Pantera Electronics Si Alternator Up-grade

Delco Remy Si Alternator Introduction

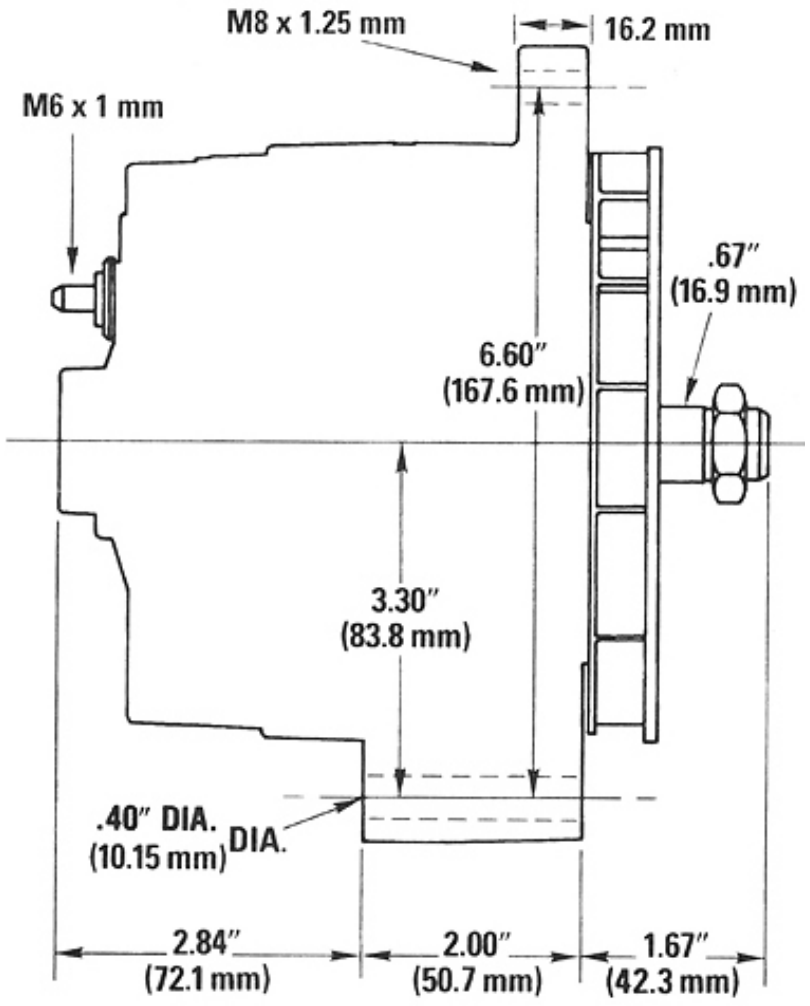
The “Si” in the model number stands for Systems Integrated, meaning that the voltage regulator is inside of the alternator. The Si is the Delco Remy model number designation, but not part number. The model Si was built in several different output ratings, and assembled with any one of four available “clock” positions for different mounting bracket arrangements. There are many different part numbers among model Si alternators. Several output ratings, and four possible “clock” positions of assembly, plus different types of pulleys are available for the model Si, so there are many different part numbers.

An exact replica of a Si can be assembled without using a single GM part and suppliers to the alternator rebuilding industry can provide any part desired for these alternators, including screws, insulators, brushes, bearings, voltage regulators, stators, rotors, rectifiers, diode trios, and small parts too. The Si alternators were built with 56amp, 66amp, 78amp, and 94amp maximum output ratings.

Alternator Pulleys

Pulleys can be interchanged between the old externally regulated Delco Remy alternators and the model SI, and with the newer model CS-130, and with the old externally regulated Ford alternators. The pulley is a slip fit on the shaft at the alternator, be sure not to loose any spacer rings behind the pulley or behind the fan. The nut used to secure the pulley is best removed with an impact wrench. If an impact wrench is not within reach, then it's really best to take the alternator to a local tire shop or auto repair shop, and have the nut "broken loose." (Alternators have been damaged while attempting to remove the nut with only hand tools.) Wearing heavy leather gloves, hold the fan at the front of the alternator, and use the impact wrench to loosen the nut. Typically a 15/16" socket will fit.

The model SI alternators will require metric fasteners at the threaded mounting boss, and also at the output stud (BAT) at the back of the alternator.

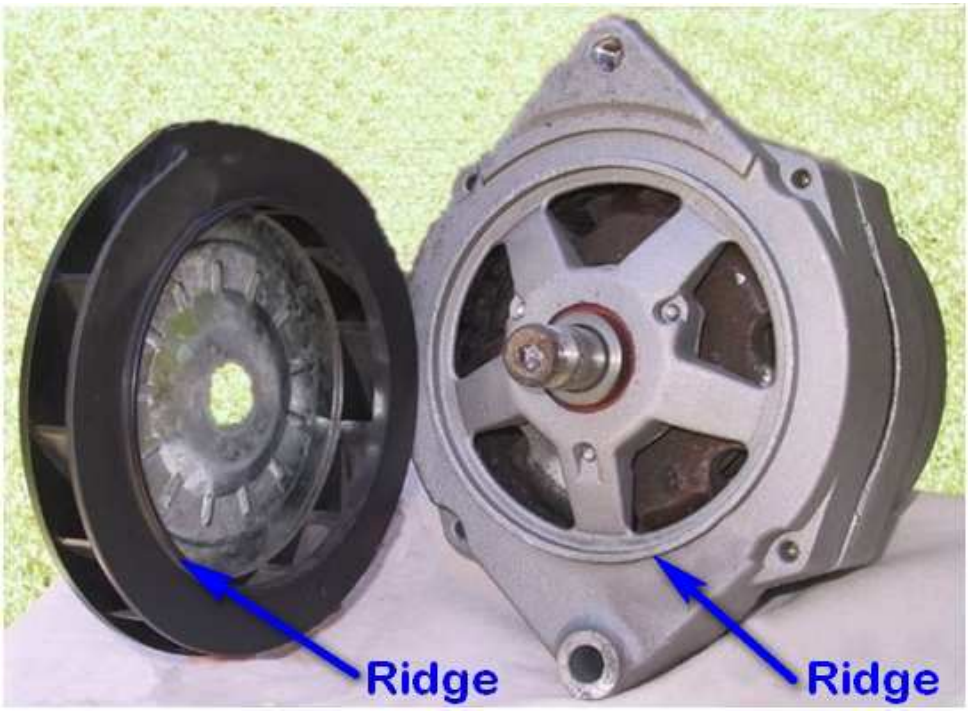


Alternator Cooling

The cooling fan provides a quick visual identification as the model Si alternator. The fan is made of black thermoplastic, and has a laminated re-enforcing metal shield at the front. These fans are strong, reliable, and efficient and are not easily damaged by excessive RPM. With the typical stamped external, steel fan, which is found on many alternators, centrifugal force at high RPM will bend the fan blades.

In the photo below model Si, which is equipped with a high performance fan, the pulley and cooling fan has been removed from a model Si, Delco Remy built alternator.

The fan and the alternator end frame both have ridges, where they will mate to each other. The ridge at the fan fits just inside the ridge at the alternator case. The effect is like a shroud, or like a seal, which will only let the fan draw air through the alternator. This fan cannot suck outside air from near the front of the alternator the fan can only draw air through the alternator. The fan at the front of these alternators is an exhaust fan. The fan draws air in through the opening at the back of the alternator, where the air will pass through cooling fins at the rectifier heat sink. And the air will be drawn through the stationary or Stator windings, where the air will also have a cooling effect. As usual with moving air through passages, the same fan efficiency will suck more air than the fan could blow through. That's why the fan at the front as an exhaust fan.



The photo below shows a model Si Delco alternator, viewed from the rear. When viewed from the rear, the air intake area is the most distinguishing visible feature of the Si.

There are two halves of the alternator case, front half and rear half. The mounting bosses are at the front half of the case. And the electrical connections are at the rear half of the case. Four screws, spaced equally around the case diameter, hold the front and rear halves of the case together. Conveniently, the rear half can assembled to the front half at any one of four directions. Industry refers to the assembly position as the "clock" position. Clock position of the Si series of alternators is determined by viewing the alternator from the rear, with the threaded mounting hole straight up. With this view, the receptacle for the two wire plug-in connector will point to any one of the four available clock positions. Straight up is 12:00, to the right is 3:00, straight down is 6:00, and to the left as shown in the above photo is 9:00.

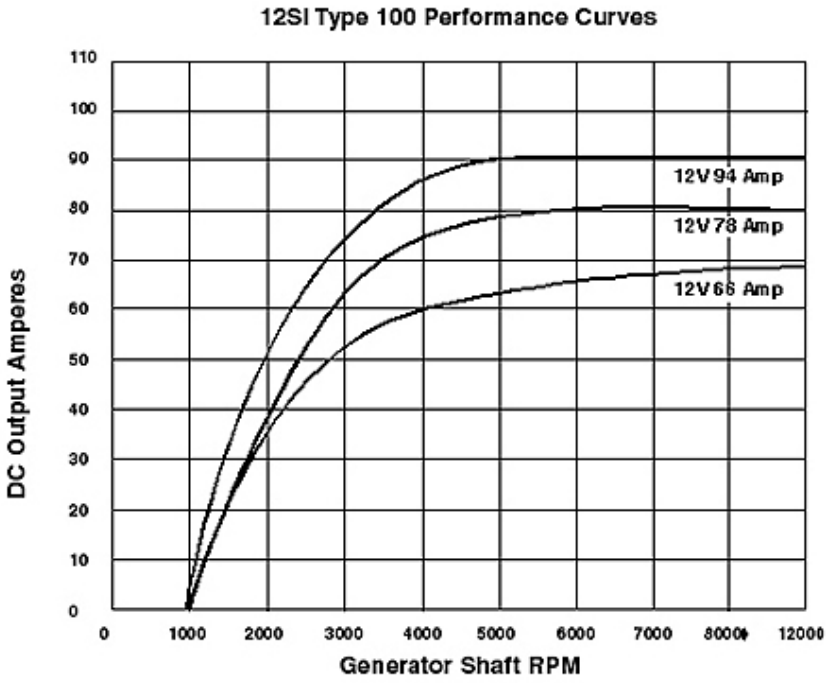
Having the different available clock assembly positions provides for proper exit of the wiring from the alternator, in any one of four directions, for use with different mounting setups. With the various clock positions available, the alternator could be mounted on the driver's side, or passenger side of the engine. And the alternator could be mounted upside down, or right side up. By choosing the proper clock position, the same model number of alternator could be used for many applications.

The 2 quick disconnect terminals are for connection to the internal voltage regulator, tabs #1 and #2. (yellow circle)

Output Power

An important point about alternator cooling, the greater the current rating of the alternator the more heat it can generate. In the alternator, current will flow through resistance at the diodes in the rectifier, and also through resistance at the stator wire winding. The math formula for calculating the amount of heat is AMPS ^{2} X OHMS = WATTS (heat). Note that current is squared.

In the case of current flow through the stator winding, the outcome will be that when the current output of an alternator is increased by only a few percent, the heat output will double in amount. In example, with a 40 amp output; 40^2 (AMPS) X 0.05 (OHM) = 80 WATTS of heat. But when output is increased to 60 amps; 60^2 (AMPS) X 0.05 (OHM) = 180 WATTS of heat! (The 0.05 ohm resistance at the stator, which we used, is only an example quantity, but it may be close to a real number.) With output increased from 40 amps to 60 amps, the amount of heat output at the same stator winding is more than double!
The significance of the previous heat calculations is that obviously when electrical power output is increased, the cooling capacity should also be increased. Therefore, 100 amp output or 120 amp rated alternators, built upon a 63 amp SI case design is not always a good idea. Burned stator windings are common, in applications that continuously require a high amount of alternator output, and so are heat-damaged rectifiers. Some alternators are able to constantly output a high percentage of their gross output rating. Yet other designs fail when producing only about 50% of their gross output rating. The Si alternators have proven to be very rugged with factory winding installed. (output not greater than factory ratings)



Alternator RPM

Alternator RPM is determined by engine speed and pulley ratio. A 3:1 ratio is typical and other ratios can be used but at low engine speeds alternator output may not be suitable. Most alternators will not tolerate more than 18,000 rpm maximum. Other pulley ratios may be needed if long term high engine speed is expected, a lower alternator pulley ratio is 2:1.

$$\text{Alternator RPM} = \frac{\text{Crank Shaft Pulley dia.x Engine RPM}}{\text{Alternator Pulley Diameter}}$$

Internal Regulator

The voltage regulator has two flat blade male terminals (see arrows). There is a third terminal of this voltage regulator, which is the ground at one of the three mounting screws.

#1 - terminal of the two flat blade terminals is wired to an ignition switched ON/ OFF source, and this circuit can also be used to operate a dash mounted warning light. The warning light is an option, not a requirement. #2 - terminal of the two voltage regulator terminals is the voltage-sensing terminal, and through this terminal the voltage regulator will monitor electrical system voltage and make adjustments to the alternator output in effort to keep system voltage at about 14.2 volts. The lamp limits the voltage to the "Field" terminal, and this current limited voltage is what tells the regulator to start, continue or stop charging. When the alternator begins to charge, the voltage increases at the battery. This increase in voltage eventually reaches a point (as the alternator charges the battery) to where it is equal to the voltage divider circuit designed into the alternators regulator.

#1 - Terminal for a “Warning” light to act as a visual indicator of under voltage and over voltage conditions at the battery. Either of these conditions will energize the "Warning" light. A resistor of 15 Ohms in lieu of the lamp to drop the voltage at this terminal to specified levels or can be used in parallel to a lamp as a back-up in case the lamp fails.

#2 - Terminal can be connected to the positive battery post or the starter solenoid where the positive battery post connects to the solenoid switch. This is an input to the alternator that is used to sense the battery voltage.

Alternator Dynamometer Sheet

This is a typical dynamometer sheet that is included with Pantera Electronics supplied alternators.

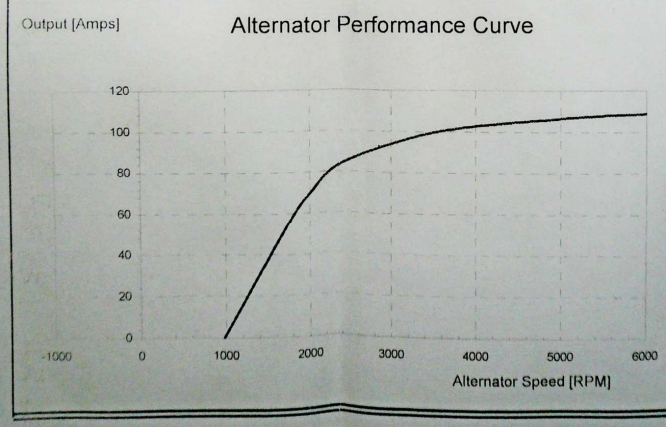
Computer Tested Alternator

12V, 94A, NEG

Alternator test sequence:	Results:	
Maximum Alternator Output:	109	Amps
Maximum Output Power:	1472	Watts
Voltage Regulator Set Point	15.0	Volts
Leakage Current Tested @ 12 V	0.61	mAmps
Ripple Current @ 2500 RPM	31	Amps
Turn On Speed Less Than	1600	RPM
Voltage regulator functions test:	Within specs	

Output tested @ 13.5 V

Alternator RPM	1800	2000	2400	3500	5000	6000
Amperage	58	69	84	100	107	109



*We certify these results are within specifications.