FLIGHT MANUAL

P92 ECHO SUPER

*Powered by ROTAX 912UL **80**Hp or ROTAX 912ULS **100**Hp.*

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

AIRCRAFT TYPE : ***P92 ECHO SUPER***

SERIAL NUMBER :.....

MANUFACTURING DATE :.....

WARNING

THIS MANUAL IS VALID FOR THE *P92 ECHO SUPER* WITH EITHER ROTAX 912 80 HP ENGINE OR ROTAX 912S 100 HP ENGINE.

FOR EVIDENT SAFETY REASONS AND UPON READING THIS MANUAL FOR THE FIRST TIME, IT IS NECESSARY TO UNDERLINE (PERHAPS ALSO HIGHLIGHT WITH A COLORED MARKER) ANY DIFFERENCES IN CHARTS AND TABLES AS APPLICABLE TO PERSONAL AIRCRAFT.

The Flight Manual must always be kept on board the aircraft. The aircraft described herein is to be operated in accordance with procedures and limitations described in this Flight Manual.

Rev. n°1, *14th April 2008*

RECORD OF REVISIONS

All revisions to the current Manual, except for actual weighing data, must be recorded in the following table.

New text or amendments to revised pages shall be clearly marked by a vertical black line on the left hand margin, with revision N° and date indicated on left side of page.

RECORD OF REVISIONS

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SECTION 1

GENERAL

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INTRODUCTION

The ***P92 ECHOSUPER*** is a twin seat single engine aircraft with a strut-braced rectangular high wing, fixed main landing gear and steerable nose wheel.

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 in addition to definitions and explanations of symbols, abbreviations and terminology commonly used.

WARNINGS - CAUTIONS - NOTES

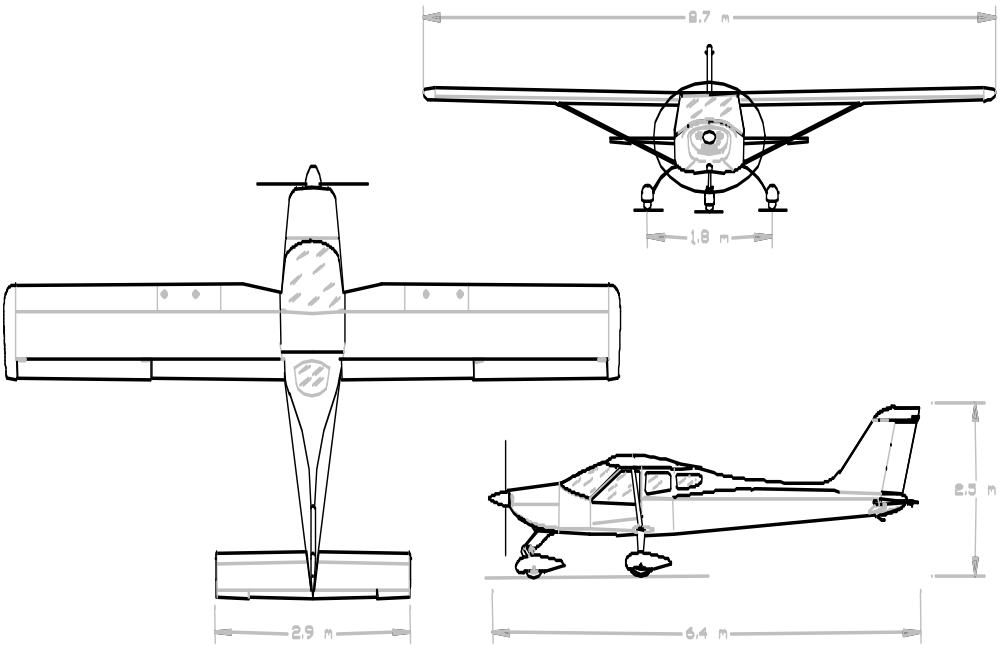
The following definitions apply to warnings, cautions and notes used in the Flight Manual.

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 to any special item not directly related to safety but which is important or unusual.

THREE VIEW DRAWING



- Dimensions shown refer to aircraft weight of 450 kg and normal operating tire pressure.
- Propeller clearance 360mm
- Propeller clearance with deflated front tire and compressed shock absorber 142mm
- Minimum ground steering radius 5.5m

DESCRIPTIVE DATA

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	6.4 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:	1.8 m
Wheel base:	1.6 m
Main gear tire. Air Trac	5.00-5
Wheel hub and brake Marc Ingegno	
Nose gear tire Sava	4.00-6

CONTROL SURFACES TRAVEL LIMITS

Ailerons	Up 20° down 15° ± 2°
Stabilator	Up 18° down 3° ± 1°
Trim-Tab	2° / 12° ± 1°
Rudder	RS 25° LS 25° ± 1°
Flaps	0° - 38° ± 1°

ENGINE

	P92 Echo Super *(80 Hp)*	***P92 Echo Super 100*** *(100 Hp)*
Manufacturer:	Bombardier-Rotax GmbH	Bombardier-Rotax GmbH
Model	912 UL	912 ULS
Engine type:	Four cylinder horizontally-opposed twins with overall displacement of 1211.2 c.c., mixed cooling, (water-cooled heads and air-cooled cylinders), twin carburetors, integrated reduction gear, (2.273:1) with torque damper. Compression ratio: 9.0:1.	Four 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 power:	81Hp (59.6 kW) at 5800 rpm - max 5 min..	100 Hp (73.5 kW) at 5800 rpm - max 5 min..

PROPELLER

	P92 Echo Super *(80 Hp)*	***P92 Echo Super 100*** *(100 Hp)*
Manufacturer:	F.lli Tonini Giancarlo & Felice S.n.c.	F.lli Tonini Giancarlo & Felice S.n.c.
Model:	GT-2/166/VSU-FW 101 SRTC	GT-2/173/VRR-FW 101 SRTC
Number of blades:	2	2
Diameter:	1660 mm	1730 mm
Type:	Fixed pitch - wood	Fixed pitch – wood

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FUEL

Fuel grade:	• High octane gasoline DIN 51600, O-NORM 1103 (red) • Unleaded gasoline DIN 51603, O-NORM 1101 • AVGAS 100LL
Fuel tanks:	2 wing tanks integrated within the wing's leading edge with drainage reservoir located in engine cowling
Capacity of each wing tank	45 liters
Total capacity	90 liters

OIL

Oil 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

COOLING

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

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WEIGHTS

Maximum takeoff:	450 kg
Standard empty weight	289 kg

SPECIFIC LOADINGS

	P92 Echo Super *(80 Hp)*	***P92 Echo Super 100*** *(100 Hp)*
Wing Loading	37.5 kg/m^2	37.5 kg/m^2
Power Loading	5.5 kg/hp	4.5 kg/hp

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ABBREVIATIONS AND TERMINOLOGY

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 on-board airspeed indicator.
TAS	True Airspeed: is calibrated airspeed 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

METEOROLOGICAL TERMINOLOGY

OAT	Outside Air Temperature is the free air static temperature expressed in degrees Celsius (°C).
T_S	Standard Temperature is 15°C at sea level pressure altitude and decreased by 2°C for each 1000 ft of altitude.
H_P	Pressure Altitude is the altitude read from an altimeter when the barometric subscale has been set to 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	is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated.
Usable fuel	is the fuel available for flight planning.
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 lift-off 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	is an imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Arm	is the horizontal distance from the reference datum to the center of gravity (C. G.) of an item.
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	is the weight of a standard airplane, including unusable fuel, full operating fuels and full engine oil.
Basic Empty Weight	is the standard empty weight plus the weight of optional equipment.
Useful Load	is the difference between takeoff weight and the basic empty weight.
Maximum Weight	is the maximum weight of the aircraft.
Maximum Takeoff Weight	is the maximum weight approved for the start of the takeoff run.
Maximum Landing Weight	is the maximum weight approved for the landing touch down.
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]	1.852	Kilometers / hour	[km/h]
Kilometers / hour	[km/h]	0.540	Knots	[kts]
PRESSURE				
Atmosphere	[atm]	14.7	Pounds / sq. in	[psi]
Pounds / sq. in	[psi]	0.068	Atmosphere	[atm]
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	[l]	0.2642	U.S. Gallons	[US Gal]
U.S. Gallons	[US Gal]	3.785	Liters	[l]
AREA				
Square meters	[m^2]	10.76	Square feet	[sq ft]
Square feet	[sq ft]	0.0929	Square meters	[m^2]

SECTION 2

LIMITATIONS

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INTRODUCTION

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

AIRSPEED LIMITATIONS

For all model

SPEED Km/h		IAS	REMARKS
V_{NE}	Never exceed speed	**260**	Never exceed this speed in any operation.
V_{NO}	Maximum Structural Cruising Speed	**200**	Never exceed this speed unless in smooth air, and then only with caution.
V_A	Maneuvering speed	**150**	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.

AIRSPEED INDICATOR MARKINGS

Airspeed indicator markings and their color code are explained in the following table valid for ***P92 Echo Super 80*** and ***P92 Echo Super 100***:

For all model

MARKING	IAS km/h	SIGNIFICANCE
White arc	**72 – 110**	Flap Operating Range (lower limit is $1.1V_{SO}$, at maximum weight and upper limit is maximum speed permissible with flaps extended at 38°)
Green arc	**110 – 200**	Normal Operating Range (lower limit is V_{FE} at maximum weight and upper limit is maximum structural speed V_{NO}).
Yellow arc	**200 – 260**	Operations must be conducted with caution and only in smooth air.
Red line	**260**	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 UL / *912 ULS***

MAXIMUM POWER:

	Max Power (HP)		Max RPM		Max time (minuti)	
	912UL	***912 ULS***	**912UL**	***912 ULS***	**912UL**	***912ULS***
Takeoff	**81**	***100***	**5800**	***5800***	**5**	***5***
Max continuous	**78**	***93***	**5500**	***5500***	**/**	**/**

TEMPERATURES:

	912UL	***912 ULS***
Coolant, monitored at cylinder heads	**150°C**	***135° C***
Maximum Oil:	**140°C**	***130° C***
Minimum Oil	**50°C**	***50° C***

OIL PRESSURE:

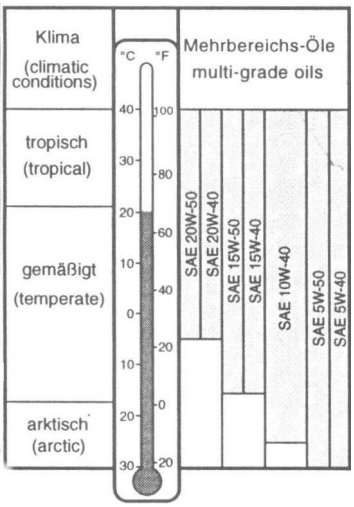
	912UL	***912 ULS***
Minimum	**0.8 bar**	***0.8 bar***
Maximum	**5 bar**	***5 bar***

CAUTION

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

VISCOSITY

Use viscosity grade oil as specified in the following table:



CAUTION

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

	P92 Echo Super (80 Hp)	P92 Echo Super (100 Hp)
MANUFACTURER:	F.lli Tonini Giancarlo & Felice	F.lli Tonini Giancarlo & Felice
MODEL:	GT-2/166/VSU-FW 101 SRTC	GT-2/173/VRR-FW 101 SRTC
PROP. TYPE:	Wood twin blade fixed pitch	Wood twin blade fixed pitch
DIAMETER:	1660 mm	1730 mm

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POWERPLANT INSTRUMENT MARKINGS

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

P92 ECHO SUPER (80 Hp)

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	90-110	50 - 90 110-140	140
Cylinder heads and coolant temp.	°C	--------	0 - 150	------	150
Oil pressure	bar	0.8	0.8 - 5	5 - 7	7
Fuel gage	li-ters	------	------	------	------

P92 ECHO SUPER (100 Hp)

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	90-110	50 - 90 110-130	130
Cylinder heads and coolant temp.	°C	--------	0 - 135	------	135
Oil pressure	bar	0.8	0.8 - 5	5 - 7	7
Fuel gage	li-ters	------	------	------	------

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	------	------

WEIGHT LIMITS

Maximum takeoff weight: 450 kg

CENTER OF GRAVITY LIMITS

Forward limit	20% MAC
Aft limit	33% MAC
Datum	Propeller support flange w/o spacer
Bubble Level	Cabin floor

It is the pilot's responsibility to insure that airplane is properly loaded.

APPROVED MANEUVERS

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.

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FUEL

TWO TANKS: 45 liters each

TOTAL FUEL CAPACITY: 90 liters

APPROVED FUEL

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

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SECTION 3

EMERGENCY PROCEDURES

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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 presented in this 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 FAILURE

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

ENGINE FAILURE DURING TAKEOFF RUN

1. Throttle: *idle* (fully out)
2. Brakes: *apply as needed*
3. Magnetos: *OFF*
4. Flaps: *extend*
5. 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. Master switch: *OFF*
7. Land with wings level

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. Fuel pump: *OFF*
5. Magnetos: *OFF*
6. Tighten safety belts, release door safety lock and unlatch doors
7. Flaps: *as needed*
8. When ready to land, Master switch: *OFF*

POWER-ON FORCED LANDING

1. Adjust descent slope
2. Extend flaps as needed
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. Before touchdown: fuel shutoff valves *OFF*
6. Flaps: *extended*
7. After touchdown: Magnetos: *OFF*, Master switch: *OFF*, Fuel pump: *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. Fuel pump: *OFF*
5. Magnetos: *OFF*
6. Warn bystanders to clear the area as fast as possible
7. 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 COMPARTMENT FIRE IN FLIGHT

1. Fuel shutoff valves: *OFF*
2. Throttle: *fully inward*
3. Magnetos: *OFF*
4. Do not try airstarting engine
5. Extend flaps as needed
6. Carry out forced landing emergency procedure
7. Master switch *OFF*

CABIN FIRE DURING FLIGHT

1. Magnetos: *OFF*
2. Door vents: *open*
3. Extinguish fire with on-board fire extinguisher (if available) directing spray towards flame base
4. Land as soon as possible

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

SECTION 4

NORMAL PROCEDURES

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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. 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.

PREFLIGHT INSPECTION

Before each flight, it is necessary to carry out a complete inspection of the aircraft 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 *Master switch*: ON

F Check generator switch is illuminated and ammeter is operational.

G *Flaps control*: activate control to full extension checking end travel and instrument indication.

H *Trim control*: activate control to full scale checking end travel and instrument indication

I *Master switch*: OFF

J *Fuel level*: check level on the basis of 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 Left side tank cap: Check proper fastening. Left fuel tank blow-out plug: check for obstructions

B Pitot tube: check pitot is unobstructed, do not blow inside vents (read note)

C Remove protection cap and check pitot on left side wing 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.

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 (1.0 bar) and condition; check condition of rubber shock absorbers.

S Propeller and spinner condition: check for nicks and fastening.

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 honeycomb cooling fins are unobstructed.

III. Check lubrication circuit for losses from tubing, check oil reservoir level, insure radiator honeycomb cooling 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.

WARNING !

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

V. Check integrity of silent-blocks.

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

VII. Check that all parts are secure or safetied.

U Close engine cowling.

V -

Z Remove tow bar and chocks

NOTE

Avoid blowing inside left strut mounted pitot as this may damage instruments.

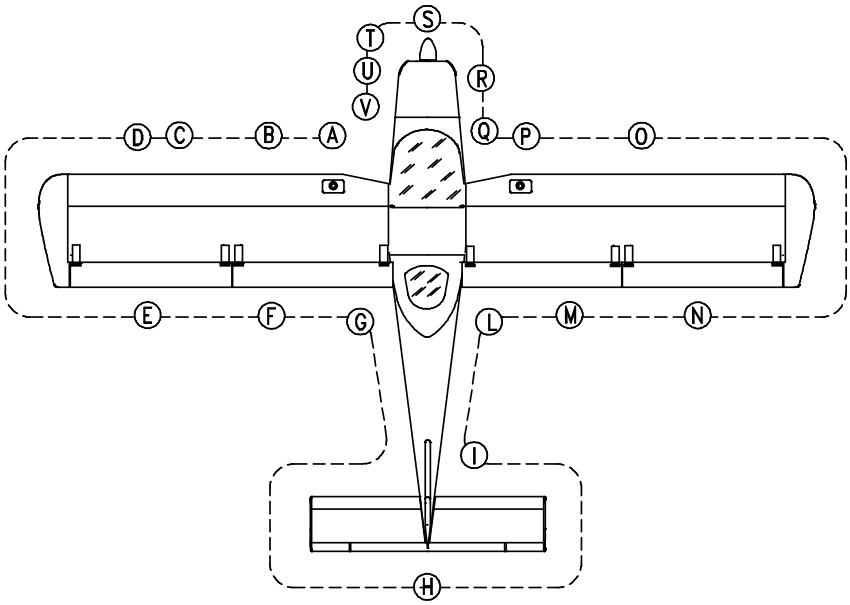

FIG. 4-1

CHECKLISTS

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.

STARTING ENGINE

I. Master switch ON.
II. Both fuel taps ON.
III. Engine throttle to idle.
IV. Choke as needed.
V. Magnetos switch to ON.
VI. Prop area: free
VII. Ignition key set to: START.
VIII. Fuel pump: ON
IX. Prop RPM: 2400 - 2600 RPM
X. Choke OFF
XI. Check engine instruments
XII. 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 equipment)

III. Check engine parameters.

	912UL	912 ULS
Oil temperature	50°- 110°	50° - 100°
Cylinder heads temperature	150°	135°
Oil pressure	0.8 - 7	0.8 - 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. Flaps at 15° (takeoff)

VIII. Stick free and zero trim

IX. Seat belts fastened and doors secured.

TAKEOFF AND CLIMB

I. Control Tower for takeoff

II. Check for clear final and wind on runway.

III. Parking brake OFF, full throttle.

IV. Carburetor heat: OFF

V. Taxi to line-up

VI. Rotation and takeoff

VII. Slight braking to stop wheel spinning.

VIII. Flaps retracted

IX. Landing light OFF.

X. Trim adjustment

XI. Establish climb rate

XII. Fuel pump: OFF

CRUISE

I. Reach cruising altitude

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

III. Check engine parameters

	912UL	912 ULS
Oil temperature	90°- 110°	90° - 100°
Temperature cylinder heads	90°- 150	90° - 135°
Oil pressure	0.8 - 5	0.8 - 5

IV. Carburetor heat as needed, see paragraph on carb heat in Section 3.

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 installed)

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

III. Extend flaps gradually to maximum deflection of 38°.

IV. Optimal touchdown speed 70 Km/h

V. Land and taxi.

VI. Flaps to 0°.

VII. Parking brake ON.

VIII. 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 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 *2*
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STALL SPEEDS *3*
CROSSWIND *4*
TAKEOFF PERFORMANCE *5*
LANDING *6*
CLIMB PERFORMANCE *7*
CRUISE *8*
CONSEQUENCES FROM RAIN AND INSECT *8*

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
- average 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 CALIBRATION

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

STALL SPEEDS

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

	LATERAL BANKING			
	0°	*30°*	*45°*	*60°*
FLAPS	IAS Km/h	IAS Km/h	IAS Km/h	IAS Km/h
0°	**74**	**78**	**84**	**101**
15°	**69**	**76**	**79**	**97**
38°	**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

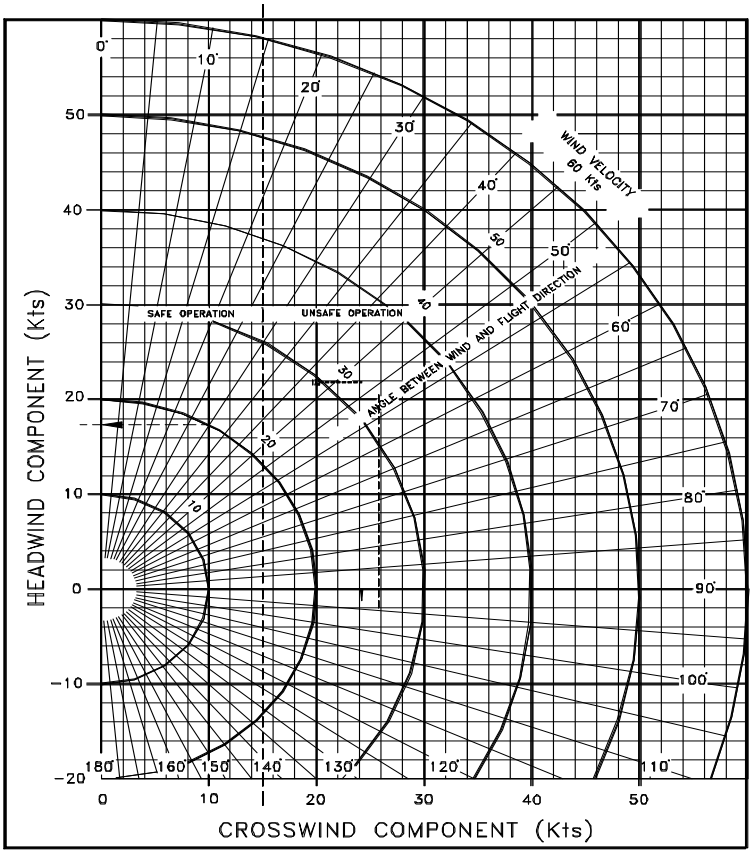

Fig. 5-1 CROSSWIND CHART

TAKEOFF PERFORMANCE

TAKEOFF DISTANCE

CONDITIONS:

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

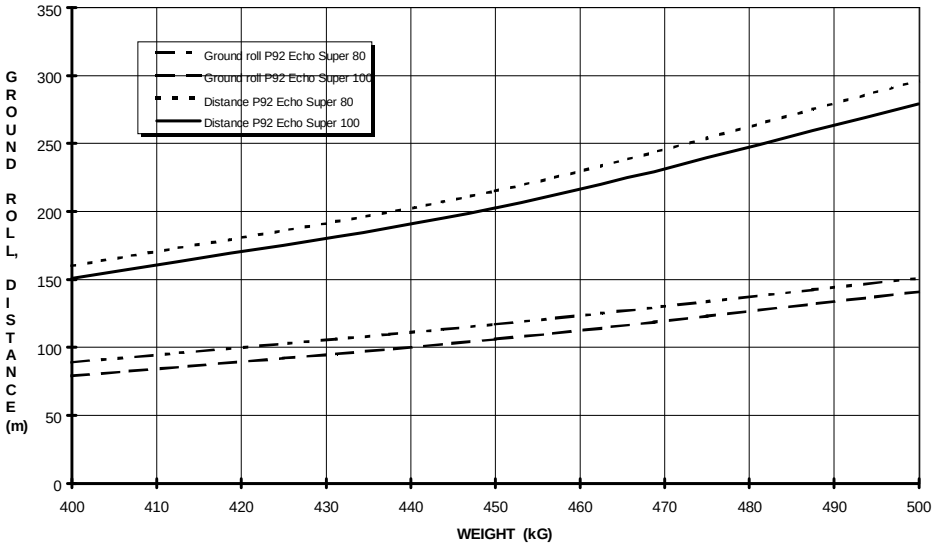

Fig. 5-2 TAKEOFF

LANDING

CONDITIONS:

Flaps: 38° Runway: dry, compact, grass

Engine: throttle idle Slope: 0° Wind: zero

Distance over a 15 m obstacle

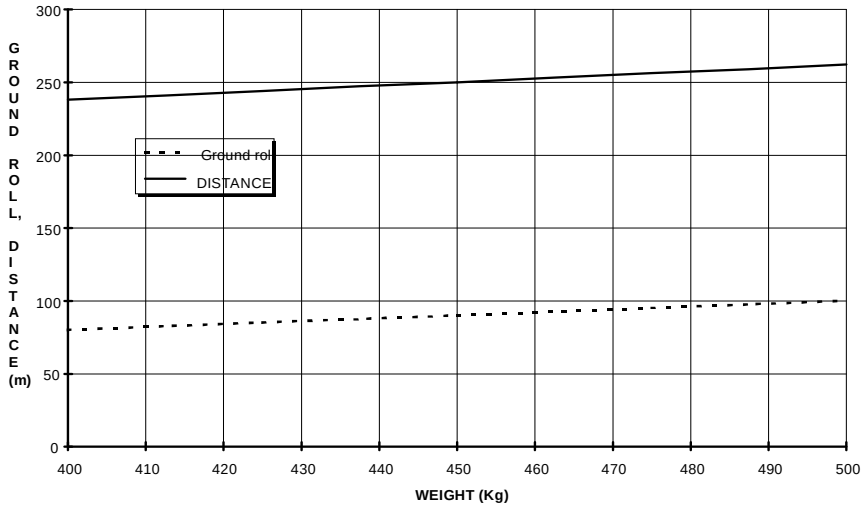

Fig. 5-3 LANDING

CLIMB PERFORMANCE

CLIMB RATE IN CLEAN CONFIGURATION

CONDITIONS:

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

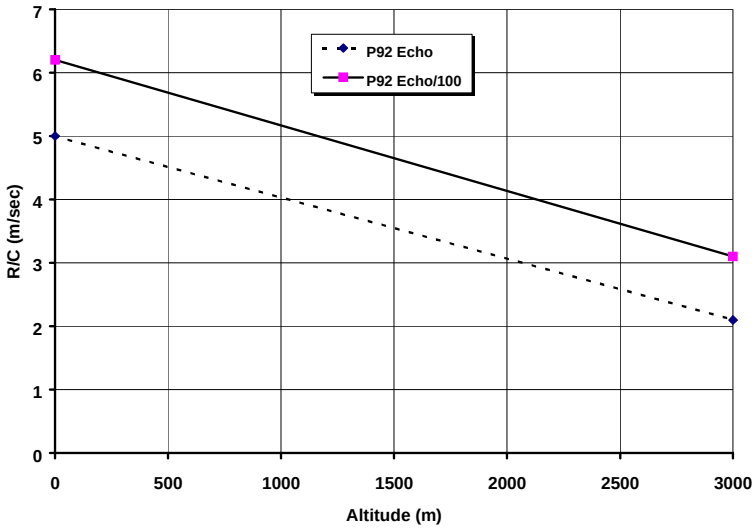

Fig. 5-4 CLIMB RATE

P92 Echo Super (80 Hp) ➔ V_Y = **120** Km/h

P92 Echo Super (100 Hp) ➔ V_Y = **120** Km/h

CRUISE

CONDITIONS:

- ISA
- Altitude: 0
- Wind: 0

P92 Echo Super (80 Hp)

RPM	CAS km/h	Hourly consumption [lt/h]
4300	160	13
4800	175	14
5000	185	16

P92 Echo Super (100 Hp)

RPM	CAS km/h	Hourly consumption [lt/h]
4300	170	14
4800	185	18
5000	200	20

CONSEQUENCES FROM RAIN AND INSECT

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

SECTION 6

WEIGHT & BALANCE

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INTRODUCTION *2*

AIRCRAFT WEIGHING PROCEDURES *2*

WEIGHING REPORT *3*

C. G. TRAVEL *4*

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 using draining reservoir
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 cabin floor as datum
b. Center bubble on level by deflating nose tire

WEIGHING

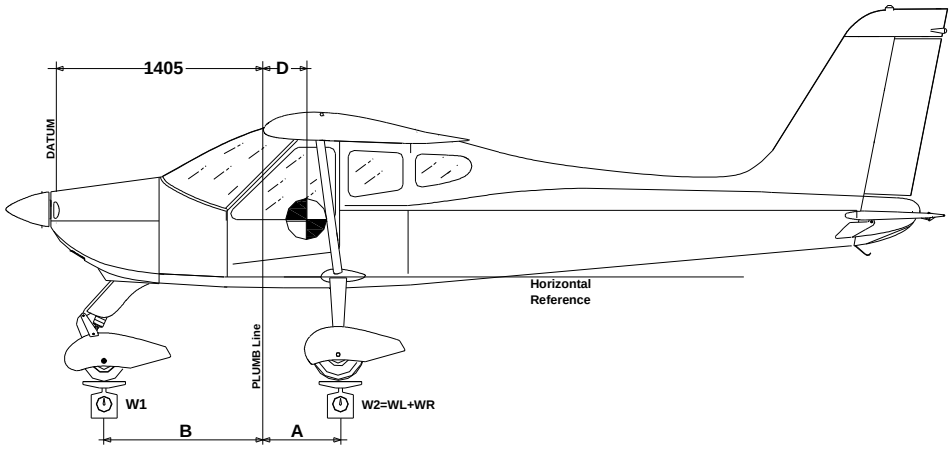
a. Record weight shown on each scale
b. Repeat weighing procedure three times
c. Calculate empty weight

DETERMINATION OF C.G. LOCATION

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. Repeat operation for other half-wing.
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 SUPER*** *s/n*:____ *Weighing n°*____ *Date*:_____



Datum: Propeller support flange without spacer

	Kg
Nose wheel weight	W_1 =
LS wheel weight	W_L =
RS wheel weight	W_R =
$W_2 = W_L + W_R$ =	

	meters
Plumb bob distance from LS wheel	A_L =
Plumb bob distance from RS wheel	A_R =
Average distance $(A_L + A_R)/2$	A =
Bob distance from nose wheel.	B =

Empty weight We = $W_1 + W_2$ =

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

Empty weight moment: M = [(D+1.425)·We] = *Kg · m*

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

C. G. TRAVEL

Maximum admissible C.G. travel exceeds actual operational limits. Moreover, occupants and fuel impact only marginally on CG travel.

When on flat terrain, exceeding CG travel aft limit will cause aircraft tail to lower.

SECTION 7

AIRPLANE AND SYSTEM DESCRIPTIONS

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AIRFRAME *2*
FLIGHT CONTROLS *2*
INSTRUMENT PANEL *3*
SEATS AND SAFETY HARNESS *4*
DOORS *4*
BAGGAGE COMPARTMENT *5*
ENGINE *5*
FUEL SYSTEM *5*
ELECTRICAL SYSTEM *6*
AIRSPEED INDICATOR SYSTEM *6*
BRAKES *6*

INTRODUCTION

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

AIRFRAME

WING

The wing is made up of a central light alloy torque box; a composite leading edge is attached to the front spar and geometrically similar flap and aileron are hinged to rear. 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 semi-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 spar connected to ribs and leading edge; the entire structure is covered with aluminium material.

FLIGHT CONTROLS

The control surfaces are manually operated using a control stick for ailerons and stabilator and rudder pedals for the rudder; longitudinal control acts through 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, an mechanical indicator shows surface position. The electric circuit is protected by a breaker positioned on the right side of the dashboard.
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 located on the control stick or on the dashboard.

INSTRUMENT PANEL

The instrument panel is of conventional type, allowing space for a broad range of equipment.

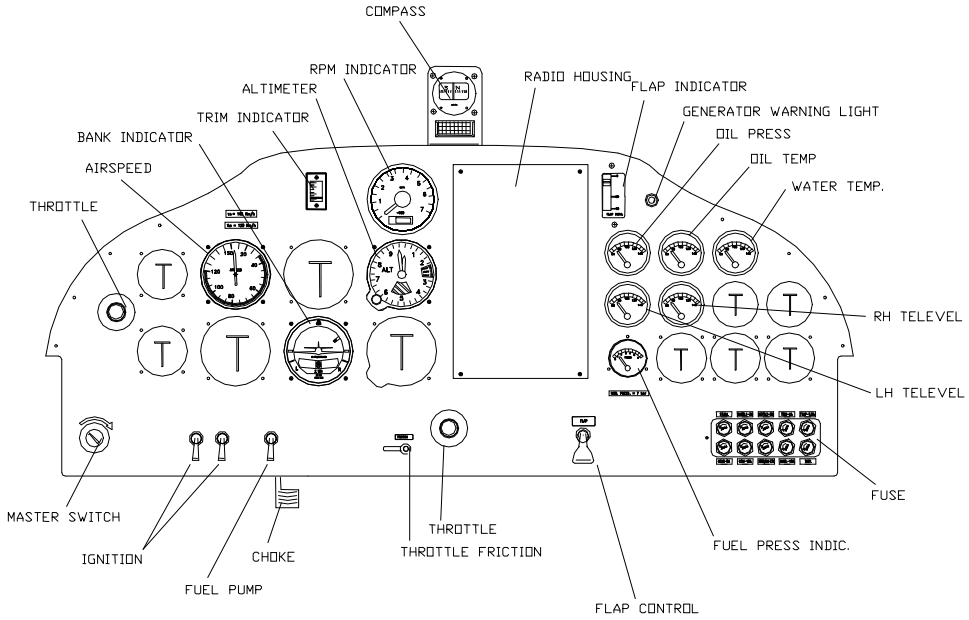

Fig. 7-1. INSTRUMENT PANEL

THROTTLE FRICTION LOCK

It is possible to adjust the engine's throttle friction by tightening appropriately the friction lock located on the dashboard near center throttle control.

SEATS AND SAFETY HARNESS

Aircraft features three point fitting safety belts with waist and diagonal straps adjustable via a sliding metal buckle.
Standard seats are fiberglass with easily removable cushions. Seats may be adjusted on ground by operating on the latch mechanism located below seating cushion.

DOORS

Standard doors feature a light alloy tubular frame supporting a transparent or tinted panel. 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, before flight, to engage door frame to cabin tubular framework.

BAGGAGE COMPARTMENT

The baggage compartment is located behind the pilots' seats. Baggage shall be uniformly distributed on utility shelf.

ENGINE

- ***P92 Echo Super (80 Hp)***

ROTAX 912UL, 4 stroke, horizontally-opposed 4 cylinder, mixed air and water cooled, twin electronic ignition, forced lubrication
Maximum rating - 81Hp (59.6 kW) at 5800 RPM
Reduction gearbox - 2.273:1
Prop. GT-2/166/VSU-FW 101 SRTC

- ***P92 Echo Super (100 Hp)***

ROTAX 912S, 4 stroke, horizontally-opposed 4 cylinder, mixed air and water cooled, twin electronic ignition, forced lubrication
Maximum rating - 100 Hp (73.5 kW) a 5800 RPM
Reduction gearbox - 2.4286:1
Prop. GT-2/173/VRR-FW 101 SRTC

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

FUEL SYSTEM

The system consists of two composite material fuel tanks that are integral part of the leading edge featuring a viewport to visually monitor fuel level of each tank. Capacity is 45 liters each. Each tank is equipped with cabin installed shut-off valve and of a main filter located on the firewall and equipped with a drainage valve.
Fuel level is detected via a calibrated scale located on fuel tank walls visible from cabin. The fuel system also features a mechanical pump operated by the engine and an emergency electric pump that allows, in case of main pump failure, engine's alimentation.

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ELECTRICAL SYSTEM

The aircraft's electrical system consists of a 12 Volt DC circuit controlled by a Master switch located on 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 a second breaker protects other instruments.

FUEL LEVEL GAUGE

Each fuel level gauge is connected with their respective floating located in each fuel tank.

WARNING !

Because aircraft's change of trim the value indicated from the instruments can differ from the effective contained fuel amount in the tanks therefore the indication is from considering itself only qualitative.

AIRSPEED INDICATOR SYSTEM

The aircraft's airspeed indicator system consists of a static vents and by a pitot tube located on left wing strut of the aircraft

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 intercept 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 SERVICE

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AIRPLANE INSPECTION PERIODS *2*

AIRPLANE REPAIR OR MODIFICATIONS *2*

GROUND HANDLING *2*

CLEANING AND CARE *5*

INTRODUCTION

This section contains factory-recommended procedures for proper ground handling and routine care and servicing. It also identifies certain inspection and maintenance requirements which must be followed if the aircraft is to retain its new-plane performance and dependability. It is wise 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.

AIRPLANE REPAIR OR MODIFICATIONS

Important that airworthiness dispatcher authority is contacted before every modify on the aircraft in way of assure that airworthiness wasn't compromise. Aircraft repair are described in the aircraft's Service Manual.

GROUND HANDLING

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 into 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.

JACKING

Given the light empty weight, lifting one of the main wheels can easily be accomplished even without the use of hydraulic jacks. 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 suitable stand below the steel spring attachment.

LEVELING

Aircraft leveling may become necessary to check wing incidence, dihedral or the exact location of CG. Leveling is obtained when the lower cabin edge and the main gear support beam are horizontal.

ROAD TRANSPORT

It is recommended to secure tightly all aircraft components onto the cart to avoid damage during transport. Minimum cart size are 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.

GROUND ANCHORAGE (OPTIONAL)

The airplane should be moored for immovability, security and protection. FAA Advisory Circular AC 20-35C, Tiedown Sense, contains additional information regarding preparation for severe weather, tiedown, and related information. The following procedures should be used for the proper mooring of the airplane:

1. Head the airplane into the wind if possible.
2. Retract the flaps.
3. Chock the wheels.
4. Lock the control stick using safety belts.
5. Secure tie-down ropes to the wing tie-down rings and to the tail ring at approximately 45-degree angles to the ground, in longitudinal direction (see Fig.8-1).

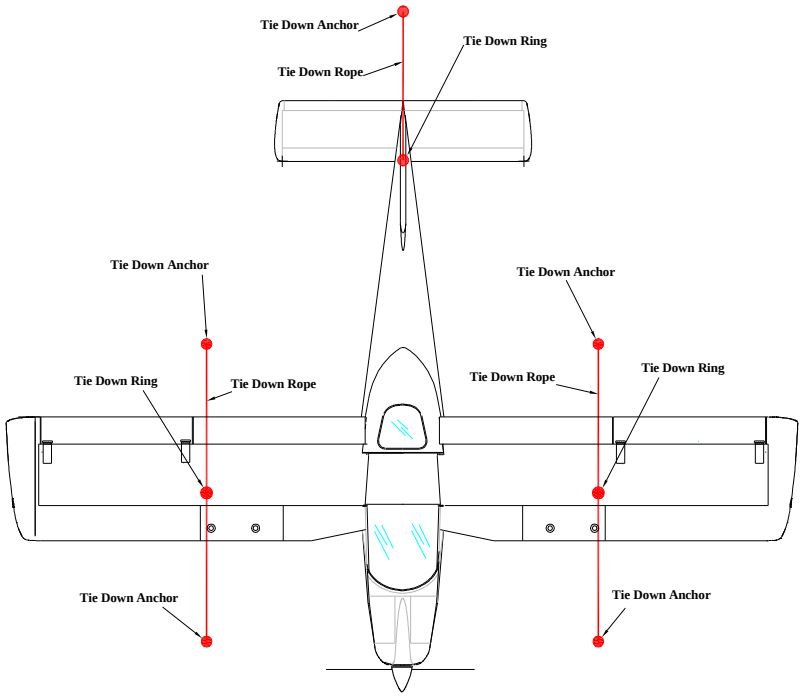

Fig. 8-1. CABLE POSITIONING

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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 luke-warm 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 soap-dry.

SECTION 9

SUPPLEMENTS

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1.3 NORMAL PROCEDURES....4
1.4 PERFORMANCE....6
1.5 SYSTEMS....7

SUPPLEMENT N° 1

GLIDER TOWING

1 INTRODUCTION

This section contains supplementary information for a safe and efficient operation of the aircraft if equipped with a hook for towing gliders.

1.1 GENERAL

PROPELLER

For higher glider-towing performances, the standard propeller should be changed for another one specifically designed for towing operations:

Manufacturer:	F.lli Tonini Giancarlo & Felice S.n.c.
Model:	GT - 2/182/VTZ – FW 101 SRTC
Number of blades:	2
Diameter:	1820 mm
Pitch:	1300 mm
Type:	Fixed pitch – wood

1.2 LIMITATIONS

This section includes operating limitations for safe sailplane-towing operations.

AEROTOWED SAILPLANES

Not more than one sailplane may be towed at a time, multiple sailplanes towing is forbidden.

WEIGHTS

P92 Echo Super MTOW, if used as an aerotow, is **480 kg.**
The maximum allowed glider's weight is **650kg.**

AIRSPEED

The towing airspeed must lie within **53** and **60** KIAS.

WARNING

In towing operations, any kind of information/limitations specified into the glider's manuals must be considered as of primary importance and followed.

APPROVED MANEOUVRES

The P92 Echo Super, while towing a glider, is cleared to do only the manoeuvres pertinent to a normal towing flight.

1.3 NORMAL PROCEDURES

In addition to what has been specified in Section 4, before each flight it is necessary to carry out the extra inspections listed below.

CABIN INSPECTION

- Weight and airfield altitude: check for compatibility with the Section 9.2 Limitations.
- Release lever: check.

EXTERNAL INSPECTION

- Adjust the rear view mirror and check for a proper fastening
- Release hook: check functionality.

BEFORE TAKE-OFF

- Set the sailplane behind the a/c so as to straighten the towing rope.
- Check the sailplane and its link to the aeroplane to insure that the connection has properly done and in compliance with the manufacturer instructions.

TAKE OFF AND CLIMB

Follow a normal take-off procedure (as described in Section 4 of the present manual) using a special care in the take-off early stages avoiding any jerk to the rope.

- Check the aerotowed's position through the rear view mirror.
- While running on the runway, let the towed sailplane to lift-off as first and then lift-off the aerotow.

CRUISE

- Check the aerotowed's position through the rear view mirror.

SAILPLANE RELEASE

- Check the aerotowed attitude through the mirror.
- From the straight level flight, let the sailplane to release from the towing rope.

TOW-ROPE DROP BEFORE LANDING

To drop the tow rope on the runway, follow this procedure:

- Set a glide to release the tow rope on the runway at a height, above ground level, not more than 100 ft.
- Pull the release lever.
- Proceed with a normal landing and check that the rope has been removed from the runway.

WARNING

If you are landing with the tow-rope linked to the a/c, please remember that it hangs behind and below the tail. Therefore set a landing glide so as to take into account a safety margin with respect to any obstacle present on the ground and that could be intercepted by the rope.

1.4 PERFORMANCE

NOTE

Into this paragraph have been reported some of the data collected during the early stages of the "Sailplane towing flight test session".

TAKE-OFF PERFORMANCES

CONDITIONS:

- Flap: 15°
- a/c take-off weight **480** kg
- Sailplane's max weight: **650** kg
- Engine throttle: Full
- Runway: dry, compact grass runway
- Runway slope: 0°
- Wind: zero
- ISA conditions

Average Ground roll: 350m

RATE OF CLIMB

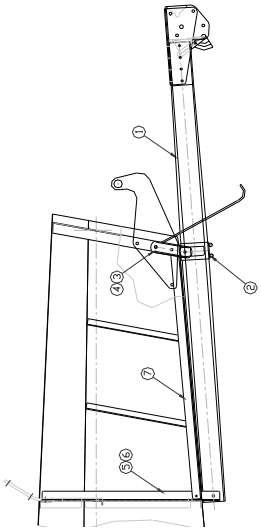
CONDITIONS:

- Flap: 0°
- Engine throttle: Full
- V_Y = **53** KIAS
- OAT ≤ 35°
- Sailplane's weight: **650** kg
- Aerotow's take-off weight: **480** kg

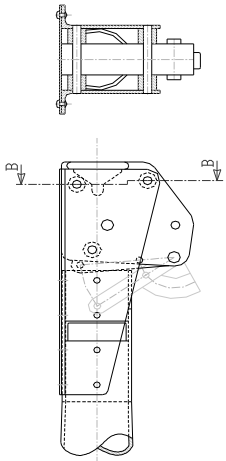
The rate of climb is ≥ 2 m/s.

1.5 SYSTEMS

The P92 Echo Super for towing gliders is equipped with a hook located in the rear part of the fuselage. This hook is supported by a tubular beam [1] that transfers the towing loads to the tail cone structure. The forward part of the beam is connected to the bulkhead #4 by means of two vertical stringers [5-6] and two longitudinal stringers [7] (not present in the P92 Echo Super, standard configuration). The rear link to the bulkhead #5 is realised by a steel support [2] connected by means of two steel ties [4-3] to the stabilator's fitting plates.
The hook is a TOST E85 and is connected to the aluminium tubular beam by means of aluminium plates.

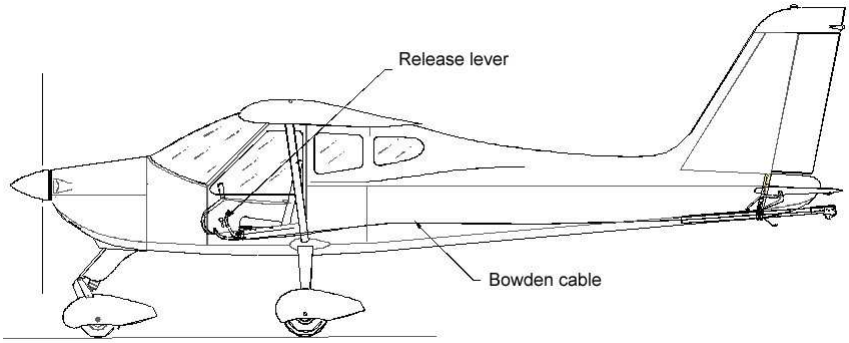


Supporting beam assembly

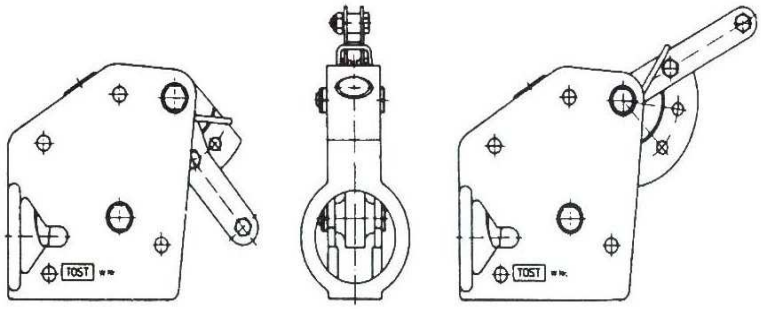


Hook connection

The towing rope is released by the Hook simply operating the release lever located in cabin between the two seats.



The towing hook is a TOST E85 approved type (Type Certificate No. 30.230/1)



Hook TOST E85

For further information, please refer to the hook's "Operating Manual for tow releases"
On the left door, a rear view mirror is positioned to let the pilot to see the glider during towing.