G-BONT

Pilot's Operating Handbook

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PILOTS NOTES
FIREFLY T67M-Mk II

RECEIVED
27 OCT 1993

THE SLINGSBY T67M-Mk II

PILOTS NOTES

incorporating the CAA approved flight manual

CIVIL AVIATION AUTHORITY
25.10.93

This is the Flight Manual which forms part of the Certificate of Airworthiness for aircraft G-BONT

First published in Great Britain by Slingsby Aviation PLC 1985

Published & printed in Great Britain by Slingsby Aviation PLC.

Nothing in this Manual must be taken as superseding the Legislation, Rules Regulations, Procedures and Information contained in the Air Navigation Order, the Air Navigation (General) Regulations, Rules of the Air and Air Traffic Control Regulations, the UK Air Pilot, NOTAMS or aeronautical Information Circulars.

PILOTS NOTES - SLINGSBY FIREFLY T67M-MKII

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NOTICE TO READERS

Introduction

1. This manual is produced by Slingsby Aviation PLC and incorporates the CAA approved flight manual; it combines all airframe, engine, propeller, systems and handling information necessary for the operation of the Firefly. The more detailed information necessary for the maintenance of the aircraft is contained in the relevant maker's publications listed on page 0-13. Sections 1 to 5 and the CAA Supplements form the Flight Manual and carry CAA approval. Where information is not subject to CAA approval within these sections the words CAA Approved will be omitted from the page reference.

Statement of Initial Certification

2. This manual complies with FAR 23 and British Civil Airworthiness Requirements where required.

Signed ......B Mellor.........

Date ....2 April 1995.

CAA Approval No ....DAI....2243/46.

Authority of this Manual

3. This manual forms part of the UK CAA documentation for the aircraft shown below and incorporates the CAA approved Aircraft Flight Manual at Section 1 to 5 and Supplements: the limitations listed in Section 2 must be observed as must any further limitations in the CAA Supplements at the end of the manual.

Registration :

Constructors Serial Number :

< >

Check Lists

4. The limitations, checks and emergencies are laid out in Sections 2,3 and 4; those to which reference might be required during aircraft operation are also laid out in the Flight Reference Cards.

Amendments

5. The amendment service consists of Permanent Amendments and Amendment Highlights (obtainable from Slingsby Aviation PLC) as follows:

a) Amendments will be issued as necessary and will be consecutively numbered: They will be issued as replacement sheets where practicable and will have the amendment list number and date presented on it. Where amendments contain significant additions or alterations to the text, these will be marked > ..... < and where text has been removed will be marked < > .

b) Amendment Highlights Where amendments contain significant changes to operating information this will be summarized on an Amendments Highlight sheet which will come with the amendment. A complete new Amendments Highlight sheet will be issued with each amendment.

< >

Adherence to Procedures

6. The procedures outlined in this manual form the basis of good operating procedures but consideration of airmanship may, on occasions, dictate other courses of action.

Convention in the Text

7. When numbers appear in brackets in the text they refer to the key in the fold-out illustrations in Section 8.

8. When reference is made to left and right, fore and aft, or clockwise and anti-clockwise, these directions are invariably intended to represent directions as seen by a pilot correctly seated in the aircraft.

9. All gauged or measured quantities quoted in the text are indicated values unless otherwise stated.

10. Warnings are inserted in the text only when they contain information of particular safety significance which might not be evident to an operator unfamiliar with the aircraft type and design.

11. Each page of this manual bears a section and page number, a document number and a date of issue. The pages of any part of the manual can be checked by referring to the list of contents for each chapter which lists the first and last effective page for each chapter and section.

Supplements

12 Where different options exist for the fitting or where additional or modified equipment may be fitted, no standard chapter can be incorporated in the manual. Information on all variable-standard or non-standard equipment is thus issued in an appropriate supplement; this is to be incorporated in Section 9 of this manual and its inclusion recorded in the supplement record at the beginning of Section 9.

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PILOTS NOTES
FIREFLY T67M-MkII

INDEX AND RECORD OF AMENDMENTS ISSUED BY THE CONSTRUCTOR

Amendments

Amendment List No:	Date Issued	Date Incorporated	Signature
1	July 86	at issue	
2	April 87	" "	
3	May 87	" "	
4	Sept 87	" "	
5	Nov 87	" "	
6	July 88	" "	
7	Oct 88	" "	
8	Nov 88	" "	
9	Feb 90	" "	
10	Sept 91	" "	
11	July 93	" "	[illegible]
12	APRIL 95 ~~JUNE 95~~	JUNE 95	[illegible]
13	FEBRUARY 97	MARCH 97	[illegible]
14	JULY 1997	22/9/97	[illegible]
15	NOVEMBER 99	15/2/2000	[illegible]
16			
17			
18			
19			
20			

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AMENDMENT HIGHLIGHTS

A complete new sheet will be issued with each amendment list; the previous 2 permanent amendment lists will be retained.

Amendment List No:	Subject	Page(s)
15	Amendment Highlights Gel Type Battery RG24-11M	0-11 (this page) Section 9 Contents
	" " " "	P.G-1

This amendment has been checked for technical content.			
Tech Pubs C D Brumte	Date 6/12/99	Design	Date 3 Dec 99

Statement of Approval
This amendment is approved by the United Kingdom Civil Aviation Authority

Signed .... Date 05/01/00

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AMENDMENT HIGHLIGHTS

A complete new sheet will be issued with each amendment list; the previous 2 permanent amendment lists will be retained.

Amendment List No:	Subject	Page(s)
14	Amendment Highlights	(this page)
	Record of Temporary Amendment Leaflets	(following page 0-9)
	Paint restrictions (Mod 734B/D)	1-1
	Mod 734B/D information added	2-4
	" " " " "	2-6
	" " " " "	2-7
	Minor change	2-8
	Mod 734B/D information added	3-1
	TAL 6 incorporated	3-10
	Minor text change	6-18
	Mod 734 information added	6-32
	" " " " "	6-33
	" " " " "	8-7D/8D
	" " " " "	8-7E/8E
	Black and yellow colour scheme	Section 9 contents
	" " " " "	F-1
	" " " " "	F-2
	" " " " "	F-3/4

Note

Only aircraft having Mod 734B/D will be supplied with the actual supplement pages (F-1 to F-3/4).

This amendment has been checked for technical content.			
Tech Pubs CDBrunton	Date 24.7.97.	Design	Date 24.7.97

Statement of Approval

This amendment is approved by the United Kingdom Civil Aviation Authority

CIVIL AVIATION AUTHORITY

Signed ....M. Owen.................. Date .7 August 1997..

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AMENDMENT HIGHLIGHTS

A complete new sheet will be issued with each amendment list; the previous 2 permanent amendment lists will be retained.

Amendment List No:	Subject	Page(s)
13	Winterisation kit Mod 693	Section 9 Contents
	" " " " "	E-1/2

Note

Only aircraft having Mod 693 will be supplied with the actual supplement page (E-1/2).

This amendment has been checked for technical content.			
Tech Pubs D Brunton	Date 14/2/97	Design B Mellers	Date 14th Feb 97

Statement of Approval

This amendment is approved by the United Kingdom Civil Aviation Authority

CIVIL AVIATION AUTHORITY

Signed ......M. Awes.................. Date ..20th February 1997..

RECORD OF TEMPORARY AMENDMENT LEAFLETS (TAL)

TAL	CONTENT	DATE RECEIVED	DELETED BY AMENDMENT
1A	Temporary performance figures Post Mod 321 - AUW increased to 2100 lb (953 kg)		AL8
2	Temporary limitations for Post Mod 177B and 272B aircraft.		Mod 366C
3	Temporary instructions for a King KCS 55A slaved compass system potential fault		Mod 417
4	Temporary limitations for aerobatics		Mod 567
5	Temporary performance figures Post Mod 537 - AUW increased to 2150 lb (975 kg)		AL12
6	Spinning - Incorrect Recovery		AL14
7	Flight in Forecast Icing Conditions		AL14
8	3.4. TESTING THE ENGINE (TAL8/P1 OF2) 6.4.4. CANOPY (TAL/8/P2 OF2)	16/7/99 [signature]	
9	TESTING engine 3-2-2 3-11-2	27/7/4	
10	LIMITATIONS FOR AEROBATICS	1-6.05	

LIST OF ASSOCIATED PUBLICATIONS

ENGINE	-	AVCO LYCOMING AEIO-320 Series Operation Manual.
PROPELLER	-	PROPELLERWERK HOFFMANN HO-V72 Instruction Manual.
RADIOS	-	Communications } } Handbooks relevant to make Navigation }

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SECTION 1 LEADING PARTICULARS AND DIMENSIONS

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> 1.1	3 View Plan with Paint Restrictions	1-1 <
1.2	Dimensions and Leading Particulars	1-2

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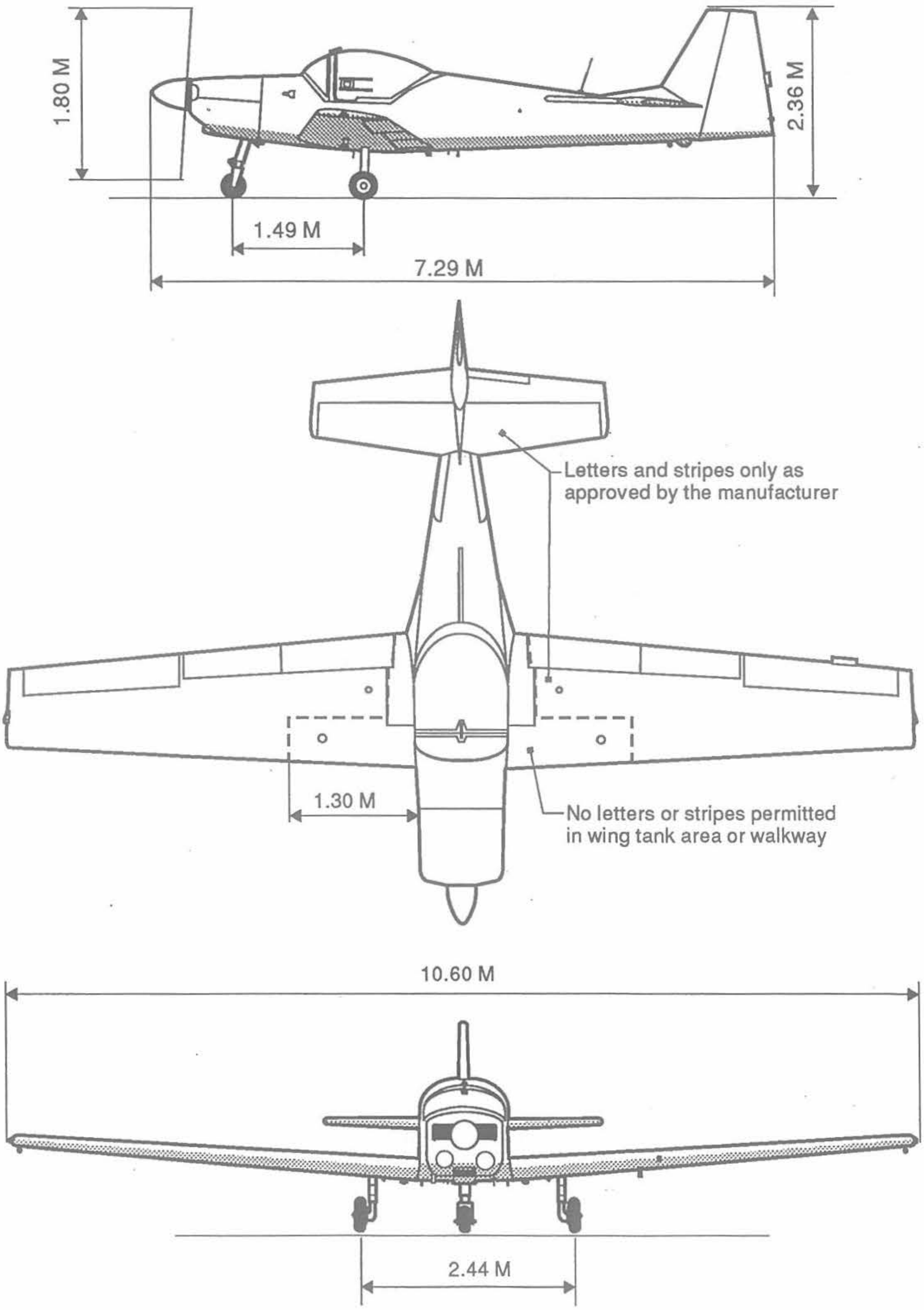
> 1.1 3 VIEW PLAN WITH PAINT RESTRICTIONS



KEY TO COLOUR RESTRICTIONS

Unrestricted   Only colours approved by the manufacturer

(Lighter colours and shades are preferable to dark ones)

<

1.2 DIMENSIONS AND LEADING PARTICULARS

Overall Dimensions

Wing span 10.60m

Overall length 7.29m

Overall height 2.36m

Wing

Surface area 12.60m²

Dihedral .... 3°30'

Profile and incidence at the wing root NACA 23 015 .... 3°

Profile and incidence at the tip NACA 23 013 .... 0°20'

Aileron

Surface area .... 0.62m² each

> Movements .... (Pre Mod 392) Up 16° ±1°
Down 12.25° ±1°

Movements ....(Post Mod 392) Up 14° ±1°
Down 11.75° ±1° <

Mass balance .... 80% +5% -0%

Flap

Total surface area 1.74m²

Deflections .... Takeoff Position 1 18° +1°-2°down
Landing Position 2 40° +1°-3°down

Tailplane

Fixed surface area .... 1.65m^2

Incidence to fuselage reference .... +1°

Elevator surface area .... 0.99m^2

Movements .... Up 22° ±2°
Down 20° ±2°

Trim tab movements .... Up & Down 24° +6° -2°

Elevator mass balance .... 100% +5% -0%

Fin

Surface area .... 0.80m^2

Rudder

Surface area .... 0.81m^2

Rudder movements (Pre Mod 458) .... Each side 30°+2°
(Post Mod 458) .... Each side 30°±1°

Undercarriage

Tricycle Type

Nosewheel shock absorber oleo-pneumatic pressure 7 bar (100 psi)

Mainwheel shock absorber oleo-pneumatic pressure 5.5 bar (80 psi)

Track 2.44m

Wheel Base 1.495m

Nosewheel Tyre .... 5.00 - 5 pressure 3.5 bar (50 psi)

Mainwheel Tyre .... 6.00 - 6 pressure 1.7 bar (25 psi) (Pre Mod 468)
pressure 2.4 bar (35 psi) (Post Mod 468)

For ground movements and taxying the nose wheel is connected to the rudder controls.

Wheel Brakes

Mainwheels only. Cleveland disc brakes with duplicate toe brakes and with parking brake.

Propulsion Unit

Engine .... Lycoming AEIO-320-D1B

Engine ratings .... 160 bhp at 2700 rpm

> Fuel ...AVGAS 100LL. Tank capacity 2 x 17.75 Imp Gall (161.4 litres total)
Usable fuel 2 x 17.31 Imp Gall (157.4 litres total) <

Oil .... MIL Spec. L-22851

Grade SAE 15W-50 or 20W-50	All Temperatures
SAE 60	Above 27°C
SAE 40 or 50	Above 15.5°C
SAE 40	from -1°C to 32°C
SAE 40 or 30	from -18°C to 21°C
SAE 20	Below -12°C

Straight mineral oil for first 50 hrs then ashless dispersant grade may be used.

An alternative warm air supply automatically opens if the engine air intake becomes blocked.

Propeller .... Hoffmann HO-V72L-V/180CB

Cockpit .... 2 seats side by side,
fixed windscreen, canopy tilting towards the rear.

Luggage .... 30 kg (66 lbs)

SECTION 2 LIMITATIONS AND PLACARDS

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2.1 CLASS AND CATEGORY OF CERTIFICATION

For the purpose of the First Schedule of the Air Navigation Order, this aircraft is classified as an Aeroplane (landplane).

The Slingsby T67M-MkII type of aircraft is eligible for certification in the United Kingdom in the Transport Category (Passenger). This aeroplane may, however, be restricted to another category and a particular use and this will be stated on the Certificate of Airworthiness.

When flown for public transport, compliance with performance Group E of the Air Navigation (General) Regulations must be established using the operating techniques and parameters laid down in the flight manual.

The Slingsby T67M-MkII type of aircraft has been certified by the CAA on the basis of compliance with U.S. CFR 14 part 23 - Airworthiness Standards: normal, utility & aerobatic cateogry aeroplanes at amendments 23-27, plus special conditions as defined by the CAA.

Special Condition - Composite Material Construction.
British Civil Airworthiness Requirements as follows:

Section K Light Aeroplanes, Issue 6 - April 1974, Chapters 2-2 to 2-5 inclusive, as necessary for the aircraft to be classified in Performance Group E.
Section N Noise, Issue 2 - November 1978.
Section R Radio, Issue 4 - April 1974.
Current Airworthiness Notices.
Electrical Power Supplies for Aircraft Radio Systems.

2.2 MINIMUM CREW

The minimum crew for operation of the aircraft is one pilot.

2.3 MAXIMUM OCCUPANTS

The total number of persons carried including crew shall not exceed two, nor the number of seats which is approved for use during take-off and landing.

2.4 ENGINE LIMITATIONS

RPM

The maximum engine speed is 2700 RPM. No overspeed is permitted.

Oil Contents

The maximum oil sump capacity is 8 US Quarts. The minimum safe quantity in the sump is 4 US Quarts.

Oil Pressure on Start-Up

The engine must be shut down if the oil pressure has not started to rise within 30 seconds of starting the engine.

Oil Pressures

	Maximum	Minimum
Normal Operating	6.2 bar (90 psi)	4.1 bar (60 psi)
Start and Warm-Up	7.0 bar (100 psi)	3.8 bar (55 psi)
Idling	- -	1.7 bar (25 psi)

Manifold Pressure/RPM Limitation

The manifold pressure measured in inches of mercury must not be allowed to exceed the RPM measured in hundreds by more than an increment of 4, eg at 2200 RPM the manifold pressure must not be allowed to exceed 26 inches.

Oil Pressure During Aerobatic Manoeuvres

Avoid flight at zero 'G' state for more than 10 seconds as in these modes the oil system will not scavenge.

Magneto Check

Maximum RPM drop when switching either magneto off at 1800 RPM.	175 RPM
Maximum difference between left and right magneto RPM drops at 1800 RPM.	50 RPM

Cylinder Head Temperature

Maximum permissible temperature	260°C

Oil Temperatures

Maximum permissible	118°C

Fuel

The minimum fuel grade is 100LL.

Tank capacity 2 x 17.75 Imp Gall (80.7 litres).
Unusable fuel is 2 x 0.44 Imp Gall (2 litres).

Ground Running

The maximum CHT of 260°C must not be exceeded during ground running and operation at full throttle should not exceed 3 minutes.

2.5 AIRFRAME LIMITATIONS

2.5.1 Centre of Gravity Measurement and Limitations

The datum for measurement of the centre of gravity is as follows:

> a) The horizontal datum is achieved by use of a rigging board (T67C Maintenance Manual) along the top of the fuselage.

b) The fore and aft datum is the forward face of the bulkhead firewall. <

The limits of the centre of gravity at MTWA are as follows, being measured aft of datum:

> Forward limit	860mm AFD
Aft limit	917mm AFD

Note....

For limits at other weights refer to Section 8 (8.1 and 8.2) <

2.5.2 Loading

a) The maximum number of occupants 2

b) The maximum baggage load in baggage compartment 30 kg (66 lbs)

2.5.3 Weights for Take-off and Landing

The maximum weight for take-off and landing 953kg (2100 lbs)

2.5.4 Limiting Speeds (IAS)

VNE Never exceed speed	180 kts
VNO Normal operating limit speed	140 kts
VA Manoeuvring speed	140 kts
Flap limiting speeds	
Post Mod 656	
Takeoff position (18°)	120 kts
Landing position (40°)	98 kts
Pre Mod 656	
Both flap positions	88 kts

> ### 2.5.5 Limitations for Aerobatics (Pre Mod 734B/D) **(For Post Mod 734B/D see Supplement F)** <

Aerobatic manoeuvres with flaps extended are not permitted.

Tail Slides and Inverted Spins are not permitted.

'g' Limitation - struct temp below 50°C

Flaps up	+6g -3g
Flaps down	+2g -1g

When structural temperature reaches 50°C or more DO NOT carry out aerobatics or impose loads which exceed:

Flaps up	+4.4g	-2g
Flaps down	+2g	-1g

Maximum permissible structure temperature for aerobatics is 50°C

	Entry Speeds (kts) (IAS)
Slow roll	110
Stall turn entry	110
Stall turn rotate	50
Loop	115
Roll off the top	125
Flick roll max	70
Spin	(Refer Section 3, Paragraph 3.7)

> ### 2.5.6 Flight in Icing Conditions

The aircraft is not cleared for flight into known icing conditions. <

2.5.5 Limitations for Aerobatics

For Post Mod 516 Addendum 1 & 2 (Works Numbers 2116, 2121) see Supplement F)

Aerobatic manoeuvres with flaps extended are not permitted.

Tail Slides and Inverted Spins are not permitted.

'g' Limitation - struct temp below 50°C

Flaps up	+6g -3g
Flaps down	+2g -1g

When structural temperature reaches 50°C or more DO NOT carry out aerobatics or impose loads which exceed:

Flaps up	+4.4g	-2g
Flaps down	+2g	-1g

Maximum permissible structure temperature for aerobatics is 50°C

	Entry Speeds (kts) (IAS)
Slow roll	110
Stall turn entry	110
Stall turn rotate	50
Loop	115
Roll off the top	125
Flick roll max	70
Spin	(Refer Section 3, Paragraph 3.7)

2.5.7 Flight in IMC or at Night

Flight is permitted in IMC day and for night flight.

For flight by night or IFR refer to the Air Navigation Legislation for equipment required.

2.5.8 Inverted Flight

When wing tanks are less than half full the fuel supply for inverted flight will be limited to the amount contained in the collector tank.

This should be enough for up to 5 min of continuous inverted flight.

2.6 PLACARDS

2.6.1 Instrument Markings

Oil Temperature

Caution range	Yellow arc below	40°C
Normal operating range	Green arc	40°C to 115°C
Maximum allowable	Red arc above	115°C

Oil Pressure

Minimum pressure	Red arc below	1.7 bar
Low oil pressure	Yellow arc	1.7 to 4.2 bar
Normal operating range	Green arc	4.2 to 6.2 bar
High oil pressure	Yellow arc	6.2 to 7 bar
Maximum pressure	Red arc above	7 bar

Cylinder Head Temperatures

Normal operating range	Green arc	100°C to 230°C
Caution range	Yellow arc	230°C to 260°C
Maximum allowable	Red arc above	260°C

Tachometer

Normal operating range	Green arc	700 to 2,700 rpm
Maximum rpm	Red line	2,700 rpm

ASI Markings

VNE	Radial red line	180 knots
Cautionary zone	Yellow arc	140 to 180 knots
Normal operating range	Green arc	56 to 140 knots
Flap speed range (Landing flap 40°)		
Post Mod 656	White arc	49 to 98 knots
Pre Mod 656	White arc	49 to 88 knots

\> OAT/Structural Temperature Gauge (Pre Mod 734B/D) **(For Post Mod 734B/D see Supplement F)** <

Structure temperature maximum	Red line	50°C

Vacuum Gauge

	Green arc	4.5 to 5.5 in Hg

OAT/Structural Temperature Gauge (For Mod 516 Addendum 1 & 2 (Works Numbers 2116, 2121) see Supplement F)

Structure temperature maximum	Red line	55°C

Vacuum Gauge

	Green arc	4.5 to 5.5 in Hg

2.6.2 Labels

The following information is to be furnished on placards well within sight of pilot.

Post Mod 537, 656, 757A and 734B/D (For Mod 516 Addendum 1 & 2 (Works Numbers 2116, 2121) see Supplement F)

NO SMOKING

LIMITATIONS

VNE (KTS) (IAS)		180
MANOEUVRING SPEED VA (KTS) (IAS)		140
FLAP LIMITING SPEEDS (KTS) (IAS)		
TAKEOFF POSITION (18°)		120
LANDING POSITION (40°)		98
MAX TOTAL WEIGHT AUTHORISED (KG)		975
MAX g LOADS (FLIGHT PROHIBITED ABOVE 55°C)	STRUCTURAL TEMPERATURE BELOW 50°C	ABOVE 50°C
FLAPS UP	+6g -3g	+4.4g -2g
FLAPS DOWN	+2g -1g	+2g -1g
ALTITUDE LOSS IN A STALL RECOVERY		150 FT (46M)

FLIGHT INTO KNOWN ICING CONDITIONS PROHIBITED

AIRCRAFT CERTIFIED FOR FLIGHT IN IMC, DAY AND FOR NIGHT FLIGHT

AEROBATIC MANOEUVRES - UP TO ALL UP WEIGHT 975 Kg (2150 lbs)

MAXIMUM PERMISSIBLE STRUCTURE TEMPERATURE FOR AEROBATICS IS 50°C

	ENTRY SPEEDS (KTS) (IAS)
SLOW ROLL	110
STALL TURN ENTRY	110
STALL TURN ROTATE	50
LOOP	115
ROLL OFF THE TOP	125
FLICK ROLL MAX	70
SPIN	SEE FLIGHT MANUAL

2.6.2 Labels

The following information is to be furnished on placards well within sight of pilot.

> Post Mod 656, 757A and Pre Mod 734B/D **(For Post Mod 734B/D see Supplement F)** <

NO SMOKING

LIMITATIONS

VNE (KTS) (IAS)		180
MANOEUVRING SPEED VA (KTS) (IAS)		140
FLAP LIMITING SPEEDS (KTS) (IAS)		
TAKEOFF POSITION (18°)		120
LANDING POSITION (40°)		98
MAX TOTAL WEIGHT AUTHORISED (KG)		975
MAX g LOADS	STRUCTURAL TEMPERATURE BELOW 50°C	STRUCTURAL TEMPERATURE ABOVE 50°C
FLAPS UP	+6g -3g	+4.4g -2g
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SLOW ROLL	110
STALL TURN ENTRY	110
STALL TURN ROTATE	50
LOOP	115
ROLL OFF THE TOP	125
FLICK ROLL MAX	70
SPIN	SEE FLIGHT MANUAL

> Pre Mod 656 and 757 <

NO SMOKING

LIMITATIONS

VNE (KTS) (IAS)	180
MANOEUVRING SPEED VA (KTS) (IAS)	140
FLAP OPERATING SPEED (KTS) (IAS)	88
MAX TOTAL WEIGHT AUTHORISED (KG)	953

MAX g LOADS	STRUCTURAL TEMPERATURE BELOW 50°C	STRUCTURAL TEMPERATURE ABOVE 50°C
FLAPS UP	+6g -3g	+4.4g -2g
FLAPS DOWN	+2g -1g	+2g -1g

ALTITUDE LOSS IN A STALL RECOVERY 150 FT (46M)

FLIGHT INTO KNOWN OR FORECAST ICING CONDITIONS PROHIBITED

AIRCRAFT CERTIFIED FOR FLIGHT IN IMC, DAY AND FOR NIGHT FLIGHT

AEROBATIC MANOEUVRES - UP TO ALL UP WEIGHT 953 Kg (2100 lbs)

MAXIMUM PERMISSIBLE STRUCTURE TEMPERATURE FOR AEROBATICS IS 50°C

	ENTRY SPEEDS (KTS) (IAS)
SLOW ROLL	110
STALL TURN ENTRY	110
STALL TURN ROTATE	50
LOOP	115
ROLL OFF THE TOP	125
FLICK ROLL MAX	70
SPIN	SEE FLIGHT MANUAL

Pre Mod 537, 656 and 757

NO SMOKING

LIMITATIONS

VNE (KTS) (IAS)		180
MANOEUVRING SPEED VA (KTS) (IAS)		140
FLAP OPERATING SPEED (KTS) (IAS)		88
MAX TOTAL WEIGHT AUTHORISED (KG)		953

MAX g LOADS	STRUCTURAL TEMPERATURE BELOW 50°C	STRUCTURAL TEMPERATURE ABOVE 50°C
FLAPS UP	+6g -3g	+4.4g -2g
FLAPS DOWN	+2g -1g	+2g -1g

ALTITUDE LOSS IN A STALL RECOVERY 150 FT (46M)

FLIGHT INTO KNOWN OR FORECAST ICING CONDITIONS PROHIBITED

AIRCRAFT CERTIFIED FOR FLIGHT IN IMC, DAY AND FOR NIGHT FLIGHT

AEROBATIC MANOEUVRES - UP TO ALL UP WEIGHT 953 Kg (2100 lbs)

MAXIMUM PERMISSIBLE STRUCTURE TEMPERATURE FOR AEROBATICS IS 50°C

	ENTRY SPEEDS (KTS) (IAS)
SLOW ROLL	110
STALL TURN ENTRY	110
STALL TURN ROTATE	50
LOOP	115
ROLL OFF THE TOP	125
FLICK ROLL MAX	70
SPIN	SEE FLIGHT MANUAL

On canopy transparency (Mod 734D aircraft)

THIS AIRCRAFT HAS GEOGRAPHICAL RESTRICTIONS. REFER TO LIMITATIONS SECTION IN FLIGHT MANUAL

Forward of the parking brake lever - on the centre console

DO NOT OPERATE
MASTER SWITCH
WITH RADIOS TURNED ON

Notice above the luggage compartment

BAGGAGE
30 Kg MAX
FOR C OF G AND TOTAL
WEIGHT LIMITATIONS
SEE FLIGHT MANUAL

Aft of the refuelling caps - on the wing upper surface

FUEL - AVGAS 100LL
78.7 Litres
17.31 Imp Gal
20.77 US Galls

Post Mod 310B A/C

Fuel type and contents, as above, in Litres.
Imp. Galls and US Galls are combined on a fuel filler/wing joint vinyl covering

At the foot of the flap control lever on the central fairing

Takeoff
Landing

> On the trim indicator in front of the trim control

D (Nose Down)
N (Neutral)
U (Nose Up) <

On the underside of the oil filler access flap

OIL
MIL-L-22851
SAE 15W50 OR SAE 20W50

On canopy frame one each side of latch mechanism

CANOPY MUST ALWAYS REMAIN CLOSED
AND LATCHED DURING FLIGHT
UNLESS EMERGENCY EVACUATION IS INTENDED

Under side of canopy latch cover

PUSH UP HERE
TO RAISE CANOPY

On the top of the instrument panel

AEROBATIC MANOEUVRES
WITH FLAPS EXTENDED
ARE NOT PERMITTED

Alongside pressure bulb on canopy sill - port side (aircraft with Mod 129 Issue 1 fitted)

ENSURE SEAL IS DEFLATED
BEFORE CLOSING CANOPY

RECOMMENDED SEAL INFLATION
4 PUMPS ON BULB

Below fuel contents gauges

USABLE FUEL
34.62 IMP GALLS

Above radio panel (where applicable)

THIS AIRCRAFT IS EQUIPPED
WITH AN ALTITUDE REPORTING
SYSTEM OPERABLE TO
20,000 FT

> On rear console above Frame 4 (between pilots seats)

FIRST AID KIT LOCATED
BEHIND SEATS IN BAGGAGE BAY

Above crash axe on Frame 5 Access Panel

IN CASE OF EMERGENCY
USE TO BREAK CANOPY

<

\> Instrument panel top left corner (Mod 506A and Mod 506B aircraft)

CAUTION

UHF trans-
missions may
cause spurious
deflections
of slaving in-
dicator needle

Instrument panel above the right hand avionics stack in line with UHF radio (Mod 506B aircraft)

CAUTION

UHF TRANSMISSION FREQUENCIES
WITHIN THE RANGE 300 TO 355 Mhz
MAY ADVERSELY AFFECT OPERATION
OF THE GLIDESLOPE SYSTEM

Nosewheel oleo leg forward face (Mod 468 aircraft)

WARNING
INFLATE SLOWLY USING
AIR OR NITROGEN

TYRE 50 PSI
OLEO 100 PSI

Mainwheel oleo legs outboard face (Mod 468 aircraft)

WARNING
INFLATE SLOWING USING
AIR OR NITROGEN

TYRE 35 PSI
OLEO 80 PSI

Above radio panel (where applicable) (Mod 485 aircraft)

WHEN EMERGENCY STATIC IS OPENED
INDICATED ALTITUDE WILL INCREASE
ERROR +180 FT MAX UP TO 130 KT
ERROR INCREASES LINEARLY UP TO
+350 FT AT 180 KT <

2.7 OPERATIONAL LIMITATIONS

2.7.1 Maximum Operating Altitude

The maximum permissible operating altitude is 12,000ft without oxygen equipment being fitted.

The aircraft should not be used without the carriage of oxygen equipment above the appropriate maximum altitude prescribed in the relevant Air Navigation Order applicable to the Country of aircraft registration.

The above limitation is 12000 ft for UK registered aircraft.

2.7.2 Maximum Takeoff and Landing Altitude

The maximum takeoff and landing altitude is 8000ft density altitude.

2.7.3 Operating Temperatures

Maximum operating temperature is ISA +23°C.

Notes....

For operations above OAT 38°C the following precautions must be observed:

(1) Ensure structural temperature remains within limits stated on limitations placard (ref para 2.6.2)

(2) Power plant cooling to remain within limits for cylinder head and oil temps (ref para 2.4.).

Minimum operating temperature is -20°C before winterisation is required.

Notes....

(1) For operations below OAT -20°C consult the engine and propeller handbooks for procedure.

(2) There is no defined lower limit for the aircraft structure.

2.8 PAINT FINISH

Certain areas of the aircraft have colour restrictions, these are indicated on the 3 View Plan (P.1-1).

Note....

The above restrictions are to assist in keeping the critical areas of structure cooler.

2.7.4 Geographical Restriction (Mod 734D Aircraft)

This aircraft is restricted to operation within these nations:

AUSTRIA
BELGIUM
CZECH REPUBLIC
DENMARK
ESTONIA
FINLAND
GERMANY
HUNGARY
IRELAND
LATVIA
LITHUNIA
LUXEMBOURG
NETHERLANDS
NORWAY
POLAND
SLOVAKIA
SLOVENIA
SWEDEN
SWITZERLAND
UNITED KINGDOM

Operation within France, Italy and Spain in restricted to north of 43°N Latitude.

SECTION 3 NORMAL PROCEDURES

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3.1 BEFORE STARTING THE ENGINE

3.1.1 Initial Check

Check loading and C of G (Section 7.1.1)

Approaching the aircraft: Chocks, towing arm, fire axe, fire extinguisher stowed, pitot cover, snow/ice/hoar frost, obstructions, aircraft attitude, obvious leaks.

Cockpit

Control lock	Remove from aircraft
Parking Brake	On
Magnetos	Off, key out
Master switch	On
Alternator warning	Cancel flasher
Pitot heater	On for 20 secs
Strobe light	On - check - off
Landing lights	On - check - off
Trim	Note position
Stall warning	Check light/horn
Pitot head	Check heat
Pitot heater	Off
(Night flying)	Nav lights on - check, landing lights on - check both - off
> (Structural temperature ..... in hot conditions) (Pre Mod 734B/D) **(For Post Mod 734B/D see Supplement F)**	Press test switch Check structural temperature - on OAT gauge below 50°C <
Master switch	Off

CAUTION

Strobe position light not to be used in cloud or mist or on the ground.

<u>3.1.2 External Check</u> (ref. illustration 8.3 Principal Features)

Start at left wing inboard trailing edge.

Left wing

Flap .... Condition, play, stiff nut

Undercarriage (rear) .... Tyre, torque link, brake leaks

Aileron .... Condition, movement, play, stiff nut, drains

Wing .... Condition, drains

Wingtip .... Nav light

Leading edge .... Condition

Fuel cap .... Correctly fitted and locked

Fuel drain .... Check for water contamination

Access panel .... Security

Pitot head .... Remove cover/hole clear

Undercarriage (front) ..... Condition/extension. Tyre creep/inflation/condition. Brakes - leaks/damage

Flap underside .... Condition, drains

Forward fuselage

Fresh air intake .... Clear

Cowling Pt side .... Security, 7 fasteners, 2 pins, oil leaks

Landing lights .... Undamaged

Propeller .... Condition, spinner

Nosewheel .... Condition, extension, tyre-cuts/creep/inflation

Engine air inlet .... Check foam filter is clean

Cowling Stbd side .... Security, 6 fasteners, 2 pins

Oil .... Contents, panel secure

Fresh air intake .... Clear. Temp. probe

3.1.2 External Check (continued)

Right Wing

Leading edge .... Condition

Fuel cap .... Correctly fitted and locked

Fuel drain .... Check for water contamination

Undercarriage (front) .... Condition, extension. Tyre-creep/inflation/condition. Brakes - damage/leaks

Flap underside .... Condition, drains

Wing surfaces .... Condition

Access panel .... Security

Wingtip .... Nav light

Aileron .... Condition, movement, play, stiff nut, drains

Wing .... Drains

Undercarriage (rear) .... Tyre, torque link, brake-leaks

Flap .... Condition, play, stiff nut

Nav aerials (if fitted) ..... Secure/undamaged

Rear fuselage

Canopy stbd side .... Cracks, clean

Static vent starboard .... Plug out, clear

VHF aerial (if fitted) ...... Secure/undamaged

Fin fairing .... Secure

Elevator .... Condition, movement, play, drains

Inspection cover .... Secure (side)

Strobe light .... Condition

Rudder .... DO NOT MOVE
Condition stiff nuts. Nav light

Trim tab .... Position, stiff nut, security, play

3.1.2 External Check (continued)

Rear fuselage (continued)

Tail bumper .... Unmarked

Static vent port .... Plug out, clear

Canopy port side .... Cracks, clean

3.2 STARTING THE ENGINE

3.2.1 Pre-start Cockpit Checks

Cockpit .... Check for loose articles

Rudder pedals .... Adjust for leg length

Harness .... Strap in (5 straps).
If solo secure RH harness

Helmet/headset .... Plugged in

Controls (ail/elev) .... Full and free movement

Lights .... All off

Radios .... Off

Avionics .... Off

Fuel pump .... Off

Alternator .... Off

Master switch .... On

Intercomm .... On

Alternator warn .... Cancel

Pitot heat .... Off

Accelerometer .... Reset

Manifold pressure .... Note

Clock .... Correct

3.2.1 Pre-start Cockpit Checks (Continued)

ASI .... Zero

VSI ......,........................... ±100ft/min

> Emergency static vent (Mod 485 .... Closed <

Circuit breakers .... All in

Throttle .... Check full movement leave closed

Propeller .... Check full movement leave at max RPM

Mixture .... Check full movement leave at cut-off

Fuel contents .... Check (both gauges wing tank A/C)

Fuel cock .... On (select tank with lowest quantity)

Parking brake .... On (Pump brakes)

Flap .... Full check - leave up

Trim .... Check full range and leave neutral

Canopy .... Secure

Propeller .... Clear

3.2.2 Starting the Engine and After Start Checks

Engine hot or cold

Mixture .... Full rich

Booster pump .... On

Throttle .... Open (1/4 inch to 1/2 inch) until a slight fuel pressure is indicated on the fuel pressure gauge

Booster pump .... Off

Mixture .... Lean to cutoff

Magneto .... Left

Starter .... Press; (check starter warning light on during start); release when engine fires

3.2.2 Starting the Engine and After Start Checks (continued)

Engine hot or cold (continued)

Mixture	Slowly to full rich
Magneto	Both
Starter warning	Check out
RPM	Set 1200 to warm up
Oil pressure	Risen within 30 secs, if not, magneto off
Fuel pressure	Check
Magneto	Check for dead cut
Alternator	On
Radios } Nav aids }	As required
Suction	Indicating
Horizon	Erecting - adjust datum
DI	Synchronise
Radio	Check on 2 freqs if possible Obtain taxy clearance
Altimeter	Check setting/indications
Ammeter	Shows positive charge
Alternator failure warning	Check light out
Canopy	Closed and locked

> CAUTION <

Should starter warning light fail to extinguish after starter button is released SHUT DOWN ENGINE and establish cause.

3.2.2 Starting the Engine and After Start Checks

Alternator .... On

NOTE

Avoid long periods of operation with the throttle at idle as this can lead to spark plug fouling.

3.4 TESTING THE ENGINE

CAUTION

WHEN CLOSING THE CANOPY PRIOR TO FLIGHT, CHECK ALIGNMENT OF WITNESS LINE ON CANOPY OPEN/CLOSE PLACARD AND BOTTOM OF RELEASE HANDLE, TO ENSURE THAT THE LATCH MECHANISM IS IN THE FULLY LOCKED POSITION

Canopy	Closed and locked
Parking brake	On (Pump brakes)
Safety	Clear behind
Fuel cock	Check on (Change tanks)
Fuel pressure	0.5 to 8 psi
Oil pressure	Green 4.2 to 6.2 bar
Oil temp	Green 40°C to 118°C
Cylinder head temp	Green 100°C to 230°C
RPM	Set 1800 RPM
Suction	Green (4.5 to 5.5 in Hg)
Magneto drop	Max 175 RPM, no more than 50 RPM difference between L and R
Propeller	Exercise pitch control 4 times RPM drop not more than 500
Idling	Check idling 800 RPM minimum

NOTE

Oil Pressure During Normal Operation Because of the greater length of the oil flow path from the sump to the oil pump, the pump has to work harder than normal to draw oil through these lines: the resultant pressure drop through these lines results in a lowered oil pressure. This effect will be more marked when the engine is cold and unlike a standard engine, the indicated oil pressure will normally tend to rise as the engine warms up. Thus it is not necessarily an indication of trouble if the oil pressure minima are only just met on start-up.

3.3 TAXYING

Check brakes immediately.

Check full rudder travel whilst taxying.

Check compasses and horizon and turn and slip for correct indications during turns.

3.4 TESTING THE ENGINE

Parking brake	On
Safety	Clear behind - Canopy locked
Fuel contents	Check (Both gauges)
Fuel cock	Check on (Change tanks)
Fuel pressure	Indicating
Oil pressure	Green (4.2 to 6.2 bar)
Oil temp	Green (40°C to 118°C)
Cylinder head temp	Green (0°C to 230°C)
RPM	Set 1800 RPM
Suction	Green (4.5 to 5.5 in Hg)
Oil pressure	Green
Magneto drop	Max 175 RPM, no more than 50 RPM difference between L and R
Propeller	Check pitch control functional
Idling	Check idling 800 RPM minimum

NOTE:

Oil Pressure During Normal Operation Because of the length of the oil flow between the sump and the oil pump there is a slightly lower oil pressure than would be expected. This effect will be more marked when the engine is cold and unlike a standard engine, the indicated oil pressure will normally tend to rise as the engine warms up. Thus it is not necessarily an indication of trouble if the oil pressure minima are only just met on start-up.

3.5 PRE-TAKEOFF VITAL ACTIONS

Throttle friction	Stiff
Suction	Green (4.5 to 5.5 in Hg)
Oil temp/press	Green
Fuel press	Green
Pitot heater	On (if conditions require)
Horizon	Erect
DI	Synchronised - note wander
Strobe light	On
Magnetos	Both
Fuel booster pump	On
Fuel contents	Check (Both gauges)
Fuel cock	Check on (Left or Right Tank)
Flaps	Up or takeoff Check liftoff speed 55 kts takeoff flap (18°) 63 kts no flaps
Trim	Set at N
Harness	Tight and secure
Controls elev/ail	Full and free movement
Canopy latch	Closed position

PRE-TAKEOFF EMERGENCY BRIEF

The following points must be briefed:

1. Engine failure on the ground.
2. Engine failure below about 300 ft.
3. Engine failure above 300 ft.

The following points must be considered:

1. Runway surface type and condition.
2. Runway length.
3. Surface wind.
4. Availability of emergency landing areas round airfield.

3.6 TAKEOFF AND CLIMB

Takeoff

Throttle	Full throttle
RPM	Check 2550 RPM minimum
Oil pressure	Green
Oil temp	Green
Cylinder head temp	Green
ASI	Increasing
Raise nosewheel	at 45 kts IAS
Takeoff - liftoff speed	55 kts takeoff flap
	63 kts no flap
Climb	70 kts takeoff flap (18°)
	77 kts no flap

WARNING

> IN STRONG CROSSWIND CONDITIONS LEAVE NOSEWHEEL ON THE GROUND UNTIL TAKEOFF SPEED THEN ROTATE TO TAKEOFF ATTITUDE. <

After Takeoff Checks

Brakes	On/off
Flaps	Raise at 73 kts
Temps & press	Check
Booster pump	Off (at a safe height)
Fuel pressure	Check

Departure Checks

Altimeter	Set as required
Temps & press	Check

3.7 ERECT SPIN RECOVERY

3.7.1 Standard Recovery Technique

a) Close the throttle.

b) Raise the flaps.

c) Check direction of spin on the turn co-ordinator.

d) Apply full rudder to oppose the indicated direction of turn.

e) Hold ailerons firmly neutral.

f) Move control column progressively forward until spin stops.

g) Centralise rudder.

h) Level the wings with aileron.

i) Recover from the dive.

WARNING

WITH C OF G AT REARWARD LIMIT THE PILOT MUST BE PREPARED TO MOVE CONTROL COLUMN FULLY FORWARD TO RECOVER FROM SPIN.

3.7.2 Incorrect Recovery

> A high rotation rate spin may occur if the correct recovery procedure is not followed, particularly if the control column is moved forward, partially or fully, BEFORE the application of full anti-spin rudder. Such out-of-sequence control actions will delay recovery, and increase the height loss. If the aircraft has not recovered within 2 complete rotations after application of full anti-spin rudder and fully forward control column, the following procedure may be used to expedite recovery.

a. Check that FULL anti-spin rudder is applied.

b. Move the control column FULLY AFT - then SLOWLY FORWARD until the spin stops.

c. Centralise the controls and recover to level flight, (observing the "g" limitations).

<

3.7.3. Aerobatics or Spinning - Gyro Instruments

Aerobatics or spinning may cause the artificial horizon or directional gyro to topple. Up to 10 minutes may be required for a gyro instrument to resume normal operation.

3.8 PRACTICE FORCED LANDINGS

Mixture rich.

Descend at 78 kts.

Warm engine and clear plugs every 1000 ft.

3.9 REJOIN CHECKS

Fuel contents .... Check (Both gauges Wing Tank A/C)

Fuel control .... Check on (Select tank with highest quantity Wing Tank A/C)

Engine .... Check gauges green. Mixture rich

DI .... Synchronise

Radio .... Select and check comms and navigation aids. Make joining call.

Altimeter .... Set correct millibar setting

3.10 LANDING CHECKS AND SPEEDS

3.10.1 Downwind Checks

Brakes .... Off - parking brake off

Engine .... Temps and press green. Mixture rich and locked. RPM to max

Fuel cock .... Check on (Left or Right Tank Wing Tank A/C)

Fuel contents .... Check (For tank selected Wing Tank A/C)

Booster pump .... On

Fuel pressure .... Check

Flaps .... As required

Altimeter .... QFE set

Harness .... Tight and locked

3.10.2 Circuit Speeds

	Normal and Glide		Flapless	
	Flap Position	Speed (Kts)	Flap Position	Speed (Kts)
Down Wind	Up	85	Up	85
Final Turn	Takeoff	75	Up	78
Finals	Landing	70	Up	75
Threshold	Landing	70	Up	75

3.10.3 Final Checks

Flap .... Set as required

Altimeter .... Correct QFE set

Landing .... Clearance received

3.11 AFTER LANDING

3.11.1 Checks After Landing

Landing light .... Off

Strobe light .... Off

Pitot heat .... Off

Booster pump .... Off

Flaps .... Up

3.11.2 Stopping the Engine

RPM ....Increase to 1800 for 15–20 seconds, then reduce to 1200 prior to shut down.

Throttle ....Closed

3.11.2 Stopping the Engine

Parking brake .... On

Run at 1000 RPM for 1 minute

Radios .... Off

Navigation Aids .... Off

Nav lights .... Off

Alternator .... Off (Check alternator fail warning operates)

Magnetos .... Check for dead cut

Throttle .... Closed

Mixture .... Cutoff

Magnetos .... When engine stops, Off

Master switch .... Off

Fuel cock .... Off

Flaps .... Down

Parking brake .... Leave on if aircraft not chocked

> 3.11.3 Fitting Flying Control Lock (Mod 435)

Flaps .... Select up

Control lock .... Fit to control sticks and flap operating lever (carefully move assembly into forward stick position)

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4.1 FIRES

WARNING

THE EXTINGUISHER IN THE COCKPIT IS BCF AND GIVES OFF TOXIC FUMES IN A CONFINED SPACE. IT SHOULD BE USED WITH CARE. ENSURE ONLY SUFFICIENT EXTINGUISHANT IS USED TO PUT OUT FIRE THEN OPEN ALL FRESH AIR VENTS.

4.1.1 Electrical Fire

Master switch .... Off

Alternator .... Off

Circuit breakers .... Trip all

Land as soon as possible - the engine will continue to run but all electrical services have been lost.

NOTE

After all circuit breakers have been tripped the battery power may be restored to enable selective resetting of circuit breakers if necessary. Should the ammeter show an excessive discharge when a particular circuit breaker is reset then leave that circuit breaker in the tripped position. Finally restore power to the alternator.

4.1.2 Engine Fire

Throttle .... Closed

Propeller .... Min RPM

Mixture .... Cutoff

Fuel cock .... Off

Magnetos .... Off

Fuel pump .... Off

Cockpit hot air .... Off

Radio .... Transmit emergency call

Master switch .... Off

Alternator .... Off

Carry out Forced Landing   DO NOT ATTEMPT RESTART

4.2 FORCED LANDING

> Glide	80 kts - gives approximately 1.5 nm per 1000 ft in still air at Max AUW. <
Radio	Emergency call
Harness	Tight
Throttle	Closed
Propeller	Min RPM
Mixture	Cutoff
Fuel cock	Off
Magnetos	Off
Boost pump	Off
Master switch	Off
Alternator	Off
Gliding speeds	Clean - 80 kts Takeoff flap - 70 kts Landing flap - 65 kts
Threshold speed	65 kts

4.3 DITCHING

Notes....

(1) If above 2000 ft AMSL consider abandonment by parachute.

(2) Ditching is best carried out whilst engine power is available to control the rate of descent.

(3) In a strong wind, land into wind preferably on the crest of a wave. If the swell is heavy land along the swell.

With Power Available

Harness	Tight and locked
Canopy	Closed or locked open (Post Mod 283 A/C)
Flaps	Fully down

4.3 DITCHING (continued)

With Power Available (continued)

Speed .... 60 kts

Rate of descent .... 300 ft min

DO NOT ROUND OUT Continue descent into the water

Without Power Available

Forced landing checks .... Completed except canopy

Canopy .... Closed or locked open (Post Mod 283 A/C)

Flaps .... Fully down

Speed .... 60 kts

Rate of descent .... As established

DO NOT FULLY ROUND OUT Check rate of descent but fly the aircraft into the water.

CAUTION

(1) In both cases the aircraft may turn on its back. Release the seat harness and exit via the open canopy before inflating the LSJ.

(2) With canopy in open position during flight suction controlled instruments will be more difficult to read due to indicator needle flutter.

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4.4 ENGINE FAILURE - PROPELLER STOPPED

WARNING

Early preparation for an emergency landing is preferable to following drills and then being left with too little height to carry out a safe landing.

Mechanical failure

If the engine stopped with unusual mechanical noise, DO NOT ATTEMPT RESTART, but do forced landing.

Restart Procedure

Throttle	1/4 open
Propeller	Max RPM
Mixture	Fully rich
Fuel contents	Check (Both gauges)
Fuel cock	On (Left or Right Tank)
Magnetos	Both
Boost pump	On
Fuel pressure	Green
Master switch	On
Alternator	Off
Fuel contents	Not zero (Both tanks)

Propeller EITHER operate starter OR dive to start propeller turning (approx 115 kts)

When engine starts,

Alternator	On
Throttle	Increase power slowly Allow engine to warm up

DIVING TO RESTART THE ENGINE USES 600-800 FT

If the propeller stopped during aerobatics, the engine may be started immediately using the starter button so long as there was no mechanical noise when the engine stopped.

4.5 ENGINE FAILURE - PROPELLER TURNING

WARNING

Early preparation for an emergency landing is preferable to following drills and then being left with too little height to carry out a safe landing.

MECHANICAL If there is no oil pressure or if there is unusual mechanical noise:

Throttle .... Closed

Propeller .... Min RPM

Mixture .... Cutoff

Fuel cock .... Off

Magnetos .... Off

Boost pump .... Off

CARRY OUT FORCED LANDING.

Restart Procedure

FUEL

Fuel cock .... On (Left or Right Tank)

Mixture .... Rich

Throttle .... 1/4 open

Boost pump .... On, check press

Fuel contents .... Not Zero (Both Tanks)

MAGNETOS

Both .... if no better

Right .... if no better

Left .... if no better

Both

IF NO IMPROVEMENT - CARRY OUT FORCED LANDING

4.6 FUMES IN THE COCKPIT

Cockpit hot air/demist .... Off

Fresh air vents .... Fully open

Check all engine instruments for any sign of malfunction. If smell is electrical - electrical fire drill. If the smell is petrol, do not make any electrical selection at all as a spark could lead to fire.

LAND AS SOON AS POSSIBLE

4.7 ALTERNATOR FAILURE

Alternator .... Off

Excitation c/b .... Set

Alternator c/b .... Set

Alternator .... On

If the alternator output cannot be regained, reduce electrical loads to a minimum, to conserve battery life. Descend out of cloud before services fail (radio, gauges etc).

> In any event, the battery duration, with all essential services operating is in excess of 30 minutes. <

4.8 COMMUNICATIONS FAILURE

Check all switches and volume controls.

Change frequency, check circuit breakers.

Change headset.

Plug in headset on other side - use other transmitter button.

Turn radios off for 5 minutes and then try again.

4.9 OIL PRESSURE FAILURE

WARNING

Prolonged use of power after engine oil pressure failure will lead to engine mechanical failure.

If oil pressure fails, the propeller will revert to the minimum RPM (Coarse Pitch) position.

Full throttle may be used in emergency but engine failure is likely to follow loss of oil pressure, particularly if much power is used.

RPM .... control with throttle

Throttle .... closed - except for emergency

Carry out forced landing at nearest available site.

4.10 PROPELLER GOVERNOR FAILURE

4.10.1 RPM will not Increase

(a) Check that engine oil pressure has not failed.

(b) Check that manifold pressure is above 15" - open throttle if necessary to achieve this.

(c) Exercise the RPM control slowly throughout the whole range.

(d) If the RPM still does not respond, leave the RPM control in mid-range and use engine power observing the RPM/Manifold pressure limits in Part 2.

(e) Land at nearest available airfield.

4.10.2 RPM Overspeeds or will not Decrease

(a) Use throttle to keep RPM in limits - use of more than about 3/4 throttle may cause RPM to overspeed.

(b) Leave RPM control in mid-range.

(c) Reduce speed to 80 kts.

(d) Land at nearest available airfield.

> 4.11 PITOT STATIC SOURCE FAILURE

In OAT below 0°C and/or flight in percipitation	switch on pitot heat
If blocked static source is suspected	open emergency static source in cockpit (Mod 485) (LH side instrument panel)

CAUTION

Whilst operating on emergency static source allowance must be made for minor errors on pitot static instruments <

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5.1 GENERAL

5.1.1 Performance Group

This aircraft is classified in Performance Group E of BCAR. This means that there is no specific provision for performance after engine failure. The performance data has been measured in accordance with both Section K BCAR and FAR Part 23.

5.1.2 Flight Over Water Speed

The declared "flight over water" speed of the aircraft is a true airspeed of 100 kts.

5.1.3 Air Speed Indicator Position Errors

Flaps Retracted

IAS (Kts)	50	60	70	80	90	100	110	120	130	140	150	160	170	180
CAS (Kts)	51	61	71	81	91	100.5	111.5	121.5	131.5	141.5	151	162	172	182

Takeoff Flap

> IAS (Kts)	50	60	70	80	90	100	110	120
CAS (Kts)	50	60.5	71	81	91	102	112	122

Landing Flap

IAS (Kts)	50	60	70	80	90	98
CAS (Kts)	51.3	61	70.7	81	91	99

<

5.1.4 Altimeter Position Errors

The maximum altimeter static error is -30 ft.

5.1.5 Maximum Crosswind Components

The maximum demonstrated crosswind component for takeoff and landing is 25 kts.

5.1.6 Stall Speeds - At Forward C of G

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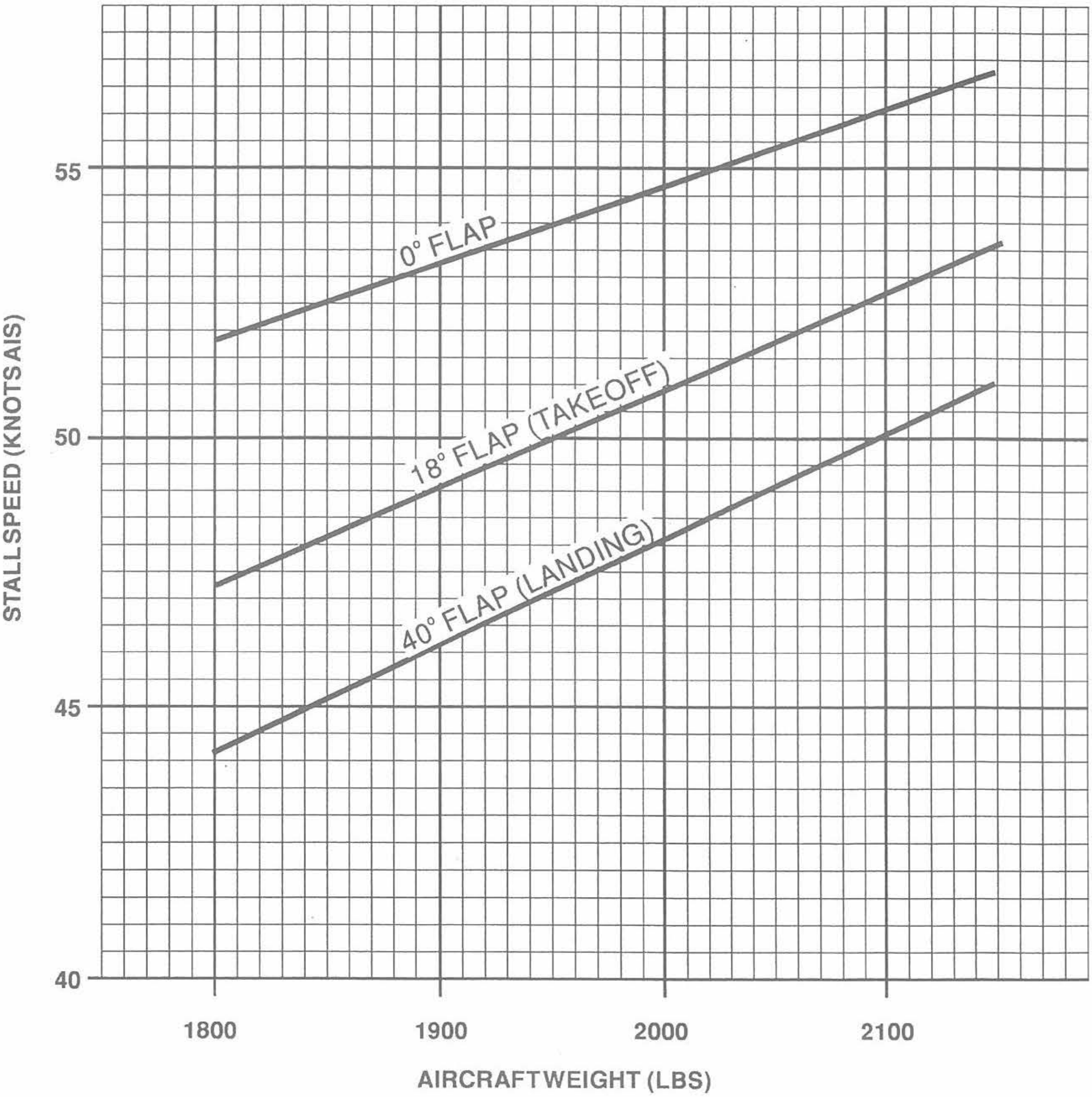

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5.2 TAKEOFF PERFORMANCE

The information is derived from the table and represents the take off distances required from rest to the 50ft (15m) height point.

Take off Distance (ft)

Conditions: Flaps 18deg / Full Throttle Prior to Brake Release / Paved,Level Runway - Zero Wind

Gross Weight	Takeoff Speed		Pressure Altitude		-5 degC		+5degC		+15degC		+25degC	
	Lift off	At 50 ft	ft	m	Ground Roll	Total to Clear 50 ft	Ground Roll	Total to Clear 50 ft	Ground Roll	Total to Clear 50 ft	Ground Roll	Total to Clear 50 ft
2150 lbs (975 Kg)	55Kts	70 Kts	Sea Level		727	1457	785	1549	846	1660	911	1771
			1000	305	791	1566	851	1668	920	1793	997	1913
			2000	610	876	1722	943	1839	1024	1976	1104	2111
			3000	914	979	1920	1061	2048	1150	2198	1250	2368
			4000	1219	1103	2139	1202	2301	1303	2466	1415	2654
			5000	1524	1248	2402	1363	2593	1483	2776	1607	3002
			6000	1829	1414	2710	1554	2938	1691	3136	1825	3404
			7000	2134	1600	3059	1770	3298	1924	3540	2070	3857
			8000	2438	1806	3447	2010	3697	2183	3990	2341	4362

For operation on grass runways the total Takeoff Distances scheduled for paved runways must be increased as follows :-

(i) Short Dry Grass : 10% of the Total Takeoff Distance

(ii) Short Wet Grass : 15% of the Total Takeoff Distance

Note : Short Grass is here Defined as 3-4" high

For operation in windy conditions the following corrections must be applied :

(i) Headwind : Decrease distances by 10% for each 10 Knots

(ii) Tailwind increase distances by 10% for each 2 Knots

In the event of a flapless takeoff (lift off speed 59Kts IAS, speed at 50ft screen height of 76 Kts IAS) the ground run and total takeoff distance should be increased 35% and 25% respectively

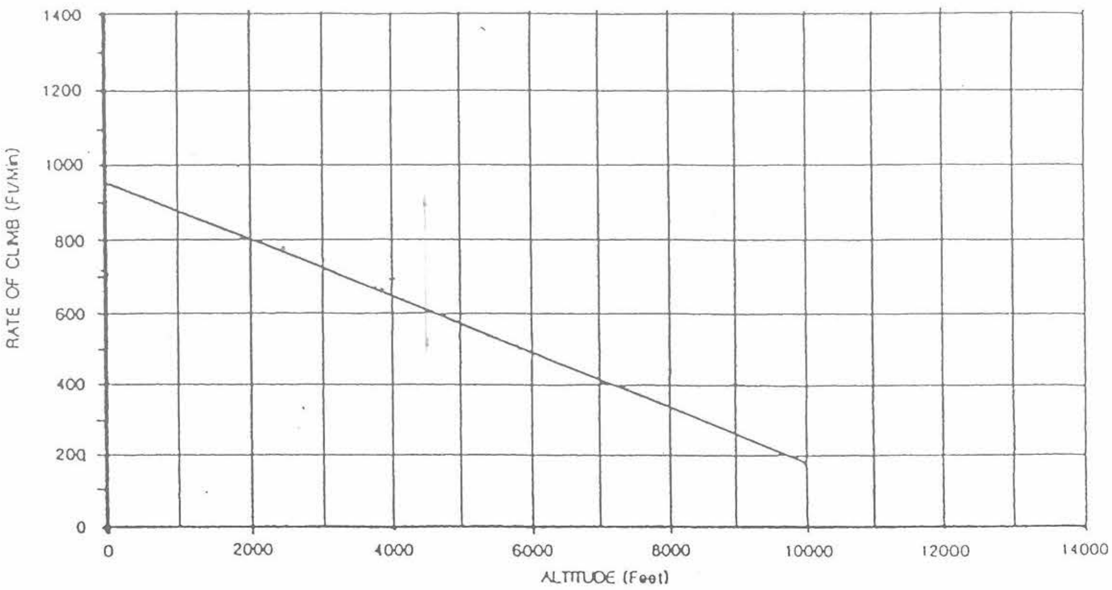
5.3 CLIMB

5.3.1 Climb Speeds

> The best rate of climb speed at maximum AUW 975 kg (2150 lbs) is 77 kts IAS without flap in ISA temperatures. <

5.3.2 Rate of Climb in ISA Temperatures

>



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Note: In hot weather, reduce the rate of climb by 20 feet per minute for every 5°C above the standard temperature at the altitude in question.

5.4 LANDING PERFORMANCE

The information is derived from the table and represents the landing distance required from a height of 50ft (15m) to bring the aircraft to rest.

Landing Distance (ft) Factored

Conditions: Flaps 40deg / Power Off / Moderate Braking / Hard Dry Runway - Zero Wind

Gross Weight	Indicated Airspeed At 50 feet	Pressure Altitude		-5 degC		+5degC		+15degC		+25degC		+35degC	
		ft	m	Ground Roll	Total to Clear 50 ft	Ground Roll	Total to Clear 50 ft	Ground Roll	Total to Clear 50 ft	Ground Roll	Total to Clear 50 ft	Ground Roll	Total to Clear 50 ft
2150 lbs (975 Kg)	70 Kts	Sea Level		987	1919	1023	1990	1060	2065	1096	2136	1135	2207
		1000	305	1023	1992	1060	2065	1100	2141	1136	2215	1175	2289
		2000	610	1060	2065	1098	2144	1140	2219	1180	2298	1220	2375
		3000	914	1098	2144	1140	2224	1184	2304	1222	2382	1264	2461
		4000	1219	1140	2223	1185	2306	1228	2391	1270	2474	1313	2557
		5000	1524	1186	2308	1229	2395	1275	2482	1319	2566	1362	2653
		6000	1829	1230	2397	1277	2485	1323	2577	1368	2665	1414	2755
		7000	2134	1278	2491	1327	2584	1375	2676	1422	2769	1470	2861
		8000	2438	1328	2586	1379	2682	1427	2779	1477	2874	1525	2972

For operation on grass runways the total Landing Distances scheduled for paved runways must be increased as follows :-

(i) Short Dry Grass : 10% of the Total Landing Distance

(ii) Short Wet Grass : 30% of the Total Landing Distance

Note : Short Grass is here Defined as 3-4" high

For operation in windy conditions the following corrections must be applied :

(i) Headwind : Decrease distances by 10% for each 10 Knots

(ii) Tailwind increase distances by 10% for each 2 Knots

In the event of a flapless landing (approach speed of 76Kts IAS), the ground roll figures should be increased by 55% and the total landing distance by 30%

5.5 GLIDE PERFORMANCE

> At maximum total weight of 975 kg (2150 lbs)

Set speed to 80 kts (IAS) (this gives the maximum glide angle which is 1 in 9.1). <

Engine Off - Propeller Windmilling - Flaps Retracted - No Wind.

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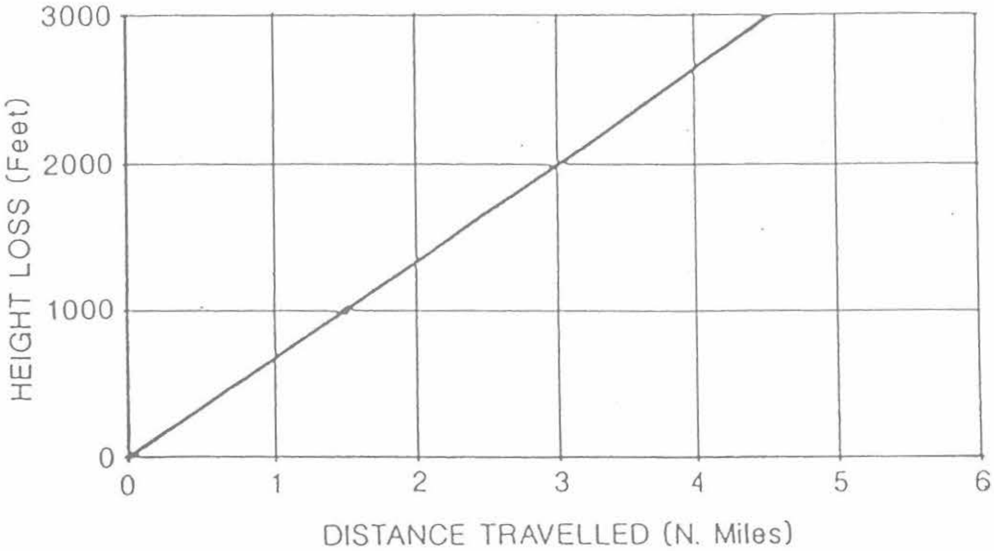

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5.6 ENDURANCE PERFORMANCE - MAX FUEL 34.62 Imp Gal (41.58 US Gal) (157.4 litres)

CONDITIONS - 2100 lbs (953 kg) POST MOD 321
STANDARD TEMPERATURE - NO WIND

At mixture setting, "BEST ECONOMY", 45% power at 2000 ft (610m) and 2100 RPM the expected endurance would be 6.16 HOURS.

NOTES:

1. This figure includes 45 min reserve at 45% Power = 3.6 Imp Gal (4.3 US Gal) (16.4 litres) BEST ECONOMY

2. This figure includes allowance for engine start, taxy and take-off = 0.9 Imp Gal (1.1 US Gal) (4.1 litres)

3. This figure includes allowance for time to climb, ref. Table 5.9.

5.7 CRUISE PERFORMANCE

CONDITIONS : 2000 lbs (907 kg)										
PRESSURE ALTITUDE : 2000 FT (610M)										
MIXTURE SETTING	MANIFOLD PRESSURE (Ins Hg)	FUEL PRESSURE (psig)	% POWER	RPM	STANDARD TEMPERATURE					
					TRUE AIRSPEED		FUEL USED			
					km/h	Kts	UK gal/h	litres /h	US gal/h	
Best Economy	27.1	4.0	94	2700	250	135	10.0	45.5	12.0	
	25.0	2.7	85	2700	226	122	8.1	36.8	9.7	
	22.0	1.9	71	2700	209	113	6.8	30.9	8.2	
	20.0	1.4	61	2700	193	104	5.8	26.4	7.0	
	27.1	4.0	89	2500	243	131	10.0	45.5	12.0	
	25.0	2.4	79	2500	224	121	7.8	35.5	9.4	
	22.0	1.6	66	2500	206	111	6.2	28.2	7.4	
	20.0	1.3	57	2500	198	107	5.6	25.5	6.7	
	18.0	1.2	48	2500	183	99	5.3	24.1	6.4	
	27.1	3.0	83	2300	235	127	8.7	39.6	10.4	
	25.0	1.6	74	2300	200	108	6.2	28.2	7.4	
	22.0	1.2	61	2300	195	105	5.3	24.1	6.4	
	19.0	1.0	48	2300	183	99	4.8	21.8	5.8	
	25.0	1.8	66	2100	217	117	6.7	30.5	8.1	
	22.0	1.3	55	2100	198	107	5.6	25.5	6.7	
	20.0	1.0	46	2100	187	101	4.8	21.8	5.8	

CRUISE PERFORMANCE (continued)

PRESSURE ALTITUDE : 4000 FT (1219 M)									
MIXTURE SETTING	MANIFOLD PRESSURE (Ins Hg)	FUEL PRESSURE (psig)	% POWER	RPM	STANDARD TEMPERATURE				
					TRUE AIRSPEED		FUEL USED		
					km/h	Kts	UK gal/h	litres /h	US gal/h
Best Economy	25.1	4.3	88	2700	248	134	10.4	47.3	12.5
	23.0	2.7	78	2700	235	127	8.1	36.8	9.7
	21.0	2.1	69	2700	129	120	7.2	32.7	8.6
	18.0	1.3	55	2700	123	115	5.6	25.5	6.7
	25.1	3.8	83	2500	139	130	9.7	44.1	11.6
	23.0	2.2	74	2500	130	121	7.3	33.2	8.8
	21.0	1.7	65	2500	122	114	6.4	29.1	7.7
	19.0	1.3	56	2500	114	106	5.6	25.5	6.7
	25.1	3.3	77	2300	235	127	9.1	41.4	10.9
	23.0	1.7	68	2300	127	118	6.4	29.1	7.7
	20.0	1.2	55	2300	118	110	5.3	24.1	6.4
	25.1	2.8	69	2100	131	122	8.4	38.2	10.1
	23.0	1.7	61	2100	118	110	6.4	29.1	7.7
	20.0	1.2	50	2100	113	105	5.3	24.1	6.4
PRESSURE ALTITUDE . 6000 FT (1829 M)									
Best Economy	23.2	4.3	82	2700	241	130	10.4	47.3	12.5
	21.0	2.7	72	2700	230	124	8.1	36.8	9.7
	17.0	1.5	53	2700	196	106	6.0	27.3	7.2
	23.2	3.8	77	2500	239	129	9.7	44.1	11.6
	21.0	2.2	67	2500	219	118	7.3	33.2	8.8
	19.0	1.7	58	2500	211	114	6.4	29.1	7.7
	17.0	1.4	49	2500	200	108	5.8	26.4	7.0
	23.3	3.4	73	2300	228	123	9.3	42.3	11.2
	21.0	1.8	63	2300	215	116	6.7	30.5	8.0
	19.0	1.4	54	2300	196	106	5.8	26.4	7.0
	23.5	3.2	66	2100	219	118	8.9	40.5	10.7
	21.0	1.8	56	2100	208	112	6.7	30.5	8.0
	19.0	1.3	49	2100	195	105	5.6	25.5	6.7

CRUISE PERFORMANCE (continued)

PRESSURE ALTITUDE : 8000 FT (2438 M)									
MIXTURE SETTING	MANIFOLD PRESSURE (Ins Hg)	FUEL PRESSURE (psig)	% POWER	RPM	STANDARD TEMPERATURE				
					TRUE AIRSPEED		FUEL USED		
					km/h	Kts	UK gal/h	litres /h	US gal/h
	21.7	3.9	78	2700	237	128	9.8	44.6	11.8
	20.0	2.0	69	2700	219	118	7.0	31.8	8.4
	18.0	1.6	60	2700	211	114	6.2	28.2	7.4
	16.0	1.2	-	2700	196	106	5.3	24.1	6.4
	21.6	2.9	73	2500	224	121	8.5	38.6	10.2
	20.0	1.7	65	2500	217	117	6.4	29.1	7.7
	18.0	1.4	56	2500	204	110	5.8	26.4	7.0
Best Economy	16.0	1.1	-	2500	191	103	5.1	23.2	6.1
	21.7	2.8	68	2300	217	117	8.4	38.2	10.1
	20.0	1.5	60	2300	211	114	6.0	27.3	7.2
	18.0	1.2	52	2300	200	108	5.3	24.1	6.4
	16.0	1.0	-	2300	185	100	4.8	21.8	5.8
	21.8	2.2	62	2100	213	115	7.3	33.2	8.8
	20.0	1.2	54	2100	200	108	5.3	24.1	6.4
	18.0	1.0	-	2100	191	103	4.8	21.8	5.8
	16.0	0.7	-	2100	176	95	4.0	18.2	4.8
PRESSURE ALTITUDE . 10,000 FT (3048 M)									
	20.0	3.0	72	2700	230	124	8.7	39.6	10.4
	18.0	1.9	63	2700	221	119	6.8	30.9	8.2
	16.0	1.4	-	2700	202	109	5.8	26.3	7.0
	20.0	2.6	67	2500	222	120	7.9	35.9	9.5
	18.0	1.4	59	2500	208	112	5.8	26.4	7.0
Best Economy	16.0	1.0	-	2500	195	105	4.8	21.8	5.8
	20.1	2.1	63	2300	222	120	7.2	32.7	8.6
	18.0	1.2	55	2300	211	114	5.3	24.1	6.4
	16.0	0.9	-	2300	200	108	4.6	20.9	5.5
	20.1	1.9	58	2100	208	112	6.8	30.9	8.2
	18.0	1.0	49	2100	196	106	4.8	21.8	5.8
	16.0	0.7	-	2100	182	98	4.0	18.2	4.8

5.8 TIME, FUEL AND DISTANCE TO CLIMB
MAXIMUM RATE OF CLIMB

CONDITIONS : CLEAN FLAP - FULL THROTTLE - FULL RICH - STANDARD TEMPERATURE - ZERO WIND

WEIGHT LBS (Kg)	PRESSURE ALTITUDE		TEMPER-ATURE	INDICATED CLIMB SPEED IAS		RATE OF CLIMB		FROM SEA LEVEL					
								TIME MIN.	FUEL USED			DISTANCE	
	FT	m	°C	Km/h	Kts	FT/MIN	m/s		Imp Gal	litres	US Gal	NM	Km
2100 (953)	Sea	Level	15	143	77	1000	5.1	0.0	0.0	0.0	0.0	0.0	0.0
	1000	305	13	143	77	922	4.7	1.1	0.2	0.9	0.2	1.4	2.5
	2000	610	11	143	77	844	4.3	2.2	0.4	1.8	0.5	2.9	5.3
	3000	914	9	143	77	766	3.9	3.4	0.6	2.7	0.7	4.5	8.3
	4000	1219	7	143	77	688	3.5	4.7	0.8	3.7	1.0	6.3	11.7
	5000	1524	5	143	77	610	3.1	6.2	1.1	4.8	1.3	8.4	15.5
	6000	1829	3	143	77	531	2.7	7.8	1.3	5.9	1.6	10.6	19.7
	7000	2134	1	143	77	453	2.3	9.6	1.6	7.2	1.9	13.2	24.4
	8000	2438	-1	143	77	375	1.9	11.6	1.9	8.6	2.3	16.1	29.7
	9000	2743	-3	143	77	297	1.5	13.9	2.2	10.0	2.6	19.3	35.8
	10000	3048	-5	143	77	219	1.1	16.4	2.6	11.7	3.1	23.0	42.7

NOTES:

1. Add 0.9 Imp Gal (1.1 US Gal) (4.1 litres) of fuel for engine start, taxy and take-off allowance
2. Increase time, fuel and distance by 10% for each 10°C above standard temperature

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6.1 THE ENGINE AND PROPELLER

6.1.1 General Description

The aircraft is powered by a 4 cylinder 4 stroke petrol engine driving a 2 bladed variable pitch propeller which rotates clockwise as viewed by the pilot. The propeller is driven directly from the engine. Fuel is provided to the cylinders by a fuel injector system equipped with throttle and mixture controls; there is provision for oil and fuel supplies to allow sustained power during inverted flight. Engine ignition is provided by twin magnetos.

6.1.2 The Engine

The engine is an Avco-Lycoming AEIO-320-D1B rated at 160 HP at 2700 RPM. A pulley on the propeller drive provides power for the belt-driven alternator; drives from the back of the engine power the vacuum pump, mechanical fuel pump, twin magnetos and engine speed tachometer: a drive from the front of the engine supplies engine speed information to the propeller constant speed unit.

6.1.3 Engine Lubrication System

General The wet sump engine oil system provides for lubrication of the internal bearings under pressure. There are no pilot-operated controls, but indicators show the oil pressure and temperature. Both gauges are marked with yellow (cautionary), green (normal) and red (danger) bands and knowledge of the corresponding temperature/pressure numerical values is unnecessary.

Oil Filler and Sump The oil sump filler is located under a flap on the top right-hand side of the engine cowling, and incorporates a dipstick. The dipstick is marked in US Quarts; the maximum level is the 8 US quart mark and the minimum level is 4 US quarts. The maximum oil consumption is 0.72 US quarts/hour at rated power and 0.37 US quarts/hour at 75% rated power. The oil filler cap should be tightened by hand only.

A procedure for establishing the normal operating level of oil contents for each individual engine is laid out in the Avco-Lycoming Operations Manual and should be followed carefully. The normal operating level may be as low as 7 US quarts and, if the engine is filled above its "normal" level it will immediately dump the excess oil during flight.

Oil Cooler An air-cooled oil cooler is mounted on the left-hand side of the engine. An integral thermostatic valve directs oil through the cooler or bypasses it dependant on oil temperature. Cooling air supply is taken from the back baffle plates on the left-hand pair of cylinders, the air first entering the main intake at the front of the cowling. The air exhausts with the rest of the engine cooling air at the bottom of the lower engine cowling.

Inverted Flight Oil System The engine inverted flight oil system incorporates a pump, a changeover valve and an oil separator. The oil separator allows the top of the engine crankcase to be vented to atmosphere and collects any oil droplets in the vented air for return to the engine sump. In inverted flight the "top" of the engine becomes the sump and the sump becomes the top: to stop the oil from being vented directly to atmosphere a steel ball in the separator moves under gravity to block the vent connection from what is now the bottom of the engine. On return to normal flight the ball falls back again and normal venting takes place. The changeover valve directs oil to the oil pump: in normal flight oil is taken from the sump; in inverted flight oil is taken via the oil breather pipe at the top of the engine (which becomes the sump), the valve changing over automatically under gravity, thus allowing a supply of oil to the pump under both normal and inverted flight. Extreme manoeuvres (eg vertical flight) will rob the pump of all oil supply and this gives rise to the limitations in Section 2.4. During transition from manual to inverted flight or back again the oil pressure may flicker momentarily, dropping by 10 to 30 psi but it should rise again within one second. Due to the longer path for oil from sump to pump in inverted flight, the sustained oil pressure in inverted flight will be 5-10 psi lower than in erect flight. If the oil pressure in inverted flight stabilizes at more than 20 psi below the erect flight figure this signifies a fault in the oil supply system and the aircraft should be righted immediately and the fault investigated on the ground.

On start-up, the oil pressure should rise to the yellow or green sector within thirty seconds; if it does not, the engine should be stopped immediately or severe internal damage may result. The engine is very slow to warm up and care should be taken to observe engine oil temperature and pressure minima and maxima. There are no oil temperature minima for run-up or takeoff but the engine run-up should not be commenced until the engine has been warmed up for four minutes from cold; takeoff should only be continued if the engine accelerates smoothly as the throttle is opened and 2550 RPM is obtainable immediately the throttle is opened fully at the beginning of the takeoff run. Engine life is maximised if the oil is warmed to 40°C before takeoff.

The engine may over-cool during a prolonged glide with the engine throttled fully back and this may lead to very poor and slow engine acceleration when the engine throttle is subsequently opened. This cooling takes place at the engine cylinders and will be apparent on the cylinder head temperature gauge. Prolonged glides are most likely during engine failure practice and, to avoid the problem of over-cooling, the engine should be cleared at least once every 1000 ft by opening the throttle to full power for at least three seconds and closing it again to idle. Additionally the throttle should be opened slowly on the climb out.

6.1.4 Magnetos

Two Bendix magnetos are employed; they are mounted at the back of the engine, the 'left one being at eleven o'clock and the 'right' one at one o'clock. Each of the four engine cylinders has two sparking plugs; both magnetos work together, each one supplying one sparking plug in each cylinder so that for safety, the engine will continue to run if one magneto fails.

> The magneto switch (Item 9 Fig 8.4 and 8.4B) controls both magnetos and is marked OFF - R - L - BOTH. In the 'OFF' position both magnetos are earthed and so will produce no spark; in the 'R' position the right magneto is made live whilst the left magneto is earthed and thus the right magneto should produce sparks. In the 'L' position the left magneto alone is now live and in the 'BOTH' position, both magnetos are live. <

The left magneto is fitted with an impulse and spark retard device which makes the engine easy to start; the device only operates at very low RPM and thus the magneto is providing a normally timed spark at all RPM settings available to the pilot. For starting the engine, the magneto switch should be selected to 'L' and then to 'BOTH' when the engine fires. Prolonged running with one magneto switched off will lead to oiling up of its sparking plugs and a consequently large magneto "drop".

If one magneto becomes dead during engine operation, it may not immediately be apparent as the engine will continue to run. It may also happen that one magneto becomes permanently live; this will not normally be discovered as it is the usual practice to stop the engine by cutting off the fuel. For this reason a "dead/live" magneto check is carried out immediately after starting and immediately before stopping the engine. The purpose of this check is to ensure that there is a drop in engine RPM when a magneto is switched off but that the engine continues to run.

An individual check of the performance of each magneto is carried out before takeoff in the Engine Run, but the 'Dead Cut' check has two purposes as follows:

a. To ensure that each magneto can run the engine.

b. To ensure that either or both can be switched off if required.

Should there be no RPM drop, then the magneto that has been switched off is permanently live and the engine is in a dangerous condition because:

1. If that magneto malfunctioned, it could not be switched off.

2. The engine could not be stopped by switching off the magnetos (eg fire drill).

3. There is a risk of the engine starting when the propeller is turned during engineering work on the ground.

The magneto performance check is done before each flight and is carried out by setting 1800 RPM with 'BOTH' selected; the right magneto is then switched off by selecting 'L' and the RPM is monitored to check that the engine runs smoothly and the RPM drop does not exceed 175 (ie the RPM does not fall below 1625 RPM). The magneto switch is returned to 'BOTH' and the RPM allowed to re-stabilize at 1800 RPM. Then the left magneto is switched off by selecting 'R'; the engine should again continue to run smoothly and the RPM should be above 1625; additionally, the RPM should be within 50 RPM of that achieved with 'L' selected. (If the engine is not within these limits an engineering investigation is required). The magnetos should then be selected to 'BOTH'.

A cêrtain type of magneto failure can occur where one magneto either sparks intermittently or sparks with the wrong timing; this can lead to rough running of the engine. If rough running occurs and cannot be attributed to any other cause (wrong mixture setting, induction icing, oil pressure failure) each magneto can be switched off in turn to check for malfunctioning. Should normal engine running be restored with one magneto switch off the aircraft should not take off and, if already airborne, should land at the nearest safe landing ground as continued engine operation now depends on a single magneto.

6.1.5 Tachometer

A drive from the back of the engine is transmitted by a sleeved cable to a tachometer in the cockpit. The face of the tachometer is graduated from 0 to 3500 RPM and the glass is marked with a red line at the limiting engine RPM of 2700 RPM. The 'hours' figure on the face of the instrument assumes a constant RPM and may therefore under- or over- read against real time; it cannot therefore be used to measure engine operating time.

6.1.6 Manifold Pressure

The manifold pressure gives the operator a direct indication of how hard the engine is working whilst the RPM tells him how fast the engine is going round. As is the case with most piston engines, the engine should not be made to work too hard at low RPM. The manifold pressure gauge shows the pressure of air being fed to the cylinders and hence, the higher the pressure, the harder the engine is working. When the engine is running, opening the throttle admits more air to the manifold and allows the pressure to rise. If the manifold pressure is too high for the RPM being used, detonation and engine damage may result: to avoid this condition the manifold pressure (in inches of mercury) should never be allowed to exceed the RPM (in hundreds) by more than 4, e.g. the maximum manifold pressure allowed at 2200 RPM is 26 inches of mercury. This condition can inadvertently be encountered when increasing or decreasing power settings, so a simple rule to remember is - when increasing power "REV UP" first, when decreasing power "THROTTLE BACK" first.

6.1.7 Starter

The starter is located at the front of the engine under the propeller drive. It is operated by a push-button on the centre console, the button being obstructed when the fuel cock is selected to 'OFF'. Electrical power is available to the starter through the starter button when the master is switched on. A starter warning light illuminates when the starter is engaged; it should light only whilst the starter button is pressed and should it fail to go out when the button is released, the engine must be stopped immediately or mechanical damage will ensue. The starter circuit is not routed through the ammeter and thus the starting current is not shown on the ammeter.

6.1.8 Propeller and Constant Speed Unit

The propeller is a Hoffmann 2 bladed variable-pitch propeller. The leading edges are covered with a replaceable metal strip. In the event of any damage, cracks, chips or surface crazing being detected, reference should be made to the maker's handbook which gives details of acceptable imperfections. The propeller rotates clockwise as seen by the pilot. The propeller hub is hidden by the spinner which is secured to the propeller back plate by screws; thus the hub cannot be inspected on a daily basis.

Propeller pitch is varied by the movement of a piston in the propeller hub: this piston is connected to both propeller blades and moves them simultaneously to vary their pitch from low pitch (fully fine) to high pitch (fully coarse). The blades have counter-weights attached at their roots; when the propeller is turning these counterweights exert a force on the blades to make them move to the fully coarse position. This action is assisted by a spring. Thus, once the engine is running, the blades can only be moved from fully coarse by applying enough pressure to the piston in the hub to overcome the force generated by the spring and counter-weights. The source of pressure is the oil pump and the amount of pressure allowed to go to the piston is controlled by the constant speed unit.

The function of the constant speed unit is to vary the pitch of the propeller blades to keep the propeller RPM at the value selected by the RPM control. It works on the principle that if the pitch of the propeller blades is increased, the blades will develop more lift (thrust) but will also develop more drag; this increase in drag will slow the propeller RPM down. Conversely, if the pitch is decreased, the propeller will speed up. The desired RPM is set in the constant speed unit by movement of the RPM control; the unit then either lets oil in under pressure to decrease the propeller pitch or lets oil out allowing the pitch to increase until the set RPM is reached. If the RPM then varies from the set value the constant speed unit changes the pitch until the correct RPM is regained.

The constant speed unit can only function correctly when the engine is developing enough power to turn the propeller at the RPM set by the RPM control. When the throttle is closed on the ground the engine develops very little power; the constant speed unit will attempt to keep the RPM at the value set by the RPM control and, as the engine slows down, will move the propeller to a lower and lower pitch until it is at minimum pitch (fully fine). At ground idle the engine is not developing enough power to keep the RPM above about 800 - even at minimum pitch. Thus it can be seen that, at low throttle settings, the propeller will be fully fine and the throttle will control the RPM; opening the throttle will increase the RPM until the engine is developing enough power to drive the propeller round at the value set by the RPM control; once the set RPM is reached, the constant speed unit will keep the RPM the same by coarsening the propeller as the throttle is opened further. Conversely, as the throttle is progressively closed from fully open, the constant speed unit progressively reduces the propeller pitch to keep the set RPM. Eventually, at a certain throttle position, the propeller is fully fine, the unit can no longer maintain the set RPM; the RPM will then fall as the throttle is closed beyond this position.

In practice, at normal flight power settings, the RPM control sets the RPM and the throttle controls the manifold pressure. It is only on the ground or when reducing to low throttle settings that the power output of the engine is too low to allow the constant speed unit to work and then the throttle controls the RPM.

Overspeed

Up to 3105 RPM If the propeller overspeeds between 2700 PRM and 3105 RPM (an overspeed of 0% - 15% over the engine takeoff RPM limit of 2700) a normal propeller periodic 100 hour inspection must be carried out.

3105 RPM tp 3375 RPM If the propeller overspeeds between 3105 RPM and 3375 RPM (representing an overspeed of 15% - 25% over the engine takeoff RPM limit of 2700) the propeller must be returned to the manufacturer or authorised agent for inspection. The exact overspeed RPM should be noted.

Above 3375 RPM The propeller should be returned to the manufacturer or authorised agent for inspection and no ferry flight should be made.

6.1.9 Normal Use

The drills for the normal use of the engine are given in Section 3 and in the Flight Reference Cards (FRCs). The limitations are given in Section 2 of this manual and critical limitations are summarised in the FRCs.

Cruising Power During First 50 hrs Engine Life Cruising should be done at 65% - 75% power until 50 hrs engine life has accumulated or oil consumption has stabilised.

6.1.9 Malfunctions

The emergencies are covered in Section 4 and are reproduced in the emergency check lists (red pages) of the FRCs.

6.2 THE AIRFRAME AND ENGINE FUEL SYSTEM

6.2.1 General Description

Fuel is contained in two separate wing tanks, it can be fed from one or other of the tanks, via a left/right selector valve, to the engine through a filter by means of an electric booster pump and an engine driven pump (EDP). The engine is equipped with a continuous flow fuel injection system which incorporates a fuel pressure sensor.

6.2.2 Fuel Tanks (Ref Illustration 8.4 and 8.4B)

The two GRP tanks form integral parts of each wing inboard leading edge structure. The capacity of each tank is 80.7 litres (17.75 Imp Galls) of which 78.7 litres (17.31 Imp Galls) are usable. Fuel type is AVGAS 100LL. The tank fillers are located on the upper surface of the wing leading edge.

Vent pipes from each tank are led separately, from a breather box assy, to vent from under the fuselage inboard of Rib 1 port and starboard. The breather box assembly incorporates a flapper valve to minimise fuel loss during inverted flight. Both filler caps incorporate a positive lock and rubber sealing washer to prevent fuel loss during inverted flight. Each tank contains a float metering unit which supplies information to the electric fuel contents gauges (Items 39 and 40 Fig 8.4) (Items 43 and 44 Fig 8.4B) when the master switch is on.

Fuel drains are fitted to both tanks. In both cases the drain is taken from the lowest point of the tank and this will collect any water that may be present in the fuel from condensation or contamination. The fuel can be sampled before each flight by pressing up on the spring loaded screw and collecting the fuel which flows out in a suitable wide necked glass container.

CAUTION

> The spring loaded screw will remain in the up position if it is inadvertently turned, therefore care must be taken to ensure that the fuel has ceased to flow after the sample has been taken.

Fuel to the engine is drawn from the bottom of the inboard side of the tank through a fuel feed pipe. Attached to the fuel feed pipe inside the tank is a flop tube which is fitted with a filter and non-return valve assembly. The flop tube is contained in a collector tank; this ensures adequate supply of fuel to the engine during inverted flight or steep turns. Fuel flows from the tank to a fuel cock (Item 4 Fig 8.4 and Fig 8.4B) mounted on the centre lower instrument panel such that the starter button is obstructed when the fuel is turned off. The fuel cock has 3 settings FUEL OFF/LEFT TANK/RIGHT TANK. From the fuel cock, fuel passes through a filter to an electrically operated booster pump. The pump is controlled by a FUEL PUMP ON/OFF SWITCH (Item 3 Fig 8.4 and Fig 8.4B), mounted on the lower centre console; it is protected by a circuit breaker located on the right of the instrument panel. Pump output is capable of supplying fuel to the engine at maximum power with the EDP failed. In cruising flight the booster pump can be switched off and fuel drawn by the EDP will be drawn through the bypass incorporated into the pump.

The EDP is mounted centrally at the back of the engine forward of the firewall; it incorporates a bypass valve so that fuel can flow when the engine is not turning or the pump has failed. A vent from the EDP emerges under the engine cowling forward of the nosewheel leg. The pilot has no controls for the EDP.

6.2.3 Fuel Contents Gauge (Ref. Illustration 8.4 and 8.4B)

The fuel gauges are mounted at the top of the instrument panel (39 and 40). (43 and 44 Fig 8.9B). They require electrical power which is supplied through the master switch. They have a circuit breaker (44) (48 Fig 8.4B) which also controls the electrical supply to the oil temperature, oil pressure and fuel pressure gauges. The gauges are marked in litres and Imperial Gallons, each full tank containing 78.7 litres (17.31 Imp galls) useable fuel. The contents metering floats are located away from the filler neck and thus the gauges may be used to give an indication of fuel levels during refuelling.

6.2.4 Fuel Pressure Gauge (Ref Illustration 8.4 and 8.4B)

The fuel pressure gauge (Item 36 Fig 8.4) (Item 37 Fig 8.4B) is mounted on the left-hand instrument panel on a gauge shared with the manifold pressure indicator. It is calibrated from 0-10 psi.

The fuel pressure sensor is mounted on the fuel distributor inlet so that the pressure recorded is the same as that being experienced at the injectors. The gauge senses the fuel pressure directly through a pipe and, for this reason, a restrictor is put in the pressure line to the gauge so that fuel is not pumped into the cockpit if the pipe breaks. The fuel pressure supplied to the distributor is controlled by the fuel control unit which responds to throttle demands. The amount of fuel fed to the engine is directly proportional to the fuel pressure and thus the fuel pressure gauge may be expected to read high when the throttle is open and low when the throttle is closed: it should never read zero when the engine is running. The relationship between fuel pressure and fuel flow is given in Section 6.2.5.

In the event of engine malfunction a check of the gauge pressure will confirm whether the problem is caused by a fuel supply problem. If the fuel pressure gauge reads very low the likely rectifiable causes are fuel pump failure or fuel supply failure; the electric pump should be switched on and the fuel control and contents checked.

6.2.5 Fuel Control Unit

The fuel control unit takes the place of the carburettor. It supplies fuel to a fuel distributor which directs fuel to the appropriate cylinder where it is injected directly into the inlet port. The fuel control unit senses the airflow through the manifold into the engine and provides the appropriate amount of fuel to give the correct air/fuel mixture. It actually achieves this by varying the fuel pressure; this changes the fuel flow and gives the correct mixture. Opening the throttle will increase the airflow in the manifold and the fuel control unit schedules a higher fuel flow. At altitude the reduction in density results in a lower manifold airflow being sensed by the unit which automatically schedules a lower fuel flow, avoiding an over-rich mixture. The fuel control unit is set to provide a maximum power (rich) fuel/air mixture throughout the operating range but weakening the mixture to economy cruise settings can be achieved by use of the mixture control.

The fuel control unit depends on the supply of fuel under pressure to function correctly and failure of the pressure supply will result in power failure. Both the engine driven fuel pump and the electric fuel pump can individually provide sufficient pressure for correct fuel supply. Under normal circumstances only the engine driven pump is used. A failure of this pump will result in power loss and low or zero fuel pressure; normal engine performance can be restored by use of the electric fuel pump.

A failure in the fuel control unit or impact icing on the throttle or air pressure sensing pipes will cause reduced fuel or air flow and will lead to loss of power: icing conditions must be avoided as there is no provision for manifold or throttle ice clearance.

> 6.2.6 Fuel Distributor (Ref. Illustration 8.4 and 8.4B) <

The fuel distributor is downstream of the fuel control unit and directs fuel to the inlet port of each cylinder in turn as they commence their induction stroke. There are no pilot controls or indicators but the fuel pressure experienced at the indicator is shown on the fuel pressure gauge (Item 36 Fig 8.4) (Item 37 Fig 8.4B) in the cockpit.

> 6.2.7 Throttle (Ref. Illustration 8.4 and 8.4B)

A throttle is provided for left-handed use by each pilot. The left-hand throttle (Item 46 Fig 8.4) (Item 51 Fig 8.4B) is of the lever type and is <
located on the left cockpit wall, incorporating a spindle friction damper.
> The right-hand throttle (Item 6 Fig 8.4 and Fig 8.4B) is on the centre lower <
instrument panel and is of the plunger type. The two throttles are ganged together and thus operate simultaneously. The throttle is fully open when the controls are fully forward.

> 6.2.8 Fuel Mixture/Cutoff Control (Ref. Illustration 8.4 and 8.4B)

The mixture/cutoff control (Item 8 Fig 8.4 and Fig 8.4B) is situated on the <
centre lower console and is of the plunger type. The mixture is fully rich when the control is fully forward and progressively weakens as the control is pulled back: the fuel is completely cutoff when the control is fully back. The control is of the vernier type and incorporates a central push button to release the vernier. An adjustable friction device is also provided which turns clockwise to increase friction. The friction control should always be set tight as vibration may otherwise cause the setting to 'creep'.

For takeoff, climb and at low levels AMSL fully rich should always be selected and locked. In the cruise it may be weakened to reduce fuel pressure to the value derived from the performance graph at Section 5. Weakening beyond this point will cause rough running and may lead to RPM surging as the constant speed unit attempts to maintain RPM under conditions of fluctuating power. This fuel pressure setting gives the mixture which is the most efficient for that particular RPM, temperature, speed and altitude and will need resetting if any of these conditions change. The mixture should always be set fully rich before changing any throttle setting or commencing any climb or descent. The engine should normally be stopped on the ground by setting the mixture to cutoff so that fuel is not left in the cylinders after the engine has stopped; this stops lubricating oil being washed from the cylinder walls and minimises the chance of the engine firing if the propeller is turned.

Should the engine ever seem to be suffering from power loss with no other symptoms (e.g. mechanical noise, oil system malfunction, induction icing) immediately select the mixture to fully rich in case incorrect mixture was the cause of the trouble.

6.2.9 Normal Use

Before Flight Ensure that there is sufficient fuel for the flight and that the fuel caps are both secure. Check that both vent pipes are clear. Sample fuel for contamination- check if required. (First flight of each day). Once the master switch is on, check fuel gauge indicators, both tanks, leave fuel on and carry out engine starting drill. After take off switch off booster pump.

During Flight Periodically monitor fuel gauge indicators. Switch from one tank to the other from time to time during long flights to maintain the balance of fuel in the tanks. Fuel asymmetry before commencing aerobatics and spinning manoeuvres should not exceed 14 litres (3 Imp Galls).

The effect of asymmetry of fuel greater than 14 litres will not hazard the aircraft but does lead to slight increase in control stick aileron forces and less precise aerobatic manoeuvres.

Switch on booster pump when beginning a landing approach.

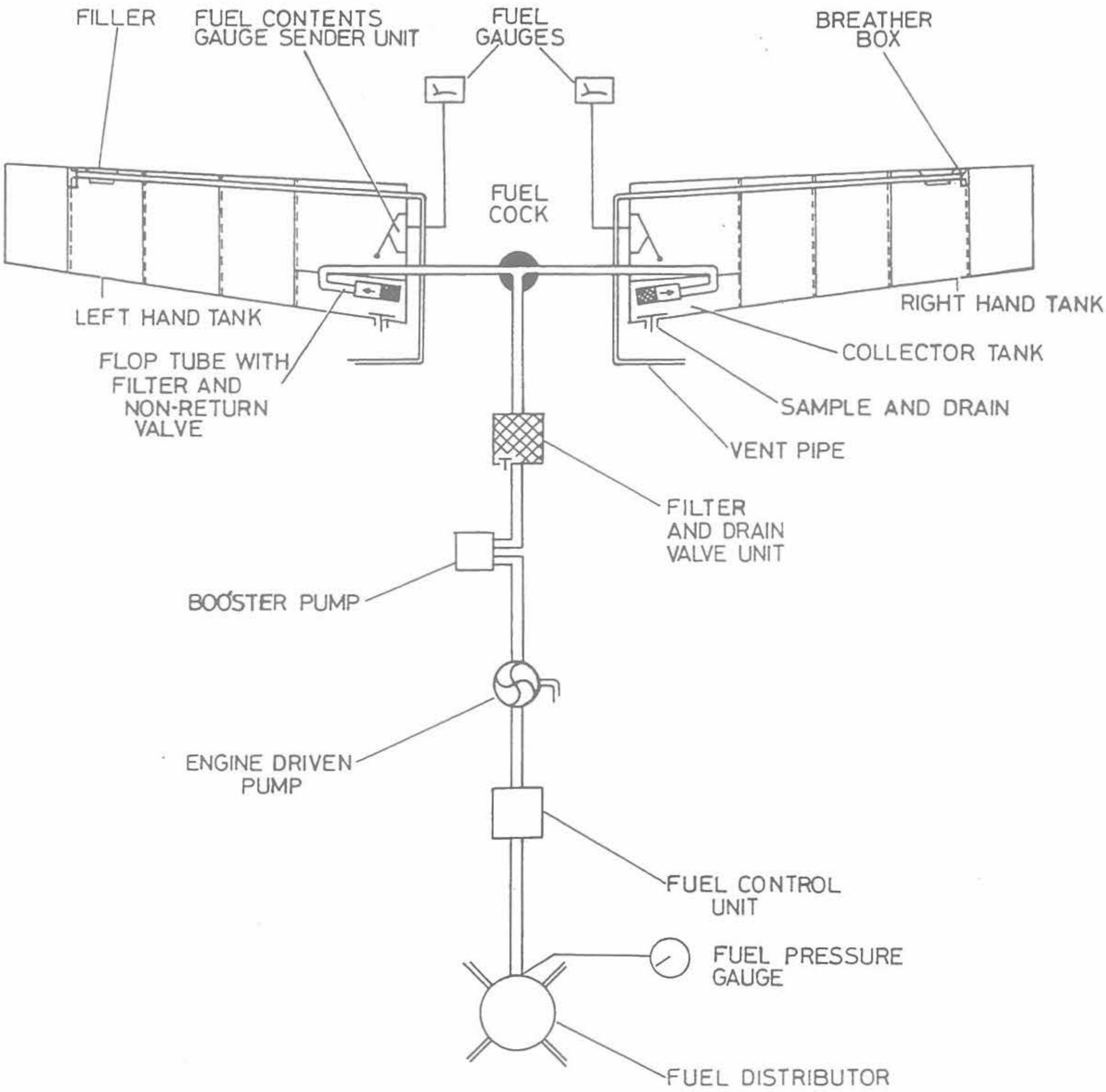
Should a low fuel situation arise, it is advisable to select one tank until the engine begins to falter and then switch to the other tank containing the remaining fuel.

After Flight Set the mixture control to cutoff. When the engine has stopped, switch off the fuel.

6.2.10 Malfunctioning

These are covered in Section 4 and in the FRCs - red section.

6.2.11 Fuel System Diagram



6.3 THE ELECTRICAL SYSTEM

6.3.1 General Description

A battery provides 24V DC for all electrical services. Any equipment requiring AC incorporates its own solid state inverter thus eliminating the need for any separate AC distribution system. An engine-driven alternator charges the battery. All circuits are protected by circuit breakers which are accessible to the pilot in flight.

6.3.2 Battery (Ref Illustration 8.4 and 8.4B)

The 24 volt battery rated at 15 ampere hours is located on the forward side of the firewall to the port side of the engine. It can supply all electrical services but demands on it should be kept to a practicable minimum until alternator output is available; this will retain battery capacity for starting the engine and for use in the air should the alternator fail before it has fully charged the battery. No emergency battery is fitted. An ammeter (Item 42 Fig 8.4) (Item 46 Fig 8.4B) indicates the rate of battery charge or discharge. The battery is connected to the DC busbar by a battery relay which is operated by the master switch (Item 2 Fig 8.4 and Fig 8.4B). No electrical services except the clock will operate until the master switch is on. Once the engine is running, the alternator may be switched on to charge the battery; the master must never be switched off when the alternator is on and the engine running, as alternator damage may occur.

6.3.3 Alternator (Ref Illustration 8.4 and 8.4B)

The 24 volt 70 amp Prestolite alternator is driven by a friction belt from a pulley on the propeller drive shaft; a red warning light marked ALT (Item 26 Fig 8.4) (Item 27 Fig 8.4B) flashes whenever the master is on and the alternator is not giving any output. The flashing can be stopped by pressing the warning button for more than half a second which will cause the light to revert to steady red. Voltage control is regulated by a Lamar regulator, this effectively cuts out the alternator in the event of over voltage. An ammeter is fitted to indicate any excessive charge or discharge.

The alternator requires an excitation current to be applied to its field coils before it will start delivering current even though it is being turned by the engine; this current is supplied from the busbar through the excitation switch (Item 1 Fig 8.4 and 8.4B). Two circuit breakers protect the alternator; one, rated at 5 amps, protects the excitation circuit and the other, rated at 60 amps, (Item 45 Fig 8.4) (Item 49 8.4B) protects the main alternator output. The alternator should be switched on once the engine is running and should be switched off before the engine has been shut down. The ammeter (Item 42 Fig 8.4) (Item 46 Fig 8.4B) indicates the rate of battery charge or discharge and should be carefully monitored when the alternator is switched on; the ammeter should immediately be expected to indicate about +20 amps but should fall to no more than +10 amps after about 60 seconds or the battery is likely to 'boil' and spill acid. The charge rate will steadily fall from about +10 to +2 amps as the battery becomes fully charged. The alternator is capable of full output at ground idle RPM (700 RPM) and will thus retain output at windmill RPM (800 RPM) at gliding speed following an engine failure; it will not produce any output when the propeller has stopped.

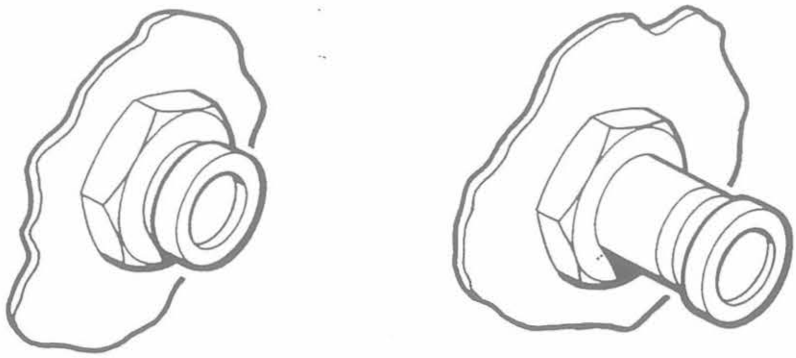
Warning

The master switch should not be switched off when the alternator is switched on with the engine running as this may result in damage to the alternator control components.

Alternator failure will be indicated by the ALT light flashing and the ammeter indicating a discharge. The alternator excitation should be switched off and the circuit breakers checked and reset if necessary; the alternator may then be switched on but if a circuit breaker trips again the alternator should be switched off and the fault investigated on the ground.

> 6.3.4 Circuit Breakers (Ref Illustration 8.4 and 8.4B)

The circuit breakers (Item 44 Fig 8.4) (Item 48 Fig 8.4B) are all accessible < to the pilot in flight. The ampere ratings are stamped on the head of each one. When a circuit breaker trips is protrudes about half-inch from the panel and a white portion on its stem is clearly visible. The circuit breakers may be tripped by the pilot by pulling out the head of the circuit breaker until the white portion is visible. They may be reset by pushing the head back to the 'set' position.



CIRCUIT BREAKER SET CIRCUIT BREAKER TRIPPED

If a circuit breaker trips, the circuit which it is protecting should be switched off (if there is a switch) before any attempt is made to reset the circuit breaker; the circuit breaker should be allowed to cool for about 30 seconds and then it may be reset. Under no circumstances should a circuit breaker ever be held pressed in as this can result in an electrical fire. Once a circuit breaker has been reset, the circuit which it was protecting may be switched on again; if the circuit breaker trips a second time the circuit should be switched off and no further attempt made to reset it. Some circuit breakers serve more than one circuit but this is not always indicated on the panel. Details of all circuit breakers, their loadings and the circuits protected by them are given on the diagram of the electrical system in this chapter at 6.3.8.

6.3.5 Normal Use of the System

Before flight: Check electrical services as detailed in the FRCs. Select the master switch on before starting the engine and leave it on until the engine has been shut down. Once the engine is running select the alternator excitation switch to ON and monitor the ammeter readings to ensure that the initial charge rate of about 20 amps falls to 10 amps in 60 seconds and about 2 amps in 5 minutes. Select services as required.

During flight: Monitor the charge rate periodically. Select services as required.

After flight: Switch off the alternator before engine shutdown and switch off the master once the engine has stopped.

Use of Avionics: Avionics should only be switched on and off whilst the alternator is running to protect them from transient voltage fluctuations.

(If avionic ground checks are required, without the engine running, do not operate master or starter switches whilst radios are turned on.)

6.3.6 Malfunctioning (Ref Illustration 8.4 and 8.4B)

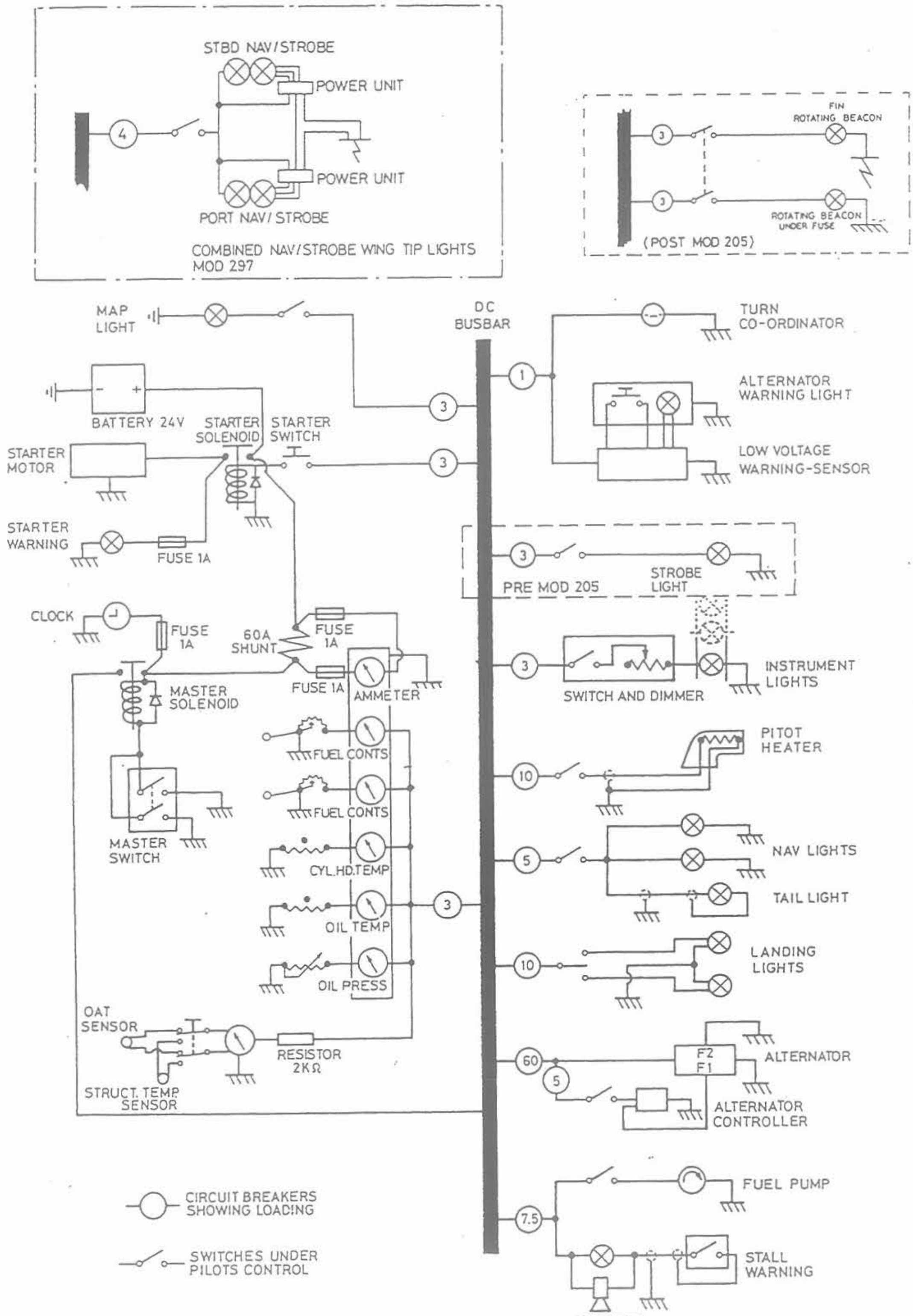
Alternator failure: Failure will be indicated by the red ALT warning (Item 26 Fig 8.4) (Item 27 Fig 8.4B) illuminating and the ammeter (Item 42 Fig 8.4) (Item 46 Fig 8.4B) indicating a discharge. The drill for attempting to restore alternator output is given in the FRC.

Flat battery: Should there be too little power in the battery to start the engine it will be necessary to have the battery changed or to fit a serviceable one. There is no provision for the connection of an external electrical supply.

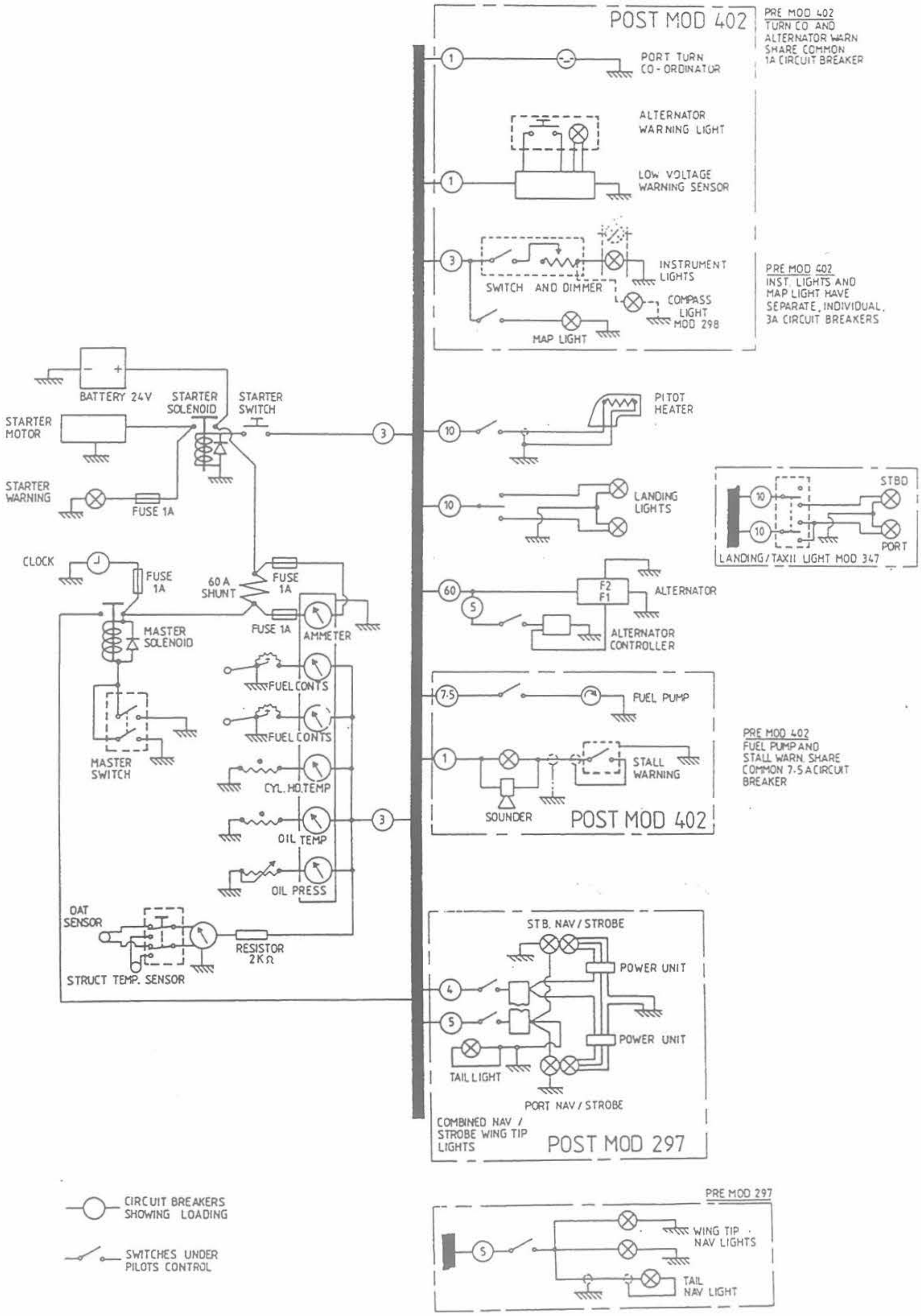
Do not take off with a flat battery. It supplies emergency electrical power in the event of an in flight alternator failure.

Circuit breaker trip: See 6.3.4 in this chapter.

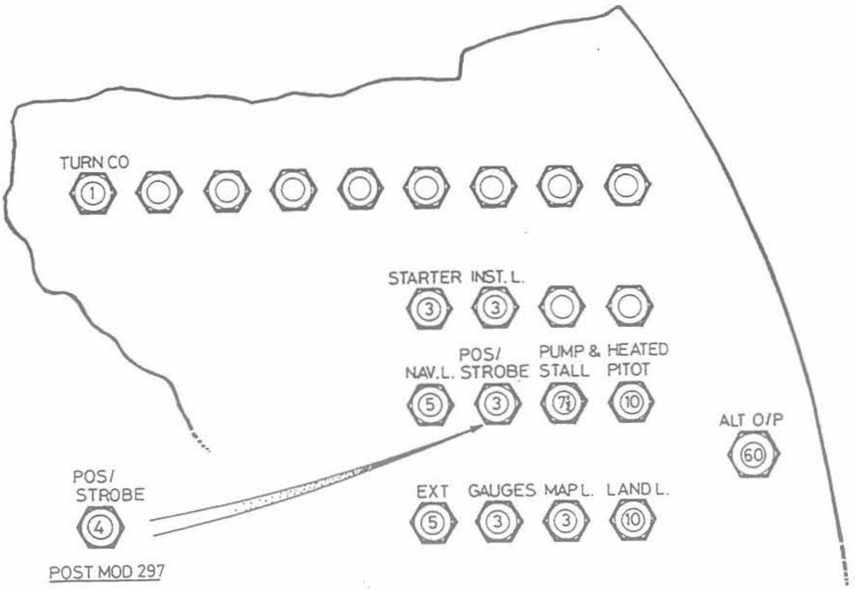
> 6.3.7 The Electrical Circuit Diagram (PRE MOD 402) <



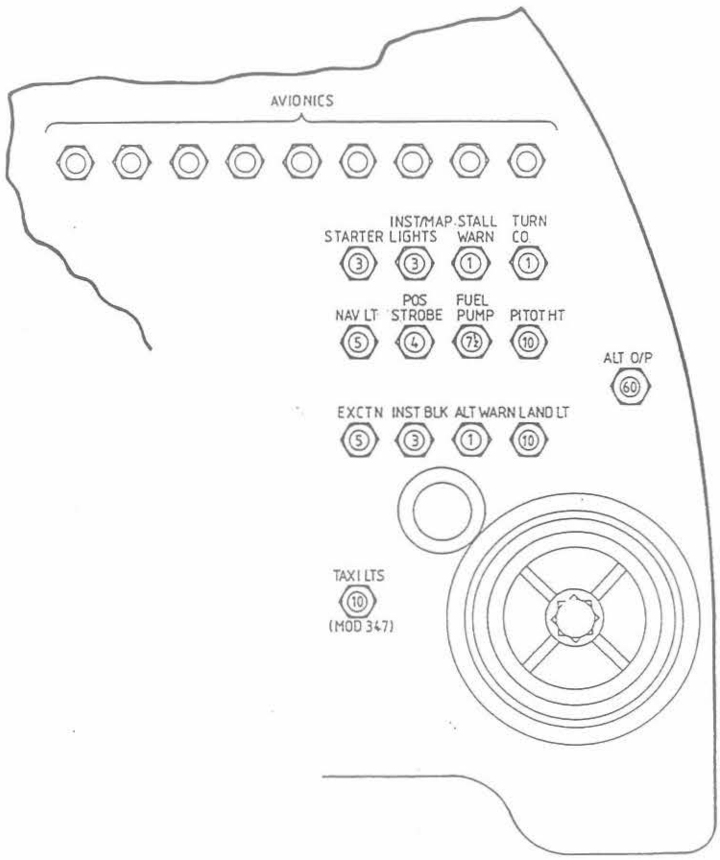
> 6.3.7A The Electrical Circuit Diagram (POST MOD 402)



> 6.3.8 Circuit Breaker Layout (PRE MOD 402) <



> 6.3.9 Circuit Breaker Layout (POST MOD 402)



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6.4 GENERAL EQUIPMENT

6.4.1 Safety Equipment

The safety equipment fitted in the aircraft is a fire extinguisher, a first aid kit and a crash axe. The fire extinguisher is filled with BCF and its use should be minimised in a confined space. The extinguisher is mounted on the back wall of the cockpit in a clip that prevents inadvertent operation but allows removal with one hand. The extinguisher is operated by squeezing the trigger on the head of the bottle. There is no provision for engine fire warning or extinction. The first aid kit is stowed on the back of the bulkhead behind the pilots seats and the axe is mounted on the back wall beside the fire extinguisher.

6.4.2 Access to the Cockpit

Access to the cockpit is by a walkway on each wing. A footstep and handhold is provided on each side of the aircraft in order to assist both pilot and co-pilot in stepping up onto the walkways. The walkways go from the trailing edge to level with the cockpit and are surfaced with non-slip material. The areas outboard and in front of the walkway are the flap and wing upper surface and the leading edge; these areas are not stressed for walking on and care must be taken when getting in and out of the cockpit to see that they are not damaged.

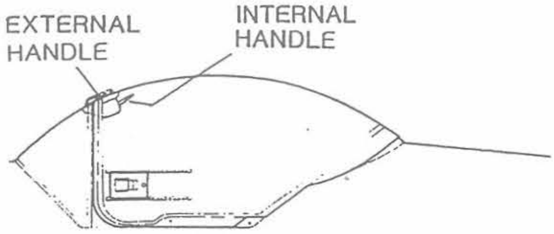
It is a sensible precaution to leave the flaps at fully down when the aircraft is not in use to make it less likely that personnel will inadvertently tread on them.

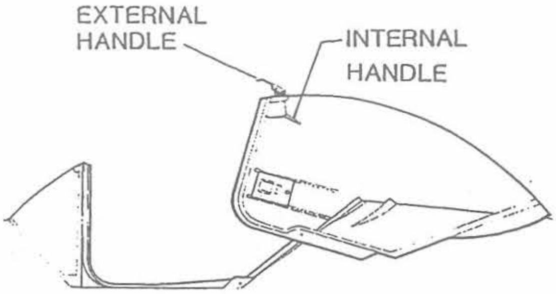
6.4.3 Aircraft Security

The canopy latch mechanism incorporates a key operated lock; also the engine cannot be started without a key to switch on the magnetos. Therefore the removal of the magneto key and locking of the canopy will totally immobilise the aircraft.

6.4.4 Canopy

The canopy consists of a fixed windscreen separated by a carbon fibre hoop from an upward and backward hinging perspex transparency. A latch mechanism is fitted to the upper forward edge of the transparency and can be operated by handles from either inside or outside the aircraft. The rear of the moveable part of the canopy is fixed to the aircraft by a runner which can slide fore and aft in a track but cannot lift up. When opening the front lifts up, hinging on 2 radius arms attached to the cockpit sill and canopy frame. The canopy is prevented from sliding too far rearwards by a stop incorporated into the track of the rear attachment.





Canopy Lock The canopy is locked by the 2 hooks of the canopy latch assembly, attached to the moveable transparency, which engage on the latch pin part of the latch block assembly, located centrally on the forward hoop. The latch mechanism has been designed so that in the open position both internal and external handles stick out whereas in the closed position they lay flat thereby giving good visual indication as to whether the latch mechanism is open or engaged.

Opening the Canopy To disengage the latch mechanism from inside or outside the cockpit a steady pull on the handle is needed until the mechanism is triggered and the handle snaps into the open position. The canopy may now be opened fully; it should always be moved in a controlled manner and never slammed open or shut. The canopy should never be left in an intermediate position as there is a risk of it falling shut and causing damage. The canopy must always remain closed and latched during flight unless emergency evacuation is intended (see P.2-10).

Post Mod 283 A split canopy slide lock is introduced to retain the canopy in the open position. The lock is operated from a lever inside the cockpit at the rear of the centre console.

Closing the Canopy Pull canopy forward until it cannot move any further ensure that the latch handle is in the open position and thus that the canopy is fully home. Press the handle into the closed position, inside or outside of the cockpit, thereby engaging the 2 hooks onto the latch pin and securing the canopy in the closed position.

6.4.5 Seats and Harnesses

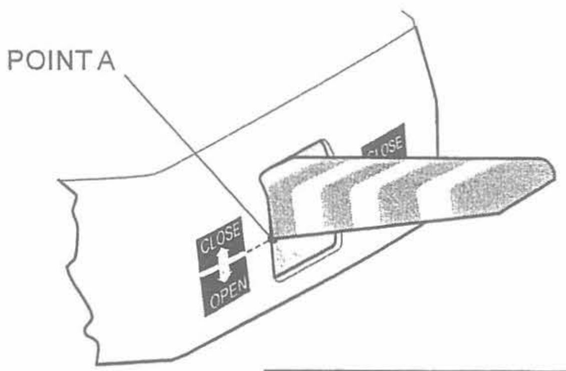
The moulded bucket seats can be used with or without parachutes. Cushions are fitted, being attached with velcro strips, and these may be removed when parachutes are worn. The seats are not adjustable for height but additional cushions can be used to correct pilot head height. Variations in leg length are allowed for by rudder pedal adjustment.

The harness is a 5-piece full body restraint type with a quick-release fitting which releases all straps simultaneously. It comprises two lap straps, two shoulder straps and a negative G restraint strap; the quick release fitting is permanently attached to the outboard lap strap and the other straps have metal tongues which fit into individual slots in the fitting. A cruciform disc on the front of the fitting is spring-loaded to the locked position and

6.4.4 Canopy

Canopy Lock The canopy is locked by the 2 hooks of the canopy latch assembly, attached to the moveable transparency, which engage on the latch pin part of the latch block assembly, located centrally on the forward hoop. The latch mechanism has been designed so that in the open position both internal and external handles stick out whereas in the closed position they lay flat. Positive visual indication as to whether the latch mechanism is locked is provided by witness marks, the white line on the OPEN/CLOSED placard aligning with the bottom of the handle (6.4.4A). The canopy latch mechanism incorporates a key operated lock.

6.4.4A Canopy Latch Witness Marks



NOTE
When latch is properly closed the line on the label will line up with POINT A.

cdata/t67m260/latch.cdr

the locked position and can be rotated about 40° both clockwise and anti-clockwise to unlock the tongues from the fitting. The shoulder straps may be released separately leaving the lap straps and negative G strap still locked; this is done by pushing forward the metal tag that protrudes upwards from the top of the locking box.

The shoulder straps are connected to a central inertia reel strap which is controlled from a locking mechanism located between the seats.

6.4.6 Aircraft External Lighting (Ref Illustration 8.4 and 8.4A)

Navigation Lights The aircraft is fitted with 3 navigation lights, one at each wingtip and one on the rudder trailing edge; an on/off switch (Item 28 Fig 8.4) (Item 32 Fig 8.4B) on the instrument panel controls the lights once the master is on.

Anti-collision Lights A strobe light is fitted under the fuselage and is controlled by an on/off switch (Item 29 Fig 8.4) (Item 33 Fig 8.4A) on the instrument panel once the master is on.

POST MOD 297 Combined nav/strobe wing tip lights are fitted they are controlled by an on/off switch (Fig 8.4A) positioned top centre of the instrument panel between the nav light and the map light switches.

Landing/Taxi Lamp Two single filament landing lamps are fitted on the front of the engine cowling. Both lamps shine straight ahead. The lights are controlled by a single three position switch such that only one lamp can be on at a time.

> POST MOD 347 The wiring is modified to enable either, one only or both landing lights to be selected as follows:

Middle position - OFF Switch up - ONE (TAXI) LIGHT

Switch down - BOTH (LANDING) LIGHTS <

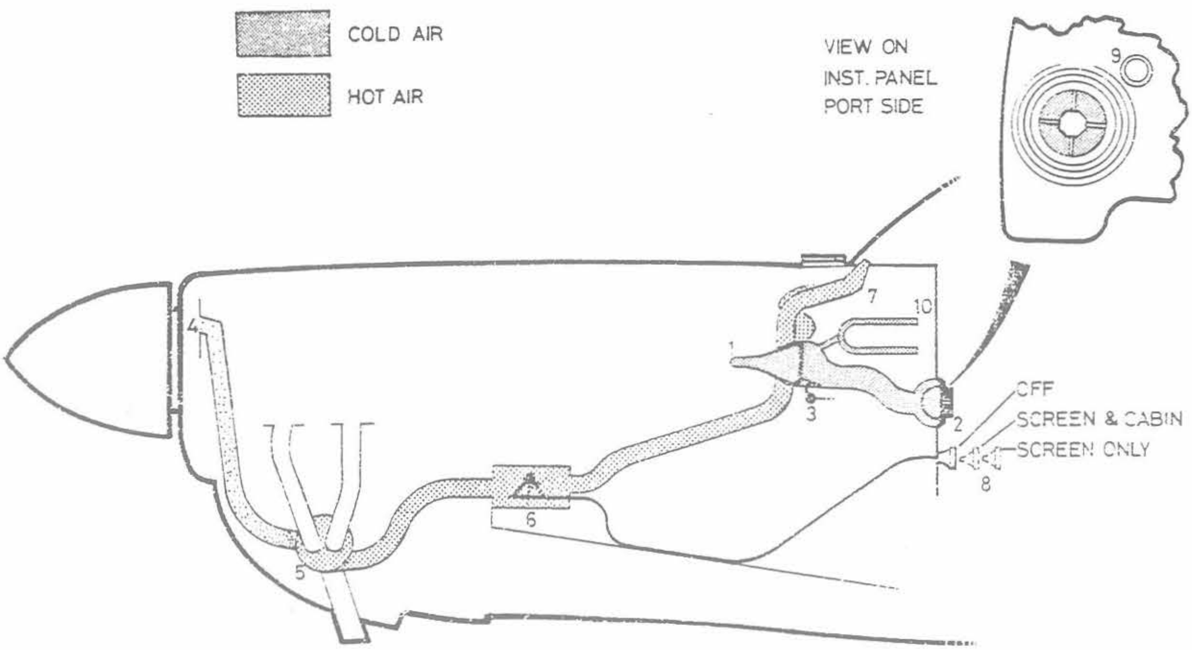
6.4.7 Cockpit Lighting (Ref Illustration 8.4 and 8.4B)

Cockpit lighting consists of pillar lamps for the instrument panel and a map light. The instrument lighting control (Item 43 Fig 8.4) (Item 47 Fig 8.4B) is a combined on/off and dimmer switch, allowing the brilliance level to be adjusted to the desired setting. The map light is mounted on the bulkhead between the pilot's seats. The map light switch (Item 30 Fig 8.4) Item 34 Fig 8.4B) is on the instrument panel left of centre. As no emergency battery lights are fitted it is essential to carry a torch in the cockpit during night flying.

6.4.8 Cockpit Ventilation and Heating (Ref Illustration 8.4 and 8.4B)

Separate cockpit hot and cold air systems are provided. The hot air system can provide for front transparency demist, for cockpit heating or for a combination of both. The control (Item 10 Fig 8.4 and Fig 8.4B) is a push/pull knob; when pulled partly out to the first stop it provides partial hot air to demist the front transparency and hot air to the pilots feet; when pulled fully out it provides full hot air to demist the front transparency

Cockpit Air Conditioning Diagram



No.	ITEM	DESCRIPTION
1	RAM AIR INTAKE (Cold air system)	One on each side of aircraft.
2	ADJUSTABLE LOUVRE	To vary the volume and direction of cold air flow. One for each pilot.
3	COLD AIR DEFLECTOR	Re-directs parts of the cold air flow down to the forward cabin area. One for each pilot.
4	RAM AIR INTAKE (Hot air system)	On engine baffle, fwd left side. Provides supply of warm air to the heat exchanger (ITEM 5).
5	HEAT EXCHANGER	Air from Item 4 is passed through this unit which encircles the exhaust pipe.

6	HOT AIR DISTRIBUTION BOX	Directs the hot air into the cockpit. There are 3 main settings - OFF, SCREEN/CABIN and SCREEN ONLY. Although there are 3 optimum positions any point in between may be selected to give a greater degree of control.
7	SCREEN DE-MIST OUTLET	Positioned forward of the instrument panel. One for each pilot.
8	HOT AIR CONTROL	Positioned on the forward console below the main instrument panel. There are 3 main positions. 1. FULLY IN ...... Heat off 2. HALF OUT ...... Heat to screen and cabin 3. FULLY OUT ..... Heat to screen only.
9	COLD AIR TO CABIN CONTROL	Fitted on instrument panel adjacent to adjustable louvre (ITEM 2). When PUSHED IN air to occupants feet ON, PULLED OUT air to occupants feet OFF. One for each pilot. The control may be turned to lock in any position.

only. The air supply comes from an air intake fitting mounted on the port-side air deflector forward of the engine and goes through an exhaust pipe heat exchanger before entering the control box for direction as dictated by control knob position.

The cold air supply comes from two intakes, one on each side of the fuselage just in front of the canopy. Each pilot has his own supply. The air can be directed to the pilot's face or body by an adjustable louvre (Item 12 Fig 8.4) (Item 14 Fig 8.4B) and to the feet by a push/on, pull/off knob adjacent to the louvre.

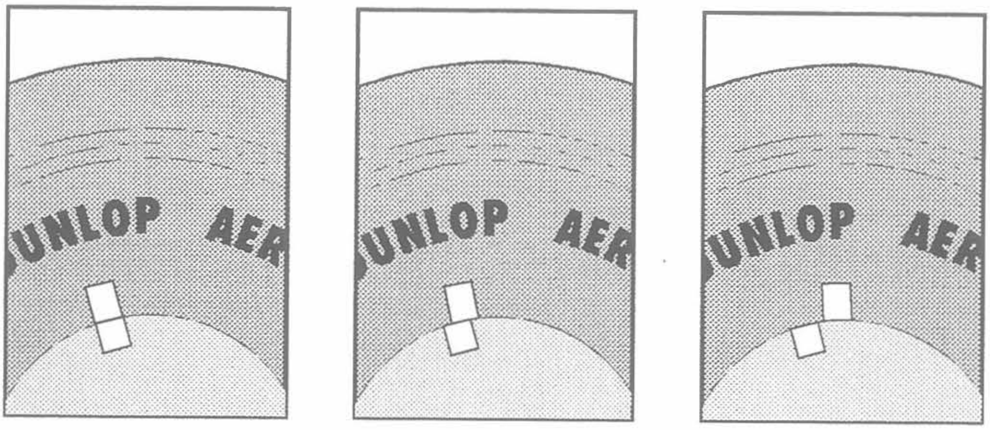
6.5 THE UNDERCARRIAGE

6.5.1 General Description

The fixed tricycle undercarriage is fitted with shock absorbers and pneumatic tyres. The nosewheel is steerable and disc brakes are fitted to the mainwheels.

6.5.2 Tyres

All the tyres are tubed and thus, if the tyre moves round on the hub, there is a danger that the inner tube valve may be torn leading to sudden tyre deflation. For this reason 'creep' marks are painted on the tyre and hub such that, with the tyre, tube and valve in the correct position, the marks on the hub and tyre are lined up. Whilst the two marks are still touching each other the amount of any creep is acceptable but the wheel must be removed for examination when the marks are no longer touching each other.



NO CREEP ACCEPTABLE CREEP UNACCEPTABLE CREEP

The tyre should never be used if the wear is such that any part of the tread is no longer visible or if any cut is sufficiently deep to have penetrated the rubber tread to the cords of the tyre carcase. Other tyre damage may include scald marks and flat spots (bald patches); engineering advice should be sought before tyres with this damage are used. The correct inflation > pressures for the tyres, as given in the leading particulars, are marked on < the undercarriage legs. The tyres are electrically conductive and thus there is no need for any earthing static discharge wires.

6.5.3 The Nosewheel

The nosewheel incorporates an oleo-pneumatic shock absorber strut. A hole in the top of each side of the nosewheel fork allows connection of a ground handling arm. See 6.5.5 for details of the nosewheel steering. Correct oleo-pressures must give a leg extension of about 3 inches as the combination of low oleo-pressure and rough ground could cause the propeller tips to strike the ground. Thus care must be taken when taxying over uneven ground or when braking hard and the control column must be kept in a position that does not tend to force the nose down.

6.5.4 The Mainwheels

The mainwheels each incorporate an oleo-pneumatic shock absorber strut Correct oleo-pressures should give leg extensions of about 3 inches.

6.5.5 Nosewheel Steering

The nosewheel is steerable by the rudder pedals and acts in the same sense as the rudder: when the right rudder pedal is pressed with the aircraft moving the aircraft nose swings to the right. When the aircraft is not moving it takes a lot of force to twist the nosewheel from side to side; for this reason the rudder pedals should not be moved when the aircraft is stationary and the rudder should not be moved during the pre-flight check or excessive strain may be put on the system. The only method of checking the rudder system for full and free movement on the ground is to find a safe area and apply full rudder in each direction whilst the aircraft is moving. The nosewheel is self-centering by a spring-and-cam mechanism and this spring action tends to give the rudders artificial "feel" in the air as the nosewheel always remains connected to the rudder controls.

6.5.6 Wheelbrakes

Independent brakes are fitted to the mainwheels. They are hydraulically operated by pedals on the rudder bars, the left wheel brake being operated by the left rudder pedal and the right brake by the right rudder pedal. The hydraulic reservoir is behind the left-hand seat on the back of the bulkhead. A set of brake pedals is fitted to both sets of rudder bars. Braking action is progressive, more pressure being applied at the discs as the pedals are pushed further. The brakes can be locked in the fully on position by first applying the brakes fully and then moving the parking brake lever back to the ON position: in this position the pressure fed to the brakes is then trapped in the system. The parking brake is released by moving the parking brake lever to OFF. A collar on the parking brake lever has to be pulled up the lever shank before the lever can be moved from ON to OFF or from OFF to ON. Once the parking brake control has been moved to ON the brakes can be applied if they are not already on; once on, they can only be released by moving the control to OFF.

The brakes are very powerful and should be used with caution on wet or slippery surfaces if skidding is to be avoided: under these circumstances it is preferable to apply the brakes with a pumping action so that, if a wheel tends to lock, it is able to start rotating again before any skid develops.

6.5.7 Tail Bumper

A tail bumper is fitted at the rear of the fuselage under the rudder. Mishandling of the controls during takeoff or landing may result in the tail bumper touching the ground. The bumper is there to minimise the damage to the fuselage should the tail touch the ground but if it is known that the tail has touched or if the bumper shows signs of having touched, an engineering investigation should be carried out to ensure that no repairs to the aircraft structure are needed.

6.5.8 Ground Handling Arms

The ground handling arm attaches to the nosewheel fork and allows the nosewheel to be turned whilst the aircraft is being handled on the ground. A larger towing arm can be used to tow the aircraft on the ground. Both arms protrude forward through the propeller disc and cannot be used when the engine is running. Either should be removed by the pilot before entering the cockpit to fly as they cannot be seen by either pilot once they are strapped in. When not in use the ground handling arm can be stowed in the luggage compartment.

6.5.9 Picketing

Three picketing rings are fitted; one is under the tail just in front of the tail bumper and two others are on each wing under surface about 2 ft in from the tips.

6.5.10 Normal Use

Before Flight Inspect the tyres for cuts, tread, creep and damage and inspect the wheelbrakes for damage or leaks. Examine the tail bumper to see if it has been touched on the ground. Check the oleos for the correct extension. Apply the parking brake before starting the engine and test the brakes immediately taxying is commenced. Whilst taxying check that the nosewheel responds fully and correctly to rudder deflection in both directions. Before takeoff and landing positively check that the parking brake is off.

After Flight When leaving the aircraft, ensure that the parking brake is left on unless the mainwheels are chocked to prevent movement. Picket the aircraft if necessary.

6.6 FLIGHT INSTRUMENTS

6.6.1 General Description

One set of flight instruments is provided, on the left of the instrument panel. Conventional pitot and static sources supply airspeed, vertical speed and altitude indicators: an engine-driven vacuum pump powers an artificial horizon and a directional gyro: the aircraft DC electrical system powers the turn co-ordinator, pitot head heater, stall warning, clock, and outside air temperature gauge: a magnetic compass provides heading information: an acclerometer provides 'g' information.

> Post Mod 506A and 506B aircraft are fitted with a Horizontal Situation Indicator (HSI) in place of the Directional Indicator and a Turn and Slip in place of the Turn Coordinator. <

6.6.2 The Pitot and Static Systems (Ref Illustration 8.4 and 8.4B)

Pitot pressure is sensed by a pressure head under the port wing outboard of the mainwheel. The head can be heated by an electrical element for which power is supplied through the pitot heater switch (Item 22 Fig 8.4) (Item 30 Fig 8.4B) when the master is on. The head supplies pitot pressure for the air speed indicator.

Two static sources are fitted, one on each side of the fuselage about half way back. Blanking plugs can be fitted on the ground to prevent the ingress of moisture or insects. These must be removed before flight. The two sources are interconnected and are needed to give a stable source of static pressure under changing aircraft attitude. Static pressure is supplied to the airspeed indicator, altimeter and vertical speed indicator. Pressure error corrections are given in Section 5.

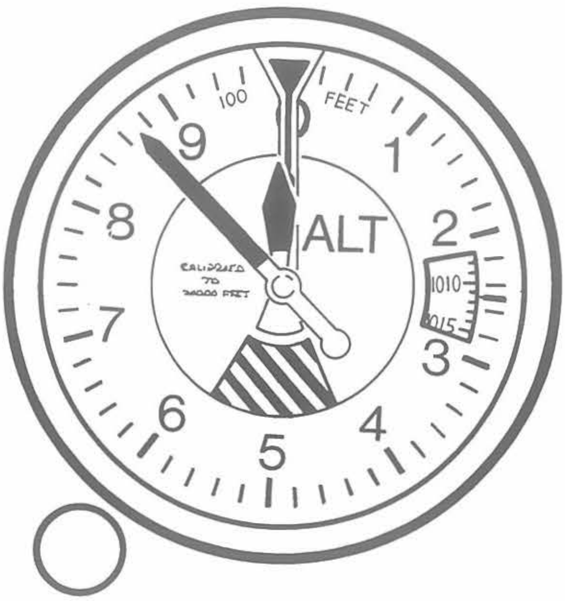
> Mod 485 introduces an alternative static source. This is in the form of a selector cock, mounted on the instrument panel above the LH fresh air louvre, which opens the static system to cockpit in the event of the normal static ports becoming blocked.

CAUTION

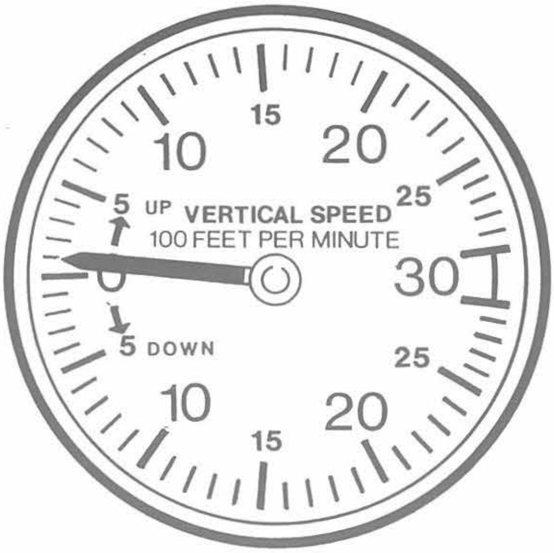
Whilst operating on emergency static source allowance must be made for minor errors on pitot static instruments. <

6.6.3 Pitot and Static Instruments (Ref Illustration 8.4 and 8.4B)

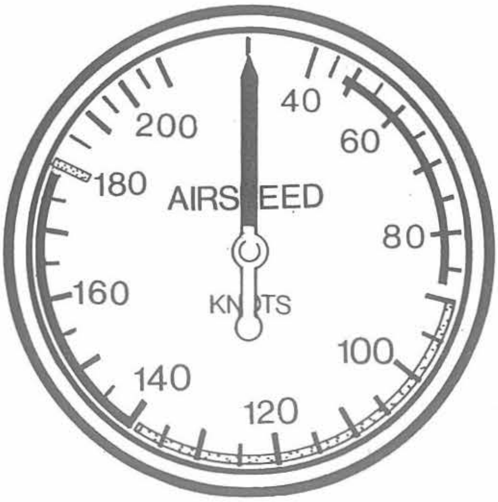
Altimeter The altimeter (Item 19 ,Fig 8.4) (item 21 Fig 8.4B) and second altimeter where fitted, are standard 3-needle instruments graduated from 0 to 9 with a mark every 1/5th unit; one needle covers 1,000 feet in one revolution and thus the graduations represent 100 feet each with a mark every 20 feet. A smaller needle covers 10,000 feet in one revolution and thus the graduations represent 1,000 feet and the marks 200 feet. The smallest needle covers 100,000 feet, the graduations representing 10,000 feet, the graduations representing 10,000 feet and the marks 2,000 feet. The instruments could thus read up to 99,995 feet, but are in practice only calibrated to 20,000 feet. A sub-scale and rotary setting knob allow for the setting of varying reference pressures; the scale is calibrated in millibars. The instruments should read within 50 feet of a known correct height when the appropriate pressure reading is set and should thus agree with each other within 100 feet. Pressure error corrections are given in Section 5.



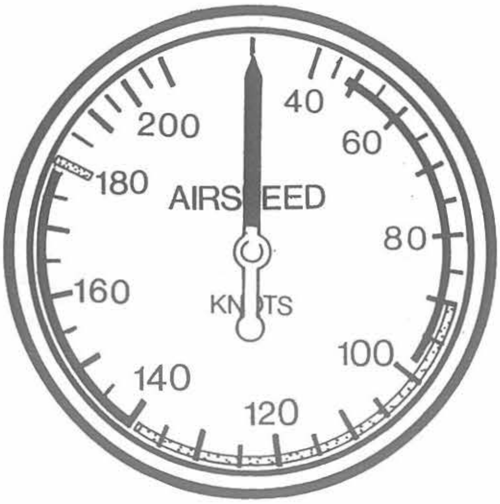
Vertical Speed Indicator The vertical speed indicator (Item 18 Fig 8.4) (Item 20 Fig 8.4B) is calibrated from 3,000 ft/min up to 3,000 ft/min down. It incorporates a mechanical stop which prevents the needle from over-running the end of either scale. There are numbers on the scale every 1,000 ft/min and marks for each 100 ft/min with a larger mark at each 500 ft/min. The instrument should read within 100 ft/min of zero when on the ground.



The Airspeed Indicator The airspeed indicator (Item 21 Fig 8.4) (Item 23 Fig 8.4B) is a single needle instrument with readings from 40 kts to 200 kts. It has standard markings on the face to indicate significant speeds as given in Section 1. Pressure error corrections are given in Section 5.



PRE MOD 656



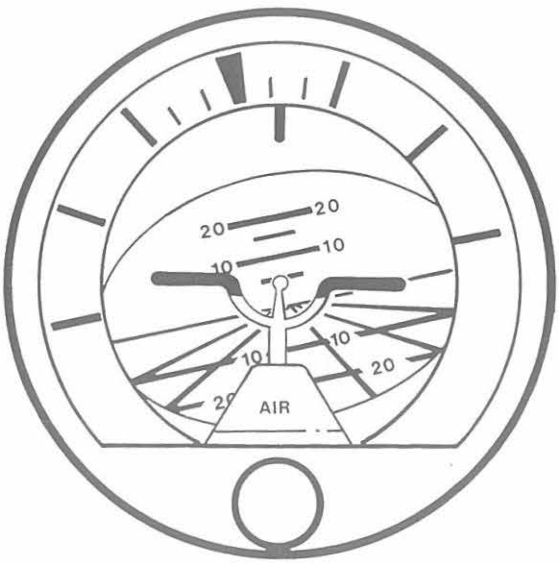
POST MOD 656

6.6.4 The Suction Supply (Ref Illustration 8.4 and 8.4B)

A suction pump is driven by the engine, the amount of suction generated being indicated on a gauge in the cockpit (Item 23 Fig 8.4) (Item 24 Fig 8.4B). For the suction instruments to be reliable, the gauge reading should be in the green sector (4.5 to 5.5 in Hg). The gauge reading will be below the green sector (4.5 to 5.5 in Hg) when the engine RPM are less than about 1500 RPM but the gyros will not slow down enough to affect instrument readings if the RPM is below this figure for short periods. The gyro instruments will take about 2 minutes to reach operating speed after start-up and will remain reliable for about 1 minute after suction failure. A failure of the suction supply is indicated only on the gauge; none of the suction-driven instruments have any sort of failure indicator on them. Thus the suction gauge should be monitored periodically during flight, particularly under instrument flying conditions.

6.6.5 Suction Driven Instruments (Ref Illustration 8.4 and 8.4B)

The Artificial Horizon The artificial horizon (Item 20 Fig 8.4) (Item 22 Fig 8.4B) indicates the pitch and bank angles of the aircraft. An aircraft symbol datum in the centre of the instrument can be adjusted with a knob on the instrument to allow for alignment of the instrument for pilots of different sitting height. The bank indications are calibrated at the top of the instrument and show 10°, 20°, 30°, 60° and 90° of bank.



The Directional Gyro The directional gyro (Item 17 Fig 8.4) is used to give correct heading information during turns when the magnetic compass can be unsteady and unreliable. It is calibrated from 0-360° with numbers, omitting the last digit, every 10°. Thus a heading 290° is shown as 29. There are marks at every intermediate 5° and reading to greater accuracy requires interpolation. The numbers on the scale increase clockwise. To align the indicator with the magnetic compass the setting knob must be pushed in and kept in whilst it is then rotated; this action uncouples the face of the instrument from the gyro and allows it to be turned to give the same reading as the magnetic compass. The knob may then be released, recoupling the face of the instrument to the gyro: the knob should then be twisted to ensure that it has disconnected from the face. As long as the correct suction pressure is maintained and the aircraft altitude is kept within the instrument limits, the direction gyro should maintain accuracy to within 10° per hour. It should be monitored regularly to ensure that it is correctly aligned with the magnetic compass. The gyro will remain accurate following manoeuvres of up to 60° of bank and pitch but its accuracy should always be checked after any violent manoeuvring.

6.6.6 The Stall Warning

Stall warning is given to the pilot by a buzzer and a warning light which come on when the wing angle of attack is approaching the stalling angle; they are set to operate between 5 and 10 kts before the stall. The warning is activated by a vane on the port wing leading edge which is held down by gravity; as the angle of attach of the wing increases, a stage is reached where the airflow is coming from under the vane and lifts it up, activating the warning device. The system is electrically powered through the master switch and a circuit breaker, and can be tested before flight by switching the master on and applying light finger pressure to lift the vane. As the system is gravity controlled and is set for erect flight it cannot be used for inverted flight.

> 6.6.7 The Magnetic Compass (Ref Illustration 8.4 and 8.4B)

The magnetic compass (Item 47 Fig 8.4) (Item 50 Fig 8.4B) is a pendulously suspended permanent magnet with liquid damping; provision is made for correction of errors and a compass error card indicates where residual errors need to be applied to obtain correct headings. The compass correction card lists headings every 30°and gives the indicated compass reading that must be steered to achieve this heading. For example, it may say 'for 120° steer 122°'; this means that if you want to fly a heading of 120°, you must steer 122° on the magnetic compass, ie the error is +2°. Steering an intermediate heading will require interpolation of the errors shown on the card. A sample card is shown below along with some worked examples. The card in your aeroplane will not have the same figures as this example. <

Compass Correction Card

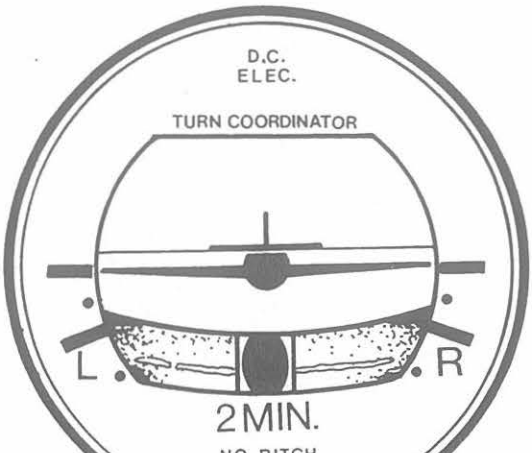
For	N	30	60	E	120	150	DATE 1-6-84
Steer	001	031	061	090	119	148	
For	S	210	240	W	300	330	
Steer	181	210	241	270	302	331	

Examples

1. If you require heading 120°, steer 119° on this compass.
2. If you require heading 160°, steer 158° on this compass.
3. If you require heading 295°, steer 297° on this compass.
4. If you require heading 040°, steer 041° on this compass.

6.6.8 The Turn Co-ordinator (Ref Illustration 8.4 and 8.4B)

The turn co-ordinator (Item 16 Fig 8.4) (Item 18 Fig 8.4B) provides the pilot with turn information only. It is calibrated to show a rate one turn (3° per second) in either direction but is not calibrated beyond this; if the aircraft is turning at more than rate one it is not possible to ascertain the actual rate of turn from this instrument. The turn co-ordinator employs a gyro whose inner gimbal is not quite horizontal; this results in the instrument being responsive to roll as well as yaw, rendering it more direct reading than the conventional turn indicator and making is possible to roll into and out of turns without having to allow for instrument lag. The instrument presentation makes use of an aircraft symbol similar to the artificial horizon but it gives no pitch information; great care must be taken not to be misled by the aircraft symbol which apparently indicates that the aircraft nose is in the level position. The gyro is electrically driven, power being supplied by the master through a circuit breaker; a small red warning flag appears on the face of the instrument when no electrical power is available. Being electrically driven the instruments will not be affected by a suction system failure. In the event of failure of the artificial horizon, the turn co-ordinator becomes a primary flight instrument.

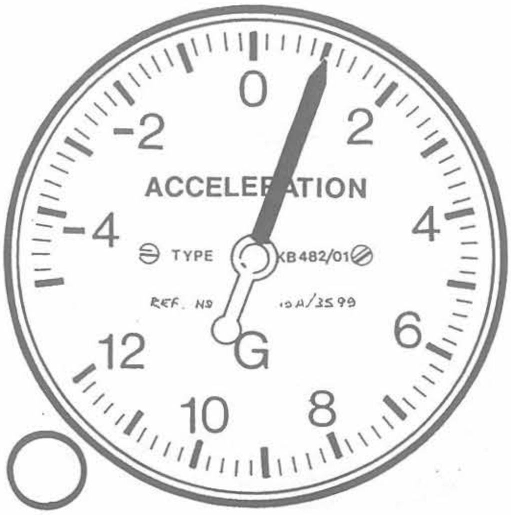


> 6.6.9 Miscellaneous Instruments (Ref Illustrations in Section 8)

The Clock The clock is electrically powered, a small spring being rewound by a solenoid every few minutes. It has a conventional face with full sweep second hand. It is permanently connected to the battery through a fuse not accessible to the pilot.

Mod 305 A battery operated digital clock is fitted in place of the original equipment.

The Accelerometer An accelerometer shows instantaneous 'g' readings and maximum and minimum pointers show the maximum and minimum 'g' experienced since the instrument was last reset. The maximum and minimum pointers can be reset by twisting the resetting knob in a clockwise direction, or by pushing the knob in, dependent on the make of instrument. The instrument requires no power.



The Outside Air Temperature Gauge An electrical outside air temperature gauge gives an instantaneous reading in °C. The temperature probe is mounted on the side of the fuselage just in front of the fresh air louvre intake. Electrical power is supplied by the master through a circuit breaker.

(PRE MOD 734)
A secondary use of the OAT Gauge is obtained by pressing test switch which then indicates temperature of the main GRP structure at the wing/fuselage junction. The sensor is placed inside the port side of the cockpit structure below the instrument panel. A limit of 50°C is placed on the aircraft structure above which aerobatics may not be performed. <

> (POST MOD 734)
A secondary use of the OAT Gauge is obtained by turning a rotary switch located next to the gauge in a left or right direction. The gauge then indicates the temperature of the main GRP structure. The switch is spring loaded to return to the center position when released. Both sensors are placed inside structure against the aft face of the main spar. The left sensor is positioned outboard of rib 6, in the port wing and the right sensor is positioned at the wing root port side. A limit of 50°C is placed on the aircraft structure above which revised "g" limits (Section 2) apply. <

6.6.8A The Turn and Slip (Mod M514) (Ref Illustration 8.4D and 8.4E)

The turn and slip indicator provides turn information. It is calibrated to show a rate of turn of up to 3° per second (two minute turn) in either direction. If the aircraft is turning at more than this rate it is not possible to ascertain the actual rate of turn from this instrument. The turn and slip indicator uses an electrically driven gyro. The instrument is responsive to roll as well as yaw, making it possible to roll into and out of turns without having to allow for instrument lag. Power for the instrument is supplied via a 1 Amp circuit breaker, when the master switch is in the ON position. A small red warning flag appears when no electrical power is available.

the inclinometer part of the instrument, a ball in a liquid filled glass tube, indicates coordination. Gravity and centrifugal force act on the ball. When the aircraft is in coordinated flight, the ball will be centered.

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6.6.10 Normal Use

Before starting the engine, remove the pitot cover and static vent plugs and test the stall warning system. Once the engine has been started, check the vacuum system, align the directional gyro (or HSI) with the magnetic compass and set the datum on the artificial horizon. Check and cross-check the altimeters with a known pressure setting and ensure that the airspeed and vertical speed indicators are within limits. Check that the power failure warning flag is not showing on the turn co-ordinator (or Turn and Slip). Once taxying, check that the compass, directional gyro (or HSI), artificial horizon and turn co-ordinator (or Turn and Slip) give correct indications in turns in both directions. Switch on the pitot head heater before takeoff if required.

In flight, monitor the vacuum and electrical systems for failure. Reset the directional gyro periodically and reset the altimeter sub-scale settings as appropriate. Relate the outside air temperature to conditions outside the aircraft for warning of icing. When manoeuvring, refer to the accelerometer to ensure that the 'g' limits are not exceeded.

6.6.11 Malfunctioning

Electrical Failure In the unlikely event of a total electrical failure (alternator and battery both dead), the pitot head heater, turn co-ordinator, stall warning, clock and outside air temperature gauge will all stop working. If any one of these services fail without signs of any other failure, check its circuit breaker and reset if necessary. The pressure instruments and suction driven instruments will continue to function but a torch would then be needed to read them at night.

Vacuum Failure The vacuum gauge will indicate below the green section and the artificial horizon and directional indicator will become unreliable. The pressure instruments and electrically driven instruments will continue to function.

6.7 FLYING CONTROLS AND FLAPS

6.7.1 General Description

The flying controls comprise conventional elevators, ailerons, rudder and flaps. Elevator trimming is available to the pilot.

6.7.2 Control Columns

The two control columns are linked together so that movement of one always results in identical movement of the other; they cannot be disconnected or removed. The top of each control column incorporates a press-to-transmit button.

6.7.3 The Elevator and Trimmer (Ref Illustration 8.5)

Mass and horn balanced elevators are fitted to both sides of the tailplane trailing edge. Fore and aft movement of the control columns is transmitted to the elevator control surface by rods and bell cranks. The system is balanced fully nose up (control columns fully rear) on the ground with no airspeed or engine airflow.

The left-hand elevator incorporates a trimming tab covering about half the elevator trailing edge. A handwheel (Item 1 Fig. 8.5) in the cockpit operates the trimmer, movement being transmitted by a solid core cable. A trimmer position indicator (Item 2 Fig. 8.5) is fitted in the cockpit just in front of the operating wheel; trim positions are marked U for nose up, N for neutral and D for nose down. About 6mm (1/4 inch) of up-and-down play can be felt at the trimming tab when it is tested for security during the pre-flight inspection; this is acceptable.

6.7.4 Ailerons

Differential Frise ailerons occupy the outboard third of each wing trailing edge. Lateral movement of the control columns is transmitted to the ailerons by control rods and bell cranks. No trimming is possible in flight but the port aileron is fitted with a metal trim tab which can be adjusted on the ground by ground engineers only.

6.7.5 Rudder

The rudder is operated by either pair of linked rudder pedals. The two sets of pedals are interconnected so that movement of one set results in identical movement of the other. Movement is transmitted from the pedals to the rudder by cables and pulleys, the cable tension being maintained by springs which hold the rudder pedals forward. The rudder pedals can be adjusted to allow for leg length. The rudder pedals also provide for nosewheel steering and wheel braking; this is described in this section at 6.5.5 and 6.5.6.

6.7.6 Control Lock

> A control lock is introduced by Mod.435. This consists of a transverse bar with sockets which locate on the rear faces of the control columns. At the centre of the bar is a further socket which, when secured by the flap lever in the Flaps Up position, locks the ailerons neutral and the elevator fully down.

There is no stowage for the control lock, which must be removed from the aircraft before flight.

Depending upon the likely wind conditions and the direction in which the aircraft is parked, the controls may be locked by using the right-hand < pilot's buckle strap and one of the right-hand shoulder straps, passing them around the left-hand control column and taking up the slack.

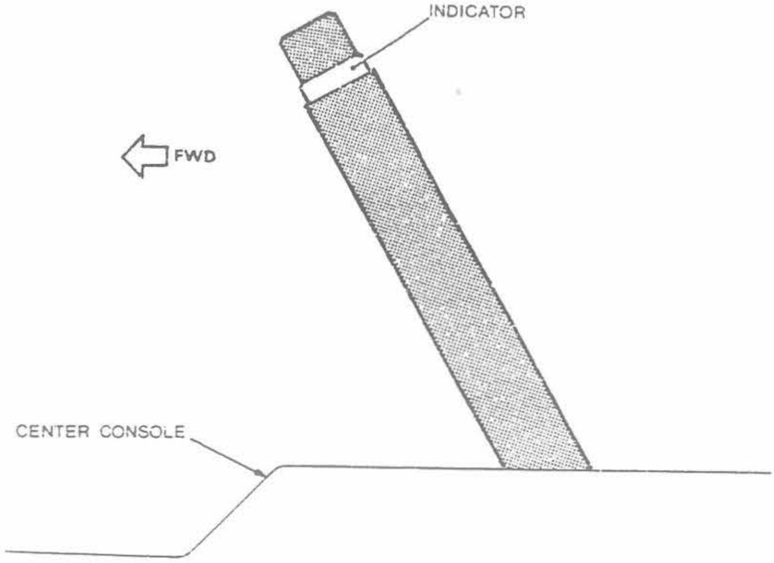
The rudder/nosewheel should be left on full right lock. In this position the nosewheel/ground friction prevents movement of the rudder in windy conditions.

6.7.7 Flaps (Ref Illustration 8.5)

The flaps occupy the inboard two-thirds of each trailing edge, a small portion of the extreme inboard trailing edge not being used so that it can form a walkway. No portion of the flaps is stressed for walking on. The flap control has 3 positions:- UP; 18° (takeoff); and 40° (landing). So that there will be no air loads felt when operating the flaps in the air, a spring is fitted which assists down selection. This results in the flaps being strongly biased in the down direction on the ground, and care must be taken when lowering them on the ground to stop them from slamming to the down position. The control lever (Item 3 Item 8.5) is positioned on the centre console and can be locked in any of the 3 flap positions; when the lock is fully engaged, a dark coloured spring-loaded button in the end of the control lever protrudes far enough to show a white ring at the base of the button. To move the flap from one selection to another, the button must first be pressed in to disengage the lock; the lever is then free to move. As the flaps approach the required position, the button should be released so that it is free to engage the lock at the new position. On the ground, the spring balance tends to pull the flaps down and this makes it difficult to disengage the lock; to achieve this it is necessary to push the flap lever in the UP direction to balance the spring pressure before attempting to press the button in.

The flaps are correctly locked when the button in the end of the selector lever protrudes far enough to enable the white band locking indicator on it to be seen. It is important, particularly when raising the flaps, to check that the locking indicator is visible; if it is not, then the flaps are not correctly locked and may move to a different position without action by the pilot.

There is no flap position indicator as both flaps can easily be seen from either seat.



Flap Lever Locking Indicator

6.7.8 Normal Use

Before flight, check the condition of the control surfaces and tabs and ensure that all drain holes are clear. Once in the aircraft, check the elevators and ailerons for full, free and correct movement. Ensure that the trimmer moves over the full range. Check the correct operation of the flaps at all 3 settings and leave them up for taxying. Once taxying, check the rudder and nosewheel for full, free and correct movement.

After takeoff, raise the flaps at a safe height and speed, ensuring that the locking indicator is then visible. For landing, use the flaps as required. After landing maintain directional control using the combination of the rudder, nosewheel steering and brakes as necessary.

6.7.9 Malfunctioning

If, immediately following flap selection, an undemanded roll occurs, visually check that both flaps are in the same position; if they are not or if difficulty is experienced in holding an out-of-trim roll force, return the flaps to the previous setting. Leave the flaps in this position and land at the nearest suitable airfield.

6.8 RADIO EQUIPMENT

The available radio fits make provision for some or all of the following facilities:

a. Intercommunication between crew members.

b. Single or two VHF communications radios.

c. An audio control panel.

d. A loudspeaker.

e. A hand microphone.

f. VOR.

g. ILS and markers.

h. DME.

i. A transponder with or without height encoding.

j. ADF.

More sophisticated equipment is available subject to special order.

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7.1 BEFORE FLIGHT

7.1.1 Before Starting the Engine

Check that the aircraft documentation is in order and that no dated or airframe hours lifed items are due for attention. Calculate the centre of gravity to ensure that it will remain within limits for the entire flight (Section 8.1).

Carry out a pre-flight inspection as detailed in the FRCs, which meets the requirement of the CAA/LAMS schedule.

7.1.2 Starting the Engine

Start the engine using the checks and drills in the FRCs. Note the warnings on the significance of the Starter warning light.

The same priming and starting drill can be applied whether the engine is hot or cold. The most likely cause of failure to start is over-priming so the drill should be followed carefully. With the fuel on, the throttle a quarter open and the mixture at cutoff, switch the fuel pump on. Move the mixture control to full rich until a slight but steady fuel flow is noticed and return the mixture control to cutoff. Switch the fuel pump off. Select the left (impulse) magneto and engage the starter. Immediately the engine fires, release the starter, select magnetos to "both" and move the mixture control smoothly to fully rich. If the engine is hot it may be found easier to start the engine without any priming. Starting should always be carried out with the mixture control initially in the lean cutoff position as described above.

If the starter motor is operated for a total of 30 seconds in any 15 minute period, a wait of 15 minutes should be observed before any further attempt is made to start so that the starter motor can cool and the battery stabilize.

Should the engine fail to start after a maximum of 10 seconds starter use, it may be that the engine is over-primed. The following drill should then be followed to avoid running out of starter time. Leave the magneto on Left and the fuel at cutoff; open the throttle fully; operate the starter for 5 seconds; this will drain the fuel from the cylinders and the engine may actually start; if it starts, quickly return the throttle to a quarter open and put the mixture to fully rich. If it does not start, set the throttle at a quarter open, leave the mixture at cutoff and the magneto on Left, and attempt another start without re-priming. If the engine still will not start it should be left for 15 minutes to allow the starter to cool. A normal start should then be attempted. Experience has provided many permutations of the failed starting drill, many of which will vary from the above and may on occasions be more successful. Whatever drill is used the limitations on starter use must be observed.

It is important that the engine is not left at idling on the ground for longer than is necessary during taxying. At all other times the engine should be set to 1200 RPM to reduce the danger of sparking plug fouling.

7.1.3 Testing the Engine

The dead cut/live magneto check is carried out after starting. Set 1200 RPM and select magneto to 'R', ensuring that there is an RPM drop but that the engine does not stop; re-select 'both' and repeat the check with magneto 'L'. As the engine is normally stopped by cutting off the fuel, this check is the only one which can easily ascertain whether a magneto is permanently live.

The engine run should only be done after 4 minutes warm-up or with the engine oil temperature at least in the yellow/green. It is done at 1800 RPM by selecting 'R' and checking that the RPM does decrease but not by more than 175 whilst the engine continues to run smoothly. 'Both' is then re-selected and the RPM allowed to stabilize at 1800 for a few seconds. The same procedure is then repeated for the 'L' magneto and, additionally, it is checked that the RPM difference between 'L' and 'R' is not more than 50.

7.1.4 Testing the Constant Speed Unit

The test of the constant speed unit achieves two objectives. Firstly it checks that the propeller pitch responds to the demands of the propeller RPM control; secondly it circulates the cold oil in the propeller hub and replaces it with warmed oil, allowing the pitch change mechanism to move more smoothly and freely. It should be done on the first flight of each day and whenever the engine is cold.

To test the unit, use the throttle to set 1800 RPM leaving the propeller control at maximum RPM. Then move the propeller control to the minimum RPM position. Note that the RPM starts to fall. Move the propeller control back to maximum RPM before the RPM falls by more than 500. Repeat the whole procedure a second time to change the oil in the propeller hub.

7.1.5 Taxying

Do not attempt to move the rudder pedals when the aircraft is not moving. To taxy, close the throttle and release the parking brake. It may be necessary to use some power to start the aircraft moving but, as soon as it moves, close the throttle and re-apply the toe brakes momentarily to ensure that they are working.

To turn the aircraft on the ground the nosewheel steering must be used. The brakes should not be used alone for turning as this will lead to excessive side loads on the nose tyre and leg. If very tight turning is required the rudder should be moved fully in the required direction and light braking applied on the appropriate (inside) wheel. Uneven ground should be crossed slowly.

7.2 HANDLING IN FLIGHT

7.2.1 Takeoff

After testing the engine, which should be done on every flight and not just on the first flight of each day, carry out the takeoff checks from the FRCs. Takeoff performances are given in Section 5.

Line the aircraft up on the takeoff path, release the brakes and open the throttle fully in about 2 seconds. Check that the RPM is a minimum of 2550 and that the oil pressure, oil temperature and cylinder head temperature are not red. There is little tendency for the aircraft to swing for reasons of torque or slipstream effects as the aircraft has been designed to minimise these characteristics. The nosewheel should be lifted just clear of the ground at 45 kts and the aircraft flown off at 55 kts with takeoff flap or 59 kts flapless.

7.2.2 Crosswind Takeoff

If the wind is approaching the crosswind limit of 25 kts, the nosewheel should not be raised until the takeoff speed when the aircraft should be rotated cleanly to the climbing altitude. Any tendency for the upwind wing to lift during a crosswind takeoff should be corrected by the use of ailerons.

7.2.3 Climb

Initially climb at a shallow angle, allowing the speed to increase to 76 kts clean, 70 kts with takeoff flap. At 200 ft, apply the brakes momentarily to stop any vibration from the rotating mainwheels and raise the flaps in stages, increasing to the appropriate speeds, until the flaps are up. There is little sink or trim change whilst the flaps are raised unless the aircraft is significantly below the correct speed. Climb at 77 kts at full throttle, checking that the RPM is approximately 2650 - 2700 RPM. Reduce the climbing speed by 5 kts every 5000 ft. The aircraft will initially climb at approximately 1300 - 1400 ft/min, depending on weight, temperature and height.

The mixture should be left at fully rich at all power settings above 75% unless this results in rough running; in this case progressively weaken the mixture and observe the manifold pressure. As the mixture is weakened, the manifold pressure will stay steady but then start decreasing. Some uneven engine running may also be apparent at this point, richen the mixture again until smooth running is regained and the manifold pressure returns to the original figure; leave the mixture at this setting. It is unlikely that any mixture adjustments will be needed below 5000 ft amsl in the climb. It should be remembered that this mixture setting is appropriate for only one combination of manifold pressure, altitude and engine RPM, and a change in any of these factors will result in the need to reset the mixture.

The mixture should always be set to fully rich before descending as the weaker mixtures applicable to flight at altitude are too weak for correct engine operation at lower levels; thus the engine may not respond correctly to throttle opening at the bottom of the descent if weak mixture is still selected.

7.2.4 General Flying

Introduction The limitations and centre of gravity requirements should always be checked before any flight to ensure that the aircraft parameters will be complied with.

Flying Controls The flying controls are well-balanced and very little rudder is required with aileron application as the ailerons cause little asymmetric drag, even at full aileron deflection.

Trimmer The elevator trimmer is very powerful and care should be exercised in its use. The out-of-trim forces require firm but manageable pressure if the trimmer is operated to either extreme within the speed range. There are no rudder or aileron trimmers available to the pilot. The directional trim changes associated with power and speed alterations require the use of only small rudder pedal movements to maintain balanced flight.

Power Mixture Changes Alterations in power settings cause pitch/yaw movements, the movements being proportional to the power change. The propeller turns clockwise, the following pitch/yaw changes occurring with power alterations:

	Power Increase	Power Decrease
Pitch	Nose Up	Nose Down
Yaw	Nose Left	Nose Right

The mixture control should invariably be set to fully rich before any change in power setting is made as the change may result in too weak a mixture and consequent rough running or high cylinder head temperatures. Mixture adjustments in the cruise should be made using the same procedure as outlined for the climb. The engine performance figures for climb, cruise and endurance are given in Section 5.

> Flaps The maximum speed for operating the flaps is 120 kts IAS takeoff position and 98 kts IAS landing position. The flaps can be operated with < little effort in the air at the normal circuit speeds, but more effort is needed at the upper speed limit. Care must be taken to ensure that the flap lever is locked in the selected position after operation. Should the flaps be left unlocked they will tend to move to the down position at low speed; this may be significant, particularly during stalling or aerobatics when the changed flight characteristics and limitations may result in unexpected aircraft behaviour or overstressing.

There is little trim change unless the flaps are operated at the extreme of the speed limit. There is significant change in lift characteristics and little drag penalty with takeoff flap (18°); landing flap (40°) selection results in very little more lift but a large increase in drag. The trim changes are as follows, the aircraft staying in level flight during all flap selections:

	88 kts	50 kts
Flap from up to takeoff	Nose pitches down	Very slight nose down pitch
Flap from takeoff to landing	Nose pitches further down	Negligible pitch
Flap from landing to takeoff	Nose pitches up slightly	Negligible pitch
Flap from takeoff to up	Nose pitches up more strongly	Slight pitch nose down

Stability The aircraft is neutrally stable in roll and has nil aileron breakout force which gives good response and a good rate of roll. The ailerons have exceptional drag balance during aileron application; very little rudder is needed to maintain balanced flight during rolling manoeuvres, even with full aileron appalication. The aircraft is stable in pitch and is easily trimmed. There is no tendency for the aircraft to become unstable in pitch at extremes of speed or 'g'.

Sideslipping The aircraft can be side-slipped well and the rate of height loss can be increased markedly by this method. The following figures give a guide.

ENGINE - Idle INDICATED AIR SPEED - 60 Kts

	No sideslip	Full left rudder	Full right rudder
R of D	700 ft/min	1250 ft/min	1050 ft/min

Reduced Visibility Flying In poor visibility it may be felt prudent to fly at reduced airspeed. The safest speed to fly is 70 kts as this represents a good speed for aircraft controllability and is also the best climbing angle speed, allowing best climb performance, should near obstacles be sighted. The best climb angle performance requires half flap at 70 kts and this should be put down whilst flying at reduced airspeed as it also results in a lower nose position giving a better field of view.

Turbulence If turbulence becomes violent enough to cause concern, the aircraft should be flown at 75 kts with the flaps up. This gives a safe margin of speed over the stalling or overstressing conditions that can result from turbulence.

Icing Conditions The aircraft is not cleared for flight in icing conditions as there is no airframe or wing protection. These conditions must be avoided and every effort must be made to fly clear of them if they are encountered inadvertently. The engine icing protection can automatically allow for air filter blocking.

> Gliding The aircraft glides well at 80 kts, covering across the ground about ten and a half times the height lost in still air. The average gliding performance is as follows, varying with height, temperature and weight (Ref graph in Section 5).

	Speed	Rate of Descent	Glide Angle Still Air
AUW 2150 lbs Engine Off Propellor Windmilling	80kts	870 ft/min	1:09.1 or 1.5 Nm/1000ft

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During a prolonged glide there is a risk of over-cooling the engine which might result in the engine subsequently not responding properly to throttle opening. Two precautions should be taken to counter this risk. Firstly the engine should be warmed and the plugs cleared by opening the throttle smoothly to full power and back every 1000 ft in glide. The second precaution against over-cooling is to open up the throttle very steadily in about 4 seconds when overshooting at the bottom of the glide. It must be remembered that there is a significant difference in the rate of descent between engine idling and propellor windmilling and realistic practice should concentrate on the much more likely cause of a failed engine, ie propellor windmilling.

7.2.5 Stalling in Level Flight

The aircraft has little aerodynamic stall warning in level flight, the approaching stall being signalled by the warning buzzer. Mild wing drop may occur in any configuration but this can always be halted by the application of opposite rudder during recovery. Ailerons remain effective up to the stall but care should be taken in the use of ailerons to keep the wings level if the stall should be prolonged. The approximate stalling speeds (IAS) are as follows:

>

	975 kg (2150 lb)
Flaps up power off	57 kts
(18°) Takeoff flap, power off	54 kts
(40°) Landing flap, power off	51 kts
Regulation of stall warning horn	7 - 10 kts above stalling speed

<

With practice a full stall may be recovered within 50 ft but if the recovery is initiated at the sound of the stall warning there should be no height loss in any configuration.

Recovery is effected by applying enough rudder to stop any further wing drop and, at the same time, moving the control column forward to unstall the wings; very little control column movement is normally necessary. If the engine power is available it should be fully applied immediately.

7.2.6 Stalling in a Turn

In a level turn the bank will either increase or decrease at the stall, but this tendency can be immediately controlled by conventional recovery action.

7.2.7 'g' Stalling

If the aircraft is deliberately pulled to the stalling angle of attack above the stalling speed, there is aerodynamic stall warning in the form of elevator buffet felt through the control column. This buffet occurs just before the aircraft stalls. At the stall the rate of pitch decreases and, if further back pressure is applied the aircraft will tend to drop a wing. If this occurs during a turn the aircraft will either roll out of the turn or roll into the turn and this is not entirely predictable or consistent. If the control column is immediately moved forward to unstall the wings, the roll will stop and autorotation or spinning will not develop.

7.2.8 'Flick' Manoeuvres

If pro-spin control is applied above the stalling speed the aircraft will flick and enter a spin in the direction of the applied control. The rate of rotation is initially very rapid but the aircraft responds immediately to corrective control action. Dependent on the airspeed at entry, the aircraft will settle into a conventional spin after one to two turns after the flick. Unless correct pro-spin or anti spin control application is applied, the aircraft may enter a spiral dive with the speed increasing very rapidly and the risk that VNO (140 kts) will be exceeded during recovery. Disorientation may occur during the initial high rotation rate of the aircraft and it is recommended that flick manoeuvres are not attempted by inexperienced pilots before adequate demonstration and supervision has been received. As the 'g' forces during flick manoeuvres will exceed 2'g', they should never be attempted with the flaps extended. Deliberate flick manoeuvres should not be entered above 70 kts IAS.

7.2.9 Erect Spinning

(a) Entry Height The height loss is about 250 ft per turn and recovery takes about 500 ft. These height losses may vary, dependant on how many turns of the spin are done and how prompt and correct the recovery action is. They may be used as a basis for planning recovery which should be complete by 1500 ft above ground level. It is recommended that inexperienced pilots allow a further 1000 ft to the entry height. Thus the entry height for a 4 turn spin for an inexperienced pilot should be:

4 turns 4 x 250	1000 ft
Recovery	500 ft
Min Height	1500 ft
Safety Allowance	1000 ft
	4000 ft above ground level.

(b) Spin Entry At stall warning apply full rudder in the intended direction of spin and at the same time bring control column centrally fully back. Hold these control positions. If the correct control movements are not applied a spiral dive may develop as shown by an airspeed increasing above 80 kts.

7.2.10 Erect Spin Characteristics

At entry, the aircraft pitches nose up slightly whilst rolling rapidly in the direction of applied rudder. The aircraft rolls almost to the inverted during the first half turn of the spin and then the spin progressively stabilizes over about 3 turns, ending up with about 50° of bank and the nose about 40° below the horizon. The rate of rotation is about 150° per second or 2½ seconds per turn. The average load factor throughout is 1.2G. The IAS stabilizes at about 75 kts to the right and 80 kts to the left. If full pro-spin control is not maintained throughout the spin, the aircraft may enter either a spiral dive or a high rotational spin. A spiral dive is recognized by a rapid increase in airspeed with the rate of rotation probably slowing down as the spin changes to a spiral dive. The wings can be levelled by using aileron with rudders central and the dive then recovered using elevator (whilst observing the 'g' limits). A high rotational spin is recognizable by a steeper nose down attitude and a higher rate of rotation than in a normal spin; airspeed will be higher than a normal spin but will not increase rapidly; recovery is as given in Section 3, Para. 3.7.2 Incorrect Recovery.

7.2.11 Erect Spin Recovery

The following actions are a composite spin recovery procedure and allow for erect spins entered from any configuration.

1. Close the throttle

2. Raise the flaps

3. Check the direction of spin as indicated by the turn co-ordinator

4. Apply and hold full rudder to oppose the direction of spin

5. Holding the ailerons neutral, progressively and firmly move the control column forward until the spin stops. It may be necessary to move it all the way forward to the front stop. The rate of control column movement should be such that it would move from fully back to fully forward in about 3 seconds

6. Immediately the spin stops, centralise the rudder

7. Level the wings with ailerons and recover from the dive

The aircraft will normally stop spinning within 1 turn of the application of the recovery action (see Section 3.7 for high rotational spin recovery). Failure to apply the correct spin recovery actions may delay or prevent exit from the spin, the most common mistakes being the use of less than full opposite rudder and slow or insufficient forward movement of the control column. As the control column is moved forward during the recovery actions, the spin may appear to speed up momentarily before stopping; this is normal and should not be taken as an indication that the aircraft is not recovering.

7.2.12 Inverted Spinning

The aircraft is not cleared for inverted spinning.

7.2.13 Tailslides

The aircraft is likely to suffer control surface damage if allowed to tailslide and this manoeuvre should not be carried out deliberately. If control is lost near the vertical the controls should be centralised and firmly held there until the nose has dropped and flying speed regained. If the throttle was closed the engine will probably stop turning and an air start will be necessary. If a tailslide is thought to have occurred the aircraft should be flown gently and landed for an engineering inspection for damage.

7.2.14 Aerobatics

Aerobatics may be carried out provided the aircraft centre of gravity is within the prescribed limits (See Section 8.1). The recommended entry speeds for an inexperienced pilot are as follows:

Rolling into and out of inverted flight	90 kts
Stabilized inverted flight	80 kts
Slow roll	110 kts
Stall turn entry	110 kts
Stall turn rotate	50 kts
Loop	115 kts
Roll off the top	125 kts
Flick roll max	70 kts

> The following precautions should be observed whenever aerobatic flight is undertaken.

1. Check that both wing fuel tanks are still functioning after aerobatic flight and each are capable of providing full fuel flow required for maximum continuous power.

2. Ensure that following aerobatics sufficient fuel will be available in either wing fuel tank to enable the aircraft to return to the nearest airfield.

3. Ensure that aerobatics are carried out at sufficient altitude to recover to normal flight and to switch fuel tanks if the engine should cut. <

7.2.15 Inverted Flight

The engine is equipped with an inverted flight oil system and the wing fuel tanks incorporate a flop tube system. Limitations on the oil pressure indications during manoeuvres involving inverted flight are fully described in Section 2.4, and must be observed.

7.3 CIRCUIT AND LANDINGS

7.3.1 Approaching the Landing Pattern

Before joining the circuit or entering any landing procedure or approach pattern, the Rejoin Checks should be carried out as laid out in the FRCs.

7.3.2 Circuit Procedure

Join at 85 kts. Carry out the pre-landing checks in the downwind position. To commence descent reduce the throttle setting to achieve approximately 1500 RPM and lower takeoff flap. Allow the speed to reduce and enter a descent at 75 kts. (78 kts if a flapless circuit is being carried out). Maintain this speed round the final turn until the wings are level on finals. Lower landing flap as required and complete the final checks. The threshold speed of 70 kts with landing flap or 75 kts flapless is achieved by throttling back smoothly as the round-out is commenced. The power setting required will vary with the wind conditions.

7.3.3 Landings

Normal With the round-out complete and the throttle closed, adjust the attitude to keep the aircraft off the ground, allowing the main wheels to touch down at 45 - 50 kts dependent on the AUW. Keep the nosewheel off the ground until 40 kts. This is easily done as the elevator remains effective throughout the landing procedure. Commence braking as necessary. Do not push the control column forward or the propeller tips could touch the ground. Keep straight with nosewheel steering and move the stick progressively aft as speed decreases.

Glide After the end of the downwind leg the speeds to be flown are 70 kts flap up, 70 kts takeoff flap and 60 kts landing flap for threshold speed 55 kts. The final turn can be commenced in about the same position as for a normal circuit and the throttle closed. The two stages of flap are used as required to achieve the touchdown point. The considerable drag of full flap may be used to dive off excess height up to the limiting speed of 88 kts. As the glide approach angle is steeper than for a normal circuit it is necessary to commence round-out slightly higher but the landing is the same as for a normal approach. An actual forced landing would probably be made with the engine failed and windmilling which would result in a higher rate of descent than with the engine idling; thus all practises should be done with the aim of touching down 1/3 way down the landing strip so that there is a margin of safety to allow for the increased rate of descent in the real case. Also it is usually less hazardous to run off the end of a landing strip at 10 kts than to fall short of the beginning at 40 kts; thus it is erring on the safe side to be slightly high.

Short Landing Fly a normal approach until lowering full flap. Reduce the power slightly and allow the speed to fall to 55 kts when power will need to be increased to stop the speed falling further. The round-out and landing are the same as for a normal landing except that power should not be reduced until after the round-out has been commenced. Once the mainwheels are on the ground the nosewheel should be lowered immediately but gently. Braking may then commence with the stick being moved progressively aft as speed decreases. As the approach speeds are significantly lower than for a normal circuit, the pilot must be ready to counter any sink or windshear effect with immediate application of power.

Flapless Landing The aircraft has a very robust manually operated flap system and thus flap failure practice has little relevance. Flapless approach may be practised but, due to the aircraft's excellent gliding performance, the approaches will be very flat; care must be taken to avoid an overshoot. With more than 15 kts headwind a nearly normal glide path angle can be flown at about 1200 RPM but, with less headwind, progressively flatter approaches are required. The speed should be held at 78 kts throughout the final turn and, once wings are level, it should be allowed to reduce to 75 kts through the threshold. The round-out should be smooth and the aircraft should be landed on the mainwheels at 50 kts to reduce the chance of touching the tail bumper.

> Crosswind Landing Landings are permitted within the crosswind limit of 25 < kts. The aircraft should be flown down the extended runway with the wings level using the "crab" technique. The excellent lateral control available results in no difficulty being experienced in holding the wings level as the aircraft is yawed straight with rudder just prior to landing. The ailerons should be held deflected into wind after landing to reduce the possibility of the upwind wing lifting during the ground roll. In high crosswind conditions the nosewheel should be gently lowered as soon as the mainwheels are on the ground so that nosewheel steering is available to assist with directional control. A slight "snatch" may be felt on the rudder pedals when the nosewheel touches the ground as the nosewheel tries to align itself with the direction of travel of the aircraft.

Abandoned Landing A landing should be abandoned if misjudgement or conditions result in a heavy bounce during the attempt to land. The elevator should be held just aft of central and the wings kept level with aileron whilst the throttle is opened fully. Any attempt to apply corrective action is likely to make the situation worse resulting in more serious bounces and probable undercarriage and propeller damage.

Touch-and-go-Landing After landing raise the flaps from the landing (40°) setting to the takeoff (18°) setting. The aircraft should then be flown off the ground at the normal speed of 55 kts and climbed at a shallow angle to reach a climbing speed appropriate to the flap setting as follows:

Takeoff flap	70 kts
Flap up	77 kts

At 200 ft the flap should be raised.

Going Round Again Open the throttle fully. Climb at the speed appropriate to flap setting and raise the flaps above 200 ft as for a touch-and-go landing.

7.3.4 After Landing

Complete the after landing and closing down checks in the FRCs. Note the flight times and details for entry in the appropriate aircraft documents.

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SECTION 8 CENTRE OF GRAVITY COMPUTER AND ILLUSTRATIONS

CONTENTS

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8.1	Centre of Gravity Overlay	8-1/2
8.2	Centre of Gravity Computer	8-3
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8.4A	Instrument Panel (Mod 299)	8-7A/8A
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> 8.4D	Instrument Panel (Mod 506A)	8-7D/8D
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8.5	Centre Console	8-9/10

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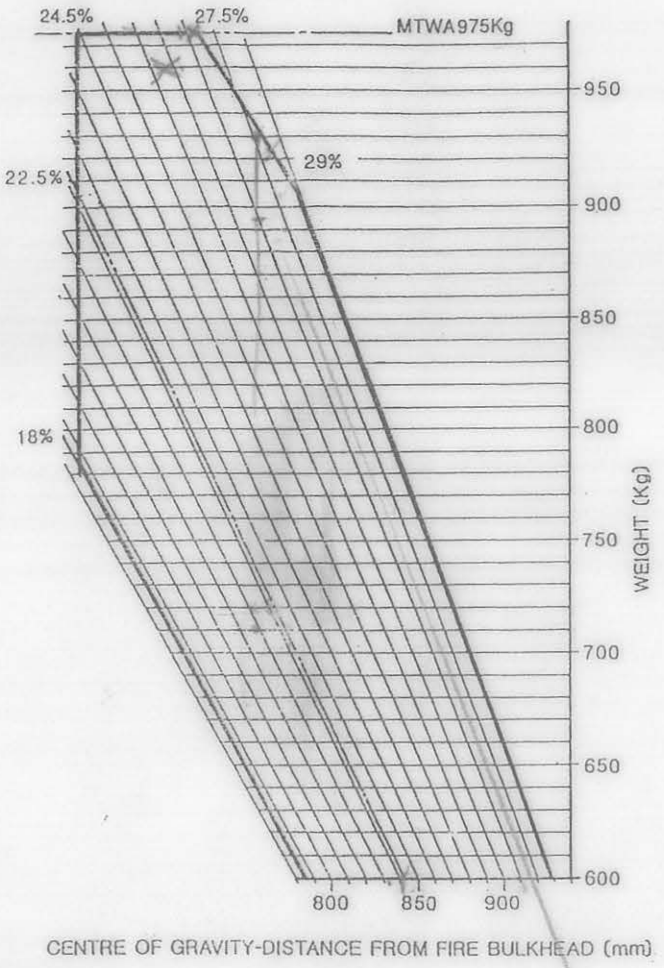
8.1 CENTRE OF GRAVITY OVERLAY



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INSTRUCTIONS FOR USE

1. Plot on this overlay the weight and CG of the aircraft to be checked.

2. Position the point plotted in (1) over point 'X' on Diagram 1 and draw a trace along the pilots line representing the total weight of pilots to be carried.

3. The top end of this line now becomes your new datum point, which must be aligned with point 'X'. Then draw a trace along the baggage line representing the amount of baggage to be carried.
ENSURE THAT THIS LINE FALLS WITHIN THE AREA OF THE ENVELOPE.

4. Using the end of this line as your new datum point, align it with position 'X' as before and trace along the fuel line the weight of fuel be carried. This will give you the position of CG for takeoff.

NOTE: When aligning diagrams check that all horizontals are parallel.

8.2 CENTRE OF GRAVITY COMPUTER

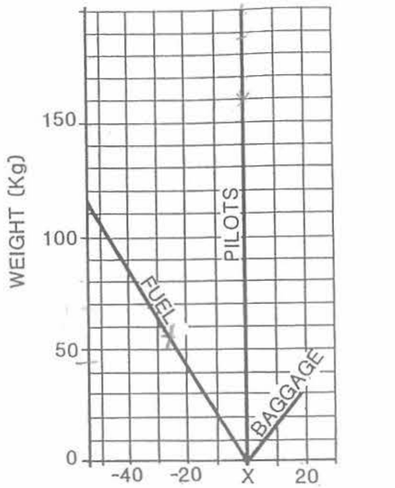
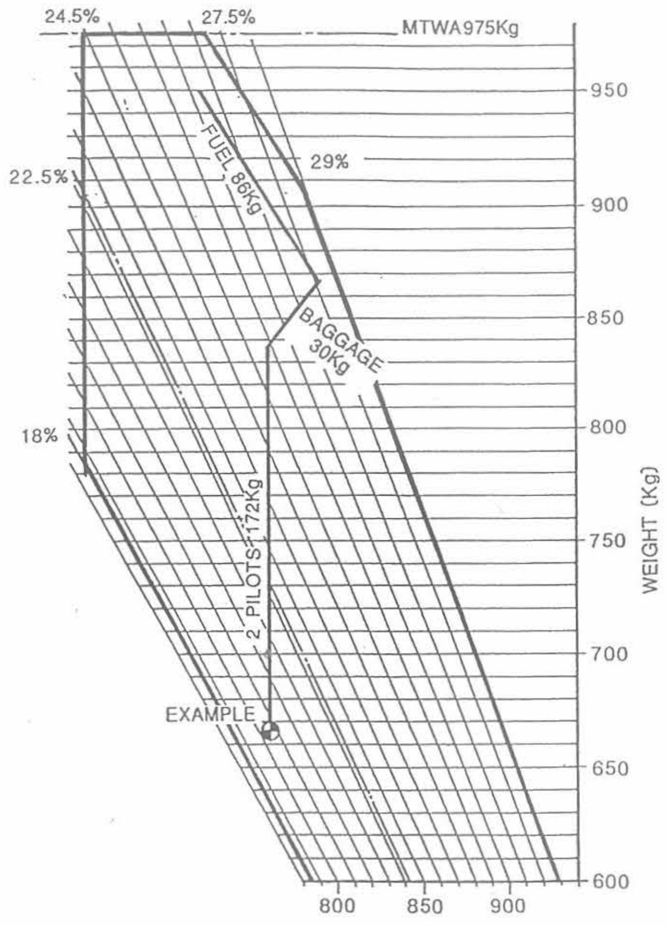


DIAGRAM 1



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SECTION 9 SUPPLEMENTS

CONTENTS

A. Wing Tip Smoke Generators Mod 337C aircraft

B. Superseded by Supplement D

C. Superseded by Supplement D

D. Superseded by Supplement F

E. Winterisation Kit Mod 693

F. Structural Temperature Limitations – Mod 516 Addendum 1 & 2 (Works Numbers 2116, 2121) Aircraft

G. Gel Type Battery RG24-11M - Mod 416A Aircraft

SECTION 9 SUPPLEMENTS

CONTENTS

A. Wing Tip Smoke Generators Mod 337C aircraft

B. Superseded by Supplement D

C. Superseded by Supplement D

D. Superseded by Supplement F

E. Winterisation Kit Mod 693

F. Black and Yellow Colour Scheme Mod 734B/D

> G. Gel Type Battery RG24-11M - Mod 416A Aircraft <

SUPPLEMENT E WINTERISATION KIT MOD 693

CONTENTS

9.E.1 Fitting procedure for winterisation kit.

9.E.2 Amendment to pre-flight checklist.

9.E.1 FITTING PROCEDURE FOR WINTERISATION KIT

When the ambient temperature falls below ISA -20°C (ie -5°C at sea level) both blanking plates should be fitted, beneath the lower cowling, to cover the air exit holes in accordance with Mod 693.

They must be removed again when the ambient temperature rises above ISA -15°C (0°C at sea level).

9.E.2 AMENDMENT TO PRE-FLIGHT CHECKLIST

When Mod 693 is embodied the Pre-flight checks, given in this Flight Manual (Section 2 para 3.1.2), must include the following.

"Ensure that winterisation blanking plates are not fitted to either of the two air exit holes beneath the lower cowling, if the ambient temperature exceeds ISA -15°C".

SUPPLEMENT F BLACK AND YELLOW COLOUR SCHEME (MOD 734B/D)

NOTE:

This supplement replaces earlier Supplement D dated April 1995.

CONTENTS

9.F.1 Revised Structural Temperature Limitations

9.F.1 REVISED STRUCTURAL TEMPERATURE LIMITATIONS

The temperatures given below override those given in the reference paragraph numbers in the relevant sections of this manual.

Section 2 Paragraph 2.5.5 Limitations for Aerobatics

Aerobatic manoeuvres with flaps extended are not permitted.

Tail Slides and Inverted Spins are not permitted.

'g' Limitation - struct temp below 42°C (Cat 'A')

Flaps up	+6g -3g
Flaps down	+2g -1g

When structural temperature reaches 42°C (Cat 'U') or more DO NOT carry out aerobatics or impose loads which exceed:

Flaps up	+4.4g	-2g
Flaps down	+2g	-1g

Flight prohibited above 45°C

Aerobatic manoeuvres - up to all up weight 975kg (2150 lb)

	Entry Speeds (kts) (IAS)
Slow roll	110
Stall turn entry	110
Stall turn rotate	50
Loop	115
Roll off the top	125
Flick roll max	70
Spin	See Paragraph 3.7

Section 8 Paragraph 2.6.1 Instrument Markings

OAT/Structural Temperature Gauge

Structure temperature maximum	Red Line	42°C

Section 2 Para 2.6.2 Labels

The following information is to be furnished on placards well within sight of pilot.

Post Mod 734B/D

LIMITATIONS

NO SMOKING

VNE	180 KIAS
MANOEUVRING SPEED VA	140 KIAS
FLAP OPERATING SPEED	
TAKEOFF POSITION (18°)	120 KIAS
LANDING POSITION (40°)	98 KIAS
MAX TOTAL WEIGHT AUTHORISED	975 KG

MAX g LOADS UP TO AUW 975KG (2150 LB)		STRUCTURAL TEMPERATURE BELOW 42°C (CAT 'A')	ABOVE 42°C (CAT 'U')
	FLAPS UP	+6g -3g	+4.4g -2g
	FLAPS DOWN	+2g -1g	+2g -1g

FLIGHT PROHIBITED ABOVE 45°C

ALTITUDE LOSS IN A STALL RECOVERY 150 FT (46M)

FLIGHT INTO KNOWN ICING CONDITIONS PROHIBITED

AIRCRAFT CERTIFIED FOR FLIGHT IN IMC, DAY AND FOR NIGHT FLIGHT

AEROBATIC MANOEUVRES - UP TO ALL UP WEIGHT 975 KG (2150 LB)

	ENTRY SPEEDS KIAS
SLOW ROLL	110
STALL TURN ENTRY	110
STALL TURN ROTATE	50
LOOP	115
ROLL OFF THE TOP	125
FLICK ROLL MAX	70
SPIN	(SEE FLIGHT MANUAL)

SUPPLEMENT F STRUCTURAL TEMPERATURE LIMITATIONS – MOD 516 ADDENDUM 1 & 2 (WORKS NUMBERS 2116, 2121) AIRCRAFT

NOTE:

This supplement replaces earlier Supplement F dated July 1997

CONTENTS

9.F.1 Revised Structural Temperature Limitations

9.F.1 REVISED STRUCTURAL TEMPERATURE LIMITATIONS

The temperatures given below override those given in the reference paragraph numbers in the relevant sections of this manual.

Section 2 Paragraph 2.5.5 Limitations for Aerobatics

Aerobatic manoeuvres with flaps extended are not permitted.

Tail Slides and Inverted Spins are not permitted.

'g' Limitation - struct temp below 42°C (Cat 'A')

Flaps up	+6g -3g
Flaps down	+2g -1g

When structural temperature reaches 42°C (Cat 'U') or more DO NOT carry out aerobatics or impose loads which exceed:

Flaps up	+4.4g	-2g
Flaps down	+2g	-1g

Flight prohibited above 45°C

Aerobatic manoeuvres - up to all up weight 975kg (2150 lb)

	Entry Speeds (kts) (IAS)
Slow roll	110
Stall turn entry	110
Stall turn rotate	50
Loop	115
Roll off the top	125
Flick roll max	70
Spin	See Paragraph 3.7

Section 8 Paragraph 2.6.1 Instrument Markings

OAT/Structural Temperature Gauge

Structure temperature maximum	Red Line	45°C

Section 2 Para 2.6.2 Labels

The following information is to be furnished on placards well within sight of pilot.

Mod 516 Addendum 1 & 2 (Works Numbers 2116, 2121) Aircraft

LIMITATIONS

NO SMOKING

VNE			180 KIAS
MANOEUVRING SPEED VA			140 KIAS
FLAP OPERATING SPEED			
TAKEOFF POSITION (18°)			120 KIAS
LANDING POSITION (40°)			98 KIAS
MAX TOTAL WEIGHT AUTHORISED			975 KG
MAX g LOADS		STRUCTURAL TEMPERATURE	
UP TO AUW 975KG (2150 LB)		BELOW 42°C (CAT 'A')	ABOVE 42°C (CAT 'U')
	FLAPS UP	+6g -3g	+4.4g -2g
	FLAPS DOWN	+2g -1g	+2g -1g

FLIGHT PROHIBITED ABOVE 45°C

ALTITUDE LOSS IN A STALL RECOVERY 150 FT (46M)

FLIGHT INTO KNOWN ICING CONDITIONS PROHIBITED

AIRCRAFT CERTIFIED FOR FLIGHT IN IMC, DAY AND FOR NIGHT FLIGHT

AEROBATIC MANOEUVRES - UP TO ALL UP WEIGHT 975 KG (2150 LB)

	ENTRY SPEEDS KIAS
SLOW ROLL	110
STALL TURN ENTRY	110
STALL TURN ROTATE	50
LOOP	115
ROLL OFF THE TOP	125
FLICK ROLL MAX	70
SPIN	(SEE FLIGHT MANUAL)

On Canopy Transparency Mod 516 Addendum 1 & 2 (Works Numbers 2116, 2121) Aircraft

THIS AIRCRAFT IS RESTRICTED TO
OPERATION IN THE U.K. ONLY

Section 3 Paragraph 3.1.1 Initial Check

(Structural temperature .... in hot conditions)	Rotary switch Check structural temperature Left and Right - on OAT gauge below 45°C

Post Mod 734B/D

THIS AIRCRAFT IS RESTRICTED TO

OPERATION IN THE U.K. ONLY

Section 3 Paragraph 3.1.1 Initial Check

(Structural temperature .... in hot conditions)	Rotary switch Check structural temperature Left and Right - on OAT gauge below 42°C

SUPPLEMENT G - GEL-TYPE BATTERY RG24-11M - MOD 416A AIRCRAFT

CONTENTS

9.G.1 Environmental restriction for Gel-Type Battery

9.G.1 ENVIRONMENTAL RESTRICTION FOR GEL-TYPE BATTERY

The installation of RG24-11M Gel-Type Battery is subject to the following environmental restriction:

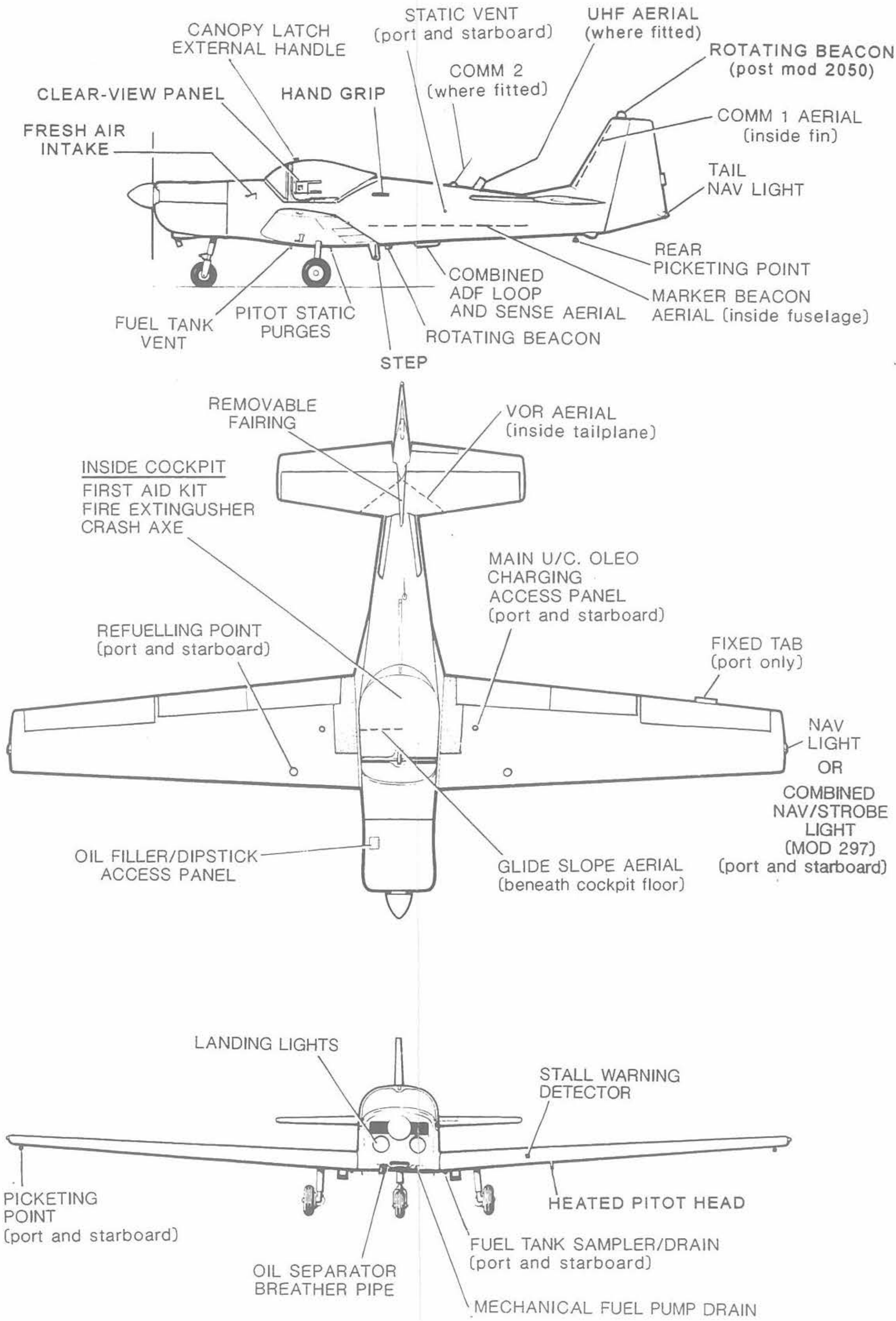
Low Operating Temperature	-20°C (See note below)
High Operating Temperature	+55°C
Transient Temperature	+70°C

NOTE

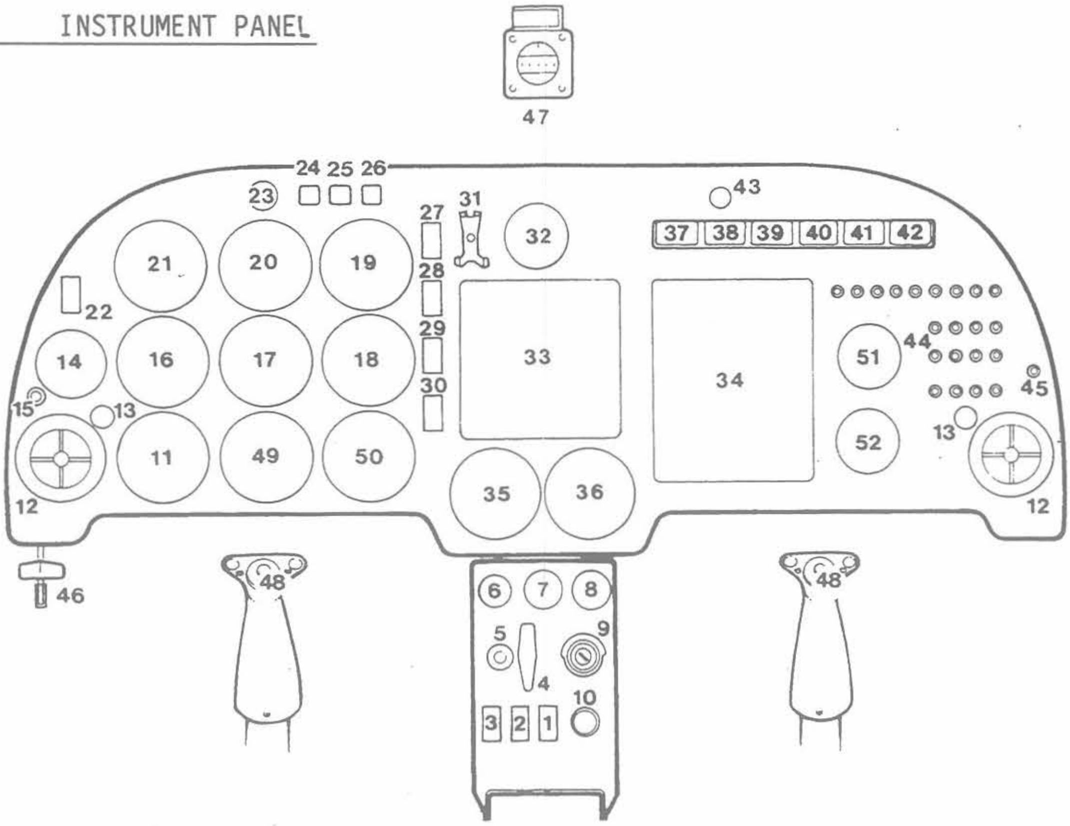
If the aircraft battery has been subjected to temperatures lower than -20°C for more than 4 hrs with the aircraft parked on the ground, then the battery must be removed from the aircraft and slowly brought up to operational temperature shown above. Subject to the above procedures, flying of the aircraft at outside air temperatures lower than -20°C is permitted.

See also Operating Temperatures ref: 2.7.3.

8.3 PRINCIPAL FEATURES



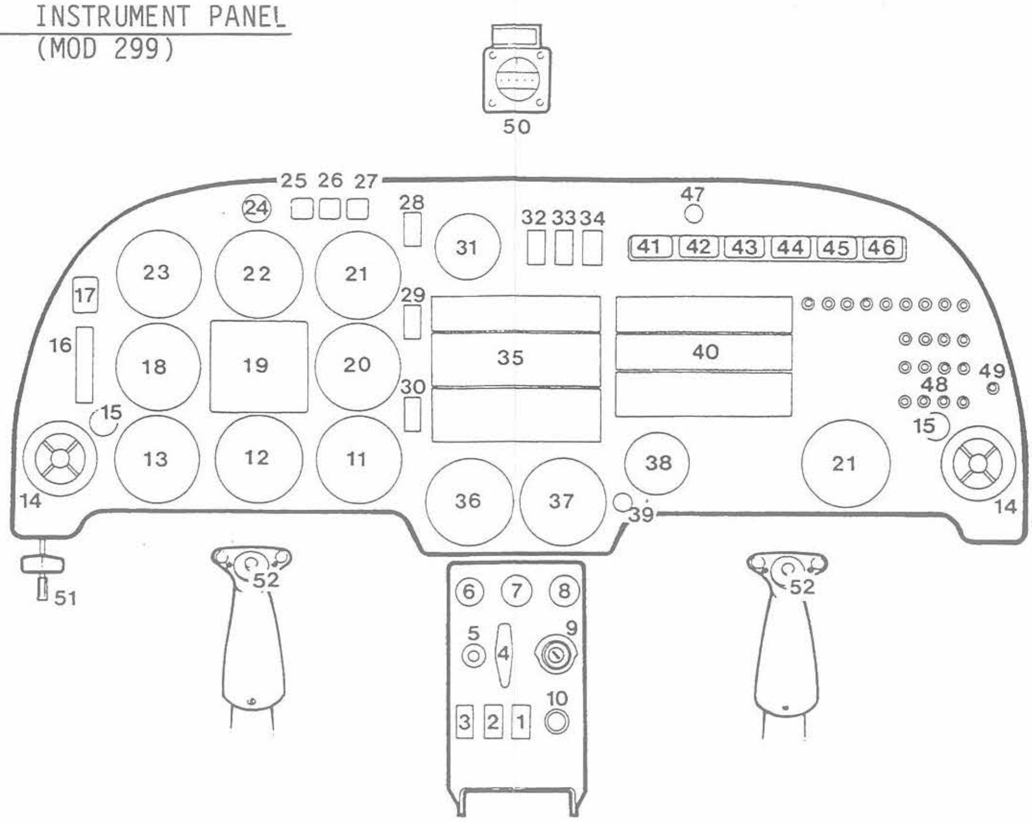
8.4 INSTRUMENT PANEL



KEY

1. EXCITATION SWITCH
2. MASTER SWITCH
3. FUEL PUMP SWITCH
4. FUEL CONTROL
5. STARTER BUTTON
6. THROTTLE CONTROL R/H
7. PROP. SPEED CONTROL
8. MIXTURE CONTROL
9. MAGNETO SWITCH
10. HEATING CONTROL
11. ACCELEROMETER (PRE MOD 274)
    ADF (POST MOD 274)
12. AIR VENT
13. COLD AIR TO CABIN CONTROL
14. OUTSIDE AIR TEMP GAUGE
15. PRESS TO TEST STRUCT. TEMP
16. TURN CO-ORDINATOR
17. DIRECTIONAL GYRO
18. VERTICAL SPEED INDICATOR
19. ALTIMETER
20. ARTIFICIAL HORIZON
21. AIRSPEED INDICATOR
22. HEATED PITOT SWITCH
23. VACUUM GAUGE
24. STALL WARNING LIGHT
25. STARTER ENGAGED W. LIGHT
26. ALTERNATOR WARNING LIGHT
27. LANDING LIGHTS SWITCH
28. NAV LIGHTS SWITCH
29. STROBE LIGHT SWITCH
30. MAP LIGHT SWITCH
31. STOP WATCH CLIP
32. CLOCK
33. RADIO PANEL
34. RADIO PANEL
35. TACHOURMETER
36. MANIFOLD/FUEL PRESSURE GAUGE
37. OIL PRESSURE GAUGE
38. OIL TEMP GAUGE
39. FUEL CONTENTS GAUGE/LEFT TANK
40. FUEL CONTENTS GAUGE/RIGHT TANK
41. CYL. HEAD TEMPERATURE GAUGE
42. AMMETER
43. DIMMER SWITCH
44. CIRCUIT BREAKERS
45. ALTERNATOR OUTPUT CIRCUIT BREAKER
46. THROTTLE CONTROL L/H
47. MAGNETIC COMPASS
48. PRESS TO TRANSMIT SWITCH
49. NAV1/VOR/LOC/GS (POST MOD 274)
50. NAV2/VOR/LOC (POST MOD 274)
51. ACCELEROMETER (POST MOD 274)
52. ALTIMETER 2 (POST MOD 274)

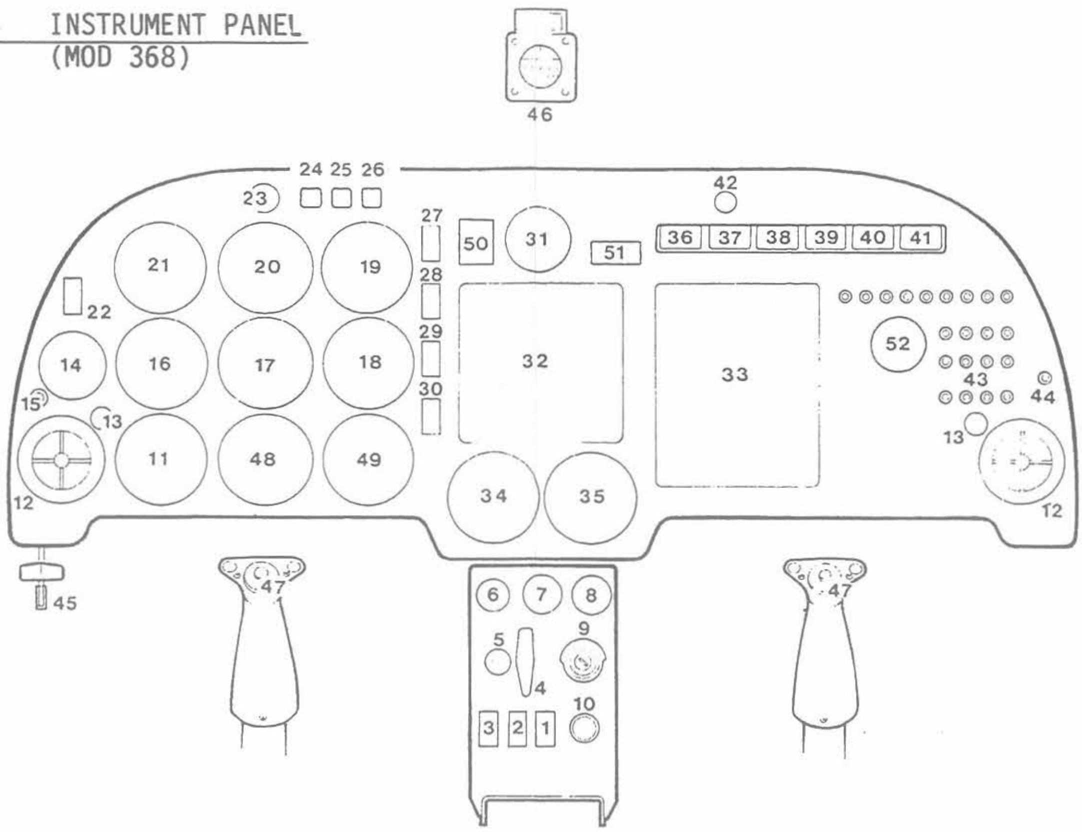
8.4A INSTRUMENT PANEL (MOD 299)



KEY

1. EXCITATION SWITCH
2. MASTER SWITCH
3. FUEL PUMP SWITCH
4. FUEL CONTROL
5. STARTER BUTTON
6. THROTTLE CONTROL R/H
7. PROP. SPEED CONTROL
8. MIXTURE CONTROL
9. MAGNETO SWITCH
10. CABIN HEAT CONTROL
11. ADF
12. NAV 2
13. ACCELEROMETER
14. AIR VENT (2 OFF)
15. COLD AIR TO CABIN CONTROL (2 OFF)
16. MKR BEACON RECEIVER
17. SLAVING ACCESSORY AND COMPENSATOR UNIT
18. TURN CO-ORDINATOR
19. PICTORIAL NAV INDICATOR
20. VERTICAL SPEED INDICATOR
21. ALTIMETER (2 OFF)
22. ARTIFICIAL HORIZON
23. AIRSPEED INDICATOR
24. VACUUM GAUGE
25. STALL WARNING LIGHT
26. STARTER ENGAGED WARNING LIGHT
27. ALTERNATOR WARNING LIGHT
28. LANDING LIGHTS SWITCH
29. NORMAL/EMERGENCY PHONES SWITCH
30. HEATED PITOT
31. CLOCK
32. NAV LIGHT SWITCH
33. ROTATING BEACON SWITCH
34. MAP LIGHT
35. AVIONICS PANEL
36. TACHOUR METER
37. MANIFOLD/FUEL PRESSURE GAUGE
38. OUTSIDE AIR TEMPERATURE GAUGE
39. PRESS TO TEST STRUCTURAL TEMP
40. AVIONICS PANEL
41. OIL PRESSURE GAUGE
42. OIL TEMP GAUGE
43. FUEL CONTENTS GAUGE/LEFT TANK
44. FUEL CONTENTS GAUGE/RIGHT TANK
45. CYL. HEAD TEMPERATURE GAUGE
46. AMMETER
47. DIMMER SWITCH
48. CIRCUIT BREAKERS
49. ALTERNATOR OUTPUT CIRCUIT BREAKER
50. MAGNETIC COMPASS
51. THROTTLE CONTROL L/H
52. PRESS TO TRANSMIT SWITCH

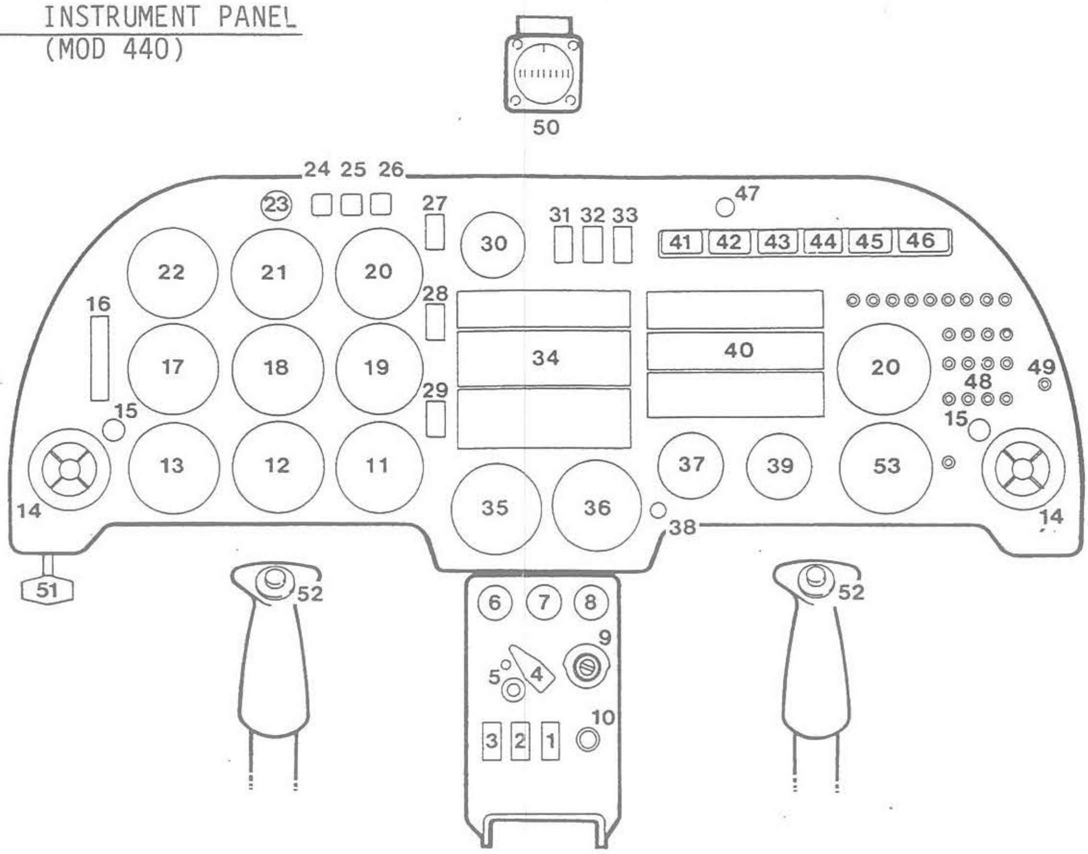
> 8.4B INSTRUMENT PANEL
(MOD 368)



KEY

1. EXCITATION SWITCH
2. MASTER SWITCH
3. FUEL PUMP SWITCH
4. FUEL CONTROL
5. STARTER BUTTON
6. THROTTLE CONTROL R/H
7. PROP. SPEED CONTROL
8. MIXTURE CONTROL
9. MAGNETO SWITCH
10. HEATING CONTROL
11. ACCELEROMETER (PRE MOD 274)
12. AIR VENT
13. COLD AIR TO CABIN CONTROL
14. OUTSIDE AIR TEMP GAUGE
15. PRESS TO TEST STRUCT. TEMP
16. TURN CO-ORDINATOR
17. DIRECTIONAL GYRO
18. VERTICAL SPEED INDICATOR
19. ALTIMETER
20. ARTIFICIAL HORIZON
21. AIRSPEED INDICATOR
22. HEATED PITOT SWITCH
23. VACUUM GAUGE
24. STALL WARNING LIGHT
25. STARTER ENGAGED W. LIGHT
26. ALTERNATOR WARNING LIGHT
27. LANDING LIGHTS SWITCH
28. NAV LIGHTS SWITCH
29. STROBE LIGHT SWITCH
30. MAP LIGHT SWITCH
31. CLOCK
32. RADIO PANEL
33. RADIO PANEL
34. TACHOURMETER
35. MANIFOLD/FUEL PRESSURE GAUGE
36. OIL PRESSURE GAUGE
37. OIL TEMP GAUGE
38. FUEL CONTENTS GAUGE/LEFT TANK
39. FUEL CONTENTS GAUGE/RIGHT TANK
40. CYL. HEAD TEMPERATURE GAUGE
41. AMMETER
42. DIMMER SWITCH
43. CIRCUIT BREAKERS
44. ALTERNATOR OUTPUT CIRCUIT BREAKER
45. THROTTLE CONTROL L/H
46. MAGNETIC COMPASS
47. PRESS TO TRANSMIT SWITCH
48. VOR INDICATOR
49. ADF INDICATOR
50. FLARES ARM SWITCH
51. PHONES SWITCH/LABEL
52. VOICE ACTIVATED INTERCOM <

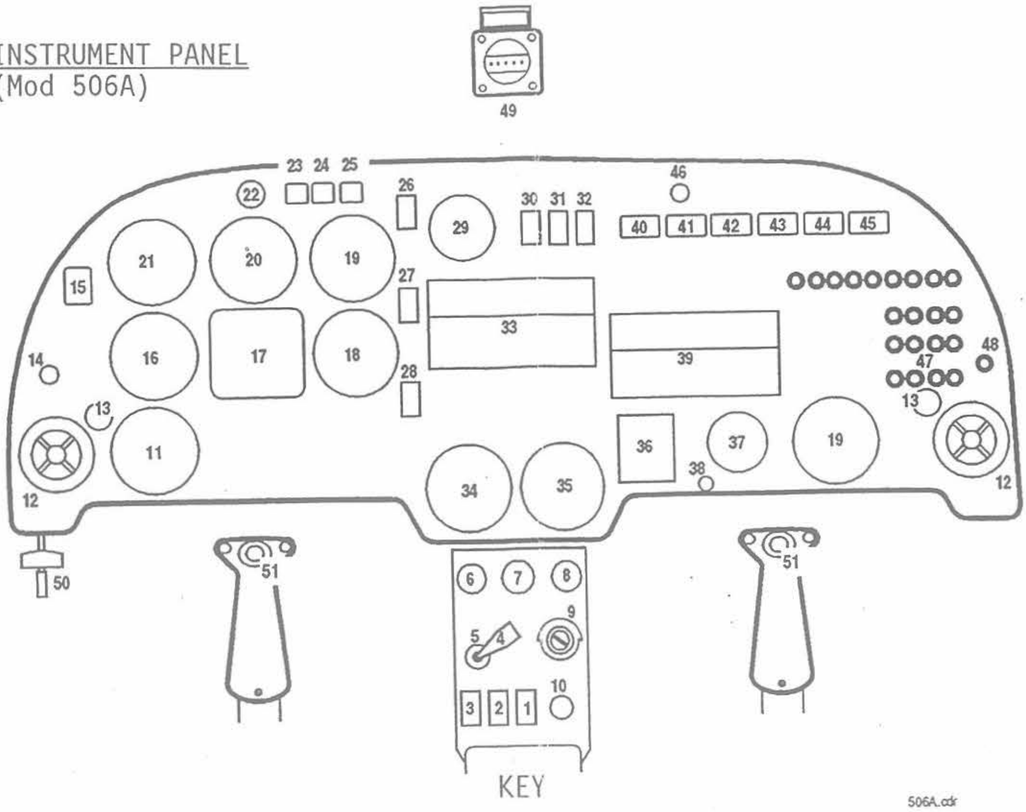
8.4C INSTRUMENT PANEL (MOD 440)



KEY

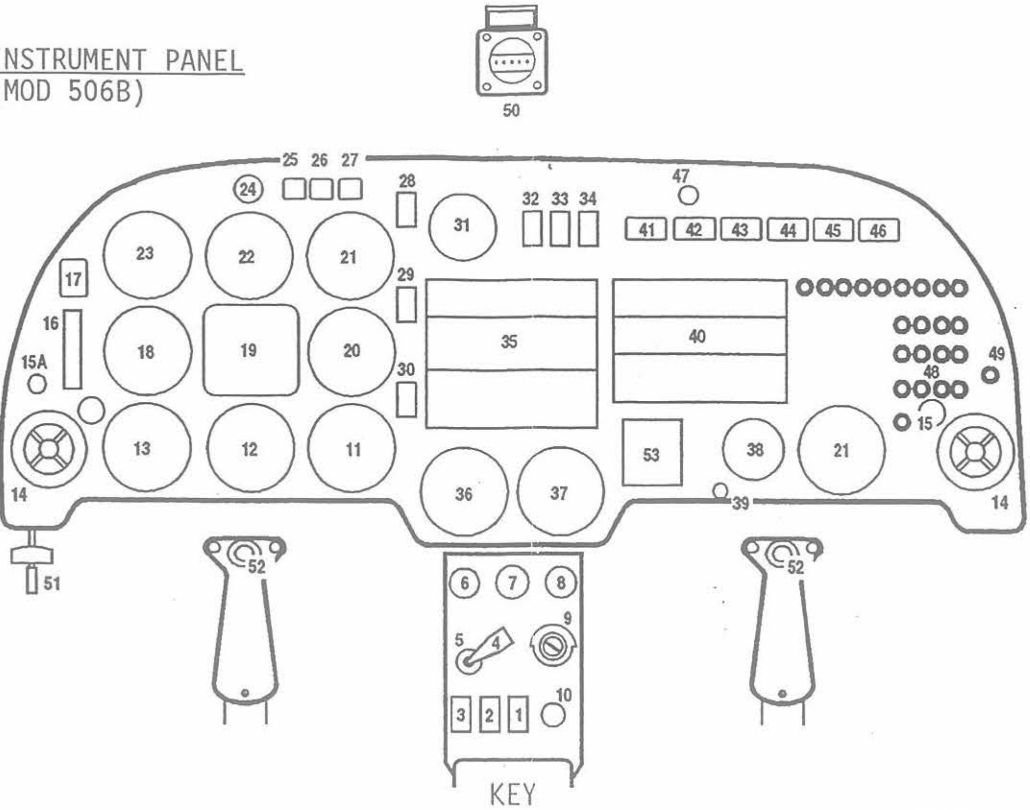
1. EXCITATION SWITCH
2. MASTER SWITCH
3. FUEL PUMP SWITCH
4. FUEL CONTROL
5. STARTER BUTTON
6. THROTTLE CONTROL R/H
7. PROP. SPEED CONTROL
8. MIXTURE CONTROL
9. MAGNETO SWITCH
10. CABIN HEAT CONTROL
11. NAV 2
12. NAV 1
13. ADF
14. AIR VENT (2 OFF)
15. COLD AIR TO CABIN CONTROL (2 OFF)
16. MKR BEACON RECEIVER
17. TURN CO-ORDINATOR
18. DIRECTIONAL GYRO
19. VERTICAL SPEED INDICATOR
20. ALTIMETER (2 OFF)
21. ARTIFICIAL HORIZON
22. AIRSPEED INDICATOR
23. VACUUM GAUGE
24. STALL WARNING LIGHT
25. STARTER ENGAGED WARNING LIGHT
26. ALTERNATOR WARNING LIGHT
27. LANDING LIGHTS SWITCH
28. NORMAL/EMERGENCY PHONES SWITCH
29. HEATED PITOT SWITCH
30. DIGITAL CLOCK
31. NAV LIGHTS SWITCH
32. ROTATING BEACON/W.TIP STROBE SWITCH
33. MAP LIGHT SWITCH
34. AVIONICS PANEL
35. TACHOURMETER
36. FUEL PRESSURE GAUGE
37. OUTSIDE AIR TEMPERATURE GAUGE
38. PRESS TO TEST STRUCTURAL TEMP
39. HOURMETER
40. AVIONICS PANEL
41. OIL PRESSURE GAUGE
42. OIL TEMP GAUGE
43. FUEL CONTENTS GAUGE/LEFT TANK
44. FUEL CONTENTS GAUGE/RIGHT TANK
45. CYL. HEAD TEMPERATURE GAUGE
46. AMMETER
47. DIMMER SWITCH
48. CIRCUIT BREAKERS
49. ALTERNATOR OUTPUT CIRCUIT BREAKER
50. MAGNETIC COMPASS
51. THROTTLE CONTROL L/H
52. PRESS TO TRANSMIT SWITCH
53. ACCELEROMETER

8.4D INSTRUMENT PANEL
(Mod 506A)



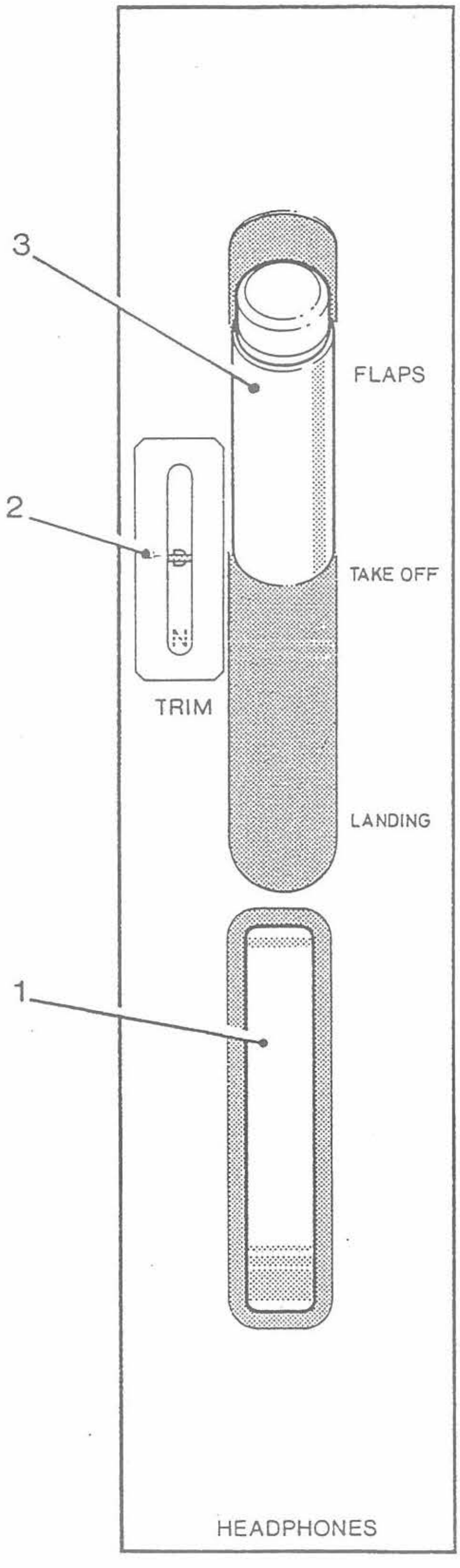
1. EXCITATION SWITCH
2. MASTER SWITCH
3. FUEL PUMP SWITCH
4. FUEL CONTROL
5. STARTER BUTTON
6. THROTTLE CONTROL R/H
7. PROP. SPEED CONTROL
8. MIXTURE CONTROL
9. MAGNETO SWITCH
10. CABIN HEAT CONTROL
11. ACCELEROMETER
12. AIR VENT (2 OFF) >
13. COLD AIR TO CABIN CONTROL (2 OFF)
14. EMERGENCY STATIC VENT
15. SLAVING ACCESSORY AND COMPENSATOR UNIT
16. TURN AND SLIP
17. PICTORIAL NAV INDICATOR
18. VERTICAL SPEED INDICATOR
19. ALTIMETER (2 OFF)
20. ARTIFICIAL HORIZON
21. AIRSPEED INDICATOR
22. VACUUM GAUGE
23. STALL WARNING LIGHT
24. STARTER ENGAGED WARNING LIGHT
25. ALTERNATOR WARNING LIGHT
26. LANDING LIGHTS SWITCH
27. NORMAL/EMERGENCY PHONES SWITCH
28. HEATED PITOT
29. CLOCK
30. NAV LIGHT SWITCH
31. ROTATING BEACON SWITCH
32. MAP LIGHT
33. AVIONICS PANEL
34. TACHOURMETER
35. MANIFOLD/FUEL PRESSURE GAUGE
36. UHF RADIO
37. OUTSIDE AIR TEMPERATURE GAUGE
38. ROTARY SWITCH - STRUCTURAL TEMPERATURE TEST <
39. AVIONICS PANEL
40. OIL PRESSURE GAUGE
41. OIL TEMP GAUGE
42. FUEL CONTENTS GAUG/LEFT TANK
43. FUEL CONTENTS GAUGE/RIGHT TANK
44. CYL. HEAD TEMPERATURE GAUGE
45. AMMETER
46. DIMMER SWITCH
47. CIRCUIT BREAKERS
48. ALTERNATOR OUTPUT CIRCUIT BREAKER
49. MAGNETIC COMPASS
50. THROTTLE CONTROL L/H
51. PRESS TO TRANSMIT SWITCH

8.4E INSTRUMENT PANEL
(MOD 506B)



1. EXCITATION SWITCH
2. MASTER SWITCH
3. FUEL PUMP SWITCH
4. FUEL CONTROL
5. STARTER BUTTON
6. THROTTLE CONTROL R/H
7. PROP. SPEED CONTROL
8. MIXTURE CONTROL
9. MAGNETO SWITCH
10. CABIN HEAT CONTROL
11. ADF
12. NAV 2
13. ACCELEROMETER
14. AIR VENT (2 OFF)
15. COLD AIR TO CABIN CONTROL (2 OFF)
15A. EMERGENCY STATIC VENT
42. OIL TEMP GAUGE
16. MKR BEACON RECEIVER
17. SLAVING ACCESSORY AND COMPENSATOR UNIT
18. TURN AND SLIP
19. PICTORIAL NAV INDICATOR
20. VERTICAL SPEED INDICATOR
21. ALTIMETER (2 OFF)
22. ARTIFICIAL HORIZON
23. AIRSPEED INDICATOR
24. VACUUM GAUGE
25. STALL WARNING LIGHT
26. STARTER ENGAGED WARNING LIGHT
27. ALTERNATOR WARNING LIGHT
28. LANDING LIGHTS SWITCH
29. NORMAL/EMERGENCYPHONES SWITCH
30. HEATED PITOT
31. CLOCK
32. NAV LIGHT SWITCH
33. ROTATING BEACON SWITCH
34. MAP LIGHT
35. AVIONICS PANEL
36. TACHOURMETER
37. MANIFOLD/FUEL PRESSURE GAUGE
38. OUTSIDE AIR TEMPERATURE GAUGE
39. ROTARY SWITCH (STRUCTURAL TEMPERATURE TEST)
40. AVIONICS PANEL
41. OIL PRESSURE GAUGE
43. FUEL CONTENTS GAUGE/LEFT TANK
44. FUEL CONTENTS GAUGE/RIGHT TANK
45. CYL. HEAD TEMPERATURE GAUGE
46. AMMETER
47. DIMMER SWITCH
48. CIRCUIT BREAKERS
49. ALTERNATOR OUTPUT CIRCUIT BREAKER
50. MAGNETIC COMPASS
51. THROTTLE CONTROL L/H
52. PRESS TO TRANSMIT SWITCH
53. UHF RADIO

8.5 CENTRE CONSOLE



KEY

1. TRIMMER HANDWHEEL
2. TRIMMER POSITION IND.
3. FLAP CONTROL LEVER