



## Service Bulletin

### Choice of Suitable Aircraft Battery

**MANDATORY**

#### Symbols:

Please pay attention to the following symbols emphasizing particular information throughout this document.

- ▲ WARNING: Identifies an instruction, which if not followed, may cause serious injury or even death.
- CAUTION: Denotes an instruction which if not followed, may severely damage the aircraft / engine or could lead to suspension of warranty.
- ◆ NOTE: Information useful to implement the change more easily.

#### 1. General

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<u>Date of effect:</u>	immediately
<u>Compliance:</u>	January 1 <sup>st</sup> 2018
<u>Release number:</u>	SB-013-aircraft-battery
<u>Superseded notice:</u>	none
<u>Referenced document:</u>	none
<u>Models affected:</u>	G3, G3/600 and GX with engines ROTAX 912 series (carbureted version)



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- Affected S/N: All aircraft REMOS G3, G3/600 and GX up to S/N419.  
Aircraft with earlier S/N may already comply with this Service Bulletin in case they have received batteries, voltage regulator and voltage limiter according to this service Bulletin as spare part.
- Reason: Several aircraft have suffered from failure of their aircraft battery. In some cases, this was due to wrong sizing, but sometimes due to selection of an unsuitable type of battery and in rare cases due to failure of components in the electric system.  
In an aircraft of another brand, the combination of an unsuitable choice of the aircraft battery and a failure of a component of the electric systems led into an inflight fire of the battery.
- Subject: Check of the installed type of aircraft battery and the equipment of the electric system, possibly exchange of the aircraft battery and/or modification of the electric system.
- Time required:
- check for applicability                      approx. 20 min
  - exchange/modification:                      approx. 1...2 hours

### 2. Material Information

- Tools needed:
- standard tools
- Parts needed:
- possibly aircraft battery
  - possibly voltage regulator
  - possibly voltage limiter
  - possibly fuse or circuit breaker 25A



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### 3. Compliance

- Schedule for inspection:
- at the next scheduled maintenance event
  - not later than September 1<sup>st</sup> 2017
  - for own safety, as soon as possible

- Level of maintenance:
- check for applicability: none
  - exchange of aircraft battery: line
  - exchange of electric components: heavy

▲ **WARNING:** Non-compliance with these instructions could result in severe damage of the aircraft and its systems, personal or even fatal injuries.

- License required:  
(US-LSA)
- owner/operator with Sport Pilot Licence (or higher)
  - LSA Repairman, or
  - A&P Mechanic, or
  - Part 145 Repair Station

- License required:  
(EASA-LSA)
- check for applicability and exchange of aircraft battery:
- pilot / owner with appropriate pilot license
  - maintenance and certifying staff as per flight conditions
- modification of electric system:
- maintenance and certifying staff as per flight conditions

Documentation: Compliance of this Service Bulletin shall be noted on the logbook and kept in the permanent maintenance records of the aircraft.

### 4. REMARKS and EXPLANATIONS

In the past, REMOS aircraft have been equipped with several different aircraft batteries (model, type and capacity) and voltage regulators. New aircraft are already equipped with a voltage limiter, that protects battery and the electric equipment from failures of the voltage regulator. Experience has shown that not all components are always safe.

Lead Batteries: The lead battery is the traditional aircraft battery. It requires little if any maintenance. Acid-lead batteries may gas out when overcharged and this gas needs to be routed away from the aircraft into the cooling outlets underneath the fuselage (this as is a mixture of hydrogen and oxygen, often referred to as oxyhydrogen or detonating gas). Gel batteries do not gas out. This later type of batteries may be stowed in any position and is completely free of maintenance.



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Gel batteries (often referred to as AGM batteries) shall therefore be preferred over acid-lead batteries.

When using this type of batteries, a failure of components of the electric system does not cause a dangerous situation. Failure of the voltage regulator will either cause the battery not being charged anymore or will lead to overvoltage. In case the battery is not charged anymore, this is indicated by the red charging alert light in the center stack of the cockpit. The voltage regulator may also fail in a mode that routes the generator voltage directly into the electric system. This overvoltage may damage electric components and the avionics. The lead battery itself, no matter what type, will most probably also be damaged, but it will not release excess energy or dangerous amounts of gas, there is no danger of an inflight fire.

Lead batteries are comparatively cheap, but at the same time quite heavy.

### NiCd or NiMH:

This type of battery has never been installed by REMOS. There is no experience with this kind of batteries. This type of batteries may not be installed.

### Li-Ion or LiPo:

Lithium batteries of this kind (Li-Ion or Li-Po) have an excellent power-to-weight ratio. Unfortunately, some failure modes may lead to thermal and/or mechanic instabilities. These batteries must only be charged with special chargers in a safe environment.

On high thermal or electric stress, Li-Ion and LiPo batteries tend to self-ignition. Such a fire is highly energetic and cannot be extinguished in flight. Huge amounts of toxic smoke gas may be emitted. Batteries of this type are not suitable at all for installation on REMOS aircraft and may never be installed.

### Lithium-Ferrophosphate

Lithium-Ferrophosphate batteries (LiFePO<sub>4</sub>) are well suitable as aircraft battery as long as certain conditions and guidelines are kept during installation. This type of battery exhibits a much less dangerous characteristic in case of a failure. However, in case of a failed voltage regulator or excessive overstress, even this kind of battery may emit toxic smoke gas.

In case a lithium battery shall be installed on the aircraft, only LiFePO<sub>4</sub> batteries may be used. Never ever install lithium ion or lithium polymer batteries. But even LiFePO<sub>4</sub> batteries need to be protected from overvoltage. In case this type of battery is exposed to excessive voltage, which may occur during a voltage regulator failure, even a LiFePO<sub>4</sub> battery may be destroyed in a thermal runaway and may emit toxic smoke gas.

### Voltage Regulator

The generator of the ROTAX 912 engine puts out a non-stabilized DC voltage that is far too high for the electric system of the REMOS aircraft, which is designed for 12...15V. The job of the voltage regulator is to provide a constant DC voltage of about 14V. By this it is ensured that the aircraft battery is charged and the installed equipment will not be damaged. Even a voltage regulator may fail. Two failure modes may occur: low-ohm failure and high-ohm failure.



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In case of a high-ohm failure the regulator will not put out any voltage anymore. This is not critical and will only cause the aircraft battery being drained from the electric components as the battery is not charged anymore. Eventually, the avionics will fail. The engine itself will keep on running as it is independent from the voltage of the electric system.

The low-ohm failure will cause the regulator to let the generator voltage pass through onto the electric system completely uncontrolled. Avionic components may be damaged as they are designed for 12...14V only. Some components may survive this event as they are designed for a 24V system. Nevertheless, in most cases even this kind of equipment may be damaged.

There are multiple reasons why a voltage regulator can fail. The most common reason is due to excessive temperature and/or too high electric load. Experience has shown that the standard ROTAX regulator (manufacturer: Ducati) is comparatively low priced, but tends to early failure due to temperature and electric load. The voltage regulator GR6 provided by SCHICKE does not show these problems as it is designed for a higher current and features a big heat sink.

### Overvoltage Protection:

It is now easy to understand that the electric system must efficiently be protected from overvoltage. This is done by electric components called overvoltage protection. They are installed in the wiring between voltage regulator and aircraft battery and will cut off the voltage regulator from the electric system.

In case LiFePO<sub>4</sub> batteries shall be used, the installation of an overvoltage protection is mandatory. In case lead batteries are used, the installation is recommended.

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### 5. CHECK for APPLICABILITY and COMPLIANCE

Lead Batteries: Lead batteries may be used without further limitations. Installation of an overvoltage protection is recommended, but not mandatory. Installation of the GR6 regulator by SCHICKE is recommended, but not mandatory. A charge fuse or circuit breaker of 25A shall be installed.

NiCd or NiMH: This type of battery may not be installed. They have never been installed by REMOS or provided as spare part. Aircraft with such a battery installed must be retrofitted with a lead- or LiFePO4-battery.

Li-Ion or LiPo: This type of battery may not be installed. They have never been installed by REMOS or provided as spare part. Aircraft with such a battery installed must be retrofitted with a lead- or LiFePO4-battery.

Lithium-Ferrophosphate Lithium-Ferrophosphate batteries (LiFePO4) may be installed as long as following conditions and guidelines are kept during installation:

- The battery should have an integrated battery management system in order to balance the single battery cells and for deep-discharge protection.
- An integrated overload protection is recommended, but not mandatory.
- According to the battery manufacturer, the battery must comply with UN Manual of Test and Criteria, Part III, Subsection 38.3 (abbreviated: UNT38.3).
- A voltage regulator type SCHICKE GR6 must be installed. The regulator provided by ROTAX (manufacturer: Ducati) is not suitable.
- Installation of an overvoltage protection SCHICKE OVP-15.2 is mandatory.
- A charge fuse or circuit breaker of 25A shall be installed.

▲ **WARNING:** Installation of batteries that do not comply with the specifications above may lead to severe damage of the aircraft, may cause serious injury or even death.

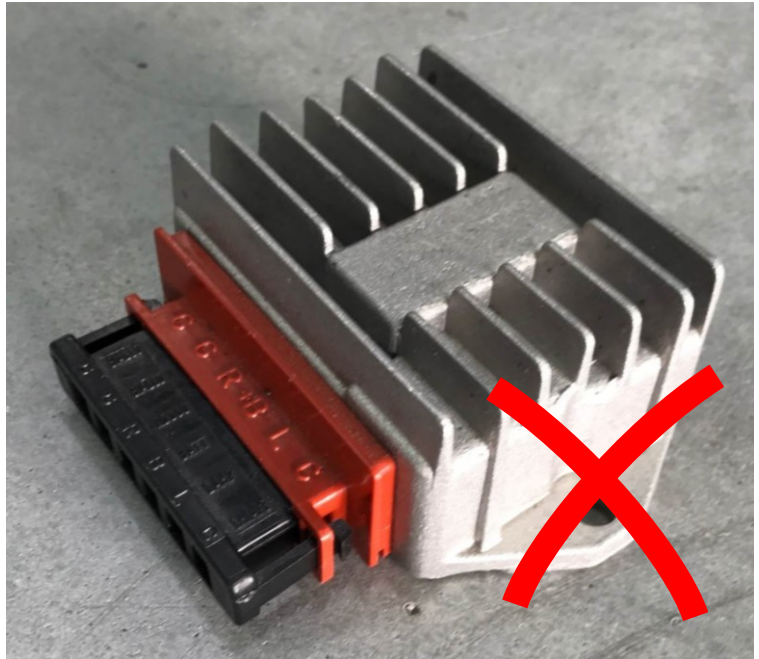
■ **CAUTION:** Installation of the SCHICKE voltage regulator GR6 and overvoltage protection OVP-15.2 is mandatory in combination with a LiFePO4 battery in order ensure safe operation. Technical equivalent components may be used, installation is on own discretion of the aircraft owner/operator.

◆ **NOTE:** A released overvoltage protection can be detected by the charging warning light: the warning light is permanently on. In this case the aircraft battery is drained. Flight may safely be continued, there is no danger of an engine failure, the electric system will fail after a complete discharge of the battery.

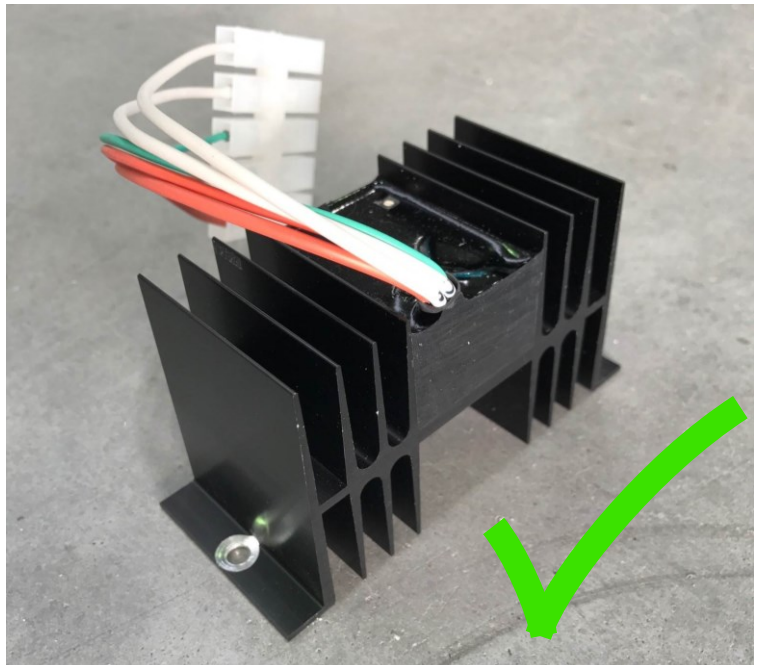
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### 6. FIGURES

ROTAX/Ducati voltage regulator



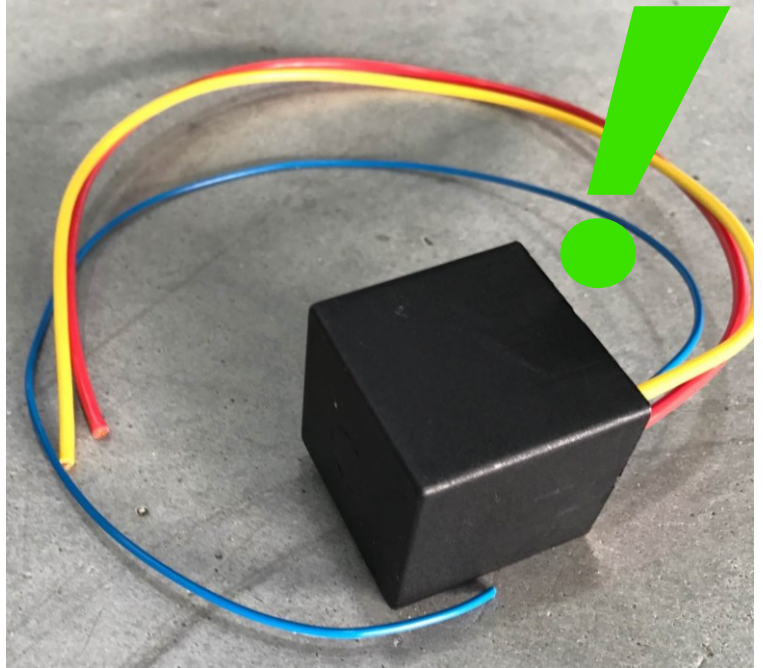
SCHICKE voltage regulator GR6





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SCHICKE overvoltage protection OVR-15.2



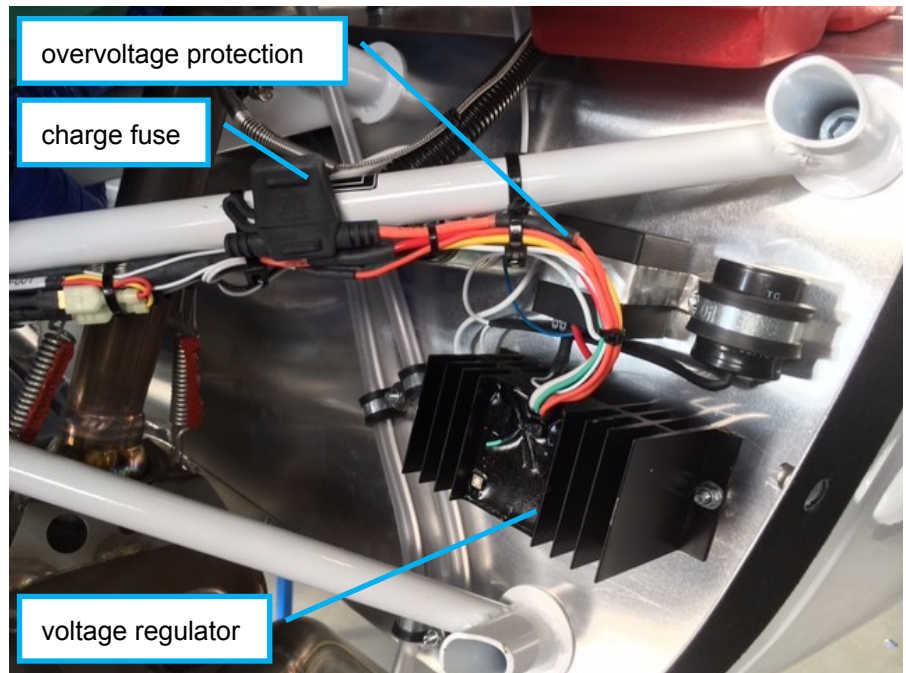
Charge Fuse or Circuit Breaker





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### Installation



### 7. SELECTION of SUITABLE BATTERIES:

#### General:

The following list is not a complete list of suitable batteries, as the market is very dynamic. On release of this service bulletin the following batteries have been found suitable for installation:

#### Lead Batteries:

- Hawker Odyssey PC545 or PC625
- Hawker Genesis 12EP13 or Hawker Genesis 12EP16
- other batteries as per specification from section 5

#### LiFePO4 Batteries:

- EarthX EXT680, EXT680C, EXT900 or ETX1200
- other batteries as per specification from section 5

#### Required Capacity:

The required capacity is defined by the power consumption of the electric components installed. After a generator failure, all non-essential systems shall be switched off immediately. The remaining battery capacity shall ensure safe operation for at least 30 minutes.

For aircraft equipped with a full set of avionics a battery of at least 6Ah shall be installed (applicable for avionic suites NXT, nXES, VOYAGER and CRUIZER). Aircraft with less extensive equipment (e.g. eLITE, TRAVELLER, EXPLORER) do not require more than 5Ah. A larger capacity is recommended for aircraft operated in flight schools or on larger airports with long taxiways.



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Insufficient Electric Power: Insufficient electric power is noticeable especially by malfunction of the ACT radio(s) while transmitting. Clear radio communication is not possible in this case anymore. The FlymapL GPS and the glass cockpit system will prompt a low voltage warning. To avoid insufficient electric power, follow this advice:

- switch off non-essential systems during taxi
- engine speed on ground at least 2,500 rpm
- engine speed in the air at least 4,200 rpm
- recommended: installation of the electro retrofit kit

### 8. MAINTENANCE, CARE and CHARGING of AIRCRAFT BATTERY

General: Low temperature cause a lower capacity of the aircraft battery and increase internal electric resistance. Because of that, problems in engine start-up may occur in the cold season of the year. REMOS recommends to uninstall the aircraft battery during wintertime and store in a warm, dry location.

Care: AGM and LiFePO4 batteries do not require special care. Keep them clean and have the terminals greased with electric grease. Lead-acid batteries need to be checked against correct level of acid.

Charging: Lead batteries may be charged with conventional (automotive) chargers. Special care must be taken as most of the automotive chargers are made for higher capacity batteries and will therefore charge with very high currents that may damage the aircraft battery. It is recommended to use smaller chargers for controlled charging process, e.g. from the RC-model airplane branch.

LiFePO4 batteries may only be charged with special chargers specified by the manufacturer.

Generally, try to avoid charging batteries below 10°C (50°F) battery temperature.



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### 9. SOURCE of SUPPLY:

any spare part:

REMOS AG (EU and ROW)  
Franzfelde 31  
17309 Pasewalk  
GERMANY  
[www.remos.com](http://www.remos.com)

Skybound Aviation LLC (USA only)  
4333 Goodwin Jr. Memorial Drive  
Scott City, MO 63780  
United States of America  
[gmac1123@gmail.com](mailto:gmac1123@gmail.com)

lead batteries:

Akku Profi Solution GmbH & Co. KG  
Valdorfer Straße 33  
32545 Bad Oeynhausen  
GERMANY  
[www.accu-profi.de](http://www.accu-profi.de)

ABH-Nord GmbH  
Eiderkamp 33  
24220 Flintbek  
GERMANY  
[www.batterie24.de](http://www.batterie24.de)

EarthX:

EarthX Inc.  
P.O. 767  
Windsor, CO, 80550  
United States of America  
[www.earthxbatteries.com](http://www.earthxbatteries.com)

SCHICKE:

Schicke elektronik GmbH  
Kanalstraße 32  
76356 Weingarten  
GERMANY  
[www.schicke-elektronic.de](http://www.schicke-elektronic.de)

The list above is just an excerpt of possible supply and shall not be any commercial advertisement for any named dealer. All parts are available through REMOS and/or the authorized REMOS spare part distributor in the US, i.e. Skybound Aviation.





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### 11. DOCUMENTATION:

Execution of this Service Bulletin must be entered in the aircraft logbook and in the aircraft permanent maintenance records by a licensed person.

### 12. NOTE of RELEASE:

This service bulletin serves as generic letter of approval in case the aircraft shall be upgraded and/or modified. An individual letter of approval is not required.

prepared	Christian Majunke REMOS – Engineering
checked	Paul Foltz REMOS – Certification Verification Engineer
released	Daniel Browne REMOS – Office of Airworthiness

Pasewalk, July 18<sup>th</sup>, 2017

**REMOS wishes you safe and fun flights!  
Always check your aircraft before you fly!**