

TABLE OF CONTENTS

3

INTRODUCTION -----	4
DATA AND DESCRIPTION -----	5
OPTIONAL EQUIPMENT-----	6
INSTALLATION -----	7
Location, Mounting, Fuel, Ventilation, Exhaust, Water, Remote Switch, Battery, Load Wires, Heat Exchanger	
PREPARATION -----	14
Lubrication, Fuel, Cooling	
OPERATION -----	16
Starting, Stopping, Standby, Shutdown, Storage, Emergency Operation	
ABNORMAL OPERATING CONDITIONS -----	19
PREVENTIVE MAINTENANCE -----	20
Periodic Service Chart	
ADJUSTMENTS -----	24
Governor, Valves, Decompression Release (MDJA)	
TABLE OF CLEARANCES -----	26
TORQUE SPECIFICATIONS -----	27
SERVICE DIAGNOSIS -----	28
Trouble-Cause-Remedy, Control Functions	
TYPICAL WIRING DIAGRAM -----	36

Model 6MDJB Spec # 3R/966

Serial #

AC 120/240/ PN 1.
KVA 6 - 6000 watts

25A 60 cy

Exciter # 045X1N1A

Gen Data 6JB3N1B

1800 RPM

Bat 12V

INTRODUCTION

This manual applies to the Onan MDJA, MDJB, and MDJC series generating plants. All are diesel fueled and water cooled.

The generating plant was run-in and adjusted at the factory. A different altitude or fuel btu rating might require a slight readjustment of the governed speed.

When instructions in this manual refer to a specific model of generating plant, the model in question can be identified by referring to the MODEL AND SPEC. (specification) NO. as shown on the plant nameplate. Electrical characteristics of the plant are shown on the nameplate lower portion.

TYPICAL MODEL AND SPEC NO.

6MDJB-3R/96C

- 1 - Factory code for general identification purposes.
- 2 - Factory code for specific optional equipment supplied.
- 3 - Specification (Spec letter), advances with factory production modifications.

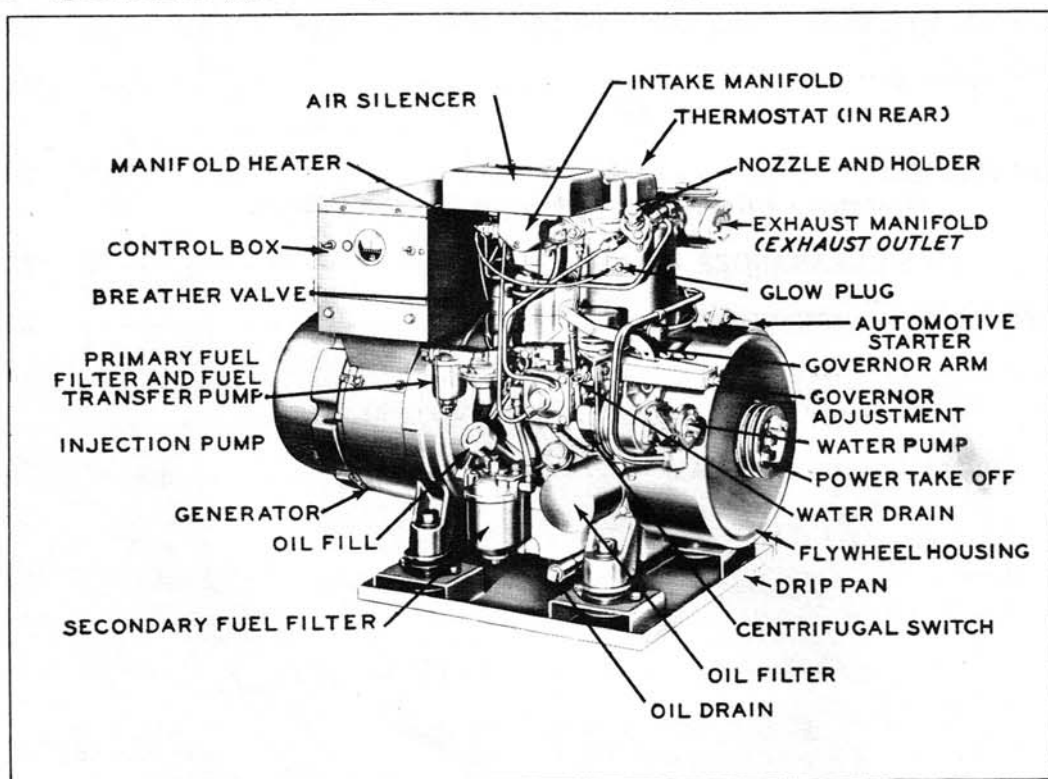


Fig. 1 Diesel Marine Electric Generating Plant
(2 cylinder model viewed from left front side)

DATA AND DESCRIPTION TABLE I

5

	Model Series		
	MDJA	MDJB	MDJC
Nominal dimensions of plant (inches)			
Height	28	28	28
Width	20	19	20
Length	28	33	49
Engine make	Onan	Onan	Onan
Number cylinders (vertical in-line)	1	2	4
Displacement (cubic inch)	30	60	120
Cylinder bore	3-1/4	3-1/4	3-1/4
Piston stroke	3-5/8	3-5/8	3-5/8
RPM (for 60 cycle)	1800	1800	1800
Compression ratio 19 to 1 for diesel fuel . .	yes	yes	yes
Exhaust connection (pipe tapped)	1-1/4	1-1/4	1-1/2
Stellite faced exhaust valve(s)	yes	yes	yes
Valve rotators on intake and exhaust	yes	yes	yes
Connecting rod bearings are tri-metal replaceable	yes	yes	yes
Main bearings are leaded bronze; precision type for replacement (quantity used).	2	2	3
Battery voltage (ac plant)	12-v	12-v	12-v
Battery size (ac plant):			
SAE group 1H	two in series		
SAE group 3KM		one	one
Amp/hr, SAE 20-hr (nominal)	100	62*	62*
Starting by solenoid shift starting motor.	no	yes	yes
Starting by exciter cranking.	yes	no	no
Centrifugal Start-Disconnect Switch	no	yes	yes
Battery charge rate amperes (normal).	2	2	2
Charge ammeter scale	5-0-5	5-0-5	5-0-5
Oil capacity in U. S. quarts - Refill.	2.5	3	5
Cooling water flow (gallons per minute) . .	4	4	4
Generator cooling air (CFM at 1800 rpm)..	75	180	120
Combustion air (CFM at 1800 rpm)	9	17	35
Total cu. ft. per min. of air required . . .	84	197	155
Air cleaner - flame arrester	dry	dry	dry
Diesel fuel lift (maximum feet)	6	6	6
Fuel tank capacity	none	none	none
Oil filter (full flow type)	yes	yes	yes
Maximum recommended power take-off			
from front pulley at any load	2 hp	2 hp	2 hp
Power take-off limit at rated load	1/2 hp	1 hp	2 hp
Glow plugs and air heater to aid starting . .	yes	yes	yes
High temperature cut-off	yes	yes	yes
Water cooled exhaust manifold	no	yes	yes
Drip pan and molded vibration mounts	yes	yes	yes
Injection pump (Am. Bosch type)	PLB	PSU	PSU
Primary and secondary fuel filters	yes	yes	yes
Generator make	Onan	Onan	Onan
Unity power factor on these models	all	1-phase	1-phase

* - Below 0°F, use 2 SAE group 1H batteries in series for 100 amp hrs, 12 volts.
(continued)

TABLE I (Cont.)

Model Series

	MDJA	MDJB	MDJC
0.8 power factor on these models	none	3-	3-
Rating is for continuous service	yes	phase	phase
Capacity in watts (60 cycle)	3, 000	yes	yes
AC voltage regulation in \pm %	5	6, 000	12, 000
AC frequency regulation in %	3	3	3
Revolving armature type generator	5	5	5
Revolving field type generator	yes	no	no
120/240-volt single phase model reconnectible	no	yes	yes
Rotating type exciter	no	yes	yes
Static type exciter (Magneciter)	yes	no	no
	no	yes	yes

OPTIONAL EQUIPMENT TABLE II

Operator's instructions on certain optional equipment may be included with the equipment and should be attached to this manual for future reference.

1. **LOW OIL PRESSURE CUTOFF** (For diesel with starting motor). - Shuts down plant if oil pressure fails. Oil level must be checked regularly as usual. Requires modified plant control with Emergency Relay and different circuitry. Once energized from low oil pressure, relay has to be reset manually.
2. **SWITCHBOARD**. - Instruments to read ac amperes, and ac volts, and to break overloaded ac circuit. Desirable information for operator. For wall mounting.
3. **AC RECEPTACLES**. - Convenience for plugging in ac loads.
4. **AUTOMATIC DEMAND CONTROL**. - Starts and stops plant automatically.
5. **LINE TRANSFER CONTROL**. - Controls running of plant and transfers load.
6. **HEAT EXCHANGER COOLING**. - Closed system using fresh water in plant.
7. **SEAMLESS FLEXIBLE EXHAUST TUBING**. - Corrugated to absorb vibrations and to make bends.
8. **"ELASTO-MUFFLE"**. - Neoprene silencer for wet exhaust.
9. **SEPARATE FUEL TANK**. - Various sizes.
10. **REMOTE START-STOP SWITCH**. - SPDT, momentary contact, center off type.
11. **OTHER**. - Ask your dealer.

GENERAL. - Proper installation is very important. Points to consider include: adequate generator cooling air; discharge of circulated air; adequate fresh induction air; adequate engine cooling water; discharge of circulated water; discharge of exhaust gases; electrical connections; fuel connection; sturdy and flat floor; and accessible for operation and service. Use this manual as a guide to help with the installation; refer to Typical Installation, figure 3. For more complete instructions, request Onan Technical Bulletin T-021.

Each installation must be considered individually and executed in compliance with all regulations which may affect the installation. The advice and guidance contained in the booklet entitled "Fire Protection Standards for Motor Craft" (NFPA No. 302) offered by the National Fire Protection Association International, Boston 10, Mass., will be helpful to the installer of equipment in vessels.

LOCATION. - Select a location for the plant, preferably near the vessel's main keel, which is dry, properly ventilated, above low lying vapors and splash from the bilge. Maintain reasonable accessibility for minor servicing operations, draining of the crankcase lubricating oil and the water system.

MOUNTING. - The floor should be flat and give support directly under the plant mounting points. The unit will rock on its mounts.

Leave an extra 2-1/2 inch clearance around the unit! To permit the unit to rock on its mounts without restraint, use adequately flexible exhaust line, fuel lines, battery cables, and electrical wires.

The proper strength mount should deflect approximately 1/4" under its load. Secure the thinner mounts under the engine oil base (lighter end of plant), with the proper length 1/2" diameter screw and other hardware as illustrated. Likewise, secure the thicker mounts under the generator support (heavier end of plant). Position the plant on the drip pan so that the thinner mount is on the higher support (chair) in the drip pan. Secure the mounts to the drip pan, figure 2.

Install a hold-down clamp at both ends or both sides of the drip pan. Secure the clamp to the floor.

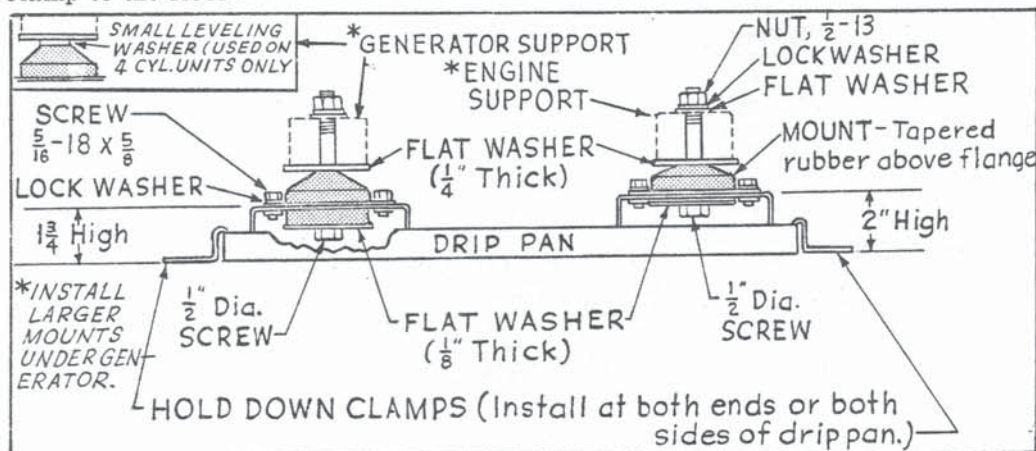
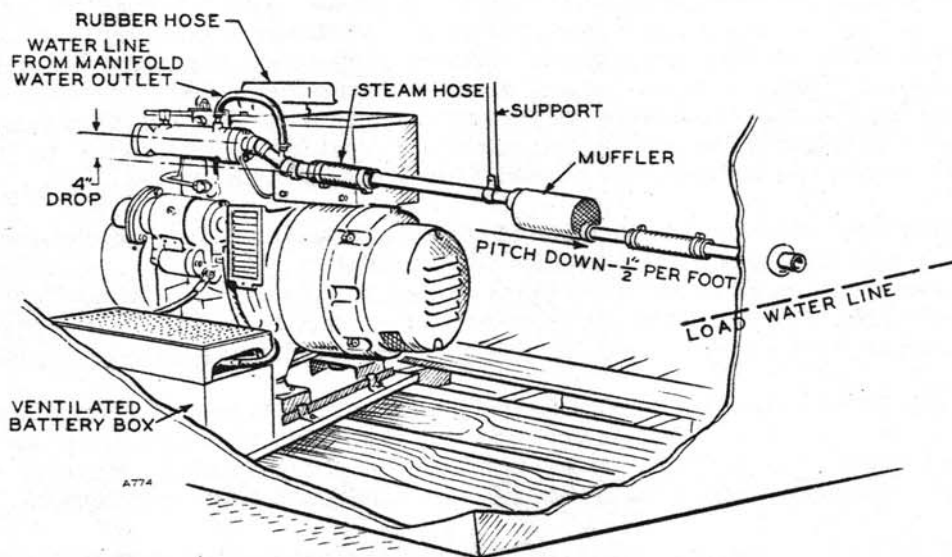
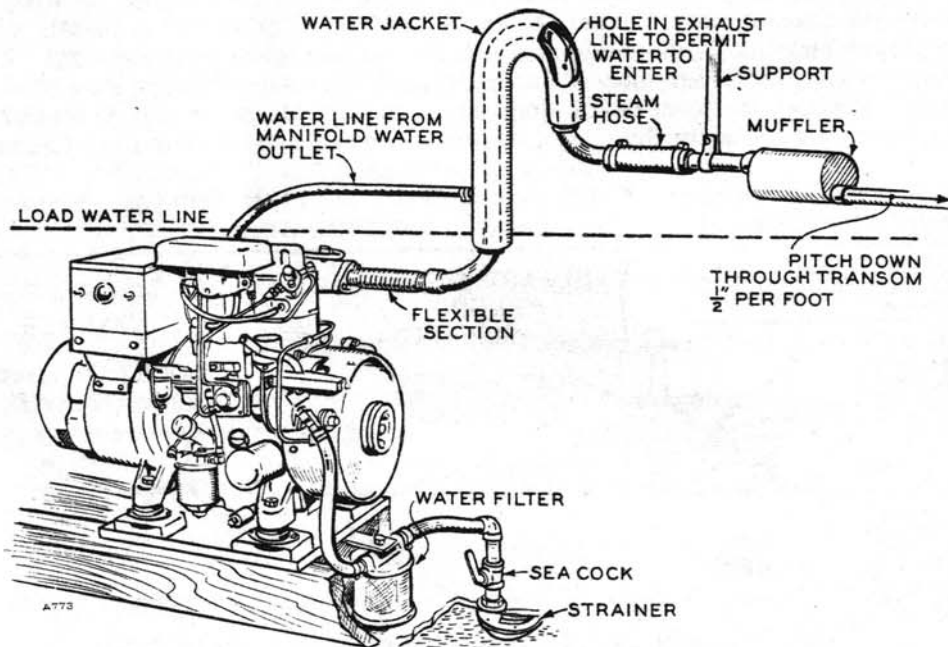


Fig. 2 Mounting Detail



ABOVE LOAD WATER LINE INSTALLATION



BELOW LOAD WATER LINE INSTALLATION

Fig. 3 Typical Installations

FUEL TANK AND LINES. - Where a separate fuel tank is used, install the fuel tank so that the bottom of the tank will be less than 6 feet below the fuel pump. If tank is above pump, provide a siphon break.

Where a fuel tank is shared, do not connect to an existing line at a point above the fuel supply level. This avoids starving the plant.

If fuel lift exceeds 6 feet, install an auxiliary electric fuel pump near the fuel supply.

Use approved flexible fuel line next to the engine. The diesel engine requires a fuel supply line and a separate fuel return line. Install the fuel supply line from near the bottom of the supply tank to the 1/8" pipe tapped inlet of the fuel pump. Install the fuel return line from the 1/4" tube inverted fitting (where the nozzle and injection pump spill lines are joined) to the top of the supply tank. See fig. 15.

A shut-off valve at the tank is recommended for servicing convenience.

OIL DRAIN. - The oil drain may be extended to suit the installation. The oil base has a 1/2" pipe tapped hole.

VENTILATION. - The generating plant requires fresh air both for combustion and to cool the generator. Compartments in which plants are installed must be ventilated. Onan recommends that the ventilation system be able to deliver 1-1/2 to 2 times the air required by the plant (see Table 1). This usually requires a mechanical ventilating system. Especially when the existing system depends on wind or boat motion, ventilation requires powered exhausters connected to run when the plant runs to provide ventilation when the boat is not in motion. For more information, refer to Onan Technical Bulletin T-021.

EXHAUST. - See Typical Installation, figure 3. Exhaust connection is 1-1/4 inch pipe tapped. Pipe exhaust gases outside any enclosure - **EXHAUST GASES ARE DEADLY POISONOUS!** Install a separate exhaust line above load water level; support it; do not share it with another engine; pitch it downward to prevent back-flow of water; shield it where hot or near combustible wall; use a section of flexible seamless tubing near the engine to absorb vibration; if turns are necessary, use sweeping (long radius) elbows; if pitched upward, install a condensation trap at point of rise; increase one pipe size for each additional 10 feet in length. On the 2 cylinder and 4 cylinder engine, the pipe tapped end of the water jacketed exhaust manifold can be changed to the opposite end for convenience in exhaust line connection. Provide a tee for water line connection for wet exhaust - refer to Water Discharge Line instructions. Raise the dry portion of the exhaust line high enough to prevent water back-flowing to the engine under all conditions.

The recommended Neoprene muffler (silencer) is an "Elasto-Muffle" brand, size "Mark 0" and 2 bushings size AB (fits 1-5/8" od) for 1 and 2 cylinder engines, or size "Mark II" and 2 bushings size CC (fits 2-1/8" od) for the 4-cylinder engine. Provide a recommended or equal silencer and install it near the end of the wet exhaust line. **WARNING:** Dry exhaust will burn this neoprene silencer.

WATER SUPPLY LINE. - A continuous supply of cooling water is required.

The water pump inlet is tapped 1/4" pipe thread. Use a section of hose (that will not collapse) near the plant (or entire run) to absorb vibration. The inside diameter of the plumbing must be 1/2" or larger. Use Permatex or other pipe sealer on all pipe fittings in supply line to pump. Normally, the pump should deliver 4 gallons of cooling water per minute. Measure the discharge water flow to assure the supply line is large enough. Reduce resistance of runs farther than 5 feet by using larger inside diameter plumbing. To prove suction line is air tight, see that no bubbles appear in discharged water. An air leak reduces lubrication and shortens life of pump's impeller. Near the water suction line inlet and where accessible, install a strainer and a check valve (on clean side of strainer to maintain prime).

WATER DISCHARGE LINE. - On the 1 cylinder engine, the 3/8" pipe tapped water outlet is next to the cylinder head. On the 2 cylinder and 4 cylinder engines, the jacketed exhaust manifold has a 3/8" pipe tapped water outlet.

Use plumbing at least as large as the supply line. Use a section of hose near the plant or all the way. Connect the line to discharge the heated cooling water into the exhaust line several feet ahead of the neoprene silencer. Be sure water will not back flow in the exhaust line. See Heat Exchanger Cooling (optional system).

REMOTE START-STOP SWITCH (Optional). - For remote control of starting and stopping ("Remote" type plant) use 3 wires to connect a remote switch (SPDT, momentary contact, center off type) to the terminal block marked B+, 1, 2, 3 in the plant control box. For MDJA models, use #18 wire up to 75 feet, #16 wire up to 120 feet, #14 wire up to 180 feet, and #12 wire up to 305 feet. For MDJB and MDJC models, use #18 wire up to 65 feet, #16 wire up to 100 feet, #14 wire up to 150 feet, and #12 wire up to 280 feet. See figure 4.

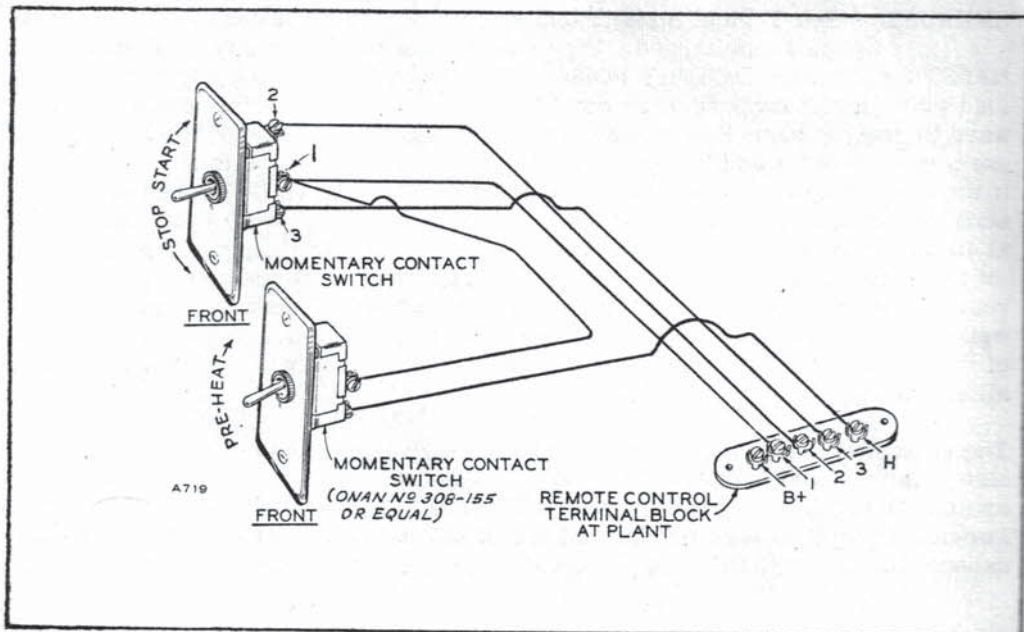


Fig. 4 Remote Start-Stop and Preheat Switches

BATTERY CONNECTION (Plant with Starting Motor - Models MDJB and MDJC). -

Refer to the wiring diagram and figure 6. Battery polarity connection must agree with the connection of the rectifier located in the control box. If battery ground must be changed to agree with polarity of other equipment aboard a vessel, then reverse the rectifier connection in the control, Fig. 5.

WARNING: If the battery is connected to the charging circuit with the wrong polarity, damage will occur after 3 minutes while stopped or in 5 seconds while running. Alternator windings will be damaged almost instantly if battery charging circuit is shorted before the resistor.

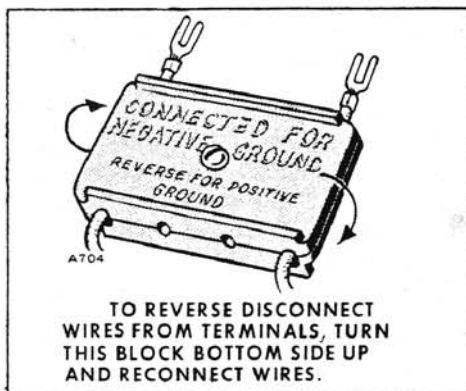


Fig. 5 Polarity Block

Provide a 12 volt battery. See DATA TABLE 1 for minimum battery amperes. Connect the battery positive (+) to the starter engaging solenoid terminal post, figure 6. Connect the battery negative (-) to a good ground on the engine.

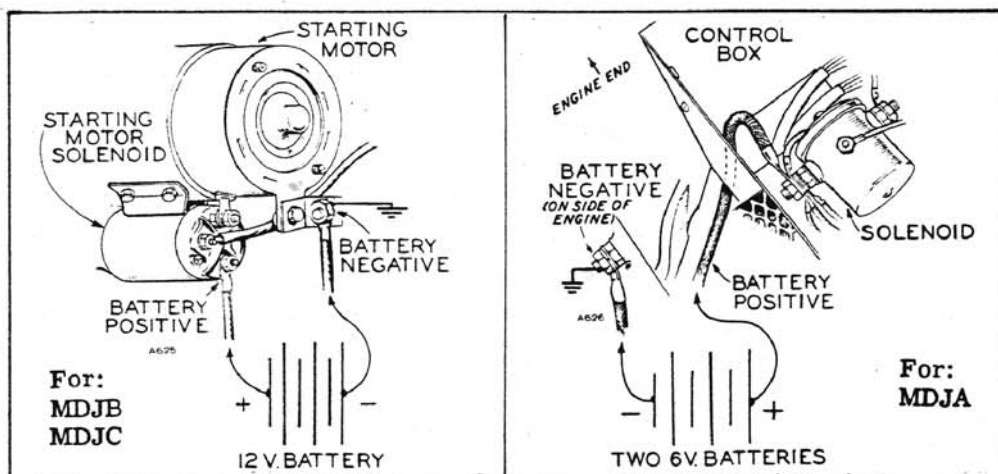


Fig. 6 Battery Connections

BATTERY CONNECTION (Exciter Cranked Plant-Model MDJA). - Refer to the wiring diagram and figure 6. If battery ground must be changed to agree with other equipment aboard a vessel, reverse the connections to the charge ammeter or remark the correct direction of charge.

Provide TWO 6 volt batteries connected in series (one battery's negative to other battery's positive) for a 12 volt source. See DATA TABLE I for minimum battery amperes. Connect the remaining battery positive (+) to the start solenoid (located in the control box). Enter from below. Connect the battery negative (-) to a good ground on the engine.

LOAD WIRE CONNECTIONS. - The plant nameplate shows the electrical output rating of the plant in watts, voltage, and cycles. The plant wiring diagram shows the electrical circuits and the connections necessary for the available output voltage.

Enter the control box (or junction box) through the KO (knock out) section. Use flexible rather than rigid conduit near the plant. Meet all applicable electrical code requirements. Use sufficiently large insulated wire. Insulate bare ends. Install a fused main switch or circuit breaker between the generating plant and the load.

When 2 or more single phase circuits are available, do not overload any one circuit — divide the load between them as equally as practical. To determine the amount of current available on each single phase circuit, subtract the higher voltage load or 3 phase load (whichever applies) from the rated output and divide remainder by quantity of single phase circuits.

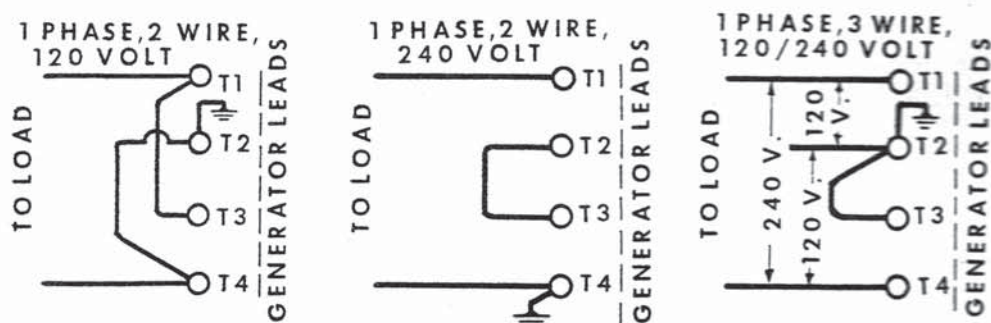


Fig. 7 Voltage Selection for 1-phase Reconnectable Generator

The revolving field single phase plants (MDJB-3R, and MDJC-3R models), except when optionally equipped with meter panel, circuit breaker, etc., are reconnectable for use as either a 120/240 volt 3 wire, a 120 volt 2 wire, or a 240 volt 2 wire unit, figure 7. Be sure to join the proper generator leads as shown for the reconnectable type generator. Be sure to connect to ground, each lead shown grounded (\oplus).

HEAT EXCHANGER COOLING (Optional). - Closed type cooling systems are commonly referred to as fresh water cooling or heat exchanger cooling. Water circulated through the engine is called "fresh water," "hot water," "jacketed water," etc. Water circulated through the heat exchanger only is called "raw water," "sea water," "cold water," "discharged water," etc. This system and anti-freeze coolant are recommended where freezing hazard exists or where the owner wants to prevent possibility of salt water problems.

Two condition prevail: (1) Factory installed heat exchanger, and (2) Customer installed Onan heat exchanger kit. Get details from Onan.

WARNING I - Do not use the existing neoprene impeller water pump in the hot water side of the cooling system. Heat or soluble oil (in many rust inhibitors and many anti-freezes) will damage the impeller. Instead, connect the neoprene impeller pump in the cold water side. Use a metal im-

pellor centrifugal type water pump (Oberdorfer 1-GP, or equal) in the fresh water side. Drive it with a belt from the plant's power take-off.

WARNING II - Use an expansion tank in the fresh water side of this system.

On early models with heat exchangers, the discharged water leaves at the exhaust manifold, but on later models, discharged water leaves at the heat exchanger. Supply line connections in both systems are the same. For general comments that apply in all cases, refer to the instructions for standard systems in this section.

Fill the closed cooling system with clean, alkali-free water to the proper level in the expansion tank. Add an approved rust inhibitor to the coolant. If the coolant is for freezing temperatures, use the necessary proportion of anti-freeze, and test it periodically.

Install a new zinc "pencil", figure 14, which screws into raw water inlet end of heat exchanger, each 2 months or as inspection dictates.

PREPARATION

CRANKCASE OIL. - Table I gives the oil capacity. Be sure the plant is sitting level when filling. Fill to "F" (full) mark on the indicator, figure 9. Use a good heavy duty detergent oil classified for service "DG" or "MS/DG". Service "DS" oil is satisfactory, but is higher in cost. Use a single viscosity oil. Oil consumption is usually greater with multi-viscosity "all season" oil such as 10W-30. Use the proper SAE number oil for the compartment temperature conditions. Do not mix brands nor grades. Always reinstall indicator **AIR TIGHT.**

GOVERNOR LINKAGE. - Lubricate the linkage ball joints, figure 10, with powdered graphite (preferably), or a light, non-gumming lubricating oil.

TEMPERATURE	GRADE
Above 90°F	SAE 50
30°F to 90°F	SAE 30
0°F to 30°F	SAE 10W
Below 0°F	SAE 5W

RECOMMENDED FUEL. - Use No. 2 Furnace Oil. Premium Diesel fuels are not required. No. 1 Furnace Oil (distillate and range oil) and kerosene may be used but for the 1 cylinder engine only, one quart (U.S. Measure) of SAE No. 30 lubricating oil should be added to each 25 gallons of such fuel to provide lubrication of the injection pump's non-rotating plunger. This is not required on the two and four cylinder diesel because the pump's plunger rotates.

Use fuel with low sulphur content to minimize ring sticking and bearing corrosion. Keep fuel supplies in clean containers and adequately protected from rain, snow and dirt. **KEEP THE FUEL SYSTEM CLEAN.** The long life built into the injection system can be destroyed by one moment of carelessness. Leave some space for fuel expansion when filling the tank.

PRIME WATER PUMP. - Temporarily remove the plug from the water pump inlet fitting, figure 11. Fill the pump with water to lubricate and prime it.

BLEED AIR FROM FUEL SYSTEM.

To find the air bleed location, see figure 7 for MDJA models and figure 12 for MDJB and MDJC models. Then operate the hand priming lever on the diaphragm type fuel pump until there are no bubbles in the fuel flowing from the bleed hole.

NOTE: If the cam is on the high side, crank the engine 1 revolution to permit hand priming. When finished, return the priming lever to the disengaged position, to permit normal pump operation, and close the bleed holes. Recheck all connections.

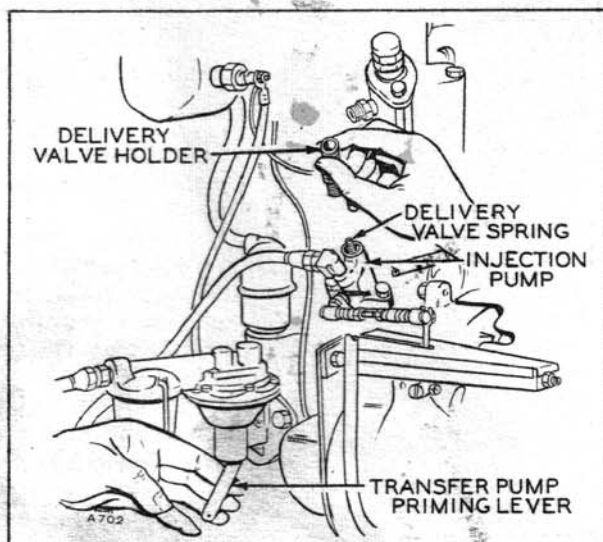


Fig 8 Priming MDJA Fuel System
(systems without return line on pump)

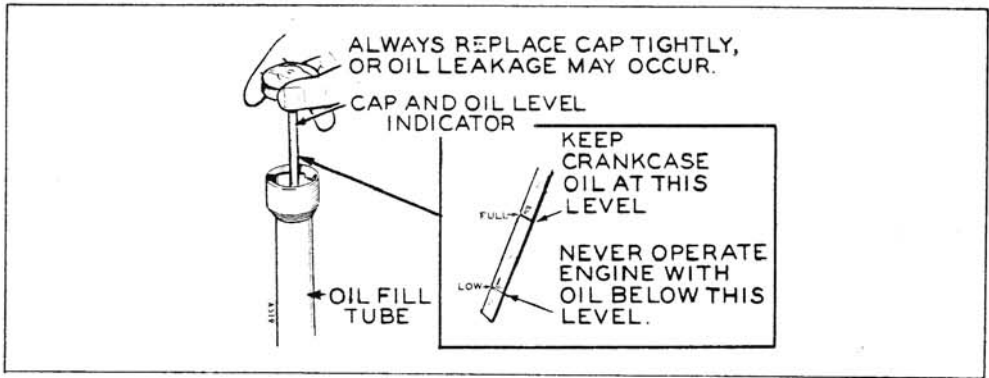


Fig. 9 Crankcase Oil Level

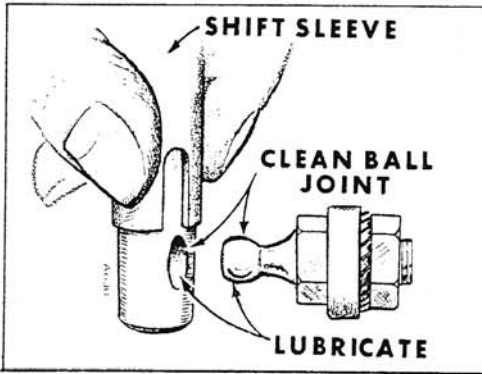


Fig. 10 Governor Linkage Lubrication

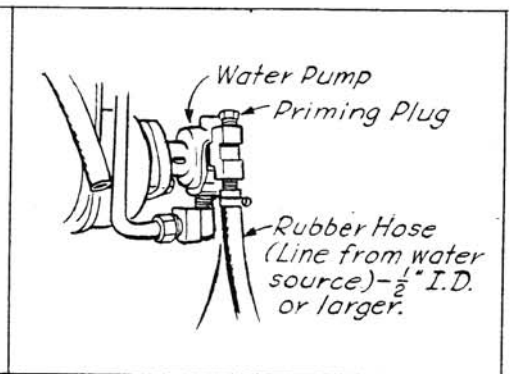


Fig. 11 Water Pump Priming

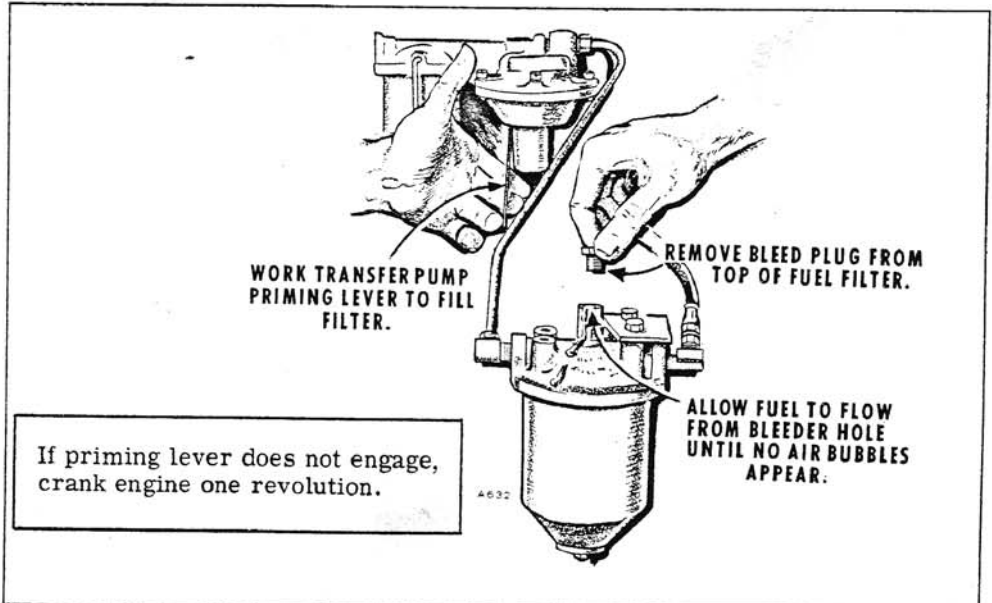


Fig. 12 Priming MDJB and MDJC Fuel Systems

OPERATION

BE SURE THE INSTALLATION IS COMPLETE. HAVE THE ENGINE SERVICED WITH LUBRICATING OIL, FUEL AND WATER.

INITIAL START. - If necessary to prime a "dry" fuel system, return the fuel pump hand lever to its inward position after priming.

STARTING. - (1) For cold starting, depress manifold heater switch for two minutes. (2) Push the START-STOP switch to its START position. (3) Release switch after engine starts and reaches speed. (4) See that oil pressure gauge reads at least 20 psi. Pressure-relief valve is not adjustable.

When starting at temperatures below 50°F., refer to the suggested aids in section, Abnormal Operating Conditions.

There is no provision for hand cranking.

Only after an emergency shutdown of a plant equipped with an optional low oil pressure cutoff switch, correct the cause and press the reset button before re-starting.

The slide tap on the adjustable resistor in the charging circuit is set to give approximately 2 amperes charging rate. For applications requiring frequent starts, check the battery charge condition (specific gravity) periodically and if necessary increase the charging rate slightly (slide resistor's tap nearer ungrounded lead) until it keeps the battery charged. Having plant stopped when readjusting avoids accidental shorts! Avoid overcharging the battery (too high charging rate). The resistor is located in the generator air outlet of revolving field generators, or on rear of control box of revolving armature generators.

When a separate automatic demand control for starting and stopping is used, adjust the charging rate for its maximum of approximately 4.5 amperes. This normally maintains battery charged condition during starts that occur as often as each 15 minutes.

On revolving field generators, the centrifugal switch automatically closes after starting to disconnect cranking and permit running. On revolving armature generators, the oil pressure switch controls the decompression circuit.

STOPPING. - (1) Push the START-STOP switch to its STOP position. (2) Release the switch as soon as the plant stops. NOTE: If stop circuit fails, hold throttle closed to stop engine.

APPLYING LOAD. - If practicable, allow the plant to thoroughly warm up before connecting a heavy electrical load. Continuous overloading of the generator will cause its temperature to rise to a point where serious damage to the windings can occur. The generator can safely handle an overload temporarily, but for normal operation, keep the load within the nameplate rating.

When practicable, connect the load in steps rather than the full load at one time. Most installations use a line switch, which must be closed to connect the load.

EXERCISE DURING STANDBY SERVICE. - Infrequent use can result in hard starting. Run the plant one 30 minute period each week. A fuel additive to minimize sludge will aid fuel filtering.

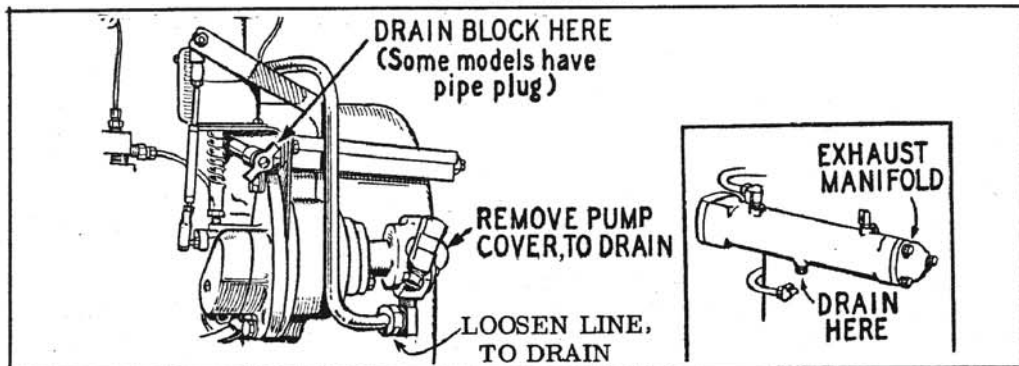


Fig. 13 Cooling System Drain Points

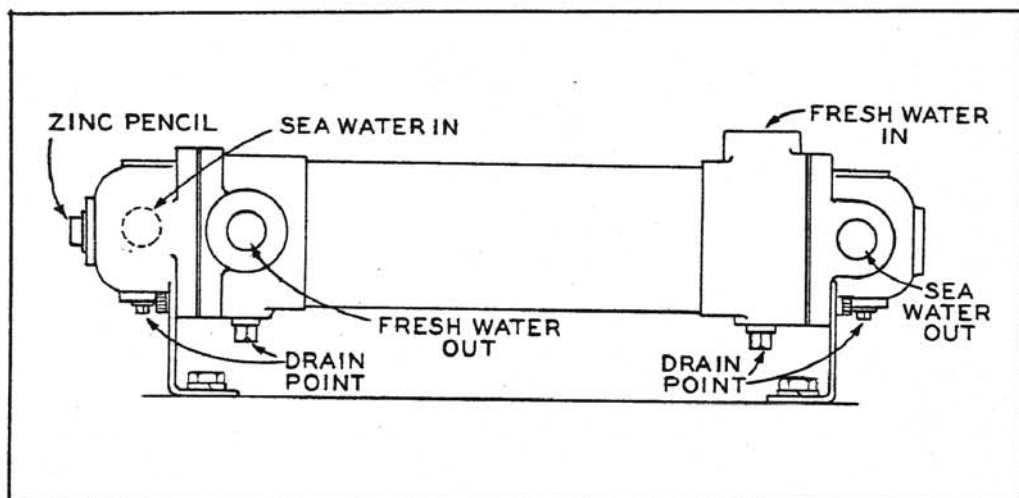


Fig. 14 Heat Exchanger (MDJB Models with Closed Cooling Systems)

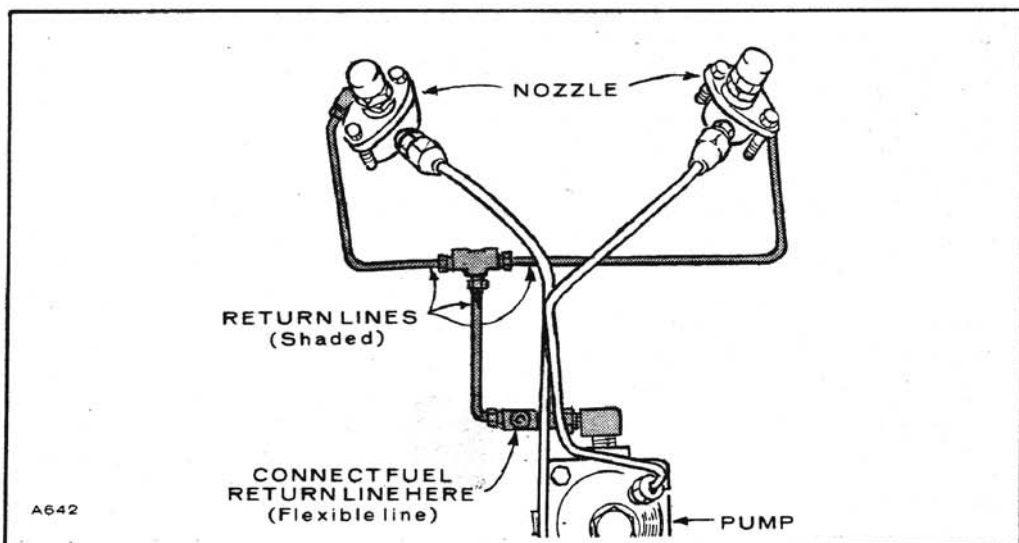


Fig. 15 Typical Fuel Return Line Connection

AUTOMATIC STARTING AND STOPPING. - Separate controls may be used for automatic starting and stopping at temperatures above 55°F. Diesel starting is not always reliable at lower temperatures.

These controls have a time delay relay to pre-heat each glow plug and the manifold heater for about 20 seconds before electric cranking occurs. Remove the jumper in the plant's control box which connects terminal H (heater) to terminal 3 (start circuit) and connect separate control's preheat circuit to the plant H terminal when installing the control. The time delay relay also delays engagement of the starter when load is re-applied before the engine stops completely.

SAFETY DEVICE. - In case of dangerously high coolant (water) temperature, the cutoff switch stops the plant.

When the revolving field generator is optionally equipped with a low oil pressure cutoff switch, an Emergency Relay with reset button is used for positive stopping. After an emergency stop, investigate and correct the cause. Press the reset button before restarting.

On the revolving armature generator, the oil pressure switch is not intended for a safety device. It will not be adequate protection in case of a gradually diminishing oil pressure or too low oil level.

PROTECTION FOR EXTENDED OUT OF SERVICE PERIOD. - Protect a plant that is to be out of service for more than 30 days as follows:

1. Run the plant until thoroughly warmed up.
2. Drain the oil from the oil base while still warm. Attach a warning to refill before operation. Drain water if it will freeze, figures 13, 14.
3. Clean the air cleaner.
4. Lubricate the governor linkage. Protect against dust, etc., by wrapping with a clean cloth.
5. Plug the exhaust outlet to prevent entrance of moisture or dirt.
6. Wipe the generator brushes, slip rings, etc., clean. Do not use any lubricant or preservative.
7. Wipe the entire unit clean. Coat parts likely to rust with a light film of grease or oil.
8. Provide a suitable cover for the entire unit.
9. Disconnect battery and follow standard battery storage procedure.

EMERGENCY OPERATION IF BATTERY FAILS. - The revolving-armature plants (MDJA) must always have the battery connected while operating. High voltage will burn relays if battery is disconnected.

The revolving field plants (MDJB, MDJC) require a battery for running. If the plant battery fails completely, but this plant must be operated during an emergency, a battery can be shared with other equipment provided the plant charging circuit is disconnected as follows: Remove at the ammeter the wire which connects to the battery polarity reconnection block, then tape the bare end. The plant would not recharge the battery.

ABNORMAL OPERATING CONDITIONS

19

HIGH TEMPERATURES

1. See that nothing obstructs water flow to and from the plant.
2. Be sure the compartment is properly ventilated.

LOW TEMPERATURES

1. Use the proper SAE No. oil for the temperature conditions. Change oil only when warm from running. If an unexpected temperature drop causes an emergency, move the plant to a warm location, or apply heat externally until oil will flow freely.
2. Protect against moisture condensation in fuel.
3. Keep batteries in a well charged condition.
4. Reduce the compartment ventilation, but use care to avoid overheating.
5. If freezing temperature occurs and engine is not protected with antifreeze, during stopped periods drain the block, pump, manifold, and muffler. Attach warning tag. See figure 13.

DUST AND DIRT

1. Keep the plant clean.
2. Service the air cleaner (silencer) as frequently as necessary.
3. Change crankcase oil every 100 operating hours.
4. Keep oil and fuel supplies in dust-tight containers.
5. Keep the governor linkage connections clean.
6. Keep the generator brushes, slip rings and commutator (where used) clean.

HIGH ALTITUDE

Maximum power will be reduced approximately 4 per cent for each 1000 feet above sea level.

20 PREVENTIVE MAINTENANCE

THE FOLLOWING MAINTENANCE IS RECOMMENDED TO KEEP THE PLANT IN GOOD OPERATING CONDITION. NEGLECT OF ROUTINE SERVICING MAY RESULT IN FAILURE OF THE PLANT AT A TIME WHEN IT IS URGENTLY NEEDED. THE CHART IS BASED ON UNITS OPERATING UNDER FAVORABLE CONDITIONS SUCH AS: PROPER INSTALLATION, RECOMMENDED FUEL AND OIL, NORMAL LOAD, ETC.

PERIODIC SERVICE CHART

SERVICE THESE ITEMS	AFTER EACH CYCLE OF INDICATED HOURS						SEE SERVICE NOTES
	8	100	200	500	1000	5000	
Inspect Plant Generally	x						A
Check Fuel Supply	x						B
Check Oil Level	x						C
Lubricate Governor Linkage		x†					D
Service Air Cleaner (Silencer)			x†				E
Change Crankcase Oil		*	x				F
Clean Crankcase Breather			x				H
Check Breaker Points			x				J
Check Battery Electrolyte Level			x				K
Empty Fuel Sediment Bowl			x				L
Check Valve Clearance	•			x			P
Inspect Generator Brushes				x			M
Inspect Water Pump Impeller				x			G
Clean Build-up Relay Contacts (02SX Magneciter only)				x			N
Replace Oil Filter			▲	x			O
Secondary Fuel Filter					x		L
Clean Rocker Box Oil Line Holes					x		P
Clean Combustion Chamber					x		P
Grind Valves					x		P
Clean Generating Plant					x		P
Complete Reconditioning						x	P

† Service more often under extreme dust conditions.

* See service note F.

▲ See service note O.

• Tighten head bolts and adjust valve clearance after first 50 hours on a new or overhauled engine.

SERVICE NOTES. - These notes supplement the Periodic Service Chart.

- A. - Inspect for leaks, loose connections, etc. **KEEP PLANT CLEAN!**
- B. - **FUEL SUPPLY.** Check supply to avoid running out of fuel. Use clean fuel as recommended in section, Preparation. Never fill completely; allow some space for expansion.
- C. - **OIL LEVEL.** Keep level to the F (full) mark on the indicator, figure 9. When adding, use the same brand as in crankcase.
- D. - **GOVERNOR LINKAGE.** Use lubricating graphite on the ball joints, figure 10. If graphite is not available, use a light non-gumming lubricating oil.
- E. - **AIR CLEANER (Silencer).** See figure 16. Wash in fuel and install dry.
- F. - **CRANKCASE OIL.** Change oil only when warm after operating. If oil is too cold to flow, do not start engine. Remove to a warm location or apply heat externally until oil flows freely. The oil filter is a full-flow type.
- * If engine is operating in extremely low temperatures; for short operating periods; with high sulfur content fuel; or in extremes of dust and dirt, then change oil every 100 hours instead of every 200 hours.
- G. - **WATER PUMP IMPELLER.** Remove water pump cover, figure 17, and inspect neoprene impeller. If worn or damaged, install new impeller. Pump should discharge a nominal 4 U.S. gallons per minute when thermostat is open. Install pump cover air tight to avoid early failure of impeller.
- H. - **BREATHING VALVE.** Lift off rubber breather cap, figure 18. Carefully pry valve from cap. Otherwise press hard with both of your thumbs on top of cap and fingers below to release valve from rubber cap. Wash this fabric flapper type check valve in fuel. Dry and reinstall positioning perforated disc toward engine.
- Valve must maintain a partial vacuum in crankcase to help control oil. If faulty, install a new valve.
- J. - **BREAKER POINTS.** Refer to Table of Clearances for correct gap distances. Replace burned or faulty points. If only slightly burned, dress smooth with file or fine stone. Measure gap with thickness gauge.
- (1) The centrifugal switch, figure 19, is wide open when engine is stopped. Loosen and move stationary contact to correct the gap.
- (2) One-cylinder non-battery charging units have breaker points, figure 19, in the anti-flicker circuit.
- The anti-flicker breaker points add a resistor to the generator field circuit only during each power stroke of the 1 cylinder engine. Crank engine to exactly align TC (top center) timing mark. Loosen and move stationary contact to correct the gap at full separation. Retighten contact and re-check gap.
- K. - **BATTERY.** - Check charge condition. Check electrolyte level. Add approved water to keep the electrolyte to its proper level. In freezing weather, run the plant immediately after adding water. Keep battery connections tight and clean.

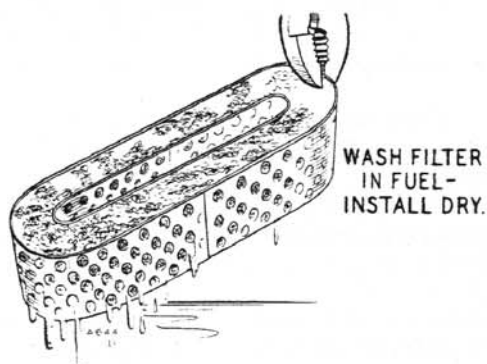


Fig. 16 Air Silencer and Flame Arrester

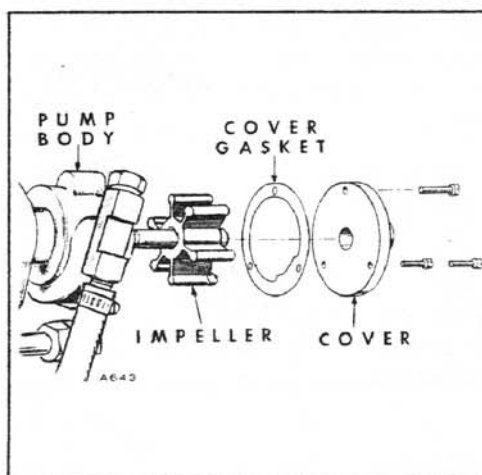


Fig. 17 Water Pump

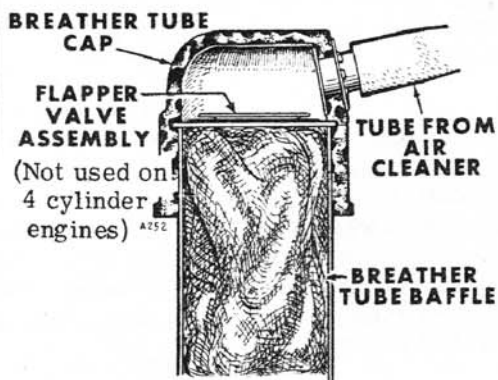


Fig. 18 Breather Valve

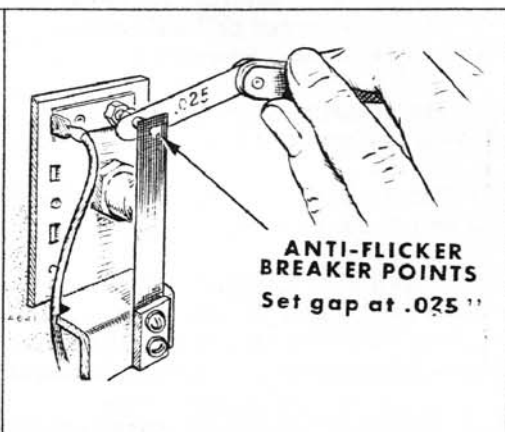
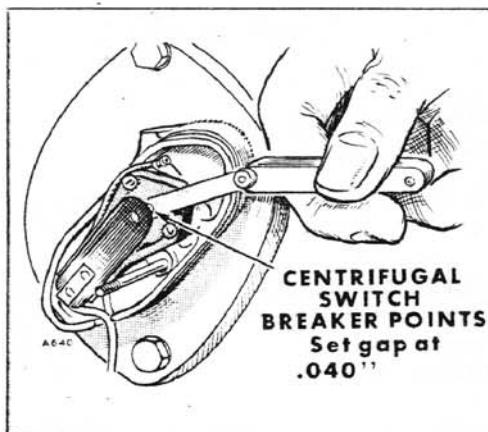


Fig. 19 Breaker Points

L. - FUEL SYSTEM. Always Be Clean. Empty fuel filter (strainer) bowl of any accumulated sediment. Clean edge type strainer in solvent if restricted. Reassemble and check for leaks.

The fuel system secondary filter is a replacement cartridge type. Keep a spare cartridge on hand to install when trouble occurs or when engine operation indicates fuel starving because of a restricted cartridge.

M. - GENERATOR. Clean slip rings and commutator (on revolving armature type generators) with a dry cloth. If heavily coated or rough, sand smooth with #00 (fine) sandpaper - never use emery (or other conductive) abrasives. Replace brushes when worn to 1/2 original length. Replace 1/4 x 3/8 inch brushes, used on revolving field slip rings, when worn to 5/16 inch or less in length. Replace all other brushes when worn to 5/8 inch or less in length. Do not disturb the brush rig to install brushes. Use only brushes specified (never substitute) in the parts list. If sparking occurs, run plant at a light load until brushes wear to a good seat.

N. - RELAY CONTACTS. The 02SX model Magneciter (used on MDJB spec A and B model plants) has a voltage build-up relay located inside near the generator air inlet. Carefully wipe the relay contacts with paper to remove any non-conductive film or dirt. Reinstall the Magneciter cover.

O. - OIL FILTER. The oil filter is a full-flow type (all oil is filtered enroute to bearings). A by-pass permits unfiltered oil to reach bearings if filter becomes clogged. Place a drip pan below filter. Unscrew oil filter counterclockwise using both hands or a filter wrench (strap type wrench). Clean filter mounting area. Install new filter turning it hand tight then 1/4 turn additional using a filter wrench. Change the oil filter oftener if, because of freezing temperatures or extreme dust conditions, the oil becomes so black and dirty, the marking on the level indicator can't be seen through the oil.

P. - MAJOR ENGINE SERVICE. Remove combustion deposits from the combustion chamber, valves, etc., as often as experience dictates, depending on operating conditions. Adjust valve clearances when cold (after engine has been stopped several hours permitting the engine to cool completely). Flush rocker box cover oil line in fuel and clean small holes using fine wire (do not enlarge holes). Clean entire generating plant to insure efficient cooling and operation. Perform other services as inspection or operation shows necessary. (A major Service Manual is available. See general information on page 1.)

ADJUSTMENTS

GOVERNOR. - The governor controls the engine speed. Rated speed and voltage appears on the nameplate. See also Data Table I. Engine speed equals current frequency multiplied by 30, on a 4 pole generator, thus 1800 rpm gives 60 cycle frequency. Preferred speed does not vary more than 2 cycles from no load to full load operation. Be sure throttle, linkage, and governor mechanism operate smoothly and unobstructed.

Speed Adjustment - Change the spring tension by holding the governor spring stud and turning the nut to adjust the engine speed, figure 20.

More spring tension (turning nut clockwise) gives more rpm. Turn nut counter-clockwise to reduce governed speed. Hold a tachometer against the stud in the axis of the generator. On the revolving armature generator, adjust the engine speed to attain the proper voltage with load connected and using a voltmeter.

Sensitivity Adjustment - Adjust for minimum speed drop without a hunting condition. If the speed drops too much when full load is applied, unscrew the governor adjusting stud, figure 20, to use more coils of the spring. Hold the stud and turn the speed nut slightly for more spring tension to compensate for reduced rpm caused by making more coils operative. A too close sensitivity adjustment, approaching no speed drop when load is applied, will result in a hunting condition (alternate increase and decrease in speed).

Throttle Stop Screw(MDJA units only) - Set the throttle stop screw located on the injection pump throttle lever. With no load connected and while running at rated speed turn the screw to give 1/32 inch clearance between the screw and pin. This prevents starving when load is suddenly removed.

Throttle Stop Screws(MDJB, MDJC) - Set the maximum stop screw while gradually increasing the load to stop the throttle at smoke point. Set the minimum stop screw to just fully close the throttle(no fuel injected).

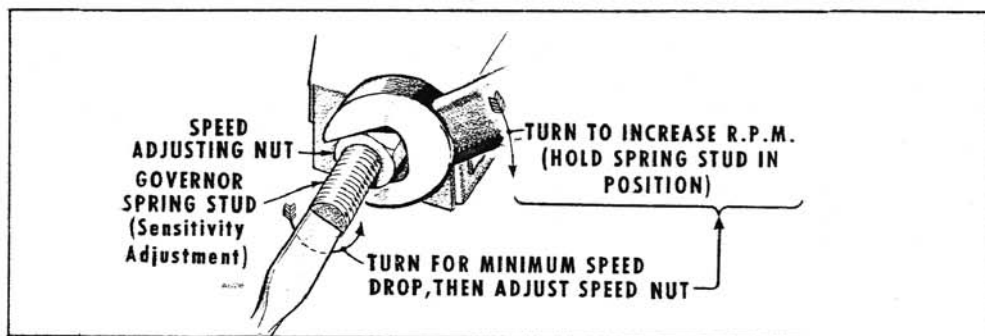


Fig. 20 Governor Adjustment

VALVE CLEARANCE. - Check valve clearance only when the engine is at room temperature (about 70°F). Turn the flywheel so the piston in the cylinder to be checked is 10° ATC. Adjust the clearance, with the rocker arm nut, to the values specified in the Table of Clearances.

DECOMPRESSION RELEASE (MDJA Only). - Before adjusting the decompression release, the valves must be set for the correct clearance. After checking valve clearance, leave the flywheel at 10° ATC so the exhaust valve will have its maximum clearance when adjusting the decompression release.

Set the arm in the decompression position (tension against release spring). Turn the set screw so the end just touches the exhaust rocker arm. Then turn the screw exactly 1 revolution clockwise. **NOTE:** if the screw is tightened more than 1 turn, the exhaust valve could hit the piston.

Hold the set screw, and tighten the lock nut, first hand tight and then $\frac{1}{4}$ to $\frac{1}{2}$ turn farther.

Release the mechanism to allow compression, and check the clearance between the screw and rocker arm. Take up valve clearance for this check by inserting a feeler gauge between the valve and rocker arm. If the set screw does not clear the rocker arm, loosen the lock nut, and back the screw out until there is clearance.

When reassembling the rocker box cover, remove the solenoid and remount it when the cover is on the engine.

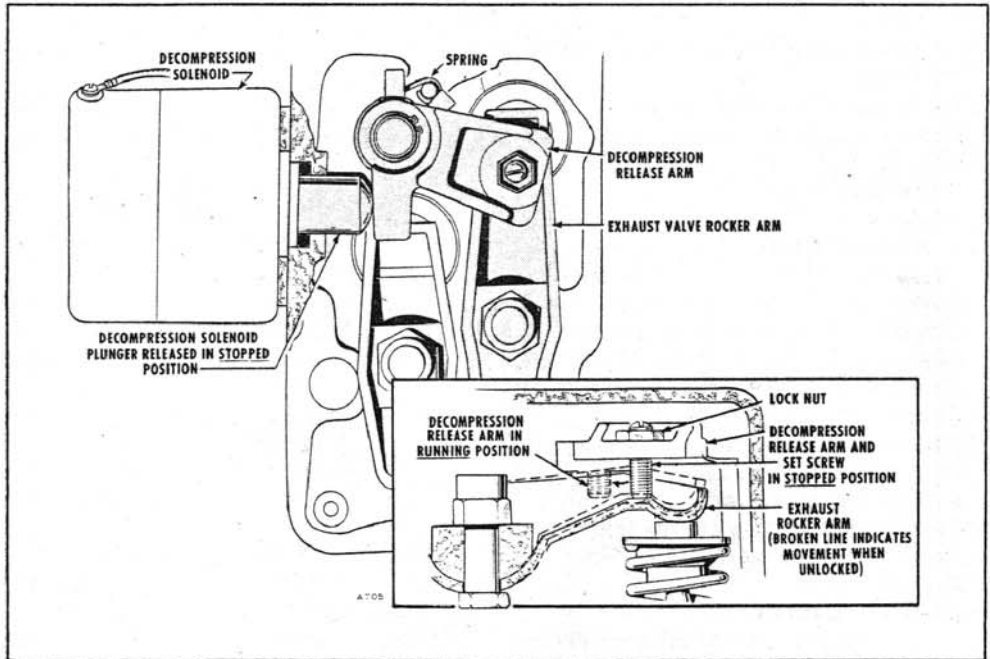


Fig. 21 Decompression Release

26 **TABLE OF CLEARANCES**

The engine should be carefully checked and necessary repairs made by a competent mechanic. Major generator or control repairs should be made by a competent electrician. Maintain factory limits and clearances as given in the Table of Clearances. Replace worn parts when necessary. Avoid accidental shorts by disconnecting the battery when servicing control parts. Refer to SERVICE DIAGNOSIS Section for aid in locating and correcting troubles which may occur.

FOR SERVICE INSTRUCTIONS NOT COVERED IN THIS BOOK, A MAJOR SERVICE MANUAL IS AVAILABLE. (See General Information on Page 1).

NEW PARTS, 70°F	MINIMUM	MAXIMUM
Valve Clearance - Intake (cold)		
MDJA .....		.020"
MDJB (prior to spec D - .010") .....		.015"
MDJC .....		.011"
Valve Clearance - Exhaust (cold)		
MDJA .....		.020"
MDJB (prior to spec D - .010") .....		.013"
MDJC .....		.016"
Valve Stem to Guide (intake) .....	.0005"	.0025"
Valve Stem to Guide (exhaust) .....	.0025"	.0045"
Exhaust Valve Face Angle		45°
Valve Seat Angle		45°
Intake Valve Face Angle		42°
Valve Seat Width	3/64"	1/16"
Valve Spring Tension (valve open)	83 lbs.	93 lbs.
Valve Spring Tension (valve closed)	45 lbs.	49 lbs.
Crankshaft Main Bearing Journal (1 & 2 cyl.)	2.2440"	2.2445"
Crankshaft Main Bearing Journal (4 cyl) ...	2.2430"	2.2435"
Crankshaft Main Bearings (1 & 2 cyl) .....	.002"	.003"
Crankshaft Main Bearings (4 cyl) .....	.003"	.004"
Crankshaft Rod Bearing Journal (std size) ..	2.0600"	2.0605"
Connecting Rod Bearing .....	.001"	.003"
Crankshaft End Play .....	.010"	.015"
Camshaft End Play (crankshaft fully back) ...	.007"	.039"
Camshaft Bearing .....	.0015"	.0030"
Cylinder Bore	3.2495"	3.2505"
Piston to Cylinder:		
(90° to pin, below oil ring groove) .....	.0045"	.0065"
Piston Pin in Piston	Thumb Push Fit	
Piston Pin in Rod .....	.0002"	.0007"
Piston Ring Gap .....	.010"	.020"
Injection Timing - PC (port closing) (MDJA)		17°BTC
Injection Timing - PC (port closing) (MDJB, MDJC)		21°BTC
Anti-Flicker Breaker Point Gap (MDJA) .....		.025"
Start-Disconnect Centrifugal Switch .....		.040"
Firing Order (4 cylinder)		1-2-4-3
Tappet Diameter (standard) .....	.7475"	.7480"
Tappet Hole Diameter .....	.7505"	.7515"

TORQUE SPECIFICATION IN POUND-FEET

27

Rocker Arm Nut	4-10	Oil Base Mounting Screw	
Center Main Bolt		(1 cylinder)	32-38
(4 cylinder)	97-102	Rear Bearing Plate	40-45
Connecting Rod Bolt	27-29	Spark Plug	25-30
Cylinder Head Bolt	44-46	Exhaust Manifold Nuts	13-15
Flywheel Mounting Screw	65-70	Rocker Arm Stud	30-35
Fuel Pump Mounting Screw	15-20	Rocker Box	8-10
Gear Cover Mounting Screw	15-20	Intake Manifold	
Oil Pump Mounting Screw	15-20	(4 cylinder)	13-15
Oil Base Mounting Screw		Generator Through Stud Nut	
(2 and 4 cylinder)	45-50	Revolving Armature	30-40
		Revolving Field	55-60



SERVICE DIAGNOSIS

TROUBLE	POSSIBLE CAUSE	REMEDY
ENGINE WILL NOT CRANK	Battery discharged.	Recharge.
	Loose connections.	Tighten connections.
	Defective starting circuit.	Repair or replace as necessary.
	Defective starting motor on revolving field generator.	Repair or replace as necessary.
	Defective switch.	Replace.
ENGINE CRANKS TOO STIFFLY	Poor generator brush contact on revolving armature generator.	Replace brush. Refinish surface.
	Too heavy oil in crankcase.	Drain, refill with lighter oil.
	Engine stuck.	Disassemble and repair.
	Load connected.	Disconnect.
	Decompression release (on 1 cyl diesel) at running position.	Place at start position.
ENGINE WILL NOT START WHEN CRANKED	Air in fuel system.	Bleed the fuel system.
	Lack of fuel or faulty injection caused by dirty fuel.	Refill the tank. Check the fuel system. Clean, adjust, or replace parts necessary.
	Clogged fuel filter.	Clean strainer (primary). Install new cartridge (secondary).
	Poor compression.	Tighten cylinder head. Replace head gasket. If still not corrected, grind the valves. Replace piston rings, if necessary.
	Wrong timing	Check injection pump timing.
ENGINE STOPS WHEN START SW. IS RELEASED	Centrifugal switch remained open.	Clean and adjust.

TROUBLE	POSSIBLE CAUSE	REMEDY
ENGINE RUNS BUT VOLTAGE DOES NOT BUILD UP	Poor brush contact.	See that brushes seat well, are free in their holders, are not worn too short, and have good spring tension.
	Open circuit, short circuit, or ground in generator.	Replace parts necessary.
	Residual magnetism lost.	Spec B exciters - press residual reset button; spec A exciters - consult dealer.
	Dirty relay contacts in 02SX Magneciter.	Clean with paper.
EXCESSIVE OIL CONSUMPTION, LIGHT BLUE SMOKY EXHAUST	Faulty Magneciter.	Trouble shoot Magneciter.
	Poor compression, usually due to worn piston, rings, or cylinder.	Refinish cylinder. Install oversize piston and rings.
	Oil leaks from oil base or connections. This does not cause smoky exhaust.	Replace gaskets. Tighten screws and connection. Check breather valve.
	Oil too light or diluted.	Drain, refill with correct oil.
	Worn engine.	Repair as necessary.
	Worn intake valve guide or valve stem.	Replace.
	Engine misfiring.	Refer to symptoms of engine misfiring.
	Too much oil.	Drain excess oil.
BLACK, SMOKY EXHAUST, EXCESSIVE FUEL CONSUMPTION, POSSIBLE LOW POWER UNDER HEAVY LOAD	Generator overloaded. Black smoky exhaust normal condition with overload.	Reduce load to within rated capacity. If smoky condition continues, stop unit and investigate.
	Poor compression.	Tighten cylinder head, grind or replace valves, replace piston rings as needed.

TROUBLE	POSSIBLE CAUSE	REMEDY
BLACK, SMOKY EX-HAUST, EXCESSIVE FUEL CONSUMPTION, POSSIBLE LOW POWER UNDER HEAVY LOAD (Cont.)	Poor grade or dirty fuel.	Use only clean, recommended fuel.
	Injection pump or nozzle not operating properly.	Clean nozzle. If necessary, install new nozzle or injection pump.
	Faulty injection timing.	Check injection pump timing.
	Dirty air cleaner.	Clean.
ENGINE STOPS UNEXPECTEDLY	Fuel tank empty.	Refill.
	Safety switch operated (where used).	Correct the overheating or the lubrication failure. Press reset switch.
DULL METALLIC THUD. IF NOT BAD, MAY DISAPPEAR AFTER FEW MINUTES OPERATION. IF BAD, INCREASES WITH LOAD.	Loose crankshaft bearing.	Replace unless one of the next two remedies permanently corrects the trouble.
SHARP METALLIC THUD, ESPECIALLY WHEN COLD ENGINE FIRST STARTED	Low oil supply.	Add oil.
	Oil badly diluted.	Change oil.
TAPPING SOUND	Valve clearance too great.	Adjust. Replace faulty valve system.
	Broken valve spring.	Install new spring.
HOLLOW CLICKING SOUND WITH COOL ENGINE UNDER LOAD	Loose piston.	If noise only slight and disappears when engine warms up, no immediate attention needed. Otherwise replace worn parts.
LIGHT POUNDING KNOCK (KNOCK FROM FIRING OF FUEL IS NORMAL)	Loose connecting rod bearing.	Adjust or replace.
	Low oil supply.	Add oil.
	Oil badly diluted.	Change oil. Investigate cause.

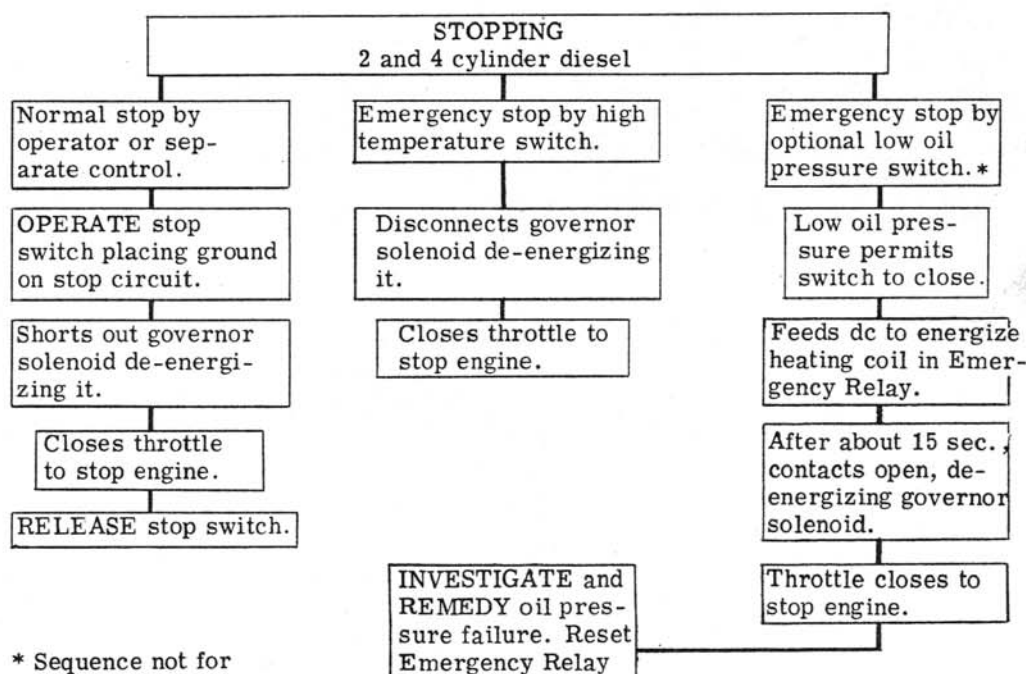
TROUBLE	POSSIBLE CAUSE	REMEDY
ENGINE RACES	Too much fuel injected. STOP UNIT AT ONCE!	Check governor performance and linkage condition.
ENGINE MISFIRES	Faulty injection.	Clean fuel system. Use clean recommended fuel.
	Low compression.	Tighten cylinder head. Service valves and piston rings as needed.
LOW OIL PRESSURE	Defective gauge.	Replace.
	Oil too light or diluted from leaking fuel pump diaphragm.	Drain. Refill with proper oil. Repair or replace transfer pump.
	Oil too low.	Add oil.
	Oil relief valve not seating.	Clean. Replace if needed.
	Badly worn bearings.	Replace.
	Sludge on oil cup screen.	Clean screen and oil sump.
	Badly worn oil pump.	Replace.
HIGH OIL PRESSURE	Defective gauge.	Replace.
	Oil too heavy grade.	Drain. Refill.
	Clogged oil passages.	Clean all lines and passages.
	Oil relief valve stuck.	Clean by-pass. Replace if needed.
ENGINE OVER-HEATING	Poor coolant circulation.	Maintain supply.
	Improper lubrication.	See Low Oil Pressure.
	Wrong injection timing.	Retime.
	Generator overloaded.	Reduce load.
VOLTAGE LOW AT FAR END OF LINE BUT NORMAL NEAR POWER PLANT	Too small line wire for load and distance.	Install larger or extra wires or reduce load.

TROUBLE	POSSIBLE CAUSE	REMEDY
ELECTRIC MOTOR RUNS TOO SLOWLY AND OVERHEATS AT FAR END OF LINE BUT OK IF USED NEAR POWER UNIT	Too small line wire for load and distance.	Install larger or extra wires or reduce load.
VOLTAGE UNSTEADY BUT ENGINE NOT MISFIRING	Speed too low.	Adjust governor to correct speed.
	Poor brush contact (or poor commutation on revolving armature models).	See that brushes seat well on commutator, are free in their holders, are not worn too short, and have good spring tension.
	Loose connections.	Tighten connections.
	Fluctuating load.	Correct any abnormal load condition causing trouble.
NOISY AND EXCESSIVE ARCING OF BRUSHES (REVOLVING ARMATURE MODEL)	Rough commutator.	Turn down. Undercut mica between bars.
	Dirty commutator.	Clean.
	Brushes not seating properly.	Sand to a good seat.
	Open circuit in armature.	Replace.
	Brush rig out of position.	Line up properly.
GENERATOR OVERHEATING (approximately 160°F. higher than ambient)	Brush rig out of position (Revolving armature generator).	Adjust.
	Overloaded.	Reduce load.
VOLTAGE DROPS UNDER HEAVY LOAD	Engine lacks power.	See remedies for engine misfires.

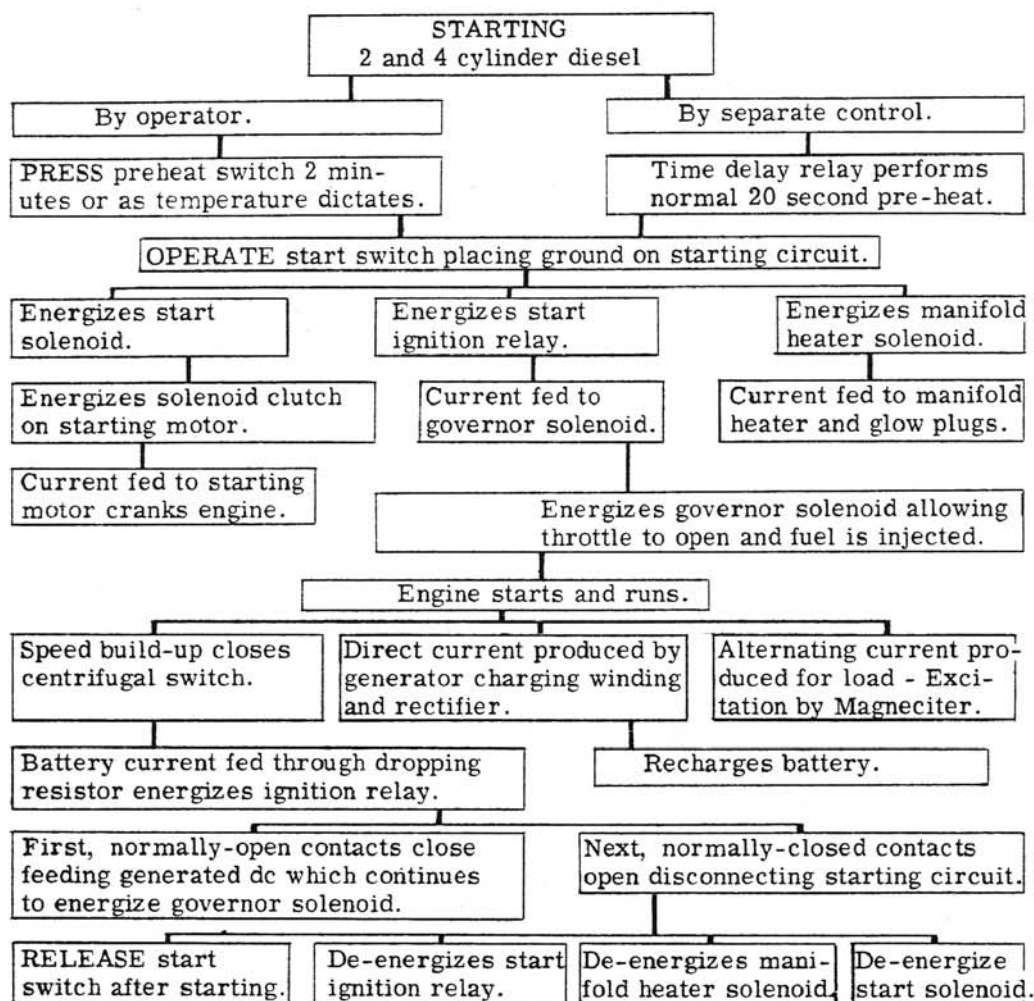
TROUBLE	POSSIBLE CAUSE	REMEDY
VOLTAGE DROPS UNDER HEAVY LOAD (Cont.)	Poor compression.	Tighten cylinder head and spark plug. If still not corrected, grind the valves. Replace piston rings, if necessary.
	Faulty injection.	Check the fuel system. Clean, adjust or replace parts necessary.
	Dirty air cleaner.	Clean.
	Restricted exhaust line.	Clean or increase the size.

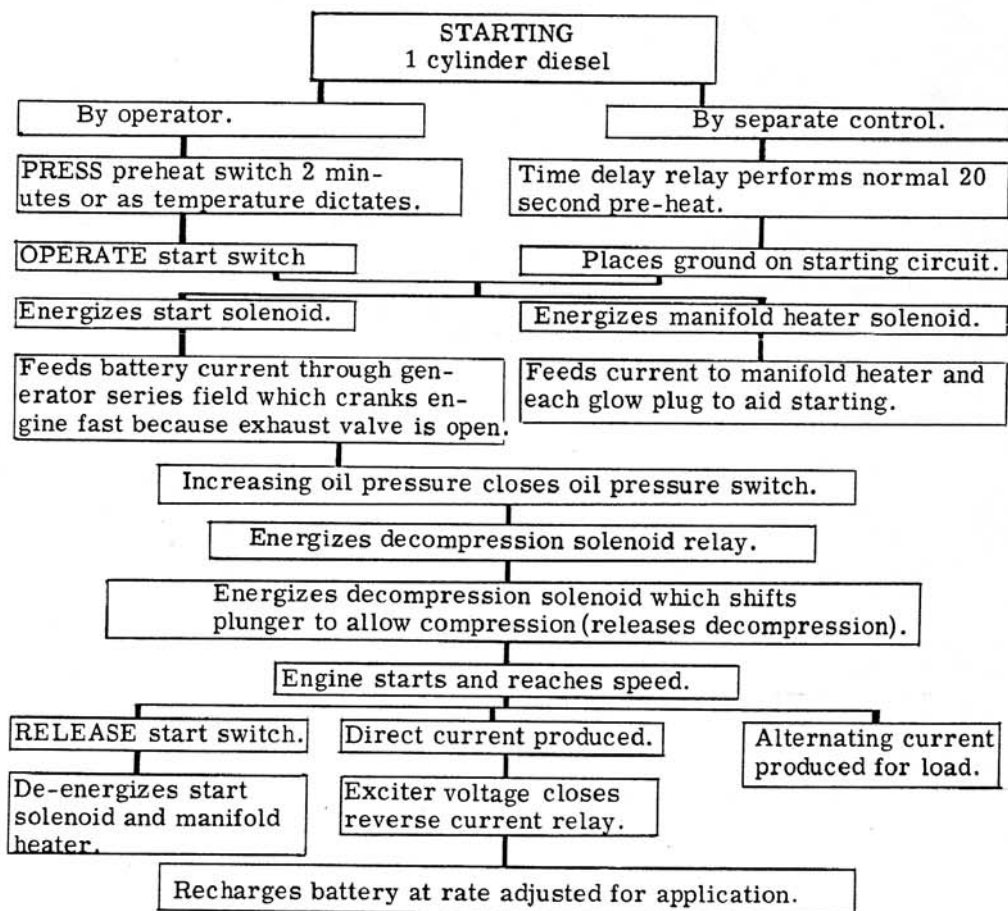
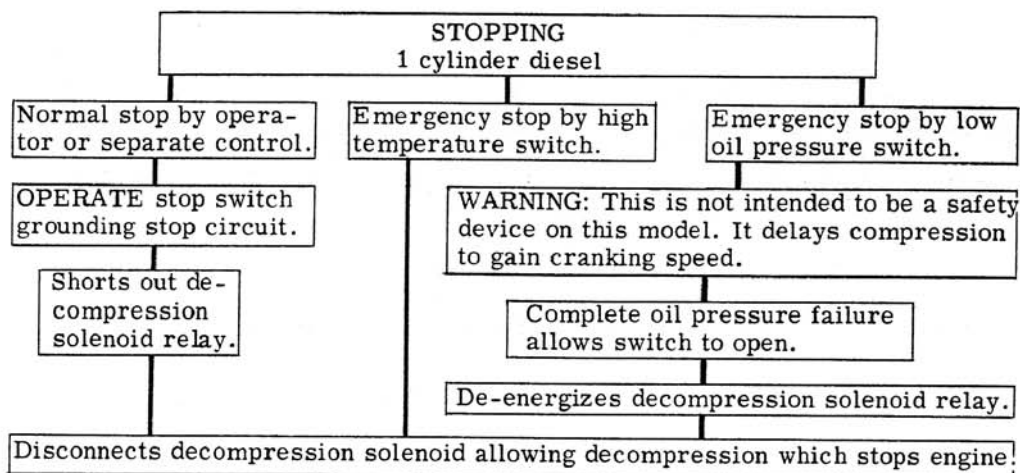
CONTROL FUNCTIONS

This sequence of control actions helps to locate and correct troubles that might occur. Trace the circuits on the wiring diagram while reading. For safety, have battery disconnected while servicing controls.



* Sequence not for early models





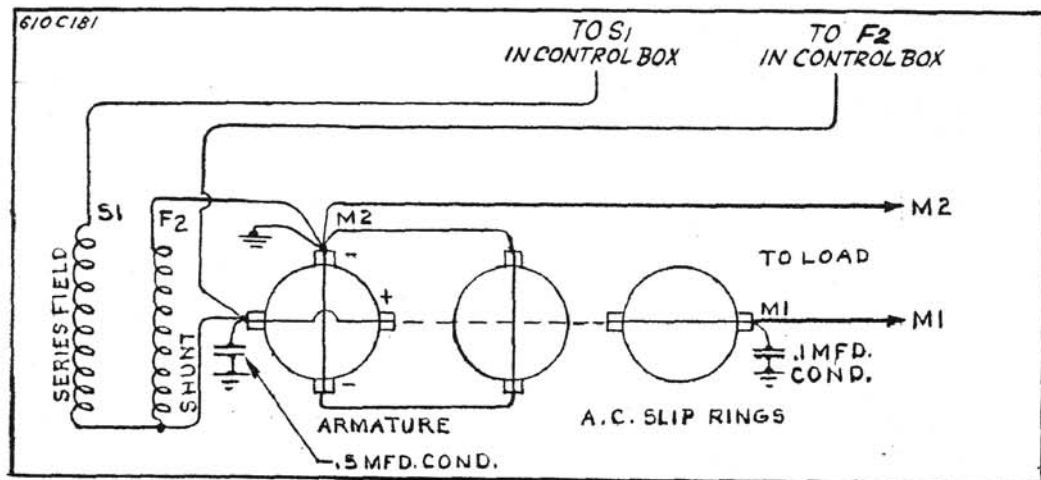
36 TYPICAL WIRING DIAGRAMS

The wiring diagrams on the following pages are typical and apply only to standard models. Wiring diagrams for special models are available on request from the factory; send generator model, spec, and serial numbers with the request.

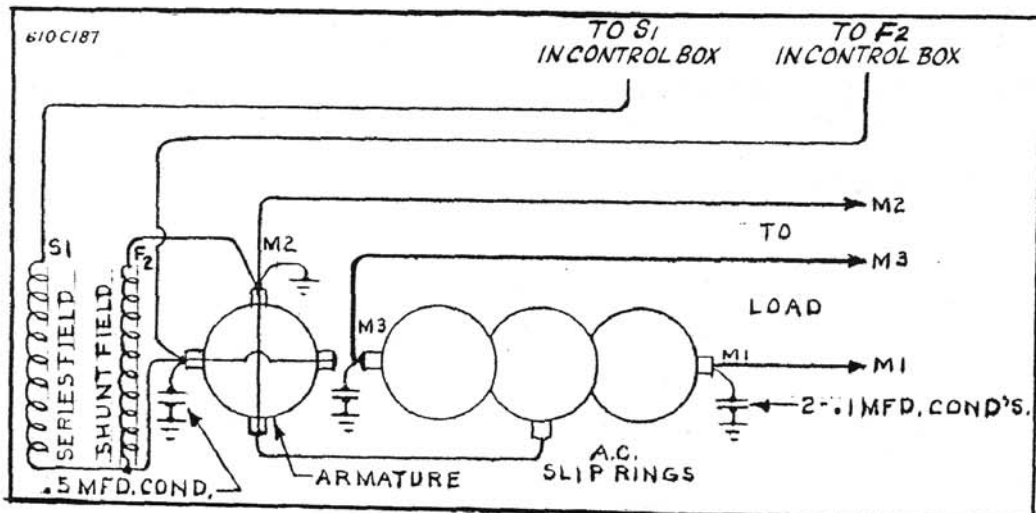
For revolving field plants, select the generator wiring diagram according to the model, phase, and number of output wires. Select the Magneciter wiring diagram from the Magneciter model number on the plant nameplate.

For revolving armature plants (MDJA), select the generator wiring diagram with the proper number of wires and phase.

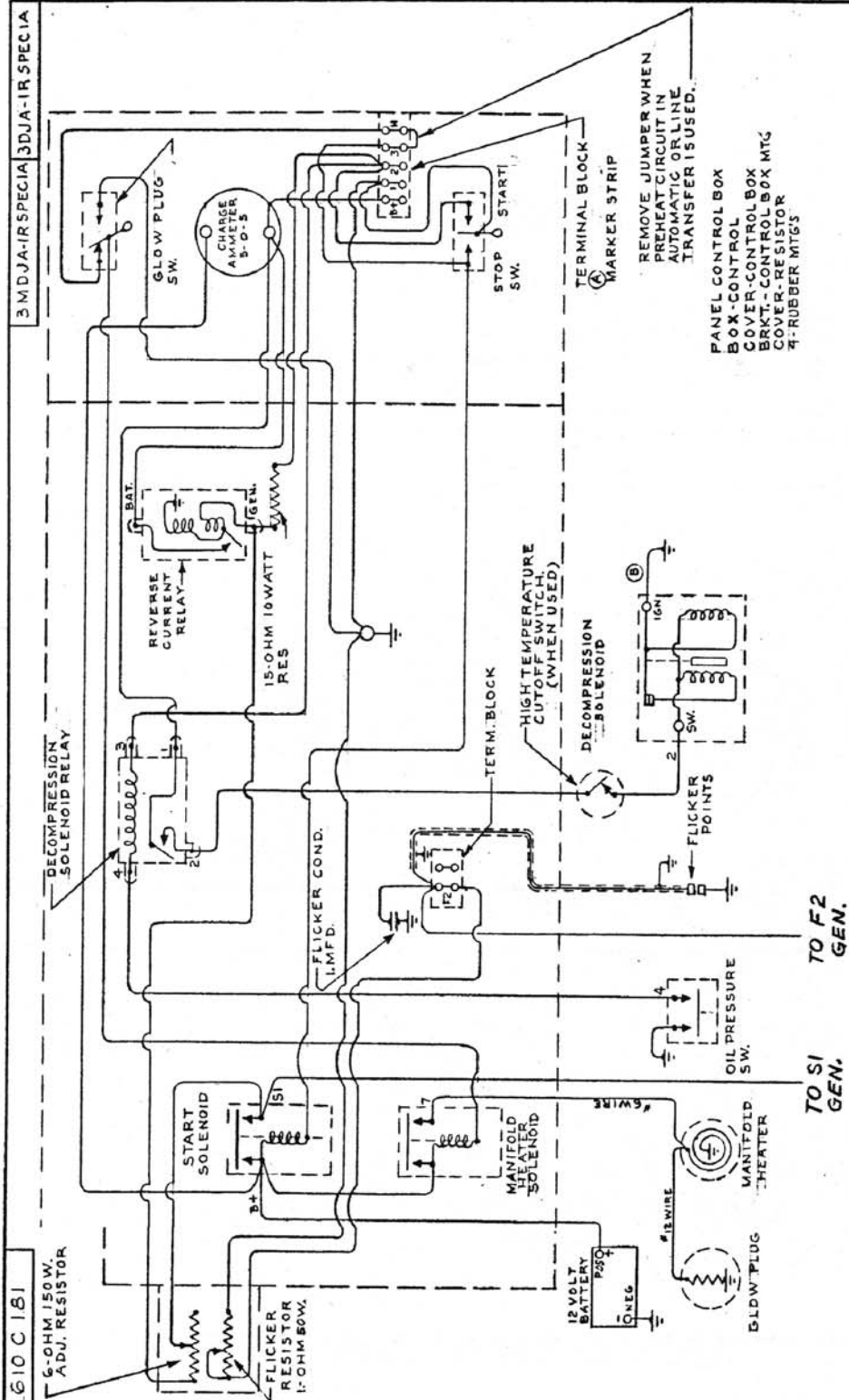
Control wiring diagrams show the standard control circuit in schematic without the optional low oil pressure circuit. Other control diagrams have the low oil pressure circuit. There is only 1 control diagram for MDJA models.

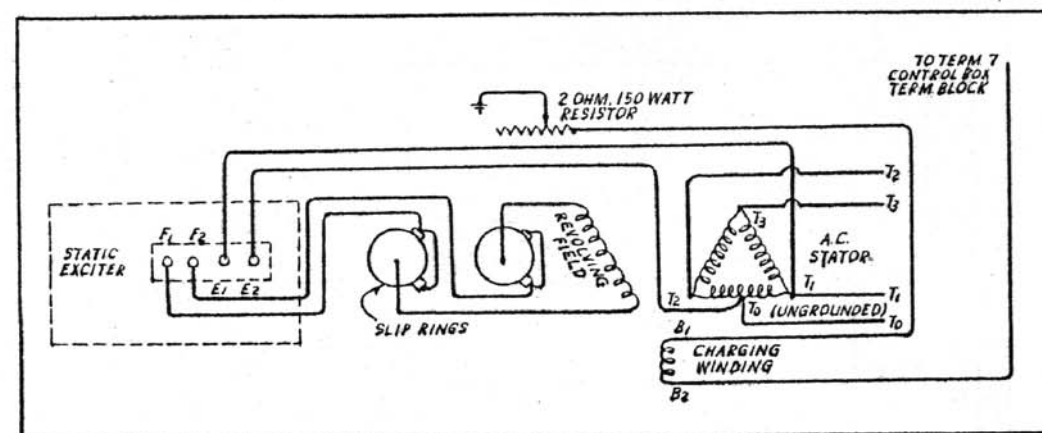
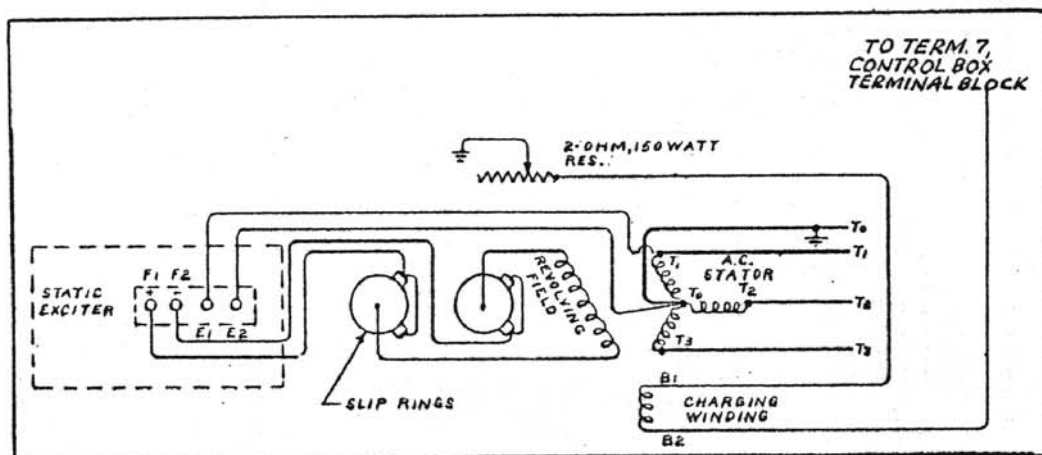
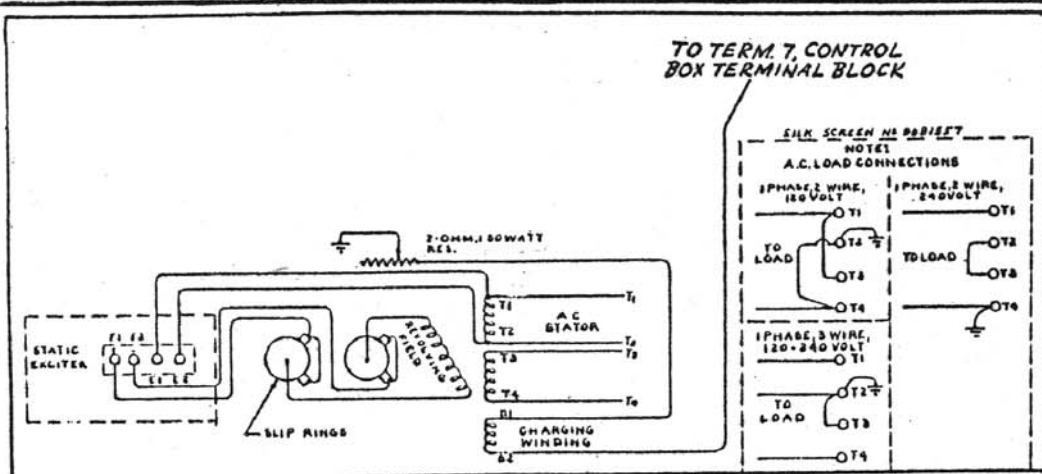


MDJA Remote (R) 2-Wire, Single Phase

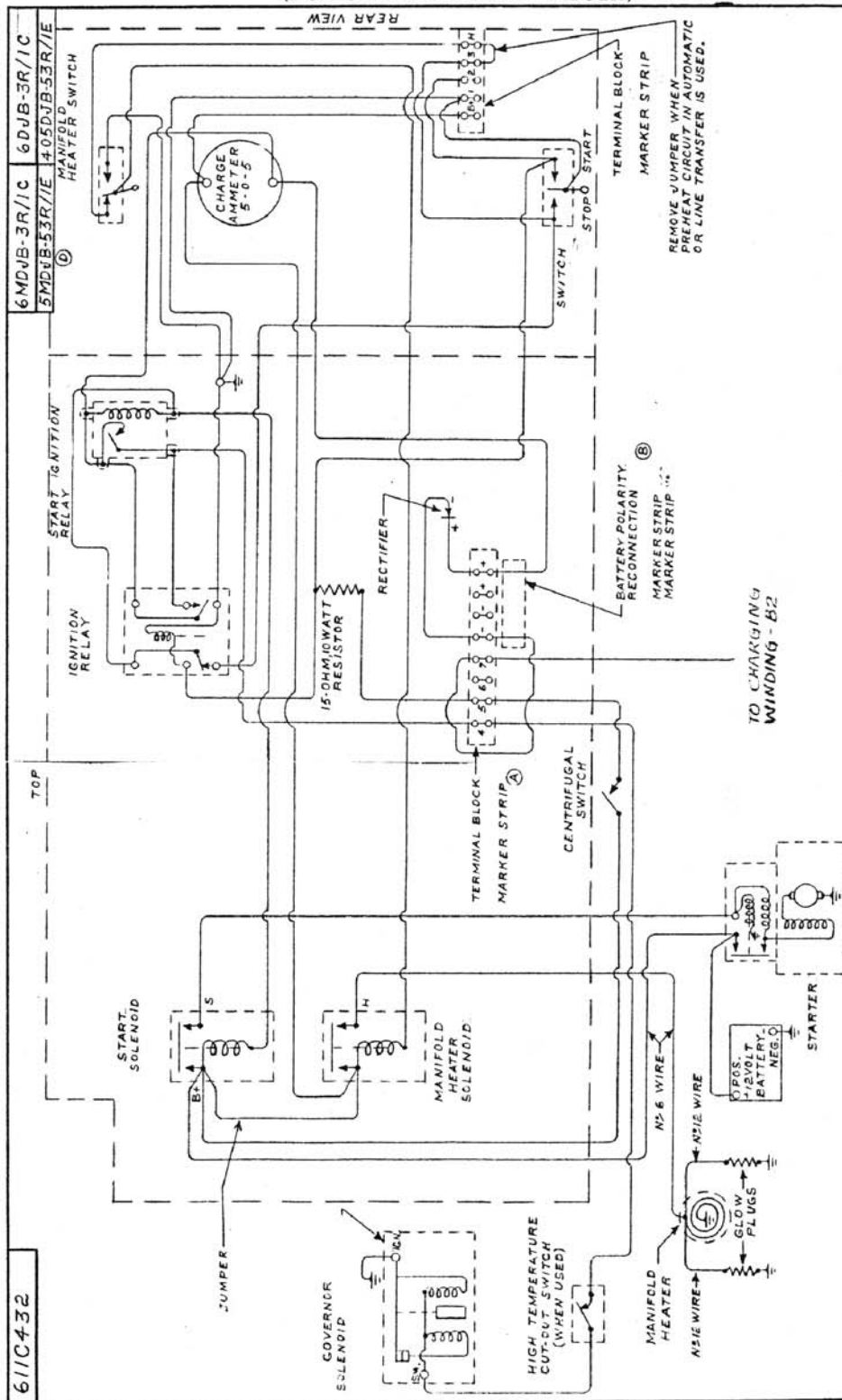


MDJA Remote (R) 3-Wire, Single Phase

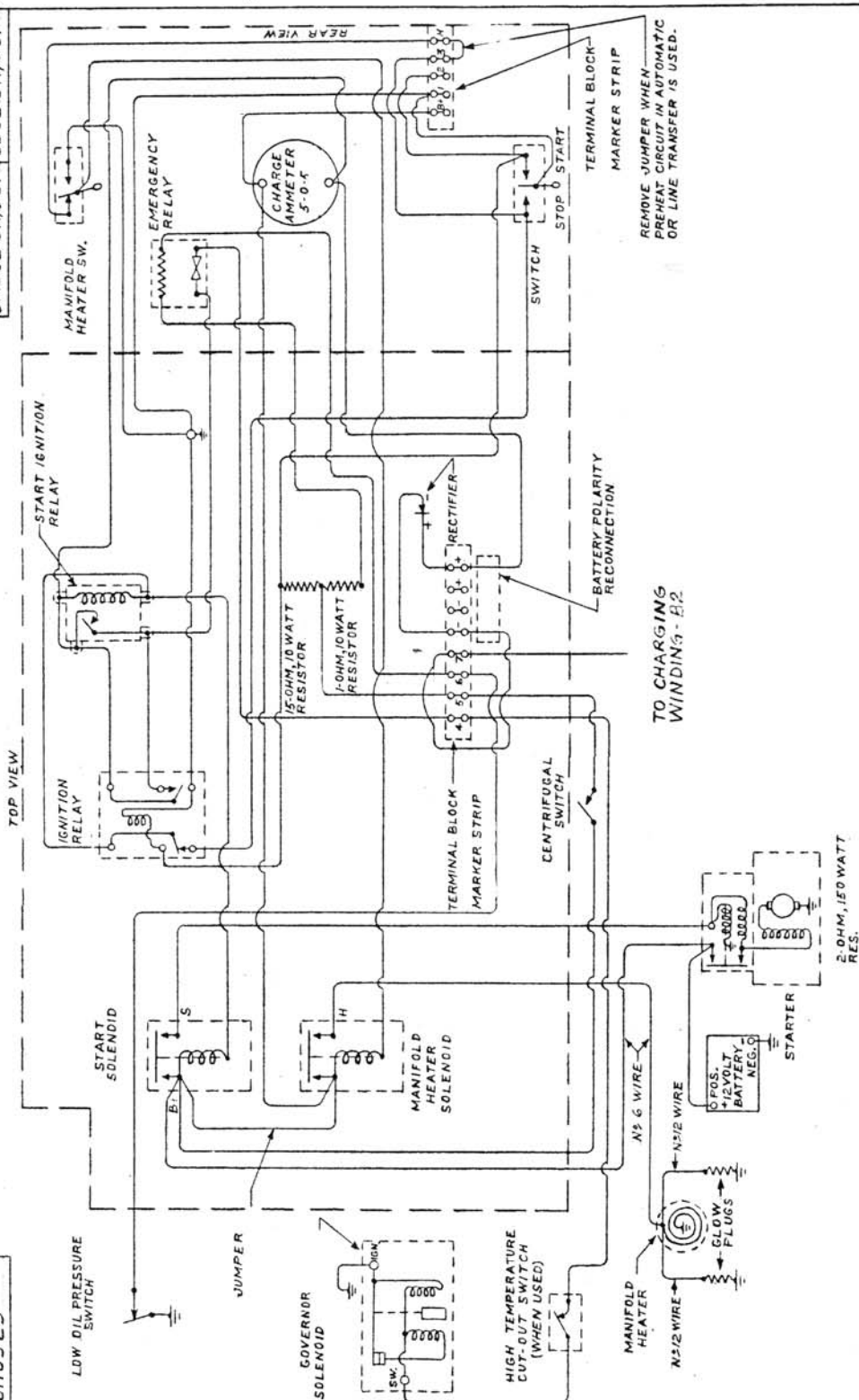




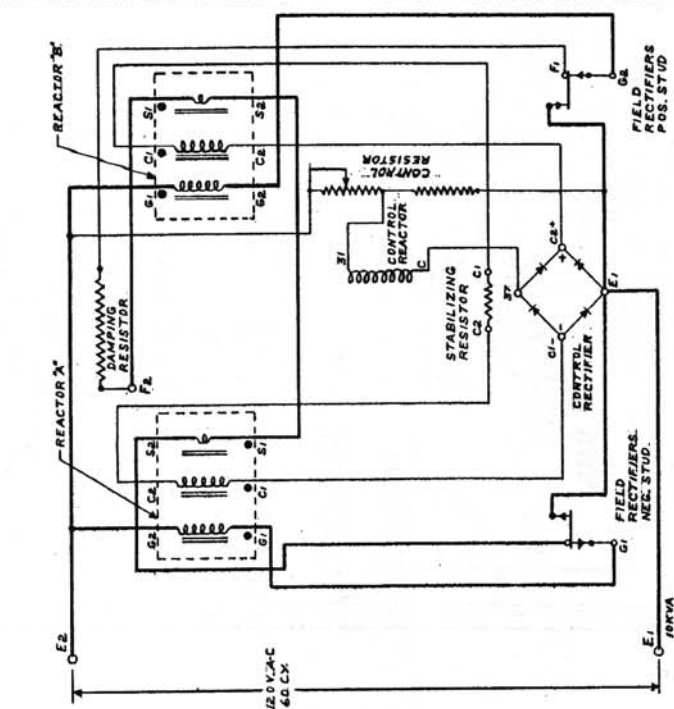
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and MDSC CONTROL WITHING DI
(With Low Oil Pressure Circuit)



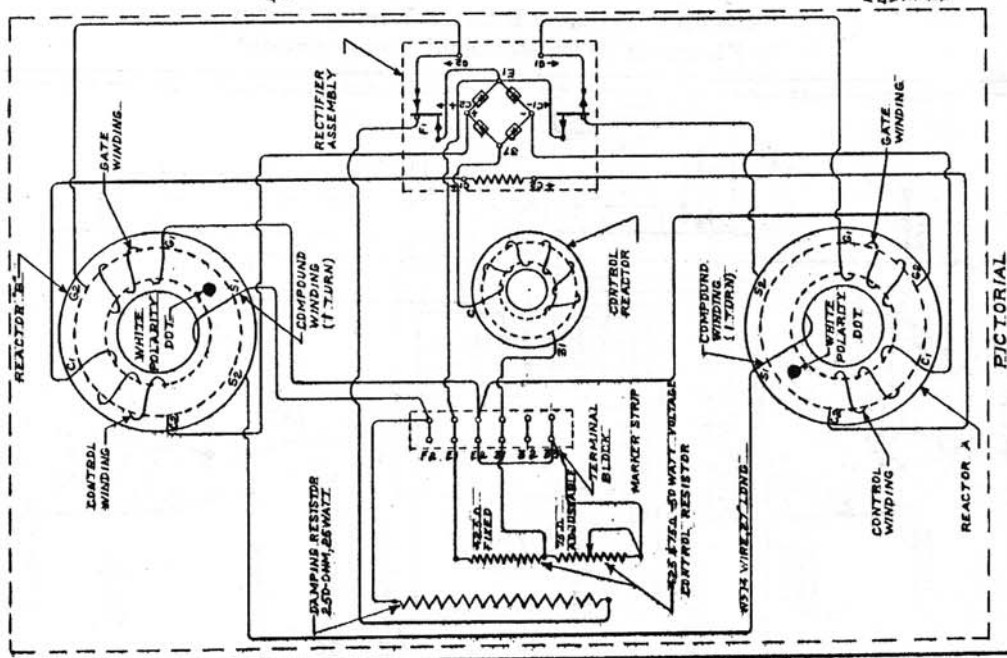
04SX1N1A



SCHEMATIC

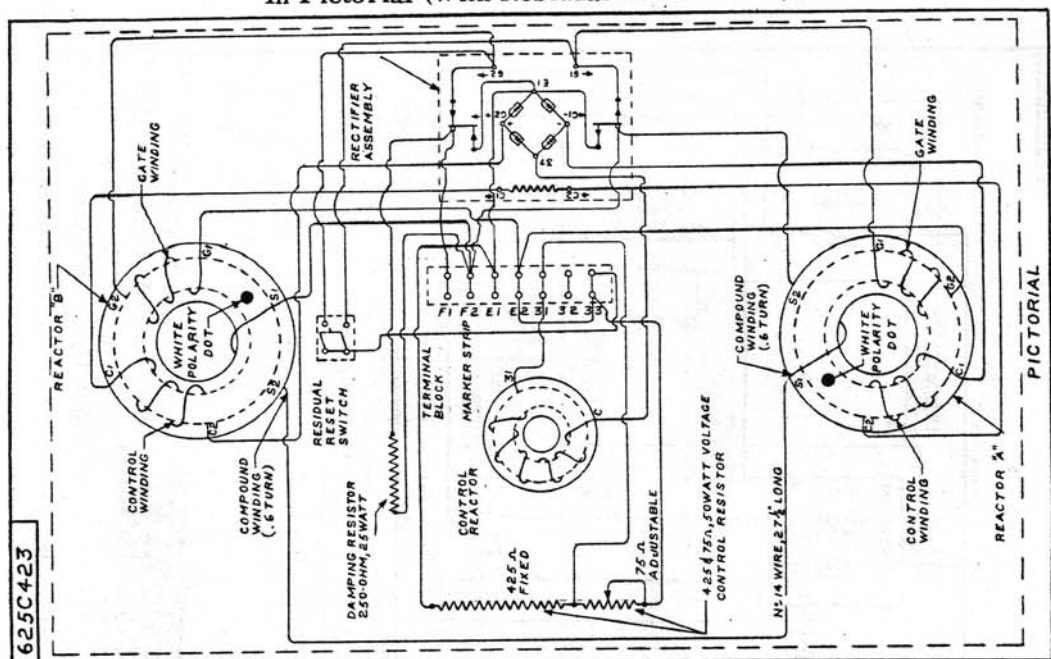
WIRING DIAGRAM
For Onan 04SX Magneciter
Used on 6MDJB plants
Spec C, D, E Models

NOTE:
LOCATION OF WHITE POLARITY DOTS -
WHEN RECTIFIER ASSY. IS TOWARDS
YOU, WHITE DOTS WILL BE TO
THE RIGHT OF EACH REACTOR.
MOUNTED ON GEN. THE DOTS
WILL BE ON TOP OF EACH REACTOR.



PICTORIAL

06SX Spec B Static Exciter Wiring Diagram
In Pictorial (With Residual Reset Switch)



04SX Spec B Static Exciter Wiring Diagram
In Pictorial (With Residual Reset Switch)

