

Subject: Installation of Equipment not listed in the Equipment List of the Maintenance Manual

Action: There are general requirements concerning the installation of equipment, requirements connected with the minimum equipment, and requirements connected with other equipment.

1. General

- The instructions in the Maintenance Manual concerning the **electrical system** have to be regarded. The electrical system must be able to cope with the additional load. This regards the capacity of the batteries, the cross sections of the wires and the fuses. In powered sailplanes with battery ignition system, the capacity of the batteries and generators must be large enough to meet the simultaneous demands of the engine ignition system and the greatest demands of any other electrical system components that draw from the same source.

Overload protection must be provided for each electrical equipment. No protective device may protect more than one circuit essential to flight safety.

Each electric connecting cable must be routed, attached and connected adequately so as to minimize the probability of short circuits and fire hazards.

- Maintenance Manual instructions concerning the pneumatic lines and ports have to be regarded. After work on the **pneumatic installation**, the system has to be checked for tightness.
- The equipment must **securely be attached** in the sailplane, must neither endanger the pilot, nor hinder bailing out, nor weaken the structure. The attachment of every item of mass that could injure an occupant, if it came loose in a minor crash landing, must bear the following loads – unless higher loads are specified in the Maintenance Manual:

Load direction	Load
upward	7,5
forward	15
sideward	6
downward	9

For (powered) sailplanes certified to specifications older than CS 22 Amendment 2 alternatively the requirements of the appropriate certification specification can be applied.

Suitable places for attaching equipment are all parts of the main structure (particularly bulkheads, baggage compartment floors, struts, glass fibre or carbon fibre fuselage skin, etc.). The attachment may not weaken the structure. Therefore, when there are no holes for screws present, an attachment with clamps or with a correct glue joint is adequate (see below: notes).

If no attachment certified for the load is present and can be used, load tests must be made – a load test for every direction, to which the equipment can get loose.

For the load test, the weight of the equipment (and if applicable, the weight of other parts attached to the same structural member) must be multiplied with the load factor given above. The load is applied for 3 seconds. After load relieve no permanent deformations may remain. The test may be performed at room temperature.

- **Instruments in the instrument panel** weighing more than 1 kg must be supported with more than only the four screws in the instrument panel.

2. Parts of the Minimum Equipment

The Equipment List, as far as it is present in the Maintenance Manual, lists the devices that are suitable for installation in the specific model. **Other devices may be installed as part of the minimum equipment, when they are certified for the designated application (TSO, JTSO, ETSO).** Furthermore the following applies:

- The scale range of the **airspeed indicator** must read at least to 1.05 VNE. The scale must be marked according to the Maintenance Manual. To ensure the airspeed indicator calibration, the total energy port and static port specified in the Maintenance Manual must be used.
- The **altimeter** must be connected to the static port specified in the Maintenance Manual.
- No **Accelerometers** (g-meters) with civil certification are known to us that are suitable for gliders. But when they are part of the Minimum Equipment, they must be capable of retaining maximum and minimum values of acceleration for any selected period of flight. Their scale must be marked according to the Maintenance Manual.
- If the **magnetic direction indicator (compass)** is part of the Minimum Equipment, it must be installed so, that in level flight it can be compensated to $\pm 10^\circ$. Additionally, it must be compensated to $\pm 15^\circ$, when the radio is transmitting, or where applicable, when the engine is running. A deviation table (in at least 30° increments) must be placarded near the instrument, if the compass cannot be adjusted more exactly than $\pm 5^\circ$.
- The **safety harness** must be designed for the type of mounting that is present in the cockpit.
- A replacement is not possible on basis of this Maintenance Instruction for those parts of the Minimum Equipment, which were certified together with the sailplane (i.e. to which the Manuals refers in detail, such as digital engine control instruments).

3. Parts not belonging to the Minimum Equipment

Further equipment, which is not listed in the Equipment List and does not belong to the Minimum Equipment, may be installed under the following conditions:

- **Additionally installed equipment** must not affect the instruments belonging to the Minimum Equipment. Flight and navigation instruments must be clearly arranged and plainly visible to the pilot. This means, that the airspeed indicator and the altimeter must be located at a prominent place on the instrument panel.
- **Electric equipment and its aerals** may neither in themselves nor by their mode of operation or by their effect upon the operating characteristics of the sailplane and its equipment constitute a hazard to safe operation.
Every electric equipment has to be checked for reciprocal influence by systematically turning off and on and operating all other instruments.
The equipment and its control and monitoring devices must be arranged so as to be easily controllable. Their installation must be such that they are sufficiently ventilated to prevent overheating
- **Radios and ATC airborne equipment (e.g. Transponders)** may be installed, when they are TSO, JTSO or ETSO certified. The mounting parts and cable harnesses provided by the manufacturer have to be used.
Those instructions have to be regarded, which are supplied in the Maintenance Manual and in separate Technical Notes concerning transponder installation.
When ATC airborne equipment has been installed, or is being installed, inspections related to this equipment always have to be done by inspectors licensed for avionic.
- As far as the Maintenance Manual does not offer more specific instructions: **Emergency Location Transmitters (ELT)** should be installed in a protected area (e.g. between the wings). The aerals must be placed on a location, where it is not shielded by carbon fibre laminate. The cable between ELT and aerial should not be routed over an unduly long distance, due to the risk of rupture in a crash.
- **Oxygen equipment** must be approved. Oxygen equipment must be free from hazards in itself, in its method of operation, and its effect upon other components. Concerning the installation of oxygen bottles refer to the Maintenance Manual. There must be a means to allow the crew to readily determine during the flight: First, whether oxygen is being delivered to the dispensing equipment. Second, the quantity of oxygen available in each source of supply.
- **External lights** must be approved (CS 22.1385). For a certification for night flights further requirements have to be fulfilled
Lights not affected by CS 22.1385 have to be certified during the TC process or as STC.

Mass and C.G.: When the mass or position of equipment is changed, it becomes necessary to re-determine the C.G data by weighing or calculation.

The useful load has to be redetermined with regard to maximum take-off weight, maximum weight of non-lifting components and permissible in-flight c.g.-range.

Notes: Subsequently, the Equipment List in the inspection records, the Mass and Balance Forms in the manuals, and the placards in the cockpit have to be readapted.

Helpful information may also be found in the Repair Manual issued by Alexander Schleicher, and in the Technical Note 02-2005.

In case that the maximum take-off weight restricts the useful load and the maximum weight of non-lifting components is not yet exploited, the LBA circular letter RS-01-38/99-1 offers further information. But this applies only to gliders, which were certified according to the airworthiness requirements BVS, and probably only to those, which are subject to LBA control (registered in Germany and subject to Annex II of Commission Regulation (EC) Nr. 1592/2002)

This Maintenance Instruction goes into all essential aspects of the installation of equipment. But it cannot impart the skills of an educated aircraft worker or workshop manager (e.g. concerning making glue joints with epoxy resin, securing of connections, laying electric wires, etc.).

The measures may be accomplished by a competent person or by a maintenance organisation according to European Union Commission Regulation (EC) 1321/2014 Part M / Section A / Subpart F.

All actions are to be inspected by certifying staff according to European Union Commission Regulation (EC) 1321/2014 Part M / Part 66 in the scope of a modification and have to be certified in the sailplane inspection documents and in the sailplane logbook. The installation and if applicable the load tests have to be documented in the aircraft service record using Appendix I of this maintenance instruction.

In countries outside the scope of EC 1321/2014 the corresponding national rules shall apply.

Poppenhausen, 25.04.2016

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i.A.



(P. Anklam)

Record of the Installation of Equipment

1. Title / Description:

2. Type:

Serial-No.:

Registration:

3. Date of the Installation:

4. List of Parts (Quantity / Description / Part-No.):

5. Manuals / Operational Limits (Copies are provided to the aircraft owner):

6. Documentation of the Installation (Copies of documents marked with * are provided to the aircraft owner):

Load Test(s) carried out, see Appendix II

7. Instruction for Continued Airworthiness (Copies are provided to the aircraft owner):

8. Other Information:

9. The Installation of Equipment complies with all relevant requirements.

10. Responsible for the Installation:

All relevant documentation is handed to the aircraft owner, and, therefore, the latter becomes aware of any impact on operations or continued airworthiness of the aircraft due to this installation of equipment.

Name and Position

Place, Date

Sign

Record of the Installation of Equipment – Load Test

1. Location:
2. Date:
3. Participant(s):

4. Test Setting (setup, method of load application, required load, used measuring devices etc.):

5. Test Procedure (incl. actual accomplished load):

No permanent deformations were found after load relieve.

Test Supervisor

Sign