Part I

Chapter 3A—Two-point Tanker Installation Mk. (K) 1A Aircraft

List of Contents

Description, controls and indicators

1 Description

(*a*) The two-point tanker installation on the Victor 1A is comprised of two Mk. 20B flight refuelling pods, one carried under each wing. Each pod is controlled from a separate control panel CI on the rear crew compartment starboard wall.

(*b*) The pods, which each have a fuel capacity of approximately 1,000 lb., are supplied with fuel transferred from the bomb bay tanks and from the wing tank groups. The port wing group and forward bomb bay tank normally supply the port pod and the starboard wing group and aft bomb bay tank supply the starboard pod.

(*c*) The flight refuelling pods are automatic in operation once certain settings and switch selections have been made by the panel operator. The control panels contain indicators and lamps to give visual evidence of the progress of the operation and warning of abnormal conditions necessitating special action. Such action may happen automatically or require further switch selections by the operator.

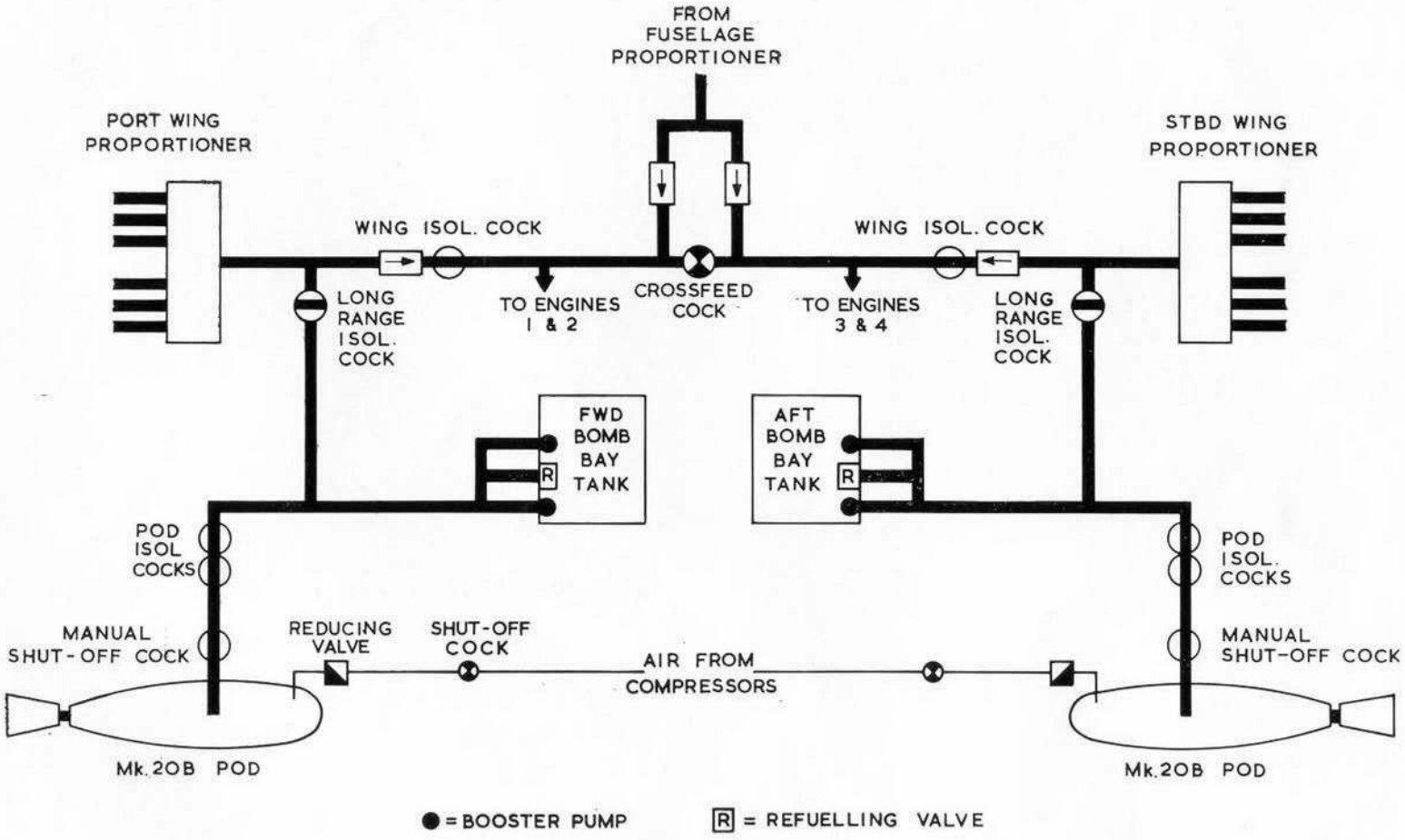

Fig. 1 Fuel system

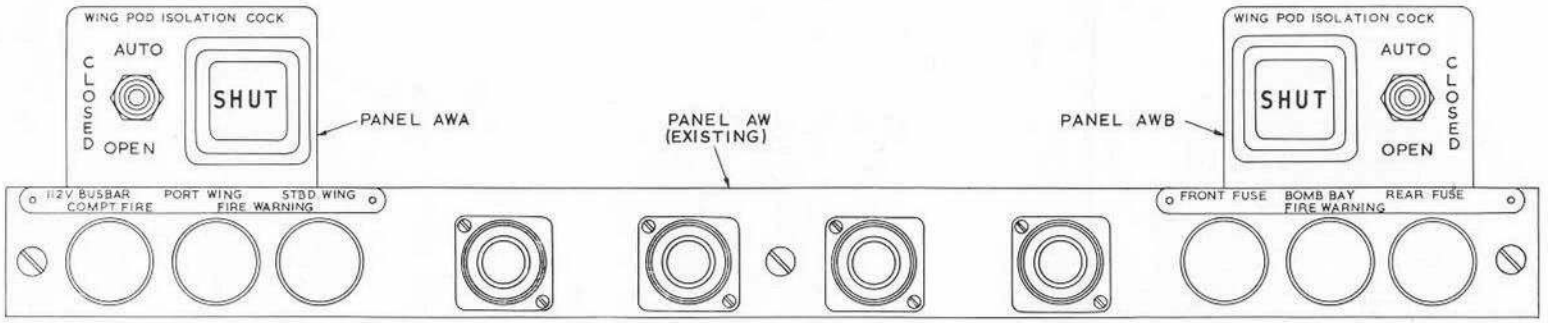

Fig. 2 Pilots' controls

2 Pilot's switch panels

(*a*) Above panel AW are two switch panels AWA and AWB. Each contains a WING POD ISOLATION COCK, AUTO-CLOSED-OPEN switch and and OPEN-striped-SHUT magnetic indicator. Panel AWA controls the fuel transfer to the port pod and AWB to the starboard pod.

(*b*) The CLOSED-OPEN settings of the switch are self-explanatory ; the AUTO setting controls, via float switches, the fuel level in the pod to maintain the pod between mid-level and full by automatically opening and closing the pod isolation cocks. There are two cocks, No. 1 and No. 2, for each pod.

(*c*) *Test switches*

On the forward face of Panel AJ are two lights, PORT No. 1 and STBD. No. 1, PRESS TO TEST No. 2. These are for checking the position of the pod isolation cocks. When the No. 1 cock of each pod is closed the light comes on. Pressing each light individually causes the light to go out and then come on again provided that the associated No. 2 cock is closed. Failure of a light to come on when the pod isolation cock switch is set to CLOSED means that the appropriate cock has not fully closed.

3 Tanker operator control panels

(*a*) On each pod control panel are the following controls :

(*b*) *Switches*

(i) *Master switch*

The MASTER (ON-OFF) SWITCH controls all electrical circuits to the pod except those controlled by the turbine overspeed switch.

(ii) *Fuel jettison switch*

The FUEL JETTISON ON-OFF controls the jettison valve in the pod. A guard on the switch must be rotated through 90° before the switch can be operated.

(iii) *Wind/trail switch*

The WIND-TRAIL switch controls the winding or trailing of the hose.

(iv) *Emergency trail switch*

The EMERGENCY TRAIL/OFF/HOSE RELEASE switch permits the hose to be extended to the full trail position from which it can be jettisoned by selecting HOSE RELEASE.

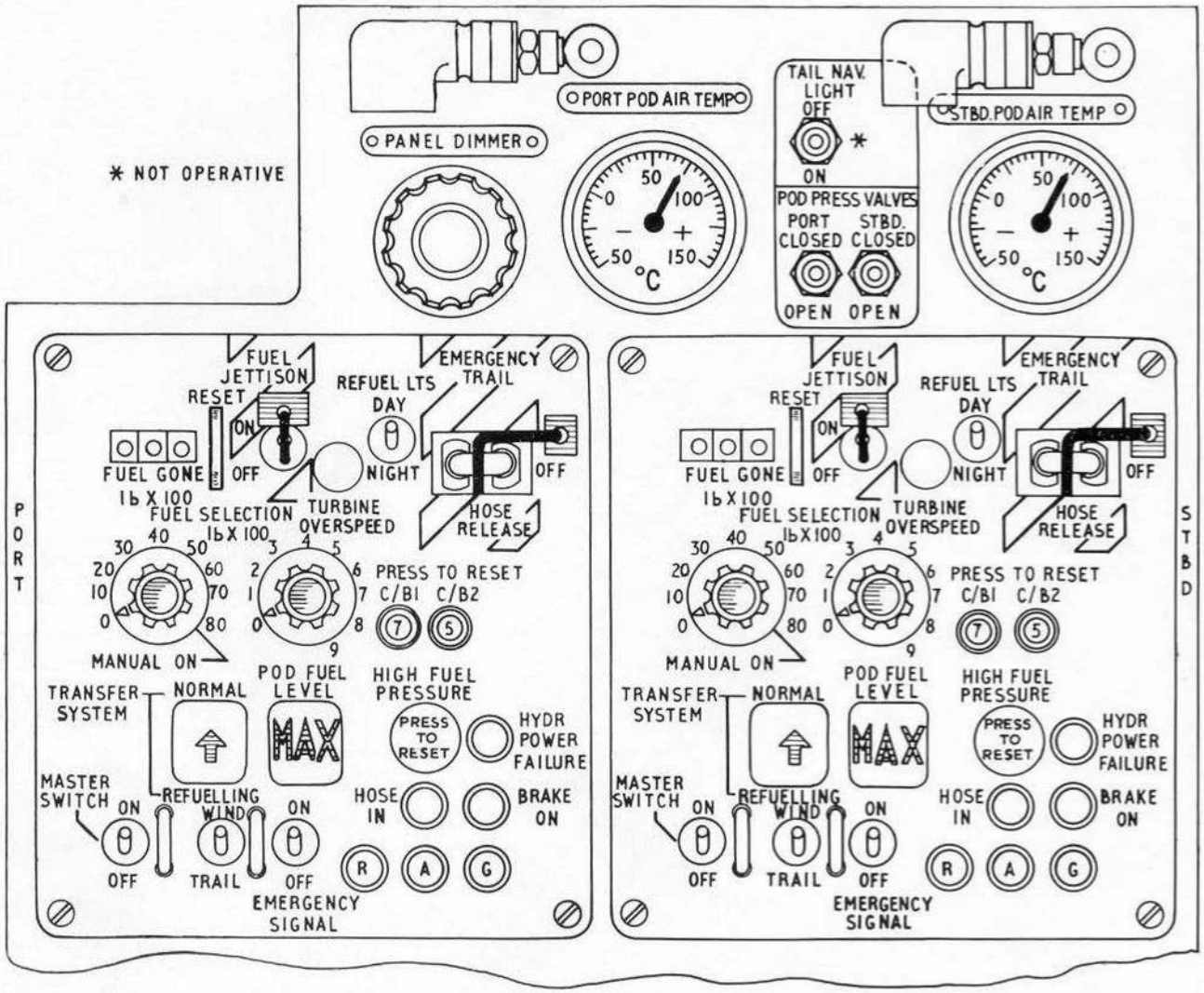

Fig. 3 Tanker operator's controls

(v) *Refuelling lights switch*

The REFUEL LTS, DAY-NIGHT switch controls the choice of brightness of the signal lights in the pod.

(vi) *Emergency signal switch*

The EMERGENCY SIGNAL ON-OFF switch causes the red signal lights to come on irrespective of any other lights which may be illuminated.

(*c*) *Fuel selection controls*

(i) *Fuel selector switches*

Two fuel selector rotary switches, one reading in tens of hundreds and the other reading in hundreds are preset to the amount of fuel required to be transferred. Passage of fuel causes the switches to rotate anti-clockwise giving an indication of the amount still to be transferred. At the end of transfer the fuel selector valve automatically closes. However the left-hand switch has a MANUAL ON position and with the switch thus set an unrestricted amount of fuel may be transferred without preset limitation.

(ii) *Fuel totaliser*

A veeder counter is mounted above the selector switches giving a reading of FUEL GONE in hundreds of pounds.

(*d*) *Magnetic indicators*

(i) *Refuelling indicator*

An arrow indication points either to NORMAL or REFUELLING. The REFUELLING indication is given whenever the pod isolation cocks are open. The NORMAL indication is given when the cocks are closed. The indicator shows black when the aircraft power supplies are off and is independent of the master switch.

(ii) *Fuel level indicator*

The POD FUEL LEVEL indicator shows MIN or MAX according to the amount of fuel in the pod. The indicator shows black at intermediate conditions.

(*e*) *Warning lights*

(i) Warning lights are fitted to provide indication of HIGH FUEL PRESSURE (amber) HYDR POWER FAILURE (red), HOSE IN (white), BRAKE ON (blue) and TURBINE OVER-SPEED (red). Additionally the HOSE IN light pulsates while the hose is being trailed or wound in.

(ii) Three signal lights operate automatically once a refuelling operation has commenced. The red light comes on when the hose is being trailed or wound in, but not at full trail. The amber light comes on when the hose is at full trail (or full trail less 6 feet). The green lights comes on when the receiver aircraft has engaged the drogue, the hose has wound in by six feet and the necessary components have functioned to permit passage of fuel.

(*f*) *Circuit breakers*

Two PRESS TO RESET circuit breakers protect the normal (CB1) and emergency (CB2) circuits in the pod.

4 Pod air pressure valves

The PORT and STBD. POD PRESS VALVES, OPEN-CLOSE switches control the supply of air from the engine compressors to pressurise the refuelling pods. Additionally an AIR TEMP. gauge is provided for each pod ; the air temperature must not exceed 100°C in use.

Management of refuelling pods

5 Preparing for contact and trailing hose

(*a*) Pilot set pod isolation cocks at AUTO. If non-feathering turbine blades are fitted to the pod, speed must first be reduced to 200 knots and then increased to the appropriate refuelling speed. This is to overcome the hysteresis of this type of turbine.

(*b*) When the tanker operator has initiated the refuelling operation the hose will take approximately 20 seconds to trail ; during this time faint jerking of the aircraft may be experienced and some shift in directional and lateral trim occurs. The HOSE IN light flashes during hose unwinding. As the hose reaches the fully trailed position the amber light comes on. The emergency signal light should be left ON until the tanker is ready for contact. Accurate trimming and smooth flying of the tanker is now essential to ensure the minimum delay in establishing a successful contact.

6 During contact and transferring fuel

(*a*) The contact is normally felt in the aircraft and some directional and lateral trim changes occur which should be corrected as gently as possible. Shortly afterwards, when the hose has wound in by about 5 feet, the amber light goes out, the green refuel light comes on and fuel starts to flow.

(*b*) *Co-pilot*

When contact is made record total fuel in aircraft.

(*c*) *Operator*

During fuel transfer monitor the high pressure fuel light. This may " flicker " in the initial stages of transfer the fault is probably caused by the receiver aircraft but in the later stages the fault is usually within the pod. If the light remains on, press and hold for two seconds to cancel signal. Three attempts should be made, pressing for two seconds each time. If the light cannot be cancelled then the flight refuelling must be abandoned. During the fuel transfer check that it is registered on the Fuel Gone counter, and that the Fuel Selector Switches are " ticking off " the required amount. Any hose movement during the transfer may be accompanied by a " flash " of the HOSE IN light.

(*d*) During multi-contact sorties, reset the fuel selector switches between engagement. The Fuel Gone counter totalises all fuel transferred. The theoretical maximum amount of transferable fuel is 50,000 lb.

(*e*) The pods should be topped up at the completion of each refuelling ; if the pod pressurisation is not switched off, the rate of flow to the pod is reduced by about 60%.

Management of the aircraft fuel system

7 Normal control in flight

(*a*) Take-off and climb with all proportioners selected to NORMAL and all wing and fuselage booster pumps ON.

(*b*) After take-off switch off the wing groups booster pumps.

(*c*) When the fuselage group contents reduce to 13,000 lb. select wing group booster pumps ON, fuselage proportioner to BY PASS, and fuselage group booster pumps OFF, except during transfers.

(*d*) When all transfers have been completed continue as per para. 10.

8 Control when transferring to a receiver

(*a*) When ready to transfer to a receiver select all proportioners to NORMAL and switch all wing and fuselage booster pumps ON.

(*b*) Open the long range tanks isolation cocks, open the pod isolation cocks, check that the wing isolation cocks are open and when the receiver is in contact switch on all bomb bay tank pumps.

(*c*) If only one pod is in use the long range tank isolation cock on the other side should be kept closed.

9 Internal transfer of fuel

(*a*) When transferring fuel from wing groups to bomb bay tanks, fly on the fuselage group with its proportioner in BYPASS and control out-of-balance by selective switching of tanks 8 and 9 booster pumps.

(*b*) Set the appropriate wing group proportioner to NORMAL, pumps ON, long range tank isolation cocks OPEN, wing and pod isolation cocks CLOSED and open the bomb bay tank refuelling valves.

(*c*) At the end of transfer revert to the appropriate method of fuel system control.

(*d*) See also para. 11(a).

10 Control after completion of all receiver transfers

(*a*) When all receiver transfers have been completed, any fuel remaining in the pods and wings should be transferred to the bomb bay tanks when possible, pod fuel being transferred first. Whenever possible the contents of each bomb bay tank should be similar.

(*b*) To transfer fuel from a pod to its associated bomb bay tank, close the appropriate long range tank isolation cock, open the pod isolation cocks, switch on the pressure air and open the bomb bay tank refuelling valve. As soon as all fuel is transferred, close the pod isolation cocks and open the long range tank isolation cock.

(*c*) To transfer fuel from a wing group to its associated bomb bay tank, ensure the pod isolation cocks closed, close the wing isolation cock, switch on the wing group pumps and open the bomb bay tank refuelling valve. Set the wing proportioner to BYPASS when a low fuel state is reached.

(*d*) When all fuel is transferred switch on all bomb bay tank and fuselage booster pumps ; set the fuselage group proportioner to BYPASS. The bomb bay tanks should overfeed the fuselage system until empty. To assist this, switch off the fuselage tanks pressurisation until the bomb bay tanks are empty.

(*e*) When the total fuel in the bomb bay and fuselage tanks is below 8,000 lb. an overshoot should not be attempted unless the fuselage contents are above 5,000 lb. or each bomb bay tank contains a minimum of 2,500 lb.

11 Use of the wing refuelling cock

(*a*) If a wing isolation cock fails to open it may be bypassed by opening the wing refuelling cock.

(*b*) To transfer fuel to the port pod from the aft bomb bay tank or to the starboard pod from the forward bomb bay tank open the appropriate pod isolation cock and bomb bay tank refuelling valve, set both long range tank isolation cocks open and open the wing refuelling cock. Revert to normal control on completion of transfer.

12 Aircraft handling

(*a*) *Taxying*

A careful watch must be kept for obstructions because the wing refuelling pods are 85 ft. apart and have a small ground clearance.

(*b*) *Take-off and landing*

(i) Care must be taken to keep the wings level during take-off and landing particularly in gusty cross-wind conditions because, with the mainwheels on the ground, application of approximately 8° of bank causes the appropriate wing refuelling pod to touch the ground.

(ii) After take-off at maximum AUW, when raising the flap below the limiting speed, slight pre-stall buffet may occur until speed is increased.

(*c*) *In flight*

(i) At all times, the pilot is to be kept informed of the progress of refuelling by the operator.

(ii) As a hose is trailed, small directional and lateral trim changes occur and, before a contact is made, the tanker should be accurately trimmed at the flight refuelling speed.

(iii) When ready for contact, the tanker must be flown as steadily as possible to create a stable platform for the benefit of the receiver. Abrupt control movements and coarse use of the throttle should be avoided. Particular care is required when handling the elevators since short period pitching oscillations can be induced causing the hose to oscillate.

(iv) When the receiver closes in, the tanker tends to roll away from the pod being used ; after contact speed tends to increase unless power is reduced by 1 to 2% RPM.

(v) Power has to be reduced and the aircraft re-trimmed as fuel is transferred to the receiver to maintain the refuelling speed and level flight.

Malfunctioning of the refuelling pods

13 Failure of pod isolation cocks to open

If this occurs the only fuel available for transfer will be that already in the pod. Diagnosis of this condition can only be made by reference to the pod isolation cocks indicator or fuel contents guages. Additionally the REFUELLING indication will not be given.

14 Hydraulic failure (Hose stowed)

The hose must not be trailed if the HYDRAULIC POWER FAILURE warning light is on.

15 Hydraulic failure (Hose trailed)

(*a*) If failure occurs during contact, fuel stops flowing. The green light goes out, the emergency red, hydraulic failure and amber lights come on. (The Blue brake light comes on if the hose is not at full trail.)

(*b*) Attempt to wind in the hose normally. If the hose fails to wind in, select the master switch to OFF : depending upon the actual failure that has occurred the hose may wind in. A reduction of airspeed may be of assistance.

(*c*) If the hose cannot be wound in, reselect the master switch to ON and jettison the hose when safe to do so.

16 Drogue breaks off

(*a*) If his occurs the hose is quickly wound in (approx. 3 secs.).

(*b*) Provided the reception coupling is retained the hose stows normally, the BRAKE ON light appearing on completion. Select all switches OFF.

(*c*) If the complete drogue assembly breaks off, or the hose parts, the hose will probably wind in before any action can be taken. Immediately the failure is apparent select the Master Switch to OFF.

(*d*) Partial breakdown of the drogue may cause hose instability. Reduce speed prior to rewind in an attempt to stabilise ; when stabilisation occurs rewind the hose. If it remains unstable the hose must be jettisoned.

17 Receiver probe lodged in coupling

(*a*) Close the pod isolation cocks. Select fuel counters to " Zero " to minimise loss of fuel from the pod.

(b) Check with Receiver aircraft whether :

(i) Nozzle.

(ii) Nozzle and fuel tube is lodged in coupling, causing hose gyrations.

(*c*) In case (i) wind in hose normally. In case (ii) the hose must be jettisoned.

18 Hose fails to wind in

If the hose fails to wind in, increase airspeed to maximum then progressively reduce airspeed with WIND selected. Rewind should commence at 240 knots. The application of sideslip may be of assistance.

19 Hose jettison (over clear area)

If the HYDRAULIC POWER FAILURE and BRAKE lights come on when the hose is trailed or being trailed, it cannot then be wound in and must be jettisoned if possible before landing. Reduce speed to 230 knots. Set the fuel selection switches to zero. Set the WIND/TRAIL switch to TRAIL and the emergency switch to EMERGENCY TRAIL. The BRAKE light cycles until the hose is full extended (amber light on) when it remains off. The hose may now be jettisoned by selecting HOSE RELEASE. After jettisoning select all panel switches to off.

20 Pod fuel jettison (Hose stowed)

(*a*) Close the pod isolation cocks, set the Master Switch on and operate the jettison switch. When the pod tank fuel indicator shows MIN. switch off the jettison and Master Switches.

(*b*) If it is required to jettison aircraft fuel, this can be done, with hose stowed, by repeating the cycle of (*a*) with the pod isolation cocks open.

21 Failure of fuel to flow following a normal contact

If, following an apparently normal contact and appearance of the green light, no fuel is transferred to the receiver—proceed as follows:

(*a*) Receiving aircraft checks all relevant switches.

(*b*) Tanker checks all relevant switches.

(*c*) The fault may have been a " soft " contact, therefore receiver withdraws and makes a further contact.

(*d*) If fuel still fails to transfer, a fault in the pod is probable and no remedial action is possible.

22 Failure of a high level float switch

If the high level float switch fails, fuel streams from a vent about fifteen feet inboard of the pod at a rate of approximately 40 gallons/minute. The pattern of flow passes above the receiver and should cause no hazard if the receiver does not fly too high above his normal station.