No 1595147.

a.c.2. M.G. Snowball.

Notes.

LANCASTER

The Patent 'LOXON' Loose-leaf BINDER

Patent Nos. 337854 and 364810

OXFORD SERIES

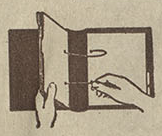
LIST OF STOCK SIZES

Ref. No.	Size of Leaf
51	8 x 6½
52	9⅛ x 7⅛
53	10¼ x 8
55	13 x 8

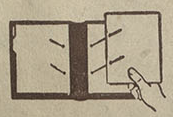
Reference for re-ordering

53 S

HOW TO USE THIS BINDER



1.—To insert or withdraw leaves, open the Binder at the place where the leaves are to be inserted or withdrawn, then draw the two sets of spear and sheath tags through to this place and disjoin.

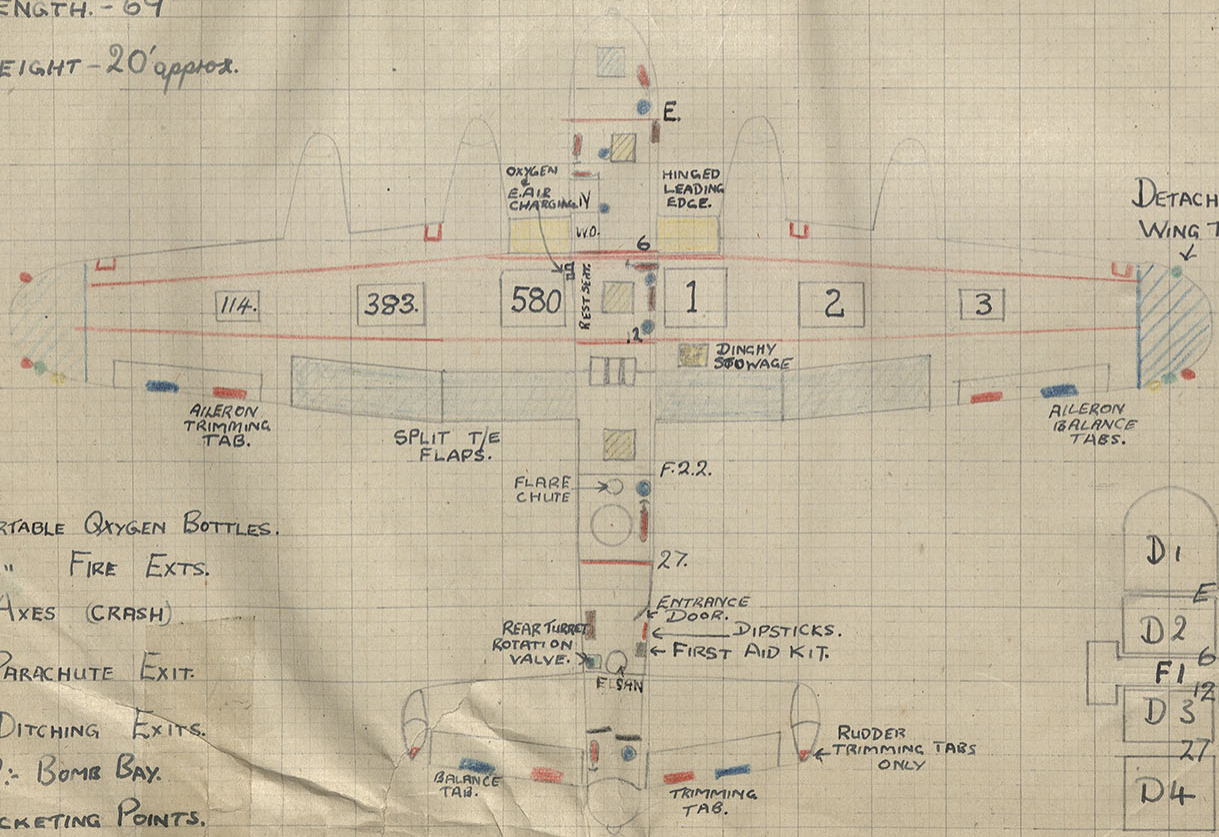


2.—Insert or withdraw the leaves and join the laces up again.

3.—Draw the laces tight and wind up under the spiral springs.

HUNT & BROADHURST LTD., OXFORD

SPAN - 102'
LENGTH. - 69'
HEIGHT - 20' approx.

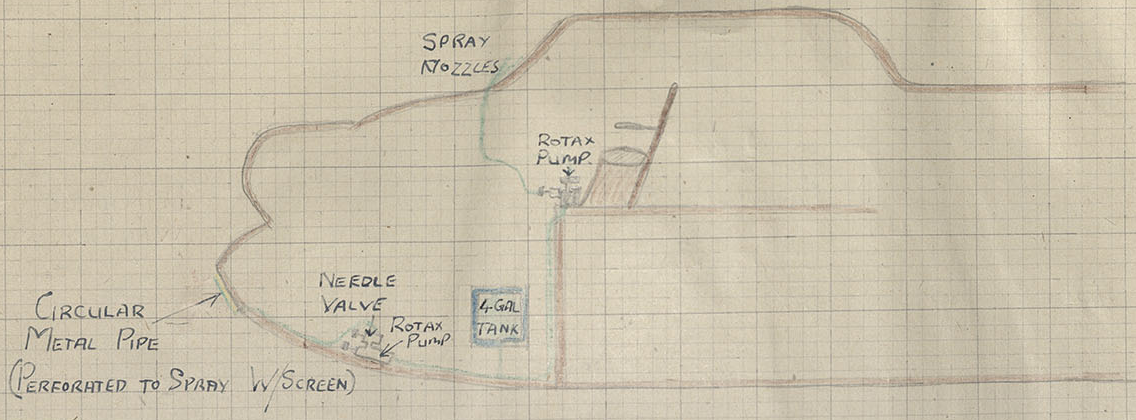


- Portable Oxygen Bottles.
- " Fire Exts.
- Axes (crash).
- Parachute Exit.
- Ditching Exits.

E to 22:- Bomb Bay.

U - Picketing Points.

Anti - Icing.



Icing Conditions.

Between +4°C. & −12°C

Critical Range 0°C & −7°C.

When moisture is present.

Use fluid de-icing D.T.D. 406 A.

Average setting for needle valve 1 2/3 open.

Consumption of pump at this setting pumping one per min – 2 pts per hr.

LANCASTER.

MARK I - Powered by 4 Merlin XX or XXII engines.
" II - 4 - Hercules IV. engines
" III - 4 - Merlin 28 or 38 engines. (Stromberg carb)

FUSELAGE CONSTRUCTION.

All metal stressed skin semi-monocoque type. The skin is Alclad and is supported by a system of formers and stringers. There are 52 formers in all "K" to "A" omitting "I" followed by numbers 1 to 42 working from nose to tail, and spaced about 18" apart. The fuselage is built up in 5 sections these sections are joined at transport joints.

The leading edge of the centre section is hinged on top of the front spar.

MAINPLANE CONSTRUCTION

Cantilever type with detachable wing tips and split trailing edge flaps.

EMERGENCY EXITS.

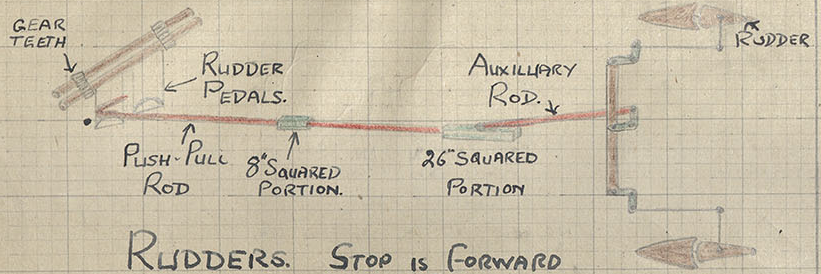
Three escape hatches No 1. in the canopy above the pilot No 2:- above the rest bed No 3. just forward of the flare chute. To release these hatches turn the handle clockwise and push out. The main PARACHUTE EXIT is in the floor of the bomb aimers compartment.

open by pulling the metal ring inwards. In extreme emergency certain of the crew will bail out through the main entrance door.

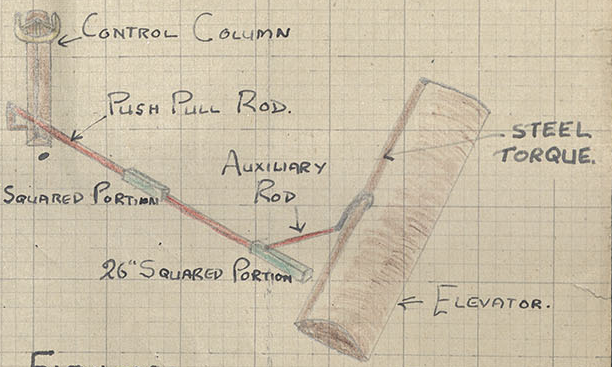
Position of Components.

1. Ground to Flight Switch.
   Starboard side between the front spar and the bulkhead doors.
2. Crash Axes.
   (a) Port Side opposite the entrance door.
   (b) Starboard Side opposite the rest bed.
   (c) Starboard Side near the Pilots Panel.
3. First Aid Kit, Fuel and Oil Dipsticks and F.E's Tool Satchel.
   Starboard side just aft of the entrance door.
4. Control Locking Gear
   Starboard side opposite the rest bed.
5. Verey Pistol.
   In a leather cup on top of the front spar. Firing point in the roof above.
6. Signal Cartridges.
   On Starboard side near the front spar.

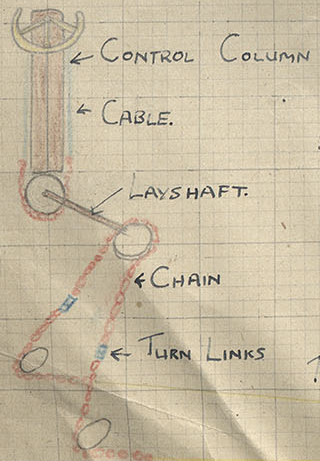
CONTROLS.



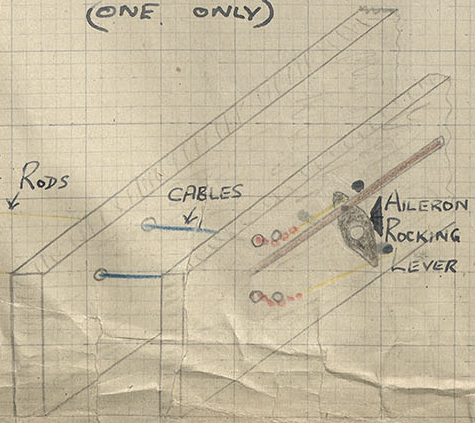
RUDDERS. STOP IS FORWARD OF PEDALS.



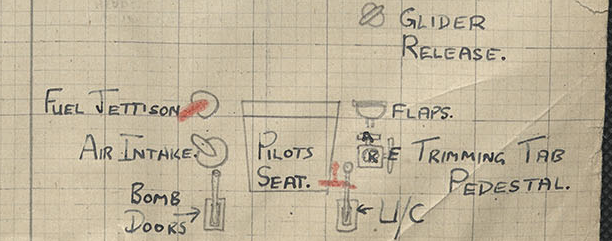
ELEVATORS.
STOPS - FORE & AFT OF C. COLUMN.



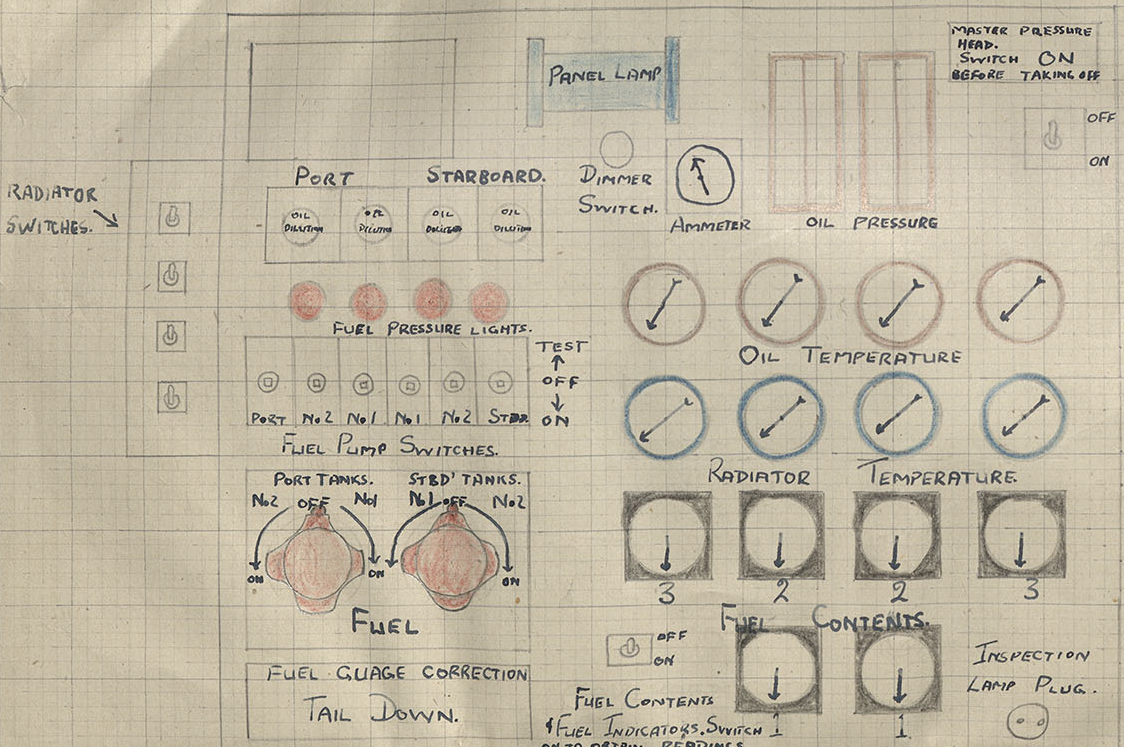
STOPS ARE ON STBD SIDE OF ROCKING LEVER. (ONE ONLY)



CONTROLS ROUND PILOT'S SEAT.



F.E's Panel



Elevator & Rudder Controls.

Push-pull tubes running down port side of fuselage. Top tube Rudders: Bottom tube Elevators: Made of Dural and supported in Tufnol Brgs. Squared Sections just aft of the rear spar and where the tubes end opposite the entrance door prevent torque.

Aileron Controls.

A system of chains, cables, and tie-rods, running down the Port side of the fuselage to the Rocking Lever on the rear face of the Rear Spar. From here push pull tubes are linked to the ailerons themselves.

Trimming Tabs.

Fitted to ailerons, elevators and rudders and controlled from a pedestal next to the pilots seat, inaticting control. Trimmer control cables must never be crossed.

Balance Tabs.

Automatic in operation, and appearing to move in the opposite direction to the control surface. Fitted to the ailerons, and elevators. The rudder being horn balanced.

Oxygen System.

Position of Components.

AMENDED F/Sgt. ADAMS.

1/. External Charger Valve. - Former 7 and 8. Port side. Centre of Bomb-bay. Next to No. 13 Bomb-slip.

2/. Bottles.

15 Underneath the Rest Bed. 1800 lbs/□" pressure. capacity 750 litres. Supply of oxygen will last approx. 8-10 hrs at 20,000 ft. Each bottle is bound with wire. Supply of oxygen remaining is entered on the log on return to base.

3/. Main Supply Cock.

At foot of rest bed.

4/. Mark 10A. Master Regulator.

Starboard side of pilots panel.

5/. Cut-off Valve, flow indicator & Economiser.

One at each crew position and also at the rest bed, flare chute and elsan,

N.B. Pilot has no cut-off valve and no flow indicator and the F.E. has no flow indicator.

Functions of Components.

Regulator: -

Reduces the pressure and regulates the flow. The contents gauge will not register until the master cock underneath it is turned on.

Economiser.

Effects a 50% saving in the use of oxygen by only delivering as the wearer breathes in. As the wearer breathes out oxygen is stored in a fabric bag

ready for the next breath.

TESTING ECONOMISERS.

1/ Turn on the main supply cock.
2/ Turn on the master cock on the regulator.
3/ Check the gauge reading.
4/ Set the regulator at emergency and then turn back to read 30,000 ft.
5/ Remove economiser hose from cut-off valve. 5 to 9 puffs per minute should be felt or heard.

NOTE:- Always smell the oxygen. A musty smell denotes presence of moisture in the system.

USE OF OXYGEN.

DAYTIME:-

All aircrew use oxygen from 15,000 ft. Use from 10,000 ft. in extremely cold weather or if flying for more than an hour at this altitude.

NIGHTTIME:

All aircrew use oxygen from 4,000 ft. and continue to use it back to base.

SETTING REGULATOR.

Initial setting is 15,000 ft. and the regulator must be kept at least a clear 5,000 ft. above the altitude of the aircraft. 15,00, next setting 25,000.

IMPORTANT POINTS.

1/ Always test equipment before flight.
2/ Carry the correct type of mask.

3/. Check the adaptors for the portable bottles.
4/. If the needle on the contents gauge approaches the red mark warn the pilot to descend below oxygen height.
5/. Remove bobbins from cut-off valves before flight.
6/. Main Supply Cock closed when charging the system
7/. Never lubricate with oil or grease
8/. All oxygen cocks should be fully open or fully closed.

PORTABLE BOTTLES.

Seven are fitted.

1/. Starboard side B.A.'s compartment.
2/. At rear of pilots' seat or on the floor near the F.E's panel.
3/. On the Nav's chair support.
4/. Starboard side just aft of the front spar.
5/. Starboard side just forward of the rear spar.
6/. Starboard side near the mid-upper turret.
7/. Starboard side just forward of the rear turret.

These bottles are of 75 litres capacity charged at 1800 lbs/□" and lasting 10 minutes.

An "ON"-"OFF" cock, reducing valve, bayonet union, re-charging point and gauge reading minutes of supply are fitted on top of each bottle.

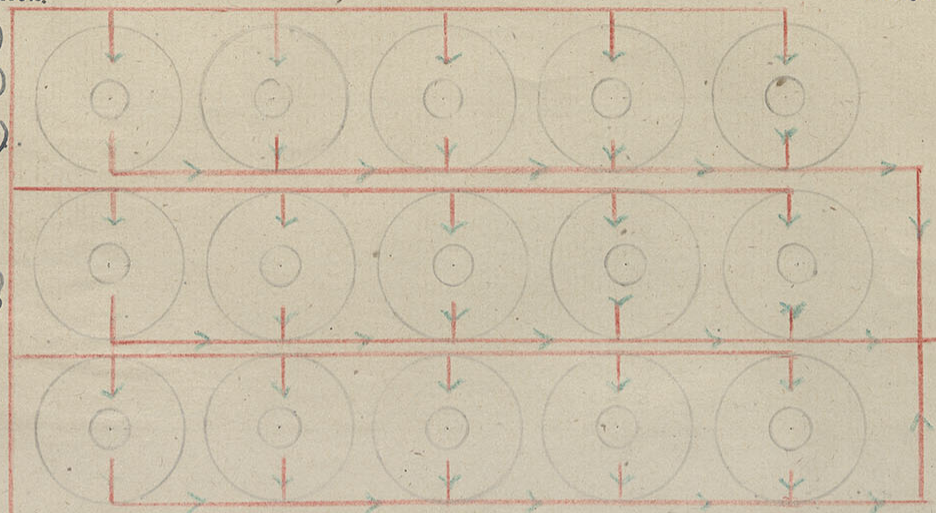
The needle is luminous and two luminous dots are marked at the bottom of the scale.

ECONOMISERS:
1 - F. TURRET.
1 - B.A's (PORTOR STED)
2 - UNDER PILOTS FLOOR.
1 - STED. SIDE. (NAV)
1 - W/OPs (P.S)
1 - REST BED (P.S).
1 - MID. UPPER.
1 - AMMO BOXES.
1 - {FLARE CHUTE. (MID-UNDER)}
1 - ELSAN
1 - R. TURRET.

OXYGEN SYSTEM.

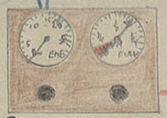
PRESSURE 1800 lbs/□"

> = N.R.V's



MAIN SUPPLY COCK.

MARK XA MASTER REGULATOR.



4 MANIFOLDS.

REGULATOR COCK & GAUGE

MASTER COCK & CONTENTS GAUGES

FILTER

BAYONET UNION

ECONOMISER HOSE

AIR VENT

MICA VALVE.

SPRING LOADED PLATE

RUBBERISED FABRIC BAG.

ECONOMISER.

FLOW METER.

ON OFF

CUT-OFF VALVE

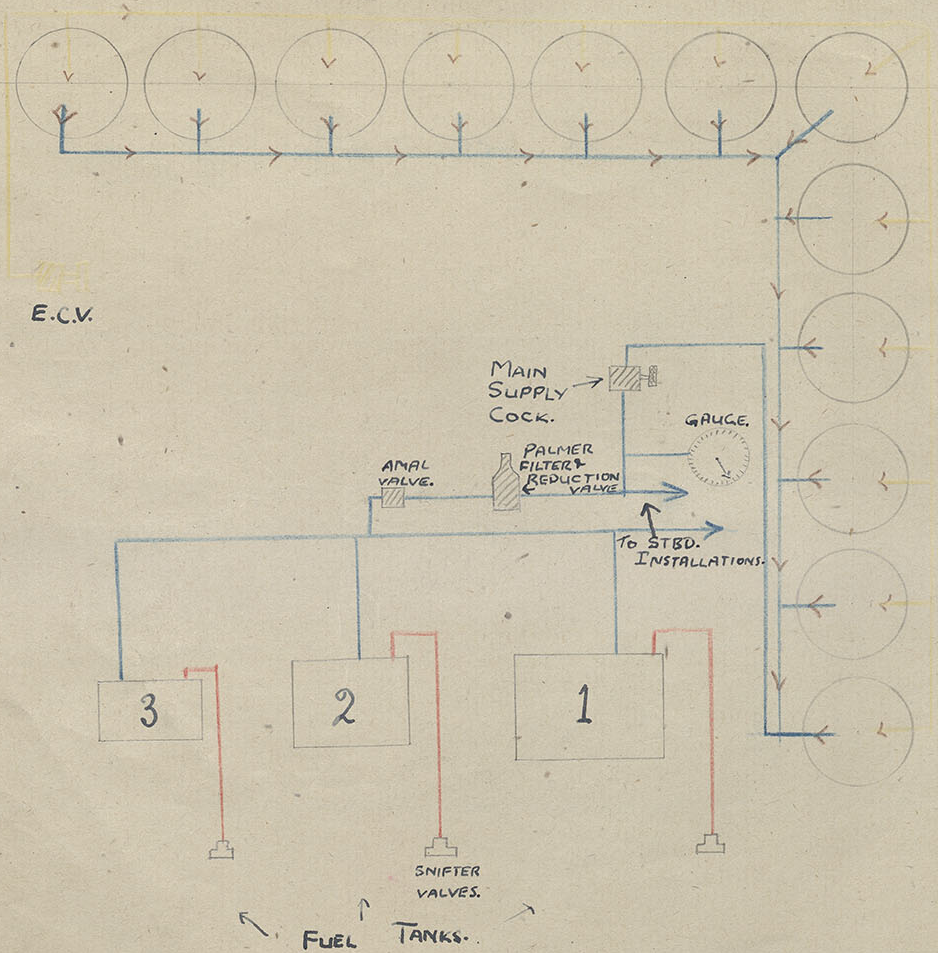
E.C.V.

2 MANIFOLDS - B.A. ROOF
1 " - BOMB S. 13.
1 " - P.S. AMMO BOXES.

NITROGEN.

PRESSURE 1800-2000.

> - N.R.V.'s



NITROGEN SYSTEM.

Supplies nitrogen gas to the six fuel tanks to fill the space above the liquid petrol.

Minimises fire risk.

BOTTLES.

12 In all, seven on the front face of the rear spar and five on the starboard side of the fuselage centre section, painted grey with black cap.

MAIN SUPPLY COCK.

Starboard side fuselage centre section near the five bottles

PRESSURE GAUGE.

Next to the main supply cock

E. C. V.

Starboard side of the bomb-bay, accessible from the outside. Next to former 11"

PALMER FILTER AND REDUCING VALVE.

One in each undercarriage nacelle on the rear face of the front spar.

SNIFTER VALVES.

Double acting relief valves one in each vent pipe.

FUNCTIONS OF COMPONENTS.

PALMER VALVE:- Reduces pressure to 15 - 25 lbs/□"

AMAL VALVE:- Reduce to ¼ to ⅜ lbs/□" above atmospheric.

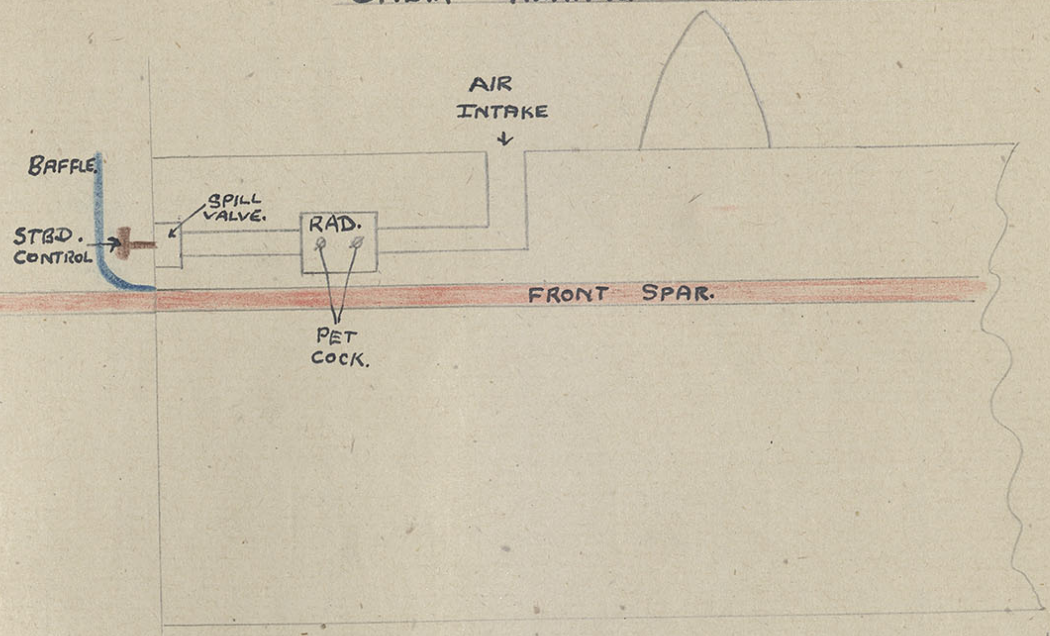
SNIFTER VALVES. Set to allow escape of nitrogen at about ¼ lbs/□" above atmospheric.

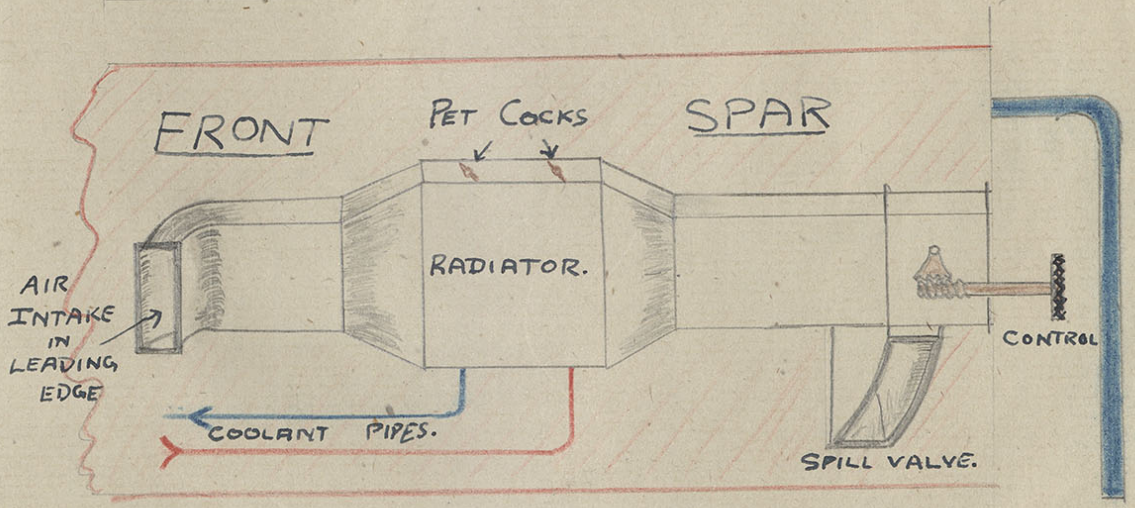
Permits entry of air if pressure in the tank drops.

PROCEDURE.

1. Turn supply cock on before starting.
2. After half an hours flying check the drop in pressure. (not to exceed 100 lbs)
3. Check every half hour.
4. At landing pressure should read at least 200 lbs/□"

Cabin Heating System.





<u>TURN OFF</u> when (a) Starting. (b) Inboard engine feathered or on fire.
(c) Fire inside fuselage.

<u>General.</u>

Radiators are connected to engine coolant of inboard engines. Pet cocks are provided to vent the system of air.

FIRE EXTINGUISHERS.

ENGINE INSTALLATIONS.

4 - 3pt. size bottles one to each engine.

INBOARD.

On the rear face of the front spar in the nacelle.

OUTBOARD.

On the engine sub-frame.

Each Bottle contains Methyl-Bromide in liquid form under pressure (60 lbs/□").

The distributing pipelines encircle the engine and lead to the air intake

OPERATION.

An electrically fired explosive charge breaks the seal on the bottle and the Methyl-Bromide reduces the engine temperature and smothers any flames.

SWITCHES.

1. 4- Push buttons mounted on the Pilots Panel with red covers.
2. Gravity switch on Starboard side of Bomb-Aimers Compartment which operates all the bottles when the a/c. turns over with the u/c. locked down.
3. Inertia Switch on Starboard side of Bomb-Aimers Compartment which operates all bottles when retardation exceeds 6 G. (ie:- crash landing.) This switch has a spring loaded plunger

on the top surface for test purpose.

NOTE:- Flame switches are fitted but not wired up.

PORTABLE EXTINGUISHERS.

1. Starboard side of fuselage nose on handling rail.
2. Port side just behind Pilots' seat.
3. Front end of navigator's table.
4. Starboard side above the front spar. 2pt.
5. Starboard side near the mid-upper turret.
6. Port side near the rear turret.

All 1 pint size except No 4. which is 2pts.

OPERATION.

Strike the plunger on No. 4 bottle and on all others turn the handles anti-clockwise.

All the pint size bottles can be shut off when partially used.

ENGINE FIRE IN FLIGHT.

1. Captain warns crew.
2. Pilot and F.E. feather the engine.
3. When engine has stopped operate the ext.
4. Do not restart the engine.

FUSELAGE FIRE IN FLIGHT.

1. Warn the crew and take oxygen. Put on goggles
2. Set the regulator at emergency.
3. Close all windows and openings to prevent draught.
4. Use portable extinguishers.

5/. When the fire is out the poisonous fumes must be cleared.

DINGHIES AND DITCHING.

TYPE "J" MK. III.

Bouyancy factor 3,000 lbs. Pressure 1½ lbs. Inflated with C.O.2. and carries seven to eight persons. Stowage - Starboard centre section near the trailing edge.

RELEASES.

1/. Electrical, by a circuit completed when water enters the 2 immersion switches in the bomb-aimers compartment, one each side.

2/. Manual, by cable carried in a red conduit tube running down the roof of the aircraft on the starboard side. Operated from 3 positions inside the aircraft, - above the flap-jack, by the rear ditching exit and above the entrance door. An external release is fitted on the starboard side next to the leading edge of the tailplane.

EQUIPMENT ON THE DINGHY.

1/. Co.2 Cylinder Gas charge 6 lbs. 7ozs.

2/. Operating head type "H." Set when the green spot is showing through the cover.

3/. Topping up valve, incorporating a 1¾ lb. relief valve.

4/. Bellows

5/. Leak Stoppers. 3 sets of 3

6/. Rescue Quoit and Line.
7/. Compass.
8/. Floating Knife.
9/. Drogue or sea anchor.
10/. Rope ladders, handling lines, stabilising pockets and trip lines.

EQUIPMENT TAKEN INTO DINGHY.

1/. Emergency pack type 7.
2/. Rocket aerial. A 200 ft aerial fired from a pistol and used to increase the range of the radio. 10 m.p.h. windspeed or over.
3/ Dinghy Radio:-
4/. Very Pistol and Signal Cartridges.

CONTENTS OF PACKS.

1/. TYPE 5. Makers canvas pack with zipp fastener.

(a) 7 tins of emergency rations. (Mk. II)
(b) 10 tins of water.
(c) 1 drinking cup.
(d) 1 pr. paddles. Glove type.
(e) 10 tins of signal cartridges. 3 per tin.
(f) 1 Signal Pistol 1"
(g) 1 fluorescine sea marker.
(h) 1 tin of matches
(i) 1 first aid outfit.
(j) 1 W.T. Aerial Mast.
(k). 1 Loading Coil. (m) 1 4" Heliograph.
(l) 1 Distress Flag. (n) 1 Sponge. (o) 1 Weather Apron.

X

TYPE 7. Valise Type.

18 Tins of Water.
18 Tins of Signal cartridges. 3 per tin.
2 Fluorescine sea markers.

STOWAGE:

Starboard side aft of the rear spar.

Skull caps are personal issue and floating torches are carried on the Mae West. Dinghy Radio and 2 kite aerial stowed above the rest bed.

TYPE Q DINGHY.

A sailing dinghy. gas pressure 1½" lb/□". Boyancy 3,000 lbs and holds 7 to 9 persons. The boyancy tube is in 2 parts joined amidships and an inflatable thwart tube gives lateral rigidity. This tube must be inflated by bellows. A canvas keel is extended by the erection of the mast and a rudder can be fitted at the stern.

STOWAGE & RELEASES.

As for "J" type.

EQUIPMENT ON DINGHY.

1/. CO.2 Cylinder containing a 7 lb gas charge.
2/. Operating head type "H."
3/. Topping up valves. On boyancy tube port side.
4/. Leak stoppers and repair outfit
5/. Rescue line and quoit. Port side at bow.
6/. Floating knife. next to CO.2. Cylinder.

7. Hauling in line amidships.
8. Drogue, in a pocket on the floor at the stern.
9. Maps. A set of 18 and one navigational chart. Stowed at the stern with instruction book.
10. Compass, at stern next to map stowage.
11. Weather cover, in 3 sections with blue undersurface for camouflage.

EQUIPMENT IN THE BAGS ON THE HAULING IN LINE.

1. Bellows and Fishing Tackle.
2. Telescopic mast and rigging lines.
   Forward - Yellow. Aft - Brown.
   Starboard - Green Port - Red
3. Sails, Halyards, canvas rudder.

These bags are in the dinghy stowage and a pair of glove type paddles are also attached to the hauling in-line.

Type 5 pack is attached to the dinghy by a lanyard.

TYPE K. Dinghy.

A 1 man dinghy usually attached to the mae west or parachute harness. Inflated with CO2. pressure ½ to ¾ lb/□". Bouyancy 320 lbs. Gas charge 12 ozs. Released by unscrewing the operating head slowly.

EQUIPMENT.

1. Topping up bellows.
2. " " valve
3. C.O.2 Cylinder.
4. Bailer.
5. Drogue.
6. Thwart Pockets.
7. Water Pocket and trip line.
8. Weather apron and hood.

Contents of Special Pack.

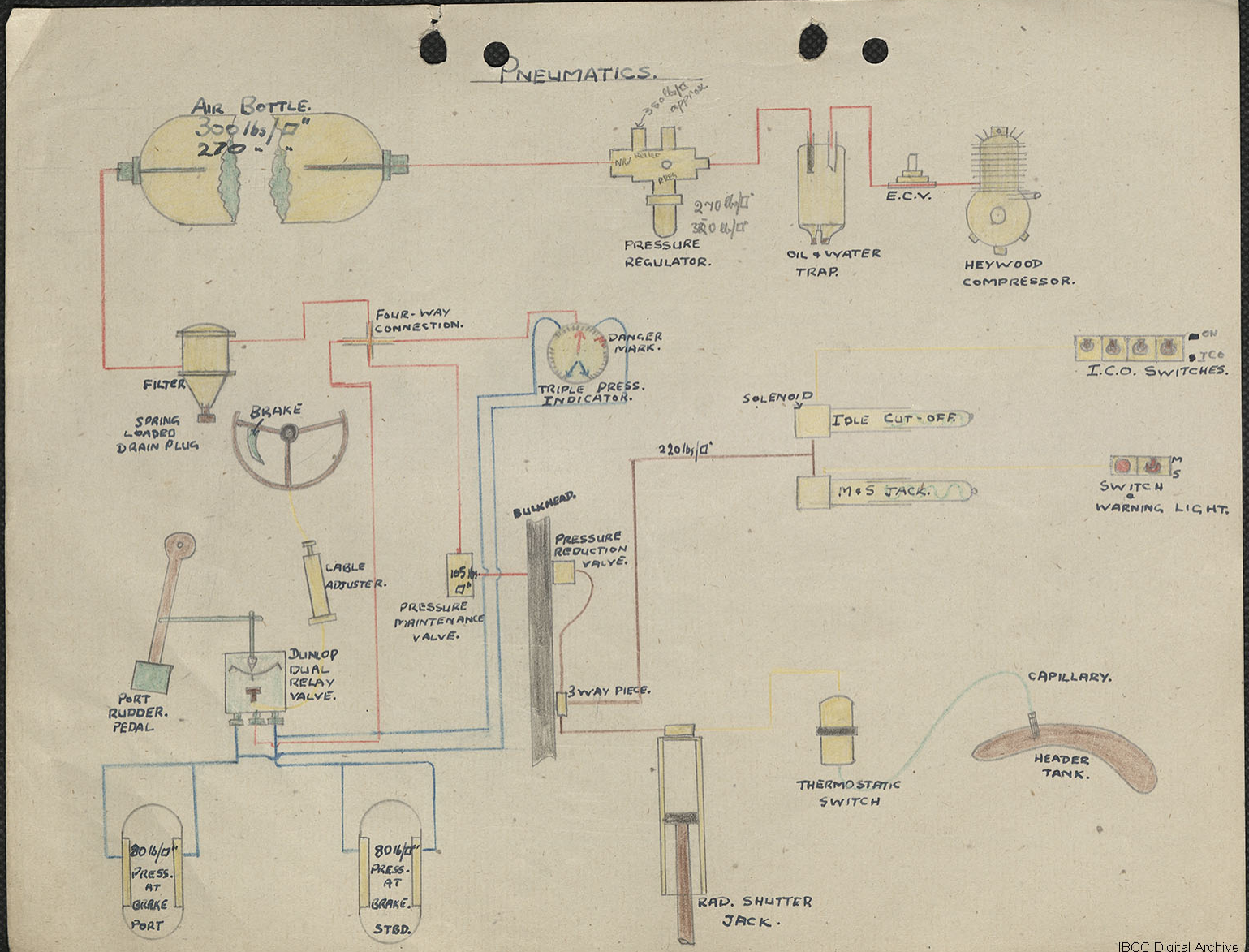
1. Rations.
2. Compass.
3. Distress Signals.
4. Leak Stoppers.
5. Sail and mast.
6. Thwart paddles.
7. Heliograph.

Flight Engineer's Ditching Drill.

Signal Received:- "Dinghy, Dinghy, Prepare for ditching" and by the call light DAH DIT DIT. (3 times).

1. Acknowledge, "Engineer ditching."
2. Remove parachute harness.
3. Assist pilot. (Safety harness, lowering flaps etc)
4. Jettison pilots' hatch.
5. Collect the axe, and move to ditching position.
6. Remove collar and tie, retaining helmet for protection.
7. Inflate Mae West. If heavily built do not inflate the Mae West fully.
8. Lie on the rest bed, face up, braced between the back rest and the bulkhead doors. Intercomm plugged in and safety strap in position. Right hand on strap release; left hand around head.
9. On receiving the order from the pilot

PNEUMATICS.



PNEUMATICS.

POSITION OF COMPONENTS.

1/. Compressor: - Starboard inner engine. A BANK.
2/. E.C.V.:- On the small wooden panel. stbd. u/c. Nacelle.
3/. Oil and Water Trap:- — Ditto. ——
4/ Regulator:- Rear face stbd. inner engine bulkhead.
5/. Air Bottle:- Roof of B.A's compartment.
6. Air Filter - 4 way union - D.R. Valve:- Port side B.A's compa
7. Maintaining Valve:- B.A's comp. just below 4 way union. Originally one on each engine bulkhead.
8/. Pressure Reduction Valves - 4:- 1 on front face of each engine bulkhead.

9. ## FUNCTIONS OF COMPONENTS.

1/. Regulator. This regulates the pressure in the system to between 320, and 270 lbs/□". As soon as the pressure has been built up a by-pass valve opens in the regulator allowing the air from the compressor to go to atmosphere. If this by-pass valve does not open a safety valve will open at a pressure slightly above normal. A non-return valve in the outlet connection traps the air already in the system.

2/. DUAL RELAY VALVE.

1. Reduces the brake pressure to a controlled maximum of 80 lbs/□"
2/. Provides differential braking action.
3/. Gives progressive braking, according to the movement
4. on the hand control.

3. MAINTAINING VALVE.

Set to close if a leak occurs and causes the pressure to drop to 105 lbs/□": ± 5 lbs/□". This will trap the last 100 lbs of air pressure for use in the brake service surface but the other services will be out of action. This only applies where the leak is beyond the pressure maintaining valve.

4. PRESSURE REDUCING VALVES.

Reduces the pressure to 220 lbs per sq. in. for operation of the auxilliary services.

5. RADIATOR SHUTTERS.

Operated by an electro-pneumatic ram which is opened and closed by air-pressure. Automatically controlled by a thermostatic switch so that they open when the coolant temp is 105°C. and close at 99°C.

OVERIDE SWITCHES.

With 150 lbs/□" or more in the air bottle the rad shutters may be opened at any time by these switches cutting out the thermostatic control. Use if during ground running, taxying or marshalling for take-off the coolant temp reaches 90°C. or the oil temp 80°C. At take-off inboard shutters are on auto and outboard open by overide switches.

SUPERCHARGER & I.C.O. RAMS.

(MK III Aircraft). Operated by electro-pneumatic rams spring loaded to the extended position (i.e:- "M" gear

position and engine running position) These rams are closed by air-pressure (ie "S" gear, and I.C.O.)

NOTE:- The control is by switches on the pilots panel. (centre) and the red warning light at the side of the u/c. switch will show if the u/c. is lowered (ie. locked down) with "S" gear in. The switch works off starboard u/c. leg only.

TESTING BRAKES.

1/. Check pressure in the main supply. (minimum 200lb)
2/. Apply the brakes fully with reudder pedals central. Pressure should be 80 lbs to each brake.
3/. Leave for 15 minutes with parking catch on. and then check for signs of a leaks
4/. Check that both brakes release quickly.
5/. Check the differential action, with fully port rudder starboard brake needle should read zero. Operate brakes just after T.O. and prior to landing.

TEST FOR S/C. & I.C.O.

Operate these switches about 6 times up and down. Pressure should drop about 10-12 lbs.

ADJUSTMENT OF BRAKES.

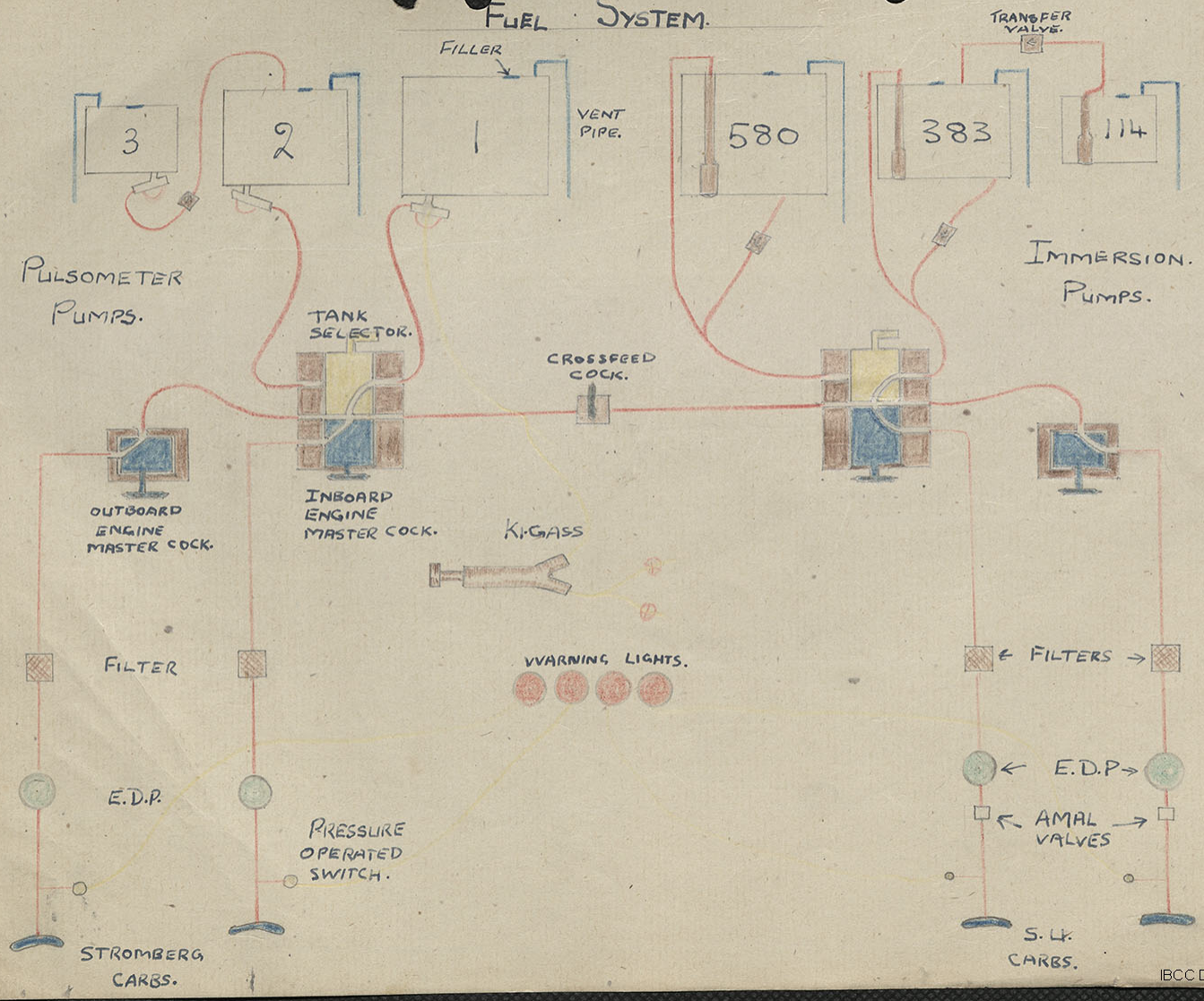
1/. Brakes applied, pedals central, and unequal pressures shown on the gauge.

Check the position of the pointer on the D.R.V. and if necessary adjust on the rod. If pointer is central and brakes central a new valve is needed.

2. Maximum pressure incorrect.

Adjust on the cable, screwing OUT to INCREASE pressure. Where this adjustment is for more than 10 lbs. change the relay valve.

FUEL SYSTEM.



FUEL SYSTEM.

6 self-sealing tanks numbered 1, 2, and 3, port and starboard. The number 3 tanks have no direct feed to the engine. The total capacity is 2,154 gallons and the system consists of seperate port and starboard installations connected only by a cross-balance line in which is fitted a cock. This cock is normally closed and the two halves of the system quite independent. 1077

In the original system immersed pumps were fitted the delivery pipe leading from the top of the tanks. To improve gravity feed seperate lines including non-return valves were fitted. On some Mk. I and all Mk. III aircraft Pulsometer Pumps are fitted underneath the tank each pump incorparating a gravity feed.

BOOSTER PUMPS.

A. Immersed Type - Electrically operated impellor type pumps with centrifugal action. Delivery 380 gallons per hour. Will build up a pressure of 12 lbs/□"

B. Pulsometer Type. - Similar to the immersed pump with approximately the same delivery. Will build a slightly higher pressure. (15 lbs/□")

TESTING PUMPS.

1. Ground/Flight Switch to FLIGHT.
2. Plug in an ammeter, unless fitted on the panel.

3. Place the booster pump switches one at a time to the up [TEST] position. Each immersed pump should give a reading of 2 to 4 amps. Each Pulsometer Pump should give a reading of 4 to 7 amps.

NOTE. Always avoid running these pumps dry.

OVERLOAD TANKS.

One or two 400 gallon tanks may be fitted in the bomb-bay, their contents being transferred into the No 1 tanks when space is available. The two selector cocks are on the floor behind the front spar PORT side and two booster pump switches and contents gauges are on a small panel in the canopy above the F.E.

RE-FUELLING.

1. If maximum bomb-load is carried fill numbers 2 tanks and put the remainder in No. 1.

During re-fuelling make a practical test of No3 tank booster pumps by transferring a little petrol

PRIMING.

A Ki-gass priming pump and 2 priming cocks are fitted in each 4/c nacelle the pump at the bottom of the wooden panel and the cocks above the panel behind the ledge. A three-way cock for priming with high

volatile fuel is now being fitted above the priming cocks.

FUEL PROCEDURE.

For Starting, Take-off, and Normal Flight.

1. Cross-balance cock off.
2. Main Panel Switch ON. (check warning lights etc.)
3. Check the fuel state making corrections for tail down.
4. Test all booster pumps by ammeter.

WITH ALL TANKS FULL.

1. Start on No 2/1 tanks with No 2/1 Booster Pumps on.
2. When all engines are running change to No 2
3. Change back to No 2 and run up. Test No 2 Gravity Feed.
4. Take-off on No 2: Pumps on for No 1 and No 2.
5. At safe height (below 17,000 ft) switch all booster pumps OFF.
6. Fly for 1 hr. 20 mins on No 2. tanks.
7. Change to No 1 and transfer from 3 to 2.
8. Use No 1 until equal to No 2. (370 gals. approx.)
9. Use alternate tanks to maintain balance (leave the last 100 in No 2)
10. Drain No 1 so that No 2 is in use when landing.

* No 3 tank empty, No 2 FULL. No 1 over 383 gals. *

1. Start on No 2/1 tanks with No 2/1 Booster Pumps ON.
2. When all engines are running change to No 2
3. Change back to No 2 tanks
4. Take-off on No 2. Pumps on for No 1 and No 2.
5. At safe height (below 17,000 ft) switch all booster pumps OFF.

1,000'

6. Change to No 1 tanks after 10 mins. (This leaves 40 gals space in No 2.)
7. Use No 1 until equal to No 2 and then alternate hourly.

WITH 400 gals or less in No 1. and No 2 full.

1. Take-off and Run for 1 hr on No 2.
2. Change to No 1 and change over hourly.

USE OF BOOSTER PUMPS.

1. Starting: No 2 pumps ON.
2. Take-off: No. 1 and 2 ON.
3. Steep climb: Tanks in use.
4. Flight above 17,000 ft.: Tanks in use.
5. Flying over target: No 1 and 2 ON. or in Evasive Action
6. Making a tank change: Tank pump to which change is to be made.
7. Landing: With fuel in 1 and 2. all pumps ON.
8. Running 4 engines off 1 tank. Tank pump for tank in use ON.

PROCEDURE OVER THE TARGET.

1. 4 booster pumps ON.
2. Select tanks containing the most fuel.
3. Keep a close check on warning lights and contents gauges.
4. If a slight leak occurs to a tank in use or serious damage to a tank not in use take no action until clear of the target.
5. Should serious damage occur to a tank in

use, warn the pilot and change tanks. Take balancing action after leaving the target.

TESTING SELF-SEALING PIPES.

On the return journey at safe height 5,000' run all four engines from each tank in turn. Engines at maximum cruising. 2650 +7 for 1 min.

FUEL JETTISON.

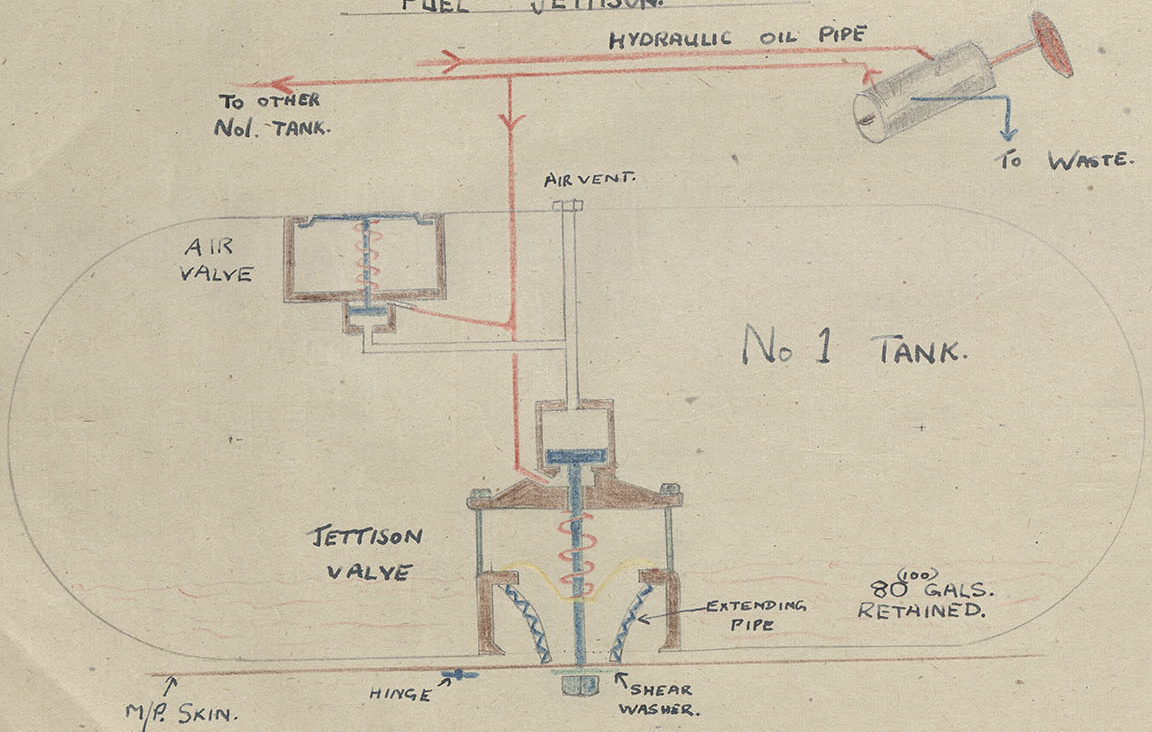
PROCEDURE.

1/. Warn the Rear Gunner
2/. Reduce speed to 115-150 M.P.H.
3/. Lower flaps 15°
4/. Available crew standby with extinguishers.
5/. Operate jettison control. (lift and turn anti-clockwise)
6/. After fuel is gone return the control to normal.

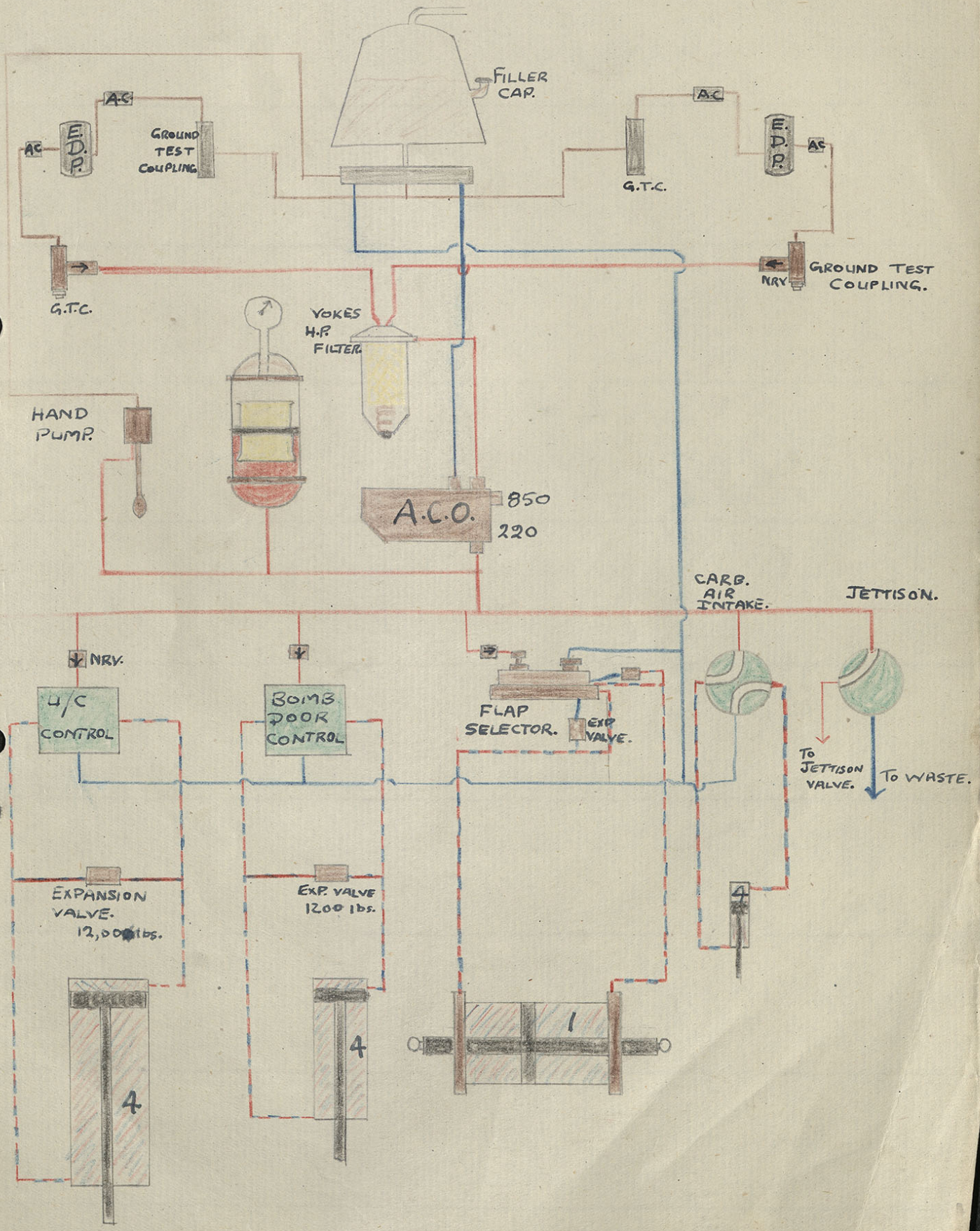
GENERAL.

1/. A 1,000 gallons can be jettisoned.
2/ Any part of this quantity can be jettisoned
3/. Use when ditching crash-landing, etc;

Fuel Jettison.



LANCASTER HYDRAULICS.



HYDRAULICS.

COMPONENTS.

1/ RESERVOIR

On top of the front spar on the port side. A 7 gallon tank (2 gals fluid, 5 gals air space). is filled to the top of the gauze filler in the filler neck with engines off, undercarriage down and bomb-doors down. Fluid used is anti-freezing mineral oil. The system contains 19½ gallons.

2/ DISTRIBUTOR BLOCK.

Directly below the reservoir. Has a slide which is pulled out for pressure test.

3/ GROUND TEST COUPLINGS.

2 in each nacelle on the wooden panels.

4/ AVERY COUPLINGS.

2 on each inboard engine bulkhead.

5/ ENGINE DRIVEN PUMPS.

One driven by each inboard engine. Dowty Spur Gear Type. With approximate delivery of 8 gals a minute each. The shaft shears at 2,500 lbs pressure.

6/ FILTER AND AUTO. CUT-OUT.

Rear Face of the Front Spar, Port side. The filter element is spring loaded to allow the fluid to by-pass if there is an increase of 5-6 lbs □" in pressure due to a dirty filter.

7. Accumulator & Hand Pump.

On the Port side of the fuselage between the front spar and the bulkhead door. The hand pump contains a relief valve set to open just above 850 lbs/□".

8. Thermal Expansion Valves.

(a) Undercarriage circuit: 1 double-acting type fitted just above the jacks in the port nacelle.

(b) Bomb Doors Circuit: 1. double-acting type between the jacks on the rear bomb-bay bulkhead.

(c) Flap Circuit: 2 single acting valves fitted at the flap selector unit.

All these valves open at 1200 lbs per sq. in. pressure.

Functions of Components.

1. Reservoir. Provides a means of storing the fluid to extend unbalanced jacks, allows for expansion of fluid, and compensates for any small leaks.

2. Automatic Cut-Out. Provides a means of unloading the E.D.P's when no hydraulic jacks are moving. When the pressure in the pressure line drops to 220 lbs per sq. in. the A.C.O. cuts-in and allows the pumps to deliver to the selected jacks. When these jacks have reached the end of their travel pressure builds up, the A.C.O. cuts-out and the idling circuit is restored. (850 lbs/□" out, 220 lbs/□" in)

3. Accumulator. This reduces the rate at which pressure builds up or drops.

(a) It prevents hammering of the A.C.O. and (b) shock loads on the E.D.P's during the operation of small jacks.

(b) Supplies the initial flow of oil to start the movement of the large jacks.

(c) Absorbs all shock loads on the system.

TESTING ACCUMULATOR AIR PRESSURE

With engines stopped make a selection to allow the fluid from the accumulator to be discharged into the jacks, gauge reading should then be 220·lbs/□".

UNDERCARRIAGE LOCKS.

DOWN POSITION

1/. Hydraulic lock by the N.R.V. at the selector.

2/. Mechanical lock by latches engaged by the final down movement of the jacks.

3/. Geometric.

UP POSITION.

1/. Hydraulic by the same N.R.V.

2/. Mechanical latches.

UNDERCARRIAGE INDICATORS.

On the port side of pilots panel with a master switch near the ignition switches. A change over switch for a duplicate set of green bulbs is fitted either below the master switch or in the centre of the indicator itself.

UNDERCARRIAGE WARNING LIGHTS. FUSE 13.

1/ Locked up - NO LIGHTS.

2/ UNLOCKED - RED LIGHTS.

3/. LOCKED DOWN - GREEN LIGHTS.

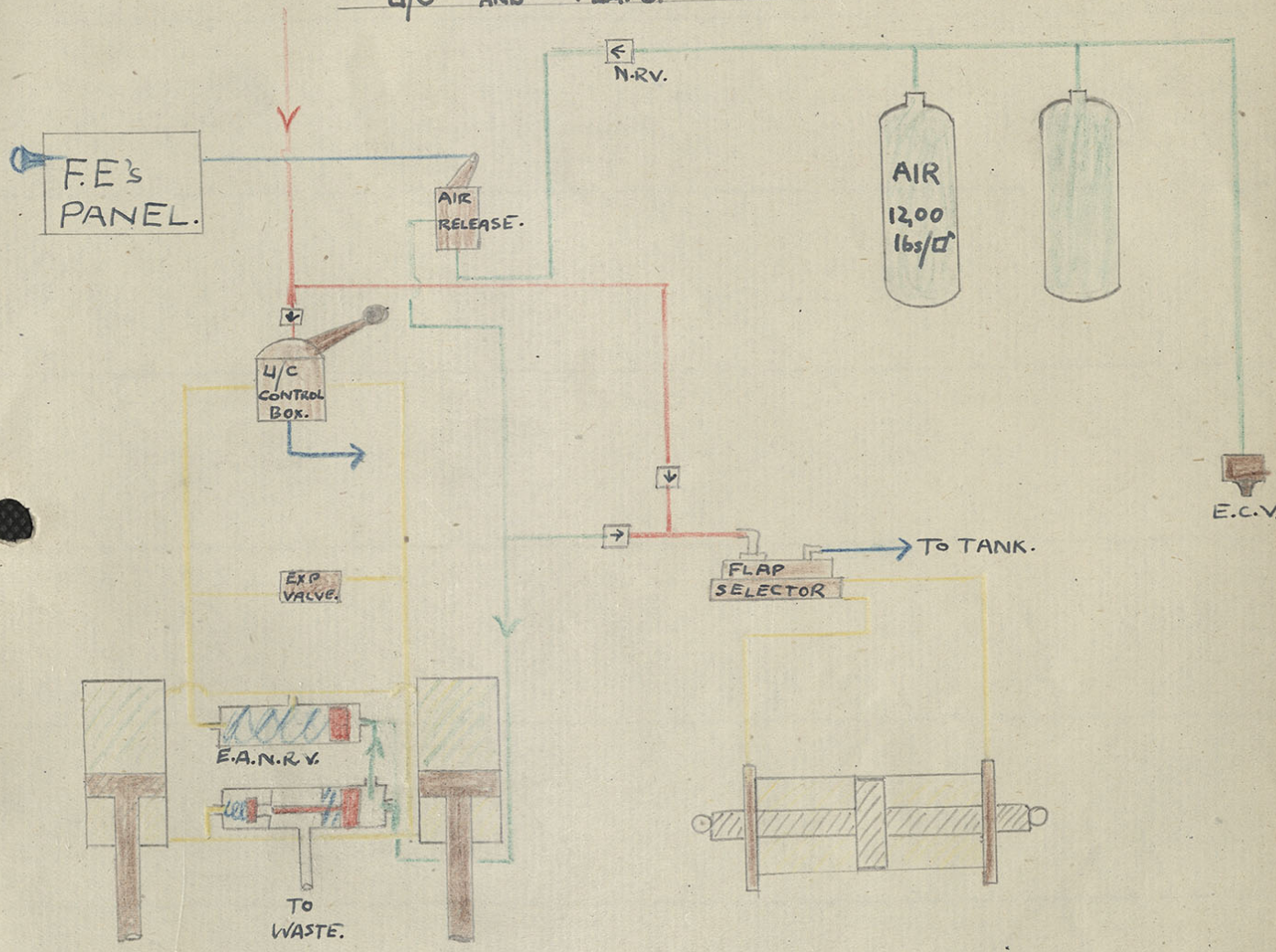
WARNING HORN.

This will sound if either inboard engine is throttled back, to less than a $\frac{1}{3}$ open and the undercarriage is not locked down. A test button and red warning light are fitted on the cockpit rail behind the pilots seat.

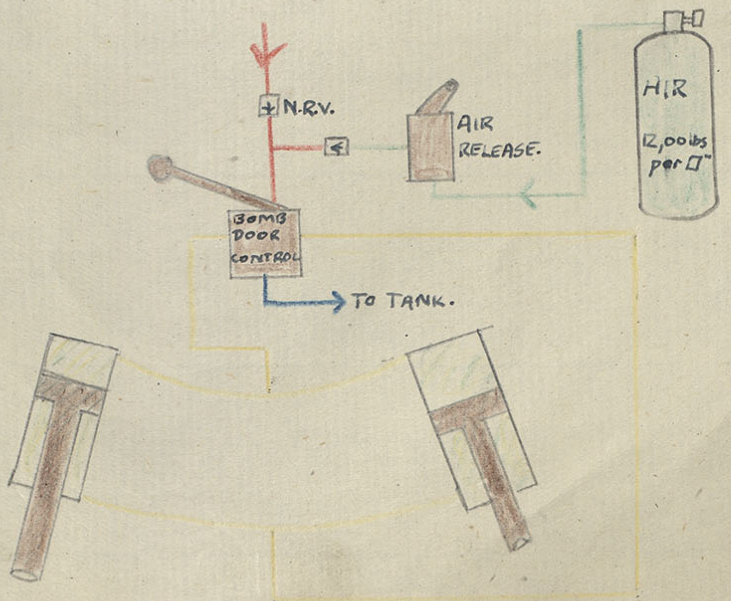
FLAP INDICATOR.

Now fitted bottom centre of the panel together with a master switch.

EMERGENCY LOWERING.
U/C AND FLAPS.



EMERGENCY LOWERING.
BOMB DOORS.



Emergency Lowering.

Position of Components.

1/ E.C.V. - In the roof of the bomb-bay just forward of No 13 bomb-slip*. Between F.798 Port Side.

2/ Bottles. - 2 on the rear face of the front spar. Pressure 12,00 lbs/□"

3/ Air Control Valve. - Stbd. side of fuselage near the front spar. Controlled from a handle just forward of the F.E.'s panel. Hold this handle in position until the undercarriage is down.

4/ Emergency Air Valve & Emerg. Air N.R.V. - Fitted in each nacelle between the u/c. jacks.

Notes on E. Lowering of U/C.

1/ The flap selector must be neutral before releasing the air.

2/ When the u/c. is down operate flaps as required, lowering a few degrees at a time.

3/ The flaps cannot be lowered without lowering the u/c.

4/ The u/c. hydraulic selector need not be down.

5/ After using air avoid making any hydraulic selections.

6/ If the emergency air is released while the a/c is standing on the ground it will be obvious by a drop in pressure and a pool of oil under the vent pipes in each nacelle.

Bomb Door Emergency Lowering.

1. Select bomb doors open and operate emergency air control
2. The doors can be opened and closed by air pressure. (4 to 5 times).
3. Hold the air control open for about 3 seconds
4. Make sure that the supply cock on the air bottle is open before take-off.

Position of Components.

Air Bottle. Front face of the bomb-bay. Port side.
Air Control. B.A's compartment next to anti-icing tank.

Undercarriage Indicator Faults.

Down selection made:-

1. No lights show, this indicates that the undercarriage is still locked up or electrical fault.

Action. 1. Look for change of trim and loss of trim speed.
2. Make a visual check
3. If the u/c appears to be down check No 13 fuse and if the lights are still out make a buzzer test.
4. If the u/c. still remained up check hydraulic pressure (Hand Pump could be tried if time permits)
5. Use emergency air if above tests fail.

2 RED LIGHTS SHOWING.

1/ Indication - neither u/c legs have logked down.

ACTION.

1/ Select up and then down again, to test hydraulic system

2/ If red lights remain on check accumulator pressure

3/ Use emergency air.

3// 1 RED & 1 GREEN LIGHT.

Indicates starboard (port) u/c locked down Port (sbrd.) & unlocked. Most probably a faulty micro switch on the Port side.

ACTION.

1/ Reselect up and then down.

2/ Make a visual check.

3/ If red light still shows try to build up pressure.

4/ Make a buzzer test

5/ Use emergency air.

4// 1 GREEN LIGHT SHOWS.

1/ Indicates 1 green bulb u/s.

ACTION.

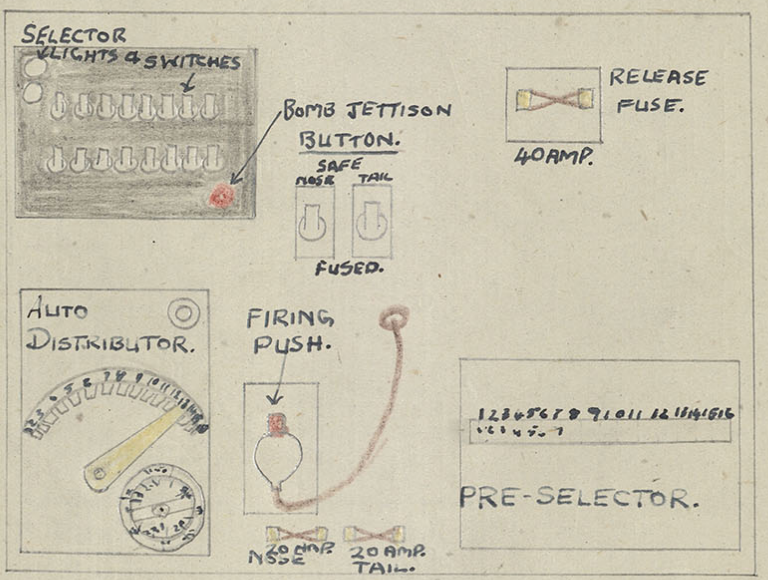
Operate the change-over switch

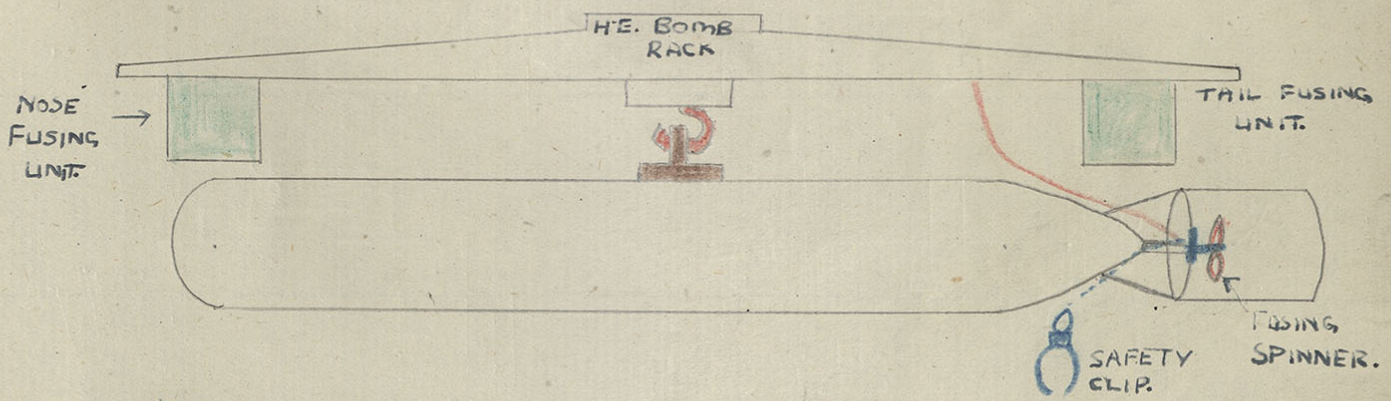
OPERATING TIMES.

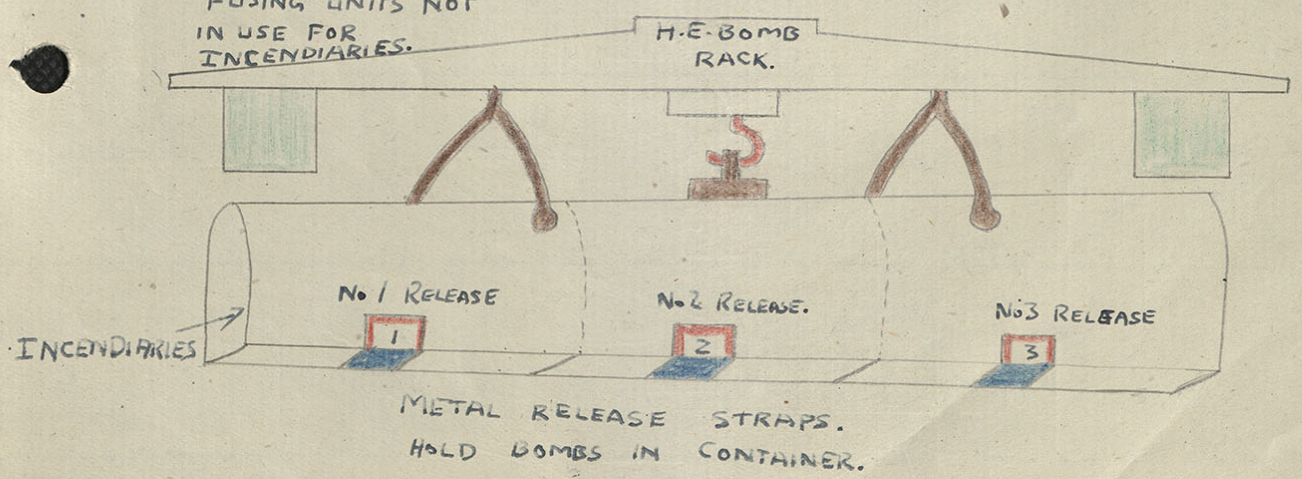
40 secs for normal lowering of the u/c.
During the movement the gauge pressure drops to 220 lbs/□" builds up to about 300-350 lbs/□

and after the undercarriage is fully down builds up to 850 lbs/□" to operate the A.C.O.

B.A. Panel & Releasing Mechanism.

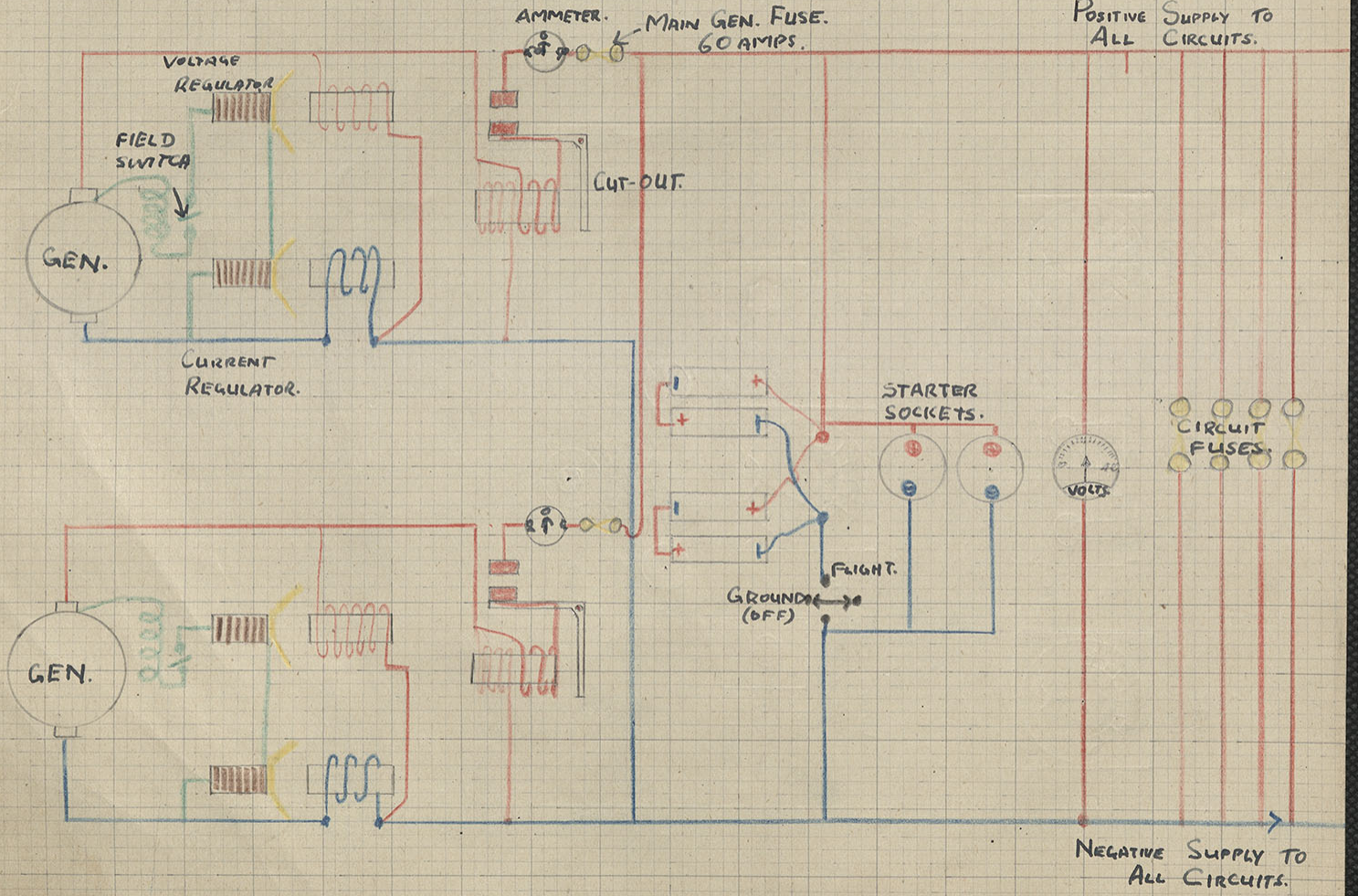


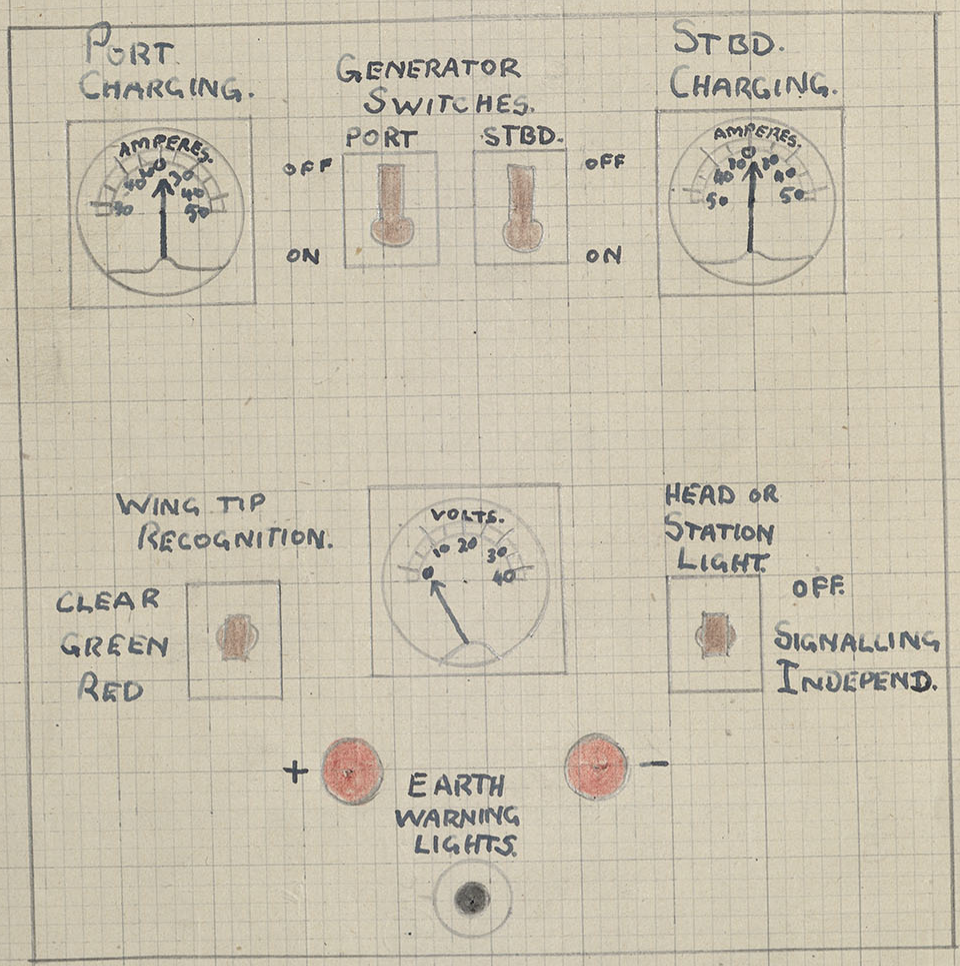




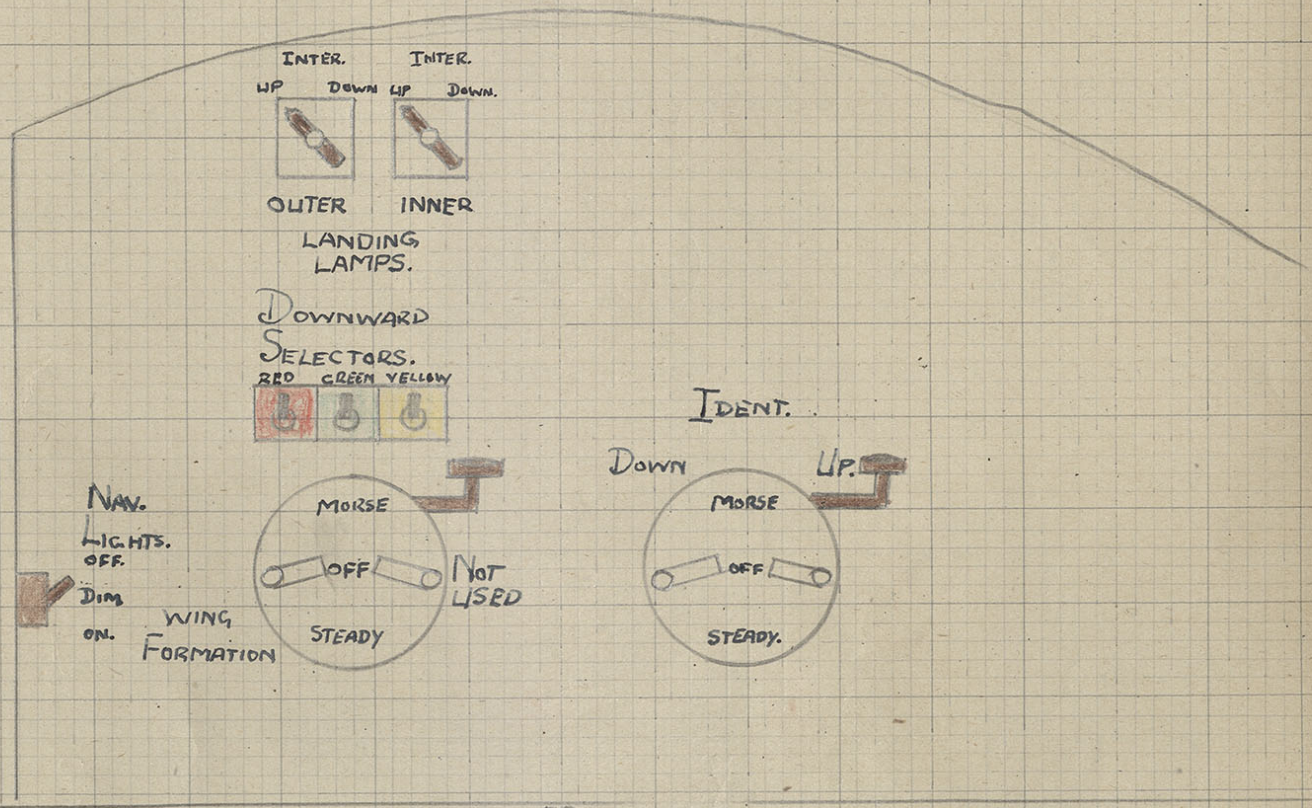
METAL RELEASE STRAPS.
HOLD BOMBS IN CONTAINER.

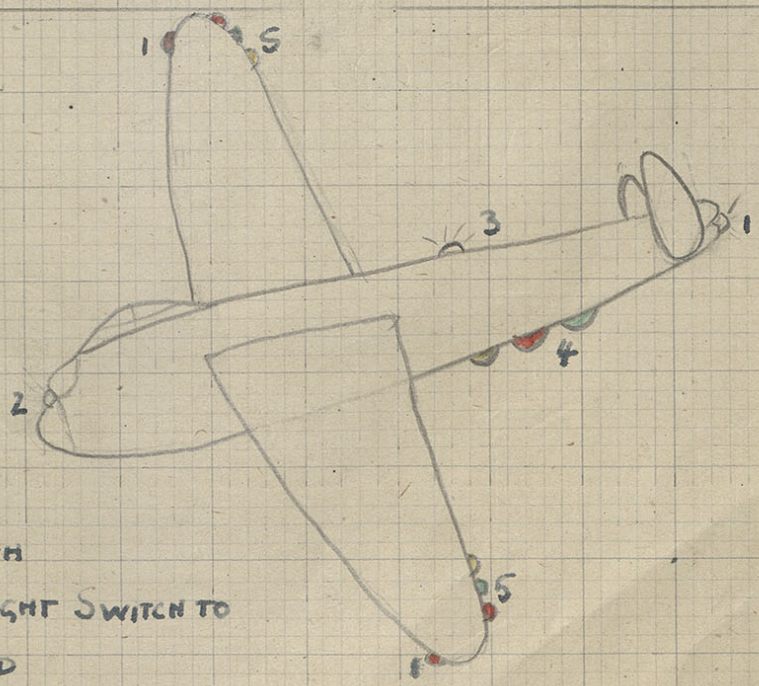
Power Circuit





ELECTRIC SERVICES CONTROL PANEL.





1. NAV. LIGHTS.
2. HEAD "
3. UPWARD IDENT.
4. DOWNWARD "
5. WING FORMATION (RECO)

NOTE:- TO SIGNAL WITH HEAD LIGHT PUT HEADLIGHT SWITCH TO "SIGNAL" AND DOWNWARD IDENT. "MORSE."

Bomb Gear.

Fusing.

H.E. bomb fusing is controlled from the bomb-aimers panel by 2 switches marked, Nose & Tail. Fusing, Safe & Fused.

Incendiaries fuse automatically as they are released from the container and are not controlled from the H.E. fusing switches. When jettisoning incendiaries safe it is necessary to jettison the container.

Safe Jettison of a Mixed Bomb-Load.

1/. Check that doors are open.
2/. Press the container jettison switch. (P. Panel)
3/. Pull the bomb jettison handle " "

Live Jettison of a Mixed Bomb Load.

1/. Doors open.
2/. Select Nose & Tail Fusing Switches to Fused.
3/. Pull bomb-jettison handle.

Mod:- In some aircraft the bomb jettison handle has been replaced by a bomb jettison push button. This does not affect the sequence of jettison.

Releasing a Bomb by Hand.

Bomb releases can be tripped by lifting the trip lever with the aid of a wire hook or in some cases a wooden handle is attached to the trip lever and located under inspection hatch cover. 4,000 lb bombs have a long lever

fitted to the release unit so that by pulling the handle towards the tail the bomb can be released.

RACK JETTISON.

1/ Unlock the 5 pin plug under inspection hatch and disconnect from the socket.
2/ Turn the steadying crutch key-way anti-clockwise.
3/ Lift safety catch then knock back the rack release lever.

GENERATOR & BATTERY CIRCUIT.

BATTERIES.

A capacity of 80 amp hrs. at 24 Volts, is obtained from 4 - 12 Volt 40 a hrs. batteries connected in series parallel. These batteries assist the generators to operate heavy loads and will maintain essential electrical services in the event of generators failing.

BATTERY TEST.

Turn G/F. Switch to FLIGHT.
Switch on a load of 8 amps for 5 mins. (W.T. motor generator.) Check that the voltmeter reading does not fall below 24 Volts for the test. Turn G/F. Switch back to GROUND.

DAMAGED BATTERIES.

One battery becoming damaged will cause the undamaged batteries to discharge into

the one damaged and may also reduce the generator voltage to a low figure. Should this occur during flight; turn the G/F. switch to GROUND, remove all the battery covers, then disconnect the pair where the one is damaged, insulate the disconnected leads, check that the two serviceable accs are in series, return the G/F. switch to FLIGHT.

GROUND & FLIGHT SWITCH.

This switch is the internal battery master switch, being on at flight and off at ground.

The switch should always be in the GROUND position when A/C is on the ground, especially when using the trolley acc for starting engines, After engines have been started the switch must be turned to FLIGHT. so that A/C circuits can be supplied from internal batteries. The effect of having the switch at FLIGHT with the trolley acc. in use, would be to discharge the batteries into the trolley accs. In some cases the discharge might cause the A/C. wiring to burn out.

If the switch is turned to GROUND whilst airborne the circuits operated from the generators are not affected, unless heavy loads are required in which case the gen. voltage would be reduced to such a low value that circuits may cease to operate.

GENERATORS.

All the a/c. circuits are supplied from 2-29 V. 60 amp. generators connected in parallel. The total output obtained are 29 V. 120 amps. As engine speed reaches 14-1600 R.P.M. the gen. voltage will rise to 27 V. this causes the automatic cut-outs to close which couples the gen. to the battery circuits. the cut-outs remain closed during flight, but will open if the gen. voltage falls below the battery voltage. This prevents the batteries from discharging back through the generators. At approximately 1600-1800 R.P.M. the gen. voltage will have increased to 29 V. this causes the carbon pile voltage regulators to come into operation, maintaining the voltage at 29 v. with any further increase in Revs.

A current regulator is included in the Voltage Regulator unit, to prevent the load on any one gen. from exceeding 60 amps. (2 generators 120 amps) The action of this regulator is to reduce the gen. voltage to that of the batteries; when heavy loads are in use, this enables the batteries to assist the generators.

INDICATORS.

With the G/F switch at FLIGHT and gens, not cut in the two ammeters read 0 (Zero) and the voltmeter 24-26 Volts.

With G/F switch at FLIGHT and Gens. cut in both ammeters read charge and voltmeter rises to 29V. maximum.

INDICATIONS OF FAULTS.

1. Voltmeter reading LOW.
One ammeter showing CHARGE, the other showing discharge.

This fault is caused by a U/S gen. where the cut-out has failed to open.

REMEDY.

Remove main fuse of circuit showing discharge.

2. Voltmeter reading over 29V.
One ammeter at charge; the other at discharge
This is due to a faulty voltage regulator

REMEDY.

Remove main fuse of circuit showing charge and switch off the gen. field switch

3. An Ammeter reading 0 (Zero). is usually caused by a blown fuse, but could be due to faulty generator.

NOTE:- The voltmeter reading should remain at 29 Volts during flight, if a low reading is noted (24 Volts) this indicates that batteries are assisting gens. and should be prevented as far as possible by switching off any unnecessary circuits.

INSTRUMENTS

MK. XIV ALTIMETER:

Consists of 3 exhausted capsules all connected to which is fixed a system of linkage, to 3 pointers which due to gearing read as follows:-

Short Needle - 10,000'
Intermediate " - 1,000' RANGE -1000 to 35,000'
Long " - 100'

The capsules are in a sealed case which is connected to the static vent. It is calibrated from a pressure of 1013 millibars. If pressure at sea level increases the pointers can show a reading up to -1,000'.

1 millibar = 30'

Millibar scale is set everyday to pressure of the day, when this is done the altimeter should read Zero! Should the glass be broken the altimeter will read high, due to the pressure in the aircraft being less than atmospheric.

A tolerance of ±50' is allowed

Obtain the pressure of the day from the Met. Office If when the pressure is set on the subsidiary scale, the reading is not in the ±50' tolerance it is due to fatiguing of the capsules and should be put U/S.

PROCEDURE FROM TAKE-OFF TO LANDING.

1. Obtain 2 pressures:
   (a) The pressure at base.
   (b) " " " sea level.
2. While flying over this country the subsidiary scale should be set to (a).
3. When the coast line is reached re-set the scale to (b).
4. Before landing wireless Q.F.E. for the new barometric pressure.

AIR SPEED INDICATOR.

Pitot head tube which transmits impact and static pressure to the inside of a single capsule. Outside of the capsule is connected to the static vent. All is enclosed in the instrument case, therefore only impact pressure is registered, it is transfered from the capsule to the indicator by means of rotating shaft, quadrant and pinion and registers on indicator the airspeed in M.P.H.

The Pitot Head is electrically heated and is controlled by a switch which is on the F.E's panel.

This switch must be put on just prior to take-off, and off when landing. Never have the switch on for more than 5 mins when a/c is on the ground.

Range is from 0 - 320 m.p.h.

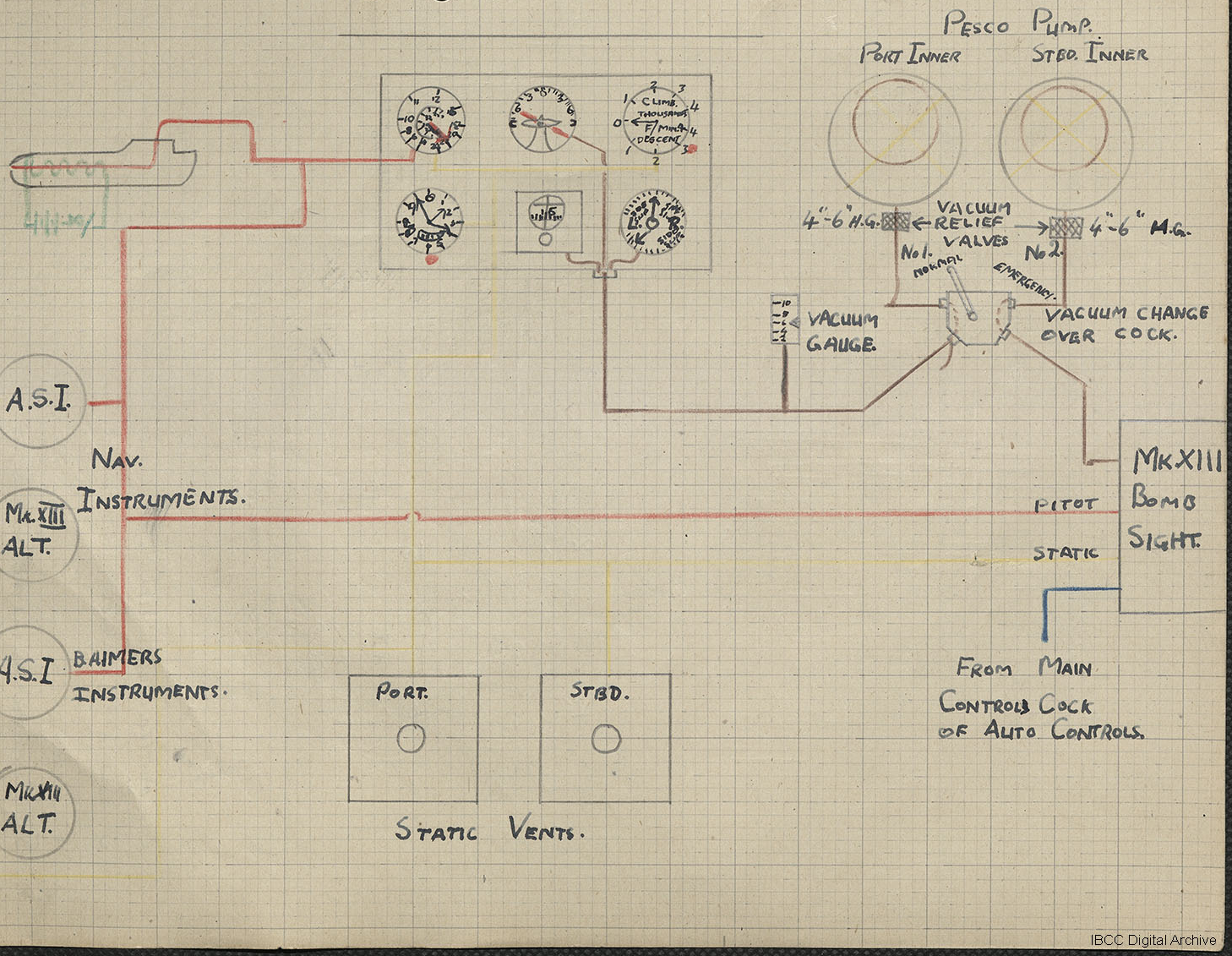
Rate of Climb or Descent Indicator.

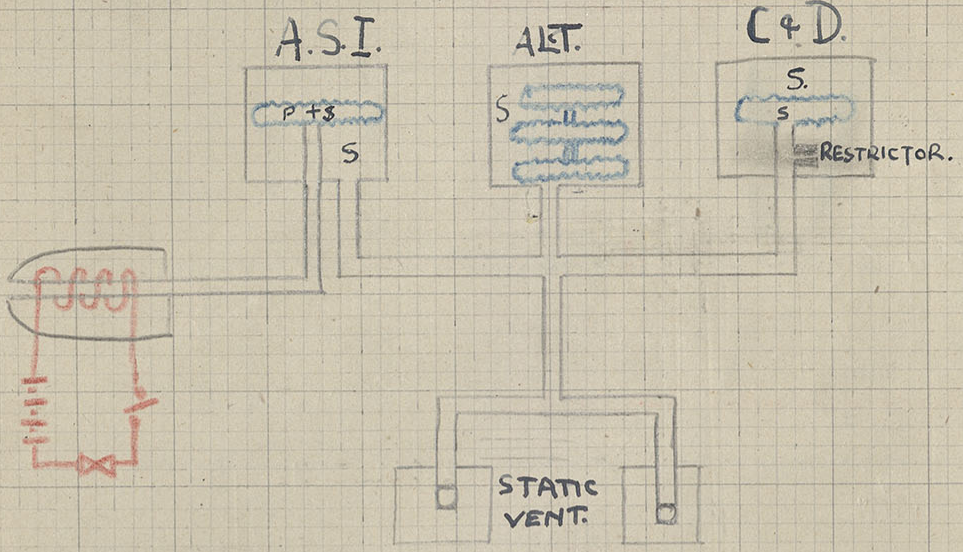
Capsule and mechanism is enclosed in an air tight case, and the capsule is connected to the Static Vent by a calibrated pipe. From this pipe inside the case is taken a lead which has a calibrated restriction. Thus when a/c. is diving, pressure in the capsule becomes greater than the pressure outside due to the restriction, thus a Rate of Descent in Ft./min is registered on the indicator. When the a/c. is climbing, the pressure outside the capsule becomes the greatest, as the air cannot escape very quickly through the restriction, whereas the air escapes immediately from the inside, and a Rate of Climb in Ft/min is registered. The reading given indicates the vertical ascent or descent of the aircraft.

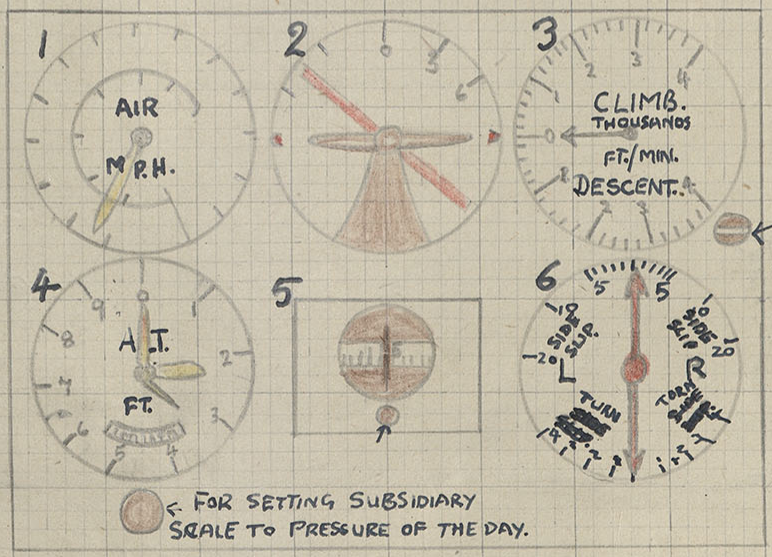
Faults.

If the glass is broken instrument is U/S. Should a small reading be observed whilst a/c. is on the ground it will be due to fatiguing of the capsule.

Adjustement of ±1 small division is allowed. (±200') and can be made on a small screw at the right side of the indicator.







· ∓200' ONLY FROM 0.
ie. ONE MARK ABOVE OR BELOW ZERO.

* 1 : A.S.I.
* 2 : Artificial Horizon.
* 3 : Climb & Descent Indicator.
* 4 : Altimeter.
* 5 : Directional Gyro.
* 6 : Turn & Bank Indicator

* Air Operated.
* Gyroscopic.

Gyroscopic Instruments

1. The gyroscope remains perfectly stationary relative to any one position.
2. If a torque is applied to one ring the other ring is precessed.

Directional Indicator.

Consists of an airtight case, containing a rotor with air buckets around the circumference. An inner and an outer ring.

A Pesco Vacuum Pump draws air from the case at the rate of 4-6 ins of mercury per min. This causes a partial vacuum in the case, and air is drawn in through a filter to a jet which is directed onto the rotor air buckets. This jet drives the rotor at 10,000 R.P.M. it taking about 5 mins for the rotor to gain top speed. At this speed centrifugal force acts upon the rotor and keeps it perfectly stationary.

A cage knob is fitted which when pushed in, by means of a cage arm locks the rotor upright, and a pinion engages into a toothed ring to lock the compass chart. Turn the knob to set chart as required.

When starting always have the button pushed in, until the engine has run for 5 min. After 5 mins. knob can be pulled out and rotor will remain stationary due to centrifugal force.

BLIND TAKE-OFF

Set indicator with knob to Zero.
Pull out the knob.
By keeping Zero in centre of instrument a straight take-off will be made.

WHEN IN FLIGHT

Set the compass chart with the caging knob, to read the same as the magnetic compass.
Re-set every 15 minutes as by that time error of 2-3 mins. will have crept in.

BLIND LANDING.

Set indicator with knob to Zero.
Pull out knob.
By keeping Zero in centre of instrument a good straight landing will be made.

Turns are always made on the directional indicator, as magnetic compass reads incorrect on turns, due to.

1. Liquid Swirl.
2. Centrifugal Force.
3. Acceleration Force.

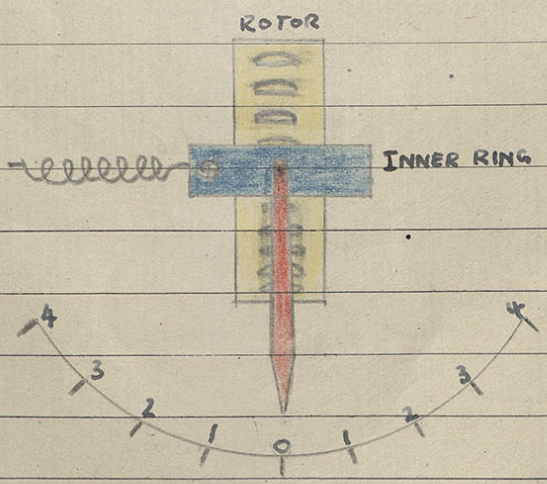
Turn and Bank Indicator.

Consists of air tight case, rotor and inner ring, the casing itself acting as an outer ring. It controls the lower pointer which indicates the rate of turn of the aircraft. The movement of the a/c. applies torque to the instrument casing (outer ring) which precesses the inner ring, so causing the rate of turn to be indicated.

There are 4 rates of turn:-

1. 170°/min.
2. 360°/min.
3. 660°/min.
4. 1080°/min.

The movement of the inner ring is controlled by a spring. Inner ring is pivoted at front and rear of the instrument.



The top pointer is connected to a pendulum, and registers the degrees of over or under bank of a turn.

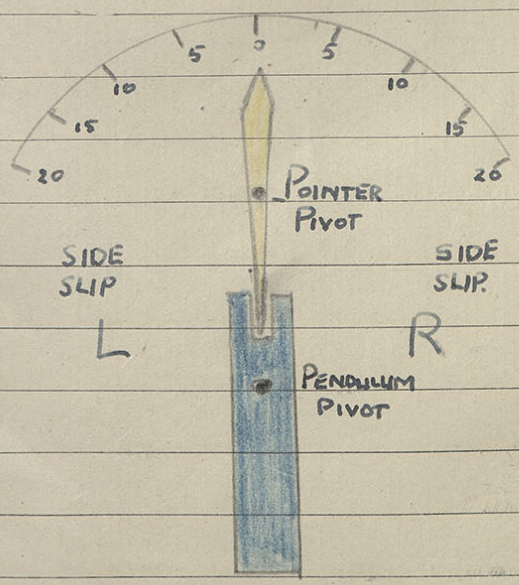
When both pointers are on left of dial, it indicates overbanking on left turn.

When top pointer is over to the right and bottom pointer to the left, it indicates underbanking on right turn.

Therefore, if both pointers were to right it shows overbanking on right turn.

When top pointer is to left and bottom to right it indicates underbanking on right turn.

The top pointer is not controlled gyroscopically but merely by action of the pendulum. Bottom of pendulum and top of pointer are always in the same direction.



Artificial Horizon

Rotor is enclosed in Inner Ring, which is pivoted in sides of outer ring. The outer ring is pivoted Fore and Aft.

Air to drive gyroscope comes in the Filter at the rear, through the outer ring, through the inner ring pivot and passes round inner ring slots and via jets to drive the rotor. Air comes out through 4 bisected slots to Pesco Pump. When Gyroscope is erect air comes out of each hole equally, but if not erect air comes out unequally and so applies a torque to ring, in opposition to centrifugal force on Pendulous Vanes. So correcting rotor for centrifugal forces.

The Pendulous Vanes are fitted over the bisected slots to keep the air outlet equal and so keep the gyro rotor upright.

Plane above horizon - climbing.
" below " - diving
Port w/plane above " - Port wing high
" " below - - - - low

In turns the Pendulous Vanes cause a slight incorrect reading due to centrifugal force.

Auto Controls.

Position of Components.

R.A.E. Compressor:- Rear of "B" Bank Port Inner.

Oil Cooler: Rear of "A" bank Port Inner.

Oil Reservoir & Separator: Auxiliary Panel Port Inner.

Chemical Air Drier. - Along Port side navigators table.

Test Cock: Just behind Pilot Port Side.

Main Control Cock: Clutch Lever, Main Switch Attitude Control All on Port side of Pilot.

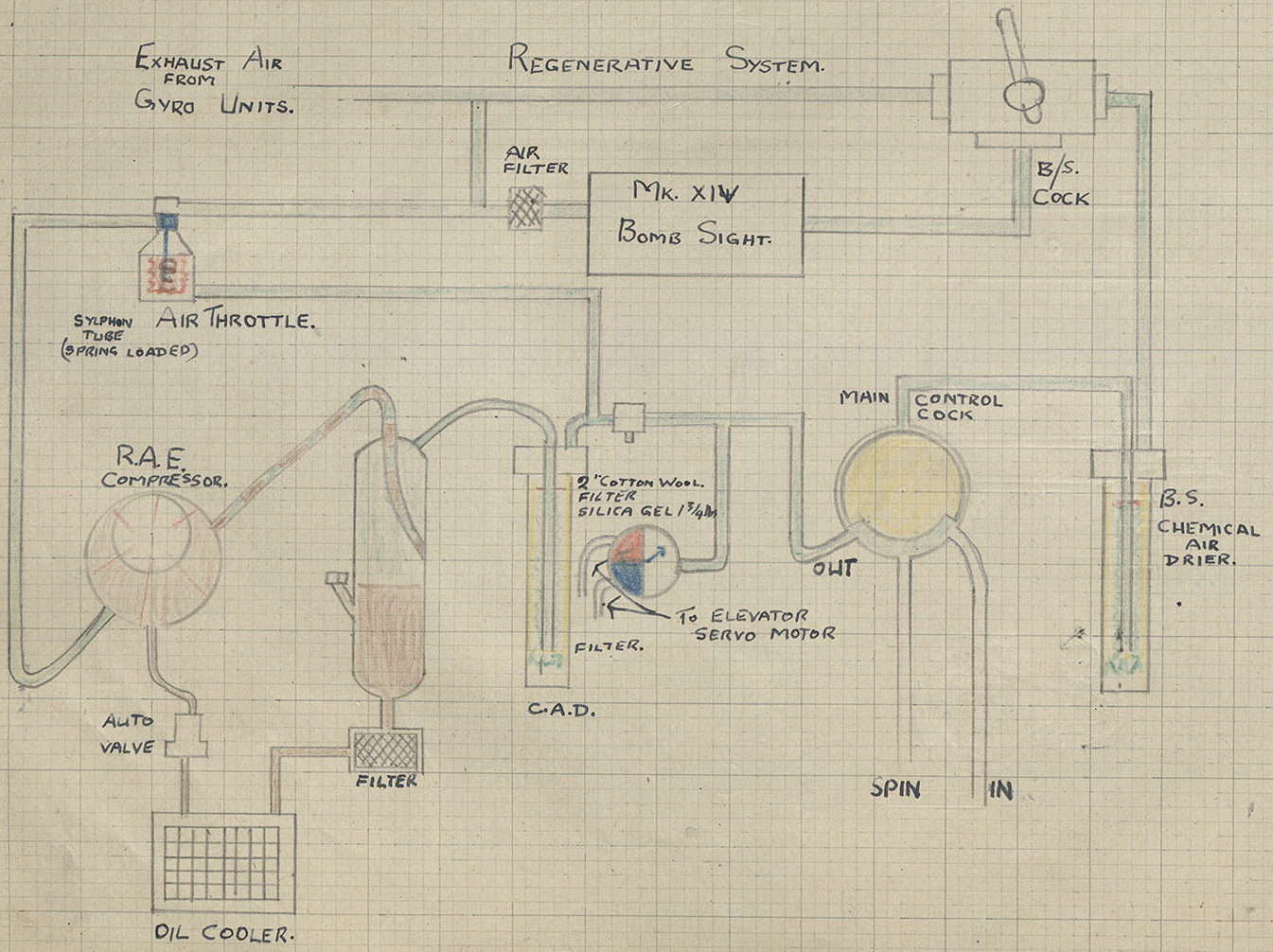
Steering Lever. On Pilots panel in front of control column.

Steering Control, Rudder & Elevator Plate, Aileron Plate; Turn Regulator Port Side Bomb Aimers Position

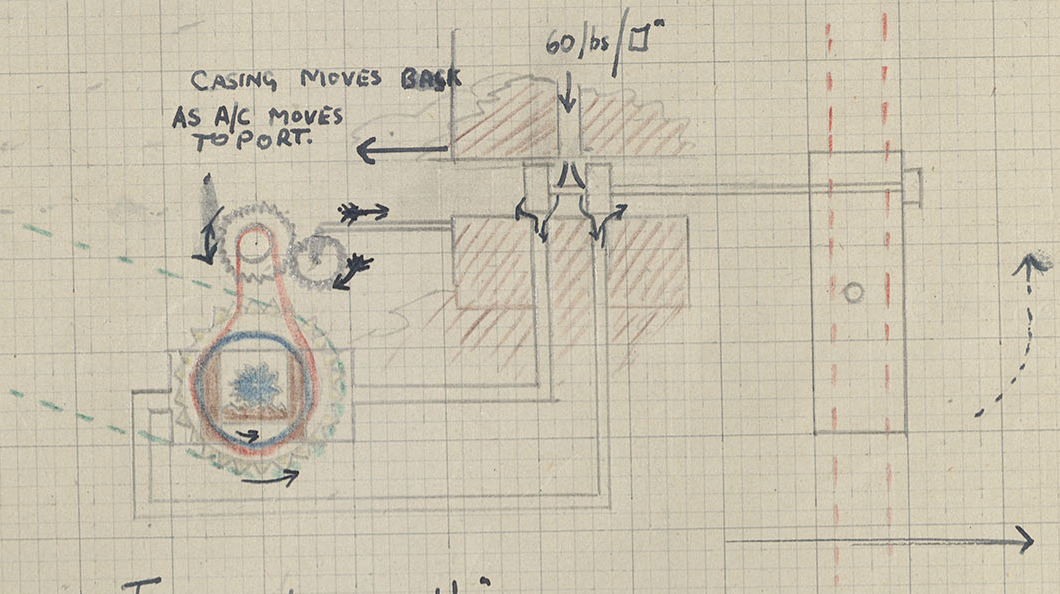
3 Servo Motors:- In front of Pilot.

Air Throttle - Port side of Bomb-Aimers Position.

Diagramatic Lay-out of Mk. IV Auto Controls.



Layout of Auto Control. (Rudder)



Inlet Lap - 1½" thou.
Exhaust " - 1½ "

Daily Inspections.

1. Put the clutch lever in, and move the controls in all directions to make certain clutches are engaged.
2. Check the oil level in the oil reservoir and separator.
3. Check the silica gel in the C.A.D. This is changed every 10 engine hrs. or every operational trip (white to brown or blue to pink.)
4. Start Port Inner Engine and put M.C.C. to spin.
5. Check air pressure. (60 lbs/□")
6. See that unit covers are secure.
7. See that attitude control is at zero. Steering lever is at central, and main switch off.
8. Centralise the controls and put the M.C.C. to the in position. Control column will now move forward. Check that all controls are locked. (Check in clutches.)
9. M.C.C. out.

Before Take-Off.

1. Clutches in
2. M.C.C. out.

In the Air.

1. Put M.C.C. to spin for 5 minutes.
2. Climb to 2,000 ft or above and level out.
3. See that attitude control is at zero, steering

lever central and main switch off.

Trim aircraft to fly hands and feet off.

5. Put M.C.C. in.

6. To climb or dive operate attitude control.

7. To turn operate steering lever after putting main switch on. After turn centralize lever and switch off.

8. If combined air pressure gauge is reading tail or nose heavy, put the M.C.C. to spin retrim the a/c. and put it back in again.

9. To take evasive action put M.C.C. to spin or out.

BEFORE LANDING.

1. Put M.C.C. out.

2. Clutches out.

N.B. Clutches are only withdrawn prior to landing and in cases of emergency. e.g. damaged servo motors.

DISTANT READING COMPASS.

For Take off, Landing and Taxying the main switch must be on, and the normal setting switch setting. After 5 mins the normal setting switch can be placed to normal.

N.B. The main switch is not to be put on until after the engines have been started.

AIRFRAMES 3RD WEEK.

FLIGHT ENGINEERS PRE-FLIGHT CHECKS.

EXTERNAL CHECKS.

1/ General aspect of aircraft (ie:- oleo leg 4-7 inches extension).
2/ Chocks under wheels.
3/ Check tyres for pressure, cuts, oil soakage and especially creep, brake leads,
4/ Jury struts removed
5/ Check for coolant leaks and any leakage from emergency air valve, oleo legs and u/c. jacks.
6/ Inspect u/c. latch locks for cleanliness and u/c members generally for damage. Check Props.
7/ See that covers are removed from the cable cutters and pitot head. (Fuel Jettison Flap).
8/ Check the hinged leading edge for security also all cowlings and panels.
9/ General check for damage to m/planes, ailerons, etc, paying particular attention to attachment screws of panels under fuel tanks.
10/ Examine fuselage for damage.
11/ Remove static vent plugs.
12/ Check external first aid and dinghy releases.
13/ General check for damage to fins, rudder, elevators and tailplane.
14/ Inspect mainwheel and tailwheel and oleo leg. (4" approx.)
15/ Check that cock on emergency air for bomb doors is open.

INTERNAL CHECKS.

(axe inside turret)

1/. Remove bobbin from rear turret cut-off valve.
2/. Check portable oxygen bottle and fire. (Release ext.) extinguisher at rear of draught proof doors.
3/. See that fuel and oil dipsticks, first aid kit and axe are correctly stowed.
4/. Check oxygen bottle and fire ext. on stbd side near mid upper gunner.
5/. Remove bobbin from mid-upper turret cut-off valve.

Check All loose equipment.

1 6/. Security of bomb-slip covers.
2 7/. Check pyrotechnics for security. (flame floats etc.)
3 8/. Check security of rear ditching exit.
4 9/. See that oxygen bottle, control locking gear and
5 axe are correctly stowed
5 10/. Check: w/op portable oxygen bottle, and fire ext. on starboard side near front spar.
6 11/. Check pressure of nitrogen system. (1800 ±200)
7 12/. Check mid-ditching exit.
8 13/. Turn on oxygen supply cock.
9 14/. Turn G/E switch to FLIGHT.
10 15/. Check emergency air pressure. 1200. Normal. 800 minimum
11 16/. Check that accumulators are connected properly.
12 17/. Check initial pressure of hydraulic accumulator. 220
13 18/. Check level of fluid in hydraulic reservoir.
14 19/. See that balance cock FRONT SPAR is off, checking
1 first of all for operation.

1520. See that all negative switches are on.

1621. Check oxygen bottle and fire extinguisher at navigators position. Cabin Heating OFF.

1722. Test operation of u/c. horn.

1823. Check Pilots oxygen bottle, fire ext, and axe.

1924. Test operation of brakes and pneumatic auxillaries.

2025. Check controls and trimmers for full, free, and instinctive movement. Auto-Control Clutches IN.

2126. Check forward ditching exit.

2227. Check fuel contents, and test booster pumps by ammeter, leaving fuel contents switch on. Pressure Test on Booster Pumps.

~~25~~ 27.

2328. Check security of bomb-aimers parachute exit.

2429. Check oxygen bottle and fire ext. and remove bobbin from front turret.

2530. Check de-icing tank.

STARTING PROCEDURE.

B. - Brake Pressure. 150 lbs/□" minimum.
I. - I.C.O.'s to I.C.O. position.
G. - G/F switch to GROUND.
B. - Boost Cut-Out Lever U.P.
U. - Undercarriage and Flaps indicators ON.
S. - Supercharger "M." Gear.
T. - Throttles 3/4" OPEN.
U. - Undercarriage lever locked DOWN. Bomb Doors CLOSED. Flaps NEUTRAL.
P - Props. MAX. R.P.M.
A. - Air Intakes COLD. Fuel Jettison NORMAL.
M. - Master Fuel Cocks "OFF"
P. - Pumps on No 2 tanks. Select No 2.
S. - Select Master Cock for engine to be started.
I. - Ignition Booster Coil "ON."
P. - Prime Engine.
S. - Starter Button "PRESSED."
I - I.C.O. to engine "RUNNING." (Back to I.C.O. if engine fails to pick up.)

I.C.O = IDLE CUT OFF

AFTER STARTING.

1. G/F Switch to FLIGHT.
2. Booster Coil OFF"
3. Check engine pressures and temperatures.
4. Test operation of flaps and bomb-doors.
5. Check change-over Vacuum Pump. Cock.
6. Carry out Running-Up Checks.

BEFORE TAXYING.

D. - D.R. Compass ON and to SETTING.
U. - Undercarriage Lights Change-Over switch - check for correct functioning.
M. - Mixer box to I/C position
B. - Brake Pressure 150 lbs/□" minimum.
B - Bomb Doors Closed
O - Oxygen checked with rest of the crew.
A - Altimeter set allowing no lag.
T. - T.R. 1196. Ground Test.
M. - Magneto switches locked on.
A. - Auto Controls main switch OFF.
N. - Navigation Lights as required.

DRILL OF VITAL ACTIONS.

A. - Auto Control Clutch IN.
A. - Auto Controls OUT.
A - Air intakes COLD.
F. - Friction nut tight.
F. - Flaps 15° Light 25° Heavy.
F. - Fuel No2 tanks, All main Boosters Pumps ON Master Cocks ON
S - Supercharger "M" Gear.
T - Trimmers set by Pilot.
R. - Radiator Flaps, outboard OPEN. inboard AUTO.
B. - Boost Cut-Out Lever as required.
P - Pitot Head Heaters ON.
P. - Pneumatic Pressure 150 lbs/□"
P. - Props maximum R.P.M.

IMMEDIATELY BEFORE TAKE-OFF

F. - Final Check on engine temperatures & pressures.
A. - All unnecessary lights OFF.
D. - Directional Gyro set to Zero and uncaged.
E. - Engines Cleared

PYROTECHNICS.

RECOGNITION OF PHOTO-FLASH.

Cylindrical in shape, body painted black, tail fins painted red, half inch red band around nose, and the word flash in white.

PURPOSE.

Illumination of target for the purpose of night photography.

SETTING & LAUNCHING.

No. 848 fuse screws into the nose, and the applicable delay capsule is inserted.

Place photo-flash in flare-chute tail first and suspended by means of a lug provided Attach static line to arming vane cover

Remove safety pin.

Launch by tripping release mechanism, either electrically or manually

PRECAUTIONS.

1. Ensure that the necessary capsule is in position.
2. If photoflash is not used replace safety pin.
3. Disconnect static line.

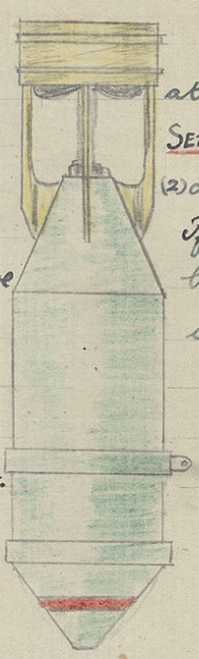
Recognition of Pyrotechnics.

Purpose is for navigational use by night at sea, air sea rescue, emergency flare path for ditching.

Setting & Launching: (1) Pierce tail sealing disc with punch & remove Punch (2) Remove safety pin & protecting nose cap. (3). Launch tail first.

Flame Float must be launched if Tail Sealing Disc is Pierced. Lasts 6 mins.

Flame Float. Mk. II

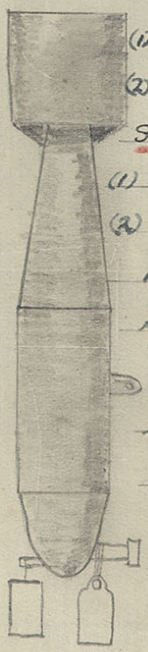


Purpose. (1) Navigational aid by day at sea (2) Air Sea Rescue Work.

Setting & Launching:- (1) Remove Safety Pin. (2) Launch tail first.

If it is not used the pin can be replaced and the float is safe. Lasts for 6 mins.

Smoke Float. Mk V



(1) Used to Mark Positions at Sea.
(2) To Provide Target for Bombing at Sea.

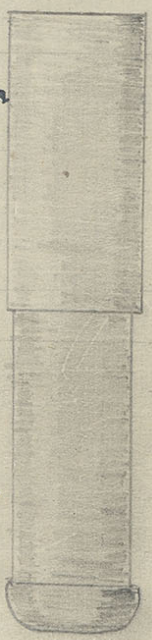
Setting & Launching.

(1) Remove transit pin.
(2) Launch tail first.

Pin can be replaced if not used.

Bursts on impact with sea and spreads over the sea a layer of aliminium.

Sea Marker (Aliminium) Mk III



Cylindrical in shape and telescopic, extend fully and launch Nose first. On impact it is contracted and a set of knives at the top cut through a bag containing aliminium and spreads it over the sea.

Sea Marker. (Aliminium. Mk X.)

RECO-FLARE.

Similar in shape and size to photo flash. Painted black with half-inch red band round nose. Fins do not protrude.

PURPOSE.

For the illumination of an area for the purpose of identification at night.

Launched the same way as photo flash. Fuse 42 used for reco flare.

SIGNAL CARTRIDGES.

1. SINGLE STAR - ONE COLOUR.

COLOURS USED:- Red (7 secs) Green (7 secs).
Ruby (8 secs) Yellow (8 secs).

NOTE: As the red cartridge is used for a distress signal, it's rimmed base is milled to enable it to be easily distinguished in the dark.

2. SINGLE STAR - CHANGING COLOUR.

Combinations - ~~Green~~ Yellow - Green: (5 and 4 seconds).
White - Green; (3 and 8 secs).

Colours are also printed on base.

3. DOUBLE STAR:

COMBINATIONS: Green - Green: Green - Red: Red - Red:
Yellow - Red: Yellow - Yellow: Green - Yellow.

Illumination Cartridge.

This is used chiefly as a preliminary to the reco. flare in order to obtain a glimpse of the country over which the a/c. is flying. It is longer than the signal cartridge and burns for approx. 10 secs.

Note:- The cartridge should not be fired at heights of less than 2,500 ft over friendly territory unless in emergency, as it is liable to set fire to objects on the ground.

Brown & White Smoke Puffs:

Are mainly used by met. sections in order to ascertain the speed and direction of the wind. Identified by 4 Coloured Serpentine Symbol, painted on the side of the cartridge and the usual label on the top.

Travelling. Form 700A.

Aircraft.			Aero Engines.		
Type.	Mark.	No.	Type.	Mark.	No.
Lancaster	Mk. III	L 2714	Merlin	Mk. XXXVIII	
			"	"	"
			"	"	"
			"	"	"

Fuel Octane 100
Oil D.T.D. 472/B
Coolant 70/30

Periodicity of Minor Inspection 40 hrs. Type of Next Inspection Due 40X

Flying Hrs. Progress to Next Inspection.

Daily Inspection Certificate.

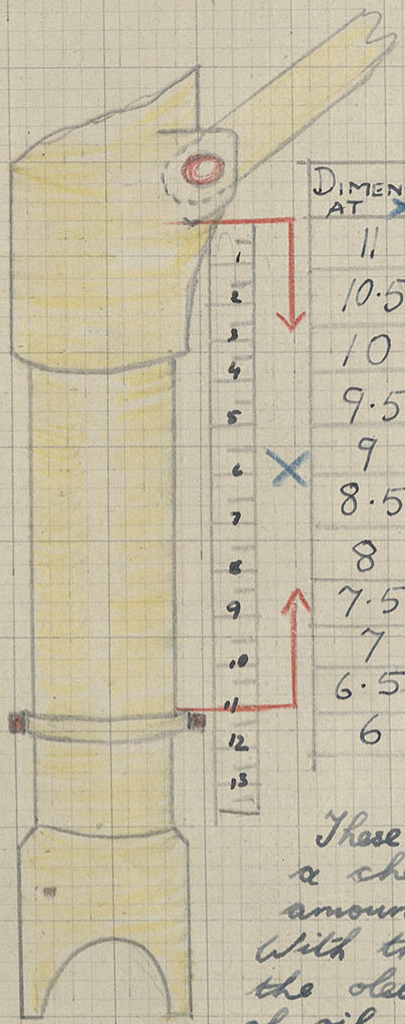
Date	Signatures of Tradesmen.										Time Insp. Complete	Signature of N.C.O. i/c
	Airframe	Aero Engine P.I.	Aero Eng. P.O.	Aero Eng. S.I.	Aero Eng. S.O.	Inst.	Elec. Equipment	Wireless Equipment	Radar Equipment	Armament "B"	Armament "G"	
25/7/44	F/E.	F/E.	F/E	F/E	F/E.	F/E.	W/OP	W/OP	NAV.	BOMB.	A/Gs.	14.00	F. Eng.

Flying Times.

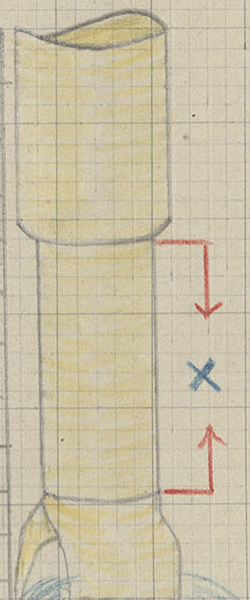
Date.	Up.	Down	In Air		Fuel put in A/C. Gals.	Total Fuel in A/C.	Oil put in A/C. Gals.	Total Oil in A/C.	Coolant State.	Signature of Airman. Responsible.	Sig. of Pilot.
			Hours	Mins.							
27/7/44	1500.	1600	1.	0	150.	150.			Full.	F/Eng	Pilot.

Fuel, Oil, and Coolant Certificate.

Oleo Struts.



Dimensions at X	Air Pressures Max.	Min.
11	1020	820
10·5	1080	870
10	1130	910
9·5	1200	960
9	1280	1020
8·5	1370	1090
8	1480	1180
7·5	1600	1280
7	1740	1390
6·5	1900	1520
6	2100	1680



These tables are to give a check against the amount of oil in oleo leg. With the weight of a/c on the oleo correct amount of oil will give a range of air pressure and an extension of oleo in inches.

Dimensions at X	Min.	Max.
4·92	650	700
4·5	690	745
4·0	750	810
3·5	820	885
3·0	905	975
2·5	1005	1080
2·0	1130	1220
1·5	1295	1395
1·0	1515	1625
·5	1830	1970
·32	1970	2120

U/C Oleos Fully Extended - 995 lb/□"

Tail " " " - 650 " "

a/c Jacked Up.

Table of Pressures.

Auto-Cut-Out	750 - 850	lbs □"
Cuts in	220	" "
Pneumatic	270 - 320	" "
Relief Valve	20% of above.	" "
Nitrogen:	1800 ± 200	" "
Oxygen	1800	" "
Main Tyres:	43	" "
Tail Tyre	34	" "
Main Oleos.	995	" " } a/c jacked up.
Tail Oleo	650	" " } a/c jacked up.
Emergency Air:	1200	" "
Expansion Valves:	1200	" "

Checking Oil Level in Oleo Legs.

1. Allow leg to support aircraft.
2. Attach Turner Adaptor to inflation valve.
3. Operate the adaptor to release air pressure and allow unit to compress fully.

If at the final stage of compression a spray of oil and air is blown off the oil level is correct.

If only oil is blown off it means there is to much oil in.

If only ~~air~~ is blown off there is too little oil.

Filling Oleo Leg with Oil.

1. Jack up aircraft
2. Connect 2 way pump to inflation valve.
3. Pump in oil until pressure gauge reads a rapid rise in pressure, not exceeding 2,325 lbs/□" main oleos, 1,200 lbs/□" on the tail oleo unit.
4. Allow unit to support aircraft.
5. Release Pressure Gradually.
6. Allowing struts to compress fully, to remove surplus oil.

Final Check.

Pump in 50 lbs/□" air pressure,
Allow legs to compress, an air an oil mist should blow out.

Jack up a/c. and pump in 995 lbs/□" air press. for main leg, 650 lbs/□" tail oleo.

N.B.

Always remove dust cap before commencing
" REPLACE " " after completion.

IDENIFICATION OF PIPELINES.

HYDRAULICS - White.

Undercarriage - Red with white background.

Hot & Cold Air Intake - Brown " " "

Bomb Doors Yellow " " "

Flaps Green " " "

Fuel Jettison Black " " "

Emergency Yellow Purple Yellow " "

Pneumatics - Yellow.

Fuel - Red

Oxygen - White - Blue.

Fire Ext: - White Red.

Nitrogen - White Red White.

Anti-icing - Brown White Brown

Auto Controls - Brown.

TURRETS:

Front - White Yellow White

Mid-Upper - " Blue "

" Under - " Green "

Rear — " Red "

Vacuum System - White Black.

Engine Starting - Green.

Coolant - Blue.

Oil - Black

Bleeding of Hydraulic System.

After Use of Emergency Air.

1. Ensure that the air control has been returned to OFF position and u/c lever LOCKED DOWN.
2. Aircraft jacked up.
3. Slacken the bleeder screws in the top of the 4 undercarriage jacks (down side).
4. Fill up reservoir.
5. Establish the cause of hydraulic failure, necessitating the use of emergency aid and rectify it.
6. Connect ground test rig to ground test couplings, and start up the rig at its slowest speed.
7. When a column of oil free of all air, emerges from the open bleeder plugs, tighten and relock plugs, and build up to cut-out pressure

Same procedure is carried out for FLAPS. Fully raise and lower the u/c and flaps several times to remove any air.

N.B.

Should oil issue from the vent under the nacelle, give the emergency air valve a sharp tap with a hide hammer

Finally lower a/c. and re-fill air bottle to 1200 lbs and top up reservoir.

First Aid Outfit for Aircraft.

1. Ampoules, Iodine. 30 Minims each.
   for minor wounds. (3)
2. Ampoules, Morphia: (syringe). in tin box with labels.
   FOR SEVERE PAIN: Use the contents of one ampoule.
   Remove Hood; Press Stylet (Wire in needle) down until it punctures top of capsule: Remove Stylet. Hold Syringe needle upwards and press capsule until a bead of moisture appears at top of needle. (2)
   Pinch up portion of skin of arm or leg. Then insert needle beneath skin obliquely; empty capsule by squeezing. Give contents of one ampoule only. Complete a label and attach it to patient.
3. Anti-burn Remedy: (in 4oz. tubes).
   For burns, spread over burn and apply dressing. Don't use it on eyes or eyelids. (1)
4. Bandages. (TRIANGULAR) (2)
   To be used as a sling or bandage.
5. Shell Dressings. (2)
   To be used as directed on outer cover.
6. Adhesive Plaster 1-inch in tin.
7. Scissors, Stretcher bearer, 7" for cutting clothing.
8. St. John Tourniquet. (2)
   When an artery of a limb is cut and blood gushes out and a firm dressing will not control bleeding, a tourniquet should be applied above wound

with block pressing on artery. The stick should then be twisted round until bleeding stops.

Secure end of stick by tying attached cord to end of D ~~Ring~~ on buckle.

At the end of each 20 minute period after application, stick should be gently untwisted to see if bleeding has stopped, if not re-apply.

If stopped apply ~~an~~ ordinary dressing.

9/ Satchel to contain above items.

Picketing Points.

One outboard of each inner engine, at leading edge.
One just inboard of detachable wing tips on each side, at leading edge.
An Eyebolt screws in to the longerons at each side approx at formes 22.

Picketing.

Always stand aircraft on firm ground.
Facing the wind.
Tie through picketing points to ground weights.

MERLIN 22-24-28-38 ENGINES GENERAL.

COOLANT SYSTEM.

Coolant is taken from the header tank to the thermostat, if the temp. is under 85° centigrade, all the coolant is by-passed, and goes straight to the pump. If over 85°C. but under 105°C. then part is by-passed and remainder goes through the radiator, at 105°C. all the coolant goes through the radiator to the Pump. From the Pump it goes to A & B. Blocks.

A. BLOCK. STBD. SIDE.

The coolant passes through A Block to an external coolant rail, which carries a part of it back to header tank, the remainder is taken by an external pipe at the rear to the carburettor jacket, (Merlin XXII). and then is led back to inlet side of coolant pump. (On Merlin XXVIII Carb union is blanked off.

B. BLOCK. PORT SIDE.

As for A Block except on the two inner engines the external pipe carries the coolant to the cabin heaters and then back to the inlet side of the pump. On the two outer engines rear of coolant rail is blanked off. The pressure is maintained and controlled by the thermostatic header tank relief valve, which has 4 main functions.

1. Relieves the system of any air locks after starting up. (Relieves at 30 lbs/□" pressure) (allows atmos. pressure in at -2½ lbs below atmospheric.

appox. 138°C.

2/. Keeps a constant pressure on coolant increasing boiling point.
3/. Prevents loss of coolant, due to venting or boiling.
4/. Compensates for depression in the tank as the coolant temp decreases.

The minimum temperature is controlled by the thermostat, the max, by the rad. shutters. A thermostatically operated switch operates the rad shutters, opens them at 105°C. as the coolant warms up, and closes them at 99°C as the coolant begins to cool down. A master switch or overide switch is fitted so that the radiator shutters may be opened or closed at will by the F.E.

The shutters must always be open for ground running and taxying.

FAULTS.

SYMPTOMS OF FAILURE.

THERMOSTAT.

1/. Long periods of warming up.
2/ Tendency for temperature to fluctuate with altitude.
3/. Tendency for thermostat to maintain low temps.

CHECKS. NOTE.

Thermostat with yellow band must only be used on pressurised 70/30 systems.

A

AUXILIARIES DRIVEN BY ENGINE.

COMPONENTS.	OPERATION	WHERE FITTED.
PORT OUTER.		
A.C. ALTERNATOR GENERATOR	WIRELESS E.F.F. etc. "GEE"	P.S. OF CRANKCASE
TURRET PUMP.	FOR REAR TURRET.	"A" BANK.
PORT INNER.		
D.C. GENERATOR.	MAIN ELECTRICAL SERVICES.	P/S. of CRANKCASE.
DOWTY HYDRAULIC PUMP.	" HYDRAULICS "	BASE OF SUMP.
PESCO PUMP No 1.	INSTRUMENTS.	STBD. SIDE DUAL DRIVE.
R.A.E. COMPRESSOR.	AUTO CONTROLS. (GEORGE ETC)	"B" BANK.
TURRET PUMP	MID UNDER TURRET.	"A" BANK.
STBD. INNER.		
D.C. GENERATOR.	MAIN ELECTRICAL SERVICES.	P.S. OF CRANKCASE.
DOWTY HYDRAULIC PUMP.	" HYDRAULIC "	BASE OF SUMP.
PESCO PUMP No.2.	INSTRUMENTS. B. SIGHT.	STBD. SIDE DUAL DRIVE.
HEYWARD COMPRESSOR	PNEUMATICS	"A" BANK.
TURRET PUMP	FRONT TURRET	"A" BANK.
STBD. OUTER.		
TURRET PUMP	MID-UPPER TURRET	"A" BANK.
GENERATOR. ALTERNATOR.	NEW DEVICE. (RADIO) H2S.	P.S. OF CRANKCASE.

COMMON TO ALL ENGINES. C.S.U. P.S. DUAL DRIVE.

OIL USED - D.T.D. 472 B.

L.A.F.U.

Engine Limitations.

Conditions		Boost	R.P.M.	Coolant	Oil.	Limits.
Max Take-Off	M	+14	3,000	125°	—	5 mins or 1,000 ft.
Max Climb.	M	+9	2850	125°C	90°C	1 Hour
" "	S	+9	2850	125°C	90°C.	1 Hour.
Max Continuous.	M	+7	2650	105°C	90°C	
"	S	+7	2650	"	"	
Combat	M	+14	3,000	125°C	105°C	5 minutes.
"	S	+16	3,000	"	"	"

+14 in "M" and +16 in "S" are obtained by pulling cut-out which should only be necessary in combat

Minimum oil pressure 30 ~~45~~ lbs/□".

Normal " " 45 to 80 lbs/□"

Full Throttle Heights.

R.P.M.	Boost	Altitude. M.	Altitude. S.	Remarks.
1800	+4	3,000	—	Full Throttle Height.
2650	+4	14,000	20,000	" " "
2650	+7	9,000	16,000	" " "
2850	+9	10,000	17,500	Rated Altitude.
3000	+9	12,250.	20,000	Max Power Altitude.
3000	+14	6,000	—	With cut-out pulled
3000	+16	—	13,000.	" " " "
3000	T.O.B. +14	—		Falls off Immediately on leaving Ground.

3,000 +18 can be got with a Merlin 24.

Lubrication System

Oil flows from tank through filter to C.R.V. This regulates pressure to between 45 and 80 lbs/□". Two main pressure connections are taken from the C.R.V. as well as temperature and pressure. One connection leads oil through a duct in the crank-case wall to lubricate the c/shaft bearings, and the other conveys oil, via an external pipe to the prop. This pipe divides just behind the reduction gear casing, one branch taking oil direct to stbd. banjo union to the front of prop. piston. The second branch takes oil to the C.S.U. booster pump which boosts up pressure to approx. 200 lbs/□", then delivers it through an external pipe, to the similar banjo union on the port side of reduction gear casing and so down to rear of prop. piston. A small pipe conveys oil direct from pressure pump to the fuel pump drive, and on the starboard inner engine only this pipe continues upwards to lubricate the Heywood Compressor. Any surplus from fuel pump drive is drained to atmosphere, while that from the compressor is drained to the wheelcase.

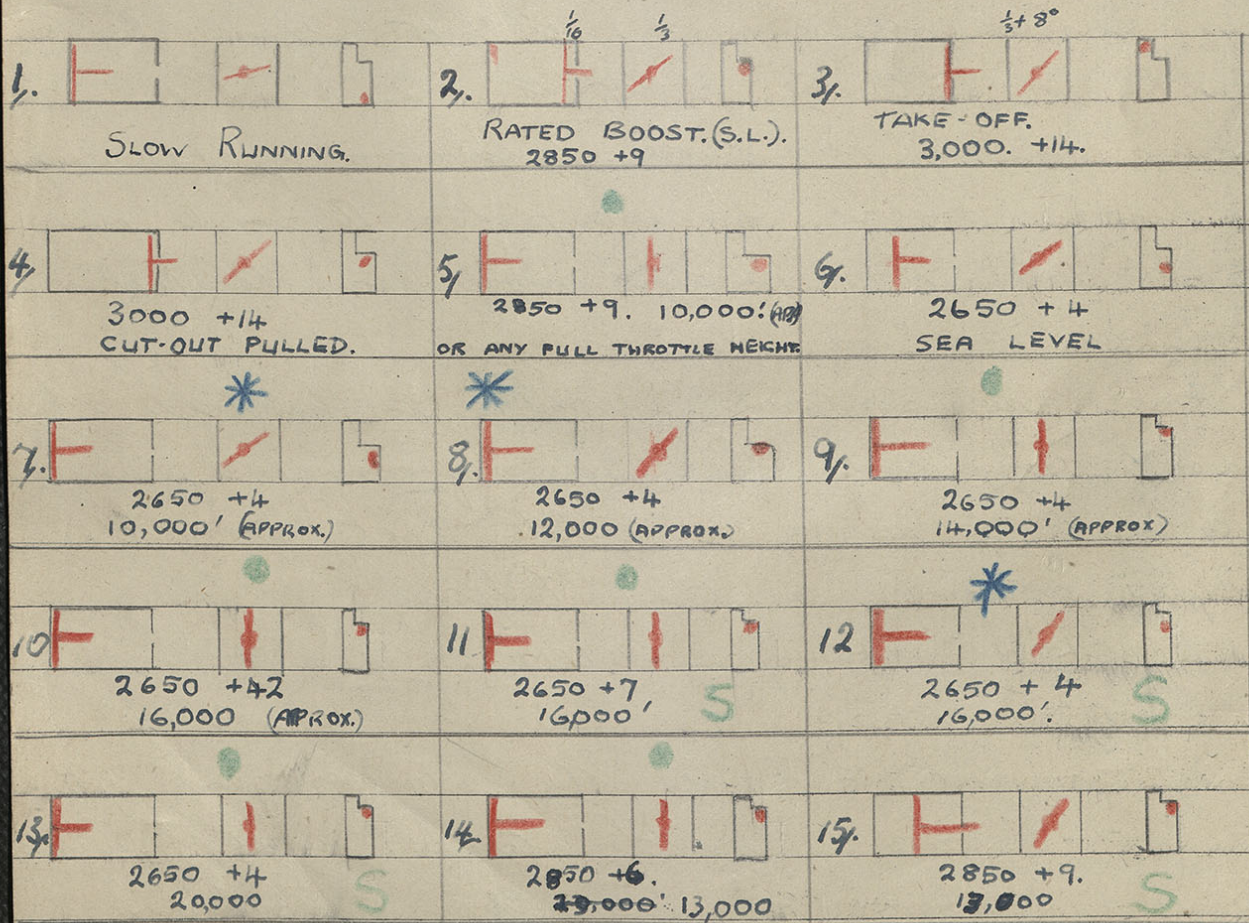
Low Pressure System.

2 low pressure connections are made from the C.R.V. one leading forward to supply the reduction gear jets while the other leads rearwards to a junction, from which branch lines are taken to lubricate, camshafts, generator drive, s/charger gears and rear s/charger brg.

Scavenge System.

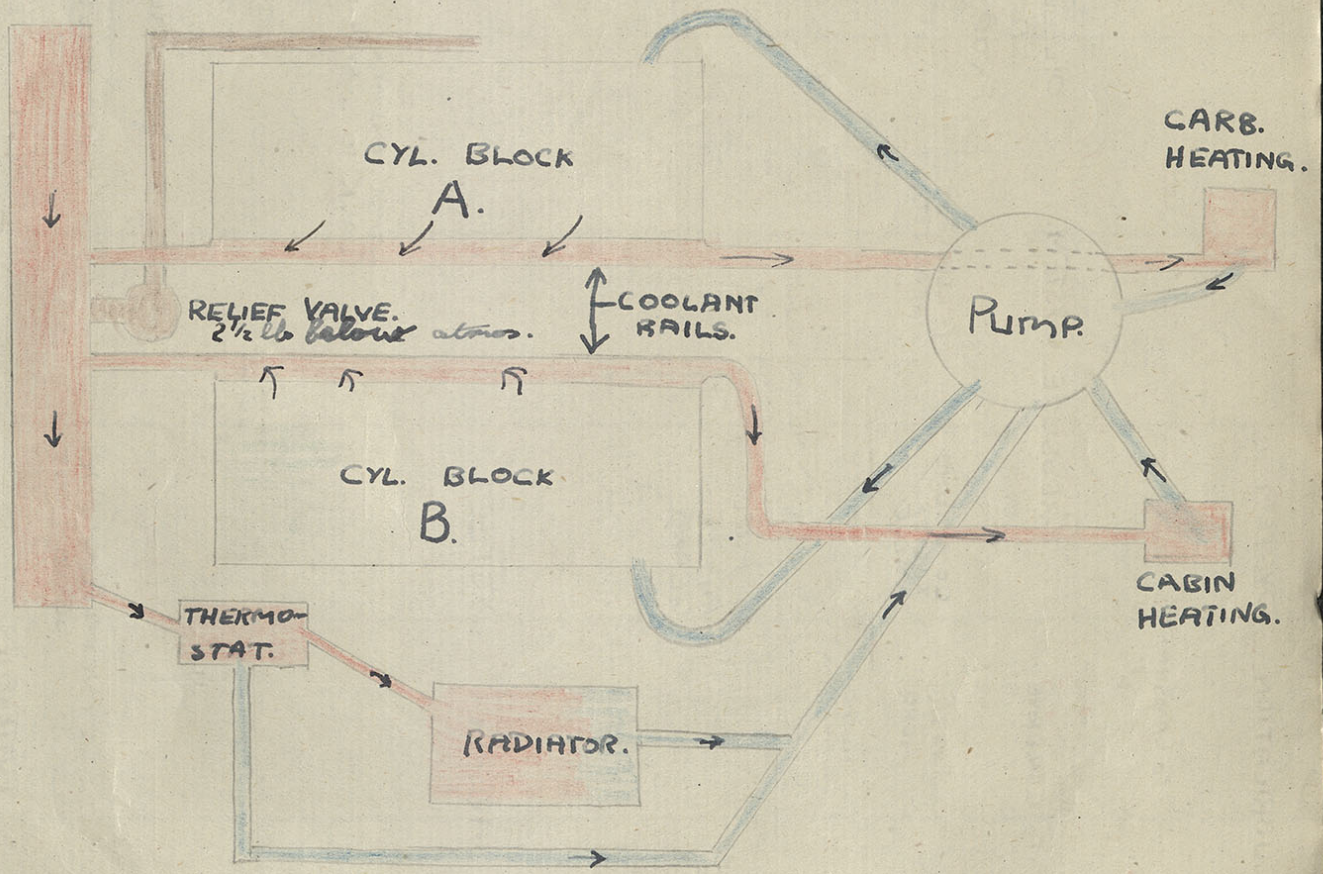
Consists of 2 Scavenge Pumps, housed in the rear sump. Each pump draining its own sump through a separate filter. Oil from the Pumps is delivered through a common outlet, in stbd side of rear sump, through an external pipe to the supercharger servo unit. From here the oil passes to the throttle butterflies (where a 30 lbs relief valve is fitted) and then on to Clarke's Viscosity Valve, which sends it direct to the tank if cold, or through the coolers, and then to the tank if hot.

Piston, Butterfly & Throttle Lever Positions.



Note that relay * piston is fully forward to maintain selected boost, Throttle lever is slowly moved towards gate as altitude increases.

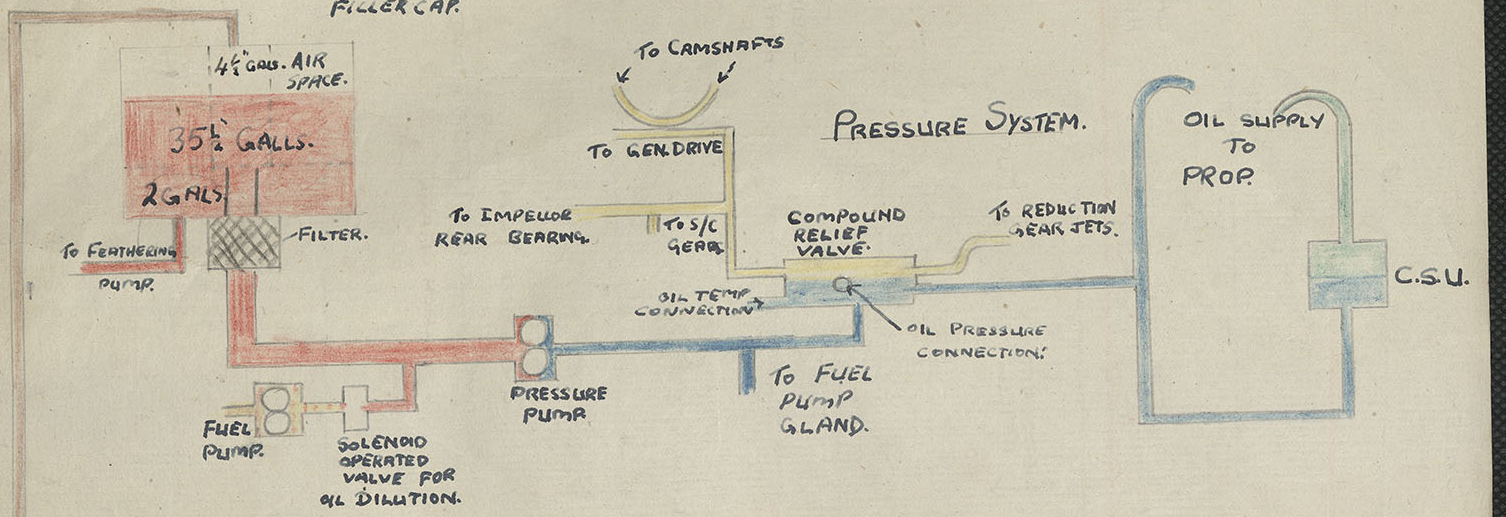
Coolant System.



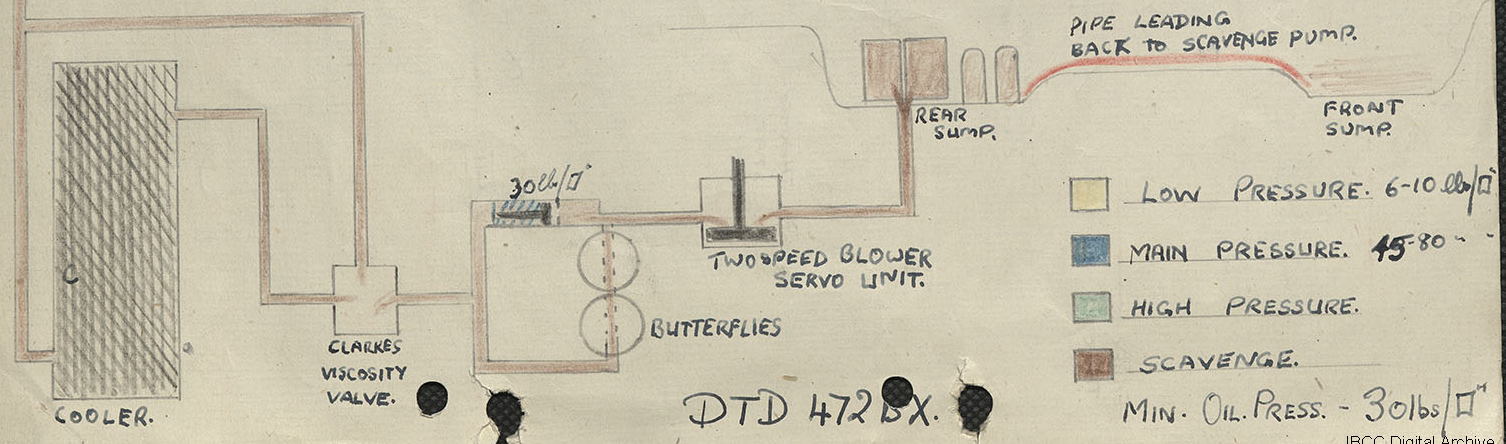
MERLIN XX. OR BELOW HAS COOLANT RAILS
" XXII " ABOVE " ONE ELBOW LEADING OUT OF EACH BANK.

MINIMUM TEMP.- 60°C.
MAXIMUM. " 135°C.

LUBRICATION SYSTEM.



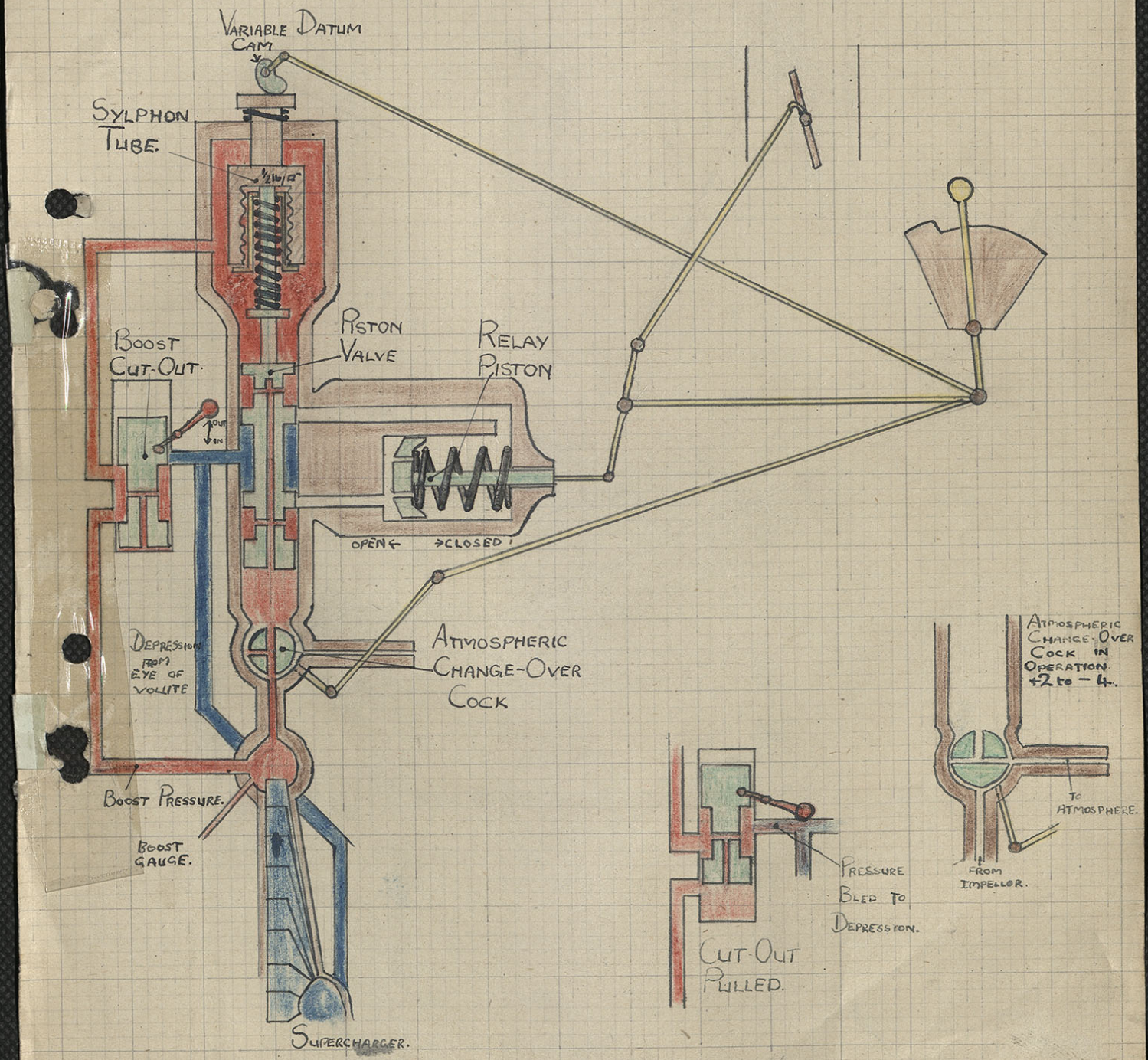
SCAVENGE SYSTEM.



DTD 472 BX.

MIN. OIL. PRESS. - 30 lbs/□"

R.R. Boost Regulator.



R.R. Boost Regulator.

The Objects of the B.R. are:

1/ To prevent the pilots lever giving and excessive boost to the engine.

2/ To ensure that a definite response is obtained from the engine for any change in throttle lever position.

3/ To prevent alteration of the boost selected by any given throttle lever position, due to changing altitude, barometer, or a/c. attitude.

4/ Similarly to maintain the boost within the range of control available in spite of engine R.P.M. alterations, by the R.P.M. Lever.

It is a control on the position of the throttle butterflies, actuated by the tendency for change in boost pressure from the value, selected from the throttle lever. The normal readiness position of the piston valve closes both ports to the front and rear of the relay piston, which will be situated at some position depending on altitude and the cockpit throttle lever. Tendency for boost change is felt by the aneroid which expands or compresses slightly so that the piston valve admits pressure to one or the other sides of the relay piston. This moves, and the link swings about the central pivot (A) to which the (assumed) stationary pilot's lever is connected, hence the ~~butterfly~~

butterfly throttles are adjusted to prevent boost from changing. The swinging link which uses the central pivot (A') when relay piston compensation takes place, and the lower pivot (C) when a fresh position of the throttle lever is selected, is identical in effect to the more complicated looking differential on the engine control shaft. Note now that any movement of the throttle lever (from 2 lbs boost upwards) bodily displaces the aneroid and piston valve assembly by a cam, and the readiness position will not be restored until a new value of boost has produced the necessary alteration to the aneroid bellows length, hence the boost changes are progressive in sympathy with the throttle lever.

MAXIMUM CLIMB.

At the gate, on the ground, the relay piston is nearly at its full rearward position (R.H. end of cylinder) leaving a bit in hand, to cope with air intake ramming effect on moving forward airborne. It gets there by the following sequence of events:- the throttle lever pushed forward to the gate finds no mechanical reason against the throttle opening wide to start with. The piston valve assembly also is pushed down by cam pressure. The rising boost compresses the aneroid, lifting the valve until it starts passing boost pressure to the forward end, (left-hand) of the relay piston,

and at the end of its travel this has limited the butterflies to the position giving rated (max. climbing) boost. Not surprisingly, this amount of (boost) opening is nowhere near the fully open butterfly position, which would give a boost about three times the value of the allowable rated boost.

On the climb, the effect of the steady decrease in atmospheric pressure at the intake is counteracted by the slow movement forward of the relay piston opening the butterflies to maintain boost.

LOWER BOOSTS.

Only at rated boost and International R.P.M. will the relay piston have its full travel available to hold the boost at rated altitude. At partial throttle lever position or a reduced R.P.M, boost will be maintained only to some lower altitude. If at partial throttle, manual opening must then be used to prevent boost falling on further climb past this height. The mechanical reason is that the relay piston is not fully to the rear, and reaches its forward stop earlier on climb, with the butterflies still short of full open.

TAKE-OFF BEHAVIOUR

Going through the gate manually opens the butterflies to a rather wider position. But, as the relay piston is already fully to the rear at the gate, it cannot prevent the boost rising to the T.O. value.

It is thus not in control and the boost will decrease during the 1,000 ft permitted for T.O. conditions.

BOOST CONTROL CUT-OUT.

This is used in emergency only, and also for take-off and its effect is to supply a false sample of boost pressure to the aneroid chamber by ducts. It is thus tricked into controlling a higher boost, which can only be maintained up to lower hieghts, as the butterflies are wider open and the relay piston already further forward than at the normal controlling condition.

When the boost obtained is less than that selected the relay piston is fully forward.

The higher the boost and fixed R.P.M. the lower the full throttle height. The lower the boost and fixed R.P.M. The higher the full throttle height.

E.G. 2650 +7 - 9,000' in M. gear.

" 2650 +4 - 14,000' - - "

The higher R.P.M. for a given boost the higher the full throttle height, the lower R.P.M. for the same boost the lower the full throttle height.

E.G. 2650 +4 - 14,000' in M. gear.

1800 +4 - 3,000 " " "

If the throttle lever is at the gate and the boost below +9 - then the butterfly is wide open and the a/c is at full throttle height.

If the throttle lever is at the gate and the boost is +9 it is impossible to tell whether the aircraft has reached rated altitude or not.

If the throttle lever is not at the gate and the boost commences to drop, then the a/c has not reached its full throttle height as it is an impossibility for the butterflies to be opened fully with the throttle lever not at the gate, manual control is necessary to open the butterfly.

FAULTS OF R.R. BOOST REGULATOR.

ADJUSTMENTS.

Rated boost, adjusted by a screw on top of regulator, quarter of a turn equals ½ lb; screw in to increase, out to decrease.

Excessively high boost

1, Failure of aneroid

2, Leak on dome nut on regulator.

Low Boost.

Usually caused by a leak between engine and gauge or on gauge itself.

SURGING BOOST.

This is noticed when boost fluctuates with a more or less rythmic period.

1. Sluggish, sticky or too slack relay piston.
2. Sticking piston valve.
3. Excessively tight or slack control rods, particularly the rod from the relay piston to the

differential gear lever.

4. Congealed oil in the differential.

LUBRICATION

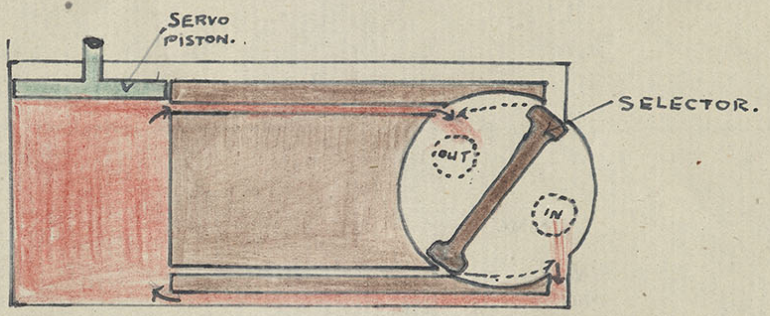
All parts to be lubricated with a mixture of 2/3 engine oil, and 1/3 anti-freeze oil. To lubricate shaft of relay piston remove triangular plate and put in 1 teaspoonful (3.5 cc) of oil.

Also lubricate piston valve and differential.

ATMOSPHERIC CHANGE-OVER COCK CLOSED.

As the difference between pressure and intake side of supercharger is practically nil at low R.P.M. a change-over cock is fitted, being controlled by the Pilots throttle lever admitting atmospheric pressure in lieu of pressure from the sft into the piston valve, this atmospheric pressure is in operation during low revs until approx. 2 lbs boost. When the valve returns supercharger pressure to the operating side of the boost regulator.

MERLIN 2 SPEED SUPERCHARGER.

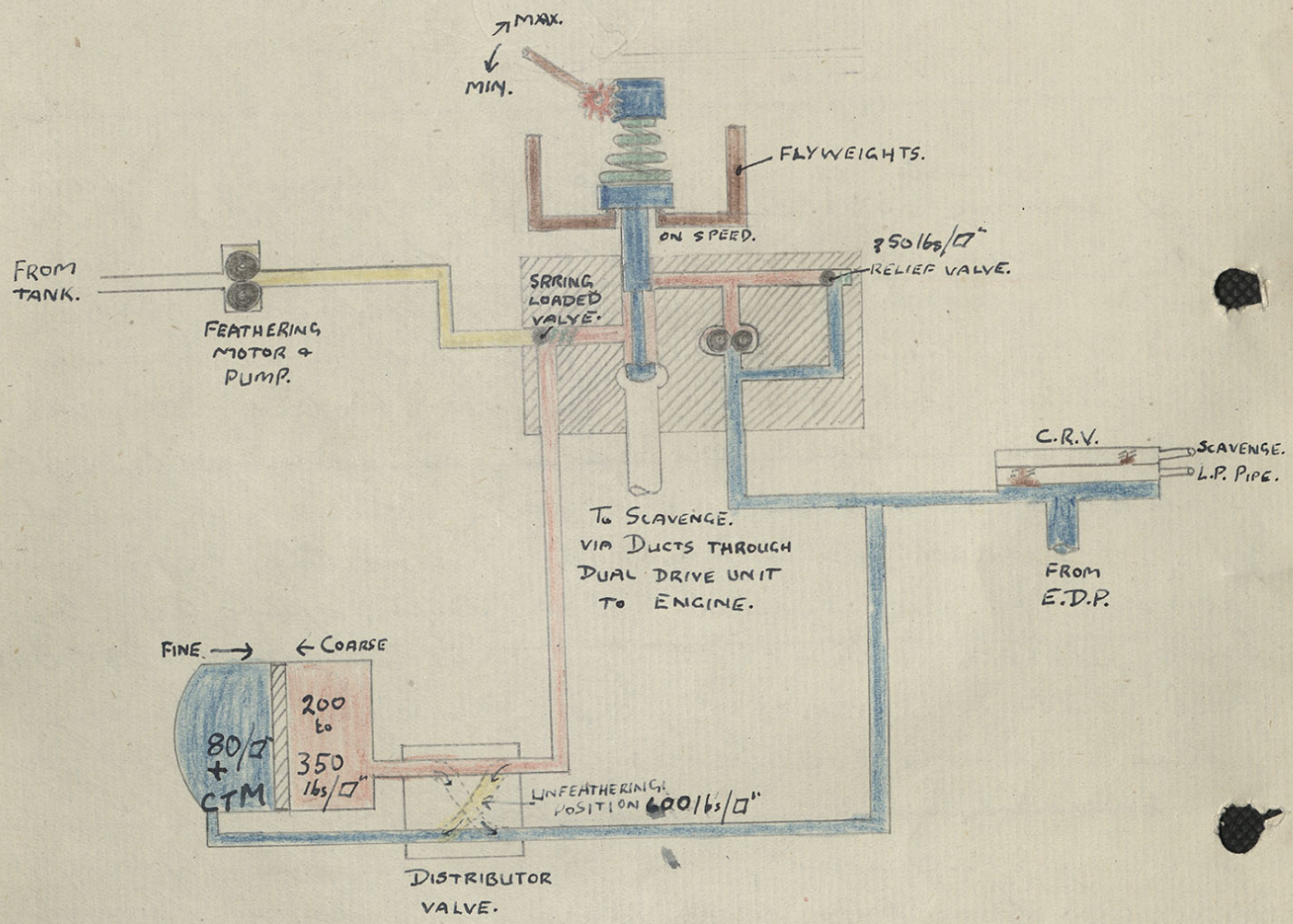


Consists of 3 multi-plate slipping clutches 2-driving "S" gear - 1-driving "M" gear. Clutches are engaged by small bobweights which, when flung out under centrifugal force, press the clutch plates together and cause the clutch to drive. To allow 1 gear to be disengaged while the other is engaged each clutch is provided with a ball race, operated by a forked arm on a cam, the cam being mounted on a small camshaft, operated by a servo piston. When "M" gear is engaged. its ball-race will be clear of the flyweights allowing them to fly outwards, so causing the gear to drive, while "S" gear ballrace will be pressing against the tips of the flyweight preventing them from being flung outwards, so allowing "S" gear to slip. (When "S" gear is engaged the procedure is reversed).

FAULTS.

1. Total loss of oil, S/C. stays in gear selected.
2. Manual control breaks S/C stays in gear selected.
3. The pneumatics fail, springloaded jacks return S/C to "M"
4. Slipping clutch. Low boost on engine concerned. (Change gear once or twice to ensure clutch is engaged.
5. Clutch burnt-out. (Engine becomes normally asperated).

D.H. Prop + C.S.U. Type 5,500.



D.H. Propeller & C.S.U. Type 5,500.

Faults and Symptoms.

Mechanical:- 1. Broken distributor valve spring
- Prop takes up Fine Pitch position.

2. C.S.U. Governor Spring breaks;
- Prop goes into coarse pitch.

3. C.S.U. Drive Shears;
Prop goes into fine pitch.

4. C.S.U. Control Fractures;
- Prop goes into coarse pitch.

5. Sticking Control Valve;
- Sluggish operation or surging R.P.M.

Oil Faults.

1. Total loss of oil
Prop goes into fine pitch.

2. Loss of C.S.U. Oil;
- Prop goes into fine pitch.

3. Faulty oil seals;
Surging R.P.M. or sluggish action.

4. Failure of C.S.U. Gasket;
Prop goes into fine pitch.

5. Cold oil in dome;
Surging R.P.M. or sluggish action.

Electrical Faults.

1. Pressure Cut-Out Switch set too low
- Prop. fails to feather completely.

2/ Pressure Cut-Out Switch set too high.
Prop. unfeathers immediately after feathering.
3/ Feathering button fails to snap out.
Prop unfeathers after feathering.

FEATHERING AND UNFEATHERING.

GROUND OPERATION.

1/ Set throttle to approx. 1,000 R.P.M.
2/ Press feathering button and release.
The prop. should feather and R.P.M. may be expected to drop to about 600 R.P.M. When feathering is complete, the button should snap out. (For normal checks the drop in R.P.M., and snapping out of button may be taken as sufficient evidence that the feathering is satisfactory.)
3/ Allow the engine to run in the feathered condition for about 10 seconds to clear it of oil discharged from the prop.
4/ Unfeather the prop by pressing the button and holding it in until R.P.M. cease to rise, when they may be expected to be about 800 R.P.M.
5/ Release button and R.P.M. should return to their original value.

FLIGHT OPERATION FEATHERING

1/ Turn off Master Fuel Cock.
2/ Press Feathering Button. (which will automatically hold in) and immediately;-
3) Close throttle.

SNOWBALL M.G. CLASS 5

19/ On (4) Pilots Panel (right side)

20/ 1014 millibars. (4)

21/ Air would be drawn into the system which is damp, before the silica gel would last as long. (4)

22/ White to brown. (4) Blue to Pink.

23/ Port Navelle (4)

24/ To remove the moisture from the air and prevent icing up of the jets. (4)

25/ Beside the navigators table. (4)

VE

QR

QA - unknown call.

AAA

HT

W - wait

K.

R -

T

EEEEEEEE

V

V E

V

If the Master Cock is not turned off and immersed pumps are not on, air will be drawn off from carb of feathered engine to good engine, which in turn will fail. If the feathering push button fails to snap out when feathering is completed and the prop. starts to rotate again, the button should be pulled out immediately. Prop can then be refeathered by pressing button again, and pulling out as soon as prop ceases to rotate.

UNFEATHERING.

1. Set all controls, switches, etc, to their normal starting positions, excepting throttle which should be fully closed and R.P.M. Lever set to minimum R.P.M.

2. Press feathering button and hold in, until R.P.M. rises to about 1,000 R.P.M. then release button. The R.P.M. will then rise to their correct minimum value and prop will then be in C.S.U. control range. If engine temperatures have dropped below minimums for opening up, the engine should be left to windmill at a low speed until it is sufficiently warmed up.

3. Open throttle to Zero boost, set R.P.M. as required, then open throttle lever to desired boost

ENGINE HANDLING.

When all engines are running the F.E. is to say "All engines running," and is to:-

(A) Switch off Booster Coil.

(B) Check oil Pressures.

(C) Ensure Main Switch is to FLIGHT. 15°-Oil. 60°-Coolant

(D) When each engine is sufficiently warmed up, the F.E. is to say "Ltbd Inner ready for running)

The Pilot repeats and engines are run as follows:-

(1) Check Mags at Slow Running for functional check.

(2) Open throttle to Zero Boost and exercise Prop.

NOTE MINIMUM R.P.M.

(3) Select 2,000 R.P.M.

(4) Open up to +4 and R.P.M. should remain constant.

(5) Select Max. R.P.M- Boost should remain constant

(6) Open throttle to the gate and check Static R.P.M. and Boost - 2850 +9.

(7) Open throttle through gate and check T.O.B. and REVS.

(8) Throttle back to gate and check mags - MAX DROP 100RPM

(9) Throttle back to Zero Boost and test 2 Speed Blower Drop in R.P.M. Approx 50 - 75.

(10) Throttle back to 12,00 R.P.M. and close throttle suddenly to check slow running.

On all engines the F/E will report:-

ENGINES O.K. or otherwise.

shout "Brace for Ditching" and disconnect Intercomm.

10. Wait for 2 impacts.

AFTER DITCHING.

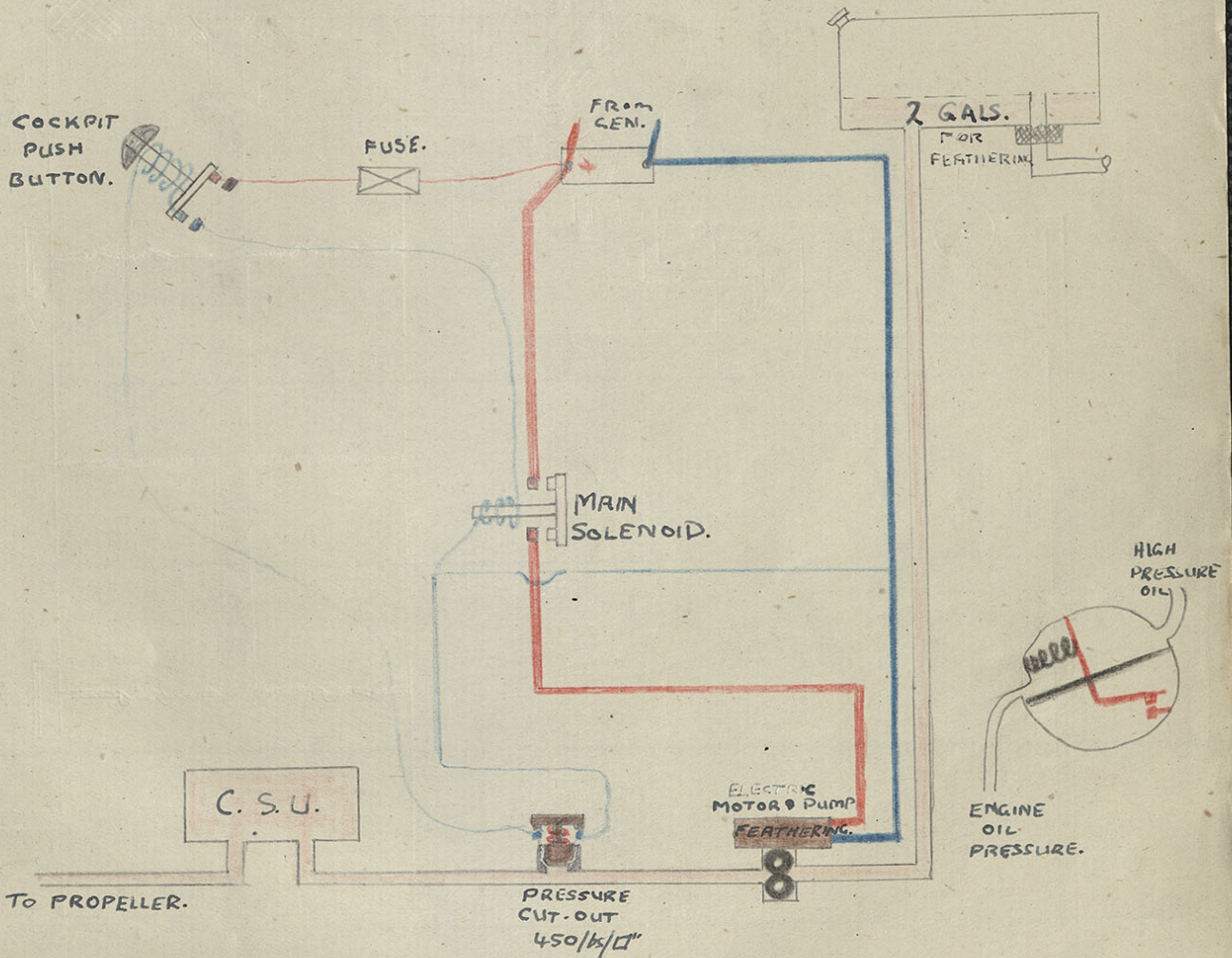
1. Leave by mid-escape hatch taking the axe, and assist the dinghy out of its stowage.

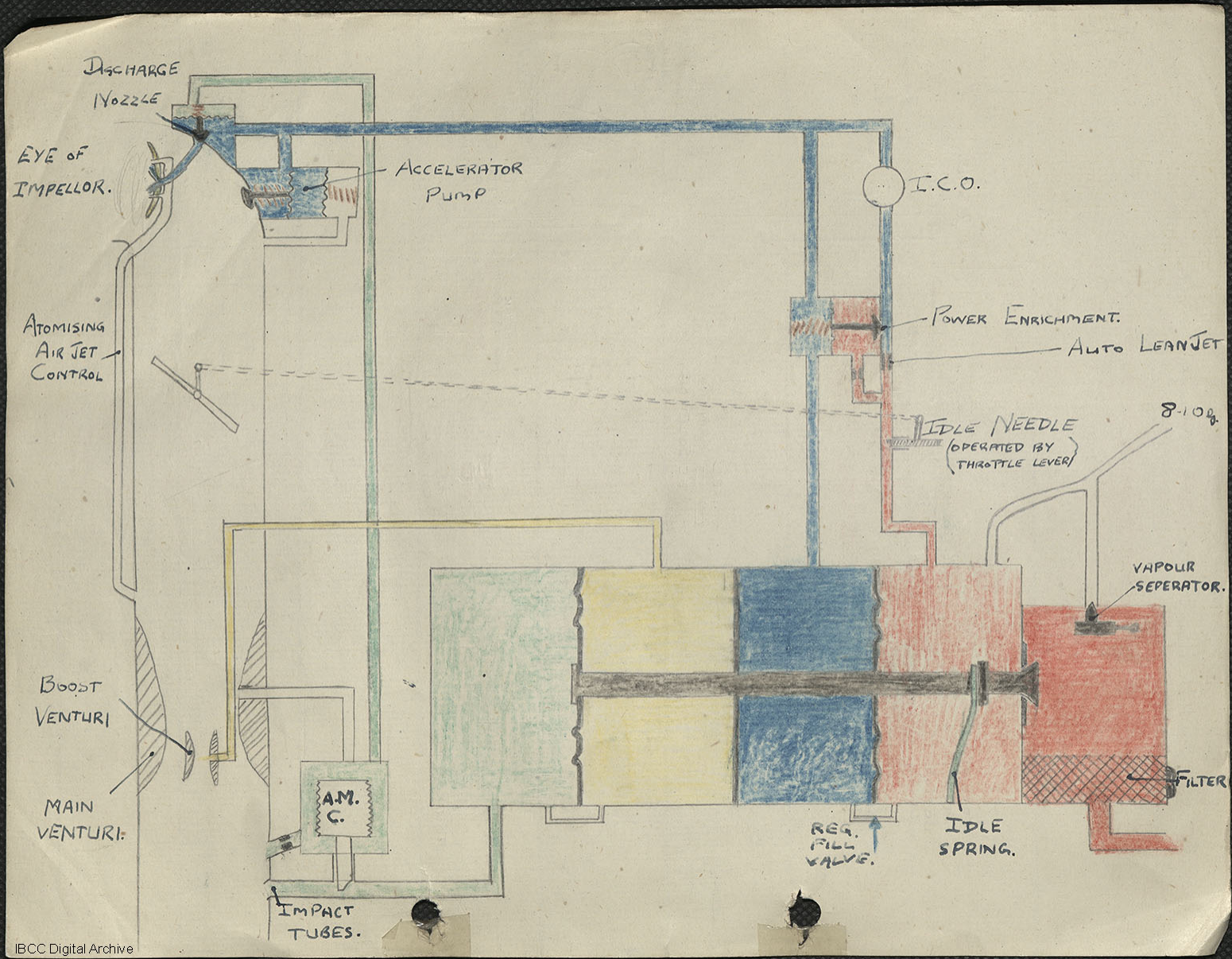
2. Get the dinghy water borne. (Navigator helps)

3. Control the dinghy from the wing.

4. Board the dinghy when all the crew are on except the pilot.

D.H. Hydromatic Prop Wiring System.





STROMBERG CARB. PD.16B/1

This carburettor is of the pressure injection type in which the fuel is sprayed into the induction system under pressure. The carb. is not prone to icing up and needs no heating also is unnaffected by the attitude of aircraft, &

CONSISTS OF 5 MAIN ASSEMBLIES:

1/ Throttle body; which houses main and boost venturi's, and throttle butterflies.
2/ Adaptor; housing spray nozzle valve and accelerator pump.
3/ Fuel regulator unit; consisting of chambers A, B, C, and D, and fuel receiving chamber
4/ fuel controlling unit: houses metering jets and power enrichment device.
5/ Altitude Mixture Control.

OPERATION:

When the engine is running the difference in pressure between air intake (impact tubes) and boost venturi is communicated to chamber A and B, and acts on the diaphragm attached to the poppet valve. The valve will open until the pressure D acting on the second diaphragm is sufficient to balance the valve. Pressure in chamber C is maintained constant at "5 lbs/□" by the spray nozzle valve. The pressure in chamber D. will cause

some certain rate of flow of fuel through the metering jet sufficient for the amount of air entering engine, as the throttle is opened the pressure difference between A and B will increase thus opening the poppet valve further and increasing the pressure in chamber D. The rate of fuel flow through the jet will increase thus keeping the mixture strength constant. At Slow Running the pressure difference between A and B is insufficient to open the poppet valve. The Idle Spring is so arranged that at engine speeds below approx 1500 R.P.M. it holds the poppet valve open. The fuel flow is now regulated by the idle needle which is linked to the throttle butterflies. The idle needle can be adjusted to regulate the slow running mixture strength, and the slow running R.P.M. can be varied by eccentric throttle stops. The idle spring adjustment must NOT be adjusted.

The metering jet (auto lean) gives an economical mixture and therefore enrichment is needed for high power output conditions. The enrichment valve is attached to a diaphragm subject to chamber D. pressure. At any power output corresponding to that obtained with 2650 +7. chamber D. pressure is sufficient to open enrichment valve and allow an extra supply of fuel to flow

through enrichment jet to the spray nozzle valve.

ALTITUDE MIXTURE CONTROL.

The bellows are subject to air intake pressure and as the aircraft climbs, will expand thus lowering the tapered needle into the duct leading from impact tubes to chamber A.

This has the effect of decreasing the pressure difference between A and B. which in turn will decrease the pressure in chamber D, thus reducing fuel flow through the jet.

The bellows are part filled with oil, to damp out vibration, and part with Nitrogen at approximately normal sea-level pressure to make it sensitive to changes in temperature.

ACCELERATOR PUMP

When the throttle is opened the pressure above butterflies will increase, this increase is felt on a diaphragm which is forced down to open a valve and allow an additional supply of fuel to engine. As the body of the pump is drained of fuel the valve gradually closes. There are NO mechanical connections between throttle lever and accelerator pump.

S.U. Carburettor A.V.T. 40/192

A duplex twin up-draught carburettor, combines the following features;

Diffuser System

Normal action supplied with correct quantity of fuel from the variable main jets

Pressure Balance.

To maintain equality of pressure between air intake and sealed float chambers.

Slow Running.

Calibrated jet in float chamber supplies fuel to the multiple nozzle in float chamber and helps to obviate flat spots during first opening of the throttles.

Accelerator Pump.

Supplies extra fuel necessary for acceleration, simultaneously with opening of throttles.

Variable Main Jets.

Two aneroid controlled tapered needles, control the fuel flow of main jets, the port controls the variation in boost pressure, starboard for variation in atmospheric pressure.

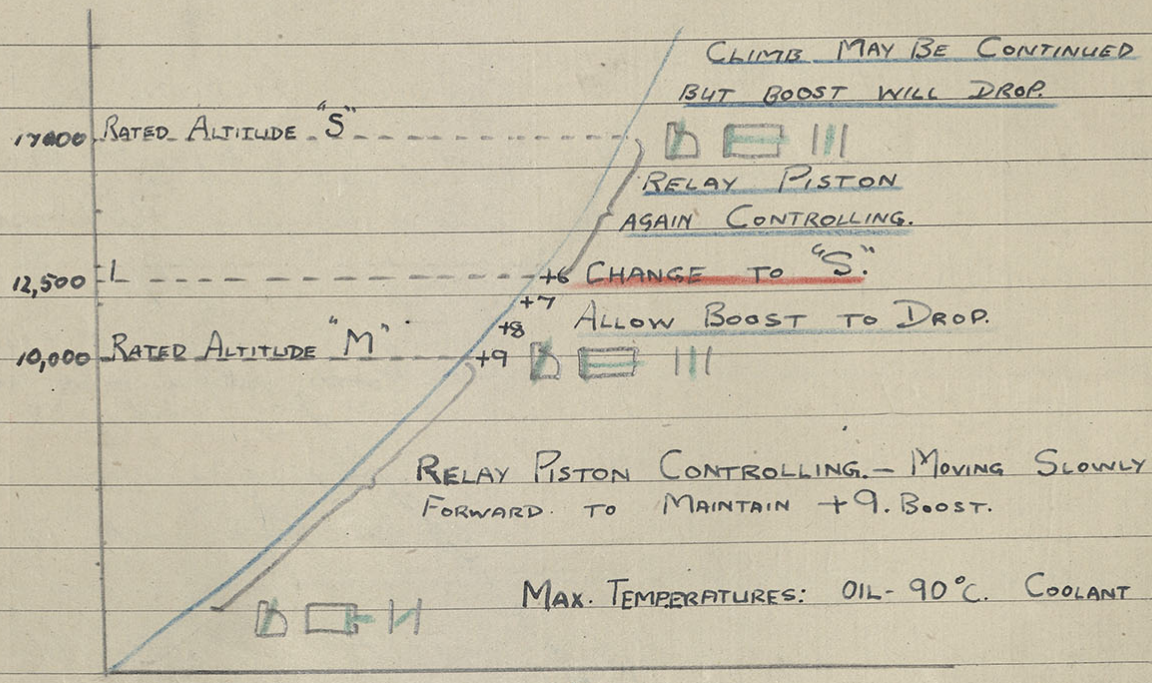
Engine Handling.

Take-Off Drill.

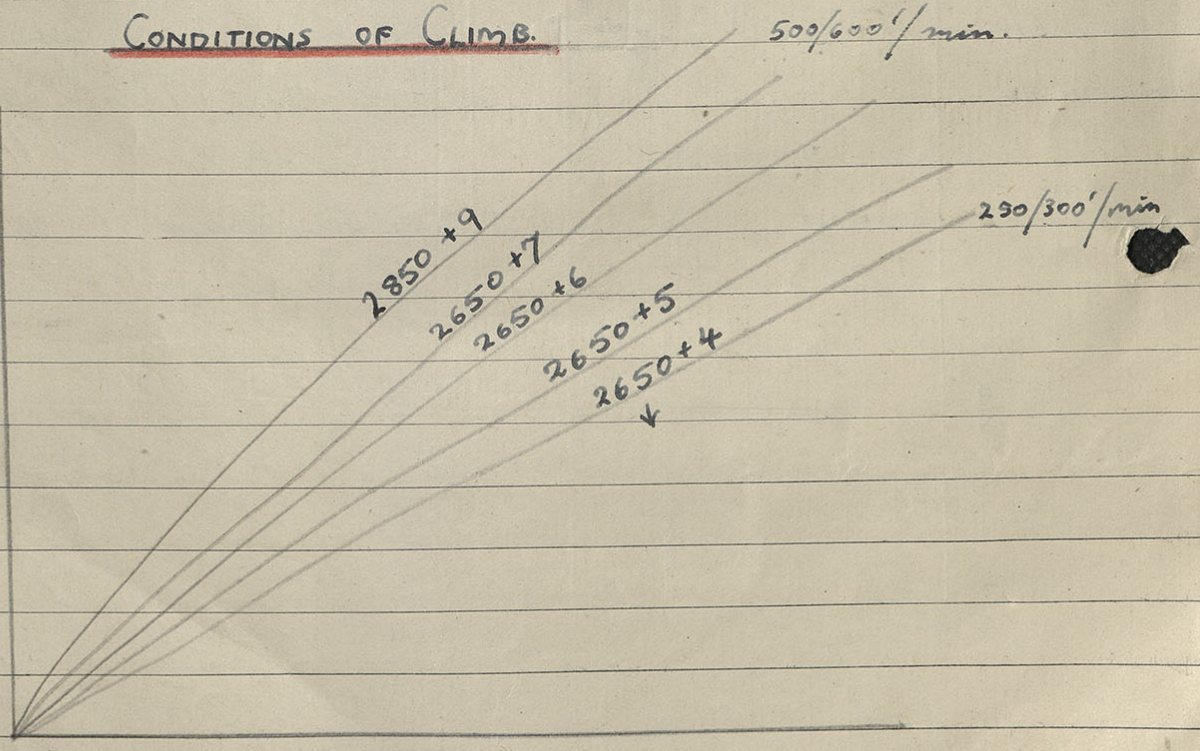
Pilot	F/E	Pause	Action By	Action.
Running Up.	Running Up.	5	Pilot	Open throttle against brakes to clear engine. +0" Boost
O.K. for Take-Off	O.K. for Take-Off	SECONDS	Pilot.	Release brakes and opens throttles slowly through gate to +14 boost.
			F/E.	Looks out of stbd side. Checks all boost and revs for 3000 +14
	Full Power		Nav.	Watches fuel pressure warning lights. If light shows turns cock to other tank.
At 100' at over drome boundary.				
Wheels Up	Wheels Up		F/E	Selects Wheels Up
Climbing	Climbing		F/E	Reduces R.P.M. to 2850. Boost to +9.
Flaps Up	Flaps Up		F/E.	Selects Flaps Up gradually.
Economical Climb	Economical Climb		F/E.	Reduces R.P.M. to 2650. Throttles to +4
			Pilot.	D.R. Compass to Normal after 5 mins
			F/E.	On reaching 2,000 ft switch off fuel booster pumps.

Maximum Climb. 2850+9

1 Hr. Limit.

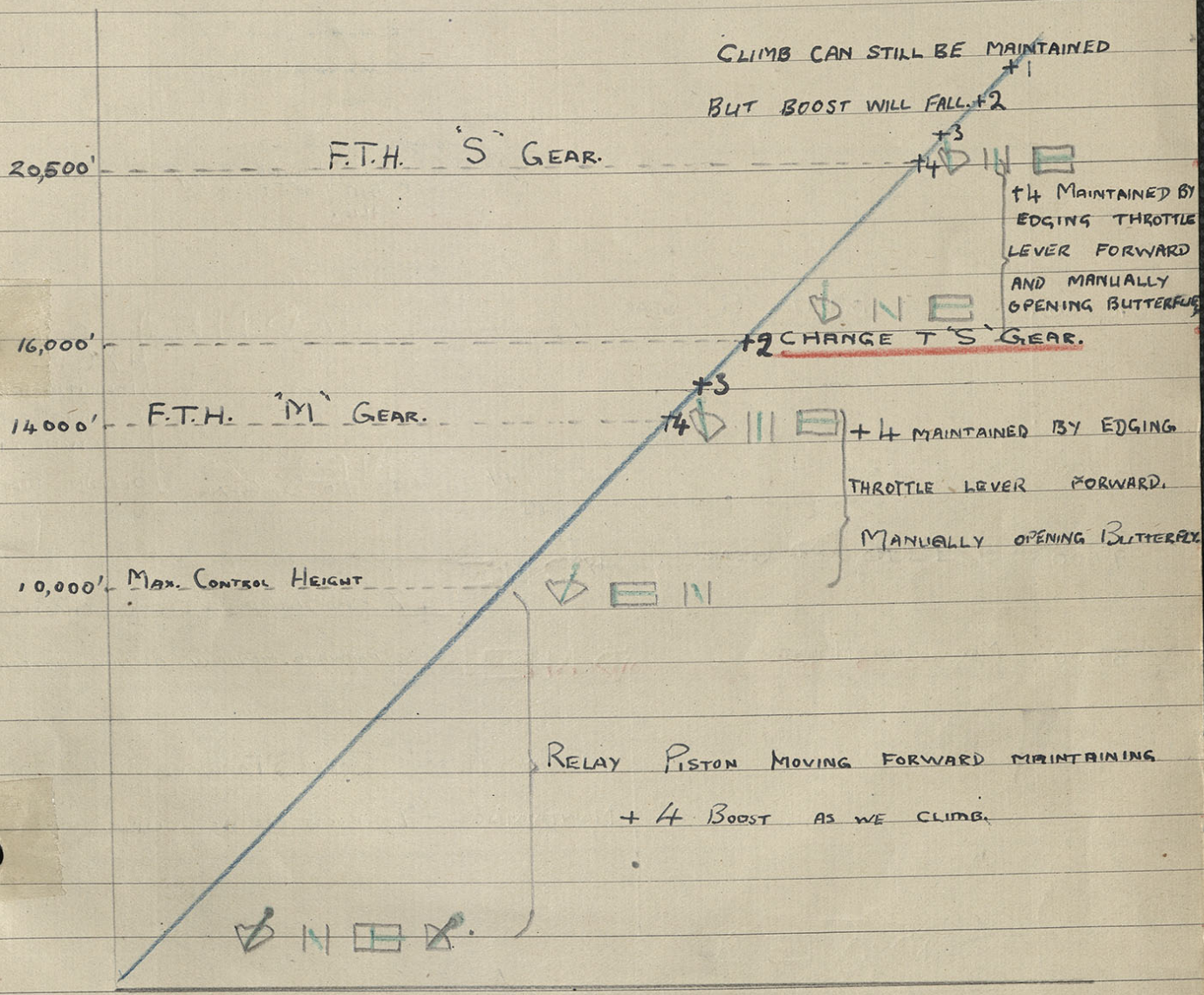


Conditions of Climb.



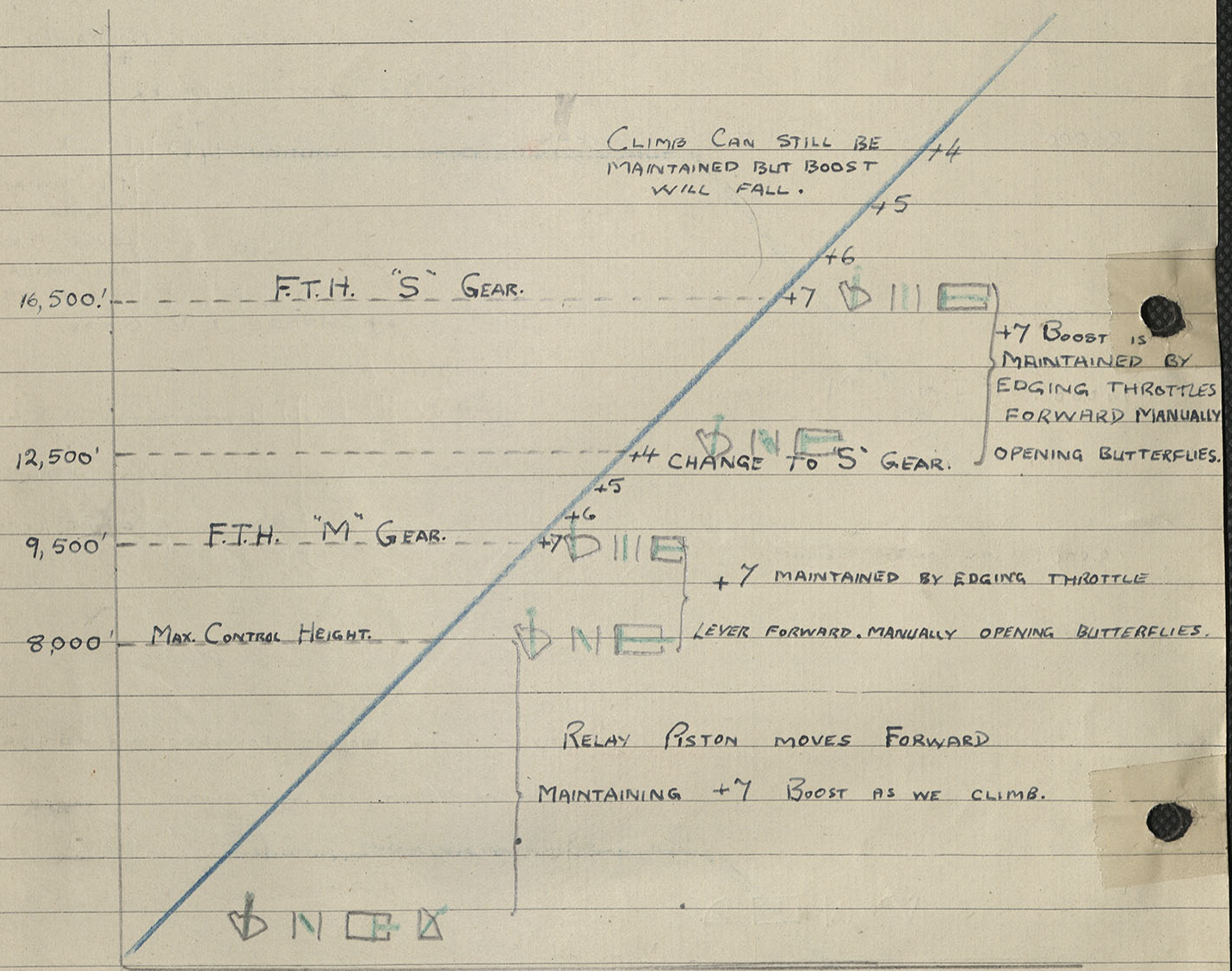
Economical Climb. 2650 +4

No Limit.



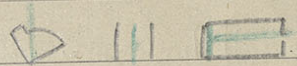
Max. Economical Climb.

2650 +7. No Limit



High Level Cruising.

Above 3,000'



M. - Outwards. 170
M - Inwards. 160
S = 160 inward or outward.

3000' ft.

1. Throttle Lever at Gate.
2. R.P.M. to give required I.A.S.

For Range Flying Conditions use High Level Cruising Conditions between recommended altitude of 8,000 and 16,000'

Low Level Cruising.

Below 3,000'

3000'

1. Throttles to give +4lbs.
2. Minimum. R.P.M.

Ignore I.A.S.

Endurance Flying.

Below 3,000'

1. Throttles set to give 135 I.A.S.
2. R.P.M. to Minimum.

Fly Low, Fly Slow.
Flaps can be used if required.
Engines may be cleared at intervals.

Descending on 3 or 4 Engines.

20,000'

2500'
2450'
2400'
2350'
2300
2500

17,000

2400
2300
2200
2100
2000
1900
1800

3,000'

Throttle at Gate
R.P.M to Give I.A.S.

Put Revs. up to 2500 - change to "M" and adjust revs to give 160 I.A.S.

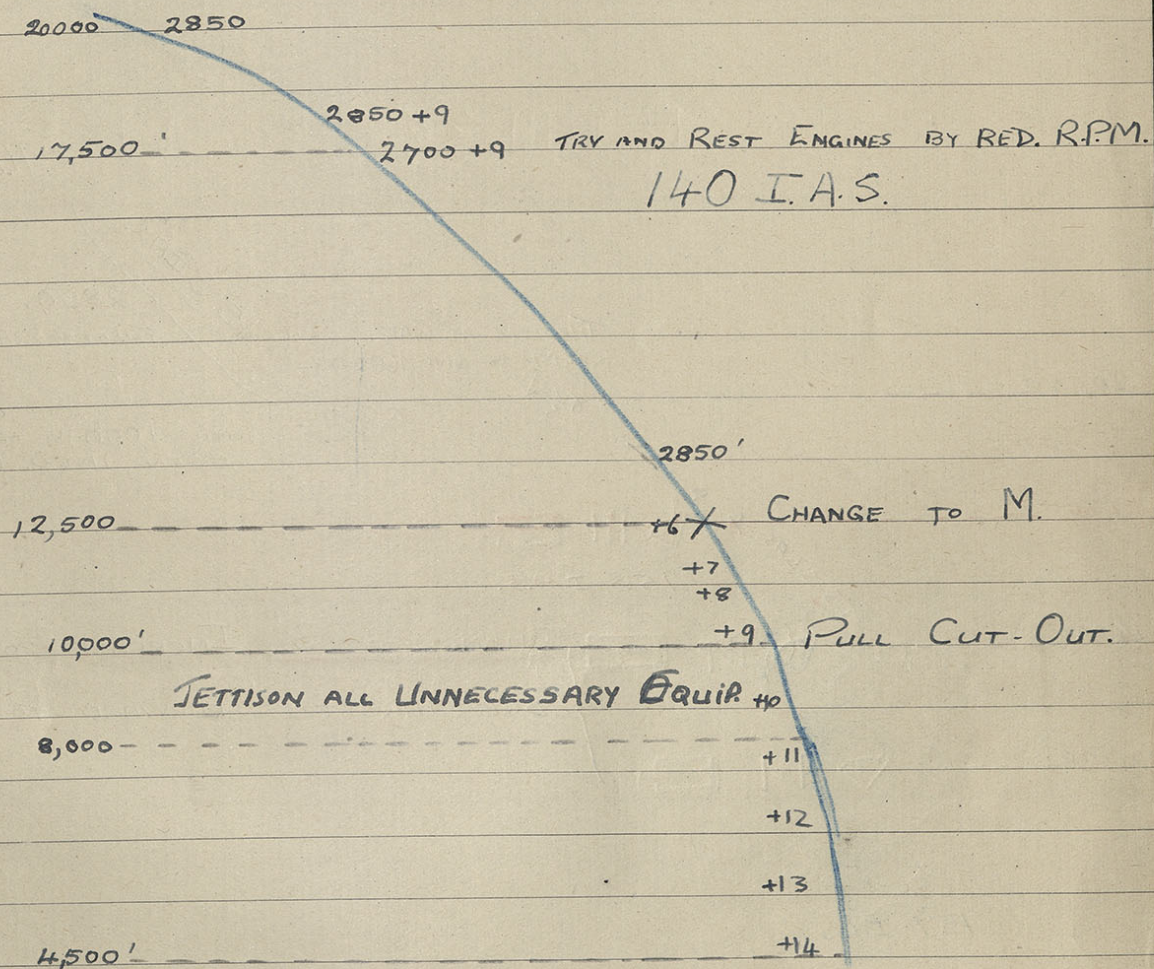
Throttles at Gate.
R.P.M. to give 160 I.A.S.

If in "M" gear, Revs are 2500 or more then change to "S" gear and adjust R.P.M. to give required I.A.S

Throttle to give +4
R.P.M. at Minimum.

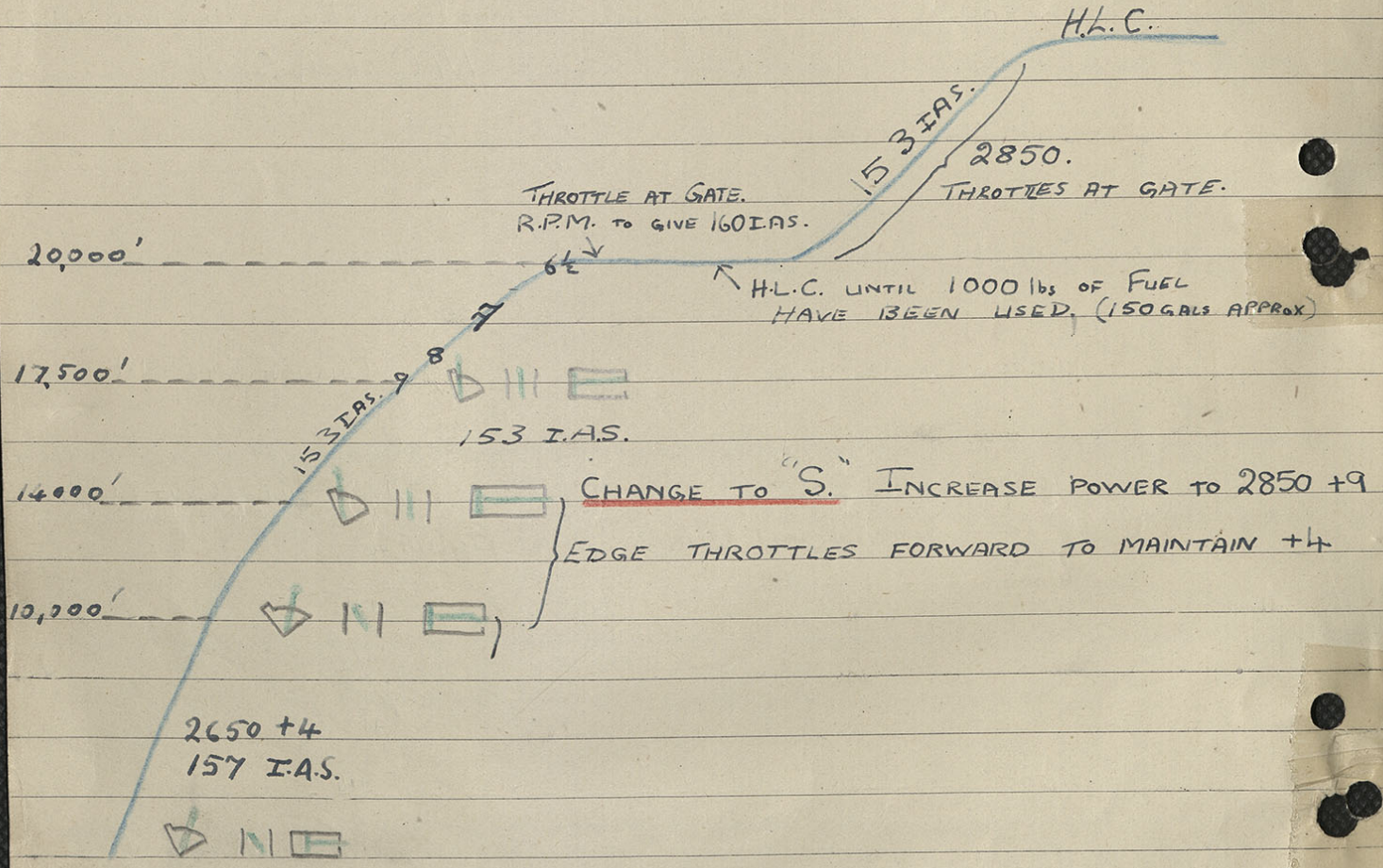
DESCENDING ON 2 ENGINES.

THROTTLE AT GATE. R.P.M. TO GIVE 160 I.A.S.



OPERATIONAL CLIMB.

A.U.W. EXCEEDS 60,000



3000 +14

Airborne - Boost to 9.
Revs to 2650
Boost +4.
Edge throttle to Gate
Boost begins to fall
Change to 2.
Boost to 6 lbs
If Climb is continued after setting course, adjust speed with attitude

At Target
Revs - 2850.
All Pumps ON
After Target.
Control Airspeed with Revs.
Descend
Throttles at Gate.
Obtain Speed with R of Descent and Revs.

M or S.

155 - 160 Light
165 - 170 Heavy

8 and 6000 ft.

10. (a) out. (b) out. (c) out. (4)

11. Pull the clutches out. (4)

12. Use throttle. (4)

13. To test whether or not the clutches are properly in. (4)

14. By turning the attitude control anti-clockwise. (4)

15. (a) The main switch is (4) 11/5 Fuse.

16. Main Switch ON — the other one at setting.
(b) Main switch on (4) the other at setting.
(c). Main switch on — the other at setting.

17. Set the barometric scale by means of the knob to the pressure of the day. The needles should read Zero. Tolerance ± 50' (4)

18. (a) Zero.
(b) Zero (4)
(c) to the magnetic compass reading.
(d) every 15 minutes.

98%

SNOWBALL M.G.
CLASS 5

1. The nose would lift and the tail would in relation appear heavy. This would cause the elevator servo motors to lower the elevators to lift the tail and keep the a/c in level flight. (4)

2. It would affect the rudder controls by trying to ~~pull~~ yaw, the auto controls would then operate and straighten the aircraft. The rudder would be constantly to one side until the auto controls corrected it. (2)

3. 10 hrs engine running, after each operational trip (4)

4. The servo motors jammed. (4)

5. The altimeter would read high. (4)

6. all altimeter, air speed indicator, climb & dive indicator, bomb sight. (4)

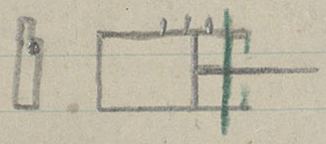
7. Emergency. (4)

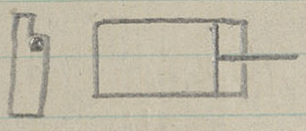
8. All except the bank pointer in the turn & bank indicator. (4)

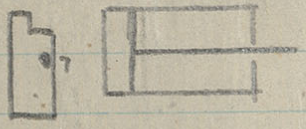
9. (a) pilot head and static vent.
(b) static vent. (4)
(c) static vent.

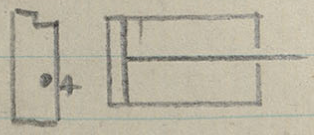
147
SNOWBALL

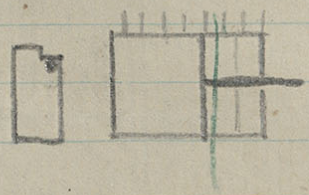
No 7

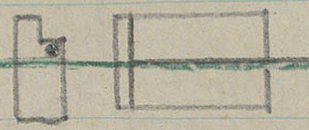
① ~~10,000~~ 1,000  1/1. C.O Pulled. 3,000 +14 M.

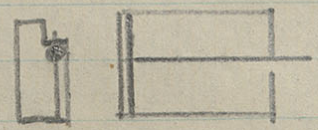
② 2,000  2850 +9 M.

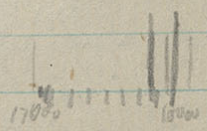
③ 6,000  2650 +7 M.

④ 8000  2650 +4 M

⑤ 11000  2850 +9 S.

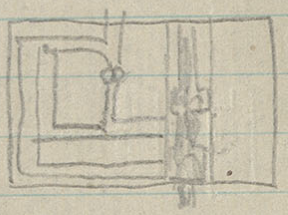
⑥ ~~12000~~  ~~3000 +16 S~~ C.O.P

⑦ 17000  2850 +9 S.

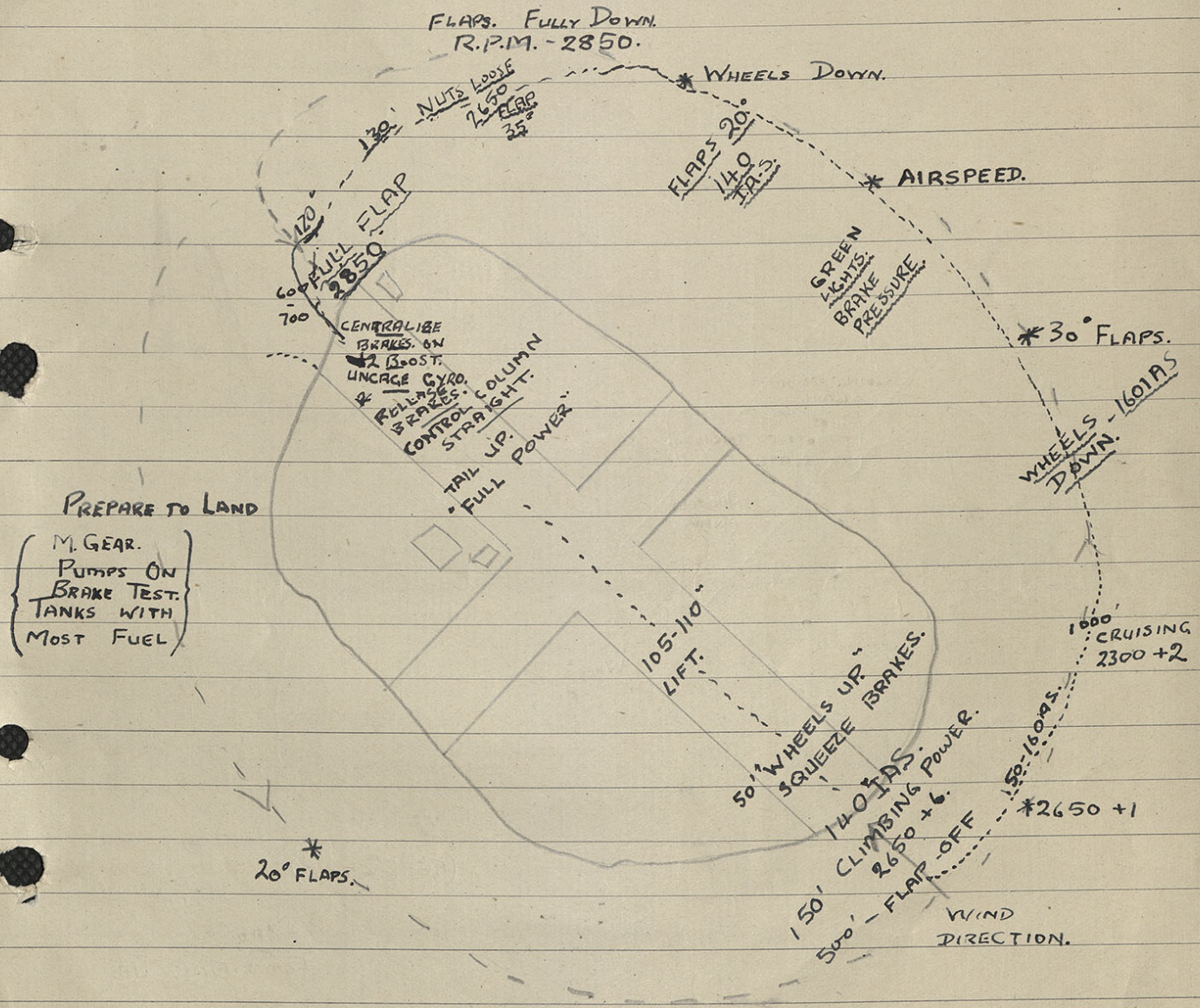


Secretary.
R.A.F. School
Woodford
Nr. Stockport.
Cheshire.

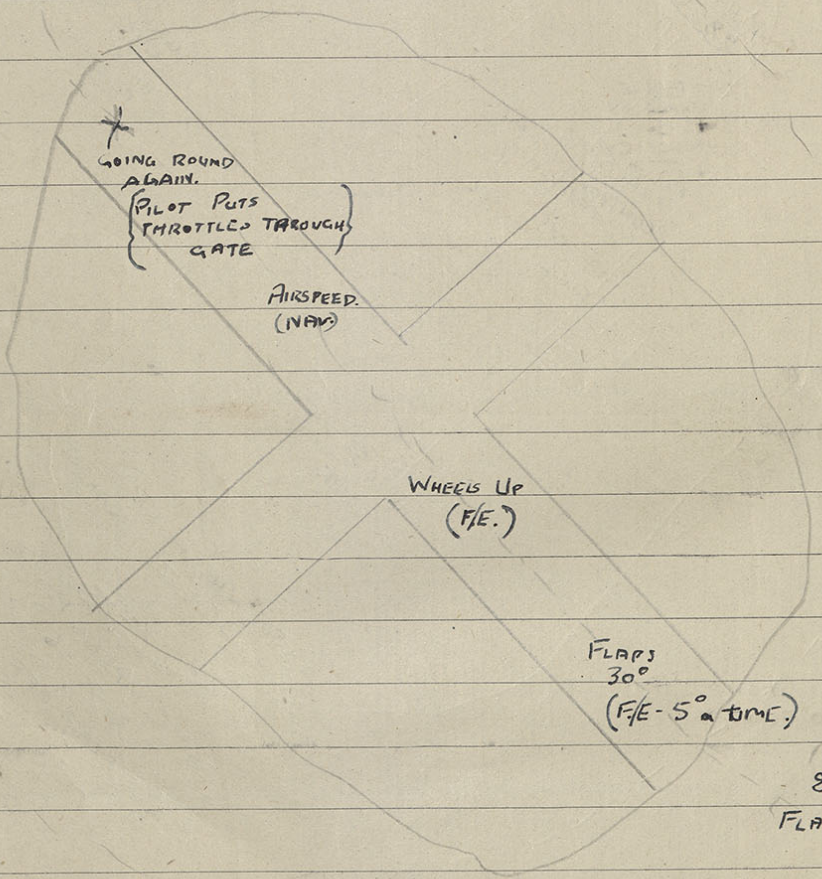
F/E's Notes for
"Lanc" Aircraft.



LANDING PROCEDURE.



Mis- Landing.



ENGINE DRILLS.

STARTING. LANC. 3.

G/F. to Ground.
Select No. 1 tanks.
Booster Coil ON.
Magnetos ON.
I.C.O. to I.C.O. position. N.B. Check Brake Pressure.
Throttles ½" open.
R.P.M. Levers - Fine
No 1 Booster Pumps ON.
O.K. for Priming.
Green Lights ON.
Master Fuel Cocks ON. for engine to be started.
Contact.
I.C.O. to Engine ON when engine picks up.

Mk. I. Aircraft.
Same with the exception of I.C.O's.

Operational Run-Up.
Warm Up at 1200 Revs.
Test for Dead Mag.
Temps. 15° Oil. 60° Coolant Run-Up.
OPEN RAD FLAPS.
Throttle to Zero Boost.
Exercise the Prop. Min - 1800 R.P.M.
Select 2300 R.P.M.
Boost up 1 and down 1.

Select +2. Move revs 100 each way
Boost should remain constant.
Revs Fully Fine. Throttles at Gate.
2900-3000, + 9.
Test for Mag. Drop. Max. 150.
Test T.O. Boost and Revs.
3,000 +14.
Select 0 Boost.
Test Two Speed Blower.
Throttle Back to Slow Running 600-700
Select 1200 R.P.M. for Idling.

FEATHERING DRILL.

Throttle Back.
Petrol OFF. (Mk I - Master Cock. Mk. III - I.C.O. off)
Press Feathering Button.
Mk. III - Master Cock OFF.

UNFEATHERING DRILL. Mk. III

Master Cock ON.
I.C.O. to I.C.O. position.
Magnetos ON.
Throttles ½" oper.
R.P.M. fully coarse.
Press Feathering Button.
I.C.O. to Engine ON when R.P.M. reach 800.
1500 - 1800 RPM. take fingers of F. Button.
Temps 65° 60°
Synchronise Engines.

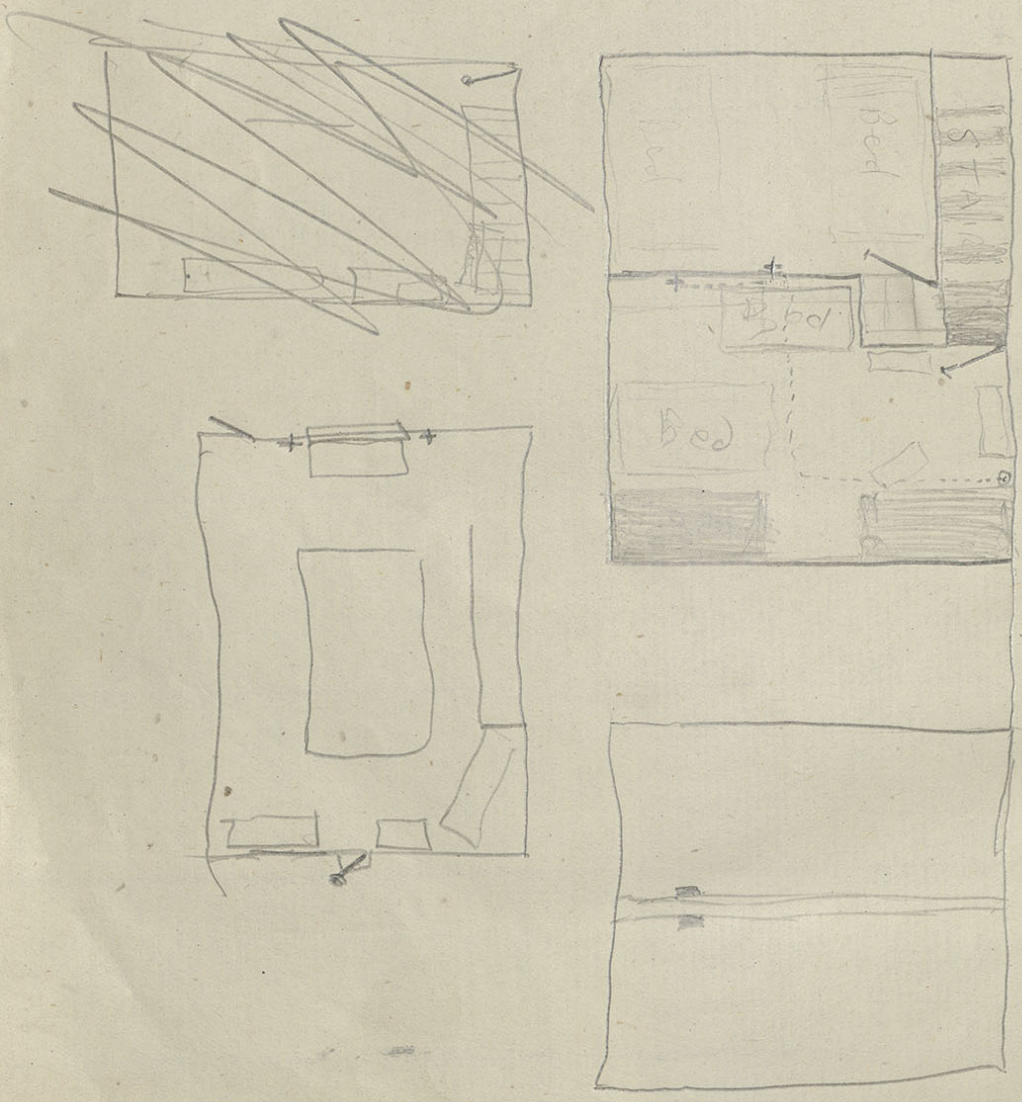
{ Paddle Blades release Button at 1000 Revs

Over-Primed.

Turn off Fuel.
Mags off.
Open throttle.
Press Starter Button

Stopping.

Test for Mag. Drop.
Throttle Back.
Petrol Off. I.C.O. (III) - Master Cocks (I).
Open throttle.
Mags OFF.
I.C.O to Engine ON.



LANC 3.		"Y"
AUW		AUW.
	65000	65000
TAREWEIGHT	36000	36000
OIL. 122 GALS.	~~1100#~~	1100#
T.S.L	2,700#	3,400#
Disposal	25,200	24,500'

200 Gals + Track Miles
.94.

Max. Landing weight - 56,000 lbs. - 63,000

Cock Pit Checks.

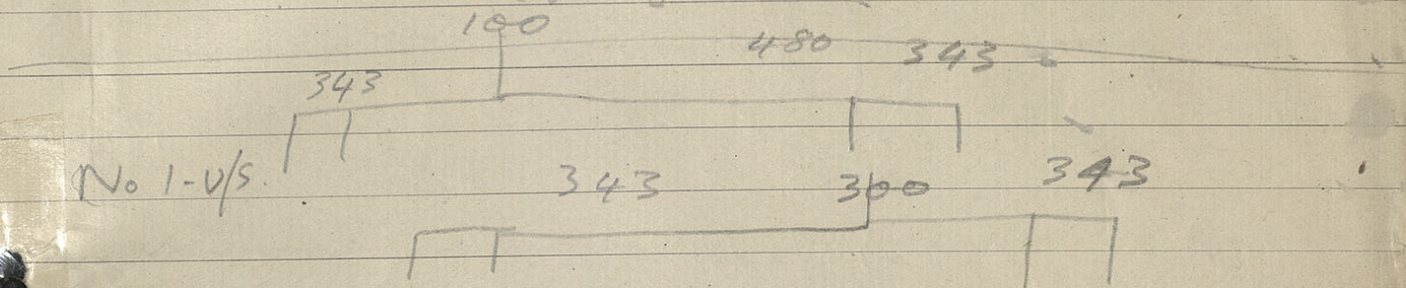
Remove Locks,
Test controls in all directions.
Brakes ON. 150# 80 lbs each brake.
External Warnings Lights.
Fire Ext.

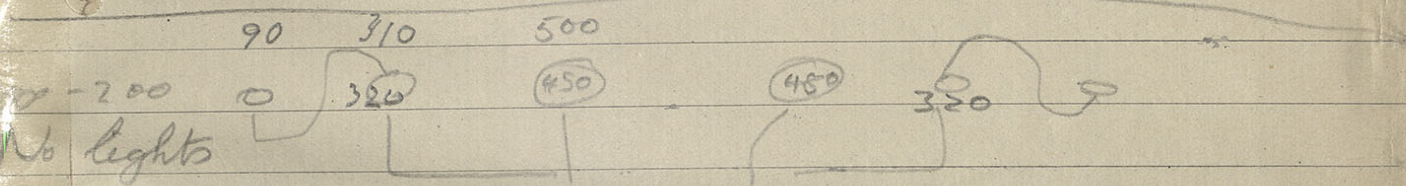
80 363 580 580 562 114

CBC.

343 450 480 343.

Watt gauge No LIGHTS



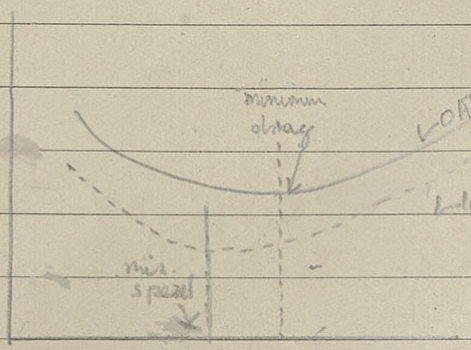


Change tanks. Note No1. - O.K.

To 3000 +4. Wheels up 400'. 2850 +9 Flaps up 800.
Select 2650 +4 climb to 8000! Pumps off 2000
Level out at 8000! Put throttle to gate, control
RPM ~~to~~ give R.A.S.
When convoy is reached fly low with 1800 Revs
Boost to give 135 I.A.S. Engines can be
cleared at intervals if necessary. Select
2650 +4 climb to 10,000'.
At 10000' T.O. gate Boost to give R.A.S.
Fly back to base, gradually descending and
lowering RPM to give Rec. A.S.
Landing - all Pumps on. Select tanks with most fuel.
Select 2850 +9. Flaps down as required.

3, Increase Speed decrease A of A

Drag and Speed



Parasitic Drag is the form drag, or the drag for which there is no lift.

Induced Drag - is drag induced with the amount of lift, and depends on A of A

Optimum Angle means minimum drag.

Max Range - Max AMPG + Economical Speed

Recommended Speed - high AMPG - but better control

P.	E.	Power		
RU	RU		Pilot	Zero Boost Brakes On
OKTO	OKTO		Pilot	Open to 3000 rpm Engineer - Checks Gauges Looks out stbd side
		Full Power	Eng	8

50
42
36
128-150

$\frac{128 \times 200}{150} = \frac{256}{3} = 85\frac{1}{3}\%$

85%

Performance Theory

Range = distance travelled on a given load (2200-240

Average A.M.P.G. = $\frac{\text{Air Miles Travelled}}{\text{Gallons used}}$

Air miles possible = A.M.P.G. attained × Gallons available.

Absolute A.M.P.G. = $\frac{\text{T.A.S.}}{\text{G.P.H. in use.}}$

" Track M.P.G. = $\frac{\text{Track Speed.}}{\text{G.P.H in use.}}$

Average T.M.P.G. = $\frac{\text{Track Miles}}{\text{Gallons used.}}$

Air Speed

I.A.S. = A Reading of the A.S.I. = pressure developed.

R.A.S. = I.A.S. — Position error

T.A.S. = R.A.S. × Altitude factor.

Track Speed = T.A.S. ± Head Tailwind.

Lift and Drag } depend on { T.A.S. / Air density / A of A } decided the I.A.S.

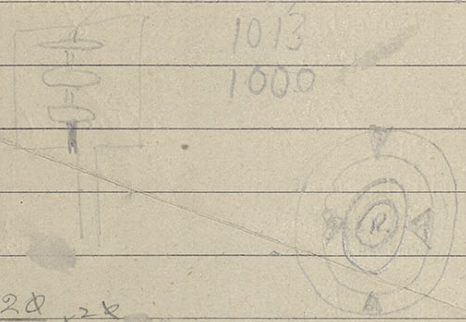
A constant I.A.S. means the same lift and drag at any altitude provided the A of A is constant.

Lift, Speed and Angle of Attack.

1. A High Speed needs a small A/A.
2. " Low " " " large " "

Reduction of weight. (Bombs gone)

1. Same Speed, decrease A of A.
2. Reduce " same A of A.



$\frac{320}{44} \times \frac{2}{2} = \frac{640}{384}$ 384

Remove bobbin from rear turret Cut off Valve.

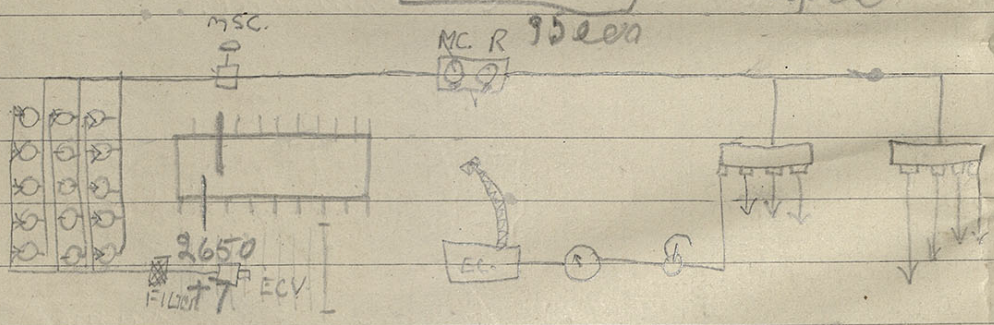
Check F Ext. & Oxygen bottle at rear of draught proof doors.

Fuel & Oil Dipsticks, crank-case for security.

Check F Ext, Oxygen bottle at Mid-Upper Turret

Remove bobbin from C O V

Check



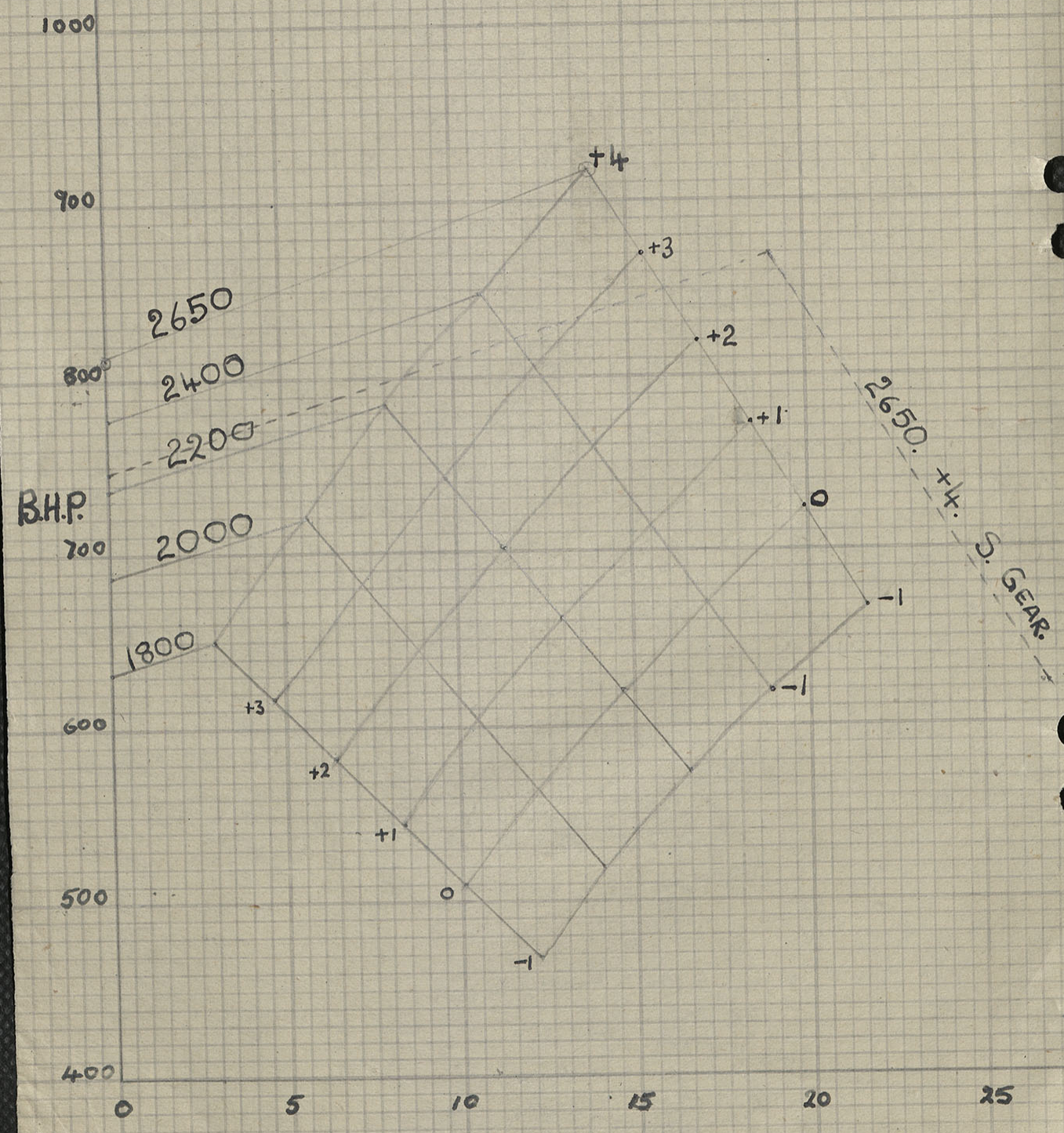
			Coolant	Oil	
Max T.O.	3000 +14	60	15	– 5 mins	– 100 off
" Climb	2850 +9	125°	90°	– 1 hr. limit	
" Continuous	2650 + 7	125°	90°		
" Combat	3000 + 9	135°	105°		

14 + 16 with one nut pulled

Sea level M. Feet +4

	1800	2000	2200	2400	2650
B.H.P.	631	687	737	777	812
C.P.A	418	447	471	513	566
	151	153	154	151	1435

MERLIN "M" GEAR.



(2) Hand Pump.

Normally used only for (a) testing on the ground.

(b) Emergency.

(3) Control Valve. (1) directs oil to ~~eight~~ either side of Jack. (2) Directs the returning supplies from the Jack back to the reservoir. 3(Sometimes forms an Hydro lock in a neutral position Jack.

Transforms oil under pressure to mechanical force.

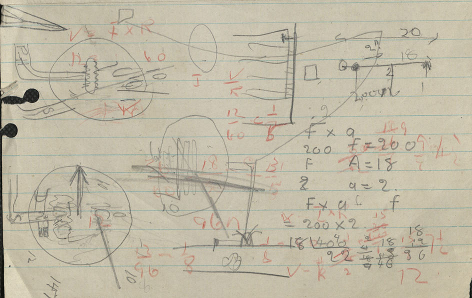
Simple system incorporating an engine driven pump.

1000.
5210000.

1000 ~~15000~~ ~~5200~~

100 ~~800~~

10000 / 100 / 5210. ~~520~~ x 5210.



Advantages of hydraulics over mechanical systems as in aft.

① Ease of steering. (by altering area of jack.)
② Easy remote control (through small bore pipes.)
③ Small number of moving parts.
④ Self lubricating and non corrosive.
⑤ Light in weight.

Oil is used in hydraulic systems because

① Oil is incompressible.
② Oil lubricates.
③ Oil has low freezing point, and high boiling point.

Oil.

Two types of oil can be used in Hydraulic systems depending on the manufacturer.

The magority use anti freezing Type "A"

One firm only uses a special oil (Lockheeds)

Anti freezing oil — A Mineral base oil.

Must not be used with rubber glands, and seals. A synthetic rubber is used instead.

Lockheeds Oil.

Used only on Lockheed systems. — A vegetable Base oil. is manufactured for use with pure rubber Glands.

Four components essential to any hydro system

① Reservoir.

A volume of oil which allows for ⓐ The displacement of the ram in the Jack. ⓑ Any minor leakage. ⓒ Thermal expension. The reservoir is always vented to atmosphere a to allow for the use and full of oil levels. b To allow for varying atmospheres at different altitudes