

**PART 1**  
**CHAPTER 6—OTHER AIRCRAFT CONTROLS**

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**UNDERCARRIAGE, FLAPS AND AIRBRAKES  
CONTROLS AND INDICATORS**

1. Details concerning the controls and indicators in the F Mk 3 and F Mk 6 for the undercarriage, flaps

and airbrakes systems are listed in Table 1, Fig 1 and Fig 2 illustrate, for the single-seat and two-seat aircraft respectively, the controls and indicators for all systems discussed in this Chapter.

RESTRICTED

Table 1 — Controls and Indicators — F Mk 3 and F Mk 6

Item No	Item	Markings	Remarks
1	Undercarriage lever	UP/DOWN	—
2	Undercarriage position indicator	—	—
3	Undercarriage emergency lowering control	U/C	Yellow and black striped
4	Flap control lever	FLAPS — UP/DOWN	—
5	Flap position indicator	FLAPS — UP/DOWN	—
6	Airbrakes control switch	IN/off/OUT	—
7	Airbrake position indicator	AIRBRAKE — IN/OUT	—

Table 2 — Controls and Indicators — T Mk 5

Item No	Item	Markings	Remarks
1	Undercarriage lever	UP/DOWN	—
2	Undercarriage position indicators (2)	—	—
3	Undercarriage emergency lowering control	U/C	Yellow and black striped
4	Flap control levers (2)	a. Pupil: FLAPS — UP/DOWN b. Instructor: FLAPS — UP/ centre/DOWN	—
5	Flap position indicators (2)	FLAPS — UP/DOWN	—
6	Airbrakes control switches (2)	AIRBRAKES — IN/off/OUT	—
7	Airbrakes position indicator	AIRBRAKES — IN/OUT	One indicator

**DESCRIPTION OF THE SYSTEMS**

**General**

2. All three systems are electrically actuated by 28V DC and hydraulically operated by the Services hydraulic system except for the undercarriage *emergency* lowering system, which is mechanically actuated and hydraulically operated by the No 1 Controls system. After a complete DC failure or a Services system failure, the flaps and airbrakes cannot be operated and they remain in the position at which the failure occurred.

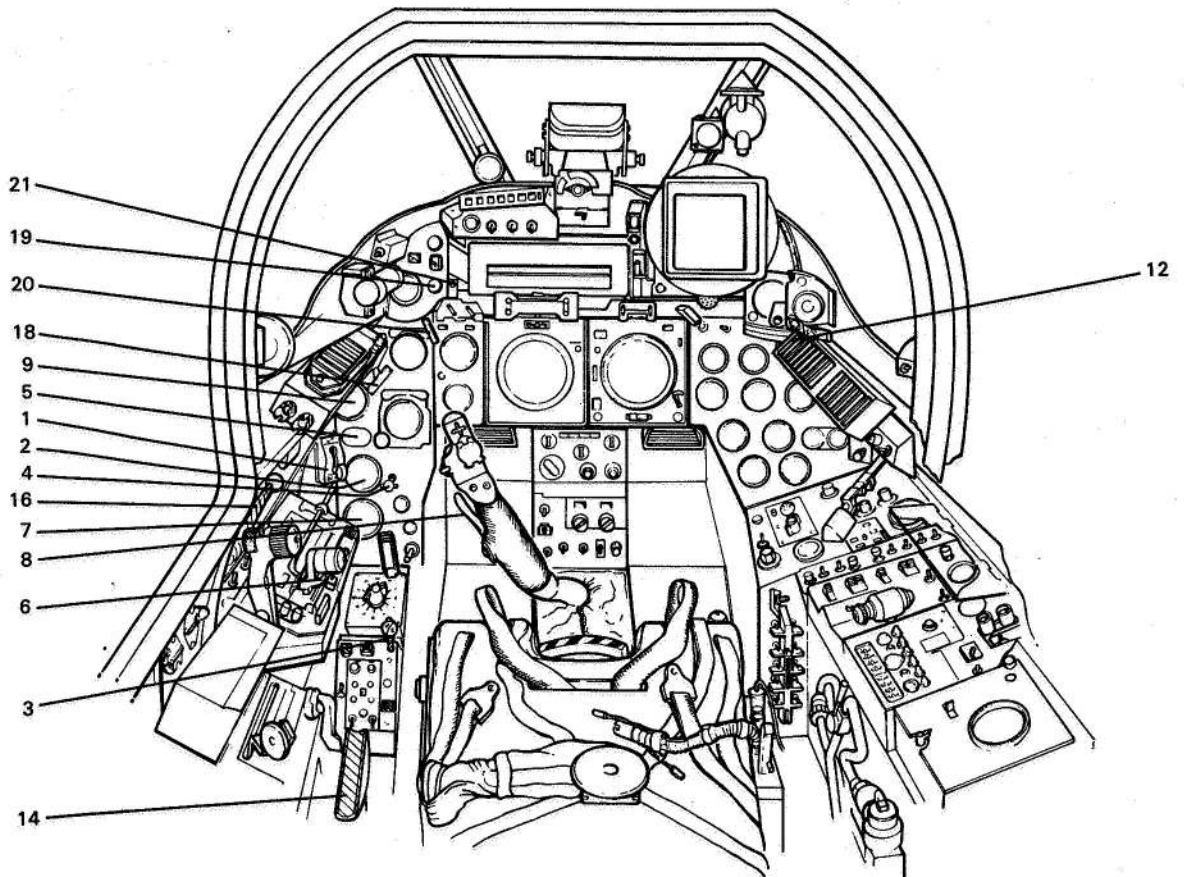
**Undercarriage**

3. The undercarriage consists of two main wheels retracting rearward and outward into the wings, and a nosewheel retracting forward into a well in the fuselage nose.

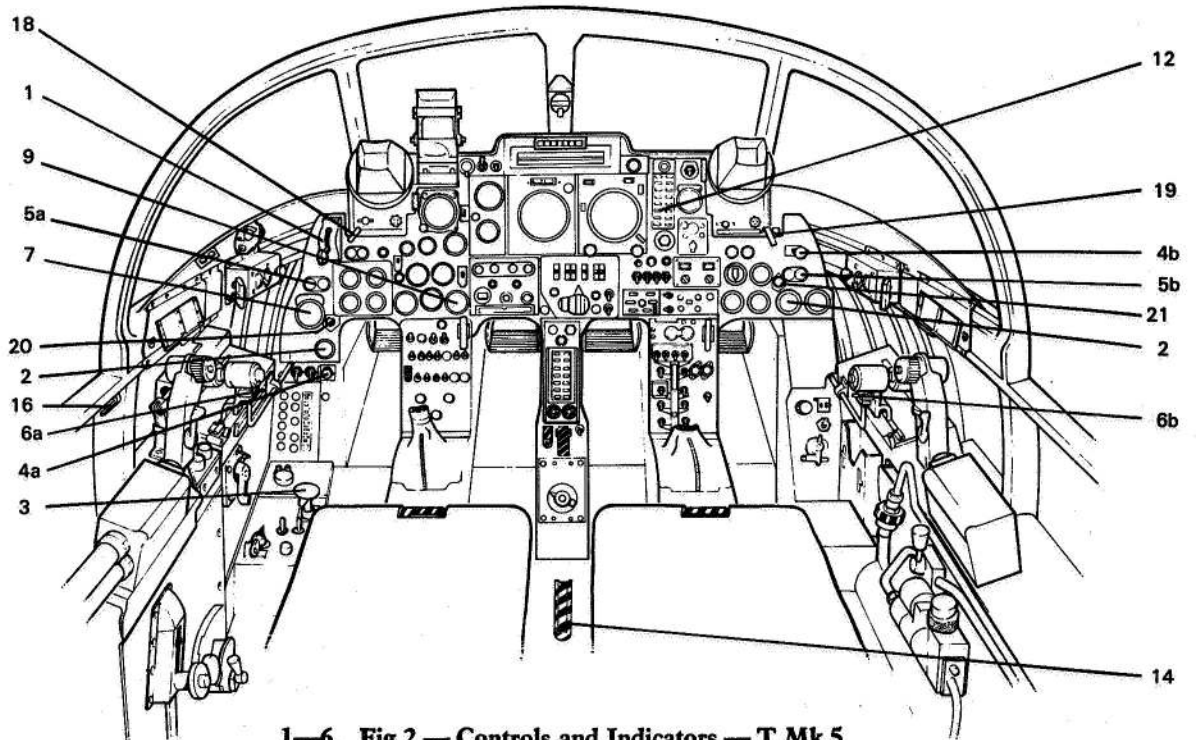
4. *Undercarriage Lever.* A 2-position lever controls the operation of the undercarriage. It carries a spring-

loaded cup, in effect a locking collar, which enters a gate in both the UP and DOWN positions to prevent inadvertent operation. Moving the lever to the UP or DOWN position energises either an up or down solenoid, both of which are integral with the undercarriage selector. The solenoids operate valves to direct fluid to the appropriate ends of the jacks and open the opposite lines to return. A pitot switch electrically prevents an UP selection being made below 165 knots.

5. *Emergency UP Selection.* In an emergency the pitot switch is overridden by turning the undercarriage lever clockwise through 45° and selecting UP. Normally this facility is only to be used on the ground. An emergency retraction is not to be used as a means of stopping the aircraft in a high-speed ground emergency because there is a strong likelihood of asymmetric retraction of the main wheels with the consequent danger of the aircraft cartwheeling. It is recommended that emergency retraction is restricted to normal taxiing speeds.



1-6 Fig 1 — Controls and Indicators — F Mk 3 and F Mk 6



1-6 Fig 2 — Controls and Indicators — T Mk 5

6. *Undercarriage Position Indicator.* The undercarriage indicator (two indicators, T Mk 5) has three red and three green lights corresponding to the three undercarriage legs. When the undercarriage legs are all down and locked the three green lights are lit, and when locked up, all lights are out. The red lights come on to indicate that the corresponding legs are neither locked up nor down. The indicator has an alternative bulb selector and can be dimmed for night operation.

7. *Emergency Lowering.* The emergency lowering system is mechanical/hydraulic, taking hydraulic power from the No 1 Controls system. The button on top of the emergency lowering control T-handle is pressed down to release the T-handle. To ensure operation, the T-handle must then be pulled to its full extent; just prior to full travel it falls away on its cable as it clears its guide. Once the emergency system has been used it is not possible to raise the undercarriage until the system has been serviced on the ground. When the T-handle is operated, No 1 Controls system pressure is directed to:

- a. Close a valve in a protection unit to isolate Services pressure from the normal selector.
- b. Open a valve in the protection unit to connect all the up lines to return, irrespective of the position of the undercarriage lever.
- c. Operate shuttle valves and relay valves to direct the No 1 Controls system pressure to lower the undercarriage.

8. *Nosewheel.* The nosewheel is free to caster through a maximum of 340°. The Services system provides hydraulic pressure for shimmy damping and for automatic wheel centring during retraction.

### Flaps

9. The flaps, which are utilised as fuel tanks, are hydraulically operated by the Services hydraulic system and electrically actuated by the 2-position FLAPS switch in the F Mk 3 and F Mk 6. In the T Mk 5 the pupil has a similar switch but the instructor's switch is 3-position, UP/centre/DOWN. In the centre position the pupil's switch controls the flaps; if the instructor's switch is moved to UP or DOWN it overrides the selection on the pupil's switch.

10. The maximum speed for flap operation or flight with the flaps lowered is 250 knots. Pitot pressure is applied to a pressure-sensitive switch in the flaps electrical circuit. The switch automatically selects the flaps up as the speed is increased above 250 knots with DOWN selected. When automatic flap retraction occurs, the FLAPS switch is to be set to UP.

11. Asymmetric operation of the flaps in hydraulic failure conditions is prevented by hydraulic locking. If hydraulic failure occurs during lowering, the flaps are held at the position reached when the failure occurs; if the flaps are fully extended, they are held in that position. However, transient asymmetry can occur with certain flap system defects. The flap jacks incorporate a mechanical lock in the up position which automatically disengages when DOWN is selected.

12. *Flap Position Indicator.* The flap position indicator (two indicators, T Mk 5) has two pointers indicating the position of its respective flap.

### Airbrakes

13. The airbrakes are hydraulically operated by the Services system and electrically selected by a 3-position switch on the No 2 throttle lever in the F Mk 3 and F Mk 6. In the T Mk 5, the pupil's airbrake switch is similar in operation and position; the instructor's switch is on his No 1 throttle and selections on this switch override the pupil's switch positions.

14. Synchronous operation of the two airbrakes, which are forward-opening doors fitted one each side of the fuselage just forward of the fin, is achieved by a valve in the hydraulic lines to the airbrake actuators which throttles the supply of fluid to either door should it tend to lead the other during operation. The airbrakes can only be selected fully out or fully in. When closed, the airbrakes are locked mechanically.

15. *Mach Switch.* The limiting speeds for airbrake operation and for flight with the airbrakes extended are 1.3M/650 knots in the F Mk 3 and F Mk 6, and 1.2/650 knots in the T Mk 5. A Mach switch, set to operate before 1.3M in the single-seat aircraft or at approximately 1.2M in the T Mk 5, automatically closes the airbrakes if the limiting speed is exceeded or prevents operation if airbrakes are selected OUT above the Mach switch speed. If the airbrakes have been retracted by the operation of the Mach switch and speed is reduced below the Mach switch setting, the airbrakes remain closed until the next OUT selection is made.

16. Airbrake position is shown on the combined trim and airbrake indicator.

## MANAGEMENT OF THE SYSTEMS

### Undercarriage Operation

17. The speed switch prevents undercarriage retraction below a speed of 165 knots. The maximum speed for undercarriage lowering is 250 knots, and with undercarriage down, 280 knots.

18. When selecting down, ensure that:
- Three red lights appear on the position indicator.
  - The locking collar is engaged in the gate.
  - Three green lights come on and the red lights go out.

19. *Emergency Lowering.* It is possible to lower the undercarriage on the emergency system with the normal undercarriage selector lever in the UP position, but DOWN should be selected to render the armament circuits safe. Emergency lowering may be achieved with only windmilling RPM on the No 1 engine: the rate of lowering is slow (approximately 70 seconds) and it is recommended that emergency selection is made in good time and that flying control demands are kept to a minimum; aerodynamic assistance may be necessary if the controls are used.

### MALFUNCTION OF THE SYSTEMS

20. The drills for malfunction of the systems are given in FRC, and failure to obtain three green undercarriage lights is discussed in Part 4, Chapter 2.

### WHEELBRAKES AND CANOPY CONTROLS AND INDICATORS

21. Details concerning the controls and indicators in the wheelbrakes and canopy systems for the F Mk 3 and F Mk 6 are listed in Table 3 and for the T Mk 5 in Table 4. The items are illustrated in Fig 1 and Fig 2 respectively.

### DESCRIPTION OF THE SYSTEMS

#### General

22. The wheelbrakes and canopy operate from the Services hydraulic system. Although the brake actuation is mechanical, both the brake pressure gauge and the canopy system are operated by 28V DC current, the brake gauge being connected to the main DC busbar and the canopy and canopy audio warning to the battery busbar.

#### Wheelbrakes

23. The main wheels have disc brakes fitted with maxaret anti-skid units which are controlled by the brake lever(s). The nosewheel has no braking system. The maxaret units cannot be switched off.

Table 3 — Controls and Indicators — F Mk 3 and F Mk 6

Item No	Item	Markings	Remarks
8	Brake operating lever	—	On control column. Embodies a parking catch
9	Brake pressure gauge (post-mod 4212, F Mk 6)	BRAKES PSI × 1000 — P/S	Triple pressure gauge
10	Canopy operating control	CANOPY — OPEN/CLOSED	Not illustrated: left of seat pan. Lever and 3-position toggle switch
11	External canopy control	CANOPY EXTERNAL RELEASE HANDLE — CLOSE/off/OPEN	Not illustrated: under panel left of fuselage spine
12	Canopy unlocked warning	CANOPY caption (AWP)	—
13	Mechanical indicators	CANOPY — FREE/LOCKED	Not illustrated: left and right lower canopy frame
14	Canopy jettison handle	CANOPY JETTISON	Yellow and black striped handle
15	External canopy jettison handle	EMERGENCY CANOPY JETTISON	Not illustrated: left fuselage below cockpit — yellow and black striped
16	Canopy jack release control	EMERGENCY CANOPY JACK RELEASE	—
17	External canopy jack release control	CANOPY EXTERNAL RELEASE	Not illustrated: adjacent to normal external canopy control

Table 4 — Controls and Indicators — T Mk 5

Item No	Item	Markings	Remarks
8	Brake operating levers (2)	—	On control columns. Pupil's lever has parking catch
9	Brake pressure gauge	PSI × 1000	—
10	Canopy operating control	CANOPY — OPEN/CLOSED	Not illustrated: left of pupil's seat pan. Lever and 3-position toggle switch
11	External canopy control	CANOPY LOCKS PULL — CLOSE/off/OPEN	Not illustrated: under panel left of fuselage spine
12	Canopy unlocked warning	CAN caption (AWP)	—
13	Mechanical indicators	CANOPY — LOCKED/UNLOCKED	Not illustrated: lower canopy frame
14	Canopy jettison handle	CANOPY JETTISON	Yellow and black striped
15	External canopy jettison handle	EMERGENCY CANOPY JETTISON	Not illustrated: left fuselage below cockpit — yellow and black striped
16	Canopy jack release control	EMERGENCY CANOPY JACK RELEASE	—
17	External canopy jack release control	CANOPY EXTERNAL RELEASE	Not illustrated: adjacent to external canopy control

24. The brake lever(s) is connected to a differential control valve which is mechanically linked to the rudder bar to give differential braking. Full differential is achieved when half rudder travel is applied, ie with half left rudder or more, operating the brake lever applies braking pressure to the left main wheel, according to the amount of brake lever movement, and no braking pressure to the right main wheel.

25. In F Mk 3 and T Mk 5 aircraft, and in the F Mk 6 pre-mod 4212, a single-pointer gauge displays accumulator pressure, which has a normal reading of  $3000 \pm 100$  PSI. In flight the pressure may build up to as much as 3600 PSI; if the pressure reaches this figure, operate the wheel brakes to relieve the pressure. Post-mod 4212 in F Mk 6 aircraft, a triple pointer gauge is fitted on which the main (lowest) pointer shows accumulator pressure and the left and right pointers indicate hydraulic pressure in the lines to the left and right brake units. The maximum left and right brake unit pressure indications are  $1500 \pm_{50}^{150}$  PSI, but when the maxaret anti-skid units are operating the indications fluctuate.

### Canopy

26. The canopy system controls and indicator locations are listed in Tables 3 and 4. The canopy is normally opened and closed by the CANOPY operating control. To open the canopy, pull up the control; this unlocks the canopy and exposes a 3-position toggle

switch in the control handle. Selecting the spring-loaded switch to OPEN enables the application of hydraulic pressure to the canopy jack to open the canopy. To close the canopy, select the toggle switch to CLOSED; when the canopy is fully lowered, push down the operating handle to engage the canopy locks. During canopy operation an electric buzzer sounds to give audible warning of canopy movement. Canopy operation may be stopped at any intermediate position by releasing the toggle switch to the central, off, position during operation.

27. After closing the canopy, correct locking of the system is confirmed by the CANOPY (CAN, T Mk 5) caption going out and by two mechanical indicators marked CANOPY — FREE/LOCKED (CANOPY — LOCKED/UNLOCKED, T Mk 5) which show the position of the canopy shoot bolts.

28. When locking the canopy, the last few degrees of downward movement of the CANOPY operating control inflates the canopy seal.

29. *External Operation.* To operate the canopy externally in the F Mk 3 and F Mk 6, a CANOPY EXTERNAL RELEASE HANDLE and CLOSE/off/OPEN spring-loaded toggle switch are provided. The canopy is opened by rotating the handle and selecting OPEN. The reverse procedure closes the canopy. In the T Mk 5, a CANOPY LOCKS PULL

handle and similar toggle switch are provided. The canopy is opened by pulling the handle outboard and selecting OPEN on the switch. The reverse procedure closes and locks the canopy.

#### Canopy Emergency Operation

30. A wire-locked EMERGENCY CANOPY JACK RELEASE (CANOPY JACK RELEASE, T Mk 5) lever may be used *on the ground* to open the canopy if the normal system fails. The cockpit lever is operated by pulling it inboard to free the jack head and then pulling up the normal CANOPY operating control; the canopy is then free to be opened manually, usually with outside assistance. The canopy jack may also be released externally by operating the CANOPY EXTERNAL RELEASE handle.

#### Canopy Jettison

31. The canopy is jettisoned by pulling up the CANOPY JETTISON handle, by operating either ejection seat handle (on either seat in the T Mk 5), or by operating the external EMERGENCY CANOPY JETTISON handle. Operating any one of these controls withdraws the sear of the jettison firing unit which then fires a charge to unlock the canopy, free the hinges and hydraulic jack-end fitting, and jettison the canopy by means of two jettison jacks. The ejection seat cannot fire until the canopy is jettisoned; a restrictor cable inhibits ejection seat operation until the canopy has gone.

### MANAGEMENT OF THE SYSTEMS

#### Wheelbrakes

32. A full description of the recommended braking techniques under various runway conditions is in Part 3, Chapter 5.

#### Canopy

33. After starting, check the CANOPY (CAN, T Mk 5) caption is on before closing the canopy. After closing and locking the canopy check the restrictor cable is in position, the caption is out, the shoot bolts are LOCKED and the seal is inflated.

34. If it is vital to vacate the aircraft quickly on the ground, do not attempt to open the canopy on the normal system but use the CANOPY JETTISON handle.

**WARNING:** If the nosewheel has collapsed and the canopy is jettisoned, there is a probability that the canopy will fall back on the cockpit.

### MALFUNCTION OF THE SYSTEMS

#### Services Pressure Failure

35. After Services pressure failure, both the canopy and wheelbrakes systems are protected by accumulators. When landing, avoid 'maxaretting' to conserve accumulator pressure.

#### Canopy Malfunction

36. If, in hydraulic or electrical failure conditions, the canopy opens only slightly after a normal selection, it may not be possible to free the jack end by use of the EMERGENCY CANOPY JACK RELEASE or by the canopy jettison system because of the canopy position. To open the canopy in this situation, adopt the following procedure:

- a. Close the canopy by selecting CLOSED on the toggle switch (manual assistance may be necessary from outside).
- b. Push down the CANOPY handle to lock the system.
- c. Operate the EMERGENCY CANOPY JACK RELEASE.
- d. Pull up the CANOPY normal operating handle taking care not to operate the OPEN/CLOSED toggle switch.
- e. With outside assistance, physically lift the canopy.

### BRAKING PARACHUTE AND ARRESTER HOOK CONTROLS AND INDICATORS

#### Braking Parachute

37. In the F Mk 3 and F Mk 6 the parachute is streamed by pulling to its full extent a handle marked TAIL CHUTE PULL (item 18, Fig 1) on the left instrument panel and is jettisoned by pressing a CHUTE JETT button (item 19, Fig 1) on the left coaming.

38. In the T Mk 5, two white-painted parachute streaming handles are positioned towards the left and right ends of panel A1 (items 18 and 19, Fig 2). There is also a CHUTE JETT button adjacent to and below each streaming handle (items 20 and 21, Fig 2).

#### Arrester Hook (F Mk 6 Only)

39. The F Mk 6 controls and indicators for the arrester hook consist of a HOOK release handle (item 20, Fig 1) on the left instrument panel and a green HOOK DOWN light (item 21, Fig 1) to the left of the speed display.

## DESCRIPTION OF THE SYSTEMS

### Braking Parachute

40. A ribbon-type braking parachute is housed in a compartment on the underside of the rear fuselage. The cable of the parachute fitted to the F Mk 6 is stressed to five tons and of that fitted to the F Mk 3 and T Mk 5 to four tons. The different cables are identified by paint marks at the aircraft attachment bullet. Pulling the TAIL CHUTE PULL, or either white-painted handle in the T Mk 5, mechanically operates a selector which hydraulically opens the housing doors, and the parachute streams. Hydraulic power is taken from the No 1 Controls system.

41. Pressing the CHUTE JETT button operates an electro-magnetic release unit which opens to jettison the parachute. The release unit can be operated only after the parachute has been streamed.

42. A shear pin in the parachute cable acts as a weak link to detach the parachute after an inadvertent streaming at an excessive speed.

### Arrester Hook (F Mk 6 Only)

43. The arrester hook on the F Mk 6 aircraft, which is fitted under the rear fuselage, is retained in the up position by a mechanically-operated release unit. When the HOOK handle is pulled the hook is released to fall down to the runway under the action of a spring, and the HOOK DOWN light comes on. The light has a press-to-test facility to check the filament. A stowage for the hook ground lock is on the left wheel well.

44. The hook may be used, within the limits given in Part 2, Chapter 1, for approach-end or overshoot-end cable engagements. The hook is not to be lowered until the aircraft is on the ground; however, once

lowered, it is permissible to overshoot from the ground and fly with the hook down at speeds up to 250 knots.

## MANAGEMENT OF THE SYSTEMS

### Braking Parachute

45. During the internal checks, ensure that the brake parachute handle is fully in.

46. When streaming the parachute, ensure that the speed is within the limits given in Table 5 and then pull the handle to its fullest extent.

47. If the handle is reset after landing it should be returned carefully to its fully in position to avoid damage to the operating cable.

Table 5 — Braking Parachute Limiting Speeds

	Speed — Knots	
	F Mk 3 & T Mk 5	F Mk 6
Normal	150	170
Emergency	170	190

Note: If the braking parachute is streamed at speeds in excess of the *Normal* speed, this fact is to be reported so that the brake parachute may be inspected for serviceability.

## MALFUNCTION OF THE SYSTEMS

### Braking Parachute

48. If the No 1 engine is shut down but windmilling, the hydraulic pressure in the system is usually sufficient to operate the parachute doors. However, a no-parachute landing is to be anticipated in this situation.

49. Failure of the braking parachute is discussed in detail in Part 3, Chapter 5.

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