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AIRPORT PLANNING MANUAL

APM-145/1238
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ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER REVISION NUMBER, DATE INSERTED AND INITIALS.

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1. INTRODUCTION

1.1 Purpose

This document provides airplane characteristics data for general airport planning. Since the operational practices vary among the airlines, specific data should be coordinated with the using airlines before the facility design is made.

EMBRAER should be contacted for any additional information required.

1.2 Scope

This document complies with NAS3601, revision 6.

It provides characteristics of the EMB-135ER and EMB-135LR aircraft models for airport operators, airlines, and engineering consultant organizations. Since the airplane changes and available options may alter the information, the data presented herein must be regarded as subject to change.

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2. AIRPLANE DESCRIPTION

2.1 General Airplane Characteristics

The airplane is an all-metal semimonocoque-type structure, low-winged, T-tailed, pressurized airplane featuring a retractable twin-wheeled, tricycle-type landing gear system and two high bypass ratio rear-mounted Rolls Royce AE 3007 turbofan engines. The airplane has convenient accommodations for a pilot, a copilot, and a flight observer. The typical passenger configuration consists of three seats abreast, with front galley and rear toilet. Accommodation for a second flight attendant is available as an option.

2.1.1 Definitions

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

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

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

Operating Empty Weight (OEW): Weight of the structure, power plant, furnishings, systems, unusable fuel, and other unusable propulsion agents, as well as other items of equipment that are considered an integral part of a particular airplane configuration. Also included are crew and crew baggage, navigation kit, and supplies necessary for full operations, excluding usable fuel and payload.

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

Maximum Payload: Maximum design zero fuel weight minus operational empty weight.

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

Maximum Cargo Volume: The maximum space available for cargo.

Usable Fuel: Fuel available for the airplane propulsion.

Table 2.1.1.1 - Airplane General Characteristics

DESIGN WEIGHTS		MODELS	
		ER	LR
Maximum Design Taxi Weight (MTW)	kg (lb)	19100 (42108)	20100 (44313)
Maximum Design Landing Weight (MLW)	Kg (lb)	18500 (40785)	18500 (40785)
Maximum Design Takeoff Weight (MTOW) [1]	Kg (lb)	19000 (41888)	20000 (44092)
Operating Empty Weight (OEW) [2]	Kg (lb)	11402 (25137)	11501 (25355)
Maximum Design Zero Fuel Weight (MZFW) [3]	Kg (lb)	15600 (34392)	16000 (35274)
Maximum Payload [2]	Kg (lb)	4198 (9255)	4499 (9919)

DESIGN WEIGHTS		MODELS	
		ER	LR
Maximum Seating Capacity	Passenger	37	37
Maximum Cargo Volume	m^3 (ft^3)	9.2 (325)	9.2 (325)
Usable Fuel [4]	kg (lb)	4173 (9200)	5187 (11435)
	Liters (US gal.)	5146 (1360)	6396 (1690)

[1] For aircraft POST-MOD. S.B. 145-00-0028, consider MTOW = 19600 kg (43210 lb).

[2] Standard configuration (weights may vary according to optional equipment installed or interior layouts).

[3] For aircraft POST-MOD. S.B. 145-00-0025 consider MZFW = 16000 kg (35274 lb).

[4] Adopted fuel density of 0.811 kg/l (6.77 lb/US gal).

2.2 Airplane Dimensions

2.2.1 External Dimensions

Overall span .... 20.04 m (65 ft 9 in)
Height (maximum) .... 6.76 m (22 ft 2 in)
Overall length .... 26.33 m (86 ft 5 in)

2.2.2 Wing

Reference area .... 51.18 m^2 (551 ft^2)
Reference aspect ratio 7.8

2.2.3 Fuselage

Total Length .... 24.39 m (80 ft 0 in)
Length of pressurized section .... 19.67 m (64 ft 6 in)
Outside diameter .... 2.28 m (7 ft 6 in)

2.2.4 Horizontal Tail

Span .... 7.55 m (24 ft 9 in)
Area .... 11.20 m^2 (120.6 ft^2)

2.2.5 Vertical Tail

Reference area .... 7.20 m^2 (77.5 ft^2)

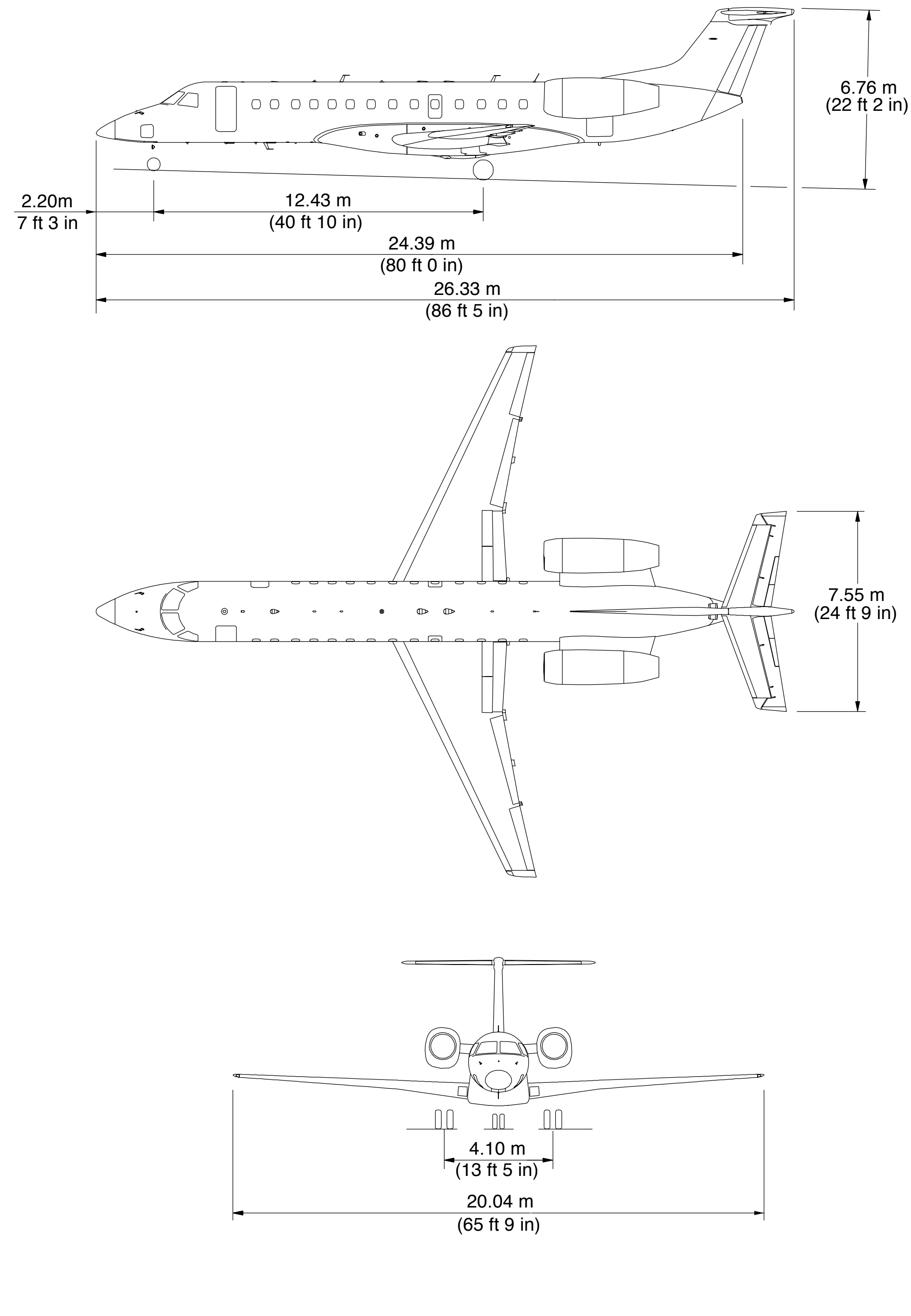
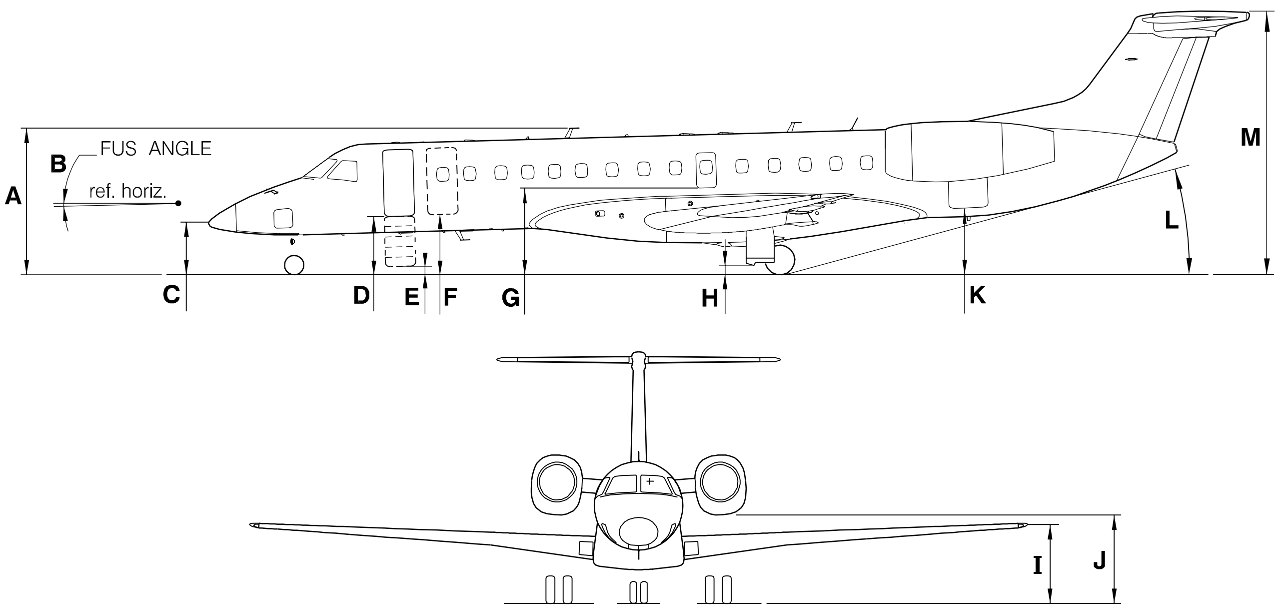


Figure 2.2.1 - Airplane General Dimensions

2.3 Ground Clearances



WEIGHT kg (lb)	CG (%) (%mac)	A ANTENNA	B FUS. ANGLE (deg)	C NOSE	D MAIN. DOOR	E OPEN 1ST.STEP	F EMERG./ SER.DOOR	G EMERG. EXIT	H MLG DOOR	I WING TIP	J NACELLE	K BAGGAGE DOOR	L TAILSKID ANGLE (deg)	M TAIL BOOM
20100 (44312)	21.1	3.733m 12ft 3in	−1.52	1.300m 4ft 3in	1.489m 4ft 10.6in	0.297m 11.7in	1.494m 4ft 11.7in	2.202m 7ft 3in	0.181m 7.1in	2.039m 6ft 6.7in	2.336 m 7ft 7.8 in	1.691m 5ft 6.6in	15.12	6.699m 21ft 11.7in
20100 (44312)	38.0	3.744m 12ft 3.4in	−1.33	1.342m 4ft 5in	1.514m 4ft 11.6in	0.322m 1ft 0.7in	1.515m 4ft 11.7in	2.201m 7ft 3 in	0.175m 6.9in	2.029m 6ft 7.8in	2.317 m 7ft 7.2 in	1.670m 5ft 5.7in	14.88	6.659m 21ft 10.2in
18500 (44785)	19.4	3.743m 12ft 3.4in	−1.57	1.302m 4ft 3in	1.495m 4ft 10.9in	0.303m 11.9in	1.501m 4ft 11.1in	2.214m 7ft 3in	0.195m 7.7in	2.054m 6ft 8.8in	2.353 m 7ft 8.6 in	1.709m 5ft 7.3in	15.29	6.721m 22ft 0.6in
18500 (44785)	38.0	3.755m 12ft 3.8in	−1.36	1.349m 4ft 5in	1.523m 5ft 0in	0.331m 1ft 1.0in	1.525m 5ft 0in	2.214m 7ft 3in	0.188m 7.4in	2.043m 6ft 8.4in	2.332 m 7ft 7.8 in	1.685m 5ft 6.3in	15.02	6.676m 21ft 10.8in
14500 (31967)	15.0	3.774m 12ft 4.6in	−1.72	1.309m 4ft 4in	1.515m 4ft 11.6in	0.323m 1ft 0.7in	1.525m 5ft 0in	2.255m 7ft 5in	0.240m 9.5in	2.102m 6ft 10.7in	2.408m 7ft 10.8in	1.766m 5ft 9.5in	15.83	6.793m 22ft 3.4in
12500 (27557)	15.0	3.797m 12ft 5.5in	−1.80	1.319m 4ft 4in	1.532m 5ft 0.3in	0.340m 1ft 1.4in	1.543m 5ft 0.8in	2.283m 7ft 6in	0.271m 10.7in	2.134m 7ft 0in	2.444m 8ft 0in	1.803m 5ft 10.9in	16.16	6.837m 22ft 5.2in
12000 (26455)	38.0	3.803m 12ft 5.7in	−1.46	1.381m 4ft 6in	1.564m 5ft 1.6in	0.372m 1ft 2.6in	1.568m 5ft 1.7in	2.268m 7ft 5in	0.245m 9.6in	2.101m 6ft 10.7in	2.395m 7ft 10.2in	1.749m 5ft 8.9in	15.60	6.750m 22ft 1.7in
11500 (25353)	30.0	3.821m 12ft 6.4in	−1.66	1.366m 4ft 6in	1.566m 5ft 1.7in	0.374m 1ft 2.7in	1.574m 5ft 2.0in	2.298m 7ft 7in	0.281m 11.1in	2.141m 7ft 2.4in	2.445m 8ft 0in	1.802m 5ft 10.9in	16.10	6.822m 22ft 4.6in

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Figure 2.3.1 - Ground Clearances

2.4 Interior Arrangements

The standard interior arrangement provides accommodation for two pilots, one flight observer, one flight attendant, and 37 passengers. One additional flight attendant seat is available as an option. The standard and optional configurations are shown in figures 2.4.1 and 2.4.2.

2.4.1 Cockpit

The ″quiet and dark″ cockpit is designed to accommodate the pilots with comfort during all flight phases, with minimum workload and maximum safety. The cockpit is provided with two pilot seats, a foldable flight observer seat, control columns and pedals, control pedestal, left, right, and aft consoles, as well as main, overhead, circuit breaker, and glareshield panels. A sun shade is provided for each pilot and the compartment is separated from the passenger cabin by a partition with a lockable door.

2.4.1.1 Panels

The main instrument panel displays the main navigation, engine, and system indications, through the PFD, MFD, and EICAS displays, the audio selection, ELT reset, and the landing gear and pedal electric adjustment controls. It also accommodates the standby instruments and displays reversionary functions.

A glareshield panel is located over the main panel, including the master caution and master warning lights, flight control, display control, and lighting intensity controls. One of the different possible configurations of glareshield panel includes dual radar control panels.

An overhead panel provides the hydraulic, electrical, powerplant, APU, fire protection, environmental, and external and internal lighting controls.

The circuit breakers, in ordered and grouped positions, are placed on a panel aft of the overhead panel.

2.4.1.2 Left and Right Consoles

The left and right consoles accommodate the nose wheel steering handle, ashtrays, cup holders, headset, and microphone, oxygen masks and oxygen control, a waste container, rechargeable flashlight, and recesses for crew publications.

2.4.1.3 Control Pedestal

The control pedestal, located between the two pilots, presents the engine control levers, the engine thrust rating panel, the speed brake lever, the emergency/parking brake lever, flight control switches (including flap selector), the pressurization control, the EICAS reversionary panel, radio management units, single radar control panel, HF control (optional), aileron/elevator disconnect handles, AP control, SPS, T/O configuration switch, and an FMS control display unit.

2.4.1.4 Pilot Seat

The pilot seat is provided with longitudinal, vertical (electrically actuated), seat back, and lumbar adjustments. The seat is attached to tracks which permit the horizontal adjustments.

An extended longitudinal travel permits pilot rest during long cruise flights (pilot foot rests are provided at the bottom of the main instrument panel).

2.4.2 Passenger Cabin

A 0.43 m (17 in) wide aisle, with a recessed floor leaving a 1.82 m (6 ft) height, allows for stand-up walking and the use of standard catering trolleys. The passenger cabin is 2.10 m (6 ft 11 in) wide and the standard configuration accommodates 37 passengers in 12 double seats on the right side, and 13 single seats on the left side, with a 31 in pitch. Different cabin layouts with increased capacity for galley and wardrobe are available as optional models.

2.4.2.1 Passenger Seat

The ergonomic reclining seats have been designed for a 0.79 m (31 in) pitch, with comfortable leg room. Double seats incorporate fold-up center arm rests. All seats are offered with snack tables, magazine pouches, underseat life-vest stowage, seat belts, and an adequate underseat room for carry-on articles with 1.9 m^3 (68.2 ft^3) net volume designed for 280 kg (558 lb) loading.

2.4.2.2 Passenger Service Unit

The passenger service unit contains gasper-type air outlets, reading lights, loudspeakers, attendant calling buttons, warnings, and oxygen dispensing unit for each seat.

2.4.2.3 Overhead Bin

The overhead bin is divided into nine sections and is installed on the right side of the cabin. The bins have a total volume of 1.20 m^3 (42.3 ft^3) and are designed for a 224 kg (494 lb) loading.

All sandwiches have Nomex honeycomb core faced by fiberglass fabric.

2.4.2.4 Wardrobe

Considering all models, the standard right wardrobe with a 0.93 m^3 (32.9 ft^3) total volume and 70 kg (154 lb) capacity is offered for carry-on articles on the forward right side of the passenger cabin between the RH side galley and cockpit partition.

The wardrobe modules are flat sandwich panel constructions with fiberglass facing the Nomex honeycomb core.

Optional LH wardrobe modules are offered as per Figure 2.4.2:

- option 1 replacing the LH standard galley.
- option 2 replacing the LH standard galley and one seat.

2.4.2.5 Flight Attendant Station

The standard flight attendant station is positioned at the cockpit partition, close to the main door. The seat is of the fold-away type to avoid interference with the door passageway. A seat for a second flight attendant is available, as an option, at the aft end of the aisle, standing in front of the lavatory door. When not in use, proper mechanisms allow its sliding against the lavatory wall, behind the last double-seat row.

The attendant seats are made up of machined parts combined with flat sandwich panels of graphite and Nomex honeycomb core.

2.4.2.6 Lavatory

The lavatory is installed at the aft cabin and contains a washbasin, waste container, ashtray, mirror, paper dispenser, automatic fire extinguisher, smoke detection system, and a recirculating toilet unit. A toilet shroud and a ventilation system, at the cabinet and waste tank, assure an odorless environment.

2.4.2.7 Galley

Two galleys modules are installed on the forward passenger cabin.
The galleys are flat sandwich panel constructions with fiberglass fabric facing the Nomex honeycomb core.

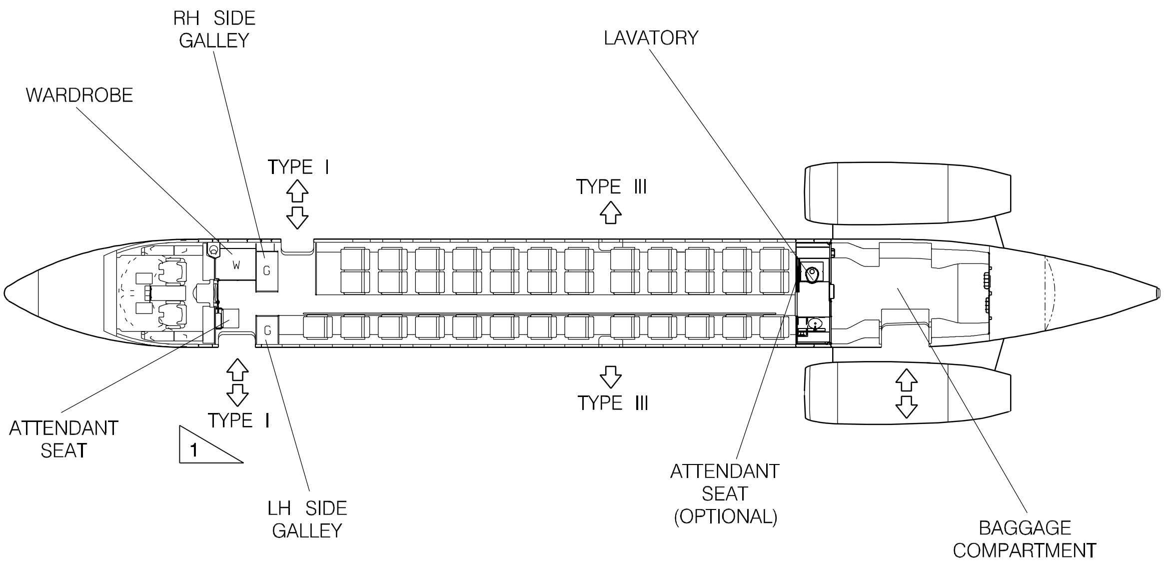
2.4.3 Baggage Compartment

The baggage compartment complies with the FAR-25 ″class C″ requirements, presenting an available volume of 9.21 m^3 (325 ft^3) and maximum loading of 1,000 kg (2,205 lb).
The floor is designed for 390-kg/m^2 (80-lb/ft^2) uniform distributed loading, and is provided with anchor plates for high-density load tie-down.
The compartment is provided with an approved smoke detector system, a ventilation system, and a baggage restraint net.

2.4.4 Observer Seat

The flight observer seat is installed right behind the copilot seat. When in use, it lies in front of the cockpit door, and when stowed, it folds up and rotates away from the door area, stowing against the right side of the cockpit partition. The cockpit door can be opened/closed either with the observer seat in use or stowed.
The observer seat is made up from machined parts combined with flat sandwich panels of graphite and Nomex honeycomb core.

CARGO/BAGGAGE VOLUME - m^3 (ft^3)	
WARDROBE	0.93 (32.9)
RH SIDE GALLEY	0.70 (24.7)
LH SIDE GALLEY	0.31 (10.9)
BAGGAGE COMPARTMENT	9.21 (325.0)
OVERHEAD BIN	1.20 (42.3)
UNDERSEAT VOLUME	1.63 (57.4)



1 TYPE I AND TYPE III ACCORDING TO FAR 25-PAR.25-807

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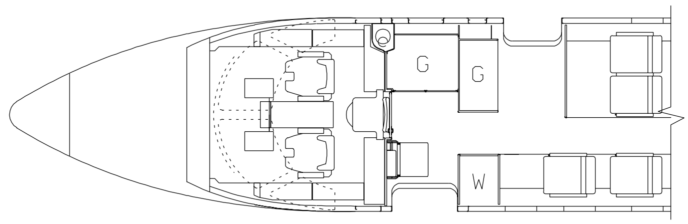
Figure 2.4.1 - Interior Arrangements - Standard Configuration

OPTION 1



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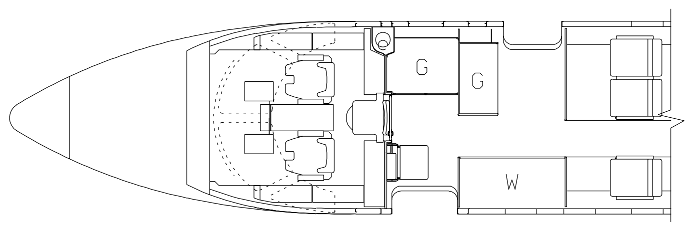
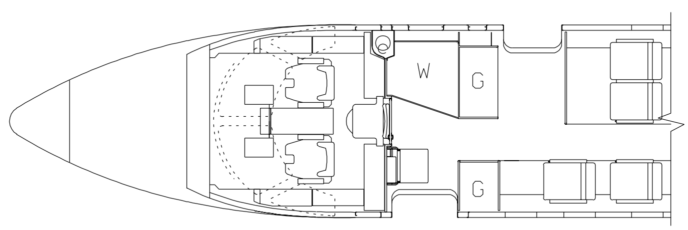


OPTION 3



ITEM	OPTION 1	OPTION 2	OPTION 3
PASSENGERS	37	36	37
HALF TROLLEY	04	04	02
GALLEY (G)	1.63 m^3 (57.5 ft^3)	1.63 m^3 (57.5 ft^3)	1.16 m^3 (41.0 ft^3)
WARDROBE (W)	0.31 m^3 (10.9 ft^3)	0.83 m^3 (29.31 ft^3)	1.04 m^3 (36.73 ft^3)
CATERING	180 kg (396 lb)	180 kg (396 lb)	180 kg (396 lb)

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Figure 2.4.2 - Interior Arrangements - Optional Configuration

2.5 Passenger Cabin Cross-Section

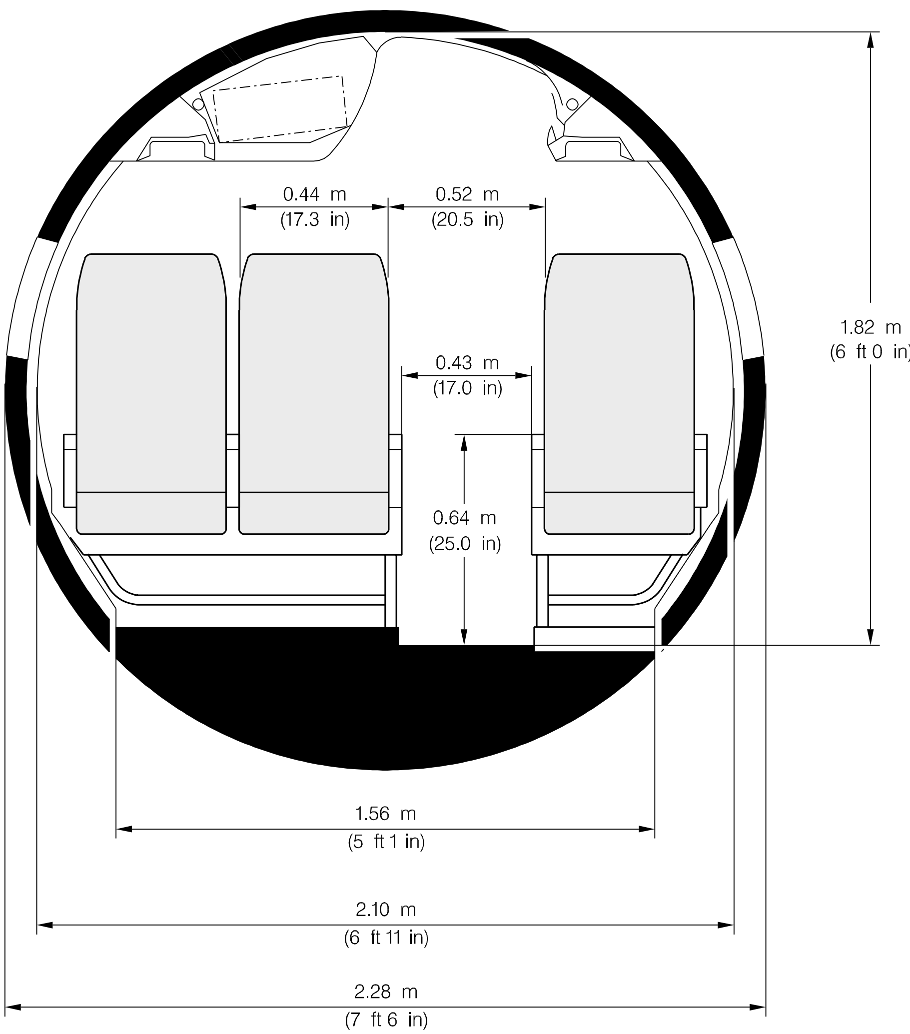

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Figure 2.5.1 - Passenger Cabin Cross-Section

2.6 Lower Compartment Containers

The EMB-135 aircraft does not have lower compartment containers.

2.7 Door Clearances

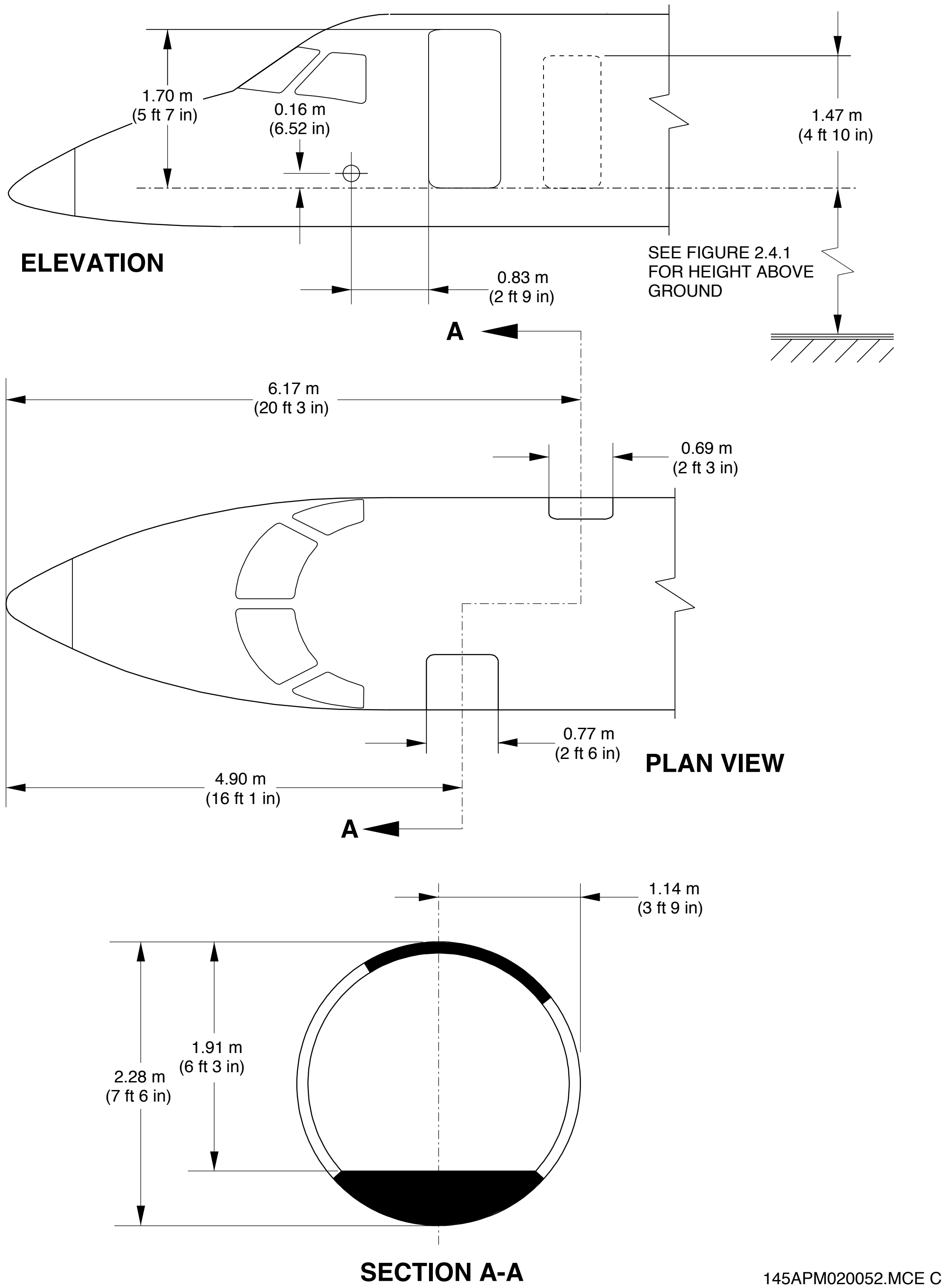

Figure 2.7.1 - Door Clearances
Sheet 1

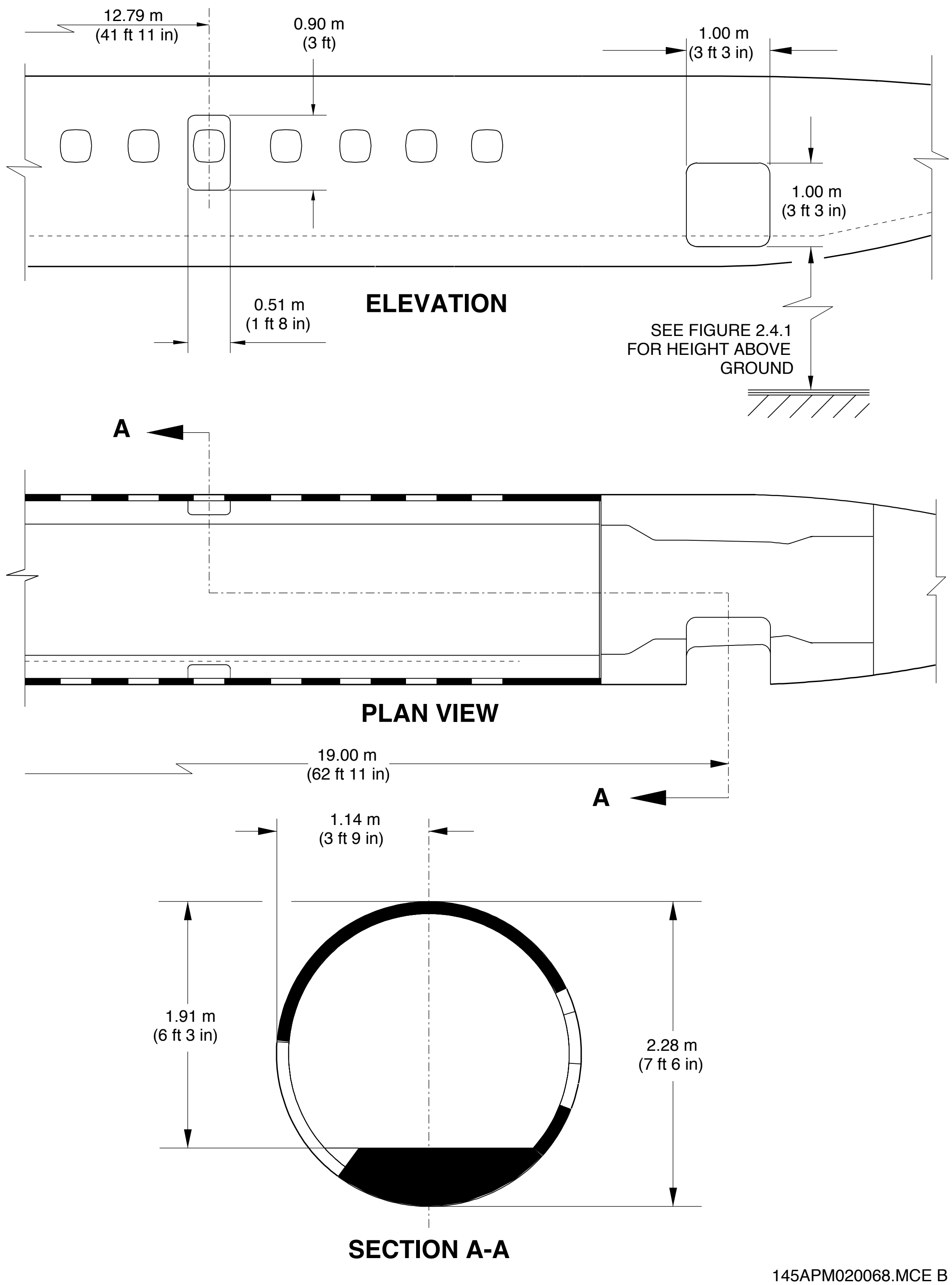

Figure 2.7.1 - Door Clearances
Sheet 2

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3. AIRPLANE PERFORMANCE

3.1 General Information

The performance of the airplane and engine depends on the generation of forces by the interaction between the airplane or engine and the air mass through which it flies. The atmosphere has a pronounced effect on the temperature, pressure and density of the air.

The ICAO - International Civil Aviation Organization establishes standard basics for estimating and comparing airplane and engine performance. Some ICAO - International Civil Aviation Organization standard basics are shown below:

1. Sea level standard day: Standard Temperature To = 15°C (288.15 K) Standard Pressure Po = 101.3 kPa (29.92 in. Hg) Standard Density ρo = 0.002377 slug per cubic feet

2. ISA - International Standard Atmosphere

Table 3.1.1 - ISA - International Standard Atmosphere

ELEVATION		STANDARD DAY TEMP	
m	ft	°C	°F
0	0	15	59
305	1000	13	55.4
610	2000	11.6	51.9
915	3000	9.1	48.3
1220	4000	7.1	44.7
1524	5000	5.1	41.2
1830	6000	3.1	37.6
2440	8000	-0.8	30.5

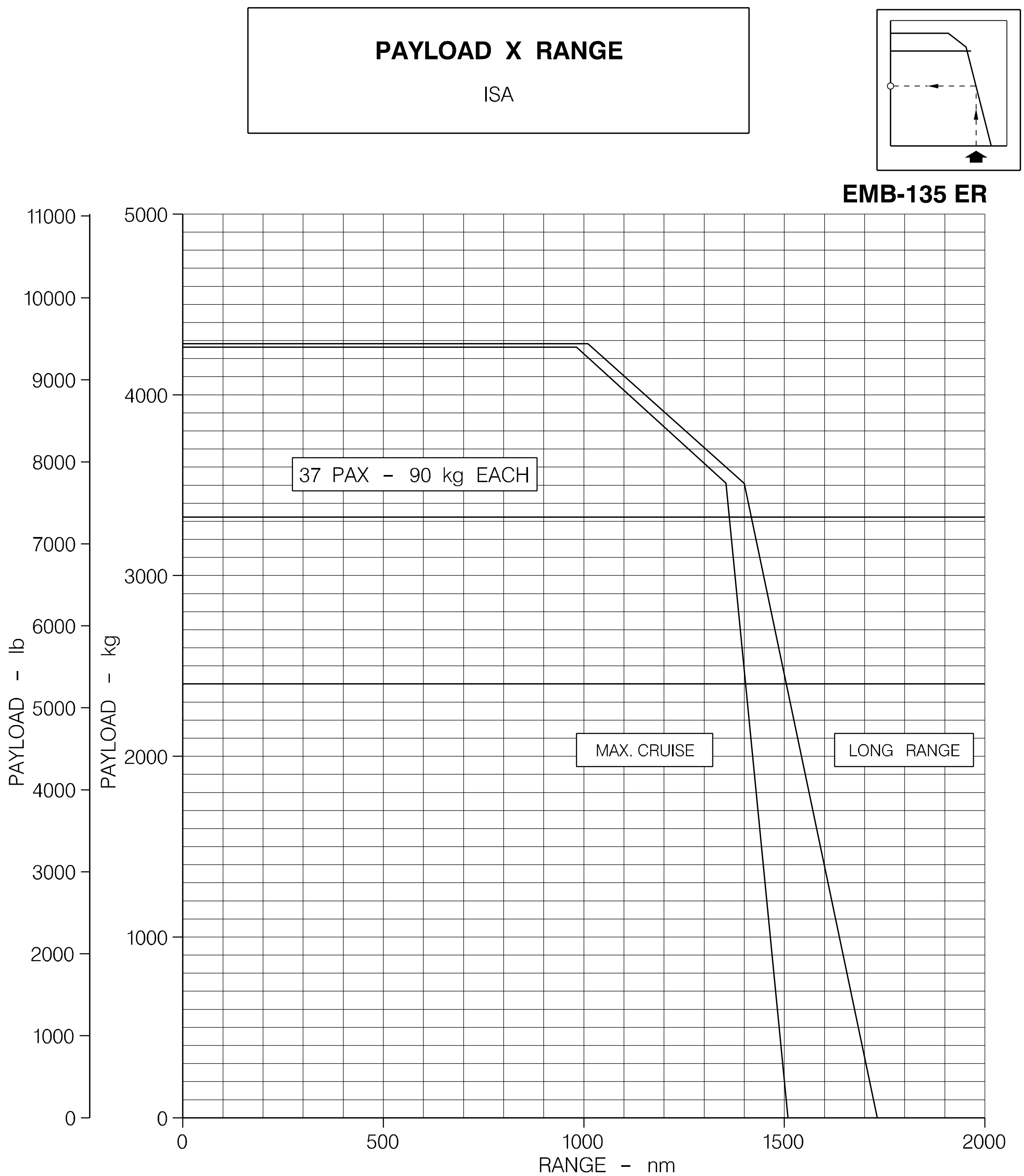
Section 3.2 presents payload x range information for a specific long range, cruise altitude, and the fuel reserve condition shown.

Section 3.3 and 3.4 represent FAR takeoff and landing runway length requirements for FAA certification.

The performance data shown in this section must be used for general airport planning. For information about performance, refer to AOM and AFM - Aircraft Flight Manual.

EMBRAER should be contacted for other charts containing payload x range, takeoff and landing runway length requirements with conditions different from those presented in this section.

3.2 Payload x Range



NOTES: FLIGHT LEVEL................................370
RESERVE...100nm ALTERNATE + 45min HOLDING
MAX TAKEOFF WEIGHT...............19000 kg (41888 lb)
MAX ZERO FUEL WEIGHT..........15600 kg (34392 lb)
BASIC OPERATING WEIGHT.......11320 kg (24956 lb)
MAXIMUM USABLE FUEL............4173 kg (9200 lb)

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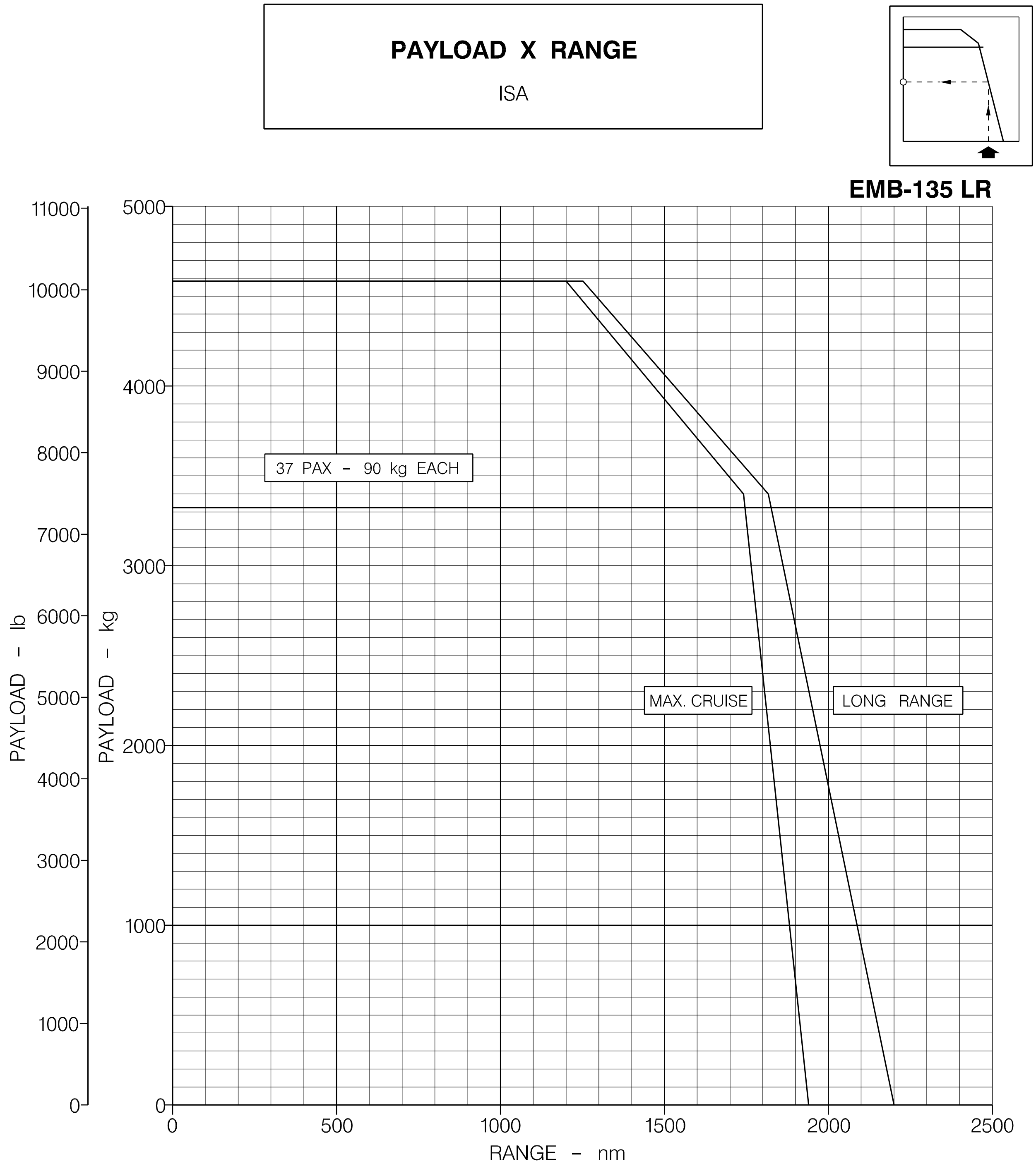
Figure 3.2.1 - Payload x Range, Engine with Thrust Reverser
Sheet 1

PAYLOAD X RANGE

ISA



NOTES: FLIGHT LEVEL...............................370
RESERVE..100nm ALTERNATE + 45min HOLDING
MAX TAKEOFF WEIGHT...............20000 kg (44092 lb)
MAX ZERO FUEL WEIGHT..........16000 kg (35274 lb)
BASIC OPERATING WEIGHT.......11426 kg (25190 lb)
MAXIMUM USABLE FUEL............5187 kg (11435 lb)

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Figure 3.2.1 - Payload x Range, Engine with Thrust Reverser
Sheet 2

3.3 FAR Takeoff Runway Length Requirements

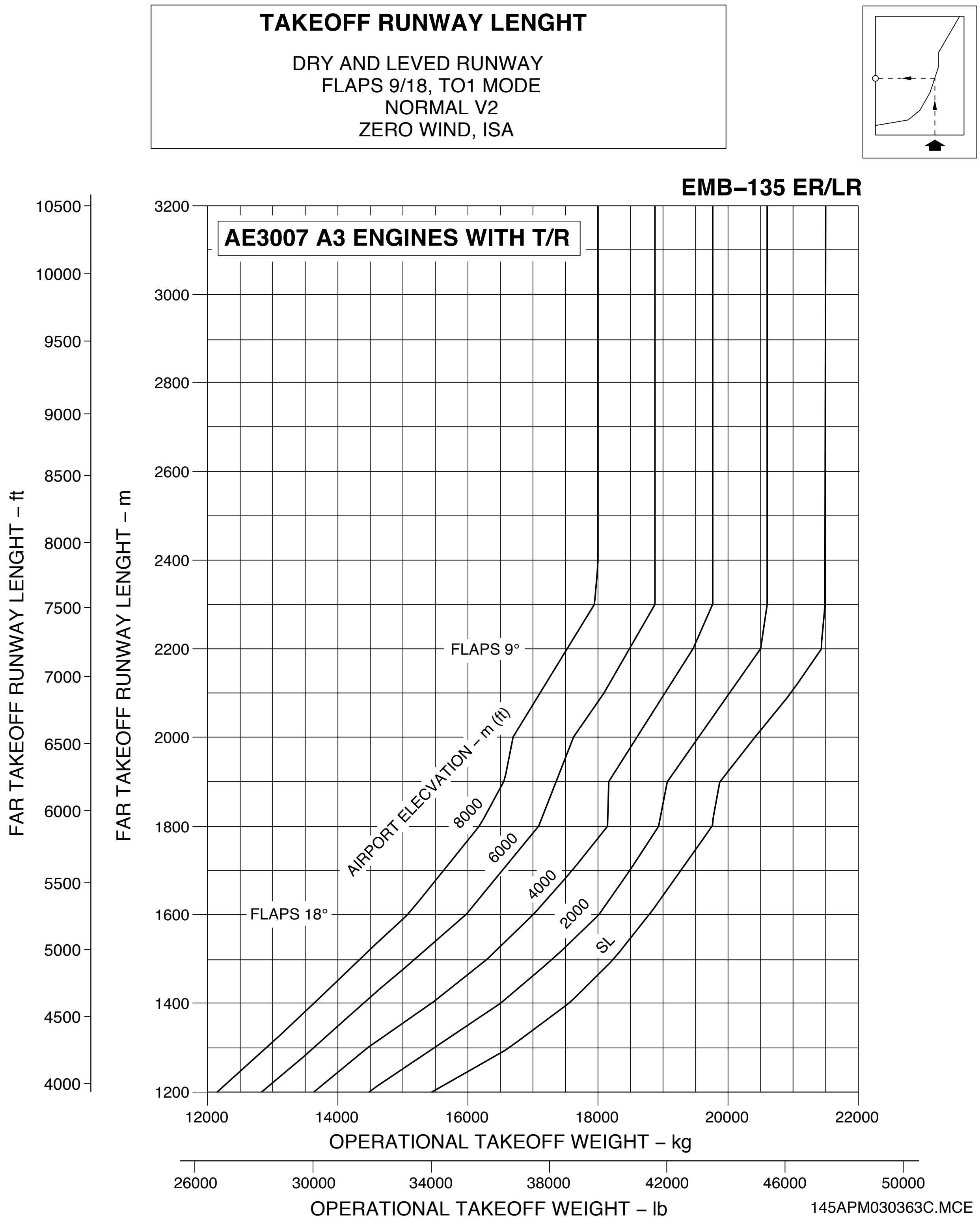
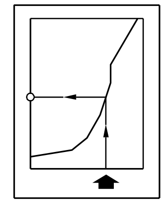


Figure 3.3.1 - FAR Takeoff Runway Length Requirements - ISA Conditions
Sheet 1

TAKEOFF RUNWAY LENGTH

DRY AND LEVELED RUNWAY
FLAPS 9/18, TO1 MODE
NORMAL V2
ZERO WIND, ISA



EMB−135 ER/LR

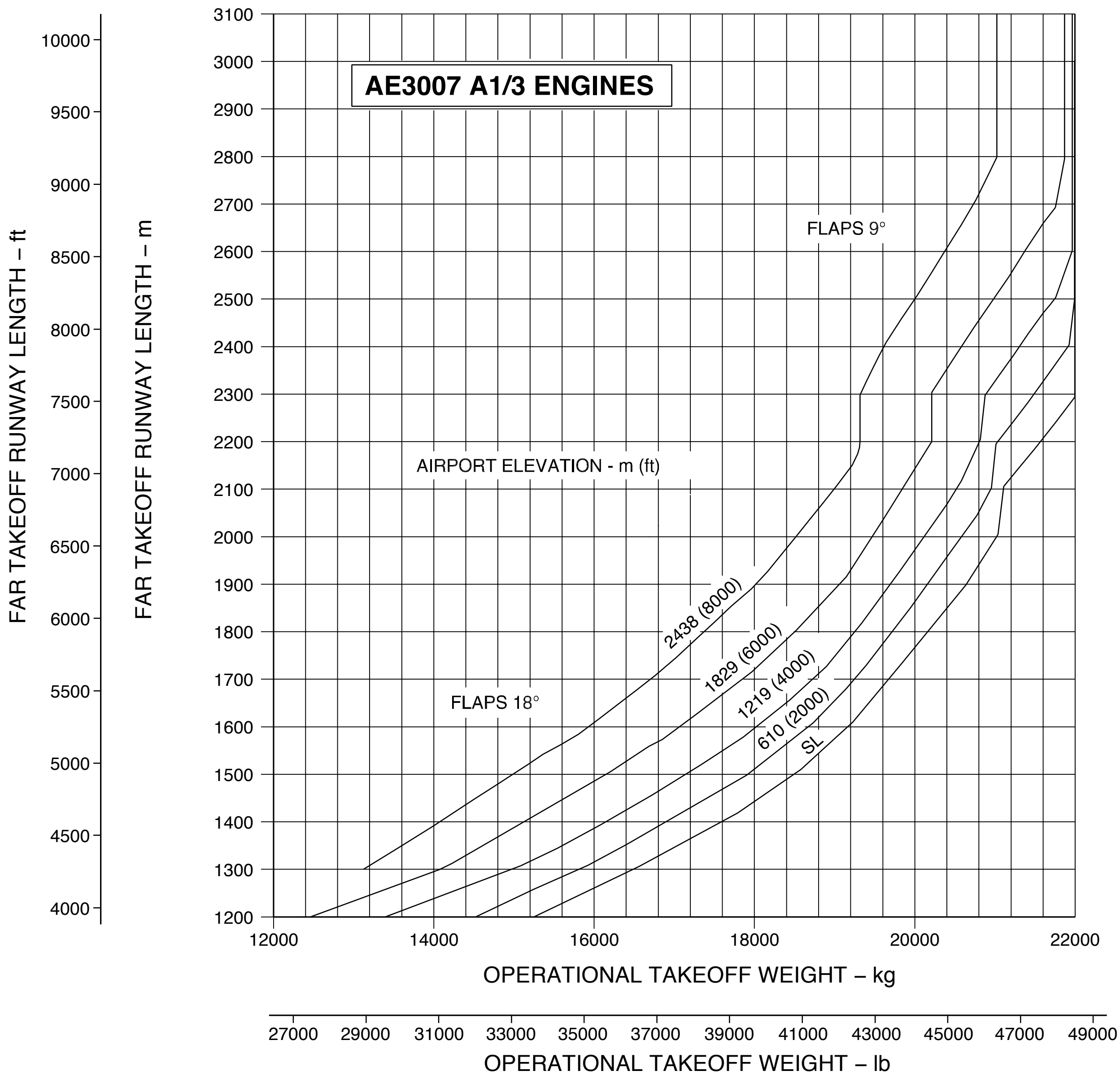


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Figure 3.3.1 - FAR Takeoff Runway Length Requirements - ISA Conditions
Sheet 2

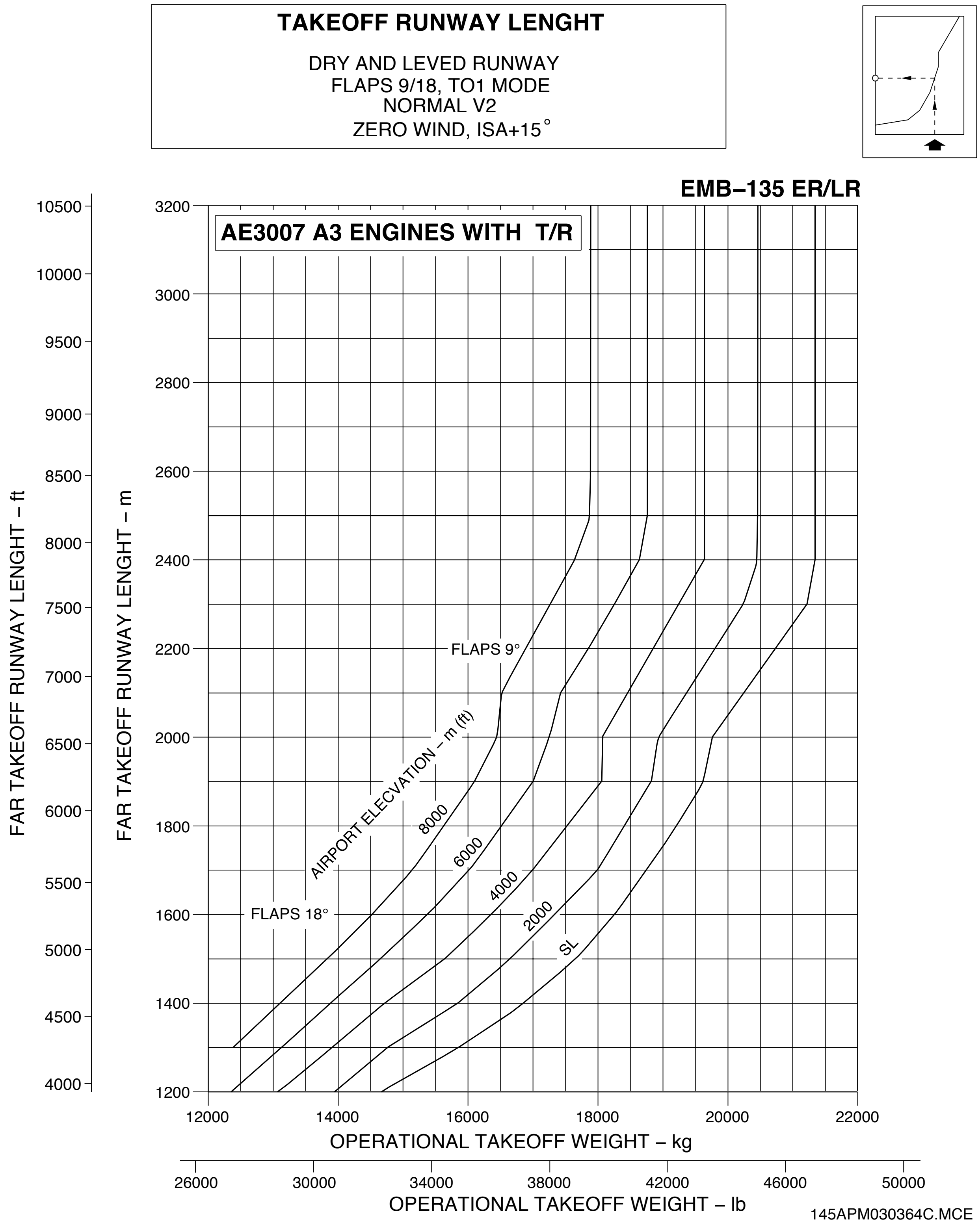
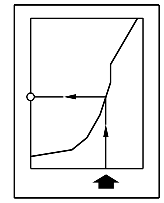


Figure 3.3.2 - FAR Takeoff Runway Length Requirements - ISA + 15°C Conditions
Sheet 1

TAKEOFF RUNWAY LENGTH

DRY AND LEVELED RUNWAY
FLAPS 9/18, TO1 MODE
NORMAL V2
ZERO WIND, ISA+15



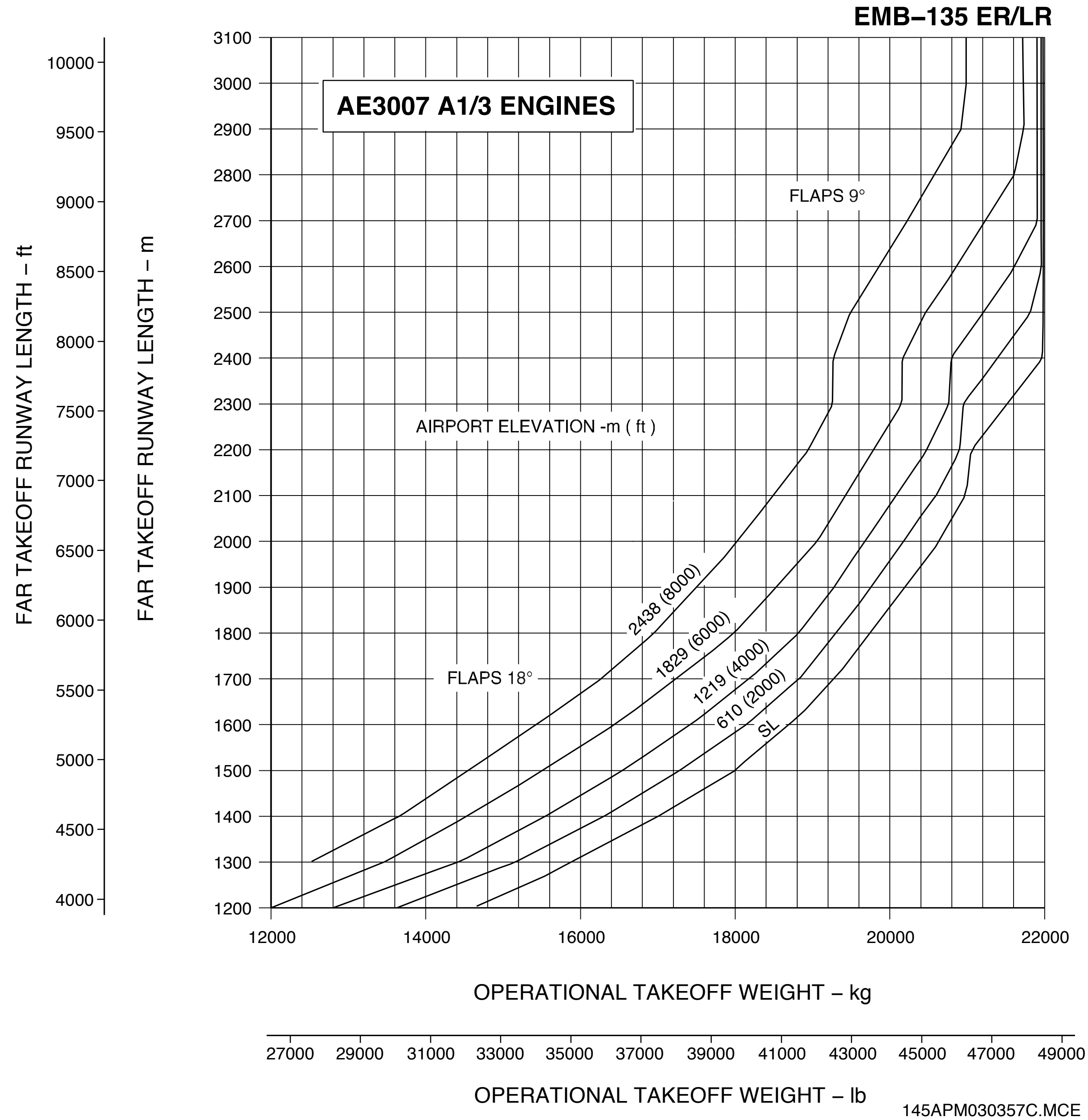


Figure 3.3.2 - FAR Takeoff Runway Length Requirements - ISA + 15°C Conditions Sheet 2

3.4 FAR Landing Runway Length Requirements

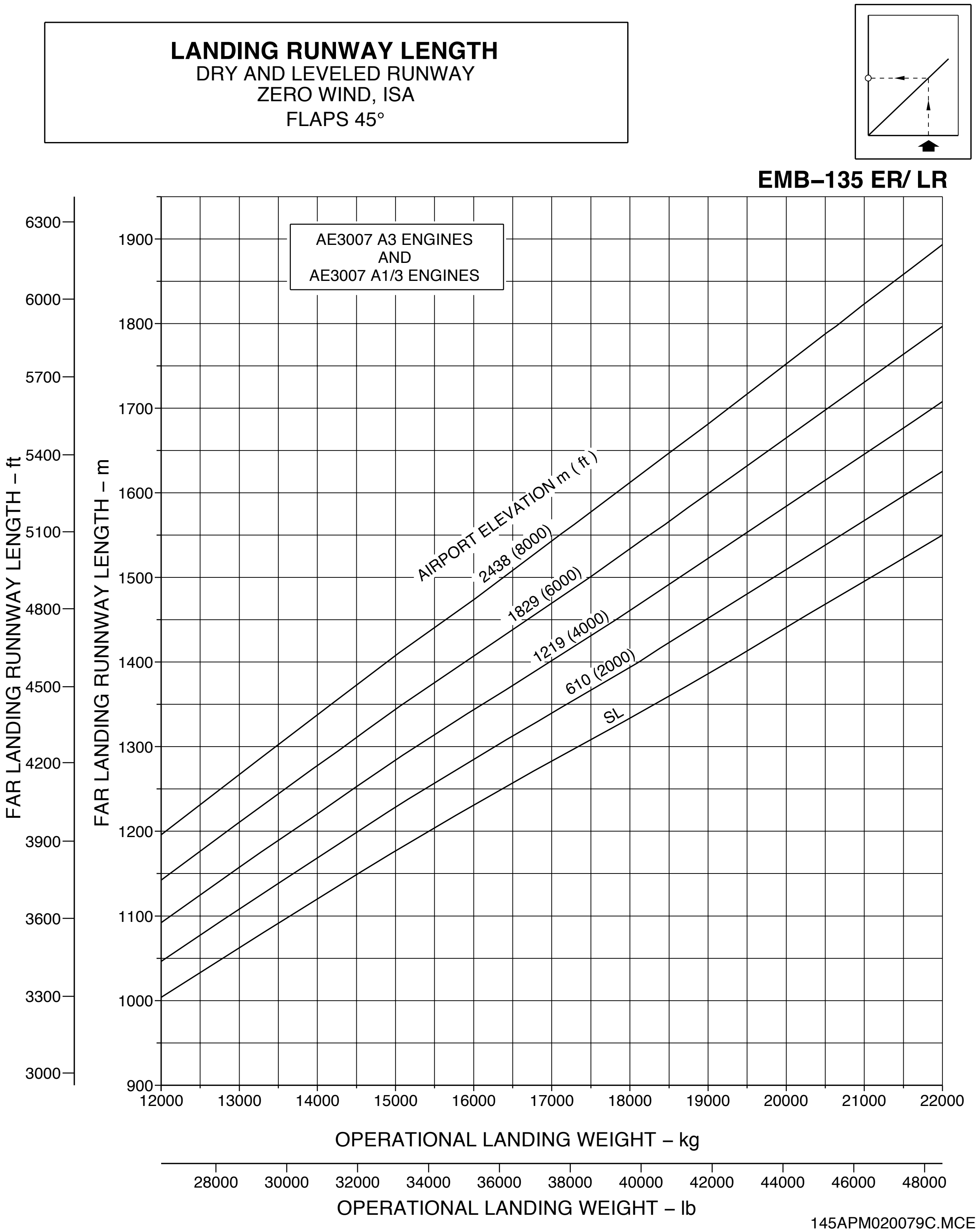


Figure 3.4.1 - FAR Landing Runway Length Requirements - Flaps 45°

4. GROUND MANEUVERING

4.1 General Information

This section provides the airplane turning capability and maneuvering characteristics. For ease of presentation, these data have been determined from theoretical limits imposed by the geometry of the aircraft.

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 the EMB-135.

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 techniques will vary, as far as the performance is concerned, over a wide range of operating circumstances throughout the world.

Variations from standard aircraft operating patterns may be necessary to satisfy physical constants within the maneuvering area, such as adverse grades, limited area, or high risk of jet blast damage. For these reasons, the ground maneuvering requirements should be coordinated with the using airline prior to the layout planning.

Section 4.2 presents the turning radii for various nose gear steering angles.

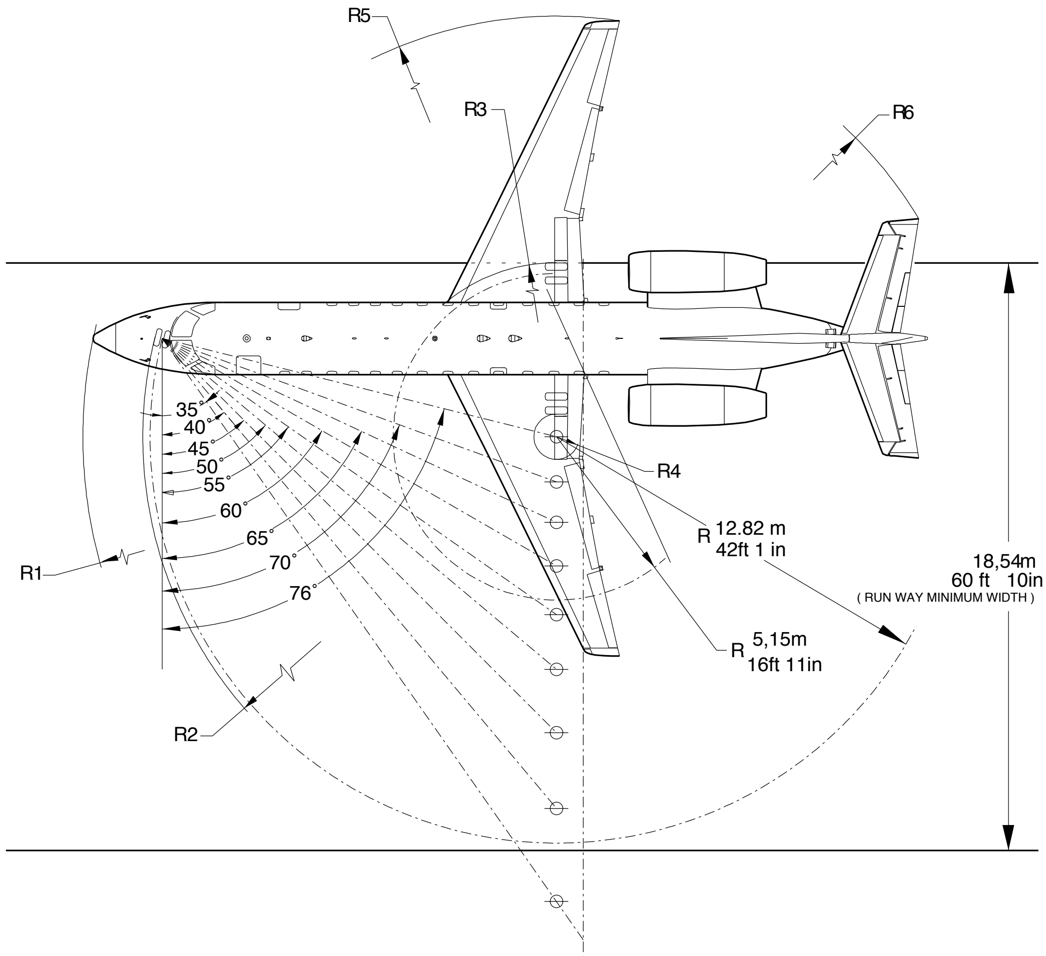
Section 4.3 presents data on the minimum width of the pavement for 180^{o} turn.

Section 4.4 presents the pilot’s visibility from the cockpit and the limits of ambinocular vision through the windows. Ambinocular vision is defined as the total field of vision seen by both eyes at the same time.

Section 4.5 presents the performance of the EMB-135 on runway-to-taxiway, and taxiway-to-taxiway turn paths.

Section 4.6 presents the runway holding bay configuration.

4.2 Turning Radii - No Slip Angle



STEERING STEEL	NOSE R1		NOSE GEAR R2		OUTBOARDGEAR R3		INBOARD GEAR R4		RIGHT WINGTIP R5		RIGHTTAILTIP R6	
35°	23,07 m	75ft 8in	21,91 m	71ft 11in	20,16 m	66ft 2in	15,38 m	50ft 6in	27,86 m	91ft 5in	24,39 m	80ft 0in
40°	20,87 m	68ft 6in	19,58 m	64ft 3in	17,22 m	56ft 6in	12,44 m	40ft 10in	24,93 m	81ft 9in	21,84 m	71ft 8in
45°	19,24 m	63ft 1in	17,82 m	58ft 5in	14,83 m	48ft 8in	10,06 m	33ft 0in	22,55 m	74ft 0in	19,84 m	65ft 1in
50°	17,99 m	59ft 0in	16,46 m	54ft 0in	12,83 m	42ft 1in	8,06 m	26ft 5in	20,56 m	67ft 5in	18,24 m	59ft 10in
55°	17,04 m	55ft 11in	15,41 m	50ft 7in	11,10 m	36ft 5in	6,33 m	20ft 9in	18,84 m	61ft 10in	16,93 m	55ft 7in
60°	16,33 m	53ft 6in	14,59 m	47ft 10in	9,58 m	31ft 5in	4,80 m	15ft 9in	17,32 m	56ft 10in	15,84 m	52ft 0in
65°	15,74 m	51ft 8in	13,95 m	45ft 9in	8,19 m	26ft 11in	3,42 m	11ft 3in	15,95 m	52ft 4in	14,91 m	48ft 11in
70°	15,31 m	50ft 3in	13,46 m	44ft 2in	6,92 m	22ft 8in	2,14 m	7ft 0in	14,69 m	48ft 2in	14,13 m	46ft 4in
76°	14,94 m	49ft 0in	13,05 m	42ft 10in	5,49 m	18ft 0in	0,72 m	2ft 4in	13,27 m	43ft 7in	13,34 m	43ft 9in

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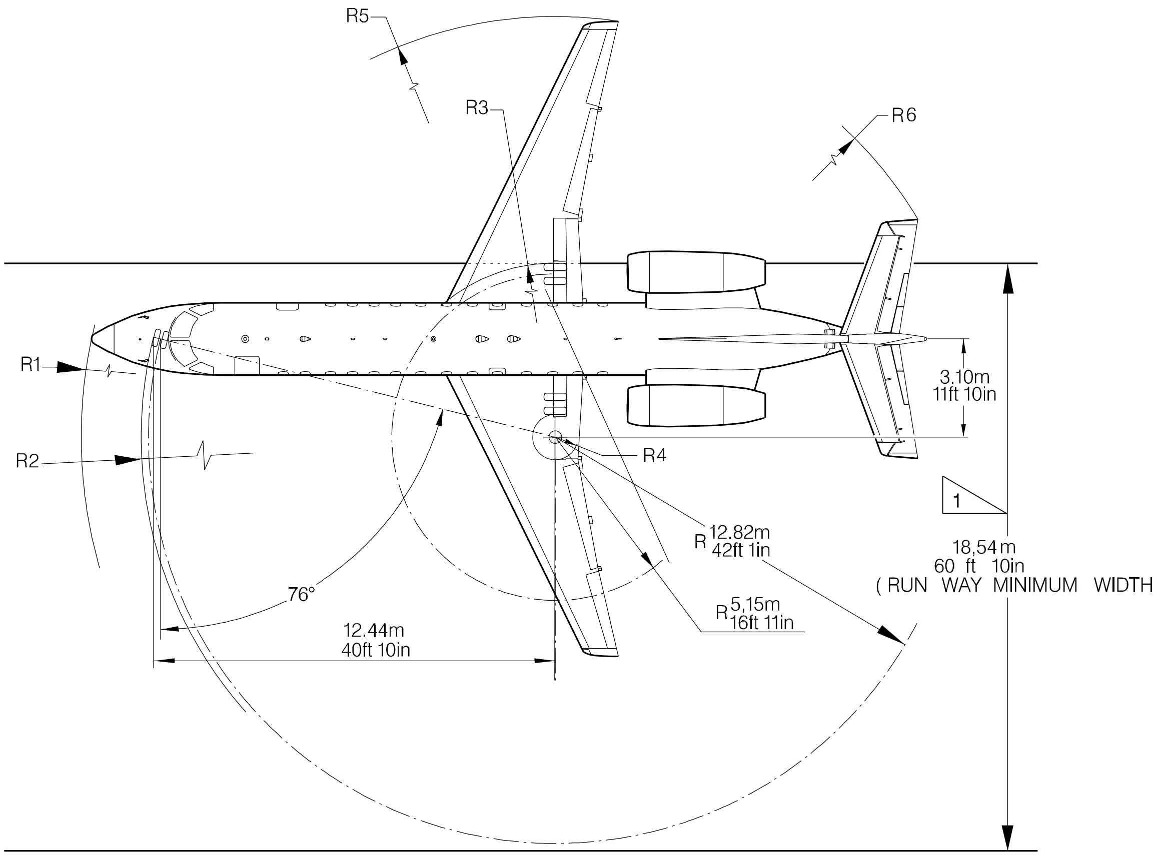
Figure 4.2.1 - Turning Radii - No Slip Angle

4.3 Minimum Turning Radii



STEERING STEEL	NOSE		NOSE GEAR		OUTBOARD GEAR		INBOARD GEAR		RIGHT WINGTIP		RIGHT TAILTIP	
	R1		R2		R3		R4		R5		R6	
76°	14.94m	49ft 0in	13.05m	42ft 10in	5.49m	18ft 0in	0.72m	2ft 4in	13.27m	43ft 7in	13.34m	43ft 9in

NOTE: ACTUAL OPERATING DATA WILL BE GREATER THAN VALUES SHOWN SINCE TIRE SLIPPAGE IS NOT CONSIDERED IN THIS CALCULATION.

1 PAVEMENT WIDTH FOR 180° TURN

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Figure 4.3.1 - Minimum Turning Radii

4.4 Visibility from Cockpit in Stationary Position

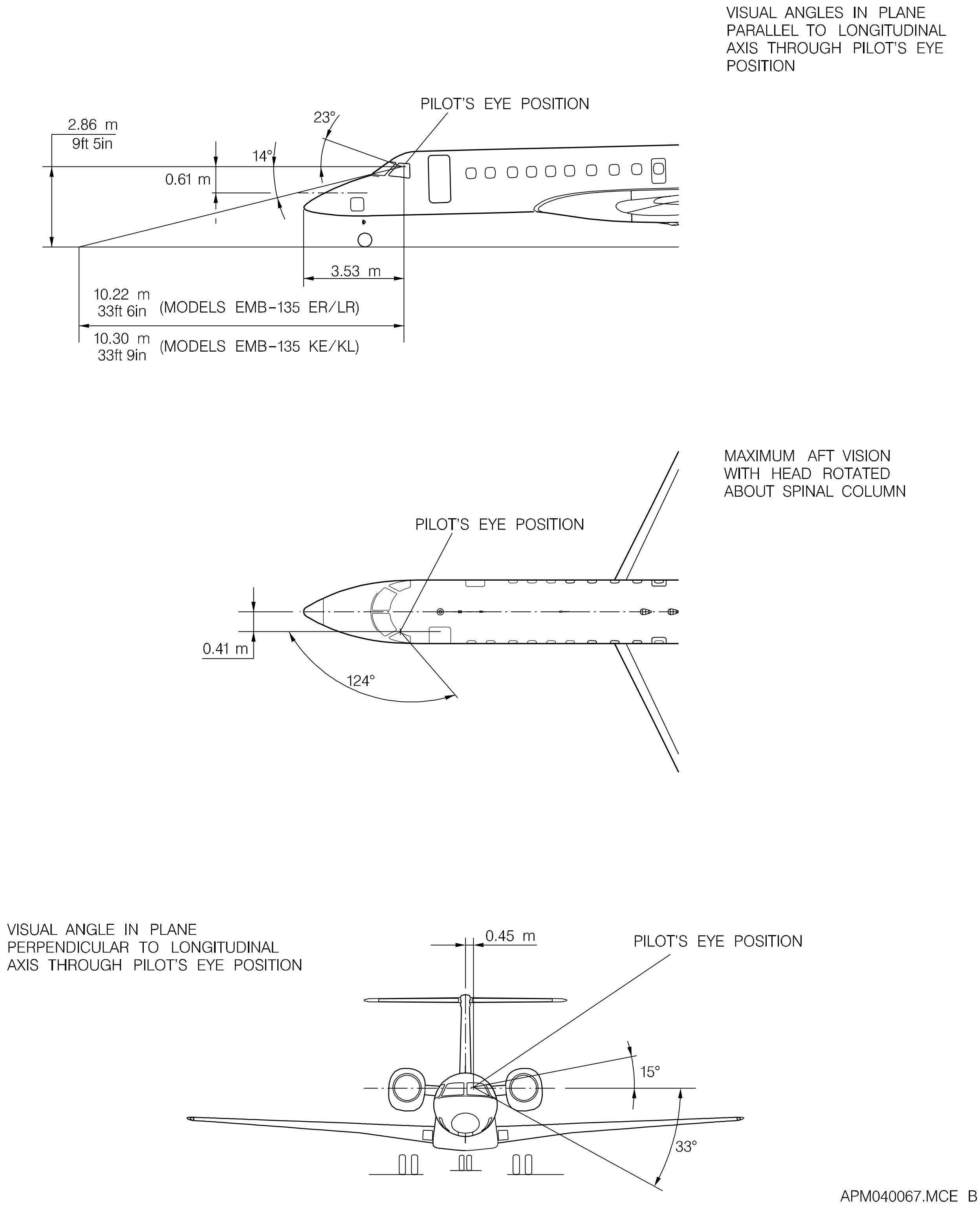

Figure 4.4.1 - Visibility from Cockpit in Stationary Position

4.5 Runway and Taxiway Turn Paths

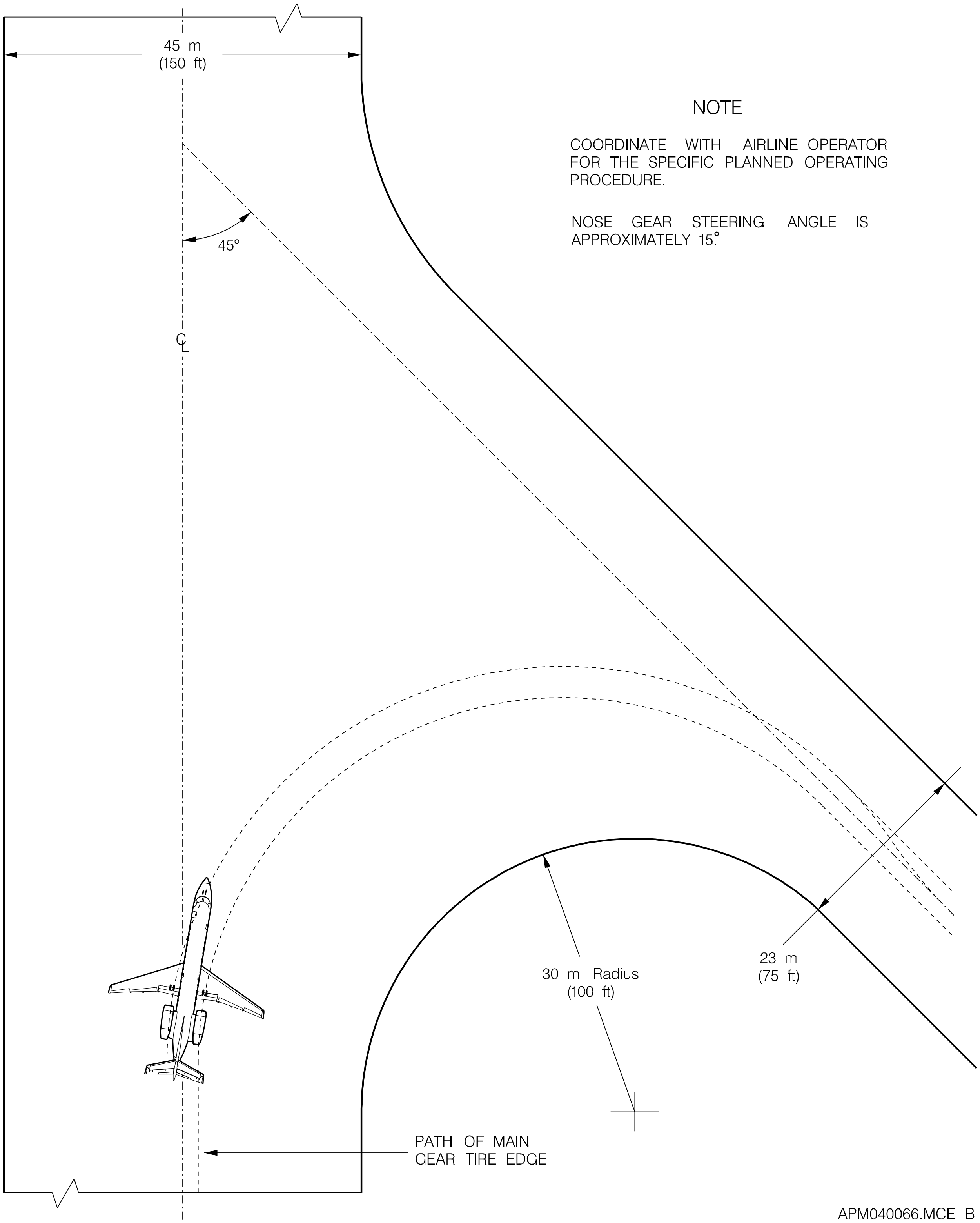

Figure 4.5.1 - More than 90° Turn - Runway to Taxiway

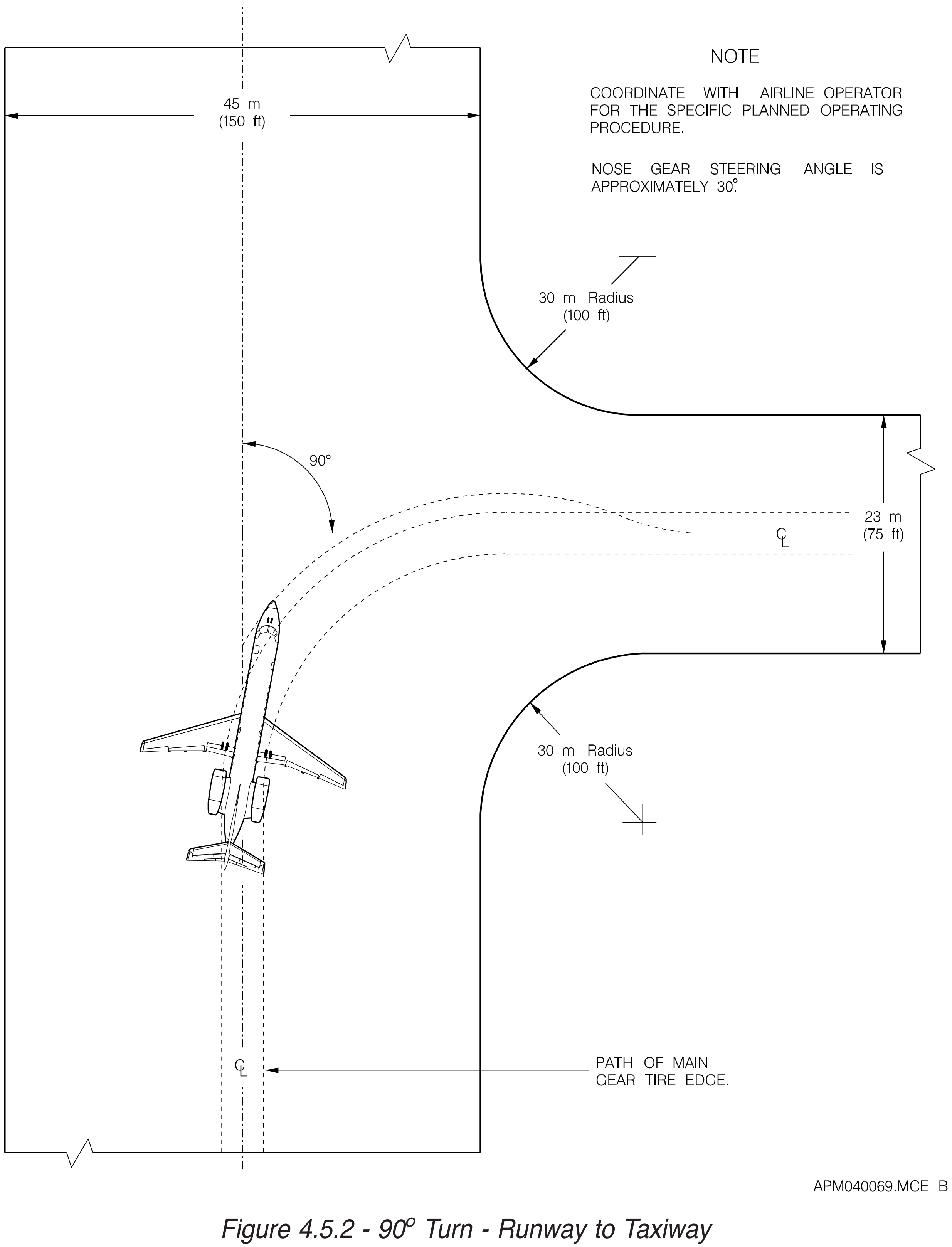

Figure 4.5.2 - 90° Turn - Runway to Taxiway

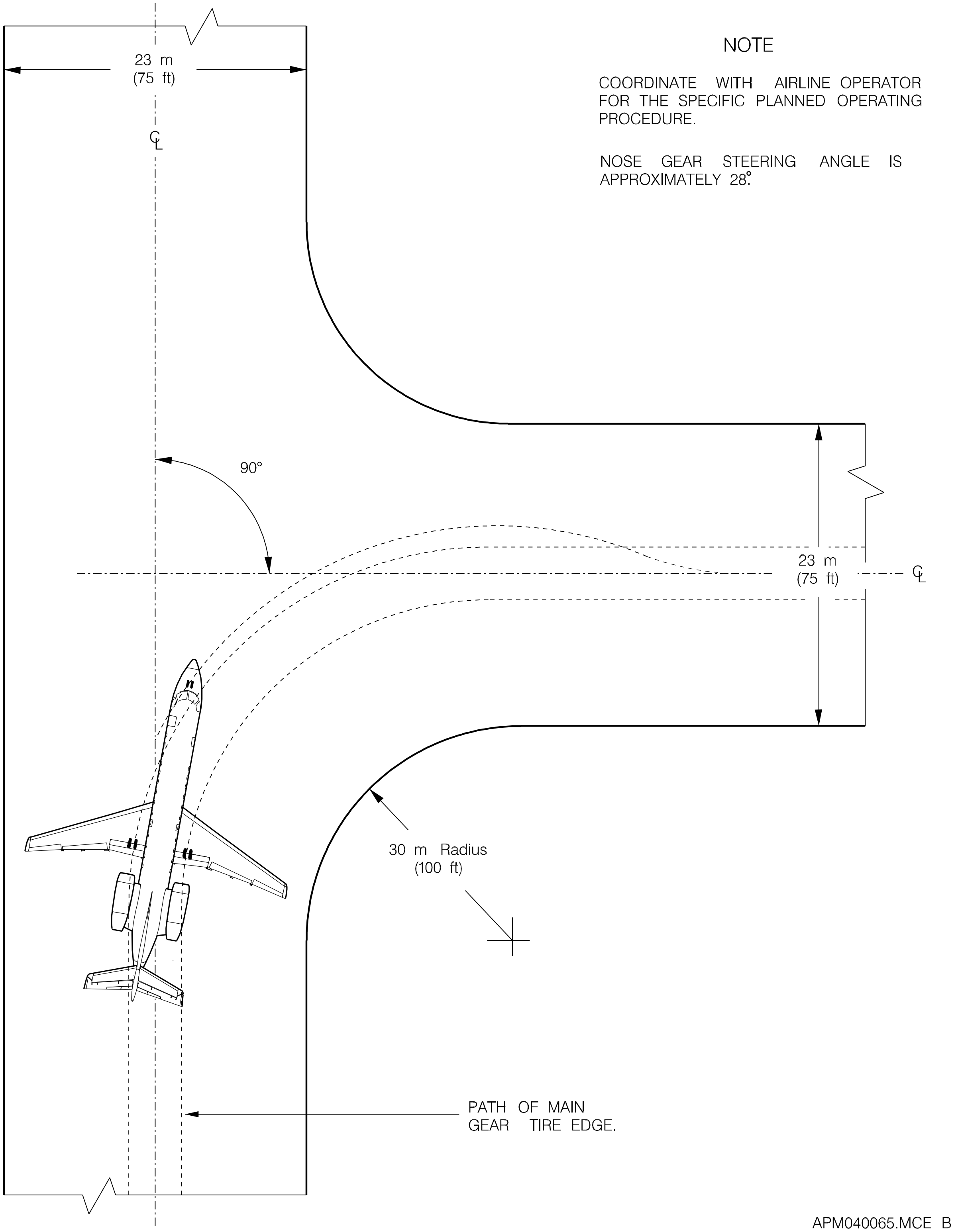

Figure 4.5.3 - 90° Turn - Taxiway to Taxiway

4.6 Runway Holding Bay

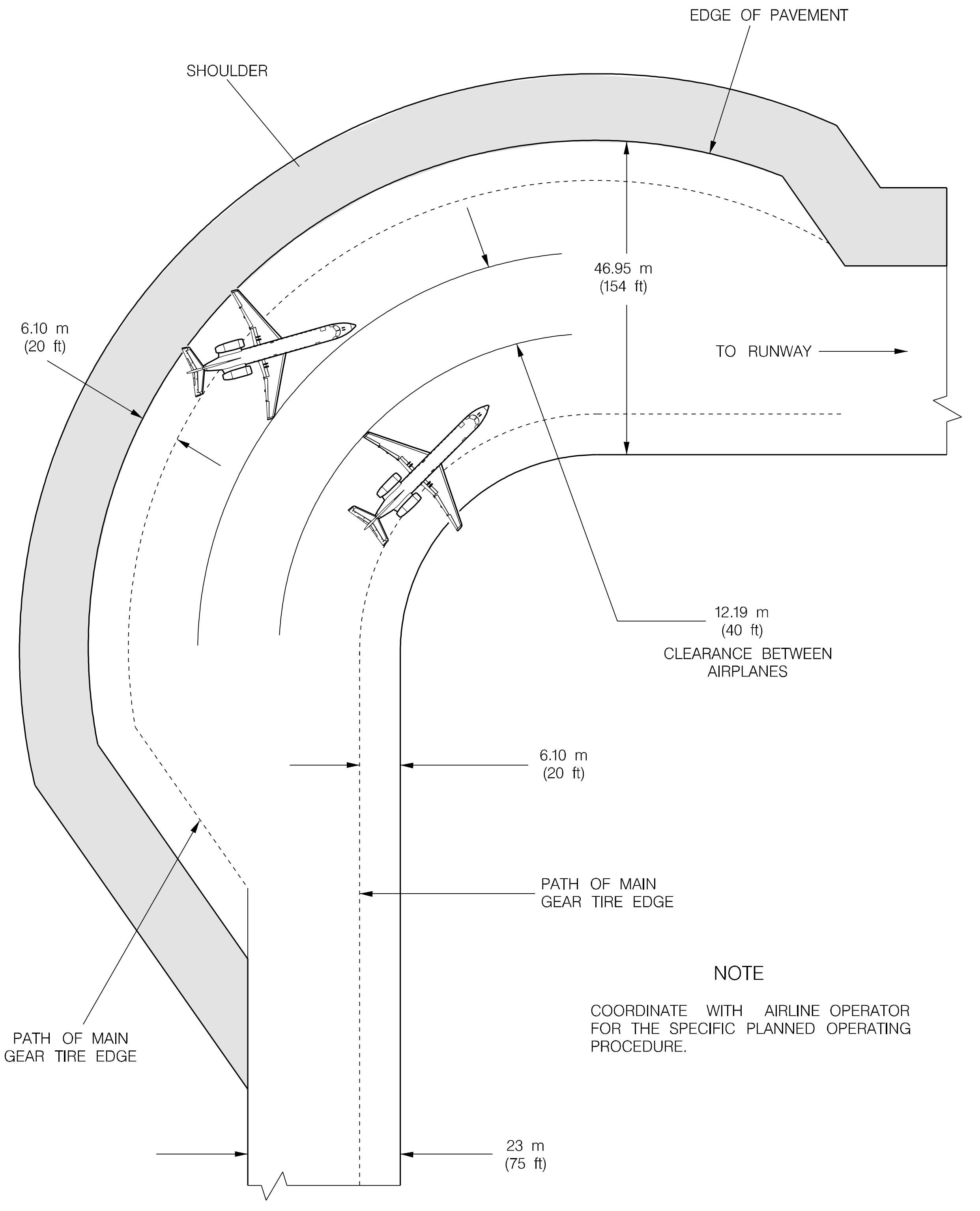

Figure 4.6.1 - Runway Holding Bay

5. TERMINAL SERVICING

5.1 General Information

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

This section provides the following information:

– Typical arrangements of ground support equipment during turnaround.

– Typical turnaround and enroute servicing times at an air terminal. These charts give typical schedules for performing servicing on the airplane within a given time. Servicing times could be rearranged to suit availability of personnel, airplane configuration, and degree of servicing required.

– The locations of ground servicing connections in graphic and tabular forms. Typical capacities and servicing requirements are shown in the figures. Services with requirements that vary with conditions are described in the subsequent figures.

– Air conditioning requirements for heating and cooling the airplane, using low-pressure conditioned air. This conditioned air is supplied through an 8-inch GAC directly to the air distribution system, bypassing the air-cycle machines. Normally, a 36000 BTU/h source would be sufficient to meet the air conditioning requirements.

– Ground towing requirements for various towing conditions. Drawbar pull and total traction wheel load may be determined by considering airplane weight, pavement slope, coefficient of friction, and engine idle thrust.

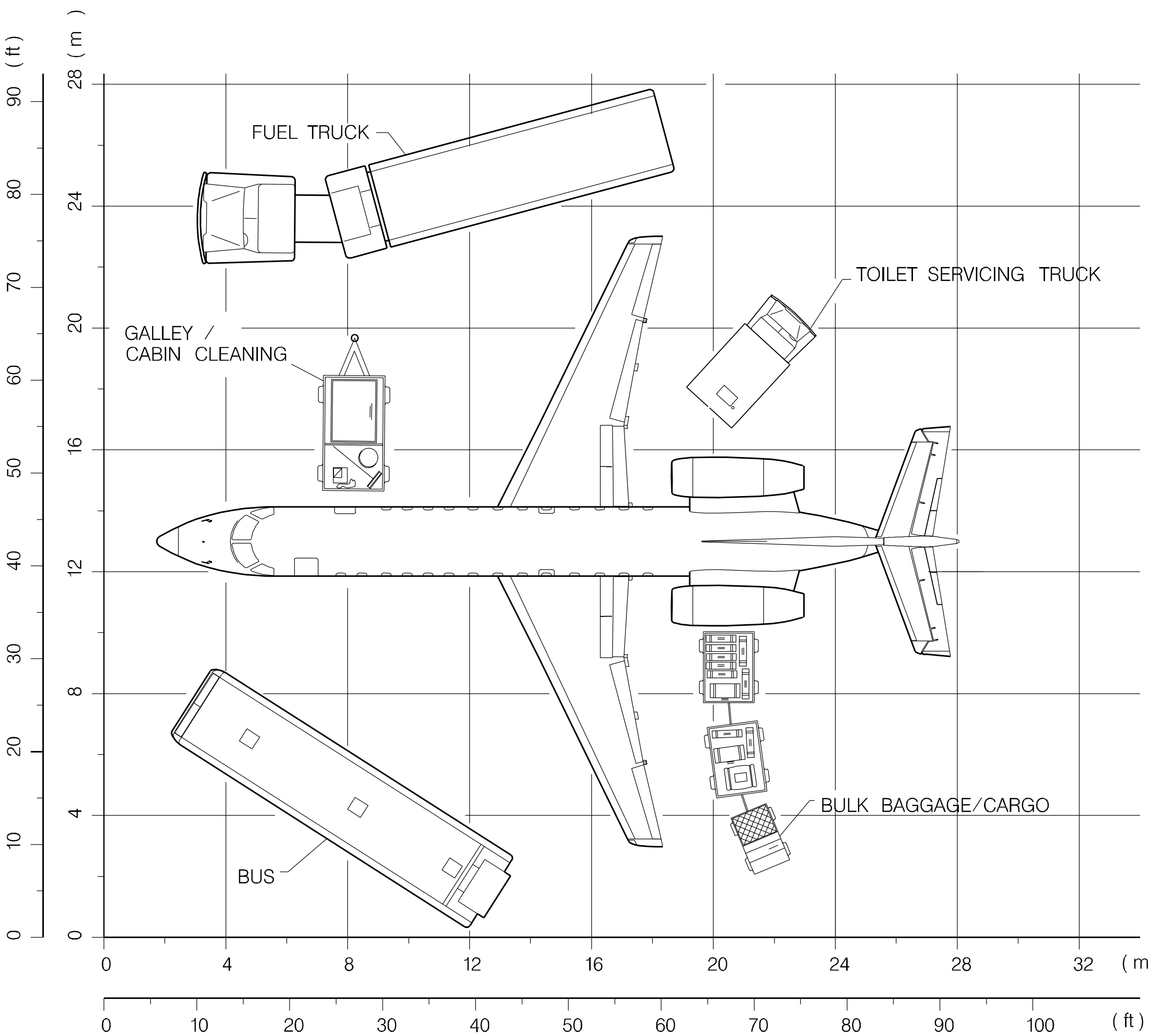

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Figure 5.1.1 - Airplane Servicing Arrangement
Sheet 1

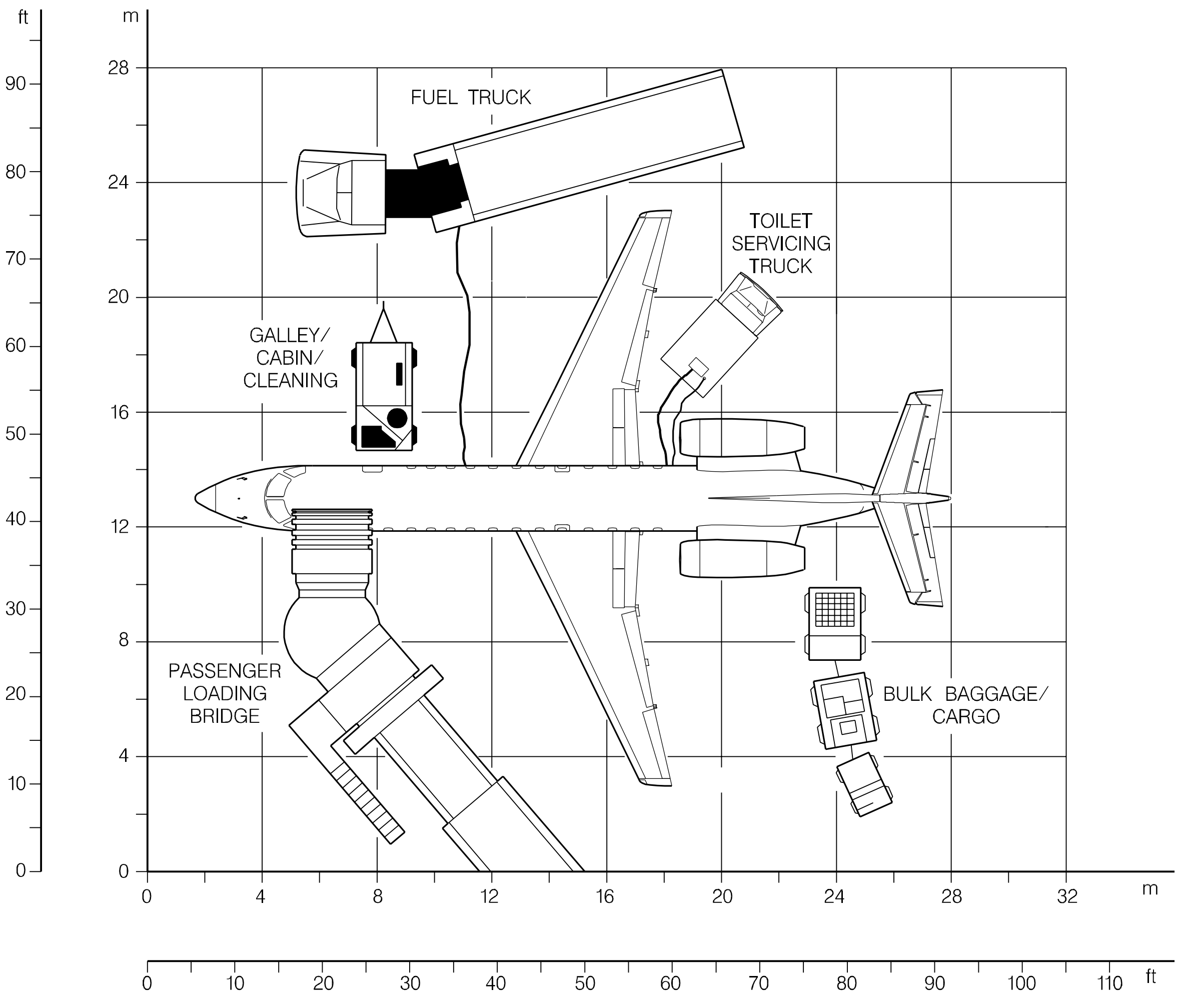

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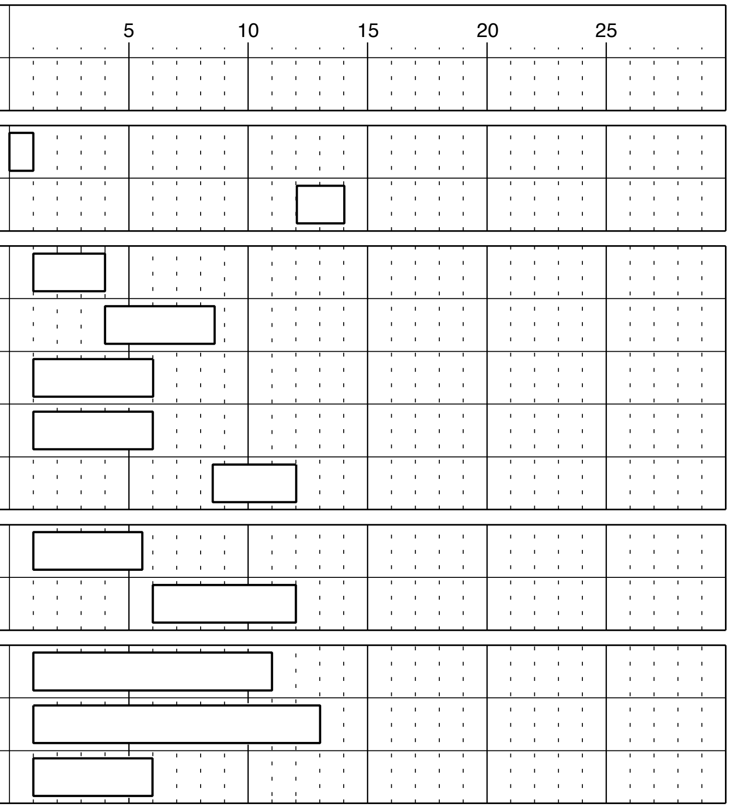
Figure 5.1.1 - Airplane Servicing Arrangement
Sheet 2

5.2 Air Terminal Operation - Turnaround Station

OPERATIONS		MIN
COCKPIT CREW DUTIES	SHUTDOWN ENGINES	1
	CLEAR AIRPLANE FOR DEPARTURE	2
PASSENGER SERVICE	DEPLANE PASSENGERS	3
	SERVICE AIRPLANE INTERIOR	4.5
	SERVICE GALLEY	5
	SERVICE POTABLE WATER	5
	ENPLANE PASSENGERS	3.5
BAGGAGE AND CARGO	UNLOAD BAGGAGE/CARGO	4.5
	LOAD BAGGAGE/CARGO	6
OTHER SERVICE	FUEL AIRPLANE (EMB–135 ER)	10
	FUEL AIRPLANE (EMB–135 LR)	12
	SERVICE TOILET	5



NOTE:

– TIME OF 14 MINUTES INCLUDES EQUIPMENT POSITIONING AND REMOVAL
– 85% FUEL TANK CAPACITY REFUELING PRESSURE 50 psi (344 kPa) at 125 gpm (473 lpm)

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Figure 5.2.1 - Air Terminal Operation - Turnaround Station

5.3 Air Terminal Operation - Enroute Station

	OPERATIONS	MIN
COCKPIT CREW DUTIES	SHUTDOWN ENGINES	1
	CLEAR AIRPLANE FOR DEPARTURE	2
PASSENGER SERVICE	DEPLANE PASSENGERS	2,5
	SERVICE AIRPLANE INTERIOR	2,5
	SERVICE GALLEY	3
	SERVICE POTABLE WATER	5
	ENPLANE PASSENGERS	2,5
BAGGAGE AND CARGO	UNLOAD BAGGAGE/CARGO	3
	LOAD BAGGAGE/CARGO	4,5
OTHER SERVICE	SERVICE TOILET	4,5

TIME (MINUTES): 5 10 15 20

NOTE:

– TIME OF 10,5 MINUTES INCLUDES EQUIPMENT POSITIONING AND REMOVAL

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Figure 5.3.1 - Air Terminal Operation - Enroute Station

5.4 Ground Servicing Connections

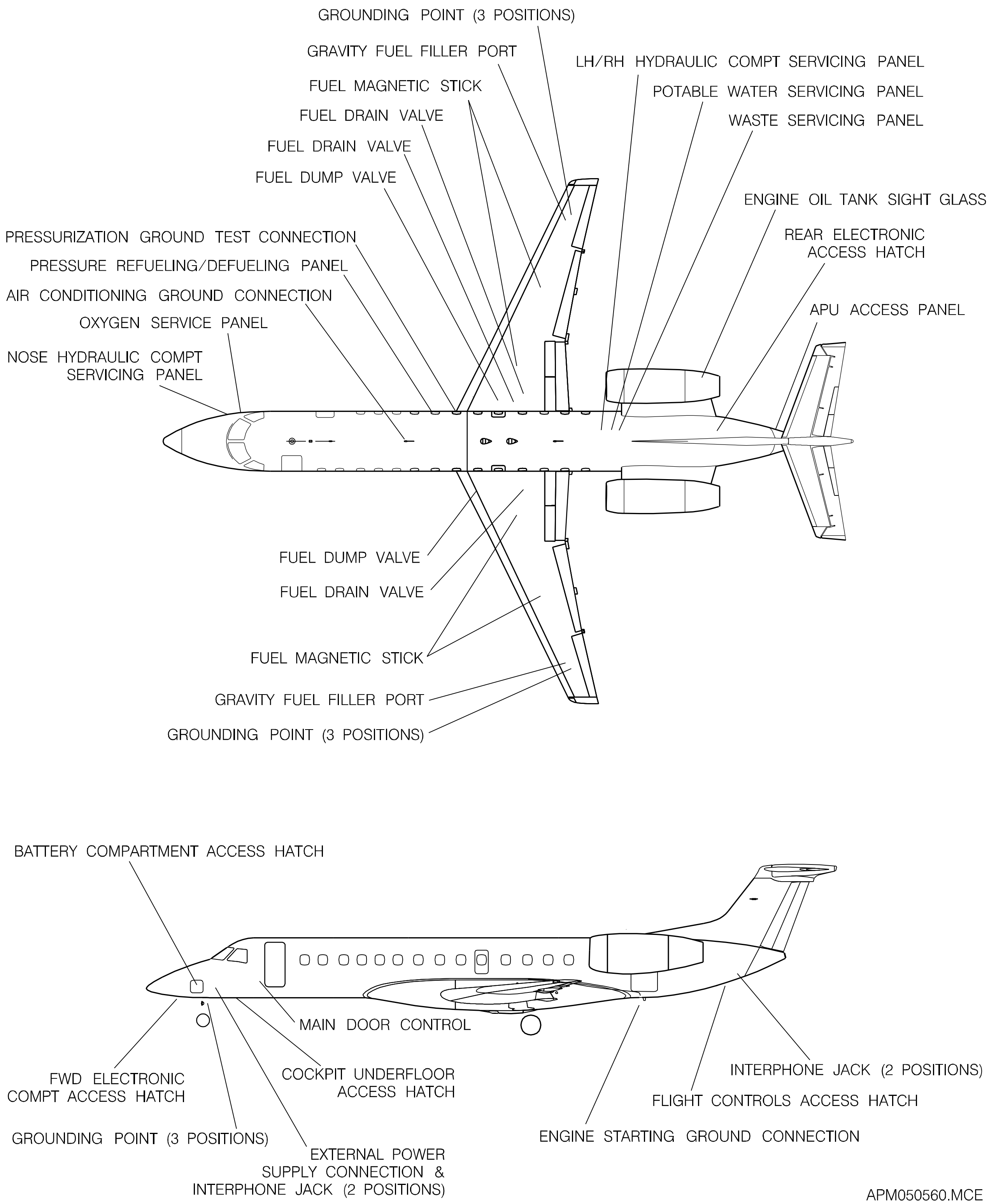
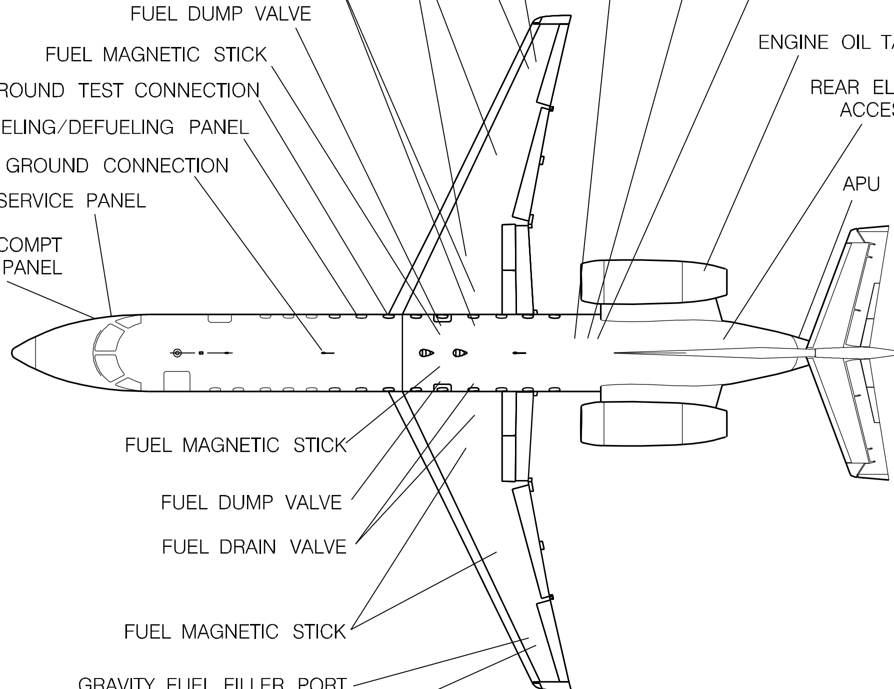


Figure 5.4.1 - EMB-135 ER Ground Servicing Connections

Table 5.4.1 - EMB-135 ER Ground Servicing Connections

SYSTEM	DISTANCE AFT OF NOSE		DISTANCE FROM AIRPLANE CENTERLINE				HEIGHT ABOVE GROUND	
			RIGHT SIDE		LEFT SIDE		MAXIMUM	
	ft-in	m	ft-in	m	ft-in	m	ft-in	m
5.4.1 Hydraulic Power System Three Servicing Connections:								
A. Nose Servicing Panel	6-3	1.90	2-8	0.81	-	-	5-7	1.69
B. LH and RH Servicing Panels	56-2	17.26	1-9	0.53	1-9	0.53	5-4	1.63
5.4.2 Electrical Power System One External Power Supply Connection 28 V DC - 1600 A...	7-5	2.26	-	-	3-1	0.94	5-7	1.71
5.4.3 Oxygen System One Servicing Panel	12-11	3.93	2-8	0.81	-	-	5-1	1.74
5.4.4 Fuel System								
A. Gravity Fuel Filler Port	45-10	15.99	17-10	5.43	17-10	5.43	6-1	1.84
B. Fuel Magnetic Stick	43-1	13.14	8-11	2.73	8-11	2.73	4-3	1.31
C. Fuel Magnetic Stick	45-10	13.98	16-4	4.98	16-4	4.98	5-6	1.57
D. Fuel Drain Valve	42-4	12.90	3-6	1.06	3-6	1.06	4-6	1.37
E. Fuel Dump Valve	41-6	12.65	5-1	1.55	5-1	1.55	3-8	1.12
F. Pressure Refueling/Defueling Panel	31-6	9.6	2-10	0.86	-	-	4-11	1.51
5.4.5 Air Conditioning System								
One Pressurization Ground Test Connection	33-4	10.17	2-5	0.73	-	-	5-6	1.68
One Air Conditioning Ground Connection	29-0	8.86	1-6	0.46	-	-	5-7	1.72
5.4.6 Portable Water System	57-1	17.67	2-3	0.69	-	-	6-5	1.97
One Servicing Panel	58-11	17.67	0-2	0.69	-	-	5-12	1.97
5.4.7 Lavatory System Waste Servicing Panel	58-7	17.87	0-4	0.40	-	-	5-3	1.86
5.4.8 Powerplant Two Engine Oil Supply/Level Check Panels								
A. LH Panel	62-11	19.20	-	-	16-1/2	1.84	10-1/2	3.06
B. RH Panel	62-11	19.20	7-8	2.35	-	-	10-1/2	3.06
Ground Connection for Engine Air Starting	65-3	19.88	0-11	0.27	-	-	5-2	1.57



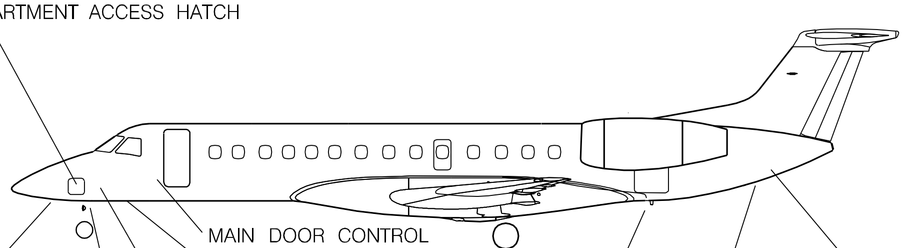


Figure 5.4.2 - EMB-135 LR Ground Servicing Connections

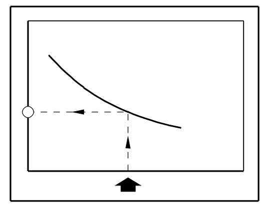
Table 5.4.2 - EMB-135 LR Ground Servicing Connections

SYSTEM	DISTANCE AFT OF NOSE		DISTANCE FROM AIRPLANE CENTERLINE				HEIGHT ABOVE GROUND	
			RIGHT SIDE		LEFT SIDE		MAXIMUM	
	ft-in	m	ft-in	m	ft-in	m	ft-in	m
5.4.1 Hydraulic Power System Three Servicing Connections:								
A. Nose Servicing Panel	6-3	1.90	2-8	0.81	-	-	5-7	1.69
B. LH and RH Servicing Panels	56-2	17.26	1-9	0.53	1-9	0.53	5-4	1.63
5.4.2 Electrical Power System One External Power Supply Connection 28 V DC - 1600 A ...	7-5	2.26	-	-	3-1	0.94	5-7	1.71
5.4.3 Oxygen System One Servicing Panel	12-11	3.93	2-8	0.81	-	-	5-1	1.74
5.4.4 Fuel System								
A. Gravity Fuel Filler Port	45-10	13.99	17-10	5.43	17-10	5.43	6-1/2	1.84
B. Fuel Magnetic Stick	43-1	13.14	8-11	2.73	8-11	2.73	4-3	1.31
C. Fuel Magnetic Stick	45-10	13.98	16-4	4.98	16-4	4.98	5-6	1.57
D. Fuel Magnetic Stick	40-9	12.43	1-1	0.35	1-1	0.35	3-6	1.06
E. Fuel Drain Valve	42-4	12.90	3-6	1.06	3-6	1.06	4-6	1.37
F. Fuel Drain Valve	42-7	12.97	1-4	0.41	1-4	0.41	3-6	1.06
G. Fuel Dump Valve	40-9	12.43	2-2	0.68	2-2	0.68	3-6	1.06
H. Pressure Refueling/Defueling Panel	31-6	9.60	2-10	0.86	-	-	4-11	1.51
5.4.5 Air Conditioning System								
One Pressurization Ground Test Connection	33-4	10.17	2-5	0.73	-	-	5-6	1.68
One Air Conditioning Ground Connection	29-0	8.86	1-6	0.46	-	-	5-7	1.72
5.4.6 Portable Water System	57-1	17.67	2-3	0.69	-	-	6-5	1.97
One Servicing Panel	58-11	17.67	0-2	0.69	-	-	5-12	1.97
5.4.7 Lavatory System Waste Servicing Panel	58-7	17.87	0-4	0.40	-	-	5-3	1.86
5.4.8 Powerplant Two Engine Oil Supply/Level Check Panels								
A. LH Panel	62-11	19.20	-	-	6-1	1.84	10-1	3.06
B. RH Panel	62-11	19.20	7-8	2.35	-	-	10-1	3.06
Ground Connection for Engine Air Starting	65-3	19.88	0-11	0.27	-	-	5-2	1.57

5.5 Engine Starting Pneumatic Requirements

EMB-145/EMB-135 PNEUMATIC STARTING SYSTEM
GROUND CART MINIMUM REQUIREMENTS

AE3007A SERIES ENGINES



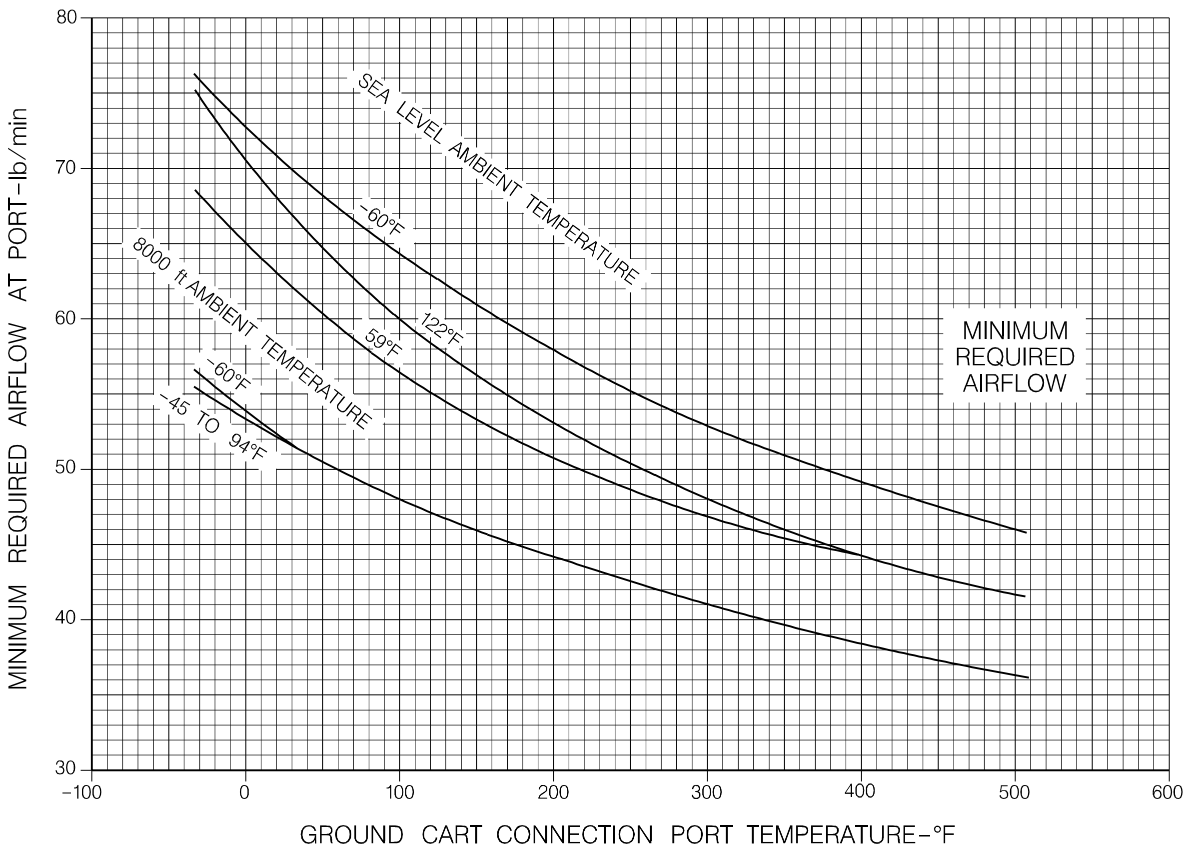


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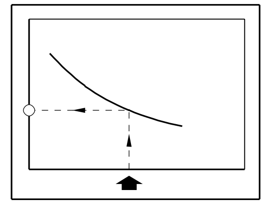
Figure 5.5.1 - Engine Starting Pneumatic Requirements - Airflow x Temperature

EMB-145/EMB-135 PNEUMATIC STARTING SYSTEM
GROUND CART MINIMUM REQUIREMENTS

AE3007A SERIES ENGINES



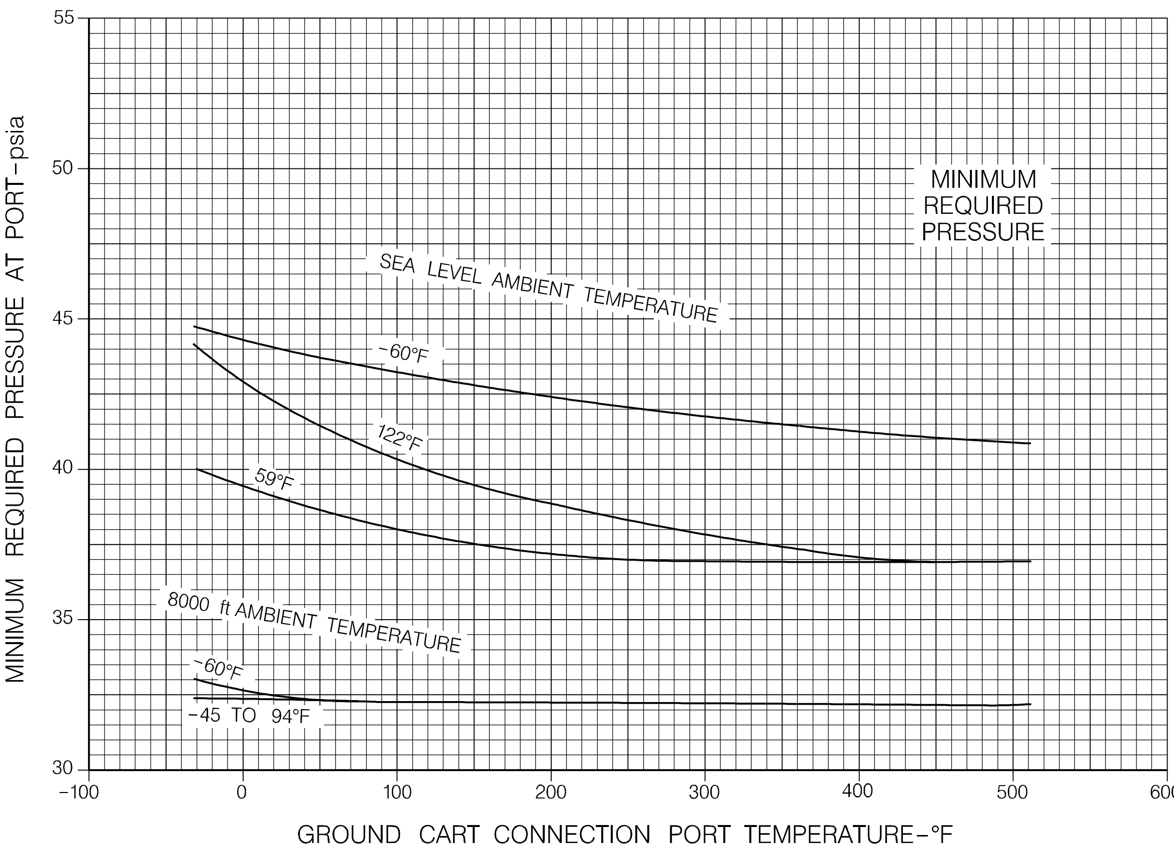


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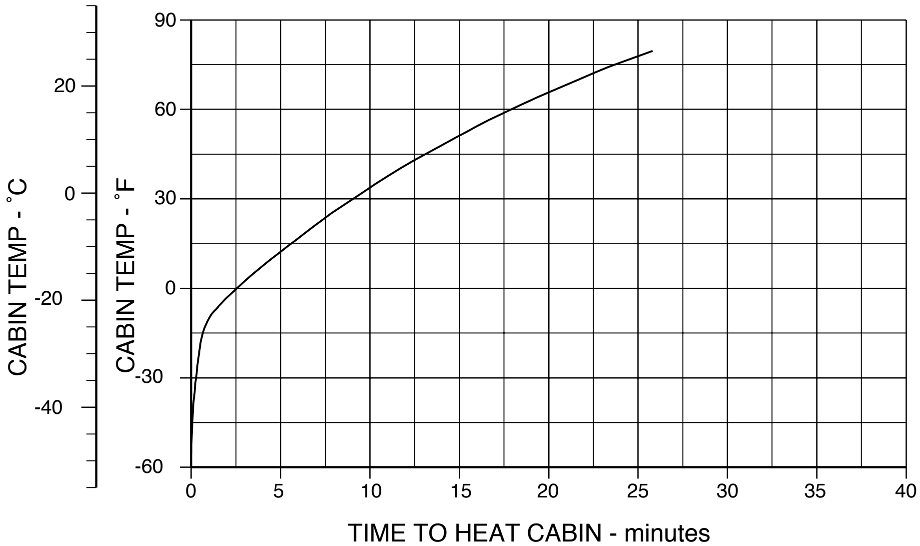
Figure 5.5.2 - Engine Starting Pneumatic Requirements - Pressure x Temperature

5.6 Ground Pneumatic Power Requirements

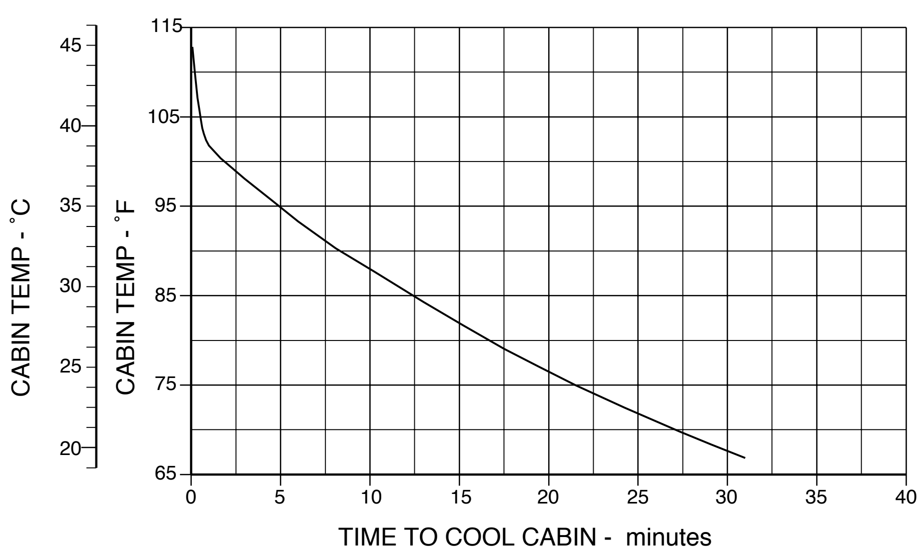


HEATING

Open door
Initial cabin temp: -54°C (-65°F)
Outside air temp: -54°C (-65°F)
Relative Humidity: 0%
No crew or passengers

Bleed air from APU:
28.5 kg/min, (62.8 lb/min)
469 kPa (68 psia)
2 operating packs (ECS)

Cabin airflow:
~ 28.5 kg/min (62.8 lb/min)
temp ~ 71°C (160°F)



COOLING

Open door
Initial cabin temp: 47°C (116°F)
Outside air temp: 40°C (104°F)
Relative Humidity: 40%
2 crewmembers and no passengers

Bleed air from APU:
22.3 kg/min, (49 lb/min)
331 kPa (48 psia)
2 operating packs (ECS)

Cabin airflow:
~ 22.3 kg/min (49 lb/min)
temp ~ 0°C (32°F)

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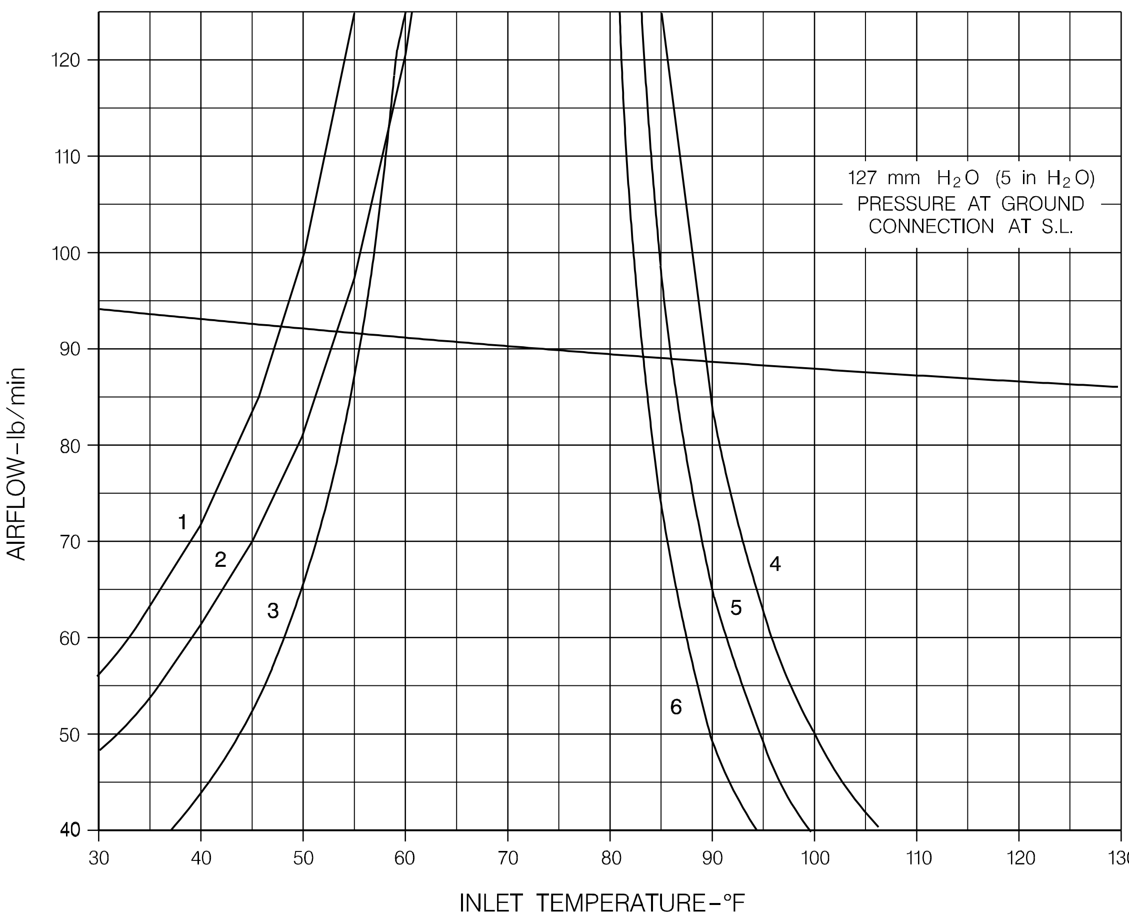
Figure 5.6.1 - Ground Pneumatic Power Requirements (APU Mode)

wipapm1238

5.7 Conditioned Air Requirements

PRE-CONDITIONED AIRFLOW REQUIREMENTS



CONDITIONS	AMBIENT TEMP		SOLAR LOAD (BTU/h)	ELECTRICAL LOAD (BTU/h)	OCCUPANTS	CABIN TEMP	
	(°C)	(°F)				(°C)	(°F)
1	39	103	7950	10150	42	24	75
2	39	103	7950	10150	42	27	80
3	39	103	0	10150	4	21	70
4	−40	−40	0	0	4	24	75
5	−29	−20	0	0	4	24	75
6	−18	0	0	0	4	24	75

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Figure 5.7.1 - Pre-conditioned Airflow Requirements

5.8 Ground Towing Requirements

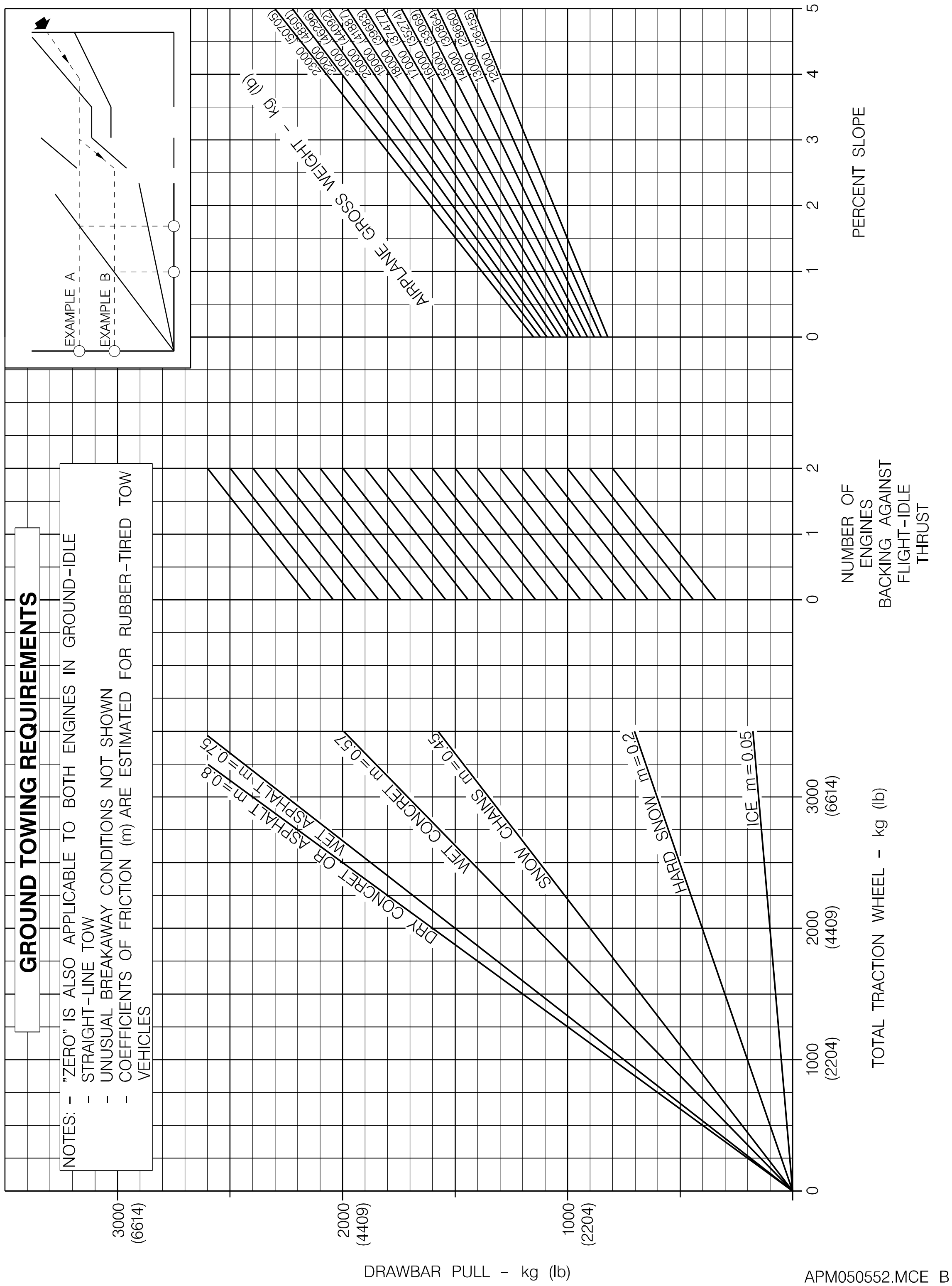


Figure 5.8.1 - Ground Towing Requirements

6. OPERATING CONDITIONS

This section presents graphics concerning:

– the jet engine exhaust velocities and temperatures;

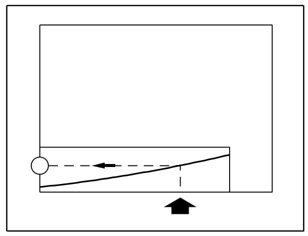
– the airport and community noise levels;

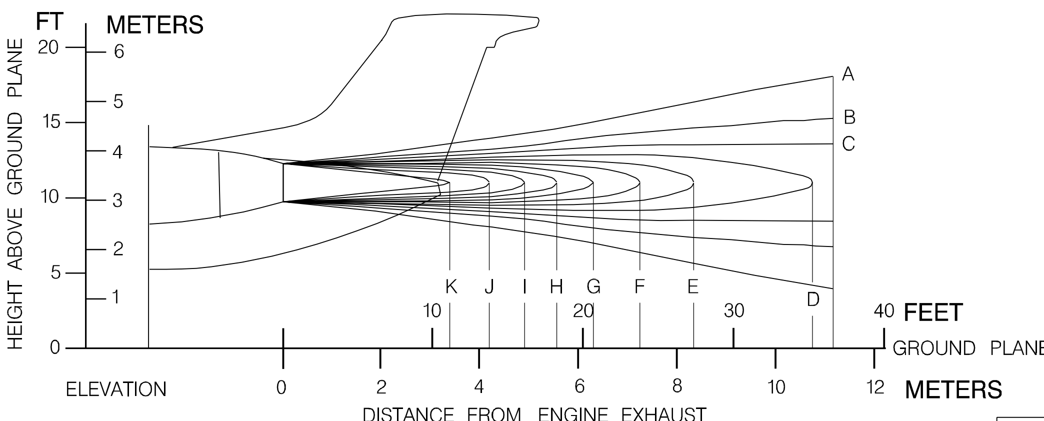
– the hazard areas.

6.1 Engine Exhaust Velocities and Temperatures

TO-1 THRUST MODE, STATIC, SEA LEVEL

ISA + 15°C





VELOCITY (ft/s)	
MAX	978
MIN	0.0
A	10
B	100
C	200
D	300
E	400
F	500
G	600
H	700
I	800
J	900
K	970

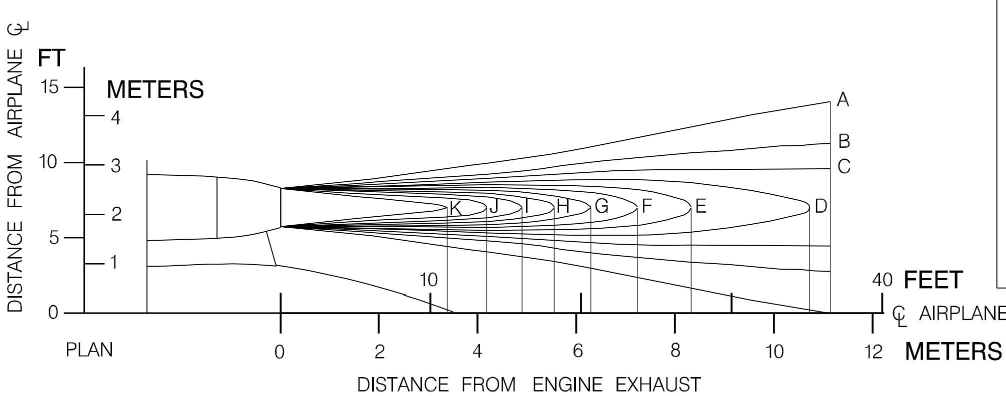


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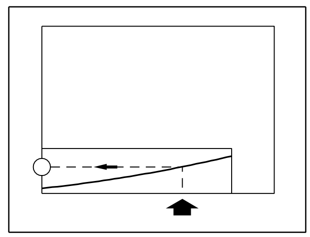
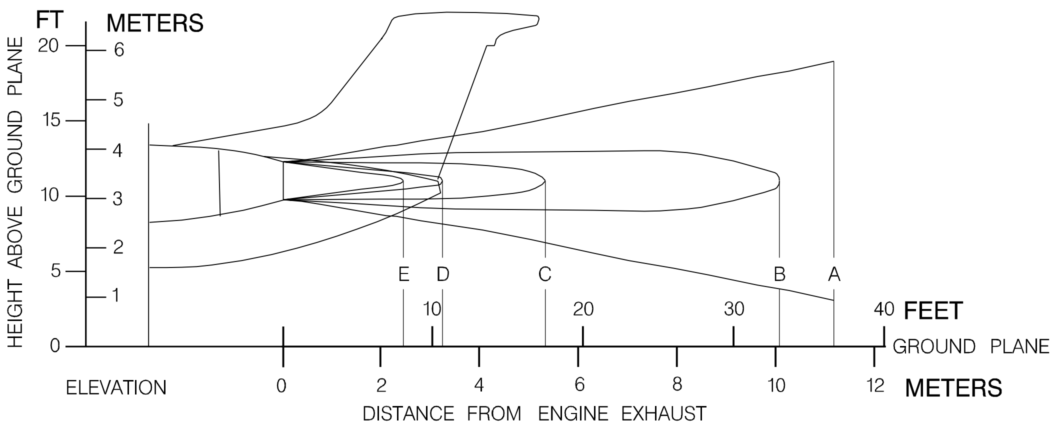
Figure 6.1.1 - Jet Wake Velocity Profile (T/O-1 Thrust Mode)

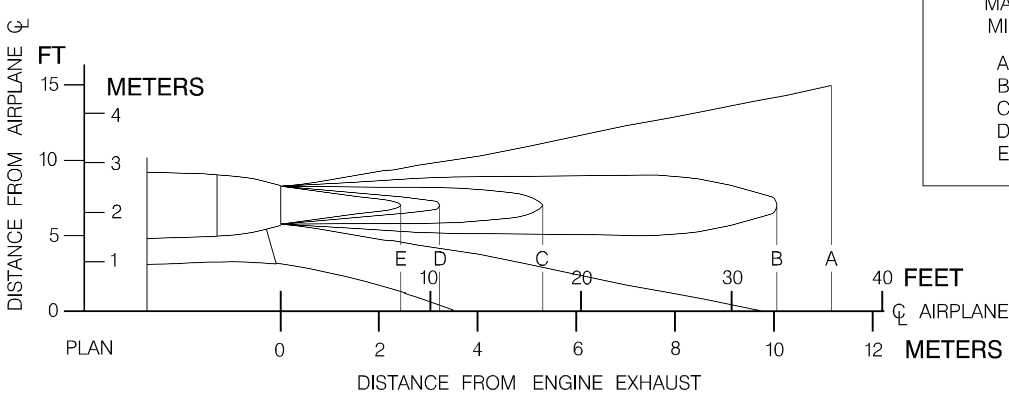
TO-1 THRUST MODE, STATIC, SEA LEVEL

ISA + 15°C





TEMPERATURE	(°F)	(°C)
MAX	252	122
MIN	86	30
A	90	32
B	140	60
C	190	88
D	240	116
E	250	121

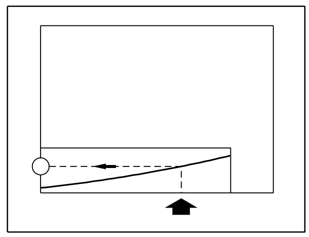


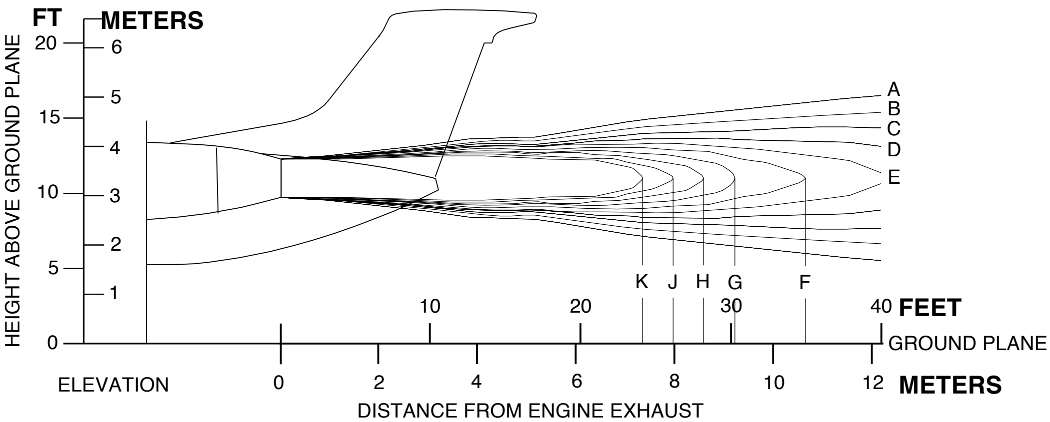
APM060019.MCE B

Figure 6.1.2 - Jet Wake Temperature Profile (T/O-1 Thrust Mode)

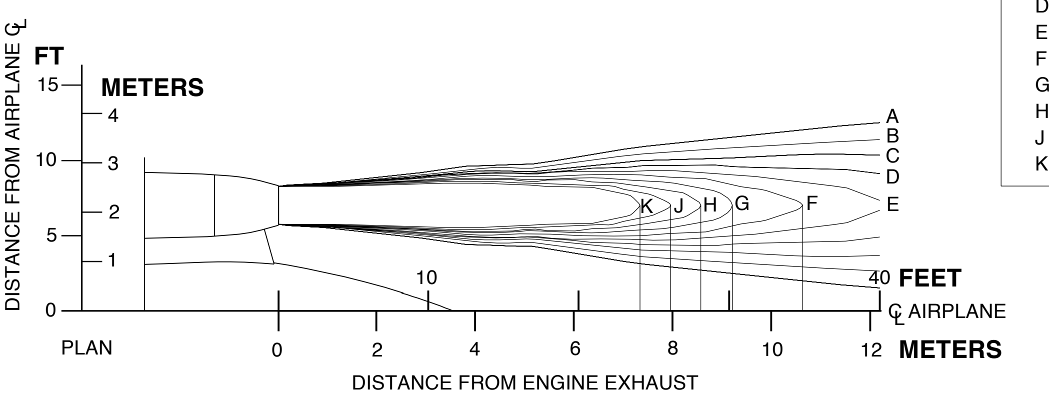
BREAKAWAY, STATIC, SEA LEVEL

ISA+15°C





LEVEL	VELOCITY (ft/s)
A	50
B	75
C	100
D	125
E	150
F	175
G	200
H	225
J	250
K	274

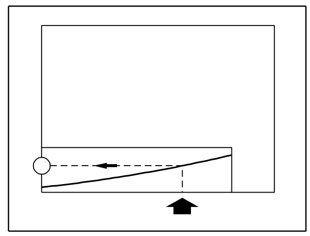


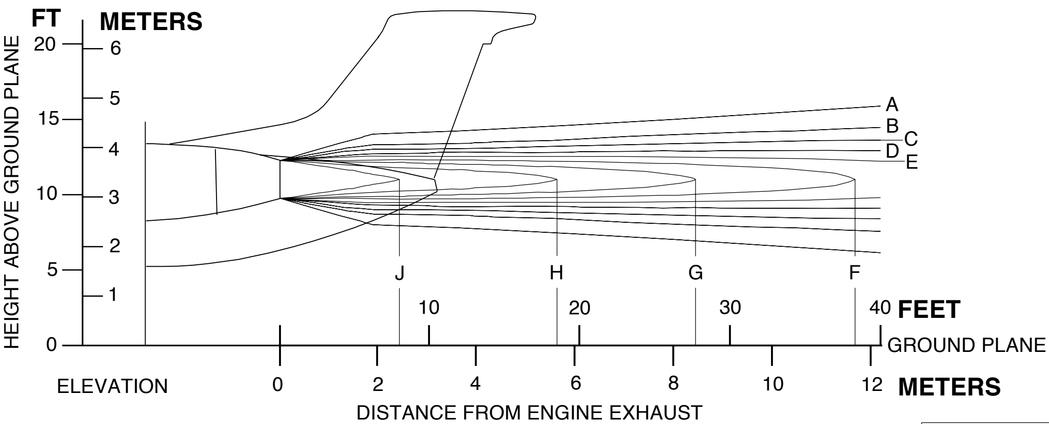
EM145APM060001B.DGN

Figure 6.1.3 - Jet Wake Velocity Profile (Breakaway)

BREAKAWAY, STATIC, SEA LEVEL

ISA+15°C





TEMPERATURE	(°C)	(°F)
A	16	60
B	21	70
C	27	80
D	32	90
E	38	100
F	43	110
G	49	120
H	54	130
J	60	140

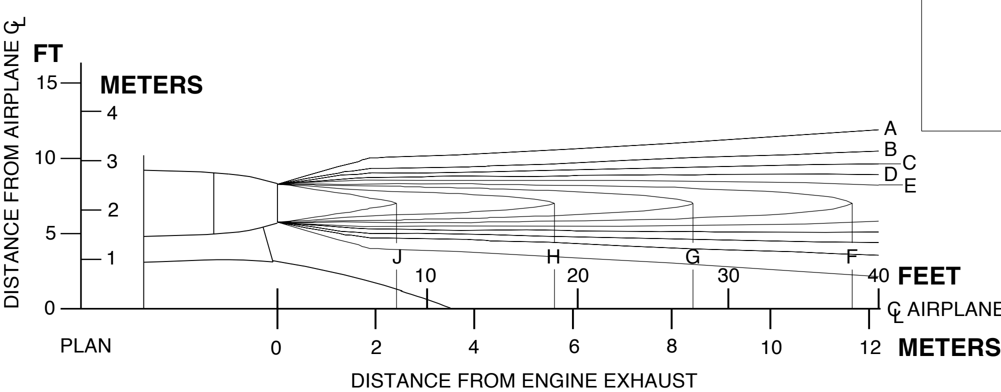


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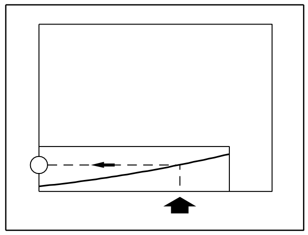
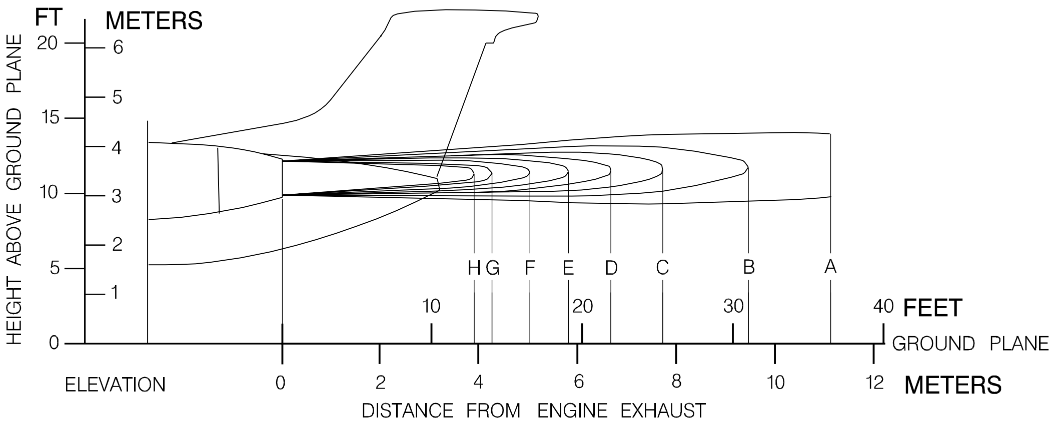
Figure 6.1.4 - Jet Wake Temperature Profile (Breakaway)

IDLE THRUST MODE, STATIC, SEA LEVEL

ISA + 15°C





VELOCITY (ft/sec)	
MAX	220
MIN	0.0
A	50
B	75
C	100
D	125
E	150
F	175
G	200
H	210

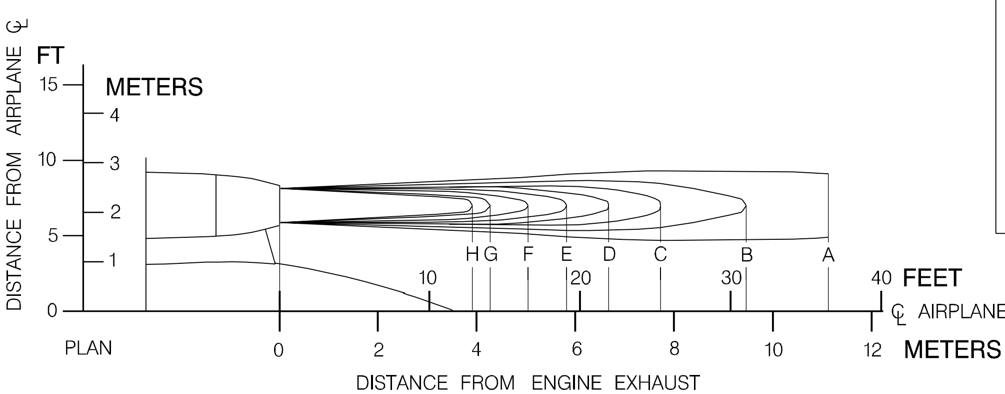


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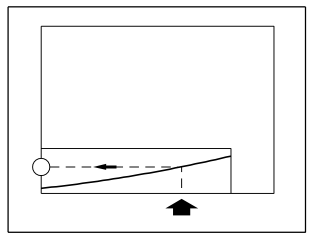
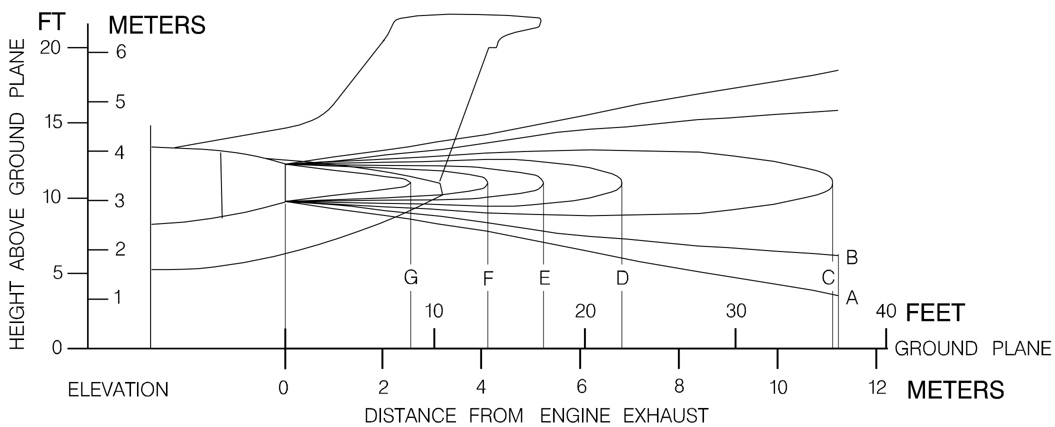
Figure 6.1.5 - Jet Wake Velocity Profile (Idle Thrust Mode)

IDLE THRUST MODE, STATIC, SEA LEVEL

ISA + 15°C





TEMPERATURE	(°F)	(°C)
MAX	201	94
MIN	86	30
A	90	32
B	100	38
C	120	49
D	140	60
E	160	71
F	180	82
G	200	93.5

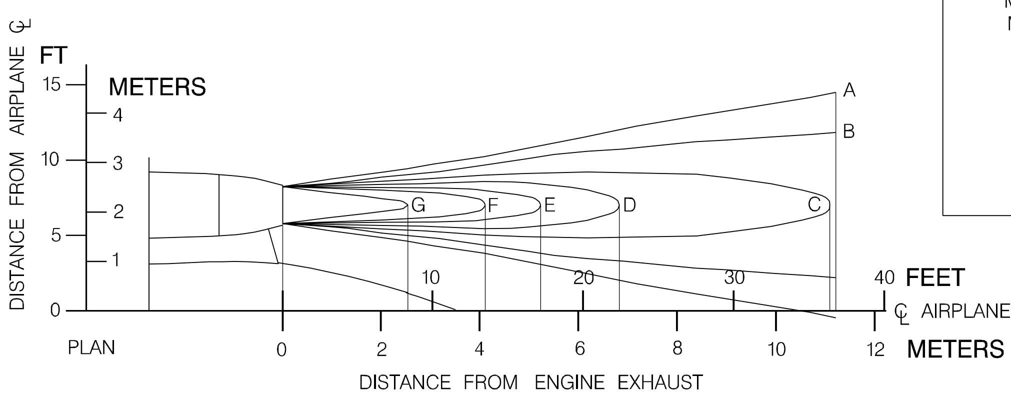


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Figure 6.1.6 - Jet Wake Temperature Profile (Idle Thrust Mode)

6.2 Airport and Community Noise

Aircraft noise is a major concern for the airport and community planner. The airport is a basic 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 noise impact on the 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 matter; 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:

6.2.1 Operational Factors

6.2.1.1 Aircraft Weight

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

6.2.1.2 Engine Power Setting

The rates of climb and descent and the noise levels emitted at the source are influenced by the power setting used.

6.2.1.3 Airport Altitude

Higher airport altitude will affect the engine performance and thus can influence noise.

6.2.2 Atmospheric Conditions - Sound Propagation

6.2.2.1 Wind

With stronger headwinds, the aircraft can takeoff and climb more rapidly relative to the ground. Also, winds can influence the distribution of noise in the surrounding communities.

6.2.2.2 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.

6.2.3 Surface Condition - Shielding, Extra Ground Attenuation (EGA)

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 the ground. Additionally, hills, shrubs, trees, and large buildings can act as sound buffers.

All of 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 on figure 6.2.1. These contours reflect a given noise level upon a ground level plane at runway elevation.

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 the maximum gross weights because the average flight distances are much shorter than the maximum aircraft range capability and the 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 for relating the acceptability of specific noise zones to specific land uses. It is therefore expected that the noise contour data for a particular aircraft and the impact assessment methodology change. To ensure that 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 the 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 be developed as required by the planners using the data and methodology applicable to their specific study.

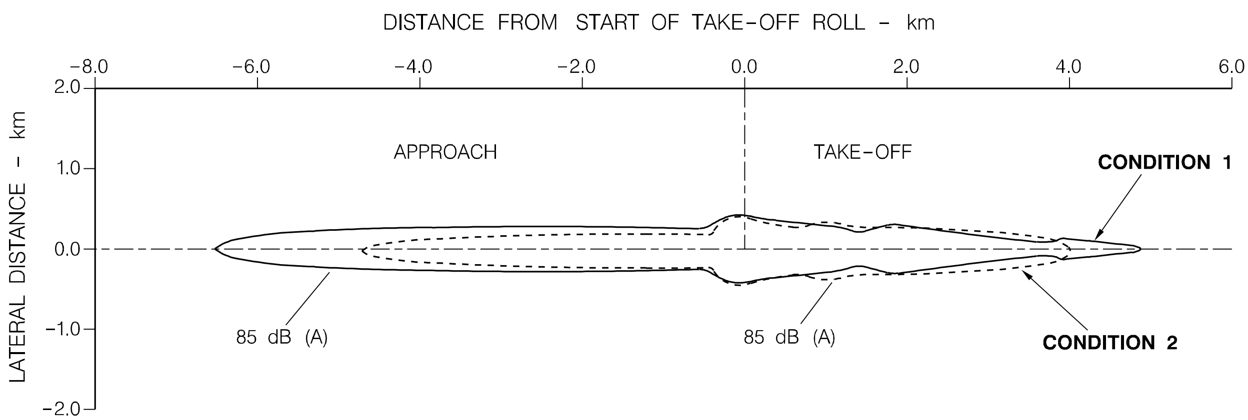
CONDITION 1

LANDING:

MAXIMUM DESIGN LANDING WEIGHT
10 knot HEADWIND
3° APPROACH
84°F
HUMIDITY 15%

TAKEOFF:

MAXIMUM DESIGN TAKEOFF WEIGHT
ZERO WIND
84°F
HUMIDITY 15%



CONDITION 2

LANDING:

85% OF MAXIMUM DESIGN LANDING WEIGHT
10 knot HEADWIND
3° APPROACH
59°F
HUMIDITY 70%

TAKEOFF:

80% OF MAXIMUM DESIGN TAKEOFF WEIGHT
ZEROWIND
59°F
HUMIDITY 70%

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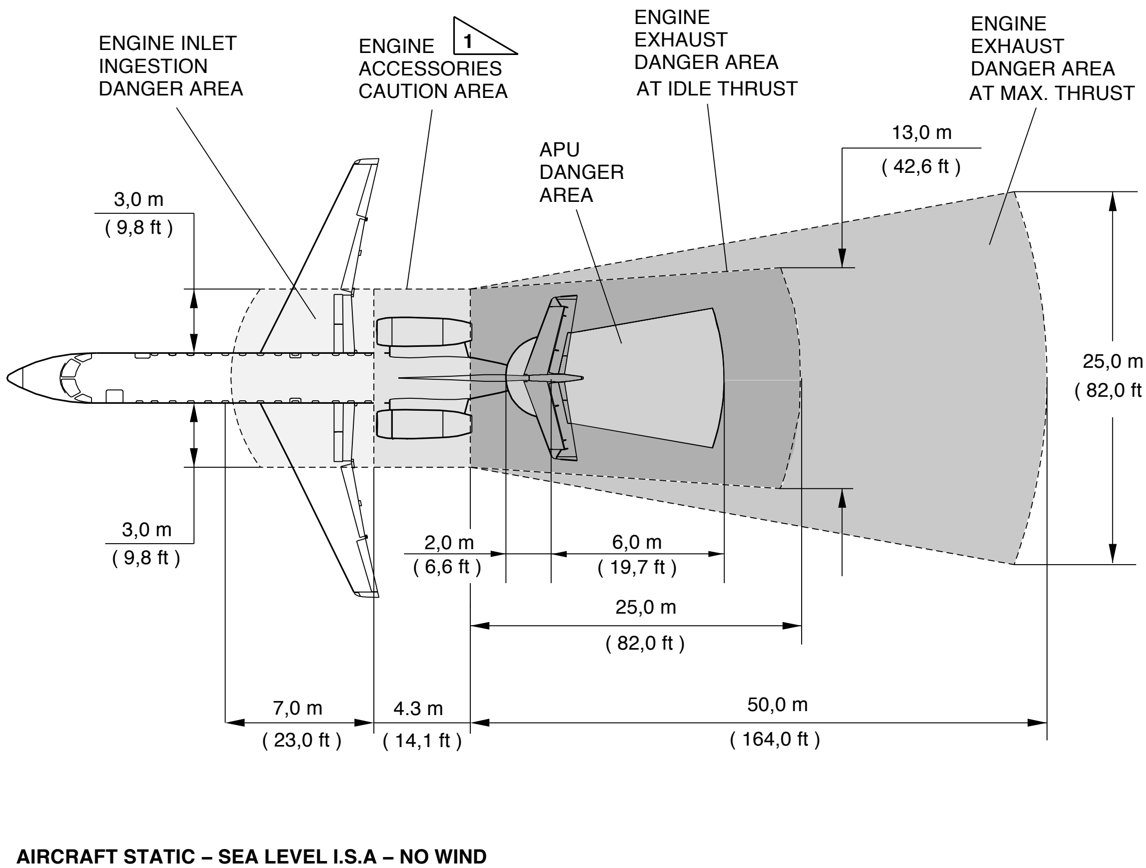
Figure 6.2.1 - Airport and Community Noise Levels

6.3 Hazard Areas



1 WITH THE ENGINE RUNNING, THE ACCESS TO THIS AREA IS PERMITTED JUST WITH THE ENGINE IN IDLE SPEED OR LESS.

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Figure 6.3.1 - Hazard Areas

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7. PAVEMENT DATA

7.1 General Information

Pavement or Pavement Structure is defined as a structure consisting of one or more layers of processed materials.

The primary function of a pavement is to distribute concentrated loads so that the supporting capacity of the subgrade soil is not exceeded. The subgrade soil is defined as the material on which the pavement rests, whether embankment or excavation.

Several methods for design of airport pavements have been developed that differ considerably in their approach.

Generally speaking, the design methods are derived from observation of pavements in service or experimental pavements. Thus, the reliability of any method is proportional to the amount of experience of experimental verification behind the method, and all methods require a considerable amount of common sense and judgment on the part of the engineer who applies them.

A brief description of the following pavement charts will be helpful 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 the interpolation between the discrete values shown. The tire pressure used for the 135 model charts will procedure the recommended tire deflection with the airplane loaded to its maximum ramp weight and with center of gravity position. The tire pressure where specifically on table and charts are values obtained under loaded conditions as certificated for commercial use.

Subsection 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-ground interfaces are shown in Subsection 7.3.

Pavement requirements for commercial airplanes are customarily derived from the static analysis of loads imposed on the main landing gear struts. The chart in Subsection 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 to enter the pavement design charts which follow, interpolating load values where necessary.

The flexible pavement design curves (Subsection 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 FAA Advisory Circular 150/5320-6D, ″Airport Pavement Design and Evaluation″, dated July 7, 1995. 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 LCN conversion curves for flexible pavements (Subsection 7.6) have been built using procedures and curves in the International Civil Aviation Organization (ICAO) Aerodrome Design Manual, Part 3 - Pavements, Document 9157-AN/901, 1983.

The same chart includes the data of equivalent single-wheel load versus pavement thickness.

Rigid pavement design curves (Subsection 7.7) have been prepared with the use of the Westergaard Equation in general accordance with the procedures outlined in the 1955 edition of ″Design of Concrete Airport Pavement″ published by the Portland Cement Association, 33 W. Grand Ave., Chicago 10, Illinois, but modified to the new format described in the 1968 Portland Cement Association publication,

″Computer Program for Concrete Airport Pavement Design″ (Program PDILB) by Robert G. Packard.

The following procedure is used to develop rigid pavement design curves such as that shown in Subsection 7.7.

1. Once the scale for the pavement thickness to the left and the scale for allowable working stress to the right have been established, an arbitrary load line is drawn representing the main landing gear maximum weight to be shown.
2. All values of the subgrade modulus (k-values) are then plotted.
3. Additional load lines for the incremental values of weight on the main landing gear are then established on the basis of the curve for k = 300, already established.

The LCN conversion curves for rigid pavements (Subsection 7.8) have been built using procedures and curves in (ICAO) Aerodrome Design Manual, Part 3 - Pavements, Document 9157-AN/901, 1983.

The same chart includes the data of equivalent single-wheel load versus radius of relative stiffness. Radius of relative stiffness values are obtained from Subsections 7.8.1 and 7.8.2.

The ACN/PCN system as referenced in Amendment 35 to ICAO Annex 14, ″Aerodromes″, 7th Edition, June 1976, 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 corresponding Pavement Classification Number. An aircraft having an ACN equal to or less than the PCN can operate without restriction on the pavement.

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 1.25 Mpa (181 psi) that would have the same pavement requirements as the aircraft. Computationally, the ACN/PCN system uses 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:

Table 7.1.1 - Pavement Evaluation

PAVEMENT TYPE	SUBGRADE CATEGORY	TIRE PRESSURE CATEGORY	METHOD
R - Rigid	A - High	W - No Limit	T - Technical
S - Flexible	B - Medium	X - to 1.5 Mpa (217 psi)	U - Using acft
	C - Low	Y - to 1.0 Mpa (145 psi)	
	D - Ultra Low	Z - to 0.5 Mpa (73 psi)	
Report example: PCN 80/R/B/X/T, where: 80 = Pavement Classification Number R = Pavement Type: Rigid B = Subgrade Category: Medium X = Tire Pressure Category: Medium (limited to 1.5 Mpa) T = Evaluation Method: Technical			

Subsection 7.9 shows the aircraft ACN values for flexible pavements. The four subgrade categories are:

A. High Strength – CBR 15

B. Medium Strength – CBR 10

C. Low Strength – CBR 6

D. Ultra Low Strength – CBR 3

Subsection 7.10 shows the aircraft ACN values for rigid pavements. The four subgrade categories are:

A. High Strength – Subgrade k = 150 MN/m^3 (550 lb/in^3)

B. Medium Strength – k = 80 MN/m^3 (300 lb/in^3)

C. Low Strength – k = 40 MN/m^3 (150 lb/in^3)

D. Ultra Low Strength – k = 20 MN/m^3 (75 lb/in^3)

7.2 Footprint

		EMB-135 MODELS	
		ER	LR
MAXIMUM DESIGN TAXI WEIGHT	lb kg	42108 19100	44313 20100
PERCENT OF WEIGHT ON MAIN GEAR		**SEE SUBSECTION 7.4**	
NOSE TIRE SIZE		19.5 x 6.75-8	
NOSE TIRE PRESSURE	psi kg/cm^2	84 ± 2 5.91 ± 0.14	
MAIN GEAR TIRE SIZE		30 x 9.5-14	
MAIN GEAR TIRE PRESSURE	psi kg/cm^2	134 ± 3 9.42 ± 0.21	148 ± 3 10.41 ± 0.21

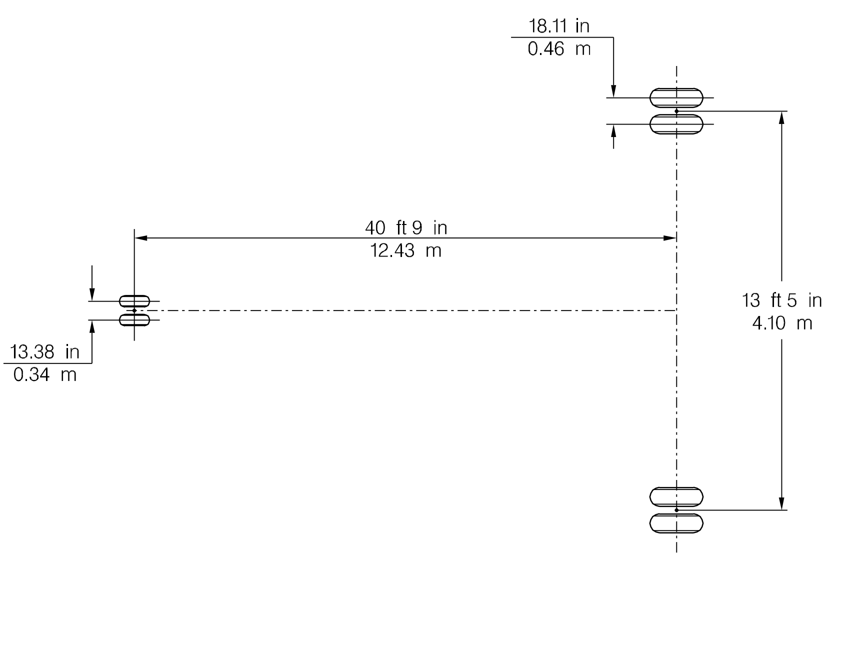
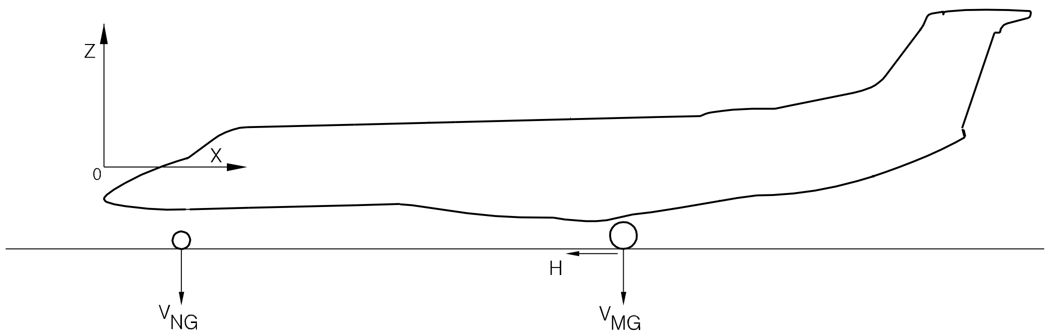


Figure 7.2.1 - Footprint

7.3 Maximum Pavement Loads



LEGEND: V_{NG} = MAXIMUM VERTICAL NOSE GEAR GROUND LOAD AT MOST FORWARD C.G.

V_{MG} = MAXIMUM VERTICAL MAIN GEAR GROUND LOAD AT MOST FOWARD C.G.

H = MAXIMUM HORIZONTAL GROUND LOAD FROM BRAKING.

NOTE: ALL LOADS CALCULATED USING AIRPLANE MAXIMUM DESING TAXI WEIGHT.

MODEL	MAXIMUM DESIGN TAXI WEIGHT		V_{NG}				V_{MG} (PER STRUT)		H (PER STRUT)			
			STATIC AT MOST FORWARD C.G.		STATIC + BRAKING 10 ft/sec^2 DECELERATION		MAXIMUM LOAD OCCURING AT STATIC AFT C.G.		AT STEADY BRAKING 10 ft/sec^2 DECELERATION		AT INSTANTANEOUS BRAKING (COEFF. OF FRICTION 0.8)	
	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb
EMB-135 ER	19100	42110	2295	5060	3130	6900	9235	20365	2765	6100	6660	14685
EMB-135 LR	20100	44315	2365	5210	3245	7150	9855	21735	2915	6425	7015	15465

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Figure 7.3.1 - Maximum Pavement Loads

7.4 Landing Gear Loading on Pavement

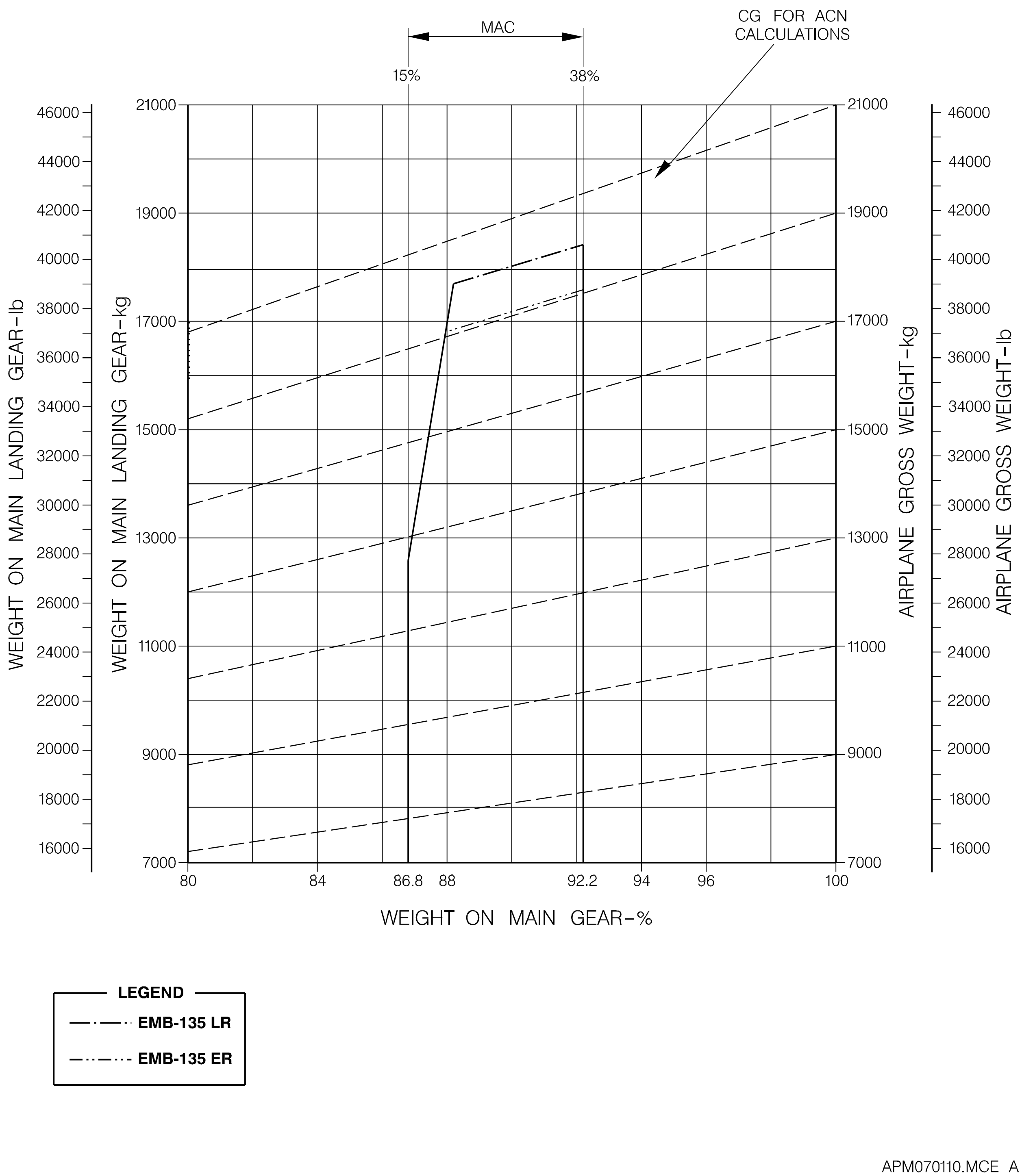


Figure 7.4.1 - Landing Gear Loading on Pavement

7.5 Flexible Pavement Requirements - U.S. Army Corps of Engineers Design Method

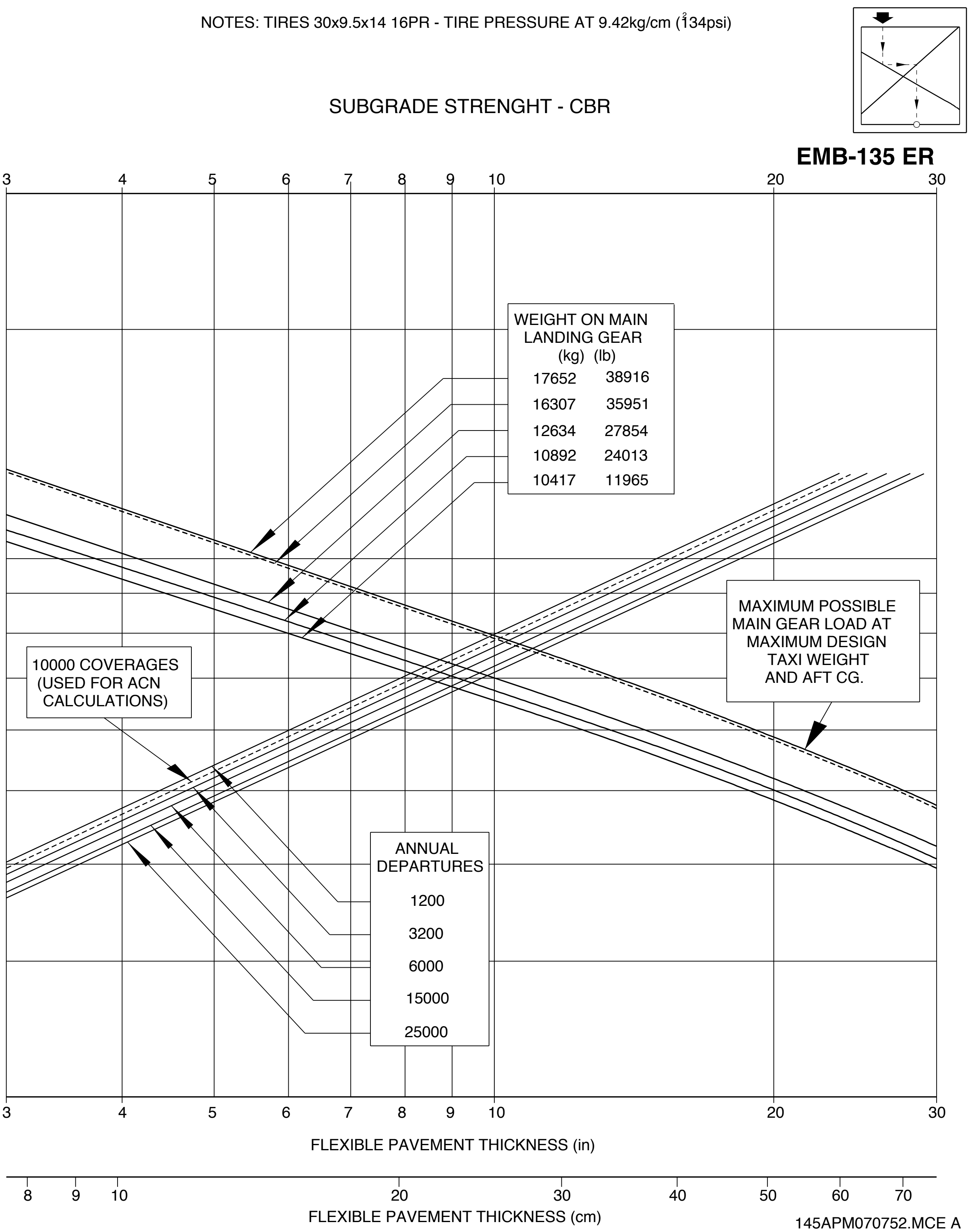
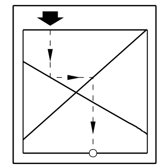


Figure 7.5.1 - Flexible Pavement Requirements - U.S. Army Corps of Engineers Design Method

Sheet 1

NOTES: TIRES 30x9.5x14 16PR - TIRES PRESSURE AT 10.41kg/cm2 (148psi)



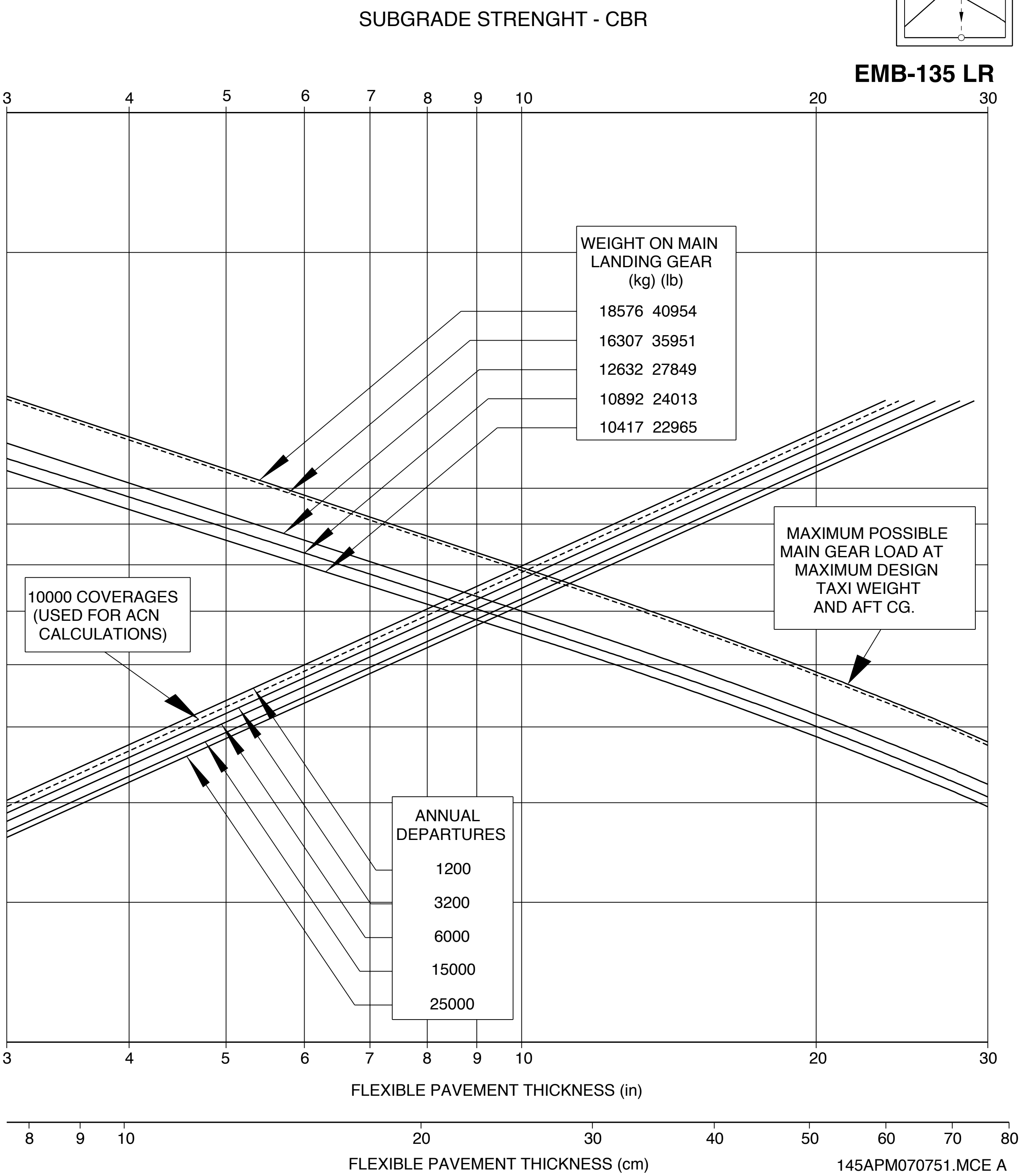
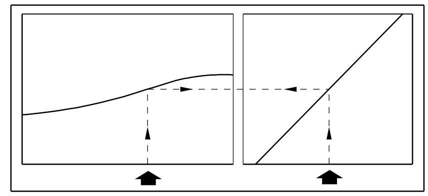
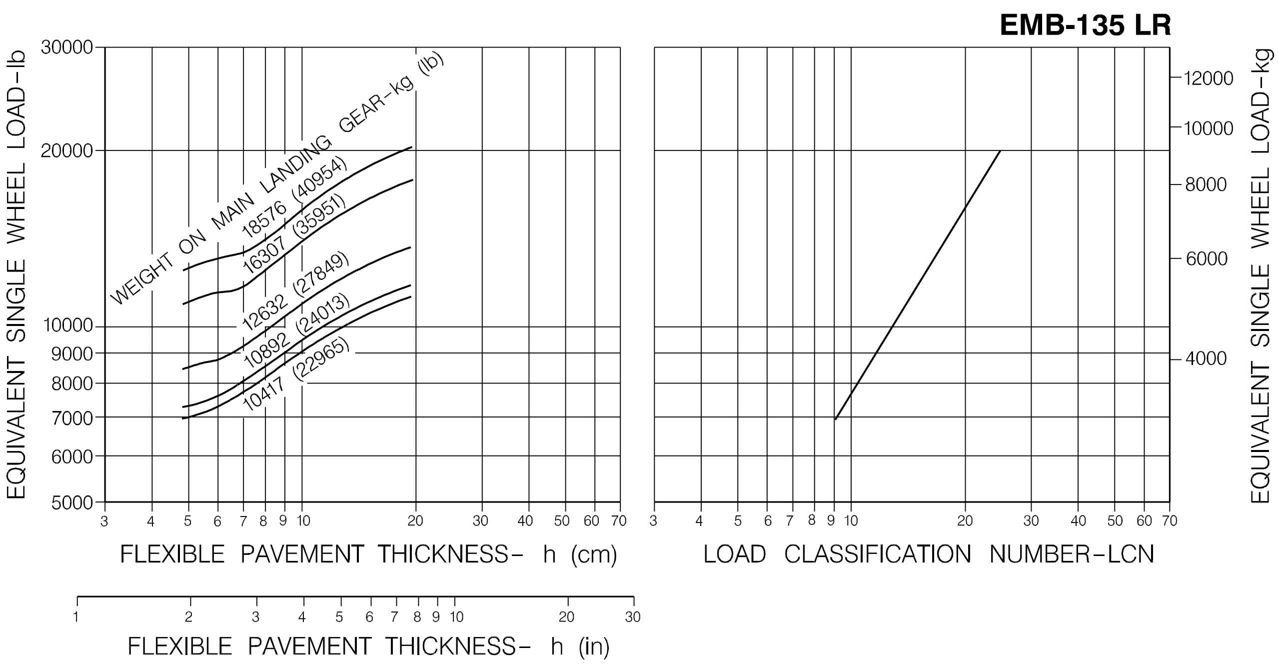


Figure 7.5.1 - Flexible Pavement Requirements - U.S. Army Corps of Engineers Design Method
Sheet 2

7.6 Flexible Pavement Requirements - LCN Method



TIRES 30 x 9.5-14 AT 10.41 kg/cm^2 (148 psi) (LOADED)



NOTE: EQUIVALENT SINGLE WHEEL LOADS ARE DERIVED BY METHODS SHOWN IN I C A O AERODROME MANUAL. PART 2, PAR. 4.1.3

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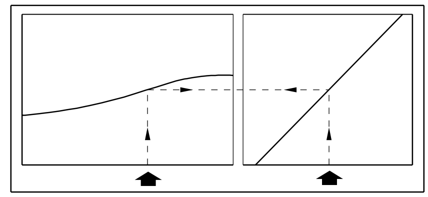
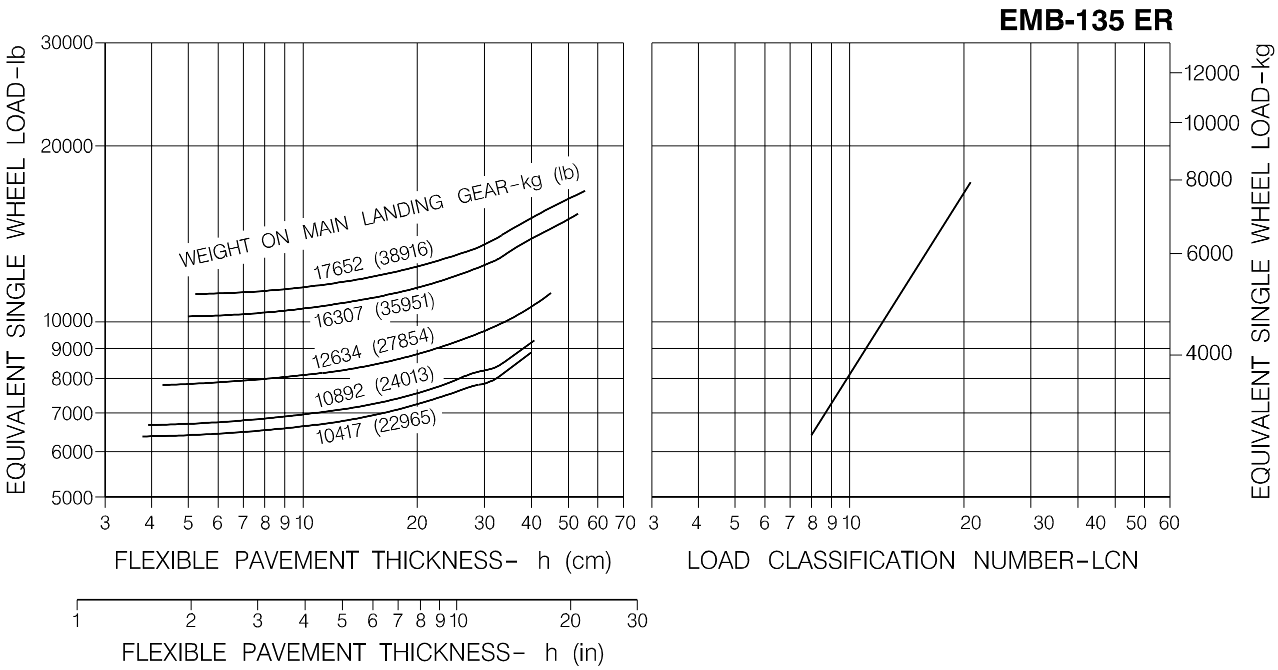
Figure 7.6.1 - Flexible Pavement Requirements - LCN Method
Sheet 1



TIRES 30 x 9.5-14 AT 9.42 kg/cm² (134 psi)



NOTE: EQUIVALENT SINGLE WHEEL LOADS ARE DERIVED BY METHODS SHOWN IN I C A O AERODROME MANUAL. PART 2, PAR. 4.1.3

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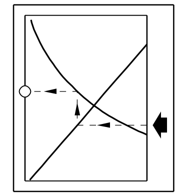
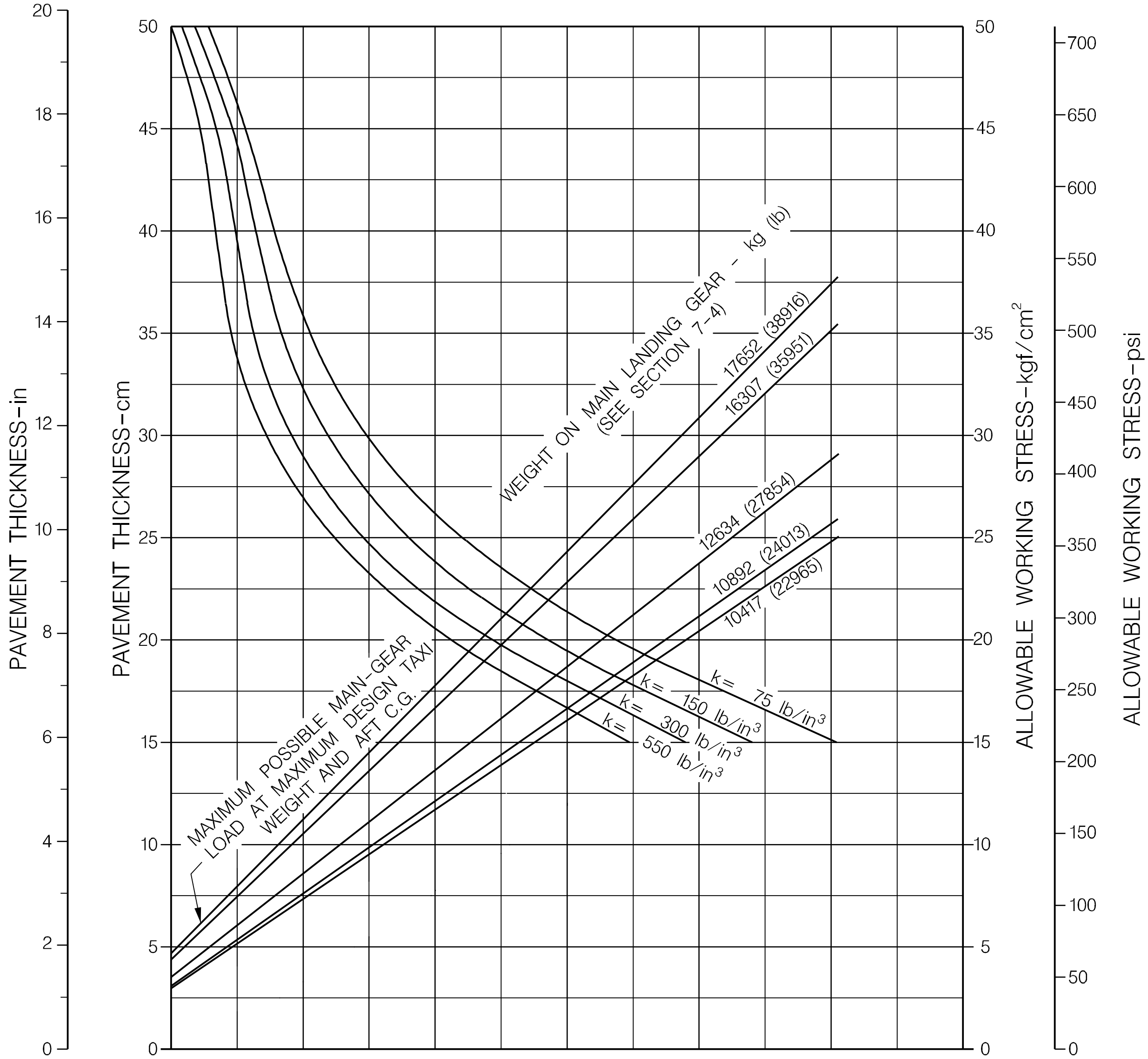
Figure 7.6.1 - Flexible Pavement Requirements - LCN Method
Sheet 2

7.7 Rigid Pavement Requirements - Portland Cement Association Design Method

RIGID PAVEMENT REQUIREMENTS - MODEL EMB-135 ER

NOTES:
- 30 x 9.5-14 16PR TIRES
- TIRE PRESSURE 134 psi (9.42 kgf/cm^2) (LOADED)
- % WEIGHT OR MAIN GEARS 92.42%





NOTE: THE VALUES OBTAINED BY USING THE MAXIMUM LOAD REFERENCE LINE AND ANY VALUE OF "K" ARE EXACT. FOR LOADS LESS THAN MAXIMUM, THE CURVES ARE EXACT FOR K=300 BUT DEVIATE SLIGHTLY FOR OTHER VALUES OF "K".

REFERENCE: PORTLAND CEMENT ASSOCIATION METHOD.

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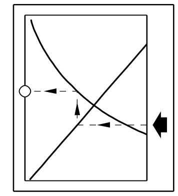
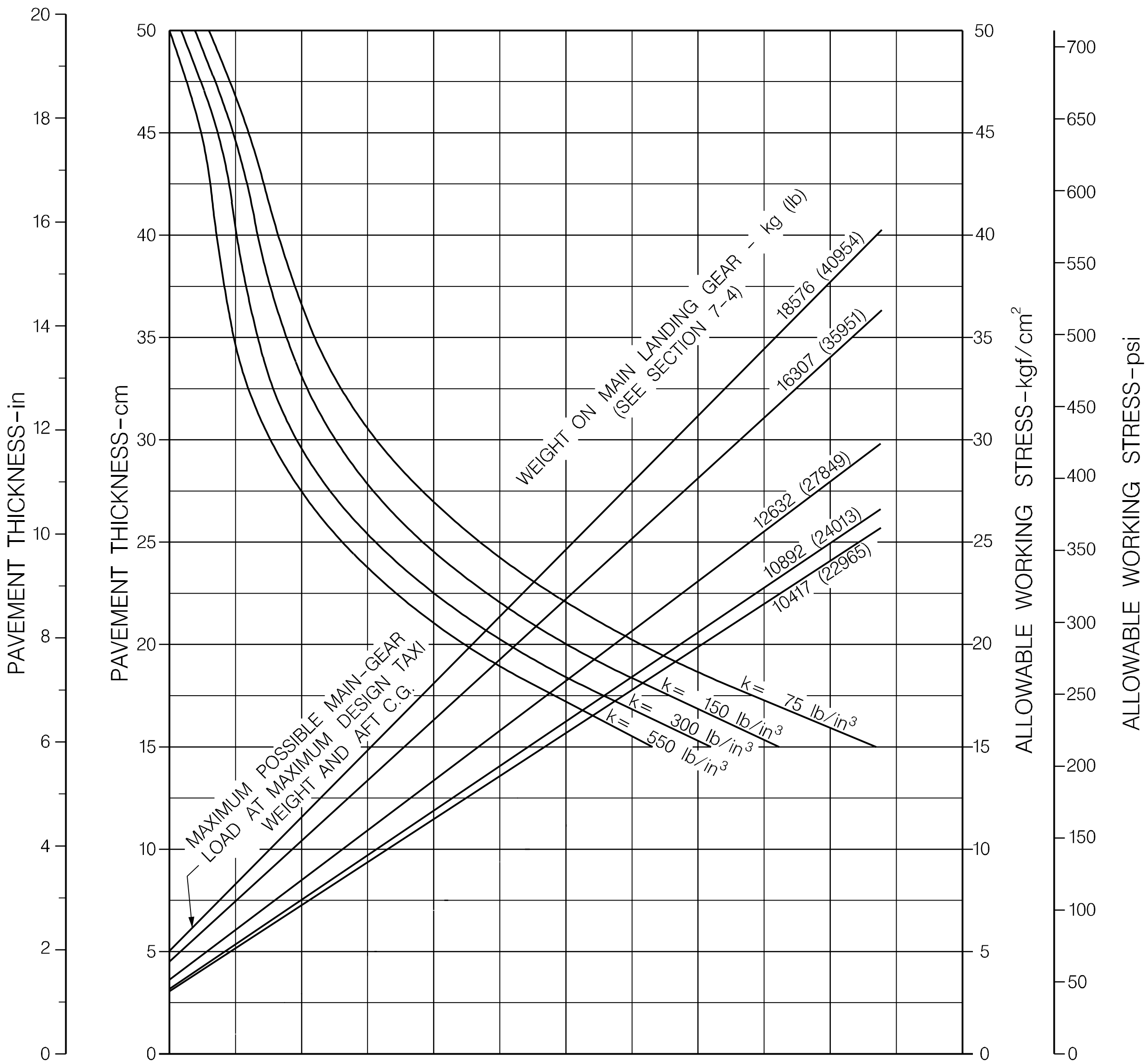
Figure 7.7.1 - Rigid Pavement Requirements - Portland Cement Association Design Method
Sheet 1

RIGID PAVEMENT REQUIREMENTS - MODEL EMB-135 LR



NOTES:
- 30 x 9.5-14 16PR TIRES
- TIRE PRESSURE 148 psi (10.41 kgf/cm^2) (LOADED)
- % WEIGHT OR MAIN GEARS 92.42%



NOTE: THE VALUES OBTAINED BY USING THE MAXIMUM LOAD REFERENCE LINE AND ANY VALUE OF "K" ARE EXACT. FOR LOADS LESS THAN MAXIMUM, THE CURVES ARE EXACT FOR K=300 BUT DEVIATE SLIGHTLY FOR OTHER VALUES OF "K".

REFERENCE: PORTLAND CEMENT ASSOCIATION METHOD.

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Figure 7.7.1 - Rigid Pavement Requirements - Portland Cement Association Design Method
Sheet 2

7.8 Rigid Pavement Requirements - LCN Method

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

7.8.1 Radius of Relative Stiffness

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 = 4×10^6 psi
k = SUBGRADE MODULUS, lb/in^3
d = RIGID-PAVEMENT THICKNESS. in.
μ = POISSON'S RATIO = 0.15

d(in)	k=75	k=100	k=150	k=200	k=250	k=300	k=350	k=400	k=500	k=550
6.0	31.48	29.30	26.47	24.63	23.30	22.26	21.42	20.72	19.59	19.13
6.5	33.43	31.11	28.11	26.16	24.74	23.64	22.74	22.00	20.80	20.31
7.0	35.34	32.89	29.72	27.65	26.15	24.99	24.04	23.25	21.99	21.47
7.5	37.22	34.63	31.29	29.12	27.54	26.32	25.32	24.49	23.16	22.61
8.0	39.06	36.35	32.85	30.57	28.91	27.62	26.58	25.70	24.31	23.74
8.5	40.88	38.04	34.37	31.99	30.25	28.91	27.81	26.90	25.44	24.84
9.0	42.67	39.71	35.88	33.39	31.58	30.17	29.03	28.08	26.55	25.93
9.5	44.43	41.35	37.36	34.77	32.89	31.42	30.23	29.24	27.65	27.00
10.0	46.18	42.97	38.83	36.14	34.17	32.65	31.42	30.39	28.74	28.06
10.5	47.90	44.57	40.28	37.48	35.45	33.87	32.59	31.52	29.81	29.11
11.0	49.60	46.16	41.71	38.81	36.71	35.07	33.75	32.64	30.87	30.14
11.5	51.28	47.72	43.12	40.13	37.95	36.26	34.89	33.74	31.91	31.16
12.0	52.94	49.27	44.52	41.43	39.18	37.44	36.02	34.84	32.95	32.17
12.5	54.59	50.80	45.90	42.72	40.40	38.60	37.14	35.92	33.97	33.17
13.0	56.22	52.32	47.27	43.99	41.61	39.75	38.25	36.99	34.99	34.16
13.5	57.83	53.82	48.63	45.26	42.80	40.89	39.35	38.06	35.99	35.14
14.0	59.43	55.31	49.98	46.51	43.98	42.02	40.44	39.11	36.99	36.12
14.5	61.02	56.78	51.31	47.75	45.16	43.15	41.51	40.15	37.97	37.08
15.0	62.59	58.25	52.63	48.98	46.32	44.26	42.58	41.19	38.95	38.03
15.5	64.15	59.70	53.94	50.20	47.47	45.36	43.64	42.21	39.92	38.98
16.0	65.69	61.13	55.24	51.41	48.62	46.45	44.70	43.23	40.88	39.92
16.5	67.23	62.56	56.53	52.61	49.75	47.54	45.74	44.24	41.84	40.85
17.0	68.75	63.98	57.81	53.80	50.88	48.61	46.77	45.24	42.78	41.78
17.5	70.26	65.38	59.08	54.98	52.00	49.68	47.80	46.23	43.72	42.70
18.0	71.76	66.78	60.34	56.15	53.11	50.74	48.82	47.22	44.66	43.61
18.5	73.25	68.17	61.60	57.32	54.21	51.80	49.84	48.20	45.59	44.51
19.0	74.73	69.54	62.84	58.48	55.31	52.84	50.84	49.17	46.51	45.41
19.5	76.20	70.91	64.08	59.63	56.39	53.88	51.84	50.14	47.42	46.30
20.0	77.66	72.27	65.30	60.77	57.47	54.91	52.84	51.10	48.33	47.19
20.5	79.11	73.62	66.52	61.91	58.55	55.94	53.83	52.06	49.23	48.07
21.0	80.55	74.96	67.74	63.04	59.62	56.96	54.81	53.01	50.13	48.95
21.5	81.99	76.30	68.94	64.16	60.68	57.97	55.78	53.95	51.02	49.82
22.0	83.41	77.63	70.14	65.28	61.73	58.98	56.75	54.89	51.91	50.69
22.5	84.83	78.95	71.34	66.38	62.78	59.99	57.72	55.82	52.79	51.55
23.0	86.24	80.26	72.52	67.49	63.83	60.98	58.68	56.75	53.67	52.41
23.5	87.64	81.56	73.70	68.59	64.86	61.97	59.63	57.67	54.54	53.26
24.0	89.04	82.86	74.87	69.68	65.90	62.96	60.58	58.59	55.41	54.11
24.5	90.43	84.15	76.04	70.76	66.92	63.94	61.52	59.50	56.28	54.95
25.0	91.81	85.44	77.20	71.84	67.95	64.92	62.46	60.41	57.14	55.79

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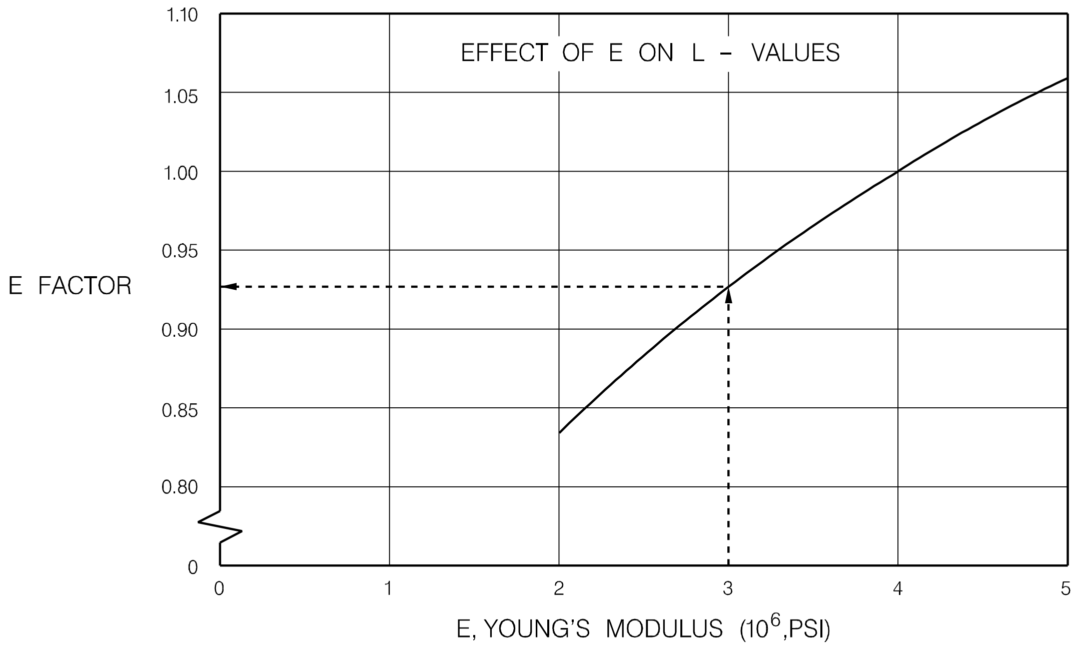
Figure 7.8.1 - Radius of Relative Stiffness

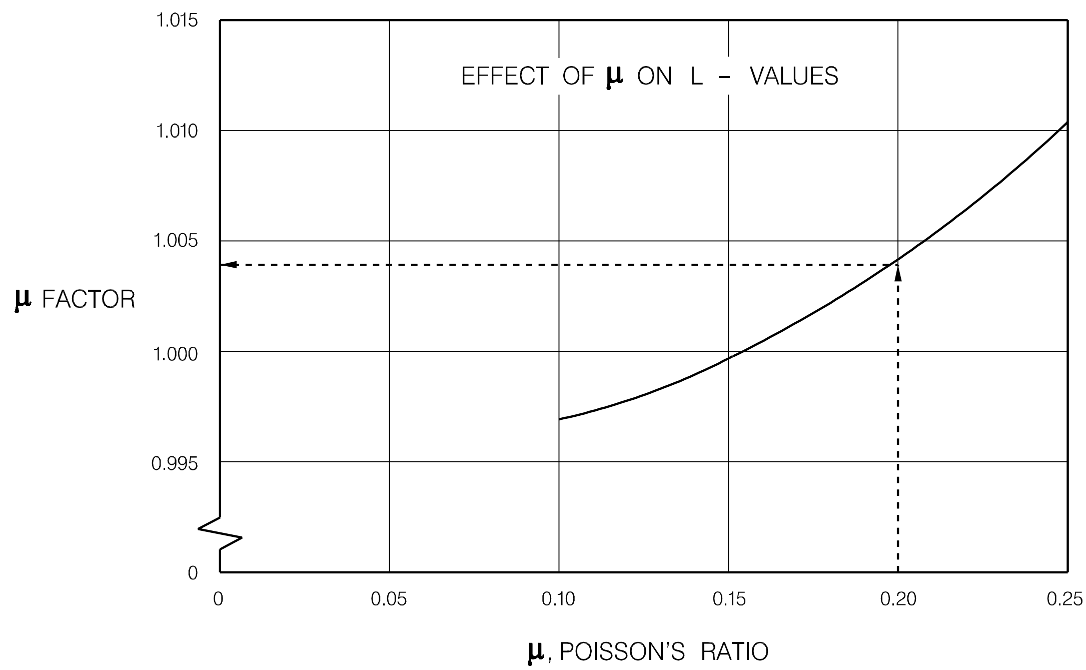
7.8.2 Radius of Relative Stiffness (other values)

The table of section 7.8.1 presents the (RRS) Radius of Relative Stiffness values based on Young's modulus (E) of 4,000,000 psi and Poisson's ratio (μ) of 0.15.

For convenience in finding this Radius based on other values of E and μ, the curves of section 7.8.3 are included.

For example, to find a RRS value based on an E of 3,000,000 psi, the ″E″ factor of 0.931 is multiplied by the RRS value found in figure 7.8.1. The effect of the variations of μ on the RRS value is treated in a similar manner.





NOTE: BOTH CURVES ON THIS PAGE ARE USED TO ADJUST THE "L"- VALUES.

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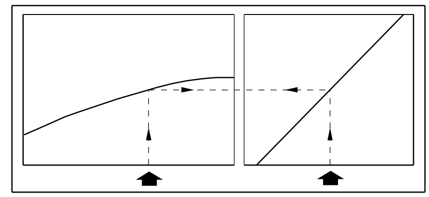
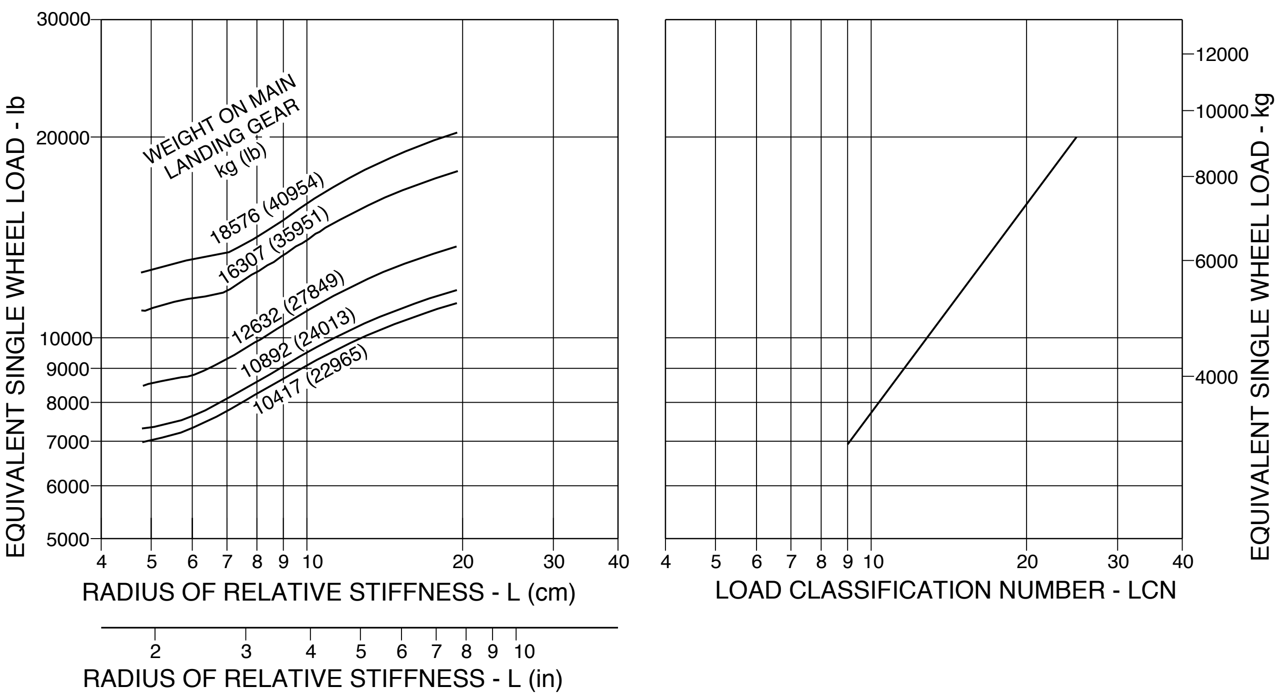
Figure 7.8.2 - Radius of Relative Stiffness (other values)

7.8.3 Rigid Pavement Requirements - LCN Method



TIRES 30 x 9.5-14 16PR AT 10.41 kgf/cm2 (148 psi) (LOADED)



NOTE: EQUIVALENT SINGLE WHEEL LOADS ARE DERIVED BY METHODS SHOWN IN ICAO AERODROME MANUAL. PART 2, PAR. 4.1.3

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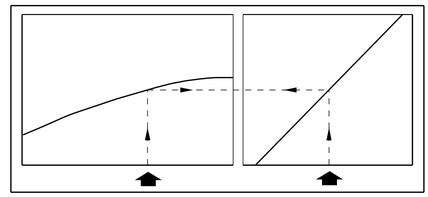
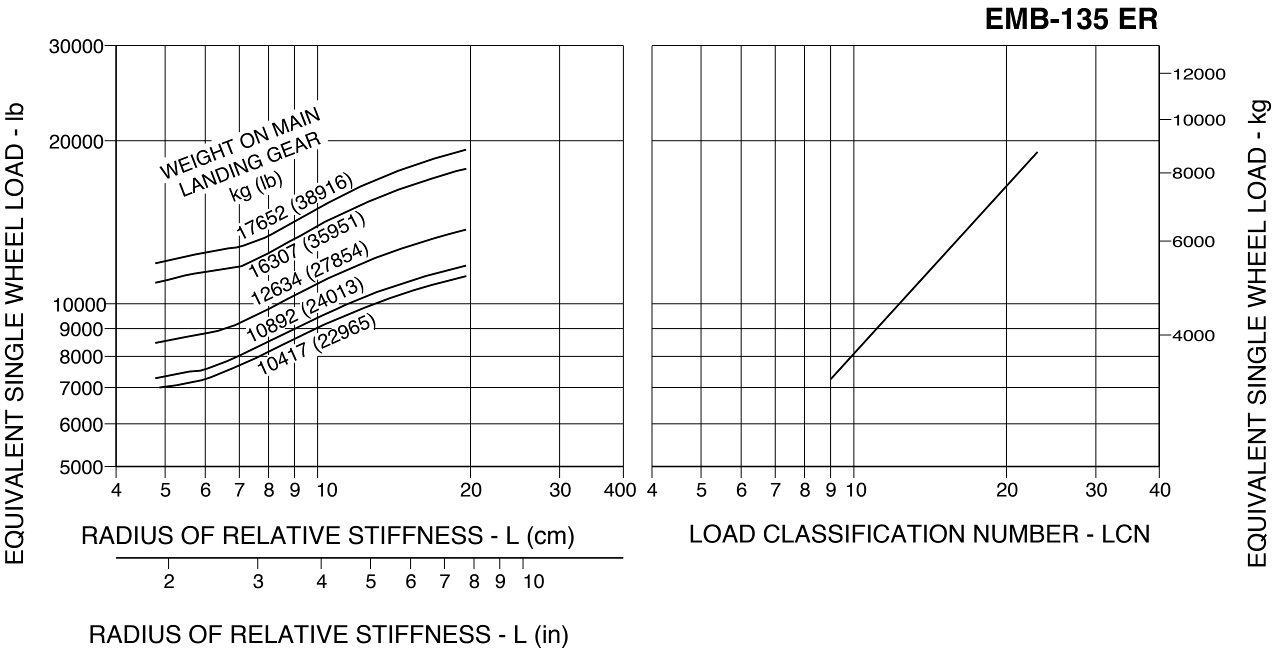
Figure 7.8.3 - Rigid Pavement Requirements - LCN Method
Sheet 1



TIRES 30 x 9.5-14 16PR AT 9.42 kgf/cm2 (134 psi) (LOADED)



NOTE: EQUIVALENT SINGLE WHEEL LOADS ARE DERIVED BY METHODS SHOWN IN ICAO AERODROME MANUAL. PART 2, PAR. 4.1.3

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Figure 7.8.3 - Rigid Pavement Requirements - LCN Method
Sheet 2

7.9 ACN/PCN Reporting System, Flexible and Rigid Pavements

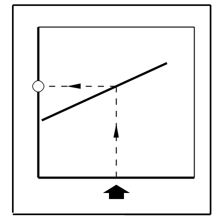
To determine the ACN of an aircraft on flexible or rigid pavement, both the aircraft gross weight and the subgrade strength must be known.

NOTE: An aircraft with an ACN equal to or less than the reported PCN can operate on the pavement subject to any limitations on the tire pressure.

7.9.1 Aircraft Classification Number Flexible Pavement

FLEXIBLE PAVEMENT SUBGRADE STRENGTH

NOTES:
- 30 x 9.5-14 16PR TIRES
- TIRE PRESSURE 9.42 kgf/cm^2 (134 psi) (LOADED)
- % WEIGHT OR MAIN GEARS 92.42%



EMB-135 ER

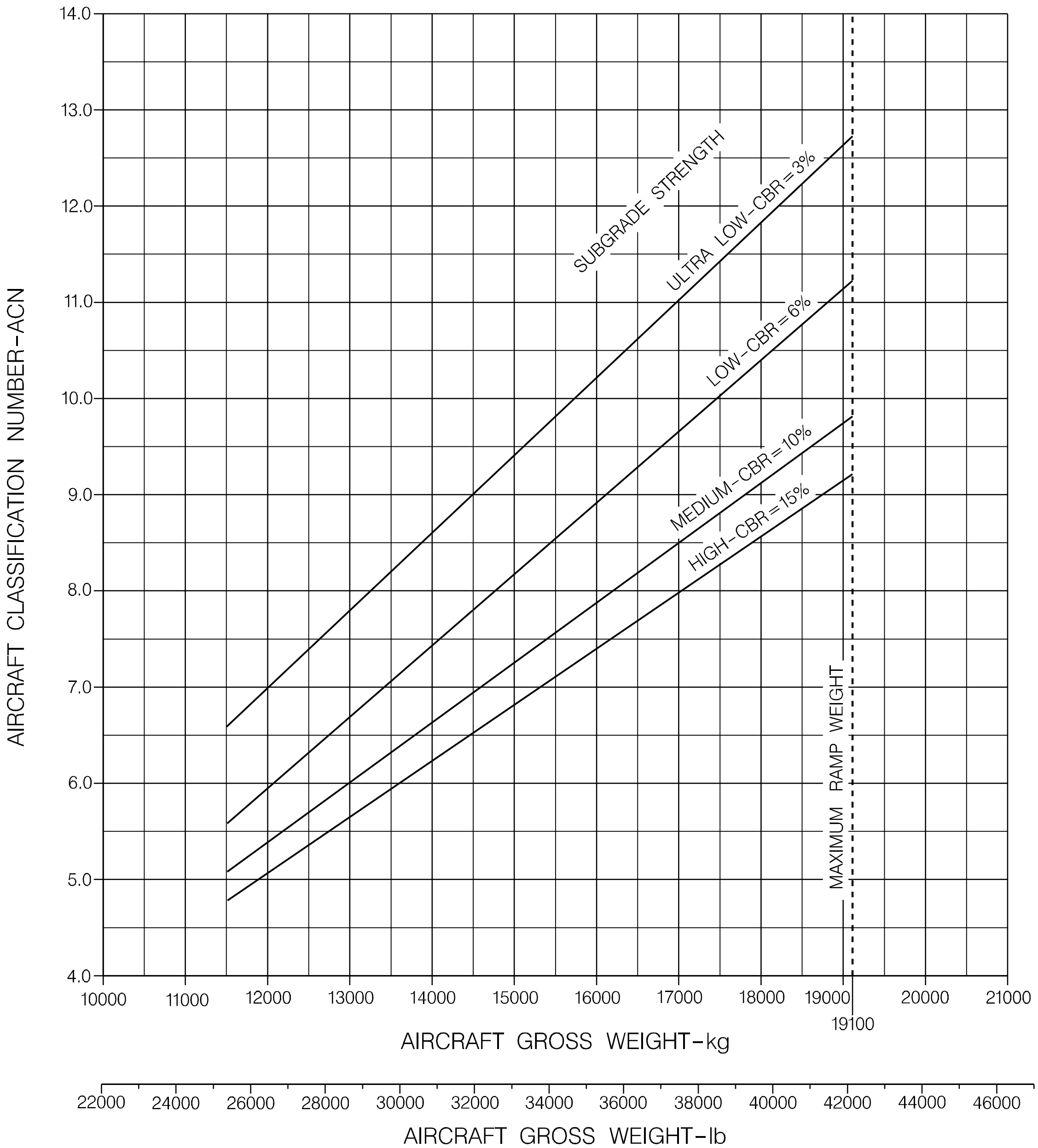
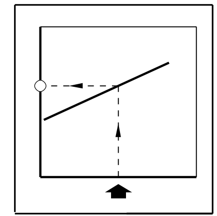


Figure 7.9.1 - Aircraft Classification Number Flexible Pavement
Sheet 1

FLEXIBLE PAVEMENT SUBGRADE STRENGTH



NOTES:
- 30 x 9.5-14 16PR TIRES
- TIRE PRESSURE 10.41 kgf/cm^2 (148 psi) (LOADED)
- % WEIGHT OR MAIN GEARS 92.42%

EMB-135 LR

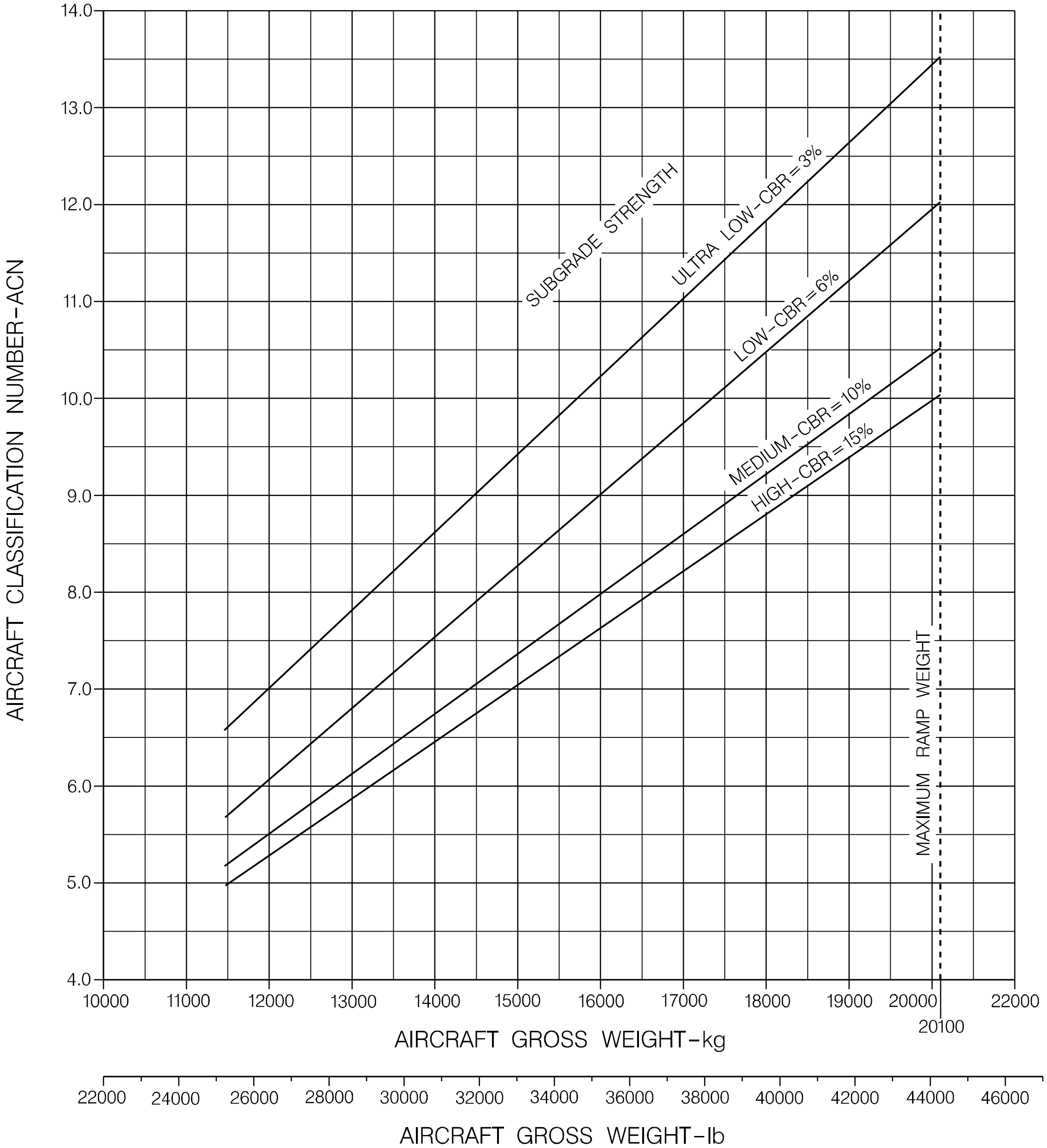


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Figure 7.9.1 - Aircraft Classification Number Flexible Pavement Sheet 2

7.9.2 Aircraft Classification Number Rigid Pavement

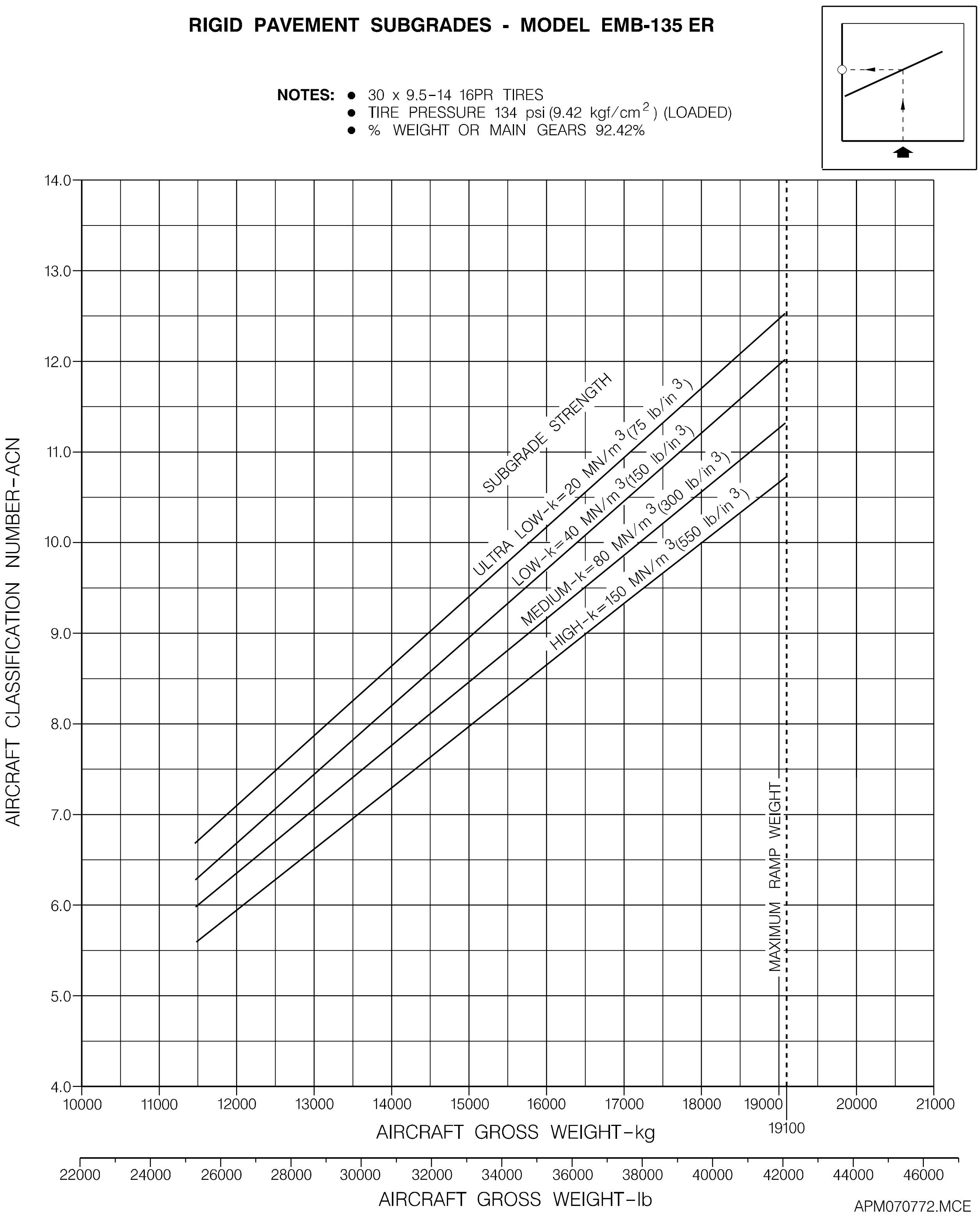

Figure 7.9.2 - Aircraft Classification Number Rigid Pavement
Sheet 1

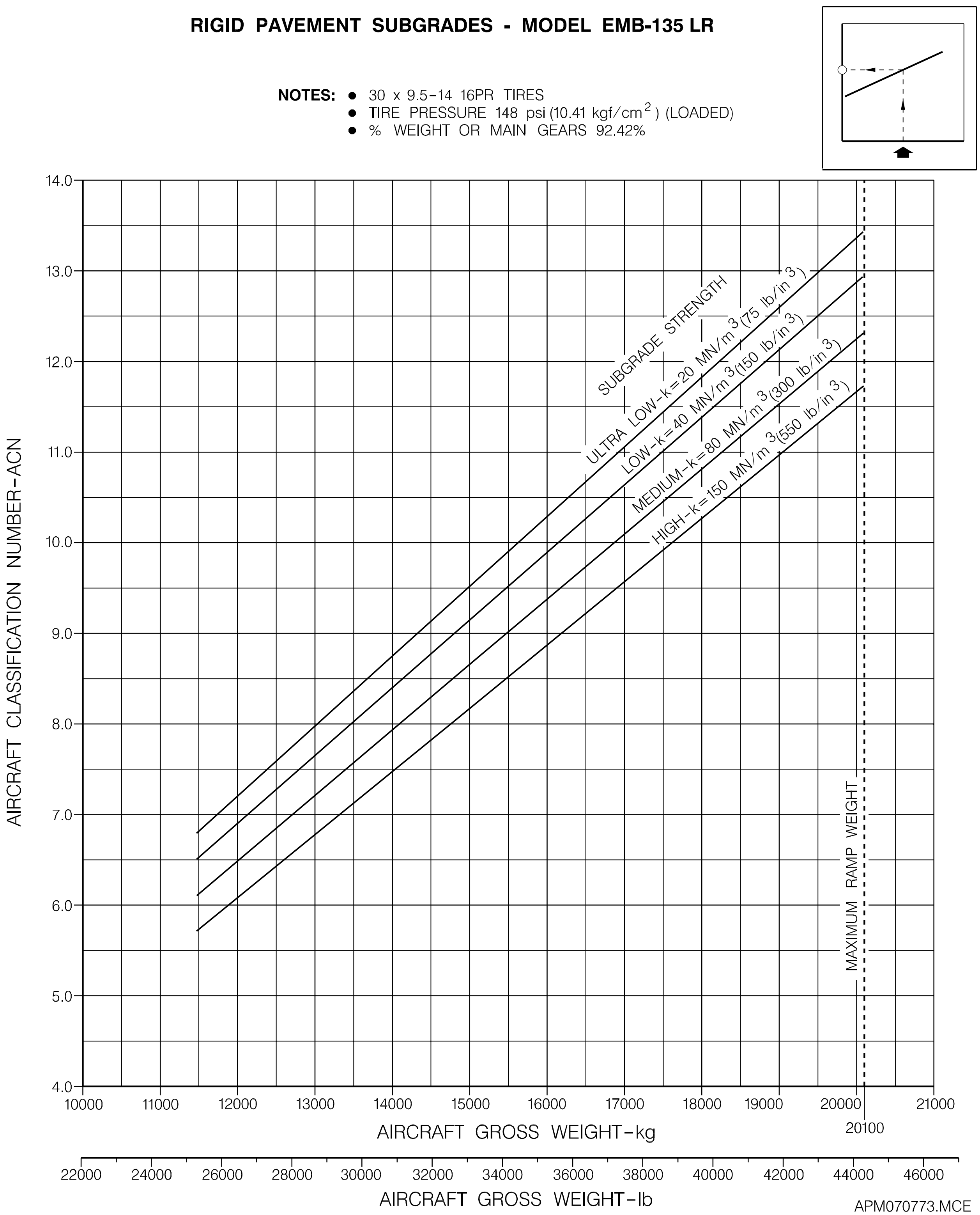

Figure 7.9.2 - Aircraft Classification Number Rigid Pavement
Sheet 2

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8. POSSIBLE EMB-135 DERIVATIVE AIRPLANES

No derivative models of the EMB-135 are current planned.

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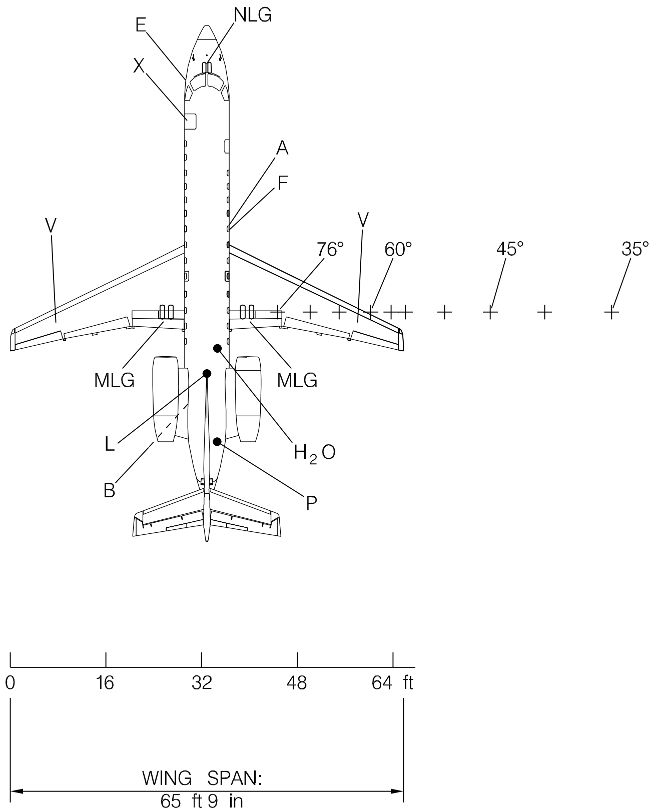
9. EMB-135 SCALE DRAWINGS

This section provides EMB-135 plan views to the following scales:

- English
  1 inch = 32 feet
  1 inch = 50 feet
  1 inch = 100 feet
- Metric
  1:500
  1:1000

9.1 EMB-135 Scale: 1 Inch Equals 32 Feet



LEGEND:

A	AIR CONDITIONING
B	BAGGAGE DOOR
E	ELECTRICAL
F	FUEL
H_2O	POTABLE WATER
L	LAVATORY
MLG	MAIN LANDING GEAR
NLG	NOSE LANDING GEAR
P	PNEUMATIC
V	FUEL VENT
X	PASSENGER DOOR
+	TURNING RADIUS POINTS: 76°, 70°, 65°, 60°, 57°, 55°, 50°,45°,40°, 35°

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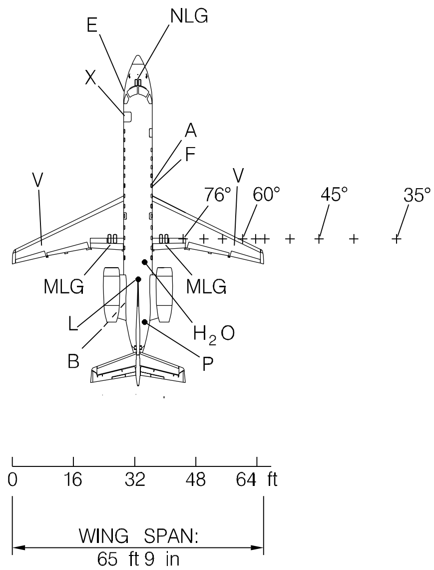
Figure 9.1.1 - EMB-135 Scale: 1 Inch Equals 32 Feet

9.2 EMB-135 Scale: 1 Inch Equals 50 Feet



LEGEND:

A	AIR CONDITIONING
B	BAGGAGE DOOR
E	ELECTRICAL
F	FUEL
H_2O	POTABLE WATER
L	LAVATORY
MLG	MAIN LANDING GEAR
NLG	NOSE LANDING GEAR
P	PNEUMATIC
V	FUEL VENT
X	PASSENGER DOOR
+	TURNING RADIUS POINTS: 76°, 70°, 65°, 60°, 57°, 55°, 50°,45°,40°, 35°

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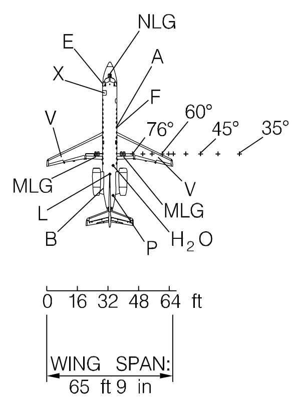
Figure 9.2.1 - EMB-135 Scale: 1 Inch Equals 50 Feet

9.3 EMB-135 Scale: 1 Inch Equals 100 Feet



LEGEND:

A	AIR CONDITIONING
B	BAGGAGE DOOR
E	ELECTRICAL
F	FUEL
H_2O	POTABLE WATER
L	LAVATORY
MLG	MAIN LANDING GEAR
NLG	NOSE LANDING GEAR
P	PNEUMATIC
V	FUEL VENT
X	PASSENGER DOOR
+	TURNING RADIUS POINTS: 76°, 70°, 65°, 60°, 57°, 55°, 50°,45°,40°, 35°

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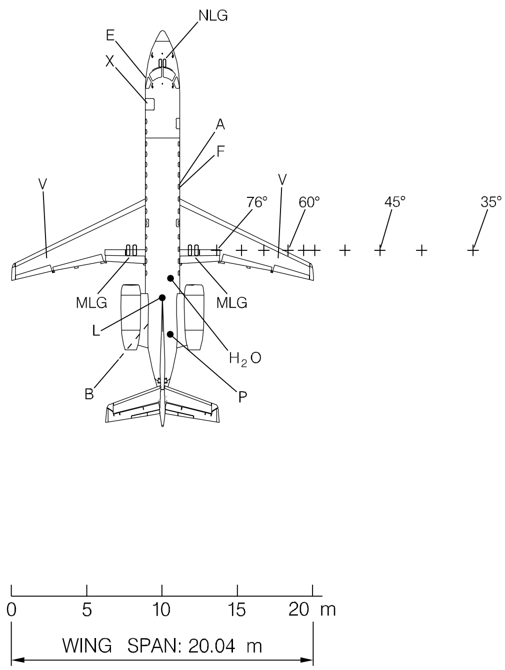
Figure 9.3.1 - EMB-135 Scale: 1 Inch Equals 100 Feet

9.4 EMB-135 Scale: 1 to 500



LEGEND:

A	AIR CONDITIONING
B	BAGGAGE DOOR
E	ELECTRICAL
F	FUEL
H_2O	POTABLE WATER
L	LAVATORY
MLG	MAIN LANDING GEAR
NLG	NOSE LANDING GEAR
P	PNEUMATIC
V	FUEL VENT
X	PASSENGER DOOR
+	TURNING RADIUS POINTS: 76°, 70°, 65°, 60°, 57°, 55°, 50°,45°,40°, 35°

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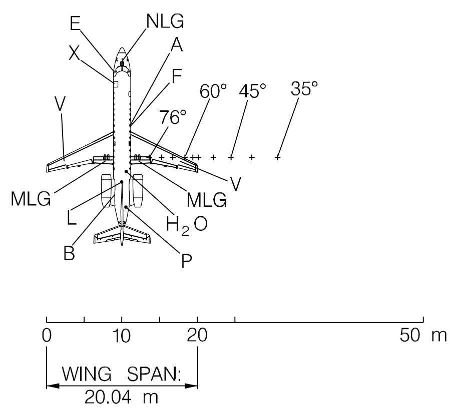
Figure 9.4.1 - EMB-135 Scale: 1 to 500

9.5 EMB-135 Scale: 1 to 1000



LEGEND:

A	AIR CONDITIONING
B	BAGGAGE DOOR
E	ELECTRICAL
F	FUEL
H_2O	POTABLE WATER
L	LAVATORY
MLG	MAIN LANDING GEAR
NLG	NOSE LANDING GEAR
P	PNEUMATIC
V	FUEL VENT
X	PASSENGER DOOR
+	TURNING RADIUS POINTS: 76°, 70°, 65°, 60°, 57°, 55°, 50°,45°,40°, 35°

APM090076.MCE A

Figure 9.5.1 - EMB-135 Scale: 1 to 1000