PART 2

Part 2

CHAPTER 1 - AIRFRAME LIMITATIONS

Contents

1 General

The following take-off configurations for the Lightning F Mk.53 have been cleared for use.

Interceptor

(a) Aircraft with missile pack without missiles, or two-inch rocket pack with launchers closed

(b) Aircraft with 2 missiles

(c) Aircraft with 2 missiles and gun pack

(d) Aircraft with two-inch rocket pack and gun pack

Ground attack

◀ (e) Aircraft with two-inch rocket pack, 2 x 1000 lb ballistic bombs/540 lb retarded bombs.

(f) Aircraft with two-inch rocket pack and underwing pylons only

(g) Aircraft with two-inch rocket pack, 2 x 1000 lb ballistic bombs/540 lb retarded bombs and gun pack. ▶

(h) Aircraft with two-inch rocket pack, underwing pylons and gun pack

(j) Aircraft with two-inch rocket pack and 2 Matra launchers

(k) Aircraft with two-inch rocket pack, 2 Matra launchers and gun pack

In normal circumstances no other configurations are permitted, however in operations of extreme necessity the aircraft can take-off with asymmetric configurations of the weapons listed above.

Note 1: *When the term 'two-inch rocket pack' is used, the clearance is valid whether the pack carries rockets or not.*

Note 2: *'Matra launchers' can mean full or empty.*

Note 3: *The 1000 lb bombs to which clearance relates are Mk.10's with Type 114 tail.*

2 Weight limitations

Max. take-off weight	42,000 lb
Max. normal landing weight	34,500 lb
Max. emergency landing weight	39,000 lb

3 CG limits

The take-off CG limits are contained in the Lightning Mk.53 Servicing Manual (BAC 53(K)-1), Book 1, Section 2, Chap.3A.

4 Maximum speeds

(a) *Normal operating limits*

(i)	Without underwing pylons	The lesser of 650 kts/2.0M
(ii)	With underwing pylons (with or without 1000 lb ballistic bombs/540 lb retarded bombs	0.9M
(iii)	With practice SNEB rockets	450 kts
(iv)	With H.E. or H.C. SNEB rockets	520 kts
(v)	No.4, Mk.2 rocket launchers extended	The lesser of 650 kts/1.7M
(vi)	Air brakes out	The lesser of 650 kts/1.3M
(vii)	Flap operation or flaps down	250 kts
(viii)	Undercarriage selection	250 kts
(ix)	With undercarriage down	280 kts
(x)	Brake parachute stream	170 kts 190 kts (emergency)
(xi)	Taxying with canopy open	65 kts (taxying speed plus wind component)

(b) *Operational necessity only*

(i)	Either two missiles or none, no underwing pylons	The lesser of 700 kts/2.0M
(ii)	With underwing pylons but without stores	The lesser of 650 kts/1.8M

5 Minimum speeds

Flaps and undercarriage up.	180 kts
Flaps and undercarriage down	140 kts

Add 5 kts per 2000 lb weight increase above 36,000 lb AUW. In all configurations higher minimum speeds must be maintained with g applied.

6 G limitations

(a) *Positive*

The maximum positive 'g' in each configuration is given opposite: lower limits apply whilst weapons are being fired *(refer to Chap.2, para.2 of this Part)*.

(i) *Symmetric configurations*

	WING FUEL			
	Less than 2500 lb/side	Full	Full	Full
	VENTRAL PACK FUEL			
Speed	*Empty*	*Up to 1000 lb*	*1000 lb to 3500 lb*	*More than 3500 lb*
No underwing pylons, no gun pack				
Up to 0.9M	6g	6g	5.5g	5.5g
0.9M to 1.8M	6g	5.5g	5g	5g
Above 1.8M	4g	4g	4g	4g
No underwing pylons, with gun pack				
Up to 0.9M	6g	6g	5.5g	5.5g
0.9M to 1.8M	5.5g	5g	4.5g	4.5g
Above 1.8M	4g	4g	4g	4g
With underwing pylons:				
◀ With and without stores, with and without gun pack ▶				
*Up to 0.9M	6g	5.5g	5g	5g
Without stores – operational necessity				
Up to 1.8M	4g	4g	4g	4g
Rocket launchers extended				
Up to 0.9M				
No underwing pylons, with and without gun pack				
	6g	6g	5.5g	5g
With underwing pylons, with and without stores				
	6g	5.5g	5g	5g
No underwing pylons				
0.9M to 1.7M	3g	3g	3g	3g

Normal acceleration clearance is to the values given above or the onset of moderate buffet whichever is less.

(ii) *Asymmetric configurations*

Single missile . . . . . 4g in any flight condition
Single underwing store . . . . . *As for symmetric configuration, above

(b) *Negative*

(i) The maximum permissible negative normal acceleration is minus 3g indicated.

(ii) Negative g must not be applied for longer than 15 seconds at any one time and a period of 1 minute should be allowed to elapse between successive applications.

7 Altitude limitations

Normal operating limit . . . . . 60,000 ft

Operational necessity only . . . . . 75,000 ft

Note: *Refer to Part 1, Chap.11, para.18 for altitude, restrictions when the high altitude aircrew equipment is not worn.*

8 Stalling and spinning

Intentional stalling and spinning are prohibited. The action to be taken in the event of an inadvertent spin is given in Part 3, Chap.3.

9 Rolling manoeuvres

(a) *Normal course-changing manoeuvres:-*

Rolling is limited to normal course-changing manoeuvres in the following circumstances:-

(i) When the speed exceeds the maximum for rapid rolling *(sub.para.(b) below)*.

(ii) In the presence of moderate buffet when flying at speeds within the hatched area shown on fig.6, Part 3, Chap.3. Failure to observe this limitation could result in excessive fin loads.

(iii) When 'g' is more than 4, or less than 0 (ground attack role), or less than 1 (interceptor role).

(iv) In the presence of moderate buffet or other signs of the approach to a stall: this applies particularly at high subsonic speeds above 10,000 feet. Failure to observe this limitation could lead to a spin.

(v) With rocket launchers extended.

(vi) At supersonic speeds when carrying underwing pylons (no stores).

(b) *Full aileron rolls:-*

(i) *General restrictions:-*

Before rolling, care should be taken to minimize sideslip by appropriate use of rudder trim; this is particularly important when the aircraft is in an asymmetric configuration (e.g. single missile/underwing store).

Airbrake position must not be varied during rapid rolling.

(ii) *Rolling restrictions - interceptor role*

Full aileron rolls up to 180° are permitted in the interceptor role (with/without gun pack, with/without missiles or 2" rocket launchers closed). In this configuration the speed must not exceed 650 kts/2.0M and the 'g' must be in the range 1 to 4g.

Interceptor aircraft (symmetric configuration only) are permitted rolls up to 360°. The speed must be in the range 300 to 650 kts/2.0M at 1g only. They must be executed from an upright position using low rates of roll and must be completed before any other manoeuvre is started.

(iii) *Rolling restrictions - ground attack role*

Aircraft carrying symmetrical or no underwing stores are permitted full aileron rolls up to 180° provided there is no fuel in the ventral pack and the speed does not exceed 0.9M in the 'g' range of 1 to 4g. Rolls up to 90° are permitted up to the same speed in the range 0 to 1g.

◂ When asymmetric stores are carried or fuel remains in the ventral pack, full aileron rolls are permitted up to 90° only, provided the speed does not exceed 0.9M and the 'g' is in the range 0 to 4g.

With underwing pylons only and in the case of operational necessity where the aircraft may be flown at 1.8 IMN/650 kts, rolling is confined to normal course changing manoeuvres only.

(iv) *Rolling restrictions – aerobatic manoeuvres*

Aircraft with/without missiles or 2" rocket launchers closed, are permitted rapid rolls through 360° at 1g using full aileron control, up to a maximum altitude of 15,000 feet. Speed range is 300 to 550 kts and maximum IMN is 0.9M.

All rolls must be smoothly executed from a normal upright attitude and must be fully completed before any other manoeuvre is started.

'Classic' slow rolls involving less than 1g are permitted.

'Derry' turns involving less than 1g and 'hesitation' rolls are prohibited. ▸

10 Aircraft approach limitations (AAL)

(a)

	BREAK-OFF HEIGHT (in feet) ABOVE RUNWAY			
	GCA/AUTO-ILS		MANUAL ILS	
	Indicated	True	Indicated	True
2½° glide path slope	250	300	300	350
3° glide path slope	300	350	350	400

(b) If main altimeter and VSI failure have occurred, the AAL is 500 ft indicated. In these circumstances it is preferable that an ILS approach is made.

(c) Manual and auto-ILS approaches should be GCA monitored where possible.

11 Airfield restrictions

(a) *Runway length*

The aircraft should be operated from runways of not less than 7500 ft in length; in certain circumstances, e.g. high ambient air temperature or high altitude, runways of greater length will be required and the Lightning ODM should, therefore, be consulted.

(b) *Runway load classification number*

(i) Rigid pavements – the aircraft LCN is 34 at 42,000 lb AUW.

(ii) Flexible pavements – the aircraft LCN is 40 at 42,000 lb AUW.

12 Crosswind limitations

The maximum crosswind component for take-off and landing is:–

25 kts – dry runway

20 kts – wet runway

15 kts – flooded runway

Part 2

CHAPTER 2 – EQUIPMENT LIMITATIONS AND MISCELLANEOUS RESTRICTIONS

Contents

1 Flight control system

(a) *Autostabilizer mode*

The autostabilizer may be used throughout the flight envelope from before take-off to after landing, except that the following restrictions and recommendations apply:-

(i) The selection of autostabilization should not be made in flight whilst the aircraft is in close proximity to the ground or another aircraft. This restriction is imposed because there may be a latent malfunction which, on selection, would become effective.

(ii) The autostabilizer can be used during close formation flying, provided that the limitations in para.(i) above, are observed.

(iii) It is recommended that, with the autostabilizers engaged (STAB on), speeds above 500 knots should not be flown at heights less than 1000 ft above ground level.

(b) *Autopilot general restrictions*

(i) The autopilot MASTER switch should be on at all times except following a malfunction.

(ii) Before engaging any autopilot mode the autostabilizer must be on and operating correctly.

(iii) An autopilot mode should not be selected when near to the ground or another aircraft.

(iv) In any mode with the autopilot engaged (i.e. (c), (d) and (e)), below 10,000 ft the pilot should have his hand on the stick so that immediate recovery action can be guaranteed in the event of a malfunction.

(c) *Attitude hold*

The attitude hold mode, including the use of 'little stick', is cleared for use within the following limits:-

(i) 250 kts to 400 kts from 1000 ft to 5000 ft above ground level (AGL).

(ii) 250 kts to 650 kts/2.0M from 5000 ft AGL to 50,000 ft.

(iii) Bank angle must not exceed 65° at any time.

(d) *Height lock, and height and heading lock*

The height lock and height and heading lock modes, including the use of 'little stick' are cleared for use within the following limits:-

(i) 1000 ft AGL to 15,000 ft at speeds between 250 kts to 400 kts/0.95M.

(ii) 15,000 ft to 45,000 ft, at speeds between 250 kts to 650 kts/2.0M.

(iii) These modes should not be used during transonic accelerations or decelerations between 15,000 ft and 25,000 ft.

(iv) With a single missile fitted, turns may not be attempted at supersonic speeds with the autopilot engaged.

(e) *Height and heading lock using the Track mode*

The use of the Track mode of the auto-ILS (without ILS) as a height and heading lock is permissible when carrying two missiles or none within the following limits:-

(i) 250 kts to 350 kts

(ii) 0.95M must not be exceeded.

(iii) 1000 ft AGL to 40,000 ft

(iv) Heading change demands must not exceed 40°.

2 Weapon firing or jettisoning limits

(a) *Air-to-air weapon firing*

(i) *Firestreak*

Maximum speed	the lesser of 650 kts/1.8M
Normal acceleration	+ 0.5g to + 3g
Minimum speed	the greater of 300 kts/0.6M at altitudes above 300 ft. Below 300 ft this is increased to the greater of 300 kts/0.7M.

(ii) *Red Top*

Maximum speed	the lesser of 650 kts/1.8M
Normal acceleration	+ 0.5g to + 4g
Minimum speed	the lesser of 300 kts/0.7M

Note 1: *In the event of a misfire with Firestreak missiles the missile fins may still operate and if one or both missiles remain on the aircraft, 3g should not be exceeded for a further 30 seconds.*

Note 2: *To avoid possible damage to the missiles it is recommended that gun firing over missiles should not be undertaken except in operations of extreme necessity.*

Note 3: *When firing missiles at low level and to allow for possible vertical dispersion of the missile, attack against targets below 300 ft should be undertaken only from altitudes above 300 ft. For targets above 300 ft attacks may be made from altitudes below 300 ft.*

(iii) *2-inch rockets*

Maximum speed	the lesser of 650 kts/1.7M
Normal acceleration	+ 0.5g to + 3g

(iv) *Aden guns*

Maximum speed	the lesser of 650 kts/1.8M
Normal acceleration	+ 0.5g to + 4.5g

Firing of all the above weapons is safe up to the maximum altitude achievable although some degradation in performance must be expected at altitudes above 60,000 ft.

The rolling limitations given in Part 2, Chap.1, should be strictly observed during any break-away manoeuvre following the firing of one or two missiles.

(b) *Air-to-ground weapon firing*

(i) *2-inch rockets*

Maximum speed	0.9M
Normal acceleration	+ 0.5g to + 3g

(ii) *Aden guns*

Maximum speed	0.9M
Normal acceleration	+ 0.5g to + 3g

(iii) *SNEB rockets*

Maximum speed	Type 252/3 (practice) head - 450 kts Type 253 (HC) head or Type 256 (HE) head with nose cones fitted to launchers - 520 kts
Normal acceleration	+ 0.5g to + 3g

(iv) *1000 lb bombs*

Maximum speed	520 kts/0.9M
Normal acceleration	+ 0.5g to + 3g

(c) *Jettisoning*

The jettison limits are:-

Firestreak and Red Top	300 kts/0.7M (250 kts with U/C down) within + 1g to + 2g
Matra Launchers	300 kts within + 0.5g to + 2g
1000 lb bombs	500 kts within + 0.5g to + 3g

Sideslip should be minimized before jettisoning

3 ILS

ILS is not to be switched on above 40,000 ft or above 400 kts.

◀ 4 Emergency arrester hook

(a) The arrester hook is cleared for emergency use with either the BLISS or all American runway gear at speeds up to 140 knots at weights up to 45,000 lb.

(b) The arrester hook must only be lowered when the aircraft is on the runway. Provided the hook has been released whilst the aircraft is on the runway, it is safe to overshoot and fly with the hook lowered at speeds up to 250 knots.

(c) Engagement should be confined to the span 40 ft either side of the arrester wire centre.

(d) After lowering, efforts should be made to avoid running the hook along the runway centre-line markings when they are composed of a material that forms raised surfaces on the runway.

(e) Use with the Bliss arrester gear

(i) At engagement speeds above 140 knots there is a risk of structure failure and the pilot should be prepared to eject.

(ii) After engagement at any speed, the aircraft and hook blade must be visually examined. After engagement above 95 knots the hook blade must be changed. At engagement speeds above 115 knots, the integrity of the aircraft's structure must be checked before further flight. ▶

◀ (f) Use with All-American arrester gear

(i) Safe engagement is possible up to 170 knots. Above this speed, structural failure is possible and the pilot should be prepared to eject.

(ii) The aircraft hook must be examined after an engagement and the hook blade changed, if engagement takes place above 140 knots the integrity of the aircraft's structure must be checked before further flight. ▶

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CHAPTER 3 - ENGINE LIMITATIONS

Contents

1 Avon Mk.302C operating limitations

POWER RATING	% RPM	MAX. JPT (°C)	TIME LIMIT (per flight)
MAXIMUM TAKE-OFF (with and without reheat)	102.5	◄ 800	15 minutes combined duration
MAXIMUM (in flight only)	104	800 ►	
INTERMEDIATE	98	755	30 minutes
MAX. CONTINUOUS	97	720	Unrestricted
APPROACH	60 min		Unrestricted
GROUND IDLING GROUND FAST IDLING	34 58 min	750 750	Unrestricted Unrestricted

Note 1: *If the rate of increase in* JPT *makes it seem likely that 800°C* JPT *will be exceeded during starts, close the* HP *cock immediately.*

Note 2: *The maximum* RPM *will rise with altitude to a limiting value of 104%* RPM *at the tropopause.*

Note 3: *During reheat selections and cancellations transient* RPM *overswings lasting up to 5 seconds may be permitted up to 106%* RPM.

Note 4: *During certain engine accelerations, temperature in excess of the limiting* JPT *may be experienced. Although the time before full control to 790°C is established should not exceed 5 seconds, temperatures up to 850°C may be tolerated for a further 10 seconds, whilst manual control is being taken in the event of* JPT *control malfunction.*

Note 5: *Under adverse conditions of hot day and/or tail wind running, the ground slow- and fast- idling and taxying temperatures may be allowed temporarily to exceed the limit of 750°C but must not exceed 800°C. Refer to Part 3, Chap.2; para.4(b).*

2 Oil pressure

The oil pressure warning lights must be out at 45% RPM and above.

3 Reheat time restriction

The total period for which reheat may be used is 15 minutes per flight. This may be continuous or cumulative and applies to all degrees of reheat.