BURKHART GROB Luft- und Raumfahrt GmbH & Co. KG
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Airplane Flight Manual

GROB G 115D

Issue : 2

Airworthiness category: Utility and Acrobatic

FAR compliance: FAR 23 incl. Amendment 32

This manual constitutes the approved airplane flight manual of the aircraft GROB G 115D and must be carried in the airplane at all times.

Scope and revised status can be seen from the Table of Contents or the Log of Revisions.

Airplane Serial No.: _____ Airplane Regist. No.: _____

Owner: _____

_____

_____

As operating instruction in accordance with § 12(1) 2 LuftGerPo LBA - approved:

30. MRZ. 1994

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THIS LBA APPROVED HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY THE FEDERAL AVIATION REGULATIONS AND ADDITIONAL INFORMATION PROVIDED BY THE MANUFACTURER AND CONSTITUTES THE FAA APPROVED AIRPLANE FLIGHT MANAUAL FOR U.S. REGISTERED AIRPLANES IN ACCORDANCE WITH 14 CFR SECTION 21.29.

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Log of Revisions

	Airplane	Airplane
GROB G115D	Serial No.:_____	Regist. No.:_____

All revision material must be inserted into the handbook without delay. Deleted pages shall be removed and destroyed. This page shall be replaced and the page check-list updated by handwriting in accordance with the revised data or replaced. Revisions are identified by a vertical black line on the side.

<u>This aircraft must only be operated when the airplane flight manual is fully updated!</u>

Revision No.	Date	Revised pages and text	German LBA approval:	Stamp and signature
1	25.07 1994	C,D,E,F, 1-6, 2-4,2-7,2-8,2-9, 2-12,2-13,2-15, 2-16,2-17,2-18, 3-2,3-7,3-8,3-9, 3-10,3-12,3-15, 4-2,4-8,4-9,4-10, 4-13,4-14,4-15, 4-16,4-17,4-18, 4-21,4-22,4-23, 4-24,4-25,4-28, 4-29, 6-15,6-19,6-22, 7-1,7-3,7-13,7-15 7-16,7-17,7-18, 7-19,7-20,7-21.		1.8.94
2	30.09 1994	C,D,E,F, 2-9,2-14,2-16, 4-5, 7-9,7-10,7-19, 7-20.	26th of October 1994	i.A.
3	03.11 1994	C,D,E,F, 2-7,2-8,2-9,2-16, 3-15,3-15a, 4-6,4-10,4-11, 4-21,4-22, 7-12,7-17,7-20.	10. NOV. 1994	i.A.
4	12.12 1994	C,D,F, 2-7,2-8,2-9,2-14, 2-14a,2-16, 3-15a, 6-15, 7-14,7-14a,7-16.	29. MRZ. 1995	i.A.

Log of Revisions

GROB G115 D

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Revision No.	Date	Revised pages and text	German LBA approval	Stamp and signature
5	27.03 1997	C2,D,F, 1-5,9-2	16 of October 1997	
6	15.09 1997	C2,D. **(refer to SB 1078-74)**	Nov. 18, 1997	LUFTFAHRT-BUNDESAMT 7 BRAUNSCHWEIG

Log of Revisions

GROB G115 D

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5	27.03 1997	C2,D,F, 1-5,9-2	October 16, 1997	
6	15.09 1997	C2,D,F, 2-9,6-16,6-17,7-4, 7-11,7-13,7-14, 7-14a,7-17,7-20	18. Nov. 1997	

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7	10.11 1999	D,E,F, 2-7,4-8,6-22,7-9 add.: C/3		15. Dez. 99

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Section 1

General

1.1 Introduction

This manual is designed for as an operating guide for the pilot of the GROB G 115D. It includes the material required to be furnished to the pilot by FAR PART 23. It also contains supplemental data supplied by the airplane manufacturer.

This manual must be read carefully by the owner and/or the pilot to become acquainted with proper aircraft operation. This manual is not designed as a substitute for adequate and competent flight instruction, knowledge of current airworthiness directives, applicable federal air regulations or advisory circulars. It is not intended to be a guide for basic flight instruction or a training manual and should not be used for operational purposes unless kept in a current status.

Assurance that the airplane is in an airworthy condition is the responsibility of the owner. The pilot in command is responsible for determining that the airplane is safe for flight. The pilot is also responsible for remaining within the operating limitations as outlined by placards, instrument markings, and this manual.

This manual has been divided into 9 numbered sections, each provided with a "fingertip" tab divider for quick reference. The limitations and emergency procedures have been placed ahead of the normal procedures, performance and other sections to provide each access to information that may be required in flight.

1.2 Warnings, Cautions and Notes

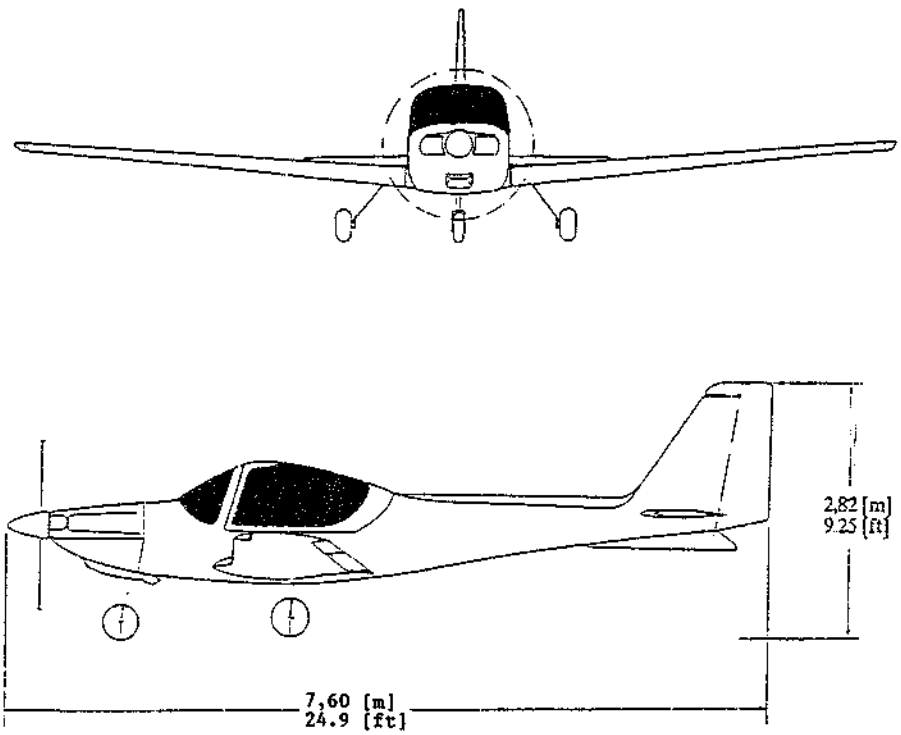
The following definitions apply to warnings, cautions and notes in the flight manual.

" **WARNING** "
means that the non-observation of the corresponding procedure leads to an immediate or important degradation of the flight safety.

" **CAUTION** "
means that the non-observation of the corresponding procedure leads to a minor or to a more or less long term degradation of the flight safety.

" **NOTE** "
draws the attention on any special item not directly related to safety but which is important or unusual.

1.3 Three-View



1.5 Dimensions

Overall dimensions	
Wing span	10,0 m (32.81 ft)
Max. Length	7,60 m (24.93 ft)
Max. height	2,82 m (9.25 ft)
Wing	
Airfoil	Eppler E 696
Wing area	12,21 m²; (131.43 sq.ft)
Dihedral	5 °
Angle of incidence	2 °
Ailerons	
Area	0,562 m² (6.1 sq.ft)
Flaps	
Area	1,146 m² (12.3 sq.ft)
Horizontal tail	
Airfoil	NACA 64010
Wing span	3,50 m (11.48 ft)
Area	2,723 m² (29.3 sq.ft)
Elevator surface	0,861 m² (9.3 sq.ft)
Vertical tail	
Airfoil	NACA 64009
Area	1,692 m² (18.2 sq.ft)
Rudder area	0,642 m² (6.9 sq.ft)
Landing gear	
Wheel track	2,50 m (8.2 ft)
Wheel base	1,61 m (5.3 ft)
Nose Wheel	5.00 - 5/6 PR
Main Wheel	15x6.00 - 6

Deflections see maintenance manual !

1.7 Engine

AVCO LYCOMING, Model AEIO-360 B1F
4 cylinders, direct drive, horizontally opposed, air-cooled

Displacement	361.0 cu.in.
Rated horsepower	180 HP
at rated speed	2700 RPM

1.9 Propeller

Three-blade constant speed propeller

a) manufacturer Hoffmann	HO-V343 K()-V / 180 FP
b) manufacturer Mühlbauer	MTV-12-B-C/C183-17e

Information for operating the aircraft with propeller b is provided in section 9, supplement 2 (if installed).

1.11 Fuel

Avgas 100 oder 100 LL

Total fuel capacity	150 liters [1]
	39.63 U.S.gal. / 33.00 Imp.gal.
Wing tank fuel capacity	each 75 liters
Usable fuel	143 liters
	37.77 U.S.gal. / 31.46 Imp.gal.
Sump tank fuel capacity	5.4 liters

[1] Nominal value

1.13 Oil

Oil capacity	8 quarts / 7.6 liters
Minimum requirement	6 quarts / 5.7 liters

The following engine oils may be used:

Average ambient air temperature	MIL-L-6082 Grades	MIL-L-22851 Ashless Dispersant Grades
above 27°C (80°F)	SAE 60	SAE 60
above 16°C (60°F)	SAE 50	SAE 40 or SAE 50
-1°C (30°F) to 32°C (90°F)	SAE 40	SAE 40
-18°C (0°F) to 21°C (70°F)	SAE 20	SAE 30 or SAE 40
below -12°C	SAE 20	SAE 30

Also comply with the rules at AVCO LYCOMING Spezification No. 301 and AVCO LYCOMING Service Instruction No. 1014, latest issue.
Engine must be run for a minimum of 50 hours on aviation oil as per MIL-L-6082. Change oil after first 25 operating hours.

Until oil consumption has stabilized cruising performance must not be reduced to below 75% to protect the cylinder liners from damage.

First filling: Aviation oil as per MIL-L-6082.

1.15 Maximum Weights

max. takeoff weight (utility category)	990 kg (2182 lbs)
max. takeoff weight (acrobatic category)	920 kg (2028 lbs)
max. landing weight (utility category)	990 kg (2182 lbs)
max. landing weight (acrobatic category)	920 kg (2028 lbs)
Standard empty weight	680 kg (1499 lbs)
max. useful load 1) (utility category)	310 kg (683 lbs)
max. useful load 1) (acrobatic category)	240 kg (529 lbs)
max. permiss. baggage load	55 kg (121 lbs)

1) at standard empty weight

WARNING

The current information of Section 6 "Weight and balance" is applicable for the preflight action.

	Utility
Wing loading at max. takeoff weight	81,08 kg/m² (16.60 lbs/sq.ft.)
Power loading at max. takeoff weight	5,50 kg/HP (12.12 lbs/HP)

	Acrobatic
Wing loading at max. takeoff weight	75,35 kg/m² (15.43 lbs/sq.ft.)
Power loading at max. takeoff weight	5,11 kg/HP (11.27 lbs/HP)

1.17 Symbols, Abbreviations and Terminology

a) General Airspeed Terminology and Symbols

CAS - Calibrated Airspeed means the indicated speed of an aircraft, corrected for position and instrument error. CAS is equal to true airspeed in standard atmosphere at sea level.

KCAS - CAS, expressed in "Knots".

GS - Ground Speed is the speed of an airplane relative to the ground.

IAS - Indicated Airspeed is the speed of an airplane as shown on a pitot static airspeed indicator.

KIAS - Indicated Airspeed expressed in "Knots".

TAS - True Airspeed is the airspeed of an airplane relative to undisturbed air which is the CAS corrected for altitude, temperature and compressibility.

V_A - Maneuvering Speed is the speed below which application of full available aerodynamic control is unlikely to overstress the airplane.

V_{FE} - Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a precribed extended position.

V_{NE} - Never Exceed Speed is the speed limit that may not be exceeded at any time.

V_{NO} - Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.

V_S - Stalling Speed or the minimum steady flight speed at which the airplane is controllable.

V_{SO} - Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration.

V_X - Best Angle-of-Climb speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.

V_Y - Best Rate-of-Climb speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time.

b) Meteorological Terminology

ISA - International Standard Atmosphere in which:
- the air is a dry perfect gas;
- the temperature at sea level is 15°C (59°F);
- the pressure at sea level is 1013.2 hpa (mb) (29.92 inches HG);
- the temperature gradient from sea level to the altitude at which the temperature is -56.5°C (-69.7°F) is -0.00198°C (-0.003566°F) per foot and zero above that altitude.

OAT - Outside Air Temperature.

Indicated Pressure Altitude
- The number actually read from an altimeter when the barometric subscale has been set to 1013.2 hpa (mb) (29.92 in. HG).

Pressure Altitude
- Altitude measured from standard sea level pressure (29.92 in. HG or 1013.2 hpa (mb)) by a pressure or barometric altimeter. It is the indicated pressure altitude corrected for position and instrument error. In this handbook altimeter instrument errors are assumed to be zero.

Station Pressure
- Actual atmospheric pressure at field elevation.

Wind - The wind velocities recorded as variables on the charts of this handbook are to be understood as the headwind or tailwind components of the reported winds.

c) Power Terminology

Takeoff Power
- Maximum power permissible for takeoff.

Maximum Continuous Power
- Maximum power permissible continuously during flight.

Maximum Climb Power
- Maximum power permissible during climb.

Maximum Cruise Power
- Maximum power permissible during cruise.

CHT - Cylinder Head Temperature.

EGT - Exhaust Gas Temperature.

d) Airplane Performance and Flight Planning Terminology

Climb Gradient
- The demonstrated ratio of the change in height during a portion of a climb, to the horizontal distance traversed in the same time interval.

Demonstrated Crosswind Velocity
- The demonstrated crosswind velocity is the velocity of the crosswind component for which adequate control of the airplane during take-off and landing was actually demonstrated during certification tests.

e) Weight and Balance Terminology

Reference Datum
- An imaginary vertical plane from which all horizontal distances are measured for balance purposes.

Arm
- The horizontal distance from the reference datum to the center of gravity (C.G.) of an item.

Moment - The product of the weight of an item multiplied by its arm.

Center of Gravity (C.G.)
- The point at which an airplane would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.

C.G. Arm
- The arm obtained by adding the airplane's individual moments and dividing the sum by the the total weight.

C.G. Limits
- The extreme center of gravity locations within which the airplane must be operated at a given weight.

Usable Fuel
- Fuel available for flight planning (without reserve fuel).

Unusable Fuel
- Fuel remaining after a runout test has been completed in accordance with governmental regulations.

Standard Empty Weight
- Weight of a standard airplane including unusable fuel, full operating fluids and full oil according to the actual weighing report.

Maximum Takeoff Weight
- Maximum weight approved for the start of the takeoff run (according to the operating category of the aircraft).

1.19 Conversion Factors

MULTIPLY	BY	TO OBTAIN
atmospheres [atm]	760	mm Hg
	29.92	in. Hg
	1.0133	bar
	1.033	kg / cm²
	14.70	lb./sq. in.
	2116	lb./sq. ft.
bars [bar]	0.98692	atm
	14.503768	lb./sq. in
centimeters [cm]	0.3937	in.
	0.032808	ft.
cubic centimeters [cm^3]	0.03381	fl. oz.
	0.06102	cu. in.
	3.531×10^{-5}	cu.ft.
	0.001	l
	2.642×10^{-4}	U.S. gal.
cubic feet [cu.ft.]	28317	cm^3
	0.028317	m^3
	1728	cu. in.
	0.037037	cu.yd.
	7.481	U.S. gal.
	28.32	l
cubic feet per minute [cu.ft./min.]	0.472	l/sec.
	0.028317	m^3/min.
cubic inches [cu.in.]	16.39	cm^3
	1.639×10^{-5}	m^3
	5.787×10^{-4}	cu.ft.
	0.5541	fl.oz.
	0.01639	l
	4.329×10^{-3}	U.S.gal.
	0.01732	U.S.qt.
cubic meters [m^3]	61024	cu.in.
	1.308	cu.yd.
	35.3147	cu.ft.
	264.2	U.S.gal.
feet [ft.]	30.48	cm
	0.3048	m
	12	in.
	0.33333	yd.
	1.894×10^{-4}	st. M.
	1.645×10^{-4}	NM

feet per minute [ft./min.]	0.01136	mph
	0.01829	km/h
	0.508	cm/sec.
	0.00508	m/sec.
gallons, Imperial [Imperial gal.]	277.4	cu.in.
	1.201	U.S.gal.
	4.546	l
gallons, U.S. liquid [U.S.gal.]	231	cu.in.
	0.1337	cu.ft.
	4.951×10^{-3}	cu.yd.
	3785.4	cm^3
	3.785×10^{-3}	m^3
	3.785	l
	0.83268	Imperial gal.
	128	fl.oz.
grams [g]	0.001	kg
	2.205×10^{-3}	lb.
grams per cubic centimeter [g/cm^3]	1000	kg/m^3
	0.03613	lb./cu.in.
	62.43	lb./cu.ft.
horsepower [hp]	33000	ft.-lb./min.
	550	ft.-lb./sec.
	76.04	m•kg/sec.
	1.014	PS
	0.7458	kW
horsepower, metric	75	m•kg/sec.
	0.9863	hp
	0.7355	kW
inches [in.]	25.40	mm
	2.540	cm
	0.0254	m
	0.08333	ft.
	0.027777	yd.
inches of mercury at O°C [in.Hg]	0.033421	atm
	0.4912	lb./sq.in.
	70.73	lb./sq.ft.
	345.3	kg/m^2
	2.540	cm Hg
	25.40	mm Hg
kilograms per cubic meter [kg/m^3]	0.06243	lb./cu.ft.
	0.001	g/cm^3

kilograms [kg]	2.204622	lb.
	1000	g
kilograms per square centimeter [kg/cm²]	0.9678	atm
	28.96	in.Hg.
	14.22	lb./sq.in.
	2048	lb.sq.ft.
kilograms per square meter [kg/m²]	2.896 x10^{-3}	in.Hg
	1.422 x10^{-3}	lb./sq.in
	0.2048	lb./sq.ft.
kilometers [km]	1 x 10^{-5}	cm
	3280.8	ft.
	0.6214	st. M.
	0.53996	NM
kilometers per hour [km/h]	0.9113	ft./sec.
	58.68	ft./min.
	0.53996	kts
	0.6214	mph
	0.27778	m/sec.
	16.67	m/min.
kilowatts [kW]	1.3596	PS
	1.341	hp
knots [kts]	1	nautical mph
	1.689	ft./sec.
	1.1516	statute mph
	1.852	km/h
	0.51444	m/sec.
liters [l]	1000	cm^3
	61.02	cu.in.
	0.03531	cu.ft.
	33.814	fl.oz.
	0.264172	U.S.gal.
	0.2200	Imperial gal.
	1.05669	qt.
liters per second [l/sec.]	2.12	cu.ft./min.
meters [m]	39.37	in.
	3.280840	ft.
	1.0936	yd.
	6.214 x10 $^{-4}$	st. M.
	5.3996 x 10^{-4}	NM
meter-kilograms [m•kg]	7.23301	ft.-lb.
	86.798	in.-lb.

meters per second [m/sec.]	3.280840	ft./sec.
	196.8504	ft./min.
	2.237	mph
	3.6	km/h
miles, statute [st.M.]	5280	ft.
	1.6093	km
	1609.3	m
	0.8684	NM
miles per hour [mph]	44.7041	cm/sec.
	4.470×10^{-1}	m/sec.
	1.467	ft./sec.
	88	ft./min.
	1.6093	km/h
	0.8684	kt
nautical miles per hour [NMph]	51.446	cm/sec.
	5.145×10^{-1}	m/sec.
	1.688	ft./sec.
	101.271	ft./min.
	1.852	km/h
millibars [mb]	2.953×10^{-2}	in.Hg
millimeters [mm]	0.03937	in.
millimeters of mercury at 0°C [mm Hg]	0.03937	in.Hg
nautical miles [NM]	6080	ft.
	1.1516	st. M.
	1852	m
	1.852	km
ounces, fluid [fl.oz.]	29.57	cm^3
	1.805	cu.in.
	0.0296	l
	0.0078	U.S.gal.
pounds [lb.]	0.453592	kg
	453.6	g
pounds per cubic inch [lb./cu.in.]	1728	lb./cu.ft.
	27.68	g/cm^3
pounds per square foot [lb./sq.ft.]	0.01414	in.Hg
	4.88243	kg/m^2
	4.725×10^{-4}	atm

pounds per square inch [psi oder lb./sq.in.]	5.1715	cm Hg
	2.036	in.Hg
	0.06804	atm
	0.0689476	bar
	703.1	kg/m²
quart, U.S.[qt.]	0.94635	l
	57.749	cu.in.
revolutions per minute [RPM or rev./min.]	0.1047	rad./sec.
square centimeters [cm²]	0.1550	sq.in.
	0.001076	sq.ft.
square feet [sq.ft.]	929	cm²
	0.092903	m²
	144	sq.in.
	0.1111	sq.yd.
	2.296×10^{-5}	acres
square inches [sq.in.]	6.4516	cm²
	6.944×10^{-3}	sq.ft.
square kilometers [km²]	0.3861	(st.M.)²
square meters [m²]	10.76391	sq.ft.
	1.196	sq.yd.
square miles [sq.mi.]	2.590	km²
yards [yd.]	0.9144	m
	3	ft.
	36	in.

Table of Contents

Section 2

Limitations

2.1 General

This section provides the "German LBA-approved" operating limitations, instrument markings, color coding and basic placards necessary for the safe operation of the airplane and its systems.

Limitations associated with those optional systems and equipment which require handbook supplements can be found in Section 9 (Supplements).

2.3 Airspeed Limitations

Speed	IAS km/h (kts)	Remarks
V_A Design Maneuvering Speed Utility Acrobatic	 212 (114) 237 (128)	Do not make full or abrupt control movements above this speed.
V_{FE} Max. Flaps Extended Speed	 208 (112)	Do not exceed this speed with the flaps extended.
V_{NE} Never Exceed Speed	 341 (184)	Do not exceed this speed in any operation.
V_{NO} Maximum Structural Cruising Speed	 248 (134)	Do not exceed this speed except in smooth air and then only with caution.

2.5 Airspeed Indicator Markings

Marking	IAS km/h	IAS kts	Meaning
white arc	95 - 208	51 - 112	Flap down Operating Range
blue radial line	145	78	Recommended climb speed
green arc	97 - 248	52 - 134	Normal Operating Range
yellow arc	248 - 341	134 - 184	Caution Range "only in smooth air"
red radial line	341	184	Never Exceed

2.7 Power Plant Limitations

a)	Number of engines	1
b)	Engine manufacturer	Lycoming
c)	Engine model	AEIO - 360 B1F
d)	Engine operating limits	
	Rated output power	180 HP/134.2 KW
	Rated output rotation speed during take-off and climb	2700 RPM
	Max. continous rotation speed	2500 RPM

e) Oil pressure

minimum	1,7 bar	(25 PSI)
normal (green arc)	4,1 - 6,2 bar	(60 - 90 PSI)
maximum	6,9 bar	(100 PSI)

f) Fuel pressure

minimum	0,97 bar	(14 PSI)
normal (green arc)	0,97 - 3,10 bar	(14 - 45 PSI)
maximum	3,10 bar	(45 PSI)

g) Oil temperature

minimum (not for continuous operation)	40 - 60 °C
normal (green arc)	60 - 118 °C
maximum	118 °C

h) suction indicator (if installed)

normal (green arc)	4.5-5.4 inch HG

i) Cylinder head temperature (if installed)

minimum	66 °C
normal (green arc)	66 - 260 °C
maximum	260 °C
For maximum engine service life avoid temperatures during continous operation	204 - 260°C

j)	Fuel grade (min. 100 octane)	Avgas 100 or 100 LL
k)	Oil specification (see page 1 - 5)	MIL-L-6082 or MIL-L-22851
l)	Number of propellers	1
m)	Propeller manufacturer	Hoffmann
n)	Propeller model	HO-V343 K()-V/180FP

o) Propeller diameter 1,80 m (5.9 ft)

p) Propeller pitch at 0,75•R 1,35 m (4.4 ft)

q) Propeller rotation speed limitations

during take-off 2700 RPM
maximum continuous 2700 RPM

2.11 Power Plant Instrument Markings

	red line	yellow arc caution-	green arc normal- Range	yellow arc caution-	red line
Tachometer [RPM]			1800-2500	2500-2700	2700
Oil temperature [°C]		40 - 60	60-118		118
Oil pressure [bar] (PSI)	1,7 (25)	1,7-4,1 (25-60)	4,1-6,2 (60-90)	6,2-6,9 (90-100)	6,9 (100)
Fuel pressure [bar] (PSI)	0,97 (14)		0,97 - 3,10 (14 - 45)		3,10 (45)
Fuel capacity [ltr] (US.gal) (Imp.gal.)		0 - 22 (0 - 5.81) (0 - 4.84)			
Suction [inch HG](PSI)			4,5-5,4 (2.2 - 2.65)		
Cylinder head temperature [°C]		0 - 66	66-260		260
Voltmeter [V]		16 - 20	20-30	30-32	32
Amperemeter [A]	-20	-20 to -10	-10 to 10	10-20	20

2.13 Weight Limits

Maximum take-off and landing weight	Utility	990 kg	(2182 lbs)
	Acrobatic	920 kg	(2028 lbs)
Maximum baggage in baggage compartment		55 kg	(121 lbs)

Acrobatic and spin maneuvers are approved without baggage only!

2.15 Center of Gravity Limits

Acrobatic		Distance from Datum [mm] (ft)
forward limit		
at 920 kg (2028 lbs)	17.60 % l_μ	219 (.718)
at 750 kg (1653 lbs)	15.90 % l_μ	197 (.646)
aft limit		
at 920 kg (2028 lbs)	23.77 % l_μ	295 (.968)
at 750 kg (1653 lbs)	23.20 % l_μ	288 (.945)
Utility		
forward limit		
at 990 kg (2182 lbs)	18.30 % l_μ	227 (.745)
at 750 kg (1653 lbs)	15.90 % l_μ	197 (.646)
aft limit		
at 990 kg (2182 lbs)	24.00 % l_μ	298 (.978)
at 750 kg (1653 lbs)	23.20 % l_μ	288 (.945)

Datum: Wing leading edge = QE 2480
l_μ: Mean aerodynamic chord = 1,242 m (4.075 ft)
Horizontal reference : Canopy sill

2.17 Maneuver Limits

The approved flight maneuvers for the **Acrobatic-Category** are detailed listed in Chapter 4 " Normal Procedures ".
Entry speed according to flight maneuver !
Inverted flights are approved for a maximum of 3 min.

WARNING
At airspeeds in excess of V_A do not apply abrupt and full control inputs! Snap roll maneuvers <u>are not</u> approved !

Utility Category :
<u>Flight maneuver :</u> Lazy Eight / Chandelle / Steep turns
Entry Speed: 245 km/h [132 kts]
Intentional spins with flap setting at 0° are approved only.
Spins <u>without</u> wheel fairings are not approved.
Recommended entry speed: ≈ 100 km/h [54 kts]

2.19 Flight Maneuvering Load Factors

	Maximum load factor	
Acrobatic (920 kg) [2028 lbs]		
Flaps retracted	+ 6,00 g	- 3,00 g
Flaps extended	+ 3,80 g	
Utility (990 kg) [2182 lbs]		
Flaps retracted	+ 4,40 g	- 1,76 g
Flaps extended	+ 3,80 g	

2.21 Seating Capacity

Number: 2

The seat of the pilot in command is the left hand seat or may be determined by the owner of the aircraft ! If the aircraft is flying single-seated, use only the left seat.

2.23 Kinds of Operation Limits

VFR / IFR day and night (with required equipment).

Flights in known icing conditions are not approved.

Flights below -10°C (OAT) are not authorised, without „cold weather kit" connected to the icing protected breather line or without the optional equipped „anti-icing box".
(pay attention to Page 7-9)

Compliance with cooling requirements according to FAR P.23 have been demonstrated up to 40°C.

NOTE
The attitude indicator will show an incorrect or false indication during flight maneuvers (e.g. spinning). To achieve a faultless function of the instrument, a level flight of approx. 20 min. will be recommended. Check that the attitde indicator is stabilized. During this period of time use only the turn coordinator and/or the directional indicator. This is advisible during abnormal flight maneuvers (e.g. high rate of roll during turbulence).

The combination of the aircraft crew must refer to national regulations.
(in Germany:" Betriebsordnung für Luftfahrtgerät § 32 ")

Kinds of Operation Equipment List
This airplane may be operated in VFR / IFR day and night when the appropriate equipment is installed and operable.

It is not intented to install an autopilot for IFR operation. (in Germany:" observe § 32 [4] Luft BO ! ")

The following equipment list identifies the systems and equipment upon which type certification for each kind of operation was predicated. The following systems and items of equipment must be installed and operable for the particular kind of operation indicated.

The ATA numbers refer to equipment classifications of Air Transport Association Specification Code 100.

	VFR-Day SR-SS	VFR-Night	IFR acc. FAR *	IFR-Day	IFR-Night
Communications (ATA-23)					
1. Communication Radio (VHF)	1	1	1	2	2
Electrical Power (ATA-24)					
1. Battery	1	1	1	1	1
2. D.C. Generator	1	1	1	1	1
3. D.C. Loadmeter	1	1	1	1	1
4. D.C. Generator Warning Light	1	1	1	1	1
Flight Controls (ATA-27)					
1. Flap System	1	1	1	1	1
2. Flap Position Indicator	1	1	1	1	1
3. Horizontal Stabilizer Trim System	1	1	1	1	1
4. Stall Warning Horn	1	1	1	1	1
Fuel (ATA-28)					
1. Fuel Boost Pumps	1	1	1	1	1
2. Fuel Quantity Indicator	1	1	1	1	1
3. Fuel Pressure	1	1	1	1	1
Ice and Rain Protection (ATA-30)					
1. Pitot Heat	0	0	1	1	1
2. Alternate Static Air Source	0	0	1	1	1
Instruments (ATA-31)					
1. Clock	0	0	1	1	1

	VFR-Day SR-SS	VFR-Night	IFR acc. FAR *	IFR-Day	IFR-Night
Lights (ATA-33)					
1. Cockpit and Instruments (Required Illumination)	0	1	1	0	1
2. Anti-Collision Light	2	2	2	2	2
3. Landing Light	0	0	0	0	2
4. Position Light	0	4	4	0	4
Navigation (ATA-34)					
1. Altimeter	1	1	1	2	2
2. Airspeed	1	1	1	1	1
3. Magnetic Compass	1	1	1	1	1
4. Outside Air Temperature	1	1	1	1	1
5. Attitude Indicator	0	0	1	1	1
6. Directional Indicator	0	0	1	1	1
7. Turn and Bank Indicator	0	0	1	1	1
8. Vertical Speed Indicator	1	0	1	1	1
9. ADF	0	0	0	1	1
10. Navigation Radio (VOR)	0	1	1	2	2
11. DME	0	0	0	1	1
12. Transponder (ATC)	0	1	0	1	1
Only for ILS-Approach:					
13. Localizer	0	0	0	1	1
14. Glide slope	0	0	0	1	1
15. Marker	0	0	0	1	1
Vacuum System (ATA-37)					
1. Suction or Pressure Gauge	0	0	1	1	1
Engine Indicating (ATA-77)					
1. Tachometer Indicator (Engine)	1	1	1	1	1
2. Cylinder Head Temperature	0	1	1	1	1
3. Carburetor Heat Temp.	0	0	0	1	1
4. Manifold pressure	1	1	0	1	1
5. Fuel flow & Fuel pressure	1	1	1	1	1
Engine Oil (ATA-79)					
1. Oil Temperature Indicator	1	1	1	1	1
2. Oil Pressure Indicator	1	1	1	1	1

NOTE : The valid operational requirements have priority over this list. The zeros (0) used in the above list mean that the equipment and/or system was not required for that kind of operation. * IFR-equipment and instrument requirements according to FAR Part 91 § 91.205 (b) through (f).

2.25 Fuel Limitations

Total capacity (nominal value)	150 liters (39.63 US.gal.)/(33.00 Imp.gal.)
Wing tank capacity	each 75 liters (19.81 US.gal.)/(16.50 Imp.gal.)
Sump tank fuel capacity	5.4 liters (1.43 US.gal.)/(1.19 Imp.gal.)
Unusable fuel	7 liters (1.85 US.gal.)/(1.54 Imp.gal.)
Usable fuel	143 liters (37.77 US.gal.)/(31.46 Imp.gal.)
Tankasymmetry	max. 20 liters (5.28 US.gal.)/(4.40 Imp.gal.)

Never takeoff when fuel gauge indication of the tank in use is in yellow arc!

2.41 Placards

On LH cabin wall:

L i m i t a t i o n s	
Category	Acrobatic airplane
Max. weight	920 kg (2028 lbs)
Max. flight maneuvering load factors (flaps UP)	+6,00 g -3,00 g
(flaps DOWN)	+3,80 g
Never exceed speed V_{NE} [IAS]	341 km/h (184 kts)
Max. structural cruising speed V_{NO} [IAS]	248 km/h (134 kts)
Design maneuvering speed V_A [IAS]	237 km/h (128 kts)
Max. flaps extended speed V_{FE} [IAS]	208 km/h (112 kts)
Intentional spins without wheel fairings or with extended flaps are not approved !	

RH and LH on canopy frame:

NO SMOKING

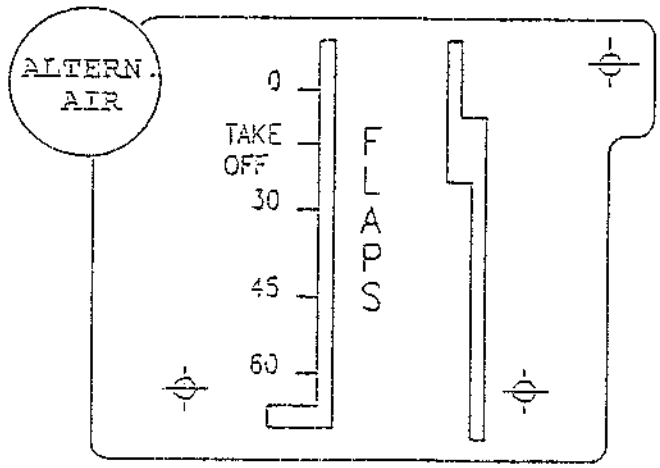
On instrument panel:

Design maneuvering speed V_A
Acrobatic: 237 km/h IAS
(128 kts)

On instrument panel: e.g.

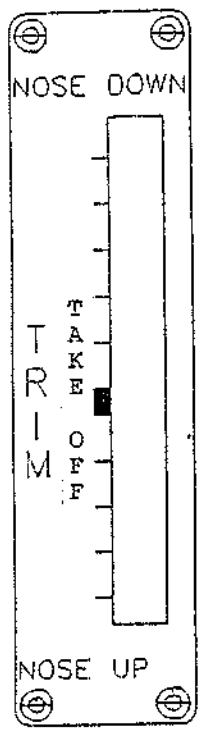
D - EECR

On flap indicator:
On alternative air:



On parking brake lever:

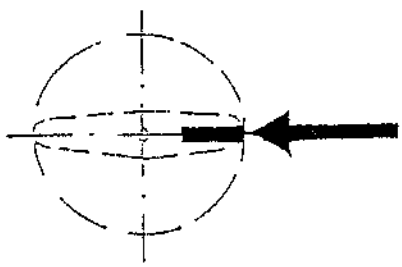
On trim indicator:



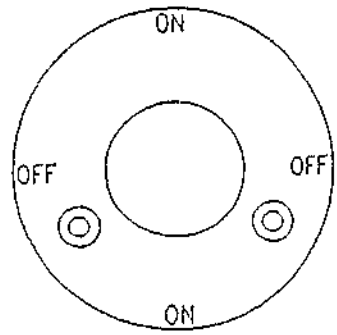
At the headset plugs between the seats:

PILOT COPILOT

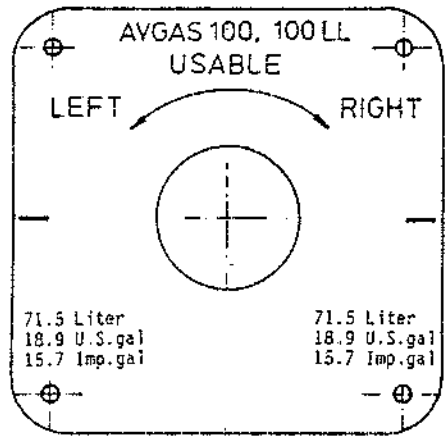
On fuel filler cap:



On fuel cock:



On fuel tank selector:



On baggage compartment:

Baggage max. 55 kg (121 lbs)
No baggage during acroba- tics and spin maneuvers !

On access hole in the top cowling:

Oil capacity:	min. 5,7 Liter	(1.51 US.gal.) (1.25 Imp.gal.)
	max. 7,6 Liter	(2.0 US.gal.) (1.67 Imp.gal.)
Oil grades see airplane flight manual		

On external power plug:

External power supply 24 V DC

On fuel filler cap:

AVGAS 100, 100 LL
Total 75 liters
(19.81 US.gal.)
(16.50 Imp.gal.)

On alternate static:
(only for Australia)

NORMAL	ALTERNATE

On main wheel fairing or on landing gear shock strut:

3,0 bar
(43.5 PSI)

On nose wheel fairing or on nose wheel fork:

2,5 bar
(36 PSI)

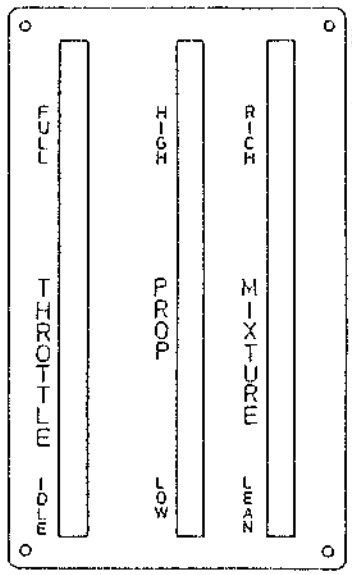
On lower wing side near drain valve:
(only for Australia)

DRAIN FUEL DAILY

On static ports at the fuselage:
(only for Australia)

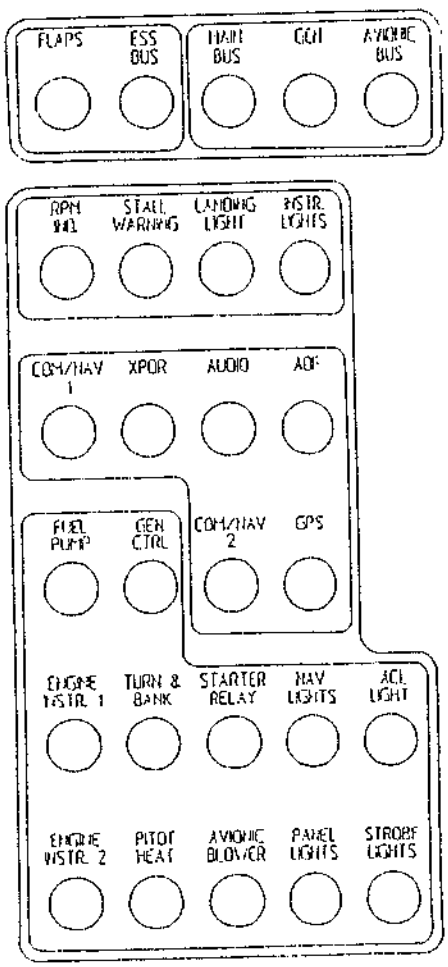
STATIC VENT

On throttle, mixture and propeller lever:

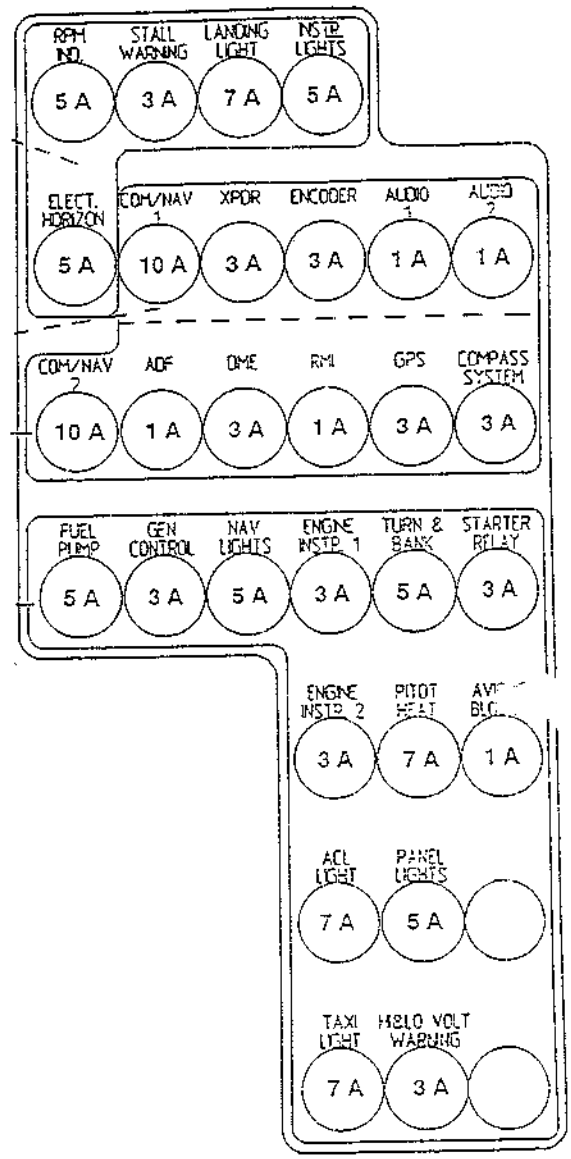


On ignition switch:

At the circuit breaker panels for VFR-operation:



At the circuit breaker panels for IFR-operation:



Button on the magnetic compass:

Calibration was made with the radios ON !

Deviation table (in vicinity of magnetic compass):

TO FLY	N	30	60	E	120	150
STEER						
TO FLY	S	210	240	W	300	330
STEER						

DATE GROB

On toggle switch for alternate static (if equipped):

On both flaps:

NO STEP

On canopy lock (inside and outside):

OPEN CLOSED

On canopy lever (outside):

PULL TO OPEN

On both sides of the rudder (bottom):

DO NOT LIFT

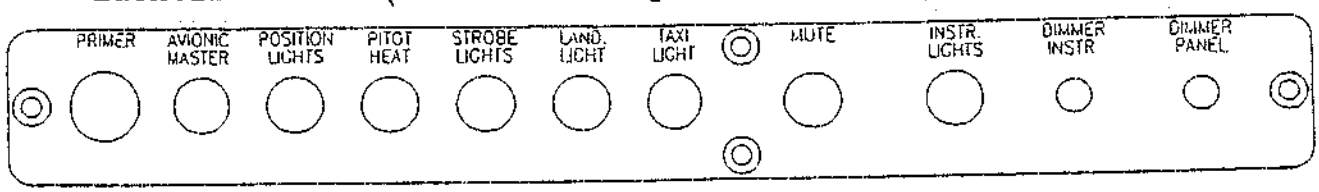
Near the VHF-Transceivers:

COM I COM II

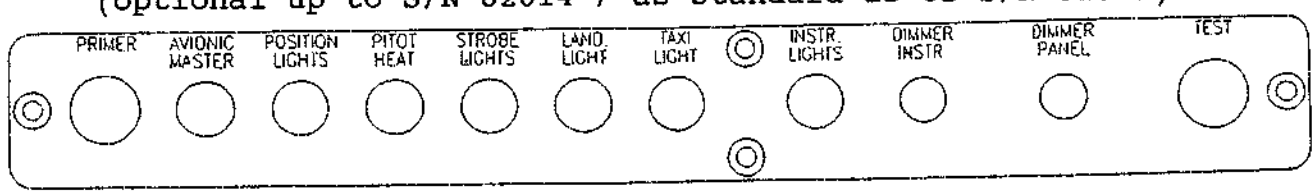
Beside the lower instrument panel switches:

ON OFF

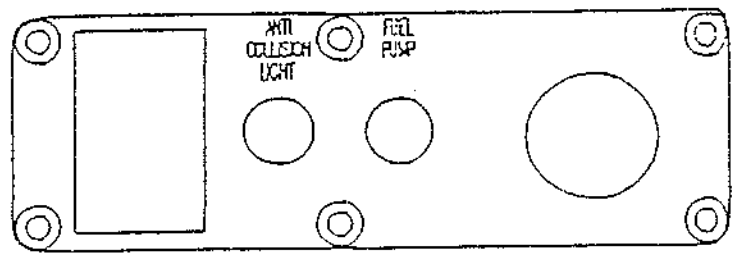
Lower instrument panel switches / (as equipped) identification (as standard up to S/N 82014) :



Lower instrument panel switches / (as equipped) identification (optional up to S/N 82014 / as standard as of S/N 82015) :



LH instrument panel switch identification (as equipped):



Above master switch:

MASTER SWITCH

All toggle switches are function-identified.

On brake fluid reservoir:

MIL-H 5606

On baggage compartment:
(only for Australia)

FLIGHT MANUAL STOWAGE

On right hand cabin wall:

The markings and placards installed in this airplane contain operating limitations which must be complied with when operating this airplane in the ACROBATIC category. Other operating limitations which must be complied with when operating this airplane in this category or in the UTILITY category are contained in the Airplane Flight Manual.

On right hand cabin wall:

This airplane is certified for the following flight operations:

VFR/IFR day and night (with required equipment). Flights into known icing conditions are prohibited.

At the lower cowling near the exhaust:

On canopy lever inner side:
(only for Australia)

E X I T

Control lock:

REMOVE LOCKING PIN BEFORE STARTING ENGINE

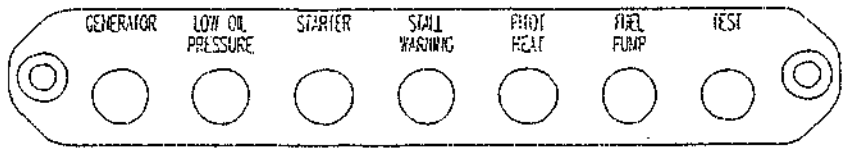
On hourmeter:

FLIGHT HOURS

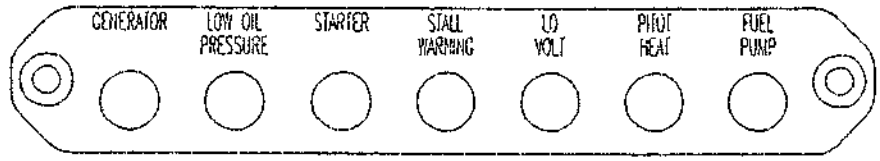
On engine hour meter:

ENGINE HOURS

On anunciator panel (as standard up to S/N 82014) :



On anunciator panel (optional up to S/N 82014 / as standard as of S/N 82015) :



On heating lever:

On red emergency lever:

CANOPY JETTISON : 1. PULL RED HANDLE 2. CANOPY HANDLE FULLY BACK 3. PUSH CANOPY TO THE REAR TOP

On instrument panel:

SPIN RECOVERY :	
1. Throttle	IDLE
2. Rudder	FULL OPPOSITE
3. Aileron	NEUTRAL OR INTO SPIN DIRECTION
4. Elevator	NEUTRAL

On left canopy frame:

Acrobatic airplane	Entry Speed [kts]
Spin	54 - 97
Inverted Spin	81 - 97
Loop positive	119 - 132
Turn (hammerhead)	119 - 132
Immelmann	132
Split-S (nose raise 45°)	132
Split-S	86
Tail Slide	108 - 132

Acrobatic airplane	Entry Speed [kts]
Cuban-Eight	132
Slow Roll	127
Steep Turn	127
Aileron Roll	127
Barrel Roll (pos./neg.)	132
Lazy Eight	132
Chandelle	132
Knife Edge	127

On instrument panel:
(if gauge installed)

FUEL FLOW [US.gal./h]
- Take off/climb V_Y
- Standard altitude
- Full throttle

MSL	:	15.0
2000 ft	:	14.3
4000 ft	:	13.4
6000 ft	:	12.8
8000 ft	:	12.1

On instrument panel:

Never take-off if fuel gauge indication is in yellow arc !

Placards only for UTILITY-CATEGORY :

Design maneuvering speed V_A
Utility: 212 km/h IAS
(114 kts)

Limitations	
Category	Utility-airplane
Max. weight	990 kg (2182 lbs)
Max. flight maneuvering load factors (flaps UP)	+4,40 g -1,76 g
(flaps DOWN)	+3,80 g
Never exceed speed V_{NE} [IAS]	341 km/h (184 kts)
Max. structural cruising speed V_{NO} [IAS]	248 km/h (134 kts)
Design maneuvering speed V_A [IAS]	212 km/h (114 kts)
Max. flaps extended speed V_{FE} [IAS]	208 km/h (112 kts)
Intentional spins without wheel fairings or with extended flaps are not approved ! **For intentional spinning a MTOW of 920 kg (2028 lbs) may not be exceeded !**	

Approved flight maneuvers in the utility category:
Lazy Eight / Chandelle / Steep turns
Entry Speed: 245 km/h [132 kts]
Intentional spins with flap setting at 0° are approved only. Spins without wheel fairings are not approved. Recommended spin entry speed:
≈ 100 km/h [54 kts]
For intentional spinning a MTOW of 920 kg (2028 lbs) may not be exceeded !

2.43 Colour

Painting of the GROB G 115D must accord to the colour specification GPS 1078/1.

Changing the paint colour and the paint thickness is only permissible after prior approval by the manufacturer of the airplane.

Table of Contents

Section 3

Emergency Procedures

Table of Contents (continued)

Table of Contents (continued)

3.1 General

This section contains procedures in the form of checklists and amplified emergency procedures for coping with an emergency situation.

Emergency situations due to aircraft or engine malfunctioning are extremely rare, as long as the preflight inspection and maintenance tasks have been carried out properly. Inflight emergencies due to inclement weather conditions are very seldom and can practically be precluded as long as the flight has been carefully planned in advance and changes in the weather duly anticipated.

Should, however, an emergency situation arise, the procedures must be in accordance with the directives of this section to the extent necessary to overcome the situation.

All data of this section are refered to a flight mass of 990 kg (2182 lbs) unless other masses are stated.

3.3 Airspeeds for Emergency Operations

	V_{IAS} [km/h]	V_{IAS} [kts]
Engine Failure after Take Off		
Flaps retracted	135	73
Flaps in take off position	130	70
Recommended gliding speed		
(flaps retracted / 990 kg / 2182 lbs)	130	70
Precautionary landing (power on)	130	70
Emergency landing (power off)		
Flaps retracted	135	73
Flaps extended (60°)	130	70

WARNING

The stall warning horn will not function with the master switch in position " OFF ".

3.5 Emergency Procedures Check List

ENGINE FAILURE

DURING TAKE OFF (roll)

1. Throttle	IDLE
2. Brakes	OPERATE AS NECESSARY

Actions in case the aircraft is departing from the runway:

3. Mixture	LEAN CUT-OFF
4. Fuel cock	OFF
5. Ignition	OFF
6. Master switch	OFF

DURING TAKE OFF (if airborne)

I. Engine power insufficient to continue flight

1. Airspeed	130 - 135 km/h (70 - 73 kts)
2. Fuel cock	ON
3. Fuel tank selection	CHECK
4. Both magnetos	ON
5. Electrical fuel pump	ON
6. Fuel pressure	CHECK
7. Mixture	CHECK
8. Propeller	HIGH RPM
9. Throttle	CYCLE

If there is no improvement

10. Mixture	LEAN CUT-OFF
11. Fuel cock	OFF
12. Ignition	OFF

If sure that the chosen landing area will be reached:

13. Flaps	60°
14. Emergency radio call	IF POSSIBLE
15. Master switch	OFF

Make emergency landing as straight ahead if possible!

II. Engine failure

1. Fuel cock	OFF
2. Throttle	FULL THROTTLE

Shortly before touchdown:

3. Flaps	60°
4. Mixture	LEAN CUT-OFF
5. Ignition	OFF
6. Master switch	OFF

IN FLIGHT

Restart of the failed engine:

1. Airspeed	MAINTAIN BLUE LINE MAX. 120 kts
2. Fuel cock	CHECK / ON
3. Fuel tank selection	CHECK / MOST CONTENT
4. Throttle	1/4 OPEN
5. Mixture	AS REQUIRED (FULL LEAN FOR WET START)
6. Propeller	HIGH RPM
7. Electrical fuel pump	ON
8. Alternative air	WARM (PULL)
9. Ignition If prop is not windmilling	BOTH START

Engine Roughness

1.	Alternative air	WARM (PULL)
2.	Mixture	FULL RICH OR AS NECESSARY
3.	Propeller	HIGH RPM
4.	Electrical fuel pump	ON
5.	Magnetos	CHECK
6.	If roughness not cured	LAND AS SOON AS POSSIBLE

EMERGENCY LANDINGS

POWER OFF LANDING

1.	Airspeed (flaps up) (flaps down)	 135 km/h (73 kts) 130 km/h (70 kts)
2.	Fuel cock	OFF
3.	Ignition	OFF
4.	Mixture	LEAN CUT-OFF
5.	Electrical fuel pump	OFF
6.	Flaps	AS REQUIRED
7.	Emergency radio call	IF POSSIBLE
8.	Master switch	OFF

POWER ON LANDING

1.	Emergency landing location	SEEK
2.	Announce your emergency landing intention and the position of the landing location on the radio to a suitable authority, if possible.	
3.	Speed	135 km/h (73 kts)
4.	Flaps	15°/Flaps in START
5.	Fly over selected area, check prevailing conditions and over shoot suitability.	
6.	Seat belts and harness	TIGHT

7.	Flaps (final approach)	60°
8.	Airspeed	130 km/h (70 kts)
9.	Master switch	OFF
10.	Touch down at min. speed	MAIN WHEELS FIRST 108 km/h (58 kts)
11.	Ignition	OFF
12.	Brakes	AS REQUIRED

DITCHING

1.	Radio	MAYDAY
2.	Heavy objects	SECURE
3.	Flaps	60°
4.	Seat belts and harness tight	CHECK
5.	Approach in prevailing strong wind and high seas	AGAINST THE WIND
	Approach in prevailing gentle wind and strong swell	PARALLEL TO THE SWELL
6.	Touch down	AT MIN. SPEED
7.	Canopy	OPEN
8.	Seat belts and harness	RELEASE
9.	Airplane	ABANDON
10.	Life jackets and dinghy	INFLATE

FIRE

ENGINE FIRE DURING START (not airborne)

1.	Fuel cock	OFF
2.	Electrical fuel pump	OFF
3.	Mixture	LEAN CUT-OFF
4.	Throttle	FULL THROTTLE
5.	Ignition	OFF
6.	Master switch	OFF

7. Combat fire with extinguisher

ENGINE FIRE IN FLIGHT

1. Fuel cock	OFF
2. Electrical fuel pump	OFF
3. Mixture	LEAN CUT-OFF
4. Throttle	FULL THROTTLE
5. Ignition	OFF
6. Cabin heating	OFF
7. Power off emergency landing	REFER TO PROCEDURE

ELECTRICAL FIRE IN FLIGHT

1. Master switch	OFF
2. Vents	CLOSED
3. Cabin heating	OFF
4. Fire extinguisher (if provided)	APPLY

NOTE: Ventilate cabin after using fire extinguisher in closed cabin. The canopy can be opened below 150 km/h (81 kts).

If fire is extinguished and electric power is required to continue the flight:

1. Avionics switch	OFF
2. All other switches, including all avionics switches (without the ignition switch)	OFF
3. Master switch	ON
4. Turn on all other switches as well as all circuit breaker in slow sequence until the short-circuit has been located.	

CABIN FIRE IN FLIGHT

1. Master switch OFF
2. Vents CLOSED
3. Cabin heating OFF
4. Fire extinguisher (if provided) APPLY

NOTE: Ventilate cabin after using extinguisher in closed cabin

5. Land as soon as possible and examine damage

WING FIRE IN FLIGHT

1. Position lights (if installed) OFF
2. Strobe lights (if installed) OFF
3. Perform side slip to keep flames away from cabin
4. Land as soon as possible

ICING

INADVERTANT FLIGHT INTO ICING CONDITIONS

1. Pitot heat ON
2. Change heading and/or altitude to leave icing conditions
3. Cabin heating to windshield ON
4. Increase RPM to prevent icing on prop blades (monitor RPM)
5. Alternative air ON
   (Observe manifold pressure !)
6. Prepare for landing at nearest airport.
7. If there is fast ice built up, search for emergency landing location.
8. In case of heavy icing on wing leading edge, higher stall speeds may be expected. The stall warning may give no or an incorrect warning.

LANDING WITH FLAT MAIN LANDING GEAR TIRE

1. Carry out normal approach
2. Flaps — 60°
3. Touch down on good tire first and keep flat tire from ground contact as long as possible.
4. Maintain direction by braking suitably with good tire.

SPIN RECOVERY

1. Rudder — OPPOSITE TO SPIN DIRECTION
2. Aileron — NEUTRAL OR INTO SPIN DIRECTION
3. Elevator — NEUTRAL

ABANDONING THE AIRCRAFT BY PARACHUTE / CANOPY EMERGENCY JETTISON

1. Engine — SHUT OFF
2. Red locking lever — PULL
3. Open canopy handle and move it backwards and up through the 90° position as far as the stop (approx. 170° position). This releases the two front attachment points on the guide rail.
4. Push the canopy simultaneously backwards and upwards.
5. Safety harness — RELEASE
6. Cockpit — ABANDON

ROUGH ENGINE OR POWER LOSS

The cause of engine roughness is not normally obvious. The following list of possibilities should be checked in the order listed.

ICED AIR INTAKE FILTER

1. Alternative air — WARM (PULL)
2. Mixture — ADJUST

FOULED IGNITION PLUGS

1. Set engine power 75 % BHP
2. Set the mixture to the recommended "best power up to best economy" position
3. Observe exhaust and cylinder head temperature
4. Check engine roughness after few minutes
5. Continue flight, if the engine is running smooth.
6. Land at the nearest airport, if the engine is running rough.

MAGNETO FAILURE

1. Use a richer mixture setting and check the engine characteristics.
2. Use different power settings and check engine characteristics.
3. Switch from "BOTH" to "L" and check engine roughness and/or misfiring.
4. Switch from "L" to "R" and check engine roughness and/or misfiring.
5. Use the good magneto.
6. Adjust mixture setting.
7. Avoid extended use of power settings above 65 %
8. Observe CHT and EGT
9. Land at the nearest airport

BLOCKED FUEL-INJECTION-NOZZLE

1. Mixture ENRICH
2. Power ADJUST
   (ev. partial power setting)
3. Land at the nearest airport

FAILURE OF THE PROPELLER GOVERNOR

The result is loss of control over the RPM by the RPM lever. The most likely result is low RPM and insufficient power for level flight.

LOW OIL PRESSURE

1. Check oil pressure

2. Check oil temperature

3. If the oil pressure is low (out of green arc) and oil temperature "NORMAL":
   - Land at the nearest airport.

   If a complete loss of oil pressure with increasing of oil temperature is observed:
   - Reduce engine power to a minimum.
   - Search an emergency landing field.
   - Use the minimum power to attain the emergency landing field.
   - The propeller speed will be low, the result is a poor propeller brake-action with longer than usual flare.

ELECTRICAL SYSTEM FAILURE

1. Generator warning light	CHECK
2. Voltmeter (Normal value)	CHECK 24 through 28 V

OVERVOLTAGE (exceeding 30 V)

1. Avionic switch	OFF
2. All lamps (incl. landing lights, if installed)	ON
3. Electrical fuel pump	ON
4. Voltmeter	CHECK

5. As soon as voltage drops below 30 V, switch on avionics.

ALTERNATOR FAILURE

(Indicated by red generator warning light and by ammeter fluctuating and/or pointer is at discharged position)

1. Alternator circuit breaker PULL
2. Turn off all non-essential electrical equipment
3. Reset alternator circuit breaker and terminate flight as soon as possible

EXCESSIVE CHARGING

1. Alternator circuit breaker PULL
2. Non-essential electrical equipment OFF
3. Terminate flight as soon as possible

MAIN BUS FAILURE

Should all indications show a Main Bus failure, the Essential Bus and the Avionik Bus I are further active.

STARTER RELAY FAILURE

(only if starter relay control lamp is installed)

Starter relay control lamp remains "ON" after the start-up procedure !

<u>On ground</u>

1. Start procedure ABORT
2. Starter relay CHECK

<u>In flight</u>

Terminate flight as soon as possible and check for starter relay failure!

Description of the electrical buses / Pull push circuit breakers

A description of the break down of each electrical bus and a function description after pulling a circuit breaker are as follows.
This description only supplies with the "Engine in operation" !
The circuit breakers, located in LH lower instrument panel, are of a push/pull-design. To interrupt pull and to reset push the circuit breaker.
The circuit breakers, located in the RH instrument panel, should be reset only. When interrupted a red-white ring on the circuit breaker is visible.

Break down of electrical bus :

Main Bus :
Fuel pump / Generator Control / Nav. Lights / Engine Instr.1 / Turn&Bank / Starter Relay / Engine Instr.2 / Pitot Heat / Avionic Blower / ACL Light / Panel Lights / Taxi Light / Hi&Lo Volt Warning.
Essential Bus :
Flaps / Ess Bus / RPM Ind. / Stall Warning / Landing Light / Instr. Lights / Elect. Horizon.
Avionic Bus I :
Main Bus / Generator / Avionic Bus / Com/Nav 1 / XPDR / Encoder / Audio / **Audio 2 only for IFR-operation.**
Avionic Bus II :
RMI / Com/Nav 2 / ADF / DME / Audio 2 / GPS / Compass System.

Circuit breaker "Flaps" :
After pulling this circuit breaker, the flaps are inoperable.

Circuit breaker "Ess Bus" :
During full power supply this circuit breaker is still in a "Stand-by-mode".

Circuit breakers "Ess Bus & Avionic Bus" :
The Avionic buses I and II will be switched off.

Circuit breaker "Main Bus" :
After pulling the Main Bus-Circuit breaker, all electrical buses are supplied from the generator.

Circuit breaker "Generator" :
After pulling the Generator-Circuit breaker, all electrical buses are supplied from the battery .

Circuit breaker "Avionic Bus" :
The Avionic Bus I will be supplied with power; the Avionic Bus II will be switched off.

Circuit breakers "Main Bus & Generator" :
After pulling together the Main Bus- and the Generator-Circuit breakers, the Essential Bus and the Avionic Bus I will be supplied with power.

3.7 AMPLIFIED EMERGENCY PROCEDURES

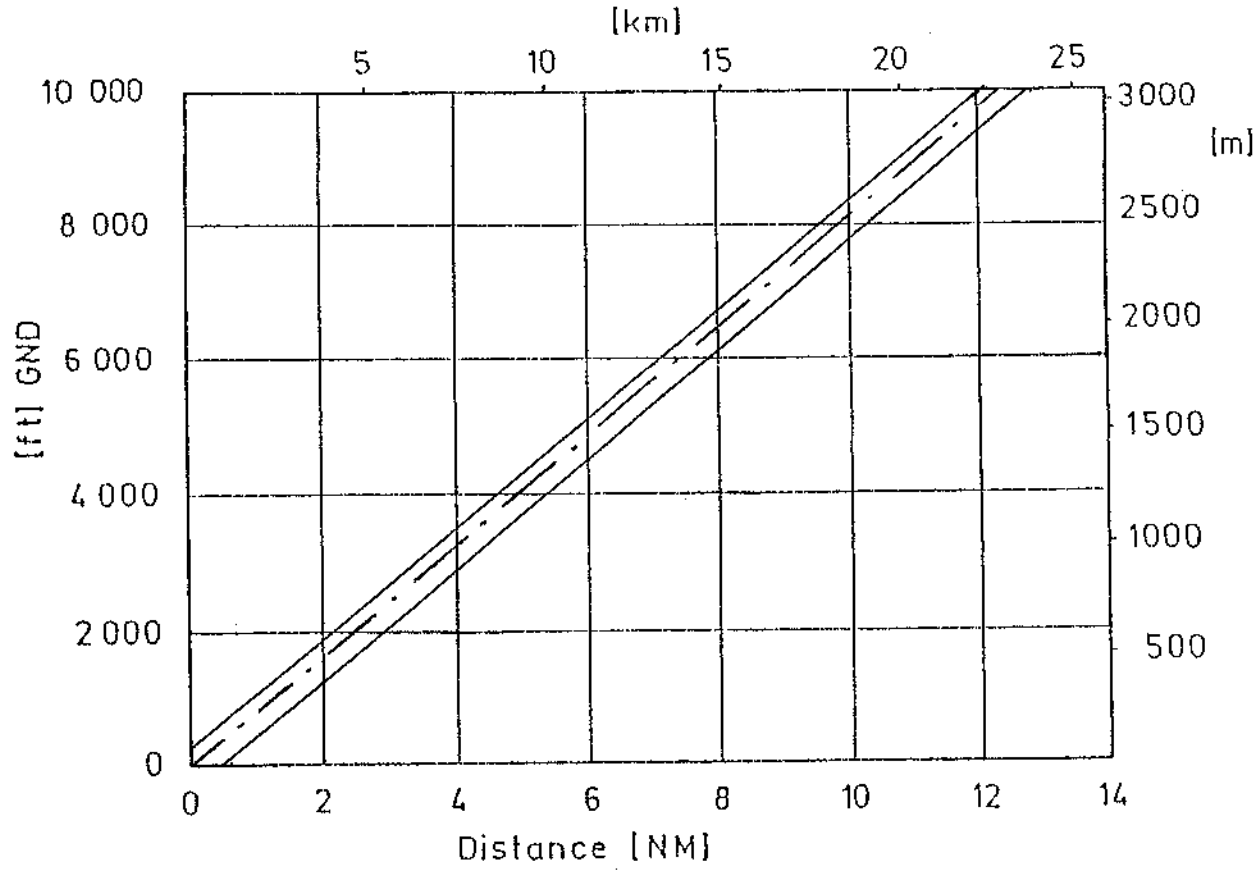
ENGINE FAILURES

If engine failure occurs before take off, it is the most important thing to bring the airplane to a stop on the remaining runway. The check list procedures enhance safety, should an emergency of this kind occur.

If engine failure occurs after take off, the first requirement is to lower the nose, because speed may have been lost during recognition of the failure it may be necessary to lower the nose more than expected. It is vital to regain safe glide speed promptly.
In most cases you proceed to a straight ahead landing with slight and gentle deviations to avoid obstacles. Altitude and speed are only seldom sufficient to carry out the necessary 180° turn in glide flight to return to the runway. The check list procedures assume that sufficient time remains to switch off the fuel supply and ignition prior to touchdown.

If engine failure occurs in flight the best glide flight speed (see also Fig. 3.1) must be attained as quickly as possible. In glide flight approach to a suitable landing location attempt to establish the cause of engine failure. If time permits, attempt to restart the engine with the aid of the check list procedures. Should the engine fail to restart, execute a power off emergency landing. By pulling the RPM lever to the "LOW" position, the L/D can be significantly improved.
Should the restart be successfull and the cause is not identified, further failures are likely and the continuation of the flight should be planned accordingly.

Fig. 3.1 Maximum Glide Distance



- windmilling Propeller
- Propeller: HIGH RPM
- Flaps up
- Calm air
- Standard altitude

Best glide speed	
Airplane weight	V (IAS)
990 kg (2182 lbs)	130 km/h (70 kts)
920 kg (2028 lbs)	125 km/h (67 kts)
850 kg (1874 lbs)	120 km/h (65 kts)
750 kg (1653 lbs)	113 km/h (61 kts)

EMERGENCY LANDING PROCEDURES

If all attempts to restart the engine have failed and an emergency landing is imminent, select a suitable landing location and prepare for landing in accordance with the check list procedures "Power Off Landing"

Before attempting to land with engine power outside of an airport, fly over the most suitable landing area at a safe height, but low enough to be able to inspect the condition of the field and to spot possible obstacles. Proceed in accordance with the check list "Power On Landing".

In preparing for ditching strap down heavy objects in the baggage compartment. Transmit " Mayday " on a frequency of 121.5 MHz indicating position and intended action. Set transponder, if provided, to 7700. Do not attempt to flare prior to touchdown, since it is difficult to assess the height of the aircraft above water.

During an emergency landing do not switch off the avionics switch and the master switch until an emergency landing is a dead certainty. Switching off too early will shut off the altimeter with coding device (if installed) and the electrical systems of the aircraft.

LANDING WITHOUT ELEVATOR CONTROL

The G 115D can be controlled from a descending attitude into a normal landing attitude by use of the elevator trim. This applies to all flap settings; a flap setting of 60° is preferable. For landings with lost elevator control, it is recommended to choose an airfield with sufficient length. Execute an approach with a RPM setting of approx. 2500 RPM. Control flaring with elevator trim and reduce power to idle shortly prior to touch down or shortly thereafter. This ensures good controllability of the nosedown pitching moment resulting from the power reduction. This procedure should be practised beforehand at a safe altitude.

LANDING WITHOUT AILERON CONTROL

If an aileron control failure occurs it is possible to enter and also to complete turns using the rudder, making sure that the speed does not drop below 130 km/h (70 kts). Should the airspeed decrease while in a turn, increase speed prior to leaving the turn. In addition the throttle can be positioned to idle to accelerate leaving the turn. Avoid bank angles in excess of 30°. If a landing must be made without lateral control, the approach must be made on idle power and without using full flaps. Such an approach should be exercised beforehand at a safe altitude.

FIRE

Although the possibility of an engine fire in flight is extremely remote, proceed in accordance with the check list should the situatuion arise and then proceed with an emergency landing. Never attempt to restart the engine under such conditions.

The first sign of a fire in the electric system is normally the smell of burning or smoldering insulation. Proceeding in accordance with the check list "Electrical Fire in Flight" is sufficient to remedy the fire.

ICING

INADVERTANT FLIGHT INTO ICING CONDITIONS

Flying into icing conditions is generally forbidden. Should this happen inadvertantly, however, the situation can be best handled by proceeding according to the check list. The best thing to do, of course, is to return, change heading and/or altitude to avoid icing.
Under an air temperature of -10°C the crankcase ventilation duct may ice up. This leads normally to an overload of the motor gaskets. Therefore the measures of the corresponding check-list must be applied under -10°C.

SPIN RECOVERY (UNINTENTIONAL SPIN)

Intentional spins without wheel fairings or with extended flaps are not approved.
Should a spin be entered unintentionally, the following procedure for spin recovery should be initiated:

1. Apply and maintain full rudder opposite to the direction of rotation.
2. Aileron — NEUTRAL OR INTO SPIN DIRECTION
3. Elevator control — NEUTRAL UNTIL ROTATION STOPS

and then

4. Rudder — NEUTRAL

Ease back on control stick to recover smoothly from the dive (Anticipated altitude loss during spin recovery is 300 m / 1000 ft).

ABANDONING THE AIRCRAFT BY PARACHUTE / CANOPY EMERGENCY JETTISON

The first action should be to close the throttle fully, then set the ignition to "OFF" and set the mixture lever to "FULL LEAN". The propeller should be "FULL FORWARD" to reduce the airspeed as much as possible. The flaps can also be used if the speed is not too high. The actual jettisoning of the canopy and the subsequent abandonment of the aircraft is initiated by pulling the red locking lever. The canopy handle is then opened and pushed backwards and up through the 90° position as far as the stop (approx. 170° position). This releases the two front attachment points on the guide rail. The canopy must now be pushed backwards using some force and at the same time pushed up and away.
The safety harness must then be released and the cockpit abandoned.

ROUGH ENGINE OR LOSS OF POWER

AIR FILTER ICING

Inexplicable loss of power can be caused by ice in the air filter (monitor the manifold pressure !)

Air filter icing : Operate the alternative air and leave it operated /set a suitable mixture.

FOULED IGNITION PLUGS

Slight engine roughness can be caused by one or more of the ignition plugs being coked or leaded up.
Remedy by turning the ignition switch briefly from the "BOTH" position to either "L" or "R". A perceptible drop in power when operating on a single magneto is a sign that an ignition plug or magneto is defective. Since an ignition plug defect is more probable, it is good practice to set the mixture to the lean value as recommended for cruising. Should this not remedy the situation within a few minutes, select a somewhat richer mixture to obtain smoother engine operation. If everthing else fails, get expert advice at the nearest airport and keep the ignition switch in the "BOTH" position, unless exceptional engine roughness necessitates using only a single magneto.

MAGNETO FAILURE

Sudden engine roughness or misfiring are usually a sign of a defective magneto. Switching the ignition switch from "BOTH" to either "L" or "R" will indicate which of the two magnetos is not working properly. If this is not the case, switch to the good magneto and have repair done at the nearest airport.

BLOCKED FUEL-INJECTION-NOZZLE

In case of blocked fuel injection nozzles, as indicated by a rough running engine, enrich the mixture. Also, readjustment of the power setting or selection of partical power may become necessary. Land at the nearest airport.

FAILURE OF THE PROPELLER GOVERNOR

If the propeller governor fails, the propeller moves to a coarse pitch position. This causes a large drop in engine RPM. Altitude can be maintained at full power. Nevertheless, a suitable landing area should be sought immediately due to the fact there is no experience indicating the expected engine life at this power setting.

LOW OIL PRESSURE

If low oil pressure occurs in conjunction with normal oil temperature, this is indicating the possibility of the oil gauge or the relief pressure valve being defective. In this case, landing at the nearest airport is recommended to have the system inspected to find out the cause of the trouble. Should a complete loss of oil pressure occur together with an increase in oil temperature, this is reason enough to suspect an imminent engine power failure. Therefore, reduce engine power without delay and search for a suitable landing field for an emergency landing, using only the minimum power to attain the field.

ELECTRICAL SYSTEM FAILURE

Trouble in the electrical system can be noticed by regularly monitoring to the ammeter and voltmeter readings, however, it is normally very difficult to find out the cause od such disturbances. The most probable cause the failure too. For instance, a faulty voltage regulator may cause the trouble. Disturbances of this kind create an "electrical emergency" requiring emergency procedures without delay.

Electrical system failures usually fall under two categories:

- excessive charging or
- inadequate charging

The following sections describe how to remedy both of these problems.

EXCESSIVE CHARGING

Should the ammeter read an excessive charging current, the alternator circuit breaker must be pulled and flight terminated as soon as possible.

ALTERNATOR FAILURE

When the red generator warning light is on, this means that the alternator is not working. The battery voltage is dropping below 24 volt. In this case, all consuming devices not essential for safe flight operations must be switched off to save the battery. Current must be saved for later operation of the flaps. Terminate flight as soon as possible.

STARTER RELAY FAILURE
(only if starter relay control lamp is installed)

Should the starter relay control lamp remain "ON" after the ignition sequence, the start-up procedure must be aborted and the starter relay has to be checked. Should a starter relay failure occur during flight, the flight must be terminated as soon as possible.

AUXILIARY FUEL PUMP FAILURE
(only if fuel pump control lamp is installed)

If the green auxiliary fuel pump control lamp is not illuminated with the switch in ON, this may be an indication of an auxiliary fuel pump failure. Terminate flight as soon as possible and check for fault.

Table of Contents

Section 4

Normal Procedures

Table of Contents (continued)

4.1 General

This section describes the recommended procedures for normal operations of the GROB G 115D and presents all of the required procedures.

Normal procedures associated with those optional systems and equipment which require handbook supplements are provided in section 9 "Supplements".

Pilots should familiarize themselves with the procedures given in this section in order to become proficient in normal operations of the airplane.

The first portion of this section consists of a short form checklist which supplies an action sequence for normal operations of the airplane.

The remainder of the section is devoted to amplified normal procedures which provide detailed information and explanations of the procedures and how to perform them. This portion of the section is not intended for use as an in-flight reference due to the lengthy explanations. The short form checklist should be used for this purpose.

All data of this section are refered to a flight mass of 990 kg (2182 lbs) unless other masses are stated.

4.3 Airspeeds for Normal Operations

Unless stated otherwise the following airspeeds apply to maximum permissible takeoff and landing weight, but can also be used for a lesser weight. To achieve the Performance stated in section 5, however, the speed as indicated for the corresponding weight must be selected.

	V_{IAS} 990 kg (2182 lbs)
Takeoff	
Climb speed under normal takeoff conditions up to 50 ft obstacle (flaps 15°)	120 km/h (65 kts)
Best rate of climb speed (flaps 0°) at sea level V_Y	150 km/h (81 kts)
Best rate of climb speed (flaps 0°) at 10 000 ft V_Y	135 km/h (73 kts)
Angle of climb speed 1,3 V_{S1} (flaps 15°) at sea level V_X	120 km/h (65 kts)
Angle of climb speed 1,3 V_{S1} (flaps 15°) at 10 000 ft V_X	120 km/h (65 kts)
Landing	
Landing final approach speed under normal landing conditions (flaps 60°)	130 km/h (70 kts)
Minimum balked landing speed (flaps 60°)	116 km/h (63 kts)
Maximum demonstrated crosswind at takeoff and landing	37 km/h (20 kts)
Cruise	
Speed limit for operating in turbulent air	248 km/h (134 kts)
Maximum maneuvering speed 990 kg (2182 lbs)	212 km/h (114 kts)
Maximum flaps extended speed	208 km/h (112 kts)

4.4 Approved Maneuvers

Utility airplane

Utility	Entry Speed (km/h)	[kts]
Lazy Eight	245	[132]
Chandelle	245	[132]
Steep turns	245	[132]

Acrobatic airplane

Acrobatic	Entry Speed (km/h)	[kts]
Spin	100 - 180	54 - 97
Inverted Spin	150 - 180	81 - 97
Loop positive	220 - 245	119 - 132
Turn (hammerhead)	220 - 245	119 - 132
Immelmann	245	132
Split-S (nose raise 45°)	245	132
Split-S	160	86
Tail Slide	200 - 245	108 - 132
Cuban-Eight	245	132
Slow Roll	235	127
Steep Turn	235	127
Aileron Roll	235	127
Barrel Roll (pos./neg.)	245	132
Lazy Eight	245	132
Chandelle	245	132
Knife Edge (only right side)	235	127

WARNING
Do not make full or abrupt control movements above V_A !
Snap roll maneuvers are not approved !
At airspeeds in excess of 180 km/h (97 kts) do not apply combined full control inputs (i.e. full rudder deflection combined with full elevator deflection).

WARNING

Do not fly more than ten seconds in the following attitudes :

1. Vertical flight, steep dive.
2. Inverted flight, steep dive.
3. Zero G periods.
4. Wing-down or knife-edge flights.

In these modes the oil system will not scavenge and engine damage can occur. Normally oil pressure will "flicker" from 10 to 30 psi when transitioning from upright to inverted flight; however, return immediately to normal attitude anytime oil pressure drops 20 psi below normal.
If inverted oil pressure fails to rise, land aircraft and troubleshoot inverted oil system.

4.5 Normal Procedures Checklist

Preflight Inspection

I.Cockpit
For night operation check necessary equipment (see chapter 2, Kinds of operation equipment list); functioning flashlight available.

a) Pilots license and papers	CHECKED
b) Checklist	IN COCKPIT
c) Control lock	REMOVE

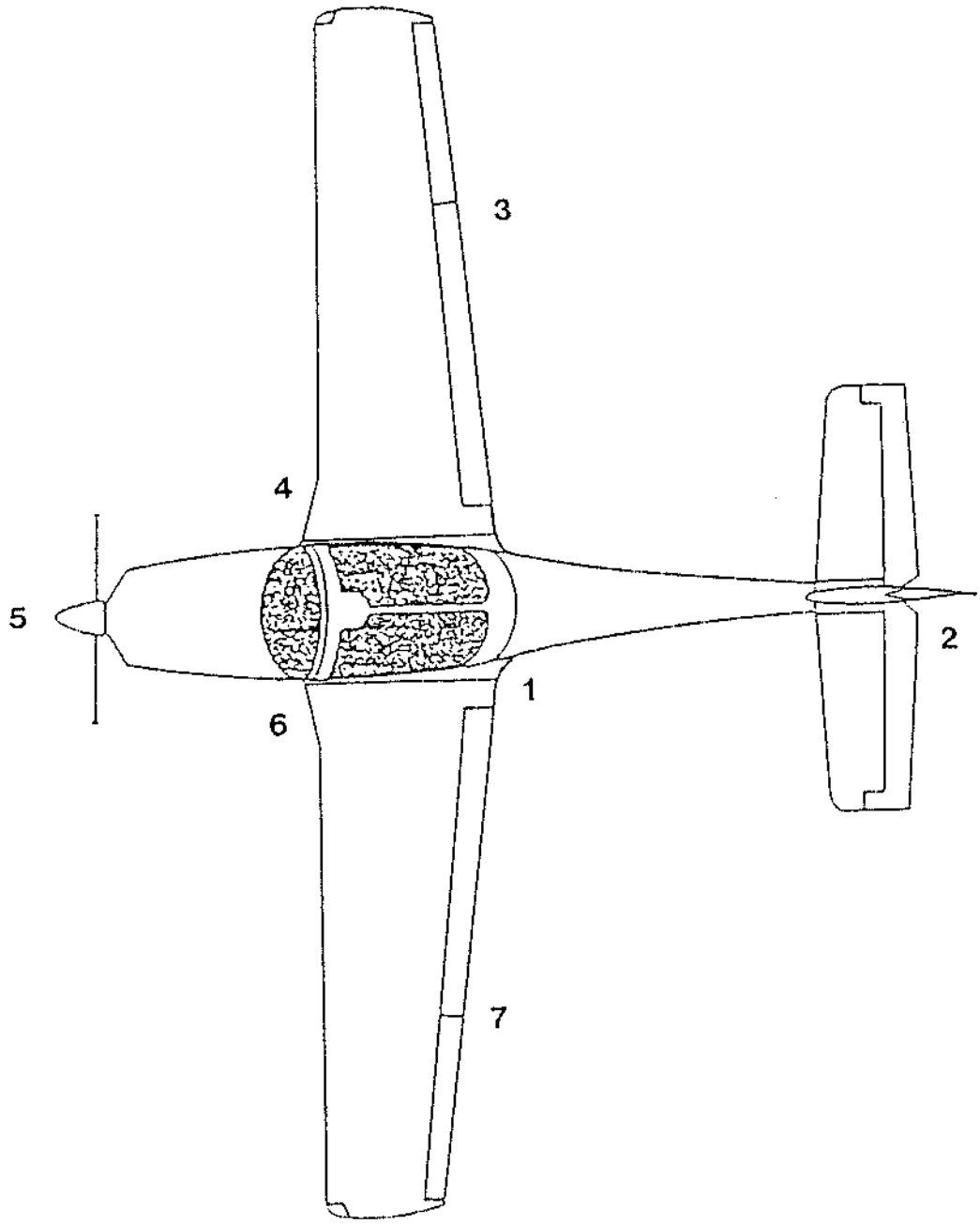
CAUTION
During acrobatic maneuvers the control lock and the towbar do not take up in plane !

d) Parking brake	AS REQUIRED
e) Ignition key	REMOVE
f) Windows	CHECK CLEAN AND UNDAMAGED
g) Circuit breakers	IN
h) All switches	OFF
i) Master switch	ON
j) Fuel quantity gauge	CHECK
k) Master switch	OFF
l) Throttle	IDLE
m) Mixture	LEAN CUT-OFF
n) Foreign objects	REMOVE
o) ELT (if installed)	POSITION "ARMED"

Green lamp on the remote control (if installed) must be shine!

II. Walk-around Inspection

Fig. 4.1. Visual Inspection



1. Fuselage

a) Damage	CHECK
b) All antennas	CHECK
c) Static pressure ports	CHECK BOTH CLEAN

2. Empennage

a) Fins and control surfaces	CHECK
b) Mass balances	CHECK
c) Trim tab	CHECK
d) Beacon	CHECK
e) Position light	CHECK

3. Right wing

a) Flap and hinges	CHECK
b) Aileron and hinges	CHECK
c) Tie-down	REMOVE
d) Position light (if installed)	CHECK
e) Strobe light (if installed)	CHECK
f) Wing tip	CHECK
g) Fuel vent	CHECK
h) Standing water in filler well Fuel quantity Fuel filler cap	REMOVE CHECK CHECK TIGHT
i) Wing surface	CHECK CONDITION

4. RH main landing gear

a) Tire, wheel and brake	VISUAL INSPECTION
b) Wheel chock	REMOVE
c) Slip mark (red paint)	VISUAL INSPECTION
d) Wheel fairing	CHECK
e) Tire pressure	CHECK

5. Nose section

a) Oil (min. 5.7 liters / 6 quarts)	CHECK QUANTITY
b) Cold weather kit (see page 7-9) Oil-cooler air-inlet (see page 7-9)	CHECK POSITION CHECK
c) Cowling	PROPERLY ATTACHED

d) Air inlet filter	FREE CHECK CONDITION CHECK ATTACHMENT
e) Landing light (if installed)	CHECK
f) Propeller	CHECK CONDITION
g) Spinner	CHECK FOR CRACKS
h) Nose gear strut	CHECK STROKE
i) Tire and wheel	VISUAL INSPECTION
j) Wheel fairing	CHECK
k) Tire pressure	CHECK
l) Towbar	REMOVE

6. Left main landing gear

a) Tire, wheel and brake	VISUAL INSPECTION
b) Slip mark (red paint)	VISUAL INSPECTION
c) Wheel chock	REMOVE
d) Wheel fairing	CHECK
e) Tire pressure	CHECK

7. Left Wing

a) Wing surface	CHECK CONDITION
b) Master switch	ON
c) Stall warning	CHECK FUNCTION
d) Pitot tube cap	REMOVE
e) Pitot tube	CHECK CLEAN
f) Pitot heat (Push test button for the anunciator panel !)	CHECK (if installed)
g) Master switch	OFF
h) Standing water in filler well Fuel quantity Fuel filler cap	REMOVE CHECK CHECK TIGHT
i) Fuel vent	CHECK

j) Wing tip	CHECK
k) Tie-down	REMOVE
l) Position light	CHECK
m) Strobe light	CHECK
n) Beacon (if installed)	CHECK
o) Aileron and hinges	CHECK
p) Flap and hinges	CHECK
q) Fuel tanks: RH wing	DRAIN
Sump tank	DRAIN
LH wing	DRAIN

Before Engine Start

1. Preflight check	COMPLETE
2. Fuel and oil levels	CHECKED
3. Seatbelts and harnesses	APPLIED AND FASTENED
4. Pedals	ADJUSTED
5. Seatbelts and harnesses on empty seat	FASTEN
6. Canopy closed and locked	CHECK
7. Parking brake	SET
8. Primary flight controls	FREE TO MOVE PROPER DIRECTION
9. Fuel cock	ON
10. Trim	FREE TO MOVE
11. Trim	NEUTRAL
12. Throttle, RPM, mixture lever	CHECK FREE MOVEMENT & TRAVEL
13. Operating levers	SET FRICTION
14. Avionics master switch	OFF

WARNING
To avoid damage to the electronic equipment always switch off the avionics master switch during start up.

15. Master switch	ON

16.	Engine instruments	CHECK
17.	Fuel quantity for the planned flight	ADEQUATE
18.	Anunciator panel lamp test	CHECK

NOTE
During "lamp-test" all lights will illuminate with full brightness.

Engine Start

1.	Mixture	FULL RICH
2.	Throttle	FULL POWER
3.	Propeller	HIGH RPM
4.	Electrical fuel pump (Activity audible / light on / fuel pressure increase)	ON (approx. 2-4 sec.)

NOTE
If instrument panel lighting is switched ON, all green anunciator lights are dimmed.

5.	Electrical fuel pump	OFF
6.	Throttle	approx. 30%
7.	Mixture	FULL LEAN
8.	Pos.-light/Beacon/Strobe light	ON
9.	Electrical fuel pump	ON
10.	Brake pedals	PRESSED
11.	Propeller vicinity	CLEAR
12.	Ignition	START, position to BOTH, as soon as engine running
13.	Mixture	FORWARD UNTIL SMOOTH RUNNING
14.	Throttle	1000 - 1200 RPM ADJUST
15.	Oil pressure	OIL PRESSURE MUST RISE WITHIN 30 SEC

16. Electrical fuel pump	OFF, as soon as engine running stable

WARNING
If oil pressure is not 1.7 bar (24.7 PSI) within 30 sec of engine running, shut off engine and do not repeat starting procedure until cause of trouble has been eliminated.

17. Anunciator Panel	CHECK
DURING ENGINE START:	
Starter light	RED

NOTE

If the engine does not start, repeat the procedure.
If the engine is flooded, proceed as follows:

- Throttle	FULL POWER
- Electrical fuel pump	OFF
- Mixture	LEAN
- Elevator	PULL
- Brake pedals	PRESSED

- Operate the starter until the engine is running, then set the mixture lever forwards and pull back the throttle.
- If necessary, switch on the electrical pump immediately (precaution against the formation of vapor bubbles).

WARNING **Make sure the aircraft is secure and that there are no obstacles in front of it ! The engine may excellerate immediately to full power.**

Warm-up

1. When engine running smoothly	MAX. 1500 RPM
2. Ampere	POSITIVE SIDE
3. Fully extend and retract flaps (indication and visual inspection checking at each stage flaps symmetry)	COMPLETED

4. Anunciator panel	NO RED LIGHTS

WARNING
No " RED-LIGHTS " must be illuminated ! If not, shut off engine and do not repeat starting procedure until cause of trouble has been eliminated !

Before Taxi

1. Flight instruments	CHECK / ADJUST
2. Engine instruments	CHECK
3. Avionics master switch	ON
4. Avionics switches	ON
5. Avionics frequency, volume, test position	CHECK
6. Maneuvering area	CHECK
7. Parking brake	RELEASE

Taxi

1. Nose wheel control	CHECK

CAUTION ! When taxiing tight turns it may be necessary to assist the nose wheel by the toe-brakes.

2. Braking action	CHECK
3. Compass	CHECK
4. Turn-and-bank indicator (if installed)	CHECK
5. Directional gyro	CHECK
6. Attitude indicator	CHECK

Ground Check / Run Up

1. Parking brake	SET
2. Oil pressure (must be at least in yellow sector)	CHECK
3. Propeller	HIGH RPM
4. Throttle	1800 RPM

5. Ignition switch set to L	RPM MUST DROP
6. Ignition switch set to BOTH	1800 RPM
7. Ignition switch set to R	RPM MUST DROP
Maximum RPM drop **Minimum RPM drop** **Maximum RPM drop difference**	**175 RPM** **50 RPM** **50 RPM**
8. Ignition switch set to BOTH	1800 RPM
9. Propeller	3x cycle full range
10. Throttle (min. oil temperature 40°C)	IDLE / 600 - 700 RPM
11. Throttle, recommended	1100 - 1500 RPM
12. Propeller	HIGH RPM

Before Take Off

1. Seatbelts and harnesses	FASTEN AND CHECK TIGHTNESS
2. Canopy closed and locked	CHECK
3. Fuel cock	ON
4. Trim	SET FOR TAKEOFF
5. Mixture	ADJUST
6. Fuel selector valve	MOST CONTENT
7. Flaps	15° (TAKE OFF)
8. Alternative air	COLD / FULLY PUSHED IN AND TORQUE
9. Electrical fuel pump	ON
10. Ignition key set to BOTH	CHECK
11. Vacuum gauge (if installed)	IN GREEN RANGE
12. Flight instruments	CHECK
13. Engine instruments	IN GREEN RANGE (EXCEPT OIL IN YELLOW ARC)
14. Oil temperature (minimum 40°C or more !)	CHECK

15.	All control surfaces for full deflection	CHECK
16.	Parking brake	RELEASE
17.	Tank asymmetry	MAXIMUM 20 ltr. (5.3 US.gal./4.4 Imp.gal.)

Take Off

1.	Brakes	HOLD
2.	Full throttle	MIN. 2550 RPM
3.	Mixture	FULL RICH

NOTE
For 5000 ft density altitude or above or high ambient temperatures, roughness or reduction of power may occur at full rich mixture. The mixture may be adjusted to obtain smooth engine operation.

4.	Brakes	RELEASE
5.	Nose gear relieve	AT MIN 60 km/h (32 kts)
6.	Nose gear lift-off	100 km/h (54 kts)
7.	Airspeed with flaps 15° at height of 15 m (50 ft)	120 km/h (65 kts)
8.	Flaps	RETRACT 150 ft ABOVE GROUND
9.	Speed with flaps 0°	145 km/h (78 kts)
10.	Electrical fuel pump	OFF (APPROX. 1000 FT ABOVE GROUND)

Climb

1.	Climb power	CHECK
2.	Mixture	FULL RICH

NOTE
For 5000 ft density altitude or above or high ambient temperatures, roughness or reduction of power may occur at full rich mixture. The mixture may be adjusted to obtain smooth engine operation.

3.	Engine instruments	CHECK

NOTE
Check the cylinderhead temperature. In the case of too high temperature, increase airspeed and/or fuel flow.

4. Airspeed	BLUE LINE or higher
5. Trim	SET
6. Altimeter setting	CHECK

Cruise

1. RPM	SEE FIGURE 5.3.11
2. Power	AS REQUIRED
3. Mixture	ADJUST
4. Trim	SET

Spin

SPIN ENTRY

1. Loose items	STOW
2. Seat belts and harnesses	TIGHTEN
3. Electrical fuel pump	OFF
4. Engine	IDLE
5. Wings	LEVEL
6. Recommended entry speed	≈ 100 km/h (54 kts) (max. 180 km/h [97 kts])
7. Rudder	FULLY IN DIRECTION
8. Elevator	FULL UP

DURING SPIN

1. Elevator	FULL UP
2. Aileron	NEUTRAL
3. Rudder	FULLY IN SPIN DIRECTION

RECOVERY

1. Rudder	OPPOSITE TO SPIN DIRECTION
2. Aileron	NEUTRAL OR INTO SPIN DIRECTION

3. Elevator	RELEASE FORCE

Descent

1. Altimeter	SET
2. Power setting (avoid lengthy idle)	AS REQUIRED
3. Mixture	ADJUST (see Chap.4.11)
4. Fuel tank selector	MOST CONTENT

Before Landing

1. Seatbelts and harnesses	FASTEN TIGHT
2. Electrical fuel pump	ON
3. Propeller	HIGH RPM
4. Mixture	AS REQUIRED (see Chap.4.11)
5. Flaps	EXTEND

WARNING: V_{max} with extended flaps 208 km/h (112 kts)

6. Recommended final approach speed with flaps 60° (990 kg)	130 km/h (70 kts)
7. Trim	SET

Balked Landing

1. Throttle	FULL THROTTLE
2. Mixture	RICH
3. Propeller	HIGH RPM
4. Flaps	RETRACT TO 0° or 15°
5. Climb	CHECK SPEED (blue line)

Normal Landing

1. Flaps	60°
2. Airspeed to flare	130 km/h (70 kts)
3. Touchdown	MAIN GEAR FIRST AT LESS THAN 108 km/h (58 kts)

4. Nose wheel	LOWER GENTLY
5. Brakes	AS REQUIRED

After Landing

1. Electrical fuel pump	OFF
2. Flaps	RETRACT
3. Trim	SET TO TAKEOFF RANGE

Before Leaving the Airplane

1. Parking brake	SET
2. ELT	CHECK FREQ. 121.5 MHz for unintentional function
3. Avionics master switch	OFF
4. All electrical aircraft systems	OFF
5. Short circuit test	COMPLETE (1000 RPM)
6. Throttle	IDLE
7. Mixture	LEAN CUT-OFF
8. Ignition switch	OFF
9. Ignition key	REMOVE
10. Fuel selector valve	MOST CONTENT
11. Master switch	OFF
12. Control lock	APPLY

Parking

1. Wheel chocks	POSITION
2. Parking brake	RELEASE
3. Tie-downs (if required)	SECURE
4. Pitot tube cap	APPLY

4.9 Amplified Normal Procedures

Preflight Inspection

The airplane should be given a thorough preflight and walk around check. These procedures can be amplified accordingly when deemed necessary by the pilot. The preflight inspection should include at least the following:

- Check airworthiness of airplane
- Check papers for completeness and validity
- Computation of weight and C.G. limits
- Determination of take-off distance
- Determination of flight performance

Before refuelling, make sure that water that has collected near the tank filler is removed !

The baggage should be weighed, properly stowed and strapped down.

The passenger should be instructed on the use of safety harnesses and the ventilation system, and should be informed that smoking is prohibited. Warn the passenger not to obstruct the controls, not to touch the instruments and not to tamper with the canopy mechanism. If aerobatics are envisaged, remove all loose objects etc. from the passenger's person.

COCKPIT

Commence internal checking by removing the control lock and setting the parking brake. Remove ignition key if still inserted. Check for unobstructed visibility and clean windows. Check guide rails and lock mechanism of the canopy for proper functioning.

After switching on the master switch the fuel gauge reading must show a sufficient quantity (incl. reserve) for the intended flight. Then turn the master switch OFF, to save the battery. Make sure that throttle and mixture are full aft (idle, lean cut-off) to prevent unintentional firing of the engine when checking the propeller.

Check the cockpit for foreign objects both on the left and right-seat and in the baggage compartment. If the right seat is vacant, close and lock the seatbelt and harness.

WALK-AROUND INSPECTION

Check fuselage for damage. Check fins and control surfaces for damage. Make sure horizontal tail is firmly in place. Operate both elevators and rudder to check freedom of movement, free play and hinge pins secure. Check elevator mass balance tips for damage. Check connection and play of the trim tab. Check beacon and position light for damage. Make sure all antennas are tightly in place.

Check pitot static system :
Check both drilled plates provided for pick-up of the static pressure are open and un-obstructed; these are located at the LH and RH side of the fuselage.
Remove the pitot tube cap at the left wing lower side and ensure that the tube is open and unobstructed. This system requires no drainage. The pitot heat system is not active on ground. To test the proper function of the system, press test button on anunciator panel approximately 5 to 10 seconds, the pitot tube should warm up.

Check right wing flap for damage. Inspect RH aileron for full freedom of movement, free play, hinge pins and proper attachment of the actuator. Remove tie-down from tie-down point.

Check position light and strobe light (if installed) for damage. Inspect wing tip and complete wing surface for damage.

Inspect RH landing gear strut, tire, wheel and brake disk for damage. Check tire and brake lining wear. Remove chocks and inspect slip mark. Inspect wheel fairing for secure fitting and damage. Check correct tire pressure (3.0 bar; 43.5 PSI).

Open the access hole in the top cowling and check the engine oil level (5.7 - 7.6 liters = 6 - 8 quarts).
For a flight of full range the engine requires 7.6 liters (8 quarts).

Check the cowling for damage and make sure it is firmly in place. Ensure that the air intake opening is free of debris and dirt and is undamaged. The air filter must be securely attached. Check the landing light (if installed) for damage. Make sure that the propeller is securely attached. Check leading edge protection and propeller surface for damage and inspect the trailing edge for chipping. Also make sure the propeller spinner is tight and check for cracks.

Excercise the stroke of the nose gear. Visually inspect nose wheel and nose wheel tire. Nose wheel tire pressure should be 2.5 bar (36 PSI). Check the nose gear fairing for damage and make sure it is firmly in place. Also remove towbar if necessary and stow safely.

Inspect LH main gear and LH wing same as for the right-hand side. To functionally check the stall warning and pitot heat switch on the master switch. Push the test button of the annunciator panel for a few seconds. The pitot tube musz warm up. Position tab upwards - stall warning must sound. Return master switch OFF. Check LH aileron and LH flap same as described for right-hand side.

Before Engine Start

After completing the preflight inspection and checking the fuel and oil level, enter the cockpit. If two heavy people stand simultaneously on the wing trailing edge the airplane may nose-up. Fasten seatbelts and harnesses and set the pedals to a safe position. If the RH seat is vacant, latch and secure this belt and harness also. Make sure the canopy is closed and locked. Then set the parking brake and check easy movement of the control surfaces and make sure that the deflection is in the correct direction. Check position of the fuel shutoff valve ("ON") and then check that trimming is possible over the full range before setting it to the range for take off. Check free movement and travel of throttle and mixture lever and set the friction. Make sure the avionics master switch is positioned "OFF". Switch on the master switch and check the engine instruments, paying particular attention to an adequate fuel quantity.

Engine Start

When starting the engine no difference is made between the warm-start- and the cold-start-procedure, if the check-list is applied.
Switch on the Position light, Beacon and the Strobe light. Make sure that the propeller area is clear. Start engine by turning the ignition key to the "START" position. As soon as the engine is running return the ignition key to "BOTH". Using the throttle, adjust an engine speed of 1000 - 1200 RPM. Oil pressure must increase to min. 1.7 bar (24.7 PSI) within 30 seconds.

WARNING
If the oil pressure does not attain 1.7 bar (24.7 PSI) within 30 sec. after starting the engine, shut down the engine and do not attempt to restart until the cause for the trouble has been eliminated.

If it is suspected that the starter motor is still energized, put master switch "OFF" to prevent electrical fire.

Warm-Up

Switch off the electrical fuel pump when warming up.

WARNING
If the engine shuts off after the first time the electrical fuel pump is switched off, a failure of the mechanical fuel pump might be the reason. Do not take off, before this malfunction has been eliminated !

As long as the engine has still not attained its operating temperature, do not exceed 1500 RPM. The ammeter must show a charging current, i.e. on the positive side. During warm-up extend and retract the flaps by using the flap switch and check the flap indication and actual flap ap position by observing from the cockpit.

Before Taxi

Set flight instruments such as altimeter, directional gyro and attitude indicator. Read the engine instruments regularly. Switch on the avionics master switch and the necessary avionics switches. Set the necessary frequencies and adjust the volume, testing if necessary. Make sure the taxi area is clear and then release the parking brake.

Taxi

During taxi check nose wheel control and brake effectiveness. Check functioning of compass, turn and bank indicator and attitude indicator.

CAUTION ! When taxi tight turns it may be necessary to assist the nose wheel with the toe-brakes.

Ground Check / Run up

Set the parking brake and pump the brake pedals once. The oil pressure must be at least in the yellow sector. Set an engine speed of approx. 1800 RPM. To check the magnetos turn the ignition key to position "L" and observe drop in RPM. Return ignition key to the "BOTH" position and check that the original RPM is reattained. Check the RH magneto. Minimum RPM drop must be 50 RPM, but not exceed a maximum of 175 RPM. The difference in the RPM drop of the LH and RH magnetos must not exceed 50 RPM. Return ignition switch to "BOTH" and set the propeller lever 3x cycle full range. Set for idle and check the idling RPM. Idling RPM must be between 600 and 700 RPM, if the oil temperature is min. 40°C. Then use the throttle to set a speed of 1100-1500 RPM. Use the tank with the most content (take notice of the tank asymmetry !).

Before Take Off

Fasten seatbelts and shoulder harnesses (on empty seat also). Make sure the canopy is properly closed and locked. The fuel shut off valve must be set to "ON", the trim in the take off range and the mixture set "FOR SMOOTH OPERATION". Flap position for take off is 15°. The alternative air must be set to "COLD" (fully pushed) and secured. Switch electrical fuel pump "ON" and make sure that the ignition key is positioned to "BOTH". If a vacuum system is installed, its indicator should read the green sector. Recheck all flight and engine instruments. In case the engine was run only for a short time, check the attitude indicator is stabilized. The oil temperature must be exceed 40°C or more before take off. Exercise all control surfaces for full response, before finally releasing the parking brake. Set the fuel selector valve to the most content fuel tank. The maximum allowable fuel asymmetry is 20 liters (5.28 US.gal. / 4.40 Imp.gal.).

Take Off

Precisely aim the aircraft on the runway in the direction of take off. Operate the brakes and apply full power. This must produce an engine speed of at least 2550 RPM. Then release the brakes and at a speed of 60 km/h (32 kts) take the load off the nose wheel. Lift the nose wheel at a speed of 100 km/h (54 kts). Climb speed for a flap position of 15° is 120 km/h (65 kts).
When the airplane has attained a height of 150 ft above ground the flaps can be retracted. The recommended climb speed in flap position 0° is at an airspeed of 145 km/h (78 kts) [blue line] at lower altitude. When the aircraft is approx. 1000 ft above ground the electrical fuel pump can be switched "OFF".

Climb

Make sure the throttle is positioned to "FULL OPEN" for max. climb and the mixture to "FULL RICH" (MSL up to density altitude 5000 ft).
Regularly read the engine instrumentation. The airspeed for climbing should be according to chart on Fig. 5.3.8. Trim the airplane accordingly. Check the altimeter setting (standard setting ?).

Cruise

Set desired engine speed and power according to cruise charts. This speed should not exceed the maximum of 2500 RPM (noise pollution). To avoid laboring the engine do not set the power to exceed 75 % over lengthy periods. Lean the mixture according to altitude. Trim the airplane as required.

Descent

Set the altimeter to the QNH of the airfield. Select power and engine speed as required, avoiding lengthy idling.

Before Landing

Make sure seatbelt and harnesses are tight. Reduce airspeed to less than 208 km/h (112 kts). Switch on the electrical fuel pump. Then position the mixture control as required (see Chapter 4-11) and extend the flaps.

WARNING: V_{max} with extended flaps

208 km/h (112 kts) [Upper limit of white range]

The propeller must be set to "HIGH RPM". The recommended final approach speed with a mass of 990 kg (2182 lbs) in the 60° flap position is 130 km/h (70 kts) for normal landings. Under cross wind or strong turbulence conditions as well as in rain or icy weather suitable higher speeds are necessary. Trim the airplane to the desired speed.

Balked Landing

Set the throttle to full power, the propeller control must be set to "HIGH RPM" and the mixture according to the table. Set the flaps to 0° or 15° depending on flight altitude. Start transition to climb.

Normal Landing

Set the flaps to 60°. The final approach speed until flare out should be 130 km/h (70 kts) unless additional speed is required due to cross wind, gusts, rain or icy weather.

Touch down with the main landing gear first when the speed indicator reads less than 108 km/h (58 kts). Gently lower the nose and apply the brakes accordingly.

After Landing

Switch off the electrical fuel pump, retract flaps and retrim the airplane for takeoff condition.

Before Leaving the Airplane

Before climbing out, set the parking brake and pump the brake pedals once. Switch off the avionics master switch and all aircraft electrical systems. To carry out a magneto ground test select a speed of max. 1000 RPM. Then briefly turn the ignition switch to the "OFF" position before immediately returning it to the "BOTH" position. This must produce a clear tendency for the engine to stop. Then shut down the engine using the normal procedure by pulling the mixture control back to the "LEAN" position. When the engine has stopped, turn the ignition key to the "OFF" position and remove the ignition key. Then switch off the master switch and apply control lock. Turn the fuel selector valve to the fullest tank to prevent fuel asymmetries.

Parking

If the airplane is to be parked for a lengthy peroid, chock the wheels and tie down the aircraft at the prescribed locations. Release the parking brake. Apply pitot tube cap.

Stalls

An approaching stall is indicated by the stall warning horn and a stall warning lamp which are activated between 19 km/h (10 kts) and 9.2 km/h (5 kts) above stall speed in calm air. Mild airframe buffeting may also preceed the stall. The loss of altitude at low altitude is approx. 300 ft. With increasing altitude, the losses will also increase.

WARNING

The stall warning system is inoperative with the master switch OFF.

During preflight, the stall warning system should be checked by turning the master switch ON, lifting the detector and checking to determine if the horn is actuated. The master switch should be returned to the OFF position after the check is complete.

Approved Maneuvers

The airplane is approved for certain maneuvers, provided it is loaded within the approved weight and center of gravity limits (See Section 2 - Limitations).

The approved maneuvers are:

Spin / Inverted Spin / Loop positive / Hammerhead Turn / Immelmann / Split-S (nose raise 45°) / Split-S / Tail Slide / Cuban-Eight / Slow Roll / Steep Turn / Aileron Roll / Barrel Roll / Lazy Eight / Chandelle / Knife Edge (only right hand).
Inverted flights are approved for a maximum of 3 min. !

Entry speeds, refer to Section 2 - Limitations.

Before performing maneuvers, check for:

Fuel shutoff valve	:	ON
Fuel selection	:	MOST CONTENT
Fuel asymmetry	:	max. 20 liters (5.3 U.S.gal./4.4 Imp.gal.)
Electrical fuel pump	:	OFF
Seatbelts and harnesses	:	APPLIED AND FASTENED
Seatbelts on empty seat	:	FASTENED
Canopy	:	CLOSED AND LOCKED
Loose objects	:	STOWED
Baggage	:	NO BAGGAGE IN BAGGAGE COMPARTMENT !

ACROBATIC - MANEUVERS

General

Prior to intentional spinning the maximum weight of 920 kg (2028 lbs) (ACROBATIC- and UTILITY category) must not be exceeded!

Before starting acrobatic maneuvers, tighten the safety harnesses and make sure that all loose objects are securely stowed. Start the maneuvers at a safe height. The electrical fuel pump must be switched off and the flaps retracted.
Unless otherwise stated, an engine RPM of 2500 and full power are recommended. The fuel flow should be set to "best power mix" (refer to cockpit decal).
If there is a danger of exceeding the max. allowable speed, close the throttle fully and set the propeller control fully forward (max. braking effect). Control surface deflections should be adapted to the situation.
The following rule applies for all pull-out radii up to V_A. Leave the engine at full power to keep the pull-out radii as small as possible.
This applies especially when the aircraft is close to the ground: Pull-out radii at load factors around 6g are very small and high engine power is required to maintain this high load factors, even though the recovery arc is towards the ground.

1. SPIN

ENTRY

Slow the airplane with engine at IDLE and the wings level. At stall speed (approx. 100-180 km/h [54-97 kts] IAS) enter the spin applying full rudder deflection into the desired spin direction and simultaneously pull the elevator full up with aileron in neutral position.

In a fully developed spin the aircraft rotates at a 2 sec. rate per turn.

DURING SPIN

During spinning, hold the stick in the full back position and keep the ailerons neutral. Full rudder deflection in direction of spin must be maintained.

The indicated airspeed will stabilize at:

- 111 - 160 km/h IAS (60 - 86 kts) IAS

RECOVERY

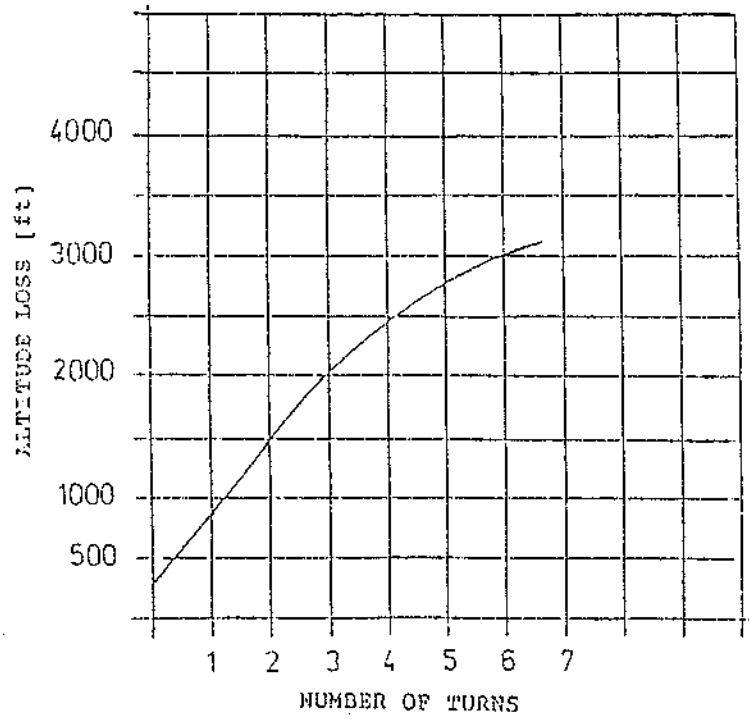
For spin recovery check throttle position is at IDLE.
Then deflect rudder fully opposite to direction of yaw rotation and put the elevator into the neutral position.
Apply no opposite aileron but hold control stick in neutral or in direction of spin. The control stick held in tn this position will greatly assist spin recovery even from the most extreme spin conditions (not described in this handbook). For the described normal spin, aileron in position NEUTRAL is sufficient to recover. For simpler handling, this position is preferable.
As soon as rotation has stopped, move all controls to neutral position and pull up smoothly.
The airplane will recover in about one additional turn within 1 - 2 sec.
If pulling out at 3g the maximum speed will be 240 km/h (130 kts) IAS. Apply normal power. For altitude loss refer to figure 4.1.

WARNING

- Do **not** attempt recovery with ailerons **against** spin direction or elevator up.
- With ailerons against spin direction and fully pushed elevator during the recovery, the airplane will continue to spin faster and flatter (despite fully opposite rudder).
- If engine stops during spin, recovery has to start immediately and the pilot has to act according to Section 3 " Restart of the failed engine " (if required, start engine with mixture lever in lean).
- During spin, the auxiliary fuel pump must not be switched on (flooding of injector !)
- The recovery sequence is important for certain types of spin. For this reason, never push the stick forwards before opposite rudder is applied.
- To recover from difficult types of spin, use the following procedure :
  - Opposite rudder
  - Full in-spin aileron
  - Stick fully back

  During the recovery phase (transition from a flat spin to a steep spin), move the elevators back to the neutral position to prevent the spin continuing in the opposite direction.
- Applying full power always encourages the aircraft's readiness to recover.

Fig. 4.1 Altitude Loss Including Recovery



NOTE

If the aircraft fails to recover, the recommended control position must be applied:
Rudder against yaw rotation, aileron neutral, elevator release force.
Fig. 4.1 shows maximum values for altitude loss obtained from flight test using the recommended spin and recovery procedure in airspace about 5000 ft MSL. At higher altitudes the altitude loss will be greater.

2. INVERTED SPIN (from inverted flight)

ENTERING THE SPIN

Entry speed	:	150 - 180 km/h (81 - 97 kts)
Engine	:	between IDLE and approx. 50% power
Control stick (elevator)	:	FULLY FORWARD
Rudder	:	FULL DEFLECTION
Ailerons	:	NEUTRAL OR OPPOSITE TO RUDDER

- Maintain the rudder position during the spin !

RECOVERY

Rudder	:	FULL DEFLECTION OPPOSITE TO DIRECTION OF SPIN
Elevator	:	NEUTRAL
Ailerons	:	NEUTRAL

- Pull out to normal attitude !

NOTE

The entry must be made dynamically and/or with engine power around 50% to get into the spin.
The aircraft spins at a rate of approx. 0.5 turn/sec. If the stick is pulled fully back during an inverted spin with out-spin aileron applied, the spin rate will increase. Recovery is quick and easy. The trim settings should be in the " TAKEOFF " position. A black-out is possible during recovery. Therefore appropriate physical condition is absolutely necessary.

For the following maneuvers a RPM of 2500 RPM, full power and " best power mix " should be maintained !

3. LOOP (positive)

Entry speed : 220 - 245 km/h (119 - 132 kts)
Load factor : approx. + 3,5g

4. TURN (hammerhead)

Entry speed : 220 - 245 km/h (119 - 132 kts)
Load factor : approx. + 5g
Start- and finish attitude : VERTICAL

Hammerhead turns can only be performed cleanly and precisely to the left (due to propeller vortex). When the first signs of instability due to lack of engine power occur, quickly apply full left rudder. As the aircraft turns, apply full opposite aileron and push the stick firmly forwards Subsequently reducing engine power to approx. 30% will facilitate completion of the maneuver.

5. IMMELMANN

Entry speed : 245 km/h (132 kts)
Load factor : approx. + 4g

At the top of the loop, push hard to achieve an opposite course.

6. SPLIT "S" FROM A 45° CLIMB

Entry speed : 245 km/h (132 kts)
Load factor : approx. + 4g

Pull the aircraft quickly into a 45° climb, then apply full aileron until inverted. Convert speed to max. height and recover to normal attitude.

7. SPLIT "S" FROM LEVEL FLIGHT

Entry speed : 160 km/h (86 kts)
Load factor : approx. + 4g

Half roll from normal attitude to inverted. Recheck the speed when inverted (should be 160 km/h [86 kts]), then recover to the normal attitude.

8. TAIL SLIDE

Entry speed : 200 - 245 km/h (108 - 132 kts)
Load factor : approx. + 4g

Pull the aircraft quickly vertical and then close the throttle. Hold the controls firmly.

9. CUBAN - EIGHT

Entry speed : 245 km/h (132 kts)
Load factor : approx. + 3,5g

In a 45° inverted dive quickly apply full aileron. The aircraft rolls relatively slowly to normal attitude. Watch the speed ! For a successful cuban eight the recovery speed should be around 250 km/h (135 kts). If the speed is too high to apply full aileron, reduce the aileron deflection and throttle the engine.

10. SLOW ROLL

Entry speed : 235 km/h (127 kts)
Load factor : approx. + 1,5g to - 1,5g

Enter the maneuver from level flight and push hard when inverted. Experience has shown that beginners should lift the nose approx. 10° before rolling.

11. STEEP TURN

Entry speed : 235 km/h (127 kts)
Load factor : approx. + 4g to -3g

The elevator forces are high during negative steep turns. To maintain maximum effectiveness for down elevator, do not retrim to reduce the forces.

12. AILERON ROLL

Entry speed	:	235 km/h (127 kts)
Load factor	:	approx. + 1,5g to 0g

Lift the nose into a 10° climb, then apply and hold full aileron until the wings are again level.

13. BARREL ROLL positive / negative

Entry speed	:	245 km/h (132 kts)
Load factor	:	approx. + 3g to - 3g

For this maneuver, make sure the nose is lifted sufficiently. If there is a danger of exceeding max. allowable speed, close the throttle and adapt the control deflections to the situation.

14. LAZY EIGHT

Entry speed	:	245 km/h (132 kts)
Load factor	:	approx. + 3g

15. CHANDELLE

Entry speed	:	245 km/h (132 kts)
Load factor	:	approx. + 3g

16. KNIFE EDGE

Entry speed	:	235 km/h (127 kts)
Load factor	:	approx. + 2g

Continous knife edge is not possible. The maneuver must be terminated early to avoid high speeds. Knife edge is only permitted to the right to ensure that the oil pressure is maintained !

4.11 Mixture Setting

General:
Leaning the fuel mixture within approved marginal conditions is necessary for full engine life, best performance, economic consumption and for safe operation of the engine, noting:
- Never exceed the maximum red line cylinder head temperature limit.
- For continuous operation cylinder head temperature should be maintained below 204°C (400°F).

- Maintain mixture control in "best power mix" position under normal conditions for rated take off, rated maximum continuous, climb and cruise powers above 75% performance.
- During take off from high elevation airport or during climb (as of approx. 5000 ft density altitude), roughness or loss of power may result from over-richness. In such a case lean mixture control only enough to obtain smooth operation - not for economy (peak EGT).
- Running the engine too rich will prove all the more unfavourable, the higher the altitude.
- Always check the mixture before increasing power.

Leaning procedures

1. Standard procedure with mixture control (75% power or less without flowmeter or EGT gage):

   - Slowly move mixture control from the "FULL RICH" position to the "LEAN" position until first indication of engine roughing.
   - Then enrich for smooth engine running.

2. Fuel flow method:

   - Slowly move mixture control toward "FUEL FLOW RATED VALUE" (see table at the instrument panel).

WARNING: Smooth engine running is always more important than fuel flow indication!

3. Leaning with the EGT indication (if EGT indication provided):

   - Above 75% power - Never lean beyond 150°F on rich side of peak EGT of lean cylinder.
   - 75% power and below - Operate at peak EGT of lean cylinder
   - Always keep an eye on the cylinder head temperature!

WARNING: Smooth engine running is always more important than the EGT readings !

4. Leaning with the EGT indication (if single-EGT-indication is installed):

- In case of engine failures such as an asymmetric mixture or different fuel-injection-nozzles, these kind of measurement may give no or an incorrect test data.

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Section 5

Performance

5.1 General

The performance charts on the following pages are presented in a way, that indicates the performance you can expect from the airplane under various conditions, whilst also facilitating complete and sufficiently accurate flight planning. The values in these charts were attained by flight testing with the airplane and engine in good operating condition and corrected to International Standard Atmosphere (ISA 15°C (59°F) and 1013.2 hPa (29.92 in. HG) at sea level).

The performance charts do not take into account various pilots' experiences or bad condition of the airplane. The stated performances may be achieved, if the mentioned procedures are used and the airplane is in good condition.

Cruising fuel consumption is based on the recommended lean mixture setting. Some non-determinable factors such as mixture setting procedure, operating condition of the engine and propeller as well as turbulence can effect range and endurance. Therefore, it is important to consider all available information when computing required fuel quantity for a flight.

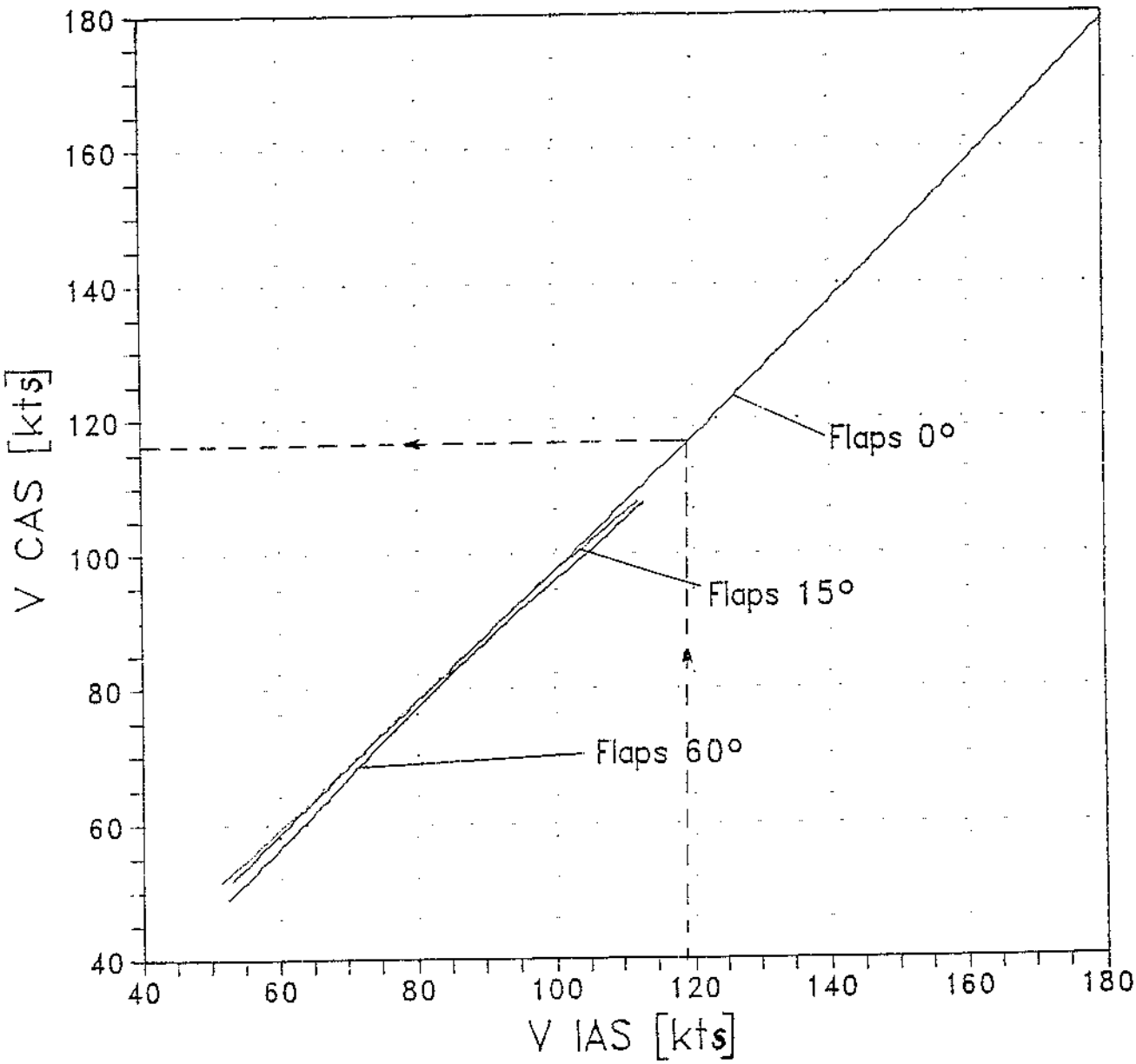
5.3 Using the Performance Tables and Charts

The performance data are presented in form of tables and graphs which consider the effect of each variable. Performance data are of sufficient detail to prepare flights with the required accuracy and to stay on the safe side.

As first step of a flight preparation it is important to confirm the weight and center of gravity being in limits. Refer to Section 6.7 for details.

Fig. 5.3.1 Airspeed Calibration
Normal static source

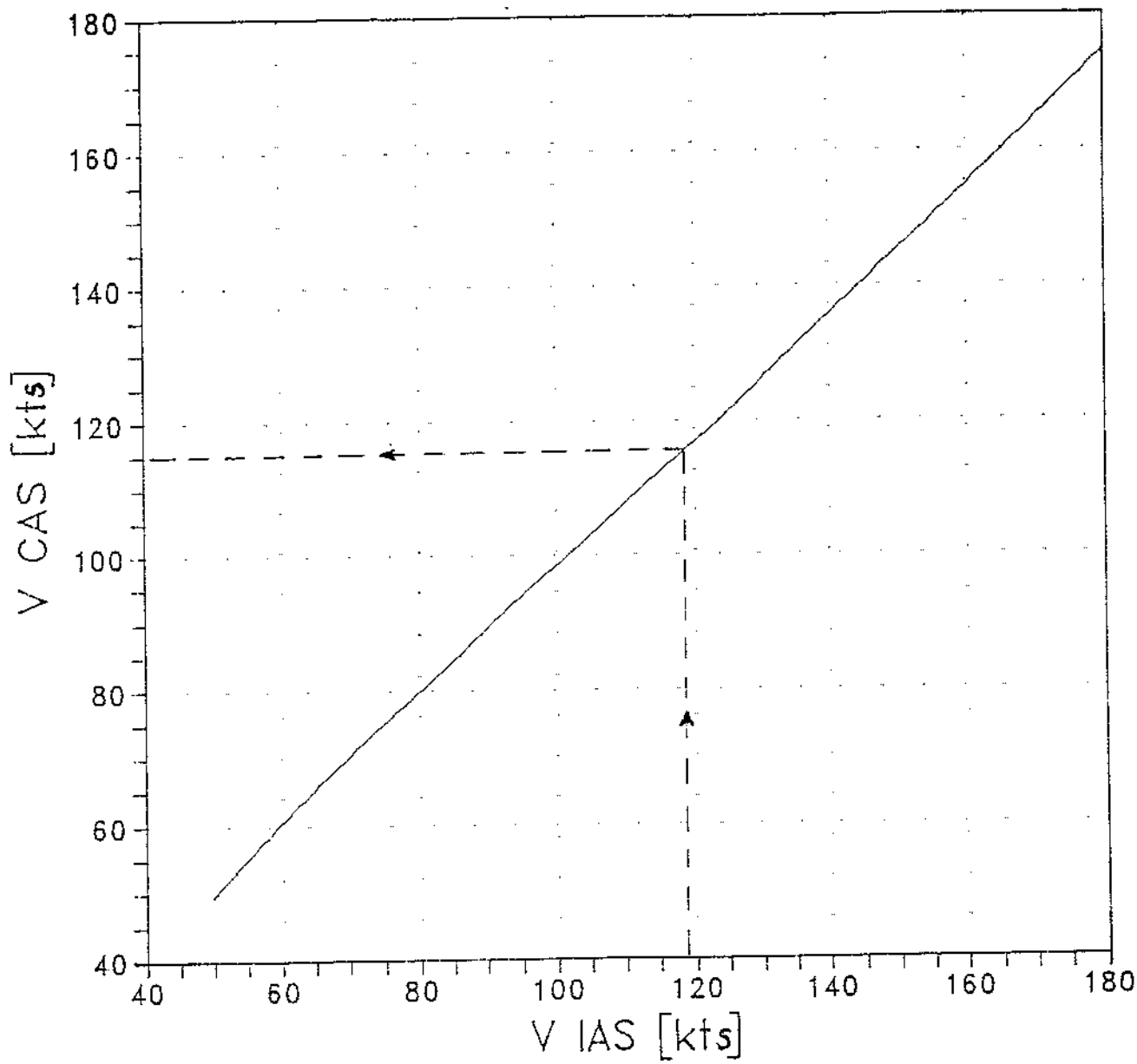
System Pitot-tube at wing, static pressure at fuselage



Example:

Flap setting 0°
V_{IAS} 119 kts
V_{CAS} 116 kts

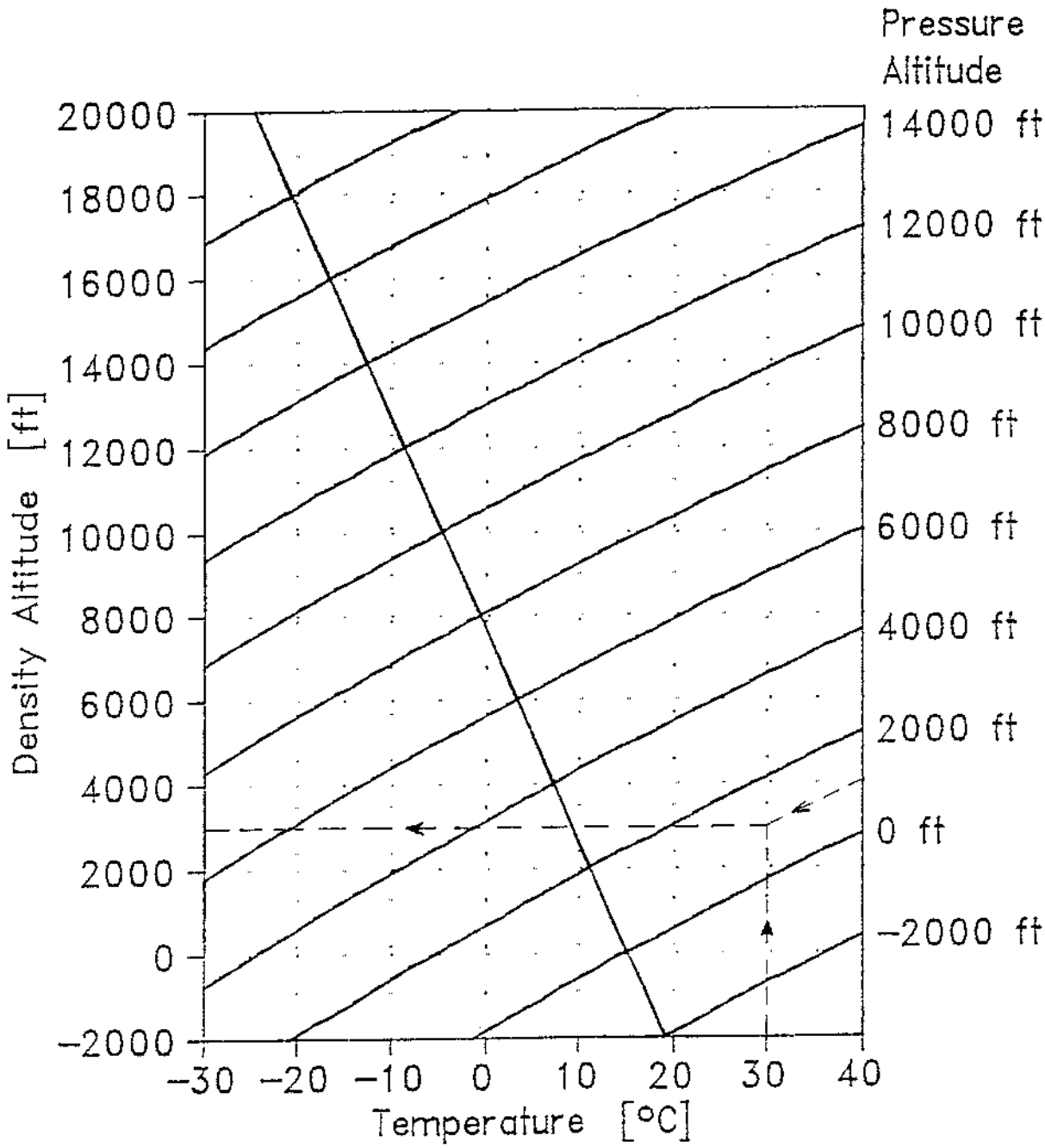
Fig. 5.3.2 Airspeed Calibration
Alternate static source



Example:

V_{IAS} 119 kts
V_{CAS} 115 kts

Fig.5.3.3 Pressure and Density Altitude

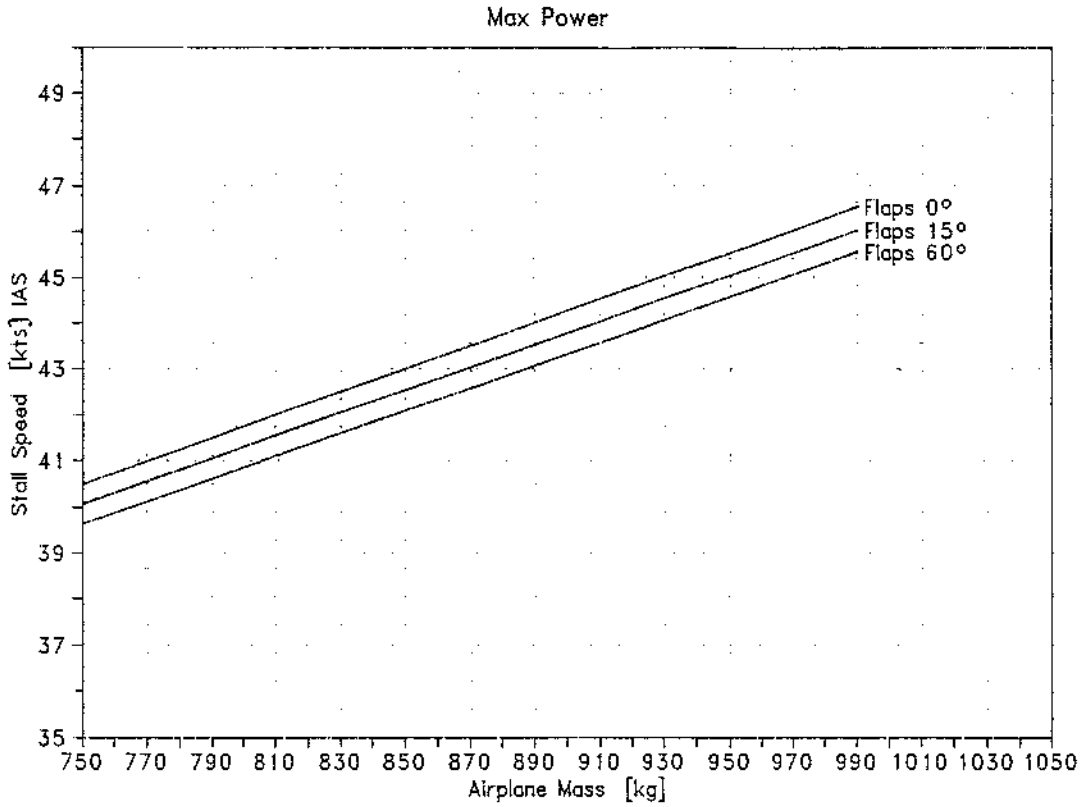


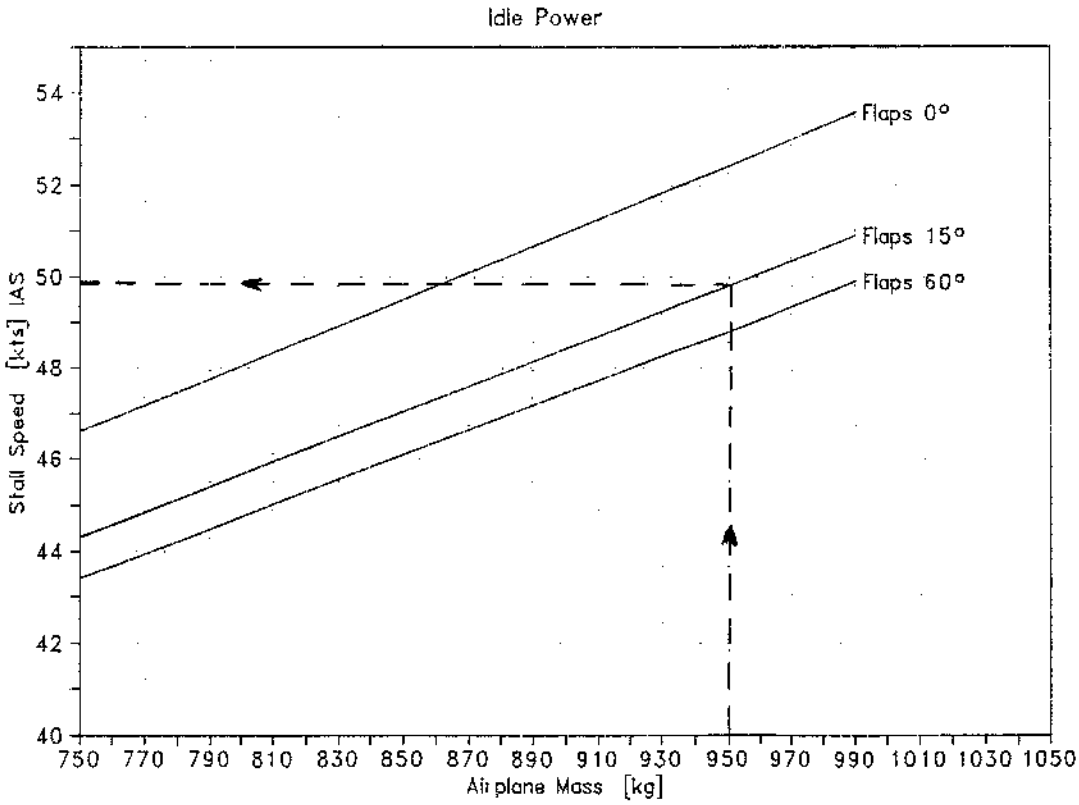
Example:

1. Set altimeter to 1013.25 hPa (29.92 in.HG) and read off pressure altitude (1000 ft).
2. Establish outside air temperature (+30°C)
3. Read off density altitude (3000 ft).

Result: The airplane has a power-related altitude of 3000 ft.

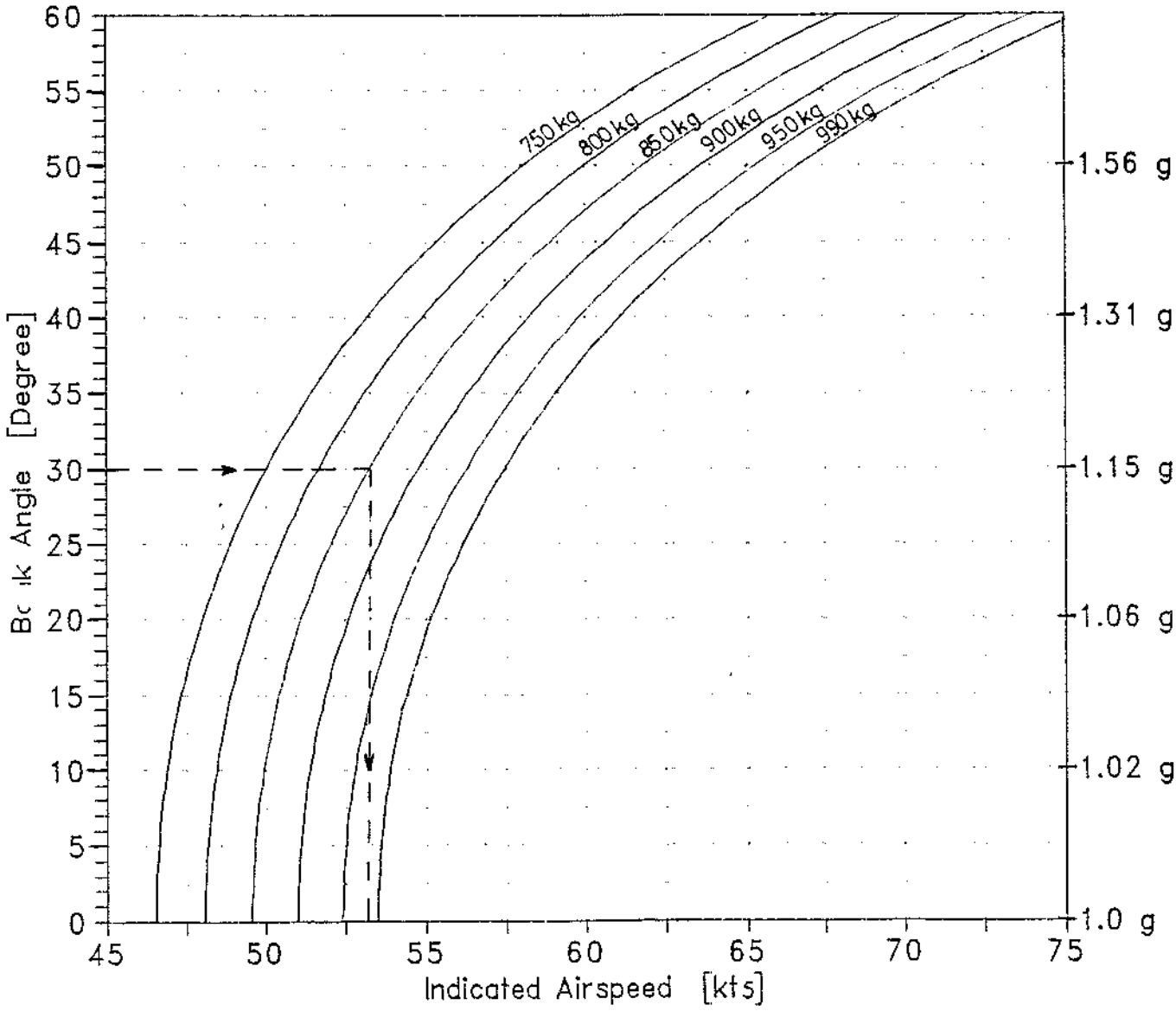
Fig. 5.3.4 Stall Speed at Various Flap Settings





Example: At a mass of 950 kg (2094 lbs), with engine idle and flaps at 15°, stall speed is approx. 50 kts (92 km/h).

Fig. 5.3.5 Stall Speed at Load Factor or Banking



Example: Stall speed when banking 30° or 1.15 g respectively is approx. 53 kts (99 km/h) for an aircraft mass of 850 kg (1874 lbs).

Fig. 5.3.6 Wind Components

Demonstrated Side Wind Component: 37 km/h (20 kts)

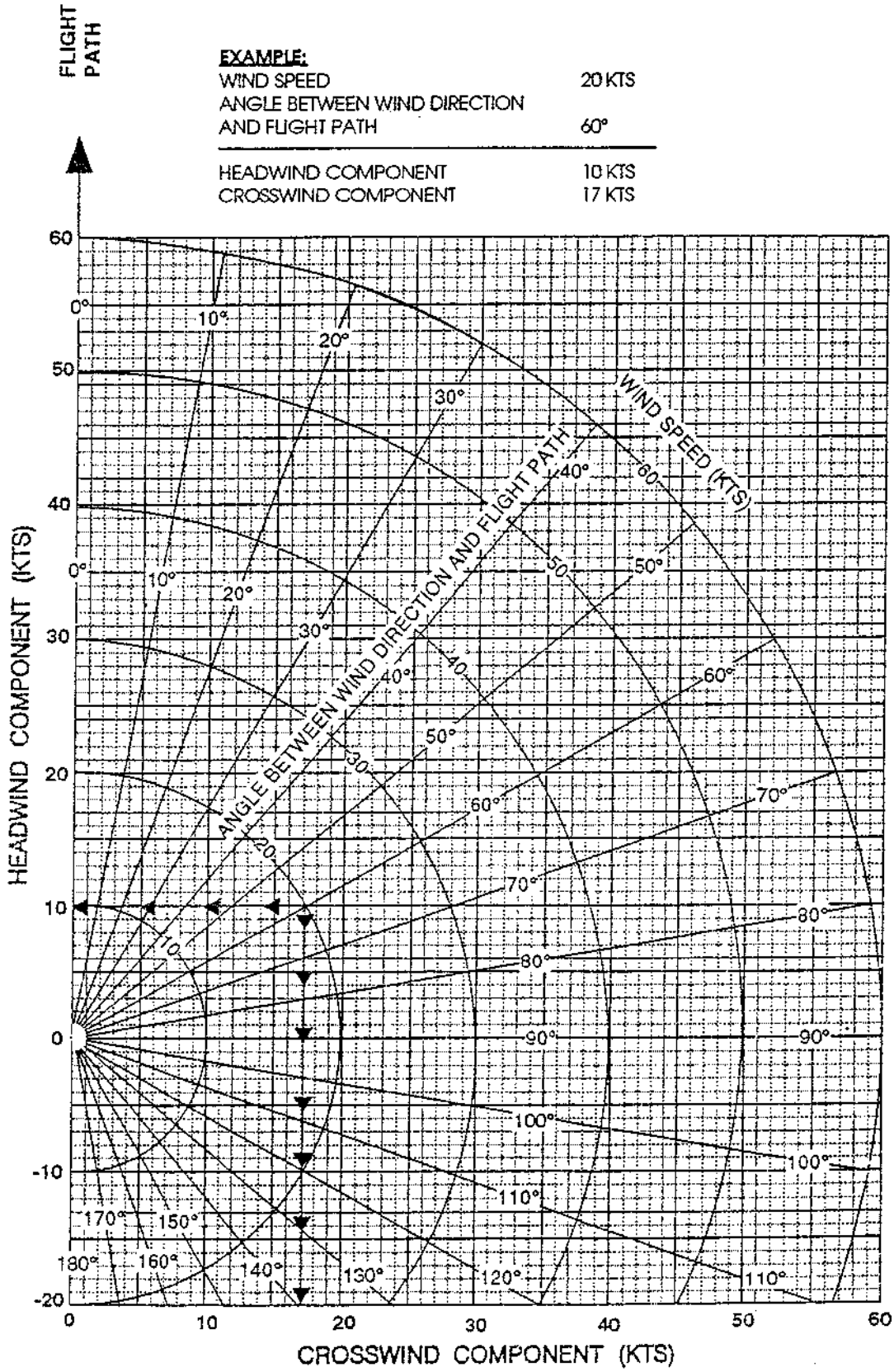
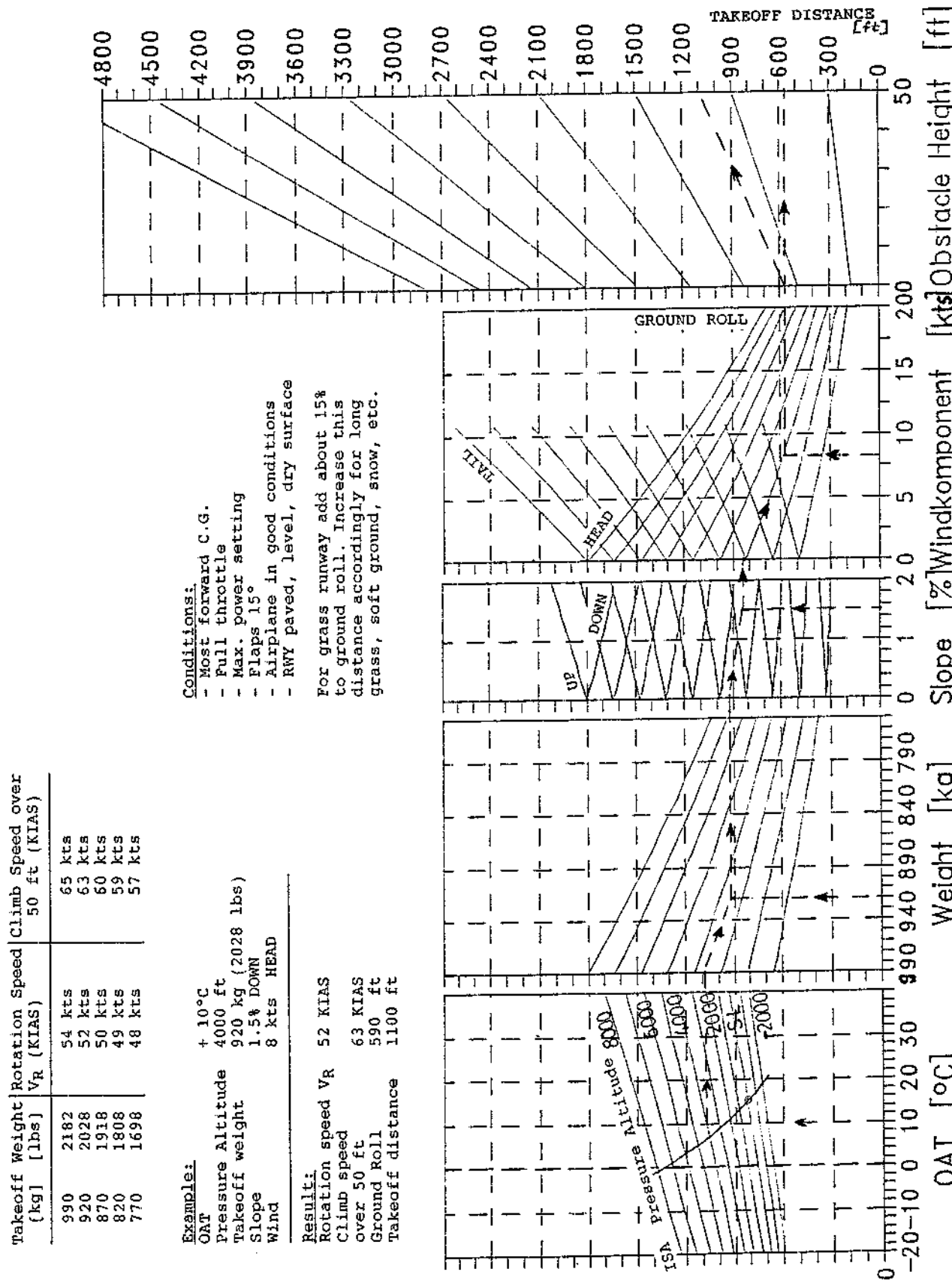


Fig. 5.3.7 Take Off Distance



Takeoff Weight (kg)	(lbs)	Rotation Speed V_R (KIAS)	Climb Speed over 50 ft (KIAS)
990	2182	54 kts	65 kts
920	2028	52 kts	63 kts
870	1918	50 kts	60 kts
820	1808	49 kts	59 kts
770	1698	48 kts	57 kts

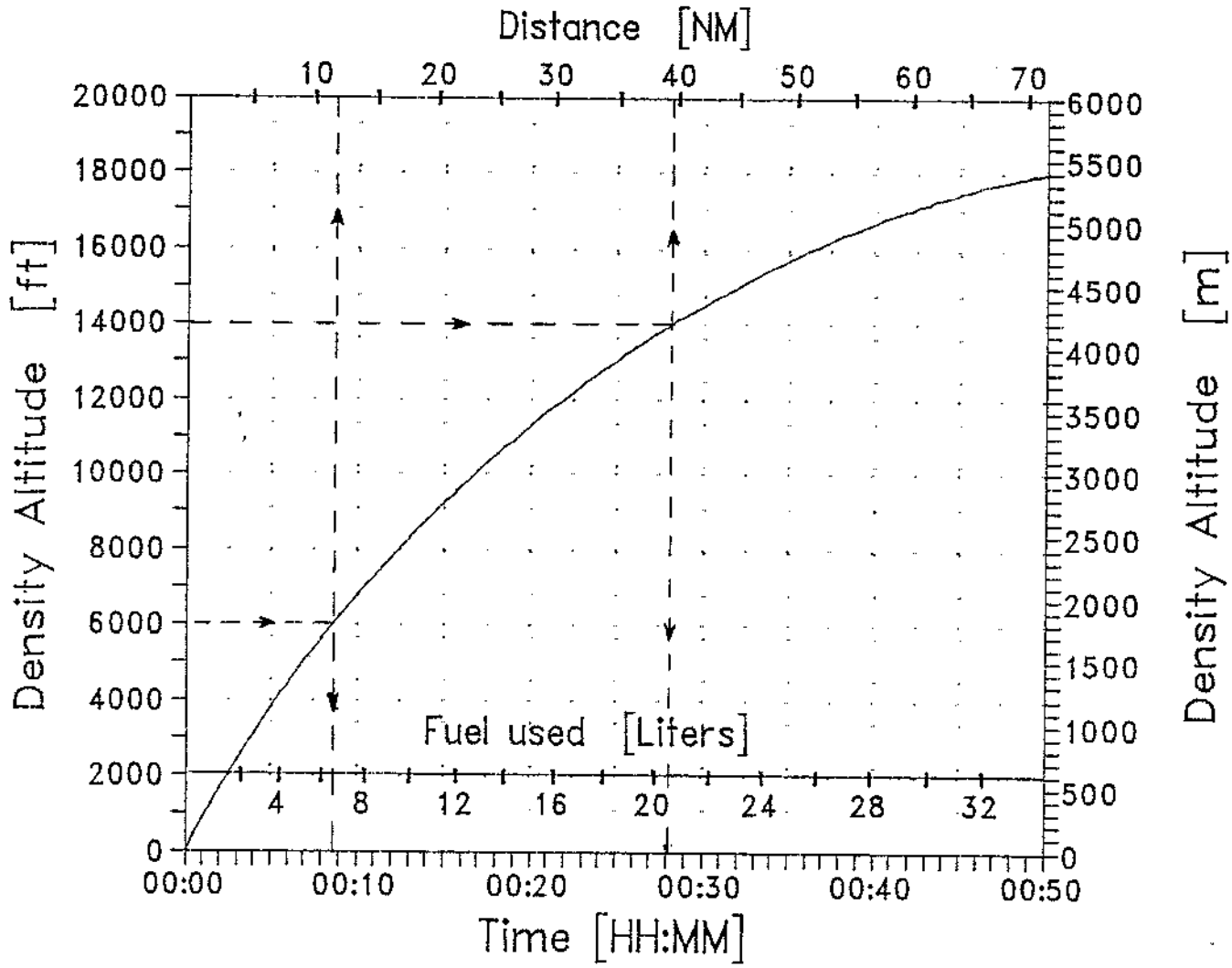
Example:
OAT + 10°C
Pressure Altitude 4000 ft
Takeoff weight 920 kg (2028 lbs)
Slope 1.5% DOWN
Wind 8 kts HEAD

Result:
Rotation speed V_R 52 KIAS
Climb speed over 50 ft 63 KIAS
Ground Roll 590 ft
Takeoff distance 1100 ft

Conditions:
- Most forward C.G.
- Full throttle
- Max. power setting
- Flaps 15°
- Airplane in good conditions
- RWY paved, level, dry surface

For grass runway add about 15% to ground roll. Increase this distance accordingly for long grass, soft ground, snow, etc.

Fig. 5.3.9 Time, Fuel and Distance to Climb



Conditions:
- Full throttle
- Mixture for Best Power
- Flaps 0°
- V = V_Y
- Standard Atmosphere
- Max. Takeoff weight
- Most forward C.G.

Example: - Climb from 6000 ft DA to 14000 DA

Result:			
	- Time to climb	(28 - 8.3)	19.3 min.
	- Fuel to climb	(20.5 - 6.5)	14.0 ltr.
	- Distance to climb	(39.5 - 12)	27.5 NM

Fig. 5.3.8 Rate of Climb

Climb speed Vy KIAS

Aircraft Weight kg	lbs	Pressure Altitude SL	8000 ft	14000 ft
990	2182	81 kts	75 kts	69 kts
870	1918	79 kts	71 kts	65 kts
750	1653	76 kts	66 kts	60 kts

Conditions:
- Full throttle
- Mixture for Best Power
- Flaps 0°
- $V = V_Y$
- Most forward C.G.

Example:
- Pressure Altitude 6000 ft
- OAT + 5 °C
- Aircraft Weight 910 kg (2006 lbs)

Result:
- Climb speed V_Y 75 kts
- Rate of climb 875 ft/min
- Density Altitude 6200 ft

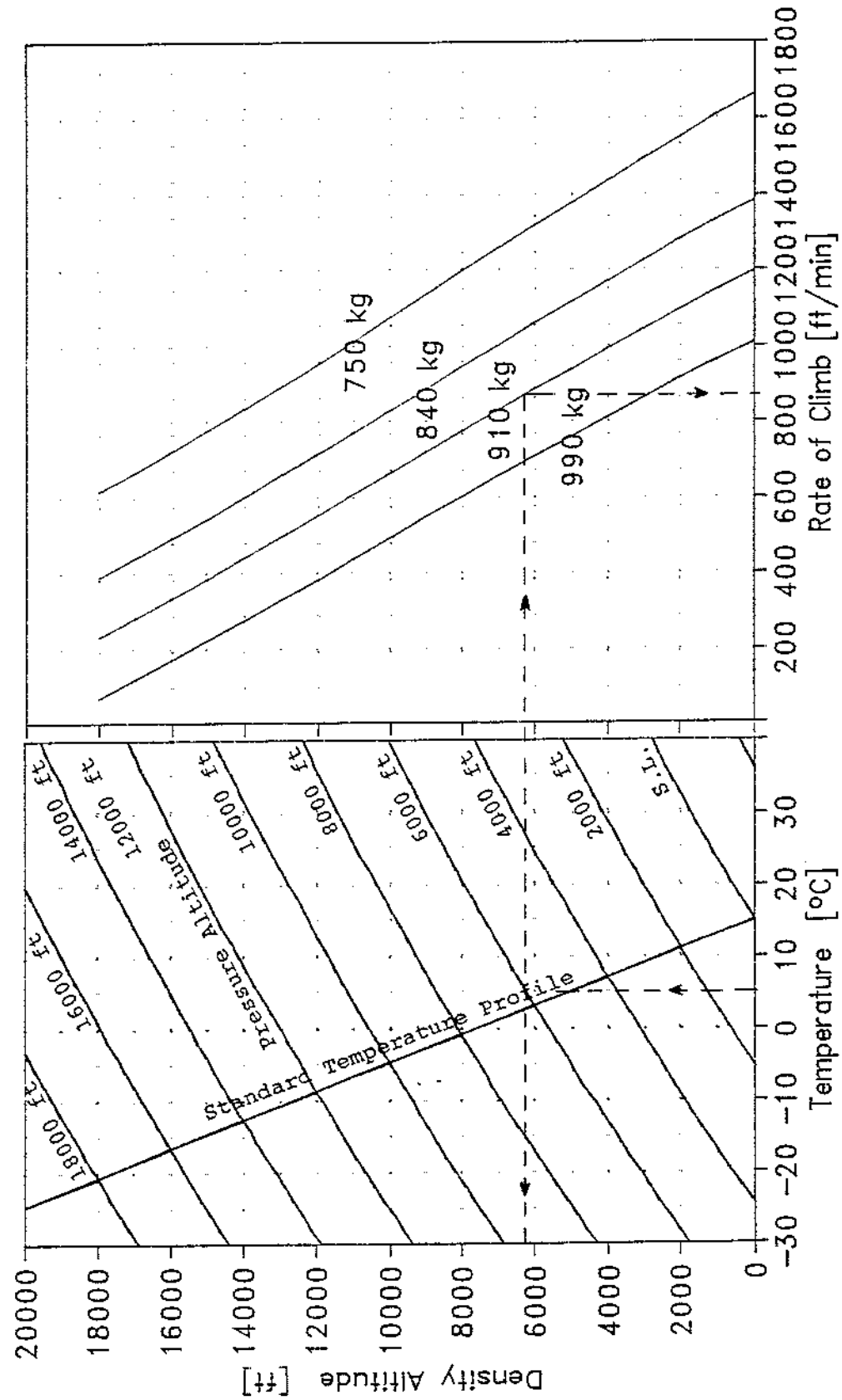


Fig. 5.3.10 a) Cruise (Fuel Consumption)
RPM : 2400 / Mixture for best Power

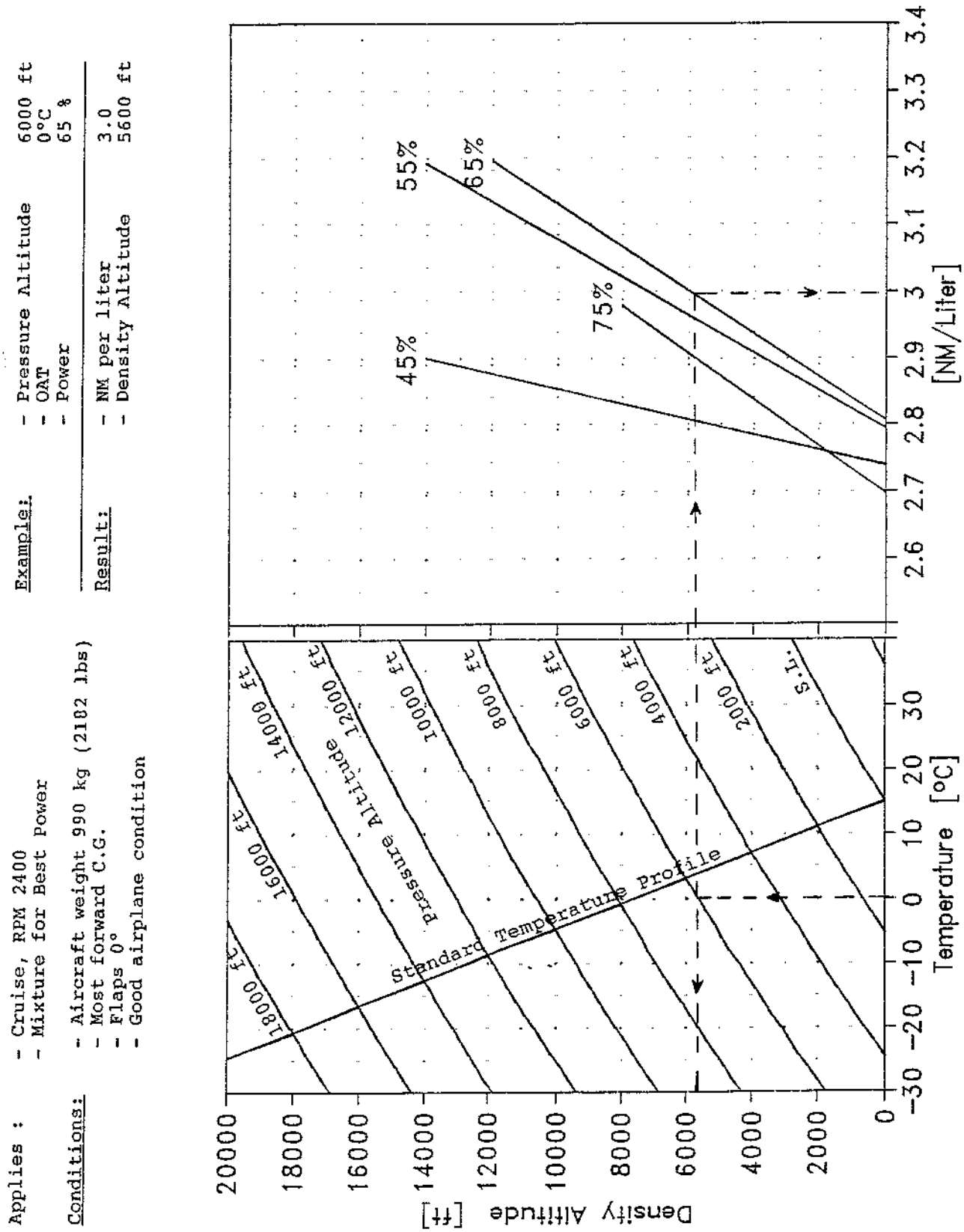


Fig. 5.3.10 b) Cruise (Fuel Consumption)
RPM : 2400 / Mixture for Best Economy

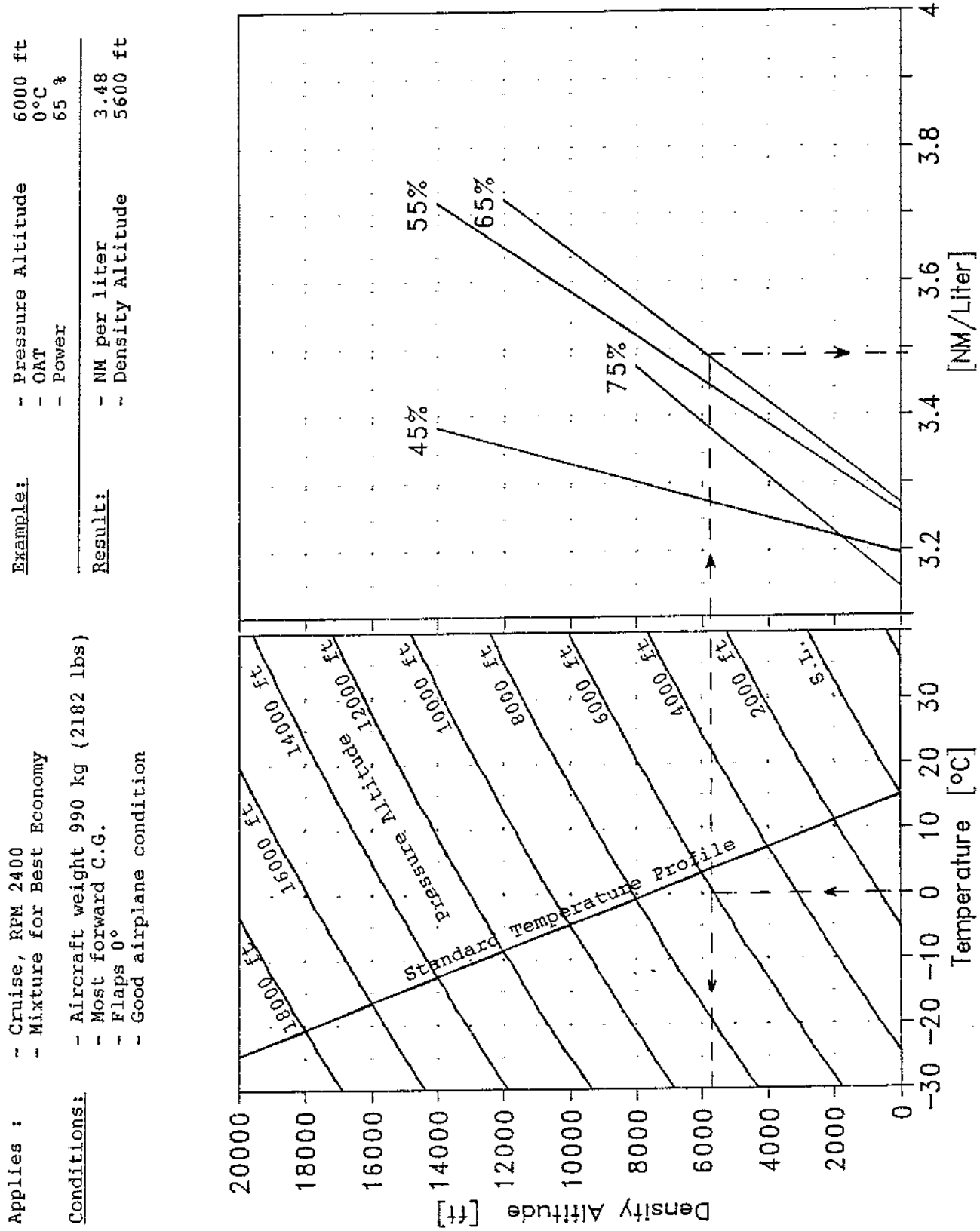


Fig. 5.3.11 a) Cruise (Manifold Pressure)
RPM : 2400

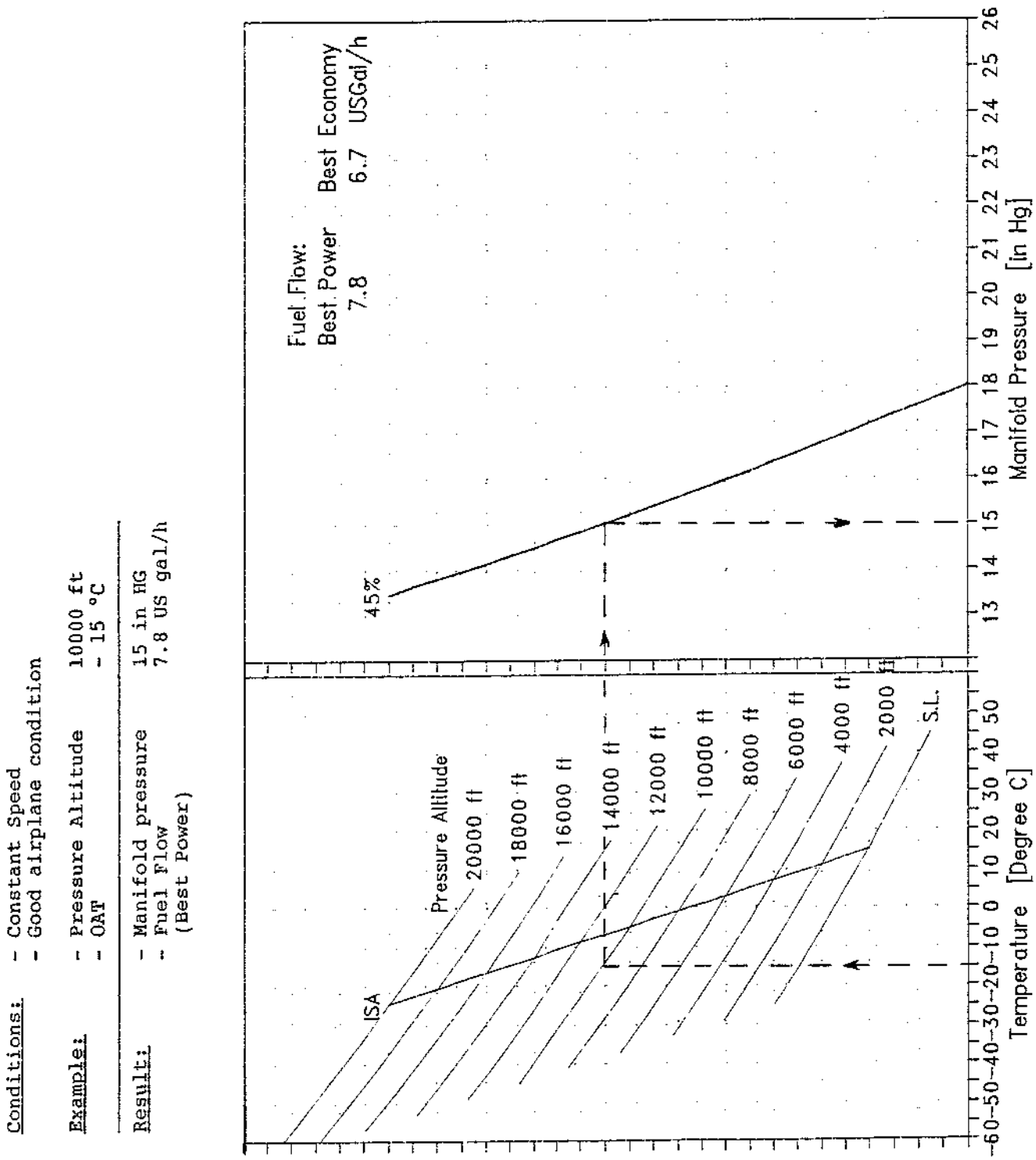


Fig. 5.3.11 b) Cruise (Manifold Pressure)
RPM : 2400

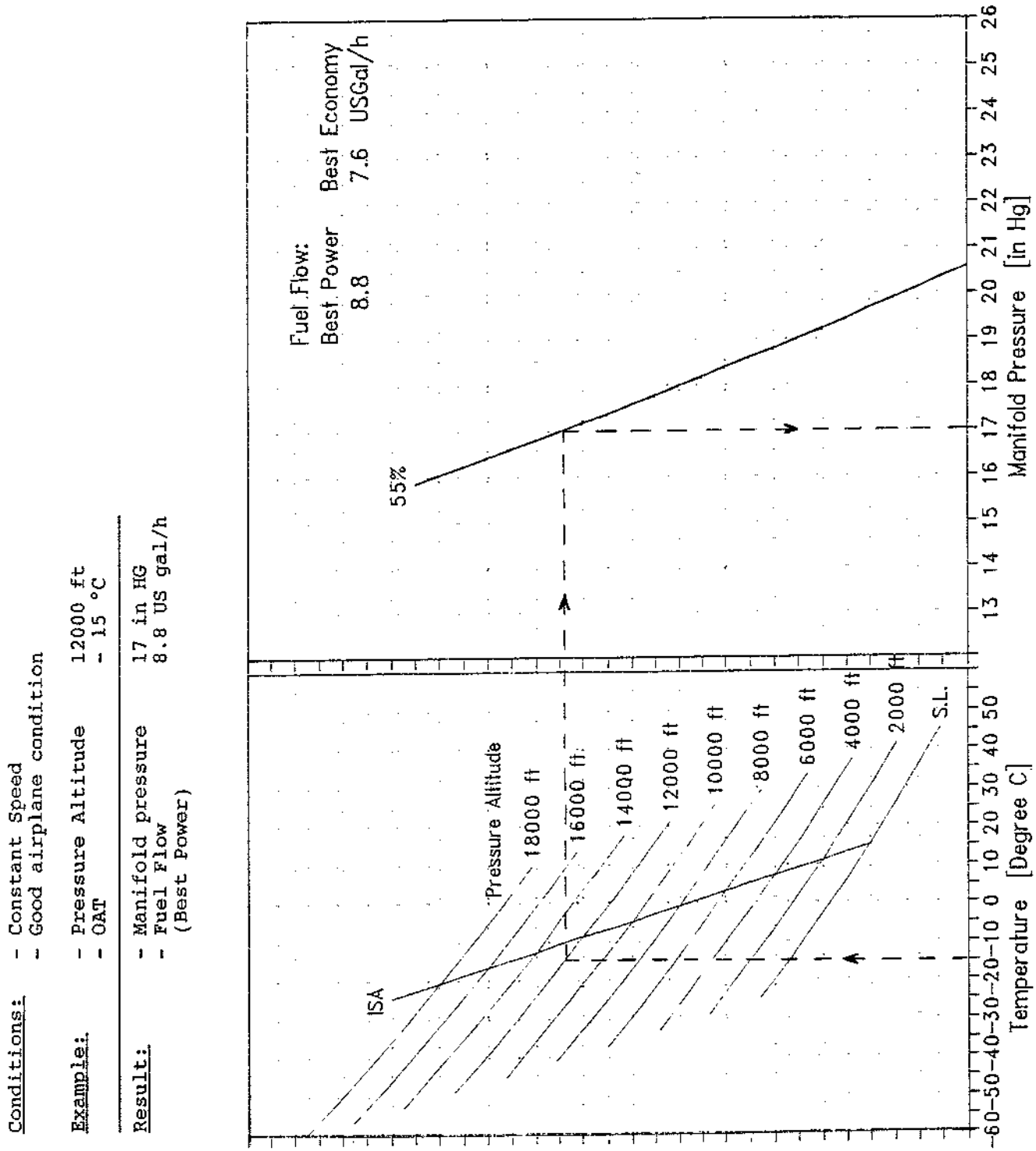
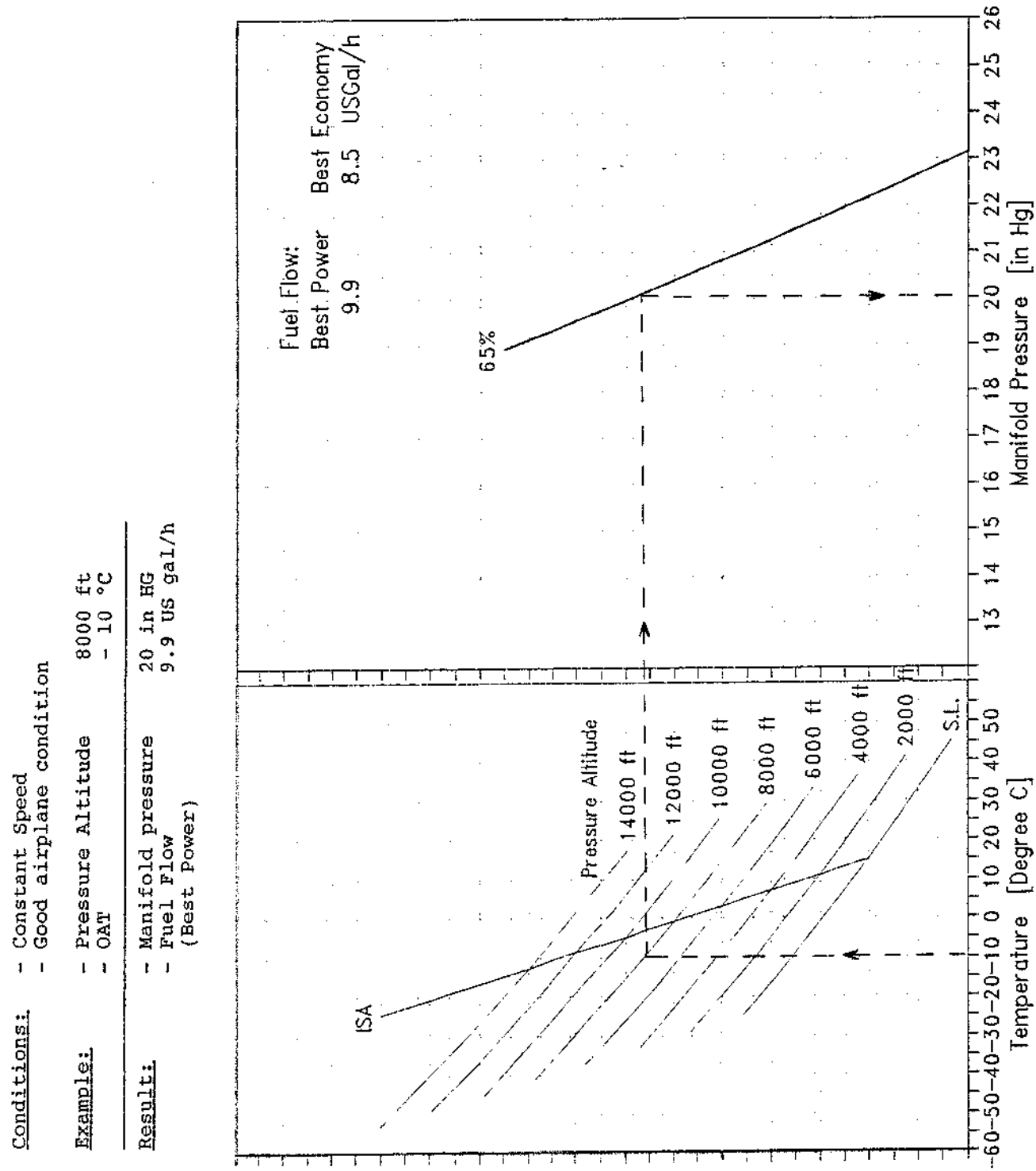


Fig. 5.3.11 c) Cruise (Manifold Pressure)
RPM : 2400



Conditions: - Constant Speed
- Good airplane condition

Example: - Pressure Altitude 8000 ft
- OAT - 10 °C

Result: - Manifold pressure 20 in HG
- Fuel Flow 9.9 US gal/h
(Best Power)

Fig. 5.3.11 d) Cruise (Manifold Pressure)
RPM : 2400

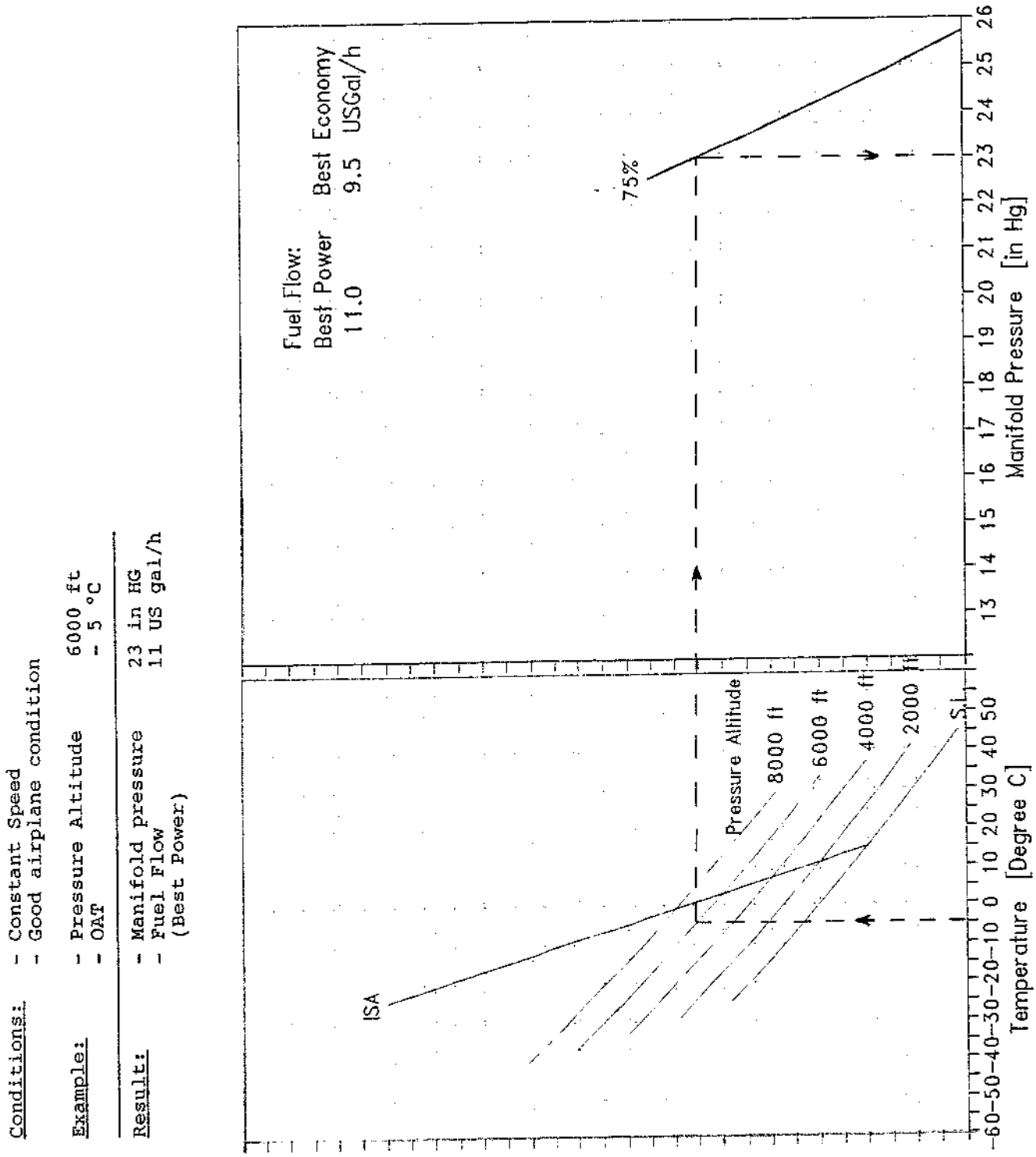


Fig. 5.3.12 a) Cruise (True Airspeed)
RPM : 2400 / Mixture for Best Power

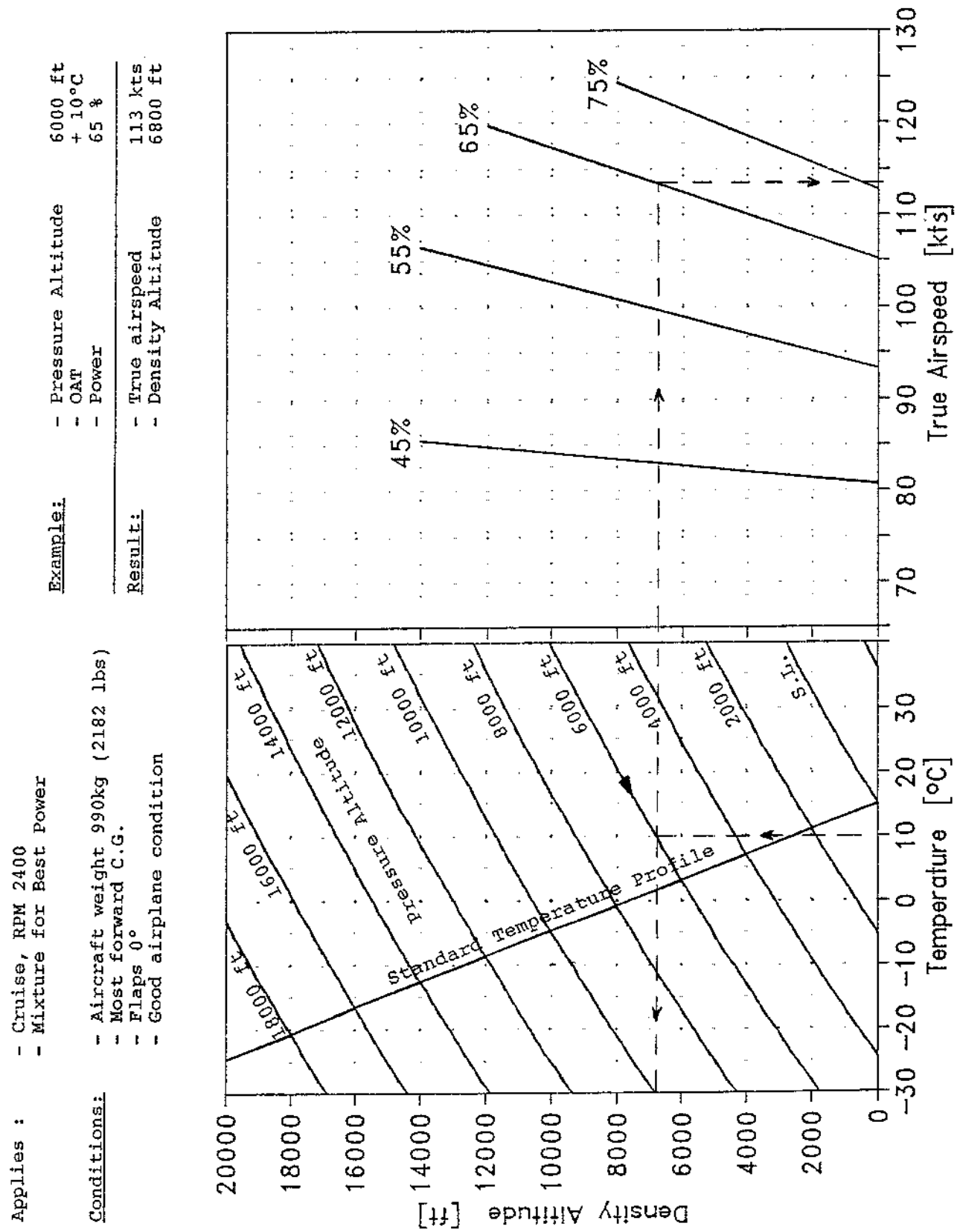


Fig. 5.3.12 b) Cruise (True Airspeed)
RPM : 2400 / Mixture for Best Economy

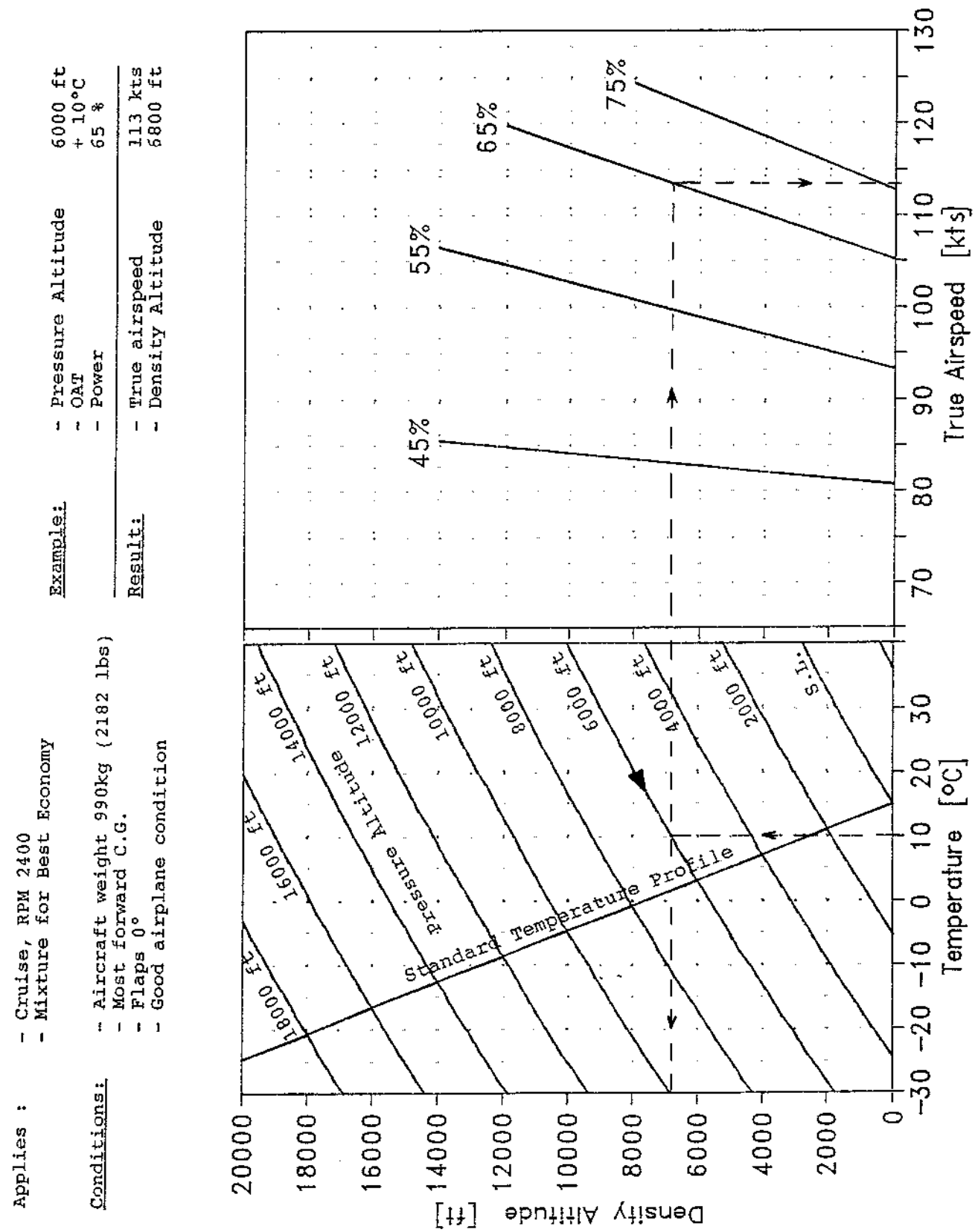


Fig. 5.3.13 a) Range Profile
RPM : 2400 / Mixture for Best Power

Applies : - Cruise, RPM 2400
- Mixture for Best Power

Example:
- Pressure Altitude 8000 ft
- OAT + 5°C
- Power 65 %

Result:
- Range 358 NM
- Density Altitude 8700 ft

Note: Range includes fuel for engine warm-up, takeoff, climb and 45 min. reserve at 45% power setting (Best Power).

Conditions:
- No wind
- Standard Atmosphere
- Takeoff Weight 990 kg (2182 lbs)
- Most forward C.G.
- Flaps 0°
- Good airplane condition
- Usable fuel: 143 ltr.
- Climb : RPM 2700 , Best Power Mix
- Mixture for cruise: Best Power Mix

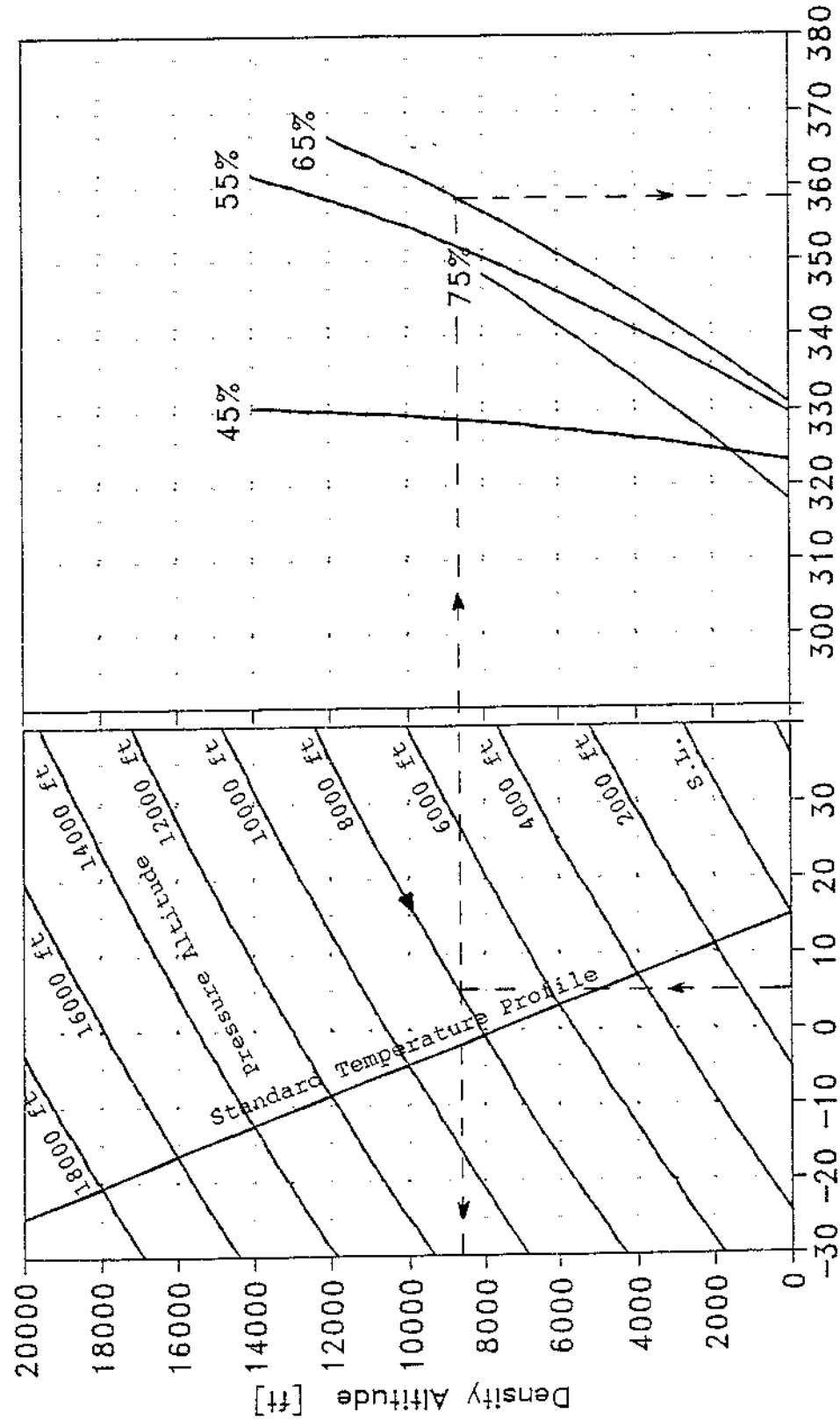


Fig. 5.3.13 b) Range Profile
RPM : 2400 / Mixture for Best Economy

Applies : - Cruise, RPM 2400
- Mixture for Best Economy

Example:
- Pressure Altitude 8000 ft
- OAT + 5°C
- Power 65 %

Result:
- Range 421 NM
- Density Altitude 8700 ft

Note: Range includes fuel for engine warm-up, takeoff, climb and 45 min. reserve at 45% power setting (Best Economy).

Conditions:
- No wind
- Standard Atmosphere
- Takeoff Weight 990 kg (2182 lbs)
- Most forward C.G.
- Flaps 0°
- Good airplane condition
- Usable fuel: 143 ltr.
- Climb : RPM 2700 , Best Economy Mix
- Mixture for cruise: Best Economy Mix

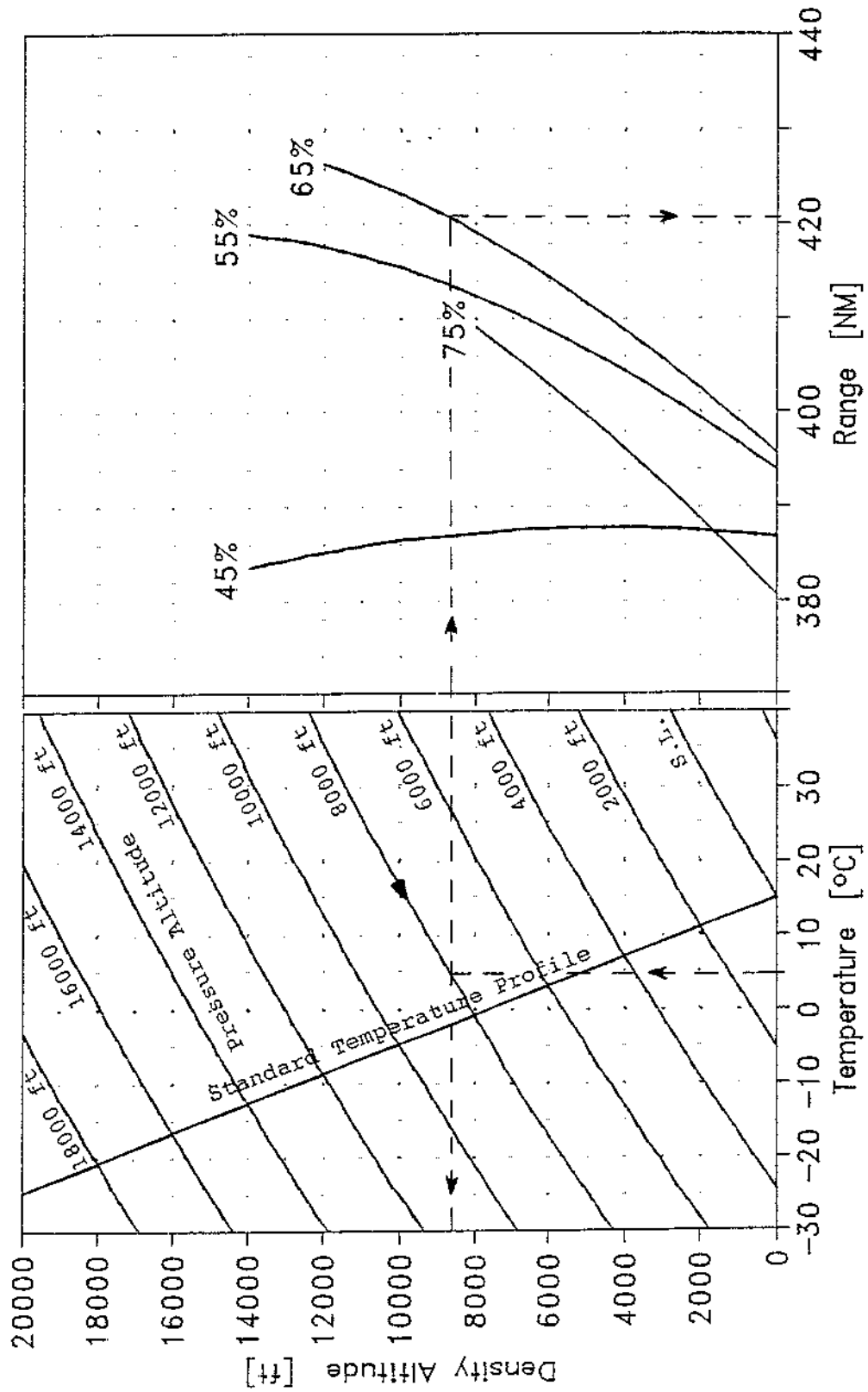
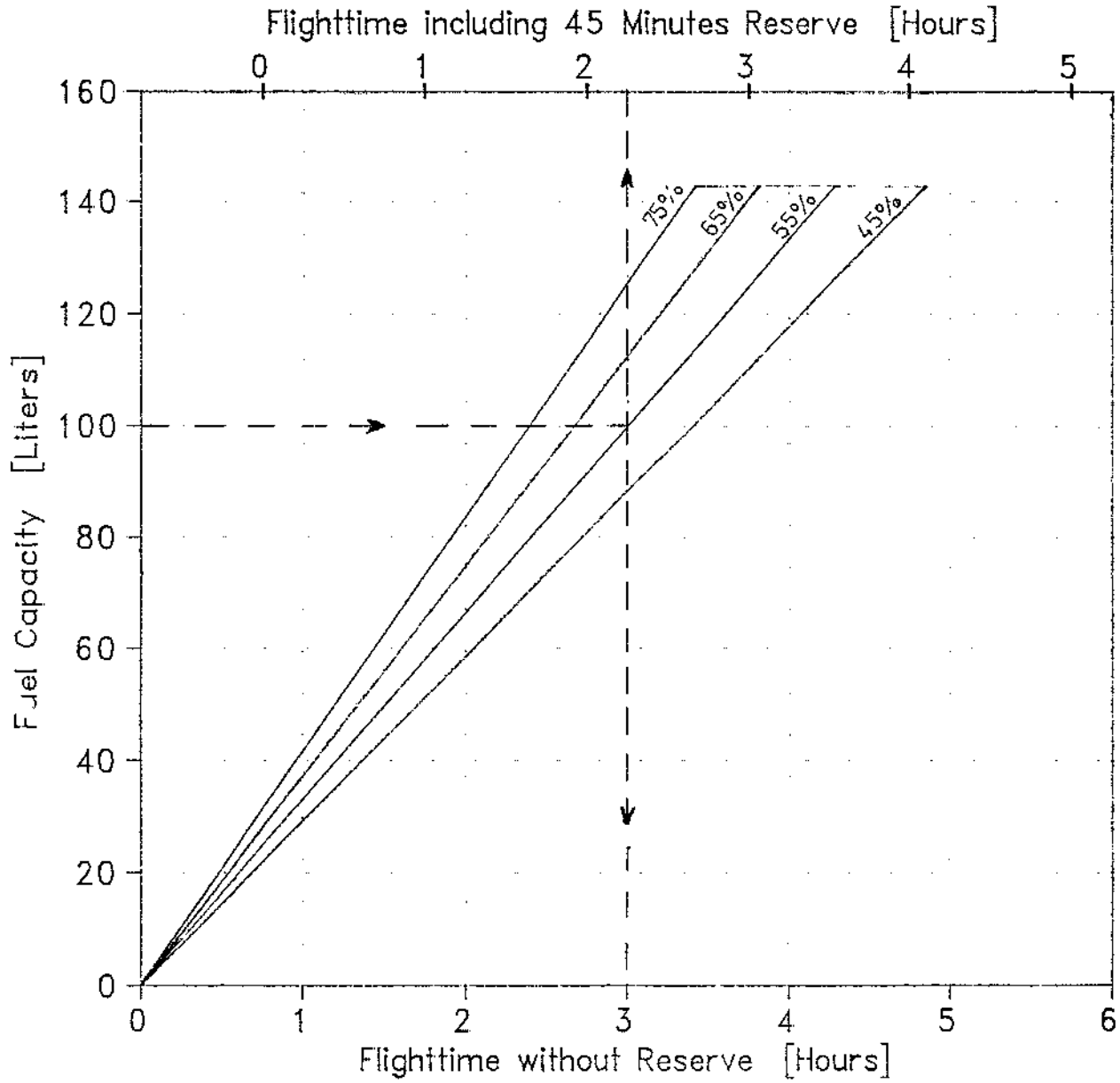


Fig. 5.3.14 a) Endurance Profile
RPM : 2400 / Mixture for Best Power

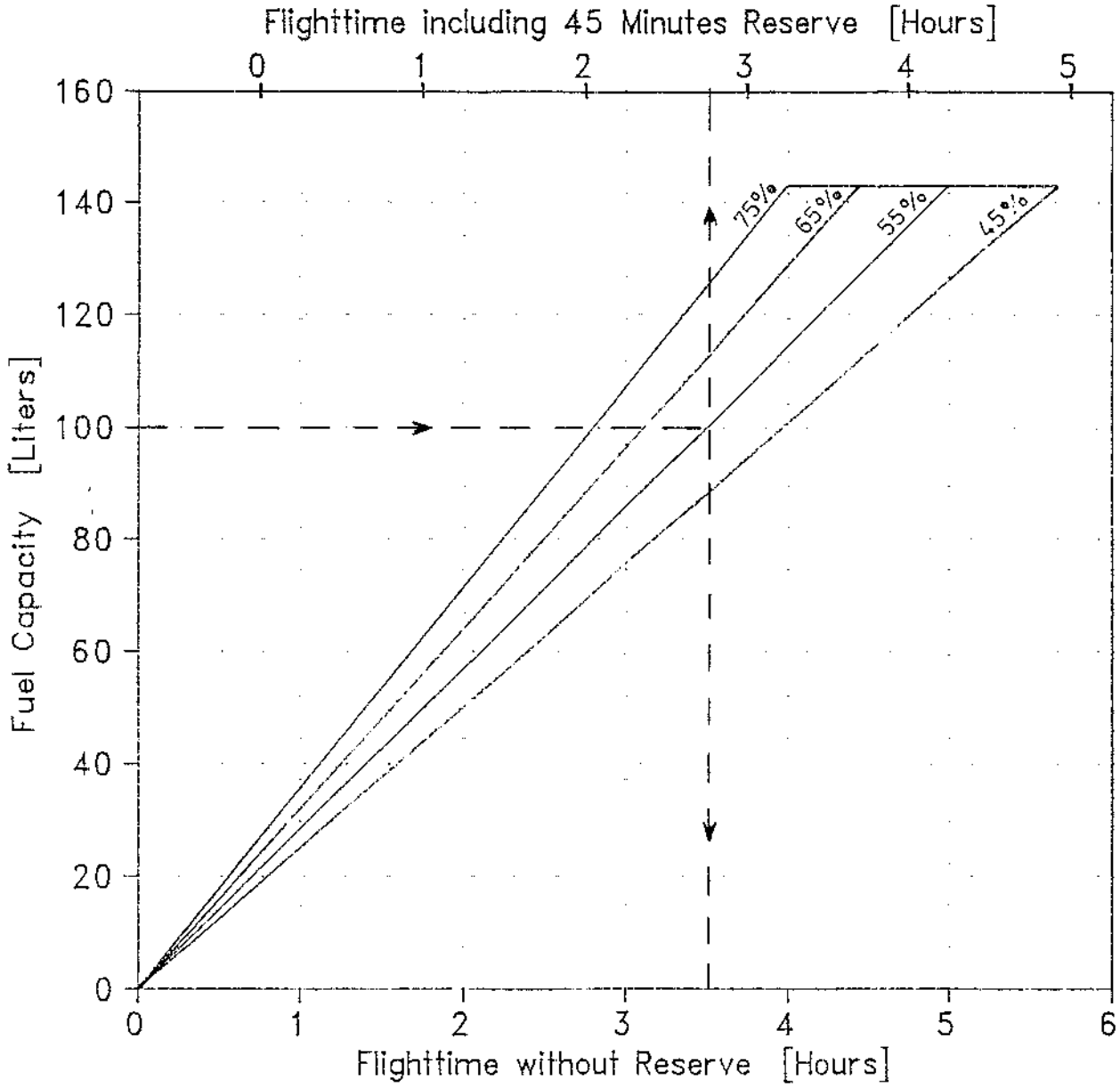


Example:	- Fuel quantity	100 ltr.
	- Power	55 %
Result:	- Endurance with 45 min. reserve	2 h 15 min.
	- Endurance without reserve	3 h 00 min.

NOTE

Datas for time to climb see Fig. 5.3.9

Fig. 5.3.14 b) Endurance Profile
RPM : 2400 / Mixture for Best Economy

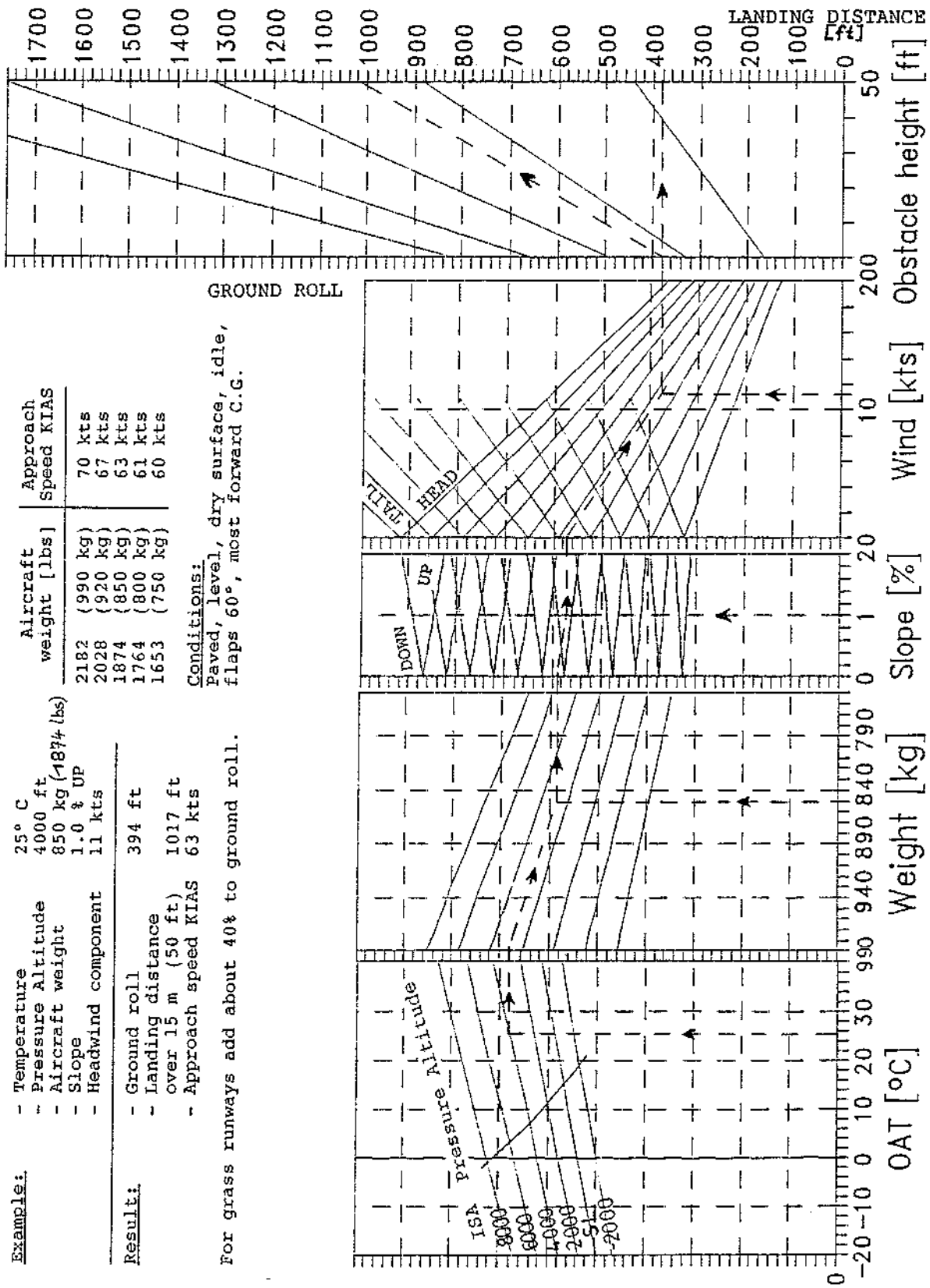


Example:	- Fuel quantity	100 ltr.
	- Power	55 %
Result:	- Endurance with 45 min. reserve	2 h 45 min.
	- Endurance without reserve	3 h 30 min.

NOTE

Datas for time to climb see Fig. 5.3.9

Fig. 5.3.15 Landing Distance



Example:

- Temperature 25° C
- Pressure Altitude 4000 ft
- Aircraft weight 850 kg (1874 lbs)
- Slope 1.0 % UP
- Headwind component 11 kts

Result:

- Ground roll 394 ft
- Landing distance over 15 m (50 ft) 1017 ft
- Approach speed KIAS 63 kts

For grass runways add about 40% to ground roll.

Aircraft weight [lbs]	Approach Speed KIAS
2182 (990 kg)	70 kts
2028 (920 kg)	67 kts
1874 (850 kg)	63 kts
1764 (800 kg)	61 kts
1653 (750 kg)	60 kts

Conditions:
Paved, level, dry surface, idle, flaps 60°, most forward C.G.

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Section 6

Weight and Balance

6.1 General

In order to achieve the flight-performance, safety and good flight characteristics which are designed into the airplane, it must be flown with the weight and center of gravity position within the approved operating range.

The pilot in command must make sure of this before taking off, and also take into account that the center of gravity will shift with fuel consumption.

The approved center of gravity locations in flight are determined in section 2.

Airplane attitude: Bottom edge of canopy frame (fuselage) horizontal

Before the airplane will be delivered, it will be weighed, and basic empty weight and center of gravity location is computed (basic empty weight consists of the standard empty weight of the airplane plus the optional equipment installed at the delivery).

The empty weight and the corresponding center of gravity location are entered in the Weighing Form (see Fig. 6.1).

Whenever new equipment is added or any modification work is done, the mechanic or inspector responsible for the work is required to compute a new basic empty weight and center of gravity position through calculation or weighing. Then he has to write down the results in the Weight and Balance record.

A weight and balance calculation is always required to determine how much fuel or baggage can be boarded, so as to keep within allowable limits.

The following pages serve as prescribed forms used in the weighing and the calculation of the basic empty weight process, center of gravity and useful load.

Note that the useful load includes usable fuel, crew, passenger and baggage.

6.3 Airplane Weighing Procedure

Computing the center of gravity location requires establishing the basic empty weight center of gravity location by weighing. For this purpose the airplane is placed on 3 scales (2 under the main wheels, 1 under the nose wheel) so that the bottom edge of the canopy frame is horizontal.

When rolling the main wheels onto the scales make sure that the shock-absorbing struts do not put side-load on the scales which would otherwise result in an erroneous reading.

The datum level is the wing leading edge at a span of 1.15m [3.8 ft] (outside of the skew wing-fuselage transition). The distances a and b are determined using a plumb line. The empty weight is determined from the sum of the single weights G_2, G_{1ri} and G_{1le}.

Weight at nose wheel	G_2	=	kg [lbs]
Weight at RH main wheel	G_{1ri}	=	kg [lbs]
Weight at LH main wheel	G_{1le}	=	kg [lbs]
Empty weight G =	$G_{1ri} + G_{1le} + G_2$		
	G	=	kg [lbs]
Distance nose wheel - datum level	a	=	mm [in.]
Distance nose wheel - LH main wheel	b_{le}	=	mm [in.]
Distance nose wheel - RH main wheel	b_{ri}	=	mm [in.]

Empty weight C. G. position

$$x_S = \frac{G_{1le} \cdot b_{le} + G_{1ri} \cdot b_{ri}}{G} - a = \text{mm [in.] aft of datum}$$

Establishing the empty weight and the corresponding C. G. location is always done without baggage but with a full oil tank and with the unusable amount of fuel.

When computing the useful load it is important to ensure that the maximum permissible weight is not exceeded.

Following repairs, varnishing, installing additional equipment or at periodical times after the last weighing the new empty weight must be determined.

Empty weight, corresponding C. G. location and useful load must all be certified by the inspector in the Weight and Balance record.

Fig. 6.1 Weighing Form

B U R K H A R T G R O B
LUFT- UND RAUMFAHRT GmbH & Co. KG
LBA-No. I - B 21

WEIGHT AND BALANCE REPORT

Date: _____

A/C Type: Reg.: _____ S/N : _____

Datum line/point (BE/BP): Wing leading edge at QE 2480 / BMET 1150
Level Means (BL): Edge of doorframe horizontal

Airworthiness category:	Gross weight [lbs]	Flight weight C.G. range from (inch)	up to (inch)
Normal (N)			
Utility (U)			
Acrobatic (A)			

Weighing:
Weighing condition:
with engine oil,
brake fluid
and unusable fuel.

Empty weight C.G. Determination:

Weighing point	Gross (lbs)	Tare (lbs)	Net (lbs)	Moment arm (inch)
G 1 LH				b = LH / RH
G 1 RH				
G 2				a =
Empty weight centre of gravity (EWCG):				Empty weight

$$\frac{G1\ LH \times b\ LH + G1\ RH \times b\ RH}{G_{empty}} - a = x_s$$

_____ - _____ = _____ inch

Airworthiness category	Normal (lbs)	
Empty weight		
Max. payload		
Max. gross weight		
Empty weight momentum:		in.lbs

Equipment by weighing see equipment list of:

_____
Date

_____
Inspector

(Stamp)

GROB Form F6/EWG.K1.

6.5 Weight and Balance Record

The basic empty weight and the corresponding C.G. location are the first entries made in the Weight and Balance record. This form is provided to present the current status of the airplane basic empty weight, empty weight C.G. location, empty weight moment and a complete history of previous structural or equipment modifications.

Any change to the permanently installed equipment or modification or aircraft repair which affects empty weight, empty weight C. G. or empty weight moment must be entered in the Weight and Balance record.

For the calculation of the gross weight and corresponding C.G. location or the weight moment respectively always use the basic empty weight, current empty weight C.G. location and the corresponding empty weight moment.

Fig. 6.2 Weight and Balance Record

GROB G 115C/D	Serial Number:	Registration No.:	Page Number:

Date	Item No IN	Item No OUT	Description of article or modification	Weight change Added Wt. lbs	Weight change Added Arm inch	Weight change Added Moment /1000 (+)	Removed Wt. lbs	Removed Arm inch	Removed Moment /1000 (-)	Running basic empty weight Wt. lbs	Running basic empty weight Moment /1000	Inspector/ Date and Stamp Inspec Date	Inspector/ Date and Stamp Stamp

6.7 Weight and Balance Determination for Flight

The following information is intended to assist you in operating your GROB G 115D within the prescribed weight and center of gravity envelope. To determine the weight and center of gravity location for the flight use the graphs Fig. 6.3 "Center of Gravity Limits", Fig. 6.4 "Massmoment Limits", Fig 6.5 "Loading Diagram" and Fig. 6.6 "Calculation of Weight Breakdown" as follows:

First obtain the basic weight and the corresponding C.G. location of your aircraft from the weighing form and the Weight and Balance Record and enter them in the corresponding columns headed "Your Airplane" of Fig. 6.6 "Calculation of Weight Breakdown".

And then, using the "Loading Diagram" (Fig. 6.5) determine the moment of all payload items and enter these moments into the corresponding column of Fig. 6.6.

NOTE

The baggage indication applies to baggage stowed in the center of the baggage compartment. Loading conditions deviating from these assumptions must be taken into account accordingly by changing the arm entries. The moments of loads which may deviate from their indicated location in the aircraft according to the loading diagram, must be additionally computed on the basis of their actual weight and arm.

Add the weights and moments of each column (item 4 and item 6 in Fig. 6.6) and enter the resulting sums in Fig. 6.4 "Massmoment Limits" to check whether they are within the envelope so that the loading condition is permissible.

Fig. 6.3 Center of Gravity Limits

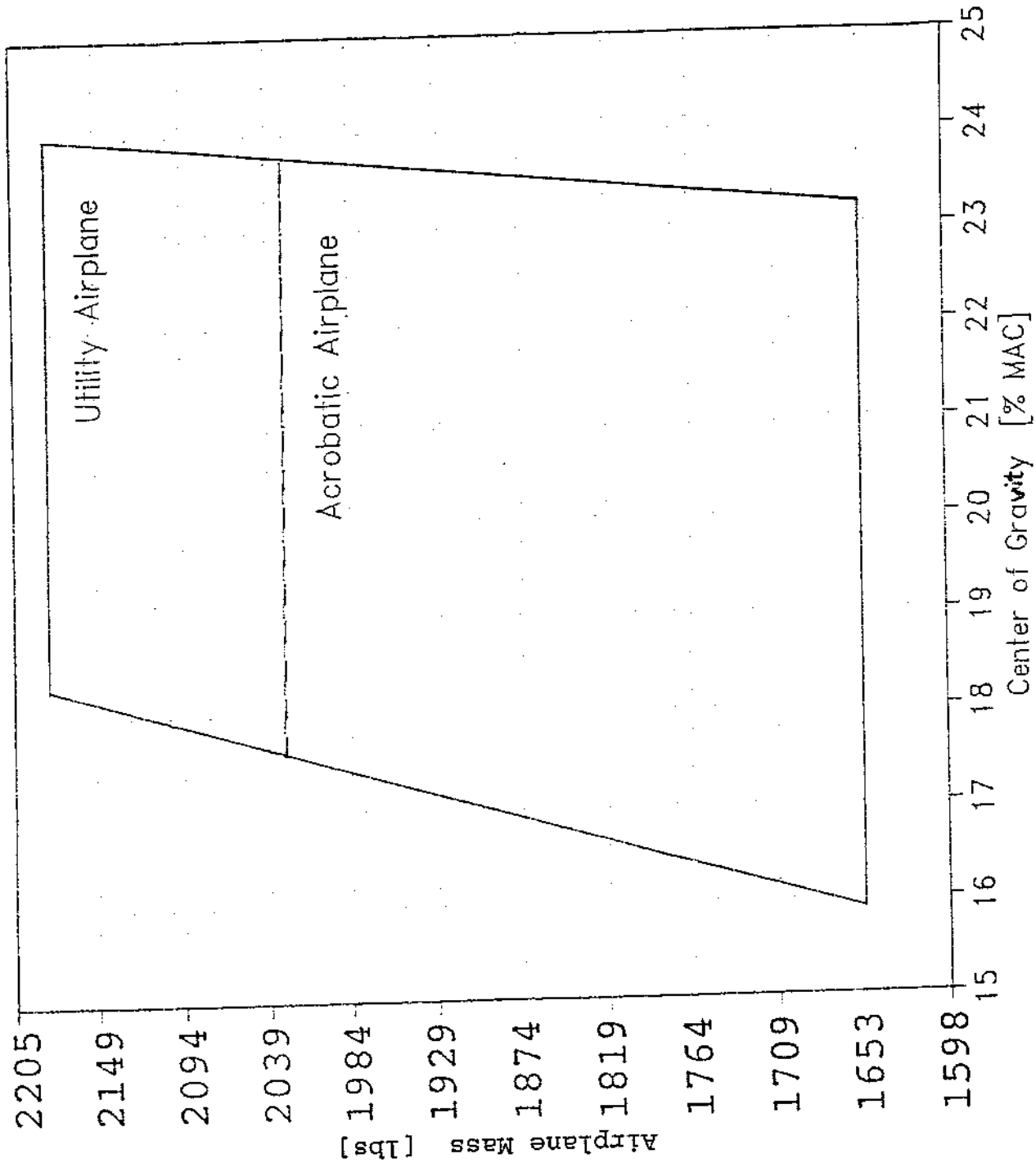


Fig. 6.4 Massmoment Limits

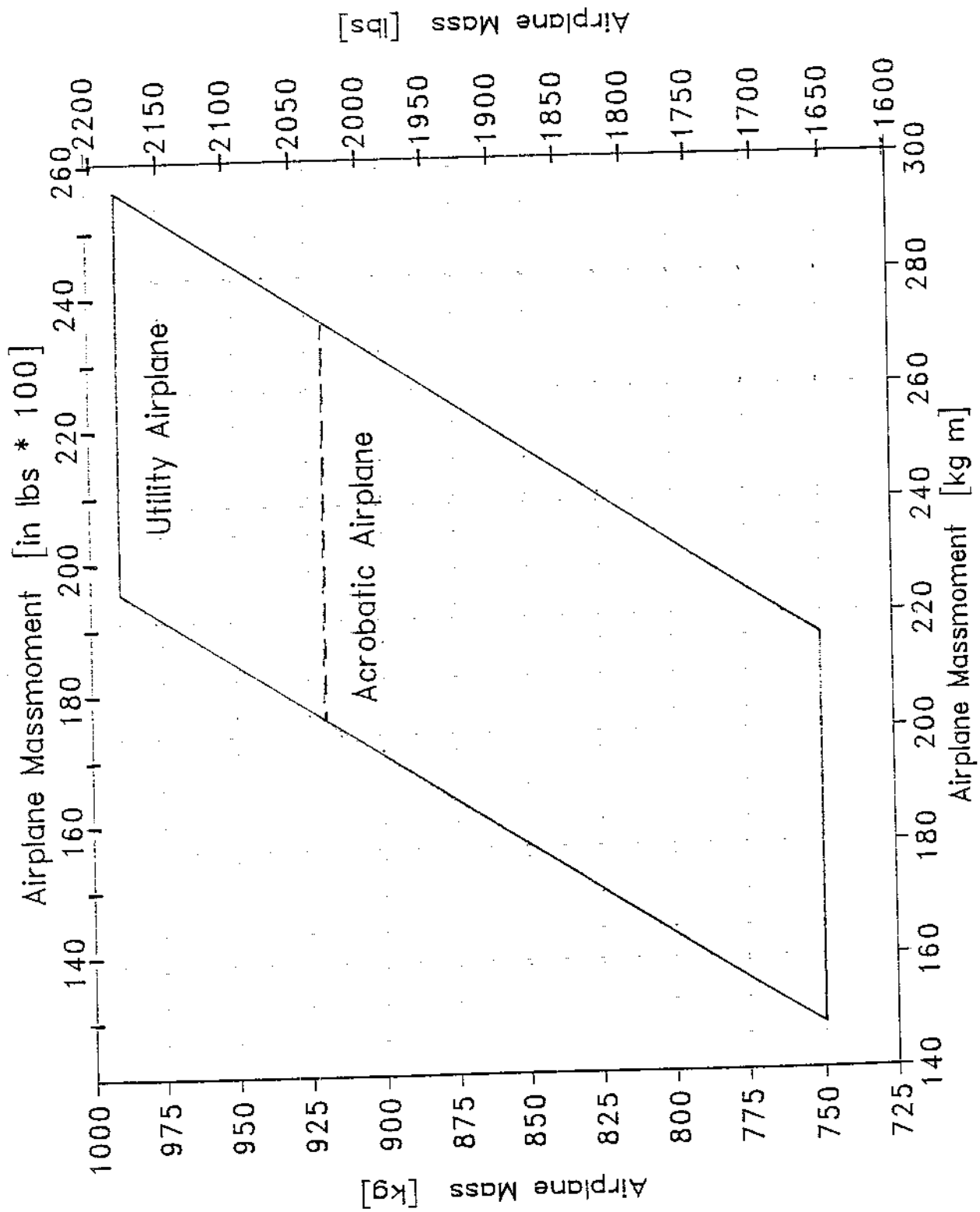


Fig. 6.5 Loading Diagram

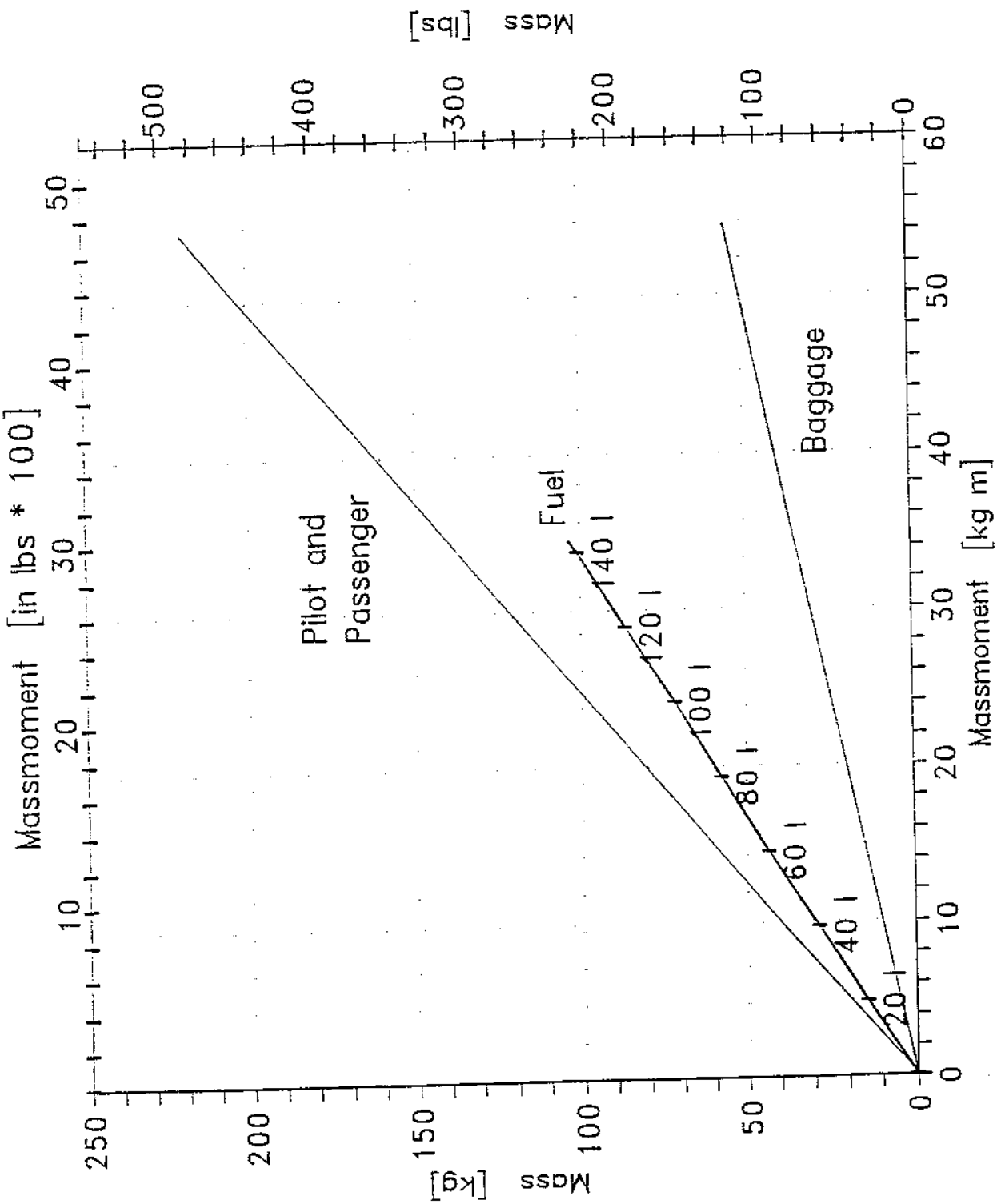


Fig. 6.6 Calculation of Weight Breakdown

CALCULATING USEFULE LOAD	SAMPLE AIRPLANE (EXAMPLE)		YOUR AIRPLANE	
	MASS kg (lbs)	MOMENT kg m (lbs in)	MASS kg (lbs)	MOMENT kg m (lbs in)
1. Basic empty weight (use the values for your airplane as currently equipped incl. nonusable fuel and full oil capacity)	697.80 (1538.4)	157.73 (13691)		
2. Pilot and passenger (Arm: 0.25 m / 9.84 in)	160.00 (352.74)	40.00 (3472)		
3. Baggage (Arm: 0.99 m / 38.98 in)	35.00 (77.16)	34.65 (3008)		
4. Total weight and total moment but fuel tank empty (total of 1. thru 3.)	892.80 (1968.3)	232.38 (20170)		
5. Usable fuel (0.72 kg/l = 6.0 lbs/US.gal.) Maximum 143 l = 37.8 US.gal. Example: 135 l = 35.7 US.gal. (Arm: 0.335 m / 13.19 in)	97.20 (214.29)	32.56 (2826)		
6. Total weight and total moment with full tank (total of 4. thru 5.)	990.00 (2182.59)	264.94 (22996)		
7. Find the computed values for the total weight 990 kg (2182.59 lbs) and the total moment 264.94 kg m (22996 lbs in) in C.G. envelope graph. Since they are within the envelope, the loading condition is permissible.				

The Center of Gravity envelope of the G 115D is such, that the landing C.G. (even after consumption of all usable fuel) will be within the approved envelope if the take-off C.G. has been within the limits.

6.9 Equipment List

The following is a list of equipment available at this time. All of the items installed in your airplane are identified in the corresponding column.

The present equipment list contains the following details:

- The item number consists of a letter identification for the associated group and a sequence number.

Letter identification is as follows:

A	Avionics
E	Electrical
F	Landing gear
I	Instrumentation
T	Engine
Z	Airframe

- The column "Code" identifies whether the equipment item is a mandatory, standard or optional equipment item according to the following abbreviations:

A	Mandatory equipment item
B	Standard equipment item
C	Optional equipment item
D	Additional optional equipment item
E	Loose item of equipment, not included in the airplane empty weight.

NOTE

When an optional equipment item is installed, this must be in agreement with the corresponding installation drawing, equipment instructions or in compliance with special approval of the Civil Aviation Authorities.

The columns "Weight" and "Arm" list the weight and and C.G. location relative to the datum of the equipment item, positive relating to distances aft of the datum, and vice versa.

Equipment List

Date of installation :			Stamp of Inspector:		
Item No.	Code	Item, Manufacturer, Type	Mark if instl.	Weight (lbs)	Arm (ft)
A 1	B	ADF Antenna, KING KA 0044B		2.799	+4.724
A 2	B	ADF Antenna, BECKER ANT 2070		3.748	+4.724
A 3	B	ADF Indicator, KING KI227		0.683	-0.951
A 4	B	ADF Indicator, BECKER ID 2070		1.102	-0.951
A 5	B	ADF Receiver, BECKER ADF 2070		2.205	-0.951
A 6	B	ADF Receiver, BECKER ADF 2079		2.205	-0.951
A 7	B	ADF-Receiver, KING KR 87		3.197	-0.951
A 8	B	ATC Transponder, BECKER ATC 2000		2.646	-0.951
A 9	D	Audio Control Console KING KA 134		1.700	-0.951
A 10	D	Audio Control Console, KING KMA 24H		1.700	-0.951
A 11	D	Audio Control Marker Receiver KING KMA 24		1.697	-1.148
A 12	D	Audio Control Panel AEE ACP 2700		.....	-0.951
A 13	B	Avionic Blower, KING KA 33		1.257	-1.148
A 14	B	Blindencoder, ACK A-30		0.397	-0.951
A 15	A	COM-1 Antenna, Dittel SPERRTOPF		0.573	+15.42
A 16	D	COM-2 Antenna, Command Ind. CI 122		0.485	+2.854

Equipment List

Item No.	Code	Item, Manufacturer, Type	Mark if instl.	Weight (lbs)	Arm (ft)
A 17	B	COM/NAV 1 Receiver, KING KX 155-35		4.739	-0.951
A 18	D	COM/NAV 2 Receiver, KING KX 155-34		4.739	-0.951
A 19	A	COM, BECKER AR3201		1.984	-0.951
A 20	D	COM BECKER AR 4201		.....	.....
A 21	D	COM/NAV, KING KX 125		3.880	-0.951
A 22	D	DC/DC Converter AEE SR 6900		0.360	-0.951
A 23	D	DME Antenna, KING KA 60		0.022	-0.984
A 24	D	DME KING, KN 63		2.799	-0.951
A 25	D	DME, KING KN 62A		2.601	-0.951
A 26	D	DME Indicator, KING KDI 572		0.794	-0.951
A 27	D	ELT, POINTER 3000		1.900	-0.951
A 28	D	ELT, ACK E-01		3.300	-0.951
A 29	D	Flux Transmitter, KING KMT 112		0.331	-0.951
A 30	D	Glide slope, KING KN 75		1.600	-0.951
A 31	D	GPS Antenna MOTOROLA EK 568		0.265	-0.951
A 32	D	GPS Antenna, SENSOR SYSTEM S67-1575-39		0.313	.....
A 33	D	GPS GARMIN 100 AVD		1.700	-0.951
A 34	D	Gyro Mount, KING KG 102A		9.400	-0.951
A 35	D	HSI, KING KI 525A		9.500	-0.951
A 36	B	Marker Antenna, Command Ind. CI-102		0.595	-0.754

Equipment List

Item No.	Code	Item, Manufacturer, Type	Mark if instl.	Weight (lbs)	Arm (ft)
A 37	D	Marker Receiver, KING KR 21		0.600	.....
A 38	B	NAV Antenna, Command Indust. CI 157P		0.353	+4.101
A 39	D	RMI Indicator, KING KI229		2.866	-0.951
A 40	D	Slaving Unit, KING KA51B		0.198	-0.951
A 41	B	Transponder Antenna, KING KA 60		0,022	-4.724
A 42	B	Transponder, KING KT 76A		3.108	-0.951
A 43	D	Universal Converter, KING KN 72		1.323	-0.951
A 44	D	VHF Com.-Transceiver, KING KY 96A		2.800	-0.951
A 45	D	VOR/LOC Indicator, KING KI 203		1.609	-0.951
A 46	D	VOR/LOC Indicator, KING KI 208		1.000	.....
A 47	B	VOR/LOC/GS Indicator, KING KI 204		1.697	-0.951
A 48	D	Intercom-Unit SIGTRONICS SPA-400		.....	.....
A 49	D	NAV-Receiver BECKER NR 3301S		.....	.....
A 50	D	Power-Converter BECKER VR 2011		.....	.....
A 51	D	GPS TRIMBLE TNL 2000 A/C (only for VFR)		.....	.....
A 52	D	GPS/COM KING KLX 135 (only for export)		.....	.....
A 53	D	Blindencoder (only for export) AMERI-KING AK 350		.....	.....

Equipment List

Item No.	Code	Item, Manufacturer, Type	Mark if instl.	Weight (lbs)	Arm (ft)
E 1					
E 2	A	ACL Power Supply, WHELEN A490A,TS,CF-14/28		1.500	+15.42
E 3	A	Batterie, Concorde RG 24-11M		26.57	+3.592
E 4	A	Engine run hour counter, KÜBLER HK 15.20.52		0.110	-0.951
E 5	C	External Power Connector, AIRCRAFT 4621B		0.816	+5.807
E 6	A	Flap Motor, MOTION 85262		4.189	+2.526
E 7	A	Flight hour counter, KÜBLER HK 15.20.52		0.110	-0.951
E 8	A	Fuel Pump, WELDON B8120-H		1.808	-3.035
E 9	A	Generator, BOSCH 28V 10/35A 0120 488 269		9.259	-5.233
E 10	A	Generator Control Lamp BOSCH 0 310 152 006		0.044	-0.754
E 11	D	Hi&Lo Volt Indicator, BOSCH 0 310 152 006		0.044	-0.754
E 12	A	Ignition Switch, TELEDYNE/ BENDIX 10-357200-1		0.353	-0.754
E 13	B	Landing Light 100W GENERAL ELECTRIC GE 4591		0.441	-5.315
E 14	A	Lift Detector, SAFE FLIGHT P/N 164		0.132	.....
E 15	A	Master Switch, HERTH&BUSS 70.579.481		0.066	-0.754
E 16					

Equipment List

Item No.	Code	Item, Manufacturer, Type	Mark if instl.	Weight (lbs)	Arm (ft)
E 17					
E 18	A	NAV+STROBE Light left, WHELEN A600-PR-D-28		0.510	-0.754
E 19	A	NAV+STROBE Light right, WHELEN A600-PG-D-28		0.510	-0.754
E 20	A	Pitot Heat Tube, AERO INSTR. AN5812-1 (24 VDC)		0.838	+0.328
E 21					
E 22	A	Stall Warning Light, BOSCH 0 310 152 006		0.044	-0.754
E 23	A	Stall Warning Horn, BÜRKLIN 36M434		0.044	-0.441
E 24	B	Taxi Light 150W General Electric GE 4626		0.441	.....

Equipment List

Item No.	Code	Item, Manufacturer, Type	Mark if instl.	Weight (lbs)	Arm (ft)
F 1	A	Brake Calliper, Cleveland 30-63a with Linings		1.378	+2.051
F 2	A	Brake Fluid Aeroshell Fluid 41			
F 3	A	Main Wheel Rim, CLEVELAND 6.00-6 40-97a incl. Brake Disc		6.063	+1.804
F 4	A	Main Wheel Tire, Goodyear Flight Special II 15x6.00-6 P/N 156 E 61-3		7.275	+1.804
F 5	A	Main Wheel Fairing		3.307	+1.804
F 6	A	Main Wheel Tube, Goodyear G15x6.00-6 reg Tube TR20		1.499	+1.804
F 7	A	Master Brake Cylinder Cleveland 10 - 30		1.389	-2.428
F 8	A	Nose Wheel Rim, Tost		3.042	-3.494
F 9	D	Nose Wheel Rim, 115C-5205		.....	-3.494
F 10	A	Nose Wheel Tire, Goodyear 380x150/15x6.00-5 PR		4.960	-3.494
F 11	D	Nose Wheel Tire, Goodyear 5.00-5/6PR 505C61-8		4.960	-3.494
F 12	A	Nose Wheel Tube, Goodyear 5.00 - 5 Tube TR 67		1.499	-3.494
F 13	A	Nose Wheel Fairing		2.646	-3.494
F 14	A	Parking Brake Valve, Cleveland 60 - 5		0.331	-2.723
F 15	A	Supply Bin, FAG 2334845		0.419	-3.117

Equipment List

Item No.	Code	Item, Manufacturer, Type	Mark if instl.	Weight (lbs)	Arm (ft)
I 1	D	Accelerometer, App.-GAUTING Typ 470L P/N 620747-1		0.660	-0.951
I 2	A	Accelerometer 3", BENDIX 10-101		.....	-0.951
I 3	A	Air Vakuum Pump, SIGMA-TEK 1U128-006		2.200	.....
I 4	A	Airspeed Indicator, SIGMA-TEK EA 5175-05L		0.992	-0.951
I 5	A	Altimeter 1 UNITED INSTR. 5934()-()		1.543	-0.951
I 6	D	Altimeter 1 UNITED INSTR. 5934()-()-L		1.543	-0.951
I 7					
I 8					
I 9	D	Ampere & Volts Indicator, IGVA 3101000		0.353	-0.754
I 10	D	CHT & Fuel pressure Indicat. ICFP 3105000		0.353	-0.754
I 11	A	Clock, BENZ-MICRO		.....	.....
I 12	D	Clock, SINN NABO 25/8		0.882	-0.951
I 13	A	Directional Gyro Air, SIGMA-TEK 1U262-001-52		2.400	.....
I 14	D	Directional Gyro Air, SIGMA-TEK 1U262-002-51		2.400	.....
I 15	D	Directional Gyro Air R.C.ALLEN RCA11A-13		2.888	-0.951
I 16	A	Directional gyro R.C.ALLEN RCA 11A-8		2.646	-0.951

Equipment List

Item No.	Code	Item, Manufacturer, Type	Mark if instl.	Weight (lbs)	Arm (ft)
I 17	D	Electrical Horizon R.C.ALLEN RCA26BK-9		2.712	-0.951
I 18	D	Horizon Air Driven R.C.ALLEN RCA22-41		2.756	-0.951
I 19	A	Horizon Air Driven R.C.ALLEN RCA 22-40		2.756	-0.951
I 20	D	Horizon Air Driven KING KG 258		2.756	-0.951
I 21	D	Horizon Air, SIGMA-TEK 23-501-06-19		1.800	-0.951
I 22	D	Horizon Air, SIGMA-TEK 1U-149-010-3		1.800	-0.951
I 23	A	Kompass Lighted, AIRPATH C2300L4		0.882	-0.754
I 24	A	Manifold Pressure & Fuel flow Indicator, SIGMA-TEK 1U028-005-28		.....	-0.951
I 25	D	Manifold pressure & fuel flow gauge R.C.ALLEN 21-1000-3		1.000	-0.951
I 26	D	Manifold pressure & fuel flow Indicator UNITED INSTR. UI-6333 Code H54		1.200	-0.951
I 27	D	OAT & EGT Indicator, IOET 3108000		0.371	-0.754
I 28	D	Oel pressure & Oel temperat. Indicator IOTP 3104000		0.362	-0.754
I 29	A	RPM Indicator, MOTOMETER 646.012.9994		0.772	-0.853
I 30	D	Suction Indicator SUP.INC. 4101-0001		0.110	-0.951
I 31	A	Suction Indicator VARGA ENTERPRISES, INC. 5001		0.110	-0.951

Equipment List

Item No.	Code	Item, Manufacturer, Type	Mark if instl.	Weight (lbs)	Arm (ft)
I 32	A	Suction filter AIRBORNE 1J7-1		0.419	-0.951
I 33	A	Suction regulator AIRBORNE 2H3-12		0.353	-0.951
I 34	D	Tank left/right Indicator, IFFQ 3102000		0.369	-0.754
I 35	B	Turn Coordinator, R.C. ALLEN RCA 82A.11		1.250	-0.951
I 36	D	Turn Coordinator, S-TEC 6407-XX		.....	-0.951
I 37	D	Turn & Slip Indicator, R.C. ALLEN RCA 56-3		1.300	-0.951
I 38	A	Vertical Speed Indicator UNITED INSTR. 7000		0.992	-0.951
I 39	D	Vertical Speed Indicator UNITED INSTR. 7000-L		0.992	-0.951

Equipment List

Item No,	Code	Item, Manufacturer, Type	Mark if instl.	Weight (lbs)	Arm (ft)
T 1	A	Air Filter, 115C-6600.14		0.198	-4.396
T 2	A	Engine Lycoming AEIO-320 D1B		306.0	-4.560
T 3	A	Exhaust System, ROLA VI B5 115C-6401/-6402		13.23	-4.462
T 4	A	Fuel pump, WELDON B-8120-H		0.820	-3.035
T 5	A	Fuel Pressure Sensor, MOTOMETER 675.003.1002		0.220	-2.772
T 6	A	Fuel Quantity Sensor MOTOMETER 608.010.1003		0.331	+2.887
T 7	A	Fuel Shutoff Valve, 115-6249		0.168	+0.754
T 8	A	Oilcooler, 115C-6045		.....	.....
T 9	A	Oil Pressure Sensor MOTOMETER 675.004.1018		0.220	-5.381
T 10	A	Oil Temperature Sensor VDO TM 014-4		0.066	-3.445
T 11	D	Oil Temperature Sensor MOTOMETER 642.009.1014		0.066	-3.445
T 12	A	Propeller, Hoffmann HO 23 CHM-188 156		.....	-6.004
T 13	D	Starter, B+C, BC 315-100-4		.....	.....
T 14	A	V-Belt Lycoming 76026		0.176	-5.495
T 15	C	anti-icing box		0.661	-3.117
T 16	C	Plate (oil cooler air inlet)		0.099	-3.517

Equipment List

Item No.	Code	Item, Manufacturer, Type	Mark if instl.	Weight (lbs)	Arm (ft)
Z 1	D	Alternate Static System 115-6207		0.265	-2.789
Z 2	E	Back Pad, Grob			
Z 3	B	Defroster Nozzles, VW 443 819 635 01C or -636 01C		0.088	-1.378
Z 4	A	Emergency Hammer, 274004 3C		0.485	-0.656
Z 5	D	Fire Extinguisher TOTAL EHAL		4.629	+2.297
Z 6	B	Handle, VW KA 15-959 659 251 857 607 01C			
Z 7	A	Harnesses, Schugu FAG-7H/O AUTOFLUG AFG 0178943		2.094	+2.231
Z 8	D	Heating Mixing Box, 115-6030		3.836	-3.379
Z 9	D	Legstrap, Bogu FAG-7D/O AUTOFLUG AFG 0525734		0.243	+2.231
Z 10	B	Pitot Tube Cap		-	-
Z 11	A	Seatbelts, Bagu FAG-7D/O AUTOFLUG AFG 0478931		3.086	+0.919
Z 12	E	Seat Pad, Grob complete		5.622	+1.411
Z 13	B	Side Fairing,			-1.476
Z 14	B	Textile,			
Z 15	B	Vent Nozzles Wemac 2550		0.022	-0.787

Table of Contents

Section 7

Airplane and System Description

7.1 General

This chapter contains the description of the airplane and its systems, operating instructions also being given for the latter. A few of the systems described here are special equipment and may not be included in your airplane. For details regarding additional special equipment systems or components please refer to section 9 of the airplane flight manual.

7.3 Airframe

The G 115D is an utility/acrobatic category airplane designed as a single-engine, two-seater low-wing aircraft with cantilever wings and a conventional empennage. The tricycle gear of the GROB G 115D is non-retractable. The G 115D is manufactured with newest knowledge to state-of-the-art requirements in industrial fiber reinforced plastic design, mainly involving glassfiber reinforced plastic.

The semi-monocoque fuselage comprises a self-supporting glass-fiber reinforced plastic shell with frame and web members. The one-part canopy has a two-part generous wrap-around glazing.

The cantilever wing of single-trapezoidal cross section has an I-beam main spar with spar caps of glass fiber roving. The wing shell is of honeycomb sandwich design, except the tank section, which consists of a PVC foam sandwich. Interconnection of the wings is made via the spar stubs, bolted together with splice metal sheets. Each wing is attached to the fuselage by two necked-down bolts. The wing trailing edge carries conventional ailerons and flaps.

The aileron shell has an aramide fiber glass plastic honeycomb sandwich structure, the web consists of glass fiber plastic honeycomb sandwich. The aileron are balanced by a horn which also holds the mass balancing lead. The structural configuration of the flaps is the same as that of the ailerons.

The conventional empennage comprises fin, rudder, tailplane, elevator and elevator trim tab. The fin integrated in the fuselage mainly comprises the main and end spar in honeycomb sandwich design and a fiber-reinforced full laminate shell. The structural configuration of the tailplane is similar to that of the wings. The tailplane is attached to the fuselage by three fittings. The structural configuration of elevator and rudder are similar to that of the ailerons. Elevator and rudder have horn balance.

The spin fin consists of a GRP-honeycomb-sandwich and is attached to the fuselage by means of screws. The installed grinding disk protects the spin fin from damage.

The complete airframe is protected from moisture and ultra-violet radiation by an UP gel-coat which is finished with a two-component-polyurethan-lacquer.

7.5 Flight Controls

The flight control system of the GROB G 115D comprises conventional ailerons, rudder and elevators. All flight control surfaces are mechanically actuated via push-pull rods, the ailerons and elevators being controlled by the control stick and the rudder via rudder toe brake pedals.

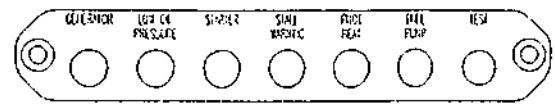
For each control stick a PTT-momentory-switch is installed.

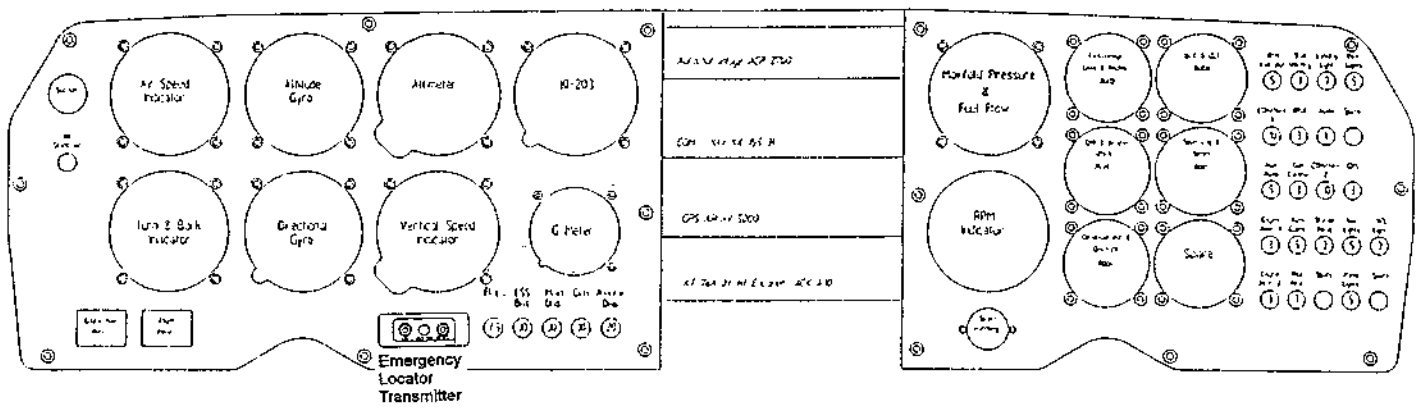
The G 115D has manual elevator trim, the corresponding trim tab being controlled by means of a hand wheel on the center console. Turning the trim wheel forward produces nose-down trimming of the airplane, turning the trim wheel aft produces nose-up trimming.

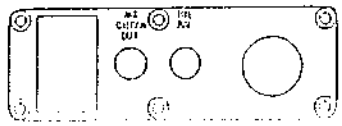
In the G 115D the aileron control is connected to the rudder control via a spring device. The device is installed in the center console.
The correct functioning of the system may be checked on the ground by moving the rudder pedals; one should then note a small movement of the ailerons.

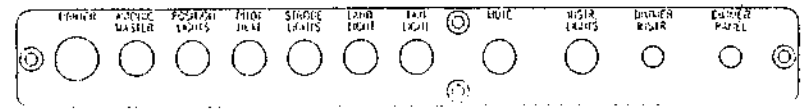
7.7 Instrument panel

Standard instrument panel

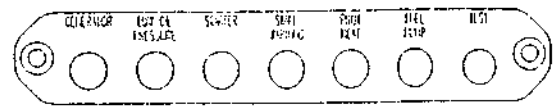


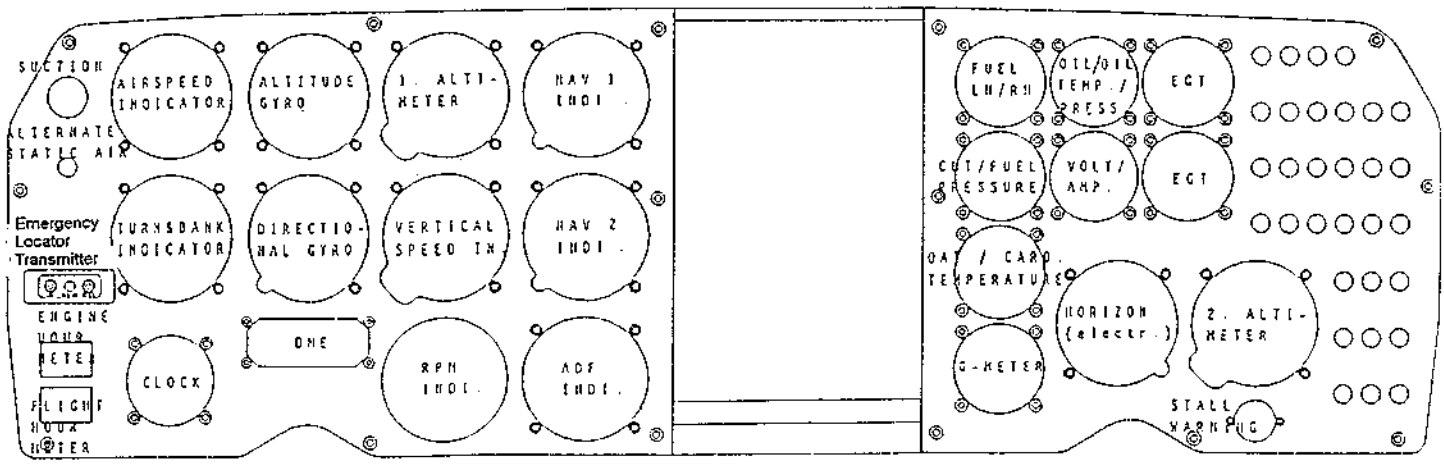


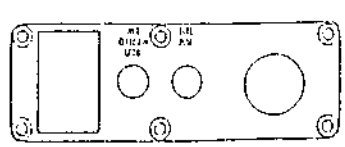


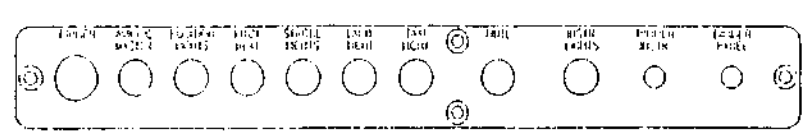


Triple-row instrument panel (large size optional)









Instrument panel layout for VFR equipment

- Airspeed indicator
- Altimeter
- Compass
- Alternator warning light
- Starter relay control lamp
- Engine instrumentation (fuel gauge, fuel pressure, oil temperature, oil pressure, voltage, amperemeter)
- Cabin vent
- Ignition switch
- Master switch
- Avionics master switch
- Toggle switch for alternate static
- Toggle switch line (for ACL-wing, beacon, position light, landing light, fuel pump switch)
- Parking brake
- Flap control
- Stall warning horn
- Stall warning lamp
- Flap position indicator
- Cabin heating
- Tachometer
- Flight hour meter
- Engine hour meter (standard only for Australia)
- Pitot heating control lamp
- Fuel pump control lamp
- Artificial horizon
- VOR indicator
- Suction gauge
- Clock
- Gyro
- Rate of climb indicator
- ADF indicator
- Turn coordinator
- Avionic support for:
  Audio panel, COM I, COM II, NAV I, NAV II, ADF, Transponder, DME, GPS
- Dimmer for instrument lighting
- NAV II - indicator
- Dimmer for instrument panel lighting
- Toggle switch for instrument-/panel lighting
- Test button for pitot-static heating
- Toggle switch for pitot-static heating
- Exhaust gas temperature gauge (EGT)
- Cylinder head temperature gauge (CHT)
- Outside air temperature gauge (OAT)
- Push button primer system

7.11 Ground Control

The G 115D has a steerable, non-retractable nose gear. The nose wheel is connected to the rudder pedals thru a spring box. A conventional shimmy damper compensates any shimming tendency. To assist steering the separate wheel brakes can be included. The maximum steering angle of the nose wheel is ±47°. When towing the airplane by a towing vehicle make sure that this steering angle is not exceeded otherwise the nose gear could be damaged. The minimum turning circle is 6.50 m (21 ft) measured over the wing tips, for full steering angle, brake actuation and assistance by engine power.

7.13 Wing Flaps

Extension and retraction of the flaps is done by means of a flap control switch. The retracted, take off and landing positions (0°, 15° and 60°) are clearly indicated by the indicator unit on the front center panel. All three positions can be pre-selected with the flap lever. Intermediate positions are possible during extension. Returning the flap control switch up results in full retraction of the flaps. Limit switches automatically interrupt the power to the electric motor, when the flaps attain the final position. Asymmetrical flap settings are eliminated by levers and pushrods interconnecting the flaps.

7.15 Landing Gear

The landing gear of the G 115D is a non-retractable tricycle landing gear with steerable nose wheel, two main wheels and fairings. Shock absorption is provided by the struts of the main gear and the gas strut of the nose gear.

Each main wheel has a hydraulically actuated single-disk brake on the inside. The hydraulic brakes are actuated by the toe brake pedals either by the pilot or the copilot.

The lever for actuating the parking brake is located at the LH side below the instrument panel on the pilot's side. To set the parking brake, move the parking brake lever to the "ON" position and pump both brake pedals until full resistance is felt. By positioning the parking brake lever to "OFF", the brakes are released.

The brake fluid reservoir is located on the RH fire wall side and is accessible by removing the upper cowling. The brake fluid level can be checked by means of the transparent reservoir. The brakes do not need adjusting. Brake lining wear is automatically compensated.

NOTE

Whenever the airplane is parked unsupervised, always chock the wheels and release the parking brake.

Temperature changes may cause a release of the brake or an excessive increase of the brake system pressure.

7.17 Baggage Compartment

The baggage area extends from the rear of the pilot and co-pilot seats to the aft cabin frame. Loading the baggage area must be in accordance with the values as stipulated in section 6 "Weight and Balance". All baggage must be safeguarded by the GROB approved baggage net included in each airplane. For this purpose the baggage net must be secured to the strapping eyebolts incorporated in the baggage area floor.

WARNING

Never accommodate children in the baggage area. Material which could be dangerous to the airplane or passengers must not be stowed in the airplane. Acrobatic and spin maneuvers are approved without baggage only !

7.19 Seats and Safety Belts

The G 115D is fitted out with comfortable seats, permitting even lengthy flights without tiring. Seats comprise the seatbacks, configured as a frame, four seat webs, the forward seat frame and the fully laminate seat buckets. All frames and webs are designed as glass-fiber reinforced plastic honeycomb sandwich structures and are firmly connected to the fuselage. Thus no seat adjustment feature is possible. Instead the pedals of the G 115D can be continuously adjusted by means of two hand wheels located on the floor. The adjustment controls of both pedal units operate independently of each other. Seats can be adapted to users by seat and seatback cushions available in different thickness. Both seats are fitted out with 5-point safety belts. A second lap safety belt is optional equipment. For attaching the AUTOFLUG harnesses insert belt and harness fittings in the buckle. Turning the buckle all belts are released.

7.21 Canopy

The G 115D has a rear-opening sliding canopy with generous glazing permitting an excellent view all round. The canopy lock is provided by an overhead latch located in the center of the canopy. Due to the deadpoint safety of the canopy lock, automatic or accidental opening is not possible. The handles incorporated on the top of the canopy facilitate entry into / out of and opening the canopy.

NOTE

Before every takeoff, make sure the sliding canopy is correctly locked ! The canopy must not be opened in flight.

The canopy on the G 115D serves as an emergency exit. A canopy emergency jettison system ensures that the aircraft can be abandoned quickly. Unlocking the red locking lever, opening the canopy handle and moving it back into the 170° position will release the two attachment points on the guide rail. The canopy is then jettisoned by pushing it back and up simultanteneously and following the slipstream to carry it away. The canopy can also be smashed in an emergency using a hammer. This is part of the standard equipment and is installed on the pilot's side of the center console.

7.23 Control Surface Lock

To protect the ailerons and the elevator from damage due to wind buffeting when the aircraft is parked, a control stick locking feature is provided.
When the aircraft is parked in areas subject to heavy winds or gusting, a rudder locking device must be applied over the fin and the rudder.

NOTE

The guide groove of the control surface lock must be attached in the two mechanical sleeves of the lower support of the instrument panel.

CAUTION

During acrobatic-maneuvers the control surface lock and the towbar do not take up in plane !

7.25 Engine

The GROB G 115D is powered by a Lycoming AEIO-360 B1F four-cylinder, direct drive, horizontally opposed engine rated at 180 horsepower at 2700 rpm (sea level).

Engine controls are grouped together on the center panel. The knobs are configured according to the design specifications so that they can be identified by gripping. The central arrangement of the engine control lever facilities its use by both the pilot and co-pilot. An adjustable friction brake on the lefthand side of the levers prevents them from moving.

The throttle control is used to set the manifold pressure which is a measure of engine output power at constant speed.

The mixture control lever permits adjustment of the air to fuel ratio. In the fully forward position a rich mixture is set. The engine is shut down by placing the mixture lever fully aft (LEAN CUT OFF).

The majority of the engine instruments is located to the right of the avionics instruments in the RH portion of the instrument panel.

The alternator warning light is located to the left of these instruments, the tachometer below.

The „cold weather kit" provides the connection to a icing protected breather line within cowling. The two positions to choose from the overboard breather line are:

- either acrobatic position
- or low temperature position

The optional equipped anti-icing box combines these two positions.

With the cold weather kit connected at „low temperature position" respectively with the overfilled anti-icing box (if main-breather line is iced and/or filled up more than 6 ltr. capacity of oil) the pilot should be aware that excess oil may be present in the engine compartment.

During the post flight inspection excess engine oil must be cleaned from the engine compartment.

To cover the „oil-cooler air-inlet" (plate optional) is recommended below ISA conditions for reaching the sufficient oiltemperature during continuos operation at low power settings.

Running-in of the engine was done at the manufacturing company. It is mandatory that you observe the instructions given in section 1 on page 1 - 5.

The oil necessary for lubricating the engine is furnished by the oil sump located underneath the engine. The oil sump capacity is 7.6 liters (8 quarts). The lube oil level can be checked by means of an access hole in the upper engine cowling. A dipstick as part of the filler cap indicates the lube oil level.

The ignition switch is located on the left hand side, bottom section of the instrument panel and has the following switch positions:

"OFF", "L" (magneto LH), "R" (magneto RH), "BOTH" (both magnetos) and "START".

When the starter has been operated, the spring-loaded switch returns to the "BOTH" position.

7.27 Propeller

The GROB G 115D has a Hoffmann Three-blade-constant-speed-propeller HO-V343 K()-V / 180 FP.

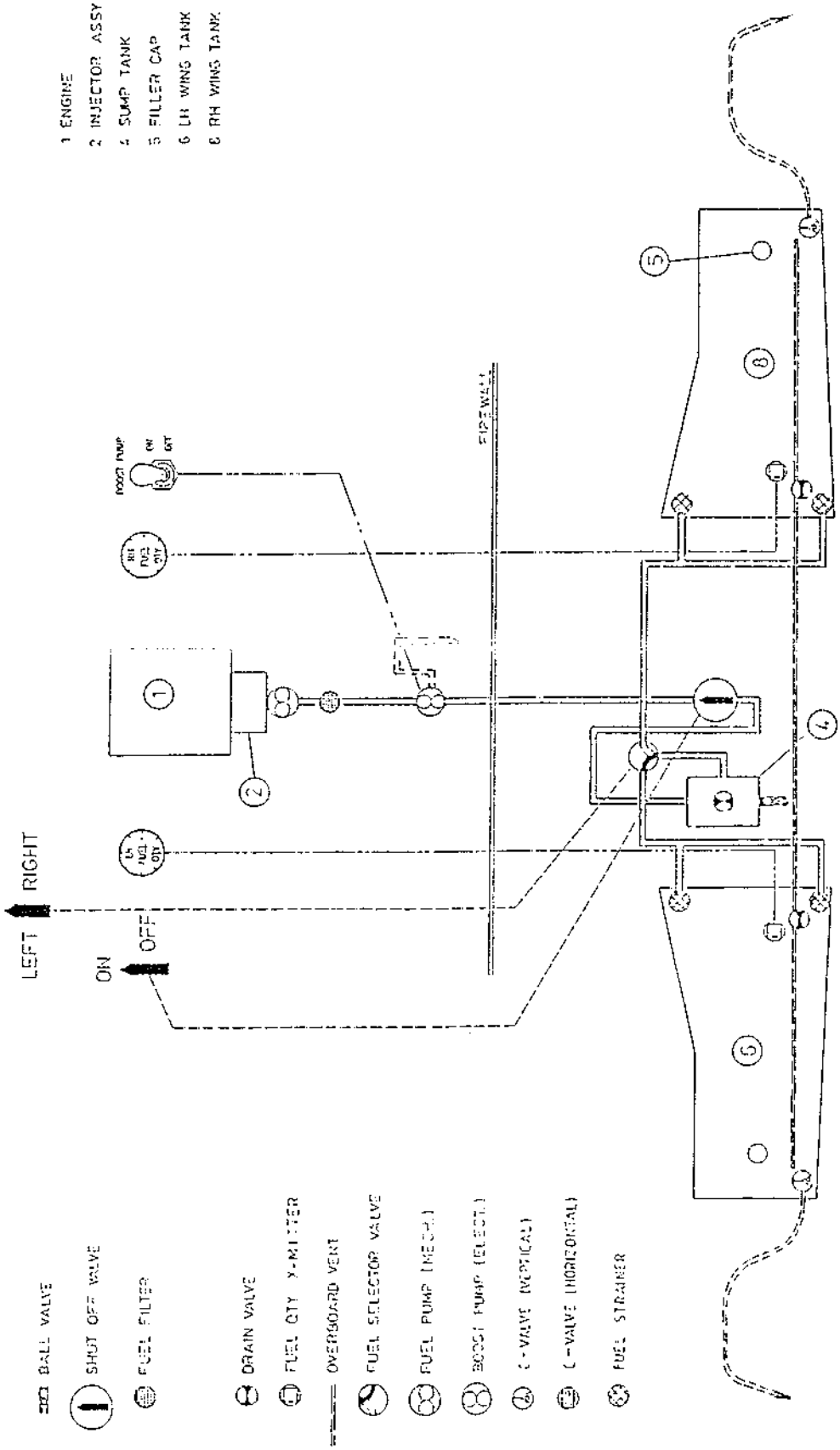
7.29 Fuel System

The G 115D fuel supply consists of two wing tanks with a total capacity of 150 ltrs. (39.63 U.S.gal / 33.00 Imp.gal), 143 ltrs. (37.77 U.S.gal / 31.46 Imp.gal) are usable. The fuel quantity indicator is gauged in 1/4 | 1/2 | 3/4 | 1/1 (1/1 ≙75 ltrs.). The operating levers for the fuel cock and the tank selector valve are installed in the center console directly behind the trim control wheel. In order to have a sufficient supply fuel for all attitudes during aerobatic flight, a sump tank with a capacity of 5.4 liters (1.43 U.S.gal./1.19 Imp.gal.) is installed. This fuel is sufficient for a flight time of approx. 3 minutes. Refuelling is carried out through a filler neck integrated into the GRP structure on the top of the wing.

WARNING
Before refuelling, electrically ground the aircraft using a ground connection (engine exhaust). There must be absoluty no potential difference !

Observe the following when refuelling from canisters or similar containers:
- use a metal funnel (connect the ground)
- cancel out any electrical potentional difference between the person refuelling and th the aircraft potentional (eg. to touch the canopy frame with one hand for at least one sec.)

Fuel schematic system



Fuel flow to the engine passes from the wing tank via the fuel shutoff valve, via the auxiliary electric fuel pump to the engine-driven fuel pump. In each pump a fuel strainer is integrated.

The auxiliary electric fuel pump is actuated by a toggle switch located beside the ignition switch. This pump must always be ON during take off and landing.

The fuel level in the tank is monitored by a fuel quantity sensor which signals the fuel gauge on the instrument panel.

NOTE
Do not expect the fuel gauge to give a precise reading when the aircraft is in an unusual attitude (e.g. yawing, sideslipping or spinning) or in climb or descent attitude. The fuel gauge was calibrated with the aircraft on flat ground. Use the fuel quantity gauge only in level flight !

The fuel tank of the G 115D is vented via the filler neck. The vent opening is located on lower side of the wing at the aileron section and is configured so that the tank is always subject to slightly more than atmospheric pressure.

The fuel system features a drain valve at the bottom of the fuselage directly beneath the tank. Pushing the valve up is sufficient to drain water or sediment from the tank.

NOTE
In making a fuel check a slight dis-colouration of the fuel may be observed - this is quite normal in new aircraft and will clear after a short period.

7.33 Brake System

The two main gear wheels of the airplane are fitted out with single-disk brakes. Separate hydraulic lines connect the master brake cylinders on the pilot's side via the parking brake valve. These cylinders are connected to the brake cylinders on the co-pilot's side by two further hydraulic lines. From these brake cylinders two hydraulic lines run to the brake fluid reservoir on the fire wall. The brake cylinders are directly connected to the rudder pedals.

The following are indications of an imminent brake failure: gradual brake fading when the brakes are operated, noisy or rubbing brakes, soft or springy pedal action and excessive pedal travel and tired brake response. Should any of these signs occur, carry out brake system maintenance without delay. Should the brakes fade during taxiing or landing, briefly release the rudder pedals and then apply full foot pressure.

7.37 Electrical System

The electrical energy required for the 28 V DC system is generated by an engine-powered alternator. Max. current output is 35 A as of 1800 RPM.

The battery box with the 24 V lead-acid accumulator is located on the RH side of the rear main frame. The battery provides the current for starting and for all electrical consumers when the engine is OFF. Battery capacity is 11 Ah which is sufficient under normal flight conditions to provide emergency power (alternator failure and/or main bus failure) for a maximum of 45 min.

CAUTION

When the engine is OFF consumers must be switched off without delay to avoid discharging the battery. When the alternator is down all consumers which are not essential to safe continuation of flight should be switched off.

The power supply of all electric circuits is provided via busbars which are located in a circuit breaker panel in the instrument panel.

Master Switch

The master switch is a toggle switch located on the left-hand side of the instrument panel at the bottom, and the corresponding master switching relay located above the battery box. Switch positions are clearly identified. In addition the green lamp incorporated in the master switch will light up in the "ON" position. In the "OFF" position all consumers are isolated from aircraft power. The avionics master switch is located directly alongside the master switch, on the right. The positions "ON" and "OFF" are identified on the instrument panel.

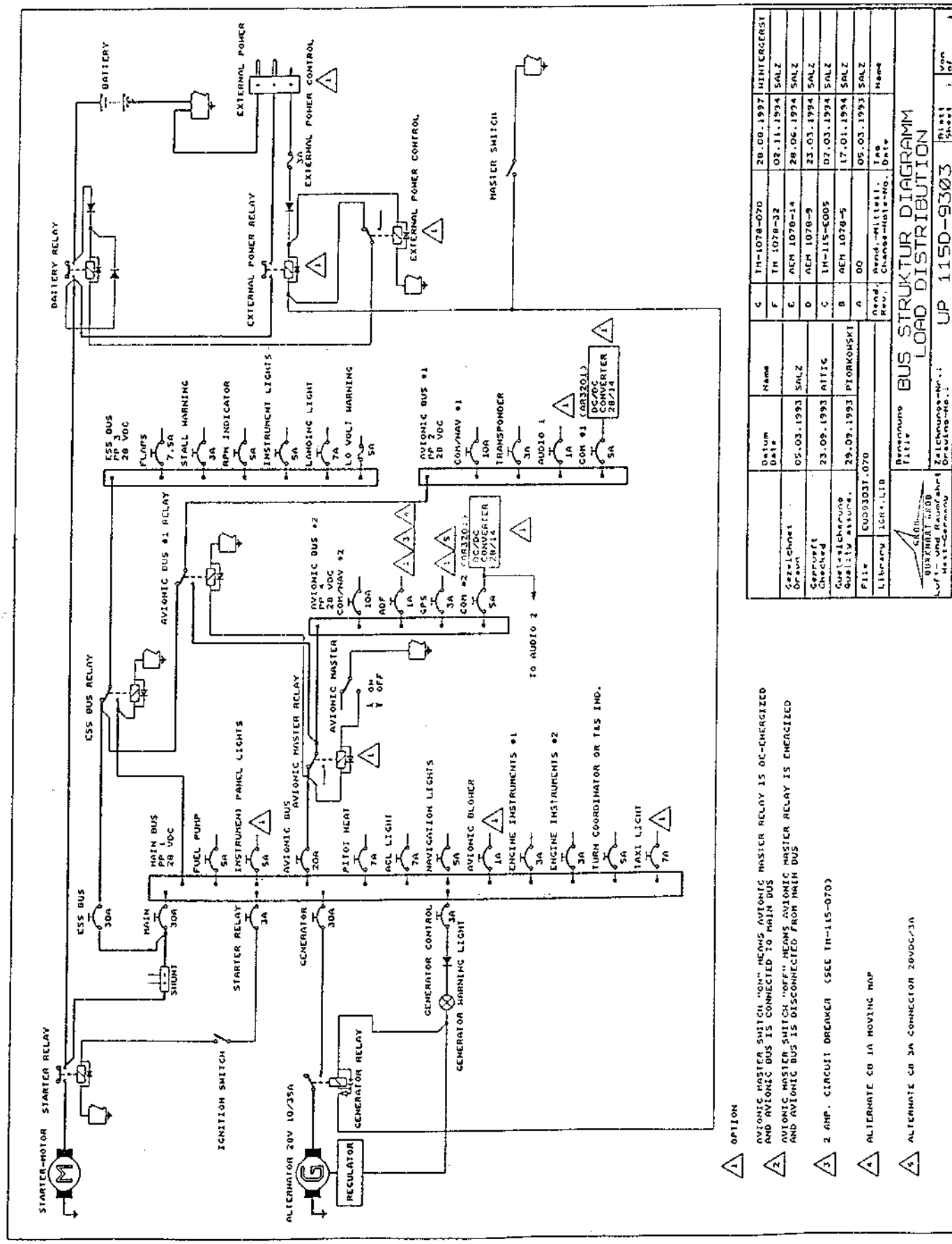
WARNING

To avoid damage to the electronic equipment always switch off the avionics master switch during starting.

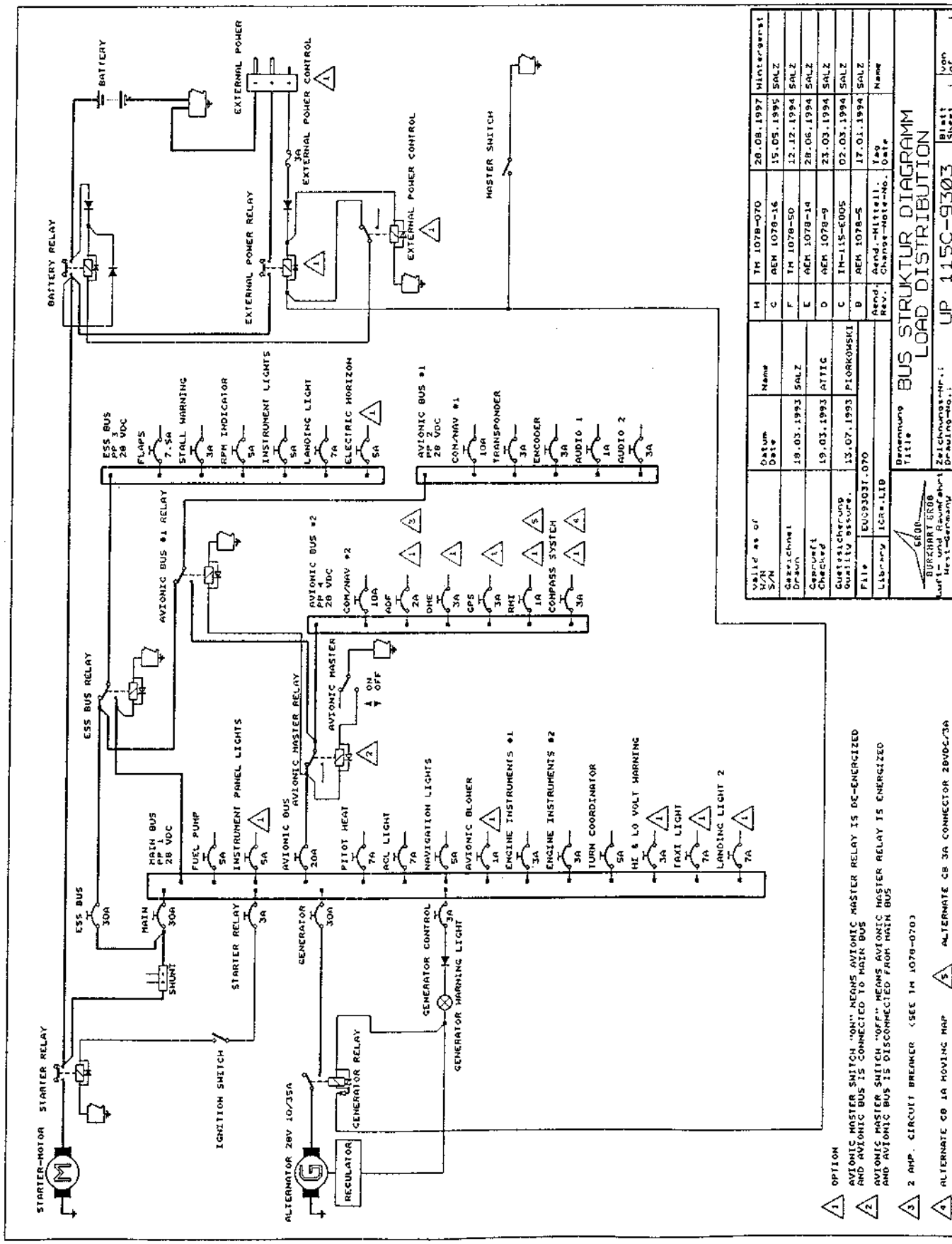
Starter

The starter is relay-controlled and is actuated by the ignition switch. To switch on the starter circuit, position the ignition switch to "START".
Only if a starter relay control lamp is equipped:
After starting the STARTER RELAY CONTROL LAMP must go out, if it doesn't the MASTER SWITCH must be switched off and a check must be made of the STARTER RELAY and associated components.

Electric System Schematic for VFR-operation



Electric System Schematic for IFR-operation



Voltmeter, Ammeter and Alternator Warning Light

The voltmeter is integrated in the engine instruments. It indicates the charging level of the battery and proper functioning of the alternator. The charging current is indicated by the ammeter, which is also integrated in the engine instruments.
In the range 24.5 V - 28 V the alternator generates voltage. When the voltage drops below 24.5 V and the red alternator warning light is on, the generator is down. In this case, the ammeter show a negative current flow. If this happened, switch off all consumers not essential to safe continuation of flight.

WARNING

When the red alternator warning light is on, this means the alternator is not working.

Circuit breakers

All circuits are protected by circuit breakers, located in the circuit breaker panel.

The circuit breakers, located in LH lower instrument panel, are of a push/pull-design. To interrupt pull and to reset push the circuit breaker.
The circuit breakers, located in the RH instrument panel, should be reseted only. When interrupted a red-white ring at the circuit breaker is visible.

NOTE

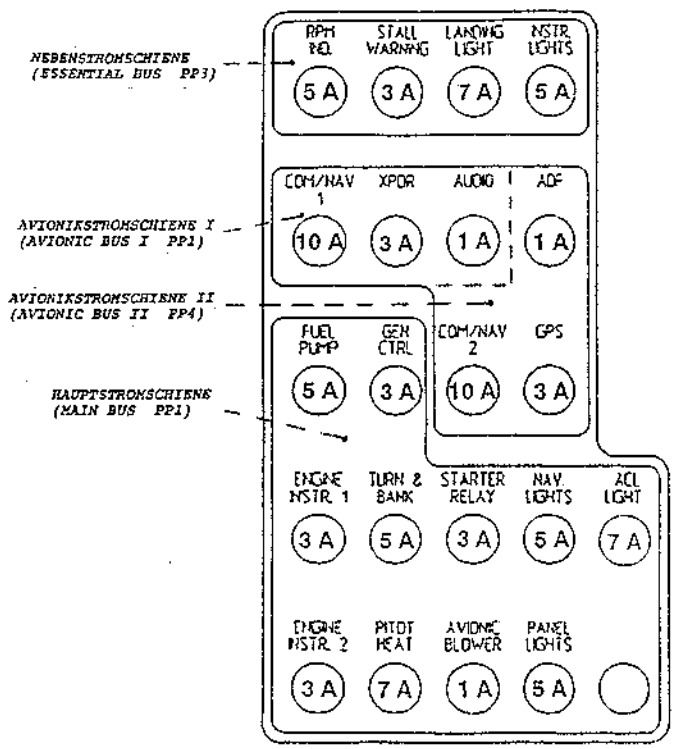
Circuit breaker "ENGINE INSTR. I" is reserved for:
- Volt / Ampere - Fuel quantity LH/RH tanks
- Oilpressure - Oiltemperature

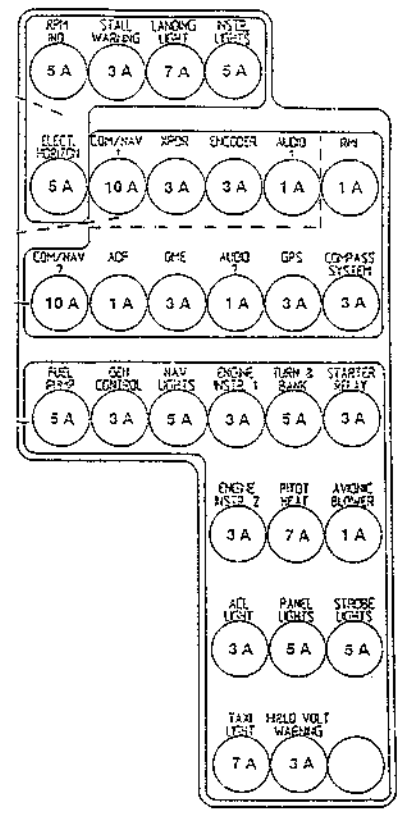
Circuit breaker "ENGINE INSTR. II" is reserved for:
- OAT - EGT - CHT - Fuelpressure

Description of the Essential/Avionic Bus switch-over-from-system

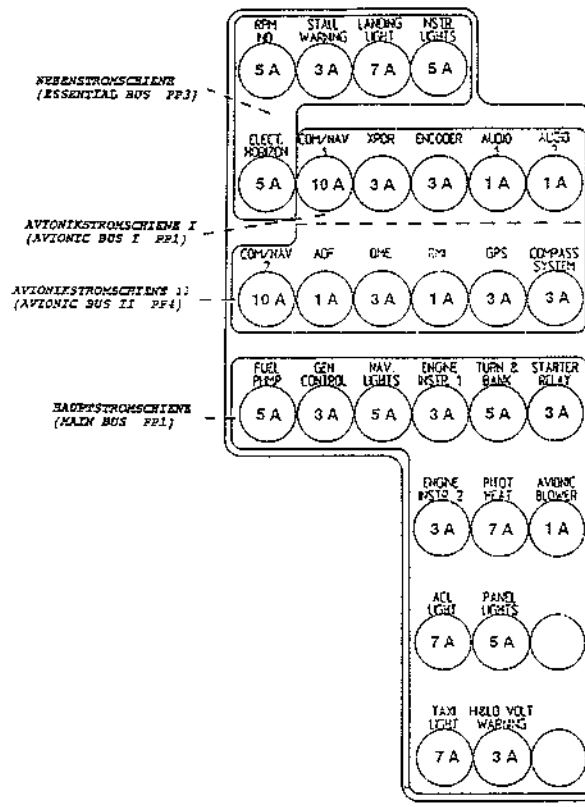
In the case of a Main Bus failure (e.g. short circuit), the Essential Bus and the Avionic Bus I will be directly connected to the battery, without pilot's action.
In this case all important electrical systems and avionic equipments remain active.
The result of this switch-over-from-system is that the Main Bus and the Avionic Bus II are deactivated.

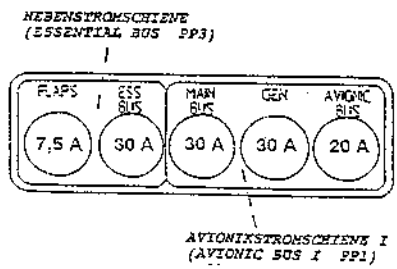
Circuit Breaker Panels for VFR - operation





Circuit Breaker Panels for IFR - operation





External Power Supply (optional)

The connection for connecting an external power is located on the RH side of the fuselage near the wing root trailing edge section and is equipped for 24 V. The external power connection is suitable for carrying out ground tests or to assist starting.

When connecting the external power supply first connect the cable clamps of the jump cable to the external power supply, making sure of correct polarity. Then position the avionics master switch OFF. The jump cable plug can then be inserted into the connector receptacle and the external power supply switched on. For engine starting procedure see section 4.

7.39 Lighting Systems

Interior Lighting

The toggle switch for activating the instrument lighting is located on the RH side of the switch panel.

The lighting consists of integrated lamps as well as lamps on the instrument panel cover bottom, which beam in "white light".

Two dimmers situated in the switch panel control the level of light given to the lamps in the instruments and the lamps on the instrument panel cover bottom.

Additional to the instrument lighting a "swan neck lamp" is standard equipment and is installed between the seats.

To allow a safe operation of the aircraft also during failure of any lights, it is recommended to have a light source (i.e. flash light) on board which is independent of the airplane power supply.

Exterior Lighting

The toggle switches for activating the exterior lights are located in the center of the lower instrument panel.
Each circuit is protected by a circuit breaker.
The exterior lighting comprises:

- Navigation lights in each wingtip, red and green to the front, 2x white to the back
- Strobe lights in each wingtip
- Landing light (optional)
- Taxi light (optional)

7.43 Heating, Ventilating, Defrosting & Air Conditioning

When flying on cold days or at high altitudes the GROB G 115D can be operated with cabin heating. The exhaust heat exchanger supplies the warm air to the front area of the cabin thru three outlets. Two of the outlets provide a flow of warm air directly to the feet area of both seats, the third outlet furnishes warm air for the windshield defroster. During flight air is scooped via an opening on the cooling air inlet to the exhaust heat exchanger where it is warmed up for passing on to the warm air distribution box. As the mixing box is also supplied with cold air, it is possible to regulate the temperature of the air leaving this mixing box. From here the warm air is supplied to the outlets in the cabin and for windshield defrosting.
When heated air is to be supplied to the cabin outlet openings, push the heating slider control to the latch identified by an arrow. If windshield defrosting is required, push the heating control full right to latch (identified by an arrow pointing upwards). Intermediate positions are also possible.

From the air inlets (NACA inlets) at the base of the windshield on both sides of the fuselage, fresh air flows to the adjustable air nozzles. These nozzles are located on the left and right in the instrument panel frame and supply the cabin with fresh air.

To ventilate the baggage compartment two loudspeaker covers are installed in the rear cockpit frame.

7.51 Pitot Static System

The pitot static system supplies static and total pressure to operate the airspeed indicator, the altimeter and the optional vertical speed indicator.

The total pressure is sensed by a heatable pitot tube located at the left wing lower side. The heating equipment should only be operated in probable icing conditions. A functional check during preflight check is performed as follows:

a) Push TEST button for the anunciator panel which is also used for instrument lighting test for approx. 10 sec..
   Pitot heat switch position has no effect on the test.
b) Check current decrease on ammeter ≈ 5-10 ampere.
c) Hand-check heated pitot tube immediately after the functional test.

The heating is being activated in flight via a switch which depends on the pitot pressure (built as a protection from overheating). The switch for activating the pitot heating is located on LH side of the lower instrument switches panel in the middle.

The static pressure is sensed at the LH and RH side of the fuselage via drilled plates. Included in delivery is a protective cap for the pitot tube. Make sure that this is in place to protect the pitot tube whenever the G 115C is moored outdutdoors or in a hangar for a longer period of time.
To drain the system there is no additional work necessary. The pitot tube is provided with a water baffle plate with drain holes, the plates for the static pressure are protected against rain by means of their configuration.

During each preflight check the pitot tube and the plates should be checked for cleanliness or blockage respectively.

NOTE

Partially or totally blocked pitot-static hoses will result in incorrect instrument readings.

Alternate Static System (optional)

If this system is equipped:

The use of this system is recommended if the normal static system is out of action. The pick-up is by means of combined and adjustable over and underpressure tubes in the engine compartment (attached to the fire wall).
The airspeed deviation of this system is less than ± 5 kts of the calibrated airspeed (refer to section 5 Fig. 5.3.2)

The alternate static system is operated by a toggle switch which is installed in the LH side of the instrument panel.
Only for Australia:
The toggle switch must be secured by a Cu-wire at any time.

7.53 Vacuum System

The vacuum system (optional) is designed to operate the air-driven gyro instruments. An engine-mounted suction pump generates the necessary vacuum pressure via a controller. This pressure can be monitored on the suction gauge located on the LH edge of the instrument panel. Instruments are protected from soilage by filters. Should the vacuum pressure slightly drop after being constant for a long period, dirty filters can be the cause. These filters are located on the equipment panel beneath the instrument panel.

7.70 Emergency Locator Transmitter (ELT) Type ACK-01

The Emergency Locator Transmitter (ELT), when installed, is mounted at the rear baggage bulkhead on the left side in the direction indicated an the top of the ELT (DIRECTION OF FLIGHT). The ELT Remote Control Panel/ Indicator (RCPI) is installed in the instrumentpanel left side.
The ELT is an autonomous unit and operates with his own battery. It transmits signals on two emergency frequencies (121,5MHz and 243,0MHz) with a transmitting range of line of side.

The ELT is operated by a 3 position main switch and/or by the push-button switches and indicator on the RCPI.

- OFF : The ELT is inactive. The ELT should be switched OFF during shipment, storage, charging the battery and after rescue.
- ARMED : The ELT is set to the automatic mode. It allows the ELT to transmit after activation by impact.
- ON : The ELT is set to the transmitting mode by placing the main switch in ON position or pushing the ON push-button on the RCPI.
- RESET : Pushing the RESET button on the RCPI resets an activated transmitter into the OFF position.
- ELT ON: The RED LED flushes if the transmitter is activated.

WARNING
Before each flight, the main switch must be set to the ARMED position. To rearm the ELT after activation, the RESET push-button should be pressed, or the main switch on the ELT should be set to the OFF position and then back to the ARMED position.

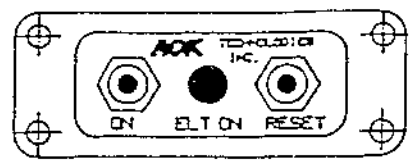
PREFLIGHT- FLIGHT- and AFTERFLIGHT CHECK
The ELT should be checked before-, during- and after each flight to make sure that the transmitter has not been unintentionally activated. Verify that the ELT ON LED is not flushing. If flushing press immediately the RESET button on the RCPI.

REMOTE TEST
The REMOTE TEST must be done every 3 month according to the Operation Manual E-01 ELT section 8.

BATTERY REPLACEMENT
The ELT- and RCPI battery replacement date is marked on the ELT- and RCPI case. The battery must be replaced on or before this date. The battery must also be replaced if the transmitter has been used in an emergency situation or with unintentionally activation for an accumulated time more then one hour.

NOTE
The ELT has to be removed from the airplane if it is parked for a long period in a hot environment (more than 40°C/104°F) to avoid reducing the battery shelf life time.

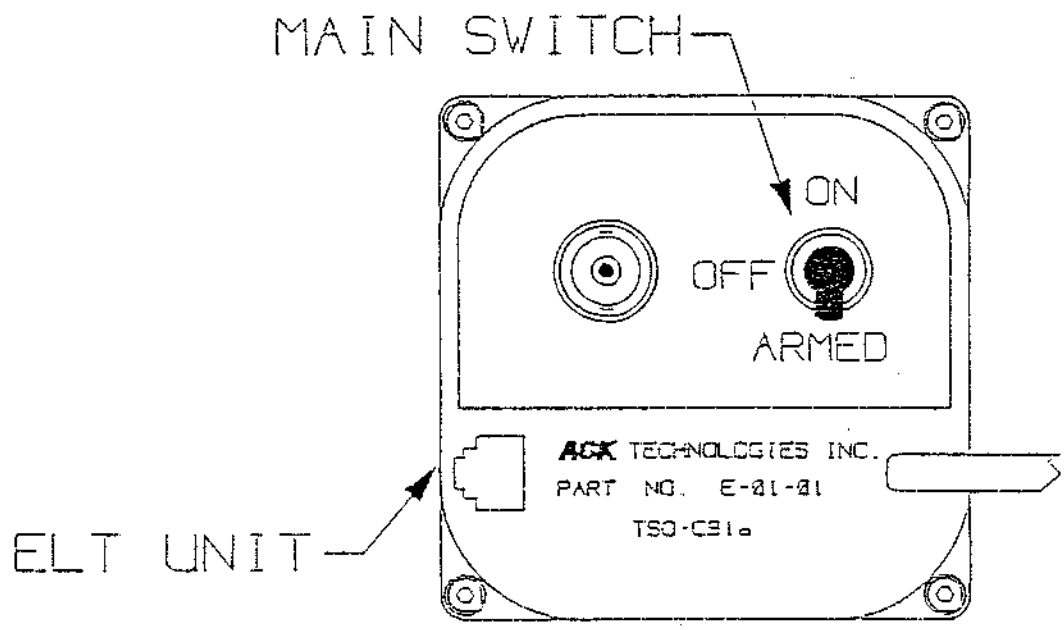
REAR CONTROL/INICATOR UNIT (RCPI)



NOTE

If for any reason a test transmission is necessary, the test transmission should be conducted only in the first five minutes of any hour and limited to three audio sweeps. If tests must be made at any other time the tests should be coordinated with the nearest FAA tower or flight service station.

Emergency Locator Transmitter (ELT)



7.71 Emergency Tool

An emergency hammer with harness cutter is installed on the left side of the middle console which is near at hand for the pilot and which can be pulled out of the holding device, if required.
If it is not possible to open the sliding canopy in an emergency, the glass has to be smashed with the carbide tip of the emergency hammer.
A harness cutter is on the lower end of the emergency tool with which the harness can be cut through, in case harness buckle cannot be opened.

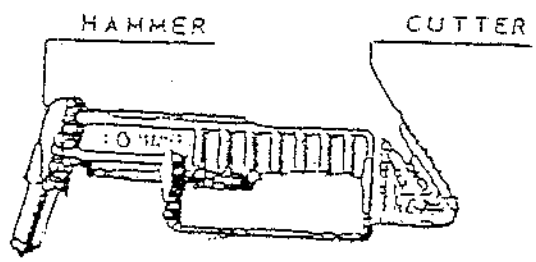


Table of Contents

Section 8

Handling, Servicing and Maintenance

8.1 Introduction

This section contains factory recommended procedures for proper ground handling, routine care and servicing of your GROB G115D.

It is recommended that all aircraft undergo a regular inspection each 50, 100 or 200 hours of operation. The scope of the respective inspection interval is given in chapter 05-20 of the G115D2 Maintenance Manual. In addition, a first inspection is necessary after 25 operating hours. Annual inspections must be performed according to the national requirements. All inspections must be performed by a designated representative of the FAA or the Aviation Authority of the country in which the aircraft is licensed.

The FAA or the Aviation Authority of the country in which the aircraft is licensed may require other inspections by the issuance of airworthiness directives applicable to the airplane, engine, propeller and other components. It is the responsibility of the owner/operator to ensure compliance with all applicable airworthiness directives and, when the inspections are repetitive, to take appropriate steps to prevent inadvertent noncompliance.

Scheduling of **ALL** maintenance is the responsibility of the aircraft operator. A general knowledge of the aircraft is necessary to perform day-to-day service procedures and to determine when unusual service or shop maintenance is needed.

Service information in this section of the manual is limited to service procedures which the operator will normally perform or supervise. For U.S. registered aircraft reference should be made to FAR Part 43 for information regarding preventive maintenance which may be performed by a U.S. licensed pilot.

It is wise to follow a planned schedule of lubrication and preventive maintenance based on climatic and flying conditions encountered in your locality.

Should an extraordinary or difficult problem arise concerning the repair or upkeep of your G 115D, consult the GROB representative in your country or Burkhart Grob Luft- und Raumfahrt, Am Flugplatz, 86874 Tussenhausen-Mattsies, Germany.

All correspondence regarding your airplane should include the model and the serial number. These numbers can be found on the identification plate of the airplane.

Publications

The following publications are available:

1. Flight Manual GROB G 115D
2. Maintenance Manual GROB G 115C and G 115D
3. Service Bulletin
4. Service Information

NOTE
Service and maintenance information of the GROB G 115D is based on the civil aviation authority requirements of the Federal Republic of Germany. Therefore, airplanes which are registered in other countries must comply according to the authority requirements of that country.

8.2 Ground Handling

The scale down dimensions of the GROB G 115D can be seen from the three view (page 1 - 3).

CAUTION

To ensure safe ground clearance of the propeller, care must be taken to the recommended maintenance procedure for the landing gear and correct tire pressures.

Towing

When towing the aircraft with a towing vehicle exercise maximum care since turning the nose gear beyond its steering radius of ± 47° (refer to chapter 7.11) will result in damage to the nose gear and steering mechanism.

The airplane can be moved on a flat, smooth surface by a single individual using the towbar which must be attached to the towing lugs on the nose gear.
Never pull at the spinner.

Where maneuvering space is limited, two persons can turn the airplane by the wheels of the main gear, this requiring one person to push the wing nose or to keep hold of the wing tip whilst the other person operates the towbar.

CAUTION

Never use force on the propeller or on the control surfaces. Never apply weights to the tailplane for the purpose of lifting the nosewheel. Also note that towing is not good practice when landing gear movements are obstructed by snow and sludge.

Parking

The parking brake lever is located on the RH side, below the LH control wheel. To set the parking brake, position the parking brake lever to the "ON" position and pump the toe brake pedals until solid resistance is felt.
Positioning the parking brake lever to "OFF" releases the brakes.

NOTE

If the airplane is parked unsupervised, instead of setting the park brake, chock the wheels, since a change in the weather could result in the brakes being released or being subjected to excessive high pressure.

Taxiing

When taxiing the G 115D can easily be steered by means of the steerable nosewheel. To achieve a tight turn, the toe brake pedals can be used to brake the corresponding wheel of the landing gear.
To prevent propeller ground contact, take caution when taxiing over uneven ground.
Apart from this, loose stones, gravel or any loose material may cause damage to the propeller blades at high speeds.

Mooring

To moor the airplane head it into the wind. Four tie-down rings are provided on the airplane: one each under the wings, one at the nosewheel fitting and one on the fuselage (in front of the tail skid). To moor the airplane proceed as follows:

1. Apply the control lock
2. Chock wheels fore and aft
3. Secure plastic or chain tie-down ropes of adequate strength to the aircraft at the tie-down rings on the nosewheel fitting and the wing adapters. In addition the tail skid may be used as a tie-down point.
4. Release parking brake

Jacking

For wheel or tire change the G 115D must be jacked up at the prescribed locations. For a detailed description see G 115D maintenance manual.

8.3 Servicing

Engine Air Filter

A Purolator PM 1711 air filter is incorporated downstream of the air intake scoop in the bottom cowling half for easy replacement.

This filter should be changed every 200 hours. When the airplane is operated in dusty locations, check and replace the air filter more often.

Brakes

Both landing gear wheels of the GROB G 115D are equipped with Cleveland disk brakes. The brake system is filled with brake fluid as per MIL-H 5606. Check brake fluid level every 50 operating hours. The brakes do not require adjustment. Changing the disk brake linings is described in the maintenance manual.

Tires

Tire size for the main gear is 15x6.00-6 and for the nose gear 5.00-5/6PR. The tire pressure for the main wheels is 3.0 bar (43.5 PSI) and for the nose wheel 2.5 bar (36 PSI).

Oil

The oil capacity of the Lycoming engine is 7.6 liters / 8 quarts, and the minimum quantity required is 5.7 liters/ 6 quarts. Before long flights the oil should always be replenished up to the top level. Change oil every 50 hours of operation. Every 50 hours of operation the oil filter should be changed.
Engine oils must comply with AVCO LYCOMING specification No. 301 and AVCO LYCOMING Service Instruction No. 1014, latest issue (see also section 1, page 1 - 5).

Fuel

The G 115D fuel is stored in two wing tanks with a total capacity of 150 ltrs. (39.63 U.S.gal / 33.00 imp.gal), 143 ltrs. (37.77 U.S.gal / 31.46 Imp.gal) are usable. Draining the tank should be done before each first flight of the day and after fuelling, paying particular attention to dirt in the fuel. Drain until fuel emerges clean. Should dirty fuel still emerge from the drain valve after one minute, have the fuel system inspected.

CAUTION

After draining make sure that there is no danger of fire from fuel spillage when starting the engine.

Aviation grade fuel: Avgas 100 or 100 LL

Exterior Cleaning

As with any composite airplane having mainly laminar flow conditions, keeping these surfaces clean is of major importance to aircraft performance. For this reason all exterior surfaces of the aircraft, in particular the wing leading edges must always be clean.

Cleaning is best accomplished with an ample supply of water, admixed with a light solvent, if required. In order to remove especially heavy dirt from the wing leading edges due to insect splatter and the like, it is good practice to undertake cleaning immediately after the flight, since deposits of this kind are more difficult to remove when dry.

Roughly once a year the surface should be treated with a paint cleaner or a non-silicone car polish and repolished to high gloss.

CAUTION

Never use cleaning agents containing silicone!

Canopy

To clean the canopy plexiglass proceed in the same way as for exterior cleaning of the G 115D, but pay particular attention to using ample water applied with clean sponges and leathers, otherwise even the smallest dust particles will tend to scratch the glazing.

CAUTION

Never polish plexiglass dry!

Dull or scratched canopy sections can be returned to their transparent state by treating with specially formulated plexiglass cleaning agents.

CAUTION

Always keep canopy clean and remember that a dirty canopy impairs the view and thus flight safety.

Engine

Use a cold solvent to clean the engine and make sure that no solvent can enter the magnetos, alternator, starter, suction pump and air intakes.

CAUTION

Do not operate the engine until excess solvent has evaporated or otherwise been removed.

Painted Exterior Surfaces

Changing the paint coat is only permissible after prior approval by the manufacturer!

Table of Contents

Section 9

Supplements

9.1 General

Section 9 of this manual contains information regarding optional equipment for the G 115D. Each supplement relates to a separate equipment item. The information given in the basic Flight Manual remains valid unless shown otherwise herein.

All approved supplements are listed in the list of contents of this section.

This manual contains only the supplements relating to the equipment actually installed.

Make sure that all supplements relating to installed equipment are included in this airplane flight manual.

9.2 Table of Contents

Supplement No.	Title	Pages	Issue	Revision	LBA approved
1	NAV/COM-System	21	1		
2	Propeller System MTV-12-B-C/C183-17e	3	1		

SUPPLEMENT 1

NAV / COM - System

Section 1
GENERAL

The GROB G 115D avionic instrumentation for VFR- and IFR-Flight conditions comprises the following instruments:

1. Audio Control Panel ACP 2700
2. COM / NAV - System KING KX 155
3. NAV - Indicator KING KI 208 (optional 203/204/209)
4. Transponder Equipment KING KT 76 with Encoder ACK 30
5. Marker Beacon Receiver KING KR 21
6. Audio Control Console KING KA 134
7. Audio Control System KING KMA 24
8. DME System KING KN 62A
9. DME System KING KN 63 with KDI 572
10. Digital ADF System KING KR 87 with KI 227
11. VHF Communications Transceiver KING KY 96A
12. Compass System with HSI KING KCS 55A
    incl. KI 525A / KI 229 / KA 51B

The operation instructions of the particulars are listed and described in Section 4.

Section 2
LIMITATIONS

The installation of this instrumentation does not influence the operational limits of the aircraft.

Section 3
EMERGENCY PROCEDURES

The emergency mode of action does not change with installation of this instrumentation.
To transmit an emergency signal via the transponder, the appropriate code as shown below has to be selected:

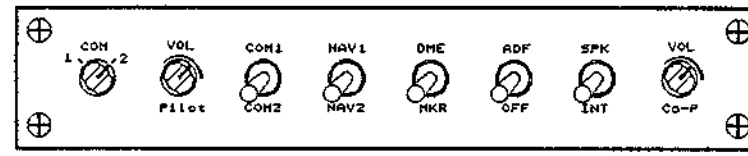
7600 Comfailure
7700 Emergency
7500 Hijacking

Section 4
NORMAL PROCEDURES

1. Audio Control Panel

GENERAL

The audio control panel has been designed as communications system controller for pilot and co-pilot radio communications and intercom operation in small aircraft.
It may be operated in aircraft with a 12 VDC or 28 VDC electrical power system.
The audio control panel is equipped with:
- two power supplies
- two mic inputs
- two PTT inputs
- a priority logic
- two headset outputs
- one intercom circuit
- seven RX audio inputs
- one audio warning input
- two controlled modulation outputs for all com radios
- two time-controlled key outputs
- one RX mute circuit for all RX audio inputs
- one cockpit speaker output



The audio control panel front panel is provided with four toggle switches for audio selections and one toggle switch for intercom operation or cockpit speaker. By means of the automatic impedance adaption all commercial aviation standard headsets and hand mic systems, e.g. Avial, Black Hawk, David Clark, Sennheiser, Sony etc., may be connected. The audio control panel also contains two controlled output amplifiers (modulation adaption) for all commercial com radios. Two time-controlled key outputs for pilot and co-pilot independant transmitter keying are also integrated in the audio control panel.

POWER SUPPLY :

The audio control panel contains two independant power supplies, which may be supplied from seperate DC busses via two circuit breakers. The power supplies are uncoupled by diodes and supply in common the audio control panel electronics. Each power supply is designed to be able to take over the supply on its own. It operates without limitations within a wide range of voltages from 10 to 32 VDC.

MIC INPUTS :

The two mic inputs are a separate pilot mic input and co-pilot mic input. Each mic input has its own mic amplifier with automatic impedance and signal levelling.

Every mic connected is provided with its own power supply. The mic inputs allow for the use of the most different commercial headset systems at the same time.
Every time when operating one of the PTT switches the selected com radio is triggered interrupting the intercom operation. Everything spoken into the mics is audible in both headsets.
The two mic inputs are also provided with audio filters. These filters, supporting only that frequency range in use for communications, considerably reduce disturbing squelch picked up by the mics in the cockpit. These filters contribute to an essential improvement of speech quality of cockpit intercommunication and radio communications.

PTT INPUTS :

The two PTT inputs are uncoupled from each other by diodes and combined via the priority logic, which also triggers the two time-controlled key outputs. The pilot and co-pilot inputs share equal priority.

PRIORITY LOGIC :

The priority logic controls all switch-over functions within the audio control panel. In case of a PTT signal it activates the proper mic input amplifier and output amplifier. During intercom operation it immediately inhibits at the same time the other mic input amplifier.
The cockpit speaker amplifier in TX operation is also reduced in volume to prevent a feedback particular to hand mic operation.

AUDIO INPUTS :

The seven RX audio inputs are used for direct connection to existing COM and NAV equipment. There is also an audio input for aural warning signals available. The audio inputs each have a 600 Ω DC input impedance blocked against HF with a filter. The audio inputs are uncoupled from each other.

HEADSET OUTPUTS :

Each pilot has his own headset amplifier used for adaptation to the various headphone impedances. The input signals, after decoupling, are adapted by the pilot and co-pilot headset amplifier, amplified, and delivered to the headsets. The headset outputs are permanently protected against short circuit and to do not influence any other output in the event of a short circuit. Amplification and thus volume may be adjusted individually for pilot and co-pilot on the front panel by means of two volume controls.

MODULATION OUTPUTS :

The audio control panel has two controlled output amplifiers. these are used for audio processing of the transmit signals for all com radios. These output amplifiers provide for an optimum modulation of the com radios during TX operation.

KEY OUTPUTS :

The two key outputs each have a time-controlled output for transmitter keying to ensure that in case of a blocked PTT switch the transmitter does not transmit for longer than two minutes and that after this time the latest the frequency is available again with no interference. This function also meets the LBA requirement for an IFR clearance.

RX MUTING :

The RX muting circuit is activated by an external push button and is used to immediately mute all incoming audio signals by 6 dB after single pust botton operation. After release of the button all audio signals will be heard at the previously selected volume. This RX mute function is highly appreciated and used during training operation.

INTERCOM OPERATION :

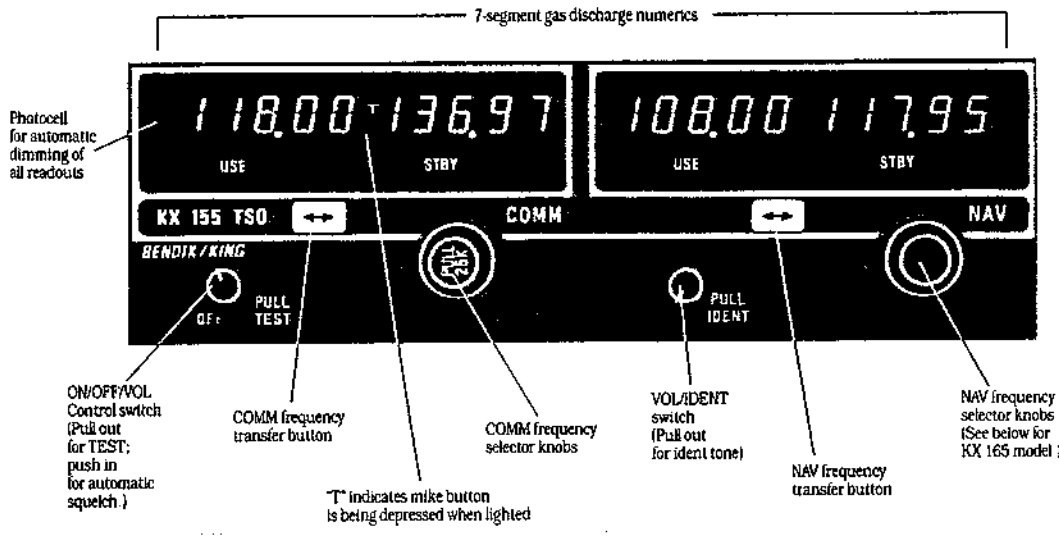
Intercom operation is activated by means of a front panel integrated toggle switch labelled "INTERCOM". During intercom operation all pilot and co-pilot mic amplifiers are activated and the mic audio is applied to all head phone amplifiers. This enables an internal communication between pilot and co-pilot without the necessity of pressing a button. Should during intercom operation e.g. the PTT switch be pressed by the pilot, intercom operation will automatically be disabled. Then only the pilot mic audio will be routed to the selected com radion via the controlled output amplifier. The co-pilot also listens to the pilot mic audio. After release of the PTT switch the audio control panel will immediately revert to intercom operation. The same happens vice versa, when the co-pilot operates his PTT switch during intercom operation.

COCKPIT SPEAKER OUTPUT :

The cockpit speaker is activated by means of the front panel integrated toggle switch labelled "SPEAKER". The cockpit speaker output is provided with a speaker amplifier used to control a 4 W speaker with an impedance from 2 to 8 Ω. The cockpit speaker amplifier performance is adapted to the individual operating conditions by the priority logic.

This means that the cockpit speaker amplifier during RX operation is automatically reduced in volume by approx. 6 dB, in order to prevent a feedback particular to hand mic operation.

2. COM / NAV - System



OPERATION :

TURN ON :
Rotate the ON/OFF/Volume Control knob clockwise from the detend "OFF"-position. Power will be activated and the unit will be ready to operate. No warm up time is required.
A non-volatile memory stores the "active" (USE) and "standby" (STBY) frequencies during power shutdown. So, when turned on, the "USE" and "STBY" windows will display the same frequencies that were selected before shutdown.

NOTE

As with all avionics, the KX 155 should be turned on only after engine start-up. In addition, the KX 155 should be turned off prior to engine shutdown.

TO COMMUNICATE :

Frequency Selection :
By rotating the concentric COMM frequency selector knobs either clockwise or counterclockwise, the desired operating frequency can be entered into the "STBY" display window. A clockwise rotation of the knobs will increase the displayed frequency number, while a counterclockwise rotation will decrease it. The outer, larger selector knob is used to change the MHz portion of the frequency display; the smaller knob changes the kHz portion.

This smaller knob is designed to change the indicated frequency in steps of 50 kHz when it ispushed in, and in 25 kHz steps when it is pulled out. At either band-edge of the 118.000-136.975 MHz frequency spectrum, an off-scale rotation will wrap the display around to the other frequency band-edge (i.e. 136.000 MHz advances to 118.000 MHz).

COMM Channeling :
To tune the COMM transceiver to the desired operating frequency, the selected frequency must first be entered into the "STBY" display window and then activated by pushing the "flip-flop" transfer button. This will interchange the frequencies in the "USE" and "STBY" displays, and the transceiver will be turned to the operating frequency appearing in the "USE" display.
As you can see, this feature makes it possible to display two COMM frequencies - one each in the "USE" and "STBY" displays - and then switch back and forth between them just by pressing the transfer button. An additional transfer button may also be remote-mounted in the aircraft.

Transmit Indicator :
Whenever the microphone is keyed, a lighted "T" will appear between the "USE" and "STBY" displays to indicate that the transceiver is operating in the transmit mode.

Volume Adjustment Test :
To verride the automatic squelch for audio test, or to aid in receiving a distant station, simply pull the volume control knob out and rotate to the desired listening level. Push the knob back in to activate the automatic squelch.

TO NAVIGATE :

NAV Frequency Selection :
By rotating the concentric NAV frequency selector knobs either clockwise or counterclockwise, the disered operating frequency can be entered into the "STBY" display window. A clockwise rotation will increase the displayed frequency number, while a counterclockwise rotation will increase it. As with the COMM frequency selectors, an off-scale rotation of the NAV frequency band-edge (108.000 to 117.95) will wrap the display around to the other edge of the frequency band (i.e.117.000 advances to 108.000 with MHz knob rotation). Remote DME and internal glideslope channeling are also controlled by these selector knobs.

NAV Frequency Operation :
To tune the NAV receiver to the desired operating frequency, the selected frequency is first entered into the "STBY" display and then "flip-flop" into "ACTIVE" status by pushing the the transfer button. When the inner knob is pulled out, the active NAV frequency is turned directly.

Ident :
The NAV "IDENT" knob is activated by pulling it outward, so that both voice and ident can be heard. When this knob is pushed in, the ident tone is muted. Volume of voice/ident can be adjusted by turning this knob - clockwise to increase, counterclockwise to decrease.

3. NAV - Indicator

VOR Operation

Channel the NAV receiver to the desired VOR and monitor the audio to positively identify the station. To intercept a selected VOR radial, turn the OBS to set the desired radial under the lubber line. The left-right needle will now deflect in the direction of the desired radial. Flying toward needle deflection will bring the aircraft to the desired radial. To fly inbound toward the station, turn the OBS to center the left-right needle while the TO-FROM is indicating. Read the bearing under the lubber line and fly that magnetic course. When the aircraft passes over the station, the TO-FROM will momentarily disappear and then reappear as FROM. This indicates the aircraft is outbound from the station.

LOC Operation

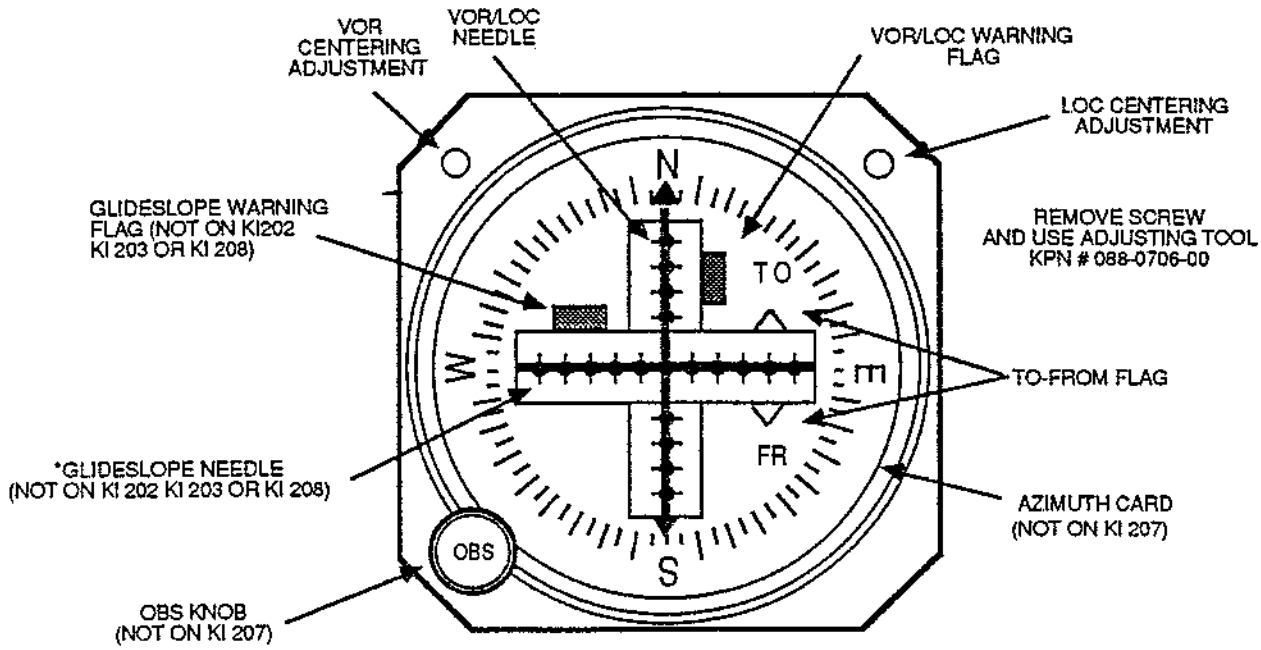
Localizer circuitly is energized when the NAV receiver is channeled to an ILS frequency. The VOR/LOC flag will be out of view when the signal is usable. Corrections for approach should be made toward the nnedle, as in VOR, but due to inincreased sensitivity, corrections are smaller. When flying inbound on a back course, deflection of the needle will be reversed.

Glideslope Operation

Glideslope operation is much the same as the localizer just discussed. An UP deflection of the needle indicates the aircraft is below desired glidepath. The pilot must fly toward the needle for correction. A warning flag is provided to indicate usable signal conditions.

Unit Control Functions

The following figure displays the control functions for the KI 204/206/209. The KI 202/203/208 differs in not having a glideslope needle or flag. The KI 207 differs in not having an OBS or Azimuth card.

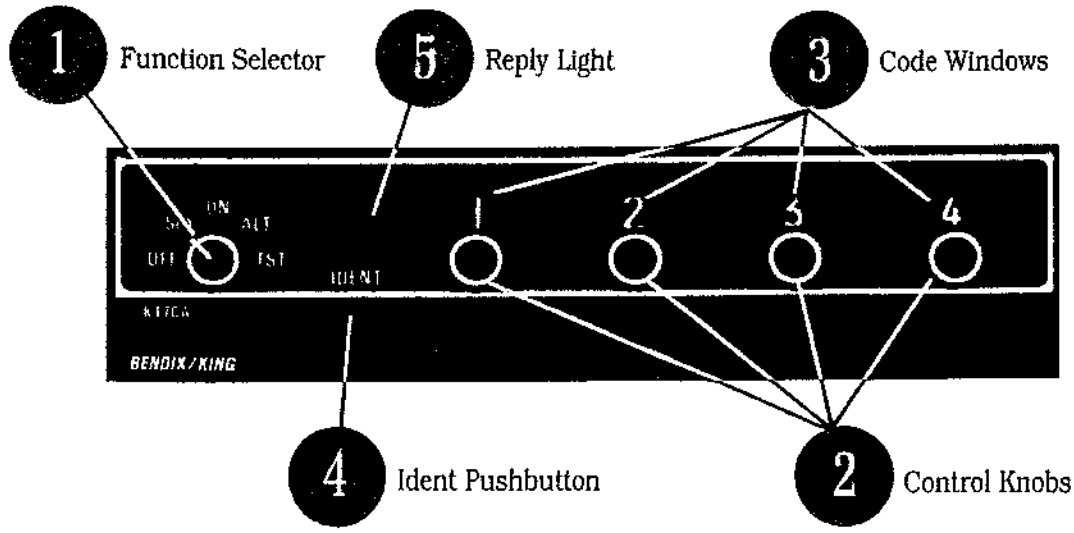


*NEEDLE OFFSET FOR CORRECT VIEWING AT NORMAL VIEWING ANGLE (15 DEGREES)

4. Transponder Equipment

GENERAL

The transponder is radio transmitter and receiver which operates on radar frequencies. Receiving ground radar interrogations at 1030 MHz, it returns a coded response of pulses to ground-based radar on a frequency of 1090 MHz.



OPERATION :

To operate the KT 76, first be sure that the function selector knob (1) [or the avionics master switch] is turned OFF before starting the aircraft's engine. Then, select the proper reply code by rotating the four control knobs (2). The reply code will be displayed in the code window (3).
After engine start, turn the function selector to SBY (Standby), giving the transponder about 45-50 seconds to become operational. As soon as you are airborne, turn the function selector to ON, which places the KT 76 in normal mode A operation.
If the aircraft is equipped with an encoding altimeter, turn the function selector to the ALT (Altitude) position, for altitude reporting (Mode C) to ATC. Altitude reports are automatically updated in 100-foot increments, from -1.000 feet to 35.000 feet.

Squawk Ident

When you are asked to "Ident" by ATC, briefly press the Ident push-button (4). The aircraft will be positively identified to the Air Traffic Controller.

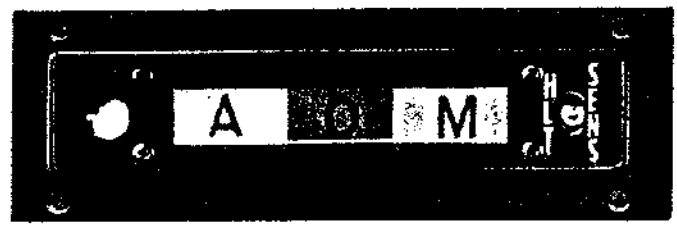
Reply Light

During normal operation, the flashing reply light (5) indicates that the KT 76 is functioning properly and replying to interrogations fromground radar. Interrogations occur at 10-15 second intervals, corresponding to each radar sweep. Frequently, the reply light will blink almost continously, meaningthat the transponder is responding to interrogations from several radar stations.

5. Marker Beacon Receiver

GENERAL

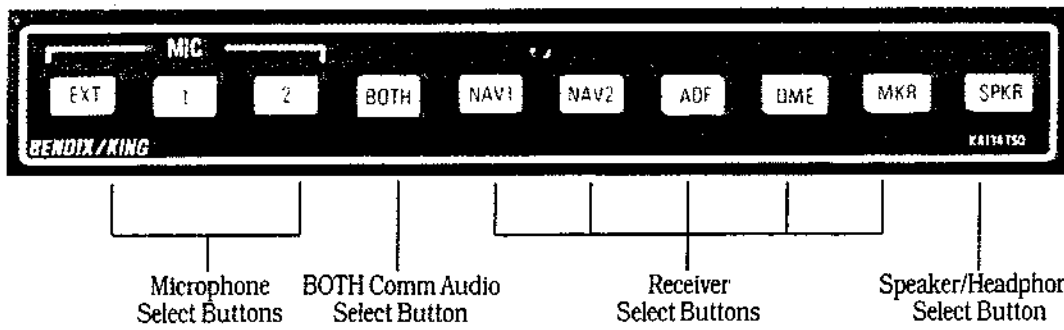
The TSO`d KR 21 Marker Receiver provides marker beacon audio signals to the KMA 24H and has a marker light display similar to that in the KMA 24. It is all solid-state and has its own self-test and automatic dimming.



6. Audio Control Console

OPERATION :

Transmitter / Receiver Control



Both microphone connection and audio distribution are controlled by means of 10 color-coded push buttons on the KA 134 console.
Automatic COMM switching matches the selected VHF transmitter with the audio of its corresponding receiver. The unit's Isolation/Speaker Amplifier automatically raises audio signals strength to the level necessary to drive the cabin speaker. Whenever headphones are used, the amplifier is bypassed to connect the headphone directly to the selected receiver.
The three yellow buttons on the left side of the KA 134 are the microphone select switches. These buttons are interlocked, so only one can be pressed at a time. The two buttons marked (COMM) 1 and (COMM) 2 control the active VHF transceiver. The third button of this group, marked EXIT, can be wired to provide an additional microphone input for such as a cabin address system, ramp hailer, pilot-copilot intercom, or a third transceiver such as HF or radio telephone.
The six white buttons to the right of the MIC group are individual audio select switches. To listen to a specific receiver, simply press the corresponding button to the "IN" position. Press again so the button returns to the "OUT" position to mute the receiver. The switch marked BOTH can be used to monitor the audio channel of the unselected COMM 1 or COMM 2 transceiver.
Speaker or phone operation is controlled by the yellow SPKR switch on the far right side. When this button is depressed, the audio is heard over the cabin speaker. If not depressed, the audio is routed directly to the headphones.
Some audio sources, such as Radar Altimeter alert or the ring signal from a radio telephone, may be wired directly into the isolation amplifier. Thus, these sources will always be routed through the cabin speaker, regardless of the position of the SPKR switch.
All speaker outputs are electronically muted whenever the microphone button is keyed, to prevent undesirable cockpit feedback in transmission.

7. Audio Control System

OPERATION :

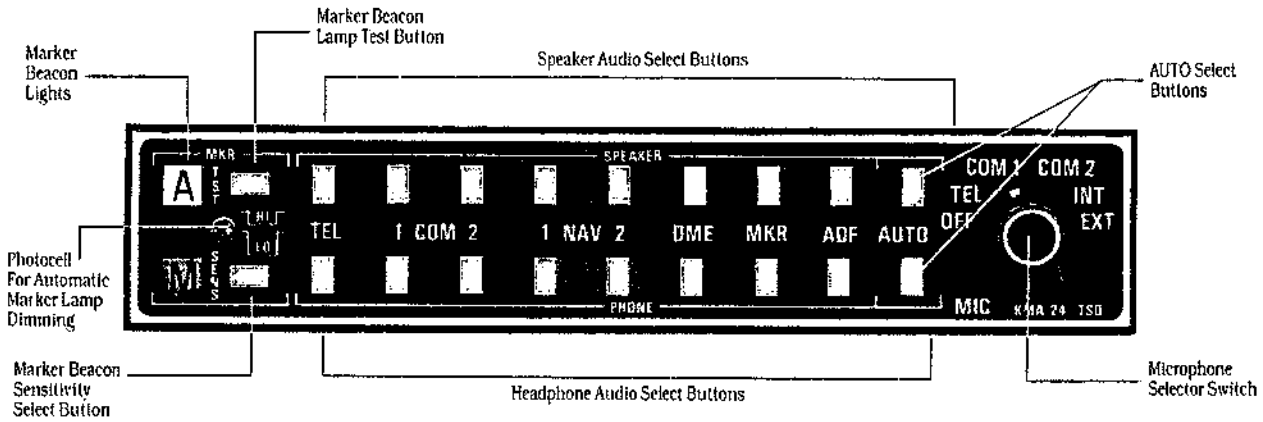
Auto Receiver Audio Select

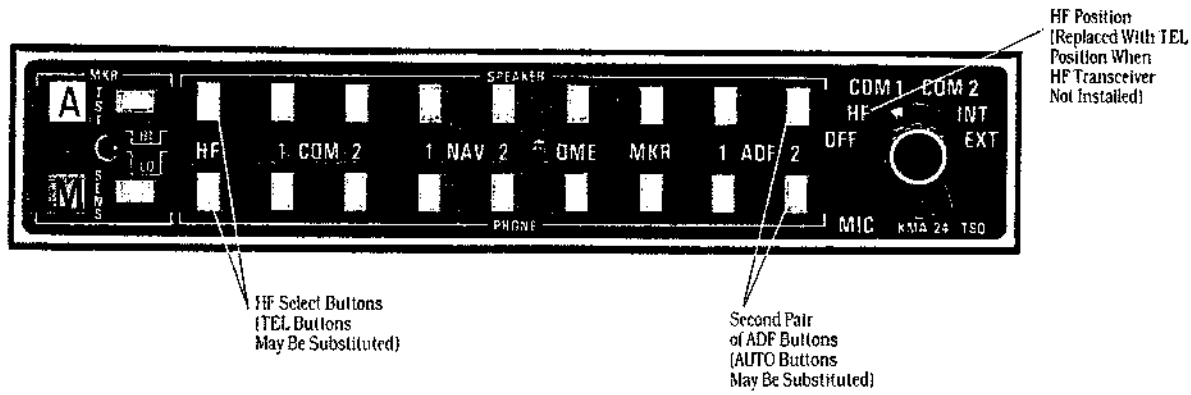
For KMA 24 models equipped with the "AUTO" Receiver select feature, the transmitter selected with the microphone selector switch will be matched automatically with the appropriate COMM receiver audio on either headphone or speaker, or both, by simply pressing the desired headphone and/or speaker "AUTO" push button. (COMM 1 and COMM 2 push buttons should be disengaged unless it is desired to additionally listen to a COMM receiver other than the one selected with the microphone selector switch).
Thus, on "AUTO" you may change the rotary microphone switch back and forth, as needed, without having to reselect the corresponding COMM, TEL, or HF receiver buttons in order to hear the receiver.
Both models of the KMA 24H have "AUTO COMM" capability and always provide automatic headphone audio selection to match the transceiver in use. The selection of speaker audio can either be made automatically by pulling out the speaker "AUTO" switch or manually with the row of speaker audio select push buttons.

Marker Beacon Receiver KMA 24

The complete TSO`d 3-light marker beacon receiver built into the KMA 24 gives you an accurate visual and aural signal when you pass over a 75 MHz beacon. The blue, amber, and white lights on the faceplate - as well as the audio tone - identify the beacon type (outer, middle or airway/inner marker).
Either the speaker or headphone MKR buttons or both must be "in" for the marker beacon receiver to provide an audio signal at beacon passage.
The horizontal push button labeled SENS on the lower left side of the console gives you the choice of two receiver sensitivities. When the button is "in", the sensitivity is on HI. During an aprroach, this setting should permit you to hear the outer marker tone about one mile out. At this point you may select LO to dampen the tone. It will start to sound again when you are closer to the marker, giving you a more precise indication of its location.
Pressing the top horizontal button marked "TST" simply applies voltage to all three lamps to show that they are functioning.
NOTE:
The "TST" button should not be pressed to test the lamps when autopilot coupled on an ILS approach inside the outer marker. This is due to the fact that some autopilots (including BENDIX/KING autopilots) use marker annunciation to change the sensitivity of the autopilot.
A photocell in the console automatically dims the lamps for night operation.

The "INT" position on the KMA 24 permit the flight crew to address cabin occupants over the cabin speaker. To do this, select "INT" with the microphone switch. When the mike is keyed, the receiver audio is muted and you may talk normally into the microphone to broadcast over the speaker.
The KMA 24 also has an "EXT" position on the microphone selector switch which connects the microphone to an external ramp hailer speaker, if installed.

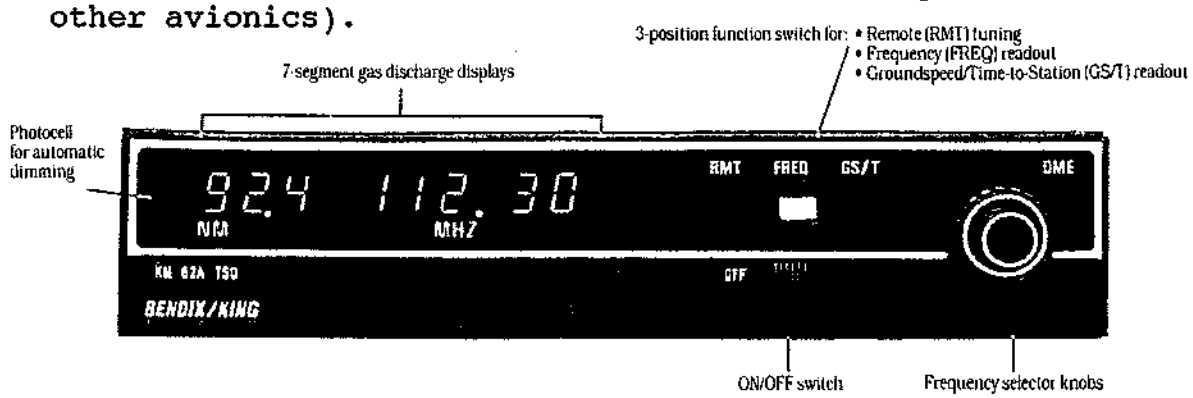




8. DME System KING KN 62A

GENERAL

The KN 62A fits right into your avionics stack, operating on any DC voltage from 11 to 33 volts without adapters or power converters. And since it draws only 15 watts of power, no external cooling is required (stack cooling is recommended whenever the KN 62A is installed in a stack configuration with other avionics).



OPERATION :

Turn on the KN 62A only after engine start-up. Also, turn avionics off prior to engine shut-down.
The 3-position function switch determines both the information displayed and the channeling source. Place the function switch on Frequency (FREQ). The KN 62A is channeled internally with its own two concentric frequency selection knobs. The smaller of the two knobs has an "in" and an "out" position. When in the "in" position, this smaller knob changes the 0.1 MHz digit (0.0, 0.1, 0.2 etc.). When pulled "out", it adds 0.05 MHz to the frequency and tunes in 0.1 MHz steps (0.05, 0.15, 0.25, etc.). Pushing the smaller knob "in" subtracts 0.05 MHz from the displayed frequency. The outer, larger knob changes the larger digits (1 MHz, 10 MHz). In FREQ mode, the KN 62A will displays distance and the selected frequency. (See Figure 1.)
Now move the function switch to the Groundspeed/Time-to-station (GS/T) position. The KN 62A will hold the internally selected frequency and will display distance, groundspeed and time-to-station. (See Figure 2.)
Rotating the frequency selector will have no effect on the display, because the DME is in "Frequency Hold". This frequency hold feature in the GS/T mode prevents accidental rechanneling of the DME when the frequency is not displayed.
Place function switch in the Remote (RMT) position, and your DME will be channeled when you select your NAV frequency on the NAV receiver. Search time is usually about one second. When the KN 62A locks on a ground station, it will display distance, groundspeed and time-to-station. (See Figure 3.)
Prior to lock on, "dashes" will be displayed. (See Figure 4.)
Note that you may have two frequencies available at all times (one remotely selected on the NAV receiver and one internally selected with the KN 62A controls).

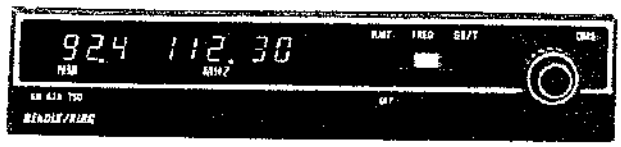


Figure 1. Distance/Frequency. FREQ mode.

Figure 3. Distance/Groundspeed/TTS. RMT mode.

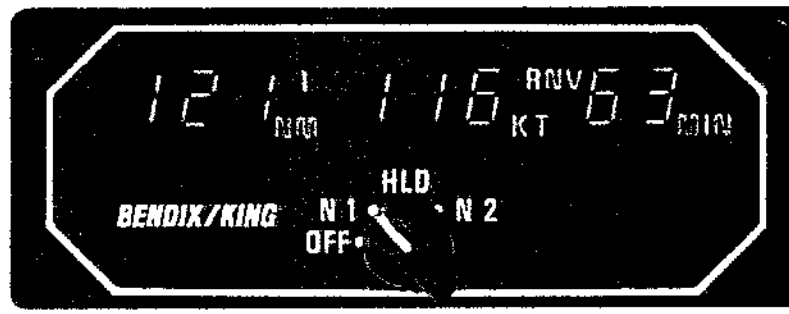
Figure 2. Distance/Groundspeed/TTS. GS/T mode.

Figure 4. Prior to lock on.

9. DME System KING KN 63 with KDI 572

GENERAL

The TSO'd KN 63 is a complete 100 watt, 200-channel remote DME system utilizing the latest state-of-art Large Scale Integrated (LSI) circuit technology.
Distances up to 389 Nm (at line-of-sight altitude), ground-speeds up to 999 kts, and time-to-station up to 99 minutes are computed digitally and displayed simultaneously on the easy-to-read KDI 572 panel display.
The KN 63 Receiver/Transmitter unit can be remotely mounted in any position such as behind the instrument panel.
The KN 63 will operate on any DC voltage from 11 to 33 volts.



KDI 572 Master Indicator

OPERATION :

Turn-on-procedure:

As with all avionics, power to the KN 63 should be turned on only after engine start-up. In addition, the KN 63 should be turned off prior to engine shut down.
The rotary function switch on the KDI 572 master unit is used to turn on the system and select the desired NAV channelling source. The KDI 572 master unit functions the same as a KDI 572, but without a rotary function switch, thus allowing for a remote-mounted function switch. DME tuning is then accomplished automatically through the selected NAV 1 or NAV 2 receiver frequency controls. Prior to station lock-on, "dashes" will appear in the window of the DME panel display. Search time is usually one second or less. Once the system has locked on, the distance readout will appear - followed quickly by groundspeed and time-to-station computations.

DME operation:

After the KN 63 has locked on to the selected VORTAC station, DME distance will be displayed in 0.1 Nm increments up to 99.9 Nm; then in increments of 1 Nm to 999 kts and time-to-station up to 99 minutes are displayed simultaneously.

The effective range of a DME system depends on several factors, including the altitude of the aircraft. Other contributing factors are the location and elevation of the ground station, DME transmitter power output, and receiver sensitivity. As a standard operating practice it is desirable to positively identify the selected VORTAC station frequency by listening to its coded identification audio signal through the aircraft headphone or speaker.
In order to generate precise DME data, The KN 63 electronically converts into distance the elapsed time required for signals to travel to and from the ground station. The resulting computation is then presented in nautical miles on the DME panel display. This distance, commonly referred to as "slant range" distance, should not be confused with actual along-the-ground distance. The differnce between actual ground and slant range distance is smallest at low altitude and long range and greatest at close range to the VORTAC facility. However, if the range is 3 times the altitude or greater, slant range error is negligible.
Groundspeed calculations are based on the rate of change in DME slant range distance with time. Time-to-station is computed by dividing the slant range distance by the computed groundspeed. To obtain accurate groundspeed and time-to-station readouts, the aircraft must be tracking directly to or from a selected station or RNAV waypoint.

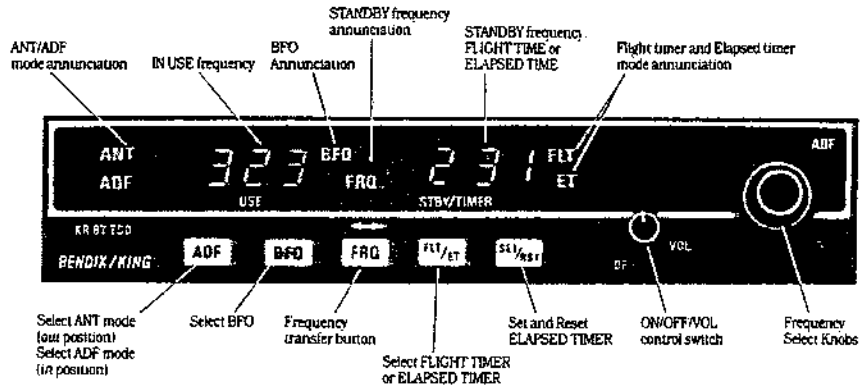
Channeling:

The KN 63 DME can be channeled automatically from most NAV receivers. When the function switch on the KDI 572 indicator is turned to the "N1" position, the DME will be channeled from NAV 1 frequency selector. In "N2" position, the DME channels from the NAV 2 receiver.
Thus, whenever the NAV receiver in use isturned to a new frequency - or a different NAV receiver is selected on the DME function switch - The KN 63 will retune itself immediately to the newly selected VORTAC station.
However, when the DME function switch is placed in the "HOLD" position, the KN 63 will remain channeled to the last selected frequency, even though the NAV frequency selectors are subsequently changed.
This feature is most useful during instrument approaches when both NAV receivers may need be tuned to an ILS frequency without DME. The KN 63 can be tuned to a nearby VORTAC station before the approach is begun, and then placed in the "HOLD" mode to provide DME information throughout the approach.
When the KDI 572 function switch is placed in "HOLD" position, a "1H" or "H2" annunciation will be displayed to indicate the channeling souce being held. An "RNV" annunciation will appear whenever the displayed readouts are based on waypoint data derived from some area navigation systems.

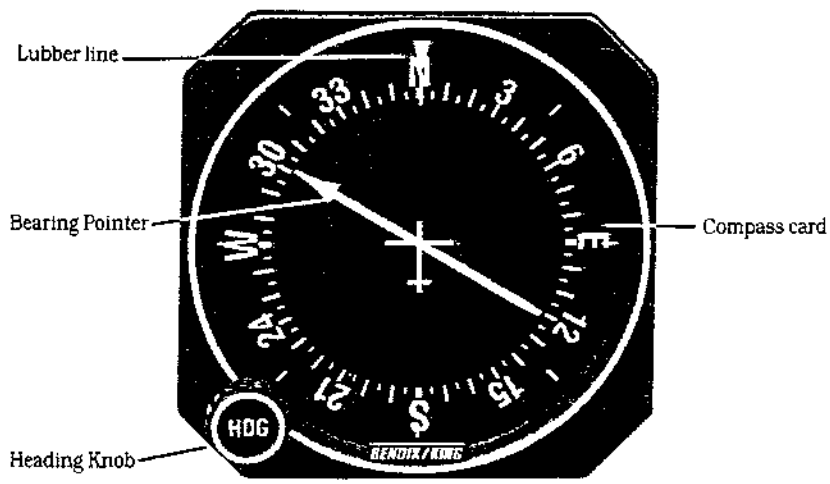
10. ADF System KING KR 87 with KI 227

GENERAL

The basic KR 87 system includes the KR 87 receiver, the KI 227 indicator with rotable compass card and the aerodynamically designed KA 44B combined loop and sense antenna, plus mounting racks and connectors.
The all solid-state KR 87 receiver will operate on any DC voltage from 11 to 33 volts. It draws only 12 watts power, so no external cooling is required.
The standard KI 227 ADF indicator has an optically coated, non-reflecting glass lens that can be cleaned without scratching and has a manually rotated compass card.



NOTE: All mode annunciation shown for illustration only, actual operation will vary



KI 227
KS 227-00 shown, non-slaved, standard

OPERATION :

Turn-on-procedure:

Rotate the ON/OFF/VOL knob clockwise from the detended "OFF" position. The unit will be activated and will be ready to operate. Rotation of this control also adjusts audio volume. The KR 87 has "audio muting" which causes the audio output to be muted unless the receiver is locked on a valid station.

Frequency selection:

The active frequency (to which the ADF is tuned) is displayed in the left side of the window at all times. A standby frequency is displayed in the right side when "FRQ" is annunciated. The standby frequency is placed in "blind" memory when either FLT (Flight Time) or ELT (Elapsed Time) mode is selected. With "FRQ" annunciated, the standby frequency is selected using the frequency select knobs which may be rotated either clockwise or counter clockwise. Pull the small knob out to tune 1's. Push the smaller inner knob in to tune 10's. The outer knob tunes the 100's and the 1000's up to 1799.
The standby frequency selected may then be put into the active window by pressing the "FRQ" button. The standby and active frequencies will be exchanged (flip-flopped), the new frequency will become active, and the former active frequency will go into standby.

Operating modes:

Antenna (ANT) mode is selected and annunciated when the "ADF" button is in the "out" position. ANT provides improved audio reception from the station tuned and is usually used for identification. The bearing pointer in the Ki 227 indicator will be deactivated and immediately turn to the 90° relative position and remain there during ANT position.
The ADF mode is selected and annunciated when the "ADF" button is in the depressed position. ADF activates the bearing pointer in the KI 227 indicator, causing it to move without hesitation to point in the directionof the station relative to the aircraft heading. The compass card on the KI 227 may be rotated as desired by using the heading knob.
The BFO mode, activated and annunciated when the "BFO" button is depressed, permits the carrier wave and the associated Morse code identifier broadcat on the carrier wave to be heard.

ADF test (Pre-flight or in-flight):

Slect ANT mode. This will cause the bearing pointer to move directly to the parked 90° position. Make sure the units is tuned to a usable frequency. Now select ADF mode and the needle should move without hesitation to the station bearing. Excessive sluggishness, wavering or reversals indicate a signal that is too weak or a system malfunction.

Operating the times:

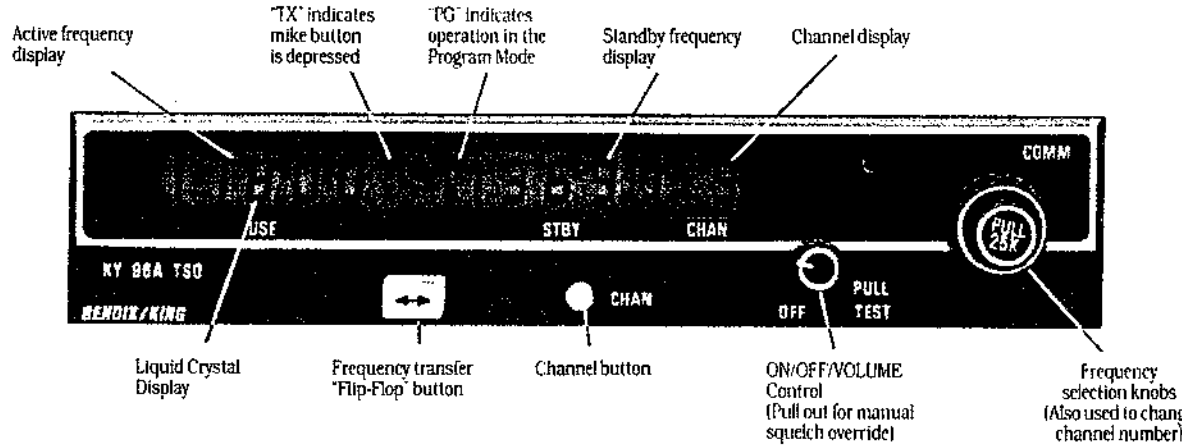
The flight timer will always be automatically reset to 0:00 whenever power is interrupted either by the avionics master switch or the unit's ON/OFF switch. An optional external switch may be installed which, when activated, will stop or start the flight timer.

This switch would be of use during a non-refueling stop when resetting the flight timer is not desired. On some aircraft it may be desirable to use the aircraft strut switch instead of a manual switch to stop and start the flight timer. It should be emphasized that the start/stop function will only opearte with power applied to the unit. Always read flight time prior to power shutdown.
Flight time or elapsed time are displayed and annunciated alternatively by depressing the FLT/ET button. The flight timer continues to count up until the unit is turned off or stopped with an external switch. The elapsed timer may be reset back to :00 by pressing the SET/RST button. It will then start counting up again. (NOTE: pressing the SET/RST button will reset the elapsed timer whether it is being displayed or not).

11. VHF Communications Transceiver

GENERAL

The KING KY 96A operates at 28 volts. With the anticipation of additional frequency allocations, the KY 96A operate on 760 frequencies from 118.00 MHz to 136.975 MHz.



OPERATION :

Power up:

When turn the ON/OFF/VOLUME knob clockwise to the "on" position, the KY 96A will display the last used frequencies in the "USE" and "STBY" (Standby) windows.
To verride the automatic squelch, pull the ON/OFF/VOLUME knob out and rotate it for the desired listening level on the noise being produced by the receiver. Push the volume knob back in to activate the automatic squelch.
NOTE:
As with all avionics, the KY 96A should be turned on only after engine start-up.

Transmitting:

During COMM transmissions, a "TX" appears to indicate the keying of the microphone.

The frequency mode (normal operation):

1. Select a new frequency in the "STBY" window using the frequency selection knobs. The larger knob offers changes of 1 MHz. The smaller knob provides changes of 50 kHz when pushed in and 25 kHz when pulled out. at outside limits of the band the display will wrap around to the other end of the band - going from 136 MHz to 118 MHz.
2. press the transfer button to activate the new frequency. The newly entered frequency in the "STBY" window flip-flops with the frequency in the "USE" window. This new frequency tunes the radio for operation. An optional remote-mounted frequency transfer button may also be used to perform this "flip-flop" function.

Programm mode:

The Programm mode is used to set memory locations for use in the channel mode.
1. Depress the channel (CHAN) button for longer than two seconds, until "PG" is annunciated on the display. The last used active frequency will remain tuned in the "USE" window and the last channel number will flash.
2. Turning either frequency selection knob changes the channel number.
3. Once you have selected the desired channel number, pressing the transfer button will cause the frequency corresponding to that channel number to flash. You may then select the frequency for the displayed channel number simply by turning the frequency selection knobs.
4. To programm additional channels, push the transfer button again to make the channel number flash andrepeat step three above.
5. If you wish to programm less tan 9 channels and have certain channel numbers skipped over when operating in the channel mode, proceed as follows: Rotate the MHZ frequency knob left or right beyond 136 or 118 MHz. Dashes "---" will appear in the "STBY" window. This indicates that the affected number will be skipped when operating in the channel mode.
6. To exit the programm mode, momentarily press the channel (CHAN) button. The unit will also automatically exit the programm mode if approx. 20 seconds elapse with no programming.

The programm secure mode:

The programm secure mode may be used to lock a desired frequency to a channel number, prohibiting programm changes by the pilot from the front of the unit. The KY 96A should be taken to your BENDIX/KING dealer for programming of the programm mode.

Channel mode:

The channel mode is used to recall preset channels stored in memory.
1. push the channel (CHAN) button while in the frequency mode to enter the channel mode. The last active frequency remains displays in the "USE" window. The last used channel number is displayed in the channel window. If no channels have been programmed, channel 1 automatically appears and dashes are displayed in the "STBY" window.
2. Turn either tuning knob to change the channel number and the channel's corresponding frequency in the "STBY" window.
3. If there is no activity for five seconds the radio will return to the frequency mode with the channel frequency remaining in the "STBY" window.
4. You can also return to the frequency mode by pressing the transfer button while in the channel mode. The channel frequency will become the "USE" frequency and the last "USE" frequency will become the "STBY" frequency.
NOTE: If the optional remote channel increment switch is installed, each activitation of the switch will put the unit in the channel mode and cause the next higher channel number and its corresponding frequency to be displayed.

12. Compass system with HSI

GENERAL

The KCS 55A Pictorial Navigation System is composed of five units: KI 525A Pictorial Navigation Indicator / KG 102A Directional Gyro / KMT 112 Magnetic Azimuth Transmitter / KA 51B Slaving Accessory / KA 52 Autopilot Adapter, if required.

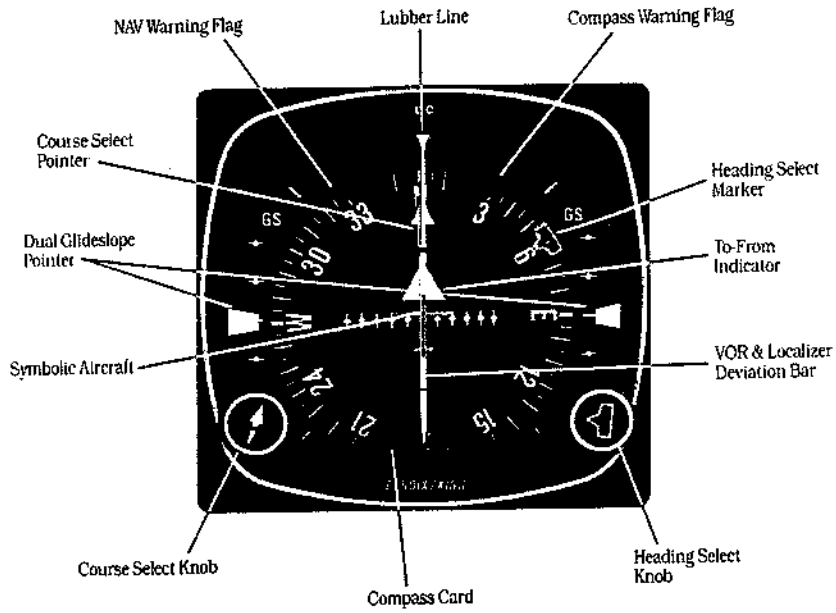
FUNCTIONAL OF THE KCS 55A SYSTEM

When power is first applied to the KCS 55A System, and the system is in the slaved gyro mode, the heading display will automatically fast slave at the rate of 180 degrees per minute to align the slaving control transformer in the KI 525A with the magnetic heading transmitted by the KMT 112. The system will remain in this fast slave mode until the slaving error is reduced to zero and then revert to the normal slaving mode and slave at a constant rate of 3 degrees per minute to keep the system aligned with the earth's magnetic field. If the system is cycled from the free gyro mode to the slaved gyro mode by means of actuating the "slave in" button on the KA 51A (toggle switches on the KA 51B), the "fast slave" will automatically be repeated.
Stabilized heading information is supplied to the KI 525A by the KG 102A. When in the slaved gyro mode this heading signal, which may vary at rates up to 30 degrees per second, is summed with the normal slaving signal from the KMT 112 to provide the final drive signal for the heading display.

When the system is in free gyro mode the heading signal from the KG 102A is the only input to the heading display drive. While in the free gyro mode the pilot may command changes in the displayed heading by means of depressing the clockwise or counterclockwise pushbuttons on the KA 51A (toggle switches on the KA 51B).

The KI 525A HSI is the panel display for the KCS 55A Compass System. It combines the functions of the standard directional gyro and the VOR/LOC/Glideslope deviation indicator. The Indicator displays the complete navigation situation at a glance:
- Slaved gyro magnetic heading
- Selected heading
- Selected VOR/RNAV or LOC course
- RNAV/VOR/Localizer deviation
- TO/FROM RNAV or VOR indicator
- Glideslope deviation

The KA 51B Slaving Control and Compensator Unit is panelmounted. It provides selection of "slaved gyro" modes for the system and manual slaving when the system is in "free gyro" mode. The meter indicates proper slaving operation. 14 and 28 volt lighting options available. The compensator may be remote-mounted for ease of installation.



KI 525A Indicator Display

Section 5
PERFORMANCE

The installation of this instrumentation does not influence the performance of the aircraft.

SUPPLEMENT 2

Hydraulically Actuated
3-Blade Constant Speed Propeller System MTV-12-B-C/C183-17e

LIST OF EFFECTIVE PAGES

Page	Date	Page	Date	Page	Date
2 - 1	27 Mar. 1997				
2 - 2	27 Mar. 1997				
2 - 3	27 Mar. 1997				

Section 1
GENERAL

Data of propeller MTV-12-B-C/C183-17e see following paragraphs.

Section 2
LIMITATIONS

Propeller MTV-12-B-C/C183-17e

Diameter:	183cm	
	cut to 180cm is admissible for repair purposes	
Incidence:	at datum radius 64cm:	
	low pitch:	12.5°±0.2°
	high pitch:	30.0°±1.0°

Number of Revolutions:

max. permissible take-off power (5 minutes):	2700RPM / full throttle (134kW)
max. permissible continous power:	2500RPM / full throttle (129kW)

Placards And Markings:
RPM indicator markings:

red radial line	at 2700 RPM
yellow arc	from 2500 RPM to 2700 RPM
green arc	from 1800 RPM to 2500 RPM

Any markings and placards that are effective only for other propellers are cancelled.

Propeller governor: according to GROB equipment list

Spinner: MT-Propeller No. P-507-1
The aircraft may also be operated without a spinner. Then the propeller blade cut out plates have to be removed.

Section 3
EMERGENCY PROCEDURES

Propeller control failure:
The propeller will regulate to the high pitch stop on oil pressure decrease or propeller control failure.
In this case the flight can be continued conditionally.
Control engine revolutions with the throttle lever.
Monitor manifold pressure, oil pressure and oil temperature.

Section 4
NORMAL PROCEDURES

Adjust the propeller control lever slowly, since the propeller MTV-12-B-C/C183-17e is equipped with light wood-composite blades and responds more rapidly to the control input than a metal-bladed propeller.

Reduce engine revolutions to a number within the RPM indicator's green arc when reaching the obstacle clearance altitude for noise reduction purposes.

Section 5
PERFORMANCE

The performance data given in the basic Flight Manual remain unchanged.

Section 6
WEIGHT AND BALANCE, EQUIPMENT

The propeller weight and center of gravity are:

standard prop. Hoffmann HO-V343K-V/180FP incl. spinner: mass = 28kg
lever arm = 1.525m

propeller MTV-14-D-/190-17 incl. spinner: mass = 24.3kg
lever arm = 1.525m

mass moment of standard propeller: = 42.7kgm
mass moment of MTV-12-B-C/C183-17e: = 37.05kgm