

GROUND TEST INSTRUCTIONS

SECTION 11

FUEL SYSTEM

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**SECTION 11**  
**FUEL SYSTEM**

**PART 1**

**FUEL FLOW AND PRESSURE TESTS**

**Mk.4 AND Mk.5 AIRCRAFT**

**I.D. INSTRUCTION H03/3 (Issue 7)**

For all the following tests, the aircraft should be in the rigging position with the necessary access doors and panels removed.

**TEST EQUIPMENT REQUIRED**

1. Sealing gland for front tank vent pipes (ID.SK.245)
2. Blanking plate assembly (ID.SK.252)
3. Valve retainer clamps (ID.SK.363)
4. Pressurising rig. (ID.SK.428)
5. Assembly to ID.SK.392
6. Fuel Flow Test Rig.
7. Assembly to ID.SK.559
8. Pressurising rig. (ID.SK.255)

**PREPARATION FOR PRESSURE TEST (SEE ID.SK.582)**

1. Check that the defuelling cock is in the OFF position.
2. That the refuelling pressure relief valves (on the undersurface inboard of the wing tanks) are free to operate.
3. That the low pressure cock in the main engine delivery pipe is at the OFF position.
4. Remove the protective covering from the engine end of the fuel pipe and fit a special assembly to ID.SK.252.
5. Connect 'Desynn' gauge transmitters (alternatives, Bourdon tube gauges or manometers) to the connections in the suction and pressure relief valves in the front tanks.
6. Connect similar measuring instruments to the connections in the suction relief valves in the centre tanks.
7. Remove the caps from the front tanks sediment drain pipes and connect special pipes, ID.SK.559, for subsequent fitment of Desynn transmitters.
8. Connect measuring instruments as in para.5 to the connections in the air delivery pipes at the inboard end of the wing tanks in the wheel well.

9. Remove dust cap from refuelling coupling in the port wheel well and couple up corresponding adaptor of the ground test rig.
10. Set aircraft master switch to ON.
11. Set rig cocks to refuel position.
12. Set refuelling time switch in port wheel well to the ON position.
13. Start rig pump to fuel tanks, check gauges in cockpit and stop rig when tanks are filled and flow ceases.

## NOTE

- a. The time switch may have to be reset in order to complete the fuelling operation, when this has been carried out let the time switch run down and do not reset until further refuelling is necessary.
  - b. There should be little or no spillage from the vent pipes either during or after filling or from the refuelling pressure relief valves.
14. Take readings of gallons gone, note total time to refuel, refuelling rate and pressure, also maximum pressure build up in each tank.

Front tanks pressure should not exceed	11½ p.s.i.
Centre tanks pressure should not exceed	8½ p.s.i.
Wing tanks pressure should not exceed	7½ p.s.i.

15. Turn ON the low pressure cock,
16. Prime feed pipe by bleeding air from the blanking adaptor at engine connection.

## PRESSURE TEST OF REFUELLING PIPES &amp; VALVES

1. Remove ground test rig refuelling nozzle and connect special Avery Hardoll nozzle, inflation valve unit and its reservoir fuel tank, ID.SK.428, to the aircraft refuelling attachment. Adjust control to allow fuel to be forced into the system at 50 p.s.i. from augmentor tank. The tank capacity will allow 5 minutes test time.
2. The pressure should be maintained at 50 p.s.i. for 5 minutes without external leakage.

## NOTE

Care should be taken to prevent the 50 p.s.i. pressure being transmitted to the main feed pipes by ensuring that the defuelling cock is fully at OFF and is leak free.

## MAIN SYSTEM PRESSURE TEST

1. Insert blanking plug ID.SK.245 at exit of front tanks vent pipe and tighten to seal. (Care must be taken to ensure that the pipe is free from paraffin or grease).
2. Fit retainer clamps ID.SK.363 to close and retain the heads of the refuelling pressure relief valves on to their seatings.
3. Fit assembly ID.SK.255 to the tapping points in the pressurising pipes in the wheel wells and admit air until the pressure rises to 13 p.s.i. as measured from the top of the front tanks.
4. Check all tanks, pipes etc. for leaks.
5. A pressure of 13 to 12 p.s.i. should be maintained for 10 minutes after turning OFF the air supply.

## MAIN DELIVERY PIPE PRESSURE TEST

## NOTE

During the following tests the engine feed pipe should be suitably supported and anchored at its extremity in order to prevent damage to the 'King' flexible couplings.

1. Remove the aircraft 'Breeze' plugs from the booster pumps and connect to the latter special plugs from the rig external source of supply.
2. Check that the air pressure in the tanks is still at 13 p.s.i., make good if necessary.
3. Start booster pumps running, adjust rheostats to give not more than 29 volts at each pump, check amperage and note that the fuel delivery pressure is not less than 28 p.s.i. gauge.
4. Check delivery line for leaks.
5. Turn OFF booster pumps and air supply and remove the blanking plug from the vent pipe together with retainer clamps.
6. Turn OFF the low pressure cock.

## AIR FLOW REGULATION TEST

1. Remove assembly ID.SK.252 and connect test rig suction line to the aircraft main delivery feed pipe.
2. Connect the special 2" rig air line to the external charging connection in the spine of the aircraft and open supply to charge tanks.
3. With the rig set for suction and throttling valve adjusted to allow 500 gallons per hour, draw off 120 gallons of fuel.
4. During the flow vary the air pressure between 10–60 p.s.i. Note any variations in pressure as may be indicated by the measuring instruments connected to the wing tanks. This must NOT rise above 6½ p.s.i. or fall below 5¼ p.s.i. when at 60 p.s.i. the feed pipe to the reducing valves should be checked for leaks.
5. Stop pump, close throttling valve, turn low pressure cock to OFF, turn OFF air supply.

PREPARATION FOR FLOW AND TRANSFER TEST

1. Check that the low pressure delivery cock is at the OFF position.
2. Connect the refuelling hose of the ground test rig to the aircraft.
3. Set Venner time switch to ON.
4. Set rig controls to refuel, start rig pump and fill tanks.
5. Stop pump, close throttling valve and set rig controls to suction.

SUCTION TEST

1. At the base of the main tanks connect to the pipe assembly as shown in ID.SK.392 and ID.SK.559 measuring instruments and turn on the pet cocks.
2. Turn on air supply to aircraft external charging connection at shop pressure, (approx. 70–80 p.s.i.)
3. Turn the low pressure cock to the ON position.
4. Start the rig pump and adjust the throttling valve to allow a flow rate of 1850 G.P.H. as denoted by the rig manometer.
5. Take readings as under when the gallons gone meter registers 25, 50 and 75 gallons.
6. The suction pressure drop will be taken as the difference between mean sediment drain pressure and that at the engine connection.

The engine delivery pressure must be within the limits of the mean front tank pressure  $2\frac{1}{4}$   $+\frac{1}{2}$   $-\frac{3}{4}$  p.s.i.

LIMITS			
Fronttank pressure (measured at sediment drain)	Port	5 – 6 $\frac{3}{4}$	p.s.i.
	Stbd.	5 – 6 $\frac{3}{4}$	p.s.i.
Centre tank pressure	Port	4 – 6	p.s.i.
	Stbd.	4 – 6	p.s.i.
Wing tank pressures	Port	5 – 6 $\frac{1}{2}$	p.s.i.
	Stbd.	5 – 6 $\frac{1}{2}$	p.s.i.

7. Pressure difference between port and stbd. wing tank pressures must not exceed  $\frac{1}{4}$  p.s.i.
8. Turn the low pressure cock to OFF.

BOOSTER PUMP BALANCE TEST

1. Repeat fuelling sequences to refill tanks and then reset rig for suction.
2. With the low pressure cock at OFF switch ON port booster pump, check that 27 volts is available to the pump.

3. Turn ON air supply to the aircraft at 20 p.s.i.
4. Turn ON low pressure cock, leave rig pump stationary and open the rig throttling valve to pass 400 gallons per hour.
5. Take readings of the engine delivery pipe outlet and front tank pressures when the gallons gone meter registers 10, 20 and 30 gallons.
6. Turn OFF the low pressure cock leaving the rig throttling valve in the position to which it has been previously adjusted.
7. Stop the port pump and switch ON the starboard, turn ON the low pressure cock and repeat Para. 5 above.
8. The pumps will be considered satisfactory if the difference in pressure between the front port tank and engine delivery pipe pressure is within  $\pm \frac{1}{2}$  p.s.i. of the same pressure difference on the starboard side at 10, 20 and 30 gallons gone.
9. The pumps are pre-set by the manufacturers at 27 volts to give  $17\frac{3}{4}$  – 18 p.s.i. delivery pressure at 400 G.P.H. By adding 1 p.s.i. to compensate for head and subtracting the front tank pressure from the engine delivery pressure, a quick assessment may be made indicating whether a faulty pump has been fitted.

BOOSTER PUMP TEST No.1 PORT

1. Repeat fuelling sequence to fill tanks, then reset rig for suction, switch ON port booster pump. Check that 26 volts is available at the pump.
2. Turn ON air supply to aircraft at 20 p.s.i.
3. Turn ON low pressure cock, start rig pump and set throttling valve by manometer to pass 1500 gallons per hour.
4. Take readings as below when gallons gone meter registers 10, 20, 30, 60, 80 and 100 gallons.

These must be within the

Limits

Front tank pressure	3 – 5 p.s.i.
Centre tank pressure	$3\frac{1}{2}$ – 6 p.s.i.
Wing tank pressure	5 – $6\frac{1}{4}$ p.s.i.
Engine delivery pipe pressure	10 p.s.i. minimum
Booster pumps at 26 V	16 amps. maximum

5. When this test has been completed, stop pump, close throttling valve, switch OFF booster pump and turn OFF air supply.

BOOSTER PUMP TEST No.2 STBD.

This test is a repeat of Test No.1 above for the starboard booster pump only.

## LEVEL BALANCING TEST (WITHOUT ELECTRICAL BALANCING)

1. Repeat fuelling sequences to refill tanks and reset rig for suction.
2. Connect the rig booster pump cables to the aircraft pumps.
3. Turn ON air and adjust to deliver to the aircraft reducing valve at 60 p.s.i.
4. Switch ON both booster pumps and set voltage at 26 V.
5. Start ground test rig pump at suction and adjust the throttling valve to pass 500 gallons per hour.
6. Take readings as below at 2 minute intervals until one side of the system has completely emptied.

Engine delivery pressure	p.s.i.
Front tank pressure	p.s.i.
Centre tank pressure	p.s.i.
Wing tank pressure	p.s.i.
Booster pumps ammeter readings	amps
Contents of port tanks.	lbs.
Contents of stbd. tanks	lbs.

7. When this test has been completed, stop pump, close throttling valve, switch OFF booster pumps, turn OFF air.

## NOTE

Some pressure variation may be expected to take place as registered by the front tank gauges when the fuel level drops and the vapour vent valves become operative. The limit for out of balance is 75 gallons (600 lbs.), if this is exceeded a closer matching of port and starboard components should be obtained.

## ELECTRICAL LEVEL BALANCE TEST

1. Repeat fuelling operations to refill tanks and reset rig for suction.
2. Turn on air and adjust to deliver to the aircraft reducing valve at 60 p.s.i.
3. Remove special rig booster pump cables and plugs and replace aircraft components.
4. Adjust ground generator to give approx. 28 volts and connect to aircraft.
5. From cockpit switch ON both booster pumps in Auto, open low pressure cock,
6. Start ground test rig pump and adjust throttling valve to pass 500 g.p.h.
7. Take readings as below at 2 minute intervals until one side of the system has completely emptied.

Front tanks pressure	p.s.i.
Centre tanks pressure	p.s.i.
Wing tanks pressure	p.s.i.
Drop tanks pressure	p.s.i.
Contents of port tanks	lb.
Contents of starboard tanks	lb.

8. When this test has been completed, stop pumps, close throttling valves, turn OFF air supply.

## NOTE

Alteration in wing tank pressures will take place due to varying flow rate.  
The wing tank pressures must not exceed  $7\frac{1}{4}$  p.s.i.  
The limit for out of balance is 13 gallons (100 lbs).

## DEFUELLING TEST

1. Repeat fuelling sequences to refill tanks and reset rig for defuelling using the Avery Hardoll nozzle.
2. Set the low pressure cock to the OFF position.
3. Remove the locking of the aircraft defuelling cock and turn it from the OFF to the ON position.
4. Adjust the shop air reducing valve to 10 p.s.i. and turn on air supply.
5. Set the throttling valve to allow the system to drain at 1,800 gallons per hour.
6. When tanks are empty turn OFF air supply and turn aircraft defuelling cock from OPEN to CLOSED or OFF and relock.
7. Remove defuelling connection and air line.
8. Note total time taken to defuel aircraft.

## PRESSURE REFUELLING.

Since the factory ground test rigs are not suitable for refuelling the aircraft either at the required speed or pressure, it will be necessary to test the complete refuelling system with the aid of a high speed bowser.

On the first refuelling with a high pressure 'bowser' the following points must be checked.

The pressure at the aircraft refuelling connection must be 45 – 55 p.s.i. except when the flow rate is greater than about 150 gallons per minute when the pressure may be less, or on shut off when flick pressures up to 75 p.s.i. are permissible.

## NOTE:

- a. No more than minute quantities of fuel spill from the vents
- b. The refuelling valves close correctly.
- c. The float switches cut off the refuelling valves at the correct fuel level.
- d. Note total time taken to refuel aircraft.

SECTION 11

FUEL SYSTEM

PART 2

FUEL FLOW AND PRESSURE TESTS

Mk.6 AIRCRAFT

I.D. INSTRUCTION H03/4 (Issue 3)

For all the following tests the aircraft should be in the rigging position with the necessary access panels removed.

TEST EQUIPMENT REQUIRED.

1. Special pipe with pressure tapping to ID.SK.448
2. Blanking plate assembly to ID.SK.447
3. Pressurising rig to ID.SK.255
4. Hose and adaptor for air ground charging ID.SK.254.
5. Air inflation adaptor with sealing gland ID.SK.243
6. Fuel Flow Test rig
7. Assembly to pressurise refuelling pipes ID.SK.428
8. Assembly of gauges and transmitters to ID.SK.392 and as in ID.SK.552
9. Special pipe assembly ID.SK.559 and ID.SK.560
10. Sealing gland ID.SK.449
11. Pressurising rig ID.SK.255
12. Assembly to ID.SK.447

PREPARATION FOR PRESSURE TEST. (See ID.SK.552, Issue A).

1. Check that the defuelling cock is in the OFF position
2. Check that the ganged 'Saunders' cocks at the rear tanks are in the open or ON position
3. Check that the low pressure cock in the main fuel delivery pipe is at the OFF position
4. Remove the dust cap from the engine end of the delivery pipe and fit special blanking plate assembly with pressure tapping to ID.SK.447.
5. Connect 'Desynn' gauge transmitters (alternatives 'Bourdon' tube gauges or manometers), to the connections in the suction and pressure relief valves in the front tanks.

6. Connect the measuring instruments as in para. 5 to the connections in the suction and pressure relief valves in the rear tanks.
7. Connect to the King valves at the front tanks sediment drains, pipe assembly ID.SK.559.
8. Connect measuring instruments as in para. 5 to the pressure tapping points in the air delivery pipes at the inboard end of the wing tanks in the wheel bay. This connection to be made through a tee piece in the wheel bay with ON—OFF cock to allow for the introduction of the air supply.
9. Connect to the King valves at the recuperator sediment drains, pipe and cock assembly to ID.SK.560 together with a 0 – 20 p.s.i. pressure gauge.
10. Connect rig refuelling coupling to corresponding aircraft unit.
11. Set aircraft master switch to ON and tank selector to AUTO.
12. Set rig cocks to refuel position.
13. Set refuelling time switch in port wheel well to the ON position: Check that 6 lights illuminate in refuelling indicator.
14. Start rig pump to fuel tanks, take time at which each lamp extinguishes.

## NOTE.

- a. The time switch may have to be reset in order to complete the filling operation, when this has been carried out let the time switch run out and do not reset.
  - b. There should be little or no spillage from the vent pipes either during or after filling.
  - c. Fuel should not spill from the refuelling pressure relief valves whilst filling the aircraft.
15. Take readings of gallons gone, note total time to refuel, refuelling rate and pressure, also maximum pressure build up in each tank.
 

Front tank pressure should not exceed	11½ p.s.i.
Rear tank pressure should not exceed (pre Mod.504)	7½ p.s.i.
Wing tank pressure should not exceed (post Mod.504)	8½ p.s.i.
	7½ p.s.i.
  16. Turn the low pressure cock to the ON position
  17. Prime the engine delivery feed pipe by bleeding air from the adaptor at the engine connection.

## PRESSURE TEST OF REFUELLING PIPES AND VALVES

1. Remove ground test rig refuelling nozzle, connect special Avery Hardoll nozzle and inflation valve with its reservoir fuel tank, ID.SK.428, to the aircraft refuelling unit, adjust control to allow fuel to flow into the refuelling system at 50 p.s.i. from the augments tank.

2. The pressure should be maintained for 5 minutes.
3. Check for, and if necessary, rectify all external leakage.

#### MAIN SYSTEM PRESSURE TEST

1. Disconnect the exhaust pipes from the Hymatic PS.48/12 pressure reducing valves and blank off the exhaust ports.
2. Insert blanking plug ID.SK.243 at exit of front tank vent pipe. (Care must be taken to ensure that the pipe is free from paraffin or grease).
3. Insert blanking plug ID.SK.243 at exit of rear tank vent pipe and tighten to seal. (Observe instructions as in para.2).
4. Fit retainer clamps, ID.SK.363 to close and retain the heads of the refuelling pressure relief valves on to their seatings.
5. Blank off the branch vent pipe A.203096 with special plug assembly ID.SK.449 and tighten to seal.
6. With pressurising assembly ID.SK.255 admit air to the front, rear, wing and drop tanks until the pressure rises to 13 p.s.i.
7. Turn OFF air supply.
8. Check all tanks, pipes, etc. for leaks.
9. A pressure of 13 – 12 p.s.i. should be maintained for 10 minutes after turning OFF the air supply.
10. When this test has been completed, remove blanks from the PS.48/12 'Hymatic' reducing valves, exhaust ports and reconnect pipes previously removed.

#### MAIN ENGINE DELIVERY PIPE PRESSURE TEST

##### NOTE.

During the following test, the engine feed pipe should be suitably supported and anchored at its extremity in order to prevent damage to the 'King' flexible couplings.

1. Remove the aircraft 'Breeze' plugs from the booster pumps and connect to the latter special plugs from the rig external source of supply.
2. Check that the air pressure in the tanks is still at 13 p.s.i. and make good if necessary.
3. Start booster pumps and adjust rheostat to give not more than 29 volts at each pump, check amperage and not that the full delivery pressure is not less than 28 p.s.i. gauge.
4. Check delivery pipe line for leaks.
5. Turn OFF booster pumps and air supply and remove the blanking plugs from the vent pipes together with retainer clamps.

6. Remove all blanks previously fitted. Failure to do so may cause damage to the aircraft on subsequent refuelling.

#### AIR FLOW REGULATION TEST

1. Remove assembly ID.SK.447 and connect to the engine delivery pipe the suction connection of the test rig ID.SK.448.
2. Connect the special 2" dia. rig air line to the a/c external charging connection in the spine of the aircraft and open air supply with rig reducing valve set to allow a pressure of 20 p.s.i. to be built up at the Hymatic valves.
3. Open low pressure cock with selector to AUTO.
4. With the rig set for suction and the throttling valve adjusted to allow 500 gallons per hour, draw off 120 gallons of fuel.
5. During this flow vary the air pressure between 10 – 60 p.s.i. up and down, note any variations in wing tank pressure.
6. Stop pump, close throttling valve, turn low pressure cock to OFF position, turn OFF air supply.
7. The fuel tanks air pressure should not fluctuate during the variations in air pressure supply to the reducing valves.
8. This pressure must not be above  $6\frac{1}{2}$  p.s.i.  
or drop below  $5\frac{1}{2}$  p.s.i.  
(measured at the wing tanks).

#### PREPARATION FOR FLOW AND TRANSFER TESTS

1. Check that the low pressure cock is at the OFF position.
2. Connect the refuelling connection.
3. Turn the aircraft master switch to the ON position and wind and start Venner time switch.
4. Set rig controls to refuel, start rig pump and fill tanks.
5. Stop pump, close throttling valve and set test rig controls to suction.
6. Fit the special rig 'Breeze' couplings to the booster pumps if they have previously been removed.

#### SUCTION TEST

1. Turn ON the pet cocks to the measuring instruments in the pipe lines from the base of the front tanks, set tank selector to AUTO.
2. Turn ON air supply to aircraft external charging valve at shop pressure providing that this is not above 90 p.s.i.

3. Turn the low pressure cock to ON position.
4. Start rig pump and adjust the throttling valve to allow a flow rate of 2,300 G.P.H.
5. Take readings as under when the gallons gone meter registers 25, 50, 75 and 100 gallons.
6. The suction pressure drop will be taken as the difference between mean sediment drain pressure and that at the engine connection.  
The pressurer must be within:—

Front tank pressures measured at sediment drain	p.s.i.
Wing tank pressure	p.s.i.
Engine delivery pressure, must be $-\frac{1}{4}$ p.s.i. minimum	p.s.i.

LIMITS

Front tank pressures measured at sediment drain	5 – 6 $\frac{3}{4}$ p.s.i.
Wing tank pressures	5 – 6 $\frac{1}{2}$ p.s.i.

PUMP SPEED CHANGE TEST

1. Repeat fuelling sequences to fill tanks and reset rig for suction.
  2. Turn ON air pressure from rig at 20 p.s.i.
  3. Connect rig booster pump plugs to aircraft components.
  4. Switch ON ground generator and adjust rheostats to give 26 volts to pumps.
  5. Turn ON low pressure cock.
  6. Switch ON both booster pumps.
  7. Start rig pump set to pass 400 gallons per hour.
  8. When flow is steady make recordings of engine delivery pressure and amps.
  9. Switch OFF port booster pump and note engine delivery pressure and amps of stbd. pump.  
The pressure should rise.
  10. Switch ON both pumps. Note drop in pressure, allow flow and pressure to become constant.
  11. Switch OFF stbd. booster pump and note engine delivery pressure and amps of port pump.  
The pressure should rise.
  12. Switch ON both booster pumps. Note drop in pressure.
  13. Switch OFF both pumps, stop rig, close low pressure cock, switch OFF ground generator.
- |  |        |
|--|--------|
| (Both pumps ON engine delivery pressure  | p.s.i. |
| ( " " "                                  | amps   |
| (Port pump OFF engine delivery pressure  | p.s.i. |
| (Stbd. " "                               | amps   |
| (Both pumps ON engine delivery pressure  | p.s.i. |
| ( " " "                                  | amps   |
| (Stbd. pump OFF engine delivery pressure | p.s.i. |
| (Port " "                                | amps.  |

## BOOSTER PUMP TEST No.1 Port.

1. Repeat fuelling sequence to fill tanks, reset rig for suction, switch ON port booster pump which will run at high speed.
2. Check that 26 volts is available to the pump.
3. Turn ON air supply at 20 p.s.i.
4. Set tank selector to AUTO.
5. Turn ON low pressure cock, start rig pump and set the throttling valve to pass 2,000 G.P.H.
6. Take readings enumerated below when the gallons gone meter registers 20, 30, 40, 60, 80 and 100 gallons.  
These must be within the limits:—
 

Front tank pressure	3 – 5 p.s.i.
Wing tank pressure	5 – 6¼ p.s.i.
Engine delivery pipe pressure – minimum	8 p.s.i.
Pump at 26 volts – maximum	26 amps
7. When this test has been completed, reduce flow to 500 G.P.H. and observe recuperator gauge, this should not rise indicating that the recuperator has discharged and is recharging.

## BOOSTER PUMP TEST No. 2 Starboard

This test is a repeat of No. 1 above but for the starboard booster pump only.

## RECUPERATOR TESTS

1. Connect to the pipe assembly, I.D. Sk.392, measuring instruments and turn On the pet cocks.
2. Repeat fuelling sequences to refill tanks and reset rig for suction tests. Selector switches in cockpit at 'Auto'.
3. Turn ON air supply at 40 p.s.i. to the aircraft reducing valves.
4. Switch ON both booster pumps from rig, set at 26 volts.
5. Turn ON low pressure cock, start rig pump and set throttling valve to 2,000 g.p.h.
6. Wait a few seconds for a steady flow from the system and then, as a stop watch is started switch OFF both booster pumps. When the engine delivery pressure drops below front tank pressure, measured at the sediment drain, stop watch. Note time of discharge.
7. Immediately switch ON both booster pumps and start watch. The pressure registered at the recuperator gauge should rise rapidly to about 16 p.s.i., maximum 16½ p.s.i.; it will stay at about this pressure for a period and then drop rapidly to about 10–11 p.s.i. Stop watch. Note time of recharge.

8. Stop rig, turn OFF low pressure cock and air supply, together with booster pumps.  
Take readings of:—
- |                         |       |
|-------------------------|-------|
| Time taken to discharge | secs. |
| Time taken to recharge  | secs. |

## LEVEL BALANCING TEST

- Repeat fuelling sequence to fill tanks and reset rig for suction.
- Turn ON air supply and adjust to deliver to the aircraft reducing valve at 60 p.s.i.
- Switch ON both booster pumps at the ground test rig and set voltage to 26 V.
- Start ground test rig pump, set at suction and adjust the throttling valve to pass 500 gallons per hour.
- Take readings as below at 2 minute intervals until the system has completely emptied.
- Observe the operation of the selector cock when the wing tanks empty and the drop in pressure when the vapour vent valves become operative.

Front tank pressures	p.s.i.
Rear tank pressures	p.s.i.
Wing tank pressures	p.s.i.
Engine delivery pressures	p.s.i.
Booster pumps	amps
Contents of port tanks	lbs.
Contents of stbd tanks	lbs.

- When this test has been completed, stop pump, close the throttling valve, switch OFF booster pumps, turn OFF air supply.

## DEFUELLING TEST

- Repeat fuelling sequence to refill tanks and reset rig for defuelling using the Avery Hardoll nozzle.
- Set tank selector to AUTO
- Set the low pressure cock to the OFF position.
- Remove the locking of the aircraft defuelling cock and turn it from the OFF position to the ON.

5. Adjust the shop air reducing valve to 10 p.s.i.
6. Set the throttling valve to allow the system to drain at 1800 G.P.H. approx.
7. When the tanks are empty turn OFF air supply and relock aircraft defuelling cock in the OFF position.
8. Remove defuelling connection and air line.
9. Note total time to defuel aircraft.
10. Remove defuelling connection, air line, and all ancillary equipment fitted for the tests.

### PRESSURE REFUELLING

Since the factory ground test rigs are not suitable for refuelling the aircraft either at the required speed or pressure, it will be necessary to test the complete refuelling system with the aid of a high geared bowser.

On the first refuelling with a high pressure 'bowser' the following points must be checked.

The pressure at the aircraft refuelling connection must be 45 – 55 p.s.i. except when the flow rate is greater than about 150 gallons per minute when the pressure may be less, or on shut off when flick pressures up to 75 p.s.i. are permissible.

Note that:

- a. No more than minute quantities of fuel spill from the vents.
- b. The refuelling valves close correctly.
- c. The float switches cut off the refuelling valves at the correct fuel level.
- d. Note total time taken to refuel aircraft.

**SECTION 11**  
**FUEL SYSTEM**  
**PART 3**

**FUEL FLOW AND PRESSURE TESTS Mk. 4 AND T. Mk. 7 AIRCRAFT –  
DROP TANKS FITTED**  
**I.D. INSTRUCTION H03/5 (Issue 9)**

**APPLICABILITY**

Hunter Mks.4 and 7 with Mods 138 and 228 incorporated and with or without four drop tanks fitted.

**TEST EQUIPMENT REQUIRED**

- |  |                     |
|--|---------------------|
| 1. Sealing gland for front tank vent pipe          | ID.Sk.245           |
| 2. Blanking plate assembly                         | ID.Sk.252           |
| 3. Valve Retainer Clamps                           | ID.Sk.363 ID.Sk.363 |
| 4. Pressurising Rig                                | ID.Sk.428           |
| 5. Pressurising Rig                                | ID.Sk.255           |
| 6. Assembly to ID.Sk.392                           |                     |
| 7. Fuel Flow Test Rig                              |                     |
| 8. Assembly for retaining drop tanks (when fitted) | SE.1227.            |

**IMPORTANT**

For all the following tests the aircraft should be in the rigging position with the necessary access doors and panels removed. Front tank pressures should be measured at the suction and pressure relief valves throughout.

**PREPARATION FOR PRESSURE TEST (SEE ID.SK.646)**

1. Check that the defuelling cock is in the OFF position.
2. That the refuelling pressure relief valves (on the under-surface inboard of the wing tanks) are free to operate.
3. That the low pressure cock in the main engine delivery pipe is at the OFF position.
4. Remove the protective covering from the engine end of the fuel delivery pipe and fit special assembly to ID.Sk.252.

5. Connect 'Desynn' gauge transmitters (alternatives Bourdon Tube gauges or manometers) to the connections in the suction and pressure relief valves in the front tanks.
6. Connect similar measuring instruments to the connections in the suction relief valves in the centre tanks.
7. Connect measuring instruments as in para.5 to the connections in the air delivery pipes at the inboard end of the wing tanks in the wheel wells. Also if drop tanks are fitted connect instruments to the tapping points in the fuel transfer pipes behind the wing nosing adjacent to rib G, port and starboard, together with similar instruments to the tappings between ribs Q and R. (Access through doors on top surface of main planes).
8. Remove the dust cap from the refuelling couplings on the port wheel well and couple up corresponding adaptor of the ground test rig.
9. Set aircraft master switch to ON.
10. Set rig cocks to refuel position.
11. Set refuelling time switch in port wheel well to the On position.
12. Check filling for content gauge indication. Disconnect electrical supply to both port tank refuelling valves. Start rig and adjust throttling valve to allow 1 800 G.P.H. Fill starboard tanks and check that starboard gauge in cockpit registers correct content. When flow ceases, stop rig, reconnect valves and then continue refuelling. Check that port gauge in cockpit registers correct content. Stop rig when tanks are filled and flow ceases. (See notes (a) and (b) ).
- 12a. Defuel aircraft and repeat (1), (10) and (11) above for further refuelling.
- 12b. Start rig pump to fill tanks and adjust throttling valve to allow maximum rate of flow. Stop rig when tanks are filled and flow ceases. (See notes (a) and (b)).

Note

- (a) The time switch may have to be reset in order to complete the fuelling operation, when this has been carried out turn off the time switch.
  - (b) There should be little or no spillage from the vent pipes either during or after the filling or from the refuelling pressure relief valves.
13. Take readings of gallons gone, note total time to refuel, refuelling rate and pressure, also maximum pressure build up in each tank.
 

Front tank pressures should not exceed	11.5 p.s.i.
Centre tank pressure should not exceed	8.5 p.s.i.
Wing tank pressures should not exceed	7.5 p.s.i.
Pressures at wheel well should not exceed	7.5 p.s.i.
  14. Turn the low pressure cock to the ON position.
  15. Prime the engine delivery pipe by bleeding air from the blanking adaptor at engine connection.

## PRESSURE TEST OF REFUELLING PIPES AND VALVES

1. Remove the ground test rig refuelling nozzle and connect special Avery Hardoll nozzle and inflation valve unit and its reservoir fuel tank ID.Sk.428, to the aircraft refuelling attachment. Adjust control to allow fuel to be forced into the refuelling system at 50 p.s.i. from the augmentor tank. The tank capacity will allow 5 minutes test time.
2. The pressure should be maintained at 50 p.s.i. for the full 5 minutes without external leakage.

## Note

Care should be taken to prevent the 50 p.s.i. pressure being transmitted to the main feed pipes to the engine by ensuring that the defuelling cock is fully at OFF and is leak free.

## MAIN SYSTEM PRESSURE TEST

1. Insert blanking adaptor plug ID.Sk.245 at exit of front tanks vent pipe and tighten to seal. (Care must be taken to ensure that the pipe is free from paraffin or grease).
2. Fit the retainer clamps ID.Sk.363 to close and retain the heads of the refuelling pressure relief valves onto their seatings.
3. Fit assembly ID.Sk.255 to the tapping points in the gauge assembly already fitted in the wheel wells and admit air until the pressure rises to 13 p.s.i. as measured from the top of the front tanks.
4. Check all tanks, pipes etc. for leaks.
5. A pressure of 13 – 12 p.s.i. should be maintained for 10 minutes after turning off the air supply.

## MAIN DELIVERY PIPE PRESSURE TEST

## Note

During the following tests the engine feed pipe should be suitably supported and anchored at its extremity in order to prevent damage to the 'King' flexible couplings.

1. Remove the aircraft 'Breeze' plugs from the booster pumps and connect to the latter special plugs from the rig external source of supply.
2. Check that the air pressure in the tanks is still at 13 p.s.i. make good if necessary.
3. Start booster pumps running, adjust rheostats to give not more than 29 volts at each pump, check amperage and note that the fuel delivery pressure is not less than 28 p.s.i.
4. Check delivery line for leaks.
5. Turn OFF booster pumps and air supply and remove the blanking plug from the vent pipe together with retainer clamps.

6. Turn OFF the low pressure cock.

Note

When sealing plugs and blanks are removed:—

Front tank pressures will drop to approx. 11.0 p.s.i.

Wing tank pressure measured at wheel well will drop to approx. 6.5 p.s.i.

#### AIR FLOW REGULATION TEST

1. Remove assembly ID.Sk.252 and connect test rig suction line to the aircraft main delivery feed pipe.
2. Connect the special 2" rig air line to the external charging connection in the spine of the aircraft and open supply to charge tanks.
3. With the rig set for suction and the throttling valve adjusted to allow 500 G.P.H. draw off 120 gallons of fuel.
4. During this flow vary the inlet pressure between 10 and 60 p.s.i. in the following manner:  
At every 10 gallons gone increase the air pressure by 10 p.s.i. until at 60 gallons start decreasing air pressure by 10 p.s.i. per 10 gallons. At 120 gallons gone increase to 60 p.s.i.
5. Stop pump, close throttling valve, turn low pressure cock to OFF turn OFF air supply.
6. The tanks air pressure should not fluctuate during variations in air supply to the reducing valves. This should be measured at the tapping point in the wheel wells.
7. Pressures measured must not exceed 6.5 p.s.i. or drop below 5.7 p.s.i.

#### PREPARATION FOR FLOW AND TRANSFER TEST

1. Check that the low pressure cock is at OFF.
2. Connect the refuelling hose of the ground test rig to the aircraft.
3. Set the Venner time switch to ON.
4. Set rig controls to refuel, start rig pump and fill tanks.
5. Stop pump, close throttling valve and set rig controls to suction.

#### SUCTION AND DROP TANK RELEASE TEST

1. Turn ON air supply to aircraft external charging connection at shop pressure (approx. 70 – 80 p.s.i.).
2. Start the rig pump and adjust the throttling valve to allow a flow rate of 1850 G.P.H. as denoted by the rig manometer.

3. Take readings as under when the gallons gone meter registers 25 – 50 – 75 gallons.
4. The readings to be taken are as follows and must be within the limits stated.

		A/c with Drop Tanks	A/c without Drop Tanks
Front tank pressures	PORT	2.0 – 6.0 p.s.i.	4.0 – 6.0 p.s.i.
	STBD.	2.0 – 6.0 p.s.i.	4.0 – 6.0 p.s.i.
Centre tank pressures	PORT	3.0 – 6.0 p.s.i.	4.0 – 6.0 p.s.i.
	STBD.	3.0 – 6.0 p.s.i.	4.0 – 6.0 p.s.i.
Rib G pressures	PORT.	3.0 – 6.0 p.s.i.	–
	STBD.	3.0 – 6.0 p.s.i.	–
Rib R pressures	PORT.	4.0 – 6.5 p.s.i.	–
	STBD.	4.0 – 6.5 p.s.i.	–
Wheel well pressures	PORT	5.0 – 6.5 p.s.i.	5.0 – 6.5 p.s.i.
	STBD.	5.0 – 6.5 p.s.i.	5.0 – 6.5 p.s.i.
Engine delivery pressure		–0.5 p.s.i.	1.25 p.s.i.

5. Pressure difference between port and starboard pressures measured at the wheel wells must not exceed 0.25 p.s.i.
6. If no drop tanks are fitted, close throttling valve at 75 gallons gone, stop rig, turn OFF air supply. When drop tanks are fitted continue flowing fuel until 160 gallons have been extracted, warn operators and jettison the outboard tanks.
7. Recordings are to be made just prior to and after dropping the tanks.
8. Continue to take readings as above at 2 minute intervals until 320 gallons have been extracted.
9. Warn operators and drop the inboard tanks. Take readings prior to and after jettisoning the tanks.
10. Maintain rate of flow at 1850 G.P.H. and take readings when 380, 400 and 420 gallons have been extracted.

#### Note

Observe after dropping the tanks that no fuel or air escapes from the pylon valves, and that the front tank pressures remain almost constant. After the completion of this test, jack tanks back to wing undersurface and re-engage with pylons.

#### BOOSTER PUMP TEST NO.1 PORT

1. Repeat fuelling sequence to fill tanks, then reset rig for suction. From rig, switch on port booster pump, check that 26 volts is available at the pump.
2. Turn on air supply to aircraft at 20 p.s.i.

3. Turn on low pressure cock, start rig pump and set throttling valve by flowmeter to pass 1500 G.P.H.
4. Take readings as below when the gallons gone meter registers 10, 20, 30, 60, 80 and 100 gallons. These must be within the limits stated.

	A/c with Drop Tanks		A/c without Drop Tanks	
Front tank pressures	0.75	p.s.i. min.	2.75	p.s.i. min.
Centre tank pressures	1.0	p.s.i. min.	3.25	p.s.i. min.
Rib G pressures	3.0 — 6.8 p.s.i.		—	
Rib R pressures	4.7 — 6.3 p.s.i.		—	
Wheel well pressures	5.0 — 6.5 p.s.i.		5.0 — 6.5 p.s.i.	
Engine delivery pressure	4.0 — p.s.i. min.		6.25 p.s.i. min.	
Booster pumps at 26v.	16 amps max.		16 amps max.	

5. When this test has been completed, stop pump, close throttling valve, switch OFF booster pump and turn OFF air supply.

#### BOOSTER PUMP TEST NO.2 STARBOARD

This test is a repeat of test No.1 above for the starboard booster pump only.

#### LEVEL BALANCING TEST

1. Repeat fuelling sequences to refill tanks and reset rig for suction.
2. Turn on air supply to aircraft external charging connection at shop pressure (approx. 70 — 80 p.s.i.).
3. Connect the rig booster pump cables to the aircraft pumps.
4. Switch ON both booster pumps and set voltage by rheostats to 26v.
5. Start ground test rig pump at suction and adjust the throttling valve to pass 500 G.P.H.

- Take readings as below at 2 minute intervals until the system has emptied.

		A/c with Drop Tanks	A/c without Drop Tanks
Engine delivery pressure		20 – 23.3 p.s.i.	21 – 23.3 p.s.i.
Front tank pressures	PORT	3 – 5 p.s.i.	3.75 – 6 p.s.i.
	STBD	3 – 5 p.s.i.	3.75 – 6 p.s.i.
Centre tank pressures	PORT	3.5 – 5.5 p.s.i.	4.5 – 6 p.s.i.
	STBD	3.5 – 5.5 p.s.i.	4.5 – 6 p.s.i.
Rib G pressures	PORT	4 – 6 p.s.i.	–
	STBD	4 – 6 p.s.i.	–
Rib R pressures	PORT	4.7 – 6.5 p.s.i.	–
	STBD	4.7 – 6.5 p.s.i.	–
Wheel well pressures	PORT	5.5 – 6.5 p.s.i.	5.5 – 6.5 p.s.i.
	STBD	5.5 – 6.5 p.s.i.	5.5 – 6.5 p.s.i.

- Turn off air supply and booster pumps, stop rig pump.

Note

The limit for out of balance is 150 lb.

#### DEFUELLING TEST

- Remove pylons from wings (if applicable)
- Replace cover plates (if applicable).
- Repeat fuelling sequences to refill tanks.
- Remove locking of aircraft defuelling cock and turn it from the OFF to the ON position.
- Adjust the shop air pressure through the rig reducing valve to 20 p.s.i.
- Set the throttling valve to allow the system to drain at 1800 G.P.H.
- Take readings at two minute intervals as below.

Front tank pressure	PORT	p.s.i.
	STBD	p.s.i.
Centre tank pressure	PORT	p.s.i.
	STBD	p.s.i.
Wheel well pressure	PORT	p.s.i.
	STBD	p.s.i.

- When tanks are empty turn OFF air supply and reposition aircraft defuelling cock to the OFF position and relock.

9. Note total time to defuel.
10. The limit for front tank pressures during this test is 3.0 p.s.i. minimum.
11. Remove defuelling connection, air line and all ancillary equipment, gauges., fitted for these tests.

#### PRESSURE REFUELLING

Since the factory ground test rig is not suitable for refuelling the aircraft at the required speed or pressure, it will be necessary to test the complete refuelling system with the aid of the high speed Bowser.

This test MUST be carried out at the first fuelling on the aerodrome at a pressure of 45 – 50 p.s.i.

#### POINTS TO BE CHECKED ARE THAT:

- (a) No more than minute quantities of fuel spill from the vent pipes.
- (b) That no fuel spills from the wing tanks pressure relief valves.
- (c) That the refuelling valves close correctly.
- (d) That the float valves cut OFF the refuelling valves at the correct fuel level.

**SECTION 11**  
**FUEL SYSTEM**  
**PART 4**

**FUEL PRESSURE SWITCH TEST (TYPE TP 5253 AND TP 1250)**

I.D. INSTRUCTION H03/7 (Issue 3)

**EQUIPMENT REQUIRED**

Pressurising Rig to ID.SK.670 Issue B 24 volt supply.

**PRESSURE TEST**

1. Connect pressurising equipment to switch, with manometer cock OFF
2. Connect shop air line to rig and close bleed valve.
3. Turn ON air supply and adjust to give 30 p.s.i. as registered on gauge.
4. Insert base of switch into tank taking care to prevent ingress of water to electrical connections.

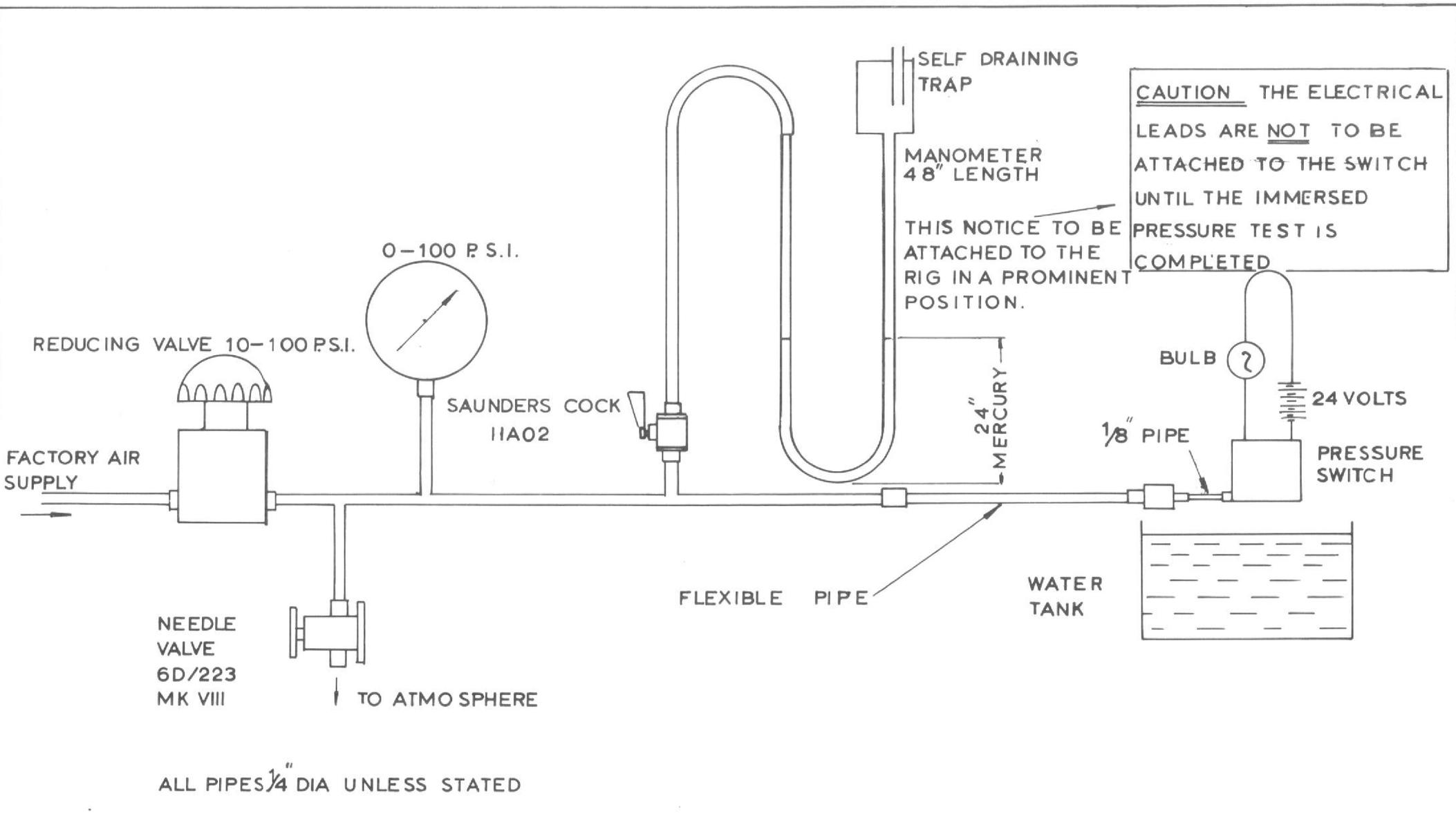
Note:

During this test there will be NO electrical connections from the switch to the 24 volt supply.

5. If leaks occur, reject component. Release air pressure through bleed valve.

**CONTROL SETTING TESTS**

1. Connect up electrical supply and warning lamp.
2. Turn on manometer cock.
3. Raise the air pressure to 20 p.s.i. and then lower the pressure slowly, through the bleed valve, and note at what pressure the lamp lights.
4. If this is above or below  $3.25 \pm 0.25$  p.s.i. re-adjust switch.
5. Carry out insulation test at 250 volts. Resistance should not be less than 20 Megohms.



**SECTION 11**  
**FUEL SYSTEM**  
**PART 5**

**FUEL PRESSURE SWITCH TEST (TYPE TP 5250)**

**I.D. INSTRUCTION H03/8 (Issue 3)**

**EQUIPMENT REQUIRED**

Pressurising Rig to ID.SK.670 Issue B 24 Volt supply.

**PRESSURE TEST**

1. Connect pressurising equipment to switch, with manometer cock OFF.
2. Connect shop air line to rig, and close bleed valve.
3. Turn ON air supply and adjust to give 30 p.s.i. as registered on gauge.
4. Insert base of switch into tank taking care to prevent ingress of water to electrical connections.

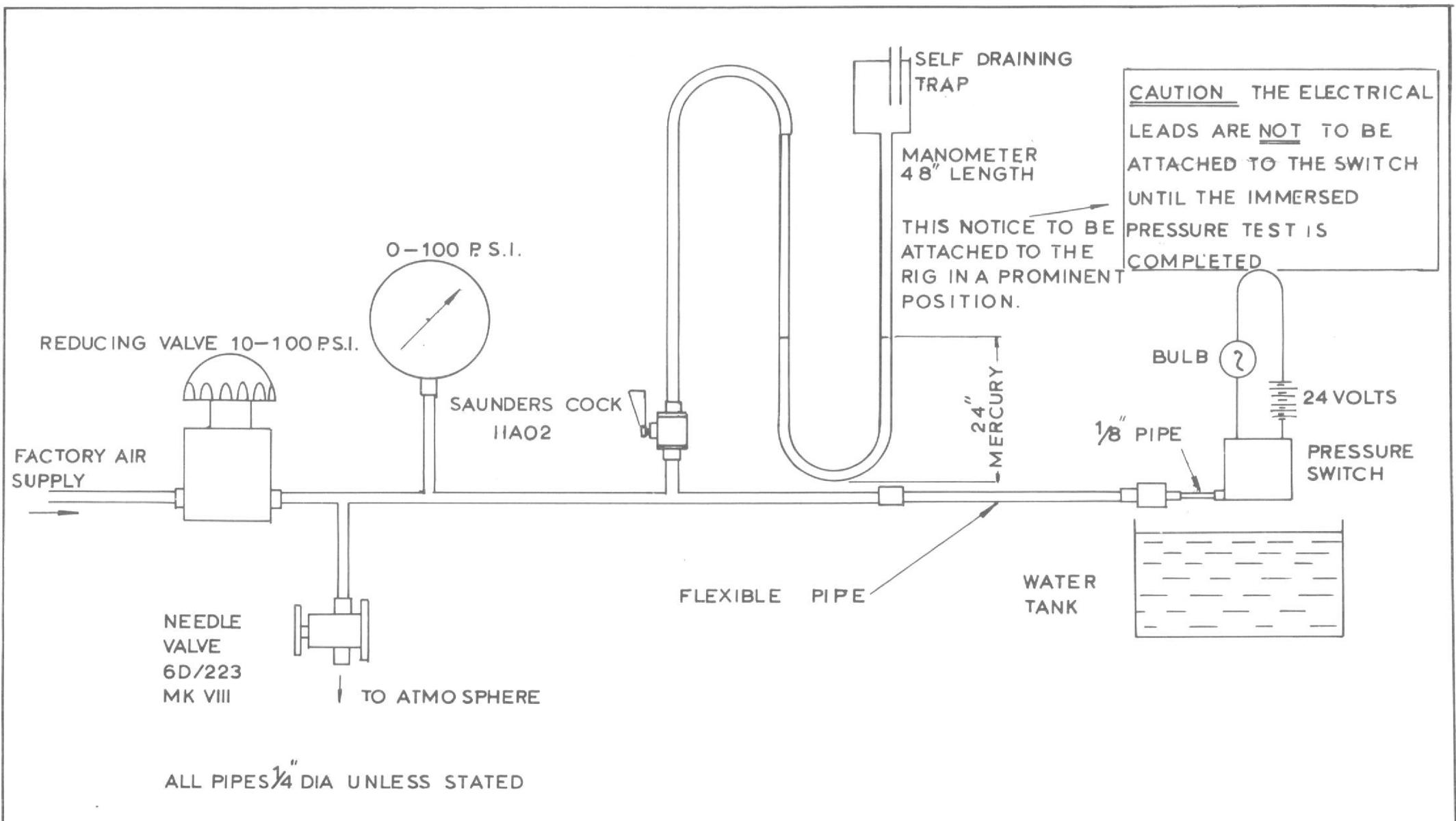
**Note:**

During this test there will be NO electrical connections from the switch to the 24 volt supply

5. If leaks occur reject component. Release air pressure through bleed valve.

**CONTROL SETTING TEST**

1. Connect up electrical supply and indicator lamp.
2. Turn ON manometer cock.
3. Raise the air pressure and note at what pressure the lamp lights. If this is above or below  $12 \pm 0.75$  p.s.i. re-adjust switch.
4. Lower the pressure through the bleed valve and note at what pressure the light goes out. This should be  $8.5 \pm 0.5$  p.s.i. If it is outside the tolerance, re-adjust the switch if possible, maintaining the pressure limits in para.3. If this is not possible, reject switch.
5. Carry out insulation test at 250 volts. Resistance should not be less than 20 Megohms.



**SECTION 11**  
**FUEL SYSTEM**  
**PART 6**

**FUEL PRESSURE SWITCH TEST (TYPE TP 5252/1 AND TP 1200)**

I.D. INSTRUCTION H03/9 (issue 4)

**EQUIPMENT REQUIRED**

Pressurising Rig to ID.SK.670 Issue B and 24 volt supply.

**PRESSURISING TEST**

1. Connect pressurising equipment to switch with manometer cock OFF.
2. Connect shop air line to rig and close bleed valve.
3. Turn on air supply and adjust to give 30 p.s.i. as registered on gauge.
4. Insert base of switch into tank taking care to prevent ingress of water to electrical connections.

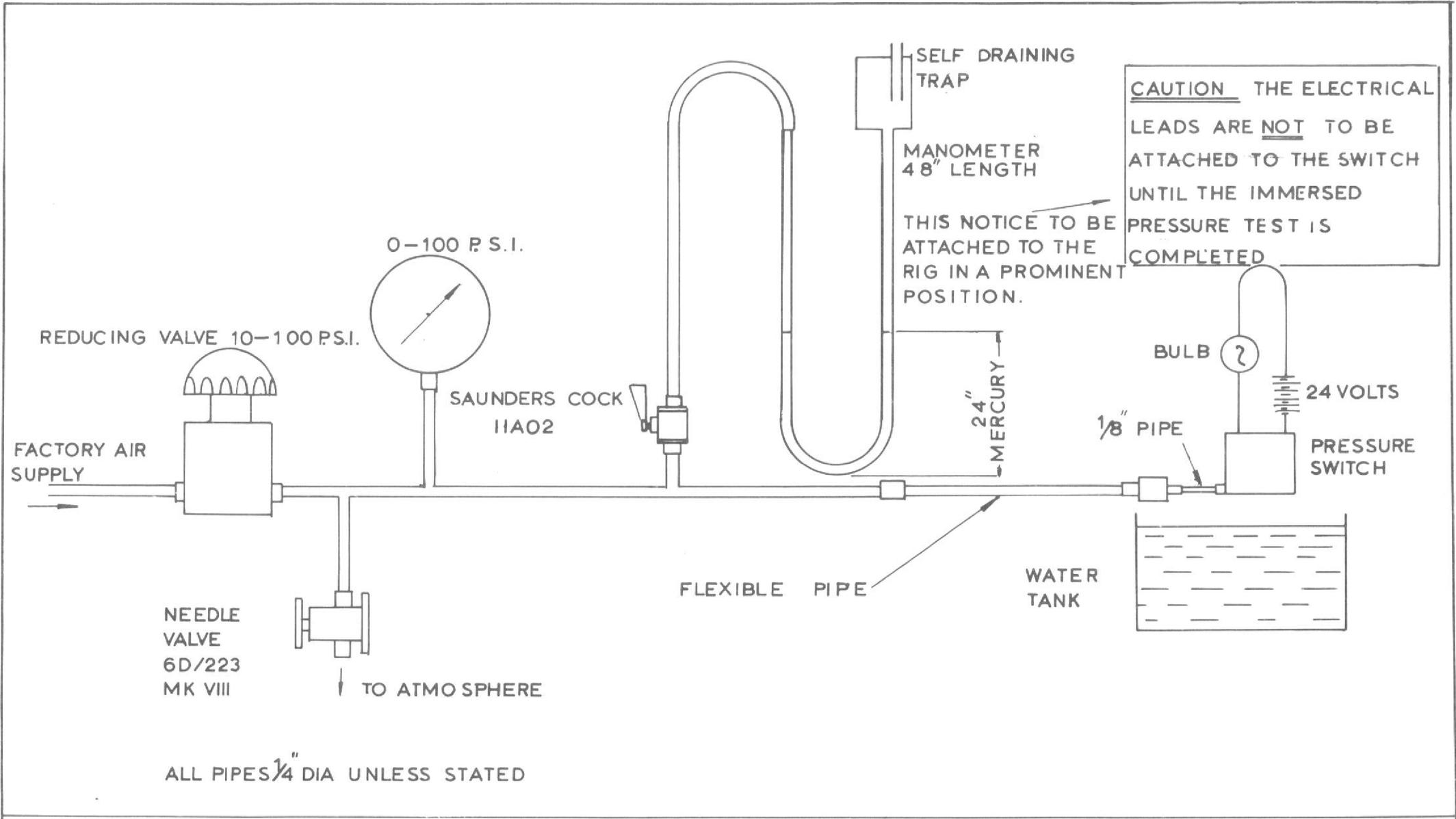
Note:

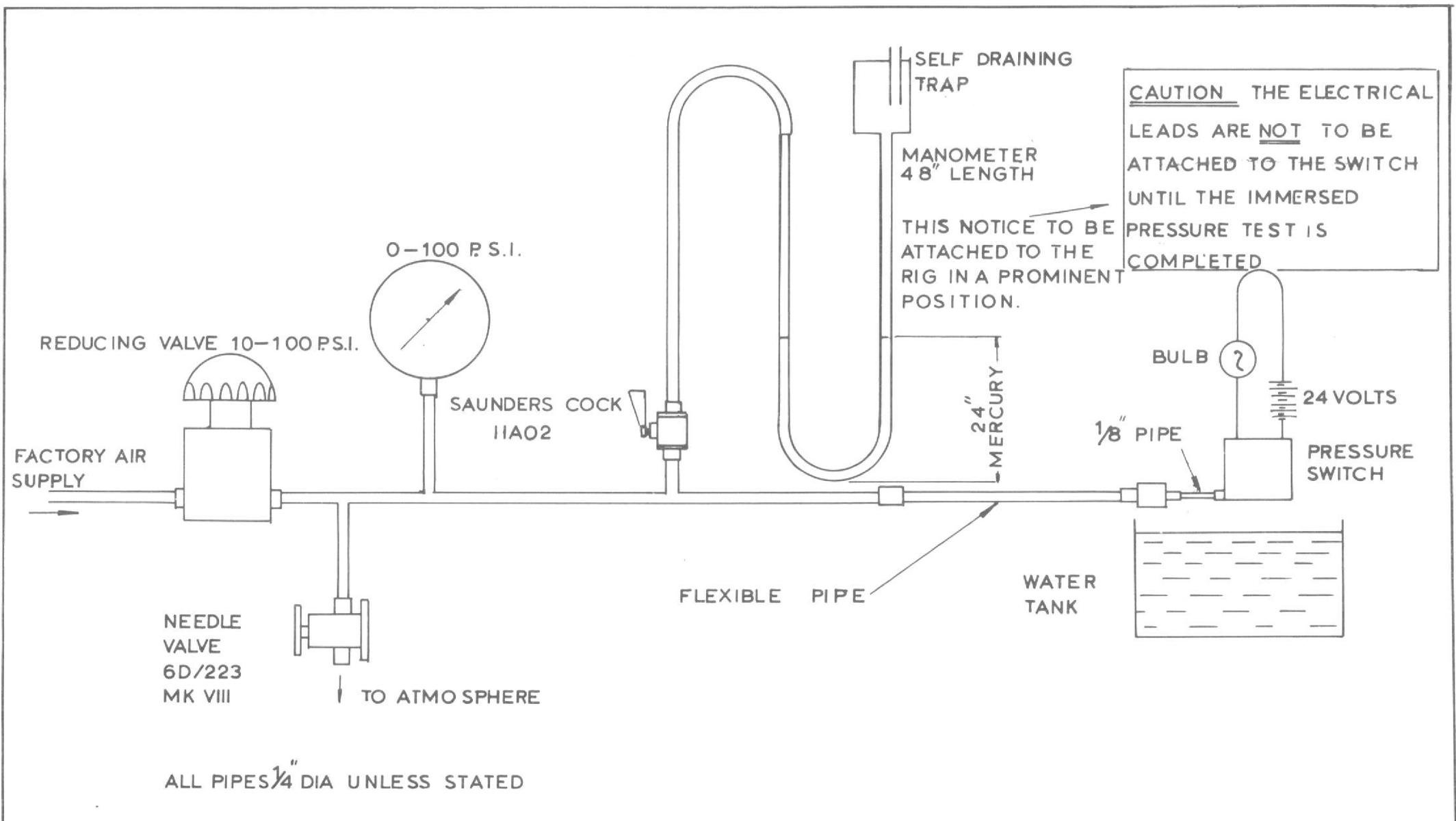
During this test there will be NO electrical connections from the switch to the 24 volt supply.

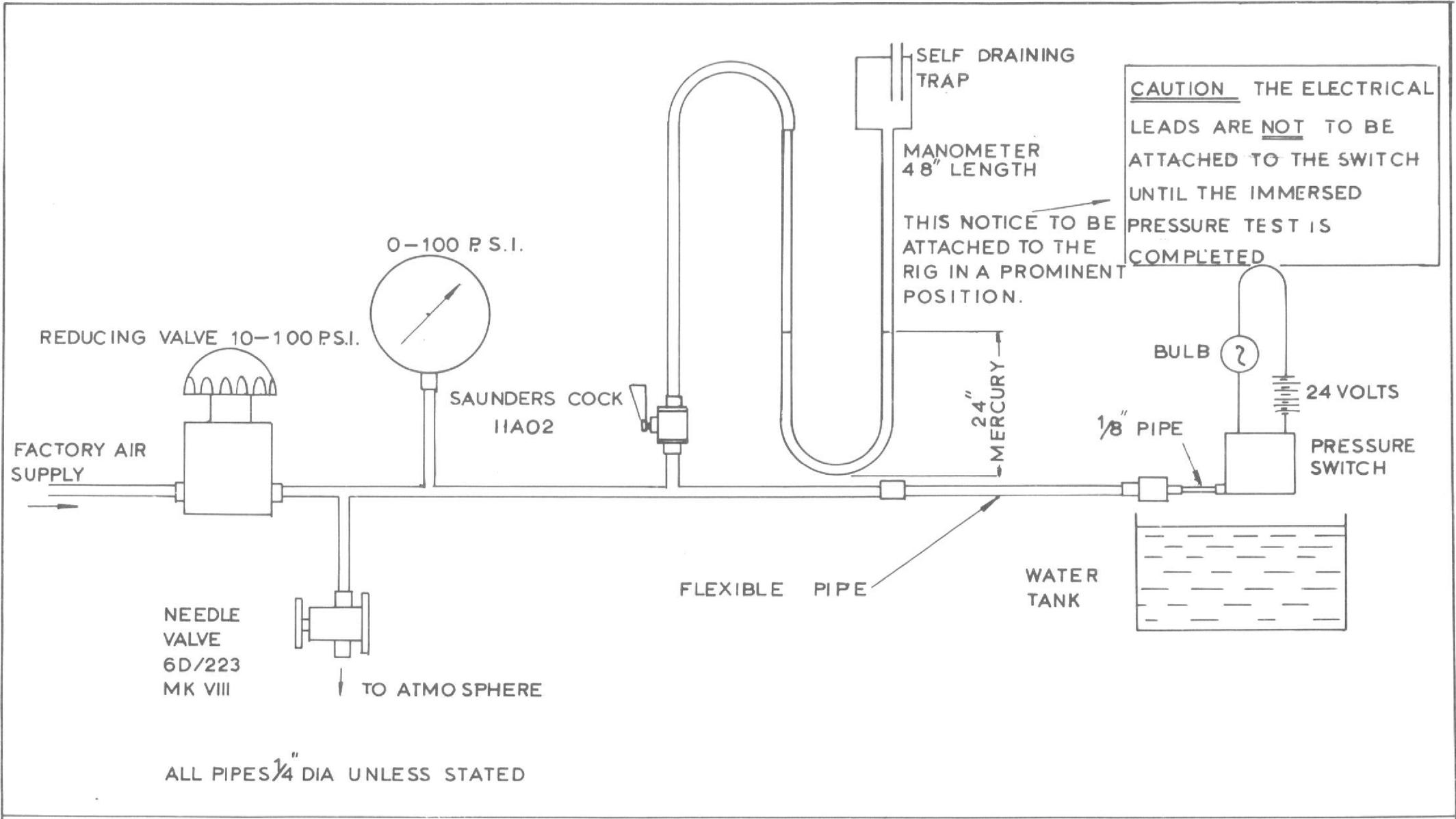
5. If leaks occur, reject component. Release air pressure through bleed valve.

**CONTROL SETTING TEST**

1. Connect up electrical circuit and indicator lamp.
2. With manometer cock OFF, raise air pressure to the switch to 13 p.s.i.
3. Gradually drop the pressure by opening the bleed cock until it stands at 4 p.s.i. Open manometer cock and lower the pressure until the light, which will be on, extinguishes.
4. If this is above  $2.25 \pm 0.25$  p.s.i. re-adjust switch.
5. With the manometer cock ON, raise the pressure slowly until the light illuminates, this should make at 2.75 p.s.i. or below.
6. Carry out insulation test at 250 volts. Resistance should not be less than 20 Megohms.







GROUND TEST INSTRUCTIONS

SECTION 11

FUEL SYSTEM

PART 7

FUEL PRESSURE SWITCH TEST (TYPE TP 5266/1)

I.D. INSTRUCTION H03/10 (Issue 2)

EQUIPMENT REQUIRED

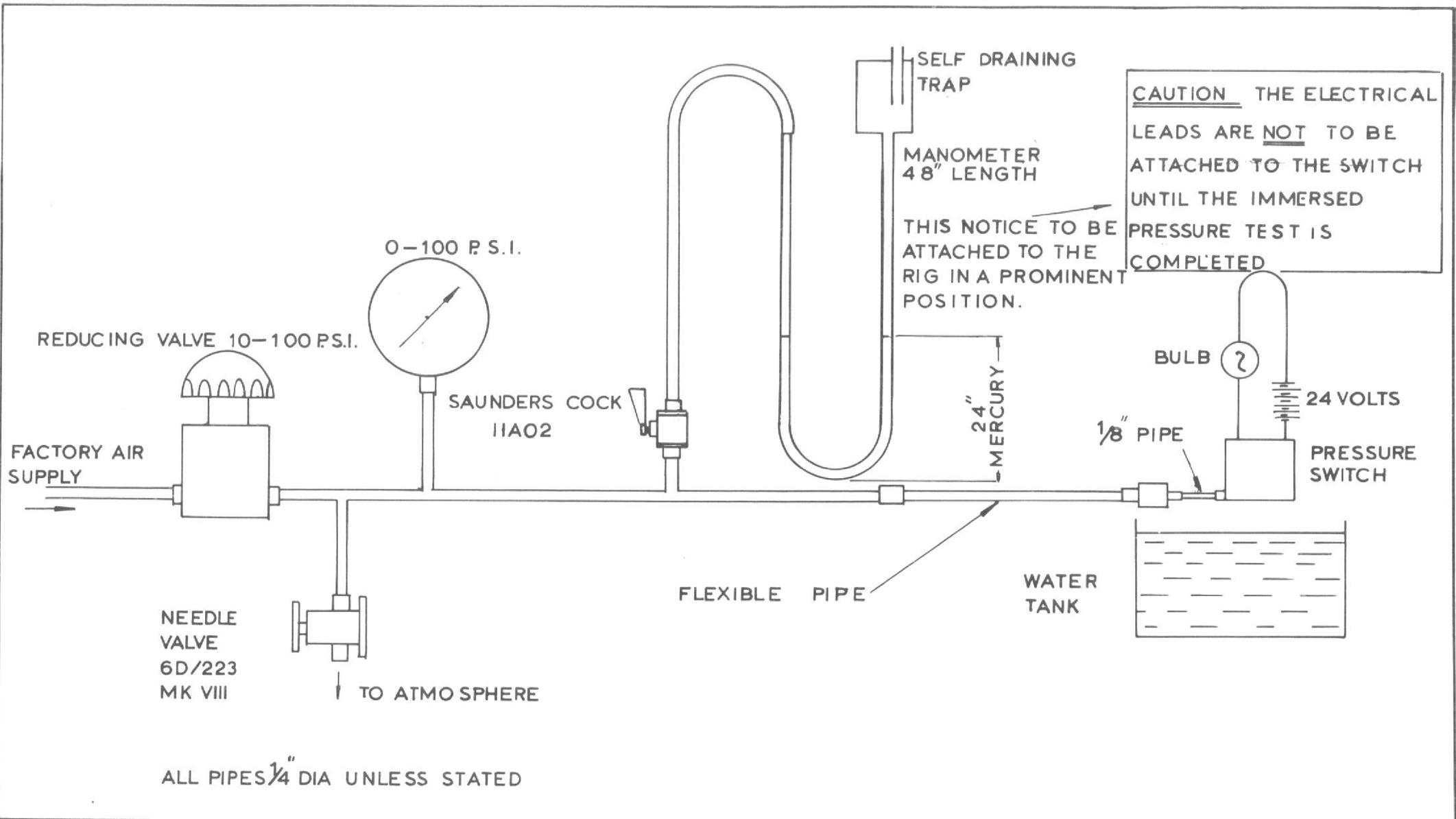
Pressurising rig to ID.SK.670 Issue B and 24 Volt supply.

PRESSURE TEST

1. Connect pressurising equipment to switch, with manometer cock off.
2. Connect shop air line to rig and close bleed valve.
3. Turn ON air supply and adjust to give 30 P.S.I. as registered on gauge.
4. Insert base of switch into tank taking care to prevent ingress of water to electrical connections.
5. If leaks occur, reject component. Release air pressure through bleed valve.

CONTROL SETTING TEST

1. Connect electrical supply and warning lamp.
2. Turn ON manometer cock.
3. Raise the air pressure to 20 P.S.I. and note at what pressure the lamp goes out.
4. Lower the pressure slowly through the bleed valve and note at what pressure the lamp lights. This should be within 0.25 P.S.I. of the extinguishing pressure.
5. If these are above or below 8 – 10 P.S.I. re-adjust switch.
6. Carry out insulation test at 250 volts. Resistance should not be less than 20 megohms.



**SECTION 11**  
**FUEL SYSTEM**  
**PART 8**

**DOUBLE FLOAT SWITCH TEST (Drawing No. D.215808)**

**I.D. INSTRUCTION H03/11 (Issue 1)**

**TEST EQUIPMENT REQUIRED**

1. Model 7 Avometer or 4½ Volt battery and lamp circuit for continuity and switching checks.
2. 500 Vol D.C. 'Megger' tester for insulation resistance.
3. Air pressurising tank rig as per set-up shown on ID.SK.878 . . . for leak checks.
4. Variable datum fuel reservoir rig complete with indicator lamps and D.C. supply. Generally to test set-up, shown on ID.SK.879 . . . This is required for level setting and differential checks.

**CONTINUITY CHECKS**

Using the 10000 ohm resistance range of the model 7 Avometer, or a suitable lamp circuit, check that there is earth continuity transfer across all bolted sub-assemblies which are separated by gaskets and or jointing compound.

Complete continuity, i.e. meter indicating zero transfer resistance, must be obtained right up to the unit mounting flange both from the switch sub-assemblies and also the outer casing.

**SWITCHING SEQUENCE**

Using the lamp circuit connected across various terminals, a switching sequence as tabulated below, must be obtained.

Switch Attitude	Terminals to Lamp Circuit	Lamp Indications
Upright & Terminal Block uppermost	1 & 2	ON
	1 & 3	ON
	2 & 3	ON
Inverted	1 & 2	OFF
	1 & 3	OFF
	2 & 3	OFF

## INSULATION RESISTANCE

1. With the switch assembly upright and terminal block uppermost, the insulation resistance, (as indicated on a 500 volts D.C. Megger tester) between each terminal and the mounting flange, must not be less than 20 megohms.
2. With switch inverted, both resistance of terminals to mounting flange, and across terminals, i.e. (1 – 2), (1–3), and (2 – 3) must not be less than 20 megohms.

## AIR LEAKAGE TEST

Assembly Unit to rig set-up as ID.SK.878 . . . Apply air pressure of 20 p.s.i. via reducing valve, and seat bell housing over switch flange so as to enclose all leak pathways.

Retain air pressure of 20 p.s.i. for 5 mins, and note that there is no change in manometer indication greater than  $\pm . 1''$  from initial valve.

## Note:

For this test, the rim of the bell housing, must be thoroughly greased in order to obtain a leak free joint at the switch mounting flange.

## LEVEL AND DIFFERENTIAL CHECKS

With Switch Unit assembled to a test set-up as ID.SK.879 . . . , fill calibrating tank to 1" above datum 1 and proceed to empty it back into feed tank at a rate not exceeding 3" per minute, until the level falls to 1" below datum 2. During this operation note the following:—

- (a) Lamp No.1 wired via D.C. supply to terminals 2 & 3, lights at a level with  $\pm \frac{1}{4}''$  of datum 1, and remains on thereafter.
- (b) Lamp No.2, across terminals 1 and 3 lights at within  $\pm \frac{1}{4}''$  of datum 2 and stays on thereafter.

Refill calibrating tank at 3"/min or less and note the levels at which the lamps extinguish.

## Note:

During these operations the tank pressure must not exceed 5 p.s.i.

From the above readings, operating differentials are derived as the difference between the 'OFF' and 'ON' levels appropriate to each light. The differential associated with each lamp, thus determined must not be less than  $\pm . 13''$ .

### SUPPLEMENTARY QUALITY CONTROL TESTS

It is proposed that over 50th production switch in a batch exceeding 50 or one in every batch of less than 50 be subjected to the following cycle of tests:—

1. Initial proving in accordance with items B to F inclusive above.
2. Immersion for 6 hours in Kerosene with constant 10 p.s.i. Air Pressure applied. (For this endurance the rig set up to ID.SK.878 . . . may be used).
3. Repeat proving on items B to F inclusive.

### REMARKS

1. The tests of headings B & C may be carried out and cleared in the assembly stage.
2. The above instruction is subject to revision of specified tolerances according to results obtained from 1st. batch of 20 switches which are tested on a representative production rig.

**SECTION 11**  
**FUEL SYSTEM**

**PART 9**

**FUEL FLOW AND PRESSURE TESTS**  
**Mk.6 AIRCRAFT – WITH**  
**OR WITHOUT DROP TANKS FITTED**  
**I.D. INSTRUCTION H03/13 (Issue 8)**

**APPLICABILITY**

Hunter Mk.6 with or without drop tanks and mods. 415, 463, 496, 503, 545 and 557 incorporated. This test instruction supersedes all issues of H.03/6 and H.03/12, and H.03/13 iss.1 to 7 inclusive.

**TEST EQUIPMENT REQUIRED**

1. Special pipe with pressure tapping to ID.SK.448
2. Blanking plate assembly to ID.SK.447, SE.730
3. Pressurising rig to ID.SK.255, SE.724
4. Hose and adaptor for air ground charging, ID.SK.254
5. Air inflation adaptor with sealing gland, ID.SK.243
6. Fuel Flow Test Rig. SE.671.
7. Assembly to pressurise refuelling pipes, ID.SK.428, SE.722
8. Assembly of gauges and transmitters to ID.SK.392, and as in ID.SK.552
9. Special pipe assembly to ID.SK.559 and ID.SK.560
10. Sealing gland, ID.SK.449
11. Assembly to ID.SK.967
12. Trolleys for drop tanks, SE.1227, (if required).

**IMPORTANT**

For all the following tests the aircraft should be in the rigging position with the necessary access panels removed. Front tank pressures should be measured at the suction and pressure relief valves throughout, unless otherwise stated.

**PREPARATION FOR PRESSURE TEST (SEE ID.SK.684)**

1. Check that the defuelling cock is in the OFF position.
2. Check that the refuelling pressure relief valves (on the undersurface inboard of the wing tanks) are free to operate.

3. That the low pressure cock in the main engine delivery pipe is at the OFF position.
4. Remove the blank from the engine end of the fuel pipe and fit special adaptor to ID.SK.447.
5. Connect 'Desynn' gauge transmitters (alternatives 'Bourdon' tube gauges or manometers) to the connections in the suction and pressure relief valves in the front tanks.
6. Connect similar measuring instruments to the connections in the valves in the rear tanks.
7. Remove the caps from the front tanks sediment drain pipes and connect special pipes ID.SK.559 for subsequent fitment of 'Desynn' Transmitters.
8. Connect measuring instruments as in para.5 to the connections in the air delivery pipes at the inboard end of the wing tanks in the wheel wells and also, if drop tanks are fitted, to the tapping points in the fuel transfer pipes behind the wing nosing adjacent to rib G port and starboard together with similar instruments to the tappings between ribs Q and R. (Access through doors on bottom surface on main planes).
9. Remove the dust cap from the refuelling coupling in the port wheel well and couple up corresponding adaptor of the ground test rig.
10. Set the aircraft master switch to ON.
11. Set rig cocks to refuel position.
12. Set refuelling time switch in port wheel well to the ON position and check that 6 lights illuminate in refuelling indicator.
13. Start rig pump to fill tanks, check gauges in cockpit and stop rig when tanks are filled and flow ceases. Take time at which each lamp extinguishes in wheel well indicator.

## NOTE

After a few seconds when the pressure drops in the wing tanks, the transfer pressure dolls eyes will function and the gauges will only indicate front and rear tank contents.

The time switch may have to be reset in order to complete the fuelling operation, when this has been carried out, turn time switch to OFF and remove Avery Hardoll nozzle. This sequence should be adopted each time the aircraft is refuelled.

There should be little or no spillage from the vent pipes either during or after filling or from the refuelling pressure relief valves.

14. Take readings of gallons gone, note time to refuel and refuelling pressure, also maximum pressure build up in each tank.
 

Front tanks pressure should not exceed	11.5 p.s.i.
Rear tanks pressure should not exceed	8.5 p.s.i.
Wheel well pressure should not exceed	7.5 p.s.i.
Wing tank pressures at Rib G	7.5 p.s.i.
15. Turn the low pressure cock to the ON position.
16. Prime feed pipe by bleeding air from blanking adaptor at engine connection.

## MAIN SYSTEM PRESSURE TEST

1. The exhaust pipes from the PS.48/12 Hymatic pressure reducing valves are to be blanked off. On aircraft fitted with Mod.545 this will be carried out automatically by insertion of front tank vent pipe blanking plug.
2. Insert blanking plug ID.SK.243 at exit of front tank vent pipe (care must be taken to ensure that the pipe is free from paraffin or grease).
3. Insert blanking plug ID.SK.243 at exit of rear tank vent pipe and tighten to seal (observe instructions as in para.2).
4. Fit retainer clamps ID.SK.363 to close and retain the heads of the refuelling pressure relief valves onto their seatings.
5. Blank off the branch vent pipe A.203096 with special plug assembly ID.SK.449, and tighten to seal.
6. With pressurising assembly ID.SK.255 connected in turn to each blanking plug ID.SK.243, admit air to the front, wing and rear tanks.
7. Check all tanks, pipes etc., for leaks.
8. A pressure of 13–12 p.s.i. should be maintained for 10 mins, after turning off the air supply.

## MAIN ENGINE DELIVERY PIPE PRESSURE TEST

## NOTE

During the following test, the engine feed pipe should be suitably supported and anchored at its extremity in order to prevent damage to the 'King' flexible couplings.

1. Remove the aircraft, 'Breeze' plugs from the booster pumps and connect to the latter special plugs from the rig external source of supply.
2. Check that the air pressure in the tanks is still at 13 p.s.i. make good if necessary.
3. Start both booster pumps and adjust the rheostats to give not more than 29 volts at each pump, check amperage and note that the fuel delivery pressure is not less than 28 p.s.i.
4. Check delivery pipe line for leaks.
5. Turn OFF booster pumps and air supply and remove the blanking plugs from the vent pipes together with retainer clamps.
6. Remove blanking from the Hymatic Valves.

## NOTE

When the sealing plugs and blanks are removed:—

The front tanks pressures will drop to approx.	11.0 p.s.i.
The rear tanks pressures will drop to approx.	8.5 p.s.i.
Wing tanks pressures measured at rib G will drop to approx.	6.5 p.s.i.

Failure to remove the blanking plugs may result in serious damage to aircraft on subsequent refuelling.

## PRESSURE TEST OF REFUELLING PIPES AND VALVES

1. Remove ground test rig refuelling nozzle and connect special Avery Hardoll nozzle with inflation valve unit and reservoir fuel tank to ID.SK.428 to the aircraft refuelling attachment.
2. Adjust control to allow fuel to be forced into the system at 50 p.s.i. from the augmentor tank. The tank capacity will allow 5 minutes test time.
3. The pressure should be maintained at 50 p.s.i. for 5 minutes without external leakage.

## NOTE

Care should be taken to prevent the 50 p.s.i. being transmitted to the main feed pipes by ensuring that the defuelling cock is fully at OFF and is leak free.

## AIR FLOW REGULATION TEST

1. Remove assembly ID.SK.447 and connect to the engine delivery pipe the suction connection of the test rig ID.SK.448.
2. Connect the special 2" diameter rig air line to the aircraft external charging connection in the spine of the aircraft and open air supply with reducing valve set to allow a pressure of 10 p.s.i. to be built up at the Hymatic Valves.
3. With the rig set for suction and the throttling valve adjusted to allow a flow rate of 500 gallons or more per hour, draw off 120 gallons of fuel.
4. During this flow vary the inlet pressure between 10 and 60 p.s.i. in the following manner.

At every 10 gallons gone increase the air pressure by 10 p.s.i. until at 60 gallons start decreasing air pressure by 10 p.s.i. per 10 gallons. At 120 gallons increase to 60 p.s.i.
5. Stop pump, close throttling valve, turn low pressure cock to OFF, turn off air supply.
6. The tanks air pressure should not fluctuate during the variations in air supply to the reducing valves. This should be measured at the tapping points in the wheel wells.
7. Pressures recorded must not exceed 6.5 p.s.i. or drop below 5.7 p.s.i.

## FRONT TANKS LOW LEVEL SWITCH TEST

In order to ascertain the front tank fuel level at which the switches operate, carry out the following:—

1. Remove, if fitted, the 'Desynn' transmitter pipes and connect to the pressure tappings in the front tanks suction and pressure relief valves, special pipe assembly ID.SK.967.
2. Set fuel flow test rig for refuelling and fill system, note total contents.
3. Set fuel cock selector to AUTO and with the rig, take out two or three gallons of fuel as registered by the gallons gone meter. This will prime the engine delivery line. Refuel aircraft, and close manually the gate valves at the rear tanks.

4. Set rig for suction and start pump, the throttling valve is to be adjusted to pass not more than 200 g.p.h.
5. Air should be introduced to the front tanks through the medium of the aerograph transformer and the pressure should be maintained as near 5 p.s.i. as possible during the extraction. When the vapour release valves open the pressures will drop, but must be maintained at over 1.5 p.s.i. measured at the sediment drain.
6. When the indicator lamps light, stop the rig, at the same time checking the quantity of fuel withdrawn, by gallons gone meter indication.
7. This should be within the range of 11.5–13.5 gallons per tank or 23–27 gallons indicated on the meter.

#### PREPARATION FOR FLOW AND TRANSFER TESTS

1. Check that the low pressure cock is at the OFF position.
2. Fit the refuelling connection.
3. Turn the aircraft master switch to the ON position and set the Venner time switch to ON.
4. Set rig controls to refuel, start rig pump and fill tanks.
5. Stop pump, close throttling valve and set ground test rig controls to suction.
6. Fit the special rig 'Breeze' couplings to the booster pumps if they have previously been removed.

#### PUMP SPEED CHANGE TEST

1. Repeat fuelling sequences to fill tanks and reset rig for suction.
2. Turn ON air supply from rig at a pressure of 20 p.s.i.
3. Connect rig booster pump plugs to aircraft components.
4. Switch on ground generator and adjust rheostats to give 26 volts to pumps.
5. Turn ON low pressure cock.
6. Switch On both booster pumps.
7. Start rig pump to pass 400 gallons per hour.
8. When flow is steady make recordings of engine delivery pressure and amps.
9. Switch OFF port booster pump and note engine delivery pressure and amps of starboard pump. The engine delivery pressure and pump amps should rise.
10. Switch On both pumps. Note drop in pressure and amps, allow flow and pressure to become constant.
11. Switch OFF starboard pump and note engine delivery pressure and amps of port pump. The pressure and amps should rise.
12. Switch ON both booster pumps, note drop in pressure.

13. Switch OFF both pumps, stop rig pump and close low pressure cock. Switch OFF ground generator.

14. Take readings thus:—

BOTH PUMPS ON:	Engine delivery pressure	p.s.i.
	Port pump current	amp
	Stbd. pump current	amp
PORT PUMP OFF:	Engine delivery pressure	p.s.i.
	Stbd. pump current	amp.
BOTH PUMPS ON:	Engine delivery pressure	p.s.i.
	Port pump current	amp
	Stbd. pump current	amp
STBD PUMP OFF	Engine delivery pressure	p.s.i.
	Port pump current	amp
BOTH PUMPS ON:	Engine delivery pressure	p.s.i.
	Port pump current	amp
	Stbd pump current	amp

15. The readings must comply with these limits:

BOTH PUMPS ON:	Engine delivery pressure	19—25	p.s.i.
	Pump current	13—18.0	amp
ONE PUMP ON:	Engine delivery pressure	20—25	p.s.i.
	Pump current	20—26	amp.

#### RECUPERATOR TEST

1. Connect to the pipe assembly ID.SK.392, measuring instruments and turn On the pet cocks.
2. Repeat fuelling sequences to refill tanks and reset rig for suction tests. Selector switches in cockpit at 'Auto'.
3. Turn ON air supply at 40 p.s.i. to the aircraft reducing valves.
4. Switch ON both booster pumps from rig, set at 26 volts.
5. Turn ON low pressure cock, start rig pump and set throttling valve to 2,000 g.p.h.
6. Wait a few seconds for a steady flow from the system and then, as a stop watch is started, switch OFF both booster pumps. When the engine delivery pressure drops below front tanks pressure, measured at the sediment drain, stop watch. Note time of discharge.
7. Immediately switch ON both booster pumps and start watch. The pressure registered at the recuperator gauge should rise rapidly to about 16 p.s.i., maximum 16.5 p.s.i., it will stay at about this pressure for a period and then drop rapidly to about 10—11 p.s.i. Stop watch, note time of recharge.

8. Stop rig, turn OFF low pressure cock and air supply, together with booster pumps.

Take readings of:—

Time taken to discharge	(12–15 secs. limits)
Time taken to recharge	(46 secs. maximum)

#### FITMENT OF DROP TANKS (WHEN APPLICABLE)

1. Remove blanking plates from the wing undersurfaces and fit pylons.
2. Fit drop tanks to the pylons and adjust.
3. Wheel under the tanks the special trolley to be adjusted to give 2" clearance between the landing surfaces and the tanks.
4. Set the aircraft master switch to ON.
5. Set rig cocks to refuel position.
6. Set refuelling time switch in port wheel well to the ON position. Check that six lamps illuminate in refuelling indicator.
7. Start rig pump to fill tanks, check gauges in cockpit and stop rig when tanks are filled and flow ceases.
8. Take time at which each lamp extinguishes and record total capacity.

#### NOTE

- (a) After a few seconds when the pressure drops in the wing tanks, the transfer pressure dolls eye will function and the gauges will only indicate front and rear tank contents.
- (b) The times switch may have to be reset in order to complete the fuelling operation. When this has been carried out let the time switch run down and do not reset until further fuelling is necessary.
- (c) There should be little or no spillage from the vent pipes either during or after filling or from the refuelling pressure relief valves.

#### BOOSTER PUMP TEST NO.1 (PORT)

1. Repeat refuelling sequence to fill tanks, reset rig for suction.

#### NOTE

Should the front tanks pressures be high, a small quantity of fuel is to be extracted to drop the pressure to approx. 5 to 5.5 p.s.i. Set tanks selector to auto.

2. Switch on the port booster pump which will run at high speed.
3. Check that 26 volts is available to the pump.
4. Turn on air supply to 20 p.s.i.

5. Turn on low pressure cock, start rig pump and set throttling valve to pass 1500 g.p.h. (drop tanks fitted) or 2000 g.p.h. (no drop tanks fitted).
6. At selected readings of the gallons gone meter, take recordings enumerated below (these must be within the limits stated):

Aircraft Without Drop Tanks

Gallons gone meter readings: 20, 30, 40, 60, 80 & 100 gallons.

Front tank pressure	2.0 to 5.5 p.s.i.
Rear tank pressure	5.0 to 6.5 p.s.i.
Wing tank pressure	5.0 to 6.25 p.s.i.
Engine delivery pressure (minimum)	8.0 p.s.i.
Pump at 26 volts	2.0 to 26.0 amps

Aircraft With 4 Drop Tanks

Gallons gone meter readings: 20, 40, 60, 80, 100, 125 & 150 gallons

Front tank pressure	0.25 to 5.0 p.s.i.
Wheel well tapping pressure	5.0 to 6.5 p.s.i.
Engine delivery pressure (minimum)	12.0 p.s.i.
Pump at 26 volts	20 to 26 amps.

7. If the aircraft is fitted with drop tanks, continue to flow fuel out until the gallons gone meter registers 240 gallons and then increase rate to 2000 g.p.h.
8. Take readings enumerated below when the gallons gone meter registers 250, 270, 290 and 310 gallons. These readings must be within the limits stated.

Front tank pressure	1.5 to 5.5 at 250 galls. gone 1.7 to 5.5 at 260 galls. gone
Wheel well tapping pressure	5.0 to 6.5 p.s.i.
Engine delivery pressure	8.0 p.s.i. minimum
Pump at 26 volts	20 to 26 amps.

9. Whether the aircraft is fitted with drop tanks or not, reduce flow to 500 g.p.h. and observe recuperator gauge. This should not rise indicating that the recuperator has discharged and is recharging.

BOOSTER PUMP TEST NO.2 (STARBOARD)

This is a repeat of test No.1 above but for the starboard pump only.

## LEVEL BALANCING TEST

1. Repeat refuelling sequence to fill tanks.
2. Set selector switches to AUTO
3. Turn on air supply and adjust to deliver between 20–40 p.s.i. to the aircraft reducing valve.
4. Switch ON both booster pumps at the ground test rig and set voltage to 26 volts.
5. Start ground test rig pump, set at suction and adjust the throttling valve to pass 500 gallons per hour.
6. Take readings as below at 2 minute intervals until the system has completely emptied; limits for these readings are stated. Observe the operation of the selector cock when the rear tanks empty and any drop in pressure when the vapour vent valves become operative. Observe low level warning light operation and check tank values which are to be recorded.
7. The following readings should be taken and must be within the limits stated:—

	A/c with Drop Tanks	A/c without Drop Tanks
Front tank pressures	3.0— 5.5 p.s.i.	4.0— 5.5 p.s.i.
Rear tank pressures	5.0— 6.5 p.s.i.	5.5— 6.5 p.s.i.
Rib G pressures	4.0— 6.0 p.s.i.	—
Rib R pressures	4.7— 6.5 p.s.i.	—
Wheel well pressures	5.7— 6.5 p.s.i.	5.5— 6.5 p.s.i.
Engine delivery pressure	18.5—23.0 p.s.i.	19.0—23.0 p.s.i.
Booster pumps	13.0— 18.0 amp	14.0— 18.0 amp
Contents of port tanks )	out of balance	out of balance
Contents of starboard tanks )	maximum 150 lb	maximum 100 lb.

8. When this test has been completed, stop pump, close the throttling valve, switch OFF booster pumps, turn OFF air supply.

## SUCTION AND DROP TANK RELEASE TEST

1. At the base of the front tanks, connect measuring instruments as shown in ID.SK.392 and ID.SK.559 to the pipe assembly and turn on the pet cocks. Repeat fuelling sequence to fill tanks. Reset rig for suction.
2. Turn ON the air supply to external charging connection at shop pressure (approx. 70–80 p.s.i.) and set tank selector to auto.
3. Start the rig pump and adjust the throttling valve to give flow rate of 1,800 g.p.h. (drop tanks fitted), 2300 g.p.h. (drop tanks not fitted).

4. Take readings as under when the gallons gone meter registers:

Aircraft without drop tanks 25, 50, 75, 100 & 120 gallons  
Aircraft with drop tanks 25, 50, 100, 150 & 180 gallons

5. The readings to be taken are as follows and must be within the limits stated:—

		A/c with Drop Tanks	A/c without Drop Tanks
Front tank pressure	PORT	3.5–6.5 p.s.i.	4.0–6.5 p.s.i.
	STBD.	3.5–6.5 p.s.i.	4.0–6.5 p.s.i.
Rear tank pressure	PORT	5.0–6.5 p.s.i.	5.0–6.5 p.s.i.
	STBD.	5.0–6.5 p.s.i.	5.0–6.5 p.s.i.
Rib G pressure	PORT	3.7–5.8 p.s.i.	—
	STBD.	3.7–5.8 p.s.i.	—
Rib R pressure	PORT	5.0–6.5 p.s.i.	—
	STBD.	5.0–6.5 p.s.i.	—
Wheel well pressure	PORT	5.7–6.5 p.s.i.	5.7–6.5 p.s.i.
	STBD.	5.7–6.5 p.s.i.	5.7–6.5 p.s.i.
Engine delivery pressure		1.0 p.s.i. min.	+0.25 p.s.i. min.

6. Pressure difference between port and starboard pressures measured at the wheel wells must not exceed 0.25 p.s.i.
7. If the aircraft is not fitted with drop tanks, stop test.
8. If the aircraft is fitted with drop tanks, continue flowing fuel until 210 gallons have been extracted, warn operators and jettison outboard tanks.

#### NOTE

Observe after dropping tanks that no fuel or air escapes from the pylon valves.

9. Record pressures as in 5. above immediately before and after dropping the tanks.
10. Continue to take readings as above at two minute intervals with flow rate at 1,800 gph until 370 gallons have been extracted as indicated by the gallons gone meter.
11. Warn operators and drop inboard tanks. Take readings as above prior to and after jettisoning the tanks.

#### NOTE

Observe after dropping the tanks that no fuel or air escapes from the pylon valves.

12. Increase flow rate to 2,300 g.p.h. and extract a further 75 gallons taking readings at 25, 50 and 75 gallons, i.e. at 395, 420 and 445 gallons gone on the Bulk Meter. Engine delivery pressure at 2,300 g.p.h. must not be less than 0.25 p.s.i. Stop test.

## DEFUELLING TEST

1. Wheel away drop tanks and remove pylons from wings.
2. Replace pylon aperture cover plates.
3. Repeat fuelling sequence to refill tanks.
4. Set tank selector to Auto.
5. Remove locking of aircraft defuelling cock and turn it from off to on position.
6. Adjust shop air pressure through the rig reducing valve to 10 p.s.i.
7. Set the throttling valve to allow the system to drain at 2,300 g.p.h.
8. The following readings, which must be within the limits stated, are to be taken EVERY TWO MINUTES.

Front tank pressure	PORT	3.0 – 5.0 p.s.i.
	STBD.	3.0 – 5.0 p.s.i.
Rear tank pressure	PORT	4.0 – 6.3 p.s.i.
	STBD	4.0 – 6.3 p.s.i.
Wheel well pressure	PORT	5.0 – 6.5 p.s.i.
	STBD.	5.0 – 6.5 p.s.i.

9. When tanks are empty turn off the air supply. Reposition aircraft defuelling cock to OFF position and relock.
10. Remove defuelling connection, air line and all ancillary equipment, gauges; etc., fitted for these tests.

## Pressure Refuelling

Since the factory ground test rig is not suitable for refuelling the aircraft either at the required speed or pressure, it will be necessary to test the complete refuelling system with the aid of a high pressure and speed Bowser.

This test must be carried out at the first fuelling on the aerodrome at a pressure of 45 – 50 p.s.i. at the connection to the aircraft coupling except when the flow rate is greater than 150 gpm, when the pressure may be less, or at shut off when flick pressures up to 75 p.s.i. are permissible.

## POINTS TO BE CHECKED

- (a) No more than minute quantities of fuel spill from the vent.
- (b) The refuelling valves close correctly.
- (c) The float switches cut off the refuelling valves at the correct fuel level.
- (d) Note total time taken to refuel aircraft.

SECTION 11

FUEL SYSTEM

PART 10

230 GALLON DROP TANK TEST

(DROP TANK PRE MOD H.1242)

I.D. INSTRUCTION H03/14

TEST EQUIPMENT REQUIRED

1. Rig for filling and emptying tank.
2. Dummy pylon with fuel connections and provision for raising tank off ground and tilting through  $12^{\circ}$  to either end.
3. Equipment for pressurising tank.
4. 1.5 V d.c. electric supply and indicator lamp for connection to float switch.

PREPARATION FOR TESTS.

1. Connect tank and raise to pylon, applying a final crutching load of  $95 \pm 2$  lb/ft.
2. Connect lines for filling and emptying tank and for applying pressure.
3. Connect indicator lamp and 1.5 V supply to float switch.
4. Paint tank rivets and joints with a mixture of whitening and methylated spirit.

REFUELLING TEST

1. Arrange tank with pylon vertical and ensure that outlet port of tank is open to atmosphere.
2. Check contents indicators in tank nose to show zero.
3. Start rig and fill tank at 30 gall/min.
4. At 200 gall. contents shown on the bulkmeter, record tank pressures.
5. Stop flow immediately float switch lamp goes out.

Note:

lamp should extinguish without fuel overflowing from the outlet port.

6. Record tank contents as shown on bulkmeter.
7. If after stopping rig, the indicator lamp relights, continue to refuel at about 5 gall/min until lamp remains out. Re-read bulkmeter.
8. Check that contents indicators in tank nose show 1700 lbs.
9. Inspect tank for leaks. No fuel stains should appear on the whitewash.

## PRESSURE TEST

1. Close cock in fuel line to tank.
2. Apply 13 p.s.i. air pressure to tank.
3. After 5 minutes, tilt tank through  $12^{\circ}$ . After a further  $2\frac{1}{2}$  minutes tilt tank through  $24^{\circ}$  in opposite direction and leave for another  $2\frac{1}{2}$  minutes. (Total time under pressure = 10 mins.)
4. Return tank to normal attitude and carefully inspect for leaks.

## SUCTION TEST

1. Reduce air pressure supply to 6 p.s.i.
2. Reset bulkmeter and start rig. Empty tank at 30 gall/min. Check that float switch lamp soon relights.
3. After withdrawing 215 gall. record tank pressures, then reduce flow rate to about 5 gall/min and continue until tank is completely empty. Stop rig.
4. Record bulkmeter reading and check that contents indicators in tank nose show zero.

**SECTION 11**  
**FUEL SYSTEM**  
**PART 11**

**FUEL FLOW AND PRESSURE TESTS Mk.6, Mk.9 AND Mk.10 AIRCRAFT  
WITH 2 X 100 GALLONS AND 2 X 230 GALLONS DROP TANKS**

I.D. INSTRUCTION H03/15 (Issue 1)

**APPLICABILITY**

Hunter Mk.6 with drop tanks and mods. 415, 463, 496, 503, 545 and 557 incorporated and Mk.9 and 10 aircraft.

**TEST EQUIPMENT REQUIRED**

1. Special pipe with pressure tapping to ID.SK.448.
2. Blanking plate assembly to ID.SK.447, SE.730.
3. Pressurising rig to ID.SK.255, SE.724
4. Hose and adaptor for air ground charging, ID.SK.254.
5. Air inflation adaptor with sealing gland, ID.SK.243.
6. Fuel Flow Test Rig, SE.671.
7. Assembly to pressurise refuelling pipes, ID.SK.428, SE.722.
8. Assembly of gauges and transmitters to ID.SK.392 and as in ID.SK.552.
9. Special pipe assembly to ID.SK.559 and ID.SK.560.
10. Sealing gland, ID.SK.449.
11. Assembly to ID.SK.96
12. Trolleys for outboard drop tanks, SE.1227.

**IMPORTANT**

For all the following tests the aircraft should be in the rigging position with the necessary access panels removed. Front tank pressures should be measured at the suction and pressure relief valves throughout, unless otherwise stated.

**PREPARATION FOR PRESSURE TEST (SEE ID.SK.684)**

1. Check that the defuelling cock is in the OFF position.
2. Check that the refuelling pressure relief valves (on the undersurface inboard of the wing tanks) are free to operate.

3. That the low pressure cock in the main engine delivery pipe is at the OFF position.
4. Remove the blank from the engine end of the fuel pipe and fit special adaptor to ID.SK.447.
5. Connect 'Desynn' gauge transmitters (alternatives 'Bourdon' tube gauges or manometers) to the connections in the suction and pressure relief valves in the front tanks.
6. Connect similar measuring instruments to the connections in the valves in the rear tanks.
7. Remove the caps from the front tanks sediment drain pipes and connect special pipes ID.SK.559 for subsequent fitment of 'Desynn' Transmitters.
8. Connect measuring instruments as in para.5 to the connections in the air delivery pipes at the inboard end of the wing tanks in the wheel wells and also if drop tanks are fitted, to the tapping points in the fuel transfer pipes behind the wing nosing adjacent to rib G port and starboard together with similar instruments to the tappings between ribs Q and R. (Access through doors on bottom surface on main planes).
9. Remove the dust cap from the refuelling coupling in the port wheel well and couple up corresponding adaptor of the ground test rig.
10. Set the aircraft master switch to ON.
11. Set rig cocks to refuel position.
12. Set refuelling time switch in port wheel well to the ON position and check that 6 lights illuminate in refuelling indicator.
13. Start rig pump to fill tanks, check gauges in cockpit and stop rig when tanks are filled and flow ceases. Take time at which each lamp extinguishes in wheel well indicator.

## NOTE

After a few seconds when the pressure drops in the wing tanks, the transfer pressure dolls eyes will function and the gauges will only indicate front and rear tank contents.

The time switch may have to be reset in order to complete the fuelling operation, when this has been carried out, turn time switch to OFF, and remove Avery Hardoll nozzle. This sequence should be adopted each time the aircraft is refuelled.

There should be little or no spillage from the vent pipes either during or after filling or from the refuelling pressure relief valves.

14. Take readings of gallons gone, note time to refuel and refuelling pressure, also maximum pressure build up in each tank.

Front tanks pressure should not exceed	11.5 p.s.i.
Rear tanks pressure should not exceed	8.5 p.s.i.
Wheel well pressures should not exceed	7.5 p.s.i.
Wing tank pressures at Rib G	7.5 p.s.i.

15. Turn the low pressure cock to the ON position.
16. Prime feed pipe by bleeding air from blanking adaptor at engine connection.

## MAIN SYSTEM PRESSURE TEST

1. The exhaust pipes from the P.S.48/12 Hymatic pressure reducing valves are to be blanked off. On aircraft fitted with Mod.545 this will be carried out automatically by insertion of front tank vent pipe blanking plug.
2. Insert blanking plug ID.SK.243 at exit of front tank vent pipe (care must be taken to ensure that the pipe is free from paraffin or grease).
3. Insert blanking plug ID.SK.243 at exit of rear tank vent pipe and tighten to seal (observe instructions as in para.2).
4. Fit retainer clamps ID.SK.363 to close and retain the heads of the refuelling pressure relief valves on to their seatings.
5. Blank off the branch vent pipe A.203096 with special plug assembly ID.SK.949 and tighten to seal.
6. With pressurising assembly ID.SK.255 connected in turn to each blanking plug ID.SK.243, admit air to the front, wing and rear tanks.
7. Check all tanks, pipes etc., for leaks.
8. A pressure of 12–13 p.s.i. should be maintained for 10 mins. after turning off the air supply.

## MAIN ENGINE DELIVERY PIPE PRESSURE TEST

## NOTE

During the following test, the engine feed pipe should be suitably supported and anchored at its extremity in order to prevent damage to the 'King' flexible couplings.

1. Remove the aircraft 'Breeze' plugs from the booster pumps and connect to the latter special plugs from the rig external source of supply.
2. Check that the air pressure in the tanks is still at 13 p.s.i. make good if necessary.
3. Start both booster pumps and adjust the rheostats to give not more than 29 volts at each pump, check amperage and note that the fuel delivery pressure is not less than 28 p.s.i.
4. Check delivery pipe line for leaks.
5. Turn OFF booster pumps and air supply and remove the blanking plugs from the vent pipes together with retainer clamps.
6. Remove blanking from the Hymatic Valves.

## NOTE

When the seal plugs and blanks are removed:—

The front tank pressures will drop to approx.	11.0 p.s.i.
The rear tank pressures will drop to approx.	8.5 p.s.i.
Wing tank pressures measured at rib G will drop to approx.	6.5 p.s.i.

Failure to remove the blanking plugs may result in serious damage to aircraft on subsequent refuelling.

## PRESSURE TEST OF REFUELLING PIPES AND VALVES

1. Remove ground test rig refuelling nozzle and connect special Avery Hardoll nozzle with inflation valve unit and reservoir fuel tank to ID.SK.428 to the aircraft refuelling attachment.
2. Adjust control to allow fuel to be forced into the system at 50 p.s.i. from the augmentor tank. The tank capacity will allow 5 minutes test time.
3. The pressure should be maintained at 50 p.s.i. for 5 minutes without external leakage.

## NOTE

Care should be taken to prevent the 50 p.s.i. being transmitted to the main feed pipes by ensuring that the defuelling cock is fully at OFF and is leak free.

## AIR FLOW REGULATION TEST

1. Remove assembly ID.SK.447 and connect to the engine delivery pipe the suction connection of the test rig ID.SK.448.
2. Connect the special 2" diameter rig air line to the aircraft external charging connection in the spine of the aircraft and open air supply with reducing valve set to allow a pressure of 10 p.s.i. to be built up at the Hymatic Valves.
3. With the rig set for suction and the throttling valve adjusted to allow a flow rate of 500 gallons per hour, draw off 120 gallons of fuel.
4. During this flow vary the inlet pressure between 10 and 60 p.s.i. in the following manner.  
At every 10 gallons gone increase the air pressure by 10 p.s.i. until at 60 gallons start decreasing air pressure by 10 p.s.i. per 10 gallons. At 120 gallons increase to 60 p.s.i.
5. Stop pump, close throttling valve, turn low pressure cock to OFF, turn off air supply.
6. The tanks air pressure should not fluctuate during the variations in air supply to the reducing valves. This should be measured at the tapping points in the wheel wells.
7. Pressures recorded must not exceed 6.5 p.s.i. or drop below 5.7 p.s.i.

## FRONT TANKS LOW LEVEL SWITCH TEST

In order to ascertain the front tank fuel level at which the switches operate, carry out the following:—

1. Remove, if fitted, the 'Desynn' transmitter pipes and connect to the pressure tapplings in the front tanks suction and pressure relief valves, special pipe assembly ID.SK.967.
2. Set fuel flow test rig for refuelling and fill system, note total contents.
3. Set fuel cock selector to AUTO and with the rig, take out two or three gallons of fuel as registered by the gallons gone meter. This will prime the engine delivery line. Refuel aircraft, and close manually the gate valves at the rear tanks.

4. Set rig for suction and start pump, the throttling valve is to be adjusted to pass not more than 200 g.p.h.
5. Air should be introduced to the front tanks through the medium of the aerograph transformer and the pressure should be maintained as near 5 p.s.i. as possible during the extraction. When the vapour release valves open the pressures will drop, but must be maintained at over 1.5 p.s.i. measured at the sediment drain.
6. When the indicator lamps light, stop the rig, at the same time checking the quantity of fuel withdrawn, by gallons gone meter indication.
7. This should be within the range of 11.5–13.5 gallons per tank or 23–27 gallons indicated on the meter.

#### PREPARATION FOR FLOW AND TRANSFER TESTS

1. Check that the low pressure cock is at the OFF position.
2. Fit the refuelling connection.
3. Turn the aircraft master switch to the ON position and set the Venner time switch to ON.
4. Set rig controls to refuel, start rig pump and fill tanks.
5. Stop pump, close throttling valve and set ground test rig controls to suction.
6. Fit the special rig 'Breeze' couplings to the booster pumps if they have previously been removed.

#### PUMP SPEED CHANGE TEST

1. Repeat fuelling sequences to fill tanks and reset rig for suction.
2. Turn ON air supply from rig at a pressure of 20 p.s.i.
3. Connect rig booster pump plugs to aircraft components.
4. Switch On ground generator and adjust rheostats to give 26 volts to pumps.
5. Turn ON low pressure cock.
6. Switch On both booster pumps.
7. Start rig pump to pass 400 gallons per hour.
8. When flow is steady make recordings of engine delivery pressure and amps.
9. Switch OFF port booster pump and note engine delivery pressure and amps of starboard pump. The engine delivery pressure and pump amps should rise.
10. Switch On both pumps. Note drop in pressure and amps, allow flow and pressure to become constant.
11. Switch OFF starboard pump and note engine delivery pressure and amps of port pump. The pressure and amps should rise.
12. Switch ON both booster pumps, note drop in pressure.

13. Switch OFF both pumps, stop rig pump and close low pressure cock. Switch OFF ground generator.

14. Take readings thus:—

BOTH PUMPS ON:	Engine delivery pressure	p.s.i.
	Port pump current	amp
	Stbd. pump current	amp.
PORT PUMP OFF:	Engine delivery pressure	p.s.i.
	Stbd. pump current	amp.
BOTH PUMPS ON:	Engine delivery pressure	p.s.i.
	Port pump current	amp.
	Stbd. pump current	amp.
STBD.PUMP OFF:	Engine delivery pressure	p.s.i.
	Port pump current.	amp.
BOTH PUMPS ON:	Engine delivery pressure	p.s.i.
	Port pump current	amp.
	Stbd. pump current	amp.

15. The readings must comply with these limits:—

BOTH PUMPS ON:	Engine delivery pressure	19–25	p.s.i.
	Pump current	13–16.5	amp.
ONE PUMP ON:	Engine delivery pressure	20–25	p.s.i.
	Pump current	20–26	amp.

#### RECUPERATOR TEST

1. Connect to the pipe assembly ID.SK.392, measuring instruments and turn ON the pet cocks.
2. Repeat fuelling sequences to refill tanks and reset rig for suction tests. Selector switches in cockpit at 'Auto'.
3. Turn ON air supply at 40 p.s.i. to the aircraft reducing valves.
4. Switch ON both booster pumps from rig, set at 26 volts.
5. Turn ON low pressure cock, start rig pump and set throttling valve to 2,000 g.p.h.
6. Wait a few seconds for a steady flow from the system and then, as a stop watch is started, switch OFF both booster pumps. When the engine delivery pressure drops below front tank pressure, measured at the sediment drain, stop watch. Note time of discharge.
7. Immediately switch ON both booster pumps and start watch. The pressure registered at the recuperator gauge should rise rapidly to about 16 p.s.i., maximum 16.5 p.s.i., it will stay at this pressure for a period of time and then drop rapidly to about 10–11 p.s.i. Stop watch. Note time of recharge.

8. Stop rig, turn OFF low pressure cock and air supply, together with booster pumps.

Take readings of:—

Time taken to discharge (12–15 secs. limits)

Time taken to recharge (46 secs. maximum)

#### FITMENT OF DROP TANKS

1. Remove blanking plates from the wing undersurfaces and fit pylons.
2. Fit drop tanks to the pylons and adjust.
3. Wheel under the outboard tanks the special trolley to be adjusted to give 2" clearance between the landing surfaces and the tanks.
4. Set the aircraft master switch to ON.
5. Set rig cocks to refuel position.
6. Set refuelling time switch in port wheel well to the ON position. Check that six lamps illuminate in refuelling indicator.
7. Start rig pump to fill tanks, check gauges in cockpit and stop rig when tanks are filled and flow ceases.
8. Take time at which each lamp extinguishes and record total capacity.

#### NOTE:

- (a) After a few seconds when the pressure drops in the wing tanks, the transfer pressure dolls eye will function and the gauges will only indicate front and rear tank contents.
- (b) The time switch may have to be reset in order to complete the fuelling operation. When this has been carried out let the time switch run down and do not reset until further refuelling is necessary.
- (c) There should be little or no spillage from the vent pipes either during or after filling or from the refuelling pressure relief valves.

#### BOOSTER PUMP TEST No.1 (PORT)

1. Repeat refuelling sequence to fill tanks, reset rig for suction.

#### NOTE

Should the front tanks pressures be high, a small quantity of fuel is to be extracted to drop the pressure to approx. 5 to 5.5 p.s.i. Set tanks selector to auto.

2. Switch on the port booster pump, which will run at high speed.
3. Check that 26 volts is available to the pump.

4. Turn on air supply to 20 p.s.i.
5. Turn on low pressure cock, start rig pump and set throttling valve to pass 1500 g.p.h. (drop tanks fitted).
6. At selected readings of the gallons gone meter, take recordings enumerated below (these must be within the limits stated):—

## Aircraft With 4 Drop Tanks

Gallons gone meter readings:	20, 40, 60, 80, 100, 125 & 150 galls.
Front tank pressure	0.25 to 5.0 p.s.i.
Wheel well tapping pressure	5.0 to 6.5 p.s.i.
Engine delivery pressure (minimum)	12.0 p.s.i.
Pump at 26 volts	20 to 26 amps.

7. If the aircraft is fitted with drop tanks, continue to flow fuel out until the gallons gone meter registers 370 gallons and then increase rate to 2000 g.p.h.
8. Take readings enumerated below when the gallons gone meter registers 380, 400, 420 and 440 gallons. These readings must be within the limits stated.

Front tank pressure	1.5 to 5.5 at 380 galls. gone 1.7 to 5.5 at 390 galls. gone increasing to 2 p.s.i.
Wheel well tapping pressure	5.0 to 6.5 p.s.i.
Engine delivery pressure	8.0 p.s.i. minimum
Pump at 26 volts	20 to 26 amps.

9. Whether the aircraft is fitted with drop tanks or not, reduce flow to 500 g.p.h. and observe recuperator gauge. This should not rise indicating that the recuperator has discharged and is recharging.

## BOOSTER PUMP TEST No. 2 (STARBOARD)

This is a repeat of test No.1 above but for the starboard pump only.

## LEVEL BALANCING TEST

1. Repeat refuelling sequence to fill tanks.
2. Set selector switches to AUTO
3. Turn on air supply and adjust to deliver between 20—40 p.s.i. to the aircraft reducing valve.
4. Switch ON both booster pumps at the ground test rig and set voltage to 26 volts.

5. Start ground test rig pump, set at suction and adjust the throttling valve to pass 500 gallons per hour.
6. Take readings as below at 2 minute intervals until the system has completely emptied: limits for these readings are stated. Observe the operation of the selector cock when the rear tanks empty and any drop in pressure when the vapour vent valves become operative. Observe low level warning light operation and check tank value which are to be recorded.
7. The following readings should be taken and must be within the limits stated.

	A/c with Drop Tanks
Front tank pressure	3.0 – 5.5 p.s.i.
Rear tank pressures	5.0 – 6.5 p.s.i.
Rib G pressures	4.0 – 6.0 p.s.i.
Rib R pressures	4.7 – 6.5 p.s.i.
Wheel well pressures	5.7 – 6.5 p.s.i.
Engine delivery pressure	18.5 – 22.0 p.s.i.
Booster pumps	13.0 – 16.5 amp
Contents of Port tanks )	out of balance
Contents of starboard tanks )	maximum 150 lb.

8. When this test has been completed, stop pump, close the throttling valve, switch OFF booster pumps, turn OFF air supply.

#### SUCTION AND DROP TANK RELEASE TEST

1. At the base of the front tanks, connect measuring instruments as shown in ID.SK.392 and ID.SK.559 to the pipe assembly and turn on the pet cocks. Repeat fuelling sequence to fill tanks. Reset rig for suction.
2. Turn ON the air supply to external charging connection at shop pressure (approx. 70–80 p.s.i.) and set tank selector to auto.
3. Start the rig pump and adjust the throttling valve to give flow rate of 1,800 g.p.h. (drop tanks fitted).
4. Take readings as under when the gallons gone meter registers:—

Aircraft with Drop Tanks:—

25, 50, 100, 150 and 180 gallons.

5. The readings to be taken are as follows and must be within the limits stated:—

	A/c with Drop Tanks	
Front tank pressure	PORT	3.5 – 6.5 p.s.i.
	STBD.	3.5 – 6.5 p.s.i.
Rear tank pressure	PORT	5.0 – 6.5 p.s.i.
	STBD.	5.0 – 6.5 p.s.i.
Rib G pressure	PORT	3.7 – 5.8 p.s.i.
	STBD.	3.7 – 5.8 p.s.i.
Rib R pressure	PORT	5.0 – 6.5 p.s.i.
	STBD.	5.0 – 6.5 p.s.i.
Wheel well pressure	PORT	5.7 – 6.5 p.s.i.
	STBD.	5.7 – 6.5 p.s.i.
Engine delivery pressure		1.0 p.s.i. min.

6. Pressure difference between port and starboard pressures measured at the wheel wells must not exceed 0.25 p.s.i.
7. If the aircraft is not fitted with drop tanks, stop test.
8. If the aircraft is fitted with drop tanks, continue flowing fuel until 210 gallons have been extracted, warn operators and jettison outboard tanks.

#### NOTE

Observe after dropping tanks that no fuel or air escapes from the pylon valves.

9. Record pressures as in 5. above immediately before and after dropping the tanks.
10. Continue to take readings as above at two minute intervals with flow rate at 1,800 g.p.h. until 670 gallons have been extracted as indicated by the gallons gone meter.
11. Increase flow rate to 2,300 g.p.h. and extract a further 75 gallons taking readings at 25, 50 and 75 gallons, i.e. at 695, 720 and 745 gallons gone on the Bulk Meter. Engine delivery pressure at 2,300 g.p.h. must not be less than 0.25 p.s.i. Stop test.

#### DEFUELLING TEST

1. Wheel away drop tanks and remove pylons from wings.
2. Replace pylon operature cover plates.
3. Repeat fuelling sequence to refill tanks.
4. Set tank selector to Auto.
5. Remove locking of aircraft defuelling cock and turn it from off to on position.
6. Adjust shop air pressure through the rig reducing valve to 10 p.s.i.

7. Set the throttling valve to allow the system to drain at 2,300 g.p.h.
8. The following readings, which must be within the limits stated, are to be taken EVERY TWO MINUTES.

Front tank pressure	PORT	3.0 – 5.0 p.s.i.
	STBD.	3.0 – 5.0 p.s.i.
Rear tank pressure	PORT	4.0 – 6.3 p.s.i.
	STBD.	4.0 – 6.3 p.s.i.
Wheel well pressure	PORT	5.0 – 6.5 p.s.i.
	STBD.	5.0 – 6.5 p.s.i.

9. When tanks are empty turn off the air supply. Reposition aircraft defuelling cock to OFF position and relock.
10. Remove defuelling connection, air line and all ancillary equipment, gauges, etc., fitted for these tests.

#### PRESSURE REFUELLING

Since the factory ground test rig is not suitable for refuelling the aircraft either at the required speed or pressure, it will be necessary to test the complete refuelling system with the aid of a high pressure and speed Bowser.

This test must be carried out at the first refuelling on the aerodrome at a pressure of 45–50 p.s.i. at the connection to the aircraft coupling except when the flow rate is greater than 150 g.p.m., when the pressure may be less, or at shut off when the flick pressures up to 75 p.s.i. are permissible.

#### POINTS TO BE CHECKED

- (a) No more than minute quantities of fuel spill from the vent.
- (b) The refuelling valves close correctly.
- (c) The float switches cut off the refuelling valves at the correct fuel level.
- (d) Note total time taken to refuel aircraft.

**SECTION 11**

**FUEL SYSTEM**

**PART 12**

**230 GALLON DROP TANK TEST**

**DROP TANK POST MOD H.1242**

**I.D. INSTRUCTION H03/16 (Issue 2)**

**TEST EQUIPMENT REQUIRED**

1. Rig for filling and emptying tanks.
2. Dummy pylon with fuel connections and provision for raising tank off ground and tilting through  $12^{\circ}$  to either end.
3. Equipment for pressurising tank.
4. Adaptor with pressure gauge for pressurising through either drop tank connection (SE.2704) and pipe bung (SE.2705) and pressure connection (SE.2707).
5. 1.5V d.c. electrical supply and indicator lamp for connection to float switch.

**FUEL TRANSFER AND VENT PIPE PRESSURE TESTS**

1. With forward end centre transfer pipes assembled in the centre shell, carry out air pressure test by blanking rear end with (SE.2705) and fitting pressure connection (SE.2707) into front end. Raise pressure to  $2\frac{1}{2}$  p.s.i., shut supply and note no pressure drop in 3 minutes. Remove pressure connection and blank.
2. With the forward section of the vent pipe connected to the sole plate, carry out air pressure test by blanking rear end with (SE.2705) and fitting pressure connection SE.2707 into front end (on sole plate rear connection). Raise pressure to  $2\frac{1}{2}$  p.s.i., shut supply. There must be no drop in pressure in 3 min.
3. Remove rear blanking plug and with rear portions of transfer pipe and vent pipe fitted together with the diaphragm in position but not sealed refit blank into vent bell mouth and carry out pressure test as in (2) above.
4. Remove rear blanking plug and pressurising connection and fit to the corresponding position on the transfer pipe and carry out pressure test as in (1) above. Note adjustment of the rear pipe connection can be made if necessary through the central access panel in the diaphragm which can be sealed later.

**DIAPHRAGM PRESSURE TEST**

1. Seal Diaphragm and assemble tank less tailcone.
2. Fit expanding rubber bung (SE.2705) in downward facing internal fuel transfer pipe bell mouth and fit pressurising adaptor (SE.2704) to the tank fuel (forward) connection.

3. Apply a pressure of 2½ p.s.i. at the tank connection and when the pressure has stabilised turn off air supply.

Note:

The pressure in the tank MUST NOT exceed 3 p.s.i. throughout any diaphragm pressure test.

4. This pressure should be held for 5 minutes. There should be no leakage.
5. Release pressure, disconnect pressurising equipment, remove bung, and remove nose cone.
6. Fit tail cone, fit bung in forward end of internal transfer pipe, and connect pressurising equipment to air (rear) tank connection.
7. Apply a pressure of 2½ p.s.i. at the tank connection, and when the pressure has stabilised, turn off air supply.
8. This pressure should be held for 5 minutes. There should be no leakage.
9. Release air pressure, remove pipe bung, remove pressurising equipment and fit nose cone.

#### PREPARATION FOR FUNCTION TEST

1. Connect tank and raise to pylon, applying a final crutching load of  $95 \pm 2$  lb/ft.
2. Connect lines for filling and emptying tank and for applying pressure.
3. Connect indicator lamp and 1.5 V supply to float switch.
4. Paint tank rivets and joints with a mixture of whitening and methylated spirit.

#### REFUELLING TEST

1. Arrange tank with pylon vertical and ensure that outlet port of tank is open to atmosphere.
2. Check contents indicators in tank nose show zero.
3. Start rig and fill tank at 30 gall/min
4. The indicator will register full F-18 at between 148 and 178 galls. passed dependant on re-fuelling rate.
5. At 200 gallons contents shown on bulkmeter, record tank pressure. At 220 gallons gone reduce rate to 5 gall/min.
6. Stop flow immediately float switch lamp goes out.

Note:

lamp should extinguish without fuel overflowing from the outlet port.

7. Record tank total contents as shown on the bulkmeter this should be between 235 – 240 gallons.
8. If after stopping the rig, the indicator lamp relights, continue to refuel at about 5 gall/min until lamp remains out. Re-read bulkmeter.
9. Inspect tank for leaks. No fuel stains should appear on the whitewash.

#### PRESSURE TEST

1. Close cock in fuel line to tank
2. Apply 13 p.s.i. air pressure to tank.
3. After 5 minutes, tilt tank through  $12^{\circ}$ . After a further  $2\frac{1}{2}$  minutes tilt tank through  $24^{\circ}$  in opposite direction and leave for another  $2\frac{1}{2}$  minutes. (Total time under pressure = 10 mins.).
4. Return tank to normal attitude and carefully inspect for leaks.

#### SUCTION TEST

1. Reduce air pressure supply to 6 p.s.i.
2. Reset bulkmeter and start rig. Empty tank at 10 galls/min. Check that float switch lamp soon re-lights.
3. Note gallons passed when indicator drum starts to move. This should occur between 60 and 67 gallons.
4. Increase flow rate to 30 gall/min. and draw off another 150 gallons. Note tank pressure.
5. Reduce flow to 10 gall/min and continue until tank is completely empty. Stop rig.
6. Record bulkmeter reading and check that contents indicators in tank nose show zero.

**SECTION 11**  
**FUEL SYSTEM**  
**PART 13**

**FUEL FLOW AND PRESSURE TEST WITH OR WITHOUT 100 GALLON  
DROP TANKS Mk.58A AIRCRAFT**  
I.D. INSTRUCTION H03/17 (Issue 1)

1. APPLICABILITY

Hunter Mk.58A with or without 100 gallon drop tanks fitted and mods embodied as in D01 H.2561/1.

Aircraft attitude horizontal.

2. EQUIPMENT REQUIRED

- (i) Special pipe with pressure tapping to I.D. Sk.448.
- (ii) Blanking pipe assembly to I.D. Sk.447 SE.730
- (iii) Pressurising rig to I.D. Sk.255 SE.724.
- (iv) Hose and Adaptor for air ground charging I.D. Sk.254.
- (v) Air inflation adaptor with sealing gland I.D. Sk.243.
- (vi) Fuel flow test rig SE.671.
- (vii) Assembly to pressurise refuelling pipes I.D. Sk.428. SE.722.
- (viii) Assembly of gauges and transmitters to I.D. Sk.392 and I.D. Sk.552.
- (ix) Special pipe assembly to I.D. Sk.559 and I.D. Sk.560.
- (x) Sealing gland I.D. Sk.449 SE.729.
- (xi) Assembly to I.D. Sk.967.

3. PREPARATION

Front tank pressures should be measured at the suction and pressure relief valves throughout, unless otherwise stated.

- (i) Check defuelling cock is in OFF position
- (ii) Check that refuelling pressure relief valves are free to operate.
- (iii) Engine delivery line LP cock is at the OFF position.
- (iv) Remove the blank from the engine end of the fuel pipe and fit special adaptor to I.D. Sk.447.
- (v) Connect "Desynn" gauge transmitters (or "Bourdon" tube gauges) to the connections in the suction and pressure relief valves in the front tanks.
- (vi) Connect similar measuring instruments to the connections in the rear tank valves.

## 3. PREPARATION (Contd.)

- (vii) Remove caps from the front tank drain pipes and connect special pipes I.D. Sk.559 for subsequent fitment of "Desynn" transmitters.
- (viii) Connect measuring instruments as in para.5 to the air delivery pipe connections at the inboard end of the wing tanks in the wheel wells and also, if drop tanks are fitted, to the tapping points in the fuel transfer pipes behind the wing nosing adjacent to rib G port and starboard together with similar instruments to the tappings between ribs Q and R (access through doors on the bottom surface of main planes).
- (ix) Remove the dustcap from the refuelling coupling in the port wheel well and couple up corresponding adaptor of the ground test rig.
- (x) Set the aircraft master switch to ON.
- (xi) Set rig cocks to refuel position.
- (xii) Set refuelling time switch in port wheel well to the ON position and check that 6 lights illuminate in refuelling indicator.
- (xiii) Start rig pump to fill tanks, check gauges in cockpit and stop rig when tanks are filled and flow ceases. Note time at which each light extinguishes in wheel well indicator.

**Note . . .**

*After a few seconds when the pressure drops in the wing tanks, the transfer pressure dolls eyes will function and the gauges will only indicate front and rear fuel contents.*

*The time switch may have to be reset in order to complete the fuelling operation when this has been carried out, turn time switch to OFF and remove Avery Hardoll nozzle. The sequence should be adopted each time the aircraft is refuelled.*

*There should be little or no spillage from the vent pipes either during or after filling or from the refuelling pressure relief valves.*

- (xiv) Note gallons gone, time to refuel and refuelling pressure, also maximum pressure Build up in each tank.
  - Front tanks pressure
  - Rear tanks pressure
  - Wheel well pressures
  - Wing tank pressure at rib G
- (xv) Turn the L.P. cock to the ON position.
- (xvi) Prime feed pipe by bleeding air from blanking adaptor at engine connection.

## 4. MAIN SYSTEM PRESSURE TEST

- (i) Blank off exhaust pipes from the PS 48/12 Hymatic pressure reducing valves, this will be carried out automatically by insertion of front tank vent pipe blanking plug.

## 4. MAIN SYSTEM PRESSURE TEST (Contd.)

- (ii) Insert blanking plug I.D. Sk.243 at exit of front tank vent pipe (ensure pipe is free from paraffin or grease).
- (iii) Insert blanking plug I.D. Sk.243 at exit of rear tank vent pipe and tighten to seal. (Observe instructions as in 2.)
- (iv) Fit retainer clamps I.D.Sk.363 to close and retain the heads of the refuelling pressure relief valves on to their seating.
- (v) Blank off the branch vent pipe A.203096 with special plug assembly I.D. Sk.449 and tighten to seal.
- (vi) With pressurising assembly I.D. Sk.255 connected in turn to each blanking plug I.D. Sk.243, admit air to the front wing and rear tanks.
- (vii) Check all tanks, pipes, etc. for leaks.
- (viii) Maintain 12–13 p.s.i. for 10 minutes after turning off air supply.

## 5. MAIN ENGINE DELIVERY PIPE PRESSURE TEST

## Note . . .

*During this test the engine feed pipe should be suitably supported and anchored at its extremity in order to prevent damage to the "King" flexible couplings.*

- (i) Remove the aircraft "Breeze" plugs from the booster pumps and connect to the latter special plugs from the rig external source of supply.
- (ii) Check tank air pressure is still at 13 p.s.i.
- (iii) Start both booster pumps and adjust rheostats to give not more than 29 volts at each pump. Check amperage and note fuel delivery pressure.
- (iv) Check delivery line for leaks.
- (v) Turn off booster pumps and air supply and remove the blanking plugs from the vent pipes together with retainer clamps.
- (vi) Remove blanking from the Hymatic valves.

## Note . . .

*When the sealing plugs and blanks are removed note –  
front tank pressures  
rear tank pressures  
wing tank pressures measured at rib G.*

*Failure to remove the blanking plugs may result in serious damage to aircraft on subsequent refuelling.*

## 6. PRESSURE TEST OF REFUELLING PIPES AND VALVES

- (i) Remove ground test rig refuelling nozzle and connect special Avery Hardoll nozzle with inflation valve unit and reservoir fuel tank to I.D. Sk.428 to aircraft refuelling attachment.

## 6. PRESSURE TEST OF REFUELLING PIPES AND VALVES (Contd.)

- (ii) Pressure test to 50 p.s.i.g. for 5 minutes noting any leakage.

**Note . . .**

*Care should be taken to prevent the 50 p.s.i.g. being transmitted to the main feed pipes by ensuring that the defuelling cock is fully OFF and leak free.*

## 7. FRONT TANKS LOW LEVEL SWITCH TEST

In order to determine the front tank fuel level at which the switches operate carry out the following:

- (i) Remove, if fitted, the "Desynn" transmitter pipe and connect to the pressure tapplings in the front tanks suction and pressure relief valves, assembly I.D. Sk.967.
- (ii) Set fuel cock selector to AUTO and take out two or three gallons, registered on Rig Bulkmeter. This will prime the engine delivery line: refuel aircraft and manually close rear tank gate valves.
- (iii) Set rig for suction and start pump, the throttling valve is to be adjusted to pass not more than 200 g.p.h.
- (iv) Pressurise front tanks to 5.0 p.s.i. with external air supply which should be maintained. During suction when the vapour release valves open, the pressures will drop but must be maintained at over 1.5 p.s.i.g. measured at the sediment drain.
- (v) When indicator lights 'ON', stop rig, whilst checking quantity of fuel withdrawn by gallons gone meter indication.  
Limits 11.5 – 13.5 galls/tanks  
23.0 – 27.0 Total on Bulkmeter

## 8. PREPARATION FOR FLOW AND TRANSFER TESTS

- (i) Check L.P. cock is off.
- (ii) Fit refuelling connection
- (iii) Turn aircraft master switch to ON and set Venner Time Switch to ON.
- (iv) Set rig controls to refuel, start rig pump and fill tanks.
- (v) Stop pump, close throttling valve and set ground testing controls to suction.
- (vi) Fit rig "Breeze" couplings to the booster pumps if they have previously been removed.

9. PUMP SPEED CHANGE TEST

- (i) Repeat fuelling sequences to fill tanks and reset rig for suction.
- (ii) Turn ON air supply from rig at a pressure of 20 p.s.i.
- (iii) Connect rig booster pump plugs to aircraft.
- (iv) Set ground generator to give 26 volts at the pumps.
- (v) Turn on L.P. cock.
- (vi) Switch on both booster pumps.
- (vii) Start rig pump to pass 400 g.p.h. and note engine delivery pressure and pump current.
- (viii) Switch OFF port booster pump and note engine delivery pressure and starboard pump current. The pressure and amps. should rise.
- (ix) Switch ON both booster pumps. Note drop in pressure and amps.
- (x) Switch off starboard pump and note engine delivery and port pump and amps of port pump.
- (xi) Switch ON both pumps. NOTE drop in pressure and amps.
- (xii) Switch OFF both pumps, stop rig pump and close L.P. Cock. Switch OFF ground generator.

	Both Pumps	Port Pump Off	Starboard Pump Off	Both Pumps	
Eng. Del. Pressure					p.s.i.g.
Port Pump Current		—			amp.
Stbd. Pump Current			—		amp.
Limits					
Eng. Del. Pressure	19-25	20-25		19-26	p.s.i.
Pump Current	13-16.5	20-26		13-16.5	amp

10. RECUPERATOR TEST

- (i) Connect the pipe assembly I.D. Sk.392 and open cocks.
- (ii) Repeat fuelling sequence to refill tanks and reset rig for suction tests. Selector switches in cockpit at "auto"
- (iii) Supply aircraft reducing valves with air at 40 p.s.i.g.
- (v) Turn on L.P. cock and set flow to 2000 g.p.h.
- (vi) Establish a steady flow from the system and as a stop watch is started, switch off both booster pumps when the engine delivery pressure falls below front tank pressure measured at the sediment drain, stop watch. Note discharge time.

## 10. RECUPERATOR TEST (Contd.)

- (vii) Immediately switch on booster pumps and start watch. Pressure registered at the recuperator gauge should rise rapidly to 16 p.s.i.g. falling to 10–11 p.s.i.g. (Max. pressure 16.5 psi). Note recharge time.
- (viii) Stop rig, turn off L.P. cock and air supply, together with booster pumps.

## 11. FITMENT OF DROP TANKS (WHEN APPLICABLE)

- (i) Remove blanking plate from the wing under surfaces and fit pylons, drop tanks.
- (ii) Set aircraft master switch to ON.
- (iii) Set rig cocks to refuel position.
- (iv) Set refuelling time switch in port wheel well ON. Check that six lamps illuminate in refuelling indicator.
- (v) Start rig pump to fill tanks, check cockpit gauges and stop rig when tanks are filled and flow ceases.
- (vi) Note time at which each light expires and record total capacity.

**Note . . .**

- (a) *When the pressure drops in the wing tanks, the transfer pressure dolls eye will function and the gauges will only indicate front and rear tank contents.*
- (b) *The time switch may have to be reset in order to complete the fuelling operation. When this has been done let the time switch run down and do not reset until further fuelling is necessary.*
- (c) *There should be little or no spillage from the vent pipes either during or after filling or from the refuelling pressure relief valves.*

## 12. BOOSTER PUMP NO.1 (PORT) AND AIRFLOW REGULATION TEST

- (i) Repeat refuelling sequence to fill tanks, reset rig for suction.

**Note . . .**

*Should the front tank pressures be high a small quantity of fuel is to be extracted to drop the pressure to 5–5.5 p.s.i.*

- (ii) Switch on the port booster pump, which will run at high speed.
- (iii) Check pump voltage.
- (iv) Turn on air supply to 10 p.s.i.g.
- (v) Turn on L.P. cock, start rig pump to pass 1500 g.p.h. (drop tanks fitted) or 2000 g.p.h. (no drop tanks fitted).
- (vi) (a) At selected readings of the gallons gone meter, take recordings as follows:

Aircraft without drop tanks:

Gallons gone	20	30	40	60	80	100	150
Front tank pressure	2.0 to 5.5 p.s.i.g.						
Rear tank pressure	5.0 to 6.5 p.s.i.g.						

## 12. BOOSTER PUMP NO.1 (PORT) AND AIRFLOW REGULATION TEST (Contd.)

Aircraft without drop tanks (Contd.)

Wing tank pressure 5.0 to 6.25 p.s.i.g.

Eng. delivery pressure (min.) 8.0

Booster pump current 20 to 26.0 amps.

With an initial air supply of 10 p.s.i.g. and noting wheel well tapping pressure at each gallon increment increase Hymatic valve pressure 10 p.s.i.g. up to 60 p.s.i.g. At 100 galls gone decrease air pressure to 10 p.s.i.g. and rapidly increase to 60 p.s.i.g. noting wheel well pressure response remains within limits.

(b) Aircraft with Two or Four 100 gallon drop tanks (if fitted)

Gallons gone 20 40 60 80 100 125 150

Front tank pressure 0.25 to 5.0 p.s.i.g.

Wheel well tapping pressure 5.0 to 6.5 p.s.i.g.

Engine delivery pressure

(min.) 12.0 p.s.i.g.

Booster pump current 20 to 26 amps.

Increase air supply as in 6(a) up to 60 p.s.i.g. and at 125 gallons gone decrease air pressure to 10 p.s.i.g. and rapidly increase to 60 p.s.i.g. noting wheel well pressure response remains within limits.

(vii) If the aircraft is fitted with drop tanks continue to pump to 240 gallons gone and then increase rate to 2000 g.p.h.

(viii) Take readings as follows:

Gallons gone 250 270 290 310

Limits:

Front Tank Pressure 1.5 to 5.5 at 250 gallons gone

1.7 to 5.5 at 260 gallons gone

Increasing to 2 p.s.i.

Wheel well tapping pressure 5.0 to 6.5 p.s.i.

Engine delivery pressure 8.0 p.s.i. min.

Booster pump current 20 to 26 amps.

(ix) Whether the aircraft is fitted with drop tanks or not reduce flow to 500 g.p.h. and observe recuperator gauge. This should not rise indicating that the recuperator has discharged and is recharging. Booster pump Test No.2 (starboard). As per starboard pump test but with starboard pump only.

## 13. LEVEL BALANCING TEST

(i) Repeat refuelling sequence to fill tanks.

(ii) Set selector switches to AUTO.

(iii) Turn on air supply and adjust to deliver between 20–40 p.s.i. to the aircraft reducing valve.

## 13. LEVEL BALANCING TEST (Contd.)

- (iv) Switch ON both booster pumps at the ground test rig and set voltage to 26 volts.
- (v) Start ground test rig pump, set at suction and adjust the throttling valve to pass 500 gallons per hour.
- (vi) Take readings as below at 2 minute intervals until the system has completely emptied; limits for these readings are stated. Observe the operation of the selector cock when the rear tanks empty and any drop in pressure when the vapour vent valves become operative. Observe low level warning light operation and check tank values which are to be recorded.
- (vii) The following readings should be taken and must be within the limits stated:

	A/C with Drop Tanks	A/C without Drop Tanks
Front tank pressures	3.0–5.5 p.s.i.	4.0–5.5 p.s.i.
Rear tank pressures	5.0–6.5 p.s.i.	5.5–6.5 p.s.i.
Rib G pressures	4.0–6.0 p.s.i.	—
Rib R pressures	4.7–6.5 p.s.i.	—
Wheel well pressures	5.7–6.5 p.s.i.	5.5–6.5 p.s.i.
Engine delivery pressure	18.5–23.0 p.s.i.	19.0–23.0 p.s.i.
Booster pumps	13.0–16.5 amps	14.0–17.5 amp
Contents of port tanks )	Out of balance	Out of balance
Contents of stbd. tanks )	Max. 150 lb.	Max. 150 lb.

- (viii) When this test has been completed, stop pump, close the throttling valve, switch OFF booster pumps, turn OFF air supply.

## 14. SUCTION AND DROP TANK RELEASE TEST

- (i) At the base of the front tanks, connect measuring instrument as shown in I.D. Sk.392 and I.D. Sk.559 to the pipe assembly and turn on the pet cocks. Repeat fuelling sequence to fill tanks. Reset rig for suction.
- (ii) Turn ON the air supply to external charging connection at shop pressure (approx. 70–80 p.s.i.) and set tank selector to AUTO.
- (iii) Start the rig pump and adjust the throttling valve to give flow rate of 1,800 g.p.h. (drop tanks fitted), 2,300 g.p.h. (drop tanks not fitted).
- (iv) Take readings as under when the gallons gone meter registers:  
Aircraft without drop tanks 25, 50, 75, 100 and 120 gallons  
Aircraft with drop tanks 25, 50, 100, 150 and 180 gallons

## 14. SUCTION AND DROP TANK RELEASE TEST (Contd.)

- (v) The readings to be taken are as follows and must be within the limits stated:

	A/C with Drop Tanks	A/C without Drop Tanks
Front tank pressure		
Port	3.5–6.5 p.s.i.	4.0–6.5 p.s.i.
Starboard	3.5–6.5 p.s.i.	4.0–6.5 p.s.i.
Rear tank pressure		
Port	5.0–6.5 p.s.i.	5.0–6.5 p.s.i.
Starboard	5.0–6.5 p.s.i.	5.0–6.5 p.s.i.
Rib G Pressure		
Port	3.7–5.8 p.s.i.	—
Starboard	3.7–5.8 p.s.i.	
Rib R Pressure		
Port	5.0–6.5 p.s.i.	
Starboard	5.0–6.5 p.s.i.	
Wheel Well pressure		
Port	5.7–6.5 p.s.i.	5.7–6.5 p.s.i.
Starboard	5.7–6.5 p.s.i.	5.7–6.5 p.s.i.
Engine Delivery Pressure	1.0 p.s.i. min	+0.25 p.s.i. min.

- (vi) Pressure difference between port and starboard pressures measured at the wheel wells must not exceed 0.25 p.s.i.
- (vii) If the aircraft is not fitted with drop tanks, stop test.
- (viii) If the aircraft is fitted with drop tanks, continue flowing fuel until 210 gallons have been extracted, warn operators and jettison outboard tanks.

**Note . . .**

*Observe after dropping tanks that no fuel or air escapes from the pylon valves.*

- (ix) Record pressure as in (v), above immediately before and after dropping the tanks.
- (x) Continue to take readings as above at two minute intervals with flow rate at 1800 g.p.h. until 370 gallons have been extracted as indicated by the gallons gone meter.
- (xi) Warn operators and drop inboard tanks. Take readings as above, prior to and after jettisoning the tanks.

**Note . . .**

*Observe after dropping the tanks that no fuel or air escapes from the pylon valves.*

- (xii) Increase flow rate to 2300 g.p.h. and extract a further 75 gallons taking readings at 25, 50 and 75 gallons, i.e. at 395, 420 and 445 gallons gone on the Bulk Meter. Engine delivery pressure at 2300 g.p.h. must not be less than 0.25 p.s.i. Stop Test.

## 15. DEFUELLING TEST

- (i) Wheel away drop tanks and remove pylons from wings.
- (ii) Replace pylon aperture cover plates.
- (iii) Repeat fuelling sequence to refill tanks.
- (iv) Set tank selector to AUTO.
- (v) Remove locking of aircraft defuelling cock and turn it from OFF to ON position.
- (vi) Adjust shop air pressure through the rig reducing valve to 10 p.s.i.
- (vii) Set the throttling valve to allow the system to drain at 2300 g.p.h.
- (viii) The following readings, which must be within the limits stated are to be taken every two minutes.

		Limits
Front tank pressure	Port	3.0—5.0 p.s.i.
	Starboard	3.0—5.0 p.s.i.
Rear tank pressure	Port	4.0—6.3 p.s.i.
	Starboard	4.0—6.3 p.s.i.
Wheel well pressure	Port	5.0—6.5 p.s.i.
	Starboard	5.0—6.5 p.s.i.

- (ix) When tanks are empty turn off the air supply. Reposition aircraft defuelling cock to OFF position and relock.
- (x) Remove defuelling connection, air line and all ancillary equipment, gauges, etc., fitted for these tests.

## 16. PRESSURE REFUELLING

Since the factory ground test rig is not suitable for refuelling the aircraft either at the required speed or pressure, it will be necessary to test the complete refuelling system with the aid of a high pressure Bowser.

This test must be carried out at the first fuelling on the airfield at a pressure of 45—50 p.s.i. at the connection to the aircraft coupling except when the flow rate is greater than 150 g.p.m., when the pressure may be less, or at shut off when flick pressures up to 75 p.s.i. are permissible.

## 17. POINTS TO BE CHECKED

- (a) No more than minute quantities of fuel spill from the vent.
- (b) The refuelling valves close correctly.
- (c) The float switches cut off the refuelling valves at the correct fuel level.
- (d) Note total time taken to refuel aircraft.

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