PART 4 CRUISE

◀ LIST OF FIGURES (F Mk.3 aircraft - white leaves)

LIST OF FIGURES (T Mk.5 aircraft - coloured leaves)

1. **Temperature correction**

(a) When flying at constant M and constant altimeter height the fuel flow *(lb/min)* is increased at high OAT and decreased at low OAT *(being in fact proportional to* $\sqrt{t}$*)*.

A plot of lb/min / $\sqrt{t}$ against M and altimeter height is therefore correct for both standard and non-standard temperature conditions.

Fig. 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 Fig. 4.1.

lb/min = 380 at -76.5°C

(b) anm/100 lb is independent of OAT at constant M and constant altimeter height and no correction for temperature is required. If follows that total distance gone in level flight for the consumption of a given amount of fuel is unaffected by OAT.

2. **Flight profiles**

(a) The range charts are presented as continuous sorties, fuel being allowed for start up and taxy *(450 lb)*, take-off *(210 lb)*, acceleration to climb speed *(240 lb)*, descent *(900 lb Mk.3 aircraft, 1,000 lb Mk.5)* and landing *(1,600 lb)*. The fuel for the climb is estimated from the data of Part 3. Range is credited for climb *(at 450 kts/0.87M)* but not for the descent.

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

(c) The range profiles 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. 4.10 - 4.17 give the supersonic values of anm/100 lb and lb/min/ $\sqrt{t}$ as a carpet graph in terms of M and altimeter height for a given mean cruise weight both with and without reheat. The 650 kt IAS line is also shown. Boundaries are plotted across the no reheat carpet for *(maximum)* 100% RPM/790°C JPT for five values of OAT, -36.5°C, -46.5°C, -56.5°C, -66.5°C and -76.5°C in green. All points lying to the right of any boundary are outside, those lying to the left are inside, this engine limit. On the reheat carpet boundaries are plotted in red for minimum reheat *(1300°K)*, 100% RPM/790°C JPT for four values of OAT, -36.5°C, -46.5°C, -56.5°C and -66.5°C. Maximum reheat *(1600°K)*, 100% RPM/790°C JPT for OAT of -36.5°C is shown in blue; lower OAT's are beyond the limits of the carpet.

Example (A)

Find the supersonic cruise data for the aircraft with 250-gal ventral tank at 36,000 ft and 1.2M at -56.5°C.

From Fig. 4.10.

This flight condition is inside the maximum engine setting without reheat, and anm/100 lb = 5.45.

From Fig. 4.12

lb/min/ $\sqrt{t}$ = 240

From Fig.4.1

The lb/min corrected for temperature = 210

Example (B)

Find the supersonic cruise data for the aircraft with 250-gal ventral tank and two Red Tops at 30,000 ft and 1.5M at -56.5°C.

From Fig.4.14

This flight condition is outside the maximum engine setting without reheat.

From Fig.4.15

anm/100 lb = 2.98

From Fig.4.17

$\text{lb/min} / \sqrt{t} = 550$

From Fig.4.1

The lb/min corrected for temperature = 478

Note...

(1) *The cruise fuel consumption has been increased by 5% in all the Figures to allow for variations between aircraft.*

(2) *The effect of the flight refuelling probe should be taken as one quarter of the difference due to missiles.*

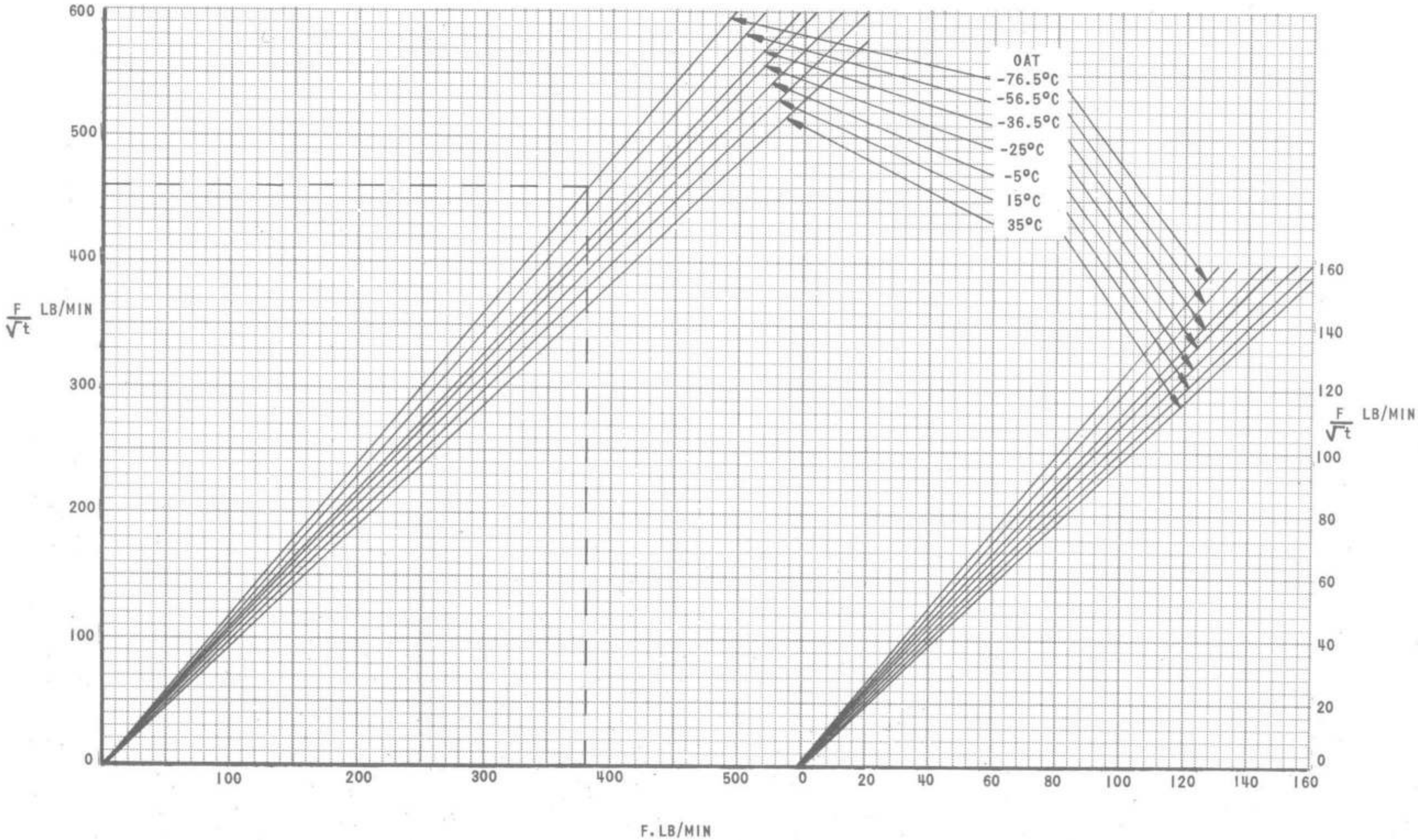
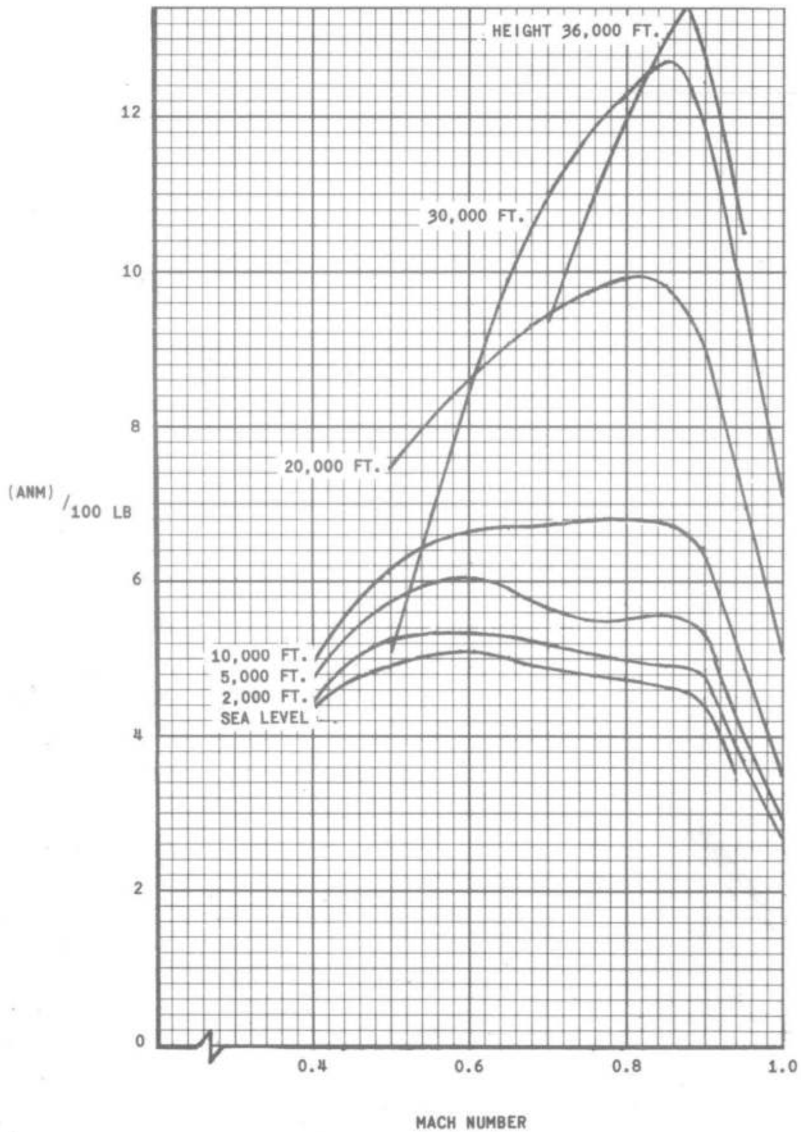


FIG.4.1. FUEL CONVERSION CHART



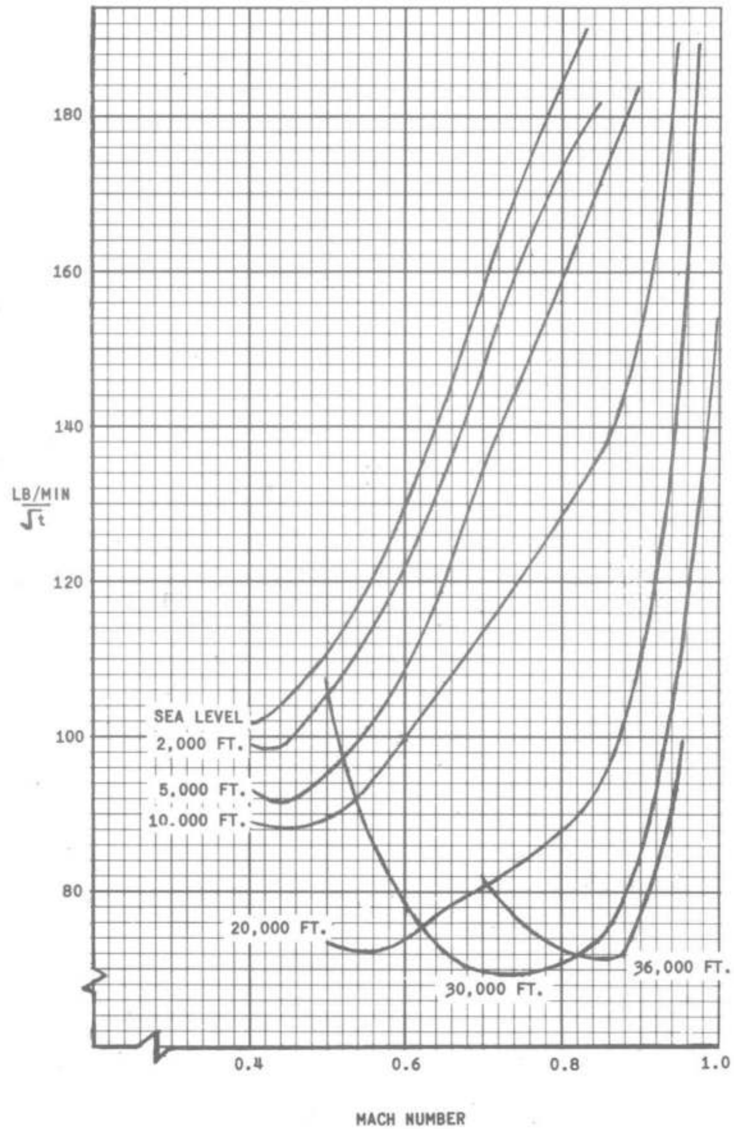


FIG. 4·2. ANM/100LB AND LB/MIN /√t - SUBSONIC

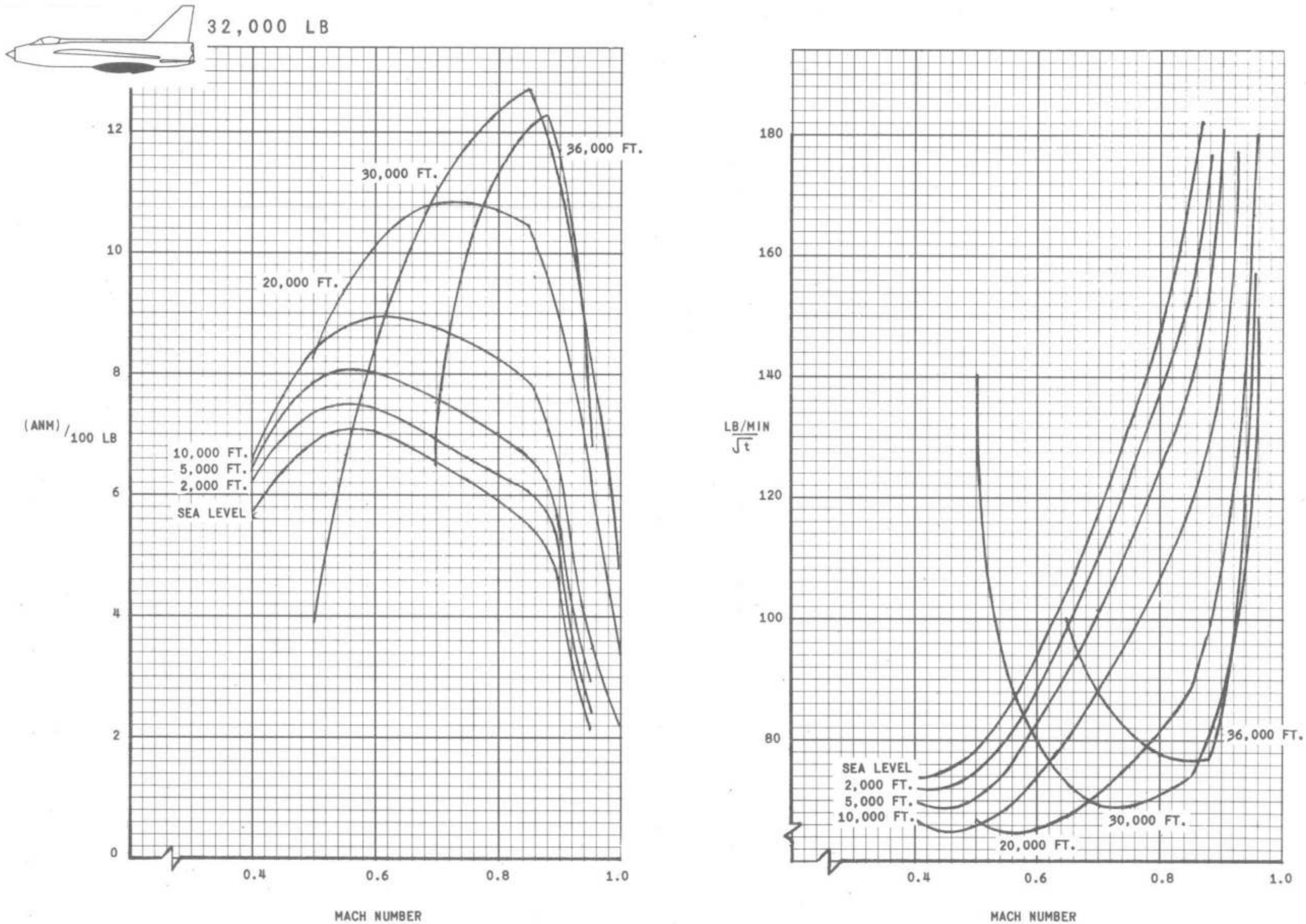


FIG. 4·3. ANM/100LB AND LB/MIN/√t - SUBSONIC - ONE ENGINE WINDMILLING

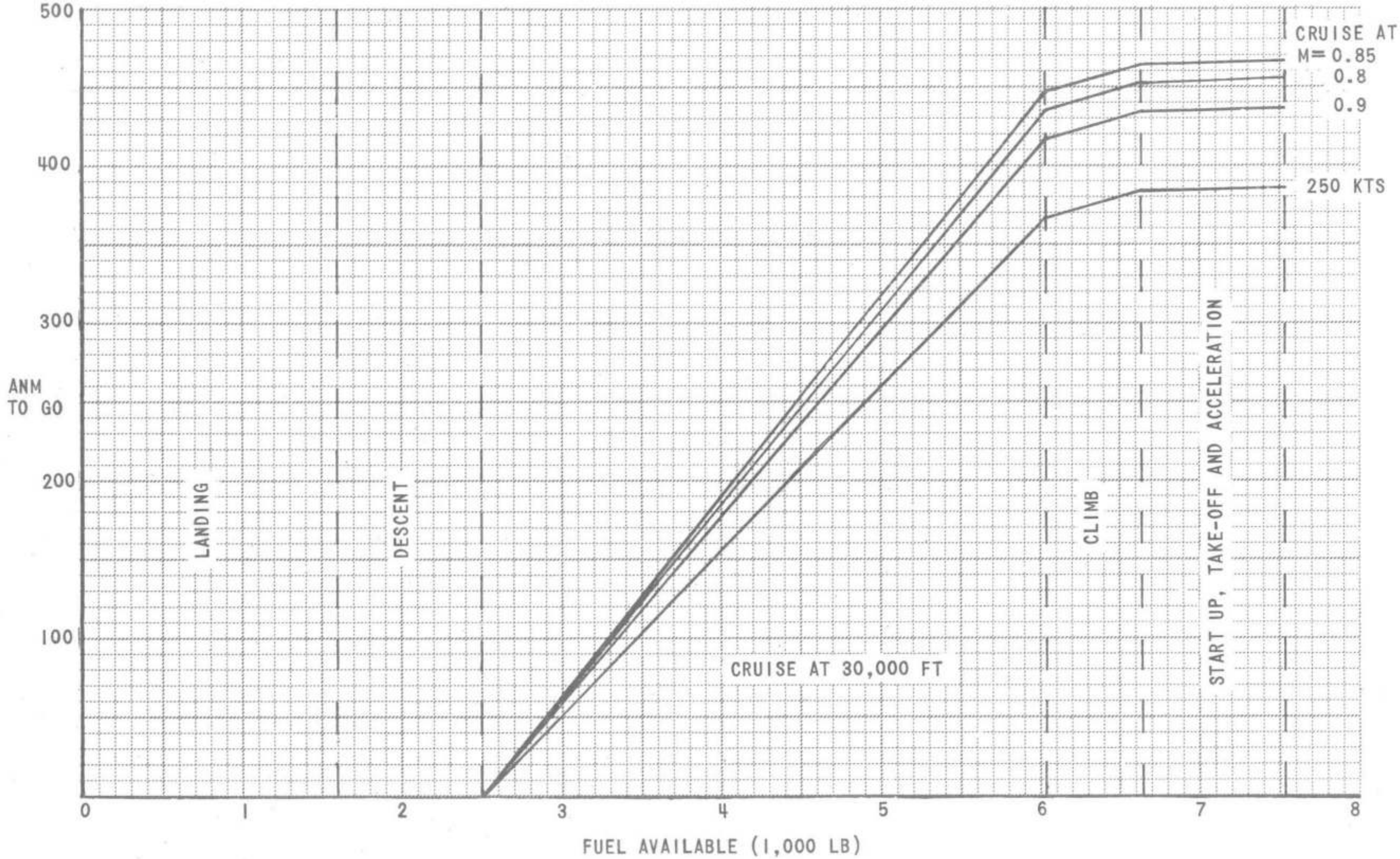


FIG.4.4. RANGE FOR SUBSONIC CRUISE AT 30,000FT - ICAO

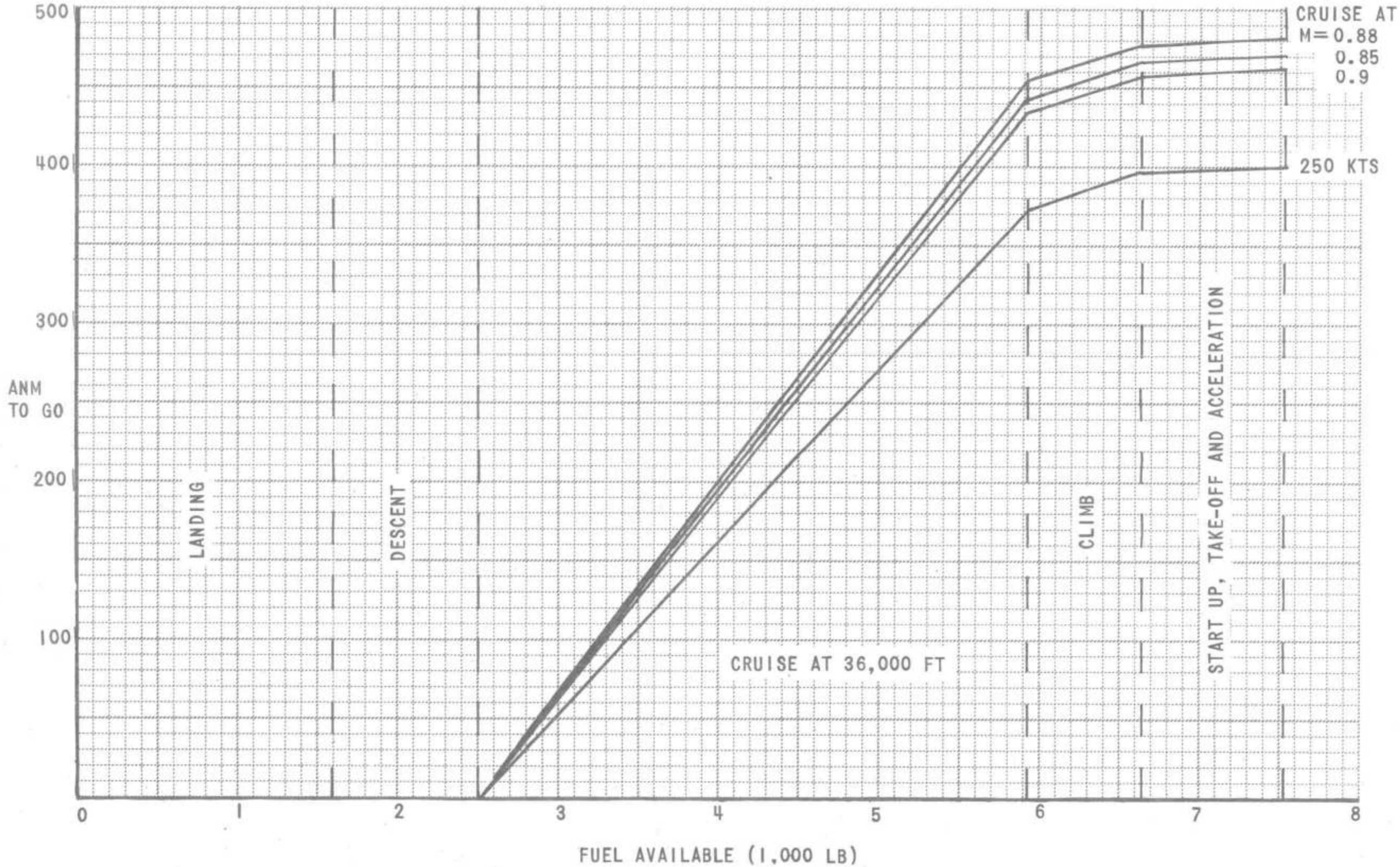


FIG.4.5. RANGE FOR SUBSONIC CRUISE AT 36,000FT - ICAO

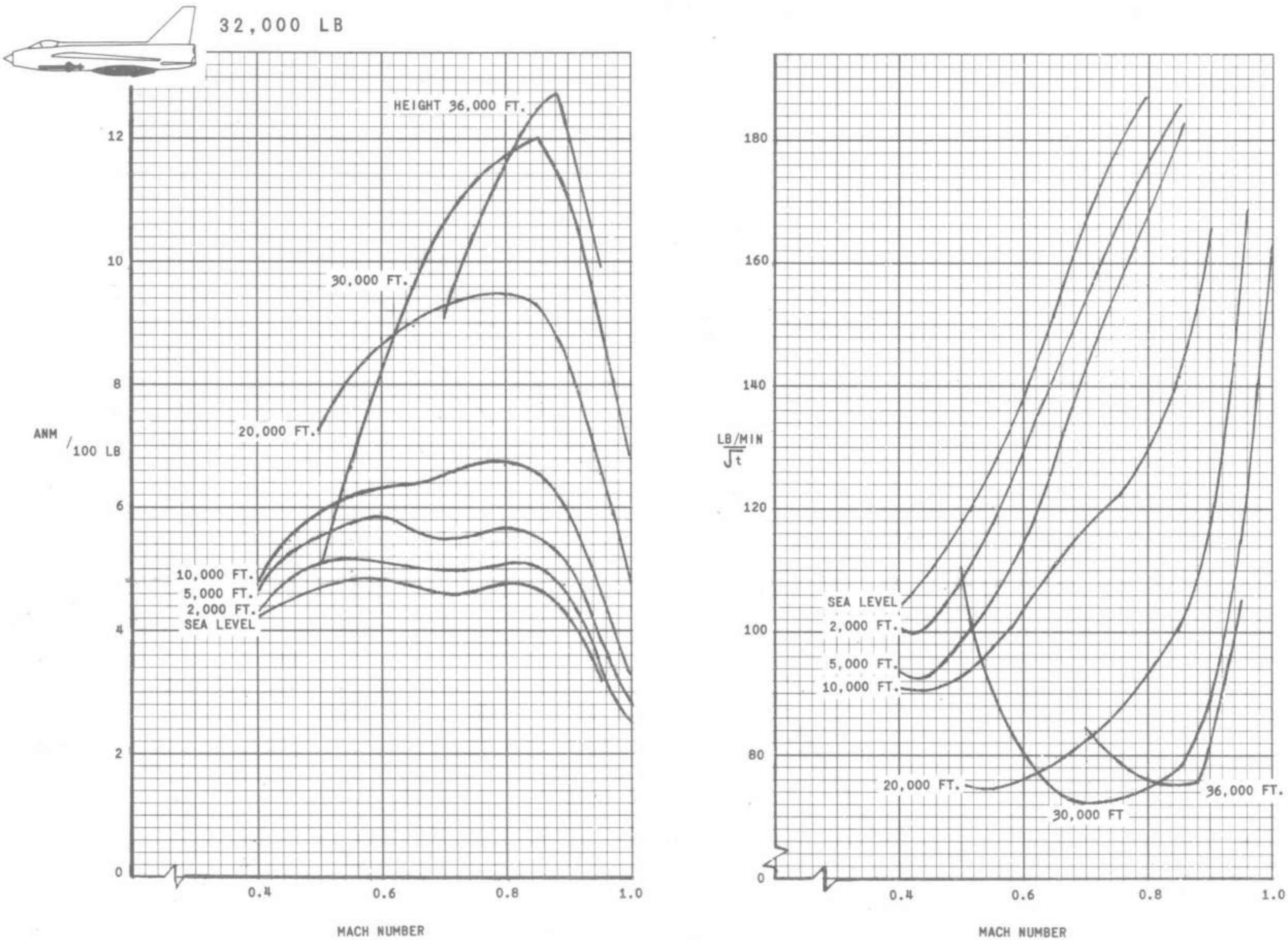


FIG. 4·6. ANM / 100LB AND LB / MIN /√t - SUBSONIC

32,000 LB

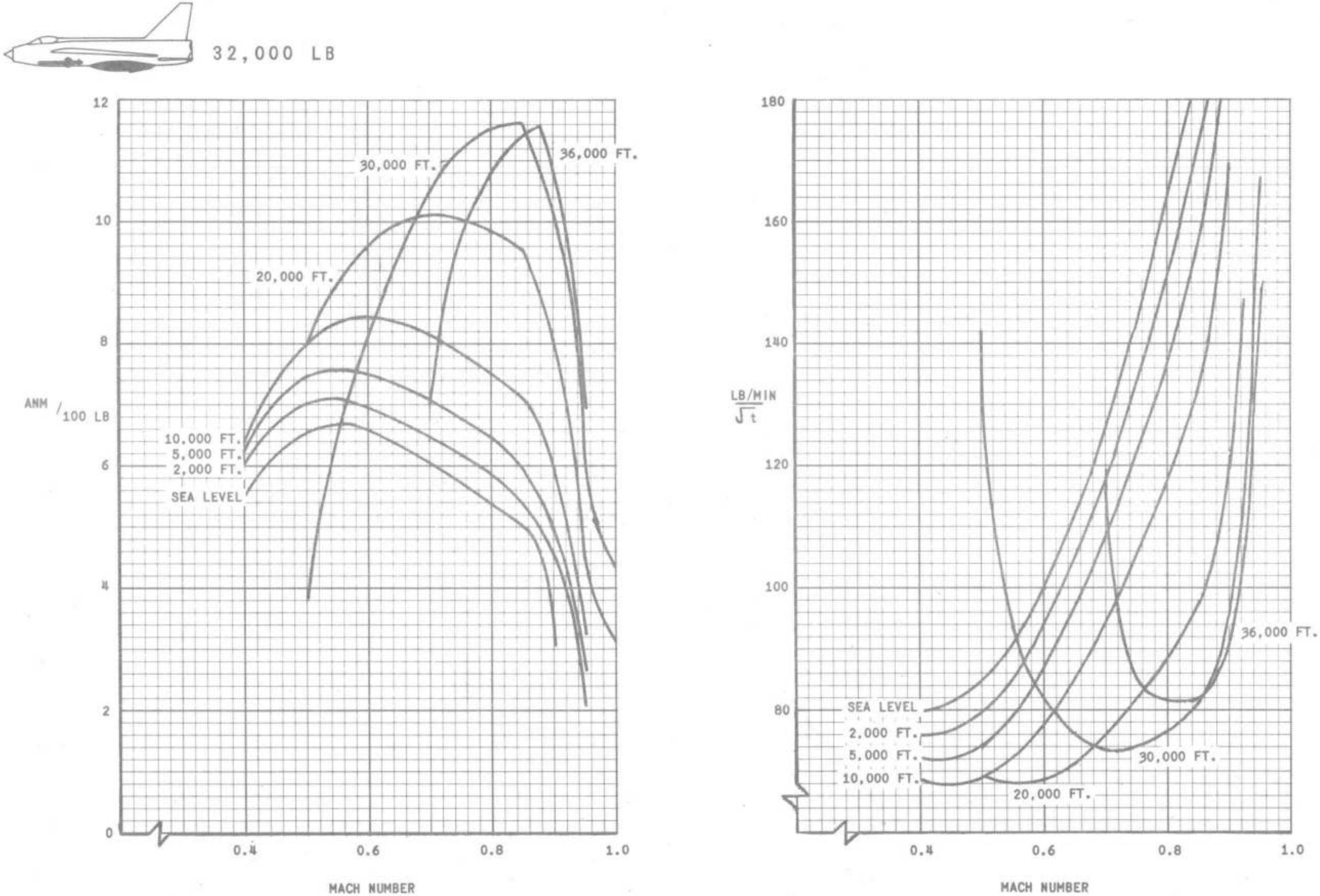


FIG. 4·7. ANM/100LB AND LB/MIN /√t - SUBSONIC - ONE ENGINE WINDMILLING

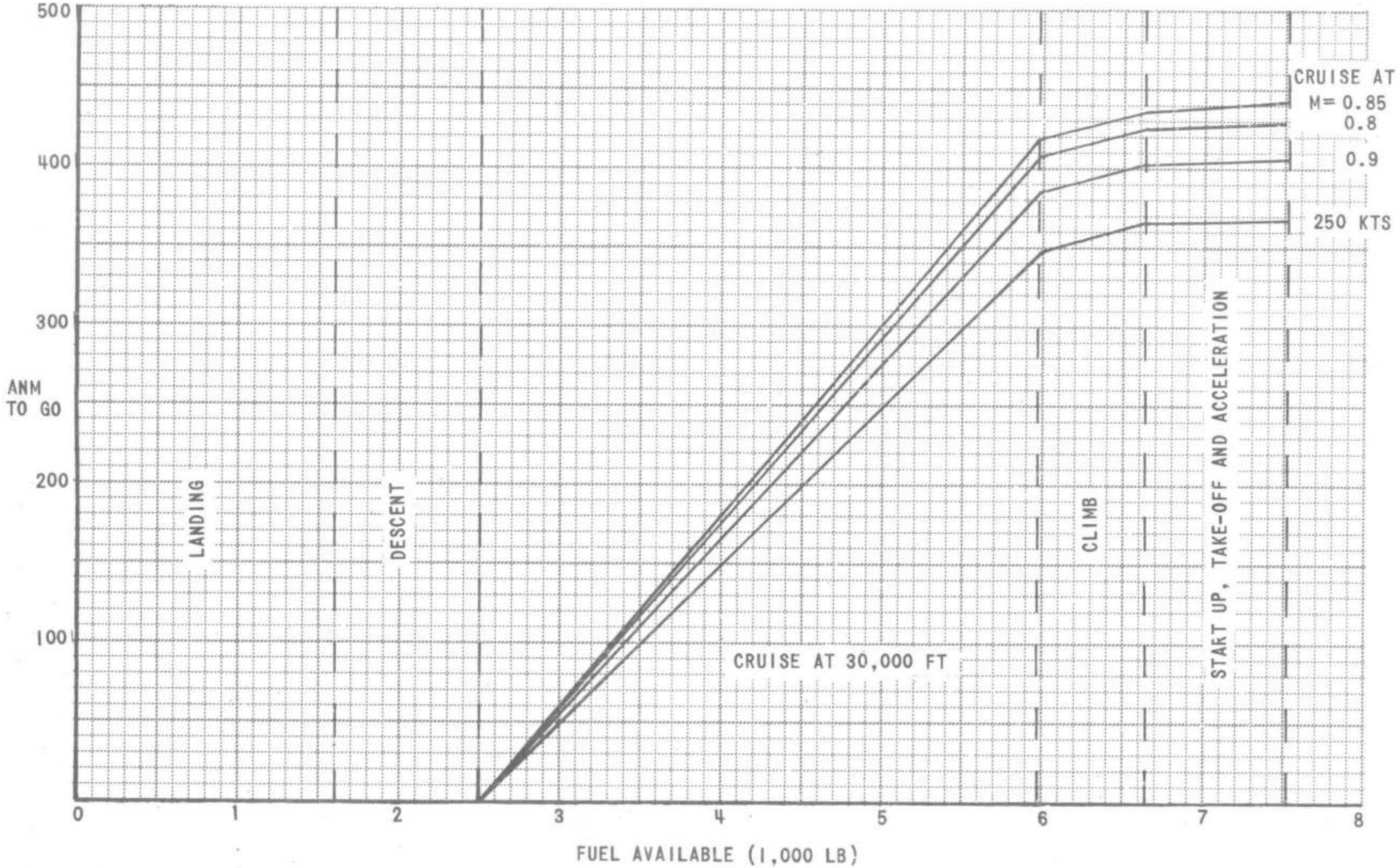


FIG.4.8. RANGE FOR SUBSONIC CRUISE AT 30,000FT - ICAO

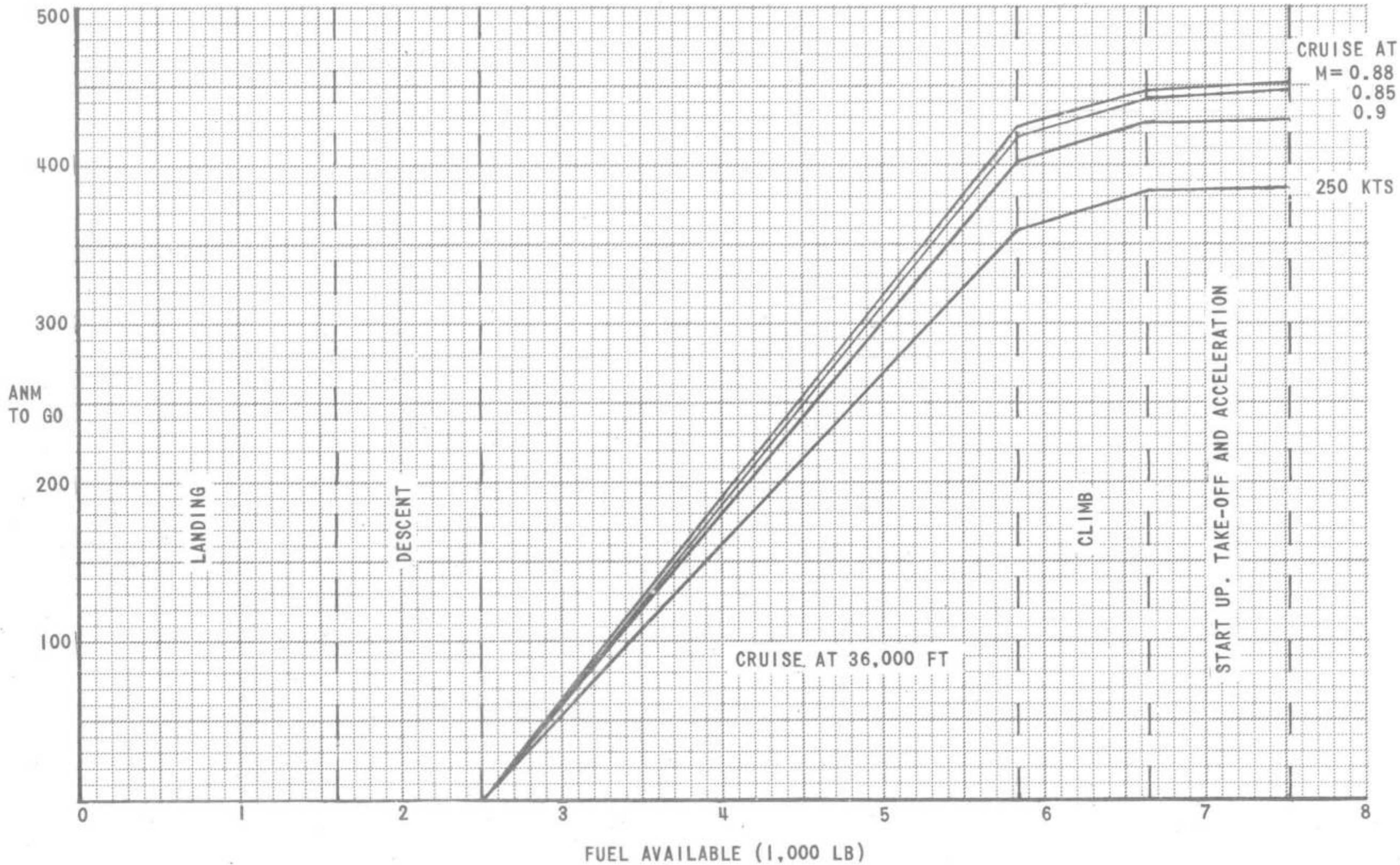


FIG.4.9. RANGE FOR SUBSONIC CRUISE AT 36,000FT - ICAO

NO REHEAT
32,000 LB

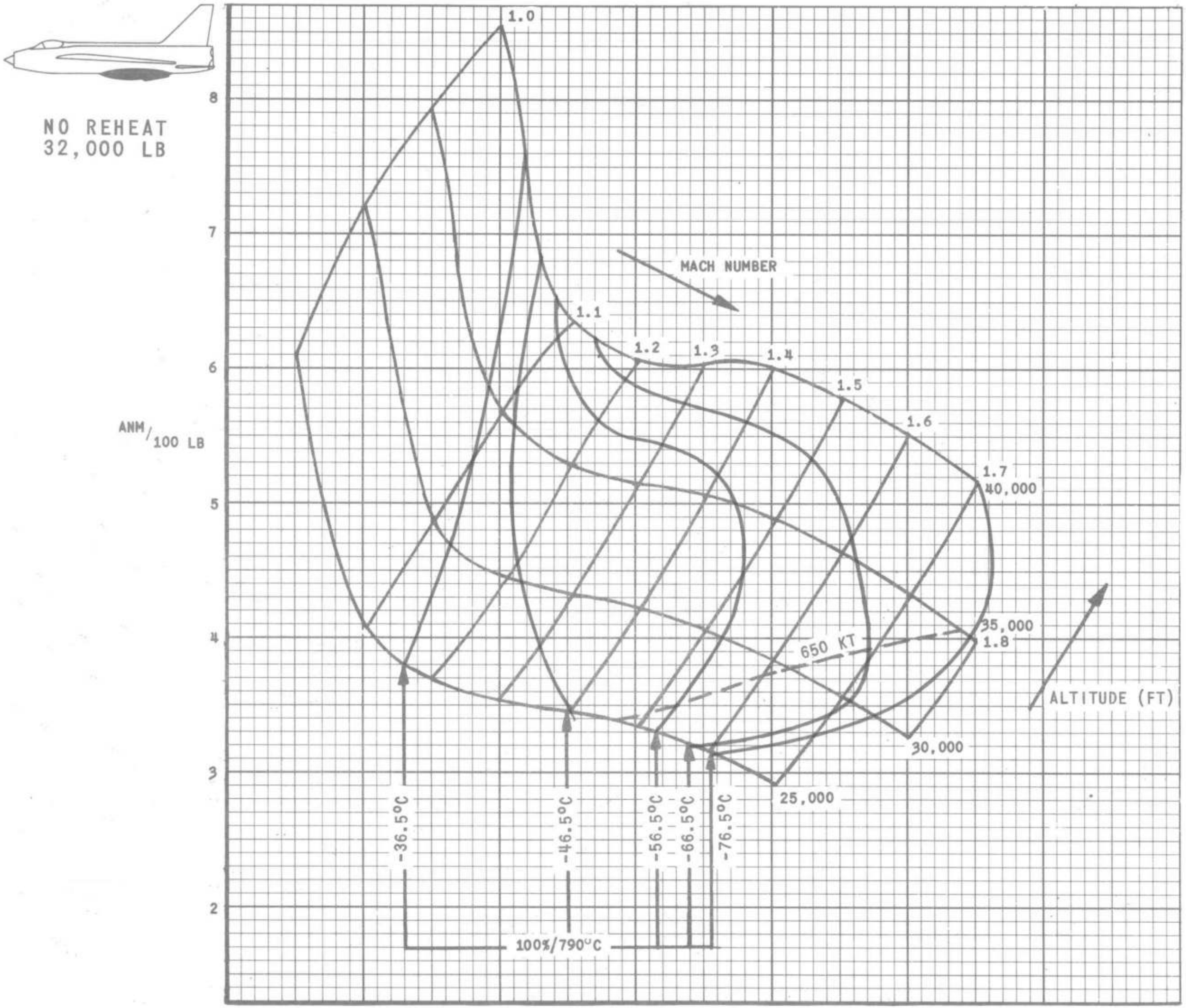


FIG.4.10. ANM/100LB - SUPERSONIC

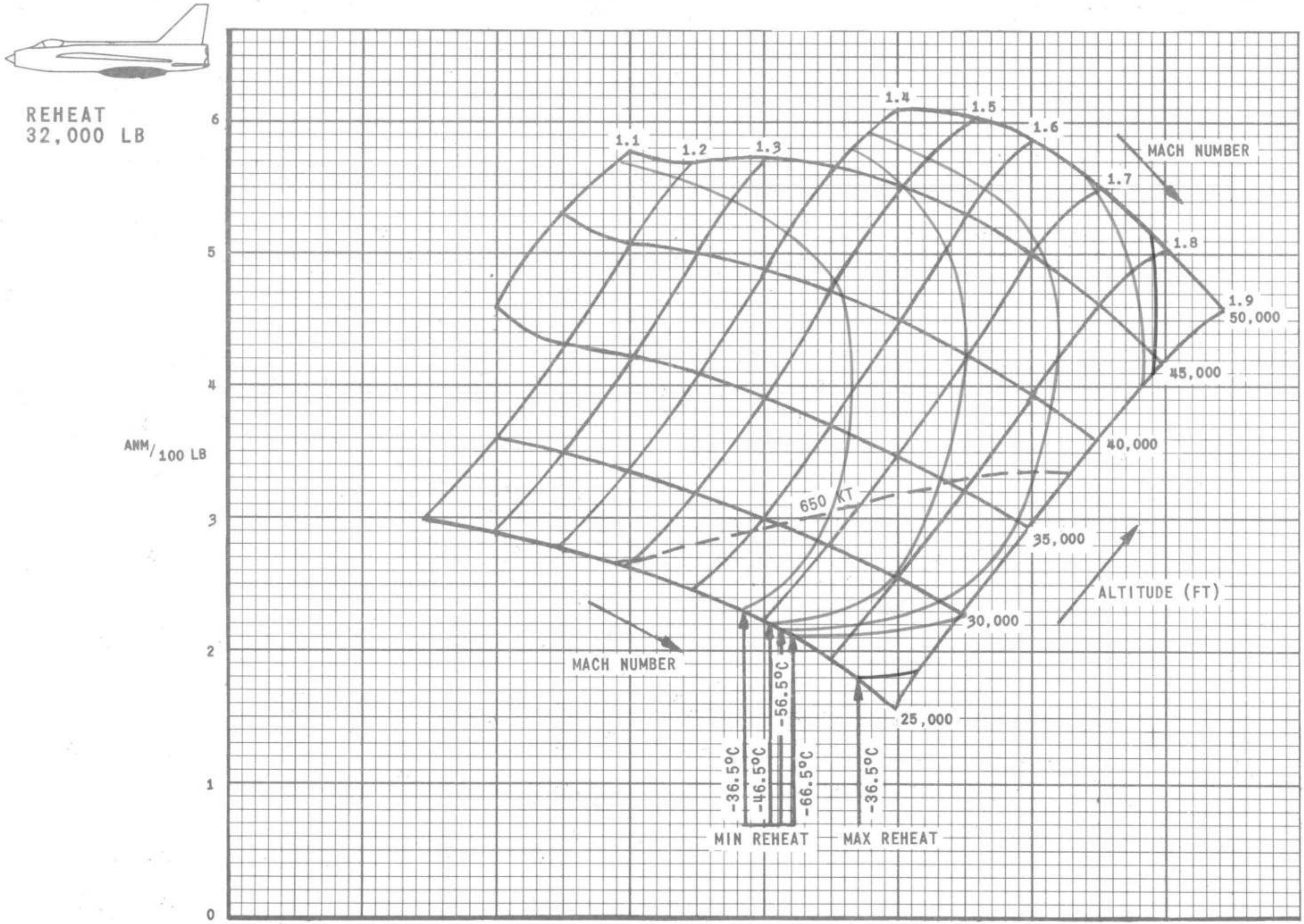
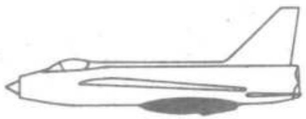


FIG.4.11. ANM/100LB - SUPERSONIC



NO REHEAT
32,000 LB

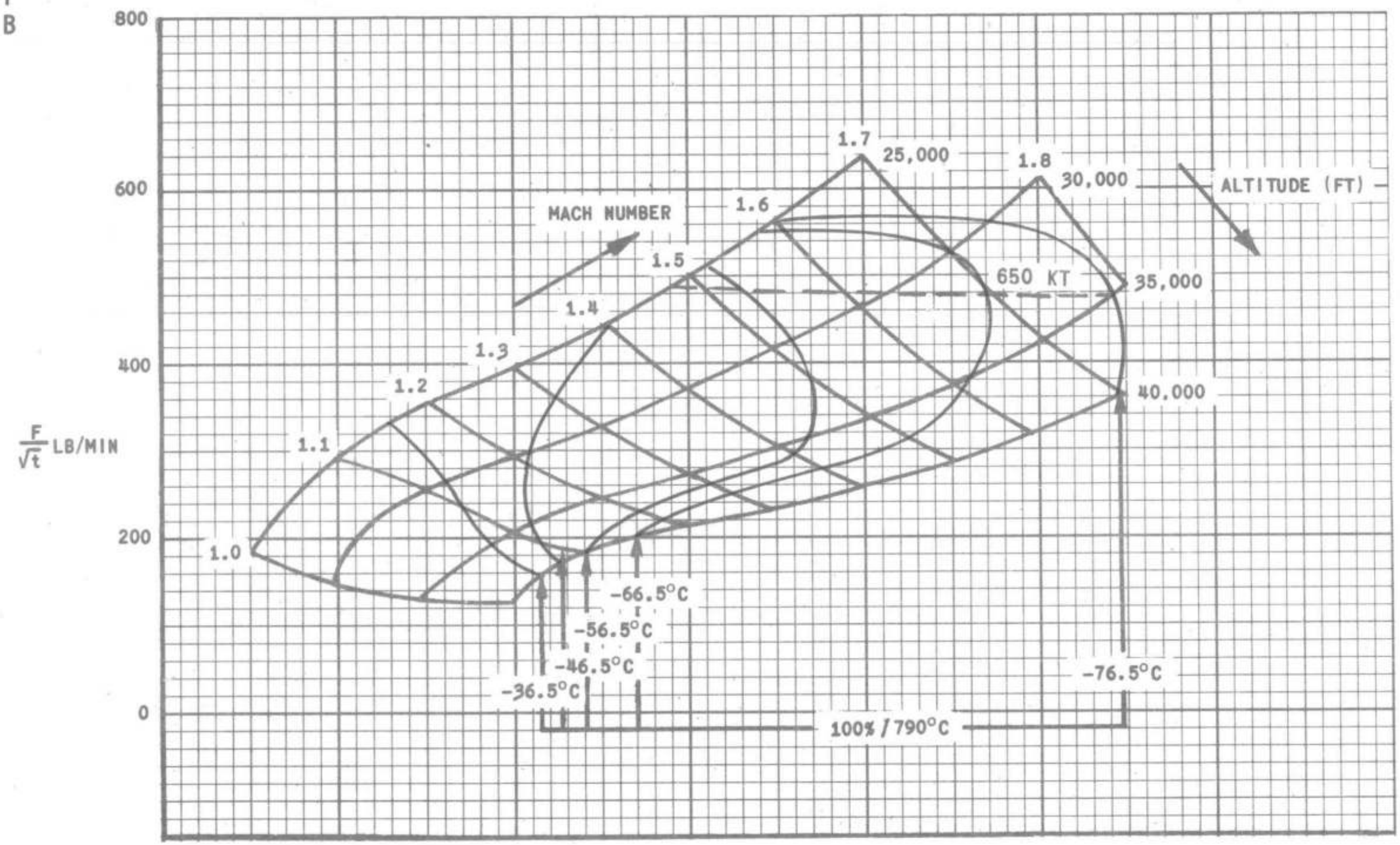
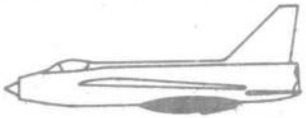


FIG.4.12. LB/MIN/$\sqrt{t}$ - SUPERSONIC



REHEAT
32,000 LB

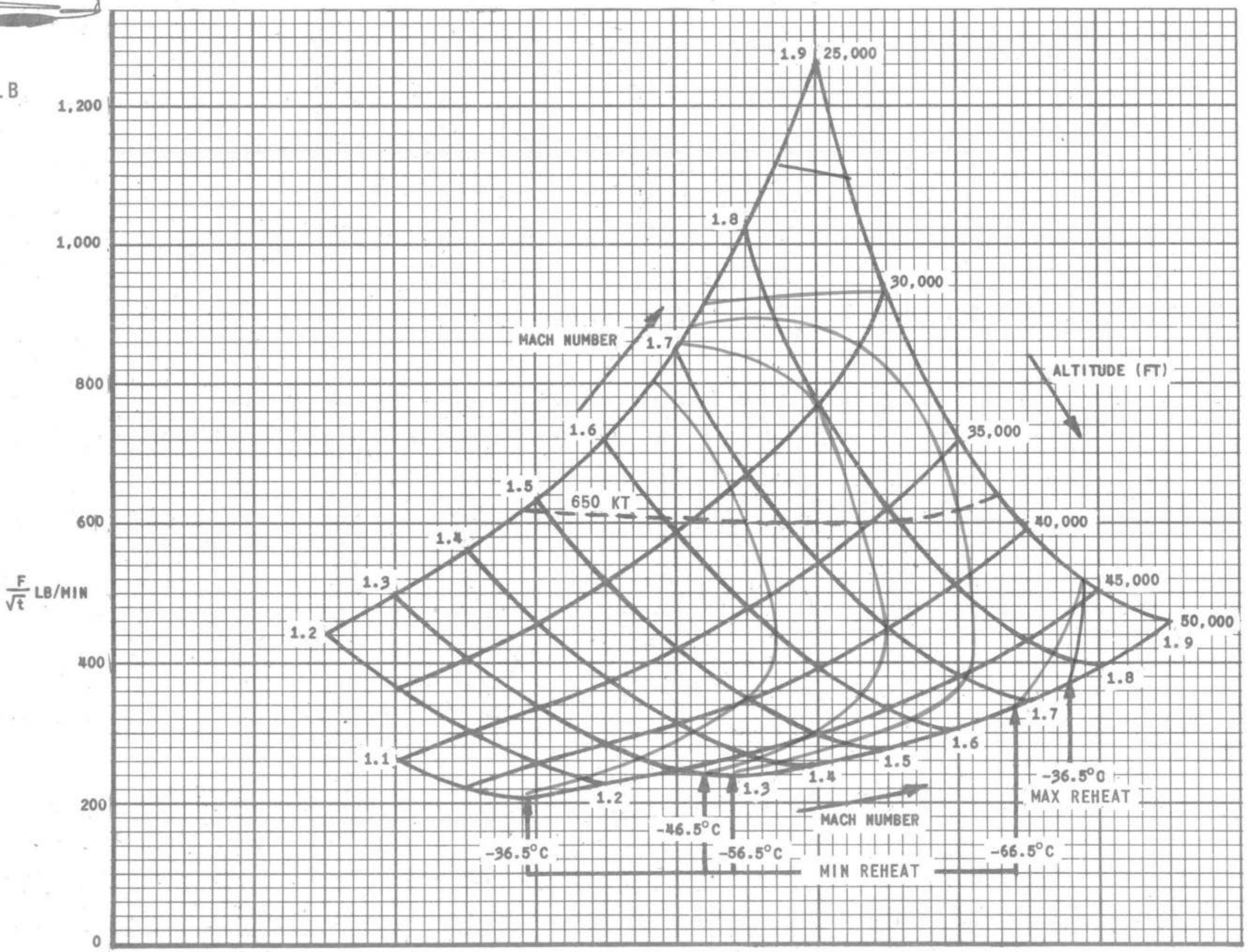
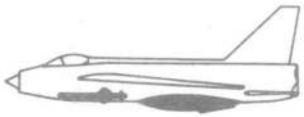


FIG.4.13. LB/MIN/√t - SUPERSONIC



NO REHEAT
32,000 LB

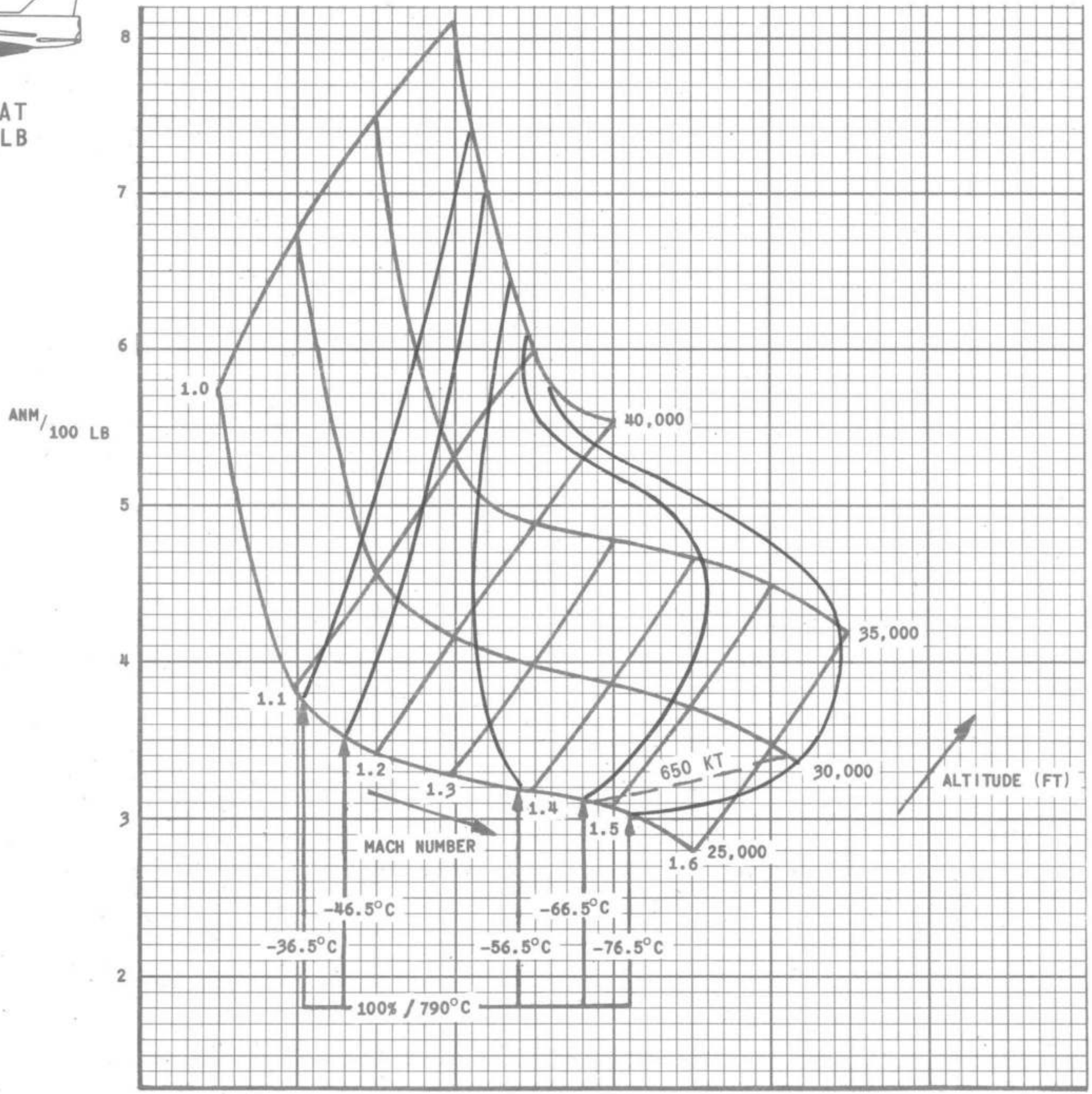


FIG.4.14. ANM/100LB - SUPERSONIC

REHEAT
32,000 LB

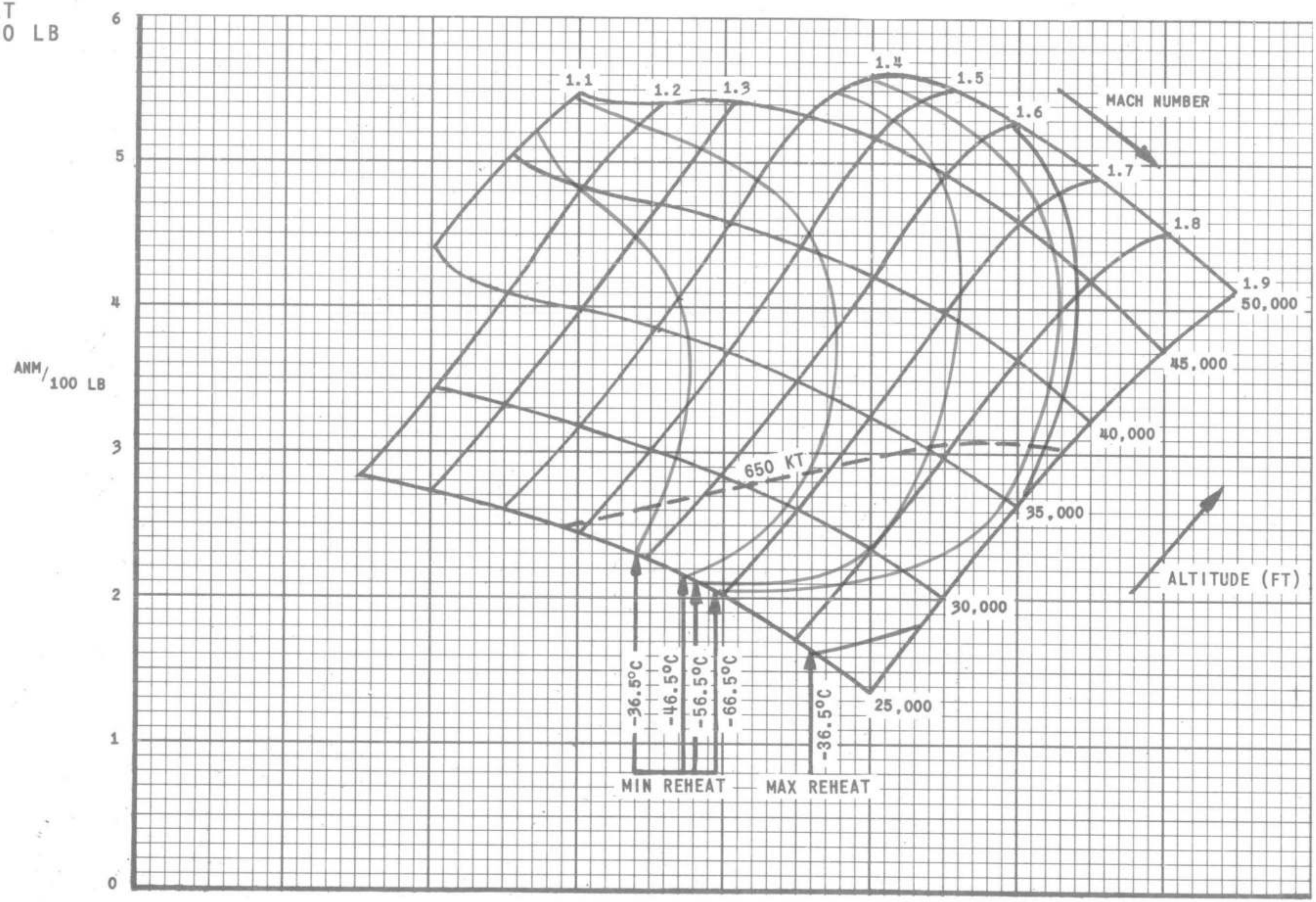
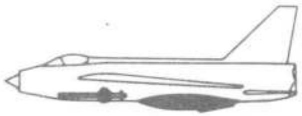


FIG.4.15. ANM/100LB - SUPERSONIC



NO REHEAT
32,000 LB

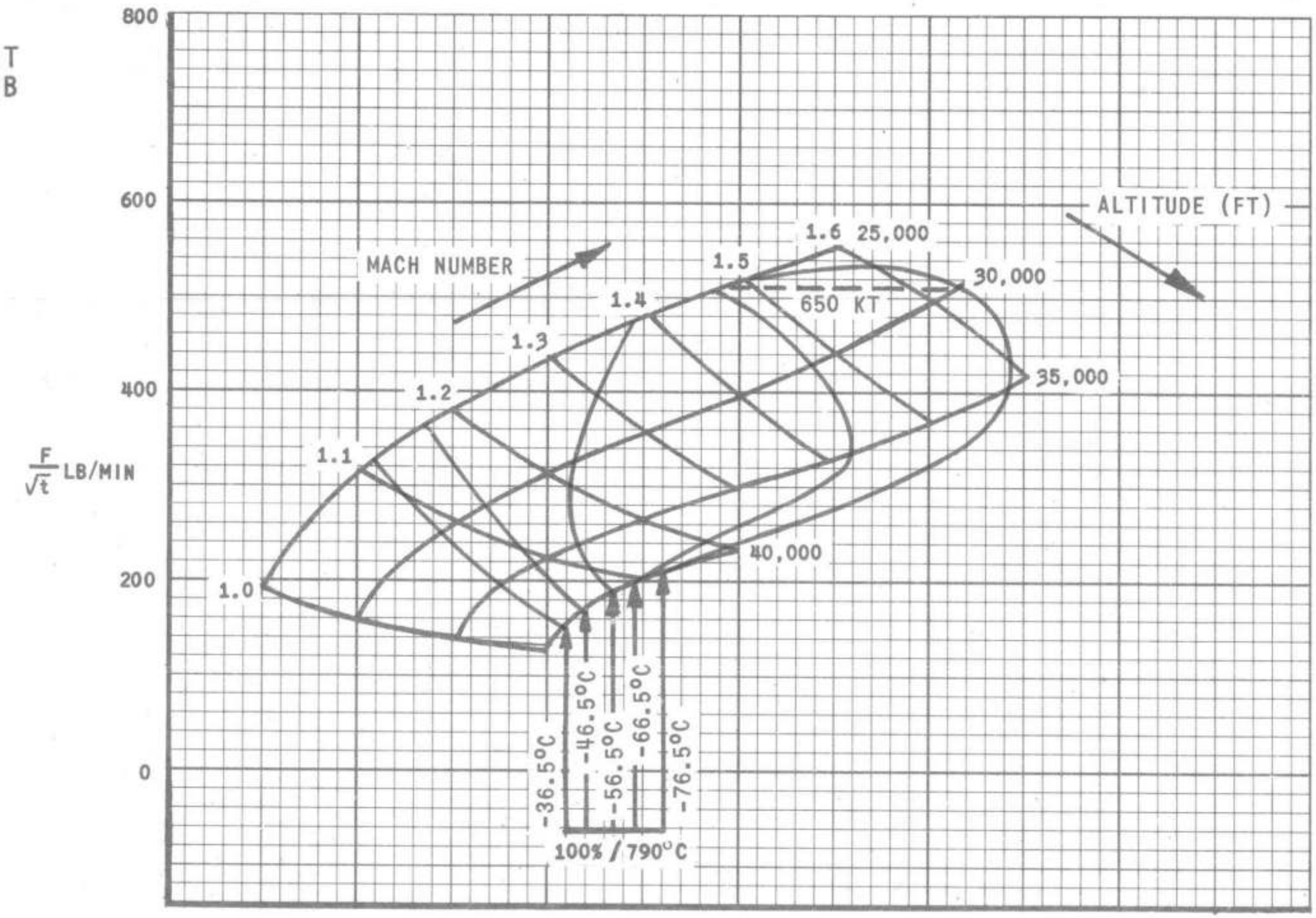
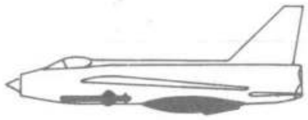


FIG.4.16. LB/MIN/√t - SUPERSONIC



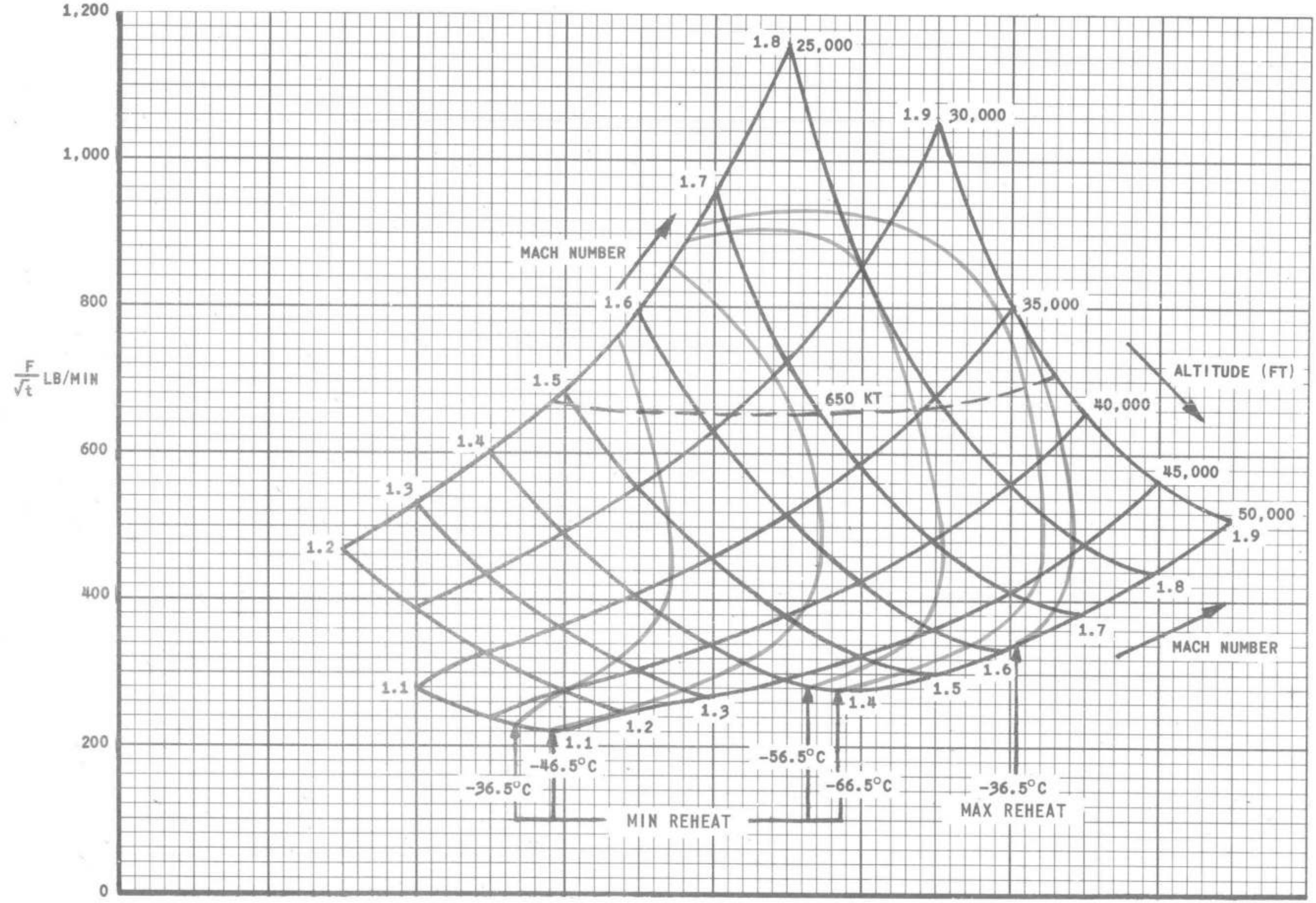


FIG.4.17. LB/MIN/√t - SUPERSONIC

32,000 LB

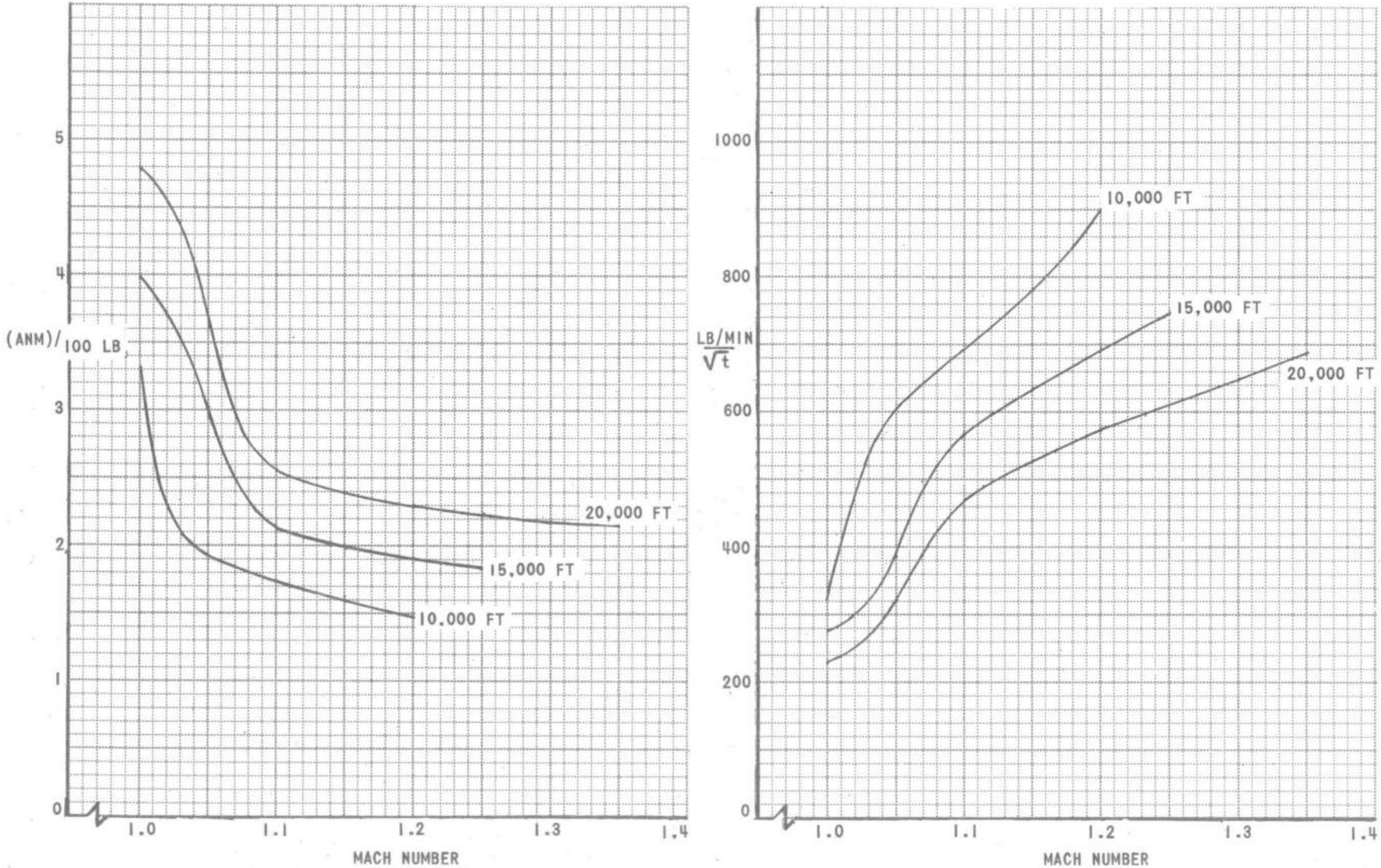


FIG.4.18. ANM/100LB AND LB/MIN/√t - SUPERSONIC

T Mk.5

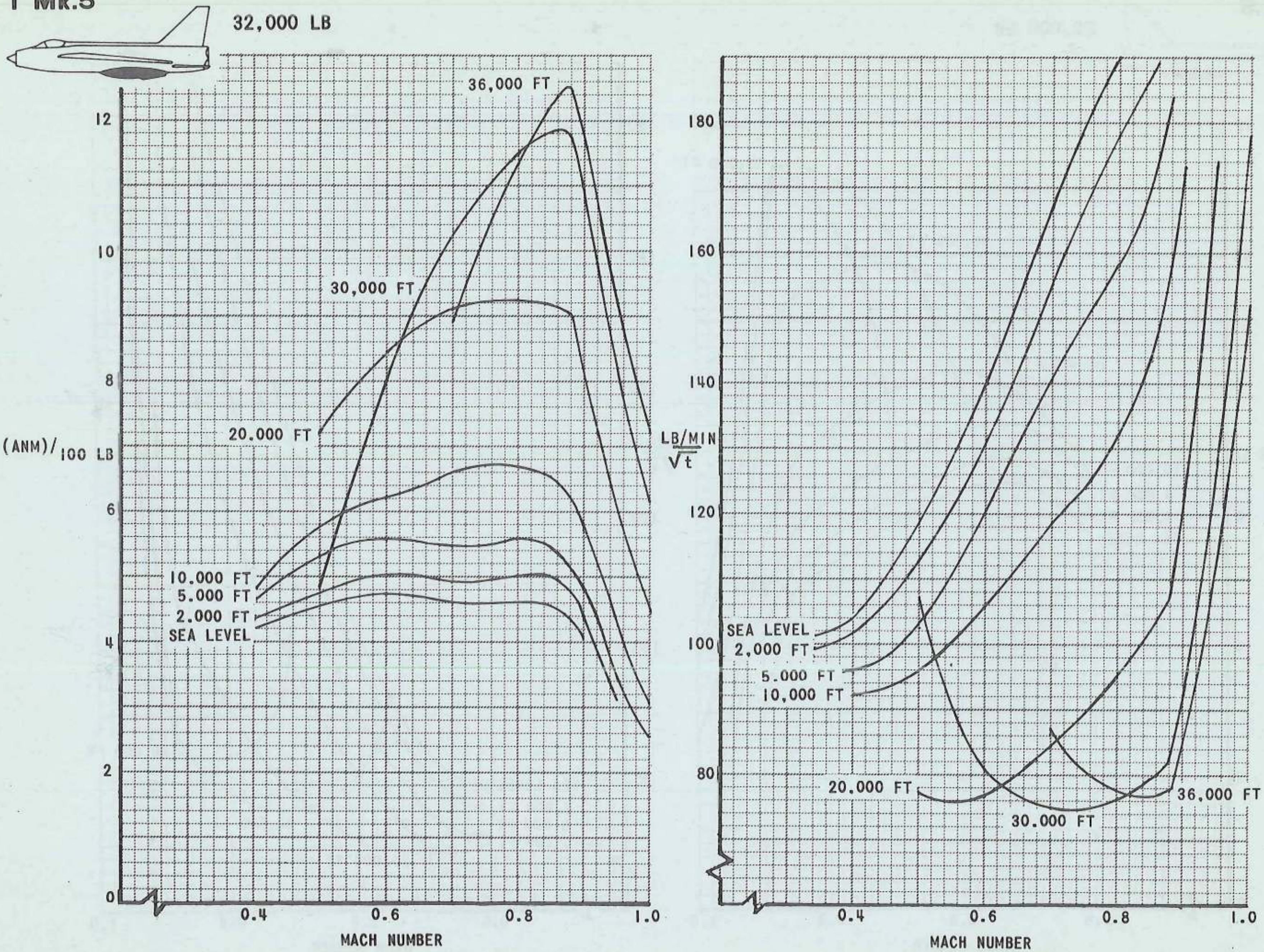


FIG. 4.1 ANM/100LB AND LB/MIN/$\sqrt{t}$ - SUBSONIC

T Mk.5

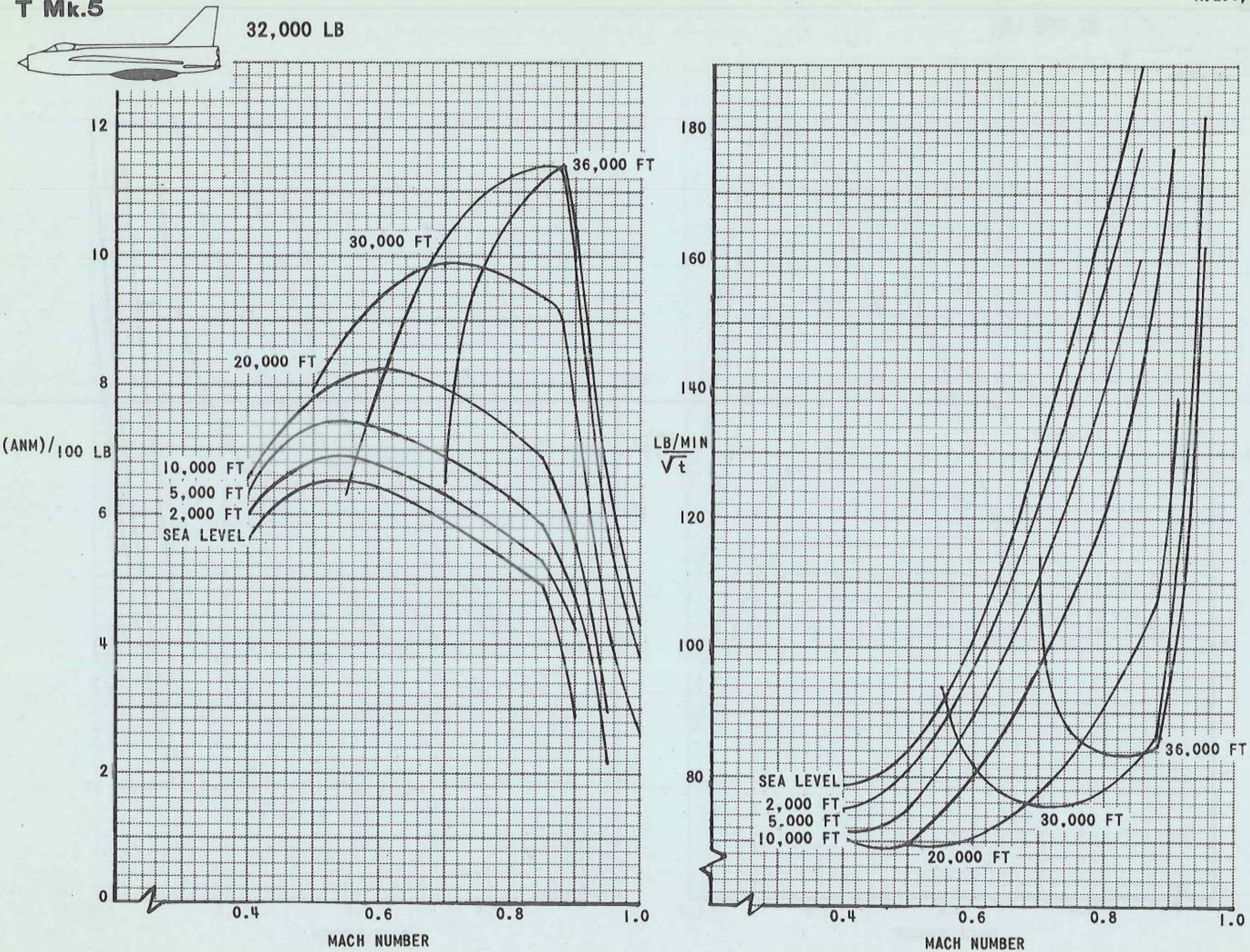
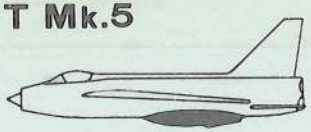


FIG. 4.2 ANM/100LB AND LB/MIN/$\sqrt{t}$ - SUBSONIC - ONE ENGINE WINDMILLING

T Mk.5



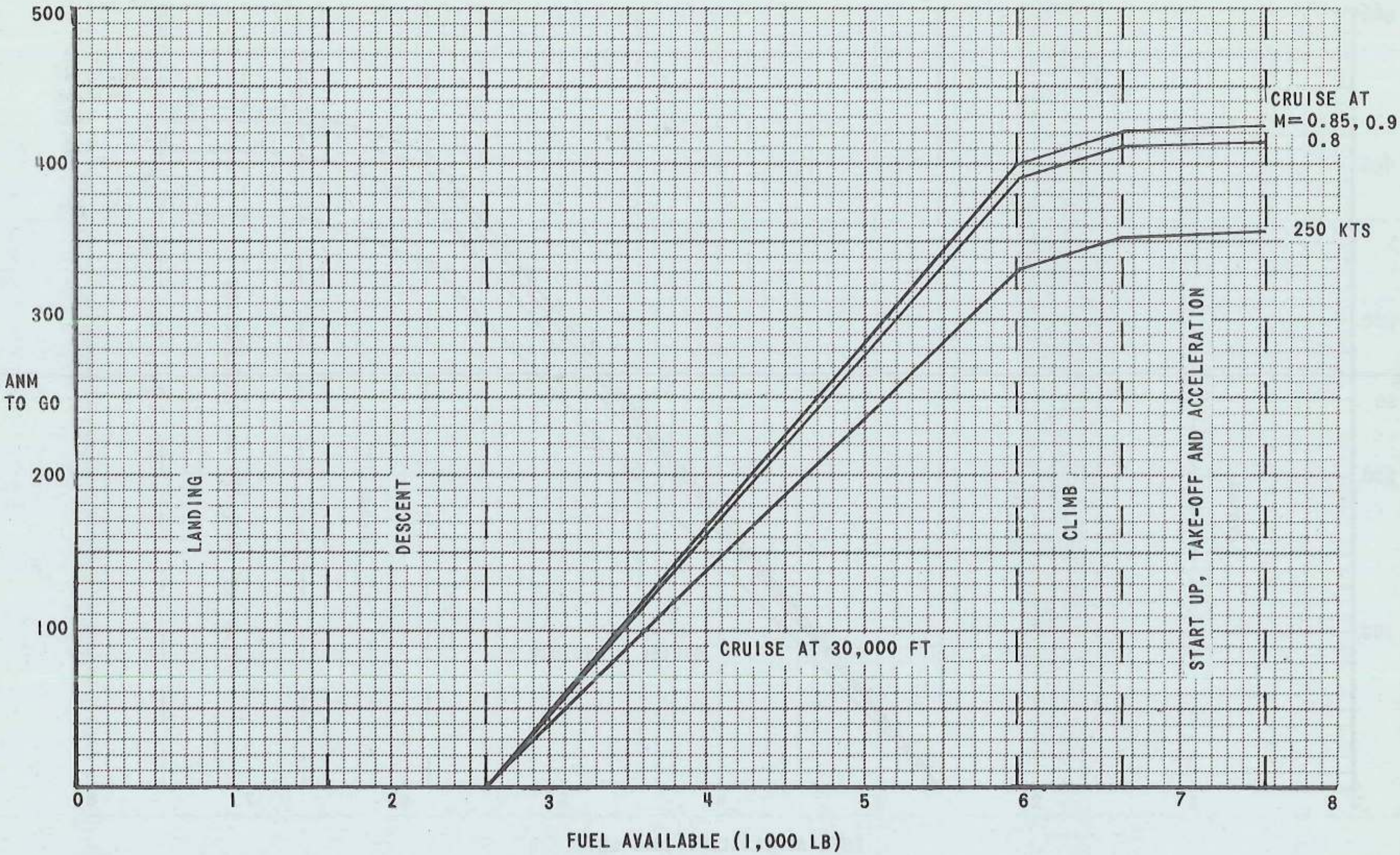
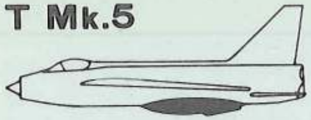


FIG. 4.3 RANGE FOR SUBSONIC CRUISE AT 30,000FT ICAO

T Mk.5



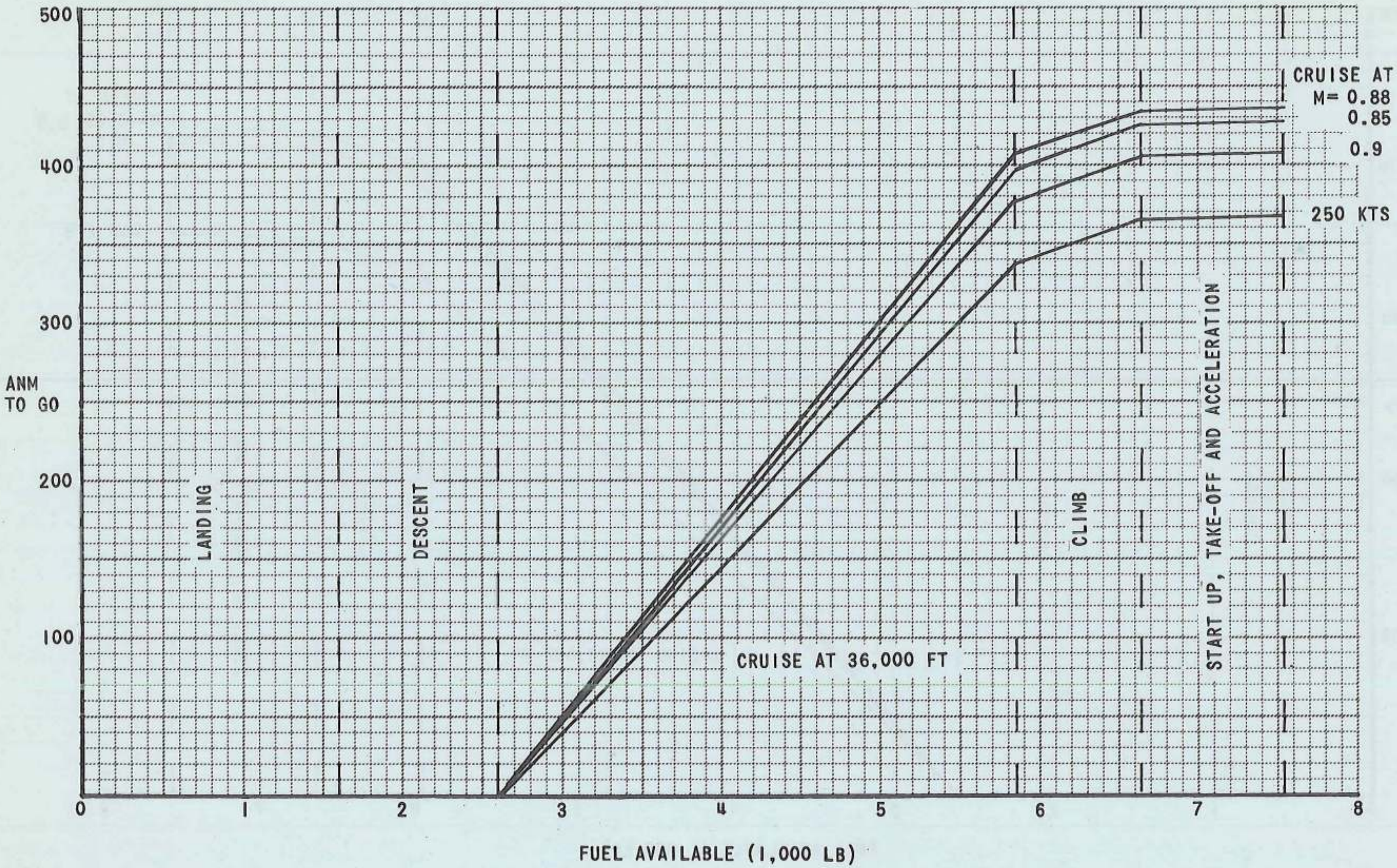


FIG. 4.4 RANGE FOR SUBSONIC CRUISE AT 36,000FT ICAO

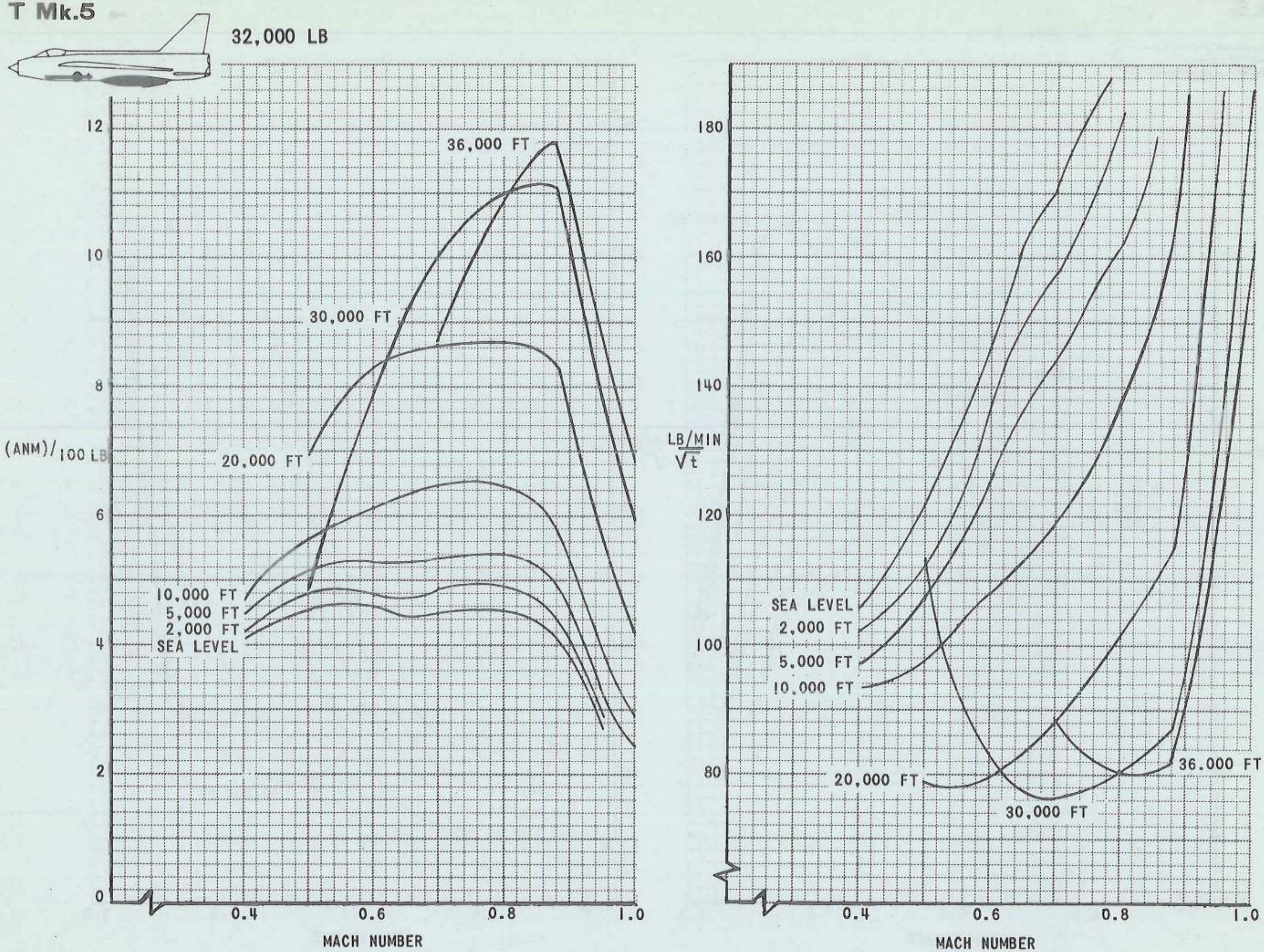


FIG. 4.5 ANM/100LB AND LB/MIN/$\sqrt{t}$ SUBSONIC

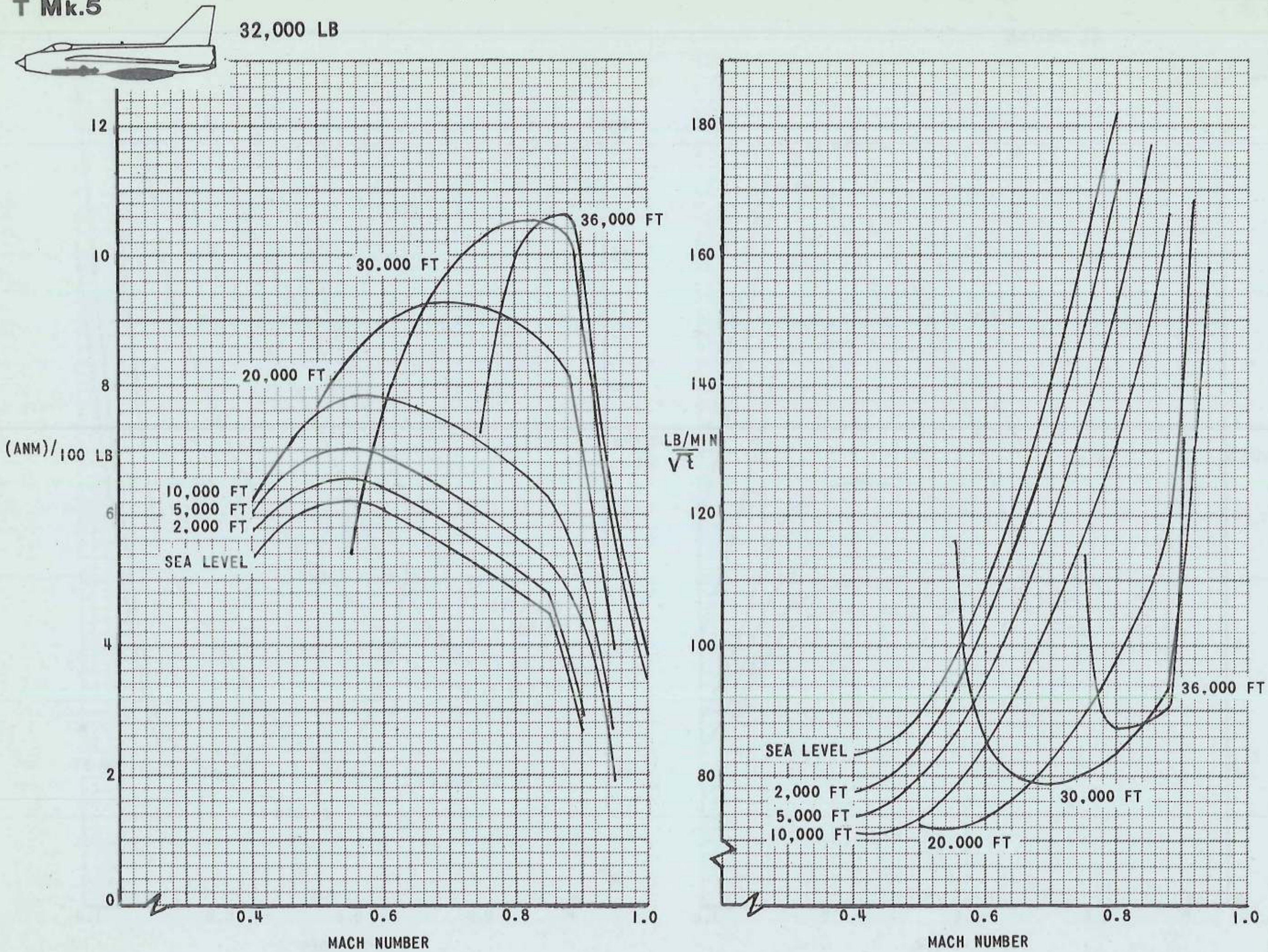


FIG.4.6. ANM/100LB AND LB/MIN/$\sqrt{t}$ - SUBSONIC - ONE ENGINE WINDMILLING

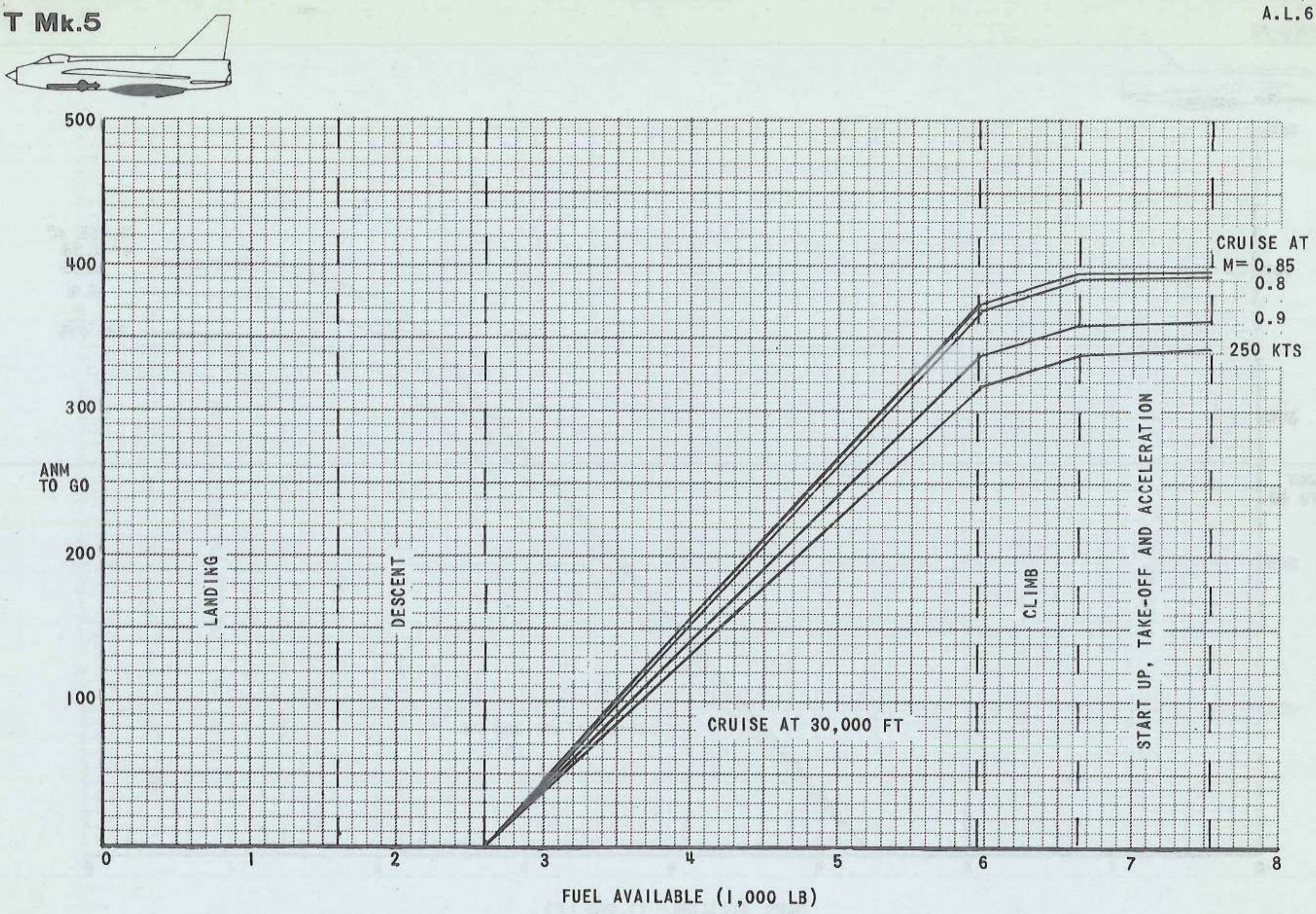


FIG. 4.7 RANGE FOR SUBSONIC CRUISE AT 30,000FT ICAO

T Mk.5

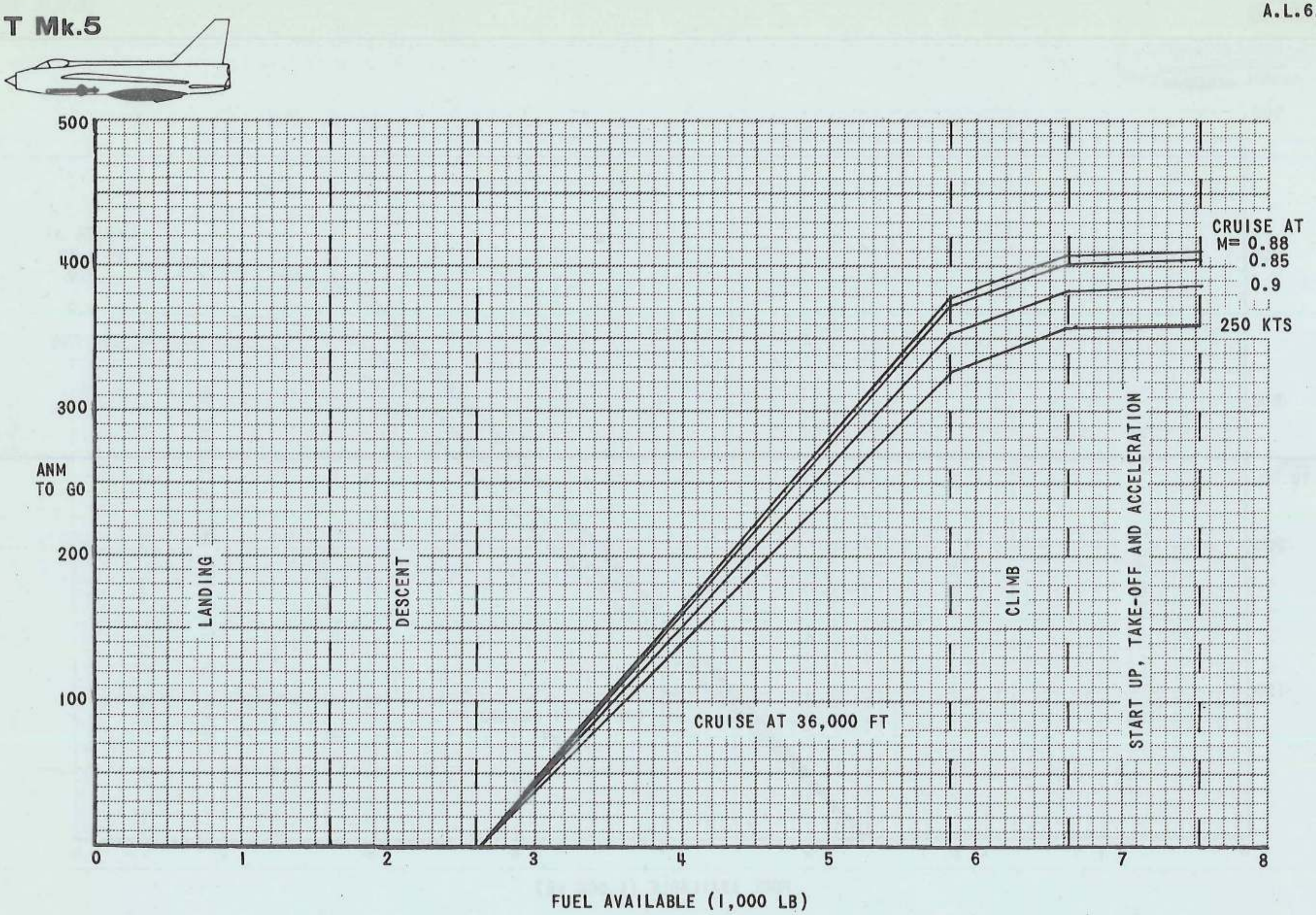
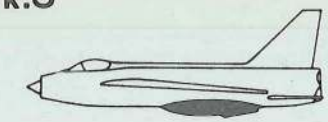


FIG. 4.8 RANGE FOR SUBSONIC CRUISE AT 36,000FT ICAO

T Mk.5



32,000 LB

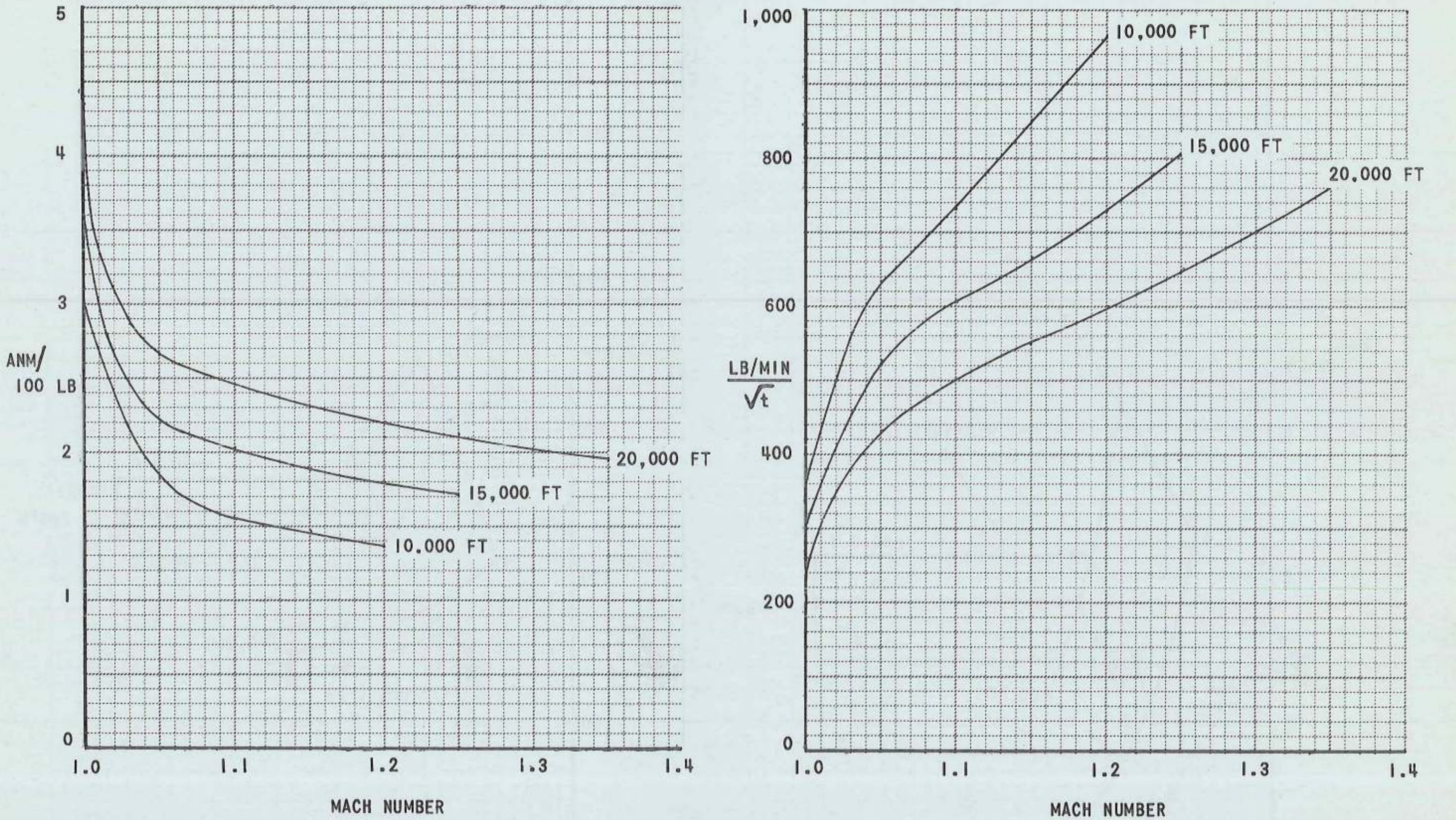


FIG. 4.9 ANM/100LB AND LB/MIN/$\sqrt{t}$ SUPERSONIC

NO REHEAT
32,000 LB

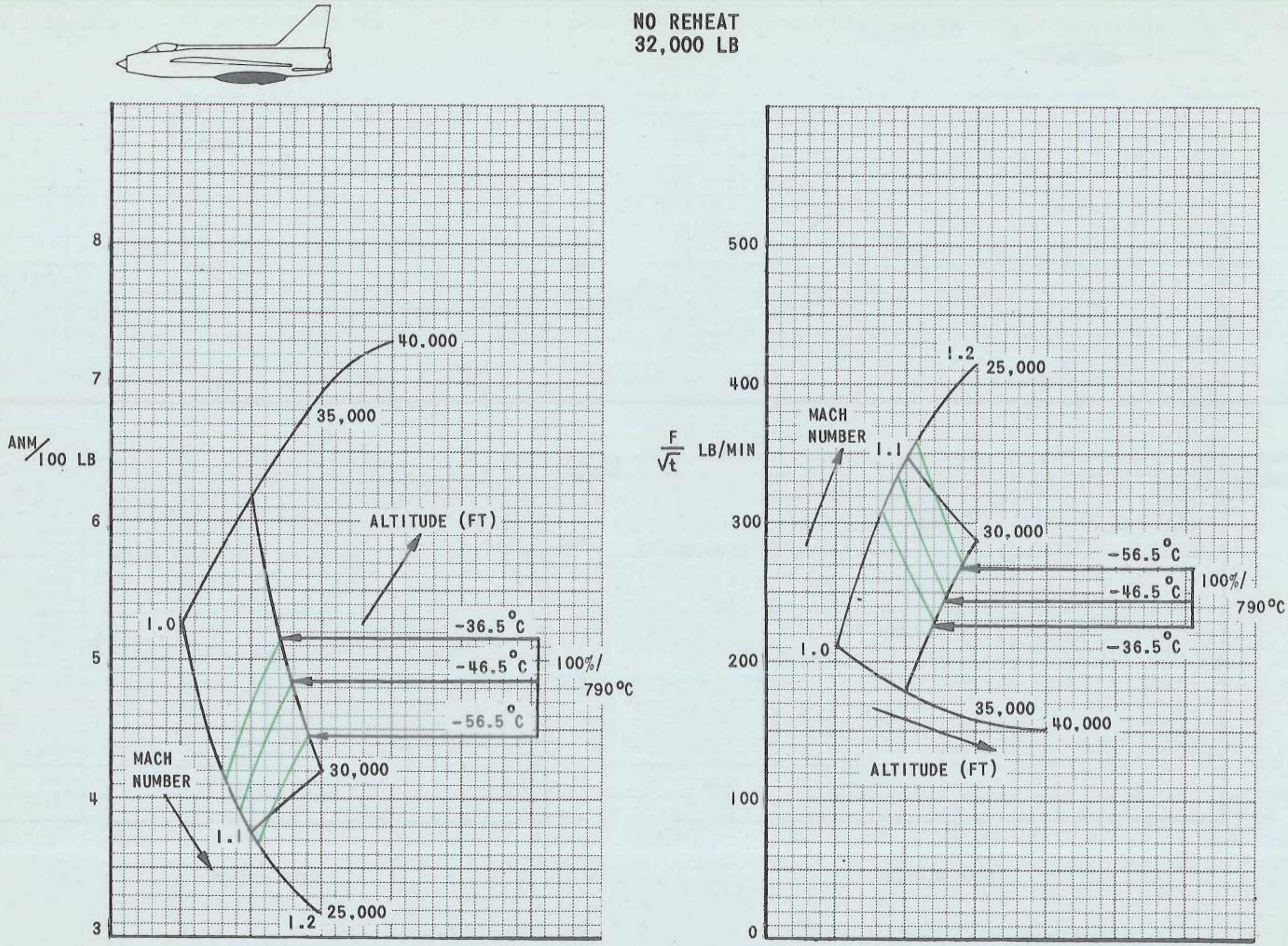
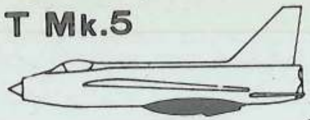


FIG. 4.10 ANM/100LB AND LB/MIN/√t SUPERSONIC



REHEAT
32,000 LB

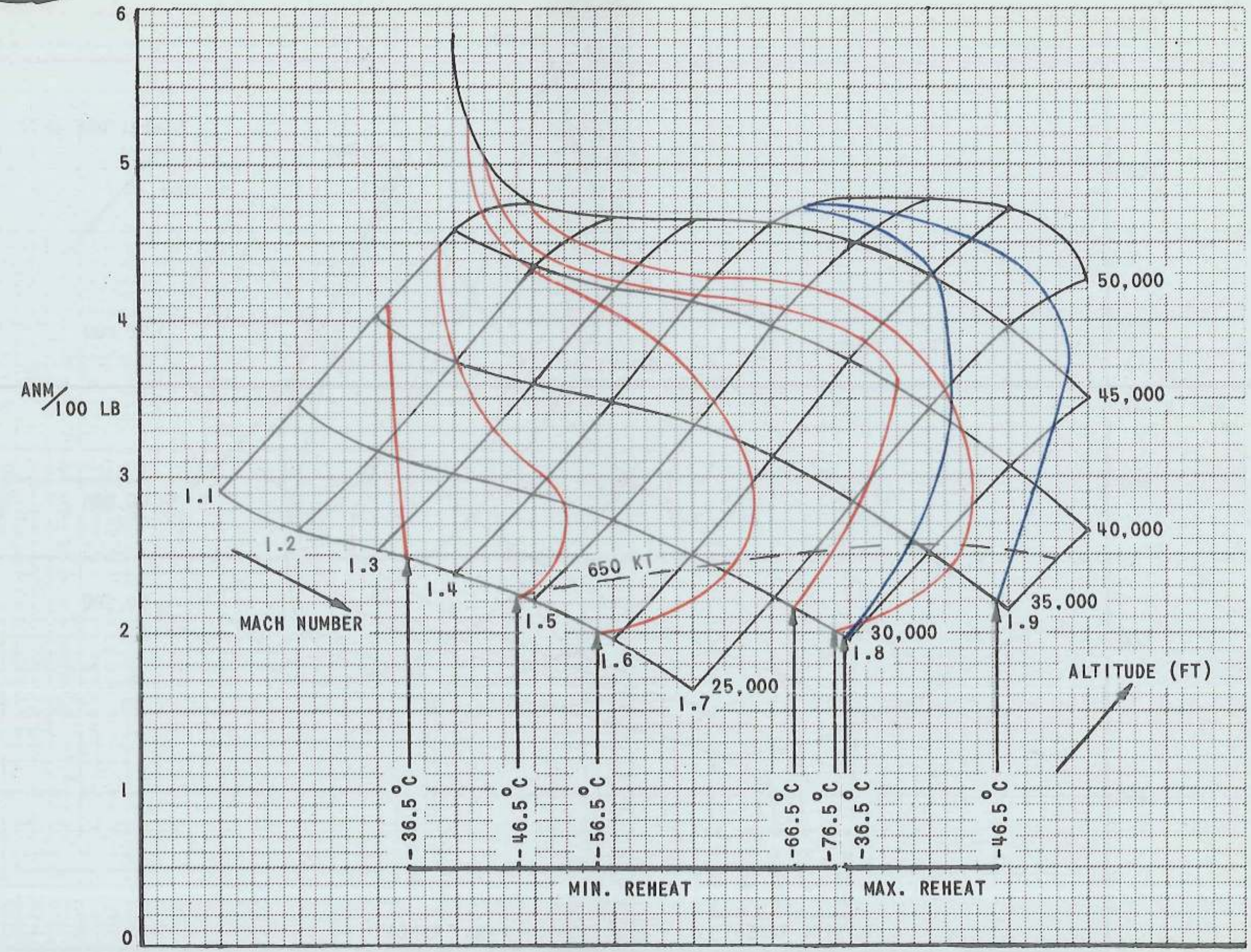


FIG. 4.11 ANM/100LB SUPERSONIC

REHEAT
32,000 LB

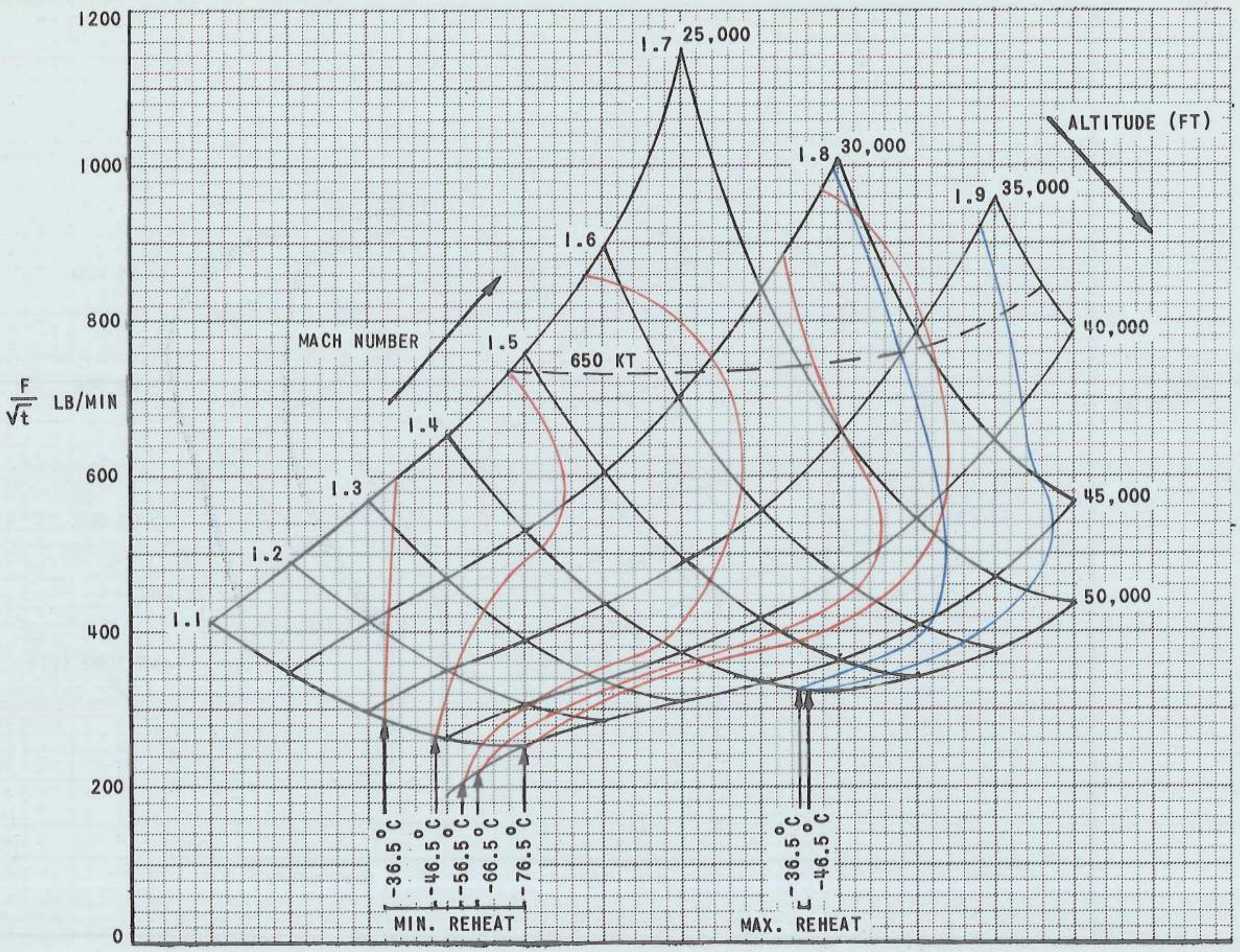
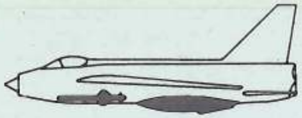


FIG. 4.12 LB/MIN/$\sqrt{t}$ SUPERSONIC

T Mk.5



32,000 LB

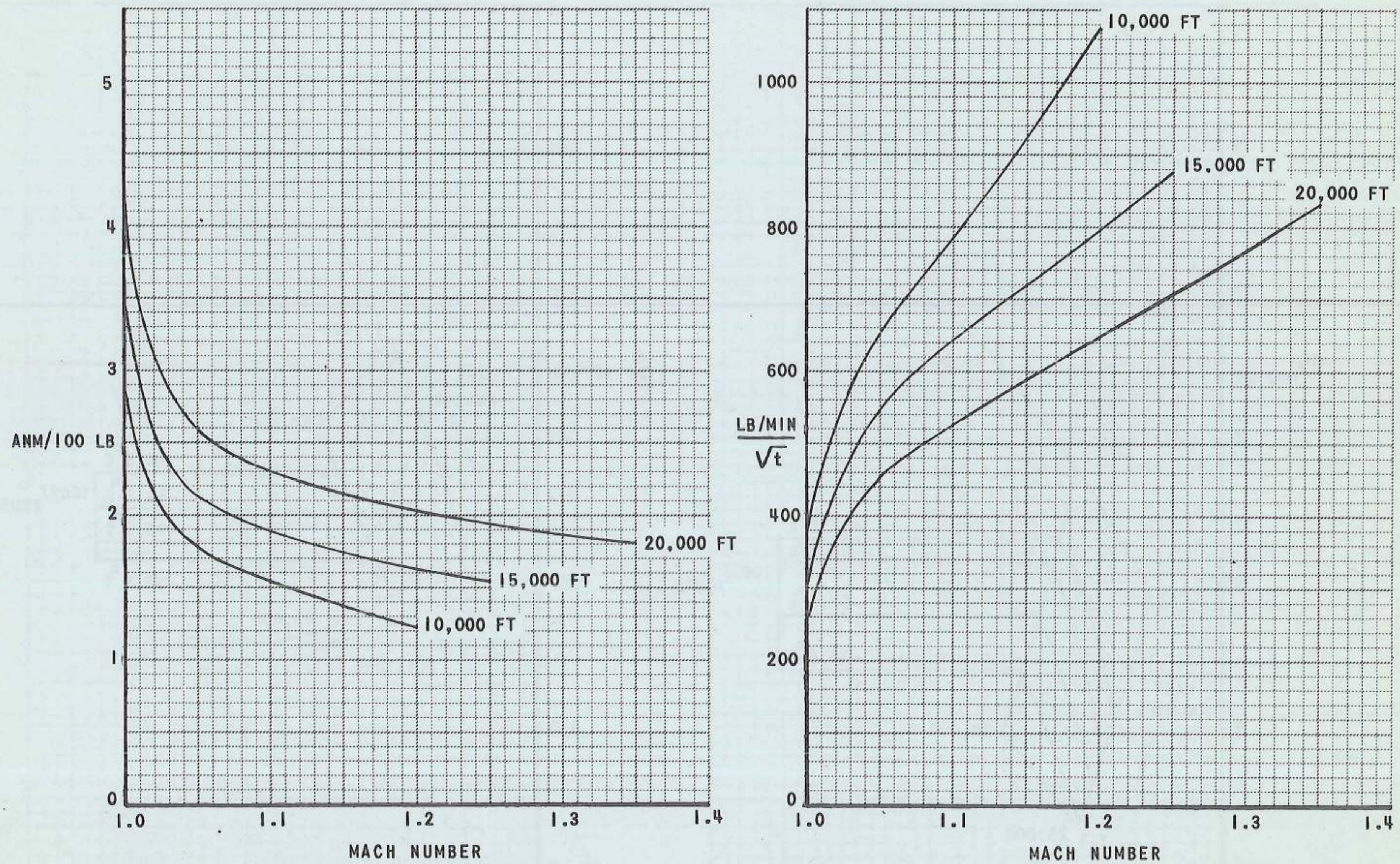
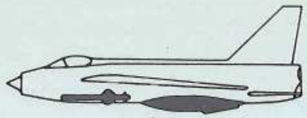


FIG. 4.13 ANM/100LB AND LB/MIN/$\sqrt{t}$ SUPERSONIC



NO REHEAT
32,000 LB

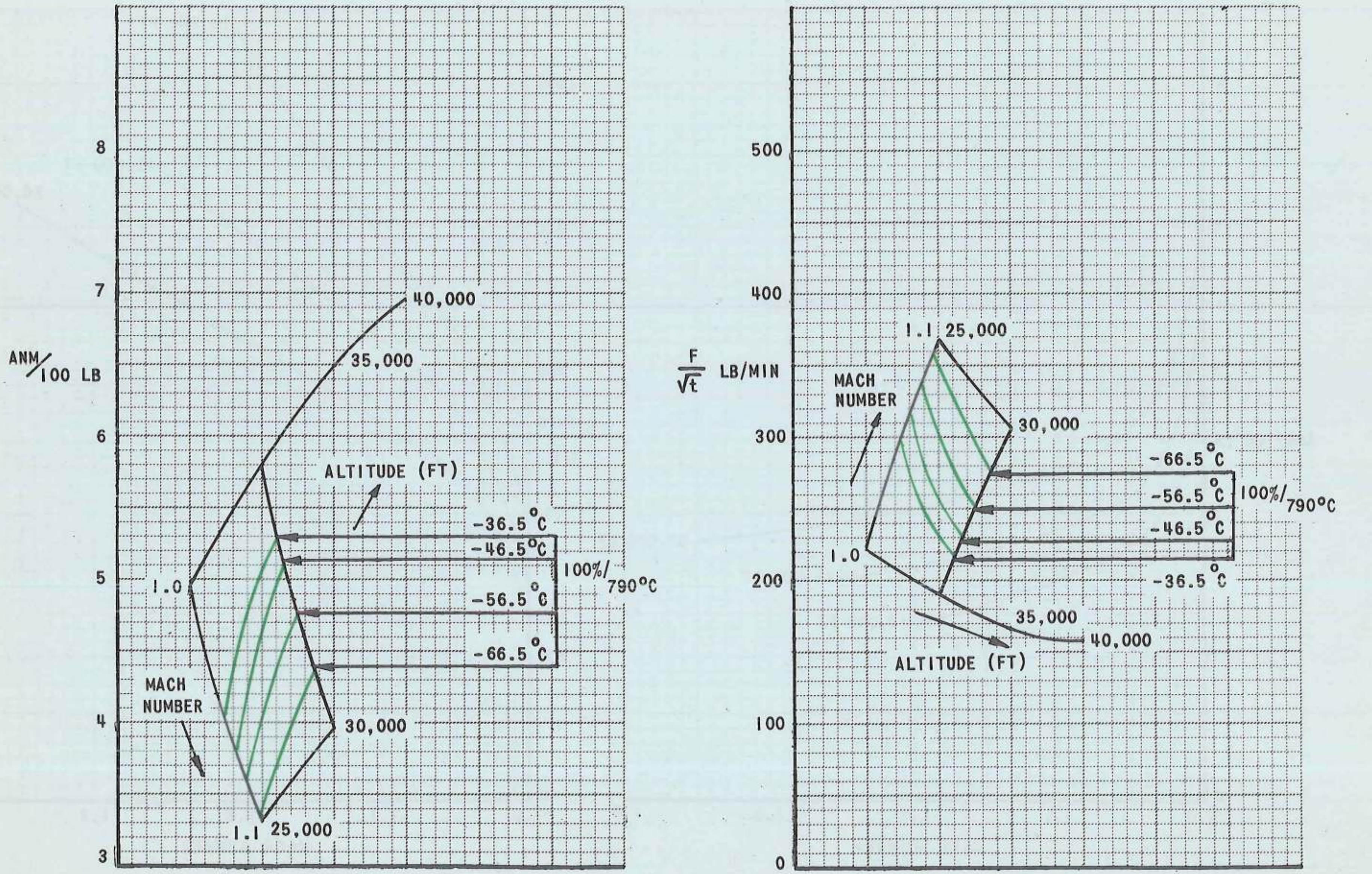


FIG. 4.14 ANM/100LB AND LB/MIN/√t SUPERSONIC

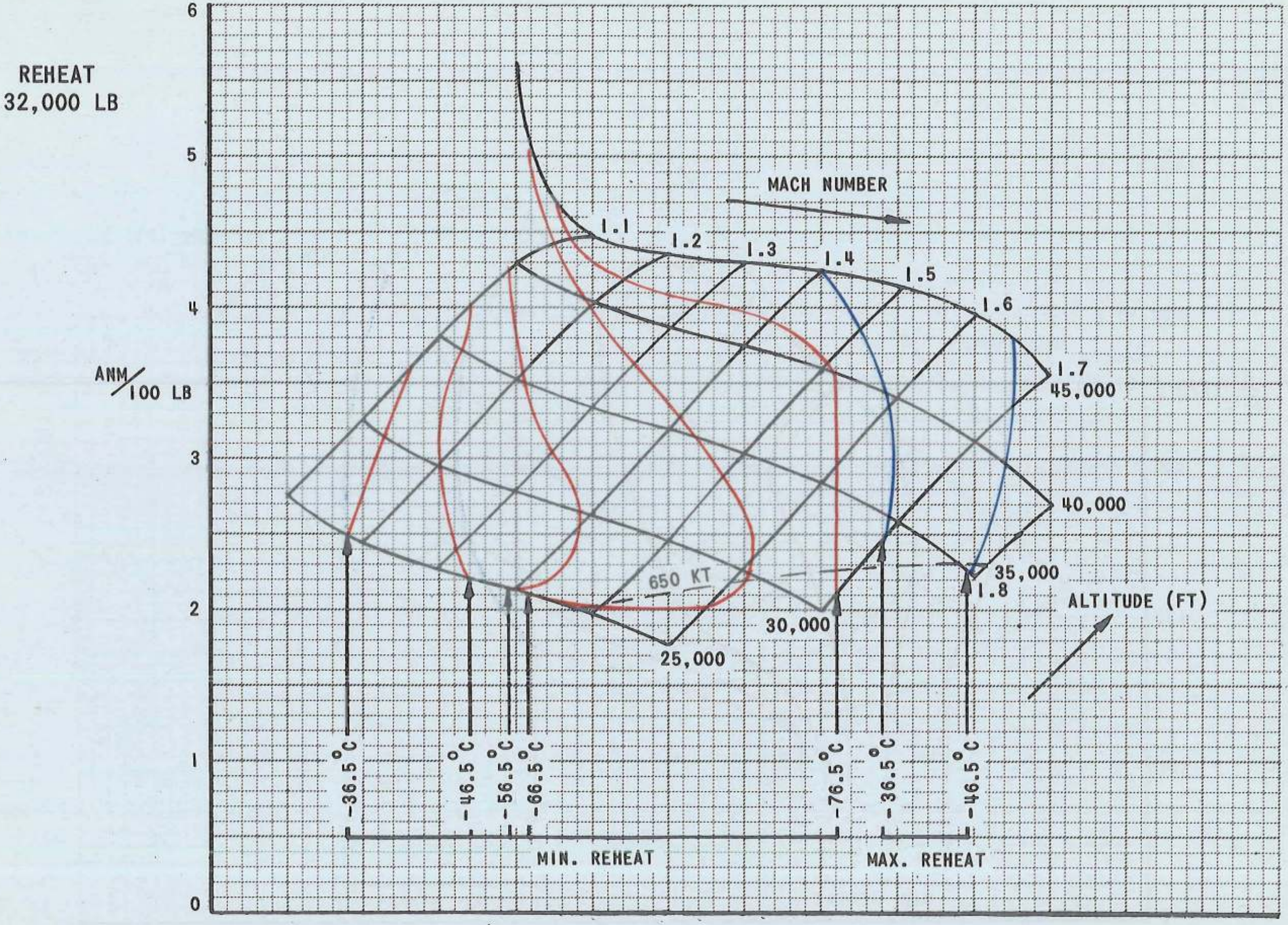
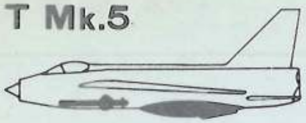


FIG. 4.15 ANM/100LB SUPERSONIC



REHEAT
32,000 LB

FIG. 4.16 LB/MIN/$\sqrt{t}$ SUPERSONIC


18
18