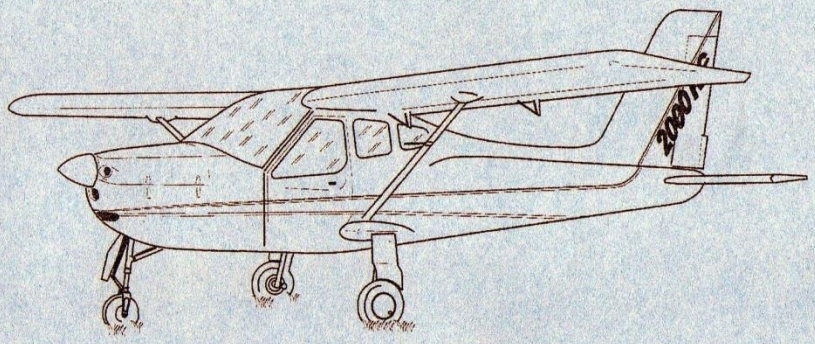
FLIGHT MANUAL

P92 Echo 2000RG



BUILDER : COSTRUZIONI AERONAUTICHE **TECNAM** S.r.l.

AIRCRAFT TYPE : **P92 ECHO 2000RG**

SERIAL NUMBER :.....

BUILD YEAR :.....

This manual must always be kept aboard aircraft. Aircraft must be operated in accordance with procedures and limitations as reported in the Flight Manual.

LIST OF REVISIONS

All revisions to the present Manual, with the exception of actual weight data, must be recorded in the following table.

New or amended text in revised pages shall be characterized by a black vertical line on the left margin; revision number and date shall be displayed on left end of page.

LIST OF REVISIONS

Rev N°	Section	Pages	Date	Date of inser.

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SECTION 1

GENERAL

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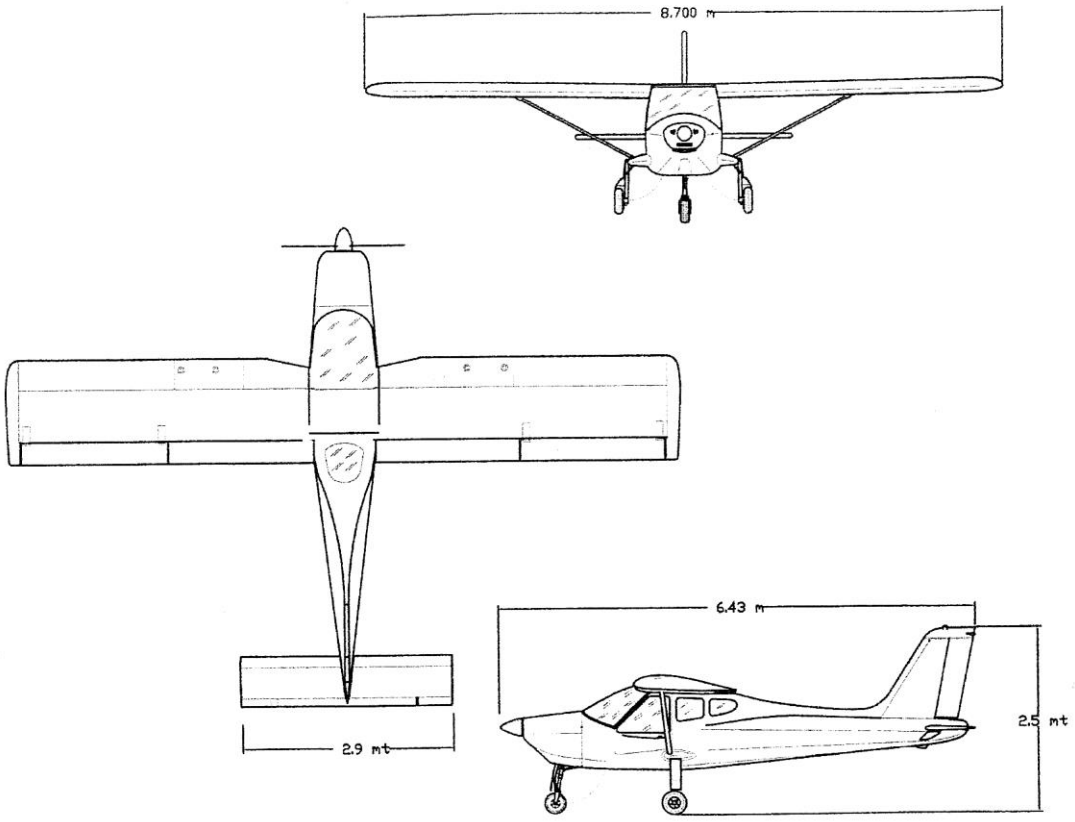
THREE-VIEW DRAWING



- Dimensions shown refer to aircraft weight of 450 kg and normal operating tire pressure.

INTRODUCTION

The ***P92 ECHO 2000RG*** is a twin seat single engine aircraft with a strut-braced rectangular high wing, retractable tricycle landing gear and nose gear is provided with a steering system.

This Flight Manual has been prepared to provide pilots and instructors with information for the safe and efficient operation of this aircraft.

This Flight Manual contains 8 sections. Section 1 provides basic data and information of general interest. It also contains definitions and explanations of symbols, abbreviations and terminology commonly used.

WARNINGS - CAUTIONS - NOTES

The following definitions apply to "WARNING", "CAUTION" and "NOTE" labels found throughout 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 to any special item not directly related to safety but which is important or unusual.

DIMENSIONI PRINCIPALI

WING	
Wing span	8.7 m
Wing chord	1.4 m
Wing surface	12.0 m^2
Wing loading	37.5 kg/m^2
Aspect ratio	6.3
Taper ratio	1.0
Dihedral	1.5°
FUSELAGE	
Overall length	6.43 m
Overall width	1.1 m
Overall height	2.5 m
EMPENNAGE	
Stabilator span	2.9 m
Vertical tail span	1.2 m
LANDING GEAR	
Wheel track:	1.75 m
Wheel base:	1.76 m
Main gear tires. Air Trac	4.00-6
Wheel hubs and brakes Marc Ingegno	
Nose gear tire *Natier*	11x4.00-5

CONTROL SURFACES TRAVEL LIMITS

Ailerons	Up 20° down 15 ° ± 2°
Stabilator	Up 18° down 3° ± 1°
Trim-Tab	+2° +12° ± 1°
Rudder	RH 25° LH 25° ± 1°
Flaps	0° - 40° ± 1°

POWERPLANT

Manufacturer:	Bombardier-Rotax GmbH
Model	912 ULS
Certification basis:	4 cylinder horizontally-opposed twins with overall displacement of 1352 c.c., mixed cooling, (water-cooled heads and air-cooled cylinders) twin carburetors, integrated reduction gear (2.4286:1) with torque damper. Compression ratio 10.3:1.
Maximum rating:	100 Hp (73.5 kW) at 5800 rpm - max 5 min..

PROPELLER

Manufacturer:	F.lli Tonini Giancarlo & Felice S.n.c.
Model:	GT- ECHO 2/173/158
Number of blades:	2
Diameter:	1720 mm
Type:	Fixed pitch - wood

FUEL

Fuel grade:	• High octane DIN 51600, O-NORM 1103 • Unleaded DIN 51603, O-NORM 1101 • AVGAS 100LL
Fuel tanks:	2 wing tanks integrated within the wing's leading edge with Gascolator located in engine cowling
Capacity of each wing tank	35 liters
Total capacity	70 liters

LUBRICANT

Lubrication System:	Forced, with external oil reservoir
Oil:	Automotive grade type oil type API "SF" or "SG" preferably synthetic or semi-synthetic
Oil Capacity:	2.5 liters

COOLANTS

Cooling system:	Mixed air and liquid pressurized closed circuit system
Coolant:	Antifreeze and water liquid mixture
Capacity	3 liters

STANDARD WEIGHTS

Maximum takeoff weight:	450 kg
Standard Empty Weight:	281 kg

SPECIFIC LOADINGS

Wing Loading	37.5 kg/m^2
Power Loading	4,5 kg/hp

ABBREVIATIONS AND TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

CAS	Calibrated Airspeed : is indicated airspeed corrected for position and instrument error.
IAS	Indicated Airspeed : is the speed shown on the airspeed indicator.
TAS	True Airspeed : is the airspeed relative to undisturbed air which is CAS corrected for altitude and temperature.
V_{FE}	Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.
V_{NO}	Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air, then only with caution.
V_{NE}	Never Exceed Speed is the speed limit that may not be exceeded at any time.
V_S	Stalling Speed.
V_{S0}	Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration at the most forward center of gravity.
V_X	Best Angle-of-Climb Speed is the speed which results in the greatest gain of altitude in a given horizontal distance.
V_Y	Best Rate-of-Climb Speed is the speed which results in the greatest gain in altitude in a given time.
Vr	Rotation speed: is the speed at which the aircraft rotates about the pitch axis during takeoff
Vobs	Obstacle speed: is the speed at which the aircraft flies over a 15m obstacle during takeoff or landing
V_{LO}	Landing Gear Out speed : is the maximum speed allowed with extended landing gear.

WEATHER TERMINOLOGY

OAT — Outside Air Temperature : is the external air temperature expressed in degrees Celsius (°C).

T_S — Standar Temperature: assumed equal to 15°C at sea level, decreasing 2°C for every 1000 ft gain in altitude.

H_P — Pressure altitude : is the altitude read by an altimeter set at 1013 mb.

ENGINE POWER TERMINOLOGY

RPM — Revolutions Per Minute: is the number of revolutions per minute of the propeller, multiplied by 2.273 (912UL) or 2.4286 (912S) yields engine RPM.

AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

Crosswind velocity — Crosswind Velocity is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated.

Usable fuel — Usable Fuel is the fuel available for flight planning.

Unusable fuel — Unusable Fuel is the quantity of fuel that cannot be safely used in flight.

g — is the acceleration of gravity.

TOR — is the takeoff distance measured from actual start to wheel liftoff point

TOD — is total takeoff distance measured from start to 15m obstacle clearing

GR — is the distance measured during landing from actual touchdown to stop point

LD — is the distance measured during landing, from 15m obstacle clearing to actual stop.

S/R — is specific range, that is, the distance (in nautical miles) which can be expected at a specific power setting and/or flight configuration per kilo of fuel consumed

WEIGHT AND BALANCE TERMINOLOGY

Datum	Datum is an imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Arm	Arm is the horizontal distance from the reference datum to the center of gravity (C. G.) of an item.
Moment	Moment is the product of the weight of an item multiplied by its arm.
C. G.	Center of Gravity is the point at which the airplane, or equipment, would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.
Standard Empty Weight	Standard Empty Weight is the weight of a standard airplane, including unusable fuel, full operating fuels and full engine oil.
Basic Empty Weight	Basic Empty Weight is the standard empty weight plus the weight of optional equipment.
Useful Load	Useful Load is the difference between takeoff weight and the basic empty weight.
Maximum Weight	Maximum Weight is the maximum certified weight of the aircraft.
Maximum Takeoff Weight	Maximum Takeoff Weight is the maximum weight approved for the start of the takeoff run.
Maximum Landing Weight	Maximum landing weight is the maximum weight approved for the landing touch down.
Tare	Tare is the weight of chocks, blocks, stands, etc. used when weighing an airplane, and is included in the scale readings. Tare is deducted from the scale reading to obtain the actual (net) airplane weight.

UNIT CONVERSION FACTORS

MULTIPLYING		BY →	YIELDS	
TEMPERATURE				
Fahrenheit	[°F]	$\frac{5}{9}\cdot(F-32)$	Celsius	[°C]
Celsius	[°C]	$\left(\frac{9}{5}\cdot C\right)+32$	Fahrenheit	[°F]
FORCES				
Kilograms	[kg]	2.205	Pounds	[lbs]
Pounds	[lbs]	0.4536	Kilograms	[kg]
SPEED				
Meters per second	[m/s]	196.86	Feet per minute.	[ft/min]
Feet per minute	[ft/min]	0.00508	Meters per second.	[m/s]
Knots	[kts]	1.853	Kilometers / hour	[km/h]
Kilometers / hour	[km/h]	0.5396	Knots	[kts]
PRESSURE				
Atmosphere	[atm]	14.7	Pounds / sq. in	[psi]
Pounds / sq. in	[psi]	0.068	Atmosphere	[aAtm]
LENGTH				
Kilometers	[km]	0.5396	Nautical miles	[nm]
Nautical miles	[nm]	1.853	Kilometers	[km]
Meters	[m]	3.281	Feet	[ft]
Feet	[ft]	0.3048	Meters	[m]
Centimeters	[cm]	0.3937	Inches	[in]
Inches	[in]	2.540	Centimeters	[cm]
VOLUME				
Liters	[lt]	0.2642	U.S. Gallons	[US Gal]
U.S. Gallons	[US Gal]	3.785	Liters	[lt]
AREA				
Square meters	[m^2]	10.76	Square feet	[sq ft]
Square feet	[sq ft]	0.0929	Square meters	[m^2]

SECTION 2

OPERATING LIMITATIONS

TABLE OF CONTENTS

INTRODUCTION

Section 2 includes operating limitations, instrument markings, and basic placards necessary for safe operation of the ***P92 ECHO 2000RG***, its engine, standard systems and standard equipment.

AIRSPEED LIMITATIONS

SPEED Km/h		IAS	REMARKS
V_{NE}	Never exceed speed	**270**	Never exceed this speed in any operation.
V_{NO}	Maximum Structural Cruising Speed	**220**	Never exceed this speed unless in smooth air, and then only with caution.
V_A	Maneuvering speed	**165**	Do not make full or abrupt control movements above this speed as this may cause stress in excess of limit load factor
V_{FE}	Maximum flap extended speed	**110**	Never exceed this speed for any given flap setting.
V_{LO}	Maximum speed for llanding gear extension	**120**	Landing gear never to be extended for speeds in excess of this value.

AIRSPEED INDICATOR MARKINGS

Airspeed indicator markings and their color code are explained in the following table.

MARKING	IAS Km/h	SIGNIFICANCE
White arc	**72 – 110**	Flap Operating Range (lower limit is $1.1*V_{SO}$, at maximum weight and upper limit is maximum speed permissible with flaps extended at 38°).
Green arc	**110 – 220**	Normal Operating Range (lower limit is V_{FE} at maximum weight and upper limit is maximum structural speed V_{NO}).
Yellow arc	**220 – 270**	Operations must be conducted with caution and only in smooth air.
Red line	**270**	Maximum speed for all operations.

POWERPLANT LIMITATIONS

The following table lists operating limitations for aircraft installed engine:

ENGINE MANUFACTURER: Bombardier Rotax GmbH.

ENGINE MODEL: **912 ULS**

MAXIMUM POWER:

	Max Power. (HP)	Max. RPM	Time. (min.)
Takeoff	*100*	*5800*	*5*
Max continuous	*94*	*5500*	/

TEMPERATURE:

Cooling liquid, monitored at cylinder heads	*135° C*
Max Oil:	*130° C*
Min. Oil:	*50° C*

OIL PRESSURE:

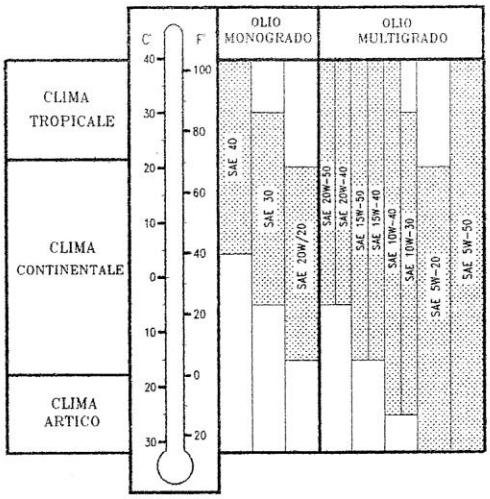
Minimum	*1.5 bar*
Maximum	*5 bar*

WARNING

Admissible pressure for cold start is 7 bar maximum for short periods.

VISCOSITY

Use viscosity grade oil as specified in the following table:



WARNING

Use of Aviation Grade Oil with or without additives is not permitted

COOLANT:

Mixture: 80% concentrated antifreeze (e.g. Fiat Paraflu) with anticorrosion additive and 20% demineralized water

PROPELLER

MANUFACTURER:	F.lli Tonini Giancarlo & Felice
MODEL:	GT-ECHO 2/173/158
PROPELLER TYPE:	Wood twin blade fixed pitch
DIAMETER:	1730 mm

POWERPLANT INSTRUMENT MARKINGS

Powerplant instrument markings and their color code significance are shown below:

INSTRUMENT		RED LINE Minimum limit	GREEN ARC Normal operating	YELLOW ARC Caution	RED LINE Maximum limit
Prop tach	RPM	--------	2160-5500	5500-5800	5800
Oil Temp.	°C	50	90-100	50 – 90 100-130	130
Cylinder heads and coolant temp.	°C	--------	0 – 135	------	135
Oil pressure	bar	1.5	1.5 – 5	5 – 7	7
Fuel gage	lit	------	------	0-5	------

NOTE

The table below is valid for both P92 models

OTHER INSTRUMENT MARKINGS

INSTRUMENT	RED LINE Minimum limit	GREEN ARC Normal operating	YELLOW ARC Caution	RED LINE Maximum limit
Voltmeter	10 Volt	12 – 14 Volt	------	------
Landing gear actuator pressure gage	-	6 – 7 bar	-----	------

WEIGHTS

Maximum takeoff weight: 450 kg

CG TRAVEL LIMITS

FWD limit	23% CMA
AFT limit	26% CMA
Bubble level	Cabin floor

Pilot is responsible for proper aircraft loading.

MANEUVER

This aircraft is intended for non-aerobatic operation only. Non-aerobatic operation includes:

- Any maneuver pertaining to "normal" flight
- Stalls (except whip stalls)
- Lazy eights
- Chandelles
- Turns in which the angle of bank is not more than 60°

Acrobatic maneuvers, including spins, are not approved

FUEL

TWO TANKS: 35 liters each

TOTAL FUEL CAPACITY: 70 liters

APPROVED FUEL

* High octane gasoline DIN 51600, O.NORM 1103
* Unleaded gasoline DIN 51603, O.NORM 1101
* AVGAS 100LL

SECTION 3

EMERGENCY PROCEDURES

TABLE OF CONTENTS

INTRODUCTION

Section 3 includes checklists and detailed procedures to be used in the event of emergencies. Emergencies caused by a malfunction of the aircraft or engine are extremely rare if appropriate maintenance and pre-flight inspections are carried out.

In case of emergency, suggestions of the present section should be considered and applied as necessary to correct the problem.

Before operating the aircraft, the pilot should become thoroughly familiar with the present manual and, in particular, with the present section. Further, a continued and appropriate training should be provided.

ENGINE FAILURES

Depending on the case that may apply, the emergency procedure should follow these guidelines.

ENGINE FAILURE DURING TAKEOFF RUN

1. Throttle: *idle* (fully out)
2. Brakes: *apply as needed*
3. Magnetos: *OFF.*
4. Flaps: *extend*
5. Generator switch and Master switch: *OFF*
6. Fuel shutoff valves: *OFF*

ENGINE FAILURE IMMEDIATELY AFTER TAKEOFF

1. Locate landing area
2. Throttle: *idle (*fully out)
3. Fuel shutoff valves: *OFF.*
4. Magnetos *OFF.*
5. Flaps: *as needed.*
6. Landing gear: *extended.*
7. Generator switch and Master switch: *OFF.*

FORCED LANDING

EMERGENCY LANDING WITHOUT ENGINE POWER

1. Set glide speed to optimal value of 110 Km/h
2. Select terrain area most suitable for emergency landing, possibly upwind.
3. Fuel shutoff valves: *OFF.*
4. Magnetos: *OFF.*
5. Tighten safety belts, release door safety lock and unlatch doors
6. Flaps: *as needed.*
7. Landing gear: extended
8. Just before touchdown, set generator and master switch to : OFF.

POWER-ON FORCED LANDING

1. Adjust glide slope.
2. Flaps as required.
3. Select terrain area most suitable for emergency landing and flyby checking for obstacles and wind direction.
4. Tighten safety belts, release door safety lock and unlatch doors.
5. Just before touchdon turn fuel taps to: OFF
6. Landing gear: extended
7. After touchdown: Generator switch and Master switch: OFF.

SMOKE AND FIRE

ENGINE FIRE WHILE PARKED OR DURING TAKEOFF

1. Fuel shutoff valves: OFF.
2. Abort takeoff if possible.
3. If engine is running let it use up remaining fuel in carburetors.
4. Magnetos: OFF.
5. Warn bystanders to clear the area as fast as possible
6. Without removing the engine cowling use a CO_2 or a powder fire extinguisher to put out flames directing spray towards cowling's air intakes.

NOTE

DO NOT USE WATER to put out fire and do not open engine cowling until absolutely certain fire is extinguished. In case an appropriate fire extinguisher is not handy, still keeping engine cowling closed, it is possible to use a woolen blanket, sand or dirt to try smothering the fire.

ENGINE FIRE IN FLIGHT

1. Fuel shutoff valves: *OFF.*
2. Throttle: *fully inward.*
3. Master switch: *OFF.*
4. Do not try airstarting engine.
5. Extend flaps as needed.
6. Landing gear: extended (check for gear-out green light)
7. Carry out forced landing emergency procedure.
8. Master switch: OFF.

RECOVERY FROM UNINTENTIONAL SPIN

In case of unintentional spin entry, follow the emergency procedure described below:

1. Adjust throttle to minimum (full outward position)
2. Activate rudder bar by pushing foot opposite spin direction.
3. Push control stick full forward and keep in position until spin is halted.
4. Center rudder bar
5. Gradually recover flight attitude easing back on the control stick avoiding to exceed V_{NE} and maximum load factor.
6. Readjust throttle to restore engine power.

LANDING GEAR MALFUNCTION

FAILED GEAR EXTENSION

1. Gear control lever: DOWN.
2. Throttle: *fully inward.*
3. Speed < 100 km/h
4. Emergency gear control lever: PULL.
5. Green lights for gear extended and locked: ON.

FAILED GEAR RETRACTION

1. Gear control lever: DOWN.
2. Green lights for gear extended and locked: ON.
3. Land as soon as possible.

DEPLOYMENT OF EMERGENCY PARACHUTE (optional)

When deciding on time of deployment it is necessary to take into account that 2 seconds are necessary to achieve full deployment of parachute. Thus:

1. Level aircraft as much as possible
2. Minimum height for successful deployment, is about 33m (100 ft).[1]
3. Pull firmly and completely on handle to initiate pyrotechnic deployment sequence.
4. Extend landing gear.
5. Shut fuel taps, Magnetos and Master switch.
6. Tighten safety belts and helmet chinstrap.
7. Unlatch safety pins and open doors
8. Before touchdown assume tuck-in position

[1] *This height is only indicative, success of deployment depends on aircraft attitude and drop speed, greater heigths increase the probability of success.*

SECTION 4

NORMAL PROCEDURES

TABLE OF CONTENTS

INTRODUCTION

Section 4 contains checklists and amplified procedures for the conduct of normal operation.

RIGGING AND DERIGGING ENGINE COWLING

UPPER COWLING:

I. Parking brake ON.

II. Fuel shutoff valves OFF.

III. Generator switch OFF, Master switch OFF, Magnetos OFF.

IV. Unlatch all four butterfly Cam-locks mounted on the cowling by rotating them 90° counterclockwise while slightly pushing inwards.

V. Remove engine cowling paying attention to propeller shaft passing through nose.

VI. To assemble: rest cowling horizontal insuring proper fitting of nose base reference pins.

VII. Secure latches by applying light pressure, check for proper assembly and fasten Cam-locks..

WARNING !

Butterfly Cam-locks are locked when tabs are horizontal and open when tabs are vertical. Verify tab is below latch upon closing.

LOWER COWLING

I. After disassembling upper cowling, bring propeller to horizontal position.

II. Using a standard screwdriver, press and rotate 90° the two Cam-locks positioned on lower cowling by the firewall.

III. Disconnect landing light wire.

IV. Pull out the first hinge pin positioned on the side of the firewall, then, while holding cowling, pull out second hinge pin; remove cowling with downward motion.

V. For installation follow reverse procedure

PRE-FLIGHT INSPECTION

Before each flight, it is necessary to carry out a complete inspection of the aircraft starting with an external inspection followed by an internal inspection as hereby detailed.

CABIN INSPECTION

A *Weight and balance*: check if within limits

B *Safety belts used to lock controls*: free

C *Flight controls*: activate flight controls to insure unhindered movement of control rods and surfaces.

D *Parking brake*: engage

E *Retractable gear*: disengage system breaker.

F *Master switch*: ON

G Check operation of generator and proper functionality of ammeter.

H *Flap control*: activate control to end travel to test functionality and instrument reading.

I *Trim control*: activate control to end travel to test functionality and instrument reading.

J *Retractable landing gear*: check for green lights testifying gear is out and locked. Insert system breaker and insure orange light comes on for proper compressor operation.

NOTE

If the pneumatic system of the landing gear is at operating pressure (6÷7 bar), compressor will not engage when breaker is inserted.

K *Master switch*: OFF

L *Fuel level*: check on the basis of the flight plan.

EXTERNAL INSPECTION

To carry out the external inspection it will be necessary to follow the checklist below with the station order outlined in fig. 4-1

A Check left side tank cap is fastened and blow-out plug is unobstructed

B -

C Remove protection cap and check Pitot mounted on left strut is unobstructed, do not blow inside vents, place protection cap inside aircraft.

D Leading edge and wing skin: check integrity

E Left aileron: check integrity and unhindered movement

F Left flap and hinges: check integrity

G Check integrity of left side main landing gear, tire inflation (1.4 bar), condition and alignment; check fuselage skin condition.

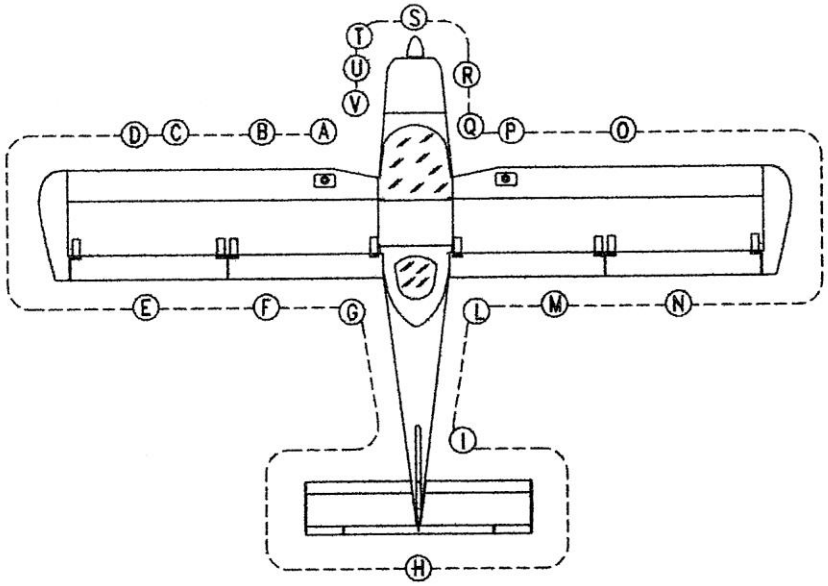


FIG. 4-1

H Horizontal tail and tab: check integrity and unhindered movement.

I Vertical tail and rudder: check integrity and unhindered movement.

L Check integrity of right side main landing gear, tire pressure (1.4 bar), condition and alignment; check fuselage skin condition.

M Right flap and hinges: check integrity.

N Right aileron: check integrity and unhindered movement.

O Leading edge and wing skin: check integrity

P Check right side tank cap is fastened and blow-out plug is unobstructed.

Q -

R Check integrity of nose landing gear strut, tire inflation (1.2 bar) and condition; check condition of oleo shock..

S Propeller and spinner condition: check for nicks and proper fitting.

T Open engine cowling and perform the following checklist:

I. Check no foreign objects are present.

II. Check the cooling circuit for losses from tubing, check coolant reservoir level, insure radiator fins are unobstructed.

III. Check lubrication circuit for losses from tubing, check oil reservoir level, insure radiator fins are unobstructed

IV. Open both fuel taps, inspect fuel circuit for losses from tubing, check integrity of fireproof protection braids, drain circuit using a container to collect fuel activating the specific drainage tap located on the firewall, shut fuel taps. Check for absence of water or other contaminants.

NOTE

Drainage operation must be carried out with aircraft parked on level surface.

V. Verify correct mounting of tubing of gear retraction system and check integrity of silent-block suspension system of pneumatic system compressor unit..

VI. Check correct alignment of nose gear leg and of its compass locking system.

VII. Check integrity of silent-block suspensions.

VIII. Check firmness and integrity of air intake system, check externally that ram air intake is unobstructed.

IX. Check that all parts are secure or safetied.

U Close engine cowling.

V -

Z Remove tow bar and chocks.

Avoid blowing inside left strut mounted Pitot and inside airspeed indicator system's static vents as this may d

WARNING !

CHECKLIST

BEFORE STARTING ENGINE (after preflight inspection)

I. Flight planning, fuel consumption, refueling.

II. Aircraft loading and related inspections (see section 6)

III. Seat and safety belts adjustment.

IV. Doors secured

V. Parking brake ON.

ENGINE STARTING

I. Generator switch and Master switch ON.

II. Both fuel taps: ON.

III. Engine throttle to idle.

IV. Choke as needed.

V. Set magnetos switch to ON.

VI. Prop area: free

VII. Ignition key set to: START.

VIII. Prop RPM: 2400 - 2600 RPM

IX. Choke OFF

X. Check engine instruments

XI. Check oil pressure rise (maximum value cold 7 bar)

BEFORE TAXING

I. Radio and utilities ON.

II. Altimeter: reset.

III. Navigation lights: as required

TAXING

I. Brakes: check operation

II. Flight instruments: check operation

HOLDING

I. Parking brake ON.

II. Turn on navigation lights, strobe light, and landing light (optional)

III. Check engine parameters.

Oil temperature	***50° - 100°***
Cylinder heads temperature: max	***135°***
Oil pressure	***1.5 - 7***

IV. Check ammeter to insure alternator is charging.

V. Prop rpm's at 3800 RPM and test magnetos.

VI. Visual check of fuel indicators.

VII. Compressor light gear retraction system: OFF

VIII. Check pressure of gear retraction system (7 bar)

IX. Green lights for gear extended and locked ON.

X. Flaps 15° (takeoff)

XI. Stick free and zero trim

XII. Seat belts fastened and doors secured.

TAKEOFF AND CLIMB

I. Check for clear final and wind on runway.

II. Parking brake OFF, full throttle.

III. Carburetor heat: OFF

IV. Taxi to line-up

V. Rotation speed and takeoff

VI. Slight braking to stop wheel spinning.

VII. Gear up.

VIII. Flaps retracted.

IX. Landing light OFF.

X. Trim adjustment

XI. Establish climb rate

CRUISE

I. Reach cruising altitude

II. Set power and engine rpm's for cruise.

III. Check engine parameters

Oil temperature	***90° - 100°***
Temperature cylinder heads	***90° - 135°***
Oil pressure	***1.5 - 5***

NOTE

Compensate unpredicted asymmetrical fuel consumption between left and right fuel tanks by shutting off appropriate fuel tap located inside cabin

LANDING

I. Turn on landing light (if available)

II. Lower landing gear on the downwind leg, flap at 15° and speed less than V_{LO} . Insure green lights for gear extended and locked are ON.

III. Check runway final and establish descent and approach to final.

IV. Extend flaps gradually to maximum deflection of 40°.

V. Optimal touchdown speed : 70 Km/h

VI. Land and taxi.

VII. Flaps at 0°.

VIII. Parking brake ON.

IX. Turn off landing light, navigation lights and strobe light.

ENGINE SHUT DOWN

I. Keep engine running at 3000 RPM for about two minutes in order to reduce latent heat.

II. Turn off all electrical utilities

III. Set Magnetos switch, Generator switch and Master switch to OFF

IV. Set both fuel taps to OFF.

V. Insert hood over Pitot tube on left side wing strut.

SECTION 5

PERFORMANCE

TABLE OF CONTENTS

INTRODUCTION

This section provides all necessary data for accurate and comprehensive planning of flight activity from takeoff to landing.

Data reported in graphs and/or tables were determined using:

- aircraft and engine in good condition
- normal piloting techniques

Each graph or table was determined according to ICAO Standard Atmosphere (ISA - m.s.l.); evaluations of the impact on performance was carried out by theoretical means for:

- airspeed
- external temperature
- altitude
- weight

AIRSPEED INSTRUMENT CALIBRATION

The difference between indicated airspeed and calibrated airspeed is kept within ± 3% of JAR-VLA limits for all speeds above 1.3 Vs.

STALL SPEEDS

CONDITIONS: - Weight 450 kg
- engine idle
- no ground effect

	LATERAL INCLINATION			
	0°	*30°*	*45°*	*60°*
FLAPS	CAS Km/h	CAS Km/h	CAS Km/h	CAS Km/h
0°	**74**	**78**	**84**	**101**
15°	**69**	**76**	**79**	**97**
40°	**65**	**69**	**78**	**91**

CROSSWIND

Maximum demonstrated crosswind velocity is 15 Kts

⇒ *Example:*

Given	***Find***
Wind direction = 30°	Headwind = 17.5 Kts
Wind velocity = 20 Kts	Crosswind = 10 Kts

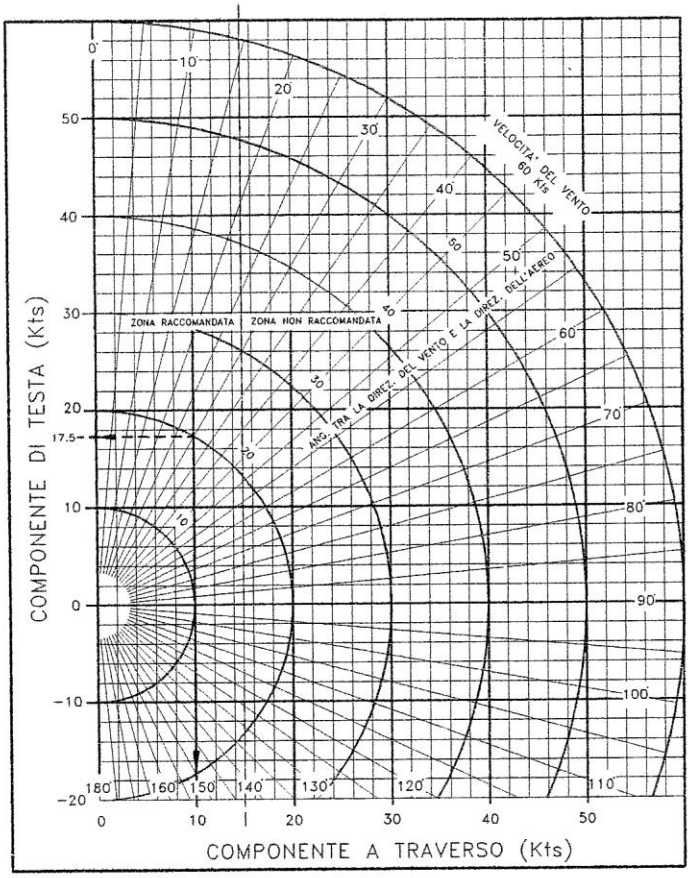


Fig. 5-1 CROSSWIND CHART

TAKEOFF PERFORMANCE

TAKEOFF DISTANCE

CONDITIONS:

- ISA
- Engine: full throttle
- Runway: dry, compact, grass
- Flap: 15°
- Slope: 0° Wind: zero

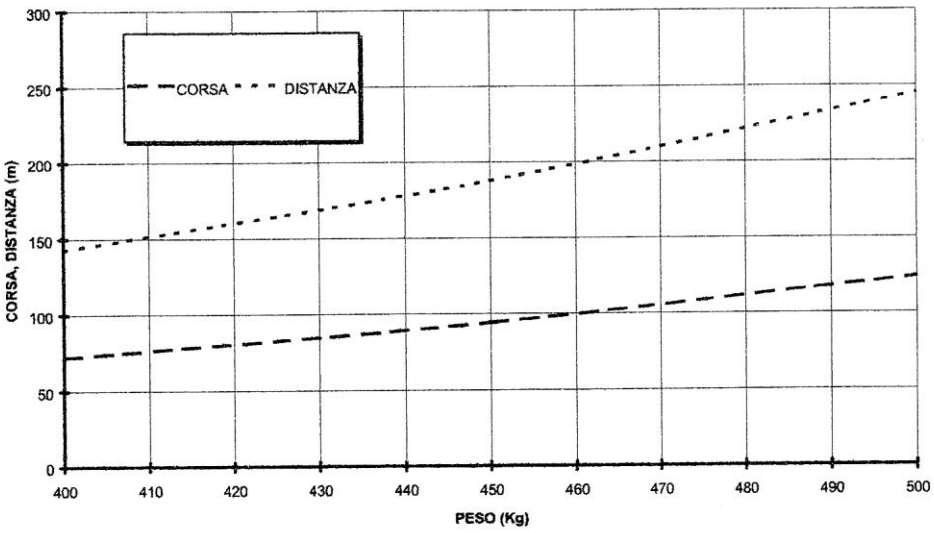


Fig. 5-2 TAKEOFF

LANDING

RUN AND DISTANCE

CONDITIONS:

Flap: 40°

Engine: idle

Runway: dry, compact, grass

Slope: 0° Wind: zero

Distance over 15 mt obstacle

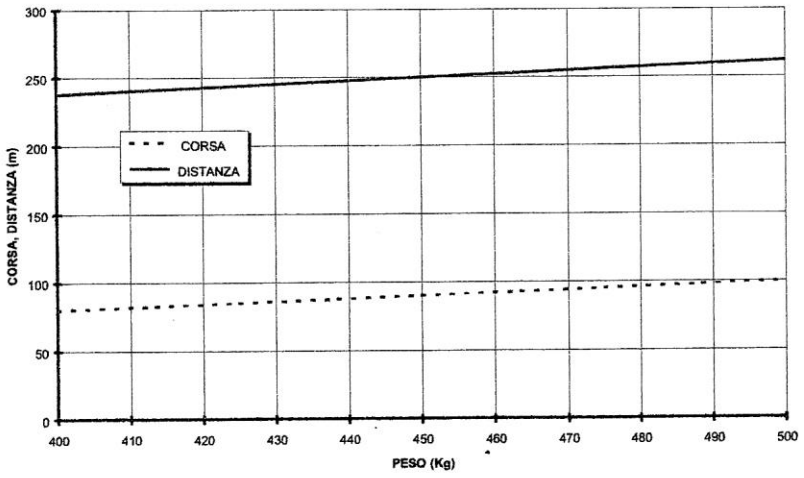


Fig. 5-3 LANDING

CLIMB PERFORMANCE

CLIMB RATE IN CLEAN CONFIGURATION

CONDITIONS:

- ISA
- Flap: 0°
- Weight 450 kg
- Engine: full throttle

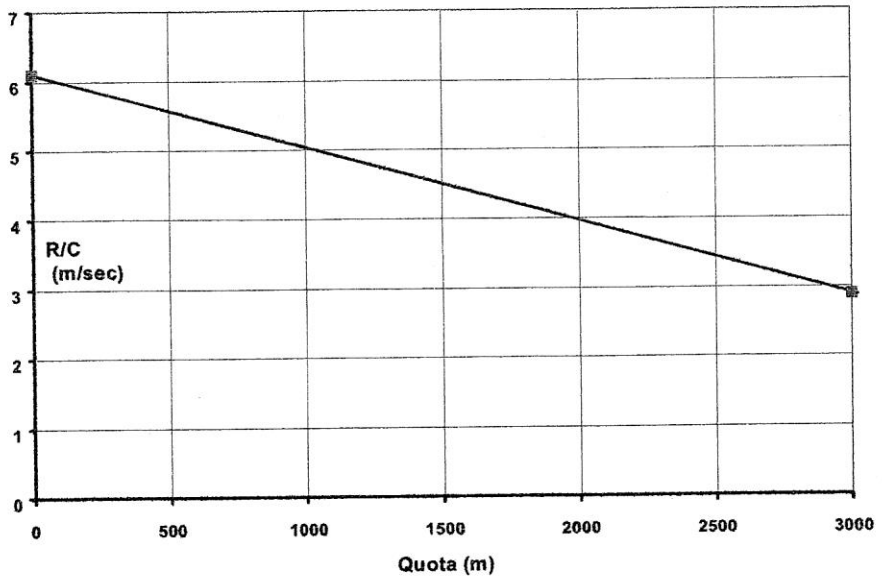


Fig. 5-4 CLIMB RATE

V_Y = **120** Km/h

NOTE

- For every 10 kg increase in weight, decrease R/C by *0.15* m/sec (*30 ft/min*).
- For every 10 kg decrease in weight, increase R/C by *0.15* m/sec (*30 ft/min*).

CRUISE

CONDITIONS:

- ISA
- Height: 0

RPM	CAS km/h	Hourly use [lt/h]
4600	190	15
4800	205	17
5200	220	19.5

CONSEQUENCES FROM RAIN AND INSECT

Flight tests have demonstrated that neither rain nor insect impact build-up on leading edge have caused substantial variations to aircraft's flying qualities.

SECTION 6

WEIGHT AND BALANCE

TABLE OF CONTENTS

INTRODUCTION

This section describes the procedure for establishing the basic empty weight and moment of the aircraft. Loading procedure information is also provided.

AIRCRAFT WEIGHING PROCEDURES

PREPARATION

a. Carry out weighing procedure inside closed hangar.
b. Remove from cabin all objects left unintentionally.
c. Align nose wheel.
d. Drain fuel via drainage outlet.
e. Oil, hydraulic fluid and coolant to operating levels.
f. Position seats to most forward position.
g. Flaps retracted (0°)
h. Control surfaces in neutral position.
i. Place scales (min. capacity 150 kg) under each wheel.

LEVELING

a. Level the aircraft using the lower door sill as datum
b. Center bubble on level by deflating nose tire

WEIGHING

a. Record weight shown on each scale
b. Repeat weighing procedure three times
c. Calculate empty weight

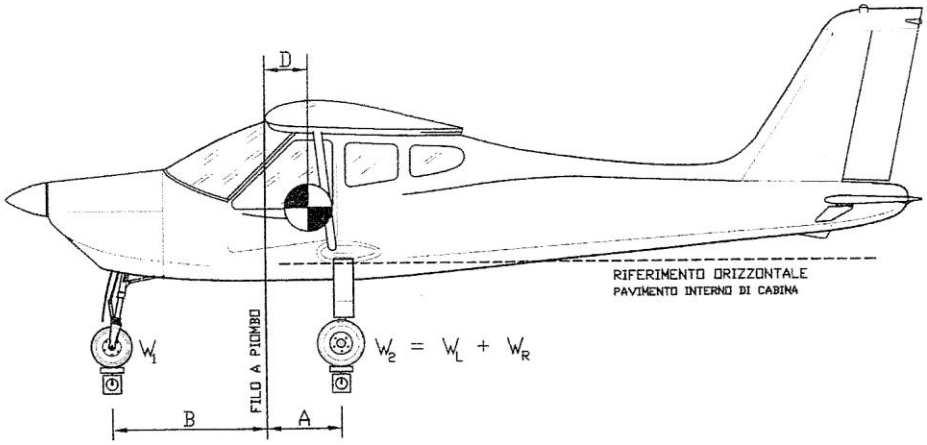
DETERMINATION OF C.G.

a. Drop a plumb bob tangent to the leading edge (in non-tapered area of one half-wing, approximately one meter from wing root) and trace reference mark on the floor.
b. Drop a plumb bob tangent to the leading edge (in non-tapered area of one half-wing, approximately one meter from wing root) and trace reference mark on the floor.
c. Stretch a taught line between the two marks.
d. Measure the distance between the reference line and main wheel axis.
e. Using recorded data it is possible to determine the aircraft's C.G. location and moment (see following table)

WEIGHING REPORT

Model **P92 ECHO** *2000RG* *s/n:*____ *Weighing n°*____ *Date:*_____

Datum: Wing leading edge in non-tapered area



	Kg
Nose wheel weight	W_1 =
" " SX	W_L =
" " DX	W_R =
$W_2 = W_L + W_R$ =	

	metri
Plumb bob distance from LH wheel	A_L =
" " " RH	A_R =
Average distance $(A_L + A_R)/2$	A =
Bob distance from nose wheel.	B =

Empty weight We = $W_1 + W_2$ =

Eliminato: +1.9

$D = \frac{W_2 \cdot A - W_1 \cdot B}{We}$ = m	$D\% = \frac{D}{1.4} \cdot 100$ =

Maximum takeoff weight	W_T = 450 kg
Empty weight	We =
Maximum useful load W_T - We	Wu =

CG TRAVEL

Admissible CG travel exceeds actual operating limitations. In fact, occupants and fuel only cause a marginal variation in CG location.

When aft CG travel limit is exceeded, aircraft, on level terrain, will drop tail.

SECTION 7

SYSTEMS

TABLE OF CONTENTS

INTRODUCTION

This section provides description and operation of the aircraft and its systems.

AIRFRAME

WING

Each half-wing is made up of a central light alloy torque box; an aluminum leading edge is attached to the front spar while a low hinge slotted flap and the aileron are attached aft. Flaps and ailerons are both made up of an aluminum spar connected to formed sheet metal leading edge and ribs and are covered by a thermoretractible synthetic material.

FUSELAGE

The front part of the fuselage is made up of a truss structure with special steel tubing and, beginning at the cabin's rear section, by an aluminum alloy monococque structure. The engine housing is isolated from the cabin by a stainless steel firewall; the steel stringers engine mount is attached to the cabin's truss structure in four points.

EMPENNAGE

The vertical tail is entirely metal: the vertical stabilizer is made up of a twin spar with load carrying skin while the rudder consists of an aluminum torque stringer connected to light alloy ribs and skin. The horizontal tail is an all moving type (stabilator); its structure consists of an aluminum tubular spar connected to ribs and leading edge; the entire structure is covered with thermoretractible synthetic material.

FLIGHT CONTROLS

Aircraft flight controls consist of aileron, rudder and stabilator control surfaces. The control surfaces are manually operated using a control stick for the ailerons and stabilators and rudder pedals for the rudder. Longitudinal control is via a system of push-rods and is equipped with a trim tab. Aileron control is of mixed type with push-rods and cables; the cable control circuit is confined within the cabin and is connected to a pair of push-rods positioned in the wings that control ailerons differentially. Aileron trimming is carried out on ground through a small tab positioned on left aileron

Flaps are extended via an electric servo actuator controlled by a switch on the dashboard. Flaps act in continuous mode and position can be monitored through a display on dashboard. A breaker located on the right side of the instrument panel protects the electric circuit. Longitudinal trim is performed by a small tab

positioned on the stabilator and controlled via an electric servoactuator by pushing an Up/Down push-button on the control stick.

INSTRUMENT PANEL

The instrument panel is of conventional type, allowing space for a broad range of equipment. Instruments marked with an asterisk (*) are optional.

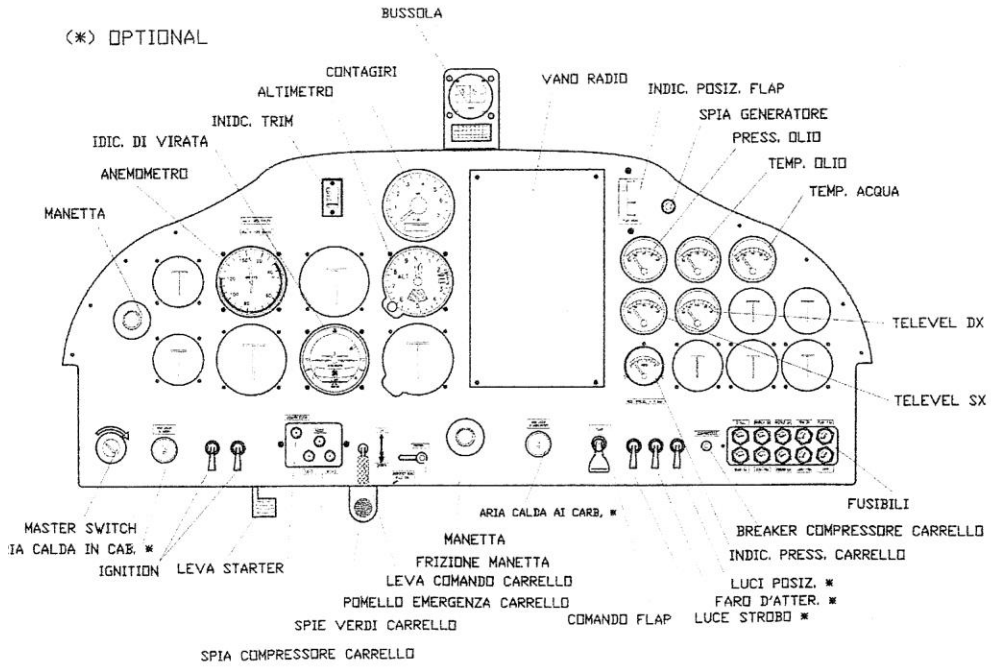


Fig. 7-1. INSTRUMENT PANEL

SEATS AND SAFETY HARNESS

Aircraft features three point fitting safety belts with waist and diagonal straps adjustable via a sliding metal buckle.
Seats are built with light alloy tube structure and synthetic material cushioning.
A lever located on the right lower side of each seat allows adjustment of seat position according to pilot size.

DOORS

Aircraft doors feature external and internal door handles with door lock provided externally on left side door. An internal safety latch mechanism is positioned in proximity of door's upper edge and must be used before flight to secure door. Mechanism rotates to engage doorframe to cabin tubular framework.

ENGINE

ROTAX 912ULS, 4 stroke, horizontally-opposed 4 cylinder, mixed air and water cooled, twin electronic ignition, forced lubrication
Maximum rating - 100 Hp (73.5 Kw) at 5800 g/min
Reduction gearbox - 2.4286:1
Propeller GT-ECHO 2/172/164

For further information refer to *"Engine Operating Manual"*.

FUEL SYSTEM

The system consists of two metallic fuel tanks that are integral part of the leading edge. Capacity is 35 liters each. Each tank is equipped with cabin installed shut-off taps and of a gascolator located on the firewall equipped with a drainage tap.
Fuel level can be monitored via gages mounted on instrument panel.

ELECTRICAL SYSTEM

The aircraft's electrical system consists of a 12 Volt DC circuit controlled by the Generator Switch located on the dashboard. Electricity is provided by an alternator and by a buffer battery placed in tailcone. Generator light is located on the right side of the instrument panel.

OIL AND CYLINDER HEADS TEMP. - OIL PRESSURE

These instruments are connected in series with their respective sensors. Temperature instruments are protected by the same breaker; oil pressure indicator and other instruments are protected by a second breaker.

Fig. 7-3. FUEL SYSTEM

FUEL LEVEL INDICATOR

Each gage is connected to its own sensors and consist of a floating potentiometer inserted within each fuel tank.

WARNING

Because of varying attitude of the aircraft in flight, instrument reading may differ from actual value present inside fuel tanks and therefore reading can only be considered indicative..

AIRSPEED INDICATOR SYSTEM

The aircraft's airspeed indicator system is shown below and consists of two static vents located on both sides of the aircraft forward of cabin and by a pitot tube located on left wing strut.

LANDING GEAR RETRACTION SYSTEM

Landing gear retraction system is electro-hydraulic. When the system's pressure falls below a given value (6●7 bar), an electro-pump located inside the engine compartment is automatically activated to re-pressurize the system. Pump operation activates also an orange light on dashboard. The compressor feeds pressurized air into two spherical reservoirs located behind the luggage compartment. The RH reservoir is for normal operation while the LH is for back-up and is activated through the use of an emergency lever located immediately below the instrument panel. Gear retraction is via three hydraulic pistons, one for each wheel, that through single point trailing arms insure proper locking. Three microswitches,one for each of the trailing arms, activate green lights for "*gear down and locked*" signal.

NOTE

During flight with gear retracted, compressor may activate to compensate for hydraulic leeks.

BRAKES

The aircraft's braking system is a single system acting on both wheels of main landing gear through disk brakes, the same circuit acts as parking brake via an interception valve.

To activate brakes it is sufficient to verify that brake shut-off valve positioned on tunnel between pilots is OFF, then activate brake lever as necessary.
To activate parking brake pull brake lever and set brake shut-valve to ON.

SECTION 8

GROUND HANDLING AND MAINTENANCE

TABLE OF CONTENTS

INTRODUCTION

This section contains factory-recommended procedures for proper ground handling and routine care and servicing. It also identifies certain inspection and maintenance requirements that must be followed if the aircraft is to retain its new-plane performance and dependability. It is sensible to follow a planned schedule of lubrication and preventive maintenance based on climatic and flying conditions encountered locally.

AIRPLANE INSPECTION PERIODS

Inspection intervals occur at 50, 100 hours and in accordance with special inspection schedules which are added to regularly scheduled inspections. Correct maintenance procedures are described in the aircraft's Service Manual or in the engine's Service Manual.

ALTERATIONS OR REPAIR

It is essential that responsible Airworthiness Authority be contacted prior to any alterations on the aircraft to ensure that airworthiness of the aircraft is not violated. For repairs, refer to aircraft's Service Manual.

GROUND HANDLING

HOISTING

The aircraft features three hoisting points correspondingly with each of the three landing gear legs. Hoisting the aircraft onto supports is easily accomplished. It is in fact sufficient that while one person lifts one half-wing by acting on the spar immediately before the wingtip, another person places a specific support below the fuselage underside. To facilitate the operation it is suggested to insert initially the forward support by lowering the tail portion of the aircraft. It is important to insure that the ground is sufficiently compact to sustain the load or to use wood panels to distribute the load.

TOWING

The aircraft is most easily and safely maneuvered by hand by pushing on wing struts near attachments or by pulling it by its propeller near the axle. A tow bar can be fixed onto nose gear fork. Aircraft may be steered by turning rudder or, for steep turns, by pushing lightly on tailcone to lift nose wheel.

PARKING AND TIE-DOWN

When parking airplane outdoors, head it into the wind and set the parking brake. If chocks or wedges are available it is preferable to use the latter.
In severe weather and high wind conditions it is wise to tie the airplane down. Tie-down ropes shall be fastened to the wing strut attachments and anchoring shall be provided by ramp tie-downs. Nose gear fork can be used for front tie-down location.
Flight controls shall be secured to avoid possible weathervaning to end travel damage of moving surfaces. For this purpose, seatbelts may be used to latch control stick to prevent its movement.

LEVELING

Aircraft leveling may become necessary to check wing incidence, dihedral or the exact location of CG. Leveling is obtained when cabin floor in proximity of the door is horizontal.

ROAD TRANSPORT

It is recommended to secure tightly all aircraft components onto the cart to avoid damage during transport. Minimum cart size is 7x2.5 meters. It is suggested to place wings under the aircraft's bottom, secured by specific clamps. Secondary components such as stabilators and struts shall be protected from accidental hits using plastic or other material. For correct rigging and derigging procedure, refer to Service Manual.

CLEANING AND CARE

To clean painted surfaces, use a mild detergent such as shampoo normally used for car finish; use a soft cloth for drying
The plastic windshield and windows should never be dusted when dry; use lukewarm soapy water and dry using chamois only. It is possible to use special glass detergents but, in any case, never use products such as gasoline, alcohol, acetone or other solvents.
To clean cabin interior, seats, upholstery and carpet, it is generally recommended to use foam-type detergents.