

PART 2
CHAPTER 1—AIRFRAME LIMITATIONS

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The Limitations in this Part are taken from the Release to Service Documents (F Mk 3 & 5, Issue 5, AL2; F Mk 6, Issue 4, AL3). The Release to Service Documents are to be consulted to ascertain the latest release standard.

General

1. The F Mk 3 and F Mk 6 aircraft are designed for duties appropriate to an interceptor fighter and the

T Mk 5 as an interceptor trainer. Intentional stalling and spinning are prohibited. The aircraft are cleared for use in temperate and tropical conditions, by day and night.

Altitude

2. Although the aircraft are cleared to fly at up to 60,000 feet, the oxygen systems and the pilots' personal equipment impose altitude limits as follows:

F Mk 3 and F Mk 6 — 50,000 feet
T Mk 5 — 43,000 feet

Note: If the canopy is lost, aerodynamic suck causes cockpit altitude to exceed aircraft altitude by up to 8000 feet in the F Mk 3 and F Mk 6, and by up to 11,000 feet in the T Mk 5.

Airspeed

3. *Maximum Speeds.* The following are the max IAS/Mach number for the configurations listed. When IAS/Mach number is quoted, the first attained is the limiting speed.

Maximum permissible: 650 knots/2.0M
Single missile
(F Mk 3/T Mk 5): 650 knots/1.8M
F Mk 6 with overwing tanks: 525 knots/0.98M
(525 knots/0.9M with single missile)

With AAR probe fitted: 625 knots

When Red Top operational missiles are carried below 10,000 feet in peace time: 550 knots
Airbrakes operation and extended:

F Mk 3 and F Mk 6: 650 knots/1.3M
T Mk 5: 650 knots/1.2M

UC selection: 250 knots

Flight with UC down: 280 knots

Flaps: 250 knots

Brake parachute:
F Mk 3 and T Mk 5: 150 knots (normal)
170 knots (emergency)
F Mk 6: 170 knots (normal)
190 knots (emergency)

Note: Brake parachute streaming above the normal speed is to be reported.

4. *Minimum Speeds.* The minimum speeds are as follows:

Flaps and UC up 180 knots
Flaps and UC down 140 knots

Note 1: In all configurations, higher minimum speeds are to be maintained with g applied

Note 2: In the F Mk 6, add 4 knots to the minimum speeds for every 2000 lb increase in AUW above 36,000 lb.

Normal Acceleration

5. *Negative g.* The maximum negative acceleration is minus 3g. Negative g is not to be applied for more than 15 seconds. Use of the ejection system is to be avoided in negative-g conditions.

6. *Positive g — F Mk 3 and T Mk 5*

Speed	Ventral	Fuel in	Single
	Empty	Ventral	Missile
Up to 0.9M	6g	6g	4g
0.9M to 1.8M	6g	5.5g	4g
Above 1.8M	4g	4g	—

Note 1: When winged Red Top missiles are carried, the limit is +4g except in operational necessity.

Note 2: Above 1.8M with two wingless Red Top missiles fitted, the limit is +3g.

7. *Positive g — F Mk 6*

a. *Without Overwing Tanks:*

Speed	Ventral Empty	Ventral Tank Fuel			Single Missile
		Up to 1000 lb	1000 to 3500 lb	More than 3500 lb	
		Up to 0.9M	6g	6g	
0.9 to 1.8M	6g	5.5g	5g	4.5g	4g
Above 1.8M	4g	4g	4g	4g	4g

Note 1: When winged Red Top missiles are carried, the limit is +4g except in operational necessity.

Note 2: Above 1.8M with two wingless Red Top missiles fitted, the limit is +3g at all fuel states.

b. *With Overwing Tanks:*

Speed (kt)	Overwing Tanks		Single Missile
	With Fuel	Empty	
Below 475	3.5g	4g	2g
Above 475	3g	3.5g	2g

Maximum Weight

8. *Take-Off.* The maximum AUW for take-off are:

F Mk 3 — 36,000 lb
T Mk 5 — 37,000 lb
F Mk 6 — 45,750 lb

Note: In the F Mk 6, the mainwheel tyres are to be used only once at take-off weights in excess of 45,000 lb.

9. *Landing.* The maximum permissible landing weights are:

- F Mk 3 and T Mk 5 — 34,500 lb (except in emergency)
F Mk 6 — Normal 34,500 lb
— Emergency 40,500 lb

Centre of Gravity (CG)

10. The take-off CG limits are contained in the Release to Service, Annex A.

Approach Criteria

11. *Aircraft Category.* The aircraft category for approaches is E.

12. *Visual Committal Height (VCH).* The VCH are as follows:

- a. *F Mk 3 and T Mk 5.* In the F Mk 3 and T Mk 5, the VCH for weights up to the maximum landing weight is zero.
b. *F Mk 6.* In the F Mk 6 without overwing tanks, the VCH is zero for weights up to 38,000 lb and 250 feet above that weight. With overwing tanks fitted, the VCH is zero for weights up to 34,000 lb and 700 feet above that weight.

13. *Engine Out Allowance (EOA).* The EOA are as follows:

- a. *F Mk 3 and T Mk 5.* In the F Mk 3 and T Mk 5, the EOA for weights up to the maximum landing weight is zero.
b. *F Mk 6.* Without overwing tanks in the F Mk 6, the EOA is zero for weights up to 38,000 lb and 150 feet above this weight. With overwing tanks fitted, the EOA is zero for weights up to 34,000 lb and 600 feet above this weight.

13A. *Standby Pressure Instrument Allowance.* The standby pressure instrument allowance is 300 feet. When using the standby altimeter, add 300 feet to the true height of DH/MDH.

Crosswind Limitations

14. *Take-Off.* The maximum crosswind component for take-off is 25 knots except in the F Mk 6 with overwing tanks, when the limit is 20 knots.

15. *Landing.* The maximum crosswind component for landing on dry runways is 25 knots, on wet runways 20 knots, and on flooded runways 15 knots. In the F Mk 6 with overwing tanks fitted, the figures are the same except that, on a dry runway, the limit is 20 knots.

Runway Restrictions

16. In the F Mk 3 and T Mk 5, the LCN is 27 at 36,000 lb AUW and, in the F Mk 6, the LCN is 30 at 39,000 lb AUW. For further information refer to the appropriate ODM.

Rolling Manoeuvre Limitations

17. *General.* The following general rolling limits apply:

- a. *Negative g.* At accelerations less than +1g, the use of aileron should be kept to a minimum although the transient use of aileron is permitted for target tracking.
b. *Buffet.* In moderate buffet or other signs of the approach of the stall, particularly above 20,000 feet or at high subsonic speed, rapid application of full available aileron is not to be made.
c. *Airbrakes.* The position of the airbrakes is not to be varied during rapid rolling.
d. *Sideslip.* Before rolling, care is to be taken to minimise sideslip by the use of rudder. Greater care is to be taken to minimise sideslip when carrying a single missile or when two missiles are carried and the AAR probe is fitted. It is essential to counteract sideslip when the AAR probe is fitted and one missile is carried on the left station.
e. *High Positive g.* Above +4g, only co-ordinated turns using low roll rates are permitted.
f. *Overwing Tanks.* When overwing tanks are fitted, change in bank angle is to be limited to normal heading change manoeuvres only.

18. *Rapid Rolling.* Rapid rolling is prohibited:

- a. When the AAR probe is fitted.
b. Above 1.8M when wingless Red Top are fitted.
c. Above +3g or the onset of moderate buffet, whichever occurs first, when drill Red Top fitted with Luneberg lens are carried.

19. *Rolls up to 180°.* Rapid rolling through not more than 180° is permitted, using full aileron, between +1g and the lesser of +4g or the onset of moderate buffet provided there is no other overriding limitation.

20. *Rolls Between 180° and 360°.* For all rolls between 180° and 360°:

- a. Either two or no missiles are to be carried.
b. The manoeuvre is to be executed smoothly from an upright attitude in 1g flight and is to be completed before any other manoeuvre is started.

c. 1g aileron rolls are permitted above 300 knots using low rates of roll.

21. *Rolls in Excess of 360°.* Rolls in excess of 360° are prohibited.

22. *Aerobatic Manoeuvres.* For training and display purposes, aerobatic manoeuvres are permitted below 15,000 feet and between 300 knots and the lesser of 550 knots/0.9M with the following restrictions:

- During rapid rolls, only aileron is to be used.
- Derry turns and hesitation rolls are prohibited.
- Winged Red Top missiles are not to be carried.
- The missile load is to be symmetrical.

Note: Co-ordinated slow rolls involving less than 1g are permitted.

Carriage of Missiles

23. The aircraft are cleared to carry Firestreak or Red Top live, acquisition or drill missiles in pairs except that flight with one wingless Red Top is prohibited. To conserve missile wing life, Red Top missiles are to be flown wingless whenever possible. Red Top missiles are cleared for flight with or without Luneberg lenses.

24. When winged Red Top are fitted, aerobatic type manoeuvres may be performed in operational circumstances only.

Missile Firing — AAR Probe Not Fitted

25. When the AAR probe is *not* fitted, one or both missiles may be fired subject to the following limitations:

- Firestreak.* Firestreak missiles may be fired:
 - At speeds between 300 knots or 0.6M, whichever is the lesser, and the maximum IAS stated in para 3, but not exceeding 1.7M.
 - At heights up to 55,000 feet.
 - At normal accelerations up to +3g or the onset of moderate buffet.
 - At low level targets, but to allow for possible vertical dispersion, if the target is below 300 feet the fighter is to be at or above 300 feet at launch, and if the target is at or above 300 feet, the fighter may be below 300 feet at launch.
 - The breakaway manoeuvre is not to exceed +4g (subsonic) or +3g (supersonic) and is strictly to adhere to the rolling limitations in para 17 to 22.

b. *Red Top.* Red Top missiles may be fired:

- At speeds between 0.5M and the maximum IAS stated in para 3, but not exceeding 1.8M.

WARNING: Reheat extinction may occur if Red Top missiles are fired below 300 knots at heights above 20,000 feet.

- At heights up to 55,000 feet.
- At normal accelerations up to +4g or the onset of moderate buffet, whichever occurs first.
- At low level targets, but to allow for possible vertical dispersion, if the target is below 300 feet the fighter is to be at or above 300 feet at launch, and if the target is at or above 300 feet the fighter may be below 300 feet at launch.
- The breakaway manoeuvre is not to exceed +4g (subsonic) or +3g (supersonic) and is strictly to adhere to the rolling limitations in para 17 to 22.

26. *Overwing Tanks.* When overwing tanks are fitted, missile firing is permitted within the above limits as modified by the speed and normal acceleration limitations for overwing tanks.

Missile Firing — AAR Probe Fitted

27. When the AAR probe is fitted, one or both missiles may be fired subject to the following limitations:

- At heights up to 55,000 feet.
- At normal accelerations between +1g and +2g or the onset of moderate buffet, whichever occurs first.
- Firestreak.* Firestreak missiles may be fired at speeds between 300 knots or 0.6M, whichever is the lesser, and 475 knots, but not exceeding 0.95M (0.9M with overwing tanks).
- Red Top.* Red Top missiles may be fired at speeds between 300 knots or 0.7M, whichever is the lesser, and 475 knots, but not exceeding 0.95M (0.9M with overwing tanks).

28. *Sideslip.* Excessive sideslip overloads the aircraft fin. Therefore, when one missile is fired, the resultant sideslip is to be counteracted immediately by use of rudder. The breakaway manoeuvre may then be initiated and is to be limited to +4g (or the onset of moderate buffet) and half aileron. The development of sideslip during the breakaway is to be counteracted by use of rudder.

Gun Firing (F Mk 6)

29. Gun firing is permitted at all heights and at accelerations between $+0.5g$ and $+4.5g$, above the following minimum speeds:

Below 10,000 feet:	180 knots	} 2-second bursts max
10,000 to 20,000 feet:	200 knots	
20,000 to 30,000 feet:	240 knots	
Above 30,000 feet:	260 knots — unlimited bursts	

30. Gun firing is prohibited when any missiles are fitted.

31. When overwing tanks are fitted, the normal acceleration limits are modified by para 7b.

32. *Ammunition.* The following ammunition may be fired:

- Practice, Mk 4Z
- HE Mk 5Z and 6 star Z
- Armour-piercing Mk 1Z

Light Fighter Sight (LFS)

33. The LFS is cleared for use by day only.

Carriage and Jettison of Ventral Tank (F Mk 3 and T Mk 5)

34. The F Mk 3 and T Mk 5 aircraft may be flown with or without the ventral tank. The tank may be jettisoned, but because of the severe nose-down trim change which may occur in certain conditions, the tank should not be jettisoned above 500 knots.

Overwing Tank Jettison

35. Empty overwing tanks may be jettisoned between 200 and 250 knots and up to 0.75M at heights up to 40,000 feet in straight and level flight. Overwing tanks containing fuel are not to be jettisoned.

Overwing Tank Fuel Dumping

36. Overwing tank fuel may be dumped at speeds between 220 knots and the maximum carriage speed at heights up to 36,000 feet. Dumping is normally to be performed in straight and level flight but turns at not more than $+2g$ may be made if necessary.

Canopy Jettison

37. A speed of 300 knots should not be exceeded when jettisoning the canopy. The canopy may also be jettisoned when the aircraft is stationary on the ground but, if the nosewheel has collapsed, there is a danger that the canopy will fall back onto the cockpit.

Flight Control System (FCS)

38. In all autopilot modes when flying below 10,000 feet, the pilot is to hold the control column and monitor the aircraft's behaviour continuously, particularly the dolls-eye indicators, in case of a malfunction.

39. *Autostabilisation.* The FCS may be used in the autostabilisation mode subject to the following restrictions:

a. The autostabilisation system may be in operation throughout flight from before take-off to landing, but it is recommended that with the autostabilisers engaged, speed should be less than 400 knots below 1000 feet AGL.

b. When STAB is selected in flight, the aircraft should not be in close proximity to the ground or another aircraft in case of a system malfunction.

40. *Pitch and Bank ATTITUDE Hold.* The FCS may be used in the ATTITUDE hold mode, including the use of the 'little stick', subject to the following limits and restrictions:

a. Speed is limited to between 250 and 400 knots between 1000 and 5000 feet, and to between 250 knots and 650 knots/2.0M between 5000 and 50,000 feet.

b. Before selection, autostabilisers are to be engaged and operating.

c. Bank angle is not to exceed 65° .

41. *Height, Height and Heading Lock Modes.* The FCS may be used in the HEIGHT and HEIGHT and HDNG lock modes, including the use of the 'little stick', subject to the following limits:

a. From 1000 feet AGL to 15,000 feet:

Without overwing tanks:

200 knots to 550 knots/0.92M

With overwing tanks:

250 knots to 525 knots/0.92M

b. From 15,000 feet to 45,000 feet, without overwing tanks: 200 knots to maximum permissible speed.

c. From 15,000 feet to 40,000 feet, with overwing tanks: 250 knots to maximum permissible speed.

d. Large power changes are to be made gently when below 10,000 feet and above 450 knots.

e. During transonic accelerations or decelerations between 15,000 feet and 25,000 feet, these modes are not to be engaged, thus preventing possible g-switch operation and automatic disconnection.

- f. With a single missile fitted, turns are not permitted at supersonic speeds.
42. *FD/ILS and Auto-ILS Modes.* The system is cleared for use up to 40,000 feet in the FD/ILS and auto-ILS modes subject to the following restrictions:
- All approaches should be PAR-monitored.
 - The approach limitations are to be observed.
43. *TRACK Mode.* The use of the TRACK mode of the auto-ILS as a height and heading lock is permissible within the following limits:
- Indicated airspeed: 250 to 350 knots
 - Mach number limit: 0.95M
 - Height limit: 1000 feet AGL to 40,000 feet
 - Heading change demands: maximum 40°
 - Undercarriage: undercarriage up
44. *Programmed Climb.* The system is cleared for use in the FD programmed climb mode except when overwing tanks are fitted.

Formation Flying

45. The limitations on high speed formation flying are to be found in Part 3, Chapter 3.

Anti-Ice and Rain Dispersal Systems

46. *Anti-Ice System*
- Engine and duct lip anti-icing are cleared for use.
 - The Spraymat system is cleared for use only when the engines are running.
47. *Rain Dispersal*
- The rain dispersal system may be used for take-off.
 - Rain dispersal may be selected on at any stage of the approach and left on for any subsequent overshoot, circuit and landing. With two engines operating, the number of normal overshoots with rain dispersal switched on is unlimited.
 - If the system is used during a single-engine approach, overshoot and landing, the fact is to be reported after landing (inspection of vinyl layer).

ILS

48. The ILS may be used at speeds up to 400 knots and at heights up to 30,000 feet, but erroneous indications may be expected when the ram air temperature exceeds 70°C for more than 20 minutes.

Arresting Barriers

49. All aircraft marks, with or without the AAR probe fitted, are clear to engage the Mk 6, 12 and 12A, and Types A and B, aircraft arresting barriers. Aircraft with overwing tanks fitted may engage the Mk 12A, Type A and Type B barriers only but the tanks should be empty to reduce fire hazards.

Arrester Hook (F Mk 6)

50. The arrester hook fitted to the F Mk 6 is cleared for use at all aircraft weights.
51. The arrester hook is not to be released in flight. However, provided the hook is released while the aircraft is on the runway, it is then safe to overshoot and fly with the hook lowered at speeds up to 250 knots.
52. Whenever possible, the cable should be engaged within 40 feet of the centre of the runway. However, discontinuities on the runway surface (as little as one-sixteenth of an inch step-up eg, centreline lighting) before the cable may cause the hook to bounce over the cable.

53. *Use with RHAG Mk 1.* Safe engagement with the RHAG Mk 1 system is possible at speeds up to 170 knots. After engagement at speeds above 170 knots there is a risk of structural failure and the pilot should be prepared to eject. At speeds up to 115 knots, the aircraft is to be visually inspected for damage and the hook blade changed. If engagement occurs at speeds above 140 knots, the integrity of the aircraft's structure is to be checked before further flight.

54. *Use with Other Arresting Gear.* The arrester hook may be used with other types of arresting gear provided they have normal performance characteristics similar to those of the RHAG Mk 1, subject to the following conditions:

- At engagement speeds above 140 knots there is a risk of structural failure and the pilot should be prepared to eject.
- After engagement at speeds above 95 knots the aircraft is to be visually inspected for damage and the hook blade changed. If engagement occurs at speeds above 115 knots, the integrity of the aircraft's structure is to be checked before further flight.

Trampling of Arresting Cables

55. The aircraft are clear to trample, at any speed, the rigged and supported centre span of the following arresting cable systems: RHAG, SPRAG, CHAG, PUAG, BLISS BAK 9, BAK 12 and 500S.

Note: The fins under the ventral tank may occasionally be struck by a cable.

Equipment Temperatures

56. The performance of certain equipment may become unreliable or give false indications in sustained high speed, low altitude flight at high ambient temperatures. Normally, therefore, speed should be restricted within the ram air temperature/height/time limits as follows:

- Airframe structure — 117°C max
- Cabin conditioning system — 80°C max above 10,000 feet
- Firestreak missile (armed) — 70°C max
- ILS — accuracy degraded after 20 minutes above 70°C
- Red Top with Luneberg lens — 70°C
- HE Ammunition (F Mk 6) — 10 minutes max above 70°C

Air-to-Air Refuelling (AAR)

57. Sorties of up to nine hours duration (11 hours, F Mk 6) may be undertaken provided that losses of engine/airframe fluids and oxygen are small. AAR is permitted as follows:

- a. From Victor K2 tankers up to 43,000 feet within the following restraints:
 - (1) *Minimum Speed.* The minimum speed for making contact and in contact is 250 knots.
 - (2) *Maximum Speeds.* The maximum speeds for making contact and in contact are:
 - Mk 20B drogue on wing stations:
 - Stainless steel hose — 280 knots/0-88M
 - Carbon steel hose — 290 knots/0-88M
 - Mk 17 HDU on centre station — 320 knots/0-88M
- b. From Buccaneer Mk 2 tankers using Mk 20C or Mk 20E refuelling pods at speeds between 250 and 290 knots.

c. From KC 135 tankers between 250 and 270 knots.

d. From VC10 K2 tankers up to 35,000 feet, between 260 and 300 knots. Optimum speed is 280 knots. AAR without autostabilisers is to be in emergency circumstances only. Bank angle in contact is to be not greater than 30° and gentle manoeuvres only are to be used.

e. If autostabilisers are required, they are to be engaged before contact.

f. If it is necessary to use reheat, it is to be engaged prior to contact.

Radar Altimeter

58. The F Mk 3 and F Mk 6 are cleared to use the radar altimeter (ARI 23232, Type 48 or 49 AMR). Momentary loss of lock occurs during taxiing and during roll and pitch manoeuvres over land, especially towards the top of the radar altimeter range.

WARNING: It is possible for the Type 48 AMR indicator to show a withdrawal of the failure warning flag after a failure, when subjected to normal acceleration greater than +2.5g. The flag reappears when the acceleration reduces below +2.1g. This limitation does not apply to the Type 49 AMR which has an improved failure flag motor solenoid.

AI 23 C/D

59. AI 23 C/D is cleared for use, including the homer, subject to the following conditions:

- a. Fast mode attacks are not to be made below 20,000 feet.
- b. Practice attacks against targets may be made provided aircraft safety can be maintained without reliance on kinematic ranging.