FLIGHT & OPERATION MANUAL
ESQUAL VM-1C

NOTICE
The information contained in this manual is to be used as guideline for the owner - pilot.
(Kit built aircraft may vary substantially, therefore good judgment and discretion must be used.)
(Edition 2018-1)

Model:	**Esqual VM 1C**
Manufacturer:	**Arsi AB** Traversgatan 2 441 34 Alingsås – Sweden admin@arsi.se +46 (0)322 611502
Registration nr:	_____
Serial nr:	_____
Man. year:	_____

This aeroplane must be operated in compliance with the information and limitations contained herein.

This POH must be available on board the aeroplane.

WARNING

This Aircraft is not fitted with a certified engine. A power failure can occur at any time. Never fly over any area on to which a safe landing cannot be made in the event of an engine failure

Flying in this and any aircraft can be dangerous either as the passenger or the pilot. You agree to fly in this aircraft entirely at your own risk.

Any acute or long term medical conditions or the taking of any medications associated with any acute or long term condition will increase your risk of flying in this aircraft safely and may lead to you becoming incapacitated at the controls. This includes the taking of any social or recreational drugs, alcohol, diving using an aqua lung , recent blood donation, cold or flu, ear infection.

On board the aircraft please ensure that loose articles are secured before flight. Loose items can jam the controls leading to a loss of control.
Stalling, spinning or any aerobatic manoeuvres during any stage of flight may lead to a loss of control.

The parachute handle safety pin can be removed at the pilots discretion before flight. Failure to do so may result in the pilots' inability to deploy the parachute due to incapacity, adverse G and or aerodynamic forces resulting from mid air collision or loss of control.

AMENDMENT RECORD

Issue	Details of change	Date	Auth by
1	Initial issue	2018-10-15	SA / AA

INDEX

CHAPTER 0

INTRODUCTION

The VM-1 Esqual is a sport airplane enclosed in the airplane & ULM category.
Before attempting to fly, it is obligatory to be fully aware of all the information and procedures regarding the Esqual and its engine.
It is also strongly recommended to study all the documents in order to become familiar with all the details about the Esqual.
The company recommends a check ride from an instructor or another experienced pilot, who is familiar with the Esqual, to ensure you are proficient with the plane.

This Flight & Operation Manual applies only to the VM-1C Esqual and contains the airworthiness limitations and essential operating data for this aircraft.
The pilot in command shall comply with all requirements, procedures and limitations with respect to the operation of the aircraft set out in the Flight & Operation Manual for the Esqual.

It is the owner's responsibility to incorporate in this manual all amendments and to enter the data of incorporation and his signature on the appropriate amendment Record Sheet.
Operating limitations, instrument markings and basic placards necessary for the safe operation of the Esqual, its engine, standard systems and standard equipment are included in this manual.
Observance of these limitations is required.

The Esqual shall be operated so that the limitations and instructions included in this manual are observed.

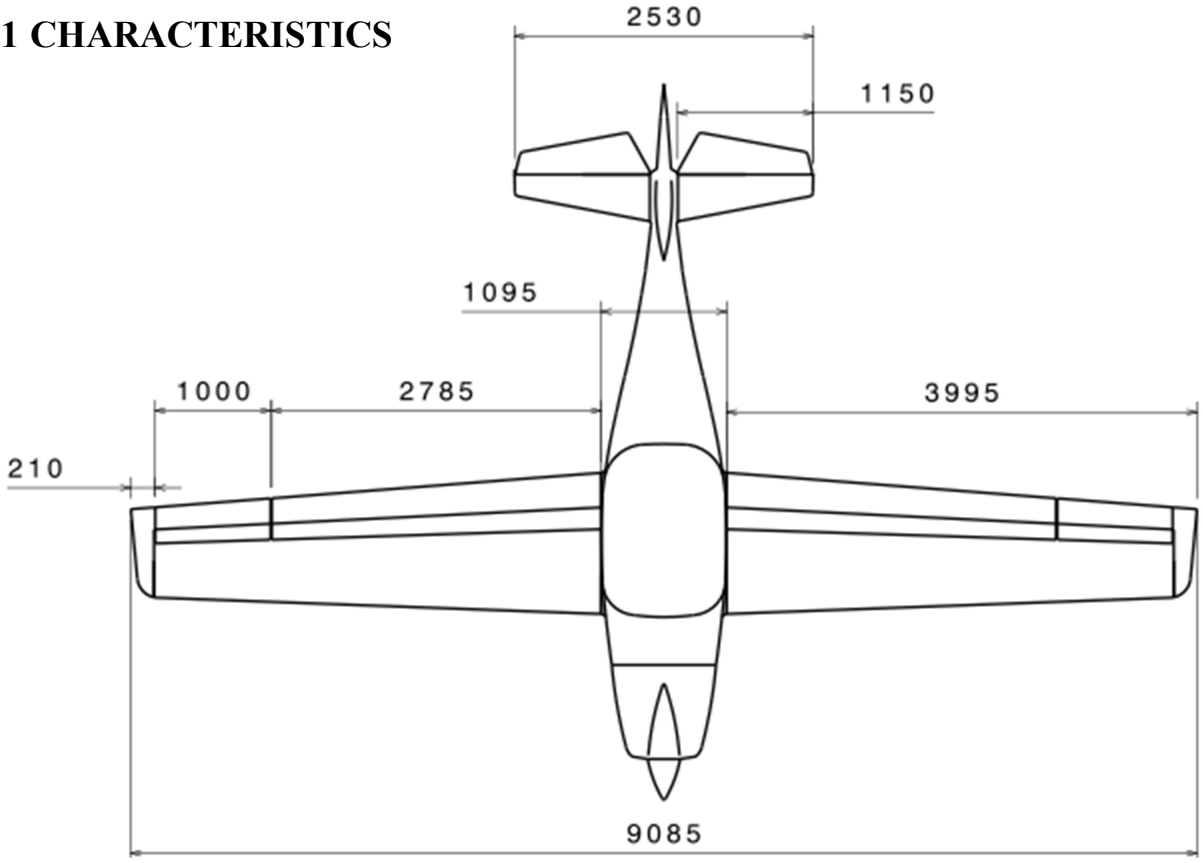
This manual provides checklist and other procedures for coping with normal operation and emergencies that may occur.

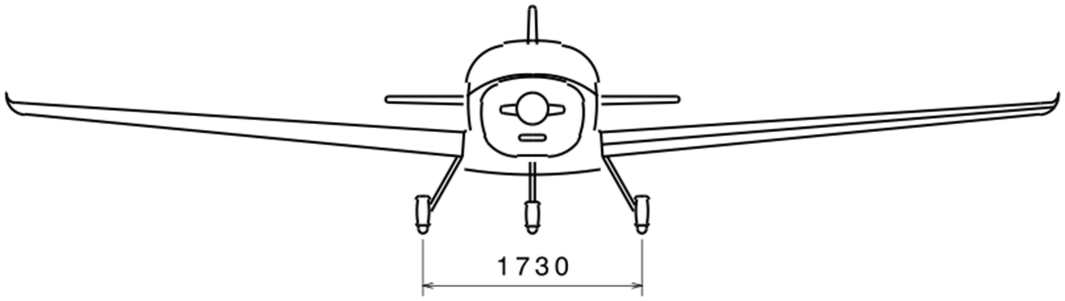
Emergencies caused by airplane malfunction are rare if proper preflight inspection and maintenance are practiced.
However, should an emergency arise the basic guidelines outlined in the manual should be considered and applied as necessary to correct the problem.

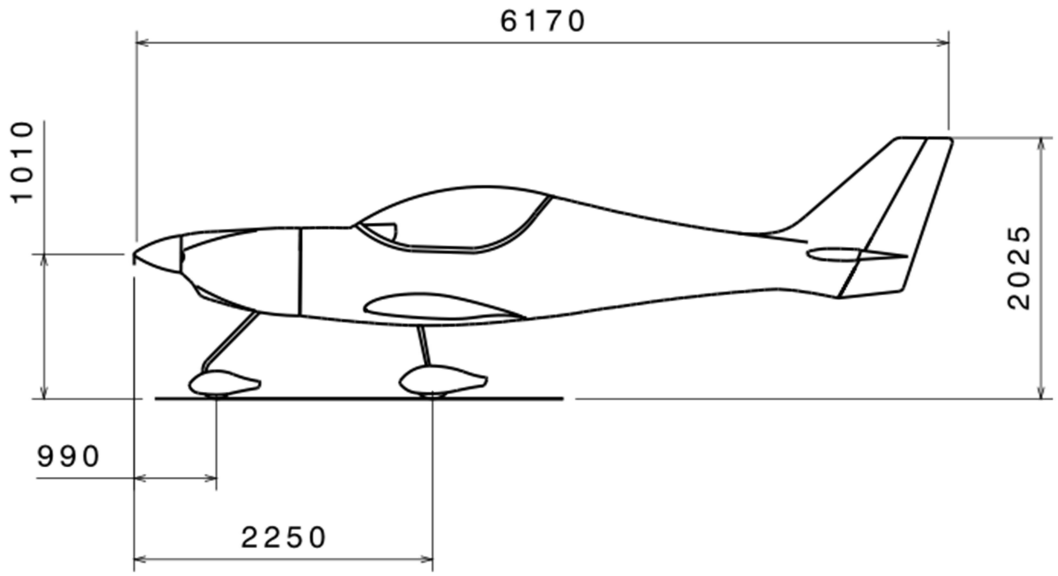
CHAPTER 1

GENERAL INFORMATION

1.1 CHARACTERISTICS







Wing Span	9.085 m	**Brakes**	Independent Hydraulic
Length	6.170m	**Wing foil**	NLF (1) –0215F
Height	2.025 m	**Engine**	Rotax 912 uls
Wing Surface	9.0 m²	**Fuel**	AVGAS 100 LL MOGAS min. 95 OCT
Wing Loading	52,83 Kg/m²	**Propeller**	Duc Swirl inc. 1660mm
Maximum Weight	472,5 Kg	**Turn Rate**	10.00 m
Empty Weight	260-297,5kg	**Cockpit Width**	1.10 m

1.2 DESCRIPTION

The Esqual is a two seater light plane manufactured in carbon fibre with high density PVC foam and Epoxy resins. Laminated in a mould and vacuum cured in an oven at constantly controlled temperature and humidity. The fuselage is monocoque.
The low cantilever wing has positive changing flaps (as high lift devices). The wing structure has a composite sandwich skin with a main double "T" composite spar and an accessory spar near the trailing edge.
The empennage has a conventional cross shape.
The cockpit seats are side by side.
The landing gear of the Esqual has a classic tricycle gear which is made of 7075 T6 aluminum grade. The main gear legs are suspended in the main carry through beam together with the reinforced wing spar zone.
The nose gear leg is supported in the engine mount and equipped with a free swivel nose wheel.
The main wheels are equipped with independent hydraulic toe brakes for steering.
The safety belts have four anchoring points.
The rudder pedals are adjustable in flight.
The luggage compartment (with 50lts capacity, 18 kg) is located behind the seats and can be accessed during flight.
An optional ballistic parachute can be mounted.
The safety reinforced cockpit has twin axle composite beams all around its frame.
Independent ventilation openings are standard; a cabin heater is an option.

1.3 REFUELING

There are two independent fuel tanks, one in each wing, with their openings on the upper surface. The fuel caps do not protrude over the wing surface and can be unscrewed with the Esqual key-ring. It is always recommended to filter the fuel and to attach a mass wire to the exhaust pipe when refueling.

1.4 HOW TO MOVE THE EQUAL WHEN STOPPED

The Esqual can be easily pulled at the propeller blades near the spinner.
You should never pull from the outer part of the blades.
The basic version does not have a parking brake. Wheel blocks should be used to secure it on the ramp.
The easiest way to move the Esqual backwards is done according to the picture below.

1.5 ANCHORING PLACES

In case you have to park the Esqual on a ramp (outside hangar), we recommend anchoring it to the floor with ropes attached to the external flap hinge and if needed also at the propeller hub.

1.6 BOARDING THE ESQUAL

From the leading edge, step onto the place marked with anti skidding stickers on the wing next to the fuselage.

1.7 CARE OF THE CANOPY

The construction of the Esqual's canopy allows it to rise to the vertical position and facilitates access to the cabin.
Nevertheless, due to its large surface, there is a risk of being damaged if it is left open.
As it is usually windy on the airfields, a wind gust could close it, damaging the canopy or the cabin frame.
Never start the engine with the canopy open or unlatched.
The frame is manufactured of carbon/epoxy as the rest of the aircraft.
During the construction process, when adjusting the Metacrilate of the canopy frame, there are stress forces that tend to settle as time passes.
The contraction/dilatation phenomena produced due to temperature changes can contribute to distort the canopy and consequently will not fit well in the frame on its bed.
Therefore it is recommended to always store the plane with its canopy well closed.
In areas of bright sunlight, protect it with a white or clear fabric cover.

In spite of following all these recommendations do not worry if you notice slight variations in the canopy adjustment in summer.
When in lower latitude, keep in mind magnifying glass effect of the high surface canopy that quickly increases the cabin inner temperature when taxiing.
The tinned canopy with UV protection allows you to fly normally in hot climates.
Always fly with a cap and sunglasses in summer.
Take into account dehydration on long flights and have a water bottle on board.

1.8 CARE OF THE CARBON FIBER AND COLOURING

The manufacture in compound materials minimizes both aircraft structural revision and surface maintenance care. However, it has to be emphasized that there are several details that specifically affect fiber and resin laminated structures.

Fiber is especially sensitive to ultraviolet radiation. The colour layer protects the inner laminate from the effects of radiation. Thus, a quick repair of any scratch or knock that has peeled the colour protection, is of vital importance.

It is highly recommended to avoid painting the aircraft with dark colors (which absorb more radiating energy).

After any minor crash or *hard* landing, check for early signs of separation of the pressed fiber layers (de-lamination) on the pieces subject to higher mechanical efforts (wing main spar).

When in doubt ask your authorized dealer before flying again. Protect the Esqual from humidity and extreme temperature changes with covers if it has to be stored outside for a few days.

1.9 SYMBOLS AND ABBREVIATIONS

International standard Atmosphere	ISA
Atmosphere	Atm.-bar
Centigrade degrees (Celsius)	°C
Litres	Lts
Kilograms	Kg
Kilowatt	kW
Square Meters	m^2
Cubic Meters	m^3
Indicated Airspeed	IAS
Stall Speed	Vs_1
Flap extended Stall Speed	Vs_o
Manouvre Speed	Va
Maximum Speed (never exceed)	VNE
Flap extended maximum Speed	Vfe
True Airspeed	TAS

Note:
VNE is always understood as a true airspeed.
Maneuver speed is the maximum airspeed that allows deflecting completely any command surface without overstressing the airplane structure.

CHAPTER 2

POWERPLANT & AIRCRAFT LIMITATIONS

2.1 ENGINE TYPE
A. Rotax 912 ULS Engine

2.2 FUEL CONSUMPTION
A. Rotax 912 ULS Engine

2.3 PERFORMANCE DATA
A. Rotax 912 ULS Engine

2.4 FUEL & LUBRICANT
A. Rotax 912 ULS Engine

2.5 OPERATING SPEEDS & LIMITS
A. Rotax 912 ULS Engine

2.6 PROPELLER
A. Duc swirl inconell

2.7 AIRCRAFT OPERATING LIMITATIONS

2.8 ELECTRICAL SYSTEM

2.8 RESCUE SYSTEM

2.1 ENGINE TYPE

A. Rotax 912 ULS Engine

Dimensions and Weights	
Bore:	84 mm
Stroke:	61.0 mm
Displacement:	1,352.2 cc
Cylinders:	4 cyl. horizontally opposed (boxer)
Compression Ratio:	10.5:1
Direction of rotation on prop shaft:	Counter-clockwise, looking at p.t.o. side of engine
Engine Curb Weight:	76 Kg complete with engine oil, exhaust and starter motor.
Reduction gear	2,43:1
Normal Equipment	
Ignition Unit:	Ducati Ddual CDI
Ignition Timing:	4° up to 1000 RPM above 26°
Spark Plugs:	DCPR8E
Electrode Gap:	0,7 – 0,8 mm
Generator:	13.5 V / 250 W DC @ 5500 rpm
DC Output:	250 W
Carburetor:	2 CD
Fuel Filtration:	0.1 mm (100 Micron) maximum particle size.
Starting System:	Electric starter
Cooling System:	Liquid-cooled cylinder heads, air-cooled cylinder

2.2 FUEL CONSUMPTION

A. Rotax 912 ULS Engine

At take-off performance	27.0 lts/h
At maximum continuous performance	25.0 lts/h
At 75% continuous performance (cruise)	18.5 lts/h
Specific consumption at maximum continuous performance	285 g/kWh

2.3 PERFORMANCE DATA

A. Rotax 912 ULS Engine

Take-off performance	(73.5 kW) at 5.800 rev/min.
Maximum continuous performance	(69.0 kW) at 5.500 rev/min.
Acceleration	5 seconds maximum at –0.5 G

2.4 FUEL & LUBRICANT

A. Rotax 912 ULS Engine

Fuel:	Automotive unleaded gasoline (RON 95/98). The use of aviation gasoline (AVGAS 100LL) produces, due to its higher lead content, the wear of the valve seats. Moreover, the sediments in the combustion chamber will increase and the lead sediments in the lubricating system will also increase. Therefore, you should only use AVGAS if you encounter problems with the fuel being steamed or if any other fuel types are not available.
Lubricant:	We recommend using AeroShell Oil Sport Plus 4 or oil recommended in The Rotax Manual.
Oil capacity	3 L. (minimum 2 L)
Oil consumption	0.1 L/h (max.)

2.5 OPERATING SPEEDS & LIMITS

A. Rotax 912 ULS Engine

Take-Off Speed:		5.800 rev/min. (5 min.)
Maximum Continuous Speed:		5.500 rev/min.
Idle Speed:		Ca 1.400 rev/min.
Oil Pressure:	Maximum:	7 bar **Attention**: For a short period admissible at cold start
	Minimum:	0.8 bar (12 psi) (below 3.500 rev/min.)
	Normal:	2.0 - 5.0 bar (29 - 73 psi) (above 3.500 rev/min.)
Oil Temperature:	Maximum	130° C (266°F)
	Minimum	50° C (120°F)
	Normal	90° - 110° C (190° - 230°F)
Cylinder Head Temp.	Maximum:	135°C (284°F) reading at observation point of the hottest cylinder head, either no. 2 or no. 3
Engine start, operating temp.	Maximum:	50° C (120°F)
	Minimum:	-25° C (-13°F)
Fuel Pressure	Maximum:	0.4 bar (5.8 psi)
	Minimum:	0.15 bar (2.2 psi)
Exhaust Gas Temp.	Max. contin:	800°C
	Max. 5 min.:	850°C
	Max. T/O:	880°C

2.6 PROPELLER

C. Duc Swirl inconell

The Esqual is equipped with a Duc Swirl inconell, a three blade carbon fiber, ground adjustable propeller.

Diameter: 1660mm
Pitch: Ground adjustable (25,5 (+ -1) deg, measured 25% in from tip)
Weight: 3,6kg

2.7 AIRCRAFT OPERATING LIMITATIONS

The Esqual has the flight certification for daylight VFR operations.

1. Airspeed Limits :

VNE – never exceed speed	290 km/h
V_A – Max Maneuvering Speed	190 km/h
Vs_0 – Stall Speed with full Flapps	62 km/h
Vs_1 – Stall Speed without Flapps	91 km/h
V_{Fe} – Max Speed with full Flapps	125 km/h
V_C – Max Design Cruise Speed	270 km/h
V_D - Max Design Dive Speed	324 km/h
V_B - Max Speed at turbulent weather	243 km/h

Use the following table for the TAS/IAS deviation according to the altitude so as not to exceed the VNE.

Altitude	m.	2000	3000	4000	5000	6000
	Ft.	6562	9843	13123	16404	19685
VNE	Km/h	272	261	249	235	218
	kts	147	141	135	127	118

2. Weights :

MTOW Maximum Take – off weight: 472,5 kg

TYPE	Empty Weight	Ballistic chute	Total Weight
Rotax 912 S	277 kg	13 kg	472,50 kg

Allowed manoeuvres:
The Esqual structure does not restrict manoeuvres, but ultra-lights and experimental aircraft are not cleared for aerobatics.

Flight load factors:
Maximum load: “+4G” & “-2G”
Ultimate load: “+6G” & “-3G”

2.8 ELECTRICAL SYSTEM

The aeroplane is equipped with a 12V DC electrical system

The engine does not require the aeroplane's DC system to function, except for starting. Its ignition system derives its power from an independent generator built into the engine. Full details of the engine's electrical system can be found in the Rotax Operator's Manual.

DC Supply

The battery (Sellpower 7800 (7,8 amps)) is located inside the cowling on the left side of the firewall. Make sure to keep the battery charged and maintained properly.

The battery receives charge from the engine's alternator via an electronic rectifier/regulator unit and a 30 amp fuse. The regulator is a switched mode unit and a large (22,000 μF) electrolytic capacitor is connected across its output to provide smoothing for avionics and other services sensitive to electrical noise. It also protects services from over-voltage in the event of battery disconnection.

Only use recommended charger. See battery manufacturers' maintenance manual

An analogue, electronic voltmeter or the EFIS mounted on the instrument panel monitors the battery voltage. Normal readings lie in the range 12 to 14.4 volts.

Distribution and Services

The battery is connected via a 30 amp circuit breaker to a +ve bus bar mounted behind the instrument panel, and switched by the Master Switch /relay. The bus bar feeds all services via circuit breakers. The circuit breakers are designed to trip if there is an overload on the circuit. To reset, push the circuit breaker in. If it trips again do not reset

Electric Starter System

The high starter motor current is switched by a relay mounted on the firewall. The starter relay is energised when the Master switch is ON and the starter key switch, mounted on the instrument panel, is turned.

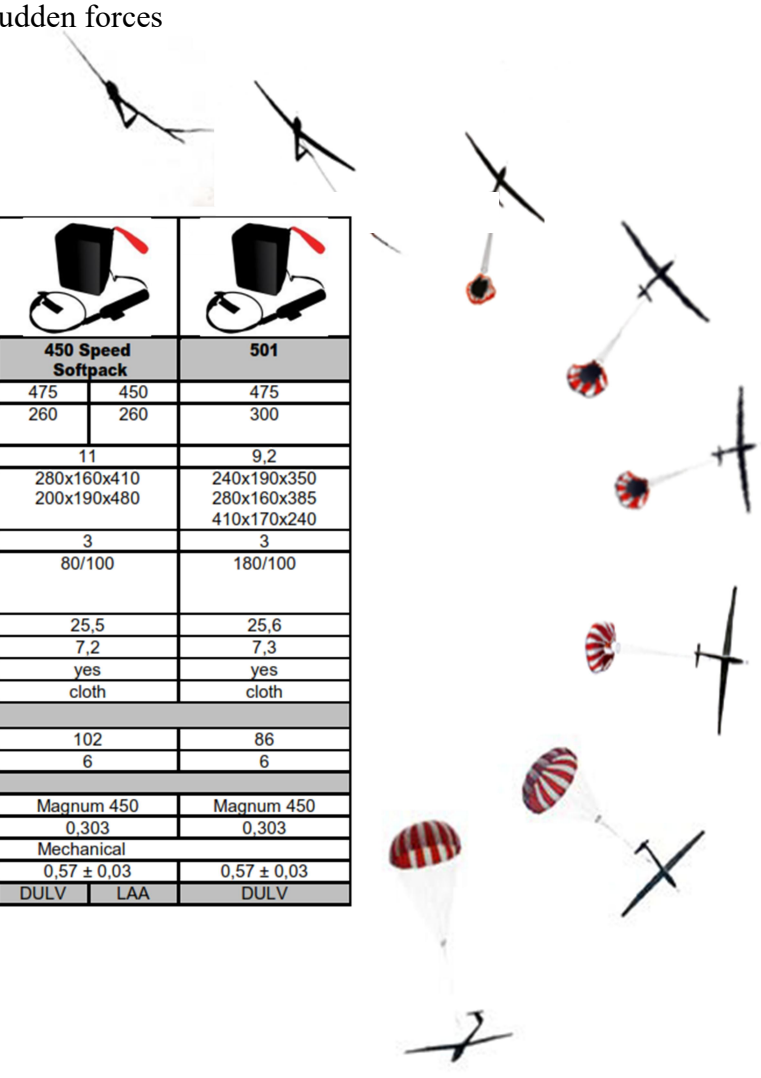
2.9 RESCUE SYSTEM (Magnum 501 softpack)

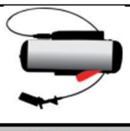
It is necessary to bear in mind, that in critical situations you must activate the rescue system as soon as practicable. In many critical situations, altitude is lost very quickly, while airspeed increases. These factors dramatically lessen the chance of rescue. It is recommended to activate the rescue system at heights greater than 200m above ground!

Best speed for activating the rescue system is 80 km/h.

1. Turn off the engine (Magnetos)
2. Turn off the fuel valve
3. Pull the rescue system handle hard. As the cable is pulled, the resistance will increase up to a maximum of 12 kg of force. The handle is located on the instrument panel.

The parachute canopy is filled gradually to decelerate the aircraft and prevent sudden forces which could damage the aircraft.



						
MAGNUM		**450 Speed**		**450 Speed Softpack**		**501**
Maximum permitted load	kg	475	450	475	450	475
Maximum speed	km/h (MPH)	260	260	260	260	300
Rescue system weight (including rocket)	kg	13		11		9,2
Dimensions l x w x h	mm	Ø206+60x587		280x160x410 200x190x480		240x190x350 280x160x385 410x170x240
Opening time at max. speed	sec	3		3		3
Minimum safe deployment altitude (AGL) during horizontal flight	m / km/h	80/100		80/100		180/100
Max. overload with max. load	kN	25,5		25,5		25,6
Descent with max. load	m/s	7,2		7,2		7,3
Slider	-	yes		yes		yes
Container type	-	duralumin		cloth		cloth
Canopy						
Area	sqm	102		102		86
Repack interval	rok	6		6		6
Ballistic device						
Rocket engine type		Magnum 450		Magnum 450		Magnum 450
Total impulse at 20°C	kNS	0,303		0,303		0,303
Activation	-	Mechanical				
Burn time at 20°C in sec.	s	0,57± 0,03		0,57 ± 0,03		0,57 ± 0,03
Certified by	-	DULV	LAA	DULV	LAA	DULV

CHAPTER 3

PLACARDS AND MINIMUM EQUIPMENT LIST

3.1 Airspeed indicator range markings

3.2 Operating limitations markings in the EFIS / Panel

3.3 Passenger warning

3.4 "NO INTENTIONAL SPINS"

3.5 Miscellaneous placards and markings
A. Rotax 912 ULS Engine

3.6 Type placard

3.7 Minimum equipment

3. PLACARDS AND MINIMUM EQUIPMENT LIST

3.1 Airspeed indicator range markings:

White:	70 km/h - 125 km/h
Green:	91km/h - 243 km/h
Yellow:	242km/h - 290 km/h
Red:	290km/h -

3.2 Operating limitations markings in the EFIS / Panel

Max RPM 5800, CHT 135°C, Oil Temp 130°C, Oil press 7 bar

3.3 Passenger warning

The warning "This aircraft was manufactured in accordance with Light Sport Aircraft airworthiness standards and does not confirm to standard category airworthiness requirements" is placed on the instrument panel passenger side.

3.4 "NO INTENTIONAL SPINS"

The placard "NO INTENTIONAL SPINS" is placed on the instrument panel passenger side.

3.5 Miscellaneous placards and markings

Type of fuel	AVGAS – MOGAS	On the fuelcap
Throttle		Throttle control panel
Choke		Throttle control panel
Trim (Elevator/Aileron)		Central Panel / Stick
Flaps	0°-38°	Efis /Panel
Charge light		Efis / Panel
Circuit Brakers		Instr. panel
Baggage Compartement	Max 18 kg	Baggage Area
Fuses	Misc Fuses	Instr. panel

3.6 Type placard

The stainless steel type placard is placed on the firewall inside the engine compartement.

CALL SIGN
Type: Esqual VM 1C
Arsi AB
Man. date: XX_XX_XX
S/N: XXX-XXX

3.7 Minimum equipment:

- ASI
- ALT
- EFIS / Engine Monitoring
- EFIS / Compass

CHAPTER 4

MAINTENANCE MANUALS

4.1 INTRODUCTION

4.2 AIRFRAME MAINTENACE

4.3 ENGINE MAINTENACE

4.4 PROP MAINTENANCE

4.5 RESCUE SYSTEM MAINTENANCE

4.6 FUEL SYSTEM MAINTENANCE

4.7 ELECTRICAL SYSTEM MAINTENANCE

4.1 INTRODUCTION

As with any Precision Machine, your new ESQUAL VM 1C will take good care of you in the air as long as you take good care of it on the ground. One thing you will appreciate is that your Esqual was designed to last a long time. However, there is no substitute for regular preflight and post flight inspections as well as preventive maintenance when it is needed.

The best way to record and track the hours-of-operation on your engine and airframe is by accurate documentation in log books. The main point is that the aircraft history of airframe, repairs or modifications are documented so that inspections are on time and in order.

4.2 AIRFRAME MAINTENACE

4.2.1 After the first 10 Hours

a) General shake down of engine and airframe.
b) Survey of engine temperatures and vibration variations at various R.P.M..
c) Test performance from low to full throttle flight.
d) Establish cross wind capabilities.
e) Stability tests for pitch roll and yaw.
   Note : test pilots should take care to sort out actual problems from perceived problems which are a result of unfamiliarity. The Esqual has been designed for quick handling and maneuverability.

4.2.2 First 50 and every 100 Hours after

Close inspection of all components including nuts, bolts, bushings, cables, pins, tubes, bearings, hinges etc.

Due to vibration during normal operation, it is important to inspect all engine mount welds, fluid levels, throttle cables, fasteners, hose clamps, electric wires, exhaust system, fuel and air filters.

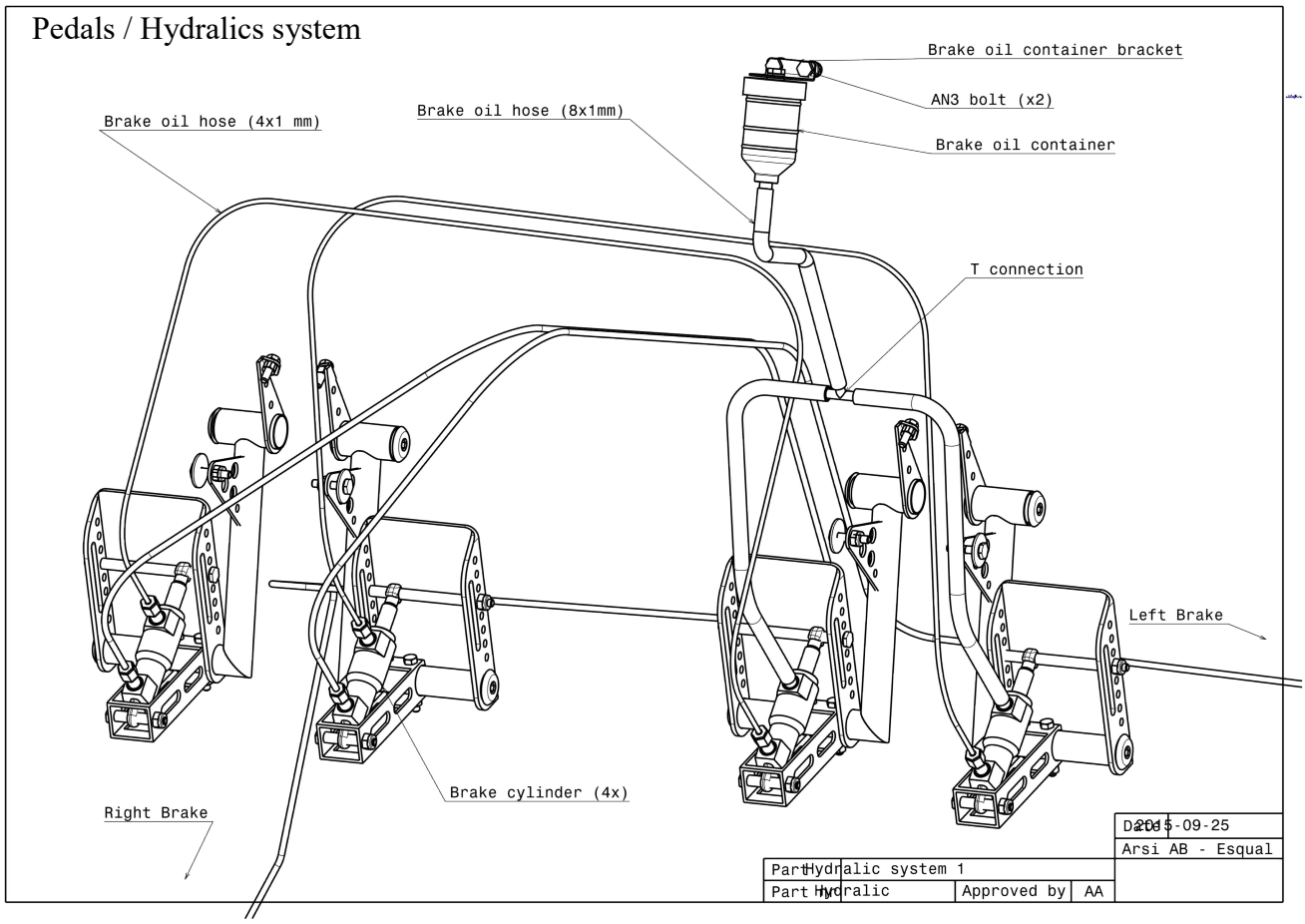
Clean and dress any nicks in propeller. Ensure balance and tracking are correct.

On landing gear, remove wheels, inspect axles and bearings. Ensure tire inflation is correct.

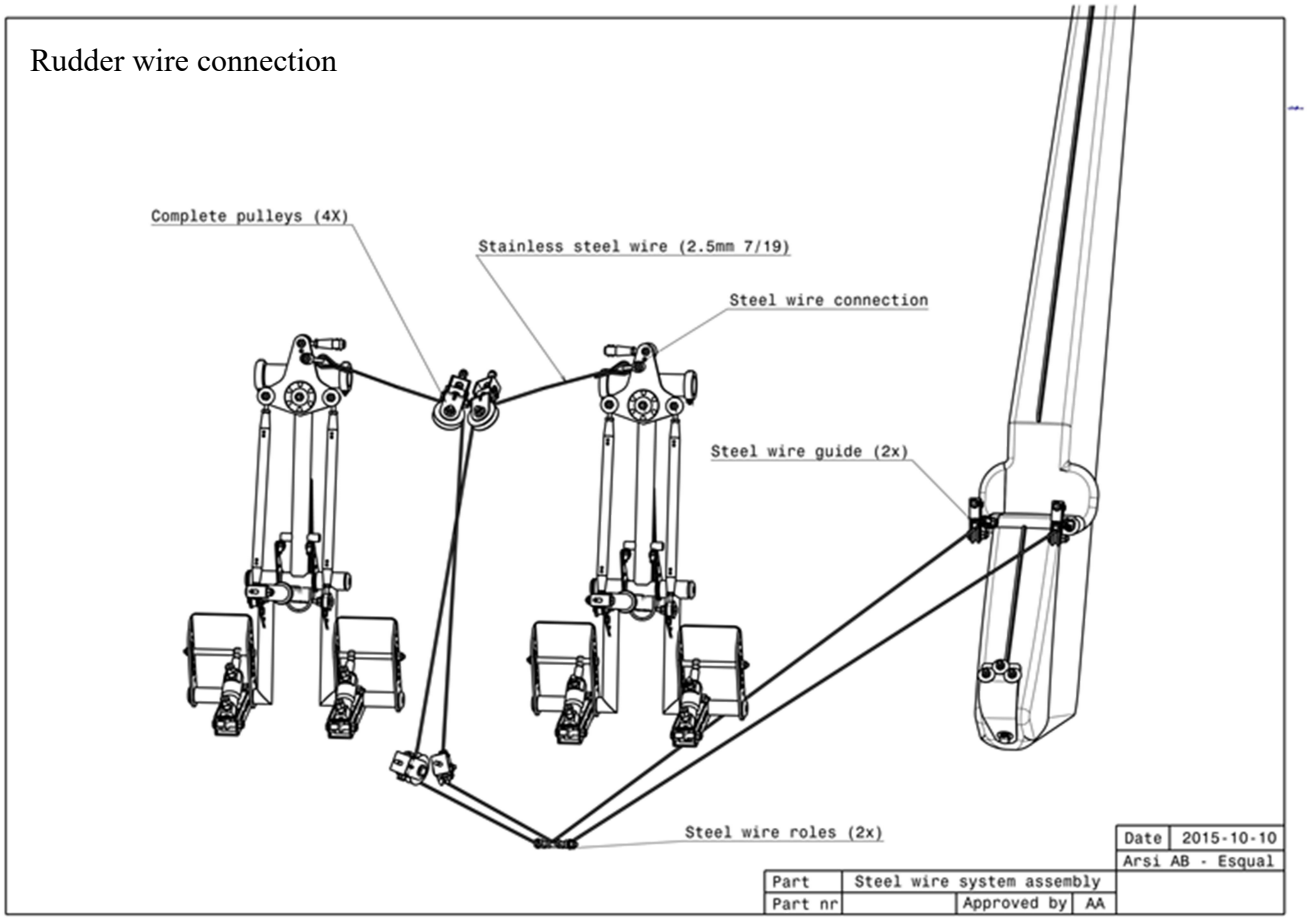
After any repairs or modifications enter work completed into the airframe log and have it signed off by the mechanic.

If in doubt about your own capabilities, consult Esqual professionals at ARSI AB.

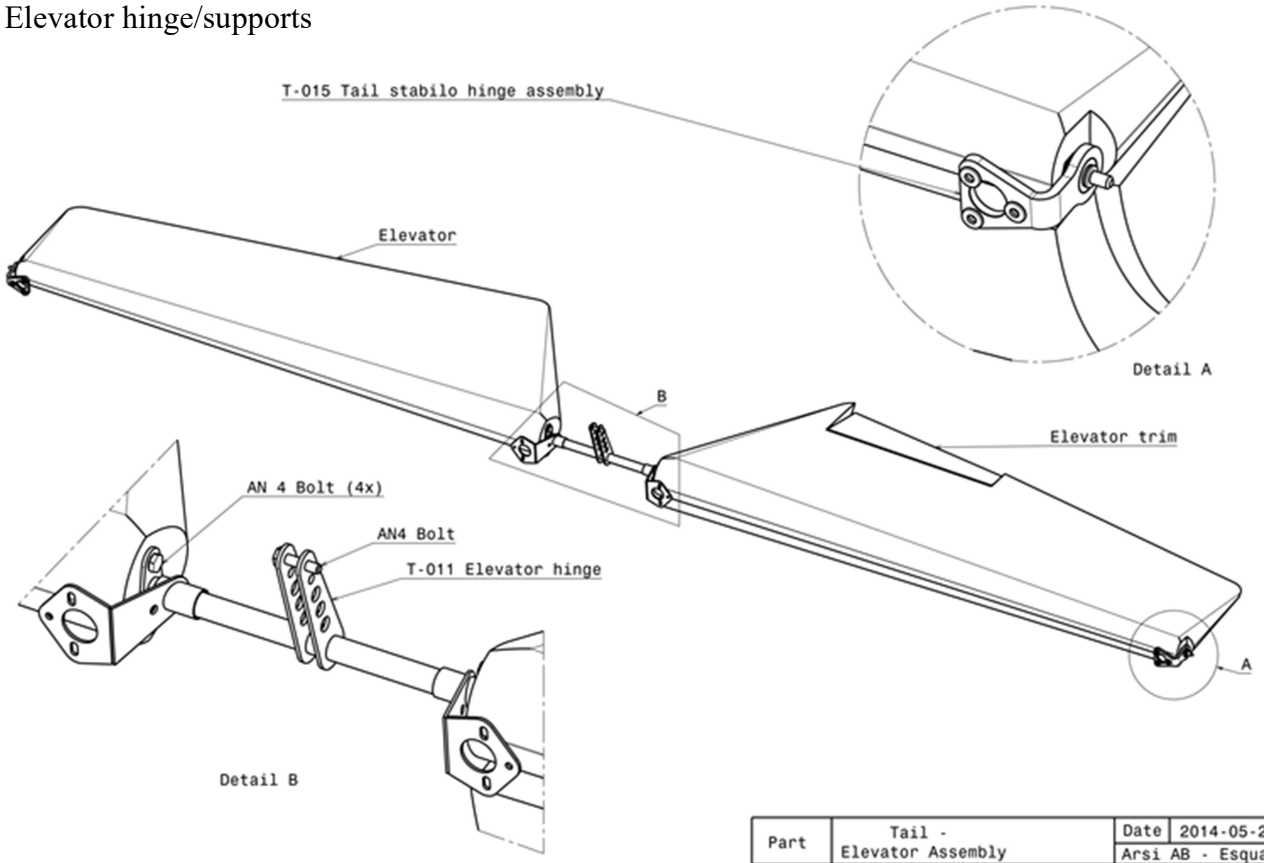
Pedals / Hydralics system



Rudder wire connection

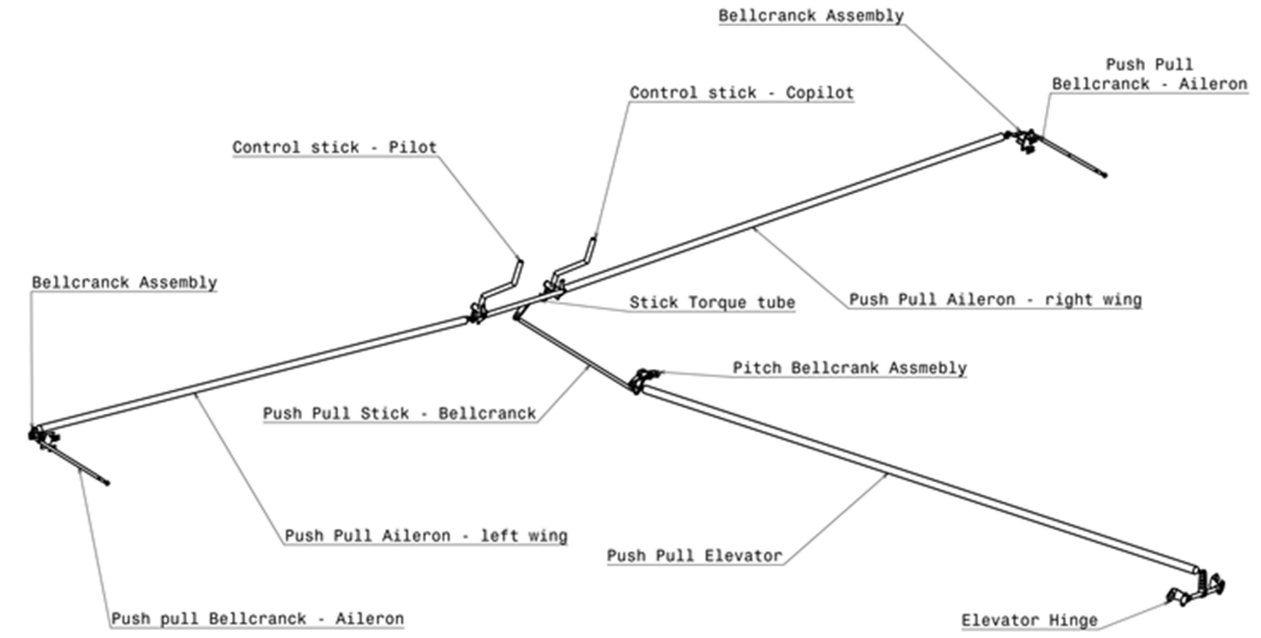


Elevator hinge/supports



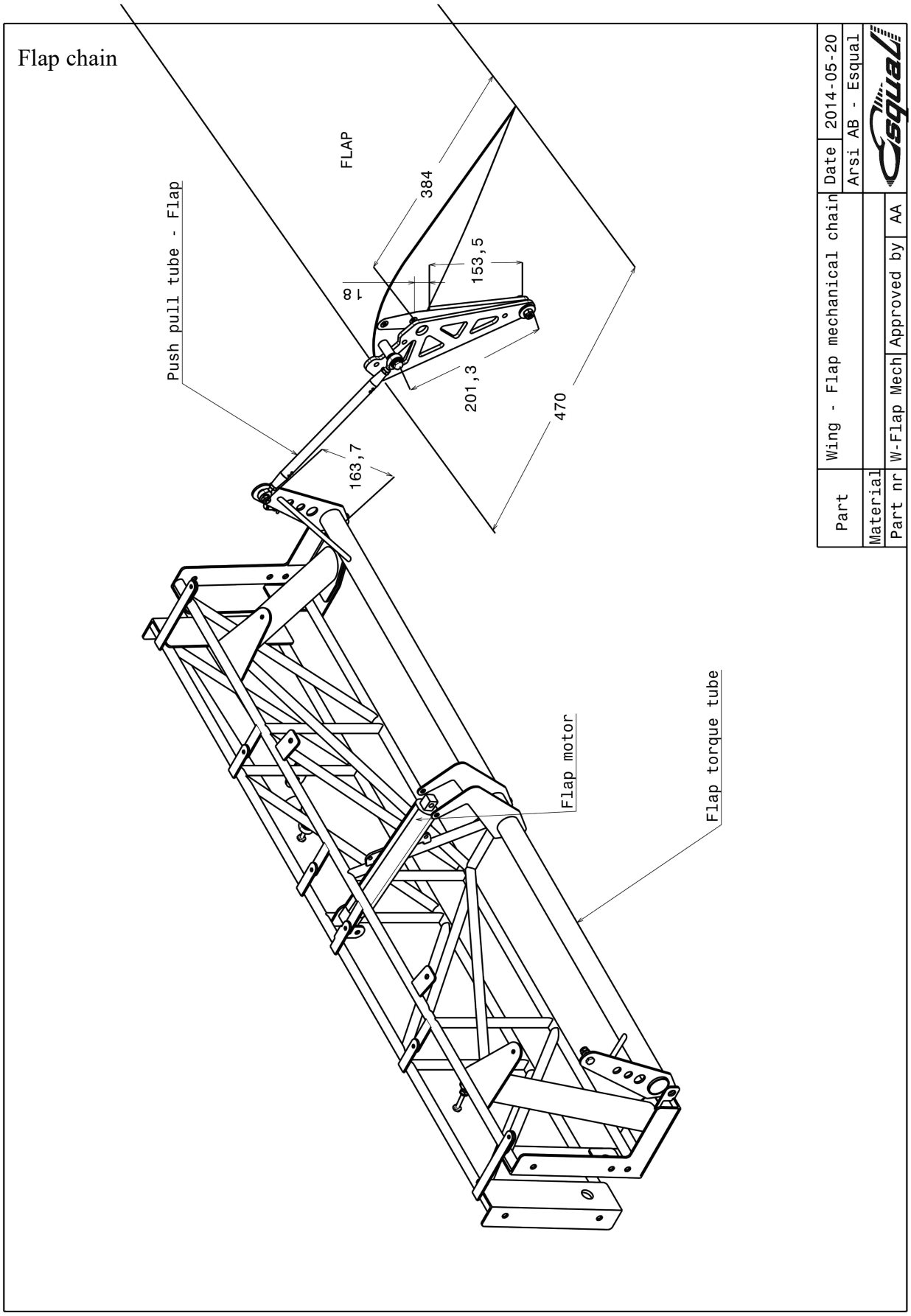
Part	Tail - Elevator Assembly		Date	2014-05-20
				Arsi AB - Esqual
Material	Carbon			
Part nr	T-Elev Ass	Approved by	AA	

Push/pull system



Part	Push Pull System		Date	2014-05-20
				Arsi AB - Esqual
Material				
Part nr	PP-Ass	Approved by	AA	

Flap chain


FLAP
384
153,5
18
201,3
470
163,7
Push pull tube - Flap
Flap motor
Flap torque tube
Part
Wing - Flap mechanical chain
Material
Part nr
W-Flap Mech
Date
2014-05-20
Arsi AB - Esqual
Approved by
AA

4.3 ENGINE MAINTENANCE PROGRAM

Engine maintenance is preformed according to the Rotax manual.

4.4 PROP MAINTENACE

Maintain the prop according to its manual.

4.5 RESCUE SYSTEM MAINTENANCE (Magnum 501, softpack)

Make sure that the belts are attached properly and free of obstacles.

Check the hatch above the rocket and make sure that the rubber seal is still fresh.

The service life of MAGNUM rescue systems is 18 years for parachutes with a slider. Regardless, it is necessary to have the system sent for service every 6 years depending on the prescribed service interval for your particular rescue system. The system must be shipped in the original shipping container which is certified for transport and sent back to the manufacturer or authorized dealer.

4.6 FUEL SYSTEM MAINTENANCE

Check the fuel hoses and connections to make sure that there is no leaking/wearing. Make sure that there are no signs of agerelated cracks, change if needed.
Check that the fuel filters are clean, change if needed.

4.7 ELECTRICAL SYSTEM MAINTENANCE

The aeroplane is equipped with a 12v DC electrical system
Full details of the engine's electrical system can be found in the Rotax Operator's Manual.

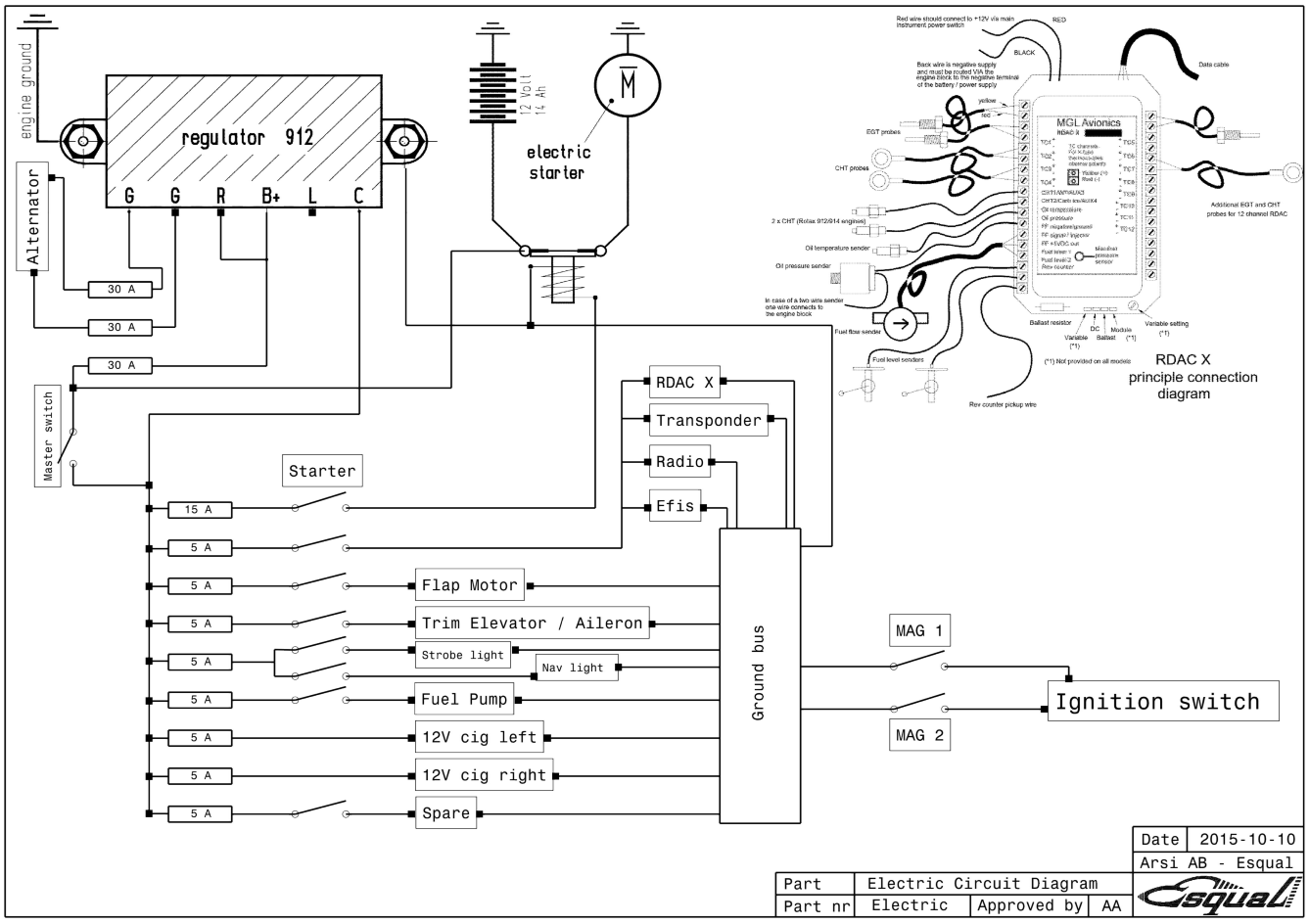
DC Supply

The battery (Sellpower 7800 (7,8 amps)) are located on the left side inside the cowling on the firewall. Make sure to keep the battery charged and maintained properly.

Only use recommended charger. See battery manufacturers' maintenance manual

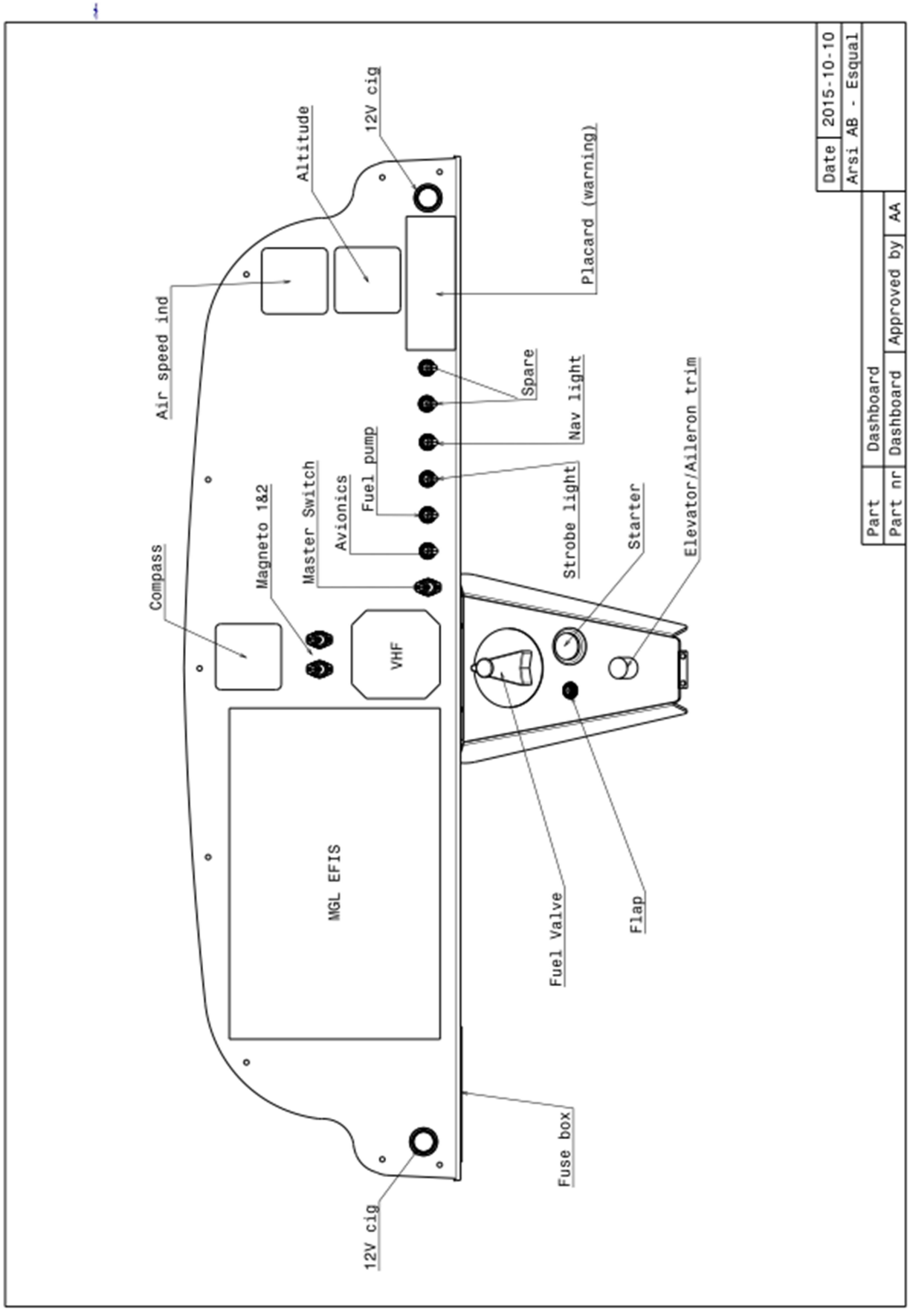
An analogue or electronic voltmeter mounted on the instrument panel monitors the battery voltage. Normal readings lie in the range 12 to 14.4 volts.

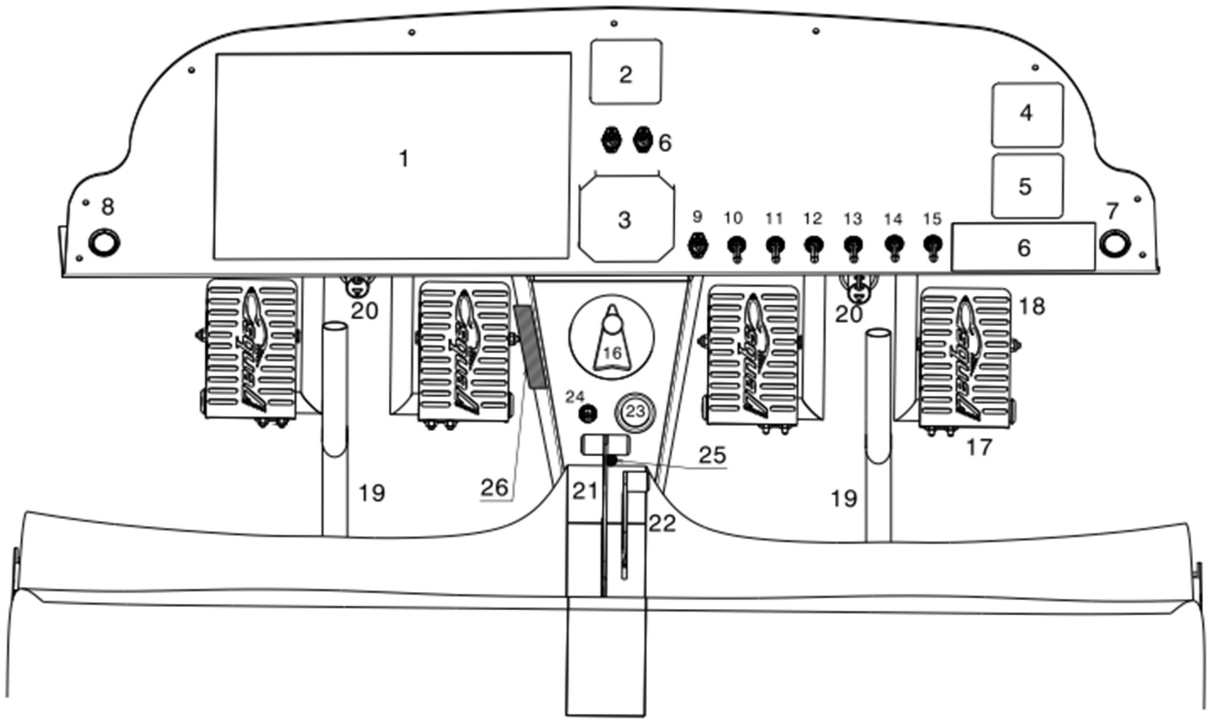
(This circuit diagram can vary, depending on avionics/equipment)



CHAPTER 5

COCKPIT LAYOUT & NORMAL OPERATING PROCEDURES


Altitude
12V cig
Placard (warning)
Air speed ind
Spare
Nav light
Fuel pump
Avionics
Master Switch
Magneto 1&2
Compass
Strobe light
Starter
Elevator/Aileron trim
VHF
MGL EFIS
Fuel Valve
Flap
Fuse box
12V cig
Date 2015-10-10
Arsi AB - Esqual
Part Dashboard
Part nr Dashboard
Approved by AA



5.1 COCKPIT LAYOUT

1-15 (see dashboard drawing)

16 FUEL SELECTOR SWITCH / FUEL VALVE

This is located in the inferior part of the central console. You have the option to use left, right, both fuel tanks and turn the fuel off.

17 / 20 STEERING PEDALS / PEDALS SUPPORT

They are installed in both seats. If you push the support bar (20) bar downwards with one hand you can push the pedals forward or backward, it will allow you to adjust the pedals in flight. Steering pedals control the rudder, left pedal A/C movement left, right pedal A/C movement right.

18 BRAKES

These are used in a conventional way: Pushing them with the top of your foot downwards. The brakes on the steering pedals are standard installed in the left seat. Right seat brakes is an option.
Effective ground control while taxiing is accomplished through the differential brakes.
Left brake pedal to steer left and right brake pedal to steer right. Both to stop the aircraft straight forward.

19 FLIGHT CONTROL LEVER (stick)

The stick is manually operated through mechanical linkage using a stick for the ailerons and elevator. The flight controls are from the standard type, push the stick to the left for left turn, to the right for right turn.
Pull the stick to move the aircraft nose up, push the stick to move the aircraft nose down.
There is a handle (stick) for each seat with a microphone switch incorporated.

21 THROTTLE LEVER

The throttle is situated on the throttle panel between the seats.

Maximum power = Lever completely forward
Idle power = Lever completely backward

22 CHOKE LEVER

By pulling the choke handle, the circuits of enrichment will open.
It should never be used to stop the engine and under no circumstances should you take off with the choke on.

Maximun choke = Lever completely backward
Minimum choke = Lever completely forward

23 STARTER

Push the start button to start the engine.

24 FLAPS

The flaps are electrical operated. The flap switches are situated on the central panel.
Depressing and holding the flap-up switch – flaps go up as long as switch is held up.
Depressing and holding flaps down switch – flaps are lowering as long as switch is held down until reaching the stop.
The left flap has a graduated scale at the surface for a correct draught.

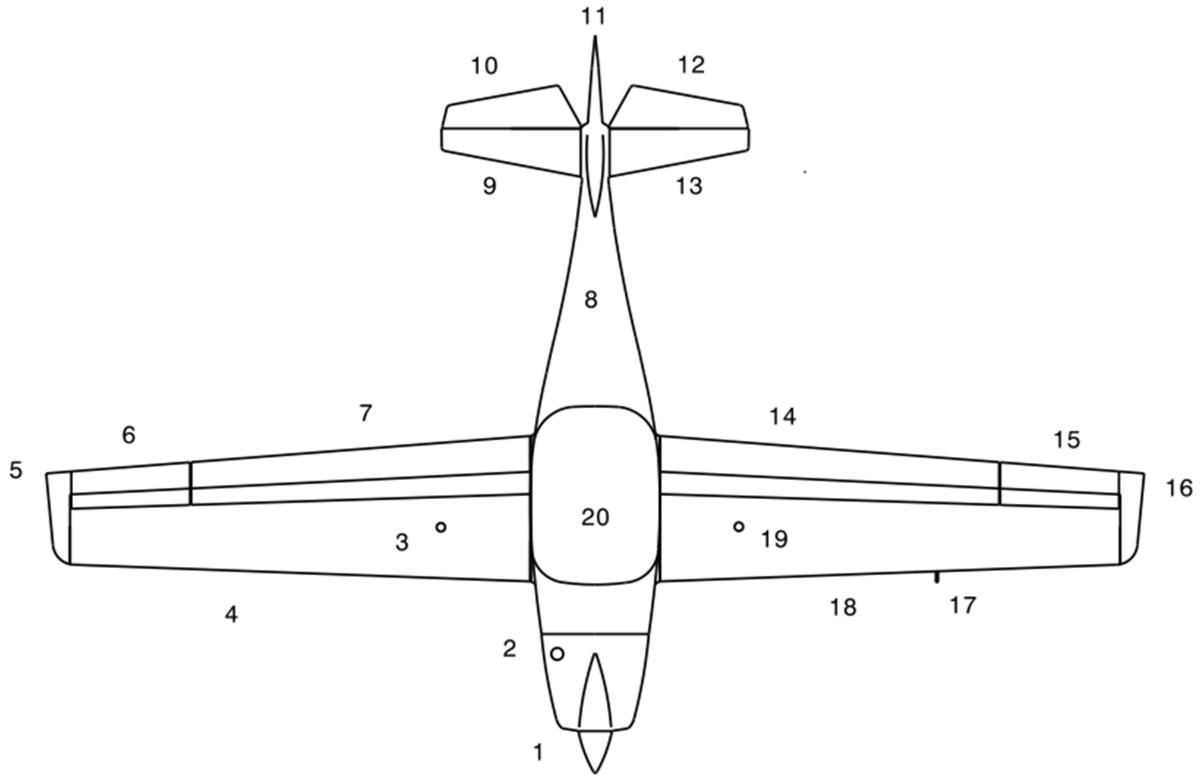
25 TRIM

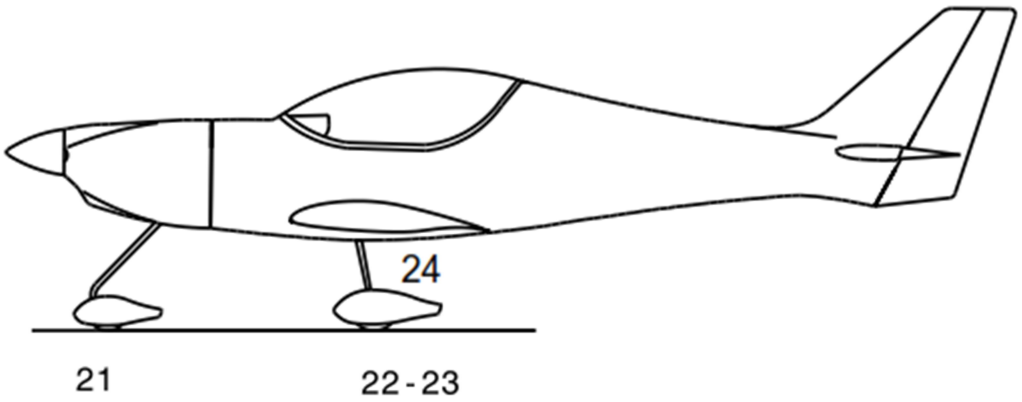
The trim is electrical operated. The trim joystick is situated on the central panel or stick (option).
The direction of movement is the same as for the stick.

26 RESCUE SYSTEM PARACHUTE LAUNCH

The ballistic parachute lever is located at the front central panel. Please see the **2.9 RESCUE SYSTEM** section for info.

5.2 PRE-FLIGHT INSPECTION





Ignition switch	OFF
Avionics	OFF
Master Switch (battery)	OFF
Fuel valve	OFF
Master Switch	OFF

Aircraft Nose (1-2)

Open cowling	Check first general appearance
Engine oil	Remove the cap from the oil container. Pull the propeller in the right direction and listen for a bubbling noise. Check oil level and leaks.
Engine Water coolant	Check the level.
Engine mount	Check: welds for cracks, bolts secured and shock rubbers in good condition
Carburettor & throttle cables	SECURE
Exhaust	Secure and no cracks
Electric & spark wires	SECURE
Nose wheel **(21)**	Inspect nose gear and tires inflation 2.0 BAR
Propeller	Inspect propeller status and be sure ALL switches are OFF before pulling the propeller in the right direction and listen for eventual irregularities of the engine.
Close cowling	Secure cowling

Right Wing (3-7)

Wing tie-down	DISCONNECT
Water drain **(24)**	Before first flight of the day and before moving the aircraft, check fuel in tank for WATER, sediment and proper fuel
Fuel quantity	Check fuel tank visually for desired level
Fuel filler cap	SECURE
Wing surface	Free of knock, damage or dirt
Flaps	Check hinges, damage and dirt
Aileron	Check hinges, ball-socket joint, damage, free movement and dirt
Main wheel **(23)**	Check tires inflation 2.0 BAR and status of wheel assembly. Check brake system for leakage and proper functionality

Fuselage (8)

Surface	Look for knocks or damage
Static ports	Open and free of dirt or ice
Parachute trapdoor	Not obstructed and clean

Tail assembly (9-13)

Elevator	Check freedom of movement, hinges, damage or dirt
Rudder	Check freedom of movement, hinges, damage or dirt
Control linkage	Inspect correct linkage

Left wing (14-19)

Wing tie-down	DISCONNECT
Water drain **(24)**	Before first flight of the day and before moving the aircraft, check fuel in tank for WATER, sediment and proper fuel
Fuel quantity	Check fuel tank visually for desired level
Fuel filler cap	SECURE
Wing surface	Free of knock, damage or dirt
Flaps	Check hinges, damage and dirt
Aileron	Check hinges, ball-socket joint, damage, free movement and dirt
Pitot tube	Remove cover and check the opening
Main wheel **(22)**	Check tires inflation 2.0 BAR and status of wheel assembly. Brake system for leakage and proper functionality

5.3 BEFORE STARTING ENGINE

Pre-flight inspection	COMPLETED
Pedals	ADJUST
Luggage	SECURED
Seat belts (shoulder harness)	ADJUST AND LOCKED
Canopy	CLOSED AND LOCKED
Flight controls	FREE
Trim	NEUTRAL
Fuel valve	OPEN
Avionics	OFF
Brakes	TEST AND SET
Altimeter	SET QNH
Parachute security	HOT
Master switch	ON
Flaps	OPERRATE DOWN – UP
Strobe light	OFF

5.4 ENGINE START

Choke	PULLED BACK
Throttle	PULL BACK, PUSH 1-2 CM FORWARD
Fuel Pump	ON
Magnet 1 & 2	ON
Propeller area	FREE
Starter	PUSH THE START BUTTON (max 3 sec.)
Engage rpm (Adjustment)	2500 rpm
Choke	OFF
Radio and Nav.	ON
Oil Pressure	CHECKED (in greens within 10 sec)
Voltmeter	CHECK 12V+ DC

5.5 ENGINE WARM-UP

Run the engine for 2 minutes at 2500 rpm, afterwards increase to 3000 rpm, until the oil temperature indicates 50°C.
If the engine does not start after three or four start attempts, the reason might be a floated engine. Turn off the magnets, full throttle, choke off, crank the engine several times with the starter for a short time.
Turn on the magnets again and now with the throttle at 1/3 open press the start button. Pull the throttle to idle immediately after you have started the engine.

5.6 TAXI

If you are flying alone, check that the right seat seat belts are secured before starting to taxi.
Keep the stick back while rolling in order to unload the stress on the nose landing gear.
You should always keep a low taxi speed and try to avoid drastic power changes, due to the fact that the inertia on the propeller mass causes important stress on the differential and the crankshaft.
We advise you to taxi with the flaps up, especially on sandy runways to avoid damage by objects or stones raised by the wheels.
Avoid flying if the runway is muddy, it will eventually damage the fairings and can affect the braking capacity of the plane.

Important:
It is completely FORBIDDEN to start taxiing if there is any malfunction of the brakes.

5.7 CHECK BEFORE TAKING OFF

1. Brakes	ON
2. Throttle	4000 RPM
3. Magnet Check	CHANGE R-L (and both)
4. Throttle	IDLE
5. Flaps	Extend 10° depending on the necessity

At the holding point, check that the engine is within the operational limits and proceed with the magnet test.

Once you have started to take off roll, there is sufficient control over the steering rudder to keep the plane on the runway axis without having to use the differential brakes.

Once a positive climb rate is established the flaps can be returned to the neutral position (0°).

Attention:
The drop in revolution with only one magnet should not be superior to 300 RPM.
The variation between both magnets should be less than 150 RPM at 4,000 (revolutions, turns).

5.8 TAKE OFF

1. Brakes	FREE
2. Trim	NEUTRAL
3. Throttle	MAX POWER (not less than 5000 RPM)
4. Stick	Slightly backwards until approx 60 Km/h
5. Fuel pump	OFF at altitude
6. Flaps	UP
7. Engine instruments	CHECK in the greens
8. Trim	Adjusted for a climb at 160 Km/h

5.9 CLIMB

Best rate of climb
The best rate of climb speed V_Y = 160 km/h. Expect about 1400 ft/min at sea level and 0° flaps.

Best angle of climb
The best angle of climb speed V_X = 140 km/h and 0° flaps.

5.10 CRUISE

Once desired height is established, accelerate until the required speed and adjust power.

5.11 DESCENT

The Esqual is a very clean, low drag, aerodynamic aircraft which accelerates very rapidly to its cruising speed and when the throttle is retarded it looses speed very slowly maintaining a lot of energy.
Therefore it is important to plan your descent and approach well in advance.
To avoid shock cooling of your engine, apply periodically some power on long descents.
Bear in mind the possibility of ice formation in the carburettor at low power settings.

5.12 APPROACH

Consider that most landings are usually only as good as the approach. Therefore master your glide for every different wind condition. In that way, should you ever have a forced landing due to an engine failure you will be prepared and trained.
Set up glide from the moment you turn base leg (if possible) and concentrate on landing behind the runway numbers (threshold). The second you realize you are too short add power accordingly.
Should you realize you are too high, start your slip immediately, keeping your target in mind.
If you are not current on side-slip, get some altitude and practice, keeping a constant airspeed between 100 and 110 km/h and straight lines ahead.

It is recommended to make full circuits to have enough time to configure the aircraft for landing. Slow down when in downwind till 130 km/h. You then can lower the flaps to 20 degrees. Slow further down below 110 km/h for higher flap setting, if needed.
Land the aircraft with 20 degrees flaps in gusty or cross winds. Full flaps for short runways. In other cases use the flaps depending on the necessity.

Fly the straight final at 1.3 V_S being approx.110 km/h pending the gross weight of the aircraft.

Don't forget "an aircraft ALWAYS stalls at the same ANGLE OF ATTACK, never at the same speed"
Increase speed with 10%, when flying in rain.
Bear in mind, that the DRAG increases with the flap setting and that you have to adjust power settings accordingly to avoid too pronounced descent rates.

In gusty wind conditions it is recommended to adapt your approach speed in regard to the value of the gust difference.
Make the difference between gust and steady wind velocity, divide by two and add this value to your approach speed.

Wind	260/15 km/h
Gust	260/25 km/h
Difference	25 km/h – 15 km/h = 10 km/h
Divide by two	10 km/h : 2 = 5 km/h
Approach	95 km/h + 5 km/h = 100 km/h

5.13 DOWNWIND

Be sure that the passenger already is briefed about your intentions and to keep clear of controls.

Fuel pump	ON
Throttle	Retard, keep in mind carburettor heater when in potential icing conditions
Flaps	20 degrees below 124 km/h
Trim	Trim A/C for horizontal flight

5.14 BASE LEG

Throttle	Retard for speed 110 km/h and start descent
Trim	Trim for glide path
Straight final	
Speed	Trim speed to 110 km/h until reaching threshold (IF using full flaps set the speed at 95km/h)

5.15 LANDING

At threshold start your flair using standard techniques and reducing power to loose excessive speed.
Touch down will be around 65 km/h in a two point landing keeping the nose high for aerodynamic braking and avoiding unnecessary loads on the nose wheel until it falls slowly down from itself and check brakes for proper function.
Keep speed under control and use differential brakes for steering to taxi in.
When landing in strong or gusty winds, land the aircraft at a higher speed without avoiding any flotation down the runway.

Airspeed	95 km/h
Flare	Level out in ground effect and retard throttle
Landing	2 point landing
Stick	Keep elevator up and applicable aileron up into wind after landing
Flaps	Flaps up during roll out
Brakes	Apply when nose wheel on the ground

5.16 BALKED LANDING

a) Throttle Full open
b) Accelerate to safe climb speed then raise nose to climb attitude.
c) Put the flaps up in increments with the correct speed and watch out for sink rates.

5.17 AFTER LANDING

a) Parachute system	SECURE
b) Fuel pump	Off
c) Flaps	UP
d) Radio, electrical equipment	Off
e) Magnets	Off
f) Strobe light	Off
g) Master switch	Off
h) Fuel	Off

5.18 NORMAL OPERATING DATA

Best rate of climb	V_Y = 160 km/h 0° flaps
Best angle of climb speed	V_X = 140 km/h 0° flaps
Glide ratio speed (19:1)	V_q = 140 km/h
Stall speed at gross weight	V_{S1} = 95 km/h
Stall speed at gross weight (full Flapps)	V_{S0} = 63 km/h

CHAPTER 6

EMERGENCY PROCEDURES

6.1 INTRODUCTION

Emergencies caused by airframe or engine malfunctions may be significantly reduced or eliminated with proper pre-flights. Emergencies can be minimized or eliminated by careful flight planning and good judgment when unexpected weather is encountered.
However, should an emergency arise the basic guidelines should be considered and applied as necessary to correct the problem.

6.2 GENERAL RECOMMANDATIONS FOR EMERGENCY PREVENTION

a) Hangar or cover your aircraft and maintain engine, airframe and pilot logs.
b) Drain old fuel and replace with fresh fuel. Spoiled auto fuel will varnish your cylinders and cause rings to stick. The hotter the weather, the faster fuel will deteriorate. Drain and clean float bowls as well, being sure they are replaced correctly.
c) Run engine regularly, if possible. For long periods of down time, store engine in accordance with manufacturers recommendations.
d) Follow your maintenance schedule and replace all parts within specified periods or when they show signs of wear.
e) Keep current. If you don't fly for any extended period get a checkout and some tips from a professional instructor. You'll be surprised how much you will learn.
f) Use a landing strip that matches your skill level and judgment. Avoid one way and uphill strips if possible.
g) Remember to always start your take off run at the very start of the runway. If full RPM are not achieved, abort take off. Treat every take off with respect, realizing that the sooner you get to altitude, the safer you are. Get off fast and climb at best rate turning crosswind as soon as you consider you couldn't make a safe emergency landing straight ahead. Keep your downwind close and within gliding distance. If at your own private strip circle it to gain altitude while monitoring engine temp and RPM.

REMEMBER ALTITUDE AND AIRSPEED ARE YOUR BEST FRIENDS

6.3 AIRSPEED FOR EMERGENCY OPERATION

Engine failure after take off	115 km/h flaps DOWN / 140 km/h flaps UP
Maximum glide	140 km/h flaps UP
Precautionary landing with engine power	95 km/h
Landing without engine power	110 km/h - FINAL
Landing without flaps	110 km/h - FINAL

6.4 ENGINE FAILURES

1. Engine failures during take off

a) Throttle: Idle
b) Brakes: Apply
c) Magnets: Off
d) Master: Off
e) Remove from runway and inspect

2. Engine failures immediately after take off

a) Lower nose to maintain airspeed of 115 km/h – when the flaps are down. When the flaps are up, keep flying 140 km/h until reaching landing area, then lower the flaps.
b) Maintain control – keep on flying.
c) Fuel, ignition and master off (if time permits)
d) Land straight ahead if possible – or within 30° of RWY-axis

3. Engine failures during flight and forced landing

a) Airspeed (best glide) 140 km/h – flaps up
b) Set up approach for field, noting wind direction and velocity
c) Fuel on
d) Magnetos on
e) Attempt restart (if time permits) (if propeller stops use starter)
f) If it does not restart turn fuel off and ignition master off
g) Pick your spot and fly over it if possible at 1000 ft, crosswind and join down wind for regular circuit. Remember you can always get rid of altitude if necessary, but you can't get it back. So, plan coming in high on your final and slipping down to your target, landing on two wheels, keep elevator up on touch down, bring nose wheel on ground and apply brakes while keeping straight.

Note: Use starter only when propeller stopped wind milling. When propeller is wind milling then the engine might restart by putting fuel and magnetos on.
Keep battery on to lower flaps during the flare.

6.5 Fires

1. On ground, engine running

a) Fuel: OFF ↔ Power 1500 RPM for a short time. (Which should probably suck the flames and accumulated fuel through the carburetor and into the engine)
b) Engine: shut down and inspect

2. During start

a) Continue cranking for 15 seconds
b) If engine doesn't start continue another 15 seconds while executing point C.
c) Engine: SECURE
1. Fuel: Off
2. Ignition: Off
d) Master switch: Off
e) Fire: Extinguish using extinguisher, wool blanket or dirt
f) Inspect and repair

3. In flight – engine

a) Throttle: CLOSED
b) Fuel valve: OFF
c) Fuel pump: OFF
d) Master switch: OFF
e) Cabin heat: OFF
f) Airspeed: 200 km/h (or faster if necessary) to provide an incombustible mixture
g) Forced landing: Execute as described in power off forced landing

4. In flight – electrical

a) Master switch: OFF
b) All other switches (except ignition): OFF
c) Vents, cabin air & heat: OPEN
d) Fire extinguisher: ACTIVATE (if necessary) *WARNING:* After discharging an extinguisher within a closed cabin ventilate cabin.

5. If fire is extinguished

If fire appears to be out and electrical power is necessary for continuance of flight:

a) Master: ON
b) Circuit Breakers: CHECK FOR FAULTY CIRCUIT
c) Radio/Electrical switches: ON - one at a time, with delay after each, until short circuit is localized.

6. Cabin fire

a) Master: OFF
b) Vents, cabin air: OPEN
c) Fire extinguisher: ACTIVATE (if applicable)
d) Ventilate cabin
e) Land airplane as soon as possible and inspect

7. Wing fire

a) Navigation light (if installed): OFF
b) Perform side slip to keep flames away from fuel tank and cabin and land as soon as possible.

6.6 DITCHING

It is a good tendency to not fly any single engine aircraft outside of gliding distance to a safe landing area. New reliability in engine and higher cruising speeds has sent many pilots venturing over mountains, forests, cities, large bodies of water and snow without consideration for emergency landings.

1. Water landing with power

a) Radio-transmit MAYDAY on 121.5 MHz giving location and intentions.
b) Heavy objects: Secure or jettison
c) Approach: High winds heavy seas: into wind
Light winds and swells: parallel to swells
d) Power: Establish 200ft/min. descent at 80km/h – flaps 30°
e) Canopy: Unlatch (if applicable)
f) Touch down: Tail low attitude at 200 ft/min. descent
g) Face: Cushion protected at touch down with coat or pad
h) Airplane: Evacuate

2. Water landing without power

SAME AS ABOVE EXCEPT

a) Set up descent at best glide speed – 140 km/h flaps up
b) Level out just above water – flaps 30°
c) Burn off excess speed and land at minimum speed

6.7 ICING

Carburettor icing
Is possible when temperature and dew points reach critical icing conditions, so be aware of any unusual engine sounds, power loss or drops in RPM. Pull carburettor heater on and the following action is recommended.

a) Turn back or change altitude to obtain outside air temperature that is less conductive to icing.
b) Open the throttle to increase engine speed and minimize ice build up on propeller blades.
c) Plan landing at the nearest airport. With an extremely rapid ice build up, select a suitable “OFF AIRPORT” landing site. Use a forward slip if visibility is a problem.
d) Consider a faster approach due to weight and drag of ice.
e) Land as level as possible.

6.8 STALL WITHOUT ENGINE

A stall is recognized by a slight disturbance or rumbling of the aircraft and an eventual loss or degradation of controls.
If you persist with this situation, then the aircraft will most probably turn around the left wing and enter a spin.
To counter the stall, keep the ailerons neutral and push the stick forward to unload the aircraft and to reduce the angle of attack considerably clearing the stall.
Special attention must be given during the pullout in not to re-stall the aircraft with high “G” rates.

6.9 STALL WITH ENGINE

Increasing the power during the above mentioned recovery procedure will help to clear the stall faster.
All the rest of the procedure remains the same as in “stall without engine”.

6.10 SPIN

Spin practice is not authorized on ultra lights. The Esqual spins like a normal aircraft and respond immediately to the normal spin recovery procedure.

6.11 LANDING WITH FLAT MAIN TIRES

a) Approach normal
b) Touchdown: good tire first, hold plane off flat tire as long as possible with aileron control.
c) Put nose wheel on ground before touch down with flat tire. Keep directional control with rudder, aileron and brakes.

CHAPTER 7

FLIGHT PERFORMANCE

7.1 TAKE OFF DISTANCE

All data is based on the ICAO legislation: standard atmosphere ISA and maximum take off weight (472,5 kg). Aerodrome conditions: calm wind and grass surface.

Take off speed: 65 km/h IAS (40mph)
Climb speed: 140 km/h IAS (83 mph)

Take off distance at 15°C: 110 m
Take off distance at 15°C, 15m obstacle clearance 155 m

7.2 LANDING DISTANCE

All data is based on the European legislation : 472,5 kg weight. Field conditions: calm wind, smooth, dry and grass surface.

Approach speed: 95 km/h (60mph)
Touch down speed: 65 km/h (40 mph)

Landing run: 100 m (350 ft)
Landing distance, 15 m (50ft) obstacle clearance : 200 m (700 ft)

7.3 CLIMB

C. Rotax 912S
Maximum climb regime: 140 km/h (83 mph) IAS >1400 fpm
Best climb regime: 160 km/h (100 mph) IAS >1100 fpm

7.4 CRUISE SPEED

Rotax 912S
At maximum continued revolutions (5500 rpm)
Maintaining altitude and level flight: 260 km/h

7.5 AIRCRAFT RANGE

Esqual C 912S
At cruise speed of 240 km/h, 5000 RPM, the range is of 1200 km with reserve.
The wind factor is not considered.
At an economic cruise speed of 200 km at 4500 RPM (<65%) and at an altitude of 1500 meters the range is approx. of 1400 km. The wind factor is not considered.

7.6 APPROXIMATE FUEL CONSUMPTION

Esqual C 912S
At an altitude of 1500 m (5000 ft) the fuel consumption is:
200 km/h 13 l/h
240 km/h 17 l/h

Attention:
The standard fuel quantity indicators have a factory error of +/- 10%
A take off with less than 10 l of fuel in the tanks is FORBIDDEN.

7.7 MAXIMUM ALTITUDE

With a weight of 472,5kg. Standard atmosphere ICAO, the Esqual has shown its capacity to climb to 5000 m (15250 ft) equipped with the Rotax 912 ULS engine.

Note: Remember that an altitude of more than 3500 meters above sea level (ASL) the use of oxygen is necessary.

CHAPTER 8

WEIGHT AND BALANCE

8.1 EMPTY WEIGHT

8.2 REFERENCE DATUM LINE (RDL) AND CENTER OF CRAVITY (C.G.) LIMITS

8.3 CENTER OF GRAVITY CALCULATIONS OF AN EMPTY AIRCRAFT

8.4 HISTORY AND WEIGHTS

8.5 MINIMUM EQUIPMENT LIST

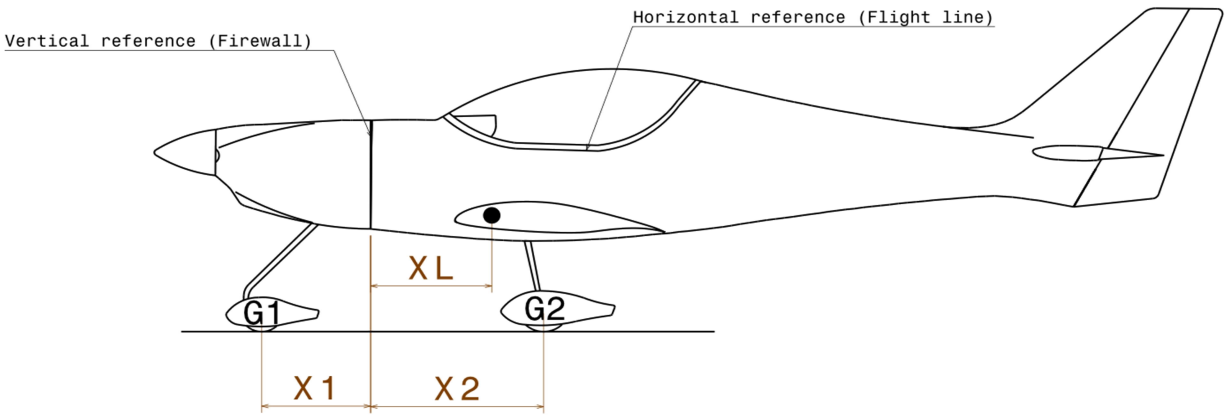
8.6 ADDITIONAL EQUIPMENT LIST

8.1 EMPTY WEIGHT

Esqual Power plant	Rotax 912 ULS
Empty weight	
Load (including fuel)	
MTOW - ULM/Aircraft	450 / 472,5 kg
Max. allowed luggage compartment	18 kg

8.2 REFERENCE DATUM LINE (RDL) AND CENTER OF GRAVITY (C.G.) LIMITS

The reference datum line is located on the firewall.
The horizontal reference line is in the center of the cockpit frame.



Esqual VM 1C - ROTAX 912ULS

Most FWD limit	794	mm AFT of RDL
Most AFT limit	937	mm AFT of RDL

8.3 CENTER OF GRAVITY CALCULATIONS

Center of Gravity - Esqual						
Firewall used as reference						
Rad		**Distance (mm)**		**Weight(kg)**		**Torque**
1	Nose wheel (-)	-258	X		=	
2	Left wheel	1015	X		=	
3	Right wheel	1015	X		=	
4	Fuel	1041	X		=	
5	Pilot	1157	X		=	
6	Co pilot	1157	X		=	
7	Luggage	1900	X		=	
8		**Total**				
9						
10		Totalt torque		Total weight (kg)		CG (mm)
11			/		=	

Calculate CG acordingly:
1. Put in the values in the proper square ("Weight" row 1-7)
2. Multiply the distance with the weight = Torque. Put the value under torque
3. Add everything up on row 8
4. Place the total value of weight and torque on row 11
5. Divide "Totalt torque" with "Total weight" on row 11
6. The result on row 11 is your actual CG in mm
7. Allowed CG (in flight) 794-937 mm

B. Esqual VM 1C – ROTAX 912 ULS

	Arm (mm)	Weight (kg)	Moment kg/mm
Front wheel	-258		
Left wheel	1015		
Right Wheel	1015		
1° Pilot	1157		
2° Pilot	1157		
Luggage (max 18 kg)	1900		
Fuel	1041		
Total			

8.4 HISTORY AND WEIGHTS

Date	Name	Empty weight (kg)	C.G. empty (after datum mm)	Moment of empty weight	Maximum useful load (kg)	Signature

8.5 MINIMUM EQUIPMENT LIST

The minimum equipment installed by the factory consists of the following:

- Air speed indicator
- Altimeter
- EFIS/ Compass
- Seat belts (x2)
- Factory date plate
- Flight manual
- EFIS / Eng mon instr
- Fuel pump

8.6 ADDITIONAL EQUIPMENT LIST

- Ballistic Parachute
- Radio
- Transponder
- Dual brakes

Accessory	Arm (mm)	Weight (kg)	Moment(kg/mm)
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			