FLIGHT MANUAL

POWERED SAILPLANE
STEMME S10, VARIANT S12

DOCUMENT NUMBER • L400-912810

DATE OF ISSUE • AUGUST 20, 2016

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SIGNATURE .....

AIRFRAME TYPE	**: STEMME S12**
TYPE CERTIFICATE	**: EASA.A.054**
SERIAL NUMBER	**: 12-**
REGISTRATION	**:**

This aircraft may only be operated in correspondence to the instructions and operating limitations specified in this manual.

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0.1 RECORD OF AMENDMENTS

Any revision of the present manual must be recorded in the following table, with the exception of:

- Updated weight data,
- Changes to the arrangement of instruments on the instrument panel.
- Data relating to the installation of supplemental or additional equipment (section »9-2« and »9-3«).

The record of amendments in section »0.1« and the list of effective pages in section »0.2« are assigned to an individual aircraft serial number. The indicated amendment no. in the feed line of these pages does not change with entries after delivery of the aircraft.

Revision of pages must be endorsed in the following list. Necessary amendments, needs to be mandatory included in the present manual.

The new or amended text will be marked on the revised page by a black vertical line on the right hand margin; the amendment number and the date will be shown in the outside of the footer page.
The inspector certifies by his signature the correspondence of this individual Aircraft Flight Manual and the following list with the aircraft designated by serial number.

Am. No.	Removed Pages	Inserted Pages	Date of Amendment	Reference	Approval	Date of Insertion	Signature
00	--	ALL	AUG 20, 2016	P061-2016-084			
01	0-1, 0-3, 0-5,0-6, 2-20	0-1, 0-3, 0-5,0-6, 2-20	AUG 28, 2017	P061-2017-094			

Am. No.	Removed Pages	Inserted Pages	Date of Amendment	Reference	Approval	Date of Inser-tion	Signa-ture
02	0-1, 0-2, 0-3, 0-4, 0-5, 0-7, 0-8, 1-1, 1-6, 1-7, 1-8, 1-11, 1-13, 2-4, 2-7, 2-8, 4-53, 6-1, 6-3, 6-6, 7-20	0-1, 0-2, 0-3, 0-4, 0-5, 0-7, 0-8, 1-1, 1-6, 1-7, 1-8, 1-11, 1-13, 2-4, 2-7, 2-8, 4-53, 6-1, 6-3, 6-6, 7-20	OCT 10, 2018	P061-2017-162	16 NOV 2018		

0.2 LIST OF EFFECTIVE PAGES

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1. GENERAL

1.1 INTRODUCTION

This Aircraft Flight Manual (AFM) was compiled to give pilots and instructors all necessary information for a safe, appropriate and performance-optimized operation of the motor glider.
The manual includes all the data required to be furnished to the pilot by CS-22 Amdt. 0. In addition, it contains a number of other data and operating hints which should be useful to the pilot from the manufacturer's point of view.

The operating instructions for the engine, variant ROTAX 914 F2-01/S1 and for the propeller, type STEMME 11AP V, are integrated in this Aircraft Flight Manual. Thus the operating manual for the engine ROTAX 914 F2-01 is not required for a safe aircraft operation; however, it is delivered with the motorglider since it contains some additional information.

The engine variant ROTAX 914 F2-01/S1, modified by STEMME, differs slightly in structural design from data given in the operating manual for ROTAX ENGINE TYPE 914 SERIES, which is not representative in this respect.
The ROTAX 914 F2-01 features a combined CHT and coolant-temperature measurement. There is no separate handbook for the propeller.

1.2 CONVERSION TABLE

For the conversion of technical data the following factors have been used:

Data	Factor
1 cubic in	16.387 cm^3
100 fpm	0.508 m/s
1 ft	0.3048 m
1 ft lb	1.356 Nm
1 hp	0.7457 kW
1 Imp.gal.	4.546 l
1 in	25.4 mm
1 inHg	33.86 hPa
1 kgm	86.8 lb in

1.5 CERTIFICATION BASIS

This motorglider STEMME S12 was certified by the EASA in accordance with Certification Specifications for Sailplanes and Powered Sailplanes CS-22 issue November 14, 2003 (Initial release of the English original).

The Type Certificate for the variant S12 was issued on March 14, 2016.

Category of Airworthiness is "Utility".

NOISE CERTIFICATION BASIS FOR THE MODEL S12

EASA Certification Specifications for Aircraft Noise – CS-36 Amdt. 3 Federal Aviation Regulations (FAR) Part 36, Appendix G, Amdt 36-30 ICAO Annex 16, Volume I, Part II, Chapter X, 6th Edition. July 2011 LBA approved MT-Propeller Noise Test Handbook Doc. No. E-141, latest issue ICAO Environmental Technical Manual No. 9501, 1st edition 2010.

1.6 DESCRIPTION AND TECHNICAL DATA

The variant STEMME S12 is a technical derivative of the S10-VT and differs from it primarily as follows:

- Geometry and structure of wings.
- Upload to 900 kg / 1984 lb MTOW and 610 kg / 1345 lb MNLP.
- Span 25.07 m / 82.25 ft
- Area of the vertical stabilizer increased to 1.78 m^2 / 19.16 sqft.
- Wider undercarriage (increased track to 1360 mm / 53.54 in) with new shock absorber system.
- New Instrument Panel Design.
- New electrical system.
- Fuel tank system.
- Cockpit Interior.
- Installation of autopilot (optional)
- Electric for elevator trim system.
- Water ballast tank in vertical tail.
- Luggage compartment in tail boom.

The STEMME S12 is a twin-seat, self-launching motorglider, constructed mostly from carbon fiber and is aerodynamically optimized for high performance. The two seats are arranged side-by-side (forward of the wing) and the S12 is equipped with dual controls.

The wing is shoulder mounted and consists of a center section with flaps and Schempp-Hirth air brakes, two outer wing sections with continuous ailerons, two wing extensions with ailerons and two winglets. The flaps and ailerons of inner and outer wing/wing extension are interconnected (“flaperons”).

The motorglider is in “T”-tail design.

The retractable two-wheel main landing gear is electrically operated and is equipped with hydraulic wheel brakes.

The engine of the STEMME S12 is based on the ROTAX 914 F2-01, which has been certificated by BRP-ROTAX® GmbH & Co.KG, Austria. STEMME modified the arrangement of some accessories (induction and exhaust system including turbo-charger, engine mounts etc.) to adapt the systems to specific installation requirements of the S12. These modifications are certified in the STEMME S12 as engine variant ROTAX 914 F2-01/S1.

ENGINE DESCRIPTION

- Four-cylinder, four-stroke opposed type Otto-engine, turbocharged with electronic manifold pressure control (TCU); a central cam shaft and tappets; OHV; liquid cooled cylinder heads, cylinder barrels cooled by ram air; dry-sump lubrication; Dual Capacitive Discharge Ignition (DCDI); 2 CD-carburetors (variable-choke); integrated reduction gear with mechanical vibration absorber and overload clutch.

The engine is mounted in the fuselage in a central steel tubing frame near the aircraft´s CG. Engine power is transmitted via a propeller shaft made of composites and a spur gear to the variable pitch propeller in the fuselage nose.

When the aircraft is in gliding configuration, the propeller blades are folded and covered by a movable nose-cone. Propeller pitch change from take-off into cruise position is accomplished by electrically heated expansion elements, and from cruise back to take-off position (elements unheated) by springs as well as aerodynamic and centrifugal forces.

A fuel tank is located at each outboard end of the wing center section. Each tank supplies the feeder tank in the fuselage by use of electrically driven fuel pumps. From the feeder tank the fuel is supplied by two fuel pumps (one main and one auxiliary) to the engine to provide required redundancy.

WEIGHTS		
Max. T/O-weight	900 kg	1984 lb
Empty weight	690 kg (approx., min. equipment.)	1521 lb
Max. wing loading	45.11 kg / m^2	9.2 lb / sqft.

ENGINE		
Design	4-cylinder 4-stroke-Otto-motor, opposed type, turbocharged, electronic manifold pressure control integrated reduction gear.	
Variant	ROTAX 914 F2-01/S1	
Engine reduction gear ratio	i = 2.4286	
Bore	79.5 mm	3.13 in
Stroke	61 mm	2.40 in
Displacement	1211 cm^3	73.89 cubic in
Compression ratio.	9.0	
Drive shafts turns.	Clockwise	
Max. T/O power.	84.5 kW at 5800 RPM	113.2 hp
Max. cont. power.	73.4 kW at 5500 RPM	98.4 hp
Fuel flow at T/O power (115%).	33.0 l/h 8.72 US gal./h 7.26 Imp.gal./h	
Fuel flow at max cont. power (100%).	27.2 l/h 7.19 US gal./h 5.98 Imp.gal./h	
Fuel flow at 75% power.	20.4 l/h 5.34 US gal./h 4.49 Imp.gal./h	
Specific fuel consumption at max. cont. power (100%).	276 g/kWh	0.454 lb/hph

1.8 THREE VIEW DRAWING

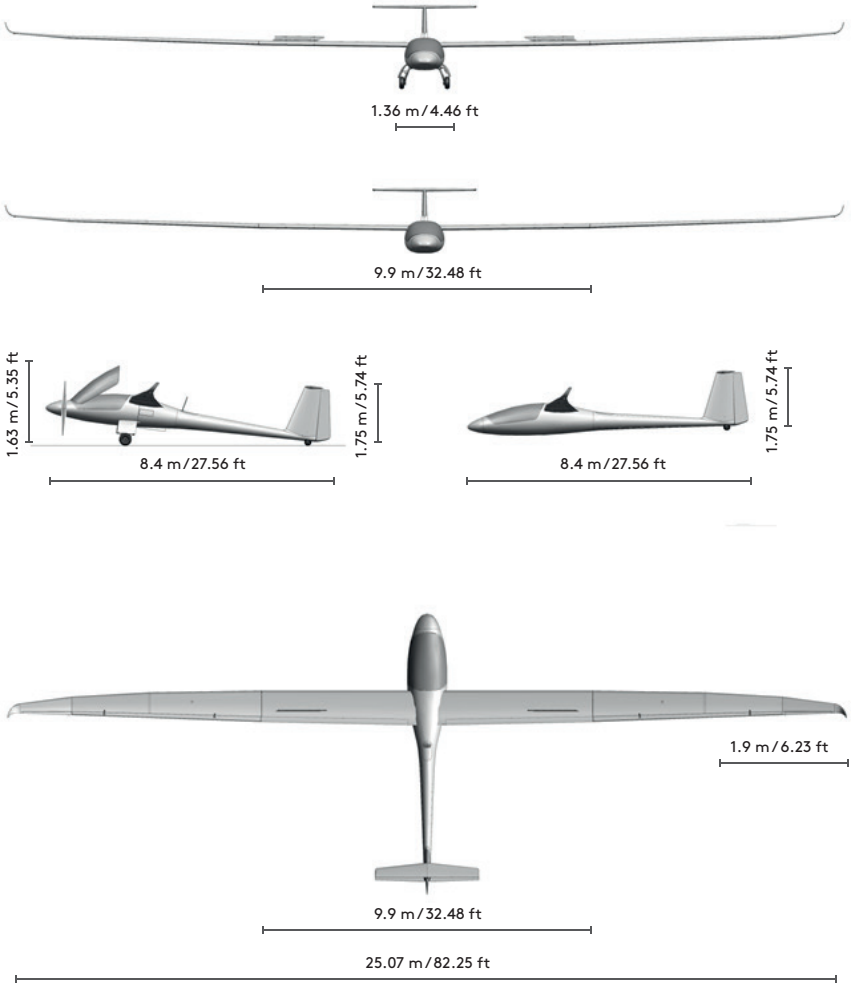

Figure 1.8.a
Three View Drawing of the S12

2.4 PROPULSION SYSTEM AND FLUIDS

2.4.1 ENGINE, PROPELLER, FUEL

ENGINE	
Manufacturer	BRP-ROTAX GmbH & Co. KG Gunskirchen, Austria.
Engine modification	STEMME AG, Strausberg, Germany
Engine/Variant	ROTAX 914 F2-01/S1
Max. T/O RPM	5800 RPM (max. 5 min)
Max. cont. RPM	5500 RPM
Idle RPM	1400 ··· 1800 RPM
T/O power (ISA)	84.5 kW/113.2 hp at 5800 RPM, 1320 hPa (39.0 inHg)
Max. cont. power (ISA)	73.5 kW/98.6 hp at 5500 RPM, 1180 hPa (34.9 inHg)
Power available at altitude T/O power: MCP (max. cont. power):	 Up to max. 2450 m/8000 ft MSL Up to max. 4500 m/16000 ft MSL
Max. cylinder coolant temperature (CCT)	120°C/248°F ROTAX 914 F2-01/S1
Oil temperature maximum: minimum:	 130°C/266°F 50°C/122°F
Temperatures for engine start-up maximum: minimum	 50°C/122°F (OAT) -25°C/-13°F (OAT)
Oil pressure minimum: maximum: normal:	 1.5 bar/22 psi 7.0 bar/101.5 psi (peak press. for cold eng. start) 1.5 – 5.0 bar/22-72.5 psi
Fuel pressure minimum: maximum: normal:	 Airbox pressure + 0.15 bar/+ 2.18 psi Airbox pressure + 0.35 bar/+ 5.08 psi Airbox pressure + 0.25 bar/+ 3.63 psi

AVGAS 100LL

When using AVGAS 100LL, valve seats are stressed by the high amount of lead and in addition combustion chambers will accumulate residues. AVGAS should be used only in case of fuel vapor problems or if other fuel is not available.

⚠ CAUTION

The engine manufacturer recommends not to use AVGAS for an extended period, because an increased amount of residues may accumulate in the engine.

⚠ CAUTION

Danger of fuel vapor lock when using “winter” fuel during summer time.

⚠ CAUTION

Use only the appropriate fuel, recommended for the climate zone.

NOTICE

In accordance with the EASA SIB 2011-01 R2 »Unleaded Aviation Gasoline (AVGAS) UL91« is also approved for operation. (See STEMME »SB A31-10-104« latest approved revision).

2.4.2.2 COOLANT FLUID

Mixture of 50% concentrated antifreeze agent with anti-corrosion additives and 50% water. Freezing point of this mixture is about -38°C / -34°F. »BASF Glysantin Antikorrosion« has proved to be good; this or equivalent coolant may be used.

⚠ WARNING

As the cooling system is pressurized, to avoid the risk of scalding by escaping hot coolant, do not open the locking cap on the coolant expansion reservoir unless the engine is cold (or barely lukewarm).

NOTICE

Waterless coolant is not approved for operation.

⚠ CAUTION

To minimize the risk of residues, concentrated antifreeze agent without water added should only be used in case of coolant evaporation after engine shut-down. Pure antifreeze agent starts freezing at -18°C / 0°F.

⚠ CAUTION

Check of the coolant fluid: The quantity in the overflow container (lower left side in the landing gear bay) must be between “min.” and “max.” markings. Missing coolant in the overflow container must be added.

⚠ CAUTION

If the level of coolant in the overflow container is below “min.” marking, proper supply to the breather valve and coolant tank is not assured and air may have been introduced into the cooling system. To check , confirm that the engine is cold, open the locking cap on the expansion reservoir (left side on fire-wall in engine compartment), and add coolant if necessary.

NOTICE

If the engine is warm, the indicated quantity in the overflow container is noticeably higher. An excessive coolant level in the overflow container will not result in engine damage, but will result in overflow of coolant into the landing gear bay.

4.5.6 HIGH ALTITUDE FLIGHT

When flying at high altitude, pilots must be aware that true airspeed (TAS) is higher than indicated airspeed (IAS).
As an approximate rule of thumb, true airspeed increases above indicated airspeed at a rate of approximately 2% per thousand feet above sea level. Thus, for example, at 12.500 feet MSL, TAS will be about 25% higher than IAS (standard atmospheric conditions).

The onset of aeroelastic flutter is dependent on true, rather than indicated, airspeed. Flutter resistance of the STEMME S12 has been validated at altitude of 2000 m/6600 ft MSL. Based on these tests the maximum permissible airspeed (never exceed speed) V_{NE} = 270 kph/146 kt has been established from see level up to 6600 ft MSL.

In order to avoid exceeding of the maximum permissible true airspeed above 2000 m/6600 ft MSL the maximum permissible indicated airspeed is reduced versus increasing altitude. The airspeed indication system is using the pitot/static air pressure where the air density is decreasing by increasing the altitude.

Based on the ICAO Standard Atmosphere (ISA) reduction of V_{NE} (IAS) - deviating from the ASI marking - is as follows:

Flight Altitude		Never Exceed Speed V_{NE}	
[ft MSL]	[m MSL]	[KIAS]	[kph (IAS)]
0 to 6,500	0 to 2.000	146	270
10,000	3.000	139	257
13,000	4.000	132	244
16,500	5.000	125	231
19,500	6.000	118	219
26,000	8.000	105	195
33,000	10.000	93	173
39,500	12.000	81	150

The above speed limits are to be observed with special care since freedom of flutter for the variant STEMME S12 can be guaranteed only up to these limits only.

6. WEIGHT AND BALANCE

6.1 INTRODUCTION

The S12 will only attain the flight performance and handling characteristics described in this operations manual if it is operated in the safe limits for loading and for the Center-of-Gravity (CG).
The pilot-in-command is responsible for the correct loading of the aircraft within the loading limits and CG limits.
This chapter presents information for weighing the aircraft and properly determining the empty CG position. Also, the measurement of the empty weight moment - as measured from the reference-plane (RP) - is given.

A list of all equipment installed in the motorglider during weighing (installed equipment list) - as well as a list of all approved equipment for this motorglider is given in chapter »6.5 Equipment list«.

The empty weight, empty CG location and empty weight moment for the aircraft are determined during the first conformity inspection. This data is then noted in the logsheet for report of the empty weight and the CG position (see section »6.3.1«).

NOTICE

The empty weight, empty CG position and empty weight moment need to be calculated or measured when making changes to the installed equipment. This data must be determined and recorded in accordance with the aeronautical regulations.

NOTICE

The empty weight, empty CG location and empty weight moment need to be measured when repairs with effects to the weight and balance have been made or when the aircraft has been painted or refinished.
The empty weight, empty CG location and empty weight moment need to be confirmed on the logsheet (section »6.3.1«) by certified personnel.

The aircraft's empty weight and empty CG location are determined using the following method. Each wheel of the landing gear is placed on a scale or load cell (left main gear: mL ; right main gear: mR ; tail wheel: mB). Weights of any wheel chocks, etc., must be subtracted (tared out).
The aircraft's longitudinal axis must be aligned in the manner described by the following diagram.

NOTICE

The leveling for Empty- CG-Determination is not equal to the aircraft leveling for determination of the angle of wing setting (refer to the S12 Aircraft Maintenance Manual).

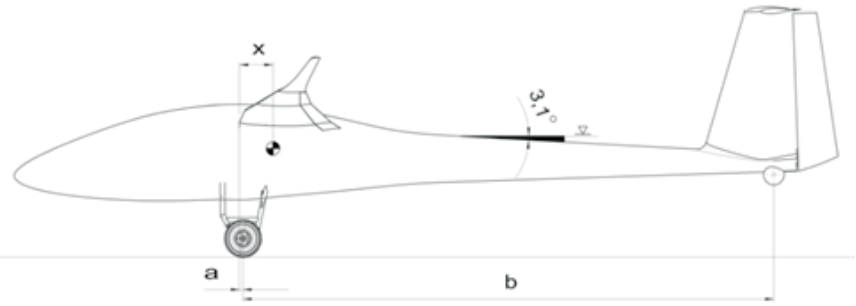

Figure 6.2.1.a
Aircraft Alignment during CG-Determination

- The reference plane (RP) is located at the leading-edge of the wing center section at the wing root. It is aligned vertically to the longitudinal-axis. This plane creates a reference line on the ground.
- Longitudinal inclination: Place a wedge cut to ratio of 1000:54 (3.1° = 3°06') on the rear fuselage-section. Align the top of the wedge horizontally using a digital or spirit level.
- Keep in mind that the lateral-axis must be almost horizontal.

Registration No.:			Serial No.:			Sheet No.:		
STEMME S12			Current Empty Weight					Signed by Authorized Personnel
Con. No.	Date	Description of Action taken	Weight [kg/lb]	Lever to RP [mm/in]	Moment [kgm/lb in]	Min. seat load [kg/lb] (empty water ballast and luggage)	Max. Load [kg/lb]	
		Weight and Balance at delivery						

7.10.1 ENGINE

7.10.1.1 HYBRID COOLING

The engine is cooled in various ways. The cylinder barrels are cooled by ram air with air from RH cooling air flap. The cylinder heads are liquid cooled. The coolant radiator is installed behind the LH cooling air flap.
A separate oil-radiator is installed on the R/H side of the aircraft behind the RH cooling air flap.

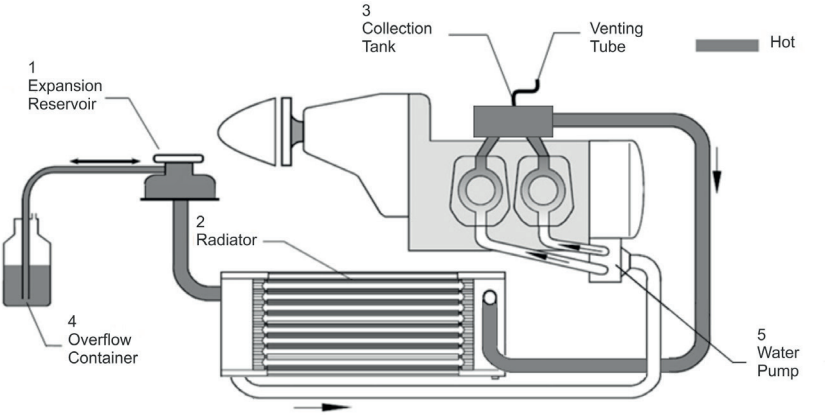

Figure 7.10.1.a
Engine Coolant Circuit

1. Expansion reservoir.
   The expansion reservoir is installed on the forward left top side of the upper firewall; it contains an over-pressure and breather valve, connected to the overflow container (4).
2. Radiator.
   The radiator for liquid cooling is installed on LH side of center fuselage frame and is cooled by ram air form the LH cooling air flap.