Australian Government

Civil Aviation Safety Authority

RPL, PPL & CPL (Aeroplane) Workbook
Version 3.0a - 02 December 2021

The workbook is only for use in training for the associated CASA RPL, PPL and CPL examinations, and is not to be used for any other purpose.

After use in a CASA examination, the workbook must not be removed from the examination room, but must be left with the PEXO examination Invigilator for destruction. Failure to comply with these instructions may give CASA grounds for taking action against the candidate under CAR 298A, which action could lead to the outcome indicated in CAR 298A (5).

FOR EXAMS FROM 2 DECEMBER 2021 ONWARDS

TABLE OF CONTENTS

CONTENTS	PAGE
Significant changes	3
Figs 1/2 – Aerodrome Markers/Markings	4
Fig 3 – Take-off Weight Chart	5
Fig 4 – Landing Distance Chart	6
Fig 5 – Take-off Weight Chart	7
Fig 6 – Landing Chart	8
ALPHA	
Loading System Alpha: Instructions	9
Fig 7 – Loading System Alpha	10
BRAVO	
Loading System Bravo: Instructions	11
Fig 8 – Loading System Bravo	12
CHARLIE	
Loading System Charlie: Instructions	13
Loading System Charlie: Index Units	14
Fig 9 – Loading System Charlie	15
ECHO	
Loading System Echo: Instructions	16
Loading System Echo: Instructions (continued)	17
Fig 10 – Loading System Echo: Index Units	18
Fig 11 – Loading System Echo: Centre of Gravity Envelope	19
Fig 12 – Take-off Weight Chart: Aircraft Echo	20
Fig 13 – Landing Weight Chart: Aircraft Echo	21
Scribble page	22

Changes from version 2 introduced with this version include:

1. The introduction of cross-wind limits for take-off and landing charts.
2. A change of fuel policy to reflect CASR Part 91 or CASR Part 135 requirements.
3. The specific gravity for AVGAS of 0.72 kg/litre is used for all loading systems.

Fuel policy information

The fuel policy for RPLA and PPLA exams will be in accordance with CASR Part 91 MOS, Chapter 19, Table 19.02 for **Aeroplane with MTOW < 5 700 kg (piston engine or turboprop)** under VFR by day.

For CPL-A exams, CFPA in particular, the fuel requirements will be carried in accordance with either:

- CASR Part 91 MOS, Chapter 19, table 19.02 for **Aeroplane with MTOW < 5 700 kg (piston engine or turboprop)** under VFR by day; or
- CASR Part 135 MOS, Chapter 7.

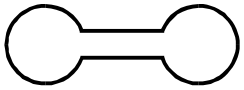
Each question involving fuel policy decisions will clearly state whether the flight is conducted as a CASR Part 91 or Part 135 operation.

AERODROME MARKERS

Figure 1

(i)

(ii)



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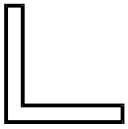

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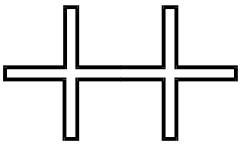
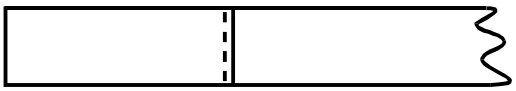


AERODROME MARKINGS

Figure 2

(i)



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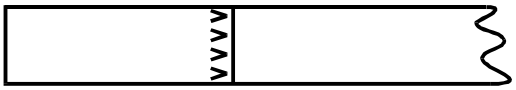

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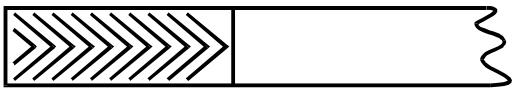
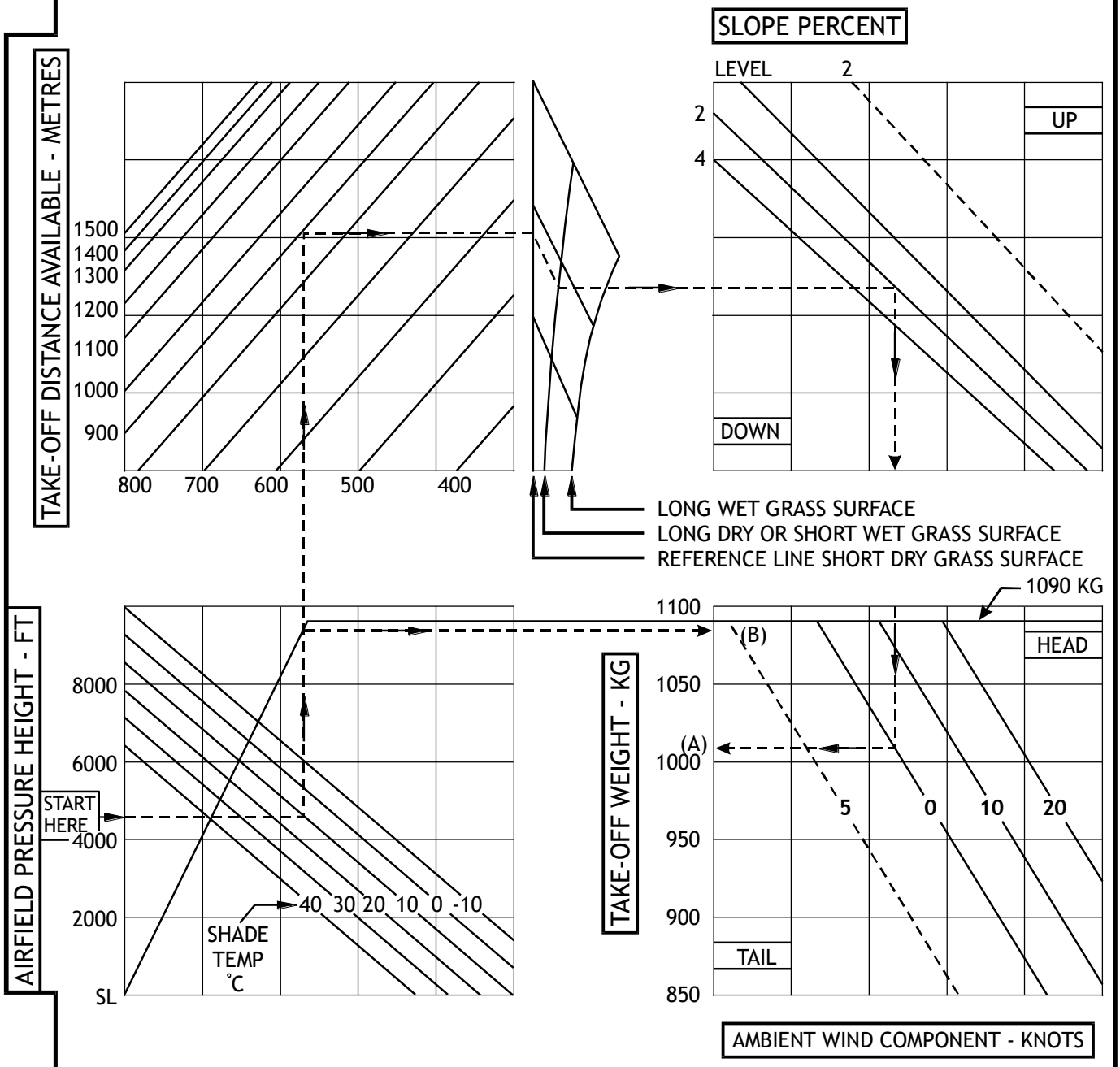


(iv)

TAKE-OFF WEIGHT CHART
Figure 3



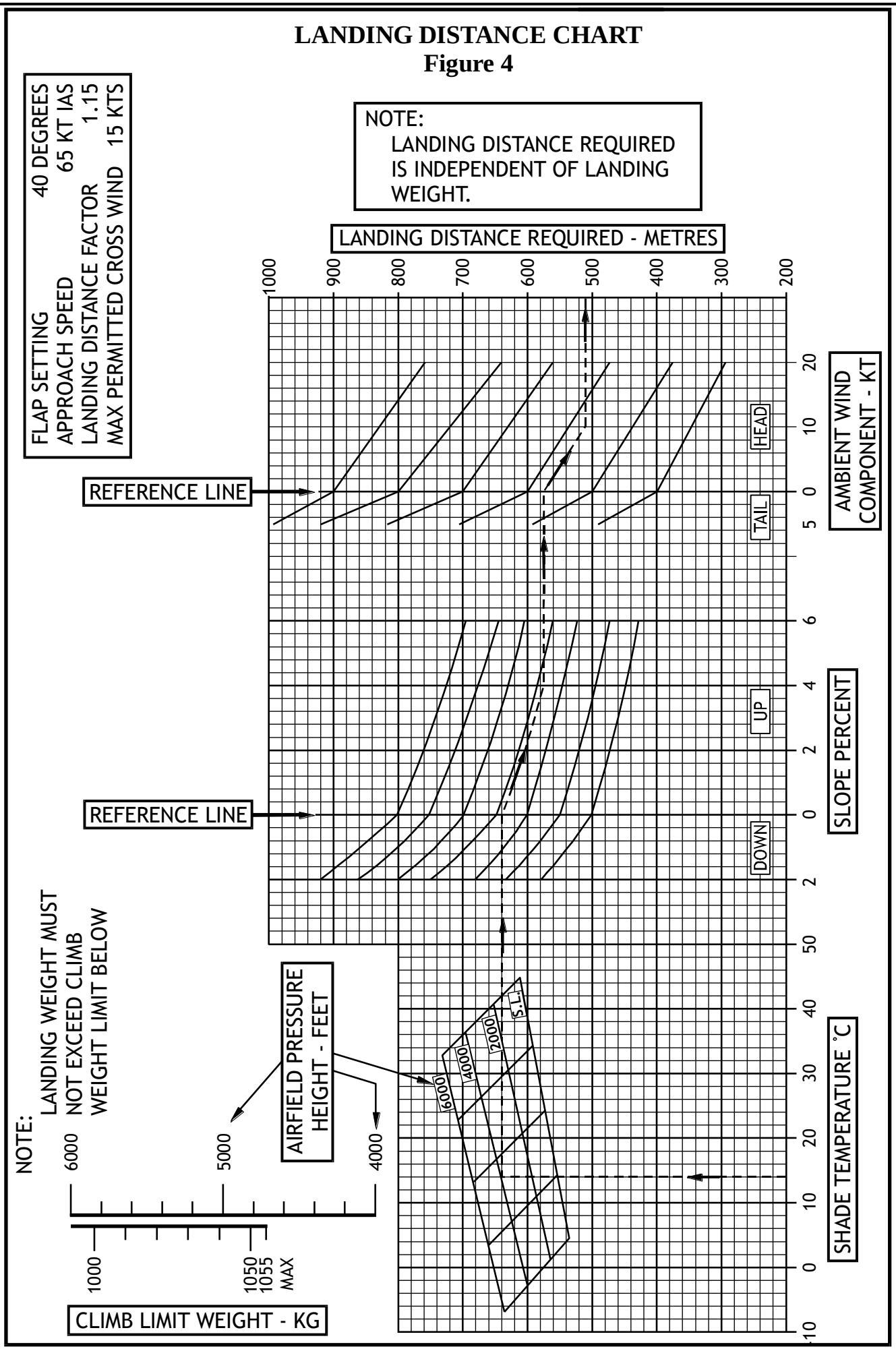
NOTES:

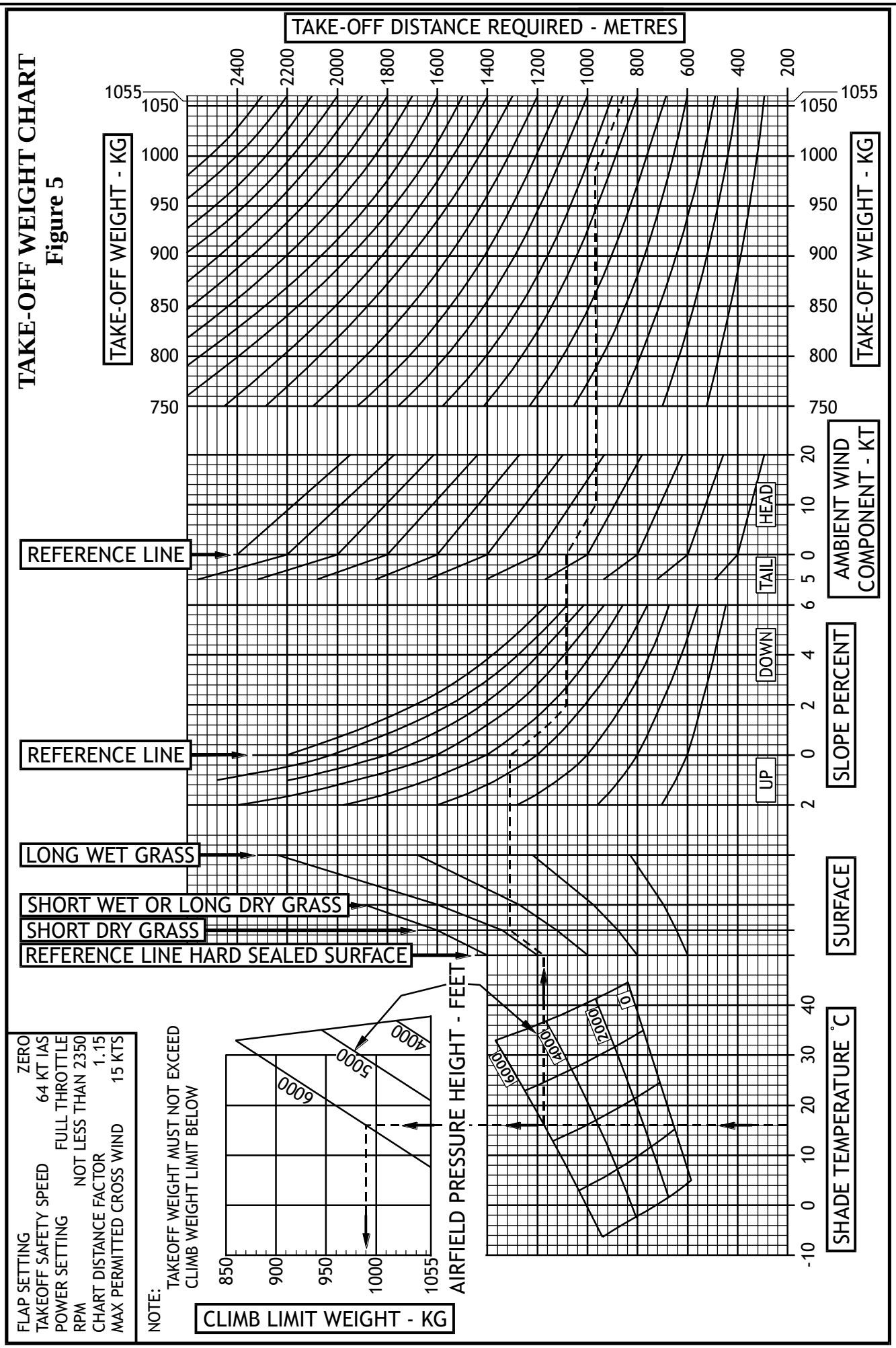
(1) THE GROSS WEIGHT AT TAKE-OFF SHALL NOT EXCEED THE LESSOR OF (A) AND (B).

(2) THE MAXIMUM TAKE-OFF WEIGHT = 1090 KG

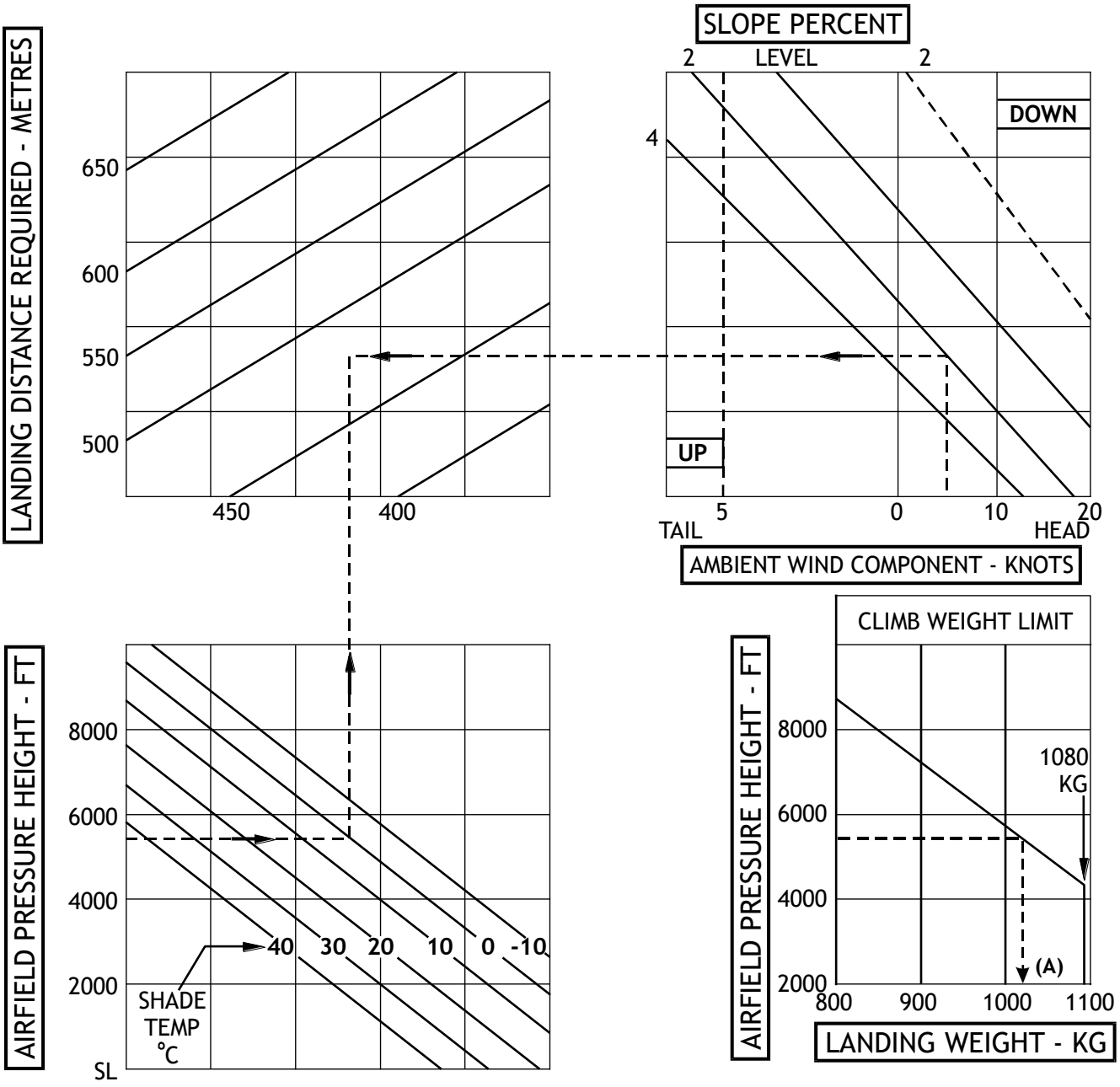
POWER TO BE USED	FULL THROTTLE
FLAP SETTING	10 DEGREES
TAKE-OFF SAFETY SPEED	60 KIAS
TAKE-OFF DISTANCE FACTOR	1.15
MAX PERMITTED CROSS WIND	15 KTS

LANDING DISTANCE CHART
Figure 4




TAKE-OFF WEIGHT CHART
Figure 5
TAKE-OFF DISTANCE REQUIRED - METRES
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
TAKE-OFF WEIGHT - KG
1055
1050
1000
950
900
850
800
750
REFERENCE LINE
REFERENCE LINE
LONG WET GRASS
SHORT WET OR LONG DRY GRASS
SHORT DRY GRASS
REFERENCE LINE HARD SEALED SURFACE
AMBIENT WIND COMPONENT - KT
HEAD
TAIL
SLOPE PERCENT
DOWN
UP
SURFACE
SHADE TEMPERATURE °C
-10
0
10
20
30
40
AIRFIELD PRESSURE HEIGHT - FEET
0
2000
4000
6000
5000
4000
6000
850
900
950
1000
1055
CLIMB LIMIT WEIGHT - KG
NOTE:
TAKEOFF WEIGHT MUST NOT EXCEED
CLIMB WEIGHT LIMIT BELOW
FLAP SETTING ZERO
TAKEOFF SAFETY SPEED 64 KT IAS
POWER SETTING FULL THROTTLE
RPM NOT LESS THAN 2350
CHART DISTANCE FACTOR 1.15
MAX PERMITTED CROSS WIND 15 KTS

LANDING CHART
Figure 6



NOTES:

(1) THE GROSS WEIGHT AT LANDING SHALL NOT EXCEED (A).

(2) LANDING DISTANCE REQUIRED DOES NOT VARY SIGNIFICANTLY WITH WEIGHT

FLAP SETTING	30 DEGREES
APPROACH SPEED	58 KIAS
LANDING DISTANCE FACTOR	1.15
MAX PERMITTED CROSS WIND	15 KTS

LOADING SYSTEM ALPHA
CONFIGURATION: 6/7 SEATS

INSTRUCTIONS FOR USE OF LOADING SYSTEM

1 Obtain Basic Empty Weight and Index Units from current Section of 6.2 of Flight Manual.

2 Mark Basic Empty Weight Index Units on top scale. Enter Basic Empty Weight at top of right-hand column.

3 Enter weights of load items required for flight in appropriate squares of right-hand column. Maximum weights for load items are indicated on Index Unit scales.

4 Total weights in right-hand column to obtain Zero Fuel Weight and Take-Off Weight. **

5 Draw horizontal lines on CG Envelope graph corresponding to Zero Fuel Weight and Take-Off Weight.

6 Draw a line vertically down from point marked on Basic Empty Weight Index Units scale to first load item scale.
* Move to the left or right on this load item index scale as per arrow directions, and mark point as appropriate to the load indicated in the right-hand column.
(e.g. 154 KG load @ 77 KG/div. = 2 div.).

7 Draw a line vertically down from the point marked on the first load item index scale to the second load item index scale and continue as per * above. Continue down the scales to "Rear Baggage". Draw a line vertically from the "Rear Baggage" point down to intersect the Zero Fuel Weight line and Take-Off Weight line previously marked on the CG envelope graph.

8 The two intersection points as per 7, above must not exceed the boundaries of the CG envelope graph. If they do, re-organise the load in the aircraft and start again with steps 3 to 7.

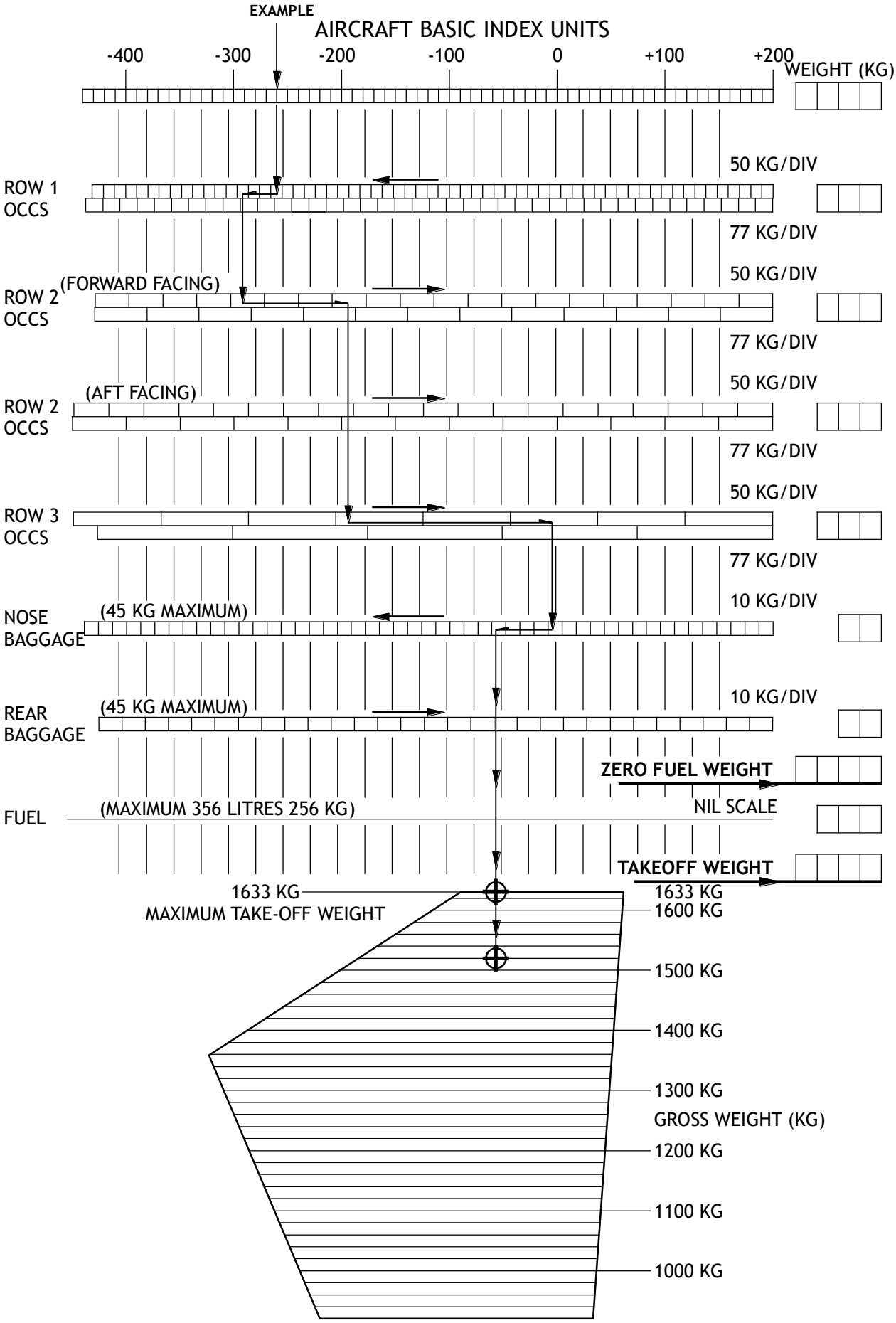
** **DO NOT EXCEED MAXIMUM TAKE-OFF WEIGHT AS SHOWN ON CG ENVELOPE DIAGRAM OF THIS LOADING SYSTEM**.

EXAMPLE:

Basic Empty Weight	1050 KG
Empty Index units	-260
Row 1	150 KG (2 persons)
Row 2 (forward facing)	160 KG (2 persons)
Row 3	120 KG (2 persons)
Nose baggage	40 KG ---------- Zero Fuel Wt = 1520 KG
Rear baggage	Nil
Fuel	113 KG ---------- Take-Off Wt = 1633 KG

Note: Basic Empty Weight includes unusable fuel and full oil.

LOADING SYSTEM ALPHA
Figure 7



LOADING SYSTEM BRAVO
CONFIGURATION: 4 SEATS

INSTRUCTIONS FOR USE OF LOADING SYSTEM

To check the loading of the aircraft before take-off, calculate the total weight and total moments as shown in the example below.

Plot the total weight and moment on the "Centre of Gravity Envelope" chart, and if the intersection point is within the envelope, the loading is acceptable.

AIRCRAFT LIMITATIONS

Maximum take-off weight
Normal category: 1000 KG / 2200 lbs
Utility category: 841 KG / 1850 lbs

Maximum cargo compartment: 154 KG / 339 lbs
Maximum baggage compartment: 54 KG / 120 lbs

Notes:

1 The aircraft is fitted with standard tanks (37 US Gallons at 6 lbs / gallon)
2 Empty weight includes unusable fuel and undrainable oil
3 Obtain Moment / 1000 inch pounds from the loading graph

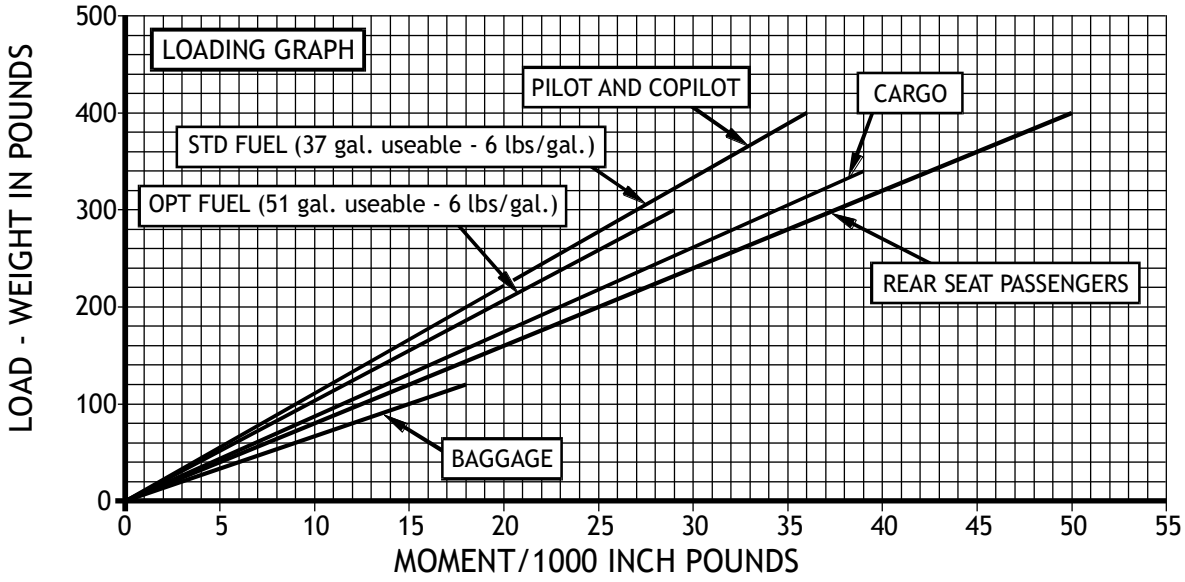
EXAMPLE:

	WEIGHT (LBS)	ARM (IN)	MOMENT/1000 IN LB
Empty weight	1260	80	100.80
Oil	15	32	.48
Pilot & Co-Pilot	320	91	29.12
Cargo compartment	80	115	9.20
Rear seat passengers	250	126	31.50
Baggage	25	151	3.78
Zero Fuel Weight	**1950**		**174.88**
Fuel (140 litres)	221	91	20.11
Take-Off Weight	**2171**		**194.99**

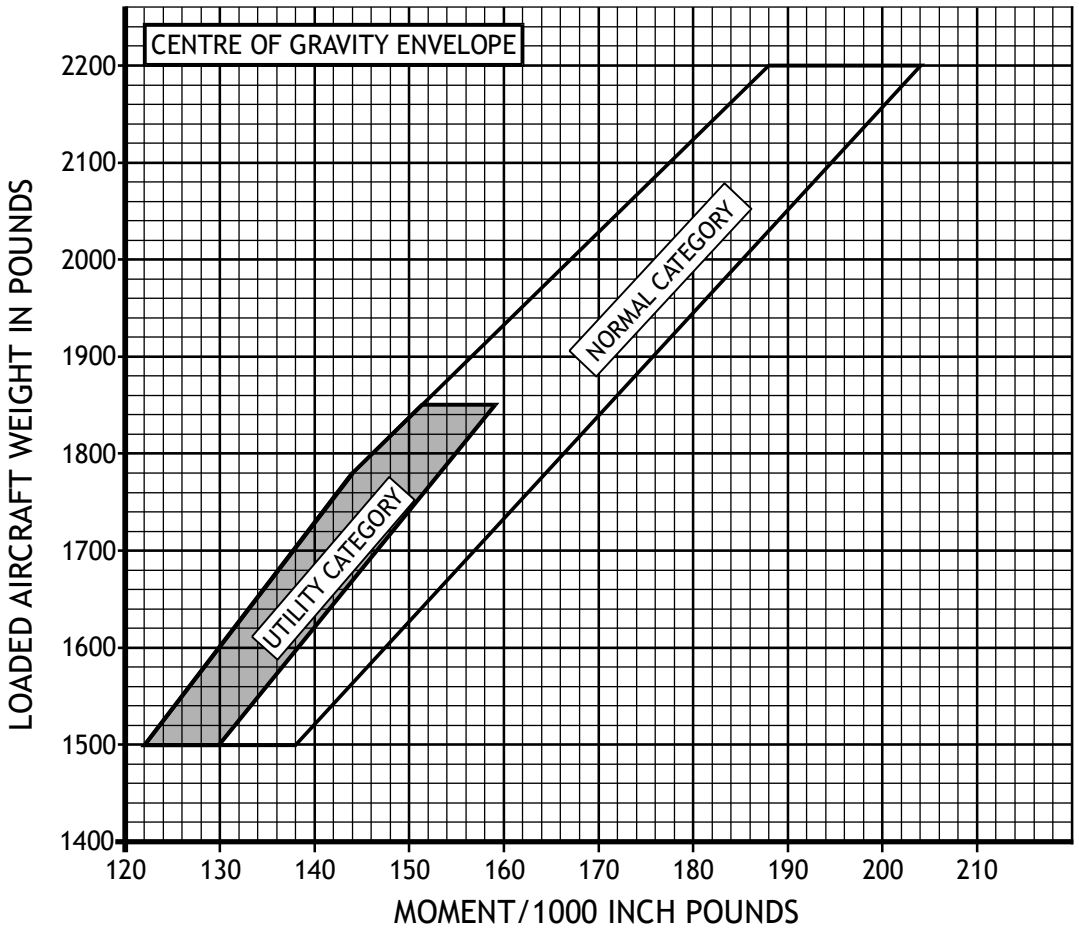
Check CG is within the envelope at both ZFW and Take-off weight

LOADING SYSTEM BRAVO
Figure 8

Add weight of items to be carried to aeroplane licensed empty weight. Add moment/1000 of items to be carried to total aeroplane moment/1000. Use Centre of Gravity Envelope to determine acceptibility.



LOADING GRAPH



CENTRE OF GRAVITY ENVELOPE

LOADING SYSTEM CHARLIE
CONFIGURATION: 4 SEATS

INSTRUCTIONS FOR USE OF LOADING SYSTEM

To check the loading of the aircraft before take-off, carry out a summation of weight and index units as shown in the example below. Check the centre of gravity of the aircraft at Zero Fuel Weight and Take-Off Weight by use of the formula:

$$\text{CG (mm aft of datum)} = \frac{\text{Index unit x 100}}{\text{Weight}}$$

The CG must be within the envelope given at all times.

AIRCRAFT LIMITATIONS

Maximum take-off weight	
Normal category:	1115 KG
Utility category:	925 KG
Maximum baggage compartment baggage:	122 KG

Notes:

1 Aircraft empty weight includes unusable fuel and undrainable oil
2 All arms are in mm aft of datum
3 1 index unit = 100 KG mm

EXAMPLE:

		KG	IU
Aircraft empty weight		687	19,522
Full oil		7	86.1
1 pilot + 1 passenger	Row 1	140	3,850
2 passengers	Row 2	160	5,760
Baggage		20	842
Zero Fuel Weight		1014	30,060.1
Fuel 140 litres		100.8	2,973.6
Take-off Weight		1114.8	33,033.7

CG check 1. At Zero Fuel Weight = (30,060.1 x 100) / 1014 = 2964.51 mm OK

2. At Take-Off Weight = (33,033.7 x 100) / 1114.8 = 2963.20 mm OK

LOADING SYSTEM CHARLIE

INDEX UNITS

Fuel @ 0.72		ARM: 2950	BAGGAGE	ARM: 4210
Litres	KG	Index Units	KG	Index Units
20	14.40	424.80	10	421
40	28.80	849.60	20	842
60	43.20	1,274.40	30	1,263
80	57.00	1,699.20	40	1,684
100	72.00	2,124.00	50	2,105
120	86.40	2,548.80	60	2,526
140	100.80	2,973.60	70	2,947
160	115.20	3,398.40	80	3,368
180	129.60	3,823.20	90	3,789
200	144.00	4,248.00	100	4,210
216	155.52	4,587.84	110	4,631
			122	5,136

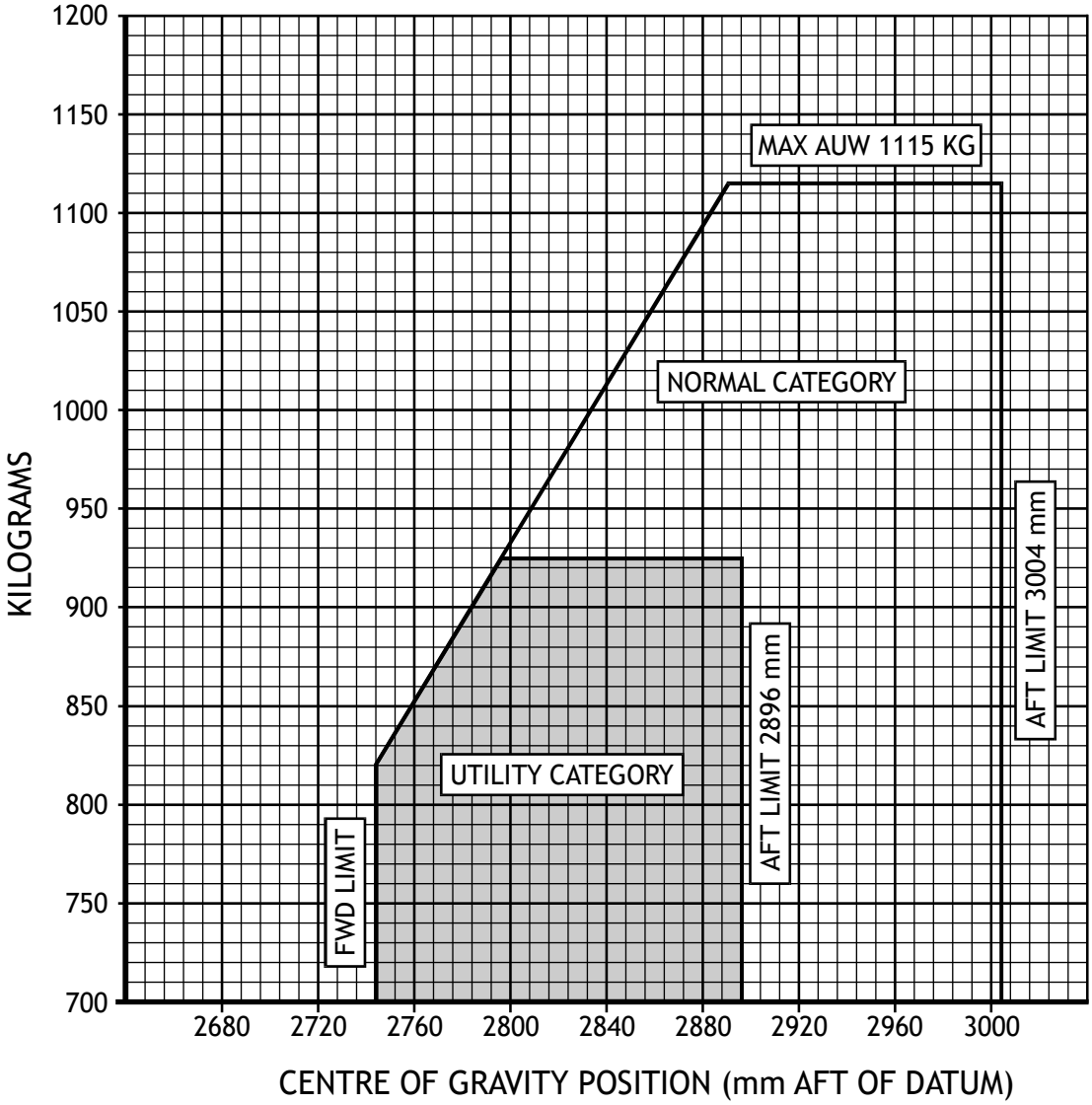
OCCUPANTS

KG	ROW 1 ARM: 2750	ROW 2 ARM: 3600
40	1,100	1,440
45	1,237	1,620
50	1,375	1,800
55	1,512	1,980
60	1,650	2,160
65	1,786	2,340
70	1,925	2,520
75	2,062	2,700
80	2,200	2,880
85	2,338	3,060
90	2,475	3,240

OIL ARM: 1230

US Quarts	LITRES	KG	INDEX UNITS
6	5.7	5.0	62
7	6.6	6.0	74
8	7.6	7.0	86

LOADING SYSTEM CHARLIE
Figure 9



ALLOWABLE CENTRE OF GRAVITY ENVELOPE

CONVERSION FACTORS

1 inch = 25.4 mm

1 foot = 0.305 metre

1 lb = 0.454 KG

1 Imp gal = 1.201 US gal = 4.546 litres

AVGAS Specific Gravity = 0.72 Kg/Litre

LOADING SYSTEM ECHO
CONFIGURATION: 6 SEATS

INSTRUCTIONS FOR USE OF LOADING SYSTEM

1 Moment Index chart (Figure 10, page 18) may be used to determine the balance of the aeroplane. Locate the weight (in KG) of a particular load item on the vertical scale and move horizontally to the line representing the location of that item. From that point drop vertically to read off the Moment Index for that item.

2 Obtain the aeroplane basic empty weight and index units from the examination question. Add up the required total weight (Gross Weight) of the aeroplane and the corresponding Total Moment Index.

3 Refer to the Centre of Gravity chart (Figure 11, page 19). Locate the Gross Weight of the loaded aeroplane (in KG) on the vertical scale and move horizontally to meet the vertical line representing the Total Moment Index of the loaded aeroplane. If the point of intersection, which represents the Centre of Gravity, falls in the shaded area, the aeroplane is correctly loaded.

Note: The Centre of Gravity must lie in the shaded area at ALL stages of flight.

Weight Limitations:

Maximum Take-off Weight	2950 KG
Maximum Landing Weight	2725 KG
Maximum Zero Fuel Weight	2630 KG

Balance Data: The Mean Aerodynamic Chord (MAC) data is as follows:

Length of chord	1900 mm
Location of leading edge	2190 mm aft of datum

Centre of Gravity range is a follows:
2400 mm to 2680 mm at 2360 KG or less
2560 mm to 2680 mm at 2950 KG
Linear variation between the points given

Loading Data:

Location	Maximum Permissible Load	Load Arm (mm Aft of Datum)
Seating:		
Row 1 (Seats 1 & 2)	Pilot + 1 Passenger	2290
Row 2 (Seats 3 & 4)	2 Passengers	3300
Row 3 (Seats 5 & 6)	2 Passengers	4300
Cargo & Baggage Compartments (Compts):		
Forward Compt	55 KG	500
Left wing Compt	55 KG	3550
Right wing Compt	55 KG	3550
Rear Compt	155 KG	5000
Floor loading intensity	(All Compts) 450 KG/m^2	
Fuel:		
Left main tank	50 gal	1780
Right main tank	50 gal	1780
Left auxiliary tank	40 gal	2800
Right auxiliary tank	40 gal	2800

LOADING SYSTEM ECHO (continued)

Note: All passenger seats weigh 5 KG each and may be removed to permit the carriage of additional cargo or baggage in the cabin.

The maximum permissible load in the area otherwise occupied by a passenger seat is 82 KG.

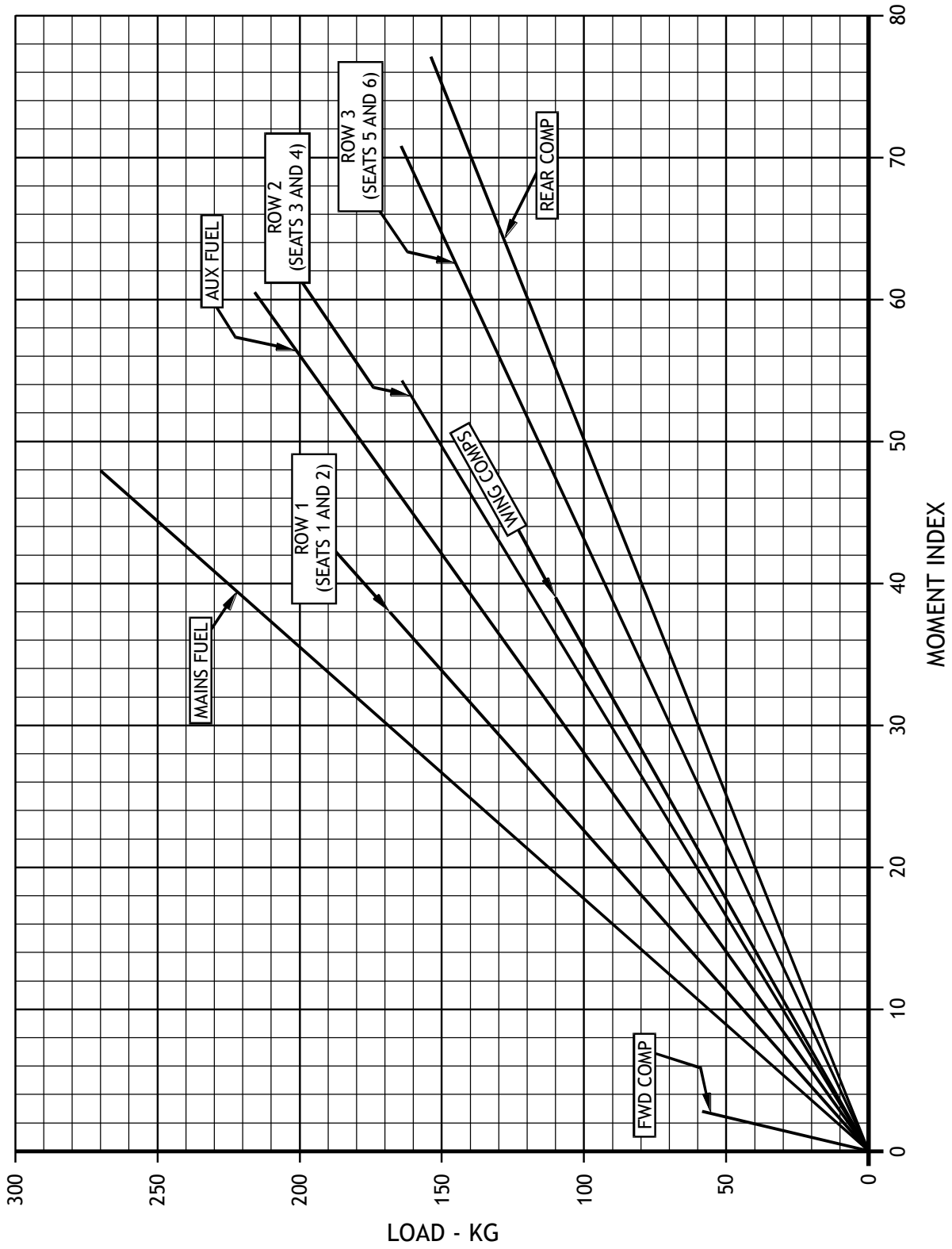
If a passenger seat is removed, adjust the empty weight and empty moment.

EXAMPLE:

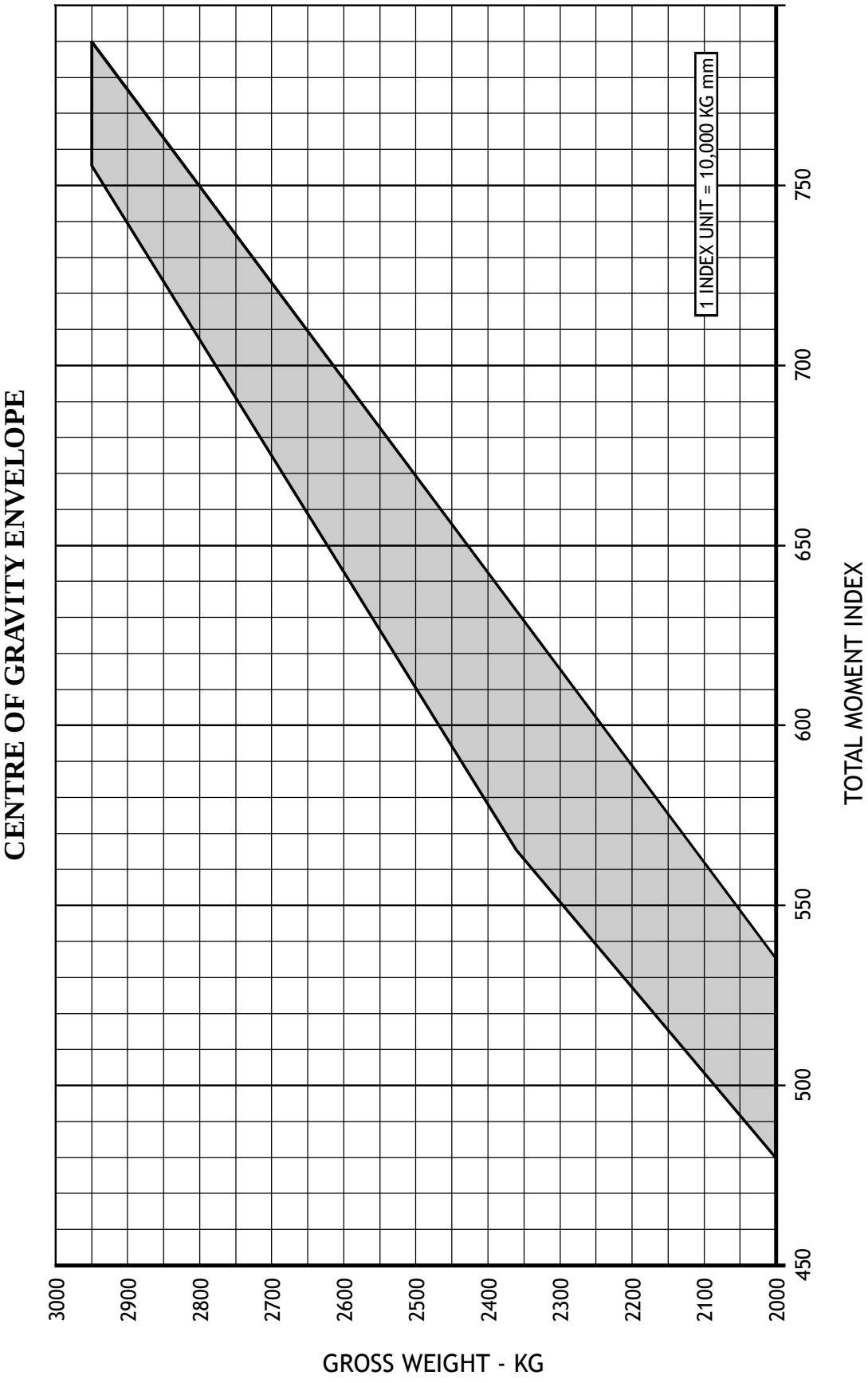
	WEIGHT (KG)	**MOMENT INDEX** (Refer to Figure 10)
Aeroplane Basic Empty Weight	1970	478.0
Row 1 (2 passengers)	150	34.0
Row 2 (2 passengers)	140	46.3
Row 3 (2 passengers)	130	56.0
Rear compartment	100	50.0
Zero Fuel Weight	**2490**	**664.3**
Fuel in Main tanks	200	35.5
Take-off Weight	**2690**	**699.8**
Fuel Burn-off	80	14.3
Landing Weight	**2610**	**685.5**

Refer to the Centre of Gravity Chart (Figure 11, page 19) to assess whether the horizontal line from the "Gross Weight" in question intersects the vertical line from its corresponding Total Moment Index in the shaded area.

LOADING SYSTEM ECHO
Figure 10

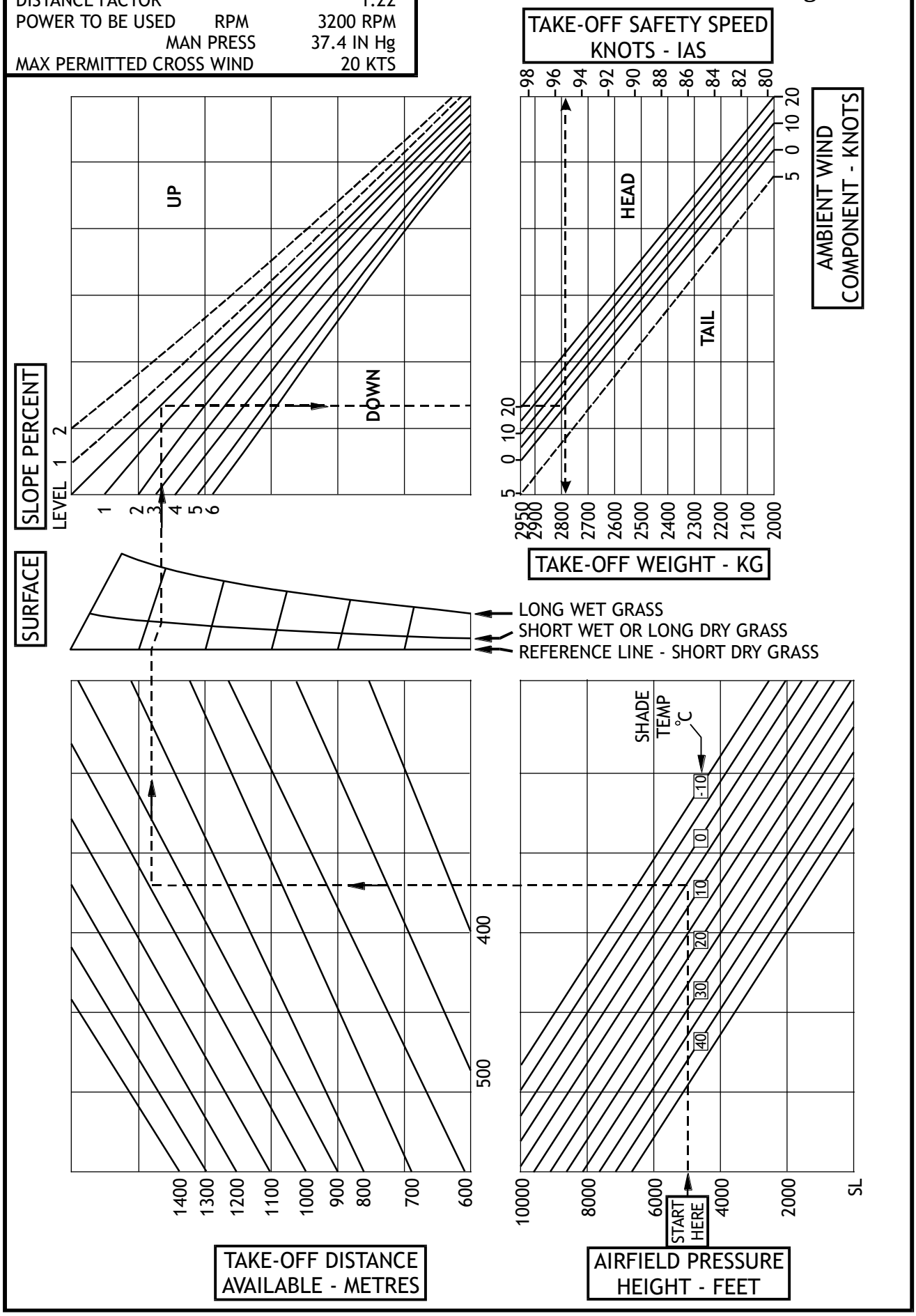


LOADING SYSTEM ECHO
Figure 11



FLAP SETTING	ZERO DEGREES
TAKE-OFF SAFETY SPEED	SEE SCALE
DISTANCE FACTOR	1.22
POWER TO BE USED RPM	3200 RPM
MAN PRESS	37.4 IN Hg
MAX PERMITTED CROSS WIND	20 KTS

TAKE-OFF WEIGHT CHART
AIRCRAFT - ECHO Figure 12



LANDING WEIGHT CHART
AIRCRAFT - ECHO
Figure 13