

Manual to Cooling Kits



for brushed motors

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picoamps GmbH

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The picoamps Cooling system provides

- **Newest and highly efficient cooling technology**
to achieve
 - ✓ **Better endurance and robustness**
 - ✓ **Increased life time**
 - ✓ **Increased performance**of your motor
- **Comes without additional devices and fans**
- **Fully flexible and modular**
 - ✓ **Different grades according your needs**
 - ✓ **Upgrade capability to higher grades**

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What is the benefit of the picoamps Cooling system



The torque of brush motors is mainly defined by the current through the armature. Especially in motor sports area, often such motors are driven with very high current values, far above the manufacturers specification in order to achieve more torque and power. On the other hand the heating power within the motor increases with the power of two to the current. Therefore the achievable power is limited by the maximum temperature of the motor parts which will increase with heating power. With excessive temperature the motor will be destroyed or stopped by a temperature emergency switch, if applied.

The reason why increasing the current above the manufacturer specification does work in practice is that the current setting in the controller is not reached in any case. The real current through the motor is determined by the application conditions of the vehicle and the corresponding mechanical power.

In motor sports the averaging effect between the alternating sequences of acceleration and deceleration leads to an averaging of mechanical power and thus reduced heating power in the motor. A main factor for this effect is the grip level of the tires. E.g. a very slippery surface leads instantly to a spinning wheel and the mechanical power drops significantly.

The cooling system of Picoamps provides cooling power in different grades according the users needs.

When using the enhanced cooling system from picoamps system the motor power and torque can be fully used without emergency stop. In many cases the current and therefore the torque can even be increased, depending on the application conditions.

The cooling stage which has to be chosen strongly depends on environmental and application conditions as well as motor tolerances. Therefore which cooling stage will be sufficient for a certain application has to be tested from case to case.

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Important notes on the picoamps cooling system



The cooling system of picoamps works with a passive cooling principle, where the aluminum cooling blades should be exposed to a flow of cool air (e.g. head wind).

Note: A forced air flow may further increase the cooling power (e.g. using cooling fans).

Note: Complete encapsulation of a motor with the picoamps cooling system will disable the cooling function.

Important:

- The picoamps cooling system is optimized for usage on motors that spin clockwise, looking onto the brush plate.
- When using it on motors that spin counter-clockwise, the cooling performance will be reduced.



The amount of cooling power necessary for a specific application strongly depends on the working conditions and the tolerances of the motor. A binding statement on which cooling system will be sufficient for a specific application is not possible.

However, as a rule of thumb the following can be assumed:

If the elapsed time from start until the thermal switch releases is in the order of 20 min under certain working conditions*), then the entry level cooling system (HD kit) should be sufficient to avoid thermal switch off under the same working conditions.

*) Working conditions include: Environmental temperature, grip level, losses through friction of moving parts, controller settings, lap times, etc.

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How to get a picoamps Kit



1. Choice of the suitable Kit

Preferably you clarify with us your envisaged application and the current state of your motor in advance. You choose the suitable Kit according your needs. We send you an offer including price and time of delivery.

2. Send the brush plate to picoamps

After your purchase order you send us your brush plate for modification. (This is not required in case you buy a complete new brush plate.) To do so you need to disassemble the brush plate from your motor as described below.

3. Modification of the brush at picoamps

We modify your brush plate according your selected kit and send it back to you in shortest possible time.

4. Assembly of the modified brush plate

You re-assemble the modified brush plate as described below. Please note the mounting instructions in this document.

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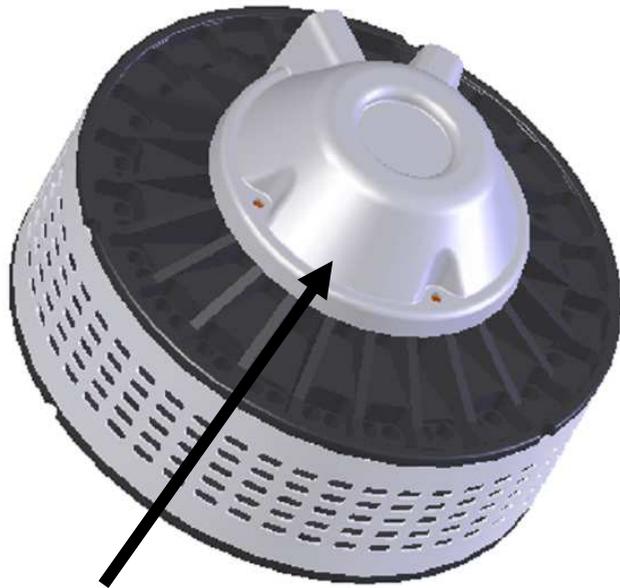
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LMC[®] 200 series brush plate



LMC[®] motors with original brush plate



Original LMC[®] brush cover

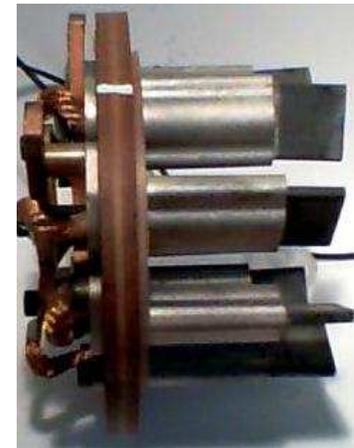
Large cover from Quantya[®]
part number XH413000M



Brush plate carrier made of fiber resin (newer motors)



Brush plate carrier made of paper based plastics (old motors)



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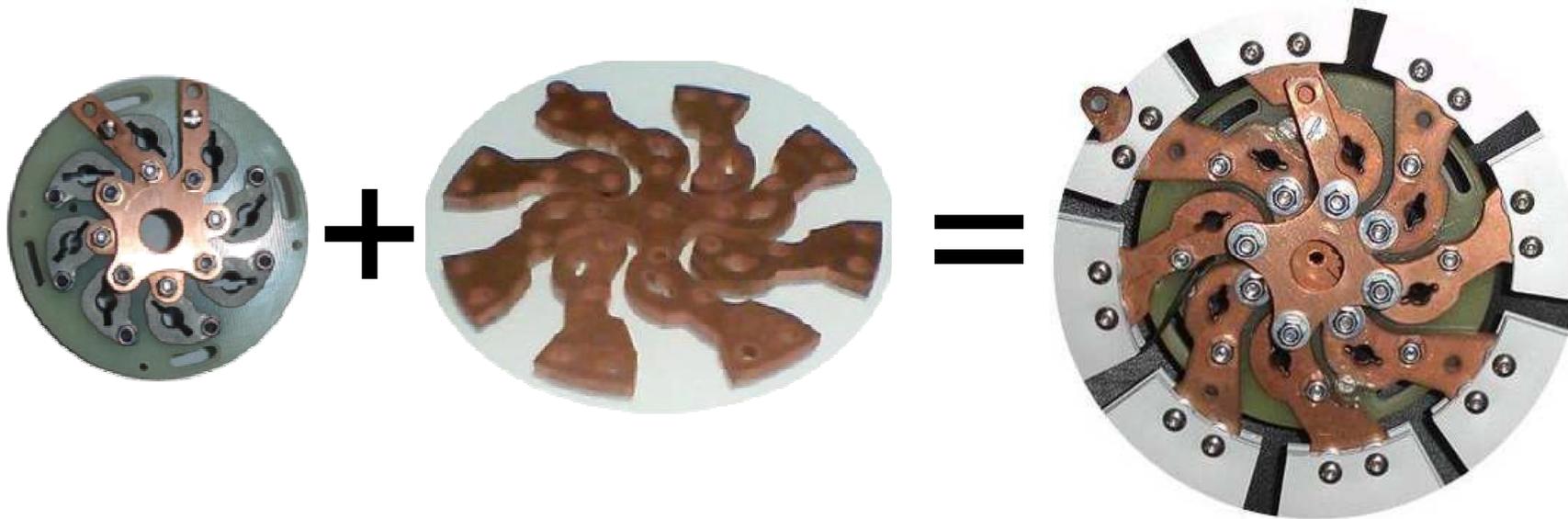
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LMC[®] 200 brush plate with Cooling Kit



Basis for all grades of Kits is the Mounting Kit, consisting of a copper star for heat dissipation and to mount the cooling blades for heat transfer to the environment



Brush plate

Mounting Kit

Two alumina blades with a ring width of 20 mm per star tip

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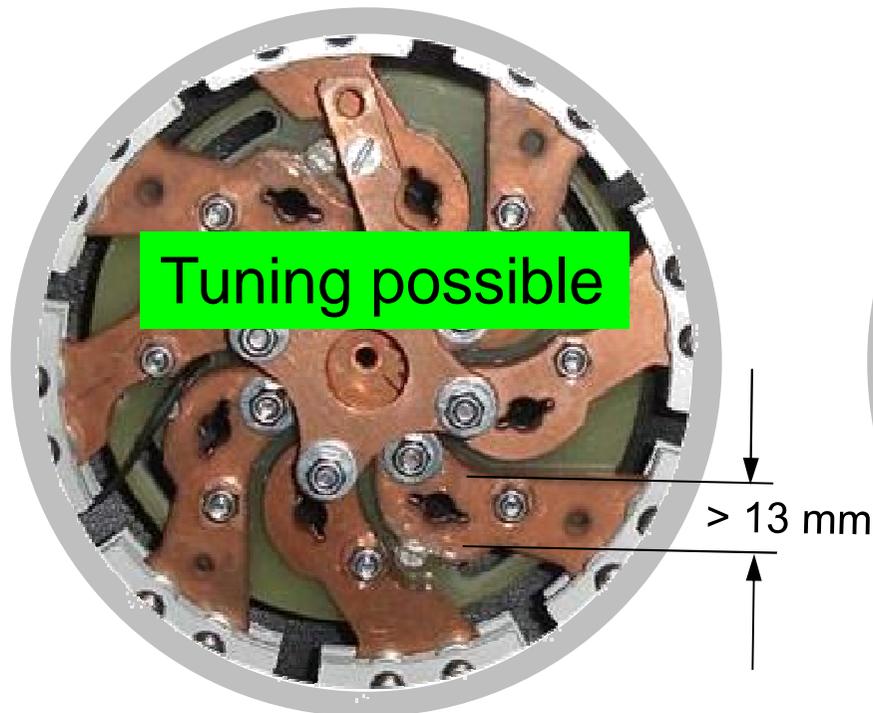


Note to Quantya® Mounting Kit

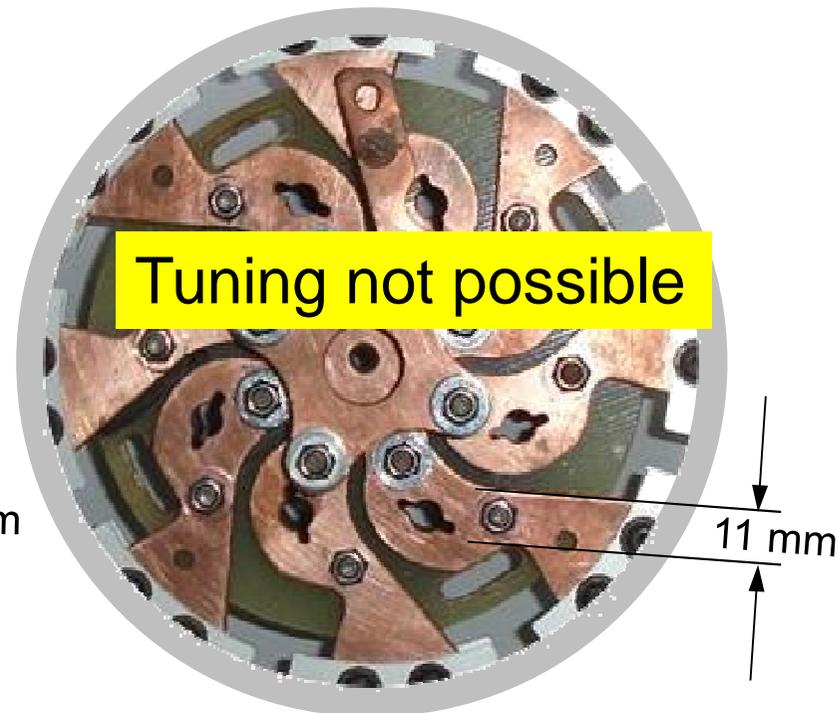


Since 2009 Quantya® bikes were stuffed with different versions of Mounting Kits. Not all versions are suitable for further cooling stages. In such a case an additional copper star is required.

Note: We recommend to verify the version of your brush plate before ordering.



Copper star with broad bars



Copper star with small bars

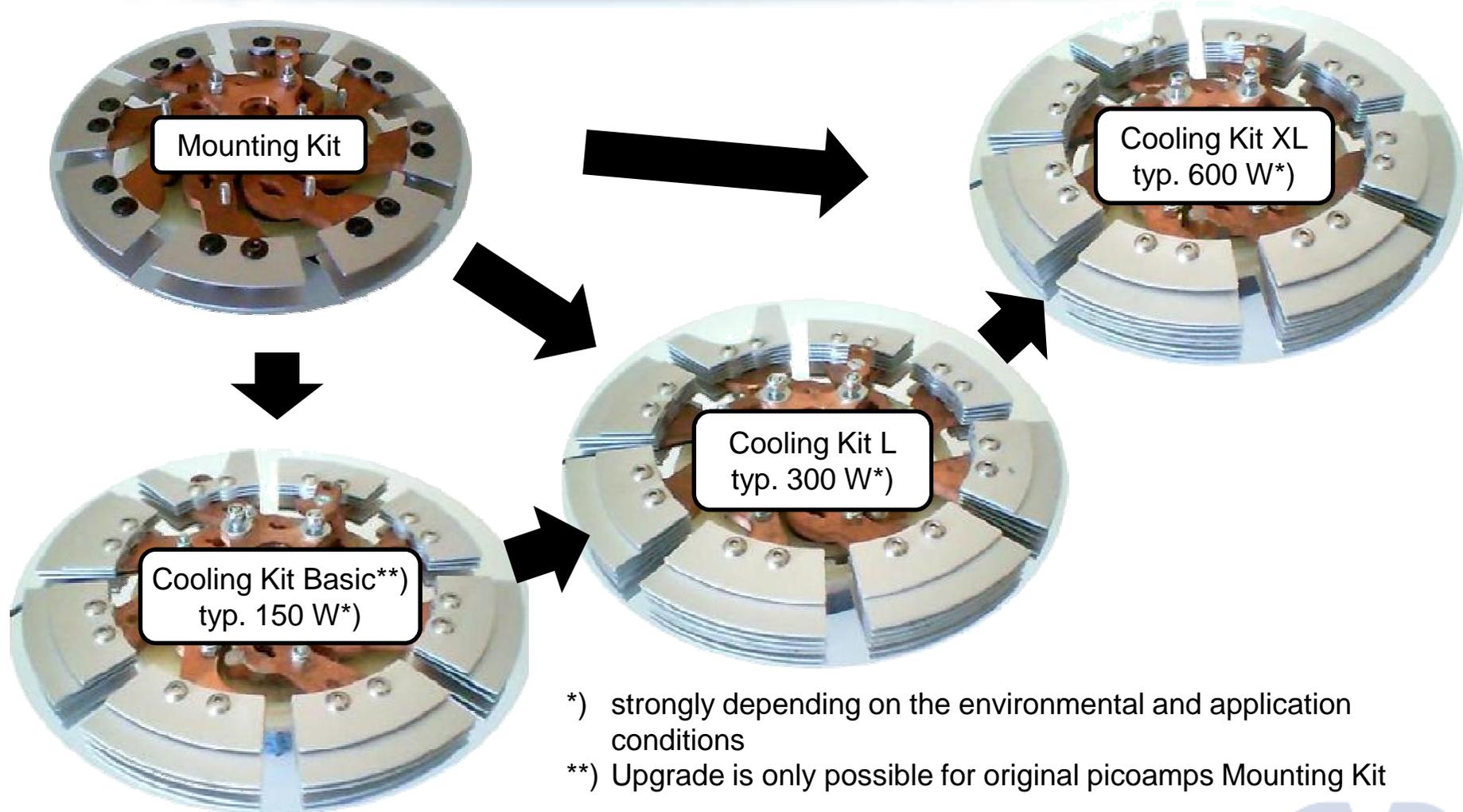
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LMC[®] 200 brush plate and cooling grades



*) strongly depending on the environmental and application conditions

***) Upgrade is only possible for original picoamps Mounting Kit

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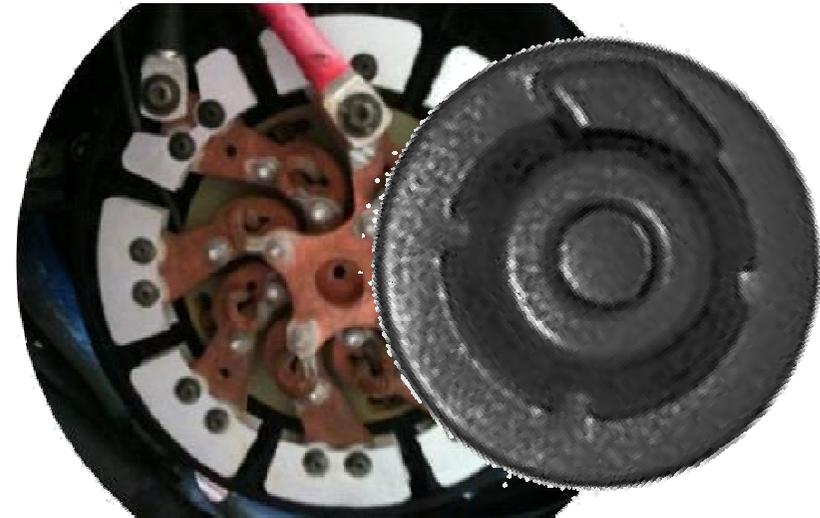
Brush plates on Quantya® bikes



Quantya® models before 2009 were equipped with original LEMCO® brush plate and cover



Since 2009 Quantya® bikes were equipped with different versions of Mounting Kits.



Mounting Kits can be identified by the copper star with two alumina blades on each star tip, covered by a large brush cover from Quantya®.

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Dismounting the brush plate on Quantya®



Place the bike on a suitable stand and fix it.



Switch off the bike

Unplug power connector from battery!!!

Unplug connector for temperature switch

Loosen power cables and remove the brush cover

Loosen the brush plate (4 x M4 Inbus)

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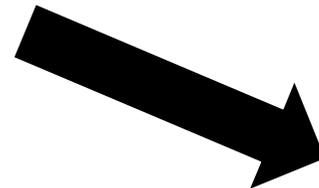
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Dismounted brush plate
ready



to send to picoamps
for upgrade



Mounting the brush plate



Insert the brush plate into the motor opening. Make sure that all brushes touch the armature evenly.

Press the brush plate against the spring force towards the motor housing.

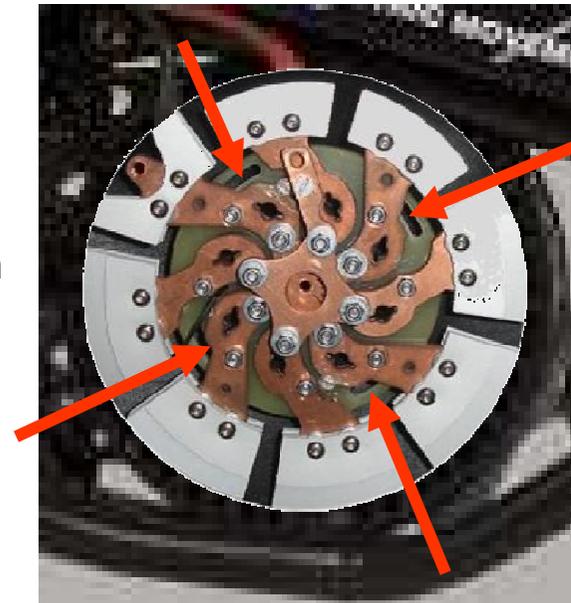
Turn the brush plate in the motor to align it with the screw holes.

The brush plate is inserted correctly, when the brush plate can be smoothly turned.

Tighten the brush plate with the four M4 screws uniformly without canting it.

Alignment of the brush plate in the motor housing:

To get maximum torque the brush plate should be tightened in neutral position, meaning that the screws are located in the center of the slotted holes.



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Mount brush cover

Large brush cover from Quantya®
purchase Nr.XH413000M should be used

Tighten power cables

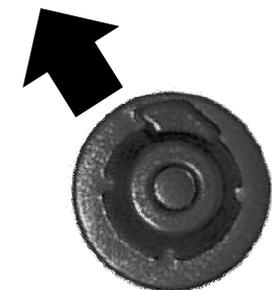
Please note safety instructions for electrical cabling

Plug temperature switch

Check if motor and rear wheel can be smoothly turned.

Only the usual sound of the sliding brushes should occur.
Otherwise remove brush plate to find the root cause.

Plug main power cable to battery, ready.



Large brush cover from Quantya®
order nr.: XH413000M

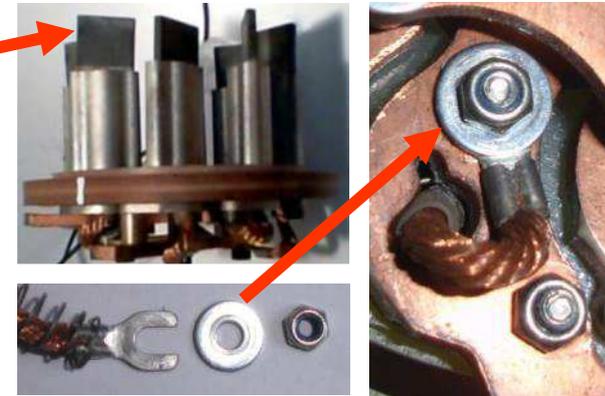
Mounting instructions for brush plate



The cable shoes of the brushes have to be fixed on the brush plate such that the brushes stand off the brush guides of about 10 mm due to the brush springs. 

Important: Follow the mounting instructions for brushes on the next page.

The torque of the cable shoe screwing should be about 2 Nm on the M4 nuts. The washers for the cable shoes should cover the shoes completely to minimize the electrical contact resistance.



The brush plate has to touch the motor housing evenly after mounting it. With applied but loose screws the brush plate should be smoothly turnable within the motor housing.

With an inaccurately mounted brush plate the brushes and also the motor could be damaged. In the worst case even a fire damage could occur.

Important: Adjacent cooling blade bundles are connected with the plus pole and the minus pole of the battery respectively. The cooling blades are made of oxidized aluminum and in principle non conductive. However due to the screwing of the alumina blades the blades can carry battery voltage.

Attention: Danger of short circuit between screws and nuts of different cooling blade bundles
Danger of short circuit can occur if the oxidized surface of the alumina blades is damaged

Therefore we recommend the larger brush cover from Quantya®, purchase number XH413000M.

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Mounting instructions for brushes



Recent versions of the picoamps cooling systems are equipped with additional springs in the brush guides for better cooling performance.

These springs have to be removed before dismantling the brushes.

To do so, carefully unlock the spring from the brush guide using a thin blade or tweezers and push the spring out by moving the brush. Take care not to squeeze the brush on its top end to avoid permanent deformation of the spring. Deformed springs have to be replaced.

The cable shoes of the brushes have to be fixed on the brush plate such that the brushes stand off the brush guides of about 10 mm due to the force of the brush springs. The brushes should slide smoothly within the whole range of the spring. If this is not the case, the brush guides may have to be cleaned.

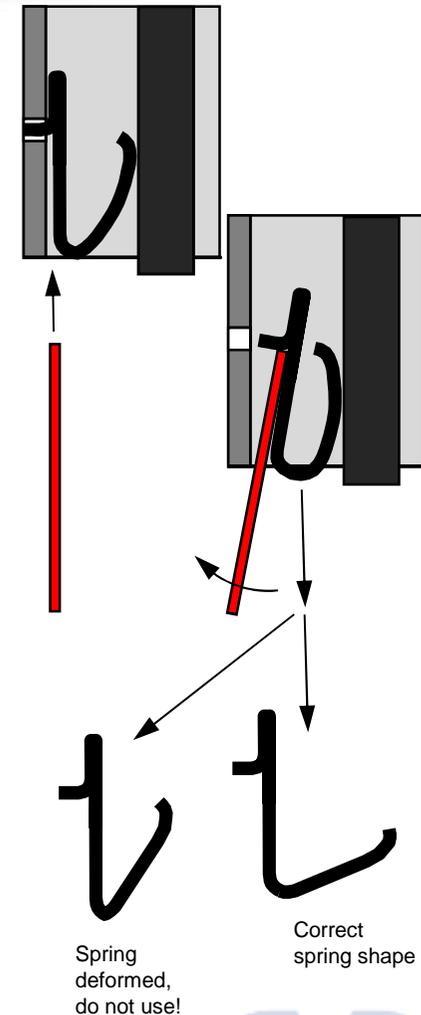
Due to fabrication tolerances of brushes and brush guides it may happen that some brushes get jammed in the brush guides. In this case try to switch position with other brushes to achieve good mobility or slightly grind off material from the brushes to reach full mobility of the brushes.

After mounting the brushes, the springs have to be carefully shifted back into the brush guides with a small tweezers until they snap in. Check if the brushes still can be moved smoothly in the brush guide.

Caution: If the brushes are not mounted correctly they can be damaged and as a consequence the complete motor can be destroyed or catch fire.

Caution: The additional springs have to snap in correctly; otherwise they may fall into the motor and as a consequence the complete motor may be destroyed.

A short video demonstrating the mounting of the brush guide springs can be seen here <http://www.automotive.picoamps.de/doc/BuerstenfedernEinbau.wmv>



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Safety instructions for electrical cabling



The power cables connecting battery, controller and motor and especially the connections need to be carefully checked.

Soiled or oxidized contacts as well as loose and improper screwing will lead to an unacceptably high contact resistance of electrical connections..

This will cause the following impacts:

- Maximum power of the motor will be reduced
- The bad contact causes large heating power, melting temperatures of the parts can be exceeded . The electrical contact will be destroyed
- As a consequence open fire can occur
- The controller can be damaged

Therefore we recommend:

- Clean all contact surfaces of electrical cables thoroughly before mounting. Remove all dust and oxides before reconnecting. Take the same care on the main power plug to the battery.
- Remove all unevenness on contacts and polish the surfaces.
- Use washers above the cable shoes which cover the shoes completely to minimize the contact resistance.
- The screwing of the main power cable of a M6 steel screw into a M6 copper winding should be tightened with a torque of about 9 Nm. It is even better to use a counter nut of steel which allows a torque of about 18 Nm.
- Copper elements with damaged windings do not offer a safe connection and should be exchanged immediately.

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