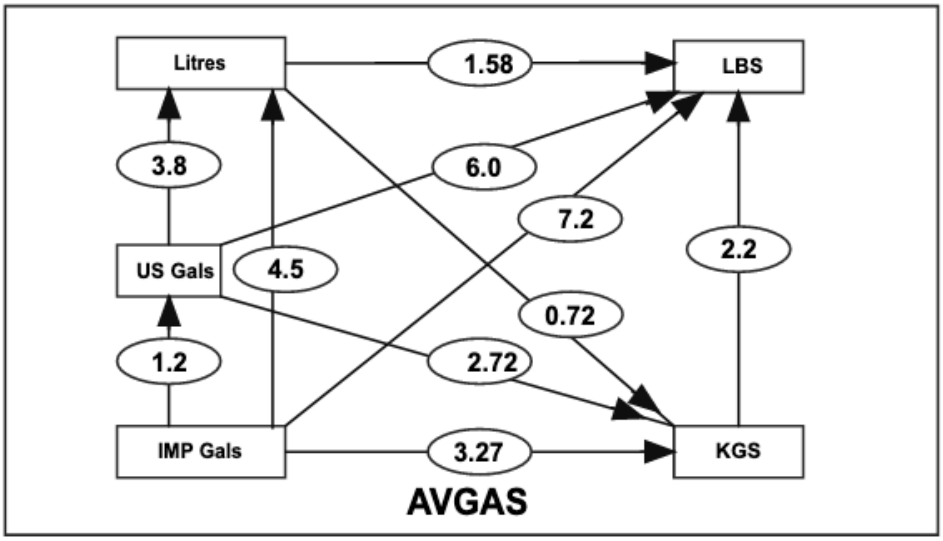
# CPL PERFORMANCE SUPPLEMENT

## 2022 Updated version

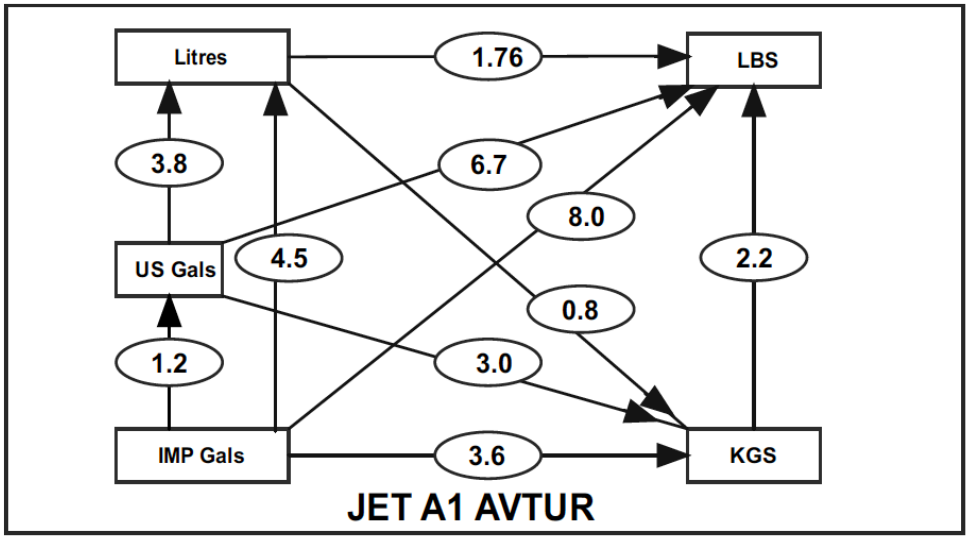
CONVERSION FACTORS (AIP GEN 2.6 - 1)




AVGAS
Multiply with the arrow

Divide against the arrow

CONVERSION FACTORS (AIP GEN 2.6 - 1)



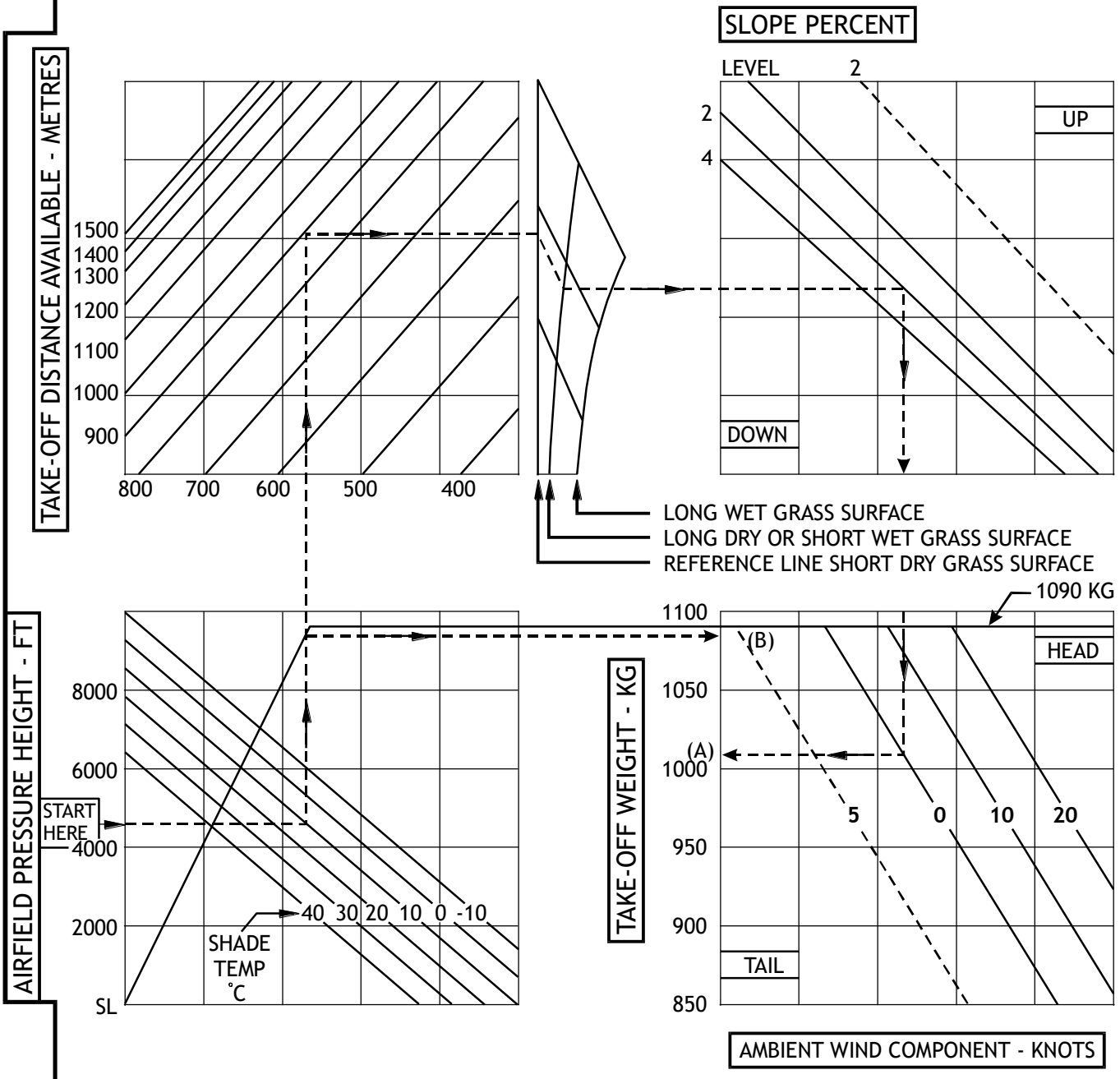

AVTUR
Multiply with the arrow

Divide against the arrow

HEAD & CROSSWIND COMPONENTS FOR RUNWAYS. (AIP GEN 2.6 - 5)

| **WIND COMPONENT TABLE** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | For crosswind component<br>Angle Between Wind Direction and Runway Heading | | | | | | | | | |
| | | **10** | **20** | **30** | **40** | **45** | **50** | **60** | **70** | **80** | **90** |
| W | **5** | 1 | 2 | 2 | 3 | 4 | 4 | 4 | 4 | 5 | 5 |
| I | **10** | 2 | 3 | 5 | 6 | 7 | 7 | 8 | 9 | 9 | 10 |
| N | **15** | 3 | 5 | 7 | 9 | 11 | 11 | 13 | 14 | 14 | 15 |
| D | **20** | 3 | 7 | 10 | 13 | 14 | 15 | 17 | 18 | 19 | 20 |
| | **25** | 4 | 8 | 12 | 16 | 18 | 19 | 22 | 23 | 24 | 25 |
| S | **30** | 5 | 10 | 15 | 19 | 21 | 23 | 26 | 28 | 29 | 30 |
| P | **35** | 6 | 12 | 17 | 22 | 25 | 26 | 30 | 32 | 34 | 35 |
| E | **40** | 7 | 14 | 20 | 25 | 28 | 30 | 35 | 37 | 39 | 40 |
| E | **45** | 8 | 15 | 22 | 29 | 32 | 34 | 39 | 42 | 44 | 45 |
| D | **50** | 9 | 17 | 25 | 32 | 35 | 38 | 43 | 47 | 49 | 50 |
| | **55** | 10 | 19 | 27 | 35 | 39 | 42 | 48 | 52 | 54 | 55 |
| K | **60** | 10 | 20 | 30 | 38 | 42 | 46 | 52 | 56 | 59 | 60 |
| N | **65** | 11 | 22 | 32 | 42 | 46 | 50 | 56 | 61 | 64 | 65 |
| O | **70** | 12 | 24 | 35 | 45 | 49 | 54 | 60 | 66 | 69 | 70 |
| T | **75** | 13 | 26 | 37 | 48 | 53 | 57 | 64 | 70 | 73 | 75 |
| S | **80** | 14 | 27 | 40 | 51 | 57 | 60 | 69 | 75 | 78 | 80 |
| | | **80** | **70** | **60** | **50** | **45** | **40** | **30** | **20** | **10** | **0** |
| | | For Headwind Component<br>Angle Between Wind Direction and Runway Heading | | | | | | | | | |

# TAKE-OFF WEIGHT CHART
# TYPE ONE



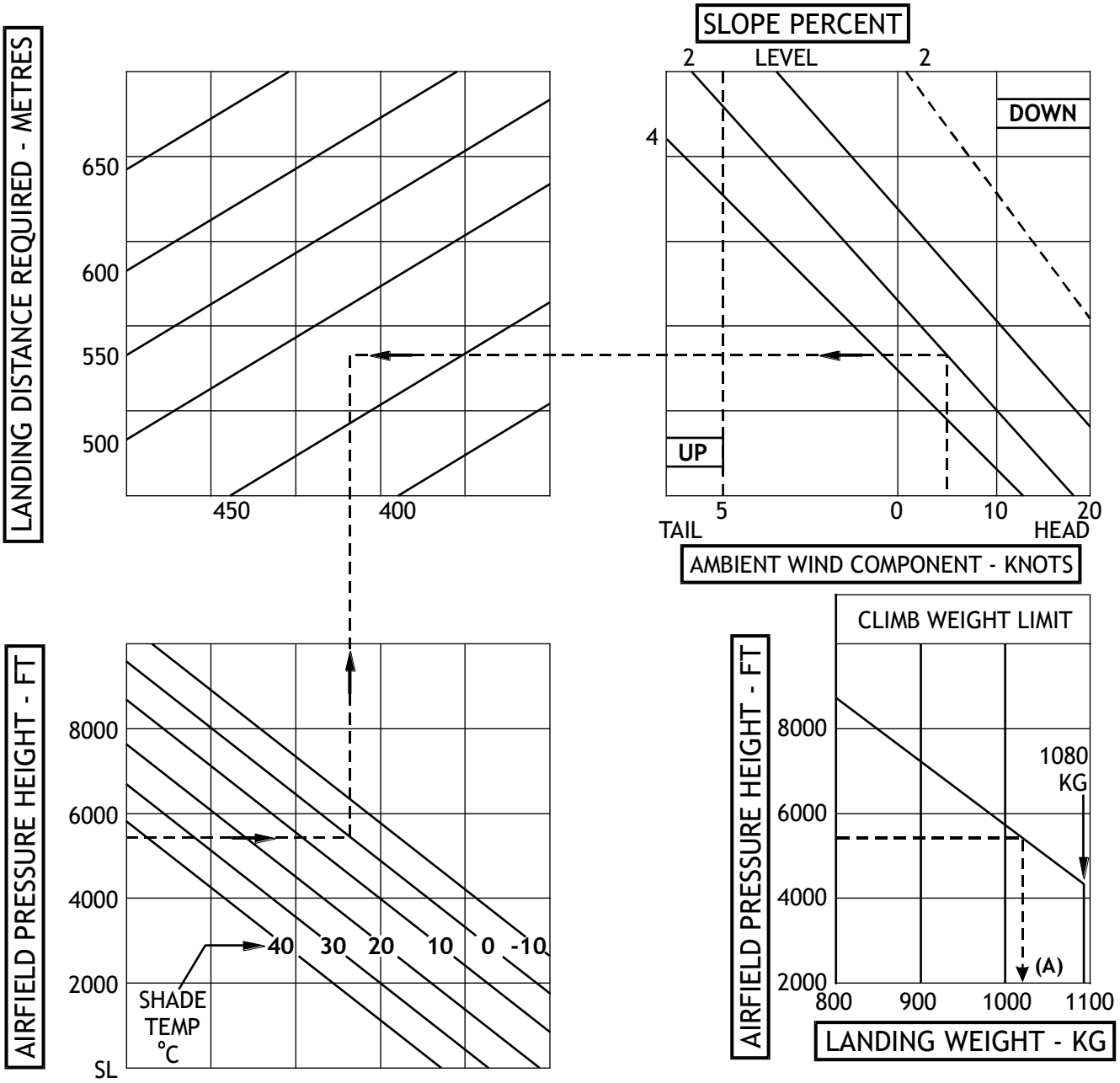

NOTES:

(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 CHART
# TYPE ONE

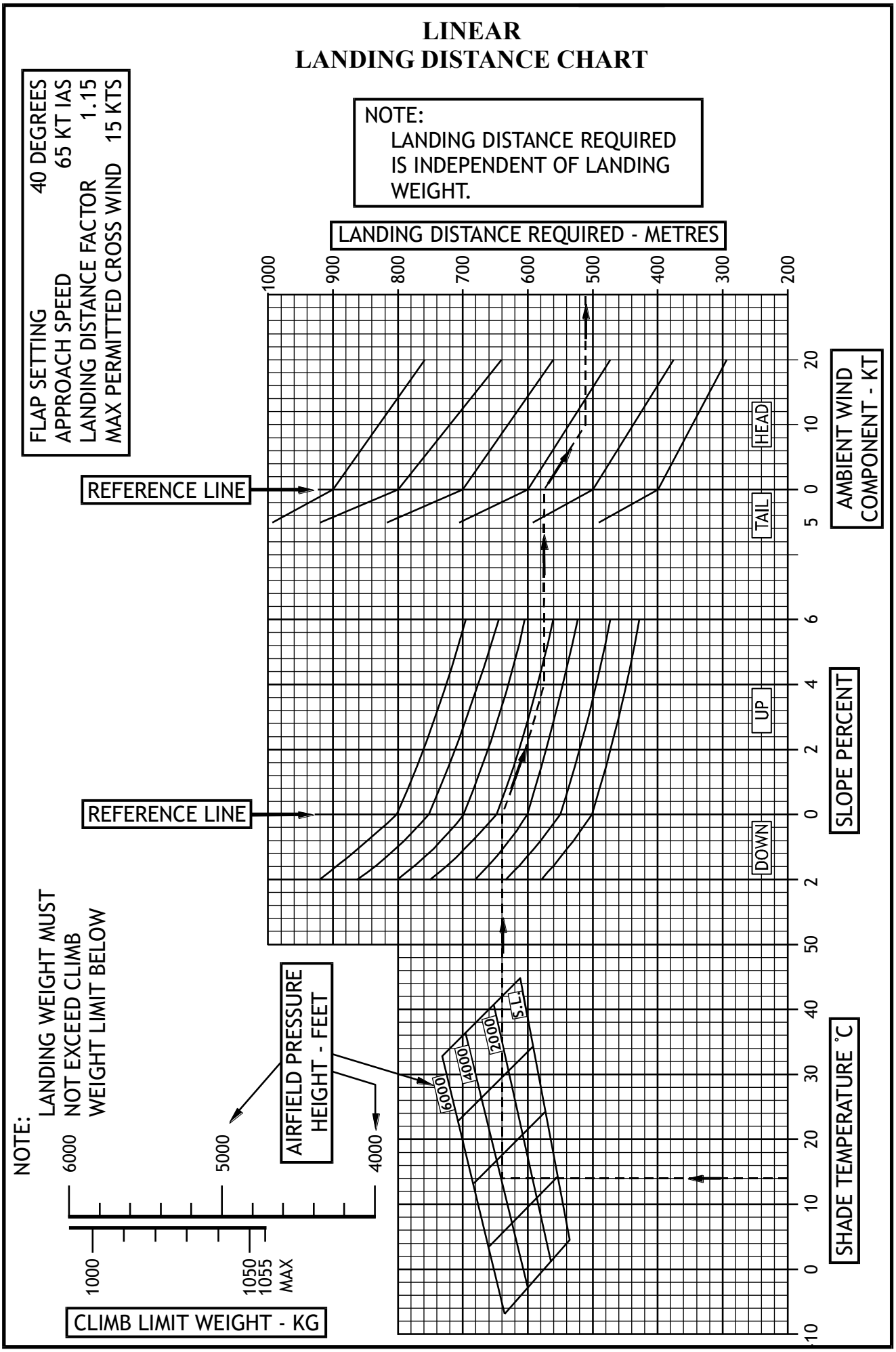


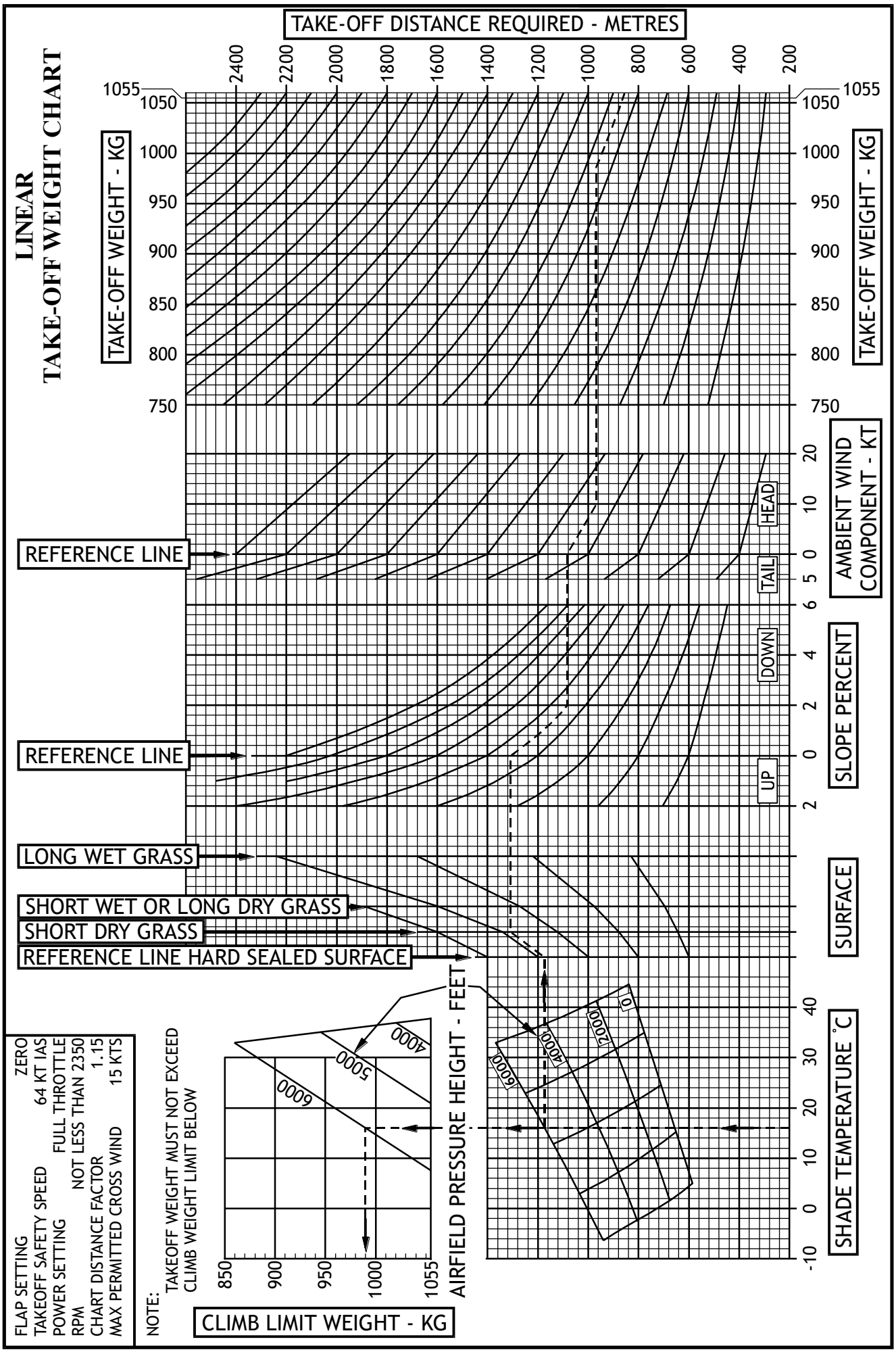

NOTES:

(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 |


LINEAR
LANDING DISTANCE CHART
FLAP SETTING 40 DEGREES
APPROACH SPEED 65 KT IAS
LANDING DISTANCE FACTOR 1.15
MAX PERMITTED CROSS WIND 15 KTS
NOTE:
LANDING DISTANCE REQUIRED IS INDEPENDENT OF LANDING WEIGHT.
LANDING DISTANCE REQUIRED - METRES
1000
900
800
700
600
500
400
300
200
REFERENCE LINE
REFERENCE LINE
HEAD
TAIL
UP
DOWN
AMBIENT WIND COMPONENT - KT
SLOPE PERCENT
SHADE TEMPERATURE °C
20
10
0
5
6
4
2
0
2
50
40
30
20
10
0
10
S.L.
2000
4000
6000
AIRFIELD PRESSURE HEIGHT - FEET
NOTE:
LANDING WEIGHT MUST NOT EXCEED CLIMB WEIGHT LIMIT BELOW
6000
5000
4000
1000
1050
1055 MAX
CLIMB LIMIT WEIGHT - KG


LINEAR
TAKE-OFF WEIGHT CHART
TAKE-OFF DISTANCE REQUIRED - METRES
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
1055
1050
1000
950
900
850
800
750
TAKE-OFF WEIGHT - KG
AMBIENT WIND COMPONENT - KT
HEAD
TAIL
SLOPE PERCENT
UP
DOWN
SURFACE
REFERENCE LINE
REFERENCE LINE
LONG WET GRASS
SHORT WET OR LONG DRY GRASS
SHORT DRY GRASS
REFERENCE LINE HARD SEALED SURFACE
AIRFIELD PRESSURE HEIGHT - FEET
SHADE TEMPERATURE °C
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
NOTE:
TAKEOFF WEIGHT MUST NOT EXCEED
CLIMB WEIGHT LIMIT BELOW
4000
5000
6000
850
900
950
1000
1055
CLIMB LIMIT WEIGHT - KG

## 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**.

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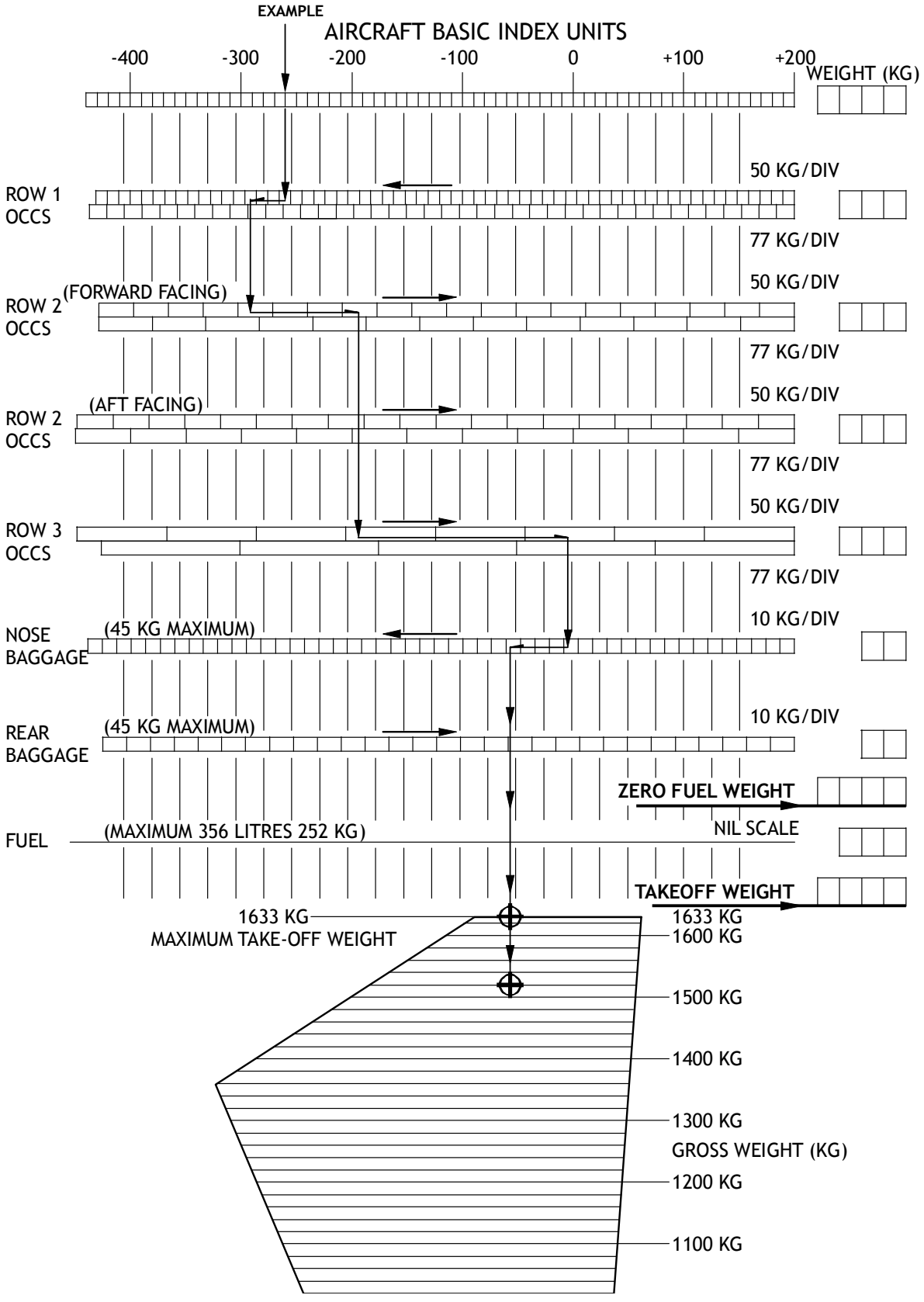
**EXAMPLE:**

| | |
|---|---|
| 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



## 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

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**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**

Note: The graph titled LOADING SYSTEM BRAVO on the next page is relic of the days before the availability of calculators. Enter at the load in pounds on the left axis, move horizontally to the loading station line, then move vertically down to extract the moment index on the bottom horizontal axis.

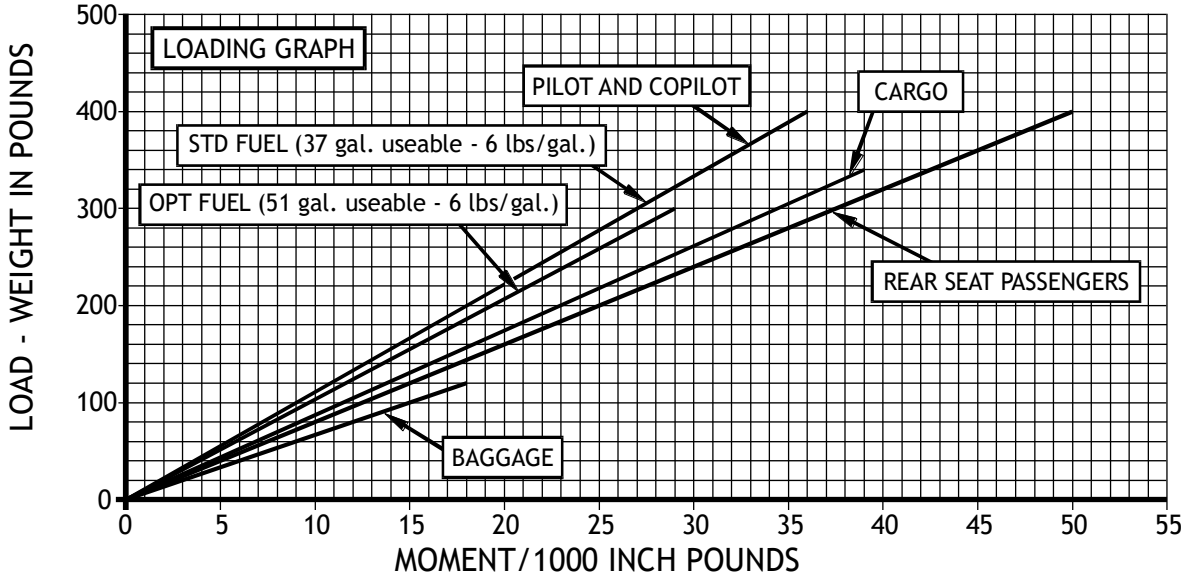
A far simpler method of obtaining the moment generated by any weight in any particular location is simply to multiply the weight in pounds by the arm in inches from the example table above and then divide by 1000. That table will be found in the Examination Workbook supplied in the exam.

Example: 25 pounds placed in the cargo compartment would create a moment index of 3.78.

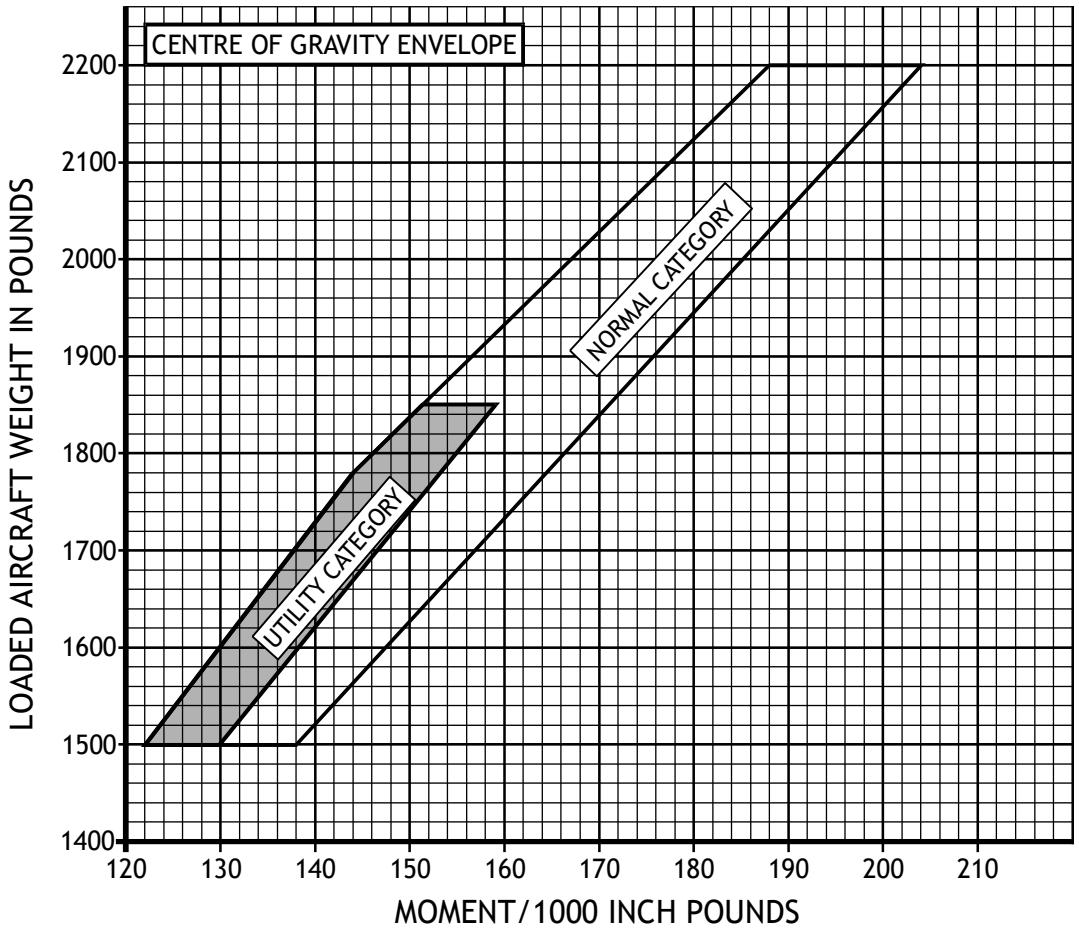
25 x 151 ÷ 1000 = 3.78

# LOADING SYSTEM BRAVO

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

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**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

| | | | |
|---|---|---|---|
| Arm for row 1 | 2750 mm | Arm for row 2 | 3600 mm |
| Arm for engine oil | 1230 mm | Arm for fuel tanks | 2950 mm |
| Arm for baggage | 4210 mm | | |

## 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 |

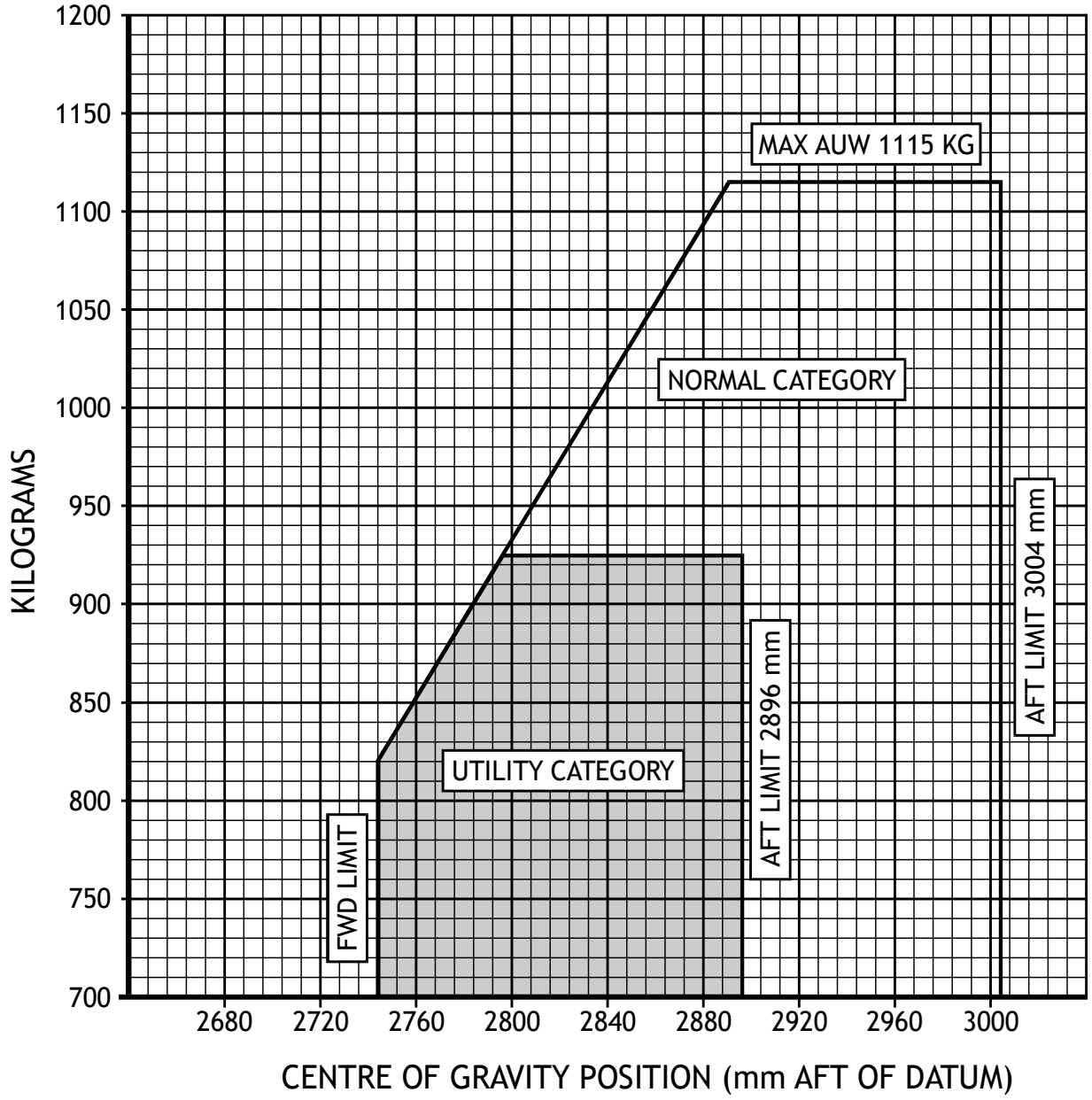
### OCCUPANTS

| 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




## 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

# COMPANY POLICY

## EXTRACT FROM COMPANY OPERATIONS MANUAL FOR THE ECHO AEROPLANE

Fuel Reserves

Fuel reserves [for all flights] shall be carried in accordance with CASR Part 91 MOS 19.02 Table 19.02 (2)

The fuel reserve recommended for a small piston-engine VFR Air Transport Flight is-

Final Reserve Fuel to allow 30 mins over the destination for private flights.
Final Reserve Fuel to allow 45 mins over the destination for air transport flights*.
Contingency Fuel equal to 10% of the trip fuel for air transport flights*.
Final Reserve Fuel for the ECHO aeroplane is calculated at 20 gal/hr.
Start-up and Taxi fuel allowance for the ECHO aeroplane is 3 gal.
*See Part 135 MOS Chapter 7 para 7.02 refers to air transport flights.

For the sake of exercises in this book the fuel reserves and allowances for the Echo aeroplane should be according to the instructions on Page 14 of this supplement unless the question specifies otherwise.

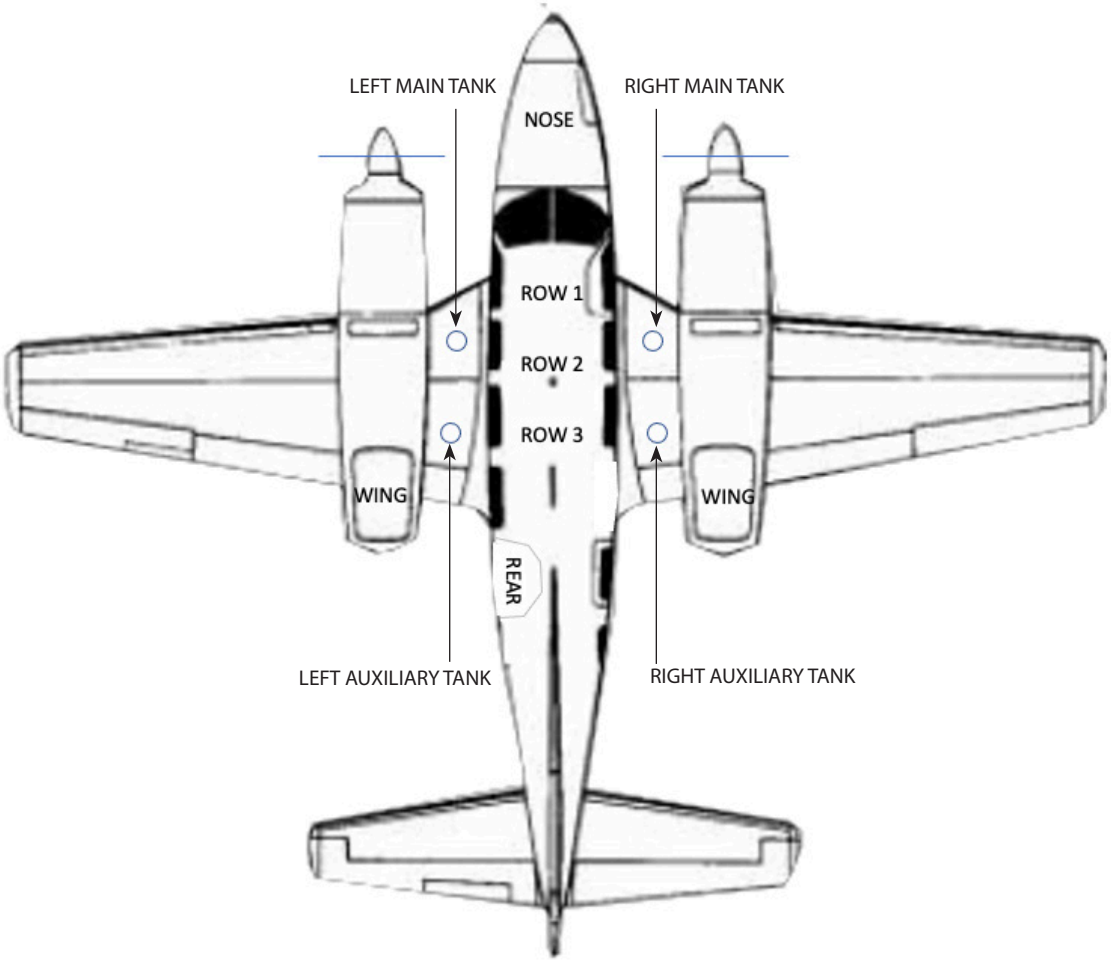
The data presented in paragraphs
2.1, 2.3, 3.1, 3.2, 4.2, 4.4, and 4.5
may be required for exercises and tests contained in the CPL Performance Book.
The CASA exam will provide this type of information in the individual question texts.

PERFORMANCE DATA FOR THE ECHO AEROPLANE.

NOTE THAT IN THE CASA EXAM YOU WILL NOT BE GIVEN THE FUEL POLICY,
RATE OF CLIMB, TAS OR FUEL FLOW TABLES.

THESE ITEMS WILL SIMPLY BE STATED IN THE QUESTION TEXT.

The Echo is a twin engine, six place unpressurised aircraft. It is fitted with fuel injected, turbo charged engines with fully feathering constant speed propellers. The aircraft is equipped with oxygen to allow flight at any level up to and including 20,000 feet. It has four separate cargo compartments the details of which are given on Page 18.




Removal of seats for freight operations.

The cabin seats are easily removable and may be stowed in the rear compartment or left at the departure aerodrome to increase the volumetric capacity of the cabin.

AIRCRAFT FUEL CAPACITY

2.1 Two main and two auxiliary fuel tanks are fitted.

| | Usable Fuel US Gallons | Unusable Fuel US Gallons | Total Fuel US Gallons |
|---|---|---|---|
| MAIN TANKS: | | | |
| Left | 50 | 2 | 52 |
| Right | 50 | 2 | 52 |
| AUXILIARIES | | | |
| Left | 40 | 3 | 43 |
| Right | 40 | 3 | 43 |
| TOTAL | 180 | 10 | 190 |

2.2 The specific gravity of the fuel is 0.72, and the weight of all unusable fuel and all engine oil is included in the aircraft's Basic Empty Weight.

THE ECHO AEROPLANE FUEL POLICY FOR EXERCISES IN THIS BOOK.
(CASR Part 135 Chapter 7 para 7.02)

2.3 Allowance for start-up and taxi is.....3 US Gallons
Reserves [for all flights]
Contingency fuel.....10% of trip fuel
Final Reserve Fuel [45 minutes minutes @ 20 US Gal/Hr.....15 US Gallons
Holding Fuel when required .....at 45% MCP*
* See para 4.5 for fuel flow figures.

Trip fuel is the fuel calculated to be consumed from take-off to arriving over the top of the destination aerodrome. For the purpose of examination questions, make no allowance for climbs or descents.

2.4 When refuelling the main tanks should be filled to capacity first. The auxiliary tanks should be used only if the required fuel cannot be accommodated in the mains.

2.5 Use MAIN TANKS for start-up, taxi, take-off, climb and descent. Once in cruise, the AUXILIARY TANKS should be selected and all auxiliary fuel should be used before the main tanks are used.

Operating Limitations:

3.1 Never Exceed Speed [Vne].....230 kt IAS
Normal Operating Speed [Vno or Maximum Structural Cruising].....199 kt IAS
Maximum Flaps Extended [Vfe].....156 kt IAS
Landing Gear Extended [Vle].....139 kt IAS
Single engine Minimum Control Speed [Vmc].....75 kt IAS
Manoeuvring Speed [Va or Maximum Control Deflection].....160 kt IAS
Maximum cross wind component.....20kt
Maximum downwind component take-off or landing.....5kt

3.2 Engine Limitations.

| | Take-off Power Power [limit of 3 minutes] | Maximum Continuous |
|---|---|---|
| Maximum RPM | 3200 | 3200 |
| Manifold Pressure | 37.4 "Hg | 34.5"Hg |
| Mixture | Rich | Rich |
| Brake Horse Power | 375 per engine | 340perengine |

3.3 Maximum Crosswind Component for take-off or landing.....20 kt.

3.4 Maximum Tailwind Component for take-off or landing.....5 kt

Performance Data.

4.1 Take off and Landing performance is given in the form of 'P' charts within this manual. The Echo is not to be operated into or out of any landing area that does not meettheperformancelimitationsobtainedbytheuseofthesecharts.Foranysealedor gravel surface, the 'short dry grass' reference line on the take-off chart should be used.

4.2 Maximum Climb Performance [Maximum Rate of Climb]. Use 100% MCP. The maximum climb performance expected at various combinations of Pressure Height andGrossWeightisgiveninthetablebelow.Notethattheperformancegiven assumes ISA conditions. If temperature deviates from ISA, density height should be used instead of pressure height.

MAXIMUM RATE OF CLIMB Gross Weight - TWO ENGINES

| Pressure Height ISA | 2950 | | 2500 | | 2000 kg | |
|---|---|---|---|---|---|---|
| feet. | TAS | ROC | TAS | ROC | TAS | ROC |
| Sea level | 101 | 1600 | 92 | 2250 | 82 | 2950 |
| 5000 | 109 | 1500 | 99 | 2100 | 88 | 2800 |
| 10000 | 118 | 1400 | 107 | 1950 | 95 | 2650 |
| 15000 | 128 | 1300 | 116 | 1800 | 104 | 2500 |
| 20000 | 139 | 800 | 126 | 1250 | 112 | 1800 |

MAXIMUM RATE OF CLIMB Gross Weight - ONE ENGINE

| Pressure Height ISA | 2950 kg | | 2500 kg | | 2000 kg | |
|---|---|---|---|---|---|---|
| feet. | TAS | ROC | TAS | ROC | TAS | ROC |
| Sea level | 105 | 280 | 97 | 525 | 92 | 780 |
| 5000 | 112 | 200 | 103 | 450 | 98 | 700 |
| 10000 | 120 | 100 | 111 | 360 | 106 | 625 |
| 15000 | 129 | 20 | 119 | 270 | 115 | 530 |

4.3 The Cruise Climb chart.

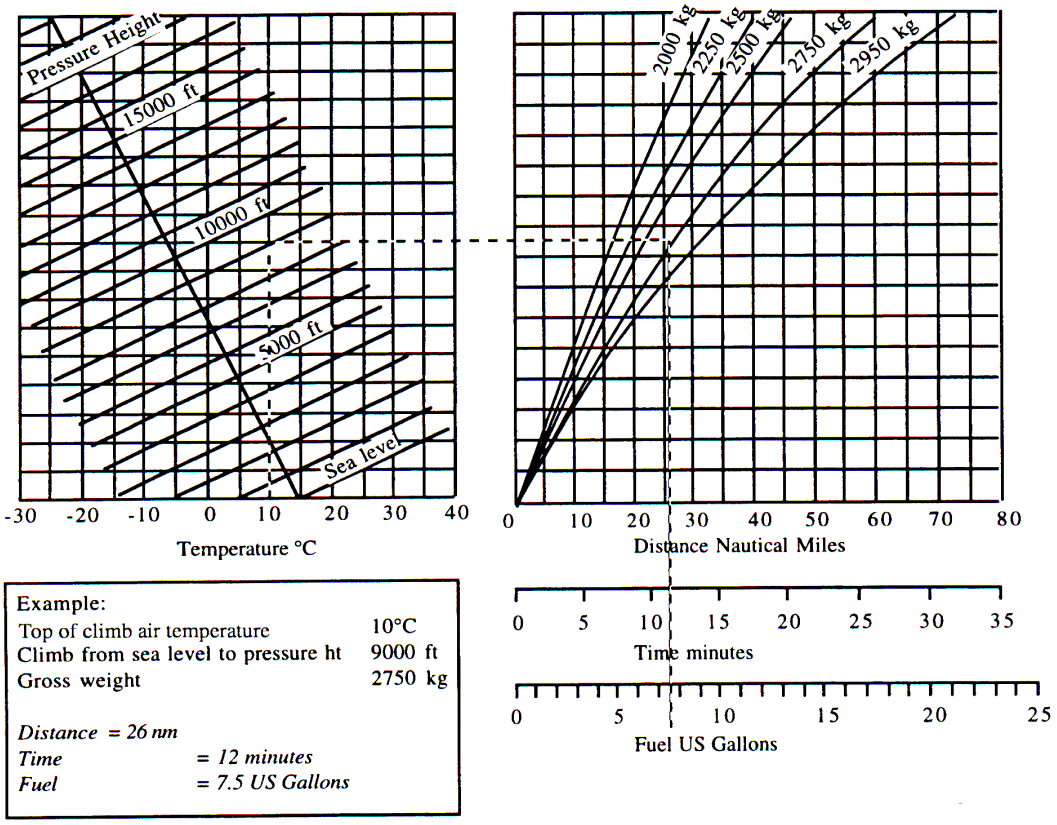
The cruise climb chart shown below gives the distance, time and fuel required to climb in no wind from sea-level to various pressure heights under various temperature and gross weight conditions. The temperatures given at the bottom of the left-hand box are the temperatures at the pressure height to which the climb is being made.

An allowance for wind can be made by calculating the distance represented by the wind speed applied to the duration of the climb. [eg a wind speed of 30 kt for a six minute climb would represent a distance of 3 nm]. This distance should be added to the distance obtained from the graph for a tailwind, and subtracted for a headwind. The time and fuel required for any given climb will not be affected by wind.

The most accurate method for obtaining the figures for a climb from an aerodrome at other than sea level [eg from 5000 ft to 15000 ft], is to calculate the set of figures from sea-level to 15000 ft, then calculate the set of figures from sea-level to 5000 ft and subtract the 5000 ft figures from the 15000 ft figures.

Power to be used for cruise climb is 75% MCP with mixture rich.
Climbing Indicated Airspeed for a cruise climb is 120kt.

CRUISE CLIMB - TWO ENGINES




Power used for cruise climb is 75% MCP with the mixture rich.
Climbing indicated airspeed for a cruise climb is 120 kt .

NOTE THAT IN THE CASA EXAM YOU WILL NOT BE GIVEN THE TAS TABLE.
THE TAS TO USE WILL SIMPLY BE GIVEN IN THE QUESTION DATA.

4.4 The TAS that may be planned for cruise at various pressure heights, temperatures, gross weights and power settings are shown in the tabe below.

| TAS knots GROSS WEIGHT | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Press Ht | Temp | 2950kg | | | | | 2500kg | | | | | 2000kg | | | | |
| | | 75% | 65% | 55% | 45% | 35% | 75% | 65% | 55% | 45% | 35% | 75% | 65% | 55% | 45% | 35% |
| SL | ISA - 20 | 177 | 165 | 156 | 142 | 116 | 180 | 168 | 159 | 145 | 118 | 184 | 171 | 161 | 149 | 120 |
| 5000 | | 185 | 172 | 160 | 145 | 116 | 188 | 172 | 163 | 147 | 119 | 192 | 178 | 166 | 151 | 121 |
| 10,000 | | 193 | 179 | 165 | 147 | 117 | 196 | 182 | 168 | 150 | 119 | 201 | 185 | 171 | 153 | 122 |
| 15.000 | | 201 | 185 | 165 | 147 | 116 | 204 | 189 | 173 | 152 | 117 | 209 | 193 | 177 | 155 | 120 |
| 20,000 | | 209 | 193 | 174 | 150 | ---- | 213 | 197 | 178 | 154 | ---- | 217 | 201 | 182 | 157 | ---- |
| SL | ISA | 181 | 168 | 158 | 144 | 116 | 184 | 171 | 161 | 146 | 118 | 188 | 174 | 164 | 149 | 121 |
| 5000 | | 189 | 175 | 162 | 146 | 117 | 192 | 178 | 165 | 148 | 119 | 198 | 181 | 169 | 152 | 122 |
| 10.000 | | 197 | 182 | 166 | 148 | 117 | 200 | 185 | 170 | 151 | 119 | 205 | 189 | 174 | 154 | 122 |
| 15,000 | | 205 | 189 | 171 | 150 | 114 | 208 | 192 | 176 | 154 | 116 | 213 | 196 | 184 | 156 | 118 |
| 20,000 | | 213 | 198 | 177 | 151 | ---- | 217 | 201 | 180 | 154 | ---- | 221 | 208 | 189 | 157 | ---- |
| SL | ISA + 20 | 185 | 171 | 160 | 145 | 116 | 187 | 174 | 163 | 147 | 119 | 191 | 177 | 166 | 151 | 121 |
| 5000 | | 192 | 178 | 166 | 145 | 116 | 195 | 181 | 166 | 150 | 119 | 200 | 185 | 171 | 153 | 122 |
| 10,000 | | 200 | 185 | 170 | 149 | 116 | 204 | 188 | 173 | 152 | 118 | 208 | 192 | 176 | 155 | 121 |
| 15.000 | | 209 | 193 | 173 | 151 | ---- | 212 | 196 | 178 | 154 | ---- | 217 | 200 | 182 | 157 | ---- |
| 20,000 | | 216 | 201 | 179 | 149 | ---- | 221 | 205 | 183 | 152 | ---- | 225 | 209 | 186 | 155 | ---- |

NOTE: THE CASA EXAM WILL NOT GIVE YOU THE FUEL FLOW TABLE.
THE FUEL FLOW TO USE WILL SIMPLY BE GIVEN IN THE QUESTION DATA.

4.5 The fuel flow that can be planned for various power settings is shown in the table below. Fuel flow depends only on the engine power output and is unaffected by the aircraft gross weight and cruising level.

The mixture should be leaned to best economy at all power settings except for 100% and take-off power, or during cruise climbs or as a means of controlling engine over-heating.

| FUEL FLOWS PER ENGINE IN US GALLONS PER HOUR | | |
|---|---|---|
| Engine Power % MCP. | Mixture leaned to best economy. | Mixture fully rich. |
| 100% | not available | 31.7* |
| 75% | 16.3 | 19.7 |
| 65% | 14.0 | 16.9 |
| 55% | 11.8 | 14.1 |
| 45% | 10.2 | 11.8 |
| 35% | 8.6 | 9.3 |

*100% power is not available above 15.000 feet.

THE FOLLOWING WEIGHT AND BALANCE DATA WILL BE SUPPLIED IN THE EXAMINATION WORKBOOK PROVIDED IN THE CASA EXAMINATION.

## LOADING SYSTEM ECHO

### INSTRUCTIONS FOR USE OF LOADING SYSTEM

1 Obtain the aeroplane basic empty weight and index units from the examination question. Multiply the weight (in kg) in each compartment by the arm (in mm) of that compartment to obtain the moment in kg/mm. Divide the moment in kg/mm by 10000 to obtain the corresponding moment index (index units).

2 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 (Fig 11, page 21) 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.

ECHO WEIGHT TO MOMENT CONVERSION

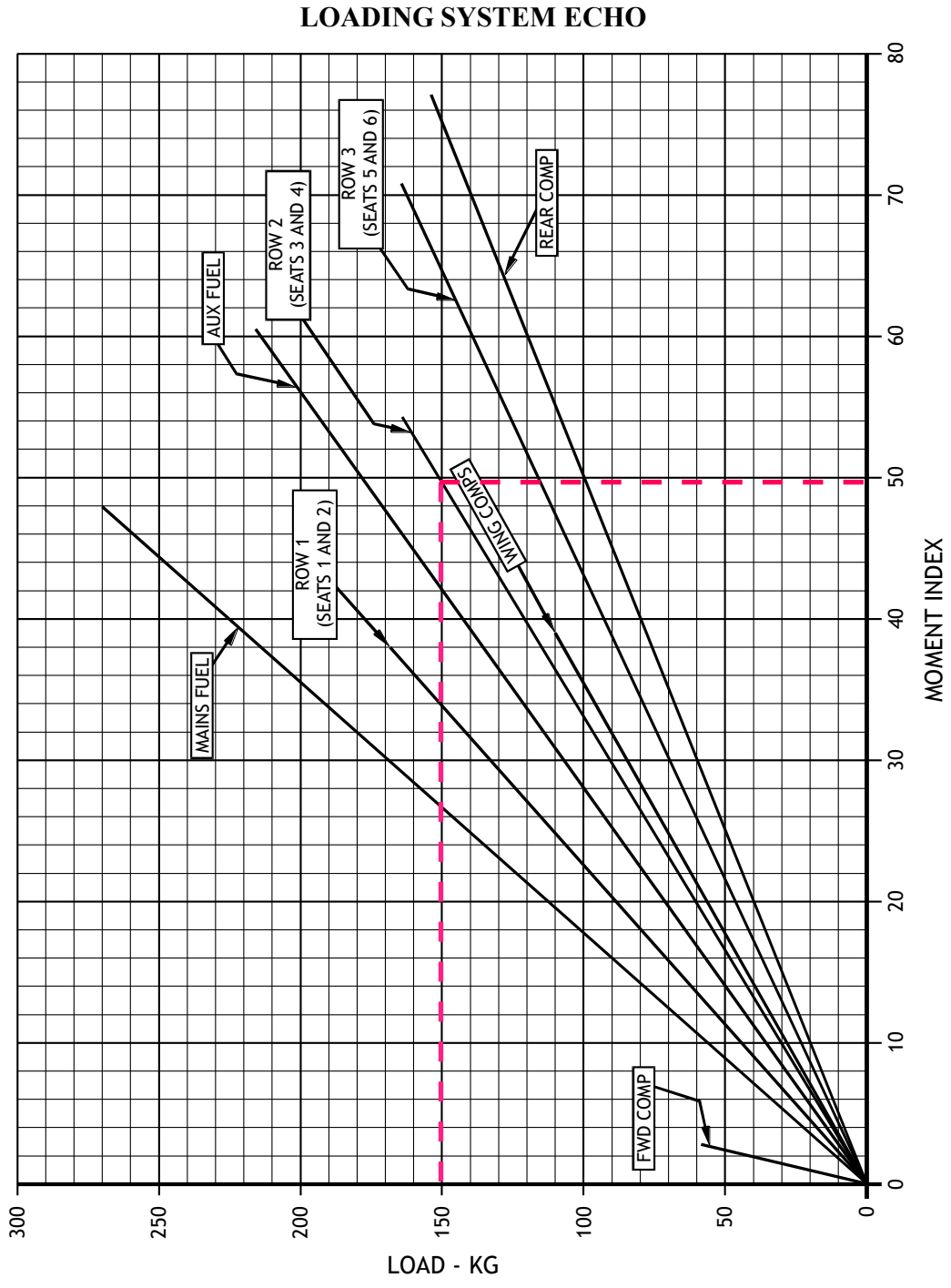
This graph allows you to determine the moment (in index units) generated by placing weight in any compartment of the ECHO aeroplane.

Example: 150kg placed in Row 2 will generate a moment index of just under 50 index units.

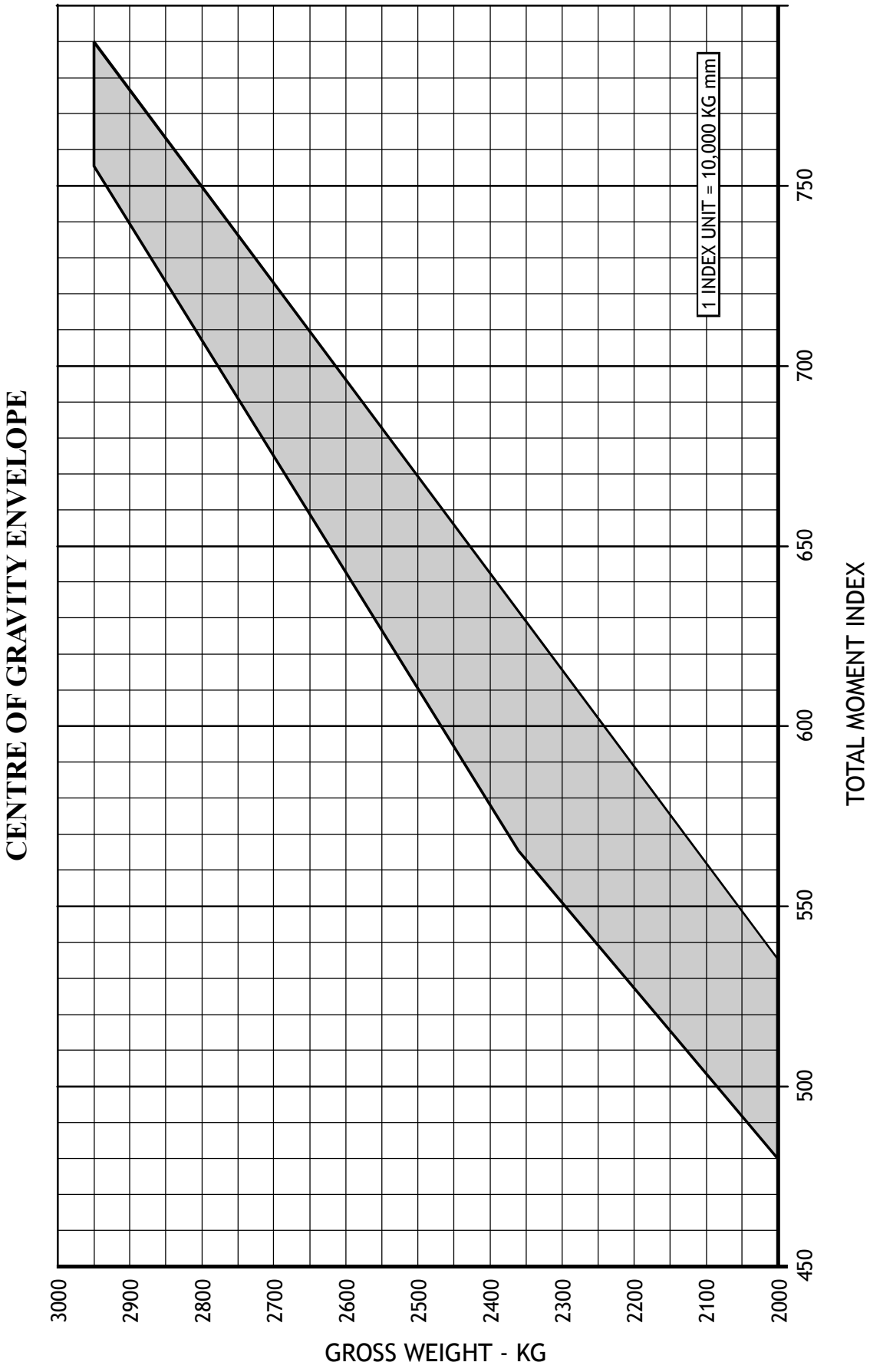
A much simpler way to find the moment is to use your calculator. Multiply the weight by the compartment arm and divide by 10,000. In the example below:

150kg x 3300mm ÷ 10,000 = 49.5 index units.

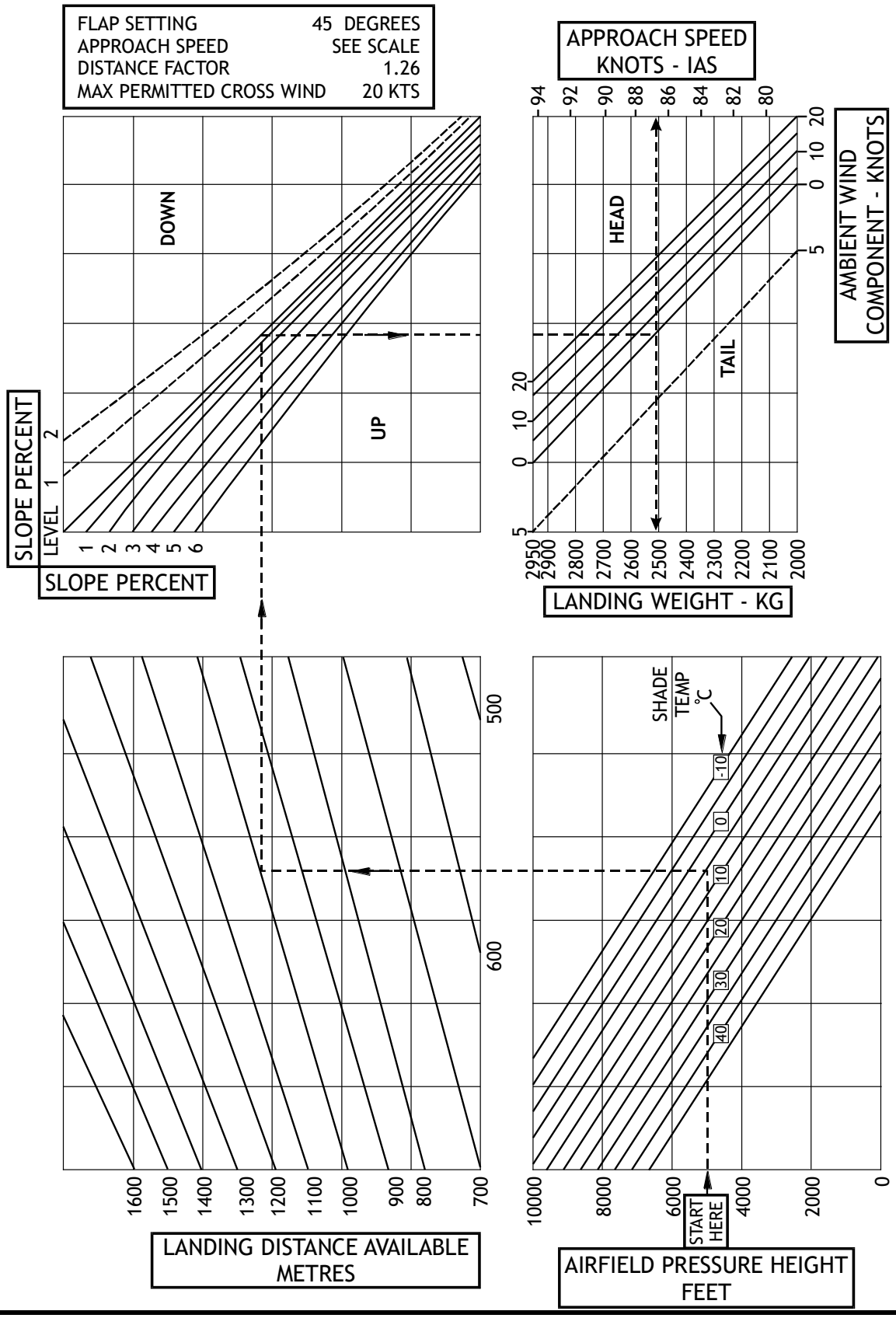
I recommend that you use the calculator rather than the graph below to obtain moment index.



## LOADING SYSTEM ECHO



**LANDING WEIGHT CHART**
**AIRCRAFT - ECHO**
**Figure 13**



# TAKE-OFF WEIGHT CHART
## AIRCRAFT - ECHO

| | |
|---|---|
| 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 |