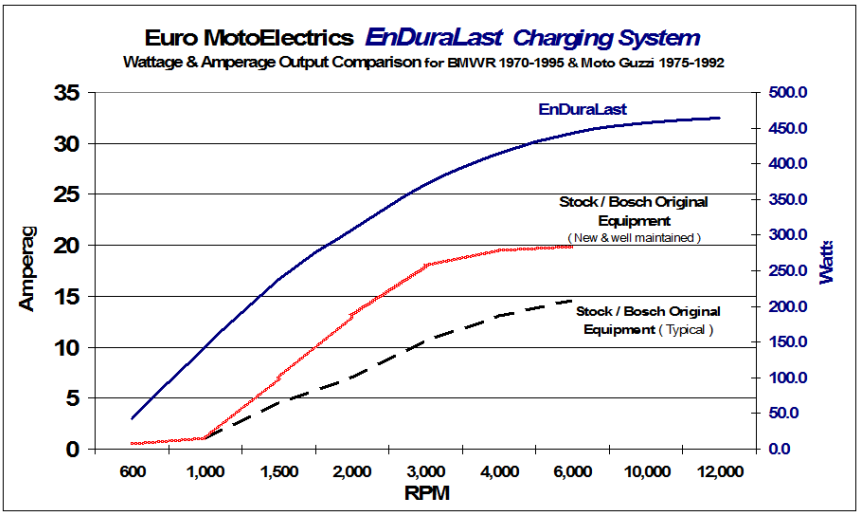
EnDuraLast

EDL4Li

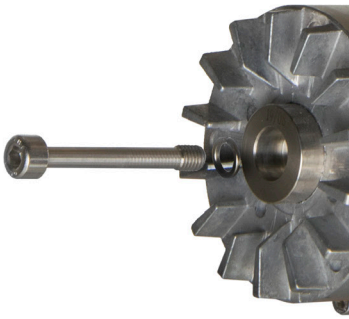
450w Lithium Style Battery Charging System Upgrade Installation Guide

EDL4Li Alternator Kit Performance

29 Amps / 400 Watts @ 5000 RPM (450 Watts Total Max Rating)
25 Amps / 350 Watts @ 3000 RPM
20 Amps / 280 Watts @ 2000 RPM

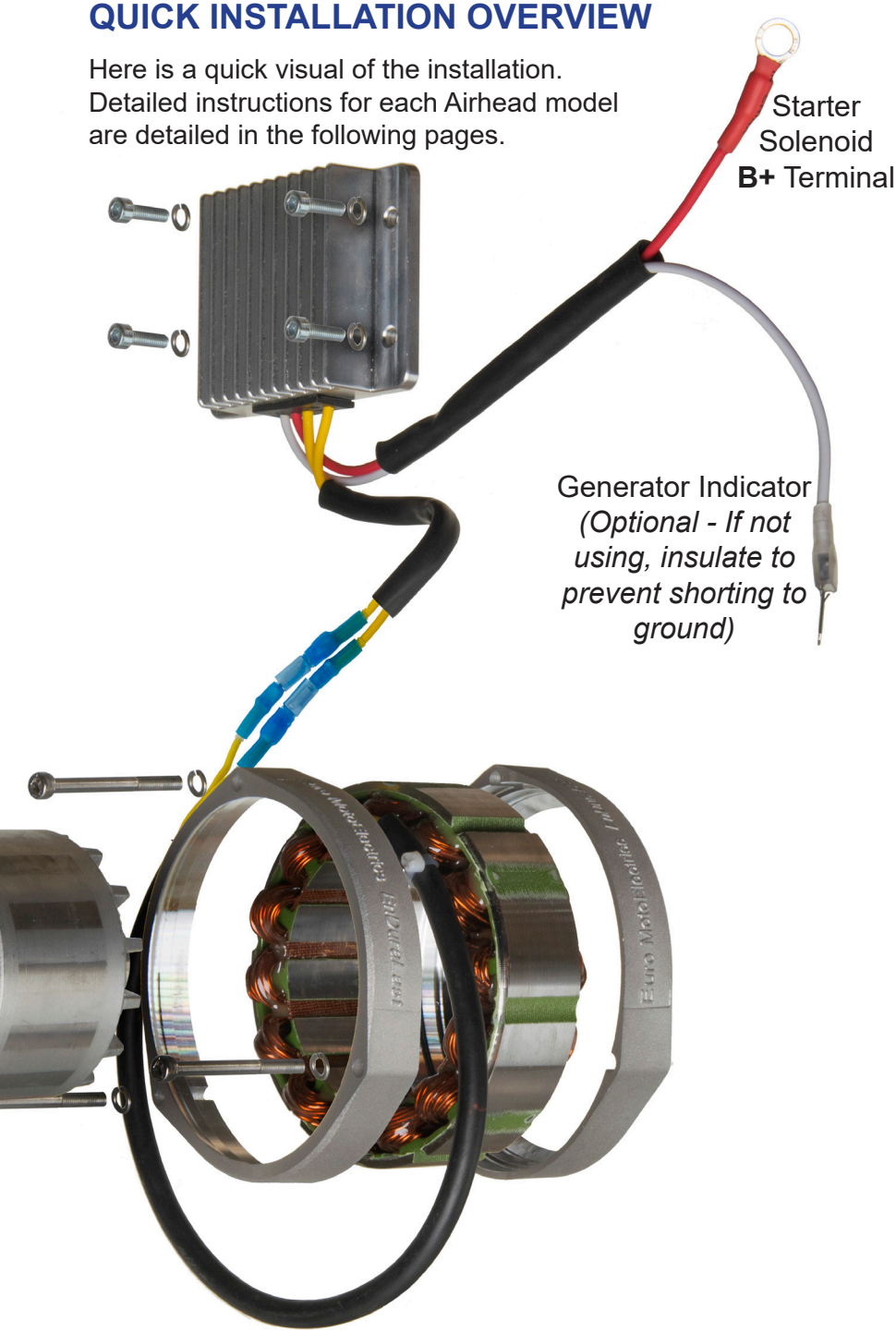


- Increases power output by up to 80% over the stock Bosch system.
- Stable voltage production under all load conditions.
- Lithium type battery compatible MOSFET voltage regulator/rectifier combination, replaces diode board rectifier & voltage regulator.
- High-tech permanent magnet rotor will never overheat or short out.
- Brush-less design eliminates worn out brush holder, rotor slip rings, and carbon brushes.
- Eliminates the *no charge* due to burnt out generator light, while retaining its function.
- Works with all BMW Airhead applications between 1970-1995, bolts right on and wires up simply.
- Designed and manufactured to modern OEM specifications.



QUICK INSTALLATION OVERVIEW

Here is a quick visual of the installation. Detailed instructions for each Airhead model are detailed in the following pages.



Theory of Operation

The original BOSCH alternator system used on BMW's and select Moto Guzzi's of the same era were designed in the late 1960's. The system is based on energizing the rotor with electricity from the diode board, through the generator light and voltage regulator. Once the rotor is electrically charged and spins inside the wire windings of the stator, AC current is generated and sent to the Diode board, or "Rectifier" to rectify or correct the AC current to DC current so it can be used to charge the battery. The Rectifier uses Diodes which are like electrical gate keepers, to change the electricity from AC to DC.

The EnDuraLast EDL4Li Alternator Kit is a significant upgrade to the original charging system. The major components are manufactured in Italy and the custom modifications done in the USA to the highest standards under ISO certifications.

It's beauty is in its simplicity. No longer is the complex wiring from the diode board, generator light, voltage regulator and brushes needed to energize the rotor because now the rotor is permanently magnetized. The brush-less, permanent magnet rotor spins inside the stator and AC current is generated in the stator wire windings. The stator is very robust. Failures are extremely rare, caused by excessive heat or physical impact damage.

The Regulator / Rectifier (R/R) has been designed specifically for use with Lithium type batteries by incorporating voltage conditioners and a lower regulation point of 14.1 volts, which most Lithium type batteries prefer. Extensive testing has been done and the best components used to ensure the MOSFET R/R can withstand the heat under the front engine cover where the original diode board was located. It is extremely simple to wire with only one wire connected to the battery positive, and plug in the stator. An optional generator indicator feed is provided, but is not necessary for the alternator to function.

This alternator can be envisioned as a stand alone system. All other electrical systems on your motorcycle including ignition are not impacted by this upgrade.

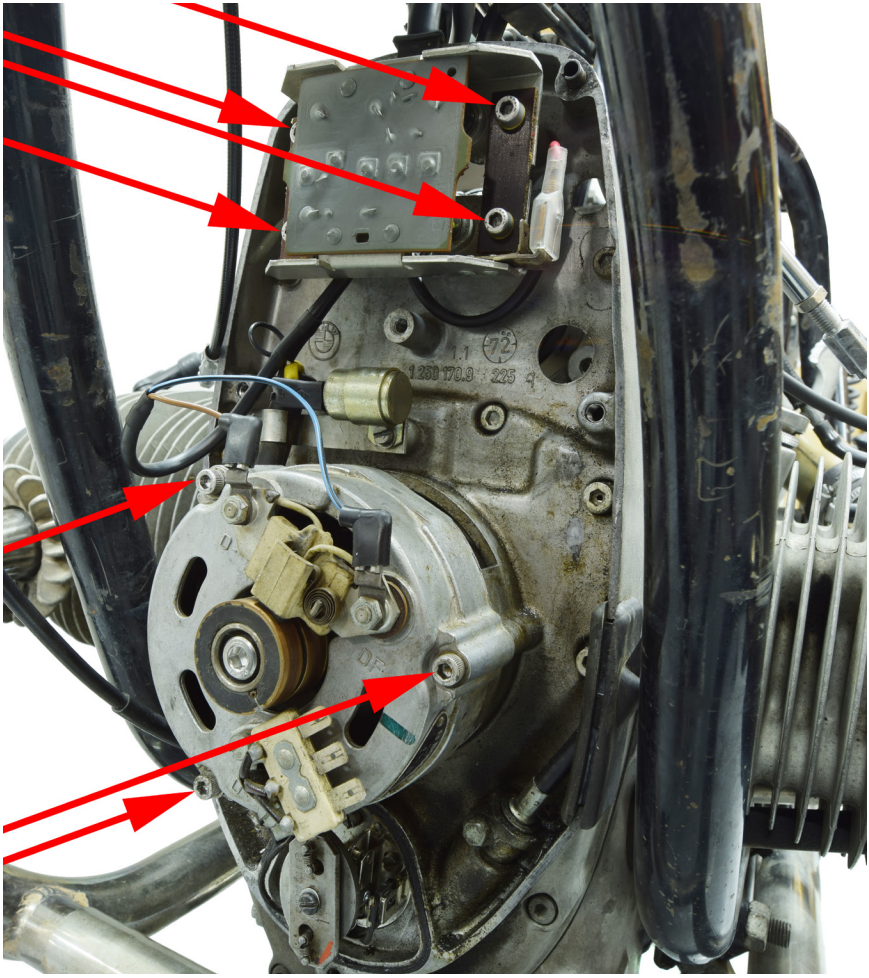
This system will still work well with a conventional AGM or Wet Acid battery, however the maximum voltage is 14.1 vs 14.3 volts.

Remove the Existing Charging Components

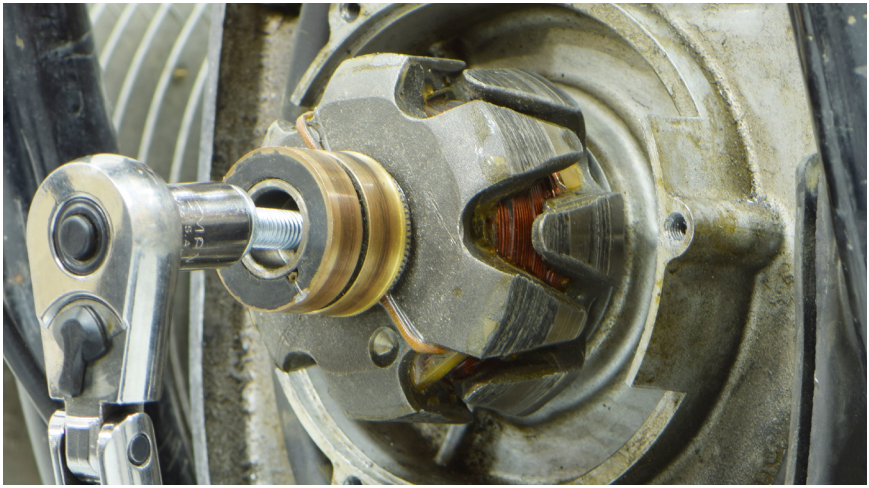
Remove the battery, any fairings, fuel tank, front engine cover, starter cover, and oil cooler.

- Remove and keep the 4 fasteners that secure the diode board.
- Remove the diode board and disconnect all wires.
- Remove the 3 fasteners that secure the alternator cover to the timing cover.

Disconnect all the electrical connectors from the alternator cover and remove the cover and stator as one unit. No need to unsolder any connections.

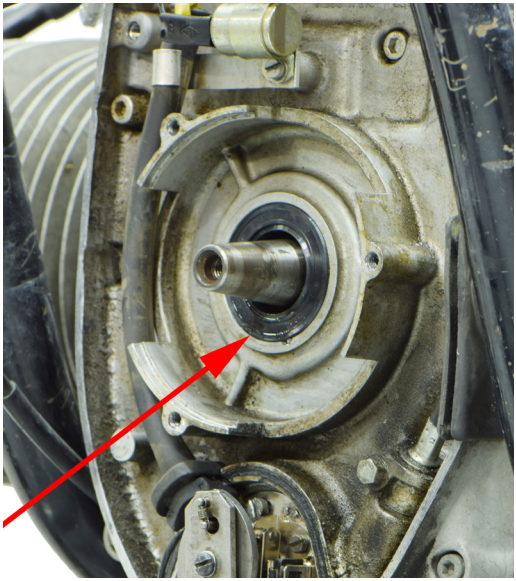


Remove the alternator rotor bolt. Place rotor removal tool into the rotor and tighten the tool.



Gently tapping the rotor with a rubber mallet after tightening the removal tool can assist in releasing the rotor from the crankshaft. The rotor can “pop” off the end of the crankshaft, so be prepared! You may need to put the transmission in gear to keep the engine from turning over during this process.

Once the rotor is removed it is time to inspect the oil seal on the crankshaft. A replacement is included in the kit as this is the best time to replace it. Note the orientation and depth so you do not drive the seal in too far.



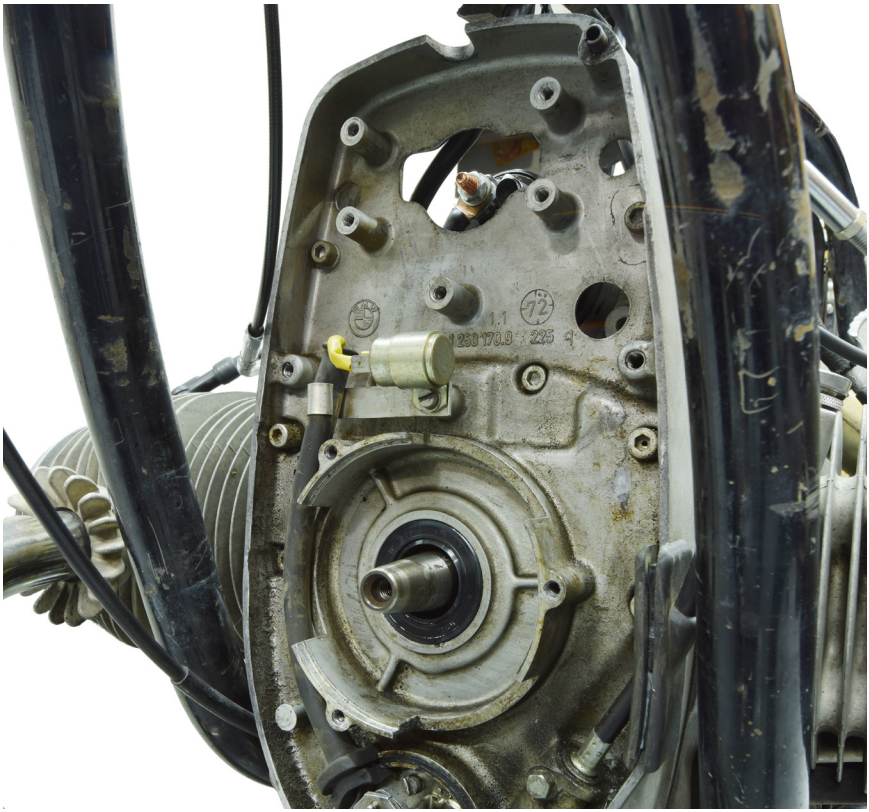
Removing the Front Engine Harness

There have been a few harness variations over the years. All the necessary wires to replace this harness are included in this kit.

Once you free the grommet from the top of the engine cover, follow the wires up to the voltage regulator and unplug the three pin connector.

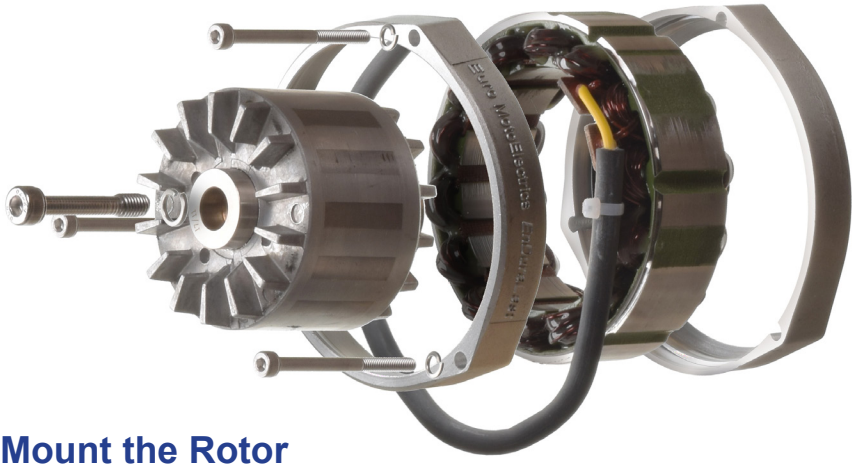
Take note of the remaining electrical connections made by this harness. Once you are doing the electrical installation you will see what connections are required.

The front of your engine should look similar to the pictue below depending on your Airhead model:



Assemble the Rotor and Stator

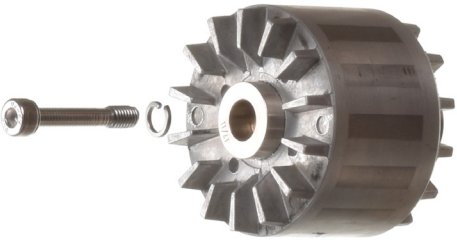
This is an exploded view of the alternator rotor and stator that will be assembled under the front engine cover.



Mount the Rotor

Now we are going to start assembly of our new high output alternator beginning with the rotor. Inspect and clean the nose of the crankshaft. Remove all remaining oil with alcohol on a clean cloth. Clean the inside of the alternator rotor of any remaining oil from the manufacturing process. *(The new rotor has a protective cap. Take care not to damage the lip of the arbor when removing it. You can easily blow it off with compressed air)* Now that both surfaces are clean and prepared, slide the new rotor onto the crankshaft. To confirm a clean interface, grasp the rotor and try turning it. If the rotor slips on the crankshaft, remove and clean again untill it grabs the crankshaft nose.

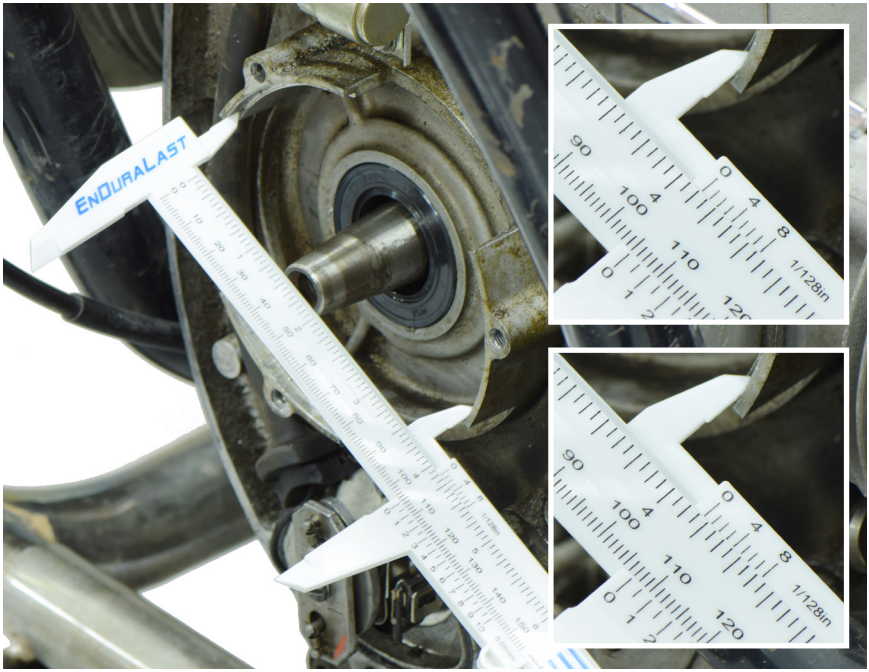
Secure the rotor in place with the included rotor bolt and lock washer with a torque setting of 14 foot pounds / 19 Newton meters.



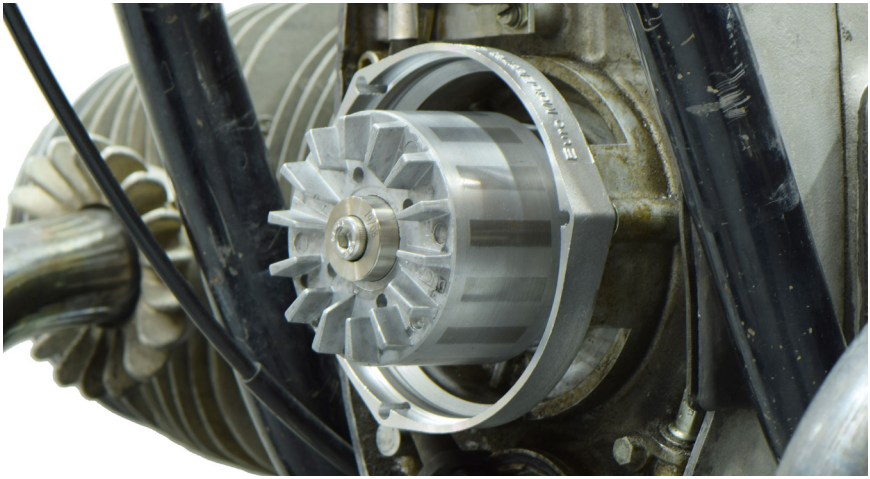
Mount the Stator

There are three stator rings included in the kit. One outer ring that is smooth and 2 inner rings with different sizes for the mounting lip. Use the included caliper to measure the inner stator rings as shown to distinguish between the 105mm and 107mm inner rings.

Measure the groove on the engine where the inner stator frame fits to determine which inner ring to install.

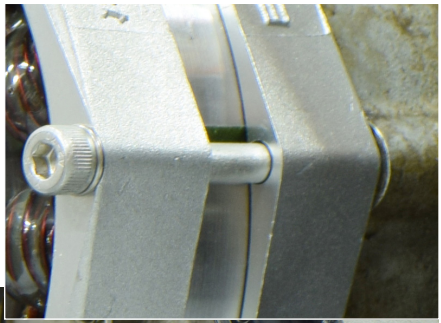


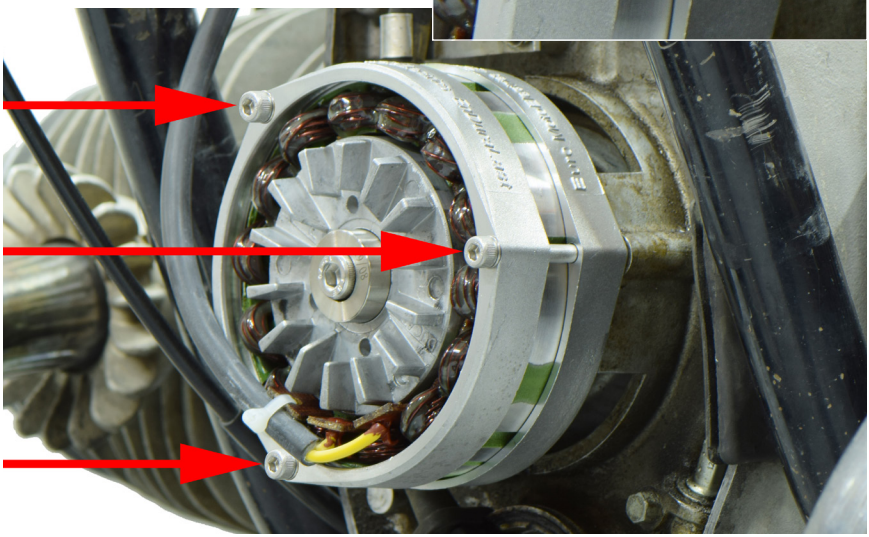
The seating of the inner stator frame into the timing chain cover machined grove is precise and tight! If there is ANY side to side movement or play in fitment, then you have selected the wrong inner ring.



Fit the stator and outer ring aligning of the cutouts on the stator body to allow the mounting bolts to pass through. Secure the entire assembly with the included bolts and lock washers.

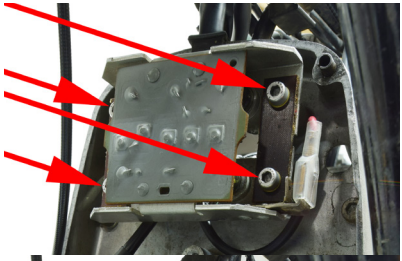
Take great care not to over tighten as you can strip the threads on your aluminum timing chain cover. It may be easier to install the stator with both rings as one pre-assembled unit. Verify the inner stator ring is seated tight to the engine.



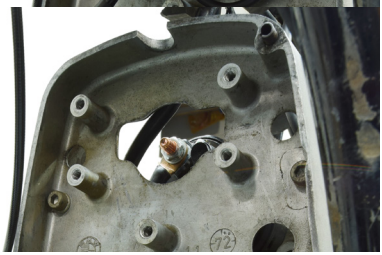


Regulator Rectifier Preperation

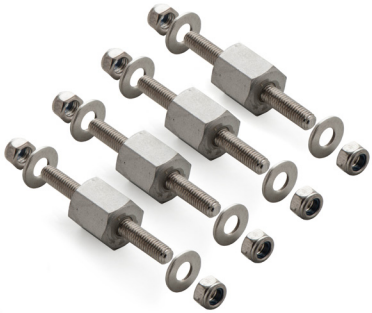
The new MOSFET Regulator Rectifier (R/R) has been designed to mount in the original location of the diode board. Extensive testing has been done to evaluate operating temperature and air flow in this location.



With the 4 mounting points and original diode board removed, take note if your model originally had solid mounting post's cast into the engine timing chain cover, or if isolating rubber bushes were used to secure the diode board.

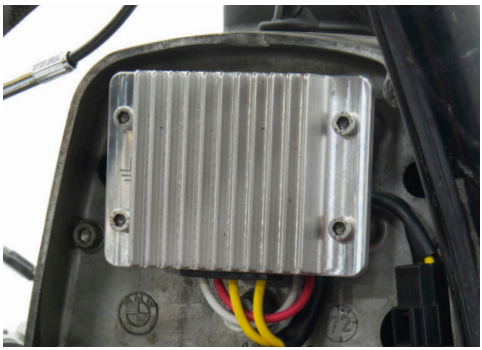


ONLY if you have a later model Airhead with rubber isolating diode board mounts, you will need to replace them with the enclosed solid diode board mounts. You may find it easier to remove the starter to access the lower mounting holes when converting to solid mounting posts. It is extremely important to make the conversion because the new R/R is a ground through the case. If you do not remove the rubber mounts, the system can fail, because the R/R has no ground connection.



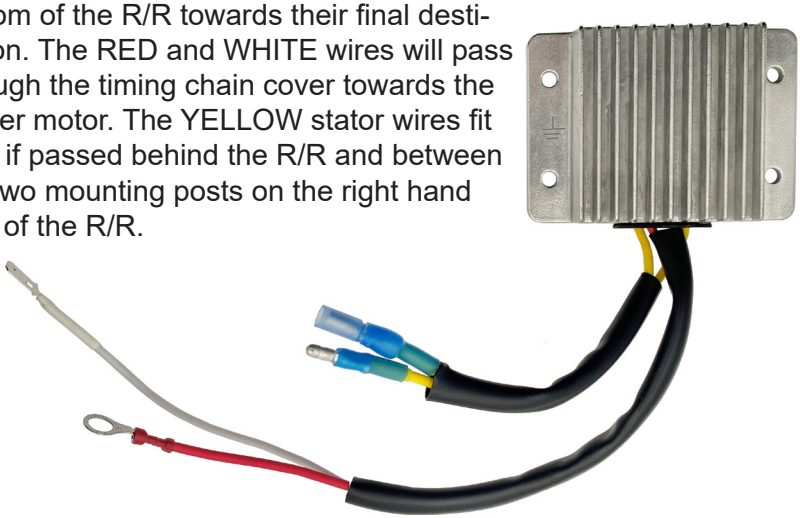
Mount the Regulator Rectifier

For earlier Airhead's use the included M5 bolts and lock washers in the same location as the original diode board bolts.



For later Airheads, the solid mounting studs are provided with washers and lock nuts to secure the R/R in place.

Take note to position the wires from the bottom of the R/R towards their final destination. The RED and WHITE wires will pass through the timing chain cover towards the starter motor. The YELLOW stator wires fit best if passed behind the R/R and between the two mounting posts on the right hand side of the R/R.



It is easy enough to pull the four bolts/nuts and re-route the wires if desired once everything is connected.

Remove the original voltage regulator (VR).

Early Airhead's have the VR mounted towards the front right hand side of the frame shown here on the top right. *If the original mechanical VR was replaced, it may look different than shown, but still mounted in the same location.*

Later Airhead's also have the VR mounted on the right hand side of the frame, located more in the middle under the tank and shown here on the bottom right.

The VR can be completely removed, and no longer required.

Install Electrical Wiring

There are many evolutions of the BMW Airhead's electrical system. The remainder of this guide is broken into these variations. The front engine harness variations define the installation variations. If you are unsure of your exact model you can enter your Vehicle Identification Number (VIN) in a website such as www.realoem.com to find the original manufactured month, year, and model.

This kit eliminates most of the need for cutting, stripping, crimping and soldering most wires. One variation across models is the generator light terminal which has two variations. *Note that the generator light is not needed for the system to function*

Some modifications or additional wiring may be needed depending on your specific installation. It is possible that your bike has been modified and does not look as described. Use your judgment or contact a professional installer for assistance.

The following pre-made wires are included with this kit and accommodates most installation variations.

HAR-4B
For /5 & /6.
Solenoid Ring Terminal /
Starter Relay

HAR-4C
For /5 & /6.
Solenoid Spade Terminal /
Starter Relay

HAR-4D
For Contact Points Ignition.
Ignition Condenser /
Coil Negative

HAR-4E
For /7 & Later.
Solenoid Spade Terminal /
Starter Relay

Please skip to the Electrical Installation section appropriate for your particular bike.

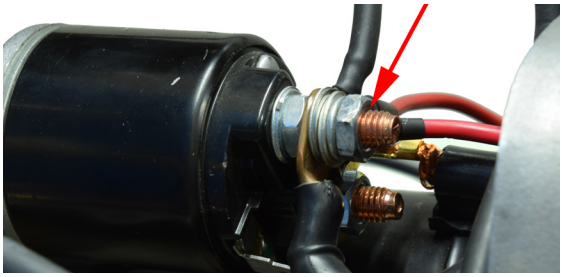
Customized Models

The increasing popularity of custom modified BMW Airheads is the driving need for this lithium battery compatible alternator. This is the highest output, most reliable, simplest, ideal solution for any custom built airhead! When paired with the crank mounted ignition system and a new EnDuraLast starter, the entire electrical system is upgraded to an extremely reliable, powerful, and trouble free solution.

Only the installation of the alternator is covered in this guide. We assume you have the remaining wiring completed or planned on your custom build with the help of a device such as a Motogadget or a custom wiring solution using relays.

The installation of this alternator is VERY simple! Mechanically the prior instructions still apply. Electrically there are only a few connections to make off of the R/R.

Connect the **RED** ring terminal to the starter solenoid positive terminal. This is the same terminal that has the battery positive cable connected to it.



Connect the **YELLOW** wires from the **R/R** to the **stator.**.

The generator light indicator is optional. Should you use a generator light on your build, this feed will supply voltage when the battery voltage is under 13 volts. Run this lead to the indicator light positive.

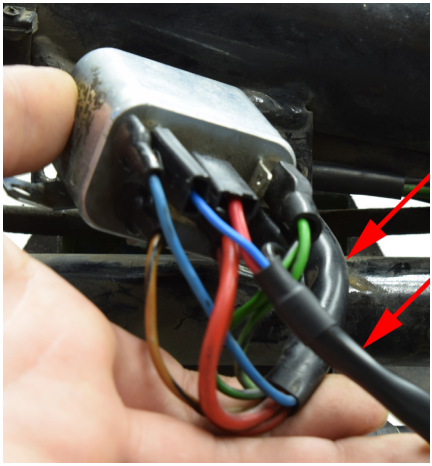
The use of this alternator is more complex when used on a BMW /5 series motorcycle because of the stock wiring architecture of the starter relay. The following modification can be done at your own discretion.

The /5 series uses a starter relay referred to as a “Cricket” relay. This relay is a safety feature on the motorcycle, and is located on the front left side of the center frame under the tank. The relay will prevent the starter from engaging while the engine is running. The starter button is the same as the turn indicator switch, it is easy enough to accidently press the button while using the turn indicators, especially when wearing riding gloves.

The relay (BMW # 12 41 1 350 775 with **SR9570** found on the front) identifies when the engine is running via the BLUE D+ wire. This is part of the rotor “Energizing Circuit”. This circuit is removed and is not replaced as part of this new alternator upgrade.

Unfortunately now the starter relay has no way of knowing if the vehicle is running, and will not start the bike. To restore the starter relay function to the bike, a new starter relay needs to be installed. In doing so remember, the safety feature of starter lock out will be removed! This modification should not be taken lightly as your safety is paramount to our company and your loved one’s.

The wires you will be using include **HAR-4C & 4D.** Start by freeing the starter relay removing the two screws holding the ears to the bike. Keep these fasteners as we will reuse them. Identify the two harnesses that lead to the starter relay. Both are identified in the image on the following page with red arrows. One will be the front engine harness which was removed earlier. The second will be part of the main chassis harness. Unplug the wires from the main harness which will be **RED, BLUE, BROWN, & GREEN.**

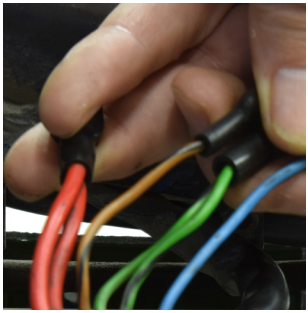


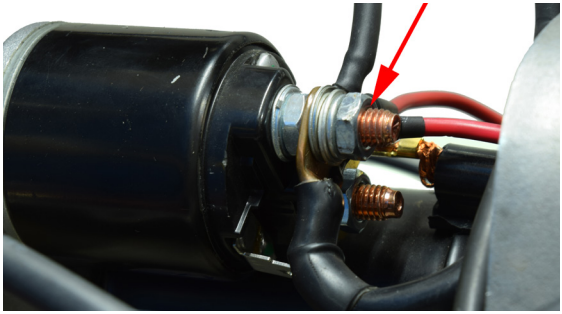
New Relay Installation

You now need to source a 12 volt 50 amp SPST *(Single Pole Single Throw)* relay.

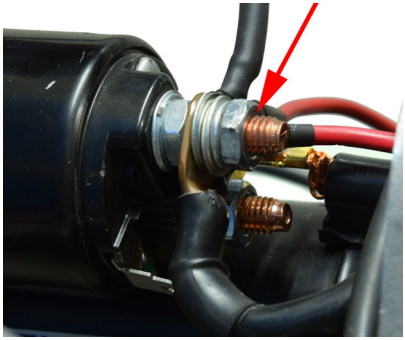
You can either purchase it from EME part # **REL-SPST50A**, or source from an auto parts supplier. It will have 4 pins numbered **30, 85, 86, 87**.

Not all relays have the same placement and orientation of the pins so you MUST confirm the terminal numbers on the specific relay you use and match them with these specifications.

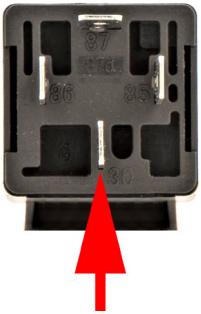




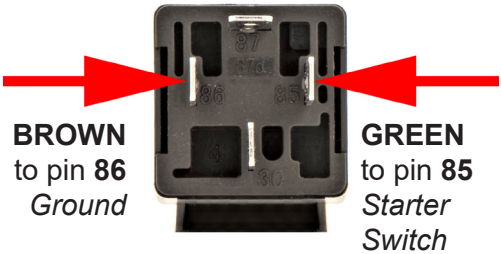
You will need to make a wire that will connect the double red wire from the chassis harness to battery voltage. *It will match HAR-4B however needs a male spade terminal instead of female.* This wire runs from the **starter solenoid positive terminal**, to the **double red wire** from the chassis harness. *This wire supplies voltage to power the bike.*



Run **HAR-4B** from the new starter relay terminal **30** to the **starter solenoid positive terminal**. *This will power the starter relay.*

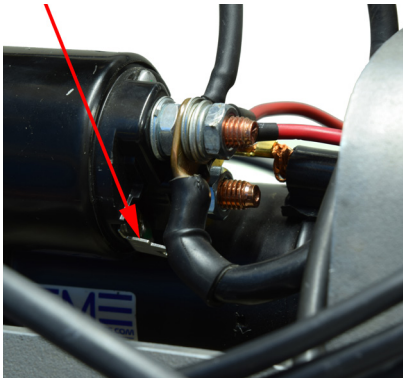


Connect from the main chassis harness:

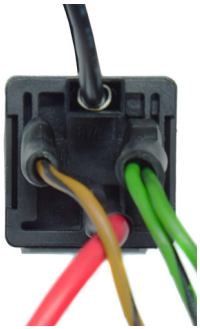


BROWN to pin **86** *Ground*

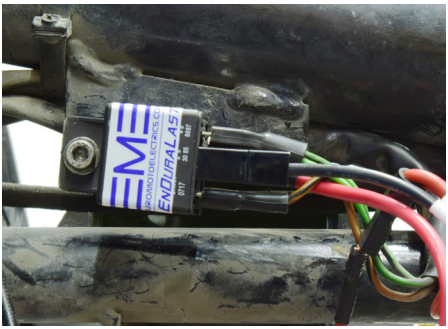
GREEN to pin **85** *Starter Switch*

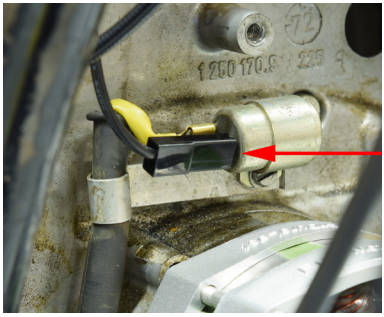
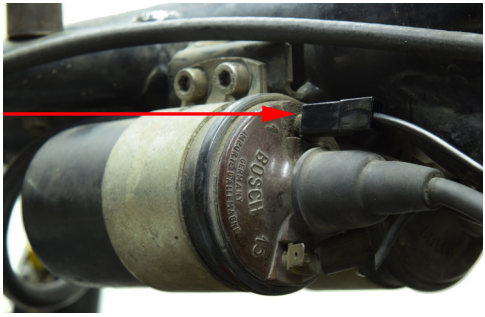


Run **HAR-4C** from the **starter solenoid spade terminal** to the new starter relay terminal **87**. *This will engage your starter when you press your starter button.*



The relay will now look like this and can be secured to the frame with one of the original relay mounting screws.

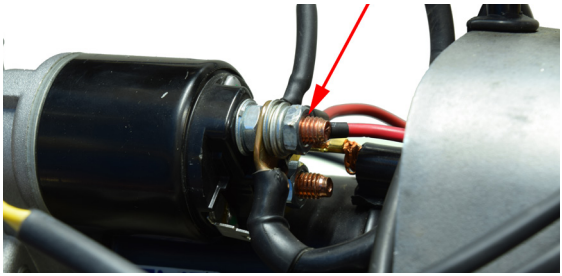


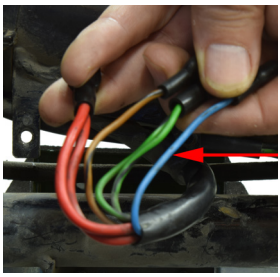
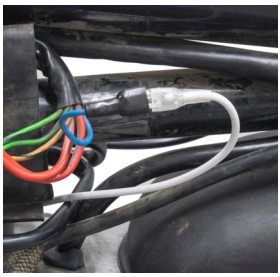
Run **HAR-4D** from the ignition **condenser** to the **coil negative** (terminal #1). This replaces the ignition wire that was part of the front engine harness.
Even if you are installing the EnDuraLast ignition system we recommended you install this wire. Cable tie the end by the coil to the trigger wire from the ignition module close to the coil. Then, should you ever need to revert back to contact point ignition, simply unplug the EnDuraLast ignition module and change the trigger wire at the coil!

Connect the **YELLOW** wires from the **R/R** to the **stator.**.

Connect the **RED** wire with the ring terminal FROM the R/R to the **starter solenoid positive** Terminal. *This is the same terminal that the battery positive cable connects to.*

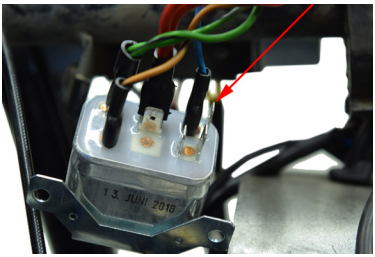


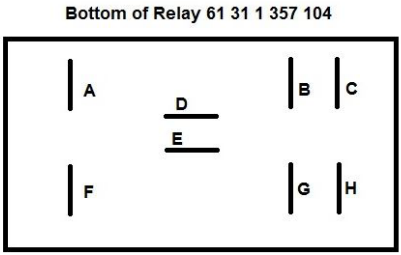
Connect the **WHITE** wire from the R/R to the **BLUE** wire coming out of the main chassis harness. *This wire is connected to the generator light in the headlight.*

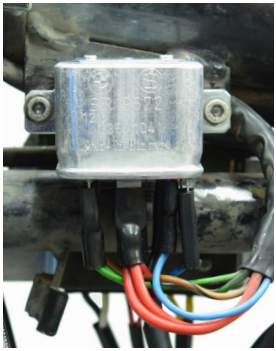
This is optional if you wish to maintain a generator indicator light.

The wires you will be using include **HAR-4A, 4B, 4C, 4D.**
The /6 starter relay BMW # 61 31 1 357 104 and the **SR9572** found on the front looks very much like the relay used on /5's. However it is VERY different. Now the D+ BLUE wires connected to the relay serve no function in the relay, it is simply a junction. Perhaps designed this way so BMW would not have to produce a new wiring harness when it moved away from the "Cricket" relay. Because of this, installation is much easier.



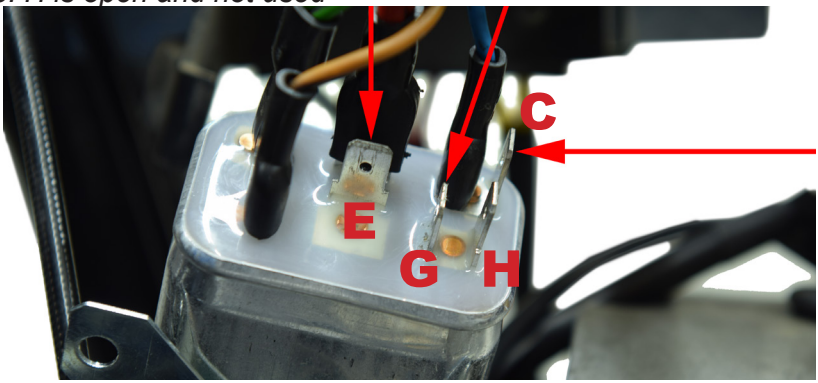


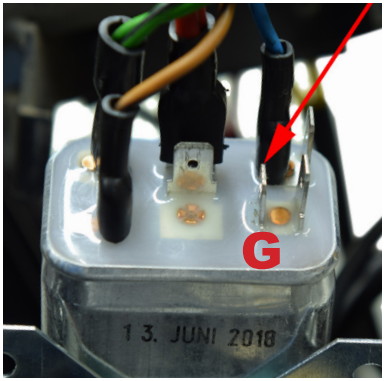
Detach the starter relay by removing the two screws holding the ears to the frame. Now you can comfortably access the terminals underneath it. *Keep the screws handy as you will reinstall the relay at the end.* Identify the terminals on the starter relay, disconnected when removing the front engine harness:

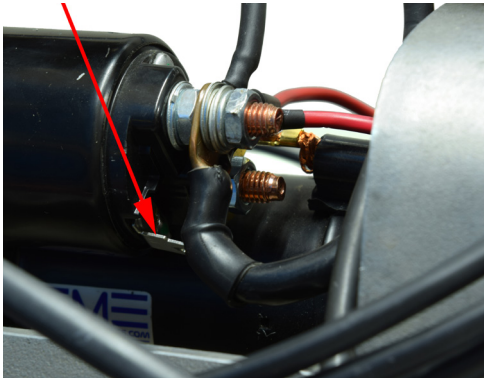


- **BLUE** wire from terminal **C**.
- **RED** wire from terminal **E**.
- **BLACK** wire going to terminal **G**.

note: H is open and not used

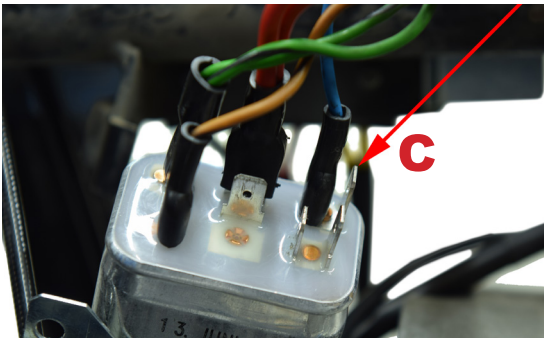


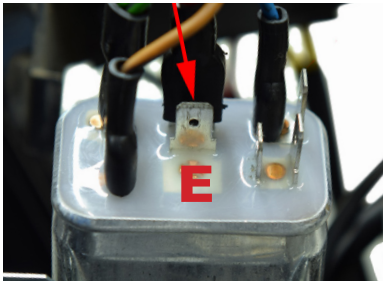


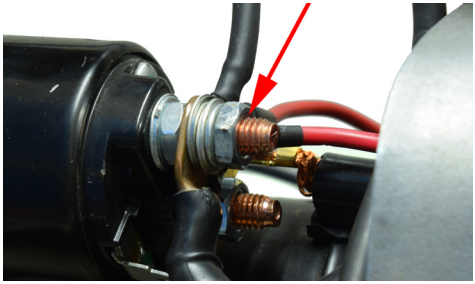


Install **HAR-4C** between the starter relay terminal **G** to the starter **solenoid spade terminal**. *This will engage your starter when you press your starter button.*

Connect the **WHITE** wire from the R/R to the starter relay terminal **C**. *This will restore the generator light function on your instrument cluster. You will have to change the terminal from Male to Female.*

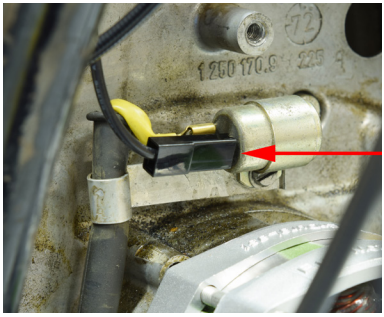


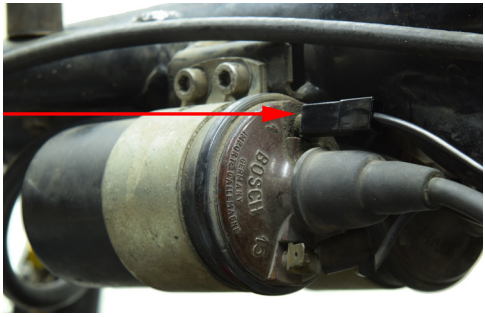




Install **HAR-4B** between the starter relay terminal **E** to the **starter solenoid positive** Terminal, where the battery positive cable connects too. This is what will restore power to the motorcycle.

Now you can fasten your starter relay back onto the frame.

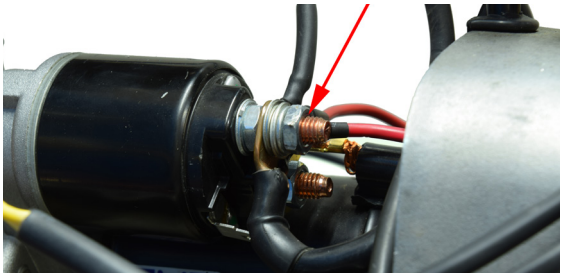




Run **HAR-4D** from the ignition **condenser** to the **coil negative** (terminal #1). This replaces the ignition wire that was part of the front engine harness.
Even if you are installing the EnDuraLast ignition system we recommended you install this wire. Cable tie the end by the coil to the trigger wire from the ignition module close to the coil. Then, should you ever need to revert back to contact point ignition, simply unplug the EnDuraLast ignition module and change the trigger wire at the coil!

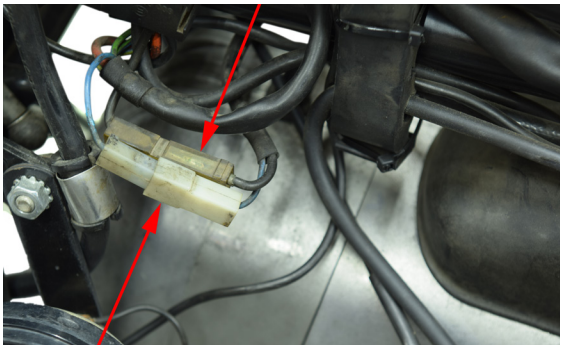
Connect the **YELLOW** wires from the **R/R** to the **stator.**.

Connect the **RED** wire with the ring terminal FROM the R/R to the **starter solenoid positive** Terminal. *This is the same terminal that the battery positive cable connects to.*

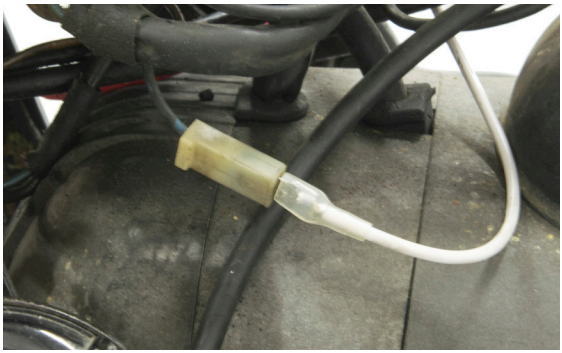


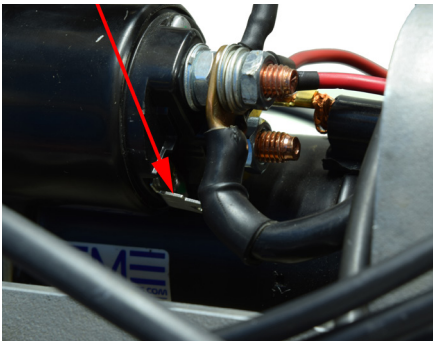
Airhead Models Up To 09/1978

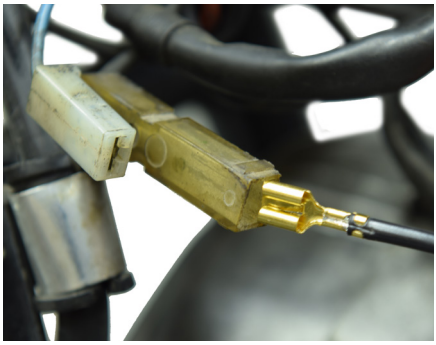
Identify the two connections from the now removed front engine harness, which terminated into two white plugs shown here.



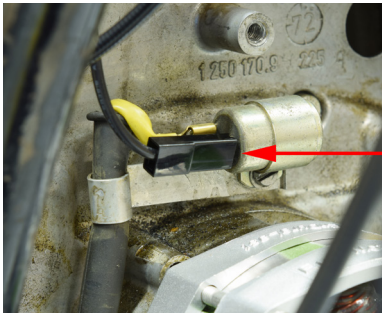
The **WHITE** wire from the **R/R** goes to the **BLUE** wire in the white plug. *This wire is connected to the generator light in the instrument cluster.*

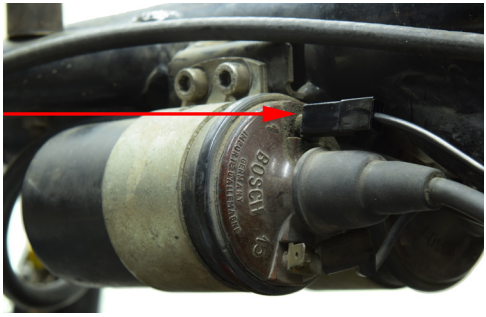






Run **HAR-4E** from the **Starter Solenoid Spade Terminal** to the **BLACK** wire in the white plug as shown. If your model does *not* have this plug, you will replace it with the bare connector into the relay block replacing the trigger wire for the starter. *This wire will trigger the starter when the start button is pressed and replaces the original wire when you removed the engine harness.*

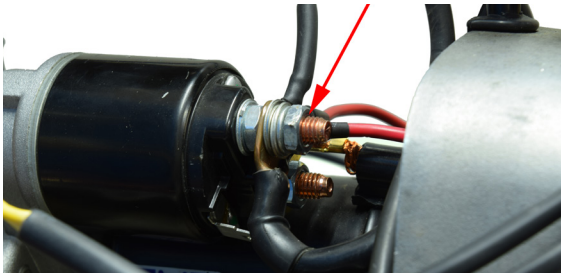




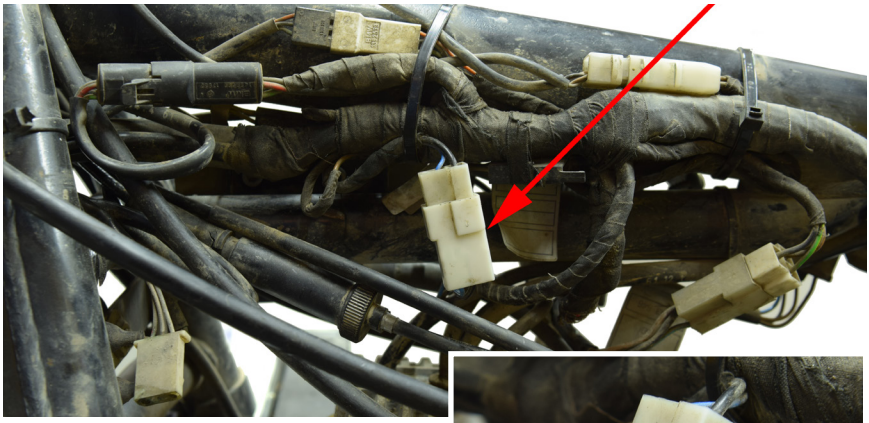
Run **HAR-4D** from the ignition **condenser** to the **coil negative** (terminal #1). This replaces the ignition wire that was part of the front engine harness.
Even if you are installing the EnDuraLast ignition system we recommended you install this wire. Cable tie the end by the coil to the trigger wire from the ignition module close to the coil. Then, should you ever need to revert back to contact point ignition, simply unplug the EnDuraLast ignition module and change the trigger wire at the coil!

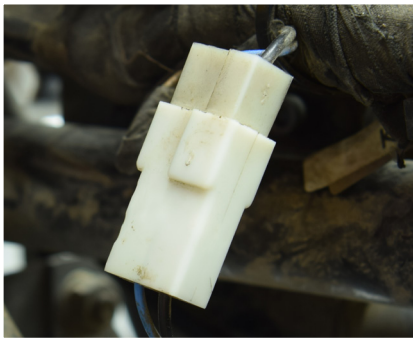
Connect the **YELLOW** wires from the **R/R** to the **stator.**.

Connect the **RED** wire with the ring terminal FROM the R/R to the **starter solenoid positive** Terminal. *This is the same terminal that the battery positive cable connects to.*



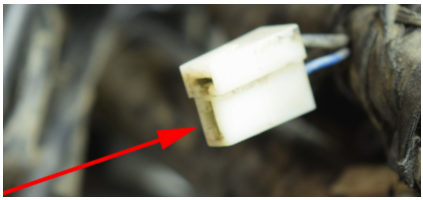
Airhead Models After 09/1978

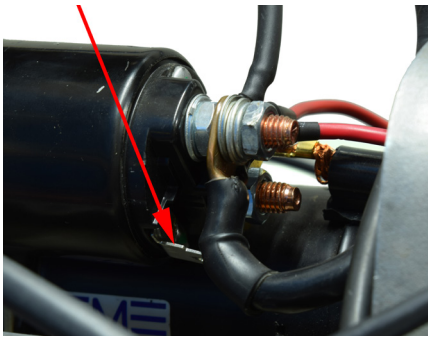


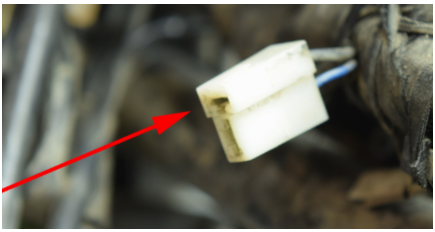


Identify the white plug on the left hand side of the chassis harness. It will have one **BLACK** and one **BLUE** wire entering it from the now removed front engine harness. *Take care when working with plastic connectors that are aged and brittle.*

The **WHITE** wire from the **R/R** goes to the **BLUE** wire in the white plug. *This wire is connected to the dash generator light*

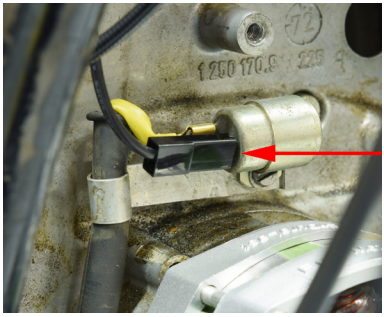


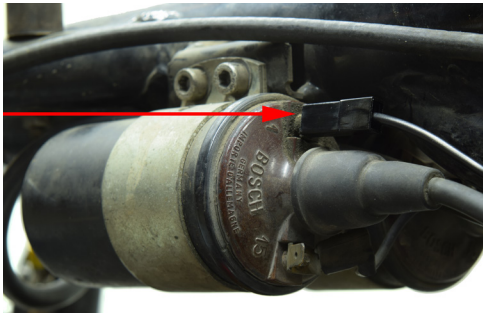




Run **HAR-4E** from the **starter solenoid spade terminal** to the **BLACK** wire in the plug.

This wire will trigger the starter when the start button is pressed and replaces the original wire removed with the engine harness.

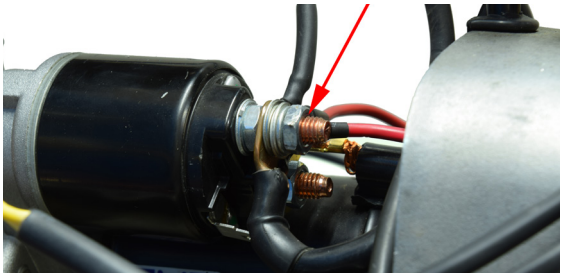




Run **HAR-4D** from the ignition **condenser** to the **coil negative** (terminal #1). This replaces the ignition wire that was part of the front engine harness.
Even if you are installing the EnDuraLast ignition system we recommended you install this wire. Cable tie the end by the coil to the trigger wire from the ignition module close to the coil. Then, should you ever need to revert back to contact point ignition, simply unplug the EnDuraLast ignition module and change the trigger wire at the coil!

Connect the **YELLOW** wires from the **R/R** to the **stator.**.

Connect the **RED** wire with the ring terminal FROM the R/R to the **starter solenoid positive** Terminal. *This is the same terminal that the battery positive cable connects to.*



Final Reassembly

To ensure ease of future service, we highly recommend that all fasteners be thoroughly cleaned and the appropriate torque applied. With the ignition switch still off and transmission in gear turn rear wheel while you watch the rotor to ensure that it runs true and straight in-line with the stator without touching. Review all work done during the installation process. Ensure that all components are mounted correctly and securely. Check all wiring to make sure that the components are connected properly and that wires are routed to avoid pinching, binding, rubbing and secured with cable ties.

Reinstall the front engine cover, starter cover, fuel tank, and all remaining components removed to restore the bike to operating condition. Reinstall the battery, and clean the terminals to ensure a solid connection to the battery cables. With this system installed there is no longer any risk of shorting out electrical components when removing/installing the engine front cover. Therefore you no longer need to worry about disconnecting the battery before working with the front cover.

Start the motorcycle. While the engine is running, connect a voltmeter across the battery terminals to check for charging voltage. Watch for voltage at the battery terminals to increase with RPM's.

After confirming correct operation of your new charging system, verify everything is reassembled properly and it is safe to ride.

Variations

A popular modification to Airheads is adding a spark plug to each head (Dual Spark) conversion. If this is done on your model, the coil configuration will look different from the original shown in this guide. All that is needed is to note the coil positive and negative and connect your configuration to match the directions when identifying coil positive and coil negative.

Aftermarket ignition systems are also a popular modification. You may not have the original contact point, condenser configuration. If so, reconnect the original ignition system as originally installed. The ignition system has no impact on the charging system other than some wires may be included in a shared harness assembly.

Trouble Shooting

With this new alternator, there are 4 possible failures.

1. The rotor is permanently magnetized, failure is rare.
2. The stator is very robust, failure is also rare, You can test for continuity between the two yellow leads on the stator, **and** verify there is no continuity to ground.
3. The R/R is the susceptible to failure however, each one is computer tested at the factory to ISO standards. The reason(s) why this regulator would fail is because of heat often caused in 3 ways;

   A. The battery used is aged and sulfated to the point where it will not accept a charge. This added resistance presented to the R/R will cause it to heat up, much like a light bulb heats up.

   B. The normal heat generated by the R/R cannot be dissipated. Thorough stress testing and measurements have been done with the R/R mounted in the original diode board location. Note that /5's have the least amount of ventilation on the front engine cover. You can mount the R/R externally, extending the wires, if this concerns you.

   C. The R/R ground connection is not solid or intermittent. This is a case of resistance to ground needs to be as low as possible. A solid ground strap is a great preventative measure you can add.
4. The battery is aged or sulfated and not able to accept a charge. We recommend having a load test performed to your battery at the start of every season. This system is very reliable however it cannot over compensate for an aged or sulfated battery.

Do not overload the system! Please review the wattage demands of all additional accessories before installation and use. To increase the reliability of the charging system, there should be a 10-20% buffer margin between demand and output capacity at your engine operating speed. *(Refer to the charging system output chart on page 2.)* Total power demand should NEVER exceed the power capacity of the system.

Complete your setup with the EnDuraLast crank mounted ignition system! Specifically designed for this EDL4Li alternator utilizing a custom pickup configuration with a HALL sensor and full digital advance curve derived from the crankshaft RPM's. Preprogrammed advance curves for stock or dual spark modified configurations.

EnDuraLast

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