

HUNTER MK. 74A—PILOT'S NOTES

INTRODUCTION

The Hunter Mk. 74A is a single seat aircraft powered by a single Avon 207 axial-flow gas turbine engine.

The ailerons and elevators are fully powered, the rudder circuit is manually operated. The electric 'follow-up' tail (when selected *ON*) will move the variable incidence tail-plane in conjunction with the elevators. A braking parachute is housed under two longitudinal doors in the tailcone upper surface, and is streamed and jettisoned by operation of a switch in the cabin.

The cabin is pressurized and accommodates a Martin Baker Mk. 3H ejector seat, use of which automatically jettisons the hood. The hood may be jettisoned separately by means of a handle on the port shelf.

The armament consists of four Aden 30-mm. guns carried semi-buried beneath the fuselage undersurface on the front port and starboard sides. Drop tanks, bombs or R.P.s can be carried externally.

PILOT'S NOTES

CONTENTS

Conditions of Release

Amendment Record Certificate

Notes to Users

Introduction

Pilot's Safety Precautions

**PART I
DESCRIPTION AND MANAGEMENT OF
SYSTEMS**

**PART II
LIMITATIONS**

**PART III
HANDLING**

**PART IV
EMERGENCY PROCEDURES**

**PART V
OPERATING DATA**

**PART VI
COCKPIT ILLUSTRATIONS**

A LIST OF CHAPTERS will be found at the front of Parts I to V

PART I

Description and Management of Systems

LIST OF CHAPTERS

CHAPTER 1	Fuel system
CHAPTER 2	Engine controls and instruments
CHAPTER 3	Electrical system
CHAPTER 4	Hydraulic system
CHAPTER 5	Powered flying controls and trimmers
CHAPTER 6	Other aircraft controls
CHAPTER 7	General equipment and controls
CHAPTER 8	Aircrew equipment and oxygen system
CHAPTER 9	Radio and radar controls
CHAPTER 10	Armament and camera installation

Note . . .

A LIST OF CONTENTS will be found at the front of each Chapter.

PART I

Chapter 1 — FUEL SYSTEM

LIST OF CONTENTS

<i>Description</i>	<i>Para.</i>
<i>Tanks</i>	1
<i>Fuel feed system</i>	4
<i>Booster pumps and fuel recuperators</i>	6
<i>Fuel proportioner</i>	8
<i>Filter de-icing</i>	12
 <i>Controls and Indicators</i>	
<i>LP and HP fuel cocks</i>	14
<i>Booster pumps</i>	15
<i>Fuel contents gauges</i>	18
<i>Fuel level indicators</i>	22
<i>Transfer system</i>	24
<i>Drop tank jettison</i>	27
<i>Pressure refuelling and defuelling</i>	29
 <i>Management of the System</i>	
<i>Pre-flight checks</i>	32
<i>Use in flight</i>	33
<i>Unusable fuel</i>	36
 <i>Malfunctioning of the System</i>	
<i>Booster pump failure</i>	38
<i>Fuel proportioner malfunction</i>	43
<i>Transfer pressure failure</i>	44
<i>Vapour release valve fails closed</i>	45
<i>Transfer changeover failure</i>	48
<i>Fuel gauge errors</i>	49
 <i>Illustrations</i>	
<i>Simplified fuel system</i>	<i>Fig.</i> 1
<i>'Flow plan' fuel panel</i>	2

Description

Tanks

1. Fuel is carried in six 'flexible bag' internal tanks, one in each wing and two front and two rear tanks in the fuselage. Each wing tank consists of four cells and is fitted in the forward edge of the wing.

PART I

CHAP. I

- Two or four drop tanks can be carried on underwing pylons. The outboard tanks are of 100 gallon capacity and those on the inboard pylons may be either 100 gallon or 230 gallon capacity.
- The tank capacities are:

	Gallons	Weight in lb at 7.7 lb/gallon
Internal tanks		
Front	200	1540
Rear	52	400
Wing	140	1078
Drop tanks		
2 × 100	200	1540
4 × 100	400	3080
2 × 230	460	3542
2 × 100 + 2 × 230	660	5082
Totals		
Internal	392	3018
Internal + 2 × 100	592	4558
Internal + 4 × 100	792	6098
Internal + 2 × 230	852	6560
Internal + 2 × 100 + 2 × 230	1052	8100

Fuel feed system

- Fuel is fed to the engine by a booster pump in each front tank via a fuel proportioner and low pressure (LP) and high pressure (HP) fuel cocks. Fuel is transferred from the rear, then wing tanks to the front tanks by air pressure from a tapping on the engine compressor. When drop tanks are carried, after the rear tanks have emptied, fuel is transferred from the outer drop tanks to the inner drop tanks and then to the wing tanks.
- The 230 gallon drop tanks are compartmented; 106 gallons of fuel is used from the rear compartment before fuel flows from the main compartment.

Booster pumps and fuel recuperators

6. Each front tank contains a two-speed electrically-driven immersed booster pump and a 3.5 gallon capacity fuel recuperator, the contents of which are used when booster pump pressure falls (*e.g. during inverted flight*). As a guide, total contents of the recuperators provide 15 seconds of flight at full power at sea level. They require 45 seconds to recharge; a pause must therefore be allowed between negative g manoeuvres.
7. The booster pumps, when switched on, normally run at low speed but each, at high speed, is capable of supplying the maximum fuel demand of the engine. High or low speed operation is automatically controlled by pressure switches. If pressure from one pump falls below 8 PSI the other is switched to high speed; above 12 PSI they revert to, or remain in low speed.

Fuel proportioner

8. From the booster pumps fuel passes to the fuel proportioner, which ensures a balanced flow from both sides of the fuel system with both booster pumps running.
9. The proportioner contains a matched pair of vane-type rotors, mounted on a common shaft. Two inlet ports, one for each rotor, accept fuel from the associated booster pump. A single exit port passes the metered fuel through the LP fuel cock to the engine.
10. If the proportioner rotors jam, fuel bypasses them via spring-loaded non-return valves.
11. Unequal feeding is only likely to occur if inlet pressures to the proportioner differ by more than 2 PSI; the greater the pressure difference, the greater the amount of unequal feeding.

Filter de-icing

12. Fuel contains a small amount of water so, to prevent ice crystals from blocking the fuel filter at low outside air temperature, an automatic de-icing system is fitted.
13. A one-gallon de-icing tank is in the engine bay; a filler access and contents indicator are in the engine gearbox

PART I

CHAP. I

bay under the fuselage. When icing occurs, an electric pump is switched on by the pressure drop through the filter and fluid is pumped to the filter; when pressure returns to normal the pump is switched off.

Controls and Indicators

LP and HP fuel cocks

14. The LP fuel cock, on the port console, controls fuel flow to the HP fuel cock. It moves forward from OFF to ON. The HP fuel cock, controlled by the throttle lever, controls fuel flow to the engine.

Booster pumps

15. Each booster pump is controlled by an ON/OFF switch on a fuel panel at the front end of the starboard console. A circuit breaker for each pump is at the rear end of the starboard console. Adjacent to the switches are two amber warning lights, one for each pump, which come on if the associated booster pump fails or is switched off.
16. A red LP FUEL WARNING light, on the starboard instrument panel, comes on if fuel pressure delivered to the engine falls below 3.5 PSI.
17. A test switch and an ammeter socket are provided for servicing purposes, on the starboard console.

Fuel contents gauges

18. Two electrical fuel contents gauges indicate the total weight of fuel, in pounds, in the PORT and STBD internal tanks (*front, wing and rear*). When all gauged tanks are full and transfer pressure is available each gauge should read 1500 lb approximately.
19. The associated gauge will indicate front tank contents only, *i.e. the amount of fuel available to the engine*, when:
 - (a) A fuel low level warning light comes on (paras. 23 and 45).
 - (b) Transfer pressure fails (paras. 25 and 44).
 - (c) Transfer changeover fails (para. 48).
20. There are no gauges in the cockpit for the 100 or 230 gallon drop tanks.

21. Each 230 gallon drop tank has a mechanical indicator, visible from the cockpit, calibrated from F (full) to E (empty) in lb \times 100; full contents are indicated until the

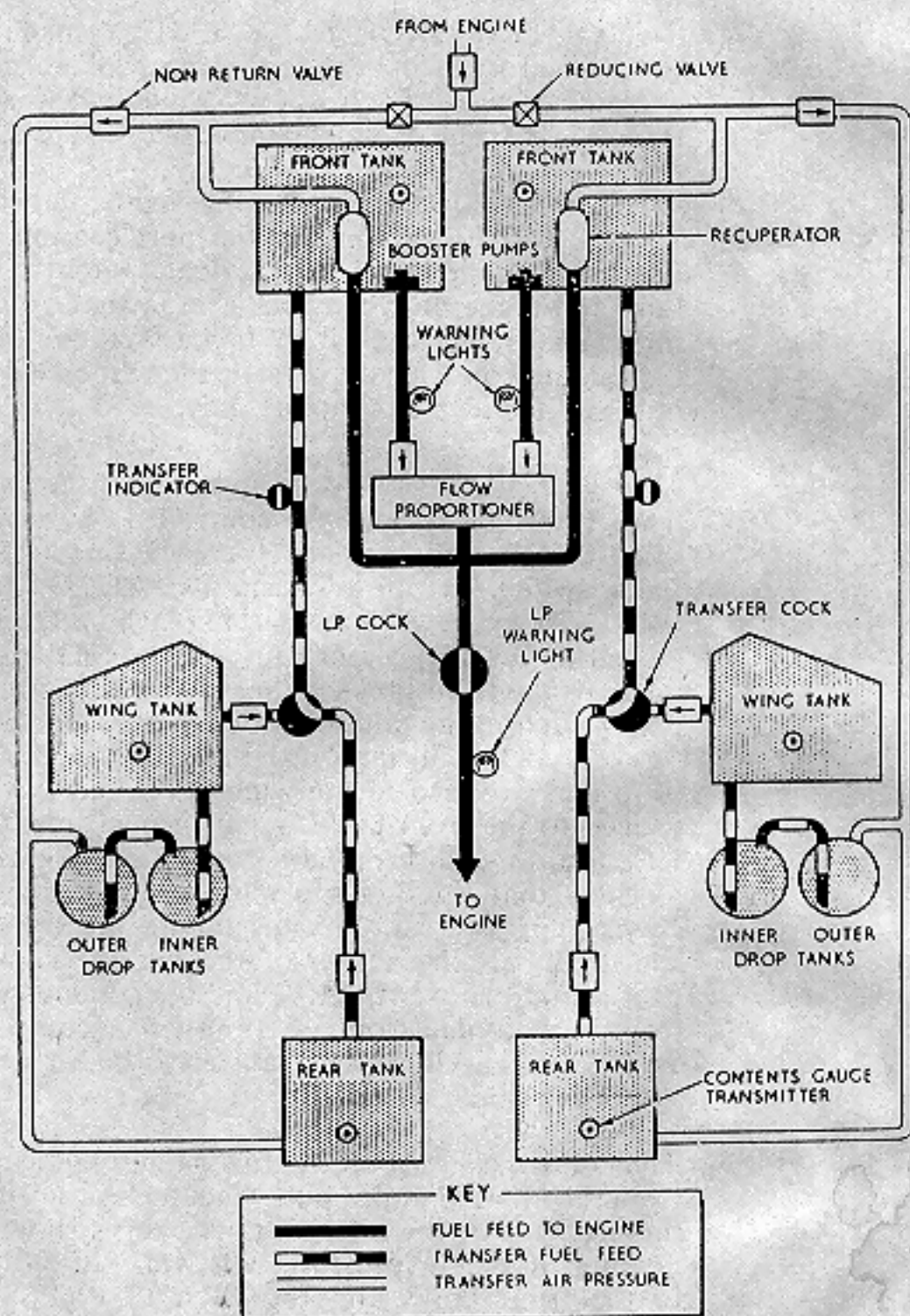


Fig. 1 Simplified fuel system

PART I

CHAP. I

rear compartment is empty. Since the mechanism is susceptible to fuel surge, the contents indication is not precise.

Fuel level indicators

22. Two OUTBOARD DROP TANK EMPTY magnetic indicators, one for each outboard drop tank, are below the contents gauges. Each shows white when all fuel has transferred from its associated tank.
23. Two amber low level warning lights, labelled FUEL LEVEL 650 LB, are under the port coaming. They are operated independently by a float switch in each front tank and come on when fuel level in the associated front tank falls to 700 ± 50 lb. When a fuel low level warning light comes on for any reason, the associated fuel gauge indicates front tank contents only.

Transfer system

24. The transfer system is controlled by two TANK SELECTOR switches, one for each side of the system. Each switch has three positions, AUTO, REAR and WING. When AUTO is selected (each switch is normally locked at AUTO) air pressure forces fuel from the rear tanks to the front tanks. When each rear tank is empty, a float switch in the tank operates to alter the setting of the transfer cock, shutting off the rear tank and allowing the drop tanks to feed to the wing tanks and the wing tanks to feed to the front tanks. At the same time, the WING/REAR tank indicator adjacent to each switch operates to show that this is happening. When changeover from either wing or rear tanks is taking place the indicator shows amber, the action of the selector cock motoring over is audible over the R/T and the contents gauges read front tank contents only. Setting either control switch to WING or REAR causes transfer to take place from the respective tank.
25. The contents shown on the fuel gauges fall as fuel is used from the internal tanks, but, when fuel is transferring from the drop tanks, the internal tank gauges show a constant reading. If the air pressure fails, very little fuel transfers to the front tanks and the TRANS PRESS indicators indicate failure by showing cross-line. At the same time

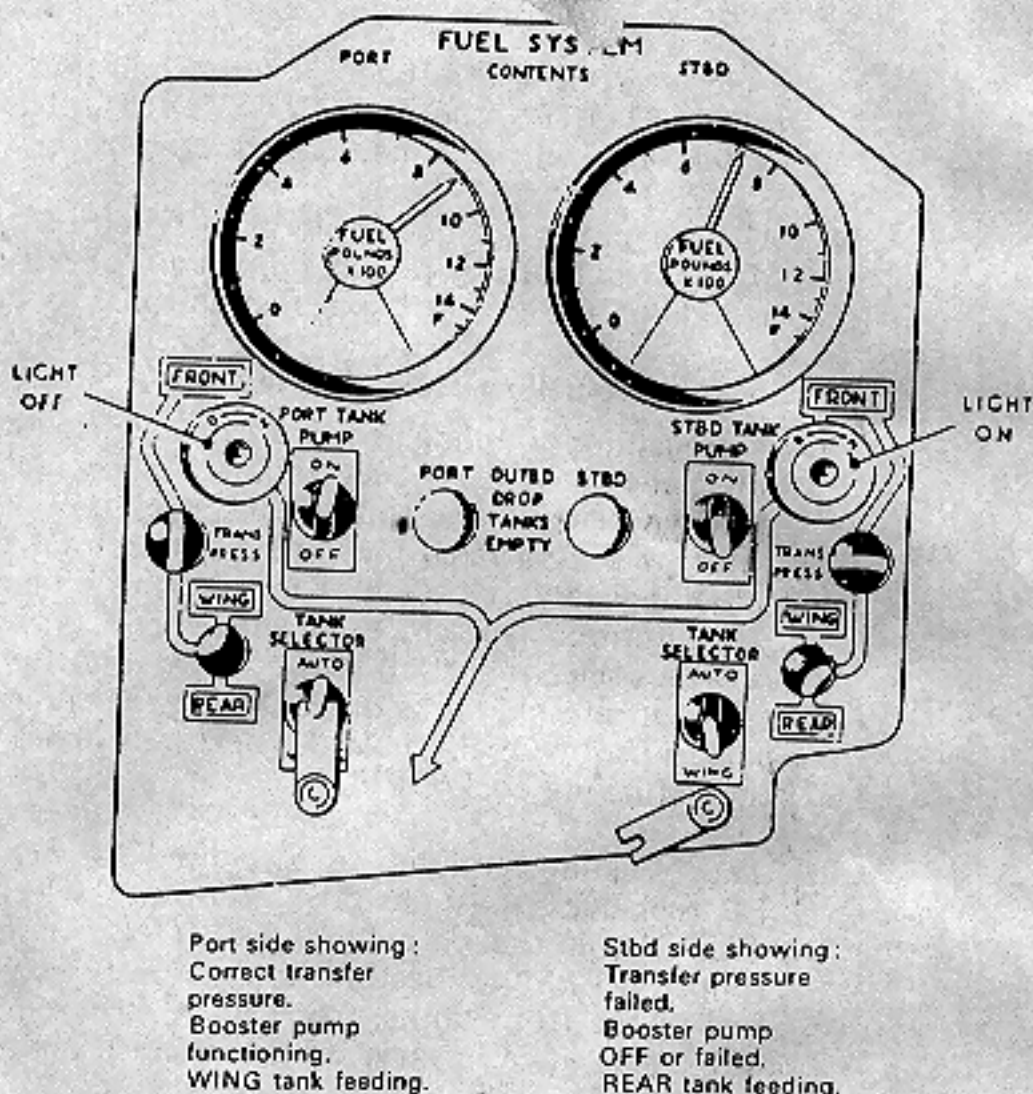


Fig. 2 'Flow plan' fuel panel

the contents gauge transmitters in the rear and wing tanks become inoperative and the gauges indicate the contents of the front tanks only *i.e. the amount of fuel available to the engine*. If only one side of the air pressure system fails, the appropriate indicator shows cross-line and the associated gauge indicates the available fuel contents on that side.

26. Each front tank has a vapour release valve which prevents the build up of vapour pressure at the top of the tank.

Drop tank jettison

27. The drop tanks can be jettisoned by pressing the appropriate JETTISON pushbutton, on the armament panel,

PART I

CHAP. 1

under the port glare shield. The pushbuttons are marked **INBD STORES** and **OUTBD STORES**. The **FUZING** switch, also on the armament panel, must be **OFF**.

28. All four tanks can be simultaneously jettisoned, with the fuzing switch off, by pressing down a **CLEAR A/C** switch bar above the two jettison pushbuttons.

Pressure refuelling and defuelling

29. A refuelling coupling, six indicator lights, one for each internal tank and an eight-minute time switch are in the port wheel bay. The time switch energises the refuelling valves and associated indicators. As each tank is filled its refuelling valve closes and the indicator light goes out. An additional switch, used when drop tanks are fitted, provides selection of all tanks, internal plus inboard drop tanks or internal tanks only. During refuelling the **LP fuel cock** must be **OFF**, the tank selector switches **AUTO** and the defuelling cock **OFF**.
30. The refuelling coupling is also used for defuelling. The **LP fuel cock** must be **OFF**, the tank selector switches **AUTO** and the defuelling cock **ON**. An external air supply (10 PSI connection, top centre fuselage), transfers fuel to the front tanks, from where it is removed by the bowser or, if necessary, by the aircraft's booster pumps.
31. The defuelling cock is accessible via the engine access door under the fuselage.

Management of the System

Pre-flight checks

32. The **HP** and **LP fuel cocks** must be on and the booster pumps should normally be on at all times when the engine is running. Switch the booster pumps on before starting, to avoid recuperator discharge. After starting, test the booster pump warning lights by switching both pumps off then on again.

Use in flight

33. The system is functioning correctly when the fuel contents gauges indicate equal fuel levels, the fuel **LP** warning light is out and the fuel panel indicators are as follows:

- (a) Booster pump warning lights out.
 - (b) Transfer indicators 'in-line' throughout the flight.
 - (c) Tank changeover indicators reading correctly (i.e. indicators should change from REAR to WING when fuel contents reduce to approximately 1300 lb per side, and remain at WING for the remainder of the flight).
 - (d) The two OUTBD DROP TANKS EMPTY magnetic indicators show white when the outboard drop tanks are empty.
 - (e) Fuel low level warning lights wink for a few seconds and then remain on when the gauges read 700 ± 50 lb per side.
34. When the aircraft is inverted the low level warning lights come on, irrespective of the fuel state. When normal flight is resumed the lights go out if the fuel state is above 700 ± 50 lb per side. When the rear tanks are empty, auto-selection to REAR occurs if the aircraft is inverted for approximately 5 seconds; on resuming normal flight a reselection to WING occurs automatically.
35. The proportioner maintains accurate fuel balancing with the booster pumps on or off, provided that the pressures at which the fuel enters the proportioner from the booster pumps do not differ by more than 2 PSI. If unequal emptying occurs with both booster pumps on, either the proportioner has failed or the pressure differential at the inlets is greater than 2 PSI. Fuel balance must be recovered and preserved by switching off the pump on the 'low' side until the levels become equal, and then switching the pump on again.

Unusable fuel

36. If a 'tank-empty' float in a rear tank becomes saturated, its switch operates before the tank has emptied. It is important to check that the changeover to wing tanks takes place at approximately 1300 lb per side. If the changeover occurs at a higher reading, set the tank selector switch from AUTO to REAR until the contents reduce to below 1300 lb, then set the switch to WING. A check that the associated low level warning light comes on at approximately 700 lb verifies that all fuel has been correctly transferred.

PART I

CHAP. 1

37. At low fuel states, i.e. below 200 lb per side, excessive attitudes or accelerations may cause fuel in the tanks to move away from the booster pumps, resulting in fuel starvation and possible flame-out.

Malfunctioning of the System

Booster pump failure

38. If a booster pump fails, fuel from that side of the system cannot be used unless the other (*serviceable*) pump is switched off. Failure is indicated by the pump's warning light coming on and the associated fuel gauge showing no further flow.
39. (a) Check the booster pump(s) circuit breaker(s) then, if failure is confirmed, reduce RPM to idling and descend quickly to:
25,000 ft – clean aircraft or empty drop tanks
20,000 ft – 2 or 4 drop tanks (*any capacity containing fuel*)
If maximum range is essential these altitudes may be increased by 10,000 ft, accepting the risk of possible damage to the HP fuel system.
- (b) Then, switch off both pumps and accept the fuel feed provided by tank pressurisation and gravity. RPM thereafter must not exceed 7200; throttle movements must be kept to a minimum.
40. (a) With both booster pumps off the fuel LP warning light will probably come on but can be ignored. The recuperators discharge and negative g manoeuvres must therefore be avoided.
- (b) If, because of a single pump failure, the two sides of the fuel system have become unbalanced, the flow proportioner maintains this condition. The side with the serviceable pump then has least fuel. With one side empty, the engine continues to run *only* if the booster pump on the side containing fuel is also running. It is important therefore to land whilst both sides contain fuel. If the fuel state permits, the serviceable pump can be switched on for landing but it must be remembered that fuel then flows *only* from that side which has least fuel.
41. With both booster pumps off and with less than 600 lb per

side there is a possibility of engine flame-out because the engine may draw air from bleed lines in the recuperator. To prevent this, RPM must be kept above 6000 until the threshold is crossed or until the serviceable pump is switched on.

42. The engine must subsequently be examined for damage to the HP fuel system.

Fuel proportioner malfunction

43. A malfunctioning proportioner can cause unbalanced fuel flow. A return to base should be made as soon as possible. An attempt may be made to correct any fuel imbalance by selective switching of the booster pumps.

Transfer pressure failure

44. If one or both transfer indicators show cross-line, transfer pressure failure has occurred and steep dives should be avoided due to the possibility of collapsing the tanks. Should an indicator show cross-line before fuel transfer is complete, any fuel remaining in the rear, drop and wing tanks is unusable and the associated contents gauge only indicates the usable fuel in the front tank (700 lb max per tank). In these circumstances, if the gauge registers more than the total contents of the front tank, a faulty gauge should be suspected and only the front tank fuel should be relied on as being available to the engine. If transfer pressure fails on one side, the booster pump on the side with the transfer failure should be switched off until both contents gauges indicate equal amounts; the pump should then be switched on again.

Vapour release valve fails closed

45. If a vapour release valve fails closed, the rate of fuel transfer from the drop/wing tank group on that side reduces. Indication is given by the fuel low level warning light coming on prematurely; the associated contents gauge therefore shows front tank contents only and thereafter the apparent fuel consumption from that side appears lower than the expected rate.
46. An attempt to clear the malfunction may be made by applying positive and negative g. Even if the fault then clears, indicated by the fuel low level warning light going
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PART I

CHAP. 1

out after a period, reliance should not be placed on extracting all the transfer fuel from the affected side as the fault may recur. A return to base or a diversion to the nearest suitable airfield should be made as soon as possible.

47. If the fault persists, leave both booster pump switches on. If the fuel contents gauge reading on the affected side reduces to 300 lb, switch off its booster pump. If the gauge reading then increases, use the booster pump switch to maintain the fuel at 300 lb. When the 'good' side fuel also reduces to 300 lb, keep both sides balanced by selective booster pump switching.

Transfer changeover failure

48. If changeover to the wing tanks does not function automatically, shown by the magnetic indicator still pointing to REAR at a fuel state less than approximately 1300 lb, set the tank selector switch from AUTO to WING. If the magnetic indicator still points to REAR a fault in the changeover system has occurred. The contents gauge will show front tank contents only (770 lb) *i.e. the fuel available to the engine*. This can be verified by noting at what fuel state the low level warning light comes on.

Fuel gauge errors

49. Fuel gauge accuracy is affected by temperature and flight conditions. Low temperatures at high altitude give gauge under-reading; high temperatures at high speeds at low altitude give gauge over-reading.
50. To assess the error, the reading of the appropriate contents gauge should be checked when a low level warning light comes on. The difference between the gauge reading and 700 ± 50 lb will be some indication of the gauge inaccuracy. During a descent from altitude, if the inaccuracy is a gauge under-reading, the gauge will progressively become more accurate and may eventually tend to over-read.