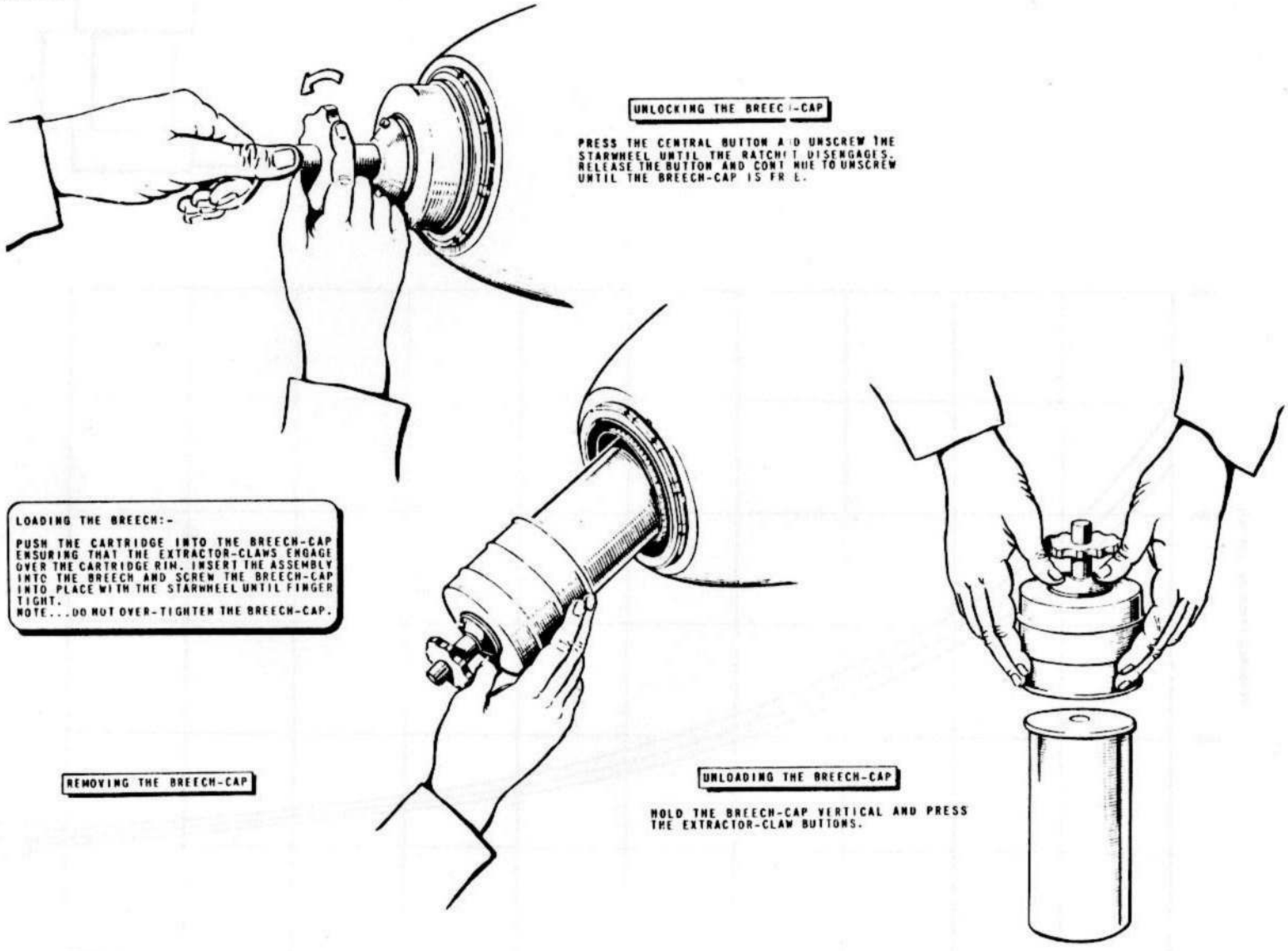

Fig.3. Turbo-starter re-loading

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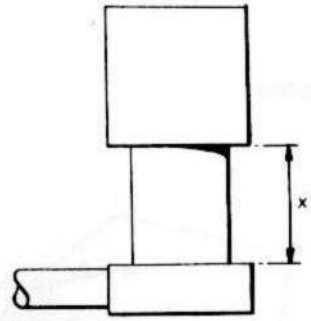

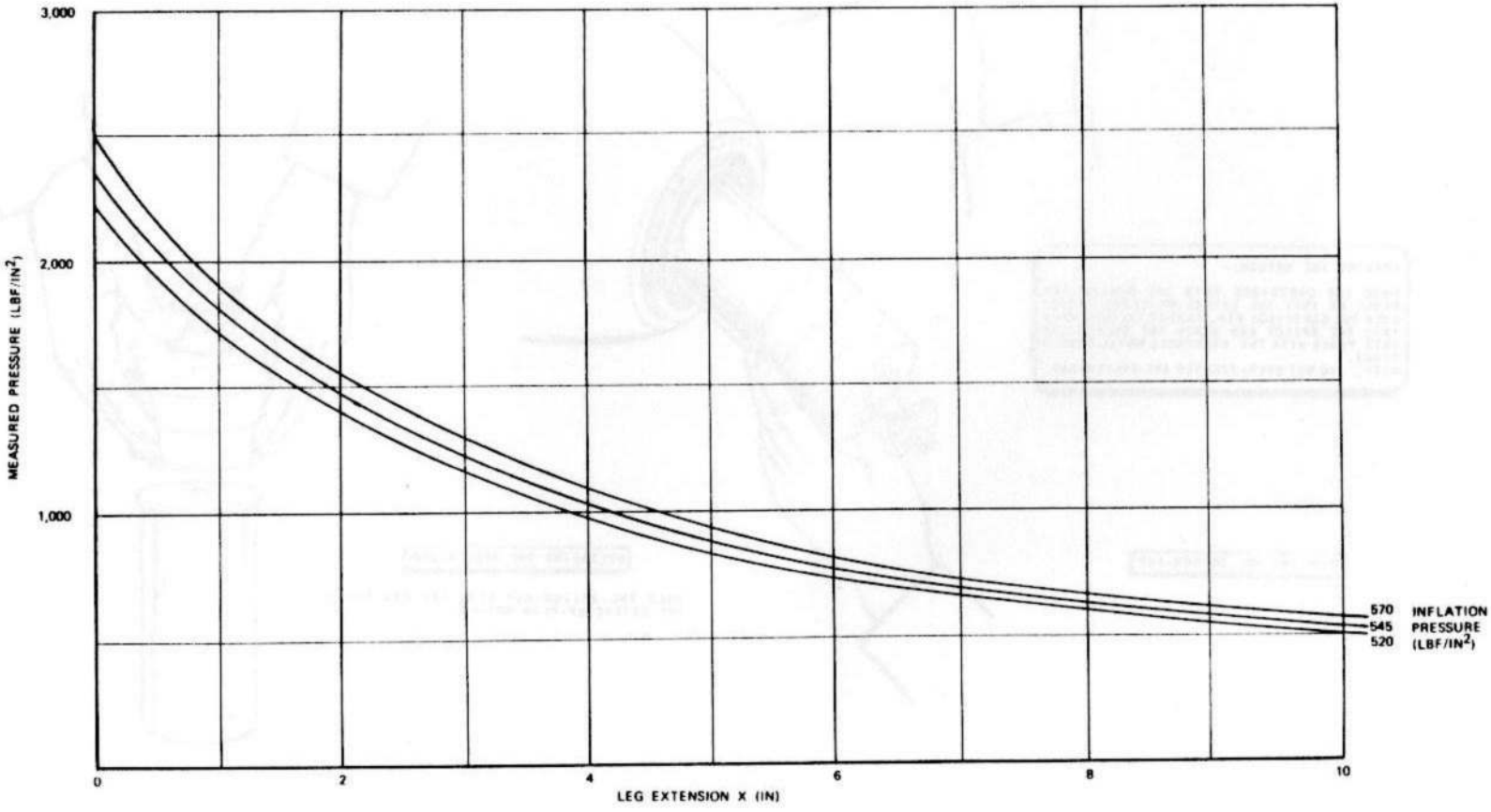

FIG. 4. MAIN UNDERCARRIAGE INFLATION CHART

◀GRAPH REDRAWN▶

◄ Chapter 3 LOADING AND C.G.DATA (MOD.5097, 5409)►

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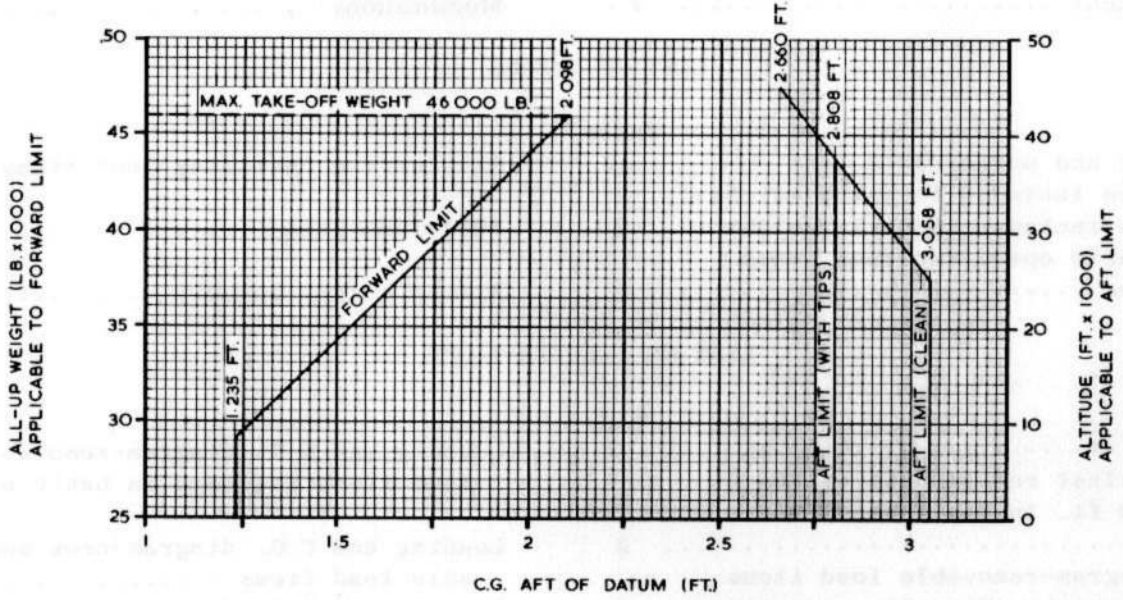

FIG. I. FLIGHT C.G. LIMITS

General information

1. This chapter deals with the effects of different and varying loads upon the C.G. position.

C.G. position

2. The aircraft C.G. position is determined with the fuselage datum horizontal (i.e. in the rigging attitude) and with the undercarriage down. All moment arms are measured in feet units parallel to the fuselage datum and are positive when they refer to items aft of the C.G. datum and negative when they refer to items forward of this datum.

C.G. datum

3. The C.G. datum is 4.695 ft forward of the spar datum and 0.455 ft below the fuselage horizontal datum. It is indicated by a screw marked C.G. datum on the port side of the fuselage. This screw can be used to suspend a plumb line during weighing operations.

Flight C.G. limits *(fig.1)*

4. Fig.1 prescribes the approved handling limits, for C.G. movement measured from the C.G. datum.

Forward limit

This is dependent upon the weight of the aircraft. At weights below 29000 lb the permissible forward limit is 1.235 ft aft and at a weight of 46000 lb the permissible forward limit is 2.098 ft aft.

Aft limit

This is dependent upon the altitude of the aircraft.

Aircraft without wing tip tanks:
Up to 25,000 ft the aft C.G. limit is 3.058 ft aft of datum; it then moves linearly forward to 2.660 ft aft of datum at 45000 ft.

Aircraft with wing tip tanks:
Up to 37,000 ft the aft C.G. limit is 2.808 ft aft of datum; it then moves linearly forward to 2.660 ft aft of datum at 45000 ft.

Note . . .

If the aircraft is to be taxied over rough ground the aft limit must not exceed 2.885 ft aft.

Effect of alighting gear retraction

5. Retraction of the alighting gear introduces a moment of −1299 lb ft which must be taken into account when making calculations which assume that the alighting gear is retracted.

Crew movement

6. Movement of the 3rd crew member from his ejection seat to the map reader's seat introduces a moment of −680 lb ft. Further forward movement to the prone position introduces an additional moment of −894 lb ft (a total moment change of −1574 lb ft).

Basic weight and moment

◄ 7. Table 6 refers to a basic weight of 21996 lb and a basic moment of +67209 lb ft. These figures are based on the average weight of WK 116 and ► WJ 678, corrected to the common modification standard detailed in para.14. A definition of the term basic weight may be found in A.P.119W-0001-1. The basic weight and moment will vary between aircraft depending on their modification standard and the figures quoted on the Mod.F751 should be substituted.

Maximum all-up weights *(fig.1)*

8. The aircraft is cleared for operational flying at the following maximum weights:—

Take off	46,000 lb
Landing	40,000 lb

Note . . .

Emergency landings only are permissible at weights in excess of this figure.

Alternative load items

9. If stores other than those given are to be carried, their disposition should be similar to that of stores given in the all-up weight summary of approximately the same weight. This will ensure that the aircraft C.G. will at all times remain within the C.G. handling limits, providing that normal fuel drill and the correct sequence for dropping stores are adhered to.

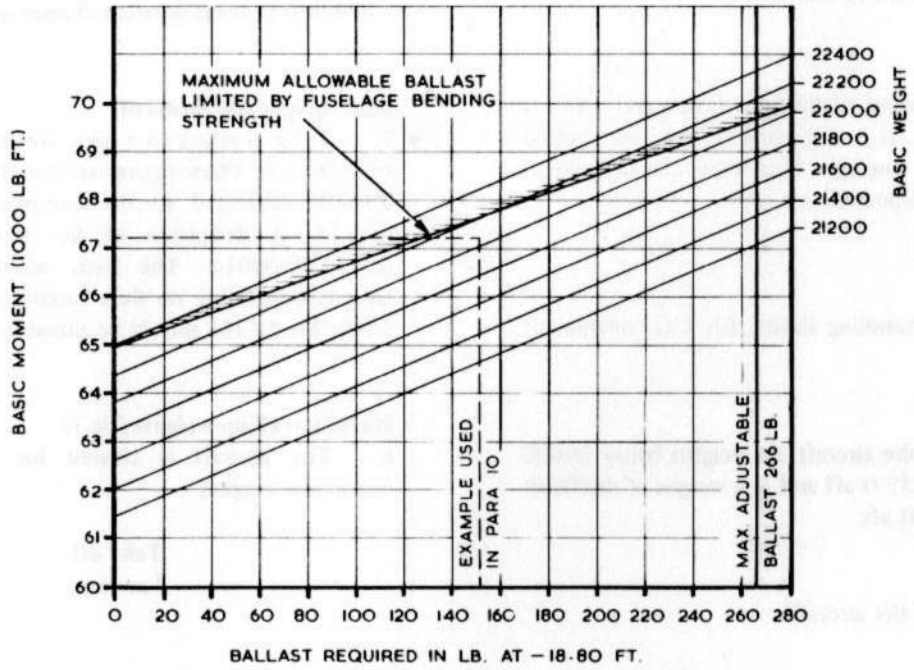

FIG.2. DETERMINATION OF BALLAST REQUIRED TO ESTABLISH C.G. AT + 2.90 FT. IN BASIC CONDITION

◀EXAMPLE AMENDED▶

Ballast

10. Ballast weights totalling 266 lb *(Sect.3, Chap.1)* are provided to help maintain the C.G. position within the C.G. range. Adjustment may be made necessary due to removal or non-fitment of equipment, introduction of modifications etc. In order to ensure that the C.G. for individual aircraft will remain within the handling limits at all times, when carrying and releasing any of the permissible loads, the C.G. of the aircraft at the basic weight plus ballast, i.e. without fuel, crew and alternative load equipment must always be maintained at +2.90 ft (± 0.05 ft).

Note . . .

The basic weight may be determined from the basic weight of the aircraft as given in Form 751 corrected for any additions or deletions of equipment etc.

Method of determining amount of ballast required:

From the vertical axis of the graph *(fig.2)* select the appropriate value of the aircraft moment and extend from this value a horizontal line to intersect the aircraft weight value on, or between the weight lines, a vertical line is then dropped from this intersection to the horizontal axis of the graph to indicate the amount of adjustable ballast required to give a C.G. position of +2.90 ft.

◀ *Example:–*

	Weight (lb)	Arm (ft)	Moment (lb ft)
Basic weight	21996	+3.055	+67209
Therefore, referring to fig.2, amount of ballast required to obtain C.G. position of +2.90 ft is:–	+152	–18.8	-2858
Basic weight plus ballast	22148	+2.905	+64351

Note . . .

An aircraft at the basic weight and moment quoted in para.7, with all its basic equipment fitted, would require 152 *lb of ballast.* ▶

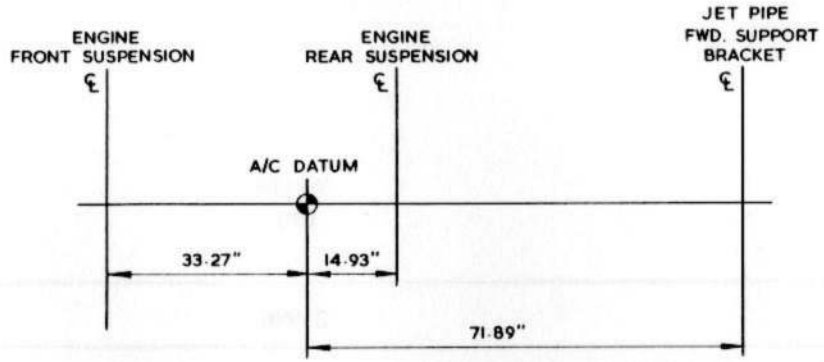

FIG. 3. ENGINE CHANGE DATA

Weighing the aircraft

Preparation

11.

(1) With the aircraft in the rigging position drain the fuel tanks *(Sect.4, Chap.2). (For details of undrainable fuel refer to Table 1.)* Remove all expendable load items and all possible alternative load items.

Non-hydrostatic method of weighing

(2) Information of a general nature concerning the practical measurement of basic weight and moment is contained in A.P.119W-0001-1.

Hydrostatic method

(3) The equipment required for weighing the aircraft using the hydrostatic method is listed in Sect.2, Chap.4, Table 2. A.P.119W-0301-1 gives general information on hydrostatic units and their use; the following instructions amplify this:–

(a) Jack the aircraft at the main and front fuselage jacking points *(Sect.2, Chap.4).*

(b) Place locally manufactured wood blocks of sufficient thickness to provide the necessary clearance for the hydrostatic unit and jacks, under the nose and main wheels. Lower the aircraft on to the blocks and remove the lifting jacks.

(c) Assemble:–

(i) A 25-ton hydrostatic unit, a 15-ton jack and jack to unit and unit to aircraft pad adapters at each main wheel jacking point.

(ii) A 10-ton hydrostatic unit, an 8-ton jack and jack to unit and unit to nose undercarriage adapters, under the nose undercarriage axle between the twin wheels.

(d) Weigh the aircraft as instructed in A.P.119W-0301-1.

(e) Lower the aircraft on to the wood blocks and remove the weighing equipment.

(f) Jack the aircraft *(operation (a))* and remove the blocks.

(g) Lower the aircraft to the ground and remove the jacks.

Basic weight determination

12. To the weight and moment obtained from weighing add:–

(1) The weight and moment of drainable unusable fuel in the pipe lines *(Note 2 of Table 1).*

(2) The weight and moment of Table 2 items not fitted at weighing but required for flight.

Deduct the weight and moment of all items from Tables 3, 4, 5 and 6 which were fitted at weighing.

The resultant figures are the basic weight and moment.

Note . . .

The total amount of adjustable ballast fitted at the time of weighing must be deducted.

Engine data

13. In the event of an engine change, Mod. F.751 must be amended to account for any changes in the engine weight and moment in accordance with the values quoted for the individual engine on the engine log card. The C.G. position as quoted on the log card will be to an engine datum, either the front or rear suspension point, which can be corrected to the A/C datum using the data given in Fig.3.

Modifications

14. The basic weight given in Table 6 includes the modifications quoted in CAN/2/Y/4 plus the modifications listed in sub-para.(1) minus those listed in sub-para.(2).

(1) 194, 254, 432, 735, 885, 890, 1019, 1027, 1047, 1155, 1158, 1159, 1191, 1198, 1259, 1275, 1276, 1282, 1288, 1290, 1415, 1419, 1423, 1424, 1426, 1452, 1457, 1460, 1474, 1490, 1494, 1497, 1704, 1712, 1713, 1722, 1740, 1745, 1771, 1777, 1905, 1919, 1945, 1958, 1997, 2108, 2125, 2132, 2160, 2177, 2178, 2308, 2361, 2391, 2527, 2545, 2576, 2599, 2605, 2677, 2689, 2703, 3158, 3211, 3278, 3296, 3369, 3383, 3480, 3528, 3545, 3562, 3585, 3706, 3710, 3726, 3747, 3757, 3759, 3841, 3849, 3900, 3905, 3922, 3971, 4003, 4011, 4024, 4094, 4112, 4288, 4357, 4451, 4476, 4478, 4930, 4937, 5055. 5409

(2) 300, 304, 431, 611, 871, 1045, 1454, 4858, 4868, 5177, 5200.

TABLE 1

Summary of drainable and undrainable unusable fuel to be included in basic weight

Location	Weight (lb)	Arm (ft)	Moment (lb ft)
Trapped (undrainable) fuel in pipes (wings and fuselage)	6.70	−0.228	− 1.53

Note . . .

(1) Due to the disposition of certain fuel pipes, the above weight of fuel will remain trapped when the fuel tanks are drained.

(2) Since all fuel in the pipelines is included in the basic weight, the following fuel weights must be added when determining the basic weight after weighing the aircraft.

Drainable fuel in pipes (wing and fuselage)	9.00	+1.534	+13.81

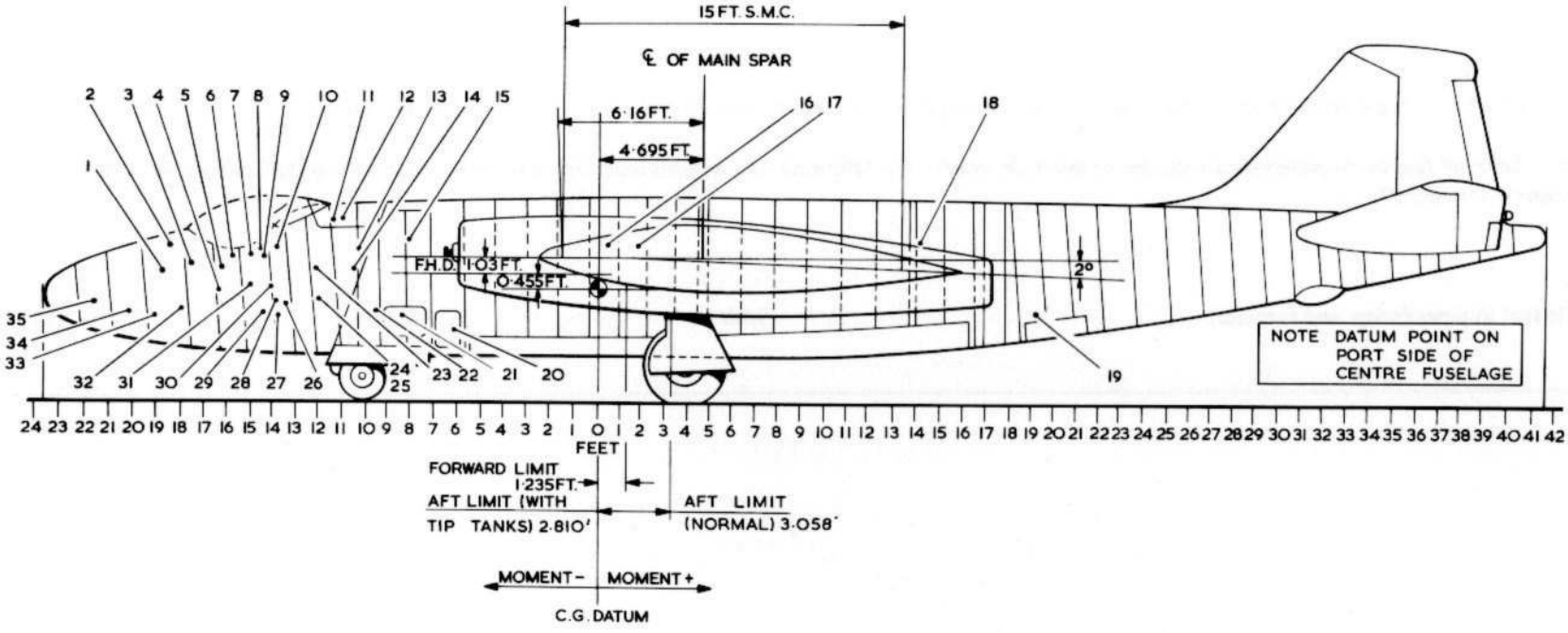

FIG. 4. LOADING AND C.G. DIAGRAM — REMOVABLE LOAD ITEMS INCLUDED IN BASIC WEIGHT (MISCELLANEOUS ITEMS)

TABLE 2 Removable load items included in basic weight *(fig.4)*

Fig.4 Item No.	Ref. or Part No.	Qty.	Description	Weight (lb)	Arm (ft)	Moment (lb ft)
			MISCELLANEOUS ITEMS			
33	EA3.83.97	1	Ballast crate, non-adjustable	21.06	−18.90	− 398.03
35	6D/1644	1	Oxygen emergency set, Mk.2A	2.00	−21.43	− 42.86
5	12G/1279	1	Detonator, electric, No.109, Mk.1 (controls)	0.02	−16.19	− 0.32
2	6A/2197	1	Clock, fluorescent, Mk.4	0.44	−18.57	− 8.17
6	12G/1278	32	Detonators, electric, No.108, Mk.1 (canopy)	0.74	−15.70	− 11.62
11	12G/1278	34	Detonators, electric, No.108, Mk.1 (hatch)	0.78	−11.20	− 8.74
15	–		Oxygen charge	25.78	− 8.14	− 209.82
19	12K/1220	6	Cartridges, engine starting	18.00	+19.14	+ 344.52
21	12L/203	1	Destructor, aircraft, No.1, Mk.1	3.25	− 8.73	− 28.37
27	6545-99-211-0670	1	First-aid outfit	3.00	−13.66	− 40.98
28	22G/108081	1	Gauntlets, fire-fighting (1 pair)	0.88	−14.12	− 12.43
7	12K/9629465	1 set	Cartridges, seat ejection, set No.1, Mk.1 (pilot)	0.47	−14.88	− 6.99
14	12K/9629465	1 set	Cartridges, seat ejection, set No.1, Mk.1 (navigator)	0.47	−10.35	− 4.86
13	12K/9629465	1 set	Cartridges, seat ejection, set No.1, Mk.1 (air bomber)	0.47	−10.29	− 4.84
4	12G/9635203	1	Charge, H.E., emergency control severing	0.37	−16.19	− 5.99
34	5J/9101808	1	Battery, secondary, alkaline, 2.4 volt, 3 amp h	1.25	−19.66	− 24.58
32	5J/9101543	1	Battery, secondary, lead acid, 12 volt, 4 amp h	4.94	−17.84	− 88.13
20	5J/9101534	4	Battery, secondary, lead acid, 12 volt, 40 amp h Type C	198.76	− 6.65	−1321.75
17	6B/4343636	1	Air mileage unit, Mk.4A	10.50	+ 1.49	+ 15.65
24	6B/4343641	1	Amplifier unit, Type B)	10.00	−11.89	− 118.90
1	6B/4343640	1	Gyro unit, Type B) G.4B compass	6.00	−18.69	− 112.14
9	6B/634	1	Indicator, master)	6.63	−14.22	− 94.28
10	6B/408	1	Panel, control, Type A)	1.28	−13.72	− 17.56
8	6B/1158	1	Indicator, air position, Mk.1B	11.20	−14.31	− 160.27
12	6B/2764	1	Periscope, aircraft, rear viewing, Type KPG 0502	4.53	−11.08	− 50.19
3	27KD/375	5	Stoppers, leak, cabin pressure	1.25	−17.50	− 21.88
26	27N/1	1	Axe. fire	2.42	−13.43	− 32.50
18	27N/100	1	Extinguisher, fire, Methyl Bromide, automatic, Type 12A	10.63	+13.96	+ 148.39
16	27N/102	2	Extinguisher, fire, Methyl Bromide, automatic, Type 14A, (wing)	38.62	+ 1.01	+ 39.01
29	27N/299	1	Extinguisher, fire, hand-operated, Type 34H	5.19	−13.72	− 71.21
31	EA3.80.1989	1	Handle for emergency hydraulic hand pump (stowed)	0.85	−14.97	− 12.72
30	27H/3224	1	Container, urine, Mk.2 and funnel	1.09	−13.97	− 15.23
24	120/	6	Cartridges, signal	2.06	−11.89	− 24.54
25	120/1211	6	Cartridges, radar echo Mk.1	2.06	−11.89	− 24.54
22	5J/1115903	1	Battery Type K	18.00	− 9.60	− 172.80
23	27N/299	1	Extinguisher, Fire, hand-operated, Type 34H	5.19	−11.89	− 61.71

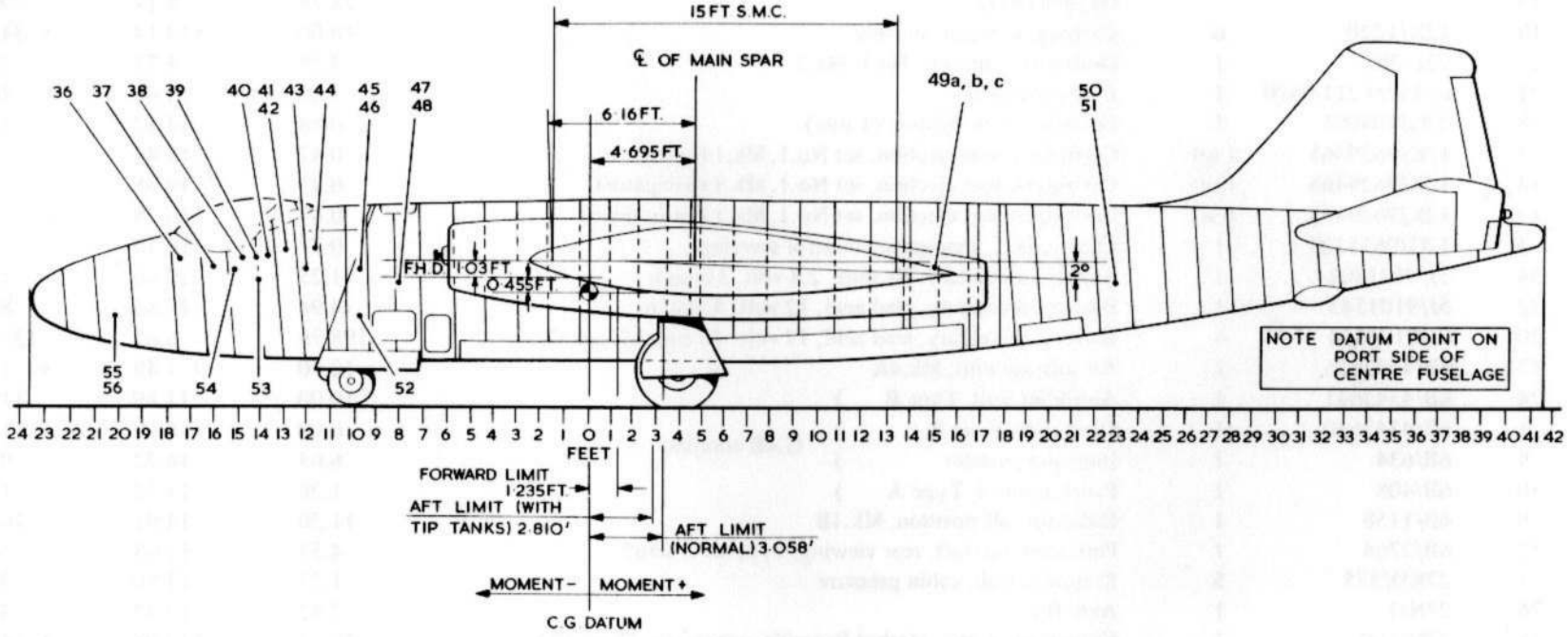

FIG. 5. LOADING AND C.G. DIAGRAM — REMOVABLE LOAD ITEMS INCLUDED IN BASIC WEIGHT

◀49 a, b, c, ADDED▶

TABLE 2 Removable load items included in basic weight *(fig.5)*

Fig.5 Item No.	Ref. or Part No.	Qty.	Description	Weight (lb)	Arm (ft)	Moment (lb ft)
			INTERCOMM ARI 18909			
37	10L/16748	1	Control unit, Type 7681A	3.00	−16.00	− 48.00
39	10L/16748	1	Control unit, Type 7681A	3.00	−14.00	− 42.00
54	10U/16596	1	Amplifier, Type A1961	6.80	−15.20	− 103.60
			U/VHF ARI 23300			
49a	630/1/37846/001	1	Interface unit PV1746B	2.64	+15.00	+17.64
49b	630/1/37851/018	1	UHF Tranceiver PTR 1751 W	15.43	+15.00	+231.45
49c	10D/6498446	1	VHF Tranceiver A A 1201-3	4.90	+15.00	+73.50
36	630/1/37854/010	1	Controller PV 1754L	3.31	-17.72	-58.65
40	630/1/37853/010	1	Controller PV 1753M	2.21	-13.43	-29.68
			IFF/SSR 1520 ARI 23134/3			
50	5895-99-956-3378	1	Transponder, 16928	30.00	+23.19	+ 695.70
51	5820-99-107-5637	1	Mounting, Type 16946	1.25	+23.19	+ 28.99
38	5895-99-956-3379	1	Control Unit, Type 16929	2.00	−14.25	− 28.50
			MILITARY ILS ARI 18011			
44	10L/263	1	Control unit, Type 705	1.75	−11.60	− 20.30
55	10D/17818	1	Receiver, localizer marker, R1964	18.00	−20.00	− 360.00
56	10D/17819	1	Receiver, Glide path, R1965	16.80	−20.00	− 336.00
			RADIO COMPASS ARI 23023			
45	10D/19598	1	Receiver, AD 7092D	15.00	−10.10	− 151.50
46	10D/17031	1	Mounting Tray, Type 182	1.25	−10.10	− 12.63
43	10L/16073	1	Receiver controller, Type 1274	2.80	−11.88	− 33.26
			STANDBY UHF ARI 23159			
52	5821-99-952-8931	1	Transmitter-receiver, D403M	5.60	− 9.82	− 54.99
			TACAN ARI 18107/18			
47	5826-00-691-4896	1	Transmitter-receiver, RT 220C/ARN 21	50.00	− 8.00	− 400.00
48	10AJ/251	1	Mounting, Type 9274	7.77	− 8.00	− 60.00
53	10L/16324	1	Control unit, Type T9273	1.23	−14.00	− 17.22
41	10D/22534	1	Coupling unit, Type 9546	7.47	−13.00	− 97.11
42	10AJ/258	1	Mounting, Type 9545	1.88	−13.00	− 24.44

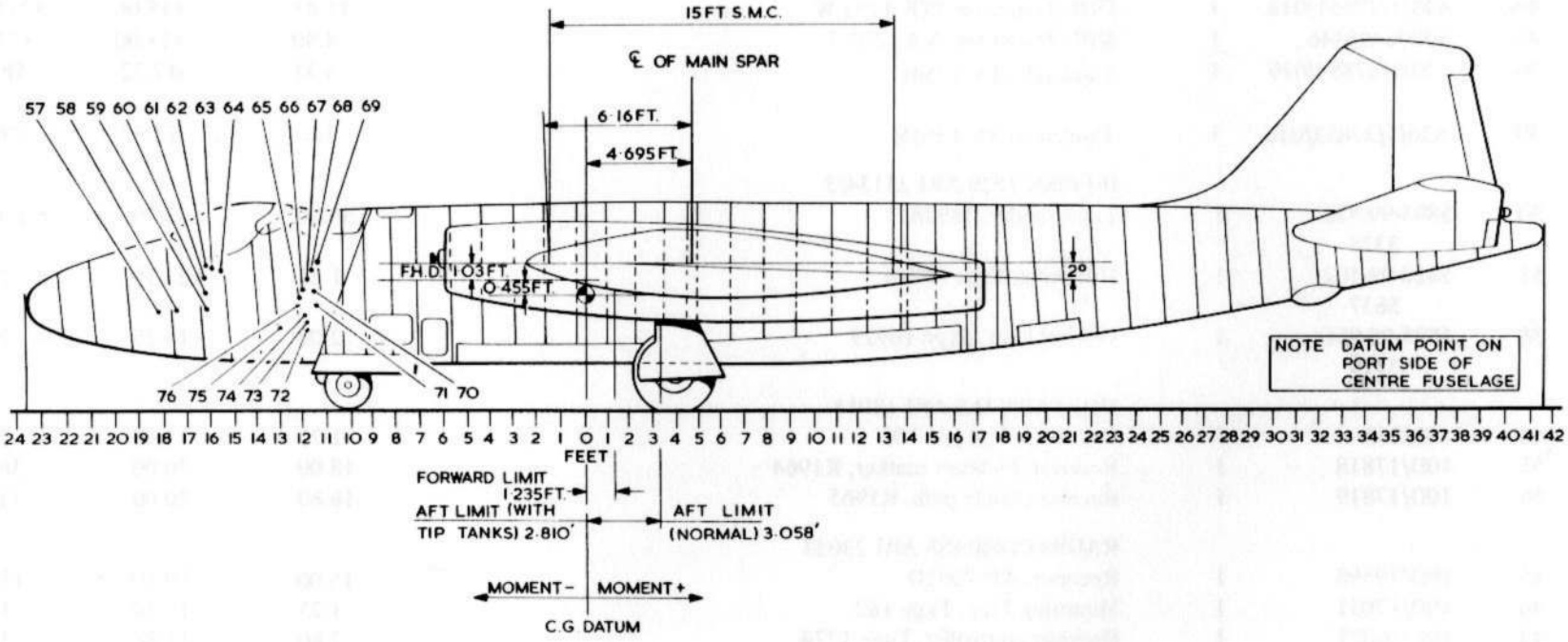

FIG. 6. LOADING AND C.G. DIAGRAM – CREW AND CREW REMOVABLE LOAD ITEMS

TABLE 3 Crew and crew removable operating load items common to all roles *(fig.6)*

Fig.6 Item No.	Ref. or Part No.	Qty.	Description	Weight (lb)	Arm (ft)	Moment (lb ft)
			PILOT AND EQUIPMENT			
63	–	1	Pilot	180.00	–16.44	–2959.20
59	15A/4177654	1	Parachute, seat type Mk.18	26.00	–16.44	– 427.44
64	22C/2274	1	Jacket, life-saving, Mk.7	6.50	–15.78	– 102.57
60	27C/1482391	1	Pack personal survival, Type M, Mk.2B	25.00	–16.40	– 410.00
61	6D/2678	1	Oxygen emergency set, Mk.7J	3.25	–16.40	– 53.30
57	–	1	Pilot's notes for Canberra B Mk.2 aircraft	0.20	–17.96	– 3.59
58	6F/171	1	Pad, writing, pilot's knee-type	1.37	–17.23	– 23.61
62	5A/9105033	1	Torch, electric, Type Y c/w cells	0.72	–16.44	– 11.84
			NAVIGATOR AND EQUIPMENT			
65	–	1	Navigator	180.00	–11.88	–2138.40
67	15A/4177654	1	Parachute, seat type Mk.18	26.00	–11.92	– 309.92
73	27C/1482391	1	Pack, personal survival, Type M Mk.2B	25.00	–11.85	– 296.25
72	22C/2274	1	Jacket life-saving, Mk.7	6.50	–11.31	– 73.52
74	6D/2678	1	Oxygen emergency set, Mk.7J	3.25	–11.92	– 38.74
75	6B/469	1	Case, carrying Navigator's equipment containing:–	1.00	–13.04	– 13.04
	5A/9105033	1	Torch, electric Type Y c/w cells	0.72	–13.04	– 9.39
	6B/9101001	1	Watches, stop	0.25	–13.04	– 3.26
	6E/293	1	Binocular, Mag. 6 Diams., 30 mm	2.00	–13.04	– 26.08
	6E/392	1	Binocular, 40 mm Mk.5 c/w rubber face plate	2.25	–13.04	– 29.34
	6B/2645	1	Computer, dead reckoning, Mk.4	0.25	–13.04	– 3.26
	6B/47	1	Protractor, Douglas 5 in.	0.14	–13.04	– 1.83
	6B/260	1	Rule navigator's, Mk.1	0.13	–13.04	– 1.70
	13/94	1	Sets, compass	0.25	–13.04	– 3.26
	6B/349	1	Straight edge, 20 in.	0.30	–13.04	– 3.91
			3rd CREW MEMBER AND EQUIPMENT			
69	–	1	3rd Crew member	180.00	–11.83	–2129.40
68	15A/4177654	1	Parachute, seat type, Mk.18	26.00	–11.87	– 308.62
66	27C/1482391	1	Pack, personal survival, Type M, Mk.2B	25.00	–11.80	– 295.00
71	22C/2274	1	Jacket life-saving, Mk.7	6.50	–11.27	– 73.24
76	6D/2678	1	Oxygen, emergency set, Mk.7J	3.25	–11.87	– 38.58
70	5A/9105033	1	Torch, electric, Type Y c/w cells	0.72	–11.83	– 8.52
			TOTAL CREW AND CREW REMOVABLE LOAD ITEMS	732.55		–9796.81

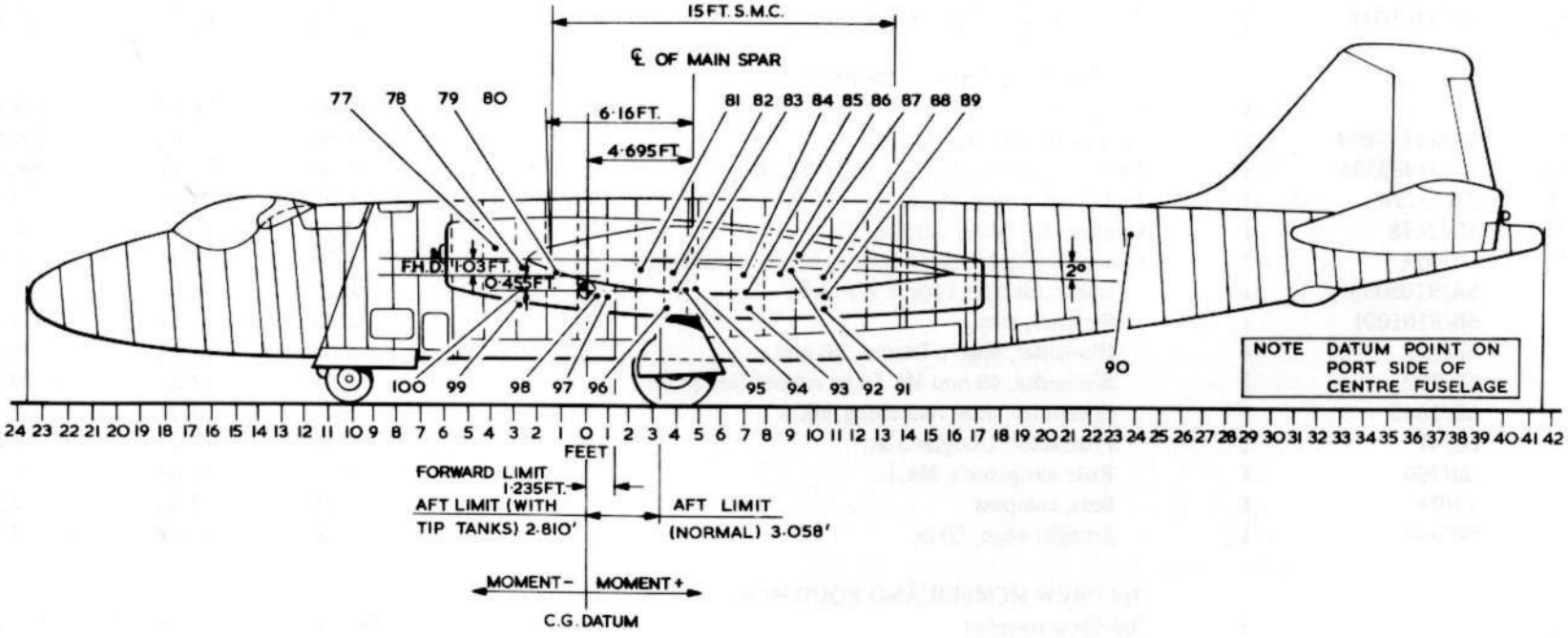

FIG. 7. LOADING AND C.G. DIAGRAM — ALTERNATIVE AND FUEL LOAD ITEMS

TABLE 4 **Alternative operating load items** *(fig. 7)*

Fig.7 Item No.	Ref. or Part No.	Description	Qty	Arm (ft.)	CASE A CLEAN Weight (lb)	CASE A CLEAN Moment (lb ft)	CASE B TIP TANKS Weight (lb)	CASE B TIP TANKS Moment (lb ft)	CASE C 300G TANK & TIP TANKS Weight (lb)	CASE C 300G TANK & TIP TANKS Moment (lb ft)	CASE D PANNIERS & TIP TANKS Weight (lb)	CASE D PANNIERS & TIP TANKS Moment (lb ft)
80	11A/6377	Bomb Beam Aux. forward	1	+ 0.20					174.64	+ 34.93	174.64	+ 34.93
92	11A/3681	Bomb Beam Aux. aft	1	+ 9.10					174.50	+1587.95	174.50	+1587.95
97	EA3.56.697	300 gal. Aux. fuel tank	1	+ 0.90					238.69	+ 214.82		
78	11A/3684	Dust cover, Stn.1	1	– 2.58					1.56	– 4.02		
79	11A/3684	Dust cover, Stn.2	1	– 1.18					1.56	– 1.84	1.56	– 1.84
82	11A/3684	Dust cover, Stn.3	1	+ 3.84					1.56	+ 5.99		
84	11A/3684	Dust cover, Stn.4	1	+ 6.87					1.56	+ 10.72		
86	11A/3684	Dust cover, Stn.5	1	+ 8.48					1.56	+ 13.23	1.56	+ 13.23
88	11A/3684	Dust cover, Stn.6	1	+10.22					1.56	+ 15.94		
99		Pannier loaded, Stn.1	1	– 2.58							100.00	– 258.00
96		Pannier loaded, Stn.3	1	+ 3.84							100.00	+ 384.00
93		Pannier loaded, Stn.4	1	+ 6.87							100.00	+ 687.00
91		Pannier loaded, Stn.6	1	+10.22							100.00	+1022.00
100		Release Unit No.3 Stn.1	1	– 2.58							10.69	– 27.58
83		Release Unit No.3 Stn.3	1	+ 3.84							10.69	+ 41.05
85		Release Unit No.3 Stn.4	1	+ 6.87							10.69	+ 73.44

(continued)

TABLE 4 Alternative operating load items *(fig. 7) (continued)*

Fig.7 Item No.	Ref. or Part No.	Description	Qty	Arm (ft.)	CASE A CLEAN Weight (lb)	CASE A CLEAN Moment (lb ft)	CASE B TIP TANKS Weight (lb)	CASE B TIP TANKS Moment (lb ft)	CASE C 300G TANK & TIP TANKS Weight (lb)	CASE C 300G TANK & TIP TANKS Moment (lb ft)	CASE D PANNIERS & TIP TANKS Weight (lb)	CASE D PANNIERS & TIP TANKS Moment (lb ft)
89		Release Unit No.3 Stn.6	1	+10.22							10.69	+ 109.25
90		Survival Packs Type M	3	+23.66	69.75	+1650.29	69.75	+1650.29	69.75	+1650.29	69.75	+1650.29
94	EA3.82.217/8	Wing tip tanks	2	+ 4.25			238.00	+1011.50	238.00	+1011.50	238.00	+1011.50
	EA1.20.2031	Bolts explosive	6	+ 4.16			2.75	+ 11.44	2.75	+ 11.44	2.75	+ 11.44
	EA1.00.81/2	Wing tip tank attachment	2	+ 4.10			0.73	+ 2.99	0.73	+ 2.99	0.73	+ 2.99
	12G/1279	Detonator electric 109 Mk.1	6	+ 4.15			0.13	+ 0.54	0.13	+ 0.54	0.13	+ 0.54
					69.75	+1650.29	311.36	+2676.76	908.55	+4554.48	1106.38	+6342.19

NOTE . . .

ALTERNATIVE TYPE SURVIVAL PACKS MAY BE FITTED IN LIEU OF DESERT TYPE i.e. ARCTIC 34 lb. EACH, TROPICAL 11 lb. EACH.

TABLE 5 Fuel load items *(fig. 7)*

Fig.7 Item No.	Ref. or Part No.	Qty.	Description	Weight (lb)	Arm (ft)	Moment (lb ft)
			FUEL IN FUSELAGE (at 8 lb/gal)			
77	–	–	Fuel, No.1 tank, 520 gal.	4160.00	– 3.86	–16057.60
81	–	–	Fuel, No.2 tank, 317 gal.	2536.00	+ 2.21	+ 5604.56
87	–	–	Fuel, No.3 tank, 540 gal.	4320.00	+ 9.13	+39441.60
			TOTAL FOR FUEL IN FUSELAGE	11016.00		+28988.56
			WING-TIP TANKS FUEL (at 8 lb/gal)			
95	–	–	Fuel, wing-tip tanks, 488 gal	3904.00	+ 3.88	+15147.52
			AUXILIARY TANK FUEL (at 8 lb/gal)			
98	–	–	Fuel, auxiliary tank, 300 gal	2400.00	+ 0.39	+ 936.00

TABLE 6 All-up weight summary

	CASE A CLEAN			CASE B TIP TANKS			CASE C 300GAL TANK AND TIP TANKS			CASE D PANNIERS AND TIP TANKS		
	Weight (lb)	Arm (ft)	Moment (lb ft)	Weight (lb)	Arm (ft)	Moment (lb ft)	Weight (lb)	Arm (ft)	Moment (lb ft)	Weight (lb)	Arm (ft)	Moment (lb ft)
Basic weight	21996	+3.055	+67209	21996	+3.055	+67209	21996	+3.055	+67209	21996	+3.055	+67209
Adjustable ballast	152	−18.80	-2858	152	−18.80	-2858	152	−18.80	-2858	152	−18.80	-2858
Alternative load items (Table 4)	70		+ 1650	311		+ 2677	909		+ 4554	1106		+ 6342
Crew and equipment (Table 3)	733		− 9797	733		− 9797	733		− 9797	733		− 9797
OPERATING WEIGHT	22951	+2.449	+56204	23192	+2.468	+57231	23790	+2.484	+59108	23987	+2.539	+60896
Fuel: (Table 5)												
Fuselage	11016		+28989	11016		+28989	11016		+28989	11016		+28989
Wing tips				3904		+15148	3904		+15148	3904		+15148
300 gal. tank							2400		+ 936			
ALL UP WEIGHT	33967	+2.508	+85193	38112	+2.660	+101368	41110	+2.534	+104181	38907	+ 2.699	+105033

◀ Appendix 1 LOADING AND C.G. DATA (PRE MOD.4937) ▶

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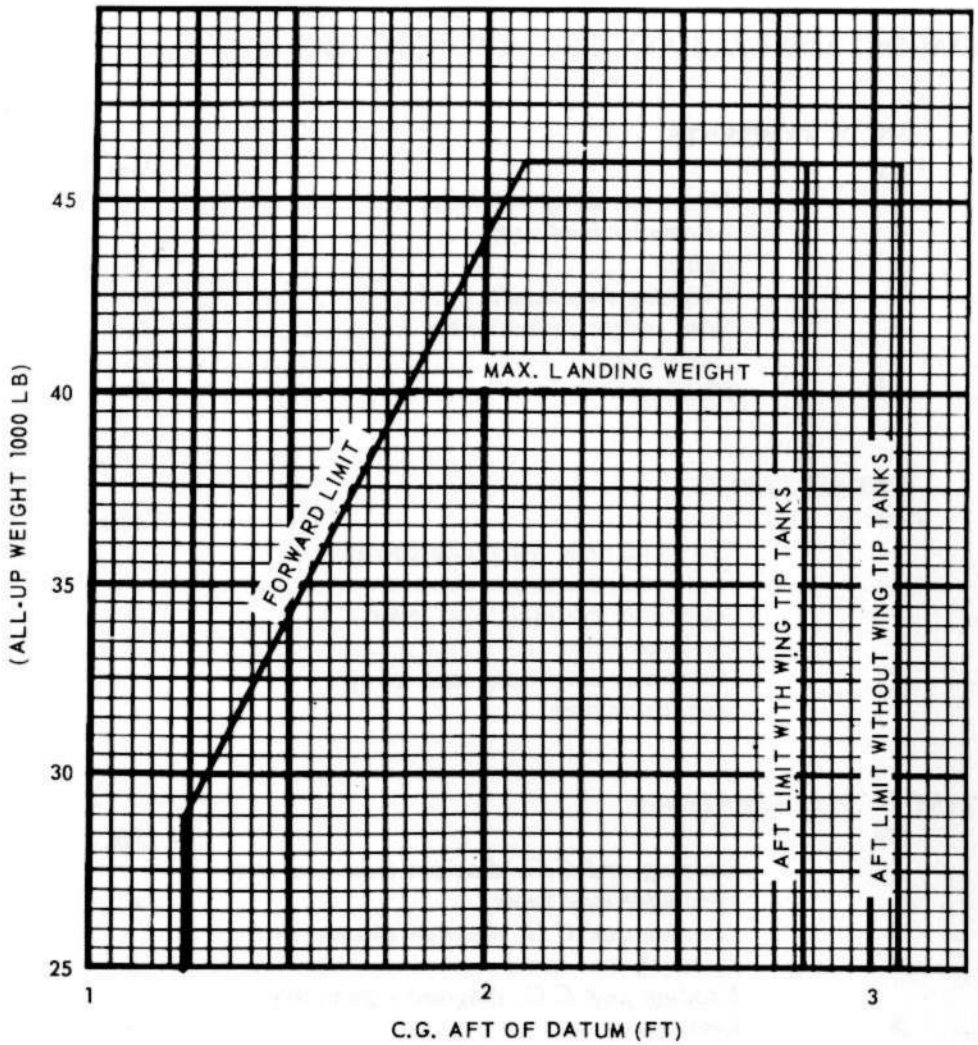

Fig. 1. Flight C.G. limits

General information

1. This chapter deals with the effects of different and varying loads upon the C.G. position.

C.G. position

2. The aircraft C.G. position is determined with the fuselage datum horizontal *(i.e. in the rigging attitude)* and with the undercarriage down. All moment arms are measured in feet units parallel to the fuselage datum and are positive when they refer to items aft of the C.G. datum and negative when they refer to items forward of this datum.

C.G. datum

3. The C.G. datum is 4.695 ft forward of the spar datum and 0.455 ft below the fuselage horizontal datum. It is indicated by a screw marked C.G. datum on the port side of the fuselage. This screw can be used to suspend a plumb line during weighing operations.

Flight C.G. limits *(fig. 1)*

4. Fig. 1 prescribes the approved handling limits, at any given weight, for C.G. movement measured from the C.G. datum.

Forward limit

This is dependent upon the weight of the aircraft. At weights below 29000 lb the permissible forward limit is 1.235 ft aft and at a weight of 46000 lb the permissible forward limit is 2.098 ft aft.

Aft limit

'Clean' aircraft	3.058 ft aft
With wing tip tanks fitted	2.810 ft aft

Note...

If the aircraft is to be taxied over rough ground the aft limit must not exceed 2.885 ft aft.

Effect of alighting gear retraction

5. Retraction of the alighting gear introduces a moment of −1299 lb ft which must be taken into account when making calculations which assume that the alighting gear is retracted.

Crew movement

6. Movement of the air bomber from his ejection seat to the map reader's seat introduces a moment of − 680 lb ft. Further forward movement to the prone position introduces an additional moment of −894 lb ft *(a total moment change of −1574 lb ft).*

Basic weight and moment

7. Table 6 refers to a basic weight of 21778 lb and a basic moment of +63213 lb ft. These figures are based on the weight of aircraft Serial No.WE.122 incorporating all basic equipment detailed in Appendix A, Serial No.2100 up to and including A.L.172 less 97, 110, 131, 132, 137, 144, 146, 166, 169 and 171. A definition of the term 'basic weight' may be found in A.P.101A-1101-1. The basic weight and C.G. will vary between aircraft depending on their modification standard.

Maximum all-up weights *(fig.1)*

8. The aircraft is cleared for operational flying as the following maximum weights:-

Take off	46,000 lb
Landing	40,000 lb

Note...

Emergency landings only are permissible at weights in excess of this figure.

Alternative load items

9. If stores other than those given are to be carried, their disposition should be similar to that of stores given in the all-up weight summary of approximately the same weight. This will ensure that the aircraft C.G. will at all times remain within the C.G. handling limits, providing that normal fuel drill and the correct sequence for dropping stores are adhered to.

Ballast

10. Ballast weights totalling 266 lb *(Sect.3, Chap.1)* are provided to help maintain the C.G. position within the C.G. range. Adjustment may be made necessary due to removal or non-fitment of equipment, introduction of modifications etc. In order to ensure that the C.G. for individual aircraft will remain within the handling limits at all times, when carrying and releasing any of the permissible loads, the C.G. of the aircraft at the basic weight plus ballast, i.e. without fuel, crew and alternative load equipment must always be maintained at +2.80 ft (+0.10 ft).

Note...

The basic weight may be determined from the basic weight of the aircraft as given in Form 4908 corrected for any additions or deletions of equipment etc.

Method of determining amount of ballast required

From the vertical axis of the graph *(fig.2)* select the appropriate value of the aircraft moment and extend from this value a horizontal line to intersect the aircraft weight value on, or between the weight lines, a vertical line is then dropped from this intersection to the horizontal axis of the graph to indicate the amount of adjustable ballast required to give a C.G. position of +2.80 ft.

Example:-	Weight (lb)	Arm (ft)	Moment (lb ft)
Basic weight from Form 4908	+21984		+63876
Less items not fitted to a/c (refer to Table 2)			
Item 29, 10DB/8118, Trans/rec. Type TR.3624	- 32		+ 258
Item 35, 10D/18501, Radar head, Type 1	- 65		- 2641
Item 17, 10D/16595, Transmitter, T.1629A	- 79		+ 1134
Basic weight	+21808		+62627
Therefore, referring to fig.2, amount of ballast required to obtain C.G. position of +2.80 ft is:-	+ 72	-18.800	- 1354
Basic weight plus ballast	+21880	+ 2.800	+61273

Note...

Provided the amount of ballast fitted does not exceed 261.75 lb and the basic weight does not exceed 23100 lb then the allowable value for bending strength will not be exceeded.

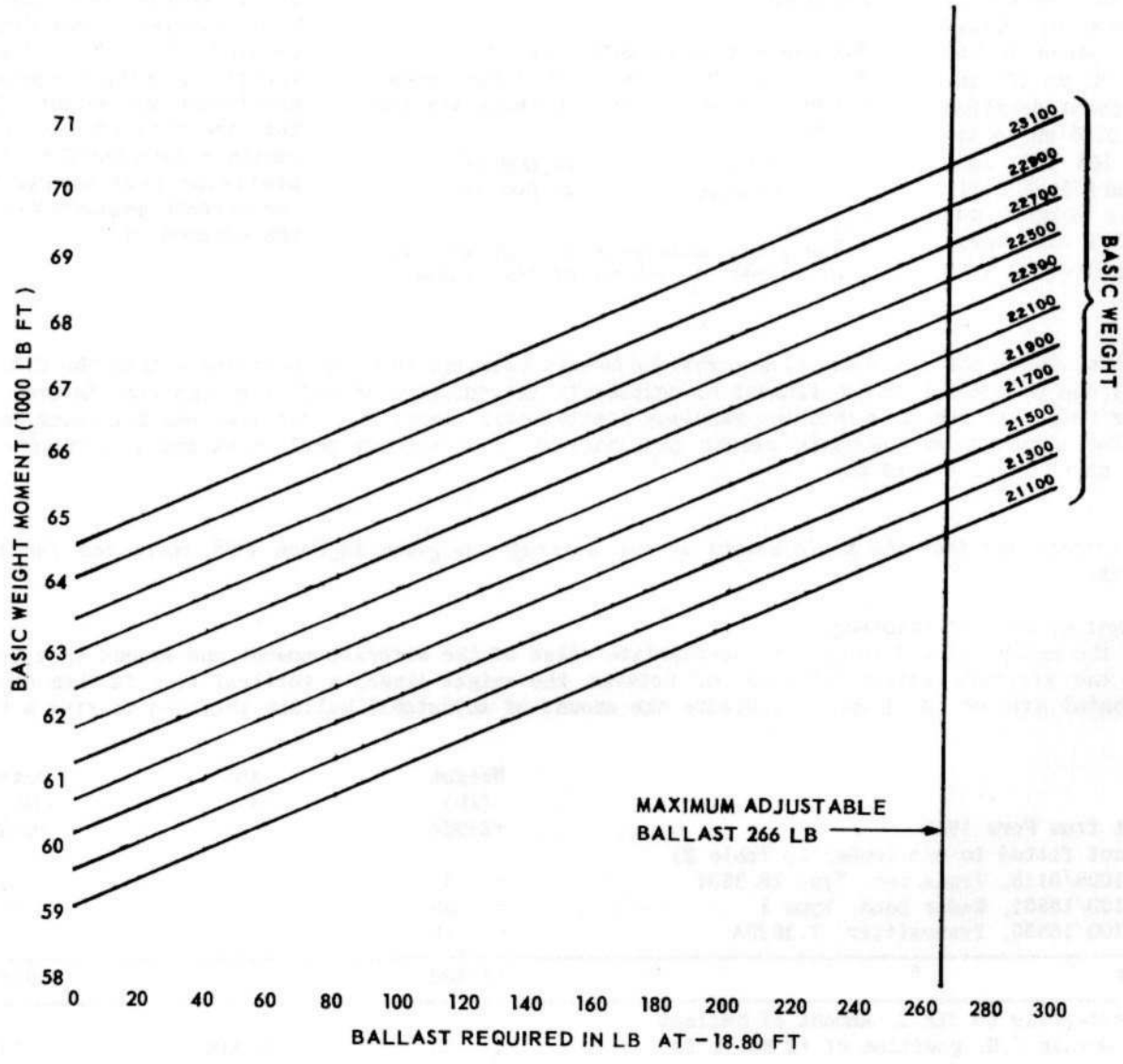

Fig.2. Determination of ballast required to establish C.G. at +2.80 ft in basic weight condition

Weighing the aircraft

Preparation

11.

(1) With the aircraft in the rigging position drain the fuel tanks *(Sect.4, Chap.2). (For details of undrainable fuel refer to Table 1).* Remove all expendable load items and all possible alternative load items.

Non-hydrostatic method of weighing

(2) Information of a general nature concerning the practical measurement of basic weight and moment is contained in A.P.119W-0001-1.

Hydrostatic method

(3) The equipment required for weighing the aircraft using the hydrostatic method is listed in Sect.2, Chap.4, Table 2. A.P.119W-0301-1 gives general information on hydrostatic units and their use; the following instructions amplify this:-

(a) Jack the aircraft at the main and front fuselage jacking points *(Sect.2, Chap.4).*

(b) Place locally manufactured wood blocks of sufficient thickness to provide the necessary clearance for the hydrostatic unit and jacks, under the nose and main wheels. Lower the aircraft on to the blocks and remove the lifting jacks.

(c) Assemble:-

(i) A 25-ton hydrostatic unit, a 15-ton jack and jack to unit and unit to aircraft pad adapters at each main wheel jacking point.

(ii) A 10-ton hydrostatic unit, an 8-ton jack and jack to unit and unit to nose undercarriage adapters, under the nose undercarriage axle between the twin wheels.

(d) Weigh the aircraft as instructed in A.P.119W-0301-1.

(e) Lower the aircraft on to the wood blocks and remove the weighing equipment.

(f) Jack the aircraft *(operation (a))* and remove the blocks.

(g) Lower the aircraft to the ground and remove the jacks.

Basic weight determination

12. To the weight and moment obtained from weighing, add:-

(1) The weight and moment of drainable unusable fuel in the pipe lines *(Note 2 of Table 1).*

(2) The weight and moment of Table 2 items not fitted at weighing but required for flight.

Deduct the weight and moment of all items from Tables 3, 4, 5 and 6 which were fitted at weighing.

The resultant figures are the basic weight and moment.

Note...

The total amount of adjustable ballast fitted at the time of weighing must be deducted.

Engine data

13. In the event of an engine change, Form 4908 must be amended to account for any changes in the engine weight and moment in accordance with the values quoted for the individual engine on the engine log card. The C.G. position as quoted on the log card will be to an engine datum and it will be necessary to correct this value to the aircraft C.G. datum *(para.3).* The following data will affect this correction.

(1) The C.G. of the engine is quoted by the manufacturers in inches aft of the front suspension, centre line.

(2) This engine datum is 33.270 inches forward of the aircraft C.G. datum point.

(3) Hence if Xe is the C.G. position of the engine, as quoted on the log card, then the C.G. of the engine in relation to the aircraft datum in feet=

$$\frac{Xe-33.27}{12}$$ =ft forward of aircraft C.G. datum

This result will be negative denoting that the engine C.G. is forward of the aircraft C.G.

Modifications

14. The basic weight given in para.7 includes the following modifications:-

1, 2, 3, 4, 8, 9, 10, 11, 12, 14, 15, 16, 18, 19, 51, 54, 56, 62, 63, 65, 66, 67, 68, 69, 71, 73, 74, 75, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 89, 90 95, 97, 98, 99, 150, 152, 153, 154, 155, 156, 157, 159, 161, 162, 163, 164, 165,

167, 168, 169, 170, 171, 174, 175, 176,
177, 178, 180, 181, 182, 183, 184, 185,
186, 187, 188, 189, 190, 195, 196, 197,
198, 199, 250, 251, 252, 253, 255, 256,
257, 258, 259, 260, 261, 262, 263, 264,
265, 266, 267, 268, 269, 275, 276, 277,
278, 279, 280, 281, 282, 283, 284, 285,
286, 291, 292, 293, 294, 296, 297, 299,
300, 301, 302, 303, 305, 306, 307, 308,
309, 311, 312, 313, 314, 315, 316, 318,
319, 320, 321, 323, 324, 325, 326, 327,
328, 329, 330, 332, 333, 334, 335, 337,
339, 340, 341, 343, 344, 345, 346, 347,
349, 400, 401, 403, 404, 405, 409, 410,
411, 413, 414, 415, 418, 419, 420, 421,
422, 425, 426, 428, 429, 430, 433, 434,
438, 439, 440, 441, 442, 443, 444, 445,
446, 447, 448, 449, 450, 451, 501, 502,
503, 504, 506, 507, 509, 511, 512, 513,
514, 519, 523, 528, 530, 531, 535, 536,
538, 540, 541, 542, 543, 545, 546, 547,
550, 606, 607, 611, 612, 616, 617, 618,
620, 621, 622, 626, 628, 631, 635, 636,
640, 643, 644, 649, 650, 706, 710, 711,
713, 716, 721, 724, 731, 733, 738, 745,
749, 750, 851, 852, 857, 858, 860, 862,
863, 864, 868, 871, 872, 874, 878, 880,
883, 885, 886, 887, 888, 890, 894, 895,
896, 899, 1002, 1007, 1008, 1009, 1019,
1021, 1022, 1023, 1024, 1027, 1033,
1036, 1040, 1047, 1151, 1152, 1155,
1158, 1160, 1165, 1169, 1170, 1171,
1176, 1189, 1197, 1199, 1254, 1259,
1266, 1271, 1276, 1277, 1288, 1290,
1294, 1401, 1407, 1421, 1425, 1426,
1431, 1432, 1433, 1434, 1435, 1442,
1452, 1457, 1460, 1464, 1465, 1466,
1470, 1477, 1493, 1494, 1497, 1498,
1703, 1704, 1705, 1707, 1712, 1713,
1714, 1716, 1720, 1724, 1728, 1734,
1740, 1744, 1745, 1750, 1771, 1777,
1919, 1924, 1925, 1932, 1945, 1958,
1968, 1973, 1995, 1997, 2107, 2121,
2132, 2134, 2148, 2151, 2154, 2158,
2159, 2160, 2183, 2186, 2301, 2306,
2308, 2317, 2334, 2335, 2347, 2348,
2353, 2372, 2379, 2380, 2386, 2392,
2394, 2395, 2398, 2511, 2517, 2535,
2541, 2545, 2548, 2555, 2564, 2571,
2576, 2578, 2580, 2585, 2593, 2599, 2605,
2634, 2670, 2689, 2690, 2704, 2712,
2740, 3156, 3158, 3211, 3221, 3225,
3244, 3258, 3274, 3278, 3282, 3299,
3330, 3333, 3352, 3367, 3368, 3369,
3391, 3396, 3461, 3480, 3481, 3487,
3521, 3522, 3545, 3562, 3701, 3703,
3706, 3710, 3728, 3745, 3747, 3749,
3759, 3773, 3881, 3900, 3906, 3911,
3922, 3948, 3949, 3955, 3960, 3962,
4003, 4005, 4011, 4045, 4058, 4077,
4094, 4100, 4107, 4151, 4152, 4160,
4220, 4309, 4333, 4335, 4337, 4357,
4412, 4437, 4442, 4451, 4454.

TABLE 1

Summary of drainable and undrainable unusable fuel to be included in basic weight

Location	Weight (lb)	Arm (ft)	Moment (lb ft)
Trapped (undrainable) fuel in pipes (wings and fuselage)	6.70	−0.228	− 1.53

Note...

(1) Due to the disposition of certain fuel pipes, the above weight of fuel will remain trapped when the fuel tanks are drained.

(2) Since all fuel in the pipelines is included in the basic weight, the following fuel weights must be added when determining the basic weight after weighing the aircraft.

Drainable fuel in pipes (wings and fuselage)	9.00	+1.534	+13.81

TABLE 2 Removable load items included in basic weight *(fig.3)*

Fig.3 Item No.	Ref. or Part No.	Qty.	Description	Weight (lb)	Arm (ft)	Moment (lb ft)
			MISCELLANEOUS ITEMS			
58	EA3.83.97	1	Ballast crate, non-adjustable	21.06	−18.90	− 398.03
60	6D/1644	1	Oxygen emergency set, Mk.2A	2.00	−21.43	− 42.86
7	12G/1279	1	Detonator, electric, No.109, Mk.1 (controls)	0.02	−16.19	− 0.32
4	6A/2197	1	Clock, fluorescent, Mk.4	0.44	−18.57	− 8.17
9	12G/1278	32	Detonators, electric, No.108, Mk.1 (canopy)	0.74	−15.70	− 11.62
22	12G/1278	34	Detonators, electric, No.108, Mk.1 (hatch)	0.78	−11.20	− 8.74
28	–		Oxygen charge	25.78	− 8.14	− 209.82
36	12K/1220	6	Cartridges, engine starting	18.00	+19.14	+ 344.52
42	12L/203	1	Destructor, aircraft, No.1, Mk.1	3.25	− 8.73	− 28.37
50	9A/02430	1	First-aid outfit	3.00	−13.66	− 40.98
53	22G/108081	1	Gauntlets, fire-fighting (1 pair)	0.88	−14.12	− 12.43
10	12K/1224	1 set	Cartridges, seat ejection, set No.1, Mk.1 (pilot)	0.47	−14.88	− 6.99
26	12K/1224	1 set	Cartridges, seat ejection, set No.1, Mk.1 (navigator)	0.47	−10.35	− 4.86
25	12K/1224	1 set	Cartridges, seat ejection, set No.1, Mk.1 (air bomber)	0.47	−10.29	− 4.84
6	12G/1339	1	Charge, H.E., emergency control severing	0.37	−16.19	− 5.99
59	5J/9101808	1	Battery, secondary, alkaline, 2.4 volt, 3 amp h	1.25	−19.66	− 24.58
57	5J/9101543	1	Battery, secondary, lead acid, 12 volt, 4 amp h	4.94	−17.84	− 88.13
40	5J/9101534	4	Battery, secondary, lead acid, 12 volt, 40 amp h Type C	198.76	− 6.65	−1321.75
31	6B/554	1	Air mileage unit, Mk.4A	10.50	+ 1.49	+ 15.65
46	6B/1994	1	Amplifier unit, Type A]	9.75	−11.89	− 115.93
1	6B/1992	1	Gyro unit, Type A]	6.19	−18.69	− 115.69
14	6B/1996	1	Indicator, master, Type A } G.4B compass	6.63	−14.22	− 94.28
16	6B/408	1	Panel, control, Type A]	1.28	−13.72	− 17.56
11	6B/458	1	Indicator, air position, Mk.1B	11.20	−14.31	− 160.27
21	6B/2764	1	Periscope, aircraft, rear viewing	4.53	−11.08	− 50.19
2	27KD/375	5	Stoppers, leak, cabin pressure	1.25	−17.50	− 21.88
51	27N/1	1	Axe, fire	2.42	−13.43	− 32.50
32	27N/100	1	Extinguisher, fire, Methyl Bromide, automatic, Type 12A,	10.63	+13.96	+ 148.39
30	27N/102	2	Extinguisher, fire, Methyl Bromide, automatic, Type 14A, (wing)	38.62	+ 1.01	+ 39.01
54	27N/299	1	Extinguisher, fire, hand-operated, Type 34H	5.19	−13.72	− 71.21
56	EA3.80.1989	1	Handle for emergency hydraulic hand pump (stowed)	0.85	−14.97	− 12.72
55	27H/3224	1	Container, urine, Mk.2 and funnel	1.09	−13.97	− 15.23
129	120/	6	Cartridges, signal	2.06	−11.89	− 24.54
130	120/1211	6	Cartridges, radar echo Mk.1	2.06	−11.89	− 24.54

continued...

TABLE 2 *(continued)* **REMOVABLE LOAD ITEMS INCLUDED IN BASIC WEIGHT (fig.3)**

Fig.3 Item No.	Ref. or Part No.	Qty.	Description	Weight (lb)	Arm (ft)	Moment (lb ft)
			A.R.I. 5800			
35	10D/18501	1	Radar head, Type 1	65.00	+ 40.63	+ 2640.95
38	10V/16057	1	Waveform generator, Type 76	22.86	- 8.34	- 190.65
39	10AJ/92	1	Mounting, Type 907	3.00	- 8.34	- 25.02
3	10Q/16073	1	Indicator unit, Type 27	3.09	- 19.24	- 59.45
44	10AC/690	1	Suppressor false warning	2.75	- 11.00	- 30.25
8	10L/16043	1	Control unit, Type 611	2.69	- 15.55	- 41.83
			A.R.I. 5829			
17	10D/16595	1	Transmitter, T1629A	78.50	- 14.44	- 1133.54
15	10P/16051	1	Filter unit, Type 504	1.56	- 14.15	- 22.07
13	10QB/6370	1	Indicator unit, Type 166A	29.00	- 14.19	- 411.51
18	10LB/6299	1	Control unit, Type 426A	16.50	- 13.95	- 230.18
45	10DB/8620	1	R.F. unit, Type 139B	7.25	- 11.98	- 86.86
27	10DB/8652	1	R.F. unit, Type 25B	7.25	- 10.99	- 79.68
47	10DB/8373	1	Receiver, R3582A	26.25	- 11.98	- 314.48
48	10QB/8807	1	Strobe unit, Type 61A	44.50	- 12.30	- 547.35
52	10DB/16461	1	Drive unit, Type 114	21.00	- 14.79	- 310.59
			A.R.I. 5848			
34	10D/20334	1	Transmitter/receiver, TR.4585	38.40	+ 24.20	+ 929.28
33	10D/21270	1	Coder unit, Type 6466	10.44	+ 23.04	+ 240.54
20	10L/16478	1	Control unit, Type 6465	1.19	- 11.77	- 14.01
19	10L/16192	1	Control unit, Type 927	0.75	- 11.81	- 8.86
			A 1961			
49	10U/16596	1	Amplifier, Type A.1961	6.25	- 12.78	- 79.88
			A.R.I. 18064			
41	10D/17937	1	Transmitter/receiver, TR.1985	26.55	- 9.17	- 243.46
43	10D/17938	1	Transmitter/receiver, TR.1986	26.34	- 9.41	- 247.86
5	10L/246	2	Control unit, Type 382	1.19	- 18.23	- 21.69
			A.R.I.5610			
29	10DB/8118	1	Transmitter/receiver, Type TR.3624 c/w valves	32.00	- 8.05	- 257.60
37	10AB/5819	1	Mounting, Type 814	3.00	- 8.05	- 24.15
24	10L/16745	1	Control unit, Type 526A	2.25	- 12.35	- 27.79
23	10AT/41	1	Visor, Type 43	1.25	- 13.17	- 16.46
12	10QB/6130	1	Indicator unit, Type 208 c/w valves	2.31	- 14.44	- 33.36

TABLE 3 CREW AND CREW REMOVABLE OPERATING LOAD ITEMS COMMON TO ALL ROLES (fig.4)

Fig.4 Item No.	Ref. or Part No.	Qty.	Description	Weight (lb)	Arm (ft)	Moment (lb ft)
			PILOT AND EQUIPMENT			
67	–	1	Pilot	180.00	– 16.44	– 2959.20
63	15A/683	1	Parachute, seat type Mk.11	27.00	– 16.44	– 443.88
68	22C/1479	1	Jacket, life-saving, Mk.4	6.50	– 15.78	– 102.57
64	27C/2229	1	Pack personal survival, Type M	22.00	– 16.40	– 360.80
65	6D/1646 (post Mod. 441 & 1413)	1	Oxygen emergency set, Mk.4A	4.00	– 16.40	– 65.60
61	–	1	Pilot's notes for Canberra B Mk.2 aircraft	0.20	– 17.96	– 3.59
62	6F/171	1	Pad, writing, pilot's knee-type	1.37	– 17.23	– 23.61
66	5A/9105033	1	Torch, electric, Type Y c/w. cells	0.72	– 16.44	– 11.84
			NAVIGATOR AND EQUIPMENT			
69	–	1	Navigator	180.00	– 11.88	– 2138.40
76	15A/683	1	Parachute, seat type Mk.11	27.00	– 11.92	– 321.84
77	27C/2229	1	Pack, personal survival, Type M	22.00	– 11.85	– 260.70
75	22C/1479	1	Jacket life-saving, Mk.4	6.50	– 11.31	– 73.52
78	6D/1646 (post Mod. 441 & 1413)	1	Oxygen emergency set, Mk.4A	4.00	– 11.92	– 47.68
79	6B/469	1	Case, carrying Navigator's equipment containing :–	1.00	– 13.04	– 13.04
	5A/9105033	1	Torch, electric Type Y c/w cells	0.72	– 13.04	– 9.39
	6B/9101001	1	Watches, stop	0.25	– 13.04	– 3.26
	6E/293	1	Binocular, Mag. 6 Diams., 30 m.m.	2.00	– 13.04	– 26.08
	6E/392	1	Binocular, 40 m.m. Mk.5 c/w rubber face piece	2.25	– 13.04	– 29.34
	6B/2645	1	Computor, dead reckoning, Mk.4	0.25	– 13.04	– 3.26
	6B/47	1	Protractor, Douglas 5in.	0.14	– 13.04	– 1.83
	6B/260	1	Rule navigator's, Mk.1	0.13	– 13.04	– 1.70
	13/94	1	Sets, compass	0.25	– 13.94	– 3.26
	6B/349	1	Straight edge, 20in.	0.30	– 13.04	– 3.91
			AIR BOMBER AND EQUIPMENT			
72	–	1	Air bomber	180.00	– 11.83	– 2129.40
71	15A/683	1	Parachute, seat type, Mk.11	27.00	– 11.87	– 320.49
70	27C/2229	1	Pack, personal survival, Type M	22.00	– 11.80	– 259.60
74	22C/1479	1	Jacket life-saving, Mk.4	6.50	– 11.27	– 73.24
80	6D/1646 (post Mod. 441 & 1413)	1	Oxygen, emergency set, Mk.4A	4.00	– 11.87	– 47.48
73	5A/9105033	1	Torch, electric, Type Y c/w cells	0.72	– 11.83	– 8.52
			TOTAL CREW AND CREW REMOVABLE LOAD ITEMS	728.80		– 9747.05

TABLE 4 ALTERNATIVE OPERATING LOAD ITEMS (fig.5)

Fig.5 Item No.	Ref. or Part No.	Qty.	Description	Weight (lb)	Arm (ft)	Moment (lb ft)
			F.24 CAMERA			
89	14A/2206	1	Control, camera, remote Type 35, No.8	4.25	− 12.12	− 51.51
107	14A/988	1	Motor, camera driving. Type B	3.70	+ 16.44	+ 60.83
108	14A/862	1	Leads, electrical camera control, No.4 2ft 6in	0.44	+ 16.68	+ 7.34
110	14A/2602	1	Camera, aircraft, F24 c/w 20in lens and cone	28.06	+ 17.28	+ 484.88
111	14A/2615	1	Filter, Type 4	0.03	+ 17.28	+ 0.52
112	14A/745	1	Covers, body	0.69	+ 17.28	+ 11.92
113	14A/4004	1	Mounting, Type 25 Mk.2	6.25	+ 17.28	+ 108.00
114	26FZ/256	1	Camera, cover removable (EA1.11.547)	0.71	+ 17.28	+ 12.27
109	14A/3568	1	Drive, camera 2ft 6in Type C	0.79	+ 16.66	+ 13.16
			TOTAL F.24 CAMERA	44.92		+ 647.41
			T2 BOMB SIGHTING EQUIPMENT			
88	109JB/271	2	Hose, flexible pitot and static, 12in x $\frac{3}{16}$in i/dia. ...	1.88	− 19.68	− 37.00
87	109JB/295	1	Hose, flexible, air pressure and exhaust 12in x ¼in i/dia.	0.94	− 19.68	− 18.50
86	9/4471	1	Bombsight, computor, T2	44.38	− 20.68	− 917.78
85	9/4482	1	Bombing, angle computor, Mk.1	0.19	− 21.35	− 4.06
84	109/82	1	Bombsight panel control, T.1	1.00	− 21.70	− 21.70
83	9/4380	2	Gearbox, right angle, c/w locknut	0.38	− 21.86	− 8.31
81	9/4472	1	Bombsight, head sighting, T.2	14.00	− 22.30	− 312.20
82	109/94	2	Shafts, flexible, No.2 length 32.5 in	1.50	− 22.05	− 33.08
			TOTAL T2 BOMBSIGHT	64.27		− 1352.63

TABLE 5 FUEL LOAD ITEMS (fig.6)

Fig.6 Item No.	Ref. or Part No.	Qty.	Description	Weight (lb)	Arm (ft)	Moment (lb ft)
			FUEL IN FUSELAGE (at 8 lb/gal)			
129	–	–	Fuel, No.1 tank, 520 gal	4160.00	– 3.86	– 16057.60
131	–	–	Fuel, No.2 tank, 317 gal	2536.00	+ 2.21	+ 5604.56
137	–	–	Fuel, No.3 tank, 540 gal	4320.00	+ 9.13	+ 39441.60
			TOTAL FOR FUEL IN FUSELAGE	11016.00		+ 28988.56
			WING-TIP TANKS AND WING-TIP TANKS FUEL (at 8 lb/gal)			
135	–	–	Fuel, wing-tip tanks, 488 gal	3904.00	+ 3.88	+ 15147.52
136	EA3.62.217/8	2	Wing-tip tanks	238.00	+ 4.25	+ 1011.50
132	26FZ/1577	6	Bolts, explosive, EA1.20.2031	2.75	+ 4.16	+ 11.44
133	EA1.00.81-2	2	Wing-tip tank attachments	0.73	+ 4.10	+ 2.99
134	12G/1279	6	Detonator, electric, No.109 Mk.1	0.13	+ 4.15	+ 0.54
			TOTAL OF WING-TIP TANKS AND WING-TIP TANK FUEL	4145.61		+ 16.173.99

TABLE 6 **Alternative load items and all-up weight summary** *(fig.5 & 6)*

FIG.5 ITEM NO.	REF. OR PART NO.	QTY.	DESCRIPTION	4 x 4, 25 LB PRACTICE BOMBS WEIGHT (LB)	ARM (FT)	MOMENT (LB FT)	CONTINUATION TRAINING WEIGHT (LB)	ARM (FT)	MOMENT (LB FT)
97	11A/6377	1	Bomb beam, auxiliary, forward	174.64	+ 0.20	+ 34.93	174.64	+ 0.20	+ 34.93
104	11A/3681	1	Bomb beam, auxiliary, aft	174.50	+ 9.10	+ 1587.95	174.50	+ 9.10	+ 1587.95
119	11A/4397	1	Carrier, bomb, light series, Mk.15 (Practice Stn.1)	45.00	+ 8.86	+ 398.70			
100	11A/4397	1	Carrier, bomb, light series, Mk.15 (Practice Stn.4)	45.00	+ 1.11	+ 49.95			
94	11A/4397	1	Carrier, bomb, light series, Mk.15 (Practice Stn.5)	45.00	- 1.77	- 79.65			
126	11A/4397	1	Carrier, bomb, light series, Mk.15 (Practice Stn.6)	45.00	- 4.65	- 209.25			
98	EA3.97.115	1	Adapter beam, fwd. (Practice Stn.4)	1.28	+ 0.67	+ 0.86			
93	EA3.97.115	1	Adapter beam, fwd. (Practice Stn.5)	1.28	- 2.20	- 2.82			
127	EA3.97.115	1	Adapter beam, fwd. (Practice Stn.6)	1.28	- 5.10	- 6.53			
99	EA3.97.117	1	Adapter beam, fwd. (Practice Stn.4)	1.28	+ 1.42	+ 1.82			
95	EA3.97.117	1	Adapter beam, fwd. (Practice Stn.5)	1.28	- 1.41	- 1.80			
125	EA3.93.117	1	Adapter beam, fwd. (Practice Stn.6)	1.28	- 4.27	- 5.47			
118	EA3.97.111	1	Adapter beam, rear (Practice Stn.1)	1.30	+ 8.40	+ 10.92			
117	EA3.97.113	1	Adapter beam, rear (Practice Stn.1)	1.30	+ 9.22	+ 11.99			
96	11A/3684	1	Dust cover (Stn.2)...	1.56	- 1.18	- 1.84	1.56	- 1.18	- 1.84
102	11A/3684	1	Dust cover (Stn.4)...	1.56	+ 6.87	+ 10.72	1.56	+ 6.87	+ 10.72
103	11A/3684	1	Dust cover (Stn.5)...	1.56	+ 8.48	+ 13.23	1.56	+ 8.48	+ 13.23
92	11A/3684	1	Dust cover (Stn.1)...	1.56	- 2.58	- 4.02	1.56	- 2.58	- 4.02
101	11A/3684	1	Dust cover (Stn.3)...	1.56	+ 3.84	+ 5.99	1.56	+ 3.84	+ 5.99
106	11A/3684	1	Dust cover (Stn.6)...	1.56	+10.22	+ 15.94	1.56	+10.22	+ 15.94
128			Adjustable ballast...	102.00		- 1917.60	102.00		- 1917.60
115			Survival packs, Type M	69.75	+23.66	+ 1650.29	69.75	+23.66	+ 1650.29
			TOTAL ALTERNATIVE LOAD ITEMS	720.53		+ 1564.31	530.25		+ 1395.59
			TOTAL FOR CREW AND CREW OPERATING LOAD (TABLE 3)	728.80		- 9747.05	728.80		- 9747.05
			ALTERNATIVE OPERATING LOAD ITEMS (TABLE 4):-						
			Bombsight	64.27		- 1352.63			
			F24 camera	44.92		+ 647.41			
			BASIC WEIGHT	21778.00		+63213.00	21778.00		+63213.00
			OPERATING WEIGHT	23336.52		+54325.04	23037.05		+54861.54

continued...

TABLE 6 **Alternative load items and all-up weight summary** *(fig.5 & 6) - continued*

FIG.6 ITEM NO.	REF. OR PART NO.	QTY.	DESCRIPTION	4 x 4, 25 LB PRACTICE BOMBS WEIGHT (LB)	ARM (FT)	MOMENT (LB FT)	CONTINUATION TRAINING WEIGHT (LB)	ARM (FT)	MOMENT (LB FT)
			Items of expendable load:-						
			TOTAL FOR FUEL IN FUSELAGE (TABLE 5)	11016.00		+28988.56	11016.00		+28988.56
138		4	Bombs, practice, 25 lb (Practice Stn.1)	100.00	+ 8.86	+ 886.00			
130		4	Bombs, practice, 25 lb (Practice Stn.4)	100.00	+ 1.11	+ 111.00			
140		4	Bombs, practice, 25 lb (Practice Stn.5)	100.00	- 1.77	- 177.00			
141		4	Bombs, practice, 25 lb (Practice Stn.6)	100.00	- 4.65	- 465.00			
			TOTAL EXPENDABLE LOAD	11416.00		+29343.56	11016.00		+28988.56
			ALL-UP WEIGHT	34752.52		+83668.60	34053.05		+83850.10
			C.G. POSITION (WHEELS DOWN)		+ 2.408			+ 2.462	
			TOTAL WING-TIP TANKS AND WING-TIP TANK FUEL (TABLE 5)	4146.00		+16174.00	4146.00		+16174.00
			ALL-UP WEIGHT WITH WING-TIP TANKS	38898.52		+99842.60	38199.05		+100024.10
			C.G. POSITION (WHEELS DOWN)		+ 2.567			+ 2.618	
			EFFECT OF RETRACTING UNDERCARRIAGE:- -1299 LB FT						

Note: *Alternative type survival packs may be fitted in lieu of Type M i.e. Arctic -34 lb, Tropical -11 lb each, Desert -44 lb each.*

continued...

TABLE 6 **Alternative load items and all-up weight summary** *(fig.5 & 6) - continued*

FIG.5 ITEM NO.	REF. OR PART NO.	QTY.	DESCRIPTION	LONE RANGER FLIGHTS WITH B.B. PANNIERS WEIGHT (LB)	ARM (FT)	MOMENT (LB FT)	300 GAL L/R BOMB BAY FUEL TANK, FWD. POSITION (Mod.3757) WEIGHT (LB)	ARM (FT)	MOMENT (LB FT)
97	11A/6377	1	Bomb beam, auxiliary, fwd.....	174.64	+ 0.20	+ 34.93	174.64	+ 0.20	+ 34.93
104	11A/3681	1	Bomb beam, auxiliary, aft.....	174.50	+ 9.10	+ 1587.95	174.50	+ 9.10	+ 1587.95
124	EA3.56.697	1	300 gal auxiliary fuel tank.....				238.69	+ 0.90	+ 214.82
92	11A/3684	1	Dust cover (Stn.1).....				1.56	- 2.58	- 4.02
96	11A/3684	1	Dust cover (Stn.2).....	1.56	- 1.18	- 1.84	1.56	- 1.18	- 1.84
101	11A/3684	1	Dust cover (Stn.3).....				1.56	+ 3.84	+ 5.99
102	11A/3684	1	Dust cover (Stn.4).....				1.56	+ 6.87	+ 10.72
103	11A/3684	1	Dust cover (Stn.5).....	1.56	+ 8.48	+ 13.23	1.56	+ 8.48	+ 13.23
106	11A/3684	1	Dust cover (Stn.6).....				1.56	+10.22	+ 15.94
90		1	Pannier (loaded) Stn.1.....	100.00	- 2.58	- 258.00			
123		1	Pannier (loaded) Stn.3.....	100.00	+ 3.84	+ 384.00			
121		1	Pannier (loaded) Stn.4.....	100.00	+ 6.87	+ 687.00			
116		1	Pannier (loaded) Stn.6.....	100.00	+10.22	+ 1022.00			
91		1	Release unit, No.3 (Stn.1).....	10.69	- 2.58	- 27.58			
122		1	Release unit, No.3 (Stn.3).....	10.69	+ 3.84	+ 41.05			
120		1	Release unit, No.3 (Stn.4).....	10.69	+ 6.87	+ 73.44			
105		1	Release unit, No.3 (Stn.6).....	10.69	+10.22	+ 109.25			
115		3	Survival packs, Type M.....	69.75	+23.66	+ 1650.29	69.75	+23.66	+ 1650.29
128			Adjustable ballast.....	102.00		- 1917.60	102.00		- 1917.60
			TOTAL ALTERNATIVE LOAD ITEMS	966.77		+ 3401.80	768.94		
			TOTAL FOR CREW AND CREW OPERATING LOAD (TABLE 3)	728.80		- 9747.05	728.80		- 9747.05
			BASIC WEIGHT	21778.00		+63213.00	21778.00		+63213.00
			OPERATING WEIGHT	23473.57		+56867.75	23275.74		+55076.36

continued...

TABLE 6 Alternative load items and all-up weight summary *(fig.5 & 6) - continued*

FIG.6 ITEM NO.	REF. OR PART NO.	QTY.	DESCRIPTION	LONE RANGER FLIGHTS WITH B.B. PANNIERS WEIGHT (LB)	ARM (FT)	MOMENT (LB FT)	300 GAL L/R BOMB BAY FUEL TANK, FWD. POSITION (Mod.3757) WEIGHT (LB)	ARM (FT)	MOMENT (LB FT)
			Items of expendable load:						
			TOTAL FOR FUEL IN FUSELAGE (TABLE 5)	11016.00		+ 28988.56	11016.00		+ 28988.56
139			Fuel, auxiliary tank, 300 gal at 8.0 lb/gal				2400.00	+0.39	+ 936.00
			TOTAL EXPENDABLE LOAD	11016.00		+ 28988.56	13416.00		+ 29924.56
			ALL-UP WEIGHT	34489.57		+ 85856.31	36691.74		+ 85000.92
			C.G. POSITION (WHEELS DOWN)		+2.489			+2.317	
			TOTAL WING-TIP TANKS AND WING-TIP TANK FUEL (TABLE 5)	4146.00		+ 16174.00	4146.00		+ 16174.00
			ALL-UP WEIGHT WITH WING-TIP TANKS	38635.57		+102030.31	40837.74		+101174.92
			C.G. POSITION (WHEELS DOWN)		+2.641			+2.478	
			EFFECT OF RETRACTING UNDERCARRIAGE:- -1299 lb ft						

Note:- *Alternative type survival packs may be fitted in lieu of Type M, i.e. Arctic -34 lb, Tropical -11 lb each, Desert -44 lb each.*

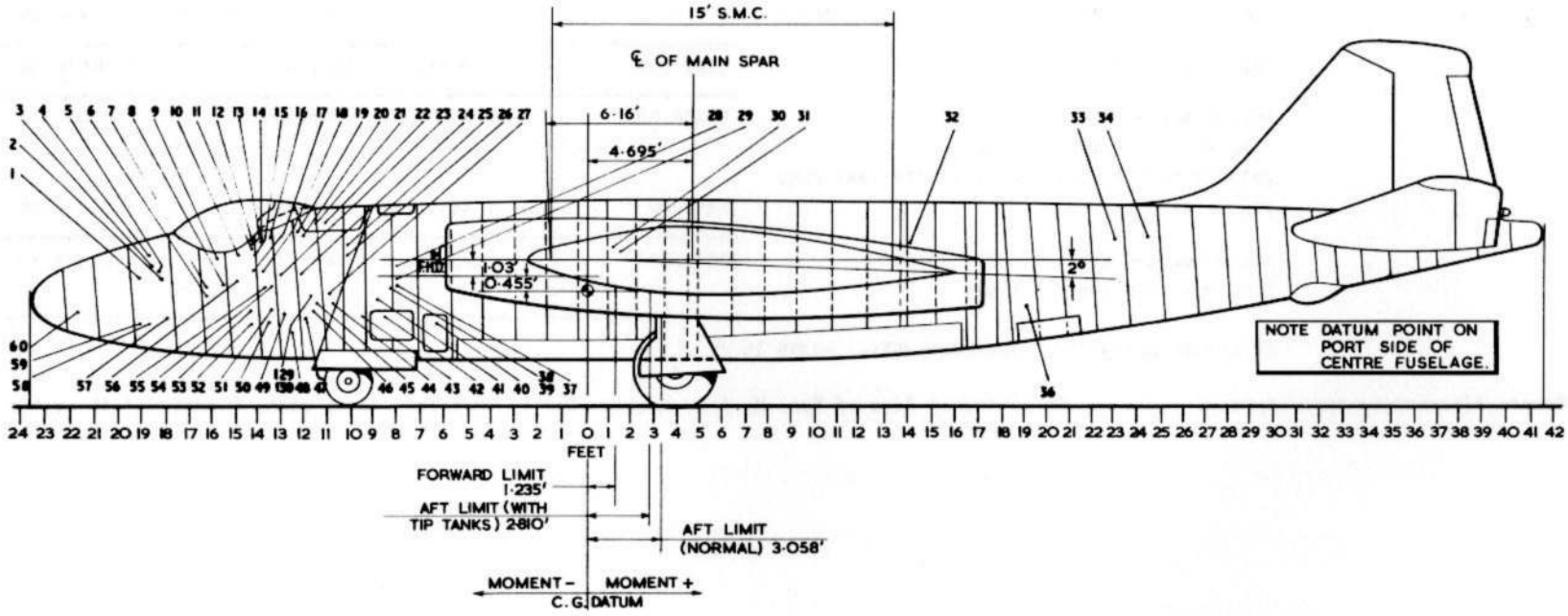

FIG. 3. LOADING AND C.G. DIAGRAM-REMOVABLE LOAD ITEMS

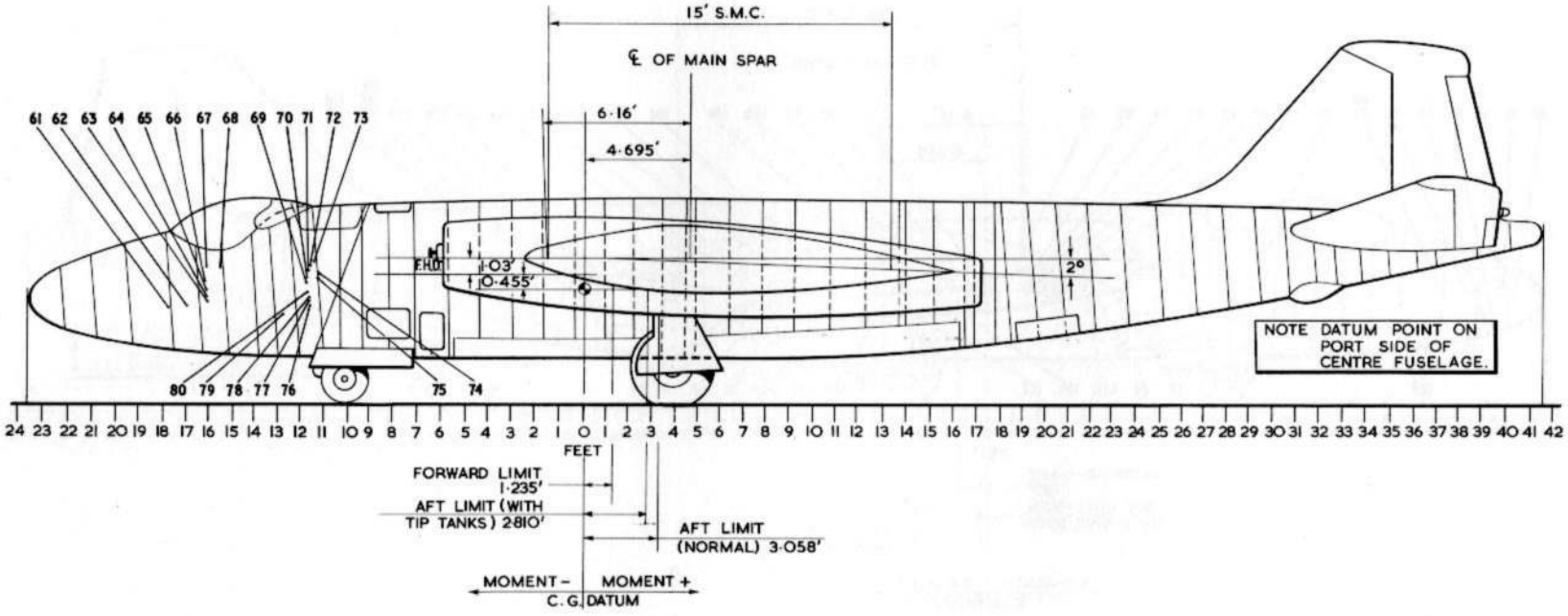

Fig. 4. Loading and C.G. diagram crew and crew removable load items

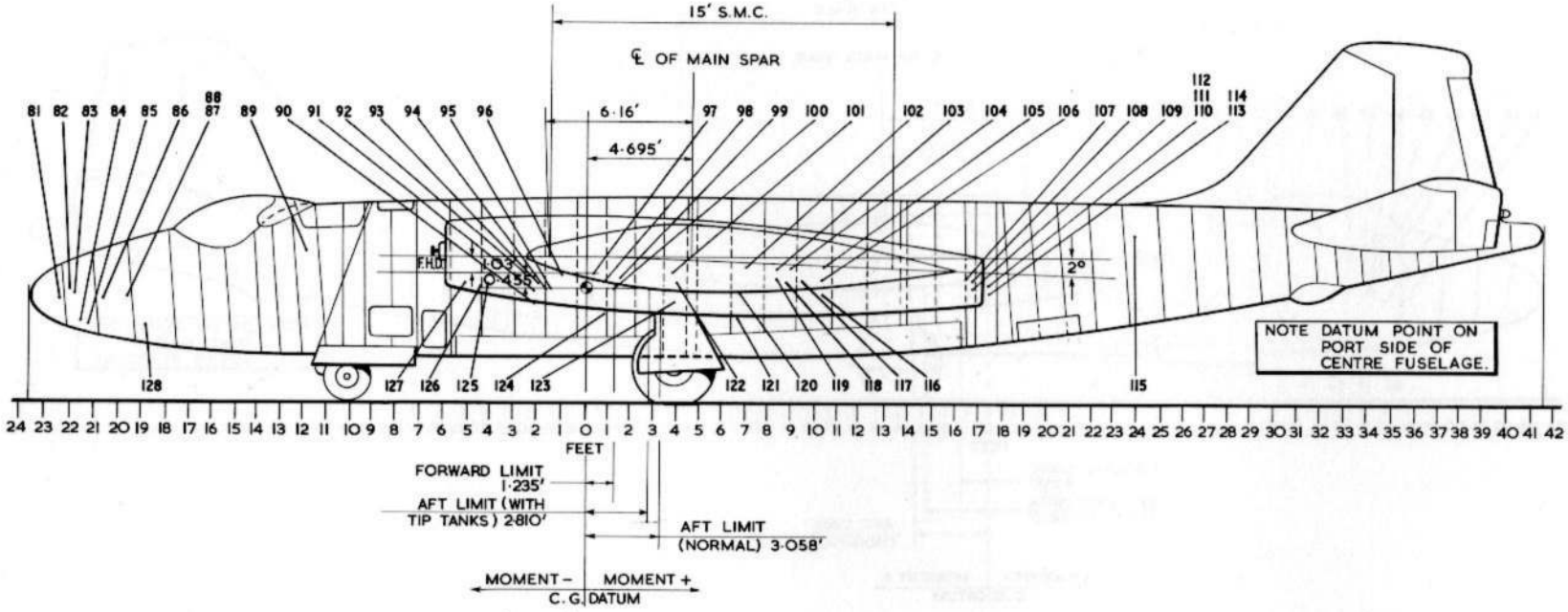

Fig. 5. Loading and C.G. diagram alternative operating load items

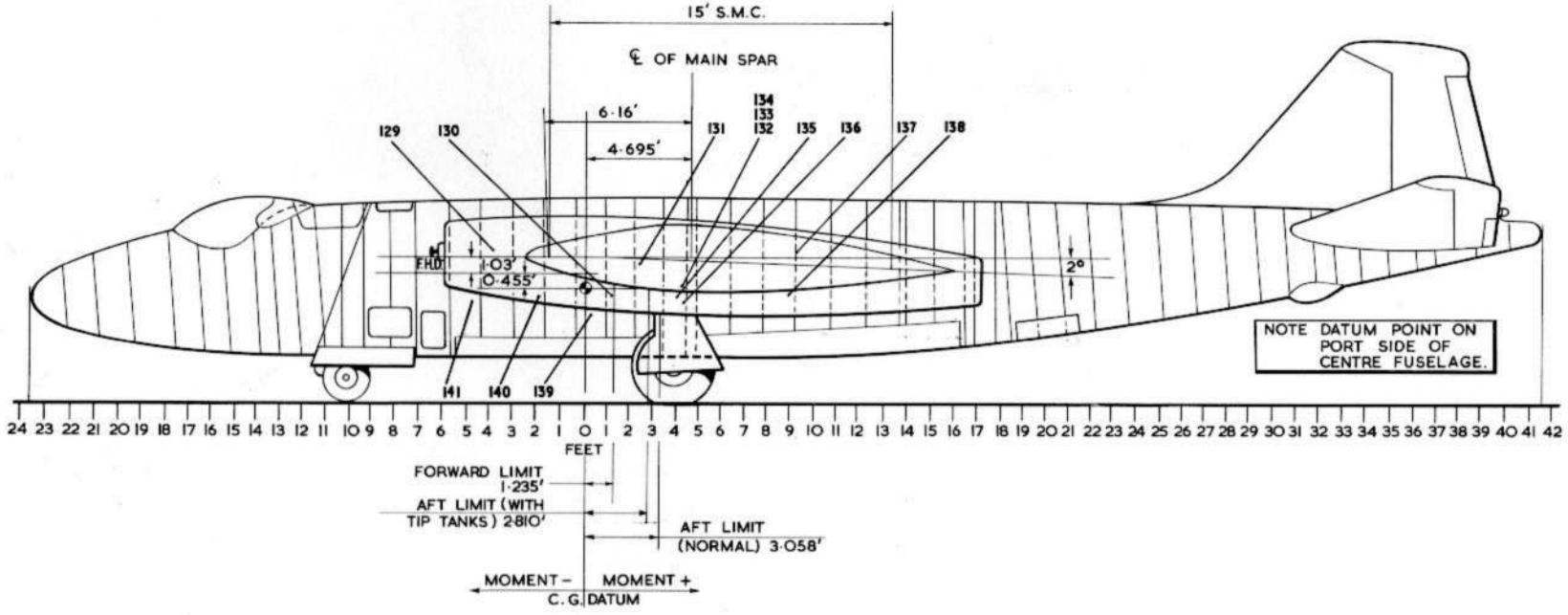

Fig. 6. Loading and C.G. diagram expendable load items

APPENDIX 2 Loading and C.G. Data Applicable to A/C WJ637 and WJ731 Only (Post Mod.5091, Less Mod.5204, Plus Mod.4868)

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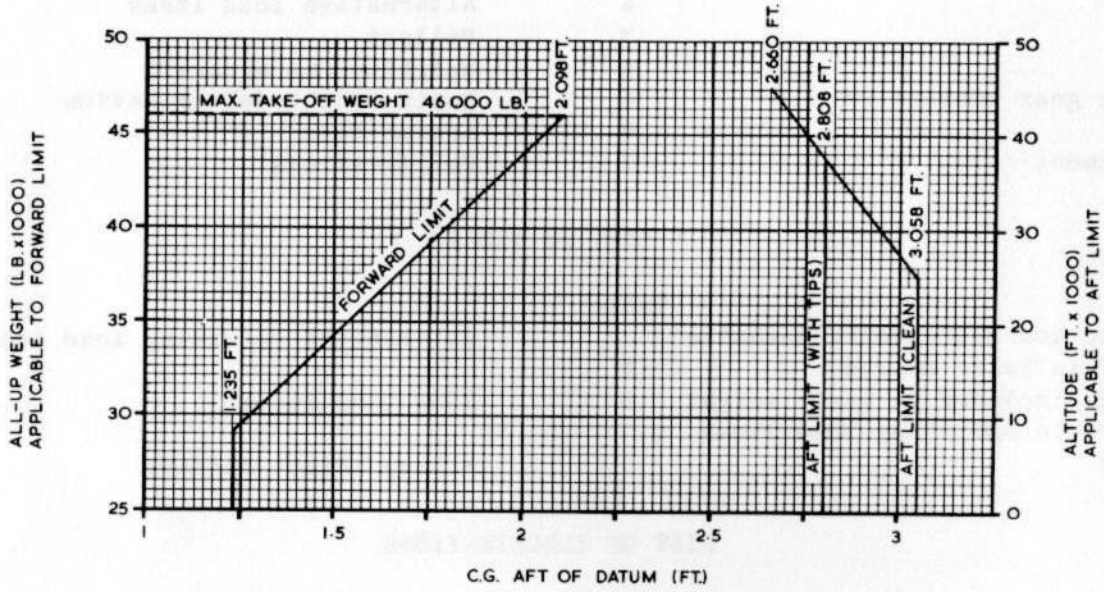

FIG. I. FLIGHT C.G. LIMITS

General information
1. This chapter deals with the effects of different and varying loads upon the C.G. position.

C.G. position
2. The aircraft C.G. position is determined with the fuselage datum horizontal (i.e. in the rigging attitude) and with the undercarriage down. All moment arms are measured in feet units parallel to the fuselage datum and are positive when they refer to items aft of the C.G. datum and negative when they refer to items forward of this datum.

C.G. datum
3. The C.G. datum is 4.695 ft forward of the spar datum and 0.455 ft below the fuselage horizontal datum. It is indicated by a screw marked C.G. datum on the port side of the fuselage. This screw can be used to suspend a plumb line during weighing operations.

Flight C.G. limits (fig.1)
4. Fig.1 prescribes the approved handling limits for C.G. movement measured from the C.G. datum.

Forward limit
This is dependent upon the weight of the aircraft. At weights below 29000 lb the permissible forward limit is 1.235 ft aft and at a weight of 46000 lb the permissible forward limit is 2.098 ft aft.

Aft limit
This is dependent upon the altitude of the aircraft.

Aircraft without wing tip tanks:
Up to 25,000 ft the aft C.G. limit is 3.058 ft aft of datum; it then moves linearly forward to 2.660 ft aft of datum at 45,000 ft.

Aircraft with wing tip tanks:
Up to 37,000 ft the aft C.G. limit is 2.808 ft aft of datum; it then moves linearly forward to 2.660 ft aft of datum at 45,000 ft.

Note...
If the aircraft is to be taxied over rough ground the aft limit must not exceed 2.885 ft aft.

Effect of alighting gear retraction
5. Retraction of the alighting gear introduces a moment of −1299 lb ft which must be taken into account when making calculations which assume that the alighting gear is retracted.

Crew movement
6. Movement of the 3rd crew member from his ejection seat to the map reader's seat introduces a moment of −680 lb ft. Further forward movement to the prone position introduces an additional moment of −894 lb ft (a total moment change of −1574 lb ft).

Basic weight and moment
7. Table 6 refers to a basic weight of 22369 lb and a basic moment of +67746 lb ft. These figures are based on WJ 731 at the modification standard detailed in para.14. A definition of the term basic weight may be found in A.P.119W-0001-1. The basic weight and moment will vary between aircraft depending on their modification standard and the figures quoted on the MOD.F751 should be substituted.

Maximum all-up weights (fig.1)

8. The aircraft is cleared for operational flying at the following maximum weights:-

Take off	46,000 lb
Landing	40,000 lb

Note...

Emergency landings only are permissible at weights in excess of this figure.

Alternative load items

9. If stores other than those given are to be carried, their disposition should be similar to that of stores given in the all-up weight summary of approximately the same weight. This will ensure that the aircraft C.G. will at all times remain within the C.G. handling limits, providing that normal fuel drill and the correct sequence for dropping stores are adhered to.

Ballast

10. Ballast weights totalling 266 lb (Sect.3, Chap.1) are provided to help maintain the C.G. position within the C.G. range. Adjustment may be made necessary due to removal or non-fitment of equipment, introduction of modifications etc. In order to ensure that the C.G. for individual aircraft will remain within the handling limits at all times, when carrying and releasing any of the permissible loads, the C.G. of the aircraft at the basic weight plus ballast, i.e. without fuel, crew and alternative load equipment must always be maintained at +2.90 ft ($\pm$0.05 ft).

Note...

The basic weight may be determined from the basic weight of the aircraft as given in Form 751 corrected for any additions or deletions of equipment etc.

Method of determining amount of ballast required: From the vertical axis of the graph (fig.2) select the appropriate value of the aircraft moment and extend from this value a horizontal line to intersect the aircraft weight value on, or between the weight lines, a vertical line is then dropped from this intersection to the horizontal axis of the graph to indicate the amount of adjustable ballast required to give a C.G. position of +2.90 ft. ($\pm$0.05 ft).

(Continued)

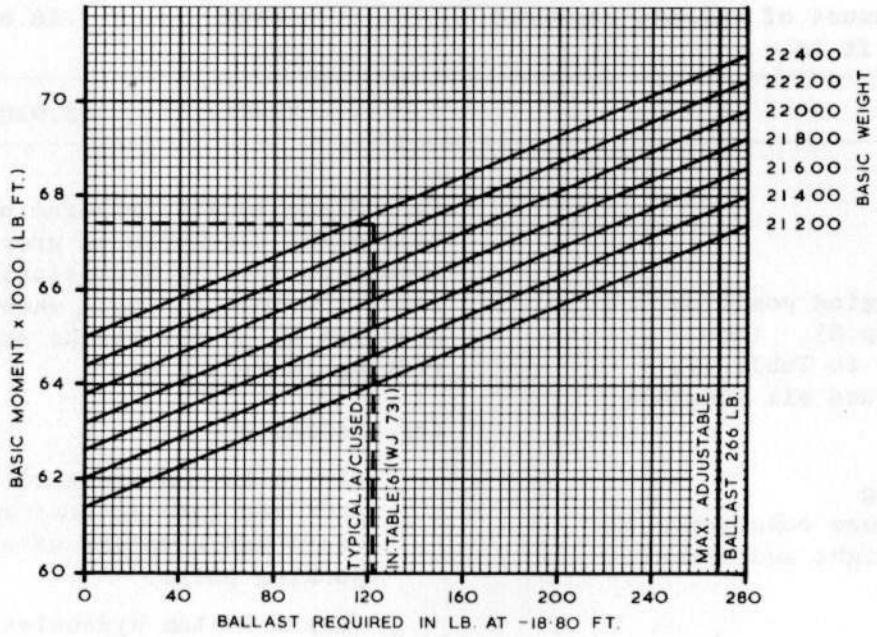

FIG. 2. DETERMINATION OF BALLAST REQUIRED TO ESTABLISH C.G. AT + 2·90 FT. IN BASIC CONDITION

Example:-

	Weight (lb)	Arm (ft)	Moment (lb ft)
Basic weight from Form 751 A/C WJ731	22369	+3.028	+67746
Basic weight	22369	+3.028	+67746
Therefore, referring to fig.2, amount of ballast required to obtain C.G. position of +2.90 ft is:-	+122	-18.8	-2294
Basic weight plus ballast	22491	+2.910	65452

Weighing the aircraft
Preparation
11.
(1) With the aircraft in the rigging position drain the fuel tanks (Sect.4, Chap.2). (For details of undrainable fuel refer to Table 1). Remove all expendable load items and all possible alternative load items.

Non-hydrostatic method of weighing
(2) Information of a general nature concerning the practical measurement of basic weight and moment is contained in A.P.119W-0001-1.

Hydrostatic method
(3) The equipment required for weighing the aircraft using the hydrostatic method is listed in Sect.2, Chap.4, Table 2.A.P.119W-0301-1 gives general information on hydrostatic units and their use; the following instructions amplify this:-

(a) Jack the aircraft at the main and front fuselage jacking points (Sect.2, Chap.4).

(b) Place locally manufactured wood blocks of sufficient thickness to provide the necessary clearance for the hydrostatic unit and jacks, under the nose and main wheels. Lower the aircraft on to the blocks and remove the lifting jacks.

(c) Assemble:-

(i) A 25-ton hydrostatic unit, a 15-ton jack and jack to unit and unit to aircraft pad adapters at each main wheel jacking point.

(ii) A 10-ton hydrostatic unit, an 8-ton jack and jack to unit and unit to nose undercarriage adapters, under the nose undercarriage axle between the twin wheels.

(d) Weigh the aircraft as instructed in A.P.119W-0301-1.

(e) Lower the aircraft on to the wood blocks and remove the weighing equipment.

(f) Jack the aircraft (operation (a)) and remove the blocks.

(g) Lower the aircraft to the ground and remove the jacks.

Basic weight determination

12. To the weight and moment obtained from weighing add:-

(1) The weight and moment of drainable unusable fuel in the pipe lines (Note 2 of Table 1).

(2) The weight and moment of Table 2 items not fitted at weighing but required for flight.

Deduct the weight and moment of all items from Tables 3, 4, 5 and 6 which were fitted at weighing.

The resultant figures are the basic weight and moment.

Note...

The total amount of adjustable ballast fitted at the time of weighing must be deducted.

Engine data

13. In the event of an engine change, MOD. F.751 must be amended to account for any changes in the engine weight and moment in accordance with the values quoted for the individual engine on the engine log card. The C.G. position as quoted on the log card will be to an engine datum, either the front or rear suspension point, which can be corrected to the A/C datum using the data given in Fig.3.

Modifications

14. The basic weight given in Table 6 includes the modifications quoted in CAN/2/Y/4 plus the modifications listed in sub-para.(1) minus those listed in sub-para.(2).

(1) 735 738 885 890 1027 1047 1155 1158 1159 1191 1259 1282 1288 1405 1426 1452 1457 1460 1494 1497 1713 1722 1740 1771 1919 1945 1995 1997 2108 2132 2160 2308 2361 2372 2544 2543 2593 2605 3211 3383 3480 3562 3585 3706 3747 3759 3849 3900 3905 3922 3971 4003 4011 4094 4112 4229 4357 4451 4930 5043 5125 5202 5209 5220 5228 5229 5237 5239 5244 4868(Pt) 4937(Pt) 5180(Pt) AS 4673

(2) 272 304 431 635 875 441 871 883 1454 1721 1960 3396 3792 4858 5193

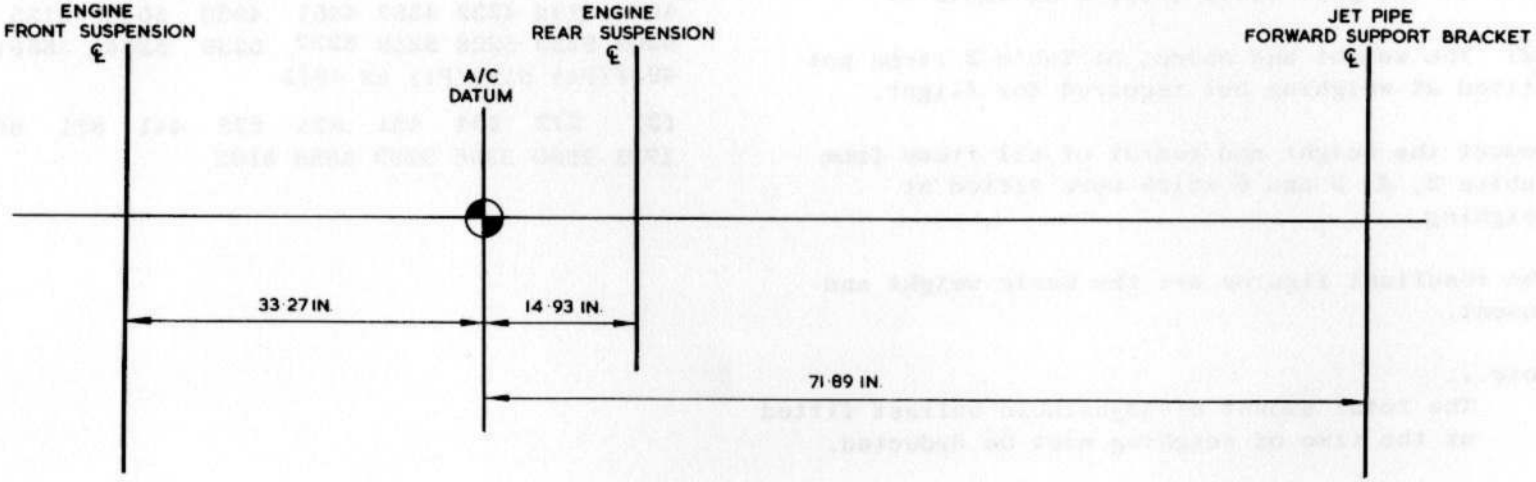

FIG. 3. ENGINE CHANGE DATA.

TABLE 1 Summary of drainable and undrainable unusable fuel to be included in basic weight

Location	Weight (lb)	Arm (ft)	Moment (lb ft)
Trapped (undrainable) fuel in pipes (wings and fuselage)	6.70	-0.228	-1.53

Note...

(1) Due to the disposition of certain fuel pipes, the above weight of fuel will remain trapped when the fuel tanks are drained.

(2) Since all fuel in the pipelines is included in the basic weight, the following fuel weights must be added when determining the basic weight after weighing the aircraft.

Drainable fuel in pipes (wing and fuselage)	9.00	+1.534	+13.81

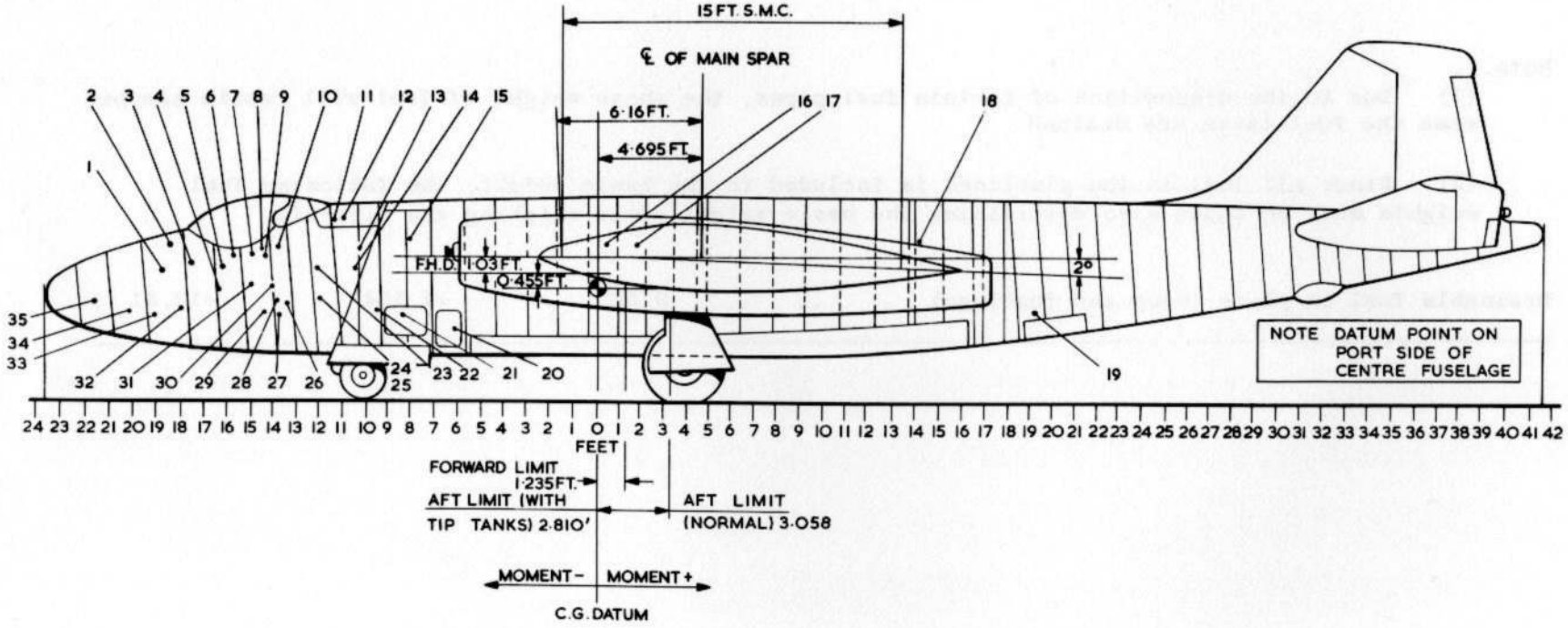

FIG. 4. LOADING AND C.G. DIAGRAM — REMOVABLE LOAD ITEMS INCLUDED IN BASIC WEIGHT (MISCELLANEOUS ITEMS)

TABLE 2 Removable load items included in basic weight (fig.4)

Fig.4 Item No.	Ref. or Part No.	Qty.	Description	Weight (lb)	Arm (ft)	Moment (lb ft)
			MISCELLANEOUS ITEMS			
33	EA3.83.97	1	Ballast crate, non-adjustable	21.06	-18.90	- 398.03
35	6D/1644	1	Oxygen emergency set, Mk.2A	2.00	-21.43	- 42.86
5	12G/1279	1	Detonator, electric, No.109, Mk.1 (controls)	0.02	-16.19	- 0.32
2	6A/2197	1	Clock, fluorescent, Mk.4	0.44	-18.57	- 8.17
6	12G/1278	32	Detonators, electric, No.108, Mk.1 (canopy)	0.74	-15.70	- 11.62
11	12G/1278	34	Detonators, electric, No.108, Mk.1 (hatch)	0.78	-11.20	- 8.74
15	-		Oxygen charge	25.78	- 8.14	- 209.82
19	12K/1220	6	Cartridges, engine starting	18.00	+19.14	+ 344.52
21	12L/203	1	Destructor, aircraft, No.1, Mk.1	3.25	- 8.73	- 28.37
27	6545-99-211-0670	1	First-aid outfit	3.00	-13.66	- 40.98
28	22G/108081	1	Gauntlets, fire-fighting (1 pair)	0.88	-14.12	- 12.43
7	12K/9629465	1 set	Cartridges, seat ejection, set No.1, Mk.1 (pilot)	0.47	-14.88	- 6.99
14	12K/9629465	1 set	Cartridges, seat ejection, set No.1, Mk.1 (navigator)	0.47	-10.35	- 4.86
13	12K/9629465	1 set	Cartridges, seat ejection, set No.1, Mk.1 (air bomber)	0.47	-10.29	- 4.84
4	12G/9635203	1	Charge, H.E., emergency control severing	0.37	-16.19	- 5.99
34	5J/9101808	1	Battery, secondary, alkaline, 2.4 volt, 3 amp/h	1.25	-19.66	- 24.58
32	5J/9101543	1	Battery, secondary, lead acid, 12 volt, 4 amp/h	4.94	-17.84	- 88.13
20	5J/9101534	4	Battery, secondary, lead acid, 12 volt, 40 amp/h Type C	198.76	- 6.65	-1321.75
17	6B/4343636	1	Air mileage unit, Mk.4A	10.50	+ 1.49	+ 15.65
24	6B/4343641	1	Amplifier unit, Type B	10.00	-11.89	- 118.90
1	6B/4343640	1	Gyro unit, Type B — G.4B compass	6.00	-18.69	- 112.14
9	6B/634	1	Indicator, master	6.63	-14.22	- 94.28
10	6B/408	1	Panel, control, Type A	1.28	-13.72	- 17.56
8	6B/1158	1	Indicator, air position, Mk.1B	11.20	-14.31	- 160.27
12	6B/2764	1	Periscope, aircraft, rear viewing, Type KPG 0502	4.53	-11.08	- 50.19
3	27KD/375	5	Stoppers, leak, cabin pressure	1.25	-17.50	- 21.88
26	27N/1	1	Axe, fire	2.42	-13.43	- 32.50
18	27N/100	1	Extinguisher, fire, Methyl-Bromide, automatic, Type 12A	10.63	+13.96	+ 148.39
16	27N/102	2	Extinguisher, fire, Methyl-Bromide, automatic, Type 14A, (wing)	38.62	+ 1.01	+ 39.01

TABLE 2 (continued) Removable load items included in basic weight

Fig.4 Item No.	Ref. or Part No.	Qty.	Description	Weight (lb)	Arm (ft)	Moment (lb ft)
29	27N/299	1	Extinguisher, fire, hand-operated, Type 34H	5.19	-13.72	- 71.21
31	EA3.80.1989	1	Handle for emergency hydraulic hand pump (stowed)	0.85	-14.97	- 12.72
30	27H/3224	1	Container, urine, Mk.2 and funnel	1.09	-13.97	- 15.23
24	120/	6	Cartridges, signal	2.06	-11.89	- 24.54
25	120/1211	6	Cartridges, radar echo Mk.1	2.06	-11.89	- 24.54
22	5J/1115903	1	Battery, Type K	18.00	- 9.60	- 172.80
23	27N/299	1	Extinguisher, Fire, hand-operated, Type 34H	5.19	-11.89	- 61.71
Fig. 5			Intercomm ARI 18909			
37	10L/16748	1	Control unit, Type 7681A	3.00	-16.00	- 48.00
44	10L/16748	1	Control unit, Type 7681A	3.00	-14.00	- 42.00
38	10U/16596	1	Amplifier, Type A1961	6.80	-15.20	- 103.60
			U/VHF ARI 23143			
53	5821-99-971-1781	1	Transmitter receiver, PTR 175	50.00	+17.50	+ 875.00
36	5821-99-945-5739	1	Control unit, Type 1607/4	3.40	-17.72	- 60.25
46	5831-99-107-0030	1	Control unit, Type 1607/7	2.40	-13.43	- 32.24
			Standby UHF ARI 23159			
58	5821-99-952-8931	1	Transmitter receiver, D403M	5.60	- 9.82	- 54.99
			IFF/SSR 1520 ARI 23134/3			
57	5895-99-956-3378	1	Transponder, Type 16928	30.00	+23.00	+ 690.00
55	10AR/1075637	1	Mounting, Type 16946	1.25	+23.00	+ 28.75
45	5895-99-956-3379	1	Controller, Type 16929	2.00	-14.00	- 28.00
			Tacan ARI 18107/18			
56	5826-00-897-5519	1	Transmitter receiver, RT 636/ARN 72	49.63	- 8.03	- 398.53
54	10AJ/4306051	1	Mounting, Type 9274	7.77	- 8.03	- 62.39
59	5826-99-723-8182	1	Control unit, Type 9273A	1.70	-13.80	- 23.46
60	5826-99-428-0416	1	Coupling unit, Type 9546	7.47	-13.97	- 104.36
61	10AJ/4280393	1	Mounting, Type 9545	1.88	-13.97	- 26.26

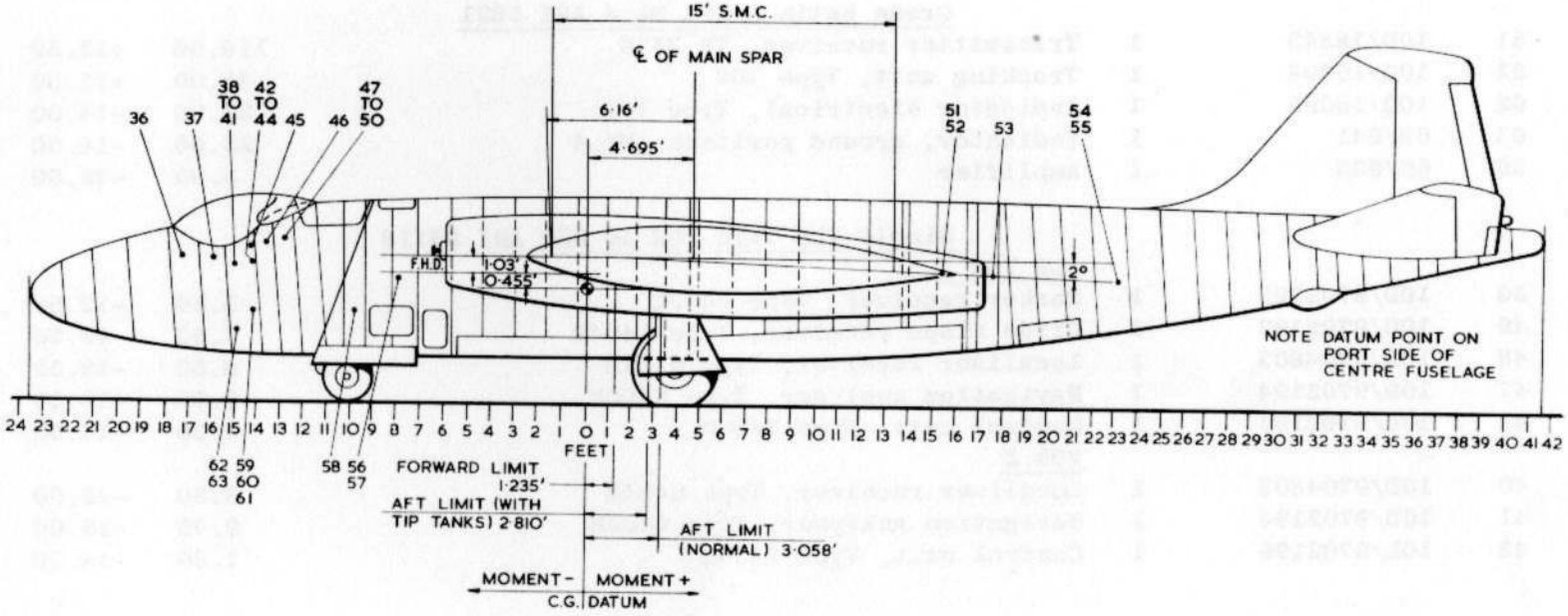

FIG. 5. LOADING AND C.G. DIAGRAM - REMOVABLE LOAD ITEMS INCLUDED IN BASIC WEIGHT

TABLE 2 (continued) Removable load items included in basic weight

Fig. 5 Item No.	Ref. or Part No.	Qty.	Description	Weight (lb)	Arm (ft)	Moment (lb ft)
			Green Satin & GP1 Mk.4 ARI 5851			
51	10D/18843	1	Transmitter receiver, TR 3710	116.00	+15.50	+1798.00
52	10Q/16094	1	Tracking unit, Type 100	48.00	+15.50	+ 744.00
62	10Q/16095	1	Indicator electrical, Type 101	21.00	-14.50	- 304.50
63	6B/541	1	Indicator, ground position, Mk.4	25.00	-14.50	- 362.50
39	6B/633	1	Amplifier	3.00	-15.00	- 45.00
			Single ILS Twin VOR AD 260 ARI 23118			
			ILS VOR 1			
50	10D/9702193	1	Marker receiver, Type 6403M	3.50	-12.50	- 43.75
49	10D/9702192	1	Glide slope receiver, Type 6404M	7.50	-12.50	- 93.75
48	10D/9704803	1	Localizer receiver, Type 6401M	8.50	-12.50	- 106.25
47	10D/9702194	1	Navigation analyser, Type 6402M	9.75	-12.50	- 121.88
42	10L/9702196	1	Control unit, Type 7430M	1.30	-14.00	- 18.20
			VOR 2			
40	10D/9704803	1	Localizer receiver, Type 6401M	8.50	-15.00	- 127.50
41	10D/9702194	1	Navigation analyser, Type 6402M	9.75	-15.00	- 146.25
43	10L/9702196	1	Control unit, Type 7430M	1.30	-14.00	- 18.20

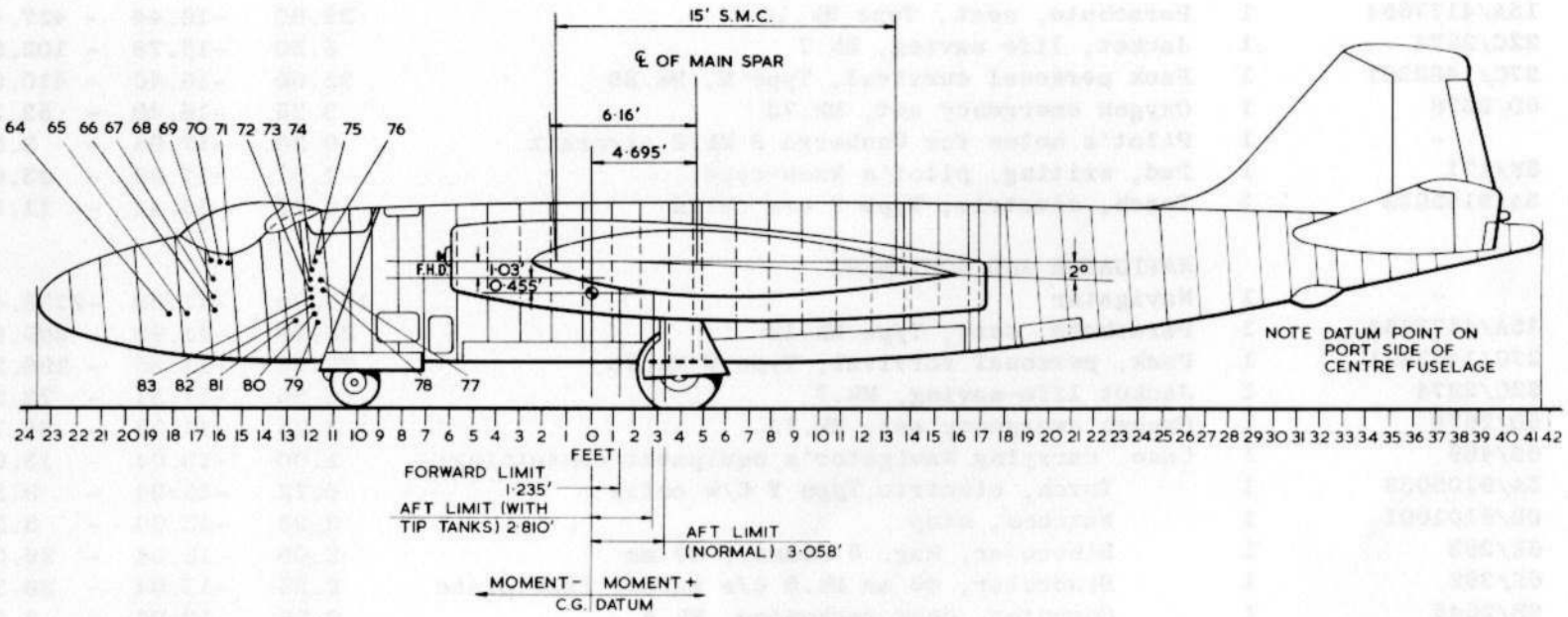

FIG.6. LOADING AND C.G. DIAGRAM – CREW AND CREW REMOVABLE LOAD ITEMS.

TABLE 3 Crew and crew removable operating load items common to all roles (fig.6)

Fig.6 Item No.	Ref. or Part No.	Qty.	Description	Weight (lb)	Arm (ft)	Moment (lb ft)
			PILOT AND EQUIPMENT			
70	-	1	Pilot	180.00	-16.44	-2959.20
66	15A/4177654	1	Parachute, seat, Type Mk.18	26.00	-16.44	- 427.44
71	22C/2274	1	Jacket, life saving, Mk.7	6.50	-15.78	- 102.57
67	27C/1482391	1	Pack personal survival, Type M, MK.2B	25.00	-16.40	- 410.00
68	6D/2678	1	Oxygen emergency set, Mk.7J	3.25	-16.40	- 53.30
64	-	1	Pilot's notes for Canberra B Mk.2 aircraft	0.20	-17.96	- 3.59
65	6F/171	1	Pad, writing, pilot's knee-type	1.37	-17.23	- 23.61
69	5A/9105033	1	Torch, electric, Type Y c/w cells	0.72	-16.44	- 11.84
			NAVIGATOR AND EQUIPMENT			
72	-	1	Navigator	180.00	-11.88	-2138.40
74	15A/4177654	1	Parachute, seat, Type Mk.18	26.00	-11.92	- 309.92
80	27C/1482391	1	Pack, personal survival, Type M Mk.2B	25.00	-11.85	- 296.25
79	22C/2274	1	Jacket life-saving, Mk.7	6.50	-11.31	- 73.52
82	6D/2678	1	Oxygen emergency set, Mk.7J	3.25	-11.92	- 38.74
81	6B/469	1	Case, carrying Navigator's equipment containing:-	1.00	-13.04	- 13.04
	5A/9105033	1	Torch, electric,Type Y C/w cells	0.72	-13.04	- 9.39
	6B/9101001	1	Watches, stop	0.25	-13.04	- 3.26
	6E/293	1	Binocular, Mag. 6 Diams., 30 mm	2.00	-13.04	- 26.08
	6E/392	1	Binocular, 40 mm Mk.5 c/w rubber face plate	2.25	-13.04	- 29.34
	6B/2645	1	Computer, dead reckoning, Mk.4	0.25	-13.04	- 3.26
	6B/47	1	Protractor, Douglas 5 in	0.14	-13.04	- 1.83
	6B/260	1	Rule navigator's, Mk.1	0.13	-13.04	- 1.70
	13/94	1	Sets, compass	0.25	-13.04	- 3.26
	6B/349	1	Straight edge, 20 in	0.30	-13.04	- 3.91
			3rd CREW MEMBER AND EQUIPMENT			
76	-	1	3rd Crew member	180.00	-11.83	-2129.40
75	15A/4177654	1	Parachute, seat, Type Mk.18	26.00	-11.87	- 308.62
73	27C/1482391	1	Pack, personal survival, Type M, Mk.2B	25.00	-11.80	- 295.00
78	22C/2274	1	Jacket life-saving, Mk.7	6.50	-11.27	- 73.24
83	6D/2678	1	Oxygen, emergency set, Mk.7J	3.25	-11.87	- 38.58
77	5A/9105033	1	Torch, electric, Type Y c/w cells	0.72	-11.83	- 8.52
			TOTAL CREW AND CREW REMOVABLE LOAD ITEMS	732.55		-9796.81

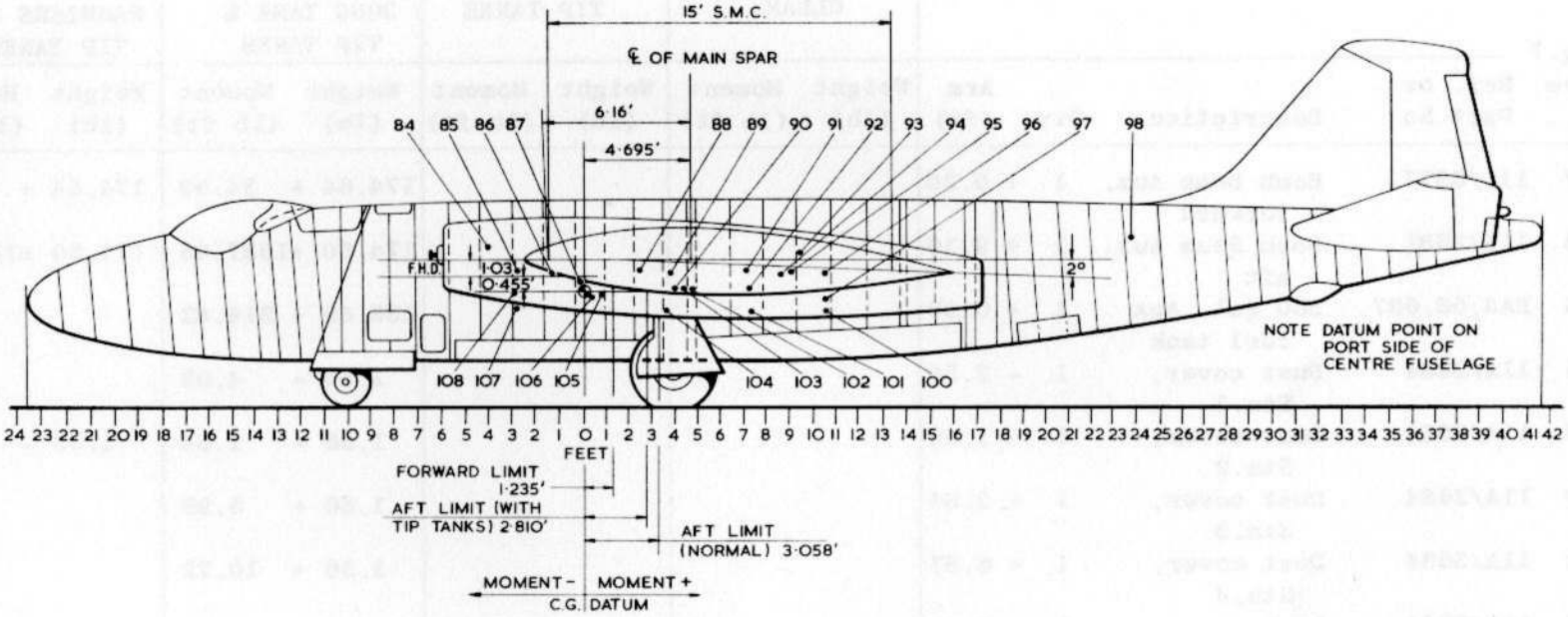

FIG. 7. LOADING AND C.G. DIAGRAM – ALTERNATIVE AND FUEL LOAD ITEMS.

TABLE 4 Alternative operating load items (fig.7)

Fig.7 Item No.	Ref. or Part No	Description	Qty	Arm (ft)	CASE A CLEAN Weight (lb)	CASE A CLEAN Moment (lb ft)	CASE B TIP TANKS Weight (lb)	CASE B TIP TANKS Moment (lb ft)	CASE C 300G TANK & TIP TANKS Weight (lb)	CASE C 300G TANK & TIP TANKS Moment (lb ft)	CASE D PANNIERS & TIP TANKS Weight (lb)	CASE D PANNIERS & TIP TANKS Moment (lb ft)
87	11A/6377	Bomb Beam Aux. forward	1	+ 0.20					174.64	+ 34.93	174.64	+ 34.93
95	11A/3681	Bomb Beam Aux. aft	1	+ 9.10					174.50	+1587.95	174.50	+1587.95
105	EA3.56.697	300 gal. Aux fuel tank	1	+ 0.90					238.69	+ 214.82		
85	11A/3684	Dust cover, Stn.1	1	- 2.58					1.56	- 4.02		
86	11A/3684	Dust cover, Stn.2	1	- 1.18					1.56	- 1.84	1.56	- 1.84
89	11A/3684	Dust cover, Stn.3	1	+ 3.84					1.56	+ 5.99		
91	11A/3684	Dust cover, Stn.4	1	+ 6.87					1.56	+ 10.72		
94	11A/3684	Dust cover, Stn.5	1	+ 8.48					1.56	+ 13.23	1.56	+ 13.23
96	11A/3684	Dust cover, Stn.6	1	+10.22					1.56	+ 15.94		
107		Pannier loaded, Stn.1	1	- 2.58							100.00	- 258.00
104		Pannier loaded, Stn.3	1	+ 3.84							100.00	+ 384.00
101		Pannier loaded, Stn.4	1	+ 6.87							100.00	+ 687.00
100		Pannier loaded, Stn.6	1	+10.22							100.00	+1022.00
108		Release Unit No.3 Stn.1	1	- 2.58							10.69	- 27.58

TABLE 4 (continued) Alternative operating load items (fig.7)

Fig.7 Item No.	Ref. or Part No.	Description	Qty	Arm (ft)	CASE A CLEAN Weight (lb)	CASE A CLEAN Moment (lb ft)	CASE B TIP TANKS Weight (lb)	CASE B TIP TANKS Moment (lb ft)	CASE C 300G TANK & TIP TANKS Weight (lb)	CASE C 300G TANK & TIP TANKS Moment (lb ft)	CASE D PANNIERS & TIP TANKS Weight (lb)	CASE D PANNIERS & TIP TANKS Moment (lb ft)
90		Release Unit No.3 Stn.3	1	+ 3.84							10.69	+ 41.05
92		Release Unit No.3 Stn.4	1	+ 6.87							10.69	+ 73.44
97		Release Unit No.3 Stn.6	1	+10.22							10.69	+ 109.25
98		Survival Packs Type M	3	+23.66	69.75	+1650.29	69.75	+1650.29	69.75	+1650.29	69.75	+1650.29
102	EA3.82.217/8	Wing tip tanks	2	+ 4.25			238.00	+1011.50	238.00	+1011.50	238.00	+1011.50
	EA1.20.2031	Bolts explosive	6	+ 4.16			2.75	+ 11.44	2.75	+ 11.44	2.75	+ 11.44
	EA1.00.81/2	Wing tip tank attachment	2	+ 4.10			0.73	+ 2.99	0.73	+ 2.99	0.73	+ 2.99
	12G/1279	Detonator electric 109 Mk.1	6	+ 4.15			0.13	+ 0.54	0.13	+ o.54	0.13	+ 0.54
					69.75	+1650.29	311.36	+2676.76	908.55	+4554.48	1106.38	+6342.19

NOTE...
ALTERNATIVE TYPE SURVIVAL PACKS MAY BE FITTED IN LIEU OF DESERT TYPE i.e. ARCTIC 34 lb. EACH, TROPICAL 11 lb. EACH.

TABLE 5 Fuel load items (fig.7)

Fig. 7 Item No.	Ref. or Part No.	Qty.	Description	Weight (lb)	Arm (ft)	Moment (lb ft)
			FUEL IN FUSELAGE (at 8 lb/gal)			
84	-	-	Fuel, No.1 tank, 520 gal.	4160.00	- 3.86	-16057.60
88	-	-	Fuel, No.2 tank, 317 gal.	2536.00	+ 2.21	+ 5604.56
93	-	-	Fuel, No.3 tank, 540 gal.	4320.00	+ 9.13	+39441.60
			TOTAL FOR FUEL IN FUSELAGE	11016.00		+28988.56
			WING-TIP TANKS FUEL (at 8 lb/gal)			
103	-	-	Fuel, wing-tip tanks 488 gal	3904.00	+ 3.88	+15147.52
			AUXILIARY TANK FUEL (at 8 lb/gal)			
106	-	-	Fuel, auxiliary tank, 300 gal	2400.00	+ 0.39	+ 936.00

TABLE 6 All-up weight summary

	CASE A CLEAN			CASE B TIP TANKS			CASE C 300GAL TANK AND TIP TANKS			CASE D PANNIERS AND TIP TANKS		
	Weight (lb)	Arm (ft)	Moment (lb ft)	Weight (lb)	Arm (ft)	Moment (lb ft)	Weight (lb)	Arm (ft)	Moment (lb ft)	Weight (lb)	Arm (ft)	Moment (lb ft)
Basic weight	22369	+3.028	+67746	22369	+3.028	+67746	22369	+3.028	+67746	22369	+3.028	+67746
Adjustable ballast	122	-18.80	- 2294	122	-18.80	- 2294	122	-18.80	- 2294	122	-18.80	- 2294
Alternative load items (Table 4)	70		+ 1650	311		+ 2677	909		+ 4554	1106		+ 6342
Crew and equipment (Table 3)	733		- 9797	733		- 9797	733		- 9797	733		- 9797
OPERATING WEIGHT	23294	+2.460	+57503	23535	+2.478	+58332	24133	+2.495	+60209	24330	+2.548	+61997
Fuel: (Table 5)												
Fuselage	11016		+28989	11016		+28989	11016		+28989	11016		+28989
Wing tips				3904		+15148	3904		+15148	3904		+15148
300 gal. tank							2400		+ 936			
ALL UP WEIGHT	34310	+2.515	+86294	38455	+2.665	+102469	41453	+2.540	+105282	39250	+2.704	+106134

Chapter 3A FATIGUE INDEX DATA

(Completely revised)

LIST OF CONTENTS

INTRODUCTION

General

1. Every aircraft structure suffers fatigue damage accumulatively, from pilot induced manoeuvres, from gust effects resulting from flight through turbulent air, and from undercarriage-to-wing load transferance during the ground-air-ground cycle of take-off and landing. Because of this, each type of aircraft has a safe fatigue life stated, which, when expired, will cause the aircraft to be withdrawn from service or modified to allow further flying. The declared safe life may be evolved, initially, from calculations but is usually confirmed by full scale fatigue testing. The consumption of fatigue life is monitored as each aircraft is flown in order to ensure that the declared safe fatigue life is not exceeded.

Fatigue Index

2. Fatigue life consumed is measured in terms of "fatigue index" (F.I.) which is a non-dimensional number, calculated either from fatigue meter readings, or by converting sortie hours flown using appropriate fatigue index rates (FI/hr). Generally the fully consumed fatigue life of an aircraft is represented by a fatigue index of 100 but in special circumstances e.g., following a modification to the aircraft, or re-testing of the structure to revised land spectra, a figure in excess of 100 may be quoted as the fully consumed limit. Also, where major components such as wings, tailplanes, and fins are considered to be interchangeable, it will be necessary to evaluate their individual limiting fatigue lives relative to that of the original critical component established by the fatigue test. The aircraft limiting FI will then have to be identified with the least of all such values. The methods of calculating F.I. are described in the following two paragraphs and at the end of this chapter.

Assessing fatigue life consumption

3. The most accurate method of determining the F.I. consumed due to gust and manoeuvreing effects is by using a fatigue meter. This instrument records on counters the number of times that 'g' thresholds of a pre-determined series of levels are reached or exceeded. By entering the difference values of the counters over a period of flying time into a formula, together wther with the appropriate number of roller and full-stop landings, the incremental F.I. consumption for the period can be calculated. One aircraft type may have several formulae to cover variations in operating role, average all-up weights, or the fitment of different types of fatigue meter. Alternatively, average all-up weight variations may be covered by the use of different weight factors inserted into the fatigue formulae.

Unmetered flying

4. For the periods prior to the fitment of fatigue meters, or when an installed meter is unserviceable, fatigue consumption is assessed from details of the flying patterns flown and is dependent upon the type of aircraft manoeuvres and theatre of operations. This assessment enables the design authority to estimate fatigue index consumption rates which, related to hours flown, enables the F.I. consumed for each sortie to be calculated. Because fatigue damage estimates based on sortie patterns are derived from average expected loadings, the F.I. rates are factored to allow for 'worst case' situations. Thus, fatigue consumption assessed on a sortie pattern basis is wasteful when compared with the more accurate fatigue meter based index. Hence, it is essential to give priority to the replacement of defective fatigue meters.

Flight patterns

5. The fatigue formulae and fatigue index rate values, for use during periods of fatigue meter unserviceability are compiled in conjunction with some of the flight details given in the 'Statement of Intent' which forms Part 2 of flying 'Patterns and Fatigue Parameters'. This document describes the various sortie patterns to which aircraft are generally expected to fly in terms of average weight, altitude, duration, percentage utilization, etc. Each of the complete sorties is summarized under a descriptive title and allocated a sortie pattern code number on the reverse side of the M.O.D. Form 725. The above parameters form the basis of fatigue consumption studies on major aircraft components other than the main wing attachment on the fuselage, the fatigue life of which is related directly to fatigue meter counts. In both contexts damage levels attributable to any particular mode or modes of flying can be isolated by use of the recorded sortie code number.

It follows that any significant proposed change to a sortie pattern should be refered to the 'Statement of Intent' issuing authority via Air. Eng. 30b.

Recording of fatigue data

6. The recording of flight data sortie codes and fatigue meter counts is made currently on M.O.D. Form 725 (Canberra) (ADP) (Revised Sept. 1983), the format of which has been adapted for Automatic Data Processing Techniques. Instructions on the use of this form are given in

M.O.D. Form 799/4 (Canberra) (ADP) (Revised Sept.1983). The in-use form is kept in the aircraft M.O.D. Form 700 and on completion, after four separately recorded flights, is processed at Station Level to yield incremental values of Fatigue Index, Landings, Cabin Pressurizations and other data to add to previously accumulated totals. A month by month return is made from these totals on STC Form STATS 2062 (Revised June 1984) as a statistical monitor of average F.I. rate per mark and of individual aircraft F.I. remaining.

7. The aircraft captain is responsible for completing the sortie details, whilst servicing personnel are responsible for reading fatigue meters and recording the information on M.O.D. Form 725 (Canberra) (ADP). All personnel responsible for the collection and compilation of fatigue data must appreciate the need for accuracy and legibility of the entries. Careless or incomplete recording is dangerous if it causes a less damaging sortie to be recorded. It is also wasteful if, in the interests of safety, the worst case has subsequently to be assumed. In extreme cases continued carelessness or incomplete recordings can result in the premature retirement of an aircraft because of doubt regarding the true F.I. situation.

8. All personnel responsible for reading fatigue meters are to be familiar with, and are to apply, the serviceability checks described in AP112G-0203-1, Chapter 2. In particular, the validity of fatigue meter readings are to be checked either before any fatigue life calculations are undertaken at the unit, or before M.O.D. Form 725 is despatched from the unit for fatigue calculations to be performed elsewhere. The replacement of unserviceable meters is to be regarded as a high priority task.

Refining of Fatigue Index

9. During the period of the Canberra Refurbishing Programme, 1978 to 1982, a parallel detailed exercise was undertaken by the A.D.A. to re-assess the flying and fatigue records of all flying Canberras. Account was taken of all special manoeuvres and allowances made to include the ground-air-ground effect on all pre-metered and metered flying. Refined totals of flying hours, landings, cabin pressurizations and F.I. were issued on a Company's marker Form 725 together with the allowable F.I. for each aircraft.

Consistent with the replacement of the fuselage Centre Section Forging (C.S.F.) which, (if not already achieved at an earlier date) was carried out during the refurbishing programme, together with the associated repair and inspection programme, agreement was reached with R.A.E. Structures Department, to extend the allowable F.I. for the Canberra to 133. For some aircraft, however, because of special circumstances, the allowable F.I. is quoted at a value less than 133 (See para.16).

When the fatigue records for an aircraft show that is has consumed 80 per cent of its allowable F.I., action is to be taken in accordance with AP100B-01 ORDER 0786, paragraphs 10 and 11. It should be noted that the return of completed Forms 725 should be limited only to those accumulated since the Refurbishing Assessment, identified by the marker Form 725 issued by BAe and filed with the completed forms.

Note . . .

Previously fatigue data was recorded on the following documents:

Entries in the Form 700
F.D.S. 1 and 2
Forms 4832 A and B
Forms 4832 A and B (Revised May, 1966)
Form 725/1 and Form 725/2 (Canberra) (Nov. 1970 provisional issue)
M.O.D. Form 725 (Canberra) (Jan.1972 issue)
M.O.D. Form 725 (Canberra) (Revised Nov.1978)
M.O.D. Form 725 (Canberra) (ADP) (Revised Sept.1983)

Collectively, these documents represent the complete fatigue history of the aircraft and therefore must be preserved intact for possible future reference.

Whenever a mainplane is removed from a refurbished or non-refurbished aircraft for retention as a spare, the above records, or copies of them, should be identified with that mainplane and be available to complete the fatigue history of any new aircraft combination.

Action on fitment of a new fatigue meter

10. When a fatigue meter is changed the current M.O.D. Form 725 is to be closed and a new form raised. Block 1 of the new sheet is to be used to record the new meter window readings and the values of total flying hours and landings brought forward from the closed sheet. Further flying is recorded under Block 2. Refer to M.O.D. Form 799/4 (Canberra) (ADP) (Revised Sep.1983), paras.4 and 5.

The checks specified in AP112G-0203-1, Chapter 2, are to be applied after three hours of flight have been completed with a new or replacement meter installed.

APPLICATION

General

11. The fatigue life of the Canberra was originally based on calculations for the high altitude bomber role. However, later operations included low level loft bombing roles, producing increased flight loading, so a full scale fatigue test was carried out.

12. Prior to the fitment of a fatigue meter, the fatigue consumption was assessed by factoring the flying hours according to the sortie flown. This produced a result called "fatigue hours". These were subsequently expressed as a percentage of a 20,000 hour datum life, and the result quoted in terms of fatigue index (F.I.). At the refurbishing fatigue record assessment all of this earlier flying assessment had to be further modified to take account of the ground-air-ground (G.A.G.) cycle with resultant increases in F.I. consumed.

Fatigue lives

13. The critical component on test proved to be the fuselage Centre Section Forging (C.S.F.) with the failure of the port front lower boom lug at the wing pick-up point. This was repaired and the test continued until failure occurred at the corresponding lug on the starboard side of the C.S.F.

14. Based on the geometric mean of the load cycles to failure of the two test results, a particular Safe Life was determined for Canberra aircraft flying in a similar manner to the test flight profiles, or from spectra plotted from actual fatigue meter counts. Safe lives for the other Canberra variants in aircraft weight, speed, altitude etc., have been derived by application of the theory of cumulative damage. In certain cases, where no fatigue meter readings are available for revised forms of flying, the safe life has had to be determined from step by step analysis of the sortie flight profiles. By further extensions of the above procedures fatigue meter formulae and F.I. rates have been derived which express the safe life in terms of the fully consumed F.I.

15. Thus the fully consumed F.I. for all original build Canberras is 100 F.I. and is based on the above mentioned failures of the C.S.F. main attachment lugs. However, because of structural integrity considerations associated with stress corrosion damage, a C.S.F. replacement programme was undertaken on all long term Canberras.

By agreement with R.A.E. Structures the remainder of the tested airframes with a replacement C.S.F. fitted, could be allowed to go to a revised limiting F.I. of 133, the equivalent of the second test failure mentioned above.

16. It follows that all mainplanes have a limiting F.I. of 133 but because certain components were removed, or not representatively loaded during the main fatigue test, revised calculated F.I.'s were allocated to these as follows:

Fin	160 F.I.
Tailplane and Attachments	200 F.I.
Front Transport Joint Cleats	231 F.I.

The replacement C.S.F. still has an allowable fatigue life of 100 F.I. based on the original test results. Therefore, if the total consumed fatigue life of an aircraft is less than 33 at C.S.F. replacement, then the revised allowable F.I. of that aircraft, post replacement, is that value of F.I. plus 100 for the new forging, a total value which will be less than 133. For such aircraft the maximum value of 133 F.I. could only be achieved by a second C.S.F. change.

Cabin life

17. Based on a full scale test carried out in 1975 a revised datum life for the pressure cabin has been established as 12,900 full pressurizations. This represents a very large increase in cabin life compared to the previously quoted value but it is applicable only to those variants having a fixed, bubble-type, canopy. This revised datum life is to be compared with the total of all cabin pressurizations. That is those recorded on the marker Form 725 issued following the refurbishing assessment (See para. 9), and the combined totals of the Form 725 recorded events when 15,000 feet and 25,000 feet are reached, plus any ground pressurizations.

Form 725 records events when 15,000 ft and 25,000 ft are reached, plus any ground pressurizations; all events being counted as full pressurizations.

Components limiting aircraft service life

18. A number of components exist on the aircraft which require replacing or reconditioning after a pre-established period. These are listed in AP101B-0400-5A1 Section 2.

Fuel tanks

19. Extended periods of flying with wing-tip tanks empty at take-off may cause an increase in fatigue damage which is not covered by existing formulae. When it is anticipated that such sorties will be flown over long periods, the tip tanks should be removed.

Fatigue monitoring

20. The BMK2 and BMK2T aircraft are fitted with a MK13 type fatigue meter which records and visibly displays, in the appropriate window, the number of times that each of eight different threshold levels of acceleration are reached or exceeded. The letter suffixes by which these 'g' levels are identified are as follows:-

A	B	C	D	E	F	G	H
0.5g	0.1g	0.5g	1.5g	1.9g	2.5g	3.5g	4.5g

21. The fatigue meter is located in the starboard main undercarriage bay attached to the slant diaphragm. It must be noted that revised fatigue formulae will be required if any type of fatigue meter other than a MK13 is fitted.

Fatigue meter formulae (B Mk.2 aircraft)

22. The formula for a BMK2 aircraft fitted with a MK13 fatigue meter is as follows:-

Note . . .

This formula is only applicable for R.A.F. BMK2 aircraft as detailed in FLA/CAN/4 Iss.1 of 2.2.82, Stress Office, BAe, Military Aircraft Division, Warton Unit, Warton, Lancashire, PR1 4AX.

METERED FLYING

For aircraft without tip tanks or bomb bay tanks fitted:-

$$FI = \frac{31.71(A)+6.63(B)+0.69(C)+0.008(D)+0.3(E)+5.6(F)+32.36(G)+92.28(H)+4.5(LF)+0.18(LR)}{1000}$$

For aircraft with tip tanks but without bomb bay tanks fitted:-

$$FI = \frac{36.90(A)+8.22(B)+0.88(C)+0.011(D)+0.39(E)+7.15(F)+39.08(G)+109.63(H)+9.8(LF)+0.4(LR)}{1000}$$

For aircraft with 300 gallon bomb bay tank fitted:-

If the 300 gallon bomb bay tank is fitted the table overleaf gives a factor to be applied to the coefficients A-H in the formulae alongside. This factor is dependent upon the fuel load at take-off in the bomb bay tanks. A new coefficient, LF, is given for each case; LR remains unchanged.

AMOUNT OF FUEL IN b.b. TANKS AT TAKE-OFF (LBS)	A/C WITHOUT TIP TANKS FITTED		A/C WITH TIP TANKS FITTED	
	FACTOR	LF	FACTOR	LF
0-600	1.14	5.6	1.11	10.98
600-1200	1.20	6.3	1.23	11.66
1200-1800	1.25	7.0	1.35	12.35
1800-2400	1.31	7.8	1.47	13.03

Where A-H represents the total counts recorded by the windows marked as follows:-

WINDOW	A	B	C	D	E	F	G	H
g	-0.5	0.1	0.5	1.5	1.9	2.5	3.5	4.5

LF is the number of full stop or braked landings.

LR is the number of roller landings.

Note . . .

LF and LR will be the totals of each form of landing recorded over the same period as the meter count sample.

UNMETERED FLYING

For periods when a fatigue meter is not fitted or is faulty, the fatigue index is to be calculated using a fatigue index rate as follows:-

F.I. = Flying hours x F.I. rate

where the F.I. rates for each sortie code are given along side.

For aircraft without tip tanks fitted:-

Use an F.I. rate of 0.011 for all sortie codes for aircraft without bomb bay tanks fitted. If bomb bay tanks are fitted use an F.I. rate of 0.015.

For aircraft with tip tanks but without bomb bay tanks fitted:-

S.C.	F.I. RATE	S.C.	F.I. RATE
1	0.011	5	0.011
2	0.023	6	0.039
3	0.015	7	0.033
4	0.011		

If the sortie pattern code for any unmetered flying is not known an F.I. rate of 0.017 should be used.

For aircraft with tip tanks and bomb bay tanks fitted:-

Use an F.I. rate of 0.025 for all sortie codes. The increment in F.I. calculated by these methods is then added to the total F.I., previously determined from formulae.

Fatigue meter formula (B2T aircraft)

23. The formula for a B2T aircraft fitted with a Mk.13 fatigue meter is as follows:-

Note . . .

This formula is only applicable for R.A.F. B2T aircraft as detailed in FLA/CAN/4 Iss. 1 of 2.2.82, Stress Office, BAe, Military Aircraft Division, Warton Unit, Warton, Lancashire, PR4 1AX.

METERED FLYING

For aircraft without tip tanks fitted:-

$$\text{FI} = \frac{26.55(A)+6.09(B)+0.65(C)+0.015(D)+0.40(E)+5.71(F)+37.38(G)+120.12(H)+5.3(LF)+0.18(LR)}{1000}$$

For aircraft with tip tanks fitted:-

$$\text{FI} = \frac{31.65(A)+7.78(B)+0.86(C)+0.02(D)+0.53(E)+7.57(F)+46.36(G)+147.12(H)+11(LF)+0.4(LR)}{1000}$$

Where A-H represents the total counts recorded by the windows marked as follows:-

WINDOW	A	B	C	D	E	F	G	H
g	-0.5	0.1	0.5	1.5	1.9	2.5	3.5	4.5

LF is the number of full stop or braked landings.

LR is the number of roller landings.

Note: LF and LR will be the totals of each form of landing recorded over the same period as the meter count sample.

UNMETERED FLYING

For periods when a fatigue meter is not fitted or is faulty, the fatigue index is to be calculated using a fatigue index rate as follows:-

F.I. = Flying hours x F.I. rate

Where the F.I. rates for each sortie code are given below:

For aircraft without tip tanks fitted:-
Use an F.I. rate of 0.018 for all sortie codes.

For aircraft with tip tanks fitted

S.C.	F.I. RATE	S.C.	F.I. RATE
1	0.019	5	0.02
2	0.045	6	0.04
3	0.026	7	0.033
4	0.006		

If the sortie pattern code for any unmetered flying is not known and F.I. rate of 0.026 should be used. The increment in F.I. calculated by these methods is then added to the total F.I. previously determined from formulae.

Chapter 4 GENERAL SERVICING

(completely revised)

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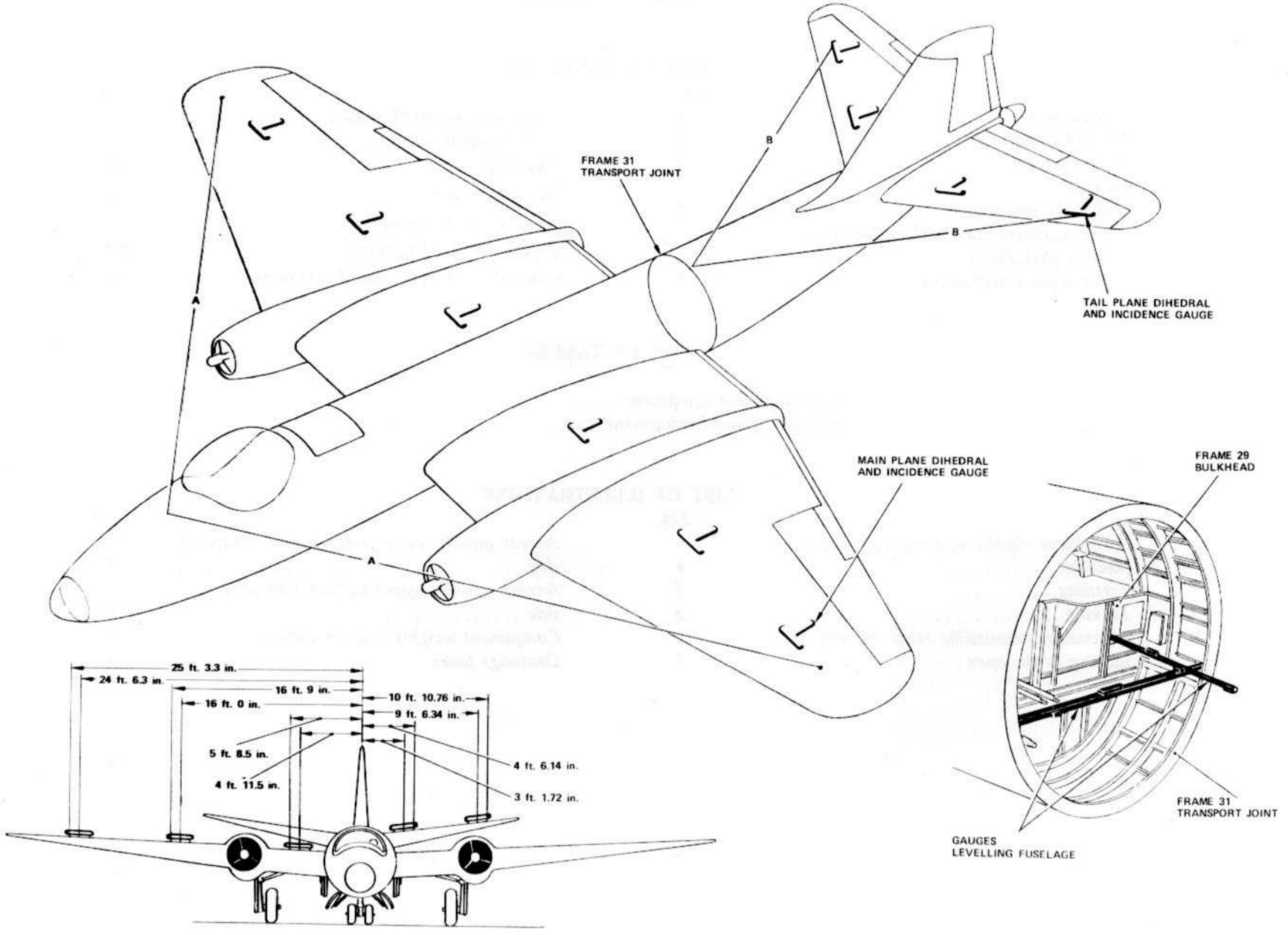


FIG. I. ALIGNMENT CHECKS AND RIGGING GAUGE POSITIONS

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

Introduction

1. This chapter contains information on the general servicing of the complete aircraft: servicing of the individual components and systems is given in the appropriate chapters of Section 3 and 4 of this volume.

Ground equipment

2. The items of ground equipment provided for handling and servicing the aircraft are listed at the end of this chapter. The items are arranged in two tables, Table 1 – Special Ground Equipment (handling and servicing equipment peculiar to this aircraft), and Table 2 – Standard Ground Equipment. These tables contain no items that are normally included in the relevant Appendix A, nor standard equipment normally provided for purposes not confined to aircraft servicing.

Access panels

◀ **WARNING**

The closing panels (Post STI/CAN/583B) must only be removed for access to the engine mounting bracket attachment fasteners. Each bolt securing the panels must be identified during removal of the panels to ensure correct relocation on reassembly of panels. ▶

3. Removable access panels and inspection doors are provided throughout the structure, for access to the controls, services, etc., the positions are illustrated in fig.5 and 6. Certain panels are secured by screws having concave slots in their heads, and a specially ground screwdriver having a convex blade must be used to remove and insert these screws; these panels are indicated on the illustrations. When securing the panels, ensure that in all cases the correct type of screw is used, as in certain comparatively thin skin areas 120 deg countersunk-headed screws are used. To facilitate inspection of the attachment angles on the fuselage, access apertures and panels are provided between fuselage frames 17 and 18 at both sides: these panels are accessible in the main wheel bays.

Jacking *(fig.3)*

Jacking procedure

4. The aircraft may be jacked by positioning one jack under each main plane in line with the engine nacelles and one on the port side of the fuselage nose. At the main plane positions the jack adapter heads fit into sockets permanently fitted to the main spar, and at the fuselage nose position a removable spigot is screwed into a socket in the structure, below the aft end of the navigator's escape hatch, to which the adapter head of the jack fits. All jacking positions are marked on the aircraft, and illustrated in fig.5 and 6.

5. The jacking sequence is as follows:-

(1) Remove the plug from the socket in the front fuselage and fit the nose jacking spigot. Unfasten the hinged panels in the jet-pipe cowlings to expose the main plane jacking points.

(2) Place a jack under each main plane jacking point and at the nose jacking spigot; the types of jacks and adapter heads to be used at these points are listed in Table 2 at the end of this chapter.

Note . . .

The main plane jacks must be positioned with the jack body vertical and with the adjustable legs parallel to the lateral axis of the aircraft. The nose jack must be positioned with the jack body vertical and with the adjustable legs parallel to the longitudinal axis.

(3) Operate the jacks to raise the aircraft, jacking the main planes slightly in advance of the fuselage nose.

(4) When the aircraft is sufficiently raised, the rear fuselage may be supported, if necessary, at the rear trestling point with a U.J. trestle, No.7, fitted with a former.

Note . . .

After the aircraft has been lowered to the ground, it should be rocked to allow the shock absorbers to settle.

UK RESTRICTED

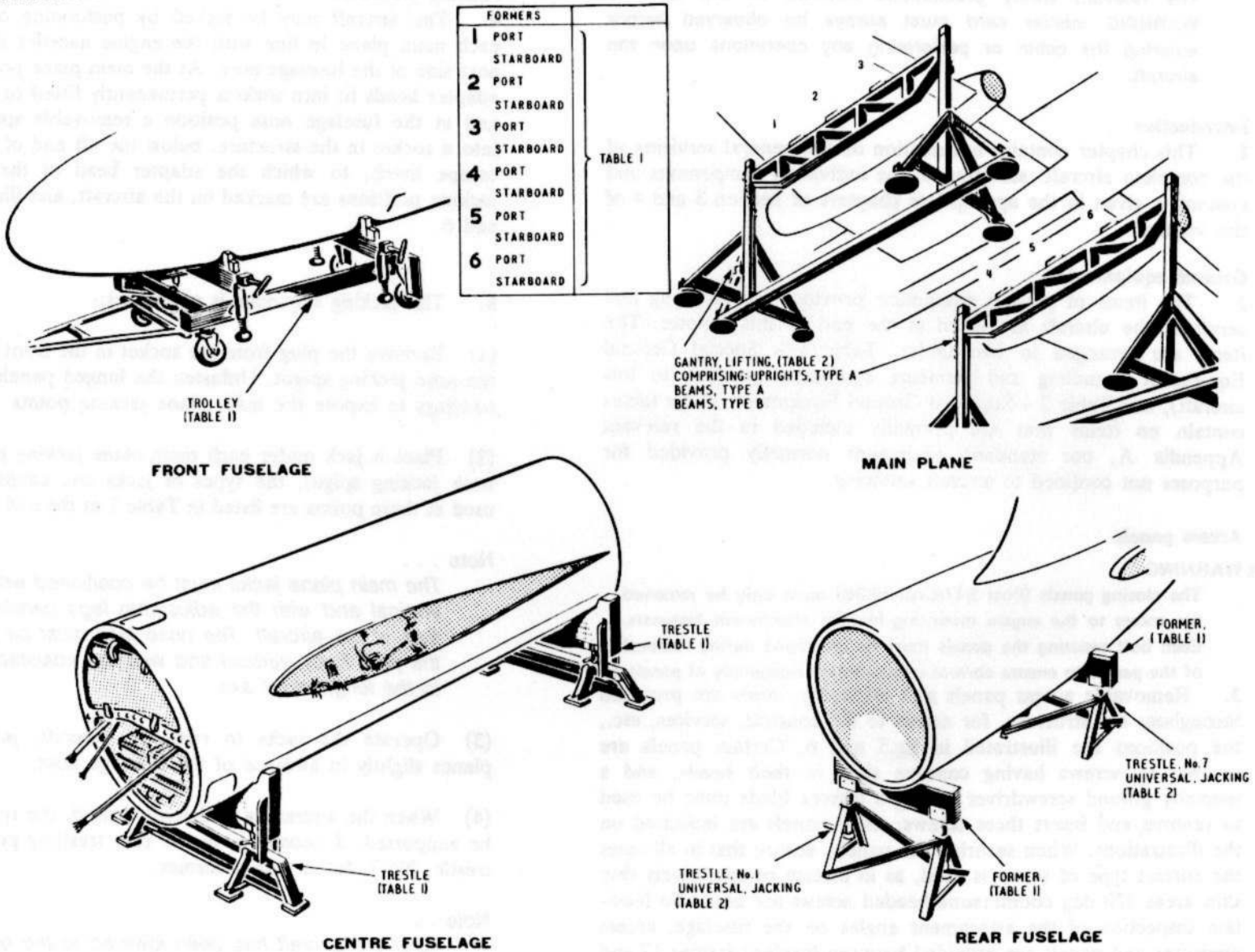


FIG.2. TRESTLING

For auxiliary fuel tank installation (post Mod.1490)

6. The method of jacking the aircraft for the installation of the tank in the bomb bay is as follows:-

(1) Ensure that the aircraft is positioned on level ground with a firm foundation.

(2) Position chocks fore-and-aft of the nose wheel.

(3) Position jacks and adapters (Mk.48) at the main wheel lifting points.

(4) Raise the aircraft to the minimum height required to allow the loaded trolley to be positioned under the bomb bay.

For main wheel changing

7. The method of jacking for main wheel changing is as follows:-

(1) Ensure that the aircraft is positioned on level ground with a firm foundation.

(2) Place chocks fore-and-aft of each wheel.

(3) Place the jack with its adapter head (Mk.27) and main wheel changing bracket in position.

(4) Raise the aircraft just clear of the ground.

For nose wheel changing

8. To jack the aircraft for nose wheel changing:-

(1) Ensure that the aircraft is positioned on level ground with a firm foundation.

(2) Using a spanner remove the plug from the socket in the nose fuselage, and insert and tighten the jacking spigot.

(3) Place chocks fore-and-aft of the main wheels, and release the brakes.

(4) Place the jack, trestle and adapter (Mk.49) under the nose spigot, and raise until the nose wheels are just clear of the ground.

(5) Support the fuselage at frame 42.

In the open

9. Fig.4 shows allowable wind velocity against wind angle through the full range of nose-to-wind to tail-to-wind at which the aircraft may be lifted on the main undercarriage pillar jacks for purposes of bomb bay loading, or unloading, or main wheel changing. In applying this graph there are certain precautions which must be observed:-

(1) Aircraft may be at any weight between basic and maximum take-off provided that fuselage fuel is evenly distributed.

(2) Fuelling or defuelling or changes to the wing loading must not be carried out whilst the aircraft is on pillar jacks.

(3) Bomb bay loading and unloading procedures are to conform with techniques laid down in relevant Air Publications.

(4) Ground slope allowance of 4 deg is permitted in the fore and aft direction only.

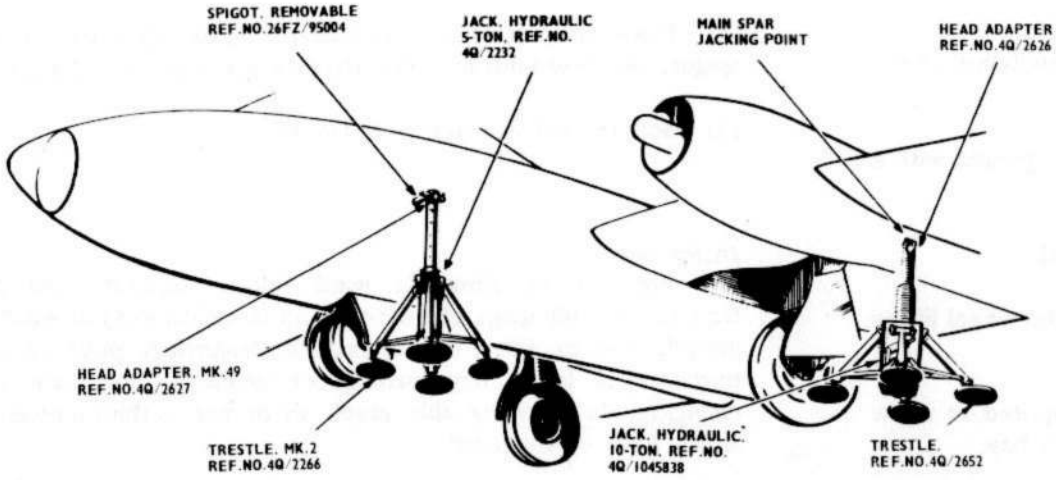
(5) Both main wheels are to be jacked simultaneously.

(6) Ground locks are to be fitted to all flying control surfaces.

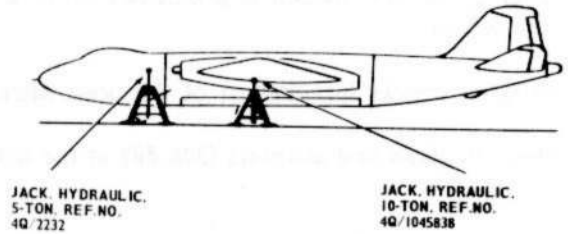
(7) The nose wheel picketing requirement must be applied when necessary *(Sect.2, Chap.1).*

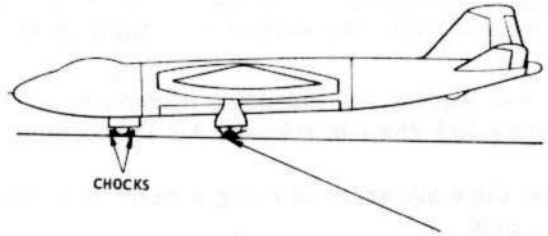
Trestling *(fig.2)*

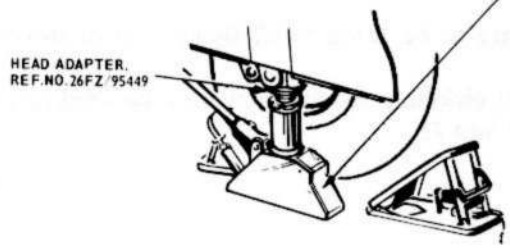
10. When trestling the aircraft, or components of the aircraft, the correct type of trestle with appropriate former as specified in Table 1 must be used.



NORMAL JACKING PROCEDURE

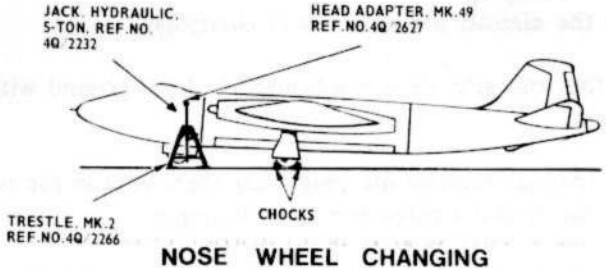






INSTALLATION OF AUXILIARY FUEL TANK
(POST MOD.1490)

MAIN WHEEL CHANGING



NOSE WHEEL CHANGING

FIG. 3. JACKING

Drainage holes

11. Drainage holes are provided in various parts of the aircraft skinning, the number of holes and their position is illustrated in fig.8. These holes must always be kept free from obstruction, especially those in the jet-pipe cowlings.

(1) A drain plug, in the shape of a large mushroom headed screw, situated in the fuselage lower skin just forward of the pressure bulkhead and starboard of the keel unit centre line, is provided for periodic draining of the pressure cabin *(fig.8)*. When unscrewed, the drain plug is retained suspended below the drain hole by a captive split-pin and no attempt should be made to remove the plug from the aircraft. After draining the cabin, care must be taken before screwing back the drain plug, to ensure that no foreign matter remains on or about the plug rubber seal as this will cause loss of cabin pressure. Two ⅛ in. drain holes are also provided for the canopy coaming tube; these are situated at the lowest points of the tube and are plugged with self-tapping screws rolled in Bostik sealing compound to prevent loss of cabin pressure.

Order of dismantling

12. The sequence of dismantling an aircraft is given below; detailed information on the removal of individual components is given in the appropriate chapters of Sections 3 and 4 of this volume.

(1) Remove the engines and jet pipes from the main planes *(Sect.4, Chap.1)*.

(2) Remove the tail plane from the rear fuselage *(Sect.3, Chap.3)*

(3) Remove the rudder and fin from the rear fuselage *(Sect.3, Chap.3)*.

(4) Remove the front fuselage from the centre fuselage *(Sect.3, Chap.1)*.

(5) Remove the rear fuselage from the centre fuselage *(Sect.3, Chap.1)*.

◄(6) Remove the main planes from the centre fuselage (*Sect.3,* ► *Chap.2)*.

The sequence of assembly is the reversal of that given for dismantling.

Rigging of fixed surfaces

13. The main plane, tail plane and fin are fixed cantilever structures which are rigged when correctly assembled to the fuselage; adjustment is, therefore, impossible. The symmetry of the aircraft and the incidence and dihedral of the planes should be checked, however, in the manner indicated in the following paragraphs, after the aircraft has been rigged or whenever it is necessary to verify that the components are true. The location points for the incidence and dihedral gauges are marked on the upper surfaces of the main and tail planes, on the centre line of the main spar booms; their positions outboard of the centre line of the fuselage are indicated in fig.1.

14. The procedure for checking the alignment and rigging of the aircraft is:-

(1) Jack the aircraft *(para.4 and 5)*.

(2) Place the lateral leveling gauge on the port and starboard leveling brackets at frame 31 *(fig.1)*; the port and starboard ends are indicated on the gauge. Using a clinometer on the gauge, level the aircraft laterally (0 deg ± 0 min).

(3) With the lateral gauge in position, place the longitudinal gauge on the leveling bracket on the starboard side of frame 29 bulkhead and on the datum pad on the lateral gauge *(fig.1)*. Using a clinometer on the gauge, level the aircraft longitudinally (0 deg ± 0 min).

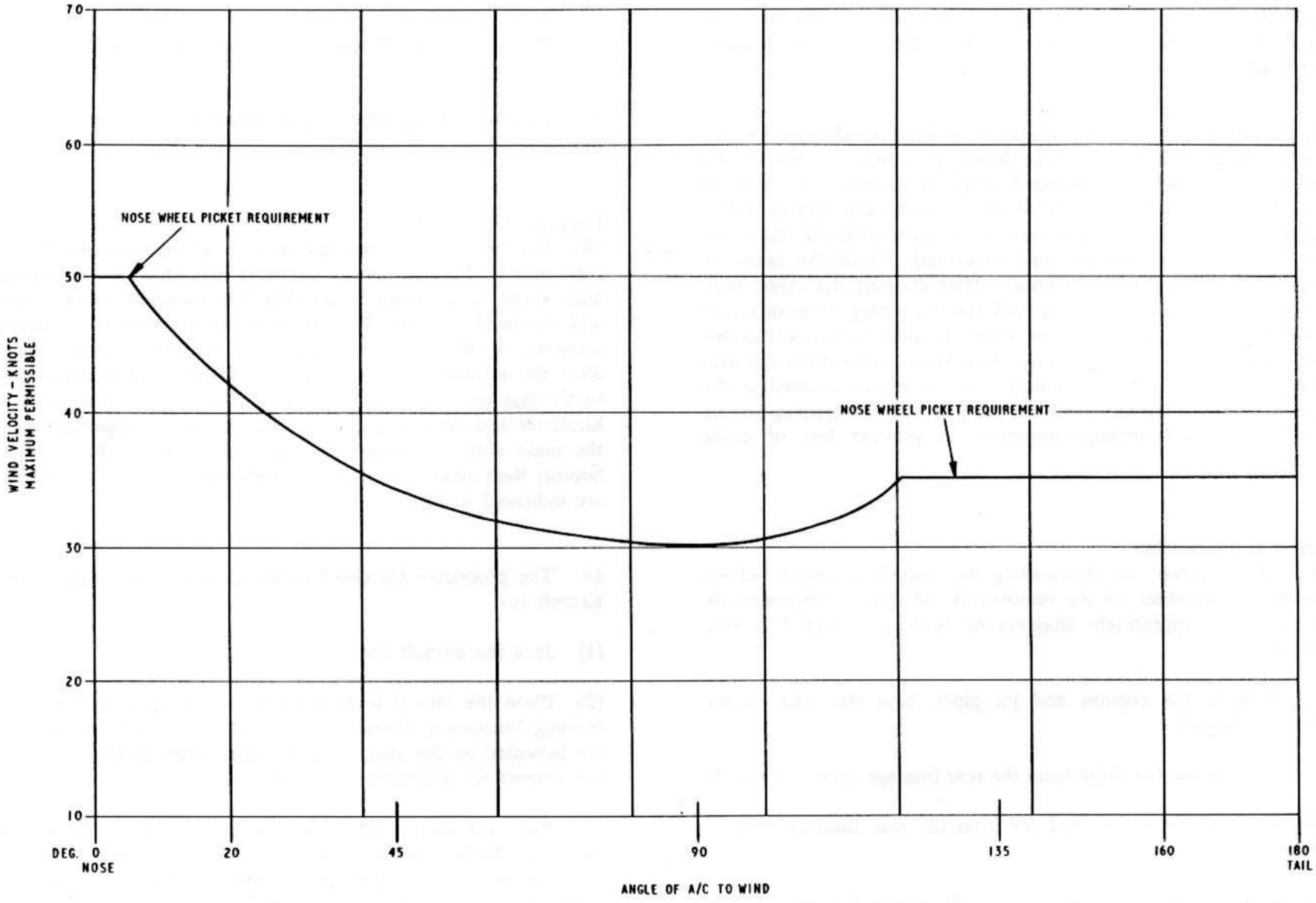


FIG. 4. MAXIMUM PERMISSIBLE WIND VELOCITY FOR JACKING IN THE OPEN

(4) Check for symmetry by measuring the diagonals at the following points on both sides of the aircraft:-

(a) From a point 2.46 in. aft of frame 1 on the upper surface of the fuselage to the datum bolt on the centre-line of the main plane spar at the wing tip *(dimension A, fig.1)*. The difference between the port and starboard diagonals must not exceed 1 in.

(b) From a point 1 in. aft of the rear fuselage transport joint to the outboard incidence gauge point on the tail plane, with the tail plane at minimum incidence *(dimension B, fig.1)*. The difference between the port and starboard diagonals must not exceed 0.5 in.

(c) From the datum bolt at the wing tip to the outboard incidence-gauge point on the tail plane, on both sides. The dimensions should be equal ±1.0 in. with the tail plane at minimum incidence.

(5) Check the main plane incidence and dihedral, using a clinometer, with the gauge positioned at each of the three points shown in fig.1. The dihedral reading should be 2 deg ±10 min at all points, and the incidence reading 5 deg 50 min ±15 min at the outboard position (rib 6) of the outer wing, 5 deg 8 min ±15 min at the inboard position (rib 3) of the outer wing and 4 deg 49 min ±15 min at the inner wing position (rib 3).

(6) Check the tail plane dihedral with the tail plane at maximum incidence, using a clinometer, with gauge positioned at the inboard position, the reading should be 7 deg 57 min ± 15 min.

(7) Check the tail plane incidence at minimum incidence, using a clinometer, with gauge positioned at the starboard inboard position, the reading should be 2 deg 12 min $\pm\frac{5}{4}$ min. Set the tail plane at maximum incidence and using a clinometer with the same gauge, check the incidence at the inboard position; this should be 3 deg 59 min $\pm\frac{5}{4}$ min. Check the incidence at the outboard position; the reading should be that obtained at the inboard position plus 1 deg 48 min $^{+1}_{-50}$ $^{\text{deg 2 min.}}_{\text{min.}}$

Component weights and dimensions

15. The component weights and dimensions are given in the key to fig.7.

TABLE 1

Special ground equipment

Ref. No.	Part No.	Description	Application
		Towing and steering equipment	
26FZ/95022	EA3.88.15	Adapter, fork	Used with towing arm Ref. No.4GB/4409924
26FZ/95087	EA3.88.157	Arm, hose steering	
		Jacking equipment	
26FZ/95004	EA1.88.23	Spigot, nose jacking	Used in conjunction with hydraulic jacks for nose raising and lowering
26FZ/95413	EA3.88.307	Bracket, main wheel jacking	Main wheel changing
26FZ/95449	EA9.88.39	Adapter, jacking	Used with jack Ref. No.4Q/1045837 for lifting aircraft when installing auxiliary fuel tank
		Slinging equipment	
26FZ/95006	EA1.88.61	Sling, centre fuselage	
26FZ/95005	EA1.88.63	Sling, fuselage nose	
26FZ/95007	EA1.88.65	Sling, fuselage tail	
26FZ/95008	◀ EA1-88-919 ▶	Sling, main plane	
26FZ/95009	EA1.88.59	Sling, tail plane	
26FZ/95084	EA1.88.601	Sling, fin and rudder	
26FZ/95273	EA1.88.785	Sling, complete aircraft	
26FZ/95013	EA3.88.79	Bridge piece, wing	Fitted when engine is removed
26FZ/95094	EA1.88.741	Sling, nose and centre fuselage	Used when lifting a damaged component
26FZ/95262	EA3.88.273	Strap, metal	
26FZ/95025	EA1.88.91A	Former, wing, forward (Rib 4 Port)	Used together with beams, gantry (4Q/4230656) and uprights, gantry (4Q/2309) for main plane changing
26FZ/95026	EA1.88.91B	Former, wing, centre (Rib 4 Port)	
26FZ/95027	EA1.88.91C	Former, wing, aft (Rib 4 Port)	
26FZ/95028	EA1.88.91D	Former, wing, forward (Rib 5 Port)	
26FZ/95029	EA1.88.91E	Former, wing, centre (Rib 5 Port)	
26FZ/95030	EA1.88.91F	Former, wing, aft (Rib 5 Port)	
26FZ/95031	EA1.88.92A	Former, wing, forward (Rib 4 Stbd.)	
26FZ/95032	EA1.88.92B	Former, wing, centre (Rib 4 Stbd.)	
26FZ/95033	EA1.88.92C	Former, wing, aft (Rib 4 Stbd.)	
26FZ/95034	EA1.88.92D	Former, wing, forward (Rib 5 Stbd.)	
26FZ/95035	EA1.88.92E	Former, wing, centre (Rib 5 Stbd.)	
26FZ/95036	EA1.88.92F	Former, wing, aft (Rib 5 Stbd.)	
—	EA1.40.169	Ring, main plane picketing/slinging	

continued . . .

TABLE 1 Special ground equipment — *continued*

Ref. No.	Part No.	Description	Application
		Trestling equipment	
26FZ/95017	EA1.88.87A	Former, rear fuselage, front	Used with U.J.T. No.1
26FZ/95018	EA1.88.87B	Former, rear fuselage, rear	Used with U.J.T. No.7
26FZ/95037	EA1.88.417	Trestle, adjustable, centre fuselage, front	
26FZ/95038	EA1.88.419	Trestle, adjustable, centre fuselage, rear	
–	EA1.88.683	Trestle assembly	EA1.88.417
–	EA1.88.689	Support block assembly	
–	EA1.88.683	Trestle assembly	EA1.88.419
–	EA1.88.691	Support block assembly	
		Rigging equipment	
26FZ/95010	EA1.88.93	Gauge, incidence and dihedral, main plane	
26FZ/95115	EA3.88.179	Gauge, incidence and dihedral, tail plane	
26FZ/95040	EA1.88.447	Gauge, leveling, fuselage	Lateral (cockpit) and longitudinal (centre fuselage)
26FZ/95093	EA1.88.747	Gauge, leveling, fuselage	Longitudinal (cockpit) and lateral (rear fuselage)
26FZ/95653		Gauges, clearance (1 set)	Aileron/shroud screen
		Miscellaneous equipment	
26FZ/95109	EA3.88.211	Cradle, wing-tip fuel tank	
26FZ/95099	EA1.88.817	Guard, safety, engine nacelle	Fitted for engine ground testing
26FZ/95091	EA1.88.797	Cowling, slave, port	
26FZ/95092	EA1.88.798	Cowling, slave, starboard	
26FZ695012	EA1.88.89	Retaining cable, bomb-bay door assembly	For assembling bomb-bay doors
26FZ/95090	EA1.88.799	Strut, jury, tail plane	
26FZ/95016	EA1.88.85	Trolley, fuselage nose	
26FZ/95089	EA1.88.743	Sleeve, locking	Main undercarriage
26FZ/95015	EA1.88.255	Pin, locking	Nose undercarriage
26FZ/95298	EA3.88.205	Cover, blanking	No.1 and 2 fuel tank vents
26FZ/95299	EA3.88.297	Block, removal	
26FZ/695412	GM/C/1776	Cover, waterproof	For Avro triple carrier

continued . . .

TABLE 1 Special ground equipment — *continued*

Ref. No.	Part No.	Description	Application
		Miscellaneous equipment - *continued*	
–	EA1.40.169	Ring, picketing/slinging	Main plane
26FZ/95416	AS.19322	Jig, alignment	
26FZ/95270	EA3.88.281	Plug, blanking	Cabin pressure control valve
26FZ/95619	EA3.88.5053	Set, testing (post Mod.4047) comprising:	
	EA3.88.5055	Case, carrying	
	EA3.88.5057	Test orifice (3)	
	EA3.88.5059	Blanking plug assembly pressure-reducing valve	For testing air-ventilated suit system
	EA3.88.5061	Blanking plug assembly, water extractor drain	
	EA3.88.5063	Blanking plug assembly, relief valve	
	EA3.88.5069	Test gauge adapter assembly	
	EA3.88.5077	Test gauge adapter assembly	
		Tools	
–	EB6.88.101	Tool, separating	To remove rudder blow back assembly
26FZ/95462	EB6.88.103	Extractor	
26FZ/95044	EA1.88.375	Extractor	Tab torque lever, aileron and rudder
26FZ/95104	EA1.88.825	Extractor	Aileron hinge pins
26FZ/95047	EA1.88.359	Extractor	Main plane pick-up pins
26FZ/95114	A.6313	Extractor	Main wheels
26FZ/95048	EA1.88.363	Inserter	Main plane pick-up pins
26FZ/95088	EA1.88.733	Inserter	Main undercarriage pivot pin
26FZ/95063	EA1.88.395	Key	Hydraulic filler cap
26FZ/95082	A/MBEU/70/EE	Rig, resetting	For elevator snatch unit
26FZ/95493	EA1.88.877	Spanner, release	For nose wheel doors
26FZ/95059	EA1.88.385	Spanner	For undercarriage pivot bolt
26FZ/95060	EA1.88.387	Spanner	For undercarriage pivot nut
26FZ/95072	EA1.88.551	Disc setting	
26FZ/95293	EA1.88.831	Indicator	
26FZ/95074	EA1.88.549	Plate, setting, throttle box	For rigging engine control
26FZ/95294	EA1.88.547	Plate, setting, port bell-crank lever	
26FZ/95295	EA1.88.548	Plate, setting, starboard bell-crank lever	

continued . . .

TABLE 1 Special ground equipment — *continued*

Ref. No.	Part No.	Description	Application
		Tools — *continued*	
26FZ/95046	EA1.88.379	Spanner, universal	Aileron centre hinge pin
26FZ/95065	EA1.88.365	Spanner	Front fuselage jacking spigot
26FZ/95264	AS.130	Spanner	Wing tip tank filler cap ▶◀
26FZ/95269	EA3.88.293	Spanner	Wing tip drain valve ▶◀
26FZ/95079	EA1.88.531	Spanner	Wing tip tank explosive bolts
26FZ/95265	EA3.88.247	Template, rigging rudder	
26FZ/95267	EA3.88.223	Template, rigging elevator	
26FZ/95266	EA3.88.257	Template, rigging aileron	
26FZ/95100	EA1.88.823	Gauge	
26FZ/95101	EA1.88.821	Tool setting	For aileron fixed tab
26FZ/95103	Messier T.1342/75	Block, split	Used on dive brakes
26FZ/95095	EA1.88.749	Spanner	For bomb crutch
26FZ/95414	EA3.04.6638	Mirror, inspection	For discharger crate
26FZ/95054	EA1.88.345	Spanner	For torque links
26FZ/95441	TS/48/21	Tool, countersinking ¾" (120°)	Nose cowlings
26FZ/95490	EA1.88.889	Bolts, slave, canopy	
26FZ/95491	EA1.88.891	Pins, locating, canopy	
26FZ/95532	EA1.88.893	Gauge, inspection	Assembly of canopy to fuselage
26FZ/95086	EA3.88.135	Spanner	Main axle clamp ▶◀

TABLE 2

Standard ground equipment

Ref. No.	Description	Application
	Towing equipment	
4GB/4409924	Arm, towing	
4GB/4409987	Bridle, towing 50 ft	
◀ 28Y/1057116	Shackle, ¾ in.	
28Y/9508299	Shackle pin ▶	
	Jacking equipment	
4Q/4230825	Adapter head, Mk.48	Aircraft jacking at main plane
4Q/1045838	Body, jacking, hydraulic, 10 ton	
4Q/4230849	Trestle, Mk.1	
4Q/4230856	Trolley, transporter	
4Q/4230826	Adapter head, Mk.49	Aircraft jacking at nose wheel
4Q/4230641	Body, jacking, hydraulic, 5 ton	
4Q/4230643	Trestle, Mk.2	
4Q/4230642	Trestle, Mk.1	Auxiliary fuel tank installation
4Q/4230661	Adapter head, Mk.27	Jacking for main wheel changing used with bracket ◀ EA3.88.307 ▶
4Q/1045837	Jack, pillar, hydraulic 15 ton	
4Q/4230862	Trolley, transporter	
	Trestling equipment	
4GB/-	Trestle, U.J. No.1 c/w Type A brackets	Rear fuselage support
4GB/-	Trestle, U.J. No.7 c/w Type A brackets	
4Q/1245	Gantry, lifting, comprising:-	For main plane changing
4Q/2309	Upright, Type A	
4Q/4230656	Beam, Type A	
4Q/4230657	Beam, Type B	
	Engine changing equipment	
4GC/4783 or	Sling, engine, Avon, universal, Mk.1	
4GC/4232188	Sling, engine, Avon, universal, Mk.2	
40B/1030 or	Stand, Avon, universal	
40B/1166 or	Stand, Avon, universal	
40B/1214 or	Stand, Avon, universal	
40B/1220	Stand, Avon, universal	
4G/4858	Trolley, E.C.U. servicing, Mk.2	
4GC/4232190	Sling, lifting, Transit/Servicing stand c/w E.C.U.	

continued . . .

TABLE 2 Standard ground equipment – *continued*

Ref. No.	Description	Application
	Miscellaneous equipment	
4G/1050581	Adapter, inflation, Mk.2	Use with pressure gauge (Ref. No.4G/4420034)
4G/4420003	Pump, oleo, undercarriage, Type A	For undercarriage shock-absorber strut charging
4G/4131	Adapter, inflation	
4G/4420233	Mat, main plane, Type C	
4GA/4409477	Trolley, bomb, Type F	
4FE/4226019	Trolley, electrical servicing, Mk.4	
4G/4221 or	Trolley, high pressure, air charging, Mk.2A	
4GD/5888 or /6731	Trolley, high pressure, air charging, Mk.2B or Mk.2C	
4F/1715 or	Trolley, instrument and autopilot testing, Mk.1A	
4F/1856	Trolley, instrument and autopilot testing, Mk.1B	
4F/1805	Trolley, low pressure, pneumatic, Mk.1B	
4GD/4220	Trolley, oxygen charging, Mk.2	
4F/1041044	Trolley, pressure cabin testing, Mk.1C	Used with adapter, air supply (Ref. No.4F/1807)
4F/4229181	Trolley, radar hoist, servicing, Type B	
4F/1796		
4F/2345	Trolley, servicing, hydraulic, Mk.2A/2B or 2B/2C	
4F/2375		
	Tools	
1A/1943999	Balance, spring, 0-10 lb	Static friction, flying controls
1B/9575401	Gun, lubricating, universal	Nose wheel strut shock absorber charging
27Q/14103	Adapter, flexible, charging	
1C/1278258	Wrench, torque, 400-2000 lb in. ½ in. s.d.	
1L/9106397	Spanner, socket, ¾ in. B.S.F. × ½ in. sq. drive	Main plane attachment bolts
1L/9106401	Spanner, socket, bi-hex, 1 in. B.S.F. × ¾ in. sq. drive	
1L/9106310	Adapter, ½ in. socket × ¾ in. plug	
1C/9105853	Screwdriver	Generator cooling duct
1C/9106265	Spanner, S.E. 1⅛ in. W	Main fuel feed
1L/32	Spanner, bi-hex, ring ¼ in. × $\frac{5}{16}$ in. W	Removal of radar head (A.R.I.5800) and generator
1C/9106572	Trammels, steel, 42 in.	Checking tail plane actuator movement
1B/4629	Level, spirit, 0-10 deg	Checking tail plane incidence

continued . . .

TABLE 2 Standard ground equipment — *continued*

Ref. No.	Description	Application
	Tools — *continued*	
27H/3222	Strap, lashing	
27BA/8782	Spanner, hook, 1 in. dia.	Used on air brakes
27Y/3564	Spanner, hook (RS.181/10)	
27Y/4933	Spanner, hook (RS.181/23)	
1C/1210252	Wrench, torque, 5-50 lb ft × ½ in. sq. drive	For explosive bolts, pilot's canopy
1L/9106303	Adapter, socket, ½ in. sq. socket × ⅜ in. sq. plug	
1L/9106389	Spanner, socket ⅜ in. W × ⅜ in. sq. drive	
5A/9105033	Torque, electric, hand, probe, illuminator	
1C/9106211	Spanner, tubular, box, $\frac{5}{16}$ in. × ¼ in. × 7½ in. long	Wing tip explosive-bolt detonators
27G/5035	Fixture, alignment (Dunlop Pt. No.A10009)	Wheel brakes
27G/4994	Gauge, friction pad wear	For checking wheel brakes
27G/5000	Gauge, tenon wear	
◀ 27Q 5120-99-4674381	Dowty resetting tool Pt. No. ST 1657. Locally manufactured resetting tool AP113D-1130-1, Chap.1, Fig.3.	For resetting U/C EMERGENCY UP selection ▶
	Weighing equipment	
4GB/4399004	Hydrostatic unit, 25-ton	Main wheel position
4GB/4398891	Adapter (unit to aircraft pad)	
4GB/4398897	Adapter (jack to unit)	For use with Ref. No.4GB/4399004
4Q/1045837	Jack, 15-ton	
4GB/4399003	Hydrostatic unit, 10-ton	Nose wheel position
4GB/4398902	Adapter (unit to nose u/c)	
4GB/4398907	Adapter (jack to unit)	For use with Ref. No.4GB/4399003
4Q/1054121	Jack, 8-ton	

KEY TO FIG.5 (ACCESS PANELS, LOWER SURFACE AND STARBOARD SIDE)

All panels in the main planes are on both port and starboard sides, unless otherwise stated.

1 WING TIP FUEL TANKS ELECTRICAL CONTACTS

2 WING TIP TANKS FUEL AND AIR CONNECTION POINTS

3 WING TIP TANKS EXPLOSIVE ATTACHMENT BOLTS

4 PICKETING POINT

5 AILERON CONTROL ROD COUPLING

6 WING TIP TANKS FUEL AND AIR PIPES, ELECTRICAL AND INSTRUMENT EQUIPMENT

7 WING TIP TANKS FUEL AND AIR PIPES HYDRAULIC PIPES

8 H.E. IGNITION UNIT

9 FIRE PANEL

10 SERVICE PANEL – ENGINE HIGH-PRESSURE FUEL COCK COUPLING, THROTTLE VALVE COUPLING, OIL SUMP FILLER CAP, OIL SUMP DRAIN, OIL FILTERS, LOW PRESSURE FUEL FILTER AND DRAIN, OIL COOLER PIPES TO SUMP, OIL PRESSURE TRANSMITTER, OIL COOLER

11. HYDRAULIC ENGINE DRIVEN PUMP

12 MAIN UNDERCARRIAGE FIXED FAIRING – HYDRAULIC CHARGING TEST VALVE, HYDRAULIC ACCUMULATOR INFLATION POINT AND GAUGE (STARBOARD SIDE ONLY)

13 WHEEL JACKING POINT

14 MAIN UNDERCARRIAGE DOOR LATCHING MECHANISM EXTERNALLY OPERATED EMERGENCY RELEASE

15 HYDRAULIC RESERVOIR FILLER CAP

16 STARBOARD EQUIPMENT COMPARTMENT:– MAIN ELECTRICAL PANEL, GROUND/FLIGHT SWITCH, EXTERNAL ELECTRICAL SUPPLY SOCKET, AIRCRAFT DESTRUCTOR STOWAGE

17 MAIN ENTRANCE DOOR:– EQUIPMENT IN PRESSURE CABIN, BALLAST WEIGHTS AND AIR DRIERS

18 NOSE WHEEL WELL:– CABIN PRESSURE TEST CONNECTION, GROUND CABIN PRESSURE CONNECTION, OIL COLLECTOR BOX, THERMAL RELIEF VALVES, UNDERCARRIAGE SEQUENCE VALVE

19 NOSE UNDERCARRIAGE DOORS LATCHING MECHANISM EXTERNALLY OPERATED EMERGENCY RELEASE

20 DOWNWARD IDENTIFICATION LAMPS

21 ACCESSORIES GEARBOX DRAIN

22 CONSTANT FLOW VALVE (PORT SIDE ONLY)

23 AIR MILEAGE UNIT (PORT SIDE ONLY)

24 ENGINE LOWER REAR COWLING

25 UNDERCARRIAGE COWLING FLAP

26 UNDERCARRIAGE COWLING FLAP ACTUATING LINK

27 AIR BRAKE JACK AND OPERATING MECHANISM

28 LANDING LAMP (PORT SIDE ONLY)

29 AILERON CONTROL ROD COUPLING

30 AILERON CONTROLS, FUEL, AIR AND HYDRAULIC PIPES

31 MAIN UNDERCARRIAGE PIVOT PIN

32 PICKETING POINT

33 AILERON CONTROL RODS, FUEL AND HYDRAULIC PIPES

34 MAIN UNDERCARRIAGE DOOR – DOOR JACK AND SEQUENCE VALVE, INTERCOMM. EXTERNAL CONNECTION (STARBOARD SIDE ONLY)

35 BOMB BAY DOORS – HYDRAULIC SELECTOR VALVES, FUEL DRAINS, FUEL PUMPS, FUEL COCKS AND ACTUATORS, AIR BRAKE, AND FLAPS GROUND SELECTOR, BRAKES ACCUMULATOR INFLATION POINT, BOMB BAY DOORS JACKS AND AUXILIARY FUEL TANK.

36 MAIN PLANE REAR WALL ATTACHMENT

37 REAR FUSELAGE HATCH, REAR DATUM BLOCKS, FLYING CONTROL ROD COUPLINGS, PICKETING RING-BOLTS STOWAGE, STARTER CARTRIDGE STOWAGE AND SURVIVAL PACKS STOWAGE

Note . . .
Should difficulty be experienced when closing and securing hatch, it is recommended that the hatch be secured by first engaging the fasteners nearest to the hinge line and then working across the fuselage to the hatch outer edge.

continued . . .

KEY TO FIG.5 (ACCESS PANELS, LOWER SURFACE AND STARBOARD SIDE) – *continued*

38 AFT PICKETING POINT

39 NAVIGATION LAMP

40 REAR CONE ATTACHMENTS, TAIL PLANE ACTUATOR, MICRO-SWITCHES AND DESYNN TRANSMITTER

41 RUDDER OPERATING LEVER

42 RUDDER TAB CONTROL ROD

43 ELEVATOR HINGE PINS INSPECTION

44 RUDDER SLINGING POINT

45 FIN SLINGING POINT

46 JET PIPE REAR CONE, JET PIPE ADJUSTMENT POINTS, THERMOCOUPLES

47 MAIN SPAR ATTACHMENT

48 MAIN JACKING POINT

49 AILERON INBOARD SHROUD SCREEN

50 AILERON OUTBOARD SHROUD SCREEN

51 AILERON OUTBOARD HINGE PIN

52 GM4B COMPASS DETECTOR (STARBOARD SIDE ONLY), ELECTRICAL CONNECTIONS

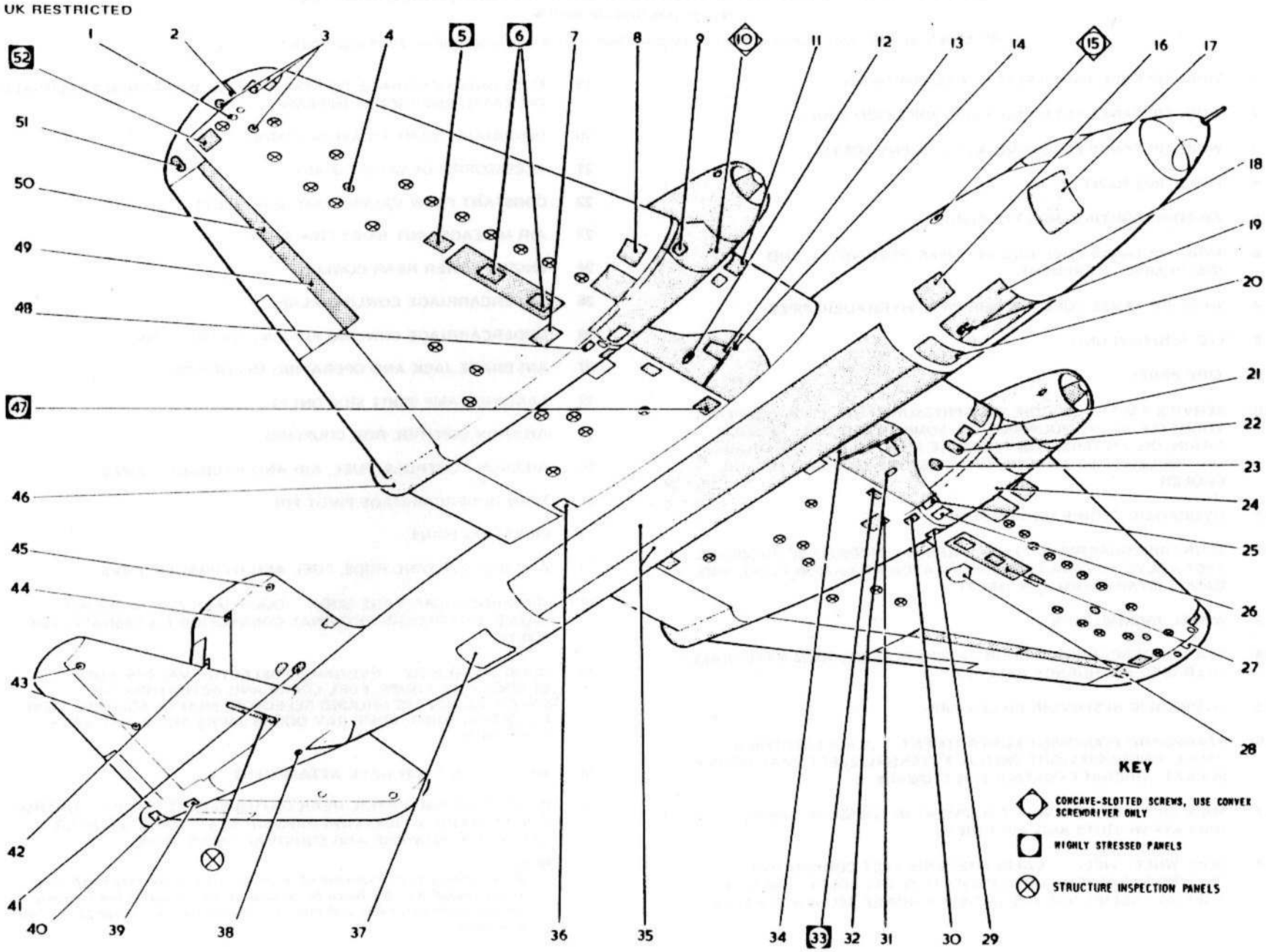


FIG.5. ACCESS PANELS, LOWER SURFACE AND STARBOARD SIDE

KEY TO FIG.5 (ACCESS PANELS, LOWER SURFACE AND STARBOARD SIDE)

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26 UNDERCARRIAGE COWLING FLAP ACTUATING LINK

27 AIR BRAKE JACK AND OPERATING MECHANISM

28 LANDING LAMP (PORT SIDE ONLY)

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30 AILERON CONTROLS, FUEL, AIR AND HYDRAULIC PIPES

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35 BOMB BAY DOORS – HYDRAULIC SELECTOR VALVES, FUEL DRAINS, FUEL PUMPS, FUEL COCKS AND ACTUATORS, AIR BRAKE, AND FLAPS GROUND SELECTOR, BRAKES ACCUMULATOR INFLATION POINT, BOMB BAY DOORS JACKS AND AUXILIARY FUEL TANK.

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37 REAR FUSELAGE HATCH, REAR DATUM BLOCKS, FLYING CONTROL ROD COUPLINGS, PICKETING RING-BOLTS STOWAGE, STARTER CARTRIDGE STOWAGE AND SURVIVAL PACKS STOWAGE

Note . . .

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continued . . .

KEY TO FIG.5 (ACCESS PANELS, LOWER SURFACE AND STARBOARD SIDE) — *continued*

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38 AFT PICKETING POINT

39 NAVIGATION LAMP

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51 AILERON OUTBOARD HINGE PIN

52 GM4B COMPASS DETECTOR (STARBOARD SIDE ONLY), ELECTRICAL CONNECTIONS

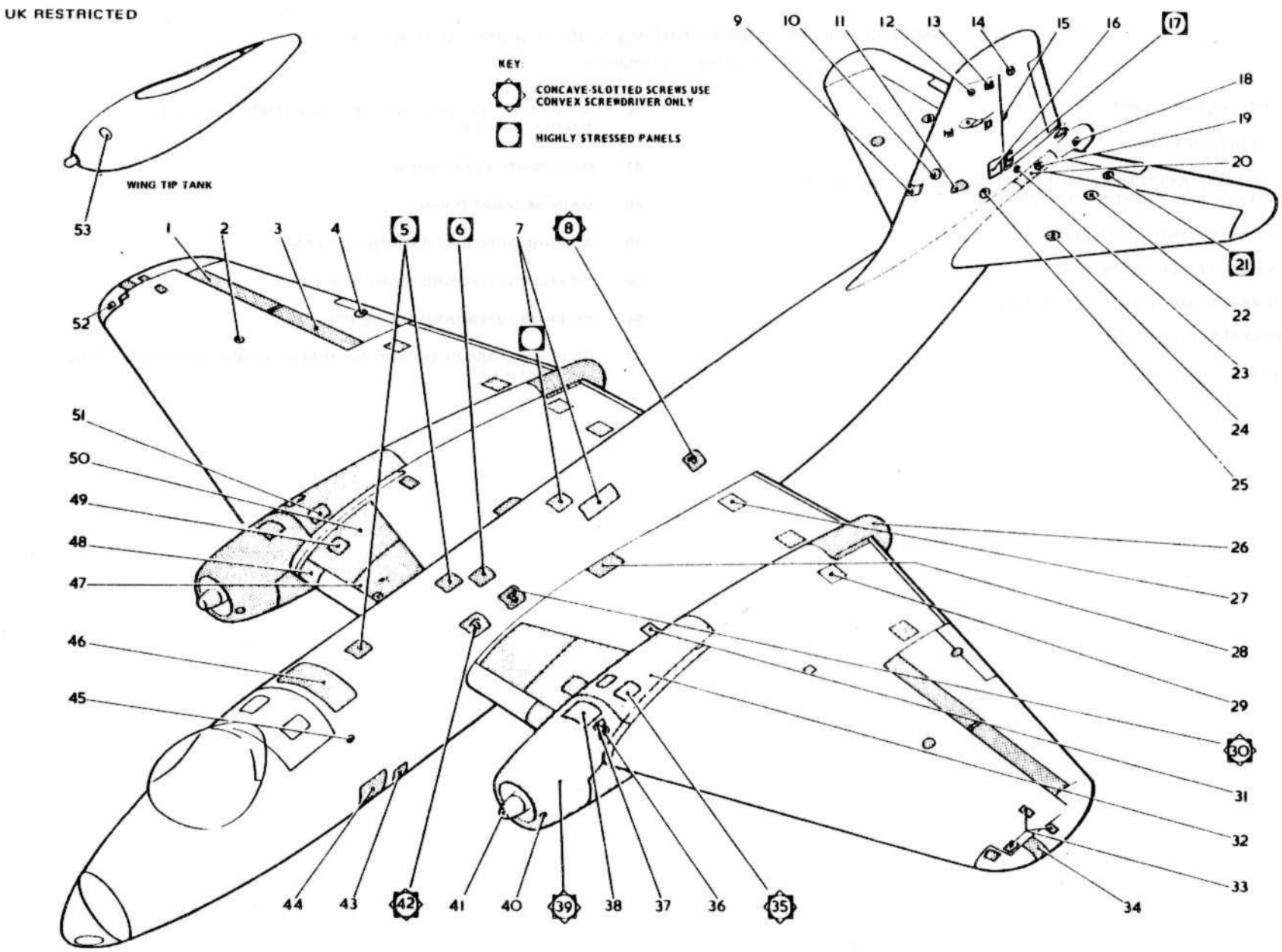

FIG.6 ACCESS PANELS, UPPER SURFACE AND PORT SIDE

KEY TO FIG.6 (ACCESS PANELS, UPPER SURFACE AND PORT SIDE)

All panels in the main planes are on both port and starboard sides, unless otherwise stated.

1 AILERON OUTBOARD SHROUD SCREEN

2 MAIN PLANE SLINGING POINT

3 AILERON INBOARD SHROUD SCREEN

4 AILERON TAB OPERATING LEVER

5 NO.1 FUEL TANK VENTING PIPE CONNECTIONS

6 NO.2 FUEL TANK VENTING PIPE CONNECTIONS

7 NO.3 FUEL TANK VENT PIPE CONNECTIONS

8 NO.3 FUEL TANK FILLER CAP

9 FIN FORWARD ATTACHMENT POINT

10 AERIAL SWITCH

11 FIN SPAR ATTACHMENT

12 FIN SLINGING POINT

13 AERIAL PLUG

14 RUDDER SLINGING POINT

15 RUDDER TAB OPERATING LEVER

16 RUDDER CONTROL ROD AND LOWER MASS BALANCE WEIGHTS (PORT SIDE), RUDDER TAB ACTUATOR LEVER AND ACTUATOR ELECTRICAL CONNECTIONS (STARBOARD SIDE)

17 RUDDER CONTROL ROD ATTACHMENT (PORT SIDE), RUDDER TAB ACTUATOR LEVER AND ACTUATOR (STARBOARD SIDE)

18 REAR CONE ATTACHMENTS

19 REAR FAIRING ATTACHMENTS

20 TAIL PLANE ACTUATOR UPPER ATTACHMENT

21 ELEVATOR TAB CONTROL LEVER

22 TAIL PLANE SLINGING POINT

23 RUDDER LOWER HINGE

24 TAIL PLANE SLINGING POINT

25 REAR FUSELAGE SUPPORT STRUT

26 JET PIPE REAR CONE, JET PIPE ADJUSTMENT POINTS, THERMOCOUPLES

27 MAIN PLANE REAR ATTACHMENT POINT, FLAP ADJUSTMENT POINTS, HYDRAULIC PIPES, WING TIP TANK FUEL TRANSFER PIPE, ELECTRICAL CONNECTIONS

28 MAIN SPAR ATTACHMENT, HYDRAULIC PIPES, AILERON CONTROL ROD CONNECTIONS, FUEL SYSTEM COMPRESSED AIR PIPES, ELECTRICAL CONNECTIONS

29 FLAP ADJUSTMENT POINTS

30 NO.2 FUEL TANK FILLER CAP

31 UNDERCARRIAGE UP-LOCK

32 ENGINE UPPER REAR COWLING

33 WING TIP TANK EXPLOSIVE BOLTS

34 WING TIP TANK FUEL AND AIR CONNECTIONS

35 TORCH IGNITER CONNECTIONS

36 P.V. RAM

37 AIR BLEED VALVES

38 ENGINE WHEELCASE BREATHER

39 ENGINE FRONT COWLING

40 TURBO STARTER EXHAUST

41 TURBO STARTER HOUSING

42 NO.1 FUEL TANK FILLER CAP

continued . . .

KEY TO FIG.6 (ACCESS PANELS, UPPER SURFACE AND PORT SIDE) — *continued*

43 BATTERY BAY:— BATTERIES, OXYGEN CHARGING VALVE, NOSE UNDERCARRIAGE UP/FLIGHT SELECTOR, WHEEL BRAKES HYDRAULIC ACCUMULATOR, HYDRAULIC HAND PUMP FILTER

44 PORT EQUIPMENT COMPARTMENT, FLYING CONTROL LEVERS, WATER EXTRACTOR (POST MOD.5 OR 2523)

45 FORWARD JACKING POINT

46 UPPER EQUIPMENT COMPARTMENT OXYGEN BOTTLES, HYDRAULIC RESERVOIR, MISCELLANEOUS ELECTRICAL EQUIPMENT, COMBINED VALVE UNIT

47 GENERATOR SUPPRESSOR, HYDRAULIC, FUEL AND AIR PIPES, CABIN AIR COOLER (PORT SIDE ONLY), HYDRAULIC ACCUMULATOR AND NON-RETURN VALVE (STARBOARD SIDE ONLY) EXTERNAL AIR THERMOMETER BULB (PORT ONLY) MAIN PLANE FORWARD ATTACHMENT POINT, FIRE PROTECTION PIPE.

Note . . .
When fitting access panel, the eight 2BA screws securing panel to fuselage boundary angle must be fully tightened and then slackened off one quarter of a turn.

48 HYDRAULIC PUMP

49 ACCESSORIES GEARBOX OIL DIPSTICK AND FILLER CAP

50 ACCESSORIES GEARBOX, ELECTRICAL GENERATOR, AIR MIXING VALVE AND CONSTANT FLOW VALVE (PORT SIDE ONLY)

51 TORCH IGNITER CONNECTIONS

52 NAVIGATION AND TAXYING LAMPS

53 WING TIP TANK INWARD VENT VALVE AND FILLER

FIG.7. COMPONENT WEIGHTS AND DIMENSIONS

(illustration overleaf)

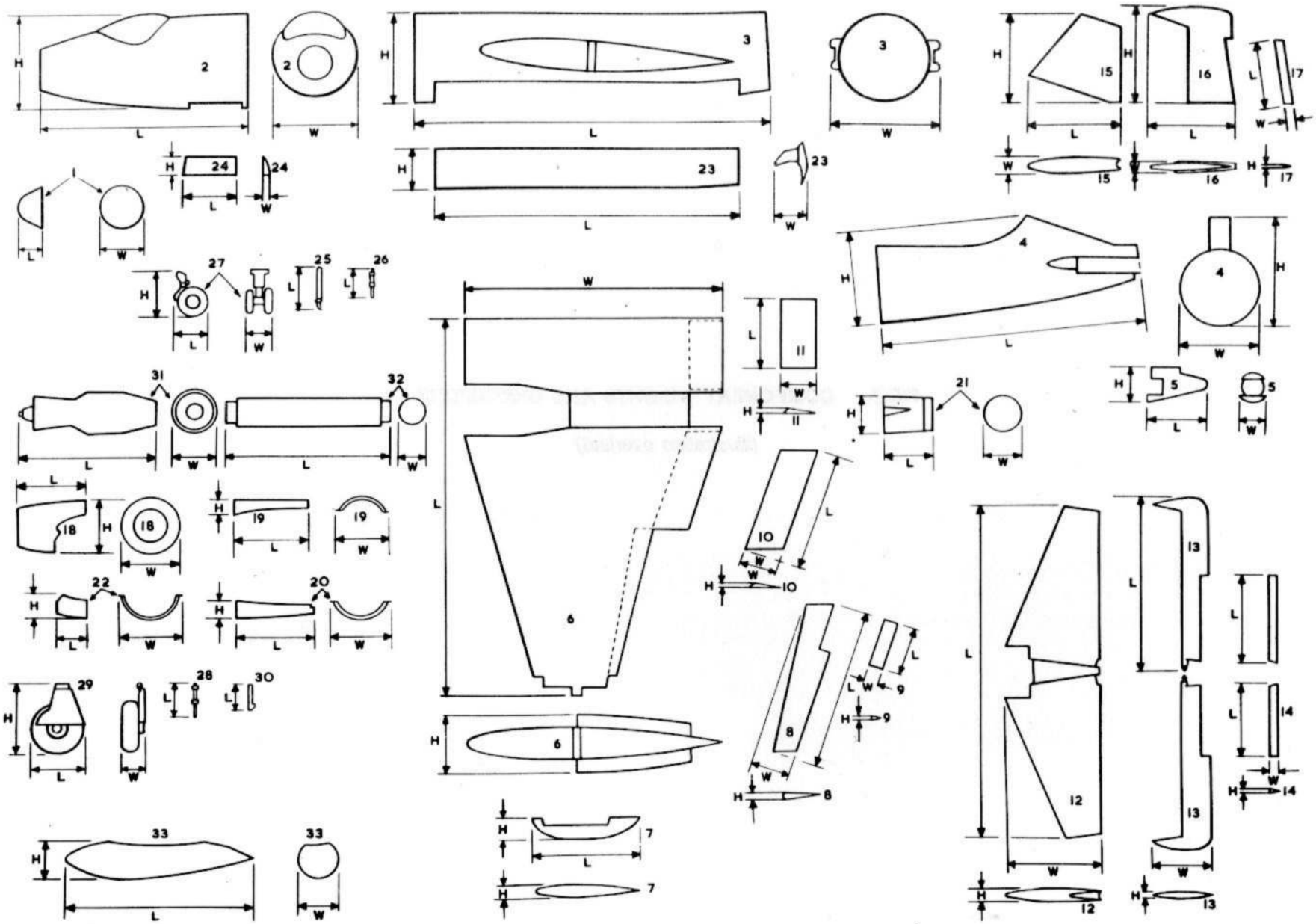

FIG.7. COMPONENT WEIGHTS AND DIMENSIONS

KEY TO FIG.7 (COMPONENT WEIGHTS AND DIMENSIONS)

Item No.	Component	Length (L)	Width (W)	Height (H)	Tare weight (lb)	Equipped weight (lb)
1	NOSE FAIRING	1 ft 5 in.	2 ft 7 in.	2 ft 7 in.	56	—
2	FRONT FUSELAGE	15 ft 0 in.	6 ft 6 in.	6 ft 6 in.	1000	2750
3	CENTRE FUSELAGE	25 ft 11 in.	7 ft 7 in.	6 ft 6 in.	2000	3500
4	REAR FUSELAGE	19 ft 1 in.	5 ft 10 in.	7 ft 11 in.	550	650
5	REAR CONE	4 ft 9 in.	2 ft 5 in.	2 ft 10 in.	25	—
6	MAIN PLANE	29 ft 1 in.	19 ft 0 in.	4 ft 3 in.	2200	2620
7	WING TIPS	1 ft 8 in.	7 ft 8 in.	10 in.	16	—
8	AILERON	12 ft 6 in.	1 ft 3 in.	9 in.	93	—
9	AILERON TAB	4 ft 2 in.	8 in.	2 in.	4	—
10	FLAP, OUTBOARD	8 ft 11 in.	2 ft 9 in.	3 in.	31	—
11	FLAP, INBOARD	5 ft 7 in.	2 ft 6 in.	3 in.	22	—
12	TAIL PLANE	26 ft 0 in.	7 ft 9 in.	1 ft 6 in.	495	—
13	ELEVATOR	13 ft 11 in.	4 ft 5 in.	5 in.	85 (with balance weights)	110
14	ELEVATOR TAB	5 ft 7 in.	8 in.	2 in.	7	—
15	FIN	6 ft 4 in.	1 ft 6 in.	6 ft 9 in.	94	—
16	RUDDER	7 ft 1 in.	1 ft 3 in.	7 ft 0 in.	132	—
17	RUDDER TAB	5 ft 5 in.	9 in.	2 in.	7	—
18	ENGINE FRONT COWLING	4 ft 9½ in.	3 ft 10 in.	3 ft 10 in.	55	—
19	ENGINE TOP REAR COWL	5 ft 5 in.	2 ft 5 in.	1 ft 3 in.	30	—
20	ENGINE BOTTOM REAR COWL	5 ft 5 in.	2 ft 0 in.	1 ft 3 in.	33	—
21	JET-PIPE COWL	3 ft 8 in.	2 ft 8 in.	2 ft 7 in.	21	—
22	SERVICE PANEL	2 ft 2 in.	2 ft 0 in.	1 ft 9 in.	15	—
23	BOMB DOORS	22 ft 1 in.	3 ft 0 in.	1 ft 8 in.	240	—
24	NOSE U/C DOORS	4 ft 2 in.	1 ft 5 in.	3 in.	10	—
25	NOSE U/C RADIUS ROD	3 ft 11 in.	4 in.	8 in.	20	—
26	NOSE U/C JACK	2 ft 2 in.	5 in.	6 in.	10	—
27	NOSE U/C WHEEL AND LEG	2 ft 2 in.	1 ft 7 in.	3 ft 7 in.	230	—
28	MAIN U/C JACK	1 ft 11 in.	4 in.	7 in.	15	—
29	MAIN U/C WHEEL AND LEG	6 ft 3 in.	3 ft 11 in.	2 ft 1 in.	600	—
30	MAIN U/C SIDE STAY	2 ft 9 in.	8 in.	8 in.	36	—
31	ENGINES	11 ft 0 in.	3 ft 6 in. (diameter)	—	2280	—
32	JET-PIPE	12 ft 3 in.	2 ft 2 in. (diameter)	—	180	
33	WING-TIP TANK	14 ft 7 in.	1 ft 11 in.	1 ft 10 in.	120	—

TABLE 1

FRONT FUSELAGE	NO. OF DRAIN HOLES
PRESSURE CABIN. AFT OF FR.7	1
COAMING TUBE	1 PORT 1 ST'BD. (SELF TAPPING SCREWS)

TABLE 2

CENTRE FUSELAGE	NO. OF DRAIN HOLES	
TANK BAYS 1,2,3	1 PORT	1 STBD.
BOMB DOORS	8	

TABLE 3

REAR FUSELAGE	NO. OF DRAIN HOLES	
LOWER SKIN AFT OF FR.33	1 PORT	1 STBD.
AFT OF FR.46 IN FAIRING	2	
ANTI-COLLISION LIGHT FR.33	1 PORT	1 STBD.
ACCESS IN REAR FUSELAGE FAIRING	2	
BUMPER	2 FWD.	2 AFT
AFT OF FR.42	2	
PICKETING PLUG	1	

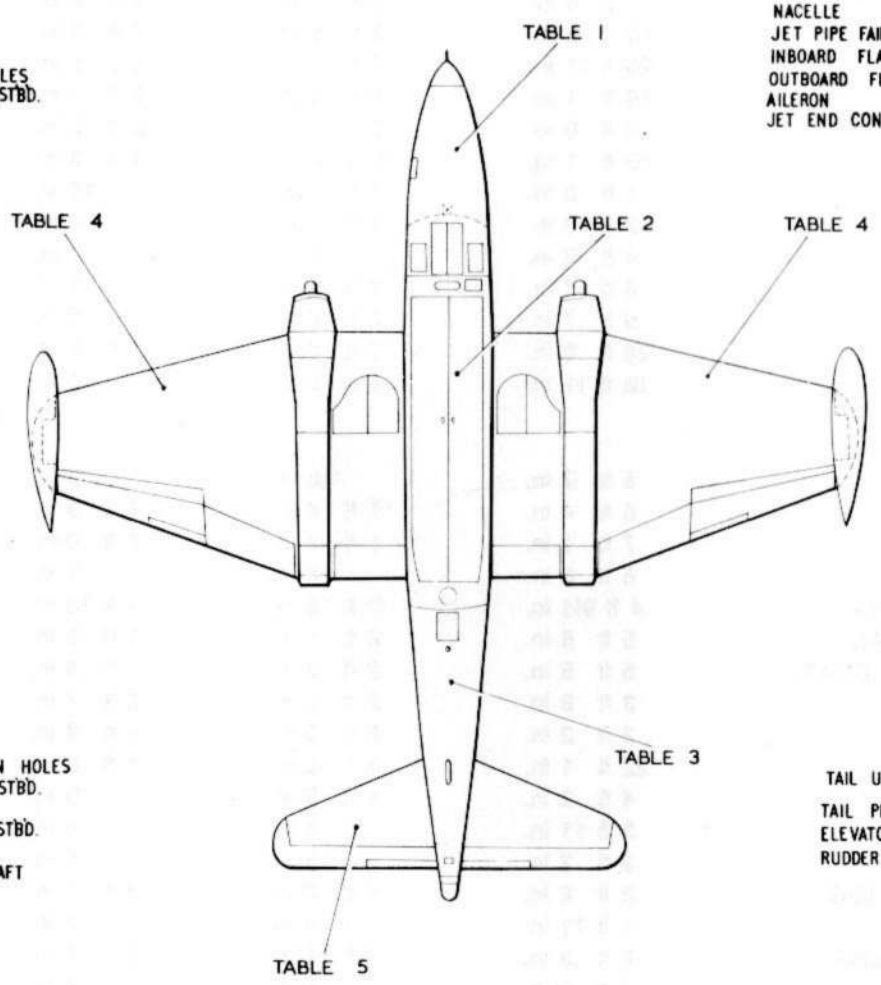

TABLE 4

WING	NO. OF DRAIN HOLES	
FRONT COWLING INTAKE		2
SERVICE PANEL		6
LOWER REAR COWL		21
NACELLE		18
JET PIPE FAIRING	10.1/8 IN. DIA.	10.1/4 IN. DIA.
INBOARD FLAP		16
OUTBOARD FLAP		27
AILERON		39
JET END CONE		1

TABLE 5

TAIL UNIT	NO. OF DRAIN HOLES
TAIL PLANE	4
ELEVATOR	5
RUDDER TAB	T/H 1

FIG. 8. DRAINAGE HOLES

Chapter 4A EXTERNAL FINISH AND MARKINGS

◀ *(completely revised)* ▶

Introduction

1. For data on external paint finish and markings, reference should be made to A.P.119A-0601-0 – AIRCRAFT PAINTING AND MARKINGS, BAe Drg. EA3-00-5475.

2. In service, care must be taken to maintain all servicing, safety and 'break-in' markings in a legible condition. This is essential to permit the correct replenishment of systems and safe emergency entries.

3. Any removal or deterioration of the external finish must be restored as soon as possible.

4. The static vent plates on the front fuselage are not to be painted or polished. They must be kept clean.

Chapter 6 PROCEDURES FOLLOWING HAZARDOUS INCIDENTS

(Completely revised)

LIST OF CONTENTS

LIST OF APPENDICES

General information

1. This chapter deals with the special checks to be made, in addition to any normal servicing which may be due, following the report on Form 720 series of a hazardous incident.

Hazardous incidents

2. The term 'hazardous incident' means an occurrence apparent to an aircrew member or other individual in which an aircraft has, or may have, exceeded limits stated in its Release to Service document, or in which the aircraft structure or controls may have been damaged by abnormal operational conditions or loadings; the meaning of the term is further amplified in AP100A-01 Leaflet 316.
This class of damage can arise from:-

(1) A heavy landing.

(2) Overweight landings

(3) Flight in excessive g conditions.

(4) Flight through turbulent air.

(5) Buffeting/vibration during flight.

(6) A lightning strike.

(7) Violent braking.

(8) Over-running of paved surfaces.

(9) Abnormal ground handling incidents.

Examination following hazardous incidents

3. Following a hazardous incident an examination is to be carried out as detailed in the appropriate appendix.

Safety precautions

4. The following general safety precautions apply throughout the chapter. Safety precautions peculiar to the different items of equipment will be found immediately preceding the relevant servicing instructions.

(1) All personnel must refer to the LETHAL WARNING marker card before entering the cabin or commencing any operation upon the aircraft.

(2) The N.C.O. immediately in charge of airframe servicing is the only person allowed to authorize the following:-

(a) Work by armament tradesmen on such equipment.

(b) Entry by any person into a cabin or compartment containing ejection seats, cartridge and detonator operated jettison equipment.

(c) The fitting, removal, or repositioning of any safety device.

(3) Upon completion of authorized servicing, all tradesmen concerned must report to the N.C.O. immediately in charge of airframe servicing.

(4) The bomb door operating switch lock must be fitted before any work is commenced in the bomb bay.

(5) Functional tests of electrical equipment must not be carried out during refuelling and defuelling operations.

(6) Before connecting an external electrical power supply, the pressure head heater switch must be OFF.

Appendix I HEAVY LANDINGS

LIST OF TABLES

TABLE 1 AIRFRAME

(This table details the examination and checks to be carried out.)

WARNING

Refer to the general safety precautions listed in para.3.

ITEM NO.	ITEM	OPERATION	A.P. REFERENCE	RECTIFICATION	A.P. REFERENCE
		ALIGHTING GEAR			
1	MAIN UNDERCARRIAGE				
	(a) Shock-absorber struts	(i) Examine for normal and equal extension (ii) Examine for oil leaks	Sect.2, Chap.2 1803P, Vol.1, Sect.6.	(i) Adjust air pressure (ii) Slight leaks – recharge strut (iii) Serious leaks – indicate gland failure – renew strut	Sect.3, Chap.5 Sect.3, Chap.5 Sect.3, Chap.5
2	NOSE UNDERCARRIAGE				
	(a) Shock-absorber strut	(i) Examine for normal extension (ii) Examine for oil leaks Note... The white line painted on the shock-absorber strut will be obscured if the pressure is low.	Sect.2, Chap.2 1803E, Vol.1, Sect.6	(i) Recharge strut (ii) Slight leaks – recharge strut (iii) Serious leaks – indicate gland failure – renew strut	Sect.3, Chap.5 Sect.3, Chap.5 Sect.3, Chap.5
		Jack and trestle the aircraft. Support the rear fuselage with No.7 universal jacking trestle and former, at frame 42.	Sect.2, Chap.4		
3	MAIN UNDERCARRIAGE				
	(a) Torque links	(i) Examine for damage (ii) Check clearance at centre pivot pin. Permissible clearance between 0.001 in. and 0.010 in.	Sect.2, Chap.2 1803P, Vol.1 Sect.6	(i) Renew torque links (ii) Clearance in excess of limit to be rectified by fitting new washer (Ref.No.26FZ/715) with the thickness adjusted to give a clearance of 0.001 in. to 0.004 in. Note... Serious deviation indicates torque link twisted – renew torque link	Sect.3, Chap.5
		(iii) Remove centre pivot pin and examine for bowing, cracks and shear		(iii) Renew pivot pin	
	(b) Torque links, side stay, and main attachment lugs (c) Side stays and stay links	Examine for damage	1803P, Vol.2 Pt.3, Sect.6	Renew if necessary	Sect.3, Chap.5
◀	(d) Side stay upper attachment brackets	(i) Examine for damage (ii) Examine securing nuts for movement, and bolts for shearing (iii) Examine spar web in vicinity of brackets for damage	101B-0400-6, Pt.1 Chap.3	(i) Renew if necessary (ii) Renew if necessary	
	(e) Retraction jacks	(i) Examine attachment fitting for damage (ii) Examine rams for damage	1803P, Vol.2, Pt.3, Sect.6	Renew jacks	
	(f) Shock-absorber strut attachment brackets	(i) Examine for damage (ii) Examine for cracks in web and flanges, and in vicinity of bolt holes Note... Access to internal parts of brackets can be obtained through lightening holes in web of inboard plate.	101B-0400-6, Pt.1 Chap.3		▶

Servicing notes

5.

(1) The examinations and checks detailed in this chapter are to be carried out by a Senior N.C.O. assisted by tradesmen as required.

(2) Unless otherwise stated, damage found during this servicing is to be categorized and repaired in accordance with A.P.101B-0400-6.

(3) The appendices list renewals and adjustments which may be made. Renewals are not to be commenced until all examinations have been completed and the overall damage assessed.

(4) The instructions have been compiled to cover any possible damage resulting from any type of hazardous incidents reported by the captain or pilot on Form 720 series. Discretion is to be used in regard to the extent to which the relevant instructions are applied.

(5) Details of new or serviced components fitted during the servicing must be entered in the relevant columns of Form 720 series.

(6) The tradesmen responsible must sign for the completed servicing in the relevant columns of Form 720 series.

Definitions

6. The definitions of technical operations mentioned in this chapter are contained in A.P.101B-0400-5A2, Sect.1.

ITEM NO.	ITEM	OPERATION	A.P. REFERENCE	RECTIFICATION	A.P. REFERENCE
	(h) Leading edge diaphragm	Examine for damage			
	(j) Skin covering	Examine for damage			
	(k) Engine attachment fittings and pivots	(i) Examine fittings for damage (ii) Examine engine mounting front outer brackets for damage (iii) Examine engine mounting bolts for tightness	101B-0400-6, Part 1, Chap.3		
7	FUSELAGE (a) Short longitudinal beams immediately forward of nose shock-absorber strut attachment.	(i) Examine double row of rivets visible on fuselage skin for damage (ii) Examine fuselage skin in vicinity of beams for damage. If strut attachment bracket bolts, or bulkhead carrying the bracket are damaged, or if defects found in (i) and (ii) above, then:– (iii) Cut 3 in dia hole in cabin floor at mid point between the two beams (starboard side of navigator's seat). (iv) Examine beams for damage (v) Carry out repairs.	101B-0400-6, Part 1, Chap.2 101B-0400-6		
	(b) Nose wheel well:– (i) Vertical beam carrying radius rod rear attachments (ii) Rear bulkhead (iii) Side walls (iv) Roof (v) Horizontal beam on roof	Examine for damage	101B-0400-6, Part 1, Chap.2		
	(c) Fuselage skin immediately aft of wheel well at bottom curve of transport joint	Examine for damage. Small wrinkles may have existed before the heavy landing occurred and, as skin in this area is unstressed, they are to be ignored.	101B-0400-6, Part 1, Chap.2		
	(d) Fuselage skin at frame 17 (main plane forward attachment point)	Examine for damage	101B-0400-6, Part 1, Chap.2		
	(e) Tail plane attachment bolts	Examine for damage	101B-0400-6, Part 1, Chap.4		
	(f) Tail plane attachment fittings	Examine for damage	101B-0400-6, Part 1, Chap.4		
	(g) Tail protecting pad	Examine pad and fuselage in vicinity for buckling and damage			
	(h) Fire extinguishers	Examine for signs of discharge	Sect.4, Chap.5	Discharge indicated by plunger protruding through cap	

continued...

TABLE 1 Airframe - *continued*

ITEM NO.	ITEM	OPERATION	A.P. REFERENCE	RECTIFICATION	A.P. REFERENCE
8	AIRCRAFT GENERALLY Carry out rigging check		Sect.2, Chap.4		
	◀ **Note . . .** *1. If rigging dimensions are found to be correct, this cannot be assumed to indicate that no defects exist.* *2. Fit all components removed, using new or serviceable items, and carry out necessary adjustments and repairs. Refit all access panels, and remove all tools, rags, and other materials used during the servicing of the aircraft. Enter details of new or serviced components fitted, and sign for completed servicing on Form 720 series.* ▶				
▶ 9	DELETED ◀				

TABLE 2 ENGINES

(This table details the examination and checks to be carried out).

WARNING
Refer to the general safety precautions listed in para.3.

SAFETY PRECAUTIONS

(1) All starter cartridges are to be removed before commencing servicing.

(2) Before any servicing on the high energy igniter plugs or the H.T. wiring is commenced, the low tension supply cable to the input plug must be disconnected by an electrical tradesman, and a period of one minute allowed to elapse. This allows dissipation of stored capacitor energy, and prevents inadvertent discharge.

(3) The high-energy unit is not to be operated with the H.T. lead disconnected.

(4) The battery isolation switch must be set to OFF, and any external electrical supply disconnected, before loading the starter breech.

(5) When the turbo-combustion starter is cold (at normal air temperature), three cartridges may be fired at 30 sec intervals. If a cartridge fails to fire, wait 30 sec before trying the next cartridge, or making an investigation. After firing three cartridges in quick succession, a period of 10 minutes must elapse before reloading with a further three cartridges. If these cartridges are fired immediately, a period of 20 minutes must elapse before further reloading.

(6) Synthetic oil has a deleterious effect on aircraft finishes and electrical cables, and any spilled oil must be cleaned off immediately. Synthetic oils are also injurious to the skin and a prophylactic ointment must be applied to the hands before commencing work.

(7) The battery isolation switch must be set to OFF before connecting an external electrical supply.

ITEM NO.	ITEM	OPERATION	A.P. REFERENCE	RECTIFICATION	A.P. REFERENCE
1	ENGINE MOUNTINGS				
	(a) Forward outboard mounting support diaphragm brackets	Examine for cracks with the aid of torch probe and mirror attachment through the forward lightening hole in rib 1A in the outer wing.			
	(b) Inner mounting brackets	Examine for damage	101B-0400-6 Part 1, Chap.3	Renew if necessary	
	(c) Rear mounting brackets	Examine for damage		Renew if necessary	
	If engine damage is suspected, refer to A.P.102C-1522-1 Part 2, Sect.3.				
	Fit all components removed, using new or serviceable items, and carry out necessary adjustments and repairs. Refit all access panels and remove all rags, tools, and other materials used during the servicing of the engine installation.				
	Sign for completed servicing on Form 720 series				

TABLE 3 ELECTRICAL SYSTEM

(This table details the examination and checks to be made to the electrical system .)

WARNING
Refer to the general safety precautions listed in para.3.

SAFETY PRECAUTIONS

(1) Before any servicing of the high-energy ignition units or the H.T. wiring is commenced, refer to the LETHAL WARNING marker card, and remove the fuses.
(2) The high-energy ignition units must not be operated with the H.T. cable disconnected.
(3) When using silicone compound, care must be taken to prevent compound making contact with the eyes.
(4) When removing lead acid batteries, disconnect the negative cable first. When refitting batteries, connect the positive cable first.
(5) When the engines are running, the battery isolation switch must be set to 'ON' before disconnecting external electrical supply.
(6) Functional tests of electrical equipment must not be carried out during refuelling or defuelling operations, and all electrical power must be OFF.
(7) Both internal and external electrical power supplies must be disconnected before any Breeze plug connections are broken. Electrical power supplies must not be re-connected until Breeze plugs have been refitted. All electrical circuits affected by disconnection of Breeze plugs, must be functionally tested when the plugs have been refitted.
(8) Dummy fuses must be fitted to all unused fuse positions.
(9) When components are removed for bay servicing, the appropriate circuit fuses must be removed, and dummy fuses fitted.
(10) When circuit fuses are removed to facilitate servicing, dummy fuses must be fitted.
(11) When servicing is completed, ensure that all dummy fuses, except those in unused fuse positions, are removed and the correct rating live fuses fitted.

ITEM NO.	ITEM	OPERATION	A.P. REFERENCE	RECTIFICATION	A.P. REFERENCE
		Before carrying out functional tests, plug in external electrical supply and switch 'ON'. On completion of tests, switch 'OFF' and disconnect external supply.			
	Battery				
(a)	Main lead acid battery stowage and adjacent structure	Examine for spilled electrolyte, and corrosion.	◀ 113D series ▶	If found, neutralise affected areas and inform airframe N.C.O. Paint with anti-sulphuric paint when requested by airframe N.C.O.	
(b)	Emergency lead acid battery stowage and adjacent structure				
(c)	Fire extinguisher circuit	Examine inertia switches. If switches have been tripped, all fire extinguishers will have been discharged. Disconnect extinguishers and inform engine N.C.O.	Sect.5, Chap.1	Reset inertia switches, and carry out full functional test of circuit. Connect serviced fire extinguishers after fitting.	
(d)	Undercarriage micro switches	Examine for damage		Renew if necessary	
Refit all access panels, and remove all tools and other materials used during the servicing of the electrical systems.					
Sign for completed servicing on Form 720 series.					

TABLE 4

Instrument installation

(This table details the examination and checks to be carried out.)

WARNING

Refer to the general safety precautions listed in para.3.

SAFETY PRECAUTIONS

(1) Ensure that the battery isolation switch is set to OFF before connecting external supply.

(2) Before disconnecting any plug connections, both internal and external electrical supplies must be disconnected. Electrical supplies must not be re-connected until all plugs have been refitted.

(3) All electrical circuits affected by disconnection of plugs are to be function-tested after the plugs have been refitted.

ITEM NO.	ITEM	OPERATION	A.P. REFERENCE	RECTIFICATION	A.P. REFERENCE
		Note... *Examine the bonding of all components for serviceability and good connection during the course of this servicing.*			
	PRESSURE CABIN				
	(a) Flight instruments (b) Engine instruments (c) Miscellaneous instruments	Examine for damage and carry out functioning tests	1275A series and 112G series	Renew items as necessary	Sect.5, Chap.2
	Refit, or replace with new or serviced parts, all components removed and make necessary adjustments and repairs. Remove all tools, rags and other materials used during servicing. Refit access panels. Sign for completed servicing on Form 720 series.				

TABLE 5 RADAR INSTALLATIONS

(To be issued later)

TABLE 6 RADIO INSTALLATIONS

(To be issued later)

Appendix 2 OVERWEIGHT LANDINGS

(To be issued later)

◀ Appendix 3 EXCESS G ▶

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TABLE

General information

Check aircraft for damage whenever 5.0 'g' has been reached or exceeded. The indication that an aircraft has exceeded the maximum permissible 'g' loading is normally obtained from the fatigue meter. On certain aircraft fitted with Mk.3 or Mk.13 fatigue meters a figure lower than 5.0 'g' may apply *(see below)*. When an increase in the reading of the highest counter of the meter is recorded beyond the stated limit, an excess 'g' check is required. Dependent on the type of fatigue meter fitted the limits are:

5.1 'g' with the Mk.16 fatigue meter
4.5 'g' with the Mk.13 fatigue meter
4.0 'g' with the Mk.3 fatigue meter

In the case of the Mk.3 and Mk.13 fatigue meters, due to the instrument limitations, these lower figures have to be applied unless a pilot's accelerometer is fitted to the aircraft. Excess 'g' checks on these aircraft are necessary only when the pilot's accelerometer readings of 5.0 'g' and above are recorded, notwithstanding the flight 'g' limitations in Pilot's Notes.

TABLE 1

Airframe

(This table details the examination and checks to be carried out.)

WARNING

Refer to the general safety precautions listed in para.3.

Item No.	Item	Operation	A.P. Reference	Rectification
1	MAIN PLANES	Carry out rigging checks. Correct rigging dimensions cannot be assumed to indicate that no defects exist.	101B-0400-6, Part 1, Chap.3	Repair as necessary
	(a) Outboard wing	Inspect the outboard wing upper surface aft of the main spar, just outboard and inboard of rib 4 (inboard aileron hinge location) for skin buckling and rib distortion.		
	(b) Leading edge	Examine the corners of the air intake slots on the wing leading edge for distortions or cracking	101B-0400-6, Part 1, Chap.3	Repair, or renew as necessary
2	SERVICES Wing root services	Examine all wing root services i.e., fuel cabin air, hydraulics, engine controls, generator controls, for looseness of joints and chafing.	101B-0400-6, Part 1, Chap.7 Sect.4, Chap.1 Sect.5, Chap.1	Repair, or renew as necessary
3	UNDERCARRIAGE	Jack and trestle the aircraft and carry out undercarriage retraction checks. Examine for alignment and locking of the main leg and 'D' doors, and check that the projecting skin tongue on the forward outboard end of the 'D' door is undamaged and fits correctly into the wing skin recess.	101B-0400-6, Part 1, Chap.5	Repair, or renew as necessary
		Examine floor girder 18, in the bomb bay at the forward door hinge point, for any distortion or buckling.	101B-0400-6, Part 1, Chap.2	Repair, or renew as necessary

continued. . .

◄ Appendix 4 FLIGHT TURBULENCE ►

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TABLE 1

Airframe

WARNING
Refer to the general safety precautions listed in para.3

Item No.	Item	Operation	A.P. Reference	Rectification
1	AIRCRAFT generally			Rectify any defects already reported
2	MAIN PLANES			
	(a) Access panels	Remove the inner and outer panels from the upper surface, inner main plane	Chap.4	
	(b) Inner wing diaphragm	Examine, particularly for cracks in area adjacent to main plane forward attachment point at fuselage frame 17 and in areas where pipes pass through the diaphragm	101B-0400-6, Part 2, Leaflet C3/17	Repair as necessary
	(c) Access panels	Refit		
3	DELETED			

◀ Appendix 5 BUFFETING/VIBRATION DURING FLIGHT ▶

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General information

1. The information contained in this appendix is intended as a guide to assist in the determination of sources of buffeting/vibration experienced during flight.

2. Table 1 lists possible sources of buffeting/vibration and the examinations required, but the possibilities of other sources should not be ruled out. Sources from engine running characteristics or malfunctions are not listed.

Note...

(1) Although a diagnosis from an aircrew's report can identify the cause of buffeting/vibration, the source is more likely to be identified from a thorough physical inspection of the airframe and engine installation.

(2) Generally it is not expected that airframe faults will generate any vibrations with frequencies above about 25 cycles per second. If the reported vibration approaches this frequency, it is probable that a flying control circuit problem exists and particular attention should be paid to the elevator geared tab backlash.

(3) If the frequency of vibrations is in excess of 25 cycles per second the most likely cause is an engine/airframe fault, regardless of any apparent effects of applied 'G' forces.

TABLE 1 - EXAMINATION OF POSSIBLE SOURCES OF BUFFETING/VIBRATION

WARNING...

Refer to the general safety precautions in para. 3 of the main chapter.

ITEM NO	POSSIBLE SOURCE	OPERATION
1	Jet pipe mounting	Check movement
2	Transport joints	Ensure tight
3	Tail plane leading edge/elevator horn	Examine and particularly for lack of continuity and check for correct gap
4	Fin and tail plane root area	Examine and particularly for poor continuity of joints, oil canning or poor finish
5	Fin stub	Examine and particularly for depressions or repair strips which might affect rudder spring tab
6	Elevator tab shrouds	Ensure not bent to obtain correct gap (gap obtained by trimming)
7	Tail plane/attachment points	Examine and particularly for excessive rock due to play at attachment points at fuselage
8	Tail plane stubs and root area	Check gaps
9	Control circuit	Check backlash, particularly elevator geared tab circuit
10	Air brakes	Examine and particularly to ensure that they lay flush with main plane and are not causing local distortion of the skin
11	Flaps	Examine and particularly for trailing edge distortion due to flap jack load or, excessive looseness
12	All controls and tabs	Ensure they conform to weight and balance requirements of drawings
13	Mass balance weights	Ensure tight
14	Undercarriage doors	Ensure rigged correctly in undercarriage UP position. Ensure seals are intact and fitting correctly
15	Static vents	Examine particularly for correct contour
16	Entrance door	Check fit with and without cabin pressure
17	Bomb or flare bay doors	Ensure seals intact and fitting correctly
18	Canopy fairing	Examine particularly for correct contour and ensure fitting tightly
19	Inner main plane	Examine particularly for poor finish which might disturb air flows and eventually affect tail plane
20	Engine/airframe	Ensure no foul exists

◀ Appendix 6 LIGHTNING STRIKES ▶

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General information

1. Lightning strikes usually result in two types of damage, that caused by the actual strikes, and that caused by the discharge of static electricity which follows the strike. It is also possible that heavy static discharges may occur without the aircraft having been struck by lightning. Further, it is possible that certain aircraft components may become strongly magnetized, it being probable that during the lightning discharge heavy electrical currents flow in the metal airframe structure. The magnetic field produced by such electric current is the cause of magnetization, this being an undesirable factor in the vicinity of a compass.

2. A lightning strike usually causes burning of small circular holes of approximately 1/8 in. dia., which may be clustered in one locality or scattered over a large area, results may also be indicated by burnt or discoloured skin, or rivets. Evidence of lightning strikes usually appears more prevalent in the fuselage nose section, and outer leading edges.

3. The effects of static discharge may occur as localized pitting or burning and may even result in circular holes of approximately 1/4 in. dia. Evidence of static discharge usually appears more prevalent on trailing edges, in the lower aft fuselage area, radio aerials and the main plane extremities, also on the fin and tail-plane tips and trailing edges.

Examination procedure

4. Whenever a lightning strike or static electricity discharge is reported, or if it is suspected that these conditions may have been encountered, the aircraft must be examined for evidence of such, as tabulated subsequently, at the first opportunity following the incident. It is emphasised, however, that where the term 'Examine' is used, the signs of damage being primarily sought are those of lightning strikes and static discharge as defined in para.2 and 3 respectively. The examination is divided into the following two categories:-

Table 1 – *Preliminary examination* – intended only for en-route aircraft landing away from base, to be followed upon return to base by:-

Table 2 – *Comprehensive examination* – the normal procedure to be carried out at base on termination of flight.

Note . . .

Categorization does not of itself determine repair deferment policy. A decision to defer the rectification of ascertained damage must be related to the effect of the damage upon the airworthiness of the aircraft.

◀ **Lightning strike responsibilities**

5. On termination of a flight in which the Captain knows or suspects that the aircraft has been struck by lightning, reference is to be made to AP 100B-01, Order 4950 "Demagnetization of Aircraft Struck by Lightning". This order details the individual responsibilities of Aircrew, Station Engineering Personnel and Command Headquarters. ▶

TABLE 1 PRELIMINARY EXAMINATION (En-route aircraft only)

ITEM NO.	ITEM	OPERATION
1	(a) Ejection seats (b) Canopy and hatch jettisoning systems	Ensure rendered safe.
2	Fuselage exterior	Examine, paying particular attention to nose section, perspex transparencies for crazing, and fuselage underside and tail fairing.
3	(a) Tail-plane surfaces (b) Elevator surfaces (c) Elevator tab surfaces	Examine, paying particular attention to trailing edges, tips and hinge areas.
4	(a) Fin (b) Rudder (c) Rudder tab	Examine, paying particular attention to trailing edges.
5	Main-plane surfaces	Examine, paying particular attention to outer leading edges, trailing edges, root-ends, air intakes and hinge areas of the control surfaces.
6	(a) Aileron surfaces (b) Aileron tab surfaces (c) Flap surfaces (d) Air brakes	Examine, paying particular attention to trailing edges and hinge areas.
7	Tip tanks	Examine.
8	(a) Main-wheel units (b) Nose-wheel unit	If extended at time of incident:– Examine, paying particular attention to lower portions.
9	(a) Main flying controls (b) Flaps (c) Air brakes	Operate each system through full range and check for smooth freedom of movement.
10	Fire extinguisher discharged indicator	Examine and check by feel the indicator pin at the base of the extinguishers for protrusion; if the pin protrudes the extinguisher must be renewed. Examine the tell-tale windows in the discharge adapter of Type 4 AX extinguishers for colour change.
11	Navigation lamps	Operate, and check for correct functioning.
12	All aerials	Examine.
13	(a) Radio equipment (b) Navigation equipment	Operate, and check for correct functioning.
14	Pressure head	Examine.
15	Compass	Carry out a check swing.

TABLE 2 COMPREHENSIVE EXAMINATION (Normal procedure)

ITEM NO.	ITEM	OPERATION	A.P. REFERENCE	RECTIFICATION
1	(a) Ejection seats (b) Canopy and hatch jettisoning systems	Ensure rendered safe.	109B-0101-1.	
2	Front fuselage	Examine, paying particular attention to (a) the perspex transparencies, (b) nose-wheel doors and underside.	101B-0400-6, Pt.1, Chap.2.	(a) Polish or renew as necessary. (b) Repair as necessary.
3	Rear fuselage	Examine, paying particular attention to the underside and rear fairing. Static discharge is usually indicated by a series of small holes along the underside at approximately the centre line.	101B-0400-6, Pt.1, Chap.2.	Repair as necessary.
4	(a) Tail plane (b) Fin	Examine, paying particular attention to the trailing edges, tips and hinge areas of control surfaces.	101B-0400-6, Pt.1, Chap.4.	Repair or renew as necessary.
5	(a) Elevators (b) Elevator tabs	(1) Examine, paying particular attention to the trailing edges. (2) Examine hinge assemblies, as far as practicable. If signs of static discharge or pitting are found, extend examination to include all bearing points in the control system. (3) Move the elevator and tabs through the full range of travel and check for freedom of movement and smooth operation.	101B-0400-6, Pt.1, Chap.4. Sect.3, Chap.4.	Repair or renew as necessary.
6	(a) Rudder (b) Rudder tab	(1) Examine, paying particular attention to the trailing edges. (2) Examine hinge assemblies and tab-operating mechanism as far as practicable. If signs of static discharge or pitting are found, the examination must be extended to include all bearing points in the control system. (3) Move the rudder and tab through the full range of travel and check for freedom of movement and smooth operation.	101B-0400-6, Pt.1, Chap.4. Sect.3, Chap.4.	Repair or renew as necessary.
7	Main planes	Examine, paying particular attention to the outer leading edges, inboard undersurfaces, air intakes, trailing edges and hinge areas of flying controls, and skin joints.	101B-0400-6, Pt.1, Chap.3.	Repair as necessary.
8	Tip tanks	Examine.	101B-0400-6, Pt.2, Leaflet C5/1.	Repair as necessary.

continued . . .

TABLE 2 COMPREHENSIVE EXAMINATION (Normal procedure) – *continued*

ITEM NO.	ITEM	OPERATION	A.P. REFERENCE	RECTIFICATION
9	Ailerons	(1) Examine, paying particular attention to the trailing edges. (2) Examine hinge assemblies, as far as practicable. If signs of static discharge or pitting are found, the examination must be extended to include all bearing points in the control system.	101B-0400-6, Pt.1, Chap.3.	Repair or renew as necessary.
		(3) Move the ailerons through the full range of travel and check for freedom of movement and smooth operation.	Sect.3, Chap.4.	
10	Aileron tabs	(1) Examine, paying particular attention to the trailing edges. (2) Examine hinge assemblies and tab-operating mechanisms.	101B-0400-6, Pt.1, Chap.3.	Repair or renew as necessary.
		(3) Operate the aileron tabs through the full range of travel and check for freedom of movement and smooth operation.	Sect.3, Chap.4.	
11	Flaps	(1) Examine, paying particular attention to the trailing edges. (2) Examine hinge assemblies. If signs of static discharge or pitting are found, extend the examination to include all bearing points in the flap control system. (3) Disconnect flap-operating rods at the rear ends. (4) Move the flaps through the full range of travel and check for freedom and smooth operation. (5) Reconnect flap-operating rods.	101B-0400-6, Pt.1, Chap.3.	Repair or renew as necessary.
		(6) Operate flap system through full range of travel and check for smooth operation.	Sect.3, Chap.4.	
12	Air-brake assemblies	(1) Extend and examine. (2) Examine all hinge assemblies. If signs of static discharge or pitting are found, extend the examination to the operation jack bearings.	Sect.3, Chap.2.	Renew as necessary.
		(3) Operate the air brakes and check for full and free movement and smooth operation.	Sect.3, Chap.4.	
13	(a) Main-wheel units (b) Nose-wheel unit	If extended at time of incident:– Examine, paying particular attention to the lower parts of the shock-absorber struts and wheels.	104 series and 1803E, Vol.1.	Renew as necessary.

TABLE 2 COMPREHENSIVE EXAMINATION (Normal procedure) – *continued*

ITEM NO.	ITEM	OPERATION	A.P. REFERENCE	RECTIFICATION
14	Aircraft generally	If any aerials (or other protuberances) have broken away during incident, examine for incidental damage.		Renew aerials and repair damage as necessary.
15	ELECTRICAL (a) External lighting (b) Cockpit lighting	Operate, and check for correct functioning.	Sect.5, Chap.1, Group L.	
16	ENGINES Fire extinguisher indicator	Check by feel, mechanical indicator pin at base of extinguisher for protrusion. If pin protrudes renew extinguisher. On Type 4AX extinguishers examine the tell-tale windows in the discharge adapter for colour change.	Sect.4, Chap.5.	Renew as necessary.
▶ 17		Deleted		
18	Aerials	Examine.	Sect.6, Chap.2.	Renew as necessary.
19	All connectors (aerials to trans/rec.)	(1) Disconnect. (2) Examine, particularly end connections. (3) Check for continuity and leakage from conductor to outer screen.	Sect.6, Chap.2.	Renew as necessary.
20	Aerial switch units	(1) Examine, particularly connections and contacts. (2) Check for continuity and leakage from conductor to outer screen in both energized and de-energized conditions.	Sect.6, Chap.2.	Renew as necessary.
21	All connectors	Reconnect		
22	Installation	Operate, and check for correct functioning.	Sect.6, Chap.2.	
23	RADIO Aerials	Examine.	Sect.6, Chap.1.	Renew as necessary.

continued . . .

TABLE 2 COMPREHENSIVE EXAMINATION (Normal procedure) – *continued*

ITEM NO.	ITEM	OPERATION	A.P. REFERENCE	RECTIFICATION
24	All connectors (aerials to trans/rec.)	(1) Disconnect. (2) Examine, particularly end connections. (3) Check for continuity and leakage from conductor to outer screen.	Sect.6, Chap.1.	Renew as necessary.
25	Aerial switch unit	(1) Examine, particularly connections and contacts. (2) Check for continuity and leakage from conductor to outer screen in both energized and de-energized conditions.	Sect.6, Chap.1.	Renew as necessary.
26	All connectors	Reconnect.		
27	Installation	Operate and, using test equipment, check for correct functioning.	Sect.6, Chap.1.	

◀ Appendix 7 VIOLENT BRAKING ▶

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General information

1. Following an emergency stop, violent braking, or overheating, the wheels, tyres and brakes must be removed and undergo full Bay Servicing.

Appendix 8 OVER-RUNNING OF PAVED SURFACES

(To be issued later)

Appendix 9 ABNORMAL GROUND HANDLING INCIDENTS

(To be issued later)