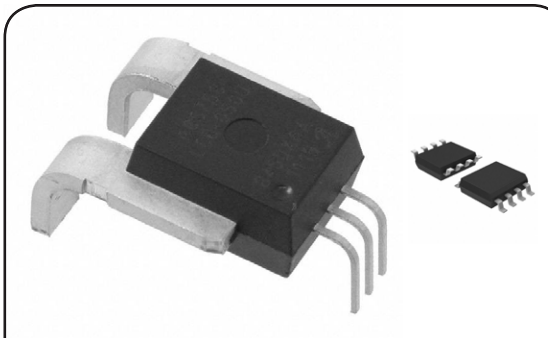
COMMENTS ON DURABLE DESIGN

I have recently seen two different voltage regulator designs on the market using similar devices to sense the current. Both of these regulators are advertised as being capable of 35 Amps. The current sensor integrated circuit is quite small, technically, a SOIC-8 size device. These small integrated circuits have very small legs to carry the current. Take a look at a 30 amp glass fuse and examined the conductor within. You will see that it is quite large. Then take a look at a small integrated circuit. The legs on the circuit are less than half the size of a 30 amp fuse which is INTENDED to melt at 30 amps!

When Lucas designed the RB-106 regulator, which was intended for usage up to approximately 22 A, they used 2mm diameter solid wire to carry the full current. We all know that Lucas, and everyone else, saved every penny that they could. Solid copper wire is very expensive. They would certainly NOT have used a wire that was unnecessarily heavy. Therefore, the engineers at Lucas felt that 2 mm diameter, 3.1 mm², was the minimum acceptable to carry 22 A. It is certainly true that for very short distances, a thinner wire can suffice, but the legs of an SOIC-8 integrated circuit are ridiculously smaller than that.

These days engineers are quite optimistic about the specifications of their devices. They are more about marketing than they are about reliability. The specifications for the Allegro ACS723 current sensor integrated circuit includes a current range of up to 40 A. Interestingly, the specifications remain silent on the maximum rated current for the legs of the IC. They do not say that they will guarantee that this device will be able to carry 40 A continuously! The legs have a minimum size of 0.17 x 0.31 mm. Two of these legs are used to carry all the current in each direction. Therefore the total cross-sectional area of the conductor is 0.1054 mm². This is an incredibly low 3.3% of the cross-sectional area of the 2mm diameter solid wire used by Lucas in their regulators.



Photos of the two current sensor devices described in the text. These are sized to the same relative scale. Which one would YOU want to carry all your generator output?

In my experiments designing a high current regulator, I successfully utilized the Allegro ACS770 Hall current sensor. This device uses comparatively huge conductors measuring 3.8 x 1.4 mm, for a cross-sectional area of 5.32 mm². Allegro rates this device for up to 200 A. Remember, the Allegro engineers (and most other commercial engineers these days) are very optimistic about current handling capabilities. Lucas would have rated that conductor, probably, at no more than 50 A. Nevertheless, assuming that this conductor really is good for up to 200 A, then this scales to 0.931 mm² for 35 amps. The SOIC-8 legs are still only 11% of this current conductor area! I think that even the Allegro engineers would admit that the legs of the SOIC-8 current sensor are inadequate to carry 35 A continuously.

Using the 2 mm diameter solid wire as a reference, Lucas, a company who DID try to plan for reliability of their devices back in the old days, would have rated the SOIC-8 integrated circuit for no more than 0.75 Amps! Even at 10 TIMES what Lucas would have allowed, that little integrated circuit is still only good for 7.5 Amps!!

In my opinion it is pure fantasy that this integrated circuit could ever reliably carry even 15 Amps, much less the 35 Amps that some regulator manufacturers are advertising. I would use nothing less than the 5.32 mm² conductors of the ACS770 current sensor for ANY dynamo applications. Unfortunately, the sheer size of this high performance sensor is so great that it is impossible to use it for a compact design like our 25 Amp ADR positive and negative ground regulators. We had to design an alternative approach, more compact and equally reliable.

Also note that this high current Hall effect sensor alone costs over $8 each! Additionally, they are hard to get and often there is zero supply.