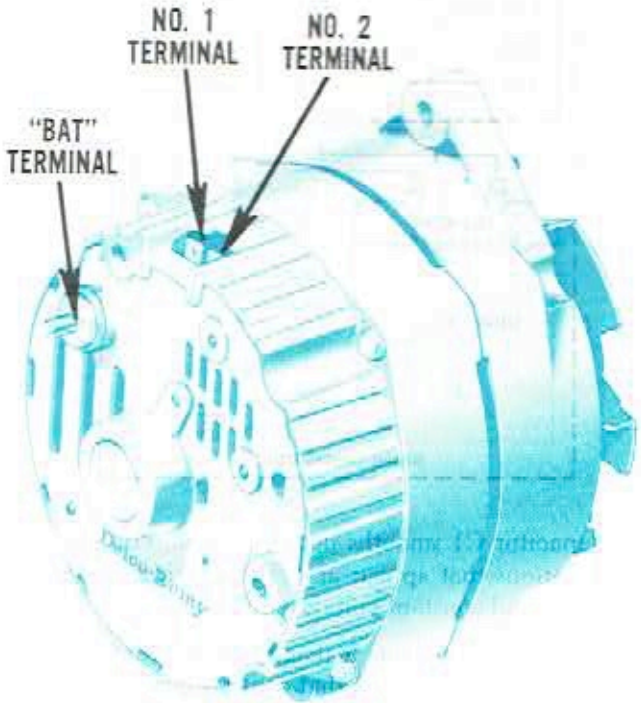
types and designs

In this section we will discuss the types and designs of Integral Charging Systems and will also explain the electrical circuits that are involved.

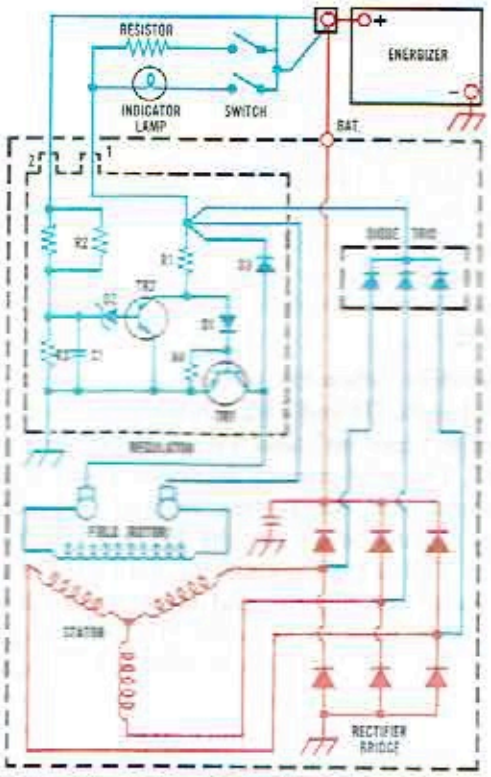
10-SI series, type 100

The 10-SI Series, Type 100 Integral Charging System is widely used on passenger car and light truck applications. It features a ball bearing in the drive end, a roller bearing in the slip ring end, and grease reservoirs to eliminate the need for periodic lubrication.



Two spring loaded brushes ride on the slip rings and carry the current to the field winding in the rotor. An external fan pulls air through the assembly for cooling.

The wiring circuit features a "No. 2" sense lead which is always connected to the Energizer or battery. Resistors R2 and R3 are of such high value that the current drain on the battery is very small.

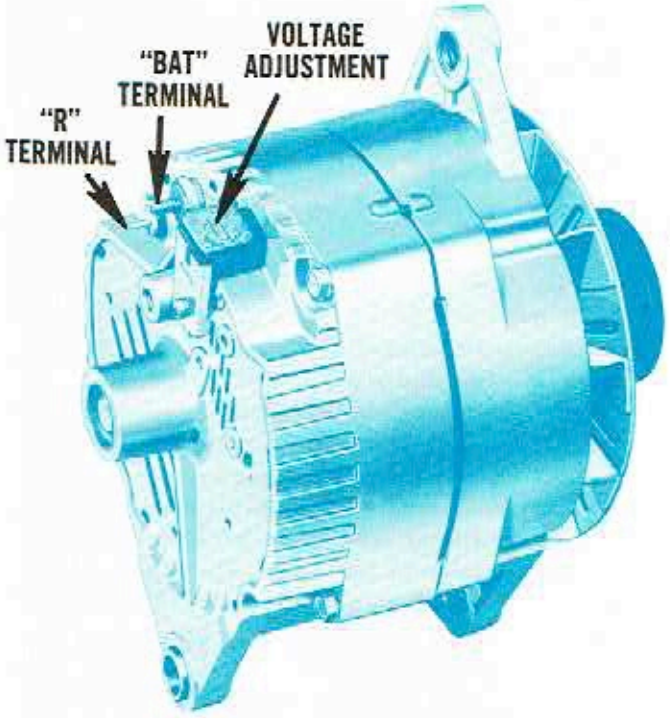


Terminal No. 1 is connected to the ignition switch through an indicator lamp and resistor in parallel. The indicator lamp will come on with the engine running to indicate most defects in the electrical system. The resistor in parallel reduces total circuit resistance to provide more field current when the switch is turned on and the engine is being started. The higher initial field current provides faster build-up of voltage in the Integral Charging System. The field current flows when the switch is closed through the lamp and resistor R1, D1, TR1 and the field winding. On some applications, the resistor in parallel with the indicator lamp is not used.

The "BAT" terminal is connected directly to the battery and discharge current is prevented by the diodes in the rectifier bridge. This circuit then works in the same manner as the basic circuit explained in the previous section. Note that the voltage provided by the diode trio and by the rectifier bridge applies the same voltage on each side of the lamp and the lamp goes out with the engine running.

Other Integral Charging Systems very similar to the 10-SI/100 just discussed are the 10-SI/106, the 10-SI/110 and the 27-SI/100.

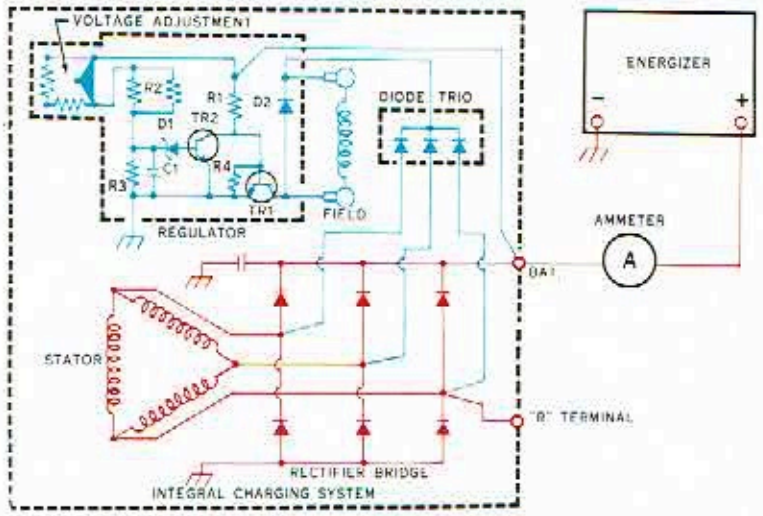
27-SI SERIES, TYPE 200



The 27-SI/200 Integral Charging System is larger in physical size than the 10-SI assembly just discussed. It features a large drive end ball bearing for heavier belt loads and longer brushes for added brush life. It is used in gasoline and diesel engine applications.

Electrically, the 27-SI is similar to the 10-SI, except it is a "one wire" system and has an external voltage adjustment feature. The external voltage adjustment consists of a square plug-in with terminals that can be inserted in any one of four positions.

Thus the voltage setting of the regulator can be changed to meet the specific needs of certain operating conditions. Note that the external voltage adjustment is in series with R2 and R3. In the position shown, no resistance is added to R2 and R3. In the other three positions, full resistance or either one of two resistors, is added to R2 and R3. This has the same electrical effect as R2 changing resistance with temperature, as was explained in the previous section.

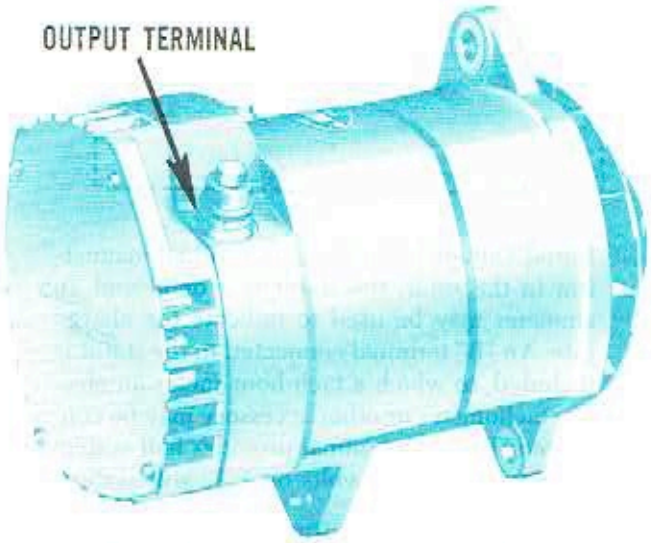


Initial voltage build-up is by residual magnetism in the rotor, the stator is a delta and an ammeter may be used to indicate the charge rate. An "R" terminal connected to the stator is included, to which a tach-hour meter, an electric tachometer or other accessory may be connected. The "R" terminal provides half system voltage, or about 7 volts on a 12-volt system.

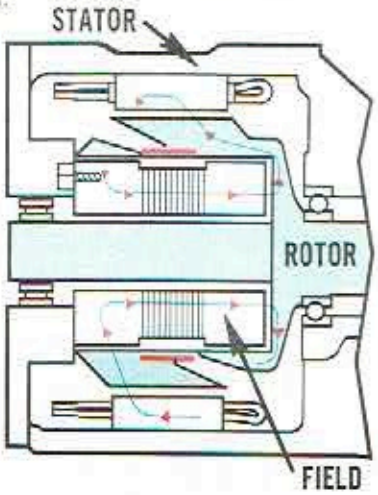
Note that the diode trio supplies only field current and regulator current is provided directly from the output terminal. There is a very small current drain from the Energizer or battery with the engine not running through R1 and TR1, but very little current flows because TR1 turns only partially on. This circuit arrangement lowers the speed at which TR1 turns full on, as compared to previous circuits.

25-SI series, type 400

The 25-SI/400 is designed for extra long life on diesel applications and its main feature is that it has no slip rings or brushes and is commonly called the "brushless" type. It has large bearings at both ends with extra large grease reservoirs and lip seals to retain the grease and keep dirt out. As in other assemblies, a fan pulls air through the unit for cooling. The regulator is a discrete component type so individual components can be replaced. The regulator compartment is air tight for long life. The 25-SI is designed essentially to operate between engine overhaul periods without attention.



In order to explain how an Integral Charging System can be made without brushes and slip rings, a simplified cross-sectional view is shown.

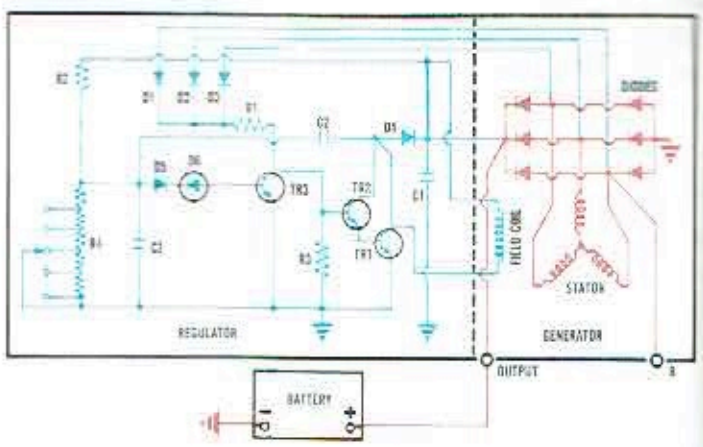


To generate voltages in the stator windings, remember it is only necessary for the rotor to cause alternate North and South magnetic lines to cut across the stator windings. The "secret" to the brushless construction is the non-magnetic ring, shown in red, that attaches one set of rotor poles to the other set.

The field coil is mounted with screws to the end frame and is stationary. The rotor fits between the stator and field coil and is mounted with bearings at both ends. The field coil produces a North pole, let us say, at the right hand side of the coil and the magnetic lines cross the air gap between field coil and rotor to make the right hand rotor poles all North poles. Since the magnetic lines cannot go through the non-magnetic ring directly to the left hand rotor poles, the magnetic lines pass through the air gap into the stator and then across the air gap into the left hand South magnetic poles of the rotor. The magnetic lines then cross the air gap between the rotor and field coil into the field coil to complete the magnetic path.

Thus the non-magnetic ring "diverts" the magnetic field into the stator windings and as the rotor turns, an A. C. voltage is generated in the stator windings.

The wiring circuit varies somewhat from the ones previously discussed. The system is "one wire", with initial voltage build-up being provided by residual magnetism in the rotor. The stator and rectifier bridge diodes, shown in red, then supply a D. C. voltage between ground and the output terminal.



One major difference is that the diode trio, which is diodes D1, D2 and D3, do not supply field current. Instead, they supply current through R1, TR2 and TR1 to turn the regulator on. Field current then flows from the rectifier bridge through the field and TR1 to ground.

R4 is a potentiometer, or variable resistor. By removing a pipe plug and inserting a small screwdriver through the hole into the potentiometer slotted screw, the voltage setting of the regulator can be adjusted to any one of five different values by turning the screw.

Like the 27-SI, the assembly has an "R" terminal. Type 450 models have regulator characteristics that permit the battery to be disconnected with the engine running without damage to the regulator. When this is done, called "load dumping", high voltages are induced in the stator windings that otherwise would damage regulator components.

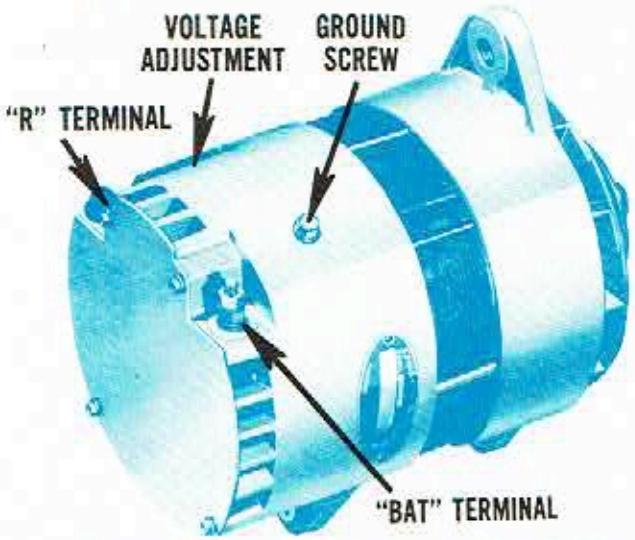
30-SI series, type 400

The 30-SI/400 Integral Charging System combines many of the features already discussed to provide a versatile high mileage generating unit. It is a brushless assembly like the 25-SI, but uses the Integrated Circuit regulator as in the 27-SI. Electrically, this unit is like the 27-SI/200, except the stator is "Y" instead of delta.

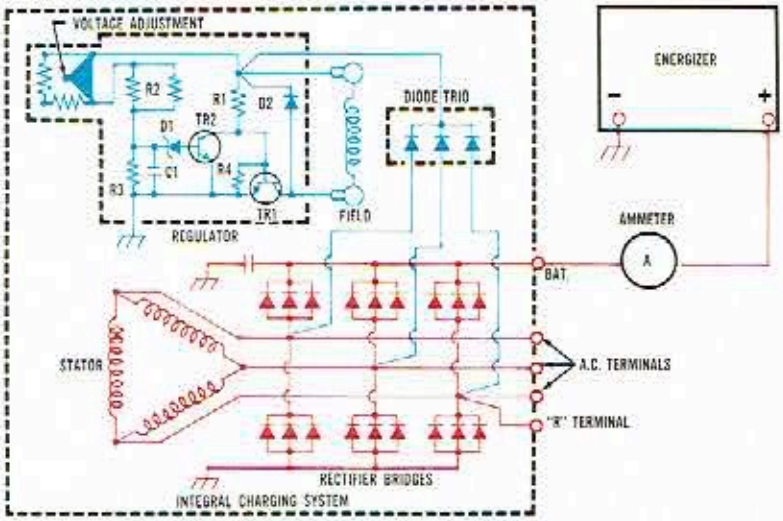
Its usage varies over a wide range of gasoline and diesel engine applications. Unlike the 25-SI, the regulator compartment is ventilated to increase output capability.

40-SI series, type 150

The 40-SI/150 is designed for heavy belt loads and high amperes output in a wide range of gasoline and diesel engine applications. The drive end ball bearing is sealed on both sides for maximum life. The rectifier end bearing is of the roll type, with a large grease reservoir and a lip seal to keep the grease in and dirt out.



Electrically, the 40-SI uses an Integrated circuit regulator and has a circuit like the one explained in the previous section. There are two major differences: there is a voltage adjustment plug like the 27-SI/200 and three rectifier bridges may be used to handle the high current outputs. With three rectifier bridges, there are three diodes in parallel instead of just one diode.



the Delco-Remy education program

The Delco-Remy Education Program is designed to provide to mechanics and students up-to-date technical information on automotive electrical equipment.

This manual, one of a series, is a part of the program. Used in a classroom in conjunction with training charts, these manuals aid in explaining the theory of operation and construction of electrical units.

Also available to servicemen and students is a series of Maintenance Service Bulletins. They serve as a reference in the maintenance and testing of electrical units.

Test Specification Booklets contain service test data for the electrical units manufactured by Delco-Remy. These booklets are designed for automotive electricians engaged in maintenance and testing.

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Carl Schleuder

Delco Remy

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