SECTION 5

PERFORMANCE

The use of data in this section is mandatory only when required by the Air Navigation Order or Regulations; otherwise its use, although most desirable on the grounds of safety, is at the discretion of the pilot in command of the aeroplane.

GENERAL

CONDITION OF AEROPLANE

The information in this section relates to a standard Bulldog Series 100 aeroplane, as shown in Figure 1-1, powered by an Avco-Lycoming IO-360-A1B6 engine fitted with a Hartzell two-blade constant speeding propeller type HC-C2YK-4/C7666A-2 or HC-C2YK-4F/FC7666A-2.

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COMPLIANCE WITH THE AIR NAVIGATION ORDER AND GENERAL REGULATIONS

Performance Group

This aeroplane is classified in Performance Group D.

Flight Over Water

The true airspeed to be assumed is 100 kn (185 km/h).

VALIDITY OF PERFORMANCE INFORMATION

The performance information contained in this section is not valid if:

(1) the total loaded weight exceeds the relevant maximum permissible (take-off or landing) weight appropriate to the altitude and temperature;

(2) the aeroplane is flown when the outside air temperature exceeds the appropriate maximum temperature for which operational suitability has been established;

(3) readings from the charts are obtained by extrapolation (ie, by using values of parameters outside the range given on the charts), except as and when specifically permitted.

NOTE: At temperatures below the lowest range scheduled, the performance shall be assumed to be not better than that appropriate to the lowest temperature scheduled.

Amend No 2

(4) a propeller of a type differing from those stated in CONDITION OF AEROPLANE is fitted;

(5) external modifications causing a significant increase in the aerodynamic drag are incorporated.

WIND COMPONENT

A graph to enable winds of known velocity to be converted into components along and at right angles to the direction of the intended flight path (ie, head or tail wind component and crosswind component respectively) is given in Figure 5-1 opposite. Arrowed example lines illustrate its use.

PITOT-STATIC HEAD POSITION

A diagram showing the position in which the pitot-static head is installed on this aeroplane is given in Figure 5-2 on Page 5-4.

POSITION AND COMPRESSIBILITY ERROR CORRECTIONS

The position and compressibility error correction (PEC) to be applied to the IAS to obtain EAS is shown in Figure 5-3 on Page 5-5 for wing-flaps retracted (UP setting), Figure 5-4 on Page 5-6 for wing-flaps extended to the 10° degree position (INTER setting) and Figure 5-5 on Page 5-7 for wing-flaps extended to the 45° degree position (FULL setting).

The static error correction to be applied to the altimeter is negligible in all cases.

NOTE: These corrections apply only when the pitot-static system defined in Figure 5-2 is installed.

STALLING SPEEDS

The power-off stalling speeds are as follows:

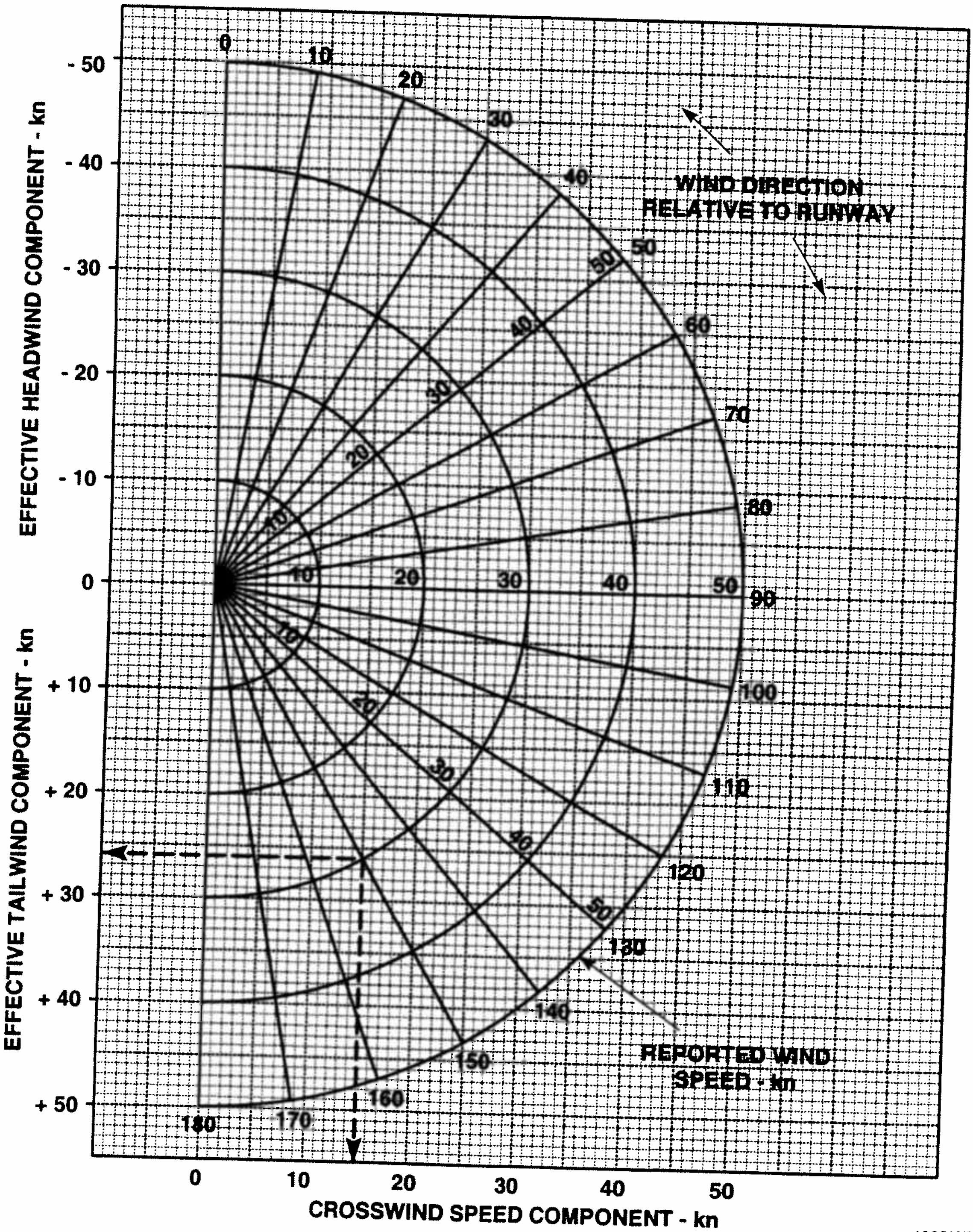
Amend No 4

Speed Units	Weight (kg)		1066		900		800		EAS Symbol
	Wing-Flap		Power-off Stalling Speed						
	Position (o)	Setting	IAS	EAS	IAS	EAS	IAS	EAS	
kn	0	UP	53.0	57.5	50.0	54.0	47.0	51.0	>V_{s1}
	10	INTER	50.5	55.5	48.0	52.0	45.5	49.0	
	45	FULL	50.0	54.0	48.0	51.0	45.5	48.0	V_{s0}
km/h	0	UP	98.0	106.5	92.5	100.0	87.0	94.5	>V_{s1}
	10	INTER	93.5	103.0	89.0	96.0	84.0	91.0	
	45	FULL	92.5	100.0	89.0	94.5	84.0	89.0	V_{s0}

The effect of angles of bank is to increase the speeds stated above by the following:

Angle of Bank (o)	Increase in Speed	
	kn	km/h
20	2	4
40	9	17
60	27	50

CONVERSION OF WIND VELOCITIES



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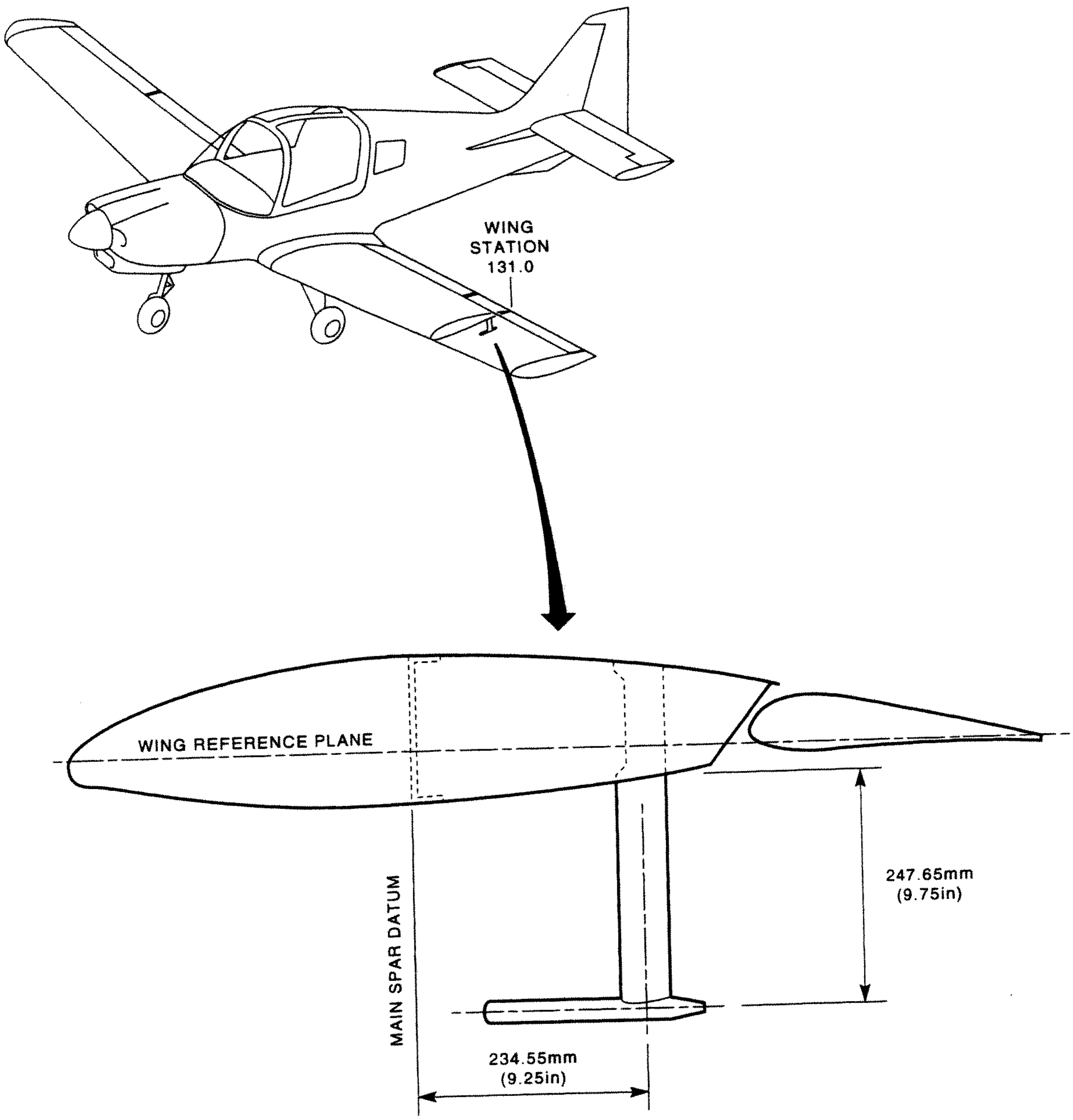
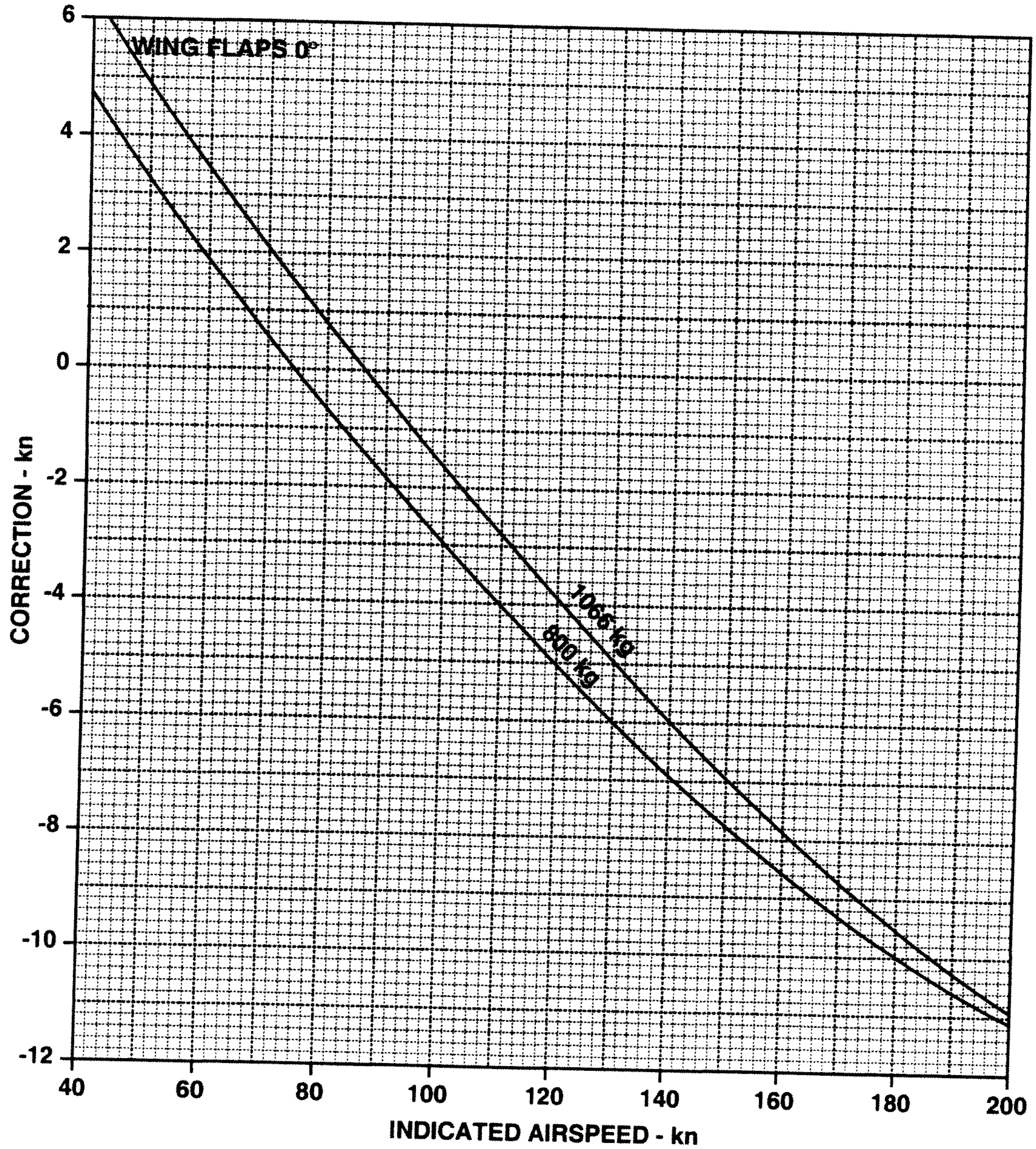
POSITION OF PITOT-STATIC HEAD



POSITION AND COMPRESSIBILITY ERROR CORRECTION TO AIR SPEED INDICATOR



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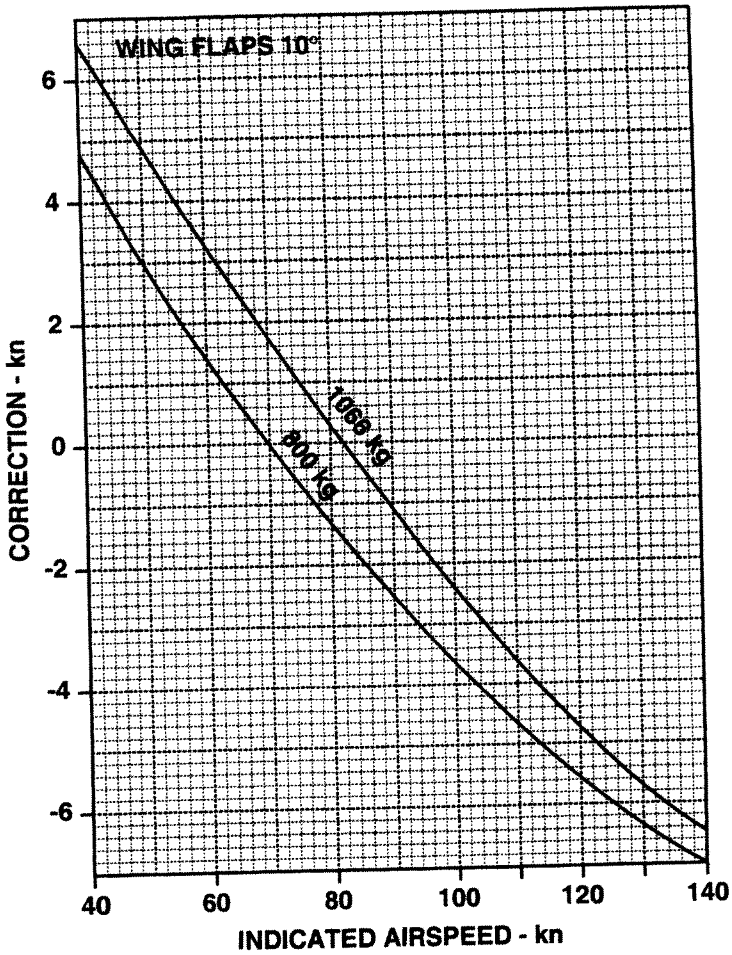
POSITION AND COMPRESSIBILITY ERROR CORRECTION TO AIR SPEED INDICATOR



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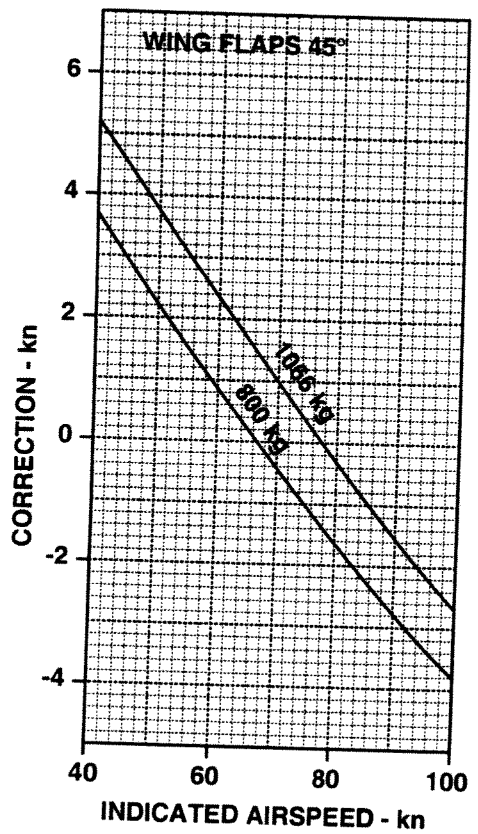
POSITION AND COMPRESSIBILITY ERROR CORRECTION TO AIR SPEED INDICATOR



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TAKE-OFF PROCEDURES AND SPEEDS

MAXIMUM CROSSWIND COMPONENT

The maximum crosswind component in which take-off has been demonstrated is 35 kn (65 km/h) measured at a height of 10 m (33 ft).

AIRSPEED

The take-off safety speed, V_2, with the wing-flaps in the 10° position (INTER setting) is given in Figure 5-6 opposite.

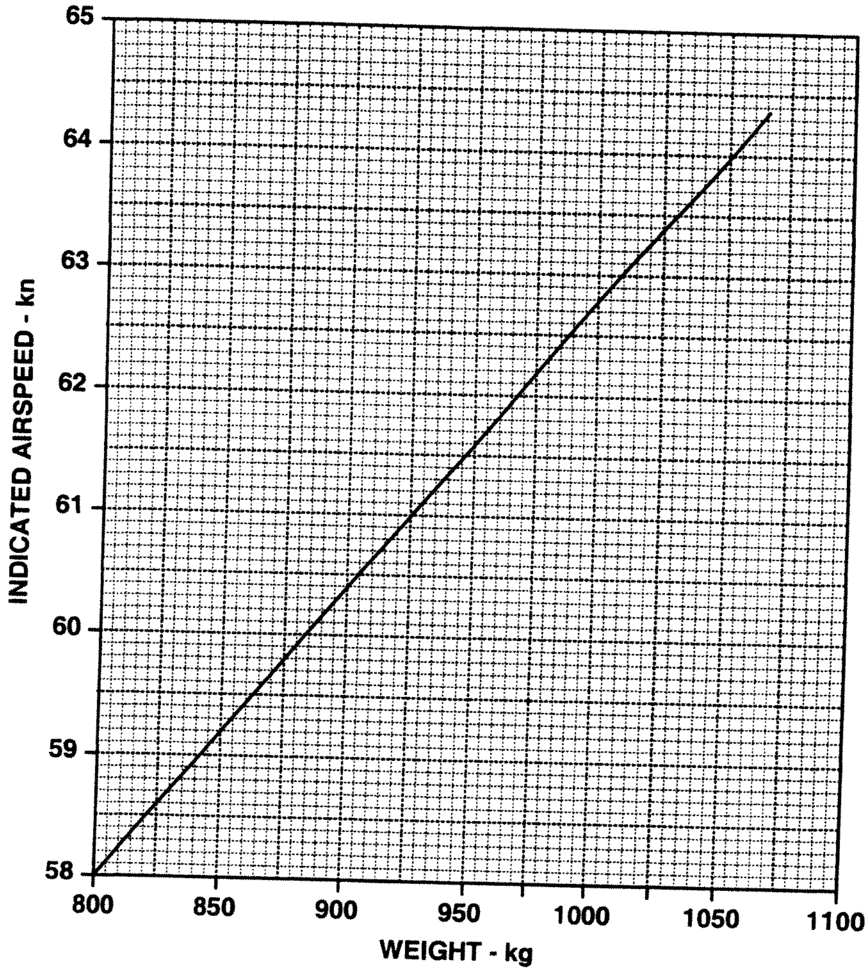
TECHNIQUE

The technique upon which the take-off performance information scheduled in this section is based is as follows.

With the wing-flaps in the 10° position (INTER setting) and the engine at maximum power, rotate at 45 kn (83 km/h) IAS and lift off at 55 kn (102 km/h) IAS. The aeroplane is then held down until the scheduled take-off safety speed appropriate to the take-off weight is reached then climbed away at this speed through the 50 ft (15 m) height point.

When field length or flight path obstacle clearance is critical, any unnecessary increase in speed above the take-off safety speed should be avoided. Reference should be made to the assumption regarding technique made in the take-off net flight path performance scheduled in this section. This technique gives the optimum obstacle clearance for the most adverse conditions.

TAKE-OFF SAFETY SPEED



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MAXIMUM TAKE-OFF AND LANDING WEIGHT FOR ALTITUDE AND TEMPERATURE

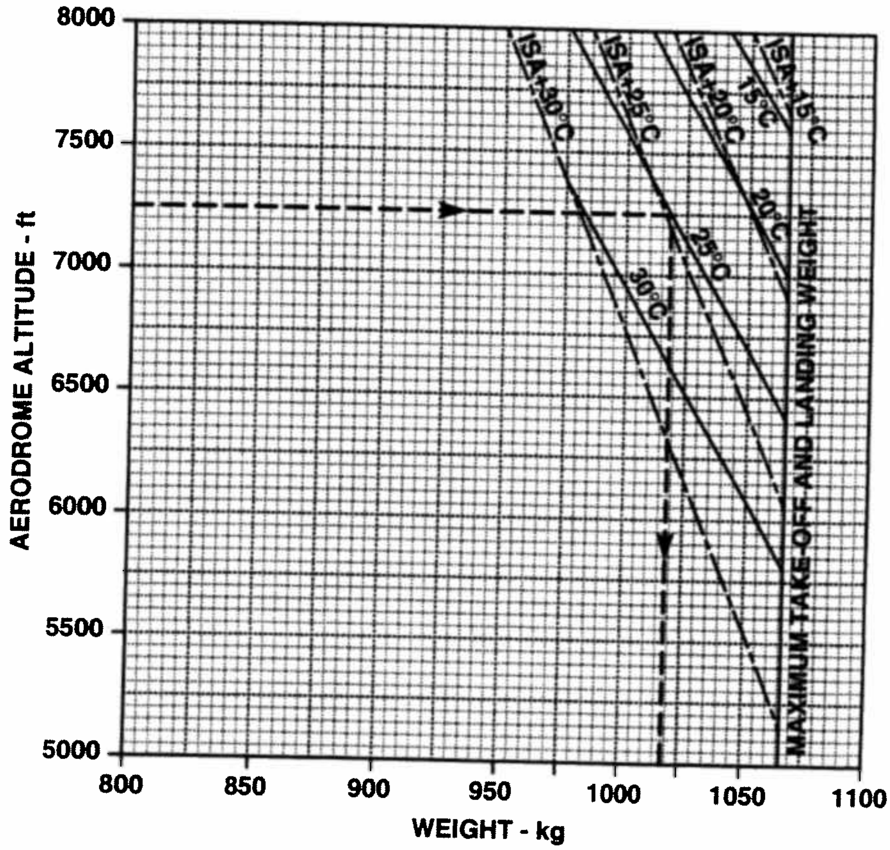
The maximum permissible take-off and landing weight for varying aerodrome altitudes and air temperatures is given in Figure 5-7 opposite.

The use of the chart is illustrated by the arrowed dotted lines. Enter the chart with the aerodrome altitude and proceed horizontally to the appropriate air temperature curve. The maximum permissible weight appropriate to these conditions is then found vertically below this point from the scale at the foot of the chart.

NOTES: (1) At a particular aerodrome, the actual weight may have to be less than the appropriate maximum value obtained from Figure 5-7 due to some operational factor such as field length available or obstacle clearance becoming critical.

(2) The data given in Figure 5-7 has been determined by the take-off climb requirement of a gross rate of climb of not less than 400 ft/min at the take-of surface.

MAXIMUM TAKE-OFF AND LANDING WEIGHT FOR ALTITUDE AND TEMPERATURE



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TAKE-OFF FIELD LENGTHS

The take-off distance required from rest to the 50 ft (15 m) height point is given in Figure 5-8 opposite for varying air temperatures, aerodrome altitudes, weights, reported wind components and uniform runway slopes.

Associated conditions:

Engine	:	Operating at maximum power (2700 rev/min, full throttle).
Induction air	:	COLD.
Wing-flaps	:	INTER (10° position).
Technique	:	After un-stick, the aeroplane is held down until the take-off safety speed appropriate to the weight is reached and is then climbed away at this speed through the 50 ft height point.
Runway	:	Dry hard surface (see Note (2)).

The use of the chart is illustrated by the arrowed dotted lines. Enter the chart with the air temperature and move vertically up to the appropriate aerodrome altitude. From this point proceed horizontally across to the weight grid reference line and follow the curves to the appropriate weight. Then proceed through the reported wind and uniform runway slope grids in the same manner to obtain the take-off distance required from the scale on the right of the chart.

NOTES:

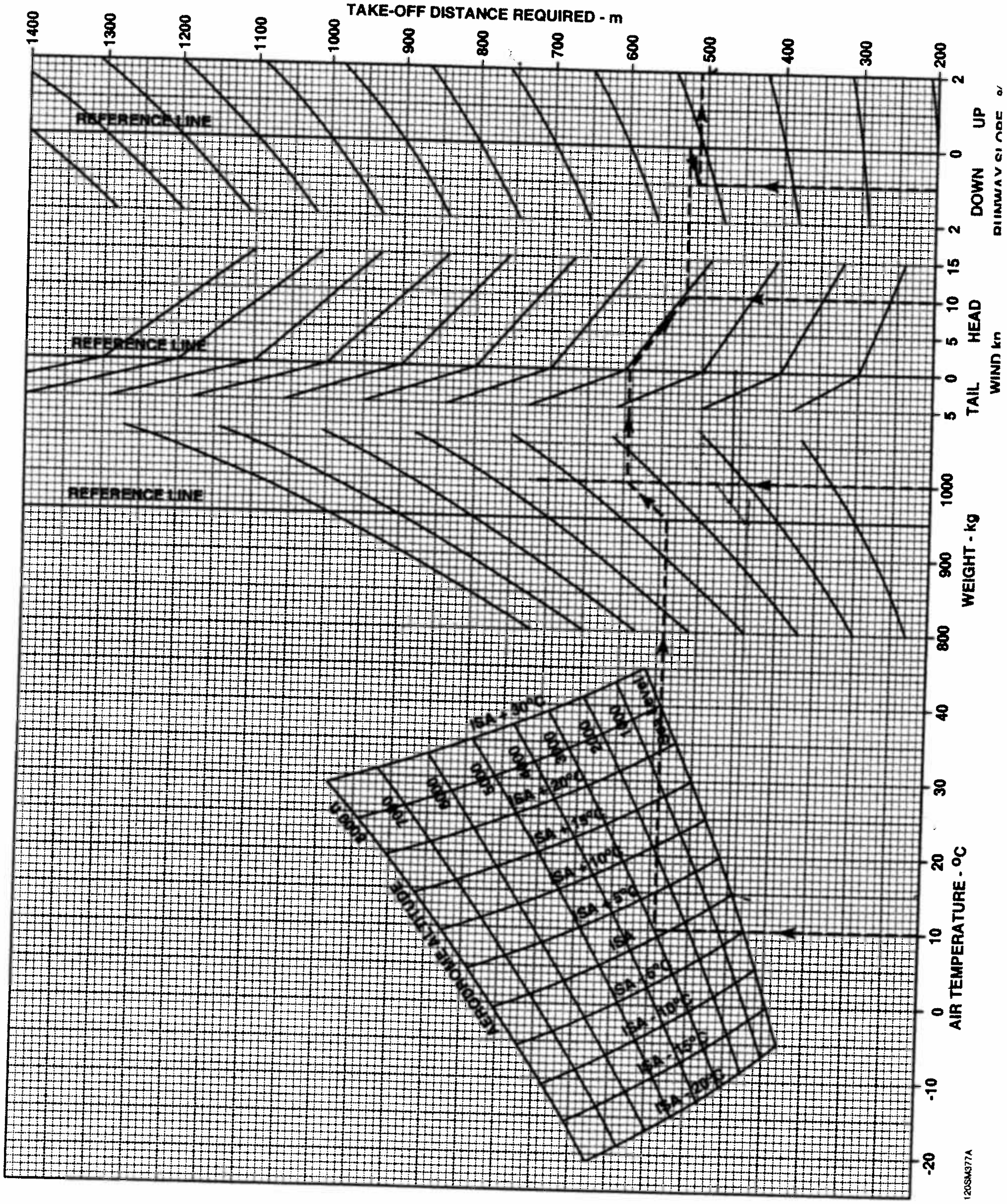
(1) The take-off run required will not exceed, and must be taken as, 67% of the take-of distance required.

(2) For operation from grass surfaces consisting of recently mown, dry grass on a firm subsoil, the distance required obtained from Figure 5-8 should be increased by 14%.

(3) The wind correction grids are factored so that 50% of headwinds and 150% of tailwinds are obtained. Reported winds may therefore be used directly in the grids.

(4) The take-off distance required data given in Figure 5-8 has been obtained by factoring the gross take-off distance by 1.25. Take-off run required is obtained by factoring the gross take-off run by 1.15.

TAKE-OFF DISTANCE REQUIRED



TAKE-OFF NET FLIGHT PATH

INTRODUCTION

The information provided in this sub-section enables a complete take-off net flight path to be constructed from the end of the take-off distance required to a height of 1000 ft (305 m) above the take-off surface. This flight path is to be used to establish that obstacles in the intended direction of take-off are cleared by the safety margins required by the operating regulations.

In circumstances when it is quite clear that all obstacles are less than 1000 ft (305 m) above the take-off surface and it has been established that they can be cleared by the margins required by the operating regulations, there is no need to proceed further with the construction of the take-off net flight path. In the event of obstacles being above 1000 ft (305 m), obstacle clearance must be established by using the en route performance data after completion of the take-off net flight path.

The weight to be used in the charts is that assumed at the beginning of the take-off run. No allowance has been made in constructing the charts for fuel consumed during the take-off run and climb as this is small and introduces only a very small degree of pessimism. Aerodrome altitudes and air temperatures are those applicable to the take-off surface.

Should a significant change in heading be necessary in determining the take-off net flight path, a radius of turn of 610 m (2000 ft) may be assumed for a steady 15° banked turn.

The take-off net flight path construction is based on the assumption that the aeroplane is flown precisely in the manner prescribed. This does not necessarily mean that the technique scheduled is mandatory for all take-offs. The pilot should, however, be aware of the assumptions made particularly when the take-off is limited by obstacle clearance considerations.

A fully worked example is given in the text and illustrated in Figure 5-9 on Page 5-17. Although in this example the weight is assumed to be known and the flight path will in effect give the net heights achieved at all points where an obstacle is known to be located (ie, at known horizontal distances from start), it is also possible, from the charts provided, to obtain the optimum weight for a given obstacle located by height and distance from the start of take-off. This will involve determining the total horizontal distance required (take-off distance required plus take-off net flight path horizontal distance) to achieve the required height for a range of weights, the other conditions remaining constant. The optimum weight is therefore obtained graphically from a plot of the resulting distance against weight as appropriate to the actual horizontal distance to the known obstacle from the start of take-off.

PRESENTATION

The information required to construct a take-off net flight path is given in Figure 5-10 on Page 5-19 and Figure 5-11 on Page 5-21. Should changes in heading become necessary, the radius of turn should be accounted for as described in INTRODUCTION and the effect of the resulting changes in wind components allowed for.

A number of terms relating to the take-off net flight path presentation used in this manual are defined as follows.

Reference Zero: This is the zero to which the co-ordinates of the various points in the take-off net flight path are referred. It is defined by a vertical datum which passes through the 50 ft (15 m) height point at the end of the take-off distance required and a horizontal datum which is 50 ft (15 m) below this point.

First Segment: This segment extends from 50 ft (15 m) above Reference Zero at the end of the take-off distance required to a height of 200 ft (61 m) above the take-off surface at which the air speed is increased to the en route climbing speed and the wing-flaps retracted. This segment therefore comprises two elements, the first being take-off climb at take-off safety speed in take-off configuration, and the second being a horizontal transition to the configuration and airspeed appropriate to final take-off climb.

Second Segment: This segment extends from the end of the First Segment to a height of 1000 ft (305 m) above the take-off surface.

ILLUSTRATED EXAMPLE

An example of the use of take-off net flight path charts is given below and illustrated as a profile in Figure 5-9 opposite for a complete flight path from Reference Zero to 1000 ft (305 m) above the take-off surface. It is assumed that climb-out is made without any change in heading. The elements making up the first segment are shown inset.

Assumed Conditions

Aerodrome altitude	:	3000 ft.
Air temperature	:	10°C (ISA + 1°C).
Weight	:	1000 kg.
Wind	:	Reported headwind component of 10 kn.

This example is shown by the arrowed dotted lines in Figures 5-10 and 5-11.

Calculation

The position of Reference Zero is established at the end of either the take-off distance required or the take-off distance available, whichever is the lesser. This therefore fixes point A, the start of the First Segment, which is 50 ft above Reference Zero, and establishes the flight path relative to the runway and to the flight path obstacles. The calculation of the flight path then proceeds as follows:

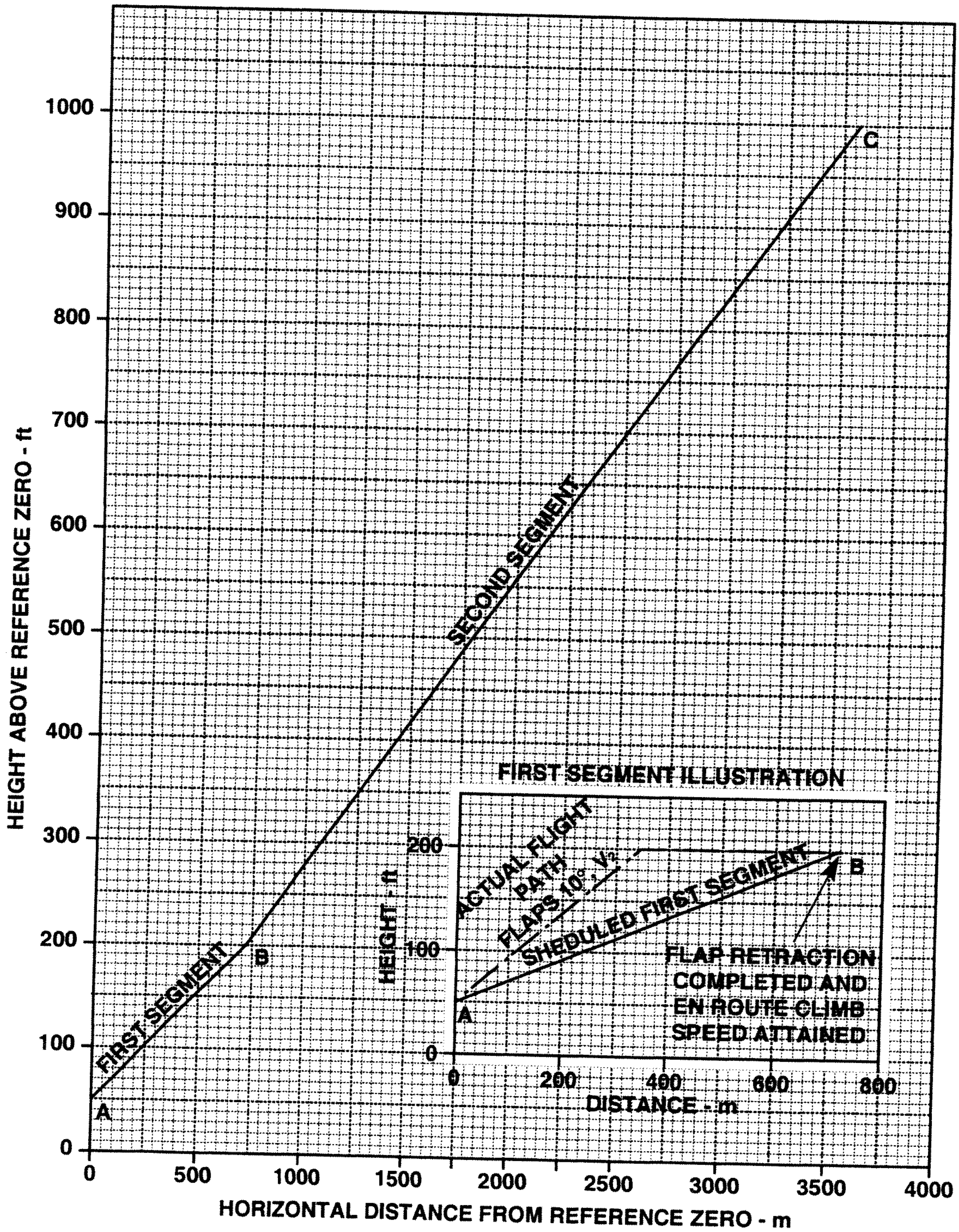
First Segment (AB) : From Figure 5-10, horizontal distance AB = 728 m

Second Segment (BC) : From Figure 5-11,
net gradient of climb = 8.55%
Height increment = 1000 - 200 = 800 ft
A 4 Horizontal distance = $\frac{800 \times 100}{8.55}$
= 9357 ft
= 2852 m

Total distance to point C (at 1000 ft) = 3580 m

The point C is now fixed.

TAKE-OFF NET FLIGHT PATH - EXAMPLE



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TAKE-OFF NET FLIGHT PATH I - FIRST SEGMENT

The horizontal distance travelled from Reference Zero to the completion of wing-flap retraction and the attainment of the en route climbing speed at a height of 200 ft (61 m) above the take-off surface is given in Figure 5-10 opposite for varying air temperatures, aerodrome altitudes, weights, and reported wind components.

Associated conditions:

Engine	:	Operating at maximum power (2700 rev/min, full throttle).
Induction air	:	COLD.
Wing-flaps	:	INTER (10° position) up to 200 ft (61 m) height point then retracted at this height.
Airspeed	:	Take-off safety speed appropriate to weight (see Figure 5-6) up to 200 ft (61 m) height point, then accelerated to the en route climbing speed appropriate to the altitude (see Page 5-22).

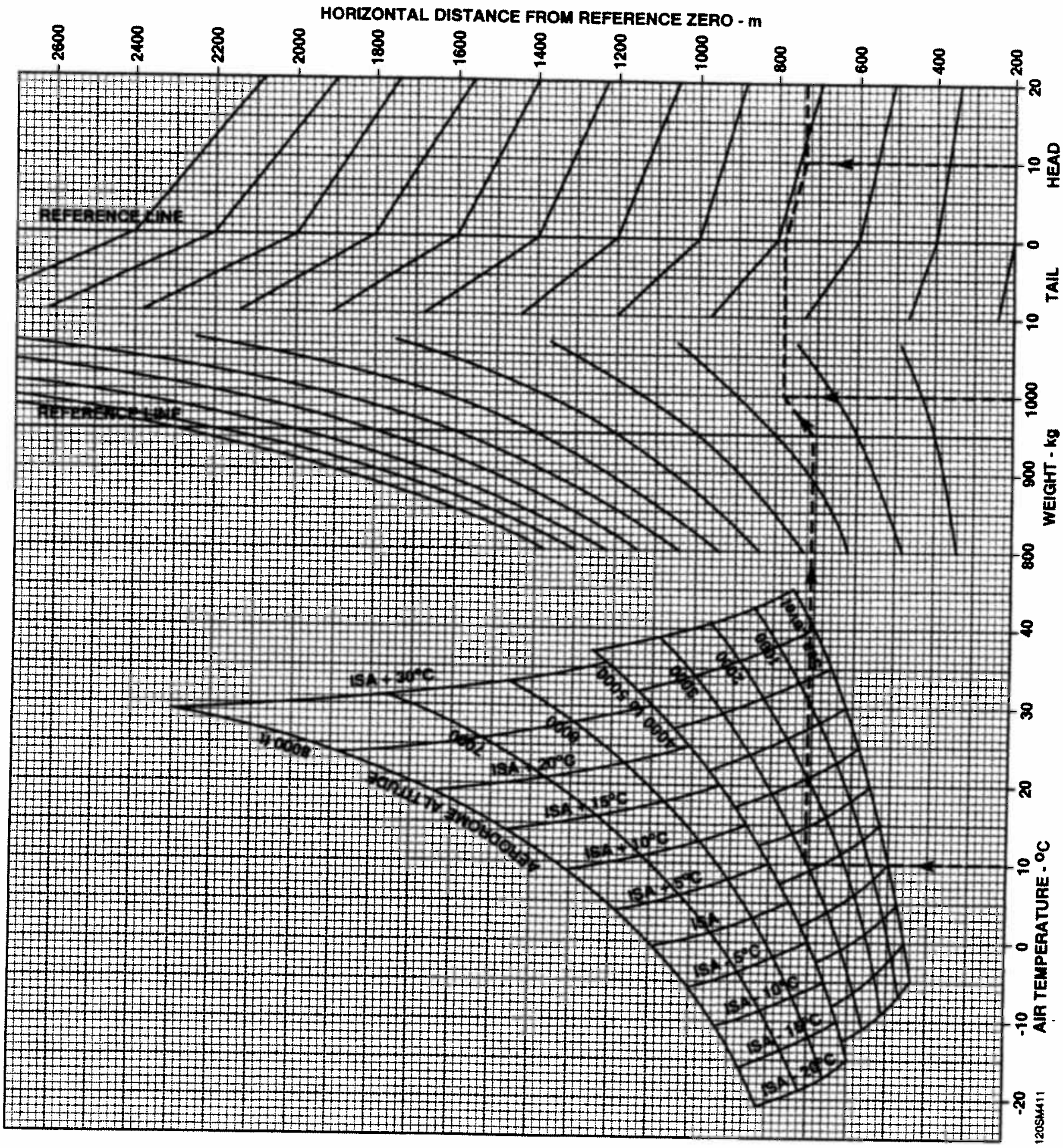
The use of the chart is illustrated by the arrowed dotted lines. Enter the chart with the air temperature and move vertically up to the appropriate aerodrome altitude. From this point proceed horizontally across to the weight grid reference line and follow the curves to the appropriate weight. Then proceed through the reported wind grid in the same manner to obtain the horizontal distance from Reference Zero from the scale on the right of the chart.

NOTES: (1) The wind correction grids are factored so that 50% of headwinds and 150% of tailwinds are obtained. Reported winds may therefore be used in the grids.

(2) The data given in Figure 5-10 has been derived from gross performance reduced by a margin of 2% gradient of climb or the equivalent horizontal acceleration.

(3) The kink in the aerodrome altitude/air temperature carpet in Figure 5-10 is due to the change in the en route climbing speed at an altitude of 5000 ft (1524 m) (see Page 5-22).

TAKE-OFF NET FLIGHT PATH I - FIRST SEGMENT



TAKE-OFF NET FLIGHT PATH II - SECOND SEGMENT

The net gradient of climb between the end of the First Segment and 1000 ft (305 m) above the take-off surface is given in Figure 5-11 opposite for varying air temperatures, aerodrome altitudes, weights, and reported wind components.

Associated conditions:

Engine	:	Operating at maximum power (2700 rev/min, full throttle).
Induction air	:	COLD.
Wing-flaps	:	UP (0° position).
Air speed	:	En route climbing speed appropriate to altitude (see Page 5-22).

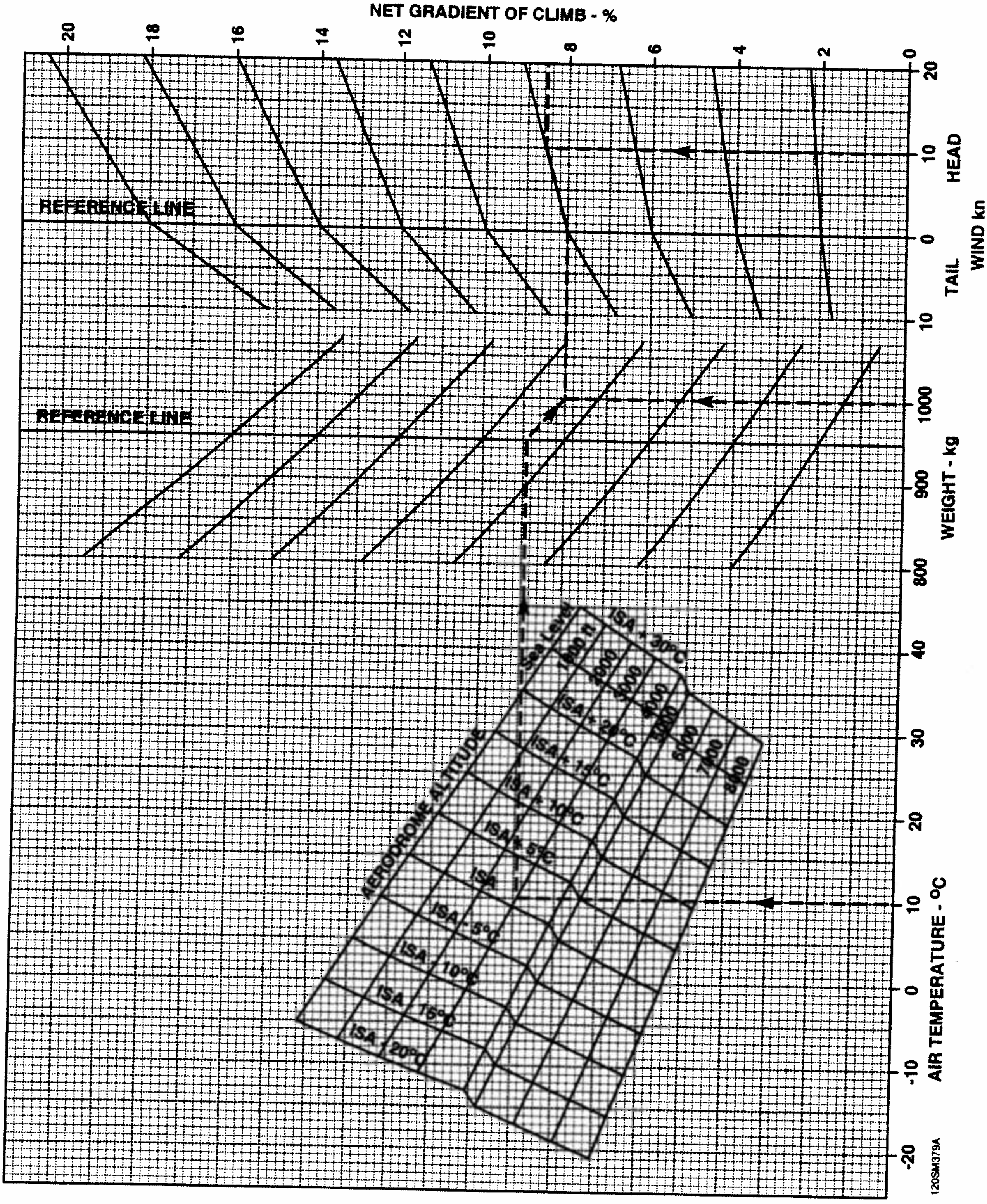
The use of the chart is illustrated by the arrowed dotted lines. Enter the chart with the air temperature and move vertically up to the appropriate aerodrome altitude. From this point proceed horizontally across to the weight grid reference line and follow the curves to the appropriate weight. Then proceed through the wind grid in the same manner to obtain the net gradient of climb from the scale on the right of the chart.

NOTES: (1) The wind correction grids are factored so that 50% of headwinds and 150% of tailwinds are obtained. Reported winds may therefore be used in the grids.

(2) The data in Figure 5-11 has been derived from gross performance reduced by a gradient margin of 2%.

(3) The kink in the aerodrome altitude/air temperature carpet in Figure 5-11 is due to the change in the en route climbing speed at an altitude of 5000 ft (1524 m) (see Page 5-22).

TAKE-OFF NET FLIGHT PATH II - SECOND SEGMENT



EN ROUTE

AIRSPEED

The en route climbing speed with the wing-flaps retracted at all weights is 80 kn (148 km/h) IAS at all altitudes up to 5000 ft (1524 m) and 75 kn (139 km/h) IAS at all altitudes above 5000 ft (1524 m). This speed provides the best gradient of climb in this configuration.

With the engine inoperative, the en route gliding speed with the wing-flaps retracted is 75 kn (139 km/h) IAS at all weights and altitudes. This speed provides the best gradient of descent in this configuration.

EN ROUTE PERFORMANCE CEILING AND GROSS RATE OF CLIMB

The performance ceiling is given in Figure 5-12 opposite together with the en route gross pressure rate of climb for varying weights, altitudes and air temperatures,

Associated conditions:

Engine	:	Operating at maximum power (2700 rev/min, full throttle).
Induction air	:	COLD.
Wing-flaps	:	UP (0° position).
Air speed	:	En route climbing speed appropriate to altitude (see above).

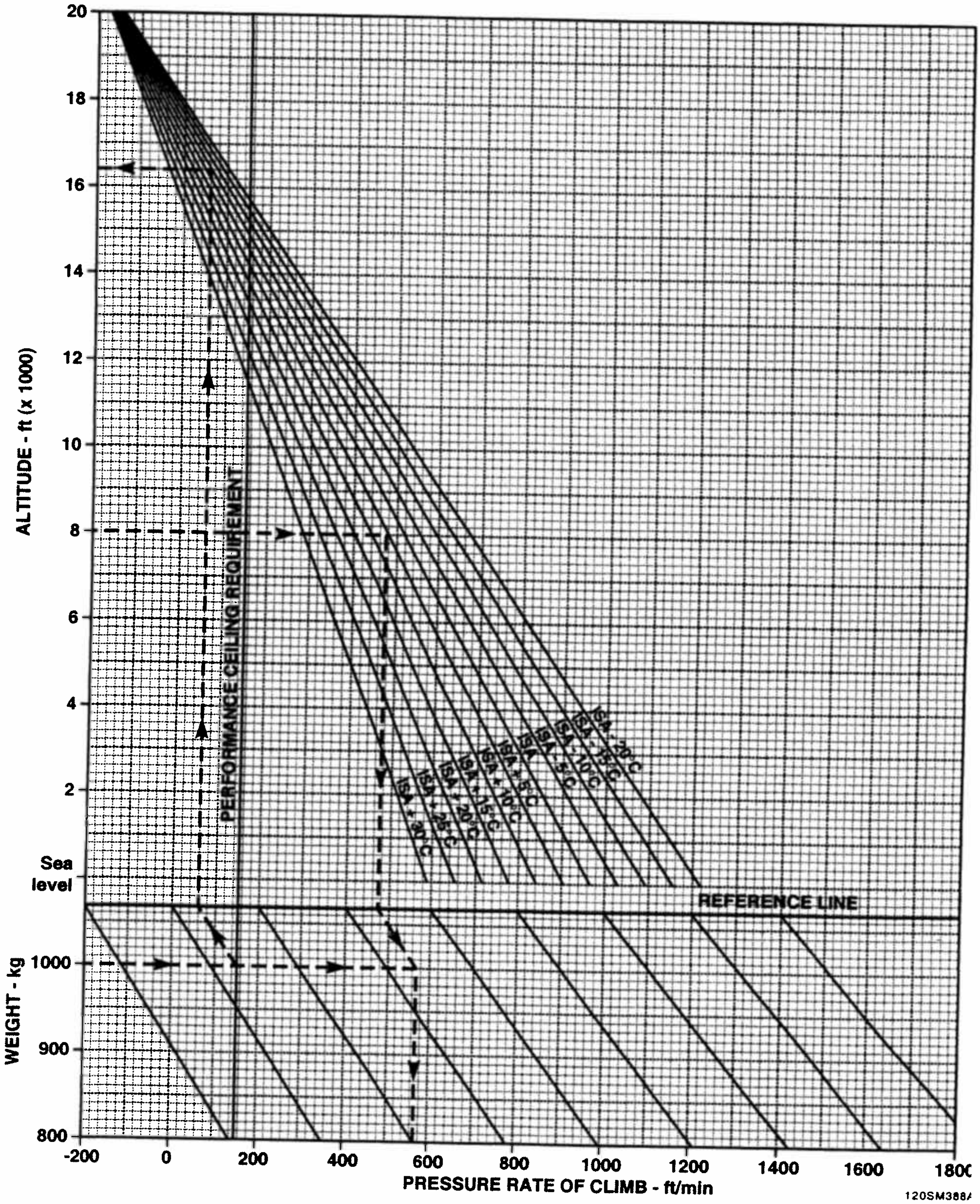
The use of the chart is illustrated by the arrowed dotted lines.

To obtain performance ceiling, enter the chart with the weight and move horizontally across to the performance ceiling requirement line and then follow the weight grid curves to the weight grid reference line. From this point, move vertically upwards to the appropriate temperature to obtain the altitude of the performance ceiling from the scale on the left of the chart horizontally across from this point.

To obtain gross pressure rate of climb, enter the chart with the altitude and move horizontally across to the appropriate temperature. From this point, move vertically down to the weight grid reference line and then follow the curves to the appropriate weight to obtain the gross pressure rate of climb from the scale at the foot of the chart vertically below this point.

NOTE: The performance ceiling is the maximum altitude which may be assumed when establishing compliance with the operating regulations dealing with en route flight. It does not prohibit flying at a higher altitude, although at some altitudes the operating regulations may require oxygen to be carried but, as net data, it represents the ceiling which the aeroplane may be regularly relied upon to achieve. The earliest point along the intended flight path at which the performance ceiling can be reached will be determined by the climb procedure adopted, but it is unlikely that the performance ceiling will be achieved unless maximum continuous power and the airspeed stated in the associated conditions above are used towards the end of the climb.

EN ROUTE PERFORMANCE CEILING AND GROSS RATE OF CLIMB



HORIZONTAL DESCENT DISTANCE

With the engine inoperative, the propeller windmilling in FINE pitch, and the wing-flaps retracted at the en route gliding speed, the net horizontal distance covered in still air is 1.25 n mile/1000 ft (0.76 km/100 m) height descended.

NOTE: This data has been derived from gross performance reduced by a gradient margin of 1%.

LANDING PROCEDURES AND SPEEDS

MAXIMUM CROSSWIND COMPONENT

The maximum crosswind component in which landing has been demonstrated is 35 kn (65 km/h) measured at a height of 10 m (33 ft).

AIRSPEED

The approach speed for a normal powered approach with the wing-flaps in the 45° position (FULL setting) is 69 kn (128 km/h) IAS at all weights.

TECHNIQUE

The technique upon which the landing performance information scheduled in this section is based is as follows.

On nearing the runway threshold following a normal powered approach, the wing-flaps are extended to the 45° position (FULL setting) and the aeroplane flown so as to achieve the scheduled approach speed over the end of the runway at the 50 ft (15 m) height point. At the threshold, the throttle is fully closed and the aeroplane landed following a smooth transition. The nosewheel is lowered immediately after touch down and wheel braking commenced as soon as possible once the aeroplane is firmly on the ground.

The balked landing climb performance, upon which is based the maximum landing weight for altitude and temperature scheduled in this section, is associated with a wing-flap position of 0° and, to ensure the best gradient of climb, the en route climbing speed appropriate to the altitude.

LANDING FIELD LENGTHS

The landing distance from a height of 50 ft (15 m) to come to rest is given in Figure 5-13 opposite for varying air temperatures, aerodrome altitudes, weights, reported wind components and uniform runway slopes.

Associated conditions:

Engine	:	Idling.
Propeller	:	FINE pitch.
Wing-flaps	:	FULL (45° position).
Technique	:	Approach at the approach speed (see Page 5-25). The nosewheel is lowered and maximum wheel braking is applied immediately after touchdown.
Runway	:	Dry hard surface (see Note (2)).

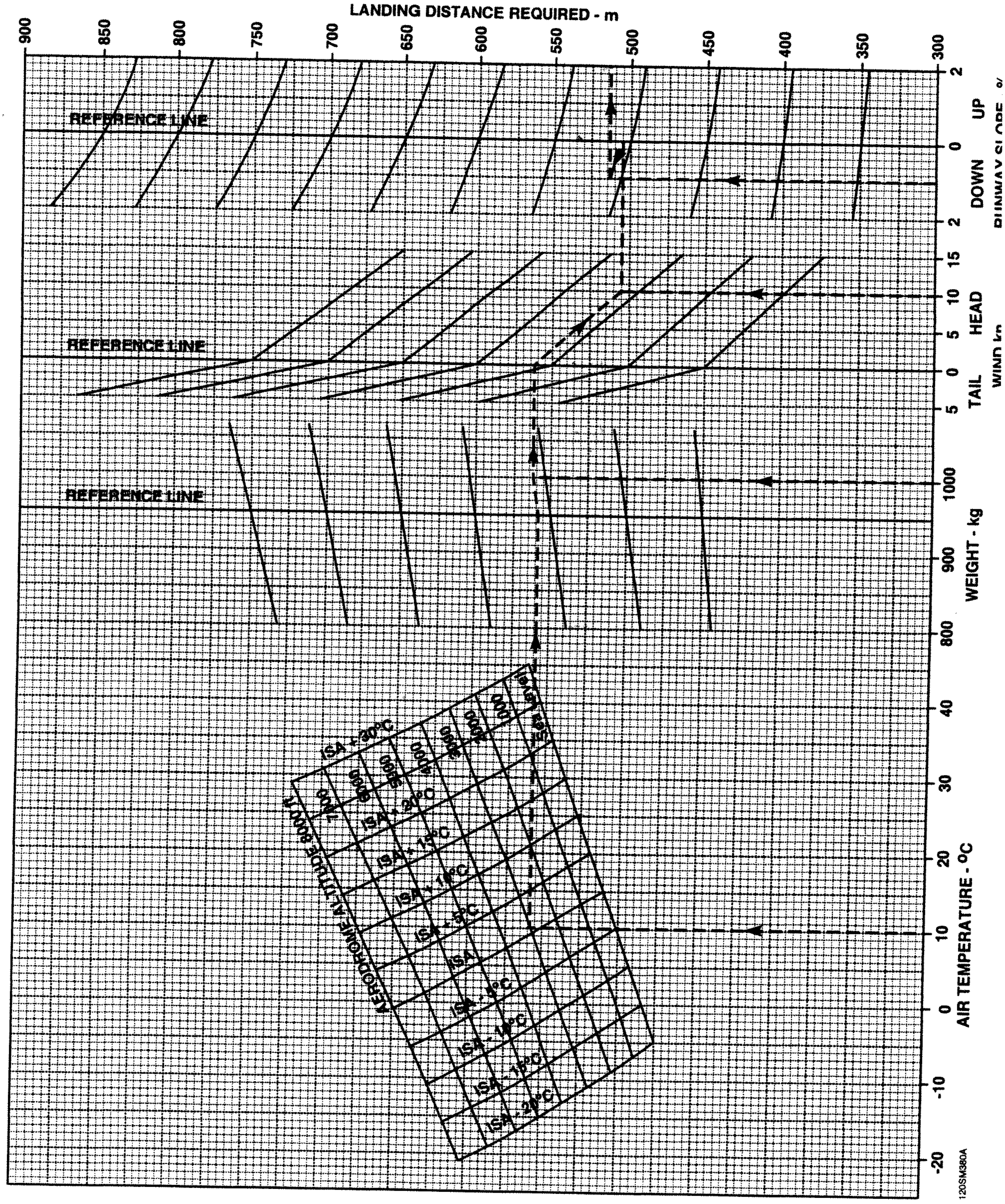
The use of the chart is illustrated by the arrowed dotted lines. Enter the chart with the air temperature and move vertically up to the appropriate aerodrome altitude. From this point, proceed horizontally across to the weight grid reference line and follow the curves to the appropriate weight. Then proceed through the reported wind and uniform runway slope grids in the same manner to obtain the landing distance required from the scale on the right of the chart.

NOTES: (1) The data given in Figure 5-13 has been obtained by factoring the measured landing distance by 1.43, so taking into account the factor required by the Air Navigation Regulations. No further factoring of landing distance required is therefore necessary.

(2) For operation from grass surfaces consisting of recently mown dry grass on a firm subsoil, the distance required obtained from figure 5-13 for a dry hard surface should be increased by 12%.

(3) The wind correction grids are factored so that 50% of headwinds and 150% of tailwinds are obtained. Reported winds may therefore be used directly in the grids.

LANDING DISTANCE REQUIRED



GROSS PERFORMANCE DATA

INTRODUCTION

This sub-section contains performance information necessary for the evaluation of Airworthiness Flight Tests. It is not to be used for the purpose of establishing compliance with the operating regulations.

The performance scheduled is "gross" data as defined on Page 1-18 and no margins have been subtracted. The rate of climb is "pressure" rate and may be directly compared with the performance measured by the aeroplane's altimeter set to 1013.2 mbar.

GROSS RATE OF CLIMB AFTER TAKE-OFF

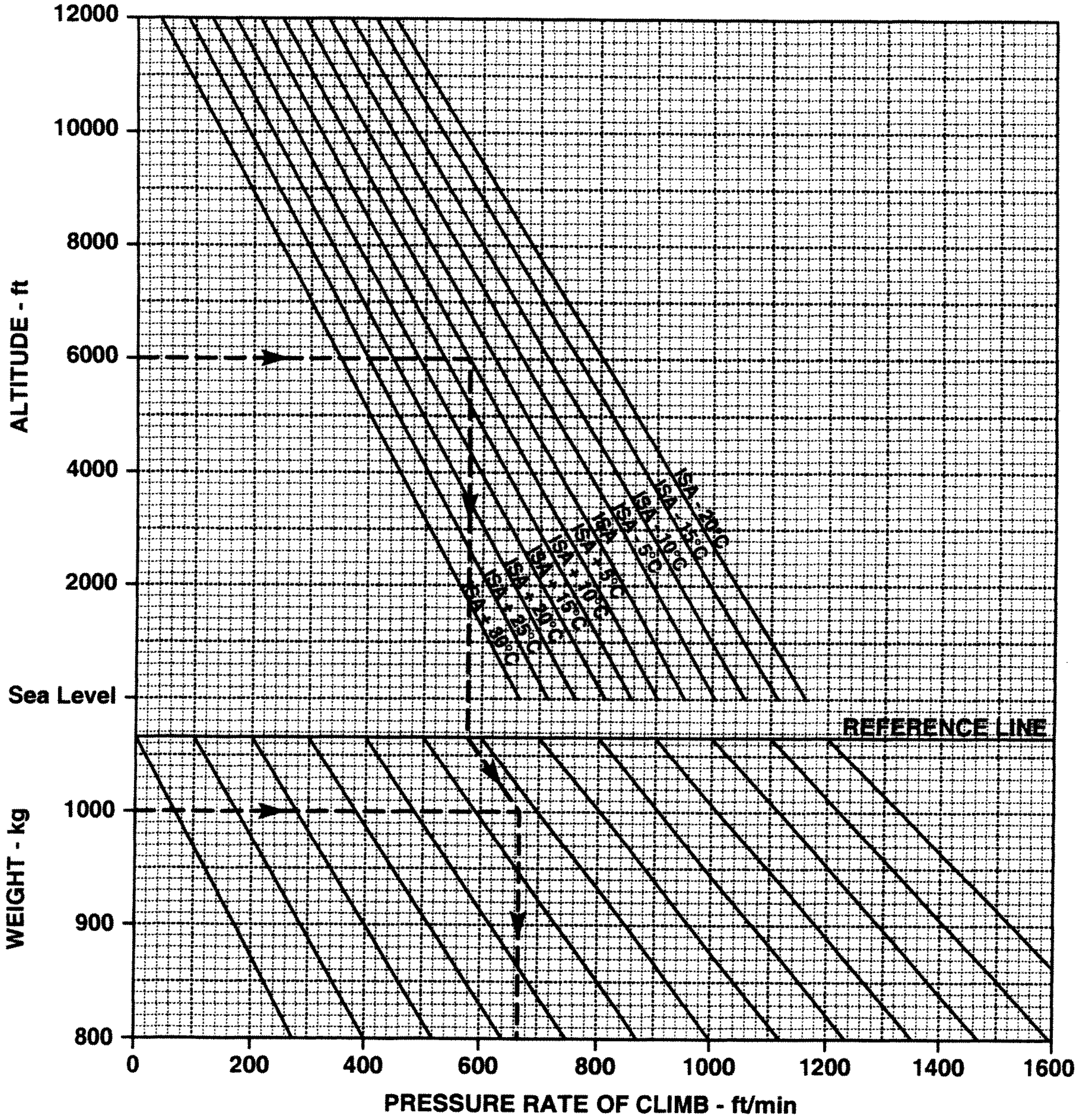
The gross rate of climb after take-off is given in Figure 5-14 opposite for varying weights, altitudes and air temperatures.

Associated conditions:

Engine	:	Operating at maximum power (2700 rev/min, full throttle).
Induction air	:	COLD.
Wing-flaps	:	INTER (10° position).
Air speed	:	Take-off safety speed appropriate to weight (see Page 5-6).

The use of the chart is illustrated by the arrowed dotted lines. Enter the chart with the altitude and move horizontally across to the appropriate temperature. From this point move vertically down to the weight grid reference line and then follow the curves to the appropriate weight to obtain the gross pressure rate of climb from the scale at the foot of the chart vertically below this point.

GROSS RATE OF CLIMB AFTER TAKE-OFF



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SECTION 6

SUPPLEMENTS

This section contains, in the form of supplements, information applicable to any particular feature or use of the aeroplane which is not covered by the information and data included in the manual proper.

The particular supplements embodied in this copy of the manual are recorded on the record sheet on Page 6-2.

RECORD OF SUPPLEMENTS

The following approved supplements have been embodied in this copy.

Supplement		Name of Publisher	Date of Approval	Embodiment	
No	Issue			Date	Signature
1	2	Scottish Aviation Limited.	03 July 72	Embodied at Issue.	

SCOTTISH AVIATION LIMITED

SUPPLEMENT NO 1

ISSUE 2

BULLDOG MODEL 101 TO SWEDISH ARMED FORCES' REQUIREMENTS

This issue of this supplement contains the following pages.

Page Number	Date of Approval
6.1-(i)	03 July 72
6.1-(ii)	03 July 72
6.1-1	03 July 72
6.1-2	03 July 72
6.1-3	15 June 71
6.1-4	15 June 71
6.1-5	15 June 71
6.1-6	15 June 71
6.1-7	15 June 71
6.1-8	15 June 71
6.1-9	03 July 72
6.1-10	03 July 72
6.1-11	03 July 72
6.1-12	15 June 71
6.1-13	15 June 71
6.1-14	15 June 71
6.1-15	15 June 71
6.1-16	03 July 72

SCOTTISH AVIATION LIMITED

SUPPLEMENT NO 1

BULLDOG MODEL 101 TO SWEDISH ARMED FORCES' REQUIREMENTS

APPLICABILITY

This supplement applies to all Model 101 variants of the Bulldog Series 100 supplied to the Swedish Armed Forces and must be incorporated in Flight Manual Document No. SH.3.1.

SPECIAL FEATURES

Special features of this variant are as follows.

CONFIGURATION

The windows aft of the canopy shown in Fig 1-1 on Page 1-7 and described in Section 7 are each divided horizontally in half, the lower half being hinged to open upwards and inwards at all speeds.

Provision is made for the attachment of skis to the landing gear in place of the wheels described on Page 7-3. External brackets are provided on the airframe for the attachment of the associated restraining cables.

External brackets are also provided for the carriage of the personal skis of the aircraft occupants and the attachment of guards to protect the windscreen and leading edge of the vertical tail from power cables, etc.

INSTRUMENTS AND CONTROLS

Instruments and controls are laid out to the requirements of The Material Administration of the Armed Forces (i.e., of Sweden). The layout is given in Fig 6.1-1 on Page 6.1-3. The key is as follows:

1. Clock.
2. Stall warning lamp.
3. Intercom panels.
4. Airspeed indicators.
5. Gyroscopic direction indicators.
6. Gyroscopic bank and pitch indicators.
7. Check list/map clips.
8. Turn and slip indicator.
9. Altimeters.
10. VHF communication transmitter and receiver.
11. Oil temperature/oil pressure/cylinder head temperature indicator.
12. VOR indicator.
13. Magnetic compass.
14. Outside air temperature gauge.
15. Manifold pressure/fuel flow indicator.
16. Engine rotational speed indicator.
17. Compass card.
18. Vacuum gauge.
19. VHF navigation receiver.
20. Press-to-transmit buttons.
21. Fresh air louvres.
22. Control columns.

23. Brake pedals.
24. Rudder pedals.
25. Mixture control.
26. Pitch control.
27. Throttle control.
28. Friction lock.
29. Elevator trim indicator.
30. Rudder trim control.
31. Elevator trim control.
32. Fuel selector.
33. Left hand throttle control.
34. Electrical system circuit breakers.
35. Electrical switches.
36. Wing-flap selector.
37. Rate of climb and descent indicator.
38. Handbrake lever.
39. Fuel contents gauge.
40. Booster pump switch.
41. Battery master switch.
42. Alternator switch.
43. Dimmer switch.
44. Alternator warning lamp.
45. Mute switch.
46. Heating system controls.
47. Induction air control.
48. Volt-ampere meter.
49. Volt-ampere selector switch.
50. Magneto/starter switch.

The main differences between this layout and that given in Figure 7-1 on Page 7-5 are the addition of avionic equipment to the instrument panel and the duplication of flight instruments.

The flap selector is located on the extreme left hand of the instrument panel. No position indicator is fitted.

No accelerometer is fitted.

The stall warning horn is replaced by a warning lamp on the upper left hand of the instrument panel. Operation of the stall warning system is as described in Section 7.

Markings of instruments and controls are in Swedish to the requirements of the Material Administration. Rudder trim is marked SIDTRIM, VÄNSTER (left) - HÖGER (right); the take-off setting is not marked. Elevator trim is marked HÖJDTRIM, NOS NED (nose down) - NOS UPP (nose up); the take-off setting band is marked S. Flap selection is marked KLAFF, I (up) - S (inter) - L (full).

The pitot static head is located on the leading edge of the port wing.

POWER PLANT

Throttle, propeller and mixture controls are marked GAS; PROPELLER, HÖGT VARV (fine) - LÅGT VARV (coarse) and BLANDN, RIK (full rich) - STOPP (cut-off), respectively.

INSTRUMENT AND CONTROL LAYOUT

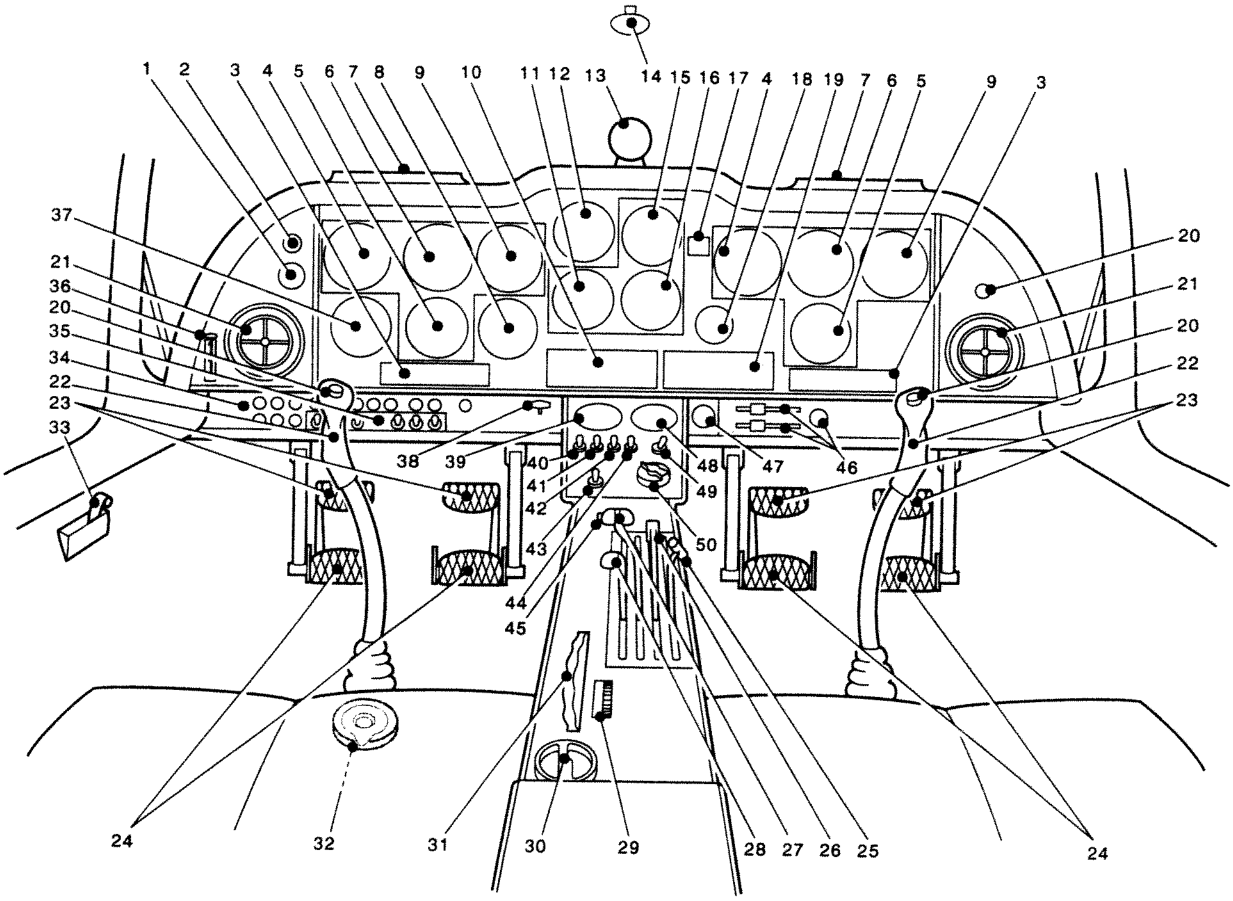


Fig 6.1-1

The key-operated magneto switch described in Section 7 is replaced by a rotary switch marked FRÅN (off) - H (right) - V (left) - H + V (both).

The induction air control is marked VARMLUFT MOTOR.

FUEL SYSTEM

The fuel pressure gauge fitted is calibrated to indicate fuel flow in accordance with the fuel pressure - fuel flow relationship given in Figure 8-1 and is marked with the maximum power "best power" mixture altitude-fuel pressure relationship to relate altitude with fuel flow for this condition and the cruise power condition bands, as described in Section 4.

The fuel selector is marked BRÄNSLE, STÄNGD (off) - V (left) - BÅDA (both) - H (right).

ELECTRICAL SYSTEM

The battery fitted is of nickel cadmium type with a 16 Ah capacity.

The starter push switch shown in Figure 7-1 and described in Section 4 is deleted. A spring-loaded position marked START is added to the ignition switch, the switch being turned clockwise from the H + V (both) position to START where the starter relay is closed to operate the starter motor. The switch is not key-operated. There is no starter warning light.

ENVIRONMENTAL CONTROL SYSTEM

The heating system controls are marked VÄRME (heat) with the upper lever marked FRÅN (off) - MAX (full) and the lower lever KABIN (cabin) - FRONTRUTA (screen). The demist control is marked FRISKLUFT, FRONTRUTA.

BRAKE SYSTEM

The parking brake is marked BROMSPARK.

AVIONICS

Panel-mounted avionic equipment is located as shown in Figure 6.1-1. An additional VHF communication set is mounted on the central console behind the front seats.

ADDITIONS AND CHANGES TO FLIGHT MANUAL SH.3.1

The following additions or changes are made to the information contained in Flight Manual Doc. No. SH.3.1. All other information contained in this Flight Manual must be assumed to apply.

SECTION 2 LIMITATIONS

Power Plant

Instrument Colour Markings

The colour markings on the power plant instrument dials have the following meaning:

Red radial line	:	Fuel flow	:77.5 l/h.
Red arc	:	Maximum range -	
		Oil temperature	:118-120°C.
		Oil pressure	:7.031-14 kg/cm².
		Cylinder head temperature	:246-260°C.
		Rotational speed	:2700-3500 rev/min.
Green arc	:	Normal operating range -	
		Oil temperature	:10-118°C.
		Oil pressure	:0-7.031 kg/cm².
		Cylinder head temperature	:38-246°C.
		Manifold pressure	:10-35 in Hg.
		Rotational speed	:0-2700 rev/min.
		Vacuum	:3.5-4.5 in Hg.
Double green arc	:	Cruise range -	
		Oil pressure	:4.22-6.33 kg/cm².
		Manifold pressure	:20-24.5 in Hg.
		Rotational speed	:2000-2500 rev/min.
Yellow arc	:	Cautionary range -	
		Fuel contents	:0-16 l.

Speed

Never Exceed Speed (V_{NE})

V_{NE} is 313 km/h IAS.

Normal Operating Limit Speed (V_{NO})

V_{NO} is 233 km/h IAS.

Manoeuvring Speed (V_A)

V_A is 241 km/h IAS.

Wing-Flaps Extended Speed (V_{FE})

V_{FE} is 232 km/h IAS for extension to the 10° position (S (inter) setting) and 176 km/h IAS for extension to the 45° position (L (full) setting).

Instrument Colour Markings

The colour markings on the airspeed indicator have the following meaning:

White arc : 40 km/h IAS to touchdown speed (110 km/h IAS).
V_{NE} (313 km/h IAS) to 390 km/h IAS.

White triangle : V_{FE} (176 km/h IAS).

Miscellaneous

Manoeuvres

Recommended entry speeds for performing aerobatic manoeuvres are as follows:

Manoeuvre	Recommended Entry IAS (km/h)
Spins	V_{s1} or 122
Inside loops	241
Half loop and roll out	248
Half roll and dive out	158
Stall turns	209
Slow rolls	209
Barrel rolls	209
Flick rolls	130 - 150

For flick rolls the speed of 150 km/h must not be exceeded.

Minimum Crew

The aeroplane must not be flown solo from the right hand seat.

Smoking

Smoking is not permitted.

Opening of Cockpit Canopy in Flight

This speed is 209 km/h IAS.

Placards

Notices placarded are displayed as follows:

BAGAGE		
MED 3 PERS		0 kg
MED 2 PERS	MAX	100 kg
ALLT BAGAGE SKALL FASTSURRAS		
BAGAGE FÅR EJ MEDFÖRAS		
UNDER AVANCERAD FLYGNING		

The compass deviation card is displayed on the instrument panel.

SECTION 3 EMERGENCY PROCEDURES

Landing with Engine Inoperative (Forced Landing)

(4) Position aeroplane so as to be at a height of 305 m (1000 ft) above ground level at the end of the downwind leg maintaining a minimum airspeed of 141 km/h IAS and judging the point to turn across wind according to wind strength.

Landing with Wing-flaps Retracted

Final approach should be made at 141 km/h IAS.

Restarting Engine in Flight with Propeller Stopped

NOTES: (1) Propeller may not commence to windmill below an airspeed of 209 km/h IAS.

System Control

Electrical System

Alternator Failure -

In the event of failure of the alternator, the aircraft battery should have sufficient capacity to permit a flight of 20 min duration at night or 40 min duration by day.

Flap Actuator Failure -

As no wing-flap position indicator is fitted, the position of the wing-flaps can only be checked by visual inspection.

SECTION 4 NORMAL PROCEDURES

Starting Engine

Cold

(4)	Ignition	:H + V (ie, both), then START.
(5)	When engine starts, turn ignition switch back to H + V.	

Hot

(3)	Ignition	:H + V (ie, both), then START.
(4)	When engine starts -	
	(a) Ignition	:H + V.
	(b) Mixture	:RIK (ie, full rich).
	(c) Throttle	:Close.

Before Take-off

(4)	Rudder trim	:2½ divisions right.

NOTE: At high altitude aerodromes, open up to full throttle against the brakes and adjust mixture so that the fuel flow indicated by the fuel flow gauge is appropriate to the altitude marked on the gauge, as explained under Climb following.

Take-off

Rotate at 102 km/h IAS and lift off at 113 km/h IAS. Take-off safety speed appropriate to the take-off weight is given in Figure 6.1-6 on Page 6.1-15 of this supplement.

Climb

Airspeed

The en route climbing speed is given on Page 6.1-11 of this supplement.

Technique

The relationship between fuel flow and altitude for maximum power (i.e., maximum take-off and maximum continuous) with "best power" mixture is marked on the fuel flow gauge. The relationship between fuel pressure and altitude for this condition is given in Figure 4-1 on Page 4-7 and the relationship between fuel flow and fuel pressure in Figure 8-1 on Page 8-2.

Mixture should be adjusted at maximum power so that the fuel flow indicated by the fuel flow gauge is appropriate to the altitude marked on the gauge.

Cruise

(2)	Mixture	: Obtain fuel pressure from Figure 8-3 appropriate to rotational speed, mixture condition and power condition. Set mixture to give the fuel flow given in Figure 8-1 appropriate to this fuel pressure.

Flight in Rough Air

Airspeed

The recommended speed for flight in severe turbulence is 157 km/h IAS with the wing-flaps retracted.

Gliding

The en route gliding speed is given on Page 6.1-11 of this supplement.

Stalling

With wing-flaps extended, a light on the instrument panel provides a visual warning 9 km/h above the true stall.

Power off stalling speeds are given on Page 6.1-11 of this supplement.

Aerobatics

Recommended entry speeds are given on Page 6.1-6 of this supplement.

Spinning

Before intentionally entering a spin, rudder trim should be set to zero and elevator trim NOS NED as appropriate between just aft of rear edge of S band for CG forward and in centre of S band for CG aft.

ELECTRICAL SYSTEM

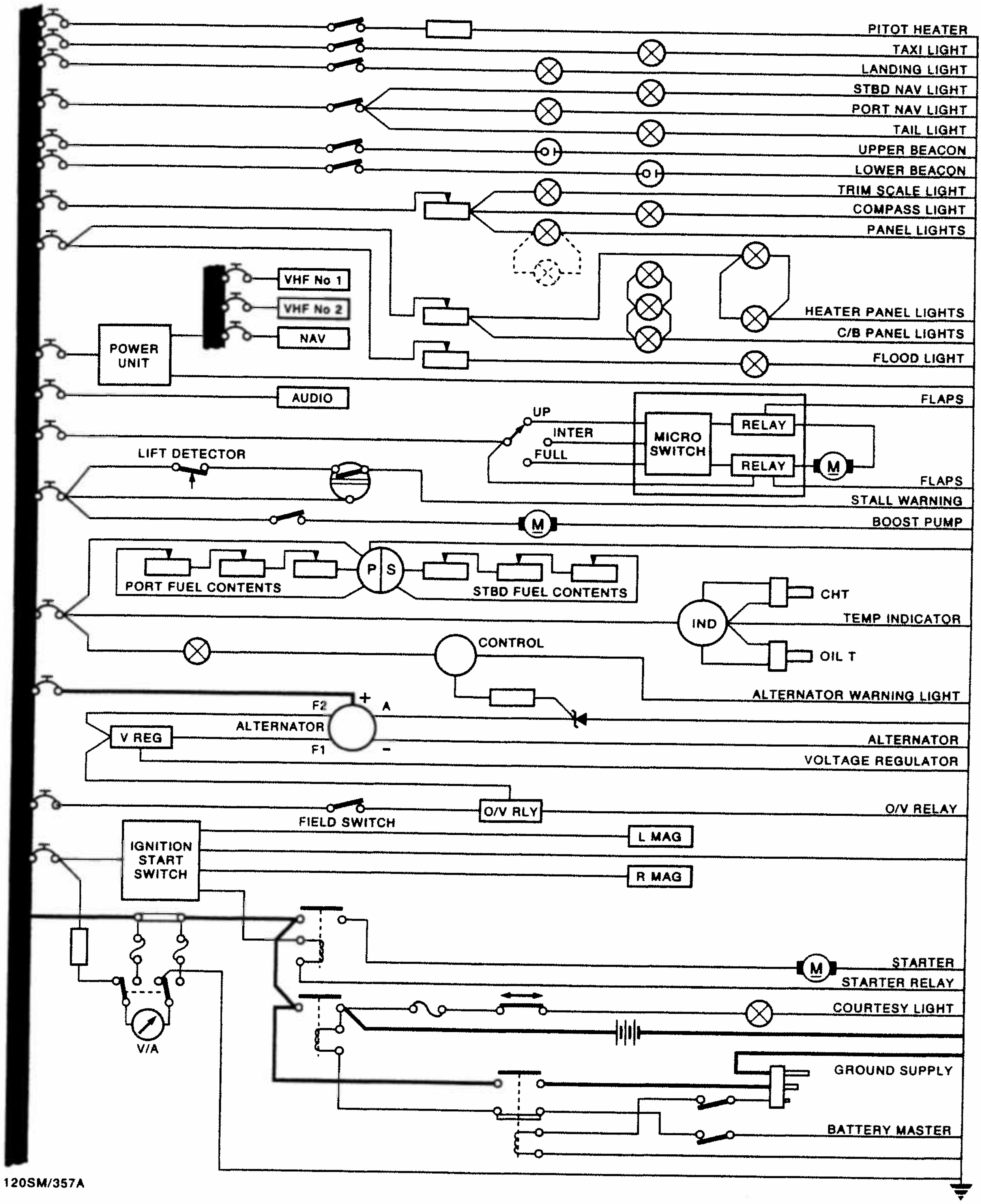


Fig 6.1-2

For a dynamic entry, apply full rudder at 122 km/h IAS and continue to pull the control column centrally back until full up-elevator is reached.

In spins to port the airspeed stabilises below 98 km/h IAS and in spins to starboard between 111 and 117 km/h IAS.

At forward CG, recovery action should be taken on approaching 150 to 165 km/h IAS.

Flick Roll

With power on at an airspeed between 130 and 150 km/h IAS, apply full rudder and full up-elevator simultaneously.

Stall Turn

With power on, pull up at 209 km/h IAS. Apply full rudder in the desired direction of turn at 135 km/h IAS.

Approach

Enter the approach at 180 km/h IAS with wing-flaps retracted.

Landing

Normal

The approach speed is given on Page 6.1-16 of this supplement.

Balked Landing

The en route climbing speed is given on Page 6.1-11 of this supplement.

Systems Control

The electrical system fitted is shown in Figure 6.1-2 on Page 6.1-9.

SECTION 5 PERFORMANCE

General

Pitot-Static Head Position

A diagram showing the position in which the pitot-static head is installed on this aeroplane is given in Figure 6.1-3 on Page 6.1-12 of this supplement.

Position and Compressibility Error Corrections

The position and compressibility error correction (PEC) to be applied to the IAS to obtain EAS is shown in Figure 6.1-4 on Page 6.1-13 for wing-flaps retracted (I setting), and Figure 6.1-5 on Page 6.1-14 for wing-flaps extended to the 10° position (S setting) and to the 45° position (L setting).

The static error to be applied to the altimeter is negligible in all cases.

NOTE: These corrections apply only when the pitot-static system defined in Figure 6.1-3 is installed.

Stalling Speeds

The power-off stalling speeds are as follows:

Weight (kg)		1066		900		800		EAS Symbo
Wing-Flap		Power-off Stalling Speed (km/h)						
Position (o)	Setting	IAS	EAS	IAS	EAS	IAS	EAS	
0	I	116.0	106.5	108.0	100.0	102.0	94.5	V_{SL}
10	S	111.5	103.0	104.0	96.0	98.0	91.0	
45	L	109.0	100.0	102.0	94.5	96.0	89.0	V_{SO}

The effect of angles of bank is to increase the speeds stated above by the following:

Angle of Bank (o)	Increase in Speed (km/h)
20	2
40	11
60	35

Take-off Procedures and Speeds

Airspeed

The take-off safety speed, V_2, with the wing-flaps in the 10° position (S setting) is given in Figure 6.1-6 on Page 6.1-15.

Technique

Rotate at 102 km/h IAS and lift off at 113 km/h IAS.

En Route

Airspeed

The en route climbing speed with the wing-flaps retracted at all weights is 148 km/h IAS at all altitudes up to 1524 m (5000 ft) and 143 km/h IAS at all altitudes above 1524 m (5000 ft).

With the engine inoperative, the en route gliding speed with the wing-flaps retracted is 143 km/h IAS at all weights and altitudes.

POSITION OF PITOT-STATIC HEAD

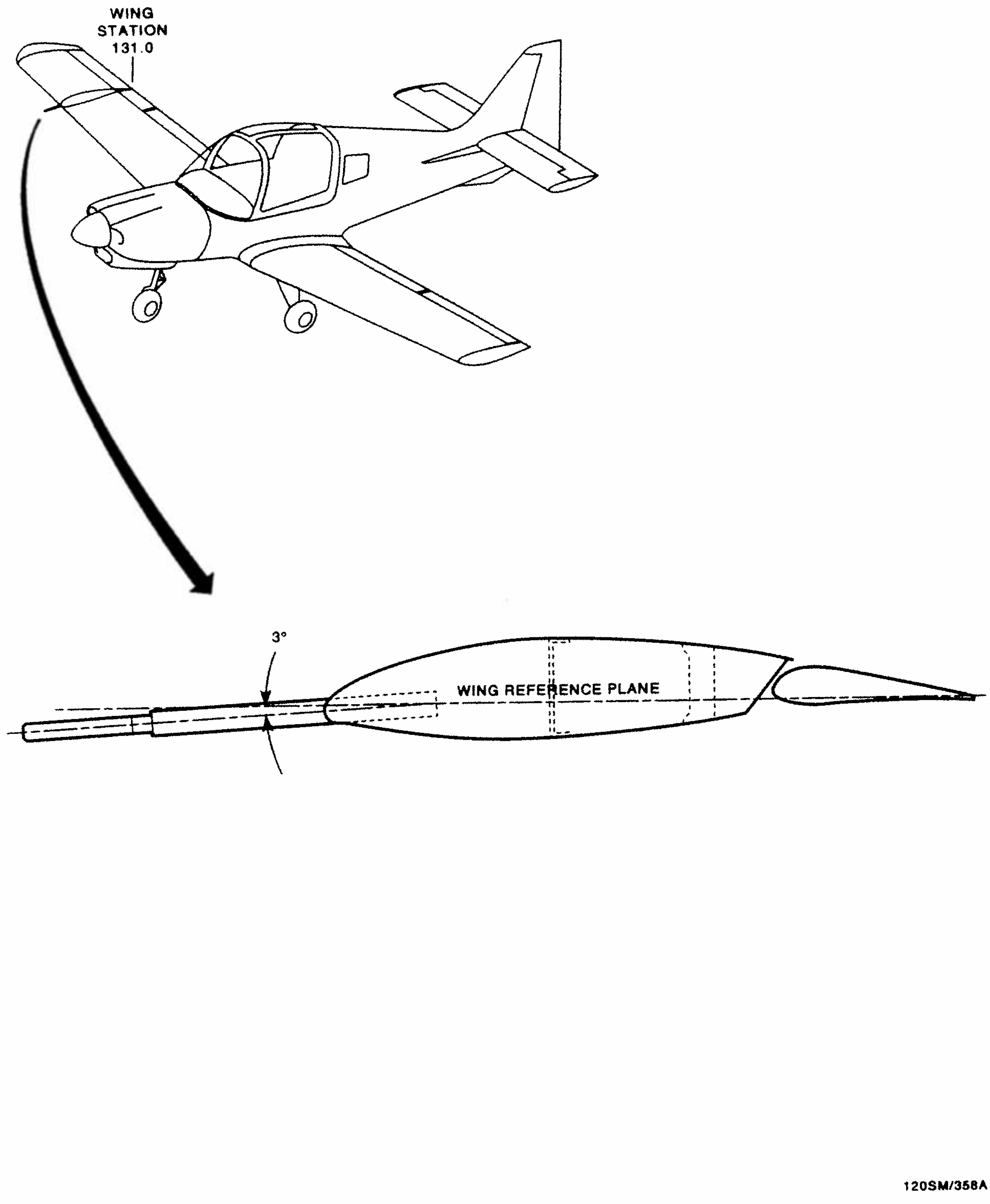


Fig 6.1-3

POSITION AND COMPRESSIBILITY ERROR CORRECTION TO AIR SPEED INDICATOR

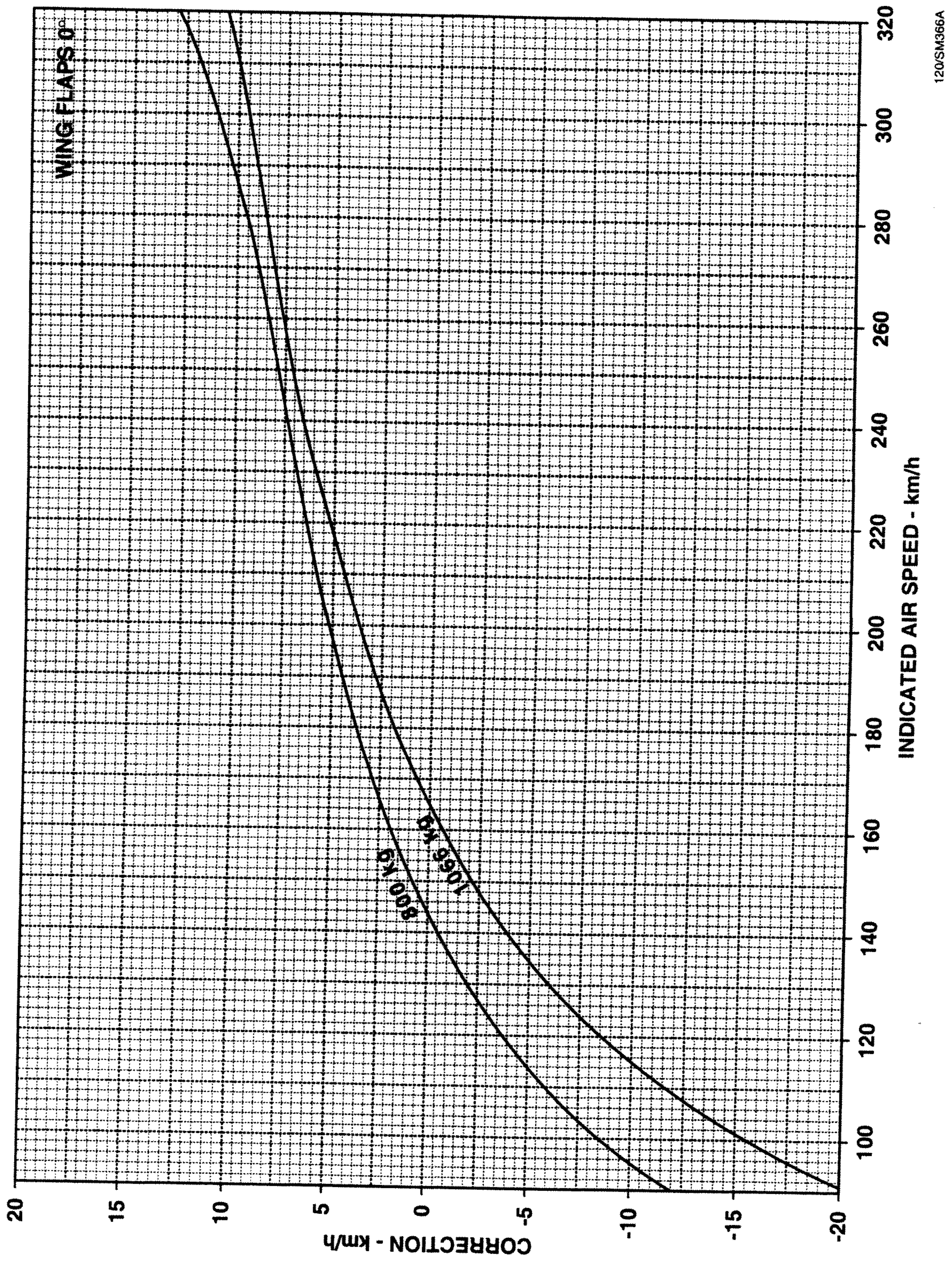
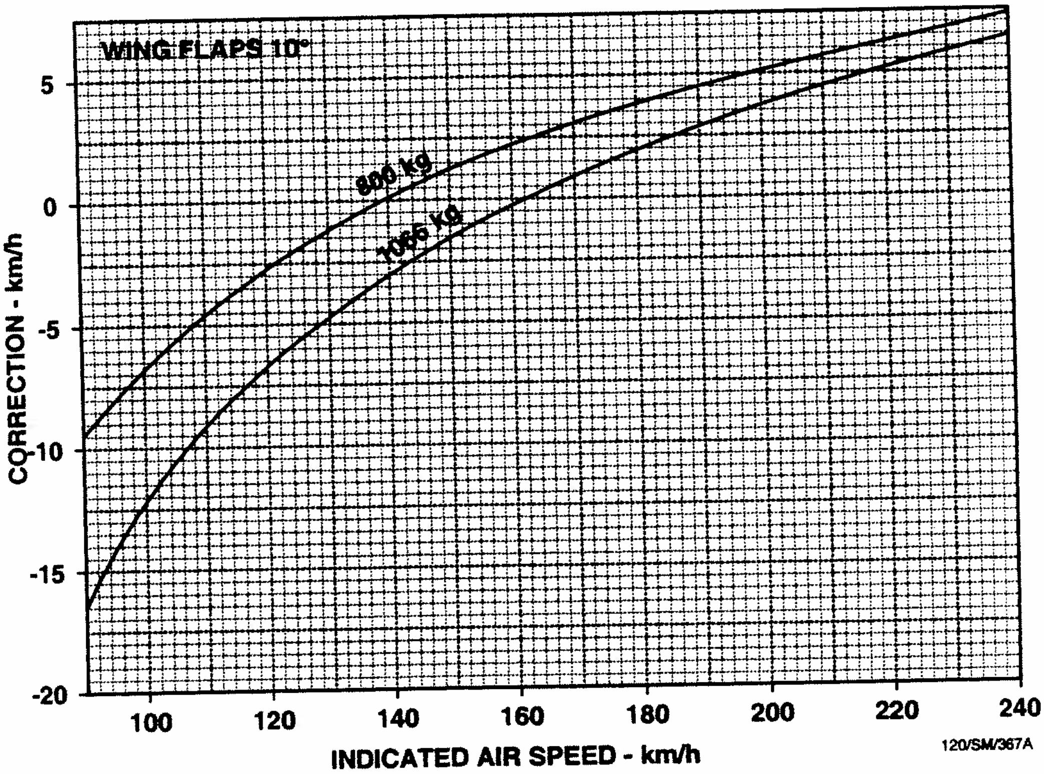


Fig 6.1-4

POSITION AND COMPRESSIBILITY ERROR CORRECTION TO AIR SPEED INDICATOR



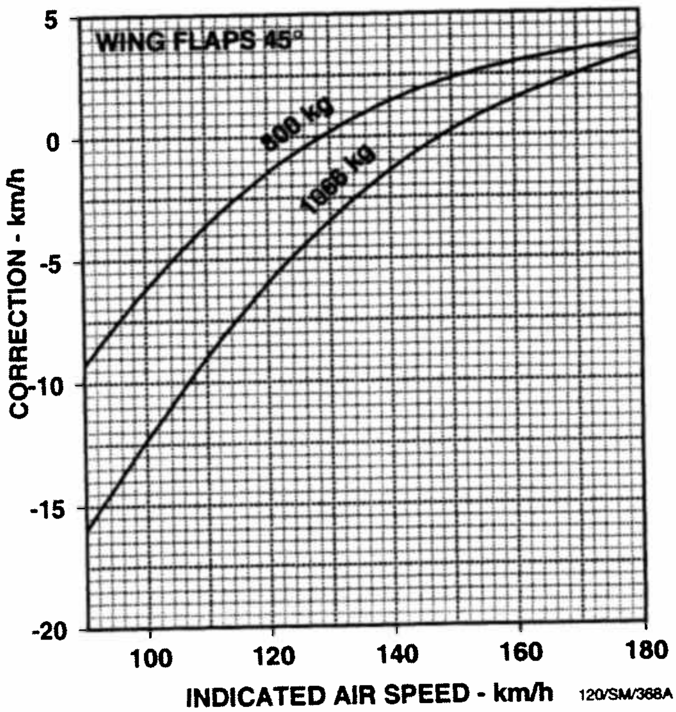
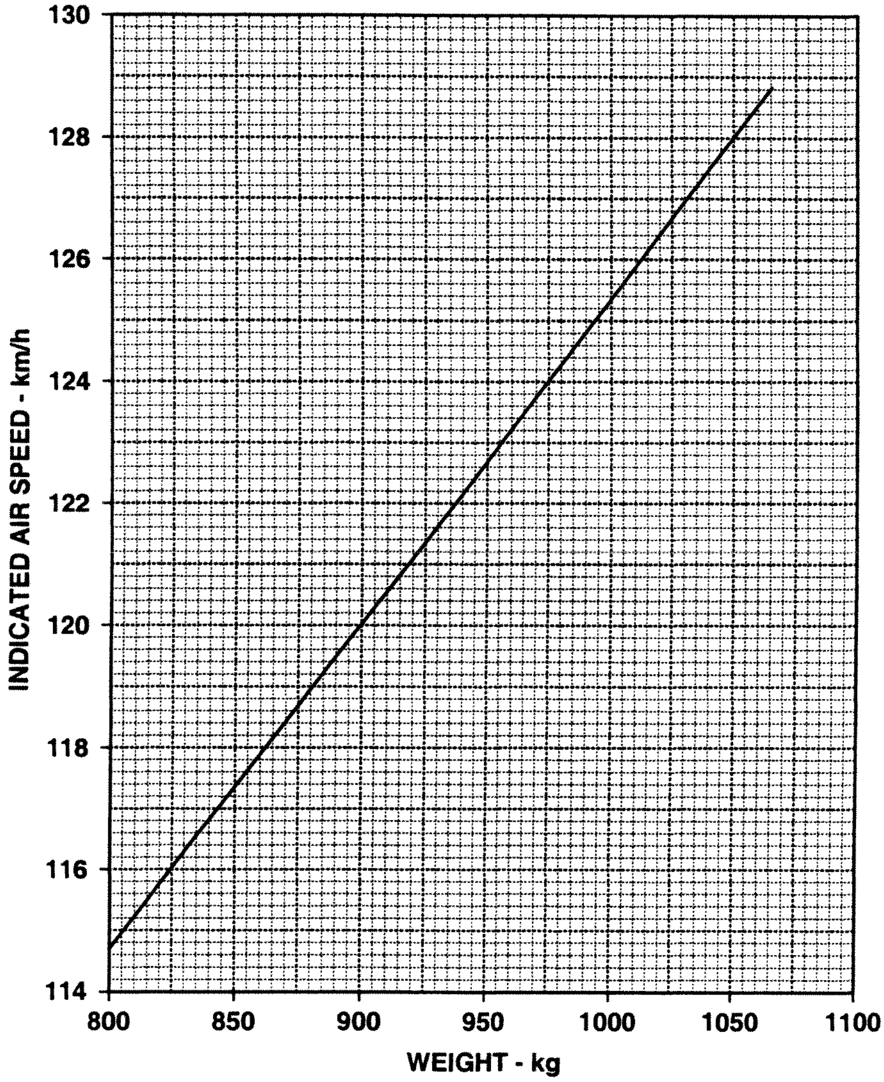


Fig 6.1-5

TAKE-OFF SAFETY SPEED



120/SM/365A

Fig 6.1-6

Landing Procedures and Speeds

Airspeed

The approach speed for a normal powered approach with the wing-flaps in the 45° position (L setting) is 133 km/h IAS.

OPERATING MANUAL

FOR THE

BULLDOG

SERIES 100

The Operating Manual contains additional instructions and information not required for inclusion in the Flight Manual but necessary for the safe operation of the aeroplane. Instructions and information on the servicing and care of the aeroplane and its components are not contained in this manual but will be found in the associated Maintenance Manual.

The Operating Manual is published under the authority of the Design Approval held by the Type Design Organisation.

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SECTION 7

DESIGN FEATURES

This section contains a description of the design features of the aeroplane not already described in previous sections.

CONFIGURATION

GENERAL

The Scottish Aviation Bulldog Series 100 is a 2/3 seat low wing monoplane of all-metal stressed skin construction with fixed tricycle landing gear and sliding cockpit canopy, powered by an Avco-Lycoming IO-360-A1B6 engine driving a Hartzell two-blade constant speeding propeller type HC-C2YK-4/C7666A-2 or HC-C2YK-4F/FC7666A-2. Principal dimensions are given in Figure 1-1 on Page 1-7. Airframe station positions are given in Figure 7-2 on Page 7-7.

LANDING GEAR

The landing gear fitted to this aeroplane is of fixed tricycle type with steerable nosewheel and differential brakes on the main wheels.

The main legs are hinged at the main spar just outboard of the fuselage and are sprung by oleo-pneumatic shock absorbers mounted transversely in the fuselage and attached to lever extensions on the legs above the hinge axis. Shock absorber stroke is 2 in and pressure 400 lb/in^2. The tyre pressure is 30 lb/in^2.

The nose leg shock absorber is also of oleo-pneumatic type and is contained within the leg. Travel is 6 in and pressure is 60 lb/in^2. Tyre pressure is 40 lb/in^2.

The nose leg is steerable through linkage from the rudder pedals.

The wheel braking system is described in Section 4.

COCKPIT CANOPY

Access to the cabin is by a rearwards-sliding canopy fitted with a lock and jettisonable in flight for emergency exit. Walkways are provided on each mainplane.

Amend No 5 | The canopy can be opened in flight for bad-weather operation. See Page 2-6 for the associated limitations and Page 4-17 for closing procedures.

Provision is made for the fitting of blind flying screens.

A window is provided on each side of the fuselage aft of the canopy to illuminate the rear seat area. If required each window may be supplied with provision for opening in flight.

ACCOMMODATION

SEATING

Accommodation is provided for 2 or 3 occupants in individual seats.

The forward seats are standard and are located side-by-side. The backs are adjustable for rake in four positions and fold forward for access to the rear seat and baggage compartment. The seat back should be adjusted on the ground only and the lock pins checked fully extended. No attempt should be made to re-adjust in flight. The seat back cushions are removable to accommodate parachutes and the base cushions to accommodate survival packs. Full shoulder harnesses are provided.

A.8

A similar seat without back adjustment may be provided in the rear of the cabin according to customer's requirements.

BAGGAGE

Baggage may be carried in the rear beside the rear seat or in the space occupied by the seat when it is removed. Suitable lashing rings are provided.

FIRE EXTINGUISHER

A hand fire extinguisher of bromochlorodifluoromethane (BCF) type is mounted on the central console behind the front seats.

INSTRUMENTS AND CONTROLS

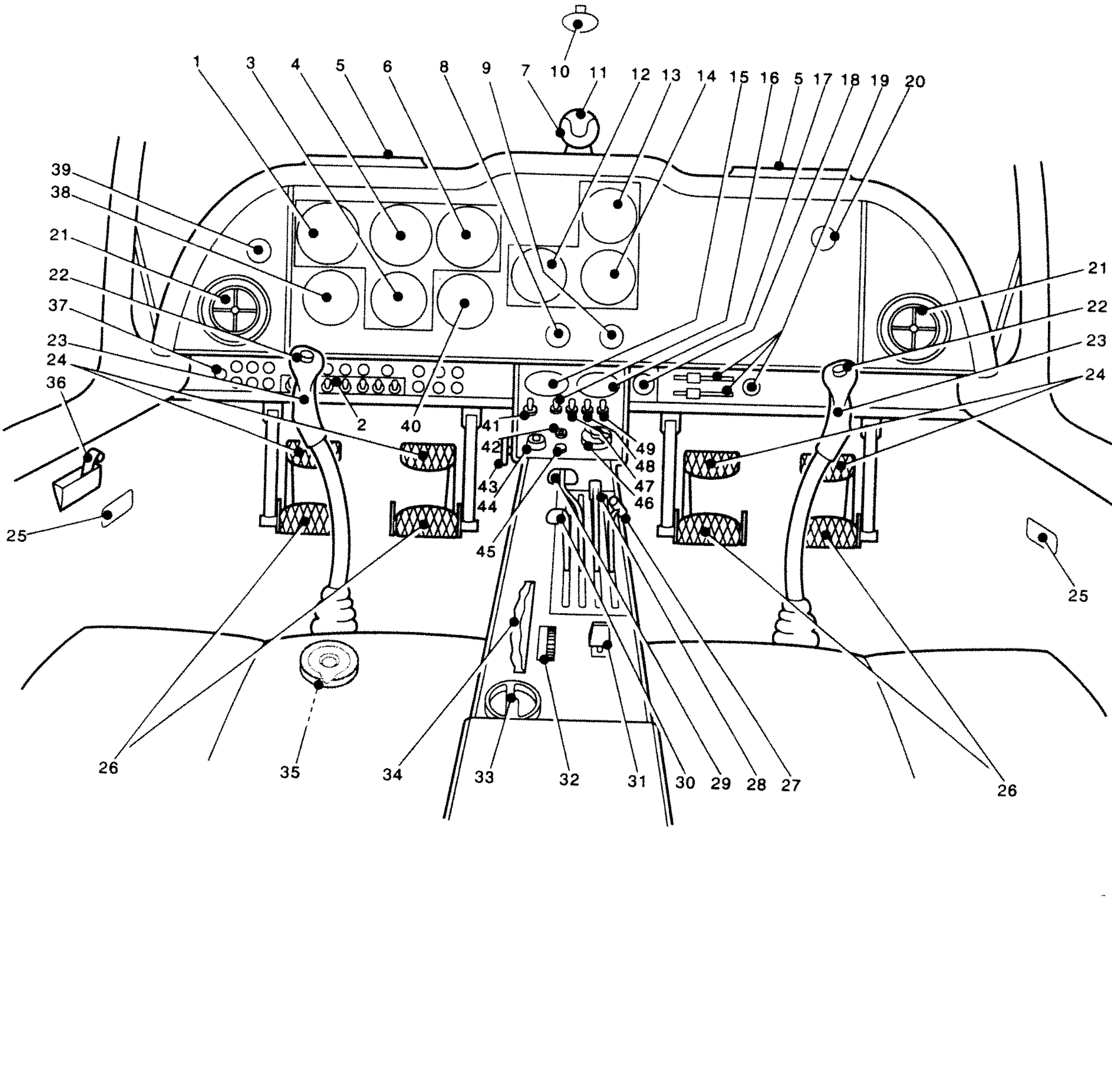
GENERAL

The standard layout of instruments and controls is given in Figure 7-1 opposite. The specific layout in this aeroplane is given in the appropriate supplement in Section 6, if different from that shown in figure 7-1.

The key to the layout given in Figure 7-1 is as follows:

1. Airspeed indicator.
2. Electrical switches.
3. Gyroscopic direction indicator.
4. Gyroscopic bank and pitch indicator.
5. Check list/map clips.
6. Altimeter.
7. Compass card.
8. Clock.
9. Wing-flap position indicator.
10. Outside air temperature gauge.
11. Magnetic compass.
12. Oil temperature/oil pressure/cylinder head temperature indicator.
13. Fuel pressure/manifold pressure indicator.
14. Engine rotational speed indicator.
15. Fuel contents gauge.
16. Alternator switch.
17. Volt-ampere meter.
18. Induction air control.
19. Heating system controls.
20. Vacuum gauge.
21. Fresh air louvres.
22. Press-to-transmit buttons.
23. Control columns.
24. Brake pedals.
25. Ashtrays.
26. Rudder pedals.
27. Mixture control.

STANDARD INSTRUMENT AND CONTROL LAYOUT



28. Pitch control
29. Throttle control.
30. Friction lock.
31. Wing-flap selector.
32. Elevator trim indicator.
33. Rudder trim control.
34. Elevator trim control.
35. Fuel selector.
36. Left hand throttle control.
37. Electrical system circuit breakers.
38. Turn and slip indicator.
39. Accelerometer.
40. Rate of climb and descent indicator.
41. Dual dimmer control.
42. Alternator warning lamp.
43. Handbrake lever.
44. Starter push switch.
45. Starter warning lamp.
46. Ignition switch.
47. Booster pump switch.
48. Volt-ampere selector switch.
49. Battery master switch.

A.

Markings and placards are as stated in Section 2 or as required by the customer and stated in the appropriate supplement in Section 6.

PRIMARY CONTROLS

The flying control surfaces are operated by conventional twin side-by-side "stick-type" control columns and pendant-type rudder pedals. The right hand column is easily removable if required. Both pairs of rudder pedals are adjustable for reach and are mechanically connected to the nosewheel steering mechanism. Each pair incorporates toe pedals to operate the wheel brakes.

TRIM

For directional trim, an adjustable trim tab is fitted to the rudder operated by a small hand control wheel mounted horizontally on the rear upper face of the central console with an adjacent indicator scale marked RUDDER TRIM, LEFT-RIGHT. Take-off setting is marked TO.

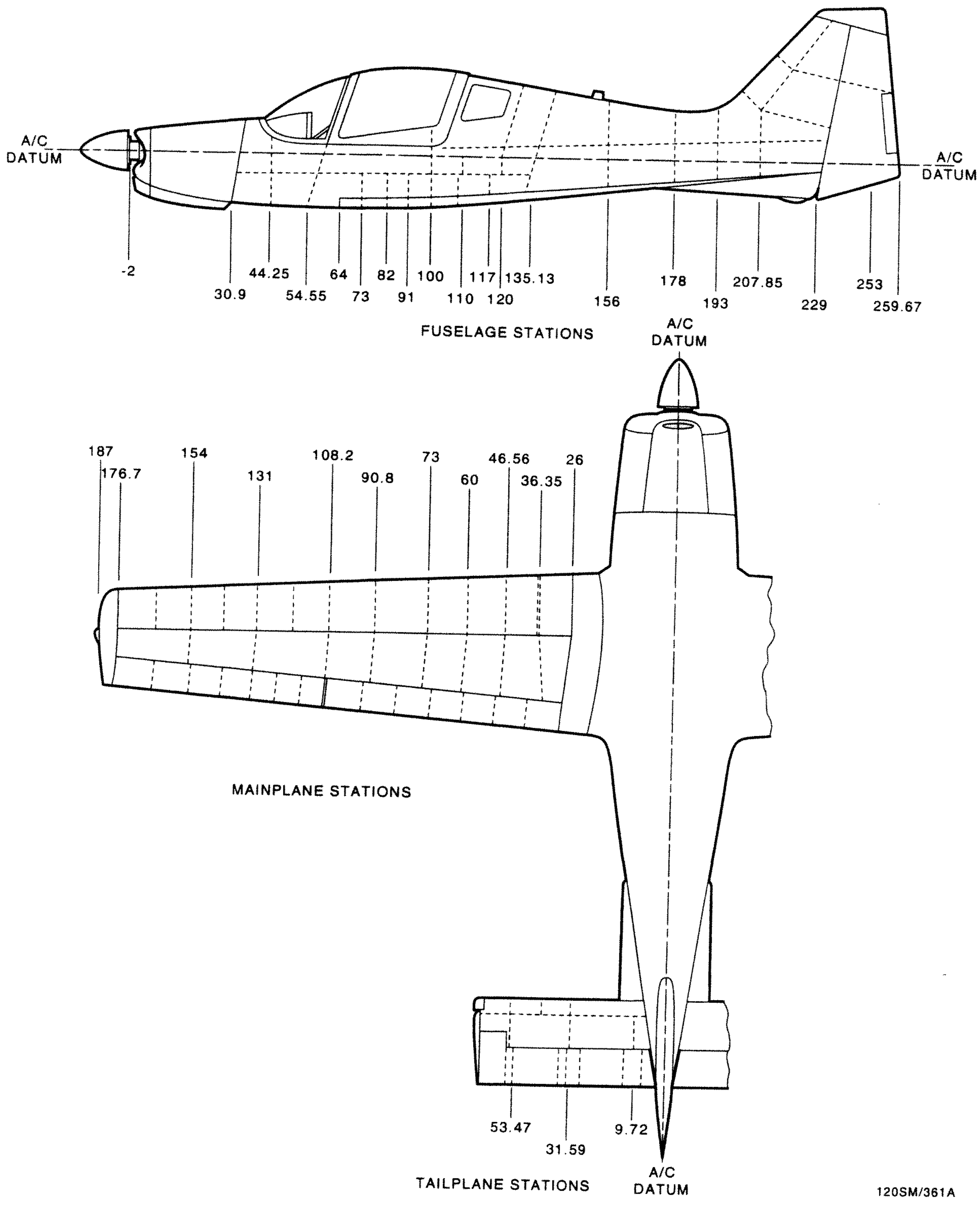
For longitudinal trim, an adjustable trim tab is fitted to the starboard elevator operated by a control wheel mounted vertically in a slot in the central console with an adjacent indicator scale marked ELEVATOR TRIM, NOSE DOWN - NOSE UP, the trim position being shown in a window to the right of the wheel. The take-off setting is indicated by a band marked TO. An additional control wheel may be mounted on the left hand cabin wall if required.

Lateral trim can only be adjusted on the ground by means of a fixed tab on the starboard aileron.

CONTROL LOCK

A control lock is provided to operate on the left hand control column. It consists of two rods mounted under the left hand forward seat free to swivel at one end and secured by a simple catch at the other when not in use. When released,

AIRFRAME STATIONS



they are turned until they meet the control column and their ends held by a pin in the bracket on the rear of the column to hold it rigid.

On the ground the rudder is prevented from moving by the nosewheel steering mechanism.

WING-FLAPS

The wing-flaps are of single-slotted type and are operated by an electrical actuator located in the starboard wing root, and may be set in any of three positions by means of a gated selector mounted on the central console and marked WING-FLAPS, UP-INTER-FULL to signify retracted (0° position), intermediate extension (10° position) and full extension (45° position) respectively.

Position is indicated by a wing-flap position indicator mounted on the instrument panel and marked as for the selector.

RIGGING & CONTROL SURFACE TRAVELS

Details of rigging and control surface travels are given in the Maintenance Manual.

STALL WARNING

To ensure adequate stall warning in all configurations, a stall warning system is installed. This consists of a vane detector fitted to the leading edge of the port wing to operate a warning horn mounted on the instrument panel when the airspeed falls to within 5 to 10 kn (9 to 19 km/h) of the true stall, depending on CG position.

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No 3

PITOT-STATIC HEAD

Airspeed and altitude are measured by a pitot-static head located under the port wing as described on Page 5-2 and fitted with an electrical heater.

POWER PLANT

The power plant comprises an Avco-Lycoming type IO-360-A1B6 4-cylinder, horizontally-opposed, air-cooled, direct-drive, fuel-injected engine, a Hartzell type HC-C2YK-4/C7666A-2 or HC-C2YK-4F/FC7666A-2 two blade, constant speeding, metal propeller of 74 in (1879.6 mm) diameter, and their accessories.

The engine is mounted off the bulkhead on dynafocal mountings. Cylinder bore is 5.125 in, stroke 4.375 in and total displacement 361 in^3. Compression ratio is 8.7:1. Rating is 200 bhp at 2700 rev/min. Limitations are given in Section 2.

The engine is fitted with an electric starter and drives an alternator as described in Section 4. In the event of a flat battery, the engine may be started by hand-swinging.

Fuel is supplied to the engine as described in Section 4 through an engine-driven pump.

Engine output is controlled by throttle, propeller and mixture levers mounted together on the console and marked THROTTLE, OPEN-CLOSED; PROPELLER PITCH, FINE-COARSE and MIXTURE, FULL RICH-CUT-OFF, respectively. The propeller pitch markings correspond to the maximum and minimum rotational speed positions. A lever to the left of the throttle marked LOCK adjusts the friction applied to these levers. An additional throttle lever is mounted on the left hand cabin wall, friction being controlled by the above mentioned lever. An additional propeller pitch lever may be mounted on the left hand cabin wall.

The engine is fitted with a dual magneto system, the left hand magneto being fitted with an impulse coupling. The system is controlled by a key-operated selector switch located in front of the throttle lever marked ENGINE, OFF-R (i.e., Right) - L (i.e., Left) - BOTH, the "R", "L" and "BOTH" signifying which magnetos are operating.

Induction air passes normally from the forward-facing air intake through a filter. Although the fuel-injection system fitted to this engine obviates the risk of carburettor icing the air filter may become blocked by foreign matter or ice. An alternative intake inside the engine cowling is provided drawing air through a heat exchanger on the exhaust system. The control is located to the right of centre under the instrument panel and marked INDUCTION AIR, COLD IN-HOT OUT. Provision is made for the automatic selection of the alternative intake should the forward facing intake or air filter become blocked.

No fire extinguishing system is fitted in the engine compartment.

AVIONICS

Provision is made on the instrument panel for fitting avionic equipment as required by the Purchaser.

ACCESS POINTS

FLOOR PANELS

Access points within the cabin in the form of floor panels are shown in Figure 7-3 on Page 7-10. The key is as follows:

1, 2, 3 and 4	Brake pipelines and structure.
5 and 6	Control column bearings, aileron control cables, brake pipelines and fuel component bay (6 only - containing the fuel filter, booster pump, fuel cock, non-return valve and pipelines).
7 and 8	Flap torque tube and aileron balance cable.
9 and 10	Structure and electrical cables only.
11 and 12	These panels are underneath the seats and give access to the main landing gear shock absorber struts and attachments.

EXTERNAL PANELS

Access points on the exterior of the airframe are shown in Figure 7-4 on Page 7-11. The key is as follows:

1. Rudder and elevator control runs.
2. Starboard main undercarriage fairing.
3. Starboard flap torque tube.
4. Starboard aileron control run and wing root structure.

FLOOR PANELS

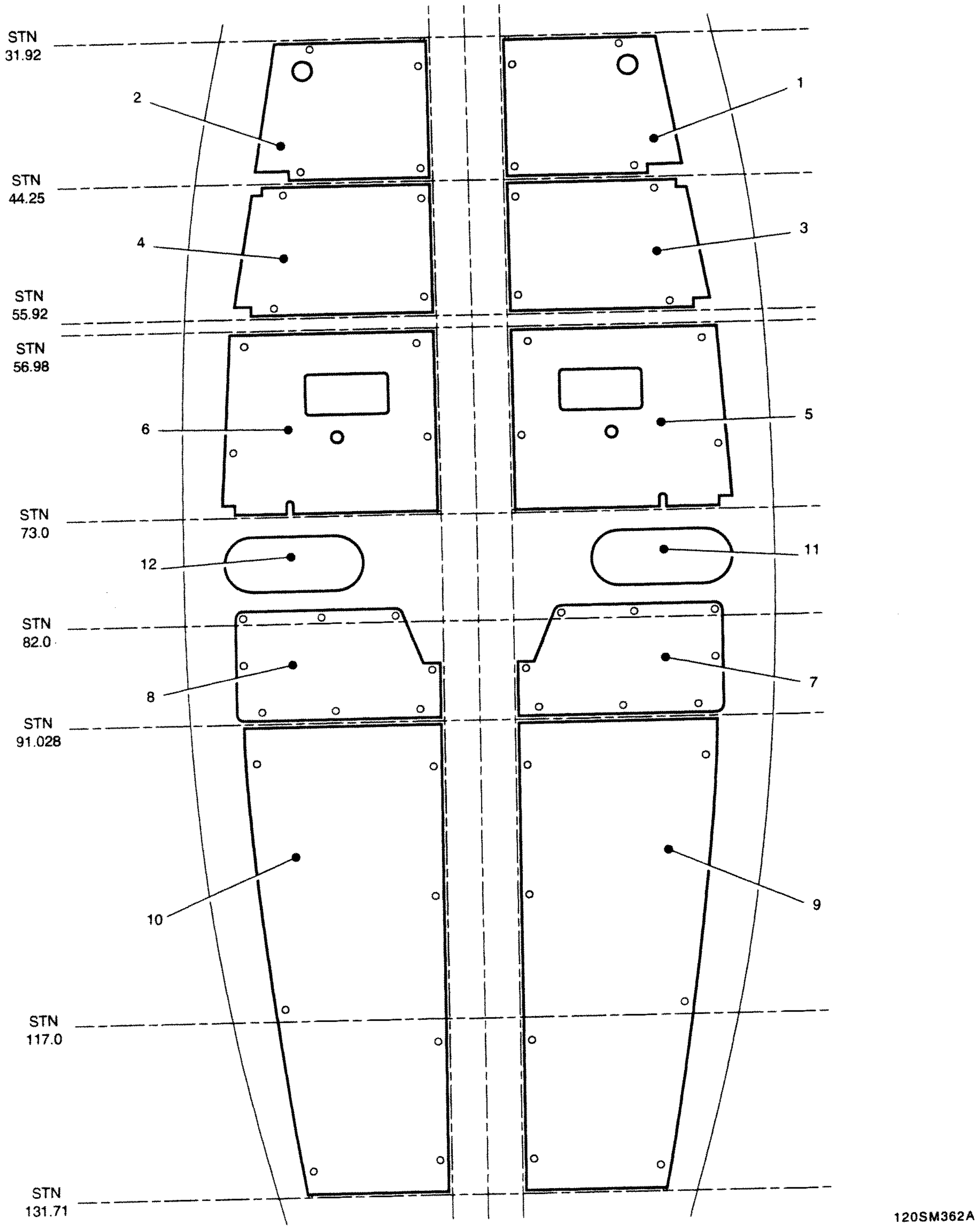
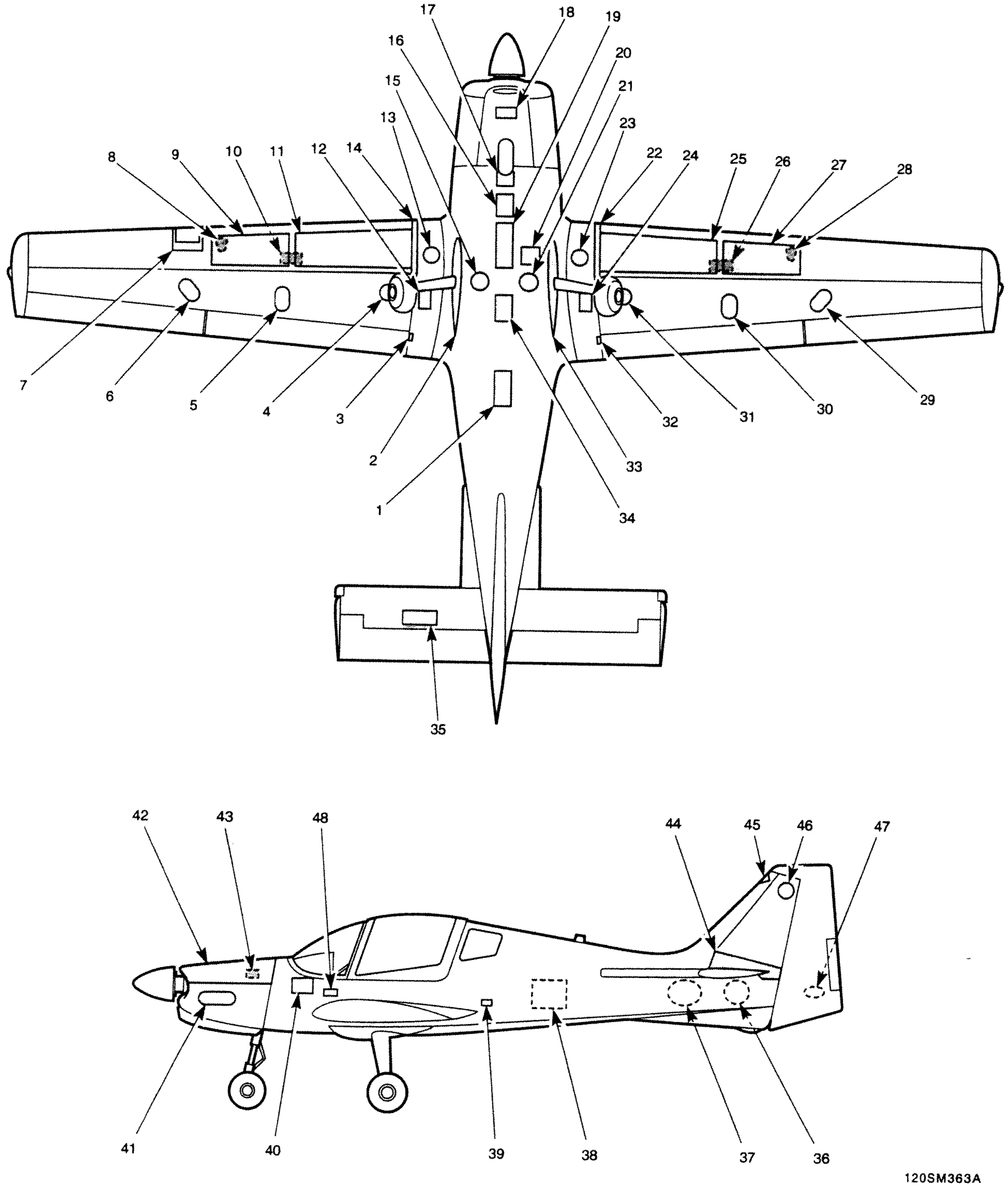


Fig. 7-3

EXTERNAL ACCESS POINTS



5. Starboard aileron control run and wing structure.
6. Starboard aileron differential lever.
7. Landing Lamp.
8. Starboard fuel tank filler cap.
9. Starboard outboard fuel tank.
10. Starboard inboard and outboard fuel tank interconnecting pipes.
11. Starboard inboard fuel tank.
12. Flap motor, pitot, static and electrical connections.
13. Starboard inboard fuel tank connections.
14. Starboard wing root.
15. Starboard main undercarriage shock absorber.
16. Rudder control.
17. Nose leg attachments.
18. Engine and fuel injection.
19. Rudder and elevator control runs.
20. Engine fuel filter and booster pump.
21. Port main undercarriage shock absorber.
22. Port wing root and pitot and static drains.
23. Port inboard fuel tank connections.
24. Aileron control runs.
25. Port inboard fuel tank.
26. Port inboard and outboard fuel tank interconnecting pipes.
27. Port outboard fuel tank.
28. Port fuel tank filler cap.
29. Port aileron differential lever.
30. Port aileron control run and wing structure.
31. Port aileron control run and wing root structure.
32. Port flap torque tube.
33. Port main undercarriage fairing.
34. Rudder and elevator control run.
35. Elevator trim screw jack.
36.–37. Rudder and elevator levers and stops.
38. Battery bay.
39. Ground starting socket.
40. Rudder torque tubes and instrument panel rear.
41. Bottom plugs.
42. Removable top engine cowling.
43. Engine oil filter and dipstick.
44. Horizontal tail attachment.
45. Aerial connections.
46. Navigation light wiring.
47. Rudder trim control. Amend No 1
48. Left hand throttle lever.

PROVISION FOR JACKING, LIFTING AND PICKETING

Three jacking points are provided in the aeroplane structure, one in the undersurface of each wing in line with the centre flap hinge aft of the main spar at wing station 73 (i.e., spanwise) and fuselage station 76.1, and one underneath forward fuselage behind and to the left of the nose wheel leg at fuselage station 39.43. Each point consists of a block into which a jacking pad may be screwed. Amend No 1

Amend No 1 — Lifting points are provided on the engine mounting and in the top surface of each wing directly above the jacking point. Each wing point consists of a block into which a lifting eye may be screwed.

For picketing, a lifting eye may be screwed into each wing jacking point. A picketing hole is provided in the tail bumper.

PROVISION FOR LEVELLING

A pair of longitudinal levelling points is located on the left hand side of the fuselage at fuselage station 104 and 128.45. Each point consists of a hole into which a 0.25 in diameter peg can be inserted as a base for a spirit level.

The canopy rails are used as a base for a spirit level for lateral levelling.

GROUND EQUIPMENT

The following standard ground equipment is supplied with the aeroplane:

Pitot-static head cover.
Hand tow bar/steering arm/tail steady.

Additional equipment may be supplied at customer's request.

SECTION 8

CRUISE CONTROL

This section contains information to enable cruise power conditions to be set up

RELATIONSHIP BETWEEN FUEL FLOW AND FUEL PRESSURE

The relationship between fuel flow and fuel pressure is given in Figure 8-1 on Page 8-2.

MANIFOLD PRESSURE

Manifold pressure is given in Figure 8-2 on Page 8-3 for ISA conditions for varying engine rotational speeds, altitudes and cruise power conditions.

For temperatures above ISA, the manifold pressure given in Figure 8-2 is increased by 0.05 in Hg/°C above the ISA temperature appropriate to the altitude; for temperatures below ISA the manifold pressure given in Figure 8-2 is reduced by 0.05 in Hg/°C below the ISA temperature appropriate to the altitude.

FUEL PRESSURE

Fuel pressure is given in Figure 8-3 on Page 8-4 for "best power" and "best economy" mixture conditions for varying engine rotational speeds and cruise power conditions.

TECHNIQUE

Any desired cruise power condition can be set up from Figures 8-2 and 8-3 in terms of manifold pressure, engine rotational speed and fuel pressure, as follows:

(1) Throttle and propeller pitch : Obtain manifold pressure from Figure 8-2 appropriate to the rotational speed, altitude and power condition. Correct manifold pressure for temperature as stated above. Set throttle and propeller pitch to give corrected manifold pressure and required rotational speed.

(2) Mixture : Set to give the fuel pressure given in Figure 8-3 appropriate to the rotational speed, mixture condition and power condition.

NOTES: (1) Leaning of fuel-air mixture is permitted for cruise speeds and cruise powers at all altitudes.
(2) Mixture must be returned to FULL RICH before increasing power settings.
(3) At low power settings care must be taken when setting "best economy" fuel pressures. Any rough running must be prevented by increasing fuel pressure until engine runs smoothly again.
(4) The rotational speed-power condition limitations shown on Page 2-3 and in Figure 8-3 for continuous operation must be observed. Rotational speed limitations stated on Page 2-3 must also be observed.
(5) To facilitate setting fuel pressure, bands of fuel pressure appropriate to "best power" mixture for power conditions of 75%, 65%, 55% and 45% may be marked on the fuel pressure gauge.

Amend No 5

RELATIONSHIP BETWEEN FUEL FLOW AND FUEL PRESSURE

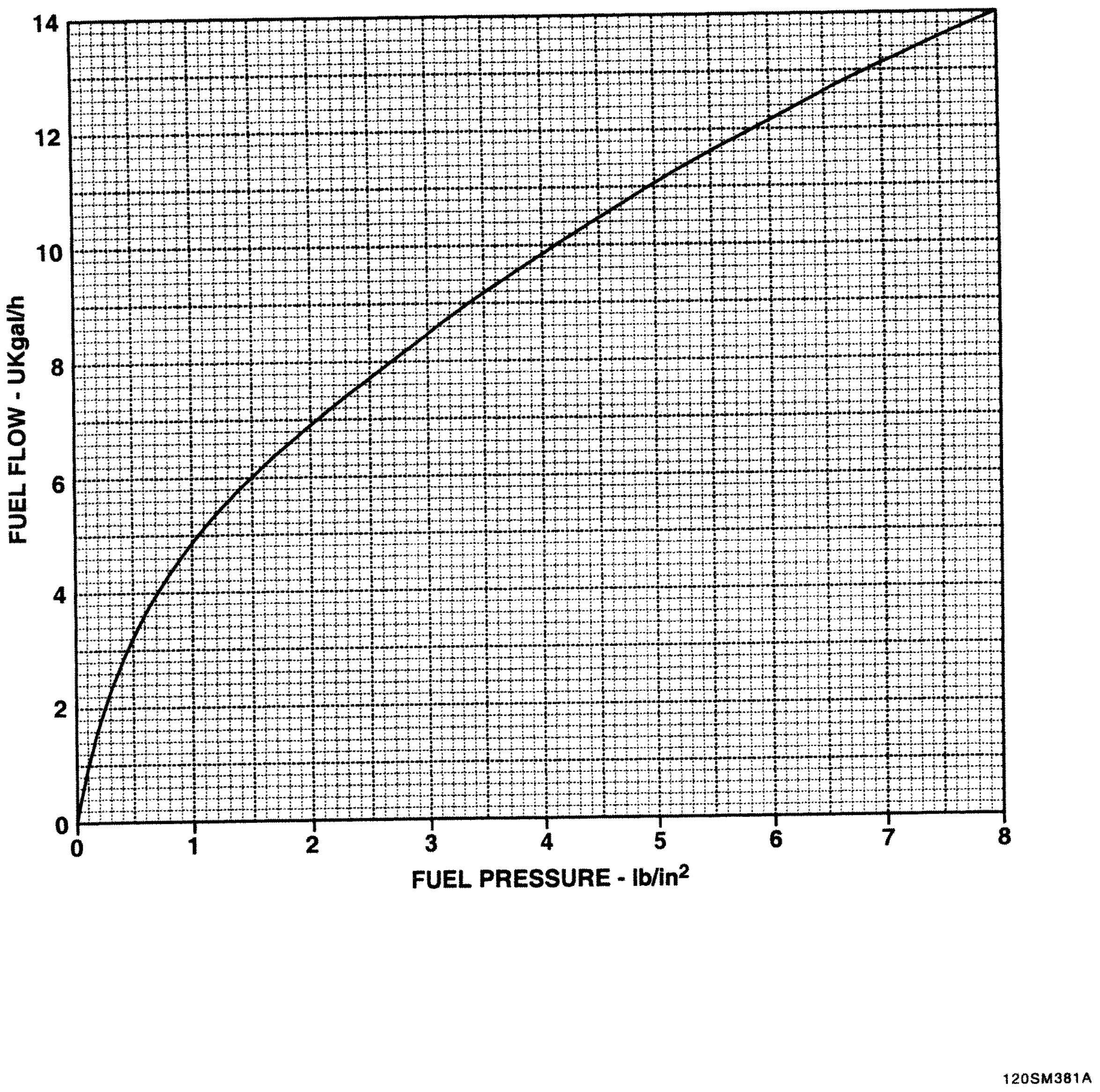
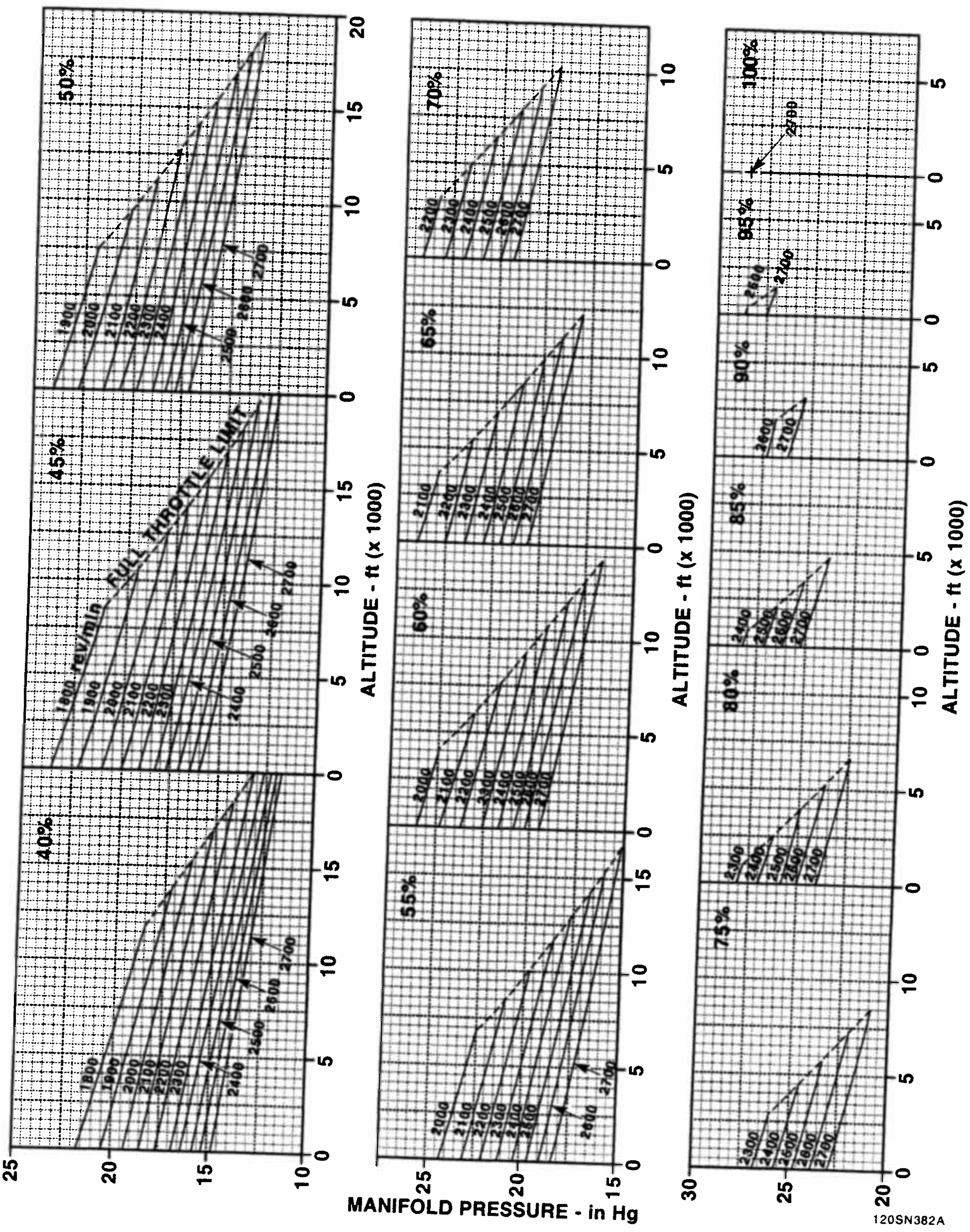


Fig 8-1


50%
45%
40%
70%
65%
60%
55%
100%
95%
90%
85%
80%
75%
FULL THROTTLE LIMIT
1800 rev/min
ALTITUDE - ft (x 1000)
MANIFOLD PRESSURE - in Hg
120SN382A

CRUISE FUEL PRESSURE

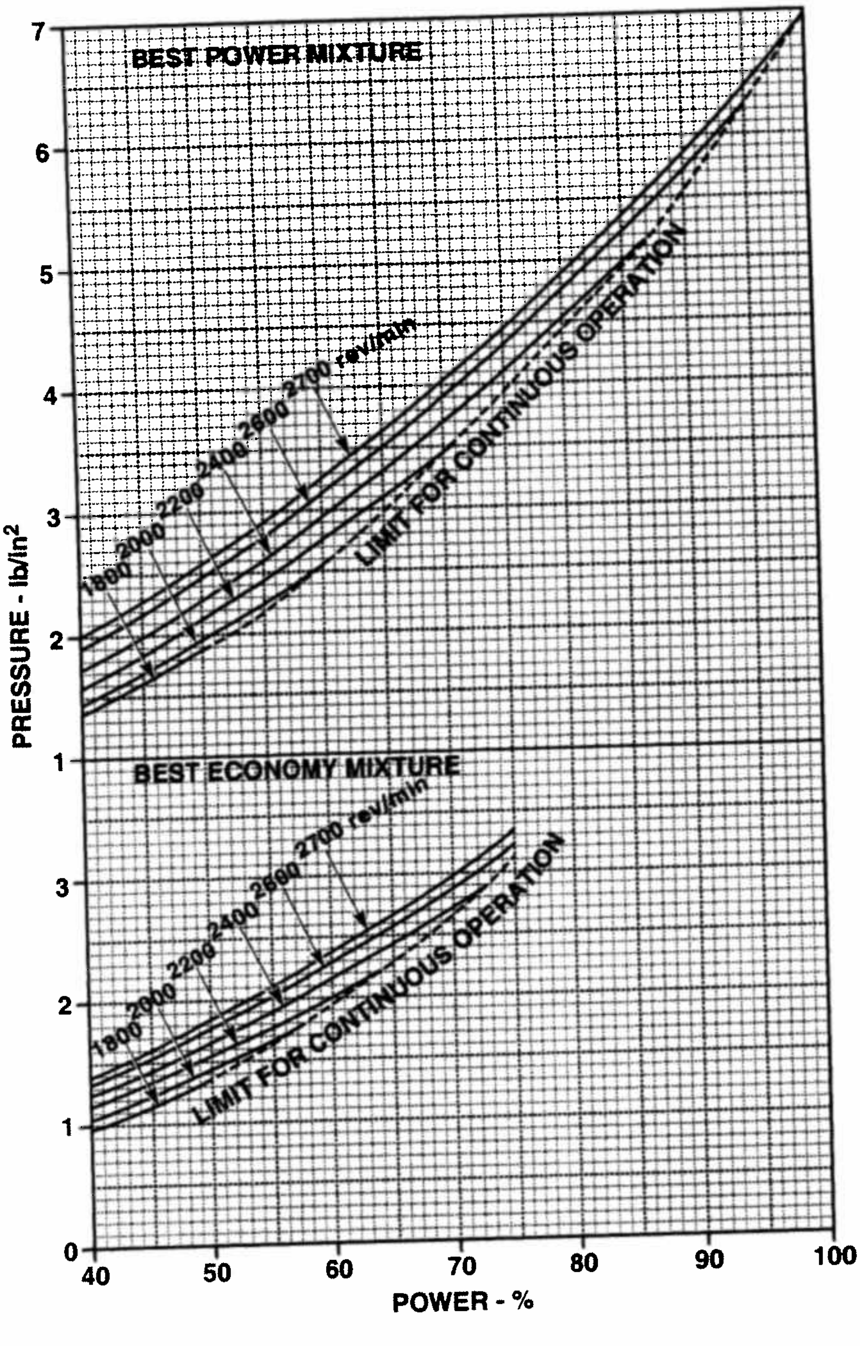
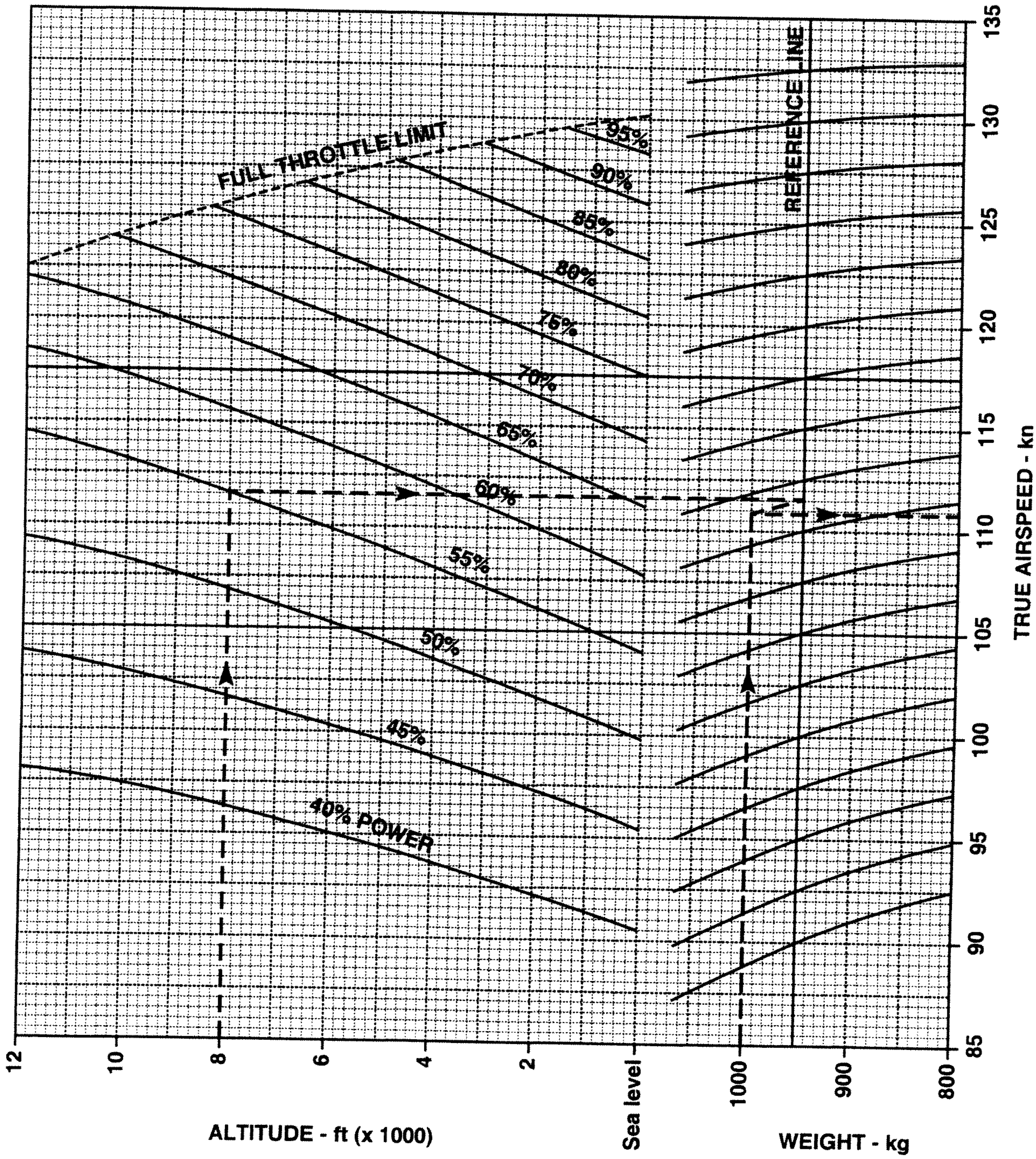


Fig 8-3

CRUISE TRUE AIR SPEEDS ON "BEST POWER" MIXTURE IN ISA



120SM384A

Fig 8-4

EXPECTED PERFORMANCE

For power condition set up for "best power" mixture as described on Page 8-1, expected true air speeds in ISA are given in Figure 8-4 on Page 8-5 for varying altitudes, power conditions and weights. The use of the chart is illustrated by the arrowed dotted lines.

Fuel consumptions for the appropriate conditions are obtained from Figure 8-3 on Page 8-4 and Figure 8-1 on Page 8-2. For preliminary calculations, the following can be assumed:

Power Conditions (%)	Fuel Consumption (UKgal/hr)
100 95	13
90	12
85 80	11
75 70	10
65 60	9
55 50	8
45 40	7

SECTION 9

UNFACTORED PERFORMANCE

This section contains gross and measured performance data as appropriate. Gross performance is as defined on Page 1-18. As this data does not include the margins required by the operating regulations, it must not be used for establishing compliance with the operating regulations; the use of the performance data contained in Section 5 is mandatory when the aeroplane is used for the purpose of public transport.

TAKE-OFF

The take-off distance required scheduled in Section 5 is obtained by factoring the gross take-off distance by 1.25.

For the conditions prescribed on Page 5-12, gross take-off distance from rest to the 50 ft (15 m) height point is therefore 80% of the take-off distance required given for the appropriate air temperature, aerodrome altitude, weight, reported wind component and uniform runway slope in Figure 5-8 on Page 5-13.

Gross take-off run will not exceed, and should not be taken as, 73% of the gross take-off distance.

CLIMB AFTER TAKE-OFF

For the conditions prescribed on Page 5-28, gross pressure rate of climb after take-off is given for the appropriate weight, altitude and air temperature in Figure 5-14 on Page 5-29.

EN ROUTE CLIMB

For the conditions prescribed on Page 5-22, gross pressure rate of en route climb is given for the appropriate weight, altitude and air temperature in Figure 5-12 on Page 5-23.

For these conditions, in climbing from sea level, the appropriate time taken, fuel used and horizontal distance travelled in still air are given in Figure 9-1 on Page 9-2, Figure 9-2 on Page 9-3 and Figure 9-3 on Page 9-4 respectively for varying weights, altitudes climbed and air temperatures. The use of the charts is illustrated by the arrowed dotted lines.

EN ROUTE GLIDE

For the conditions prescribed on Page 5-24, the horizontal distance covered in en route glide in still air is 1.35 n mile/1000 ft (0.82 km/100 m) height descended.

LANDING

The landing distance required scheduled in Section 5 is obtained by factoring the measured landing distance by 1.43.

For the conditions prescribed on Page 5-26, measured landing distance from a height of 50 ft (15 m) to come to rest is therefore 70% of the landing distance required given for the appropriate air temperature, aerodrome altitude, weight, reported wind component and uniform runway slope in Figure 5-13 on Page 5-27.

TIME TAKEN IN EN ROUTE CLIMB

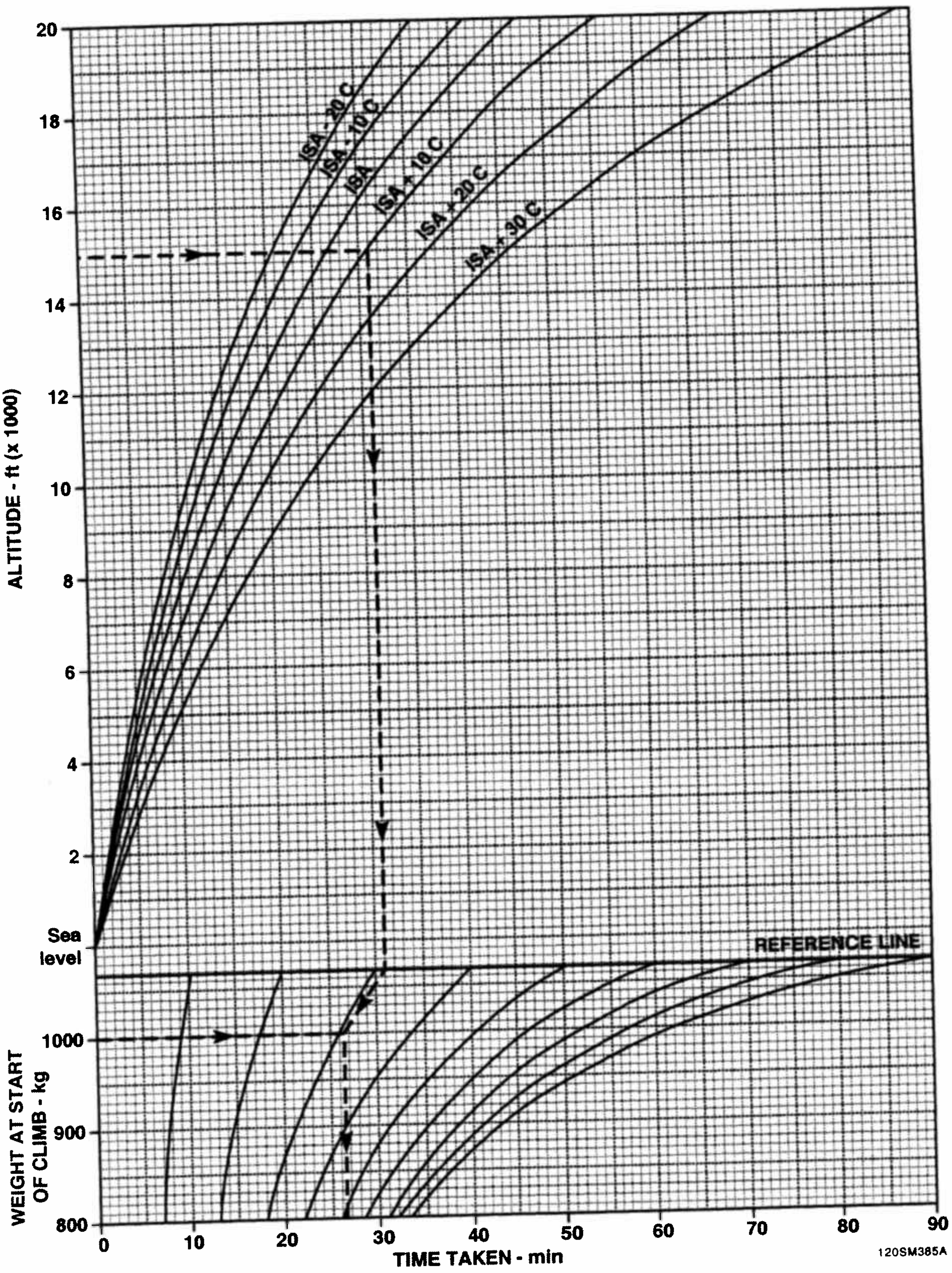


Fig 9-1

FUEL USED IN EN ROUTE CLIMB

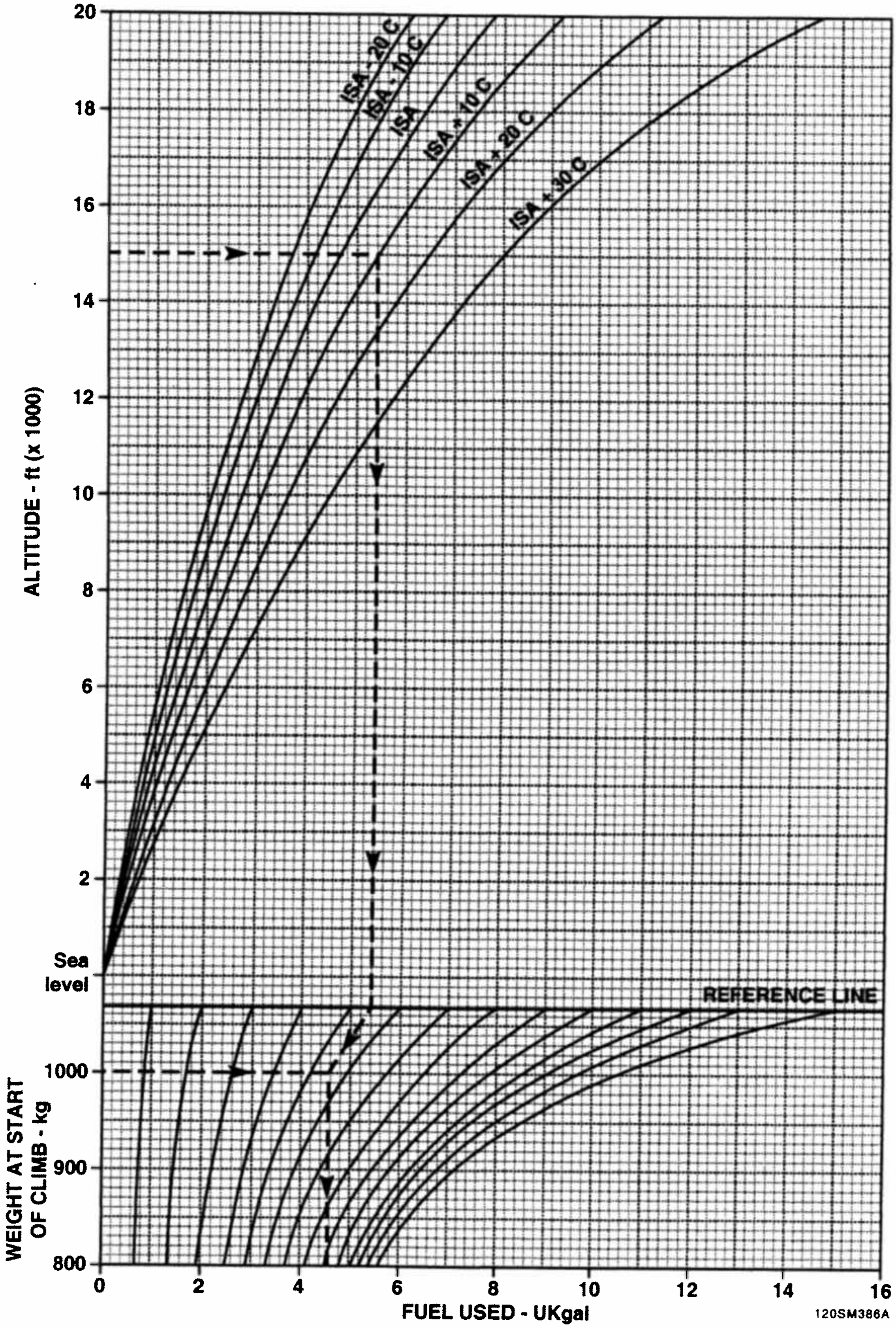


Fig 9-2

HORIZONTAL DISTANCE TRAVELLED IN STILL AIR IN EN ROUTE CLIMB

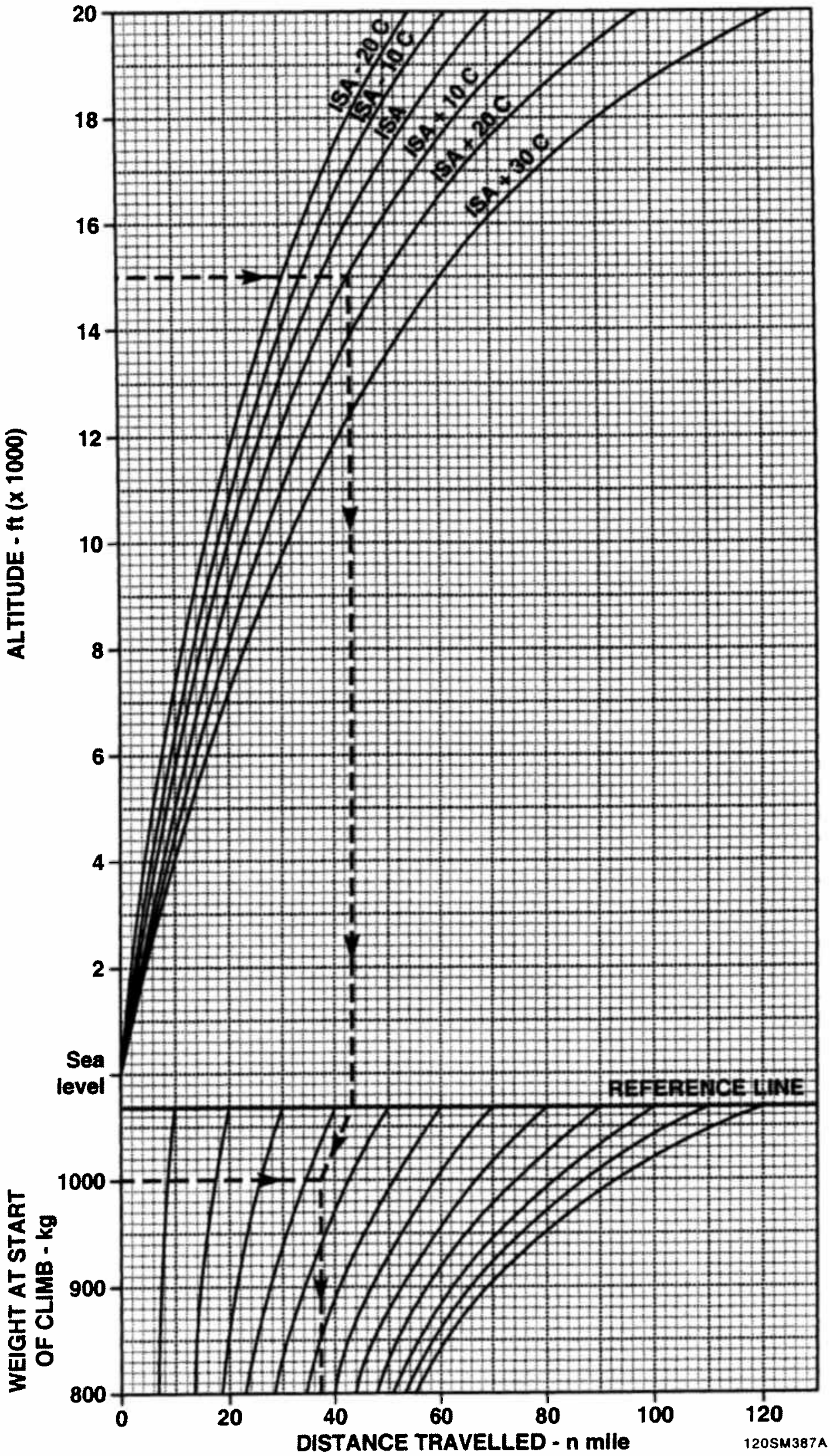


Fig 9-3

SECTION 10

LOADING

This section contains general information on loading the aeroplane. A Weight and Balance Report incorporating the Weight and CG Schedule for this aeroplane required by British Civil Airworthiness Requirements, Section A, is contained in the appropriate supplement in Section 6. Any information contained in the Weight and Balance Report which differs from that contained in this section must be regarded as replacing the information in this section and used accordingly.

Terms are defined on Pages 1-19 and 1-20.

GENERAL

It is the responsibility of the operator and the pilot in command to ensure before flight that the aeroplane is properly loaded.

the weight of the aeroplane at take-off must not exceed the maximum permissible weight appropriate to the form of operation (i.e., non-aerobatic or aerobatic) given on Page 2-1. In particular circumstances, operational performance considerations may advise or enforce a lower weight.

The centre of gravity of the aeroplane must lie between the forward and appropriate aft limits given in Figure 2-1 on Page 2-2. As the fuel tanks are slightly forward of the normal centre of gravity position, the aircraft centre of gravity will move aft as fuel is consumed. Aircraft weight and centre of gravity should therefore be determined for both the take-off and zero fuel conditions to ensure that the appropriate aft limit is not exceeded as fuel is consumed.

In determining aircraft weight and centre of gravity all items of equipment and load relevant to the particular role and flight must be accounted for.

Essential loading information to enable the aeroplane to be correctly loaded is contained in the Weight and Balance Report in the appropriate supplement in Section 6 and is applicable to the condition in which the aeroplane is delivered by the manufacturer. It is the responsibility of the operator to record any subsequent changes affecting the weight and/or the centre of gravity of the aeroplane or its equipment as shown in the Weight and CG Schedule in the Weight and Balance report, or as required by the appropriate foreign authority.

The datum to which the centre of gravity limits of Figure 2-1 relate, and about which moments are taken, is fuselage station zero as defined on Page 2-1. For this aeroplane, fuselage stations are designated as inches from station zero and are given in Figure 7-2 on Page 7-7 for the complete airframe and Figure 10-1 on Page 10-3 for the cabin. For any item, the moment, or lever, arm is its distance from the datum and therefore its station and is expressed in m. The term "arm" is used in this handbook for moment, or lever, arm. Moment is the appropriate weight in kg multiplied by the associated arm and is therefore expressed as kg m. Aircraft CG position is expressed as m aft of datum.

ACCOMMODATION

The internal layout of the cabin is given in Figure 10-1 on Page 10-3. Relevant dimensions are shown.

FORWARD COMPARTMENT

The part of the cabin containing the two forward seats forward of fuselage station 91.03 is designated forward compartment. The mean station of this compartment appropriate to the occupants of the seats is 78 giving an arm of 1.98 m.

REAR COMPARTMENT

The remainder of the cabin aft of fuselage station 91.03 is designated rear, or baggage, compartment and is divided laterally by the central console into two equal spaces, the space on the right being designated baggage area A and the space on the left baggage area B. The additional seat described on Page 7-4, when provided, is installed in area A as shown by dotted line in Figure 10-1. Lashing rings are provided as shown in Figure 10-1. The mean station of this compartment appropriate to both the occupant of the seat and baggage is 113 giving an arm of 2.87 m.

Loading limitations for the rear compartment are given on Page 2-1 and must be observed. These limitations apply to the compartment as a whole as the loading imposed on the floor of the compartment and therefore include the seat and its occupant, his personal equipment, baggage, and any items of equipment to be carried on the floor.

BAGGAGE

For convenience, the term "baggage" is used in this handbook to describe any non-human item of internally-carried payload.

DISTRIBUTION

When baggage of a weight in the order of the maximum load permitted on Page 2-1 is to be carried, it should be distributed as evenly as possible between areas A and B. The largest items should be placed forward with smaller items consolidated progressively behind leaving no intervening gaps.

When the fitting of the rear seat, or the nature of the baggage itself, precludes such distribution the baggage may be placed in one area and should be distributed as uniformly as possible over the entire area.

INTENSITY

If the baggage consists of heavy or high density items, the load intensity must be checked to ensure that the appropriate limitation given on Page 2-1 is not exceeded. This is obtained by dividing the weights of the items by their respective areas in contact with the floor.

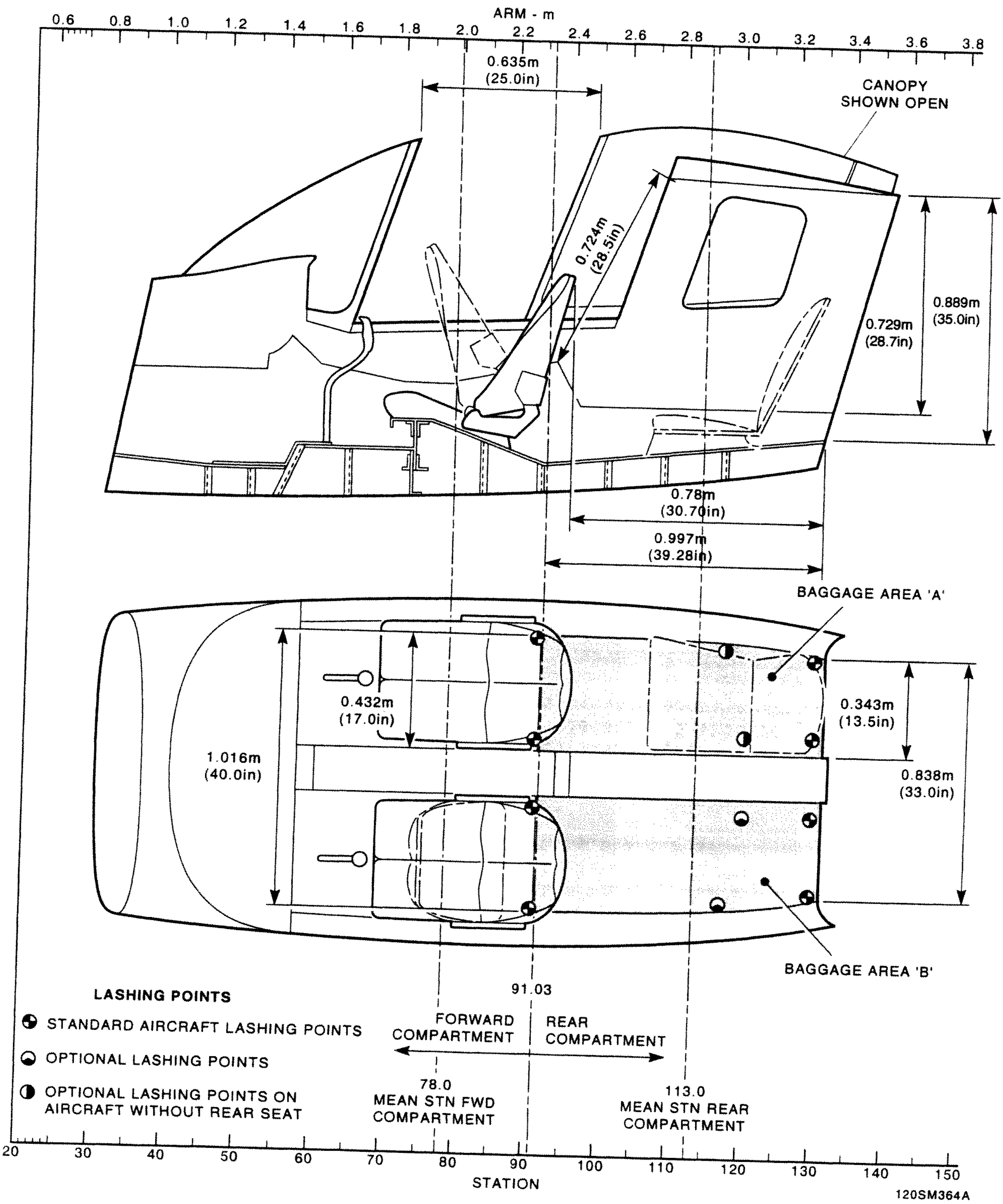
RESTRAINT

All items must be adequately restrained before flight to prevent movement in any direction.

The baggage in each area must be secured to a minimum of four lashing rings.

ARM

In the determination of the suitability of a particular loading, it will generally be satisfactory to use the mean rear compartment station given above



ARM - m
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8
0.635m
(25.0in)
CANOPY
SHOWN OPEN
0.724m
(28.5in)
0.729m
(28.7in)
0.889m
(35.0in)
0.78m
(30.70in)
0.997m
(39.28in)
BAGGAGE AREA 'A'
0.432m
(17.0in)
1.016m
(40.0in)
0.343m
(13.5in)
0.838m
(33.0in)
BAGGAGE AREA 'B'
LASHING POINTS
STANDARD AIRCRAFT LASHING POINTS
OPTIONAL LASHING POINTS
OPTIONAL LASHING POINTS ON
AIRCRAFT WITHOUT REAR SEAT
91.03
FORWARD
COMPARTMENT
REAR
COMPARTMENT
78.0
MEAN STN FWD
COMPARTMENT
113.0
MEAN STN REAR
COMPARTMENT
20
30
40
50
60
70
80
90
100
110
120
130
140
150
STATION
120SM364A

as the arm applicable to either a rear seat occupant or baggage. However, when an item of baggage is carried whose shape or density precludes the safe use of this arm, the actual arm should be measured and used in the determination.

FUEL

The mean station of the fuel is 65.1 giving an arm of 1.653 m.

PROCEDURE

To determine the suitability of a particular loading proceed generally as follows:

(1) Obtain basic condition in terms of basic weight and associated moment from the Weight and CG Schedule.

(2) For the required role, obtain the weights and associated moments of the items of role and portable equipment from the Weight and CG Schedule or Weight and Balance Report.

(3) Obtain equipped condition in terms of equipped weight and associated moment by adding the items of (2) to basic weight and moment. This gives:

(a) equipped CG position as m aft of datum by dividing moment by equipped weight, and

(b) the weight available for pilot in command, his personal equipment, and disposable load by subtracting equipped weight from take-off weight.

(4) From the appropriate weights and moment arms of the pilot in command, his personal equipment, and each item of payload obtain the associated moments.

(5) Obtain zero-fuel condition in terms of zero-fuel weight and associated moment by adding the items of (4) to equipped weight and moment. This gives the zero-fuel CG position as m aft of datum by dividing moment by zero-fuel weight. This CG must lie between the forward and appropriate aft limits of Figure 2-1.

(6) Obtain fuel weight and associated moment.

(7) Obtain take-off condition in terms of take-off weight and associated moment by adding (6) to zero-fuel weight and moment. This gives the take-off CG position as m aft of datum by dividing moment by take-off weight. This CG must lie between the forward and appropriate aft limits of Figure 2-1.

EXAMPLES

Two examples of the determination of aircraft loading are as follows for typical conditions on a representative aeroplane.

Item		Weight (kg)	Arm (m)	Moment (kg m)
Basic condition (from Weight and CG Schedule - in this case typical)		692	-	1140.11
Example 1 - training role (aerobatic)	Role and portable equipment: Seat base cushions (forward seats).	2	-	4.25
	Equipped condition Pilot in command, with parachute (P1) 2nd pilot, with parachute (P2).	694 86 80	1.649 1.980 1.980	1144.36 170.28 158.40
	Zero fuel condition. Fuel (full usable, 32 UKgal).	860 105	1.713 1.653	1473.04 173.57
	Take-off condition.	965	1.706	1646.61
Example 2 - liaison role (non-aerobatic)	Role and portable equipment: Seat base cushions (forward seats). Rear seat, complete.	2 6	- -	4.25 17.64
	Equipped condition Pilot in command, with parachute (P1) Passenger, with parachute, in forward seat. Baggage.	700 90 82 60	1.66 1.98 1.98 2.87	1162.00 178.20 162.36 172.20
	Zero-fuel condition. Fuel, 27 UKgal.	932 88	1.797 1.653	1674.76 145.46
	Take-off condition.	1020	1.785	1820.22

Reference to Figure 2-1 shows that for Example 1 both the zero-fuel and the take-off condition lie within the aerobatic limits and for Example 2 both lie within the non-aerobatic limits. In each case the loading is therefore suitable.

LOADING CHART

A simple step-by step determination of aircraft loading is given in Figure 10-2 on Page 10-7 for varying equipped conditions and applied loads.

The lower part of the chart is constructed in terms of an index, as defined on Page 10-6, and includes a representation of the centre of gravity envelope of Figure 2-1 obviating any need for cross-referencing. The arm for the rear compartment is taken as the mean station as defined on Page 10-2.

A similar chart is included in the Weight and Balance Report for this aeroplane in the appropriate supplement in Section 6 and is applicable to the condition in which the aeroplane is delivered by the manufacturer. This chart may incorporate additional load grids to account for additional load stations and, if appropriate, should be used in preference to Figure 10-2.

PARAMETERS

The parameters used in the chart are as follows:

(1) Index = $\frac{\text{(appropriate weight) X (arm - 1.65)}}{10}$

The constant used in this expression effectively permits fuel load to be ignored in negotiating the lower part of the chart.

(2) Equipped Weight and CG.

(3) Forward Compartment Load : This is the total weight of items to be carried in the forward compartment in addition to those included in the equipped weight and therefore comprises the weight of the forward seat occupants and their personal equipment.

(4) Rear Compartment Load : This is the total weight of items to be carried in the rear compartment in addition to those included in the equipped weight and therefore comprises the weight of the rear seat occupant, his personal equipment, and/or baggage. It does not include the weight of the rear seat; this is an item of role equipment.

(5) Fuel Load : This is the total quantity of usable fuel to be carried.

(6) Aircraft Weight : This is the total weight of the aircraft appropriate to the condition for which the suitability of the loading is to be determined, i.e., take-off and zero-fuel.

PROCEDURE

The use of the chart is illustrated by the arrowed dotted lines which show Example 2 given on Page 10-5. Proceed as follows:

(1) Determine the equipped condition in terms of equipped weight and associated CG position as prescribed on Page 10-4.

(2) Enter the chart with the equipped weight and move vertically up to the appropriate CG position and the reference line to obtain points A and B respectively.

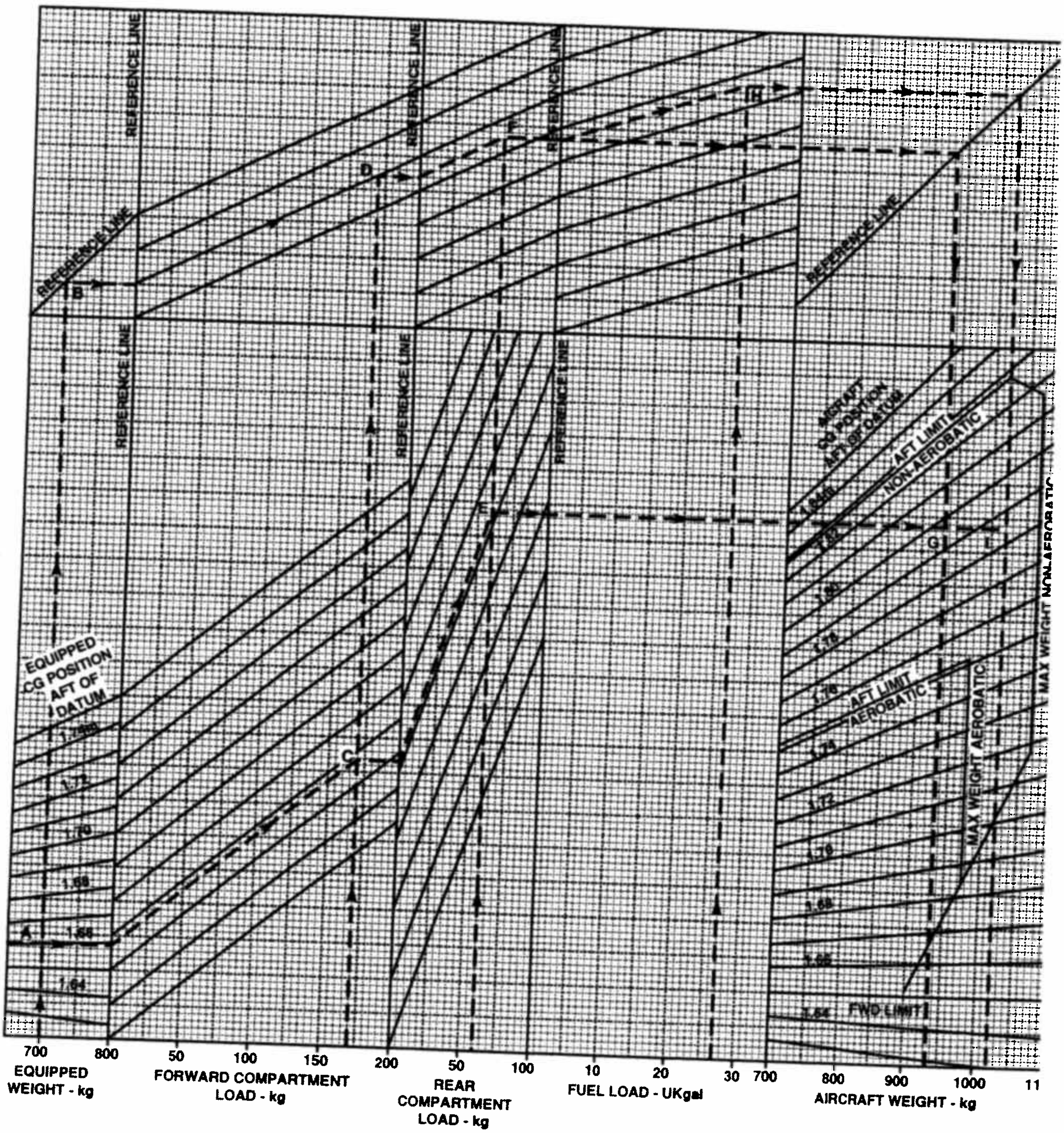
(3) From these points move horizontally across to the forward compartment load grid reference line and follow the lines to the appropriate load to obtain point C in the lower part of the chart and point D in the upper part.

(4) Proceed through the rear compartment load grid in the same manner to obtain point E in the lower part of the chart and point F in the upper part.

(5) From point F proceed horizontally across the fuel load grid to the aircraft weight grid reference line to obtain the aircraft zero-fuel weight from the scale at the foot of the chart vertically below this point.

(6) From point E proceed horizontally across the fuel load grid to the aircraft zero-fuel weight to obtain point G which therefore represents the aircraft CG for the zero-fuel condition.

LOADING CHART



(7) If fuel load is known proceed as follows:

(a) From point F proceed horizontally across to the fuel load grid reference line and follow the lines to the appropriate fuel load to obtain point H.

(b) From this point proceed horizontally across to the aircraft weight grid reference line to obtain the aircraft take-off weight from the scale at the foot of the chart vertically below this point.

(c) From point E proceed horizontally across the fuel load grid to the aircraft take-off weight to obtain point I which therefore represents the aircraft CG for the take-off condition.

(8) If the take-off weight is known, available fuel load can be determined by working backwards from point I.

(9) The loading is suitable if points G and I lie within the appropriate loading envelope.