FLIGHT MANUAL

POWERED SAILPLANE
STEMME S10, VARIANT S12

DOCUMENT NUMBER • L400-912810
DATE OF ISSUE • AUGUST 20, 2016

Revision No.02 to AFM AUGUST 20, 2016 is approved
under the Authority of DOA ref. EASA.21J.250.

STAMP

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.

CONTACT

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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.

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AMENDMENT: 02  
DATE: OCT 10, 2018

DOCUMENT NUMBER: L400-912810 ISSUE AUG 20, 2016
0.2 LIST OF EFFECTIVE PAGES

This list is valid only for the aircraft serial no. specified on title page.

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</table>
0.3 CONTENTS

Cover Sheet. ................................................................. 0-1
0.1 Record of Amendments. ........................................... 0-3
0.2 List of Effective Pages. ........................................... 0-5
0.3 Contents ............................................................... 0-11
1. General. ................................................................ 1-1
1.1 Introduction ......................................................... 1-1
1.2 Conversion Table .................................................. 1-1
1.3 Abbreviations ....................................................... 1-2
1.4 Safety Symbols .................................................... 1-5
1.5 Certification Basis .................................................. 1-6
1.6 Description and Technical Data ............................... 1-7
1.7 Technical Data ..................................................... 1-9
1.8 Three View Drawing .............................................. 1-13
2. Limitations .............................................................. 2-1
2.1 Introduction ......................................................... 2-1
2.2 Airspeed ............................................................... 2-1
2.3 Airspeed Indicator Markings .................................... 2-3
2.4 Propulsion System and Fluids ................................. 2-4
2.4.1 Engine, Propeller, Fuel ........................................ 2-4
2.4.2 Fluids .............................................................. 2-6
2.4.2.1 Fuel ............................................................. 2-6
2.4.2.2 Coolant Fluid .................................................. 2-7
2.4.2.3 Lubrication Fluids .......................................... 2-9
2.5 Power-Plant Instrument Markings ............................ 2-12
2.6 Weights .............................................................. 2-13
2.7 Center of Gravity ................................................... 2-14
2.8 Approved Maneuvers ............................................. 2-14
2.9 Load Factors ........................................................ 2-15
2.10 Flight Crew ........................................................... 2-15
2.11 Kinds of Operation ................................................. 2-15
2.12 Minimum Equipment List ...................................... 2-16
2.13 Towing by Aircraft, Winch Launching. ..............................2-17
2.14 Other Limitations............................................................2-17
2.15 Cockpit Placards..............................................................2-19
3. Emergency Procedures....................................................3-1
3.1 Introduction.................................................................3-1
3.2 Canopy Jettison...............................................................3-1
3.3 Bailing Out. .................................................................3-1
3.4 Stall Recovery..............................................................3-2
3.5 Spin Recovery...............................................................3-2
3.6 Recovery from Spiral Dive.............................................3-4
3.7 Engine Failure.............................................................3-5
3.7.1 Engine Failure During T/O.........................................3-5
3.7.2 Engine Failure During Flight......................................3-6
3.7.3 Failure of Engine Starter.........................................3-9
3.8 Fire........................................................................3-11
3.8.1 Fire in Engine Compartment..................................3-11
3.8.2 Electrical Fire..........................................................3-12
3.8.3 Lightning Strike or Possible Lightning Strike. ............3-13
3.9 Other Emergencies......................................................3-14
3.9.1 Take-Off.................................................................3-14
3.9.1.1 T/O Abort..........................................................3-14
3.9.1.2 Go-around with Propeller in Cruise Position..........3-15
3.9.2 Landings.................................................................3-16
3.9.2.1 Off-Airfield Landing...........................................3-16
3.9.2.2 Intentional Ground-Loop....................................3-16
3.9.3 Emergency Landing................................................3-17
3.9.3.1 Emergency Landing with Landing Gear Retracted....3-17
3.9.3.2 Emergency Landing with the Landing Gear not fully down and locked...............................3-19
3.9.3.3 Emergency Landing on water (ditching)...............3-20
3.9.4 System Malfunctions.................................................3-21
3.9.4.1 Fuel Pressure......................................................3-21
3.9.4.2 Green Light for Auxiliary FUEL PUMP................3-23
3.9.4.3 Red Warning Light for Manifold Pressure Steady ON or Flashing.................................3-24
3.9.4.4  Yellow Low Fuel Caution Light ....................................... 3-25
3.9.4.5  Yellow TCU-Caution Light Flashes .................................. 3-26
3.9.4.6  Red Battery Charge Warning Light for the External Alternator Illuminated ........................................... 3-27
3.9.4.7  Yellow Caution Light for the internal Generator Illuminated ................................................. 3-28
3.9.4.8  Total Electrical Failure .................................................. 3-29
3.9.4.9  Loss of RPM-Indication ................................................ 3-30
3.9.4.10 Sudden Decrease of MAP and RPM ................................. 3-30
3.9.4.11 Sudden Increase of MAP and RPM ................................. 3-31
3.9.4.12 Oscillating of RPM, Increase and Decrease ...................... 3-32
3.9.4.13 Exceedance of Maximum Allowed Cylinder Coolant Temperature (CCT) .............................................. 3-33
3.9.4.14 Exceedance of Maximum Allowed Oil Temperature .................... 3-34
3.9.4.15 Oil Pressure below Minimum During Flight ....................... 3-35
3.9.4.16 Oil Pressure below Minimum on Ground ............................ 3-35
3.9.4.17 Exceedance of Maximum Allowed Engine RPM .................. 3-36
3.9.4.18 Loss of Propeller Pitch Control ....................................... 3-36
3.9.4.19 Propeller Vibrations ..................................................... 3-37
3.9.4.20 Landing Gear Malfunction - Emergency Gear Extension .... 3-38
3.9.5 Flight in Icing Conditions .............................................. 3-40
4.  Normal Operating Procedures ......................................... 4-1
4.1  Introduction ................................................................. 4-1
4.2  Aircraft Assembly .......................................................... 4-1
4.2.1  Rigging and Deregging ................................................... 4-1
4.2.1.1  Fuselage ................................................................. 4-1
4.2.1.2  Wing ...................................................................... 4-1
4.2.1.3  Horizontal Tail .......................................................... 4-3
4.2.1.4  Fuselage Fairings ....................................................... 4-3
4.2.2  Fueling .................................................................. 4-4
4.3  Daily Inspection ............................................................. 4-5
4.3.1  Engine .................................................................. 4-5
4.3.2  Wing Connecting Area ................................................... 4-7
4.3.3  Propeller, Nose-cone and Front Gear ............................... 4-8
4.3.4  Landing Gear .............................................................. 4-10
4.3.5 Wings ................................................................. 4-10
4.3.6 Empennage .......................................................... 4-11
4.3.7 Fuselage .............................................................. 4-11
4.4 Pre-Flight Inspections .............................................. 4-13
4.4.1 Checks Before Entering Cockpit ......................... 4-13
4.4.2 Check of Flight Controls and Pressure Probes .......... 4-15
4.4.3 Checks Before Engine Start ................................. 4-16
4.5 Normal Operating Procedures and Recommended Airspeeds ........................................... 4-17
4.5.1 Engine Start, Warm-Up and Taxi Procedures ......... 4-17
4.5.1.1 Engine Start ....................................................... 4-17
4.5.1.2 Engine Warm-Up ................................................ 4-20
4.5.1.3 Taxiing .............................................................. 4-21
4.5.2 Take-Off and Climb ............................................ 4-22
4.5.2.1 Checks before take-off .................................... 4-22
4.5.2.2 Interpretation of the Three T/O Procedures ......... 4-26
4.5.2.3 T/O and Climb .................................................. 4-28
4.5.3 Cruise and Cross-Country Flying .......................... 4-31
4.5.3.1 General Remarks .............................................. 4-31
4.5.3.2 Powered Flight .................................................. 4-31
4.5.3.3 Gliding Flight .................................................... 4-34
4.5.3.4 Change of Aircraft Configurations (Powered, Gliding Flight) ....................................... 4-36
4.5.3.5 Flying in Strong Turbulence .............................. 4-42
4.5.3.6 Cold Weather Operation .................................. 4-42
4.5.4 Approach ......................................................... 4-43
4.5.5 Landing, Taxi and Parking ..................................... 4-48
4.5.5.1 Landing ............................................................ 4-48
4.5.5.2 Taxi and Ground Operation .............................. 4-49
4.5.5.3 Parking and Shut-Down .................................. 4-49
4.5.6 High Altitude Flight ............................................. 4-53
4.5.7 Flight in Rain ..................................................... 4-55
4.5.8 Aerobatics .......................................................... 4-55
5. Performance ........................................................... 5-1
5.1 Introduction .......................................................... 5-1
5.2 Approved Data. ............................................................. 5-1
5.2.1 Airspeed Indicator System Calibration. ...................... 5-1
5.2.2 Stall Speeds and Minimum Speeds. ......................... 5-2
5.2.2.1 Stall and Minimum Speeds in Powered-Configuration ... 5-3
5.2.2.2 Stall and Minimum Speed in Glider Configuration. .... 5-4
5.2.3 Take-Off Procedure. .................................................. 5-5
5.2.3.1 Engine Rotational Speeds. ...................................... 5-5
5.2.3.2 T/O Performance. .................................................... 5-8
5.2.3.3 T/O Performance for Non-Standard Conditions. ....... 5-11
5.2.3.4 Climb Performance. .................................................. 5-17
5.2.4 Max. demonstrated Crosswind Component. ............... 5-17
5.3 Additional Information (Non-Approved). ................. 5-18
5.3.1 Gliding Flight Polar. ................................................... 5-18
5.3.2 Noise Data. ............................................................... 5-19
6. Weight and Balance. ...................................................... 6-1
6.1 Introduction. ............................................................... 6-1
6.2 Aircraft Weights. ......................................................... 6-2
6.2.1 Configuration during weighing. ................................. 6-2
6.3 Empty Weight and CG Location. .................................... 6-5
6.3.1 Record Empty Weight and Empty CG Location. .......... 6-5
6.4 Operating Weight and Operating CG. ......................... 6-7
6.4.1 Weight and Moments Logsheet. ................................. 6-9
6.4.2 Weight and Moments Diagrams. ................................. 6-10
6.5 Equipment List and Installed Equipment List. ............... 6-12
7. System Description of the S12 and its Equipment. ........ 7-1
7.1 Introduction. ............................................................... 7-1
7.2 Cockpit Controls. ....................................................... 7-1
7.2.1 Cockpit Controls Overview. .................................... 7-1
7.3 Instrument Panel. ......................................................... 7-4
7.4 Landing Gear. ............................................................. 7-9
7.5 Seats and Seatbelts. ..................................................... 7-10
7.6 Electrical Trim. ............................................................ 7-11
7.7 Pitot and Static Pressure System. ................................. 7-13
7.8 Airbrakes. ................................................................. 7-14
8.4.4 Preparation for Road Transportation ............................... 8-4
8.5 Cleaning and Care. .......................................................... 8-5
8.6 Engine - Troubleshooting .................................................. 8-7
9. Supplements .................................................................. 9-1
  9.1 Introduction .................................................................. 9-1
9.2 Installation of Alternative Equipment .............................. 9-1
  9.3 Supplemental and Additional Equipment ...................... 9-5
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:

<table>
<thead>
<tr>
<th>Data</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 cubic in</td>
<td>16.387 cm³</td>
</tr>
<tr>
<td>100 fpm</td>
<td>0.508 m/s</td>
</tr>
<tr>
<td>1 ft</td>
<td>0.3048 m</td>
</tr>
<tr>
<td>1 ft lb</td>
<td>1.356 Nm</td>
</tr>
<tr>
<td>1 hp</td>
<td>0.7457 kW</td>
</tr>
<tr>
<td>1 Imp.gal.</td>
<td>4.546 l</td>
</tr>
<tr>
<td>1 in</td>
<td>25.4 mm</td>
</tr>
<tr>
<td>1 inHg</td>
<td>33.86 hPa</td>
</tr>
<tr>
<td>1 kgm</td>
<td>86.8 lb in</td>
</tr>
<tr>
<td>Data</td>
<td>Factor</td>
</tr>
<tr>
<td>----------</td>
<td>----------------</td>
</tr>
<tr>
<td>1 kgmm</td>
<td>0.001 kgm</td>
</tr>
<tr>
<td>1 kgmm</td>
<td>0.007 lb ft</td>
</tr>
<tr>
<td>1 kt</td>
<td>1.852 kph</td>
</tr>
<tr>
<td>1 lb</td>
<td>0.4536 kg</td>
</tr>
<tr>
<td>1 lbf</td>
<td>4.45 N</td>
</tr>
<tr>
<td>1 lbf ft</td>
<td>135.6 Ncm</td>
</tr>
<tr>
<td>1 mph ft</td>
<td>1.609 kph</td>
</tr>
<tr>
<td>1 sqft</td>
<td>0.0929 m²</td>
</tr>
<tr>
<td>1 oz.</td>
<td>28.349 g</td>
</tr>
<tr>
<td>1 psi</td>
<td>0.06895 bar</td>
</tr>
<tr>
<td>1 US gal.</td>
<td>3.785 l</td>
</tr>
</tbody>
</table>

1.3 ABBREVIATIONS

The following abbreviations are used for clarity:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACL</td>
<td>Anti-Collision Light</td>
</tr>
<tr>
<td>AD’s</td>
<td>Airworthiness Directives</td>
</tr>
<tr>
<td>AGL</td>
<td>Above Ground Level</td>
</tr>
<tr>
<td>AMM</td>
<td>Aircraft Maintenance Manual</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td>AOA</td>
<td>Angle Of Attack</td>
</tr>
<tr>
<td>ASAP</td>
<td>As Soon As Possible</td>
</tr>
<tr>
<td>ASI</td>
<td>Airspeed Indicator</td>
</tr>
<tr>
<td>AUW</td>
<td>All-Up-Weight</td>
</tr>
<tr>
<td>CB</td>
<td>Circuit Breaker</td>
</tr>
<tr>
<td>CCT</td>
<td>Cylinder Coolant Temperature</td>
</tr>
<tr>
<td>CD</td>
<td>Constant Depression</td>
</tr>
<tr>
<td>CFRP</td>
<td>Carbon Fiber Reinforced Plastic</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>CG</td>
<td>Center Of Gravity</td>
</tr>
<tr>
<td>CHT</td>
<td>Cylinder Head Temperature</td>
</tr>
<tr>
<td>DCDI</td>
<td>Dual Capacitive Discharge Ignition</td>
</tr>
<tr>
<td>EFIS</td>
<td>Electronic Flight Information System</td>
</tr>
<tr>
<td>EMC</td>
<td>Electromagnetic Compatibility</td>
</tr>
<tr>
<td>EQL</td>
<td>Equipment List</td>
</tr>
<tr>
<td>FBO</td>
<td>Fixed-Base Operator</td>
</tr>
<tr>
<td>FOD</td>
<td>Foreign Object Damage</td>
</tr>
<tr>
<td>FRP</td>
<td>Fiber Reinforced Plastic</td>
</tr>
<tr>
<td>GEN</td>
<td>Generator</td>
</tr>
<tr>
<td>GFRP</td>
<td>Glass Fiber Reinforced Plastic</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>IMC</td>
<td>Instrument Meteorological Conditions</td>
</tr>
<tr>
<td>IPC</td>
<td>Illustrated Parts Catalog</td>
</tr>
<tr>
<td>KIAS</td>
<td>Knots Indicated Airspeed</td>
</tr>
<tr>
<td>kt</td>
<td>Knots (equivalent to KIAS)</td>
</tr>
<tr>
<td>LBA</td>
<td>Luftfahrtbundesamt - German Civil Aviation Authority</td>
</tr>
<tr>
<td>LH</td>
<td>Left Hand</td>
</tr>
<tr>
<td>MAP</td>
<td>Manifold Pressure</td>
</tr>
<tr>
<td>MCP</td>
<td>Maximum Continuous Power</td>
</tr>
<tr>
<td>MEL</td>
<td>Minimum Equipment list</td>
</tr>
<tr>
<td>MMEL</td>
<td>Master Minimum Equipment list</td>
</tr>
<tr>
<td>MNLP</td>
<td>Maximum Weight of Non Lifting Parts</td>
</tr>
<tr>
<td>MTOW</td>
<td>Maximum Take-Off Weight</td>
</tr>
<tr>
<td>NLP</td>
<td>Non Lifting Part</td>
</tr>
<tr>
<td>OAT</td>
<td>Outside Air Temperature</td>
</tr>
<tr>
<td>OVP</td>
<td>Over Voltage Protection</td>
</tr>
<tr>
<td>PIC</td>
<td>Pilot In Command</td>
</tr>
<tr>
<td>PPC</td>
<td>Propeller Pitch Control</td>
</tr>
<tr>
<td>PTT</td>
<td>Push To Talk</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>R/C</td>
<td>Rate Of Climb</td>
</tr>
<tr>
<td>RH</td>
<td>Right Hand</td>
</tr>
<tr>
<td>RP</td>
<td>Reference Plane</td>
</tr>
<tr>
<td>RPM</td>
<td>Revolutions Per Minute</td>
</tr>
<tr>
<td>RTD</td>
<td>Resistance Temperature Detector</td>
</tr>
<tr>
<td>RWY</td>
<td>Runway</td>
</tr>
<tr>
<td>SB’s</td>
<td>Service Bulletins</td>
</tr>
<tr>
<td>SI</td>
<td>Service Information</td>
</tr>
<tr>
<td>SL</td>
<td>Service Letter</td>
</tr>
<tr>
<td>STC</td>
<td>Supplemental Type Certificate</td>
</tr>
<tr>
<td>TBO</td>
<td>Time Between Overhaul</td>
</tr>
<tr>
<td>TBR</td>
<td>Time Between Replacement</td>
</tr>
<tr>
<td>TC</td>
<td>Type Certificate</td>
</tr>
<tr>
<td>TCDS</td>
<td>Type Certificate Data Sheet</td>
</tr>
<tr>
<td>TCU</td>
<td>Turbocharger Control Unit</td>
</tr>
<tr>
<td>TE</td>
<td>Total Energy</td>
</tr>
<tr>
<td>T/O</td>
<td>Take-Off</td>
</tr>
<tr>
<td>TSO</td>
<td>Technical Standard Order</td>
</tr>
<tr>
<td>TTL</td>
<td>Transistor-Transistor Logic</td>
</tr>
</tbody>
</table>
### 1.4 SAFETY SYMBOLS

The following safety instructions are based loosely on the ANSI Z535.

<table>
<thead>
<tr>
<th>Symbols</th>
<th>Z535.3 Criteria for Safety Symbols.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signs and Labels</td>
<td>Z535.4 Product Safety Signs and Labels.</td>
</tr>
<tr>
<td>Product Safety</td>
<td>Z535.6 Product Safety Information in Product Manuals, Instructions, and Other Collateral Materials.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>![WARNING] WARNING</th>
<th>WARNING An operating procedure or technique that may result in personal injury or loss of life if not followed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>![CAUTION] CAUTION</td>
<td>CAUTION An operating procedure or technique that may result in damage to equipment if not followed.</td>
</tr>
<tr>
<td>![NOTICE] NOTICE</td>
<td>NOTICE An operating procedure or technique needing special emphasis.</td>
</tr>
</tbody>
</table>
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

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 m² / 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.
## 1.7 TECHNICAL DATA

### FUSELAGE

<table>
<thead>
<tr>
<th>Design</th>
<th>Front section CFRP-Kevlar-GFRP-structure, central steel tube frame, GFRP-fairing, tail boom with integrated vertical tail fin (CFRP).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>8.42 m 27.62 ft</td>
</tr>
<tr>
<td>Width</td>
<td>1.18 m 3.87 ft</td>
</tr>
<tr>
<td>Cockpit width</td>
<td>1.16 m 3.81 ft</td>
</tr>
<tr>
<td>Cockpit height</td>
<td>0.93 m 3.05 ft</td>
</tr>
<tr>
<td>Height of tail unit</td>
<td>1.75 m 5.74 ft</td>
</tr>
</tbody>
</table>

### WING

<table>
<thead>
<tr>
<th>Design</th>
<th>5 sections CFRP-spar with GFRP-shearweb. CFRP-sandwich skin.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wing span</td>
<td>25.07 m 82.25 ft</td>
</tr>
<tr>
<td>Central wing span</td>
<td>9.90 m 32.48 ft</td>
</tr>
<tr>
<td>Wing area</td>
<td>19.95 m² 214.75 sqft</td>
</tr>
<tr>
<td>Aspect ratio</td>
<td>31.5</td>
</tr>
<tr>
<td>Dihedral angle (V-form)</td>
<td>0.75° / 1.75° / 4°</td>
</tr>
<tr>
<td>Mean aerodynamic chord</td>
<td>0.741 m 2.43 ft</td>
</tr>
<tr>
<td>Wing airfoil</td>
<td>HQ41/14.35</td>
</tr>
<tr>
<td>Sweep of wing center section leading edge</td>
<td>0°</td>
</tr>
<tr>
<td>Sweep of outboard wing leading edge up to the bend</td>
<td>0°</td>
</tr>
</tbody>
</table>
### AIR BRAKES

<table>
<thead>
<tr>
<th>Type</th>
<th>Two blade Schempp-Hirth type, position outer part of wing center section.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>1.50 m 4.92 ft / 59.01 in</td>
</tr>
<tr>
<td>Area</td>
<td>0.22 m² 2.37 sqft.</td>
</tr>
<tr>
<td>Maximum height above wing upper surface.</td>
<td>0.16 m 0.52 ft / 6.29 in</td>
</tr>
</tbody>
</table>

### HORIZONTAL TAIL

<table>
<thead>
<tr>
<th>Design</th>
<th>Web CFRP, skin CFRP-Sandwich, elevator GFRP-Sandwich.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Span</td>
<td>3.10 m 10.17 ft</td>
</tr>
<tr>
<td>Area</td>
<td>1.46 m² 15.72 sqft.</td>
</tr>
<tr>
<td>Aspect ratio</td>
<td>6.58</td>
</tr>
<tr>
<td>Airfoil</td>
<td>FX 71-L-150 / 25</td>
</tr>
</tbody>
</table>

### VERTICAL TAIL

<table>
<thead>
<tr>
<th>Design</th>
<th>Web GFRP, skin CFRP, rudder GFRP-sandwich.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Span</td>
<td>1.60 m 5.25 ft</td>
</tr>
<tr>
<td>Area</td>
<td>1.78 m² 19.16 sqft.</td>
</tr>
<tr>
<td>Airfoil</td>
<td>FX71-L150 / 30 x*1.3</td>
</tr>
</tbody>
</table>
### WEIGHTS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. T/O-weight</td>
<td>900 kg</td>
</tr>
<tr>
<td>Empty weight</td>
<td>690 kg</td>
</tr>
<tr>
<td>Max. wing loading</td>
<td>45.11 kg/m²</td>
</tr>
</tbody>
</table>

### ENGINE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>4-cylinder 4-stroke-Otto-motor, opposed type, turbocharged, electronic manifold pressure control integrated reduction gear.</td>
</tr>
<tr>
<td>Variant</td>
<td>ROTAX 914 F2-01/S1</td>
</tr>
<tr>
<td>Engine reduction gear ratio</td>
<td>i = 2.4286</td>
</tr>
<tr>
<td>Bore</td>
<td>79.5 mm 3.13 in</td>
</tr>
<tr>
<td>Stroke</td>
<td>61 mm 2.40 in</td>
</tr>
<tr>
<td>Displacement</td>
<td>1211 cm³ 73.89 cubic in</td>
</tr>
<tr>
<td>Compression ratio</td>
<td>9.0</td>
</tr>
<tr>
<td>Drive shafts turns.</td>
<td>Clockwise</td>
</tr>
<tr>
<td>Max. T/O power</td>
<td>84.5 kW at 5800 RPM</td>
</tr>
<tr>
<td>Max. cont. power</td>
<td>73.4 kW at 5500 RPM</td>
</tr>
<tr>
<td>Fuel flow at T/O power (115%)</td>
<td>33.0 l/h 8.72 US gal./h</td>
</tr>
<tr>
<td>Fuel flow at max cont. power (100%)</td>
<td>27.2 l/h 7.19 US gal./h</td>
</tr>
<tr>
<td>Fuel flow at 75% power</td>
<td>20.4 l/h 5.34 US gal./h</td>
</tr>
<tr>
<td>Specific fuel consumption at max. cont. power (100%)</td>
<td>276 g/kWh 0.454 lb/hph</td>
</tr>
</tbody>
</table>
### PROPELLER

<table>
<thead>
<tr>
<th>Design</th>
<th>2-blade folding propeller, CFRP blades, propeller hub and blade suspension. Forks aluminum. Pitch control via electrically heated thermo elements.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>STEMME 11AP-V</td>
</tr>
<tr>
<td>Propeller diameter</td>
<td>1.63 m</td>
</tr>
<tr>
<td>Propeller blade angle (station 0.7)</td>
<td>17.65° in T/O 24.05° in cruise.</td>
</tr>
<tr>
<td>Propeller blade pitch (station 0.7)</td>
<td>114 cm / 44.9 in (T/O position) 160 cm / 63.0 in (Cruise position)</td>
</tr>
<tr>
<td>Propeller turns</td>
<td>Counter-clockwise</td>
</tr>
</tbody>
</table>

### PROPELLER GEARBOX

<table>
<thead>
<tr>
<th>Design</th>
<th>Helical spur gear, aluminum alloy-housing, elastic mounting in rubber elements.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>STEMME 11AG</td>
</tr>
<tr>
<td>Drive shaft turns</td>
<td>Clockwise</td>
</tr>
<tr>
<td>Ratio of propeller gearbox</td>
<td>i = 1.109</td>
</tr>
</tbody>
</table>

### FUEL SYSTEM

<table>
<thead>
<tr>
<th>Design</th>
<th>2 FRP-tanks in wing center section + 1 feeder tank, 1 electrical fuel transfer pump for each wing-tank + 2 electrical pumps from feeder tank to the engine.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum fuel volume</td>
<td>126.0 l (± 2%) 33.28 US gal. 27.72 Imp.gal.</td>
</tr>
<tr>
<td>Unusable fuel</td>
<td>1.4 l 0.37 US gal. 0.31 Imp.gal.</td>
</tr>
</tbody>
</table>
1.8 THREE VIEW DRAWING

Figure 1.8.a
Three View Drawing of the S12
2. LIMITATIONS

2.1 INTRODUCTION

This section includes operating limitations, instrument markings and the information signs which are necessary for the safe operation of the motorglider, its engine, standard systems and standard equipment. The operating limitations included in this section and in section \textgt;9\textlt; have been approved by the authority.

2.2 AIRSPEED

Airspeed limitations and their meaning for operation of the aircraft:

<p>| (V_{\text{NE}}) | Never exceed speed (maximum permissible airspeed in calm air, with flap positions (0^\circ), (-5^\circ) and (-10^\circ) only) | 270 kph 146 kt | This speed can not be exceeded and control movement can not be more than (1/3) of maximum deflection. It needs to be reduced with increasing altitude. |
| (V_{\text{RA}}) | Maximum airspeed in rough air. | 180 kph 97 kt | Do not exceed this speed except in smooth air and then only with caution. Examples of rough air are lee-wave rotors, thunderclouds etc. |
| (V_{\text{A}}) | Design maneuvering speed. | 180 kph 97 kt | Above this limit the controls can not be moved fully or abruptly because the motorglider structure could be over-stressed under certain conditions. |</p>
<table>
<thead>
<tr>
<th>$V_{FE}$</th>
<th>Permissible maximum airspeed for operation of flaps and with flaps extended:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Positive position $+5^\circ$, $+10^\circ$</td>
<td></td>
</tr>
<tr>
<td>• Landing position $L$ ($+16^\circ$)</td>
<td></td>
</tr>
<tr>
<td>IAS</td>
<td>Remarks</td>
</tr>
<tr>
<td>180 kph</td>
<td>97 kt</td>
</tr>
<tr>
<td>140 kph</td>
<td>76 kt</td>
</tr>
<tr>
<td>This airspeed may not be exceeded during flap operation and with flaps in indicated position.</td>
<td></td>
</tr>
<tr>
<td>$V_{LO}$</td>
<td>Permissible maximum airspeed for the operation of the landing gear and with gear extended.</td>
</tr>
<tr>
<td>140 kph</td>
<td>76 kt</td>
</tr>
<tr>
<td>This airspeed may not be exceeded during landing gear operation and with gear extended.</td>
<td></td>
</tr>
<tr>
<td>$V_{PO}$</td>
<td>Permissible maximum airspeed for propeller deployment and engine start.</td>
</tr>
<tr>
<td>140 kph</td>
<td>76 kt</td>
</tr>
<tr>
<td>Above this airspeed if propeller is folded engine may not be started.</td>
<td></td>
</tr>
</tbody>
</table>
2.3 AIRSPEED INDICATOR MARKINGS

The following table gives the airspeed indicator markings and the meaning of the colors (AUW = All-Up Weight).

<table>
<thead>
<tr>
<th>Marking</th>
<th>IAS (Value or Range)</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>White arc</td>
<td>88-180 kph 48-97 kt</td>
<td>Positive flap operation range. (Lower limit is 1.1 ( V_{S0} ) in landing configuration at MTOW. Upper limit is the maximum airspeed with positive flap position.)</td>
</tr>
<tr>
<td>Green arc</td>
<td>96-180 kph 52-97 kt</td>
<td>Normal operating range. (Lower limit speed is 1.1 ( V_{S1} ) at MTOW and most forward C.G. with flaps neutral; upper limit is rough air speed.)</td>
</tr>
<tr>
<td>Yellow arc</td>
<td>180-270 kph 97-146 kt</td>
<td>Maneuvers must be conducted with caution and only in smooth air.</td>
</tr>
<tr>
<td>L</td>
<td>140 kph 76 kt</td>
<td>Max. permissible airspeed with flaps in landing position and for landing gear operation.</td>
</tr>
<tr>
<td>Red line</td>
<td>270 kph 146 kt</td>
<td>Max. airspeed for all operations.</td>
</tr>
<tr>
<td>Blue line</td>
<td>115 kph 62 kt</td>
<td>Best rate of climb speed ( V_y )</td>
</tr>
<tr>
<td>Yellow triangle</td>
<td>110 kph 59 kt</td>
<td>Approach speed at MTOW.</td>
</tr>
</tbody>
</table>
## 2.4 PROPULSION SYSTEM AND FLUIDS

### 2.4.1 ENGINE, PROPELLER, FUEL

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

The range between 110 and 115% corresponding to throttle settings between the first and second stop, should be avoided.

<table>
<thead>
<tr>
<th>PROPELLER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propeller manufacturer</td>
</tr>
<tr>
<td>Propeller type</td>
</tr>
<tr>
<td>Data sheet-no.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FUEL SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. capacity</td>
</tr>
<tr>
<td>Wing tanks:</td>
</tr>
<tr>
<td>2 x 60 l (± 2%)</td>
</tr>
<tr>
<td>2 x 15.83 US gal.</td>
</tr>
<tr>
<td>2 x 13.21 Imp.gal.</td>
</tr>
<tr>
<td>Feeder Tank:</td>
</tr>
<tr>
<td>6 l</td>
</tr>
<tr>
<td>1.58 US gal.</td>
</tr>
<tr>
<td>1.32 Imp.gal.</td>
</tr>
<tr>
<td>Max. available fuel quantity</td>
</tr>
<tr>
<td>126.0 l (± 2%)</td>
</tr>
<tr>
<td>33.28 US gal</td>
</tr>
<tr>
<td>27.72 Imp.gal.</td>
</tr>
<tr>
<td>Unusable fuel</td>
</tr>
<tr>
<td>1.4 l</td>
</tr>
<tr>
<td>0.37 US gal.</td>
</tr>
<tr>
<td>0.31 Imp.gal.</td>
</tr>
</tbody>
</table>
2.4.2 FLUIDS

2.4.2.1 FUEL

It is recommended to use premium gasoline, unleaded, minimum RON 95.

Basic suitable fuels:

- Super DIN EN 228
- Super Plus DIN EN 228

ACCORDING TO DOT

Gasoline min. grade 1, AKI 90.0, acc. to Canadian General Standard Board CAN/CGBS 3.5 (Unleaded Automotive Gasoline)

ACCORDING FAA


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**NOTICE**

STEMME AG have also positive operation experiences in use of high premium gasoline brands.

---

**WARNING**

In deviation to ROTAX SI-914-019 the automotive Fuel type E10 is not approved for operation.

---

**NOTICE**

The content of Ethanol must be less than 3 %.
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.
2.4.2.3 LUBRICATION FLUIDS

ENGINE WITH INTEGRATED REDUCTION GEAR

According to the ROTAX Operation Manual the following oil specification should be met:

- Use only oil with API classification SG or higher!
- Due to the high stresses in the reduction gears, oils with gear additives such as high performance motor cycle oils are recommended.
- Heavy duty 4-stroke motor cycle oils meet all the requirements. These oils are normally not mineral oils but semi- or full synthetic oils.
- Oils primarily for Diesel engines have insufficient high temperature properties and additives which favor clutch slipping, and are generally unsuitable.

For more detailed information refer to appropriate ROTAX publications (SI-914-019 latest approved revision).

<table>
<thead>
<tr>
<th>Oil quantity</th>
<th>1.30 US gal./ 0.86 Imp. gal./ 3.9 l (minimum 0.53 US gal./ 0.44 Imp.gal./ 2 l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil consumption</td>
<td>max. 0.026 US gal./h/ 0.022 Imp.gal./h/ 0.06 l/h</td>
</tr>
</tbody>
</table>

**CAUTION**

The reduction gear additives, specified “GL4” or “GL5”, are required for a safe lubrication of the integrated reduction gear. Never use other oil additives!

**CAUTION**

A full synthetic oil in combination with AVGAS results in abnormally high abrasion and/or residues. During utilization of AVGAS, only semi-synthetic oils should be used.
NOTICE

Full- or semi-synthetic oils are to be preferred because of the temperature stability and less residue formation.

a) Viscosity:

Use of multi-grade oils is recommended. Viscosity of multi-grade oils is less depending on temperature compared to single-grade oils. Multi-grade oils can be used year-round; after an engine start at low temperatures the engine components are lubricated faster and at higher temperatures the oil is heavier. Temperatures of adjacent SAE-classes overlap, so for short-term temperature variations there is no need to change oil. The suitable oil grade can be chosen from the table.

![Engine Oil Table]

Figure: 2.4.2.3.a
Engine Oil Table
PROPELLER GEARBOX

Oil for the propeller reduction gear must be according to specification MIL-L-2105C,D all year round.

NOTICE

Oil specification: Only use “GL5” oils according to the API-system, i.e. ARAL reduction gear oil HYP 80W, 85W-90, 85W-140.
2.5 POWER-PLANT INSTRUMENT MARKINGS

The following table shows the markings of the engine instruments and the meaning of the colors used.

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Red line = Minimum limit</th>
<th>Green arc = Normal Operating Range</th>
<th>Yellow arc = Caution Range</th>
<th>Red line = Maximum Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tachometer 1) [rpm]</td>
<td>-</td>
<td>1400···5500</td>
<td>0···1400 5500···5800</td>
<td>5800</td>
</tr>
<tr>
<td>Oil temperature 2) [deg. C] [deg. F]</td>
<td>-</td>
<td>50···130 122···266</td>
<td>- 20···50 - 68···122</td>
<td>130 266</td>
</tr>
<tr>
<td>Cylinder Coolant Temp.2) [deg. C] [deg. F]</td>
<td>-</td>
<td>50···120 122···248</td>
<td>-</td>
<td>120 248</td>
</tr>
<tr>
<td>Oil pressure 3) [p.s.i.] [bar]</td>
<td>22 1.5</td>
<td>22···73 1.5···5.0</td>
<td>73···102 5.0···7.0</td>
<td>102 7.0</td>
</tr>
<tr>
<td>Fuel quantity gauge:</td>
<td></td>
<td>“E” at white line = empty</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes 1) Reading error 50 RPM 2) Display in [°C] 3) Display in [bar]
## 2.6 WEIGHTS

<table>
<thead>
<tr>
<th>Description</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum permissible take-off weight</td>
<td>900 kg / 1984 lb</td>
</tr>
<tr>
<td>Maximum permissible landing weight</td>
<td>900 kg / 1984 lb</td>
</tr>
<tr>
<td>Maximum weight of all non-lifting parts (Including load)</td>
<td>610 kg / 1344.8 lb</td>
</tr>
<tr>
<td>Maximum weight in tail luggage compartment</td>
<td>20 kg / 44.2 lb</td>
</tr>
<tr>
<td>Maximum weight in the tail water ballast tank</td>
<td>15 kg / 33.1 lb</td>
</tr>
<tr>
<td>Maximum weights in the luggage compartment behind seat</td>
<td>10 kg / 22.05 lb (each)</td>
</tr>
<tr>
<td>Maximum weights in the luggage compartment upper rear</td>
<td>2 kg / 4.41 lb</td>
</tr>
<tr>
<td>Maximum weights in the luggage compartment rear center console</td>
<td>0.5 kg / 1.10 lb</td>
</tr>
<tr>
<td>Maximum weights in the luggage compartment forward center console</td>
<td>0.3 kg / 0.66 lb</td>
</tr>
</tbody>
</table>

---

**CAUTION**

All luggages in the baggage compartments must be fastened and secured at the provided mounting points with appropriate means against movement in all possible directions (i.e. 9 g forward).
2.7 CENTER OF GRAVITY

Independent of AUW the limits of the in-flight center of gravity are:

- Forward limit: 265 mm / 10.4 in aft of reference plane
- Rear limit: 420 mm / 16.5 in aft of reference plane

The reference plane is the vertical plane which corresponds to the leading edge of the wing center section at a given angle of the longitudinal axis. This is defined as the longitudinal inclination, at which the top edge of a wedge of 1000:54, lying on the upper surface of the tail boom, is horizontal (refer to the S12 Aircraft Maintenance Manual).

**WARNING**

The actual CG must be within the certified CG range. The Operating CG has to be determined according section »6.4 Operating Weight and Operating CG«.

2.8 APPROVED MANEUVERS

The S12 is certificated in the category "utility, self-launching".

**WARNING**

Aerobatic maneuvers and flights in IMC (Instrument Meteorological Conditions) are not approved!
2.9  LOAD FACTORS

The following load factors (related to earth gravity g) must not be exceeded.

<table>
<thead>
<tr>
<th>Air-brakes stowed</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to maneuvering speed $V_A = 180$ kph / 97 kt</td>
<td>5.3 g</td>
<td>2.65 g</td>
</tr>
<tr>
<td>Up to maximum speed $V_{NE} = 270$ kph / 146 kt</td>
<td>4.0 g</td>
<td>1.5 g</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Air-brakes extended</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to maximum speed $V_{NE} = 270$ kph / 146 kt</td>
<td>3.5 g</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flaps in Landing position</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to maximum speed $V_{FE +16°} = 140$ kph / 75 kt</td>
<td>4.0 g</td>
<td>-</td>
</tr>
</tbody>
</table>

2.10  FLIGHT CREW

The crew of the S12 consists of 2 persons; minimum crew is one person. When operated solo, the left seat is for the pilot in command.

⚠️ WARNING

Minimum cockpit load must be observed! Installation of cockpit ballast might be required. See section »6.2 Weights Logsheet and Permitted Payload Range«.

2.11  KINDS OF OPERATION

The S12 is certificated for Day VFR operation with the required minimum equipment operable. (See section »2.12 Minimum Equipment List«).
2.12 MINIMUM EQUIPMENT LIST

Instruments and other components of the minimum equipment and the air navigation and communication equipment must be of accepted standards or type certificated. Parts tested by STEMME are listed in the S12 Aircraft Maintenance Manual, chapter »9 Equipment«.

S12 MINIMUM EQUIPMENT INCLUDES

- Airspeed Indicator up to 300 kph/160 kt with colored markings acc. section »2.3«.
- Altimeter
- Magnetic compass
- Engine tachometer with colored markings per section »2.5«.
- Propeller T/O-position indicator light (green light ON indicates, propeller blades in T/O-position).
- Trim position indicator
- Engine hour meter
- Oil pressure indicator
- Oil temperature indicator
- Fuel quantity indicator (right/left)
- Low fuel warning light
- Alternator warning light
- Coolant temperature indicator
- Four-point seat belt and shoulder harness for each seat.
- Parachute or back cushion (approx. 5 cm/2 in compressed).
- OAT indicator (can be integrated in other instruments).

NOTICE

This Minimum Equipment List (MEL) does not comply with a Master Minimum Equipment List (MMEL) as part of the operational suitability data.
2.13  **TOWING BY AIRCRAFT, WINCH LAUNCHING**

Aero tow or winch launching of the S12 is prohibited.

2.14  **OTHER LIMITATIONS**

Operation of the variable pitch propeller has been demonstrated up to a temperature of +38°C/100°F (OAT).

---

**CAUTION**

Since operation of the propeller pitch control mechanism is influenced by OAT and starts actuating at 55°C/131°F, indication of the green T/O-position light during take-off must be observed particularly at higher OAT’s.

The only permitted color for the aircraft exterior paint is white due to the necessity of protecting the structure from high temperatures caused by sunlight (approved up to +54°C/129°F structural component temperature). For colored warning paintings the areas of the nose-cone, the wing tips, coverings and, if optional installed, the winglets may to be used.
2.15 COCKPIT PLACARDS

This section shows cockpit placards containing operation limits data.

**NOTICE**

For further placards refer to the S12 Aircraft Maintenance Manual.

**NOTICE**

The units of limitations shown in the following placards have to be adapted depending on the installed instrumentation and nationality. The values shown in chapter »2« of the S12 AFM apply. Affected placards are marked with (*)

Figure 2.15.a.
Cabin Placards
<table>
<thead>
<tr>
<th>Placard Location/Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Descriptions/Displays:</td>
</tr>
<tr>
<td>Manufacturer: STEMME AG</td>
</tr>
<tr>
<td>Type: STEMME S10</td>
</tr>
<tr>
<td>Model: S12</td>
</tr>
<tr>
<td>Serial No.: 12- Year of Constr:</td>
</tr>
<tr>
<td>Certificated for: Never exceed Speed: $V_{max}$ 270 kmh</td>
</tr>
<tr>
<td>Manoeuvring Speed: $V_{s}$ 180 kmh</td>
</tr>
<tr>
<td>Maximum Speeds: - Rough Air: $V_{sha}$ 180 kmh</td>
</tr>
<tr>
<td>- Landing Gear extended: $V_{var}$ 140 kmh</td>
</tr>
<tr>
<td>- Inflight Engine start: $V_{peo}$ 140 kmh</td>
</tr>
<tr>
<td>- Flaps extended: +5° / +10° $V_{var}$ 180 kmh</td>
</tr>
<tr>
<td>L (+16°) $V_{var}$ 140 kmh</td>
</tr>
<tr>
<td>Empty Mass: kg</td>
</tr>
<tr>
<td>Max. Take-off Mass: 900 kg</td>
</tr>
<tr>
<td>Min. Seat Load (no water ballast and luggage) kg otherwise Ballast</td>
</tr>
<tr>
<td>Max. Cockpit Load: kg</td>
</tr>
<tr>
<td>Tire inflation pressure Main Wheels: 2.6 bar</td>
</tr>
<tr>
<td>Tire inflation pressure Tail Wheel: 2.8 bar</td>
</tr>
<tr>
<td>WARNING: Check for WATER BALLAST and BAGGAGE in the tail before each flight. Do NOT FLY with WATER BALLAST and/or BAGGAGE without prior CG calculation (acc. to AFM 6.4)</td>
</tr>
<tr>
<td>[ft MSL]</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>10,000</td>
</tr>
<tr>
<td>13,000</td>
</tr>
<tr>
<td>16,000</td>
</tr>
<tr>
<td>19,500</td>
</tr>
<tr>
<td>26,000</td>
</tr>
<tr>
<td>33,000</td>
</tr>
<tr>
<td>39,500</td>
</tr>
<tr>
<td>On top of shaft tunnel cover between throttle and choke lever. (1)</td>
</tr>
<tr>
<td>Baggage: Only light items Total: max. 0.3 kg / 0.66 lb</td>
</tr>
<tr>
<td>On flap of front center tunnel storage compartment cover (1)*</td>
</tr>
</tbody>
</table>
### Placard Location/Remarks

<table>
<thead>
<tr>
<th>Placard</th>
<th>Location/Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only logbook or lights items up to max. 0.5 kg / 1.10 lb</td>
<td>On flap of rear center tunnel storage compartment cover (7)*.</td>
</tr>
<tr>
<td>Baggage max. 10 kg / 22.05 lb</td>
<td>On top edge of luggage compartments behind the pilot and copilot seat (3,4)*.</td>
</tr>
<tr>
<td>Baggage: Only light items Total: max. 2 kg / 4.41 lb</td>
<td>On lower edge of luggage compartment behind/between the pilot and copilot headrest (5)*.</td>
</tr>
<tr>
<td>Baggage max. 20 kg / 44.09 lb</td>
<td>Placard on upper cover of tailboom luggage compartment*.</td>
</tr>
<tr>
<td>Detergent Oil API-SF or API-SG</td>
<td>On right rear side of steel frame near the oil reservoir.</td>
</tr>
</tbody>
</table>

### PLACARD LOCATION/REMARKS

<table>
<thead>
<tr>
<th>PLACARD</th>
<th>LOCATION/REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c) Switches:</td>
<td>Above fuel tank selector switch in lower central part of instrument panel (2)*.</td>
</tr>
<tr>
<td>L ← Both → R 59.3 l / 15.6 US gal. 59.3 l / 15.6 US gal.</td>
<td>Below fuel tank selector switch in lower central part of instrument panel.</td>
</tr>
<tr>
<td>Fuel Tank</td>
<td></td>
</tr>
</tbody>
</table>

b) Handles

Refer to the S12 Aircraft Maintenance Manual.
d) Fuses / Circuit breakers

Refer to the S12 Aircraft Maintenance Manual.

e) Warning and caution lights

Refer to the S12 Aircraft Maintenance Manual.
3. **EMERGENCY PROCEDURES**

3.1 **INTRODUCTION**

Section »3« provides checklists and amplified procedures for coping with emergencies that may occur.

3.2 **CANOPY JETTISON**

- Canopy locks: OPEN (left OR right lever)
- Red emergency handle: PULL for canopy release. (Center of instrument console).
- The canopy is pushed upwards by gas springs. If necessary push manually.

**WARNING**

The rear canopy lock ("Röger"-hook) must be locked when the canopy is jettisoned! It functions such that the canopy is only lifted at the front and is torn away by wind forces.

3.3 **BAILING OUT**

After canopy is jettisoned:

- Central lock of seat-belts: OPEN
- Bail-out to the side, attempt to leave so as to clear below the wing to avoid collision with the tail.

**NOTICE**

The fixed part of the cockpit edge is of strong structure without sharp edges; it should be used to pull out and to brace.
3.4 STALL RECOVERY

Stall speed depends on flap deflection and actual weight and may occur in unaccelerated wings-level flight below 91 kph/49 kt (worse case for flaps -10°, max. weight) in turns the aircraft stalls at higher speeds depending on g-force. If after stall-onset the angle of attack is further increased or a turn is initiated, a wing-drop may occur, and depending on CG, the aircraft may spin.

Stall recovery:

- Elevator REDUCE back pressure, move forward if necessary.
- Airspeed WAIT for increase.
- Attitude CORRECT with rudder and aileron.

WARNING

Altitude loss for recovery from stall in level flight should be up to 30 m/100 ft, out of a turn up to 40 m/130 ft and for a delayed reaction up to 60 m/200 ft.

3.5 SPIN RECOVERY

If the aircraft spins unintentionally, the procedures to recover are the same for the powered or unpowered (glider) configuration:

- Rudder APPLY FULLY against the direction of turn.
- Aileron NEUTRAL
- Flaps (if in L (16°) position) SET to +10 or less position.
- Throttle (if engine is running) IDLE
- Elevator PUSH forward beyond the neutral position.
- Controls HOLD until rotation stops, then
- Rudder NEUTRAL
- Recover to normal attitude, use elevator with caution during pull-out of dive.

**WARNING**

Altitude loss between counteracting spin and level flight can be up to 100 m / 330 ft.

**WARNING**

Spinning with flaps in “L” (+16°) can result in structural damage, if recovery after the spin stopped was performed too slowly and speed during recovery becomes too high.

**CAUTION**

In case the aircraft spins unintentionally with the engine running, use standard recovery procedure and reduce power to idle.

**NOTICE**

With an aft CG position spinning is accompanied by strong, oscillating pitching movements, about one oscillation per turn. During the first three spin turns the recovery may require almost one full turn. After the third rotation can usually be stopped in less than ¼ turn.

If the aircraft stops spinning by itself, it may transition into a spiral dive.
3.6 RECOVERY FROM SPIRAL DIVE

In middle and forward CG positions the aircraft has tendencies to stop spinning automatically or to go directly into a spiral dive.

Spiral dive is stopped by the following maneuver:

- Aileron and Rudder STOP ROTATION by deflecting controls against the direction of turn.
- Elevator PULL OUT of dive with caution

⚠️ WARNING

Do not exceed $V_{ne} = 270$ kph/146 kt during pull-out!
Ensure rotation has stopped before initiation pull-out to avoid asymmetric g-loading.
3.7 ENGINE FAILURE

3.7.1 ENGINE FAILURE DURING T/O

- If RWY-length is sufficient land straight ahead.

If a straight landing is not possible, the pilot has to decide depending on altitude, position and suitable landing fields etc. how to proceed next.

- Approach procedure DEFINE
- Fuel shut-off valve CLOSE
- Ignition OFF (switch to OFF)
- Engine Switch OFF
- Landing gear DOWN and LOCKED (2 green lights)
- Master Switch OFF

**CAUTION**

If the situation allows leave master switch ON until shortly before landing, because all electrical equipment including landing gear operation will become unavailable with master switch OFF.

If the landing gear was already selected UP and decision is made to land with gear down, the master switch must remain ON until the green gear lights show the landing gear is down and locked (both green gear lights ON).

If the landing gear was already selected UP and pilot’s decision is to land with gear retracted, the master switch has to be ON until gear retraction is complete and the red flashing gear lights are extinguished.

If situation allows, glide ratio and range can be improved by the following procedure, which also minimizes the risk of serious propeller and transmission system damage in case of a gear-up landing:

- Propeller BRAKE and wait for blades to retract
- Propeller POSITION
- Nose-cone CLOSE
CAUTION

Due to the S12 configuration, there is almost no difference in aircraft behavior with regard to propeller position in or out.

With the engine stopped and the propeller still windmilling, the rotating propeller causes much higher additional drag than the additional drag of the open nose-cone and the open cowl flaps. Therefore it is most important to brake down the propeller until it is automatically folded. The nose-cone closing should be considered if the pilot workload allows.

3.7.2 ENGINE FAILURE DURING FLIGHT

Normally the engine only stops in case of fuel shortage or if the ignition is switched off. Engine failure due to carburetor icing has not been observed thus far since carburetor air is heated by the turbocharger. Even in case of total electrical failure (for example, if the engine master switch at the nose-cone actuating handle fails) the engine will not stop because its ignition circuits are separate and powered by engine's internal generator.

After an engine failure in flight, the following restart procedure is recommended:

- Airspeed < 140 kph / 75 kt
- Fuel shut-off valve OPEN
- Fuel selector switch BOTH tanks
- Auxiliary fuel pump ON (green light ON)
- CB’s for all fuel pumps CHECK (two for the main pumps, one for the auxiliary pump)
- Fuel pressure CHECK (red warning light not ON or FLASHING, see section »3.9.4.1«)
• Fuel quantity CHECK AMOUNT (fuel quantity indicators for both tanks)
• Low fuel indication CHECK OFF (fuel quantity in feeder tank)
• Choke OFF
• Throttle IDLE, max. 10%
• Starter START (for a minimum of three seconds)
• Engine tachometer CHECK for RPM-Indication

As soon as the engine starts firing, release the key from START position to stop the starter. If the engine is not running after 10 seconds, wait for 2 minutes for starter cool-down and repeat starting procedure.

If engine start unsuccessful:

• Prepare for engine-off landing on next suitable landing field

---

**WARNING**

Unintentionally actuation of the starter during powered flight will cause the ignition to quit for three seconds, and consequently cause an engine failure. The engine can be immediately re-started by operating the starter again (for at least three seconds!).

---

**CAUTION**

In flight engine start: After an unsuccessful engine-start the propeller may turn (windmill) with engine not running, because engine and propeller are isolated by a centrifugal clutch. A running engine is indicated only by the tachometer, not by seeing the propeller turning.
CAUTION

An automatic electronic device inhibits the ignition with a time delay of three seconds after the starter is actuated, to ensure that the propeller blades are fully unfolded before the engine starts, thus avoiding excessive loads on the propeller blades and their corresponding stops. The time delay starts from the beginning each time the starter is actuated, which means that the starter must always be operated for at least three seconds.

CAUTION

The engine can be restarted with the propeller either turning or folded.

Within 10 seconds after engine start, oil pressure must be within green arc! If not, a serious engine problem should be the reason.

See section »4.5.3.4« for more information about engine starting.
3.7.3 FAILURE OF ENGINE STARTER

If the engine starter does not operate during an attempted in-flight engine start, the reason might be an incorrect locking of the nose-cone in the open position, or failure of the engine master switch, connected to the nose-cone interlock.

In this case proceed as follows:

- **Engine Switch** ON (Voltmeter must show correct voltage of engine system.
- **Handle for nose-cone** CHECK (pushed and LOCKED, push down handle against pressure-point, verify that engine instrumentation and lights are on, especially the red alternator failure light.
- If unsuccessful prepare for power-off emergency landing.
3.8 FIRE

3.8.1 FIRE IN ENGINE COMPARTMENT

The standard fire warning system generates an acoustic warning using the landing gear warning horn and illuminates the red FIRE warning light. In case of in flight fire warning or smell of fire or smoke, the following procedure is recommended:

DURING FLIGHT

Immediate reaction:

- Fuel shut-off valve \textit{CLOSE}
- Throttle \textit{FULLY OPEN} (to empty fuel lines and carburetors)

When engine has stopped:

- Ignition \textit{OFF}
- Engine Switch \textit{OFF}
- Master Switch \textit{OFF}
- Airspeed \textit{Approx. 100-120 kph / 55-65 kt}
- Propeller \textit{(1) BRAKE and (2) POSITION}
- Nose-cone \textit{CLOSE}
- Cabin ventilation \textit{OPEN in case of smoke in cockpit. (side-window and/or nozzle)}
- Emergency descent \textit{INITIATE as soon as possible, EXTEND air-brakes.}
- Emergency landing \textit{PREPARE for next suitable terrain.}

\textbf{WARNING}

With the master switch OFF, COM and all other electrical equipment is not available, including fire-warning system. The landing gear must be extended manually (see section »3.9.4.19«). Depending on situation and landing terrain, it might be preferable to land with the gear retracted.
CAUTION

Normally the propeller will continue turning (windmilling) with the engine not running, because engine and propeller are isolated by a centrifugal clutch. A running engine is indicated only by the engine tachometer, not by observing the propeller turning.

3.8.2 ELECTRICAL FIRE

IN-FLIGHT ELECTRICAL FIRE

- Engine Switch OFF
- Master Switch OFF
- Cabin ventilation OPEN (side-window and/or nozzle)
- Throttle SET ~50%
- Approach next suitable airfield
- Landing gear EMERGENCY EXTENSION (see section »3.9.4.19«).

WARNING

With the Engine Master Switch in OFF, COM/NAV and most of the electrical equipment is not available, including engine instruments, (RPM, engine temperature, etc.), warning lights, normal landing gear operation and fire-warning system. The propeller returns into T/O position within 2-5 minutes without indication.

Engine ignition as well as the electrically driven main fuel pump are independent of the master switch or engine switch position; if there is no fire in the engine bay, the engine can be operated to find an area for emergency landing and to set-up for landing. A low power setting for level flight at approximately $V_y$ is recommended to avoid engine damages.

The remaining engine time is depending on the fuel level in the feeder tank and selected power setting.
ELECTRICAL FIRE ON GROUND

- Engine switch  OFF
- Master switch  OFF
- Fuel shut-off valve  CLOSE
- Throttle  FULL OPEN
- Ignition  OFF after the engine has stopped
- T/O  ABORT (see section »3.9.1.1«)

3.8.3 LIGHTNING STRIKE OR POSSIBLE LIGHTNING STRIKE

- REDUCE air-speed to less than maneuvering speed
  \( V_{RA} = 180 \text{ kph} / 97 \text{ kt.} \) Reduce further as required.
- CHECK if all flight-controls react as intended
- Land as soon as possible on next suitable airfield.

**WARNING**

An aircraft made of composite materials is more easily damaged by lightning strikes than an aircraft made of metal.

Flights in/near cumulonimbus's are prohibited.

**CAUTION**

After a lightning strike, all electrical systems will most likely malfunction or be completely inoperative. Communication, radio, transponder and navigation devices will most likely be the first systems to fail after a lightning strike.
3.9 OTHER EMERGENCIES

3.9.1 TAKE-OFF

3.9.1.1 T/O ABORT

If a take-off abort is urgently required during take-off run for technical reasons or flight safety, the following actions are recommended:

- Throttle IDLE
- Airbrakes EXTEND
- Elevator control PULL carefully to lower the tail
- Wheel brakes ACTIVATE with caution

In case of an engine failure shortly after lift-off, the recommended procedure is similar, but be sure to establish a stable attitude and maintain sufficient airspeed before an extension of the air-brakes. Apply forward stick pressure as necessary to gain and maintain sufficient airspeed.

- Throttle IDLE
- Airspeed > 110 kph/59 kt (yellow triangle)
- Airbrakes EXTEND as required
- Landing normal FLARE and TOUCHDOWN
- Elevator PULL carefully to lower the tail
- Wheel brakes ACTIVATE with caution

If runway remaining is too short to come to a normal stop or if there are obstacles:
• Fuel shut-off valve  
  CLOSE
• Ignition  
  OFF
• Engine Switch  
  OFF
• Master switch  
  OFF
• If necessary perform a ground loop to stop the aircraft  
  (see section »3.9.2.2«).

3.9.1.2  GO-AROUND WITH PROPELLER IN CRUISE POSITION

If a go-around in landing configuration is necessary for reasons of safety with the propeller not in T/O-position (green pitch position indicator not ON) proceed as follows:

• Throttle  
  FULL POWER
• Airbrakes  
  IN and LOCKED
• Airspeed  
  115 kph / 62 kt (blue line)
• Elevator  
  PULL slightly establish a shallow climb angle
• Landing gear  
  RETRACT
• Flaps  
  +5°
• Propeller-pitch  
  TAKE-OFF
• Cowl flaps  
  FULLY OPEN

WARNING

Monitor max. 5800 RPM during climb. Correct RPM by throttle if necessary while Propeller Pitch Control system (PPC) is moving propeller blades from cruise to T/O position. The climb performance is significantly reduced if the propeller is not fully in its take-off position (green light OFF). The exact value depends on atmospheric conditions such as temperature and density altitude (elevation).
3.9.2  LANDINGS

3.9.2.1  OFF-AIRFIELD LANDING

If an off-airfield landing is required by technical malfunctions or by reasons of flight safety, special care must be taken to verify the suitability of the selected landing area and the characteristics of the landing surface.

If the landing area is found to be suitable, a landing in gliding configuration is recommended as described in sections »4.5.3.4.1« and »4.5.4.1«.

If landing on a soft surface not able to support the load of the aircraft cannot be avoided, a landing with the landing gear retracted should be considered to reduce the risk of damage (see section »3.9.3.1«).

In anticipation of any forced or emergency landing, always prepare as follows:

- Loose items  SECURELY FASTEN
- Seat belts  TIGHTEN
- Review Emergency Landing Procedures as given in sections »3.9.3.1 – 3.9.3.3«.

3.9.2.2  INTENTIONAL GROUND-LOOP

If insufficient room to avoid overrun or obstacles remains during the final phase of landing or landing roll and it is decided to ground-loop the aircraft, the recommended procedure is:

- Wheel brakes  APPLY as hard as possible without nosing-over

In time before collision with the obstacle, simultaneously:

- Rudder  APPLY FULLY in desired direction
- Aileron simultaneously  APPLY FULLY to lower wing (same direction as rudder).
- Elevator  PUSH BRIEFLY to raise the tail but not too hard, to avoid nose-over.
NOTICE

The elevator should be deflected so that the tail is lifted off the ground to reduce the risk of structural damage to the fuselage during yaw and skidding, but not so much that the aircraft noses over, which would damage the propeller and the front section of the fuselage. The correct elevator deflection depends on deceleration while braking. The more effective the braking and the softer the surface, the more aft stick is required to prevent nose-over.

3.9.3 EMERGENCY LANDING

3.9.3.1 EMERGENCY LANDING WITH LANDING GEAR RETRACTED

In all cases in which serious landing gear malfunctions cannot be corrected and emergency deployment is not possible, as well as in unavoidable off-field landings with soft ground, a landing with retracted landing gear is recommended in the following sequences.

After gliding range to suitable airfield is assured, change to gliding configuration:

- Fuel shut-off valve: CLOSE
- Ignition: OFF (if possible wait until carburetor reservoirs are empty and engine stops)
- Propeller: (1) BRAKE and (2) POSITION
- Nose-cone: CLOSE
- Engine Switch: OFF

Before landing:

- Loose items: STOW and SECURE
- Seat belts: TIGHTEN
- Flaps: L (+16°)
- Master switch: OFF
• Approach path flat and smooth
• Landing moderate round-out and flare for to avoid stalling, touch down in 2-point attitude, use minimum airbrakes.

**WARNING**

The energy absorption capacity with retracted landing gear is much less than with extended landing gear. To avoid a stalled landing, it is recommended to approach above minimum speed. The touch-down should be in a two-point-landing attitude (tail wheel and bottom of forward fuselage).

**CAUTION**

Because of the long landing gear legs of the S12, pitch angle and height above ground are significantly lower compared to a landing with landing gear extended. In addition, the ground clearance of the wing-tips is much less and it is very important to hold wings level at touch-down.
3.9.3.2 EMERGENCY LANDING WITH THE LANDING GEAR NOT FULLY DOWN AND LOCKED

Landings with only one wheel down and locked have been demonstrated several times without damage to pilot or aircraft.

In all cases in which serious landing gear malfunctions cannot be corrected according to the procedures given in section »3.9.4.19« and the landing gear position indicator lights show only one landing gear leg Up or DOWN, try to get confirmation on this status by an external observer (ground station or another aircraft).

For a one-wheel landing the following actions are recommended (landing in gliding configuration!):

- Be prepared or an unintended ground loop and uncontrollable yawing off the runway, plan for sufficient space.
- Loose items STOW and SECURE
- Seat belts TIGHTEN
- Fuel shut-off valve CLOSE
- Ignition OFF (if possible wait until carburetor reservoirs are empty and engine stops)
- Engine Switch OFF
- Propeller BRAKE and POSITION
- Nose-cone CLOSE
- Wing flaps position 0° (to keep retain aileron efficiency as long as possible)
- Master switch OFF
- Short final normal flight path
- Landing FLARE cautiously, avoid stalled-landing, keep the tail up
- Lateral control maintain wings level as long as possible
- Wheel brakes when the wing begins to drop and is no longer controllable by fully deflected aileron, APPLY FULL BRAKES and use FULL RUDDER against direction of yaw.
3.9.3.3  EMERGENCY LANDING ON WATER (DITCHING)

An emergency landing on water is associated with considerable risks and should only be undertaken as a last resort. If a ditching is unavoidable, it is recommended to land in the glider configuration and, due to the special design of the landing gear, with the landing gear retracted. Cabin ventilation and emergency-window should be closed prior to ditching.

Approach and landing:

- Approach: GLIDER CONFIGURATION
- Landing gear: UP
- Ventilation, emerg.-window: CLOSE
- Final and touch-down: MINIMUM SPEED

If the aircraft submerges after touchdown and does not immediately rise to the surface and the cockpit stays below the water surface, it is recommended to open emergency-window and ventilation to accelerate pressure balance and allow canopy opening. If necessary, opening of the canopy can be improved by pulling the emergency canopy handle after opening the canopy locks and the “Röger-hook” (see section »3.2 Canopy Jettison«):

- Lateral canopy locking lever: OPEN
- “Röger”-hook: UNLOCK
- Canopy emergency handle: PULL (red handle on the instrument panel)
- Ventilation, emerg.-window: OPEN

NOTICE

Experience shows, that gliders tend to submerge at touchdown instead of sliding on the water surface. So long as the cockpit is forced below the water surface, (usually only briefly), it is almost impossible to open the canopy.
**CAUTION**

Do not eject the canopy prior to water impact. Jettisoning of the canopy can cause a loss of stability by negative changes in weight and balance of the aircraft.

---

### 3.9.4 SYSTEM MALFUNCTIONS

#### NOTICE

In case of abnormal system behavior conduct checks as per sections »3.9.4.1« through »3.9.4.19«. Before the next flight determine and eliminate the cause of the system failure acc. to the S12 Aircraft Maintenance Manual.

---

#### 3.9.4.1 FUEL PRESSURE

**FUEL PRESSURE TOO LOW**

An indication of fuel (differential) pressure of less than 1.5 is below the allowable limit (or should be caused by a malfunction of the indicator or sensor). The engine may stop due to low fuel pressure. The reason for low fuel pressure could be a malfunction in the fuel-supply, an engine defect, fuel-pressure control or fuel pumps.

Proceed as follows:

- Fuel shut-off valve  **OPEN**
- Fuel selector switch  **BOTH tanks**
- Auxiliary fuel-pump  **ON** (green light must be ON)
- CB’ s for all fuel pumps  **CHECK** (two for the main, and one for the auxiliary pump)
- Fuel quantity  **CHECK** (fuel quantity indicators for both tanks, low fuel indication OFF)
- Additionally, if remaining fuel quantity is low: If necessary reduce power setting and airspeed, fly without bank or sideslip.
• If engine has stopped proceed with normal engine start in the air (see »4.5.3.4 Change of Aircraft Configuration«).

If fuel pressure can be restored by use of the auxiliary fuel pump, but drops again when deselecting the auxiliary fuel pump, most likely the main fuel pump or the internal generator are malfunctioning.

With the auxiliary fuel pump continuously ON, it can be assumed that the flight can be completed as planned, but with a remaining higher risk of engine stoppage.

If it is not possible to restore normal fuel pressure, plan to land on the nearest suitable airfield. A sudden engine failure must be expected at any time.

---

**CAUTION**

In flight engine start: The propeller may continue turning with the engine not running (following an unsuccessful in flight engine start), because engine and propeller are isolated by a centrifugal clutch. A running engine is indicated only by the engine tachometer, not by observing the propeller turning.

**FUEL PRESSURE TOO HIGH**

A number higher than 3.5 indicates that fuel pressure is above the upper limit (or should be caused by a malfunction of the indicator or sensor). The engine may stop. The reason for high fuel pressure could be a problem in the engine fuel pressure control unit or blocked venting of the feeder tank or of the fuel pumps. (If the main and the auxiliary fuel pump are operating simultaneously, the auxiliary fuel pump can be checked by deselecting it; if the red warning light stops flashing, the auxiliary fuel pump is the reason).

This problem should be caused by normal closure of the feeder tank vent float valve (for example, by negative g-loads due to rough air). Continue flight at MCP and/or switch the fuel tank switch to only one fuel tank (left or right) to reduce the flow into the feeder tank until the pressure decreases.

If the pressure doesn’t decrease be prepared for engine malfunction.
3.9.4.2  GREEN LIGHT FOR AUXILIARY FUEL PUMP

The green light is a reminder that the auxiliary fuel pump is operating, e.g. during cruise.

If the green light is not illuminated with the aux. fuel pump switched ON, either the pump or the indication is a malfunctioning. This is not a flight critical item as long as the main fuel pump is operating properly, and the fuel pressure remains within its limits.

When observing this:

- CB's for aux. fuel pump  CHECK
- Fuel pressure  MONITOR (red fuel pressure warning light OFF).
3.9.4.3 RED WARNING LIGHT FOR MANIFOLD PRESSURE STEADY ON OR FLASHING

RED WARNING LIGHT FOR MANIFOLD PRESSURE STEADY ON

Maximum allowed manifold pressure has been exceeded; procedure:

- Manifold Pressure (MAP) is not automatically controlled.
- Throttle REDUCE
- RPM and MAP CONTROL with throttle (red warning light must extinguish).
- RPM setting < 4500 RPM recommended
- Limited engine power range has to be expected, manifold pressure control is not operating properly.

NOTICE

The exceedance of maximum allowed engine limits must be documented in the aircraft-logbook with details including nature of incident, date, duration and the degree of exceedance.

RED WARNING LIGHT FOR MANIFOLD PRESSURE FLASHING

T/O-power has been set for more than 5 minutes, procedure:

- Throttle REDUCE to max. continuous power or less.

CAUTION

The manifold pressure is not automatically limited or reduced.

NOTICE

The exceedance of the 5 minute takeoff power limitation must be documented in the aircraft-logbook with date and duration of exceedance.
3.9.4.4 YELLOW LOW FUEL CAUTION LIGHT

The yellow low fuel caution light indicates that the level of fuel within the feeder tank has dropped below 4.5 liters. This should be the result of a malfunction of the left and/or right hand transfer pump between the wing tanks and the feeder tank. It could also indicate a malfunction of the float switch in the feeder tank that triggers the operation of the two transfer pumps or the sensor for the warning light should be malfunctioning and the wing tanks could be empty.

In case that the low fuel caution light is illuminated, proceed as follows:

- Fuel tank selector switch SWITCH to “both tanks”.
- Engine power REDUCE as much as possible to reduce fuel flow.
- Main wing tanks CHECK fuel level.
- Low fuel caution light Monitor status.

In the worst case (no fuel transfer from wing tank to feeder tank, low fuel light remains illuminated), the remaining fuel in the feeder tank is sufficient for the following remaining engine run time

<table>
<thead>
<tr>
<th>Engine Power</th>
<th>Remaining engine run time [min]</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>10</td>
</tr>
<tr>
<td>80%</td>
<td>12.5</td>
</tr>
<tr>
<td>50%</td>
<td>20</td>
</tr>
<tr>
<td>30%</td>
<td>33</td>
</tr>
</tbody>
</table>

If the caution light remains illuminated, expect that the engine may fail anytime. Continue the flight so as to permit a safe landing at any time or land at the next suitable airfield to analyze and rectify the problem.
3.9.4.5  YELLOW TCU-CAUTION LIGHT FLAShes

A failure of sensors, sensor wiring, TCU or a leakage in the airbox is possible, procedure:

- RPM and MAP CONTROL with throttle (red MAP warning light must stay OFF). Recommended < 4500 RPM.

If manual control is not possible:

- TCU isolation switch UPWARDS (lift red switch over) to isolate wastegate actuator.

- Expect limited engine performance available, manifold pressure control degraded or inoperative.

NOTICE

Flashing of the yellow TCU caution light must be documented by the pilot in the aircraft-logbook with details including nature of incident, date, duration and the degree of exceedance.
3.9.4.6  RED BATTERY CHARGE WARNING LIGHT FOR THE EXTERNAL ALTERNATOR ILLUMINATED

Illumination of the red battery charge warning light for the external engine-driven generator indicates that it is not producing adequate electrical output. This is normal if the engine is not running with the master switch ON and the nose-cone OPEN and LOCKED.

If the warning light is ON with the engine running, a malfunction must be expected and following procedure is recommended:

- EXT ALT OFF
- Non-essential equipment OFF
- Ammeter CHECK for reduced current.
- Pull fuses of “EFIS” and “GPS”
- Minimize use of electrical trim.

In case of a failed generator, the main battery is the only source of electrical energy and will be discharged continuously; energy can be saved by switching OFF all non-essential electrical consumers (mainly in the avionic panel), extending time for the most important systems. A fully charged battery should provide a minimum operating time of 42 minutes.

Execution of the following load shedding instructions will increase the possible duration up to minimum 2.5 hours:

- Switch off / disconnect all loads powered via auxiliary sockets.
- Switch off autopilot “AP”.
- Pull CB “EFIS” to shift it to its internal battery.
- Pull CB “GPS” to shift the unit to its internal battery.
- Switch off transponder, if not required for safe flight.
- Minimize use of electric elevator trim.
- Minimize communication radio transmissions.
3.9.4.7  YELLOW CAUTION LIGHT FOR THE INTERNAL GENERATOR ILLUMINATED

Illumination of the yellow caution light with engine operating indicates failure of the internal generator. This means the main fuel pump, the wing transfer fuel pumps and the TCU are supplied only from the engine battery. If this battery is fully charged and in nominal condition, the remaining engine run time from the first indication until engine stoppage is approximately one hour. However, this time can be achieved only by reducing the energy consumption of fuel pumps and propeller control.

Procedure is:

- Propeller switch to T/O position.
- Fuel tank switch to only one fuel tank (fullest tank).
- Climb to highest possible altitude.
- Prepare for a landing at the next suitable airfield.

⚠️ CAUTION

Cruising with propeller in T/O position (green light ON) results in lower cruising speed and reduced range.

⚠️ CAUTION

With the propeller in T/O position, engine RPM limits should be exceeded even at power settings below 100% caused by altitude. Power and/or airspeed must be reduced (by climbing if possible) to keep engine RPM below the max continuous limit of 5500 RPM.
3.9.4.8  TOTAL ELECTRICAL FAILURE

Reason for a total electrical failure could be a short circuit in one of the electrical systems. This failure cause a lost of: COM-systems, electrically operated instruments, engine instruments, wing transfer fuel pumps, auxiliary fuel pump and all indication lights. Additionally the propeller-blade actuating system is not energized; the propeller blades will move automatically within 2-5 minutes into T/O position but the green annunciator light will not illuminate.

The remaining engine time is depending on the fuel level in the feeder tank and the selected power setting.

The main fuel pump and the TCU remain powered by the engine internal generator. The RPM can be controlled only acoustically.

Following procedure is recommended:

- Master switch OFF
- Prepare for landing at the next suitable airfield.

NOTICE

Investigation of the electric system is required before next flight.
3.9.4.9  LOSS OF RPM-INDICATION

The loss of RPM-Indication can be caused by various malfunctions, i.e.:

- Engine tachometer failed.
- The Power supply for the TCU failed.

The procedure is:

- RPM  Control acoustically with throttle.
- Prepare for landing at the next suitable airfield.

3.9.4.10  SUDDEN DECREASE OF MAP AND RPM

When MAP and RPM suddenly decrease, accompanied by heavy noise or a bang, it is most likely that the turbocharger is damaged. Recommended procedure:

- Engine  SHUT-DOWN as soon as practicable, change to glider configuration and look for safe landing area.

- If safe landing is not possible, limited engine operation might be possible; monitor engine instruments, especially oil pressure indication.

When MAP and RPM suddenly decrease, accompanied by the yellow TCU caution light flashing, most likely the TCU has failed.

Procedure:

- Be prepared for reduced engine power, because the waste-gate may not close (with an open waste-gate, about 88.5 hp / 66 kW engine power are available).

**NOTICE**

An exceedance of maximum allowed engine limits and/or the flashing of the yellow TCU caution light must be documented by the pilot in the aircraft-logbook with details including kind of incident, date, duration and the degree of exceedance.
3.9.4.11 SUDDEN INCREASE OF MAP AND RPM

When MAP and RPM suddenly increase and simultaneously the yellow TCU-caution light starts flashing, turbocharge control most likely is malfunctioning; procedure:

- RPM and MAP CONTROL MANUALLY with throttle (red MAP-warning light may not be ON), recommended < 4500 RPM.
- Engine power available expect limited engine power available, waste-gate should be fully closed and manifold control is only by throttle

When MAP and RPM suddenly rise and RPM cannot be reduced by throttle, most probably the throttle linkage has failed or become disconnected. In this case, the mechanical carburetor input is moved by spring force to the 115% -position. It is recommended to climb to a safe altitude, change to glider configuration and land as glider on a suitable field; procedure (once landing field within gliding range:

- Airspeed 115 kph / 62 kt
- Fuel shut-off valve CLOSE
- After engine stops, Ignition OFF
- After engine cool-down Change to GLIDER CONFIGURATION and land in glider configuration.

⚠️ WARNING

If the engine is restarted with throttle set for full power, the power transmission system should be severely damaged.

⚠️ NOTICE

An exceedance of maximum allowed engine limits and/or the flashing of the yellow TCU caution light must be documented by the pilot in the aircraft-logbook with details including nature of incident, date, duration and the degree of exceedance.
3.9.4.12 OSCILLATING OF RPM, INCREASE AND DECREASE

A periodic increase and decrease of the RPM is most likely caused by oscillations of the TCU controlled manifold-pressure, with the yellow TCU-caution light not ON. The manifold pressure will be adjusted by opening or closing of the turbocharger waste-gate operated by the TCU-servo. The actuation of the TCU isolation switch interrupt the power supply to the TCU-servo, the waste-gate is no longer operated.

- TCU isolation switch UPWARD briefly to isolate waste-gate actuator.
- After max. 5 seconds TCU isolation switch DOWNWARD

Continue mission if system is operating normally; if not:

- TCU isolation switch UPWARDS to isolate waste-gate.
- RPM and MAP CONTROL MANUALLY, automatic manifold pressure control is not available, recommended setting < 4500 RPM.

CAUTION

When the TCU-actuator is switched OFF, limited engine power range has to be expected, manifold pressure can only be controlled manually.

NOTICE

Exceedance of maximum allowed limits and/or deselecting the TCU-actuator must be documented by the pilot in the aircraft-logbook with details including kind of incident, date, duration and the degree of exceedance.
3.9.4.13 EXCEEDANCE OF MAXIMUM ALLOWED CYLINDER COOLANT TEMPERATURE (CCT)

If max. Coolant Temperature is exceeded, the procedure is:

- Cowl flaps FULLY OPEN
- Throttle REDUCE as necessary for safe flight.
- CCT MONITOR. If temperature does not decrease to below maximum, change to glider configuration when possible for safe landing (see section »4.5.3.4 a«).
- Prior to next flight check engine cooling system.

NOTICE

Exceedance of maximum CCT must be documented by the pilot in the aircraft-logbook with details including nature of incident, date, duration and the degree of exceedance.
3.9.4.14 EXCEEDANCE OF MAXIMUM ALLOWED OIL TEMPERATURE

If maximum oil temperature is exceeded, the procedure is:

- Cowl flaps  fully OPEN
- Throttle  REDUCE as necessary for safe flight.
- Oil temperature  MONITOR. If oil temperature does not decrease to below maximum, change to glider configuration when possible for safe landing (see section »4.5.3.4«).
- Prior to next flight check engine oil system.

NOTICE

Exceedance of maximum oil temperature must be documented by the pilot in the aircraft-logbook with details including nature of incident, date, duration and the degree of exceedance.
3.9.4.15 OIL PRESSURE BELOW MINIMUM DURING FLIGHT

If oil pressure is below minimum during flight, the procedure is:

- Engine SHUTDOWN and change to glider configuration, if situation allows (see section »4.5.3.4«).

If situation requires engine operation:

- Engine power REDUCE to minimum required for safe flight.
- Be prepared for sudden engine stoppage at any time.
- Land as soon as practicable.
- Prior to next flight check engine oil system.

NOTICE

If the oil pressure was below minimum, this must be documented by the pilot in the aircraft-logbook with details including nature of incident, date, duration and the degree of exceedance.

3.9.4.16 OIL PRESSURE BELOW MINIMUM ON GROUND

If oil pressure is below minimum on ground, the procedure is:

- Engine SHUTDOWN (Ignition OFF)
- Oil quantity CHECK
- Type of oil in use CHECK
- Oil system and engine CHECK prior to next flight.
3.9.4.17 EXCEEDANCE OF MAXIMUM ALLOWED ENGINE RPM

If maximum engine RPM is exceeded, the procedure is:

- Throttle REDUCE immediately until RPM is below max.

**CAUTION**

Because of the manually controlled two-position propeller in combination with the turbocharged engine, a significant increase of RPM at constant power-setting has to be considered during climb (about 200 RPM per 1,000 m (60 RPM/1000 ft, respectively). The throttle has to be set accordingly to avoid overspeed.

**NOTICE**

Exceedance of maximum allowed engine RPM must be documented by the pilot in the aircraft-logbook with details including nature of incident, date, duration and the degree of exceedance.

3.9.4.18 LOSS OF PROPELLER PITCH CONTROL

Loss of propeller pitch control means that the propeller blades change to T/O-position (low pitch). This is not a dangerous situation, continue with propeller in T/O position.

**WARNING**

A cruise flight in T/O-position causes a lower cruising speed and changes in fuel consumption. This needs to be considered in the further flight planning (i.e. endurance, daylight).
**CAUTION**

During cruise with propeller in T/O-position, the engine RPM could be too high, even with power settings below 100%. The throttle has to be set accordingly to maintain engine speeds below 5500 RPM (max. cont. RPM).

### 3.9.4.19 PROPELLER VIBRATIONS

Reasons for abnormal propeller vibrations can be local propeller damage or rough engine running. It is recommended to reduce RPM immediately in case of unusual propeller vibrations.

If vibrations cannot be reduced, the following procedure is recommended:

- Throttle **IDLE**
- Ignition **OFF**
- Fuel shut-off valve **CLOSE**
- Change to glider configuration (see section »4.5.3.4«).
- Prepare for landing at the next suitable airfield.
3.9.4.20  LANDING GEAR MALFUNCTION - EMERGENCY GEAR EXTENSION

If after normal landing gear travel time (max 45 seconds), the gear is not down and locked, indicated by two green landing gear indicator lights ON, following procedure is recommended:

- Landing gear CB CHECK IN (push in if necessary).

If unsuccessful after several attempts, retract the gear slightly and extend again. Check CB and push if necessary.

---

**CAUTION**

Side slip angles more than 5° increase the retraction/extraction forces significantly and could result in overload of the actuators (CB will trip).

---

**NOTICE**

Basically the landing gear can be retracted and extended from any intermediate position.

If it is not possible to obtain a safe gear-down indication (two green gear-down and locked lights), it is recommended to retract the gear as far as possible and then apply the emergency landing gear procedure:

---

**CAUTION**

For trouble-free emergency gear extension the following procedure must be performed!

- Normal Landing gear lever NEUTRAL
- Emergency landing gear handle 1 (RH side) PULL HARD
Down-lock of the right gear is noticeable by a bang.

- Emergency landing gear handle 2 (LH side) PULL HARD

Down-lock of the left gear is noticeable by a bang.

- Normal landing gear lever DOWN to activate indication
- Landing gear indication CHECK both green lights ON
- If the system does not indicate BOTH GREEN, probably based on an electrical failure, the gear position should be checked by a ground observer.
- If the down-and-locked position cannot be confirmed or if unsure about the situation, attempt to lock the gear by side-slippering or by pulling g-loads within the limits.

If emergency landing gear procedure is unsuccessful, an emergency landing has to be performed according to section »3.9.3.1« or »3.9.3.2«, respectively.

⚠️ CAUTION

Landing gear retraction following an emergency extension is not possible in flight.
3.9.5 FLIGHT IN ICING CONDITIONS

Flying under icing conditions is not allowed. If icing conditions are entered unintentionally and cannot be avoided, it must be considered that ice can buildup on wings, tail surfaces, flight controls and propeller, affecting both performance and flying qualities. Outside view can be heavily reduced by canopy icing.

An emergency descent to lower and warmer altitudes is recommended:

- Throttle IDLE
- Cowl flaps OPEN to avoid freezing in closed position.
- Airbrakes EXTENDED (see WARNING below)
- Landing gear DOWN (do not exceed $V_{LO,LE} = 140 \text{ kph} / 76 \text{ kt}$).
- Flight controls MOVE to avoid icing freezing.

**WARNING**

Even a small amount of ice on the aircraft-surface can increase stall speed significantly and can change aircraft-behavior, controllability and flutter. When ice, even light icing of parts of the aircraft is expected, stall speed should be assumed to be 15 - 20% higher than for clean aircraft. If airbrakes are extended in icing condition, it may not be possible to close them completely until icing conditions have been left and ice has been shed.
4. NORMAL OPERATING PROCEDURES

4.1 INTRODUCTION

Normal procedures for additional and optional equipment are described in section »9.«

This section provides normal procedures for rigging and fueling, the daily and pre-flight inspection. In addition checklists as well as descriptions of the normal operating procedures and the recommended airspeeds are given.

4.2 AIRCRAFT ASSEMBLY

4.2.1 RIGGING AND DERIGGING

- Prior to rigging clean and grease any connecting points of fuselage, wing, empennage and controls.
- Derigging is carried out in the reversal sequence of rigging.

4.2.1.1 FUSELAGE

- Place fuselage on extended landing gear. Check locking of the locking struts of the landing gear legs.
- Select flap lever position “L”.
- Remove side cowlings and wing fairings.

4.2.1.2 WING

- Place inner wing on the fuselage. Take care not to jam fuel lines and connecting cables.
- Insert the four wing bolts with operating lever (on-board tools) against the stop in the bushings of the inner wing and secure with safety bolts and Fokker-pin and recheck.
• Connect the controls for flaps, ailerons and air-brakes on both sides with the locking device and secure with the attached spring pin through the control pinholes and recheck carefully.

• Connect the fuel line on the wing to their corresponding fuel line in the fuselage by use of the quick-connector fittings. To guarantee good sealing, the connecting elements must be clean.

---

**CAUTION**

Pay attention to correct (i.e. audible) engagement of the tank quick-connector fitting. Pull to test for secure fit!

---

• Insert plugs for the electrical connector of the wing electric into the bushings in the wing root rib.

• Push left outer wing into the spar pocket of the inner wing until there is about 1.6 in (about 40 mm) clearance.

• Connect aileron push rods and secure the push wedge of the quick connector with a spring pin through the control pinhole.

• Push in outer wing fully and observe the engagement of the wing shear pins in the bushings of the inner wing. When bolts are snugly fitted to the bushings, insert the main bolt fore-aft using the rigging tool and push until the safety pin is in line with the borehole in the main bolt. Remove the rigging tool.

---

**CAUTION**

The main bolts of the wing connection are secured by safety pins, which are flush to the upper wing surface in properly secured position. The safety pin must not protrude above the surface!

---

• Install and secure right outer wing using the same procedure.

• Push left wing extension into the spar pocket of the outer wing, insert aileron pin into the outer wing aileron rib and secure in the same way like inner-outer wing connection and close with cap.
• Install and secure right wing extension using the same procedure.

• Insert winglet to the 25.07 m / 82.25 ft wing extension: Put the winglet spar stub into the wing extension spar pocket. The spring loaded locking pin of the winglet must completely engage in the hole on the underside of the wing, it must then be nearly flush with the surface. It is recommended to cover the gap between winglet and wing, and the hole on the underside with elastic adhesive tape.

**CAUTION**

Recheck all bolts, pins and safety devices for proper fitting and all flight controls for clearance and proper operation!

4.2.1.3 HORIZONTAL TAIL

The elevator is provided with an automatic connector. It is pushed from the front to the fuselage centering bolts until the front fitting tongue fits into the receptacle slot. Then unlock the receptacle with the on-board rigging tool, push the tailplane downwards into the fitting until the spring bolt is freed. The spring bolt must engage.

• The interlocking bolt must not stick out beyond the leading edge of the fin. Only then is the connection properly secured.

• Check correct fitting of the horizontal tailplane by pushing the leading edge upwards.

4.2.1.4 FUSELAGE FAIRINGS

• Install side and upper fairings. Following this, engage the two bowden cables for the cowl flaps.

**NOTICE**

Before installing fairings, the Daily Inspection (see section »4.3.1« and »4.3.2«) has to be completed.
4.2.2 FUELING

The wing tanks are filled via the filler caps in the outer area of the center wing section upper surface. To open the tank caps the slotted screw is pushed in and turned counterclockwise with a screw-driver; to close the cap, push and simultaneously turn the screw clockwise.

Certified fuels see section »2.4.2 Fluids«, maximum fuel volume see section »2.4.1 Engine, Propeller, Fuel«.

**WARNING**

There must be sufficient fuel in both tanks for take-off. Do not perform a take-off when there is fuel in only one tank.

**CAUTION**

The S12 tends to fly slightly right-wing-low during fast cruise at high power settings, which adversely affects the fuel supply from the right wing tank. For refueling please consider that the left tank should be at least as full as the right tank.

**NOTICE**

Fuel fillers are close to the upper part of the tanks; ensure that wings are level before opening the caps or when fueling to avoid overflow of fuel spills.

At high temperatures or when high temperatures are expected, tanks should not be filled completely to allow for temperature expansion and to avoid overflow through the fuel vents.
4.3 DAILY INSPECTION

A daily inspection, which is more detailed than a quick preflight inspection, should be performed at the beginning of each flying day.

It is essential to perform a thorough check any time the aircraft has been rigged or maintenance has been performed on the aircraft or its systems. The daily check prior to the first flight of a day is an ideal time for such an inspection. Many past accidents might have been prevented had such a check been carried out.

A first walk-around item is to check all surfaces for cracks in coating, for indication of local damage and for roughness or "hangar rash". If something appears unusual ask a specialist. During walk-around check all drainage and ventilation holes and pick clean if necessary.

Sequence for visual check (check ignition and master switch OFF!)

4.3.1 ENGINE

- Remove upper and both side cowlings;
- Visual inspection of the engine - inspect cooling air ducts for foreign objects,
- Check oil, coolant and fuel system hoses for leakage (including fuel supply line from the wing tank (refer to section »4.3.2«));
- Check level of cooling fluid in overflow reservoir when the system is cold; quantity should be between min and max marking; fill up if necessary; for details see section »2.4.2.2 Coolant Fluid«.
- Check oil quantity between min and max marking and refill if necessary; for flight-times of more than 8 hours oil level should at least indicate halfway between min and max marking; for details see section »2.4.2.3 Lubrication Fluids«.

NOTICE

An oil level above 1/2 full can cause an oil blow out via the venting line under various flight conditions.
• Reinstall engine side cowlings and secure; reconnect bowden cables for cowl flaps.
• Cowl flaps: Check for proper function by operating the nose-cone (move forward and backward several times);
• Cowl-flaps: Check for proper adjustment by operating cowl flap handle several times;
• Check all three fuel vent outlets: Open and unobstructed (located on wing lower surface between center and outer wing section as well as at the right landing gear door);
• Visual inspection of fuel quantity through fuel cap;
• Drain fuel system by pressing the fuel quick drain in the landing gear bay and the two fuel quick drains on the lower wing surface. Drain as much fuel as is necessary into a suitable container to ensure that possible dirt and water has been removed. Collect drained fuel in vessel and examine for water and dirt.
• Check throttle and choke mechanisms for clearance and proper operation.

⚠️ CAUTION

The aircraft should be parked wings level for sufficient time (several hours) before draining.

After operating the drain valves, verify valves closed with no leakage. Any leakage is a possible indication of contaminated fuel.

Draining of fuel increases the danger of fire. Make sure before engine start up that immediate fire risk does not exist.

⚠️ NOTICE

The fuel drained from the aircraft needs to be disposed sustainable.
NOTICE

The fuel line leakage test should be performed with fuel pressure in the lines. Therefore:

- CHECK landing gear lever DOWN and ignition OFF, then switch ON Engine and Master switch; Fuel selector switch BOTH tanks and auxiliary fuel pump ON (green status light ON).

Perform inspection with fuel shut-off valve OPEN and CLOSED. After inspection switch OFF auxiliary fuel pump and set Master switch OFF.

4.3.2 WING CONNECTING AREA

- Wing pins in the fuselage (4) properly secured (Fokker pins).
- Flight controls connected and secured by safety spring-pins - two connectors each for ailerons, flaps and air-brakes.
- Flight controls: Check for free movement.
- Fuel supply line connected.
- Check for leakage according instruction under note »4.3.1«.
- Both electrical connectors for wing electric attached and secured.
- Check for foreign objects.
- Check oil filler cap properly closed.
- Re-install upper engine cowling.
4.3.3 PROPELLER, NOSE-CONE AND FRONT GEAR

- Check nose-cone engine switch for proper function. The engine electric must be switched off, when nose-cone operating handle is unlocked in the forward position of nose-cone (and vice versa).

- Visual inspection of propeller - central part and pitch control unit. Check for loose connections and local damages;

- Propeller blades can be moved freely from inner folded stop to extended stop.

- Propeller blades free of damage, on leading edge protection strip in good condition.

- Check pitch control mechanism for freedom of motion over the complete working range (T/O-position to cruise position) by extending one blade to approx. 90° from flight position and pull blade tip in flight direction (induce force into the outer third of blade and support blade root hinge). The mechanism must return easily after releasing of the applied force.

- Check clearance in pitch control linkage by pushing blade tip (in 90° position) slightly opposite to flight direction. There must be no significant rotation of the suspension forks before the control mechanism starts moving. Check both blades one after the other.

- Extend blades successively into fully extended position and check play of articulation needle bearing - in and against flight direction (fore and aft), as well as direction of pitch change (check for torsion around longitudinal axis of blades). This is to check for unusual wear of the blade hinge bearings. A total of 4 mm / 0.16 in free motion at the blade tips is acceptable, in pitch change direction the play must be nearly zero.

- Folded propeller. Push on the propeller fork backward and forward with moderate force. By doing so observe (a) the propeller fork bearing and (b) the bearing in the front gear. There must not be significant play in either of these bearings.

- Check propeller gearbox housing for leaks. A light film of oil on housing due to oil vapor passing the shaft seal is acceptable.
- Check oil quantity in propeller gearbox (tail on ground, wings leveled).
- Oil quantity must show between min and max marking. Fill up oil if required. (Specification see section »2.4.2 Fluids«).

**WARNING**

The propeller gearbox must never consume more oil than what could have passed as oil vapor from the shaft seal. Reasons for a higher oil consumption during short operation time must be investigated and must be eliminated before continuing aircraft-operation.
4.3.4 LANDING GEAR

- Tire pressure: Main wheels 2.6 ± 0.1 bar / 37.7 ± 1.5 psi
  Tailwheel 2.8 ± 0.2 bar / 40.6 ± 2.9 psi
- Check tire slip marks and tread.
- Check master switch ON, landing gear lever DOWN and both landing gear indicators “GREEN”.
- Examine components for emergency landing gear release: Check attachment of jackscrews to over-center struts, locking plate attaching spring in correct position, cables drawn downward completely (min. 30 mm / 1.2 in slack), cable coverings unobstructed and free to move and not jammed or blocked.
- Examine position switches for foreign bodies and dirt. Position switch for gear down and locked is located on the locking strut and two for gear retracted at the upper forward frame strut.
- Check quantity of brake fluid. Brake fluid reservoir is located in the landing-gear bay, cabin rear wall.
- Check movement of both LG doors, specially condition and proper installation of cables, pulleys, strut and spring of the LH gear door.

4.3.5 WINGS

- Check aileron, flaps and air brakes for condition, unobstructed movement and play (axial and radial; limits refer to the S12 Aircraft Maintenance Manual).
- Check center-to-outboard wing connection as well as wing extension-outer wing connection - safety bolt must be flush with wing surface.
4.3.6 EMPENNAGE

- Check horizontal tail plane for proper rigging - front arresting bolt (colored red) must not protrude from leading edge of the vertical fin.
- Examine rudder and elevator for unobstructed movement, play and damage (refer to the S12 Aircraft Maintenance Manual).

4.3.7 FUSELAGE

- Examine for damage.
- Check static pressure ports on both sides of the tail boom.
- Check pressure opening of the stall warning system on nose-cone below pitot-static probe.
- Canopy emergency release locked (arresting bolt on central canopy mounting must be in marked position).
- Clean canopy with care. Examine cockpit for foreign objects and loose items.
4.4 PRE-FLIGHT INSPECTIONS

4.4.1 CHECKS BEFORE ENTERING COCKPIT

- Verify daily inspection performed.
- Check oil quantity through the opening in the upper cowling and replenish if necessary (use oil filler cap on the upper engine cowling).
- Check coolant quantity, replenish if necessary (visual check of overflown reservoir in gear bay).
- Check visually fuel quantity.
- If both tanks indicate a fuel level above the locking mechanism of the filler cap, fuel quantity is sufficient for take-off and a minimum cruise time of 30 min; confirm indication on fuel quantity indicators in cockpit; close caps of tanks and lock.

⚠️ CAUTION

In level flight attitude the Fuel Quantity Indicators will show less than at ground attitude.

- Insert pitot/static/total energy tube into the opening of the nose-cone, twisting it slightly.

⚠️ NOTICE

Grease the connection area of the tube from time to time with a thin coating of vaseline (to seal systems from each other and protect the inner sealing rings.)

⚠️ CAUTION

It is recommended to secure the pitot/static/total energy tube with adhesive tape or with a suitable plastic sleeve of about 25 mm/1 in length. If the pitot tube is not installed, the air speed indicator will read low by up to 50% at speeds below 100 kph/54 kt and indications of specialized soaring instruments (soaring computer, variometer) will be erroneous!
To avoid damage to the pitot/static/total energy tube, it should be removed after each flight (or, at least, before parking) and placed in a conspicuous location (for example, on top of the instrument panel) to ensure it will be reinstalled before next flight.

- Adjust backrests: Simultaneously unlock both lower arresting devices against spring force, evenly shift backrest to suitable position and allow them to lock. Unlock the upper adjustment and allow locking at suitable backrest angle.

**WARNING**

Make sure that both upper and lower arresting devices are locked completely. Ensure that the lower LH and RH arresting devices are locked in the same notch (backrest not crooked).

**CAUTION**

Do not shift lower arresting device too far forward or unevenly to prevent the locking device from popping out of its guide and spring loaded parts from coming off.
4.4.2 CHECK OF FLIGHT CONTROLS AND PRESSURE PROBES

To check flight controls concerning function, stiffness, continuity, backlash and deflection, an assisting person is needed. Flight control structure is checked by moving control elements, flap- and airbrake-handles while the assisting person is holding the relevant surface cautiously in position to check for mechanical failures. Deflections, especially aileron-flap-interconnect, and backlash are checked visually and by moving cautiously up and down. The pitot/static/total energy prop should be checked for cleanliness and damage.

<table>
<thead>
<tr>
<th>Recommended sequence for outside-check</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LH airbrake</td>
<td>CHECK stiffness, backlash, full deflection.</td>
</tr>
<tr>
<td>LH aileron, flaps 0°</td>
<td>CHECK stiffness, backlash, full deflection.</td>
</tr>
<tr>
<td>LH flap</td>
<td>CHECK stiffness, backlash, movement from +16° to -10°.</td>
</tr>
<tr>
<td>Elevator</td>
<td>CHECK stiffness, backlash, full deflection.</td>
</tr>
<tr>
<td>Rudder</td>
<td>CHECK stiffness, backlash, full deflection.</td>
</tr>
<tr>
<td>RH flap</td>
<td>CHECK stiffness, backlash, movement from +16° to -10°.</td>
</tr>
<tr>
<td>RH aileron, flaps 0°</td>
<td>CHECK stiffness, backlash, full deflection.</td>
</tr>
<tr>
<td>RH airbrake</td>
<td>CHECK stiffness, backlash, full deflection.</td>
</tr>
<tr>
<td>Dynamic and static pressure</td>
<td>CHECK airspeed and/or VSI when blowing slightly (and dry!) towards the end of the pitot/static/total energy tube.</td>
</tr>
</tbody>
</table>

**CAUTION**

For installation of the pitot-static tube do not turn on the metal measurement head, otherwise the gluing connection to the carbon tube will be damaged.
4.4.3 CHECKS BEFORE ENGINE START

- Load and trim sheets COMPLETED and CHECKED.
- Parachute/cushion INSTALLED and properly secured.
- Back rest & rudder pedals FIXED, comfortable position

**WARNING**

Never unlock arresting device of back rest during flight.

- Seat belts FASTENED and TIGHT
- Control elements and instruments WELL WITHIN RADIUS of action
- Flight controls (incl. flaps) FREE movement
- Altimeter SET
- Canopy CLOSE AND LOCK (left, right and top rear) Canopy tether removed.
4.5 NORMAL OPERATING PROCEDURES AND RECOMMENDED AIRSPEEDS

4.5.1 ENGINE START, WARM-UP AND TAXI PROCEDURES

4.5.1.1 ENGINE START

- Parking brake SET (turn brake valve to ON position and operate brake lever multiple times)
- All switches/avionics OFF
- Circuit breakers CHECKED
- TCU isolation switch OFF (guarded position)
- Landing gear lever DOWN
- Master switch ON, (normal voltage indication, green gear lights ON)
- Engine switch ON
- Nose-cone handle OPEN and LOCKED, (TCU performs self-test, main fuel pump cycles, engine instruments are activated, red battery charge warning light ON).

**CAUTION**

When the TCU is initially energized (master switch ON and nose-cone OPEN and LOCKED), the TCU-warning and -caution light is automatically activated for about 1-2 seconds, then it extinguishes again. If this is not observed, the TCU may have a malfunction.

- Fuel shut-off valve OPEN in vertical position.
- Propeller switch T/O position (check green position light ON).
- Cowl flaps FULLY OPEN
- Fuel selector switch BOTH tanks.
• Fire-warning TEST by pressing indicator (confirm acoustic and optical warning).
• With cold engine - Choke ON

**NOTICE**

Do not use the choke, if the engine is warm.

• Throttle IDLE (if engine is cold) / MAX 10% (if engine is warm).
• Propeller area CLEAR of persons and obstacles.
• Ignition START (for a minimum of three seconds).
• As soon as the engine fires, release starter key to disconnect the starter motor. If the engine does not fire after 10 seconds of starter operation, stop and wait for at least 2 minutes for starter to cool-down before the next start attempt.

**CAUTION**

An automatic electronic device inhibits the ignition with a time delay of three seconds after the starter is actuated, which means that the starter must always be operated for at least three seconds.

The time delay allows the propeller blades to be fully extend before the engine starts, and consequently reduces the loads for the propeller blades and their corresponding stops. In case that the propeller blades are not fully extended after two seconds, the engine start-up should be aborted before the ignition comes on.

In case of repeated problems to extend the propeller blades in time, make sure that the spring load of the propeller blades is correct, and that the blades can be easily moved and folded (refer to the S12 Aircraft Maintenance Manual).
If the engine fires before the expected time delay of three seconds is over, i.e. in case of a malfunctioning electronic device, the following checks must be performed before the intended flight in accordance with the S12 Aircraft Maintenance Manual.

**CAUTION**

During a cold engine start-up, the power lever must be fully on the idle power stop.
In case of a warm engine start-up, it is possible to open the throttle slightly (add up to 10% power) to improve the engine start-up behavior. The choke needs to be closed.

- Engine RPM: SET approx. 2000 RPM
- Oil pressure: GREEN arc after 10 seconds

**WARNING**

If the minimum oil pressure is not indicated within 10 seconds, stop engine immediately!

**NOTICE**

Minimum oil pressure 1.5 bar / 22 psi; with cold engine at low RPM, up to 7.0 bar / 102 psi are normal.

- Warning and caution lights: CHECK all OUT
- Choke: OFF with increasing engine temperature (1-2 minutes should be sufficient).
- COM, NAV: ON & SET
4.5.1.2  ENGINE WARM-UP

- Cowl flaps  CLOSE as required (position 1-5) for engine warm-up

NOTICE

Cowl flaps should be closed only at cold OAT; they should be opened at the latest when oil temperature reaches 50°C/122°F or CHT reaches 100°C/212°F.

- Parking brake  ON (turn brake valve to ON position and operate brake lever multiple times, for pressurizing the brake system).
- Throttle  2500 RPM (after about 2 minutes at 2000 RPM)
- Oil pressure  GREEN ARC
- Engine temperatures  GREEN ARC

CAUTION

To avoid engine damage, engine has to be warmed up until minimum temperatures attained, before engine power is increased and RPM selected above values for the warm-up period.

To avoid engine and systems (in engine bay) overheating, extended high power ground runs should not be performed, because sufficient cooling for extended high power settings is only achieved in flight.
4.5.1.3  TAXIING

- Cowl flaps          FULLY OPEN
- Parking brake      RELEASE (turn brake valve to OFF position, use brake lever simultaneously if required).
- Directional control with RUDDER
- Taxi area          OBSERVE
- Throttle           AS REQUIRED
- Wheel brake        AS REQUIRED

**CAUTION**

Seating position as well as wing span do not allow the crew to observe the outer wing outside of the leading edge sweep-back. This must always be considered during taxiing.

While taxiing, operate wheel brakes with caution, to avoid an aircraft nose down.

Depending on surface conditions and because of the large moment of inertia the function of the tailwheel steering is delayed.

To avoid damaging the propeller, taxi on surfaces with loose stones and gravel using low propeller RPM and avoid large RPM changes.
4.5.2 TAKE-OFF AND CLimb

**WARNING**

It is highly advised not to attempt take off with wet wing or during rain! (See section »4.5.7«)

4.5.2.1 CHECKS BEFORE TAKE-OFF

In run-up area:

- **Parking brake**  
  ON (turn brake valve to ON position and operate brake lever multiple times).

- **Choke**  
  OFF (pushed in)

- **Cowl Flaps**  
  FULLY OPEN

- **Elevator**  
  PULL to stop and hold

- **Engine indications**  
  CHECK green arc

- **Throttle**  
  FULL POWER (115%), for high field elevation see remarks below.

- **Engine RPM**  
  CHECK 5200 ± 200 RPM at MSL + 60 RPM/1000 ft or 200 RPM/1000 m above MSL

**WARNING**

At very high field elevations take care not to exceed max T/O RPM of 5800 RPM. It is recommended to set 100% (throttle on soft stop) for engine run-up on airfields above about 2000 m/6600 ft.

The RPM observed may not differ more than +/-200 RPM from the value, taken from second diagram in section »5.2.3.1«, valid for 100% power setting.
Because of the manually controlled two-position propeller in combination with the turbocharged engine, a significant increase of RPM with altitude at constant power-setting has to be considered (about 200 RPM per 1000 m / 60 RPM per 1000 ft). This rule-of-thumb is valid for ISA.

If actual temperature differs significantly from ISA, at high field elevations > 2000 m / 6600 ft and if uncertain, refer to diagrams for 115% and 110% power settings in section »5.2.3.1«.

The aircraft should be directed into the wind for run-up and magneto-check to have a good airflow in the cowl flap area. In crosswind or tailwind conditions cooling should be inadequate and engine temperatures may steadily increase.

Run-ups at high power settings should be reduced to a minimum. The S12 cooling system is designed for airborne operation, not for extended ground-runs with T/O or max continuous power setting.

- **Magneto check**
  - SET 4150 RPM
  - (mag switch position BOTH)

- **Separate magnetos**
  - CHECK RPM
  - drop of rotational speed < 300 RPM
  - difference between $M_1$ and $M_2$ < 120 RPM

**WARNING**

If RPM’s during run-up or magneto check differ more than the limits given, T/O is not allowed, malfunction of engine or propeller must be expected.

**NOTICE**

For correct magneto check wait until RPM with both magnetos is stabilized. Select left magneto and wait until RPM is stabilized before reading indicator. Select both and wait for stabilized RPM. Select right magneto and again let RPM stabilize before reading indicator.
- Canopy  LOCKED (LH, RH, rear)
- Air-brakes  IN and LOCKED
- Flaps  CHECK +5°
- Cowl flaps  OPEN
- Trim for climb speed $V_y$  NEUTRAL (depending on load, slightly nose-up).
- Warning and caution lights  CHECK all OUT
- Landing gear lever  DOWN (both green lights ON).
- Engine instruments  CHECK GREEN arc.
- Propeller position  T/O (green light ON).
- Fuel quantity  CHECK (sufficient fuel in both tanks).

**WARNING**

There must be sufficient fuel in both tanks for take-off. Do not perform a take-off when there is fuel in only one tank.

- Fuel shut-off valve  OPEN

**WARNING**

Always check fuel shut-off valve to be open. When fuel shut-off valve is closed, the engine will run for about 1 - 3 minutes and may lead to a loss of engine power within the take-off phase.
• Fuel selector switch BOTH tanks
• Auxiliary fuel pump ON (green light ON)
• Ignition BOTH
• Decide on T/O procedure due to conditions.
• Check field length available and required.

The Decision on the T/O-procedure can be made with the RPM observed while checking engine at 115% full power (refer to the S12 AFM, chapter 4.5.2.2). The Static RPM at 115% Power setting for T/O:

<table>
<thead>
<tr>
<th>Static RPM at 115%</th>
<th>T/O procedure</th>
<th>Power setting for T/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5500</td>
<td>No. 1</td>
<td>115% power setting</td>
</tr>
<tr>
<td>5500 - 5600</td>
<td>No. 2</td>
<td>100% power setting</td>
</tr>
<tr>
<td>&gt; 5600</td>
<td>No. 3</td>
<td>T/O with reduced power for static 5400 RPM</td>
</tr>
</tbody>
</table>

• Check runway for obstacles.
• Parking brake RELEASE (turn brake valve to OFF position, use brake lever simultaneously if required).

⚠️ CAUTION

Before taxiing from taxi-hold position to take off position, pay attention that the parking brake valve is in OFF position. Do not use the parking brake after entering the runway.
4.5.2.2  INTERPRETATION OF THE THREE T/O PROCEDURES

The STEMME S12 does not have a constant speed propeller control. The T/O Position of the propeller is to be used for take-off. The power of the turbo-charged engine, which is independent of density over a wide range, results in an increase of RPM vs. altitude at constant indicated speeds. To avoid engine overspeeds in T/O without active control of the power lever by the pilot, three T/O-procedures have been established for special pressure altitude ranges, which avoid overspeeding up to a safety altitude of about 150 m / 500 ft AGL while climbing at $V_y = 115$ kph / $62$ kt IAS.

For these three power settings, required ground runs and T/O distances as a function of pressure altitude and OAT are given in section »5.2.3.2 T/O performance«, though valid for a climb speed of $V_x = 94$ kph / $51$ kt which is only recommended instead of $V_y$ for short airfields.

Basically T/O procedure is defined via static RPM for 115% power setting, using the RPM-limits given above. At very high altitude airfields even static RPM (aircraft stationary) at 115% may exceed 5800 RPM. In this case check engine at 100% and decide, using the values in section 5.2.3.1 valid for 100%, if T/O with 100% is either allowable or T/O-procedure No. 3 has to be used.

Further, in any case of doubt, refer to RPM diagrams for 115% and 110% in section »5.2.3.1«. These diagrams include RPM limit lines, which show if take-off is allowable with 115% or with 100%, respectively.

**T/O PROCEDURE 1**
Static RPM at 115% power setting < 5500 RPM

Throttle is set to maximum T/O power 115%. T/O ground run and T/O distance (hard surface, no slope, no wind) see section »5.2.3.3 T/O-distance (50 ft) and ground run with power setting 115%«.

**T/O PROCEDURE 2**
Static RPM at 115% power setting 5500 - 5600 RPM

Throttle is set to maximum continuous power 100%. T/O ground run and T/O distance (hard surface, no slope, no wind) see section »5.2.3.3 T/O-distance (50 ft) and ground run with power setting 100%«.
T/O PROCEDURE 3
Static RPM at 115% power setting > 5600 RPM

Throttle is manually set to a position for 5400 RPM with the aircraft static, to be stabilized at the take-off point prior to brake release. T/O ground run and T/O distance (hard surface, no slope, no wind) see section »5.2.3.3 T/O-distance (50 ft) and ground run with reduced power for 5400 RPM static«.

WARNING

To avoid excessive RPM after T/O from high altitude airfields in the first part of a climb at $V_y$ the correct static T/O power setting must be selected. In case of doubt, diagrams in section »5.2.3.1« are effective, giving static RPM’s for 115% and 100% and RPM limits for T/O.
If static full power check at a high altitude airfield was performed with 100% power setting, the observed RPM and the diagram for 100% power should be used to determine if take off at 100% power is permitted.

CAUTION

The throttle has two stops: A first stop, soft spring loaded, can be reached when moving the throttle straight forward - this is for the 100% power setting. To reach the second stop and 115%, the throttle lever must be pushed slightly over the spring lock and then further forward.
For a reduced-power take off at high altitude (T/O procedure 3) power must be set manually until at 5400 RPM prior to beginning the takeoff roll.

CAUTION

T/O length can differ noticeably depending on T/O procedure.
4.5.2.3  T/O AND CLimb

In T/O position:

- Aircraft on runway: ALIGN
- Wheel brakes: ACTUATE until aircraft is stationary.
- Throttle: SET POWER according to selected T/O procedure.
- Stabilized RPM: WAIT (for reduced power T/O adjust for 5400 RPM).
- Wheel brakes: RELEASE
- PITCH attitude: PUSH SLIGHTLY to lower the nose so as to lift-off at about 88 kph / 47 kt, accelerate in ground effect to 115 kph / 62 kt and maintain.

⚠️ CAUTION

If the aircraft tends to oscillate in pitch due to roughness of ground surface, hold elevator static and do not try to counteract, as this might cause pilot-induced-oscillations.

The elevator down-spring effects a nose-down force, pushing the stick forward during T/O-roll and thus unloading the tail. With increasing airspeed the stick moves due to increasing aerodynamic forces towards a neutral position, which is ideally correct for lift-off and climb.

If trim is set too far nose-down, there might be a tendency to lift the tail too much without pilot counteraction. Thus, pitch attitude must be controlled actively until lift-off.

- Climb speed 115 kph / 62 kt for best rate of climb.
WARNING

T/O length in section »5.2.3.2« are valid with airspeed for best angle-of-climb \( V_x = 94 \text{ kph} / 51 \text{ kt} \) and are shorter than those which must be expected for a climb at best rate-of-climb speed \( V_y = 115 \text{ kph} / 62 \text{ kt} \).

CAUTION

Monitor oil temperature (max 130°C / 266°F) and CCT (120°C / 248°F) during climb. Increase airspeed if close to limits.

NOTICE

For an airfield with short runway or obstacles in departure sector, initial climb can be performed at \( V_x = 94 \text{ kph} / 51 \text{ kt} \) (best angle-of-climb) to gain altitude over a shorter distance. T/O diagrams in section »5.2.3.2« are valid for this case.

For safety reasons, the airspeed never should be reduced below \( V_x = 94 \text{ kph} / 51 \text{ kt} \), this would not reduce T/O field length.

• Landing gear lever UP at a safe altitude (red lights will flash during retraction)
• Landing gear lights OUT
• Landing gear lever in position RETRACT

CAUTION

If the automatic circuit breaker of the landing gear trips during retraction, an intermediate (not properly retracted) position of the gear will not be indicated because both lights are not energized. On trying to deploy the landing gear, this might be noticed too late and could lead to an "inadvertent gear up landing".
NOTICE

During landing gear retraction the red warning light appropriate for the moving gear leg, flashes (left side first, then right side). The landing gear is fully retracted when red landing gear lights are OFF. The landing gear CB’s to the left of the landing gear lever should be checked additionally.

- T/O power  REDUCE before reaching 5 minutes in use
- Max cont. Power  SET (max. 100%, max. 5500 RPM)
- Auxiliary fuel pump  OFF (green status light OUT)
- Cowl flaps  AS REQUIRED
  Recommended temperatures:
  OIL 90-110°C / 194-230°F,
  CCT ≈ 100°C / 212°F

WARNING

Due to the combination of the fixed position propeller and the turbocharged engine, RPM will increase with altitude for constant power setting and constant IAS. Therefore, depending on pressure altitude and temperature, during climb at Vy, it should be necessary to reduce power even immediately after T/O and initial climb to avoid exceeding of max RPM. The RPM limits are 5800 RPM for max 5 minutes and 5500 RPM continuously.

CAUTION

Cowl flaps must be fully open as long as T/O power (115%) is set. For a long climb at reduced power setting (max continuous or less) cowl flap angle should be reduced if engine temperatures are well below limits. In this case, only the first two notches of the cowl flap handle should be selected. Engine temperatures must be monitored continuously.
4.5.3 CRUISE AND CROSS-COUNTRY FLYING

4.5.3.1 GENERAL REMARKS

Thanks to the unique propulsion concept of the S12, flight characteristics are almost similar in the different configurations and during transitions. The motorglider S12 has good handling characteristics at all speeds and loadings and is as easy to fly as a glider as with the propeller system driving the aircraft.

With CG in mid range, trim is possible from approx. 90-230 kph / 50-124 kt.

With aft CG, change of stick position with speed is small. The stick force gradients remain positive throughout the speed range.

System reliability is high, but it is not wise to rely on the assumption that the drive system will never fail. When flying in glider configuration, it is recommended to plan the flight as if there were no engine. In powered flight always be prepared for an engine failure, with a safe possibility to land within your gliding range. If the engine either refuses to start or simply quits, you may still land as a normal glider.

CAUTION

Areas and meteorological conditions, where lightning strikes or icing condition could be expected must be avoided.

4.5.3.2 POWERED FLIGHT

CRUISE

To change configuration and to verify cruise conditions, proceed as follows:

- PPC switch CRUISE
CAUTION

During propeller blade angle transition, RPM changes at constant power setting. Especially during change from CRUISE to T/O, RPM must be monitored not to exceed the allowed limits (max continuous 5500 RPM), reduce power if necessary.

NOTICE

Propeller pitch change from T/O to CRUISE position requires 2 - 5 minutes depending on OAT. Cruise position is not verified by an indication.

- Cowl flaps

AS REQUIRED

Recommended temperatures:
OIL 90-110°C / 194-230°F,
CCT ≈ 110°C / 230°F

WARNING

Cowl flaps should not be closed fully during cruise (5th notch), because cooling airflow into the engine bay is insufficient in this position. Lever position 5 should only be used during descent with reduced power and during engine warm-up on ground.

CAUTION

Cowl flap angle can be selected by the lever in 5 steps. The center (3rd.) notch has been found to be a suitable position for good engine temperatures with normal cruise power.

Recommended temperatures are: Oil 90-110°C / 194-230°F, CCT about 110°C / 230°F. Continuous oil temperatures below 90°C / 194°F may result in increased sedimentation in the engine and to condensed water in engine oil.
• Flaps  AS REQUIRED (depending on airspeed)
• Throttle  SET (max 5500 RPM, recommended 4300 - 5000 RPM)
• Fuel selector switch  Fuel management as required (right, left, or both tanks)

⚠️ CAUTION

The S12 tends to fly slightly right wing low during high speed cruise, due to high engine torque caused by a high power setting, combined with a small rolling moment due to sideslip at high airspeeds.

For power settings, speeds, fuel consumption and other data refer to section »5.3.1 Performance in powered-configuration«.

⚠️ WARNING

Engine RPM will increase at constant power setting with altitude at constant airspeed! Above about 2000 m/6600 ft altitude (ISA) engine RPM could exceed the max. continuous limit of 5500 RPM for 100% engine power. Engine power must be reduced as necessary to maintain engine RPM below max. 5500 RPM.

SLOW FLIGHT AND STALL BEHAVIOR IN POWERED CONFIGURATION

Approach to stall speed in powered configuration is indicated by an acoustic warning, set about 5-8 kph/3-7 kt above stall speed. Speed should be increased immediately at acoustic stall warning onset. Minimum speeds are given in section »5.2.2.1 Stall and minimum speeds in powered-configuration« for unaccelerated straight and level flight.

Procedures to recover from unintended stall or spin are given in section »3.4 Stall Recovery« and »3.5 Spin Recovery«.
4.5.3.3 GLIDING FLIGHT

GLIDER CONFIGURATION

With the engine stopped, propeller blades folded and nose-cone closed the S12 is a normal glider with flaps.

The S12 has good balanced flight characteristics and well harmonized flight controls. Bank can be changed from +45° to -45° within about 4,8 seconds without side-slipping (110 kph/59 kt, MTOW).

The speed-polar (envelope curve for optimal flap settings) is given in section 5.3.3 “Gliding Flight Polar”.

HIGH SPEED

Up to $V_{NE} = 270$ kph/146 kt the S12 is well easily controllable. Above $V_A = 180$ kph/97 kt flight controls can not be deflected fully or abruptly.

At $V_{NE} = 270$ kph/146 kt the control is limited: Not more than 1/3.

Limit load factors are given in section »2.9«.

If strong turbulence are anticipated such as in rotors of mountain waves, in thunderstorms or when passing mountain ridges, the maximum airspeed in rough air $V_{RA} = 180$ kph/97 kt must not be exceeded.

Airbrakes should be deployed up to $V_{NE} = 270$ kph/146 kt.

Flight path during steep decent at $V_{NE} = 270$ kph/146 kt, airbrakes fully extended, is -30°.

WARNING

The airbrakes should be deployed carefully above $V_A = 180$ kph/97 kt. A high deceleration rate results with airbrakes extended at high airspeeds. The seat belts need to be well tightened and objects in cockpit area need to be properly secured.
SLOW FLIGHT AND STALL BEHAVIOR IN GLIDER CONFIGURATION

Gliding and searching for thermals often requires flying at low speed.

When flying at mid and forward CG, minimum airspeed should be limited by the aft stop of the elevator and only dynamic stalls (rapid pull-up) should be possible. Indication of stall in glider configuration is by aerodynamic buffeting (in level flight and in turns), when vortices of separated airflow from the wing root area impinge on the tail surface. This aerodynamic buffeting occurs about 5-8 kph / 3-7 kt above stall speed. At first indication of stall warning (aerodynamic buffeting) reduce elevator back pressure to reduce angle-of-attack and increase airspeed.

If speed is not increased at stall warning onset and reduced further, the aircraft may stall with a wing drop. Up until wing drop, aileron and rudder are effective and correct; controllability is restored immediately, even during stall, when elevator is released forward. An uncontrollable tendency to spin has not been observed.

**WARNING**

Altitude loss for recovery from stall in level flight should be up to 30 m/100 ft, out of a turn up to 40 m/130 ft and for a delayed reaction up to 60 m/200 ft.

Minimum speeds are given in section »5.2.2.1 Stall and minimum speed in glider configuration« for unaccelerated straight and level flight. During turns, depending on bank angle and corresponding g-load, minimum speeds are higher.

Example:
Minimum speed and stall during steady turns with 60° of bank and a g-load of 2, are expected to be higher by a factor of \( \sqrt{2} \approx 1.4 \) compared to unaccelerated level flight.

Procedures to recover from unintended stall or spin are given in section »3.4 Stall Recovery« and »3.5 Spin Recovery«.
4.5.3.4 CHANGE OF AIRCRAFT CONFIGURATIONS (POWERED, GLIDING FLIGHT)

CHANGE FROM POWERED TO GLIDER CONFIGURATION

- PPC switch T/O
- Throttle IDLE
- Air speed REDUCE to approx. 100 kph / 54 kt
- Cowl flaps FULLY OPEN

⚠️ CAUTION

With cowl flaps fully open, the engine cools down fast and the risk of unintentionally overheating engine after engine stop is reduced.

- Engine temperature WAIT for cool-down (CCT and oil temperature < 100°C / 212°F).
- Ignition OFF (switch position OFF, tachometer reads “0” RPM).

⚠️ WARNING

If the engine is operated under load, a sudden shutdown can result in overheating and damage to the turbocharger system.

⚠️ CAUTION

If the engine is shut-down without a sufficient cool-down period prior to shut-down, this can result in local overheating of the engine and coolant overflow. To avoid this, engine should be cooled down at idle power until engine temperatures are <100 °C / 212 °F (CCT and oil temperature) before shutdown.

- Propeller-brake PULL until propeller stops.
CAUTION

To avoid excessive wear of the centrifugal clutch, avoid extended periods of propeller windmilling with engine not running.

- Propeller positioning  PULL handle very slowly and smoothly to its stop.

NOTICE

If the handle is pulled too fast, the propeller unit will turn over neutral position and cause structural damage to the propeller and/or nose-cone.

CAUTION

If the propeller positioning handle is pulled too fast, the propeller should be driven past the correct position for nose-cone closure. If the nose-cone cannot be closed, the propeller positioning must be repeated; never pull handle for closing nose-cone quickly. If unsure of correct propeller position, repeat positioning.

- Fuel shut-off valve  CLOSE
- Electric equipment  AS REQUIRED for gliding.
- Cooling of engine bay  WAIT for at least for 3 minutes.

CAUTION

Before cowl flaps are closed with the nose-cone, the engine should cool down for three minutes after shutdown, cowl flaps fully open, to avoid overheating of areas in engine bay.

- EXT ALT  OFF
- Engine Switch  OFF
- Nose-cone handle  CLOSE and LOCK (red alternator warning light OFF).
NOTICE

When closing and locking nose-cone, all engine and electrical instruments except for comm radio, soaring computer and variometer are switched off by the electrical logic.

CAUTION

Operate only minimum essential electric or electronic equipment when soaring for extended periods. Engine restart and electrical landing gear operation are impossible with the battery discharged.

CHANGE FROM GLIDER TO POWERED CONFIGURATION

- Airspeed < 140 kph / 76 kt (recommended 100 kph / 54 kt).
- Fuel shut-off valve OPEN
- Engine switch ON
- Nose-cone OPEN and LOCKED (engine instruments on).
- Cooling air flaps FULLY OPEN
- Propeller T/O position (green light)
- Fuel selector switch BOTH tanks
- Choke ON for cold engine OFF for warm engine.
- Throttle IDLE if choke on Max. 10% for warm engine.
- Ignition START (for a minimum of three seconds).
- Engine tachometer Check for indicated RPM.
**WARNING**

If OAT is extremely low, i.e. at high altitudes or in cold areas, battery capacity after longer soaring time might be too low for engine restart. Successful engine restart might only be possible at higher temperatures and lower altitudes. This must be taken into account for flight and route planning.

**CAUTION**

In flight engine start: The propeller may continue turning with the engine not running (following an unsuccessful engine re-start), because engine and propeller are isolated by a centrifugal clutch. A running engine is indicated only by the engine tachometer, not by observing propeller turning.

**CAUTION**

After the starter is actuated an automatic electronic device inhibits the ignition with a time delay of three seconds. The starter must be operated always for at least three seconds. The time delay allows the propeller blades to be fully extended before the engine starts, and consequently reduces the loads for the propeller blades and their corresponding stops.

**CAUTION**

If the engine fires before the expected time delay of three seconds is over, i.e. in case of a malfunctioning electronic device, system checks must be performed before the next flight in accordance with the S12 Aircraft Maintenance Manual.

**CAUTION**

During a cold engine start-up, the power lever must be fully pulled back to its “IDLE power” stop. In case of a warm engine start-up, it is possible to open the throttle slightly (add up to 10% power) to improve the engine start-up behavior.
CAUTION

If the drive system was not operated for > 5 minutes, propeller blades are in T/O-position regardless of actual switch position. If switch is in cruise position, the pitch control mechanism begins to change the propeller pitch when the engine starts.

CAUTION

If engine starter does not operate for restart, refer to section »3.7.3.«

NOTICE

As soon as the engine fires up, release the starter key to disconnect the starter motor. If the engine does not fire after 10 seconds of starter operation, stop and wait for at least 2 minutes for the starter to cool down, then try again.

- Ignition  BOTH
- Throttle  about 2000 RPM
- Oil pressure  GREEN ARC after max. 10 seconds.

WARNING

If the minimum oil pressure is not indicated within 10 seconds, stop engine immediately.

NOTE

Minimum oil pressure 1.5 bar / 22 psi; with cold engine at low RPM, up to 7.0 bar/102 psi are normal.
• Fuel selector switch: Fuel management as required (right, left, or both tanks).

• Warning and caution lights: OUT

• EXT ALT: ON

• Electrical systems: ON as required

• Choke: OFF with increasing engine temperature (1-2 minutes should be sufficient).

• Engine warm-up: At approximately 2500 RPM if the engine is cold.

**WARNING**

The engine must be warmed-up at a reduced power setting. If either the power setting of a cold engine is too high, or the choke is still applied, the engine may run rough, splutter or even quit.

**CAUTION**

During engine warm-up, oil temperature and CCT have to be monitored continuously. In case of a malfunction of the cowl flaps, a danger of overheating and engine damage exists.
4.5.3.5  FLYING IN STRONG TURBULENCE

When encountering areas with strong turbulence or crossing strong thermals airspeed must be reduced to below $V_{RA} = 180$ kph / 97 kt.

4.5.3.6  COLD WEATHER OPERATION

Before operating the aircraft in cold areas, an inspection is recommended. In particular, coolant and lubrication fluid must be checked (refer to section »2.4.2 Fluids«).

Engine starting at low OAT:

- Start engine with throttle full IDLE and with choke ON (open throttle renders starting carb ineffective!)
- Crankshaft speed of at least 220 RPM is required for ignition to function.
- As the performance of the electric starter is greatly reduced when hot and the battery capacity is low at cold temperatures, limit starting attempts to periods no longer than 10 seconds. With a well charged battery, adding a second battery will not improve cold cranking performance.

**WARNING**

If the OAT is below $-10^\circ$ C / $14^\circ$ F, i.e. at high altitudes or in cold areas, battery capacity might be too low to crank the engine with more than 220 RPM for ignition. Successful engine restart might only be possible at higher temperatures and lower altitudes. This must be taken into account for flight and route planning.

**CAUTION**

Any water present in the fuel system will seek to the lowest areas of the fuel system and freeze at low temperatures. This can block fuel pipes, filters and orifices. Thus, it is particularly important to drain the fuel system properly to remove contained water especially when low OAT must be expected. Refer to section »4.3 Daily Inspection«.
4.5.4 APPROACH

Landing can be done either in gliding or in powered configuration.

WARNING

Before landing ensure parking brake lever is in the OFF position. A landing with parking brake set ON results in uncontrollable braking and, in the worst case, in locking of the wheels.

APPROACH IN POWERED CONFIGURATION

- PPC switch  T/O

CAUTION

The change-over of propeller-blade pitch can take up to 5 minutes; thus, PPC has to be activated in time. If, in case of a go-around, the propeller is not in T/O position, rate of climb will be significantly reduced.

Landing pattern should be planned in a way that landing can be performed at idle power. On downwind:

- Fuel shut-off valve  OPEN
- Fuel selector switch  BOTH tanks
- Cowl flaps  FULLY OPEN
- Flaps  +5°
- Auxiliary fuel pump  ON (green light ON)
- Throttle  REDUCE as required.
- Airspeed  110 kph / 59 kt (yellow triangle on airspeed indicator scale).
- Landing gear lever  DOWN (extension time about 30 seconds).
- Landing gear indicator  CHECK 2 GREEN lights.
- Parking brake valve  CHECK in OFF position.
CAUTION

During gear extension the two landing gear lights flash RED (right first, then left). In case of no indication after selecting landing gear switch down, check CB (left side of switch) and reset if necessary. If both indicator lights are not on and green after max 45 seconds, perform emergency gear extension (refer to section »3.9.4.19«).

NOTICE

If airbrake handle is unlocked prior to gear-down indication, gear warning horn will sound and both gear warning lights will flash RED until the landing gear is down and locked.

On final approach:

- Flaps
  L (+16°) or other positive flap setting.

CAUTION

If turbulence or cross wind is expected, select flap position +10° or +5° to achieve better effectiveness of lateral control. Increase approach speed by 10%.

- Throttle
  IDLE
- Approach speed
  110 kph / 59 kt (yellow triangle on airspeed indicator scale; increase depending on weather conditions).

WARNING

If the aircraft is wet or in rain increase approach speed by 10 %! (refer to section »4.5.7«).

- Propeller pitch indicator
  GREEN for T/O position.
- Airbrakes
  AS REQUIRED
CAUTION

If propeller T/O-position is not indicated within an adequate time (max 5 minutes) by green light, propeller pitch position can be checked as follows:

- Airspeed 110 kph / 59 kt
- Throttle INCREASE to max 5500 RPM

If 5400 RPM or more are attained, T/O blade-position has probably been attained (light has failed).
If turbulence or cross wind is expected, select flap position +10° or +5° to achieve better effectiveness of lateral control. Increase approach speed by 10%.

NOTICE

It is recommended to fly the approach such that touch-down area can be reached with engine in idle. In this case flight path corrections are made only by applying and modulating airbrakes.

APPROACH IN GLIDER CONFIGURATION

Landing pattern must be planned so that landing area can be reached in a safe flight path.

- Flaps +5°
- Airspeed 110 kph / 59 kt (yellow triangle on airspeed indicator scale).
- Landing gear lever DOWN (extension time is about 30 seconds).
- Landing gear indicator both GREEN for down and locked
- Parking brake valve CHECK in OFF position.
**CAUTION**

During gear extension the two landing gear lights flash RED (right first, then left). In case of lacking indication after selecting landing gear switch down, check CB (left side of switch) and reset if necessary. If both indicator lights are not on and green after max 45 seconds, perform emergency gear extension (refer to section »3.9.4.19«).

**NOTICE**

If airbrake handle is unlocked prior to gear-down indication, gear warning horn will sound and both gear warning lights will flash RED until the landing gear is down and locked.
ON FINAL APPROACH:

- Wing flaps L (+16°) or other positive flap setting

⚠️ CAUTION ⚠️

If turbulence or cross wind is expected, select flap position +10° or +5° to achieve better effectiveness of lateral control. Increase approach speed by 10%.

- Approach speed 110 kph / 59 kt (yellow triangle on airspeed indicator scale; increase depending on weather conditions).

⚠️ WARNING ⚠️

If the aircraft is wet or in rain increase approach speed by 10%! (Refer to section »4.5.7«).

- Airbrakes AS REQUIRED

NOTICE

With airbrakes fully extended, nose-cone closed and 59 kt/110 kph glide ratio is about 1:7.
4.5.5 LANDING, TAXI AND PARKING

4.5.5.1 LANDING

On short final:

- Airbrakes: AS REQUIRED
- Attitude: Maintain WINGS LEVEL
- Directional control: Stay on centerline if necessary and turn the aircraft nose into the wind for drift.
- Elevator: APPLY for touch-down in three-point attitude.

⚠️ CAUTION ⚠️

Do not flare too low (high landing gear)! Close to the ground maintain wings level. Use rudder for directional control. Turn the aircraft nose back into the runway direction by full rudder deflection against the drift short before touch down. Reduce speed to the minimum until touch down with main landing gear and tail wheel simultaneously in three-point attitude.

Roll out after touchdown:

- Airbrakes: FULLY EXTENDED and HOLD
- Elevator: HOLD on aft stop
- Wheel brakes: AS REQUIRED with caution

⚠️ CAUTION ⚠️

During roll out apply rudder cautiously, sensitivity is increased because pedals actuate rudder and tailwheel.

Off-field landing: It is the pilot’s decision on whether to land with landing gear up or down; decision depends on surface and status of selected area. Several landings wheels-up have been performed on dry, solid, level and flat ground without any harm to the crew or damage to the aircraft (crew had seat belts well fastened and tightened).
4.5.5.2 TAXI AND GROUND OPERATION

If the aircraft was landed in glider configuration, engine should be restarted to taxi to parking position:

- Fuel shut-off valve OPEN
- Engine switch ON
- Nose-cone handle OPEN and LOCK
- Cowl-flaps FULLY OPEN
- Fuel selector switch BOTH tanks
- Auxiliary fuel pump ON
- Choke ON (only if engine is cold)
- Throttle IDLE (max 10%)
- Ignition START
- Oil pressure GREEN
- Auxiliary fuel pump OFF
- Flaps 0°

4.5.5.3 PARKING AND SHUT-DOWN

At parking position:

- Parking brake SET (turn parking brake lever to ON position and operate brake lever multiple times).
- Throttle SET about 2200 RPM (for engine cool down).
- Cowl-flaps FULLY OPEN
- Engine cool-down WAIT for CCT and oil temperature < 100°C/212°F.
WARNING

If the engine is operated under load during shut-down, a sudden engine stop may result in overheating and damaging turbocharger.

CAUTION

Engine cool-down: Do not shut down the engine until engine temperatures are below 100 °C/212 °F (CT/CCT and OIL temperature), but maximum after 5 minutes; for cool-down set 2000 - 2500 RPM and open cooling air flaps fully. Normally, the engine is cooled-down during approach and taxi.

CAUTION

During cool-down the aircraft should be directed into the wind to have a good airflow in the cowl-flap area. In crosswind or tailwind conditions cooling is inadequate and engine temperatures can steadily increase. If at high OAT’s or poor wind conditions the engine temperatures do not decrease to below 100 °C/212 °F the engine should be shut-down after 5 minutes cool-down run.

CAUTION

If the engine is shut-down without a sufficient cool-down period prior to shut-down, this can result in local overheat of the engine and cooling fluid can overflow.

- COM and NAV OFF
- Throttle IDLE
- Ignition OFF
- Engine switch OFF
- Fuel shut-off valve CLOSE
- If parking area is not even WHEEL CHOCKS as required.
- Cooling of engine bay WAIT for 10 minutes.
• Nose-cone handle CLOSE

CAUTION

Nose-cone should be closed about 10 minutes after engine shut-down to avoid heat accumulation and local overheat.

• Airbrakes UNLOCK (in case of need).
• Pitot-static tube REMOVE CLOSE the port.

CAUTION

For removal of the pitot-static tube do not turn on the metal measurement head, otherwise the gluing connection to the carbon tube will be damaged.
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) \( V_{NE} = 270 \text{ kph} / 146 \text{ kt} \) 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:

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

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.
4.5.7 FLIGHT IN RAIN

Rain, rime or ice on wing and control surfaces affect the aerodynamics of the aircraft, significantly changing aircraft performance, flight characteristics and controllability.

Therefore, the following procedures after unintentional flight into rain or icing conditions are recommended:

- Keep margin of at least 10 kph/6 kt above any given minimum speeds.
- Be aware that the climb rate decreases by up to 50%.
- Be aware that cruise speed decreases up to 30% with consequences to maximum range (re-plan flight).

**WARNING**

Take-off run can be increased up to 30% of the normal take-off run; it must be emphasized as strongly as possible that take-off in rain should be avoided.

4.5.8 AEROBATICS

Aerobatics, including intentional spins, are prohibited.
5. PERFORMANCE

5.1 INTRODUCTION

Section 5 provides approved data for airspeed calibration, stall speeds, static engine RPM and T/O performance, as well as other data and additional information which do not require authority approval. Data in charts have been computed from actual flight tests with the motorglider and engine in good condition and using average piloting techniques.

5.2 APPROVED DATA

5.2.1 AIRSPEED INDICATOR SYSTEM CALIBRATION

Following diagram shows airspeed system errors. Handbook data are given as indicated airspeed (IAS).

![ASI-Calibration Curve](image)

Figure 5.2.1.a
ASI-Calibration Curve.
During powered flight there are only minimal changes.

\[ V_{\text{IAS}} = \text{Indicated Air Speed} \text{ (airspeed shown on the installed ASI)} \]

\[ V_{\text{CAS}} = \text{Calibrated Air Speed} \]

(airspeed shown on a system, corrected for instrument and pitot-static error)

### 5.2.2 STALL SPEEDS AND minimum SPEEDS

The stall / minimum speeds of the STEMME S12 depend on actual configuration. In this document, stall speed is defined as speed at stall onset and minimum speed is the lowest attainable steady speed, at which the aircraft is controllable, limited by aft elevator stop (stick). The following data are stall and minimum speeds established in unaccelerated level flight at MTOW 900 kg/1984 lb.

**CAUTION**

Stall speed increases with weight and g-load. In turns stall speed depends on angle-of-bank and corresponding g-load.
5.2.2.1 STALL AND MINIMUM SPEEDS IN POWERED-CONFIGURATION

The following table lists stall speeds in powered configuration with high engine power and aft CG. These are the lowest stall speeds at maximum weight.

- Propeller in T/O position
- Throttle 90% power

<table>
<thead>
<tr>
<th>Airbrakes</th>
<th>Flaps</th>
<th>Landing Gear</th>
<th>Minimum Speed</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>+16° (L)</td>
<td>UP</td>
<td>70 kph / 38 KIAS</td>
<td>Elevator stop (full aft)</td>
</tr>
<tr>
<td>IN</td>
<td>+10°</td>
<td>UP</td>
<td>72 kph / 39 KIAS</td>
<td>Elevator stop (full aft)</td>
</tr>
<tr>
<td>IN</td>
<td>0°</td>
<td>UP</td>
<td>76 kph / 41 KIAS</td>
<td>Elevator stop (full aft)</td>
</tr>
<tr>
<td>IN</td>
<td>-10°</td>
<td>UP</td>
<td>80 kph / 43 KIAS</td>
<td>Elevator stop (full aft)</td>
</tr>
<tr>
<td>OUT</td>
<td>+16° (L)</td>
<td>DOWN</td>
<td>74 kph / 40 KIAS</td>
<td>Elevator stop (full aft)</td>
</tr>
</tbody>
</table>

The following table lists minimum airspeeds in powered configuration, idle power at forward CG. These are the highest minimum speeds in powered configuration.

- Propeller in T/O position
- Throttle Idle

<table>
<thead>
<tr>
<th>Airbrakes</th>
<th>Flaps</th>
<th>Landing Gear</th>
<th>Minimum Speed</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>+16° (L)</td>
<td>UP</td>
<td>80 kph / 43 KIAS</td>
<td>Stall</td>
</tr>
<tr>
<td>IN</td>
<td>+10°</td>
<td>UP</td>
<td>83 kph / 45 KIAS</td>
<td>Elevator stop (full aft)</td>
</tr>
<tr>
<td>IN</td>
<td>0°</td>
<td>UP</td>
<td>87 kph / 47 KIAS</td>
<td>Elevator stop (full aft)</td>
</tr>
</tbody>
</table>
### WARNING

Altitude loss for recovery from stall in level flight should be up to 30m/100 ft, out of a turn up to 40 m/130 ft and for a delayed reaction up to 60 m/200 ft.

### NOTICE

Lower speeds with idle power can be attained with more aft CG, aircraft will stall before reaching the aft stop for elevator.

### 5.2.2.2 STALL AND MINIMUM SPEED IN GLIDER CONFIGURATION

Following table lists minimum airspeeds in glider configuration at forward CG. These are the highest minimum speeds in glider configuration.

- Propeller folded, nose-cone closed

<table>
<thead>
<tr>
<th>Airbrakes</th>
<th>Flaps</th>
<th>Landing Gear</th>
<th>Minimum Speed</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>+16° (L)</td>
<td>UP</td>
<td>80 kph / 43 KIAS</td>
<td>Stall</td>
</tr>
<tr>
<td>IN</td>
<td>+10°</td>
<td>UP</td>
<td>83 kph / 45 KIAS</td>
<td>Elevator stop (full aft)</td>
</tr>
<tr>
<td>IN</td>
<td>0°</td>
<td>UP</td>
<td>87 kph / 47 KIAS</td>
<td>Elevator stop (full aft)</td>
</tr>
<tr>
<td>IN</td>
<td>-10°</td>
<td>UP</td>
<td>90 kph / 49 KIAS</td>
<td>Elevator stop (full aft)</td>
</tr>
<tr>
<td>OUT</td>
<td>+16° (L)</td>
<td>DOWN</td>
<td>80 kph / 43 KIAS</td>
<td>Stall</td>
</tr>
</tbody>
</table>
**WARNING**

Altitude loss for recovery from stall in level flight should be up to 30 m/100 ft, out of a turn up to 40 m/130 ft and for a delayed reaction up to 60 m/200 ft.

---

**CAUTION**

In glider configuration stall warning is only by aerodynamic buffeting only, onset is about 5-8 kph/3-4 kt before stalling.

---

**NOTICE**

Lower speeds with idle power can be attained with more aft CG, aircraft will stall before reaching the aft stop for elevator.

---

5.2.3 **TAKE-OFF PROCEDURE**

5.2.3.1 **ENGINE ROTATIONAL SPEEDS**

**STATIC RPM FOR RUN-UP TO CHECK ENGINE**

Engine RPM at a specific power lever position depends on pressure altitude and OAT. The combination of turbo-charged engine and a non-constant speed propeller requires special attention concerning this behavior (see section »4.5.2.1 Checks before take-off«).

---

**NOTICE**

Actual pressure altitude can be read from altimeter by setting 1013 hPa/29.92 in.

---

Following diagrams show “normal data” of static RPM for 115% (T/O power) and for 100% (max continuous power) as a function of pressure altitude and OAT for an engine in good condition.
Run-up (115% or 100%) must show RPM’s within the allowed tolerance of +/- 200 RPM deviation from “normal” RPM indicated in the relevant diagram, otherwise an engine malfunction or incorrect propeller-blade position must be expected and T/O is not allowed.

The diagram for 115% static RPM in case of doubt is a substitute for the rule of thumb given in section »4.5.2.1« for the 115% setting (5200 + 60 RPM per 1000 ft / + 200 RPM per 1000 m elevation ± 200 RPM tolerance).

**STATIC RPM TO DECIDE ON T/O PROCEDURE**

***NOTICE***

Fixing the take-off throttle setting as defined by the three take-off procedures is described in section »4.5.2«.

The diagrams for 115% and 100% additionally show static RPM limit lines. If a static RPM above the limit line is observed in the run up, engine overspeeding (> 5800 RPM) is to be expected during initial climb at V\text{y}\text{,} after T/O at 115% or 100%, respectively.

If in doubt, these RPM limits for 115% and 100% must be used instead of the criteria “static RPM at 115%” given in section »4.5.2.1« (5500 RPM for T/O with 115% and 5600 RPM for T/O with 100%). If it is questionable after 115%-run up, if a 100%-T/O keeps in limits, run up at 100% and decide based on the RPM limit in the second diagram for 100%.

***WARNING***

T/O at full throttle (115% power) is not allowed if static RPM at full throttle exceeds RPM-limit given in the 115%-diagram. T/O at 100% power setting is not allowed if static RPM at 100% exceeds RPM limit given in the 100%-diagram. In this case T/O with reduced power, established by a throttle setting for 5400 RPM static, is required.
Normal Run Up Static RPM, Power Rating 115% and RPM Limit for Takeoff

Warning: If static RPM exceeds limit line, takeoff with 115% power is not permitted.

Normal Run Up Static RPM, Power Rating 100% and RPM Limit for Takeoff

Warning: If static RPM exceeds limit line, takeoff with 100% power is not permitted.
5.2.3.2 T/O PERFORMANCE

The following data contain T/O ground run distances and T/O distances required to 15 m / 50 ft height (AGL) for power settings according to the three T/O procedures described in section »4.5.2«, via pressure altitude for differing, constant OAT’s and, bold lined, for ISA-temperatures.

The following performance data describe T/O ground runs and T/O distances with full throttle, maximum take-off power (115%), respectively. The T/O distances indicated are valid for a S12 in a good condition, at the best angle-of-climb speed $V_x = 94$ kph / 51 kt, and for:

- **TOW 900 kg / 1984 lb**
- **No wind**
- **Dry concrete runway surface**
- **No slope**

Additions to the T/O ground run have to be made for surfaces not comparable to a hard surface runway. The following list shows additions according to AIP I and corresponding factors.

If more than one item is relevant, the factors on the ground run have to be added:

- Grass RWY, flat, dry, hard, short grass +20% or factor 1.2
- Grass, wet +10% or factor 1.1
- High growth of grass, max 3 in / 8 cm +20% or factor 1.2
- Soft ground +50% or factor 1.5
- Slush, standing water +30% or factor 1.3

Take off distance has been determined for the worst-case takeoff configuration until 15 m height is reached.

The takeoff distance over 15 m / 50 ft height (AGL) for the 25 m / 82.02 ft span-version at standard ISA conditions at MSL was determined to 401 m / 1315.62 ft.
The take-off ground roll distance was determined to be 212 m / 696 ft.

⚠️ CAUTION

T/O distances in section »5.2.3.2« are valid for a T/O with climb speed \( V_x = 94 \text{ kph} / 51 \text{ kt} \) and are shorter than those resulting from T/O with \( V_y \) (recommended in section »4.5.2.3«).
## 5.2.3.3 T/O PERFORMANCE FOR NON-STANDARD CONDITIONS

### TAKE-OFF DISTANCE TO 15 M / 50 FT (AGL)

#### Pressure altitude 0 m / 0 ft

| Headwind [kt] | 0   | 2   | 4   | 6   | 8   | 10  | 12  | 14  | 16  | 18  | 20  |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| -20 / -4      | 329 | 313 | 299 | 286 | 274 | 263 | 253 | 244 | 235 | 226 | 219 |
| -10 / 14      | 349 | 333 | 317 | 304 | 291 | 279 | 268 | 258 | 249 | 241 | 232 |
| 0 / 32        | 370 | 352 | 336 | 321 | 307 | 295 | 284 | 274 | 263 | 254 | 246 |
| 10 / 50       | 391 | 372 | 355 | 339 | 325 | 312 | 300 | 289 | 278 | 268 | 259 |
| 20 / 68       | 411 | 392 | 374 | 358 | 343 | 329 | 316 | 304 | 293 | 283 | 274 |
| 30 / 86       | 433 | 412 | 394 | 376 | 361 | 346 | 333 | 320 | 309 | 298 | 288 |

#### Pressure altitude 150 m / 500 ft

<table>
<thead>
<tr>
<th>OAT [°C / °F]</th>
<th>-20 / -4</th>
<th>-10 / 14</th>
<th>0 / 32</th>
<th>10 / 50</th>
<th>20 / 68</th>
<th>30 / 86</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 / 32</td>
<td>339</td>
<td>359</td>
<td>380</td>
<td>401</td>
<td>423</td>
<td>445</td>
</tr>
<tr>
<td>10 / 50</td>
<td>322</td>
<td>342</td>
<td>362</td>
<td>382</td>
<td>402</td>
<td>423</td>
</tr>
<tr>
<td>20 / 68</td>
<td>307</td>
<td>326</td>
<td>345</td>
<td>364</td>
<td>385</td>
<td>405</td>
</tr>
<tr>
<td>30 / 86</td>
<td>294</td>
<td>312</td>
<td>330</td>
<td>349</td>
<td>367</td>
<td>387</td>
</tr>
</tbody>
</table>

#### Pressure altitude 300 m / 1000 ft

<table>
<thead>
<tr>
<th>OAT [°C / °F]</th>
<th>-20 / -4</th>
<th>-10 / 14</th>
<th>0 / 32</th>
<th>10 / 50</th>
<th>20 / 68</th>
<th>30 / 86</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 / 32</td>
<td>316</td>
<td>335</td>
<td>355</td>
<td>375</td>
<td>393</td>
<td>412</td>
</tr>
<tr>
<td>10 / 50</td>
<td>316</td>
<td>335</td>
<td>355</td>
<td>375</td>
<td>393</td>
<td>412</td>
</tr>
<tr>
<td>20 / 68</td>
<td>316</td>
<td>335</td>
<td>355</td>
<td>375</td>
<td>393</td>
<td>412</td>
</tr>
<tr>
<td>30 / 86</td>
<td>316</td>
<td>335</td>
<td>355</td>
<td>375</td>
<td>393</td>
<td>412</td>
</tr>
</tbody>
</table>
## TAKE-OFF DISTANCE TO 15 M / 50 FT (AGL)

### Pressure altitude 450 m / 1500 ft

<table>
<thead>
<tr>
<th>Headwind [kt]</th>
<th>-20 / -4</th>
<th>-10 / 14</th>
<th>0 / 32</th>
<th>10 / 50</th>
<th>20 / 68</th>
<th>30 / 86</th>
</tr>
</thead>
<tbody>
<tr>
<td>OAT [°C / °F]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-20 / -4</td>
<td>358 m</td>
<td>340 m</td>
<td>325 m</td>
<td>310 m</td>
<td>298 m</td>
<td>286 m</td>
</tr>
<tr>
<td>0 / 32</td>
<td>379 m</td>
<td>361 m</td>
<td>345 m</td>
<td>330 m</td>
<td>316 m</td>
<td>303 m</td>
</tr>
<tr>
<td>10 / 50</td>
<td>402 m</td>
<td>382 m</td>
<td>365 m</td>
<td>350 m</td>
<td>334 m</td>
<td>321 m</td>
</tr>
<tr>
<td>20 / 68</td>
<td>424 m</td>
<td>404 m</td>
<td>385 m</td>
<td>368 m</td>
<td>353 m</td>
<td>339 m</td>
</tr>
<tr>
<td>30 / 86</td>
<td>471 m</td>
<td>448 m</td>
<td>427 m</td>
<td>408 m</td>
<td>391 m</td>
<td>376 m</td>
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### Pressure altitude 600 m / 2000 ft

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<th>10 / 50</th>
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### Pressure altitude 760 m / 2500 ft

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### TAKE-OFF DISTANCE TO 15 M / 50 FT (AGL)

Pressure altitude 910 m / 3000 ft

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<td>505 m</td>
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<td>454 m</td>
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**OAT [°C / °F]**

- 20 / -4:
  - 0°C / 32°F: 863 m / 2241 ft
  - 10°C / 50°F: 863 m / 2241 ft
- 0 / 32:
  - 0°C / 32°F: 863 m / 2241 ft
  - 10°C / 50°F: 863 m / 2241 ft
- 10 / 50:
  - 0°C / 32°F: 863 m / 2241 ft
  - 10°C / 50°F: 863 m / 2241 ft
- 20 / 68:
  - 0°C / 32°F: 863 m / 2241 ft
  - 10°C / 50°F: 863 m / 2241 ft
- 30 / 86:
  - 0°C / 32°F: 863 m / 2241 ft
  - 10°C / 50°F: 863 m / 2241 ft
# TAKE-OFF ROLL DISTANCE

## Pressure altitude 0 m / 0 ft

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<tbody>
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<td>174 m 571 ft</td>
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<td>138 m 453 ft</td>
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<td>120 m 394 ft</td>
<td>113 m 371 ft</td>
<td>105 m 345 ft</td>
<td>99 m 325 ft</td>
<td>93 m 306 ft</td>
<td>88 m 289 ft</td>
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<td>118 m 388 ft</td>
<td>112 m 368 ft</td>
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<td>111 m 365 ft</td>
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<td>158 m 519 ft</td>
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<td>139 m 457 ft</td>
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## Pressure altitude 150 m / 500 ft

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<tbody>
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<td>102 m 335 ft</td>
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<td>96 m 315 ft</td>
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## Pressure altitude 300 m / 1000 ft

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<td>135 m 443 ft</td>
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## TAKE-OFF ROLL DISTANCE

### Pressure altitude 450 m / 1500 ft

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### Pressure altitude 600 m / 2000 ft

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<th>30 / 86</th>
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### Pressure altitude 760 m / 2500 ft

<table>
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<th>30 / 86</th>
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<td>219 m</td>
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</tr>
<tr>
<td>-10 / 14</td>
<td>212 m</td>
<td>225 m</td>
</tr>
<tr>
<td></td>
<td>696 ft</td>
<td>758 ft</td>
</tr>
<tr>
<td>0 / 32</td>
<td>225 m</td>
<td>207 m</td>
</tr>
<tr>
<td></td>
<td>758 ft</td>
<td>680 ft</td>
</tr>
<tr>
<td>10 / 50</td>
<td>237 m</td>
<td>218 m</td>
</tr>
<tr>
<td></td>
<td>778 ft</td>
<td>715 ft</td>
</tr>
<tr>
<td>20 / 68</td>
<td>250 m</td>
<td>231 m</td>
</tr>
<tr>
<td></td>
<td>821 ft</td>
<td>758 ft</td>
</tr>
<tr>
<td>30 / 86</td>
<td>263 m</td>
<td>242 m</td>
</tr>
<tr>
<td></td>
<td>863 ft</td>
<td>794 ft</td>
</tr>
</tbody>
</table>
### TAKE-OFF ROLL DISTANCE

#### Pressure altitude 910 m / 3000 ft

<table>
<thead>
<tr>
<th>Headwind [kt]</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
<th>18</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>-20 / -4</td>
<td>206 m / 676 ft</td>
<td>190 m / 624 ft</td>
<td>175 m / 575 ft</td>
<td>163 m / 535 ft</td>
<td>151 m / 496 ft</td>
<td>142 m / 466 ft</td>
<td>133 m / 437 ft</td>
<td>124 m / 407 ft</td>
<td>117 m / 384 ft</td>
<td>111 m / 365 ft</td>
<td>104 m / 342 ft</td>
</tr>
<tr>
<td>-10 / 14</td>
<td>218 m / 716 ft</td>
<td>202 m / 663 ft</td>
<td>186 m / 611 ft</td>
<td>173 m / 568 ft</td>
<td>161 m / 529 ft</td>
<td>150 m / 493 ft</td>
<td>141 m / 463 ft</td>
<td>133 m / 437 ft</td>
<td>124 m / 407 ft</td>
<td>117 m / 384 ft</td>
<td>111 m / 365 ft</td>
</tr>
<tr>
<td>0 / 32</td>
<td>231 m / 758 ft</td>
<td>213 m / 699 ft</td>
<td>197 m / 647 ft</td>
<td>183 m / 601 ft</td>
<td>170 m / 558 ft</td>
<td>160 m / 525 ft</td>
<td>149 m / 489 ft</td>
<td>140 m / 460 ft</td>
<td>132 m / 434 ft</td>
<td>124 m / 407 ft</td>
<td>117 m / 384 ft</td>
</tr>
<tr>
<td>10 / 50</td>
<td>243 m / 798 ft</td>
<td>225 m / 739 ft</td>
<td>208 m / 683 ft</td>
<td>193 m / 634 ft</td>
<td>181 m / 594 ft</td>
<td>168 m / 552 ft</td>
<td>158 m / 519 ft</td>
<td>147 m / 483 ft</td>
<td>139 m / 457 ft</td>
<td>131 m / 430 ft</td>
<td>123 m / 404 ft</td>
</tr>
<tr>
<td>20 / 68</td>
<td>257 m / 844 ft</td>
<td>237 m / 778 ft</td>
<td>219 m / 719 ft</td>
<td>204 m / 670 ft</td>
<td>190 m / 624 ft</td>
<td>178 m / 584 ft</td>
<td>166 m / 545 ft</td>
<td>156 m / 512 ft</td>
<td>146 m / 480 ft</td>
<td>138 m / 453 ft</td>
<td>131 m / 430 ft</td>
</tr>
<tr>
<td>30 / 86</td>
<td>270 m / 886 ft</td>
<td>250 m / 821 ft</td>
<td>231 m / 758 ft</td>
<td>214 m / 703 ft</td>
<td>199 m / 653 ft</td>
<td>187 m / 614 ft</td>
<td>174 m / 571 ft</td>
<td>164 m / 539 ft</td>
<td>155 m / 509 ft</td>
<td>145 m / 476 ft</td>
<td>137 m / 450 ft</td>
</tr>
</tbody>
</table>
5.2.3.4  CLIMB PERFORMANCE

The best rate of climb of 3.28 m/s / 645 ft/min at MTOW has been determined at \( V_y = 115 \) kph / 62 kt with flaps at +5°.

The time to reach 360 m altitude from line-up position on ground (MSL at 15°C / 59°F) approximated: 1 min 43'.

Following table shows the climb performance (MSL at 15°C/59°F) with various flap settings:

<table>
<thead>
<tr>
<th>Flaps</th>
<th>( V_y ) [KIAS]</th>
<th>Climb speed [m/s / ft/min]</th>
<th>Climb angle [°]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>66</td>
<td>3.13 / 616</td>
<td>5.3</td>
</tr>
<tr>
<td>+ 5°</td>
<td>62</td>
<td>3.28 / 645</td>
<td>5.9</td>
</tr>
<tr>
<td>+ 10°</td>
<td>59</td>
<td>3.16 / 622</td>
<td>6.0</td>
</tr>
</tbody>
</table>

**NOTICE**

The best rate of climb can be achieved in a wide speedrange:

95-139 km/h / 51-75 kt

5.2.4  MAX. DEMONSTRATED CROSSWIND COMPONENT

**NOTICE**

Max. demonstrated crosswind component for taxi, T/O and landing is:

9 kt / 16 kph
5.3 ADDITIONAL INFORMATION (NON-APPROVED)

5.3.1 GLIDING FLIGHT POLAR

Figure 5.3.1.a
Speed polar (t.b.d. for S12)
5.3.2 NOISE DATA


NOTICE

The Noise data has been recorded with:

- MTOW 900 kg / 1984 lb
- Wing span 25.07 m / 82.25 ft
- Propeller in take-off position
- Flaps +5°
- Power setting: take-off (115%)

Measured noise level according

to Chapter X : 67.8 dB(A)
Limit value LSL : 77.1 dB(A)
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.
NOTICE

The weighing logsheet in section 6.3.1 includes information about the minimum seat loads in the cockpit which are determined while weighing the aircraft.

The value for “full water ballast and luggage” takes the worst case of loading the tail boom into account so that this value should be higher than the maximum load. This minimum permissible cockpit load can be reduced if the operating CG is determined before the flight according section »6.4 Operating Weight and Operating CG« and is within the prescribed limits.

If an empty tail water ballast tank and luggage compartment is ensured, the minimum seat load for “empty water ballast and luggage” can be applied without further CG calculations.

6.2 AIRCRAFT WEIGHTS

If ANY changes to the delivery configuration of the aircraft are made, the new empty weight must be determined newly.

The state of the aircraft and its equipment when weighing must be recorded precisely, i. e. equipment list, etc.

More information about weighing the aircraft is given in the S12 Aircraft Maintenance Manual.

6.2.1 CONFIGURATION DURING WEIGHING

- Installed equipment according to the current equipment list
- No removable ballast
- Aircraft dry, including operating-fluids:
  - Brake fluid
  - Amount of engine-oil (0.5 – 1.03 US gal./2 – 3.9 liters)
  - Coolant (0.63 – 0.66 US gal./2.4 – 2.5 liters)
  - Unusable fuel (0.37 US gal./1.4 l)
- 25.07 m / 82.25 ft wing extensions installed
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: \( m_L \); right main gear: \( m_R \); tail wheel: \( m_B \)). 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 \((3.1^\circ = 3^\circ06'\) 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.
When the aircraft is aligned properly, all reference points are projected vertically down onto the ground (using a plump bob).

- Center wing root rib leading edge L/H & R/H
- Center of main wheels
- Center of tail wheel

The connecting line between the two reference points from the center wing is a reference line. From this reference line, the distance to centers of the tailwheel (distance b) and main landing gear (distance a) is measured (see figure »6.2.1.a. Aircraft Alignment during CG-Determination«).

The following formulas are used to calculate the empty weight, the empty weight moment and the empty CG location:

Empty weight $m_{\text{Empty}}$ [kg] :

$$m_{\text{Empty}} = m_L + m_R + m_B$$

Empty weight moment $M_{\text{Empty}}$ [kgm] :

$$M_{\text{Empty}} = m_L \cdot a + m_R \cdot a + m_B \cdot (a + b)$$

Empty CG location from the reference plane $D_{SL}$ [m] :

$$x = \frac{M_{\text{Empty}}}{m_{\text{Empty}}}$$
6.3 EMPTY WEIGHT AND CG LOCATION

The current empty weight and empty CG location must be documented chronologically in a record of empty weight and CG location (see section »6.3.1«).

Every change in the empty weight or empty CG location (which might be caused by changes in equipment, repainting, repairs or similar) must be recorded in this record.

If the cause of the changes is precisely known (weight and lever must be known; for example, when changes in equipment are made), then new empty weight and its CG location can be determined through calculations. If the cause of the changes is NOT precisely known (for example, when making repairs), the aircraft must be weighed again.

6.3.1 RECORD EMPTY WEIGHT AND EMPTY CG LOCATION

The following logsheet describes the chronological changes in the aircraft’s empty weight and CG location. These changes might be caused by changes in equipment and/or structural parts (for example: repairs). All levers refer to the reference plane (RP). (Behind RP: positive lever, in front of RP: negative lever).

The first entries are the values determined during the pre-delivery inspection.
<table>
<thead>
<tr>
<th>Registration No.:</th>
<th>Serial No.:</th>
<th>Sheet No.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEMME S12</td>
<td>Current Empty Weight</td>
<td></td>
</tr>
<tr>
<td>Weight and Balance at delivery</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6.4 OPERATING WEIGHT AND OPERATING CG

Only operate the aircraft within the loading limits and limits for the CG location.

WARNING

The current operating weight and operating CG must only be calculated by determining the payload for each flight. To determine the operating weight and operating CG graphically and/or through calculations, use the tables and diagrams given in:

Chapter 6.4.1 : Weight and Moments Logsheet
Figure 6.4.2.a : Individual Weights and Moments
Figure 6.4.2.b. : Moment and Flight CG Limits

PERFORM THE FOLLOWING STEPS

1. Take the empty weight moment \( M_{\text{Empty}} \) [kgm/\text{lb in}] from the current weighing report or from the weighing logsheet and place this value in the corresponding table in chapter »6.4.1 Weight and Moments Logsheet«.

2. Determine the total weight in the cockpit – including the weight of the pilot, copilot and payload carried in the cockpit. From this data, determine the corresponding weight moments by using figure »6.4.2.a. Individual Weights and Moments«.

3. Determine the payload carried in the rear baggage-compartment and the tail water ballast tank by using the same methods as in point 2. Place these values in the corresponding columns of the table in chapter »6.4.1 Weight and Moments Logsheet«. Take care of the positive or negative orientation of the moment.

4. Add all weights and moments the table.

5. Check with figure »6.4.2.b. Moment and CG Limits« if the combination of the total moment and total mass is within the given limit.

All referenced or used moment arms are in terms of the distance from the corresponding CG to the reference plane (RP)!
WARNING

The CG must always stay within the allowed limits. If this is not the case, unstable aircraft behavior might result!

NOTE

Any luggage placed behind the backrests increase the weight without influence to the aircraft total moment.

NOTE

The change of the wing span to 21.4 m / 70.2 ft changes the aircraft total moment by -19.2 kgm / -1666.48 lb in.
The empty weight will be reduced by 10 kg / 22.05 lb.
### 6.4.1 WEIGHT AND MOMENTS LOGSHEET

<table>
<thead>
<tr>
<th>Calculation of the proper loading for flight</th>
<th><strong>STEMME S12</strong>&lt;br&gt;Reg.-No.: ............</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weight [kg/lb]</td>
</tr>
<tr>
<td>1. Empty Weight and Empty Weight Moment</td>
<td><img src="image" alt="Weight" /></td>
</tr>
<tr>
<td>(from current Report of Empty Weight and CG Location.)</td>
<td></td>
</tr>
<tr>
<td>2. Pilot and Copilot.</td>
<td><img src="image" alt="Left" /></td>
</tr>
<tr>
<td>3. Luggage behind seats.</td>
<td><img src="image" alt="Value" /></td>
</tr>
<tr>
<td>4. Luggage in tail boom.</td>
<td><img src="image" alt="Value" /></td>
</tr>
<tr>
<td>5. Ballast in vertical tail.</td>
<td><img src="image" alt="Value" /></td>
</tr>
<tr>
<td>6. Fuel (l * 0.75 kg/l = kg)</td>
<td><img src="image" alt="Value" /></td>
</tr>
<tr>
<td>Total Sum</td>
<td><img src="image" alt="Value" /></td>
</tr>
</tbody>
</table>
6.4.2 WEIGHT AND MOMENTS DIAGRAMS

Figure 6.4.2.a.
Individual Weights and Moments
Example:

TOW : 810 kg/1785 lb (left scale)
Total aircraft moment calculated : 280 kgm/24302 lb in (bottom scale)
Flight CG-position = 345 m/13.6 in (follow up parallel to the next curve - reading CG-position)
6.5 EQUIPMENT LIST AND INSTALLED EQUIPMENT LIST

The equipment list is a list of all certified equipment which can be installed in the STEMME S12.

The installed equipment list is a list of all equipment which is actually installed in the specific aircraft associated (by serial number) with its manual. All equipment items actually installed in the aircraft are marked with “X” in the column “Inst.” (Installed).

NOTICE

The installation of additional equipment must be performed in correspondence with the S12 Aircraft Maintenance Manual.

The given equipment list contains the following information for a better overview:

The column „Con. No.“ includes a continuing number and a character for specification with the meaning:

- I Instruments
- A Avionics
- M Miscellaneous Equipment Items

The columns „Weight“ and „Arm“ give the weight and the effective arm relative to the reference plane (RP) of the equipment item listed in the column.

- Positive arms are displacements aft of the RP
- Negative arms are displacements in forward of the RP

NOTICE

The AFM-pages follows the page 6-12 presents the latest issue of the Equipment List associated with the aircraft serial number. These pages are listed in chapter »02. List of Effective Pages« as EQL.
## Equipment List

**STEMME S10 all Models**

<table>
<thead>
<tr>
<th>Qty</th>
<th>Object</th>
<th>Type</th>
<th>S/N</th>
<th>Manufacturer</th>
<th>Location</th>
<th>Weight [kg]</th>
<th>Moment Arm [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ELT</td>
<td></td>
<td></td>
<td>Tail Boom</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>ELT Antenna</td>
<td></td>
<td></td>
<td>Engine Cowling</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Engine**

<table>
<thead>
<tr>
<th>Qty</th>
<th>Object</th>
<th>Type</th>
<th>S/N</th>
<th>Location</th>
<th>Weight [kg]</th>
<th>Moment Arm [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CHT-Indicator right</td>
<td>Instr.-Panel</td>
<td>0.1</td>
<td></td>
<td>-1200</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>CHT-Indicator left</td>
<td>Instr.-Panel</td>
<td>0.1</td>
<td></td>
<td>-1200</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Oil temperature meter</td>
<td>Instr.-Panel</td>
<td>0.1</td>
<td></td>
<td>-1200</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Oil pressure meter</td>
<td>Instr.-Panel</td>
<td>0.1</td>
<td></td>
<td>-1200</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Fuel level indicator left</td>
<td>Instr.-Panel</td>
<td>0.1</td>
<td></td>
<td>-1200</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Fuel level indicator left</td>
<td>Instr.-Panel</td>
<td>0.1</td>
<td></td>
<td>-1200</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Voltmeter</td>
<td>Instr.-Panel</td>
<td>0.1</td>
<td></td>
<td>-1200</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Amperemeter</td>
<td>Instr.-Panel</td>
<td>0.1</td>
<td></td>
<td>-1200</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Differential Fuel pressure Indicator</td>
<td>Instr.-Panel</td>
<td>0.05</td>
<td></td>
<td>-1200</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Fuel Flow Meter</td>
<td>Instr.-Panel</td>
<td>0.34</td>
<td></td>
<td>-1200</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Fuel Flow Transducer, LH</td>
<td>Center fuselage</td>
<td>0.08</td>
<td></td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Fuel Flow Transducer, RH</td>
<td>Center Fuselage</td>
<td>0.08</td>
<td></td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Fuel-Flow Differential Modul</td>
<td>Instr.-Panel</td>
<td>0.11</td>
<td></td>
<td>-1300</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Engine Hour Meter</td>
<td>Center Console</td>
<td>0.05</td>
<td>Cockpit</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Tachometer</td>
<td>Instr.-Panel</td>
<td>0.188</td>
<td></td>
<td>-1200</td>
<td></td>
</tr>
<tr>
<td>Qty</td>
<td>Object</td>
<td>Type</td>
<td>S/N</td>
<td>Manufacturer</td>
<td>Location</td>
<td>Weight [kg]</td>
</tr>
<tr>
<td>-----</td>
<td>-----------------------</td>
<td>---------------</td>
<td>-------</td>
<td>--------------</td>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>1</td>
<td>Autopilot Modul</td>
<td>Instr.-Panel</td>
<td>0,59</td>
<td></td>
<td></td>
<td>600</td>
</tr>
<tr>
<td>1</td>
<td>Autopilot Servo (Roll)</td>
<td>Center Fuselage</td>
<td>1,36</td>
<td></td>
<td></td>
<td>700</td>
</tr>
<tr>
<td>1</td>
<td>Autopilot Servo (Pitch)</td>
<td>Tail Boom</td>
<td>1,36</td>
<td></td>
<td></td>
<td>1500</td>
</tr>
<tr>
<td>1</td>
<td>Trimmervo</td>
<td>Tailboom</td>
<td>1,0</td>
<td></td>
<td></td>
<td>1500</td>
</tr>
<tr>
<td>1</td>
<td>Main battery</td>
<td>Front Bulhead</td>
<td>1,3</td>
<td>Front Bulhead</td>
<td>Tailboom</td>
<td>1430</td>
</tr>
<tr>
<td>1</td>
<td>Avionic battery</td>
<td>Front Bulhead</td>
<td>1,7</td>
<td>Front Bulhead</td>
<td>Tailboom</td>
<td>1450</td>
</tr>
<tr>
<td>2</td>
<td>Seat Belt</td>
<td>Cockpit</td>
<td>-</td>
<td></td>
<td></td>
<td>-300</td>
</tr>
<tr>
<td>2</td>
<td>Shoulder Harness</td>
<td>Cockpit</td>
<td>-</td>
<td></td>
<td></td>
<td>-300</td>
</tr>
</tbody>
</table>
7. SYSTEM DESCRIPTION OF THE S12 AND ITS EQUIPMENT

7.1 INTRODUCTION

This section provides description and operational advice for the STEMME S12 motorglider and its systems and equipment. Section 9 includes Aircraft Flight Manual Supplements, if required, related to non-standard systems and equipment. For more information about components and systems refer to the S12 Aircraft Maintenance Manual.

7.2 COCKPIT CONTROLS

7.2.1 COCKPIT CONTROLS OVERVIEW

<table>
<thead>
<tr>
<th>Controls at the airframe.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Control Stick</td>
<td>Centered in front of each seat.</td>
</tr>
<tr>
<td>2. Rudder Pedals</td>
<td>For each seat and adjustable. The pedals also steer the tail wheel, which is coupled to the rudder via a spring device.</td>
</tr>
<tr>
<td>3. Rudder Pedal Adjustment Handle</td>
<td>In front of each seat. Pull and hold handle to unlock.</td>
</tr>
<tr>
<td>4. Airbrake Lever</td>
<td>At the LH side of each seat - not connected to the wheel brake. Blue lever at LH cockpit side (for pilot) and on the center console between seats (copilot). Airbrakes locked closed (over-center) when lever is fully forward.</td>
</tr>
<tr>
<td>5. Flap Lever</td>
<td>At the LH side of each seat. Black lever at LH cockpit side (for pilot) and on the center console (copilot). Indication of settings (-10, -5, 0, +5, +10, L (16°) in center console and on control cover beside the control. Levers must be shifted to the right (against spring force) to unlock and select desired flap setting, release to the left for locking.</td>
</tr>
</tbody>
</table>
### Controls at the airframe.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Canopy Locks</td>
<td>Two white handles with red stripe, one on left and one on right side of the canopy frame, to open or lock the canopy. The handles are mechanically interconnected so that operation of either handle actuates locks on both sides. In addition, a white handle at top rear operates a lock pin to retain the rear of the canopy in the correct position for controlled positive separation during emergency canopy jettison (&quot;Röger-hook&quot;).</td>
</tr>
<tr>
<td>7</td>
<td>Brake Lever</td>
<td>Lever on each control stick; separate control for parking brake valve on the floor panel console in front of the LH control stick.</td>
</tr>
<tr>
<td>8</td>
<td>Trim Control</td>
<td>Green two-way switch on the control stick.</td>
</tr>
<tr>
<td>9</td>
<td>Throttle Lever</td>
<td>Single black lever on center console with two forward stops (for max. continuous and max. T/O-power). It is coupled with a spring acting forward in the FULL POWER direction. Its position is fixed by friction discs, which can be adjusted with a knurled knob on LH side of the center console.</td>
</tr>
<tr>
<td>10</td>
<td>Choke Lever</td>
<td>Black lever on center console, RH side of the throttle lever. It is coupled with a spring acting rearward in CHOKE OFF direction. Its position is fixed by friction discs, which can be adjusted with a milled-nut on RH side of the center console.</td>
</tr>
<tr>
<td>11</td>
<td>Propeller Pitch Control</td>
<td>Switch on center console. The forward position is the TAKE-OFF position. A green light located in the upper left area of instrument panel indicates if actual propeller pitch (not merely the switch) is in T/O-position.</td>
</tr>
<tr>
<td>12</td>
<td>Fuel shut-off valve</td>
<td>Red handle on the rear console between the seat backrests. Turning the handle to its horizontal position (Fuel shut-off valve CLOSED) cuts off the fuel supply for the engine.</td>
</tr>
</tbody>
</table>
### Controls on instrument panel

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Emergency Canopy Release</td>
<td>Red pull-handle on LH side of the switch panel. It is pulled for emergency canopy jettison after opening the canopy locks on LH or RH side of the canopy frame. (Operating either canopy lock handle unlocks both sides of the canopy.)</td>
</tr>
<tr>
<td>14</td>
<td>Cowl Flap Adjustment</td>
<td>Black T-handle on LH side of the lower middle section of the instrument panel to reduce engine cooling in cruise condition. The forward most position sets the cowl flaps fully OPEN, moving the control aft over 5 available notches reduces the opening of the cowl flaps.</td>
</tr>
<tr>
<td>15</td>
<td>Nose-cone Operation</td>
<td>Black handle at the bottom center of the instrument panel to open, close and lock the nose-cone, linked to the engine electric master switch. Unlock by lifting, lock by pushing down the handle. In the forward position (Nose-cone OPEN) the engine master switch turns ON when nose-cone is LOCKED (handle fully forward and pushed DOWN).</td>
</tr>
<tr>
<td>16</td>
<td>Propeller Brake</td>
<td>Black T-handle to the right of the cowl flap control to brake the (windmilling) propeller to a full stop after engine switched off in flight. Braking is by pulling the handle.</td>
</tr>
<tr>
<td>17</td>
<td>Propeller Positioning</td>
<td>Black T-handle on RH side of the propeller brake to position the propeller so as it fits into the nose-cone contour. Operation is by a slow, steady pull of the handle through its full range.</td>
</tr>
<tr>
<td>18</td>
<td>Air Vents</td>
<td>Two adjustable air vents are provided for cockpit ventilation, one on LH and one on RH side of the Instrument panel.</td>
</tr>
<tr>
<td>19</td>
<td>Canopy Ventilation / Defog</td>
<td>Knob on RH side of the ignition/starter switch to ventilate or defog the canopy. (Ventilation OPEN when knob pulled.)</td>
</tr>
</tbody>
</table>
**WARNING**

The most closed position of cowl flaps (rearmost notch 5) is intended only for low power or idle-descent and for engine warm-up on ground. During all other operations cowl flap should be opened farther to allow for higher cooling airflow into engine bay.

---

**CAUTION**

Throttle positions for 115% and 100% can be selected by feel. The first stop is the 100% throttle position (100% power). To select maximum take-off power (115%; 5 minute limit) the throttle lever must be moved through a throttle gate to the left and then pushed forward to the next stop.

---

**NOTICE**

The controls at the lower area of the instrument panel are included in the picture of the instrument panel (see figure »7.3.a. Arrangement of Elements on the Instrument Panel«).

---

### 7.3 INSTRUMENT PANEL

The following chapter gives an overview of instruments, controls, monitor devices and CB’s installed in the instrument panel. The positions of the elements is shown in the picture of the instrument panel figure »7.3.a. Arrangement of Elements on the Instrument Panel«, valid for the serial number as indicated on the title page of this S12 Aircraft Flight Manual.
This page is valid for Serial Number: __________

Figure 7.3.a.
Arrangement of Elements on the Instrument Panel
This page is valid for Serial Number: ___________

Figure 7.3.b.
Position and Description of Elements on the Instrument Panel
7.4 LANDING GEAR

The landing gear (L/G) consists of a tail wheel and two retractable main landing gear legs, hinged at the center fuselage frame with the hinge axis in flight direction and locked in the extended position by means of an over-center locking brace for each leg. The wheel is mounted on a trailing arm that is supported against the leg’s frame by a pre-loaded elastomeric spring for shock absorption purposes.

Retracting of the L/G legs and doors is managed by an electrically driven linear actuator for each leg that is built up around a high precision recirculating-ball screw jack. Each of the linear actuators is hinged with its upper end at the fuselage frame; the bottom end is coupled to the respective locking brace by means of a locking mechanism which can be released for emergency extension by pulling a T-handle in the cockpit (one for each of the legs) via a Bowden cable. In case of an emergency extension the two legs should be released in succession (correct order is recommended, but wrong order not critical); they then extend out by gravitational force and are locked in the extended position achieved by a spring that forces the locking brace into its over-center position.

The actuators are controlled by stop switches; the switches for EXTENDED are integrated in the locking braces and detecting their over-center position, those for RETRACTED are mounted on the fuselage frame and detect the retracted position of each L/G leg. All these switches are duplicated, the second one providing the signal for the indication and warning system, which is displayed by focused green and red LED’s on the right side of the instrument panel.

Both LG doors are actuated by the landing gear legs. The RH landing gear door is coupled directly to the RH landing gear leg via a spring device. The LH door is controlled by a cable mechanism. During retraction, the LH landing gear leg starts closing the LH door by means of a cable so far as to allow retraction of the RH landing gear leg. The RH landing gear leg effects complete closing of the door via the cable during the last portion of its retracting. Opening of the LH door is by a spring loaded roller strut, which rolls on the LH door. It pushes the door to the outside against the cable to keep the door from waving, and is blocked with the landing gear retracted, thus locking the door. In closed position the doors are additionally locked at the rear by means of magnets.
The disk brakes on the main L/G wheels are operated hydraulically. The master cylinders for both the left and right wheel are located on the control sticks. The pressure line from the main brake cylinders to the brake calipers of the wheel brake in the center fuselage are designed as metal-shielded brake hoses. The brake fluid reservoir is located in the landing-gear bay, cabin rear wall.

The parking brake valve to set and to release the parking brake is located on the floor panel console in front of the LH control stick. The parking brake valve is operated by a lever or rotary handle.

The tail wheel does not have a vertical shock absorber and is guided in a trailing fork that is pivoted at its bottom in a thin section ball bearing, and at its top in a combined radial/axial sleeve bearing. The main journal is constructed so that a certain amount of friction damping is produced at the axial sleeve surfaces when loaded in the axial direction to prevent tail wheel shimmy during taxi. For steering on the ground the tail wheel fork is coupled with the rudder by means of two pre-loaded tension springs.

7.5 SEATS AND SEATBELTS

The seats are recessed into the bottom fuselage secondary structure (integrated seating) and have multiple adjustable back rests made of GFRP.

Each seat is equipped with 4-point seatbelts and a central harness. The lap straps are supported at the sides of each seat. The shoulder harness is fastened to a tube behind each back rest.

Certified seat belts are indicated in the S12 Aircraft Maintenance Manual, section »9.1«.
7.6 ELECTRICAL TRIM

The S12 is equipped with an electric trim system. An actuator is controlled by a two-way, center-off switch installed on the control stick. This actuator adjusts the pre-load on a “down-spring” system in the elevator control linkage of the aircraft. The following drawing shows the assembly of the trim system mounted next to the luggage compartment in the tail boom. There is access to the system through a maintenance cover in the luggage compartment.

![Diagram of Electrical Trim System]

Figure 7.6.a.
Electrical Trim System
7.7 PITOT AND STATIC PRESSURE SYSTEM

Total pressure, static pressure and TEC (total energy compensated pressure) are measured with a combination pitot / static / total energy probe (min. protrusion 800 mm/31.5 in) on the nose-cone. The pressures are transmitted via pressure hoses to the instrument panel.

Total pressure from the pitot tube and a reference pressure, taken from an inclined part of lower side of nose-cone, are used to supply the optionally installed stall warning system.

Any pressure transmission tubes are provided with water separator and filter elements.

The following drawing shows the pitot and static pressure system of the S12 with the certified connections.

![Pitot and Static Pressure System Diagram](image-url)

Figure 7.7.a Pitot and Static Pressure System
7.8 AIRBRAKES

Dual-blade Schempp-Hirth airbrakes (spoilers) are installed on the upper surface of the wing center section. The airbrakes are operated by torque tubes with an over-center locking mechanism in the center fuselage. Interconnection of wing and fuselage parts of the airbrakes drive is achieved by inserting and securing coupling bolts for LH and RH airbrakes.

Figure 7.8.a.
Control Connection Fuselage
7.9 LUGGAGE COMPARTMENT

A baggage compartment is installed aft of each backrest; each compartment should be loaded with up to 10 kg/22.05 lb if permitted by weight and balance calculations. Another baggage compartment is above the center console, maximum load is 2 kg/4.41 lb.

NOTICE

Do not load compact items and no objects of more than 0.5 kg/1.10 lb each unless secured.

The tail boom contains the largest luggage compartment with a total volume of 90 l. It can be loaded with up to 20 kg/44.09 lb depending on weight and balance limitations. The cover of the compartment can be locked by an aircraft individual key system.

Figure 7.9.a.
Luggage Compartment
7.10  POWER-PLANT

The STEMME S12 turbocharged engine ROTAX 914 F2-01/S1 is based on the ROTAX 914 F2-01, adapted for the requirements of the S12. (Four-cylinder, four-stroke opposed type Otto-engine, turbocharged with electronic charge-control (TCU = Turbocharger Control Unit); a central cam shaft and tappets-OHV; liquid cooled cylinder heads, cylinders cooled by ram air; dry-sump lubrication; Dual Capacitive Discharge Ignition (DCDI); 2 CD-carburetors; integrated reduction gear, mechanical vibration absorber and overload clutch).

Engine power is transmitted via the following elements, beginning at the engine:

- Flywheel-clutch with overload protection and flexible couplings.
- Drive-shaft with sliding element for linear displacement and flexible coupling.
- Forward propeller gearbox.
- Variable pitch propeller STEMME 11AP-V with folding blades.
Figure 7.10.a
Propulsion System Engine - Propeller

1 2 3 4 5 6
1. Foldable Variable Pitch Propeller
   Diameter extended 1.63 m / 5.35 ft. Extension by centrifugal forces, folding by retraction springs; propeller pitch actuation by electrically heated expansion elements; central body (hub and blade suspension) and pitch control mechanism are of aluminum alloy, blades are of fiber composite.

2. Propeller gear
   Helical spur gear, gear ratio: i = 1.01

3. Carbon Drive Shaft
   Carbon fiber composite, weight: about 3.0 kg / 6.61 lb, diameter: 65 mm / 2.6 in, length: 1.9 m / 5.25 ft, first critical bending freq. > 5200 RPM. Coupled to other components with flexible disks and sliding joint for axial movement.

4. Centrifugal Clutch
   The clutch damps starting shocks, protects against overload and allows an independent slowdown of the propeller after shutting down the engine.

5. Engine
   Turbocharged, 4 cylinders, 4 stroke opposed-type engine, dual capacitive discharge ignition, cylinder barrels ram-air cooled, cylinder heads liquid cooled; reduction gear (i = 2.4286).

6. Landing Gear
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.

![Engine Coolant Circuit Diagram](image)

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.
3. Collection tank.
The collection tank is a STEMME part. It is installed on top of the engine. The venting tube is used only for maintenance tasks.

4. Overflow container.
The overflow container, installed in the LH landing gear bay. It is a buffer for cooling fluid expansion. Cooling fluid quantity is checked and replenished at the overflow container, marked “min” and “max”.

5. Water pump.
The water pump is part of the ROTAX-engine. The cooling fluid circulation is a closed system. Fluid is pumped by a water pump, driven in connection with the camshaft. The expansion reservoir has an over-pressure valve which releases fluid to the overflow container in case of fluid expansion. When the system cools down again, it is sucked back from overflow container into the expansion reservoir. The cooling fluid system is self-vented via the overflow reservoir.

⚠️ CAUTION

Danger of scalding by escaping hot coolant!
Do not open the locking cap on the expansion reservoir when engine is warm!
The cooling fluid system is pressurized.

⚠️ NOTICE

Due to the pressure valve, if coolant is lost (below MIN) from the overflow reservoir, it will not replenish the expansion reservoir. It will be necessary to top up coolant directly into the expansion reservoir (with engine COLD only).
7.10.1.2 LUBRICATION SYSTEM

The ROTAX 914 F2-01/S1 is equipped with a dry-sump pressure lubrication; the main oil pump is integrated with a pressure regulator and additional turbocharger scavenge pump. The oil pumps are driven by the camshaft.

Figure 7.10.1.2.a
Lubrication System

1. Pressure regulator
2. Oil pump
3. Oil tank
4. Oil cooler
5. Venting bore
6. Oil pressure sensor
7. Oil line (main oil pump)
8. Oil line (secondary oil pump to oil tank)
9. Oil temperature sensor
The engine oil is sucked from oil tank through oil cooler and pumped through the oil filter to the different points of lubrication. Oil from points of lubrication flows to the bottom of the crankcase and returns, forced by blow-by gases in the crankcase, to the oil tank.

Turbocharger bearings are lubricated and cooled by a separate oil line from the main oil pump. The turbocharger has a separate scavenge pump to return oil to the tank.

The oil tank is ventilated by a ventilation line at the tank to the outside of the aircraft (on bottom of the center fuselage).

The sensor for oil temperature is installed in a recess in the oil pump and senses oil pump inlet temperature.
7.10.1.3 IGNITION SYSTEM

The ROTAX 914 F2-01/S1 is equipped with a contact-less dual capacitive discharge ignition (DCDI) system with an integrated generator. The ignition system does not require scheduled maintenance and requires no external energy.

![Ignition circuit A]

![Ignition circuit B]

Figure 7.10.1.3.a Ignition System

1. Charging coils
2. Electronic modules
3. Trigger coils
4. Dual ignition coils
5. Trigger coils
Two independent high voltage coils on the internal generator’s stator, one for each ignition circuit, are installed in the crankcase. Energy is accumulated in capacitors on the electronic module. For ignition, 2 of the 4 externally arranged sensors control discharge of capacitors via the primary coils of the dual ignition transformers. The firing order is 1-4-2-3.

An automatic electronic device is connected to the keyed ignition/starter switch. It inhibits ignition operation with a time delay of three seconds after the starter is actuated, allowing the propeller blades to deploy completely before the engine starts, consequently reducing the loads on the propeller blades and their corresponding stops. An abort of the start-up sequence causes the electronic device to reset. It is therefore not possible for the engine to fire within any start-up sequence before the three seconds time delay has expired.
7.10.1.4 TURBOCHARGER AND TURBO CONTROL UNIT

The ROTAX 914 F2-01/S1 is equipped with an exhaust turbocharger, extracting kinetic energy from exhaust gas to compress intake air.

The turbocharger RPM and the pressure in the airbox (manifold pressure) is controlled by deflection of a waste gate, discharging turbocharger outlet pressure to the engine exhaust gas system. The electric servo waste gate actuator is controlled by the electronic turbocharger control unit (TCU). Manifold pressure is controlled by throttle position, actuated by pilot’s throttle lever.

![WARNING]

Close to max T/O position, between power settings for 108 and 110%, manifold pressure is increased non-linearly. In this range, exact power setting is not possible and control system and engine RPM may oscillate. The range between 110 and 115% corresponding to throttle settings between the first and second stop, should be avoided. For selection of MTOP, throttle should be moved steadily and not too slowly.

To avoid engine damage, manifold pressure is reduced automatically by the waste gate in case of excessive RPM.
Manifold pressure control is monitored by a red warning light for high manifold pressure and a yellow caution light for TCU malfunction. After initially switching on the engine electrical system, both lights are on for 1-2 seconds during system self-test.

![CAUTION]

If the TCU-Self-Test is unsuccessful, one or both lights will remain illuminated, the engine can not be operated.

Yellow caution light for TCU:

<table>
<thead>
<tr>
<th>OUT</th>
<th>Turbocharger operable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flashing</td>
<td>Turbocharger not operable, refer to section »3.9.4.4«</td>
</tr>
</tbody>
</table>
Red warning light for manifold pressure:

<table>
<thead>
<tr>
<th>OUT:</th>
<th>Engine is operated in limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON:</td>
<td>Permitted manifold pressure is exceeded (refer to section »3.9.4.3«)</td>
</tr>
<tr>
<td>Flashing:</td>
<td>5 minutes T/O-power setting is exceeded (refer to section »3.9.4.3«).</td>
</tr>
</tbody>
</table>

---

**CAUTION**

If red manifold pressure warning light comes on, reduce power immediately!

---

**7.10.2 DRIVE SHAFT AND PROPELLER REDUCTION GEAR**

The propeller hub is mounted to the output shaft of the propeller gearbox, which is a pair of helical gears in a metal housing, ratio 1.109. It is bolted to an aluminum structure, supported by 4 shock absorber in the front frame.

The oil level of the propeller reduction gear can be checked by a front sight glass with MIN/MAX markings, when the nose-cone is open. The filler hole on the front side is closed by a magnetic screw. The oil must be changed in accordance with the S12 Aircraft Maintenance Manual. Under normal circumstances it is not necessary to top up the oil before the next scheduled oil change.

---

**WARNING**

The front gear must never consume more oil than what could have passed as oil vapor from the shaft seal(s). A higher oil consumption during short operation time must be investigated and must be eliminated before continuing aircraft-operation. In any case, inform the manufacturer or maintenance technician.

The drive shaft transmits the power from the engine to the propeller gear. It is made of carbon-fiber-composites. Flexible disks are installed for compensation of angle errors and angular movements. A splined joint at its aft end accommodate axial movements. The engine and drive shaft are isolated by a bivalent centrifugal clutch with servo effects. It damps shocks during engine starting; it protects against overload and allows freewheeling (propeller windmilling with engine not running).
7.10.3 VARIABLE PITCH PROPELLER

7.10.3.1 GENERAL

The two-blade variable pitch propeller 11AP-V has two operating positions: TAKE-OFF and CRUISE. Once rotation has stopped the blades fold in, regardless of propeller pitch. The folded propeller must be rotated into a certain position (manually via the propeller positioning control) before the nose-cone can be closed. In this configuration the STEMME S12 is configured for high-performance gliding.

Propeller-blade angles, TAKE-OFF (low pitch) and CRUISE (high pitch), allows an adaption to different flight conditions and improves powered flight performance including shorter take-off distances, higher climb rates and higher cruise speeds.

7.10.3.2 PRINCIPLE OF OPERATION

The propeller hub is pivoted to allow for variation of blade pitch angle; the blade attachment and actuating mechanism are made of high strength aluminum alloy.

The blades are actuated electrically from T/O to CRUISE position. Electric power (8 Amp.) is transferred via double slip rings to the rotating propeller and heats up two thermo-elements which expand above a defined temperature. These actuate two pistons with a mechanism to increase or decrease the propeller pitch.

High pitch position (CRUISE) is sustained by a position-dependent two-point regulator for the heating circuit and is supported by two fly-weights, the force of which increases with propeller rpm. The temperature of the thermo-element corresponding to the cruise position is about 70°C/158°F, limited to 85°C/185°F by means of a protection circuit.

Return of the blades to low pitch after switching to TAKE-OFF (or de-energizing heating-elements) begins with cooling down of thermo-elements and is terminated at 55°C/131°F; it takes about 2 to 5 minutes depending on OAT and propeller rpm. It is achieved by springs, aided by aerodynamic forces which always try to turn the blades to low pitch, the moment depending on RPM.
Aerodynamic forces plus springs always tend to turn blades towards low pitch, and only relatively small actuator forces are needed to shift and sustain cruise position.

The heating circuits are disconnected by PPC switch or by a limit switch for “nose-cone open but not locked”. This guarantees that the propeller blades are in take-off position when required, independent of actual PPC switch position.

The maximum time required for full change in pitch position in each direction in an OAT range between -30°C/22°F and +38°C and +100°F remains below 5 min. Experience in service has showed under all normal atmospheric conditions a mean time for the full pitch travel of 2½ min. with only minor divergence.

### 7.10.3.3 LIMITS AND TECHNICAL DATA

- Max. propeller RPM 2650 RPM
- Max. engine RPM (max. 5 min) 5800 RPM
- OAT range (-30°C to +38° / -22 to +100°F)
- Range of pitch angle 6.4°
- Voltage min. 12 V, max. 14.7 V
- Current required max. 10 Amp.
- CB for propeller blade control 15 Amp
7.11 FUEL SYSTEM

7.11.1 FUEL SYSTEM RELATED CONTROLS AND INDICATION SYSTEM

The S12’s cockpit provides the following fuel system related controls and indication systems:

- The fuel shut-off valve (horizontal “OFF”; vertical “ON”) is located on the rear center console.
- The fuel selector switch (with positions “LEFT”, “BOTH”, and “RIGHT”) is located on the instrument panel.
- The switch for the auxiliary fuel pump (with positions “ON” and “OFF”) is located on the instrument panel.
- The fuel pressure indication, the low-fuel light for the feeder tank as well as the green status light for the operation of the auxiliary fuel pump, are located on the instrument panel.
- The fuel quantity indicators for the two wing tanks are on the instrument panel.
- The four fuel pumps (one main and one auxiliary pump plus one transfer pump from each wing fuel-tank) have separate fuses, which are located in the Electronic System Boxes on top of the steel frame (refer to the S12 Aircraft Maintenance Manual).

**NOTICE**

For the location of the listed switches, lights or indicators please refer to section »7.3 Instrument Panel«.
7.11.2 FUEL SYSTEM DESIGN

WING FUEL SYSTEM

Both wing tanks are located in the outer sections of the wing center section. The ends of the vent lines are located at the lower, outer ends of the wing center section. The filler caps are located on the upper surface of the wing center section. The fuel line from each tank includes a strainer, a fine filter and quick drain as well as a piston pump including a fuel-check valve for each tank.

All these components are accessible through an opening in the lower wing skin near the root rib. Depending on the position of the fuel selector switch and a float switch in the feeder tank, the feeder receives fuel from either the right or the left tank separately, or from both tanks simultaneously. A single quick release connector is located between the fuel line from the wing and the corresponding connection in the fuselage.

FUEL SYSTEM OF THE FUSELAGE

Beginning at the quick release connector, fuel flows directly to the feeder tank. A float switch in the feeder tank prevents feeder tank overfilling. The feeder tank is vented through the right shell of the forward fuselage above the landing gear door at the rear edge. The feeder tank has a sump at its bottom that is connected to a quick drain. From the lower part of the feeder tank (approximately 1cm above the bottom) the fuel is pumped by the main fuel pump (powered by the engine electric system) or the auxiliary fuel pump (powered by the main electric system) to the engine.

The main pump runs continuously whenever the engine electrical system is powered (nose-cone is pushed forward and locked). A fuel return line delivers surplus fuel back to the feeder tank. Contaminated fuel (i.e. particles, water, etc.) from the sumps can be drained by use of the quick drain in the landing gear bay or by the two quick drains in the wing tanks.
7.11.3 ELECTRICAL LAYOUT AND OPERATION OF THE FUEL PUMPS

For normal operation, the auxiliary fuel pump is switched off, and only the main pump is operating. The main pump is electrically supplied by the internal generator of the engine, or the engine battery respectively.

The auxiliary fuel pump can be added if necessary, for example during take-off and landing. It is supplied by the external alternator, or the main battery respectively:

- The right wing tank pump operates with the fuel selector switch in position “RIGHT” or “BOTH” tanks and the float switch in the feeder tank switching the pumps “ON”.
- The left wing tank pump works with the fuel selector switch in position “LEFT” or “BOTH” tanks, plus the float switch in the feeder tank switching the pumps “ON”.
- The main pump works when the engine electrical system is powered.
- The auxiliary fuel pump works when the main electrical system is powered and the auxiliary fuel pump switch is selected “ON”.


Figure 7.11.a
Diagram of the Fuel System
7.12 ELECTRICAL SYSTEM

7.12.1 DESCRIPTION

The electrical system of the S12 consists of two independent, separate subsystems: The main system and the engine system. Each system incorporates its own dedicated battery and generator resp. alternator. Failures of one system will not interfere the other system. There is no provision for a bus tie.

The engine system powers exclusively those devices needed to operate the engine or which are available only when the engine is running. Under normal conditions the engine system battery is charged by the internal generator of the ROTAX engine.

The engine system is shut down completely during gliding flight, so no load is placed on its battery. In normal operation this battery will be discharged only while cranking the engine to start. After a few minutes of engine operation the battery will be recharged. The engine battery will provide power to crank the engine at any time, independent of the duration of a gliding flight.

NOTICE

The available battery capacity is depending on the battery condition, i.e. charging, aging, temperature. Especially the battery temperature, after long flights in high altitudes or during the winter time, reduce the available capacity significantly.

The main system powers all other devices of the aircraft. During powered flight its battery will be charged by the external, belt driven alternator. During gliding flight the main system battery has to power all devices. It is the responsibility of the pilot to save battery power by shedding unnecessary loads.

Once the main system battery is empty, the pilot is able to restart the engine using the engine system battery. After successful restart of the engine, the external alternator will power the main system and will recharge the main system battery again.
Figure 7.12.a.
Electrical System
7.13 TAIL WATER BALLAST

7.13.1 DESCRIPTION

The S12 is equipped with a water ballast tank in the vertical tail. This tank is made to adjust and optimize the center of gravity so that it is possible to compensate for varying payloads in the cockpit. This is done by filling water in the tank while the aircraft is on ground, which moves the center of gravity aft. To adjust the center of gravity exactly, different amounts of water can be filled. The possible range is between 1 l and 15 l. Accurate measurement is accomplished by holes in the right-side skin of the vertical tail, which can be closed with normal (gap seal) tape. A scale directly beside the holes shows the user the corresponding water amount at each hole.

The tank itself is a prefabricated FRP-part that is bonded into the vertical tail. It is formed like a tub so that the inner surface of the right vertical tail shell is part of the water ballast tank. The tub is equipped with a flange that is used to bond the prefabricated part to the right shell.

7.13.2 FROST PROTECTION

The water ballast tank in the vertical tail of the S12 is designed to be filled and emptied only on the ground. Therefore no dump valve or comparable means is provided to empty the ballast tank in flight.

Liquid in the water ballast tank can be subject to freezing. A mixture of water and standard antifreeze additive based on Ethylene glycol should be used to avoid freezing and possible structural damage to the vertical tail.

WARNING

Use only antifreeze additives based on Ethylene glycol. Select the freezing point of the mixture in accordance with the manufacturers specifications of the antifreeze additive and stay at least 10°C below the minimum expected OAT during the planned flight(s).
**WARNING**

Do not fly in areas/altitudes with OATs lower than the freezing temperature of the water ballast on board or leave such areas/altitudes as soon as possible!

**CAUTION**

Use of water ballast is allowed only in combination with an installed OAT sensor and/or indicator.

**CAUTION**

Before handling of antifreeze additives read the manufacturer’s safety data sheet and follow its instructions. Observe local and international regulation for the disposal of chemical fluids. Do not contaminate the environment when emptying or draining the ballast tank.

**NOTICE**

Before storing the aircraft it is recommended to empty the ballast tank.
7.13.3 DRAIN AND VENT

The ballast tank is equipped with several holes in the lateral wall which are used to adjust the water ballast in the ballast tank. The lower and upper holes are made larger because they are used for filling and emptying of the ballast tank.

![Image of tail ballast tank with labeled holes]

Upper hole for fill in.
Additional hole for vent.
Holes to adjust ballast.
Hole for removal of ballast.

Figure 7.13.3.a. Holes of the tail ballast tank

The lower hole is positioned during fabrication process so that the lower edge of the whole is level with the lowest level of the ballast tank with the aircraft in ground position.

While emptying the tank the outflow speed can be increased by uncovering all holes. It is possible to drain the ballast tank completely via the available holes.
7.13.4 FILLING

Connect a hose to the upper hole (see figure »7.13.4.a«) to fill the ballast tank. Even in case of complete filling of the water tank (15 l) an additional hole just below the uppermost hole allows the tank to vent during filling. When the tank is emptied all holes are available to vent the tank.

The possible loading range of the tank is between 1 l and 15 l which can be measured by the holes in the right shell of the vertical tail. A scale directly beside the holes shows the corresponding water amount for each hole. To select the desired amount of water all holes up to the hole below the desired marking, beginning with the lowest hole, must be closed with normal tape.

Figure 7.13.4.a.
Filling the Tail Ballast Tank
7.13.5 WEIGHT AND BALANCE

If flights with water ballast are planned, a detailed weight and balance calculation has to be performed according »6.3 Empty Weight and CG-Location«. Each kg (or each liter of water) in the water ballast tank increases the minimum cockpit load by 9 kg/19.84 lb.
8. HANDLING, MAINTENANCE AND SERVICE

8.1 INTRODUCTION

This section covers manufacturer’s recommended procedures for proper ground handling, servicing and maintaining the S12. It also lists certain inspection and maintenance requirements which must be observed to ensure continued airworthiness and high performance.

**CAUTION**

It is highly advised to follow the lubrication schedule as listed in the S12 Aircraft Maintenance Manual, section »6.5«, and to carry out preventive maintenance more frequently if unfavorable climatic or environmental conditions are encountered.

8.2 INSPECTION PERIODS

Maintenance activities are described in the S12 Aircraft Maintenance Manual. For a new aircraft the first inspection is after 25 hours of operation.

**NOTICE**

All inspections of the aircraft must be performed by authorized personnel, and according to the local requirements of the country where the aircraft is registered.

8.3 MODIFICATIONS AND REPAIRS

Details of who is authorized to perform modification and repair work on the motorglider and information on the limits between minor and major repairs can be found in applicable AIRWORTHINESS LAW.

These regulations are to be respected with highest priority. For standard maintenance and minor repairs please refer to the S12 Aircraft Maintenance Manual.
8.3.1 MODIFICATIONS

The responsible national CAA or the FAA office has to be contacted prior to any modifications on the motorglider to ensure that the airworthiness of the aircraft is not compromised.

8.3.2 REPAIRS

Before commencing flight operations, especially after a period of non-operation, a thorough inspection of the motorglider should be performed, refer to section »4.3 Daily Inspection«. Check surfaces for cracks in coating, for local distortion, roughness, holes and delamination of coatings and structure.

If something seems unusual or the significance of any damage is questionable, a specialist for CRFP/GFRP should always be consulted. Minor damage without influence on the airworthiness should be repaired by a qualified person. Definitions to decide on grade of damage are given in the supplement »Repair Instructions« in the S12 Aircraft Maintenance Manual. Any “major damage” must be repaired by appropriately rated repair stations only. Contact the manufacturer concerning major repairs.

WARNING

Repair work or embellishment of control surfaces have an influence on airworthiness (refer to the S12 Aircraft Maintenance Manual).
8.4  GROUND HANDLING / ROAD TRANSPORT

8.4.1  TOWING / PUSHING

Due to the large wing span, it is recommended to have persons available to check clearance of wing tips.

If the S12 is towed by car, use only properly fixed and suitable towing equipment, move slowly and do not make tight turns to reduce loads on the tail wheel and aircraft structure. If the S12 is towed by rope, it is recommended to attach it to both landing gear struts and to have someone prepared to decelerate and stop the aircraft.

- Pushing backwards: Steer by moving rudder pedals and push only at wing center section (close to the fuselage) or at the canopy opening of the fuselage.

8.4.2  STORING

The S12 should only be stored in well ventilated spaces. A closed, weather-proof trailer or container must be provided with sufficient ventilation ports or facilities. Take care for stress-free support of the aircraft and components.

8.4.3  PARKING

If the aircraft is not derigged for a year, all connection bolts, nuts and elements at fuselage, wing and empennage must be properly protected from corrosion. Dust covers should be appropriate for high quality surfaces and materials on the S12. When parked outside, the aircraft should be tied down and/or loaded with sufficient ballast.

- Tiedown: Insert eye-bolts in receptacles in lower surface of wing center section.
- Parking: SET parking brake (turn lever to ON position and operate brake lever).
- Hangaring: Unlock airbrakes (to relieve loads on airbrake pushrods); unlock parking brake and secure the motorglider with wheel chocks.
8.4.4 PREPARATION FOR ROAD TRANSPORTATION

In particular, the one-piece wing center section must be carefully supported in a trailer because of its heavy weight. At least three wide supporting jigs, well adapted to wing section shape, are recommended. Support the leading edge, if the inner wing is transported upright.

Fuel from the wing tanks must be drained before road transportation and filled into approved fuel containers (refer to relevant regulations). The best way to empty the wing tanks is with a device for the quick release coupling or through the wing quick drains before de-rigging.

If the fuselage is transported with wheels retracted, it must be supported in a wide area with well shaped supports below cockpit. It is recommended to transport the horizontal tail surface with well shaped supports.

All supports should be covered by soft material (e.g., carpet) to protect the high quality aircraft surfaces and components.

- Road transport: See manual for trailer.
8.5 CLEANING AND CARE

The surface of plastic aircraft should be maintained in spite of sturdiness and strength. For cleaning and maintenance, the following procedures should be used (for additional information refer to the S12 Aircraft Maintenance Manual):

- Surfaces should be cleaned periodically with clear water, sponge and chamois leather, especially leading edges of wing and empennage, if possible after each flight. To remove mosquitoes, insects and dirt thrown up by the propeller, special mosquito-sponges are recommended;
- Keep pitot clean of dirt and water, clear water drain holes regularly;
- Do not use cleaning additives too often;
- Polishing medium must be free of silicon;
- Fuel and alcohol should be used temporarily; it is not recommended to use any dilution liquid; never use chlorinated hydrocarbon (Tri, Tetra, Per or other cleaners of this style);
- The canopy can be cleaned preferably with special cleaning fluid for acrylic glass but also with pure water. Never rub dry on acrylic glass, use a wet, clean, soft chamois!
- The aircraft should be protected against moisture; if water has penetrated parts of the aircraft, it should be stored in a dry environment and components should periodically be turned around.
- It is recommended not to store the aircraft outside unnecessarily, since the paint can become brittle and crack due to UV radiation.

⚠️ WARNING

Composite structure exposed to solar radiation must have a white surface, except for identification, caution and warning markings. Colors other than white may result in excessive heating of the surface and structure, which could reduce structural strength of components.
8.6 ENGINE - TROUBLESHOOTING

**WARNING**

Only qualified mechanics, trained for this engine, are authorized for engine repair or maintenance. If the following procedures are unsuccessful, an authorized service station should be consulted. The engine must not be operated before repair.

**NO ENGINE STARTING**

- Nose-cone: LOCK nose-cone handle
- Fuel shut-off valve: OPEN
- Fuel quantity: CHECK and REFUEL
- Starter RPM too low: CHECK battery voltage
- Engine too cold: PREHEAT engine, use high quality engine oil, allow starter to cool down after prolonged operation.

**ROUGH ENGINE RUNNING AFTER WARM-UP**

- Choke: CLOSE choke, check mechanism

**OIL PRESSURE TOO LOW**

- Oil quantity: CHECK, refill if required

**ENGINE FIRING (DIESELING) AFTER SHUT-DOWN**

- Engine overheated: COOL DOWN at about 2000 RPM
- Throttle not on IDLE: Set IDLE before shut-down

**ENGINE KNOCKS UNDER HIGH LOAD**

- Fuel quality: REFUEL with higher octane number
PROBLEMS IN COLD ENVIRONMENT

- Starter RPM too low  PREHEAT engine
- Battery voltage low  INSTALL a fully charged battery or CONNECT suitable external power source
- Oil pressure high  NORMAL up to 7 bar/101 psi or when cold CHANGE oil if necessary
- Oil pressure low after cold start  SHUT DOWN engine and PREWARM oil. (viscosity is too high in suction line at too low temperature.)
9. SUPPLEMENTS

9.1 INTRODUCTION

This section contains appropriate supplements required, if various items of optional equipment are installed in the individual motorglider, that are not part of the S12 Aircraft Flight Manual. With these supplements, the pilot is provided with additional information and instructions required for safe and efficient operation of the optional equipment.

The installation of optional, supplemental or additional equipment is normally based on a Service Bulletin (SB) or by a STC. The respective supplemental information will be issued in the form of an Aircraft Flight Manual Supplement and in the case of a retrofit it will be supplied together with the retrofit kit. The supplement is to be filed following the cover page of section »9.3«.

The accomplishment of any SB having an effect on the Aircraft Flight Manual is to be attested prior to the next flight in the aircraft log book and in the record of accomplished SB’s/AD’s by approved certifying staff. This signature also covers a review of the Aircraft Flight Manual.

9.2 INSTALLATION OF ALTERNATIVE EQUIPMENT

The installation of equipment and systems alternative to the standard build version which affects parts of the Aircraft Flight Manual is a special case. In such cases, approved alternative pages are inserted into the individual Aircraft Flight Manual to replace the corresponding original pages. Thus the Aircraft Flight Manual represents the precise build specification of each individual STEMME S12.

The page numbers of the alternative pages are designated by the suffix »a« and are part of the whole approved Aircraft Flight Manual document.

The following table records the build specification and hence the applicable ‘suffix a’ pages. The installed alternative equipment has to be marked and countersigned by approved certifying staff and has to be updated (see section »0.2 List of Effective Pages«). This procedure must be done during the first conformity inspection as well as on subsequent alternative installation. (i.e. wheel size)
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* Mark relevant items with a cross in the respective field.
9.3 SUPPLEMENTAL AND ADDITIONAL EQUIPMENT

Supplemental and additional equipment could have influence on the contents of the Aircraft Flight Manual. They may, however, require additional instructions, which have been inserted into this Aircraft Flight Manual following this page and entered in the list below.

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