Buell 1125r - Rotor and Stator Replacement

A collection of documentations, by TMB
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Feedback please to tmb//at//nginet//de or put directly into the document using the “add comment” feature.

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Sources

Buell Service Manuals
http://www.ukbeg.com/downloads.php

BadWeatherBikers
Stator/Voltage Regulator/Charging System subforum

TwinMotorCycles
http://www.twinmotorcycles.nl

Before you decide to replace

Buell 1125R & 1125CR Stator Test
https://youtu.be/oag9bKcJUM0

XBORG Forum

Sinnvoll wäre noch der Zusatz ... Rotax Motoren ab 2009 ...

Mir ist keine 2008er (blauer Rahmen mit Limaproblemen bekannt.

XBorg Forum

Problem:

- Der Stator der 1125 Rotax Motoren brennt durch

Lösungen (bis jetzt):

- Harley Davidsons „Kabelupdate“
- Ölbohrung
- Compu-Fire Lima Regler

Probleme

Warum brennt der Stator durch? Muss ein besserer Stator her?

Das Problem ist nicht der Stator selbst, sondern der Lichtmaschinenregler aka Spannungsregler/ Gleichrichter/ Regulator/ Rectifier.

Der originale LiMa-Regler der 1125er Rotax ist ein Shunt(Kurzschluss)Regler. Der LiMa-Regler schließt die Phasen des Stators kontrolliert kurz, um bei zu viel angelieferter Leistung das Bordnetz zu schützen.

Das Stator erhitzt und brennt durch.

Lösungen

Harley Davidsons „Kabelupdate“ war gepfusche. Per Relais wird eine Phase des Stators lahmgelegt, die Leistung sinkt, der LiMa-Regler muss nicht per Kurzschluss den Stator drosseln. Folge ist, dass nicht genug Leistung da ist die Batterie zu laden. Man hat also neue Probleme, so wie die ersten 1125er Motoren mit der schwächeren LiMa, die bei viel Stadtverkehr die Batterie nicht auflädt.

Empfehlung: Wieder ausbauen.

Ölbohrung

Die Ölbohrung am Rotor und die damit einhergehende Kühlung hat geholfen das Problem später oder nicht auftreten zu lassen. Sie ist in jedem Fall empfehlenswert.

Empfehlung: Bohrung am Rotor machen lassen

Compu-Fire 55402

Der Compu-Fire LiMa-Regler hat Besserung versprochen. Das hat allerdings nicht immer gut funktioniert, weil der Compu-Fire Regler mit hohen Drehzahlen wie sie bei unseren 1125er Motoren auftreten nicht zurecht kam, und die Batterie überladen wurde, was wiederum auch zu neuen Problemen führt.

Empfehlung: Neuer Regler ja! Welcher? Darum gehts hier!

Was hilft dauerhaft?

Der original LiMa-Regler der 1125er ist ein Shunt-Regler (Kurzschlüsse zur Leistungsdrosselung).

Wir brauchen also einen Längsrichter LiMa-Regler, welcher keine Kurzschlüsse verursacht, sondern einzelne Phasen öffnet, was zu einer deutlichen Entlastung des Stators führt. Unsere hohen Drehzahlen muss er auch verkraften.

Aktuell ist ein guter verfügbar, und zwar der Shindengen SH847. Das ist der LiMa-Regler aus der Suzuki V-Strom 1000 ab 2014. Bekommen könnt ihr den unter anderem hier:

https://mtp-racing.de/WE-Spann…gler-Laengsregler-SH847AA

Auf Dauer fahren wir also wie folgt ohne Probleme:

- Rotor mit Ölbohrung
- Längsrichter LiMa-Regler (Shindengen SH847) direkt mit der Batterie verbunden 30A abgesichert

Das sind Informationen die ich ohne große Detailtiefe zusammengetragen habe. Hier sind die Quellen dazu für diejenigen, die es genau nachlesen möchten

- upgrade auf MOS FET-Regler hat keine Besserung gebracht, da auch diese Regler Shunt-Regler sind hildstrom.com/projects/buellregulator
- sehr detaillierte Infos zu LiMa-Reglern (Shunt/MOS FET Shunt/Längsregler) und warum Shunt Regler problematisch sind, inklusive Wärmebildkamera Aufnahmen wichtig ist Seite 2 triumphrat.net/speed-triple-forum/104504-charging-system-diagnostics-rectifier-regulator-upgrade.html

Ich baue demnächst um, ich fahre mit Kabelupdate, meine Batterie ist andauernd leer. Auf jeder Fahrt kann man zusehen, wie die Spannung fällt.

Ich hoffe das hilft einem von uns mal bei Problemen.

Gruß boggie

In case you have to replace

TwinMotorCycles - TM1125StatorKit
http://www.twinmotorcycles.nl/webshop/artikel.asp?guid=YXHFSC&aid=5320&cid=0&s=stator%20fix&a=&aname=TM_Buell_1125RCR_09-10_burned_stator_fixing_kit

Comment by TMB: I ordered this one, but no warranty is provided if you place it in yourself. I'll post a report about my experience once I am done with the replacement.

Motek
http://xborgforum.de/showthread.php/18226-Firma-Motek-und-Lichtmaschine?highlight=motek

Comment by TMB: Motek provides you with a 2-year warranty.

Discussion about Motek and TwinMotorCycles Updates

http://xborgforum.de/showthread.php/20087-Twinmotorcycles-Rotor-Upgrade/page3?highlight=motek

Buell Service Manual

ALTERNATOR 7.10

REMOVAL AND DISASSEMBLY

PART NUMBER	TOOL NAME
B-48857	ALTERNATOR ROTOR REMOVER
B-48858	CRANKSHAFT LOCKING TOOL

Rotor

1. Drain the engine oil.
2. Remove the seat.

⚠WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

3. Remove the negative battery cable.
4. Separate the stator connector [46] pin and socket housings.

NOTE

Remove the wire terminals from the socket housing and tape a length of mechanics wire to the leads. Lubricate the leads with silicon spray and guide the leads through the engine wire harness support.

5. Remove the CKP sensor. See 7.18 CRANKSHAFT POSITION SENSOR (CKP), Removal.
6. Remove the ignition cover. See 3.11 ALTERNATOR SIDE, Ignition Cover.

NOTE

To remove the flywheel crankshaft nut, it will be necessary to remove the plug for the crankshaft locking tool.

7. Remove the plug and lock the crankshaft with the CRANKSHAFT LOCKING TOOL (Part No. B-48858).
8. Remove the flywheel crankshaft nut.
   a. Use a hot air gun at 500 °C (932 °F) to soften threadlocker.
   b. With a breaker bar, turn nut back and forth to clean threads of threadlocker.
   c. Remove crankshaft nut.
9. See Figure 7-32. Fit the end cap to the crankshaft and thread the ALTERNATOR ROTOR REMOVER (Part No. B-48857) onto the flywheel hub. Turn the forcing screw to remove the rotor from the crankshaft splines.
10. See Figure 7-33. Remove the starter gear from the rotor assembly.
11. Remove the six hex key bolts to remove the rotor from the sprag clutch housing.

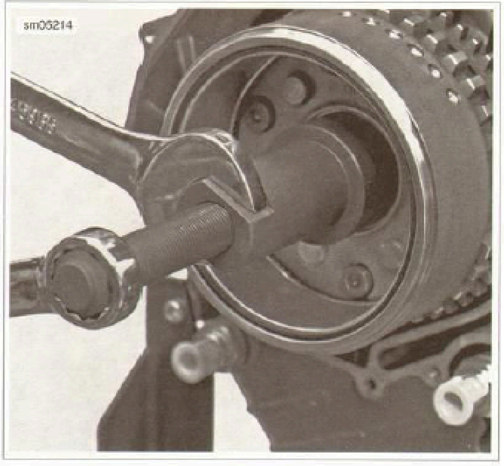
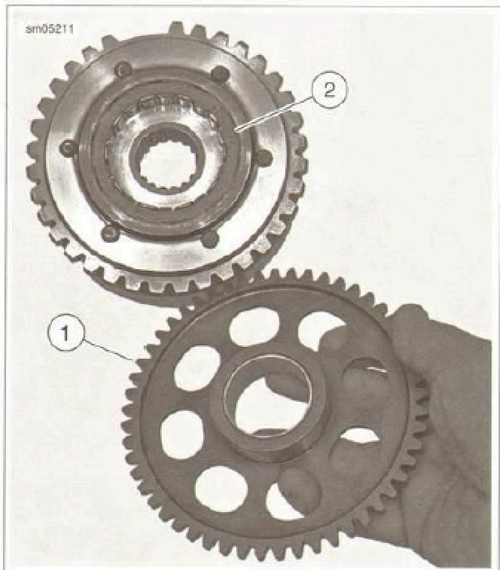


Figure 7-32. Alternator Rotor Remover



1. **Starter gear**
2. **Sprag clutch**

Figure 7-33. Sprag Clutch on Rotor and Starter Gear

Stator

1. See Figure 7-34. Remove the stator wire harness from the clip on the top of the ignition cover.
2. See Figure 7-35. Remove the two screws (1) securing the cable holder (2).

7-18 and 3.11 can be further down in this document

3. Remove the three screws (3) securing the stator to the ignition cover.
4. Slide the rubber seal (4) out of the slot in the ignition cover.

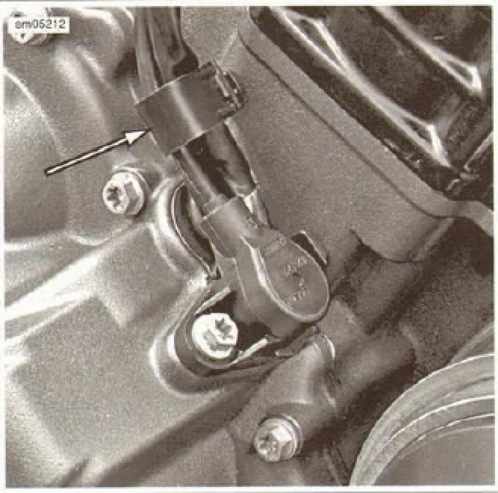
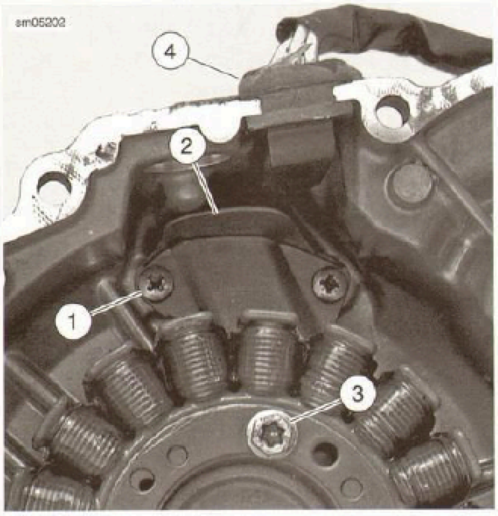


Figure 7-34. Stator and CKP Sensor Wire Harness Clip



1. **Screw**
2. **Cable holder**
3. **Screw**
4. **Seal**

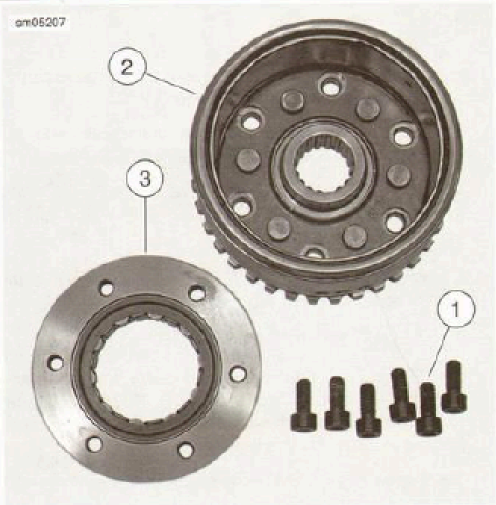
Figure 7-35. Stator

ASSEMBLY AND INSTALLATION

PART NUMBER	TOOL NAME
B-48858	CRANKSHAFT LOCKING TOOL

Rotor

1. Apply LOCTITE 648 (green) to the sprag clutch fasteners.
2. See Figure 7-36. Install the six hex key fasteners (1) through the rotor (2) into the sprag clutch housing (3).
3. Tighten to 30 Nm (22 ft-lbs).
4. See Figure 7-37. Fit starter gear to sprag clutch and rotate slightly until starter gear hub drops into sprag clutch.
5. See Figure 7-38. Match the double tooth spline on the crankshaft with the gap in splines in the rotor hub and slide the rotor hub onto the crankshaft.
6. Rotate the starter gear and the freewheeling gear until the teeth mesh.
7. Clean the threads of the crankshaft and the crankshaft nut.
8. Apply LOCTITE 648 (green) to threads of crankshaft nut.
9. Install the crankshaft nut.
10. Tighten to 280-290 Nm (207-214 ft-lbs).
11. Remove the CRANKSHAFT LOCKING TOOL (Part No. B-48858).
12. Install the plug and tighten to 15 Nm (11 ft-lbs).



1. **Fasteners**
2. **Rotor**
3. **Sprag clutch housing**

Figure 7-36. Alternator Rotor/Flywheel

Figure 7-37. Rotate Starter Gear to Fit Sprag Clutch

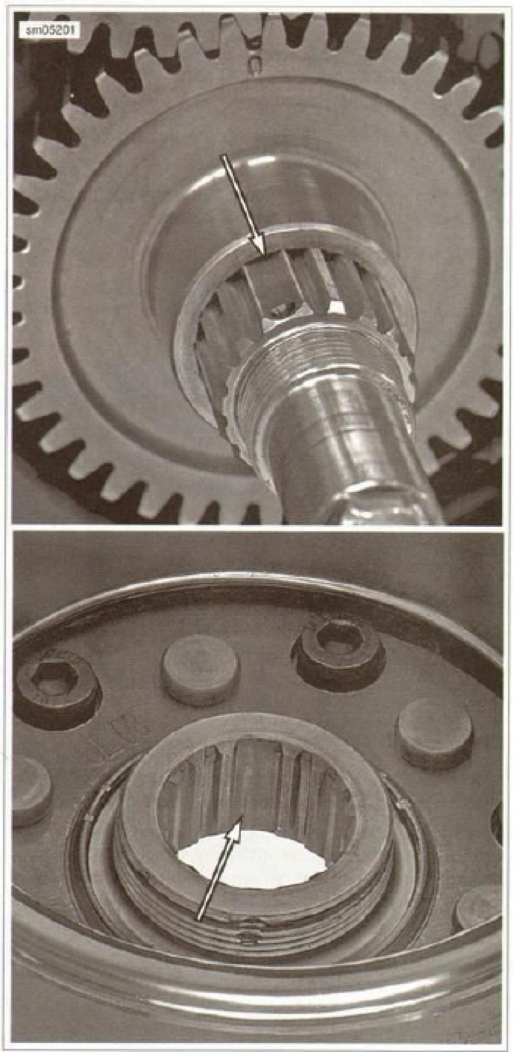


Figure 7-38. Crankshaft Spline Double Tooth and Gap in Splines in Rotor

Stator

1. See Figure 7-39. Fill groove of rubber seal (2) with H-D HIGH-PERFORMANCE SEALANT, GRAY (Part No. 99650-02) and slide into groove in the ignition cover.
2. Apply LOCTITE 243 (blue) to the threads of the three shouldered flange bolts.
3. Install the flange bolts through the stator into the ignition cover and tighten to 11 Nm (97 **in-lbs**).
4. Apply LOCTITE 243 (blue) to the threads of the two cable cover fasteners.
5. Install the cable cover over the stator cable with the fasteners.
6. Tighten to 4 Nm (35 **in-lbs**).
7. Install the ignition cover. See 3.11 ALTERNATOR SIDE, Ignition Cover.
8. Wrap the stator leads around the mechanics wire and lubricate with silicon spray.
9. Pull the stator leads through the engine wire harness support and install the socket terminals and join the stator connector [46] pin and socket housings.
10. Cable strap the stator wire harness to the engine and main harness under the seat.

NOTE

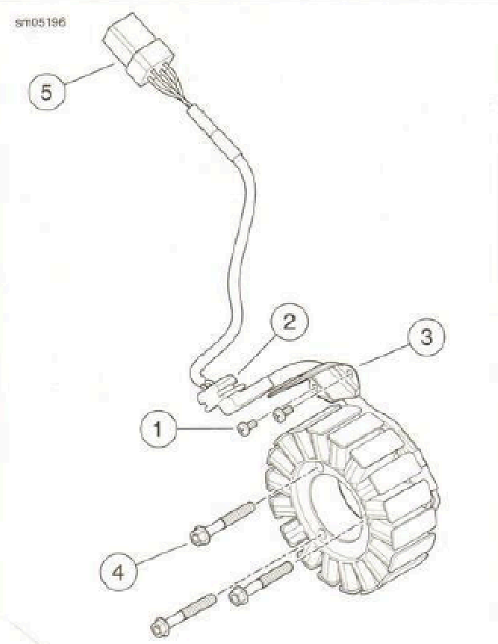
If removed, install the muffler. See 4.7 EXHAUST SYSTEM, Muffler: Installation.

11. Connect the negative battery cable.

⚠WARNING

After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

12. Install the seat.
13. If drained, fill with engine oil.



1. **Cable holder fasteners**
2. **Rubber seal**
3. **Cable holder**
4. **Shoulder bolts**
5. **Stator connector [46]**

Figure 7-39. Stator Assembly

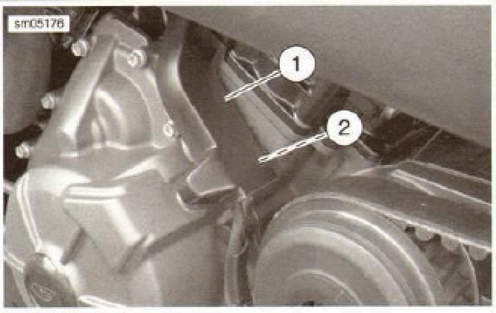
REMOVAL

1. Remove seat.
2. Remove the battery fuse.
3. Remove the sprocket cover.
4. See Figure 7-90. Lift up the engine wire harness support.
5. See Figure 7-91. Open wire clamp (3) to release the sidestand sensor and neutral indicator switch leads.
6. Remove fastener (1) securing the CKP sensor (2). Carefully remove CKP sensor and O-ring from engine crankcase.
7. Remove the rubber bands securing the CKP lead in the support channels.
8. Pull the CKP lead from the rear and center engine wire harness support channels.

NOTE

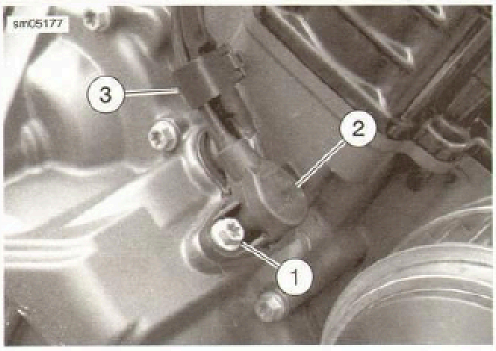
The engine must be rotated to disconnect the CKP from the engine harness. See 3.4 ENGINE ROTATION.

9. See Figure 7-92. Remove the radiator shroud to access the CKP connector [79].
10. Disconnect the CKP connector [79] from engine harness.



1. **Engine harness support**
2. **CKP (hidden)**

Figure 7-90. Crank Position Sensor (CKP) Location



1. **Fastener**
2. **CKP**
3. **Wire clamp**

Figure 7-91. Crank Position Sensor (CKP)

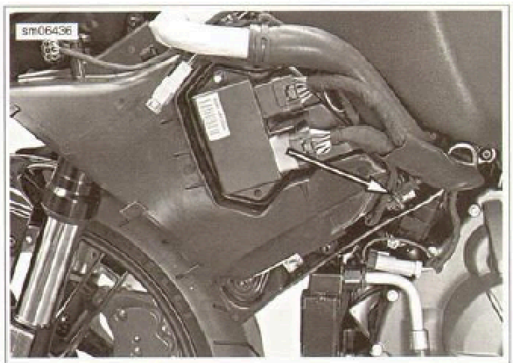


Figure 7-92. CKP Sensor Connector [79]

INSTALLATION

1. Inspect CKP O-ring and replace if necessary. Apply a light coat of engine oil to the CKP O-ring.
2. See Figure 7-93. Install the plastic wire clamp (3) on the CKP lead.
3. Secure the sidestand sensor lead in the wire clamp.
4. Carefully install CKP and O-ring (1) into engine crankcase along with the wire clamp.
5. Install and tighten fastener to 11 Nm (97 **in-lbs**).

OIL FILTER

NOTE

Determine if the oil filter cartridge is to be replaced according to the service interval. Refer to Table 1-1.

1. See Figure 3-135. Remove the two fasteners to remove the oil filter cover.
2. Drain the oil from the filter and remove the filter from the cover.
3. Clean inside the oil filter recess in the crankcase. Remove any debris.
4. See Figure 3-136. Apply a light film of clean engine oil to a **new** O-ring and fit the O-ring to the cover.
5. See Figure 3-137. Push a **new** oil filter into the cover until it seats.
6. See Figure 3-138. Apply a light film of clean engine oil to the rubber seal on the filter.
7. Install the filter (rubber seal first) into the crankcase.
8. Install the cover and tighten the fasteners to 11 Nm (97 **in-lbs**).

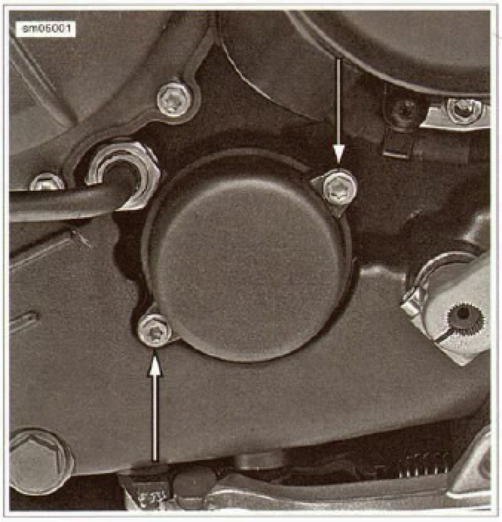


Figure 3-135. Oil Filter Cover Fasteners

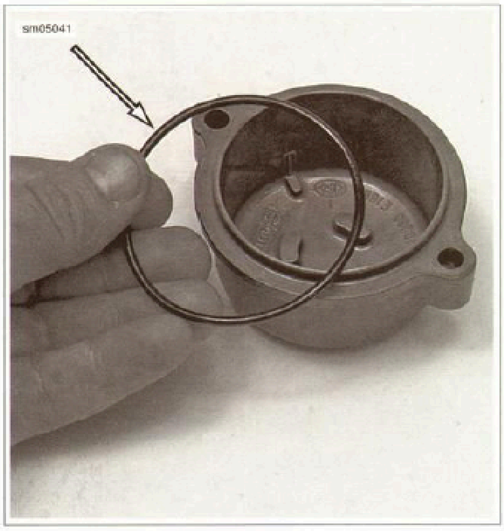


Figure 3-136. Oil Filter Cover O-ring

Figure 3-137. Oil Filter and Cover

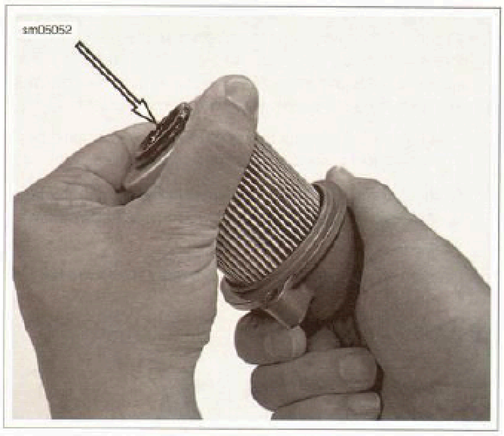


Figure 3-138. Rubber Seal

PRESSURE RETAINING VALVE

See Figure 3-139 and Figure 3-140. Tighten to 30 Nm (22 ft-lbs).

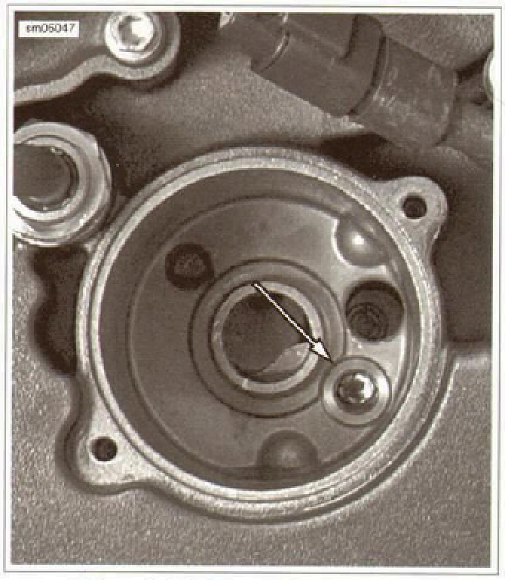


Figure 3-139. Pressure Retaining Valve

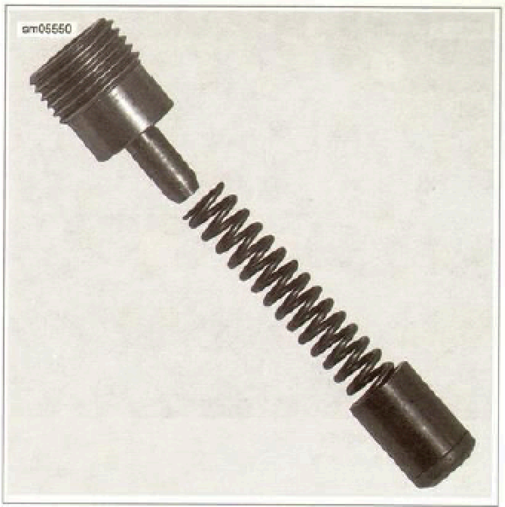
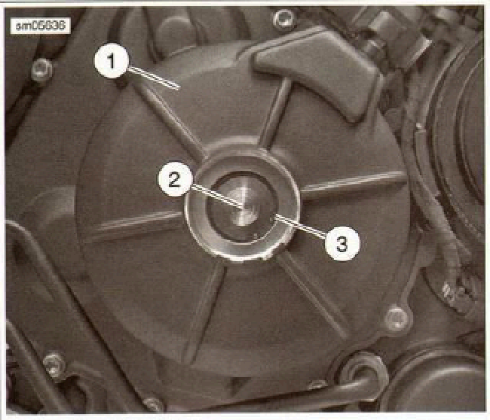


Figure 3-140. Pressure Relief Valve

SEALING SLEEVE

1. See Figure 3-141. Remove ignition cover plug.
2. See Figure 3-142. Remove retaining ring (3) securing sealing sleeve (2).
3. See Figure 3-143. Remove sealing sleeve. Discard O-ring.
4. Coat **new** sealing sleeve O-ring with a thin layer of clean engine oil. Install sealing sleeve.
5. See Figure 3-142. Install retaining ring (3).
6. Install ignition cover plug.

Figure 3-141. Ignition Cover Plug



1. **Ignition cover**
2. **Sealing sleeve**
3. **Retaining ring**

Figure 3-142. Sealing Sleeve Retaining Ring

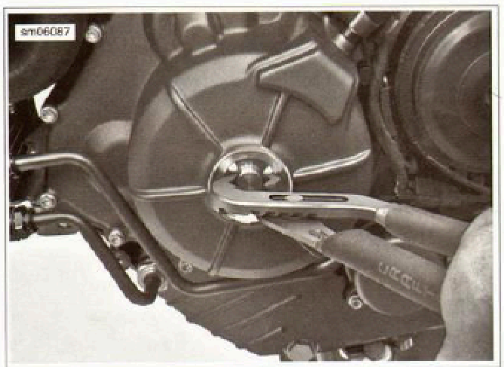


Figure 3-143. Sealing Sleeve Removal

IGNITION COVER

PART NUMBER	TOOL NAME
HD-45340	GASKET ALIGNMENT DOWELS

Removal

1. Remove the seat and pillion.

⚠WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

2. Disconnect the negative battery cable.
3. See Figure 3-144. Under the seat, separate the stator connector [46] pin and socket housings.

NOTE

See Figure 3-145. The wire terminals can be removed from the connector socket housing and taped to a length of mechanics wire to guide the leads through the engine wire harness support. Lubricate the stator lead with silicon spray.

4. See Figure 3-146. Pull the engine harness support back from the CKP sensor and remove the fastener.
5. Remove the CKP sensor and wire clamp from the ignition cover. Separate out the stator wire harness from the wire clamp.
6. Remove the oil cooler return and supply lines. See 5.9 OIL COOLER.
7. Remove the ignition cover.

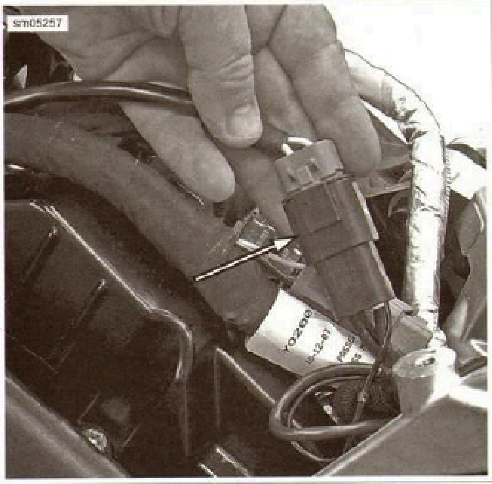


Figure 3-144. Stator Connector [46]

Figure 3-145. Mechanics Wire Lead

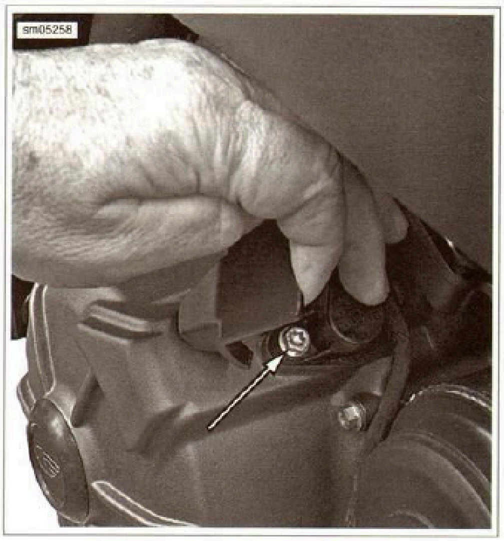


Figure 3-146. CKP Sensor Fastener

Installation

1. See Figure 3-147. Check the locating pins (1) in the case.
2. Thread GASKET ALIGNMENT DOWELS (Part No. HD-45340) (2) into their locations.
3. Fit a **new** gasket (3) over the dowels and the locating pins.

NOTE

Remove the dowels after the cover has been installed with a flatblade screwdriver.

4. Slide the cover over the dowels and pins.

NOTE

The fastener with the brass washer threads into the torque sequence position eight.

5. Loosely thread in the cover fasteners.
6. Route the stator wire harness through the clip with the CKP sensor wire harness and snap in place.
7. Wrap the stator leads around the mechanics wire left as a leader through the engine support. Lubricate with silicon spray and pull the leads through the support.
8. See Figure 3-148. In sequence, tighten the cover fasteners to 11 Nm (97 **in-lbs**).
9. Install the oil cooler lines. See 5.9 OIL COOLER.

NOTE

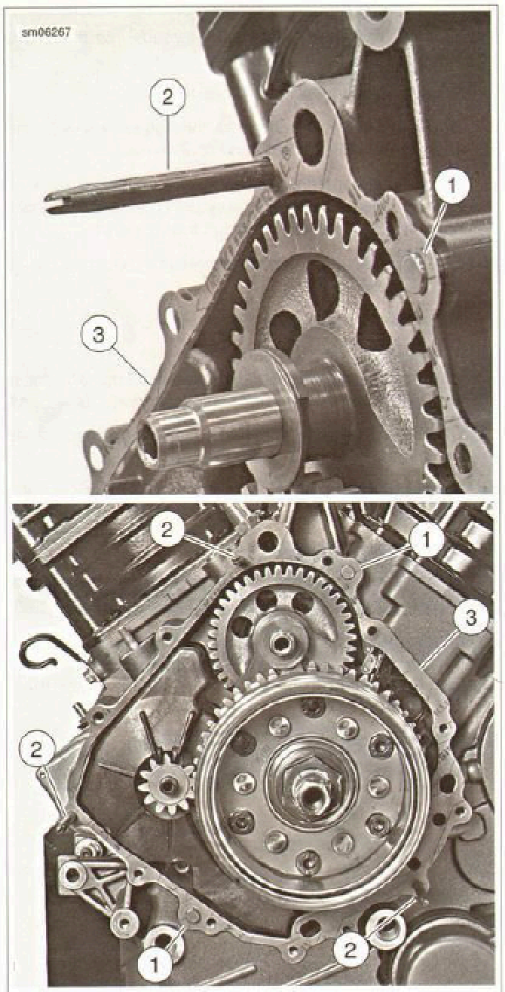
Route the stator wire harness alongside the engine harness in the support channel and secure with a support rubber band.

10. Cable strap the stator wire harness to the engine harness and the main harness under the seat.
11. Install the socket terminals in the housing and mate the stator connector [46] pin and socket housings.
12. Connect the negative battery cable.

⚠WARNING

After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

13. Install the seat.



1. **Locating pin**
2. **Dowel**
3. **Gasket**

Figure 3-147. Alignment Dowel and Locating Pin Locations

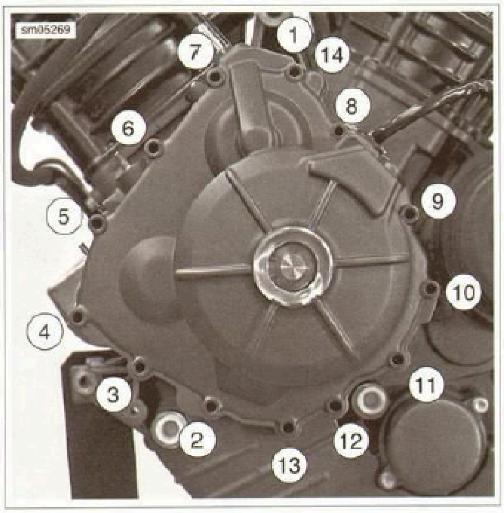


Figure 3-148. Ignition Cover Torque Sequence

BALANCER: TOP

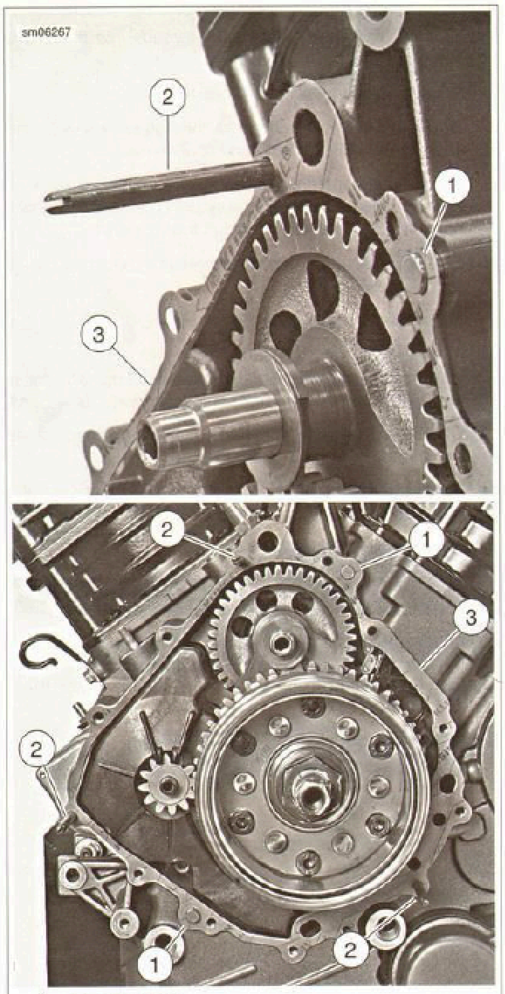
PART NUMBER	TOOL NAME
B-48858	CRANKSHAFT LOCKING TOOL
B-48862	TOP BALANCER BEARING INSTALLER
B-49194	SEAL INSTALLER
HD-95760-69A	BUSHING AND BEARING PULLER
HD-95766-69A	COLLET, 5/8"

Removal

NOTE

To rotate the gears for clearance, remove the crankshaft locking tool.

1. See Figure 3-149. Remove the washer (2) from the balancer shaft (1).
2. Remove the starter ring gear (3).
3. Remove the balancer shaft and the rear washer.



1. **Locating pin**
2. **Dowel**
3. **Gasket**

Figure 3-147. Alignment Dowel and Locating Pin Locations

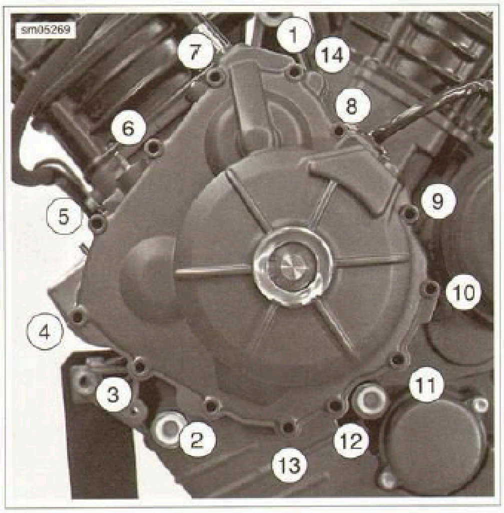


Figure 3-148. Ignition Cover Torque Sequence

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Removal

NOTE

To rotate the gears for clearance, remove the crankshaft locking tool.

1. See Figure 3-149. Remove the washer (2) from the balancer shaft (1).
2. Remove the starter ring gear (3).
3. Remove the balancer shaft and the rear washer.

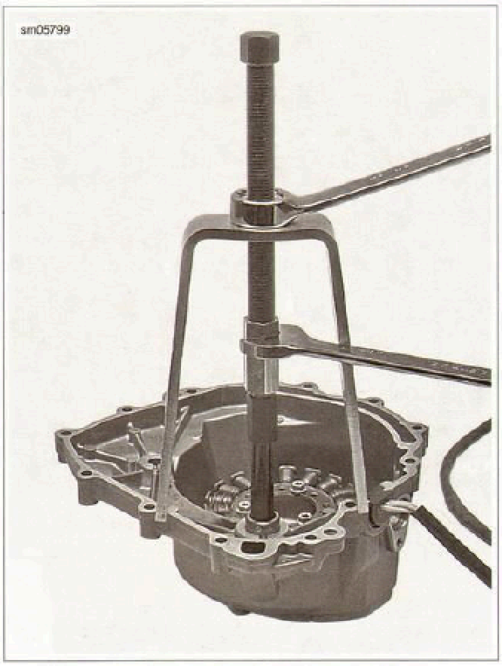


Figure 3-152. Bushing and Bearing Puller

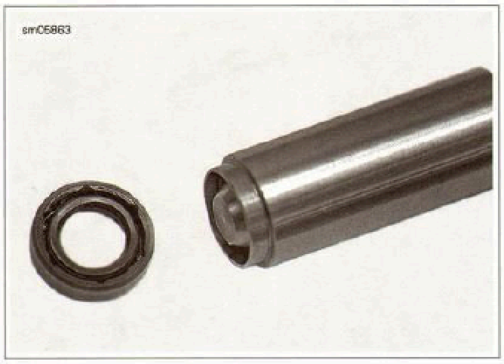


Figure 3-153. Top Balancer Seal Installer

Figure 3-154. Top Balancer Needle Bearing Installer

Installation

NOTE

Lubricate inner washer, bearings and bearing surfaces with a thin film of LUBRIPLATE No. 105 Motor Assembly Grease. In addition apply a thin film of clean engine oil to bearings and bearing surfaces.

1. Lock the engine at front cylinder TDC with the CRANKSHAFT LOCKING TOOL (Part No. B-48858).
2. See Figure 3-155. Install the inner washer on the balancer crankcase side shaft.

NOTE

See Figure 3-156. Match the timing mark on the balancer with the timing mark on the valve train drive gear.

3. See Figure 3-157. Install the inner washer (1) and the balancer (2).
4. Install the outer washer (3).
5. Install the starter ring gear.

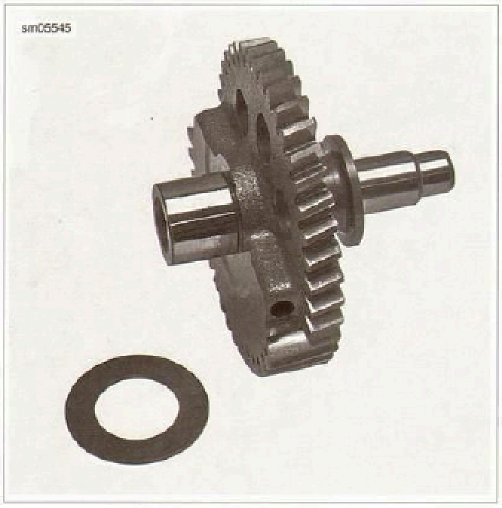


Figure 3-155. Top Balancer

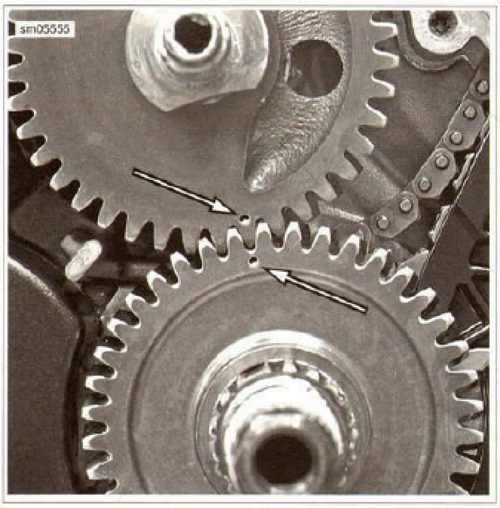
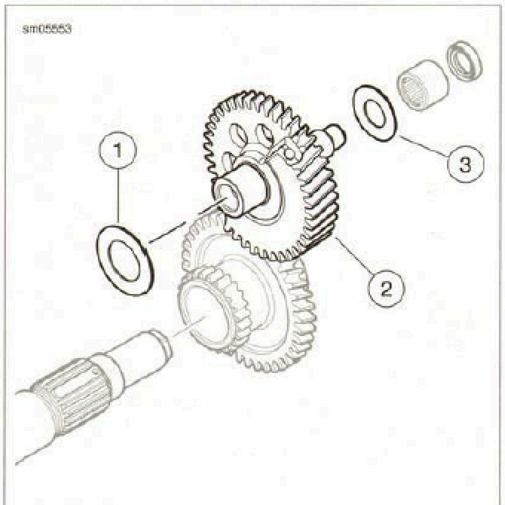


Figure 3-156. Timing Marks



1. Washer
2. Balancer shaft
3. Washer

Figure 3-157. Top Balancer Assembly

STARTER FRICTION CLUTCH

Removal

1. Remove alternator rotor. See 7.10 ALTERNATOR.
2. See Figure 3-158. Remove the starter ring gear (1).
3. Remove top balancer. See 3.10 CLUTCH SIDE, Balancer: Water Pump Shaft.
4. Remove friction clutch cover fasteners and shoulder screw.
5. Remove friction clutch cover.
6. Remove rear cylinder valve train drive. See 3.12 VALVE TRAIN DRIVE, Rear Cylinder.
7. See Figure 3-159. Remove friction clutch.

TwinMotorcycles - Buell 1125R/CR stator and Rotor repair

How to remove a Buell 1125 rotor in case it is damaged

https://youtu.be/jfXS4vzaMOU

Buell 1125R & 1125CR stator replacement Twin Motorcycles

https://youtu.be/Smio69nfA2Q

02-1-2015 - Buell 1125R/CR stator and Rotor repair

3. Remove the three screws (3) securing the stator to the ignition cover.
4. Slide the rubber seal (4) out of the slot in the ignition cover.

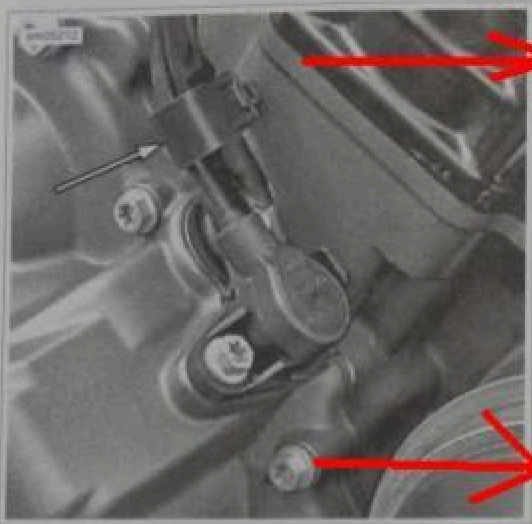
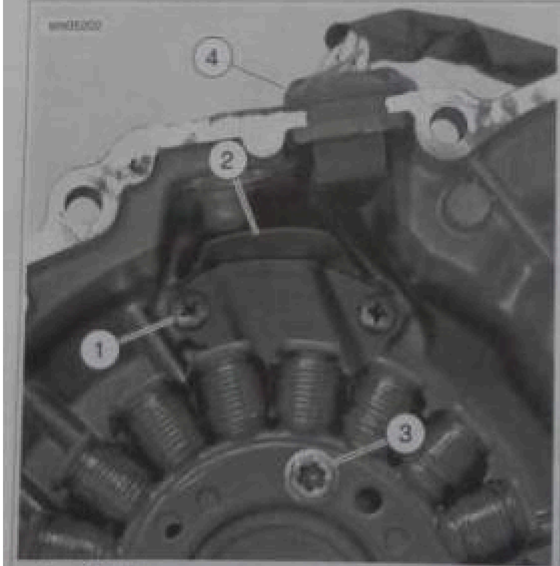


Figure 7-34. Stator and CKP Sensor Wire Harness Clip



1. Screw
2. Cable holder
3. Screw
4. Seal

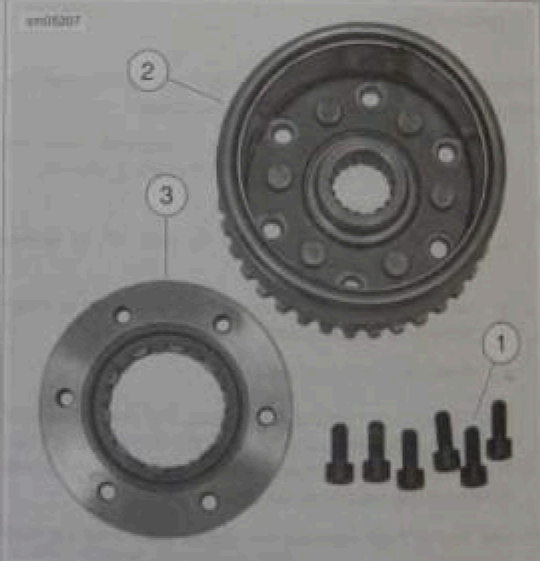
Figure 7-35. Stator

ASSEMBLY AND INSTALLATION

PART NUMBER	TOOL NAME
B-48858	CRANKSHAFT LOCKING TOOL

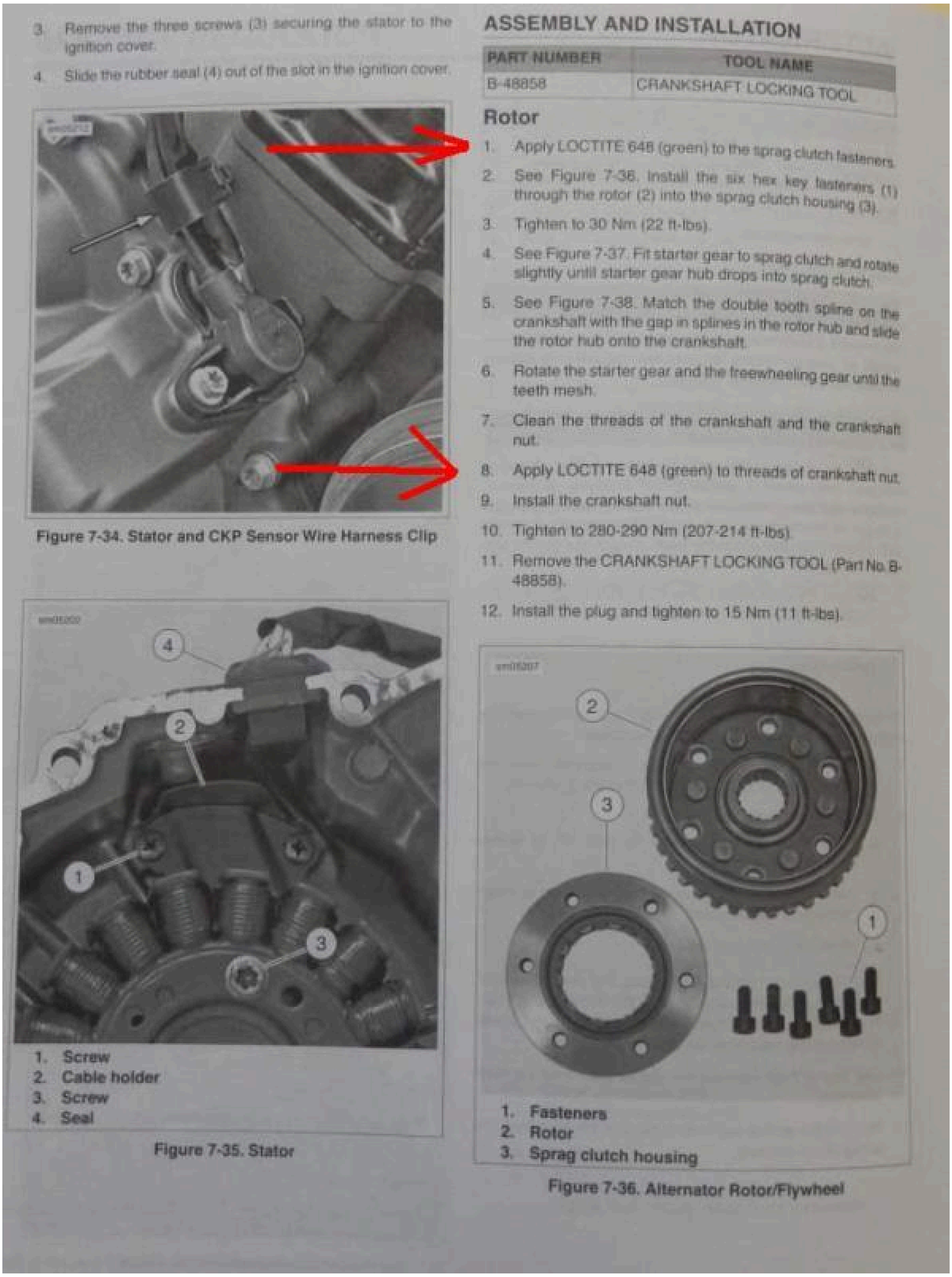
Rotor

1. Apply LOCTITE 648 (green) to the sprag clutch fasteners.
2. See Figure 7-36. Install the six hex key fasteners (1) through the rotor (2) into the sprag clutch housing (3).
3. Tighten to 30 Nm (22 ft-lbs).
4. See Figure 7-37. Fit starter gear to sprag clutch and rotate slightly until starter gear hub drops into sprag clutch.
5. See Figure 7-38. Match the double tooth spline on the crankshaft with the gap in splines in the rotor hub and slide the rotor hub onto the crankshaft.
6. Rotate the starter gear and the freewheeling gear until the teeth mesh.
7. Clean the threads of the crankshaft and the crankshaft nut.
8. Apply LOCTITE 648 (green) to threads of crankshaft nut.
9. Install the crankshaft nut.
10. Tighten to 280-290 Nm (207-214 ft-lbs).
11. Remove the CRANKSHAFT LOCKING TOOL (Part No. B-48858).
12. Install the plug and tighten to 15 Nm (11 ft-lbs).



1. Fasteners
2. Rotor
3. Sprag clutch housing

Figure 7-36. Alternator Rotor/Flywheel



3. Remove the three screws (3) securing the stator to the ignition cover.
4. Slide the rubber seal (4) out of the slot in the ignition cover.

Figure 7-34. Stator and CKP Sensor Wire Harness Clip

1. Screw
2. Cable holder
3. Screw
4. Seal

Figure 7-35. Stator

ASSEMBLY AND INSTALLATION

PART NUMBER	TOOL NAME
B-48858	CRANKSHAFT LOCKING TOOL

Rotor

1. Apply LOCTITE 648 (green) to the sprag clutch fasteners.
2. See Figure 7-36. Install the six hex key fasteners (1) through the rotor (2) into the sprag clutch housing (3).
3. Tighten to 30 Nm (22 ft-lbs).
4. See Figure 7-37. Fit starter gear to sprag clutch and rotate slightly until starter gear hub drops into sprag clutch.
5. See Figure 7-38. Match the double tooth spline on the crankshaft with the gap in splines in the rotor hub and slide the rotor hub onto the crankshaft.
6. Rotate the starter gear and the freewheeling gear until the teeth mesh.
7. Clean the threads of the crankshaft and the crankshaft nut.
8. Apply LOCTITE 648 (green) to threads of crankshaft nut.
9. Install the crankshaft nut.
10. Tighten to 280-290 Nm (207-214 ft-lbs).
11. Remove the CRANKSHAFT LOCKING TOOL (Part No. B-48858).
12. Install the plug and tighten to 15 Nm (11 ft-lbs).

1. Fasteners
2. Rotor
3. Sprag clutch housing

Figure 7-36. Alternator Rotor/Flywheel

This article will be written to help customers out to analyze and repair there Buell 1125R/CR stator and Rotor. IT IS NOT FINISHED YET.

The point for the worries about the nut coming loose, which actually is a problem caused by the splines having too much play, cause the rotor can move under extreme acceleration and deceleration.

EBR has experienced under racing conditions that it came loose and advises customers to tighten the nut to a whopping 400 NM of Torque.
In our own Buell 1125R racer who did raced in the super stock 1000 cup (our little local AMA class) we have not experienced this yourself.
But we take EBR's experience very serious, so we advise customers to tight the nut to the 400 NM of Torque.
In our opinion a better solution would be to fill the splines with a filler type Loctite to fill the play on the splines, ensuring the rotor would not move anymore,
but this will have an effect on servicing the bike as pullers and heat guns would be needed to pull off the rotor when needed.
As these pullers are very rare under our customers, and if used wrong or the magnets can break, we don't advice to do this.
Instead we advise to use Loctite 272 for the rotor nut. As Buell revised the manual to this see below for the revised tightening procedure for the crank nut
Installation 1125 Rotor / Nut (update tightening procedure)
Note Crank Locking tool is already in position

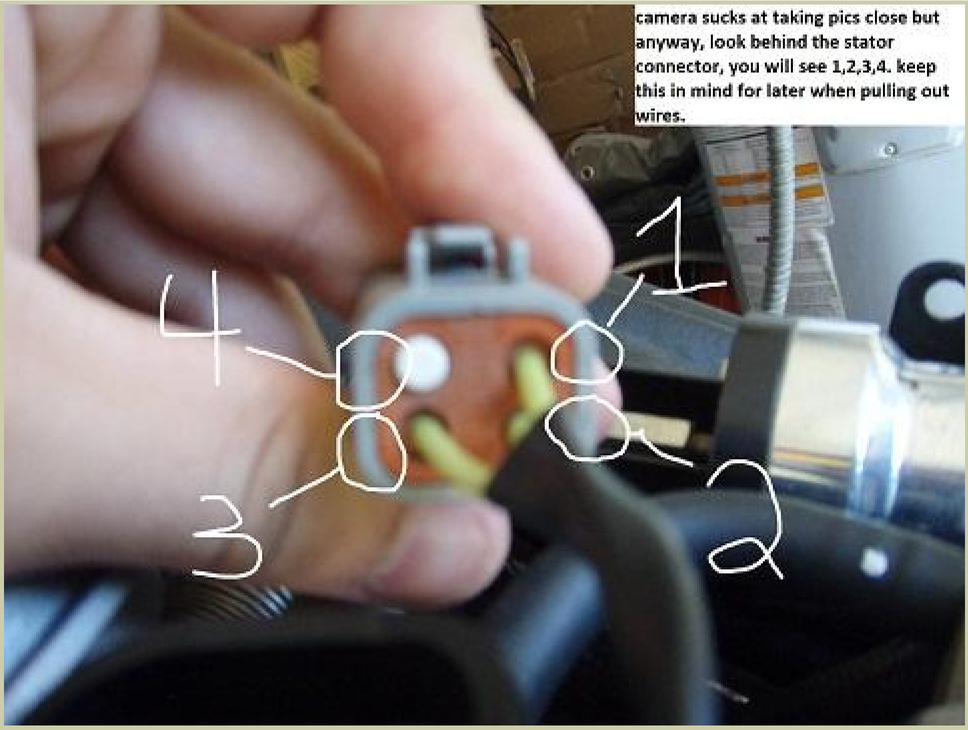
1. Match the double tooth spline on the crankshaft with the gap in splines.
2. in the rotor hub and slide the flywheel hub onto the crankshaft
3. Press the flywheel onto the starter gear.
4. Rotate the starter gear and the freewheeling gear until the teeth mesh
5. Clean the threads of the crankshaft and crankshaft nut (ALWAYS USE A NEW NUT) with brake cleaner
6. Note Where LOCTIDE 272 (red) is unavailable , Use LOCTIDE 278 (red)
7. Install the flywheel nut
   a. Apply LOCTITE 272 (red) to the threads and the mating face off the crankshaft nut.
   b. Tighten to 285 NM (210 ft-lbs)
   c. Back off the nut counter clockwise approximately 720 degrees
   d. Tighten to 285 NM (210 ft- lbs)
   e. Back off the nut counter clockwise approximately 720 degrees
   f. Final tighten to 400 NM (295 ft-lbs)
8. Remove the crank shaft locking tool
9. Install the plug and tighten to 15 Nm (11 ft-lbs)

By Ultimo_justin, Step by Step removal of Ignition Cover

Link to the photos in HD quality
http://s739.photobucket.com/albums/xx39/ultimo_justin/Step%20by%20Step%20guide%20to%20remove%20Ignition%20Cover%201125R/

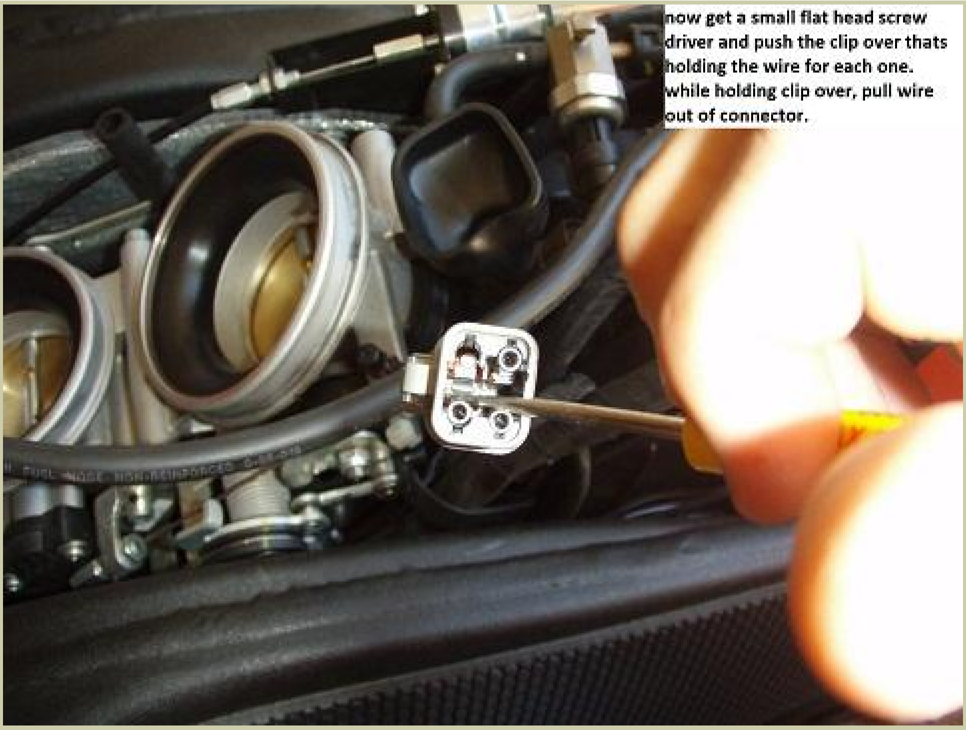
Then its time to remove your air box cover, inner air box, air filter, and the baseplate assembly (the air intake snorkel) til your bike looks like what mine does in the picture.

now, disconnect your Stator from the Voltage Regulator.



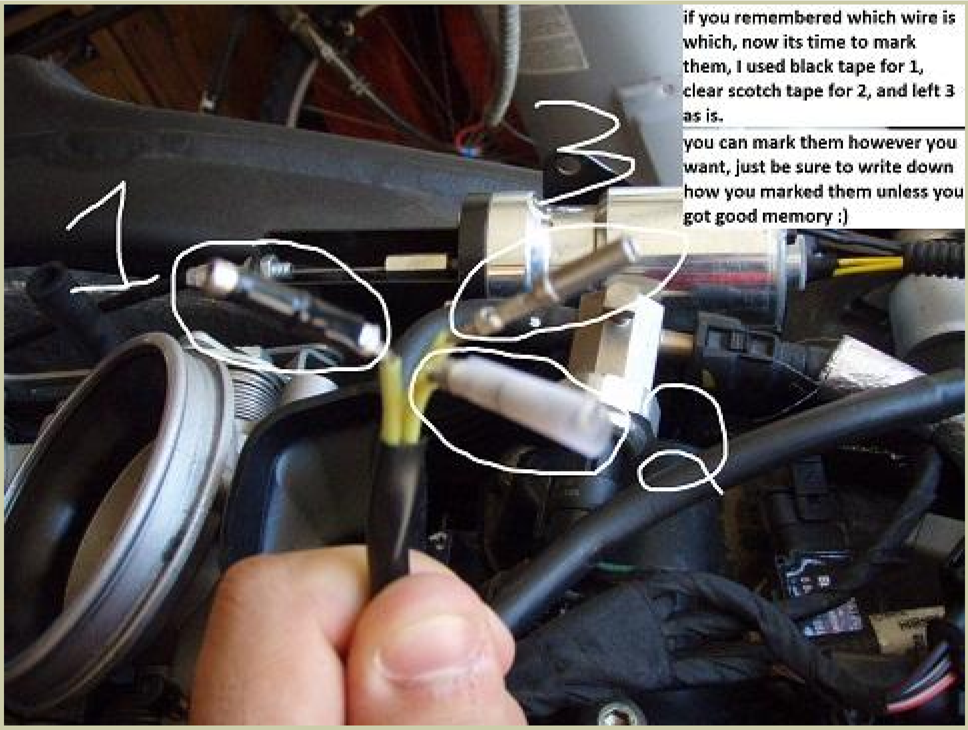
camera sucks at taking pics close but anyway, look behind the stator connector, you will see 1,2,3,4. keep this in mind for later when pulling out wires.

next, get a needle nose that isnt as ugly as mine and pull out the orange covering of the connector.

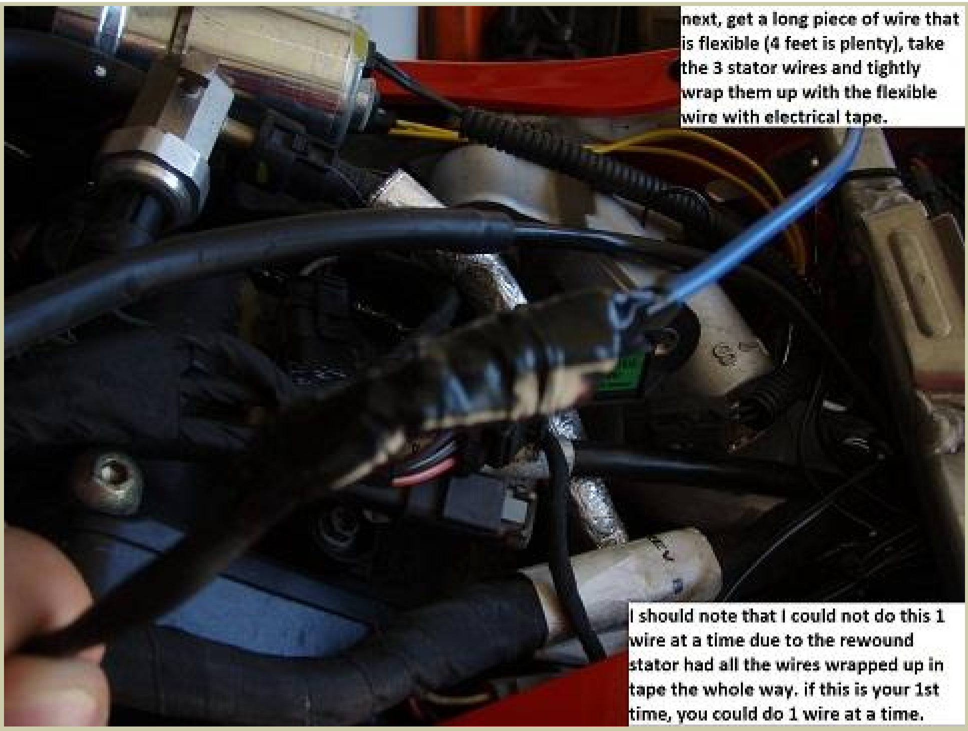


now get a small flat head screw driver and push the clip over thats holding the wire for each one. while holding clip over, pull wire out of connector.

with all 3 wires pulled out, remove the orange rubber and put it with your connector.



if you remembered which wire is which, now its time to mark them, I used black tape for 1, clear scotch tape for 2, and left 3 as is.
you can mark them however you want, just be sure to write down how you marked them unless you got good memory :)
1
2
3

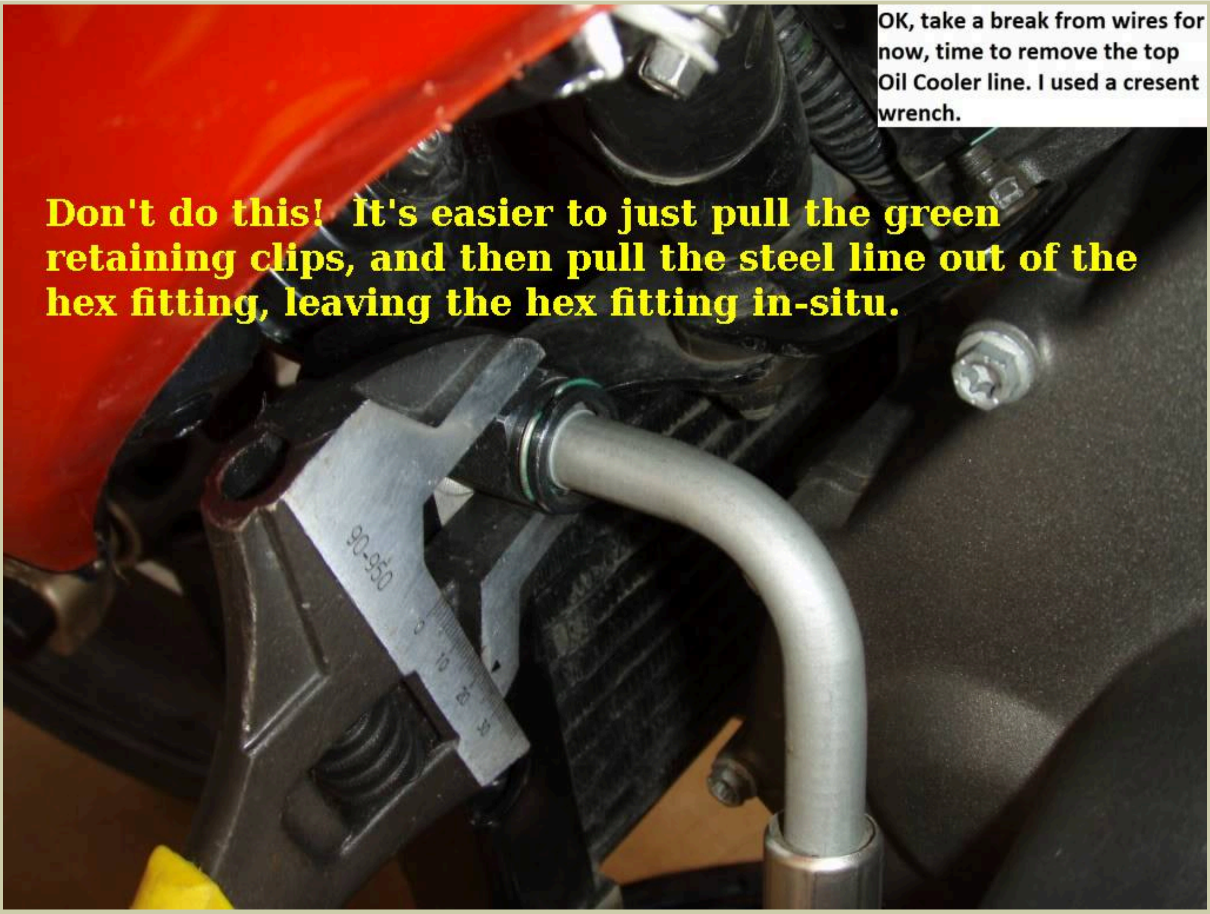


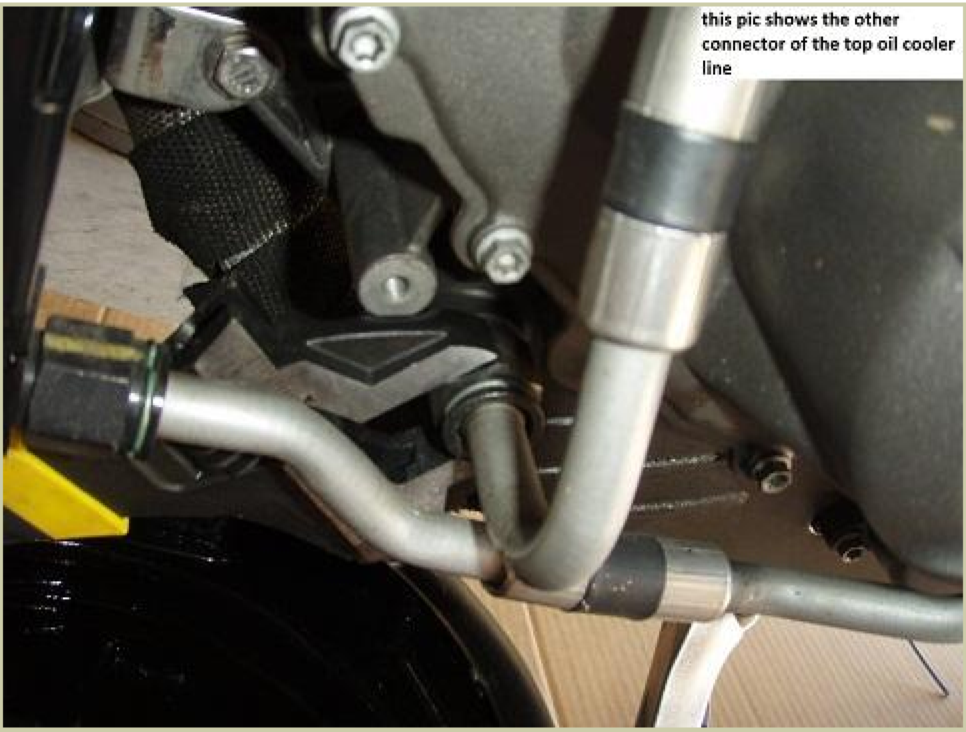
next, get a long piece of wire that is flexible (4 feet is plenty), take the 3 stator wires and tightly wrap them up with the flexible wire with electrical tape.
I should note that I could not do this 1 wire at a time due to the rewound stator had all the wires wrapped up in tape the whole way. if this is your 1st time, you could do 1 wire at a time.

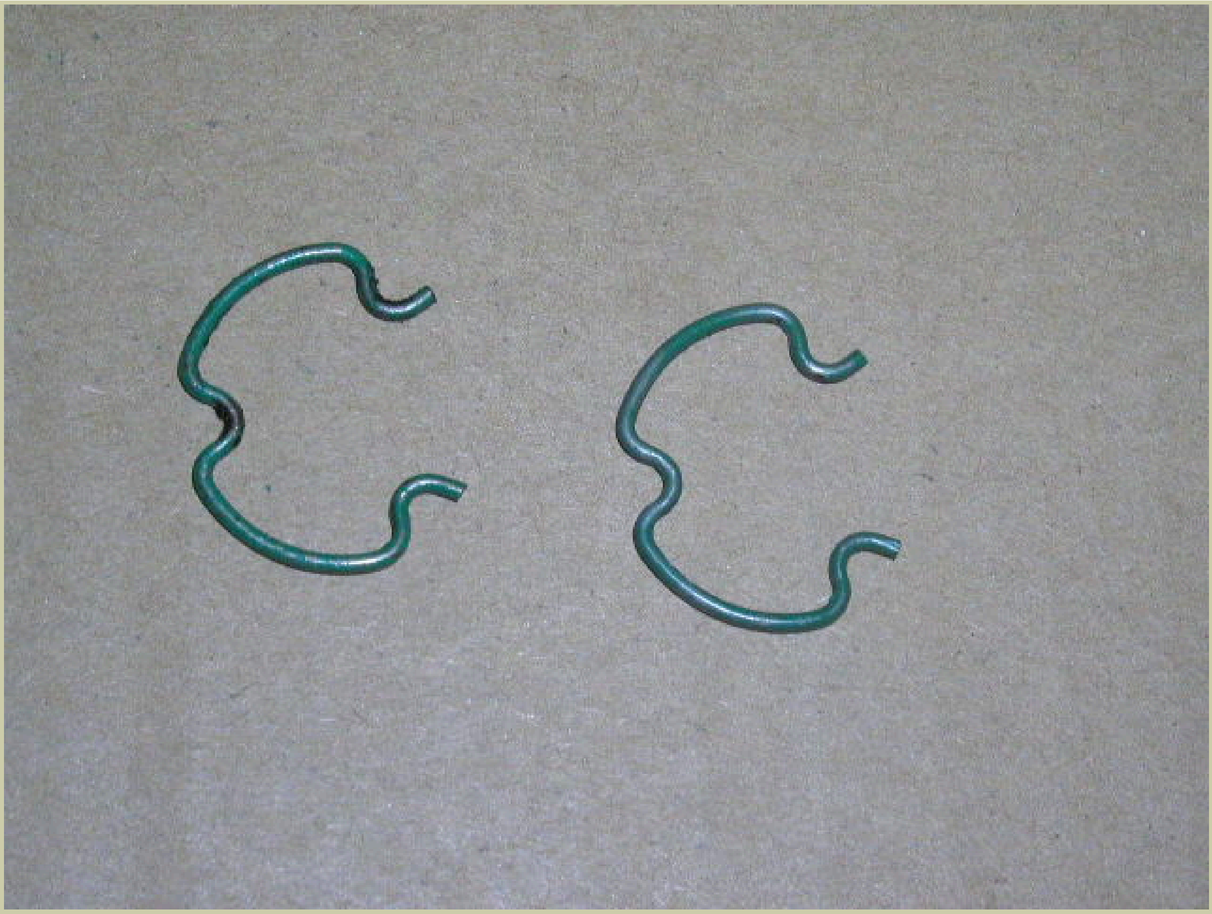
==

Mind: Intervention by Timebandit

http://www.badweatherbikers.com/cgibin/discus/discus.cgi?pg=next&topic=290431&page=592310


OK, take a break from wires for now, time to remove the top Oil Cooler line. I used a cresent wrench.
Don't do this! It's easier to just pull the green retaining clips, and then pull the steel line out of the hex fitting, leaving the hex fitting in-situ.
90-950


this pic shows the other connector of the top oil cooler line



End of Intervention
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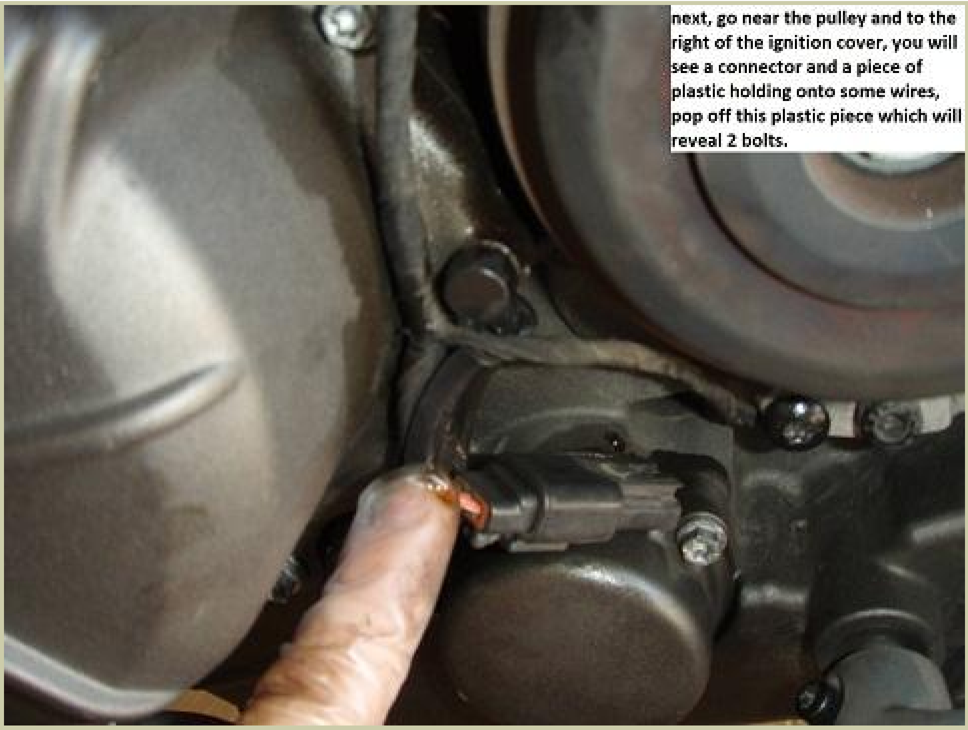
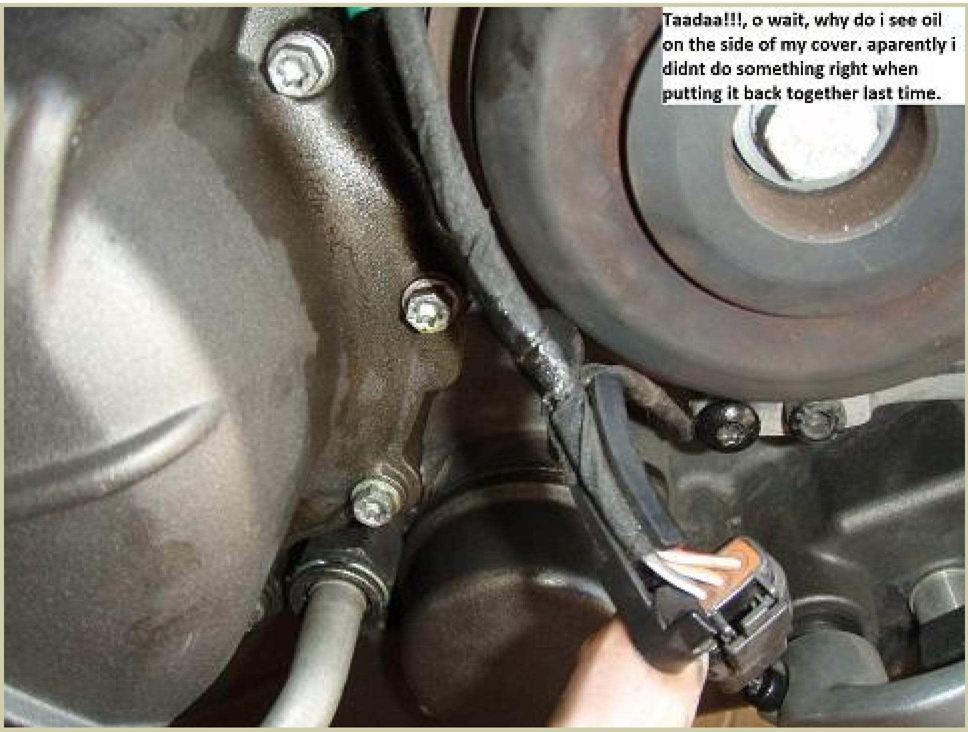
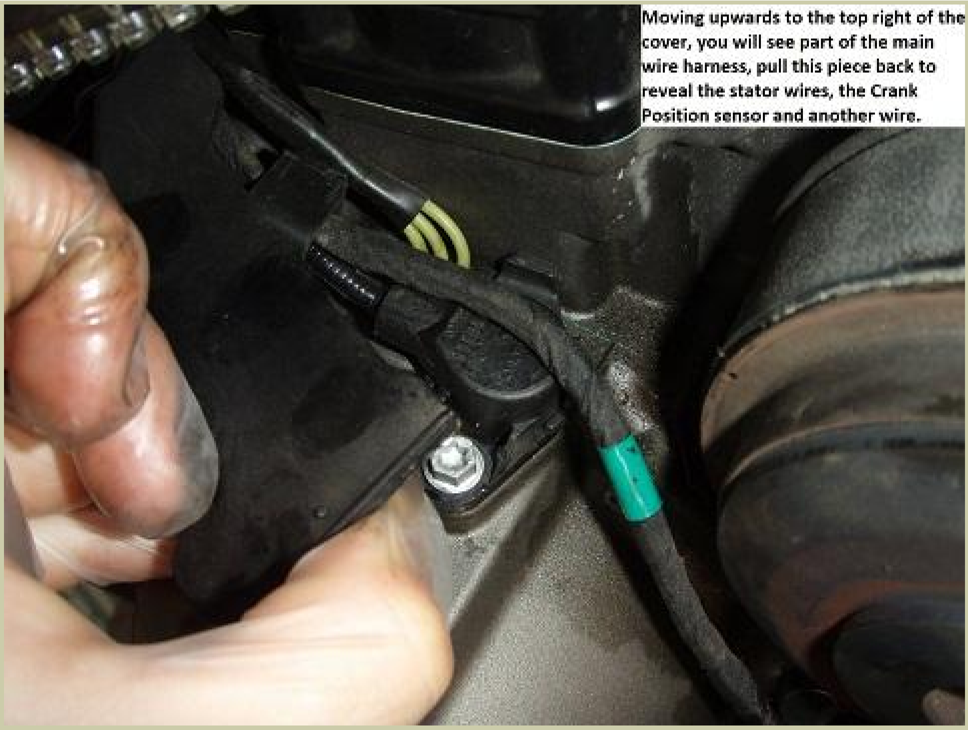
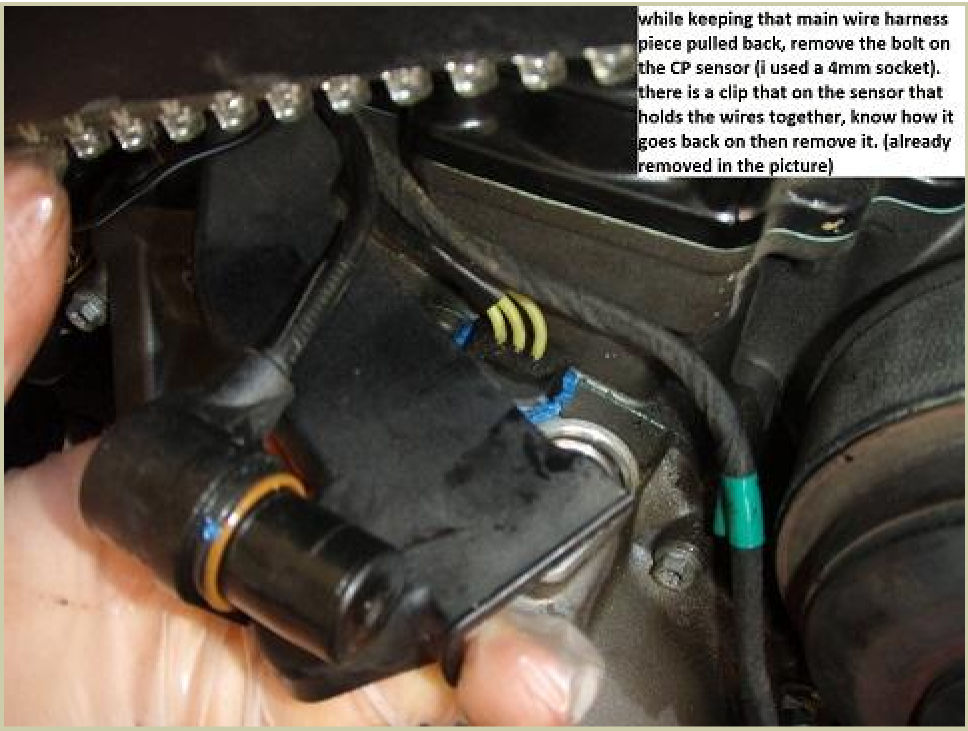

next, go near the pulley and to the right of the ignition cover, you will see a connector and a piece of plastic holding onto some wires, pop off this plastic piece which will reveal 2 bolts.


Taadaa!!!, o wait, why do i see oil on the side of my cover. aparently i didnt do something right when putting it back together last time.


Moving upwards to the top right of the cover, you will see part of the main wire harness, pull this piece back to reveal the stator wires, the Crank Position sensor and another wire.

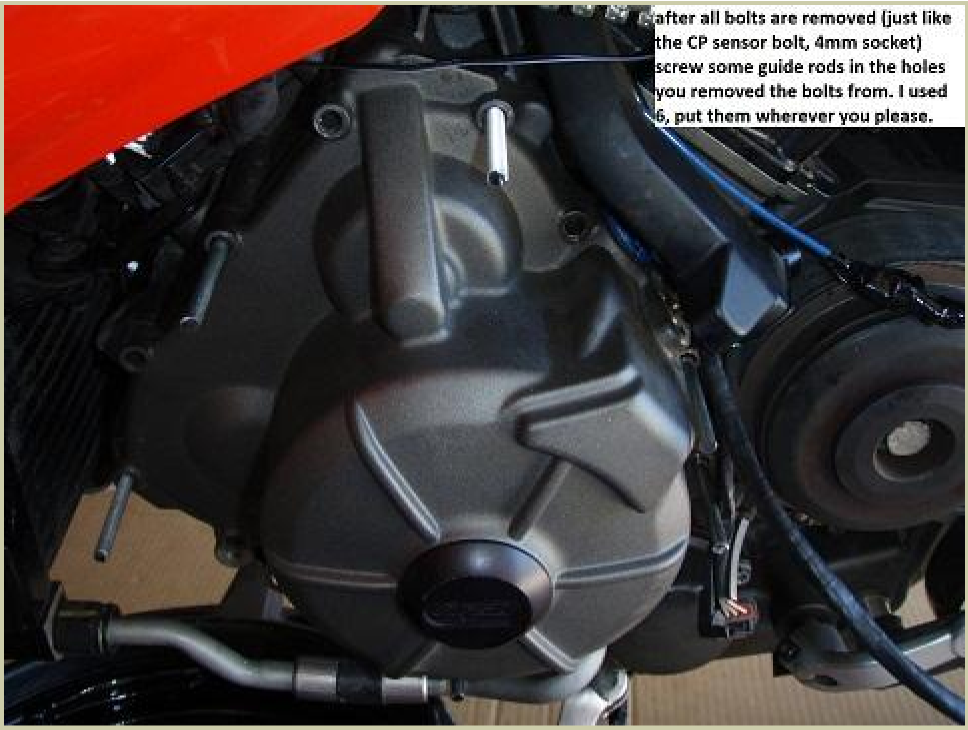

while keeping that main wire harness piece pulled back, remove the bolt on the CP sensor (i used a 4mm socket). there is a clip that on the sensor that holds the wires together, know how it goes back on then remove it. (already removed in the picture)

going back to the stator wires that are now ready to be pulled. Lubricate as much as u can then pull them through. once through, you can remove the tape. go slow and easy when pulling through, try to wiggle it if it gets tight or stops.

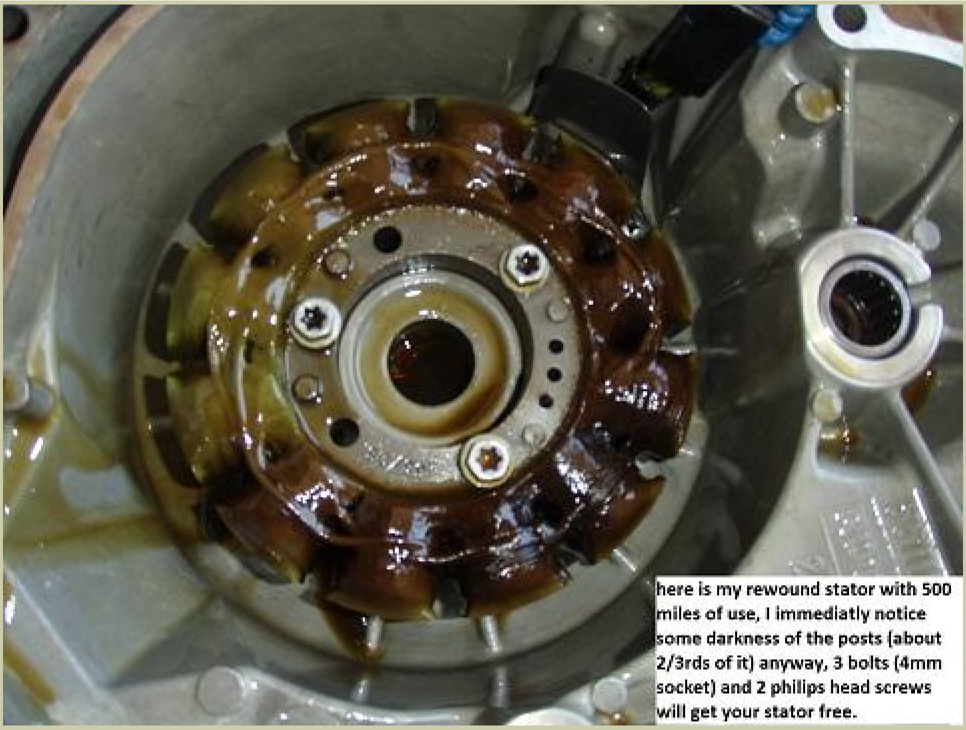
be sure to keep your flexible wire where its at so you can pull the wires back up through the main harness.

now you can start removing the bolts on the cover, NOTE where this one is, this is the only one that has a copper washer on it. be sure that it goes back in the same spot when installing

same bolt as descibed before, just a wider picture.


after all bolts are removed (just like the CP sensor bolt, 4mm socket) screw some guide rods in the holes you removed the bolts from. I used 6, put them wherever you please.


with the guide rods in place, now u can remove the cover, the magnet on the rotor is strong so it will require some pull on your part to get it off. Well looky here, as i mentioned before about some oil running down the side of my cover, I now see what my problem was. at least...I hope this was my problem.
congrats, your cover is now removed, what do you do from here? take a look at your stator, and try to save the gasket for the cover.

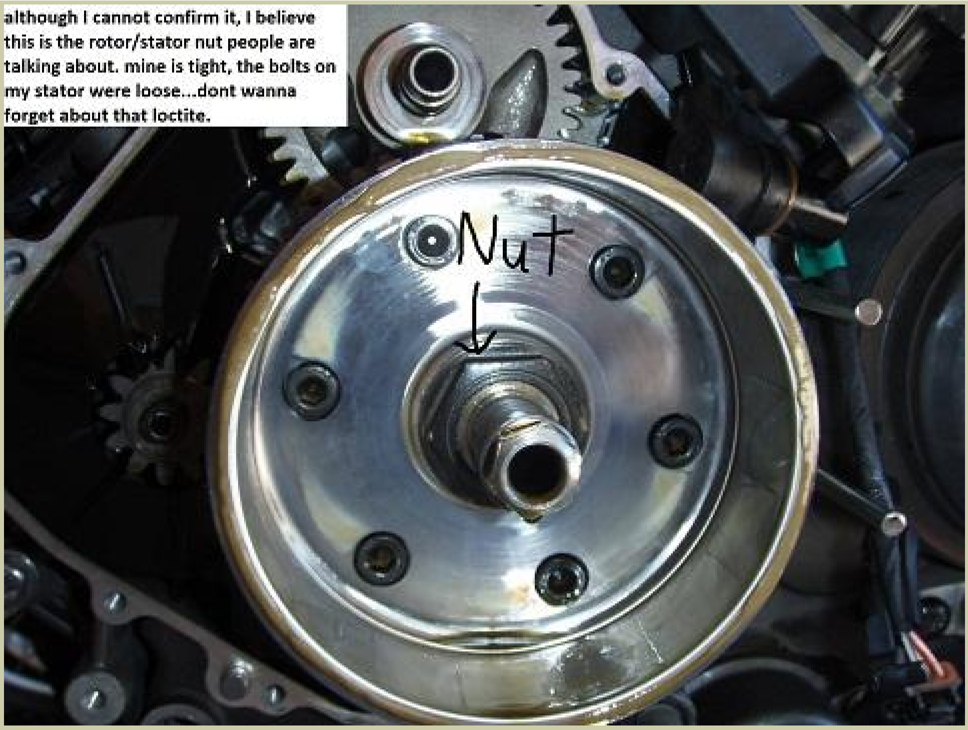


here is my rewound stator with 500 miles of use, I immediatly notice some darkness of the posts (about 2/3rds of it) anyway, 3 bolts (4mm socket) and 2 philips head screws will get your stator free.

Front part of stator.

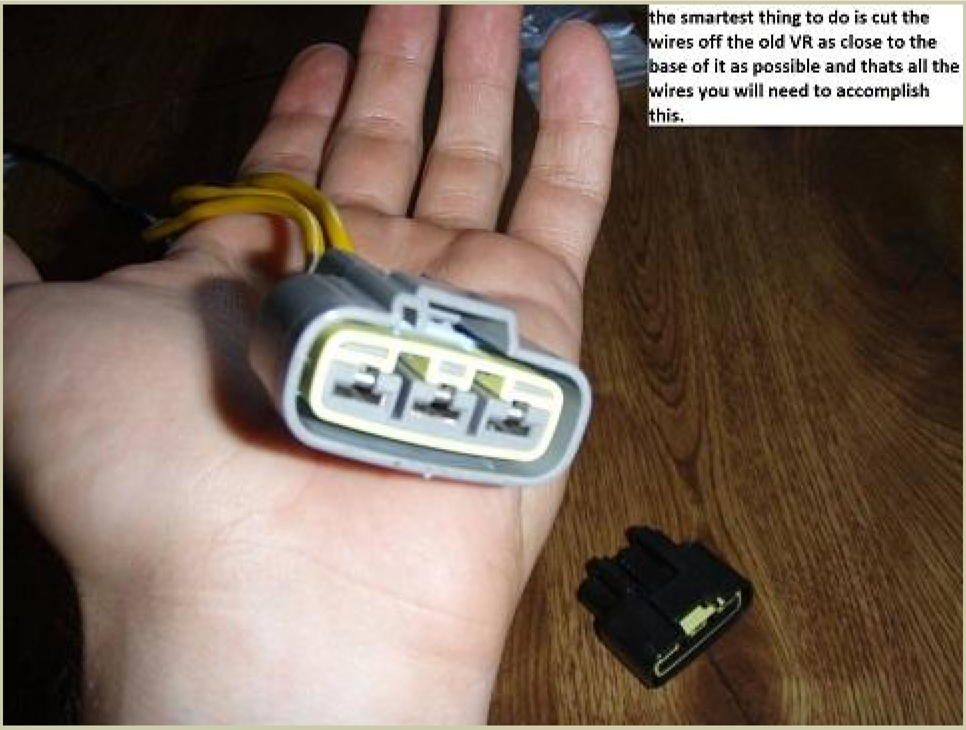

Rear part of stator.
I dunno what to say of it, it is wiped clean, it dont smell burnt, could it be that the oil is sat in just turned it that color? I got no voltage issues, maybe it got like this while i had the original VR on it....beats me, im calling custom rewind.


if you are removing your stator for the 1st time you will notice some GOOP on the cover, Parrick on BADWEB removed his GOOP and I as well. takes alot of picking at, and finally debure the sharp edges of where the GOOP was.
GOOP

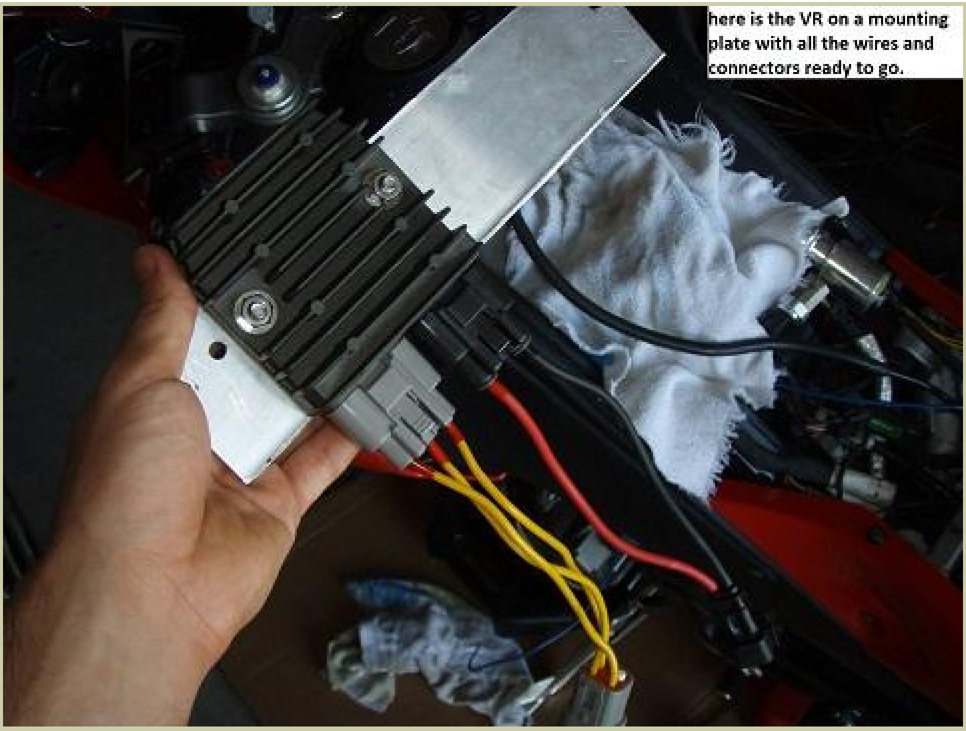


although I cannot confirm it, I believe this is the rotor/stator nut people are talking about. mine is tight, the bolts on my stator were loose...dont wanna forget about that loctite.


for those of you who decide to get the FH012 Mosfet VR along with the weather proof connectors, here you can how its coming along. gray connector is done.



the smartest thing to do is cut the wires off the old VR as close to the base of it as possible and thats all the wires you will need to accomplish this.



here is the VR on a mounting plate with all the wires and connectors ready to go.

I decided to go with Parricks idea to mount it, mainly because I dont need any extra length of wires. the mounting plate is aluminum, its 10 and 3/8ths" long, and 2 1/2" wide.

Robert Ferris - Buell 1125CR Charging System Overhaul

https://baf.zone/projects/1125-charging-system/writeup.pdf

Buell 1125CR Charging System Overhaul

This writeup covers the charging system work I did on my 2009 Buell 1125CR. It should apply to any 2009 or 2010 Buell 1125 motorcycle. This writeup is provided for informational purposes only; I accept no responsibility for the results of applying this information.

Introduction

The 2009 and 2010 Buell 1125 motorcycles (the 1125R and the 1125CR) are notorious for their charging system issues. In 2009, the stator output was increased, and due to the use of a shunt-style regulator, this lead to higher stator temperatures. Take this increased heat and add the fact that there is very little air or oil flow to the stator, and it's easy to see why these stators fail often. Eventually, the heat breaks down the insulation on the stator windings, causing a short. A shorted winding takes out two of the three phases, leaving you at roughly one-third electrical capacity.

When I bought my 2009 1125CR, it still had the original factory charging system. I began to make some preventive upgrades, but the damage was already done. Once my stator failed, I was lucky enough to have research and discussion from several other people available to me online. Leveraging this, I overhauled my charging system. My new system has been rock solid for the past several thousand miles, and I am confident that the original shortcomings have been fixed, and that the problem is solved for good on my bike.

Many others have purchased and installed 2008-spec stators and rotors, as those were reliable. However, this solution didn't appeal to me. My goal was to fix the 2009-spec system, and maintain the higher charging system output. These machines tend to run hot and, when running on full blast, the electric cooling fans can overtax the charging system while idling. Getting caught in traffic with a motorcycle on a hot day can be stressful enough without worrying about your charging system!

My solution is similar to one by Gregory Hildstrom. In fact, his extensive documentation is what inspired me to tackle the task. There is a link to his writeup, among other useful links, in the *more reading* section at the bottom.

The overhauled charging system on my machine has been changed in several ways:

- Rotor was replaced with one that sprays oil on the stator
- Stator was rewound with high temperature wire and high temperature epoxy
- Regulator was replaced with a series regulator

Rotor Replacement

The stock rotor is nothing special. It's pretty typical of similar charging systems – just a spinning permanent magnet whose purpose is to induce electrical current in the stator windings. It forms a pretty close fit with the stator, and doesn't allow very much oil or air past it at all. For a stator that's constantly overheated, lack of oil- and air-flow is not your friend.

It turns out that the crankshaft has an oil port where the rotor bolts on. Very convenient, as this means with a specially machined rotor, we can get some oil flow to the stator.

Erik Buell Racing, in their very gracious support of the 1125 platform, developed and released such a rotor! The cost of this rotor is $425, $250 of which is a core charge that gets refunded upon return of your original rotor.

I purchased one for installation on my machine. I needed to tear it down to do a valve check anyway, so this gave me the perfect opportunity to kill two birds with one stone.

If you look carefully at the photo of the rotor above, you can see the tiny oil spraying hole in the area circled in yellow. It looks tiny, but it doesn't take a very big hole to spray enough oil to cool things down.

Materials Required

When I did this, some parts had to be ordered from Harley Davidson. Now, EBR offers most, if not all, of these parts.

- EBR modified rotor
- Hardened crankshaft locking tool
- Replacement rotor nut
- Loctite 272 (or Permatex 27200 - same thing, same company, but much easier to find) - for rotor nut
- Loctite 648 - for sprag clutch bolts
- Ignition cover gasket - it's only paper, and easy to tear during removal

Installation

Installation of this new rotor is definitely not for the faint of heart. The nut that holds it on needs to be heated up for removal, and needs to be installed to a high torque value.

Crankshaft Locking Tool

A special locking tool is required to lock the crankshaft in place while applying the torque required to remove and install the rotor nut. From time to time, you can buy one of these from EBR. However, it was out of stock for quite a while when I was looking for one, and I was ultimately unable to source one. I attempted to make my own, but it didn't work out very well.

I drilled out an appropriately sized bolt (to protect the threads in the engine casing), and used an appropriately sized hardened steel rod.

I was able to get the crankshaft locked with the tool, however, the tool slipped out of the hole with only around 50 ft-lbs of torque applied. Rotor nut installation requires 295 ft-lbs, so this was nowhere near enough! *Note: I wouldn't recommend attempting to DIY this tool, unless you or someone you know is skilled in toolmaking. I've read reports of others not faring as lucky as I did, and having the tool break off rather than slip. If you have something break off in the crankshaft, it will ruin your day!*

I had an air impact that was rated for 300 ft-lbs tightening, which is just beyond the torque spec from EBR. Many people recommend not using an impact wrench for installing bolts like this. I did, and it worked out fine, but you will have to weigh the risks involved before deciding to do so yourself.

Removal of Rotor Nut and Rotor

Removal of the rotor begins with dissembling the motor to get to the rotor. This isn't particularly difficult, but there are several steps involved. I'd recommend consulting a service manual here if you're not familiar with the process. The rotor nut torquing process has been revised by EBR, however. The torquing instructions and threadlocker specifications I give below will disagree with your service manual, but are in fact correct as of this writing.

Since the locking tool I made wouldn't hold enough torque to remove the nut, I used the impact to remove it. The DIY locking tool *did* hold enough to keep the crankshaft still during impact use, but in retrospect, it was probably a bad idea to continue using the tool in this manner.

Some folks report being able to remove the nut with very little force and without needing to heat the nut to release the Loctite already installed. I had no such luck. I used a small hand-held torch to apply heat to the nut for several seconds, then hit it with the impact. After going back and forth a couple of times, it came off. Careful with the heat though – too much can affect the magnets in the rotor – so try and keep it localized to the nut.

After removing the nut, the rotor (and sprag clutch attached to the back) slid right off the crankshaft.

Preparation of New Rotor

The new rotor came bare, so I had to detach the sprag clutch assembly from the back of the old rotor and transfer it to the new. Just a few bolts are involved with this. Be sure to apply Loctite to the bolts when installing on the new rotor. Loctite 648 is recommended here, but I couldn't source any, and used Permatex 27200 (Loctite 272). This is probably going to make removing these bolts later, if necessary, a nightmare though.

Installation of Rotor and Rotor Nut

Once the splines are lined up properly, the new rotor slides right on the crankshaft. I cleaned up the crankshaft threads with brake cleaner, and applied threadlocker, and loosely put the nut on. The recommended torquing procedure is to tighten to 210 ft-lbs, back the nut off 2 full turns, then tighten to 295 ft-lbs. This is to get the thread locker activated and such. I had to improvise here, so I lightly torqued the nut on with the impact, backed it off a couple of turns, then tightened it on. Since my impact was rated for 300 ft-lbs, I let it work nut on for a couple seconds.

Afterwards, reassemble the engine, and it's done!

A quick note on the threadlocker: Loctite 272 is recommended. However, this isn't the easiest thing to find in small quantities. Permatex 27200 is the same thing, just with a different name. Permatex and Loctite are the same company.

Stator Rewinding

Unfortunately, when installing the new rotor, I could tell that my stator was almost toast. It had the tell-tale burnt epoxy and looked in bad shape. So, I began investigating options for a new stator.

There are several options now for having your stator rewound with high quality materials. When I made the decision to rewind mine myself, there were less options, and they cost more. Thanks to Gregory Hildstrom's writeup, I was able to source my wire from the same place he did (and for a similar cost), and purchase one of the epoxies he discussed.

Materials Required

- Wire - I purchased the same wire as Hildstrom (AWG 16 size magnet wire with double polyimide insulation, good to 240C) I, also, opted to purchase 1000 feet. Somewhere around 150 feet is required, however, I was quoted a significantly lower price when buying in bulk, such that 1000 feet barely cost more than the 150 required. The decision to purchase extra turned out to be a good one.
- Epoxy - Duralco 4461. This stuff is fairly expensive, though research indicates it's quite durable, good at penetrating windings, and is electrically resistant properties. It is rated to 500F, which slightly higher than the rating of the wire. The epoxy is important for holding the windings in place against engine vibration.
- Rescue tape - high temperature, self-fusing silicone tape. I used this as wrapping around the junctions where the stator windings hook to the harness. It's oil/chemical resistant, electrically insulative, and can withstand high temperature.
- Loctite 243 (a.k.a. Permatex 24300) - for the bolts that hold the stator in place.

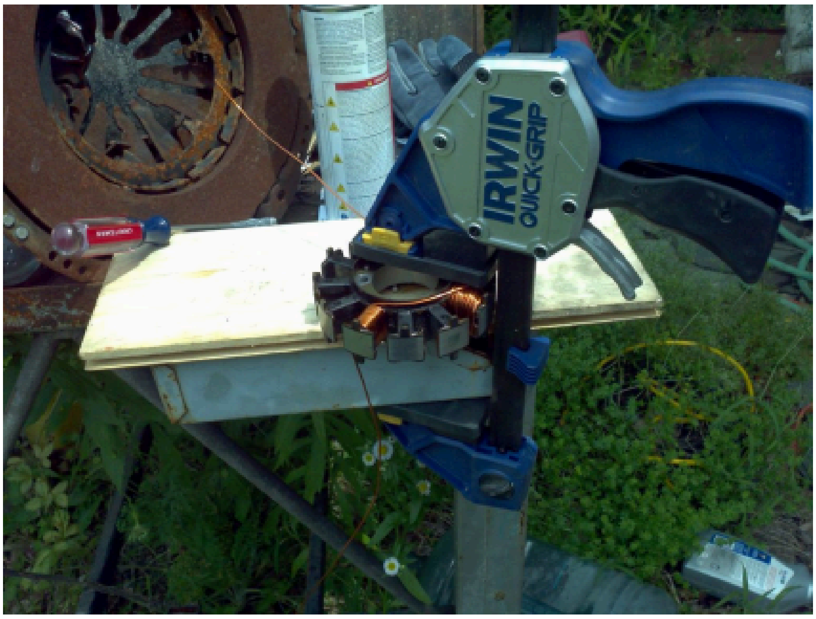
More discussion of wire and epoxy can be found in Hildstrom's writeup (see *more reading*).

Re-winding

I won't go into too much detail here, as Hildstrom's writeup (see *more reading*) already does an excellent job of this.

Take One, Failure

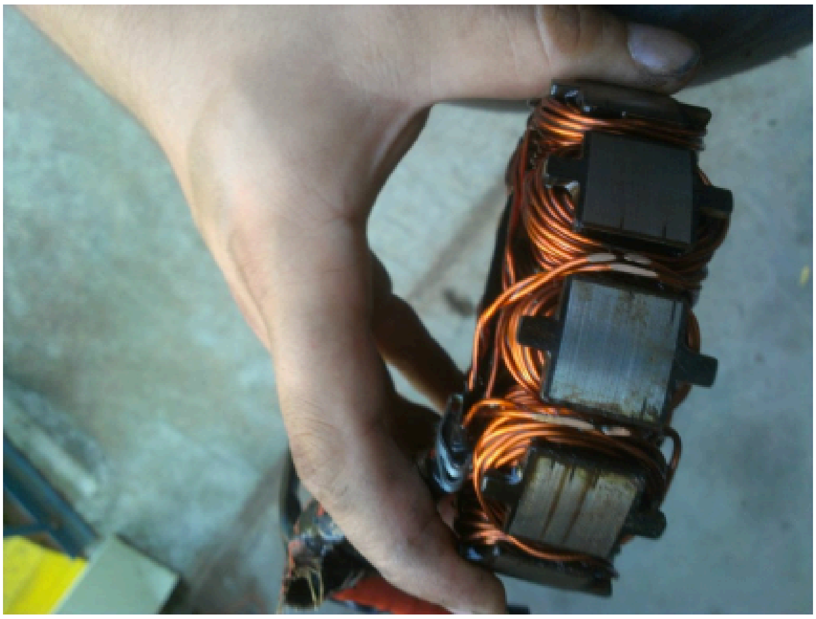
My first rewound stator failed. This was due to my windings being messy. I'm almost embarassed to show pictures…


IRWIN
QUICK-GRIP

I got everything buttoned up, and on the stock regulator, voltage output was fine.

After the rewind, I bought the CE-605 SB regulator. My first one failed relatively quickly after installation, and after receiving a replacement, I started having charging issues. I rode using the stock regulator for a while, and didn't rewind the stator again until I was preparing for a cross-country trip.

I took the stator out, and immediately saw why it failed:



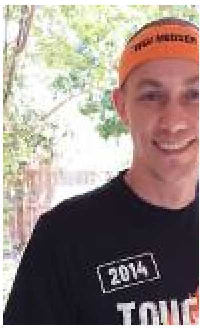
The windings were too messy, and some made contact with the rotor, and eventually rubbed through. Unfortunately, this took a toll on my new rotor as well. Rotor is still working fine, it just looks ugly. Next time I have the motor apart for a valve check/adjustment, I'm going to fill in the damaged section with epoxy.

The stator lasted several thousand miles before failing, and almost all of that time was spent on the stock, shunt regulator (I'll discuss this in the regulator section, but shunt regulators short the stator out to bring it down to the regulated voltage, so stator is always running at maximum output). The stator, aside from the damage, still looked brand new, so I'm confident in the wire and epoxy choice:

Take Two, Success!

I rewound another failed stator core, this time taking more care in keeping the windings neat and compact. It's still not as good as Hildstrom's job, but it did come out *much* neater. I'm happy with the result.

2009 Buell 1125R Stator Rewind and Rotor Modification



Introduction

The 2009 Buell 1125R has problems with overheating stators right out of the factory. The high electrical load from lights and radiator fans coupled with inadequate stator cooling tends to melt the insulation and short the stator windings out over time. The stator is definitely not bathed or sprayed with oil; it gets a tiny dribble from nearby bearings at best. This means it is cooled mostly by conduction to the case and by air circulation inside the engine. This means that battery charging capability slowly decreases over time until the bike fails to start or run completely. I upgraded the voltage regulator to the FH012AA, but my stator failed anyway because this was still a maximum-current shunt-type regulator. It failed to keep the battery charged while running and charging voltages dropped into the mid-11V range. With the stator disconnected and the bike running on the battery, I got 18V AC, 18V AC, and 1.5V AC from the three output phases, which confirmed the fried stator. That's pretty poor performance from a 2-year-old bike with only 4000 miles on the odometer. My first order of business was to upgrade the [voltage regulator]() again, but to the CE-605 SB, which is a minimum-current series-type regulator. After reading about rewound stator failure and seeing the high price of 2008 or EBR replacement parts, I decided to rewind it myself to have complete control over quality and materials.

Disassembly


34/08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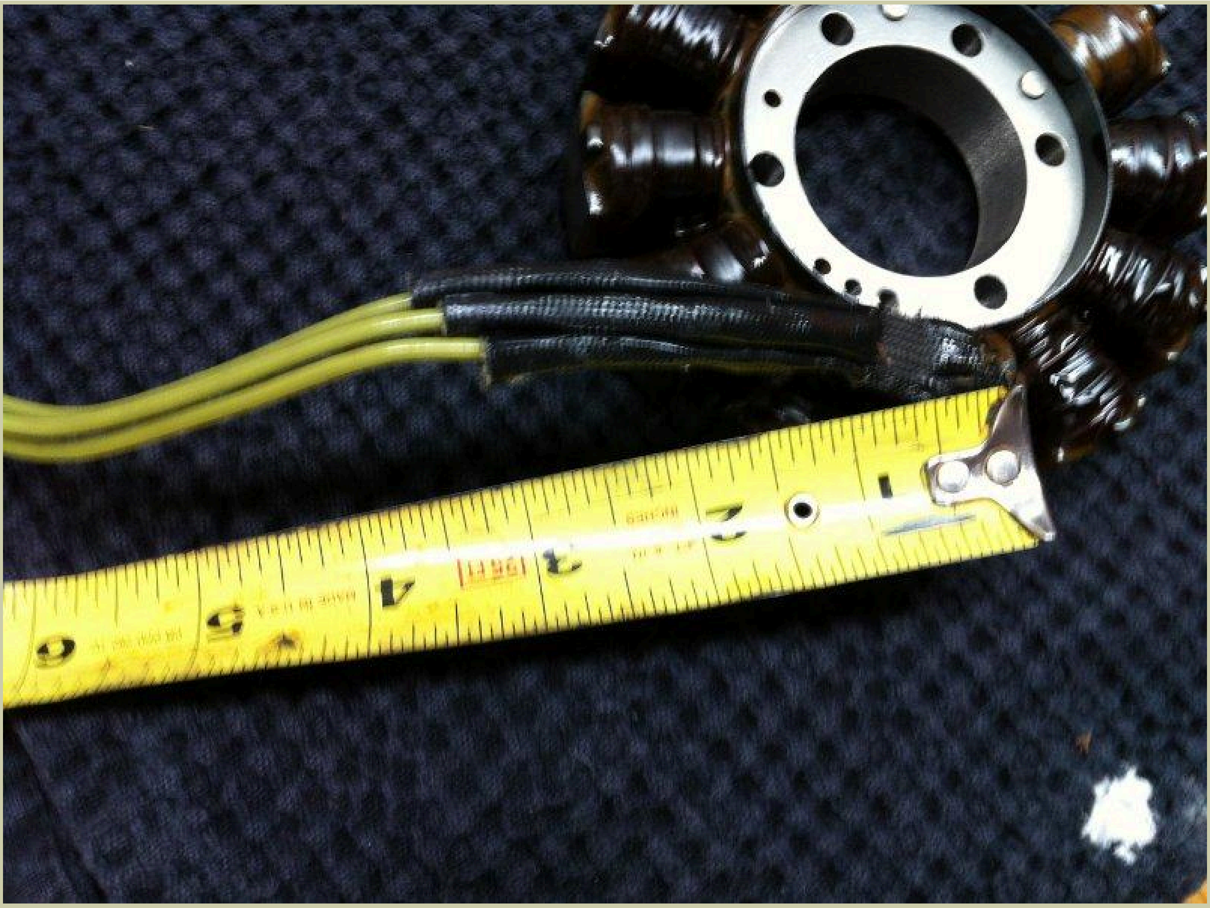
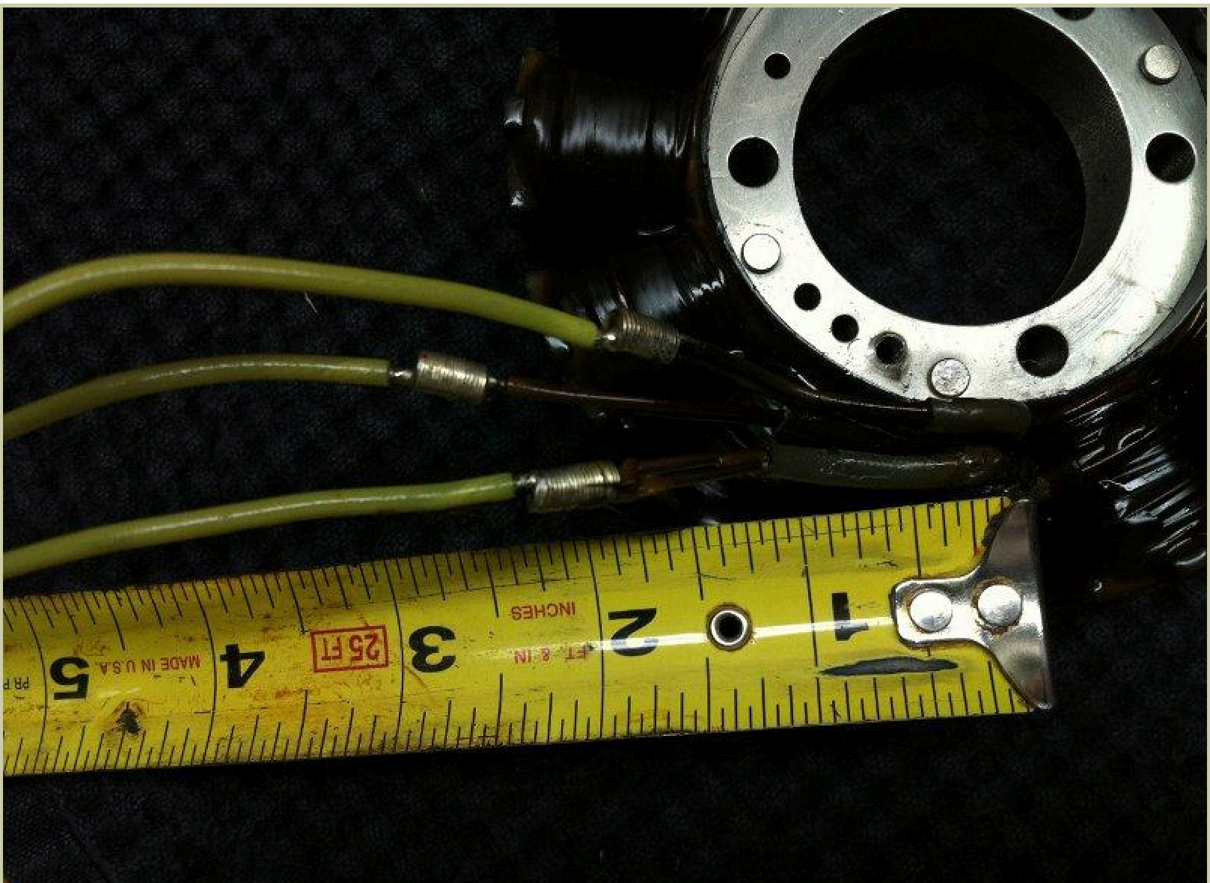
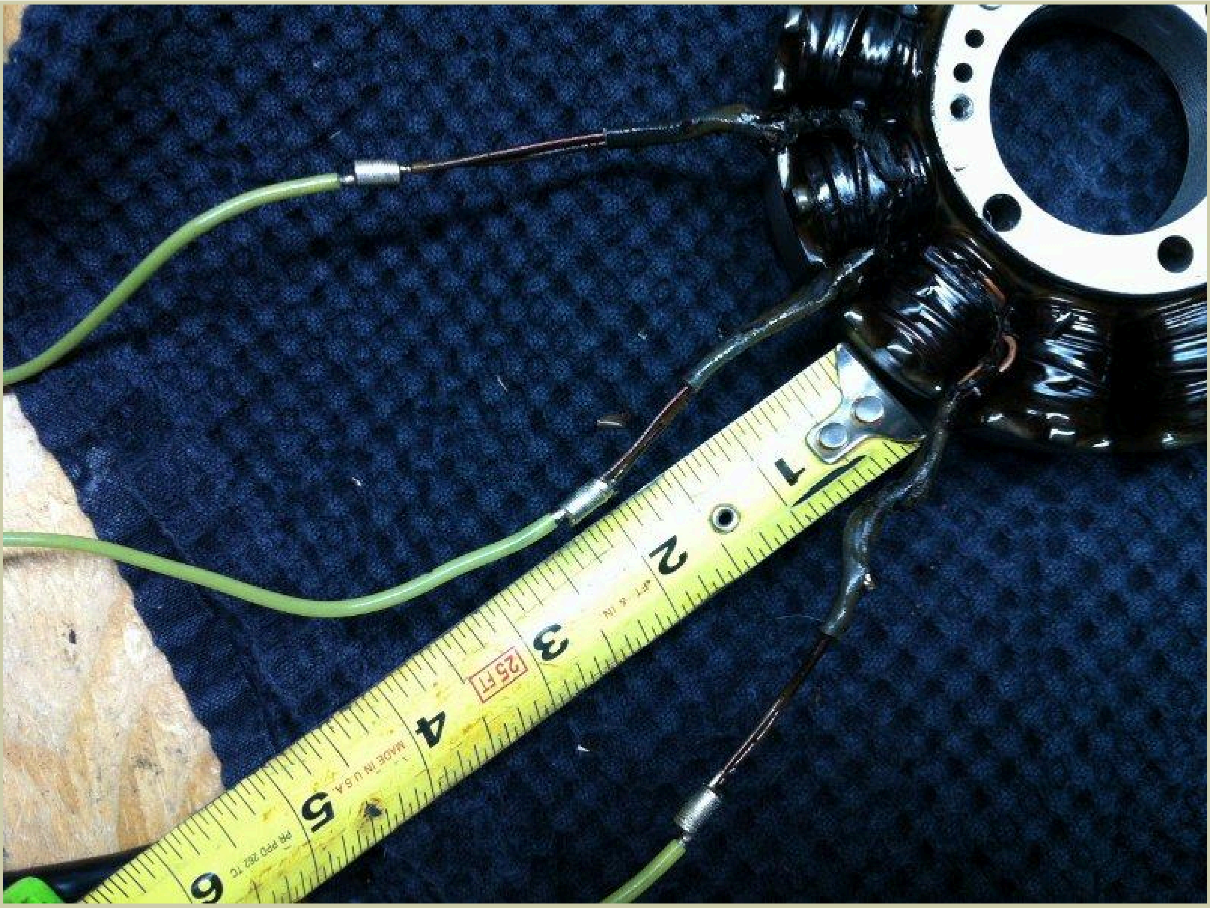
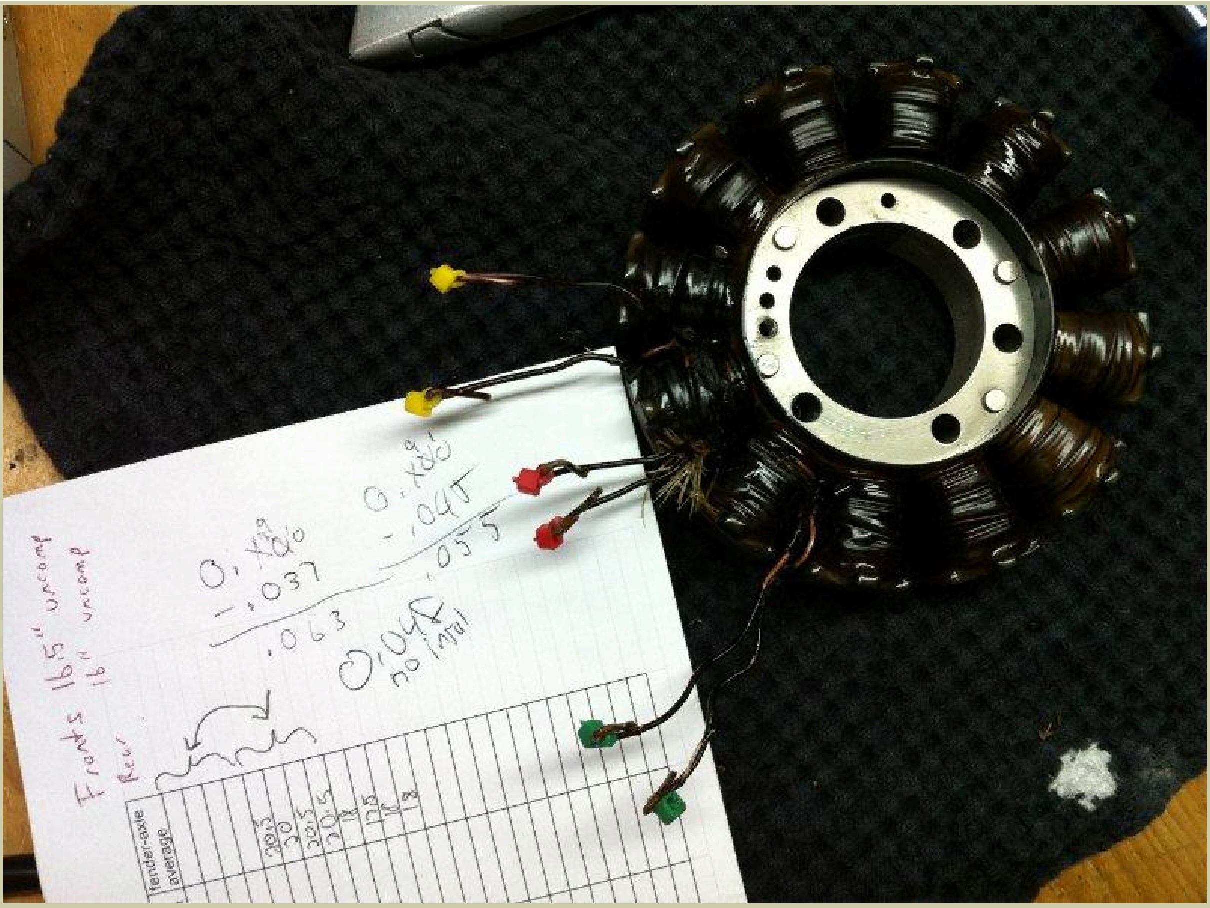
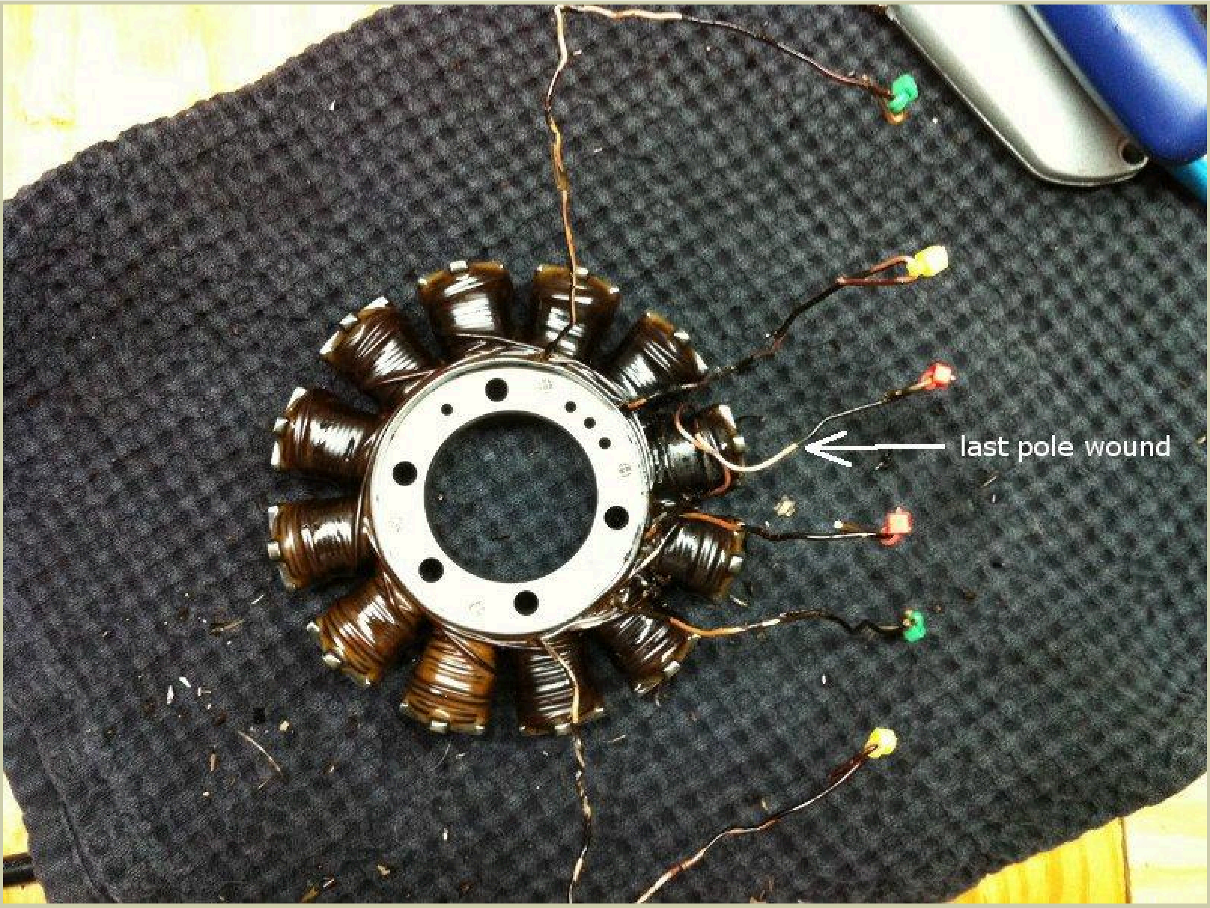




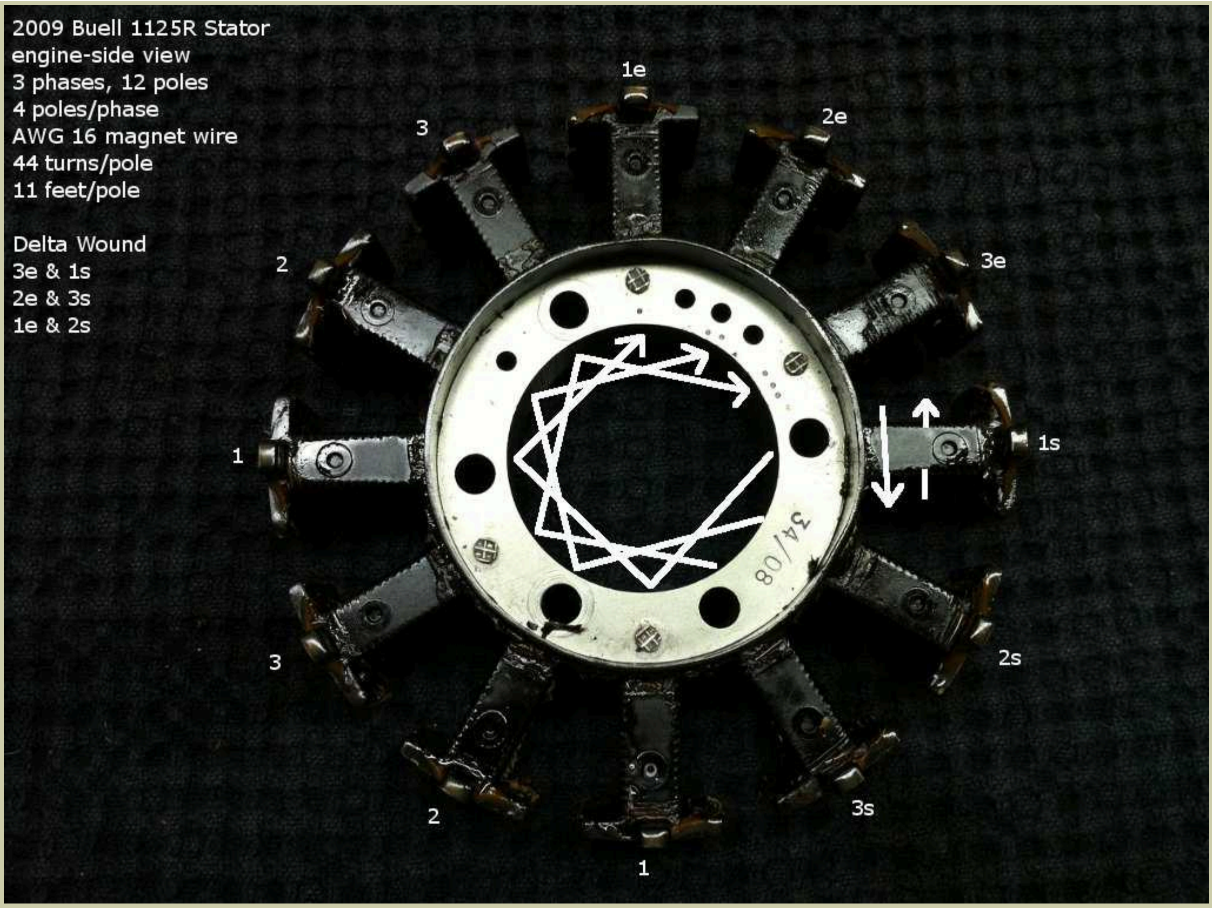

MADE IN U.S.A.
25 FT


Fronts 16.5" uncomp
Rear 18" uncomp
fender-axle
average


last pole wound

Winding Pattern

The three phases are connected together in a delta configuration. When viewed from the engine side, the poles are wound in a clockwise direction and each pole starts and finishes on the engine side. I sanded the enamel off of the wire and measured it with a micrometer, which showed that it was AWG 16 wire. Each pole had 44 turns of wire, which was about 11 feet of wire when straightened out. So, 150 feet of wire should be plenty to rewind it. The following photo describes my rewind plan.



Wire

I have been unable to determine the insulation class or varnish/epoxy type used on the factory stator. My plan is to use 240C polyimide (ML) coated magnet wire in AWG 16 size with heavy build. Thankfully, MWS Wire provided me with a decent quote for more wire than I needed in 16 HML. You cannot get much higher temperature wire without moving to ceramic coated wire, but that requires much larger bend radius. If the original stator was wound with polyimide-insulated wire, parts of the windings must have spent significant time at or above 270C/518F for it to fail at 4000 miles/hours. It is also possible that the original stator was wound with different insulation or a bad batch of polyimide that would fail at lower temperatures.

Epoxy

Special thermally conductive epoxy, like Duralco 132, has viscosity comparable to or greater than J-B Weld and it is expensive at $86/pint. Electrically resistant epoxy, like Duralco 4461, is good at penetrating windings, but expensive at $90/pint and not thermally conductive. I plan to use J-B Weld epoxy, which can withstand 500F/260C continuous, to hold the windings in place and protect against vibration, but I plan to use as little as possible. The thermal conductivity of J-B Weld is 0.59 W/(m*C) or 2.36 BTU-in/(hr*ft^2*F), which is similar to water and a bit less than Cotronics Duralco 4460/4461 at 4 BTU-in/(hr*ft^2*f). I bought the J-B INDUSTRO WELD package that works out to $15/10oz or $24/pint. I tested some J-B Weld thinned with acetone, which would penetrate windings better, heated to 500F for 4 hours and it held up really well. It was still strong and hard as a rock afterward, but I did not like the surface microcracks. The internal color was a lot more uniform than the photo, which over-emphasizes the fracture surface shadows, but I should have probably done a more thorough mixing job.


1oz J-B Weld & 1/2tsp acetone cured 48 hours


1oz J-B Weld & 1/2tsp acetone
after 4 hours at 500F

I tested some J-B Weld heated to 500F for 4 hours and it held up great. The embedded popsicle stick turned to charcoal. The very dark gray surface is due to either surface overheating from the radiant heating elements, surface oxidation at elevated temperature, or bread crumb smoke absorption.

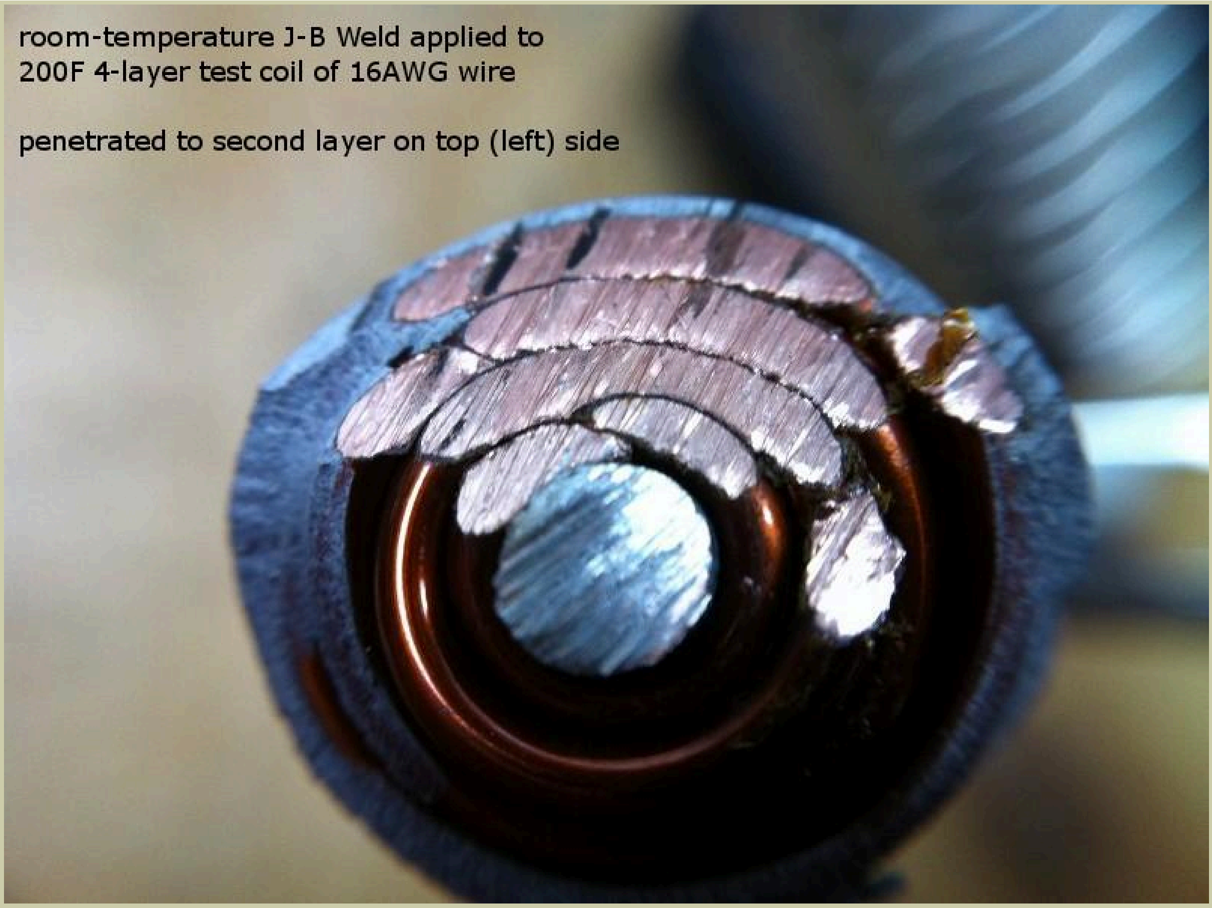

1/4oz J-B Weld cured 2 weeks


1/4oz J-B Weld cured 2 weeks
after 4 hours at 500F

Next I tested how J-B Weld flows when heated instead of thinned with a solvent. After I smeared the room-temperature J-B Weld on the 200F 4-layer 16 AWG test coil, it thinned, flowed over the coil, and dripped off the bottom. It flowed better with heat than with the recommended amount of acetone. After curing for 24 hours, I cut it open at an angle to see how well it penetrated. It penetrated the first and second layers on the top side with gravity's help. It barely penetrated the first layer on the bottom side with gravity working against it. I think the J-B Weld pulled a significant amount of heat out of my tiny test coil, which also limited the penetration. The stator has significantly more thermal mass. If I heat it to 200F and keep my heat gun on it, I should get much better penetration. I also plan to wipe any excess off for a very thin layer on the outside.


test coil heated to 200F


room-temperature J-B Weld applied
to 200F test coil


room-temperature J-B Weld applied to
200F 4-layer test coil of 16AWG wire

penetrated to second layer on top (left) side


room-temperature J-B Weld applied to
200F 4-layer test coil of 16 AWG wire

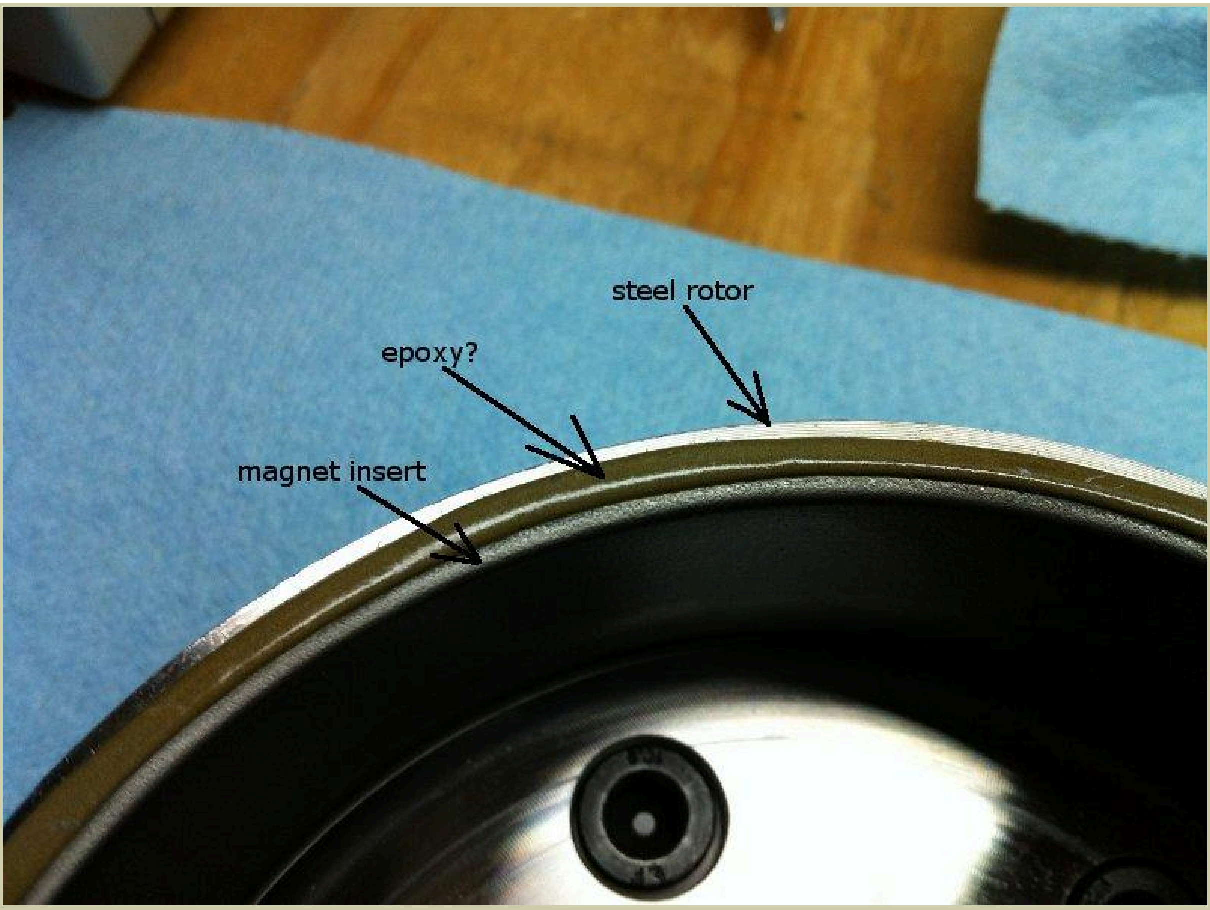
barely penetrated first layer on bottom (right) side

Rotor Modification

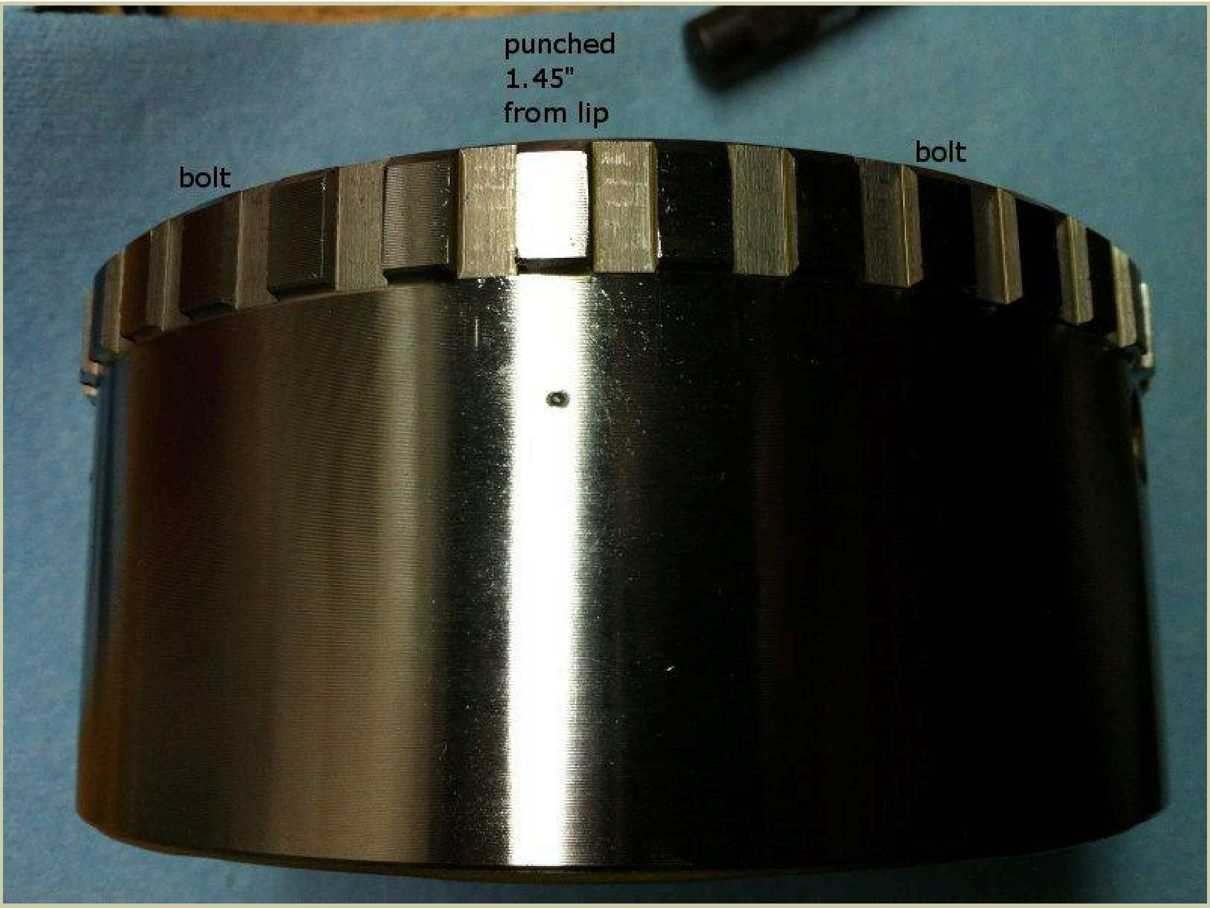
Removing the 8-magnet rotor was easy with my impact wrench and no crankshaft locking tool was necessary. I put the bike on my rear stand and put it in sixth gear with the rear tire off the ground. I used my propane torch to heat the rotor nut along all sides for about 20 seconds total. Then it turns out my DeWALT DW059 cordless 1/2" impact wrench was absolutely perfect for this. It has a maximum torque rating of 300 ft-lbs and it took the nut right off. I'm sure someone will say that this put way too much stress on the transmission, but they would be mistaken because I did not use a breaker bar or torque wrench. The rear wheel was free-floating and it did not move at all. The impact wrench worked against the inertia of everything (rotor, crankshaft, rods, pistons, transmission, etc) to loosen the nut. I imagine that the inertia of the rotor and crankshaft alone are enough for the impact wrench to reach 300 ft-lbs. So, I'll be using the same technique to reinstall the rotor since my impact wrench has a maximum torque rating equal to the revised torque spec. I'll use Permatex High Temperature Threadlocker Red, which is essentially the same as the EBR-recommended Loctite 272 Red High Temperature Threadlocker. Months later, I helped Jsg4dfan with his stator and rotor; he removed and reinstalled his rotor nut with same impact wrench and with the transmission in neutral. Neither one of us used the crankshaft locking tool.

EBR's original fix for the overheating stator problem was a kit that contains a rotor with a precision machined oil jet in addition to a lower power rotor and stator. This oil jet sprays oil on all of the stator poles as the rotor rotates. That's pretty cool, but I'm not willing to try that with my hand tools or spend that much money right now. One thing I noticed is the total lack of forced air cooling for the stator. The stator fits tightly in the rotor and there is nothing forcing air in or out of the rotor. My idea, which is sure to be controversial, is to drill six small air cooling holes in the rotor between the magnet insert and the rotor flange. I did not find any oil in this area of the rotor when I removed the case, so this modification will not affect oil distribution. These holes will be small and will not interfere with the magnets, so I feel risk is minimal. Also, the holes are symmetrical, so balance should not be affected much. As the rotor spins, these six holes will function as a crude impeller / centrifugal air pump and force air from inside the rotor to outside the rotor on the engine side, which must be replaced by air flowing past the stator and into the rotor on the open side. I started by punching the hole location to accurately locate the drill, used an 1/8" drill, and then finished up with a 3/16" drill. The steel rotor is about 1/4" thick where I drilled the holes.


plan to drill air
cooling holes in
gap between
magnet insert and
rotor flange


steel rotor
epoxy?
magnet insert


6 air-cooling holes
should function as crude impeller
to draw more air through the stator

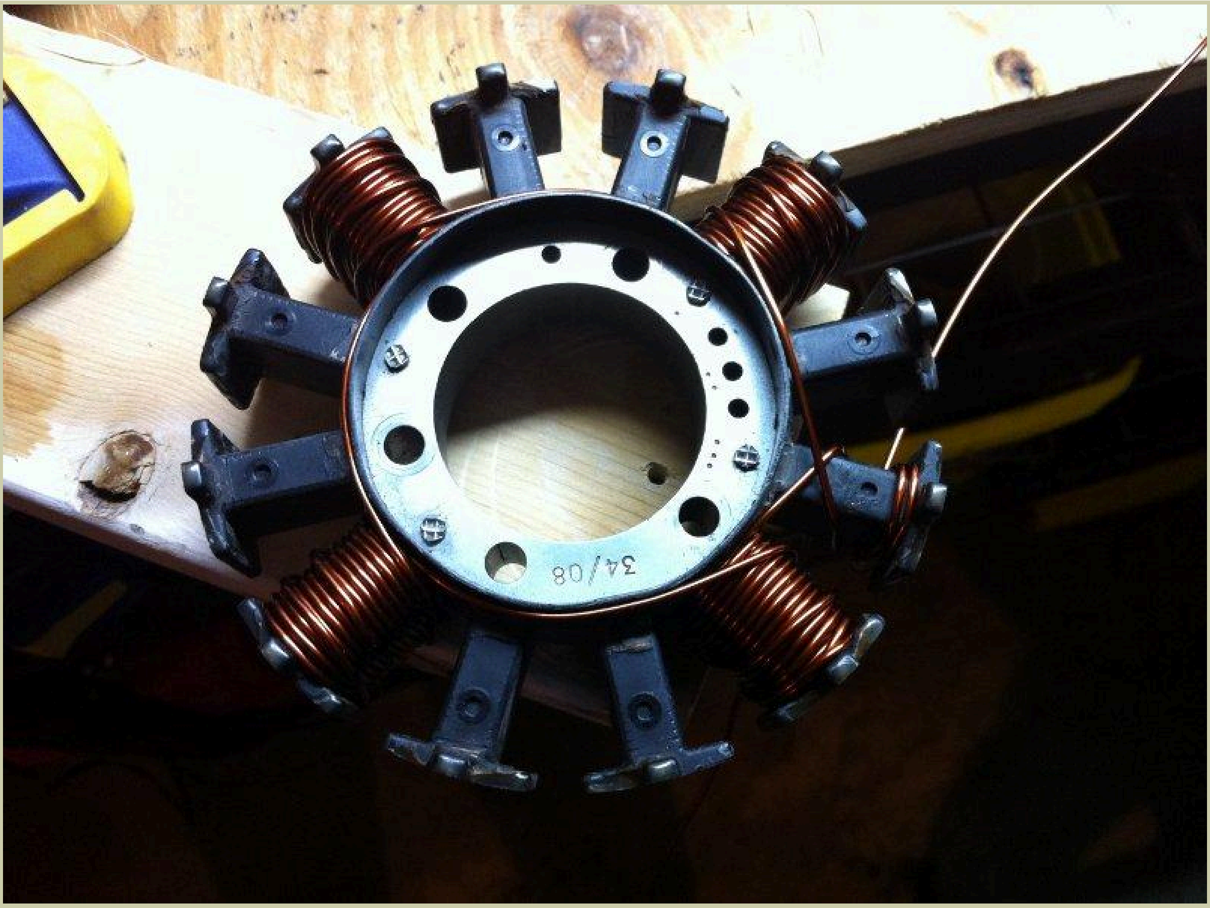

punched
1.45"
from lip
bolt
bolt

Almost a year after doing this rotor modification and debating its effectiveness on BadWeB, an interested reader informed me of some overheating stator problems on the BMW F800GS, which has a parallel-twin Rotax motor. The official fix from BMW/Rotax is, get this, an air-cooling rotor design. Hopefully this lends a little credibility to my hair-brained hand-drilled idea. Notice the same 6 air holes spaced exactly half way between the 6 bolts. The main difference is that I placed my air-cooling holes at the rotor perimeter and BMW/Rotax chose the rotor flange. These flange holes are bigger, but I obviously thought perimeter holes would make better use of centrifugal force. Anyway, the original rotor construction looks remarkably similar to the 1125, which is no surprise. Both this air-cooling design and my hand-drilled one are easier to manufacture than the precision machined oil jet in EBR's rotor. Very interesting.

People known to have the 1125 air-cooling rotor mod as of 7/5/2015: me (Hildstrom), Jsg4dfan, Mitchell, Zew2888, Mike, and Craig. There may be others, but these are the people I've heard from.

Rewinding

I first tried to hold the laminations in my left hand and wind with my right hand, with no gloves. Big mistake. I could not get the wire tight, my hands hurt, and the ridges in the lamination plastic coating made it very difficult to adjust the first layer of windings. So, I sanded the plastic coating around each of the corners. Then I rigged up some clamps and 2x4s to hold the laminations, which allowed me to wind using two gloved hands to pull the wire tight. I used an old wire brush handle to manipulate the windings and to press the first finished layer flat. The first three layers were all about 13 turns with the fourth layer 5 turns or less; 13*3+5=44. I was happy to complete the four poles of the first phase. I did one phase per day for three days and finally twisted the proper wires together for the delta configuration. Check each phase for continuity and ground isolation as you go.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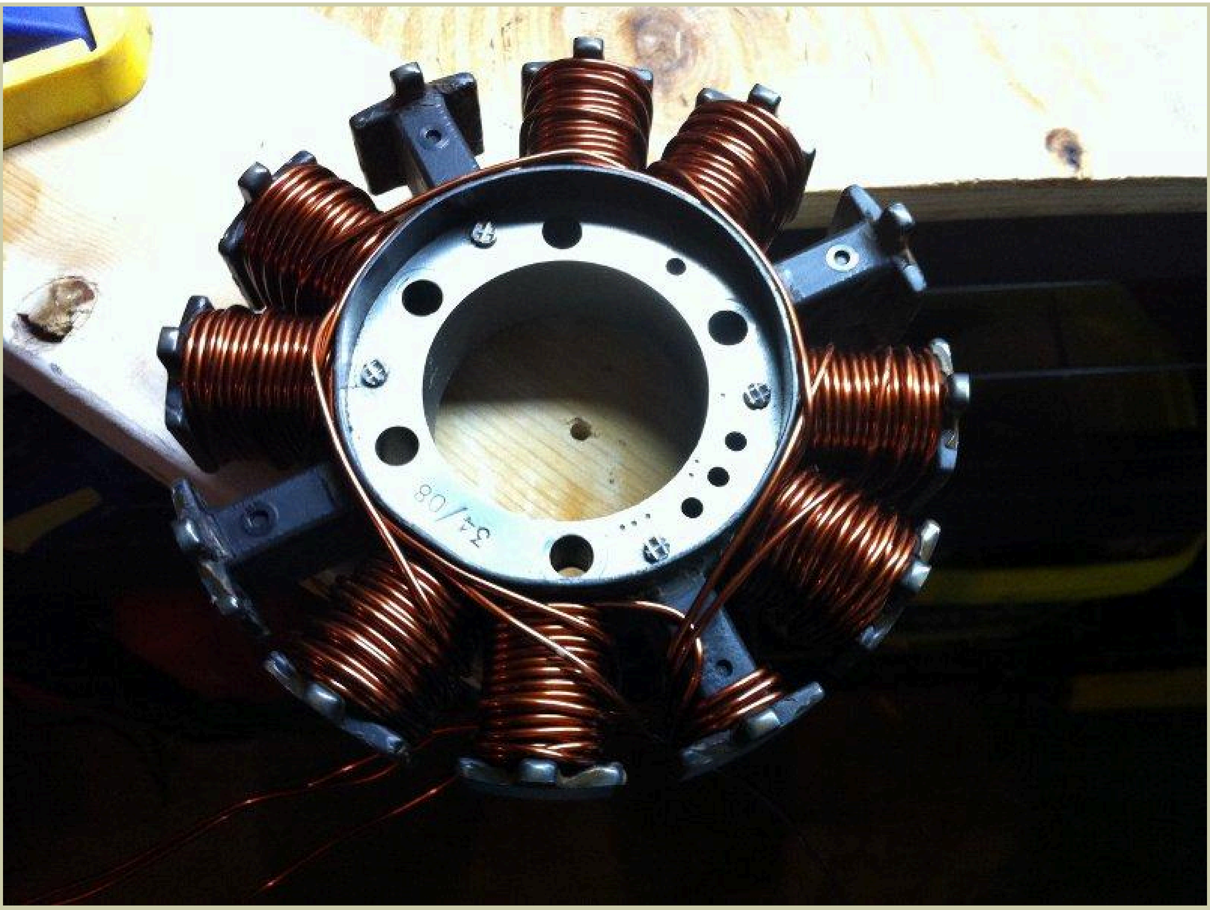
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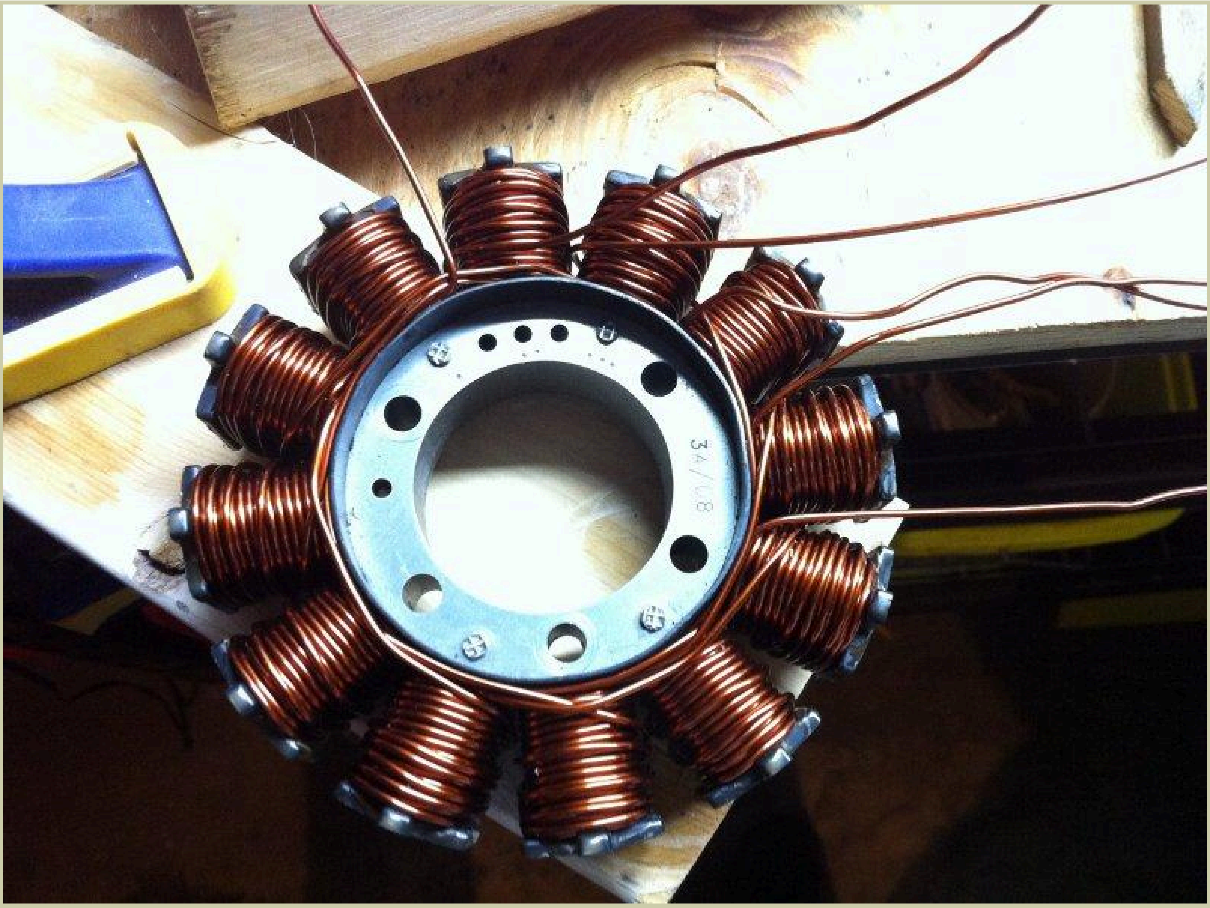

34/08


2e & 3s
3e & 1s
1e & 2s
34/08

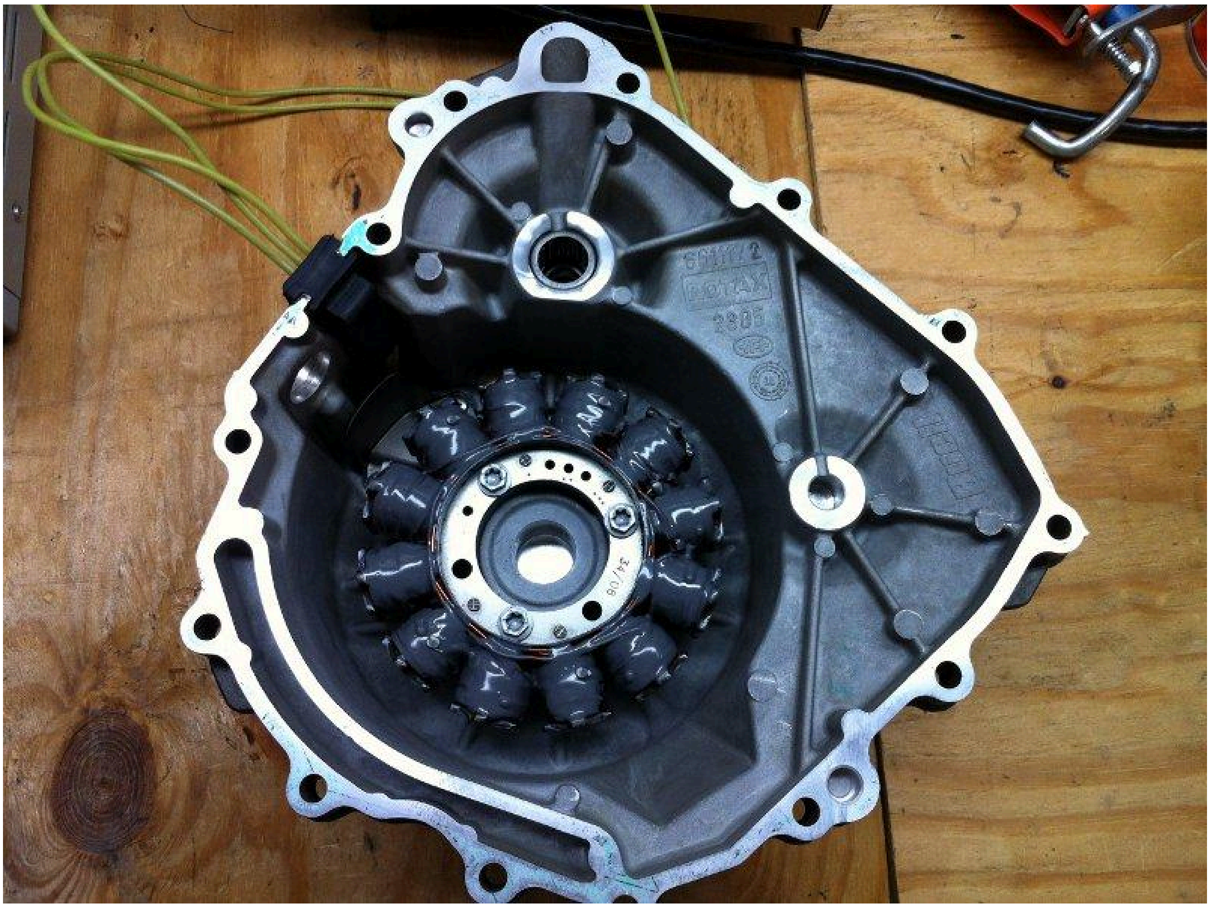
Next, I heated the stator in our toaster oven on convection bake, which uses an internal air circulation fan, at 200F for one hour to make sure it was heated completely through. I marked the inside of a bathroom cup with a pencil using tablespoons of water as a guideline. I mixed up two tablespoons (1 oz) of J-B Weld using one tablespoon of resin, one tablespoon of hardener, and a Popsicle stick. As soon as I felt it was mixed thoroughly, I removed the stator from the oven and set it on a 2.25" hole saw on top of some newspaper. I applied J-B Weld to the engine side first. It had a thick and almost pasty consistency at room temperature (70F), but it thinned, ran, and dripped after a few seconds on the hot stator coils. The drips did not form J-B Weld stalactites on the bottom of the stator, so I know that was a result of small thermal mass in my penetration test earlier. The larger thermal mass of the stator allowed its temperature to stay elevated for much longer, which allowed the J-B Weld to remain thinner for longer. I did not need my heat gun. I applied two coats on the engine side, but that was probably not necessary. A side effect of the heat was extremely fast cure time. A few minutes after I finished coating the engine side, it was no longer tacky and I flipped the stator over to coat the cover side. After pulling the delta wires through to the cover side, I applied one coat on the cover side and you can see it is thinner. In most places the engine side and cover side flowed enough to run and meet in between poles, but some windings were exposed in several places. I was not looking for perfect coverage, just enough to keep things from vibrating and to help conduct heat between layers. With my rotor modification, any exposed copper between poles will function as cooling fins. The side of a pole shown below with exposed windings was the one with the least side coverage; all the rest had better coverage. Based on my lower-temperature penetration test and the fact that the fourth stator layer was only 5 turns with huge gaps, winding layers 2-4 should be well bonded together at the top and bottom of the poles. The elevated temperature and longer duration may have even penetrated into the first layer, but I'd rather not disassemble it just to find out. After doing both sides of the stator and waiting for it to set up (20 minutes), the J-B Weld in the mixing cup was still usable.


2¼"
34/08


2¼

In hindsight, a combination of acetone and heat may have been the best approach for this application with this particular epoxy. That would have thinned the J-B Weld even more for better penetration and it would have lengthened the set-up time at this elevated temperature for better penetration. However, my stator is complete, I'm itching to ride, and I'm done testing for now.

The polyimide coating is incredibly tough. I tried hand sanding the ends of the wire, but that got me nowhere fast. I used my mini torch to heat the ends of the wire until they glowed orange, which charred and destroyed the polyimide. Then I removed the charred remains of the coating with a wire wheel and my drill. I used self-fusing silicone tape, aka Rescue Tape, aka F4 Tape, for electrical tape. It is good to 500F, a great electrical insulator, chemical resistant, and very tough. In order to try to replicate the original attachment method, I used a strand of wire to wrap each lead to each pair of delta windings. Then I soldered it, taped it all up, put down a bead of Permatex Ultra Black RTV Silicone, and mounted it back in the ignition cover. Again, check for continuity between phases and isolation from ground.


ROTAX

Installed Stator Test
I installed the stator. At cold idle, the stator produced about 21V AC on each phase. At cold 3000 rpm, the stator produced about 40V AC on each phase.

Hot Idle Testing
I connected it to the new CE-605 SB series rectifier regulator and did some testing. I idled the bike in various states on my rear stand for about an hour. The voltage never dipped below 12.1 with both cooling fans running and the high beams on; even a slight increase in rpm brought the voltage above 13. The voltage never dipped below 12.6 with both cooling fans running and the high beams off. Here are the results:

time	coolant temperature (F)	gear	high beams	rpm	voltage
12:49	159	n	y	1600	14.3
12:54	179	n	y	1500	13.6
13:02	193	n	y	1300	12.4
13:10	199	1st	y	1700	13.6
13:12	200	n	y	1300	12.3
13:19	208	n	y	1300	12.1
13:24	208	1st	y	1700	13.2
13:31	209	n	y	1300	12.1
13:33	209	1st	y	1700	13.2
13:34	209	1st	n	1700	13.8
13:35	209	n	n	1300	12.6
13:49	209	n	n	1300	12.6

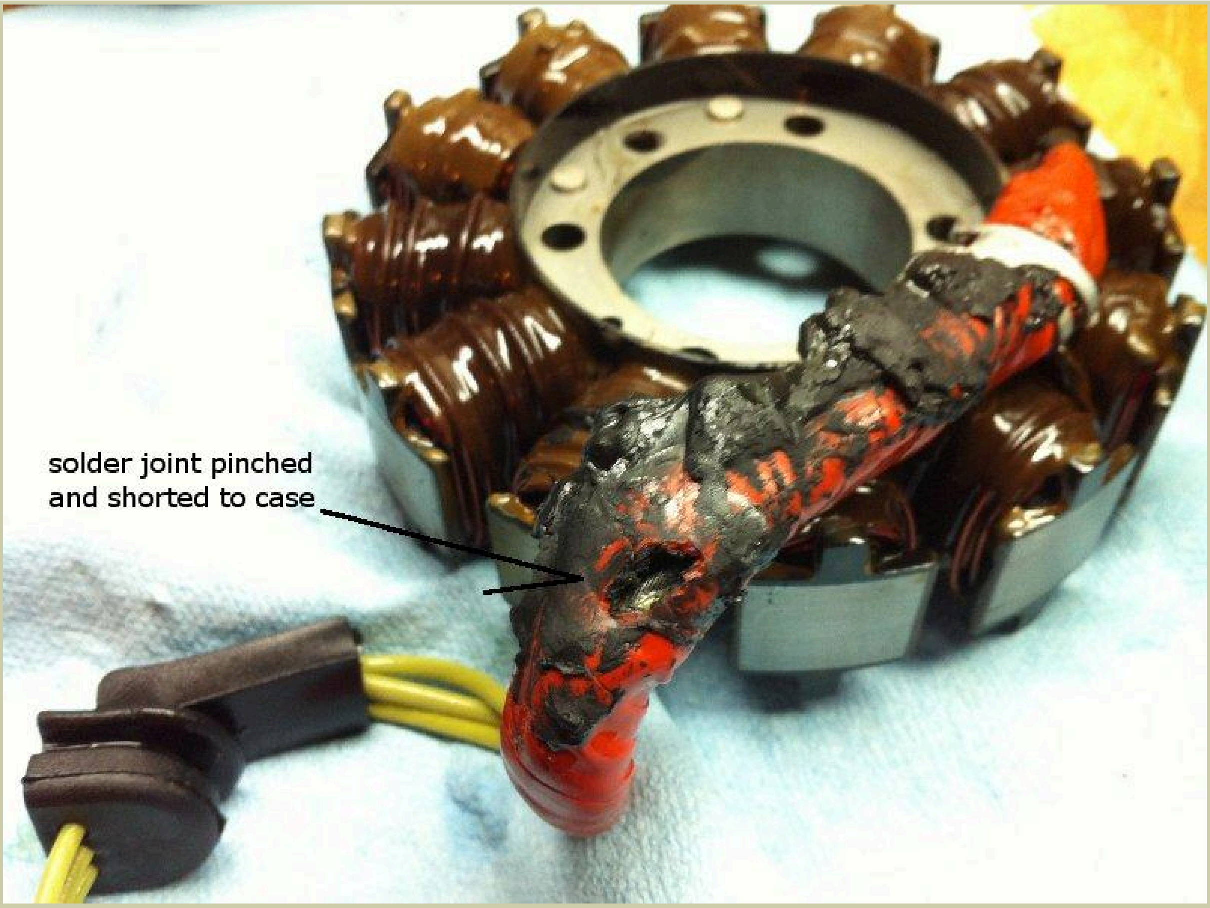
First Ride
Next, I went for a 30 mile cruise. It was mostly 20-45 mph with only a few miles of highway in the middle. I sat through probably 15-20 stop lights. The ride finished with about a mile at 20 mph. Ambient air temperature was about 80 F. The voltage never dipped below 13.8 even at the longest stop light. Most of the time it was between 14.1 and 14.5. The voltages would

probably be a bit lower if the air temperature was above 100 F. As soon as I pulled into the garage, I stopped the engine, removed my gloves, and felt the CE-605 SB regulator temperature. It was warm, not hot; I could grab the regulator continuously with my hand or press my inner forearm against it continuously. I think the mounting location I chose for the new regulator is great.

Now only time will tell if this fix is permanent.

Short to Ground

About 200 miles later, on my 12 mile ride home from work, voltage dropped from 13-14 to 11-12 regardless of RPM. It got as low as 11.1 when I had to wait for 3-4 traffic light cycles. It was about 90F in the shade and my coolant temperature got up to 220F thanks to the extremely low fan voltage. I knew something was very wrong. As soon as I got home, I removed the seat, unplugged the stator, and tested it for a short to ground. It was shorted to ground. I disassembled it this past weekend and found the short. One of the solder joints had been pinched between the cable clamp and the case. The silicone tape could only withstand so much pressure and heat before it tore open. This was probably a result of different wire lengths, different insulating tape thickness, and improper centering of the wires under the cable clamp.


solder joint pinched
and shorted to case


solder joint pinched
and shorted to case

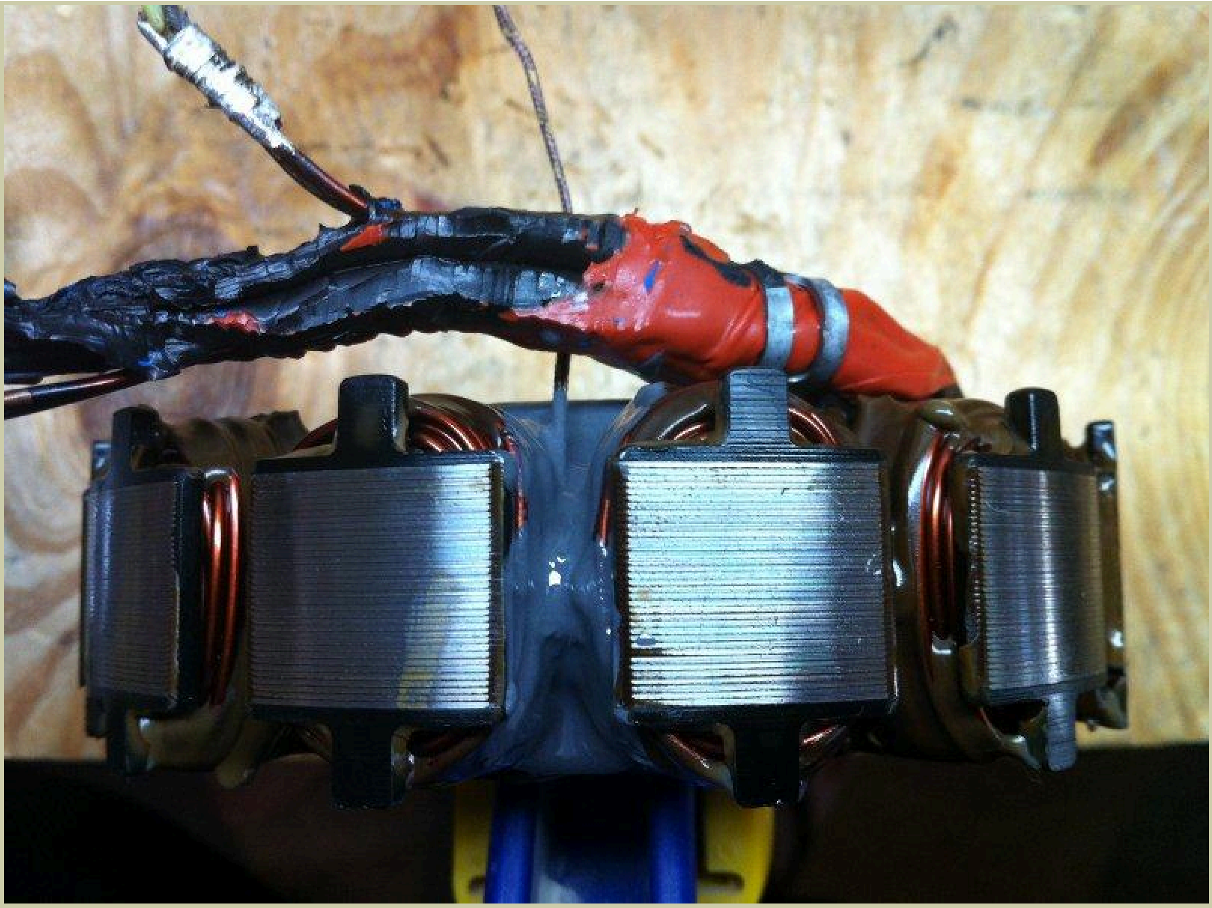
I was very curious about the discoloration of the J-B Weld after only about 190 miles of normal operation and 10 miles shorted to ground. I really hoped that the discoloration was not throughout the J-B Weld, which would indicate severe overheating and a need to rewind again. I lightly sanded the surface of the J-B Weld on two poles. The discoloration was only on the surface. The internal color was at least as light as my 500F test sample if not lighter. The discoloration must be a result of the oily mist getting deposited on or sticking to the hot stator.

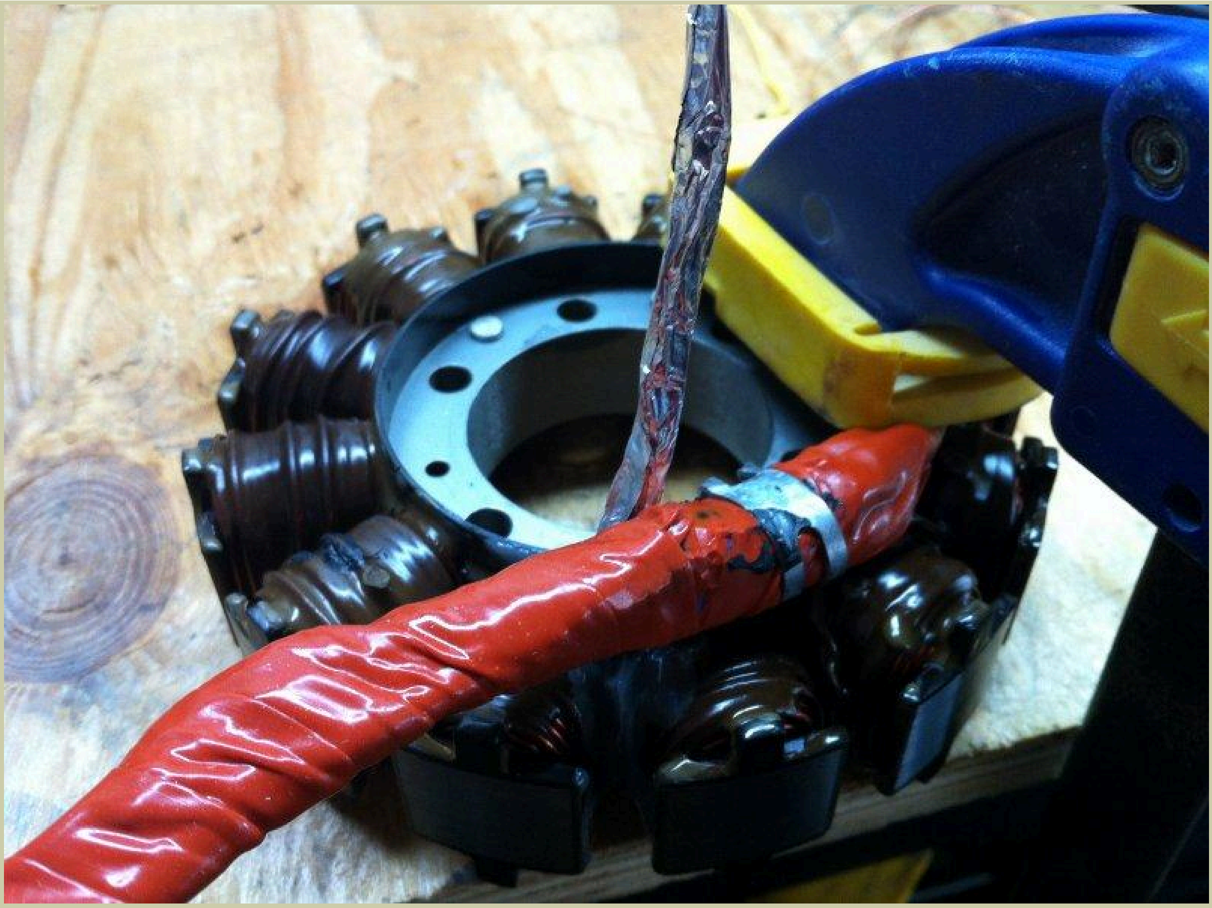

34/08

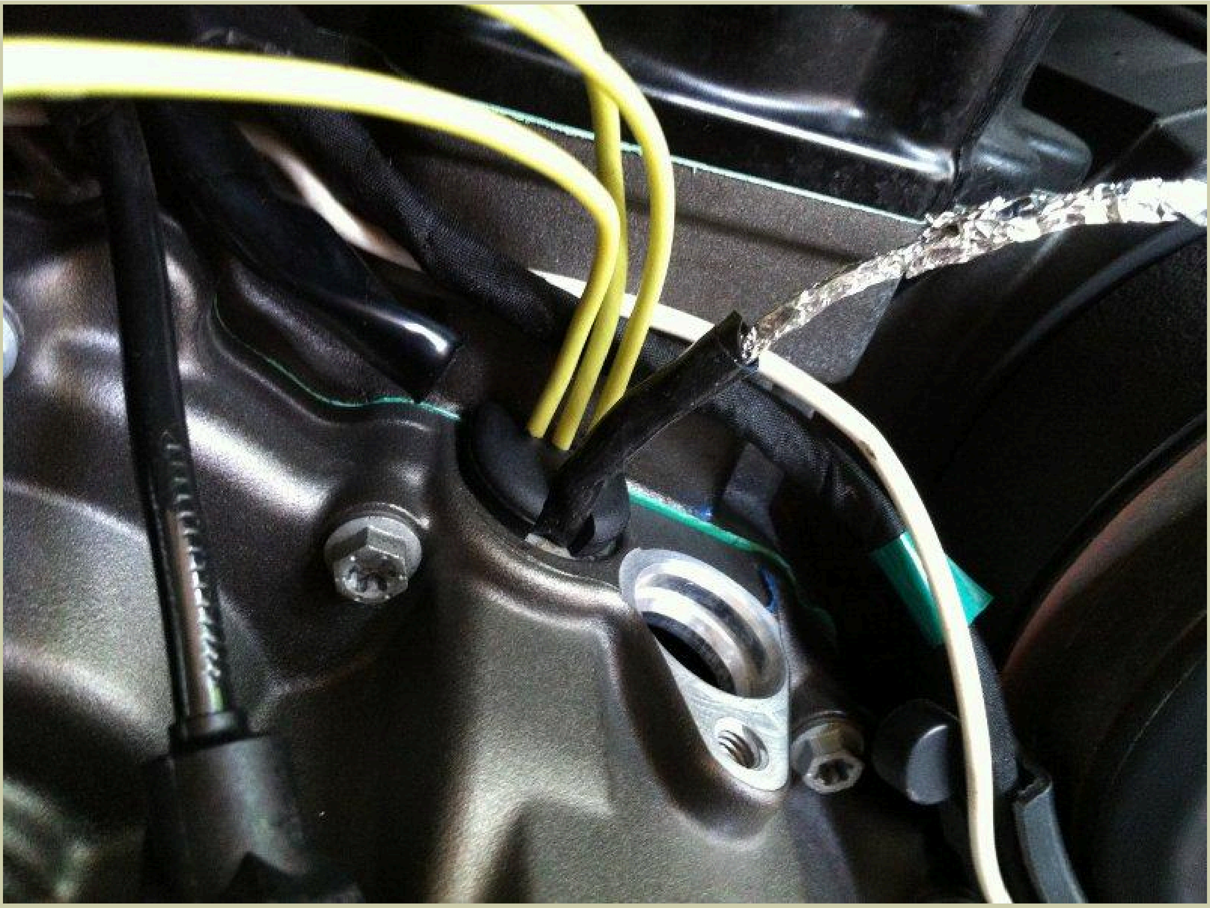
If you look at the photos, you can see why I did not center the wires properly. There is a sharp raised stiffening rib cast right in the middle of the clamp area where the clearance should be at a maximum. I went crazy with my air die grinder and took care of that.

Logger (4-channel)

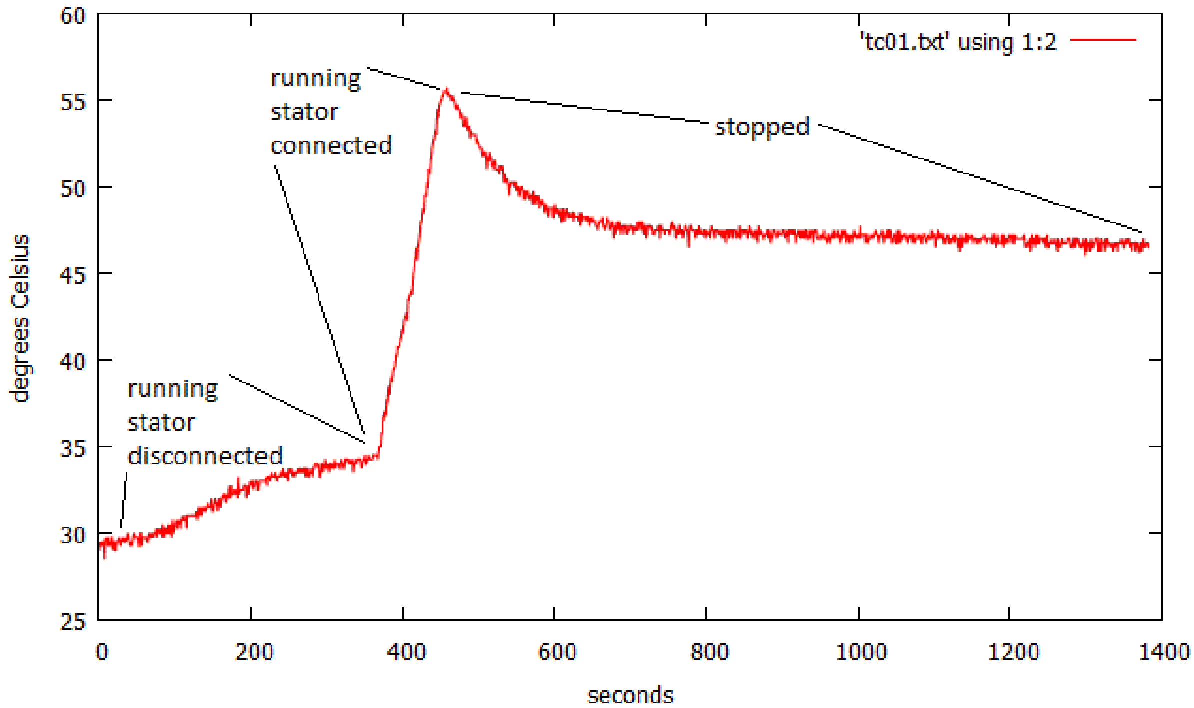
I bought and tested a thermocouple. I hooked it up to an Arduino Uno using a ProtoShield and MAX6675 IC, but I should have bought a MAX6675 pre-mounted to a breakout board or a SOIC to DIP breakout board because soldering tiny wires to tiny SOIC pins is difficult. I tested the sensor at room temperature and in boiling water; it was within about 5 degrees Fahrenheit for both. Then I tested it in my toaster oven at 300, 400, and 500F. My toaster oven has about +15F -25F range as its thermostat cycles. I used J-B Weld to attach the thermocouple as deep between two poles as I could. I applied several coats, so the thermocouple is embedded under 1/8" to 1/4" of epoxy. After twisting the wire a bit, I shielded it with 1"x1' strips of aluminum foil before taping it along side the stator wires. I paid much more attention to routing the stator wires to avoid pinching them this time and they were taped wide and flat instead of circular.



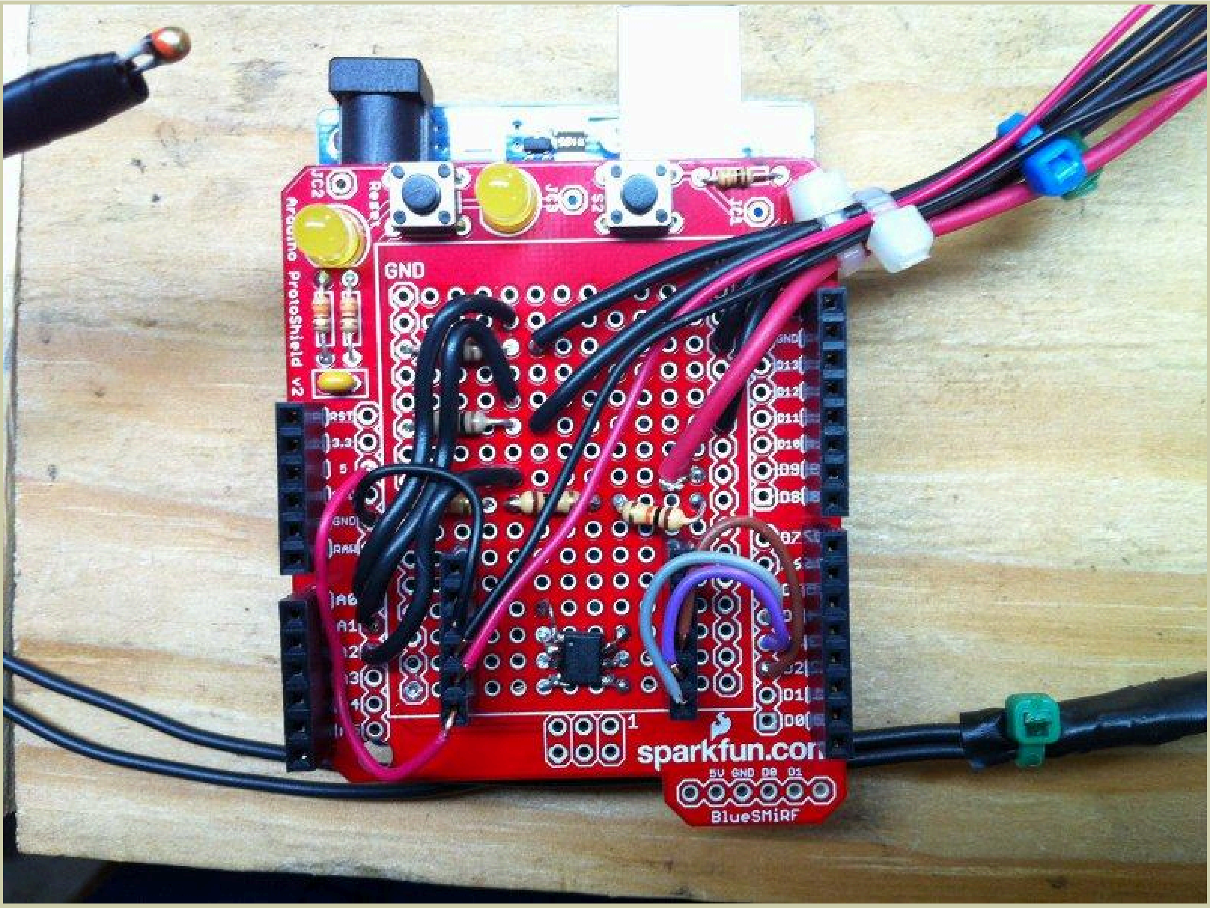


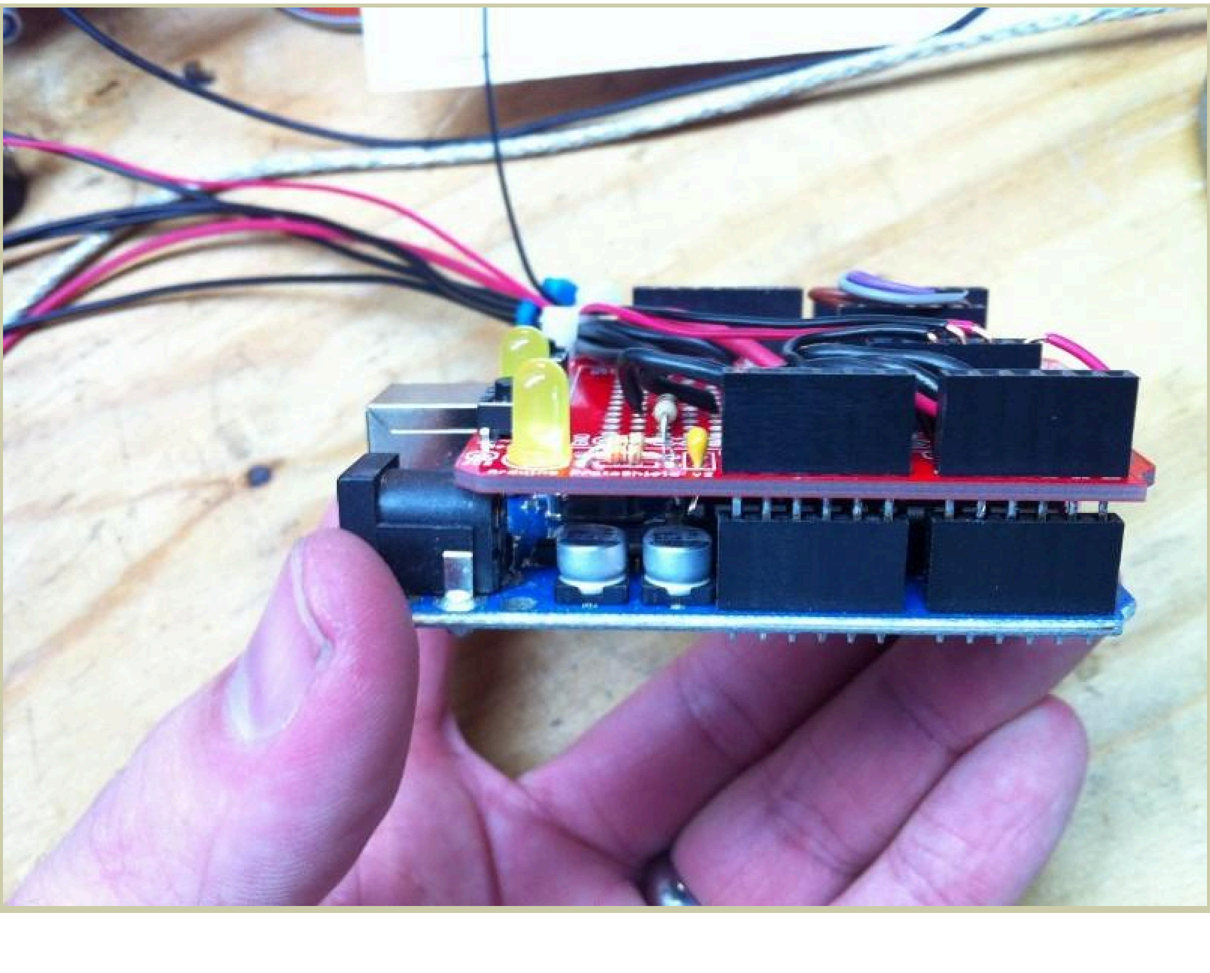



I wrote up a simple Arduino sketch based on this example and logged 1Hz data to the serial monitor. The J-B Weld had only partially cured, but I had to know if it was going to work properly. I started the bike with the stator disconnected. I got 21VAC at idle just like before. The thermocouple temperature rose steadily and the interference was not bad. Next, I started the bike with the stator connected to the CE-605 SB voltage regulator, temperature rose more quickly, and interference was still not bad at all. Then I stopped the bike and let it cool some. I have three more sensors to add to the data logger before I start riding and logging, but at least I know the stator thermocouple is working well. I'll post photos, schematics, and code once the logger is complete.



I added thermistors and a voltage divider to the ProtoShield. Notice the difficulty I had attaching tiny wires to the SOIC leads; sloppy but functional. That brings the sensor count to 4: stator thermocouple, regulator thermistor, air thermistor, and battery voltage. I finished the board and did some sketch debugging last night. I seemed to be getting the correct numbers from all 4 sensors in the 1Hz live serial monitor and the 1 sample/minute EEPROM log. I used some J-B Kwik to fix the wires going into the SOIC headers. I also used J-B Kwik to attach one of the thermistors to the back of the CE-605 SB regulator in the corner between the heat sink and the epoxy backing. After experimenting with J-B Weld so much, J-B Kwik seems near instant with a very short working time. I used a cable tie to attach the other thermistor to the left bottom license plate bolt hole. It hangs down about 1/2" past the plate, so it should give decent air temperatures near where I mounted the regulator. I put some duct tape on the back of the Arduino to prevent shorts and tucked it and the excess wiring near the battery. I connected a barrel connector to an ignition-switched fuse so the logger will only have power when the key is in the on position or when I connect via USB. The latest Arduino sketch archive, logger-120419a.zip, works with Arduino 1.0 on Linux and Windows. Pin connections are explained in the code comments.


GND
sparkfun.com
5V GND D8 D1
BlueSMiRF

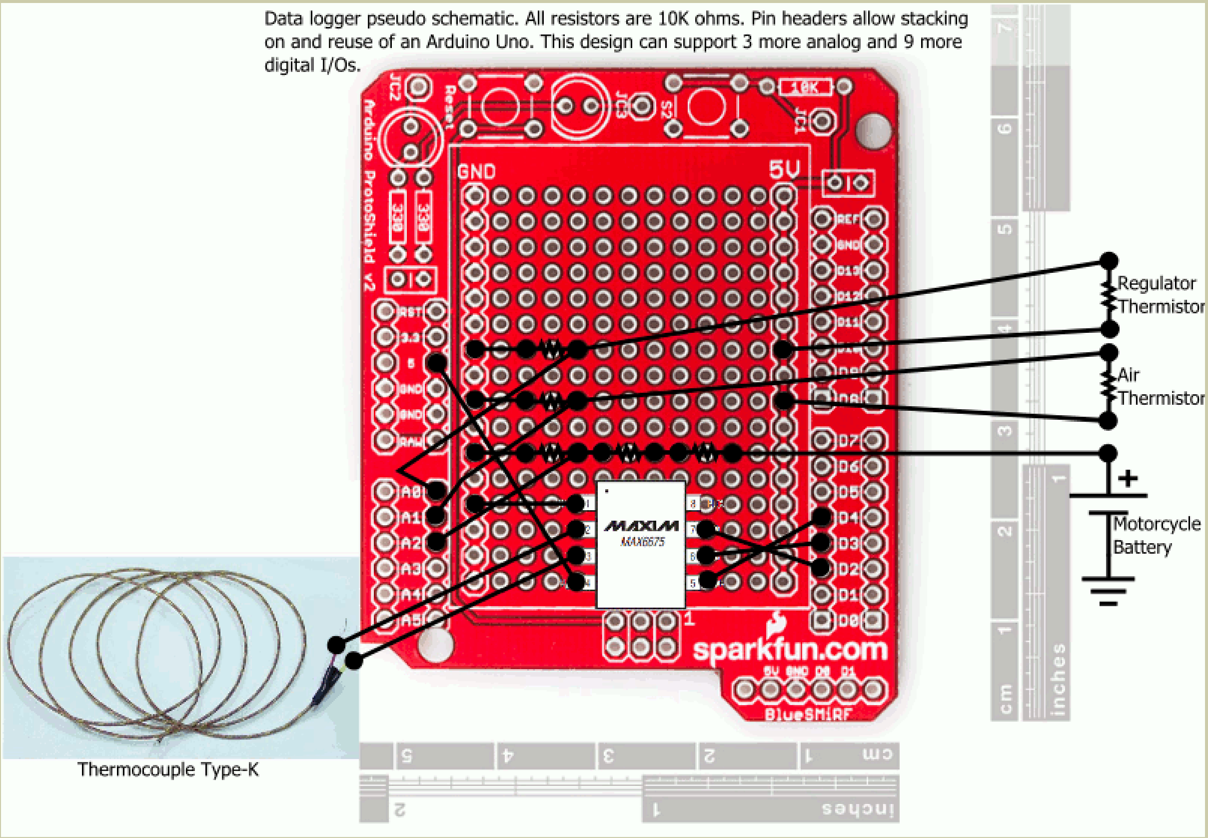


Gnuplot rules, even on Windows. Here is the command I use to quickly and easily recreate plots from the logged data: "load 'gnuplot.txt'". I capture the EEPROM dump in Linux using screen, but you can easily grab it from Arduino's serial monitor window using ctrl-a/ctrl-c and then paste it into a text editor or Excel. Gnuplot handles the LOGDATA strings and the column headers without complaining. The current logdata.txt file must be in gnuplot's current working directory for this to work.

I developed a short on the logger almost immediately. The bike's vibration caused the solder dots on the back of the Arduino to rub through the single layer of protective duct tape and contact the battery box. The SPI pins for the MAX6675 were intermittently shorting out, which is why the stator measurement was dropping out to zero and everything else was ok. I fixed this with five layers of duct tape and a cable tie.

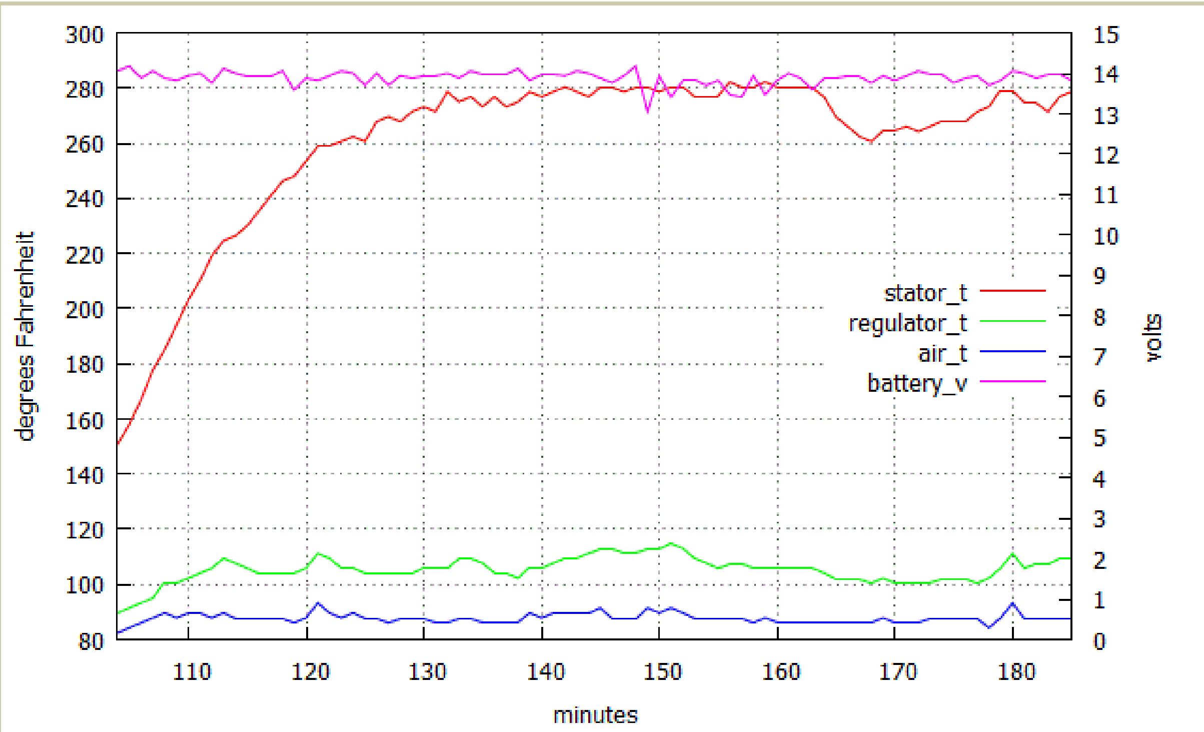
Part	Sparkfun Part Number	Unit Price
Arduino Uno	DEV-11021	$29.95
Arduino ProtoShield Kit	DEV-07914	$14.95
Thermocouple Type-K	SEN-00251	$13.95
Thermocouple Amplifier Digital MAX6675	COM-00307	$11.95
SOIC to DIP Adapter 8-pin	BOB-00494	$2.95
Thermistor 10K	SEN-00250	$1.95
9V to Barrel Jack Adapter	PRT-09518	$2.95
Total w/o shipping, resistors, & wire		$78.65

This design can support three more analog inputs, for a total of 6 analog inputs. It can also support at least three more MAX6675 thermocouple ICs for a total of 4 thermocouples. If you share the clock and output pins between MAX6675 ICs, you could connect 10 of them to D2-D13 in addition to the 6 analog inputs A0-A5. These additional measurements would certainly reduce the time capacity of the EEPROM or you could reduce the sample rate, but you could also log via USB or alter the design to use a microSD shield. However, I do not need many more measurements and the current EEPROM design seems to be working well for me. The capacity at 1 scan/minute with 4 8-bit samples is over four hours. Here is a pseudo schematic of what I built:



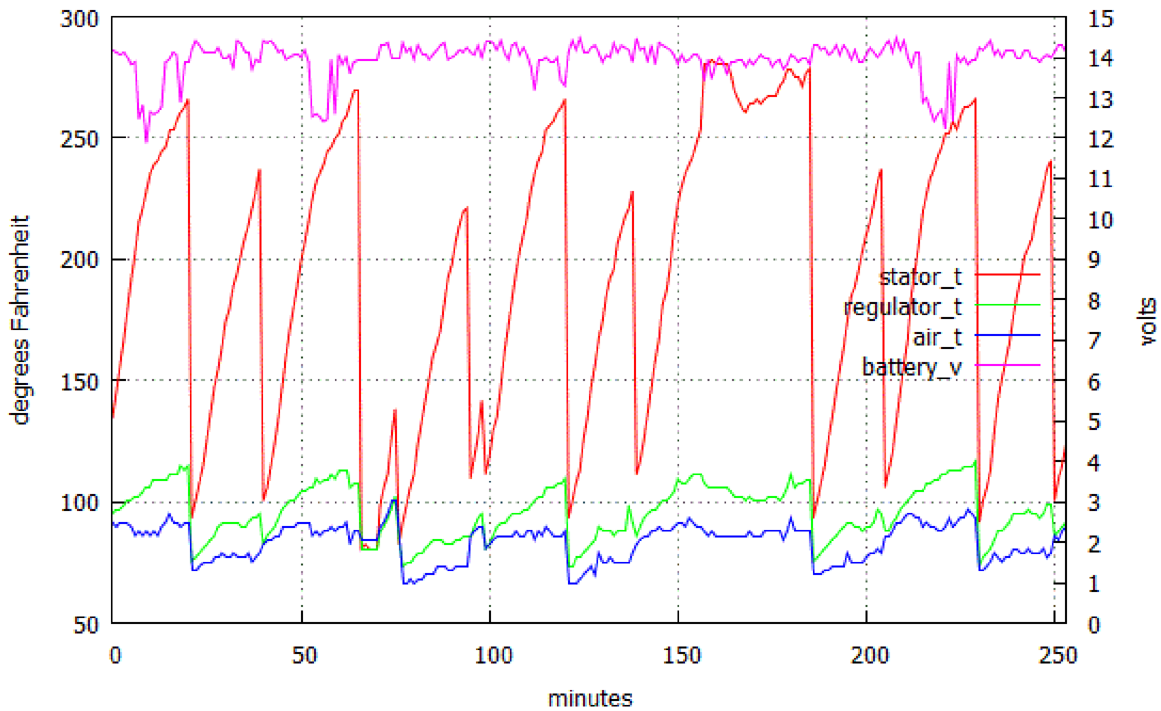
Results (4-channel)

I went for an 80-minute ride to test it out. My ride included highway, 20-30mph, and a few traffic lights; almost all of it was below 5000rpm. Here are the results from logdata01.txt:



Everything looks good to me. The maximum stator temperature (282F) is well below the maximum wire insulation temperature (464F) and the maximum voltage regulator temperature (115F) is well below the maximum safe operating temperature of most electronic components. However, the average air temperature was about 88F and I did not have to sit through consecutive light cycles. Things will probably look a bit different when I have to sit through four consecutive light cycles in over 100F.

I commuted for a week with daytime highs in the upper 80s and low 90s. Here are the results from [logdata02.txt]:



The log data revolved and you can only see a portion of my first 80-minute test ride remaining around minute 170. My commute is usually 20-30 minutes. The lower peaks at 40, 95, 138, 205, and 248 are the end of my morning commutes. The higher peaks at 20, 65, 120, 156, and 230 are the end of my afternoon commutes. The dips in battery voltage at 10, 55, 115, and 220 correspond to sitting through 3-4 consecutive traffic lights toward the end of my evening commute. Both radiator fans draw enough current to reduce idle voltage to the low 12s. What is really interesting is the amount of time required to get the stator up to full temperature; at least with these modifications and air temperatures. My 30-minute afternoon commute with several traffic lights was not long enough to get the stator up to the same temperature recorded during my long test ride, which is a good thing. The small peak at 75 was a quick test after fixing my ignition cover gasket situation. The small peak at 98 was a quick 3-mile ride from my office to my wife's office.

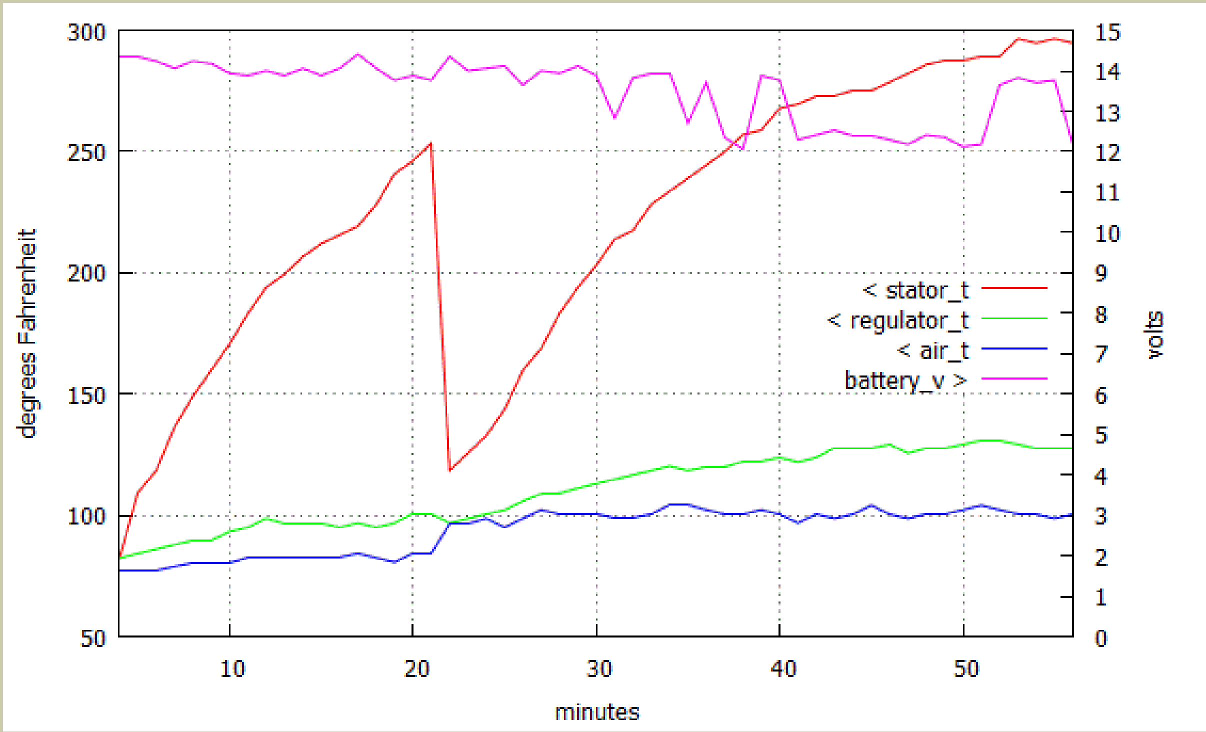
Logger (4-channel + ECM)

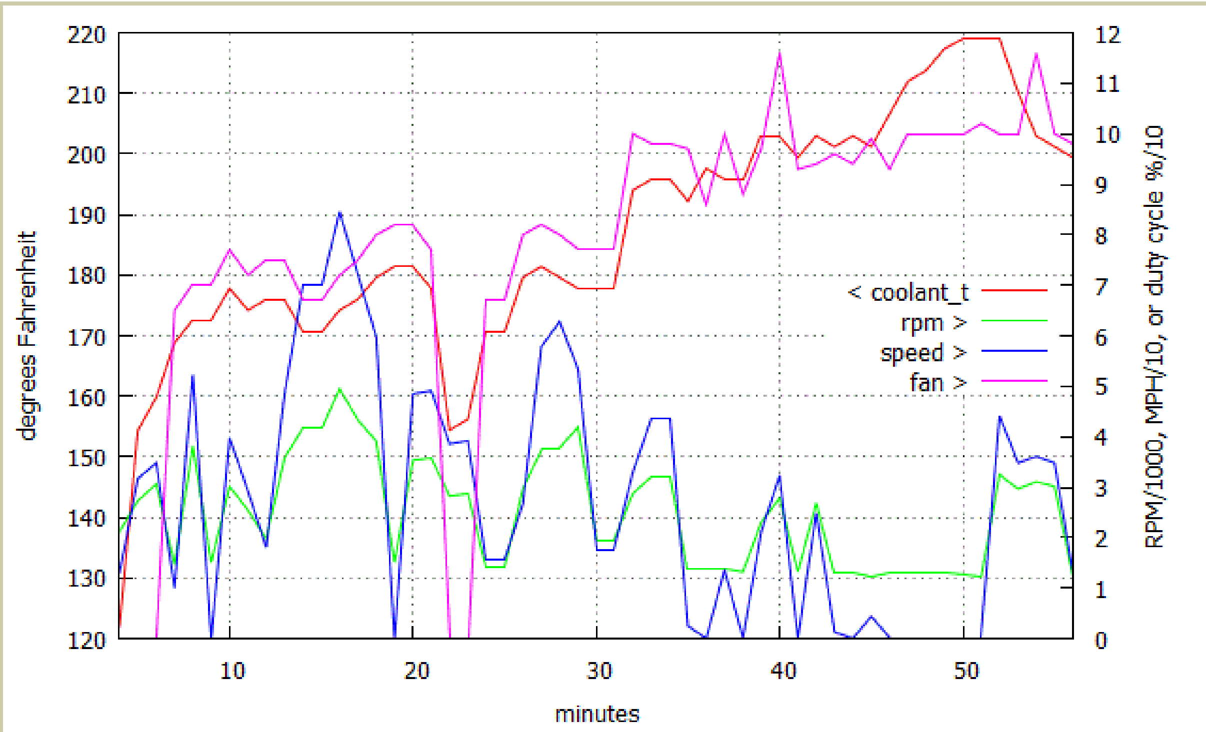
Numerous people on [BadWeB] have suggested that it would be nice to have RPM and speed data to help make sense of the temperature and voltage measurements. Sniffing the CAN bus would be cool, but that is a research project in itself. Thankfully, EcmSpy can log run-time data and they have published a lot of information about serial communication with the Buell 1125 DDFI-3 ECM. Since I'm not concerned with ECM data faster than 1Hz or even 1/60Hz, polling the ECM via serial should work fine for this temperature logging application. While I was searching for more information on the checksum byte in serial requests and responses, I came across the Buell ECM to Arduino project, which aims to display instantaneous horsepower, torque, and shift point in addition to logging ECM data. The information posted in that blog is extremely helpful even though it is for a Buell XB9 DDFI-2 ECM. I combined the information from the EcmSpy website and the Buell ECM to Arduino blog to add some ECM logging to my 4-channel logger. I made the serial ECM cable, connected ECM TX to D8, and connected ECM RX to D9. I did not run the ground wire since the two controllers already share a common ground. The latest Arduino sketch, loggerecm-120502c.zip, logs 4 sensor values (stator_thermocouple, regulator_thermistor, air_thermistor, battery_voltage*255/15) and 4 ECM values (RPM*255/12000, VSS, CLT, Fan_Duty) to the EEPROM. With 1 scan/minute and 8 1-byte channels, the EERPOM can hold just over 2 hours of data. The gnuplot script I use to plot this data is gnuplotecm.txt.

On a side note, if you require higher performance or more features, the TI LM4F232 USB+CAN Evaluation Kit, the BeagleBone, or the Raspberry Pi may be good alternatives to the Arduino platform.

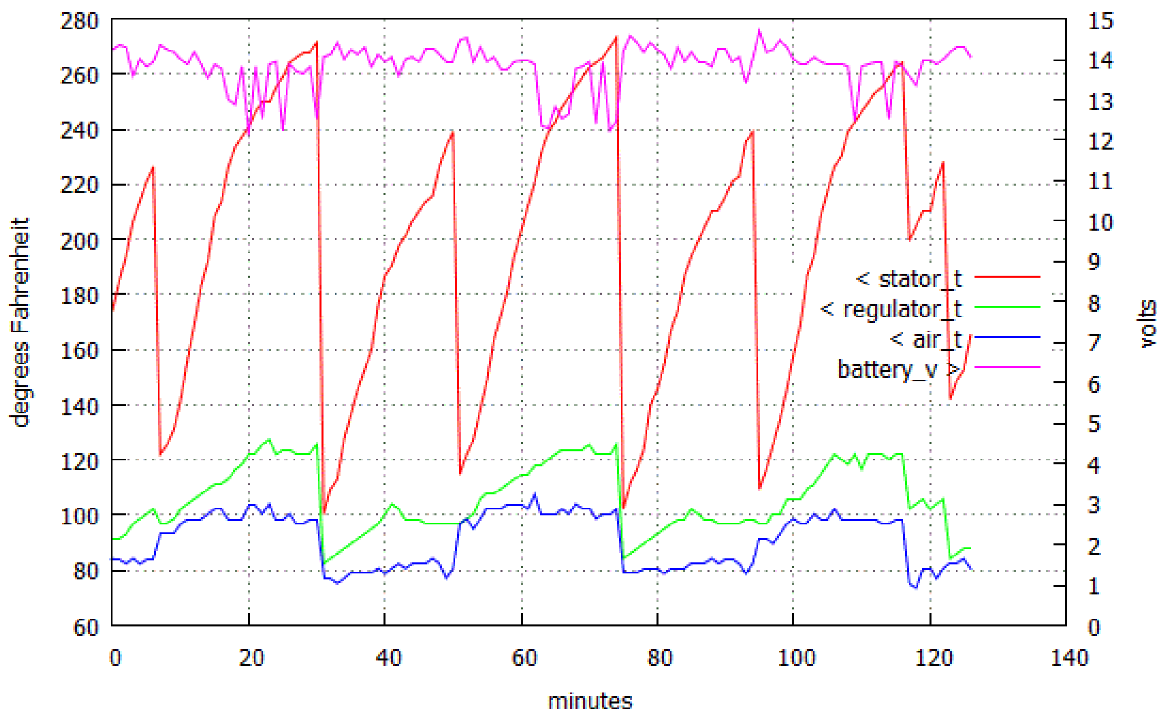
Results (4-channel + ECM)

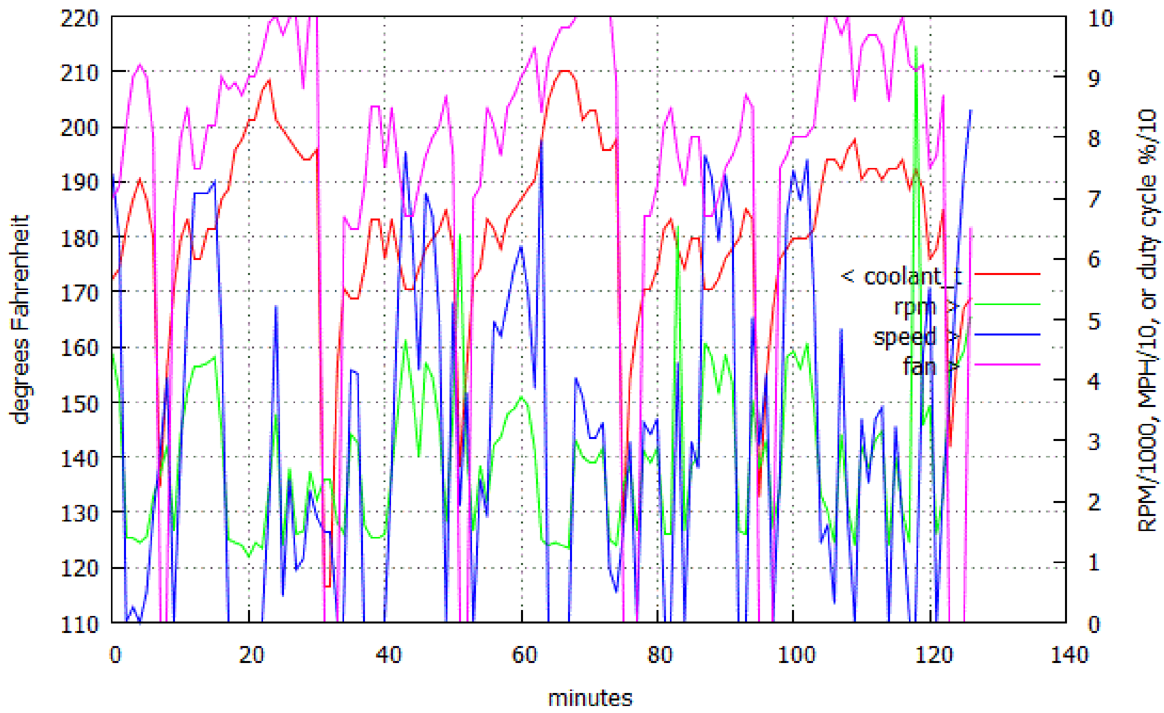
Here is my first commute with ECM data being logged. I took a route home with less highway and a lot more traffic lights. Temperatures are still in a safe range, but the most interesting thing is that the fan duty cycle field exceeded 100%. My best guess is that this value is calculated based on what the ECM thinks is needed and that values above 100 indicate you are at the mercy of ambient air temperatures and ambient air flow. Here are the results from logdata03.txt:



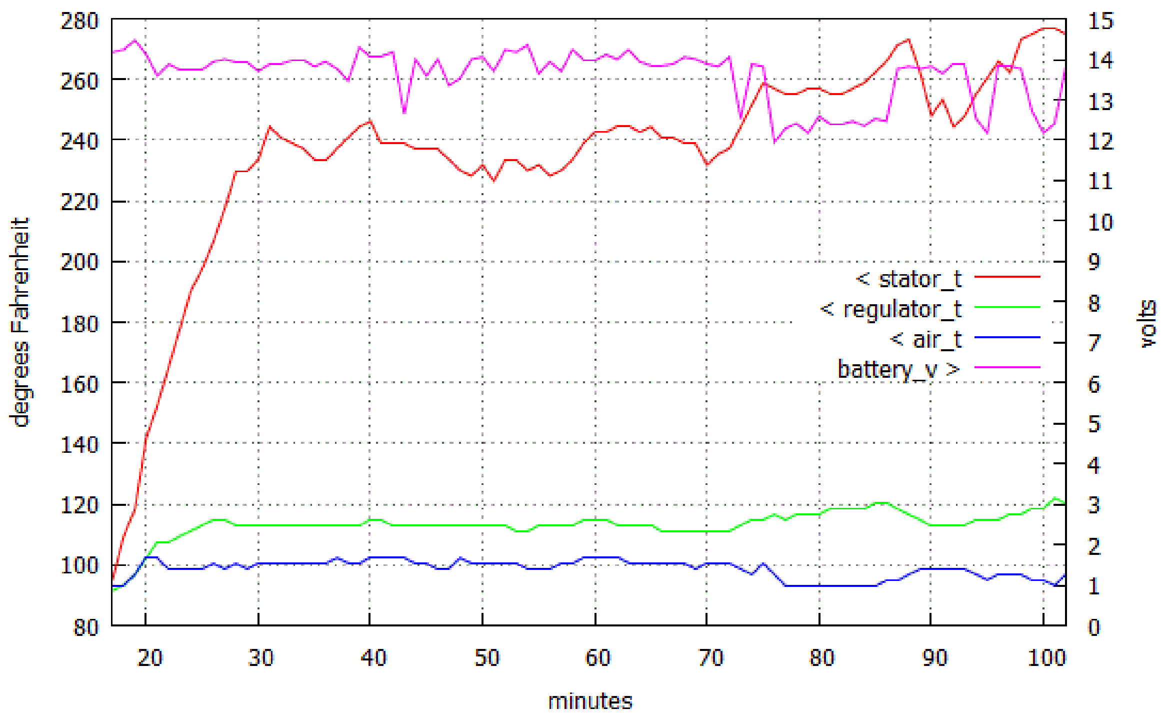


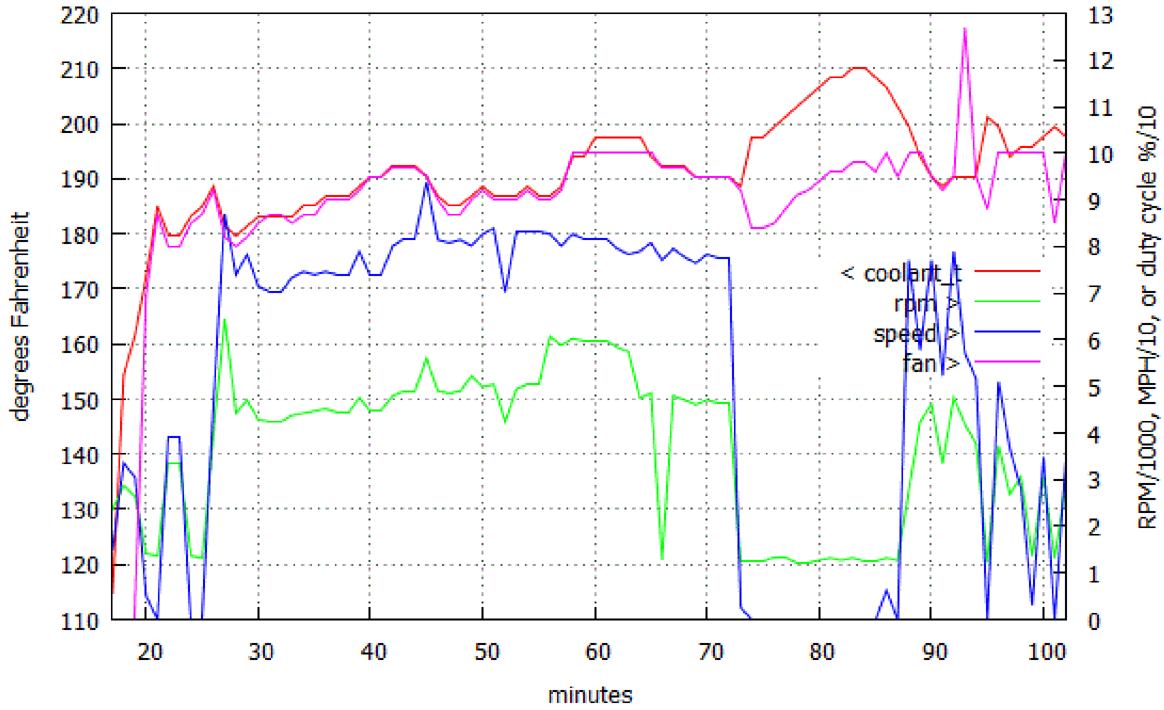
Here are many more commutes from logdata04.txt:





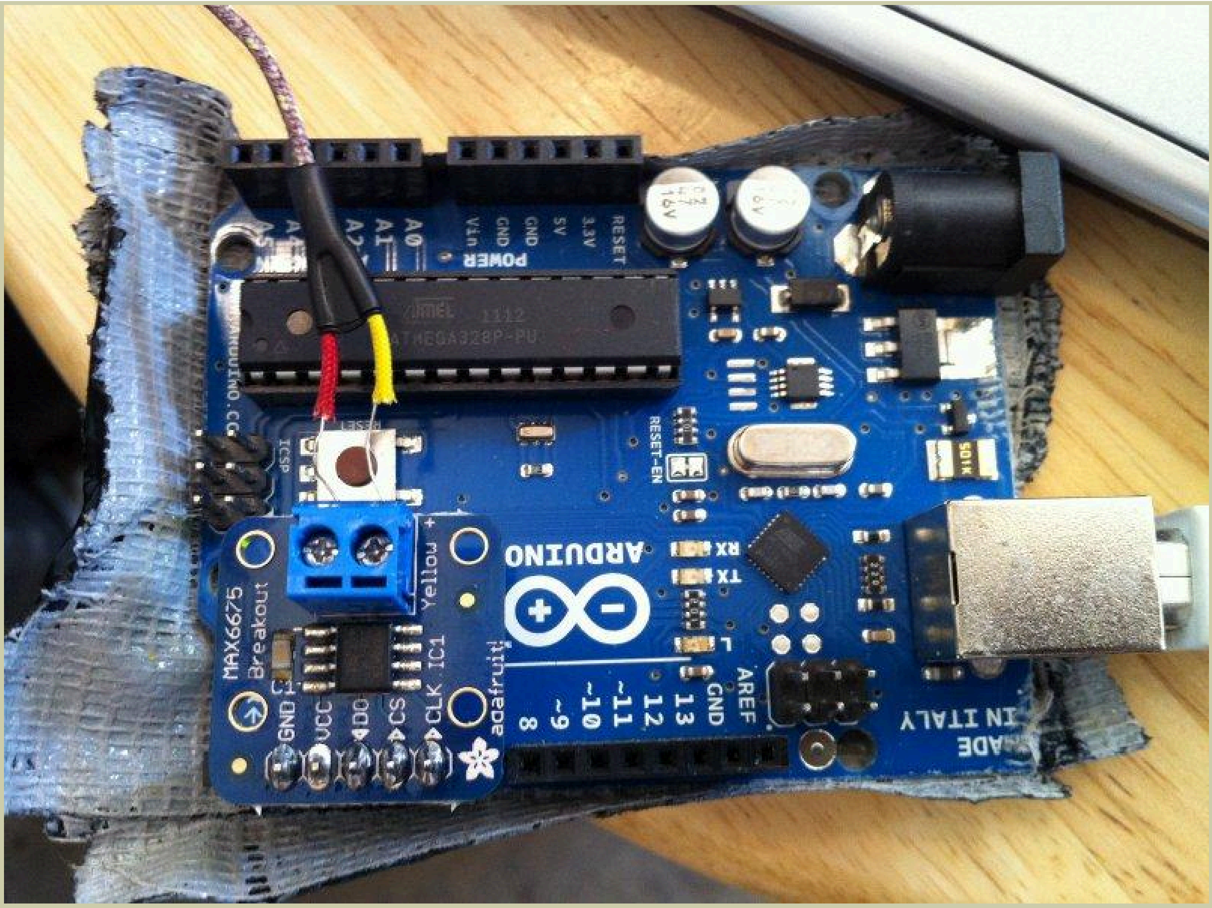
Here is a 90-minute ride from logdata05.txt:





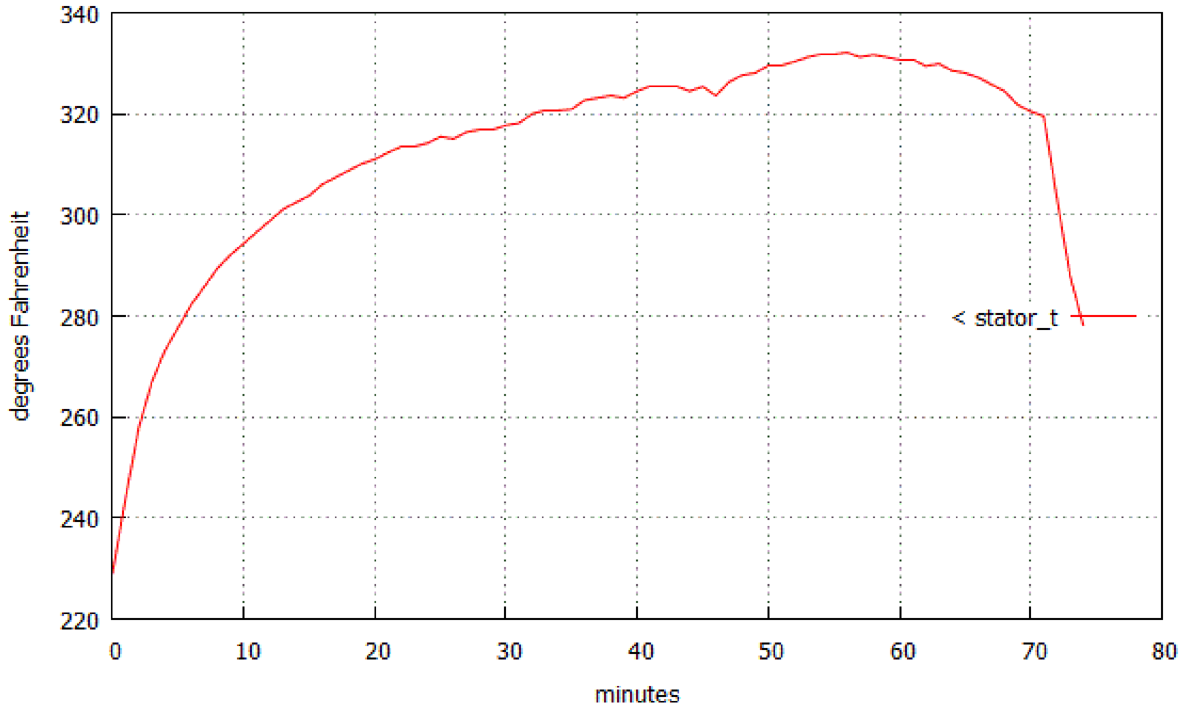
Logger (4-channel + ECM) Death

I set out to capture the idle stator temperature plateau. I went on a long ride and then idled the bike for an hour. Afterward, when I downloaded the data, I had hardly any stator thermocouple measurements; they were mostly zero. This is probably from my shoddy SMD workmanship around the MAX6675 chip. I removed the Arduino from the ProtoShield and then soldered up one of Adafruit's MAX6675 breakout boards, which provides much better connections to the IC and the thermocouple. It works great.



Idle Plateau

Ambient air temperature was 100F. I went for a 1-hour ride around town and then pulled into the garage. I put the bike on a rear stand and put a 24" fan behind the rear tire blowing out of the garage. Both doors were open. Ambient air temperature rose from 100F to 104F during the test. I connected my Arduino and MAX6675 board to my laptop and to the stator thermocouple leads. I idled for 40 minutes and observed the plateau of 163C or 325F; maximum coolant temperature was 225F. At minute 47, I disconnected the rear fuel injector and later observed a higher peak of 167C or 333F. At minute 50, coolant temperature was 211F. At minute 66 coolant temperature was 194F. I think stator temperature rose 4 degrees when the rear injector was disconnected because of the slight drop in idle speed and the rough running on one cylinder with the high fan current draw. It took a while, 20+ minutes, but coolant temperature dropped enough so the ECM could reduce fan duty cycle and the combination eventually reduced stator temperature. At minute 71, stator temperature was 159C or 318F and I turned off the engine. I am pleased with these results. My stator should survive this kind of torture indefinitely. Even a stator wound with 200C insulated wire instead of 240C insulated wire should survive this torture. These numbers lead me to believe that the air-cooling rotor is an improvement over stock, but I do not know by how much. I am also pleased with the rear fuel injector disconnect modification because it works. If I had started the idle test with the rear injector disconnected, like shifting into neutral with the mod at a light, coolant and stator temperatures would never have climbed to the plateau levels I observed. However, there has been some debate about whether the temperature actually plateaued during 2-cylinder operation; people want to make plots with large dots and ignore the obvious kink in the data when I switched to 1-cylinder operation. I should have let it run longer on 2 cylinders to silence the skeptics, but temperatures were in a safe range either way. The results from logdata07.txt are plotted here:



Also, fuel started boiling at some point during the test.

After 5000 Miles

I had a little oil mist leak around where the additional thermocouple wire exited the ignition cover. It had also been about 5000 miles since I rewound the stator, so I figured it would be a good chance to fix the leak and inspect the stator. My charging system is still working great. The voltage doesn't dip quite as low at long traffic lights since I've had my BatteryMINDer 12248 charger/maintainer/desulfator, so I think a weak battery was related to that. As you can see in the following photos, the J-B Weld is still discolored about the same as it was when I had the short to ground around 200 miles. I lightly sanded it again to verify that the discoloration is still only on the surface of the epoxy. The J-B Weld certainly wasn't designed for this application, but aside from the surface discoloration, it seems to be holding up great. The exposed polyimide insulation I can see still looks like new with no discoloration. I now have 1000 more miles on the rewind, air-cooling rotor, and series regulator than I had on the original charging system.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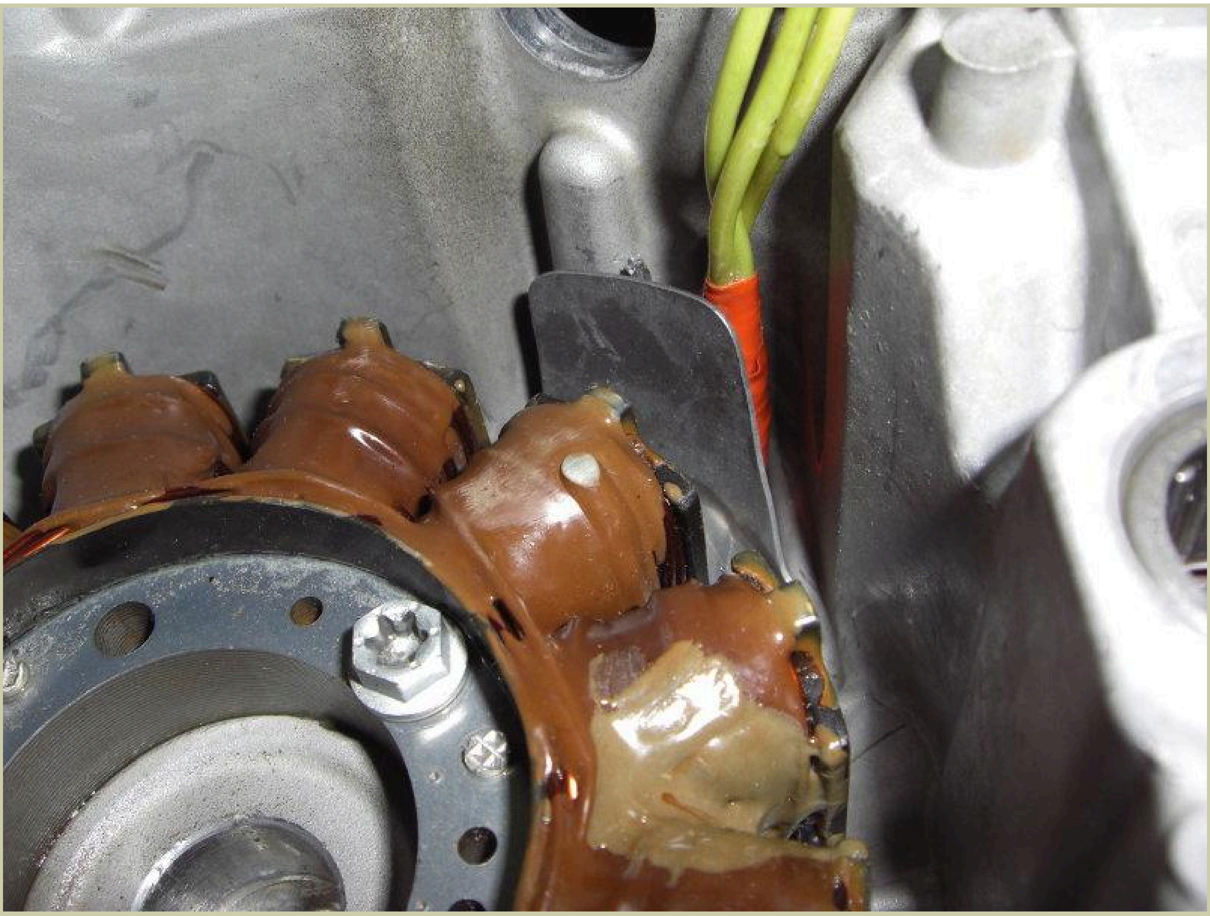

After 7000 Miles

I sold my 1125R right around 11000 miles on 10/22/2014. My rewind, rotor mod, and series-style regulator had about 7000 miles and almost 3 years on them when I sold it. Everything was still working great. I sold it because I was ready for a change, not because of any problem with the bike. I was a bit sad to see it go, but it went to a good home and I really enjoyed my time with it.

Additional Information

- BadWeB: Stator/Voltage Regulator/Charging System subforum
- BadWeB: Diy stator rewind and rotor modification
- BadWeB: Stator Rewind Options
- Baf's (Robert Ferris') Buell 1125 stator rewind and series voltage regulator writeup pdf
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