

JOHNSON

JOHNSON MOTORS
2600 Pershing Rd.
Waukegan, Illinois

ELECTRICAL SYSTEM

BATTERY

A 6-volt battery system was used on motors before 1957, and a 12-volt system 1957 and later. Make sure battery is securely fastened in a safe location in the boat. Long battery cables are to be avoided, but battery must be located so that it will not be in path of motor when fully tilted. Negative battery terminal is grounded on all models.

IMPORTANT: Always remove battery from boat to charge the battery. Always disconnect battery cables when boat is not being used.

STARTER

Autolite starting motors are used on all models. When servicing the starting circuits refer to the appropriate wiring diagram in the individual engine sections. Many motors are equipped with a mercury switch or safety switch which interrupts the starting circuit when throttle or shift lever is in an improper position. Consider and/or check the safety circuit when checking the circuits. Starter test data are as follows:

Model MAK-4033M	
Volts	6
Rotation	CCW
Armature end play	0.005-0.062
Brush spring tension (oz.)	38-61
No-Load Test	
Volts	5.0
Amperes	70
RPM	4700
Lock Test	
Volts	2.0
Amperes	250
Torque (ft.-lbs.)	2.5

Model MDH-4001M	
Volts	6
Rotation	CCW
Armature end play	0.005 min.
Brush spring tension (oz.)	42-66
No-Load Test	
Volts	5.0
Amperes	52
RPM	8100
Lock Test	
Volts	2.0
Amperes	230
Torque (ft.-lbs.)	1.6

Model MDO-4002M	
Volts	12
Rotation	CCW
Armature end play	0.005 min.
Brush spring tension (oz.)	42-66
No-Load Test	
Volts	10.0
Amperes	38
RPM	10000
Lock Test	
Volts	4.0
Amperes	170
Torque (ft.-lbs.)	1.5

Model MDO-4003M	
Volts	12
Rotation	CW
Armature end play	0.010-0.035
Brush spring tension (oz.)	42-66
No-Load Test	
Volts	10.0
Amperes	38
RPM	10000
Lock Test	
Volts	4.0
Amperes	170
Torque (ft.-lbs.)	1.5

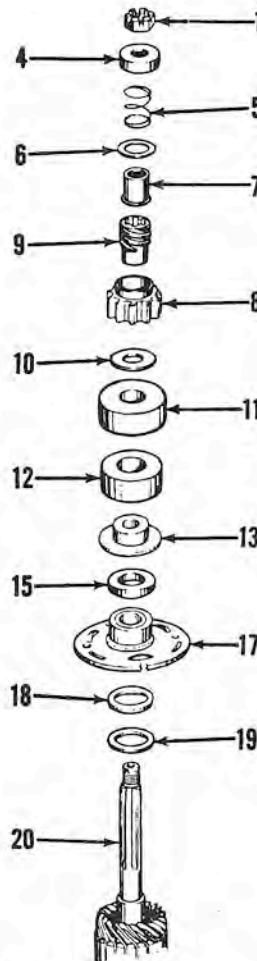


Fig. J120—Exploded view of starter drive used on two cylinder models.

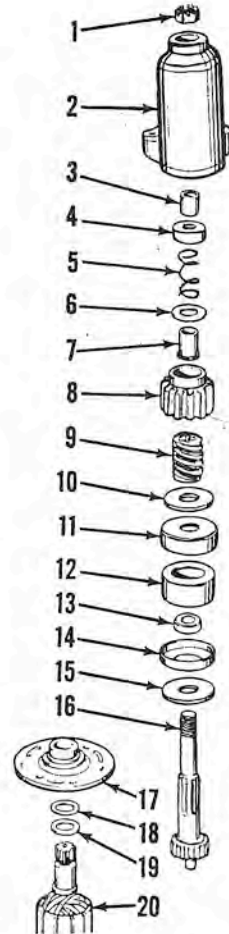


Fig. J121 — Exploded view of gear reduction starter drive used on four cylinder models.

Models MDW-4001M, MDW-4101M,
MDW-4103, MDW-4103M

Volts	12
Rotation	CW
Armature end play	0.010-0.035
Brush spring tension (oz.)	42-66
No-Load Test	
Volts	10.0
Amperes	26
RPM	8500

Lock Test

Volts	4.0
Amperes	160
Torque (ft.-lbs.)	2.1

Models MDW-4002M, MDW-4102M,
MDW-4104M

Volts	12
Rotation	CCW
Armature end play	0.005 min.
Brush spring tension (oz.)	42-66
No-Load Test	
Volts	10.0
Amperes	26
RPM	8500

Lock Test

Volts	4.0
Amperes	160
Torque (ft.-lbs.)	2.1

The starter drive unit is assembled on the armature shaft on two-cylinder motors as shown in Fig. J120. Four-cylinder motors use a separate jack shaft driven by a pinion on armature as shown in Fig. J121. Most drive units use a rubber cushion (12) to absorb the shock as starter is engaged. The Bendix drive unit should be lightly lubricated with a non-gummy graphite oil or light grease, and cleaned occasionally to permit free engagement and disengagement.

Note sequence of disassembly and refer to Fig. J120 or J121, to be sure parts are assembled in proper order on shaft. Tighten shaft nut (1) until rubber cushion is slightly compressed, then continue tightening until cotter pin hole in shaft is aligned. Do not back off the nut to install cotter pin.

VOLTAGE REGULATOR

Electric starting models may be equipped with a generator and voltage regulator. Some four-cylinder models are equipped with a flywheel alternator which is controlled by a single unit, transistor type regulator.

An Autolite Model VRU-6101A regulator is used on all models with DC generator. This regulator contains two soldered resistance units below base of regulator. Test specifications are as follows:

Cutout Relay

Air gap	0.031-0.034
Point gap	0.015 min.
Closing voltage (range)	12.6-13.6
Opening reverse current (amps) ..	3.0-5.0

Voltage Regulator

Air gap	0.048-0.052
Voltage range (hot)	14.2-15.0

Current Regulator

Air gap	0.048-0.052
Output (amperes)	9.0-11.0
Ground Polarity	Negative

A Delco-Remy Model 9000561 or 9000598 one-unit, transistorized regulator is used on all models with alternator-generator. These regulators are especially designed for the purpose, and another regulator should not be substituted.

Only a voltage regulator unit is required, as the need for a cut-out unit is eliminated by the rectifier units, and design of the alternator eliminates the necessity for a current regulator. In addition to the voltage regulator unit and transistor, the unit contains two diodes which absorb transient voltages, a resistor and a suppression condenser.

The unit is designed for a negative ground, and regulator may be burned out if battery leads or regulator leads are reversed. Also, an alternator system MUST NOT be polarized during installation or at any other time. Test specifications are as follows:

Voltage Regulator

Air gap	0.070
Voltage range	14.4-15.0
Adjust to	14.7
Ground polarity	Negative

The transistor can be tested without disconnecting any of the circuit wiring or removing the regulator. To test the transistor, turn the ignition switch to "ON" position without starting the motor. Connect the positive lead of a voltmeter to the "Field" terminal of regulator and the negative voltmeter lead to a good ground. The reading should be 1-2 volts. If the reading is zero volts the transistor is shorted and must be renewed. If reading is 8-9 volts the transistor is burned open. If reading is 12 volts, both the transistor and resistance unit are burned open. To renew the transistor or resistance unit the regulator must be disconnected and removed from the junction box. Remove the voltage regulator cover. The resistance unit is the small coil-like wire soldered to the "F" terminal and to one of the transistor leads. To remove the resistance unit, melt the solder with an iron and lift out the resistor. The transistor is fastened underneath base of regulator with two screws. To remove the transistor, remove the two screws and unsolder the two transistor connections inside the regulator.

An open transistor can be caused by a short; by reversed battery or regulator connections; or by an attempt to polarize the alternator. If an open transistor is found, the regulator points must be cleaned with a point file, polished with crocus cloth or similar material, then washed with trichloroethylene or other non-toxic solution, and readjusted.

The two diodes are mounted on an extension of the "BAT" terminal inside the regulator. The lead of the Field Discharge diode is soldered to the "F" terminal. To test the diode, disconnect all electrical connections and remove regulator cover. Sepa-

rate the voltage regulator points and temporarily place an insulating piece of paper between the contacts. Touch the two leads of a battery powered ohmmeter to the "BAT" and "F" terminals of regulator and note the reading. Reverse the ohmmeter leads and again note the reading. If field discharge diode is in good condition, one reading should be very high or at infinity and the other reading should be zero. If readings are approximately equal the diode is faulty, and must be renewed by unsoldering the connections.

The Suppression Diode lead is grounded to the regulator base. To test the diode, unsolder the lead and test with an ohmmeter as outlined for the field discharge diode. Approximately equal ohmmeter readings indicate a faulty diode.

Check the contact point air gap and voltage setting and adjust as required, before releasing the unit for service.

GENERATOR

The Autolite DC generator is belt driven from a pulley mounted on top of flywheel on two cylinder models; or below flywheel and magneto drive pulley on four cylinder motors. Generator belt tension should be adjusted to allow a deflection of 1/4-3/8 inches on two cylinder motors or 1/8-1/4 inches on four cylinder units. Do not run belt too tight. On four cylinder models, to renew or install generator drive belt it is necessary to remove magneto drive belt and flywheel. Reinstall and time the magneto drive belt as outlined in the overhaul section for the motor. Generator test specifications are as follows:

Brush spring tension	12-24 oz.
Field draw	
Volts	10.0
Amperes	1.7-1.9
Motoring draw	
Volts	10.0
Amperes	4.0-5.0
Output	
Volts	15.0
Amperes	10.0
RPM	7000

ALTERNATOR

STATOR ASSEMBLY. The flywheel mounted alternator consists of two elements: A stator assembly containing a circular field winding and a coil wound continuously around 36 pairs of legs on the laminated iron core; and a rotor, brazed to the flywheel, which concentrates the magnetic field. When an activating current is introduced into the field winding, a pulsating, alternating current is produced which can be used to maintain battery charge and furnish power for electrical accessories. The alternator will charge at the rate of 12 amperes at 1000 engine rpm, and produce the maximum output of 20 amperes at 2000 rpm, at which speed the DC generator is just beginning to show charge.

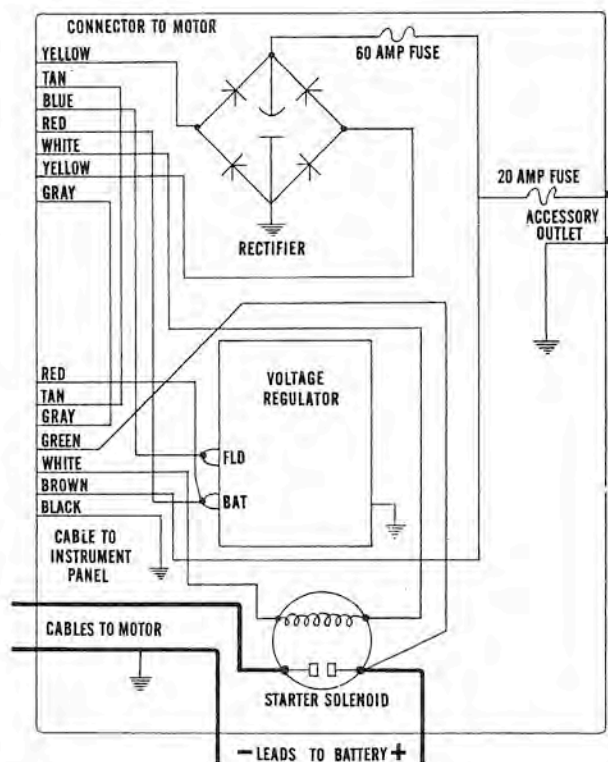


Fig. J122 — Wiring diagram of junction box used on alternator models.

Service on the stator assembly consists of renewing the unit. The rotor is only available as a component part of the flywheel. Test the unit before removal of any of the components, if possible.

To test the windings of the stator assembly, remove motor cover and disconnect the stator lead plugs on starboard side of power head. Connect one ohmmeter lead to either the red or blue field lead, and ground the other test lead to power head. A reading of less than 5,000 ohms indicates that field windings are grounded, and stator must be renewed. Test field windings for open or short circuit by connecting the ohmmeter test probes to the red and blue field leads. A reading of 1.69-3.14 ohms indicates that field windings are in good condition. A high reading indicates an open winding and a low reading indicates a short circuit. In either case, stator assembly must be renewed.

Test the coil windings by connecting one test probe to either of the yellow (coil) leads, and grounding the other probe to power head. A reading of less than 5,000 ohms indicates coil windings are grounded, and stator assembly must be renewed. Connect the test probes to the two yellow (coil) leads and check for an open circuit. A reading of less than one ohm indicates windings are good, while an infinite reading denotes an open circuit.

Whenever trouble is encountered anywhere in the charging circuit, the entire system should be checked. Malfunction of one part may damage other components, which could result in early or immediate failure of a newly installed part.

Refer to POWERHEAD Section for procedure of removing flywheel and stator, and for retiming of ignition system when reinstalling.

JUNCTION BOX. The junction box contains the rectifier diodes, voltage regulator and starter solenoid; and should be installed as nearly as possible in a vertical position and located to allow ample air circulation. The junction box is connected to the switch panel by a cable and to the motor by a cable and quick disconnect plug. Heavy cables run to starting motor and to a ground connection on power head. Refer to Fig. J122 for a wiring diagram of the junction box.

The rectifier consists of two positive diodes which screw into an insulated heat sink; and two negative diodes which screw into the junction box frame. Both the insulated heat sink and junction box wall have cast cooling fins to dissipate the heat. The heat sink also contains the 60 ampere charging circuit fuse. The positive and negative diodes are similar in appearance, but are marked plus or minus on hex end of case. One positive and one negative diode connect to each of the yellow leads of the alternator coil. To check the diodes, disconnect all rectifier leads. **IMPORTANT:** Use only an ohmmeter powered with a 1½-volt battery. Under no circumstances use higher than 12 volts in making any check on the diodes.

Touch one test probe to the diode lead and the other probe to the threaded case. The reading should either be above 300 ohms or at or near zero, and the opposite

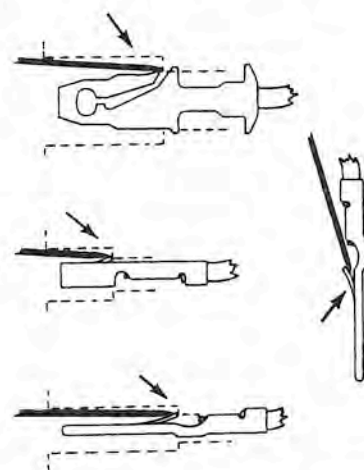


Fig. J123 — Schematic view of wiring terminals showing method of removal from quick-connectors. The retaining clip must be bent down with a thin tool as shown by arrows. Clip must be repositioned before reinsertion as shown in right hand view.

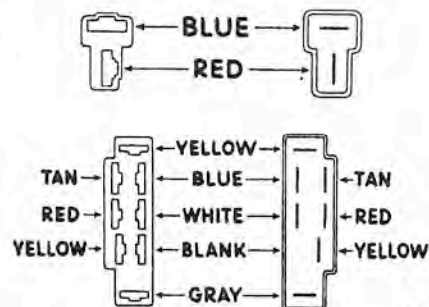


Fig. J124 — Color code for wire installation in the quick connectors. A second alternator-stator connector contains two yellow leads which may be installed in either position.

reading should be obtained when test probes are reversed. Move the diode leads to check for loose or broken connections when making the tests. If either high or low readings occur in both directions through the diode, the unit must be renewed. Remove the diode with a suitable wrench and coat threads of new diode lightly with silicone grease or light engine oil. Install an identical new diode and tighten to a torque of 150-180 inch-pounds.

If leads, lead terminals or connectors must be removed, refer to Fig. J123 for method of disassembly. The lead terminals are retained in connectors by a spring clip as shown. Insert a thin tool into connector at side of terminal, compress the clip, then pull out the wire. The clip will not assume its original shape, and must be wedged out as shown at right, before reinstalling.

Refer to Fig. J124 for proper installation of lead wires into the connectors. The yellow wires in the second stator connector may be installed in either of the positions in the connector.