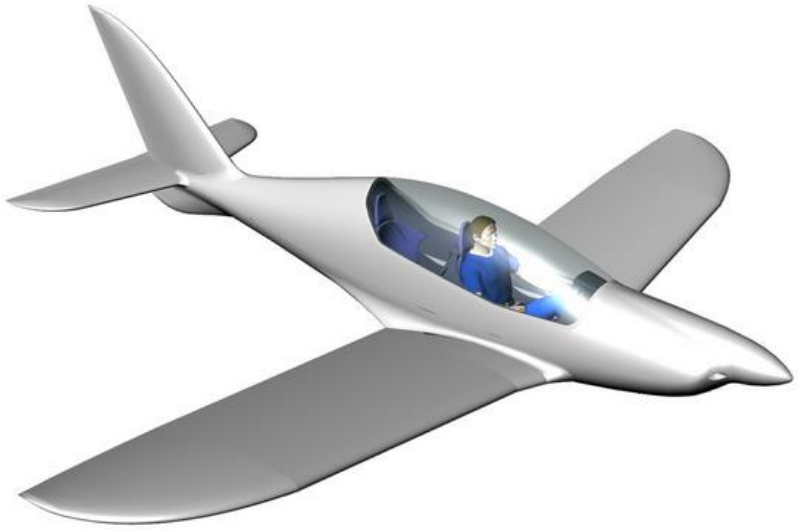
MAINTENANCE MANUAL



Airplane Type / Version:	SHARK UL/600 – all versions
Serial Number:	
Registration:	
Document Number:	Shark600_MA_097
Revision:	**E**
Date of Issue:	28.03.2024
Approval Number and Date:	
Manufacturer: **SHARK UL, 600, 600 F**	**SHARK.AERO s.r.o.**, Senica Airport, Hlboké 406 906 31 Hlboké, Slovak Republic +421 903 655977 shark@shark.aero
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0 Foreword

0.1 Record of Revisions

Revision - No.	Number of the document - bulletin	It concerns pages No.	Date of issue	Signature
IR	-	New document		
A	-	Added UL version data into chapters 1.7, 1.11, 2.14, 3.13 Formatting and headers changes of all chapters	30.05.2022	
B	-	Revision and Issue date added to title page. Added chapters valid Revisions to 0.2. Modified chapters 3.2, 3.3, 3.4, 3.5 Added chapter 3.10, following chapters renumbered	20.9.2022	
C	-	Modified chapter 2.9	21.02.2023	
		Added chapter 4.3.11. Adjusted numbering of following chapters correspondingly.		
D	-	Modified Sec.2 – added Garmin avionic, updated placards Modified Sec.3 – added chapter 3.11. Adjusted numbering of following chapters correspondingly.	25.04.2023	
E	-	Sec.1 - 1.2 Added BCAR CAP482, 1.4 Three View Drawing updated, 1.11 UK model added, 1.13 updated Sec.2 – Fig. 2-14 updated, 2.5 added chapter about battery, updated electric scheme, 2.10 Updated parachute info, 2.14 Placards for UK model updated	28.03.2024	

		Sec.3 – 3.13 Antitiab deflections updated Sec.4 – Task 3.4.2. Added ballancing of the battery, 4.3.16 updated Sec.6 - Cancelled		

NOTE

It is the responsibility of the owner to keep this manual up to date. Check www.shark.aero for the latest updates.

0.2 Table of contents

Section	Content	Valid Revision
0	Foreword	E
1	General	B
2	Airplane description	D
3	Operations	D
4	Maintenance	C
5	Winter operation and care	A

TABLE OF CONTENTS

1 General

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1.1 Introduction

This maintenance manual is provided with your airplane to allow you to obtain as much knowledge as possible for maintenance of SHARK and its variants. Additionally, this section contains definitions or explanations of symbols, abbreviations, and terminology used in this manual.

Read this manual before your first flight and make sure you understand all the information presented here. This manual does not replace a professional aircraft mechanic!

1.2 Certification Bases

The following standards were used for approval and testing:

UL 2	Czech Republic requirements of LAA
LTF UL	German requirements for ultralight airplanes
ASTM	Standard Requirements for Light Sport Aircraft (LSA) valid in US and used as a background for European light airplane standards
ULM	French requirements for ultralight airplanes
CAP 482	British Civil Airworthiness Requirements, Section S Issue 8, Microlight and Small Light Aeroplanes

Figure 1-1 SHARK

1.3 Warnings, Cautions and Notes

The following definitions apply to Warnings, Cautions and Notes are used in this manual:

WARNING

THE NON-OBSERVATION OF THE CORRESPONDING PROCEDURE CAN LEAD, AS IMMEDIATE EFFECT, TO A SIGNIFICANT REDUCTION OF FLIGHT SAFETY.

CAUTION

The non-observation of the corresponding procedure can lead to equipment damage which leads to reduction of the flight safety in a short or longer time interval.

NOTE

Information not directly related to the safety of the flight.

1.4 Three View Drawing

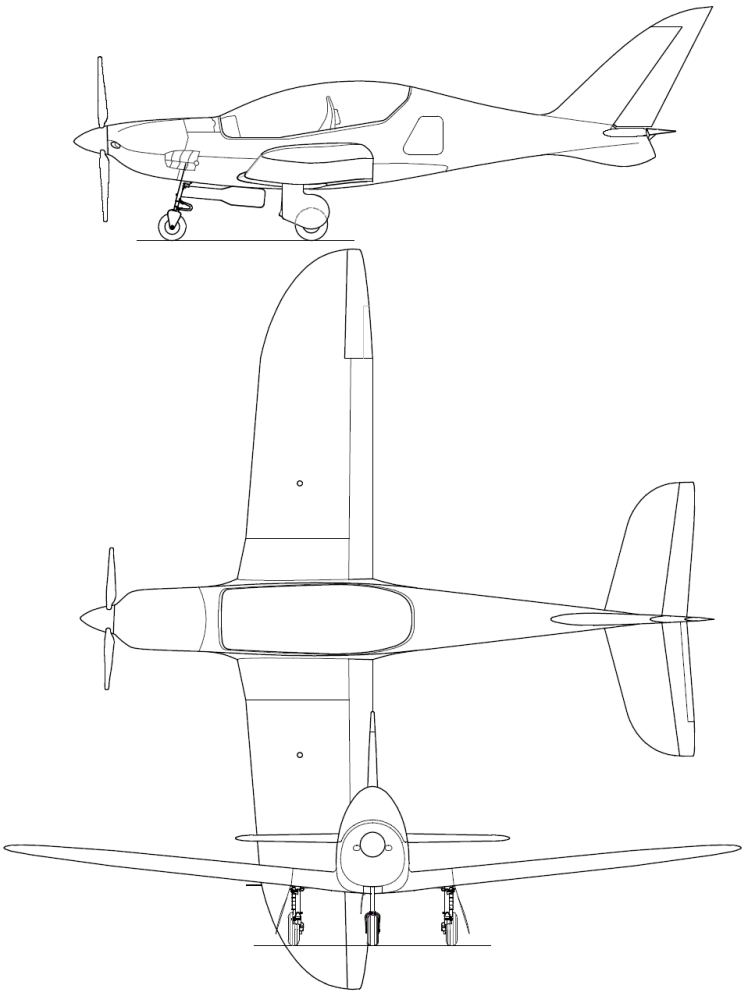

Figure 1-2 Three View Drawing

1.5 Dimensions

Heading - non numbered

Overall Dimensions

Wing Span:..... 7.9 m

Length:..... 6.85 m

Height: ..... 2.5 m

Wings

Airfoil: ..... JS20 – JS80

Wing Area:..... 9.5 m

Mean Aerodynamic Chord (MAC): ..... 1.237 m

Aspect Ratio:..... 6.671

Dihedral: ..... 6°

Sweep of Leading Edge:..... 3.53° / 13.8° / 39.8°

Aileron

Area: ..... 0.281 m^2 each aileron

Flaps

Area: ..... 0.922 m^2 each flap

Horizontal Stabilizer

Area: ..... 2.154 m^2

Elevator Area: ..... 0.662 m^2

Angle of Incidence: ..... -1.5°

Vertical Stabilizer

Area: ..... 1.062 m^2

Rudder Area:..... 0.335 m^2

Landing Gear

Track: ..... 1.694 m

Wheel Base:..... 1.48 m

1.6 Engine

Rotax 912 ULS Engine, 4 Cylinder, 4-Stroke, Horizontally Opposed, Liquid Cooled Cylinder Heads, Air Cooled Cylinders.

Propeller is driven via an integrated Reduction Gear.

Reduction Ratio: 2.43 : 1

Displacement; 1.352 liters

Output Power:73.5 kW / 100hp @ 5800 rpm

1.7 Propeller

Two-bladed Variable Pitch Propeller, manufactured by Woodcomp, Neuform and E-prop:

- In flight electrically Adjustable (Woodcomp SR 3000 2WN)
- In flight hydraulically Adjustable (Woodcomp KW20W)
- In flight electrically Adjustable (Neuform TXR2-V-70)
- In flight electro-hydraulically Adjustable (E-prop Glorieuse) – version 600F

1.8 Fuel

Approved fuel grades are:

- MOGAS EN 228 Super/Super plus (minimum 95 octane).
- MOGAS ASTM D4814.
- AVGAS 100LL (ASTM D910) *see restrictions in 2.12.

Total Capacity:

- 100 liters or optional 150 liters, both configurations 1 liter unusable.

Please refer to Rotax service instruction for more info

1.9 Lubricant and oil

Lubrication system is “forced type” with an external reservoir.

Type:

- for MOGAS: API SL
- for AVGAS / 100L: API SL

Oil capacity:

- 3 liter maximum
- 2 liter minimum

Please refer to Rotax service instruction for more info

1.10 Cooling

The Cooling System consist of a combination of forced air and a pressurized closed liquid system.

Type:

- BASF Glysantin Protect Plus/G48 50% / water 50%

Capacity:

- Minimum: 2.4 Liter
- Maximum: 2.5 Liter

1.11 Weights

Type / Model / Version	UL	600, 600 UK	600F
Minimal Empty Weight, standard version	295 kg	324 kg	
Typical Empty Weight, fully equipped version	325 kg	350 kg	
Maximal Empty Weight	330 kg	374 kg	337 kg
Max Take Off Weight, *(including Parachute rescue system)*	472,5 kg	600 kg	525 kg
Minimum Weight of Crew *(one Pilot, front seat)*	55 kg	55 kg	55 kg
Maximum Weight One Pilot *(front seat, empty rear seat)*	110 kg	110 kg	110 kg
Maximum Weight in Rear Seat	95 kg	110 kg	**
Maximum Weight of 2 Occupants	200 kg	200 kg	**
Maximum Weight Baggage Area • Pilot Only Flight • Flight with Passenger, baggage weight depends on the weight in Rear Seat	 25 kg 0 – 15** kg	 25 kg 0 – 15** kg	 25 kg 0 – 15** kg

** refer to Chapter 6 Aircraft Flight Manual for maximum baggage weight.

WARNING

DO NOT EXCEED THESE WEIGHT LIMIT. PAY ATTENTION TO FUEL, QUANTITY ESPECIALLY WHEN 2 PERSONS ARE ON BOARD.

1.12 Maneuvering load factor

Refer to the PILOT'S OPERATING HANDBOOK (POH), Section 2 for more details about the following operating limits:

- Airspeed limits
- Approved manoeuvres

Flaps up 0°	Maximum positive load factor	**+ 4 G**
	Maximum negative load factor	**- 2 G**
Flaps down I, II, III	Maximum positive load factor	**+ 2 G**
	Maximum negative load factor	**0 G**

1.13 List of abbreviations

Abbreviation	Definition
CAS	Calibrated airspeed; Indicated speed corrected for installation and instrument errors. CAS is equal to TAS at standard atmospheric conditions at MSL
Center of Gravity	Point of equilibrium for the airplane mass (weight)
CG	Centre of Gravity
CG Arm	Distance from the reference datum to the CG, it is determined by dividing the total moment (sum of the individual moments) by the total mass (weight)
CG Limits	The CG range which an airplane with a given mass must be operated within
Demonstrated crosswind component	The max. speed of the crosswind component at which the maneuverability of the airplane during take-off and landing has been demonstrated during test flights
EW	Empty Mass (Weight) of the airplane including unusable fuel, all operating fluids and maximum oil amount. Movable ballast is not included in Empty Weight
GS	Ground Speed. Speed of the airplane relative to the ground
hp	Horsepower
IAS	Indicated airspeed as shown on the airspeed indicator
ISA	International Standard Atmosphere
KCAS	Calibrated airspeed on knots
KIAS	Indicated airspeed in knots
KTAS	True airspeed in knots
Lever Arm	The horizontal distance from the reference datum to the center of gravity (of a component)
MAC	Mean Aerodynamic Chord
MAP	Manifold (intake) Pressure
MCP	Maximum permissible continuous engine output power during flight
MLW	Maximum mass (weight) permissible for landing
Moment	The mass (weight) of a component multiplied by its lever arm
MPG	Miles (nautical) per US gallon
MSL	Mean Sea Level
MTOW	Maximum Take-off Mass (Weight), the maximum mass (weight) permissible for take-off
OAT	Outside Air Temperature
RD	Reference datum (RD)/ Reference plane. An imaginary vertical plane from which all horizontal distances for the center of gravity calculations are

Abbreviation	Definition
	measured. It is the plane through the leading edge of the wing root rib, perpendicular to the longitudinal axis of the airplane.
rpm	Revolutions per minute
Station	A defined point along the longitudinal axis which is generally presented as a specific distance from the reference datum
Take-off Power	Maximum engine power for take-off
TAS	True airspeed. Speed of the airplane relative to air. TAS is CAS corrected for altitude and temperature error
TFUEL	Temperature (Fuel) (at a specific critical point under the engine cowling)
TMOT	Temperature (Motor) (at a specific critical point under the engine cowling)
Unusable Fuel	The amount of fuel remaining in the tank which cannot be used
Usable Fuel	The amount of fuel available for the flight plan calculation
Useful Load	The difference between take-off mass (weight) and empty mass (weight)

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2 Airplane Description

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2.1 Introduction

SHARK is a composite high-performance low-wing airplane with tandem seats and retractable tricycle type landing gear, designed according to European UL and US Light Sport Airplane criteria.

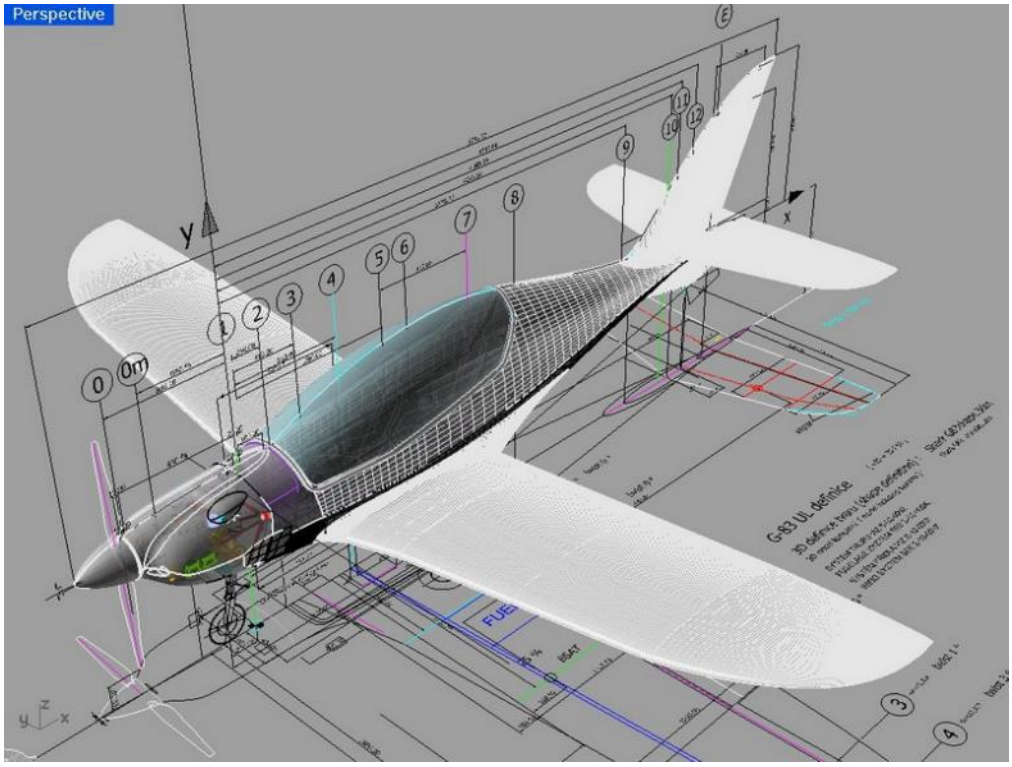


Figure 2-1 Perspective schematic

The airplane is powered by 100HP Rotax 912ULS with a variable-pitch propeller and 100/150 litres integral fuel tanks in the wings.

Front EFIS/EMS is a standard display for Pilot, rear one is optional.

Shark is equipped by an upholstered two-seat tandem cockpit with adjustable seats, full dual control (with sidesticks on the right) and throttle / propeller levers on the left panels. Integrated in the sidesticks are buttons for elevator trim tab, radio and autopilot.

The single-piece cockpit canopy opens to starboard and is supported by gas struts.

Baggage compartment is located behind the rear seat, accessible from the rear pilot seat, and it has lockable baggage door on the left side of fuselage.

2.2 Airframe

Carbon composite airframe

The airframe is primarily made of carbon-epoxy composite with small amount of glass and aramid fibres, with PVC foam and aramid honeycomb core in sandwich panels. Composite wing with carbon main spar and an auxiliary spar carrying aileron hinges and flaps have a 60% of trailing edge employed as Fowler flap. Wings and stabilizer are dismountable.

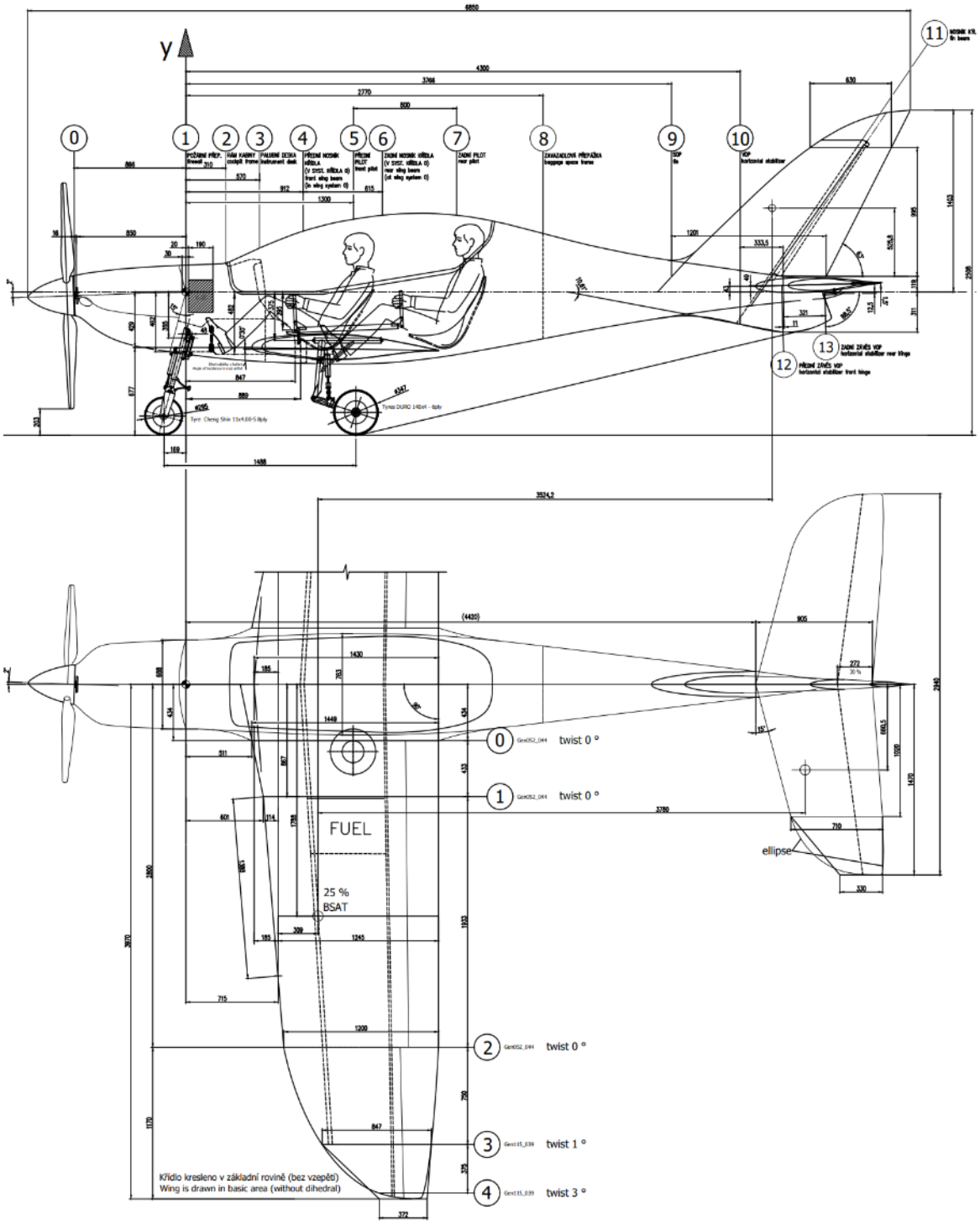


Figure 2-2 SHARK airplane system drawing S-01-000X

Fuselage

Self-supporting monocoque fuselage with integral fin is made as one piece with integral interior, armrests, and floors. Interior shell has aramid-carbon layer for better passive safety and it is integrated into the middle part of the fuselage with added ribs. It creates integral ergonomic cabin structure for two crew members sitting in tandem configuration. The luggage space is located behind the rear seat, accessible from inside, or from left side of the fuselage. Part of central fuselage creates a 1,73m long center-wing, used for main undercarriage retracting.

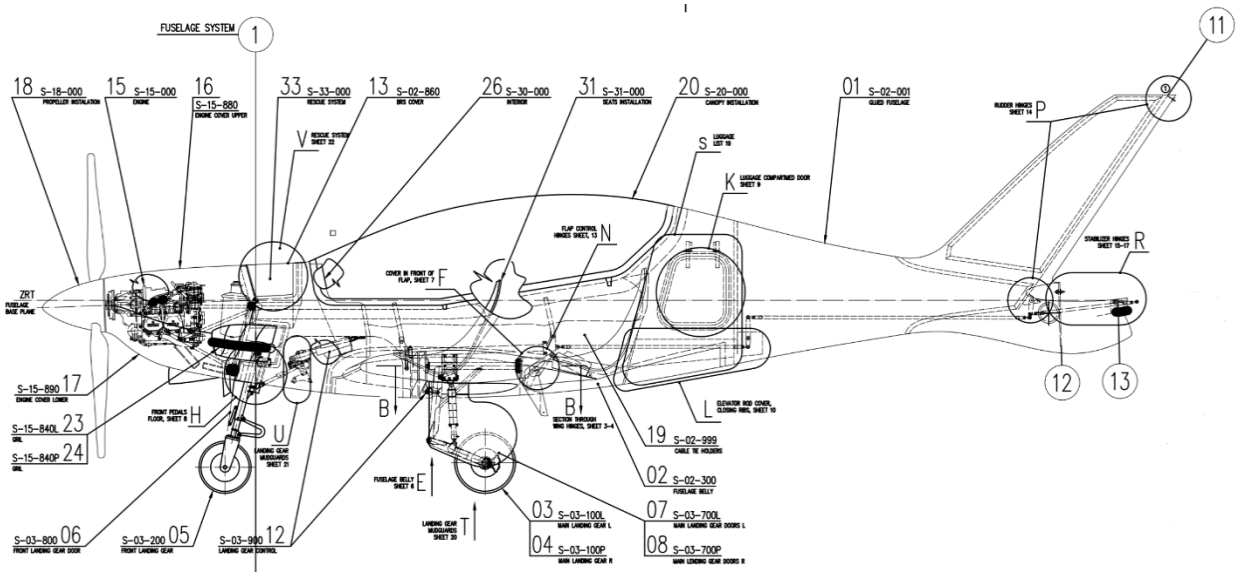


Figure 2-3 Fuselage drawing S-02-000

Fuselage airframe includes firewall with four engine mounting hinges, BRS and front landing gear hinges, main landing gear and cockpit hinges, 2+1 hinges of horizontal stabilizer, 2 hinges of rudder in the rear part, together with bottom fin, optionally with integrated structure for a glider towing mechanism.

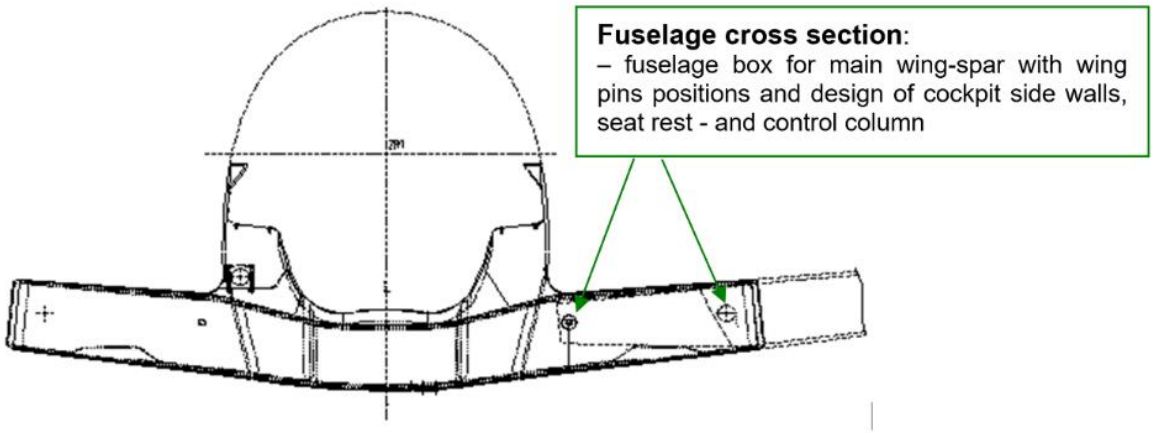


Figure 2-4 Fuselage cross section

Wing

SHARK has a composite wing with trapezoidal root part, and elliptically shaped tip part. Wing planform and airfoil is optimized for fast cross-country flights.

Wing structure consists of a carbon-fibre/epoxy monocoque, with a PVC foam sandwich. The carbon-fibre main spar is placed at 25% of the chord and the rear spar carries the flap levers and aileron hinges. 60% of the trailing edge is equipped with very efficient single-slotted flaps.

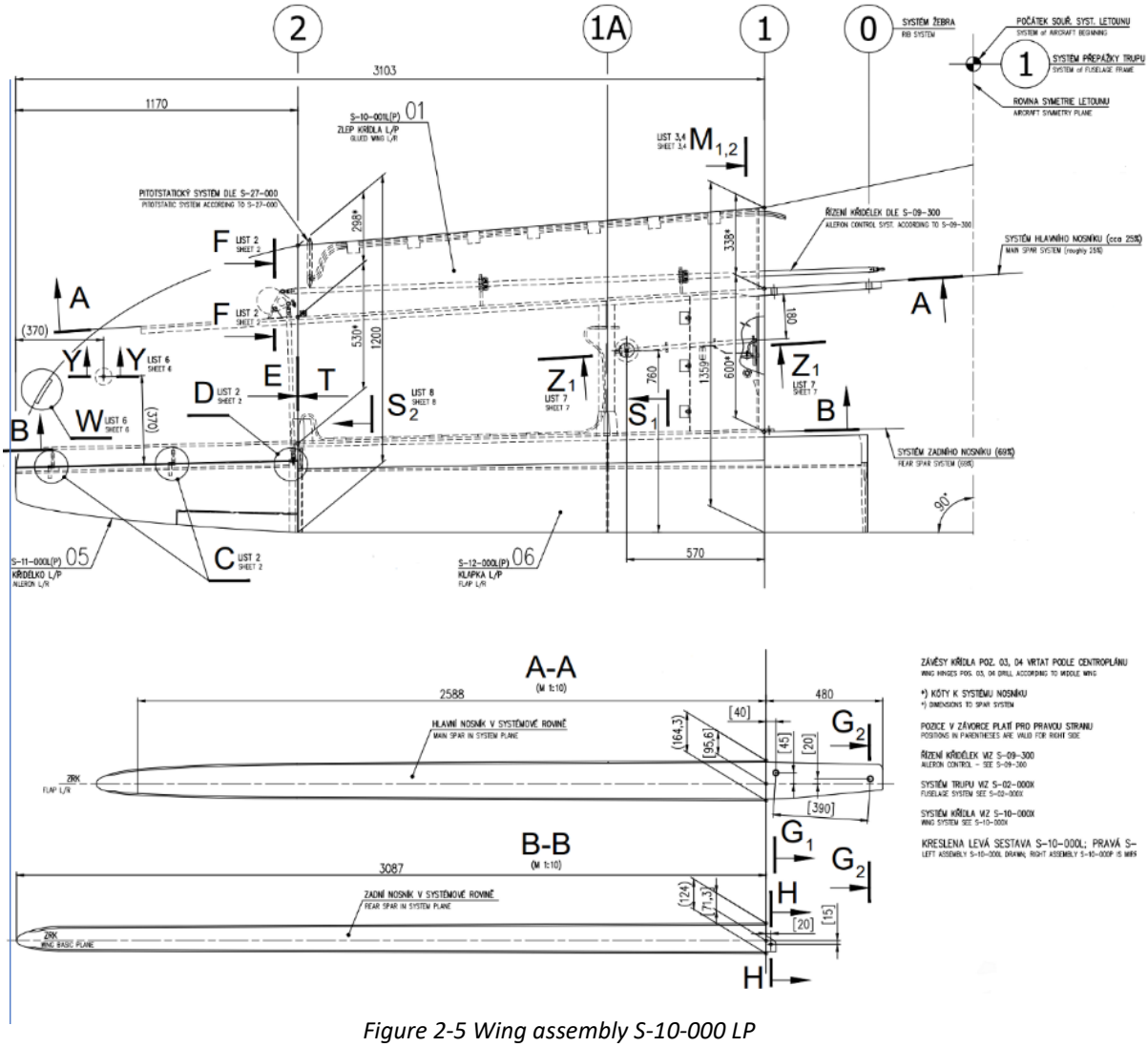


Figure 2-5 Wing assembly S-10-000 LP

There is an integral fuel tank in each wing (50 or 75 litres) positioned between the main and rear spar. Fuel gauges, fuel lines (feed and return line) are installed in the structure. Drain valves are positioned on the lowest point.

Figure 2-6 Fuselage rib for wing connection

Fuel tank ventilation lines are integrated in the most outbound flap hinges.

The wing is optionally equipped with integral position lights at the leading edge of wing tips. The wings can be dismounted for transport or storage by removing two main pins and one rear wing pin, dismounting flaps drive, ailerons control, fuel hoses and electrical connectors.

Figure 2-7 Fuel tank air vent

Aileron

The 40% differential ailerons with carbon monocoque structure are hinged on three carbon hinges attached to the top wing shell. A push-pull tubes and bellcrank are used for control.

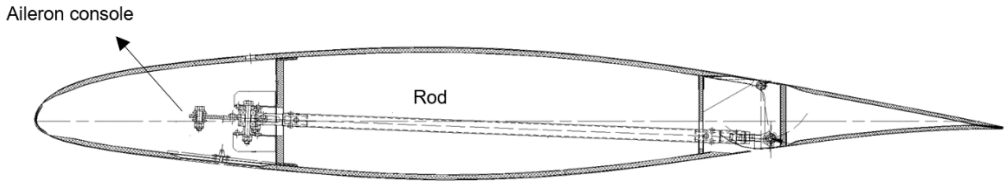


Figure 2-8 Aileron control system link in the wing

Automatic tabs on ailerons

Tabs on ailerons are located on the part of ailerons close to fuselage. Their function is to reduce forces from ailerons at higher speed to acceptable level for pilot. They are fixed with 3 hinges on aileron, on the root rib connected with rod with small rib on wing. They automatically deflect in opposite direction than aileron.

Figure 2-9 Automatic tabs on aileron

Flaps

Fowler flaps with monocoque sandwich design are hinged on three lever hinges and driven by root-rib lever. The flap system is driven by an electric motor and 4 positions are pre-programmed; **0°** (flaps up) **20°** (take-off), **30°** (short take off/ landing), and **38°** (landing). Flaps are controlled by electric actuator (LINAK LA12) placed under the left armrest of the rear seat. The short rod at the root rib controls the flaps through the torsion tube with the lever placed on the first flap hinge.

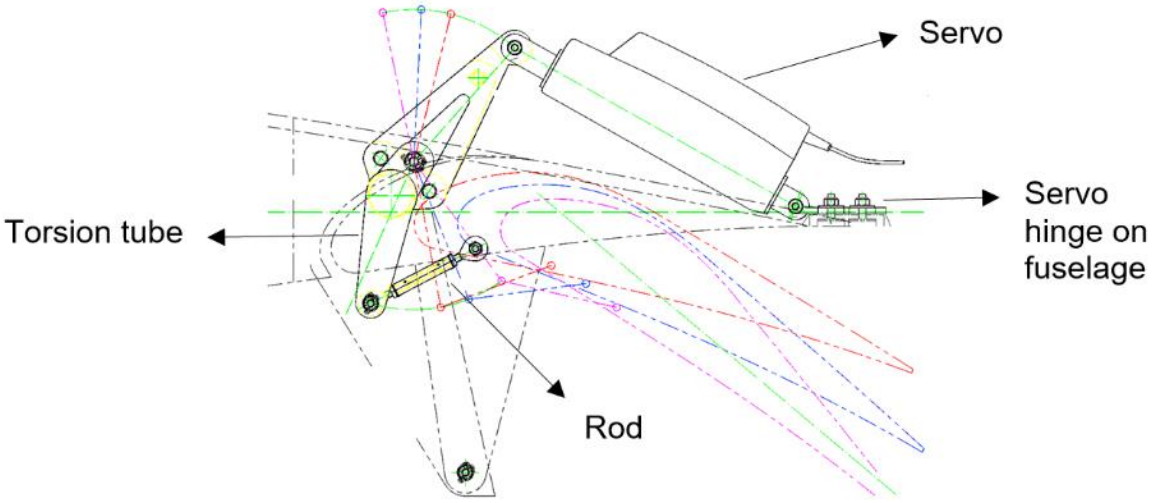


Figure 2-10 Flap control system schematic

Horizontal stabilizer

Stabilizer has carbon monocoque sandwich design with continual rear spar and auxiliary front spar. Hinges for elevator are attached on the top shell. Stabilizer is attached to fuselage by two hinges on the rear fin frame and by one to the rear fuselage bracket.

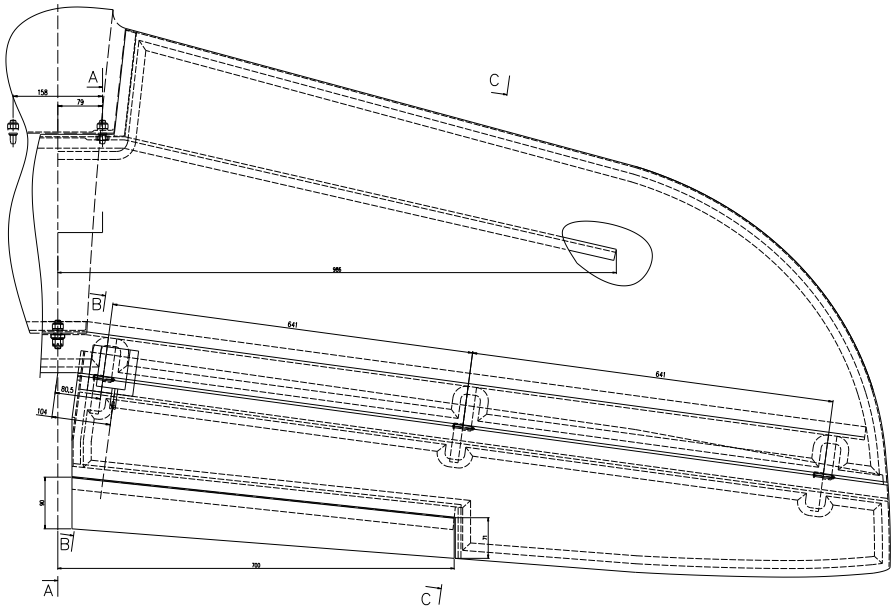


Figure 2-11 Horizontal stabilizer , elevator, trim

Elevator

Split carbon monocoque elevator is hinged to stabilizer by 3 hinges, both halves are weight-balanced to eliminate any possibility of flutter. Left part is equipped with electrically controlled trim-tab, using servo.

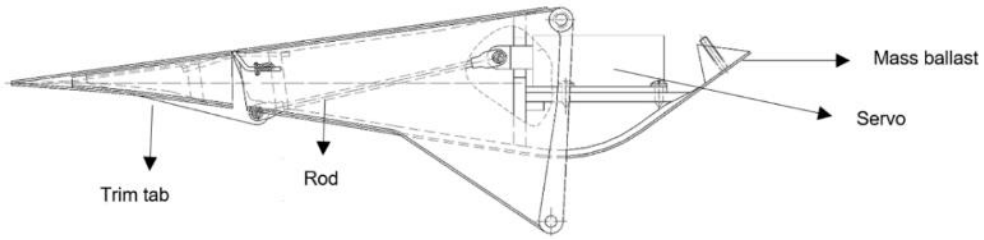


Figure 2-12 Elevator and trim tab

Fin

The composite fin with symmetrical 12% airfoil NACA 641012 MOD is an integral part of the rear fuselage structure. Rudder is suspended on two hinges and controlled from bottom by control cables.

Rudder

Carbon monocoque rudder is hinged in two hinges and controlled by lever on root rib, through steel cables. A slot for optional tail light is located at the top of the rudder.

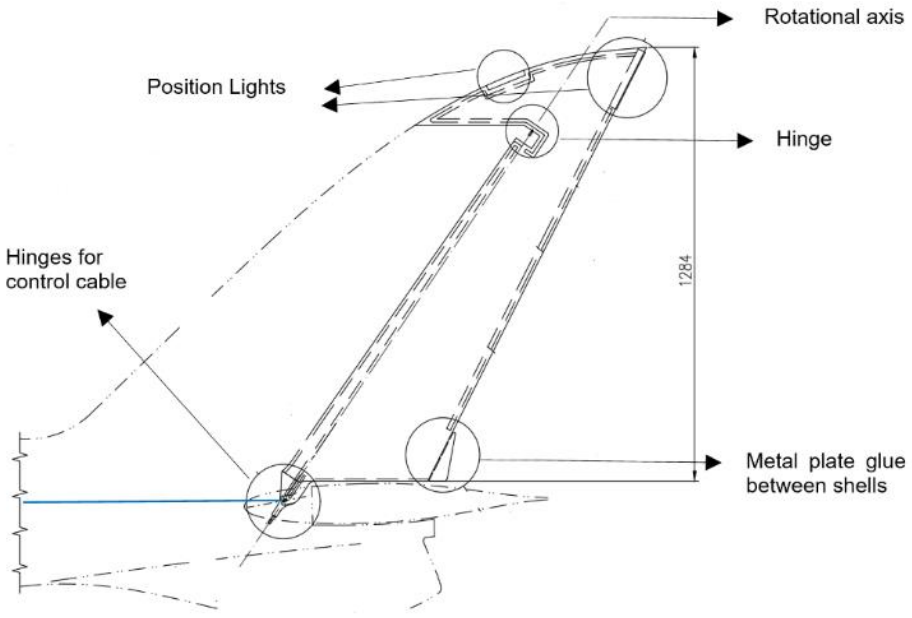


Figure 2-13 Rudder schematic

Cockpit canopy

One-piece cockpit canopy consists of a carbon fibre frame with a Plexiglas windscreen. Canopy is fixed on the right side of fuselage with two hinges. On left side it is fixed in closed position with 2 pins, and it is locked in one point, which is possible to reach from front and rear seat, or from outside through window. In the cross frame between pilots there is gas strut, which limits the open position range. Gas-spring helps to open canopy and to hold it in open position.

2.3 Landing gear

SHARK is equipped with retractable, tricycle landing gear, welded from steel tubes and sheets. The nose wheel is steerable. Main gear is equipped with hydraulic brakes. Nose and main wheels are Beringer type with hydraulic disc brakes. Front undercarriage is retracted backwards into wheel-well behind the firewall backwards, while the main landing gear is being retracted inwards into the wing centreplane and the middle part of the fuselage. Undercarriage is extended and retracted by electromechanical servos. Emergency extension is performed by disconnecting the locking strut from servo and undercarriage opens and locks with its own weight and pneumatic struts.

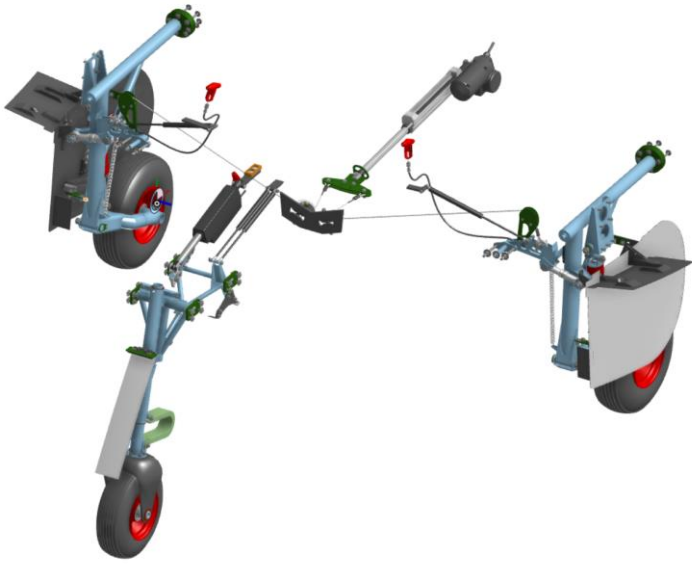


Figure 2-14 Open landing gear system schematic

Both gears are in retracted position fully covered by wheel doors.

Front Landing Gear

Figure 2-15 Front landing gear

Parts and subassemblies of front undercarriage leg are welded from steel tubes and sheets. Front wheel fork is made of carbon. The front gear suspension is secured by a composite spring. The nose leg is steerable and it rotates after contact with the rudder control lever on the triangle, which is attached to the undercarriage shaft. In the extended state, the leg of the nose landing gear is held by a folding strut on the triangle and in the brackets of the landing gear shaft. The folding strut is secured in the open position by two pneumatic struts Bansbach F1D1-46-150-358-005 with nominal force 200N.

Undercarriage damping is provided by composite spring with U-shape. Front undercarriage is retracted to the rear position, into box between front pilot legs. Front Beringer wheel is equipped with tyre AERO CLASIC 11x 4.00-5.

Main landing gear

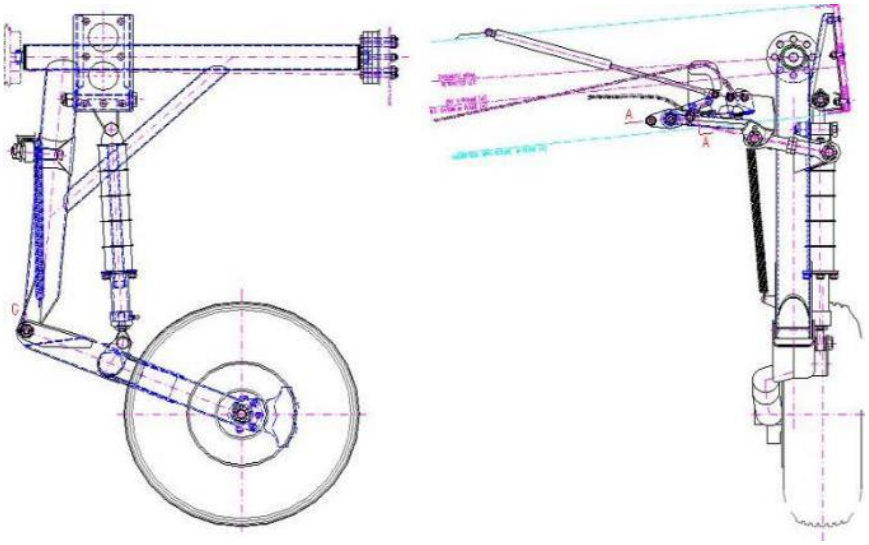


Figure 2-16 Main landing gear drawing

The legs of main undercarriage are welded from steel tubes and sheets. The main parts are hardened. The legs of the main landing gear are suspended in two brackets between the wing centerplane spars and during a retracting they move towards the fuselage into the landing gear shafts. Fork hinges on main leg are equipped with grease-caps and all other movable joints are self-lubricated.

Figure 2-17 Main landing gear

Shock absorbers are assembled from five polyurethane blocks EFFBE 50 mm (P/N 5040 U90) which are fixed on trailing arm fork and root rib of centerplane. Legs are secured in extended position by locking -struts and held in locked position by gas strut and steel spring. Main wheels Beringer with tyres AERO CLASSIC 4.00-6,14 x 4 are equipped with Beringer hydraulic disc brakes, controlled by toe brake pedals on the front pedals, optionally as well central brake lever in the rear cockpit. Pneumatic struts are BANSBACH F1D1-46-150-358-005 with nominal force 200N. In the case of gas-strut damage, locking-strut is secured in locked position by steel spring.

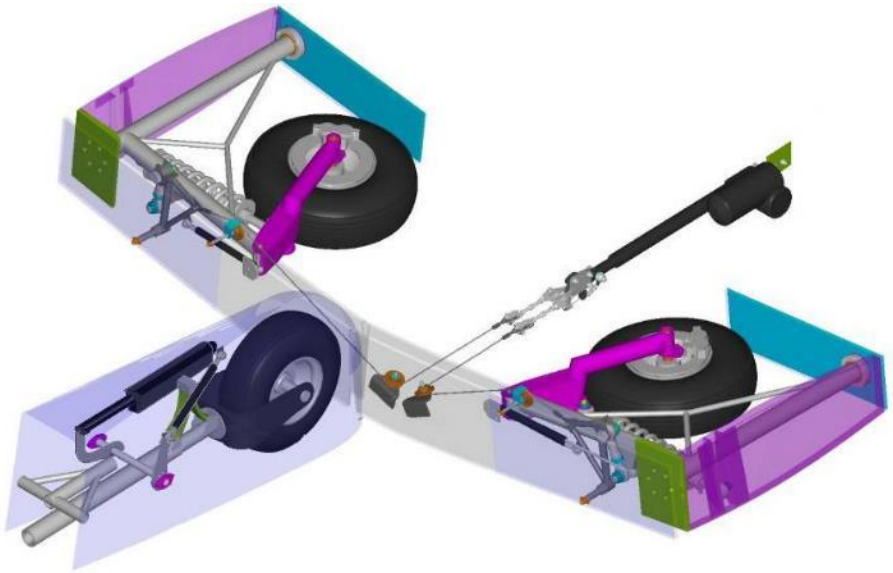


Figure 2-18 Retracted landing gear schematic

Extension and retraction

A 2,5 mm steel cables routed via pulleys are connected to an electromechanical strut (LINAK LA30). Time of retraction is approximately 15 seconds and time of extension approximately 10 seconds. The main servo is placed on the rear cockpit floor below the seats, fixed to auxiliary wing spar.

Locking

Landing gear legs are secured in the up position by self-locking electromechanical struts, in down position by gas struts, springs and its own weight. Electric strut regulates speed of opening. Strut is stopped by proximity inductive sensors when required position is reached.

Emergency landing gear extension

Three mechanical locks controlled by Bowden cables release each landing gear leg. The Bowden cables are connected to T-handles accessible from the front pilot seat. A pressure switch for landing gear, connected to pitot-static system, is installed in the electrical circuit. Pressure switch is adjusted to speed 120 km/h. This should prevent unintentional retracting of landing gear while plane is standing on the ground. Control unit does not allow to retract landing gear, until speed of 120 km/h is reached. Shortcut connector bypassing this pressure switch is installed on instrument panel for maintenance purposes. Extension of landing gear is not blocked by any switch and works at any speed.

In case the speed drops below 120 km/h and landing gear legs are not locked, warning sound signal, flashing of particular LED diode on LG control panel, and voice warning “Check Gears” in headset is activated. Opened and locked position of locking struts on all three legs can be checked through small windows. Visual inspection is always superior to electrical signal and pilot should use it routinely during undercarriage checkup or in case of any doubts of correct function of electronic system.

Extension, Retraction and Indications of the landing gear

The Landing Gear is controlled by the electronic module designed for this purpose, placed behind the instrument panel on the parachute wall together with other electronic modules. Other components of the system are:

- relay switching voltage to the servo of main landing gear
- control and display panel, on the instrument panel, associated with flaps control panel
- pressure switch set to 120km/h, provides signal to control unit
- warning horn
- contactless inductive position sensors, placed in the landing gear bays, provide information about landing gear
- second control and display panel can be optionally placed on the rear instrument panel

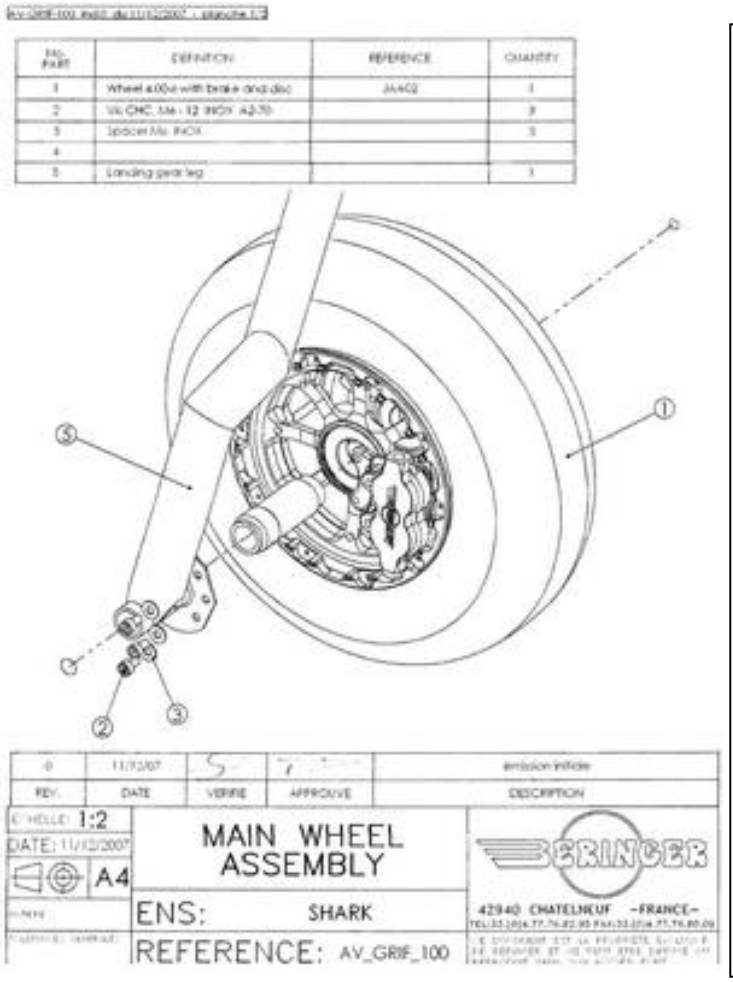
Landing gear doors

Landing gear doors fully cover bays in retracted position. Doors are easily removable – need to remove just 3 bolts. In case of flying when there is snow or mud, it is recommended to remove doors.

Front door is fixed to nose leg. System must be properly adjusted on lifted aircraft. After any modification it is needed to check proper fit.

Figure 2-19 Landing gear doors

Wheels



Main undercarriage wheels

Beringer with brake and disc 4.00-6'' **JAA02**

Main undercarriage tires

AERO CLASSIC 4.00 - 6 6 ply **14x 4.00**

Nose undercarriage wheel

Beringer 4.00-5'' JBA02

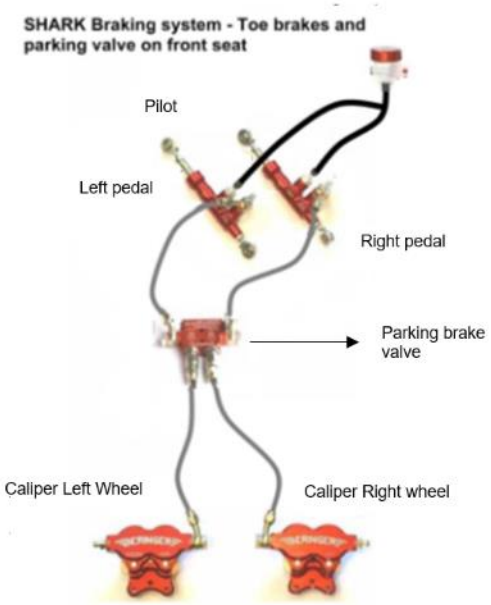
Nose undercarriage tire

AERO CLASSIC 11x 4.00-5 8ply

Figure 2-20 Wheel assembly

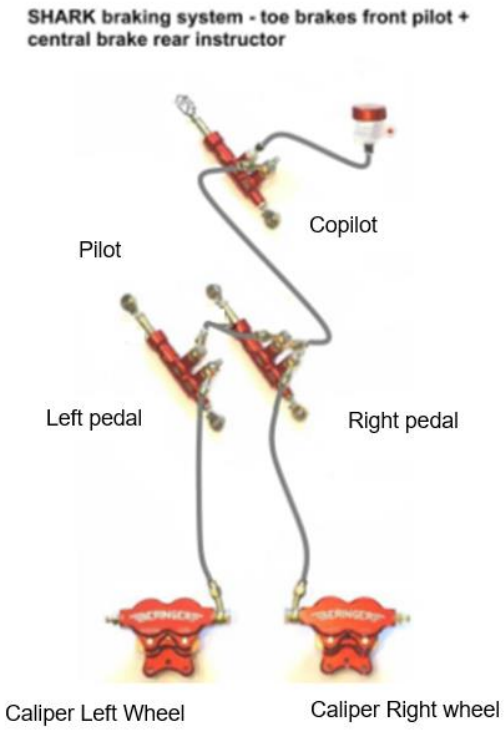
Wheel Brakes

STANDARD



Standard brake system BERINGER consists of two toe brake master cylinders, mounted on front pilot pedals, connected by stainless steel braided hoses with banjo fittings with brake cylinders of left and right wheel calliper.

OPTION



Toe - Brake system with rear central brake/ parking brake (option). The rear central brake is placed in the left side of the seat.

Figure 2-21 Brakes schematic

Fixed landing gear (option)

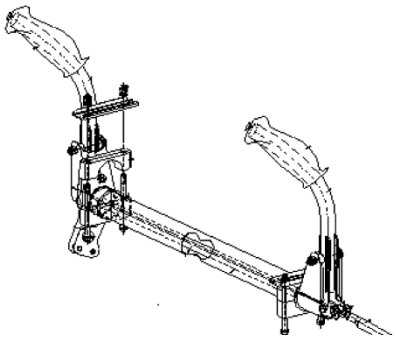
Not used.

2.4 Flight control system

Both occupants have access to a side-stick positioned on their right armrest. Rudder pedals are adjustable and equipped with toe-brakes. Flaps and landing gear are operated from switches on the Instrument Panels. Trim switches are located on the side-stick.

Figure 2-22 Control system example

Elevator control



The elevator is controlled by two sidesticks, hinged in a control column through a system of push-pull rods and levers connected directly to the two-piece elevator. The pushrod in the baggage compartment is connected by cable and spring system to flap control system. This improves trimming on low speeds with flaps and it reduces the need for trimming when flaps are extended.

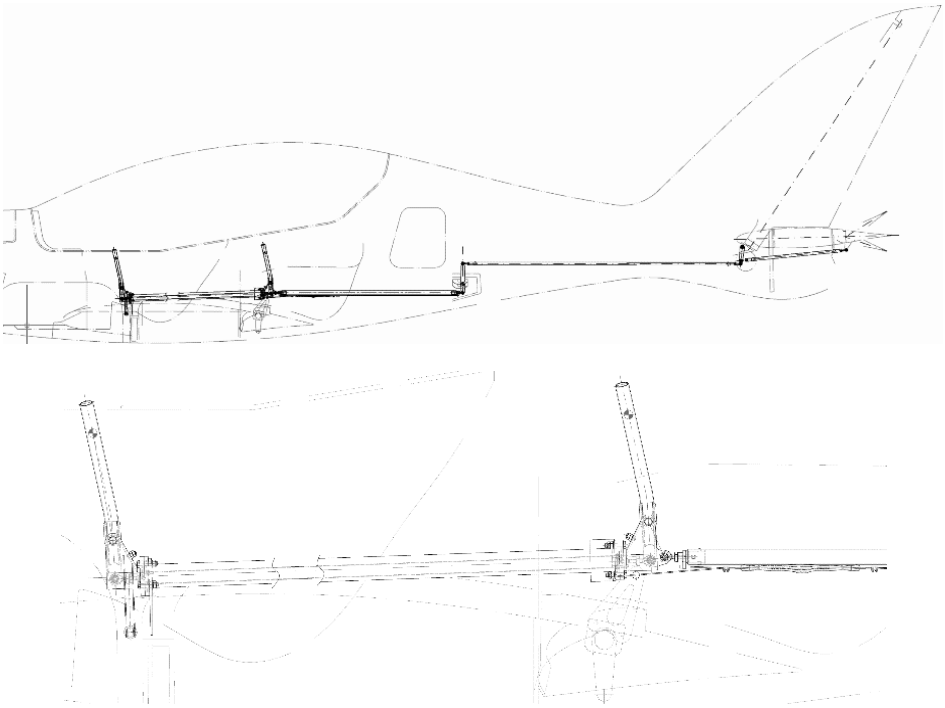


Figure 2-23 Elevator control system

Aileron control

Ailerons are controlled by the side movement of sidesticks, mounted in a manual control block by the system duralumin draw rods, welded levers and bearings, fastened in carbon brackets. Ailerons have automatic balance tabs in the root parts and spring centering to neutral position. Aileron control system can be disconnected.

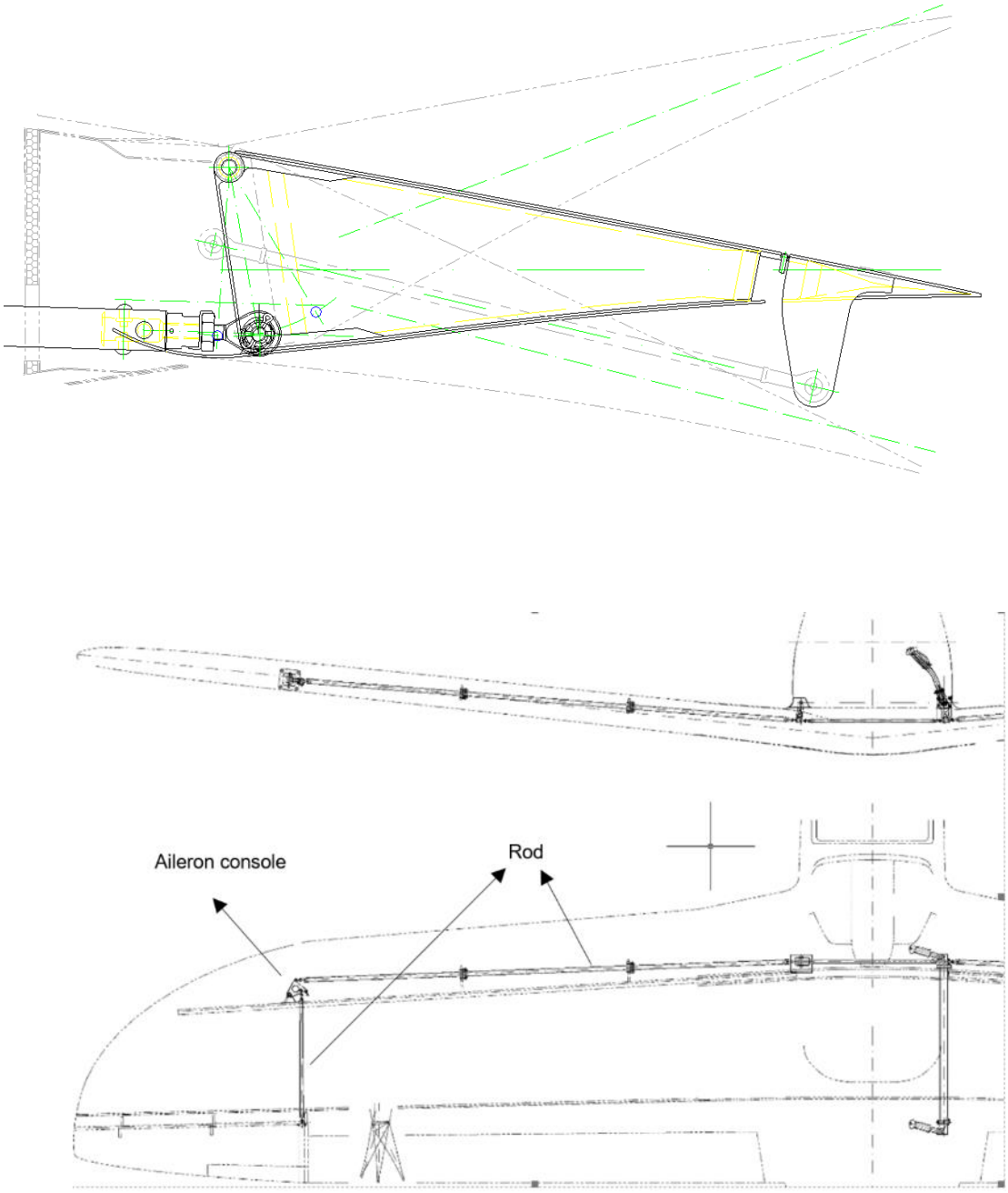


Figure 2-24 Aileron control system

Rudder control

The rudder is controlled by two steel cables, connected to rudder lever and front pedals. They also turn the front wheel at opened front leg, and thus steer the airplane on the ground. Rear pedals are connected to the system too. The system which is steering front wheel is automatically disconnected when landing gear is retracted. System is closed-loop, turnbuckles are behind pedals, adjusted to 300N force (tolerance + 50N).

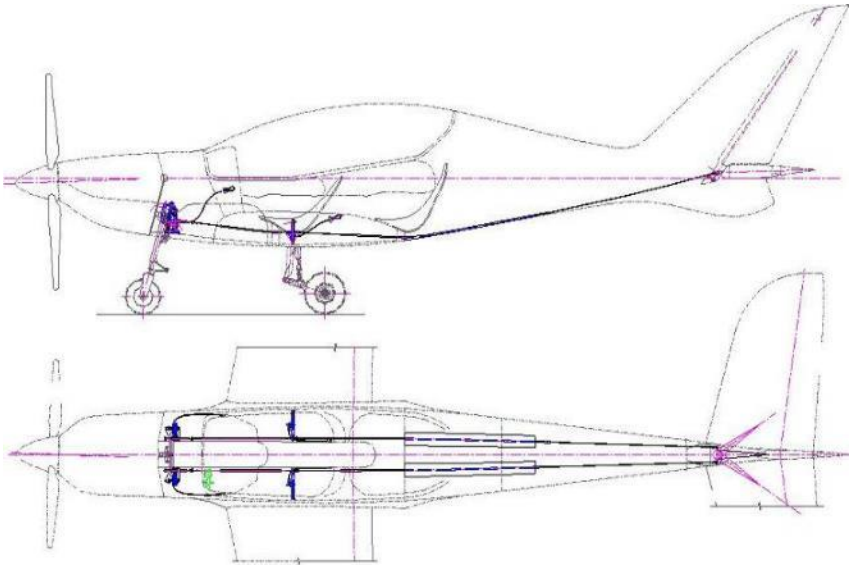


Figure 2-25 Rudder control system

Flaps

The flaps are controlled by electric actuator (LINAK LA12) placed under the left armrest of the rear seat. The short rod at the root rib controls the flaps through the torsion tube with the lever placed on the first flap hinge. The system is controlled by Arduino electronic module which has control and signalisation panel placed together with undercarriage panel on front instrument panel. The same panel can be optionally placed on the rear instrument panel.

The flaps deployment mechanism is connected to the pitot static system in order to inhibit flaps deployment at a speed higher than 130-135 km/h. When flaps are already extended above this speed limit, position LED blinking warning is activated.

Figure 2-26 Flap actuator LINAK LA12

Elevator trim tab control

Carbon trim-tab of elevator is controlled by servo Ray Allen T2-10A, placed on root part of left elevator. System uses original bolts for installation and drive, screws and ends. Servo is mounted in front of elevator spar and it works as a part of elevator mass balance.

Position is displayed on indicator on instrument panel, or in EFIS. Switches are on control sticks.

Figure 2-27 Trim tab actuator Ray Allen

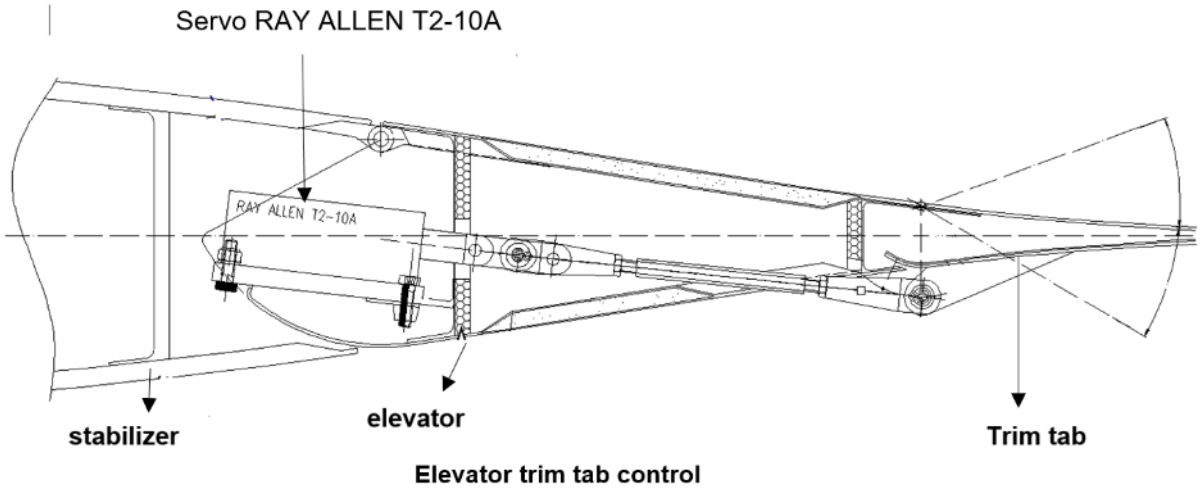


Figure 2-28 Elevator trim tab control system

2.5 Electric system

The electric system is a single-wire type with the negative side connected to the chassis. The power source is a single-phase generator integrated to the engine. Aircraft uses a 12V/4,6Ah LiFePo4 very light battery as a standard. Separate appliances have separate switches/breakers. The standard battery which is located in a case on the engine firewall. Dual engine ignition is separate from the electrical system. The wiring system will vary and depends on the instrumentation, electronic equipment and electric accessories of aircraft.

2.5.1 Battery

Standard: SHORAI LFX 14 L2-BS

EarthX ETX12A

Optional: SHORAI LFX 18 L1-BS

EarthX ETX680C

The SHARK comes equipped with a standard simple charger that is adequate for recharging the battery via the connector situated beneath the left gills.

Figure 2-29 Battery SHORAI LFX L2-BS installed on SHARK

It is strongly recommended to periodically condition the battery using a more sophisticated charger equipped with cell balancing functionality (for example TECMATE OPTIMATE Lithium LFP Select).

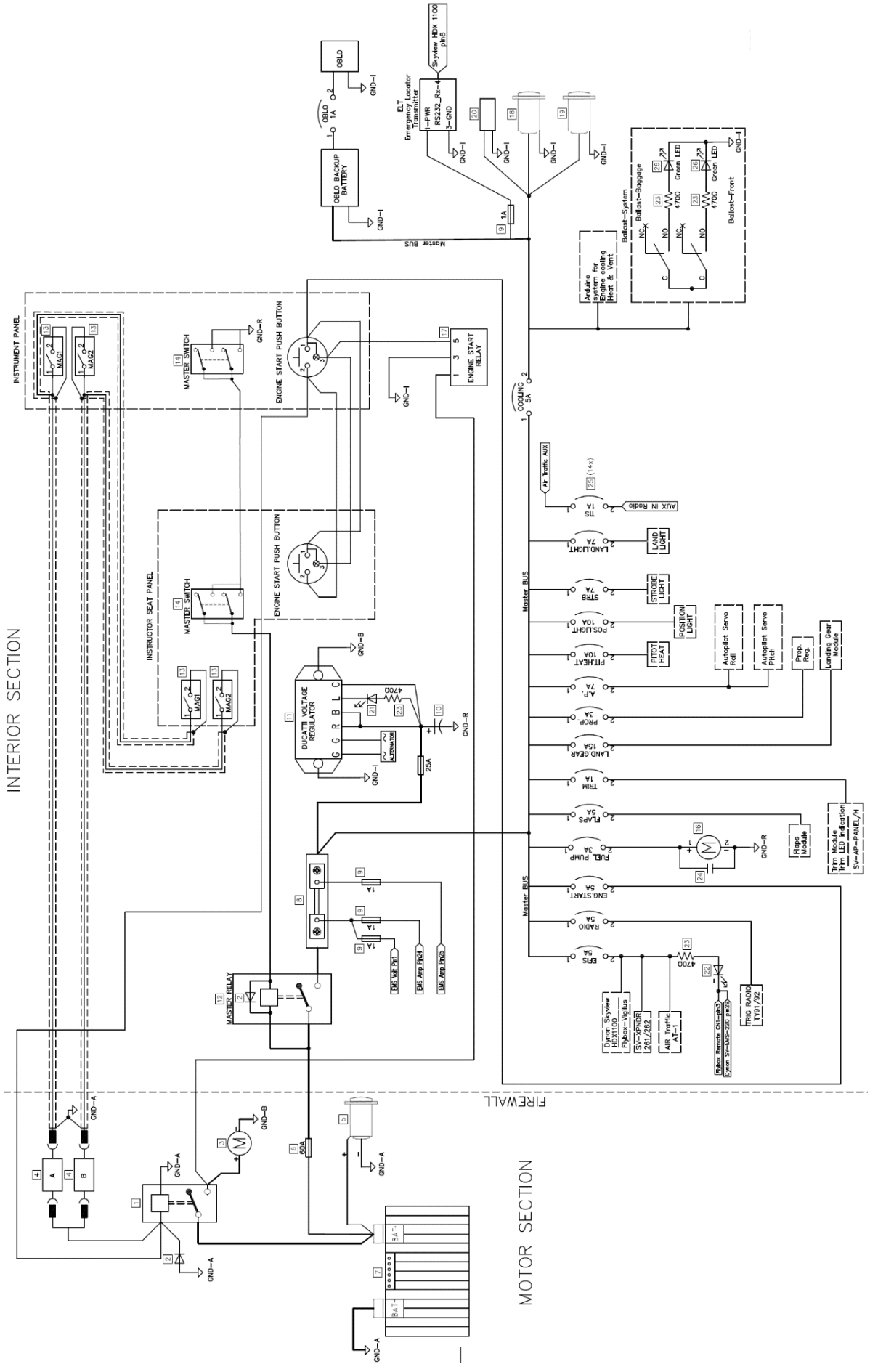
The minimum period for battery balancing is 100 flight hours or 1 year.

WARNING

NO JUMP STARTING PERMITTED WITH LITHIUM (LIFEPO4) BATTERY.

LITHIUM BATTERY MUST BE DISPOSED OF IF DEEP DISCHARGED (BELOW 8V) DUE TO DENDRITIC DAMAGE

2.5.2 Electric system scheme



2.6 Fuel system

The fuel tank volume is 2x 50 l, optionally 2x75 l. The tanks are integrated inside the wings. Fuel is piped from the fuel tanks through the fuel valve located inside the cockpit on the left–side of the front pilot armrest, then through the fuel filter to the engine fuel pump and into the carburettor. The gascolator is located on the left side of the firewall behind left gills. Tanks have drain valves at lowest points.

Fuel tank filler neck is placed on the upper side of the wing. Fuel quantity is indicated by EMS system.

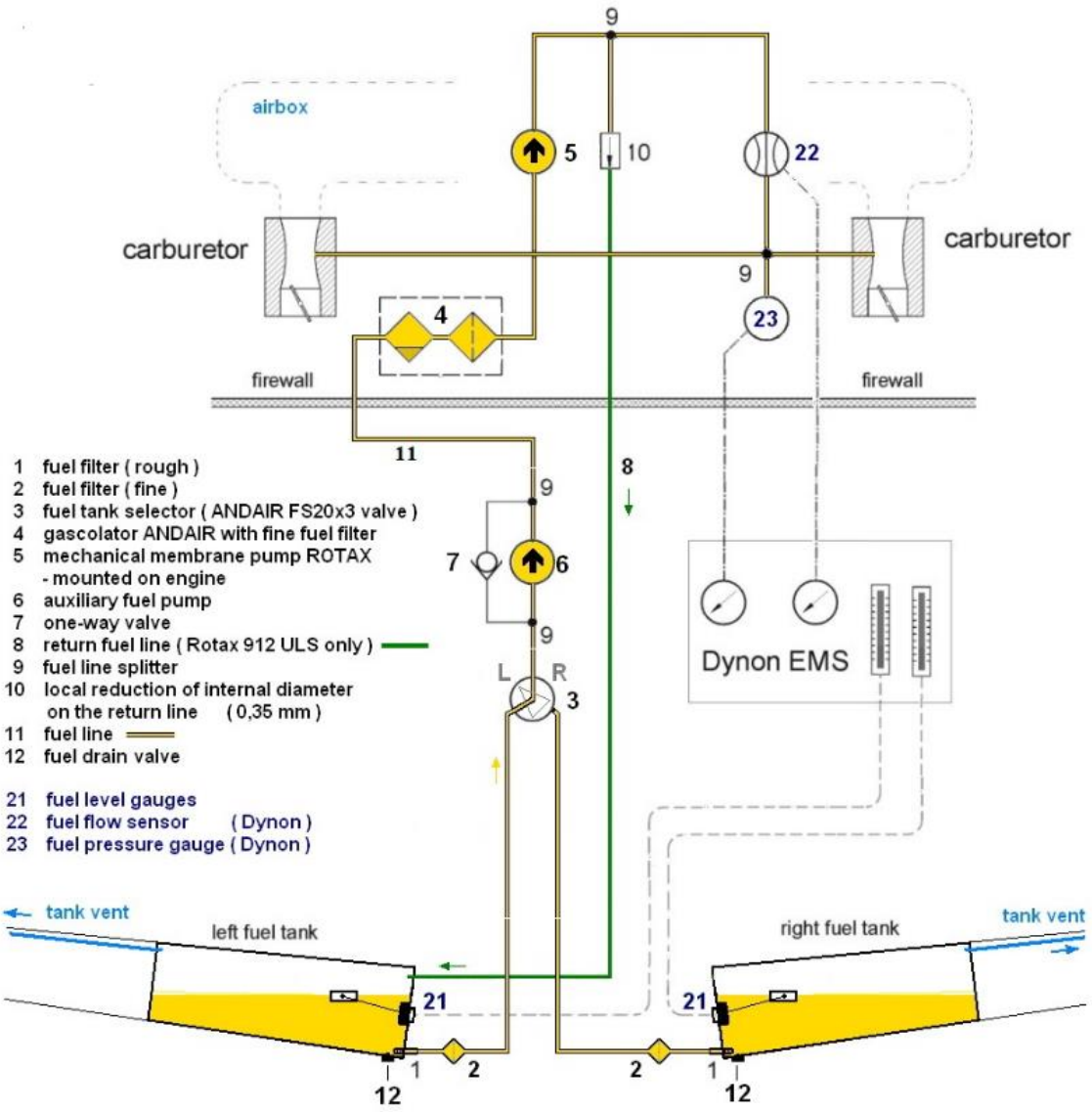


Figure 2-30 Fuel system

Figure 2-31 Fuel tank air vent

The Air Vent of each fuel tank is incorporated in the most outbound flap hinge.

CAUTION

Clogging or obstructing of the fuel vent could cause problem with fuel supply, even the wing surface to implode, caused by pressure difference in different altitudes.

2.7 Cockpit – Interior and instrument

The following picture shows positions of all basic control levers, drivers, installation of instruments and cabin equipment, needed for basic pilot information about correct use of plane:

Figure 2-32 Cockpit arrangement example

Access to pilot place through right-side opening canopy (11) with lock (12)

- Two composite seats (9), pneumatically height adjustable after pushing adjusting button (8), four-point safety belts (10) each.
- Dual controls with two sidesticks (7) on the right side**,** dual rudder control pedals (5), connected with front wheel control. On left panel is located throttle (4) and choke levers, optionally control lever of hydraulic adjustable prop, knob of engine cooling flap for starts in hot conditions. On right panel are knobs for heating and ventilation.
- Hydraulic brakes are controlled by the toe-brakes (5) on front pedals, optionally by lever on the left side of rear pilot seat.
- Instrument panel (1) with air vents (3) on sides. Small rear instrument panel (2) is placed on the canopy frame – folded with canopy.
- Flap control and undercarriage retracting control panels (6) are integrated, placed on left side of instrument panel, optionally installed for rear pilot.
- Middle panel is used for EFIS (Dynon SKYVIEW, Garmin). Below EFIS screen there are circuit breakers / switches. Below breakers are placed autopilot panels and starter, magnetos and master switches.

- Right side of instrument panel is used for backup instruments, GPS.
- Trim switch, radio button, autopilot ON/OFF buttons are placed on the top of sidestick's grips.
- Fuel valve is placed on the left armrest behind throttle body. Indication of fuel amount is visible on EFIS/EMS display.
- Baggage compartment situated behind the rear seat is accessible from inside or from outside through lockable doors.
- Ballistic rescue system has 2 independent activation **RED grips** (13) installed on the middle panel between pilot and passenger legs.
- Below left and right armrests there are small storage compartment.

Front instrument panel

EFIS/EMS/GPS DYNON SKYVIEW HDX + backup conventional instruments Winter.

Figure 2-33 Example front instrument panel with DYNON SKYVIEW HDX

- SHARK instrument panel is equipped with the **centrally** located DYNON SKYVIEW HDX EFIS/EMS, NAV/COM panel, transceiver and transponder.
- **Left side** is equipped with flaps control, undercarriage control, propeller rpm control, radio, movable ballast position indicator.
- **Right side** is equipped with backup instruments – small EFIS, altimeter, speedometer.
- Starter and master switches, circuit breakers and autopilot are placed at the **bottom of centre panel**.

Standard instruments, electronic engine monitoring device MiniEIS, EFIS OBLO

Figure 2-34 Example of classical instrument panel

Rear instrument panel (optional)

- Rear instrument panel is part of canopy frame, optionally equipped with EFIS/EMS screen connected to main device.
- The Instructor configuration option gives the rear Pilot the possibility to control flaps and landing gear from the rear position. On the central panel are switches for engine start, magnetos, master switch. On the left panel is a single brake-lever which activates both main wheels.
- A slaved radio control panel can be installed optionally.

Figure 2-35 Rear instrument panel Dynon SKYVIEW

2.8 Powerplant

Engine

Shark is equipped with **ROTAX 912 ULS** 100HP. It is a 4-stroke, 4 cylinders horizontally opposed, spark-ignition engine with stainless steel exhaust and possesses one central camshaft-push-rods-OHV. Rotax 912 has got liquid-cooled cylinder heads, ram air-cooled cylinder, dry sump forced lubrication, and dual capacitor discharge ignition. The engine is fitted with an electric starter, AC generator, and mechanical fuel pump.

Figure 2-36 Rotax 912 ULS installed on SHARK

Technical Data

Performances are valid for standard conditions (MSA/ISA).

Engine Model	912 ULS D.C.D.I.
Engine power Max. 5 min.:	69.0 kW (95 hp) @5500 RPM 73.5 kW (100 hp) @5800 RPM
Torque	128 Nm @ 5100 RPM
Maximum speed	5800 RPM
Bore:	84.0 mm
Stroke:	61.0 mm
Cylinder capacity:	1352.0 cm3
Compression ratio:	10,5:1
Ignition:	DUCATI double CDI
Ignition timing:	4° to 1000 RPM / above 26°
Sparking plugs:	ROTAX part no. 297 940
Generator output:	250 W DC @ 5500 RPM
Voltage:	13,5 V

For more detailed information see the Rotax 912 ULS Operator's Manual supplied with the engine.

Engine instrument indicators

Engine outputs like fuel pressure, the quantity of fuel, cylinder head temperature, oil temperature, etc. are displayed on EFIS/EMS.

If the cockpit is not equipped with EFIS/EMS display there can be set up conventional instruments.

Engine instruments limit indicators show the following limit and range:

Function	Minimum Limit	Normal Operating	Caution Range	Maximum Range
Engine speed (RPM)	-	1 400-5 500	5 500-5 800	5 800
Cylinder Head Temperature (CHT)	-	-	-	135 ^{0}C 275 ^{0}F
Exhaust Gases Temperature (EGT)	-	-	-	880 ^{0}C 1616 ^{0}F
Oil Temperature	50 ^{0}C 120 ^{0}F	90 -110 ^{0}C 194 - 230 ^{0}F	50 -90 ^{0}C 122 - 194 ^{0}F 110 -130 ^{0}C 230 - 266 ^{0}F	130 ^{0}C 266 ^{0}F
Oil Pressure	0,8 bar 12 psi Below 3500 rpm	2 – 5 bar 29 – 73 psi	0,8 – 2 bar 12 – 29 psi 5 – 7 bar 72,5 – 102 psi	7 bar 102 psi cold engine starting

Figure 2-37 example of Dynon SkyView engine parameter

Propeller

Shark can be equipped by different propellers:

- Woodcomp SR 3000 2WN - 2 blade, in flight electrically adjustable
- Woodcomp KW20W - 2 blade, in flight hydraulically adjustable
- Neuform TXR2-V-70 - 2 blade, in flight electrically adjustable
- E-prop Glorieuse - 3 blade, in flight electro-hydraulic adjustable

Woodcomp SR 3000 2WN

An Electrically In Flight Adjustable propeller with Two wood-composite blades, designed for Rotax 912 UL, Rotax 912 ULS and Rotax 914. Blades angle is controlled by an electric servo mechanism and can be adjusted from minimum to maximum angle within approximately 8 seconds. The pitch angle of the blades is adjusted by means of an electrical servomotor, controlled from the cockpit, and it can be smoothly changed in the range from minimum angle valid for take-off up to the maximum angle. The system allows a range of adjustment of the pitch angle of at least 20 degrees over the minimum angle.

Figure 2-38 Constant speed unit and Woodcomp SR 3000 2W

The end positions of blade pitch adjustment are locked by three systems**:**

Main system

The main system is an electrical one. It operates when the end stop on the blade comes into contact with the end switch and closes it, which terminates the motion of the blade at this angle.

Back-up system

To allow for the possibility of main system failure, the electric servomotor is provided with a duplicate end switch, for both fine and coarse end positions.

Constant Speed unit

The unit sets and maintains the desired propeller speed. It Is mounted on the instrument panel.

Woodcomp KW 20W

Propeller has identical blades and same performance as the electrically adjustable SR 3000 2W propeller described above.

Blades adjustment is controlled by a hydraulic regulator using oil from engine lubrication system. Oil goes through hollow shaft in gearbox to the piston inside propeller hub. Regulator is controlled by lever placed next to the throttle lever.

Neuform TXR2-V-70

Figure 2-39Neuform TXR2-V-70 and constant speed unit

Neuform TXR2-V-70 is an electrically in-flight adjustable propeller with two composite blades. The blades are made of glass-fiber and are hollow. Root of blade is duralumin. Outside part of blade leading edge is casted of plastic material with improved resistance to abrasion. A Servo controls the angle of the blades and is located on the engine gearbox.

Mechanical stops and micro switches of maximum and minimum angle of attack are situated on the servo brackets. A Flybox unit is used to set the required propeller RPM.

E-prop Glorieuse (applicable for Shark 600F)

E-prop Glorieuse is a 3-blade tractor propeller, full Carbon with Titanium leading edge protection, in-flight variable pitch system (Constant Speed). The propeller speed control is secured by electro-hydraulic unit and constant speed box installed on the instrument panel.

Figure 2-40 E-prop Glorieuse and constant speed unit

2.9 Engine systems

Engine mount

The engine mount is welded from CrMo tubes and is attached to the firewall with 4 bolts. The bed is spring–mounted with four rubber silent blocks to the firewall.

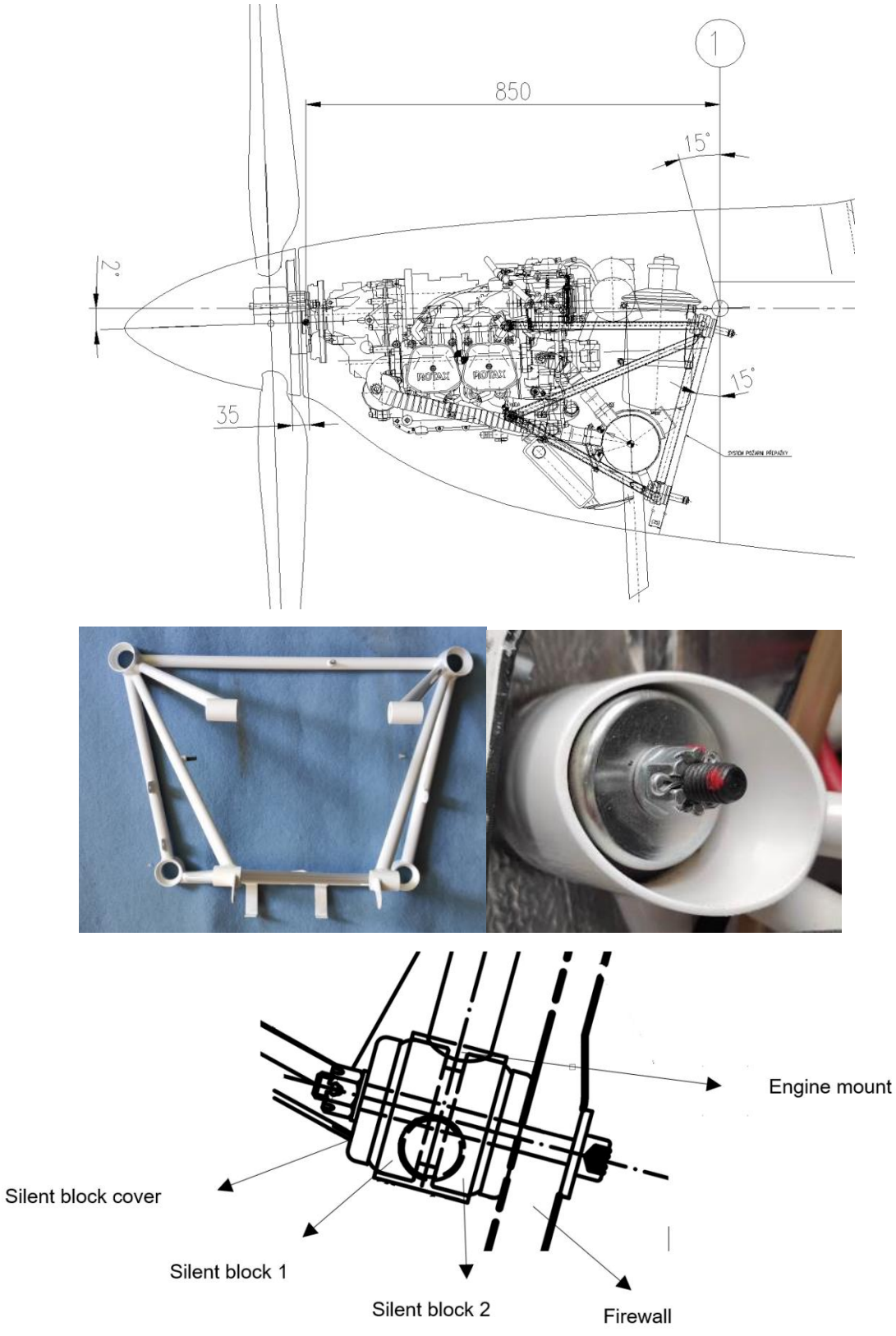


Figure 2-41 Engine mount system

Lubrication system

Rotax 912 is provided with a dry-sump forced lubrication system. The oil pump pulls the motor oil from the oil tank via the oil cooler and then forces it through the oil filter to the lubrication points in the engine. Surplus oil emerging from the lubrication points is accumulated on the bottom of the crankcase and is forced back to the oil tank by the blow-by gases. The oil tank is equipped with a vent hose. The engine lubrication system is further described in the documentation supplied with the engine.

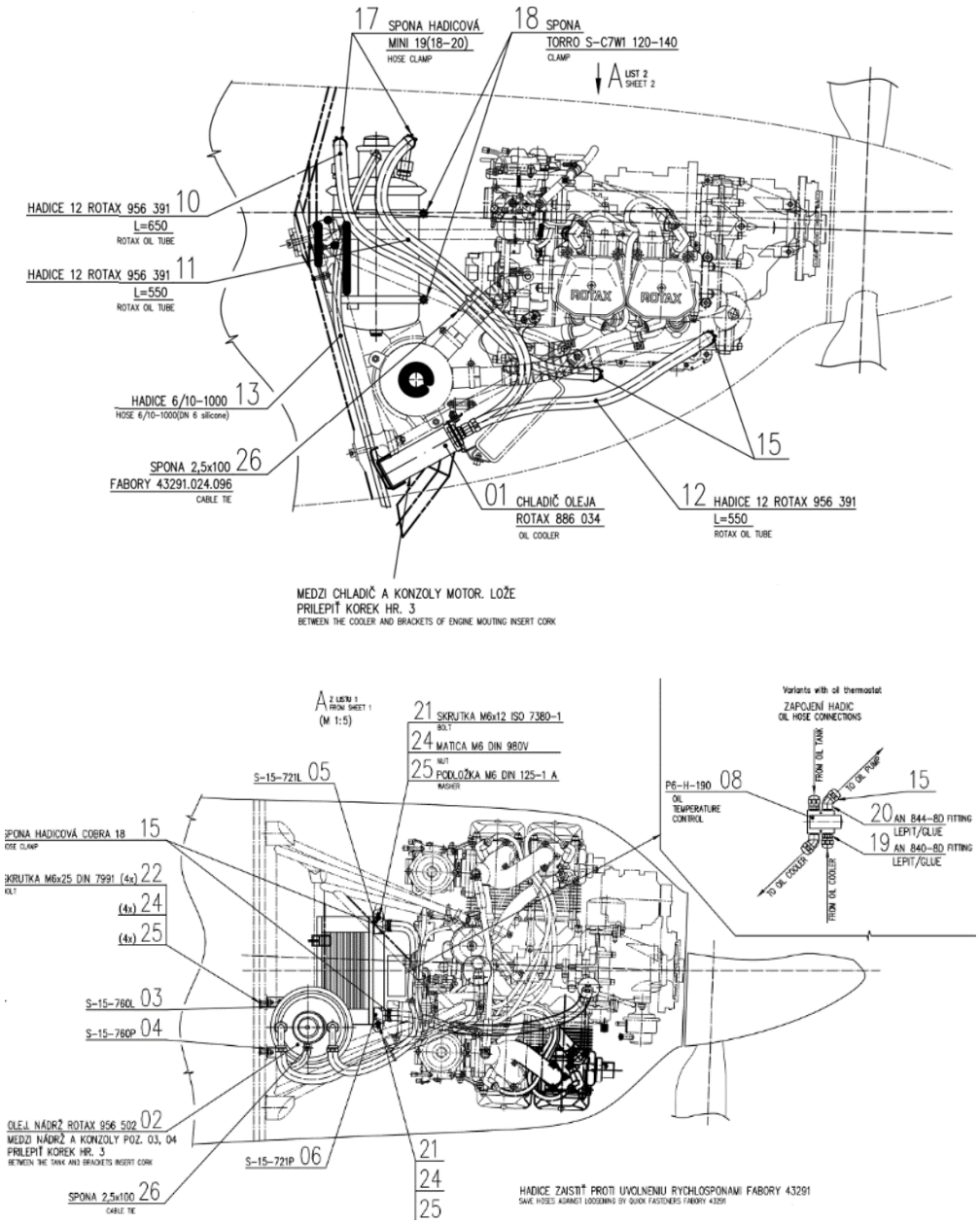


Figure 2-42 Engine Lubrication system

Cooling system

The cooling system uses two forms of cooling. Cylinder heads are liquid-cooled and cylinders are ram air-cooled. The radiator is located in the bottom of the extended engine cowling – rear to NACA intake. Coolant is forced through the radiator by a water pump, driven from the crankshaft to the cylinder heads. From the top of the cylinder heads, the coolant passes on to the expansion tank which allows for coolant expansion. The expansion tank is closed by a pressure cap with an excess pressure valve and return valve. When the temperature rises, coolant creates excess pressure, the relief valve opens and coolant flows through a hose to the overflow tank mounted on the firewall.

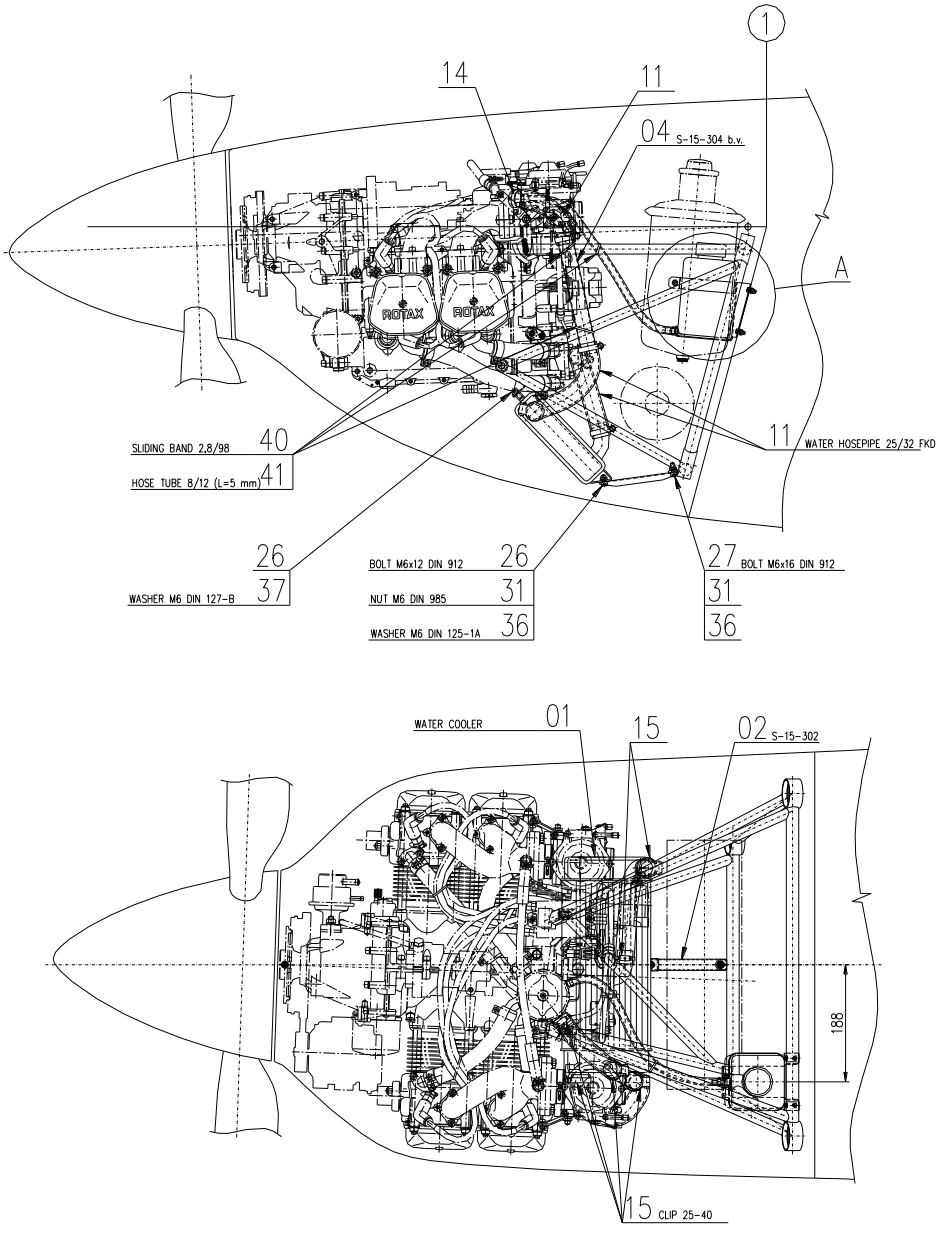


Figure 2-43 Engine cooling system

The engine cooling system is completely described in documentation supplied with the engine.

Engine cowlings

eComposite engine cowlings are designed with natural aerodynamic shape, smoothly continuing to large spinner with diameter ø 324mm.

Bottom cowling and upper cowling are fixed to the firewall and together with cam-locs, to be easily dismountable for pre-flight inspection.

The bottom engine cowling has two small intake holes for direct engine heads cooling and both sides outlets in the style of shark's gills.

Large bottom NACA air intake for water and oil-cooler has flap / "jaw", controlled by small electric servo, increasing intake cross-section for flights in hot conditions, taxiing and take-off. In the front part of NACA intake is installed plexiglass, working as winter plug. For more details check chapter 3.5

Adjustable deflector is fixed on the leading edge of flap, with purpose to balance airstream on water and oil radiator, and to equal their temperatures in normal operation.

Figure 2-44 Air intake regulated by servo

Engine control system

The engine control system consists of two throttle levers, parallelly connected and mounted on the left side of cockpit armrests. Front throttle quadrant includes a choke lever and fuel valve. Front throttle lever is connected with both carburettors through a system of Bowden cables with screw-ends to adjust that during service. Optionally is installed lever for the hydraulic prop and central brake on the instructor seat.

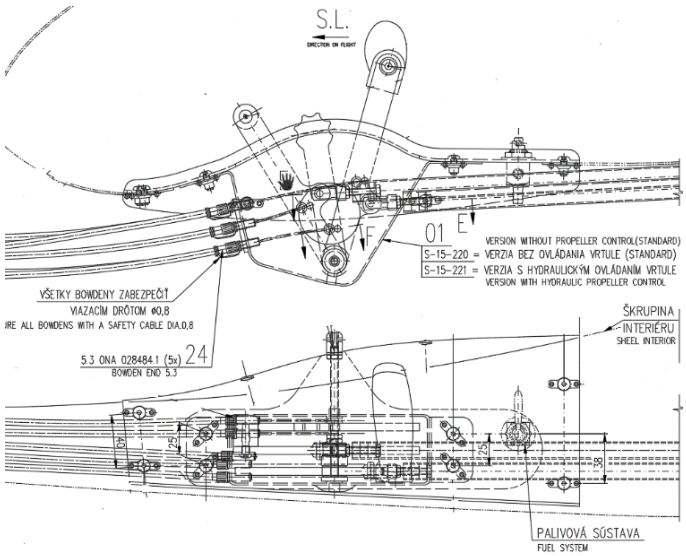


Figure 2-45 Engine control system

Exhaust system

Engine installation uses an exhaust system, created directly for SHARK and Shark UL. The exhaust system is welded from stainless steel tubes and sheets and uses flexible tubes to eliminate vibration influence. Exhaust silencer is mounted behind engine, inside of engine bed. On silencer is fixed deflector routing air for cockpit heating system. The exhaust pipe is on the right side of the engine cowlings bottom.

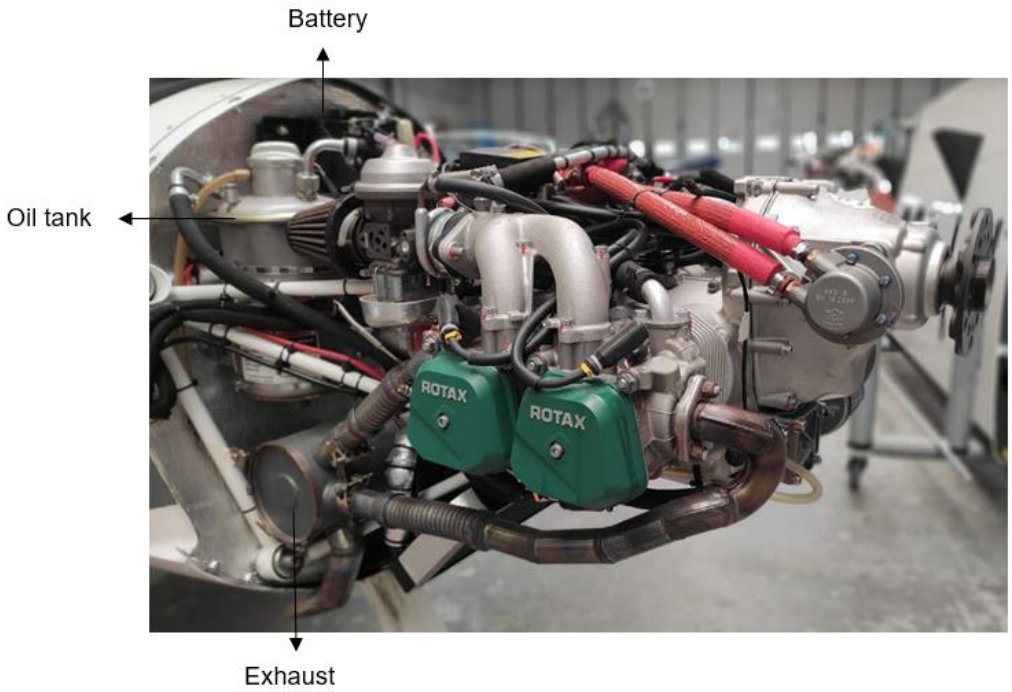


Figure 2-46 Exhaust system

Engine cowling control

The lower and upper engine cowlings are attached to the fuselage, and mutually fastened to each other by quick-opening CAM-LOC locks. The lower part has a NACA air intake for the water cooler and oil cooler at the front controlled by an opening servo, equipped with a lower intake for better air supply during taxi and lower speeds. The lower and upper engine cowlings are attached to the fuselage, and mutually fastened to each other by quick-opening CAM-LOC locks. The lower part has a NACA air intake for the water cooler and oil cooler at the front controlled by an opening servo, equipped with a lower intake for better air supply during taxi and lower speeds. Inside the NACA intake, a transparent acrylic-glass deflector can be adjusted to three positions to reduce the cross-sectional size of the intake at low temperatures. A landing / anti-collision reflector is located behind the acrylic glass. The lower engine cover has small intakes on both sides for direct cooling of the cylinders. The air outflow out of the engine compartment is dissipated by gills on both sides. The top cover has a vent at the highest point, an oil check access door that can be left unlocked on hot days, and an installed spring that keeps them fully open at low speeds, significantly improving engine compartment ventilation. At the front, on the left side of the upper motor cover, there is a door ensuring quick and smooth access to the movable ballast (where applicable).

Heating interior

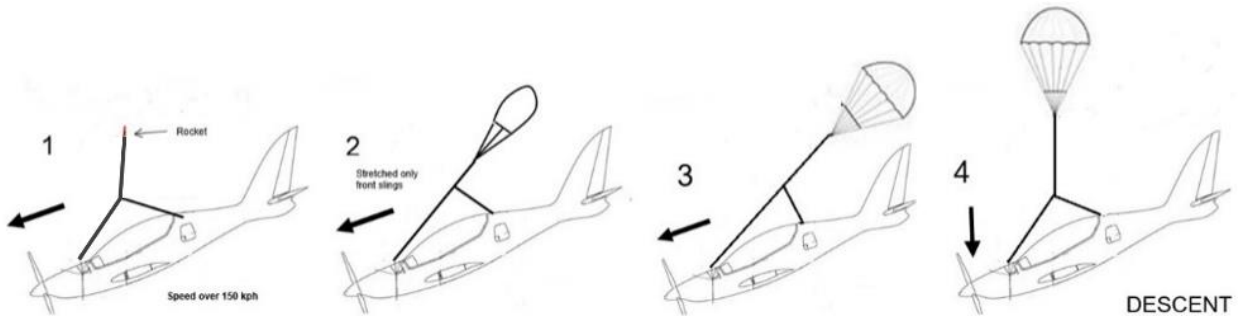
Figure 2-47 Ball vent and heating regulator knob

Part of air entering oil radiator is entering the intake of deflector fixed on the muffler. Exit is to valve regulating heating. Valve is operated with electric motor adjustable with a knob on the right panel in front of the control stick.
2/3 of hot air is directed to front pilot legs, 1/3 is entering channel connected with the ventilation system. This system, in combination with ventilating flap, and ball vents can deliver hot air to airstream and stream to the canopy, and the whole system can be adjusted according to pilot needs.

Turn the knob HEAT - to open the heating valve and bring warm air into the cockpit
Turn the knob VENT - to open the valve for airflow into the cockpit

2.10 Rescue System

Shark 600 is standardly equipped with a ballistic rescue system **Stratos/Junkers Magnum 601 LSA** with 2 independent release handles.



Description

Parachute canopy is pulled out by a specially designed rocket engine. The time required to launch is between 0.6 - 1.2 seconds, depends on the type of system and air temperature. The rocket engine is located in the rocket case. After the activation by activation handle the movement is mechanically transported by a Bowden cable on a percussive device. It activates two percussion caps which ignite the rocket box. After ignition, the rocket escapes under high pressure from the rocket box, towing the rope which releases the cap of the parachute container, and the parachute is pulled out of the container. Then the bag of the parachute is discarded, and the parachute canopy is filled with air. The minimum recommended height of use is 200 m, but there are noticed cases of successful application from the extend height than 80 m. It also depends from the horizontal and vertical components of velocity. System life is 18 years if the revision and repacking is performed every 6 years.

CAUTION

The parachute must be sent to manufacturer for repacking each 6 years including the rocket.

Figure 2-48 Parachute case with rocket

The activation mechanism

The activation mechanism is made of a Teflon Coating Steel Cable and an outside sleeve. (Bowden type). The activation handle has a double safety mechanism to prevent accidental launch and lock mechanism for storage and transport. The mechanism is designed to have minimal activation forces under all circumstances. This minimal resistance remains throughout the life of the system.

Figure 2-49 Activation handles inside of cockpit

Rescue system Installation

The rescue system is installed on all Sharks between the firewall and canopy/instrument panel.

Two rescue system belts are mounted to the top of engine mounting and are folded inside of rescue system box. A third belt is guided under left cockpit-frame to the rear of the cabin. There it is mounted to the top of the baggage space frame. If the system is activated, the parachute cover is broken in defined places and a strip of fuselage skin is ripped open under the left side of the cabin/canopy frame.

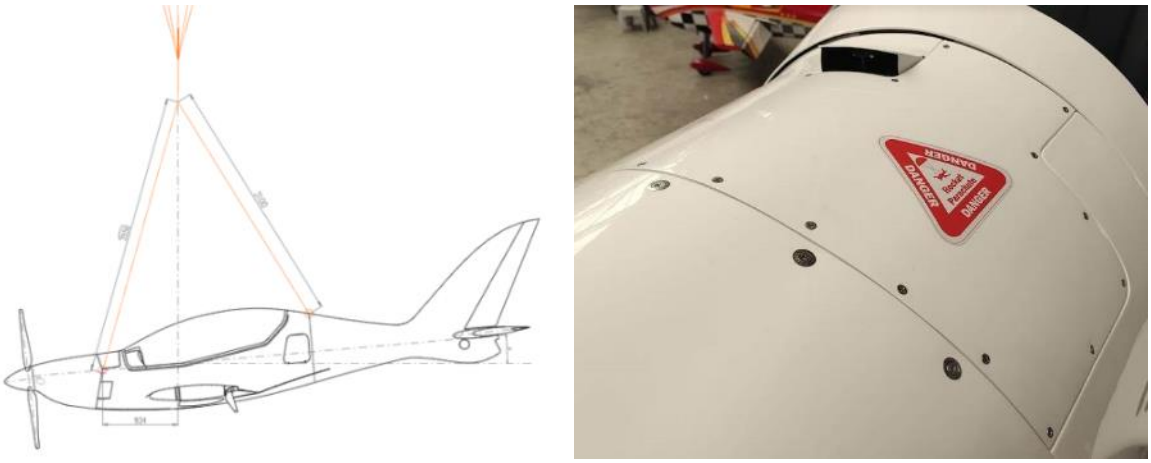


Figure 2-50 Figure 2 49 Parachute installation scheme and canopy

2.11 Pitot static system

The Pitot tube from Dynon or Garmin, located in the front bottom of the left-wing leading-edge, provides total air pressure and pressure for the angle of attack evaluation. Static air pressure intakes are on fuselage sides. Pressure distribution to individual instruments is done through flexible plastic hoses. The Pitot tube is removable, can be installed with an integrated heating system.

Keep the system clear to ensure its correct function.

2.12 Avionics

Dynon Avionics SkyView HDX

Figure 2-51 Dynon SKYVIEW HDX

Dynon SKYVIEW HDX is technologically advanced GA aircraft flying. *SkyView HDX* continues that tradition with the next generation of glass panels, including features that exceed those of systems costing much more. ***SkyView HDX*** offers fully redundant networks and systems, incredibly bright touch screen, design flexibility, worldwide terrain (synthetic vision and top-down terrain) and future upgradability unsurpassed by any other glass panel system. Displays are fully dimmable for night flight. Multi-function control knobs (left, right, up, down, diagonal, push, and rotary) offer easy and intuitive control of displays.
SkyView HDX system display and module is connected by two independent power and data buses. The failure of any bus connection or module will result in automatic fail-over to a working bus or module. Convenient program and data updates via USB memory stick.

GARMIN G3X Touch (Optional)

GDU 460 – front cockpit

Garmin G3X Touch is a cutting-edge glass cockpit avionics suite that boasts advanced features and functionality for general aviation aircraft. With a sleek, high-resolution touchscreen display and intuitive multi-function control knobs, ***G3X Touch*** offers pilots easy and seamless control of critical flight data and systems.
One of the standout features of the G3X Touch system is its fully customizable interface, which allows pilots to tailor the display to their specific needs and preferences. In addition, G3X Touch offers worldwide terrain mapping and synthetic vision, providing pilots with a detailed and

GDU 450 – rear cockpit

Figure 2-52 Garmin G3X Touch

accurate view of their surroundings, even in challenging weather conditions.
G3X Touch also features fully redundant networks and systems, ensuring maximum reliability and safety in the air. Dual data and power buses provide automatic fail-over in the event of a bus or module failure, while convenient USB memory stick updates ensure that pilots always have the latest software and data.

The system battery will provide over an hour of backup power to displays and modules.

Radio – transceiver used: Trig (Standard version)

The Trig TY91 operates on a frequency range of 118.000 MHz to 136.992 MHz with selectable channel: 760 channels at 25 kHz spacing, 2280 channels at 8.33 kHz spacing. There are two microphone inputs, suitable for conventional aircraft microphones. The TY91 radio is controlled using separate front panel controller, called TC90.

Figure 2-53 Trig TY91

The radio includes a dual-frequency listen feature in this way it is possible to check two frequencies at the same time.

Main Features:

- Frequency Range: 118.000 MHz to 136.992 MHz
- Channel Spacing: 8,33 or 25 kHz
- Channel Selection: 8,33 or 25 kHz (selectable)
- Transmitter Power: 6 W nominal carrier power
- Receiver Sensitivity: < 5uV for 6 dB SINAD
- Operating Temperature Range: – 20 ° C to + 70° C,

For more information, please see the manufacturer's manual.

Radio antenna

VHF antenna **AV-17** is used in SHARK. The range is 118-136 MHz, developed especially for "bottom mounted" position – increases the efficiency of device (communication air-to-ground).

Figure 2-54 Radio antenna

Transponder (Standard)

Dynon avionics SV-XPNDR-262

The Dynon is Mode-S transponder connects to a serial data line on each SkyView HDX Display and is also controlled via Dynon SkyView HDX. The transponder module can be mounted anywhere in the airplane that is convenient. A quick release mounting system allows for simple installation and easy removal if needed for service.

Figure 2-55 Dynon avionics SV-XPNDR-262

Transponder (Optional)

GARMIN GTX 45R (with G3X Touch)

The Garmin GTX 45R is a modern Mode-S transponder that seamlessly integrates with the Garmin G3X Touch avionics suite, providing precise ATC communication and traffic identification for pilots.

The GTX 45R connects to the G3X Touch display and is fully controlled through its intuitive touchscreen interface. This allows pilots to easily manage transponder functions, such as squawk codes and flight identification, with minimal effort. Additionally, the GTX 45R provides reliable traffic information through its advanced ADS-B In technology, which displays nearby aircraft on the G3X Touch display.

Figure 2-56 Garmin GTX 45R

Trig TT21 AND TT22

The Trig TT22 is designed to connect to a wide range of avionics systems, and its compact and lightweight design allows for easy installation in any aircraft.

The TT22 boasts a range of advanced features, including a bright and easy-to-read display, intuitive controls, and advanced interrogation capabilities. This transponder is fully compatible with the Trig TY96 and TY97 radios, as well as other popular avionics suites.

Figure 2-57 Trig TT

Antenna

TDE XPDR is a monopole transponder/DME antenna used for transponder.

Autopilot (Optional)

The Autopilot is dual-axis, controlling ailerons and elevator.

The Control System is integrated in all modern EFIS systems. Position of the two Servos is:

- behind baggage compartment
- fuselage, right side stub wing in front of spar channel

The system is activated via separate Autopilot (AP) switch/fuse on the forward instrument panel.

Figure 2-58 Elevator's servo, autopilot , ELT

The autopilot can be controlled via the main EFIS screen or alternatively via the panel/s placed on the instrument panel.

Autopilot (de)activate buttons are located on both sidesticks.

ELT (Optional)

The ELT unit is installed on a bracket behind the rear baggage bulkhead. It’s accessible by removing the cover of rear baggage bulkhead. There is small window for an easy ELT check. An antenna is placed on the upper rear part of the baggage bulkhead and it is extended above the fuselage surface.

The ELT is controlled via a control panel on the instrument panel.

2.13 Light system

Position light (Optional)

The airplane can be optionally equipped by position and strobe lights. Lights are made of streamlined transparent material with integrated LED lights.

Position lights (Red / Green / White LEDs) operate constantly. Lights are designed according to the regulations with defined angles and colors.

For aircraft delivered before February 2024, the strobe lights flash continuously when position lights are ON. For aircraft delivered after this date, there are independent switches for the position and strobe lights.

The left wing tip has a red position light combined with white strobe. The right wing tip has a green position light combined with white strobe. There also is a white strobe light on the top of vertical fin, the rudder has a “rearview” white position light plus white strobe in trailing edge.

The strobe flashes are synchronized, three flashes followed by a time break.

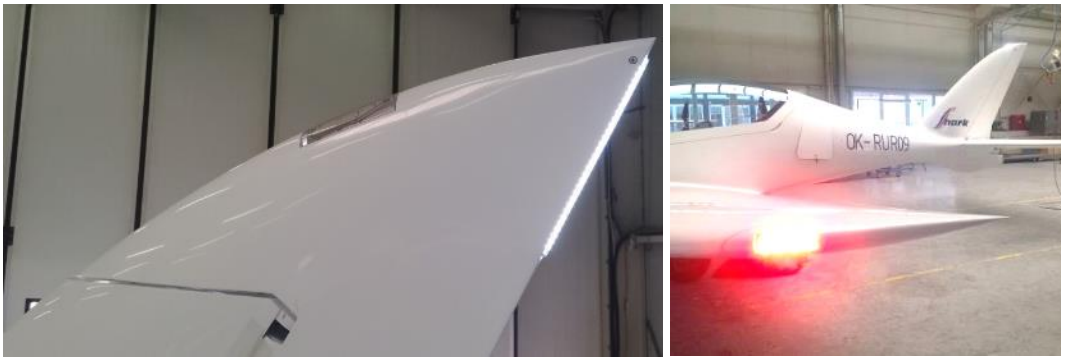


Figure 2-59 Position lights

Landing/anticolision light (Optional)

Landing/anticollision LED lights can be optionally installed in NACA intake.

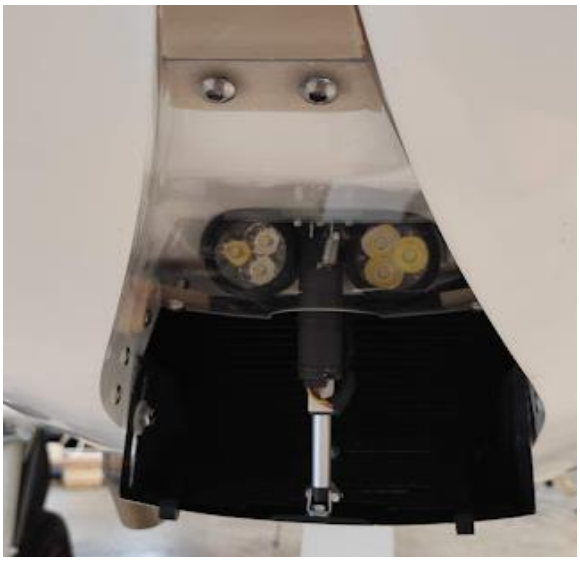


Figure 2-60 Landing light

2.14 Placard

New aircraft is equipped with placards supplied by the airplane manufacturer. These placards explain the purpose of controls, instruments, airspeed limits, weight limits, etc. Placards are usually attached to the appropriate instruments and controls. Limitation placards are attached to the canopy, external placards are attached on the appropriate aircraft part, however, placards may vary slightly from plane to plane according to registration country.

In case of placard damage or unreadability, it is permissible to copy placards (copy on suitable adhesive tape) and replace the damaged placard.

Production label

Producer : SHARK.AERO s.r.o
Serial number : XXX
Year : YYYY
Type / Model : SHARK 600

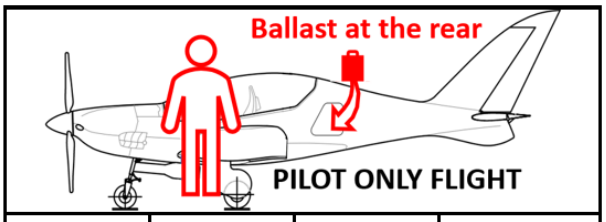
Registration Label

Registration:
Producer: SHARK.AERO s.r.o.
Type/Name : SHARK UL
Production number/year:
Empty weight: kg
Max. take-off weight: 472,5 kg

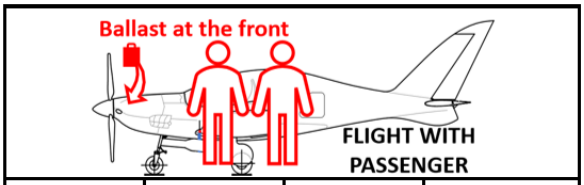
Registration:
Producer: SHARK.AERO s.r.o.
Type/Name : SHARK 600
Production number/year:
Empty weight: kg
Max. take-off weight: 600 kg

Registration:
Producer: SHARK.AERO s.r.o.
Type/Name : SHARK 600F
Production number/year:
Empty weight: kg
Max. take-off weight: 525 kg

Front and rear seat / luggage weight limit label - not used for SHARK 600F and SHARK UL



Front seat kgs		Rear seat kgs		Baggage kgs		Fuel litres	
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
55	110	0	15	0	25	0	150**



Front seat kgs		Rear seat kgs		Baggage kgs		Fuel litres	
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
55	90*	95	110*	0	0	0	25
55	100*	95	100*	0	0	0	100**
55	105	25	95	0	0	0	100**
55	110	25	85	0	5	0	100**
55	110	25	75	0	10	0	100**
55	110	25	70	0	15	0	100**

* Sum of weights on front and rear seat is 200 kg maximally.
** Maximum amount of fuel is limited by MTOW = 600 kg.

Basic information placards – SHARK 600:

AEROBATICS MANEUVERS AND INTENTIONAL SPINS ARE PROHIBITED

This product is not subject of the National Civil Aviation Authority approval and is operated at the user's own risk.

This ultra-light aircraft has been approved only for VFR day flights under no icing conditions.

This UL is operated with a permit to fly. Full proof of airworthiness requirements is not available. 2000 ft minimum altitude above ground with active AP

German planes only

This aircraft has not been flight tested for recovery from unintentional spins.

OPERATION INFORMATION AND LIMITS - speeds IAS			
Call Sign			
Empty Weight			kg
Max. Take-off Weight		**600**	kg
Max. Payload			kg
Max. Baggage Weight for 1 occ. / 2 occ.		**25 / 0-15**	kg
Min / Max. Pilot Weight		**55 / 110**	kg
Max. Passenger Weight (Rear Seat)		**110**	kg
Max. Pilot + Passenger Weight		**200**	kg
Stall Speed, Landing Configuration	**VS0**	**60**	km/h
Stall Speed, Clean Configuration	**VS**	**85**	km/h
Maximum Flap Extended Speed	**VFE**	**141**	km/h
Max. Gear Operating Speed	**VLO**	**130**	km/h
Design Maneuvering Speed	**VA**	**185**	km/h
Max. Extended Gear Speed	**VLE**	**230**	km/h
Rough Air Speed	**VRA**	**268**	km/h
Never Exceed Speed	**VNE**	**328**	km/h

OPERATION INFORMATION AND LIMITS – speeds kts KIAS			
Call Sign			
Empty Weight			**kg**
Max. Take-off Weight		**600**	kg
Max. Payload			kg
Max. Baggage Weight for 1 occ. / 2 occ.		**25 / 0-15**	kg
Min / Max. Pilot Weight		**55 / 110**	kg
Max. Passenger Weight (Rear Seat)		**110**	**kg**
Max. Pilot + Passenger Weight		**200**	**kg**
Stall Speed, Landing Configuration	**VS0**	**32**	**KIAS**
Stall Speed, Clean Configuration	**VS**	**46**	KIAS
Maximum Flap Extended Speed	**VFE**	**76**	KIAS
Max. Gear Operating Speed	**VLO**	**70**	KIAS
Design Maneuvering Speed	**VA**	**100**	KIAS
Max. Extended Gear Speed	**VLE**	**124**	KIAS
Rough Air Speed	**VRA**	**145**	KIAS
Never Exceed Speed	**VNE**	**177**	KIAS

Basic information placards – SHARK 600 UK:

OPERATION INFORMATION AND LIMITS – speeds kts KIAS			
Registration			
Empty Weight			**kg**
Max. Take-off Weight		**600**	kg
Max. Payload			kg
Max. Baggage Weight		**25**	kg
Min / Max. Pilot Weight		**55 / 110**	kg
Max. Passenger Weight (Rear Seat)		**110**	**kg**
Max. Pilot + Passenger Weight		**200**	**kg**
Stall Speed, Landing Configuration	**VS0**	**40**	**KIAS**
Stall Speed, Clean Configuration	**VS**	**47**	KIAS
Max. Gear Operating Speed	**VLO**	**70**	KIAS
Maximum Flap Extended Speed	**VFE**	**76**	KIAS
Design Maneuvering Speed	**VA**	**100**	KIAS
Max. Extended Gear Speed	**VLE**	**124**	KIAS
Rough Air Speed	**VRA**	**145**	KIAS
Never Exceed Speed	**VNE**	**177**	KIAS

Autopilot operation is not permitted below 1000 ft AGL

WARNING – EMERGENCY PARACHUTE
(Action to be taken)
Unapproved Equipment - see Pilot's Handbook

AEROBATICS MANEUVERS AND INTENTIONAL SPINS ARE PROHIBITED

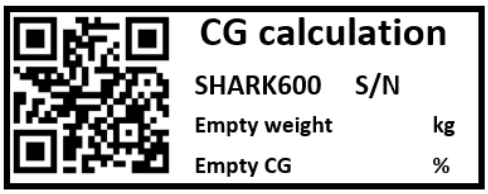
Occupant Warning: This aircraft has not been certificated to an International Requirement.

This microlight aircraft has been approved only for VFR day flights under no icing conditions.

Cockpit placard with limits:

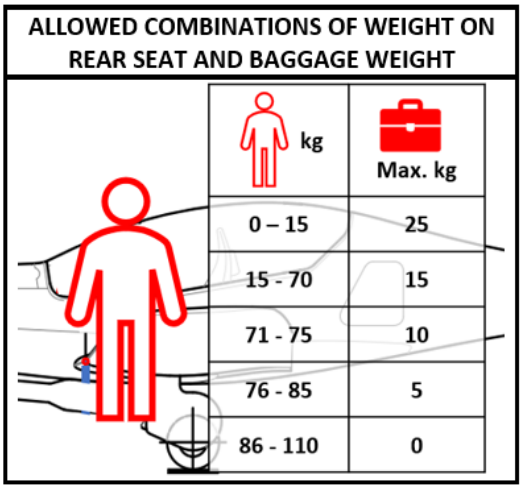
ENGINE SPEED

Max. take-off (max 5min)	**5 800** rpm
Max. continuous	**5 500** rpm
Idling	**1 400** rpm



Baggage Compartment placards:

SHARK 600



SHARK 600F

ALLOWED BAGGAGE WEIGHT
PILOT ONLY FLIGHT (1 OCCUPANT) **Max. 25 kg**
FLIGHT WITH PASSENGER (2 OCCUPANTS) **Max. 0-15 kg*** *Check actual allowed baggage weight acc. to Flight Manual, Chapter 6

SHARK UL

Aircraft outer surface placards:

FUEL TANK VOLUME LIMIT
Standard

FUEL TANK VOLUME LIMIT
Optional (Long Range)

tyre 3,0 Bar
44 PSI

On Landing Gear

NO STEP

On the Wing close to the Fuselage

NO PUSH

On Control Surfaces

Rescue Parachute Warning on motor cowling close to canopy-frame

Rescue Parachute Warning on fuselage adjacent to occupant entrance (UK only)

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TABLE OF CONTENTS

3 Operation

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3.1 Introduction

During operation of the **SHARK** it is required to have the following documentation in the plane:

- **Aircraft Maintenance Manual** for **SHARK**
- **Aircraft Flight Manual** for **SHARK**
- **Engine Operator's Manual**
- **Propeller Operator's Manual**
- Additional documents supplied with instruments or equipment used in specific aircraft

The airworthiness and operational readiness of the airplane depend upon the careful adherence to the recommended procedures and regulations.

Climate, aerodrome conditions, dustiness, manner of hangaring and other factors, such as corrosive effects of industrial or seaside areas, should be considered.

The procedures given in this manual suit average operational conditions, more harsh environments may require more frequent maintenance intervals.

3.2 Wing

Wing disassembly/assembly procedure

2 persons are needed to accomplish this task.

Necessary tools

- reverse/inertial hammer to push main wing pins
- screwdriver to tight fuel hoses rings
- socket wrench 7, 13
- fork wrench 10
- Phillips screwdriver
- grease (recommended Wurth Long-life grease III)
- safety wire + pliers
- rag
- white tape for gaps
- cotter pins 1,8x16 mm
- paper adhesive tape
- stand for placing removed wing

Wing-to-fuselage disassembly procedure

Disassembly procedures are similar for both wings.

1. Connect the aircraft to an **external power supply**
2. Drain fuel from the left and right tanks with the on-board electric pump (MASTER-FUEL PUMP). Outlet **hose 6mm dia**. (min. 1m length) connected to the gascolator on the left side in the engine compartment with **socket wrench 7**. Pump fuel into the pre-prepared fuel canisters according to the remaining fuel volume

3. After draining the fuel, disconnect the external source (MASTER-FUEL PUMP OFF) and reconnect the fuel supply hose to the engine on the gascolator with **socket wrench 7**!
4. Loosen the tie wire of the aileron rods on the left and right sides under the front seat with **pliers**
5. Unscrew the screws (butterfly screws) of the aileron rods. On the right side, the autopilot rod is connected to the screw. After loosening the tie rods, put the screws back into the steering levers

Figure 3-1 Disconnect butterfly bolt

6. In the main landing gear shaft, loosen the main wing pins with the tie wire **pliers**
7. Remove the main landing gear barrier with a **Phillips screwdriver**. 3x M5x16 on each side
8. Flap to position II (MASTER-FLAPS-II)
9. Loosen the closing cotter pin on the rear spar pin and unscrew the M8 nut with washers with **socket wrench 13**

Figure 3-2. Remove rear spar bolt

10. Pull the rear spar pin out from the flap side by turning with socket wrench 13 under slight rotation and pressure from the shaft side. Loosen the pin while pulling out by waving and rocking the wing slightly
11. Disconnect the fuel gauge connector. Release the connector by prying the binder out with **pliers**
12. Unscrew and remove a mudguard from the landing gear bay

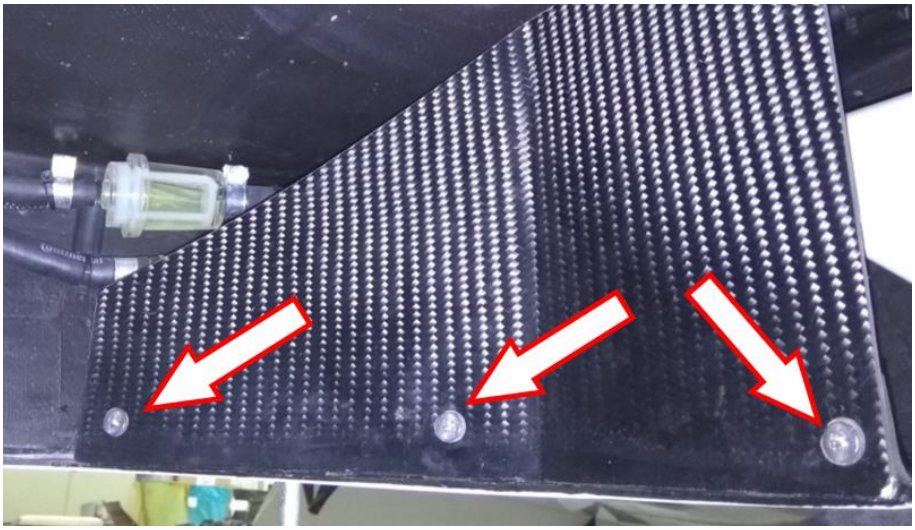


Figure 3-3 Remove a mudguard

13. Disconnect the fuel hoses at the FILTER-WING location with **socket wrench 7**. On the left side, disconnect the fuel system return line with **socket wrench 7**. When disconnecting, the fuel will drain out of the filter! **(use a rag)** Loosen the hoses by prying out the binders with **pliers**

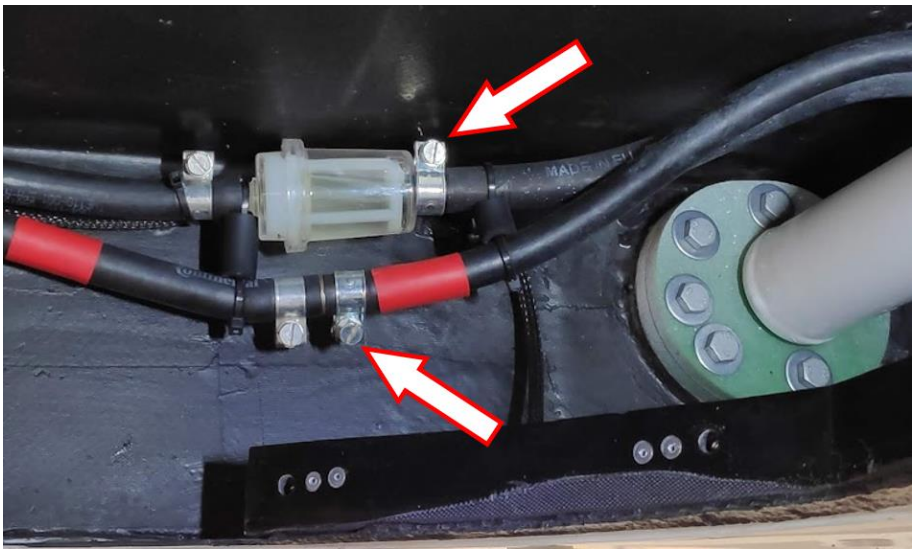


Figure 3-4 Disconnect fuel hoses

14. Disconnect the flap rod from the flap drive fork. Loosen the cotter pin, loosen the nut, and pull the bolt out of the fork with a **socket and fork wrench 10**
15. Carefully lower the flap to the down position and put back the crown nut with the correct orientation!

16. Loosen the cotter pin, loosen the nut and pull the screw out of the flap root hinge with **socket and fork wrench 10**

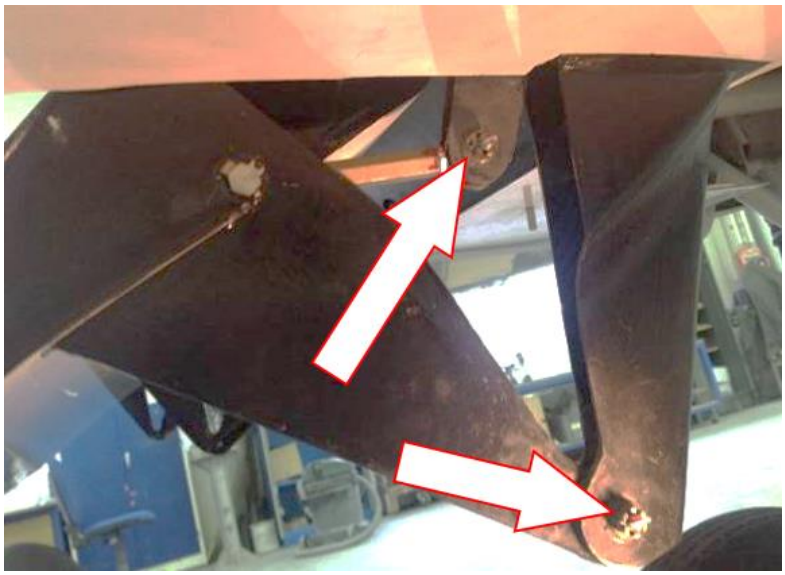


Figure 3-5 Disconnect flap control system and root flap hinge

17. Return the flap actuator to position 0 after both flaps have been released. This will secure the bolts and nuts in the fork against falling out during transport
18. Cut safety wire from wing pins. Pull the main pins out by turning the handle, if necessary using an **reverse/inertial hammer**. Loosen the pins when pulling out by waving and rocking the wing slightly

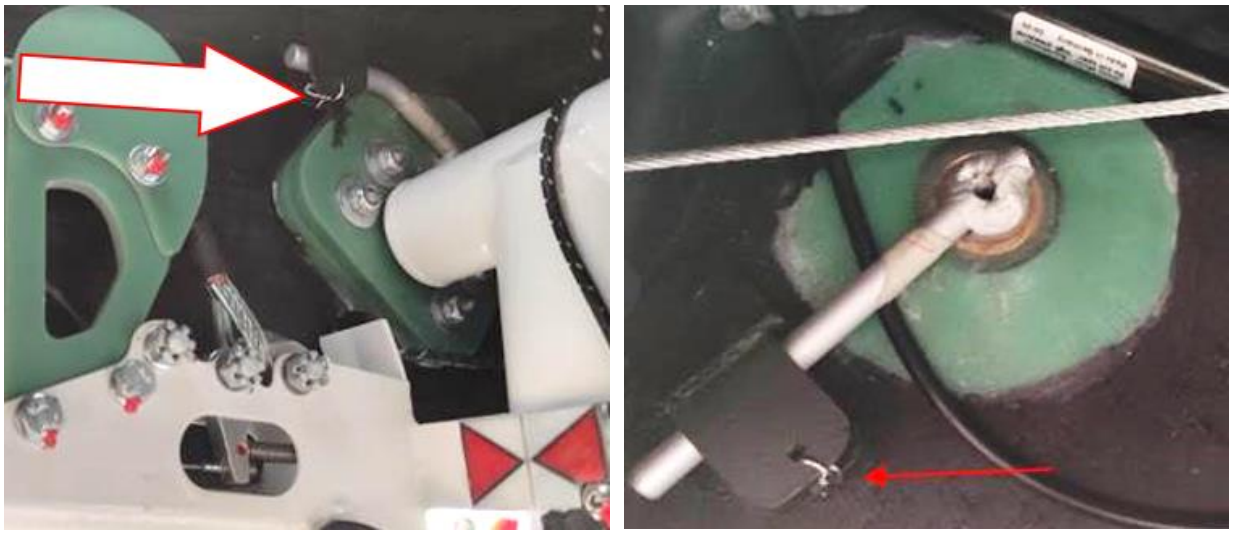


Figure 3-6. Cut safety wire from wing pins

Figure 3-7 Reverse hammer used to remove wing pins

19. Peel off the wing-fuselage cover tape
20. Secure the flexible part of the landing gear door with paper adhesive tape
21. Extend the wing by 10 cm (extend the flap root hinge from the fork by deflecting the flap rearwards) and disconnect the position light connector at the rear spar. On the left wing, disconnect the pitot-static system and the pitot tube heating connector

Figure 3-8 Wires disconnected

22. Pull out the wings, set them in the jig and secure the flap and aileron position to neutral + secure the position of the fuel hoses and flap control rods with paper adhesive tape
23. Once both wings are out, return the bolts and nuts to the fuselage flap hinges in the correct orientation and secure with paper adhesive tape to prevent them from falling out in transport

- Repeat the same steps with another wing

Wing-to-fuselage assembly procedure

- Thoroughly clean and lubricate all pins and bushings with suitable grease before the assembly. Also, lubricate the flap hinge pins and bushings, and flap steering arms, aileron control tube ball bearing
- Repeat steps 1. to 23. in reverse order
- Check all:
  - function and leakage of the pitot-static system
  - function of ailerons, stick, limit stops
  - check fuel indication at empty tanks, fill some amount of fuel, check the indicated amount of fuel
  - check fuel supply – start electric fuel pump, EFIS, check fuel pressure, change fuel valve to next tank and check again
  - check leakage of fuel hoses connection
  - check flaps free movement, stiffness, and no-free movement in system

check wing lights function

3.3 Horizontal tail unit

2 persons are recommended to accomplish this task

Necessary tools

- Socket and fork wrench 10, 17
- Plies for cotter pins
- Paper and white tape
- Grease (recommended Wurth Long-life grease III)
- Stand for storage

HTU-from-fuselage removal procedure

24. Loosen the locking nut and disconnect the trim connector
25. Disconnect elevator control rods. Loosen the cotter pin, loosen the nut and pull the bolt out of the rib with a **socket and fork wrench 10**

Figure 3-9 Remove cotter pin, bolts and electric connector

26. Once both elevator control arms are loose, return the bolts and nuts to the elevator root rib horns with the correct orientation and secure with **paper adhesive tape** to prevent them from falling out in transport
27. Loosen the locking cotter pin on the stabilizer pivot and unscrew the M10 crown nut with a **socket wrench 17**
28. Peel off the stabilizer-fuselage cover tape
29. Tilt the rudder to the left side. Push the stabilizer towards the rear by lightly striking the leading edge. There is a danger of damaging the stabilizer by collision with the rudder!
30. After disassembly, set the stabilizer in the jig and secure the position of the elevators with paper adhesive tape
31. Wrap the elevator rods with foam insulation to prevent damage to the rods during transport

Figure 3-10 Horizontal tail unit removal example

HTU-to-fuselage assembly

- Clean and lubricate bolts, pins ball bearings
- Repeat steps 23. to 30. in reverse order

- Check free movement of elevator, function of trim tab

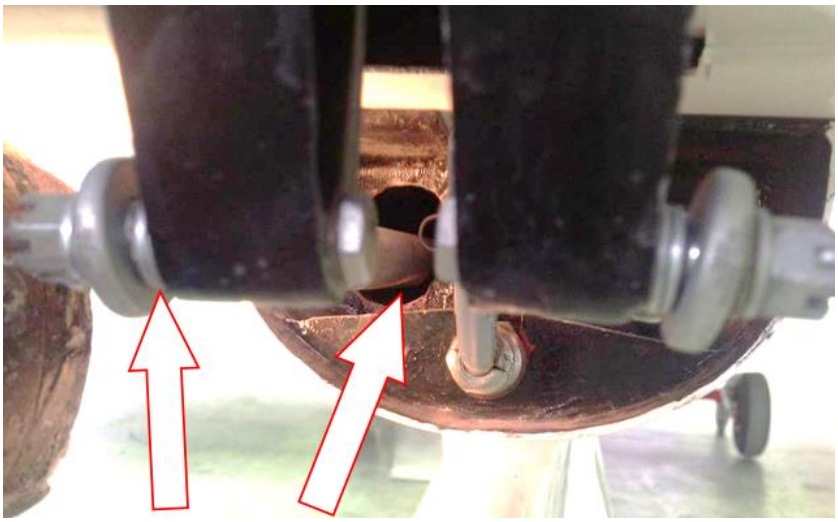


Figure 3-11 Check washer and gap between rod and washer.

3.4 Vertical tail unit

2 persons are recommended to accomplish this task.

Necessary tools

- Plies for safety wire
- Wrench 13
- Screwdriver
- Cotter pins
- Paper and white tape
- Grease (recommended Wurth Long-life grease III)
- Tool for measuring cable tension

Rudder assembly procedure

- Clean and grease pins on rudder and bushings on fuselage, bushings for control cable bolts and bolts
- Put the rudder on the fin hinges from above
- Check clearance on upper pin 0,5-1,5 mm, if needed add washers on bottom bolt

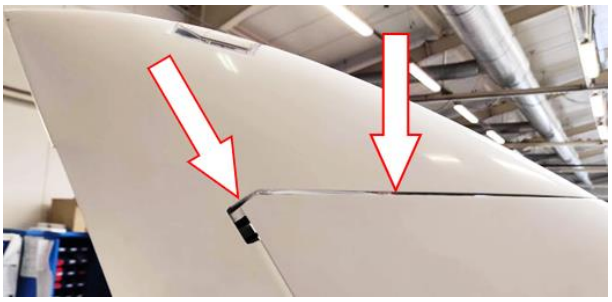


Figure 3-12 Check clearance

- Put the washer on the lower suspension bolt, tighten the castle nut – for rudder has free movement but not free play, and secure with a cotter pin

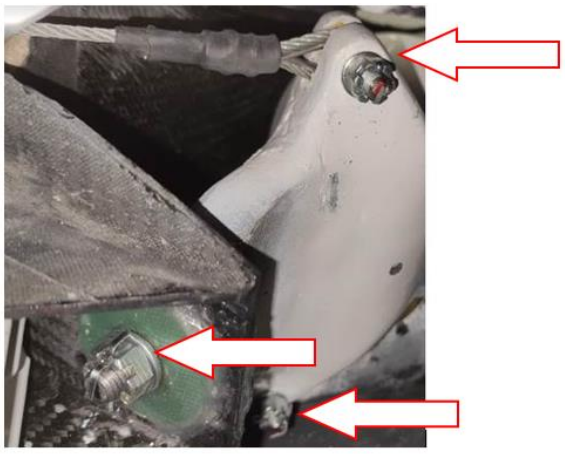


Figure 3-13 Remove cotter pin and bolts

- Attach the rudder control cables, insert bolts, nuts, washer, cotter pins
- Adjust turnbuckles so pedals are in the same position, and rudder is in neutral. Tighten turnbuckles symmetrically to reach 30 kg = 300 N tension in cables. Secure turnbuckles with safety wire

Figure 3-14 Adjustment on turnbuckles to reach required tension

Rudder removal procedure

- Remove safety wire from turnbuckles which are placed behind front pilot pedals, turn – release turnbuckles, release rudder cables

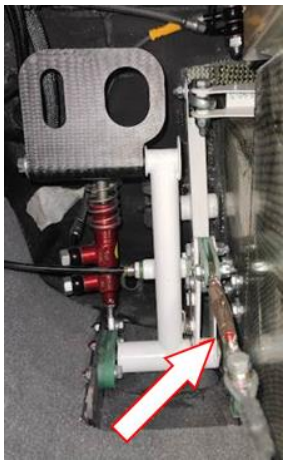


Figure 3-15. Remove safety wire and remove turnbuckles

- Remove 2 covering rings on the rear of fuselage

Figure 3-16 Fuselage ring

- Remove cotter pins from bolts fixing steering cables, remove castle nuts, washers. Pull out bolts, disconnect cables from rudder

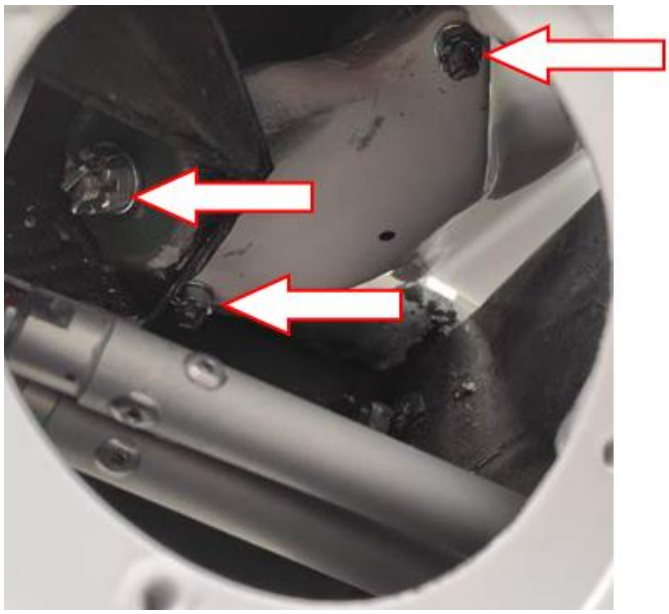


Figure 3-17 Remove cotter pin and bolts

- Remove cotter pin from the lower bolt of rudder. Remove the castle nut and washer
- Lift and remove the rudder from fuselage and disconnect lights connector
- Install bolts, washers, fuselage rings back on place, secure them with a paper tape

3.5 Engine cowlings

Upper engine cowling removing

- Open CAM-LOCs on sides and on the upper side
- Open CAM-LOCs on gills, remove gills
- Disconnect movable ballast indication connector
- Remove the upper engine cowling

Upper engine cowling installing

- Give upper engine cowling on place and let CAM-LOCs fit together
- Close CAM-LOCs on sides, on upper side
- Connect movable ballast indication connector, if applicable
- Insert gills, close CAM-LOCs holding gills

During engine test performed without upper engine cowlings, lower engine cowling needs to be fixed to engine in the front with wire or ties, otherwise the spinner can damage lower engine cowling.

Lower engine cowling removing

- Remove upper engine cowling and gills
- Remove safety wire/zip ties from electric cables and unplug landing light and mouth servo connectors
- Open CAM-LOCs, remove lower cowling

Lower engine cowling installing

- Put cowling in place
- Close CAM-LOCs
- Plug wires for landing light and servo, secure free wires by zip-tie to protect them from vibrations and exhaust
- Check sealing of water and oil radiator

NACA winter plug

SHARK is equipped with a on-ground adjustable/removable winter plug securing proper engine cooling during different periods of a year. When installed, the winter plug has 3 basic positions defined by nut inserts on NACA inlet sides. Adjusting is possible by removing 2 bolts holding angle brackets and fixing them in another position. Next adjusting is possible by turning angle brackets upside-down. It is possible to fully remove the winter plug when front bolt is released/unbolted from bottom engine cowling.

For flying in OAT over 20˚C it is recommended to have plexiglass fully opened – in the maximum upper position or removed. For temperatures below 0˚C it is recommended to have plexi adjusted in bottom position, near or fully closed.

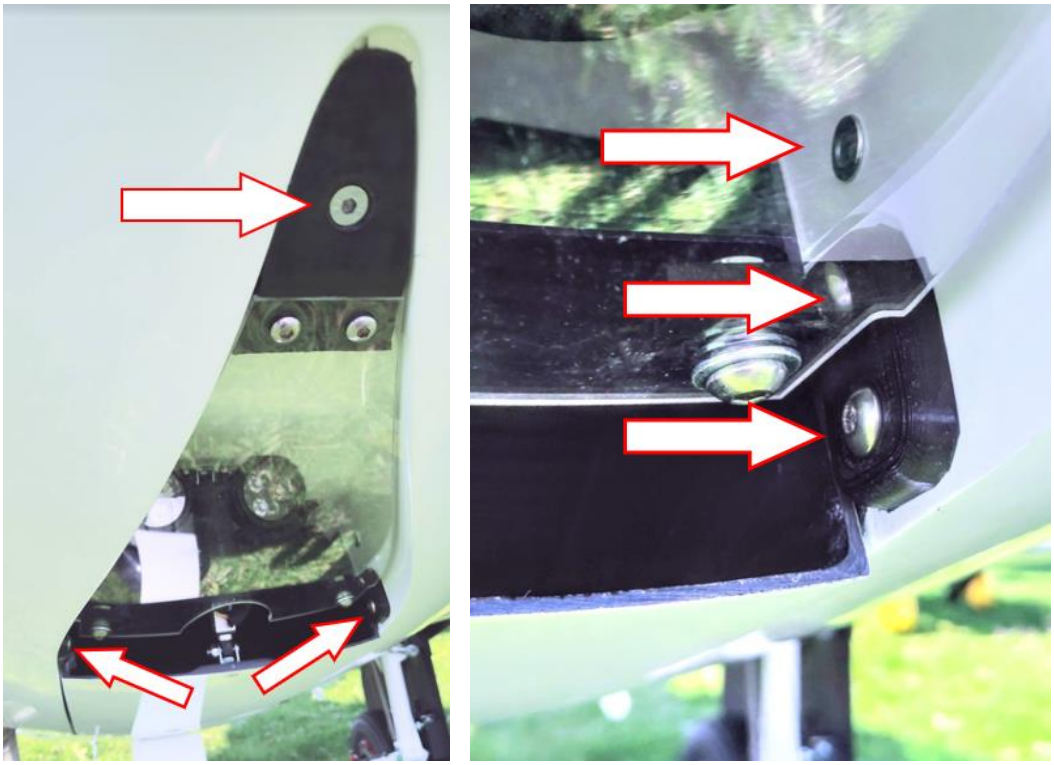


Figure 3-18 Winter plug in fully closed position, positions of nuts for adjusting

3.6 Instrument panel

For access to instruments:

- Remove 4 screws fixing instrument panel to upper cover.
- Remove 4 screws fixing bottom cover to instrument panel

Figure 3-19 Remove screws

- Remove screws fixing panel cover to fuselage, remove panel cover
- Unplug GPS antenna
- Rotate instrument panel around hinges

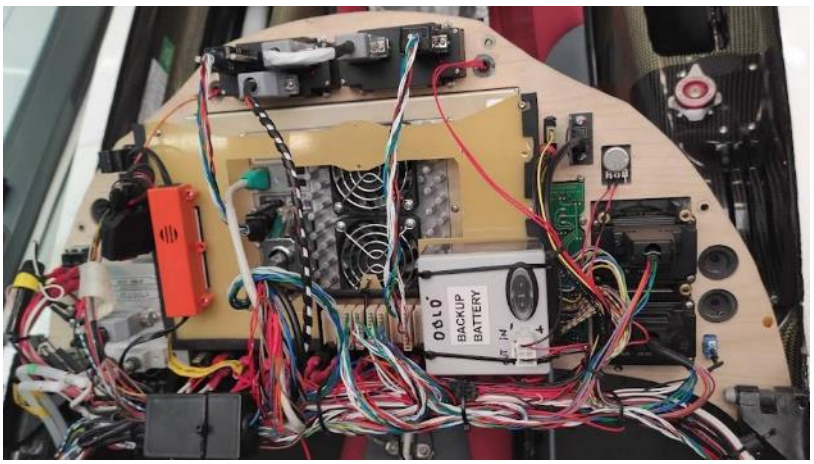


Figure 3-20 Example rear instrument panel

3.7 Seats

Disassemble front seat

- Front seat needs to be removed for better inspection, but for basic check of servo, pulleys, cables of retracting system of main landing gears – it is enough to follow this procedure
- Push the button to release the seat to the maximum forward position

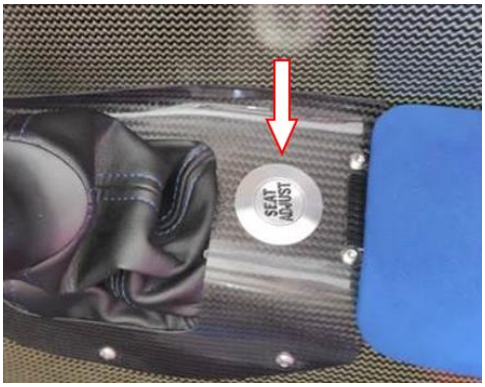


Figure 3-21 Push seat adjust bottom

- Now, you can see the gas spring at maximum forward position of the seat

Figure 3-22 Maximum forward seat

- Remove bolt (Allen key 6)

Figure 3-23 Remove bolt on seat side

- Release the gas spring from the seat
- Remove cotter pins and two bolts from the hinge. Now you can move the seat to forward position and you have access to remove cover on the bottom of interior shell

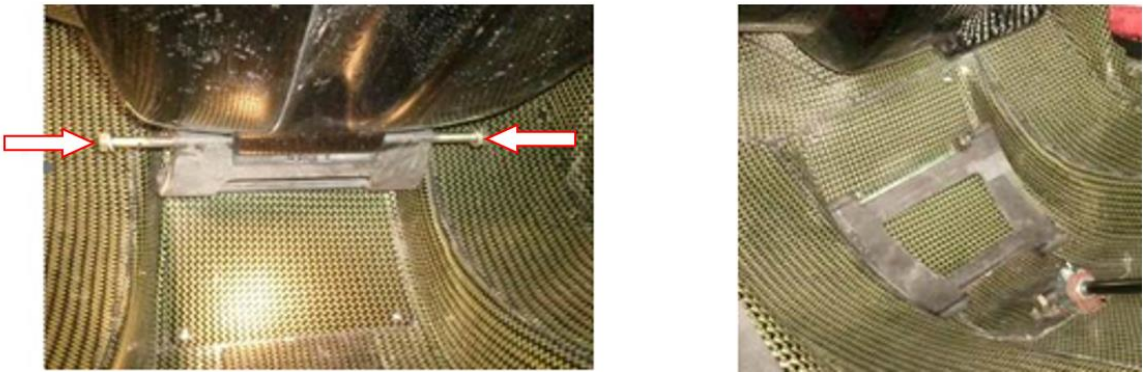


Figure 3-24 Remove bottom seat hinge

- For full removal of front seat you have to remove the bolts under the front seat. The bolts are under both sides of seat. Nuts are located inside front leg bay

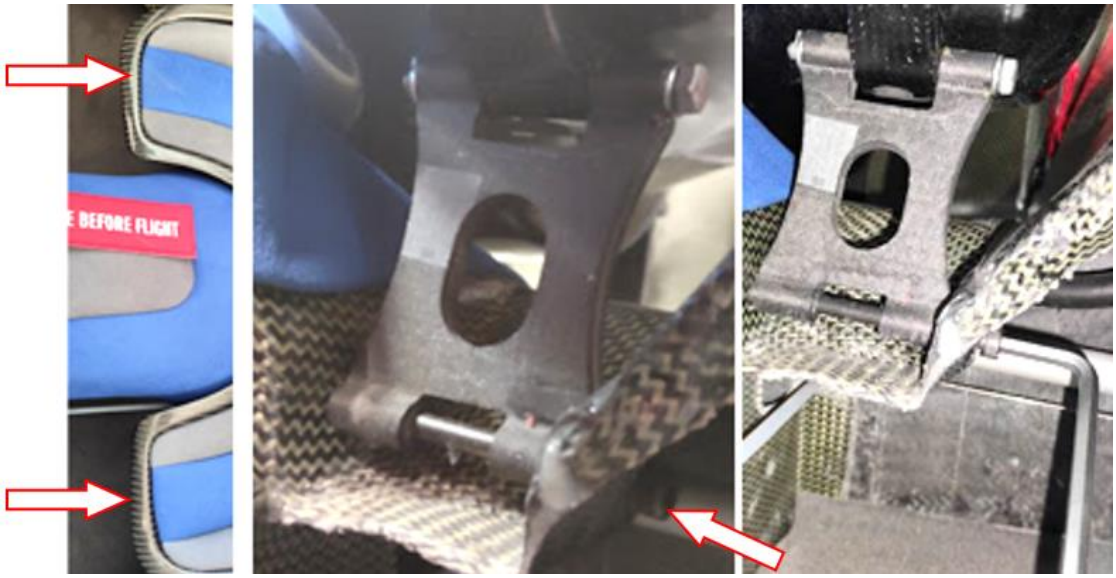


Figure 3-25 Remove bolts under the front seat

Assemble front seat

- During assembly of seat, please follow these steps in reverse order

3.8 Parachute

Disassembly of parachute Magnum 601

- Check and lock the front and rear activation handle of rocket

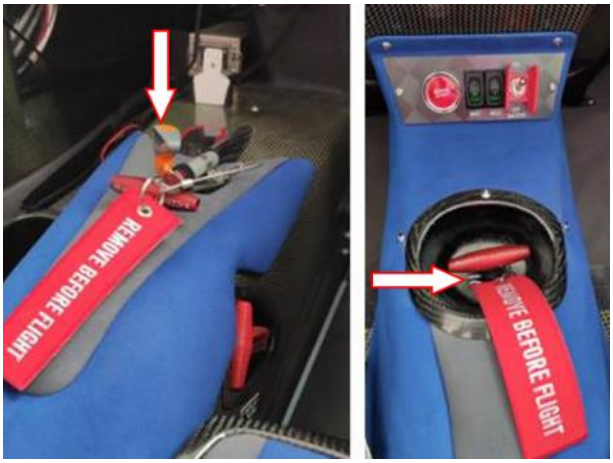


Figure 3-26 Lock activation handle

- Unscrew all screws and remove parachute cover

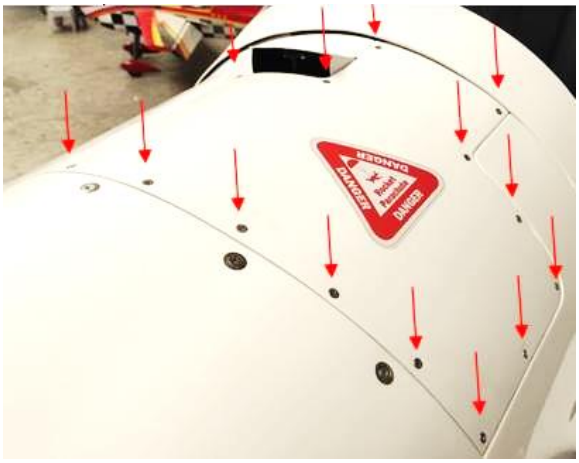


Figure 3-27 Remove all screws

- Remove the two bolts from brackets holding parachute bag

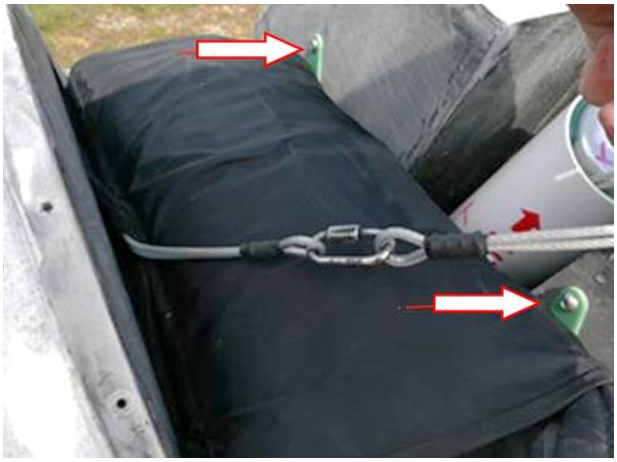


Figure 3-28 Remove screw holding parachute bag

Dismount the small carbine to disconnect parachute from rocket and also big carbine of belts connecting parachute with airframe

Figure 3-29 Dismount carbines

- Now remove the parachute bag and belts out from container

Disassembly of ballistic device rocket engine type for Magnum 601

- Remove instrument panel cover screws. Remove 4+4 screws from the instrument panel (4 from the panel cover + 4 under the instrument panel cover)

Figure 3-30 Remove instrument panel cover

- Remove the cover (4 screws) in the front landing gear compartment

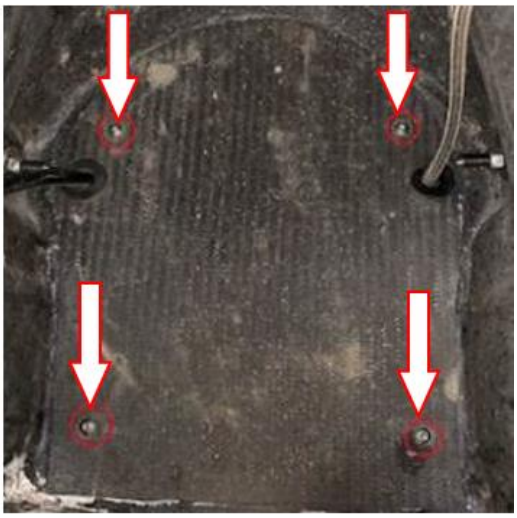


Figure 3-31 Remove front landing gear cover

- Remove the back seat tunnel cover, remove the handle, remove the safety pin, then screw the base nut

Figure 3-32 Remove cover

- Behind the back seat tunnel cover cut the zip ties, after this step you can get the Bowden cable through the removed cover back to be able to remove all unwanted parts. Get the Bowden cable released through the big service hole (be careful it is not secured) to be able to secure it before removal

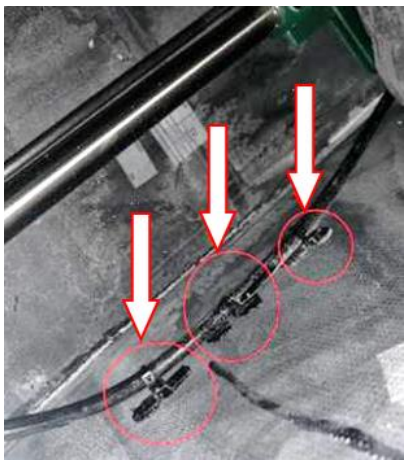


Figure 3-33 Cut zip

- On the backside of the plane, you need to prepare the handle like it is shown in the picture and only this way you will be able to dismount

Figure 3-34 Secure the handle

- Remove front seat (chapter 3.7)
- Dismount the under-seat cover

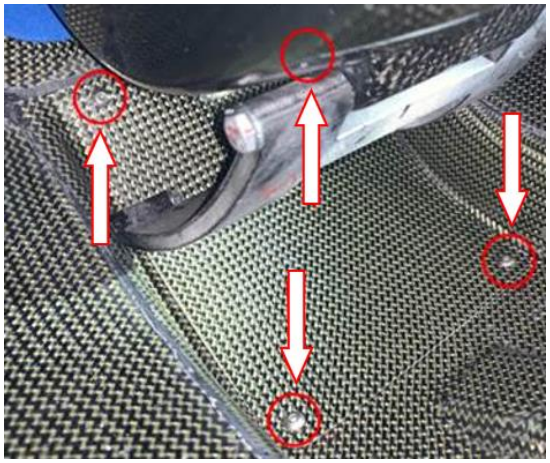


Figure 3-35 Remove cover under front sear

- Check the Bowden cable of parachute and cut out the zip ties. Also on the front seat, remove the handle and secure it like it is on the backside then remove the 2 screws. Two people are required since bottom nuts are in the front landing gear compartment

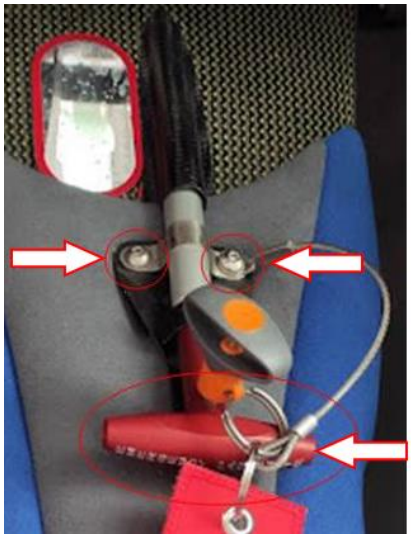


Figure 3-36 Remove screws from handle

- Cut all zip ties in front landing gear compartment which are holding the Bowden's cable
- Critical point!! After all is prepared, one person should push the back Bowden cable forward, the second person should pull it slowly; be very careful when you reach this critical point, proceed slowly. The front Bowden cable will be much easier
- After you got both Bowden cables released in front landing gear compartment you can dismount the rocket behind the control panel. Remove the regulator 2 screws, then 4 screws for the rocket

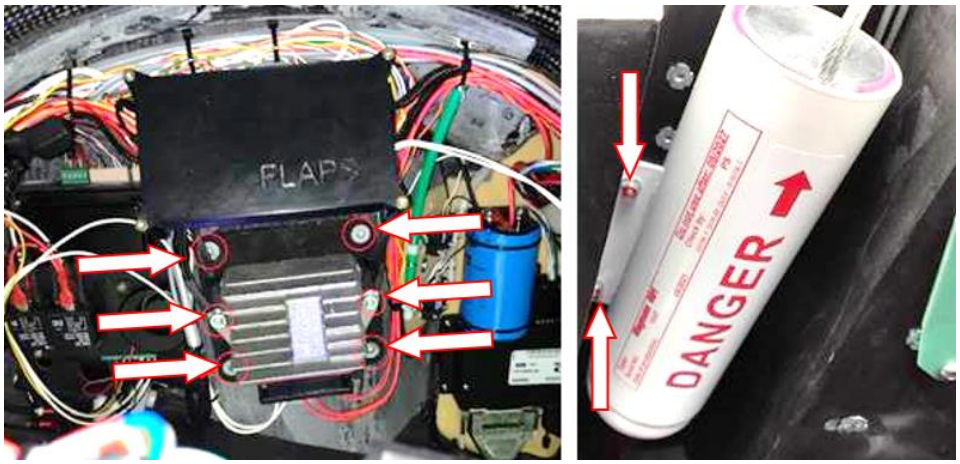


Figure 3-37 Dismount rocket

Disassembly of parachute Magnum 601

- Assembly of parachute is in reverse order

At parachute activation a rocket is fired. Rocket pulls out from container parachute in sleeve, and finally the belts are pulled out. It is needed to take care of the position of steel wire from rocket – for it is not placed over rocket. In the next step it is needed to place the belts on the side of parachute container, not over.

Figure 3-38 Position of rope

3.9 Canopy

Cockpit canopy disassembly

- Disconnect battery in engine compartment
- Remove rear EFIS, disconnect it and as well all other electric plugs. Prepare these wires for being pulled out from cabin frame if needed

Figure 3-39 Remove rear EFIS screen

- Disconnect the gas strut. It can be disconnected at the rear instrument panel or at fuselage bridge

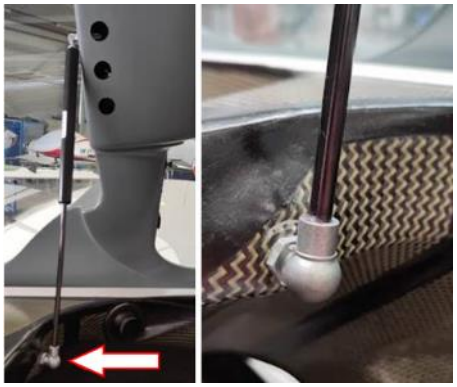


Figure 3-40 Remove gas spring

- Be AWARE, when you release the nut, the cockpit canopy will lose support. It has no stop for opening position, and if not supported it will fall and it will be damaged. You need 2 persons for holding of cockpit canopy. When you dismount the gas strut, close the cockpit canopy
- Remove hinge covers

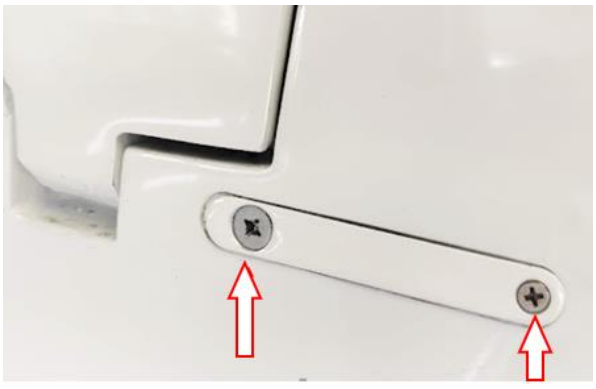


Figure 3-41 Remove hinge cover

- Screw a bolt M4 to hinge pin, do not use long screw because it can bend the pin nut. Turn it and slide maximum forward

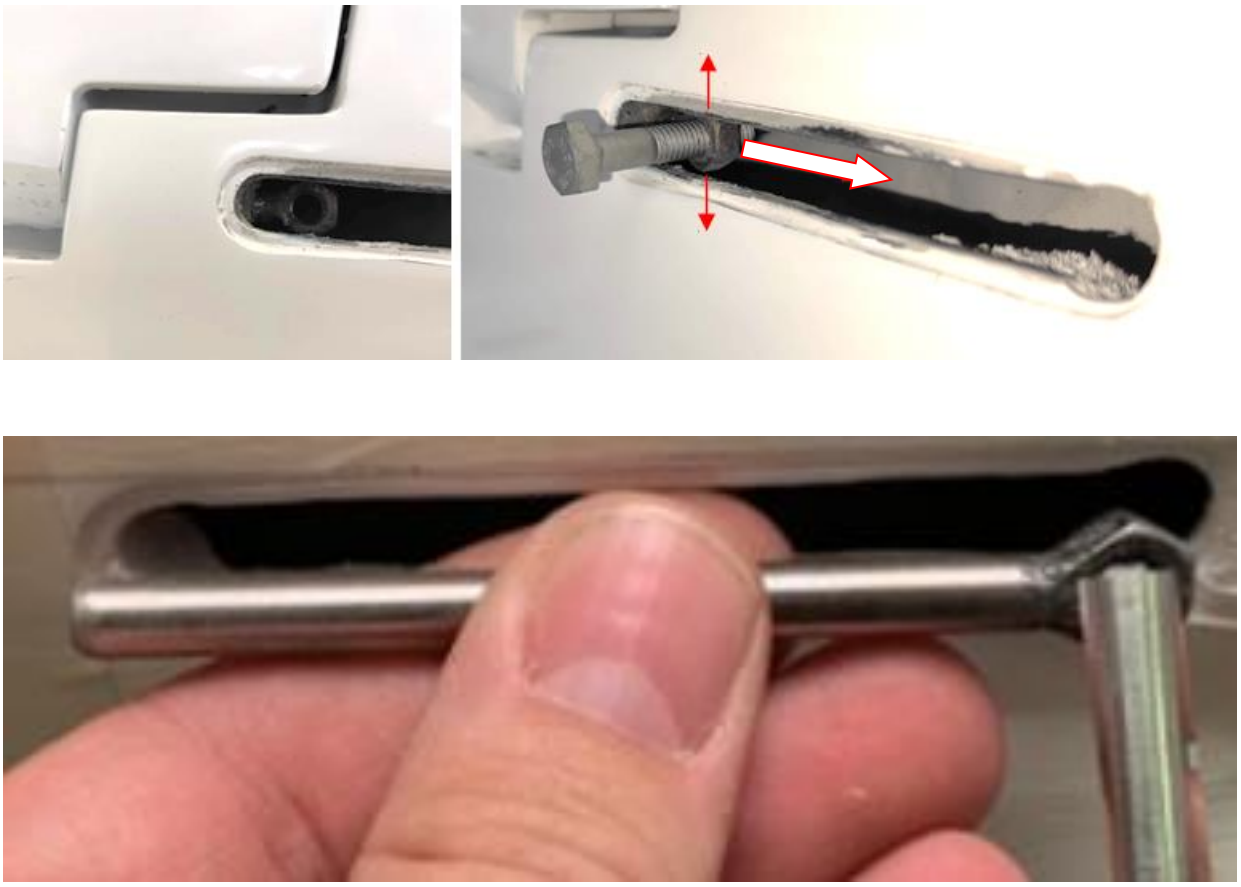


Figure 3-42 Remove pin

- Do the same procedure with rear hinge

NOTE: Be careful - don´t let the pins fall inside of fuselage.

- If you have unhinged both parts, one person must stand in front of cockpit canopy and start to slowly pull out the electric wires. When all wires are pulled out, the cockpit canopy can be removed

3.10 Main landing gear doors

Doors disassembly

- HINT – make a photo of gear door brackets to record a position of the green insert and orientation of bolts
- Unscrew 3 M6 bolts located in the metal holders. Green inserts remain attached on the door

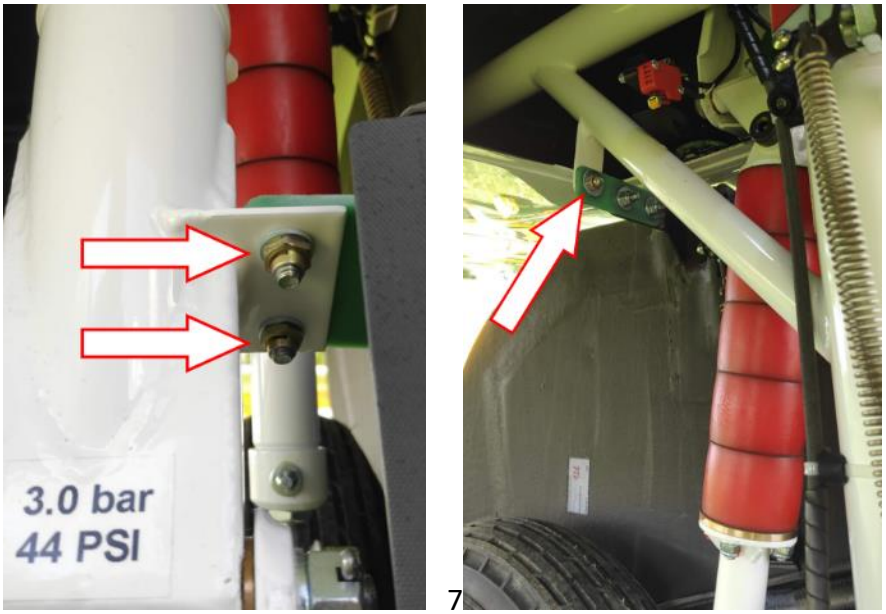


Figure 3-43 Remove bolts from metal holders

Doors assembly

- Put aircraft to lifting jacks
- Place the green inserts of door to metal holders keeping its original position – use the photo you take before disassembly for correct position. Alternatively follow the marker position lines on the green insert to set the correct (original) orientation.
- Check the hook of door holder is located behind the holding part on the landing leg

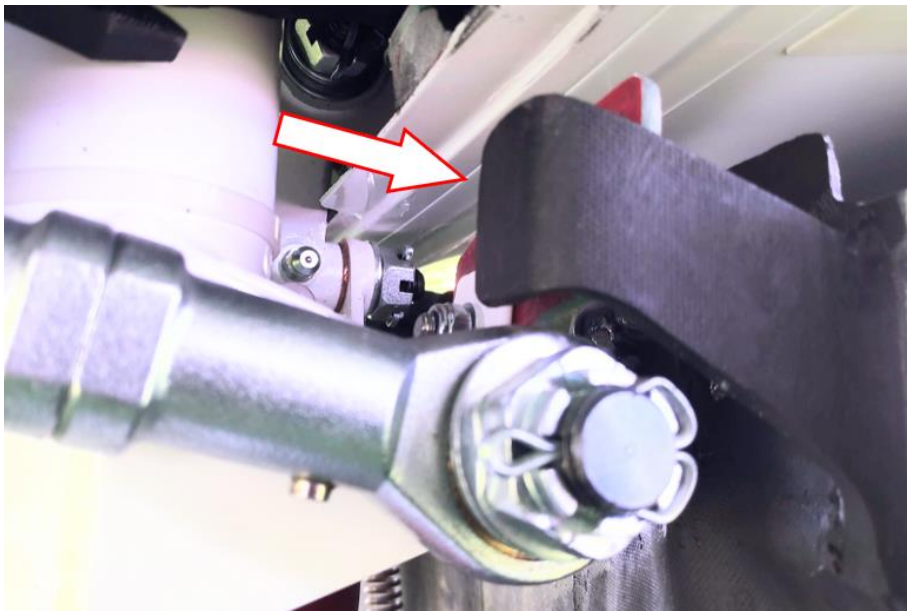


Figure 3-44 Correct hook position

- Place washers and nuts to bolts loosely, keep original orientation of bolts, big washer is located on the top bolt, small washers on the bottom ones.
- Set the green inserts precisely to lines on green inserts. Tighten bolts in following order 1. Bottom rear, 2. Bottom front, 3. Top

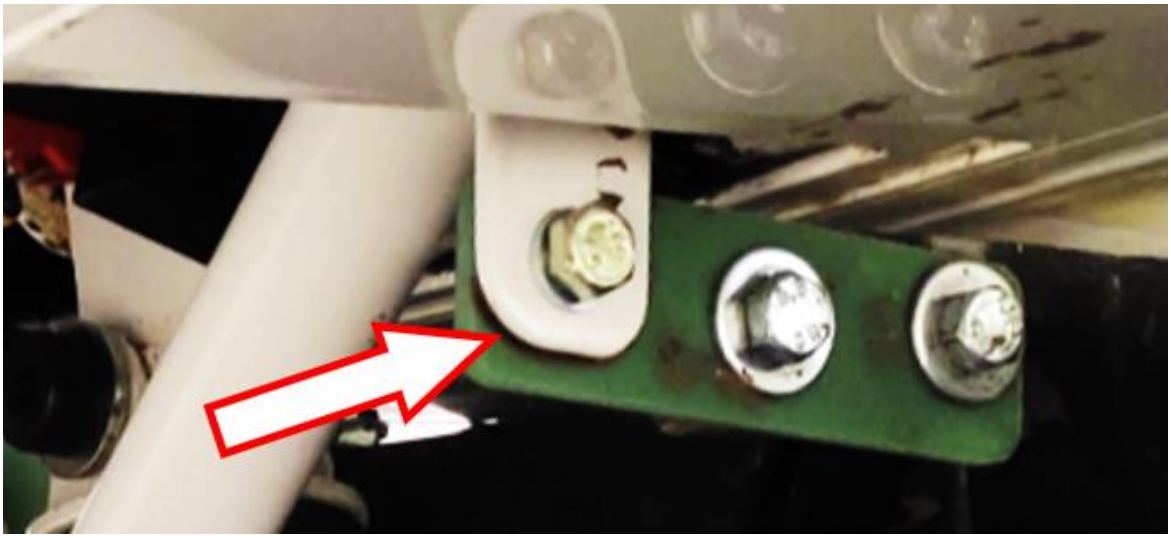


Figure 3-45 position line on the green insert

- Retract the landing gear, carefully hold the small door opened against the spring

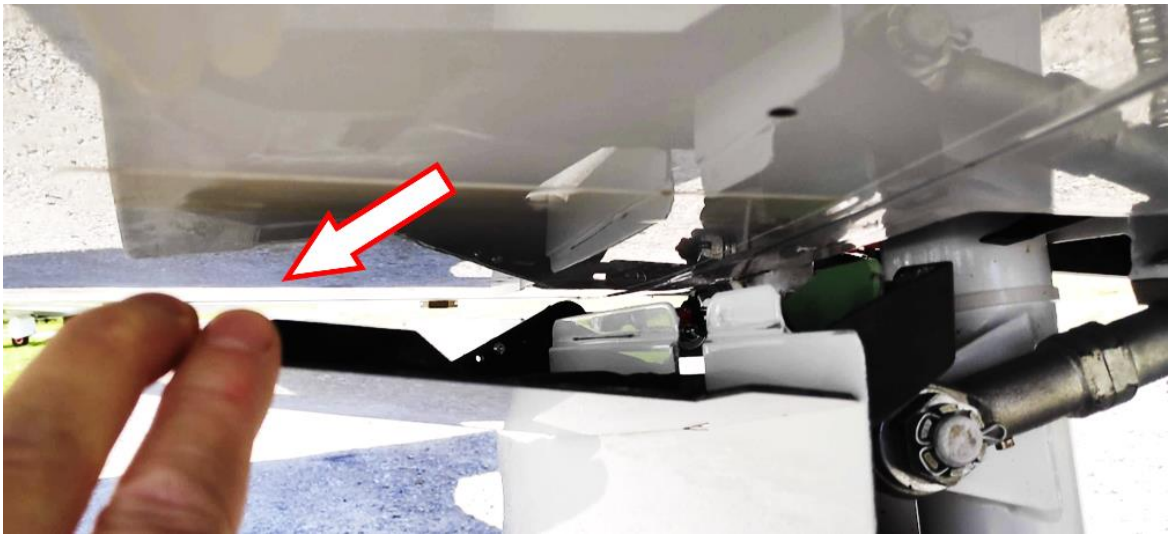


Figure 3-46 position line on the green insert

- Check correct position of closed big doors, then release the small door

3.11 GARMIN autopilot servo disconnection

In case there is such a problem with the GSA28 autopilot servo that the autopilot servo has to be removed and the pilot wants to continue flying, the "**removal adapter** (part number 011-03158-00)" must be attached to the connector that has been disconnected from the GSA28 autopilot servo and properly secured. This adapter serves to preserve the electrical characteristics of the circuit and ensures proper operation of the elevator trim.

To install the "removal adapter (part number 011-03158-00)" follow these steps.

Aileron servo

- Disconnect the connector from the aileron autopilot servo GSA28
- Connect and properly secure using the screws **the removal adapter** to the wiring connector that was connected in the autopilot servo connector GSA28

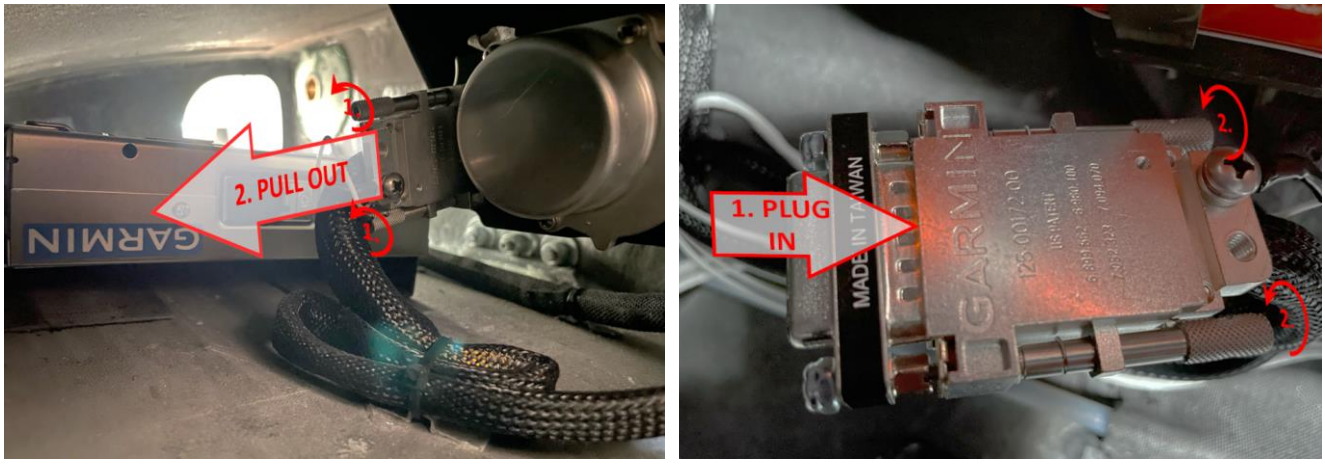


Figure 3-47 unscrew and unplug connector, plug in a removal connector into the connector and secure by screws

- Secure the wiring and connector with the removal adapter attached against movement by a cable tie

Figure 3-48 secure connector by a cable tie

Elevator servo

- Use analogic 3 steps as for Aileron servo
- Disconnect the connector from the elevator autopilot servo GSA28

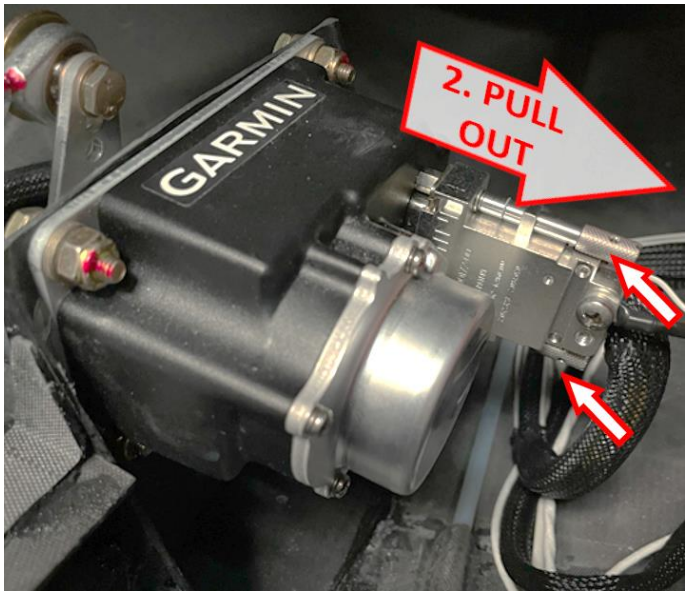


Figure 3-49 unscrew and unplug connector

- Connect and properly secure using the screws **the removal adapter** to the wiring connector that was connected in the autopilot servo connector GSA28
- Secure the wiring and connector with the removal adapter attached against movement by a cable tie

To disassemble the "removal adapter (part number 011-03158-00)" and connect autopilot servo back, follow these steps:

- Loosen the cable tie and disconnect the removal adapter
- Connect the connector to the GSA28 autopilot servo and properly secure against disconnection with the screws on the connector
- Secure the cabling against movement by new cable tie

3.12 Leveling

Leveling is an important procedure to check the geometry of specific aircraft after assembly, repairing or “hard” landing. This is necessary to perform to prove that specific parts of the aircraft are correctly fitted together. We have to measure different lengths and angles, for example the angles of attacks, angle of dihedral of wing, angles of front and main undercarriage legs, etc.

When you want to perform leveling of SHARK, you need special tools:

- Level
- Measuring tape (at least 5 m long)
- Tool for leveling of airfoil – adjustable (small V slots are centred on leading edge and trailing edge)

Figure 3-50 Example of tools for leveling

Before starting to level, be sure the control levers, flaps and elevator trim are in NEUTRAL position. The airplane should stand on level ground.

Procedure

- Measure angle of reference plane at the longitudinal direction – parallel to axis of aircraft - on front side of cabin frame. Angle should have to be close to 0° relating to ground. This is not needed to adjust, the wing and stabilizer angle is related to this measured angle
- Measure angle of reference plane at latitudinal direction – direction of wing spans. Measured on front side of cabin frame. Angle should have to be 0°. It is possible to adjust it at shock absorbers. Take in mind that different amount of fuel in fuel tanks has impact on this. This has impact on adjusting zero on artificial horizon
- Measure front leg deviation angle from vertical
- Measure angle of front leg at side view
- Measure main legs deviation angle from vertical. R+L
- Measure angle of main legs at side view. R+L
- Measure angle of attack at wing root. It is measured at connection of wing with fuselage. Leveling tool is needed. R+L

- Measure angle of attack at aileron root rib / flap end rib on the wing. Leveling tool is needed. R+L
- Measure wing upper surface dihedral angle. R+L
- Measure horizontal stabilizer dihedral angle. This should be done for both sides of stabilizer, the average is final value, should have to be zero. R+L, average
- Measure stabilizer angle of attack with elevator and trim to neutral. Leveling tool is needed. R+L, average
- Measure length between the highest tip of cabin at symmetry plane (the rear part of cabin) and the tip of horizontal stabilizer. R+L
- Measure length between the point at trailing edge (point between flap and aileron) and rear bottom tip of vertical stabilizer (tail). R+L

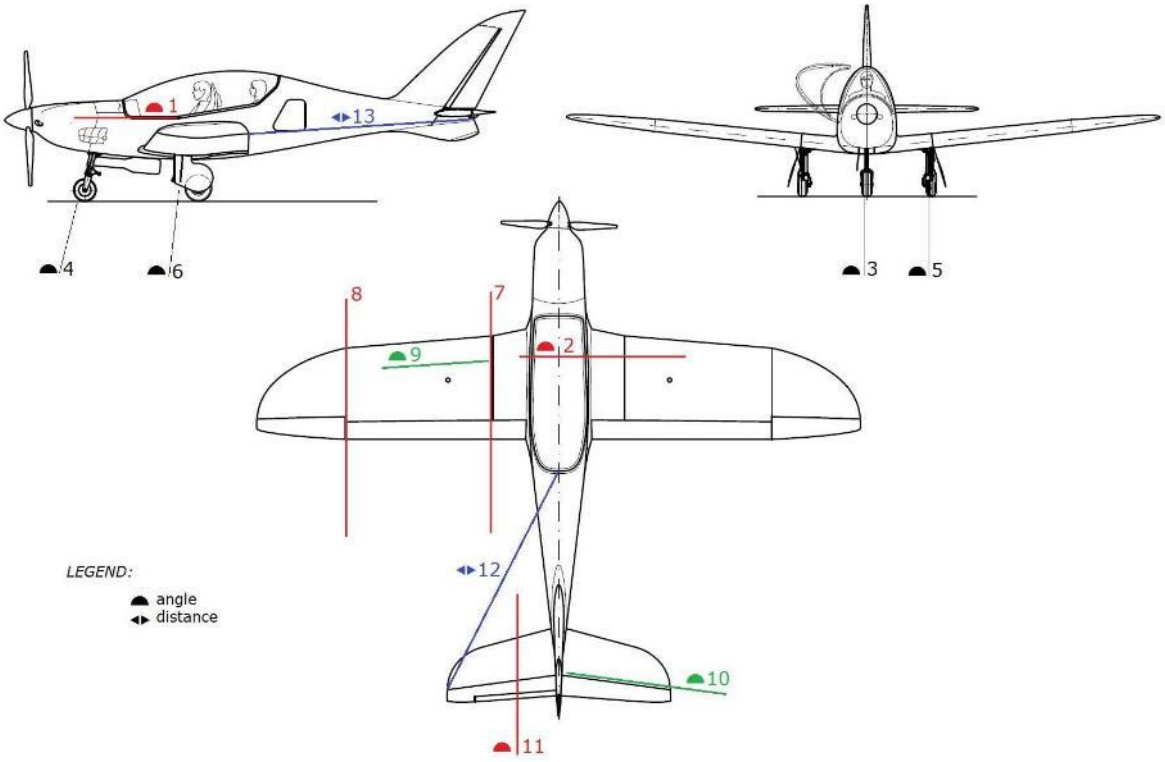


Figure 3-51 Leveling schematic

3.13 Control surface protocol

Required deflection

The deflections of the control surfaces are specified in the ***Control surfaces deflections and rudder control cables tension*** technical protocol.

ELEVATOR		**Prescribed:**
	up	26 º + 1.5 º
	down	16 º + 1.5º

elev. TRIM	**up**	15 º + 1.5 º
	neutral (down)	-6º ± 2 º
	down	30 º ± 2 º

RUDDER	**left**	35 º ± 2 º
	right	35 º ± 2 º

AILERONS	**neutral**	0 °
	up	21 ° ± 1 °
	down	14 ° ± 1 °

ANTITABS	**tab arm**	7 ° ± 2 °
	aileron arm	3 ° ± 2 °

FLAPS	**neutral (0)**	0 °
	TAKE-OFF (I)	20 ° ± 1 °
	SHORT **TAKE-OFF(II)**	30 ° ± 1 °
	LANDING (III)	38 ° + 2 °

CABLE		300 + 50 - 0 N

Electronic inclinometer with is used by the airplane manufacturer to measure deflections. Another tool can be used as well. Rudder deflection is measured with a template. Deflections of aileron antitabs are defined by arms, so arms must be checked.

Weight and static moments

Weight and static moments of control surfaces are measured and results are recorded in protocol: ***Record about weight and static moments of control surfaces and flaps.***

Aircraft control surface must be removed. Simple tools to fix pins in correct position above table are used.

Figure 3-52 Tools for weight and static moment determination

A small electronic scale is positioned below the trailing edge of the control surface at the maximum arm. Control surface is fixed to tools in horizontal position, must be free movement, on trailing edge supported with a small block of foam placed on scale. Weight of part and weight on trailing edge is recorded, and the static moment is calculated in excel spreadsheet. Elevators are measured before and after installing mass ballast.

	Weight	Mass in point of contact	Arm	Calculation	Static moment	Static moment limits
	g	g	mm		Ncm	Ncm
Aileron right			300	**Weight (g) x Arm (mm) / 981**		110 - 140
Aileron left			300			110 - 140
Rudder			330			65 - 85
Flap right			335			400 - 470
Flap left			335			430 - 510
Right elevator without balance			270			80 - 110
Left elevator without balance			270			120 - 150
				Totals		
Right elevator with balance			270			0,0 – 5,0
Left elevator with balance			270			0,0 – 5,0

Friction in control system and flaps operating force

In protocol ***Record about friction of control surfaces and flaps operating force*** is recorded measured friction in control system of ailerons, elevator and rudder. Force on flaps is checked. All control system surfaces are measured on assembled aircraft, in configuration ready to flight. Force is measured by electronic or mechanical beam-scale or load-cell. It is fixed at maximum arm at trailing edge of control surface by tape. Control surface is adjusted to neutral. Force is applied, while surface starts to move. Maximum force is recorded. In excel spreadsheet the friction moment is calculated. Rudder is measured at disconnected front leg – tail of aircraft if pressed down, nose is lifted up. Emergency release of front leg is activated – servo is disconnected from system. Then it is possible to retract front landing gear by hand after unlocking strut, and rudder control system is disconnected from front wheel steering system. Maximum flap operating force – 26 kg at trailing edge - is checked. The rope is fixed on trailing edge of left flap at root rib by tape. The rope goes through pulley fixed on table, and a ballast is hanging on other rope end – bags weighing 26 kg. Flap control system is activated, and checked if flap is able to overpower this force. Time to reach position at this load is recorded.

	Friction of control system values measured				
	up	down	arm	calculation	moment
	g	g	mm		Ncm
Aileron right			300	Weight (g) x Arm (mm) / 981	0
Aileron left			300		0
Elevator			270		0,0

	right	left	arm	calculation	moment
Rudder (retracted LG)			330		0,0

	Operating force				
	position	load (kg) *	arm (mm)	time (sec)	N/A
Flaps	0 - I.	26	335		
	I. - II.	26	335		
	II. - III.	26	335		

3.14 Permissible tolerances

The following table indicates the permissible tolerances for critical parts of the airplane.
These values should not be exceeded in operation. It is expected that an operator will take steps if excessive plays are found on/in part not listed below.

System	Procedure to find a play	Procedure to remedy a play	Max. product. play	Max. operat. play
Ailerons control system	Block ailerons up to the wing and move the control stick to the left and right	Check condition of bearings and replace if needed	*0.08 in* *2* mm	*0.2 in* 5 mm
Elevator control system	Block elevator up to the stabilizer, pull and push the control	Check condition of bearings and replace if needed	*0.08 in* *2* mm	*02 in* 5 mm
Flaps control system	Set the flaps in all position by degrees and then grab the flap trailing edge near the flap root, move the trailing edge up/downward to find possible plays	Check and change bushings in system where necessary	*0 08 in* *2* mm	*0.2 in* 5 mm
Trim tab control system	Set trim tab in neutral position and then handle the trim tab trailing edge, move the trailing edge up/downward to find possible plays	Check control servo rod and pin and condition of electric cables	*0.08 in* *2* mm	*0.2 in* 5 mm
Wing-Fuselage attachment	Move the wing tip and note play in wing suspensions	Check wing suspensions, replace pins, bushings	0	*0.08 in* *2* mm
HTU attachment	Move the stabilizer tip forward-rearward	Replace bearings in suspension points and bearings in control system	0	*0 08 in* *2* mm
Rudder hinges	Lift the rudder	Change swivel bearing or insert a washer under the lower hinge pin	*0.04 in* 1 mm	*0 08 in* *2* mm
Nose wheel	Push the rear part of the fuselage down (use a weight) to lift the nosewheel, then move the wheel forward- backward	Replace bushings	*0.04 in* 1 mm	*0.12 in* 3 mm
Main landing gear	Lift the wing tip (hold the wing under the main spar) to lift a main leg, then move the wheel forward-rearward and note play in bearings or leg attachment	Check the leg attachment and wheels attachment replace the bearings if necessary	*0.04 in* 1 mm	*0 12 in* 3 mm

3.15 Weight and balance

Empty weight

The empty weight of an aircraft includes all operating equipment that has a fixed location and is actually installed in the airplane. It includes the weight of the painted airplane, accumulator, standard and optional equipment, full engine coolant, hydraulic fluid, brake fluid, oil. The aircraft is weighed without crew, fuel and baggage and movable ballast.

Weight procedure

- Remove excessive dirt, grease and moisture from the airplane before weighing
- Remove movable ballast (if applicable)
- Weigh the airplane inside a closed building to prevent errors due to wind
- Place the scales, calibrate zero
- All tyres must have correct size and pressure
- Fluids must be filled to the normal volume and only unusable fuel amount must be in the tanks
- Place the airplane on the scales (use boards to run on the scales or lift the airplane – see airplane jacking)
- Place the airplane in a level flight position (insert suitable plates under the wheels)
- Check the configuration for weighing (e.g. empty weight)
- Weigh the airplane and record the values in *Record about the weighing and location of gravity* (make a copy of standard Record included in section Appendices)
- Compute the weight and C. G. position according to the formula *Record about the weighing and location of gravity*
- Compute and record permitted crew weight for fuelling and baggage - see Aircraft Flight Manual
- Update the placard "Load Limits" (make a new one) and attach in the cockpit

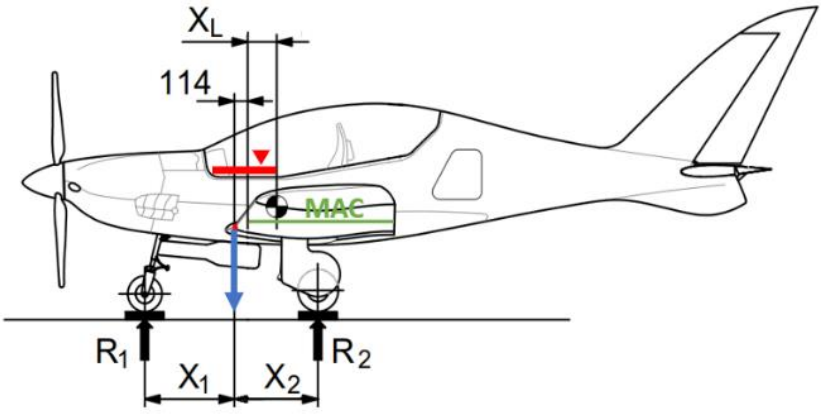


Figure 3-53 Weighing scheme

The following values have to be measured:

Front wheel reaction	R_1 =		kg
Main Left wheel reaction	R_{2L} =		kg
Main Right wheel reaction	R_{2R} =		kg
Distance between Front landing gear and reference line	X_1 =		mm
Distance between Main landing gear and reference line	X_2 =		mm

To find the Airplane Empty Weight (M_L);

$$M_L = R_{2L} + R_{2R} + R_1$$

To find the Centre of Gravity (CG) **position to MAC:**

$$X_L = \frac{(R_{2L} + R_{2P}) \cdot X_2 \quad - \quad R_1 \cdot X_1}{M_L} - 114 = \qquad [\text{mm}]$$

Centre of gravity position XT **to MAC in %:**

$$X_T = \frac{X_L \times 100\ \%}{b_{MAC}} = \frac{\qquad \times 100\ \%}{1\ 237} = \qquad [\%\text{MAC}]$$

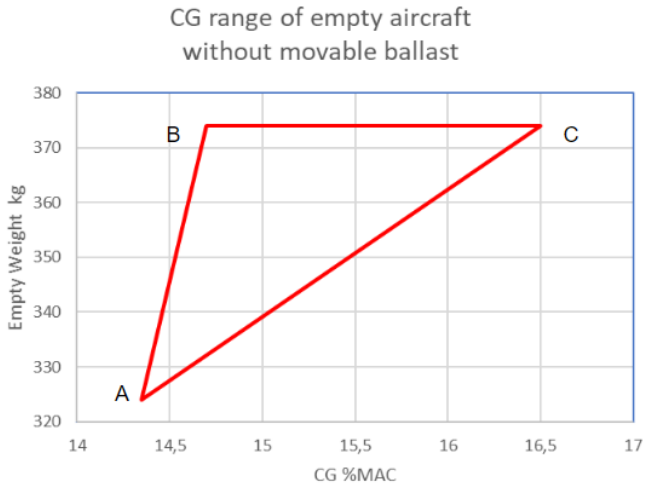
The removal or addition of equipment may result in changes to the centre of gravity and empty weight of the aircraft. The permissible useful load can also be affected. In such case a new weight and balance is necessary to determine the new empty weight and centre-of-gravity position.

The new empty weight and C.G. position should be recorded in the *Flight Manual, Record about the weighing and location of gravity*. Then a new permitted crew weight for fuelling and baggage must be computed on these new data. The cockpit placard "Load Limits" should also be updated.

Empty weight limits

SHARK 600 – Aircrafts equipped with the movable ballast

During the production process (or after a repair or modification) each aircraft will be balanced by using fixed ballast attached to engine reductor that will ensure, that empty weight and CG are inside limits given by corner points A, B, C. Fixed ballast is counted into the Empty Weight.



	Empty weight	CG %MAC
	kg	%
A	**324**	**14,35**
B	**374**	**14,70**
C	**374**	**16,50**

Figure 3-54 Empty Weight Envelope SHARK 600/600C

This will guarantee CG in flight within range 17,5-31,5%, for useful load required by rules. Then CG of empty aircraft, without movable ballast is defined by 3 corner point:

SHARK 600F – Aircrafts without the movable ballast

Version of SHARK 600F (France) does not have the provisions for movable ballast installation nor the movable ballast itself.

After production process (or after a repair or modification) following limits are applicable:

- **Empty Weight CG** **17% +/- 0,2% MAC**
- **Maximum Empty Weight** **337 kg**

SHARK UL – Aircrafts without the movable ballast

Version of SHARK UL does not have the provisions for movable ballast installation nor the movable ballast itself.

After production process (or after a repair or modification) following limits are applicable:

- **Empty Weight CG** **15 - 20% MAC**
- **Maximum Empty Weight** **330 kg**

Movable ballast – not applicable for SHARK 600F and SAHRK UL

SHARK 600/600C uses a movable ballast weight. It is a 6 kg non-structural weight that is added to the aircraft to reduce CG travel to adjust the location of the CG to keep handling characteristics within limits. The movable ballast is not counted into the Basic Empty Weight, but it must be always present on board during the flight operations, placed and secured in front or rear slot.
It is pilot's responsibility to check visually that the movable ballast is on the correct position according to following principles:

There are two positions where the movable weights can be placed;

- **PILOT ONLY FLIGHT (1 Occupant operations) - if only the pilot is on board, no passenger or heavier load is in the rear seat (less than 15 kg)** – **Movable ballast is placed in the rear position** - in the pocket located in the baggage compartment rear bulkhead, accessible through the baggage door
- **FLIGHT WITH PASSENGER in the rear seat (2 Occupant operations), or any load heavier than 25 kg placed on the rear seat** - **Movable ballast is placed in the front position** - in the pocket on engine cowling, accessible through the lid

Figure 3-55 Movable ballast engine compartment - in baggage compartment

3.16 Fuel tank tightness

In order to check fuel tank tightness, a pressure test is used. The result is reported in protocol supplement: **RECORD about fuel tanks tightness test.**

- Drain bolt, fuel cup and electric fuel level sensor have to be installed in place
- Fuel cups must be without locks, as caps with locks are not tight
- The vent hole on the outer flap hinge must be sealed
- The fuel return hose must be sealed
- T connector with connected manometer is installed on fuel hose
- Tank is pressurized to 0,25 bar and hose is sealed
- Pressure is checked after two hours
- Results are written in protocol
- If there is some leak, check hose connections and all sealed holes with water with soap

After test do not forget to release all holes –especially the vent hole in the flap hinge.

CAUTION

Be very careful with pressurization of the system. Do not use high pressure, as it can easily break fuel tank and then whole wing

3.17 Pitot-static system tightness

After maintenance work on instruments connected to the pitot-static system, or just after wing removing, it is needed to check the system tightness. The result is reported in protocol supplement: **RECORD about pitot-static system tightness test.**

- It is good to test separate systems and instruments before their installation
- But after installation it is needed to check the whole system with aircraft ready to fly
- We check line of total pressure from pitot tube
- On Dynon pitot tube it is needed to seal small drain hole on the bottom – with plastic tape
- Switch on Master and EFIS system and backup system – OBLO
- One person applies light pressure to the system by blowing to the pitot tube, another person is checking indicated speed on EFIS and backup speedometer
- At speed 150-250 km/h pitot is sealed, exact indicated speed is recorded. After 2 minutes indicated speed is checked again and recorded. Loss between indicated speed and speed per minute is calculated

- The more precise and most safe method is to use water level, 2 transparent tubes are connected to U shape, and 50% filled with water. One end is connected to T joint. The other end is connected to valve and to pitot tube
- Avoid water penetration into pitot-static system
- Pressurize system slightly through the valve, while water level show one meter step – then pressure from water column is equal to dynamic pressure of air at 40 m/s = 144 km/h. 1,5 m water step is equal to 50 m/s = 180 km/h
- After test do not forget to remove tape from Dynon pitot drain hole

CAUTION

Be very careful at pressurisation of system. Do not use higher pressure, as it can damage pressure sensors and instruments. Blow in pitot very slightly, other person must check indicated speed and report this. Never use pressure 6 bar from workshop pressure system. Never use syringe – as you have control of volume, but not of pressure – and as we have small volume in system, you can easily over pressurize and damage sensors and instruments.

3.18 Ground operation

Assembling for transportation and hangaring – Wing and stabilizer removal procedure

Refer to point 3.2 and 3.3 of this manual for wing and horizontal tail disassemble procedure.

Parking and mooring

Aircraft must be secured during parking. It is recommended to moor aircraft in bad weather conditions or when the aircraft is left unattended (overnight etc.)

Ground equipment:

- Cover of pitot tube
- Securing set for mooring
- Fabric covers
- Pitot tube has to be protected against blowing air and rain by a cover. The cover is provided with a red flag – remove before flight

Mooring

The airplane should be moored if parked outside the hangar to protect it against possible damage in case of increased wind intensity.

The airplane mooring equipment consists of the following:

- 4 mooring ground bolts
- 3 long and 1 short mooring cables
- 2 wing bolts with ring

Figure 3-56 Wing bolts with ring

Mooring bolts should be screwed in the ground and the airplane should be moored with cables as shown below:

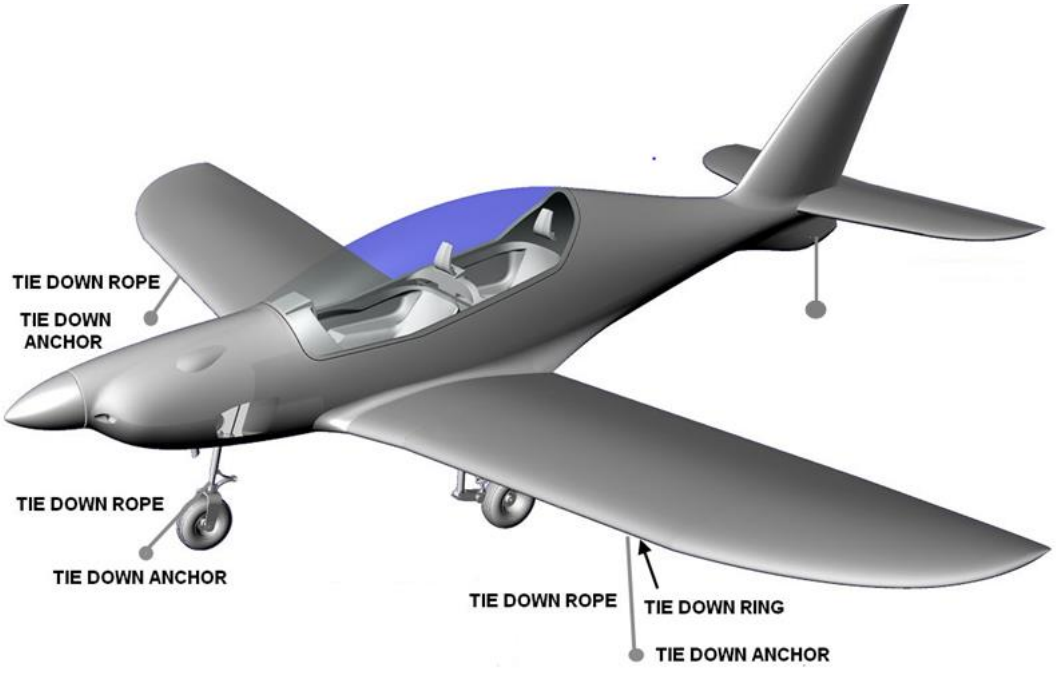


Figure 3-57 SHARK 600 mooring schematic

Hangaring

It is recommended to push the empty airplane during hangaring and parking. It is possible to use towing bar connected to axis of front wheel if the front landing gear door is dismounted.

Some surfaces are reinforced with extra layers of carbon fabric, to avoid surface damage at ground transport:

- Fuselage-fin area is reinforced with round carbon layer of 350 mm diameter. Only in this area it is possible to carefully push down fuselage to lift up nose wheel
- Leading edge of fin, 500 mm height, 100 mm width on sides
- Upper surface of leading edge of wings, 200 mm wide
- Top of leading edge of stabilizer, width 150 mm
- Surface around fuel caps
- Stepping stripe on left wing root on fuselage
- Whole upper surface of wings is reinforced, but its resistance to local load is still limited
- Spinner is reinforced
- Propeller blades can be used for towing – use only root of blades, not tips

CAUTION

The SHARK 600 composite surface is produced by the thinnest allowed layer of carbon fabric, to keep the lowest possible weight. Under the carbon fiber layer there is PVC foam with relatively low firmness and stiffness. Common finger or hand pressure can result in surface dimple, damage, and complicated repair. Gentle ground handling is therefore highly recommended

CAUTION

The airframe has integrated lifting points for landing gear maintenance. Metal brackets with nuts are bolted on the front wall of the fuselage main spar.
If the plane is lifted by pulling the wings, it is necessary to follow basic rules. The supported area should be wide enough and below wing spar, which is passing just behind bottom checking window on the wings. Otherwise wing bottom shell can be broken or damaged.

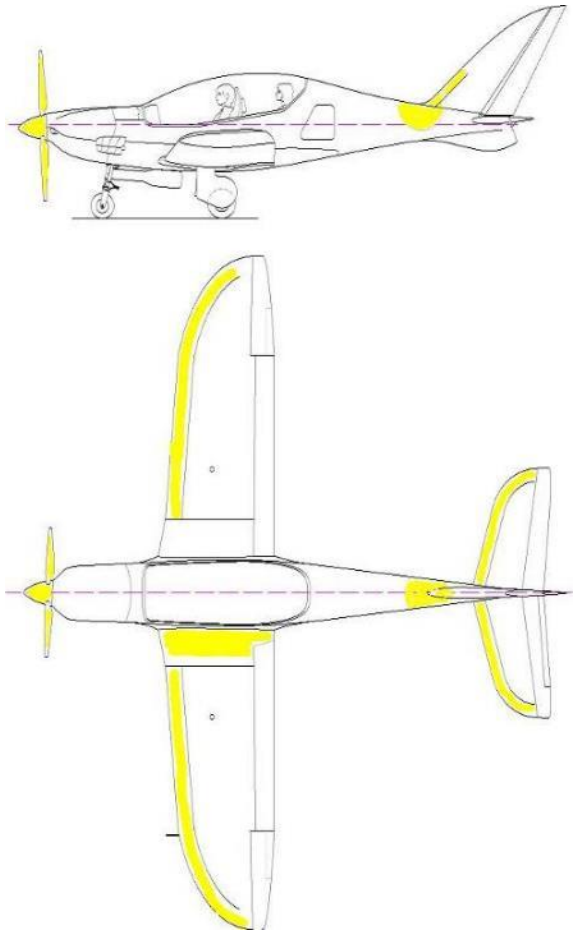


Figure 3-58 Layout of surfaces reinforced for ground handling

Towing

It is easy to tow the airplane for short distances by holding the blade root, since the empty weight of SHARK is relatively low.

Suitable surface to hold the aircraft airframe is the rear part of the fuselage before the fin. A tow bar may be used to tow the aircraft over long distances. Steerable nose wheel is equipped with stops, it is not possible to turn it around.

Table of Contents

4 MAINTENANCE

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4.1 Introduction

Airplane maintenance is required to maintain its airworthiness. Periodical inspections are performed (periodical and pre-flight inspections) along with irregular events e. g. a repair of damage as required.

- **Pre-flight inspection** Refer to AFM 4.1.
- **Post-flight inspection** Refer to AFM 4.1.

Periodical inspection intervals

The periods for overall checks and contingent maintenance will depend on the conditions of the operation and the overall condition of the airplane. The manufacturer recommends maintenance checks and periodic inspections in the following periods:

1. after the first 25±2 flight hours
2. after the first 50±3 flight hours
3. after every 100±5 flight hours or annual inspection

Refer to the Rotax 912 Operator's Manual for engine maintenance.

Refer to the propeller Maintenance Manual for propeller maintenance.

4.2 Periodical inspections Sign off sheets

The following Periodical maintenance Sign off Sheet is intended for copying and serves as Maintenance Records. It is also recommended to include small repairs, damages and their remedy or replacement.

Some parts of the airplane (engine, propeller etc.) may have special time limits – refer to the appropriate manuals for maintenance time limits and procedures.

Periodical inspections – events

Type:	S/N.:	Flight hours:	Date of inspection:
SHARK	Registration:	No. of Take-offs:	

Task No.	Maintenance task description	Inspection			Carried out by:	Inspected by:
		the first 25 hrs	the first 50 hrs	every 100 hrs		
1.	Prior to the inspection clean and wash the airplane surfaces, if needed	x	x	x		
2.	**Engine**	**See engine manufacturer's instructions**				
3.	**Engine compartment**					
3.1.	**Fiberglass engine cowlings**					
3.1.1.	Check outside condition of cowlings surface and locks- repair any damage			x		
3.1.2.	Remove engine cowlings	x	x	x		
3.1.3.	Visually check cowlings inside - repair any damage		x	x		
3.2.	**Engine mount**					
3.2.1.	Visually check condition, welded joints, welded brackets, locking of bolts, paint, firewall	x	x	x		
3.2.2.	Visually check condition of rubber silent blocks – replace those cracked and excessively deformed			x		
3.3.	**Suction / air intake system**					
3.3.1.	Visually check condition, attachment and security of air filter at carburettor inlet - clean filter acc. to the engine manual	x	x	x		

Task No.	Maintenance task description	Inspection			Carried out by:	Inspected by:
		the first 25 hrs	the first 50 hrs	every 100 hrs		
3.3.2.	Visually check condition of suction tubing	x	x	x		
3.3.3.	Check carburettor – condition: attachment, bowdens, free movement of control arms, bowls below carburettors, preheating	x	x	x		
3.4	**Battery**					
3.4.1.	Visually check attachment and security		x	x		
3.4.2.	Check charging and ballancing: Use a charger with cell balancing functionality. Allow the charger to balance the cells, ensuring each cell reaches the same voltage level.			x		
3.4.3	Visually check condition and attachment of wire leads - replace those damaged	x	x	x		
3.5.	**Wiring**					
3.5.1.	Visually check condition and integrity of wires, damage from contact with engine, damage from heat, fixed position	x	x	x		
3.6.	**Fuel system**					
3.6.1.	Visually check condition, integrity, attachment and security of hoses – replace those damaged	x	x	x		
3.6.2.	Visually check fuel filters condition, clean, replace	x	x	x		
3.6.3.	Visually check system for leaks, smell, tight clamps	x	x	x		
3.7.	**Cooling system**					
3.7.1.	Visually check radiator for condition and leaks			x		

Task No.	Maintenance task description	Inspection			Carried out by:	Inspected by:
		the first 25 hrs	the first 50 hrs	every 100 hrs		
3.7.2.	Visually check condition, attachment of hoses, check system for leaks	x	x	x		
3.7.3.	Check coolant quantity in the expansion tank – add or change coolant acc. to the engine manual if needed	x	x	x		
3.7.4.	Visually check condition and attachment of overflow bottle on the firewall			x		
3.8.	**Lubrication system**					
3.8.1.	Visually check condition and attachment of oil tank, pull out and check internal rib			x		
3.8.2.	Check oil cooler for condition, attachment and leaks	x	x	x		
3.8.3.	Visually check hoses for condition, leaks, attachment and security – replace damaged hoses	x	x	x		
3.8.4.	Check oil quantity – add or change oil acc. to the engine manual if needed	x	x	x		
3.9.	**Exhaust system**					
3.9.1.	Visually check exhaust system for condition, cracks, deformations or damage – repair / replace	x	x	x		
3.9.2.	Visually check condition and attachment of the muffler – repair / replace if needed	x	x	x		
3.9.3.	Check joint security	x	x	x		
3.10.	**Heating and cooling**					
3.10.1.	Check hot air valve function – Bowden		x	x		
3.10.2.	Check condition, function and control of the ventilating flap and eyeball ventilating valves in cabin		x	x		

Task No.	Maintenance task description	Inspection			Carried out by:	Inspected by:
		the first 25 hrs	the first 50 hrs	every 100 hrs		
3.11.	**Lubricate per Lubricating Chart**	x	x	x		
4.	**Propeller**	**See manufacturer's instructions**				
4.1.	**Blades**					
4.1.1.	Inspect blades for abrasions, cracks, paint damage, condition of blades leading edges and tips – repair according to the propeller manual	x	x	x		
4.2.	**Spinner**					
4.2.1.	Visually check spinner for condition, abrasions, cracks, paint damage – repair large damage		x	x		
4.2.2.	Remove spinner		x	x		
4.2.3.	Check prop attachment, security of bolts		x	x		
4.2.4.	Check blades adjusting mechanism		x	x		
4.2.5.	Install spinner		x	x		
4.2.6.	Check according manufacturer manual					
5.	**Landing gear** **Nose wheel landing gear**					
5.1.	**Nose wheel leg**					
5.1.1.	Check condition, attachment, gaps of the nose wheel leg – 4 bearings (lift airplane nose)	x	x	x		
5.1.2.	Check paint, welds, condition of all metal parts, condition of carbon fork, mud guard	x	x	x		

Task No.	Maintenance task description	Inspection			Carried out by:	Inspected by:
		the first 25 hrs	the first 50 hrs	every 100 hrs		
5.1.3.	Check doors, hinges, arms closing doors	x	x	x		
5.1.4.	Visually check condition of composite spring	x	x	x		
5.1.5.	Check secured cotter pins on all castle nuts	x	x	x		
5.2.	**Front wheel retracting mechanism**					
5.2.	Check function of emergency release lock – unlock and lock	x	x	x		
5.2.1.	Check servo and gas spring condition, test unlock force	x	x	x		
5.2.2.	Check position of sensors, gaps, correct fixing, wiring, flags with yellow/black arrow	x	x	x		
5.2.3.	Lift aircraft, shortcut pressure switch, connect external electric power			x		
5.2.4.	Retract leg, make emergency release			x		
5.2.5.	Unlock by hand and check free movement of leg without friction and collision			x		
5.2.6.	Make recovery after emergency release			x		
5.2.7.	Disconnect doors to be able to check retracted leg.			x		
5.2.8.	Make 3 times retracting –opening sequence. Check free movement, gaps, risk of collisions in wheel bay at retracting and at opening as well.			x		
5.2.9.	Connect doors, make again 3 times retracting –opening sequence –check doors function.			x		
5.2.10	Disconnect pressure switch shortcut, check adjustment of pressure switch – speed at switch ON.			x		

Task No.	Maintenance task description	Inspection			Carried out by:	Inspected by:
		the first 25 hrs	the first 50 hrs	every 100 hrs		
5.2.11	Check control panel diodes –front and rear seat, voice warning	x	x	x		
5.4.	**Tire**					
5.4.1.	Check tire condition, cuts, uneven or excessive wear and slippage– replace if needed		x	x		
5.4.2.	Check pressure – inflate to required pressure	x	x	x		
5.5.	**Wheel**					
5.5.1.	Visually check for cracks, permanent deformation – if damaged, replace			x		
5.5.2.	Check valve condition around the hole in the rim			x		
5.5.3.	Check condition of bearings, wheel free rotation, clearance			x		
5.7.	**Nose wheel control system**					
5.7.1.	Check free movement in steering system, up to stops, adjust 2 bolts if needed		x	x		
5.8.	**Lubricate per Lubricating Chart**	x	x	x		
6.	**Landing gear** **Main landing gear**					
6.1.	**Main Landing gear legs R+L**					
6.1.1.	Check condition, attachment, gaps in main leg bearings	x	x	x		
6.1.2.	Check paint, welds, condition of all metal parts, mud guards	x	x	x		
6.1.3.	Check secured cotter pins on all castle nuts	x	x	x		
6.2.	**Shock absorbers**					

Task No.	Maintenance task description	Inspection			Carried out by:	Inspected by:
		the first 25 hrs	the first 50 hrs	every 100 hrs		
6.2.1.	Check gap on unloaded shock absorber – lift wing or whole aircraft. If found gap – remove shock absorber and insert washers.	x	x	x		
6.2.2.	Check EFFBE PUR blocks – if “tired”, or damaged, install new.		x	x		
6.2.3.	Check metal parts, free movement, secured bolts	x	x	x		
6.3.	**Main wheel retracting mechanism**					
6.3.1.	Check function of emergency release lock – unlock and lock, check cable and cable guide condition	x	x	x		
6.3.2.	Check steel spring and gas spring condition, test unlock force	x	x	x		
6.3.3.	Check position of sensors, gaps, correct fixing, wiring, flags with yellow/black arrow	x	x	x		
6.3.4.	Lift aircraft, shortcut pressure switch, connect external electric power			x		
6.3.5.	Retract legs, make emergency release			x		
6.3.6.	Make recovery after emergency release			x		
6.3.7.	Remove doors to be able to check retracted leg.			x		
6.3.8.	Unlock by hand and check free movement of leg without friction and collision			x		
6.3.9.	Make 3 times retracting –opening sequence. Check free movement, gaps, risk of collisions in wheel bay at retracting and at opening as well.			x		

Task No.	Maintenance task description	Inspection			Carried out by:	Inspected by:
		the first 25 hrs	the first 50 hrs	every 100 hrs		
6.3.10	Install doors, make again 3 times retracting – opening sequence – check doors function.			x		
6.3.11	Disconnect pressure switch shortcut, check adjustment of pressure switch – speed at switch ON.			x		
6.3.12	Check control panel diodes –front and rear seat, voice warning	x	x	x		
6.4.	**Tires**					
6.4.1.	Check tires for condition, cuts, uneven or excessive wear and slippage– replace if needed	x	x	x		
6.4.2.	Check pressure – inflate to required pressure	x	x	x		
6.5.	**Wheel**					
6.5.1.	Visually check wheel rims for cracks, permanent deformations – replace wheel rim in case of cracks			x		
6.5.2.	Check valve condition around the hole in the disc			x		
6.5.3.	Check condition of bearings, wheel free rotation, clearance		x	x		
6.6.	**Brakes**					
6.6.1.	Check attachment of brake system hoses to the main leg			x		
6.6.2.	Visually check condition of pads – steady and symmetry abrasion of pads – replace pads if needed		x	x		
6.6.3.	Check wear of the disc			x		
6.6.4.	Check brake system for leaks – add brake fluid and bleed the system if a brake pedal has soft movement	x	x	x		

Task No.	Maintenance task description	Inspection			Carried out by:	Inspected by:
		the first 25 hrs	the first 50 hrs	every 100 hrs		
7.	**Wing**					
7.1.1.	Visually check condition – deformations, cracks or any other damage – contact the airplane manufacturer	x	x	x		
7.1.2.	Check clearance of wing pins – move the wing tip upward-downward, frontward-rearward			x		
7.1.3.	Check flap lever-hinges for condition and attachment	x	x	x		
7.1.4.	Visually check condition of wing pins, clean of system, lubrication	x	x	x		
7.2.	**Ailerons + Anti-tabs**					
7.2.1.	Visually check condition	x	x	x		
7.2.2.	Check free movement, clearances	x	x	x		
7.2.3.	Check hinges, pins, bolts	x	x	x		
7.2.5.	Check security of control rod ends	x	x	x		
7.2.6.	Lubricate per Lubricating Chart	x	x	x		
7.3.	**Flaps**					
7.3.1.	Fully extend the flaps and visually check condition	x	x	x		
7.3.2.	Check flap hinges	x	x	x		
7.3.3.	Check clearance, free movement	x	x	x		
7.3.4.	Check condition of flap control (rods, torsion tubes, joints, security)	x	x	x		
7.3.5.	Lubricate per Lubricating Chart	x	x	x		
7.4.	**Pitotstatic tube**					

Task No.	Maintenance task description	Inspection			Carried out by:	Inspected by:
		the first 25 hrs	the first 50 hrs	every 100 hrs		
7.4.1	Check pitotstatic tube attachment			x		
7.4.2.	Check pitotstatic system for leaks			x		
7.5.	**Lubricate per Lubricating Chart**	x	x	x		
8.	**Fuselage**					
8.1.	**Fuselage surface**					
8.1.1.	Visually check condition – deformations, cracks or any other damage - repair small damage or contact the airplane manufacturer	x	x	x		
8.1.2.	Visually check condition and function of baggage door, check parachute cover, antennas			x		
8.2.	**Cockpit canopy**					
8.2.1.	Visually check canopy condition for – cracks, scratches, any other damage - drill end of cracks	x	x	x		
8.2.2.	Check canopy hinges, locks, gas spring for condition and operation	x	x	x		
8.2.3.	Check function of windows		x	x		
8.2.4.	Check canopy sealing, install new if needed		x	x		
9.	**Horizontal tail unit**					
9.1.	Visually check condition - deformation, cracks, scratches, and any other damage – contact the airplane manufacturer	x	x	x		

Task No.	Maintenance task description	Inspection			Carried out by:	Inspected by:
		the first 25 hrs	the first 50 hrs	every 100 hrs		
9.2.	Check rear castle nut, safety pin, elevator rods bearing, bolts, nuts, cotter pins, trim connector	x	x	x		
9.3.	Check elevator free movement	x	x	x		
9.4.	Check elevator hinges, root ribs	x	x	x		
9.5.	Check clearance – move stabilizer upward-downward, frontward-rearward - contact the airplane manufacturer if clearance exceeded tolerances		x	x		
9.6.	Check security of joints at control lever	x	x	x		
9.7.	Trim					
9.7.1.	Visually check condition		x	x		
9.7.2.	Check hinges, control rod		x	x		
9.7.3.	Check function		x	x		
9.8.	**Lubricate per Lubricating Chart**	x	x	x		
10.	**Vertical tail unit**					
10.1.	Visually check condition - deformation, cracks, scratches and/or other damage – contact the airplane manufacturer	x	x	x		
10.2.	Remove control rings on fuselage sides			x		
10.3.	Check free movement of the rudder	x	x	x		
10.4,	Check rudder control lever, cables, bolts, nuts, cotter pins, clearances			x		

Task No.	Maintenance task description	Inspection			Carried out by:	Inspected by:
		the first 25 hrs	the first 50 hrs	every 100 hrs		
10.5.	Check bottom pin, castle nut and cotter pin, check clearance – move rudder upward-downward			x		
10.6.	Lubricate per Lubricating Chart	x	x	x		
11.	**Cockpit**					
11.1.	**Instrument panel**					
11.1.1	Visually check condition and attachment of the instrument panel		x	x		
11.1.2	Visually check condition and attachment of individual instruments		x	x		
11.1.3	Check function of instruments			x		
11.1.4	Check throttle and choke levers free movement	x	x	x		
11.1.5	Inspect completeness and readability of placards			x		
11.2.	**Seats**					
11.2.1	Visually check seat upholstery, remove, check and repair dismountable upholstery parts damages			x		
11.2.2	Visually check seats and backrests fixing condition			x		
11.2.3	Check function of the seats adjustment system			x		
11.3.	**Safety belts**					
11.3.1	Visually check condition, attachment and security			x		
11.3.2	Check the function and all safety belts hinges			x		
12	**Control systems**					

Task No.	Maintenance task description	Inspection			Carried out by:	Inspected by:
		the first 25 hrs	the first 50 hrs	every 100 hrs		
12.1.	**Elevator control**					
12.1.1	Check elevator control free movement	x	x	x		
12.1.2	Check clearance	x	x	x		
12.1.3	Check joints security	x	x	x		
12.1.4	Check control stops for condition			x		
12.1.5	Lubricate per Lubricating Chart	x	x	x		
12.2.	**Aileron control**					
12.2.1	Check aileron control free movement	x	x	x		
12.2.2	Check clearance	x	x	x		
12.2.3	Check joints security	x	x	x		
12.2.5	Lubricate per Lubricating Chart	x	x	x		
12.3	**Rudder control**					
12.3.1.	Check stiffness of movement	x	x	x		
12.3.2.	Check joint security	x	x	x		
12.3.3.	Check stops condition			x		
12.3.4.	Check condition and security of cables	x	x	x		
12.3.5.	Check tension of control cables			x		
12.3.6.	Lubricate per Lubricating Chart	x	x	x		
12.4	**Flap control**					
12.4.1	Check operation of flap and its deflections for the free movement		x	x		

Task No.	Maintenance task description	Inspection			Carried out by:	Inspected by:
		the first 25 hrs	the first 50 hrs	every 100 hrs		
12.4.2	Check flap control system (levers, rods, brackets) for the damages or clearances		x	x		
12.5	**Trim control**					
12.5.1	Check operation of trim and its deflections for the free movement		x	x		
12.5.2	Check trim control system (levers, rods, brackets) for damages or clearances		x	x		
12.6	**Complete lubricating per lubricating Chart**	**x**	**x**	**x**		
13.	**Engine Test Run (see FM)** • idling • throttle and choke levers operation • acceleration – deceleration • r.p.m. drop with either magneto switched off • max. r.p.m. • test brake system efficiency	x	x	x		
14.	**Test flight**	x	x	x		
14.1.	**Clean the airplane surface**	x	x	x		

4.3 Fluids

The fluids are:

- Engine oil
- Fuel
- Coolant
- Brake fluid

4.3.1 Engine oil

Check Rotax Engine Operator's Manual for suitable oil grades

Oil quantity

The total oil quantity in the Rotax 912 lubricating system amounts to 3,5 litres. Prior to oil check, turn the propeller by hand **(ignition switched off!!!!)** several times to pump oil from the engine into the oil tank, or leave the engine idle for 1 minute. The oil level in the oil tank should be between the min. and max. marks and should not be below min. mark.

Oil filling

The oil tank is located in the engine compartment and is accessible from a small window on the engine upper cowling. The oil level in the oil tank should be between the min. and max. marks and should not be below min. mark.

Oil emptying

Oil emptying is performed by sucking oil directly from the tank. It is not allowed to unscrew the plug located on the bottom of the oil tank to empty out the tank since it is close to the exhaust.

It is recommended to empty oil when the engine is warm.

Figure 4-1 Engine oil tank

4.3.2 Coolant

Recommended types

Refer to the Rotax 912 Service Instruction for recommended coolant types.

Convectional coolant used in automotive mixed with water is used. It has the advantage of higher specific thermal capacity than water-less coolant. The „BASF Glysantin Anticorrosion“, Glysantin Protect Plus (produced BASF)“ is example from the engine manufacturer. The engine manufacturer also recommends to use antifreeze concentrate during cold weather operation.

See Rotax Service Instruction for more information.

Coolant quantity

Total coolant quantity is about 1,5 litres.

Coolant refilling

The expansion tank is placed in the engine compartment. Verify coolant level in the expansion tank, replenish as required up to the top. The max. coolant level must be flush with the bottom of the filler neck. Verify coolant level in the overflow bottle, replenish as required. The coolant level must be between max. and min. mark.

Coolant emptying

Disconnect the hose going from the radiator into the pump (on the lowest part of the cooling system) to empty coolant into a suitable container.

4.3.3 Brake fluid

Recommended types

Only brake fluid of J 1703c (DOT3,DOT4,DOT5 or DOT5.1) classification should be used for hydraulic brake system (type for middle hard or hard operation). DOT3 has lower performance and has been replaced by DOT4. DOT4 is the most commonly used fluid in motor vehicles. DOT5 is usually silicone-based, but is not commonly used, and is not miscible (“mixable”) with DOT3 or DOT4. The DOT5.1 is not miscible with DOT5 and may also be not miscible with DOT3 or DOT4.

In the “DOT” family Beringer recommends using DOT4 because the performance is adequate, and all DOT4 brands are miscible with each other.

Brake fluid refilling

Brake fluid refilling is necessary when low brake system efficiency occurs due to fluid leak. The brake fluid filling hole is in the brake master cylinder. It is recommended to use a hypodermic needle to refill the brake cylinder. See table for suitable brake fluid types to use for refilling the brake system. Press brake repeatedly during refilling. Bleed the system after refilling. Pressurised system is recommended for refilling.

Brake fluid emptying

Brake fluid thickens during aircraft operation and absorbs water. This condition can cause brake system failures. It is not possible to determine when this may occur. The best way to prevent trouble is to change the brake fluid every year.

For detailed procedure refer to Beringer manual -producer of wheels and brakes.

4.3.4 Fuel

Recommended brands

Refer to the ROTAX 912 Operator's Manual.

Fuel quantity

The standard aircraft is equipped with two 50 l integral wing fuel tanks, optionally 75 l integral tanks. Keep in mind the maximum permitted take-off weight and CG allowed range when you refuel the aircraft.

Fueling

Fuel tank filler is located on the upper side of the wings.

The following precautions should be maintained during fuelling to prevent fire.

WARNING

- **No smoking or open flames during fuelling!**
- **Fire extinguisher should be within reach!**
- **Under no circumstances add fuel with the engine running!**
- **Connect the aircraft to ground prior fuelling!**
- **No person in the cockpit during fuelling!**

CAUTION

It is highly recommended to pass gasoline through a filter if it was not tested for water content. After fuelling, it is recommended to wait 20 min. for water to settle out on the bottom. Drain off some fuel and look for water. Avoid getting gasoline on the cockpit canopy which will ruin the Perspex canopy!!!

Fuel emptying

Use the same precautions as during fuelling.

Draining procedure

- Connect the airplane to the ground
- Remove maximum of fuel with hose with oscillating valve through fuel tank necks
- Put an empty gas can under the main LG bays
- Use drain vent valves or disconnect fuel hose inside main LG bays
- Light pressure is possible to apply through ventilating opening in flap hinges to expedite tanks draining

Smell of petrol inside of cabin

If the smell of petrol occurs in the cabin, it is needed to check all fuel hoses connections and tighten or change clamps – OETIKER 15,5 mm:

- Remove left front armrest and container. The fuel valve is placed below and there is access to connected hoses. Press OETIKER clamps, or replace them with the new one

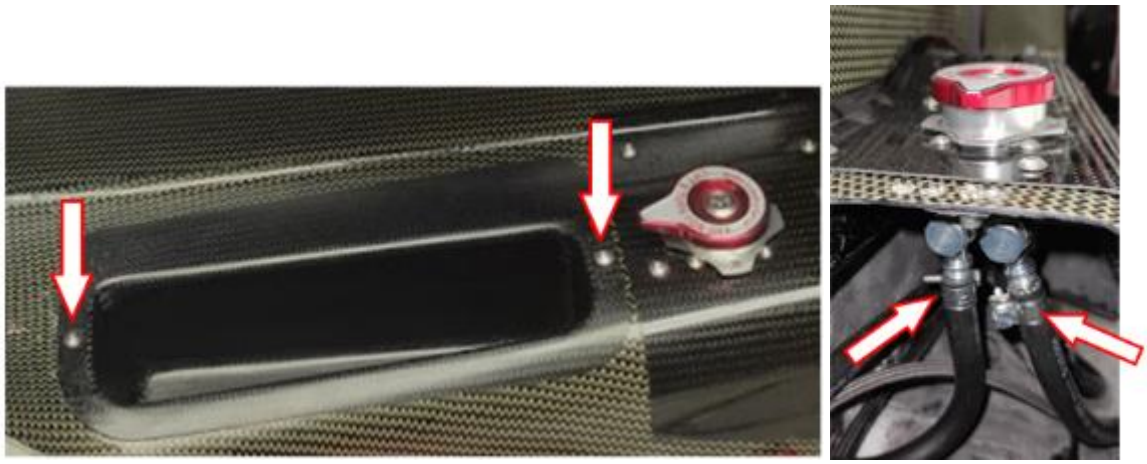


Figure 4-2 Remove front left armrest and check fuel switch

- On the front seat, left side in front below interior shell is situated electric fuel pump with return valve. Altogether there are 10 hose joints. Check all joints, tighten or change clamps

Figure 4-3 Fuel pump hoses connection

4.4 Lubrication

There are some parts, which are exposed to external conditions and varying loads. These parts should be inspected during pre-flight and periodical inspections. These parts should be lubricated as is necessary, but at least in the intervals specified below.

Recommended lubricants

Standard automotive grease is suitable to use (recommended HHS FLUID Wurth). Where lower viscosity is required, automotive gearbox oil is suitable (recommended LONG-LIFE GREASE Wurth).

Lubrication points

Unit	Lubricating point	After the first 25 hrs	Every 50 hrs	Every 100hrs	Lubricant
Prop	Adjustable props acc. to Prop Manual				
Engine	Oil change acc. to Engine Manual				
	Carburetor control in engine compartment	x	x	x	grease
	Choke control	x	x	x	grease
Nose wheel landing gear	Leg moving at spring	x	x	x	grease
	Bearings in pull rod terminals	x	x	x	grease
Main landing gear	Pins of brake pad holder		x	x	grease
	Main leg brackets		x	x	grease
	Locking strut hinges, ball bearings		x	x	grease
	Emergency release locks		x	x	grease
Wing	All movable joints of wing folding mechanism (if mounted)		x	x	grease
Ailerons	Hinges		x	x	oil
	Control hinge pin			x	grease
	Two armed aileron control levers inside the wing			x	grease
	The passages of aileron control cables			x	grease
Flaps	Hinges			x	grease
	All movable joints in cockpit			x	grease
	Flap control pins		x	x	grease
HTU	Elevator hinge		x	x	oil
	Elevator control rod			x	grease
VTU	Rudder pins			x	grease
	Rudder control cables			x	oil
Trim tab	Trim tab hinge	x	x	x	oil
	Control rods		x	x	oil
Stick control	All moveable joints in cockpit			x	grease
Rudder control	All moveable joints in cockpit			x	grease
	The passages of rudder control cables			x	grease

4.5 Torque moments

Torque moments required for screws.

Metric thread		Strength class									
		4D	5D	4S	6E	5S	5R	6S	8G	10K	12K
M4	N.m					1,67					
	kg.m					0,17					
M5	N.m					3,45					
	kg.m					0,35					
M6	N.m	4,31	4,90	5,39	5,88	6,86	7,84	8,33	9,80	13,72	16,67
	kg.m	0,44	0,50	0,55	0,60	0,70	0,80	0,85	1,00	1,40	1,70
M7	N.m	5,88	7,84	8,82	9,80	10,78	11,76	12,74	14,70	20,59	25,49
	kg.m	0,60	0,30	0,90	1,00	1,10	1,20	1,30	1,50	2,10	2,60
M8	N.m	8,33	10,78	12,74	13,72	15,69	17,65	19,61	22,55	32,36	38,24
	kg.m	0,85	1,10	1,30	1,40	1,60	1,80	2,00	2,30	3,30	3,90
M10	N.m	16,18	21,57	24,51	27,45	31,38	34,32	37,26	44,12	61,78	73,54
	kg.m	1,65	2,20	2,50	2,80	3,20	3,50	3,80	4,50	6,30	7,50
M12	N.m	27,45	36,28	42,16	47,07	52,95	58,83	63,74	74,53	104,93	125,52
	kg.m	2,80	3,70	4,30	4,80	5,40	6,00	6,50	7,60	10,70	12,80
M14	N.m	43,14	58,83	66,68	73,54	78,54	93,16	98,06	117,67	164,75	196,13
	kg.m	4,40	6,00	6,80	7,50	8,00	9,50	10,00	12,00	16,80	20,00
M16	N.m	60,80	78,45	93,16	98,06	107,87	127,48	131,29	164,75	225,55	274,58
	kg.m	6,20	8,00	9,50	10,00	11,50	13,00	14,00	16,80	23,00	28,00
M18	N.m	88,25	117,67	137,29	156,90	171,61	196,13	205,93	245,16	343,23	411,87
	kg.m	9,00	12,00	14,00	16,00	17,50	20,00	21,00	25,00	35,00	42,00
M20	N.m	117,67	156,90	176,51	196,13	225,55	245,16	274,58	313,81	441,29	539,36
	kg.m	12,00	16,00	18,00	20,00	23,00	25,00	28,00	32,00	45,00	55,00
M22	N.m	147,09	196,13	225,55	245,16	284,39	313,81	333,42	392,26	558,97	676,65
	kg.m	15,00	20,00	23,00	25,00	29,00	32,00	34,00	40,00	57,00	69,00
M24	N.m	205,93	274,58	313,81	353,03	392,26	441,29	470,71	549,17	755,11	970,85
	kg.m	21,00	28,00	32,00	36,00	40,00	45,00	18,00	56,00	77,00	99,00
Ultimate strength		37	50	37	-	50	-	60	80	100	120
9 in %		25	22	14	-	7	-	8	12	8	8
Yield point		21	28	32	36	40	45	48	64	90	108

Torque moment formula (valid for all bolt sizes):

$M_{kmax} = 1{,}065 \times ((D \ \mathbf{s} \ S) / M)$

Legend:

M_k	torque moment	kg. cm
D	bolt shank diam.	cm
s	min. yield point	kg / cm^2
M	safety factor	(M = 1,25 for **s**<50 kg/mm^2, M =1,43 for **s**>50 kg/mm^2)
S	lead of helix	cm

4.6 Maintenance operations

4.3.5 Lifting airplane

- On the fuselage main spar close to wing root ribs are bolted 2 welded brackets as points to lift aircraft. On brackets are welded M8 nuts. In the bottom skin are holes for bolts

Figure 4-4 Welded bracket for airplane lifting

- Lifting tool is finished with a M8 bolt. At lifting it is needed to screw bolt inside the bracket minimum 10 mm, to be safe

Figure 4-5 Airplane on lifting tool

- Third point to support fuselage is on tail. Soft surface sleeve-fitting to fuselage in front of bottom fin is the best solution. But a simple table with soft foam below bottom fin is enough

Figure 4-6 Tail cover for airplane lifting

- As front supporting points are close to CG, there is risk of drooping nose down at manipulation of lifted aircraft. Therefore, it is needed to add some ballast on the tail. 20 kg of sandbags or rope around tail with two 10 l canisters with water will work well. 20 kg is minimum 40 kg is the best

Figure 4-7 Example of airplane balance

There are other safe possibilities to lift aircraft, while standard lifting tool is not available.

- If it is needed to hang aircraft stored in a hangar, the best solution is to use the same brackets. It is only needed to drill a hole in the correct position to upper shell, through this hole screw long bolt with an eye on the end to the bracket
- It is again needed to support the tail of aircraft, together with added ballast to stabilize position

Another option is to wrap a rope around the spar through gap between wing and fuselage.

- Then it is needed to grind light gap in the edges of gap to pull rope through. Apply the same rule for lifting tail and add ballast on tail

Figure 4-8 Lifting by rope

- It is possible to use wide belts positioned close to leading edge and trailing edge of fuselage wing part

Figure 4-9 Airplane lifted with belts

- If there is need to only lift one leg for short time – to check shock absorber, wheel, brake – it is OK to lift by one person below wing. Be careful to apply pressure in the area where the main spar is – close to inspection window on the bottom of wing

Figure 4-10 Airplane lifted with operator below main spar

- If there is need to only lift thefront wheel, it is enough to carefully press down the stabilizer, or to put sandbags on the stabilizer. About 40 kg is needed to balance empty aircraft. NOTE: this procedure – hard blocks below wing is not a good solution – this will break bottom wing skin

Figure 4-11 Do not use hard block below wing

4.3.6 Landing gear emergency release check

The emergency release must be checked every 100h according to maintenance **protocol**.

- Lift aircraft (chapter 4.6.1)
- Switch ON Master
- Place LG service shortcut in instrument panel
- Switch ON LG breaker
- Retract landing gears
- Switch OFF LG breaker
- Pull all 3 handles of emergency release
- After emergency release check LG if all parts are OK
- Make assembly after emergency release

Recover Main Landing gear retraction system after emergency release

For this procedure you will need a special trestle and at least 2 persons even if we recommend 3 persons.

For a trained mechanic, who is fully familiar with systems, the whole procedure of recovery of landing gears after emergency release takes less than 10 minutes. It is possible to realise it even without lifting aircraft. However, lifting is highly recommended, so that a check of proper function of retracting and opening can be realised.

- The aeroplane shall be placed on the trestle-stand, it means the landing gear should not touch the ground. The trestle must be fixed under aeroplane in that position which allows retraction of landing gear without any impacts or touches of landing gear with trestle. It means no obstacles in the retracting direction. You need a special trestle which allows you to retract landing gear safely. Standard aircraft lifting tripods will not work, as they would collide with leg at opening/closing

Figure 4-12 Example of airplane on trestle-stand

- Before emergency release action the landing gear circuit breaker has to be in **OFF** position

Figure 4-13 Landing gear circuit breaker OFF

- The pressure switch is installed in the landing gear electric circuit and is situated under main board. It is connected to pitot-static system and is adjusted to speed around 120km/h. The function of this pressure switch is to prevent unintentional retraction of landing gear on the ground. Place LG service shortcut in instrument panel

Figure 4-14 LG service shortcut

- One person is lying under fuselage and catches and pulls the wires of the landing gear (one wire for each leg). These wires stick out/protrude from undercarriage bays. The wires are very short and are finished with small eye

Figure 4-15 Catching the wire- view from the front and from the rear

- The second person is also lying under fuselage. This person pushes up the locking strut of the leg to disconnect contact/signal sensor. Required force is 20-30kg. Hold these 10 seconds, while servo works = releases wire. It will stop on endswitch inductive sensor position

Watch video: recovery of main LG retraction system after emergency release step 5.

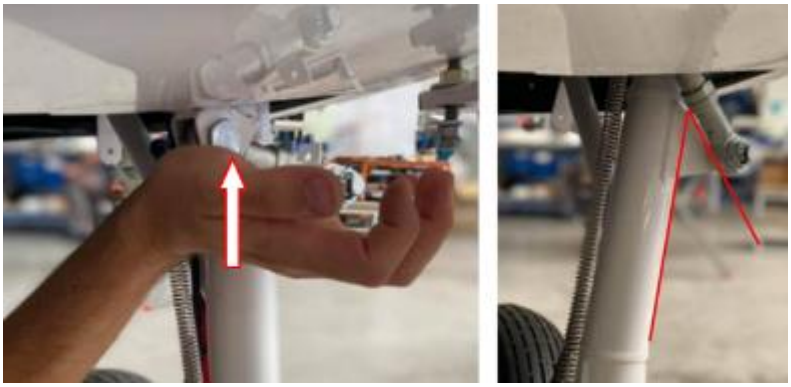


Figure 4-16 Pushing up the locking strut and hold in this position

- Third person has to:

1) Switch ON LG retracting system, wait for initialization procedure – voice + blinking

2) Push the landing gear button to down position, which is the initiation position for the servo movement

Figure 4-17 Switch on LG retracting system and push switch down

- Now, when the servo starts its function/movement, first person lying under plane and holding the wires, starts to pull/tow the wires to their maximal position (to the end of servo). **It is necessary to pull both wires simultaneously and continuously**

Watch video: recovery of main LG retraction system after emergency release step 7.

Figure 4-18 Pulling wire to its maximal position

- After servo stops, the second person can leave the leg and it will be automatically fixed in extended position

Figure 4-19 Leg fixed in extended position

- When the wires have the maximum extension, the person has to lead the wire via upper side of pulley

Watch video: recovery of main LG retraction system after emergency release step 9, 10, 11

Figure 4-20 Wire must go via pulley

- The eye of the wire must be locked in the teeth by a light press

Watch video: recovery of main LG retraction system after emergency release step 9, 10, 11.

Figure 4-21Pressing on the tooth

- After previous step, it must be checked if it is correctly locked

Watch video: recovery of main LG retraction system after emergency release step 9, 10, 11.

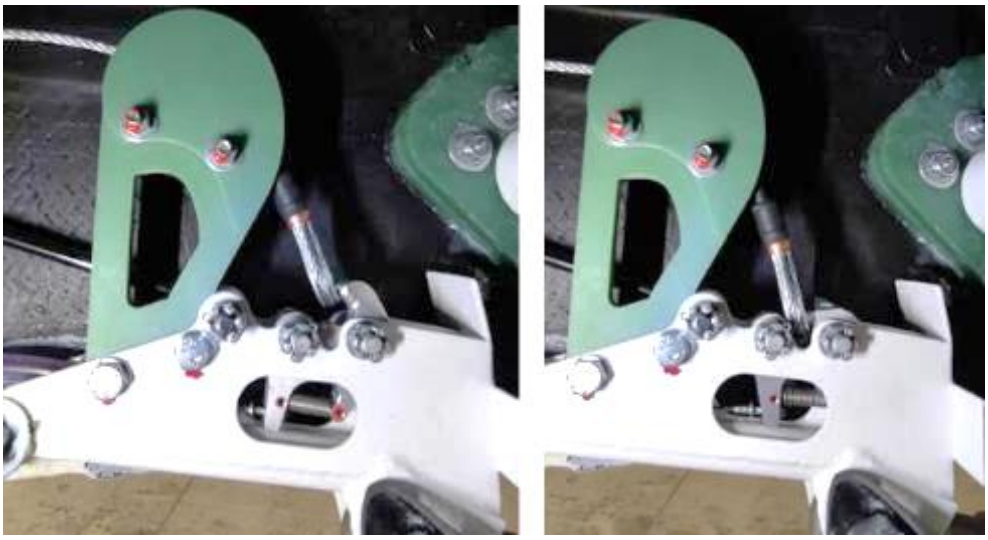


Figure 4-22 Open and locked position

- After this complete procedure, try it more times on the stand (fully opening and closing, we recommend 5 times). It is necessary to use ground power
- If everything works properly, you have to remove LG service shortcut or disconnect the wires on the pressure switch sensor

For normal operation, the shortcut must be **removed.**

- Release the aircraft from the trestle – stand

Recover Front Landing gear retraction system after emergency release

For this procedure you will need a special trestle and 2 persons.

- The aeroplane should be on the trestle-stand (Figure 4-12), it means the landing gear should not touch the ground. The trestle must be fixed under aeroplane in that position which allows retraction of landing gear without any impacts or touches of landing gear with trestle. It means no obstacles in the retracting direction. You need a special trestle which allows you to retract landing gear safely
- Before recovering procedure, be sure the emergency release handle of front landing gear is at standard position

Figure 4-23 Emergency release handle

- When you are ready, push landing gear circuit breaker to ON position *(figure 4-12).* Wait for initialization procedure – voice + blinking. Then green LED is ON = indicates landing gear fully extended
- First person is lying under front undercarriage bay. With one hand push up the locking strut of the front leg – which switches OFF proximity sensor for position DOWN = green LED information. Required force is about 30kg

Watch video: SHARK front LG recovery after emergency landing step 4,6,7.

Figure 4-24 Nose landing gear unlock procedure.

- With second hand keep wheel in unlocked position

Figure 4-25 Keep front leg in unlocked position

- Second person pushes the landing gear button to down position (Figure 4-17), to give an order to open landing gear – servo starts to push rod out

- The first person must immediately slightly lift up servo rod when second person pushes the LG button down (previous step). The support of servo for rod is necessary otherwise there is collision with the locking strut

Watch video: SHARK front LG recovery after emergency landing step 4,6,7.

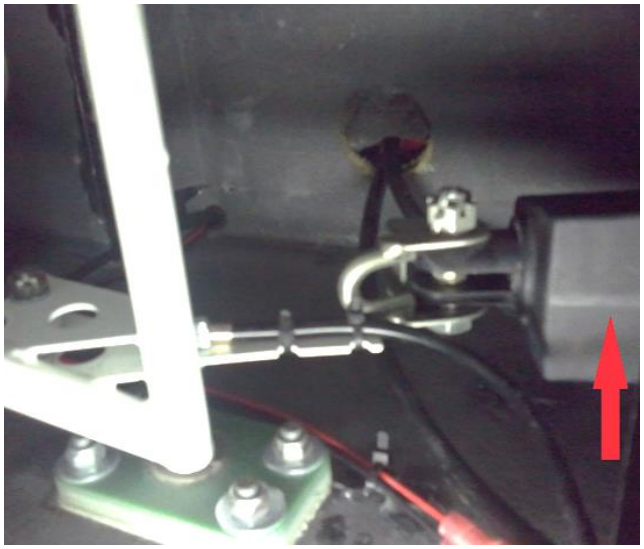


Figure 4-26 Lift up servo to avoid collision

- Servo rod is moving while sensor is OFF = strut must be hold in unlocked position until servo stops at internal end-switch. It takes about 12 seconds. When the servo stops, the slider rod has its maximal length

Watch video: SHARK front LG recovery after emergency landing step 4,6,7.

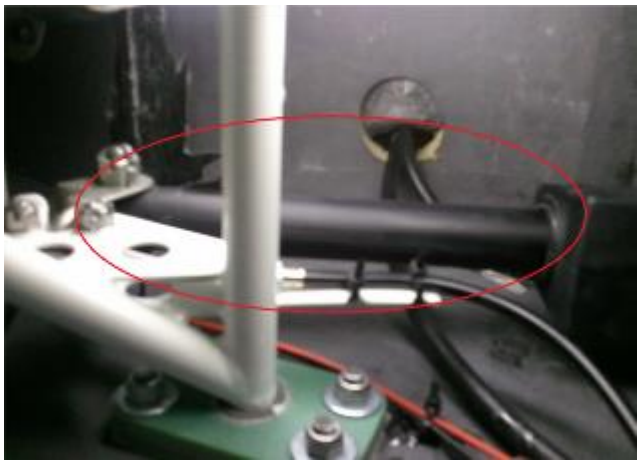


Figure 4-27 Extended rod

- After servo stops, you can release the front leg, gas spring will push it to locked position
- The eye of rod must be locked in the teeth by a press

Watch video: SHARK front LG recovery after emergency landing step 9,10.

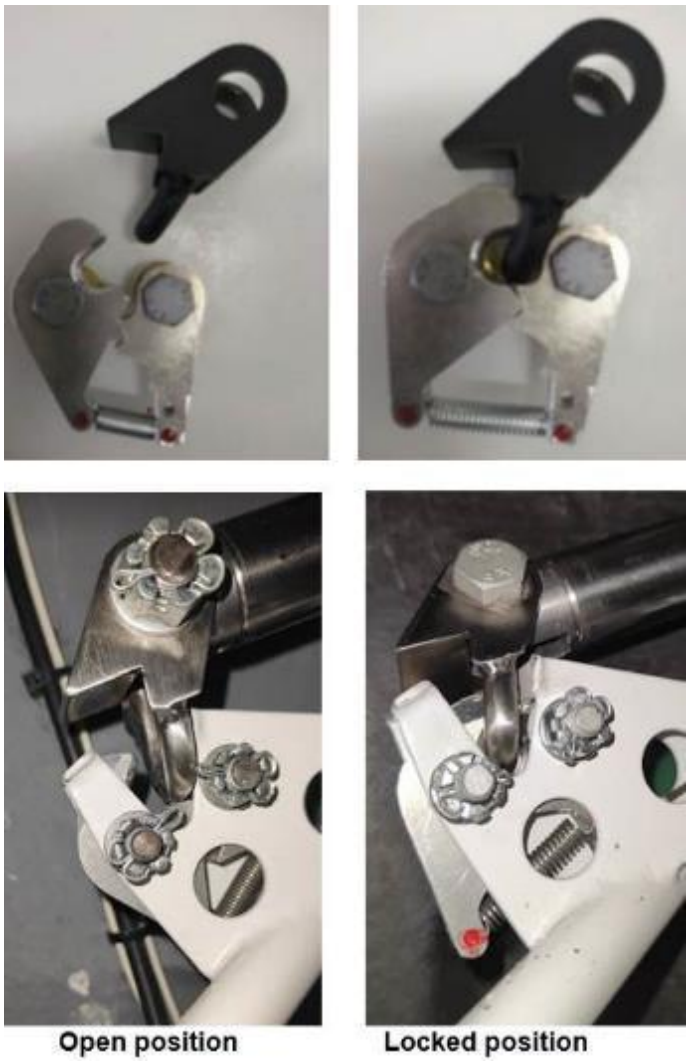


Figure 4-28 Open and locked position

- Doublecheck that it is correctly locked

Watch video: SHARK front LG recovery after emergency landing step 9,10.

Figure 4-29 Checking of locked rod eye

- After this complete procedure, try repeatedly opening and retracting landing gears on the stand (fully opening and closing, we recommend 5 times). Check the critical points (freedom of leg movement, wheel movement). We recommend using external power. On board battery is quite weak and high current needed for repeating landing gear retraction can discharge it fully and destroy it

4.3.7 Main LG retraction and opening test

For this procedure you will need a special trestle and 1 person.

Watch video: Checking of main leg after emergency release recovery.

- The aeroplane should be on the trestle-stand (Figure 4-12), it means that the landing gear should not touch the ground. The trestle must be fixed under aeroplane in position which allows retraction of landing gear without any impacts or touches with trestle. It means no obstacles in the retracting direction. You need a special trestle which allows you to retract landing gear safely
- Before checking action, we expect the landing gear circuit breaker is in **OFF** position and landing gear is fully extended (Figure 4-13)
- One person is lying under fuselage and pushes up the locking strut of the leg**.** Required force is 20-30kg

Figure 4-30 Push locking strut

- When the strut is unlocked, catch the wire from undercarriage bay and pull it down a bit and start to push the leg up

Figure 4-31 Avoid wire collision

- You have to check the freedom of operation movement. When you hold the wire, you can start to push the leg of landing gear up to its closed position
- The wheel at closed position should still be free to move. Try to turn wheel clockwise and anticlockwise

Figure 4-32 Rotate wheel to check eventual contact

4.3.8 Landing gear adjustment

- With ball bearings on locking strut rod it is possible to adjust vertical position of main leg

Figure 4-33 Ball bearing to adjust vertical position

- On shock absorbers it is possible to adjust by screwing the ball bearing, and to level the aircraft this way. Nominal length is 333 mm eye-eye. Be careful – this adjusting can cause collision of retracted wheel – as the gaps here are only 5 mm. It is necessary to check this

Figure 4-34 Ball bearing to adjust shock absorber length

- By moving sensors in brackets on landing gear bays it is possible to adjust position where electronic unit switches off servo in final retraced or opened position on landing gears - this is indicated by LED on control panel. If LED is blinking – there is not signal from end-switch, and adjustment is required. It is also important to check gap between proximity sensor and steel flag – ideal is 0,5-1 mm

Figure 4-35 Sensor adjustment, example on nose landing gear

- End-switches on main LG servo can be adjusted – this will adjust maximum travel of servo rod
- On main landing gear servo, the steel cables can be fixed in different holes – which are 3 mm apart for fine adjustment
- Adjustment of cables, end-switches and sensors are linked together – results in retracted position of leg. It is needed to keep slight gap of just very light contact of retracted leg to structure. If force is high, there is risk of stuck emergency release – force in lock is too high and unlocking is not possible

- Hinge holding servo for front leg can slide to desired position

Figure 4-36 Nose leg servo adjustment

- Front servo rod can be screwed in and out – maximum 3 turns, for fine adjustment of front leg retracting
- With 2 bolts on the nose leg, it is possible to remove gaps from steering front wheel, and also to adjust wheel to neutral position with reference to rudder neutral position

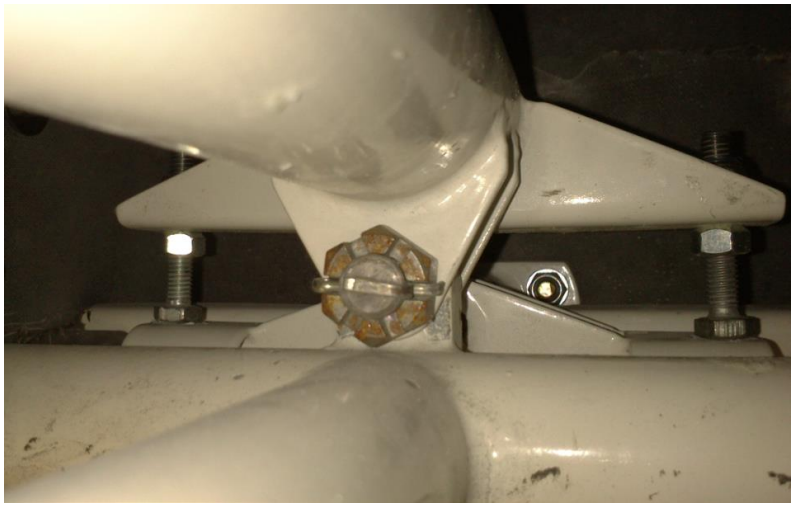


Figure 4-37 Nose leg adjusted to neutral position

4.3.9 Main landing gear servo inspection

- Front seat needs to be removed *(Chapter 3.7)* for better inspection, but for basic check of servo, pulleys, cables of retracting system of main landing gears it is enough to follow this procedure
- Remove 4 bolts from cover; remove cover. You will see pulleys, wires, end of the servo rod with hinge arm. You can check if they are OK by retracting and opening LG

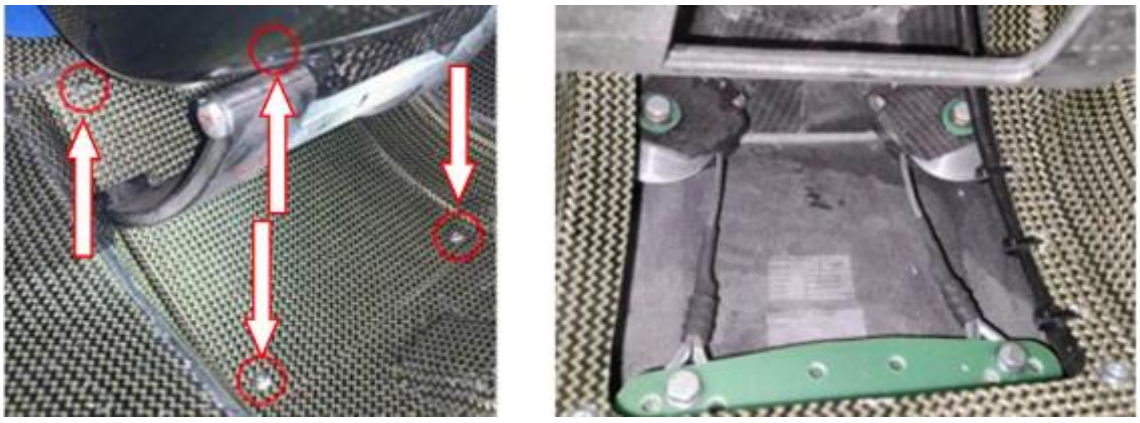


Figure 4-38 Remove cover

- When you remove fairing in front of rear seat, you can see and check servo rod traveling at opened and retracted main legs. Remove 4 screws with an Allen key 3 and place console on the side. Be aware of the electric cables

Figure 4-39 Remove fairing in front of rear seat

Now you are able to see the mechanism of the servo (rod and cables) in extended position and in retracted position.

Servo piston fully out = landing gears opened.

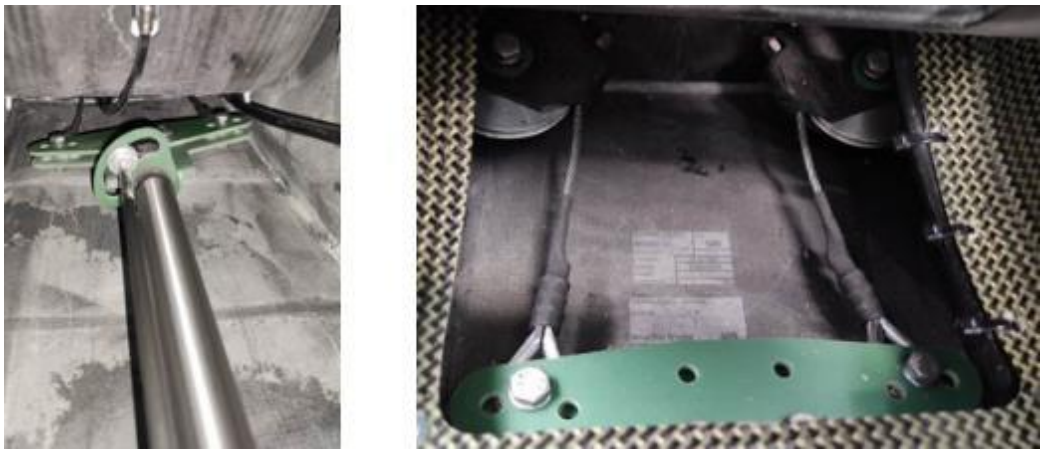


Figure 4-40 View through hole in front of rear seat *View through inspection window below front seat*

Servo piston fully in = landing gears retracted.

Figure 4-41 View through inspection window below front seat

4.3.10 Shock absorber adjustment

Shock absorber check is needed every 50 hours – if EFFBR PUR blocks are in good condition and if there is no gap. Simple lifting of wing is OK to check unloaded shock absorber.

If gap occurs, disassembly of shock absorber is required, and washer must be added – including light pre-compression, for correct function.

- Lift aircraft (Chapter 4.3.5)
- Remove shock absorber
- Check lengths – eye-eye nominal length is 333 mm. Check gap. Prepare washers to fill it + add another 5-8 mm for pre-compression. Washers can be steel or plastic, it does not matter if there is one thick or multiple thinner pieces. Inside diameter is 17 mm, outside 50 mm

Figure 4-42 Shock absorber nominal length

- Remove cotter pin

Figure 4-43 Remove cotter pin

- Remove upper bracket

Figure 4-44 Remove upper bracket

- Add washers

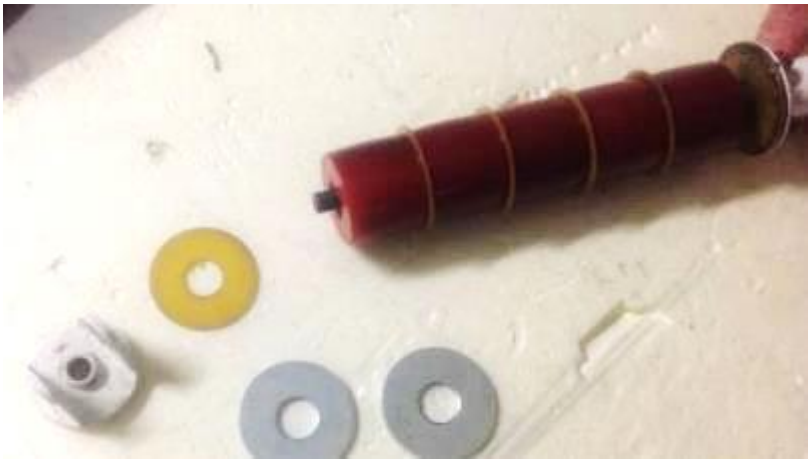


Figure 4-45 Add washer

- Screw upper bracket in place, check dimension – adjust previous measured, secure with cotter pin. Install in place on landing gear

Figure 4-46 Shock absorber

4.3.11 Shock Absorber Spacers

To reduce the permanent deformation of the shock absorber's elastomers, it is recommended to instal spacers anytime, when pro-longed parking is expected.

For the spacer's installation, lifting (unloading) the landing gear is necessary. Consult chapter 4.3.5 for various options of aircraft's lifting. With the landing gear lifted, install the spacer (see Figure 4-47) and release the lifting support.

Figure 4-47

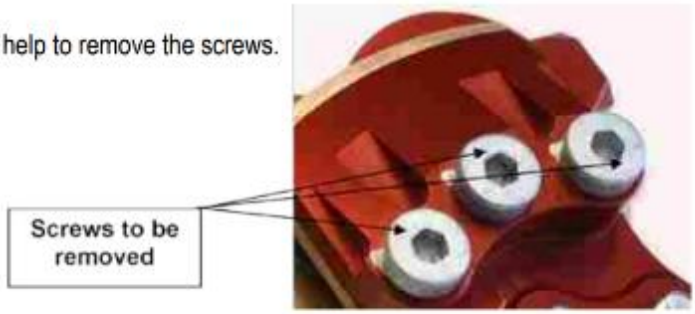
4.3.12 Brake pad replacement

Procedure is given from producer, Beringer web pages, for details refer to www.beringer-aero.com.

Procedure to change brake pads on brake caliper

1- Remove the 3 screws M8

Heat the caliper to 60-80°C can help to remove the screws.



2- Clean the outsides of the pistons all around with a dry cloth

3- Push back the pistons with one finger (no force is needed)

If you cannot push back the piston with one finger, caliper must be checked and rebuilt.

4- Assemble the pads and back plate of the caliper with the caliper body

- Put blue Loctite 243 on the end of each screw and all of them

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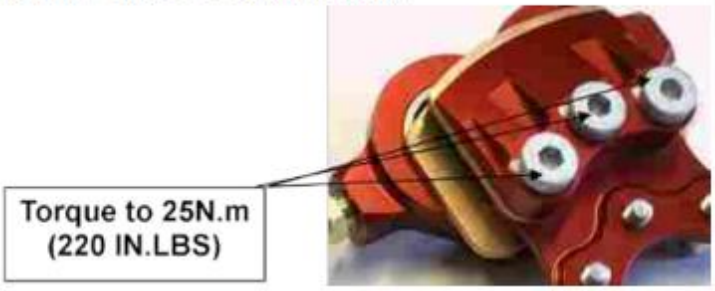
- Then torque to **25N.m** each screw
(respect of torque value is very important).



- Put a drop of white paint between each screw and back plate

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4.3.13 Brake system bleeding procedure

Procedure is given from producer, Beringer web pages, for details refer to www.beringer-aero.com.

Brake system bleeding procedure

A. Bleeding of the braking system :

USE ONLY the brake fluid indicated on BERINGER parts

During the bleeding procedure, Master cylinders and regulators MUST be positioned horizontally with the screws up.

1- Tools
- Pressure bleeder kit
- lots of rags

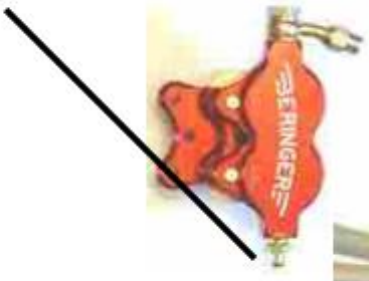
2- Method

To bleed the brake system consists in removing all air bubbles.
If bleeding is not done properly, bubbles can stay in the brake system. It will result in poor brake performances, or no brake torque at all.

Next are some recommendations:

- open the reservoir of the master cylinder : remove the reservoir cap and replace it with the proper cap delivered in the bleeding kit. Then connect the small bottle to the cap as shown on the photo.

- Open the bleeding screw of the caliper



- Connect the pressure tank to the bleeding screw of the caliper as shown on the photo

- Protect CAREFULLY the brake disc and the brake pads from the brake fluid.

- Fill in the pressure tank with brake fluid
- Pump on to the handle of the pressure tank to reach a 15psi pressure
- The fluid goes fom the caliper up to the master cylinder reservoir

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- When the reservoir is full, the extra fluid goes away to the small bleeding bottle through the transparent hose. You can see the air bubbles leaving the circuit through this hose.
- The bleeding operation is completed when no bubble can be seen any more in the hose

At this step, you should have some brake pressure when pulling master cylinder lever.
If you feel no effort at all on the master cylinder lever, that means too much air bubbles are still in the brake system. Repeat the operation taking care that you still have fluid in the tank under pressure.

- Inorder to help the bleeding process, release and pull lever 5-6 times and check if lever is harder to pull (or push) than before.

When the bleeding is completed on the first wheel:
- Close the bleeder screw of the caliper
- Disconnect the hose of the caliper
- Repeat the same operation on the other wheel.
-

When the bleeding is completed **on both wheels.**
- Disconnect the hose of the bleeding bottle
- Remove carefully the bleeding cap of the reservoir
- Replace it with the normal reservoir cap

Air bubbles stay always at upper points

Check your brake lines

Bleeders should be at each upper point of the brake system

Do not use thinner or equivalent, it will damage the seals inside the braking parts.

Clean the parts only with dry rags or with soaper water

B. SECURITY CHECKS before flying :

it is necessary to check next points before the first flight

- **All bolts and nuts must be torqued to appropriate value and locked with wire.**
- **Distance between controls and new parts must be checked.**
- **Wheels must turn freely on the axle (2 revolutions min. when turning with hand).**
- **Safety wire around the disc must be in place.**

- **Level of brake fluid adjusted to maximum (indicated on reservoir).**
- **Clean brake fluid with dry rags.**
- **Place lever in parking position during 15min and check eventual leakage of fluid around parts and fittings. Torque again if necessary.**
- **Place lever in parking position and check that plane cannot be moved by 2-3 persons.**

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On the ground:

- **Check brake efficiency: performs 2-3 stops at low speed on taxiway (do not perform more than 2-3 consecutive brakings, system can overheat).**
- **place lever in parking position and apply engine power: the plane should not move at all, even at full power.**
- **After theese tests, check again that wheel are turning freely when brakes are released (2 revolution min. when turning by hand).**

ATTENTION: Brake efficiency can be surprising. Make sure than you can control the new brake system before flying.

For any question, please contact directly BERINGER AERO

4.3.14 Change tyre

These procedures are taken from Beringer manufacturer's manual, which is available on the web page https://www.beringer-aero.com/. On this page, you can find the manufacturer's catalogue where you can see needed tools and also ordering form, if you want to buy tools, spare parts, tires, brake pads, wheel-O-rings or tire mounting lubricant etc. You can buy these tools from our company SHARK or look at theproducer’s page and find the closest distributor.

Preliminary

These procedures are suitable for light wheel. We have these types of tires:

Front	AERO CLASSIC	11x4.00-5	8PLY	PAC01
Main	AERO CLASSIC	4.00-6	6PLY	PAD03
	MITAS	4.00-6	6PLY	PAD01

Necessary tools

- click-type torque wrench
- Loctite 243 (blue)
- thinner
- tyre mounting lubricant “TYRE UP” or “MICHELIN BIB'UP”

Special tools

- **5” wheel** Tyre change tool, part number OT-002
  - O - ring kit, part number KDF01
- **6” wheel** Tyre change, part number OT-001
  - O - ring kit, part number KDF02

Procedure to change tire on the BERINGER wheel SL & LE 6 inch - LIGHT 5 and 6 inch - CLASSIC 6 inch

B. To remove the tire:

1 Deflate the tire to zero pressure, unscrew the needle valve.

2 Separate the tire from the 2 sides of the wheel, specified below:

- Press the tire with a clamp until the separation with the wheel. .
  CAUTION: Do not pry on the side of the wheel.
- Turn 90° and press again.
- Continue turning 90° and pressing till the tire is totally separated.
- Use tire mounting lubricant to facilitate the separation of the tire.

- Invert the wheel and do the same operation.
- Use tire mounting lubricant to facilitate the separation of the tire.

3 Check that the tire is totally free from the wheel: *The tire can rotate on the wheel by hand turning. It is recommended to spray a tire mounting lubricant to make the separation easier.*

4 Remove the M6 screws and lay them on the work-bench, as detailed on the photos.

In the case of the SL 6" wheel , the screws are located on the internal side of the wheel.

MM

5 Extract the side of the wheel which has the disc brackets, see photos below:

Revert the whole wheel with the tire delicately.

Pull up delicately by hand the side of the wheel with disc brackets.
CAUTION: No extra force is needed if the tire is correctly separated.

TAKE CARE
of the O-ring

6 Remove the tire from the 2 other parts of the wheel, as detailed below.

Spray tire mounting lubricant between the tire and the wheel.

BE CAREFUL this operation is delicate !
Pull up the tire and push the wheel at the same time with the thumbs.

7 When the tire is removed, clean all the parts. The wheel is ready for mounting a new tire, as detailed after.

CAUTION :
Use **brand new O-rings clean and lubricated with a light coat of grease for bearings** when you change the tire.

C. To mount a new tire:

NOTE : - Mounting correctly a brand new tire is not possible without the special tool: **Ref. OPA01** (5" wheel) et **Ref. OPA02** (6" wheel).
- A proper mounting could not be guarantied without using this special tool.

All the parts must be clean and dry

Special tools for tire mounting

WARNING: The following steps are different depending on the type of wheel: **SL**, **Light** or **Classic**.

MM

1 type of wheel: **SL and LE 6" wheel** (wheel in 2 parts)

Clean all the parts.
COMMENT: You must use a brand new O-ring kit at each tire changing.
Place the external part of the wheel on the special tool.

Clean the 2 tire flanges with thinner to remove residual wax.

Spray tire mounting lubricant on the tire flanges.

BE CAREFUL: The tire has a **red triangle** that must be in front of the valve.

- Place the second part of the special tool then insert the 3 bolts.
- Press the tire with the tool till the tire flange is totally under the level of the horizontal surface of the wheel.
- Clean the horizontal surface of the wheel.

Clean with pressurized air or dry cloth the other wheel flange. Check that there is no dirt in the ring groove.

Insert the new O-ring in the ring groove.

Place the flange with O-ring onto the other side of the wheel.

Put Loctite 243 (blue) at the end of each screw.

Insert all the screws that bolt the 2 wheel flanges.

Then refer to chapter:
D. To screw the wheel page 6

MM

2 type of wheel: **LIGHT wheel** (wheel in 3 parts)

Remove the needle valve with the appropriate tool as detailed above.

Ø 3mm axle without sharp edges

- Insert a Ø 3mm axle without sharp edges in the valve hole.
- Insert the small O-ring (clean and dry) on the Ø 3mm axle.
- Check that there is no dirt in the ring groove.
- Insert the large O-ring on the side of the wheel (clean and lubricated).

Place the wheel spacer on the wheel flange and press by hand, as shown above.
Check that the 2 parts are in contact.

Clean all the parts.
COMMENT: You must use a brand new O-ring kit at each tire changing.
Place the 2 wheel parts previously assembled (spacer and flange) on the special tool in the right orientation for the tire mounting.

Clean the 2 tire flanges with thinner to remove residual wax.

Spray tire mounting lubricant on the tire flanges.

BE CAREFUL: The tire has a **red triangle** that must be in front of the valve.

- Place the conical aluminium tool on the wheel spacer as shown above.
- Spray tire mounting lubricant on this tool then put the tire on it.
- Press by hand to insert the tire on the wheel.

- Place the second part of the special tool then insert the 3 bolts.
- Press the tire with the tool till the tire flange is totally under the level of the horizontal surface of the wheel.
- Clean the horizontal surface of the wheel.

Place the whole assembly on the wheel flange as shown above.
BE CAREFUL: The O-ring must stay in the ring groove during this operation.

Put Loctite 243 (blue) at the end of each screw.

Insert all the screws that bolt the 2 wheel flanges.

MM

Then refer to chapter:
D. To screw the wheel page 6

3 type of wheel: **CLASSIC wheel** (flanges without holes)

- Insert a wire without sharp edges in the valve hole.
- Check that there is no dirt in the large O-ring groove.
- Insert the large O-ring on the side of the wheel (clean and lubricated).

Place the wheel spacer on the wheel flange and press by hand, as shown. Check that the 2 parts are in contact.

Clean all the parts.
COMMENT: You must use a brand new O-ring kit at each tire changing.
Place the 2 wheel parts previously assembled (spacer and flange) on the special tool in the right orientation for the tire mounting.

Clean the 2 tire flanges with thinner to remove residual wax.

Spray tire mounting lubricant on the tire flanges.

BE CAREFUL: The tire has a **red triangle** that must be in front of the valve.

- Place the conical aluminium tool on the wheel spacer as shown above.
- Spray tire mounting lubricant on this tool then put the tire on it.
- Press by hand to insert the tire on the wheel.

- Place the second part of the special tool then insert the 3 bolts.
- Press the tire with the tool till the tire flange is totally under the level of the horizontal surface of the wheel.
- Clean the horizontal surface of the wheel.

MM

Place the 2 guide screws in 2 opposite holes on the wheel flange as illustrated.

Place the whole assembly on the wheel flange as shown above.

BE CAREFUL: The O-ring must stay in the ring groove during this operation.

Put Loctite 243 (blue) at the end of each screw.

Insert all the screws that bolt the 2 wheel flanges.

D. To screw the wheel:

Tighten all the wheel screws to contact (2 to 4 Nm).

BE CAREFUL

Respect the order when you torque tighten the 8 x M6 screws.

Torque tighten to 10N.m (+-1Nm) equivalent to 1m.kg (+-0.1m.kg)

Then torque tighten twice each screw to 10N.m .

E. To inflate the tire:

- Screw the needle valve with the appropriate tool.
- Inflate the tire to the appropriate air pressure.
- 24h later : check that the air leak is not more than 10%
- Inflate tire to the appropriate air pressure and screw the valve cap.

4.3.15 Control surfaces deflection setting

Control surfaces deflections of a new aircraft are set by the manufacturer. Deflections are adjusted to values specified in the Control Surfaces Deflection Record enclosed in this manual. A neutral position of the control surfaces and controls is used as a base for the adjustment of deflections.

Aileron deflection adjustment

A range of deflections is adjusted by bolts on aileron levers, accessible through window holes in the bottom of wings, covered by plexiglass windows. Fine adjustment on neutral is possible by ball bearings on control rods.

Elevator deflection adjustment

The range of elevator deflection is adjusted by stop bolts on the tube connecting the control stick. Fine adjustment is possible by ball bearings on control rods.

Rudder deflection adjustment

The range of rudder deflection is adjusted by glued insert blocks on firewall. Neutral is adjusted by turnbuckles on rudder cables.

Trim deflection adjustment

The range of trim deflection is adjustable by ends on the rod.

Flap deflection adjustment

The closed position of the flap, and symmetric adjustment is possible to set on ball-bearing on rod connecting flap root rib with torsion control tube. Steps I-II-III of flap deflection is adjustable electronically on the control unit.

4.3.16 Ballistic rescue system

Ballistic rescue system can be dismounted according to Chapter 3.8.

Disassemble of parachute is required for:

- Parachute revision
- Repack interval: 6 years, send parachute and rocket to producer
- Maintenance or check of rudder/brake pedals and heating channel

4.3.17 Rudder pedals check

- Remove parachute bag according to Chapter 3.8
- There is a carbon/honeycomb sandwich floor on the bottom of the bay. Just pull it out, it is not fixed

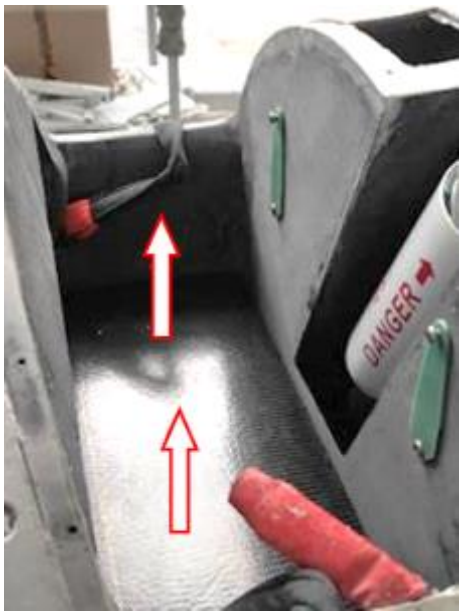

Figure 4-48 Remove carbon plate

- Now you have access to rudder/brake pedals (left and right). You can check kinematics of pedal control and adjust setting (green arrow), check and adjust setting of lift of brake cylinder (blue arrow), adjust setting of pedals (yellow arrow) and tension and securing of pedal control wire (red arrow)

Figure 4-49 Front pilot pedals

4.3.18 Seat adjustment

If the setting of seat does not work (movement of seat is blocked), follow this procedure:

- Check the setting button of seat (in front of right armrest) if it is pushed down or in normal position

Figure 4-50 Seat adjustment button

- Remove right front armrest and container

Figure 4-51 Armrest and container

- Through the gap you can see bottom part of button connected with a Bowden cable

Figure 4-52 Button connected to a cable

- Check the bottom side of the button if the end of a Bowden cable is correctly locked/secured

Figure 4-53 Correct position of bowden end

- Now through the cargo gap, you can see small hole with opposite end of Bowden cable

Figure 4-54 View from cargo gap

- Check this end of Bowden cable if it stays in normal position or it is out of housing. When the Bowden cable is out of housing try to get it into the correct position. Pull the Bowden cable till down by one hand and with small knife or thin screwdriver try to press up the white lock. Put the wire of Bowden cable into correct position inside of housing

Figure 4-55 Correct and incorrect position

- This end of Bowden cable is connected with the end of gas strut. The gas strut is situated behind the seat

Figure 4-56 Gas strut

- Check the nut of gas strut

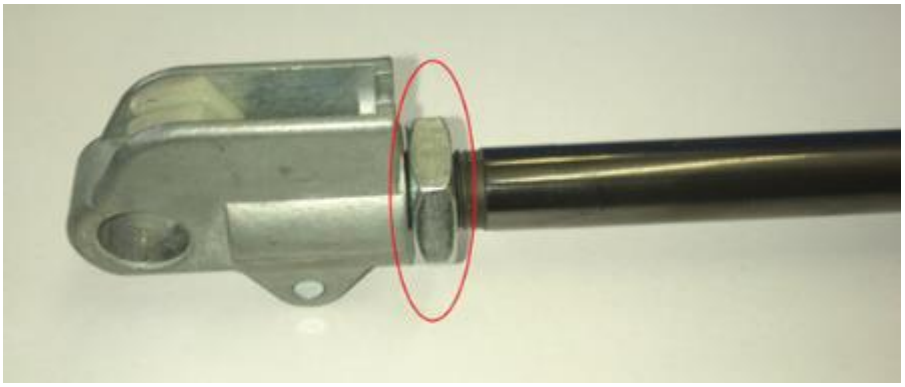

Figure 4-57 Gas strut nut

- Make sure the Bowden cable along its length is free without any tension

4.3.19 Engine maintenance

Refer to the engine manufacturer's instructions for engine maintenance.

4.3.20 Engine idle adjustment

The engine idle is adjusted on a running engine, use extreme caution near the propeller. The aircraft should be tied down. Use the adjustment screw on the carburettor of the Rotax 912 engine to adjust the idle. Idle engine speed is approximately 1400 r.p.m.

For details refer to Rotax manuals.

4.3.21 Propeller maintenance

Refer to the propeller manufacturer's instructions for propeller maintenance.

4.7 Maintenance tools

No special tools are needed for the SHARK maintenance. Tools used for automotive maintenance are suitable.

Before reparation of any composite parts please contact SHARK.AERO.

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5 Winter operation and care

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5.1 Winter operation

It is considered a winter operation, if outside temperature falls below 41°F (+5°C).

Aircraft airframe

- Lubricate the aircraft according to Lubrication Chart (100hr. inspection) if the last inspection was not within 6 months
- Check and adjust rudder control cable pre-stress
- Check cockpit canopy sealing – replace if damaged
- Check fuel tank venting
- Check attachment of wing, ailerons, flaps and tail units, lubricate per Lubrication Chart
- Check function of heating valve
- Switch on/check carburettors preheating
- Charge battery full
- Check shock absorbers more intensively
- Install winter plug to mouth NACA inlet
- Check water in fuel – drain valves, gascolator

Engine

Refer to the engine manual for more details

The following should be done:

- Add anti-freeze to the cooling system as required (usually 50/50mix)
- Change the oil. DO NOT USE DRAINING VALVE, but suck oil from tank
- Check spark plug gaps

If low cylinder head or oil temperatures occur during operation under low outside temperature, then perform the following procedures:

Pre-heating engine and oil

It is permissible to start an engine without pre-heating if the outside air temperature is not below +5º C. Pre-heat the engine and oil if air temperature falls below 41º F (+5 ˚C). Use suitable air heater or a dryer. Blow hot air from the front into the hole around the prop (engine covered with glass fiber cowlings). The temperature of the hot air should not exceed 212º F (100 ˚C) at air heater output. Warm up the oil tank along with the oil in the engine. Pre-heat until cylinder head and oil temperatures exceed 68º F (+20 ˚C).

Engine starting

- Turn the propeller by hand **(ignition switched off!!!)**
- Open the fuel valve
- Set throttle lever to idle
- Open the choke
- Master switch to „ON“
- Switch on ignition to „START“, after starting to „BOTH“
- Adjust engine RPM after starting
- Close the choke
- Warm up the engine

Parking and taxiing

Check wheel brakes for freezing when parked outside and temperature is below zero. Check wheels free rotation prior to taxiing (Grasp the propeller and pull the airplane). Heat the brakes with hot air (to melt snow or ice). Frozen materials should not be removed by forced towing.

Flying

In case of wet snow, or mud, on runway it is recommended to remove landing gear doors. Doors can fully block retracting of landing gears. In same way doors can block the deployment of landing gear, if snow or mud will freeze and block doors in retracted position. Emergency release will not work in this case.

5.2 Cleaning and care

Airplane care outlines

Use mild detergents to clean the exterior surfaces. Oil spots on the surfaces (except the canopy) may be cleaned with gasoline or strong detergents such as 409. Upholstery covers can be removed from the cockpit, brushed or washed in lukewarm water with a laundry detergent. Dry the upholstery before reinstalling.

External surfaces cleaning

The external surfaces of the airplane are protected with weather-proof paint. Wash the airplane surface with lukewarm water and car wash type detergents. Then wash the airplane with water and sponge dry. It is recommended to protect painted external surfaces twice a year, by applying an automotive type polish. Use only on a clean and dry surface, and polish with a soft flannel rag.

Interior cleaning

Keep in mind the following advice:

- Remove any loose objects from cockpit
- Vacuum the interior, upholstery and carpets
- Wipe the upholstery using a rag with lukewarm water and mild laundry detergent. Then dry or remove the seat upholstery, side panels, carpet and clean with lukewarm water and/or carpet cleaners, upholstery cleaners. Dry thoroughly before reinstallation
- Clean the cockpit canopy interior surface

Cockpit canopy cleaning

The canopy may be cleaned by washing it with lukewarm water and car or laundry type detergents using a clean, soft cloth. Then use a suitable polisher on the canopy such as Meguiars plastic polish.

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