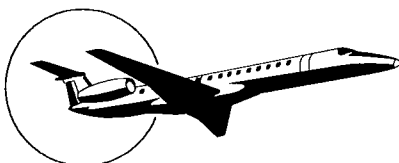


EMB145



BRAZILIAN WEIGHT AND BALANCE MANUAL

EMPRESA BRASILEIRA DE AERONÁUTICA S.A.

THIS DOCUMENT INCLUDES ALL INFORMATION REQUIRED TO BE FURNISHED TO THE PILOTS BY THE "REGULAMENTO BRASILEIRO DE HOMOLOGAÇÃO AERONÁUTICA" (RBHA 25). THIS DOCUMENT IS APPLICABLE TO EMB-145 STANDARD, EMB-145EU, EMB-145ER, EMB-145EP, EMB-145MK, EMB-145MP, EMB-145LU, EMB-145LR, EMB-145XR, EMB-135ER, EMB-135LR, EMB-135KE AND EMB-135KL AIRPLANES.

NOTE: THE EMB-135KE AND EMB-135KL MODELS HAVE THE COMMERCIAL DESIGNATIONS OF ERJ-140ER AND ERJ-140LR, RESPECTIVELY.

CTA APPROVAL: _____

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CHEFE DA DIVISÃO DE HOMOLOGAÇÃO
AERONÁUTICA

DATE: 29 de Novembro de 1996

REGISTRATION NUMBER: _____

SERIAL NUMBER: _____

WB-145/1160

NOVEMBER 29, 1996

REVISION 16 – JANUARY 25, 2008

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			DATE	SIGNATURE
1 DEC 20, 96	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 and 22	General improvement and updating.	DEC 20, 96	<i>Ratios</i>
2 APR 15, 97	1, 10, 10A, 10B, 11 and 12	Includes new CG envelope and EMB-145EU Model.	APR 15, 97	<i>Ratios</i>
3 MAY 22, 97	13, 15 to 17	Updates fuel and hydraulic data.	22 MAY, 97	<i>[Signature]</i>
4 APR 20, 98	Title, 1, 10, 10A, 10B, 11, 12, 13, 14, 15, 16, 16A and 16B	Includes the CG envelope for flaps 22° and other data for EMB-145MR and EMB-145LR models.	APR 20, 98	<i>[Signature]</i>
5 JAN 12, 99	15 and 22	Updates figures for fuel and baggage compartment capacity.	Jan 12, 1999	<i>Pamot Hag G.</i>

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**WEIGHT AND
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LOG OF REVISIONS

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LOG OF REVISIONS

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9 JUL 13, 00	1, 2, 6, 7, 8, 11, 14, 15, 16A, 16C, 16D, 16E, 16F, 17, 18, 21, 22, 24 and 40	Include flaps 18° information and aft attendant balance arm. Include EMB-145MK model. Remove EMB-145MR model. Correct EMB-145MP CG envelope. Expand EMB-145MP model weight limits.	July 13, 2000	<i>[Signature]</i>
10 JUN 19, 01	1, 2, 30, 31, 32, 33, 34, 35, 36, 37, 40, 41, 42, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59 and 60	Include flaps 18° information related to the EMB-135 models ER and LR. Include ERJ-140ER and LR models (EMB-135KE and KL models respectively).	JUN 19, 01	<i>[Signature]</i>

WB-145/1160 - CTA

CTA APPROVED
REVISION 10

**WEIGHT AND
BALANCE
MANUAL**



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(WB-145/1160)**

LOG OF REVISIONS

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11 AUG 30, 02	2A, 2B, 10 and 61 to 74	Include EMB-145XR model. Update the baggage compartment loading criterion.	Aug 30, 2002	<i>[Signature]</i>
12 FEB 17, 03	10 14 58	Update the baggage compartment loading criterion. Change EMB-145MK model MLW and MZFW values. Change ERJ-140 passenger average CG value.	Feb 17, 2003	<i>[Signature]</i>
13 JUL 05, 03	10	Exclusion of the necessity of the use of horizontal net to airplanes Post-Mod. SB 145-25-0261 (reinforced liners) or equipped with an equivalent modification factory incorporated.	<div style="border: 1px solid black; padding: 5px;"> <p align="center">WB-145/1160 Revision 13 approved by CTA on July 05, 2003</p> <p align="center"><i>[Signature]</i></p> </div>	

WB-145/1160 - CTA

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LOG OF REVISIONS

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LOG OF REVISIONS

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14 OCT 19, 05	32 and 33	Update the MZFW of the EMB-135ER model.	<div>WB-145/1160 Revision 14 approved by CTA on October 19, 2005. </div>
15 DEC 14, 05	14 to 18, 32 to 34, 48 to 50, 64 and 65	Update limitations.	<div>WB-145/1160 Revision 15 approved by CTA on December 14, 2005 José Renato Oliveira Ten Cel Eng R1 Adjunto CTA / IFI / CAVC</div>
16 JAN 25, 08	21, 37, 53 and 68 1, 2, 2A, 26 to 28, 42, 43, 58 to 60 and 73 to 76	Update definition. Update Interior Arrangement information.	<div>WB-145/1160 Revision 16 approved by ANAC on January 25, 2008. </div>

WB-145/1160 - CTA

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REVISION 16

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**WEIGHT AND
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LIST OF EFFECTIVE PAGES

ORIGINAL	0	NOV 29, 1996
REVISION	1	DEC 20, 1996
REVISION	2	APR 15, 1997
REVISION	3	MAY 22, 1997
REVISION	4	APR 20, 1998
REVISION	5	JAN 12, 1999
REVISION	6	APR 01, 1999
REVISION	7	JUN 11, 1999
REVISION	8	AUG 06, 1999
REVISION	9	JUL 13, 2000
REVISION	10	JUN 19, 2001
REVISION	11	AUG 30, 2002
REVISION	12	FEB 17, 2003
REVISION	13	JUL 05, 2003
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* Title	REVISION 16	3	REVISION 7
		4	ORIGINAL
I	REVISION 5	5	REVISION 1
II	REVISION 8	6	REVISION 9
III	REVISION 10	7	REVISION 9
IV	REVISION 13	8	REVISION 9
* V	REVISION 16	9	REVISION 7
* VI	REVISION 16	10	REVISION 13
		10A (del)	REVISION 7
* i	REVISION 16	10B (del)	REVISION 7
* ii	REVISION 16	11	REVISION 9
		12	REVISION 7
* 1	REVISION 16	13	REVISION 7
* 2	REVISION 16	14	REVISION 15
* 2A	REVISION 16	15	REVISION 15
2B	REVISION 11	16	REVISION 15

* Asterisk indicates pages revised, added or deleted by the current revision.

**WEIGHT AND
BALANCE
MANUAL**



16A (del).....	REVISION 15	52.....	REVISION 10
16B (del).....	REVISION 15	* 53.....	REVISION 16
16C (del).....	REVISION 15	54.....	REVISION 10
16D (del).....	REVISION 15	55.....	REVISION 10
16E (del).....	REVISION 15	56.....	REVISION 10
16F (del).....	REVISION 15	57.....	REVISION 10
17 (del).....	REVISION 15	* 58.....	REVISION 16
18 (del).....	REVISION 15	* 59.....	REVISION 16
19.....	REVISION 8	* 60.....	REVISION 16
20.....	REVISION 7	61.....	REVISION 11
* 21.....	REVISION 16	62.....	REVISION 11
22.....	REVISION 9	63.....	REVISION 11
23.....	REVISION 7	64.....	REVISION 15
24.....	REVISION 9	65.....	REVISION 15
25.....	REVISION 7	66.....	REVISION 11
* 26.....	REVISION 16	67.....	REVISION 11
* 27.....	REVISION 16	* 68.....	REVISION 16
* 28.....	REVISION 16	69.....	REVISION 11
29.....	REVISION 7	70.....	REVISION 11
30.....	REVISION 10	71.....	REVISION 11
31.....	REVISION 10	72.....	REVISION 11
32.....	REVISION 15	* 73.....	REVISION 16
33.....	REVISION 15	* 74.....	REVISION 16
34.....	REVISION 15	* 75.....	REVISION 16
35.....	REVISION 10	* 76.....	REVISION 16
36.....	REVISION 10		
* 37.....	REVISION 16		
38.....	REVISION 7		
39.....	REVISION 7		
40.....	REVISION 10		
41.....	REVISION 10		
* 42.....	REVISION 16		
* 43.....	REVISION 16		
44.....	REVISION 7		
45.....	REVISION 10		
46.....	REVISION 10		
47.....	REVISION 10		
48.....	REVISION 15		
49.....	REVISION 15		
50.....	REVISION 15		
51.....	REVISION 10		

* Asterisk indicates pages revised, added or deleted by the current revision.

TABLE OF CONTENTS

GENERAL.....	3
STANDARD TERMS AND DEFINITIONS.....	4
WEIGHING FACILITIES.....	6
WEIGHING EQUIPMENT	6
WEIGHING INSTRUCTIONS	6
PASSENGERS	9
PASSENGER LOCATION	9
PASSENGER WEIGHT	9
BAGGAGE LOADING.....	10
BAGGAGE WEIGHT AND LOCATION	10
BAGGAGE LOADING PROCEDURES.....	10
CARRY-ON BAGGAGE	10
BAGGAGE COMPARTMENT	10
EMB-145 STANDARD, EU, ER, EP, MK, MP, LU AND LR MODELS.....	11
BALANCE REFERENCE SYSTEM (EMB-145 MODELS).....	12
BALANCE ARMS/BODY STATION	12
AIRPLANE JACKING (EMB-145 MODELS)	13
JACK POINTS LOCATION	13
MAXIMUM GROSS WEIGHT AND CENTER OF GRAVITY LIMITS (EMB-145 MODELS)	14
CG CONSTRAINTS	14
CG ENVELOPE FOR OPERATION (EMB-145 MODELS)	15
CG ENVELOPE FOR JACKING (EMB-145 MODELS).....	19
MOMENT/CG CHANGES (EMB-145 MODELS)	20
FUEL DATA (EMB-145 MODELS)	21
FUEL DEFINITIONS	21
FUEL QUANTITIES	21
FUEL DISTRIBUTION TABLE (EMB-145 STANDARD, EU, ER, EP, MK AND MP MODELS).....	22
FUEL DISTRIBUTION TABLE (EMB-145 LU AND LR MODELS) ..	23
MISCELLANEOUS FLUIDS (EMB-145 MODELS)	24
FLIGHT CREW ITEMS (EMB-145 MODELS)	24
BAGGAGE LOADING (EMB-145 MODELS)	25
BAGGAGE LOADING PROCEDURES.....	25
INTERIOR ARRANGEMENT (EMB-145 MODELS)	26
STANDARD CONFIGURATION (EXAMPLE).....	27
EMB-135 ER AND LR MODELS.....	29
BALANCE REFERENCE SYSTEM (EMB-135 ER AND LR MODELS).....	30
BALANCE ARMS/BODY STATION	30

AIRPLANE JACKING (EMB-135 ER AND LR MODELS)	31
JACK POINTS LOCATION.....	31
MAXIMUM GROSS WEIGHT AND CENTER OF GRAVITY	
LIMITS (EMB-135 ER AND LR MODELS)	32
CG CONSTRAINTS.....	32
CG ENVELOPE FOR OPERATION (EMB-135 ER AND LR MODELS).....	33
CG ENVELOPE FOR JACKING (EMB-135 ER AND LR MODELS).....	35
MOMENT/CG CHANGES (EMB-135 ER AND LR MODELS).....	36
FUEL DATA (EMB-135 ER AND LR MODELS).....	37
FUEL DEFINITIONS.....	37
FUEL QUANTITIES.....	37
FUEL DISTRIBUTION TABLE (EMB-135 ER MODEL)	38
FUEL DISTRIBUTION TABLE (EMB-135 LR MODEL).....	39
MISCELLANEOUS FLUIDS (EMB-135 ER AND LR MODELS)	40
FLIGHT CREW ITEMS (EMB-135 ER AND LR MODELS)	40
BAGGAGE LOADING (EMB-135 ER AND LR MODELS)	41
BAGGAGE LOADING PROCEDURES.....	41
INTERIOR ARRANGEMENT (EMB-135 ER AND LR MODELS)	42
STANDARD CONFIGURATION (EXAMPLE)	42
ERJ-140 ER AND LR MODELS	45
BALANCE REFERENCE SYSTEM (ERJ-140 ER AND LR MODELS).....	46
BALANCE ARMS/BODY STATION.....	46
AIRPLANE JACKING (ERJ-140 ER AND LR MODELS)	47
JACK POINTS LOCATION.....	47
MAXIMUM GROSS WEIGHT AND CENTER OF GRAVITY	
LIMITS (ERJ-140 ER AND LR MODELS)	48
CG CONSTRAINTS.....	48
CG ENVELOPE FOR OPERATION (ERJ-140 ER AND LR MODELS).....	49
CG ENVELOPE FOR JACKING (ERJ-140 ER AND LR MODELS).....	51
MOMENT/CG CHANGES (ERJ-140 ER AND LR MODELS).....	52
FUEL DATA (ERJ-140 ER AND LR MODELS).....	53
FUEL DEFINITIONS.....	53
FUEL QUANTITIES.....	53
FUEL DISTRIBUTION TABLE (ERJ-140 ER MODEL)	54
FUEL DISTRIBUTION TABLE (ERJ-140 LR MODEL).....	55
MISCELLANEOUS FLUIDS (ERJ-140 ER AND LR MODELS)	56
FLIGHT CREW ITEMS (ERJ-140 ER AND LR MODELS)	56
BAGGAGE LOADING (ERJ-140 ER AND LR MODELS)	57
BAGGAGE LOADING PROCEDURES.....	57
INTERIOR ARRANGEMENT (ERJ-140 ER AND LR MODELS)	58
STANDARD CONFIGURATION (EXAMPLE)	59

EMB-145 XR MODEL	61
BALANCE REFERENCE SYSTEM (EMB-145 XR MODEL)	62
BALANCE ARMS/BODY STATION.....	62
AIRPLANE JACKING (EMB-145 XR MODEL)	63
JACK POINTS LOCATION	63
MAXIMUM GROSS WEIGHT AND CENTER OF GRAVITY	
LIMITS (EMB-145 XR MODEL).....	64
CG CONSTRAINTS	64
CG ENVELOPE FOR OPERATION (EMB-145 XR MODEL).....	65
CG ENVELOPE FOR JACKING (EMB-145 XR MODEL)	66
MOMENT/CG CHANGES (EMB-145 XR MODEL)	67
FUEL DATA (EMB-145 XR MODEL)	68
FUEL DEFINITIONS	68
FUEL QUANTITIES.....	68
FUEL DISTRIBUTION TABLE (EMB-145 XR MODEL)	69
MISCELLANEOUS FLUIDS (EMB-145 XR MODEL)	71
FLIGHT CREW ITEMS (EMB-145 XR MODEL).....	71
BAGGAGE LOADING (EMB-145 XR MODEL).....	72
BAGGAGE LOADING PROCEDURES.....	72
INTERIOR ARRANGEMENT (EMB-145 XR MODEL).....	73
STANDARD CONFIGURATION (EXAMPLE)	74

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GENERAL

The Weight and Balance Manual provides instructions referring to the weighing and loading of the EMB-145 airplane models.

The Instructions and Data herein presented are approved by the Airworthiness Authority to comply with the applicable regulations.

The Basic Empty Weight value obtained during the airplane weighing procedures should be used as point of departure for each loading operation.

Based on the contained information, the operator can determine the airplane weight and CG at any time of flight.

STANDARD TERMS AND DEFINITIONS

EQUIPPED EMPTY WEIGHT (EEW) OR MANUFACTURER EMPTY WEIGHT (MEW)

It is the weight of structure, power plant, instruments, interior furnishings, systems, optional, portable, and emergency equipment and other items of equipment that are an integral part of the airplane configuration. It is essentially a dry weight, including only those fluids contained in closed systems such as oxygen, fire extinguisher agent, landing gear shock absorber fluid, etc...

BASIC EMPTY WEIGHT (BEW)

It is the MEW plus the weight of the following items:

- APU oil
- Engine oil
- Hydraulic fluid
- Unusable fuel

OPERATIONAL EMPTY WEIGHT (OEW)

It is the BEW plus the weight of the operational items.

Operational items are those necessary for airplane operation and not included in the BEW.

The operational items are:

- Crew and crew baggage
- Navigation kit (manuals, charts, etc.)
- Catering (beverages and foods) and removable service equipment for galley (such as standard units, etc.)
- Lavatory rinse water
- Lavatory chemical fluid

ACTUAL ZERO FUEL WEIGHT (AZFW)

This is the OEW plus actual payload.

PAYLOAD

This is the weight of passengers, baggage and cargo.

MAXIMUM ALLOWABLE PAYLOAD

It is the maximum approved weight that can be loaded into the airplane. Maximum payload is the Maximum Zero Fuel Weight (MZFW) less Operational Empty Weight (OEW).

MAXIMUM DESIGN ZERO FUEL WEIGHT (MZFW)

This is the maximum authorized weight before usable fuel be loaded. The MZFW is related to airplane structural limitations.

MAXIMUM DESIGN RAMP WEIGHT (MRW)

This is the maximum authorized ramp weight.

MAXIMUM DESIGN TAKEOFF WEIGHT (MTOW)

This is the maximum authorized weight for takeoff.

MAXIMUM DESIGN LANDING WEIGHT (MLW)

This is the maximum authorized weight for landing.

MINIMUM OPERATING WEIGHT (MOW)

This is the minimum authorized weight to operate the airplane.

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WEIGHT AND BALANCE MANUAL

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PASSENGERS

PASSENGER LOCATION

The passenger location and respective balance arm are shown in the applicable Interior Arrangement. Seats are numbered sequentially from the left to the right, and from the front to the rear. The seat numbers are for the identification on the Interior Arrangement list and may not necessarily coincide with the actual seating identification on the airplane standard configuration.

Enclosed, the Standard Configuration is presented, including the plan view and the Balance Arms.

For other interior configuration options, the passenger locations and the respective Balance Arms are supplied together with the "Airplane Weighing Form", inserted in the "FINAL INSPECTION REPORT", by the time of the airplane delivering.

PASSENGER WEIGHT

Actual or average passenger weights may be used to compute passenger loads.

Actual passenger weights should be used in case of flights carrying large groups of passengers whose average weight obviously does not conform with the normal standard weight such as athletic squads or other groups which are smaller or larger than the local average. The actual passenger weight may be either determined by scale weighing of each passenger, or by asking each passenger their weight and adding there to a predetermined constant to compensate the handcarried articles and clothing.

The following standard average weight may be adopted:

- Adult passenger..... 82 kg → Summer
84 kg → Winter
- Children (age 2-12)..... 36 kg

NOTE: - Adult passenger weight includes 9 kg of carry-on baggage.
- Children under age 2 are considered "babies-in-arms" and children over age 12 should be treated as adult passengers for purposes of standard average weights.

BAGGAGE LOADING

BAGGAGE WEIGHT AND LOCATION

The baggage weight limits, location and the respective balance arm may be obtained from the applicable interior arrangement.

The data shown enclosed are applicable to Standard Configuration. For other interior configuration options the weight limits, location and the respective balance arm are supplied together with the "Airplane Weighing Form", inserted in the "FINAL INSPECTION REPORT".

BAGGAGE LOADING PROCEDURES

Refer to weight and balance data associated to each model.

CARRY-ON BAGGAGE

Carry-on volumes may be stowed in the overhead bins and in the wardrobe.

There is no specific requirement for underseat carry-on volumes; however a maximum of 9.0 kg is allowable, provided the volume is properly restrained to avoid sliding.

BAGGAGE COMPARTMENT

The baggage compartment is designed for a maximum floor distributed load of 390 kg/m^2 and a total maximum capacity of 1200 kg (EMB-145 and ERJ-140) or 1000 kg (EMB-135).

Cargo and baggage loading up to 990 kg are not required to be tied down. Loads exceeding this value must be placed under the cargo restraint net.

Maximum load that can be placed under the cargo restraint net P/Ns 7162041-501 or -503 is 450 kg.

Maximum load that can be placed under the cargo restraint net P/N 7162041-505 is limited to the maximum capacity of the baggage compartment.

For airplanes Post-Mod. SB 145-25-0261 (reinforced liners) or equipped with an equivalent modification factory incorporated, the use of the horizontal net is not required.

Baggage and cargo should be evenly distributed over the baggage compartment to avoid load concentration.

Cargo must not become a hazard to the airplane structure or systems as a result of shifting under operational loads. Sharp edges (like wooden or metal containers) or dense cargo (objects significantly more dense than typical passenger baggage) must be placed under the cargo restraint net to prevent shifting.

EMB-145 STANDARD, EU, ER, EP, MK, MP, LU AND LR MODELS

The following pages present the weight and balance data for EMB-145 STD, EU, ER, EP, MK, MP, LU and LR models.

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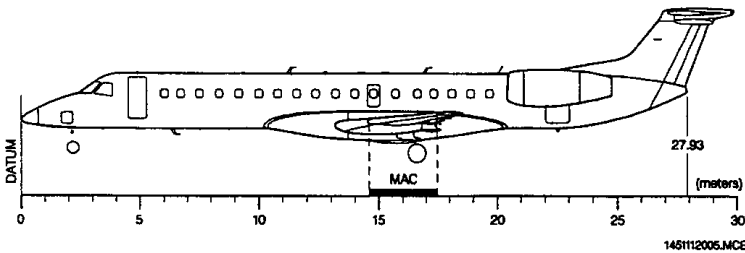
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formula:

$$\frac{(X - 14.600) \times 100}{2.865}$$

where X = Balance Arm of airplane CG measured in meters.



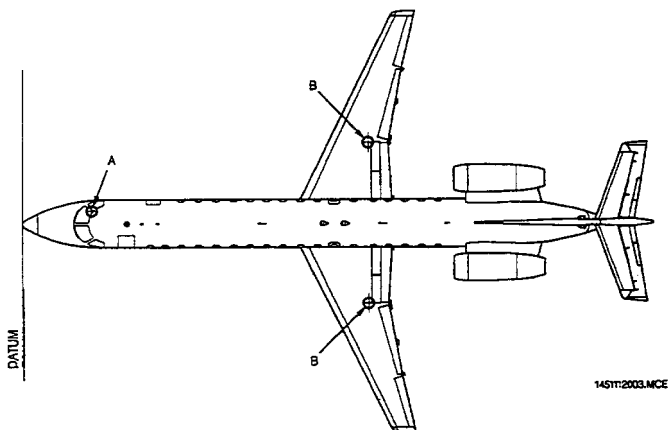
AIRPLANE JACKING (EMB-145 MODELS)

Refer to Chapter 7 of the Aircraft Maintenance Manual for airplane jacking procedures.

JACK POINTS LOCATION

POINT	BALANCE ARM (meters)	CENTERLINE DISTANCE (meters)
A	3.260	0.330
B	16.500	3.815

NOTE: The jack points balance arms refer to the Airplane Datum.



JACK POINTS

MAXIMUM GROSS WEIGHT AND CENTER OF GRAVITY LIMITS (EMB-145 MODELS)

When performing an approved loading schedule, ensure that the airplane weight and center of gravity remains within the Weight x CG Envelope by accounting for airplane weight and balance with all load conditions.

For maximum structural weights, refer to Airplane Flight Manual (AFM-145/1152).

CG CONSTRAINTS

When performing the airplane weighing and balancing, appropriate constraints must be established and applied in order to assure that the center of gravity limits are not exceeded in any airplane operating condition, due to:

- Fuel density variation.
- Passenger seat variation.
- Cargo location variation.
- Landing gear inflight movement.
- Passenger and crew member inflight movement.



WEIGHT AND BALANCE MANUAL

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CG ENVELOPE FOR OPERATION (EMB-145 MODELS)

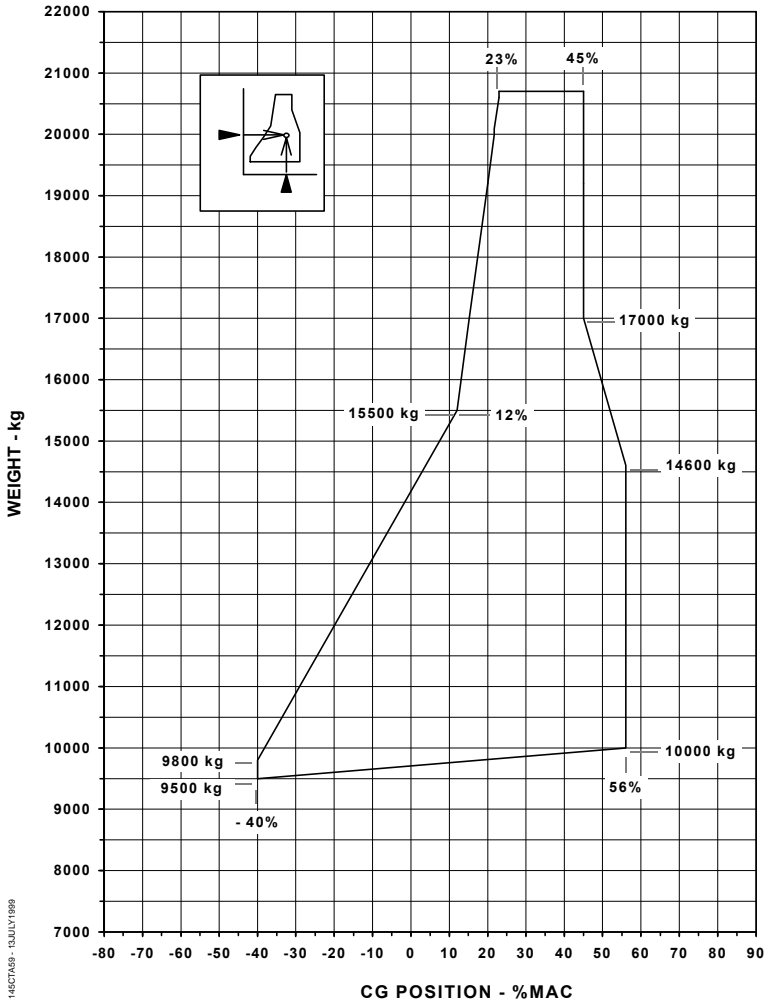
For center of gravity envelopes, refer to Airplane Flight Manual (AFM-145/1152).



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CG ENVELOPE FOR JACKING (EMB-145 MODELS)



- CAUTION:**
- MAXIMUM ALLOWABLE FUEL ASYMMETRY: 363 KG.
 - BEFORE JACKING THE AIRPLANE, CHECK CG WITHIN THE JACKING ENVELOPE.
 - ABOVE 17000 KG, ONLY LANDING GEAR JACKING IS ALLOWED.

NOTE: Refer to maximum gross weight associated to each model.

CTA APPROVED
NOVEMBER 29, 1996
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FUEL DATA (EMB-145 MODELS)

FUEL DEFINITIONS

- **USABLE FUEL** - Is the fuel to be effectively consumed by the engines.
- **UNUSABLE FUEL** - Is the fuel remaining after total usable fuel has been consumed.
- **DRAINABLE FUEL** - Is that portion of fuel which can be drawn off through fuel drains with the airplane leveled.
- **UNDRAINABLE FUEL** - Is that portion of fuel which can not be drawn off by standard draining procedures.

FUEL QUANTITIES

EMB-145 STANDARD, EU, ER, EP, MK and MP Models:

FUEL CATEGORY	VOLUME (liters)	WEIGHT (kg)	CG BALANCE ARM (m)
UNUSABLE UNDRAINABLE	6	5	14.740
UNUSABLE DRAINABLE	48	39	14.740
TOTAL UNUSABLE	54	44	14.740
USABLE	5146	4174	15.332

EMB-145 LU and LR Models:

FUEL CATEGORY	VOLUME (liters)	WEIGHT (kg)	CG BALANCE ARM (m)
UNUSABLE UNDRAINABLE	10	8	14.741
UNUSABLE DRAINABLE	34	28	14.741
TOTAL UNUSABLE	44	36	14.741
USABLE	6396	5187	15.153

NOTE: Fuel density may range from 0.785 kg/l to 0.811 kg/l. The values above have been determined for an adopted fuel density of 0.811 kg/l.

FUEL DISTRIBUTION TABLE (EMB-145 STANDARD, EU, ER, EP, MK AND MP MODELS)

FUEL DISTRIBUTION ON THE LEFT AND RIGHT WING TANKS	
VOLUME (liters)	CG BALANCE ARM (meters)
200	14.616
400	14.660
600	14.697
800	14.728
1000	14.756
1200	14.781
1400	14.805
1600	14.827
1800	14.849
2000	14.872
2200	14.896
2400	14.920
2600	14.943
2800	14.966
3000	14.988
3200	15.009
3400	15.031
3600	15.052
3800	15.074
4000	15.100
4200	15.130
4400	15.165
4600	15.203
4800	15.246
5000	15.293
5146	15.332

FUEL DISTRIBUTION TABLE (EMB-145 LU AND LR MODELS)

FUEL DISTRIBUTION ON THE LEFT AND RIGHT WING TANKS	
VOLUME (liters)	CG BALANCE ARM (meters)
200	14.480
400	14.502
600	14.525
800	14.547
1000	14.568
1200	14.587
1400	14.606
1600	14.623
1800	14.641
2000	14.657
2200	14.673
2400	14.688
2600	14.704
2800	14.720
3000	14.736
3200	14.754
3400	14.771
3600	14.787
3800	14.804
4000	14.821
4200	14.837
4400	14.854
4600	14.870
4800	14.886
5000	14.906
5200	14.931
5400	14.958
5600	14.989
5800	15.023
6000	15.061
6200	15.104
6396	15.153

5 MODELS)

BALANCE ARM (m)		
ENGINE OIL (1)	24.0	22.33
APU OIL (1)	2.0	27.19
HYDRAULIC (2)		
• WITH THRUST REVERSER	36.0	18.68
• WITHOUT THRUST REVERSER	33.0	18.20
LAVATORY CHEMICAL FLUID	7.0	20.58
LAVATORY RINSE WATER	20.0	20.66

NOTE: (1) Adopted engine oil density (ref. MIL-L-7808): 0.98 kg/l.

(2) Adopted hydraulic fluid density (ref. SAE AS 1241A TYPE IV): 0.99 kg/l.

FLIGHT CREW ITEMS (EMB-145 MODELS)

ITEM	WEIGHT (kg)	BALANCE ARM (m)
PILOT	82	3.63
COPILOT	82	3.63
OBSERVER	82	4.20
FORWARD ATTENDANT	82	4.80
CREW BAGGAGE	15	5.00
NAVIGATION KIT	10	3.95
AFT ATTENDANT	82	19.88

NOTE: - The adopted flight crew items are in accordance with the approved average weight, not including the respective carry-on baggage.

- The crewmembers and attendants weights presented herein refer to male. For female crewmembers and attendants, a weight equal to 59 kg may be adopted (FAA-AC120-27C).

BAGGAGE LOADING (EMB-145 MODELS)

BAGGAGE LOADING PROCEDURES

To load the baggage compartment above 1000 kg (for airplane without Thrust Reverser) or above 800 kg (for airplane with Thrust Reverser), the following simultaneous conditions shall be observed:

- Airplane shall be with a minimum required fuel of 907 kg.
- No more than one person can be at the airplane cone either inside the baggage compartment or inside the rear electronic compartment.

CAUTION: IF THE CONDITIONS ABOVE ARE NOT OBSERVED, AN AIRPLANE TILTING (TAIL DOWN) MAY OCCUR.

INTERIOR ARRANGEMENT (EMB-145 MODELS)

The passenger location and respective balance arm are shown in the applicable interior arrangement. Herein, the Standard Configuration is presented as an illustrative example, including the plan view and the balance arms.

For other interior configuration options, the passenger locations and the respective balance arms are supplied together with the “Airplane Weighing Form”, inserted in the “FINAL INSPECTION REPORT”, by the time of the airplane’s delivery.

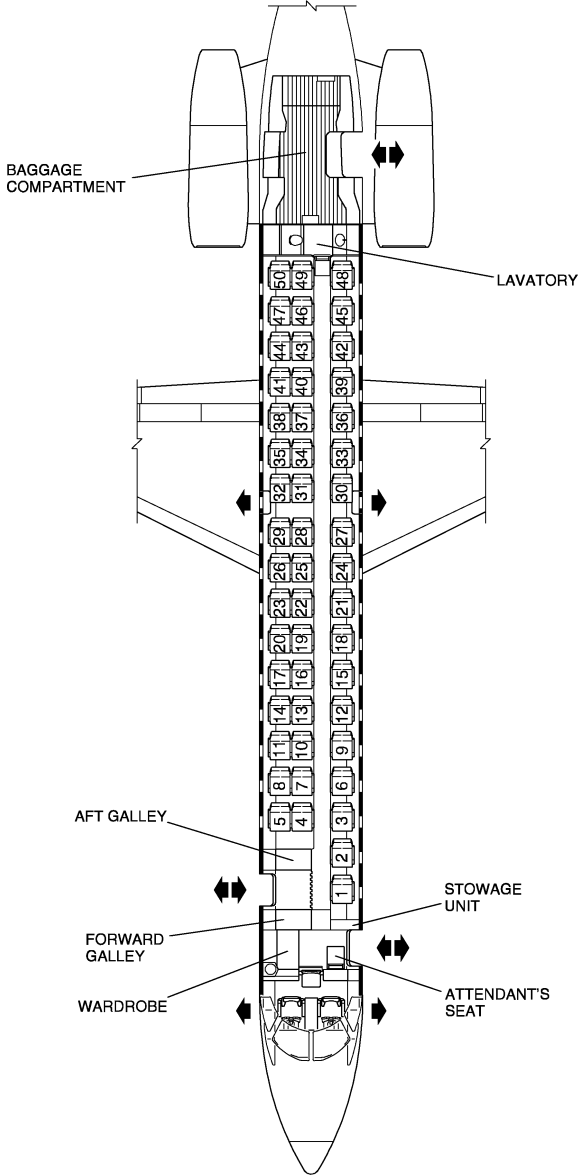
STANDARD CONFIGURATION (EXAMPLE)

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)
1	1	6.193
2	2	6.980
3	3,4,5	7.768
4	6,7,8	8.555
5	9,10,11	9.343
6	12,13,14	10.130
7	15,16,17	10.917
8	18,19,20	11.705
9	21,22,23	12.492
10	24,25,26	13.280
11	27,28,29	14.067
12	30,31,32	15.083
13	33,34,35	15.870
14	36,37,38	16.658
15	39,40,41	17.445
16	42,43,44	18.233
17	45,46,47	19.020
18	48,49,50	19.807

PASSENGER AVERAGE CG: 13.486 m.

	BALANCE ARM (m)
WARDROBE	5.000
STOWAGE COMPARTMENT	5.550
FORWARD GALLEY	5.550
AFT GALLEY	6.800
BAGGAGE COMPARTMENT	22.600

BAGGAGE COMPARTMENT CAPACITY: 1200 kg or 390 kg/m².



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STANDARD CONFIGURATION (EXAMPLE)



WEIGHT AND BALANCE MANUAL

WEIGHT AND
BALANCE

EMB-135 ER AND LR MODELS

The following pages present the weight and balance data for EMB-135 ER and LR models.

BALANCE REFERENCE SYSTEM (EMB-135 ER AND LR MODELS)

BALANCE ARMS/BODY STATION

Longitudinal location of the Centers of Gravity (CG) identified throughout this Manual regarding airplane and components will be referred to as Balance Arms. Balance Arms are the distance in meters from the Airplane Datum which is located at the zero station of the fuselage.

Balance Arms (BA) are equivalent to Body Station (BS) on the EMB-135 ER and LR models.

AIRPLANE DATUM

The Airplane Datum is a plane, perpendicular to the fuselage centerline, located at 11.595 m ahead of the wing stub front spar.

For external reference, the Datum is located at 14.494 m ahead of the wing jack points.

WING MEAN AERODYNAMIC CHORD (MAC)

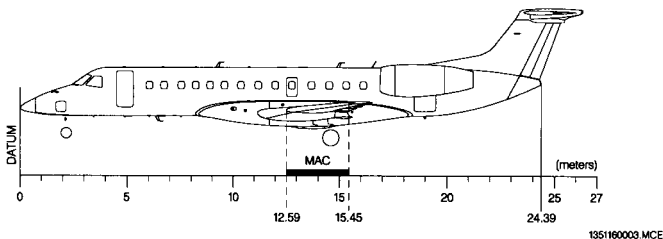
The length of the MAC is 2.865 m.

The leading edge of the MAC (LEMAC) is Balance Arm 12.594 m.

Percentage of MAC is obtained using the following formula:

$$\%MAC = \frac{(X - 12.594) \times 100}{2.865}$$

where X = Balance Arm of airplane CG measured in meters.



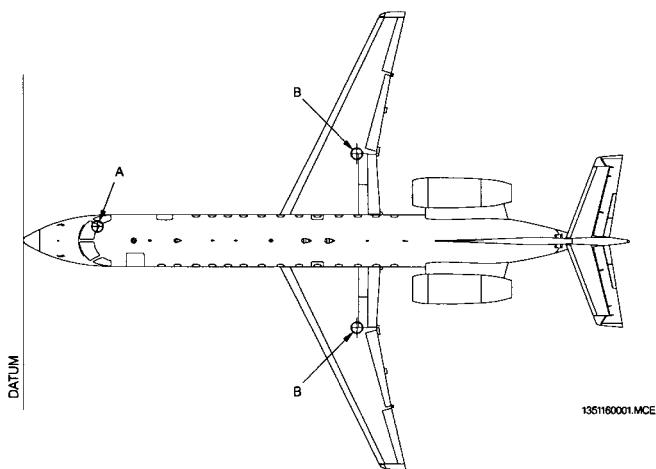
AIRPLANE JACKING (EMB-135 ER AND LR MODELS)

Refer to Chapter 7 of the Aircraft Maintenance Manual for airplane jacking procedures.

JACK POINTS LOCATION

POINT	BALANCE ARM (meters)	CENTERLINE DISTANCE (meters)
A	3.260	0.330
B	14.494	3.815

NOTE: The jack points balance arms refer to the Airplane Datum.



JACK POINTS

MAXIMUM GROSS WEIGHT AND CENTER OF GRAVITY LIMITS (EMB-135 ER AND LR MODELS)

When performing an approved loading schedule, ensure that the airplane weight and center of gravity remains within the Weight x CG Envelope by accounting for airplane weight and balance with all load conditions.

For maximum structural weights, refer to Airplane Flight Manual (AFM-145/1152).

CG CONSTRAINTS

When performing the airplane weighing and balancing, appropriate constraints must be established and applied in order to assure that the center of gravity limits are not exceeded in any airplane operating condition, due to:

- Fuel density variation.
- Passenger seat variation.
- Cargo location variation.
- Landing gear inflight movement.
- Passenger and crew member inflight movement.



WEIGHT AND BALANCE MANUAL

WEIGHT AND
BALANCE

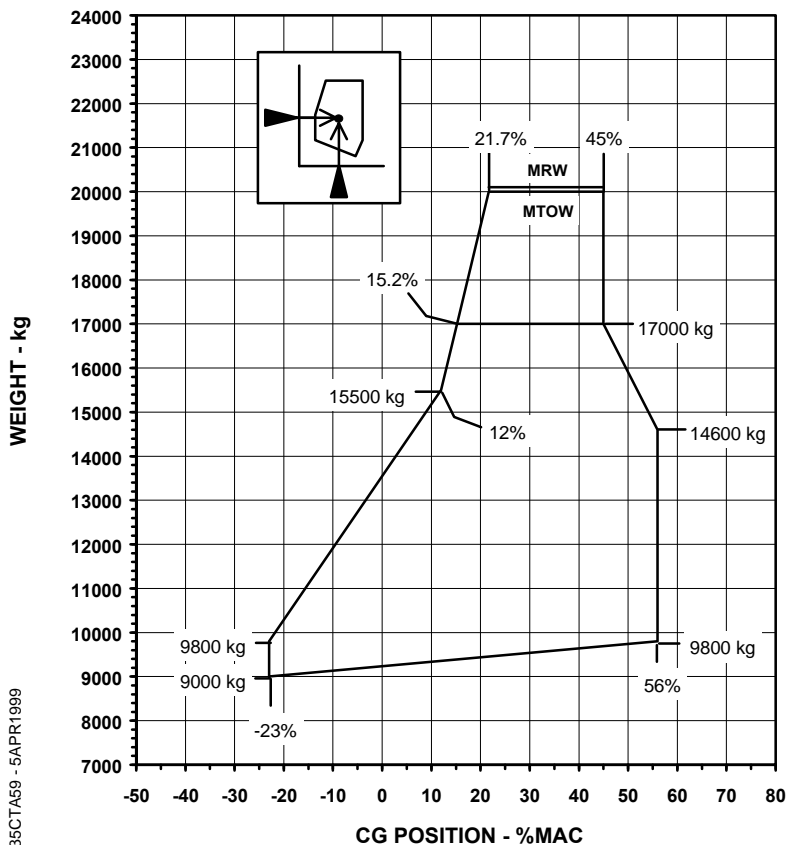
CG ENVELOPE FOR OPERATION (EMB-135 ER AND LR MODELS)

For center of gravity envelopes, refer to Airplane Flight Manual (AFM-145/1152).



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CG ENVELOPE FOR JACKING (EMB-135 ER AND LR MODELS)



CAUTION: • MAXIMUM ALLOWABLE FUEL ASYMMETRY: 363 KG.

- BEFORE JACKING THE AIRPLANE, CHECK CG WITHIN THE JACKING ENVELOPE.
- ABOVE 17000 KG, ONLY LANDING GEAR JACKING IS ALLOWED.

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FUEL DATA (EMB-135 ER AND LR MODELS)

FUEL DEFINITIONS

- **USABLE FUEL** - Is the fuel to be effectively consumed by the engines.
- **UNUSABLE FUEL** - Is the fuel remaining after total usable fuel has been consumed.
- **DRAINABLE FUEL** - Is that portion of fuel which can be drawn off through fuel drains with the airplane leveled.
- **UNDRAINABLE FUEL** - Is that portion of fuel which can not be drawn off by standard draining procedures.

FUEL QUANTITIES

EMB-135 ER Model:

FUEL CATEGORY	VOLUME (liters)	WEIGHT (kg)	CG BALANCE ARM (m)
UNUSABLE UNDRAINABLE	6	5	12.734
UNUSABLE DRAINABLE	48	39	12.734
TOTAL UNUSABLE	54	44	12.734
USABLE	5146	4173	13.326

EMB-135 LR Model:

FUEL CATEGORY	VOLUME (liters)	WEIGHT (kg)	CG BALANCE ARM (m)
UNUSABLE UNDRAINABLE	10	8	12.734
UNUSABLE DRAINABLE	34	28	12.734
TOTAL UNUSABLE	44	36	12.734
USABLE	6396	5187	13.147

NOTE: Fuel density may range from 0.785 kg/l to 0.811 kg/l. The values above have been determined for an adopted fuel density of 0.811 kg/l.

FUEL DISTRIBUTION TABLE (EMB-135 ER MODEL)

FUEL DISTRIBUTION ON THE LEFT AND RIGHT WING TANKS	
VOLUME (liters)	CG BALANCE ARM (meters)
200	12.610
400	12.654
600	12.691
800	12.722
1000	12.750
1200	12.775
1400	12.799
1600	12.821
1800	12.843
2000	12.866
2200	12.890
2400	12.914
2600	12.937
2800	12.960
3000	12.982
3200	13.003
3400	13.025
3600	13.046
3800	13.068
4000	13.094
4200	13.124
4400	13.159
4600	13.197
4800	13.240
5000	13.287
5146	13.326

FUEL DISTRIBUTION TABLE (EMB-135 LR MODEL)

FUEL DISTRIBUTION ON THE LEFT AND RIGHT WING TANKS	
VOLUME (liters)	CG BALANCE ARM (meters)
200	12.474
400	12.496
600	12.519
800	12.541
1000	12.562
1200	12.581
1400	12.600
1600	12.617
1800	12.635
2000	12.651
2200	12.667
2400	12.682
2600	12.698
2800	12.714
3000	12.730
3200	12.748
3400	12.765
3600	12.781
3800	12.798
4000	12.815
4200	12.831
4400	12.848
4600	12.864
4800	12.880
5000	12.900
5200	12.925
5400	12.952
5600	12.983
5800	13.017
6000	13.055
6200	13.098
6396	13.147

BALANCE ARM (m)		
ENGINE OIL (1)	24.0	18.787
APU OIL (1)	2.0	23.64
HYDRAULIC (2)		
• WITH THRUST REVERSER	34.0	15.45
• WITHOUT THRUST REVERSER	31.0	15.10
LAVATORY CHEMICAL FLUID	7.0	17.03
LAVATORY RINSE WATER	20.0	17.11

NOTE: (1) Adopted engine oil density (ref. MIL-L-7808): 0.98 kg/l.
(2) Adopted hydraulic fluid density (ref. SAE AS 1241A TYPE IV): 0.99 kg/l.

FLIGHT CREW ITEMS (EMB-135 ER AND LR MODELS)

ITEM	WEIGHT (kg)	BALANCE ARM (m)
PILOT	82	3.63
COPILOT	82	3.63
OBSERVER	82	4.20
FORWARD ATTENDANT	82	4.80
CREW BAGGAGE	15	5.00
NAVIGATION KIT	10	3.95
AFT ATTENDANT	82	16.34

NOTE: - The adopted flight crew items are in accordance with the approved average weight, not including the respective carry-on baggage.
- The crewmembers and attendants weights presented herein refer to male. For female crewmembers and attendants, a weight equal to 59 kg may be adopted (FAA-AC120-27C).



BAGGAGE LOADING (EMB-135 ER AND LR MODELS)

BAGGAGE LOADING PROCEDURES

To load the baggage compartment above 800 kg (for airplane with Thrust Reverser), the following simultaneous conditions shall be observed:

- Airplane shall be with a minimum required fuel of 907 kg.
- No more than one person can be at the airplane cone either inside the baggage compartment or inside the rear electronic compartment.

CAUTION: IF THE CONDITIONS ABOVE ARE NOT OBSERVED, AN AIRPLANE TILTING (TAIL DOWN) MAY OCCUR.

INTERIOR ARRANGEMENT (EMB-135 ER AND LR MODELS)

The passenger location and respective balance arm are shown in the applicable interior arrangement. Herein, the Standard Configuration is presented as an illustrative example, including the plan view and the balance arms.

For other interior configuration options, the passenger locations and the respective balance arms are supplied together with the “Airplane Weighing Form”, inserted in the “FINAL INSPECTION REPORT”, by the time of the airplane’s delivery.

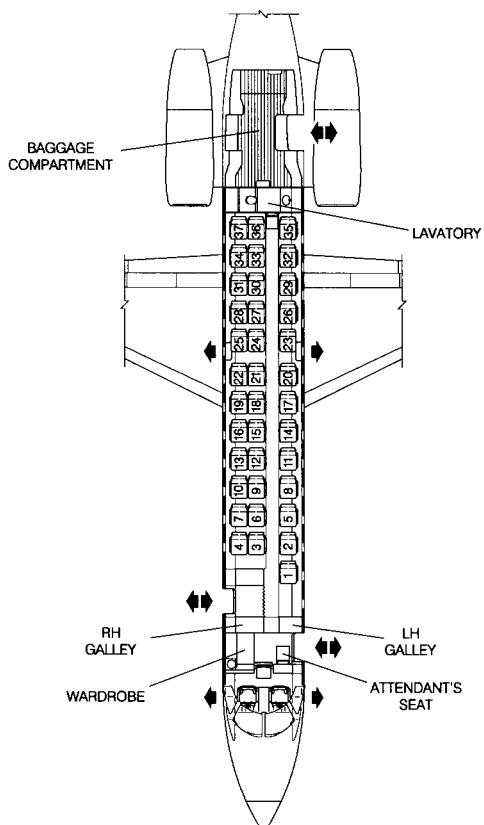
STANDARD CONFIGURATION (EXAMPLE)

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)
1	1	6.58
2	2,3,4	7.367
3	5,6,7	8.154
4	8,9,10	8.942
5	11,12,13	9.729
6	14,15,16	10.517
7	17,18,19	11.304
8	20,21,22	12.091
9	23,24,25	13.107
10	26,27,28	13.895
11	29,30,31	14.682
12	32,33,34	15.470
13	35,36,37	16.257

PASSENGER AVERAGE CG: 11.652 m.

	BALANCE ARM (m)
WARDROBE	4.840
GALLEY, RIGHT SIDE	5.500
GALLEY, LEFT SIDE	5.500
BAGGAGE COMPARTMENT	19.050

BAGGAGE COMPARTMENT CAPACITY: 1000 kg or 390 kg/m²



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STANDARD CONFIGURATION (EXAMPLE)



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ERJ-140 ER AND LR MODELS

The following pages present the weight and balance data for ERJ-140 ER and LR models.

NOTE: THE ERJ-140 ER AND ERJ-140 LR MODELS HAVE THE TYPE CERTIFICATION DESIGNATIONS OF EMB-135 KE AND EMB-135 KL, RESPECTIVELY.

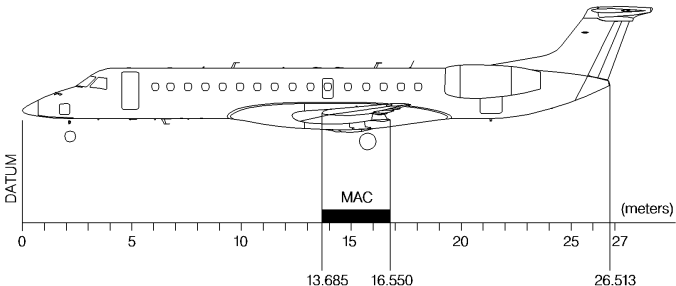
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$$\frac{(X - 13.685) \times 100}{2.865}$$

where X = Balance Arm of airplane CG measured in meters.



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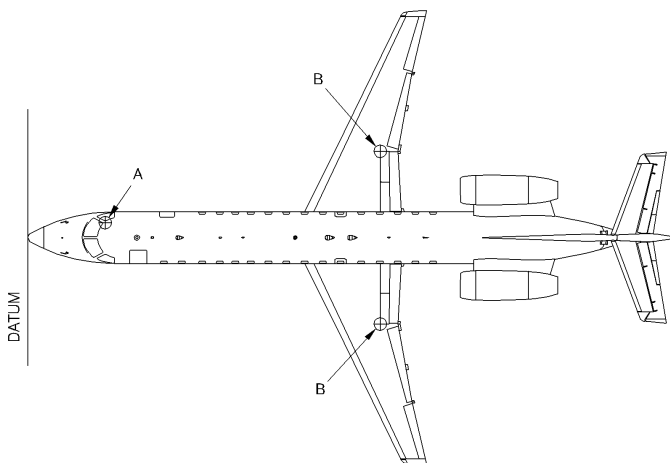
AIRPLANE JACKING (ERJ-140 ER AND LR MODELS)

Refer to Chapter 7 of the Aircraft Maintenance Manual for airplane jacking procedures.

JACK POINTS LOCATION

POINT	BALANCE ARM (meters)	CENTERLINE DISTANCE (meters)
A	3.260	0.330
B	15.585	3.815

NOTE: The jack points balance arms refer to the Airplane Datum.



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JACK POINTS

MAXIMUM GROSS WEIGHT AND CENTER OF GRAVITY LIMITS (ERJ-140 ER AND LR MODELS)

When performing an approved loading schedule, ensure that the airplane weight and center of gravity remains within the Weight x CG Envelope by accounting for airplane weight and balance with all load conditions.

For maximum structural weights, refer to Airplane Flight Manual (AFM-140/1329).

CG CONSTRAINTS

When performing the airplane weighing and balancing, appropriate constraints must be established and applied in order to assure that the center of gravity limits are not exceeded in any airplane operating condition, due to:

- Fuel density variation.
- Passenger seat variation.
- Cargo location variation.
- Landing gear inflight movement.
- Passenger and crew member inflight movement.



WEIGHT AND BALANCE MANUAL

WEIGHT AND
BALANCE

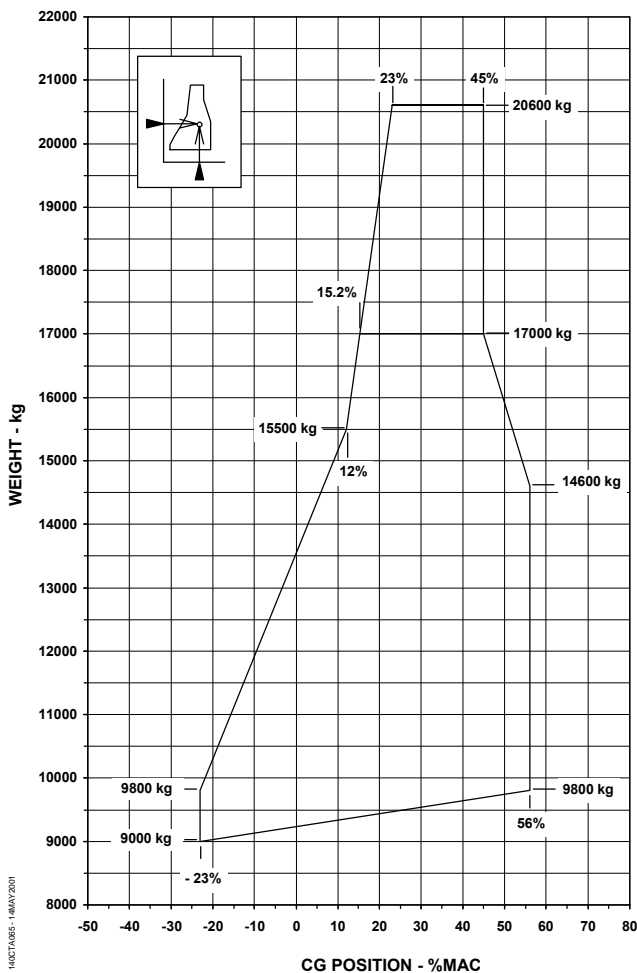
CG ENVELOPE FOR OPERATION (ERJ-140 ER AND LR MODELS)

For center of gravity envelopes, refer to Airplane Flight Manual (AFM-140/1329).

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CG ENVELOPE FOR JACKING (ERJ-140 ER AND LR MODELS)



CAUTION: • MAXIMUM ALLOWABLE FUEL ASYMMETRY: 363 KG.

- BEFORE JACKING THE AIRPLANE, CHECK CG WITHIN THE JACKING ENVELOPE.
- ABOVE 17000 KG, ONLY LANDING GEAR JACKING IS ALLOWED.

NUMBER INFLIGHT

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FUEL DATA (ERJ-140 ER AND LR MODELS)

FUEL DEFINITIONS

- **USABLE FUEL** - Is the fuel to be effectively consumed by the engines.
- **UNUSABLE FUEL** - Is the fuel remaining after total usable fuel has been consumed.
- **DRAINABLE FUEL** - Is that portion of fuel which can be drawn off through fuel drains with the airplane leveled.
- **UNDRAINABLE FUEL** - Is that portion of fuel which can not be drawn off by standard draining procedures.

FUEL QUANTITIES

ERJ-140 ER Model:

FUEL CATEGORY	VOLUME (liters)	WEIGHT (kg)	CG BALANCE ARM (m)
UNUSABLE UNDRAINABLE	6	5	13.825
UNUSABLE DRAINABLE	48	39	13.825
TOTAL UNUSABLE	54	44	13.825
USABLE	5146	4173	14.417

ERJ-140 LR Model:

FUEL CATEGORY	VOLUME (liters)	WEIGHT (kg)	CG BALANCE ARM (m)
UNUSABLE UNDRAINABLE	10	8	13.825
UNUSABLE DRAINABLE	34	28	13.825
TOTAL UNUSABLE	44	36	13.825
USABLE	6396	5187	14.238

NOTE: Fuel density may range from 0.785 kg/l to 0.811 kg/l. The values above have been determined for an adopted fuel density of 0.811 kg/l.

FUEL DISTRIBUTION TABLE (ERJ-140 ER MODEL)

FUEL DISTRIBUTION ON THE LEFT AND RIGHT WING TANKS	
VOLUME (liters)	CG BALANCE ARM (meters)
200	13.701
400	13.745
600	13.782
800	13.813
1000	13.841
1200	13.866
1400	13.890
1600	13.912
1800	13.934
2000	13.957
2200	13.981
2400	14.005
2600	14.028
2800	14.051
3000	14.073
3200	14.094
3400	14.116
3600	14.137
3800	14.159
4000	14.185
4200	14.215
4400	14.250
4600	14.288
4800	14.331
5000	14.378
5146	14.417

FUEL DISTRIBUTION TABLE (ERJ-140 LR MODEL)

FUEL DISTRIBUTION ON THE LEFT AND RIGHT WING TANKS	
VOLUME (liters)	CG BALANCE ARM (meters)
200	13.565
400	13.587
600	13.610
800	13.632
1000	13.653
1200	13.672
1400	13.691
1600	13.708
1800	13.726
2000	13.742
2200	13.758
2400	13.773
2600	13.789
2800	13.805
3000	13.821
3200	13.839
3400	13.856
3600	13.872
3800	13.889
4000	13.906
4200	13.922
4400	13.939
4600	13.955
4800	13.971
5000	13.991
5200	14.016
5400	14.043
5600	14.074
5800	14.108
6000	14.146
6200	14.189
6396	14.238

BALANCE ARM (m)		
ENGINE OIL (1)	24.0	20.915
APU OIL (1)	2.0	25.775
HYDRAULIC (2)		
• WITH THRUST REVERSER	34.0	17.760
• WITHOUT THRUST REVERSER	31.0	17.379
LAVATORY CHEMICAL FLUID	7.0	19.155
LAVATORY RINSE WATER	20.0	18.201

NOTE: (1) Adopted engine oil density (ref. MIL-L-7808): 0.98 kg/l.

(2) Adopted hydraulic fluid density (ref. SAE AS 1241A TYPE IV):
0.99 kg/l.

FLIGHT CREW ITEMS (ERJ-140 ER AND LR MODELS)

ITEM	WEIGHT (kg)	BALANCE ARM (m)
PILOT	82	3.63
COPILOT	82	3.63
OBSERVER	82	4.20
FORWARD ATTENDANT	82	4.80
CREW BAGGAGE	15	5.00
NAVIGATION KIT	10	3.95
AFT ATTENDANT	82	19.99

NOTE: - The adopted flight crew items are in accordance with the approved average weight, not including the respective carry-on baggage.

- The crewmembers and attendants weights presented herein refer to male. For female crewmembers and attendants, a weight equal to 59 kg may be adopted (FAA-AC120-27C).



BAGGAGE LOADING (ERJ-140 ER AND LR MODELS)

BAGGAGE LOADING PROCEDURES

To load the baggage compartment above 1000 kg (for airplane with Thrust Reverser), the following simultaneous conditions shall be observed:

- Airplane shall be with a minimum required fuel of 907 kg.
- No more than one person can be at the airplane cone either inside the baggage compartment or inside the rear electronic compartment.

CAUTION: IF THE CONDITIONS ABOVE ARE NOT OBSERVED, AN AIRPLANE TILTING (TAIL DOWN) MAY OCCUR.

INTERIOR ARRANGEMENT (ERJ-140 ER AND LR MODELS)

The passenger location and respective balance arm are shown in the applicable interior arrangement. Herein, the Standard Configuration is presented as an illustrative example, including the plan view and the balance arms.

For other interior configuration options, the passenger locations and the respective balance arms are supplied together with the “Airplane Weighing Form”, inserted in the “FINAL INSPECTION REPORT”, by the time of the airplane’s delivery.

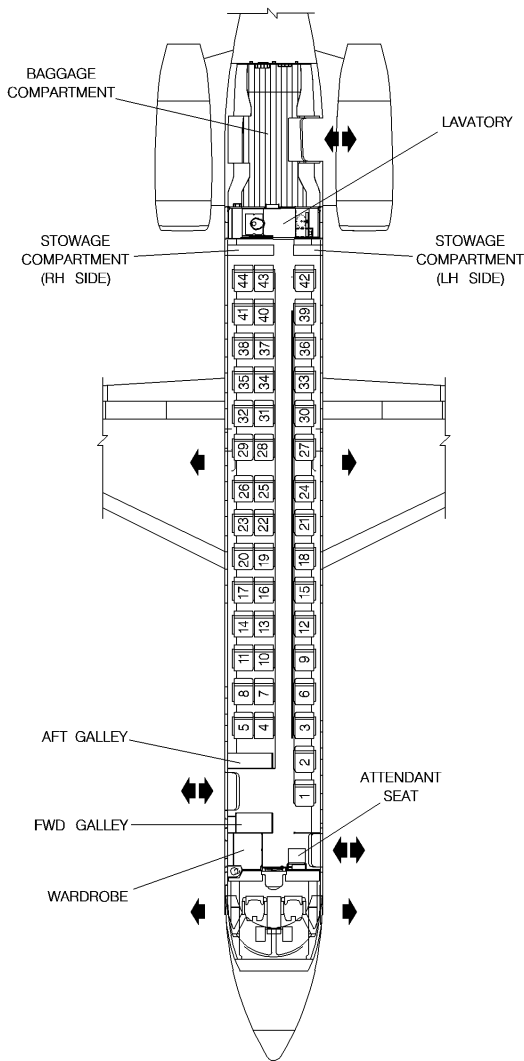
STANDARD CONFIGURATION (EXAMPLE)

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)
1	1	6.152
2	2	6.939
3	3,4,5	7.726
4	6,7,8	8.513
5	9,10,11	9.300
6	12,13,14	10.087
7	15,16,17	10.874
8	18,19,20	11.661
9	21,22,23	12.448
10	24,25,26	13.235
11	27,28,29	14.251
12	30,31,32	15.038
13	33,34,35	15.825
14	36,37,38	16.612
15	39,40,41	17.399
16	42,43,44	18.186

PASSENGER AVERAGE CG: 12.649 m.

	BALANCE ARM (m)
WARDROBE	4.840
FWD GALLEY	5.298
AFT GALLEY	6.560
STOWAGE COMPARTMENT (RH)	18.502
STOWAGE COMPARTMENT (LH)	18.502
BAGGAGE COMPARTMENT	21.175

BAGGAGE COMPARTMENT CAPACITY: 1200 kg or 390 kg/m².



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STANDARD CONFIGURATION (EXAMPLE)

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WEIGHT AND BALANCE MANUAL

WEIGHT AND
BALANCE

EMB-145 XR MODEL

The following pages present the weight and balance data for EMB-145 XR model.

BALANCE REFERENCE SYSTEM (EMB-145 XR MODEL)

BALANCE ARMS/BODY STATION

Longitudinal location of the Centers of Gravity (CG) identified throughout this Manual regarding airplane and components will be referred to as Balance Arms. Balance Arms are the distance in meters from the Airplane Datum which is located at the zero station of the fuselage.

Balance Arms (BA) are equivalent to Body Station (BS) on the EMB-145 XR model.

AIRPLANE DATUM

The Airplane Datum is a plane, perpendicular to the fuselage centerline, located at 13.601 m ahead of the wing stub front spar.

For external reference, the Datum is located at 16.500 m ahead of the wing jack points.

WING MEAN AERODYNAMIC CHORD (MAC)

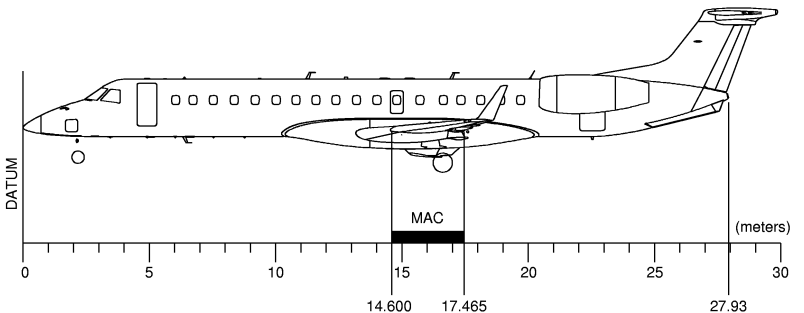
The length of the MAC is 2.865 m.

The leading edge of the MAC (LEMAC) is Balance Arm 14.600 m.

Percentage of MAC is obtained using the following formula:

$$\%MAC = \frac{(X - 14.600) \times 100}{2.865}$$

where X = Balance Arm of airplane CG measured in meters.



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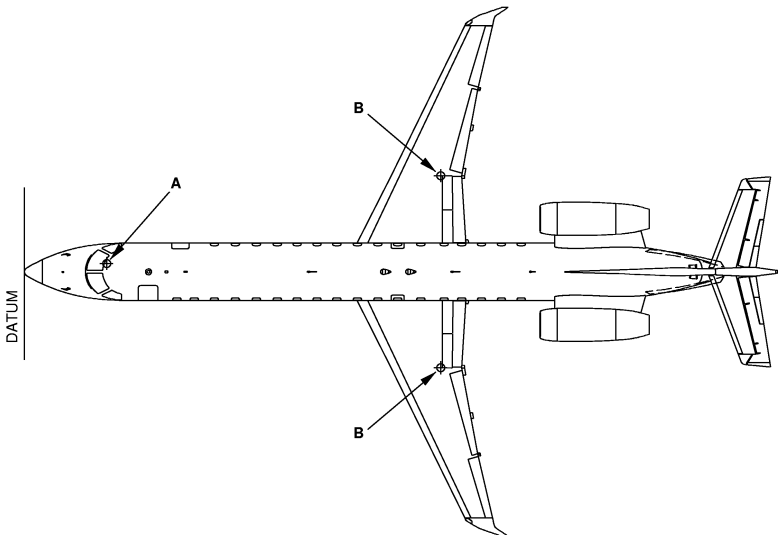
AIRPLANE JACKING (EMB-145 XR MODEL)

Refer to Chapter 7 of the Aircraft Maintenance Manual for airplane jacking procedures.

JACK POINTS LOCATION

POINT	BALANCE ARM (meters)	CENTERLINE DISTANCE (meters)
A	3.260	0.330
B	16.500	3.815

NOTE: The jack points balance arms refer to the Airplane Datum.



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JACK POINTS

MAXIMUM GROSS WEIGHT AND CENTER OF GRAVITY LIMITS (EMB-145 XR MODEL)

When performing an approved loading schedule, ensure that the airplane weight and center of gravity remains within the Weight x CG Envelope by accounting for airplane weight and balance with all load conditions.

For maximum structural weights, refer to Airplane Flight Manual (AFM-145/1152).

CG CONSTRAINTS

When performing the airplane weighing and balancing, appropriate constraints must be established and applied in order to assure that the center of gravity limits are not exceeded in any airplane operating condition, due to:

- Fuel density variation.
- Passenger seat variation.
- Cargo location variation.
- Landing gear inflight movement.
- Passenger and crew member inflight movement.



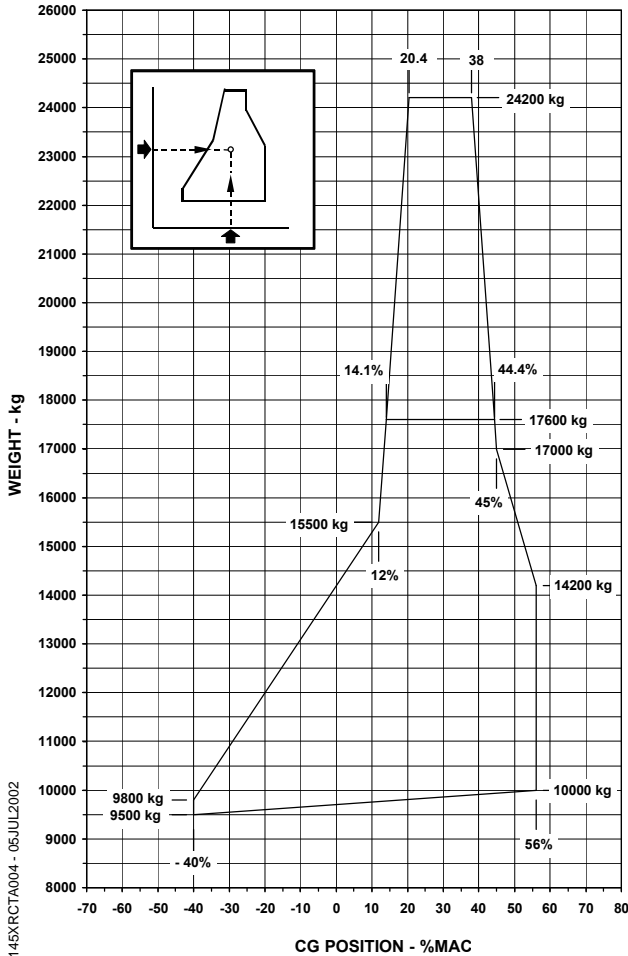
WEIGHT AND BALANCE MANUAL

WEIGHT AND
BALANCE

CG ENVELOPE FOR OPERATION (EMB-145 XR MODEL)

For center of gravity envelopes, refer to Airplane Flight Manual (AFM-145/1152).

CG ENVELOPE FOR JACKING (EMB-145 XR MODEL)



CAUTION: • MAXIMUM ALLOWABLE FUEL ASYMMETRY: 363 KG.

- BEFORE JACKING THE AIRPLANE, CHECK CG WITHIN THE JACKING ENVELOPE.
- ABOVE 17600 KG, ONLY LANDING GEAR JACKING IS ALLOWED.

MOMENT/CG CHANGES (EMB-145 XR MODEL)

DUE TO ANY PASSENGER OR CREW MEMBER INFLIGHT MOVEMENT

A person moving from the front to the rear of the cabin or vice-versa causes the following CG travel:

- For 13000 kg: CG moves aft or forward in a maximum range of 3.5% of MAC.
- For 20600 kg: CG moves aft or forward in a maximum range of 2.2% of MAC.
- For 24200 kg: CG moves aft or forward in a maximum range of 2.1% of MAC.

DUE TO LANDING GEAR CONFIGURATION

When the landing gear is retracted, there is a reduction of 117 kg.m of the moment in respect to the airplane datum.

- For 13000 kg: CG moves forward 0.3% of MAC.
- For 20600 kg: CG moves forward 0.2% of MAC.
- For 24200 kg: CG moves forward 0.2% of MAC.

DUE TO FUEL CONSUMPTION AND DENSITY VARIATION TEMPERATURE

The fuel CG variation with the consumption is shown in the Fuel Distribution Table (the fuel CG changes for different fuel volumes). The variation of fuel density with temperature has negligible effects in the airplane CG.

FUEL DATA (EMB-145 XR MODEL)

FUEL DEFINITIONS

- **USABLE FUEL** - Is the fuel to be effectively consumed by the engines.
- **UNUSABLE FUEL** - Is the fuel remaining after total usable fuel has been consumed.
- **DRAINABLE FUEL** - Is that portion of fuel which can be drawn off through fuel drains with the airplane leveled.
- **UNDRAINABLE FUEL** - Is that portion of fuel which can not be drawn off by standard draining procedures.

FUEL QUANTITIES

Wing Tank

FUEL CATEGORY	VOLUME (liters)	WEIGHT (kg)	CG BALANCE ARM (m)
UNUSABLE UNDRAINABLE	10	8	14.741
UNUSABLE DRAINABLE	34	28	14.741
TOTAL UNUSABLE	44	36	14.741
USABLE	6396	5187	15.153

Ventral Tank

FUEL CATEGORY	VOLUME (liters)	WEIGHT (kg)	CG BALANCE ARM (m)
UNUSABLE UNDRAINABLE	2.8	2.3	17.232
UNUSABLE DRAINABLE	9.0	7.3	17.288
TOTAL UNUSABLE	11.8	9.6	17.295
USABLE	1042	845	17.688

NOTE: The values above have been determined for an adopted fuel density of 0.811 kg/l.

FUEL DISTRIBUTION TABLE (EMB-145 XR MODEL)

FUEL DISTRIBUTION ON THE LEFT AND RIGHT WING TANKS	
VOLUME (liters)	CG BALANCE ARM (meters)
200	14.480
400	14.502
600	14.525
800	14.547
1000	14.568
1200	14.587
1400	14.606
1600	14.623
1800	14.641
2000	14.657
2200	14.673
2400	14.688
2600	14.704
2800	14.720
3000	14.736
3200	14.754
3400	14.771
3600	14.787
3800	14.804
4000	14.821
4200	14.837
4400	14.854
4600	14.870
4800	14.886
5000	14.906
5200	14.931
5400	14.958
5600	14.989
5800	15.023
6000	15.061
6200	15.104
6396	15.153

FUEL DISTRIBUTION ON THE VENTRAL TANK	
VOLUME (liters)	CG BALANCE ARM (meters)
100	17.505
200	17.570
300	17.622
400	17.688
500	17.700
600	17.722
700	17.737
800	17.747
900	17.729
1000	17.699
1042	17.688

MISCELLANEOUS FLUIDS (EMB-145 XR MODEL)

FLUID	WEIGHT (kg)	BALANCE ARM (m)
ENGINE OIL (1)	24.0	22.33
APU OIL (1)	2.0	27.19
HYDRAULIC (2)		
• WITH THRUST REVERSER	36.0	18.68
• WITHOUT THRUST REVERSER	33.0	18.20
LAVATORY CHEMICAL FLUID	7.0	20.58
LAVATORY RINSE WATER	20.0	20.66

NOTE: (1) Adopted engine oil density (ref. MIL-L-7808): 0.98 kg/l.

(2) Adopted hydraulic fluid density (ref. SAE AS 1241A TYPE IV): 0.99 kg/l.

FLIGHT CREW ITEMS (EMB-145 XR MODEL)

ITEM	WEIGHT (kg)	BALANCE ARM (m)
PILOT	82	3.63
COPILOT	82	3.63
OBSERVER	82	4.20
FORWARD ATTENDANT	82	4.80
CREW BAGGAGE	15	5.00
NAVIGATION KIT	10	3.95
AFT ATTENDANT	82	19.88

NOTE: - The adopted flight crew items are in accordance with the approved average weight, not including the respective carry-on baggage.

- The crewmembers and attendants weights presented herein refer to male. For female crewmembers and attendants, a weight equal to 59 kg may be adopted (FAA-AC120-27C).

BAGGAGE LOADING (EMB-145 XR MODEL)

BAGGAGE LOADING PROCEDURES

To load the baggage compartment above 1000 kg (for airplane without Thrust Reverser) or above 800 kg (for airplane with Thrust Reverser), the following simultaneous conditions shall be observed:

- Airplane shall be with a minimum required fuel of 907 kg.
- No more than one person can be at the airplane cone either inside the baggage compartment or inside the rear electronic compartment.

CAUTION: IF THE CONDITIONS ABOVE ARE NOT OBSERVED, AN AIRPLANE TILTING (TAIL DOWN) MAY OCCUR.

INTERIOR ARRANGEMENT (EMB-145 XR MODEL)

The passenger location and respective balance arm are shown in the applicable interior arrangement. Herein, the Standard Configuration is presented as an illustrative example, including the plan view and the balance arms.

For other interior configuration options, the passenger locations and the respective balance arms are supplied together with the “Airplane Weighing Form”, inserted in the “FINAL INSPECTION REPORT”, by the time of the airplane’s delivery.

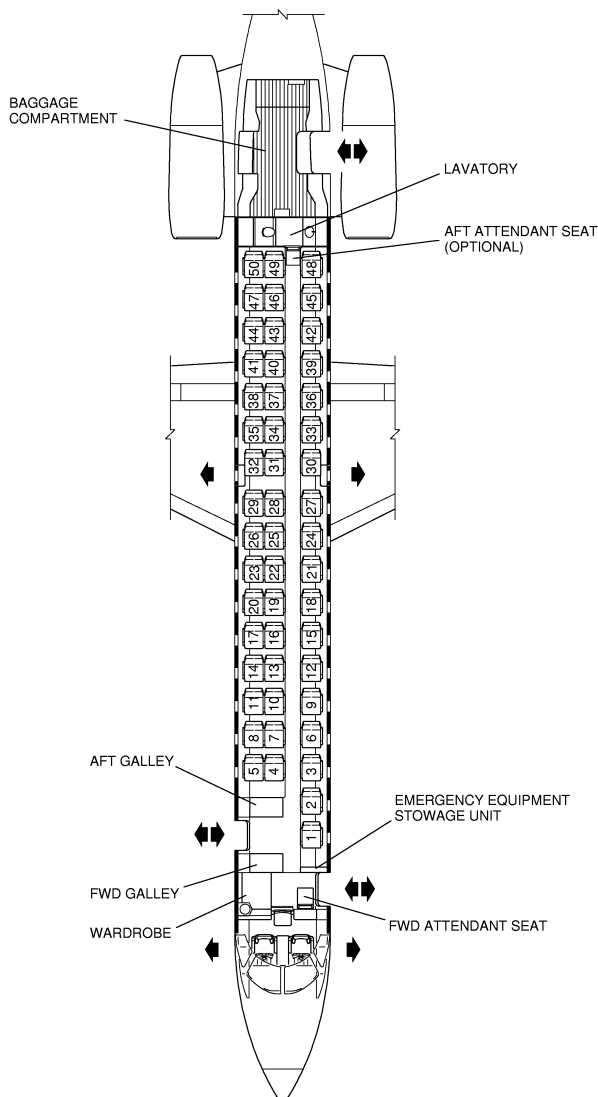
STANDARD CONFIGURATION (EXAMPLE)

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)
1	1	6.193
2	2	6.980
3	3, 4, 5	7.768
4	6, 7, 8	8.555
5	9, 10, 11	9.343
6	12, 13, 14	10.130
7	15, 16, 17	10.917
8	18, 19, 20	11.705
9	21, 22, 23	12.492
10	24, 25, 26	13.280
11	27, 28, 29	14.067
12	30, 31, 32	15.083
13	33, 34, 35	15.870
14	36, 37, 38	16.658
15	39, 40, 41	17.445
16	42, 43, 44	18.233
17	45, 46, 47	19.020
18	48, 49, 50	19.807

PASSENGER AVERAGE CG: 13.486 m.

	BALANCE ARM (m)
WARDROBE	5.000
EMERG. EQUIP. STOWAGE UNIT	5.350
FWD GALLEY	5.550
AFT GALLEY	6.800
BAGGAGE COMPARTMENT	22.600

BAGGAGE COMPARTMENT CAPACITY: 1200 kg or 390 kg/m².



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STANDARD CONFIGURATION (EXAMPLE)



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