WEIGHT AND BALANCE MANUAL A220-300

CSA-MN-XXX

1st REVISION

XX XXX 2021

České aerolinie a.s.

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G0. CREDITS AND APPROVALS

This document complies with all applicable regulations and with the terms and conditions of valid AOC and has been worked out in accordance with the relevant standards of international organisations (ICAO, IATA, EU, EASA), states rules and procedures, in accordance with flight operations documentation of aircraft manufacturers and approved principles, rules and internal regulations of the Company. IR ORO.MLR.100

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Lucie Wágnerová
Prepared by | Smartwings a.s.

Checked by | Smartwings a.s.

Approved by | ČSA a.s.

Approved by | ČSA a.s.

G1. RELATION TO OTHER DOCUMENTS

This document (if applicable):

☐ Cancels following documents:

☐ Replaces following documents:

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1	NEW DOCUMENT		

G4. LIST OF EFFECTIVE PAGES

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G5. ACRONYMS AND ABBREVIATIONS

ABBR.	DESCRIPTION
0A, 0B...	Cabin Sections
ACLW	Aircraft and Load Weights
ACMI	Aircraft Crew Maintenance and Insurance (Lease Operations)
ACTL	Actual
ADRL	Aircraft Dimension Reference and Limitations
AFT	Aft/Backwards
AHM	Airport Handling Manual
AIMS	Airline Information and Management System
AM	Air Marshall
AMC	Acceptable Means of Compliance
APU	Auxiliary Power Unit
ARM	Arm (Balance)
AT	Advanced Technology (Winglets)
ATD	Actual Time of Departure
AUX	Auxiliary
AVI	Live Animals
BA	or B.A. Balance Arm
BAG	Baggage
BI	Basic Index
BOB	Buy on Board (InFlight Sevice and Pantry Code)
BS	or B.S. Body Station
BTS	IATA Code of Bratislava Airport
BW	Basic Weight
BWCG	CG BA at Basic Weigth
C	Moment Constant
CAT	Commercial Ait Transport
CC	Cabin Crew
CMD	Commander
CG	Center of Gravity
cm	Centimeters
COGL	Center of Gravity Limits
COMAT	Company Material
CPT	Captain
CS1, CS2...	Company Standard Pantry Codes
CSA	Czech Airlines
CU FT	Cubic Feet
DCS	Departure Control System
DEST	Destination
DG	Dangerous Goods
DHC	Dead Head Crew
DOI	Dry Operating Index
DOW	Dry Operating Weight (OEW)

ABBR.	DESCRIPTION
EC	European Commission
ECU	Electronic Control Unit (for APU in Compartment 4)
E6/EE6	Electronic Equipment (Rack in Compartment 4)
EEL	Emergency Equipment Layout
EFA	Extranet Flight Application
EFB (IMB)	Electronic Flight Bag (Internal Mass and Balance)
EFO	Expert Flight Observers
ER	Extended Range
EU	European Union
EWBC	EFA WBC Detailed Description
EZFW	Estimated Zero Fuel Weight
F/A	Flight Attendant
FCOM	Flight Crew Operations Manual
FDS	Flight Dispatch Support
FMS	Flight Management System
FO	First Officer
FOB	Fuel On Board
FOO	Flight Operations Officers
FSFW	Fuel, System Fluids and Water
FT	Foot/Feet
FWD	Forward
G1, G2...	Galley Structures
GAL	Gallon
GE	Technician
GOM	Ground Operations Manual
HUM	Human Remains
HVC	Hold Volume Constraints
HW	Hardware
IATA	International Air Transport Association
IDG	Integrated Drive Generator
IN	Inch(es)
JS	Jumpseat
K	Shift Constant
kg	Kilogram(s)
l	Liters
LAW	Landing Weight (LW)
lb	Pounds
LEMAC	Leading Edge of Mean Aerodynamic Chord
LILAW	Load index at Landing Weight
LIR	Loading Instruction Report
LITOW	Load index at Take Off Weight
LIZFW	Load index at Zero Fuel Weight
LMC	Last Minute Change
LMT	Limit
LOPA	Layout Of Passenger Arrangement

ABBR.	DESCRIPTION
LS	Loadsheet
LSOD	LS OPT Detailed Description
LS OPT	Weight and Balance module in OPT
LTI/E	Line Training Instructor/Examiner
LW	Landing Weight (LAW)
LWMAC	MAC CG percentage at LAW
m	Meters
m2	Square Meters
m3	Cubic Meters
MAB	Mass and Balance
MAC	Mean Aerodynamic Chord
MCC	Maintenance Control Center
MEL	Minimum Equipment List
MFW	Minimum Flight Weight
MLW	Maximum Landing Weight or Main Landing Wheel
MPLW	Maximum Permissible Landing Weight
MPTOW	Maximal Permissible Take Off Weight
MTOW	Maximal Take Off Weight
MTW	Maximal Taxi Weight
MZFW	Maximal Zero Fuel Weight
NAV	Navigation (Department)
NLW	Nose Landing Wheel
NU	Not Usable
O2	Oxygen
OBS	Observer
OC	Observer Cabin
OCC	Operations Control Center
OE	Overwater Equipment (Life Rafts)
OF	Observer Flight (Deck)
OFP	Operational Flight Plan
OM-A	(Company) Operations Manual part A
OPAL	Operational Procedures for Aircraft Loading
OPT	Boeing Onboard Performance Tool
OTF/OTC	Other Persons
PAX	Passengers
PIC	Pilot In Command
PNL	Passenger Name List
POL	Performance and Operating Limitations
PR	Purser
PRG	IATA Code of Prague Airport
QRDD	Quick Reference DOW/DOI Values
QRH	Quick Reference Handbook
QRSQ	Quick Reference SPEQ Quantities
QTY	Quantity
REFSTA	Reference Station (20% of MAC)

ABBR.	DESCRIPTION
RWY	Runway
SAP	Accompanying Service Personnel
SCCM	Senior Cabin Crew Member
SDC	Schedule Database Control
SOP	Standard Operating Procedure
SPEQ	Special Sport Equipment
Sq FT	Square Feet
Sq IN	Square Inches
STD	Standard or Scheduled Time of Departure
SVF/SVC	Supervising Personnel
t	Ton (Metric)
T/O	Take Off
TAP	Accompanying Technical Personnel
TDGP	Tiedown General Principles
TOF	Take Off Fuel (Weight)
TOMAC	MAC CG percentage at TOW
TOW	Take Off Weight
TR	Tilting Required
TRA	Base Training Trainees
TVS	Smartwings a.s. ICAO Code
ULD	Unit Load Device
USG	United States Gallons
W&B	Weight and Balance
WBC	Weight and Balance Calculator feature in EFA
WBDD	Weight & Balance Documents, Applications and Data
WBM	Weight and Balance Manual
WBMA	WBM Attachments Description
WGT	Weight
WL	Water Line
XBAG	Extra (Large) Baggage
YD	Yard(s)
ZFMAC	MAC CG percentage at ZFW
ZFW	Zero Fuel Weight

G6. ANNOTATION OF CHANGES

CHAPTER	DESCRIPTION

G7. DISTRIBUTION LIST

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CSA/TVS	DCS
CSA	LPS
CSA	Cargo
TVS	FDS
TVS	Navigator (Manager)
CSA/TVS	OCC (Supervisor/Manager)
TVS	Ops Specialists

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Chapter 1 AIRCRAFT DIMENSION REFERENCE AND LIMITATIONS

This chapter describes basic general airplane dimensions and defines units of distance measurement.

1.1 DISTANCE UNIT CONVERSION CHART

Default unit of distance measurement for a purpose of weight and balance is one meter [m]. However, some generic distances may be described in units of feet [FT] or inches [IN].

Table 1-1 Distance conversion chart

Units	Inches [IN]	Feet [FT]	Yards [YD]	Centimeters [cm]	Meters [m]
1 IN	1	0.0833 (1/12)	0.0278 (1/36)	2.54	0.0254
1 FT	12	1	0.3333 (1/3)	30.48	0.3048
1 YD	36	3	1	91.44	0.9144
1 CM	0.3937	0.0328	0.0109	1	0.01
1 M	39.37	3.2808	1.0936	100	1

1.2 AREA AND CUBIC UNITS CONVERSION CHARTS

Default units of area or volume are square and cubic meters respectively. Some volumetric units of various tanks and liquids may be defined in liters.

Table 1-2 Area unit conversion chart

Units	Square Feet [Sq FT]	Square Inches [Sq IN]	Square Meters [m^2]
1 Sq FT	1	144	0.0929
1 Sq IN	0.0069	1	0.0006
1 m^2	10.76	1550.0031	1

Table 1-3 Volumetric unit conversion chart

Units	Cubic Feet [CU FT]	US Gallons [USG]	Liters [L]	Cubic Meters [m^3]
1 CU FT	1	7.4805	28.3168	0.0283
1 USG	0.1337	1	3.7854	0.0038
1 L	0.0353	0.2642	1	0.001
1 m^3	35.3167	264.1721	1000	1

1.3 AIRCRAFT DIMENSIONS EXTERIOR

Following chart describes exterior dimensions of Airbus models. Dimensions can be also seen on diagrams further on in this chapter.

Figure 1-1 Aircraft Dimensions A220 - Top View

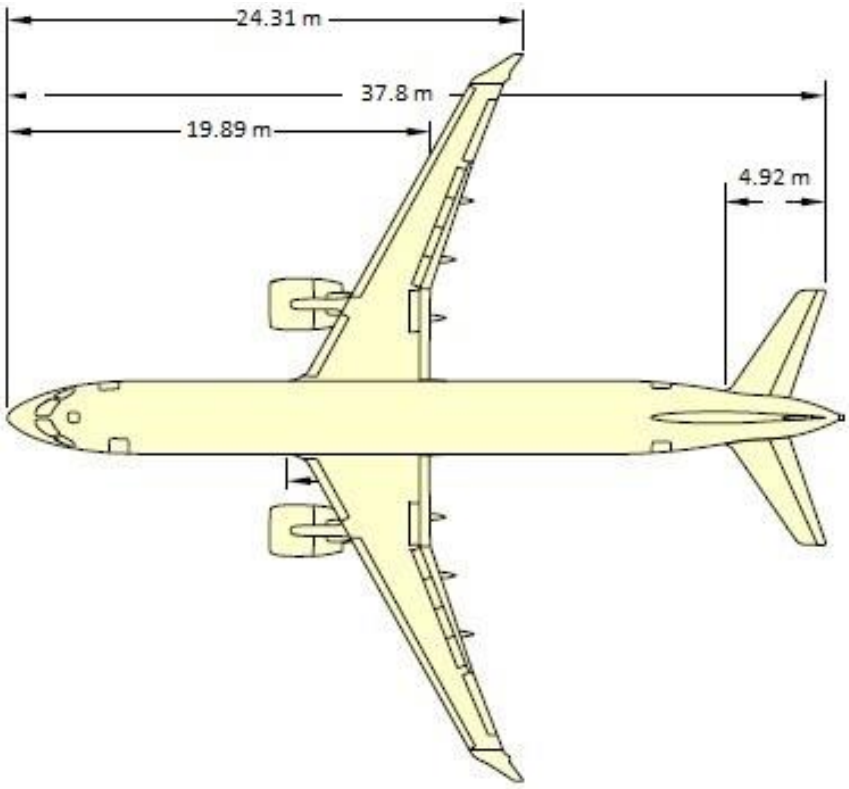


Figure 1-2 Aircraft Dimensions A220 - Side View

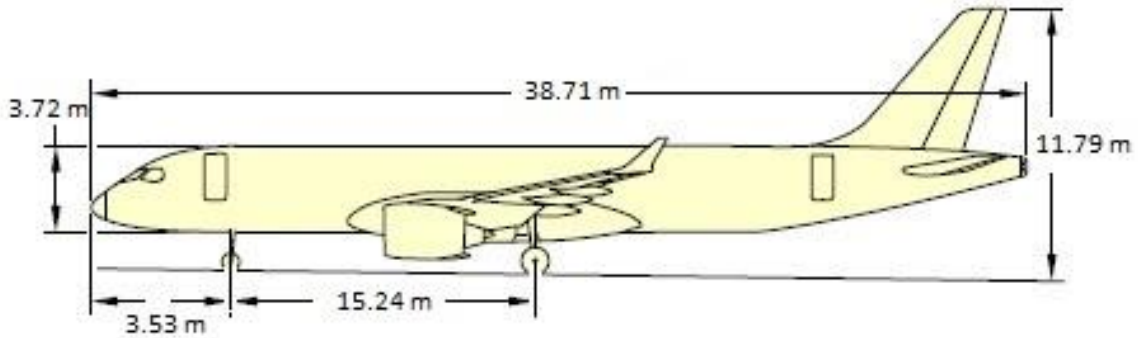
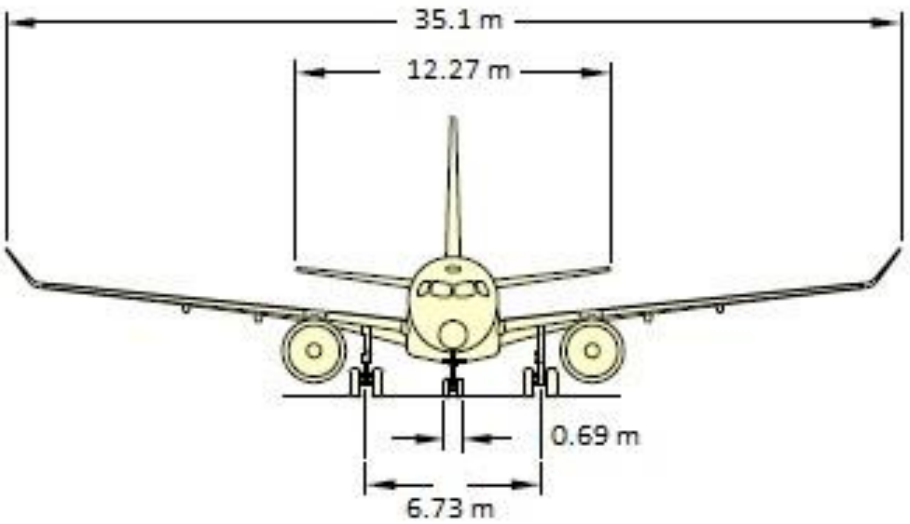


Figure 1-3 Aircraft Dimensions A220 - Front View



1.4 AIRCRAFT REFERENCE SYSTEM

Longitudinal location of all airplane component centers of gravity identified throughout this manual will be referred to as Fuselage Stations (FS). The Fuselage Station is a true measure in meters from the reference datum 4,267 m forward of the front spar. Following figures show the relationship between FS and Fuselage Frames.

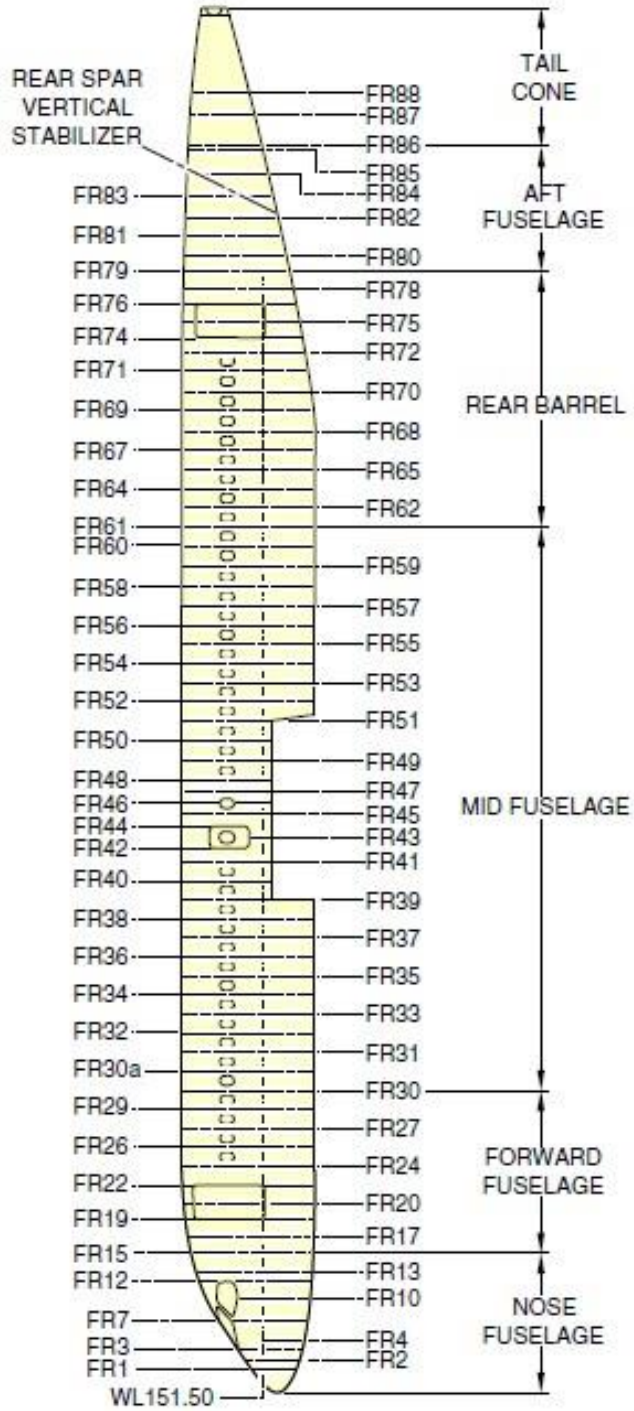
Table 1-4 Fuselage Frames

Frame number	FS (m)
1	4.902
2	5.131
3	5.436
4	5.662
5	5.889
6	6.115
7	6.342
8	6.558
9	6.775
10	7.009
11	7.242
12	7.474
13	7.700
14	7.927
15	8.153
17	8.636
19	9.119
20	9.601
22	10.084
24	10.617
25	10.770
26	11.151
27	11.684
28	12.065
29	12.217
30	12.751
30a	13.284
31	13.818
32	14.351
33	14.884

Frame number	FS (m)
34	15.418
35	15.951
36	16.485
37	17.018
38	17.551
39	18.085
40	18.617
41	19.159
42	19.529
43	19.846
44	20.164
45	20.485
46	20.803
47	21.120
48	21.437
49	21.996
50	22.555
51	23.114
52	23.647
52a	24.003
53	24.181
53a	24.562
54	24.714
55	25.248
56	25.781
57	26.314
58	26.848
59	27.381
60	27.915

Frame number	FS (m)
61	28.448
62	28.981
63	29.134
64	29.515
65	30.048
66	30.429
67	30.582
68	31.140
69	31.699
70	32.258
71	32.817
72	33.350
74	33.731
75	34.201
76	34.671
78	35.103
79	35.621
80	36.039
81	36.536
82	37.032
83	37.647
84	38.315
85	38.989
86	39.116
87	39.815
88	40.249

Figure 1-4 Fuselage Frames



1.4.1 MAC Reference

Mean Aerodynamic Chord (MAC) length is used for an actual CG arm reference. For the sake of simplicity, the CG position may be described as percent of MAC (0% - leading edge of MAC, 100% - trailing edge of MAC).

MAC formula:

$$\%MAC = \frac{[(FS - \text{LEMAC}).100]}{\text{MAC}}, \text{ where}$$

- **LEMAC** [m] – the distance from the reference datum to the Leading Edge of the MAC
- **MAC** [m] – the overall MAC length.

1.4.2 INDEX System

All operational loading and limits are defined in INDEX units in order to convert the large KG.IN moment values to more manageable numbers. INDEX is a dimensionless unit used for A220s fleet to describe a moment or moment change, the same sign convention as for moment applies:

INDEX/Moment: Positive (+) = CG shift aft/pitch up

INDEX/Moment: Negative (-) = CG shift forward/pitch down

INDEX formula:

$$INDEX = Weight\ [KG].\frac{(FS\ [m] - \text{REFSTA})}{\text{C}} + \text{K}, \text{ where}$$

- **REFSTA** [m] – the Reference Station corresponding to 25% of MAC;
- **C** [m.KG]– an arbitrary moment constant used to size down moment values to more manageable numbers;
- **K** [ ] – the shifting arbitrary constant.

Table 1-5 Index system constants

Dimension	A220
LEMAC [m]	20.803
MAC [m]	3.781
REFSTA [m]	21.748
C [m.KG]	806.487
K [ ]	50

1.5 INTERIOR ARRANGEMENT

This chapter provides a basic overview of reference balance arms and available facilities in the fleet.

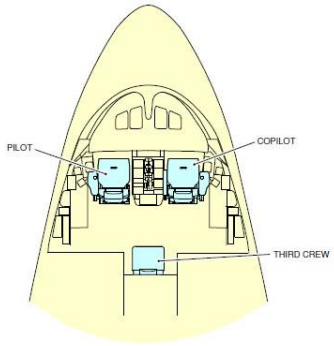
Table 1-6 Door sizes.

Door	Width [m]	Height [m]
Forward Entry	0.81	1.88
Aft Entry	0.76	1.83

1.5.1 Flight Deck

Flight deck is equipped with two seats for Captain and First Officer and one or two seats for observer(s) - “jumpseats”. These positions are crucial for DOW / DOI calculation.

Table 1-7 Arrangement of the flight deck seats



Seat	FS [m]
Captain	6.883
First Officer	6.883
First Observer	7.889

1.5.2 Cabin Crew Seats

Cabin is equipped with two seats for attendants next to forward entry door, two attendant seats by the aft entry door.

Figure 1-5 The Location of Cabin Crew Seats in Passenger Cabin. Note the passenger cabin seats are for illustration only.

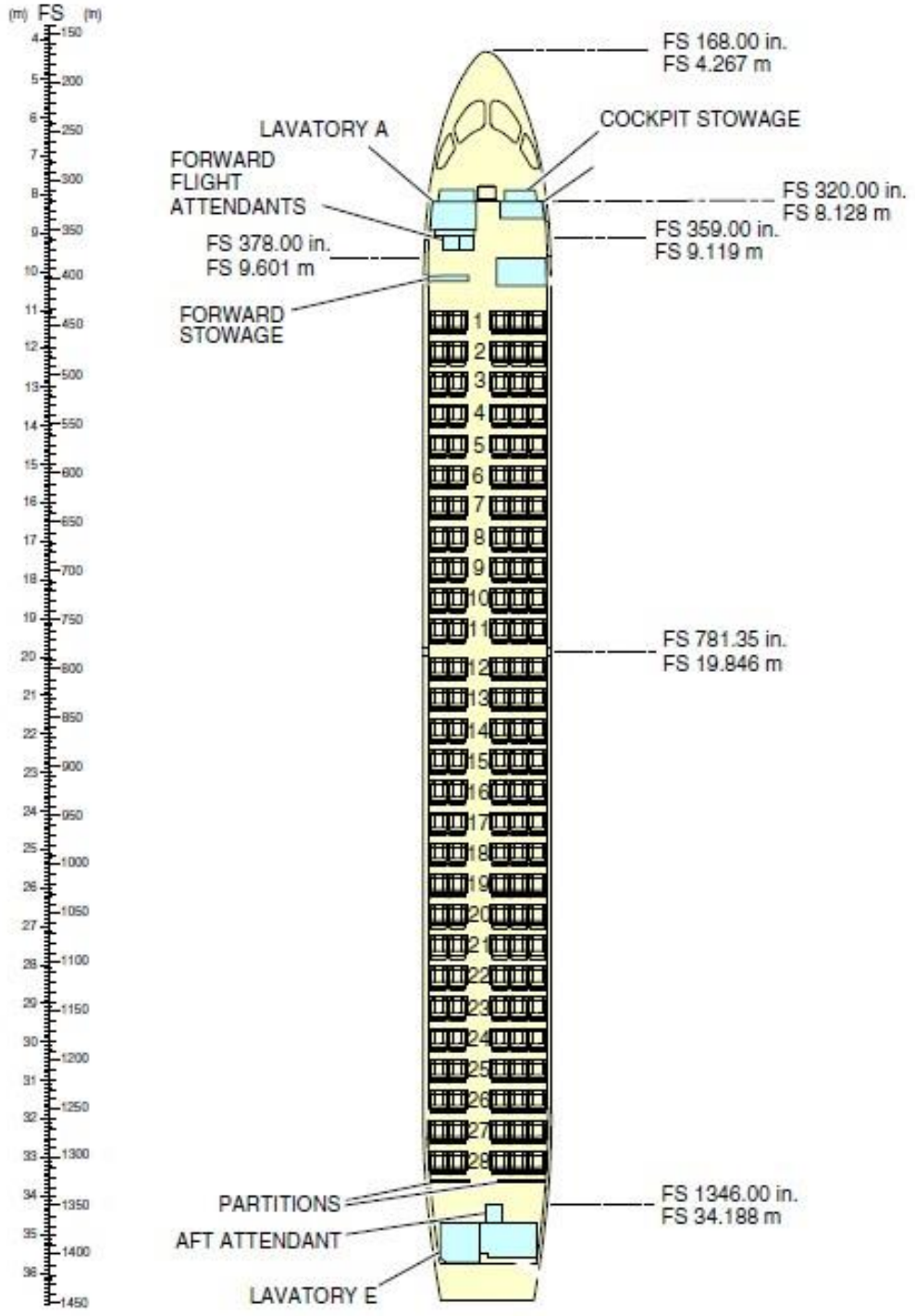


Table 1-8 Attendant Seats Fuselage Stations.

Cabin Crew Seat Locations	Fuselage Stations [m]
Forward Flight Attendant Station (2 Seats)	9.195
Aft Flight Attendant Station (1 Seat-LAV)	33.858
Aft Flight Attendant Station (1 Seat-G4)	34.569

1.5.3 Galley Structures

Aircraft are equipped with main galley structures installed on company aircraft: the most forward **G1**, neighboring **G2B**, aft **G4** and **G4A**.

Actual fuselage stations are to be found in Table 1-99 below.

Table 1-9 Galley installations Fuselage Stations and Maximal Load – the maximal load does not include fixed galley structures and equipment.

Galley Installation	Fuselage Stations [m]	Maximal Weight [KG]
	A220	
Galley 1 (G1, Fwd)	8.382	238
Galley 2 (G2B, Fwd)	9.982	399
Galley 3 (G4, Aft)	35.052	626
Galley 4 (G4A, Aft)	35.128	463

1.5.4 Passenger Cabin & Configurations

The cargo structure is designed for a maximum load of 350 kg/m. The flat floor are designed for a maximum load of 732 kg/m².

The running load limit is the maximum weight acceptable on the distance, in the flight direction, between two successive seat front studs.

The distance between two successive seat front studs is the seat row pitch.

The running load depends on the number of seats per row, the seat row pitch, and the assigned weight per seat place.

The weight per seat place is the sum of the following:

- The weight of the seat
- The weight of the seat equipment (IFE, life vest, etc.)
- The assigned weight of the passenger hand baggage, transported on the cabin Floor
- The assigned weight of the passenger.

Standard configuration for A220 is 140Y. In order to cover most operational cases this configuration may be modified into a specific version using convertible seats.

Table 1-10 Standard (STD) Cabin Configuration

Type	STD Cabin Configurations
A220	140Y

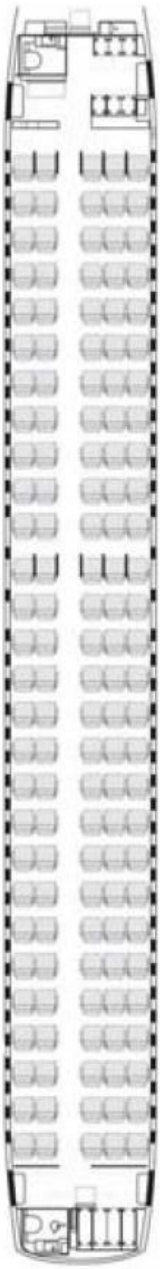
1.5.4.1 Cabin Sections

Each cabin configuration is divided into several sections for trimming purposes. Each section has its assumed centroid which acts as a Reference Balance Arm for a cumulative passenger weight seated in the given sections. A row trimming is NOT used by our company since there are slight row differences among many airplanes in the fleet. For the exact row balance arms see an actual LOPA drawing applicable for the given aircraft. LOPA drawings are stored on an engineering division drives and every new LOPA is evaluated by Weight and Balance specialist, whether it fits stipulated limits and current CG envelope.

Table 1-11 STD Cabin Section division Ref. BAs in [m]

Type	Cabin Config.	STD Cabin Sections											
		0A			0B			0C			0D		
		Seats	Rows	Ref. BA	Seats	Rows	Ref. BA	Seats	Rows	Ref. BA	Seats	Rows	Ref. BA
A220	140Y	25Y	1-5	12,7	30Y	6-11	17,78	50Y	12-21	23,686	35Y	22-28	30,417

Figure 1-6 A220 (140Y) all economy configuration

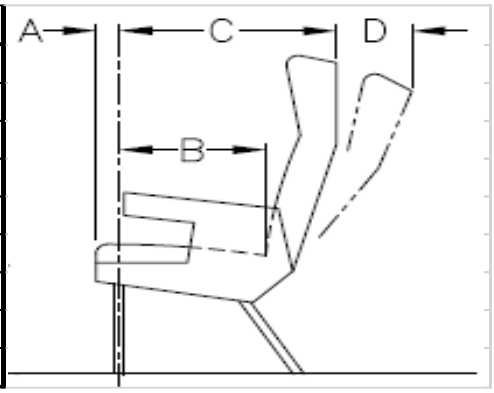


1.5.4.2 Cabin Monuments Dimensions

Basic properties of economy seats in standard all economy configurations may vary by aircraft and its actual fitting. For detailed information including total passenger weight limits refer to the actual seat type and manufacturer limits described in respective documentation or LOPA at FDS department or company engineering (interior specialist) department.

Table 1-12 Quick Reference economy seat geometry

Quick Reference Economy Seat Properties [IN]		
Seat Geometry	Values	
	A	2.20
	B	16.38
	C	24.00
	D	4.50
	Width	17.00
First Rows Pitch	From - To	29 - 33
Standard Pitch		28 - 31
Emergency Exit Pitch		38 - 43



1.6 CARGO COMPARTMENTS

This section provides lower deck cargo compartment description and loading. It contains the maximum allowable weights that can be basic monocoque structure. Cargo compartments are used only for bulk load, Unit Load Devices (ULD) are not used.

Figure 1-7 Basic cargo holds arrangement

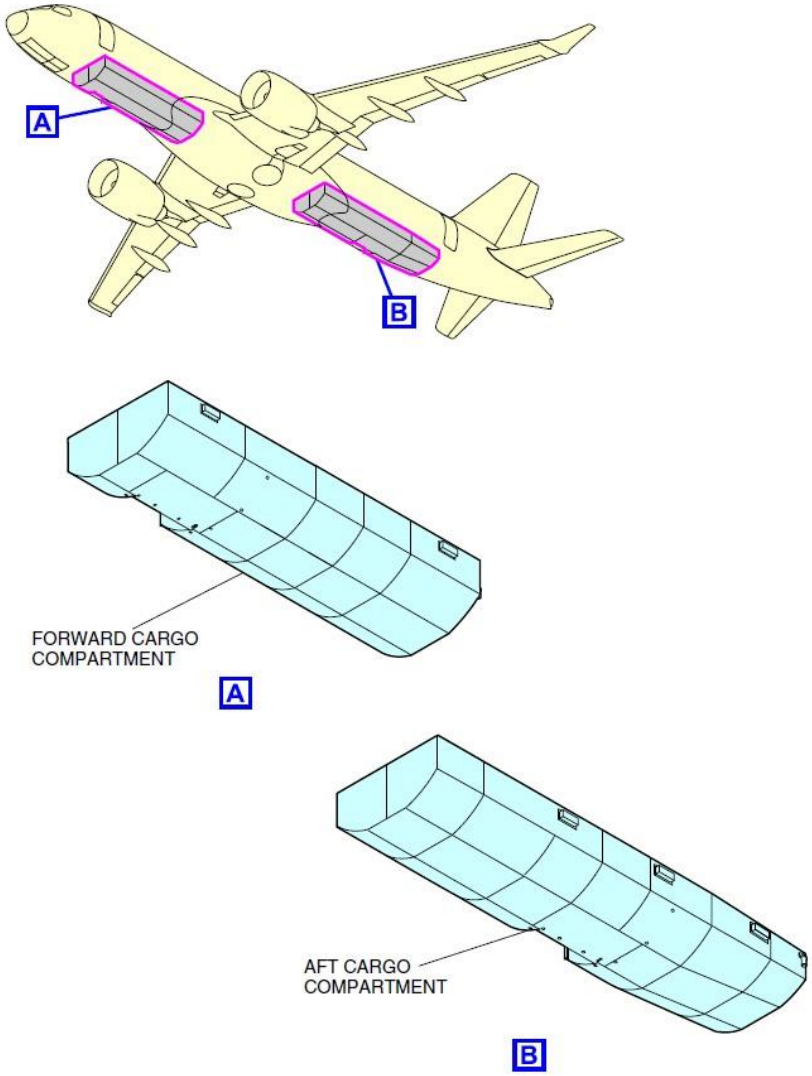


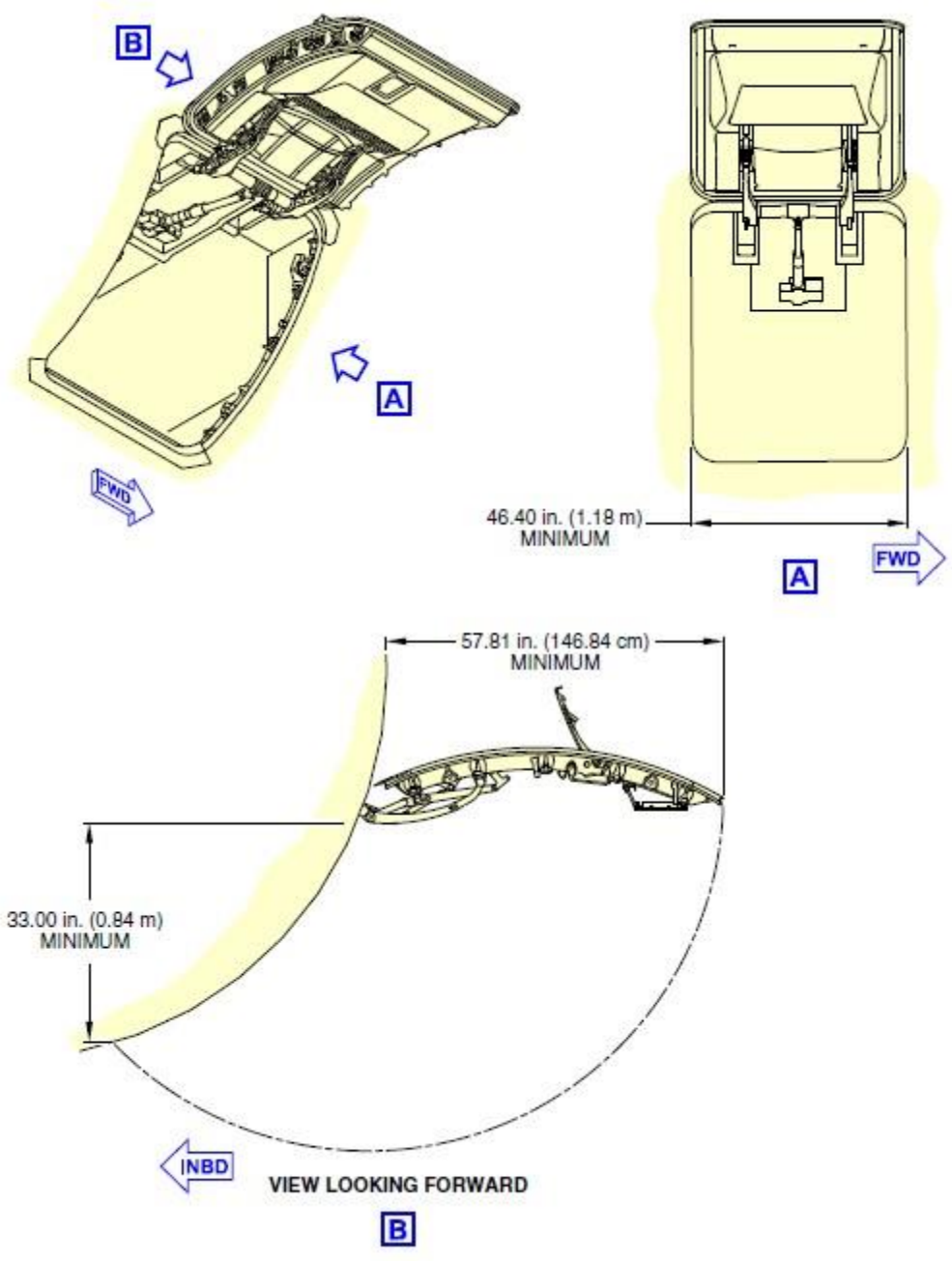
Table 1-13 Basic Balance Arms of Cargo Compartments

Compartment	A220	
	BA From [m]	BA To [m]
Forward Hold	11,110	14,607
Aft Hold	27,961	33,223

1.6.1 Cargo Compartment Dimensions

All aircraft are equipped with bulk compartments only. CLC not installed. Forward and aft cargo compartment have the same door and the same clear opening.

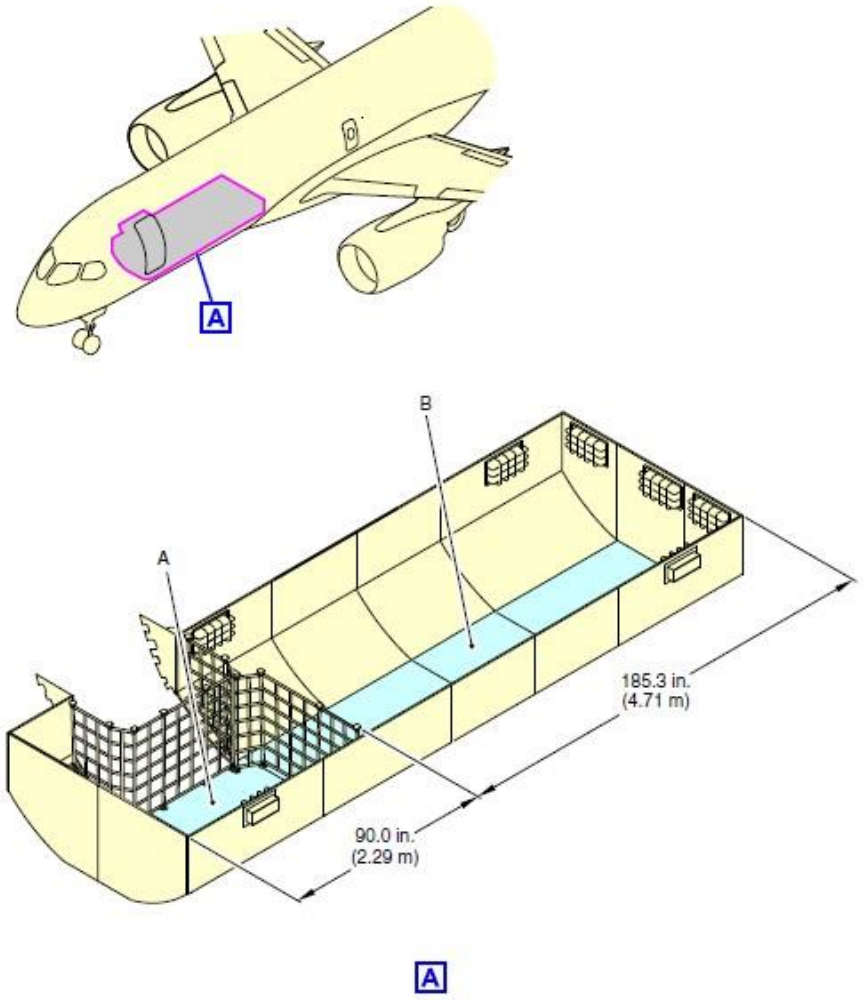
Figure 1-8 Compartment door dimensions.



1.6.1.1 FWD Compartment

Forward cargo compartment is further divided into bays A and B.

Figure 1-9 Typical forward cargo compartments of A220

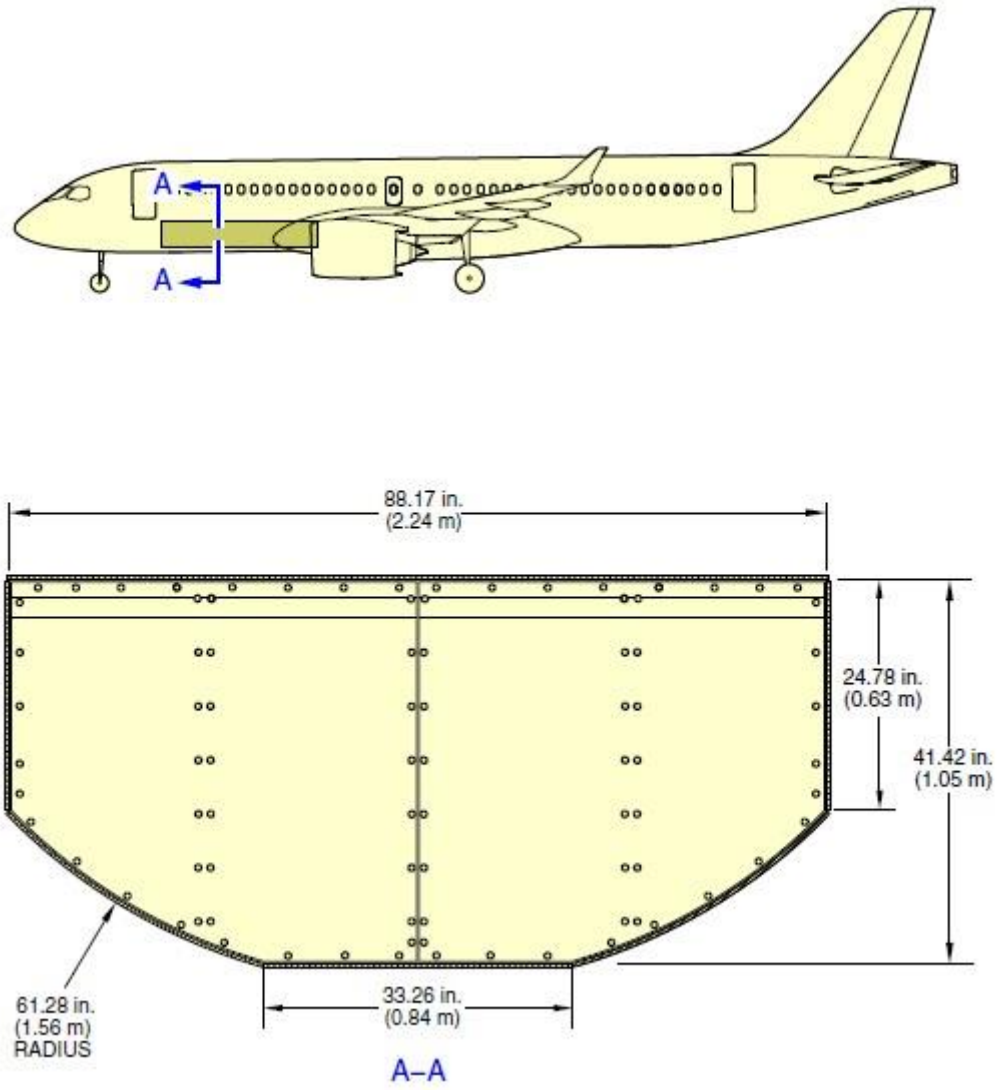


Cargo hold compartments have similarly to cabin sections their assumed reference balance arm centroids, which are used for operational loading and balancing.

Table 1-14 A220 FWD Compartment reference BAs

Hold	Balance Arms [m] (A220)		
	Centroid	FWD	AFT
FWD Compartment	13,463	9,967	16,960
A	11,11	9,967	12,253
B	14,607	12,253	16,960

Figure 1-10 Fwd Cargo compartment cross section



1.6.1.2 AFT Compartment

Aft cargo compartment is further divided into bays C, D and E.

Figure 1-11 Typical aft cargo compartments of A220

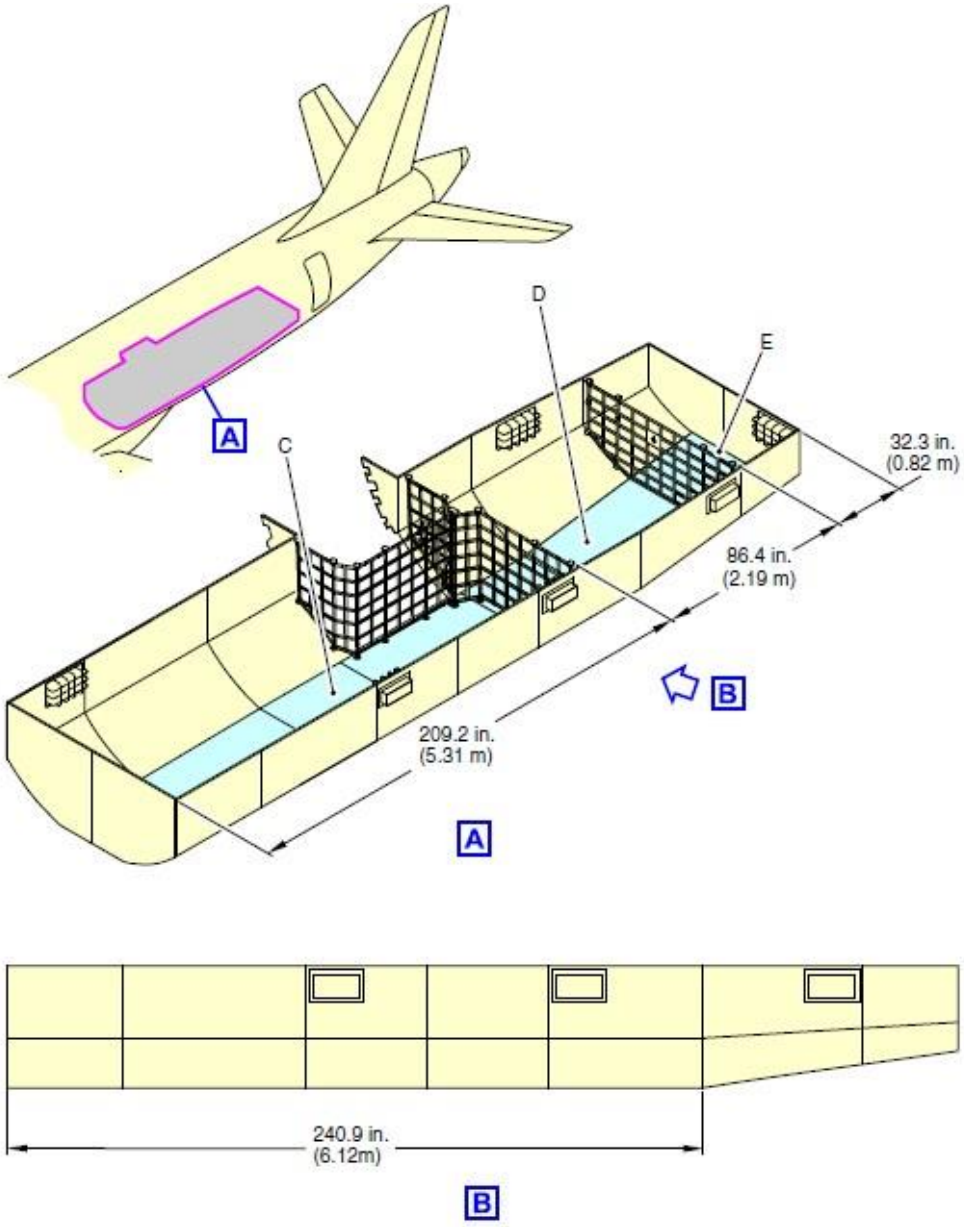
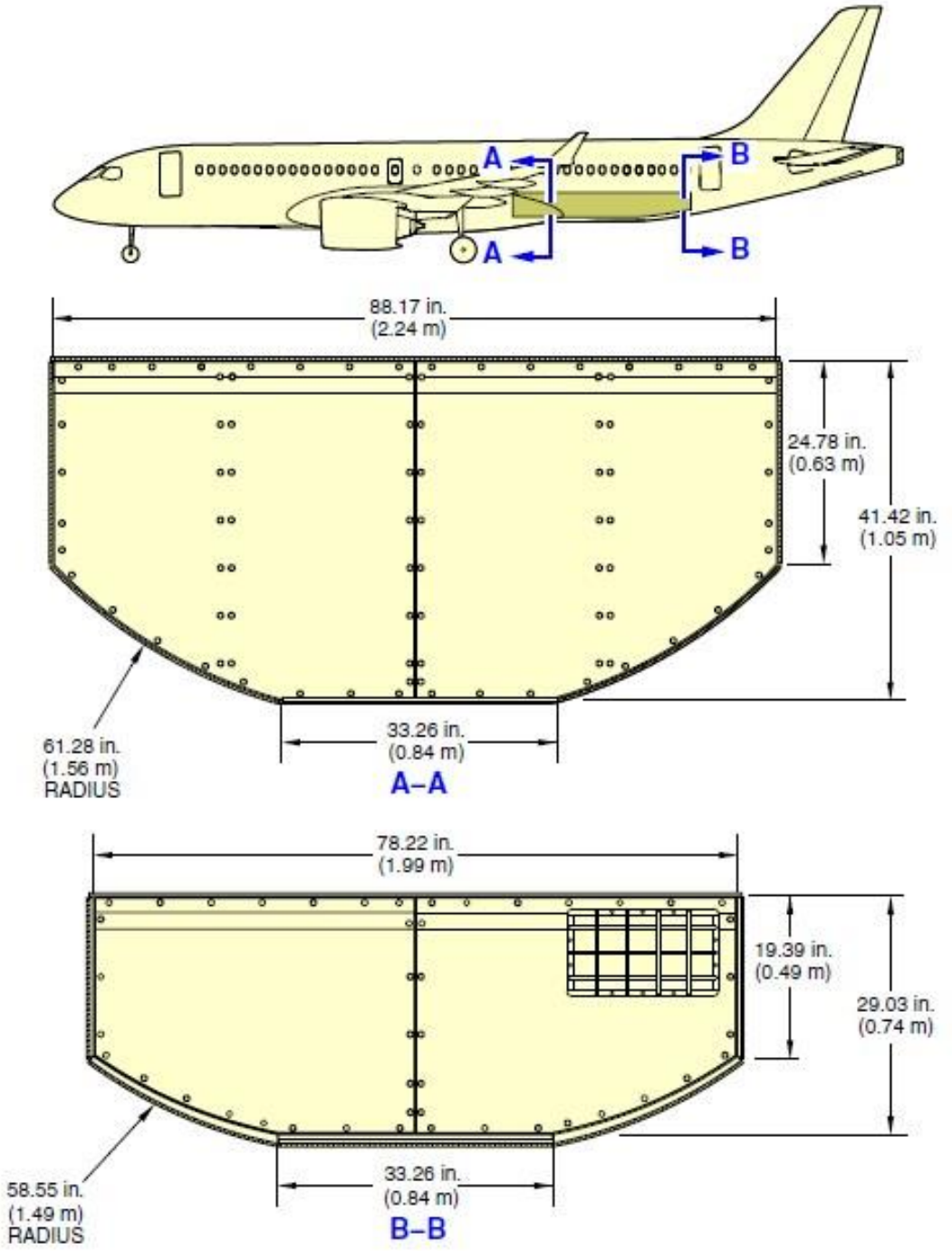


Table 1-15 A220 FWD Compartment reference BAs

Hold	Balance Arms [m] (A220)		
	Centroid	FWD	AFT
AFT Compartment	29,469	25,305	33,633
C	27,961	25,305	30,618
D	31,715	30,618	32,812
E	33,223	32,812	33,633

Figure 1-12 Aft Cargo compartment cross section



1.6.1.3 Maximum Package Sizes

For loading the packages with the maximum dimensions shown in the following table it is not necessary to tilt the packages, but they must be lifted on the sloping part of the floor. The maximum width dimensions are reachable by positioning the one end of them on the sloping part of the floor and the other end on the horizontal floor.

Table 1-16 Package dimensions in forward cargo compartment

Width (m)	Height (m)									
	0 to 0.304	0.304 to 0.508	0.508 to 0.584	0.584 to 0.635	0.635 to 0.685	0.685 to 0.736	0.736 to 0.762	0.762 to 0.787	0.787 to 0.812	0.812 to 0.838
	Maximum package length (m)									
0 to 0.076	5.842	5.410	4.622	4.114	3.632	3.175	2.946	2.743	2.489	2.209
0.076 to 0.152	5.689	4.826	4.191	3.784	3.378	2.971	2.768	2.565	2.336	2.108
0.152 to 0.228	5.054	4.368	3.860	3.505	3.149	2.794	2.590	2.438	2.235	2.006
0.228 to 0.304	4.572	4.013	3.556	3.251	2.946	2.641	2.463	2.311	2.108	1.905
0.304 to 0.381	4.165	3.708	3.327	3.048	2.768	2.489	2.336	2.209	2.032	1.828
0.381 to 0.457	3.835	3.454	3.124	2.870	2.641	2.362	2.235	2.108	1.930	1.752
0.457 to 0.533	3.556	3.225	2.946	2.717	2.514	2.260	2.133	2.006	1.854	1.676
0.533 to 0.609	3.327	3.022	2.794	2.590	2.387	2.159	2.032	1.930	1.778	1.600
0.609 to 0.685	3.124	2.870	2.641	2.489	2.286	2.082	1.955	1.854	1.727	1.549
0.685 to 0.762	2.971	2.717	2.540	2.362	2.184	2.006	1.879	1.778	1.651	1.498
0.762 to 0.838	2.819	2.616	2.438	2.286	2.108	1.930	1.803	1.727	1.574	1.422
0.838 to 0.914	2.692	2.489	2.336	2.184	2.038	1.854	1.752	1.651	1.524	1.371
0.914 to 0.990	2.565	2.387	2.235	2.108	1.955	1.778	1.676	1.574	1.447	1.295
0.990 to 1.066	2.463	2.286	2.159	2.006	1.854	1.676	1.574	1.473	1.346	1.193
1.066 to 1.168	2.159	1.955	1.803	1.651	1.498	1.320	1.193	1.117	0.965	0.838

CAUTION: – If the package is loaded in the forward section of the forward cargo compartment, the maximum length is limited to 1.778 m.

NOTE: Example: The maximum length for a package with a width of 0.760 m and a height of 0.630 m is 2.362 m.

Table 1-17 Package dimensions in forward section of the aft cargo compartment

Width (m)	Height (m)									
	0 to 0.304	0.304 to 0.508	0.508 to 0.584	0.584 to 0.635	0.635 to 0.685	0.685 to 0.736	0.736 to 0.762	0.762 to 0.787	0.787 to 0.812	0.812 to 0.838
	Maximum package length (m)									
0 to 0.076	4.826	4.826	4.622	4.114	3.632	3.175	2.946	2.743	2.489	2.209
0.076 to 0.152			4.191	3.784	3.378	2.971	2.768	2.565	2.336	2.108
0.152 to 0.228		4.368	3.860	3.505	3.149	2.794	2.590	2.438	2.235	2.006
0.228 to 0.304	4.572	4.013	3.556	3.251	2.946	2.641	2.463	2.311	2.108	1.905
0.304 to 0.381	4.165	3.708	3.327	3.048	2.768	2.489	2.336	2.209	2.032	1.828
0.381 to 0.457	3.835	3.454	3.124	2.870	2.641	2.362	2.235	2.108	1.930	1.752
0.457 to 0.533	3.556	3.225	2.946	2.717	2.514	2.260	2.133	2.006	1.854	1.676
0.533 to 0.609	3.327	3.022	2.794	2.590	2.387	2.159	2.032	1.930	1.778	1.600
0.609 to 0.685	3.124	2.870	2.641	2.489	2.286	2.082	1.955	1.854	1.727	1.549
0.685 to 0.762	2.971	2.717	2.540	2.362	2.184	2.006	1.879	1.778	1.651	1.498
0.762 to 0.838	2.819	2.616	2.438	2.286	2.108	1.930	1.803	1.727	1.574	1.422
0.838 to 0.914	2.692	2.489	2.336	2.184	2.038	1.854	1.752	1.651	1.524	1.371
0.914 to 0.990	2.565	2.387	2.235	2.108	1.955	1.778	1.676	1.574	1.447	1.295
0.990 to 1.066	2.463	2.286	2.159	2.006	1.854	1.676	1.574	1.473	1.346	1.193
1.066 to 1.168	2.159	1.955	1.803	1.651	1.498	1.320	1.193	1.117	0.965	0.838
NOTE:	Example: The maximum length for a package with a width of 0.760 m and a height of 0.630 m is 2.362 m.									

Table 1-18 Package dimensions in aft section of the aft cargo compartment

Width (m)	Height (m)									
	0 to 0.304	0.304 to 0.508	0.508 to 0.584	0.584 to 0.635	0.635 to 0.685	0.685 to 0.736	0.736 to 0.762	0.762 to 0.787	0.787 to 0.812	0.812 to 0.838
	Maximum package length (m)									
0 to 0.076	4.064	4.064	4.064	3.886	3.454	3.048	2.819	2.667	2.413	2.184
0.076 to 0.152			3.962	3.556	3.200	2.844	2.692	2.514	2.311	2.057
0.152 to 0.228			3.632	3.327	3.022	2.717	2.540	2.413	2.184	2.006
0.228 to 0.304		3.810	3.403	3.149	2.844	2.565	2.438	2.286	2.082	1.905
0.304 to 0.381	3.962	3.556	3.225	2.946	2.717	2.438	2.311	2.159	1.981	1.828
0.381 to 0.457	3.657	3.302	3.022	2.819	2.565	2.336	2.209	2.082	1.930	1.752
0.457 to 0.533	3.429	3.124	2.844	2.667	2.438	2.235	2.108	2.006	1.854	1.676
0.533 to 0.609	3.225	2.946	2.717	2.540	2.362	2.133	2.006	1.930	1.778	1.600
0.609 to 0.685	3.048	2.819	2.590	2.413	2.260	2.057	1.955	1.854	1.727	1.549
0.685 to 0.762	2.870	2.667	2.463	2.336	2.159	2.006	1.879	1.778	1.651	1.498
0.762 to 0.838	2.768	2.540	2.387	2.260	2.082	1.930	1.803	1.727	1.574	1.422
0.838 to 0.914	2.616	2.438	2.311	2.159	2.006	1.854	1.752	1.651	1.524	1.371
0.914 to 0.990	2.514	2.362	2.209	2.082	1.955	1.778	1.676	1.574	1.447	1.295
0.990 to 1.066	2.438	2.260	2.108	2.006	1.854	1.676	1.574	1.473	1.346	1.193
1.066 to 1.168	2.133	1.955	1.803	1.651	1.498	1.320	1.193	1.117	0.965	0.838

1.6.2 Compartments Volume and Maximal Floor Loading

The floor structure can sustain on the flat and sloped floor via floor panels a maximum distributed load of 732 kg/m^2.

The cargo structure is designed for a maximum load of 350kg/m. The curved floor and canted floor are designed for a maximum load of 293 kg/m^2.

Following table describes the maximal floor loading and volumetric capacities by compartments. Note the volume is the maximal theoretical value. Guaranteed volume of transported packages may be lower by 40% depending on the shape(s) of packages, tiedown requirements, dangerous goods regulations etc.

The greater volumetric loading is allowed up to the manufacturer's limits (subject to weights limits) and it could also be guaranteed in advance in case to case basis after a thorough study carried out by FDS Department.

Table 1-19 The Maximal compartment Weight and Volume per compartment.

Type	Comp. A		Comp B		Comp C		Comp D		Comp E	
	Max. Weight	Max. Volume.	Max. Weight	Max. Volume.	Max. Weight	Max. Volume.	Max. Weight	Max. Volume.	Max. Weight	Max. Volume.
A220	800	3,65	1646	9	1858	9,49	768	4,13	287	1,19

Note: Maximum allowed total load for AFT (C+D+E) compartment is 2606 kg.

Special cargo may require the use of the ventilation and(or) temperature control systems. To transport special cargo, the operator should consider both of the following:

- WBM requirements,
- requirements or regulations of any specific documentation applicable to special cargo.

It is Ramp Agent duty to ensure that Live Animals are stowed and secured according to ICAO, IATA and CSA Czech Airlines regulations/instructions.

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Chapter 2 AIRCRAFT LOAD AND WEIGHTS

This chapter describes weight units and airplane actual and certified weight values. Company preferred term is “weight”, however some stations may use the word “mass” – for the purpose of all company procedures “weight” is equal to “mass”. Default unit for weight is one kilogram (kg). For a unit conversion see a conversion table below.

Table 2-1 Weight unit conversion chart

Unit	Pounds [lb]	Kilograms [KG]	Tons [T]
1 lb	1	0.4536	0.0004536
1 KG	2.205	1	0.001
1 T	2205	1000	1

2.1 AIRCRAFT WEIGHTS

BW – Basic Weight of an aircraft includes:

The structure, power plants, systems, furnishings and other items of equipment that are integral part of a particular aircraft configuration, including the fluids contained in closed systems as follows:

- unusable fuel,
- oil for engines, IDG and APU,
- lavatory precharge,
- aircraft documents and tool kits,
- passenger seats, passenger life jackets and safety cards including seatback literature
- tables and baby bassinets,
- galley structure and fixed equipment,
- emergency equipment as described in EEL including: evacuation aids, portable O2 bottles and boxes, fire extinguishers, megaphones, flash lights, first aid kits, emergency radio beacons, asbestos gloves and smoke goggles, demonstration kits, life jackets for crew and children.

Company basic weights, index and CG data are published in attachment 1 - QRDD. For procedures of BW value establishment and monitoring see chapter 5.2.

DOW – Dry Operating Weight is a total weight of the aircraft ready for a specific type of operation excluding all usable fuel and traffic load. This weight includes BW plus items such as:

- Cockpit crew, cabin crew and supernumeraries incl. their baggage,
- Catering and removable service equipment,
- Potable water,
- Equipment necessary for the specific flight such as Overwater Equipment or Survival equipment (Miscellaneous Items)

Items above may be referenced to as Variable Load items.

Payload is the weight summary of passenger including their baggage, cargo and mail (just the revenue load).

Traffic load is the total weight of passengers, baggage and cargo, including both revenue and non-revenue load (Company Material/COMAT, Fly Away Kits etc.). **Allowed traffic load** is the maximal amount of load that could be carried without exceeding any maximal limiting weights listed below. **Underload** is the difference between the actual traffic load and the allowed traffic load.

ZFW – Zero Fuel Weight is a combined weight of DOW and actual traffic load. ZFW is limited by **MZFW** (Maximal structural certified ZFW) and it is given by the aircraft manufacturer.

EZFW is Estimated ZFW which is used for OFP calculation or by load control prior actual ZFW is determined. EZFW may be based on statistical data to predict the actual ZFW to a higher level of accuracy.

TOW – Take Off Weight is the combined weight of ZFW and Take Off fuel. It may be also referenced as Brake Release Gross Weight. TOW is limited by (whichever is lower):

A. **MTOW** (Maximal certified structural TOW), which is given by the aircraft manufacturer;
B. **MPTOW** is the Maximal Performance TOW and it depends on company Take Off performance calculation, which considers the actual departure aerodrome weather conditions, aircraft systems, thrust setting, RWY length and condition, obstacles, brake limit and brake energy limit.
C. **MATOW -** Maximal Allowed TOW – the lower of MTOW or MPTOW

MTW – Maximum Taxi Weight is the maximum permissible total weight for ground maneuver (including the weight of run-up, APU and taxi fuel).

LW – Landing Weight is the weight of aircraft at the moment of landing maneuver. For the purpose of loadsheet it is determined as TOW minus planned Trip Fuel. The LW may be referred as **LAW** in some applications and documents. The LW is limited by (whichever is lower):

A. **MLW** (Maximal certified structural LW), which is given by the aircraft manufacturer;
B. **MPLW** is Maximal Performance LW and it depends on company landing performance calculation, which considers expected destination aerodrome weather conditions, aircraft systems, RWY length and condition, brake limit and brake energy limit.
C. **MALW -** Maximal Allowed LW – the lower of MLW or MPLW

Maximal certified structural weights applicable for a particular aircraft are listed in attachments 1 - QRDD.

2.2 CREW WEIGHTS

Crew member abbreviations are defined in Table 2-2 Standard crew weights are used for variable load calculations.

Table 2-2 Standard crew weights listed. Note that weights include 10 KG of crew hand luggage. Any crew bags carried in cargo hold shall be accounted for using its actual weights

Crew Member	Weight [KG]
Pilot (CD, CP, FO, LT, GE, OF/*)	85
Cabin crew (SC, PR, CC, OC/*)	75

Refer to DOW/DOI calculation procedures in chapter 5.3.1.1 for an assumed seating of crew members. For the extra crew and supernumerary seating rules see chapter 5.3.1.2.

2.3 PASSENGER AND BAGGAGE WEIGHTS

Company A220 fleet uses two sets of standard passenger weights in accordance with EC regulation 965/2012, AMC1 CAT.POL.MAB.100 (e).

Table 2-3 Standard passenger weights listed. Note the weights include 5 KG of hand luggage and the weight of any infant carried by an adult on one passenger seat

Set of Weights	**Male [KG]**	**Female [KG]**	**All Adult [KG]**
Standard	88	70	N/A
Holiday charters	N/A	N/A	76
Child	35		
Infant	0		

Notes:

1. *Child is a passenger from 2 up to 12 years of age.*
2. *Infant is a passenger below 2 years of age. If an infant is carried by an adult on one passenger seat, they do not affect weight calculations. Infants occupying separate passenger seats must be considered as children.*

Holiday charter means a charter flight that is part of a holiday travel package. On such flights the entire passenger capacity is hired by one or more charterer(s) for the carriage of passengers who are travelling, all or in part by air, on a round- or circle-trip basis for holiday purposes. The holiday charter weight values apply provided that not more than 5 % of passenger seats installed in the aircraft are used for the non-revenue carriage of certain categories of passengers. Categories of passengers such as company personnel, tour operators' staff, representatives of the press, authority officials, etc. can be included within the 5% without negative the use of holiday charter weight values.

In case of flights with special type of passengers such as soldiers, sports teams, children´s tours etc. the standard male/female/children weights used are in accordance with relevant part of EC regulation 965/2012.

Baggage weight is calculated as actual weight of the baggage. Only in case when the actual weight of checked baggage is not possible to determine by weighing, the following standard weight per one piece are used in accordance with AMC1 CAT.POL.MAB.100(e).

Table 2-4 Standard baggage weights listed

Type of Flight	Baggage standard weight
Within the European Region	13 KG / pc.
Intercontinental	15 KG / pc.
All Other	13 KG / pc.

2.4 CARGO AND MAIL WEIGHTS

Cargo, COMAT or mail weights are calculated by respective actual weights determined by weighing or appropriate cargo manifest.

Chapter 3 FUEL, SYSTEM FLUIDS AND WATER

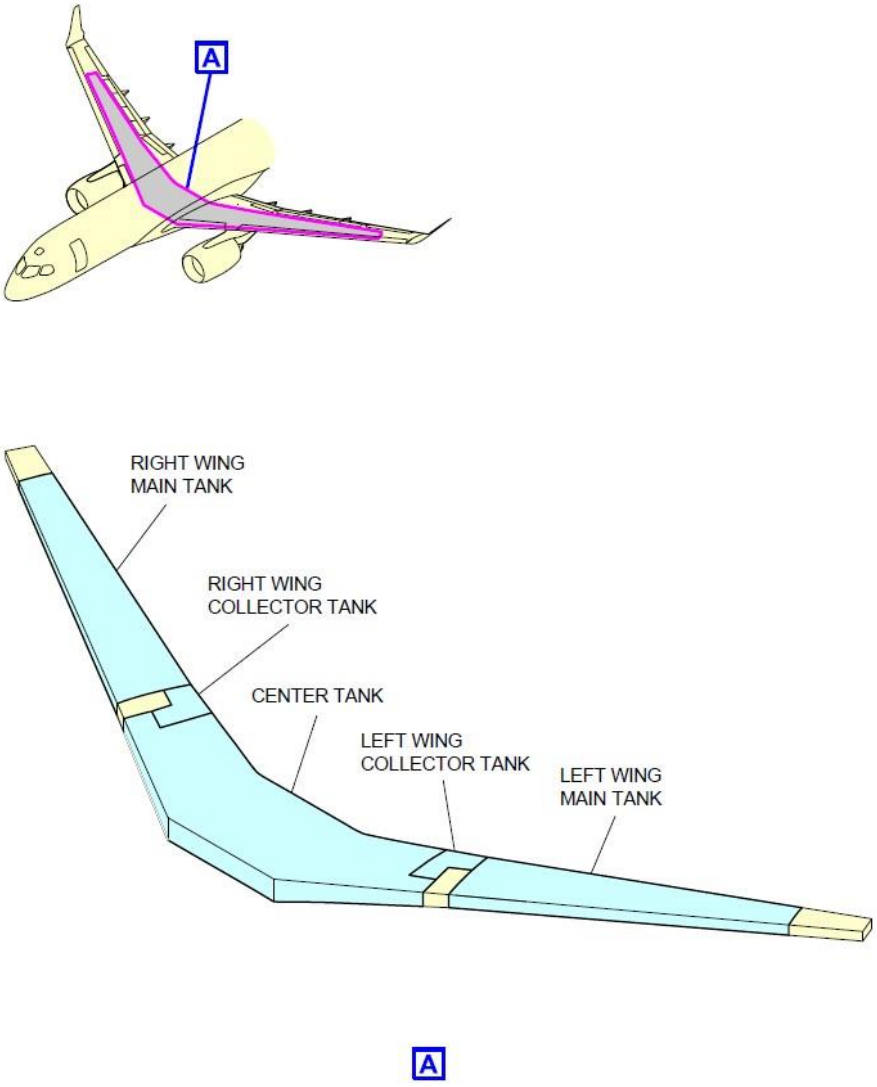
This chapter describes all fluids affecting weight and balance of the aircraft in terms of assumed volumetric quantity, density and respective weights.

3.1 FUEL

The A220 aircraft have fuel tank arrangement of 3 tanks as follows:

- Two main tanks in wings:
  - right wing main tank
  - left wing main tank
- One tank in the fuselage:
  - The center tank between the left and right pylons.

Figure 3-1 Fuel tank arrangement



The usable fuel is available for the aircraft propulsion, the unusable fuel is not part of usable fuel. The CG in each tank varies with fuel quantity.

Table 3-1 Tank capacities with density 0.809 KG/L

Tank	A220 Capacity (L)	A220 Weight (KG)
Left Main Tank	3770	3050
Right Main Tank	3770	3050
Center Tank	13968	11300
Total	21508	17400

3.1.1 Fuel Loading Limitations

It is allowed to load only type of fuel compliant to those stated in the respective AFM. The **fuel density** must be between minimum allowable fuel density of 0.7549 KG/L (6.3 LB/GAL) and the maximum allowable fuel density of 0.8507 KG/L (7.1 LB/GAL).

An actual fuel density of fuel temperature (see Table 3-2) shall be considered for balancing purposes – index changes are listed on the reverse or AHM documents.

Table 3-2 Fuel density conversion chart

Fuel temperature	Density [KG/L]	Density [KG/USG]
-31°C and below	0.84	3.179
-30°C to -21°C	0.834	3.157
-20°C to -11°C	0.827	3.130
-10°C to -1°C	0.82	3.104
0°C to 10°C	0.813	3.077
11°C to 20°C	0.806	3.051
21°C to 30°C	0.799	3.024
31°C to 40°C	0.792	2.998
41°C to 50°C	0.785	2.971
51°C to 60°C	0.778	2.945
61°C to 70°C	0.771	2.918
71°C to 80°C	0.764	2.892
81°C to 90°C	0.757	2.865
91°C and above	0.75	2.839

3.1.2 Fuel Loading Procedures

During automatic refueling (normal procedure) the quantity of selected fuel is delivered to the tanks with the following logic.

If presented fuel quantity is:

A) Less than the quantity required to fill both main tanks to 88,7%:

All fuel will be added equally in both main tanks.

B) Between the quantity required to fill both main tanks to 88,7% and the quantity required to fill both main tanks to 88.7% plus the center tank to 7,2%:

Main tanks will be filled to 75,3% and the remaining fuel will be added in the center tank.

C) Between the quantity required to fill both main tanks to 88,7% plus the center tank to 7,2% and the quantity required to fill both main tanks to 88,7% plus the center tank to “FULL”:

Main tanks will be filled to 88.7% and the remaining fuel will be added in the center tank.

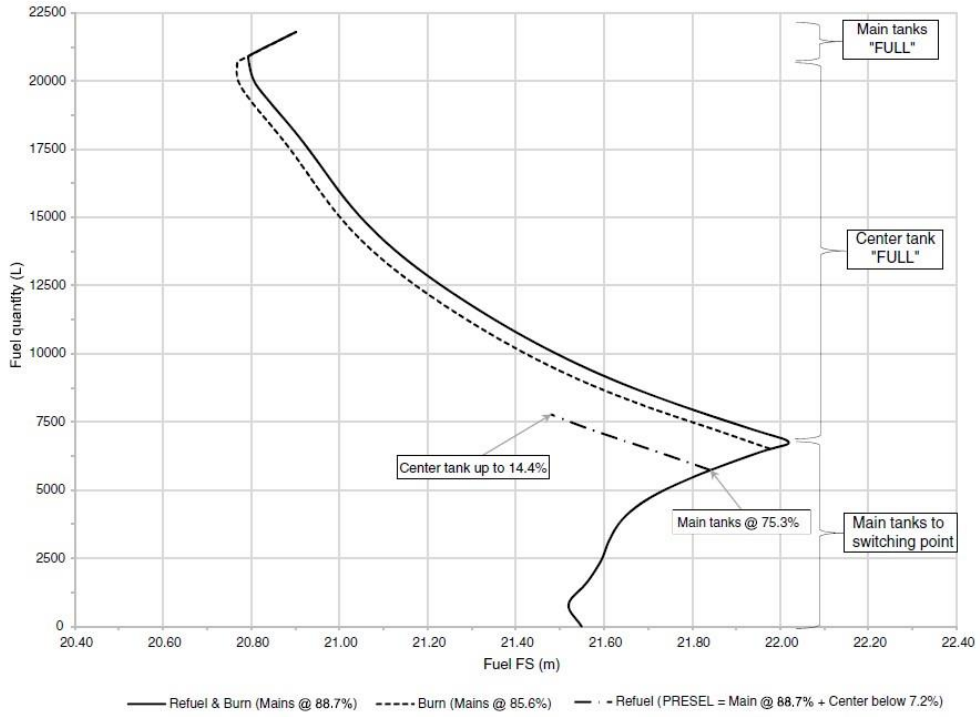
D) Greater that the required quantity to fill both tanks to 88.7% plus the center tank to "FULL":

The center tank will be filled to "FULL" and the remaining fuel will be added equally in both main tanks.

NOTE: Fuel quantity are presented in percentage (%) of their maximum usable quantity.

The balance arm (H-arm) of fuel as a function of the quantity, during the refueling sequence, when fueling from zero usable level up to the maximum quantity, is shown Figure 3-2 below.

Figure 3-2 Fuel Curves



3.1.3 Fuel Burn sequence

During flight in normal condition, starting with all tanks at “FULL”, the fuel burn sequence is the following:

1) Fuel will be burnt from the main tanks until they reach 85,6%.
2) The ejector pump will start to transfer the fuel from the center tank to the main tanks. Main tanks level will vary between 85,6% and 88,7% until center tank is empty.
3) Fuel from the main tanks will be burnt until they are empty.

3.1.4 Usable Fuel Tank Quantities

Useable fuel quantities are described in table below.

Table 3-3 A220 Fuel volumetric capacity.

	Weight (kg)	Main Tanks	Centre Tank	Total
	Quantity (l)	7540	13968	21508
Fuel Density (kg/l)	0,75	5655	4241	9896
	0,78	5881	4587	10469
	0,785	5919	4646	10565
	0,79	5957	4706	10662
	0,795	5994	4765	10760
	0,8	6032	4826	10858
	0,805	6070	4886	10956
	0,81	6107	4947	11054
	0,815	6145	5008	11153
	0,82	6183	5070	11253
	0,825	6221	5132	11352
	0,83	6258	5194	11453
	0,835	6296	5257	11553
	0,84	6334	5320	11654

3.2 SYSTEM FLUIDS

The Fluids chapter contains information on all the following:

- The oil used in the engines, the engine-driven generators, and the Auxiliary Power Unit (APU)
- The hydraulic fluids of the engines and systems

Table 3-4 Engine fluids (density: 0,987 kg per liter)

System	Quantity [l]	Weight [kg]	BA A220 [m]
Engine oil tank	24,4	24,1	19,565
Engine internal oil	29,2	28,8	18,901
Engine hydraulic oil	3,8	3,8	19,032

Table 3-5 APU fluids (density: 0,956 kg per liter)

System	Quantity [l]	Weight [kg]	BA A220 [m]
APU oil tank	7,3	7	39,700
APU lines and internal oil	3,2	3,0	39,700

Table 3-6 Hydraulic fluids (density: 0,983 kg per liter)

System	Quantity [l]	Weight [kg]	BA A220 [m]
No.1 reservoir	18,8	18,5	25,119
No.2 reservoir	16,4	16,1	25,311
No.3 reservoir	16,4	16,1	36,699
Systems and lines	150,6	147,9	25,793

3.3 WATER SPECIFIC WEIGHT AND QUANTITIES

Assumed density of water is 1kg per 1l. The aircraft is equipped with potable water tank for lavatory and galley use. Table 3-7 describes its volume and BAs.

Table 3-7 Potable water volume and locations.

Type	Volume [l]	Weight [kg]	Balance Arm [m]
A220	158,8	158,8	34,973

The aircraft is also equipped with waste tanks for lavatory waste. Most of the used water is discharged overboard with except of human waste. Table 3-8 describes the waste tank location and content weights.

Table 3-8 Waste tank capacity and weight. The tank is prefilled with 7,6 l of chemical fluids.

Type	Capacity [l]	Weight [kg]	Balance Arm [m]
A220	143,8	143,8	34,828

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Chapter 4 CENTER OF GRAVITY LIMITS

During any phase of the loading, the load and center of gravity must comply with the limitations specified in this manual and derived AHM565 documents. To handle an aircraft properly, all required documents such as loading instructions, loadsheet/trimsheet forms, message forms, DOW/DOI data for specific aircraft etc. are always available and up to date and may be provided as an attachment to this manual. To check validity of corresponding attachment information in order to secure a safe operation, check EFA web application for the latest versions of this document, check current WBM revision number, attachment revision number and/or its effective date.

The aircraft manufacturer – Airbus publishes certified CG limits also known as certified CG envelopes. Our company is obliged to ensure that during flight and ground operations these CG limits are not exceeded in any case. Therefore, certified CG envelopes as published by manufacturers are further curtailed to obtain operational CG envelopes, which ensure CG values stay within certified forward and aft limits throughout aircraft operation with below listed inaccuracies. All company operational CG envelopes are curtailed to take account for:

- passenger seating variations,
- cargo location variations,
- landing Gear and Flap Retraction moments,
- in-flight passenger movement,
- fuel loading and usage,
- fuel density variations,
- method inaccuracy.

Operational CG envelope (also referred to as Balance Chart) for A220-300 aircraft series is published in this chapter. Operational CG envelopes are then used in DCS systems for electronic loadsheet calculation, Weight & Balance software and Backup Trimsheet Forms.

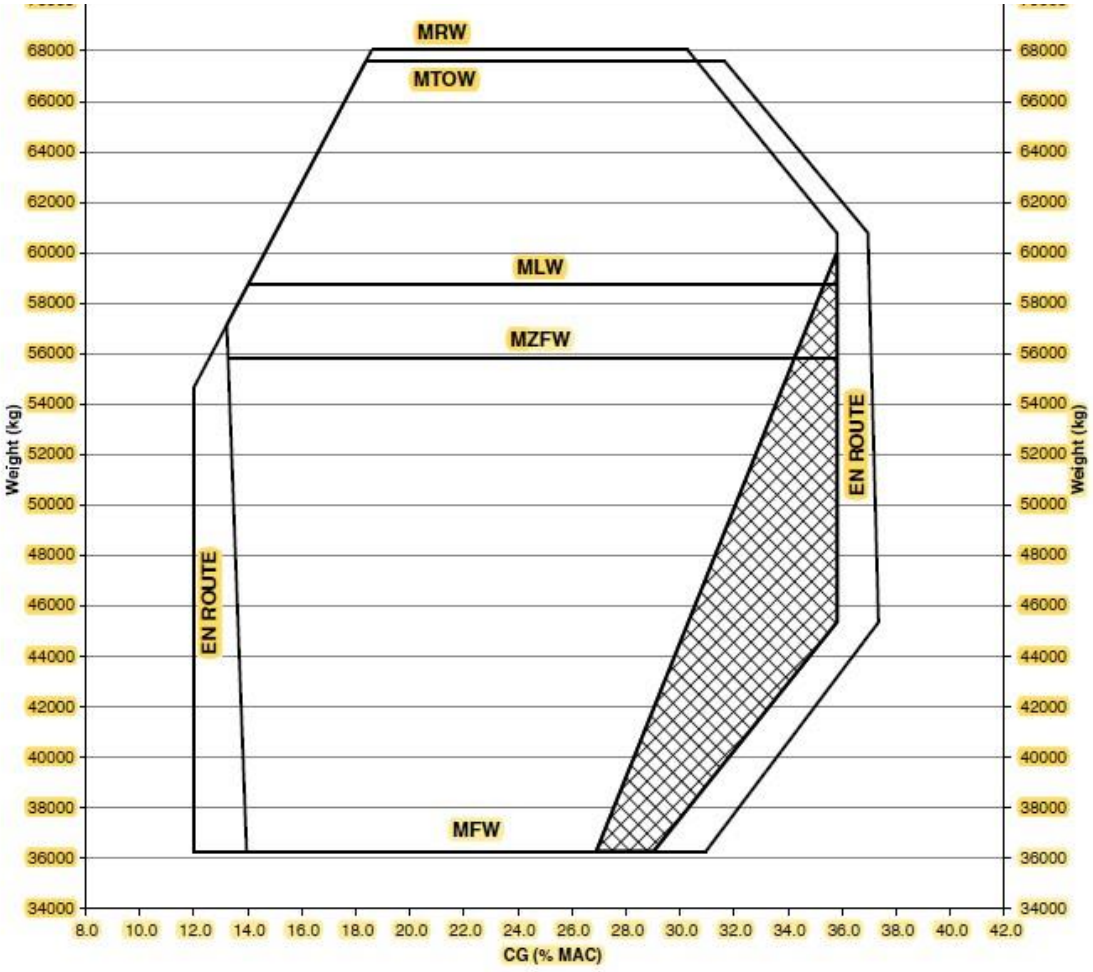
Company balance charts are always arranged and presented as weight over index value graphs. Should any system require different CG envelope definition (e.g. by % MAC), proper values are listed in tabular description.

4.1 CERTIFIED REFERENCE CG ENVELOPES

The following diagrams represent the certified Center of Gravity limits in Metric units used as a reference for curtailed operational envelopes.

4.1.1 A220 Certified CG Envelope

Figure 4-1 Certified CG envelope for A220 used as a reference envelope.



4.2 OPERATIONAL CG ENVELOPES

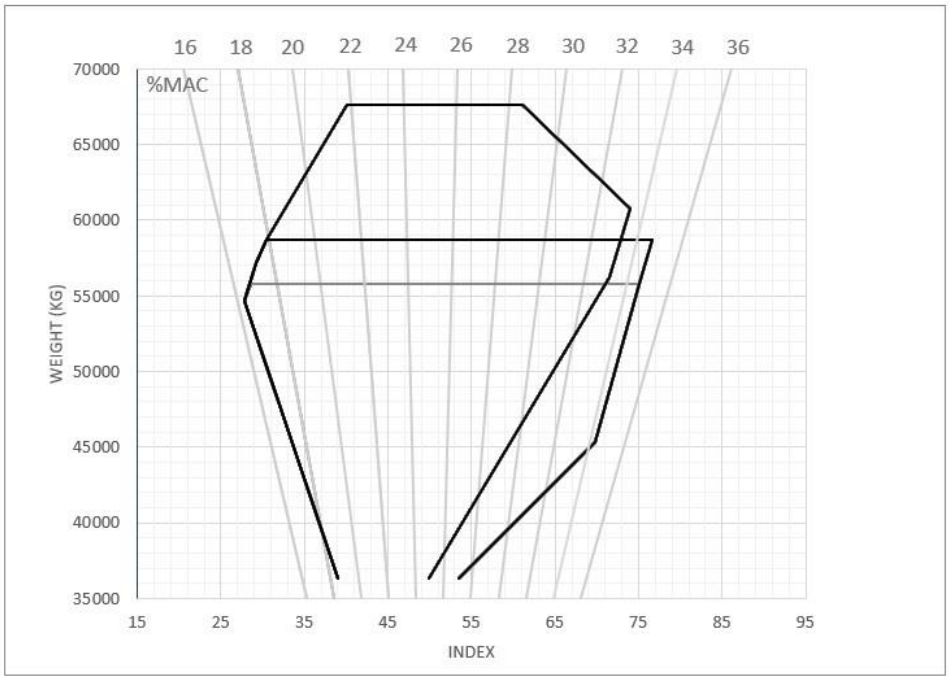
This chapter provides tabular descriptions of A220 CG envelope used in company operations.

4.2.1 A220 Operational CG Envelope

Table 4-1 Operational CG envelope for A220.

Specify applicability	Weight	Index value	Specify applicability	Weight	Index value
ZERO-FUEL	*36287*	*38,98*	*ZERO FUEL*	*36287*	*53,45*
	54658	*27,86*		*45359*	*69,79*
	55792	*19,01*		*55792*	*75,10*
TAKE OFF	*36287*	*38,98*	*TAKE OFF*	*36287*	*49,85*
	54658	*27,86*		*56257*	*71,49*
	57140	*29,19*		*60781*	*73,99*
	58 740	*30,49*		*67585*	*61,04*
	67585	*40,15*			
LANDING	*36287*	*38,98*	*LANDING*	*35 400*	*26,32*
	54658	*27,86*		*48 700*	*31,49*
	57140	*29,20*		*49 600*	*31,66*
	58 740	*30,49*		*58 500*	*33,33*

Figure 4-2The graph of company operational A220-300 CG envelope



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Chapter 5 WEIGHT & BALANCE DOCUMENTS, APPLICATIONS AND DATA

All crucial data for company A220 family fleet´s weight and balance is published in this document **(WBM)** and its attachments managed by FDS Department. This document is the primary source of BW and BWCG data - contains all aircraft related weights and indices including limiting maximal weight and values for DOW/DOI calculations. FDS Department is fully responsible for data accuracy and integrity.

5.1 OPERATIONAL DOCUMENTS AND APPLICATIONS

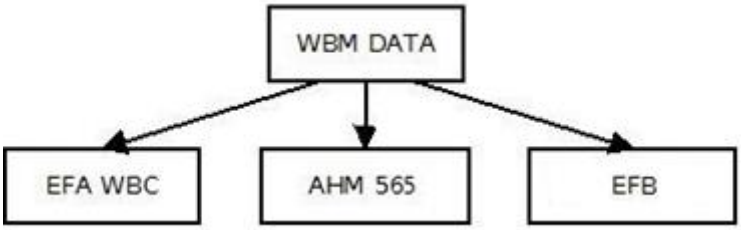
Main operational documents based on WBM data are:

- **AHM 565** – contains all aircraft related weights and indices including limiting maximal weight and CG values for all weight and balance calculations carried out by ground handling agents in a form of semi-permanent data. FDS department is fully responsible for AHM 565 data accuracy, integrity and distribution to ground stations. AHM stands for Airport Handling Manual. AHM 560 format is not available.
- **Ground Operations Manual (GOM)** – contains information for ground handling agents about passenger boarding, cargo loading, dangerous goods, animal carriage and other procedures. Ground Operations Division is responsible for GOM content and accuracy.

Data from above listed sources are further distributed by FDS department to following applications:

- **EFA Weight & Balance Calculator (WBC)** - a dynamic EFA based application, which calculates DOW/DOI and EZFW values automatically. FDS is responsible to ensure that all data from DOW/DOI are transferred to the EFA WBC database and thus for the accuracy and integrity of the data. Whenever any data modification is prepared, FDS shall make a proper testing on the EFA test environment that EFA WBC calculates correct by making several test examples on the revised dataset. The data modification can be released to the “EFA production version” just in case that the testing is successful.
- **EFB iMB** (Electronic Flight Bag internal Mass and Balance, herein after EFB) application capable of weight and balance calculations. FDS is responsible for the data accuracy and integrity in cooperation with CSA IT Department.
- **Departure Control Systems (DCS)** - used at most airports for passenger electronic check-in, boarding and automated load control based on **AHM data**. DCS operates on the platform of approved electronic database valid solely for airline, which it has been created for. DCS testing is carried out in accordance to procedures described in chapter 5.5.1.

Figure 5-1-Basic diagram of weight and balance data flow. Note the GOM is missing – it is standalone document



Determination of values from shall be based on sources listed in priority order in Table 5-1 below:

Table 5-1 Table Sources and tools for balancing data – calculation results using these tools are equivalent

Value	Source Priority	
	Main	Alternative
DOW/DOI	EFA WBC	WBM-QRDD or AHM
ZFW/LIZFW	DCS/"Electronic" Loadsheet from an approved station based on AHM	EFB
TOW/LITOW		
LW/LILW		

5.2 BASIC WEIGHT AND INDEX DATA GATHERING

An **aircraft weighing** is carried out prior **every** initial aircraft entry into service within company fleet unless the previous operator is **EU registered carrier** and the last weighing protocol with an appropriate weighing checklist is available, complete, trustworthy and dated less than 4 years to the past; the list of all maintenance actions having an effect to aircraft weight and/or CG is provided. The company weighing is not required, when the aircraft is new and the weighing protocol is provided by the manufacturer.

Every **aircraft weighing** is carried out **periodically** with a period of **4 years** or less from the last weighing (date of last aircraft weighing is listed in attachment 1 QRDD). The weighing is carried out according to company weighing checklist, manufacturer's recommended procedure and it is supervised by company engineer. The weighing **protocol and checklist** are then **immediately** sent by Technical Division staff to email address weighing@smartwings.com, so that the new BW and BI is updated in WBM (consequently AHM 565) and connected systems such as EFA Weight and Balance Calculator (WBC), EFB Software and various DCS systems. All necessary distribution steps are carried out according to internal FDS aircraft weighing checklist in Confluence application.

BW of individual aircraft is continually monitored for changes affecting weight and balance. These changes include but are not limited to:

- Interior seat configuration changes,
- (Un)Installation of various equipment,
- Structural Repairs,
- Aircraft Livery (Re)Painting,

- Other maintenance actions having the impact on weight or moment change.

These changes are monitored for each aircraft individually against the reference BW / BWCG established since the last weighing. In case the BW exceeds a **cumulative change** equal or greater than **±0.5% of the aircraft MLW** and/or the cumulative CG change exceeds **±0.5% of MAC**, the new BW/BWCG is established by calculation or preferably by weighing and published as the new reference value of BW and BWCG for the given aircraft. The cumulative change monitoring is done by using excel file named “CUMMULATIVE IMPACT” located on a shared server disc: G:\Ground Operations Division\FDS\Weight & Balance\Cumulative weight impact.

FDS department is responsible for **BW/BWCG evaluation, publication and monitoring.** FDS may use the access to OASES system to have a better overview of maintenance actions affecting the weight & balance.

5.3 DOW/DOI DETERMINATION

FDS further processes all data required for DOW/DOI calculation. DOW/DOI values are to be found in Attachment 1 – QRDD.

5.3.1 Standard Crew Seating Assumptions

Standard crew is the minimal number of crew members required for a given flight. It is both 2 pilots and 0 cabin crew (or F/A – Flight Attendants) members for a ferry flight or 2 pilots and minimum required cabin crew members for a commercial passenger flights on the given type, see Table 5-2 below. The crew composition convention is number of cockpit/cabin crew.

Table 5-2 Standard Crew Compositions

Type	STD Crew Ferry Flight	STD Crew Commercial Flight
A220	2/0	2/3

Under some circumstances there is different number of crew members onboard for the given flight. In any case seating rules from Table 5-3 are assumed to for correct DOW/DOI calculation.

Table 5-3 A220 Crew Assumed Seating

Crew Assumed Seating for A220				
Crew Comp.	**Pilots**	**Observer Seat**	**Cabin Attendant Seats**	
			FWD	**AFT**
2/0	2	0	0	0
2/1	2	0	1	0
2/2	2	0	1	1
2/3	2	0	1	2
2/4	2	0	2	2
3/0	2	1	0	0
3/1	2	1	1	0
3/2	2	1	1	1
3/3	2	1	1	2
3/4	2	1	2	2

5.3.2 Extra Crew Seating Assumptions

Extra crew is any crew member in excess of the standard crew. The special group of extra crew members is a supernumerary (company observer, air marshal etc. refer to CSA-MN-1 Operations Manual). With an exception of Air Marshals (OC/AM) the default assumed seat is the respective jumpseat (OF/* - cockpit observer seat or OC/* - exit row seat) and the assumed position for air marshals is the first cabin section – 0A. In case jumpseats (JS) in respective locations are occupied by non-supernumerary extra crew members, seating rules from Table 5-4 are assumed.

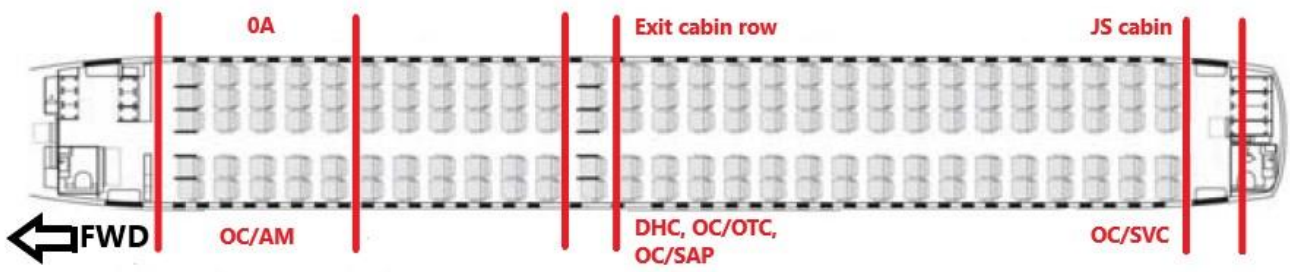
CAUTION:

DEADHEAD CREW (DHC) MUST BE CONSIDERED AS PASSENGERS AND THEREFORE ARE NOT TO BE INCLUDED IN DOW/DOI ITEMS!

Table 5-4 Extra Crew and Supernumerary Seating Rules are listed for DOW/DOI calculation assumptions

Crew Code	Crew Suffix	STD Location	Location 2	Remark
N/A	DHC	Exit Row Seats	Cabin 0A	
TD	OF/TAP	Cockpit	Cabin 0A	
OD	OF/FOO	Cockpit	-	
FD	OF/FOO	Cockpit	-	
FC	OC/OTC	Exit Row Seats	Cabin 0A	
CC	OC/OTC	Exit Row Seats	Cabin 0A	
TU	OC/OTC	Exit Row Seats	Cabin 0A	
LU	OC/OTC	Exit Row Seats	Cabin 0A	
XO	OC/SAP	Exit Row Seats	Cabin 0A	
N/A	OC/SVC	JS Cabin	-	
N/A	OC/AM	Cabin 0A	-	

Figure 5-2 Extra Crew and Supernumerary assumed seating locations are shown in example cabin



5.3.3 Pantry Codes

Pantry weight and index change is based on standardized list of pantry codes. The list of such is published in attachment 2 – PCWI and is based on actual pantry weights. The pantry weights are provided to FDS Department by **In-Flight Department** via Confluence application and usually the selection of the correct pantry code is based on a nature of flight and its in-flight document. ACMI Out operations require additional rules to the meal type method such as destination airport or flight length. The correct pantry code may be found in WBC.

Some ad-hoc flights may have a special pantry loading (based on meal type in EFA) which requires finding the most appropriate pantry code to reflect the actual loading. **In-Flight department informs FDS department by email** about the **ad-hoc pantry weight** and distribution and FDS Department selects the appropriate pantry code in WBC and advises the flight crew about the special loading via EFA.

5.3.3.1 Potable Water

Potable water is considered to be a part of the Dry Operating Weight.

5.3.3.2 Miscellaneous Items

Miscellaneous item adjustments such as spare wheels, flyaway kit and spare parts or overwater equipment are published in attachment 1 – QRDD. It is a responsibility of Engineering Division to inform FDS Department about special spare parts loading to an aircraft via Fleet Overview interface in EFA or by email, if the loading is not normally carried.

5.3.4 DOW/DOI Calculation

DOW/DOI values must be determined prior every flight by the crew or stowing. The crew obtains information about the relevant operating items for each particular flight as a part of their briefing package and handling partner gets the same information in Loadsheet Info. Handling partner shall check, if all mentioned operating items are present onboard in prescribed/assumed positions and all items are accounted for in DOW/DOI calculation in accordance to this manual and its respective attachment. The crew may refer to the WBC application (described in chapter 8) or Loadsheet info in EFA for DOW/DOI figures. The crew or stowing shall correct for any discrepancy found in the actual aircraft loading against DOW/DOI assumed locations either by rearranging the loading or manual correction of the existing DOW/DOI calculation. In case of uncertainty, the crew shall contact OCC or other relevant departments for appropriate correction (e.g. contacting MCC to load missing item such as occasionally necessary overwater equipment for the upcoming flight).

DOW/DOI values may be obtained from (priority order):

1. **EFA Weight & Balance Calculator**

The application recalculates weight and balance values of DOW, DOI and EZFW) every 5 minutes in case of any changes of aircraft, pantry, crew composition, equipment and expected/listed payload. It does so in a time frame from 30hrs prior the flight´s STD until an actual departure movement of the flight is received and processed by the EFA. The application is almost fully autonomous and incorporates all WBM logic including a correct pantry code selection and crew seating based on data available in EFA. The WBC is described further in chapter 8 of this manual.

2. **Manual calculation based on WBM Data**

WBM and its attachments contain all data and instructions required for the correct DOW/DOI calculation including extra crew and supernumeraries seating rules in chapter 5.3.2. Attachment 1 - QRDD may be used for calculation.

3. **iMB Software**

IMB provides the most accurate DOI figures (for listed items) because it sums up single balance moments whereas WBC or manual DOW/DOI calculation may be working with index values.

5.4 LOAD CONTROL DOCUMENTS

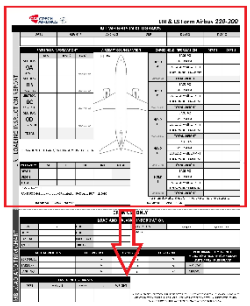
This chapter presents and describes the load control documents that are utilized in operations. The sample versions may be found in CSA OM-A, GOM or SharePoint application.

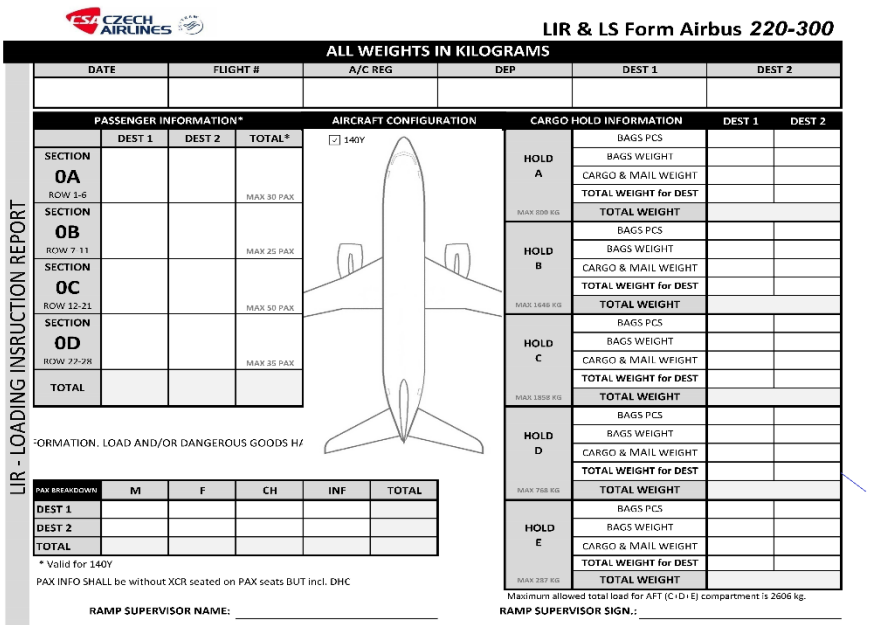
The folder designated **"Fuel"** in the EFA>Flight brief is normally used by the FC to provide relevant ground departments with the required information (Fuel request) for Loadsheet document construction.

The electronic version of the loadsheet information form labelled "**Fuel sheet**" can be found as CSA-F-664 in the folder of forms on CSA SharePoint. It's only used by the FC to send the relevant information for loadsheet purposes to PRG from the other stations.

Loading Instruction Report (abbreviated as **LIR**) is to be found on the combined LIR & LS form. These forms are carried aboard each aircraft on a carbon paper books so three copies may be easily produced, if the form is used as a loadsheet as well. However, the bottom loadsheet form is to be filled by flight crew members only. Pilots are obliged to report any missing or insufficient number of books aboard to OCC or to FDS department.

Figure 5-3 LIR Form





LIR & LS Form Airbus *220-300*

ALL WEIGHTS IN KILOGRAMS

DATE	FLIGHT #	A/C REG	DEP	DEST 1	DEST 2

PASSENGER INFORMATION*	DEST 1	DEST 2	TOTAL*
SECTION 0A ROW 1-6			MAX 30 PAX
SECTION 0B ROW 7-11			MAX 25 PAX
SECTION 0C ROW 12-21			MAX 50 PAX
SECTION 0D ROW 22-28			MAX 35 PAX
TOTAL			

AIRCRAFT CONFIGURATION ☑ 140Y

CARGO HOLD INFORMATION		DEST 1	DEST 2
HOLD A (MAX 896 KG)	BAGS PCS		
	BAGS WEIGHT		
	CARGO & MAIL WEIGHT		
	TOTAL WEIGHT for DEST		
	TOTAL WEIGHT		
HOLD B (MAX 1648 KG)	BAGS PCS		
	BAGS WEIGHT		
	CARGO & MAIL WEIGHT		
	TOTAL WEIGHT for DEST		
	TOTAL WEIGHT		
HOLD C (MAX 1858 KG)	BAGS PCS		
	BAGS WEIGHT		
	CARGO & MAIL WEIGHT		
	TOTAL WEIGHT for DEST		
	TOTAL WEIGHT		
HOLD D (MAX 768 KG)	BAGS PCS		
	BAGS WEIGHT		
	CARGO & MAIL WEIGHT		
	TOTAL WEIGHT for DEST		
	TOTAL WEIGHT		
HOLD E (MAX 287 KG)	BAGS PCS		
	BAGS WEIGHT		
	CARGO & MAIL WEIGHT		
	TOTAL WEIGHT for DEST		
	TOTAL WEIGHT		

-ORMATION. LOAD AND/OR DANGEROUS GOODS HA

PAX BREAKDOWN	M	F	CH	INF	TOTAL
DEST 1					
DEST 2					
TOTAL					

* Valid for 140Y

PAX INFO SHALL be without XCR seated on PAX seats BUT incl. DHC

Maximum allowed total load for AFT (C+D+E) compartment is 2606 kg.

RAMP SUPERVISOR NAME: _____ RAMP SUPERVISOR SIGN.: _____

LIR - LOADING INSRUCTION REPORT

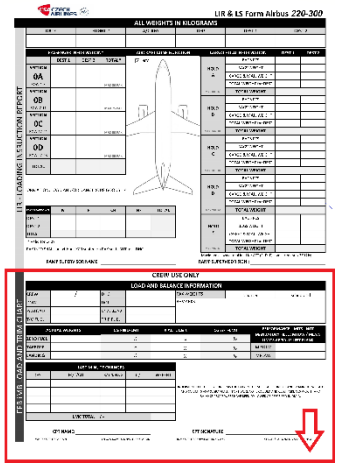
Loadsheet (LS) – a document containing information about actual aircraft loading as it is laid specifically for every flight. It provides a proof that all weights and CG positions are within limits. The allowable formats of loadsheet are:

1. **Electronic Loadsheet** issued by ground handling company using authorized DCS system,
2. **LIR & LS form** using values manually copied from EFB iMB or values calculated using the backup trimsheet procedure.

In any case the final loadsheet is checked and approved by the flight crew and approved by PIC in the form of signature. Rights of PIC are reserved to demand a new loadsheet or change of the actual loading in case of any discrepancy found.

Electronic loadsheet might be presented in various forms. The sample of commonly used loadsheet is described in CSA OM-A chapter 8.1.8.6 in full details.

Figure 5-4 Bottom part of LIR &LS form, which serves as loadsheet form intended for manual copying of i loadsheet values.



EFB iMB LOAD AND TRIM CHART

CREW USE ONLY

LOAD AND BALANCE INFORMATION						
CREW	/	DHC		PAX WEIGHTS	Charter	Scheduled
DOW		DOI		REMARKS		
PAYLOAD		UNDERLOAD				
T/O FUEL		TRIP FUEL				

ACTUAL WEIGHTS		CG FWD-LMT	≤ ACTL CG ≤	CG AFT-LMT	PERFORMANCE LIMITS - NOT MANDATORY FIELD; MTOW / MLAW LIMITS APPLY, IF LEFT BLANK	
ZERO FUEL		%	%	%		
TAKEOFF		%	%	%	MPTOW	
LANDING		%	%	%	MPLAW	

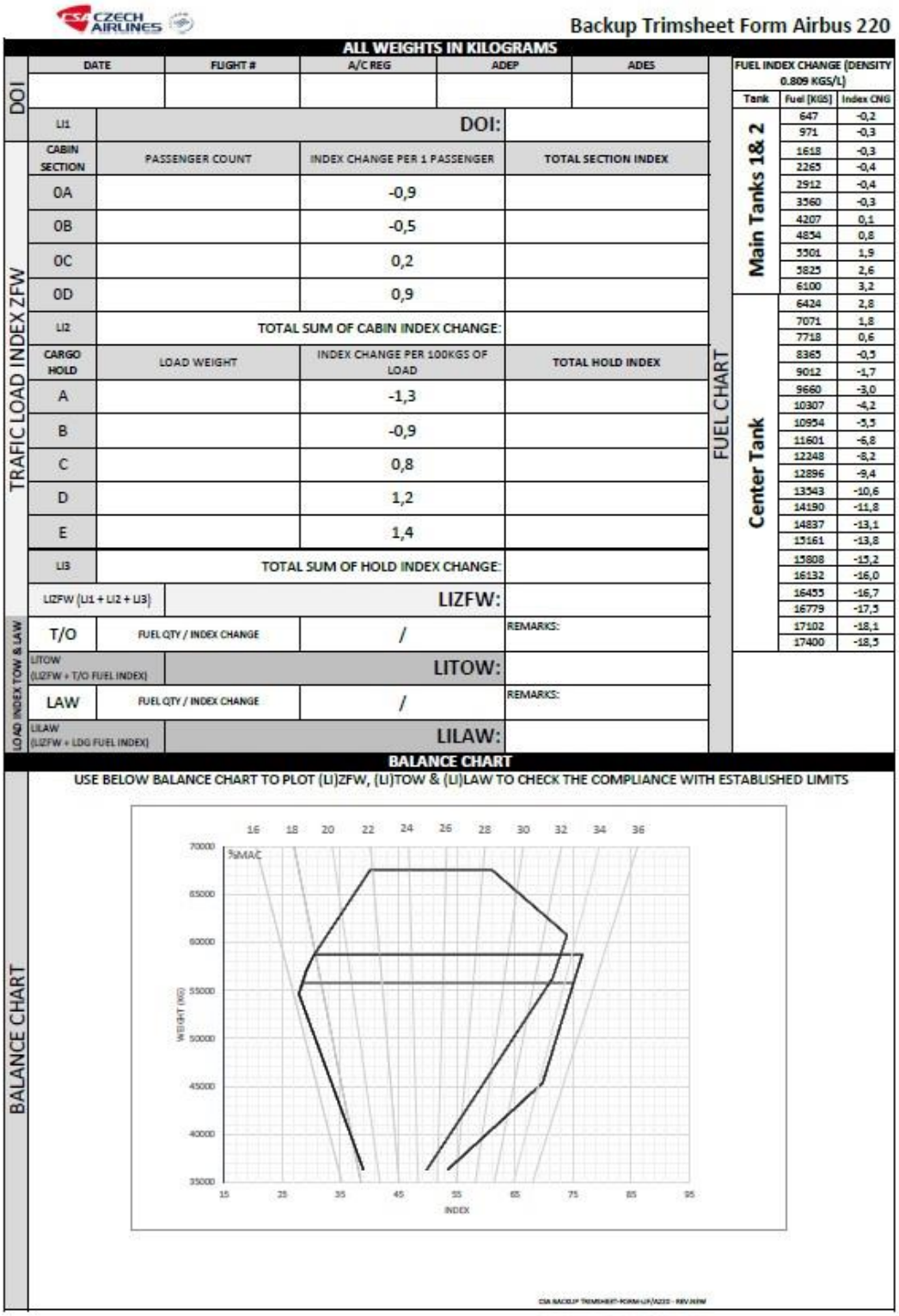
LAST MINUTE CHANGES				
DEST	M/F/CH	CABIN/HOLD	+ / -	WEIGHT
LMC TOTAL + / -				

UNDERSIGNED CPT HEREBY CONFIRMS THE DATA IN THIS SHEET ARE CORRECT AND MAXIMUM WEIGHTS AND CG LIMITS AS PROGRAMMED IN OPT WERE NOT EXCEEDED AND CZECH AIRLINES WEIGHT AND BALANCE PROCEDURES HAVE BEEN FOLLOWED AS DESCRIBED IN OM-A.

CPT NAME: _____ CPT SIGNATURE: _____

WHITE COPY TO CAPTAIN YELLOW COPY TO DEPARTURE STATION BLUE COPY TO ARRIVAL STATION VIA SC CSA LIR & LS FORM-LIF/220 - REV.NEW

Figure 5-5 - Backup trimsheet form for A220-300 used for manual calculation of CG values in case of DCS or iMB failure



Backup Trimsheet Form Airbus 220

ALL WEIGHTS IN KILOGRAMS

DOI

DATE	FLIGHT #	A/C REG	ADEP	ADES

TRAFIC LOAD INDEX ZFW

LI1	DOI:		
CABIN SECTION	PASSENGER COUNT	INDEX CHANGE PER 1 PASSENGER	TOTAL SECTION INDEX
0A		-0,9	
0B		-0,5	
0C		0,2	
0D		0,9	
LI2	TOTAL SUM OF CABIN INDEX CHANGE:		
CARGO HOLD	LOAD WEIGHT	INDEX CHANGE PER 100KGS OF LOAD	TOTAL HOLD INDEX
A		-1,3	
B		-0,9	
C		0,8	
D		1,2	
E		1,4	
LI3	TOTAL SUM OF HOLD INDEX CHANGE:		
LIZFW (LI1 + LI2 + LI3)	LIZFW:		

LOAD INDEX TOW & LAW

T/O	FUEL QTY / INDEX CHANGE	/	REMARKS:
LITOW (LIZFW + T/O FUEL INDEX)	LITOW:		
LAW	FUEL QTY / INDEX CHANGE	/	REMARKS:
LILAW (LIZFW + LDG FUEL INDEX)	LILAW:		

FUEL CHART

FUEL INDEX CHANGE (DENSITY 0.809 KGS/L)

Tank	Fuel [KGS]	Index CNG
Main Tanks 1& 2	647	-0,2
	971	-0,3
	1618	-0,3
	2265	-0,4
	2912	-0,4
	3560	-0,3
	4207	0,1
	4854	0,8
	5501	1,9
	5825	2,6
	6100	3,2
Center Tank	6424	2,8
	7071	1,8
	7718	0,6
	8365	-0,5
	9012	-1,7
	9660	-3,0
	10307	-4,2
	10954	-5,5
	11601	-6,8
	12248	-8,2
	12896	-9,4
	13543	-10,6
	14190	-11,8
	14837	-13,1
	15161	-13,8
	15808	-15,2
	16132	-16,0
	16455	-16,7
	16779	-17,5
	17102	-18,1
	17400	-18,5

BALANCE CHART

USE BELOW BALANCE CHART TO PLOT (LI)ZFW, (LI)TOW & (LI)LAW TO CHECK THE COMPLIANCE WITH ESTABLISHED LIMITS

5.5 DATA ACCURACY AND INTEGRITY CONTROL

5.5.1 DCS Procedures

The following procedures regarding data accuracy and integrity control are subcontracted and provided by the Smartwings FDS Department.

Database format: Aircraft data are submitted to DCS administrators in format of AHM565 semi-permanent data.

Distribution: Duly signed AHM565 copies and/or its revisions are distributed by means of e-mail or through EFA Library. A receipt confirmation from all recipients is always requested either by EFA Library confirmation system or AHM565 return form.

Database loading to DCS: Database and its revisions are always loaded to system by DCS administrator upon receipt. Upon loading of initial database or major revision DCS administrator produces a Database Printout and Test loadsheets. Major revision is considered to be a revision of the entire WBM that would require modifying any values of existing balance arms).

Database approval: Database Printout and Test loadsheets are submitted to FDS Department by DCS administrator for verification and approval every time any major revision of weight and balance data is made (or to set up a DCS provider on a new station). FDS should verify the test loadsheet(s) with loadsheet made in the test LS checker. Input data from test loadsheets is filled to the Loadsheet Checking Worksheet and the results are compared.

Upon successful checking procedure, FDS approves DCS database for a live use by the relevant DCS. Further comments may be submitted to DCS administrator. If the loadsheet is not correct, immediate FDS investigation will be carried out to identify root causes and corrective actions are taken.

In case the airport is unable to provide crew with valid LS flight crews are obliged to produce the loadsheet by EFB or by backup trimsheet. **Manual loadsheet provided by the handling agent is not authorized and its use is strictly forbidden.**

Database periodic control: Databases are periodically checked at least in a period of 6 (six) months, if possible before an end of relevant IATA schedule period (summer and winter seasons).

Database check method: Database data accuracy is verified by checking of “live” loadsheet upon flight. At least 1 (one) loadsheet for each approved DCS is taken from the flight folder upon the flight is performed, scanned and submitted by the Controlled Documentation Department to the FDS for verification. FDS should compare this „live“ loadsheet with loadsheet made in the test LS checker. Input data from “live” loadsheet is filled to the Loadsheet Checking Worksheet and the results are compared.

Chapter 6 OPERATIONAL PROCEDURES FOR AIRCRAFT LOADING

Loading of company flights is coordinated with contractual ground handling providers. Load control procedures and responsibility for contractual ground handling providers are described in detail in the GOM.

6.1 GENERAL RULES

Pre-flight consideration of expected load weight and distribution is essential. The primary objective is to comply with all the limits for the specific aircraft that are listed and described in this manual and its attachments to ensure the high level of safety during operations is achieved. The secondary key is to arrange loading with regard to the company recommendations and standards connected to fuel and operational efficiency. The actual loading must never deviate from the loading as manifested in the final loadsheet document.

All procedures concerning following items may be found in GOM and CSA-MN-1 Operational Manual:

4. Dangerous Goods and Weapons (DG),
5. Live Animal Carriage (AVI).

The cooperation with ground handling agent is crucial to obtain the most accurate log of the aircraft actual loading. The actual loading is checked for CG limits against published operational balance chart and a **loadsheet is produced** as a proof of compliance with published limits **prior every flight**.

The loading and balancing of the Airbus A220 family aircraft must be carried out strictly in accordance with technical instructions provided in this manual.

Allowed units of measurements for operational aircraft loading are:

- Kilogram [KG] for weight,
- INDEX [ ] as per chapter 1 for moment/balance purposes,
- MAC [%] as per chapter 1 for CG position.

Note unit conversion of input parameters may be necessary in some cases to get results in above listed units. In order to prevent damage to the aircraft and its interior equipment both on the ground and during the flight the highest possible care must be taken in the loading and stowing of the freight. In the event of any damage being sustained by the aircraft or to its interior equipment a report must be immediately made either to the head of the shift responsible for the aircraft ground handling or to the aircraft crew. During loading a sudden aircraft drop in the landing gear shock absorbers may be experienced due to the change in aircraft weight. This is likely to occur when refueling is in process. In order to avoid damage to the aircraft drop during loading operations care must be taken to ensure that the clearance between the highest point of the loading vehicle or the loaded object and the aircraft or its parts is not less than 0.2m minimum.

6.2 LOADING PROCEDURE AND RESPONSIBILITIES

This chapter describes typical loading procedure after which a valid loadsheet is completed. A standard procedure is described by Table 6-1.

Table 6-1 Loading procedure lifecycle

Output Step	DCS Electronic LS	LS by Crew	Responsible Person
1	Crew ensures to provide the Loadsheet preliminary Info or Fuel request/Trip Info to the handling agent/stowing prior every flight. Crew may present a preferential load distribution.		Flight Crew
2	Handling agent respectively a person responsible for load planning fills in the LIR and hands it over to the PIC. Passengers, bags and cargo shall be distributed in a manner not violating any maximal weight limits or CG limitations published in AHM. In the ideal case the number of bags should be stated in the form.		Handling Agent / Load Control
3	The written name and signature of the person filling the LIR form verify that the form accurately reflects the actual loading. Planned loading values shall be clearly legible and actual values shall be clearly marked as “ACTL”, if there is any difference between planned and actual figures.		Handling Agent / Supervisor
4	The LIR form is handed over to the crew for the reference and checking purposes (1 copy is enough, if the handling agent does not require a copy for their records).	The LIR form is handed over to the crew.	Handling Agent
5	Flight crew checks the LIR (incl. checking of the data logic – e.g. ratio of bags number and weight distribution) and asks handling agent to rearrange the actual loading, if necessary (incl. correction of LIR document). Handling agent may request a copy of the LIR final version for the ground record.		Flight Crew
6	DCS electronic LS is produced and signed by the handling agent/stowing and handed over to the crew. Note: If crew finds out that any limit (weight or CG) is exceeded, the load must be redistributed and new LIR form and LS calculation must be completed. The crew shall check the final weights against OFP and FMS and search for a reason, if a significant weight difference is found.	EFB or balance computer output is used by the flight crew to record and check actual weights and CG limits.	By the column
7	The loadsheet is produced in up to 3 copies, signed by the PIC and one copy is handed over to: • Flight Crew must have a paper copy • Cabin Crew must have an information about PAX seating Ground Handling Agent may get electronic version only		Flight Crew / PIC
8	If any change of loading is encountered after the loadsheet is completed, Last Minute Change procedures may be used according to 6.2.3. In case LMC limits do not apply, a new loadsheet must be produced (go step 5).		PIC
9	One signed copy of LS must be stored in the Flight Documents Folder by the Flight Crew, one signed copy must be given to the Senior Cabin Crew Member (for the purpose of passenger count check and passenger distribution check) of the flight and the third and possibly electronic copy must be stored on the ground by the Handling Company at least for a period of 3 (three) months.		PIC / Handling Agent

6.2.1 Loadsheet Document Verification

Printed names and signatures of persons preparing the LIR or Loadsheet (in the field “CHECKED”) and printed name and signature of the PIC (in the field “APPROVED”), certify that the Loadsheet accurately reflects the actual loading of the aircraft based on the LIR.

The final loadsheet always is checked and approved by the flight crew and approved by PIC in the form of signature. Rights of PIC are reserved to demand a new loadsheet or change of the actual loading in case of any discrepancy found.

CAUTION:

ELECTRONIC LOADSHEET FROM UNAPPROVED AIRPORT SHALL BE CONSIDERED INVALID AND FLIGHT CREW SHALL USE EFB IMB OR BACKUP TRIMSHEET!

6.2.2 Loadsheet Documents Storage

Loadsheets are archived with other flight documents in the flight envelope by the Crew Control and Planning org. unit and stored in Load Control workplace at PRG airport for a minimal period of 3 months since the flight date as per OM-A.

6.2.3 Last Minute Change Procedures

If any last minute change (LMC) occurs after the completion of the weight and balance document (Load Sheet), this must be brought to the attention of the commander and the last minute change must be entered on the weight and balance document (Loadsheet). The maximum allowed change in the number of passengers or cargo compartments load acceptable, as a last minute change, must be specified in the Operations Manual (part A – general) and Ground Operations Manual CSA. If this number is exceeded, new weight and balance document (Load Sheet) must be prepared.

6.3 EFB INTERNAL MASS AND BALANCE APPLICATION

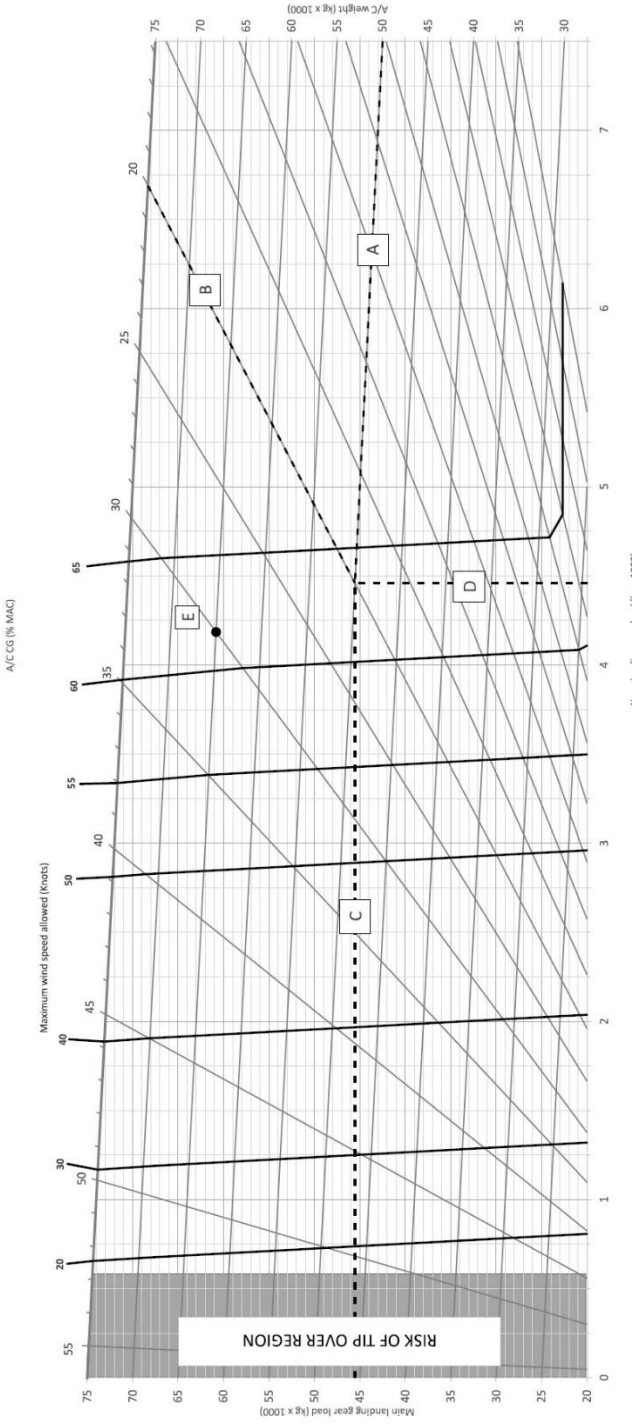
The application use is described fully in FCOM.

6.4 AIRCRAFT GROUND STABILITY

A220 aircrafts are tail heavy and to minimize tip-over risks loading/offloading sequence must always be followed if inbound and/or outbound load in AFT holds exceed 1500 kg.

Offloading must be started from AFT holds and loading with FWD holds.

Figure 6-1 Aircraft stability on wheels



6.5 STANDARD LOADING PROCEDURES

General rule is to carry passengers and their hand baggage and carry-on items in cabin following the rules of cabin baggage stowage and checked baggage, cargo or mail on the cargo hold compartments.

6.5.1 Live Animal

Passengers can carry live animals either as cabin baggage in the passenger cabin (PETC) or as checked baggage in the baggage compartment (AVIH), if the local regulations of the country of departure, arrival or transfer allow so. Passenger is responsible for the compliance with all required transport regulations regarding the entry of the animal to the given country.

PETC

Live animals can be transported in aircraft cabin (PETC) without previous approval of captain and fellow passengers. PETC is carried in the passenger cabin and the following conditions must be complied with:

•Only dog or cat may be carried in the passenger cabin in a suitable container.

•Three containers with PETC animals can be carried in the passenger cabin as a maximum, one in Business Class, two in Economy Class.

•Maximum dimensions of PETC container: 43cm (length), 30cm (width) and 27cm (height). Total weight including the animal (or animals, see below) must not exceed 8 kg.

•Container shall be placed under the seat in front of passenger.

•Container must not be placed in first row or emergency exit row(s).

•Bottom of the container shall be covered with cloth or layer of absorbing material (e.g. wood shavings). Hay cannot be used as this can be allergenic and is forbidden to import to majority of countries.

•If the regulations of the country allow so, with respect to the size of the container and the animals, a maximum of two small animals of the same species, provided they are used to co-habit or young animals of the same litter between 8 weeks and 6 months old, or adult mother with young animals from 8 weeks to 6 months old, can be transported in one container. Other animals may only be transported as cargo, in accordance with the regulations and the aircraft capacity.

•PETC animals must be kept in container during the whole flight.

The cargo compartment No. A and B should be used for the transport of livestock. It is Ramp Agent duty to ensure that Live Animals are stowed and secured according to ICAO, IATA and CSA Czech Airlines regulations/instructions.

A **guide dog(s)** is not considered as PETC and are to be placed in the cabin to assist the blind passenger – GOM described procedure is applied.

AVIH

Animals not qualifying for carriage in cabin, are transported in cargo compartment (AVIH). Carrier may decide to carry a PETC eligible animal as AVIH for operations reasons. It is Ramp Agent duty to ensure that Live Animals are stowed and secured according to ICAO, IATA and CSA Czech Airlines regulations/instructions.

It is strongly advised to consult the AVIH carriage with FDS department in advance.

6.6 STABILIZER TRIM SETTING

The recommended stabilizer trim setting for a given takeoff may be found in EFRAS takeoff performance calculation after insertion of takeoff CG (%MAC value) and calculation for the given conditions.

Alternatively, the stab trim setting may be found in graphs in FCOM.

Chapter 7 TIEDOWN GENERAL PRINCIPLES

CAUTION:
A MINIMUM CLEARANCE OF 51 MM TO THE MARKED AREA ON THE CARGO HOLD CEILING HAS TO BE RESPECTED AT ALL TIMES.

Both cargo bays are provided with tie-down anchor. Cargo nets can be installed in the forward and aft cargo compartments, but they are not mandatory.

The standard cargo tie-down attachments are designed to an ultimate load of 626 kg. Based on those loads, each package or box weight cannot exceed **159 kg**.

CAUTION:
CARGO, AN ITEM OR GROUP(S) OF ITEMS, MUST NOT BECOME A HAZARD TO THE AIRPLANE STRUCTURE, SYSTEMS OR BALANCE AS A RESULT OF SHIFTING UNDER OPERATIONAL LOADS. SHARP EDGED* OR DENSE CARGO* MUST EITHER BE LOCATED SO THAT CRUSHABLE TYPE CARGO ACTS AS ABUFFER TO PREVENT HAZARD, OR BE RESTRAINED TO PREVENT SHIFTING. SEE TIEDOWN LIMITATIONS ABOVE FOR THE MEANS OF CARGO RESTRAINT. CRITERIA COVERING DENSE CARGO APPLY ANYTIME A NET IS MISSING OR DAMAGED AND THE COMPARTMENT IS NOT AT LEAST 90% FULL BY VOLUME.

**Note: Sharp edged and dense cargo items are defined as follows:*

- *Weighs 45 KG (100 LB) or more with the smallest end having height and width dimensions both less than 15.24 CM (6 IN).*
- *Slender tubing or rods with a density equal to or greater than 9 KG (20 LB)/CU FT*
- *Weighs 226 KG (500 LB) or more*
- *Weighs 136 KG (300 LB) or more with a density equal to or greater than 9 KG (20 LB)/CU FT*
- *Weighs 45 KG (100 LB) or more and due to package shape (cylindrical, spherical, etc.) is likely to topple or roll during airplane operation.*

7.1 OPERATIONAL TIEDOWN PROCEDURES

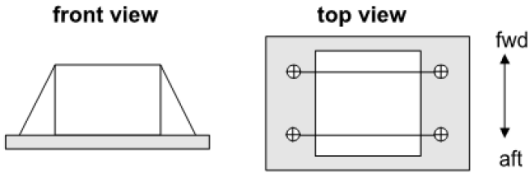
The list of items that need to be **tied-down at all times**:

a) All high density packages,
b) Power driven wheelchairs or scooters,
c) Live Animal Cages (AVI),
d) Human remains (HUM),
e) Items weighing 150 kg or more,
f) Items with individual weight between 50 to 150 kg, if the respective compartment is completely full in terms of its volume,
g) Any other items which by their nature, shape or density may inflict a hazard to the airplane or its structure, if left loose.

A possible shifting in a following list of directions **MUST** be considered for tiedown of any package:

- Vertical (Upwards)

Figure 7-1 Vertical restraining of a package



- Longitudinal (Forwards and aftwards)

Figure 7-2 Forward restraining of a package

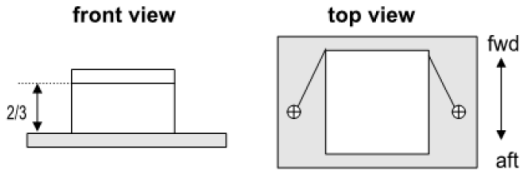
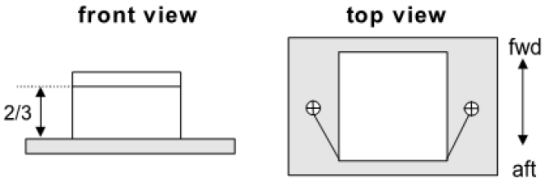
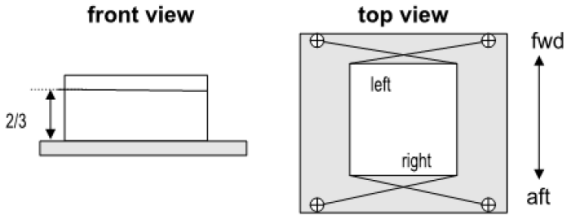


Figure 7-3 Aftward restraining of a package



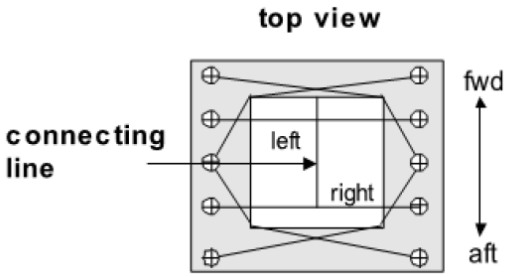
- Lateral (Sideward)

Figure 7-4 Sideward restraining of a package



CAUTION:
PROPERLY TIED-DOWN PACKAGE MUST HAVE ALL DIRECTIONS ABOVE SECURED. SEE FIGURE 7-5 FOR COMPLETE TIEDOWN OF A PACKAGE.

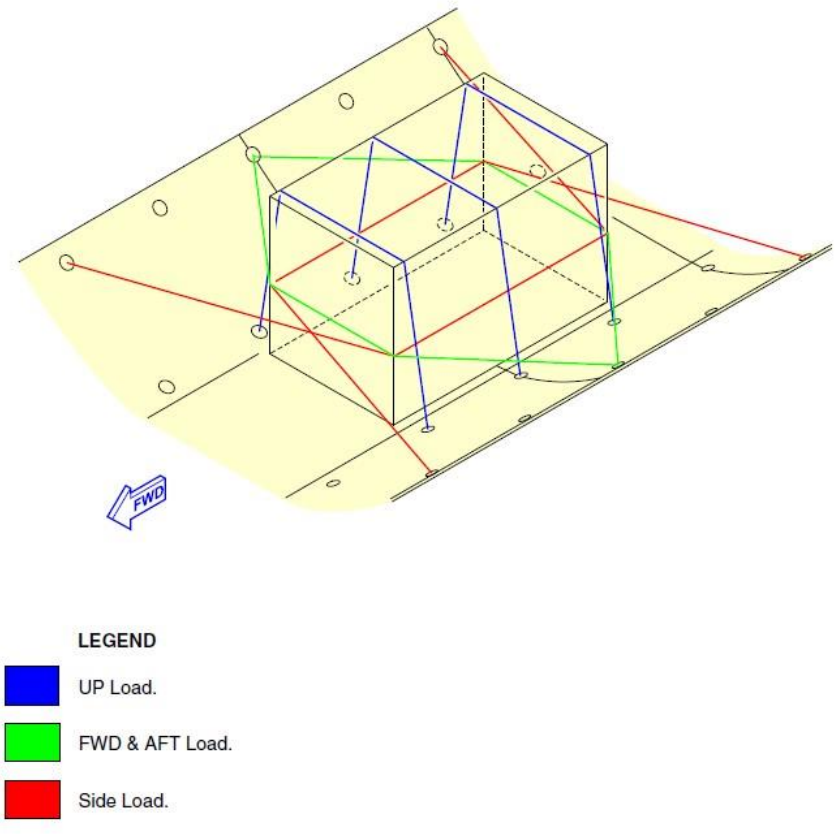
Figure 7-5 Completed and proper tiedown/restraining of a package



CAUTION:
REFER TO THE GOM FOR TIEDOWN LIMITATIONS AND FLOOR LOAD LIMITS. FOR COMPLEX LOADING, ANALYSIS BY FDS MAY BE REQUIRED IN ADVANCE

The following diagram shows the general arrangement of tie down of a typical package to the cargo hold floor.

Figure 7-6 Tiedown diagram



7.1.1 Tiedown points

This part provides the location of all the tiedown points installed in the forward and AFT cargo hold.

Figure 7-7 Forward cargo tie-down

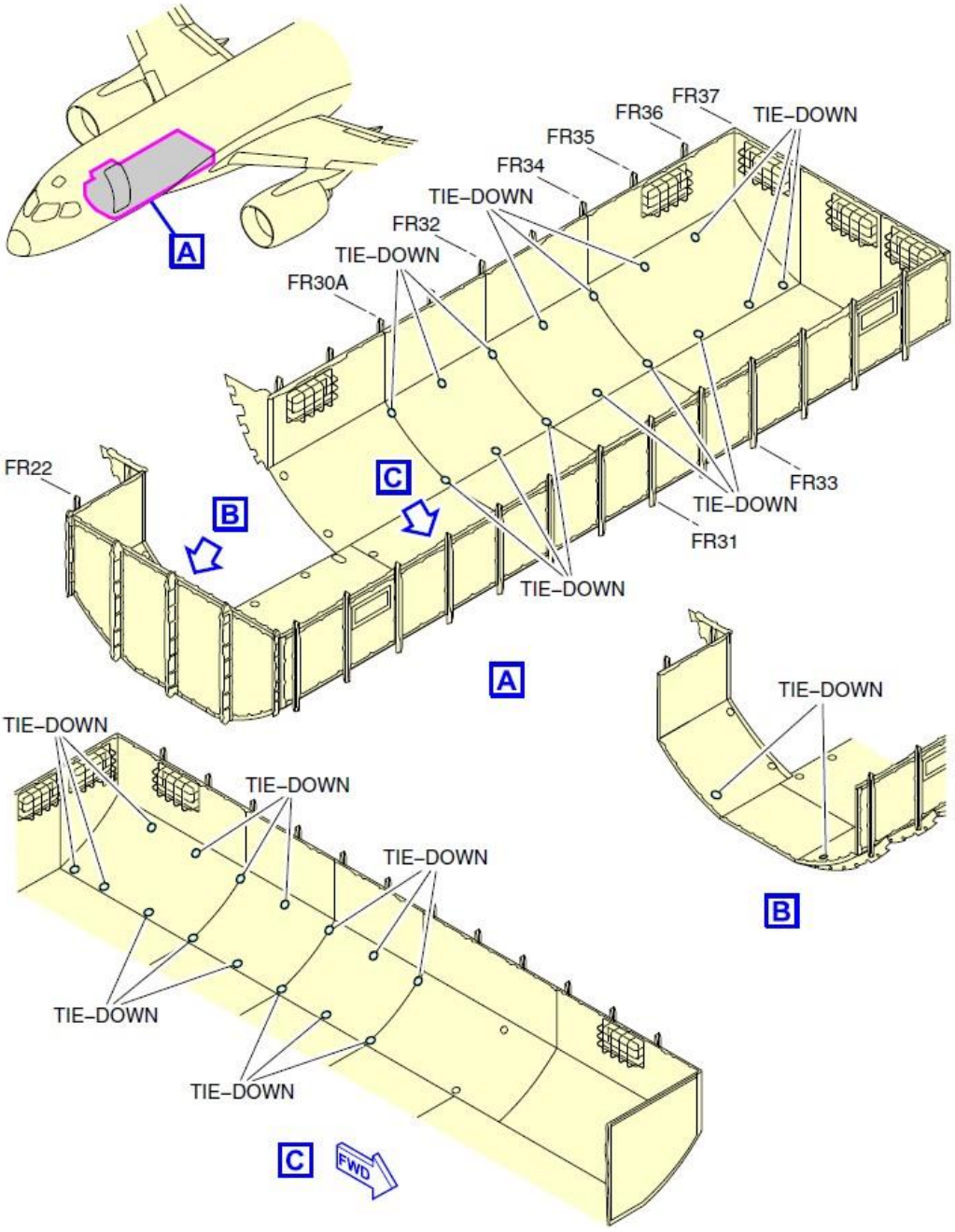
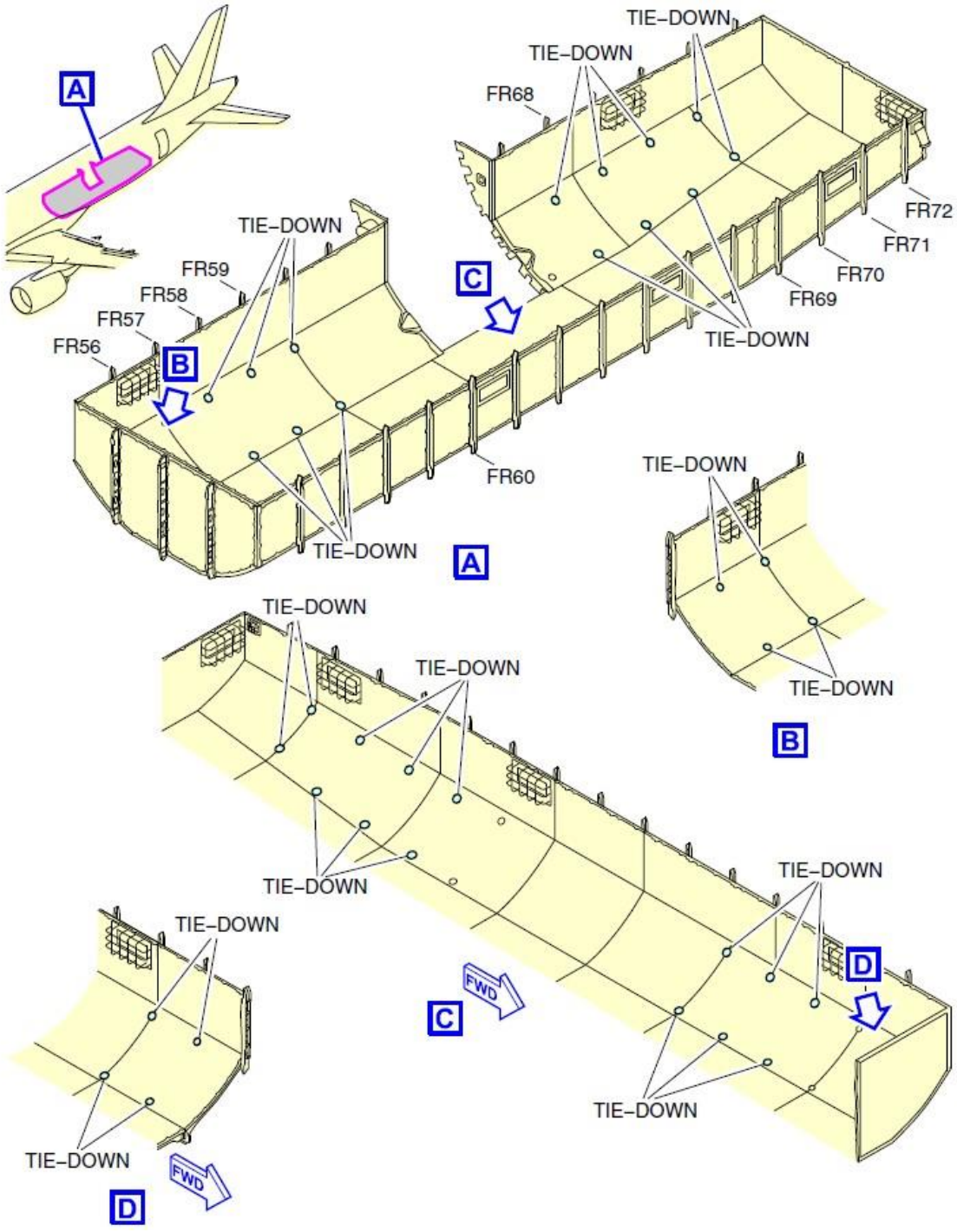


Figure 7-8 AFT cargo tie-down



7.1.2 Tie-down limitations

Load components shall be calculated for each tie-down anchor point based on ultimate acceleration. Refer to Table 7-1 for the ultimate inertia force to be considered acting on the cargo content (in aircraft coordinate system).

The resulting load distribution among retention straps depend on the package size, shape and CG location and on the straps

Table 7-1 Ultimate inertia force

Direction	Acceleration (g)
Upward	4,5
Forward	3,0
Sideward	3,0
Rearward	1,5
Downward*	3,0
CAUTION: Ultimate inertia forces provided in this table are acting separately and should not be combined with any other acceleration factor.	
NOTE: *Downward inertia force is provided for reference only as it will be reacted by cargo floor panels and not by retention straps.	

Cargo tie-down anchor allowable differ depending on their location. Refer to Table 7-2 for the different tie-down class and their specific location.

Table 7-2 Cargo tie-down anchors ultimate strength

Tie-down class	Ultimate strength (N)		
	Fx (forward or rearward)	Fy (sideward: left or right)	Fz (upward)
1	667	2669	3603
2	2335	1334	1334
3	2335	5338	1868
Class 1 tie-down: There is two of them and they are located the forward section of the forward cargo compartment (FS 10,083 m). Class 2 tie down: There is two of them and they are located the aft section of the fwd cargo compartment (FS 16,844 m). Class 3 tie down: All the remaining tie-down anchors.			

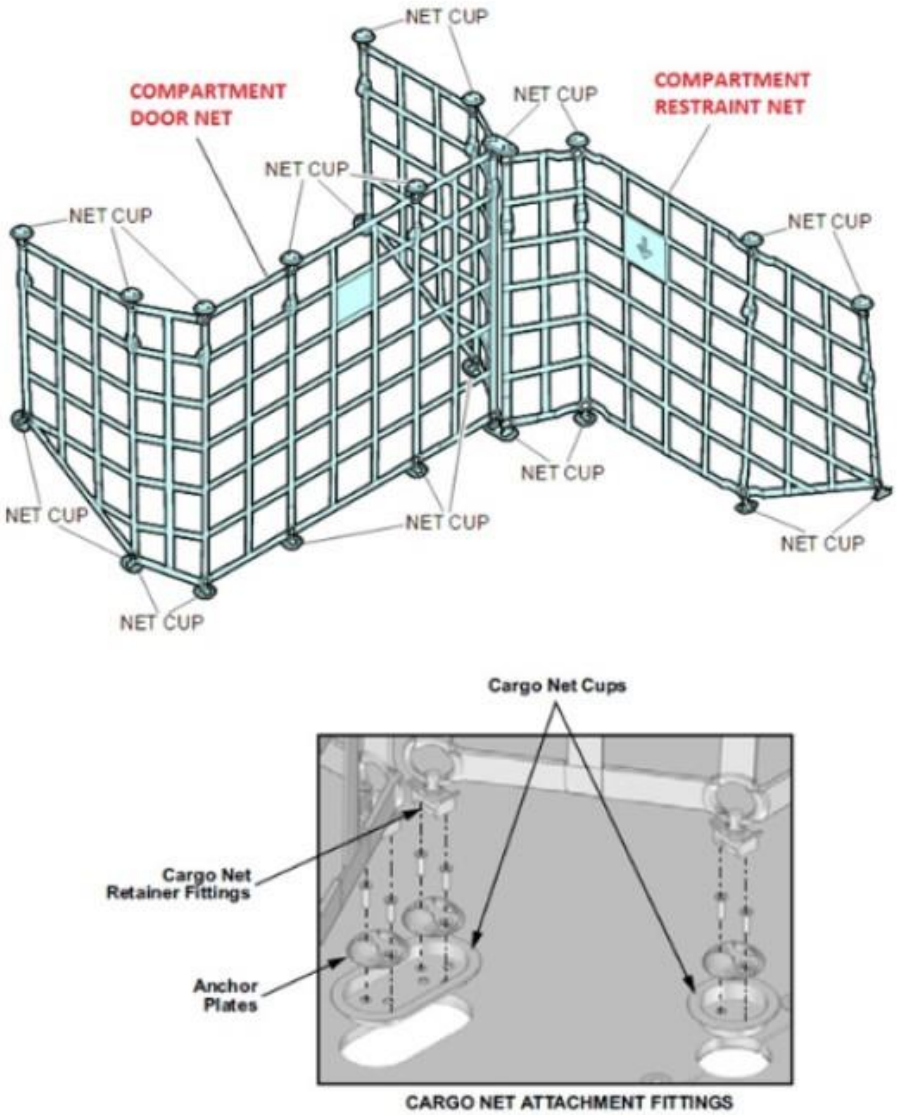
7.2 CARGO COMPARTMENT NETS

The cargo compartment nets keep the baggage in their position and do not let the baggage hit the cargo compartment door. There are two types of cargo compartment nets: the compartment door net and the compartment restraint net.

Caution: compartment door and restraint nets must be installed for flight. If nets are inoperative or missing, following restrictions apply:

- No door net: no loading in compartment A or C.
- No restraint net: no loading in the respective hold.

Figure 7-9 Net types



Chapter 8 EFA WBC

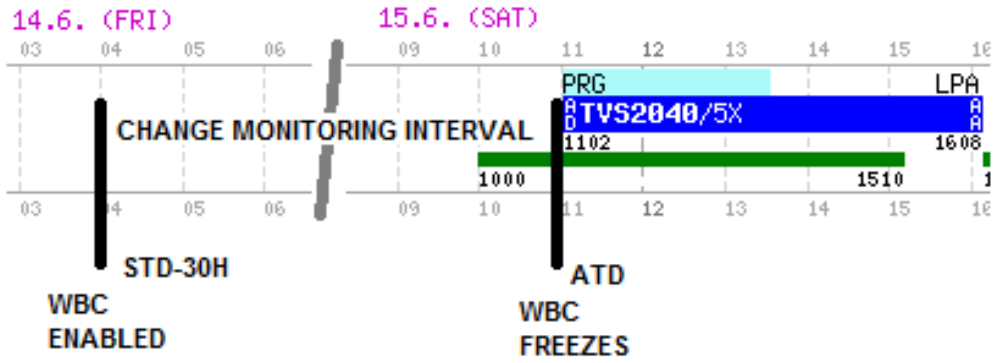
This chapter provides detailed description of Weight and Balance Calculator (WBC) sub-application within EFA system. As mentioned earlier – the purpose of WBC is to provide flight crews with DOW/DOI values as needed for their flight and to provide flight planning with EZFW value on which flight planning fuel figures shall be based on. DOW/DOI values may be further distributed to ground handlers via Fuel request/Trip info sheets, which contain the latest DOW/DOI values as presented in WBC.

8.1 WBC RUNTIME

The WBC is a semi-automatic program and its proper function depends on various systems, such as AIMS (aircraft tail number, crew composition), EFA Fleet Overview etc. WBC calculation is unique for each flight, meaning each flight may have its unique DOW/DOI and EZFW value combinations. The unique calculation may be accessed by using WBC Interface.

The WBC calculation starts **30 hours prior STD** of a given flight. The WBC then continues to recalculate the values in **5 minute intervals** to ensure that any changes made to the flight are included in the calculation. The calculation stops at the moment, when departure movement (**ATD**) is received and processed by the EFA system and the final WBC values freezes, so no further changes of the calculation are possible.

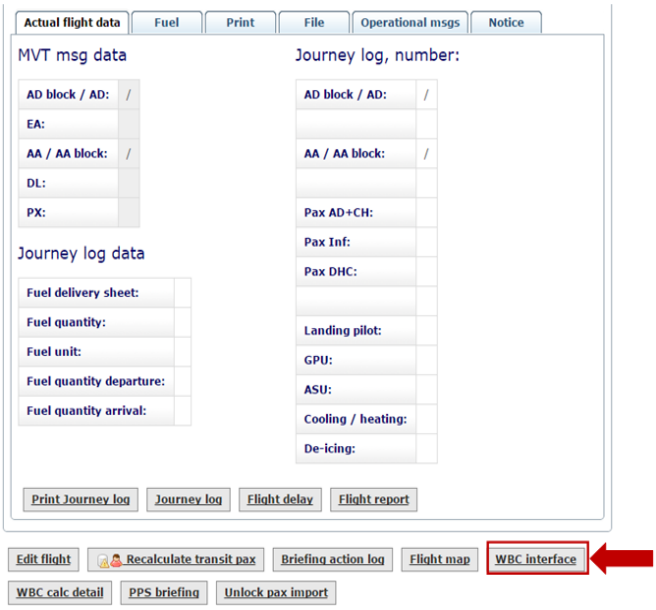
Figure 8-1 WBC Calculation 30h interval shown on EFA flight graph (timeline) example for flight TVS2040



8.2 WBC INTERFACE & CALCULATION SOURCE DATA

The WBC Interface may be accessed by clicking on the button: “WBC interface“ on the given flight detail page in EFA (shown on the figure 8.2-1).

Figure 8-2 “WBC interface” button location on the flight detail page in EFA



The WBC interface button toggles a new web browser window that contains a list of data connected to the listed values of weight and index adjustments. The description of the interface is shown on below figures with notes containing information about the data source/origin.

Figure 8-3 WBC sample interface – separate fields are described further.

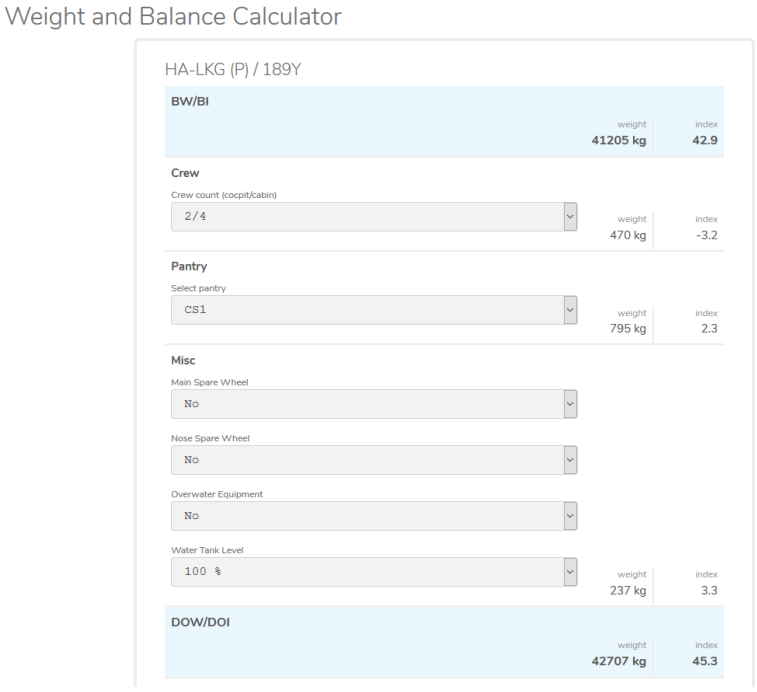


Figure 8-4 WBC DOW/DOI section – description is to be found in Table 8-1

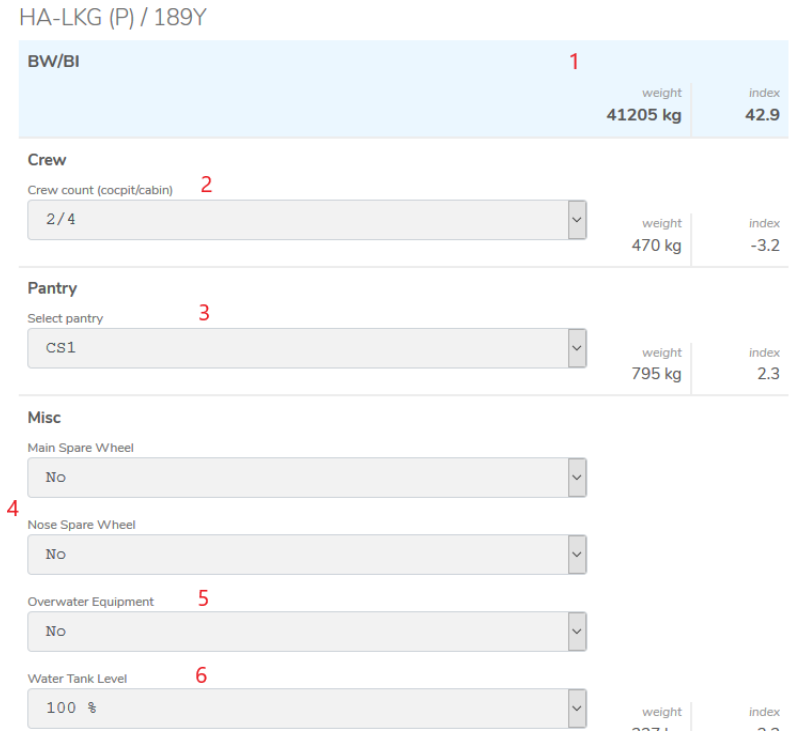
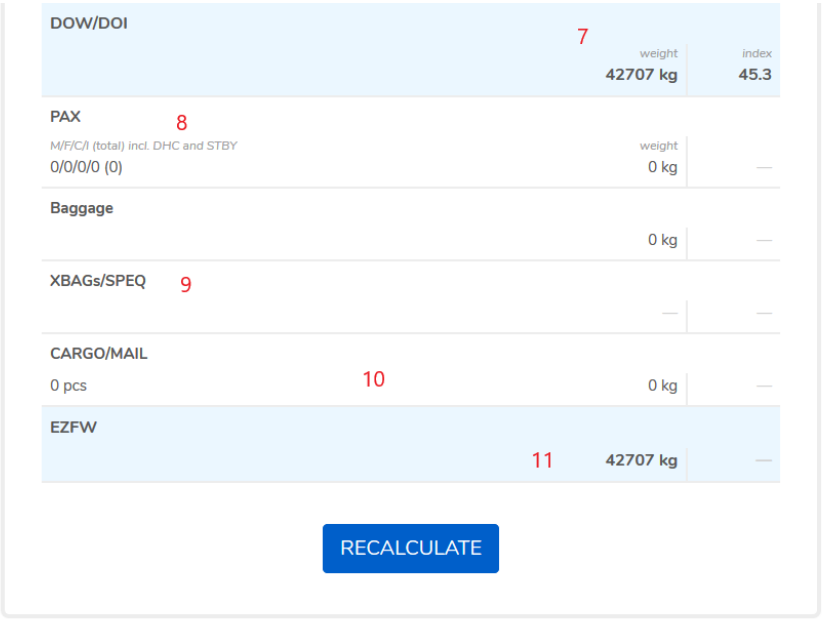


Table 8-1 WBC - DOW/DOI section description – the sum of weight and index adjustments provides the final DOW/DOI values

WBC Number	Field	Description	Source / Responsibility
1	BW/BI	The field displays the BW/BI figures corresponding to the respective aircraft and its (cabin) configuration.	AIMS – Aircraft ID/Reg. (SDC, OCC); EFA Fleet overview – Configuration (MCC)
2	Crew	The field displays a delta of the weight and index for the planned crew composition. The crew composition in cockpit/cabin format is displayed in the Info column. If other crew composition is desired, it can be manually selected using Manual/Auto Recalculate Option.	AIMS – Crew planning
3	Pantry	The field displays delta values of weight and index for the corresponding pantry code which is automatically selected based on the specific meal type inserted by InFlight Department. The Manual/Auto Recalculate Option is available. **CAUTION: "DEF" PANTRY CODE MEANS "DEFAULT"– THE TYPICAL LOADING OF THE GIVEN AIRCRAFT.**	EFA –InFlight Departmentor Manual selection
4	Spare wheel	Spare wheel selection is part of Miscellaneous (Misc) items row – indicates whether a spare wheel(s) are located in hold number 2 or not. The Manual/Auto Recalculate Option is available.	EFA – Fleet overview, MCC or Manual selection
5	Overwater equipment	The field indicates, if overwater equipment is located on board or not. If there is no overwater equipment on board, no delta of weight/index is applied on the DOW/DOI. The Manual/Auto Recalculate Option is available.	EFA – Fleet overview, MCC or Manual selection
6	Water tank	The field takes into the account the amount of the potable water on board. The default setting is always 100% full. The Manual/Auto Recalculate Option is available.	Full (100%) or Manual selection

Note that fields 2 to 6 (from figure 8.2-3) utilize a drop-down menu - if different option is needed, user can select a new one from the drop-down menu and then by clicking at the “Recalculate” button values change. Once done, the WBC calculation switches to a “Manual” mode and any further change of the modified option must be made by a new manual option selection from the drop-down menu. If return to the Automatic mode is desired, user may select the “Auto compute” option in the drop-down menu and click “Recalculate”. WBC will then continue to automatically monitor any change in EFA loaded items and will recalculate the figures, if necessary. This feature is called **Manual/Auto Recalculate Option.**

Figure 8-5 WBC EZFW section – description is to be found in Table 8-2



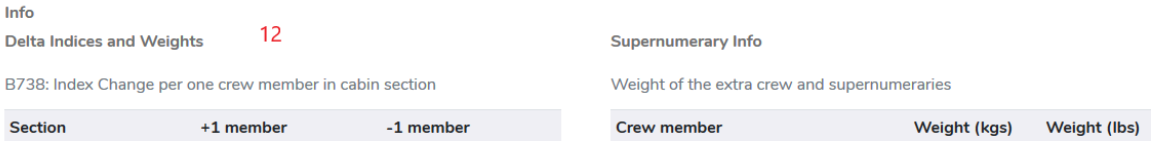


Table 8-2 WBC - EZFW section description; the sum of weight adjustments provides EZFW value mainly for flight planning purposes

Number	Field	Description	Source / Responsibility
7	DOW/DOI	Final DOW/DOI values.	WBC, see table 8.2.4
8	PAX and Baggage	The field displays the estimated weight of passengers and/or baggage (baggage row may be provided separately). It considers either the charter or scheduled weights based on the flight type. PAX constitution is displayed in the info column (M/F/C/I). Both STBY and DHC are included in the PAX count and weight. The max PAX count is limited by the aircraft passenger seating configuration. If the flight is overbooked, the booking figures are displayed in the Info field (no. 12). Note: Index values are not provided further since the actual distribution of loading is not known.	EFA PAX Info (Flight Type from AIMS by Commercial dept.) – PNL or AIMS (ACMI partners, inserted by OCC)
9	XBags / SPEQ	The field displays the estimated weight of special equipment booked by PAX in advance, provided the sum of all such baggage weight exceeds 200kg.	EFA PAX Info (Commercial dept.) – PNL
10	CARGO / MAIL	The field displays the total estimated weight of cargo and/or mail.	EFA Cargo Info (Commercial dept.)
11	EZFW	The field displays estimated ZFW calculated from above mentioned values. The value is used in the new flight planning system for the calculation of OFP. The value shall never exceed the MZFW. If it does exceed MZFW, it will be noted in the Info field (12) below and MZFW is used for flight planning. Various methods of EZFW calculations are commonly used. The main method is to calculate Male/Female/Children times their respective regulatory weights plus a baggage weight. Other two major statistical automated methods are 50:50 calculation of Male/Female PAX and statistical PAX/BAG weight could be used. An information about EZFW calculation is described in the Info row.	WBC
12	Info	The field displays additional information such as: assumed seating for crew members not seated on jump seats for DOW/DOI in above calculation; information about overbooking and the real booking figures; DHC Number and STBY PAX information about MZFW exceeding; information about EZFW calculation method.	WBC

Figure 8-6 WBC – Bottom section that provides delta indices and regulatory weights of crew members (for the respective aircraft type), if a manual correction is necessary

Info

Delta Indices and Weights

B738: Index Change per one crew member in cabin section

Section	+1 member	-1 member
COCKPIT JS	-1.4	1.4
FWD CC	-1.2	1.2
0A	-0.9	0.9
0B	-0.5	0.5
0C	0	0
0D	0.5	-0.5
0E	0.9	-0.9
LAST ROW	1	-1
AFT CC	1.1	-1.1

Supernumerary Info

Weight of the extra crew and supernumeraries

Crew member	Weight (kgs)	Weight (lbs)
CD, CP, FO, LT, GE, OF, OC/AM	85	187
SC, PR, CC, OC/* except OC/AM	75	165

Chapter 9 WBM ATTACHMENT LIST

This chapter provides a tabular list of effective WBM attachments in below Table 9-1.

Table 9-1 The list of affective attachments.

Attachment	Description	Effectivity (Type/Registration)	Effective Date
1 - QRDD	DOW/DOI Data	OK-CAC	xx xxx 2021
2 – PCWI	Pantry Code List	OK-CAC	xx xxx 2021