787
Airplane Characteristics for Airport Planning

Boeing Commercial Airplanes

787 AIRPLANE CHARACTERISTICS FOR AIRPORT PLANNING
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1.0 SCOPE AND INTRODUCTION

1.1 Scope

This document provides, in a standardized format, airplane characteristics data for general airport planning. Since operational practices vary among airlines, specific data should be coordinated with the using airlines prior to facility design. Boeing Commercial Airplanes should be contacted for any additional information required.

Content of the document reflects the results of a coordinated effort by representatives from the following organizations:

- Aerospace Industries Association
- Airports Council International - North America
- Air Transport Association of America
- International Air Transport Association

The airport planner may also want to consider the information presented in the "Commercial Aircraft Design Characteristics – Trends and Growth Projections," available from the US AIA, 1250 Eye St., Washington DC 20005, for long-range planning needs. This document is updated periodically and represents the coordinated efforts of the following organizations regarding future aircraft growth trends:

- International Coordinating Council of Aerospace Industries Associations
- Airports Council International - North American and World Organizations
- Air Transport Association of America
- International Air Transport Association

1.2 Introduction

This document conforms to NAS 3601. It provides characteristics of the Boeing Model 787 airplane for airport planners and operators, airlines, architectural and engineering consultant organizations, and other interested industry agencies. Airplane changes and available options may alter model characteristics; the data presented herein reflect typical airplanes in each model category.

For additional technical data or to contact the Boeing Airport Compatibility organization, please see the following webpage:

www.boeing.com/airports

1.3 A Brief Description of the 787 Family of Airplanes

The 787 Dreamliner is a super-efficient family of twin-engine airplanes with exceptional environmental performance and new passenger-pleasing features. An international team of aerospace companies builds the 787, led by Boeing at its Everett facility near Seattle,Washington and in North Charleston, S.C

787 Family

The 787 family is designed for medium- to long-range flights. In a three-class configuration, the 787-8 can carry 242 passengers; the 787-9 can carry 280 passengers; and the 787-10 will carry 323 passengers.

787 Engines

The 787 features new engines from General Electric and Rolls-Royce, that represent nearly a two-generation jump in technology.

Cargo Handling

The lower lobe cargo compartments can accommodate a variety of containers and pallets now in use.

Ground Servicing

The 787 is designed as an "all-electric" airplane and does not have a traditional pneumatic system. The traditional pneumatic starters on the engines are replaced with a pair of gearbox-mounted main-engine starter/generators. Cabin air conditioning and wing anti-ice systems are also electrically driven. The remaining pneumatic system is for engine nacelle anti-ice. The airplane has ground service connections compatible with existing ground service equipment, and no special equipment is necessary. In case of an inoperable APU, engine starts may be accomplished via the airplane's external ground electrical connections.

2.0 AIRPLANE DESCRIPTION

2.1 General Characteristics

2.2 General Dimensions

2.3 Ground Clearances

2.4 Interior Arrangements

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2.0 AIRPLANE DESCRIPTION

2.1 General Characteristics

Maximum Design Taxi Weight (MTW). Maximum weight for ground maneuver as limited by aircraft strength and airworthiness requirements. (It includes weight of taxi and run-up fuel.)

Maximum Design Takeoff Weight (MTOW). Maximum weight for takeoff as limited by aircraft strength and airworthiness requirements. (This is the maximum weight at start of the takeoff run.)

Maximum Design Landing Weight (MLW). Maximum weight for landing as limited by aircraft strength and airworthiness requirements.

Maximum Design Zero Fuel Weight (MZFW). Maximum weight allowed before usable fuel and other specified usable agents must be loaded in defined sections of the aircraft as limited by strength and airworthiness requirements.

Operating Empty Weight (OEW). Weight of structure, powerplant, furnishing systems, unusable fuel and other unusable propulsion agents, and other items of equipment that are considered an integral part of a particular airplane configuration. Also included are certain standard items, personnel, equipment, and supplies necessary for full operations, excluding usable fuel and payload.

Maximum Structural Payload. Maximum design zero fuel weight minus operation empty weight.

Maximum Seating Capacity. The maximum number of passengers specifically certificated or anticipated for certification.

Maximum Cargo Volume. The maximum space available for cargo.

Usable Fuel. Fuel available for aircraft propulsion.

CHARACTERISTICS	UNITS	ENGINE MANUFACTURER	
		GENERAL ELECTRIC	ROLLS-ROYCE
MAX DESIGN TAXI WEIGHT	POUNDS	503,500	503,500
	KILOGRAMS	228,384	228,384
MAX DESIGN TAKEOFF WEIGHT	POUNDS	502,500	502,500
	KILOGRAMS	227,930	227,930
MAX DESIGN LANDING WEIGHT	POUNDS	380,000	380,000
	KILOGRAMS	172,365	172,365
MAX DESIGN ZERO FUEL WEIGHT	POUNDS	355,000	355,000
	KILOGRAMS	161,025	161,025
OPERATING EMPTY WEIGHT (1)	POUNDS	259,500	259,700
	KILOGRAMS	117,707	117,798
MAX STRUCTURAL PAYLOAD (1)	POUNDS	95,500	95,300
	KILOGRAMS	43,318	43,227
SEATING CAPACITY	ONE-CLASS	375 ALL-ECONOMY SEATS; FAA EXIT LIMIT = 381 SEATS	
	MIXED CLASS	242 THREE-CLASS; 16 FIRST CLASS, 44 BUSINESS CLASS, 182 ECONOMY CLASS (SEE SEC 2.4)	
MAX CARGO - LOWER DECK	CUBIC FEET	4,826 (2)	4,826 (2)
	CUBIC METERS	136.7 (2)	136.7 (2)
USABLE FUEL	US GALLONS	33,340	33,340
	LITERS	126,206	126,206
	POUNDS	223,378	223,378
	KILOGRAMS	101,323	101,323

NOTES: (1) ESTIMATED WEIGHT FOR TYPICAL ENGINE / WEIGHT CONFIGURATION SHOWN IN MIXED CLASS, ACTUAL WEIGHT WILL VARY FOR EACH AIRPLANE SERIAL NUMBER AND SPECIFIC AIRLINE CONFIGURATION.

(2) 16 LD-3 CONTAINERS IN FWD COMPARTMENT AT 158 CU FT (4.5 CU M) EACH ; 12 LD-3 CONTAINERS IN AFT COMPARTMENT; 402 CU FT (11.4 CU M) IN BULK CARGO COMPARTMENT. SEE SEC 2.6 FOR OTHER LOADING COMBINATIONS.

2.1.1 GENERAL CHARACTERISTICS

MODEL 787-8

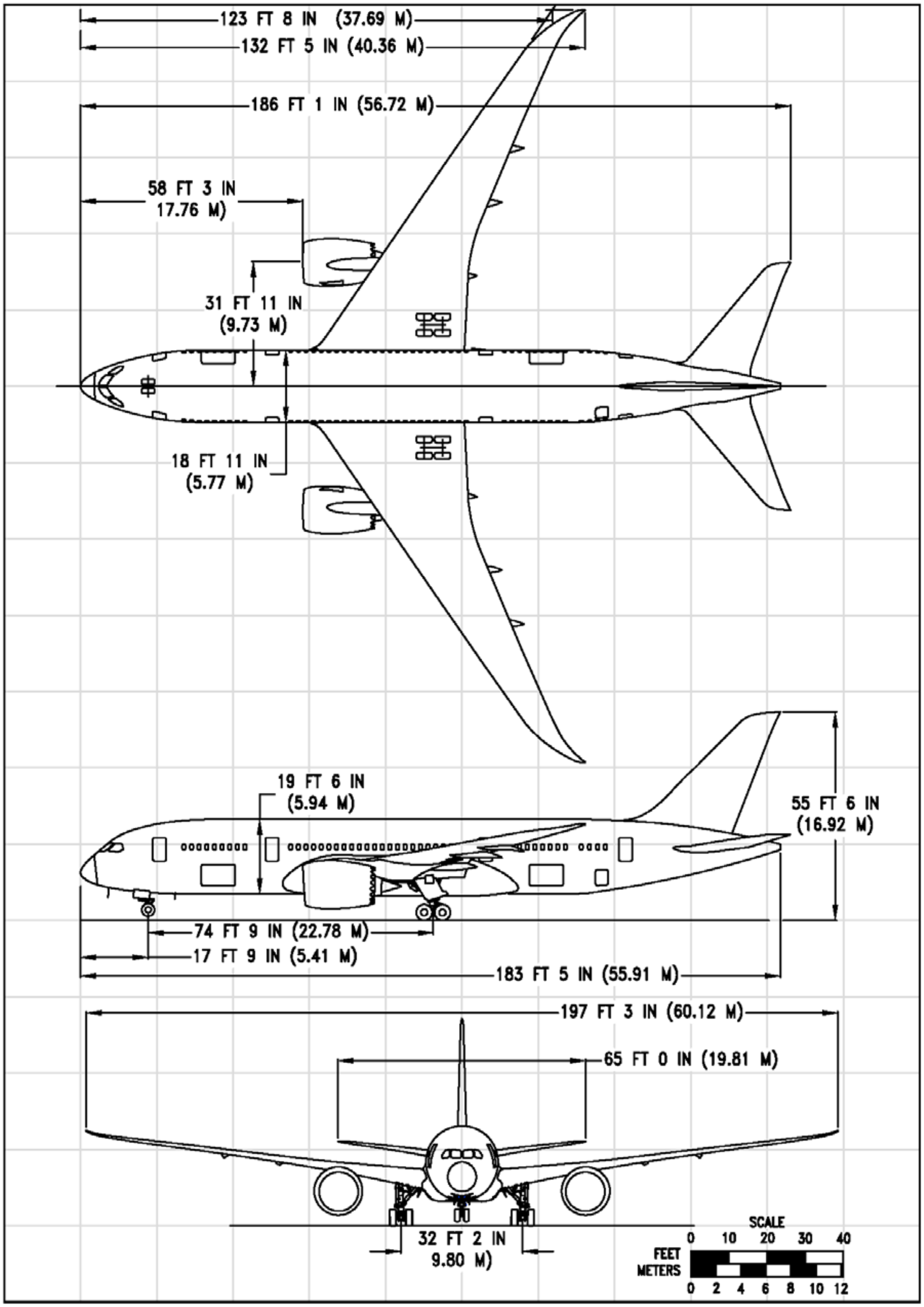
CHARACTERISTICS	UNITS	ENGINE MANUFACTURER	
		GENERAL ELECTRIC	ROLLS-ROYCE
MAX DESIGN TAXI WEIGHT	POUNDS	559,000	559,000
	KILOGRAMS	253,558	253,558
MAX DESIGN TAKEOFF WEIGHT	POUNDS	557,000	557,000
	KILOGRAMS	252,651	252,651
MAX DESIGN LANDING WEIGHT	POUNDS	425,000	425,000
	KILOGRAMS	192,777	192,777
MAX DESIGN ZERO FUEL WEIGHT	POUNDS	400,000	400,000
	KILOGRAMS	181,437	181,437
OPERATING EMPTY WEIGHT (1)	POUNDS	TBD	TBD
	KILOGRAMS	TBD	TBD
MAX STRUCTURAL PAYLOAD (1)	POUNDS	TBD	TBD
	KILOGRAMS	TBD	TBD
SEATING CAPACITY	ONE-CLASS	408 ALL-ECONOMY SEATS; FAA EXIT LIMIT = 440 SEATS	
	MIXED CLASS	280 THREE-CLASS; 16 FIRST CLASS, 50 BUSINESS CLASS, 214 ECONOMY CLASS (SEE SEC 2.4)	
MAX CARGO - LOWER DECK	CUBIC FEET	6,090 (2)	6,090 (2)
	CUBIC METERS	172.5 (2)	172.5 (2)
USABLE FUEL	US GALLONS	33,384	33,384
	LITERS	126,372	126,372
	POUNDS	223,673	223,673
	KILOGRAMS	101,456	101,456

NOTES: (1) ESTIMATED WEIGHT FOR TYPICAL ENGINE / WEIGHT CONFIGURATION SHOWN IN MIXED CLASS, ACTUAL WEIGHT WILL VARY FOR EACH AIRPLANE SERIAL NUMBER AND SPECIFIC AIRLINE CONFIGURATION.

(2) 20 LD-3 CONTAINERS IN FWD COMPARTMENT AT 158 CU FT (4.5 CU M) EACH ; 16 LD-3 CONTAINERS IN AFT COMPARTMENT; 402 CU FT (11.4 CU M) IN BULK CARGO COMPARTMENT. SEE SEC 2.6 FOR OTHER LOADING COMBINATIONS.

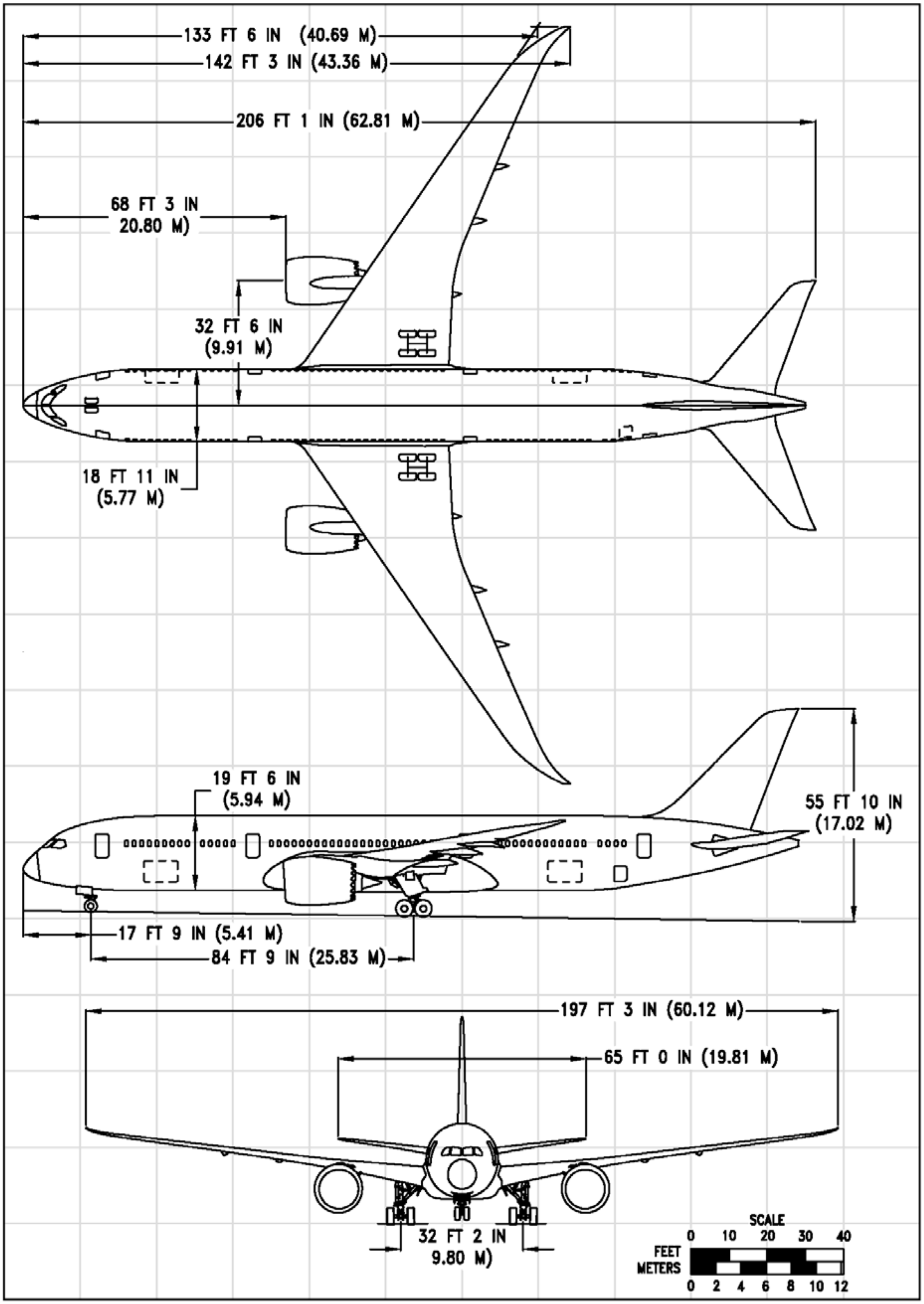
2.1.2 GENERAL CHARACTERISTICS

MODEL 787-9



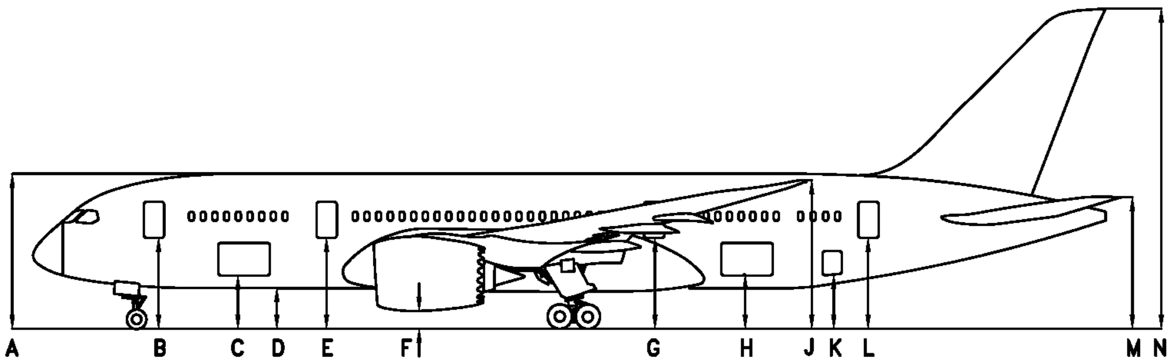
2.2.1 GENERAL DIMENSIONS

MODEL 787-8



2.2.2 GENERAL DIMENSIONS

MODEL 787-9



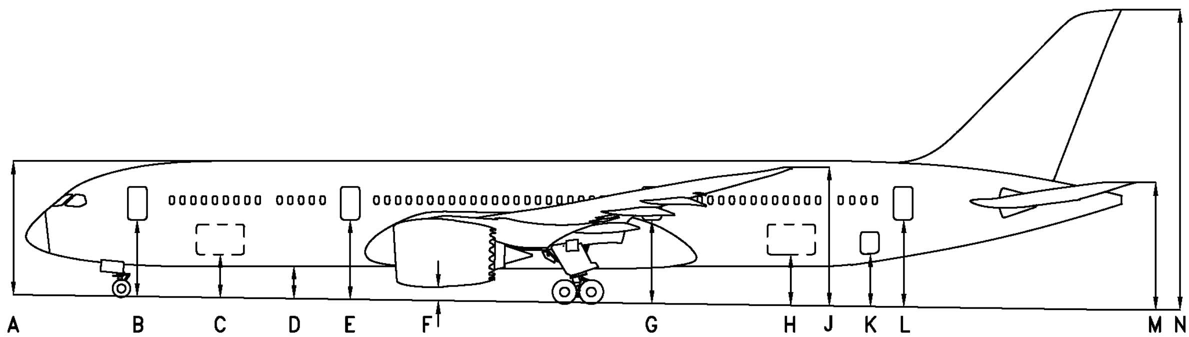
	MINIMUM		MAXIMUM	
	FEET - INCHES	METERS	FEET - INCHES	METERS
A	25 – 2	7.67	26 – 4	8.03
B	13 – 11	4.24	15 – 6	4.72
C	7 – 9	2.36	9 – 0	2.74
D	5 – 6	1.68	6 – 10	2.08
E	14 – 5	4.39	15 – 5	4.70
F (GE ENGINES)	2 – 5	.74	3 – 6	1.07
F (RR ENGINES)	2 – 4	.71	3 – 6	1.07
G	15 – 1	4.60	15 – 8	4.78
H	8 – 9	2.67	9 – 6	2.90
J	23 – 10	7.26	25 – 5	7.75
K	8 – 11	2.72	9 – 10	3.00
L	15 – 3	4.65	16 – 2	4.93
M	22 – 3	6.78	23 – 5	7.14
N	54 – 5	16.59	56 – 1	17.09

NOTES:

1. VERTICAL CLEARANCES SHOWN OCCUR DURING MAXIMUM VARIATIONS OF AIRPLANE ATTITUDE. COMBINATIONS OF AIRPLANE LOADING AND UNLOADING ACTIVITIES THAT PRODUCE THE GREATEST POSSIBLE VARIATION IN ATTITUDE WERE USED TO ESTABLISH THE VARIATIONS SHOWN.
2. DURING ROUTINE SERVICING, THE AIRPLANE REMAINS RELATIVELY STABLE, PITCH AND ELEVATION CHANGES OCCURRING SLOWLY.

2.3.1 GROUND CLEARANCES

MODEL 787-8



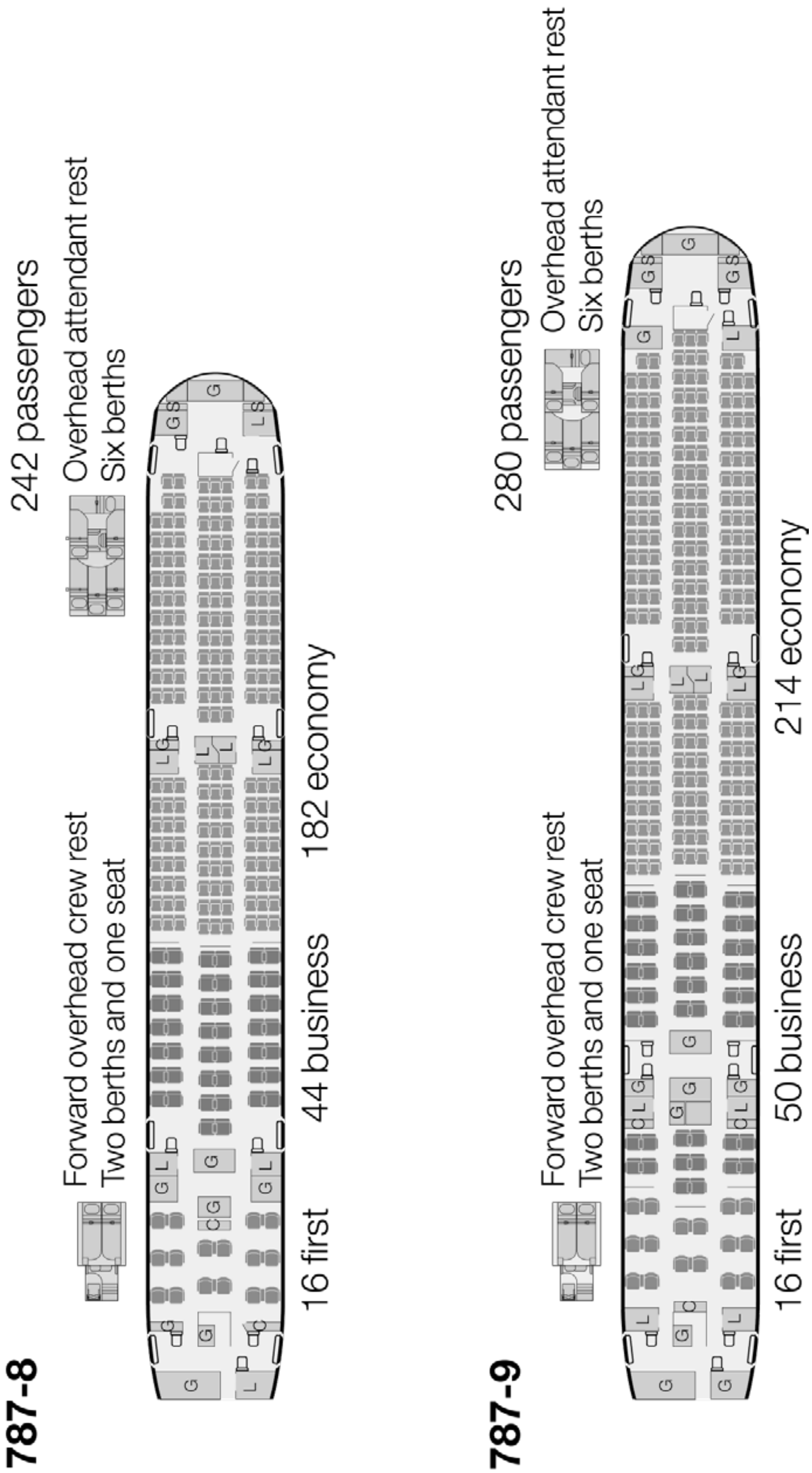
	MINIMUM		MAXIMUM	
	FEET - INCHES	METERS	FEET - INCHES	METERS
A	24 - 4	7.42	25 - 8	7.82
B	13 – 11	4.24	15 – 9	4.80
C	7 – 8	2.34	9 – 3	2.82
D	5 – 9	1.75	6 – 1	1.85
E	14 – 6	4.42	15 – 9	4.80
F (GE ENGINES)	2 – 3	.69	2 - 6	.76
F (RR ENGINES)	2 – 0	.61	2 – 7	.79
G	15 – 2	4.62	16 – 0	4.88
H	8 – 10	2.69	9 – 11	3.02
J	24 – 0	7.32	25 – 6	7.77
K	9 - 0	2.74	10 - 0	3.05
L	15 – 5	4.70	16 – 8	5.08
M	22 – 7	6.88	23 – 5	7.14
N	55 – 2	16.81	56 – 1	17.09

NOTES:

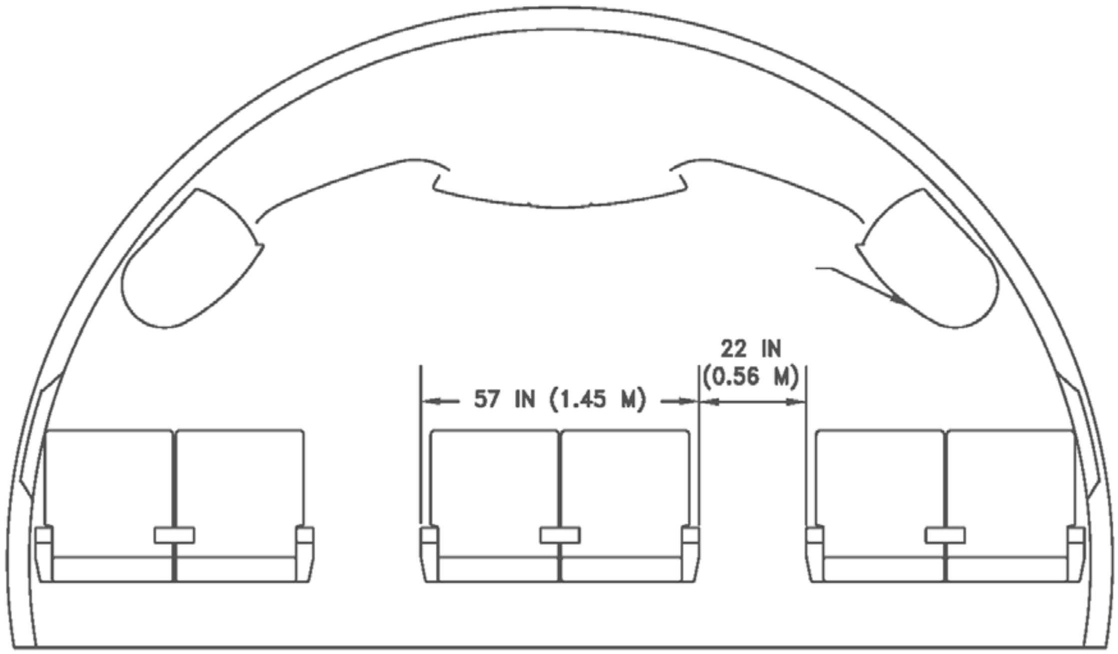
1. VERTICAL CLEARANCES SHOWN OCCUR DURING MAXIMUM VARIATIONS OF AIRPLANE ATTITUDE. COMBINATIONS OF AIRPLANE LOADING AND UNLOADING ACTIVITIES THAT PRODUCE THE GREATEST POSSIBLE VARIATION IN ATTITUDE WERE USED TO ESTABLISH THE VARIATIONS SHOWN.
2. DURING ROUTINE SERVICING, THE AIRPLANE REMAINS RELATIVELY STABLE, PITCH AND ELEVATION CHANGES OCCURRING SLOWLY.

2.3.2 GROUND CLEARANCES

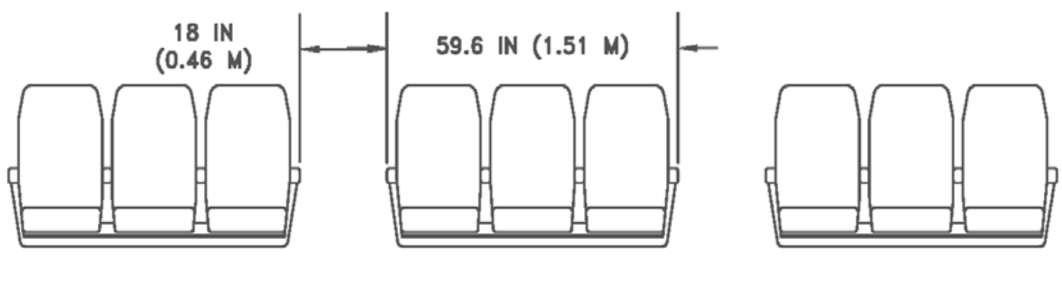
MODEL 787-9



2.4.1 INTERIOR ARRANGEMENTS – TYPICAL
MODEL 787-8, 787-9



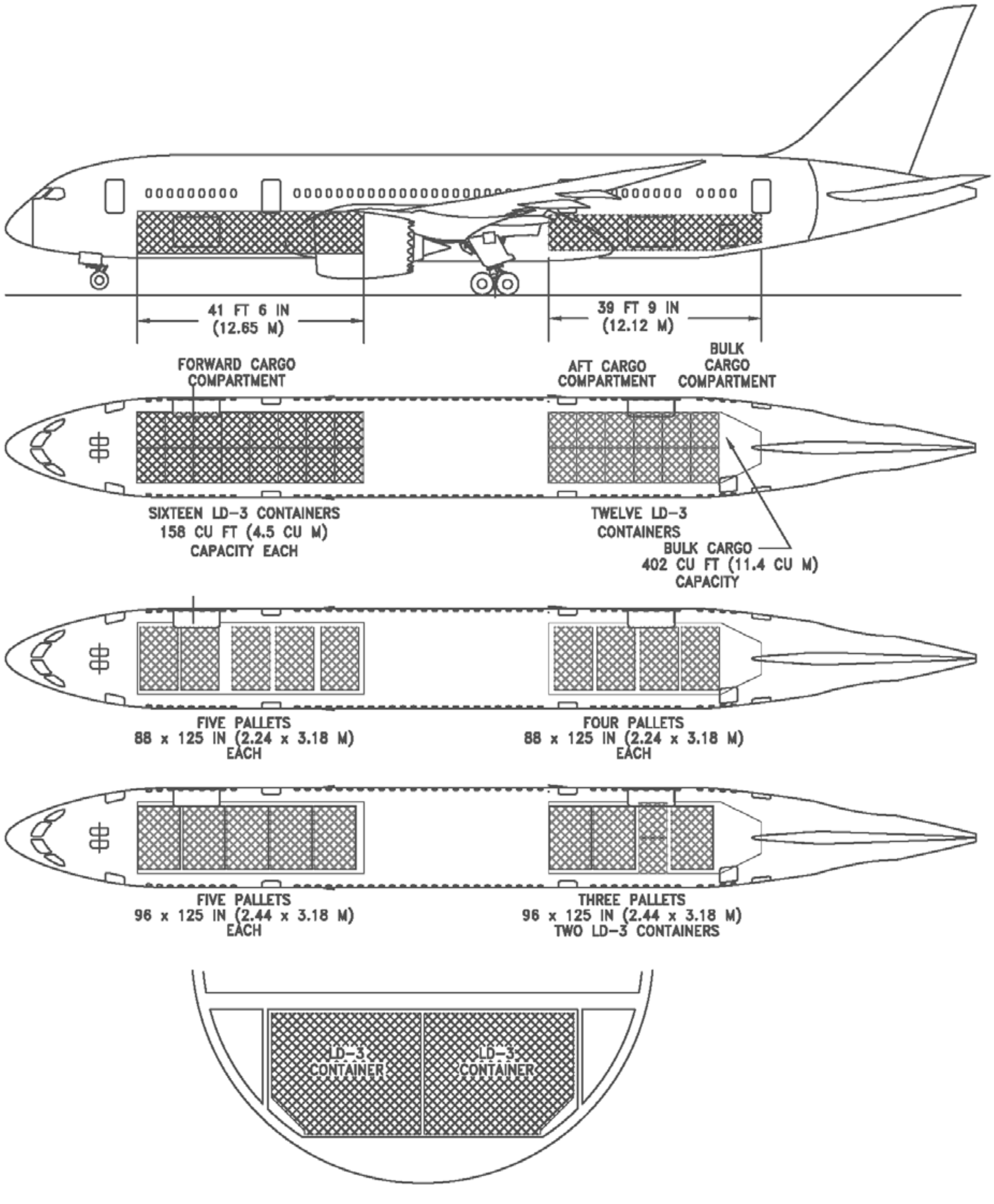
FIRST CLASS/BUSINESS CLASS SEATS



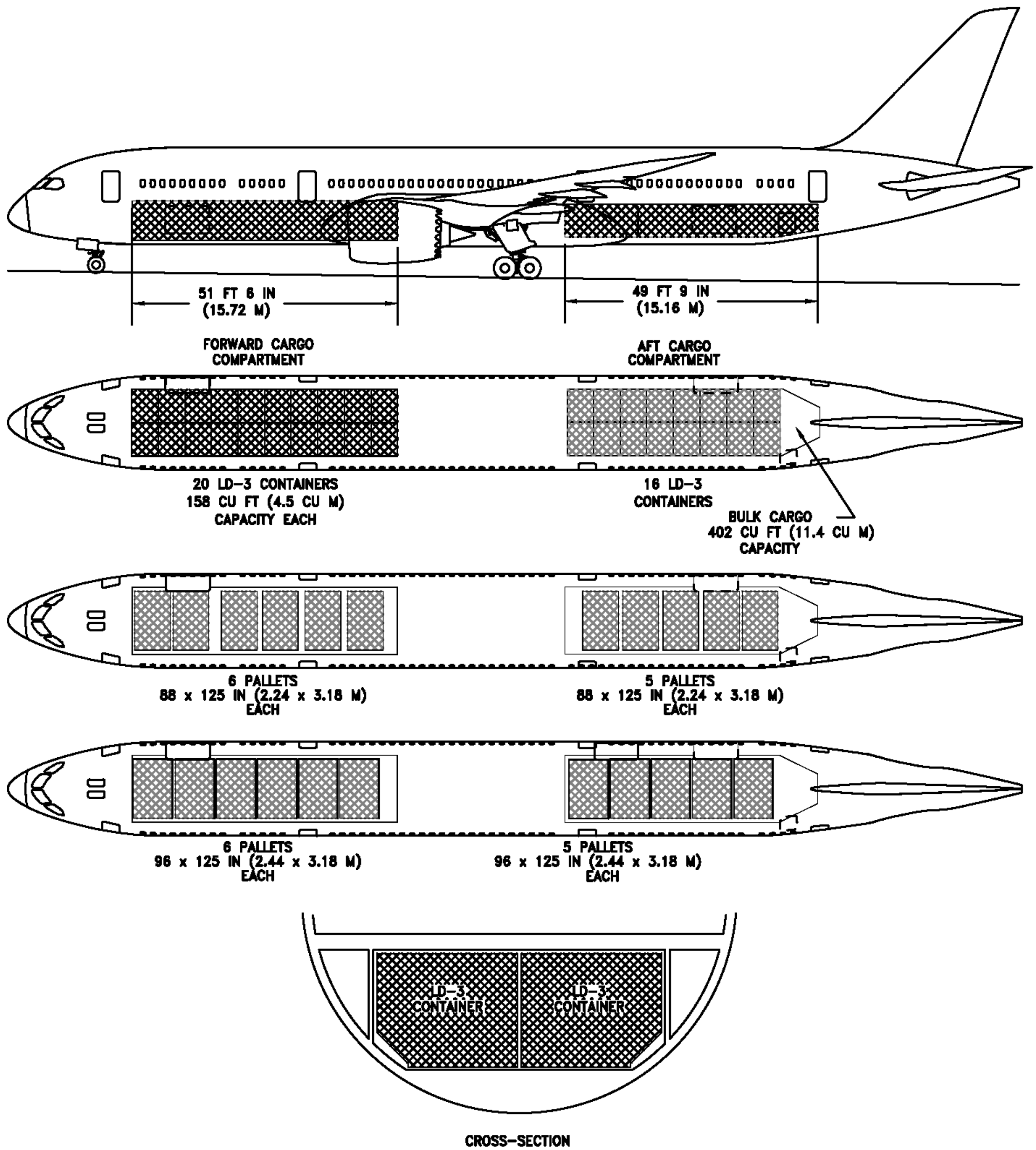
9-ABREAST ECONOMY SEATS

2.5 CABIN CROSS-SECTIONS – FIRST CLASS AND BUSINESS CLASS SEATS

MODEL 787-8, 787-9

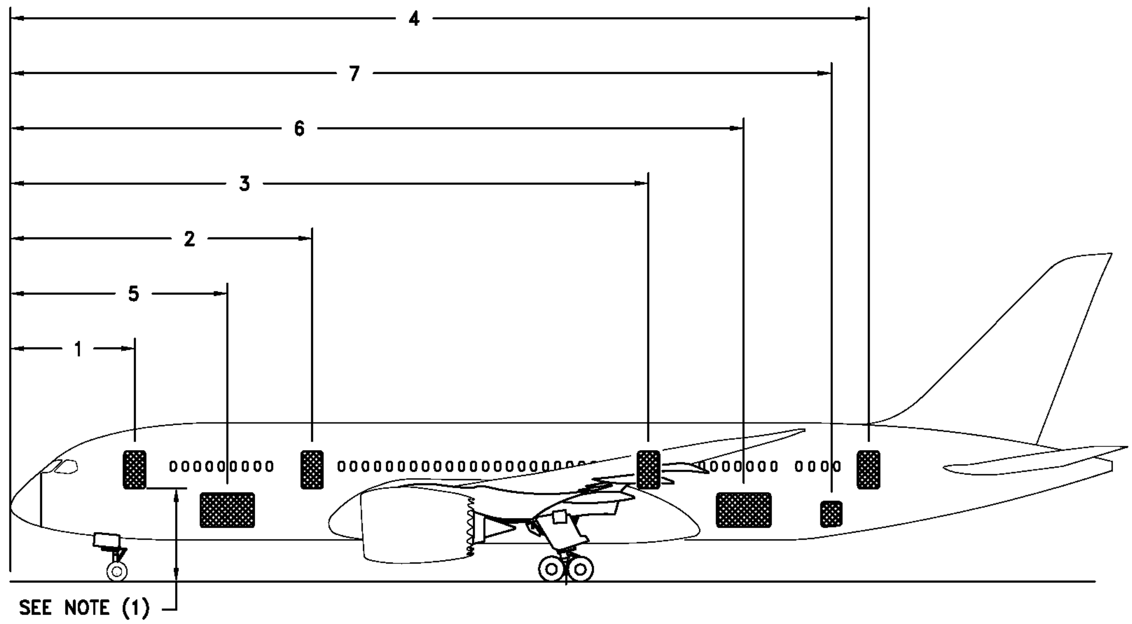


2.6.1 LOWER CARGO COMPARTMENTS – CONTAINERS AND BULK CARGO
MODEL 787-8



2.6.2 LOWER CARGO COMPARTMENTS – CONTAINERS AND BULK CARGO

MODEL 787-9



	DOOR NAME	DOOR LOCATION	787-8 FT-IN / M	787-9 FT-IN / M
1	MAIN ENTRY/SERVICE DOOR NO 1 (2)	LEFT AND RIGHT	20-8 / 6.30	20-8 / 6.30
2	MAIN ENTRY/SERVICE DOOR NO 2 (2)	LEFT AND RIGHT	50-3 / 15.32	60-3 / 18.36
3	EMERGENCY EXIT DOOR NO 3	LEFT AND RIGHT	106-3 / 32.39	116-3 / 35.43
4	MAIN ENTRY/SERVICE DOOR NO 4 (2)	LEFT AND RIGHT	142-11 / 43.56	162-11 / 49.66
5	FORWARD CARGO DOOR	RIGHT	36-1 / 11.00	36-1 / 11.00
6	AFT CARGO DOOR	RIGHT	122-1 / 37.21	142-1 / 43.31
7	BULK CARGO DOOR	LEFT	136-8 / 41.66	156-8 / 47.75

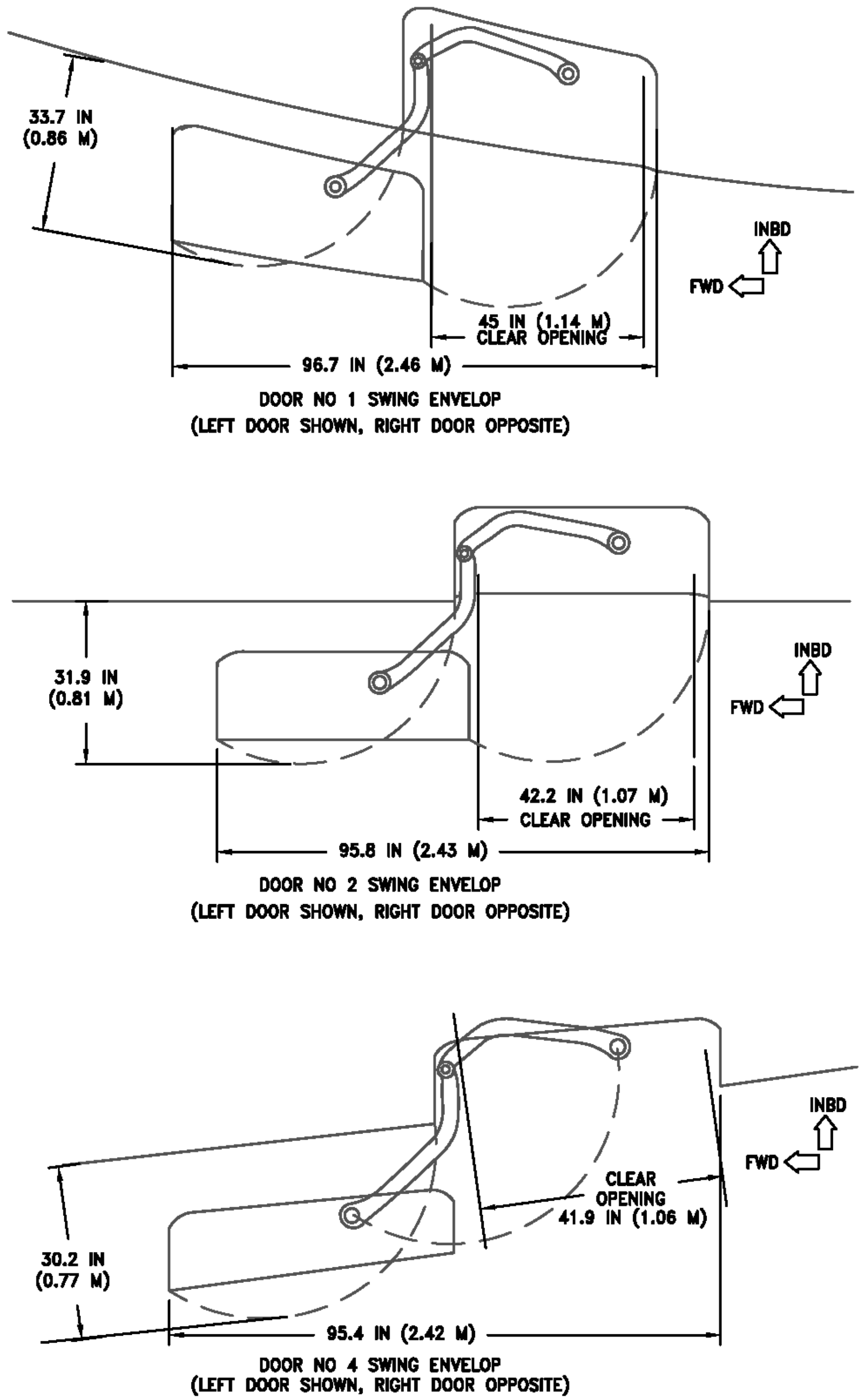
NOTES:

(1) SEE SEC 2.3 FOR DOOR SILL HEIGHTS

(2) ENTRY DOORS LEFT SIDE, SERVICE DOORS RIGHT SIDE

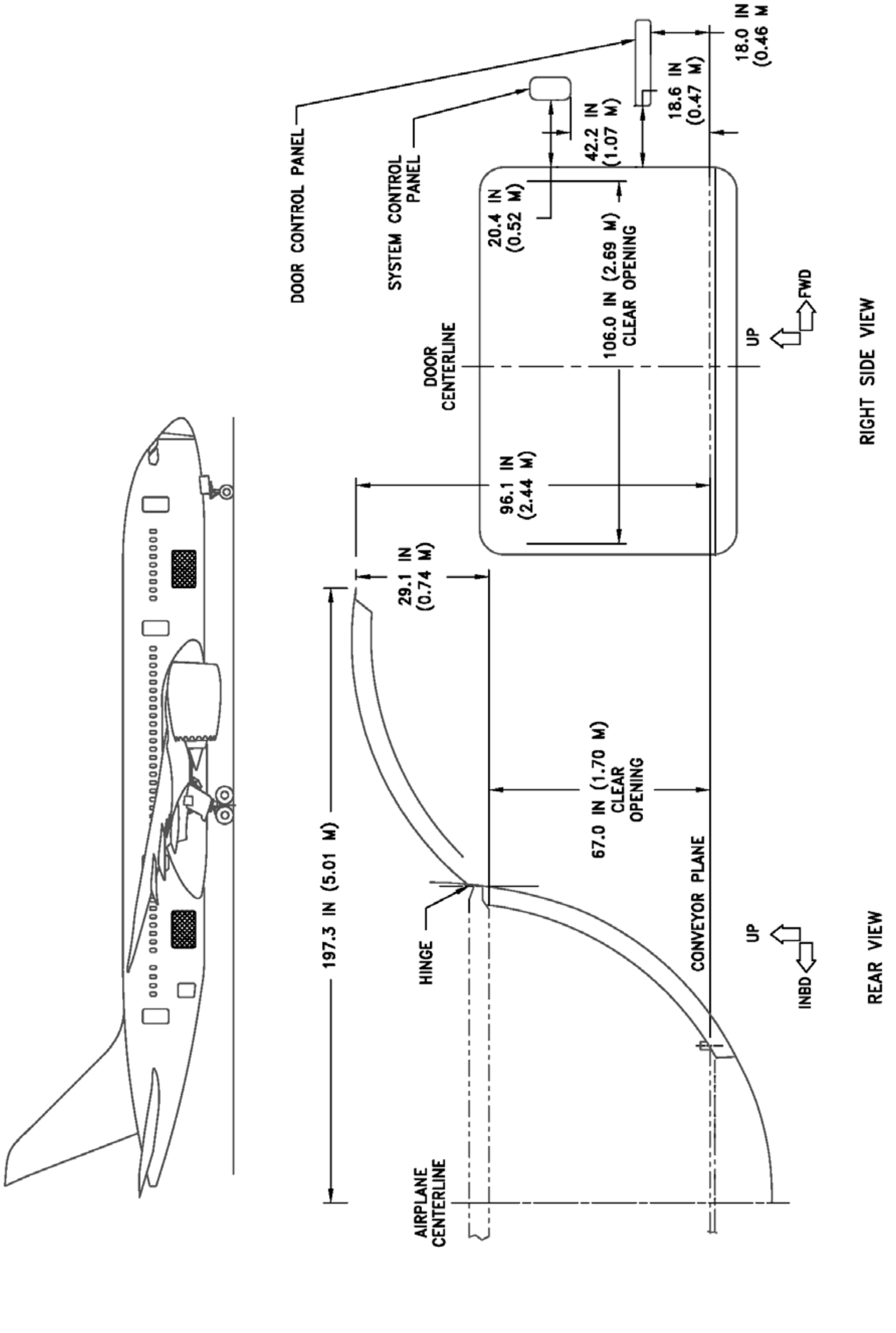
2.7.1 DOOR LOCATIONS -- PASSENGER AND CARGO DOORS

MODEL 787-8, 787-9



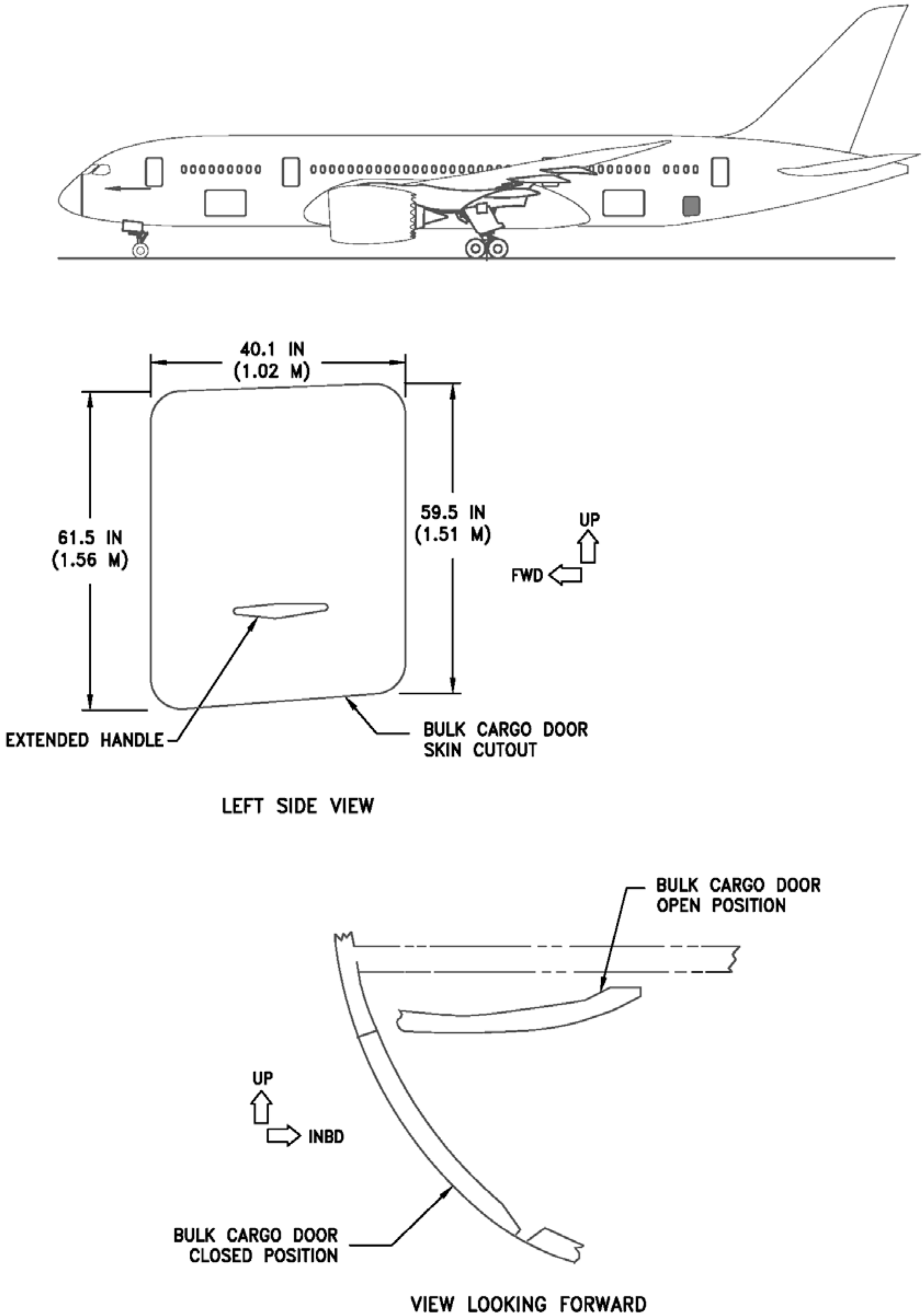
ALL DOORS

2.7.2 DOOR CLEARANCES – MAIN DECK ENTRY AND SERVICE DOORS
MODEL 787-8, 787-9



2.7.3 DOOR CLEARANCES – LOWER DECK CARGO DOOR (FORWARD & AFT)

MODEL 787-8, 787-9



2.7.4 DOOR CLEARANCES - BULK CARGO DOOR

MODEL 787-8, 787-9

3.0 AIRPLANE PERFORMANCE

3.1 General Information

3.2 Payload/Range

3.3 FAA/EASA Takeoff Runway Length Requirements

3.4 FAA/EASA Landing Runway Length Requirements

3.0 AIRPLANE PERFORMANCE

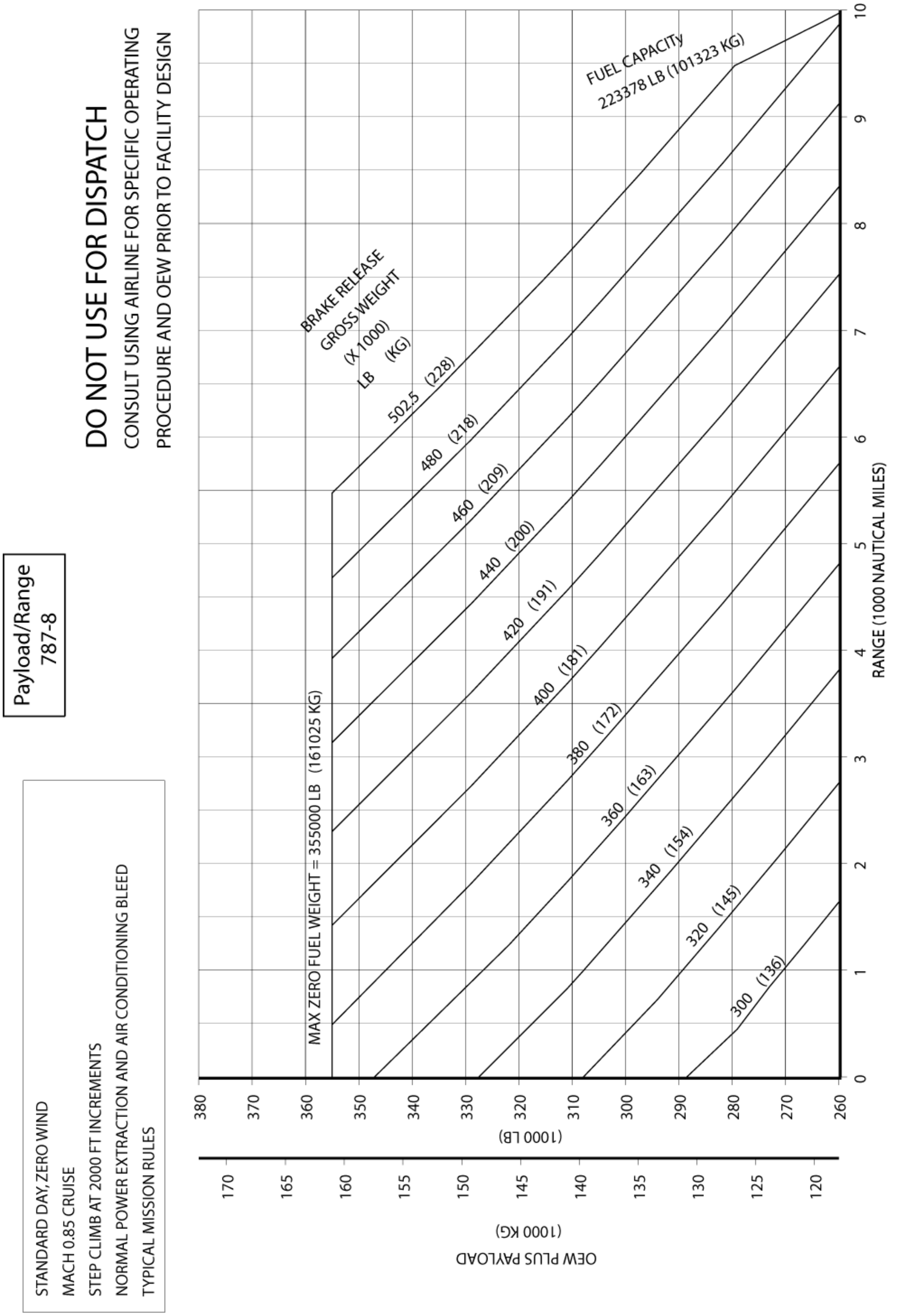
3.1 General Information

The graphs in Section 3.2 provide information on payload-range capability of the 787 airplane. To use these graphs, if the trip range and zero fuel weight (OEW + payload) are known, the approximate takeoff weight can be found, limited by maximum zero fuel weight, maximum design takeoff weight, or fuel capacity.

The graphs in Section 3.3 provide information on FAA/EASA takeoff runway length requirements with typical engines at different pressure altitudes. Maximum takeoff weights shown on the graphs are the heaviest for the particular airplane models with the corresponding engines. Standard day temperatures for pressure altitudes shown on the FAA/EASA takeoff graphs are given below:

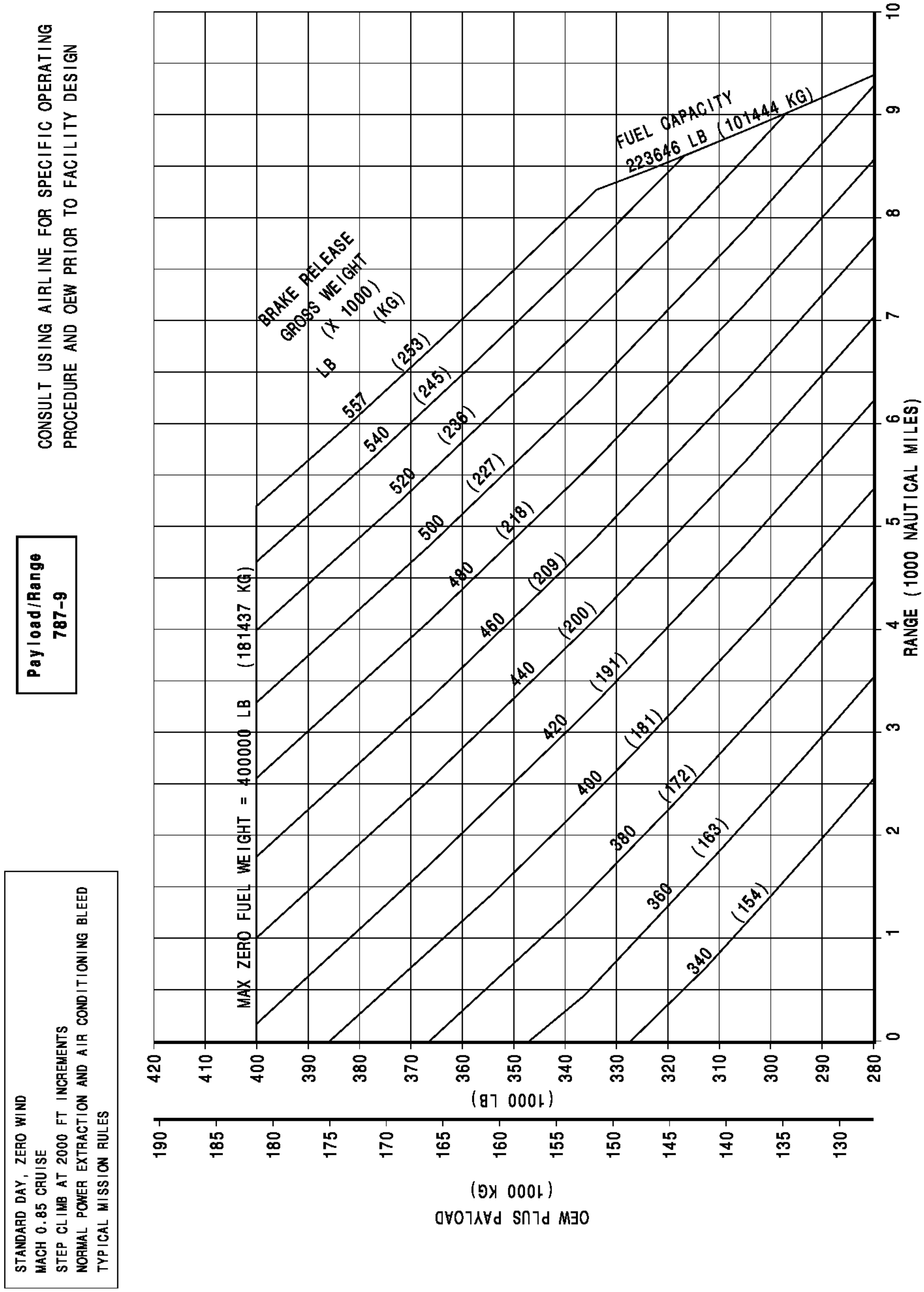
PRESSURE ALTITUDE		STANDARD DAY TEMP	
FEET	METERS	°F	°C
0	0	59.0	15.0
2,000	610	51.9	11.0
4,000	1,219	44.7	7.1
6,000	1,829	37.6	3.1
8,000	2,438	30.5	-0.8
10,000	3,048	23.3	-4.8
12,000	3,658	16.2	-8.8
14,000	4,267	9.1	-12.7

The graphs in Section 3.4 provide information on landing runway length requirements for different airplane weights and airport altitudes. The maximum landing weights shown are the heaviest for the particular airplane model.



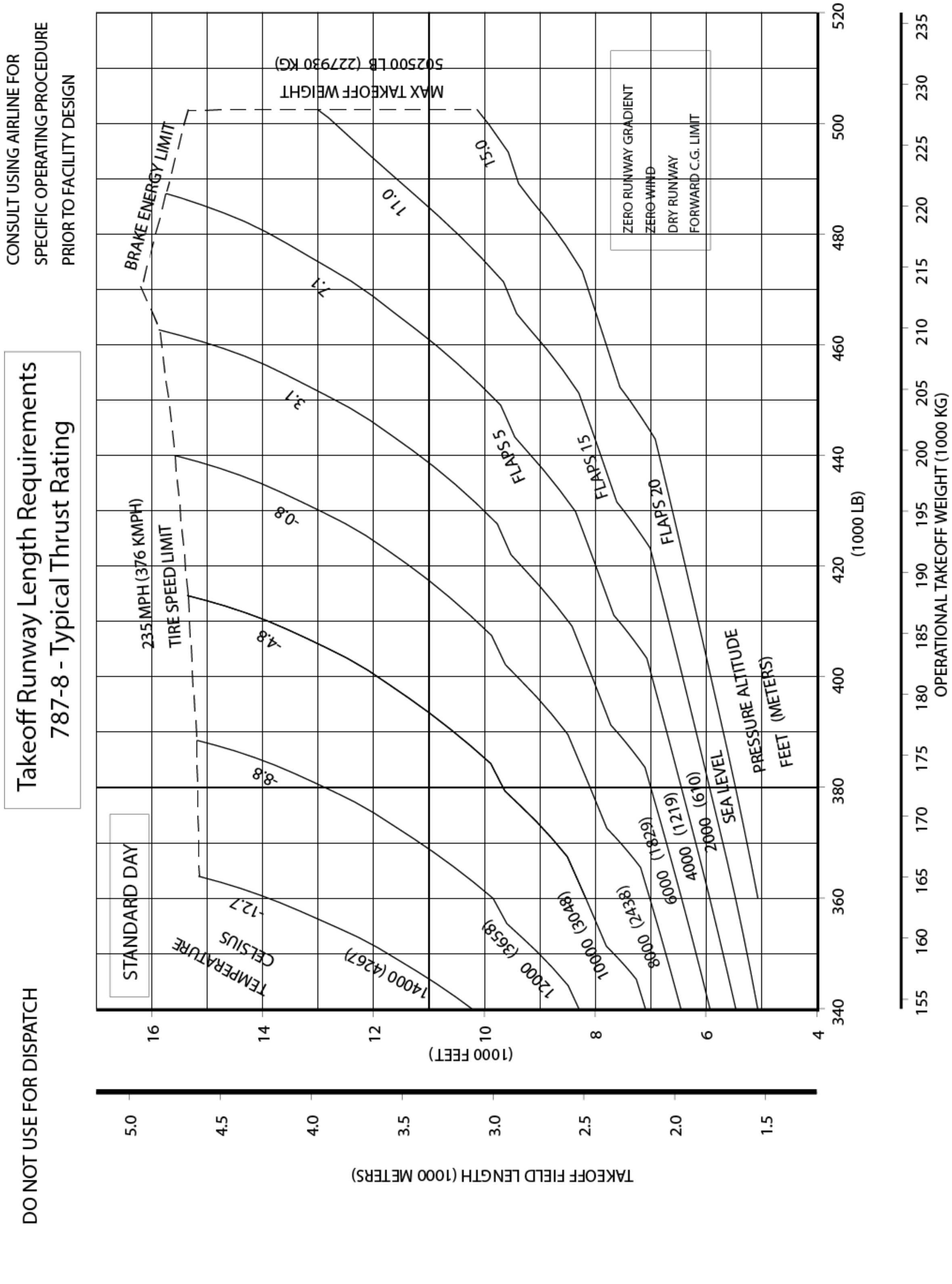
3.2.1 PAYLOAD/RANGE FOR LONG-RANGE CRUISE

MODEL 787-8 (TYPICAL ENGINES)

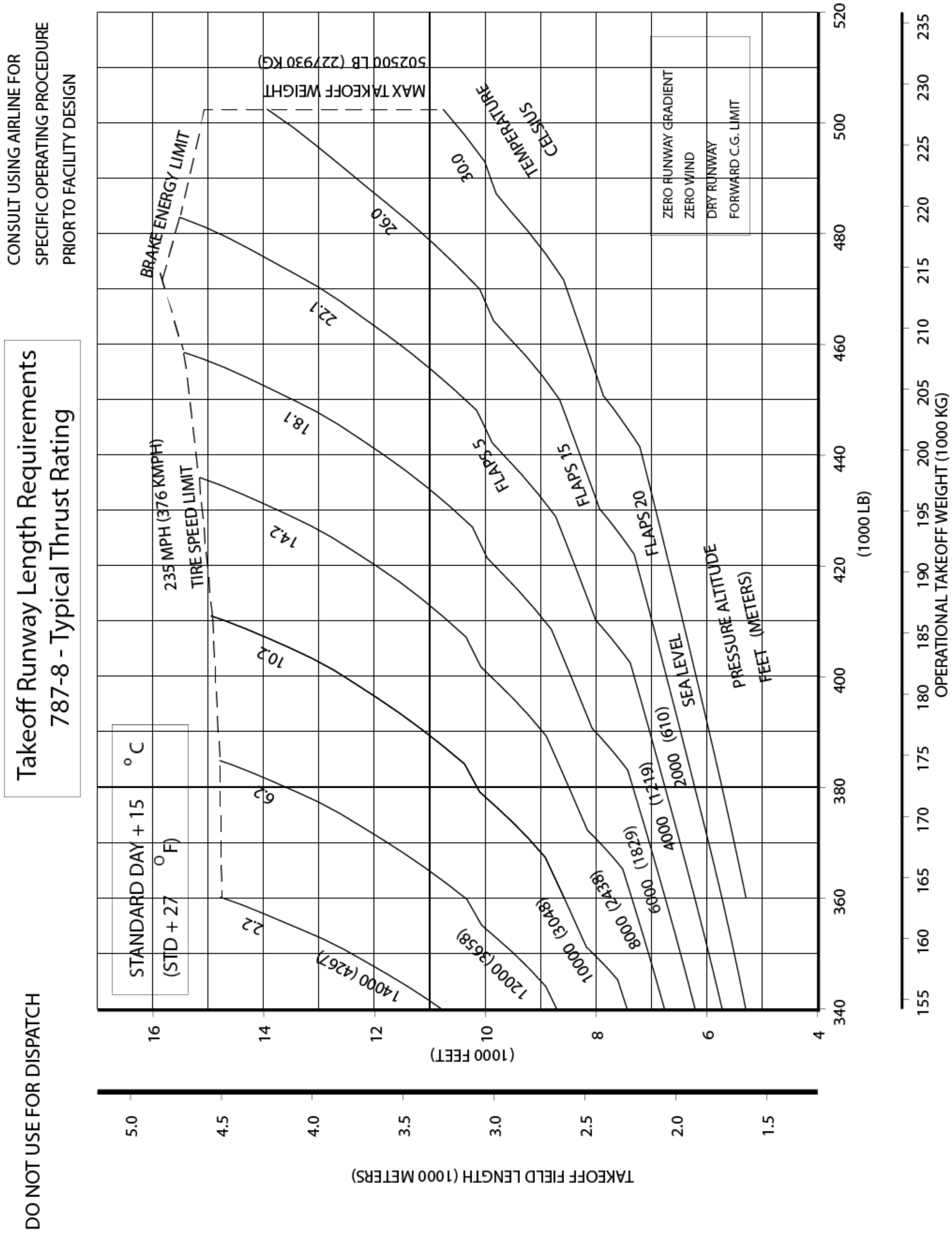


3.2.2 PAYLOAD/RANGE FOR LONG-RANGE CRUISE

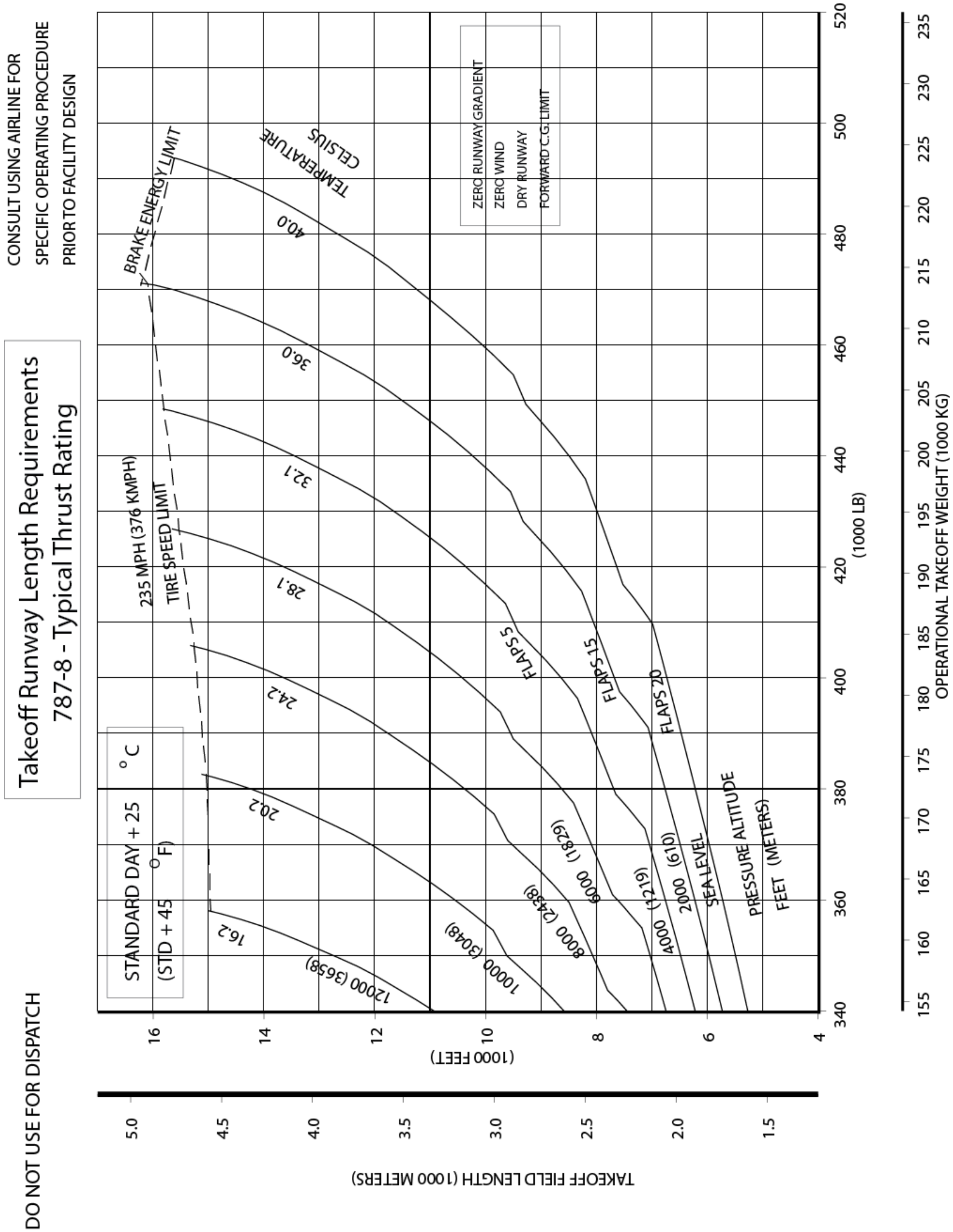
MODEL 787-9 (TYPICAL ENGINES)



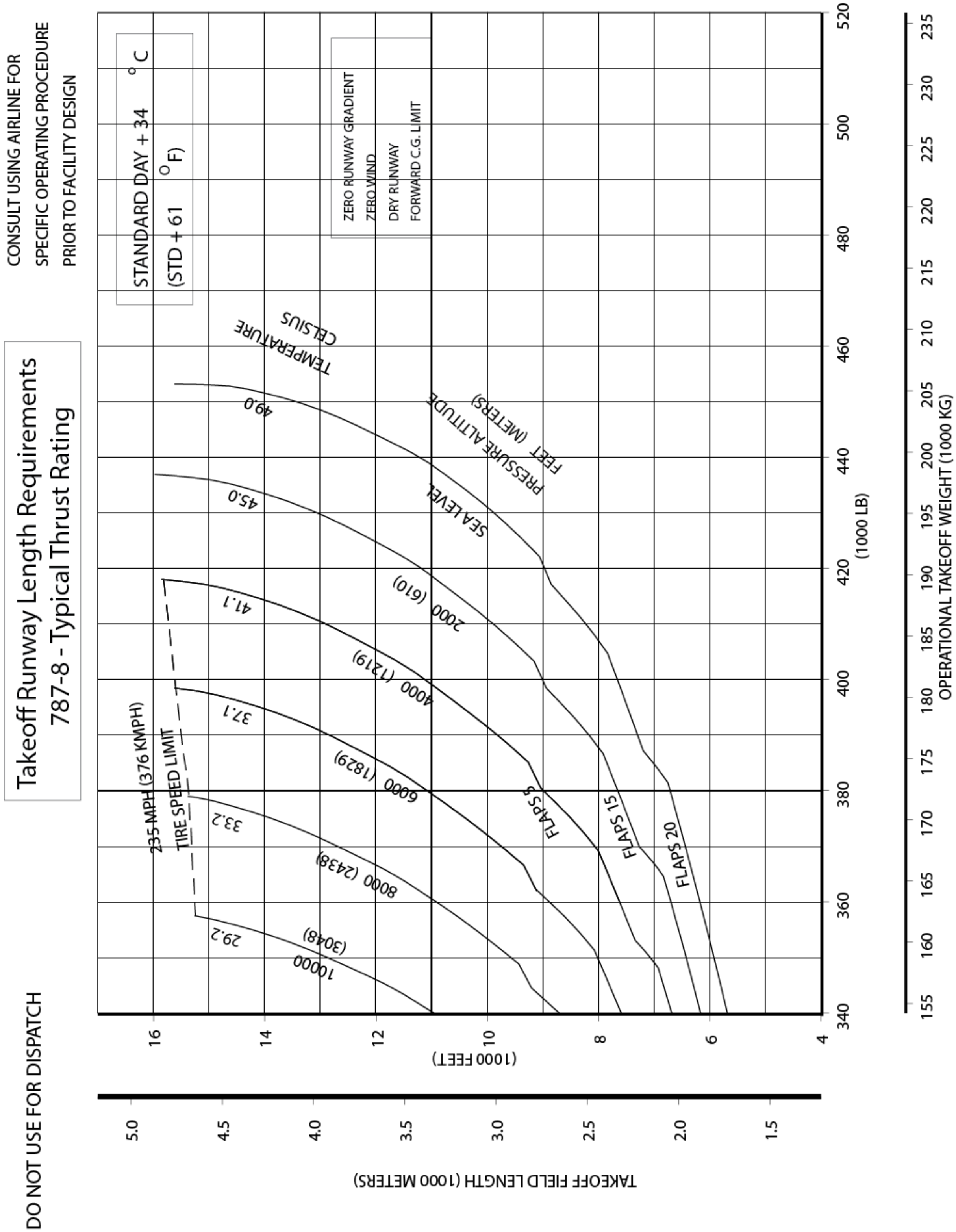
3.3.1 FAA/EASA TAKEOFF RUNWAY LENGTH REQUIREMENTS STANDARD DAY, DRY RUNWAY
MODEL 787-8 (TYPICAL ENGINES)



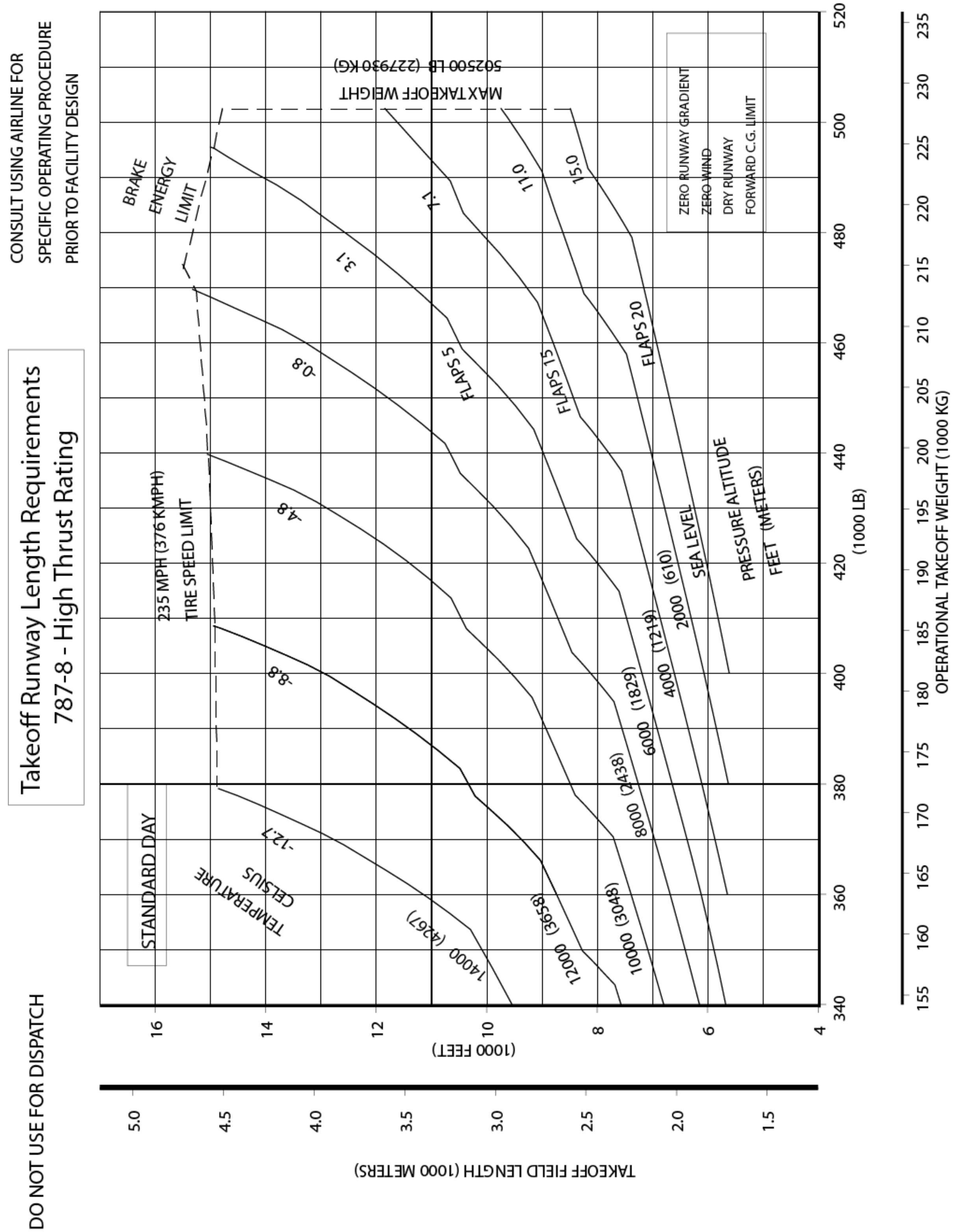
3.3.2 FAA/EASA TAKEOFF RUNWAY LENGTH REQUIREMENTS
STANDARD DAY + 27°F (STD + 15°C), DRY RUNWAY
MODEL 787-8 (TYPICAL ENGINES)



3.3.3 FAA/EASA TAKEOFF RUNWAY LENGTH REQUIREMENTS
STANDARD DAY + 45°F (STD + 25°C), DRY RUNWAY
MODEL 787-8 (TYPICAL ENGINES)

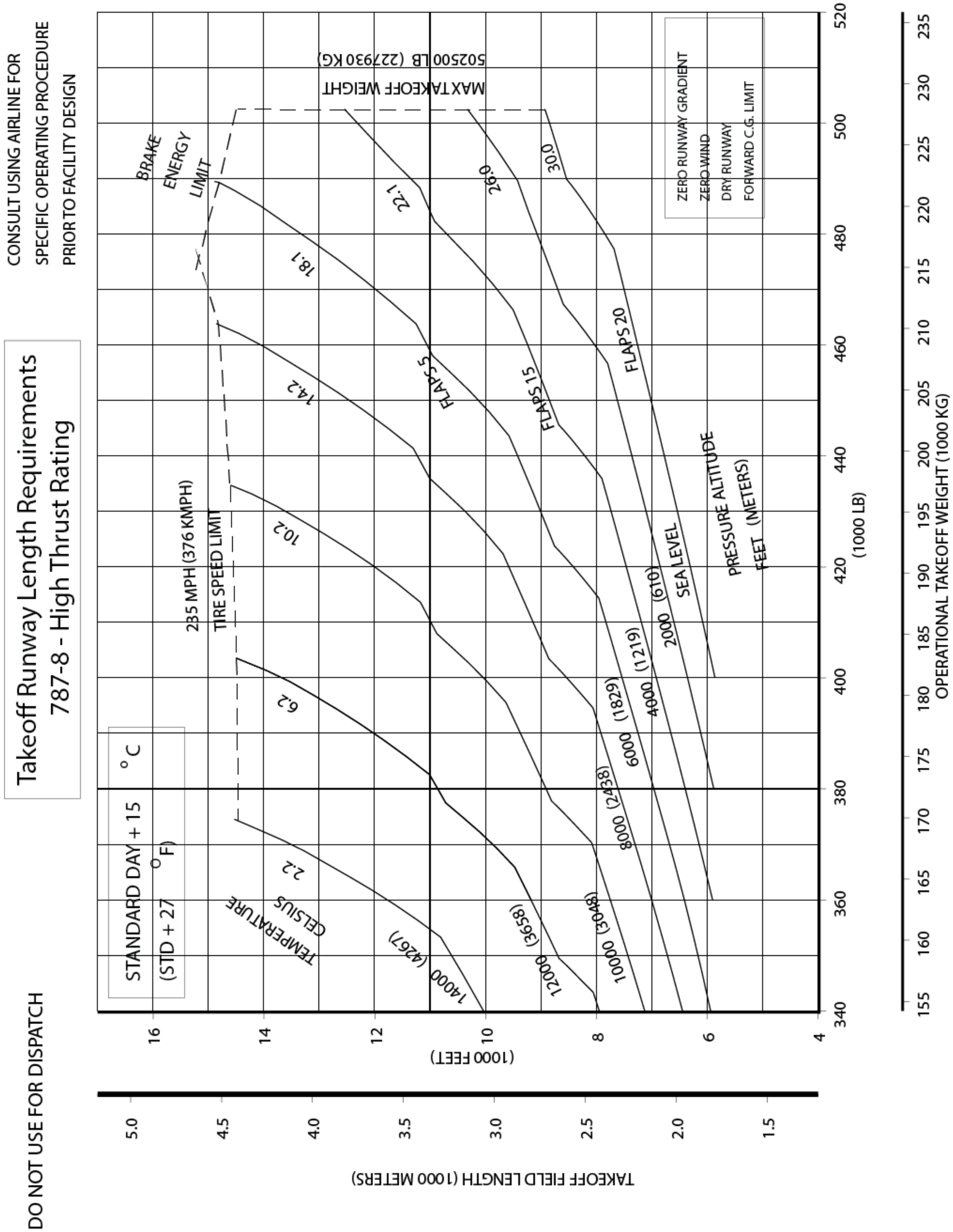


3.3.4 FAA/EASA TAKEOFF RUNWAY LENGTH REQUIREMENTS
STANDARD DAY + 61°F (STD + 34°C), DRY RUNWAY
MODEL 787-8 (TYPICAL ENGINES)

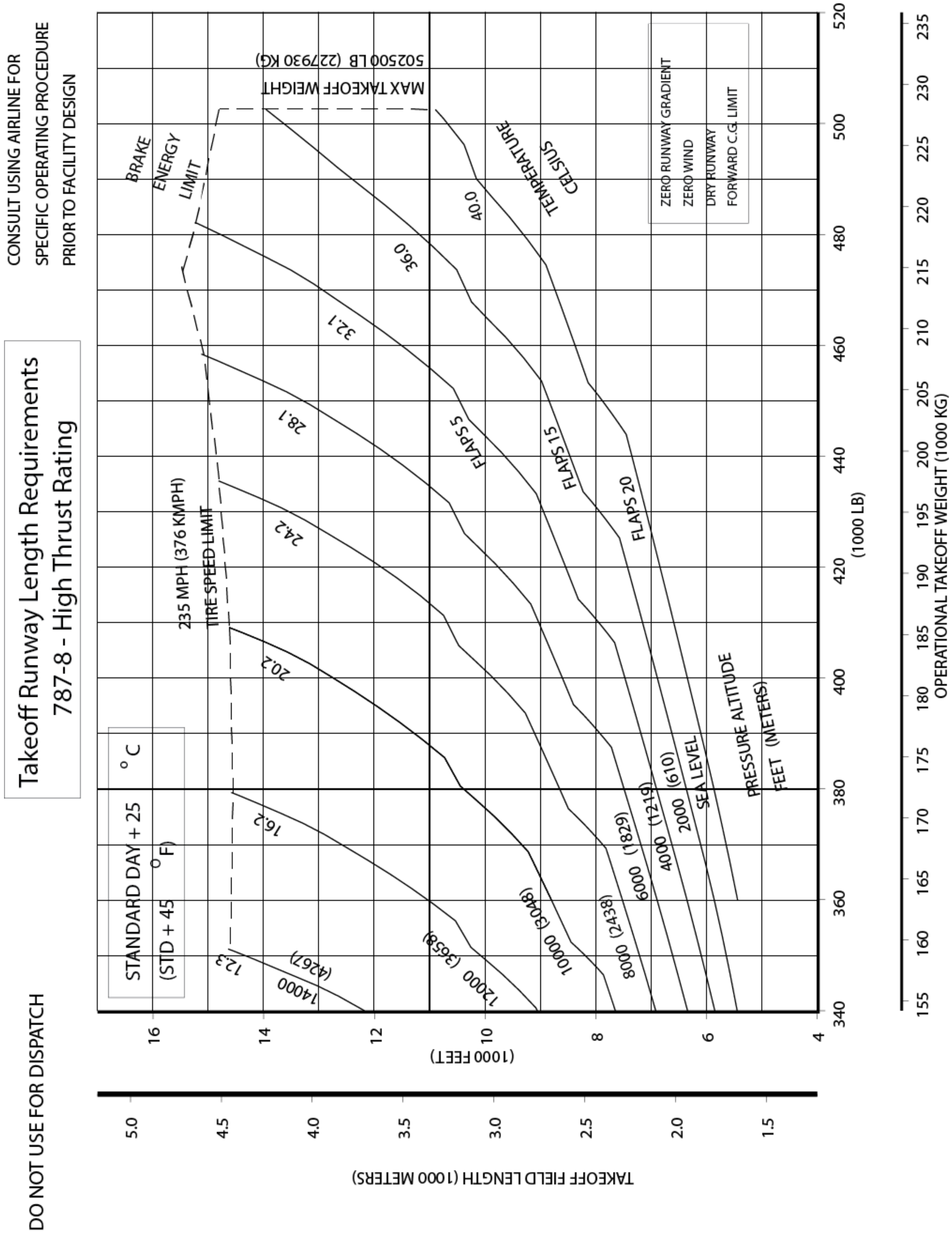


3.3.5 FAA/EASA TAKEOFF RUNWAY LENGTH REQUIREMENTS STANDARD DAY, DRY RUNWAY

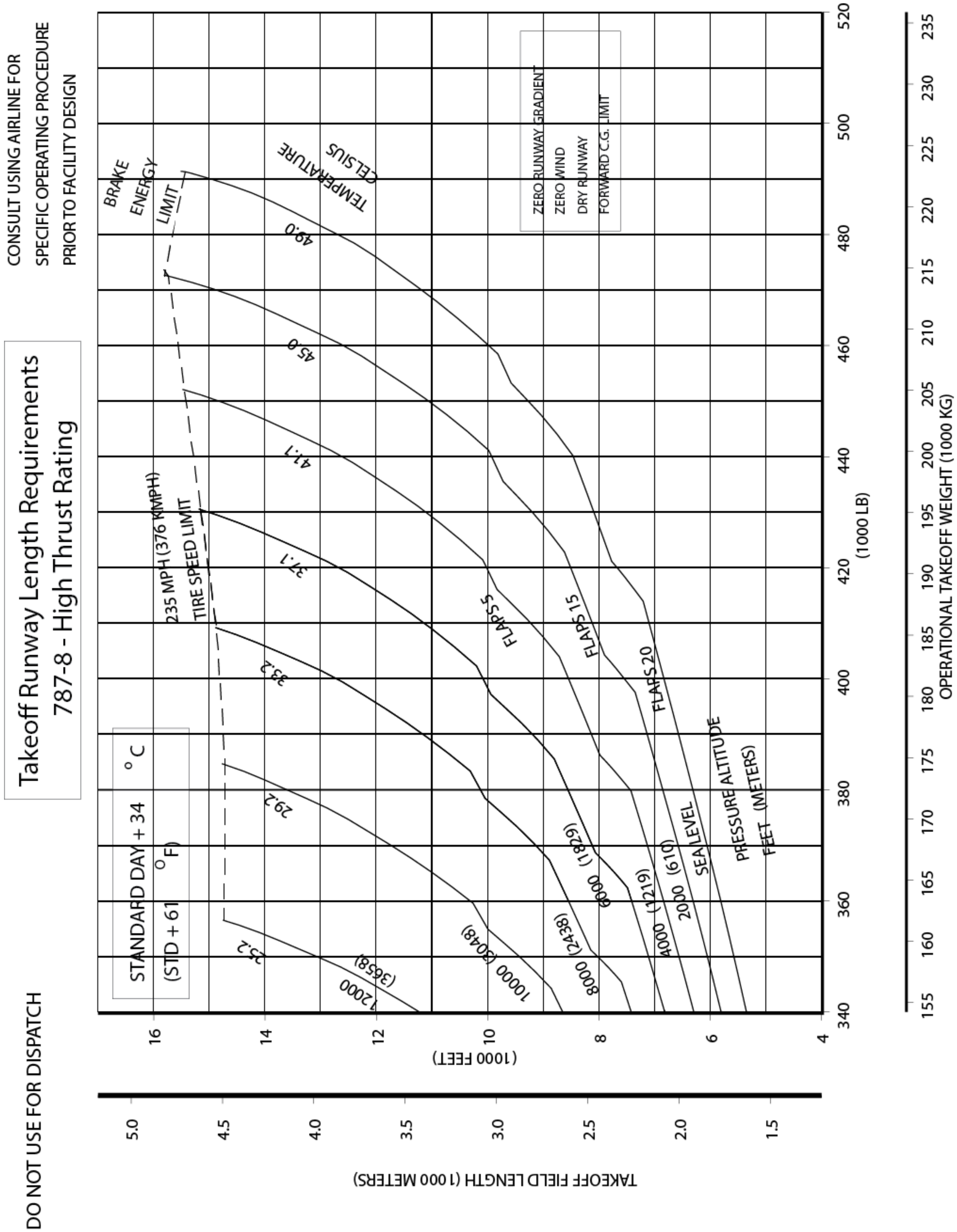
MODEL 787-8 (HI-THRUST ENGINES)



3.3.6 FAA/EASA TAKEOFF RUNWAY LENGTH REQUIREMENTS
STANDARD DAY + 27°F (STD + 15°C), DRY RUNWAY
MODEL 787-8 (HI-THRUST ENGINES)



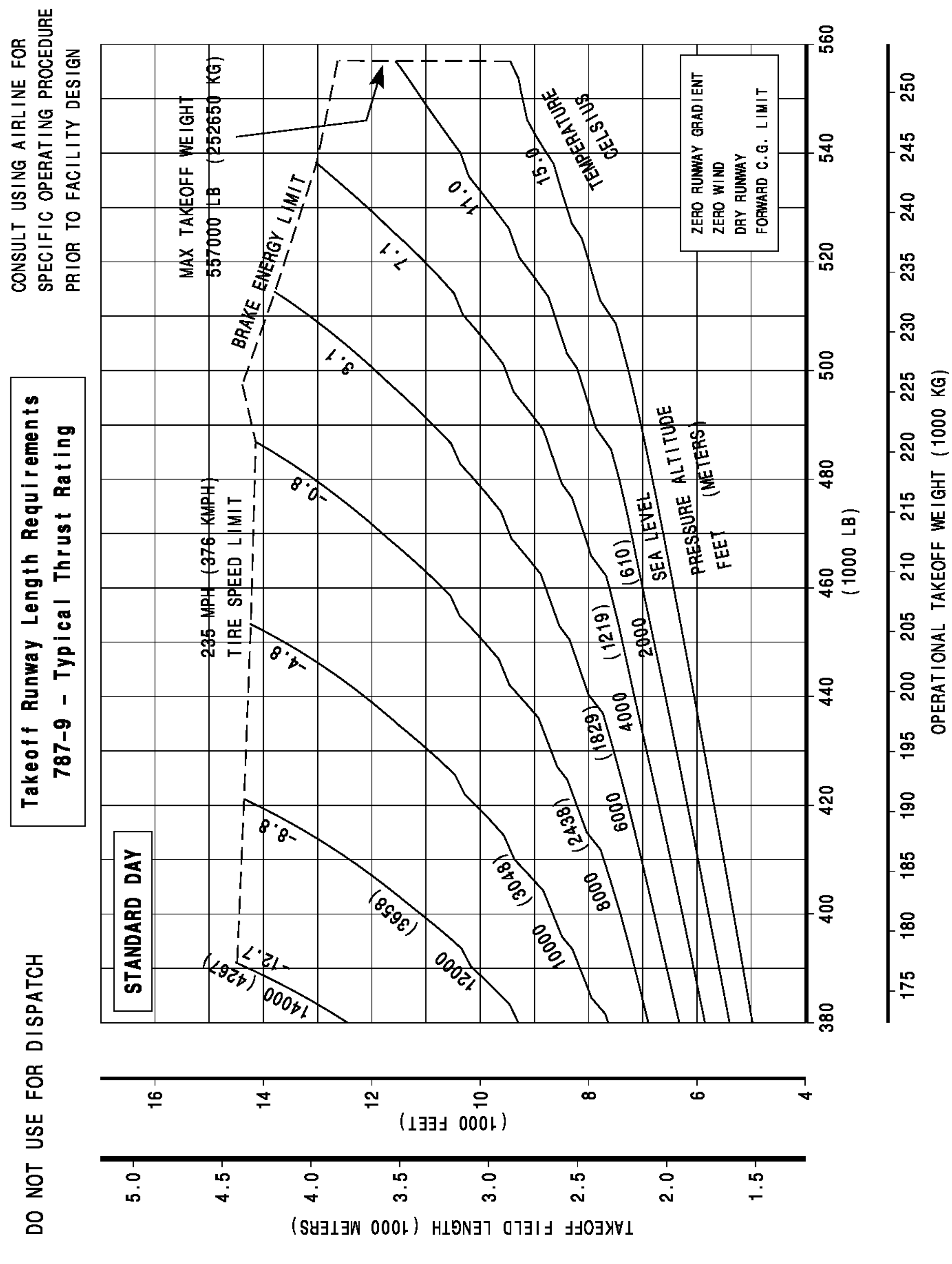
3.3.7 FAA/EASA TAKEOFF RUNWAY LENGTH REQUIREMENTS
STANDARD DAY + 45°F (STD + 25°C), DRY RUNWAY
MODEL 787-8 (HI-THRUST ENGINES)



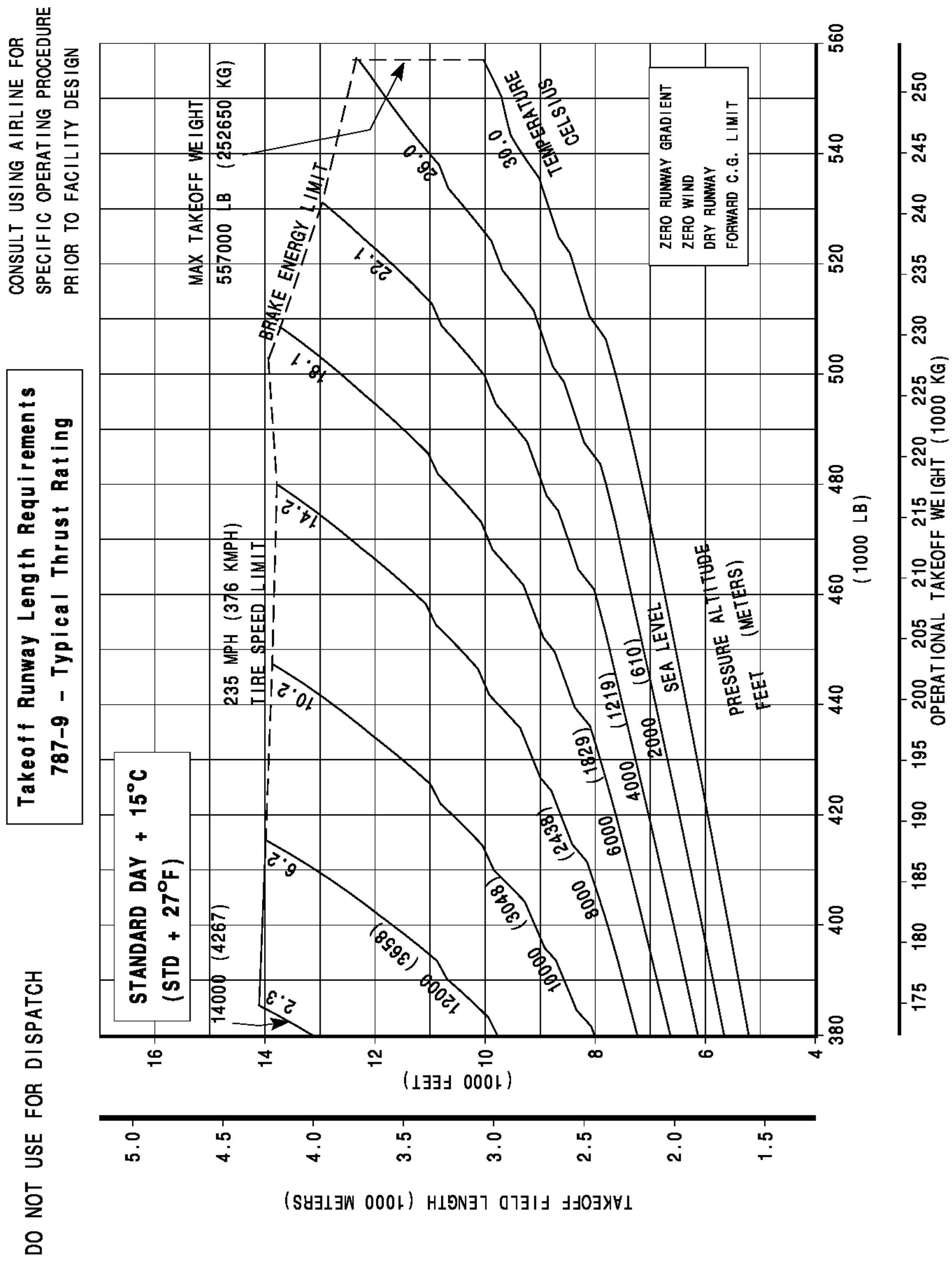
3.3.8 FAA/EASA TAKEOFF RUNWAY LENGTH REQUIREMENTS

STANDARD DAY + 61^{O}F (STD + 34^{O}C), DRY RUNWAY

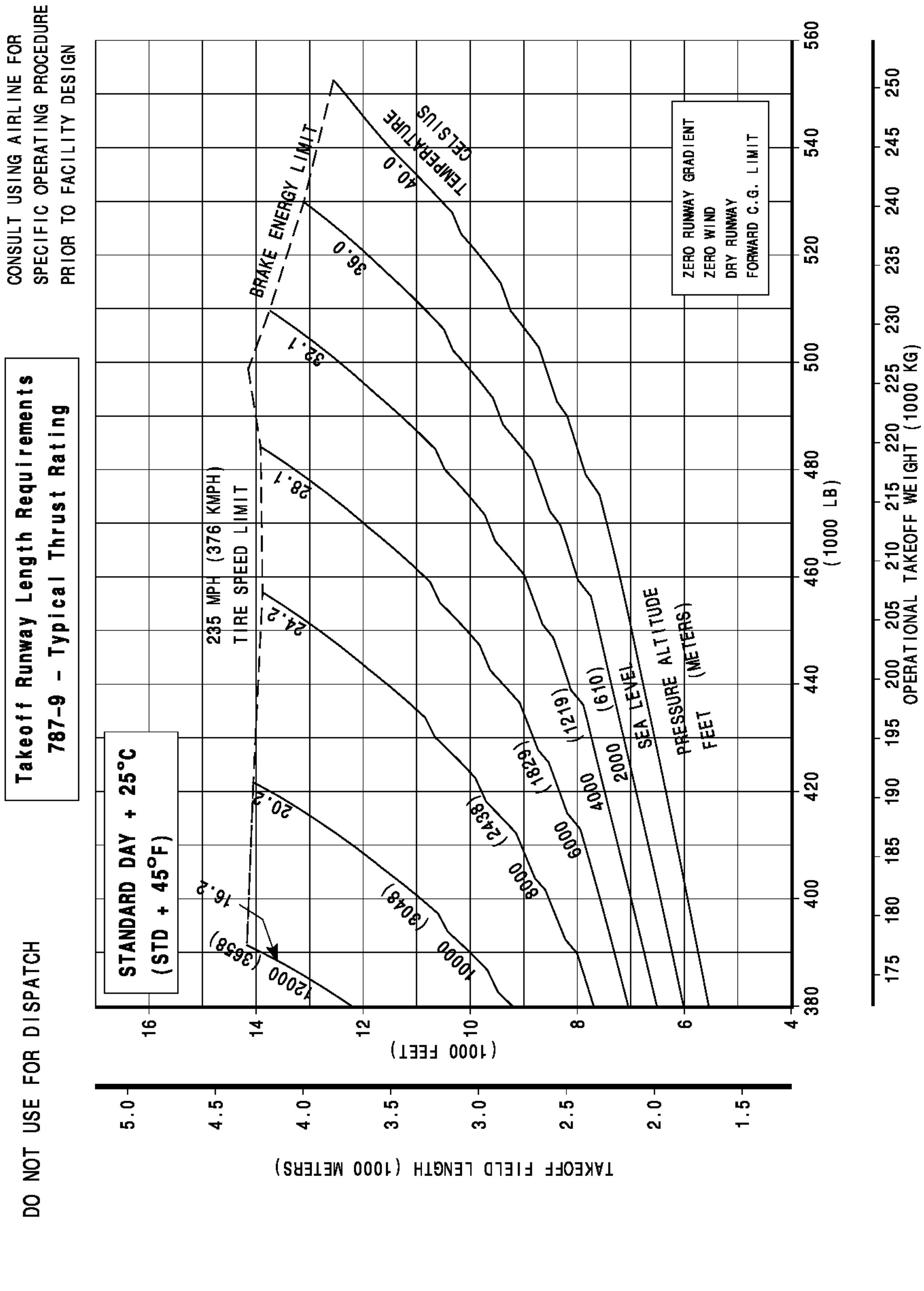
MODEL 787-8 (HI-THRUST ENGINES)



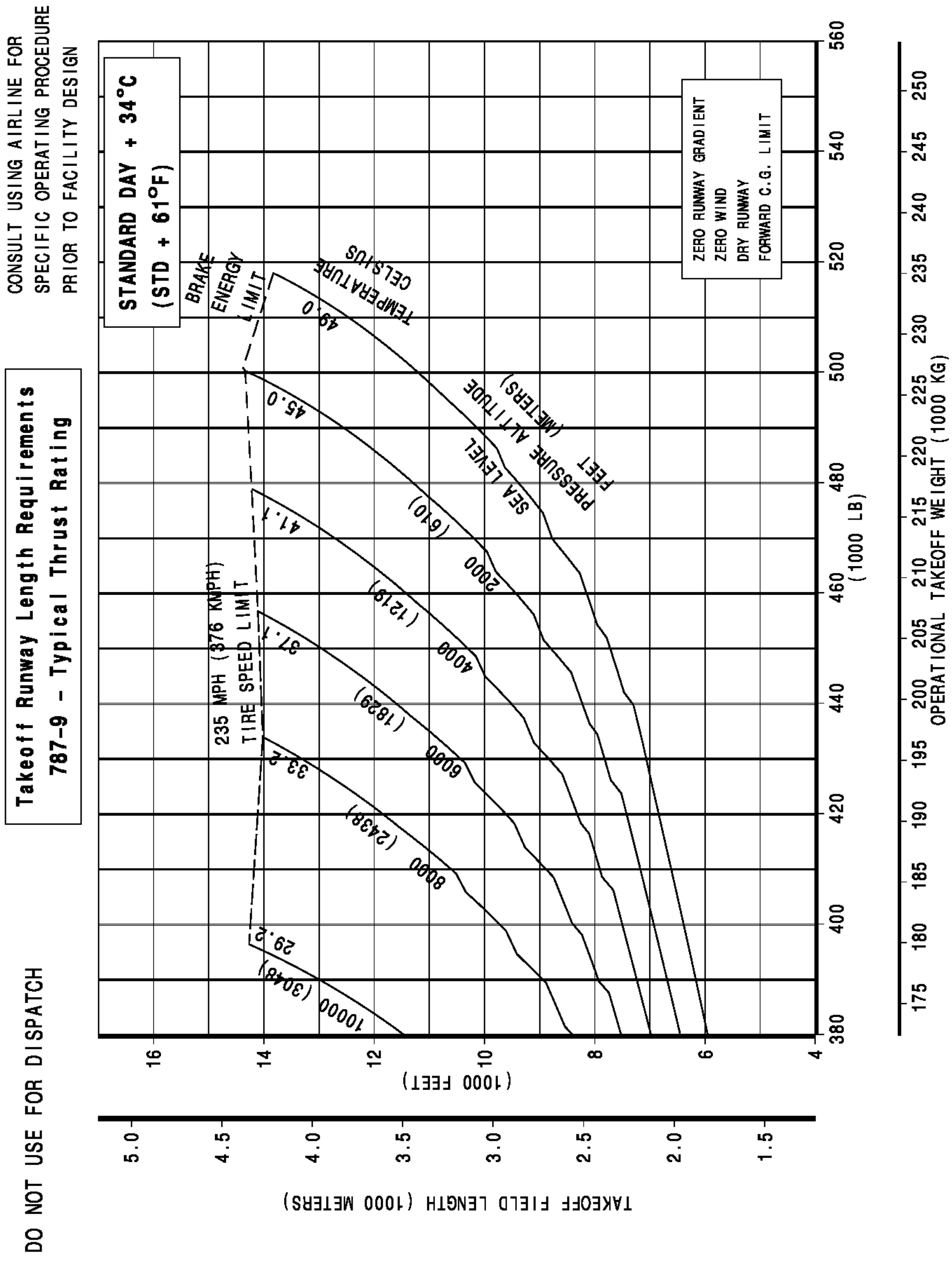
3.3.9 FAA/EASA TAKEOFF RUNWAY LENGTH REQUIREMENTS
STANDARD DAY, DRY RUNWAY
MODEL 787-9 (TYPICAL ENGINES)



3.3.10 FAA/EASA TAKEOFF RUNWAY LENGTH REQUIREMENTS
STANDARD DAY + 27°F (STD + 15°C), DRY RUNWAY
MODEL 787-9 (TYPICAL ENGINES)



3.3.11 FAA/EASA TAKEOFF RUNWAY LENGTH REQUIREMENTS
STANDARD DAY + 45^{O}F (STD + 25^{O}C), DRY RUNWAY
MODEL 787-9 (TYPICAL ENGINES)

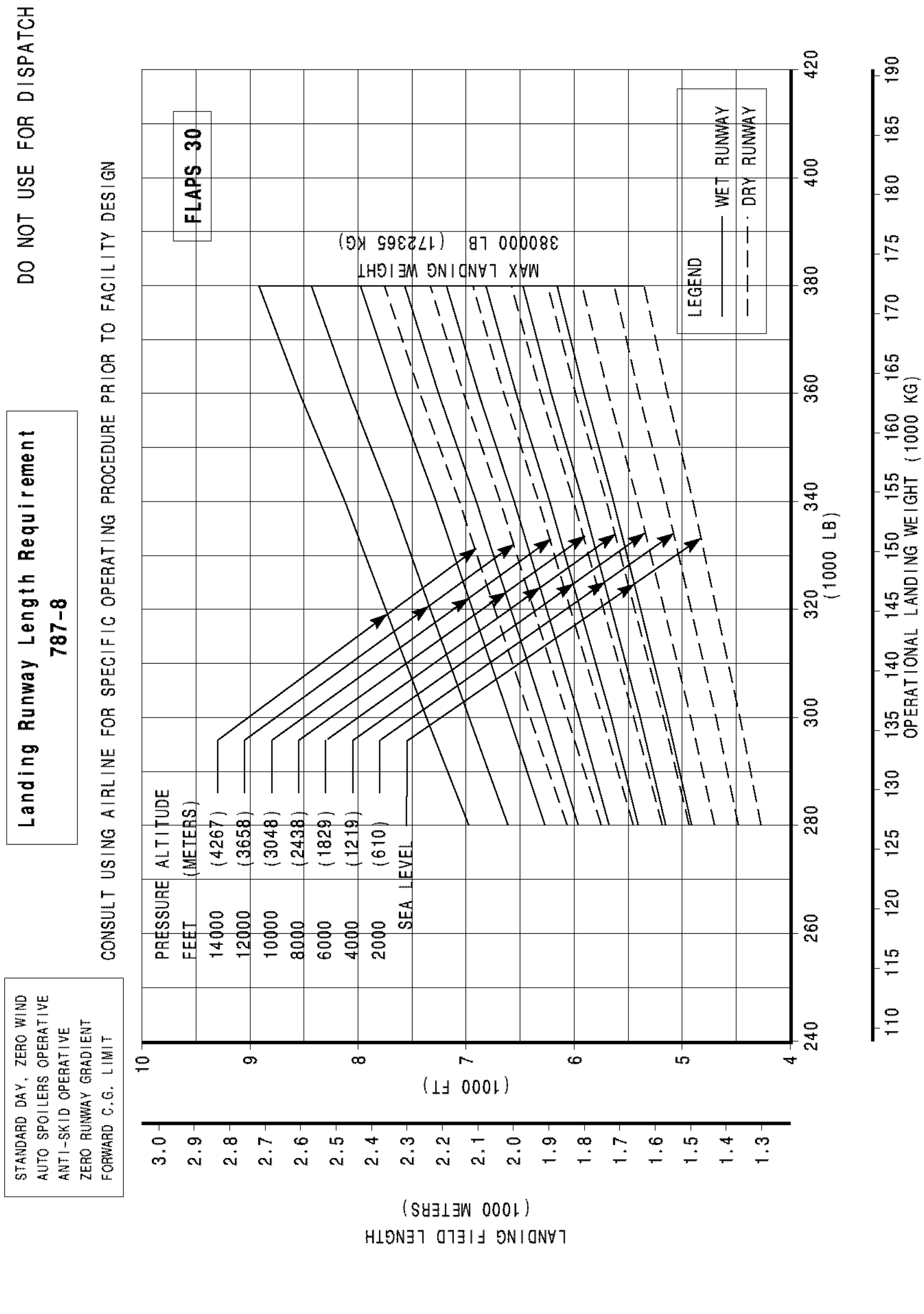


3.3.12 FAA/EASA TAKEOFF RUNWAY LENGTH REQUIREMENTS
STANDARD DAY + 61°F (STD + 34°C), DRY RUNWAY
MODEL 787-9 (TYPICAL ENGINES)

787-9 DATA SUPPORTING THE HI-THRUST ENGINE OPTION
TO BE SUPPLIED AT A FUTURE DATE

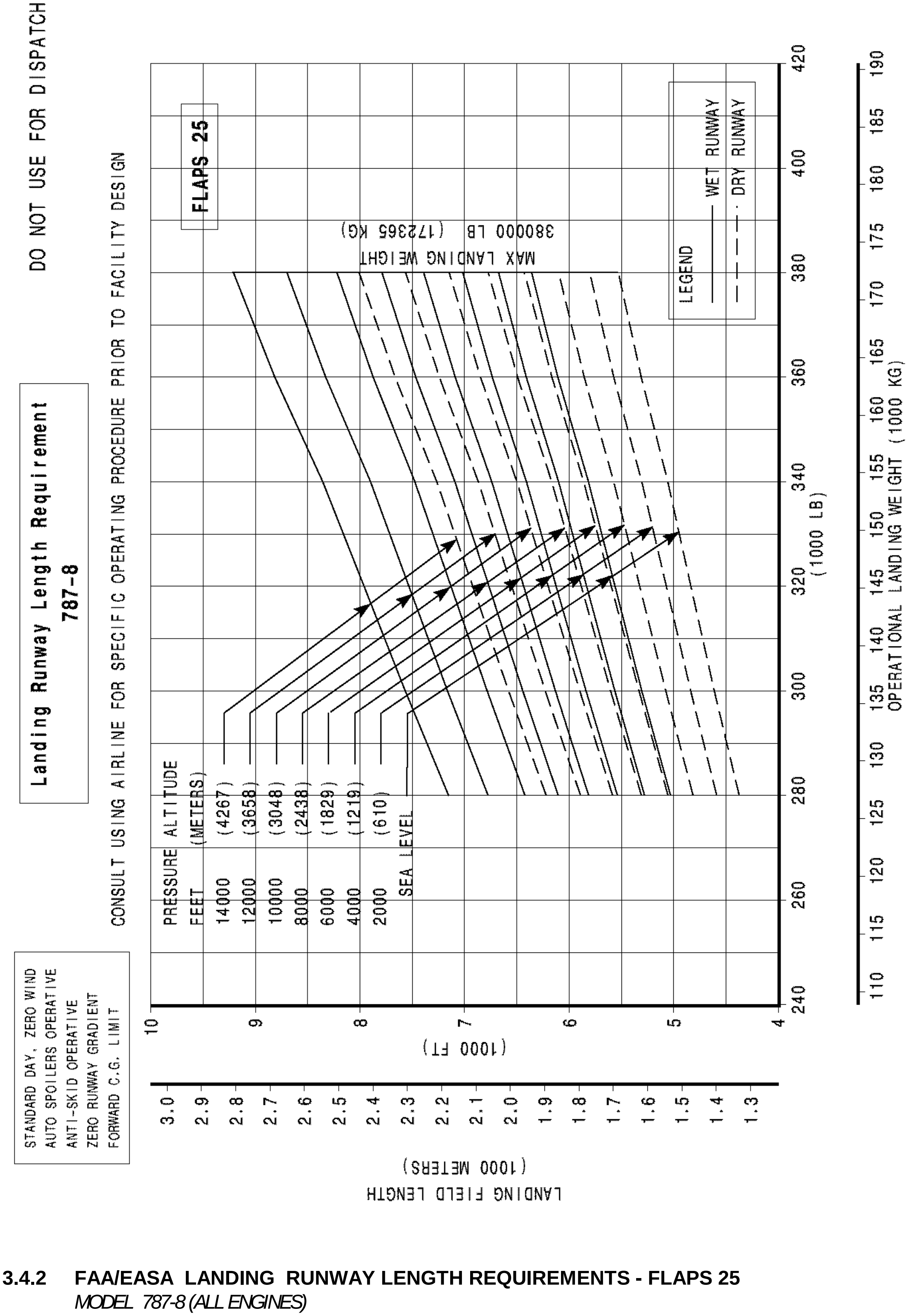
For technical data related to this topic,
please contact you specific customer airline, as required.

3.3.13 FAA/EASA TAKEOFF RUNWAY LENGTH REQUIREMENTS
MODEL 787-9 (HI-THRUST ENGINES)



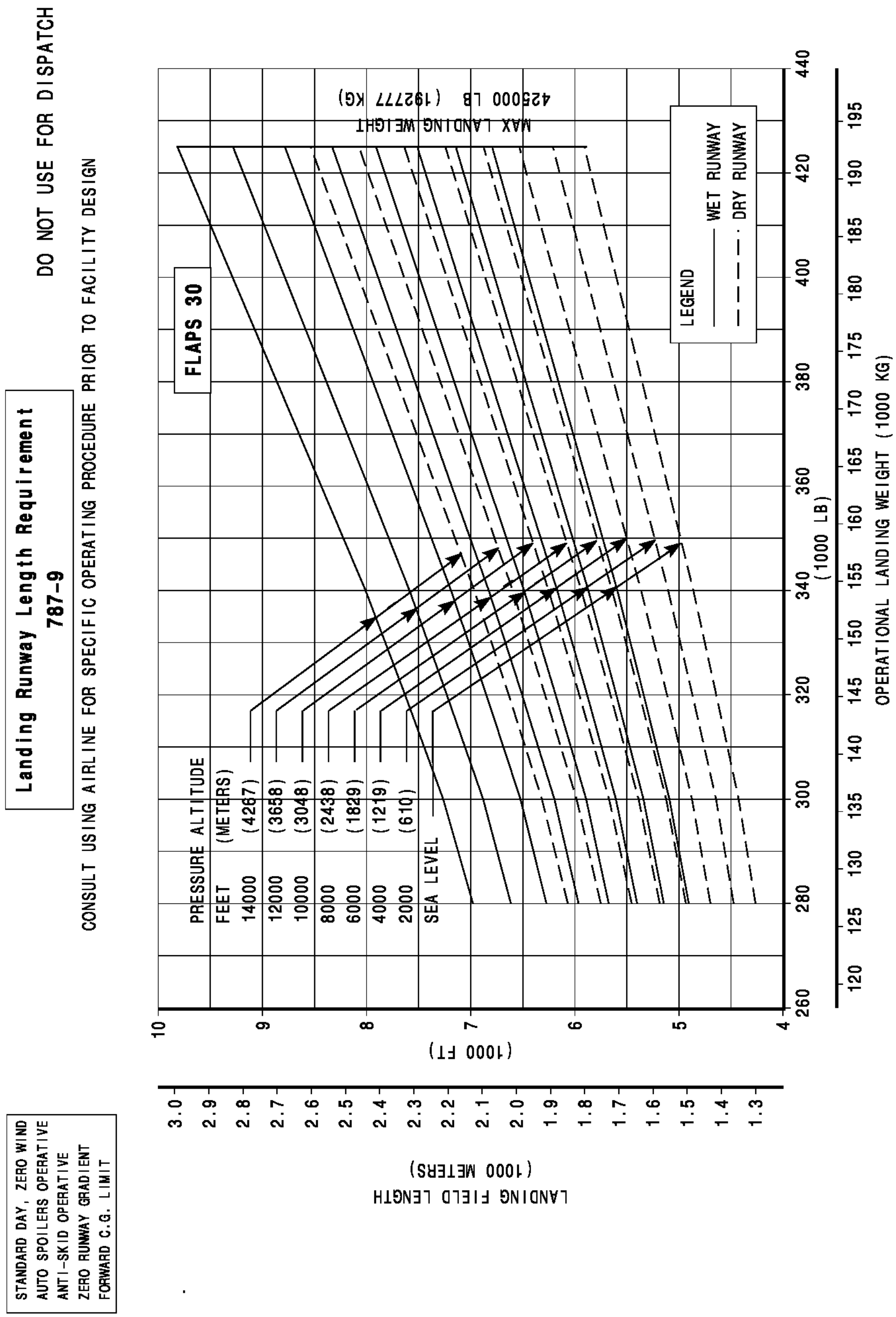
3.4.1 FAA/EASA LANDING RUNWAY LENGTH REQUIREMENTS - FLAPS 30

MODEL 787-8, (ALL ENGINES)



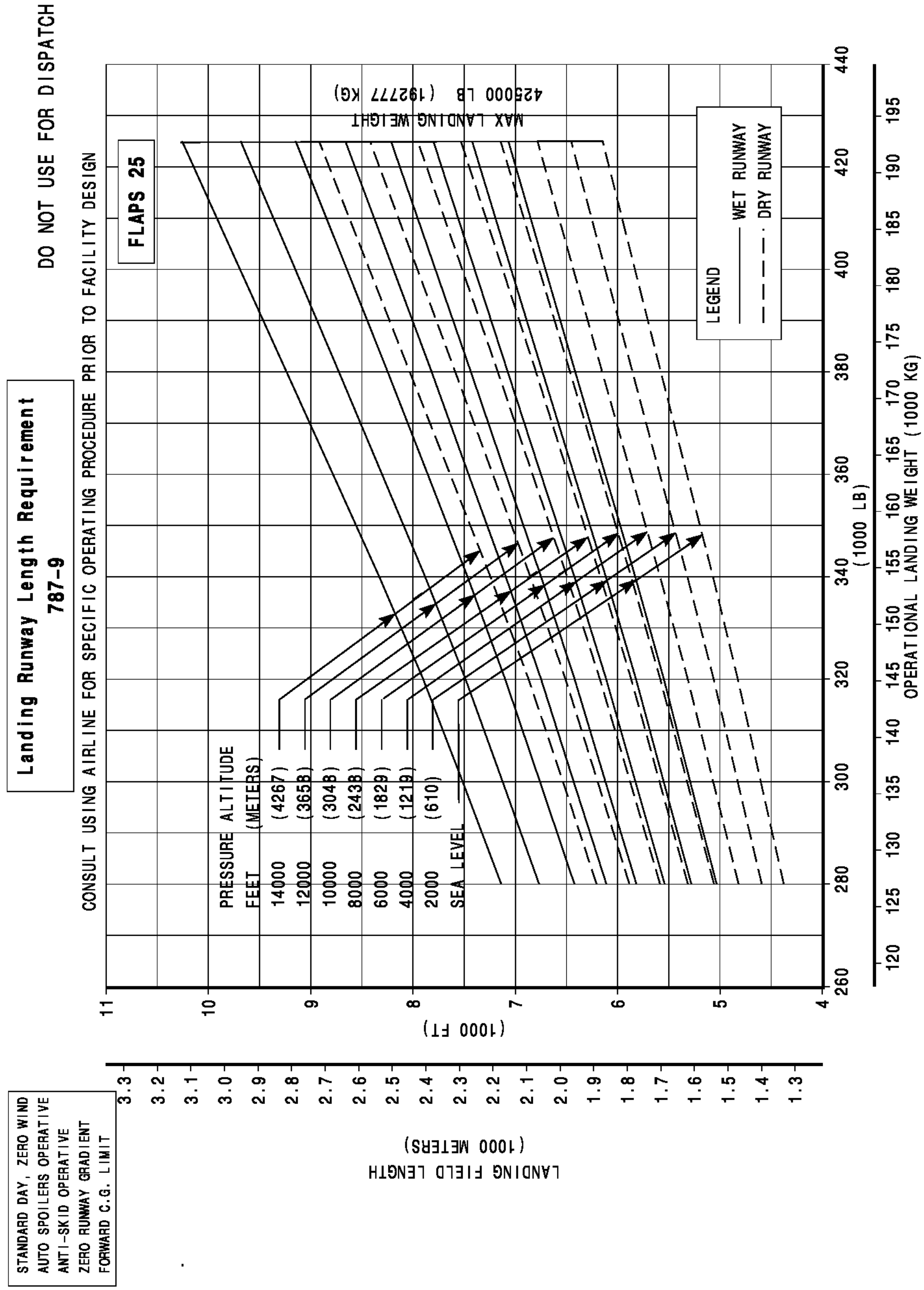
3.4.2 FAA/EASA LANDING RUNWAY LENGTH REQUIREMENTS - FLAPS 25

MODEL 787-8 (ALL ENGINES)



3.4.3 FAA/EASA LANDING RUNWAY LENGTH REQUIREMENTS - FLAPS 30

MODEL 787-9, (ALL ENGINES)



3.4.4 FAA/EASA LANDING RUNWAY LENGTH REQUIREMENTS - FLAPS 25

MODEL 787-9 (ALL ENGINES)

4.0 GROUND MANEUVERING

4.1 General Information

4.2 Turning Radii

4.3 Clearance Radii

4.4 Visibility From Cockpit in Static Position

4.5 Runway and Taxiway Turn Paths

4.6 Runway Holding Bay

4.0 GROUND MANEUVERING

4.1 General Information

This section provides airplane turning capability and maneuvering characteristics.

For ease of presentation, these data have been determined from the theoretical limits imposed by the geometry of the aircraft, and where noted, provide for a normal allowance for tire slippage. As such, they reflect the turning capability of the aircraft in favorable operating circumstances. These data should be used only as guidelines for the method of determination of such parameters and for the maneuvering characteristics of this aircraft.

In the ground operating mode, varying airline practices may demand that more conservative turning procedures be adopted to avoid excessive tire wear and reduce possible maintenance problems. Airline operating procedures will vary in the level of performance over a wide range of operating circumstances throughout the world. Variations from standard aircraft operating patterns may be necessary to satisfy physical constraints within the maneuvering area, such as adverse grades, limited area, or high risk of jet blast damage. For these reasons, ground maneuvering requirements should be coordinated with the using airlines prior to layout planning.

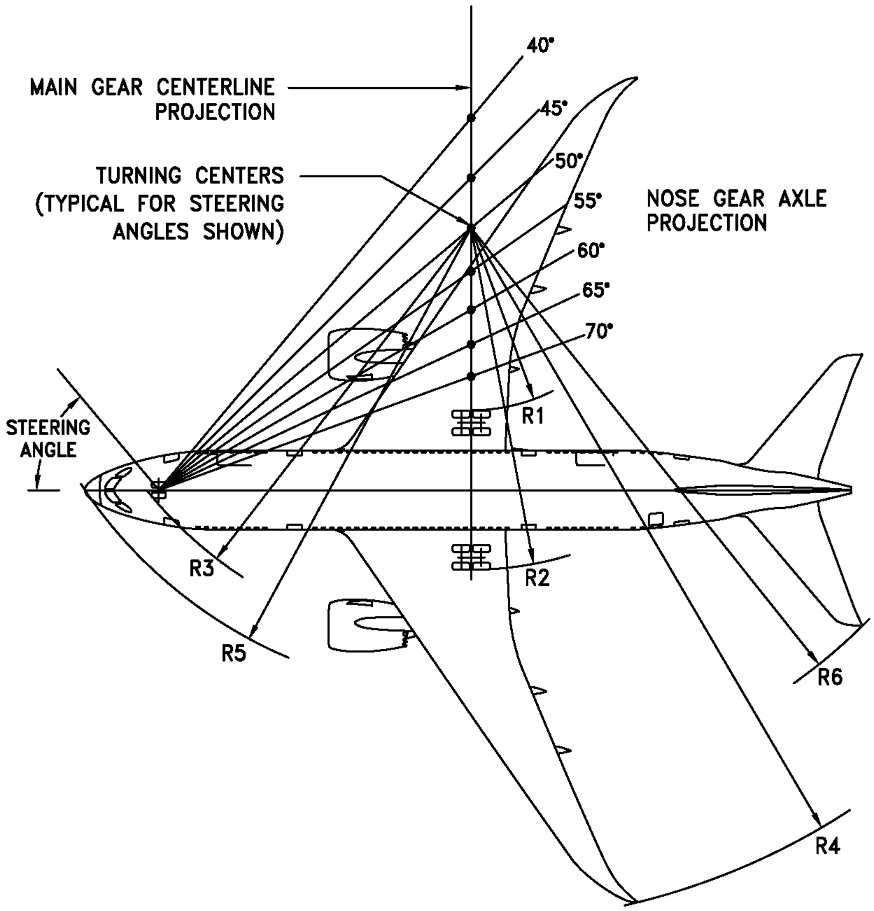
Section 4.2 presents turning radii for various nose gear steering angles. Radii for the main and nose gears are measured from the turn center to the outside of the tire.

Section 4.3 shows data on minimum width of pavement required for 180^{o} turn.

Section 4.4 provides pilot visibility data from the cockpit and the limits of ambinocular vision through the windows. Ambinocular vision is defined as the total field of vision seen simultaneously by both eyes.

Section 4.5 shows approximate wheel paths for various runway and taxiway turn scenarios.

Section 4.6 illustrates a typical runway holding bay configuration.

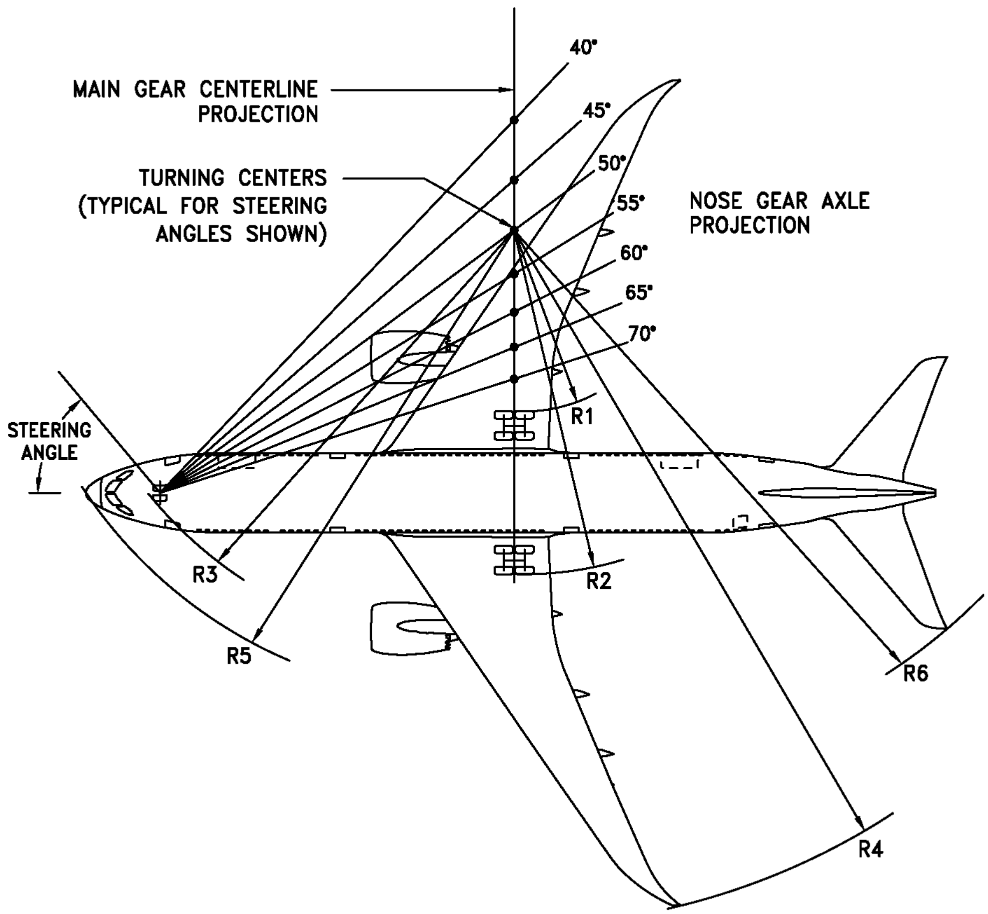


NOTES: * ACTUAL OPERATING TURNING RADII MAY BE GREATER THAN SHOWN.
* CONSULT WITH AIRLINE FOR SPECIFIC OPERATING PROCEDURE

STEERING ANGLE (DEG)	R1 INNER GEAR		R2 OUTER GEAR		R3 NOSE GEAR		R4 WING TIP		R5 NOSE		R6 TAIL	
	FT	M	FT	M	FT	M	FT	M	FT	M	FT	M
30	111	33.7	149	45.3	151	46.1	232	70.6	160	48.5	187	57.0
35	88	26.7	126	38.3	132	40.3	209	63.8	142	43.3	168	51.1
40	70	21.4	108	33.0	118	36.0	192	58.5	129	39.3	153	46.8
45	56	17.0	94	28.6	108	32.8	178	54.2	119	36.4	142	43.4
50	44	13.3	82	24.9	100	30.3	166	50.7	112	34.2	134	40.7
55	33	10.2	71	21.8	93	28.4	156	47.6	107	32.5	126	38.5
60	24	7.3	62	19.0	88	26.9	147	44.9	102	31.2	120	36.7
65	16	4.8	54	16.4	84	25.7	139	42.5	99	30.2	115	35.1
70	88	2.5	46	14.1	82	24.8	132	40.2	97	29.4	111	33.8

4.2.1 TURNING RADII - NO SLIP ANGLE

MODEL 787-8

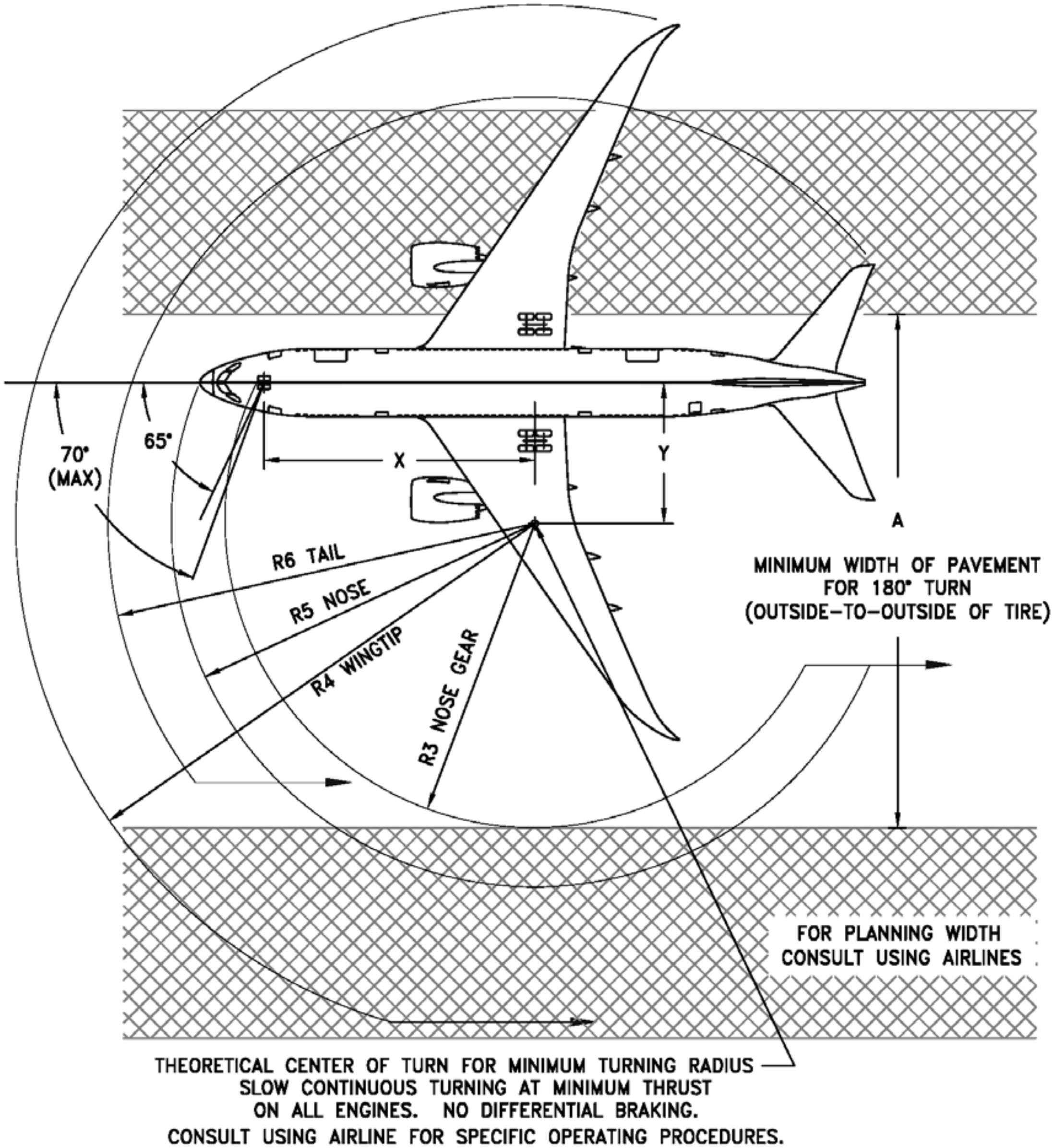


NOTES: * ACTUAL OPERATING TURNING RADII MAY BE GREATER THAN SHOWN.
* CONSULT WITH AIRLINE FOR SPECIFIC OPERATING PROCEDURE

STEERING ANGLE (DEG)	R1 INNER GEAR		R2 OUTER GEAR		R3 NOSE GEAR		R4 WING TIP		R5 NOSE		R6 TAIL	
	FT	M	FT	M	FT	M	FT	M	FT	M	FT	M
30	128	39.0	166	50.6	170	51.8	249	75.9	179	54.6	207	63.1
35	102	31.1	141	43.0	150	45.7	223	68.0	159	48.5	185	56.4
40	82	25.0	121	36.9	134	40.8	204	62.2	144	43.9	169	51.5
45	65	19.8	104	31.7	122	37.2	188	57.3	133	40.5	157	47.9
50	52	15.8	91	27.7	113	34.4	175	53.3	125	38.1	147	44.8
55	40	12.2	79	24.1	105	32.0	163	49.7	119	36.3	139	42.4
60	30	9.1	69	21.0	100	30.5	153	46.6	114	34.7	132	40.2
65	20	6.1	59	18.0	95	29.0	144	43.9	110	33.5	126	38.4
70	12	3.7	51	15.5	92	28.0	136	41.5	107	32.6	122	37.2

4.2.2 TURNING RADII - NO SLIP ANGLE

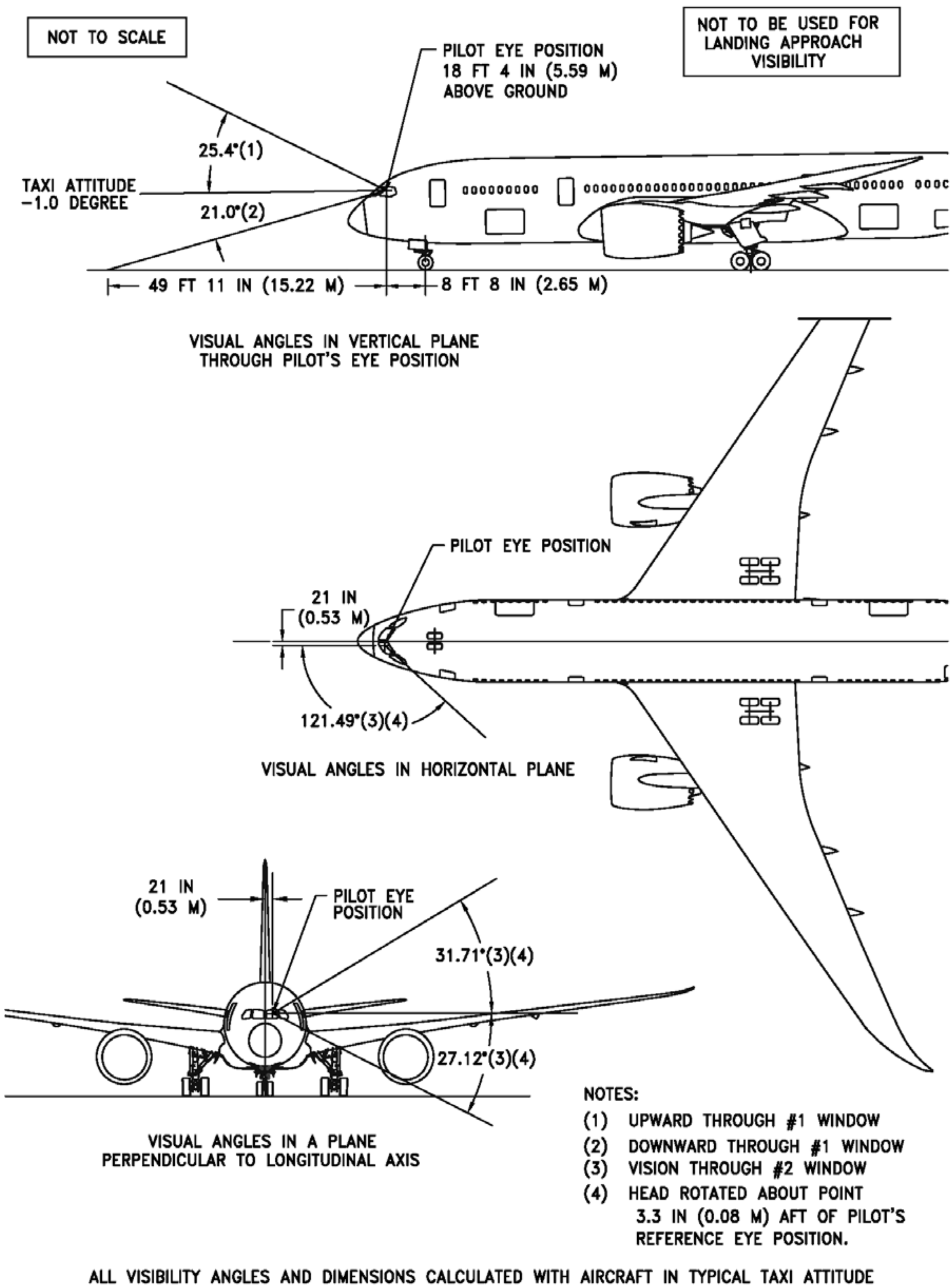
MODEL 787-9



MODEL	EFFECTIVE STEERING ANGLE (DEG)	X		Y		A		R3		R4		R5		R6	
		FT	M	FT	M	FT	M	FT	M	FT	M	FT	M	FT	M
787-8	65	75	22.8	35	10.6	138	42.2	85	25.7	139	42.5	99	30.2	115	35.1
787-9	65	85	25.9	40	12.2	154	46.9	95	29.0	144	43.9	110	33.5	126	38.4

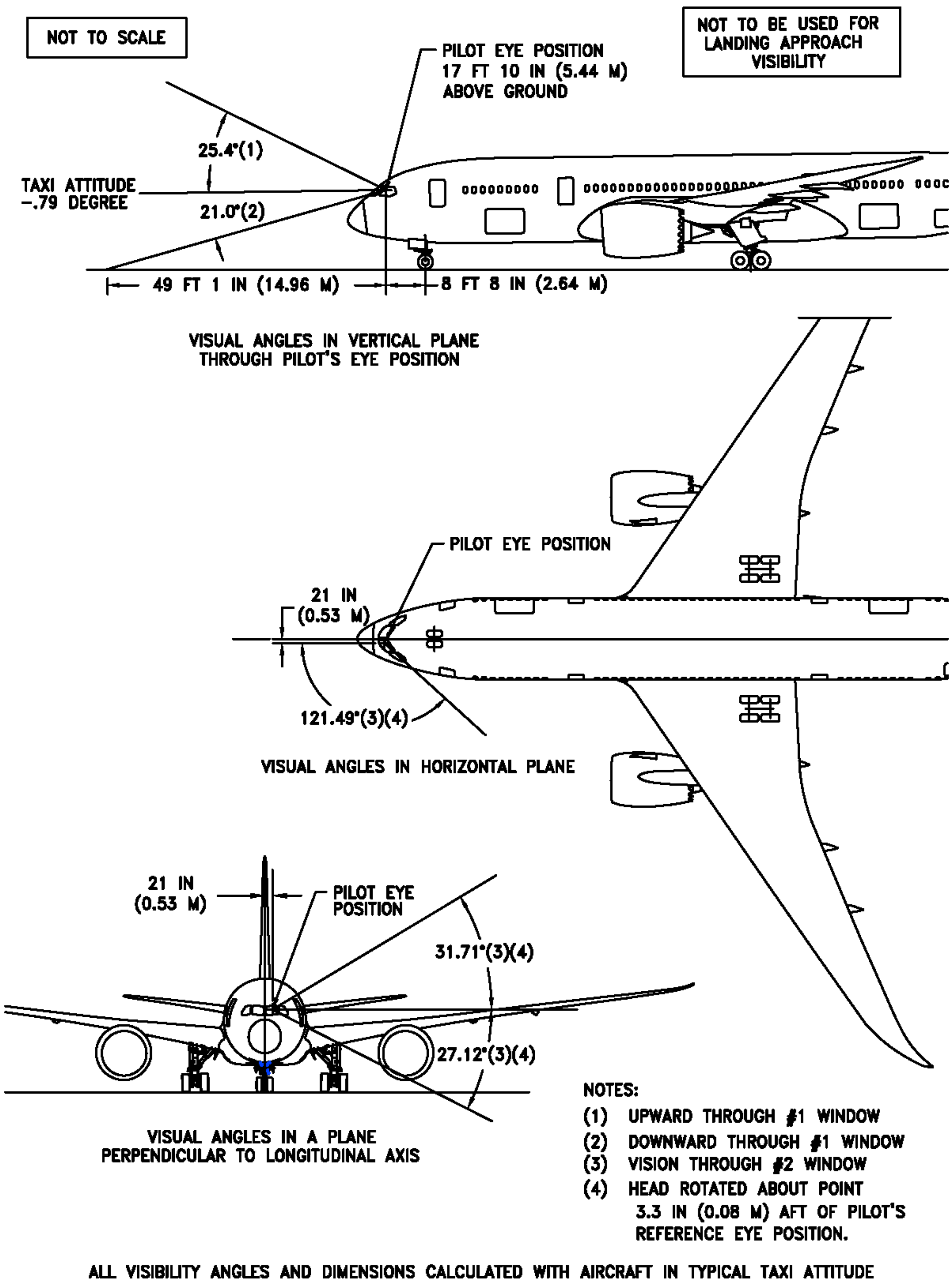
4.3 CLEARANCE RADII

MODEL 787-8, 787-9



4.4.1 VISIBILITY FROM COCKPIT IN STATIC POSITION

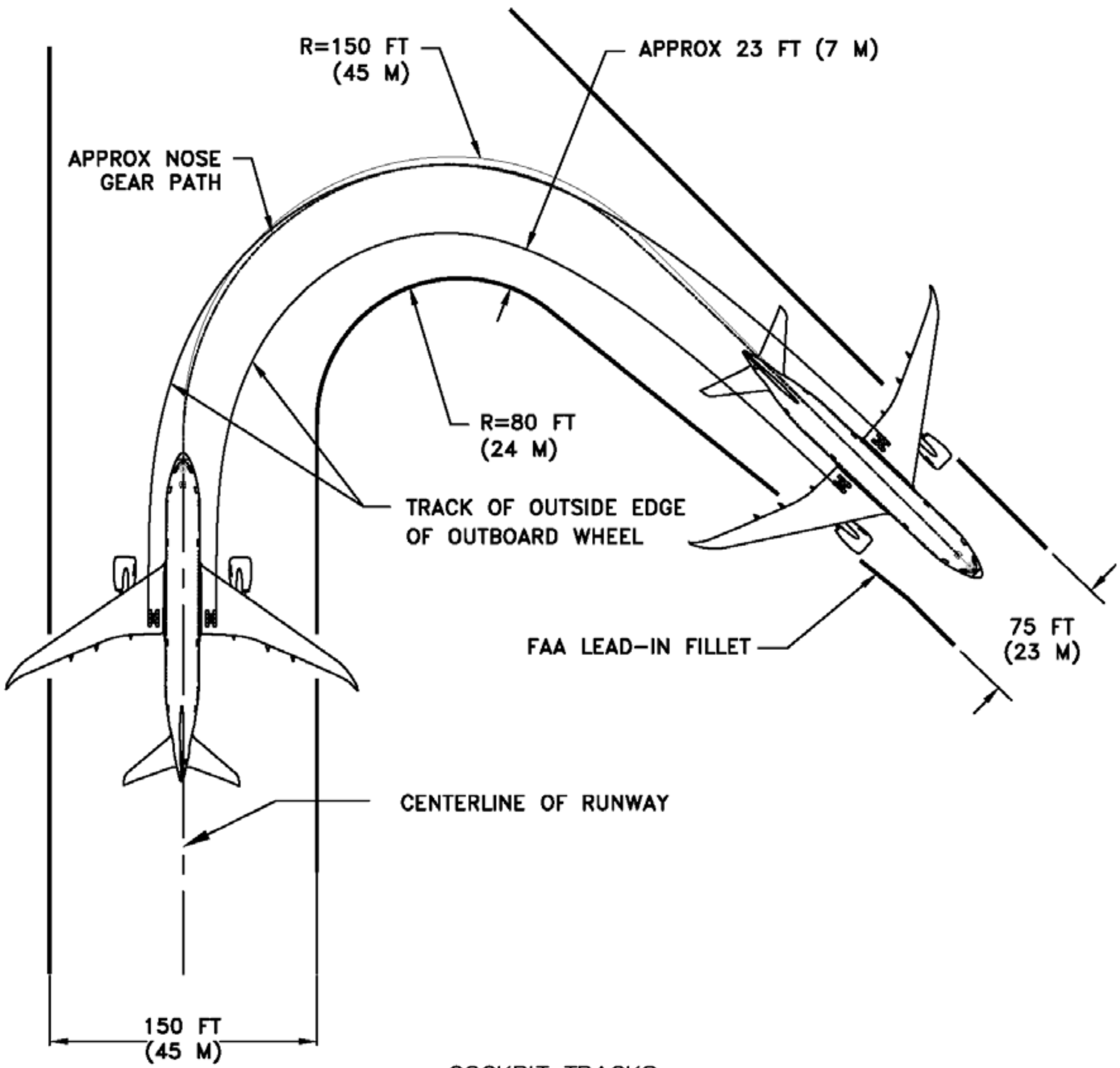
MODEL 787-8



4.4.2 VISIBILITY FROM COCKPIT IN STATIC POSITION
MODEL 787-9

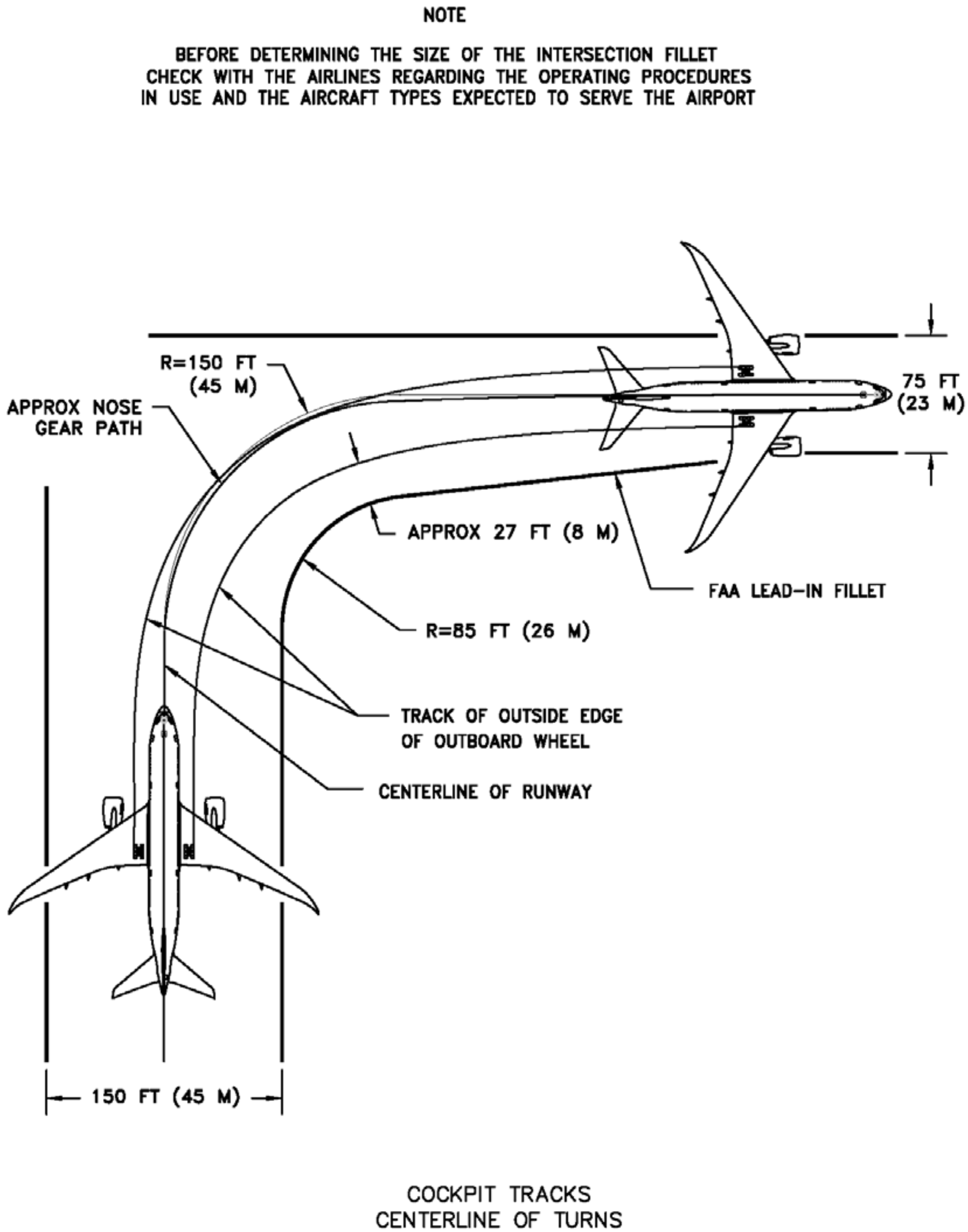
NOTE

BEFORE DETERMINING THE SIZE OF THE INTERSECTION FILLET CHECK WITH THE AIRLINES REGARDING THE OPERATING PROCEDURES IN USE AND THE AIRCRAFT TYPES EXPECTED TO SERVE THE AIRPORT



COCKPIT TRACKS
CENTERLINE OF TURNS

4.5.1 RUNWAY AND TAXIWAY TURNPATHS - RUNWAY-TO-TAXIWAY, MORE THAN 90-DEGREE TURN
MODEL 787-8

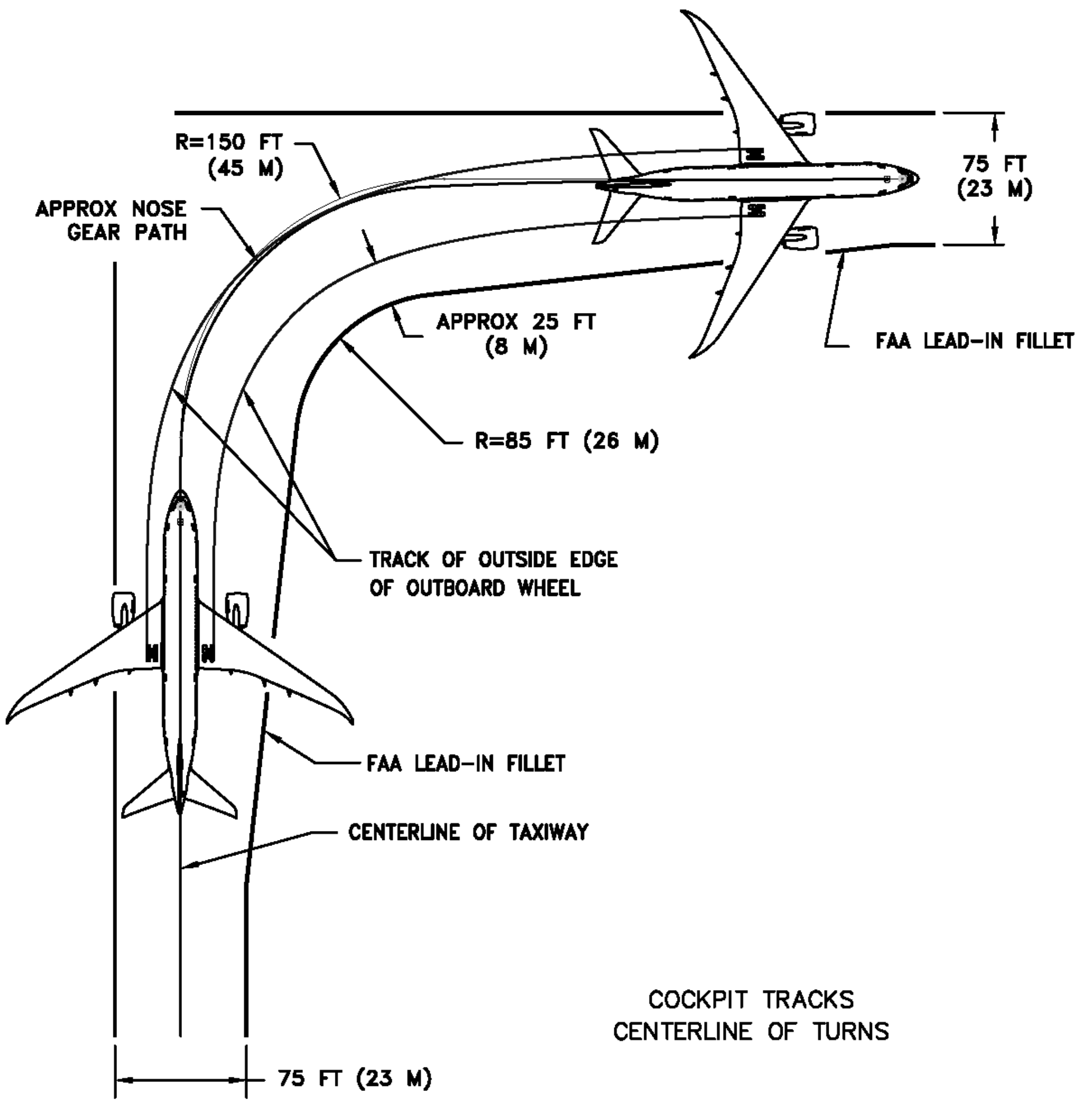


4.5.2 RUNWAY AND TAXIWAY TURNPATHS - RUNWAY-TO-TAXIWAY, 90-DEGREE TURN

MODEL 787-8

NOTE

BEFORE DETERMINING THE SIZE OF THE INTERSECTION FILLET CHECK WITH THE AIRLINES REGARDING THE OPERATING PROCEDURES IN USE AND THE AIRCRAFT TYPES EXPECTED TO SERVE THE AIRPORT

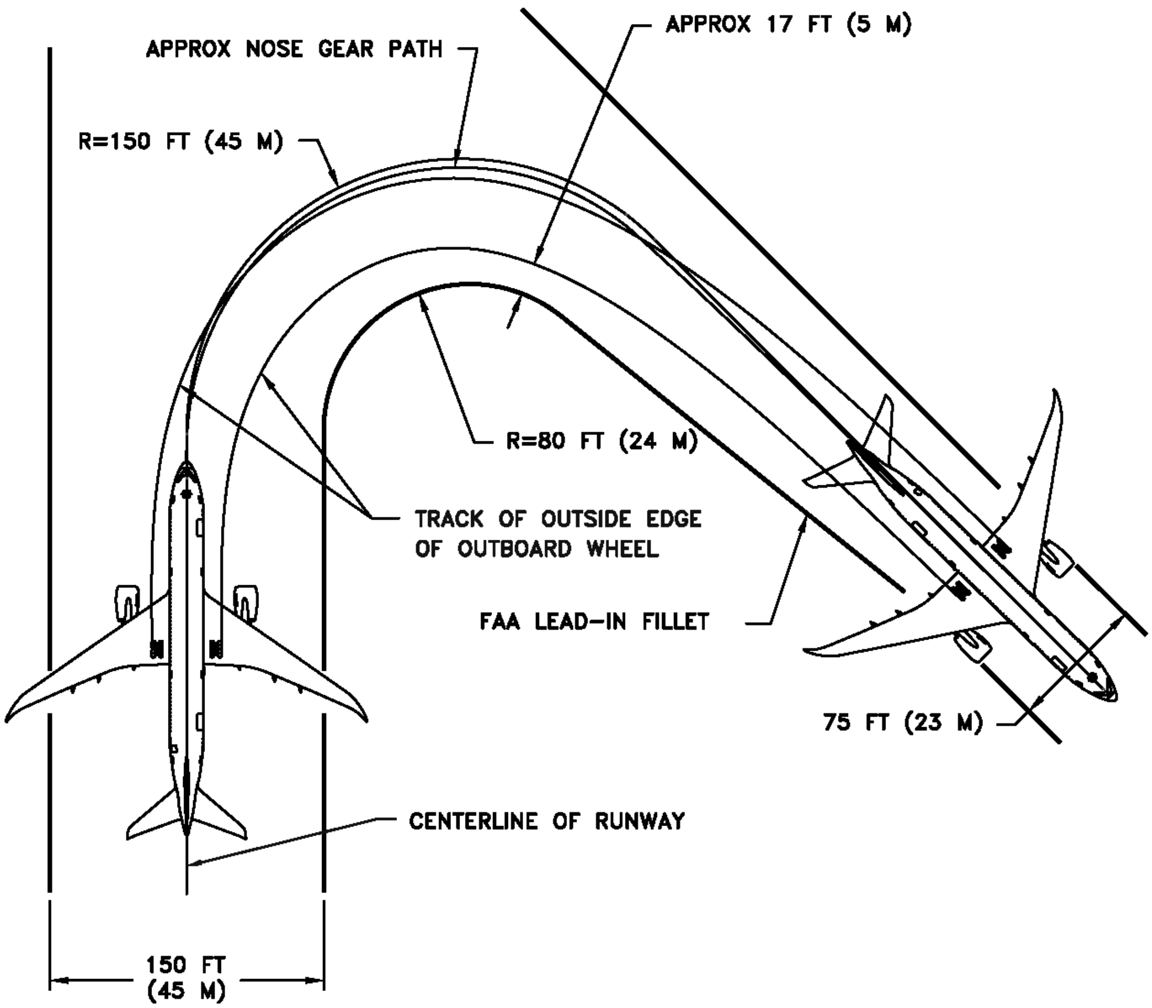


4.5.3 RUNWAY AND TAXIWAY TURNPATHS - TAXIWAY-TO-TAXIWAY, 90-DEGREE TURN

MODEL 787-8

NOTE

BEFORE DETERMINING THE SIZE OF THE INTERSECTION FILLET CHECK WITH THE AIRLINES REGARDING THE OPERATING PROCEDURES IN USE AND THE AIRCRAFT TYPES EXPECTED TO SERVE THE AIRPORT



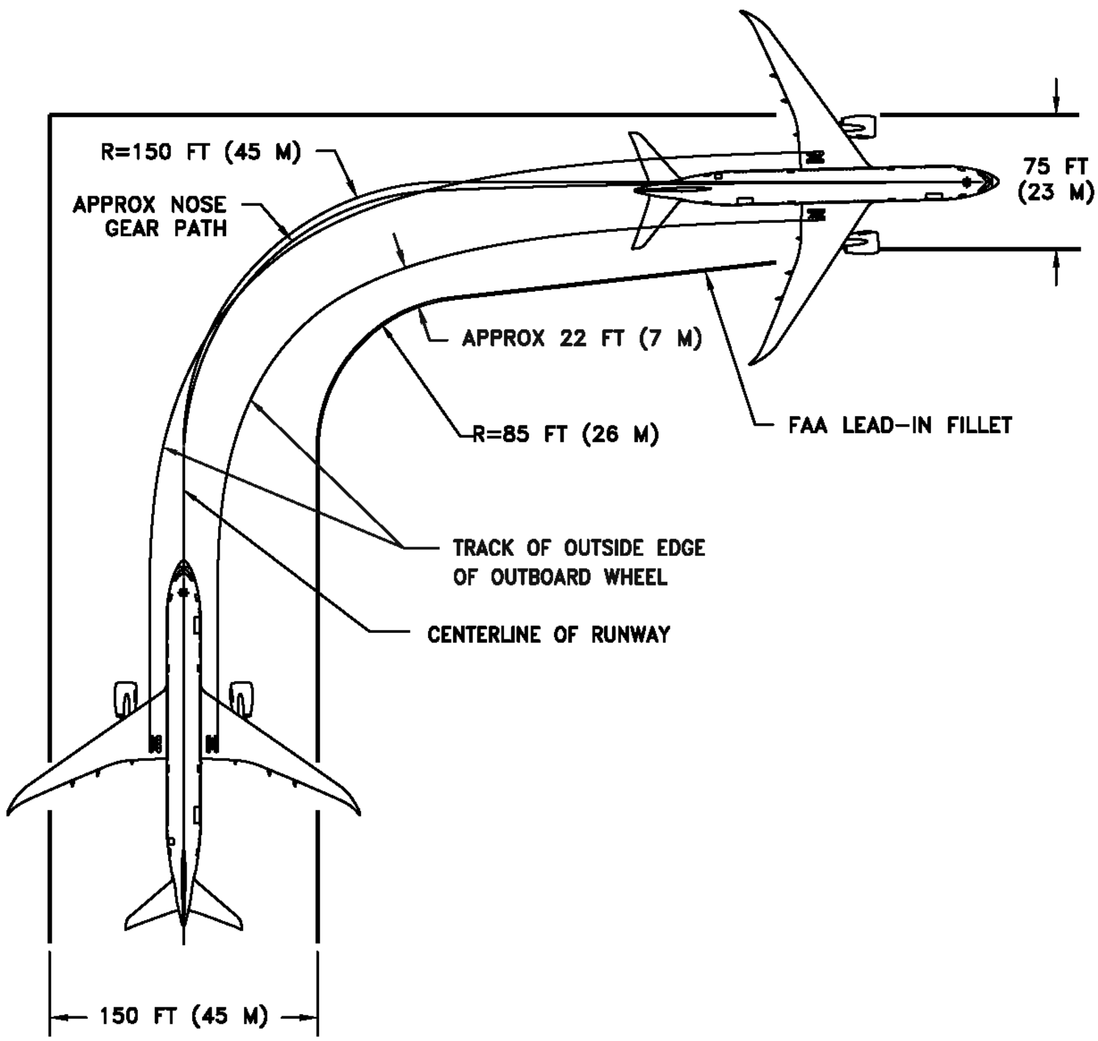
COCKPIT TRACKS
CENTERLINE OF TURNS

4.5.4 RUNWAY AND TAXIWAY TURNPATHS - RUNWAY-TO-TAXIWAY MORE THAN 90-DEGREE TURN

MODEL 787-9

NOTE

BEFORE DETERMINING THE SIZE OF THE INTERSECTION FILLET
CHECK WITH THE AIRLINES REGARDING THE OPERATING PROCEDURES
IN USE AND THE AIRCRAFT TYPES EXPECTED TO SERVE THE AIRPORT



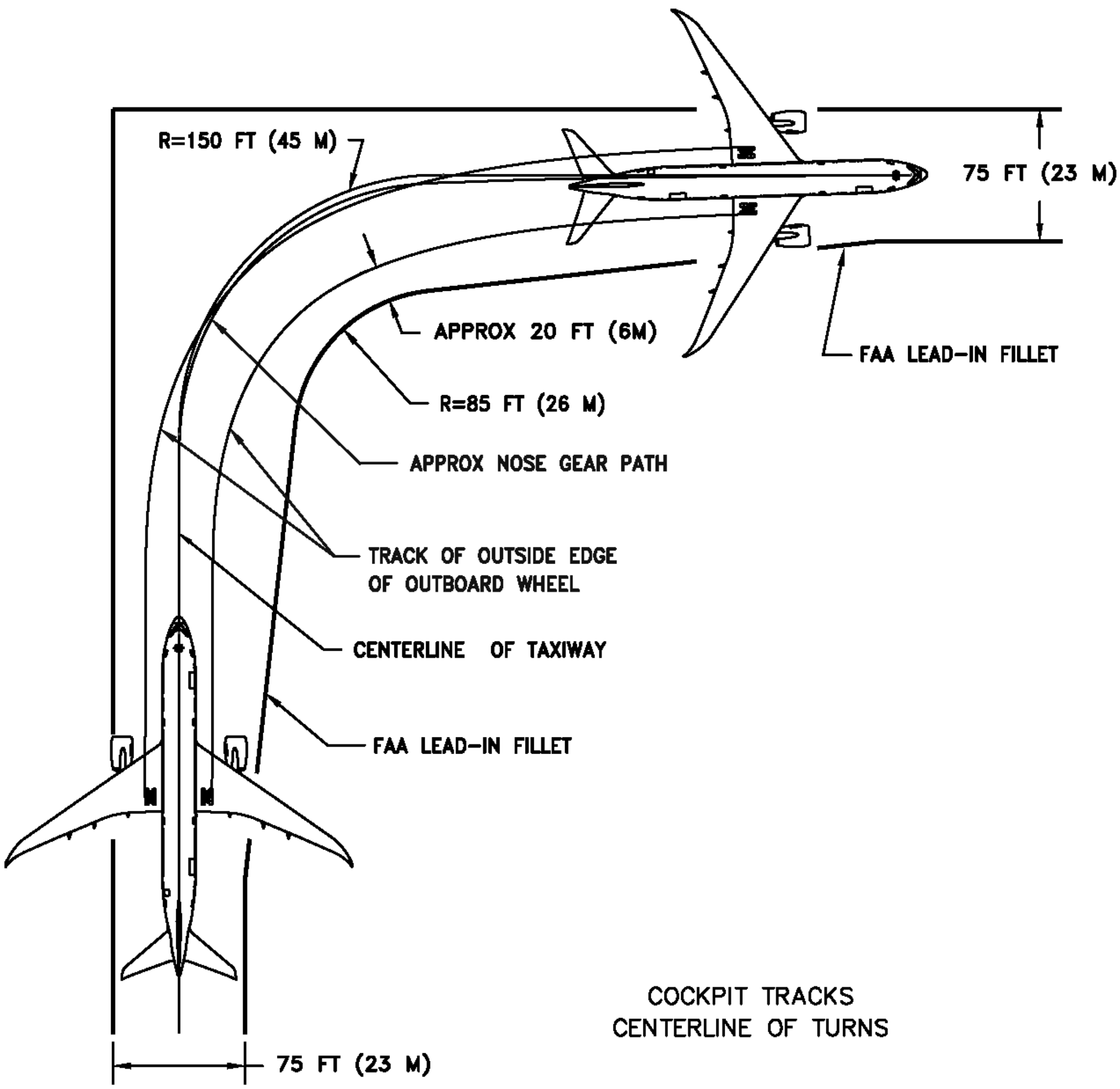
COCKPIT TRACKS
CENTERLINE OF TURNS

4.5.5 RUNWAY AND TAXIWAY TURNPATHS - RUNWAY-TO-TAXIWAY, 90-DEGREE TURN

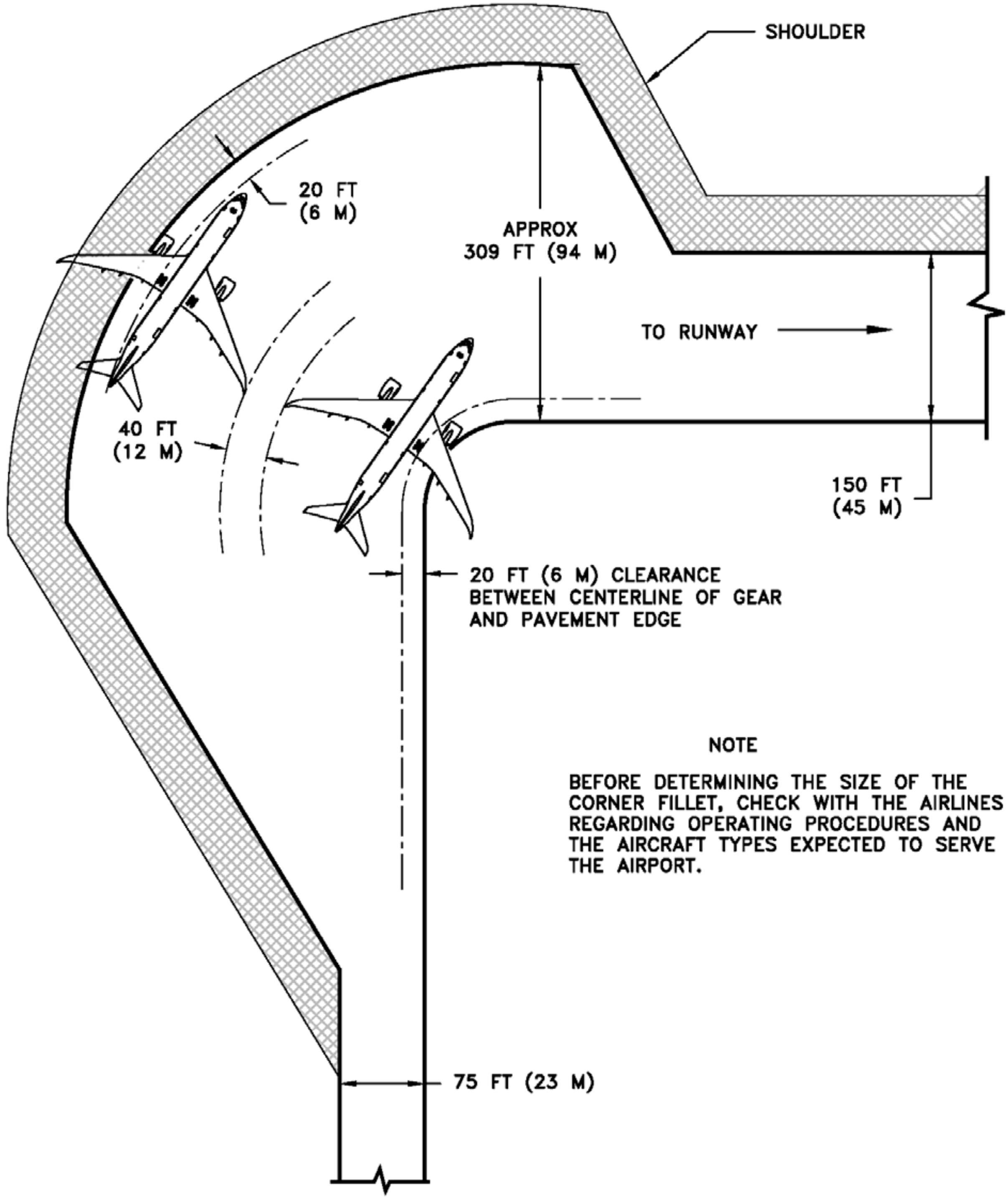
MODEL 787-9

NOTE

BEFORE DETERMINING THE SIZE OF THE INTERSECTION FILLET CHECK WITH THE AIRLINES REGARDING THE OPERATING PROCEDURES IN USE AND THE AIRCRAFT TYPES EXPECTED TO SERVE THE AIRPORT



4.5.5 RUNWAY AND TAXIWAY TURNPATHS - TAXIWAY-TO-TAXIWAY, 90-DEGREE TURN
MODEL 787-9



4.6 RUNWAY HOLDING BAY

MODEL 787-8, 787-9

5.0 TERMINAL SERVICING

5.1 Airplane Servicing Arrangement - Typical Turnaround

5.2 Terminal Operations - Turnaround Station

5.3 Terminal Operations - En Route Station

5.4 Ground Servicing Connections

5.5 Engine Starting and Ground Power Requirements

5.6 Conditioned Air Requirements

5.7 Ground Towing Requirements

5.0 TERMINAL SERVICING

During turnaround at the terminal, certain services must be performed on the aircraft, usually within a given time, to meet flight schedules. This section shows service vehicle arrangements, schedules, locations of service points, and typical service requirements. The data presented in this section reflect ideal conditions for a single airplane. Service requirements may vary according to airplane condition and airline procedure.

Section 5.1 shows typical arrangements of ground support equipment during turnaround. As noted, if the auxiliary power unit (APU) is used, the electrical, air start, and air-conditioning service vehicles would not be required. Passenger loading bridges or portable passenger stairs could be used to load or unload passengers.

Sections 5.2 and 5.3 show typical service times at the terminal. These charts give typical schedules for performing service on the airplane within a given time. Service times may be rearranged to suit availability of personnel, airplane configuration, and degree of service required.

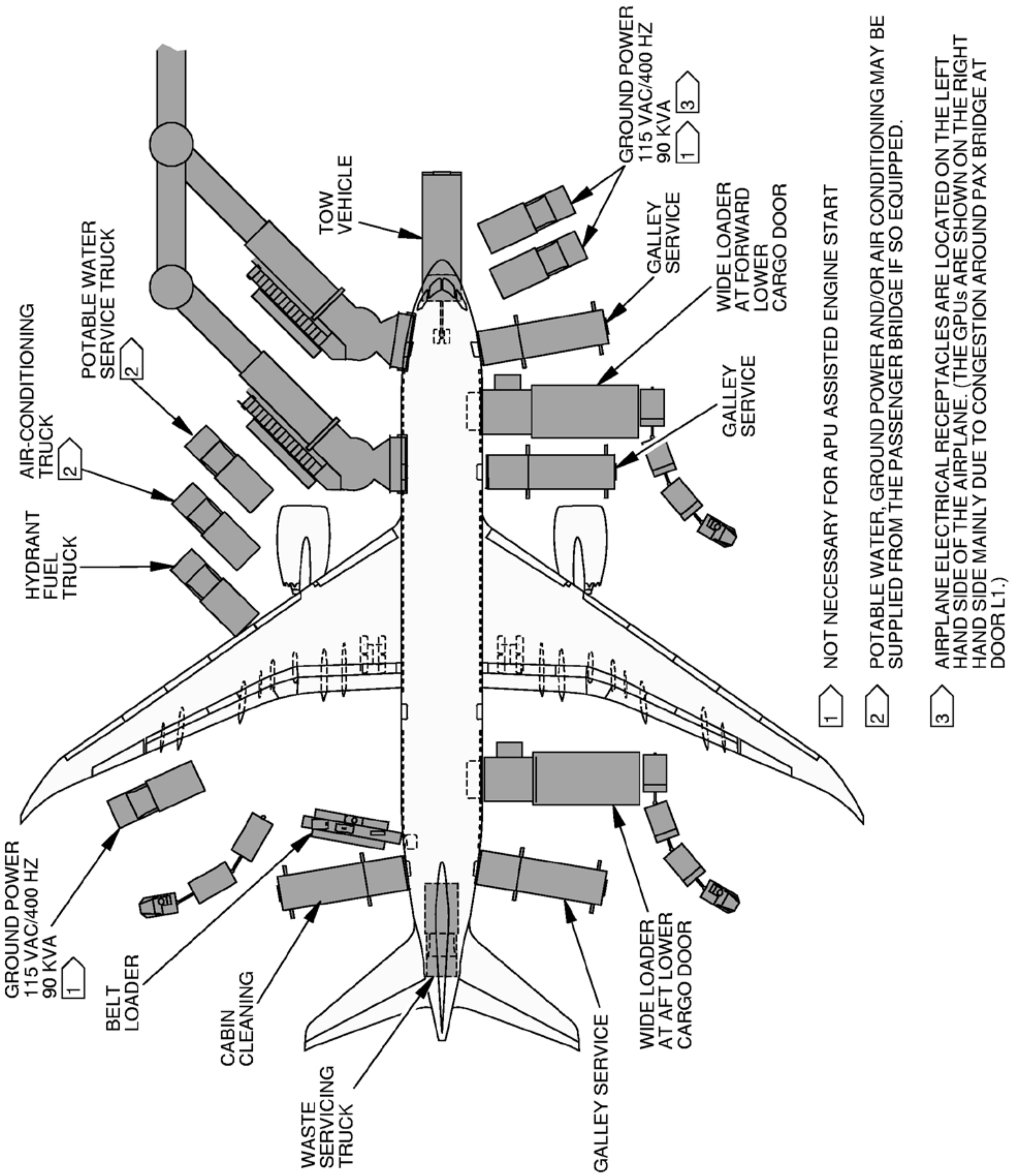
Section 5.4 shows the locations of ground service connections in graphic and in tabular forms. Typical capacities and service requirements are shown in the tables. Services with requirements that vary with conditions are described in subsequent sections.

Section 5.5 shows minimum electrical ground power requirements for engine start. The curves are based on 120-second and 180-second start times depending on the ground power unit.

Section 5.6 shows air conditioning requirements for heating and cooling (pull-down and pull-up) using ground conditioned air. The curves show airflow requirements to heat or cool the airplane within a given time at ambient conditions.

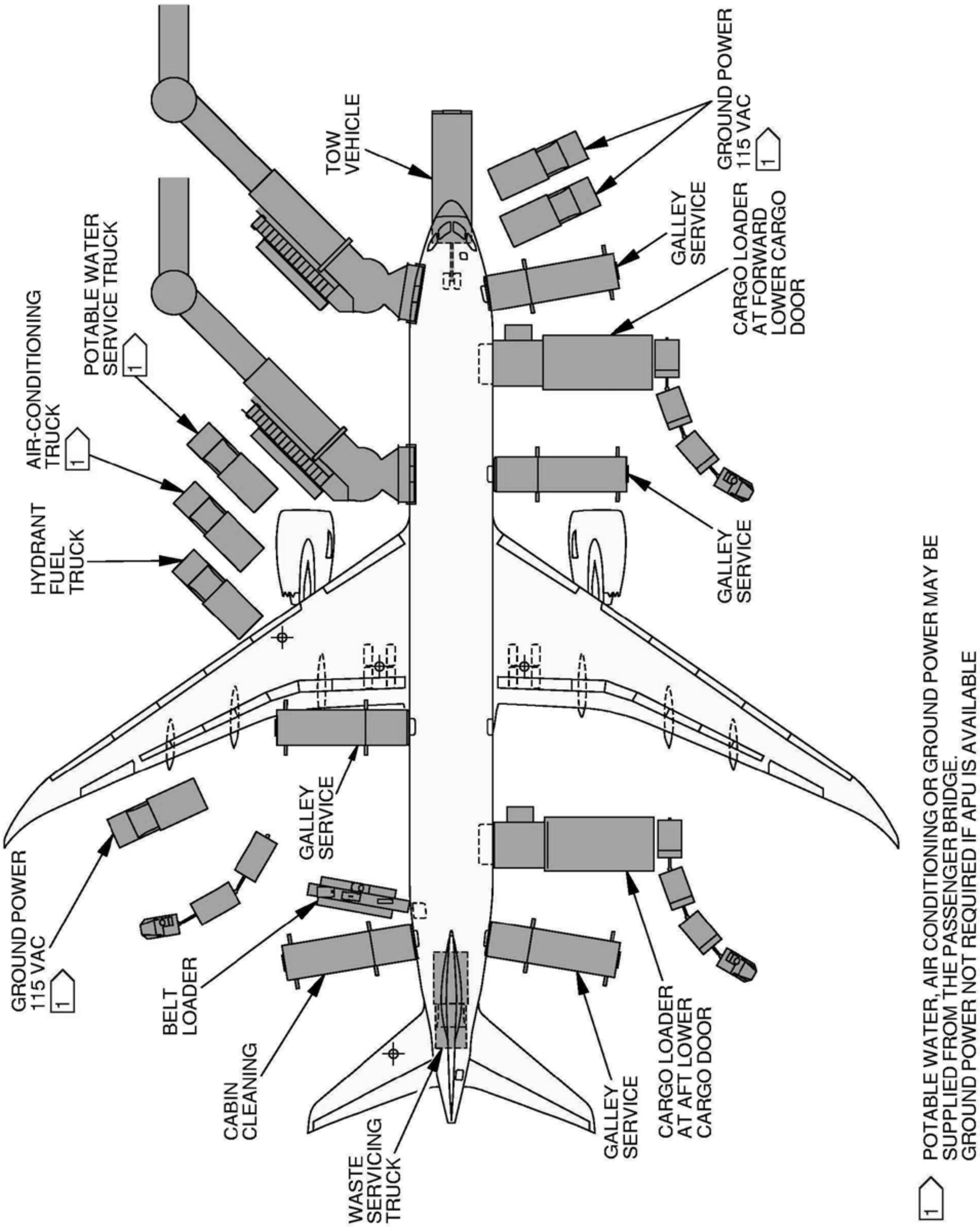
Section 5.7 shows air conditioning requirements for heating and cooling to maintain a constant cabin air temperature using low pressure conditioned air. This conditioned air is supplied through an 8-in (20.3 cm) ground air connection (GAC) directly to the passenger cabin, bypassing the air cycle machines.

Section 5.8 shows ground towing requirements for various ground surface conditions.

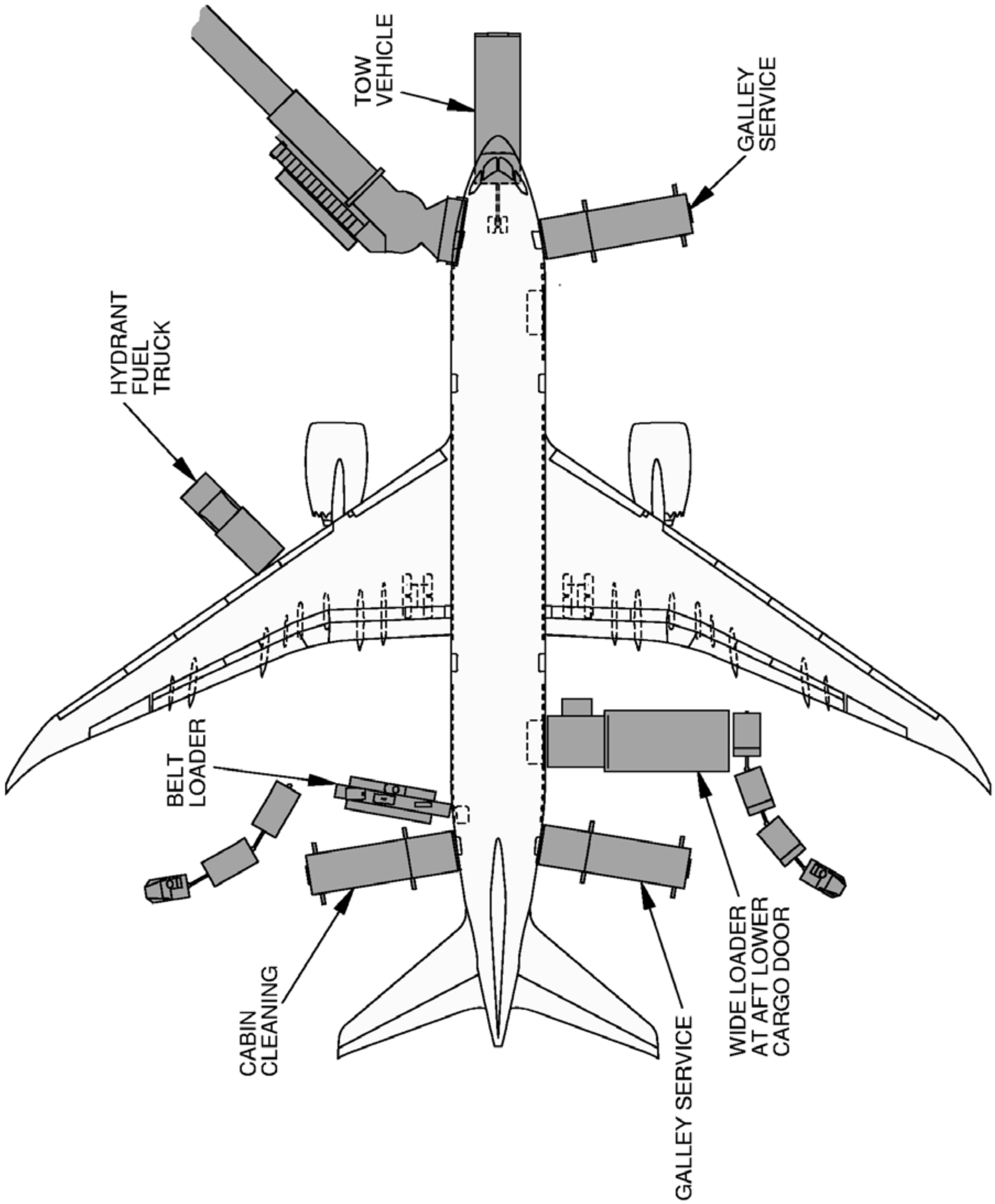


5.1.1 AIRPLANE SERVICING ARRANGEMENT - TYPICAL TURNAROUND

MODEL 787-8

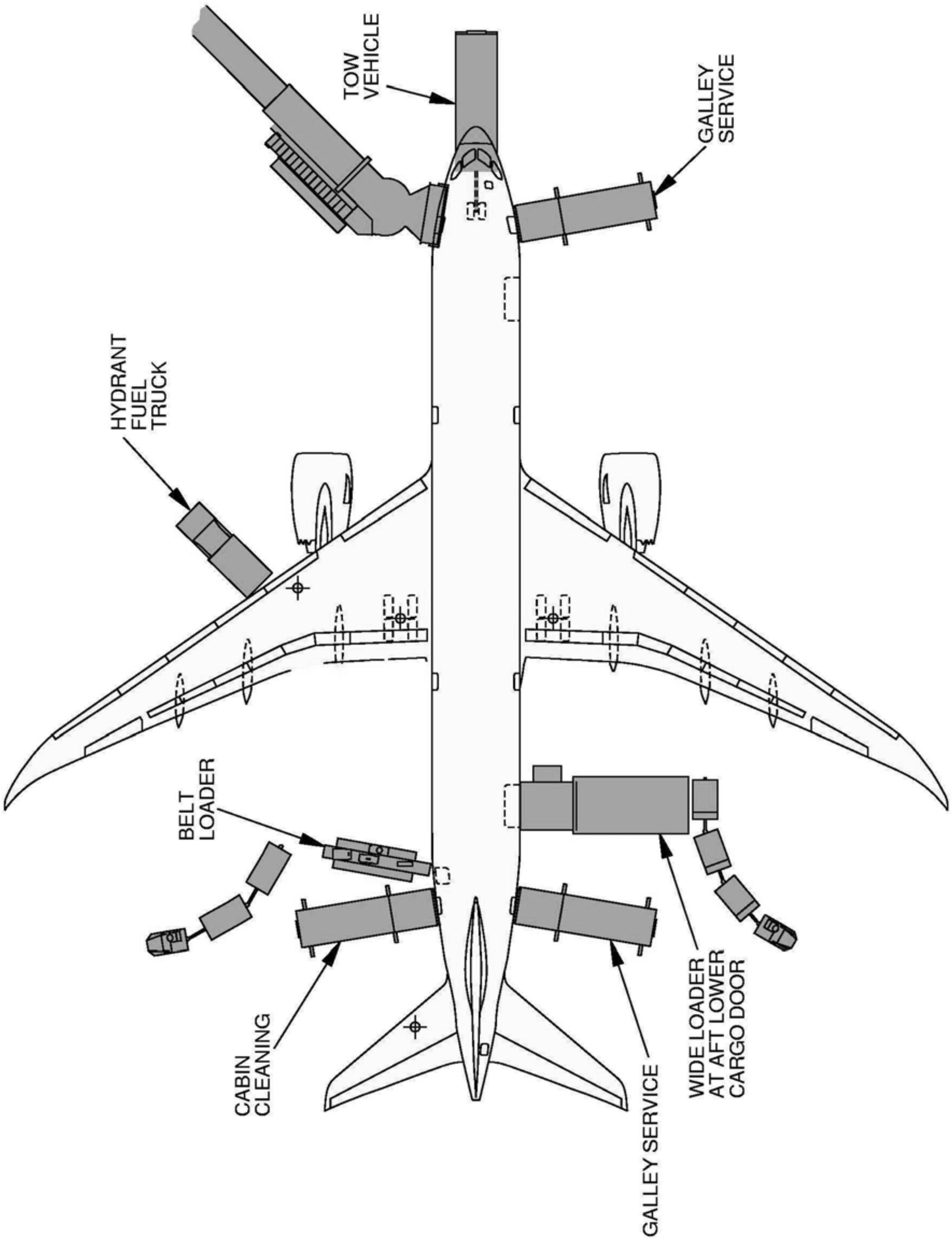


5.1.2 AIRPLANE SERVICING ARRANGEMENT - TYPICAL TURNAROUND
MODEL 787-9



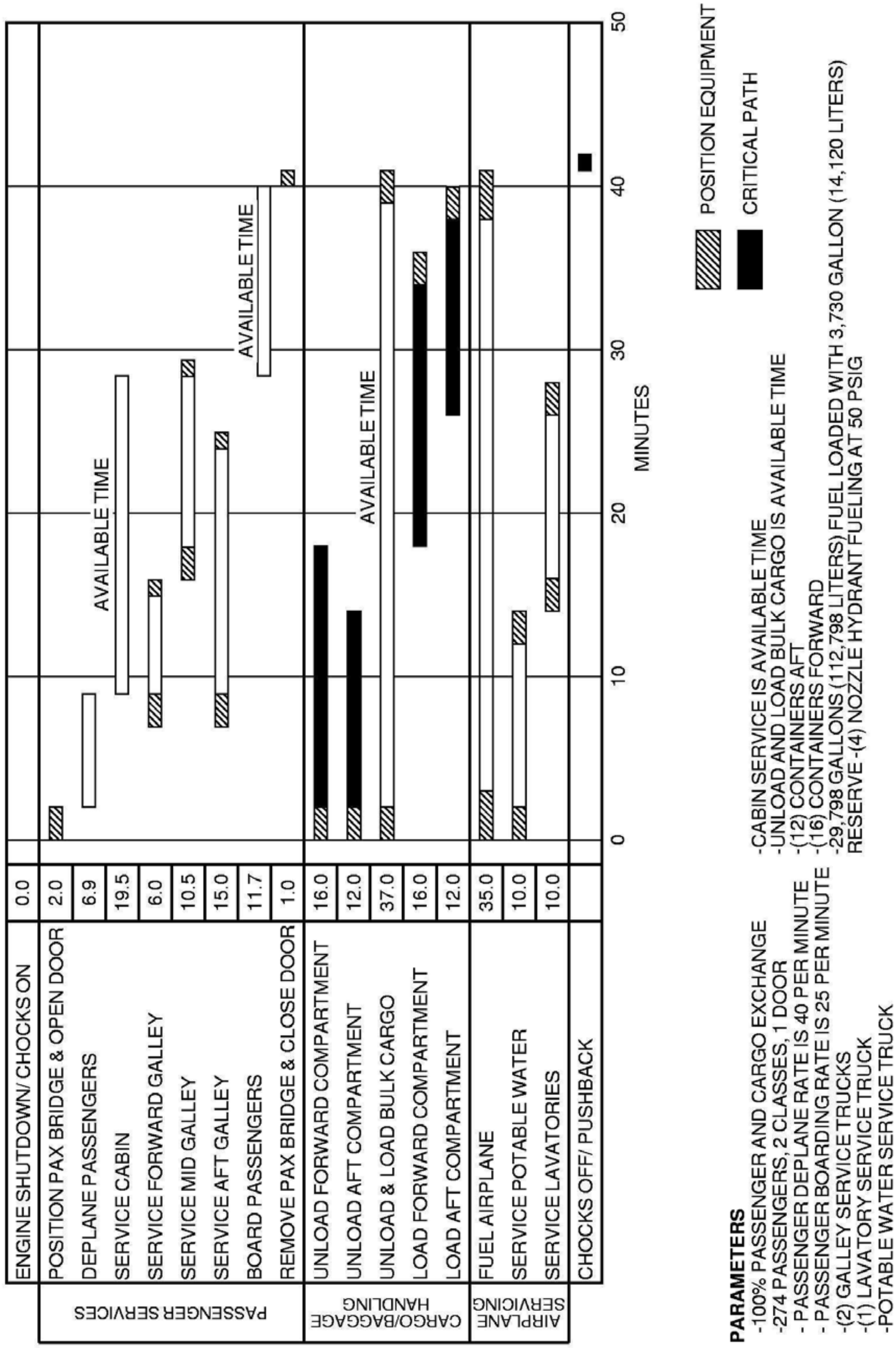
5.1.3 AIRPLANE SERVICING ARRANGEMENT - TYPICAL EN ROUTE

MODEL 787-8



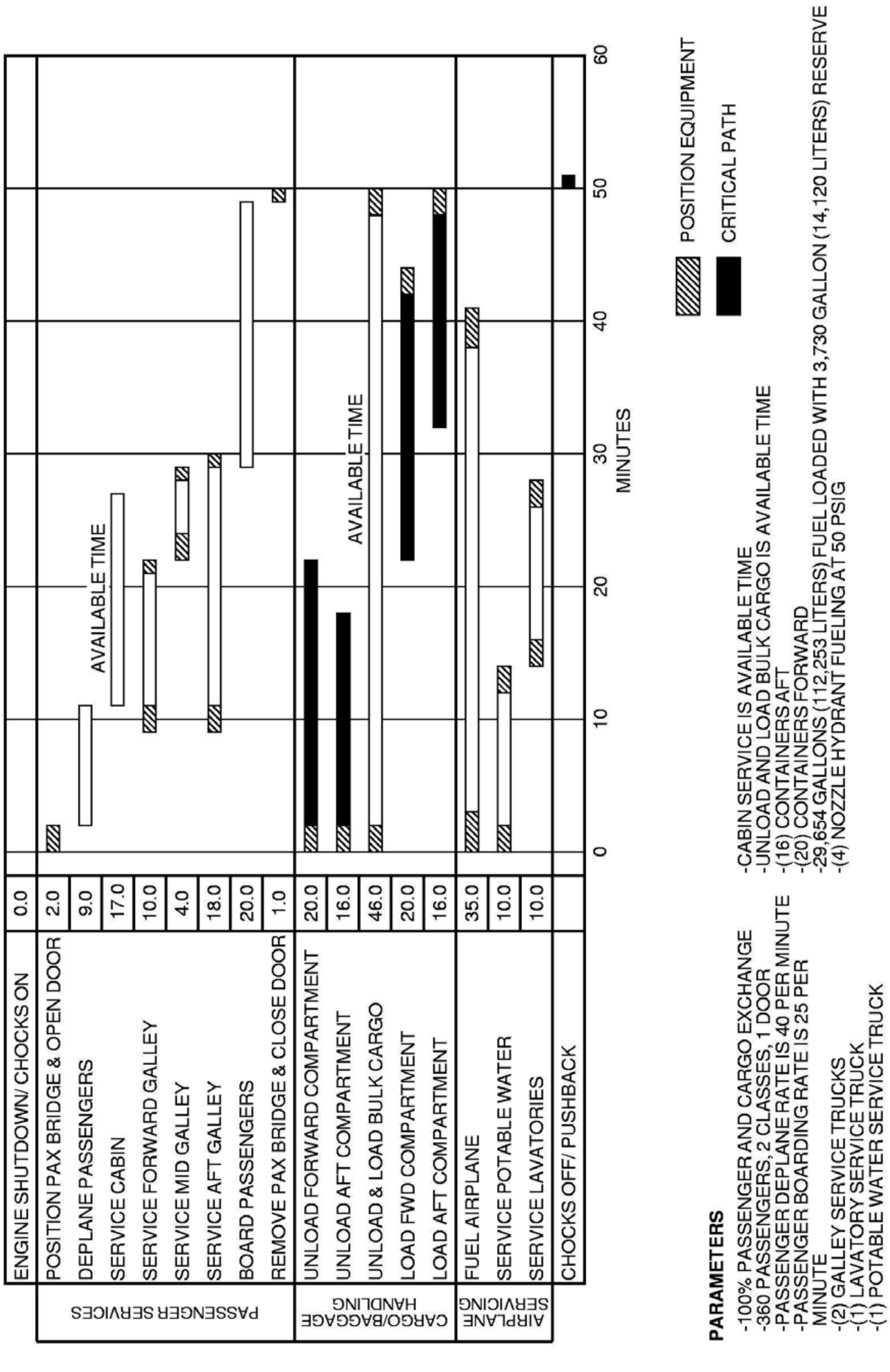
5.1.4 AIRPLANE SERVICING ARRANGEMENT - TYPICAL EN ROUTE

MODEL 787-9



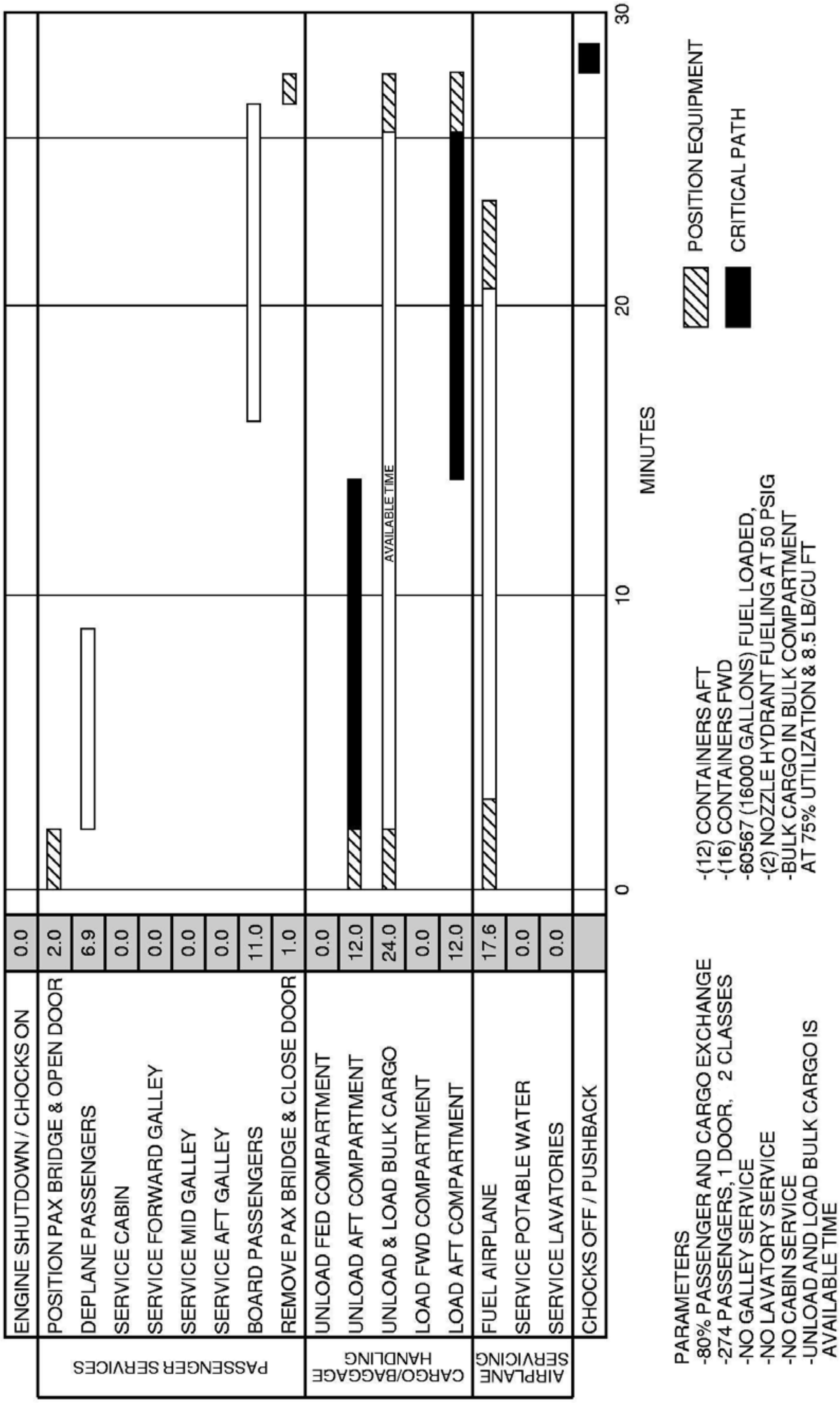
5.2.1 TERMINAL OPERATIONS, TURNTIME ANALYSIS - TURNAROUND STATION

MODEL 787-8



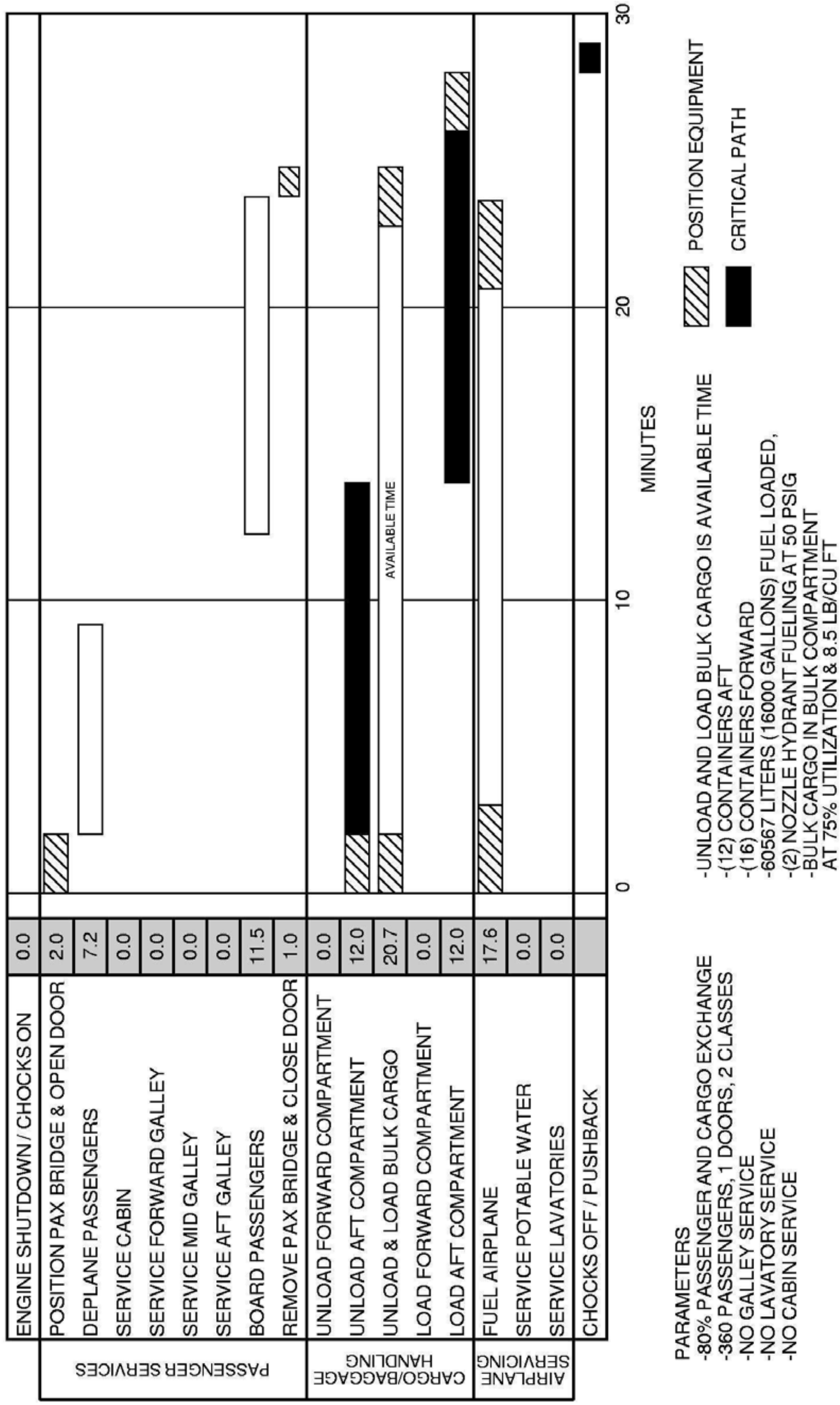
5.2.2 TERMINAL OPERATIONS, TURNTIME ANALYSIS - TURNAROUND STATION

MODEL 787-9



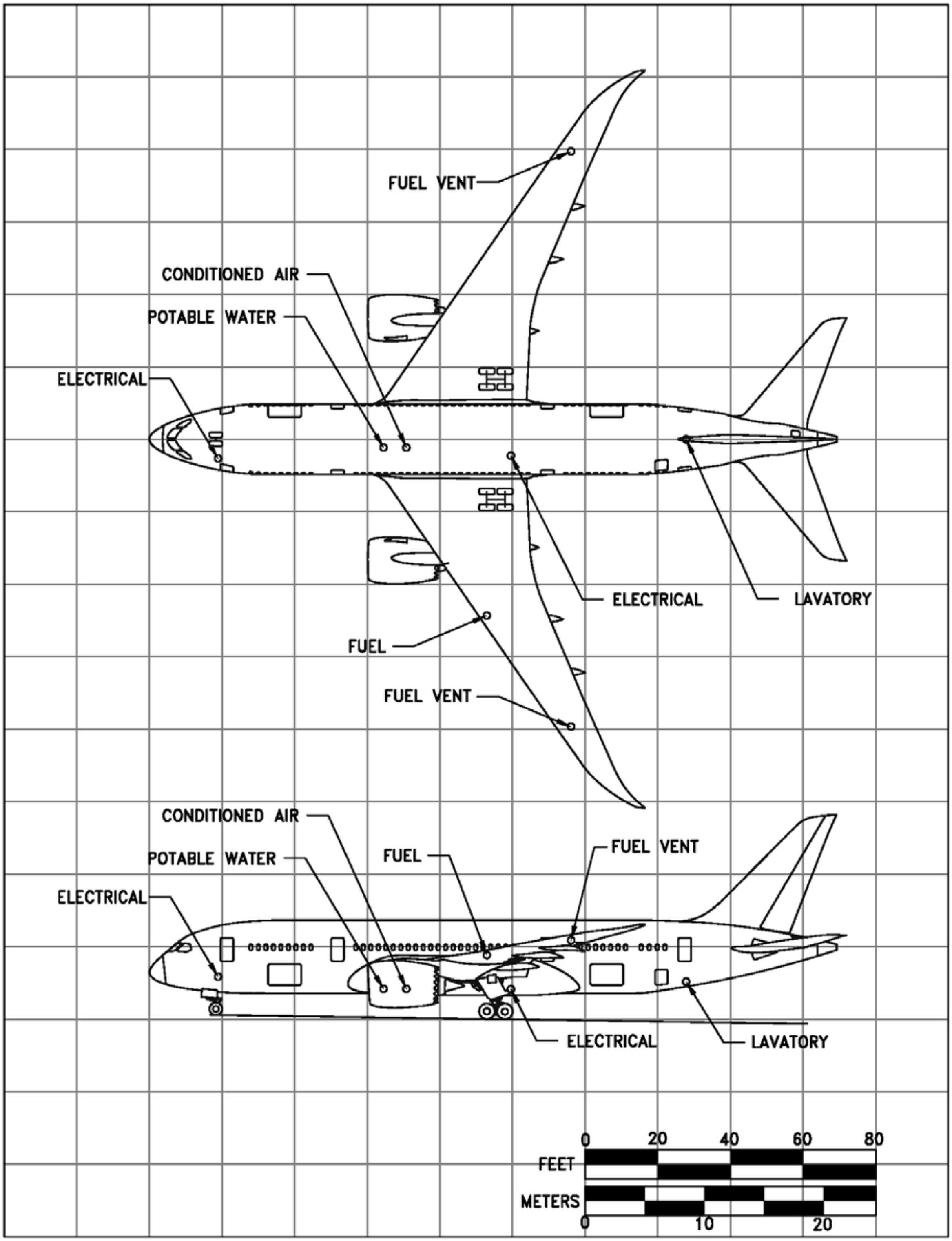
5.3.1 TERMINAL OPERATIONS, TURNTIME ANALYSIS –EN ROUTE STATION

MODEL 787-8



5.3.2 TERMINAL OPERATIONS, TURNTIME ANALYSIS – EN ROUTE STATION

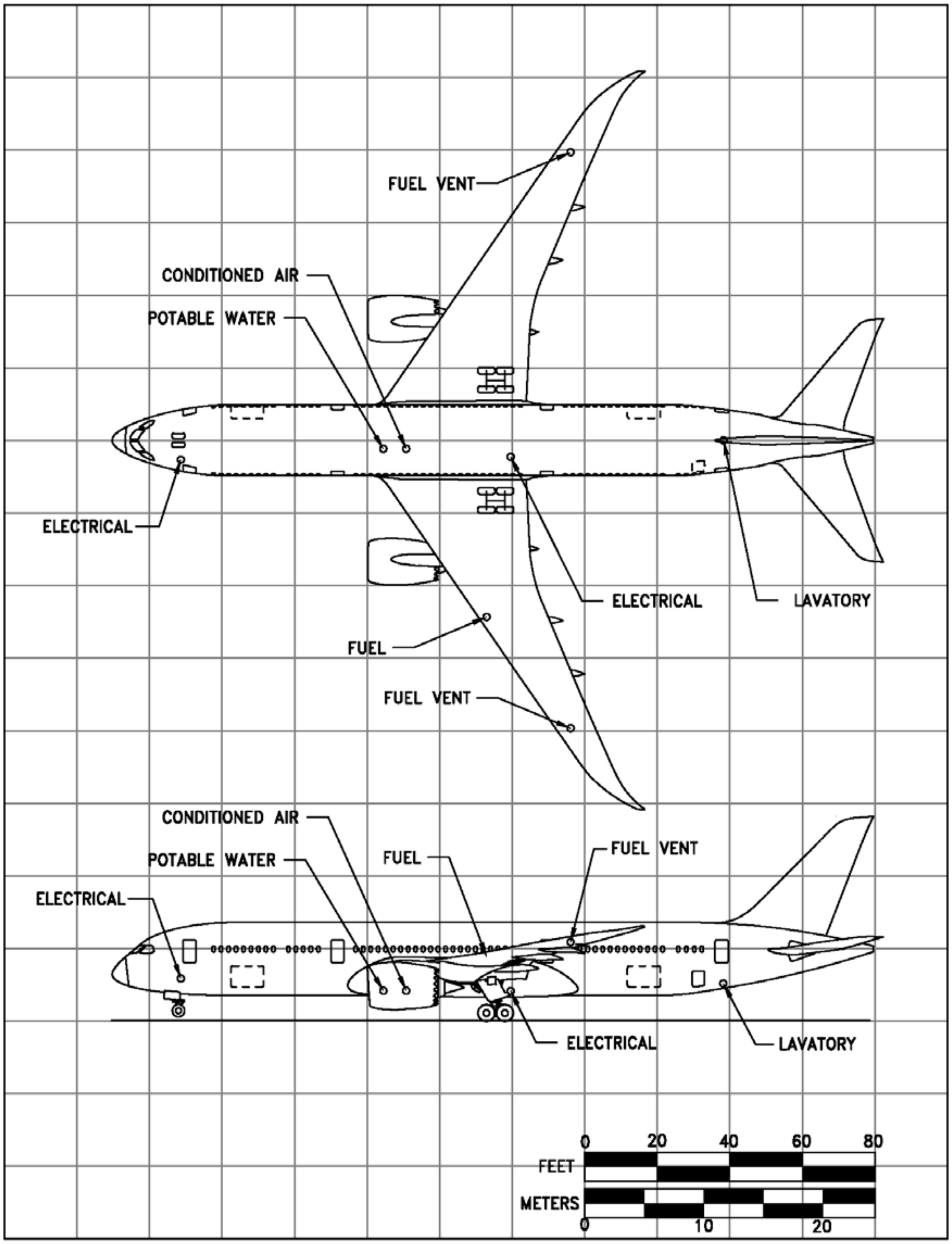
MODEL 787-9



5.4.1 GROUND SERVICING CONNECTIONS
MODEL 787-8

SYSTEM	MODEL	DISTANCE AFT OF NOSE		DISTANCE FROM AIRPLANE CENTERLINE				MAX HT ABOVE GROUND	
				LH SIDE		RH SIDE			
		FT	M	FT	M	FT	M	FT	M
CONDITIONED AIR ONE 8-IN (20.3 CM) PORTS	787-8	71	21.6	2.4	0.7	-	-	6.6	2.0
ELECTRICAL TWO FORWARD GROUND POWER RECEPTACLES ONE MID-AFT GROUND POWER RECEPTACLE ALL RECEPTACLES ARE 90 KVA , 200/115 V AC 400 HZ,	787-8	19.5 99.1	5.9 30.2	4.7 5.1	1.4 1.6	- -	- -	8.9 7.3	2.7 2.2
TWLU ANTENNA LOCATION IS ON THE CENTERLINE	787-8	23.4	7.1	0	0	0	0	26.9	8.2
POTABLE WATER ONE SERVICE CONNECTION	787-8	63.4	19.3	3.3	1.0	-	-	6.4	2.0
FUEL ONE UNDERWING PRESSURE CONNECTOR WITH TWO FUELING PORTS FUEL VENTS TOTAL CAPACITY 33,340 US GAL (126,205 LITERS)	787-8	90 112	27.4 34.2	48 76	14.6 23.1	- 76	- 23.1	17 21	5.2 6.4
LAVATORY BOTH FORWARD AND AFT TOILETS ARE SERVICED THROUGH ONE SERVICE PANEL	787-8	143.7	43.8	0	0	0	0	9.9	3.0

5.4.2 GROUND SERVICING CONNECTIONS AND CAPACITIES
MODEL 787-8

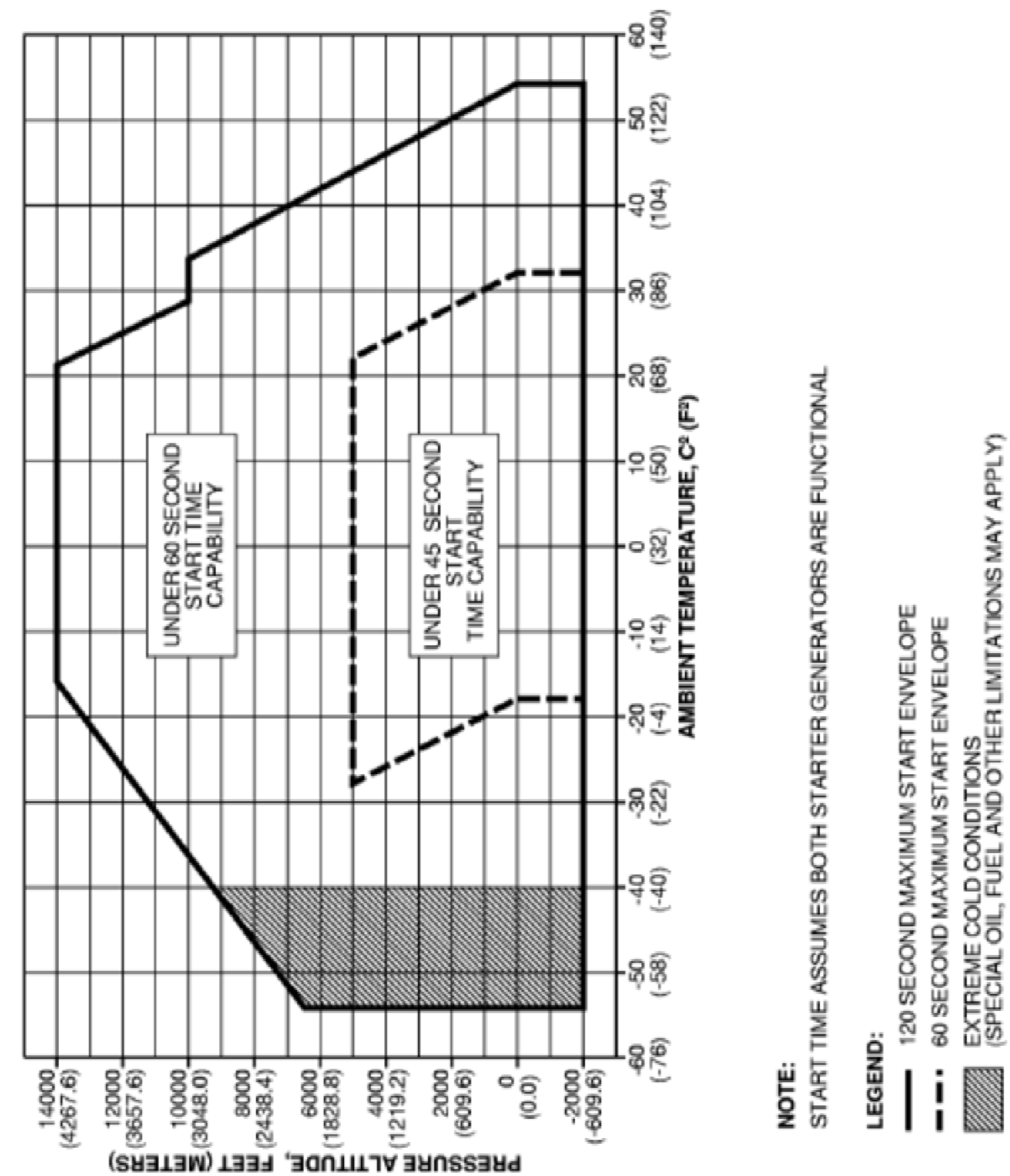


5.4.3 GROUND SERVICING CONNECTIONS
MODEL 787-9

SYSTEM	MODEL	DISTANCE AFT OF NOSE		DISTANCE FROM AIRPLANE CENTERLINE				MAX HT ABOVE GROUND	
				LH SIDE		RH SIDE			
		FT	M	FT	M	FT	M	FT	M
CONDITIONED AIR TWO 8-IN (20.3 CM) PORTS	787-9	81	24.7	2	0.6	2	.06	7.0	2.1
ELECTRICAL TWO FORWARD GROUND POWER RECEPTACLES	787-9	20	6.1	5	1.5	-	-	9	2.7
ONE MID-AFT GROUND POWER RECEPTACLE ALL RECEPTACLES ARE 90 KVA , 200/115 V AC 400 HZ,		109	33.2	5	1.5	-	-	7	2.1
TWLU ANTENNA LOCATION IS ON THE CENTERLINE	787-9	23	7.0	0	0	0	0	27	8.2
POTABLE WATER ONE SERVICE CONNECTION	787-9	73	22.3	3	.9	-	-	6	1.8
FUEL ONE UNDERWING PRESSURE CONNECTOR WITH TWO FUELING PORTS	787-9	100	30.5	48	14.6	-	-	17	5.2
FUEL VENTS TOTAL CAPACITY 33,380 US GAL (126,205 LITERS)		122	37.2	76	23.2	76	23.1	21	6.4
LAVATORY BOTH FORWARD AND AFT TOILETS ARE SERVICED THROUGH ONE SERVICE PANEL	787-9	164	50.0	0	0	0	0	10	3.0

5.4.4 GROUND SERVICING CONNECTIONS AND CAPACITIES

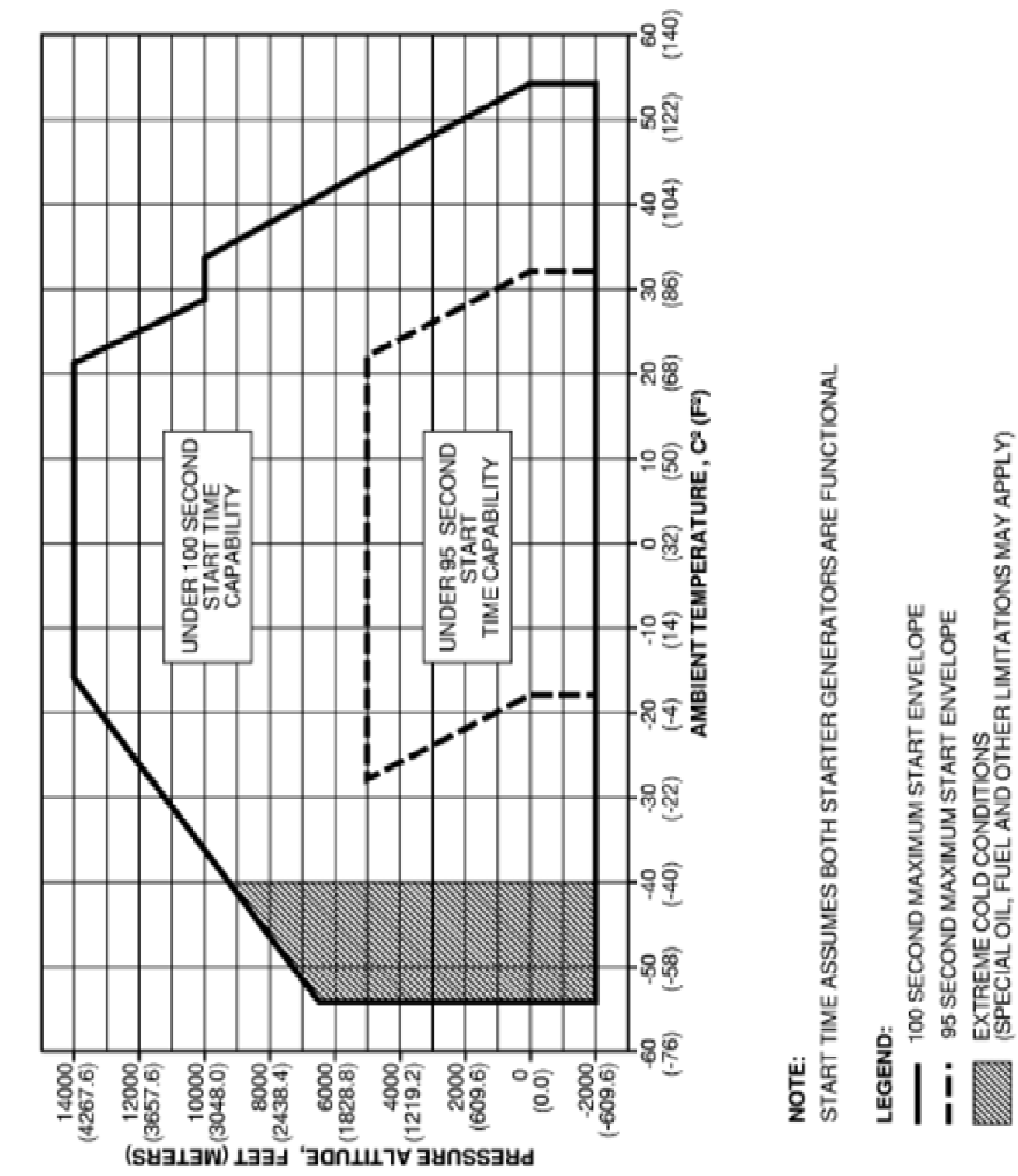
MODEL 787-9



Normal engine start for the 787 uses the APU to provide electrical power. If the APU is inoperative or unavailable, an engine start can be accomplished using a minimum of two 90 kVA external ground power units connected to the two forward external receptacles. Boeing recommends using three 90 kVA ground power sources to minimize the effect on cabin load shedding of ventilation, In Flight Entertainment, and cabin lighting.

5.5.1 ENGINE STARTING GROUND POWER REQUIREMENTS – ELECTRICAL – APU

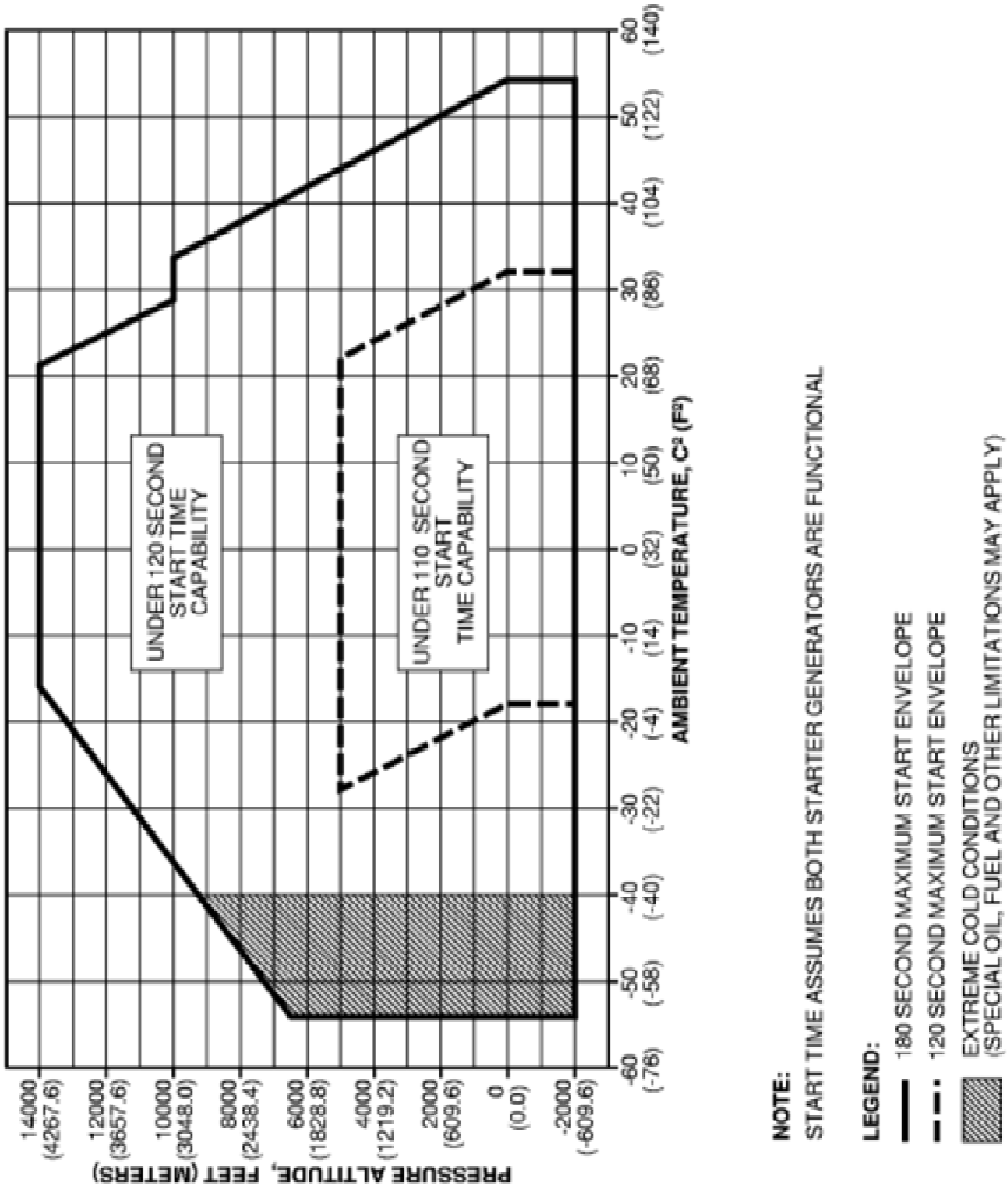
MODEL 787-8, 787-9



Normal engine start for the 787 uses the APU to provide electrical power. If the APU is inoperative or unavailable, an engine start can be accomplished using a minimum of two 90 kVA external ground power units connected to the two forward external receptacles. Boeing recommends using three 90 kVA ground power sources to minimize the effect on cabin load shedding of ventilation, In Flight Entertainment, and cabin lighting.

5.5.2 ENGINE STARTING GROUND POWER REQUIREMENTS – ELECTRICAL – APU INOPERATIVE – THREE GPU

MODEL 787-8, 787-9



Normal engine start for the 787 uses the APU to provide electrical power. If the APU is inoperative or unavailable, an engine start can be accomplished using a minimum of two 90 kVA external ground power units connected to the two forward external receptacles. Boeing recommends using three 90 kVA ground power sources to minimize the effect on cabin load shedding of ventilation, In Flight Entertainment, and cabin lighting.

5.5.3 ENGINE STARTING GROUND POWER REQUIREMENTS – ELECTRICAL – APU INOPERATIVE, TWO GPUs

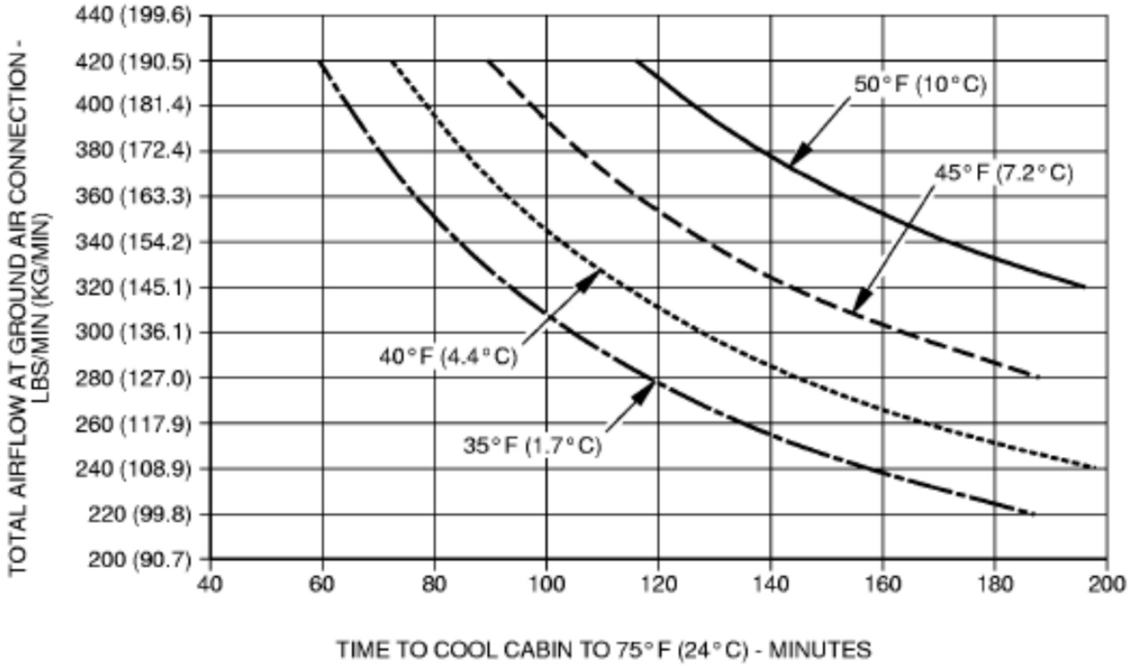
MODEL 787-8, 787-9

The 787 aircraft is an electric aircraft and does not

have a traditional pneumatic system onboard,

thus there are no ground pneumatic connections.

5.5.4 GROUND POWER REQUIREMENTS - PNEUMATIC
MODEL 787-8, 787-9



CONDITIONS:

- OUTSIDE AIR TEMPERATURE: 103° F (39.4° C)
- INITIAL CABIN TEMPERATURE: 115° F (46.1° C)
- ALL EXTERIOR DOORS AND WINDOWS ARE CLOSED
- "HEAT REDUCTION MODE" SELECTED VIA CABIN ATTENDANT PANEL TO DIM WINDOWS AND LIGHTING
- RECIRCULATION FANS SELECTED OFF
- ICS RECIRCULATION CHILLING OFF
- IFE OFF
- NO OCCUPANTS
- FULL SOLAR LOAD

LEGEND:

PCA TEMPERATURE AT GROUND CONNECTION

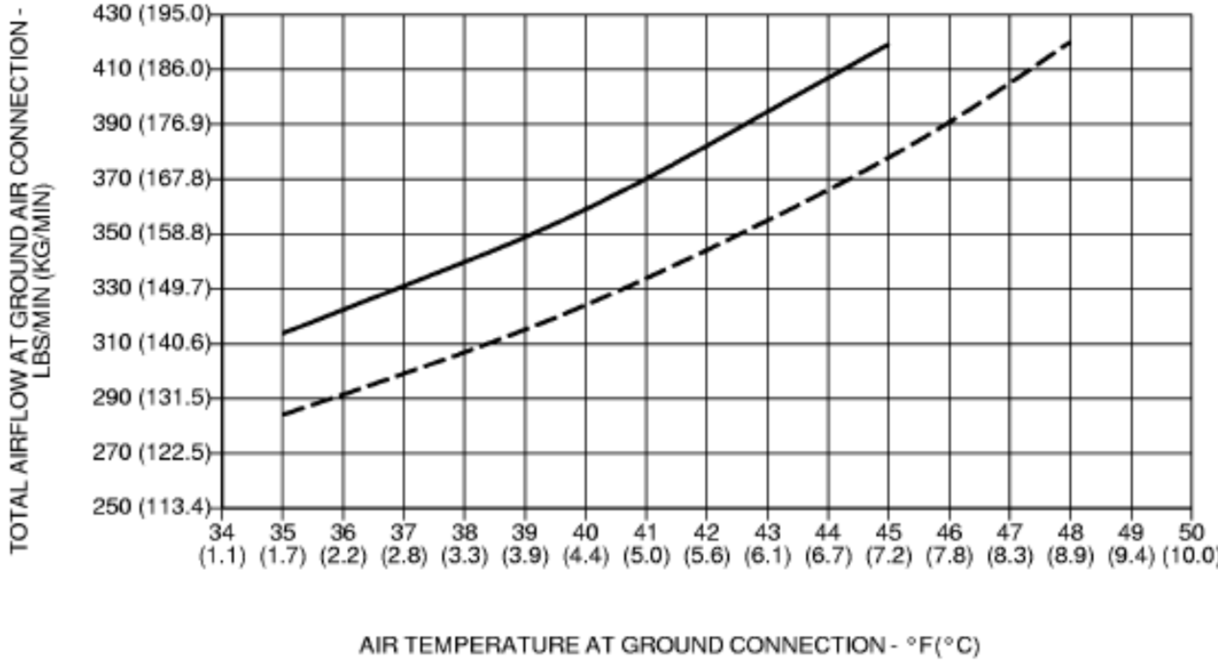
- 50° F (10° C) (solid line)
- 45° F (7.2° C) (long dashed line)
- 40° F (4.4° C) (short dashed line)
- 35° F (1.7° C) (dash-dot line)

NOTE:

THIS GRAPH PROVIDES THE PREDICTED TIME REQUIRED TO COOL THE AIRPLANE'S CABIN TO A BULK AVERAGE OF 75° F (24° C) AS A FUNCTION OF AIRFLOW AND TEMPERATURE, AT THE GROUND AIR CONNECTION, WHEN USING A PRE-CONDITIONED AIR (PCA) SOURCE.

5.6.1 CONDITIONED AIR FLOW REQUIREMENTS – COOLING TIME

MODEL 787-8



CONDITIONS:

- OUTSIDE AIR TEMPERATURE: 103°F (39.4°C)
- ALL EXTERIOR DOORS AND WINDOWS ARE CLOSED
- "HEAT REDUCTION MODE" SELECTED VIA CABIN ATTENDANT PANEL TO DIM WINDOWS AND LIGHTING
- RECIRCULATION FANS SELECTED OFF
- ICS RECIRCULATION CHILLING OFF
- IFE OFF
- 100% OCCUPANT LOAD
- FULL SOLAR LOAD

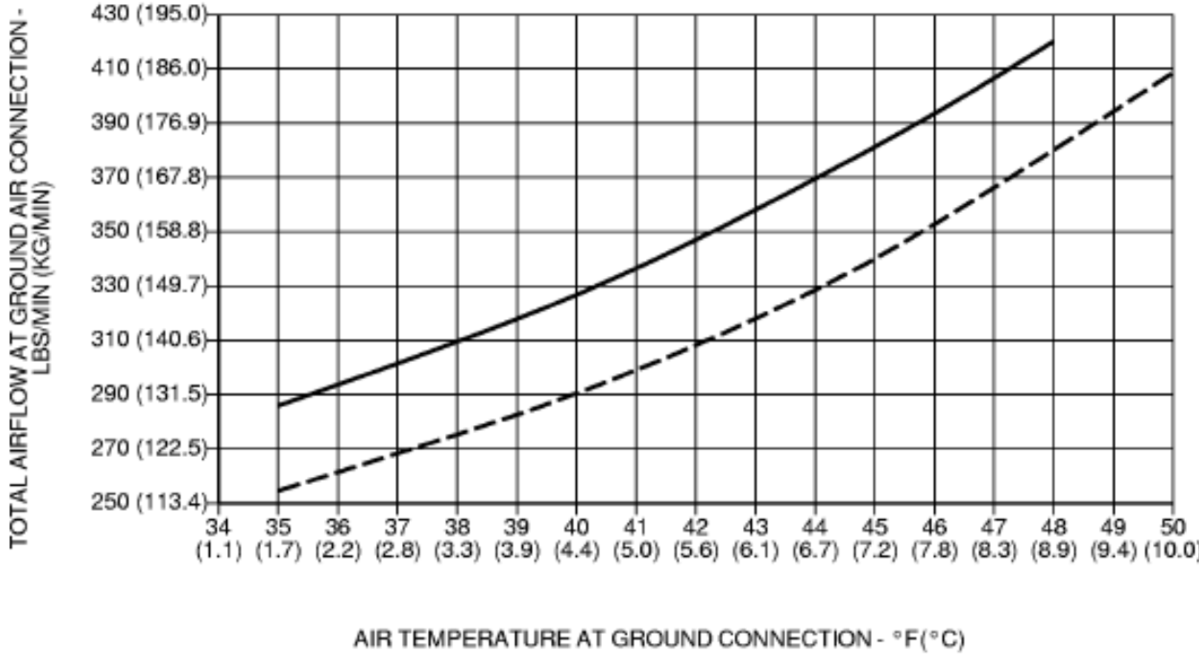
LEGEND:

——— 353 SEATS
– – – 284 SEATS

NOTE:

THIS GRAPH PROVIDES THE FLOW RATE AND TEMPERATURE, AT THE AIRPLANE'S GROUND AIR CONNECTION, THAT IS REQUIRED TO MAINTAIN THE AIRPLANE'S CABIN AT A BULK AVERAGE OF 75°F (24°C) WHEN USING A PRE-CONDITIONED AIR (PCA) SOURCE.

5.6.2 CONDITIONED AIR FLOW REQUIREMENTS – COOLING – STEADY STATE (103 F AMBIENT AIR)
MODEL 787-8



CONDITIONS:

- OUTSIDE AIR TEMPERATURE: 80°F (26.7°C)
- ALL EXTERIOR DOORS AND WINDOWS ARE CLOSED
- "HEAT REDUCTION MODE" SELECTED VIA CABIN ATTENDANT PANEL TO DIM WINDOWS AND LIGHTING
- RECIRCULATION FANS SELECTED OFF
- ICS RECIRCULATION CHILLING OFF
- IFE OFF
- 100% OCCUPANT LOAD
- FULL SOLAR LOAD

LEGEND:

——— 353 SEATS

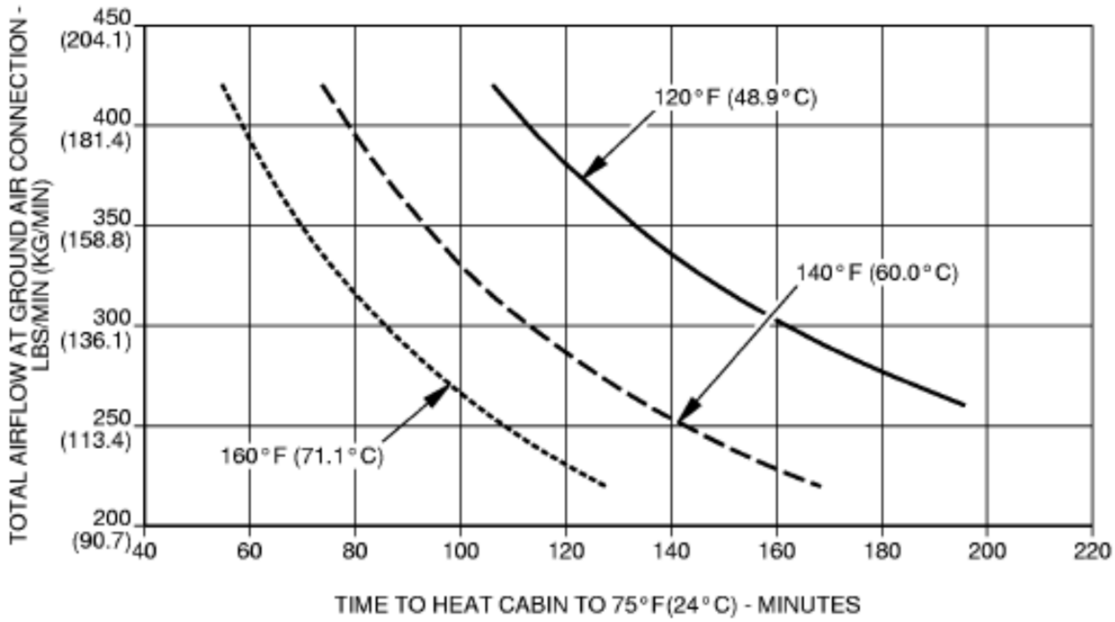
– – – 284 SEATS

NOTE:

THIS GRAPH PROVIDES THE FLOW RATE AND TEMPERATURE, AT THE AIRPLANE'S GROUND AIR CONNECTION, THAT IS REQUIRED TO MAINTAIN THE AIRPLANES'S CABIN AT A BULK AVERAGE OF 75°F (24°C) WHEN USING A PRE-CONDITIONED AIR (PCA) SOURCE.

5.6.3 CONDITIONED AIR FLOW REQUIREMENTS – COOLING – STEADY STATE (80 F AMBIENT AIR)

MODEL 787-8



CONDITIONS:

- ALL EXTERIOR DOORS AND WINDOWS ARE CLOSED
- OUTSIDE AIR TEMPERATURE IS -40°F (-40°C)
- INITIAL CABIN TEMPERATURE IS -25°F (-32°C)
- NO SOLAR LOAD
- RECIRCULATION FANS SELECTED OFF
- ICS RECIRCULATION CHILLING OFF
- NO OCCUPANTS
- IFE OFF
- NO ELECTRICAL LOADS

LEGEND:

PCA TEMPERATURES AT GROUND CONNECTION

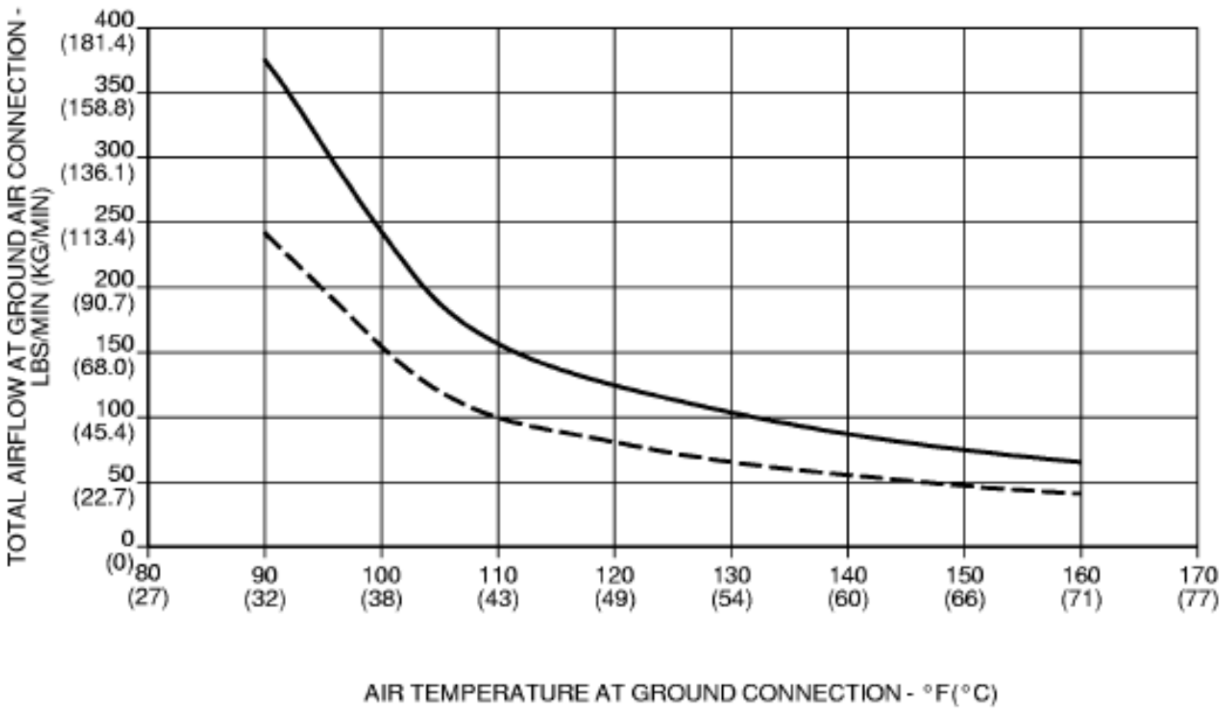
- 120°F(48.9°C) (solid line)
- 140°F(60.0°C) (dashed line)
- 160°F(71.1°C) (dotted line)

NOTE:

THIS GRAPH PROVIDES THE PREDICTED TIME REQUIRED TO HEAT THE AIRPLANE'S CABIN TO A BULK AVERAGE OF 75°F (24°C) AS A FUNCTION OF AIRFLOW AND TEMPERATURE, AT THE GROUND AIR CONNECTION, WHEN USING A PRE-CONDITIONED AIR (PCA) SOURCE.

5.6.4 CONDITIONED AIR FLOW REQUIREMENTS – HEATING TIME

MODEL 787-8



CONDITIONS:

- ALL EXTERIOR DOORS AND WINDOWS ARE CLOSED
- NO SOLAR HEAT LOAD
- RECIRCULATION FANS SELECTED OFF
- ICS RECIRCULATION CHILLING OFF
- NO OCCUPANTS
- NO ELECTRICAL HEAT LOADS

LEGEND:

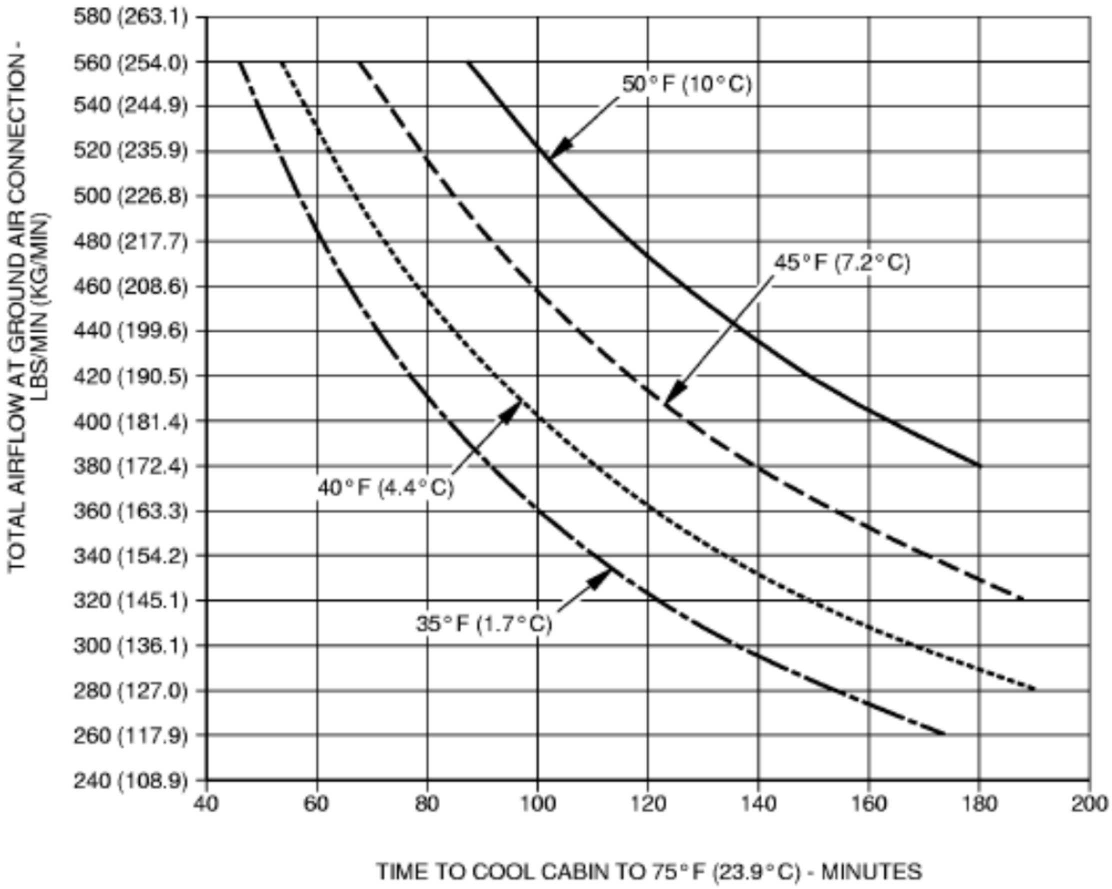
——— 40°F(-40°C) AMBIENT
– – – 0°F(-17.8°C) AMBIENT

NOTE:

THIS GRAPH PROVIDES THE FLOW RATE AND TEMPERATURE, AT THE GROUND AIR CONNECTION, THAT IS REQUIRED TO HEAT THE AIRPLANE'S CABIN TO A BULK AVERAGE OF 75°F (24°C) WHEN USING A PRE-CONDITIONED AIR (PCA) SOURCE.

5.6.5 CONDITIONED AIR FLOW REQUIREMENTS – HEATING – STEADY STATE

MODEL 787-8



CONDITIONS:

- OUTSIDE AIR TEMPERATURE: 103°F (39.4°C)
- INITIAL CABIN TEMPERATURE: 115°F (46.1°C)
- ALL EXTERIOR DOORS AND WINDOWS ARE CLOSED
- "HEAT REDUCTION MODE" SELECTED VIA CABIN ATTENDANT PANEL TO DIM WINDOWS AND LIGHTING
- RECIRCULATION FANS SELECTED OFF
- ICS RECIRCULATION CHILLING OFF
- IFE OFF
- NO OCCUPANTS
- FULL SOLAR LOAD

LEGEND:

PCA TEMPERATURE AT GROUND CONNECTION

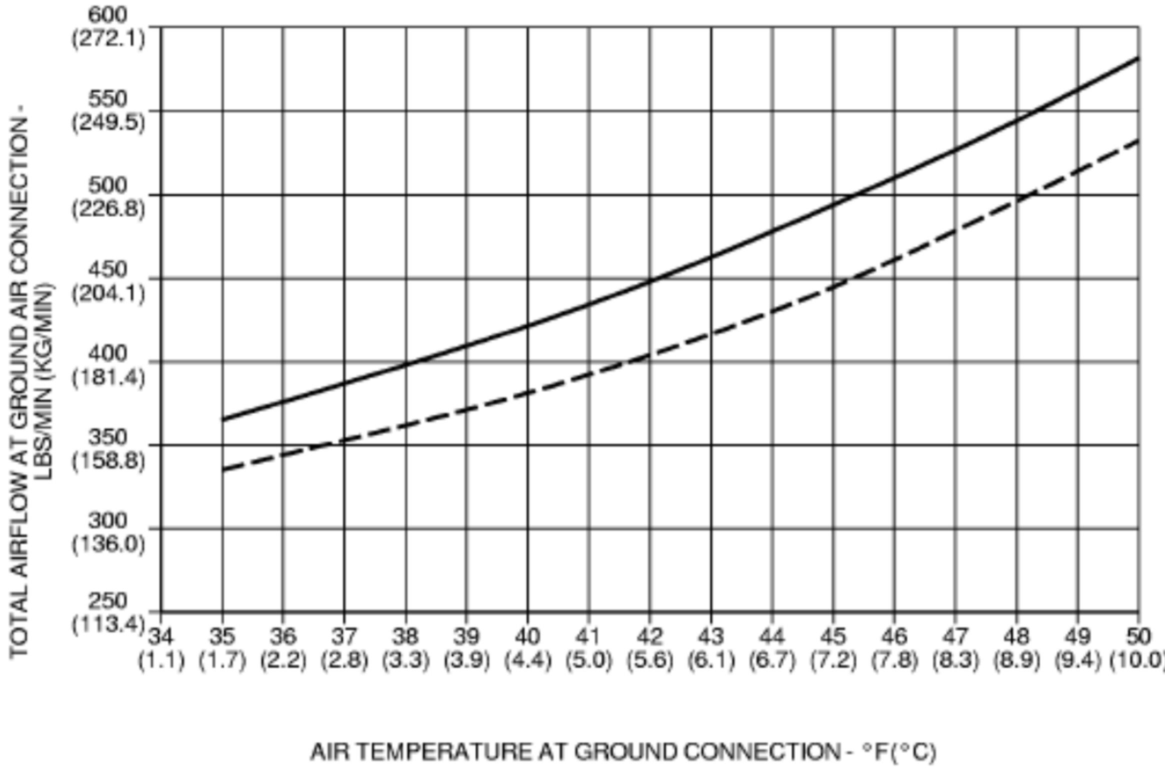
solid	50°F (10°C)
long dash	45°F (7.2°C)
dotted	40°F (4.4°C)
dash-dot	35°F (1.7°C)

NOTE:

THIS GRAPH PROVIDES THE PREDICTED TIME REQUIRED TO COOL THE AIRPLANE'S CABIN TO A BULK AVERAGE OF 75°F (24°C) AS A FUNCTION OF AIRFLOW AND TEMPERATURE, AT THE GROUND AIR CONNECTION, WHEN USING A PRE-CONDITIONED AIR (PCA) SOURCE.

5.6.6 CONDITIONED AIR FLOW REQUIREMENTS – COOLING TIME

MODEL 787-9



CONDITIONS:

- OUTSIDE AIR TEMPERATURE: 103°F (39.4°C)
- ALL EXTERIOR DOORS AND WINDOWS ARE CLOSED
- "HEAT REDUCTION MODE" SELECTED VIA CABIN ATTENDANT PANEL, DIMMED WINDOWS AND LIGHTING
- LOWER RECIRCULATION FANS SELECTED OFF (UPPER FAN ON)
- ICS RECIRCULATION CHILLING OFF
- IFE OFF
- 100% OCCUPANT LOAD FACTOR
- FULL SOLAR LOAD

LEGEND:

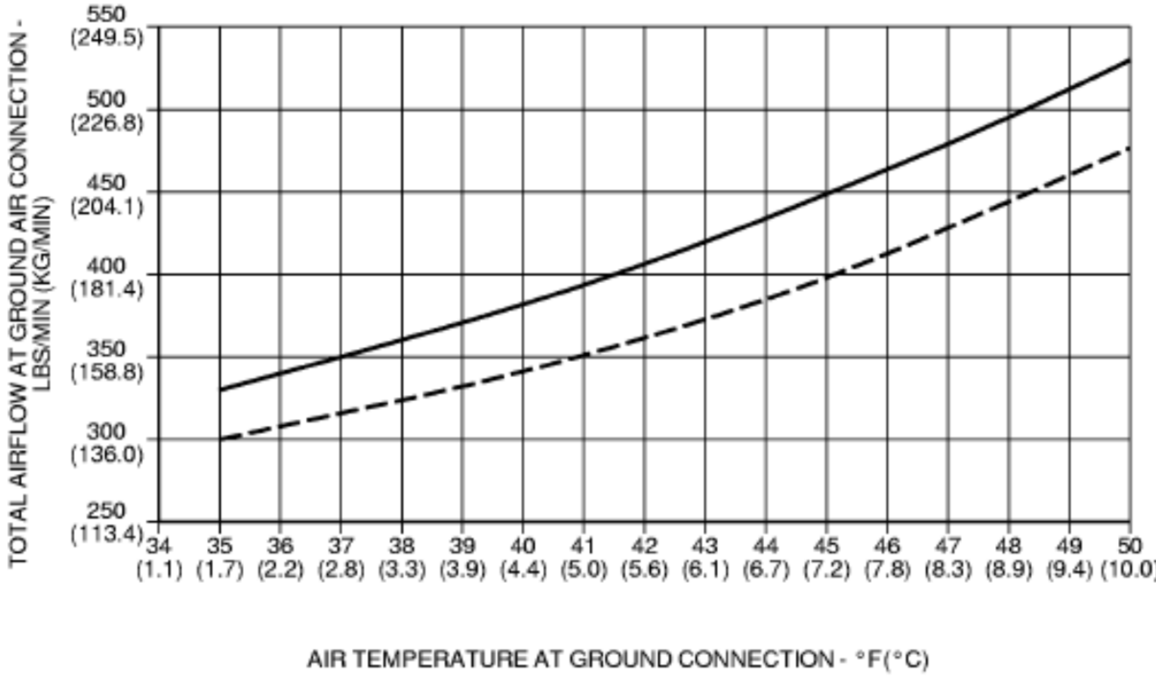
——— 402 SEATS
– – – 330 SEATS

NOTE:

THIS GRAPH PROVIDES THE FLOW RATE AND TEMPERATURE, AT THE AIRPLANE'S GROUND AIR CONNECTION, THAT IS REQUIRED TO MAINTAIN THE AIRPLANE'S CABIN AT A BULK AVERAGE OF 75°F (24°C) WHEN USING A PRE-CONDITIONED AIR (PCA) SOURCE.

5.6.7 CONDITIONED AIR FLOW REQUIREMENTS – COOLING – STEADY STATE (103 F AMBIENT AIR)

MODEL 787-9



CONDITIONS:

- OUTSIDE AIR TEMPERATURE: 80°F (26.7°C)
- ALL EXTERIOR DOORS AND WINDOWS ARE CLOSED
- "HEAT REDUCTION MODE" SELECTED VIA CABIN ATTENDANT PANEL, DIMMED WINDOWS AND LIGHTING
- LOWER RECIRCULATION FANS SELECTED OFF (UPPER FAN ON)
- ICS RECIRCULATION CHILLING OFF
- IFE OFF
- 100% OCCUPANT LOAD FACTOR
- FULL SOLAR LOAD

LEGEND:

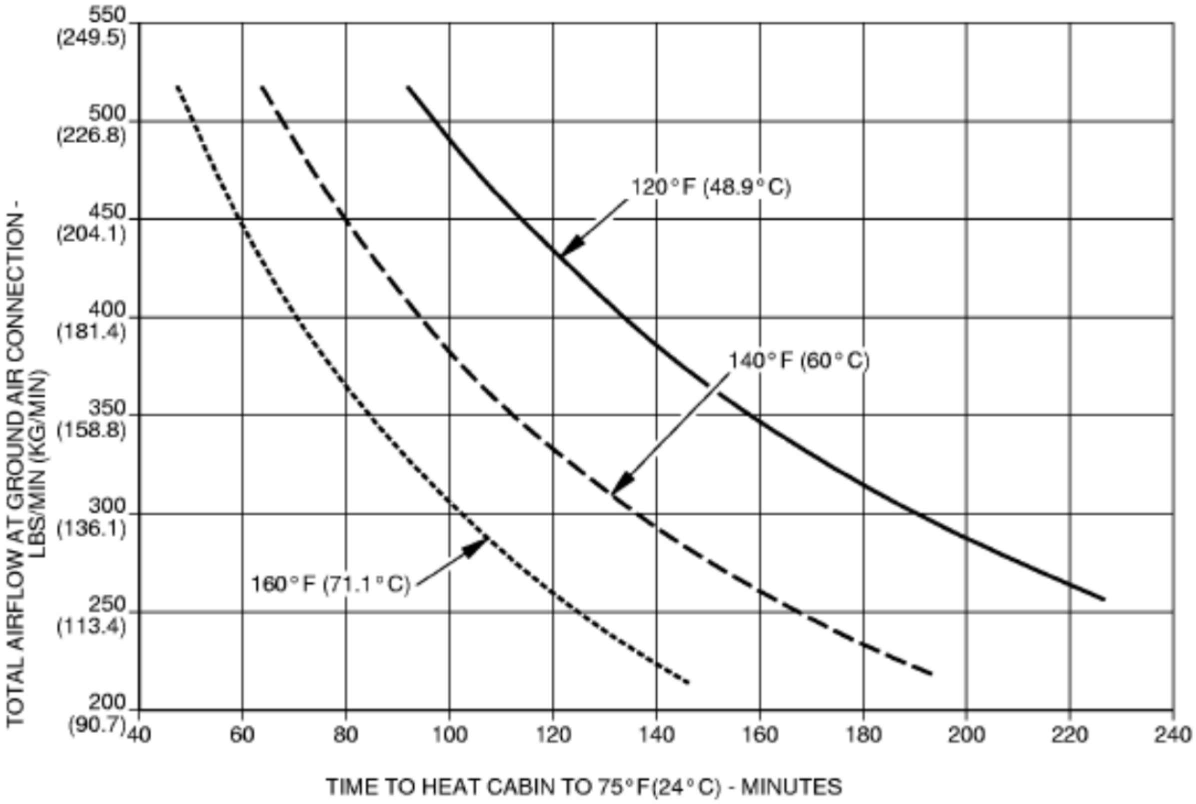
402 SEATS (solid line)
330 SEATS (dashed line)

NOTE:

THIS GRAPH PROVIDES THE FLOW RATE AND TEMPERATURE, AT THE AIRPLANE'S GROUND AIR CONNECTION, THAT IS REQUIRED TO MAINTAIN THE AIRPLANES CABIN AT A BULK AVERAGE OF 75°F (24°C) WHEN USING A PRE-CONDITIONED AIR (PCA) SOURCE.

5.6.8 CONDITIONED AIR FLOW REQUIREMENTS – COOLING – STEADY STATE (80 F AMBIENT AIR)

MODEL 787-9



CONDITIONS:

- ALL EXTERIOR DOORS AND WINDOWS ARE CLOSED
- OUTSIDE AIR TEMPERATURE IS -40°F (-40°C)
- INITIAL CABIN TEMPERATURE IS -25°F (-31.7°C)
- NO SOLAR HEAT LOAD
- LOWER RECIRCULATION FANS SELECTED OFF (UPPER FAN ON)
- ICS RECIRCULATION CHILLING OFF
- NO OCCUPANTS
- IFE OFF
- NO ELECTRICAL HEAT LOADS

LEGEND:

PCA TEMPERATURE AT GROUND CONNECTION

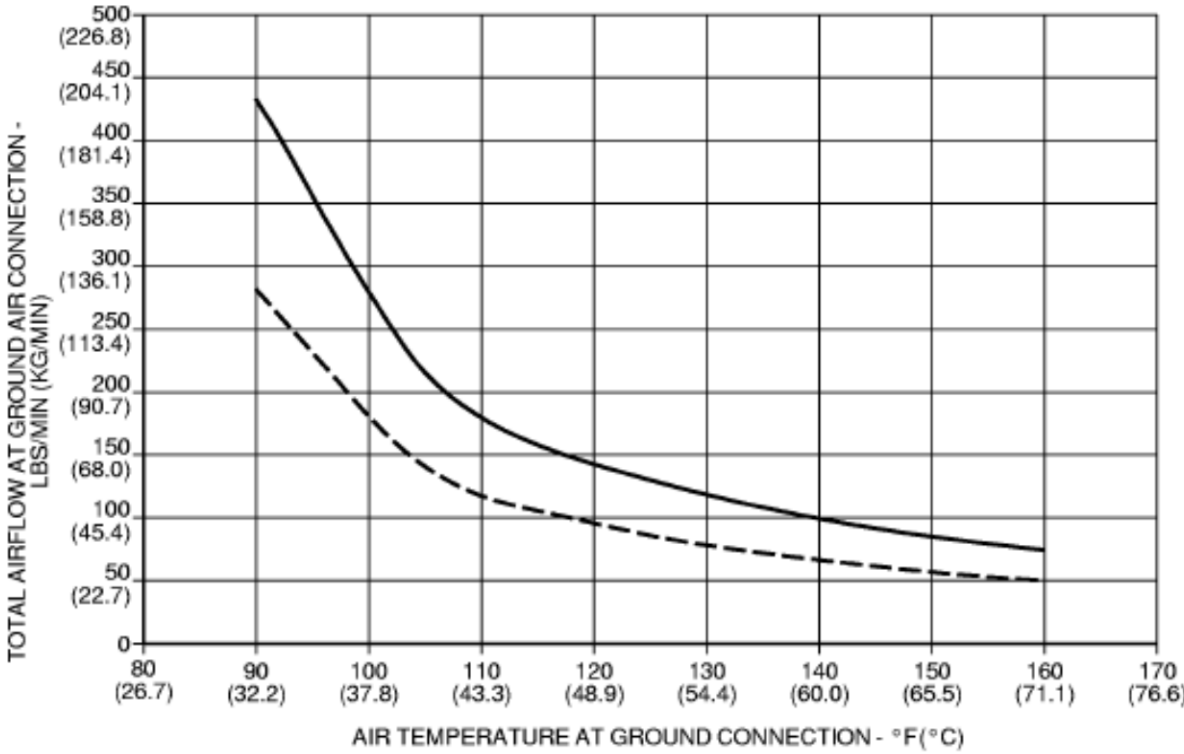
- ——— 120°F(48.9°C)
- – – – 140°F(60.0°C)
- -------- 160°F(71.1°C)

NOTE:

THIS GRAPH PROVIDES THE PREDICTED TIME REQUIRED TO HEAT THE AIRPLANE'S CABIN TO A BULK AVERAGE OF 75°F (24°C) AS A FUNCTION OF AIRFLOW AND TEMPERATURE, AT THE GROUND AIR CONNECTION, WHEN USING A PRE-CONDITIONED AIR (PCA) SOURCE.

5.6.9 CONDITIONED AIR FLOW REQUIREMENTS – HEATING TIME

MODEL 787-9



CONDITIONS:

- ALL EXTERIOR DOORS AND WINDOWS ARE CLOSED
- NO SOLAR HEAT LOAD
- LOWER RECIRCULATION FANS SELECTED OFF (UPPER FAN ON)
- ICS RECIRCULATION CHILLING OFF
- NO OCCUPANTS
- IFE OFF
- NO ELECTRICAL HEAT LOADS

LEGEND:

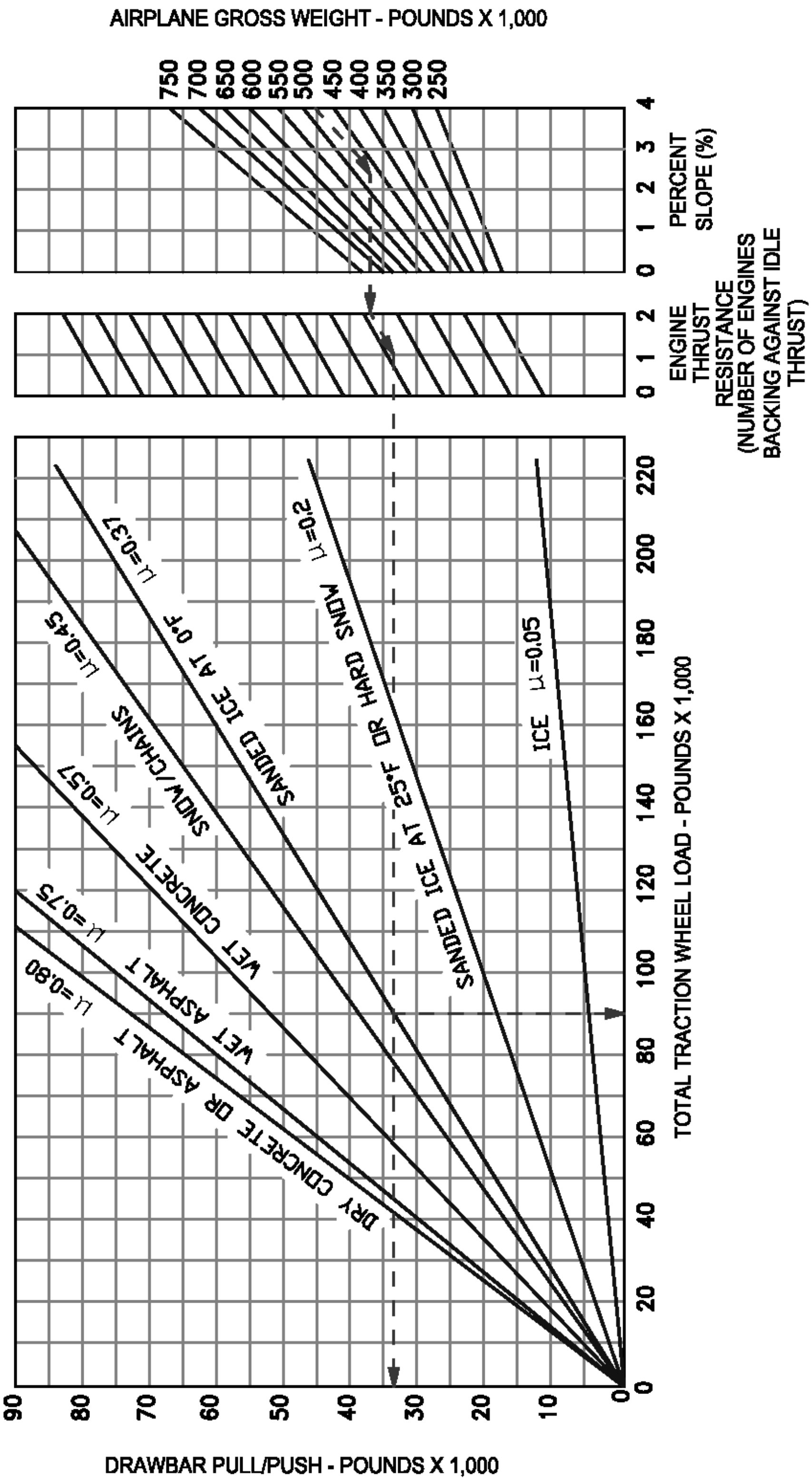
——— 40°F(-40°C) AMBIENT

– – – 0°F(-17.8°C) AMBIENT

NOTE:

THIS GRAPH PROVIDES THE FLOW RATE AND TEMPERATURE, AT THE GROUND AIR CONNECTION, THAT IS REQUIRED TO HEAT THE AIRPLANE'S CABIN TO A BULK AVERAGE OF 75°F (24°C) WHEN USING A PRE-CONDITIONED AIR (PCA) SOURCE.

5.6.10 CONDITIONED AIR FLOW REQUIREMENTS – HEATING – STEADY STATE
MODEL 787-9

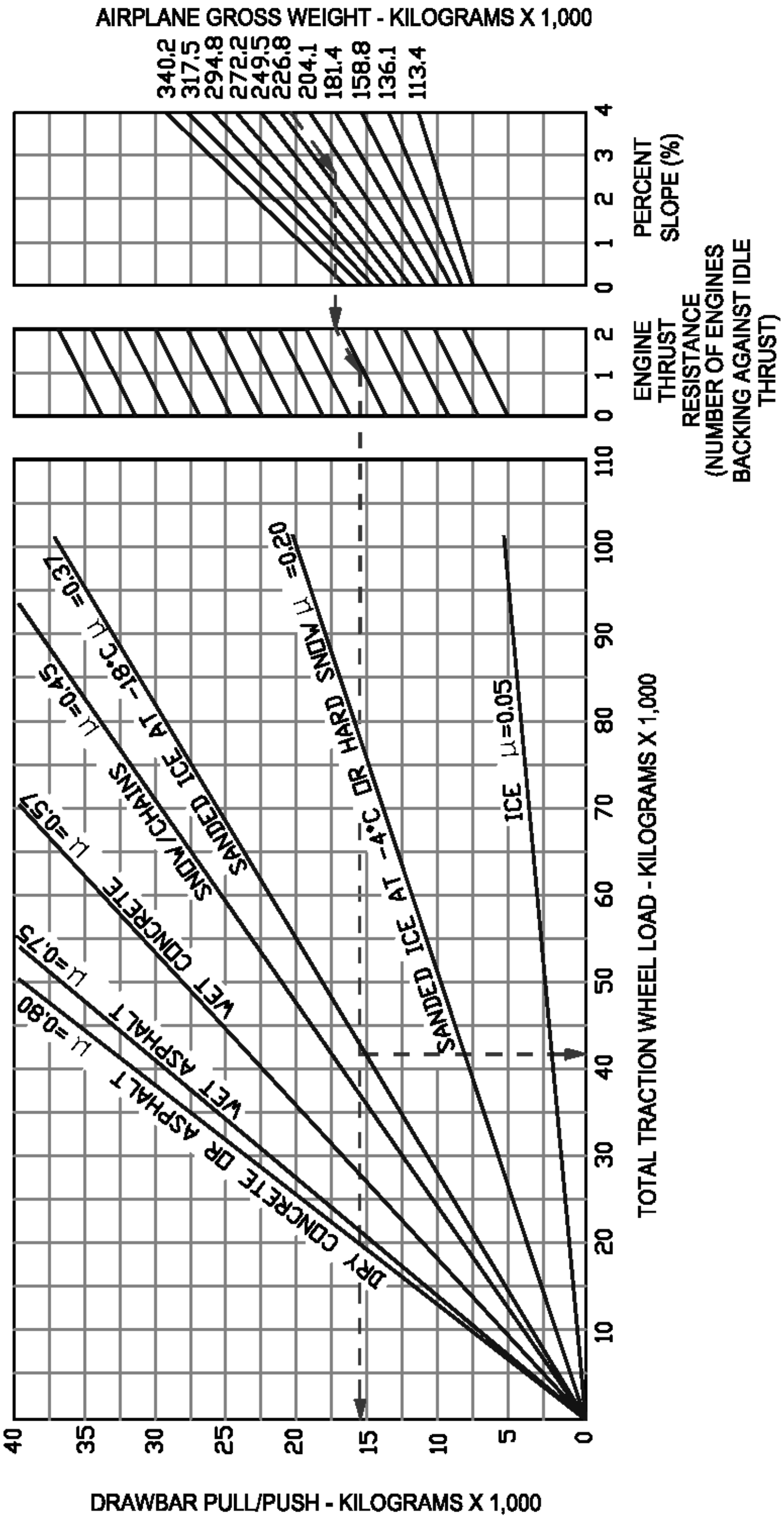


NOTE:

1. EXAMPLE-----SHOWS A 787 WEIGHING 486,000 POUNDS BEING PUSHED UP A 2.5% SLOPE ON SANDED ICE AT 0°F BACKING AGAINST ONE ENGINE AT IDLE THRUST 33,460 POUNDS OF DRAW BAR PUSH AND A WHEEL TRACTION LOAD OF 90,000 POUNDS ARE REQUIRED FOR TOWING
2. UNUSUAL BREAKAWAY CONDITIONS NOT SHOWN
3. STRAIGHT-LINE TOW
4. COEFFICIENTS OF FRICTION (μ) ARE ESTIMATED FOR RUBBER-TIRED TOW VEHICLES

5.7.1 GROUND TOWING REQUIREMENTS - ENGLISH UNITS

MODEL 787-8, 787-9



NOTE:

1. EXAMPLE-----SHOWS A 787 WEIGHING 220,445 KILOGRAMS BEING PUSHED UP A 2.5% SLOPE ON SANDED ICE AT -18°C BACKING AGAINST ONE ENGINE AT IDLE THRUST 17,411 KILOGRAMS OF DRAW BAR PUSH AND A WHEEL TRACTION LOAD OF 43,057 KILOGRAMS ARE REQUIRED FOR TOWING
2. UNUSUAL BREAKAWAY CONDITIONS NOT SHOWN
3. STRAIGHT-LINE TOW
4. COEFFICIENTS OF FRICTION (μ) ARE ESTIMATED FOR RUBBER-TIRED TOW VEHICLES

5.7.2 GROUND TOWING REQUIREMENTS - METRIC UNITS

MODEL 787-8, 787-9

6.0 JET ENGINE WAKE AND NOISE DATA

6.1 Jet Engine Exhaust Velocities and Temperatures

6.2 Airport and Community Noise

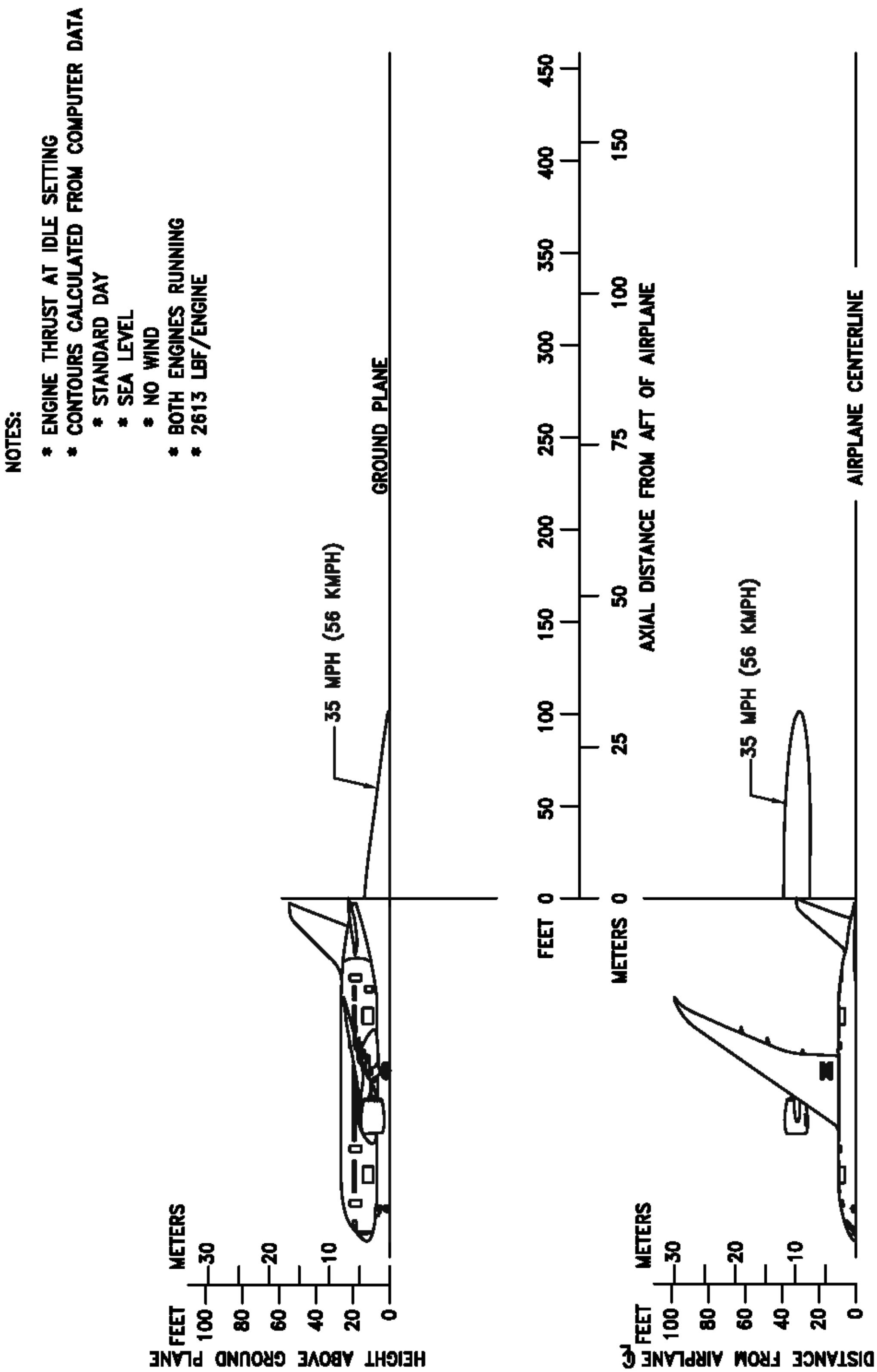
6.0 JET ENGINE WAKE AND NOISE DATA

6.1 Jet Engine Exhaust Velocities and Temperatures

This section shows exhaust velocity and temperature contours aft of the 787 airplane. The contours were calculated from a standard computer analysis using three-dimensional viscous flow equations with mixing of primary, fan, and free-stream flow. The presence of the ground plane is included in the calculations as well as engine tilt and toe-in. Mixing of flows from the engines is also calculated. The analysis does not include thermal buoyancy effects which tend to elevate the jet wake above the ground plane. The buoyancy effects are considered to be small relative to the exhaust velocity and therefore are not included.

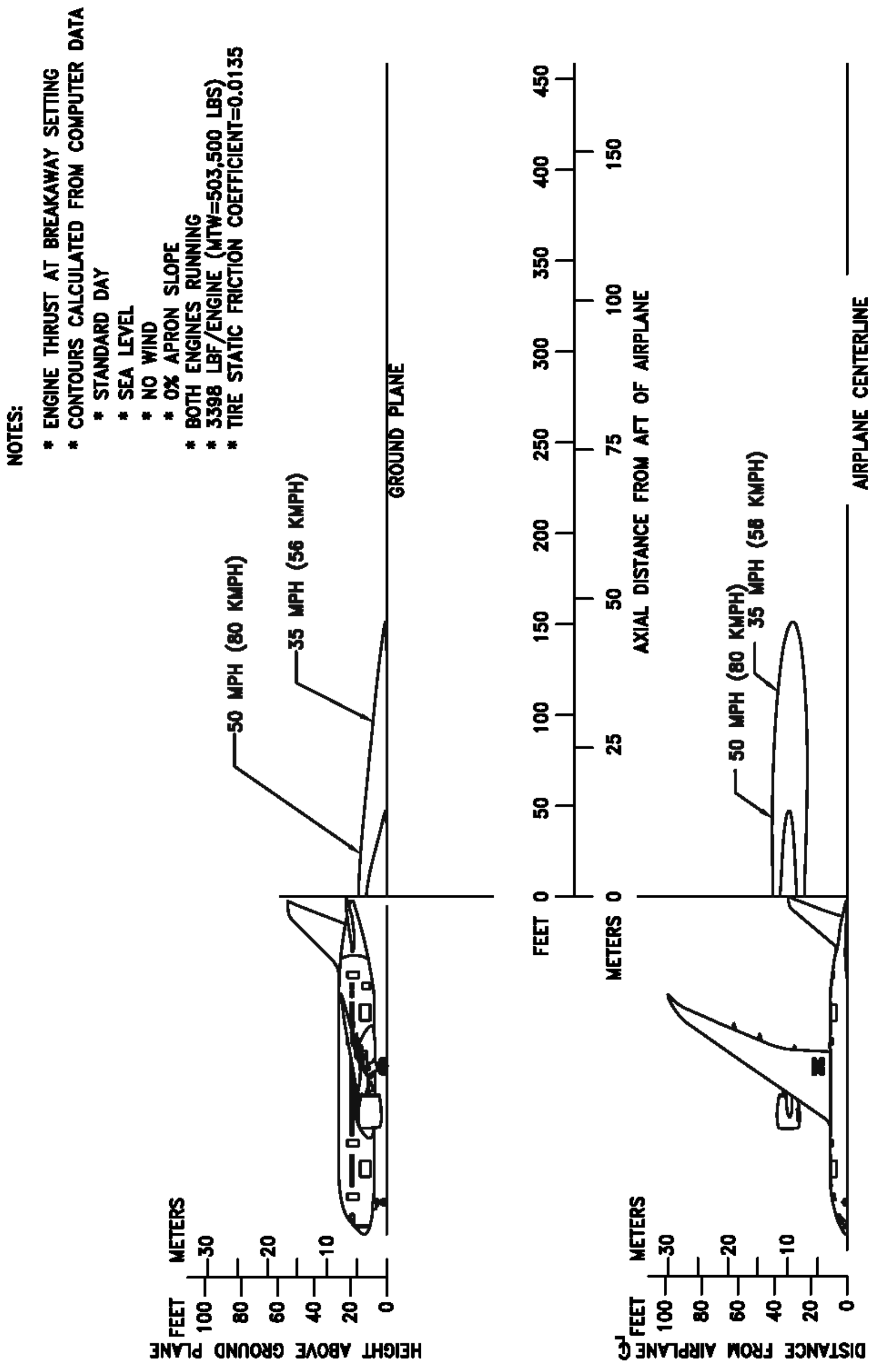
The graphs show jet wake velocity and temperature contours for representative engines. The results are valid for sea level, static, standard day conditions. The effect of wind on jet wakes is not included. There is evidence to show that a downwind or an upwind component does not simply add or subtract from the jet wake velocity, but rather carries the whole envelope in the direction of the wind. Crosswinds may carry the jet wake contour far to the side at large distances behind the airplane.

It should be understood, these exhaust velocity contours reflect steady-state, at maximum taxi weight, and not transient-state exhaust velocities. A steady-state is achieved with the aircraft in a fixed location, engine running at a given thrust level and measured when the contours stop expanding and stabilize in size, which could take several seconds. The steady-state condition, therefore, is conservative. Contours shown also do not account for performance variables such as ambient temperature or field elevation. For the terminal area environment, the transient-state is a more accurate representation of the actual exhaust contours when the aircraft is in motion and encountering static air with forward or turning movement, but it is very difficult to model on a consistent basis due to aircraft weight, weather conditions, the high degree of variability in terminal and apron configurations, and intensive numerical calculations. If the contours presented here are overly restrictive for terminal operations, The Boeing Company recommends conducting an analysis of the actual exhaust contours experienced by the using aircraft at the airport.

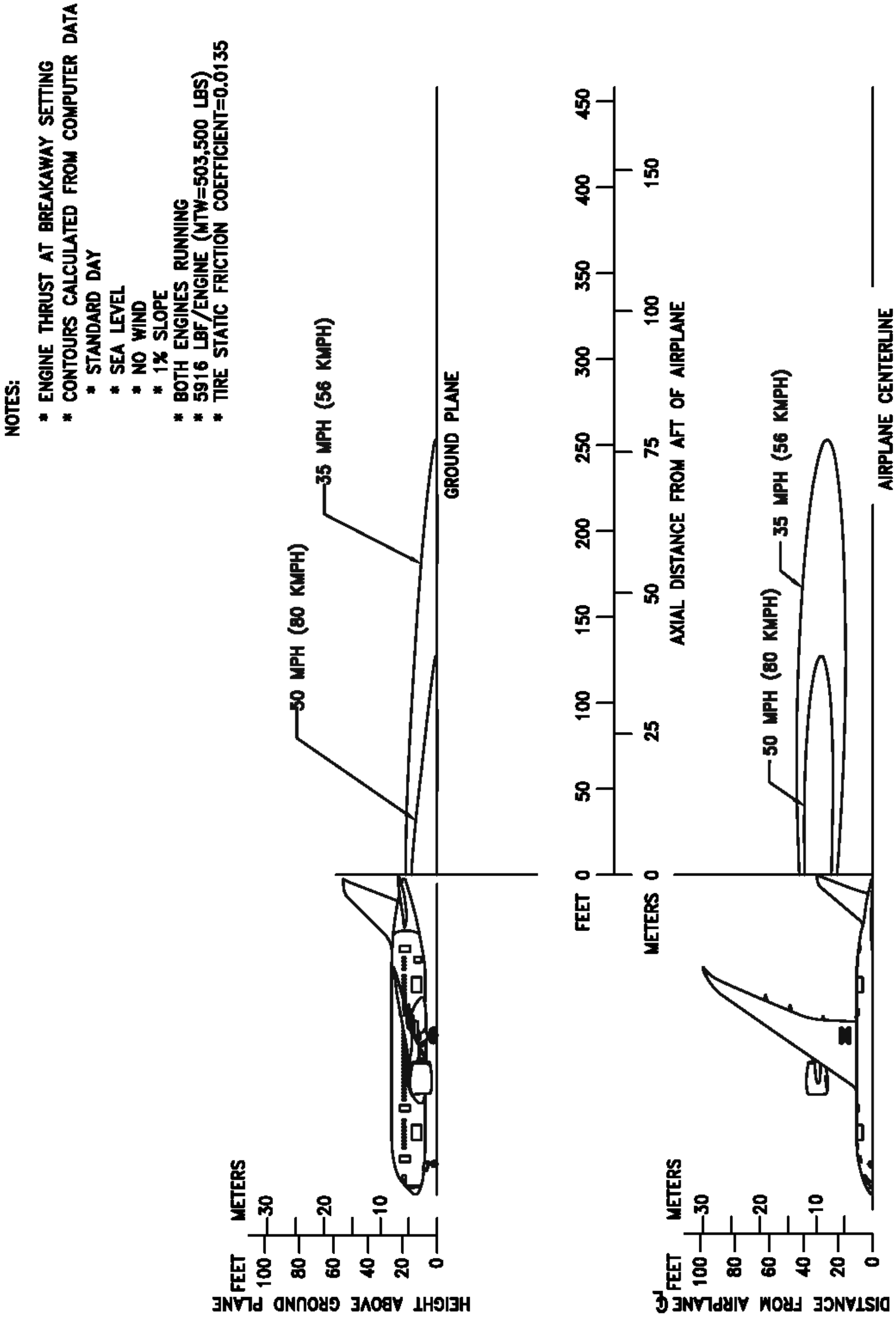


6.1.1 JET ENGINE EXHAUST VELOCITY CONTOURS - IDLE THRUST

MODEL 787-8

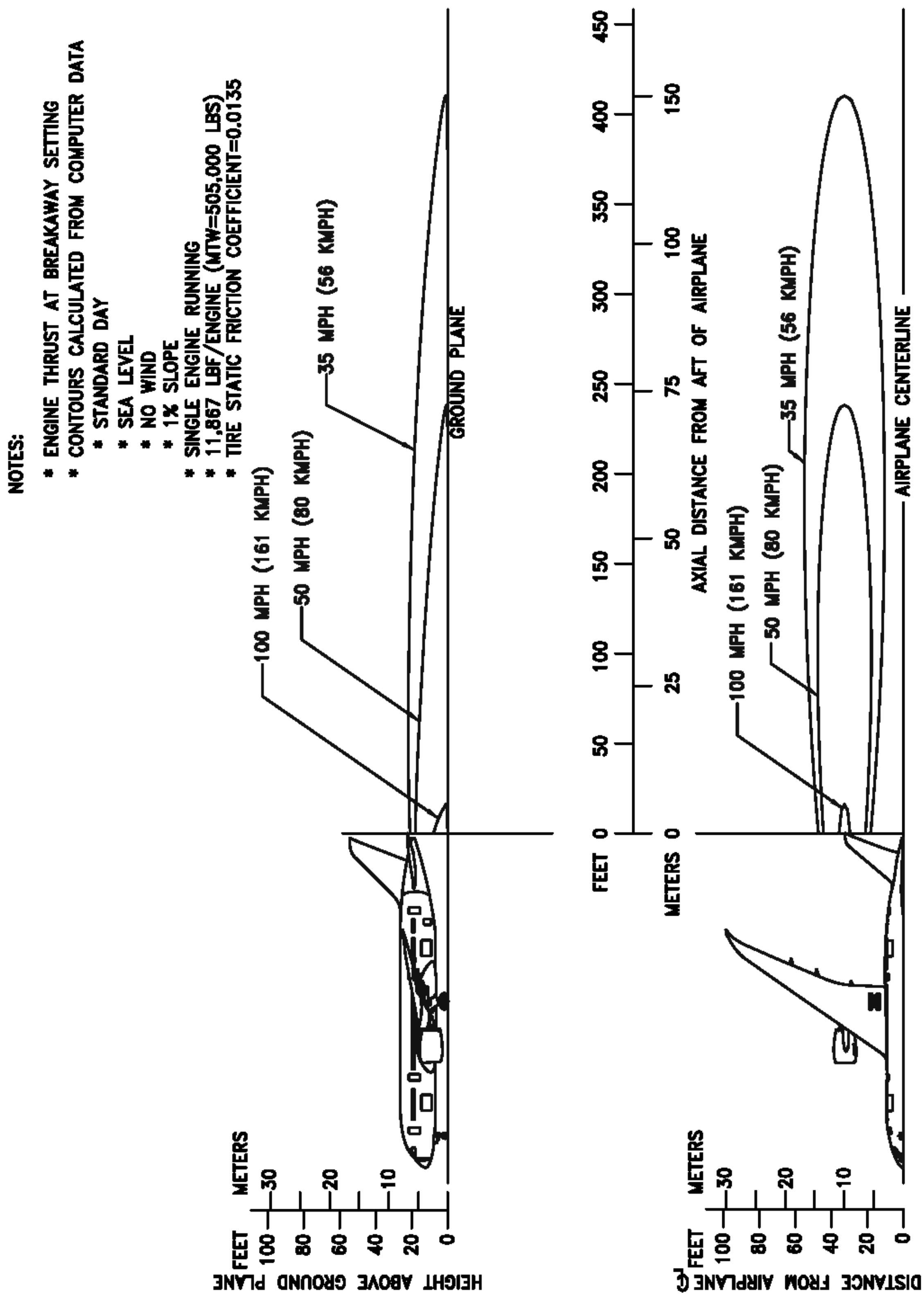


6.1.2 JET ENGINE EXHAUST VELOCITY CONTOURS - BREAKAWAY THRUST / 0% SLOPE
MODEL 787-8



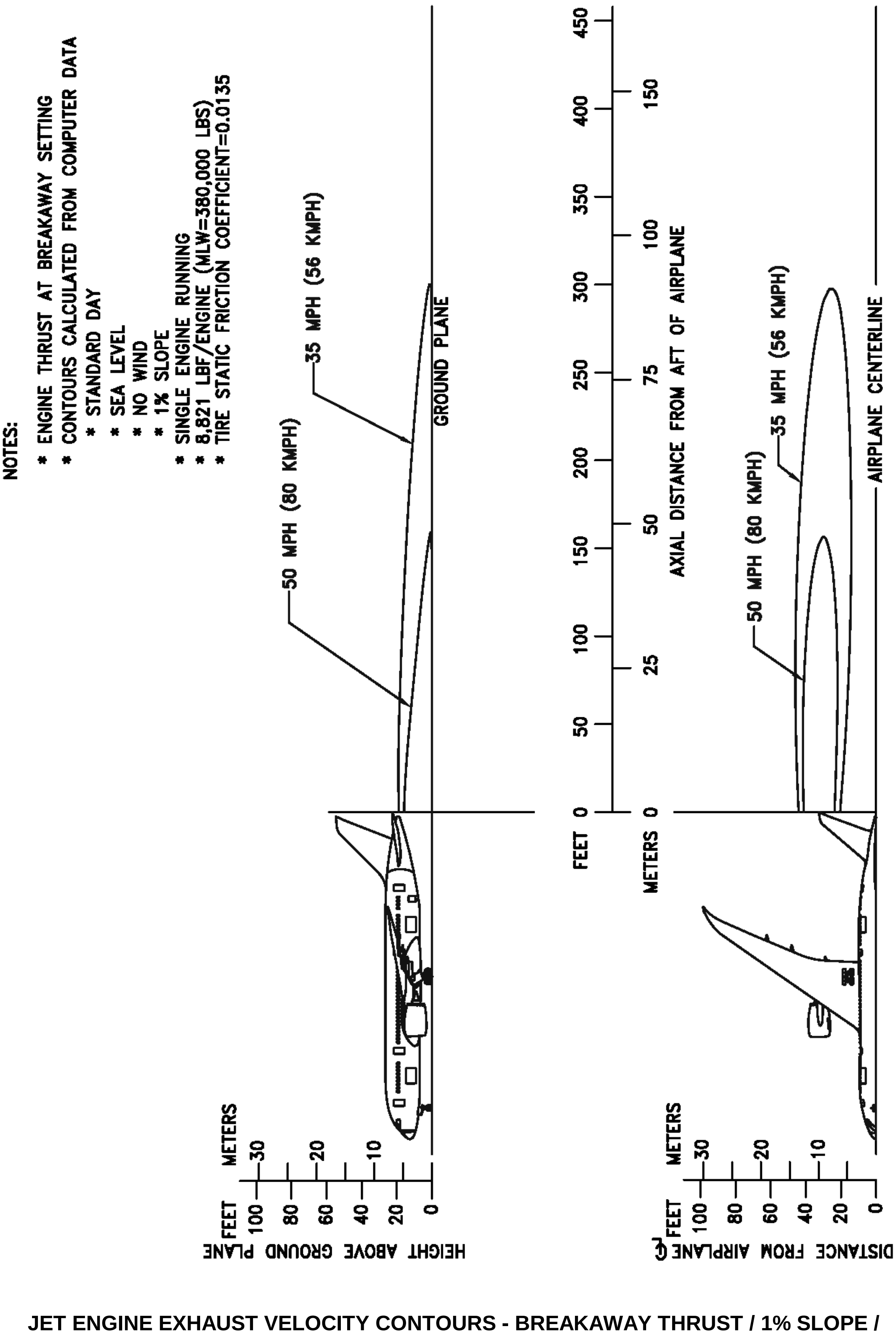
6.1.3 JET ENGINE EXHAUST VELOCITY CONTOURS - BREAKAWAY THRUST / 1% SLOPE / BOTH ENGINES / MTW

MODEL 787-8



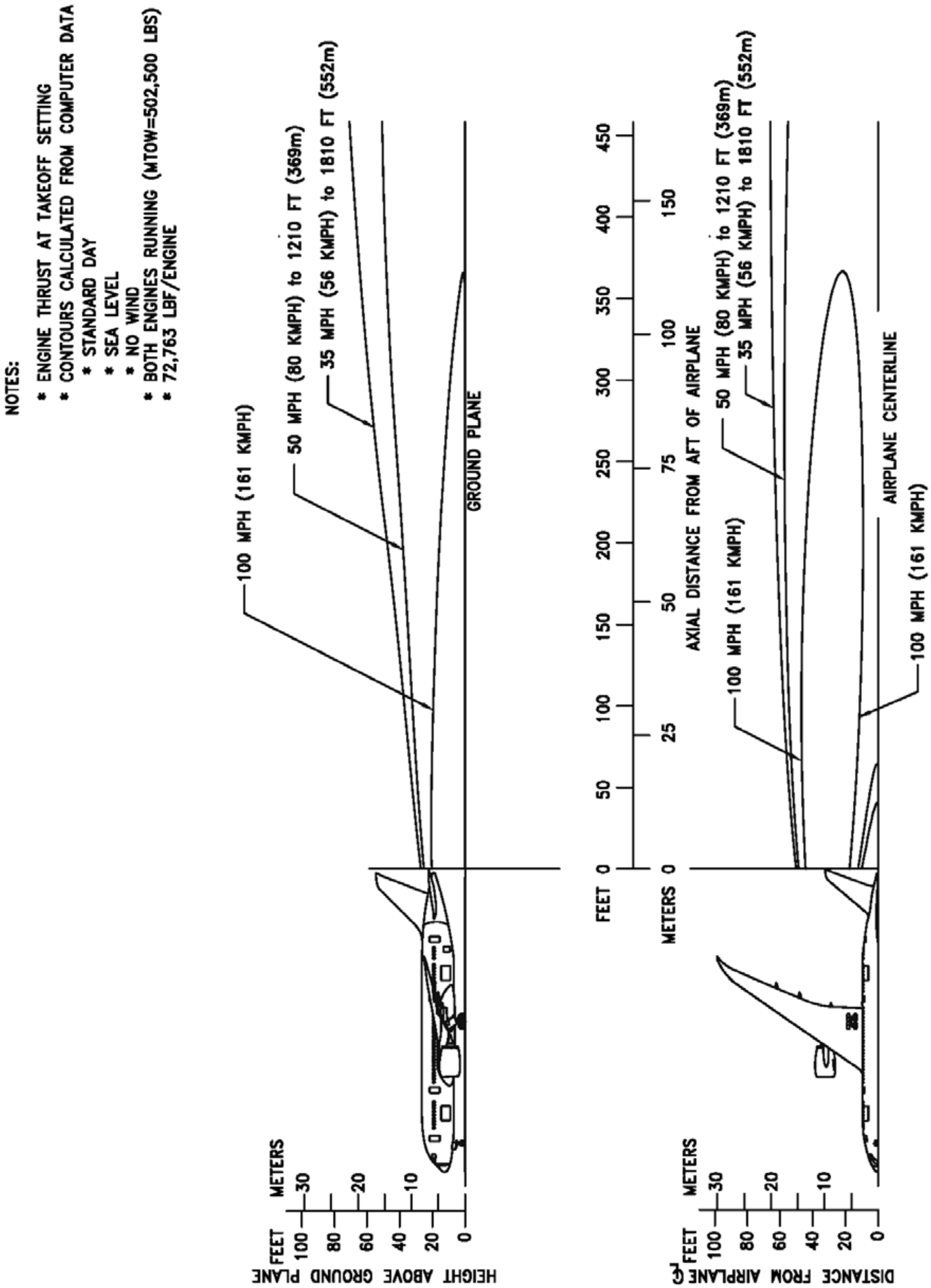
6.1.4 JET ENGINE EXHAUST VELOCITY CONTOURS - BREAKAWAY THRUST / 1% SLOPE / SINGLE ENGINE / MTW

MODEL 787–8



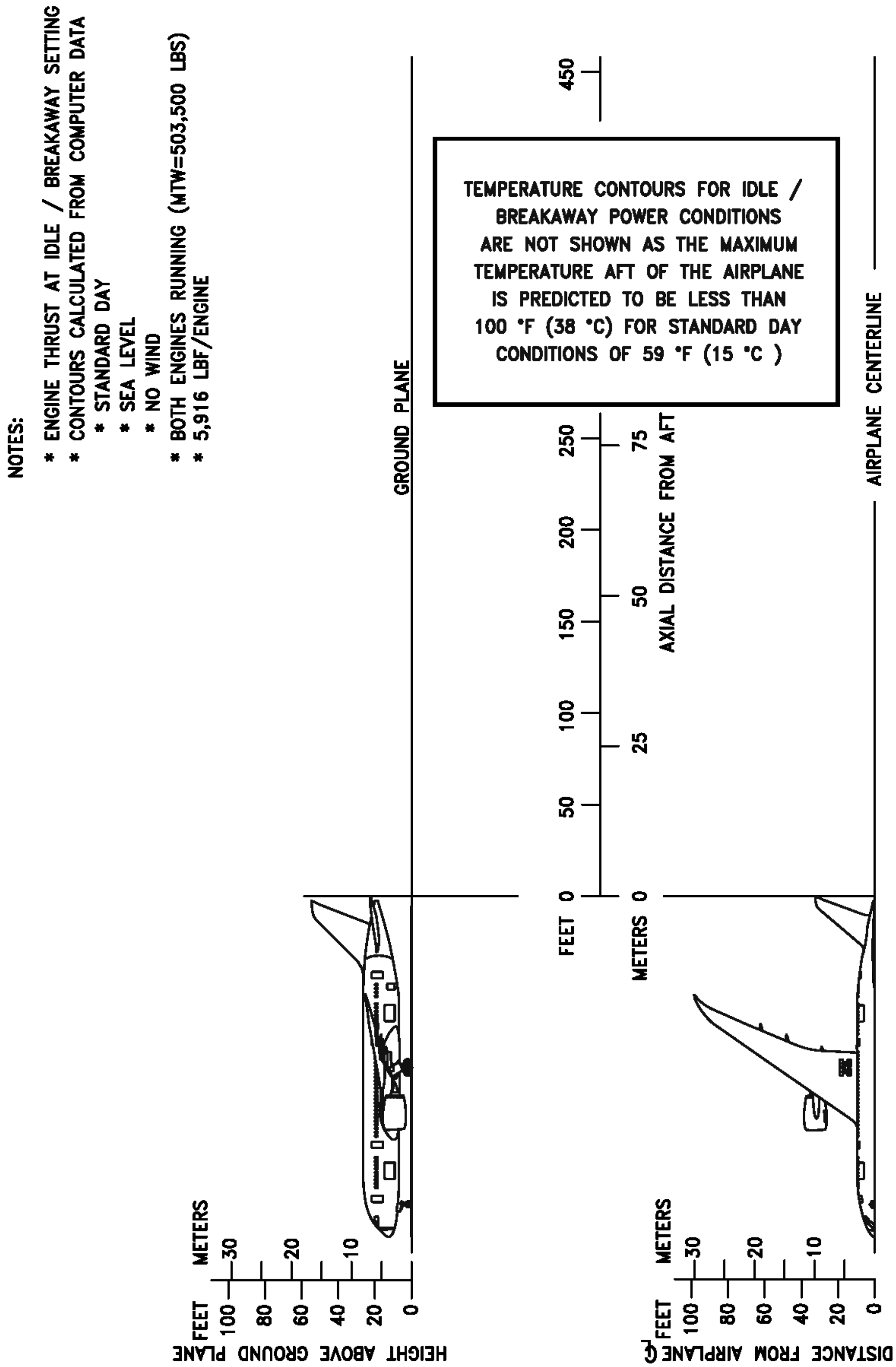
6.1.5 JET ENGINE EXHAUST VELOCITY CONTOURS - BREAKAWAY THRUST / 1% SLOPE / SINGLE ENGINE / MLW

MODEL 787-8



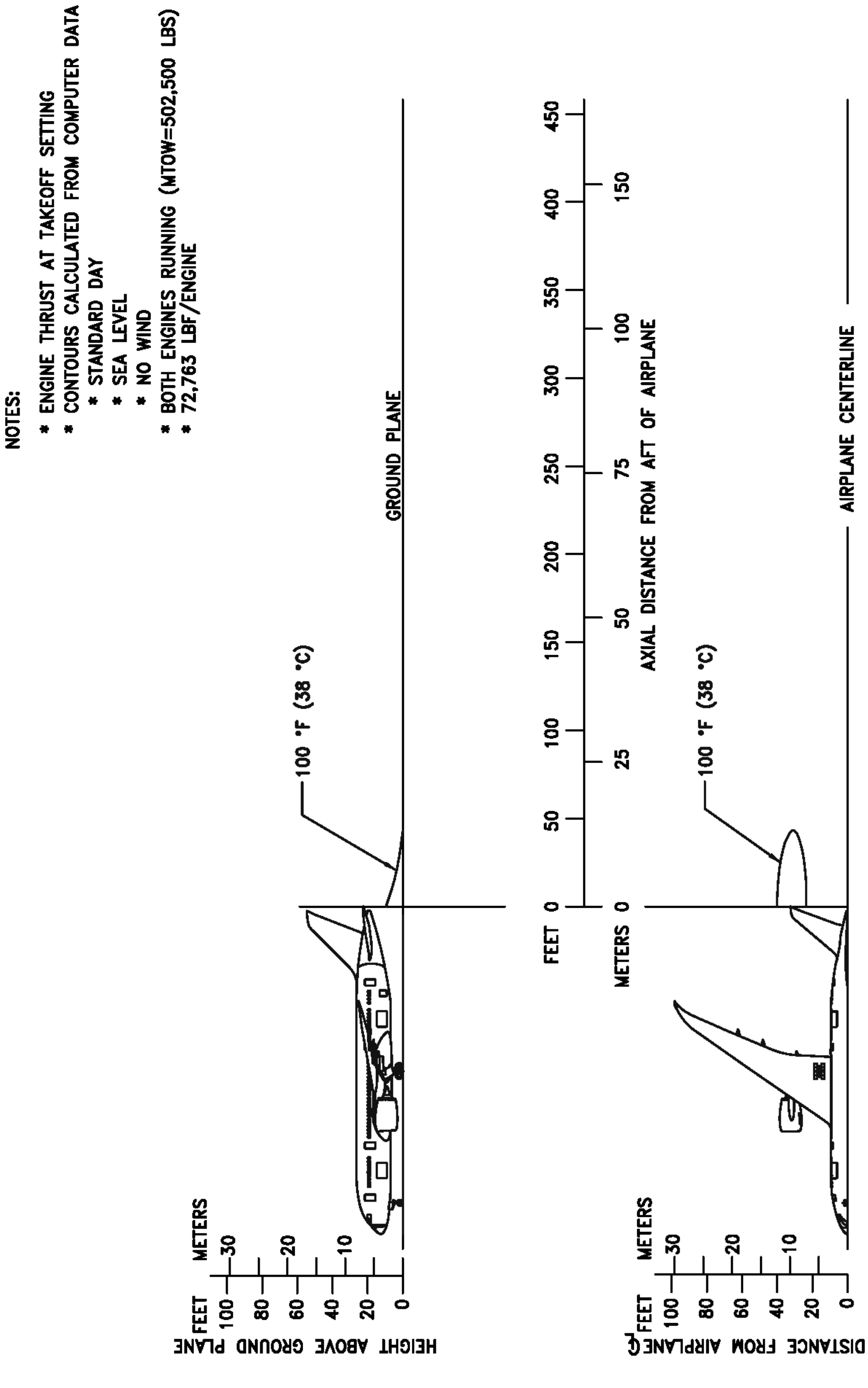
6.1.6 JET ENGINE EXHAUST VELOCITY CONTOURS - TAKEOFF THRUST

MODEL 787-8



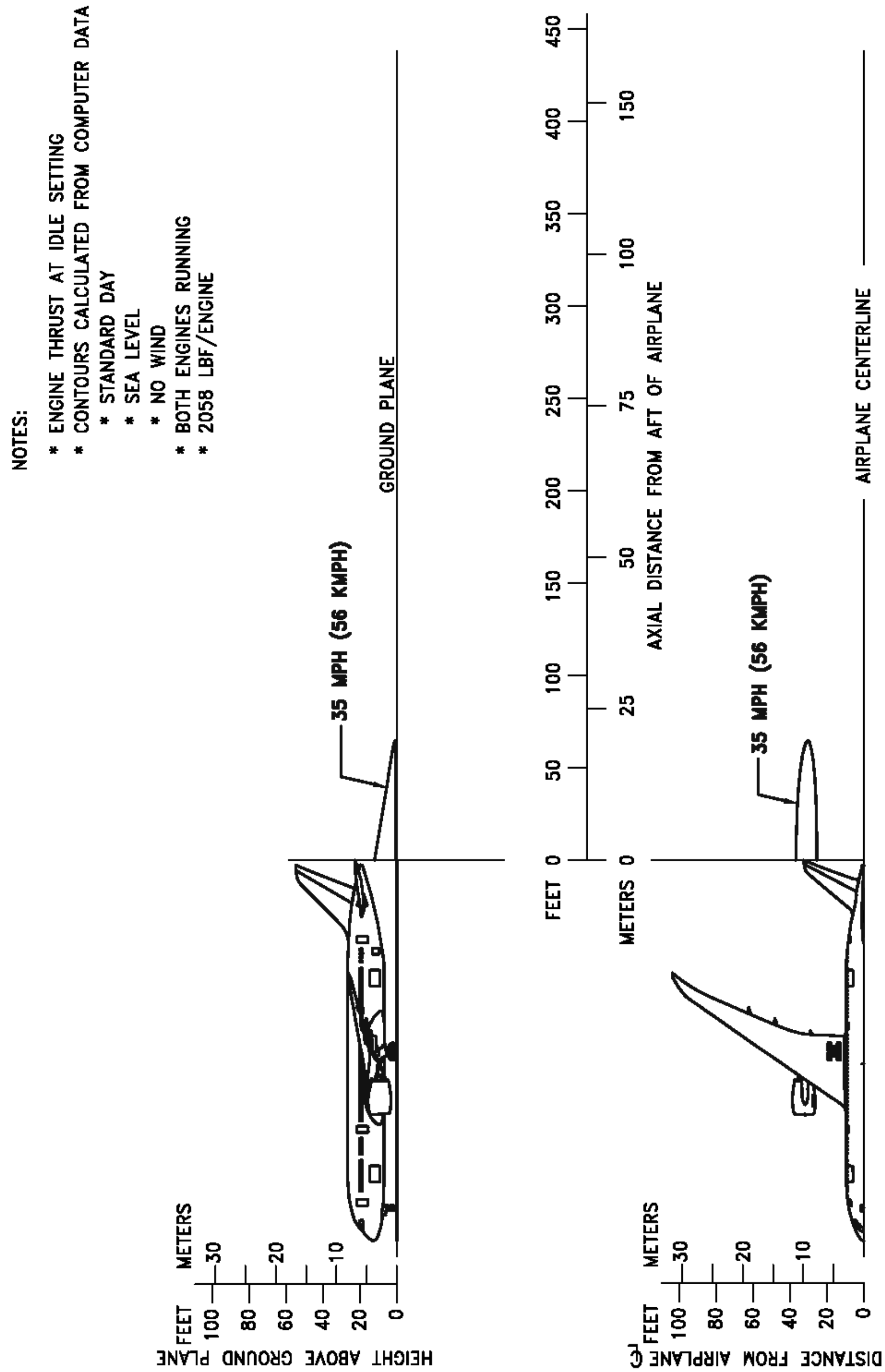
6.1.7 JET ENGINE EXHAUST TEMPERATURE CONTOURS – IDLE/BREAKAWAY THRUST

MODEL 787-8



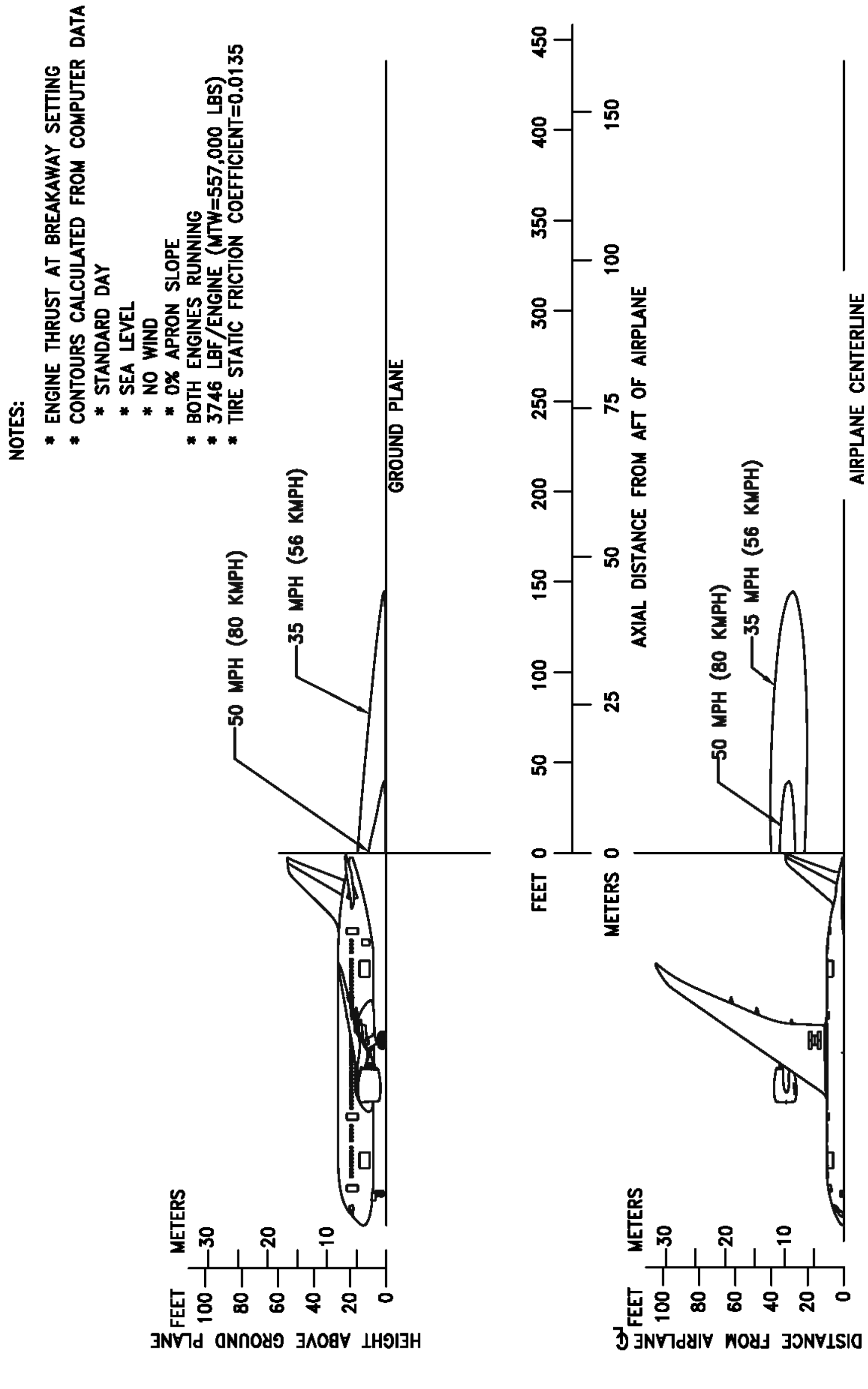
6.1.8 JET ENGINE EXHAUST TEMPERATURE CONTOURS – TAKEOFF THRUST

MODEL 787-8



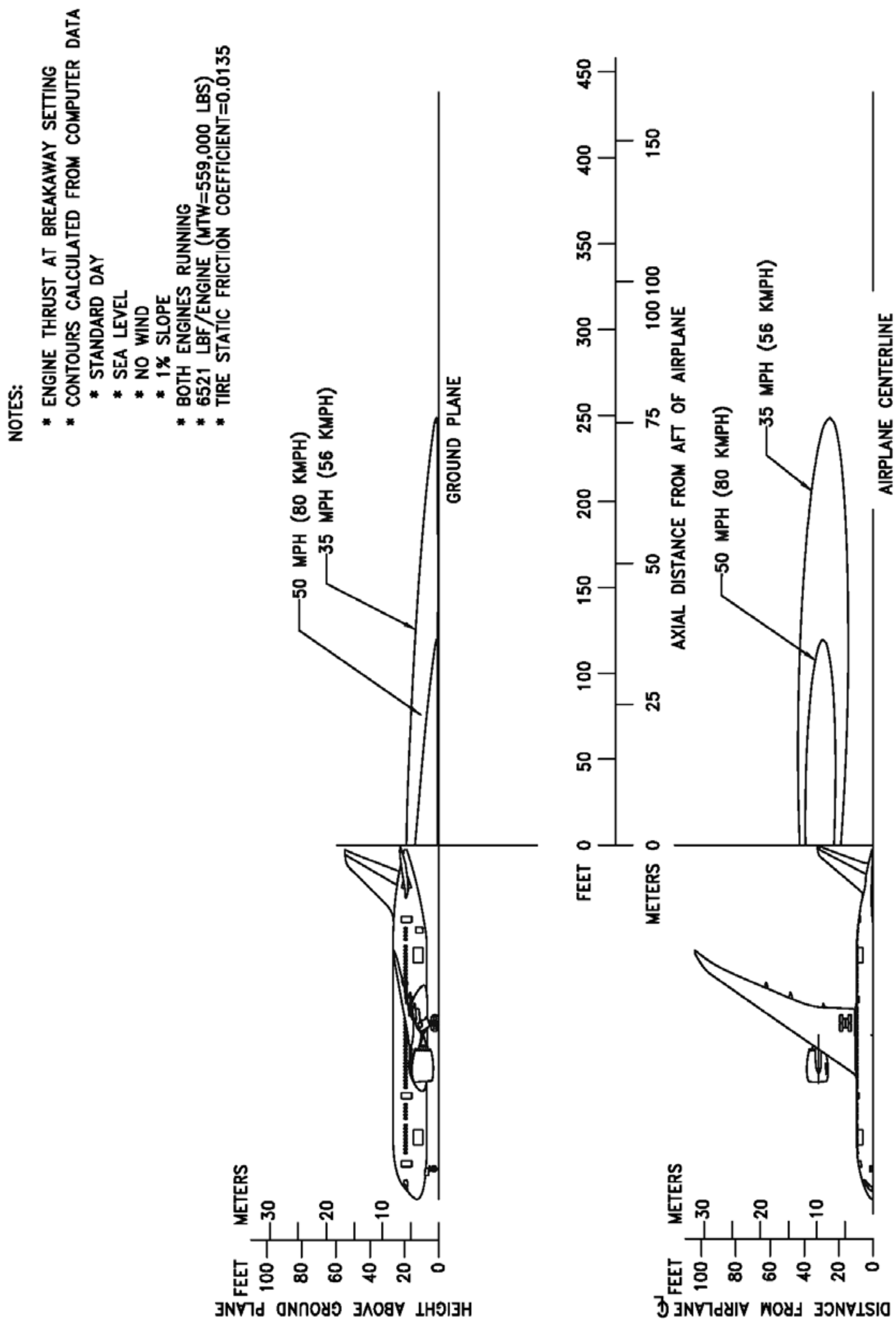
6.1.9 JET ENGINE EXHAUST VELOCITY CONTOURS - IDLE THRUST

MODEL 787-9



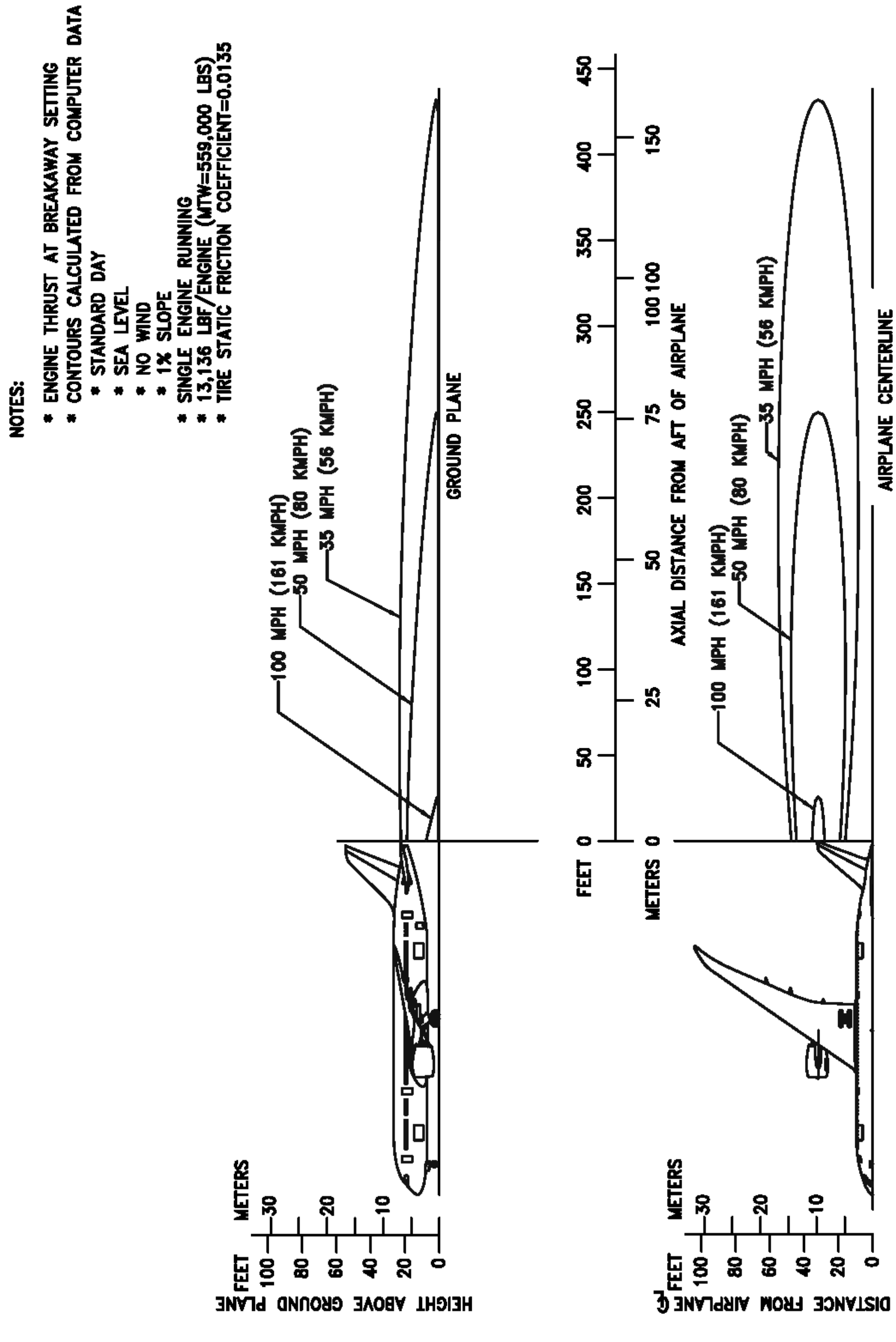
6.1.10 JET ENGINE EXHAUST VELOCITY CONTOURS - BREAKAWAY THRUST / 0% SLOPE

MODEL 787-9



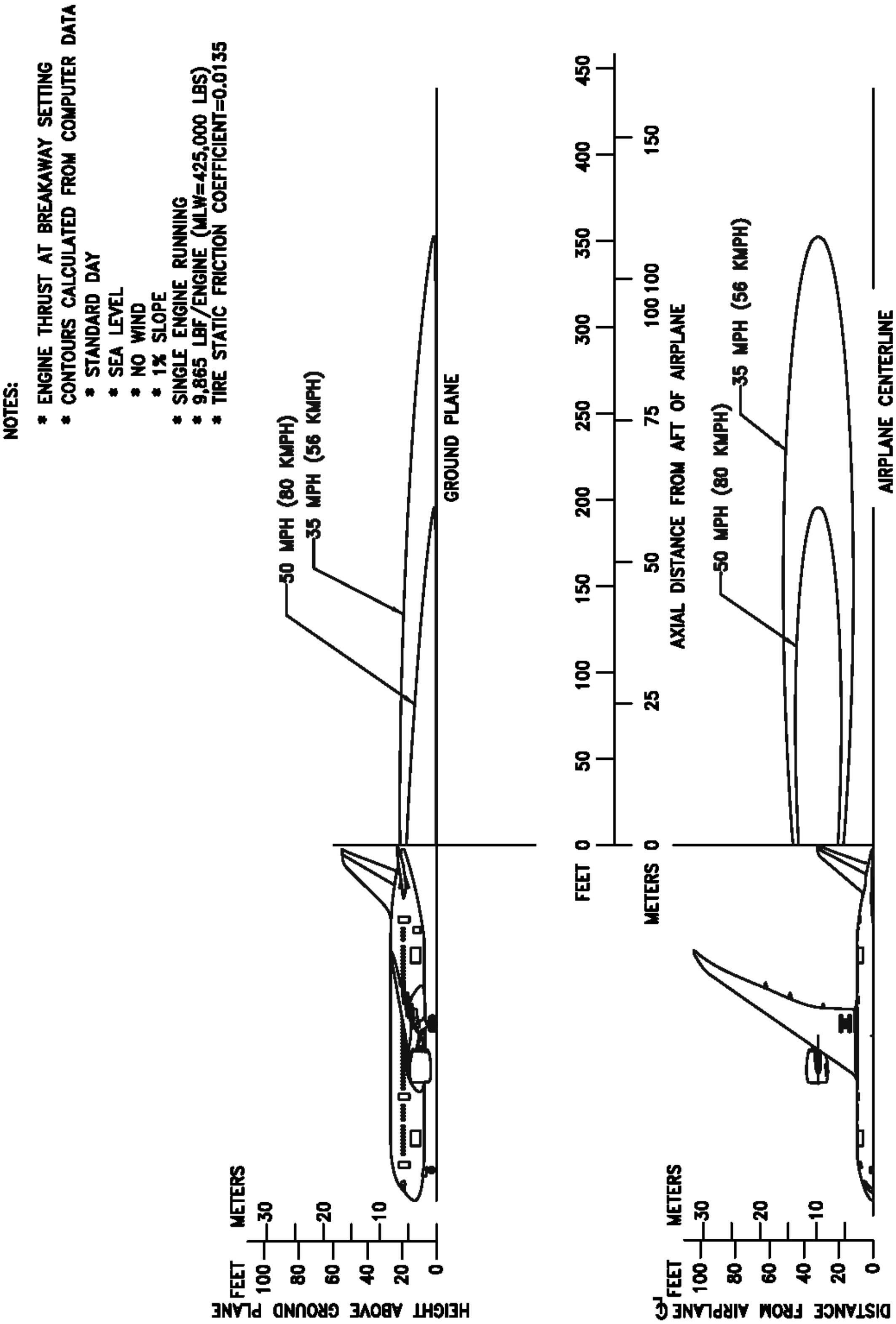
6.1.11 JET ENGINE EXHAUST VELOCITY CONTOURS - BREAKAWAY THRUST / 1% SLOPE / BOTH ENGINES / MTW

MODEL 787-9



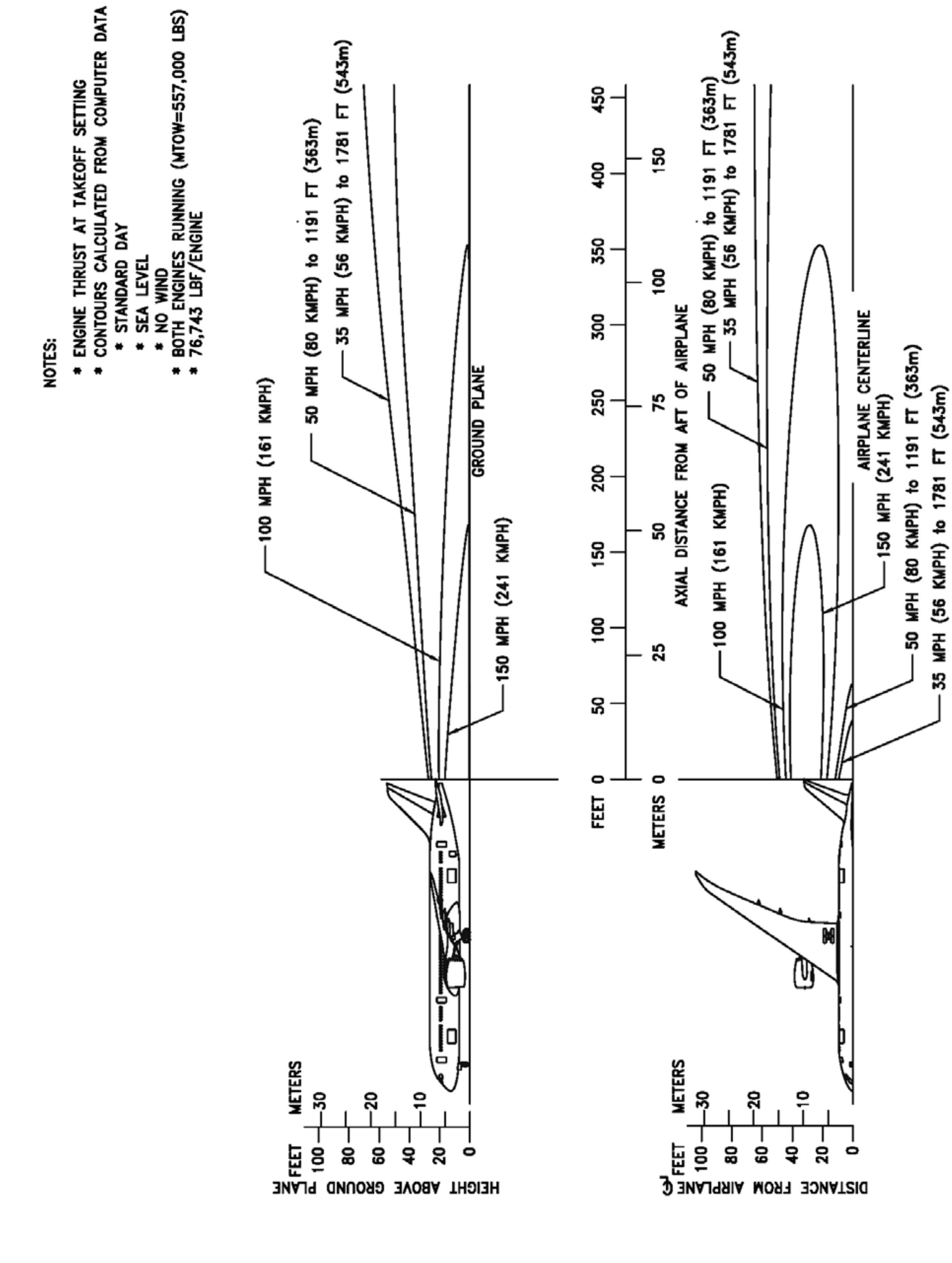
6.1.12 JET ENGINE EXHAUST VELOCITY CONTOURS - BREAKAWAY THRUST / 1% SLOPE / SINGLE ENGINE / MTW

MODEL 787--9



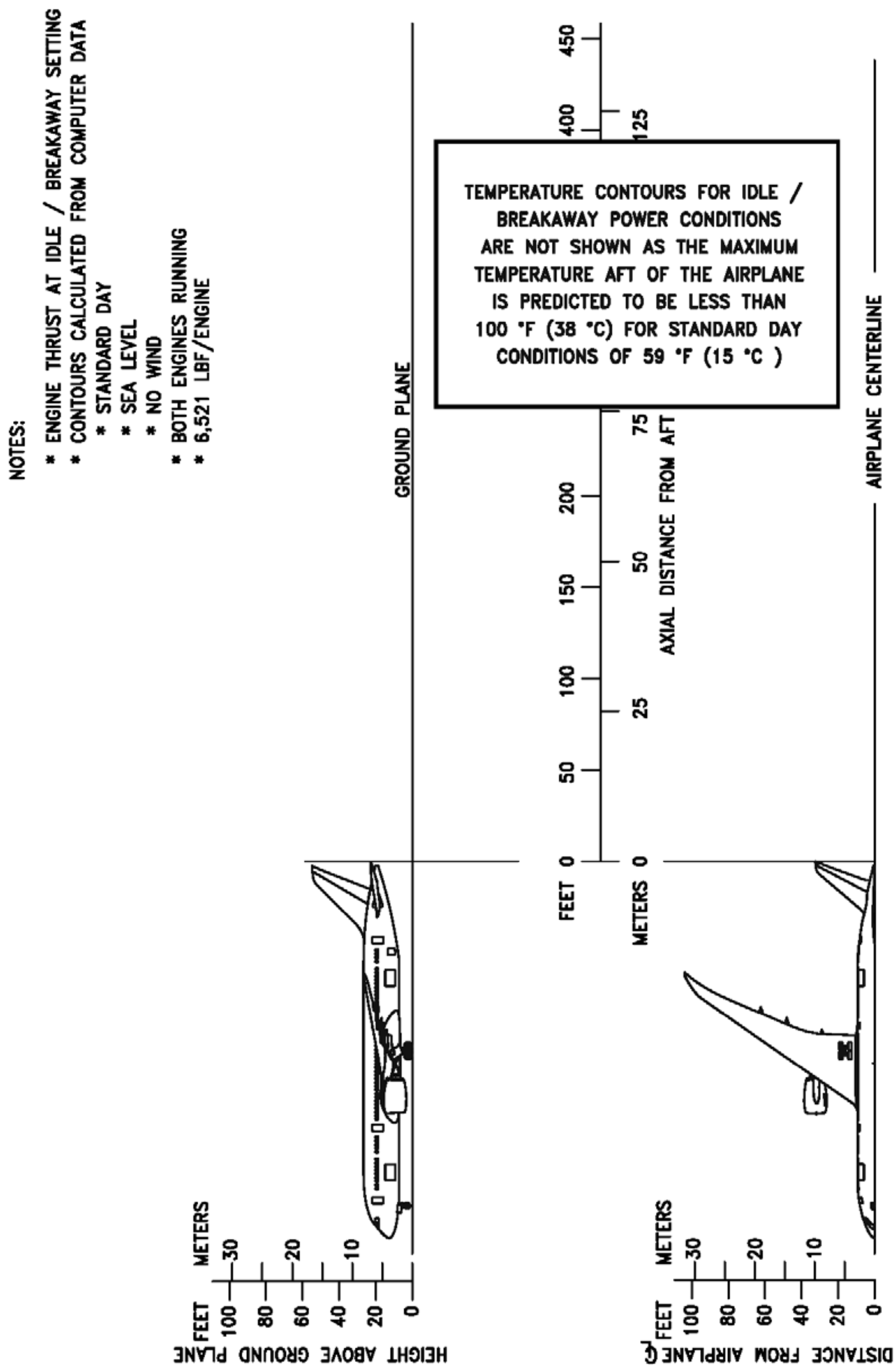
6.1.13 JET ENGINE EXHAUST VELOCITY CONTOURS - BREAKAWAY THRUST / 1% SLOPE / SINGLE ENGINE / MLW

MODEL 787-9



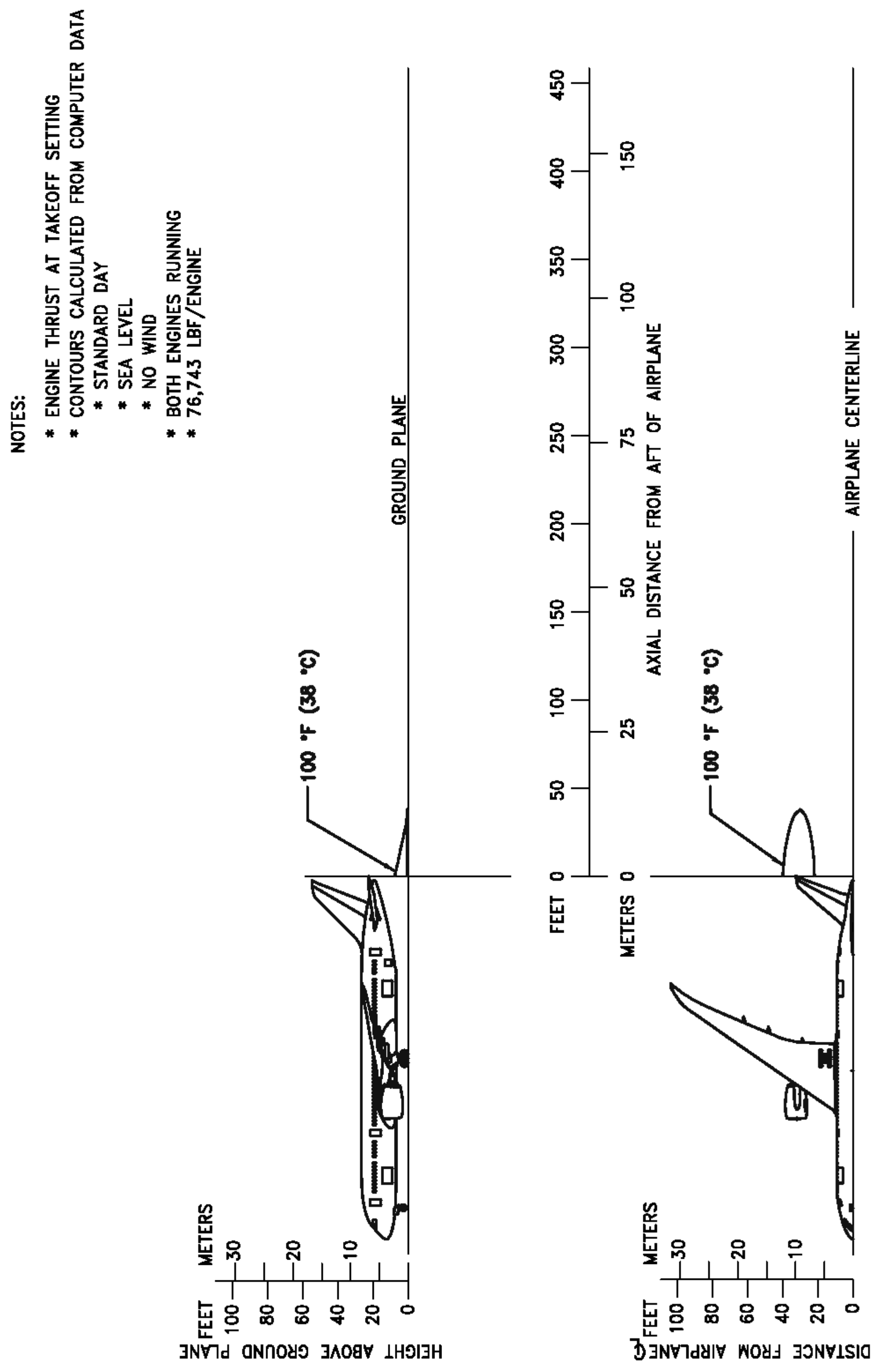
6.1.14 JET ENGINE EXHAUST VELOCITY CONTOURS - TAKEOFF THRUST

MODEL 787-9



6.1.15 JET ENGINE EXHAUST TEMPERATURE CONTOURS – IDLE/BREAKAWAY THRUST

MODEL 787-9



6.1.16 JET ENGINE EXHAUST TEMPERATURE CONTOURS – TAKEOFF THRUST

MODEL 787-9

6.2 Airport and Community Noise

Airport noise is of major concern to the airport and community planner. The airport is a major element in the community's transportation system and, as such, is vital to its growth. However, the airport must also be a good neighbor, and this can be accomplished only with proper planning. Since aircraft noise extends beyond the boundaries of the airport, it is vital to consider the impact on surrounding communities. Many means have been devised to provide the planner with a tool to estimate the impact of airport operations. Too often they oversimplify noise to the point where the results become erroneous. Noise is not a simple subject; therefore, there are no simple answers.

The cumulative noise contour is an effective tool. However, care must be exercised to ensure that the contours, used correctly, estimate the noise resulting from aircraft operations conducted at an airport.

The size and shape of the single-event contours, which are inputs into the cumulative noise contours, are dependent upon numerous factors. They include the following:

1. Operational Factors

    (a) Aircraft Weight - Aircraft weight is dependent on distance to be traveled, en route winds, payload, and anticipated aircraft delay upon reaching the destination.

    (b) Engine Power Settings - The rates of ascent and descent and the noise levels emitted at the source are influenced by the power setting used.

    (c) Airport Altitude - Higher airport altitude will affect engine performance and thus can influence noise.

2. Atmospheric Conditions-Sound Propagation

    (a) Wind - With stronger headwinds, the aircraft can take off and climb more rapidly relative to the ground. Also, winds can influence the distribution of noise in surrounding communities.

    (b) Temperature and Relative Humidity - The absorption of noise in the atmosphere along the transmission path between the aircraft and the ground observer varies with both temperature and relative humidity.

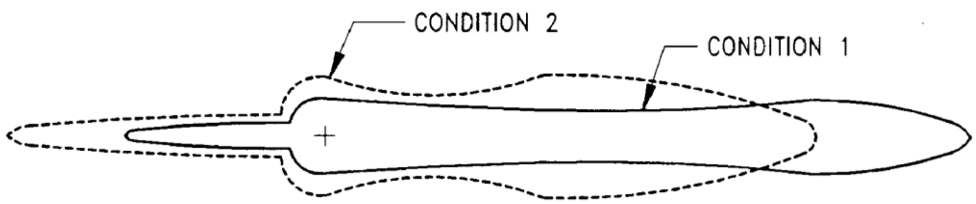
3. Surface Condition-Shielding, Extra Ground Attenuation (EGA)

(a) Terrain - If the ground slopes down after takeoff or up before landing, noise will be reduced since the aircraft will be at a higher altitude above ground. Additionally, hills, shrubs, trees, and large buildings can act as sound buffers.

All these factors can alter the shape and size of the contours appreciably. To demonstrate the effect of some of these factors, estimated noise level contours for two different operating conditions are shown below. These contours reflect a given noise level upon a ground level plane at runway elevation.

Condition 1

Landing	Takeoff
Maximum Structural Landing Weight	Maximum Design Takeoff Weight
10-knot Headwind	Zero Wind
3^{o} Approach	84 ^{o}F
84 ^{o}F	Humidity 15%
Humidity 15%	



Condition 2

Landing:	Takeoff:
85% of Maximum Structural Landing Weight	80% of Maximum Design Takeoff Weight
10-knot Headwind	10-knot Headwind
3^{o} Approach	59 ^{o}F
59 ^{o}F	Humidity 70%
Humidity 70%	

As indicated from these data, the contour size varies substantially with operating and atmospheric conditions. Most aircraft operations are, of course, conducted at less than maximum design weights because average flight distances are much shorter than maximum aircraft range capability and average load factors are less than 100%. Therefore, in developing cumulative contours for planning purposes, it is recommended that the airlines serving a particular city be contacted to provide operational information.

In addition, there are no universally accepted methods for developing aircraft noise contours or for relating the acceptability of specific zones to specific land uses. It is therefore expected that noise contour data for particular aircraft and the impact assessment methodology will be changing. To ensure that the best currently available information of this type is used in any planning study, it is recommended that it be obtained directly from the Office of Environmental Quality in the Federal Aviation Administration in Washington, D.C.

It should be noted that the contours shown herein are only for illustrating the impact of operating and atmospheric conditions and do not represent the single-event contour of the family of aircraft described in this document. It is expected that the cumulative contours will be developed as required by planners using the data and methodology applicable to their specific study.

7.0 PAVEMENT DATA

7.0 PAVEMENT DATA

7.1 General Information

A brief description of the pavement charts that follow will help in their use for airport planning. Each airplane configuration is depicted with a minimum range of five loads imposed on the main landing gear to aid in interpolation between the discrete values shown. All curves for any single chart represent data based on rated loads and tire pressures considered normal and acceptable by current aircraft tire manufacturer's standards. Tire pressures, where specifically designated on tables and charts, are at values obtained under loaded conditions as certificated for commercial use.

Section 7.2 presents basic data on the landing gear footprint configuration, maximum design taxi loads, and tire sizes and pressures.

Maximum pavement loads for certain critical conditions at the tire-to-ground interface are shown in Section 7.3, with the tires having equal loads on the struts.

Pavement requirements for commercial airplanes are customarily derived from the static analysis of loads imposed on the main landing gear struts. The chart in Section 7.4 is provided in order to determine these loads throughout the stability limits of the airplane at rest on the pavement. These main landing gear loads are used as the point of entry to the pavement design charts, interpolating load values where necessary.

The flexible pavement design curves (Section 7.5) are based on procedures set forth in Instruction Report No. S-77-1, "Procedures for Development of CBR Design Curves," dated June 1977, and as modified according to the methods described in ICAO Aerodrome Design Manual, Part 3, Pavements, 2^{nd} Edition, 1983, Section 1.1 (The ACN-PCN Method), and utilizing the alpha factors approved by ICAO in October 2007. Instruction Report No. S-77-1 was prepared by the U.S. Army Corps of Engineers Waterways Experiment Station, Soils and Pavements Laboratory, Vicksburg, Mississippi. The line showing 10,000 coverages is used to calculate Aircraft Classification Number (ACN).

The following procedure is used to develop the curves, such as shown in Section 7.5:

1. Having established the scale for pavement depth at the bottom and the scale for CBR at the top, an arbitrary line is drawn representing 6,000 annual departures.

2. Values of the aircraft gross weight are then plotted.

3. Additional annual departure lines are drawn based on the load lines of the aircraft gross weights already established.

4. An additional line representing 10,000 coverages (used to calculate the flexible pavement Aircraft Classification Number) is also placed.

All Load Classification Number (LCN) curves (Sections 7.6 and 7.8) have been developed from a computer program based on data provided in International Civil Aviation Organization (ICAO) document 9157-AN/901, Aerodrome Design Manual, Part 3, “Pavements”, Second Edition, 1983. LCN values are shown directly for parameters of weight on main landing gear, tire pressure, and radius of relative stiffness (ι) for rigid pavement or pavement thickness or depth factor (h) for flexible pavement.

Rigid pavement design curves (Section 7.7) have been prepared with the Westergaard equation in general accordance with the procedures outlined in the Design of Concrete Airport Pavement (1973 edition) by Robert G. Packard, published by the American Concrete Pavement Association, 5420 Old Orchard Road, Suite A-100, Skokie, Illinois 60077-1059. These curves are modified to the format described in the Portland Cement Association publication XP6705-2, Computer Program for Airport Pavement Design (Program PDILB), 1968, by Robert G. Packard.

The following procedure is used to develop the rigid pavement design curves shown in Section 7.7:

1. Having established the scale for pavement thickness to the left and the scale for allowable working stress to the right, an arbitrary load line is drawn representing the main landing gear maximum weight to be shown.

2. Values of the subgrade modulus (k) are then plotted.

3. Additional load lines for the incremental values of weight on the main landing gear are drawn on the basis of the curve for k = 300, already established.

For the rigid pavement design (Section 7.9) refer to the FAA website for the FAA design software COMFAA:

http://www.faa.gov/airports/engineering/design_software/

The ACN/PCN system (Section 7.10) as referenced in ICAO Annex 14, "Aerodromes," Sixth Edition, July 2013, provides a standardized international airplane/pavement rating system replacing the various S, T, TT, LCN, AUW, ISWL, etc., rating systems used throughout the world. ACN is the Aircraft Classification Number and PCN is the Pavement Classification Number. An aircraft having an ACN equal to or less than the PCN can operate on the pavement subject to any limitation on the tire pressure. Numerically, the ACN is two times the derived single-wheel load expressed in thousands of kilograms, where the derived single wheel load is defined as the load on a single tire inflated to 181 psi (1.25 MPa) that would have the same pavement requirements as the aircraft. Computationally, the ACN/PCN system uses the PCA program PDILB for rigid pavements and S-77-1 for flexible pavements to calculate ACN values. The method of pavement evaluation is left up to the airport with the results of their evaluation presented as follows:

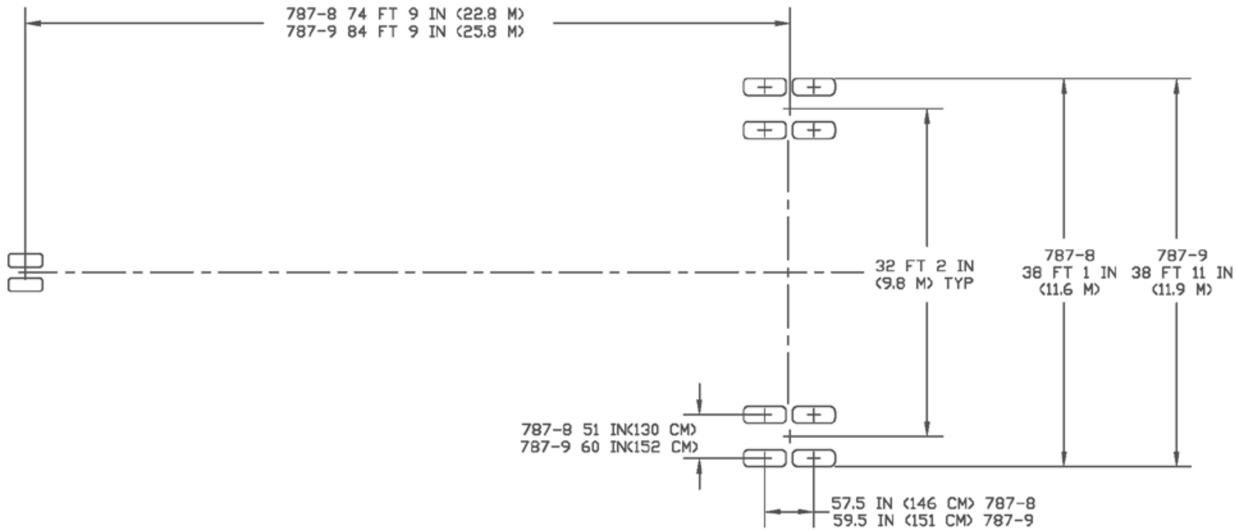
PCN	PAVEMENT TYPE	SUBGRADE CATEGORY	TIRE PRESSURE CATEGORY	EVALUATION METHOD
	R = Rigid	A = High	W = No Limit	T = Technical
	F = Flexible	B = Medium	X = To 254 psi (1.75 MPa)	U = Using Aircraft
		C = Low	Y = To 181 psi (1.25 MPa)	
		D = Ultra Low	Z = To 73 psi (0.5 MPa)	

Section 7.10.1 shows the aircraft ACN values for flexible pavements. The four subgrade categories are:

Code A - High Strength - CBR 15
Code B - Medium Strength - CBR 10
Code C - Low Strength - CBR 6
Code D - Ultra Low Strength - CBR 3

Section 7.10.2 shows the aircraft ACN values for rigid pavements. The four subgrade categories are:

Code A - High Strength, k = 550 pci (150 MN/m^3)
Code B - Medium Strength, k = 300 pci (80 MN/m^3)
Code C - Low Strength, k = 150 pci (40 MN/m^3)
Code D - Ultra Low Strength, k = 75 pci (20 MN/m^3)

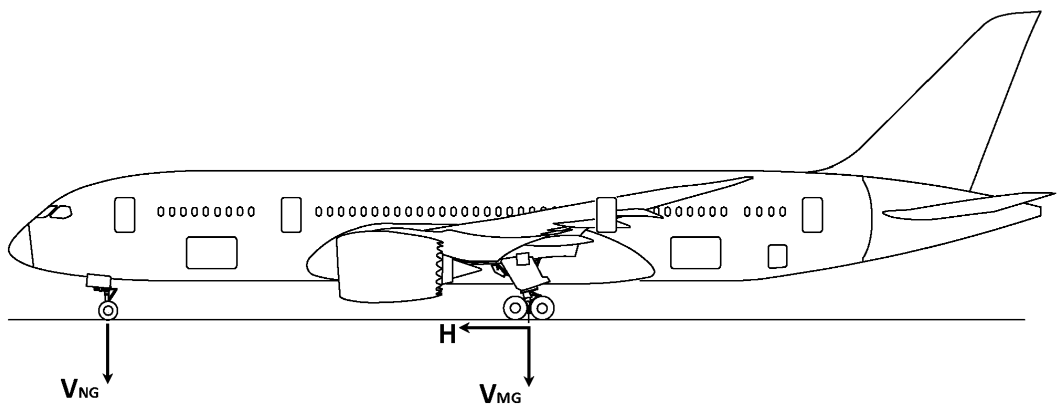


	UNITS	787-8	787-9
MAXIMUM DESIGN	LB	503,500	559,000
TAXI WEIGHT	KG	228,384	253,558
PERCENT OF WEIGHT ON MAIN GEAR		SEE SECTION 7.4	
NOSE GEAR TIRE SIZE	IN.	40 x 16.0 R16 26PR	
NOSE GEAR	PSI	187	182
TIRE PRESSURE	KG/CM^2	13.15	12.80
MAIN GEAR TIRE SIZE	IN.	50 x 20.0 R22 34 PR	54 x 21.0 R23 38 PR
MAIN GEAR	PSI	228	224
TIRE PRESSURE	KG/CM^2	16.03	15.75

7.2 LANDING GEAR FOOTPRINT

MODEL 787-8, -9

$V_{(NG)}$ = MAXIMUM VERTICAL NOSE GEAR GROUND LOAD AT MOST FORWARD CENTER OF GRAVITY
$V_{(MG)}$ = MAXIMUM VERTICAL MAIN GEAR GROUND LOAD AT MOST AFT CENTER OF GRAVITY
H = MAXIMUM HORIZONTAL GROUND LOAD FROM BRAKING

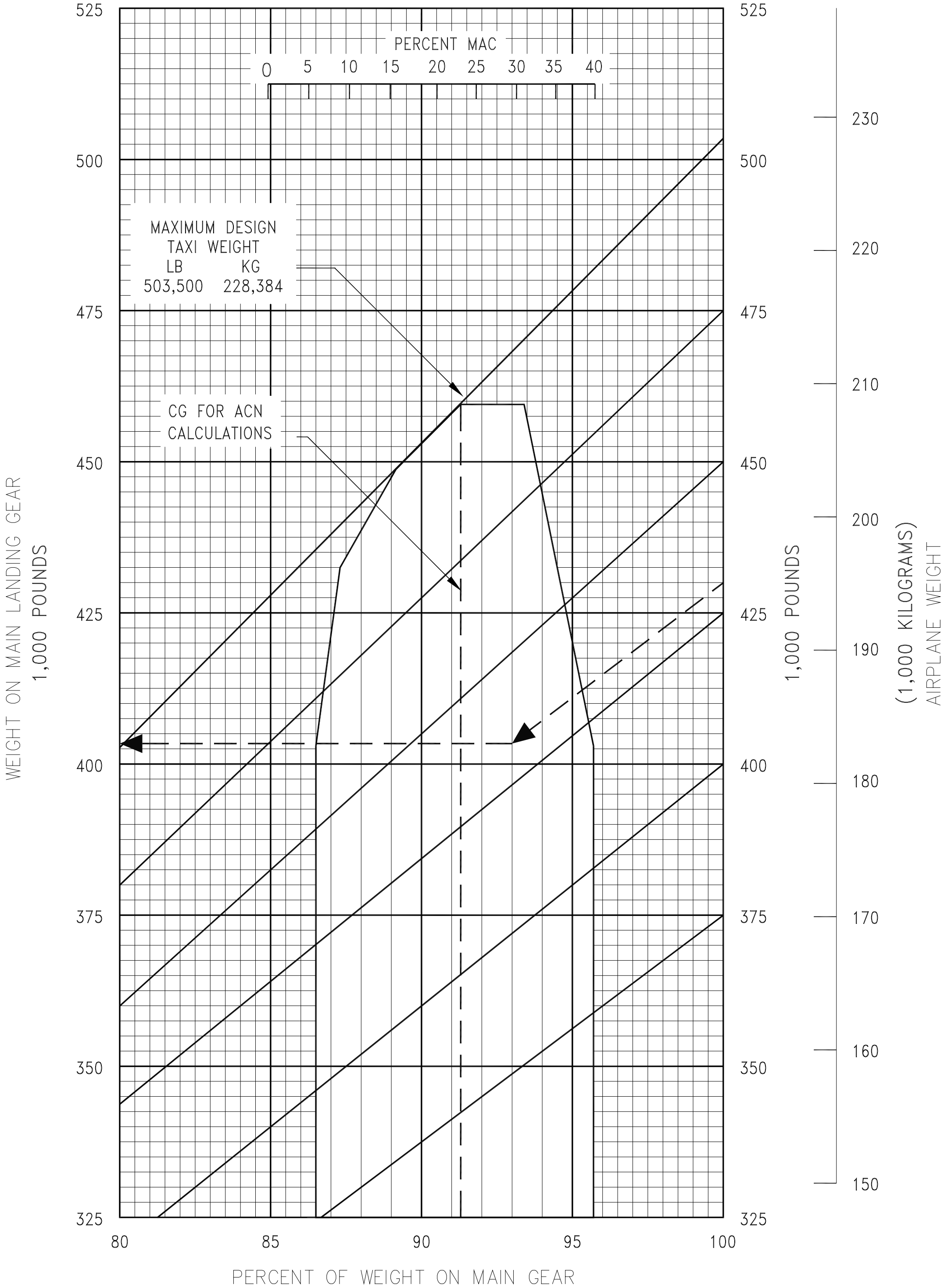


NOTE: ALL LOADS CALCULATED USING AIRPLANE MAXIMUM DESIGN TAXI WEIGHT

MODEL	UNIT	MAXIMUM DESIGN TAXI WEIGHT	$V_{(NG)}$		$V_{(MG)}$ PER STRUT	H PER STRUT	
			STATIC AT MOST FWD C.G.	STATIC + BRAKING 10 FT/SEC^2 DECEL	MAX LOAD AT STATIC AFT C.G.	STEADY BRAKING 10 FT/SEC^2 DECEL	AT INSTANTANEOUS BRAKING (u = 0.8)
787-8	LB	503,500	54,716	85,086	229,798	78,194	183,838
	KG	228,384	24,819	38,594	104,234	35,468	83,388
787-9	LB	559,000	50,050	81,634	259,572	86,813	207,652
	KG	253,558	22,702	37,029	117,740	39,378	94,189

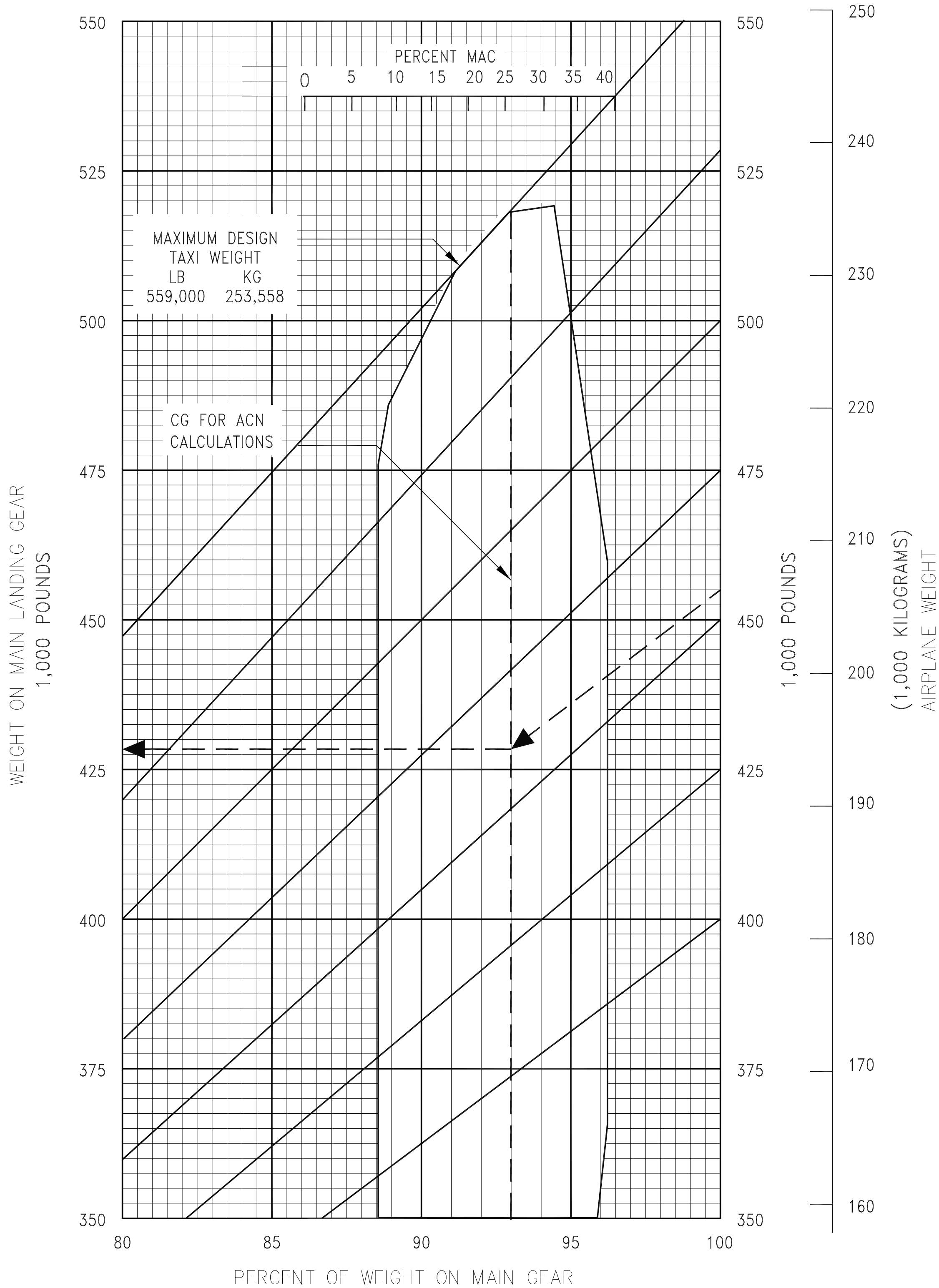
7.3 MAXIMUM PAVEMENT LOADS

MODEL 787-8,-9



7.4.1 LANDING GEAR LOADING ON PAVEMENT

MODEL 787-8



7.4.2 LANDING GEAR LOADING ON PAVEMENT

MODEL 787-9

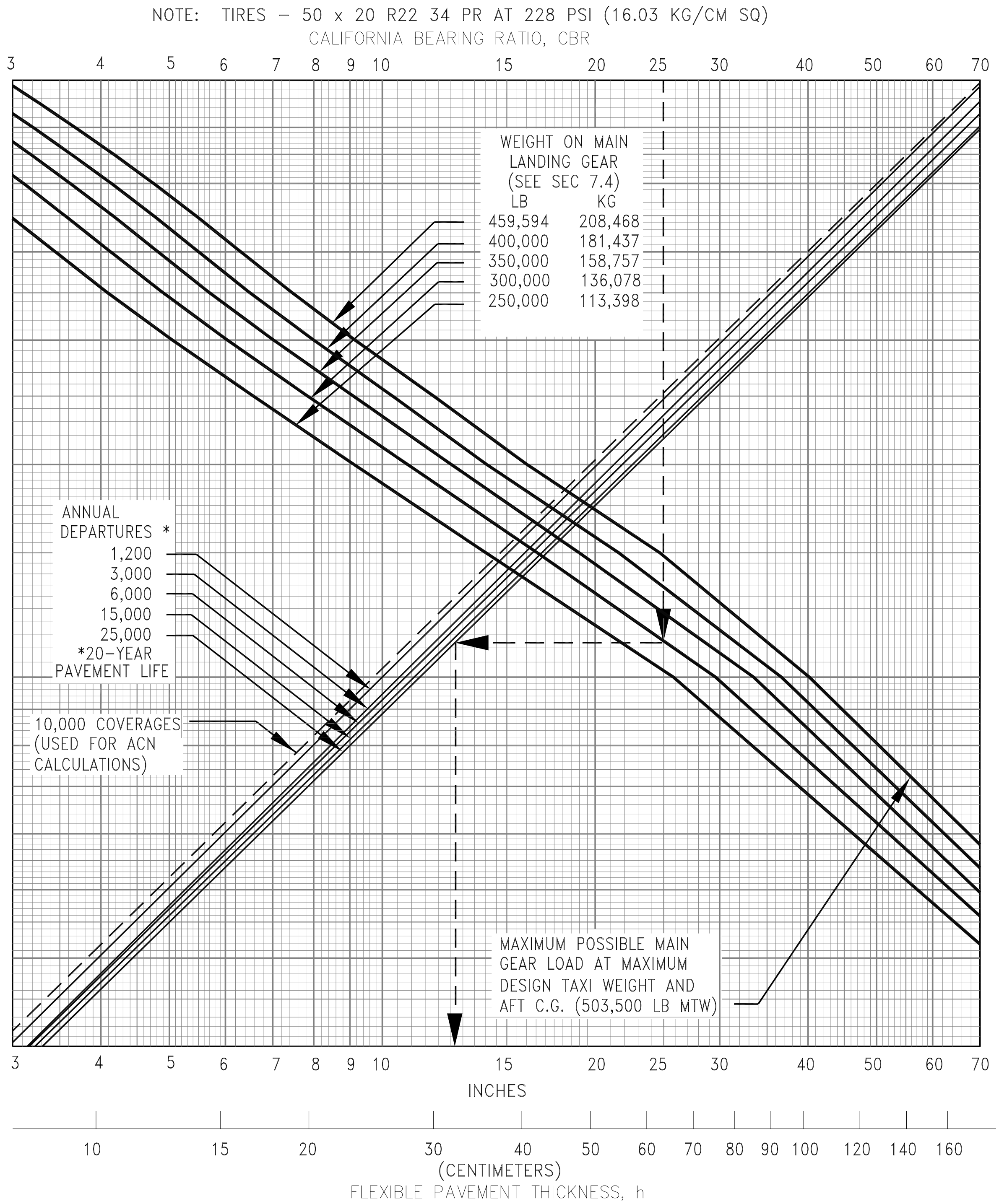
7.5 Flexible Pavement Requirements - U.S. Army Corps of Engineers Method (S-77-1)

The following flexible-pavement design chart presents the data of five incremental main-gear loads at the minimum tire pressure required at the maximum design taxi weight.

In the example shown in 7.5.1, for a CBR of 25 and an annual departure level of 25,000, the required flexible pavement thickness for an airplane with a main gear loading of 300,000 pounds is 12.6 inches.

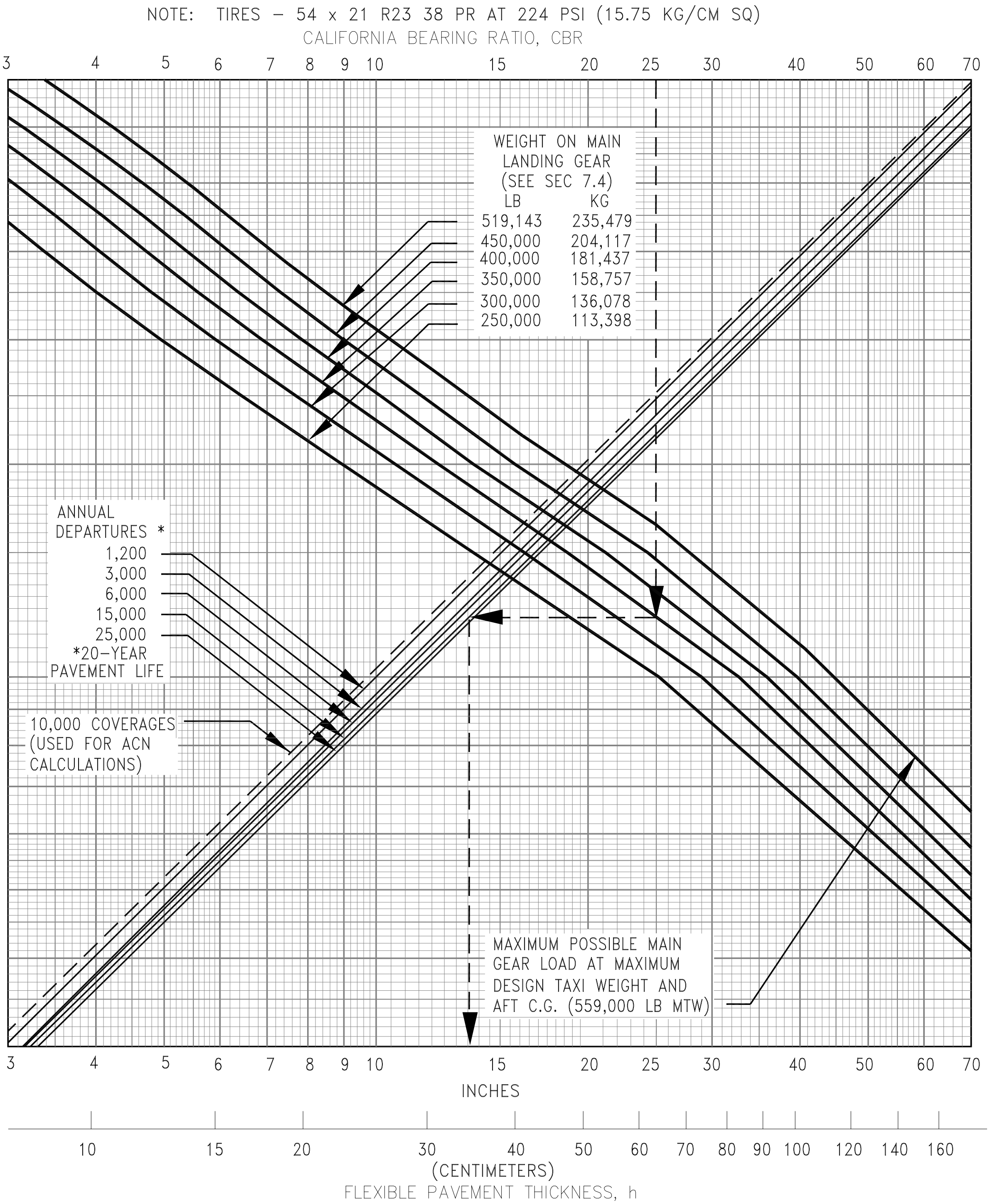
The line showing 10,000 coverages is used for ACN calculations (see Section 7.10).

The traditional FAA design method used a similar procedure using total airplane weight instead of weight on the main landing gears. The equivalent main gear loads for a given airplane weight could be calculated from Section 7.4.



7.5.1 FLEXIBLE PAVEMENT REQUIREMENTS - U.S. ARMY CORPS OF ENGINEERS DESIGN METHOD (S-77-1)

MODEL 787-8



7.5.2 FLEXIBLE PAVEMENT REQUIREMENTS - U.S. ARMY CORPS OF ENGINEERS DESIGN METHOD (S-77-1)

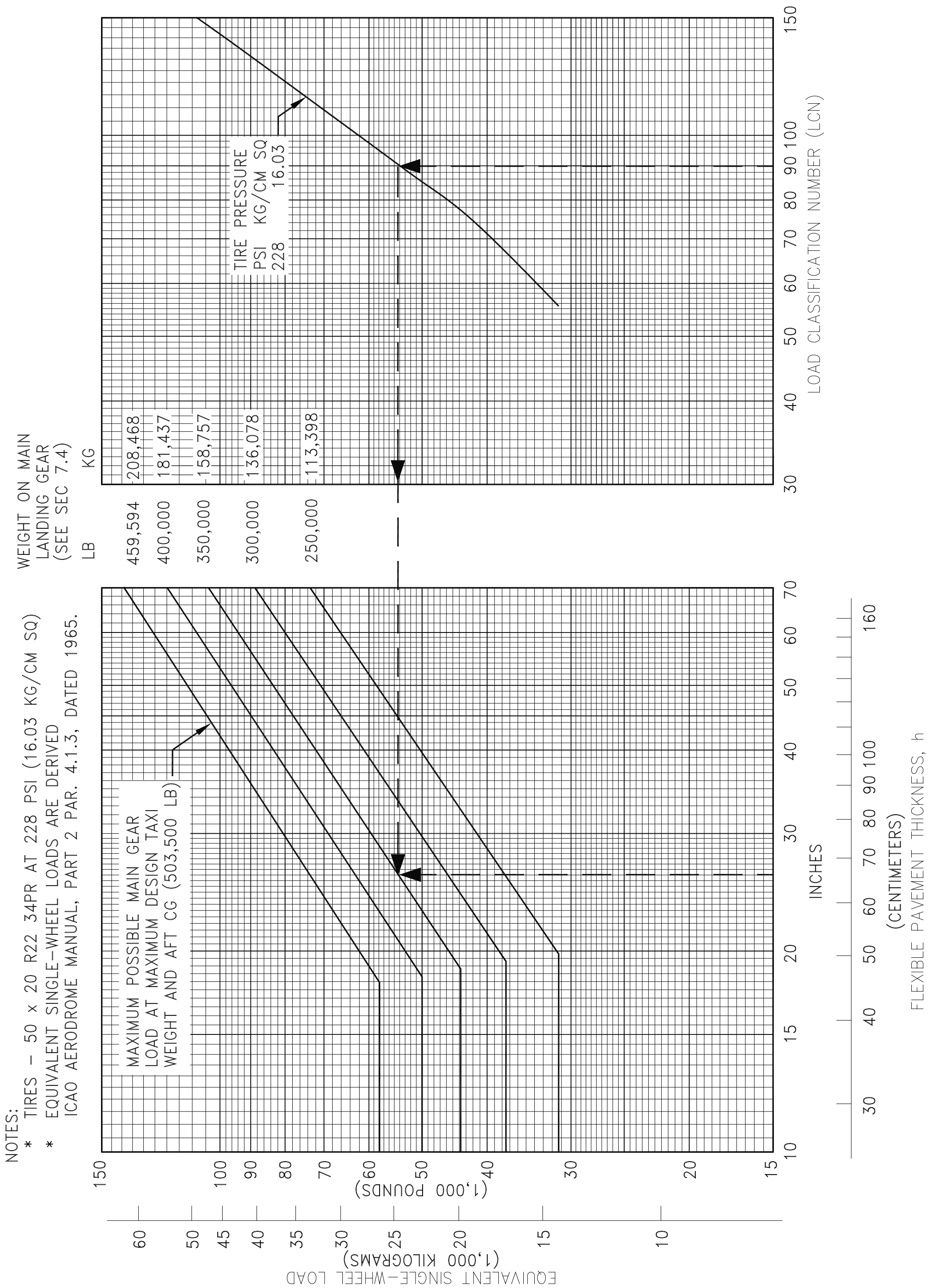
MODEL 787-9

7.6 Flexible Pavement Requirements - LCN Method

To determine the airplane weight that can be accommodated on a particular flexible pavement, both the Load Classification Number (LCN) of the pavement and the thickness must be known.

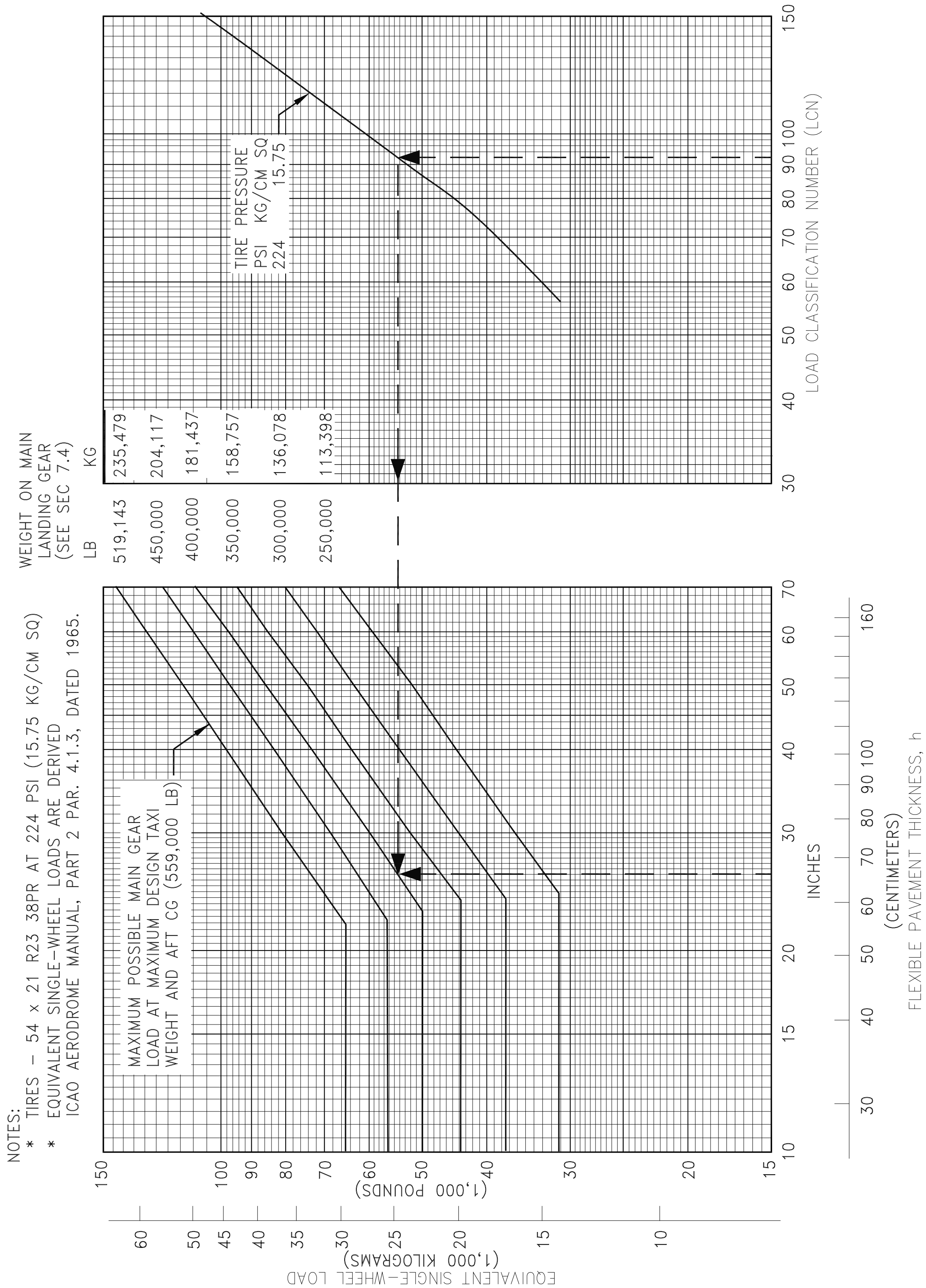
In the example shown in 7.6.1, flexible pavement thickness is shown at 26 in. with an LCN of 90. For these conditions, the apparent maximum allowable weight permissible on the main landing gear is 350,000 lb for an airplane with 228-psi main gear tires.

Note: If the resultant aircraft LCN is not more that 10% above the published pavement LCN, the bearing strength of the pavement can be considered sufficient for unlimited use by the airplane. The figure 10% has been chosen as representing the lowest degree of variation in LCN that is significant (reference: ICAO Aerodrome Manual, Part 2, "Aerodrome Physical Characteristics," Chapter 4, Paragraph 4.1.5.7v, 2nd Edition dated 1965).



7.6.1 FLEXIBLE PAVEMENT REQUIREMENTS - LCN METHOD

MODEL 787-8



7.6.2 FLEXIBLE PAVEMENT REQUIREMENTS - LCN METHOD

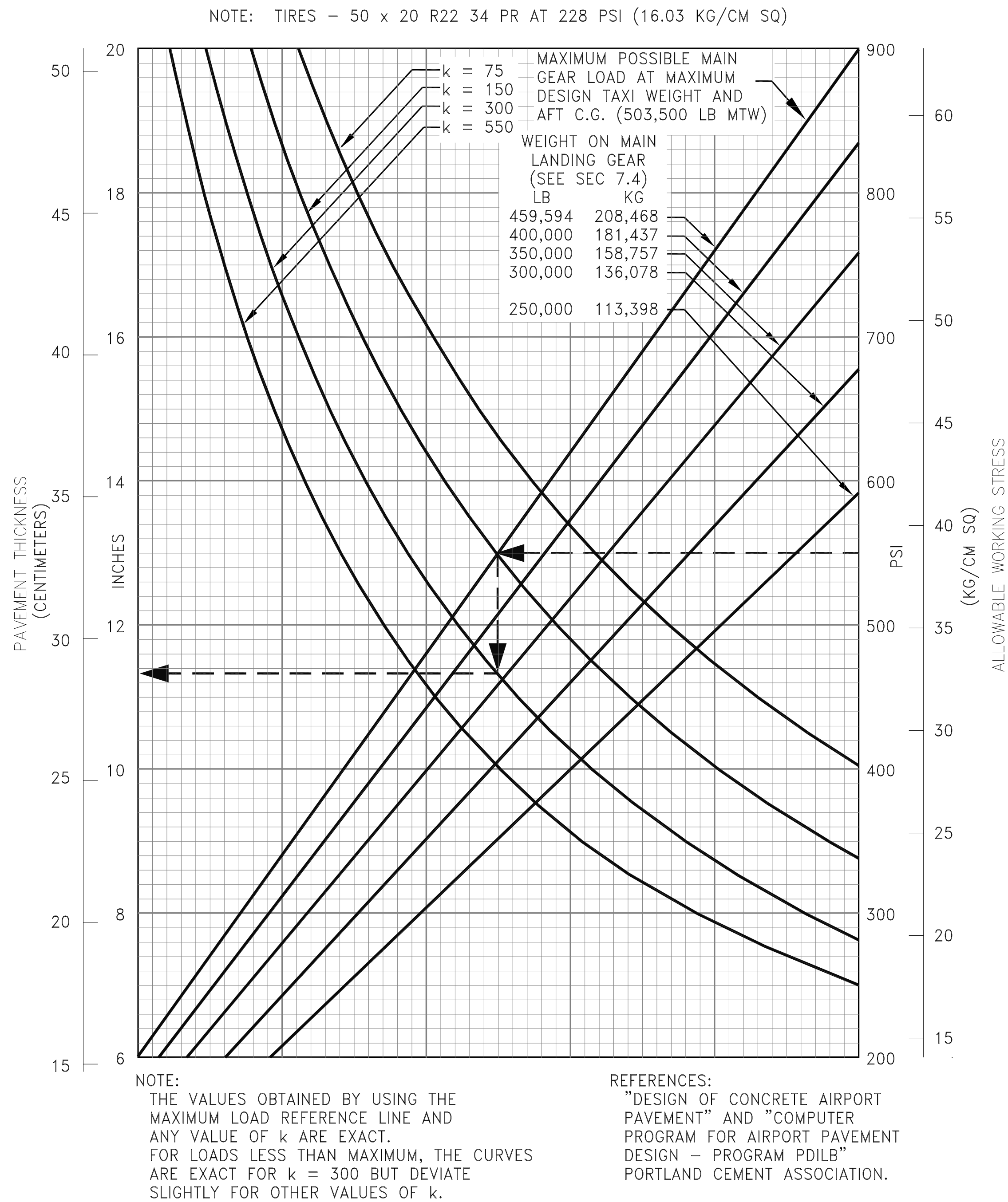
MODEL 787-9

7.7 Rigid Pavement Requirements - Portland Cement Association Design Method

The Portland Cement Association method of calculating rigid pavement requirements is based on the computerized version of "Design of Concrete Airport Pavement" (Portland Cement Association, 1973) as described in XP6705-2, "Computer Program for Airport Pavement Design" by Robert G. Packard, Portland Cement Association, 1968.

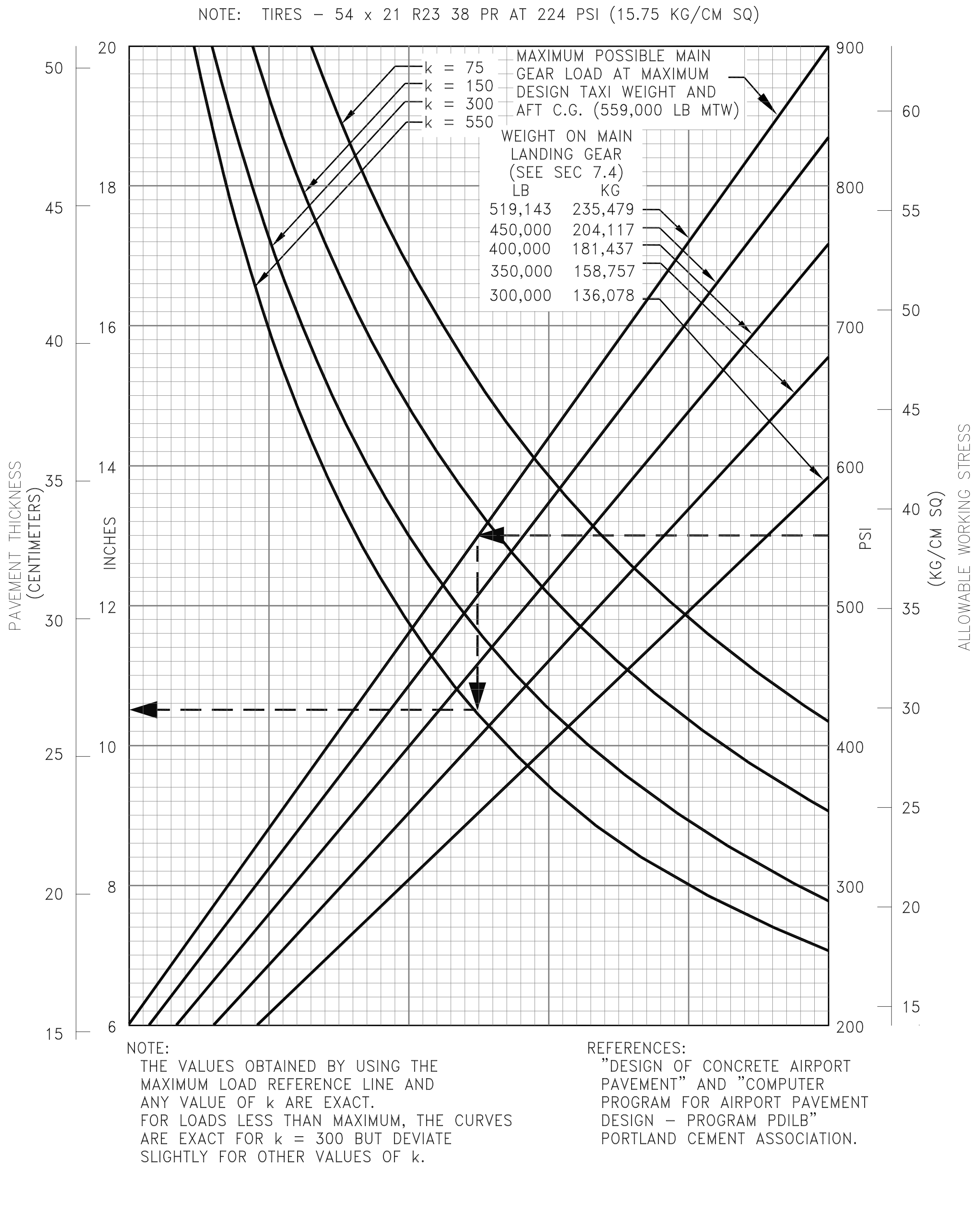
The following rigid pavement design chart presents the data for five incremental main gear loads at the minimum tire pressure required at the maximum design taxi weight.

In the example shown 7.7.1, for an allowable working stress of 550 psi, a main gear load of 459,594 lb, and a subgrade strength (k) of 300, the required rigid pavement thickness is 11.3 in.



7.7.1 RIGID PAVEMENT REQUIREMENTS - PORTLAND CEMENT ASSOCIATION DESIGN METHOD

MODEL 787-8



7.7.2 RIGID PAVEMENT REQUIREMENTS - PORTLAND CEMENT ASSOCIATION DESIGN METHOD

MODEL 787-9

7.8 Rigid Pavement Requirements - LCN Conversion

To determine the airplane weight that can be accommodated on a particular rigid pavement, both the LCN of the pavement and the radius of relative stiffness (l) of the pavement must be known.

In the example shown in 7.8.2, for a rigid pavement with a radius of relative stiffness of 39 with an LCN of 90, the apparent maximum allowable weight permissible on the main landing gear is 350,000 lb for an airplane with 228-psi main tires.

Note: If the resultant aircraft LCN is not more that 10% above the published pavement LCN, the bearing strength of the pavement can be considered sufficient for unlimited use by the airplane. The figure 10% has been chosen as representing the lowest degree of variation in LCN that is significant (reference: ICAO Aerodrome Manual, Part 2, "Aerodrome Physical Characteristics," Chapter 4, Paragraph 4.1.5.7v, 2nd Edition dated 1965).

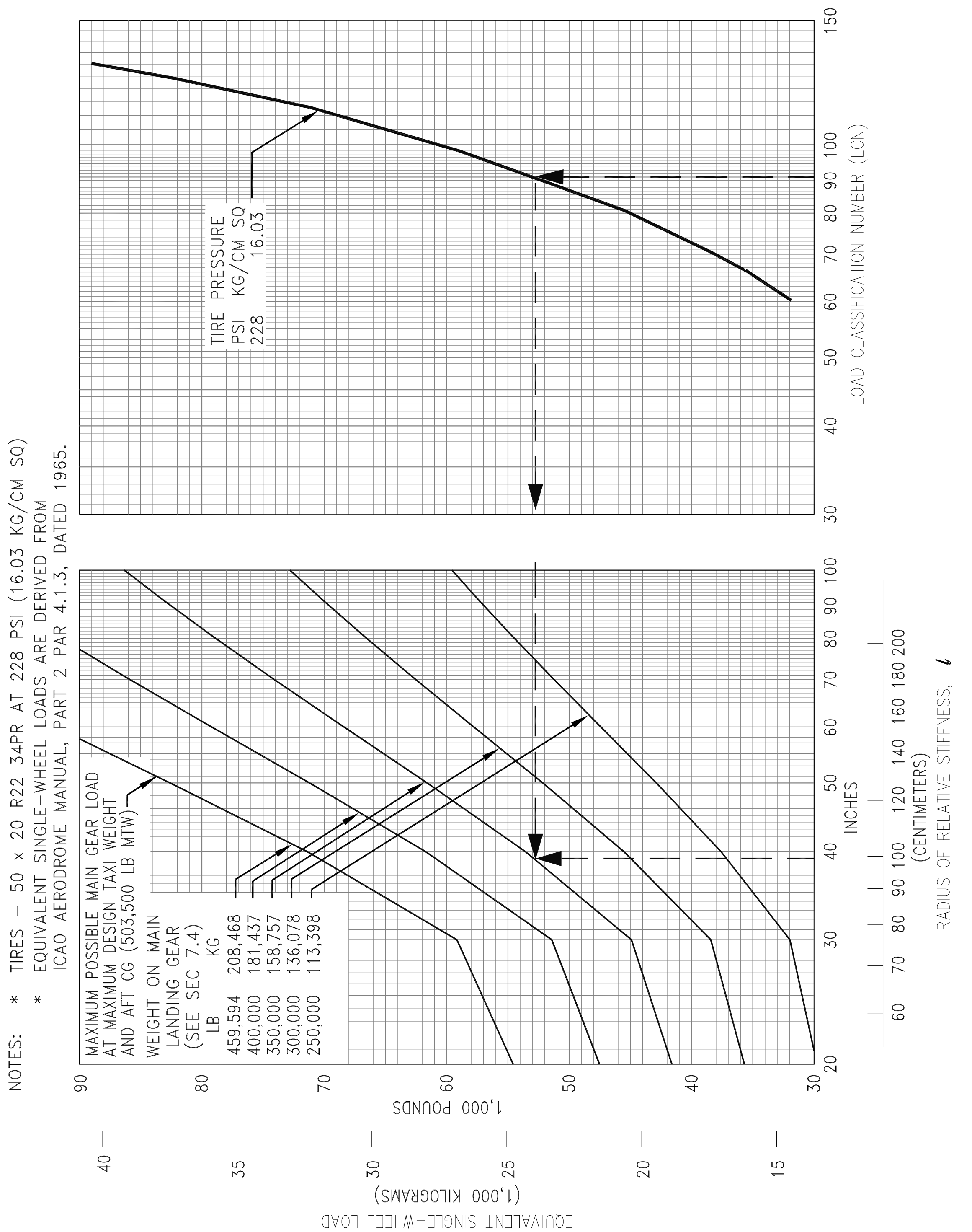
RADIUS OF RELATIVE STIFFNESS (l)
VALUES IN INCHES

$$l = \sqrt[4]{\frac{Ed^3}{12(1-\mu^2)k}} = 24.1652\sqrt[4]{\frac{d^3}{k}}$$

WHERE: E = YOUNG'S MODULUS OF ELASTICITY = 4 x 10^6 psi
k = SUBGRADE MODULUS, LB PER CU IN
d = RIGID PAVEMENT THICKNESS, IN
μ = POISSON'S RATIO = 0.15

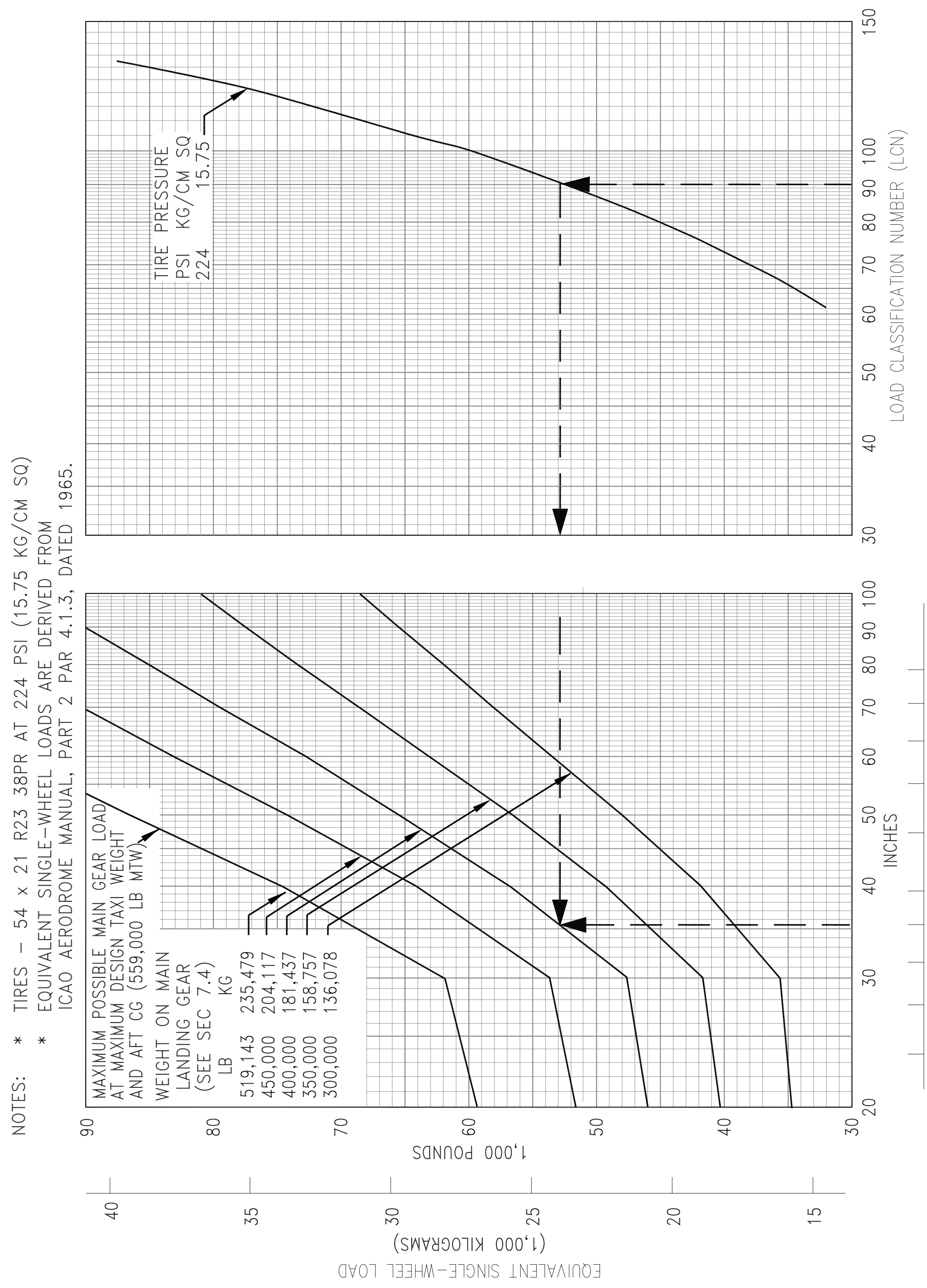
d	k = 75	k = 100	k = 150	k = 200	k = 250	k = 300	k = 350	k = 400	k = 500	k = 550
6.0	31.48	29.29	26.47	24.63	23.30	22.26	21.42	20.71	19.59	19.13
6.5	33.42	31.10	28.11	26.16	24.74	23.63	22.74	21.99	20.80	20.31
7.0	35.33	32.88	29.71	27.65	26.15	24.99	24.04	23.25	21.99	21.47
7.5	37.21	34.63	31.29	29.12	27.54	26.31	25.32	24.49	23.16	22.61
8.0	39.06	36.35	32.84	30.56	28.91	27.62	26.57	25.70	24.31	23.73
8.5	40.87	38.04	34.37	31.99	30.25	28.90	27.81	26.90	25.44	24.84
9.0	42.66	39.70	35.88	33.39	31.57	30.17	29.03	28.07	26.55	25.93
9.5	44.43	41.35	37.36	34.77	32.88	31.42	30.23	29.24	27.65	27.00
10.0	46.17	42.97	38.83	36.13	34.17	32.65	31.41	30.38	28.73	28.06
10.5	47.89	44.57	40.27	37.48	35.44	33.87	32.58	31.52	29.81	29.10
11.0	49.59	46.15	41.70	38.81	36.70	35.07	33.74	32.63	30.86	30.14
11.5	51.27	47.72	43.12	40.12	37.95	36.26	34.89	33.74	31.91	31.16
12.0	52.94	49.26	44.51	41.43	39.18	37.43	36.02	34.83	32.94	32.17
12.5	54.58	50.80	45.90	42.71	40.40	38.60	37.14	35.92	33.97	33.17
13.0	56.21	52.31	47.27	43.99	41.60	39.75	38.25	36.99	34.98	34.16
13.5	57.83	53.81	48.63	45.25	42.80	40.89	39.34	38.05	35.99	35.14
14.0	59.43	55.30	49.97	46.50	43.98	42.02	40.43	39.10	36.98	36.11
14.5	61.01	56.78	51.30	47.74	45.15	43.14	41.51	40.15	37.97	37.07
15.0	62.58	58.24	52.62	48.97	46.32	44.25	42.58	41.18	38.95	38.03
15.5	64.14	59.69	53.93	50.19	47.47	45.35	43.64	42.21	39.92	38.98
16.0	65.69	61.13	55.23	51.40	48.61	46.45	44.69	43.22	40.88	39.92
16.5	67.22	62.55	56.52	52.60	49.75	47.53	45.73	44.23	41.83	40.85
17.0	68.74	63.97	57.80	53.79	50.87	48.61	46.77	45.23	42.78	41.77
17.5	70.25	65.38	59.07	54.97	51.99	49.68	47.80	46.23	43.72	42.69
18.0	71.75	66.77	60.34	56.15	53.10	50.74	48.82	47.22	44.65	43.60
19.0	74.72	69.54	62.83	58.47	55.30	52.84	50.84	49.17	46.50	45.41
20.0	77.65	72.26	65.30	60.77	57.47	54.91	52.83	51.10	48.33	47.19
21.0	80.55	74.96	67.73	63.03	59.61	56.95	54.80	53.00	50.13	48.95
22.0	83.41	77.62	70.14	65.27	61.73	58.98	56.75	54.88	51.91	50.68
23.0	86.23	80.25	72.51	67.48	63.82	60.98	58.67	56.74	53.67	52.40
24.0	89.03	82.85	74.86	69.67	65.89	62.95	60.57	58.58	55.41	54.10
25.0	91.80	85.43	77.19	71.84	67.94	64.91	62.46	60.41	57.13	55.78

7.8.1 RADIUS OF RELATIVE STIFFNESS
(REFERENCE: PORTLAND CEMENT ASSOCIATION)



7.8.2 RIGID PAVEMENT REQUIREMENTS - LCN CONVERSION

MODEL 787-8



7.8.3 RIGID PAVEMENT REQUIREMENTS - LCN CONVERSION

MODEL 787-9

7.9 Rigid Pavement Requirements - FAA Design Method

For the rigid pavement design refer to the FAA website for the FAA design software COMFAA:

http://www.faa.gov/airports/engineering/design_software/

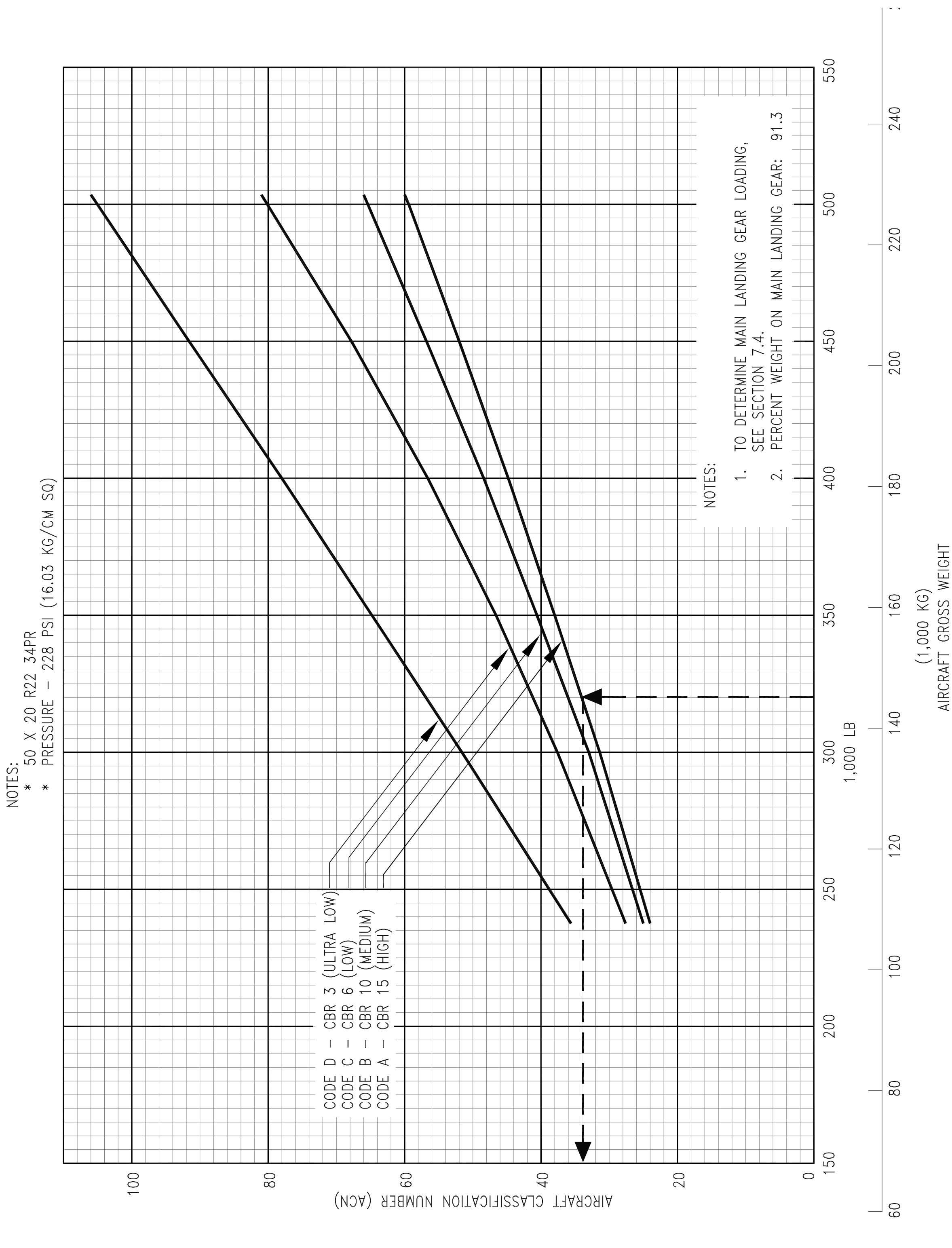
7.10 ACN/PCN Reporting System - Flexible and Rigid Pavements

To determine the ACN of an aircraft on flexible or rigid pavement, both the aircraft gross weight and the subgrade strength category must be known. In the chart in 7.10.1, for an aircraft with gross weight of 320,000 lb on a (Code A), the flexible pavement ACN is 34. Referring to 7.10.2, the same aircraft on a high strength subgrade rigid pavement has an ACN of 34.

The following table provides ACN data in tabular format similar to the one used by ICAO in the "Aerodrome Design Manual Part 3, Pavements." If the ACN for an intermediate weight between maximum taxi weight and minimum weight of the aircraft is required, Figures 7.10.1 through 7.10.4 should be consulted.

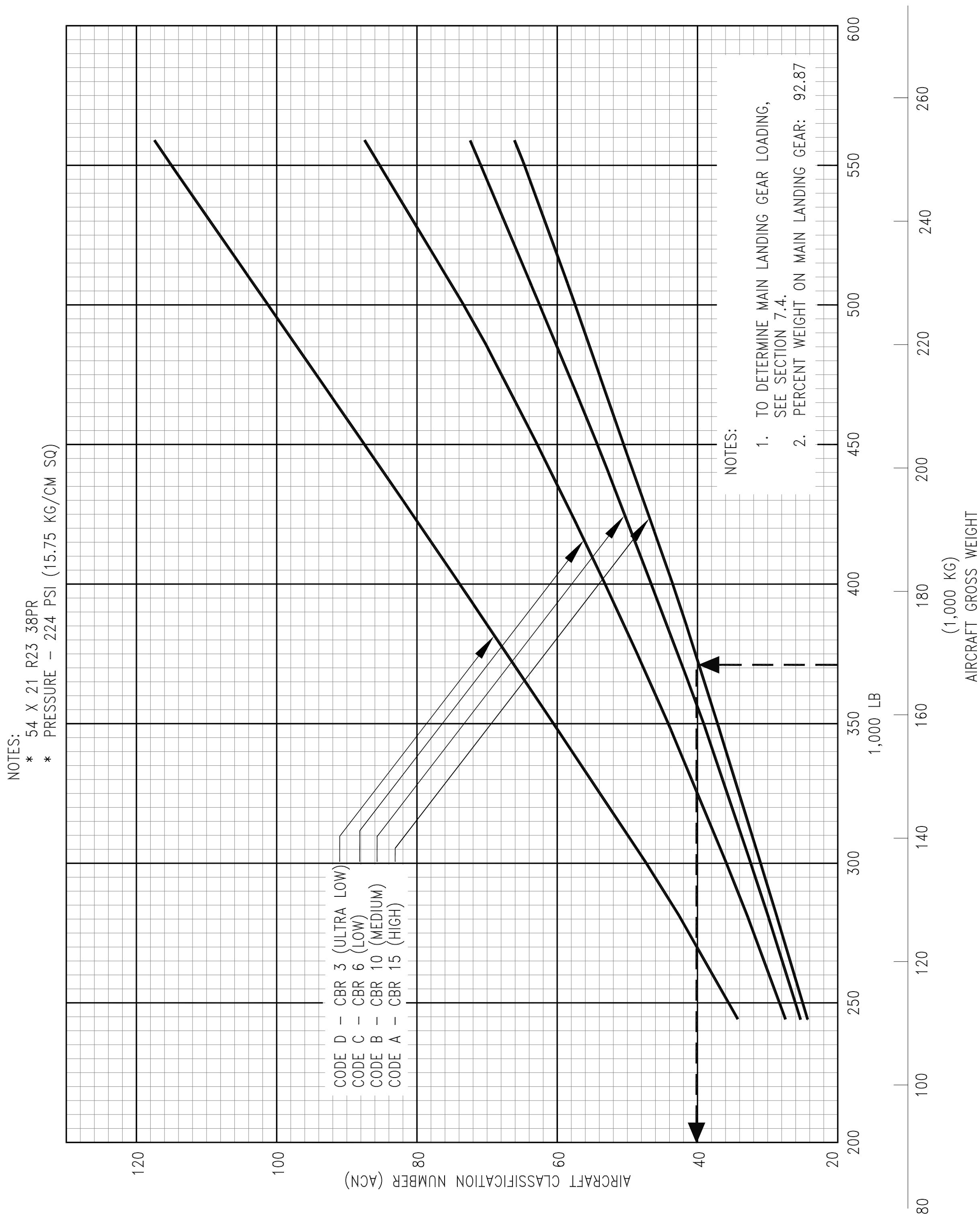
				ACN FOR RIGID PAVEMENT SUBGRADES – MN/m³				ACN FOR FLEXIBLE PAVEMENT SUBGRADES – CBR			
AIRCRAFT TYPE	MAXIMUM TAXI WEIGHT/ MINIMUM WT (1) LB (KG)	LOAD ON ONE MAIN GEAR LEG (%)	TIRE PRESSURE PSI (MPa)	HIGH 150	MEDIUM 80	LOW 40	ULTRA LOW 20	HIGH 15	MEDIUM 10	LOW 6	ULTRA LOW 3
787-8	503,500(228,384) 237,400(107,683)	45.64	228 (1.57)	61 24	71 26	84 30	96 35	60 24	66 25	81 28	106 36
787-9	559,000(253,558) 244,000(110,676)	46.43	224 (1.54)	65 25	76 26	90 30	104 34	66 24	73 25	87 27	117 34

(1) Minimum weight used solely as a baseline for ACN curve generation.



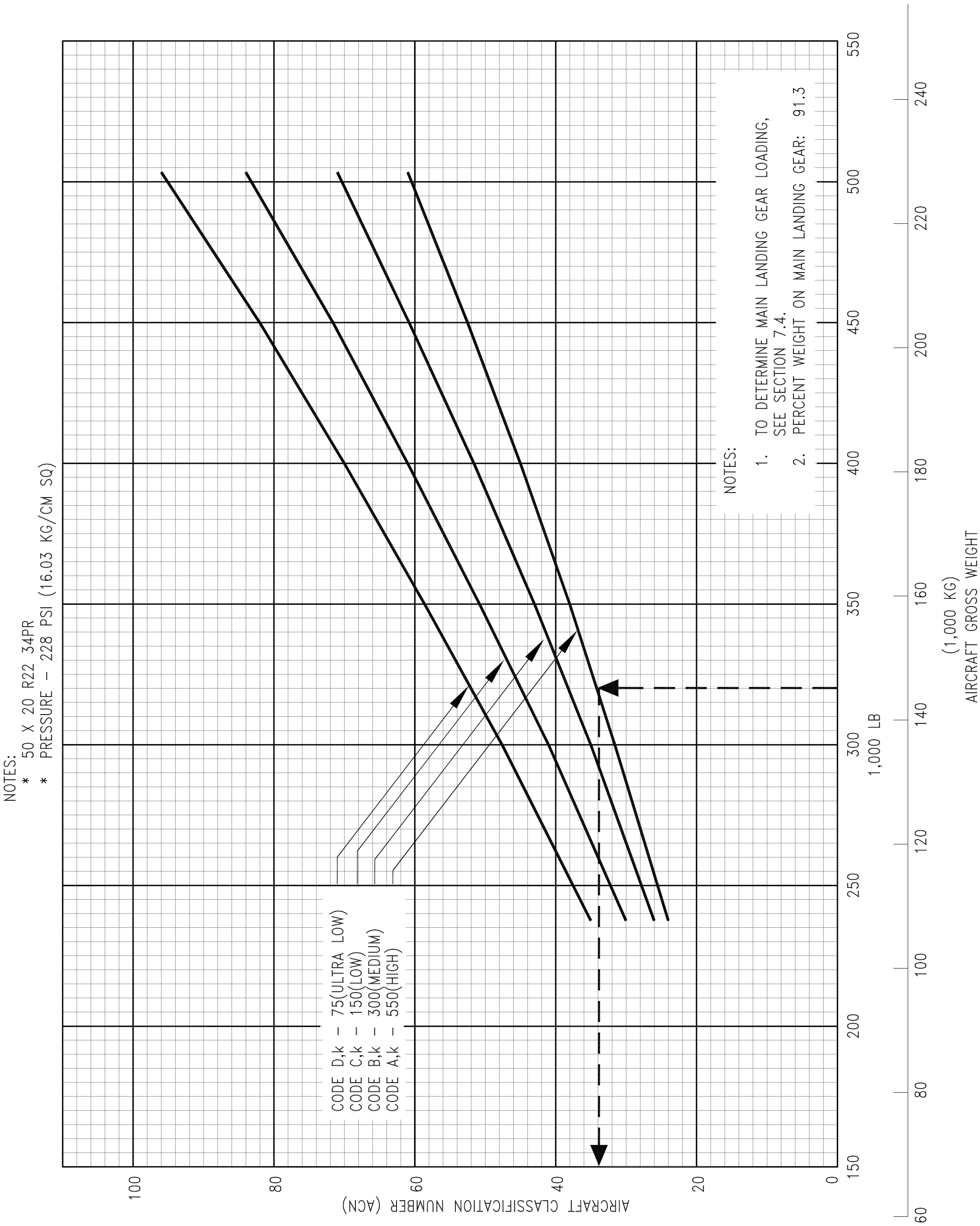
7.10.1 AIRCRAFT CLASSIFICATION NUMBER - FLEXIBLE PAVEMENT

MODEL 787-8

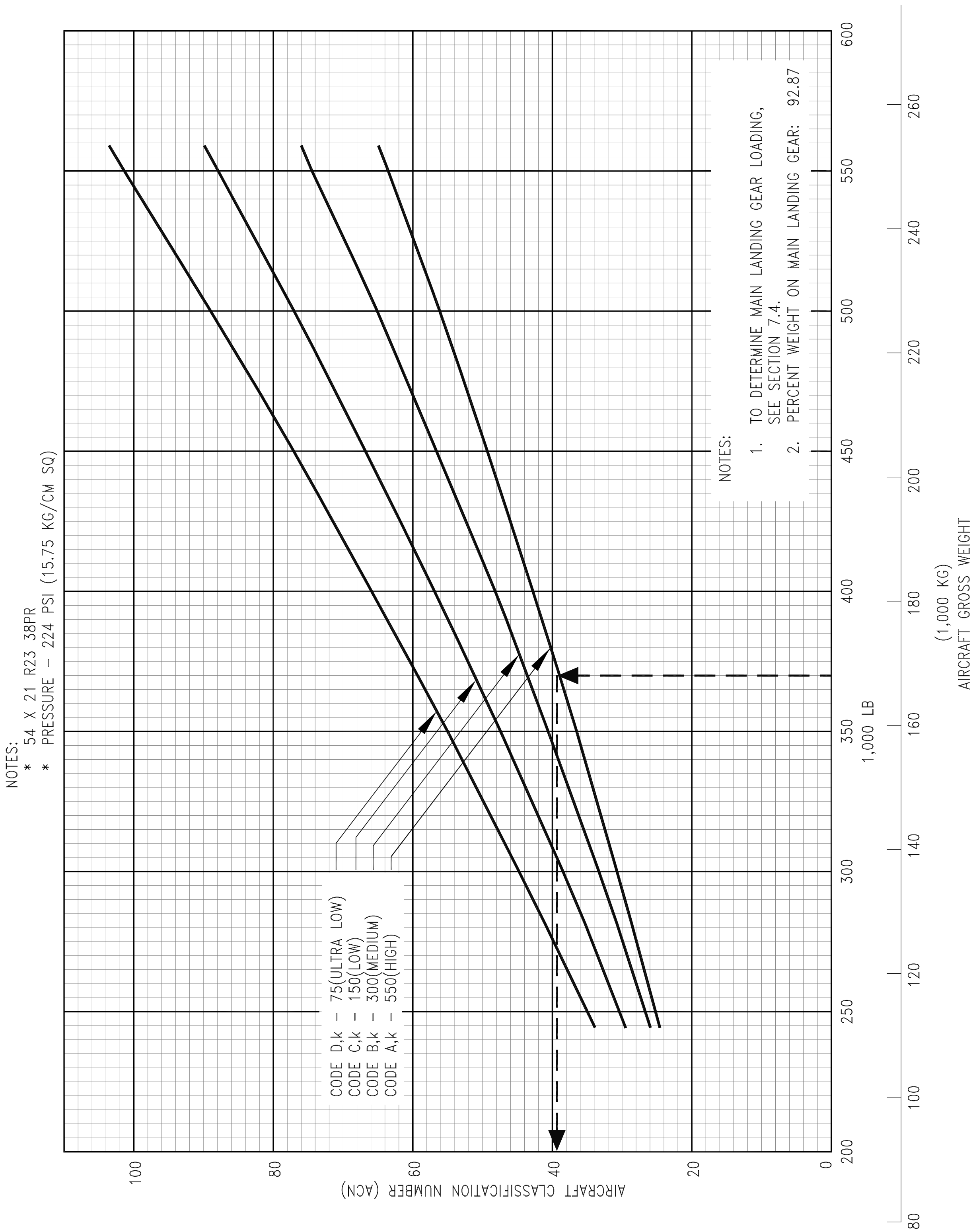


7.10.2 AIRCRAFT CLASSIFICATION NUMBER - FLEXIBLE PAVEMENT

MODEL 787-9



7.10.3 AIRCRAFT CLASSIFICATION NUMBER - RIGID PAVEMENT
MODEL 787-8



7.10.4 AIRCRAFT CLASSIFICATION NUMBER - RIGID PAVEMENT
MODEL 787-9

8.0 FUTURE 787 DERIVATIVE AIRPLANES

8.1 FUTURE 787 DERIVATIVE AIRPLANES

Part of the Boeing philosophy is to continously investigate derivative potential for it's aircraft, in order to provide capabilities which support the intended market segment. Future versions could address both increase or decrease of passenger count, payload, cargo capacity and /or range.

Decisions to design and manufacture future versions of the airplane depend entirely on airline customer requirements. Along with many other parameters, impact on airport facilities will be considered in the development of any future aircraft design.

9.0 SCALED 787 DRAWINGS

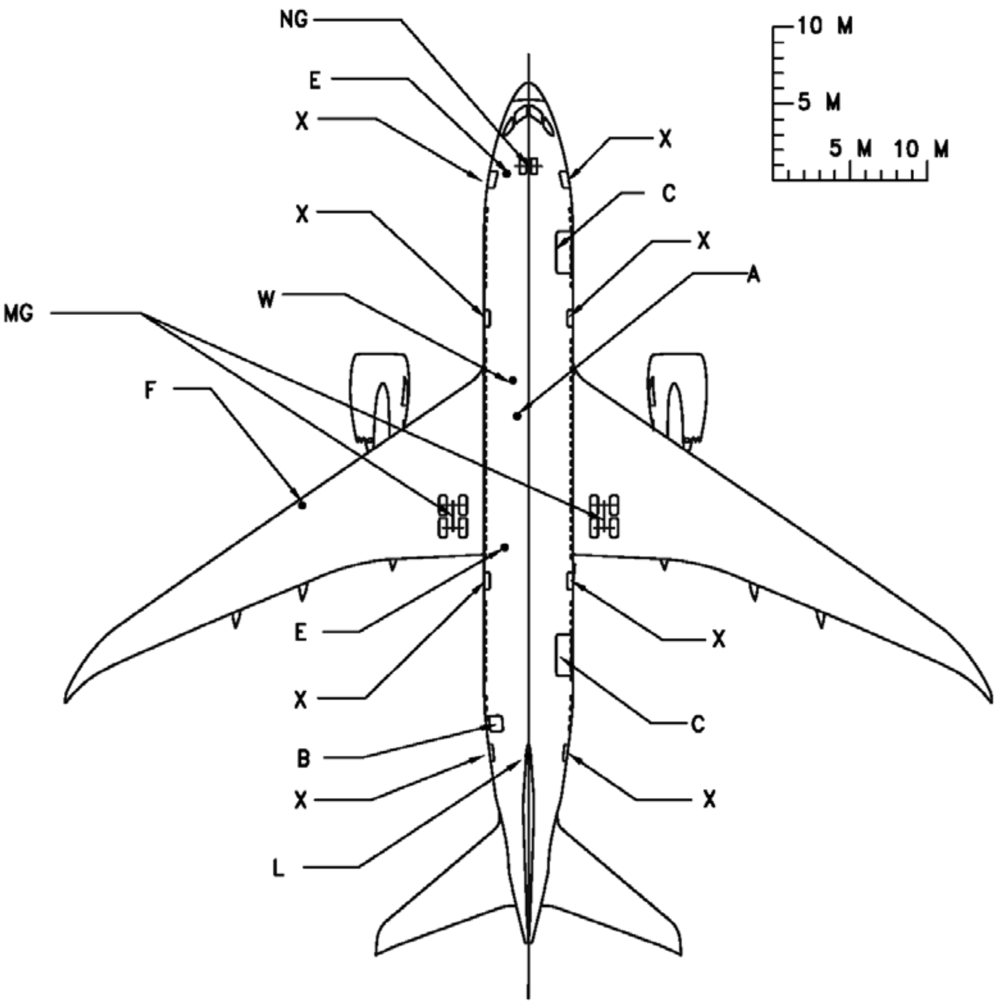
9.1 Model 787-8

9.2 Model 787-9

9.0 SCALED DRAWINGS

The drawings in the following pages show airplane plan view drawings, drawn to approximate scale as noted. The drawings may not come out to exact scale when printed or copied from this document. Printing scale should be adjusted when attempting to reproduce these drawings. Three-view drawing files of the 787, along with other Boeing airplane models, can be downloaded from the following website:

http://www.boeing.com/airports



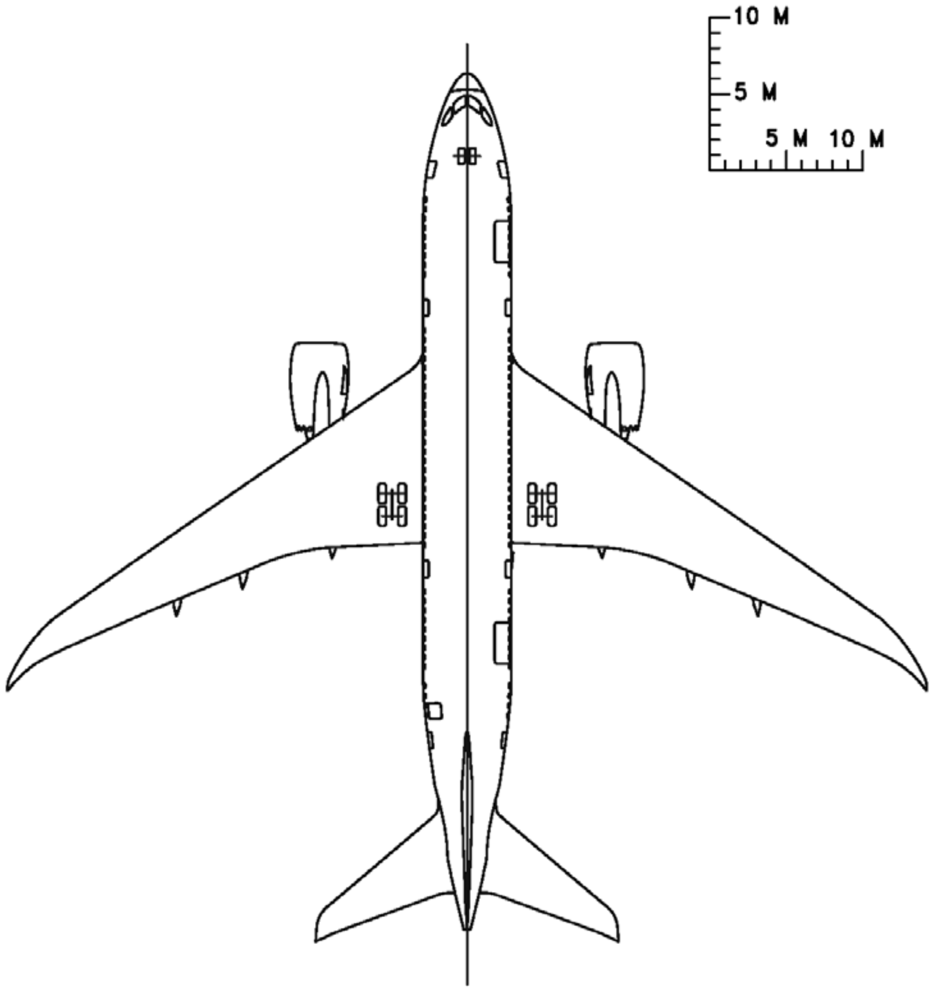
LEGEND

A	CONDITIONED AIR
B	BULK CARGO DOOR
C	CONTAINER CARGO DOOR
E	ELECTRICAL
F	FUEL
L	LAVATORY
MG	MAIN GEAR
NG	NOSE GEAR
W	POTABLE WATER
X	PASSENGER DOOR

NOTE: WHEN PRINTING THIS DRAWING, MAKE SURE TO ADJUST FOR PROPER SCALING

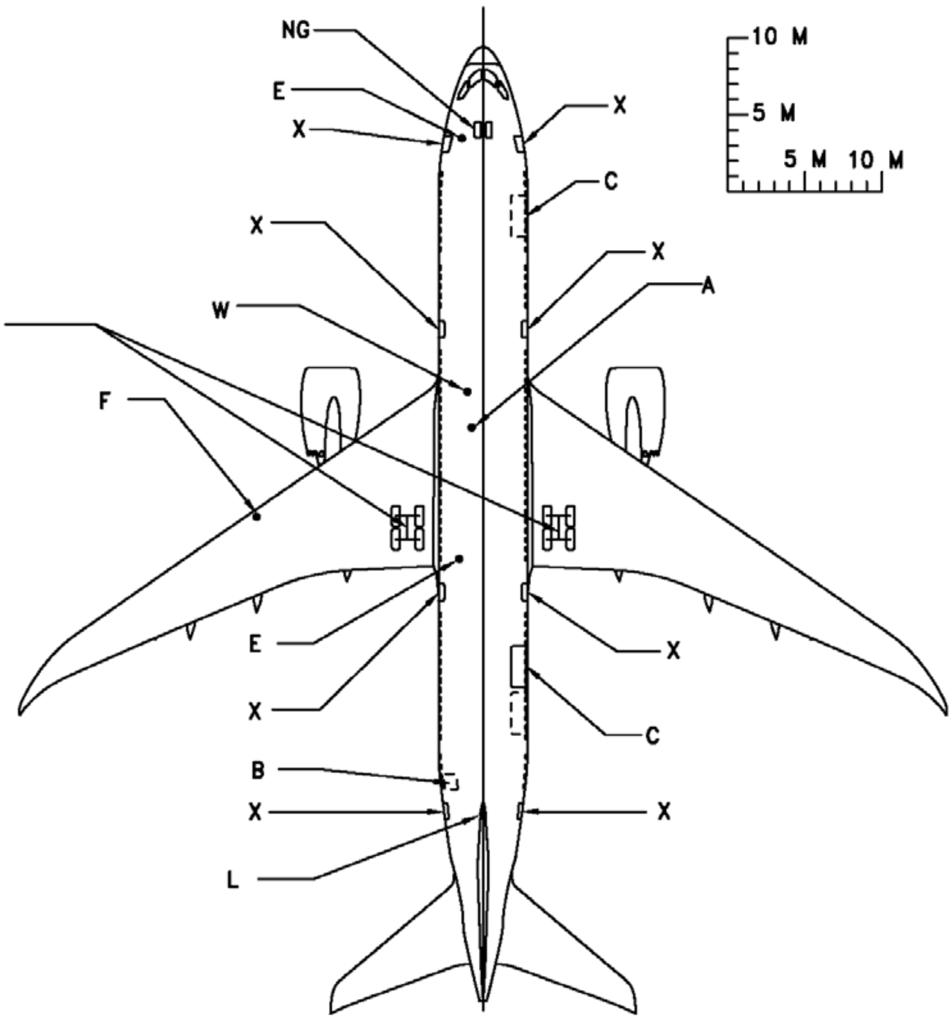
9.1.1 SCALED DRAWING – 1:500

MODEL 787-8



NOTE: WHEN PRINTING THIS DRAWING, MAKE SURE TO ADJUST FOR PROPER SCALING

9.1.2 SCALED DRAWING - 1:500



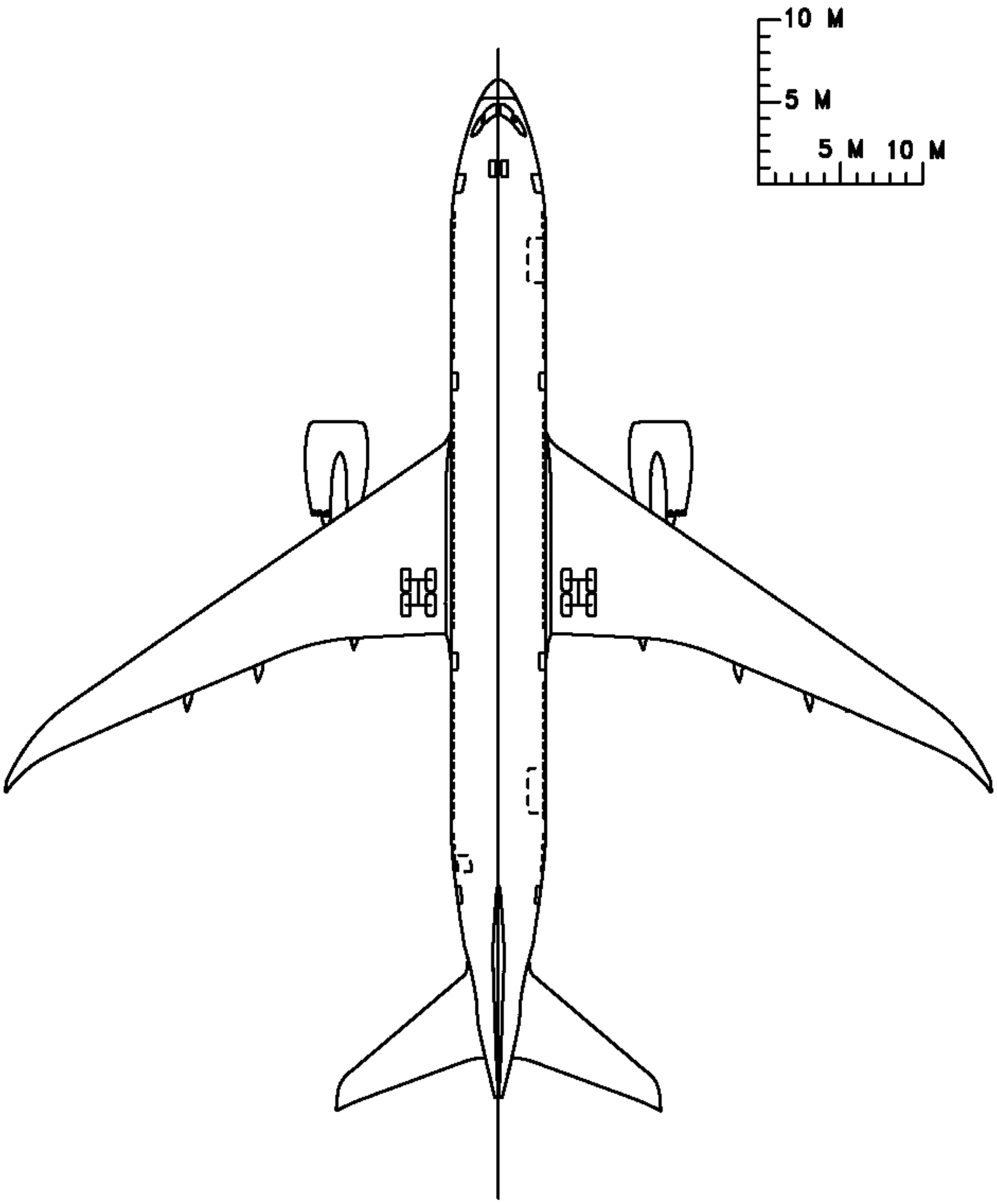
LEGEND

A	CONDITIONED AIR
B	BULK CARGO DOOR
C	CONTAINER CARGO DOOR
E	ELECTRICAL
F	FUEL
L	LAVATORY
MG	MAIN GEAR
NG	NOSE GEAR
W	POTABLE WATER
X	PASSENGER DOOR

NOTE: WHEN PRINTING THIS DRAWING, MAKE SURE TO ADJUST FOR PROPER SCALING

9.2.1 SCALED DRAWING - 1:500

MODEL 787-9



NOTE: WHEN PRINTING THIS DRAWING, MAKE SURE TO ADJUST FOR PROPER SCALING

9.2.2 SCALED DRAWING - 1:500
MODEL 787-9