PART 4. CRUISE

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Data for the T Mk.4 are given on the coloured leaves placed together with the corresponding data on white leaves for the F Mk.1, 1A and 2. The T Mk.4 figures are distinguished by the affix T after the figure number.

LIST OF FIGURES

1. **Temperature correction**

(a) When flying at constant M and constant altimeter height the fuel flow *(lb/min)* is increased at high O.A.T. and decreased at low O.A.T. *(being in fact proportional to* $\sqrt{t}$*)*. A plot of lb/min ÷ $\sqrt{t}$ quantity against M and altimeter height, *(as in figures 4.2, 4.5, 4.9 and 4.11)* is therefore correct for both standard and non-standard temperature conditions. Figure 4.1 gives the conversion from lb/min ÷ $\sqrt{t}$ to lb/min over a range of temperatures.

Example: If lb/min ÷ $\sqrt{t}$ = 460, then from 4.1, lb/min = 380 at -76.5°C

(b) A.n.m./100 lb is, on the other hand, independent of O.A.T. at constant M and constant altimeter height and no correction for temperature is required. It follows that total distance gone in level flight from the consumption of a given amount of fuel is unaffected by O.A.T.

2. **Flight profiles**

◀ The range charts are presented as continuous sorties with the following fuel allowances:

Start-up and taxi	450 lb
Take-off and acceleration to climb speed	295 lb
Descent and approach	800 lb (Mk.1)
	900 lb (Mk.4)
Landing	1600 lb

The fuel for the climb is estimated from the data of Part 3. Range is credited for the climb *(at 450 kts/0.9M)* but not for the descent. ▶

These profiles apply strictly only to standard conditions since the climb performance and, therefore, the amount of fuel available for cruising varies with O.A.T. Since, however, the climb fuel is small compared with the cruise fuel the effect of O.A.T. will be small. For cruising heights above 36,000 ft the effect will, of course, be greater.

The range charts are plotted as distance-to-go against fuel available. Each chart gives the range for various subsonic cruising speeds including the optimum.

3. **Supersonic cruise**

Fig.4.8 to 4.11 give the supersonic values of a.n.m./100 lb and lb/min ÷ $\sqrt{t}$ as a carpet graph *(see Introduction)* in terms of M and altimeter height for a given mean cruise weight both with and without reheat.

Boundaries are plotted across the carpet *(green for no reheat and red for reheat)* for the following engine settings.

(a) intermediate 97.5% r.p.m./740°C J.P.T. and

(b) maximum 100% r.p.m./775°C J.P.T. for three values of O.A.T. -36.5°C, -56.5°C and -76.5°C

A reheat temperature of 1400°K is assumed. All points lying to the right of any boundary are outside, those lying to the left are inside, this engine limit.

Examples:

Find the supersonic cruise data for the aircraft with ventral tank +2 Firestreaks at

(a) 36,000 ft and 1.4M at -56.5°C

From 4.10, this flight condition is outside the maximum engine setting without reheat. With reheat it is within the intermediate setting, the a.n.m./100 lb = 3.9 and the lb/min ÷ $\sqrt{t}$ = 397 *(from 4.11)*. From 4.1 the lb/min corrected for temperature = 346.

(b) 41,000 ft, 1.07M and -70°C

From 4.10, this point is outside the maximum engine setting at -70°C without reheat but within the intermediate setting with reheat.

The a.n.m./100 lb = 5.3

From 4.11 lb/min ÷ $\sqrt{t}$ = 218

From 4.1 lb/min at -70°C = 183

(c) at intermediate rating 97.5% r.p.m./740°C and -56.5°C at 39,000 ft

From 4.10 M = 1.02 a.n.m./100 lb = 7.9 without reheat
M = 1.68 a.n.m./100 lb = 3.8 with reheat

From 4.11 M = 1.02 lb/min ÷ $\sqrt{t}$ = 144 without reheat
M = 1.68 lb/min ÷ $\sqrt{t}$ = 493 with reheat

From 4.1 at -56.5°C
lb/min = 125 without reheat
lb/min = 425 with reheat

Note 1

t = relative air temperature

$$= \frac{\textit{O.A.T. in degrees absolute}}{288}$$

O.A.T. = outside air temperature

Note 2

The subsonic cruise consumption has been increased by 5% in all figures to allow for variations between aircraft.

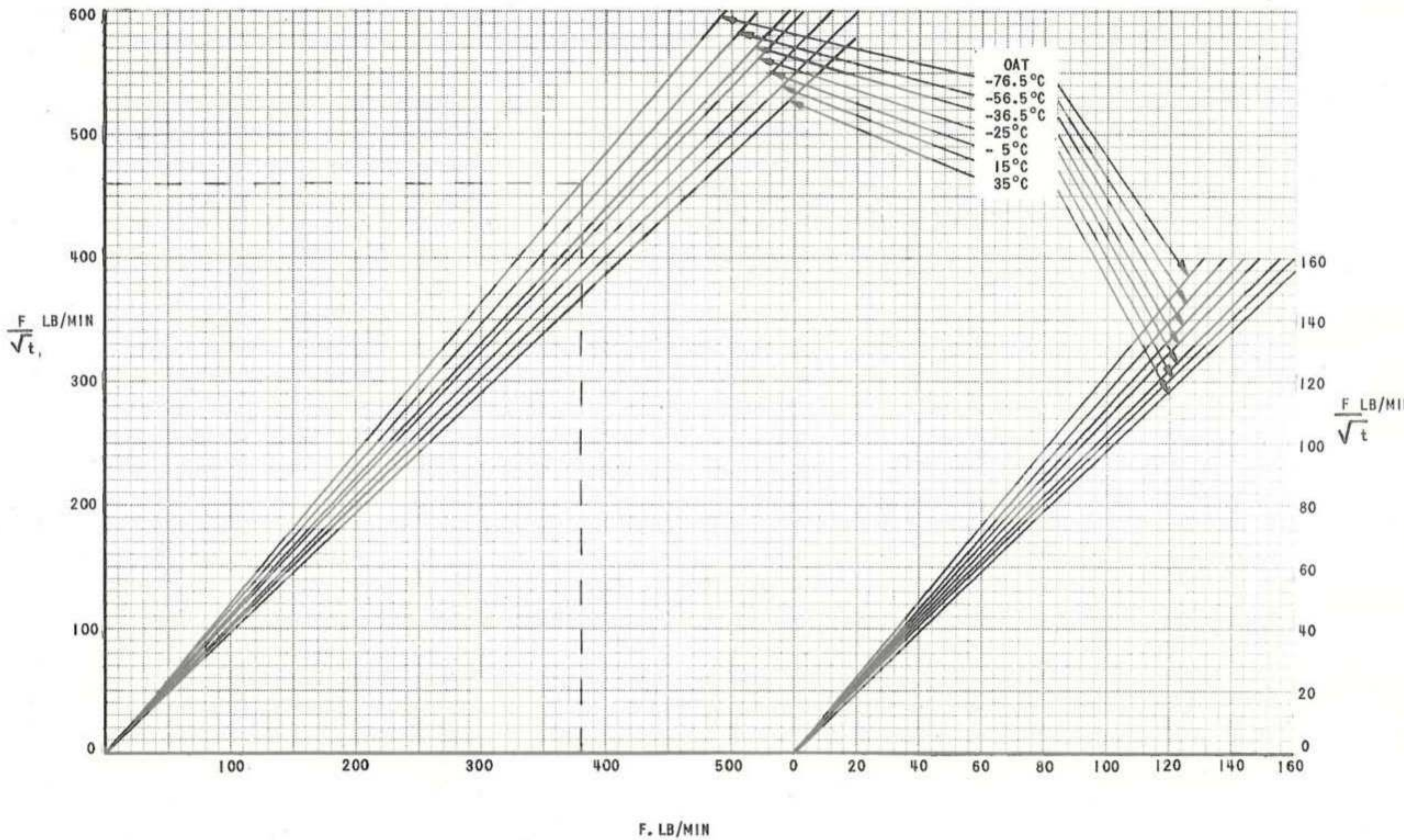


FIG.4.1. FUEL CONVERSION CHART

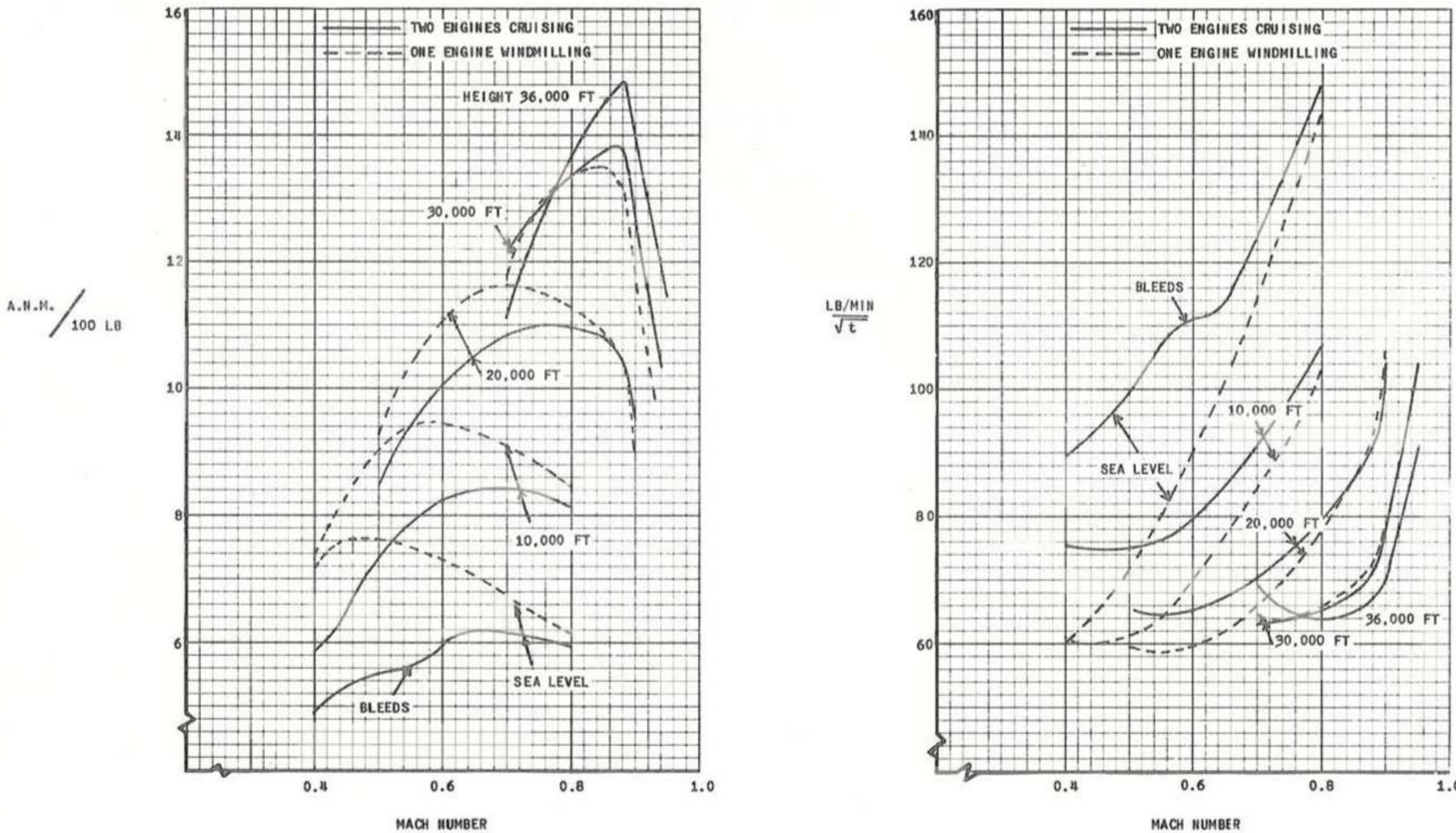
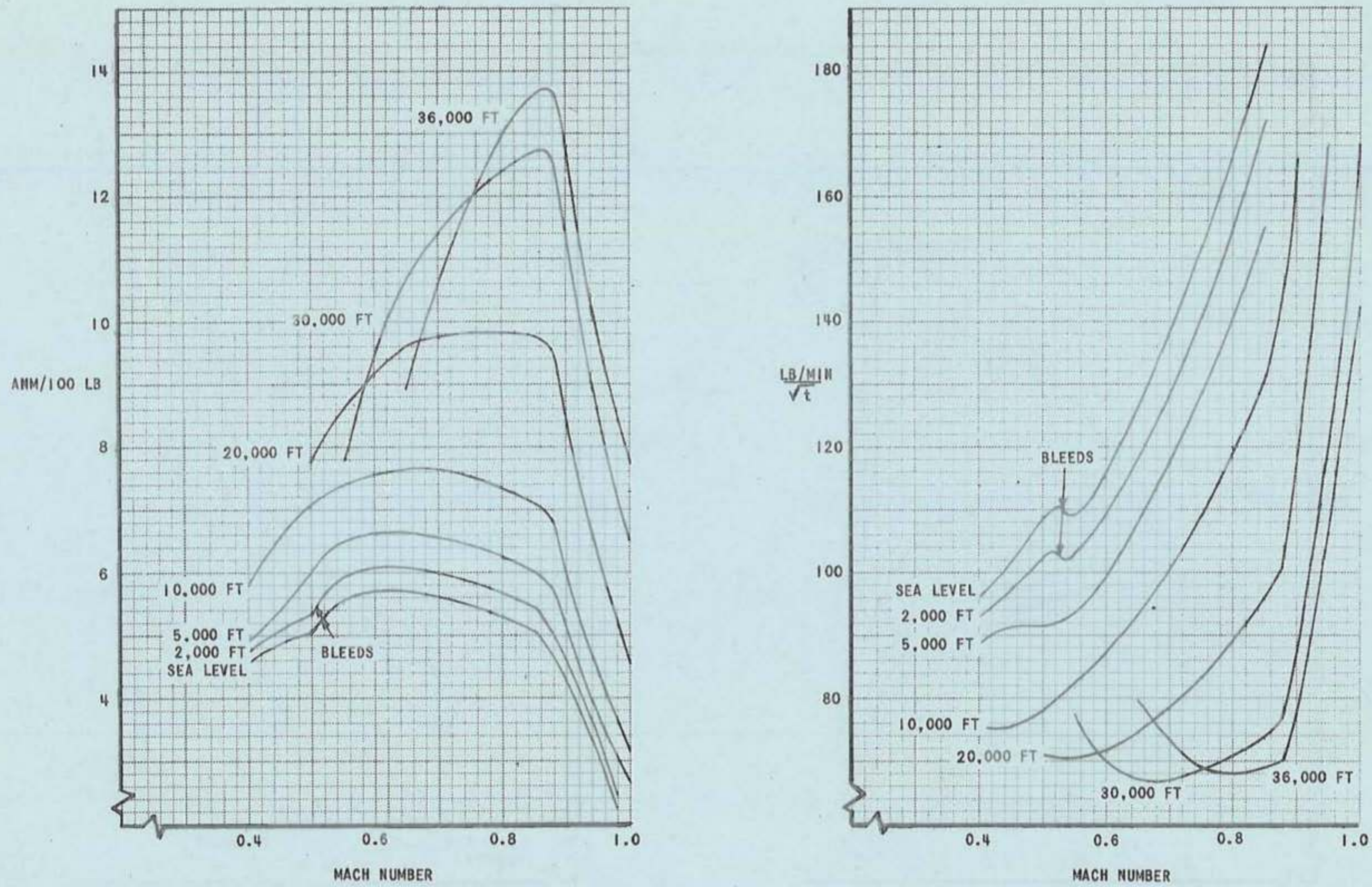
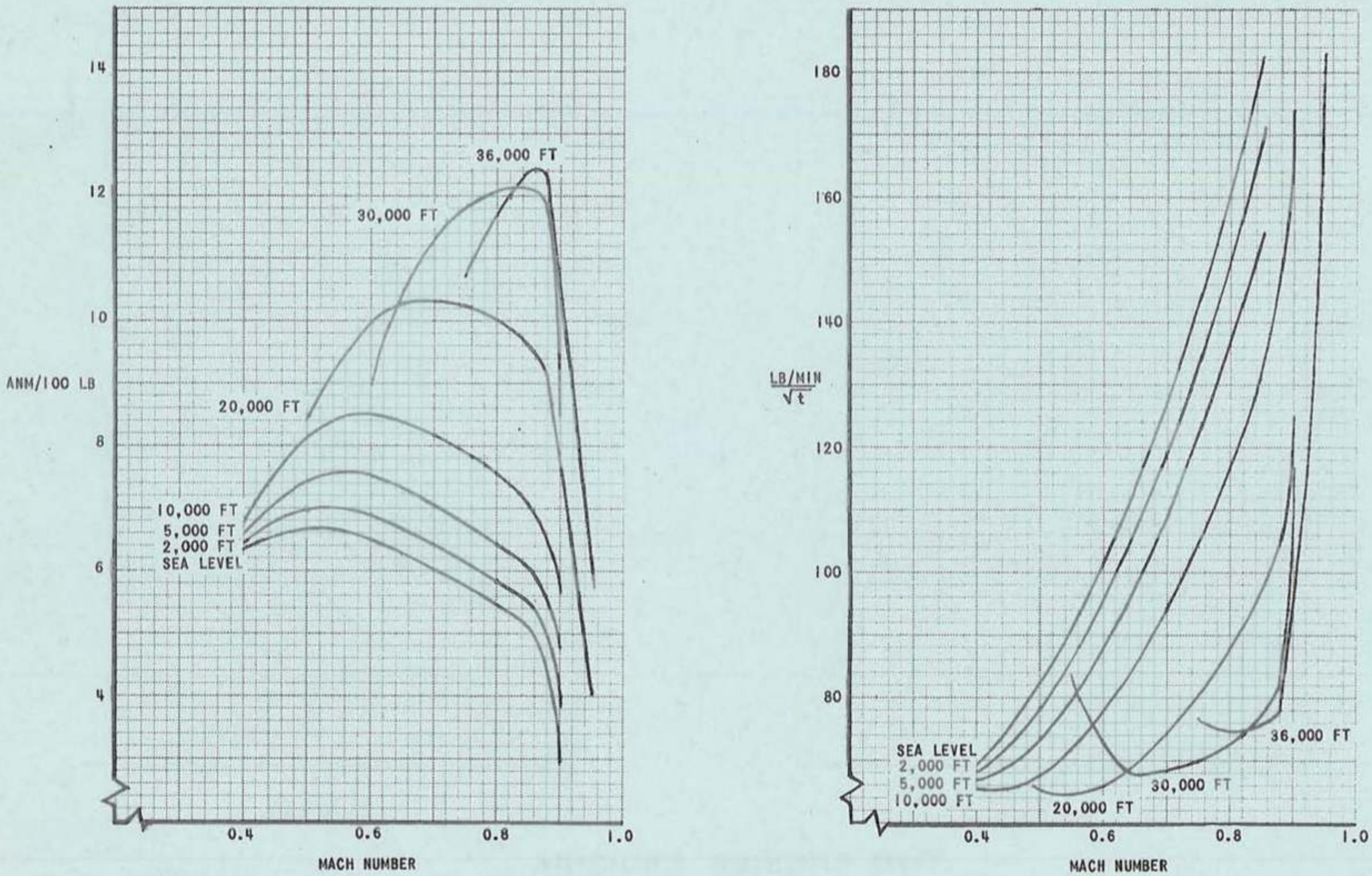


FIG.4·2. A.N.M./100 LB AND LB/MIN ÷ √t SUBSONIC 30,000 LB



TWO ENGINES CRUISING

FIG.4.2T. ANM/100LB AND LB/MIN/÷ √t – SUBSONIC – 30,000LB



ONE ENGINE WINDMILLING

FIG.4.2T/I. ANM/100LB AND LB/MIN/÷ √t – SUBSONIC – 30,000LB

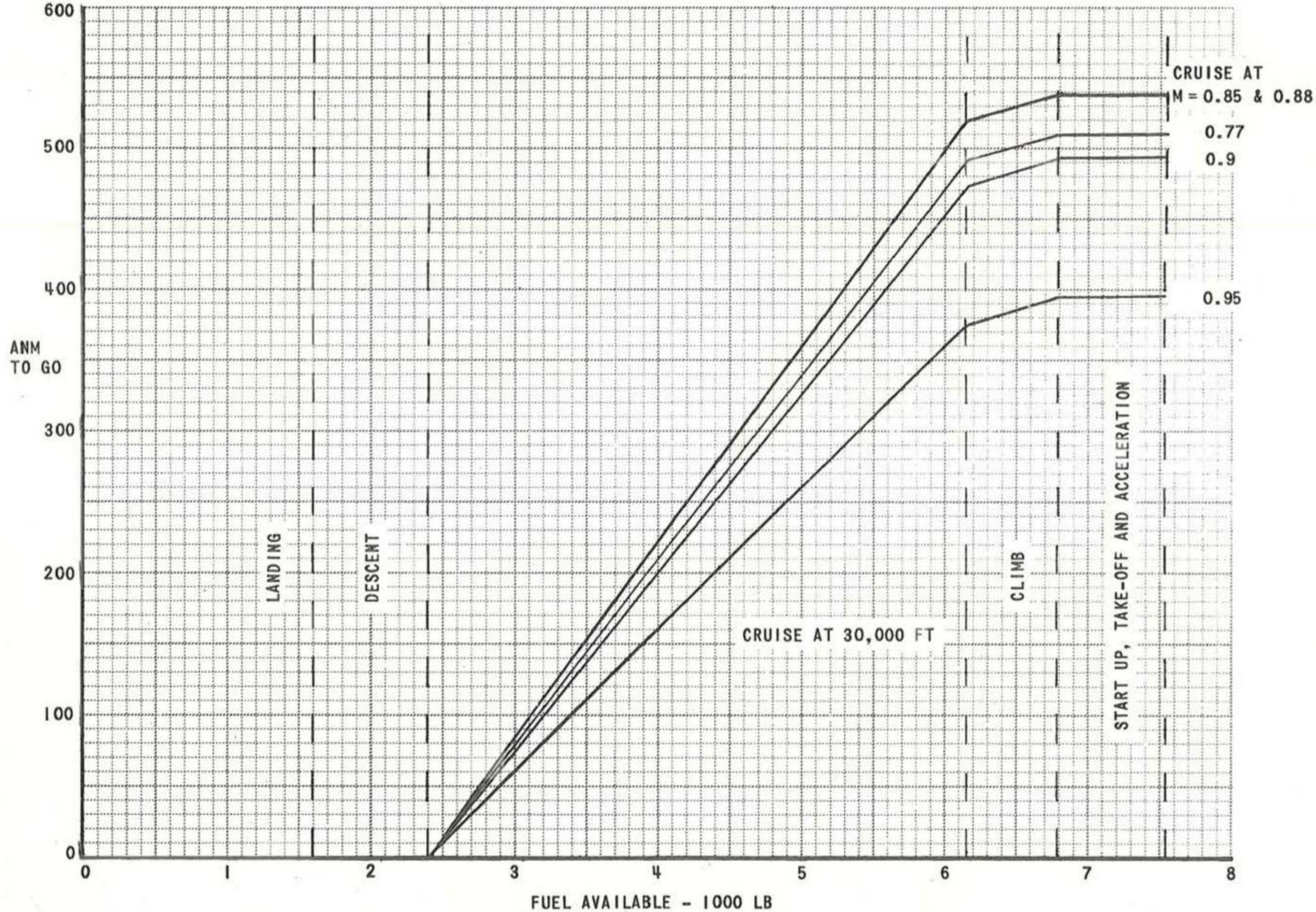


FIG.4.3. RANGE FOR SUBSONIC CRUISE AT 30,000FT. I.S.A.

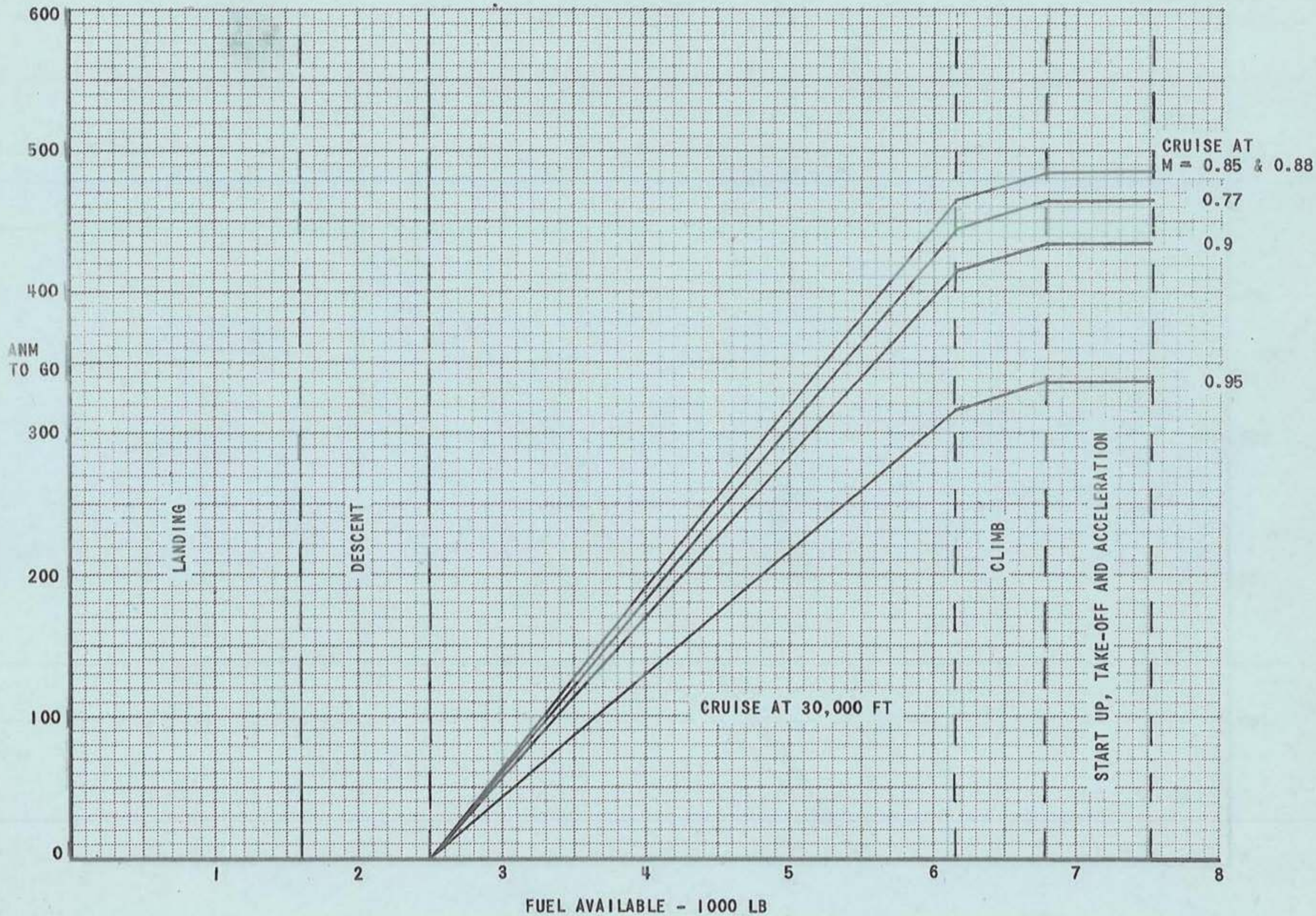


FIG.4.3T. RANGE FOR SUBSONIC CRUISE AT 30,000FT. I.S.A.

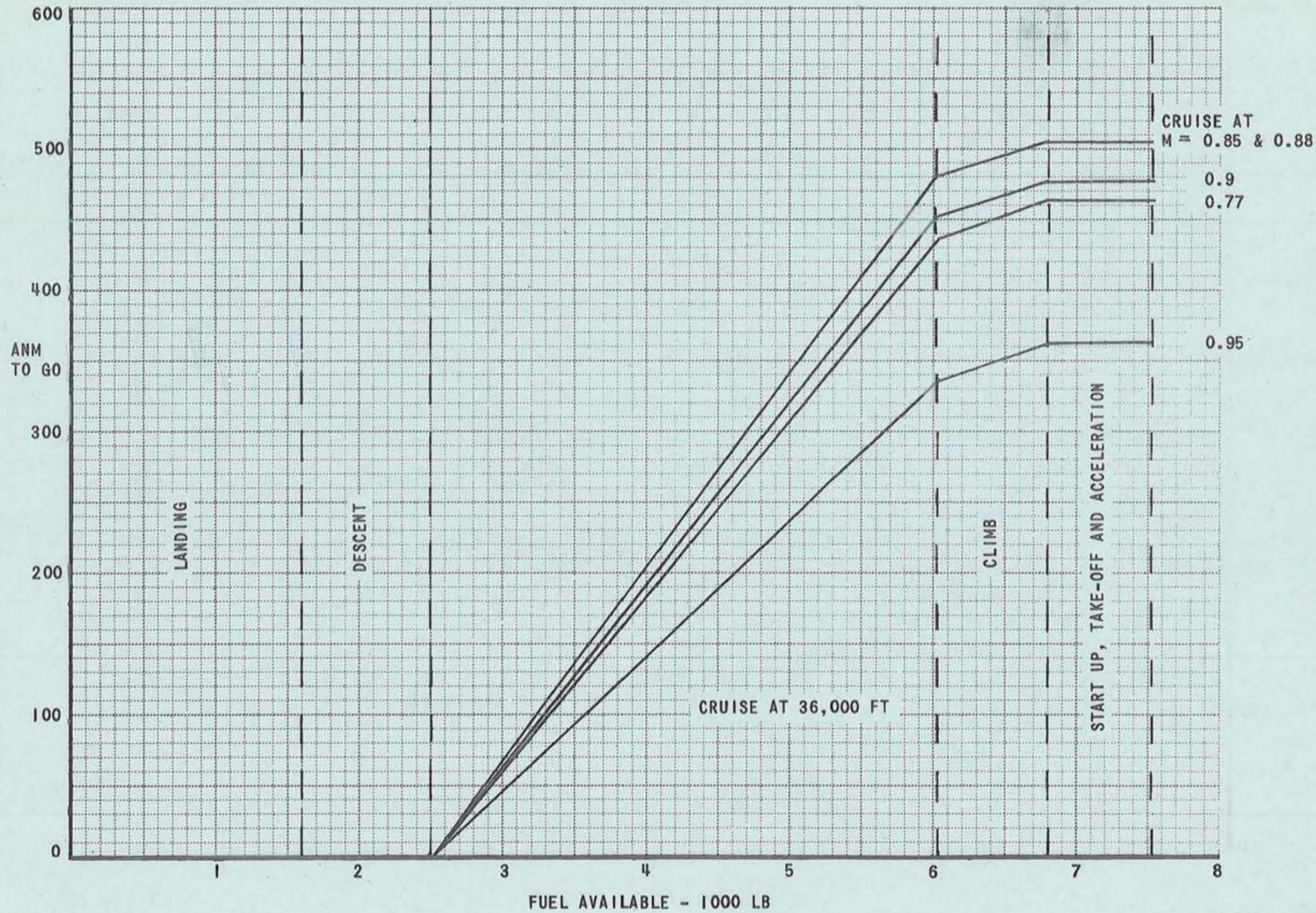


FIG.4.4T. RANGE FOR SUBSONIC CRUISE AT 36,000FT. I.S.A.

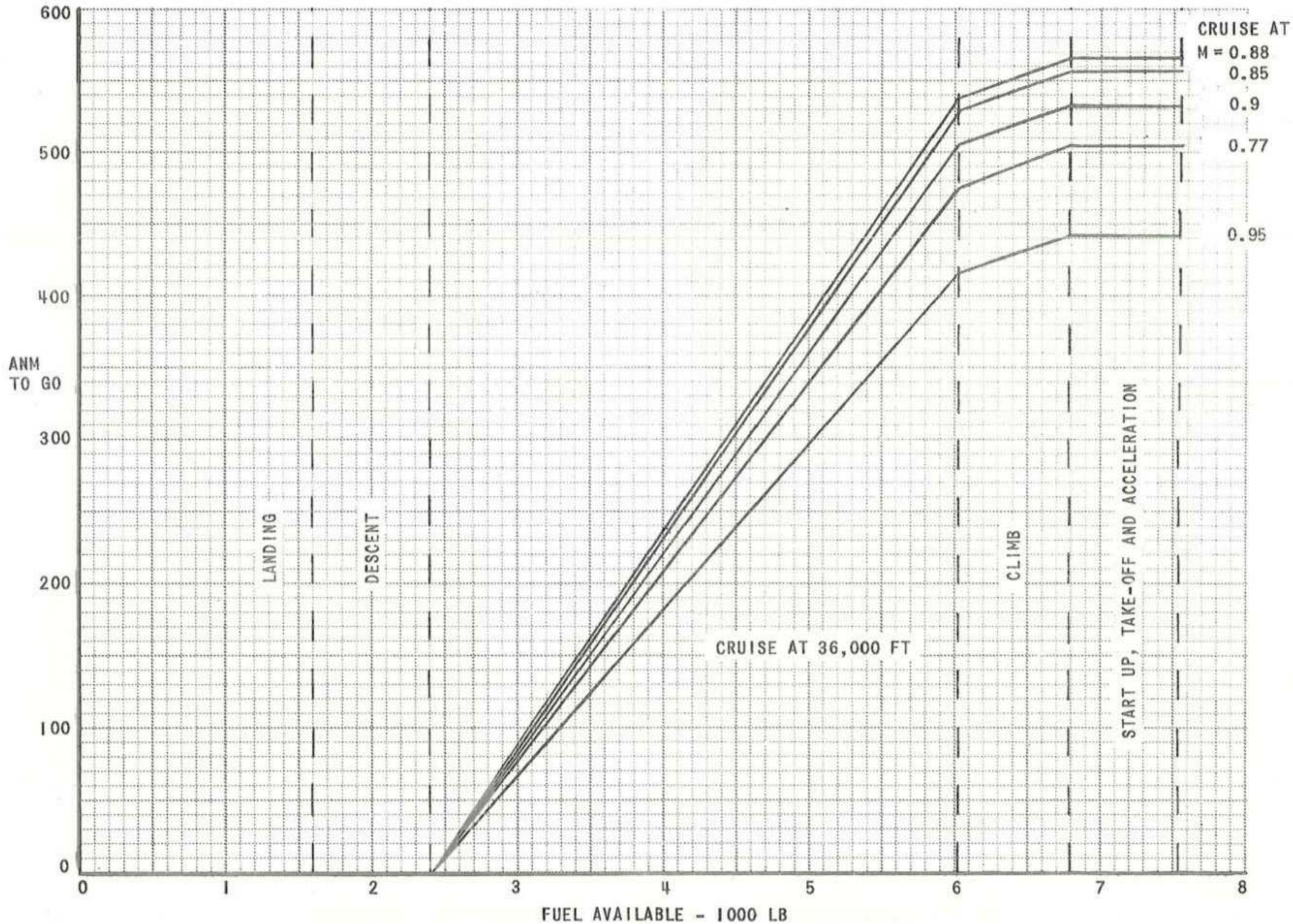


FIG.4.4. RANGE FOR SUBSONIC CRUISE AT 36,000FT. I.S.A.

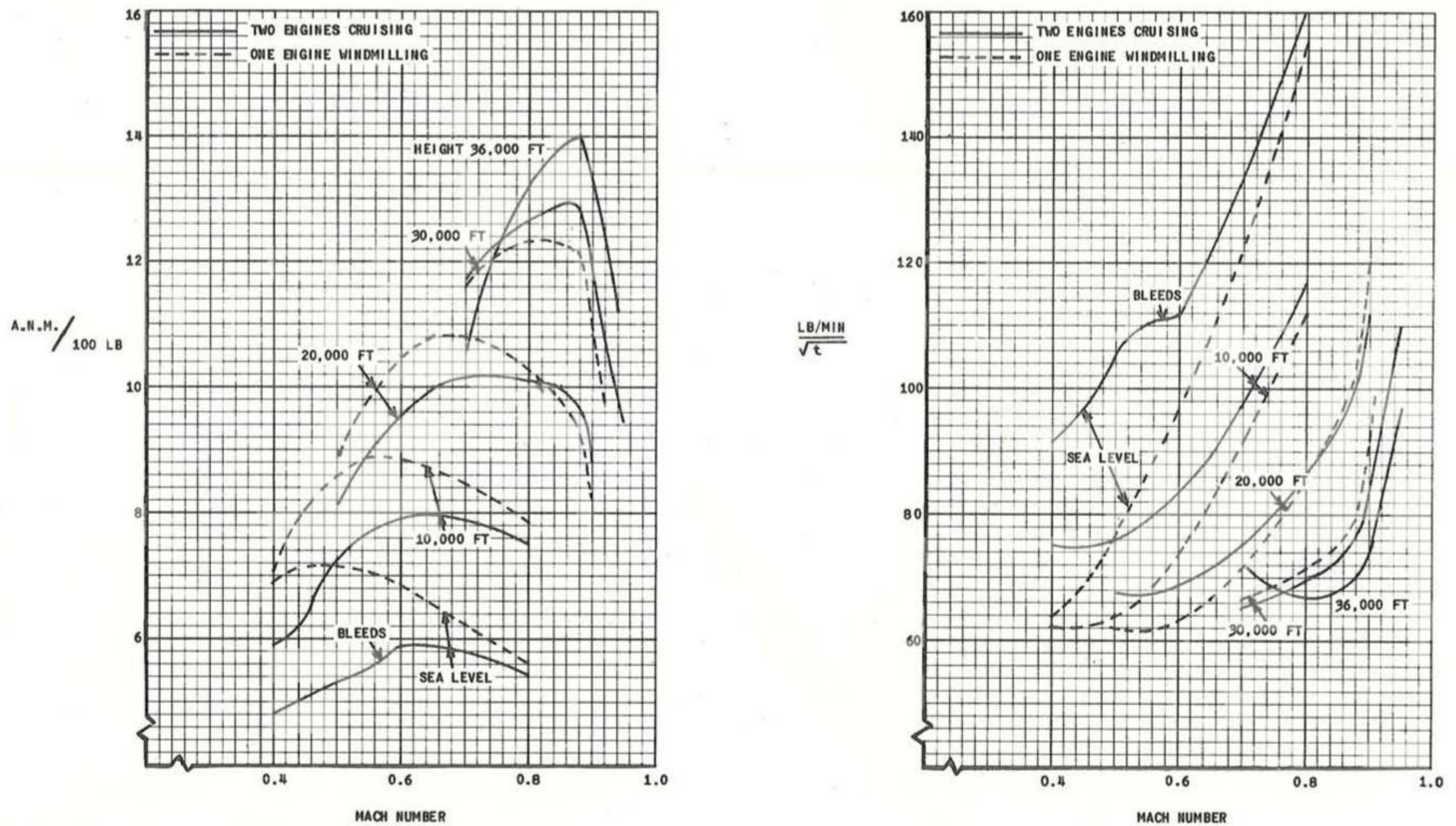
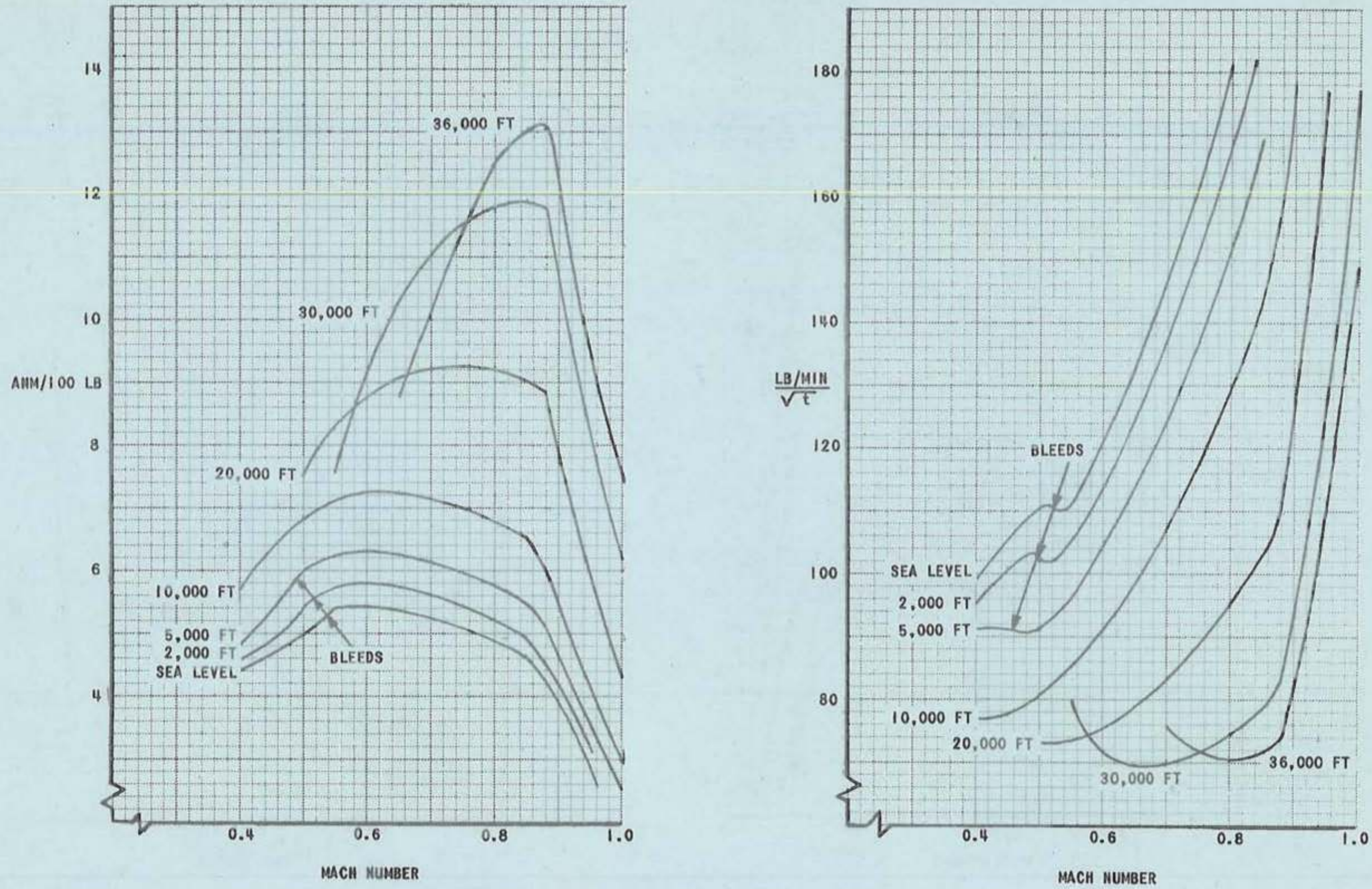
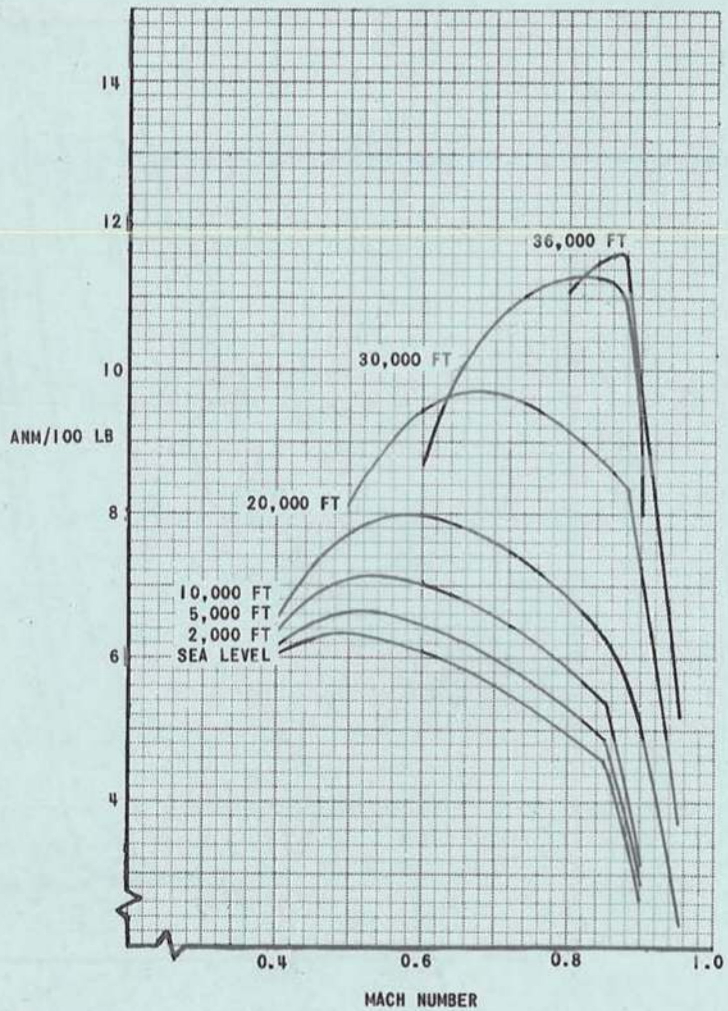


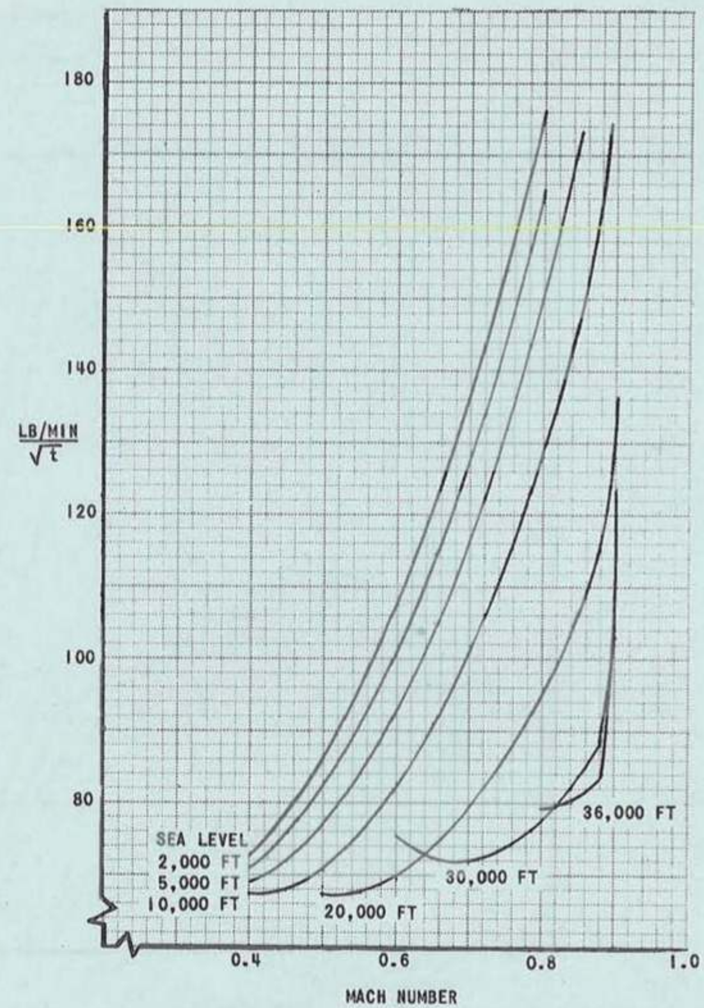
FIG. 4·5. A.N.M./100 LB AND LB/MIN ÷ √t SUBSONIC 30,000 LB



TWO ENGINES CRUISING

FIG.4.5T ANM/100LB AND LB/MIN/÷ $\sqrt{t}$ — SUBSONIC — 30,000LB





ONE ENGINE WINDMILLING

FIG.4.5T/1. ANM/100LB AND LB/MIN/÷ $\sqrt{t}$ – SUBSONIC – 30,000LB

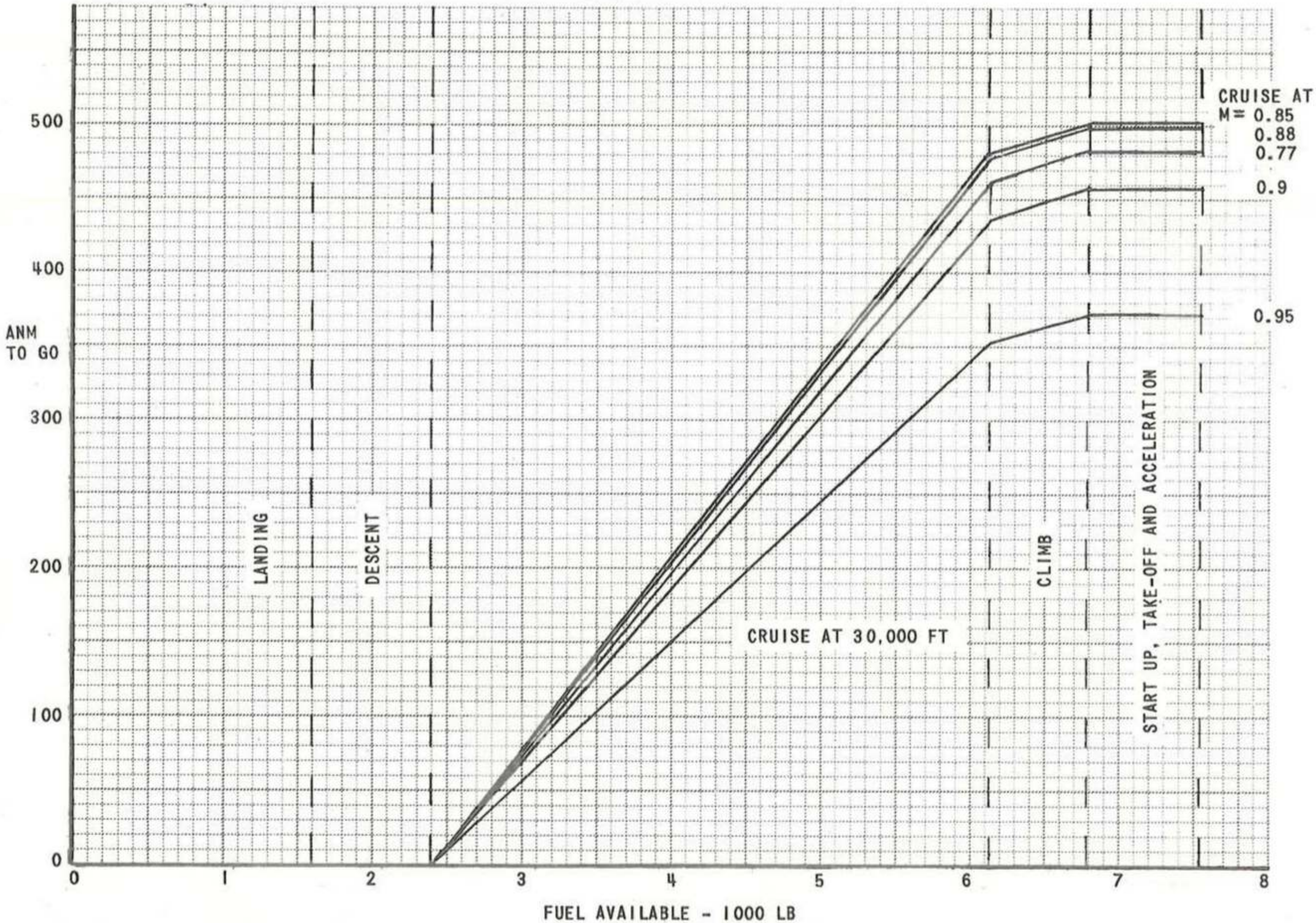


FIG.4.6 RANGE FOR SUBSONIC CRUISE AT 30,000FT. I.S.A.

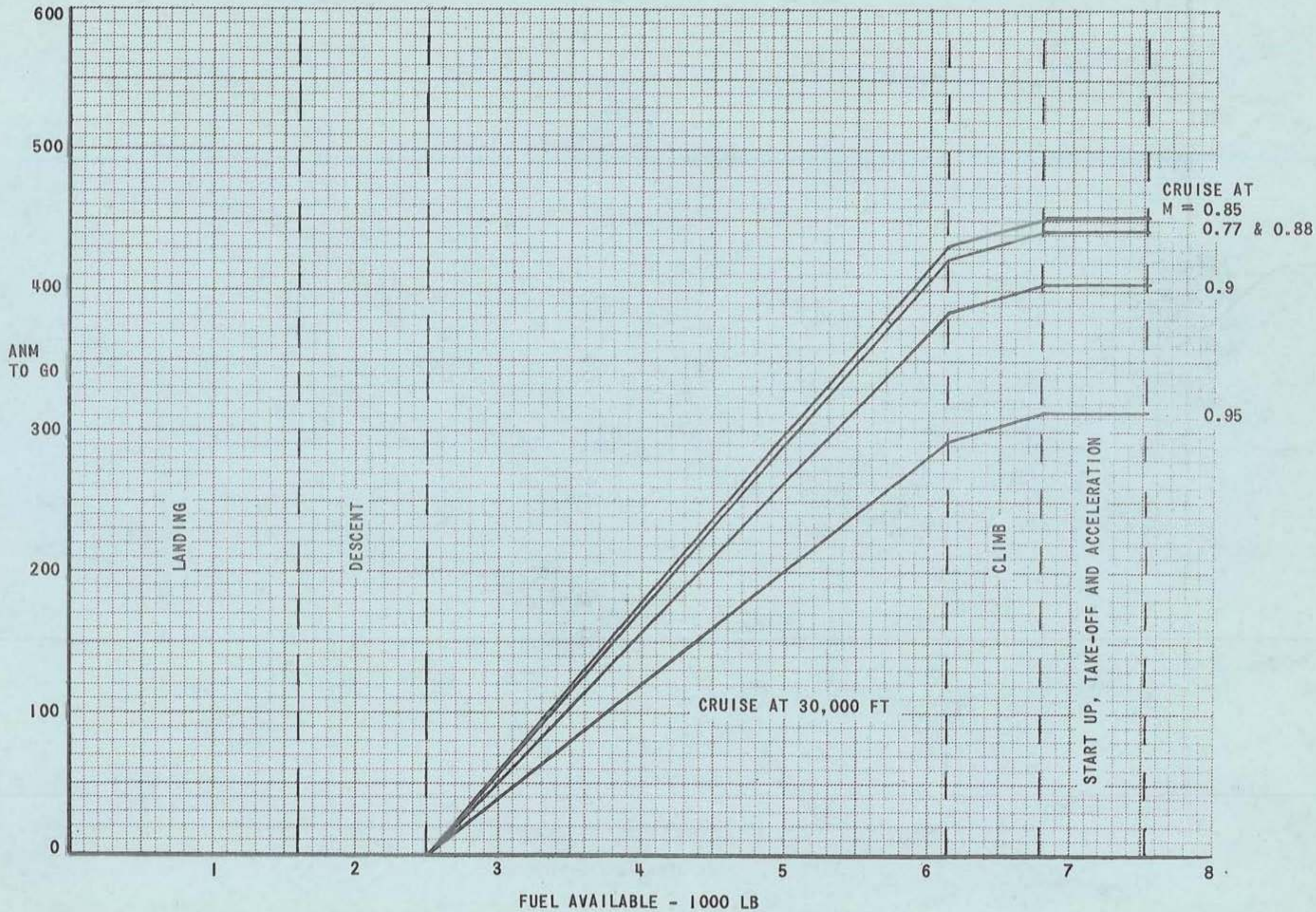


FIG.4.6T. RANGE FOR SUBSONIC CRUISE AT 30,000FT. I.S.A.

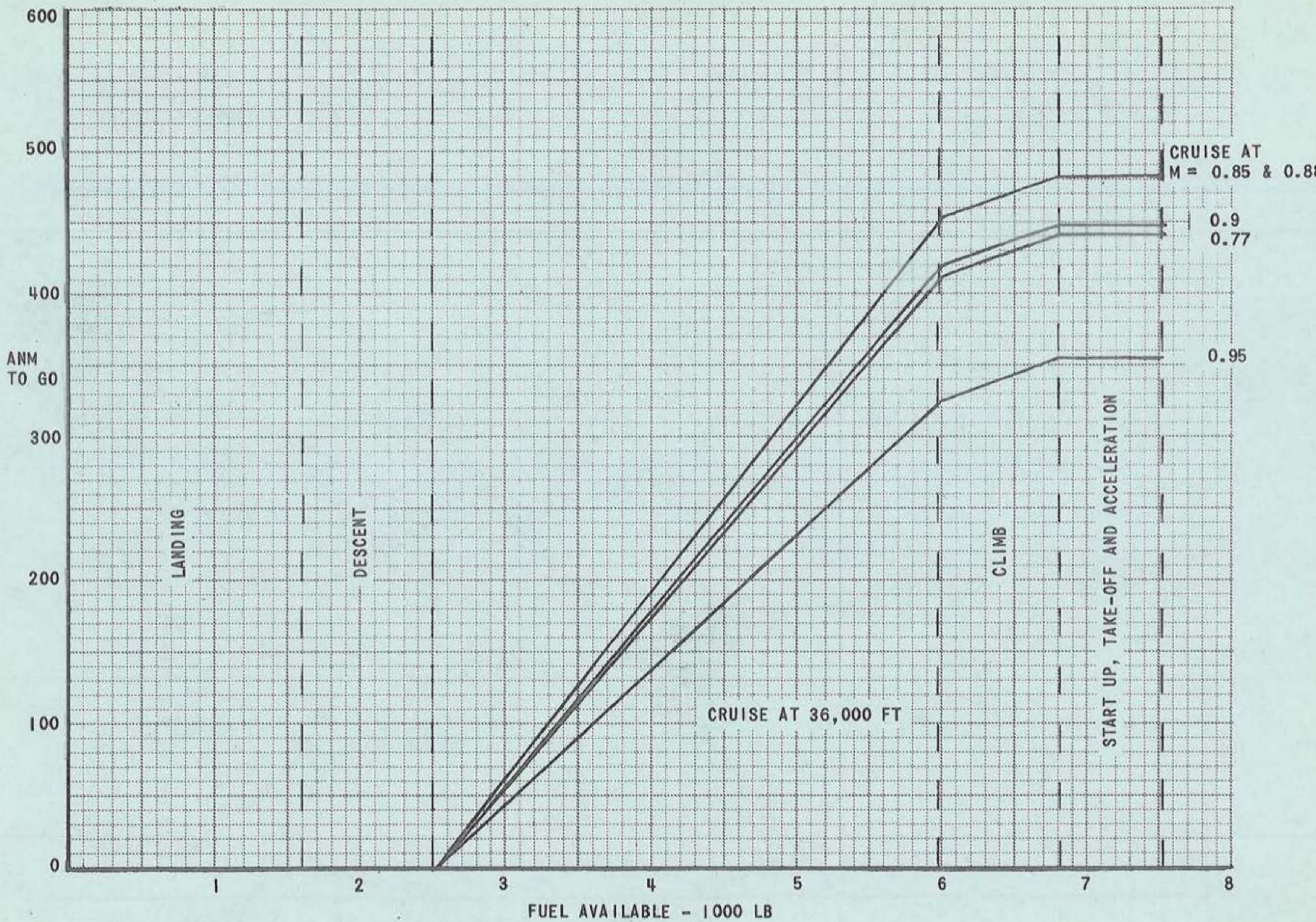


FIG.4.7T. RANGE FOR SUBSONIC CRUISE AT 36,000FT. I.S.A.

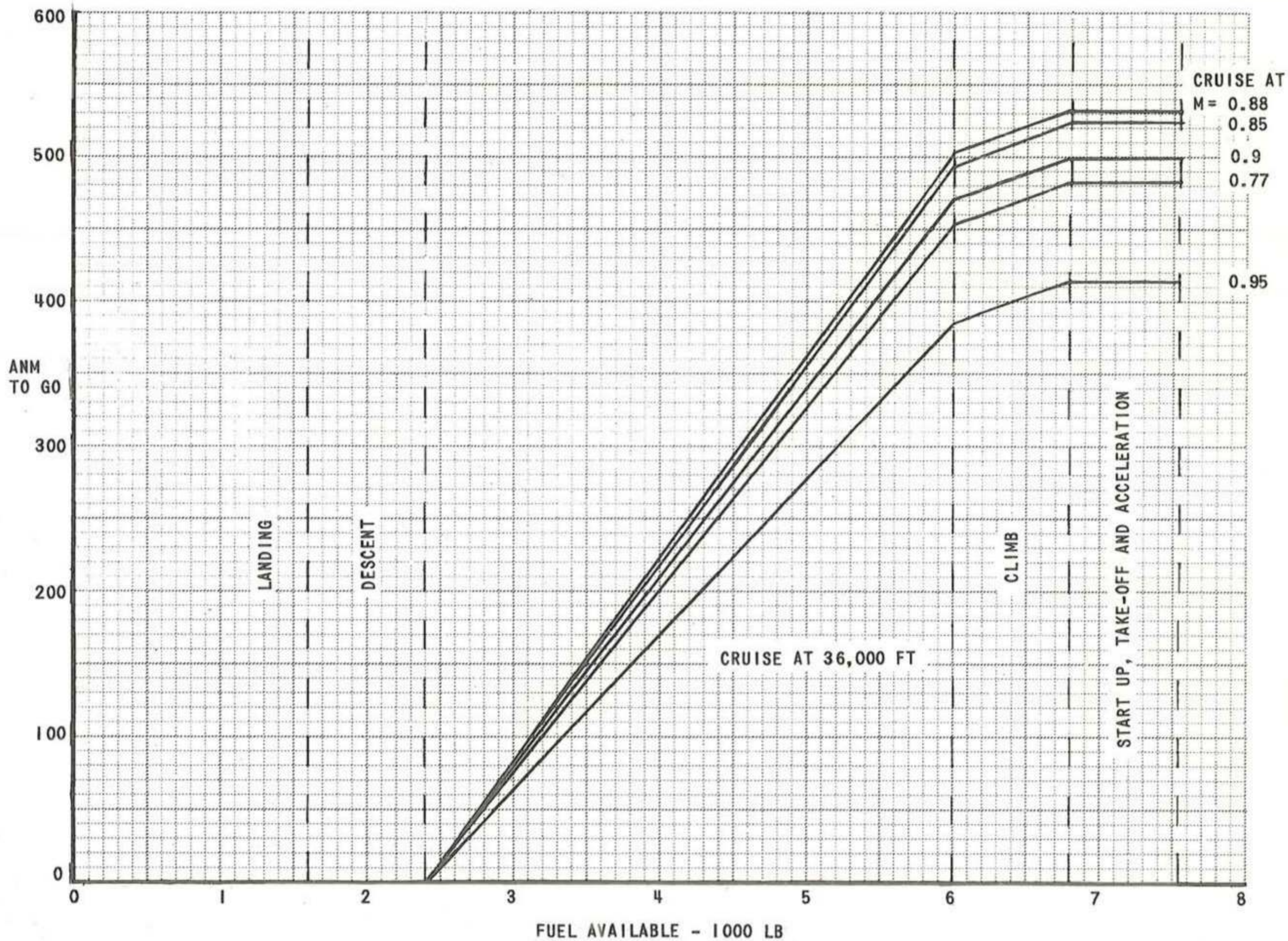


FIG.4.7. RANGE FOR SUBSONIC CRUISE AT 36,000FT. I.S.A.

LIGHTNING T MK. 4 ONLY

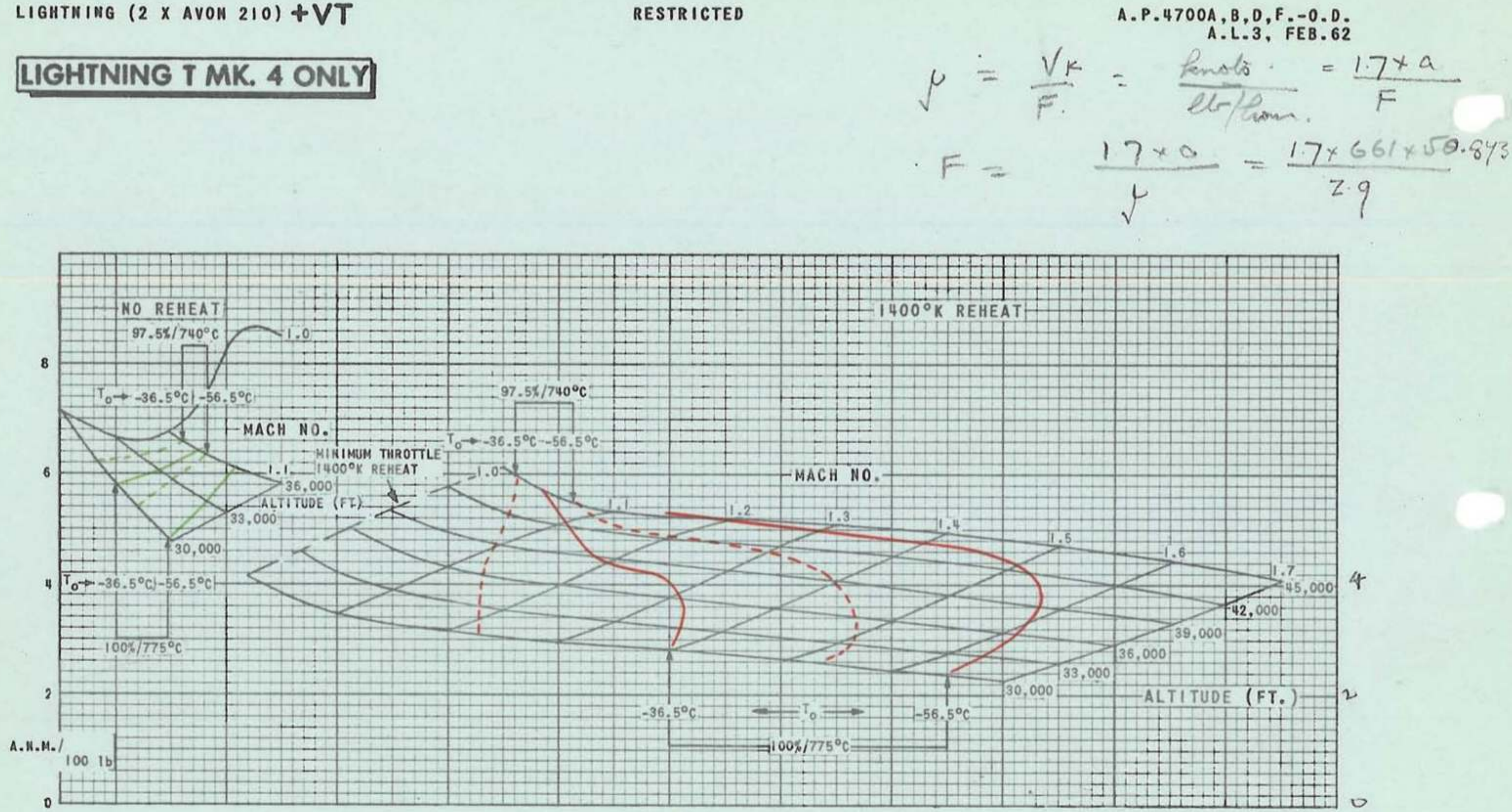


FIG. 4·8T. SUPERSONIC A.N.M./100LB-WITH AND WITHOUT REHEAT-32,000LB

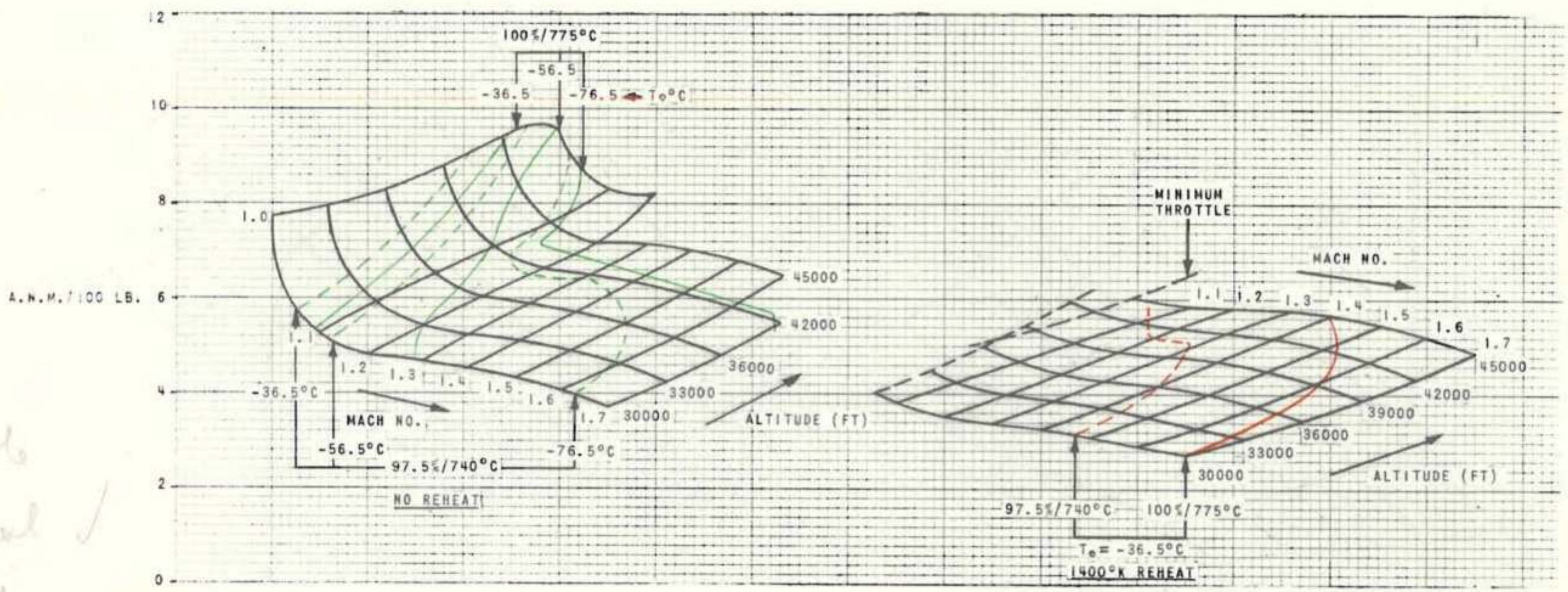


FIG. 4·8. SUPERSONIC A.N.M./100lb. WITH & WITHOUT REHEAT. VENTRAL TANK 30000 LB.

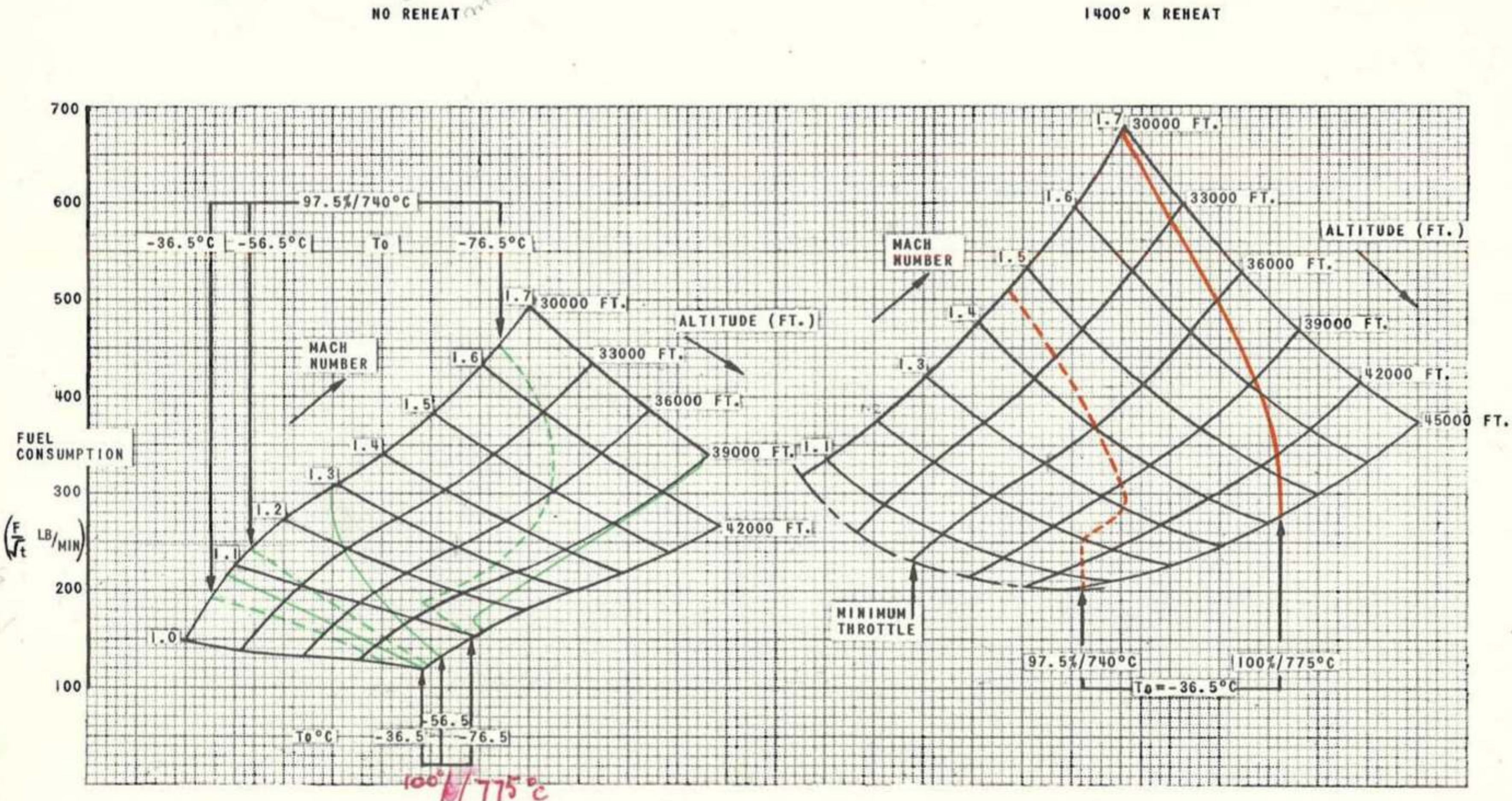


FIG.4-9. SUPERSONIC LB/MIN. ÷ $\sqrt{t}$. WITH & WITHOUT REHEAT — VENTRAL TANK.-30000 LB

LIGHTNING T MK. 4 ONLY

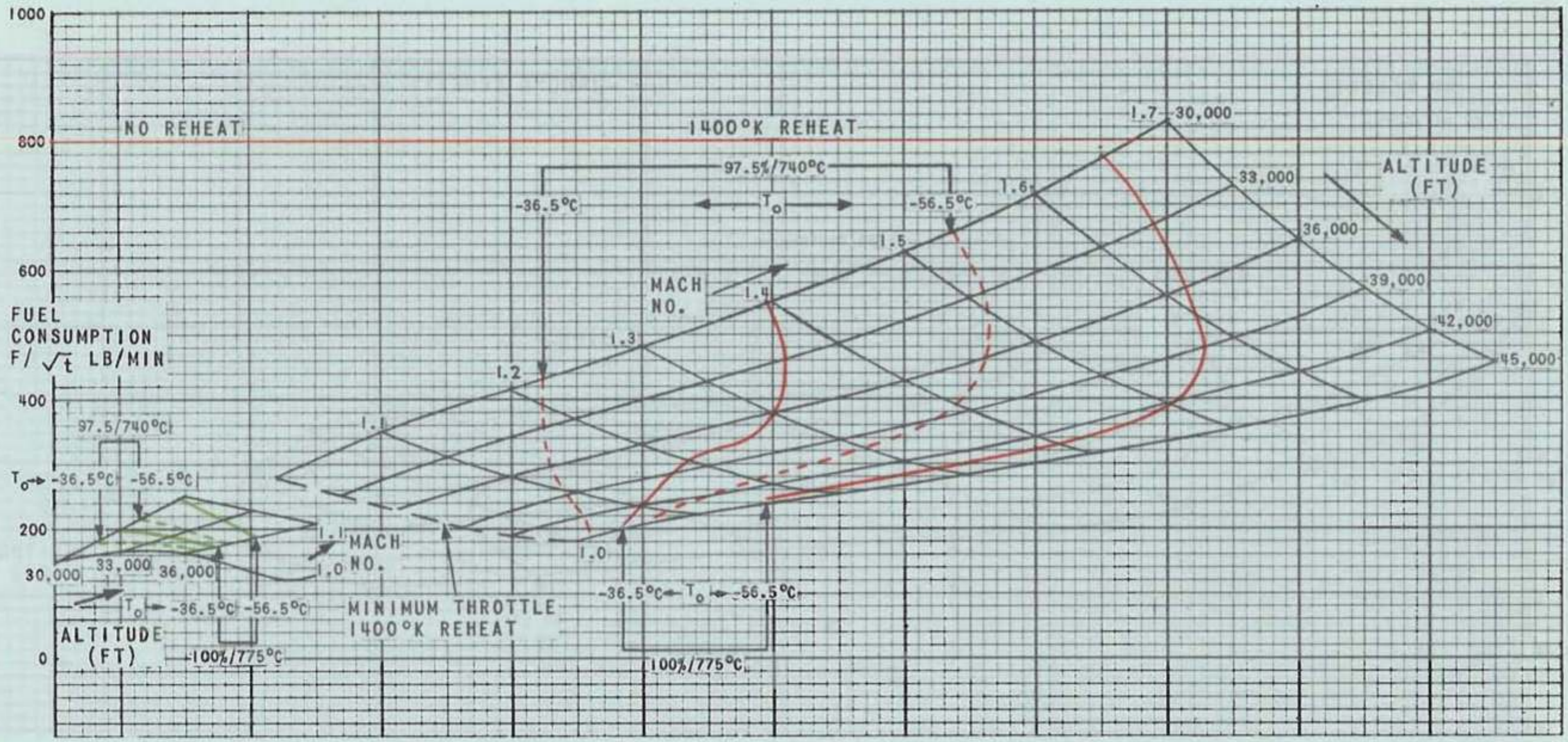


FIG. 4·9T. SUPERSONIC LB/MIN÷$\sqrt{t}$ – WITH AND WITHOUT REHEAT — 32,000 LB

LIGHTNING T MK. 4 ONLY

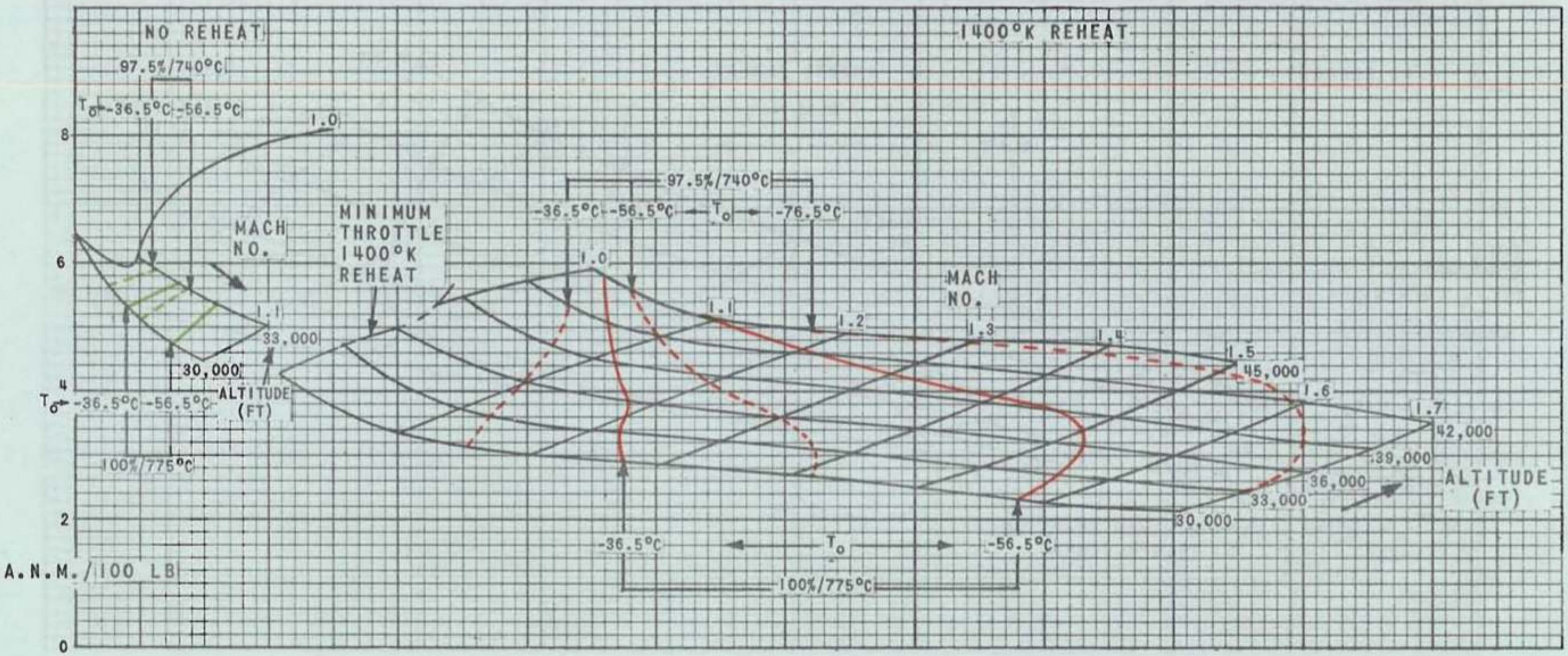


FIG. 4·10T. SUPERSONIC A.N.M./100LB WITH AND WITHOUT REHEAT—32,000LB

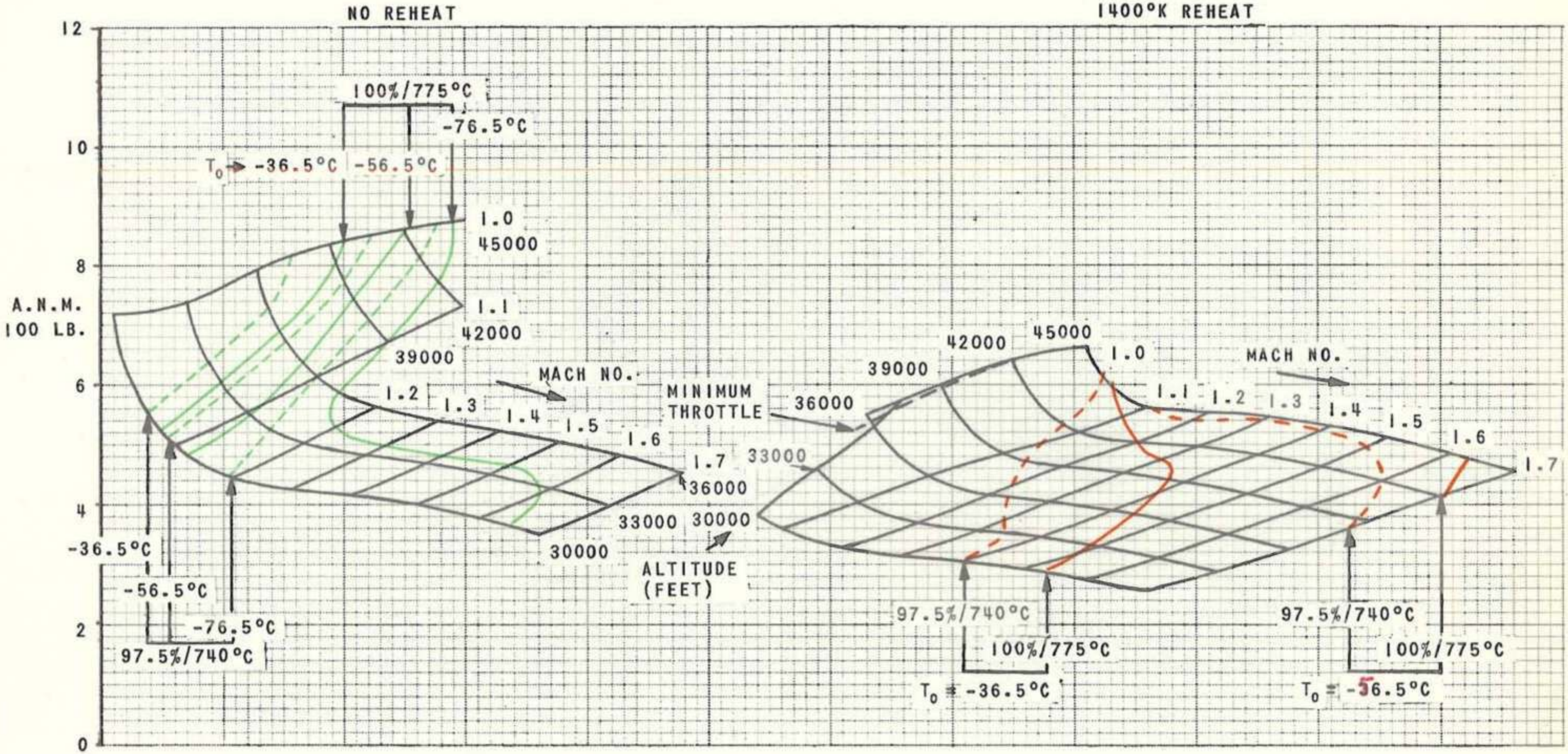


FIG. 4·10. SUPERSONIC A.N.M./100 LB. WITH & WITHOUT REHEAT. VENTRAL TANK & 2 FIRESTREAKS. 32000 LB

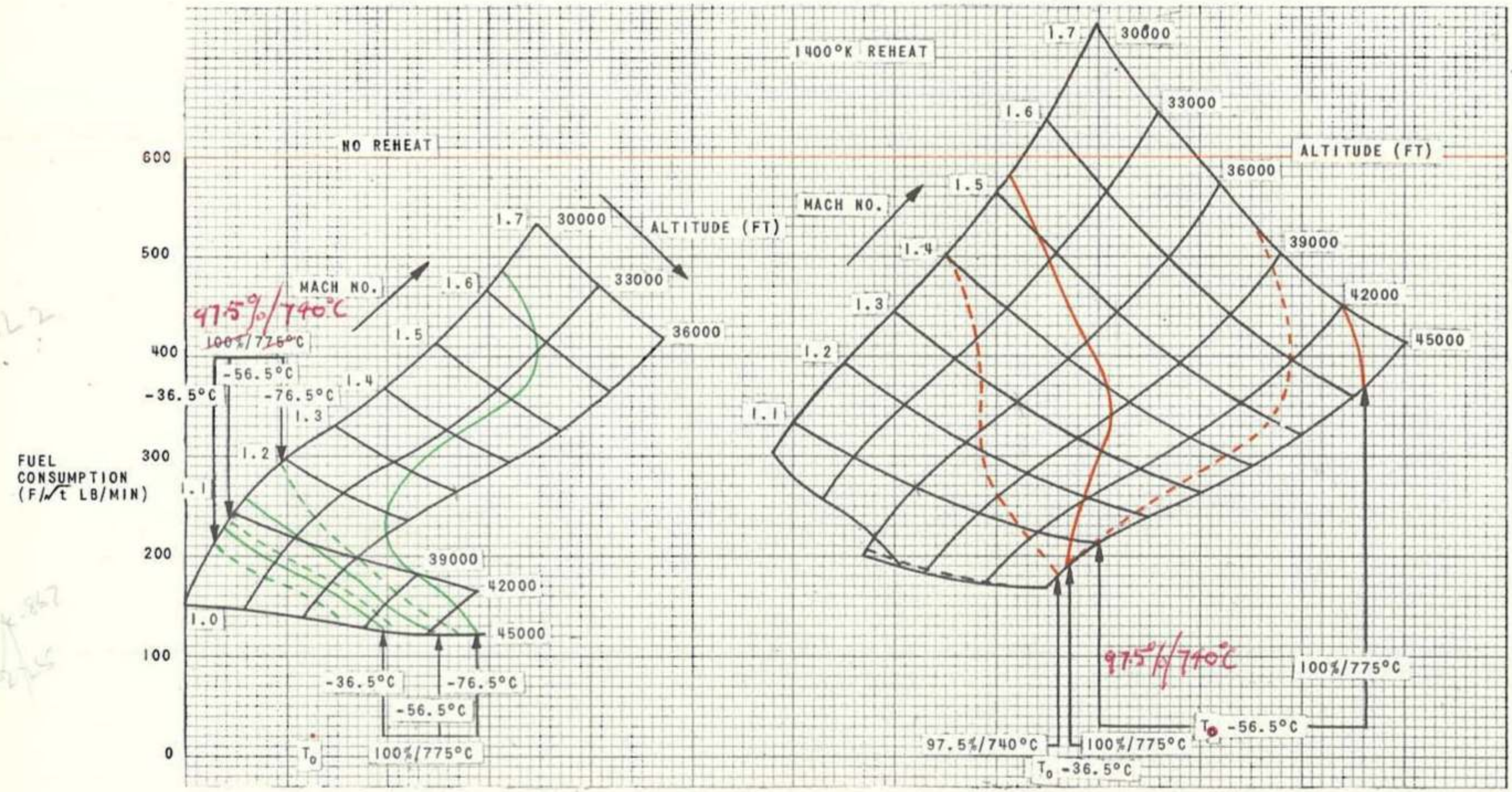


FIG. 4·11. SUPERSONIC LB/MIN ÷ √t WITH & WITHOUT REHEAT VENTRAL TANK & 2 FIRESTREAKS 32000 LB.

LIGHTNING T MK. 4 ONLY

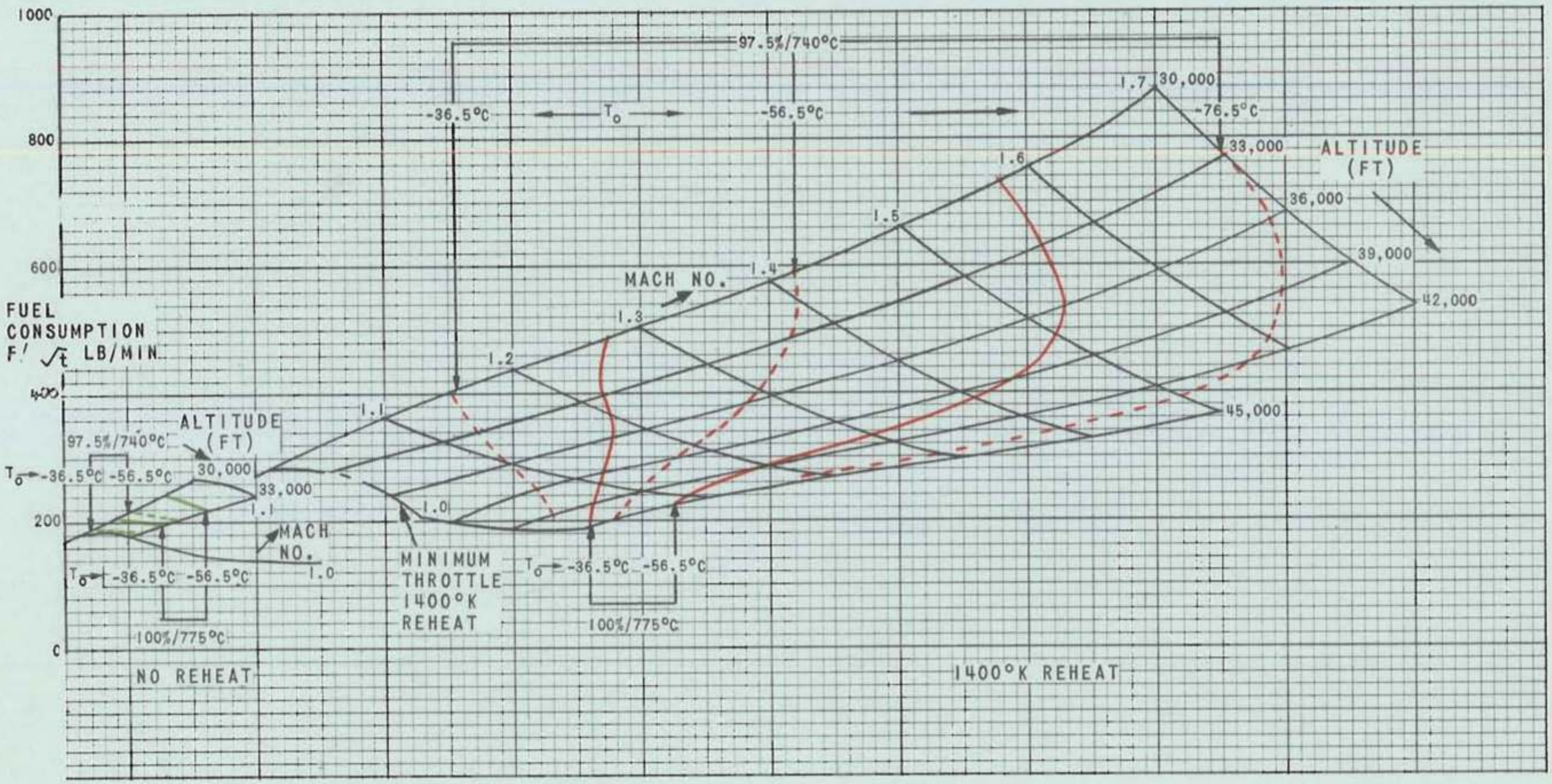


FIG. 4·11T. SUPERSONIC LB/MIN ÷ $\sqrt{t}$ – WITH AND WITHOUT REHEAT – 32,000LB


847
DANGER
CANOPY
DANGER
EJECTION SEAT
ENTRANCE OTHER SIDE