

Part II—Limitations

Chapter 2—Aircraft Limitations

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1 General

The Vulcan B Mk. 1A is designed for manoeuvres appropriate to the role of a medium bomber. Aerobatics, stalling and spinning are prohibited. Speed must not be reduced below that for the onset of pre-stall buffet, and in any case not below the threshold speed for the weight, less 5 knots. The aircraft is cleared for the use of AVTUR and AVTAG fuel.

2 Speed and mach number limitations

(a) *With all power-flying controls working, and with pitch damper, yaw damper and auto-mach trimmer in operation:*

- From sea-level to 20,000 ft 250 knots
- From 20,000 ft to 30,000 ft 300 knots
- Above 30,000 ft 300 knots/0.95M

(b) For operating airbrakes, and with airbrakes extended Unrestricted

(c) For operating bomb-doors, and with bomb-doors open As in (a) above

(d) For operating undercarriage, and with undercarriage locked down 220 knots

- (e) With yaw damper or both pitch dampers inoperative As in (a) above
- (f) With rudder on stand-by PFC As in (a) above
- (g) With auto-mach trimmer inoperative 0.95M
(But 0.90M is not normally to be exceeded)
- (h) With any one elevator or aileron PFC unit inoperative 0.90M
- (j) If an elevator, aileron or rudder artificial feel unit fails, or is relieved
 - Below 30,000 ft 275 knots
 - Above 30,000 ft 275 knots/0.95M
- (k) For brake parachute streaming 135 knots
- (l) With the brake parachute door open, speed must not exceed 180 knots and sideslip must be avoided.
- (m) Maximum cross-wind component for streaming brake parachute and for take-off and landing 20 knots
- (n) Flight with the entrance door open 220 knots

3 G-limitations

The maximum permissible accelerometer readings are as follows:

(a) *During symmetrical wing-loading manoeuvres*

(i.e. Those in which elevator alone is used.)

Weight (lb)	Airspeed (M)	Bomb load less than 2,000lb	Bomb load greater than 2,000lb
At and below 138,000	Less than 0.89	2G	1½G
Above 138,000	Above 0.89	1¾G	1½G
	At all mach numbers	1¾G	1½G

(b) *During asymmetric wing-loading manoeuvres*

(i.e. Those where aileron is used.)

(i) Rapid and coarse application of aileron with G is prohibited.

(ii) A maximum of 1½G must not be exceeded.

(iii) In all other respects existing limitations are to be observed.

NOTE 1: These limitations must be borne in mind when entering and leaving turns particularly in escape manoeuvres.

NOTE 2: When Mod. 1001 is embodied, and prior to embodiment of Mod. 1706, the G limitations above must be reduced by ¼G.

3A Emergency operational limitations

(a) The aircraft can be operated at up to 185,000 lb in emergency operational conditions.

(b) The maximum permissible accelerometer reading during symmetrical wing-loading manoeuvres is as follows:

Weight (lb)	Airspeed (M)	Bomb load 21 x 1,000lb
Between 167,000 and 185,000	less than 0.89	1.3G

(c) At weights above 150,000 lb, when carrying 21 × 1,000 lb bombs, speeds in excess of 0.89M are prohibited.

(d) When carrying 21 × 1,000 lb bombs, the maximum speed is 310 knots.

(e) At weights above 167,000 lb:

(i) The aircraft is not to be flown in turbulence greater than ± 0.5G.

(ii) The aircraft is cleared only for gentle asymmetric manoeuvres.

(iii) When re-landing in an emergency, the rate of descent at touch-down must be kept to a minimum.

(iv) When the aircraft is on the ground, sharp or fast turns must be avoided.

4 Maximum weights

	Normal	Operational Emergency
For take-off	167,000 lb	185,000 lb (See para. 3A)
For landing	125,000 lb	—
For landing in emergency	167,000 lb	185,000 lb (See para. 3A)

NOTE: Up to a weight of 109,000 lb full undercarriage strength factors are maintained; above this weight the strength factors are progressively reduced and appropriate care should be taken.

5 C of G limits

Forward limit	137 inches aft of datum
Aft limit	151 inches aft of datum

5A Anti-icing systems

(a) *Airframe anti-icing*

The airframe anti-icing system is cleared for use when Mods. 686, 777 and 940 are embodied and when the wing duct blanks introduced by Mod. 1144 are removed. *Part of Mod. 686 blanks off the fin anti-icing system.*

(b) *Engine anti-icing system*

The engine anti-icing system is cleared for continuous use at a minimum engine RPM of 55% ▶ ◀ The system is cleared for operation for periods of up to two minutes below 55% RPM.

6 Temporary restrictions

◀ The NBS equipment may be used for direct and off-set manual bombing and navigation, but pending modification to provide more accurate pitot-static information to the AMU, the maximum true airspeed indication on the nav/plotter's panel must not exceed 550 knots. ▶

7 Aircraft approach limitations (AAL's)

(a) The aircraft approach limitations are as follows:—

	<i>Height* (feet)</i>	
	<i>True</i>	<i>Altimeter</i>
GCA	300	350
ILS manual	400	450
ILS/Zero-reader	300	350
Auto/ILS	250	300
<i>No glide path</i>		
P/P radar/Babs	500†	500†

* Above runway level

† Apply to GCA or ILS when glide path is suspect

(b) The aircraft approach limitations make no allowance for any errors in indicated pressure height readings other than normal pressure error corrections; mean errors of 200 feet have been recorded. The value of AAL quoted should only be used in estimating a break-off height when some form of true height monitoring is available. If accurate height information is not available with the approach aid in use, then the break-off height should be increased by 200 feet to allow for possible indicated height errors.

8 Auto-pilot limitations

(a) *Maximum speed under auto-pilot control*

- (i) With pitch damper and auto-mach trimmer operative 0·93M or 300 knots above 20,000 ft
250 knots below 20,000 ft
- (ii) With auto-mach trimmer and one or both pitch dampers inoperative 0·90M
- (iii) For opening bomb doors 0·90M

(b) *Minimum operating altitude* 1,500 ft above ground level except on auto-approach

(c) The auto-pilot must not be used unless the artificial feel is functioning correctly, and it must not be used when artificial feel relief is in operation.

(d) Auto/ILS approaches may be carried out.

(e) The track switch must not be pulled on with the undercarriage lowered at speeds in excess of 180 knots.

(f) Longitudinal trim must be maintained so that the pointer is within the safe range indicated on the auto-pilot trim indicator, i.e. the white sector.

(g) One pilot must at all times be strapped in his seat.

9 Armament limitations

Information on armament limitations is contained in the Release to Service Document.

10 Flight refuelling limitations

(a) The aircraft is cleared for flight refuelling contacts, by day or night, with Valiant B(K) Mk 1 tankers, subject to the following conditions:—

- (i) Speed of the tanker at and during contact should be 220 to 240 knots. It is recommended that contacts be made and held at 230 knots.
 - (ii) Air brakes may be used if required.
 - (iii) In other respects normal flying limitations apply.
 - (iv) That Mk 8 refuelling equipment is modified up to Mod FR1010 before night contacts are attempted, and that sufficient reserve fuel is maintained in the receiver aircraft to allow for the possibility that the first contact is unsuccessful.
 - (v) Pilots must receive proper and adequate training in flight refuelling.
- (b) Speed is referred to in terms of the tankers instruments ; because there is evidence that there may be a discrepancy between the two aircraft during contact. There is no height limitation.
- (c) Before night flights the probe lighting should be adjusted so that the outer third of the probe is illuminated.
- (d) Until Mod 1143 is embodied, contact must be broken immediately three tank indicator lights on one side go out (this includes tanks shut off by use of the C of G control switches). This is necessary because ground tests have shown that under certain conditions a fuel tank may become over-pressurised if both halves of the double level float switch fail to close. In these circumstances the vent system is not capable of passing fuel at the rate required to avoid a pressure build-up in the tank.
- (e) When Mod 1143 is embodied 100% refuelling may be carried out provided that the aircraft fuel system is depressurised.
- ▶◀
- (f) Fuel C of G control switches may be used within the limits mentioned in (d) above, but contact must be broken if either needle of the C of G indicator goes into the red sector.

11 ECM Equipment

Information on ECM clearance and limitations is contained in the Release to Service Document.

12 Radio clearances

The following radio/radar equipment/installations are cleared for use:

- (a) Intercomm. ARI 18089
- (b) VHF ARI 18064
- (c) Gee Mk. 3. ARI 5874
- (d) NBS Mk. 1. ARI 5810
- (e) HF STR 18 B2. ARI 5874
- (f) ILS. ARI 18011
- (g) IFF Mk. 10. ARI 5848
- (h) Radio altimeter Mk. 6A. ARI 18090
- (j) Green Satin and GPI Mk. 4. ARI 5851
- (k) Tail warning. ARI 5919.
- (l) Window launcher. ARI 18105 when fully modified
- (m) Rebecca Mk. 10. ARI 5924
- (n) UHF. ARI 18124/1
- (o) ILS/Zero-reader
- (p) Radio compass. AD 7092D. ARI 23023.

13 Bleed-air turbine limitations

When the turbine is used below 10,000 feet, the RPM of the engine supplying air must not exceed the following:

(a) At sea-level	. . . . .	80% RPM
2,000 feet	. . . . .	86% RPM
4,000 feet	. . . . .	87% RPM
6,000 feet	. . . . .	89% RPM
8,000 feet	. . . . .	91% RPM
10,000 feet	. . . . .	93% RPM

- (b) If the gear box oil supplies fail, indicated by erratic frequency control, ECM equipment is to be switched off and the bleed-air shut-off valve closed.
- (c) The gear-box oil level is to be checked after every flight, whether the ECM equipment has been used or not.
- (d) Before every flight, to ensure that it is fully open, a physical check is to be made of the frequency control butterfly valve.



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