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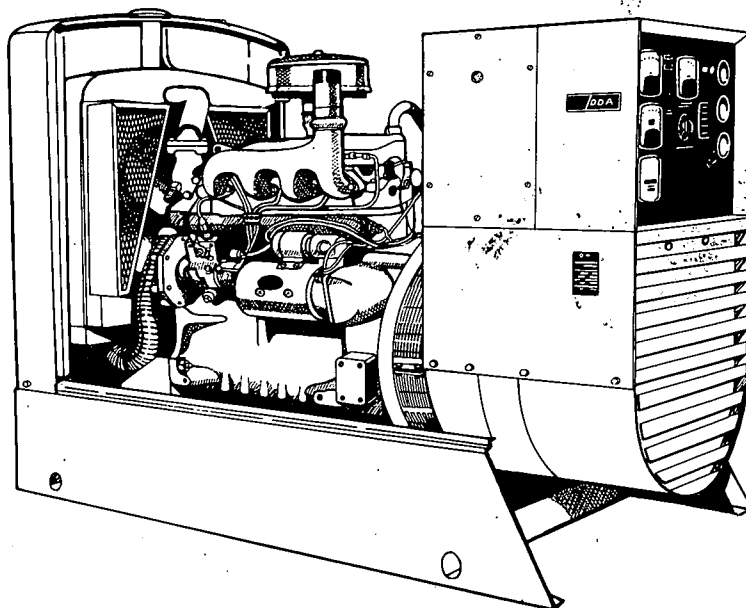
OPERATOR'S MANUAL

FOR

ELECTRIC GENERATING SETS

SERIES
DDA

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SAFETY PRECAUTIONS

The following symbols in this manual signal potentially dangerous conditions to the operator or equipment. Read this manual carefully. Know when these conditions can exist. Then, take necessary steps to protect personnel as well as equipment.

ONAN recommends that you read your manual and become thoroughly acquainted with it and your equipment before you start your unit. These recommendations and the following safety precautions are for your protection.

Fuels, electrical equipment, batteries, exhaust gases and moving parts present potential hazards that could result in serious, personal injury. Take care in following these recommended procedures.

WARNING Onan uses this symbol throughout this manual to warn of possible serious personal injury.

CAUTION This symbol refers to possible equipment damage.

General

- Keep your electric generating set and the surrounding area clean and free from obstructions. Remove any debris from set and keep the floor clean and dry.
- Provide appropriate fire extinguishers and install them in convenient locations. Consult your local fire department for the correct type of extinguisher to use. Do not use foam on electrical fires. Use extinguisher rated ABC by NFPA.
- Make sure that all fasteners on the generating set are secure. Tighten supports and clamps, keep guards in position over fans, driving belts, etc.
- Do not wear loose clothing in the vicinity of moving parts, or jewelry while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts; cause shock or burning.
- If adjustment *must* be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.
- Do not work on this equipment when mentally or physically fatigued.
- Coolants under pressure have a higher boiling point than water. DO NOT open a radiator or heat exchanger pressure cap while the engine is running. Bleed the system pressure first.

Protect Against Moving Parts

- Keep your hands away from moving parts.

- Before starting work on the generating set, disconnect batteries. This will prevent starting the set accidentally.

Fuel System

- DO NOT fill fuel tanks while engine is running, unless tanks are outside engine compartment. Fuel contact with hot engine or exhaust is a potential fire hazard.
- DO NOT SMOKE OR USE AN OPEN FLAME in the vicinity of the generator set or fuel tank. Internal combustion engine fuels are highly flammable.
- Fuel lines must be of steel piping, adequately secured, and free from leaks. Piping at the engine should be approved flexible line. Do not use copper piping on flexible lines as copper will work harden and become brittle.
- Be sure all fuel supplies have a positive shutoff valve.

Guard Against Electric Shock

- Remove electric power before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages cause injury or death. DON'T tamper with interlocks.
- Follow all state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches.
- DO NOT SMOKE while servicing batteries. Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.

Exhaust Gases Are Toxic

- Provide an adequate exhaust system to properly expel discharged gases. Check exhaust system regularly for leaks. Ensure that exhaust manifolds are secure and not warped. Do not use exhaust gases to heat a compartment.
- Be sure the unit is well ventilated.

Keep the Unit and Surrounding Area Clean

- Make sure that oily rags are not left on or near the engine.
- Remove all oil deposits. Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and subsequent engine damage and may present a potential fire hazard.

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WARNING

TO AVOID POSSIBLE PERSONAL INJURY OR EQUIPMENT DAMAGE, A QUALIFIED ELECTRICIAN OR AN AUTHORIZED SERVICE REPRESENTATIVE MUST PERFORM INSTALLATION AND ALL SERVICE.

INTRODUCTION

FOREWORD

This manual is applicable to the DDA Series electric generating set, consisting of an Onan UR 30.0KW AC generator, driven by a John Deere 4219D diesel engine. Information is provided on installation, operation, troubleshooting and parts ordering for the set. The manual should be used in conjunction with the John Deere engine manual, as your specific engine may have variations due to optional equipment available.

MODEL IDENTIFICATION

Identify your model by referring to the MODEL and SPECIFICATION NO. as shown on the Onan nameplate. Electrical characteristics are shown on the lower portion of the nameplate.

30.0 DDA 15R / 1 C
1 2 3 4 5

1. Indicates kilowatt rating.
2. Factory code for SERIES identification.
3. 15 = 60 Hz. Reconnectable
515 = 50 Hz. Reconnectable
R—Indicates remote starting feature.
4. Factory code for designating optional equipment.
5. Specification letter. (Advances when factory makes production modifications.)

If it is necessary to contact a dealer or the factory regarding the set, always mention the complete Model, Spec No. and Serial No. as given on the Onan nameplate. This nameplate information is necessary to properly identify your unit among the many types manufactured. Refer to the engine nameplate when requesting information from its manufacturer. The Onan nameplate is located on the right side of the generator; the John Deere nameplate is on the left side, on the engine block.

Left side and right side are considered when viewed from the engine or front end of the generating set.

WARNING

ENGINE EXHAUST GAS (CARBON MONOXIDE) IS DEADLY!

Carbon monoxide is an odorless, colorless gas formed by incomplete combustion of hydrocarbon fuels. Carbon monoxide is a dangerous gas that can cause unconsciousness and is potentially lethal. Some of the symptoms or signs of carbon monoxide inhalation are:

- Dizziness
- Intense Headache
- Weakness and Sleepiness
- Vomiting
- Muscular Twitching
- Throbbing in Temples

If you experience any of the above symptoms, get out into fresh air immediately.

The best protection against carbon monoxide inhalation is a regular inspection of the complete exhaust system. If you notice a change in the sound or appearance of exhaust system, shut the unit down immediately and have it inspected and repaired at once by a competent mechanic.

SPECIFICATIONS

ENGINE DETAILS

Engine Manufacturer	John Deere
Engine Series	300-4219D
Number of Cylinders	4
Displacement	219 cu. inch (3.59 litres)
BHP @ 1800 r/m	58 (43.27 kW)
Compression Ratio	16.3:1
Bore	4.02-inches (102.11 mm)
Stroke	4.33-inches (109.98 mm)
Fuel	ASTM No. 2 Diesel
Battery Voltage	12
Battery Group (Two 6-Volt, 135-A.H. [486 kC])	2H
Starting Method	Solenoid Shift
Governor Regulation	5% No Load—Full load
Battery Charging Current	35

GENERATOR DETAILS

Type	UR 15, 60 Hz UR 515, 50 Hz UR 3, 60 Hz
Rating (Watts)	
60 Hertz Continuous Standby	30,000 (37.5 kVA)
50 Hertz Continuous Standby	25,000 (31.25 kVA)
AC Voltage Regulation	[2%
60 Hertz r/m	1800
50 Hertz r/m	1500
Output Rating	0.8 PF
AC Frequency Regulation	3 Hz

CAPACITIES AND REQUIREMENTS

Cooling System (Includes Radiator)	4.25 gal. (16.1 litre)
Engine Oil Capacity (Filter, Lines, Crankcase)	9 qt. (8.6 litre)
Exhaust Connection (inches pipe thread)	2

AIR REQUIREMENTS (1800 r/m)

Engine Combustion	135 CFM (0.06 m ³ /s)
Radiator Cooled Engine	3875 CFM (1.83 m ³ /s)
Total for Radiator Cooled Model	4010 CFM (1.9 m ³ /s)
Alternator Cooling Air	
(1800 r/m)	1000 CFM (0.47 m ³ /s)
(1500 r/m)	834 CFM (0.4 m ³ /s)
Fuel Consumption at Rated Load	2.50 Gallon/Hr. (9.5 lit/hr)

GENERAL

Height	45.5-inches (1.16 m)
Width	33.0-inches (0.838 m)
Length	66.0-inches (1.8 m)
Approx. Weight (Mass)	1780 lbs. (799 kg)

TABLE 1. UR GENERATOR VOLTAGE/CURRENT OPTIONS

VOLTS	FREQ.	PHASE	AMPERES	DOUBLE DELTA	SERIES DELTA	PARALLEL WYE	SERIES WYE	REF. VOLTAGE WIRE (W12) TAP
110/220	50 Hz	1	142	x				H6
115/230	50 Hz	1	136	x				H6
120/240	60 Hz	1	156	x				H5
110/190	50 Hz	3	94			x		H3
115/200	50 Hz	3	90			x		H4
120/208	60 Hz	3	104			x		H4
110/220	50 Hz	3	82		x			H6
127/220	60 Hz	3	98			x		H4
115/230	50 Hz	3	78		x			H6
120/240	60 Hz	3	90		x			H5
139/240	60 Hz	3	90			x		H5
220/380	50 Hz	3	47				x	H3
230/400	50 Hz	3	45				x	H4
240/416	60 Hz	3	52				x	H4
254/440	60 Hz	3	49				x	H5
277/480	60 Hz	3	45				x	H5
9X 347/600	60 Hz	3	36					H5 — Not Reconnectible
3 120/240	60 Hz	1	156					Not Reconnectible
53 115/230	50 Hz	1	136					Not Reconnectible

30.0 kW 37.5 kVA 60 Hz
25.0 kW 31.25 kVA 50 Hz

* - These current values are available only from special long stack units. When standard 3-phase unit is reconnected into Double Delta configuration, maximum current is 2/3 that of value given.

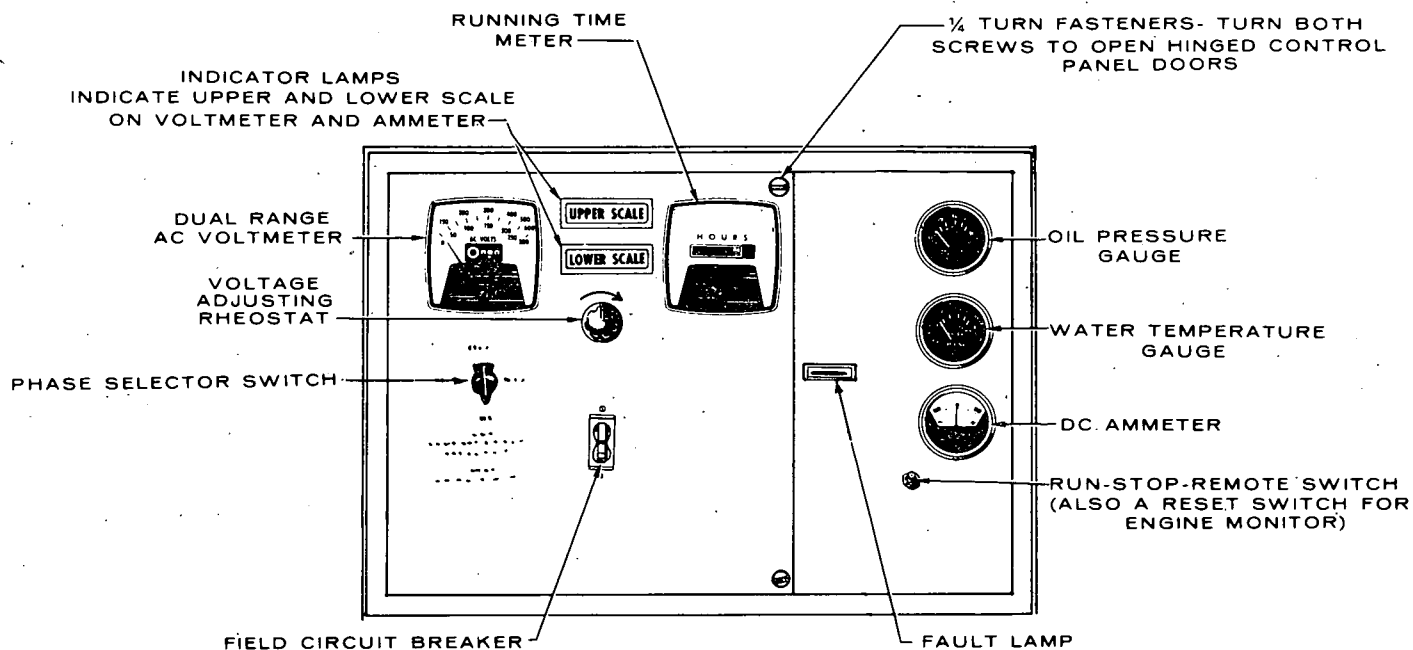


FIGURE 1. TYPICAL CONTROL PANEL (ONE FAULT LAMP)

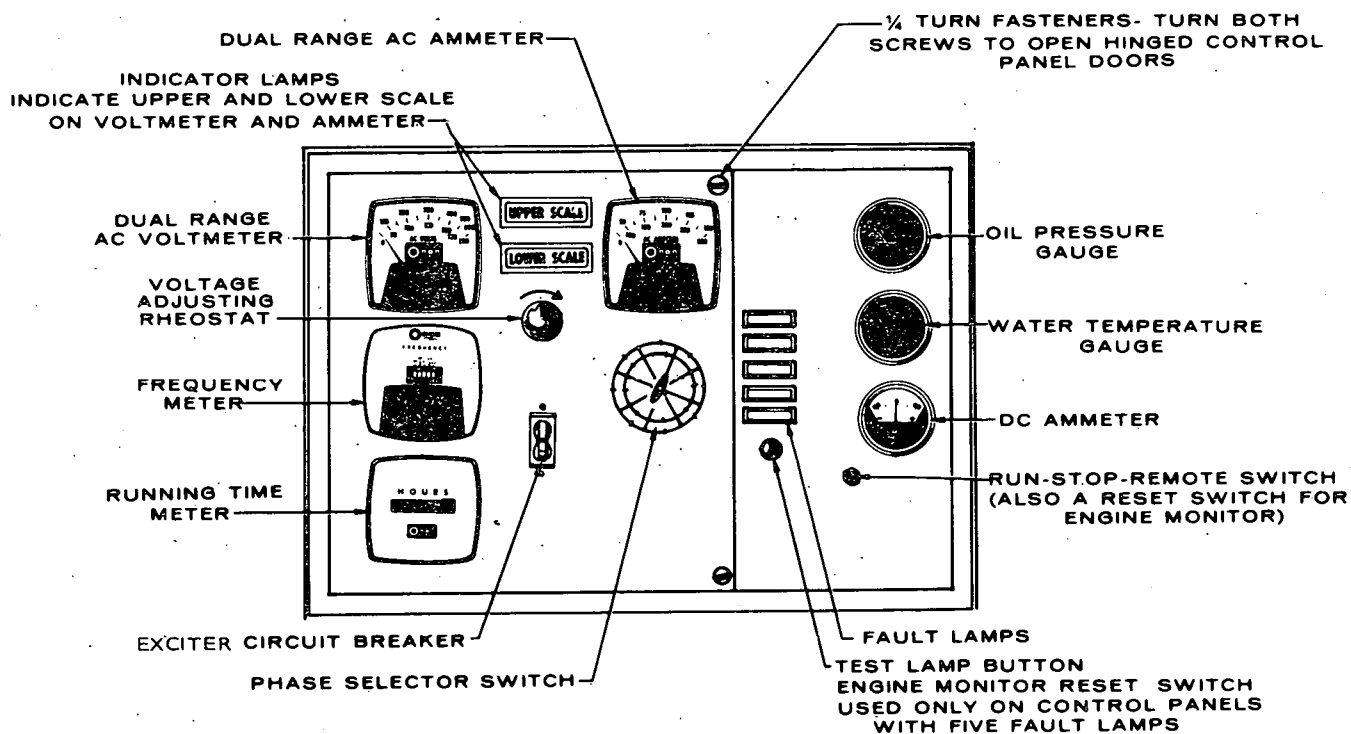


FIGURE 2. OPTIONAL CONTROL PANEL (FIVE FAULT LAMPS)

DESCRIPTION

GENERAL

An Onan DDA series electric generating set is a complete unit consisting of an engine driven AC generator, with standard and optional controls and accessories as ordered.

ENGINE

The engine on the DDA is a John Deere 4219 D as described in the engine manual. Basic measurements and requirements will be found under *Specifications*. For operation, maintenance and service information, consult the John Deere manual.

AC GENERATOR

The generator is an ONAN Type UR, 12 lead 4-pole revolving field, reconnectable, brushless unit. The main rotor is attached directly to the engine flywheel, therefore engine speed determines generator output frequency. The 60 Hz set operates at 1800 rpm, the 50 Hz at 1500 rpm. Excitation is achieved as follows—

Residual alternating current from the stator winding is applied to the voltage regulator, where it is compared with a reference voltage, rectified and returned to the field winding of the exciter. Current then induced in the exciter rotor is rectified and fed into the generator rotor. This induces a current in generator stator which is applied to the load.

CONTROL PANEL

The following is a brief description of each of the standard controls and instruments located on the face of the panel. See Figure 1.

DC Panel

Oil Pressure Gauge: Indicates pressure of lubricating oil in engine (wired to a sensor unit located on the engine).

Water Temperature Gauge: Indicates temperature of circulating coolant in engine. (Wired to a sensor unit located on the engine.)

Battery Charge Rate DC Ammeter: Indicates the battery charging current.

Run-Stop/Reset-Remote Switch: Starts and stops the unit locally or from a remote location.

Warning Light: Indicates "Fault" in engine operation.

AC Panel

AC Voltmeter: Indicates AC generator output voltage. Dual range instrument: measurement range in use shown on indicator light.

Voltmeter Phase Selector Switch: Selects phases of generator output to be measured by AC voltmeter.

Voltage Regulator: Rheostat, provides approximately plus or minus 5% adjustment of the rated output voltage.

Exciter Circuit Breaker: Provides generator exciter and regulator protection from overheating in the event of certain failure modes of the generator, exciter and voltage regulator.

Running Time Meter: Registers the total number of hours, to 1/10th that the unit has run. Use it to keep a record for periodic servicing. Time is accumulative, meter cannot be reset.

OPTIONAL EQUIPMENT

DC Panel

Warning Lights: Eliminates the one "Fault" light and substitutes five indicator lights to give warning of —

- a. Overcrank (failed to start)
- b. Overspeed
- c. Low oil pressure
- d. High engine temperature
- e. Low engine temperature

Operation of these lights will be discussed in conjunction with engine monitor panel.

AC Panel

AC Ammeter: Indicates AC generator output current. Dual range instrument: measurement range in use shown on indicator lights.

Voltmeter-Ammeter Phase Selector Switch: Selects the phases of the generator output to be measured by the AC voltmeter and AC ammeter.

Reset Switch: Manual reset for engine monitor after shut-down.

Lamp Test: Press to test warning lamp bulbs (when engine is running only).

Frequency Meter: Indicates the frequency of the generator output in hertz. It can be used to check engine speed. (Each hertz equals 30 rpm.)

CONTROL PANEL INTERIOR

The only equipment discussed in this section will be that which the operator may have reason to adjust or inspect for service.

Terminal Board (TB) 21: Connection of wire W12 to terminals H3, H4, H5, and H6 is made at this point, to change reference voltage when reconnecting generator for different voltages. Refer to Figure 14.

Voltage Regulator: Solid state unit, consisting of VR21, CR21 and L21. Controls AC output from generator at predetermined level regardless of load. Regulation plus or minus 2% from no load to full load, 0.8 P.F.

Engine Monitor: Printed circuit plug-in modules provide the following functions:

1. A 75 second cranking period.
2. Approximately a 12.5-second time delay for oil pressure buildup.
3. An external alarm contact to light a fault lamp and shut down the set for alarm conditions such as:
 - a. Overcrank (failed to start after cranking 75 seconds).
 - b. Overspeed (engine speed reaches 2100 r/m).

- c. Low oil pressure (14 psi: 96.6 kPa).
- d. High engine temperature (215°F: 102°C).

On standard control panels, all four alarms are wired into one common fault lamp; on units with five fault lamps, four have shutdown alarms, the fifth (low engine temperature) lights a fault lamp only. Refer to Table 2.

Standard Cranking Module: Limits engine cranking time to 75 seconds. If engine fails to start after 75 seconds the engine monitor lights a fault lamp and opens the cranking circuit.

OPTIONAL MODULES

Cycle Cranker: Plug-in module replaces standard cranking circuit. Automatically provides a 15-second crank time and a 10-second rest time for three ON and two OFF cycles in 65 seconds. If engine fails to start, after 75-seconds the engine monitor lights a fault lamp and opens the cranking circuit.

Pre-Alarm: Gives advance warning for low oil pressure or high engine temperature. Requires two sensors each for engine temperature and oil pressure.

TABLE 2. FAULT LAMP OPTIONS

SYSTEM	FAULT	FAULT LAMP	STOP ENGINE	EXTERNAL ALARM	PRE-ALARM
PENN STATE. SINGLE LIGHT	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x		x	
	High Engine Temperature	x		x	
STANDARD SINGLE LIGHT	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x	x	x	
	High Engine Temperature	x	x	x	
5 LIGHT	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x	x	x	
	High Engine Temperature	x	x	x	
	Low Engine Temperature	x			
5 LIGHT PRE-ALARM	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x	*	x	x
	High Engine Temperature	x	*	x	x
	Low Engine Temperature	x			

* - With additional optional sensors.

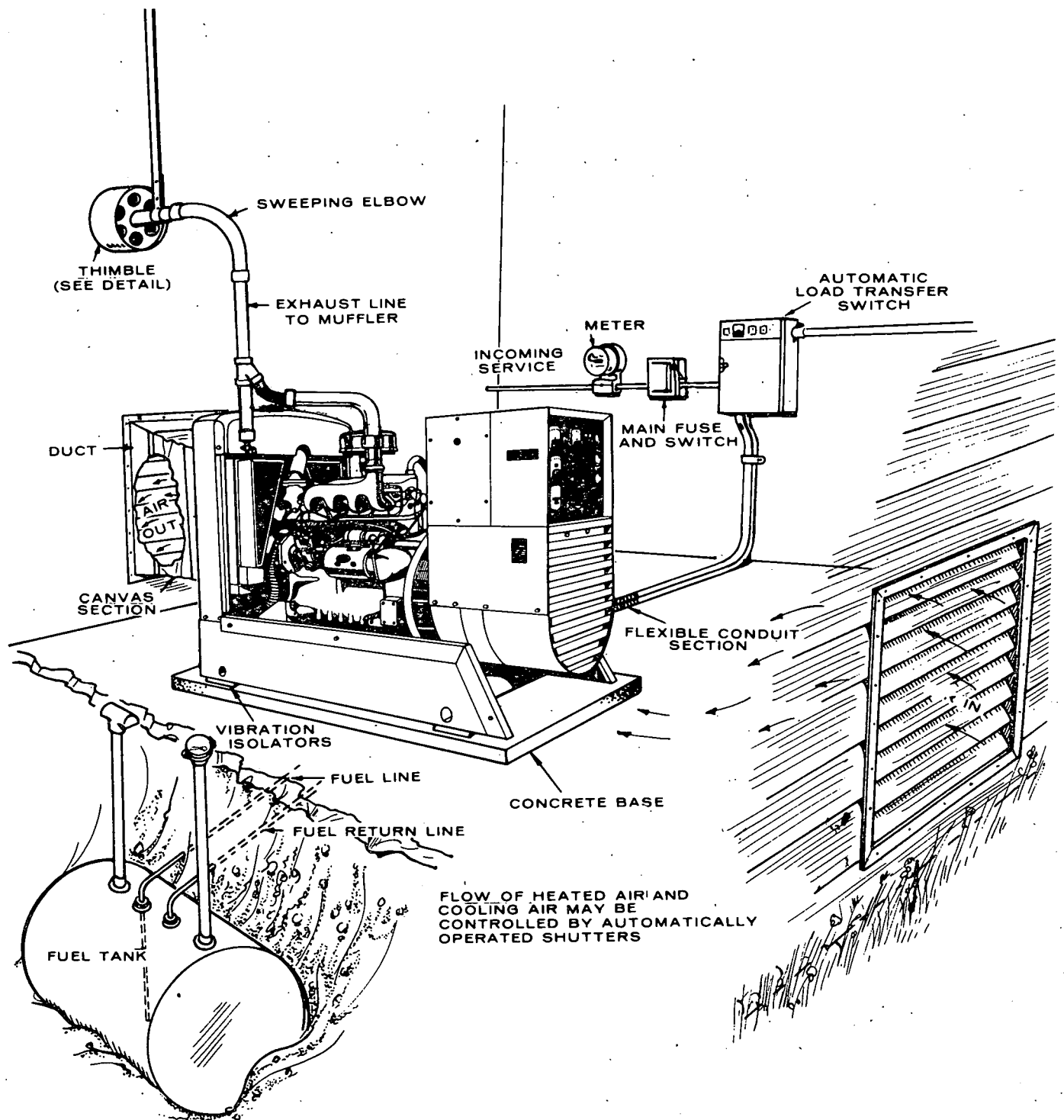


FIGURE 3. TYPICAL INSTALLATION

INSTALLATION

GENERAL

Installations must be considered individually. Use these instructions as a general guide. Meet regulations of local building codes, fire ordinances, etc., which may affect installation details. See Figure 3.

Installation points to consider include:

1. Level mounting surface.
2. Adequate cooling air.
3. Adequate fresh induction air.
4. Discharge of circulated air.
5. Discharge of exhaust gases.
6. Electrical connections.
7. Fuel connections.
8. Water connections.
9. Accessibility for operation and servicing.
10. Vibration isolation.
11. Noise levels.

LOCATION

Provide a location that is protected from the weather and is dry, clean, dust free and well ventilated. If practical, install inside a heated building for protection from extremes in weather conditions.

MOUNTING

Generating sets are mounted on a rigid skid base which provides proper support. Install vibration isolators between skid base and foundation. For convenience in draining crankcase oil and general servicing, mount set on raised pedestals (at least 6 inches high). If mounting in a trailer, or for other mobile applications, bolt securely in place. Extra support for the vehicle flooring may be necessary. Bolting down is recommended for stationary installations.

VENTILATION

Generating sets create considerable heat which must be removed by proper ventilation. Outdoor installations rely on natural air circulation but mobile and indoor installations need properly sized and positioned vents for the required air flow. See *Specifications* for the air required to operate with rated load under normal conditions at 1800 rpm.

Radiator set cooling air travels from the rear of the set to the front end. Locate the room or compartment air inlet where most convenient, preferably to the rear of the set. Make the inlet opening at least as large as the radiator area (preferably 1-1/2 times larger).

Engine heat is removed by a pusher fan which blows cooling air out through the front of the radiator. Locate the cooling air outlet directly in front of the radiator and as close as practical. The opening size should be at least as large as the radiator area. Length and shape of the air outlet duct should offer minimum restriction to air flow. Use a duct of canvas or sheet metal between the radiator and the air outlet opening. The duct prevents recirculation of heated air.

Provide a means of restricting the air flow in cold weather to keep the room or compartment temperature at a normal point.

A shelter housing with electrically operated louvres is available as an option. Transformers connected across the generator output supply current to the motors.

When the generator is operating, current in the transformers actuate the motors and open the louvres. The louvres are held open for the duration of the set operation, then are closed by return springs when the set is shut down.

City water cooled sets do not use the conventional radiator. A constantly changing water flow cools the engine. Ventilation is seldom a problem, but sufficient air movement and fresh air must be available to properly cool the generator, disperse heat convected off the engine and support combustion in the engine.

For small compartments, a duct of equal or larger area than generator outlet is recommended to remove the heated air from the generator air outlet to the outside atmosphere. Limit bends and use radius type elbows where needed. A larger, well ventilated compartment or room does not require a hot air duct.

Installations made in a small room may require installation of an auxiliary fan (connected to operate only when the plant is running) of sufficient size to assure proper air circulation.

CITY WATER COOLING

An optional method of engine cooling, in place of the conventional radiator and fan, uses a constant pressure water supply. This is referred to as CITY WATER COOLING. There are two varieties of city water cooling: the HEAT EXCHANGER SYSTEM and STANDPIPE SYSTEM. See Figures 4 and 5.

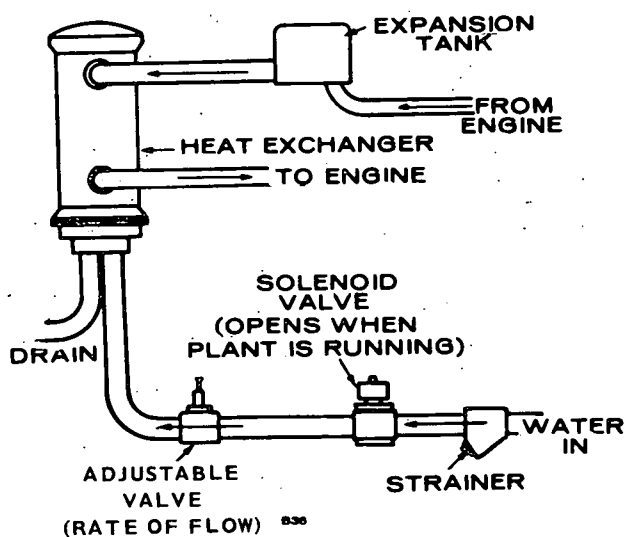


FIGURE 4. TYPICAL HEAT EXCHANGER SYSTEM

The HEAT EXCHANGER provides for a closed engine cooling system. Engine coolant flows through a tubed chamber, keeping the coolant separate from the cool "raw" water supply. The coolant chamber must be filled for operation, as for a radiator cooled set.

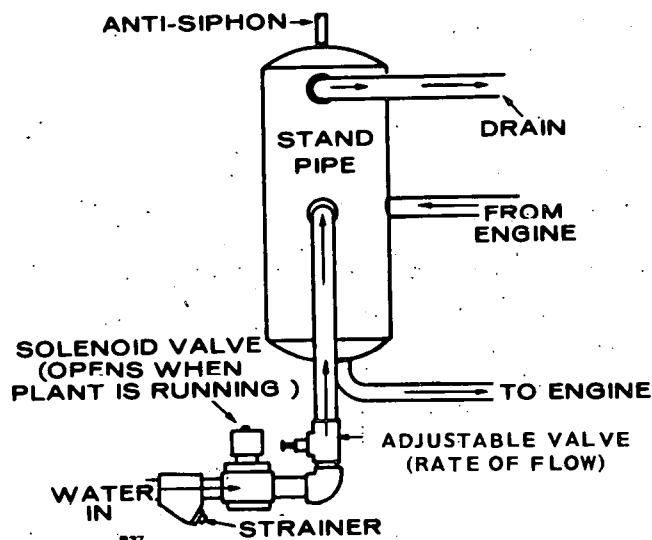


FIGURE 5. TYPICAL STANDPIPE SYSTEM

The STANDPIPE SYSTEM uses a mixing or tempering tank. Cooling water that circulates through the engine-mixes with a source of cool "raw" water. The "raw" water supply must be free of scale forming lime or other impurities.

On both systems use flexible pipe for connecting water supply and-outlet flow pipes to engine. Pipe the outlet flow to a convenient drain. Install an electric solenoid valve and a rate of flow valve in the water supply line. The electric solenoid valve opens and allows water flow through the system only when the plant operates. The rate of flow valve, either automatic or manual, provides for the proper flow rate to the engine. Adjust the flow to maintain water temperature between 165°F and 195°F (74°C to 91°C) while viewing the water temperature gauge.

Before filling cooling system check all hardware for security. This includes hose clamps, capscrews, fittings and connections. Use flexible coolant lines with heat exchanger, standpipe or remote mounting radiator.

WATER JACKET HEATER (Optional)

This heater is installed to maintain an elevated engine temperature in lower ambient temperature applications. It heats and circulates engine coolant, and is thermostatically controlled (Figure 19).

EXHAUST

WARNING

Inhalation of exhaust gases can result in death.

Engine exhaust gas must be piped outside building or enclosure. Do not terminate exhaust pipe near inlet vents or combustible materials. An approved thimble (Figure 6) must be used where exhaust pipes pass through walls or partitions. Pitch exhaust pipes downward or install a condensation trap (Figure 7) at the point where a rise in the exhaust system begins. Avoid sharp bends; use sweeping long radius elbows. Provide adequate support for mufflers and exhaust pipes. Refer to Figure 3 for a typical exhaust installation. Shield or insulate exhaust lines if there is danger of personal contact. Allow at least 9-inches (230 mm) of clearance if the pipes run close to a combustible wall or partition. Use a pipe at least as large as the 2-inch pipe size outlet of the engine with a flexible

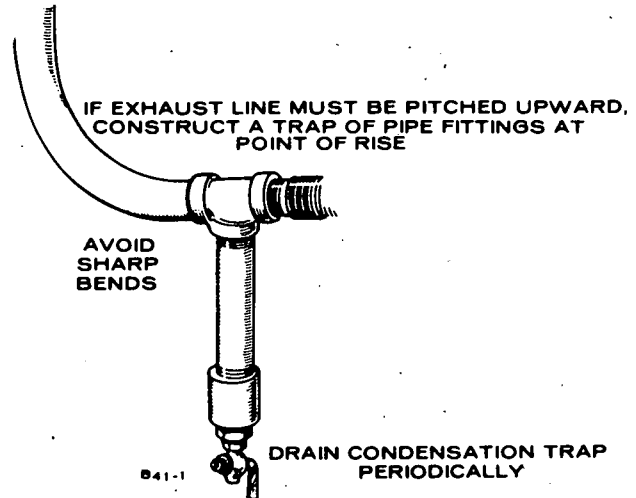


FIGURE 7. EXHAUST CONDENSATION TRAP

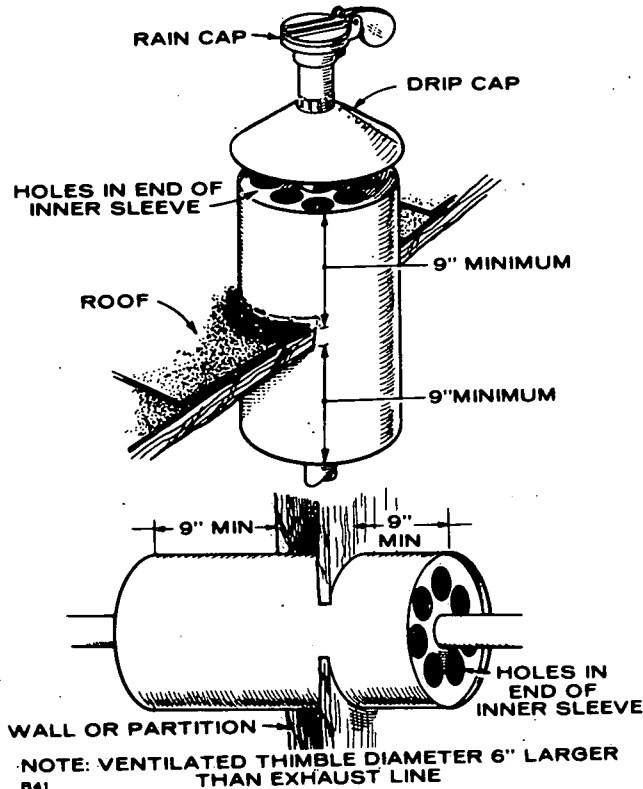


FIGURE 6. EXHAUST THIMBLE

portion between the engine and the muffler. Do not connect a flexible line to the exhaust manifold. Minimum diameters and maximum lengths of pipe (with critical muffler) are as follows:

Single Exhaust system:

2½-inch pipe	58-feet (17.68 m)
3-inch pipe	191-feet (58.2 m)
3½-inch pipe	419-feet (128 m)

Maximum permissible exhaust restriction (back pressure) is 25-inches H₂O (1.84-inches Hg [6.23 kPa]).

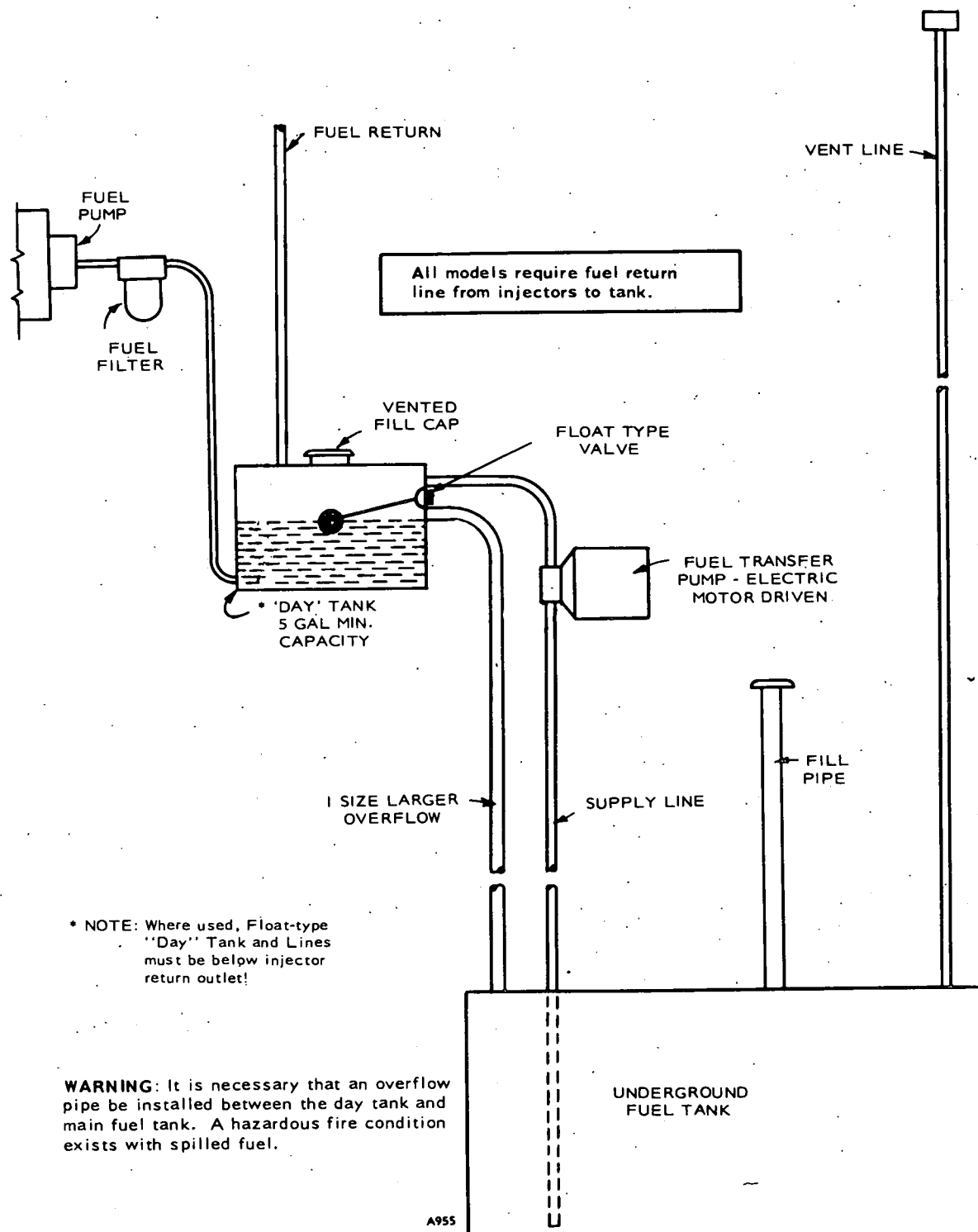


FIGURE 8. DAY TANK INSTALLATION

FUEL SYSTEM

The John Deere engines used on the DDA sets are designed for use with ASTM No.2 Diesel fuel. They will however, operate on diesel fuels within the specifications delineated in the John Deere engine manual.

FUEL CONNECTIONS

Check local regulations governing the installation of a fuel supply tank.

In any diesel engine installation, fuel system cleanliness is of utmost importance. Make every effort to prevent entrance of moisture or contaminants of any kind. Do not use lines or fittings of galvanized material.

A fuel lift in excess of 10-feet (3 m) is not recommended without a day tank installation, because of fuel drainage. Horizontal run, if the supply tank is level with the fuel pump should not exceed 25-feet (7.62 m). However, a day tank is again recommended.

The fuel inlet is to the transfer pump and is threaded for 1/8-inch pipe. Injector pump return line is common with the injectors' return line, and requires a 1/8-inch low pressure hose connection.

DAY TANK

Generator set installations may be equipped with an optional integral fuel Day tank. A float operated valve controls fuel flow into the fuel tank. The correct level is maintained to assure a constant source of fuel. It is necessary to install an overflow line between the Day tank and the main fuel tank. Refer to the installations included with the tank. See Figure 8 for an example of a Day tank installation.

BATTERY

Starting the plant requires 12-volt battery current. Use two 6-volt (see specification) batteries for a normal installation. Connect the batteries in series (negative post of first battery to positive post of second) as in Figure 9. Necessary battery cables are on unit. Service the batteries as necessary. Infrequent plant use (as in emergency standby service) may allow the batteries to self-discharge to the point where they cannot start the plant. If installing an automatic transfer switch that has no built-in charge circuit, connect a separate trickle charger. Onan automatic transfer switches include such a battery charging circuit.

WARNING

being charged.

Do not smoke while servicing batteries. Lead acid batteries give off explosive gases while

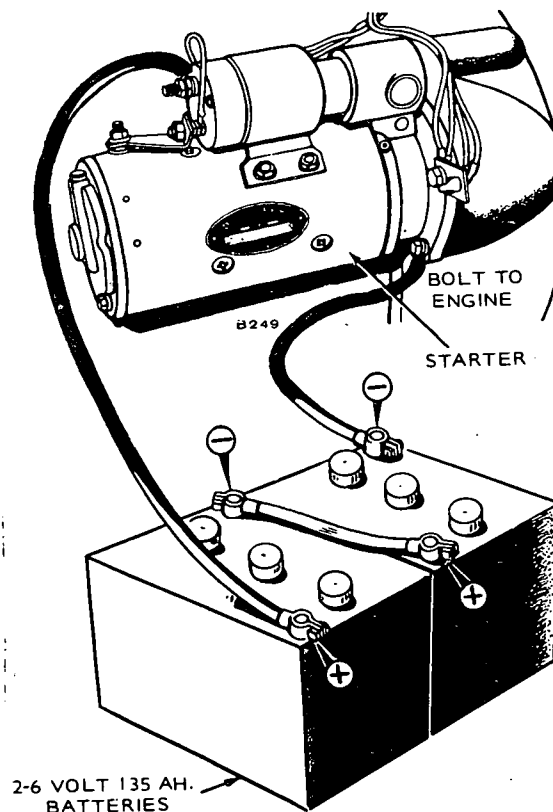


FIGURE 9. BATTERY CONNECTION

BATTERY, HOT LOCATION

Batteries will self discharge very quickly when installed where the ambient temperature is consistently above 90° F (32.2° C), such as in a boiler room. To lengthen battery life, dilute the electrolyte from its normal 1.260 specific gravity reading at full charge to a 1.225 reading. The cranking power is reduced slightly when the electrolyte is so diluted, but if the temperature is above 90° F (32.2° C), this should not be noticed. The lengthened battery life will be worth the effort.

1. Fully charge the battery.
2. With the battery still on charge, draw off the electrolyte above the plates in each cell. DO NOT ATTEMPT TO POUR OFF; use an hydrometer or filler bulb and dispose of it in a safe manner. Avoid skin or clothing contact with the electrolyte.
3. Refill each cell with distilled water, to normal level.
4. Continue charging for 1 hour at 4 to 6 amperes.
5. Test each cell. If the specific gravity is still above 1.225, repeat steps 2, 3, and 4 until the reading is reduced to 1.225. Usually, repeating steps twice is sufficient.

REMOTE CONTROL CONNECTIONS

Provision is made for addition of remote starting. This is accomplished on a 4 place terminal block situated within the control box. Connect one or more remote switches across remote terminal and B+ terminal as shown in Figure 10. If the distance between the set and remote station is less than 1000-feet (300 m), use No. 18 AWG wire; between 1000- and 2000-feet (600 m), use No. 16 AWG wire.

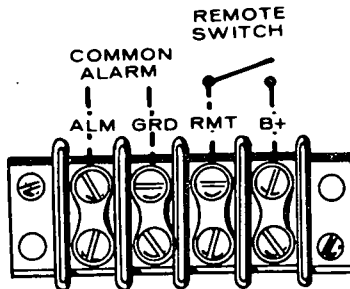
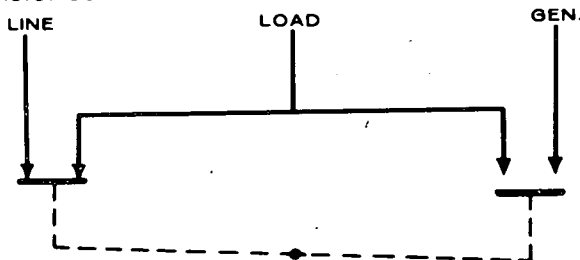


FIGURE 10. REMOTE STARTING

WIRING CONNECTIONS

Most local regulations require that wiring connections be made by a licensed electrician and that the installation be inspected and approved before operation. All connections, wire sizes, etc. must conform to requirements of electrical codes in effect at the installation site.

If the installation is for standby service, a double throw transfer switch must always be used. Connect this switch (either automatic or manual) so that it is impossible for commercial power and generator current to be connected to the load at the same time. Instructions for connecting an automatic load transfer control are included with such equipment.



NOTE: SHOWN WITH LINE CONNECTED TO LOAD.

FIGURE 11. LOAD TRANSFER SWITCH

Control Box Connections: The factory ships these 12 lead generators with load connection wires NOT connected together in the control box. These 12 wires are labeled T1 through T12 and must be brought together before making load connections. Proceed as follows:

1. Remove either right, left or top panel from control box. See Figure 12.
2. Connect wires together as shown on panel and in Figure 13 according to voltage desired.
3. Open hinged control panel doors. Connect lead from terminal 63 to correct terminal for voltage desired. These terminals are labeled H2, H3, H4, H5 and H6. See Figure 14.
4. Close front panel and secure with 1/4 turn fasteners.
5. Connect load wires to generator leads.

Preceding instructions do not apply to models with a 347/600 voltage (designated 9X) or a 120/240 voltage (designated 3R); these connections are made at the factory. The installer must only connect load wires.

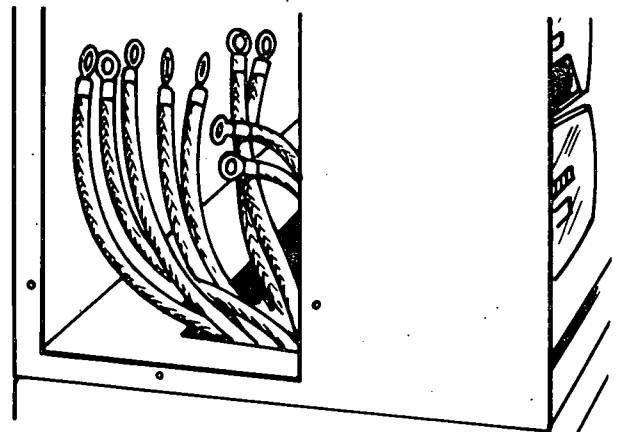


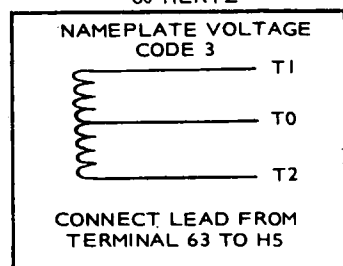
FIGURE 12. CONTROL BOX (SIDE PANEL REMOVED)

THIS DIAGRAM APPLIES TO 12 LEAD GENERATORS ONLY

NAMEPLATE VOLTAGE CODE	VOLTAGE	PHASES	HERTZ	CONNECT LEAD FROM TERMINAL 63 TO	GENERATOR CONNECTION	GENERATOR CONNECTION SCHEMATIC DIAGRAM	GENERATOR CONNECTION WIRING DIAGRAM (WITH CURRENT TRANSFORMERS WHEN USED)
15	120/240	1	60	H5	DOUBLE DELTA		
515	115/230	1	50	H6			
515	110/220	1	50	H6			
60	240/480	3	60	H5	SERIES DELTA		
15	120/240	3	60	H5			
515	115/230	3	50	H6			
15	120/208	3	60	H3	PARALLEL WYE		
15	127/220	3	60	H4			
15	139/240	3	60	H5			
515	110/190	3	50	H3	PARALLEL WYE		
515	115/200	3	50	H4			
515	120/208	3	50	H4			
515	127/220	3	50	H5			
15	240/416	3	60	H3	SERIES WYE		
15	254/440	3	60	H4			
15	277/480	3	60	H5			
515	220/380	3	50	H3	SERIES WYE		
515	230/400	3	50	H4			
515	240/416	3	50	H4			
515	254/440	3	50	H5			
7	220/380	3	60	H3			

98C2193

120/240 VOLT, 1 PHASE
60 HERTZ



347/600 VOLT, 3 PHASE,
60 HERTZ

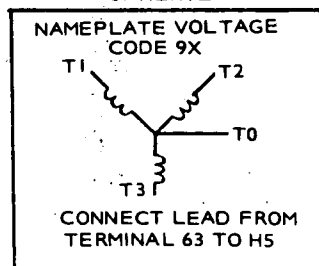


FIGURE 13. VOLTAGE CONNECTIONS

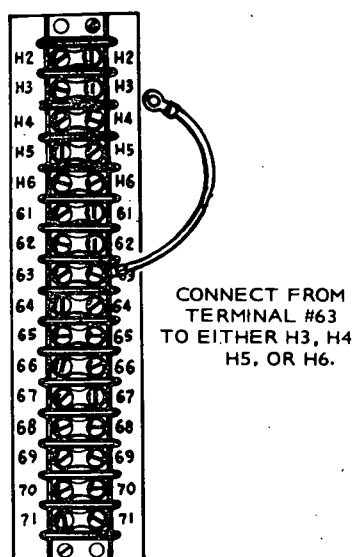


FIGURE 14. CONNECTING LEAD FROM TERMINAL 63

120/240 Volt, Single Phase, 12 Lead: Terminal connection L0 can be the ground (neutral). For 120 volts, connect the hot load wires to either the L1 or L2 connection, Figure 15. Connect the neutral load wire to the L0 connection. Two 120 volt circuits are thus available, with not more than 1/3 the rated capacity of the set available on either circuit. If using both circuits, be sure to balance the load between them.

For 240 volts, connect one load wire to the L1 connection and the second load wire to the L2 connection. Terminal connection L0 is not used for 240 volt service.

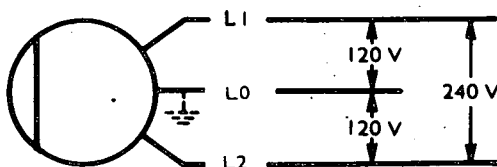


FIGURE 15. 120/240 VOLT, SINGLE PHASE, 12 LEAD

120/240 Volt, 3 Phase, 4 Wire Delta Connected Set; 12 Lead: The 3 phase Delta connected set is designed to supply 120- and 240 volt, 1 phase current and 240 volt, 3 phase current, Figure 16. For 3 phase operation, connect the three load wires to generator terminals L1, L2 and L3 — one wire to each terminal. For 3 phase operation the L0 terminal is not used.

For 120/240 volt, 1 phase, 3 wire operation, terminals L1 and L2 are the "hot" terminals. The L0 terminal is the neutral, which can be grounded if required. For 120 volt service, connect the black load wire to either the L1 or L2 terminal. Connect the neutral (white) wire to the L0 terminal. Two 120 volt circuits are available.

Any combination of 1 phase and 3 phase loading can be used at the same time as long as no terminal current exceeds the NAMEPLATE rating of the generator. If no 3 phase output is used, usable 1 phase output is 2/3 of 3 phase KVA.

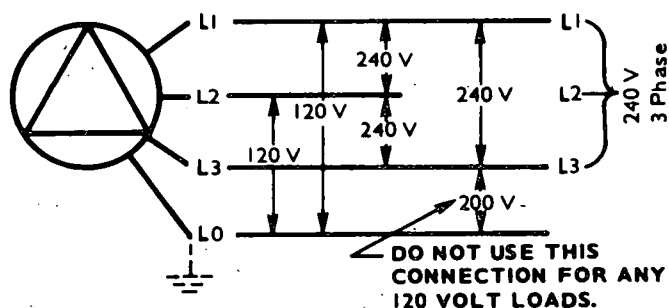


FIGURE 16. 3 PHASE, DELTA CONNECTION, 12 LEAD

3 Phase, 4 Wire, Wye Connected Set; 12 Lead: The 3 phase, 4 wire set produces line to neutral voltage and line to line voltage. The line to neutral voltage is the lower voltage as noted on the unit nameplate, and the line to line voltage is the higher nameplate voltage.

For 3 phase loads, connect separate load wires to each of the set terminals L1, L2 and L3. Single phase output is obtained between any two 3 phase terminals.

The terminal marked L0 can be grounded. For 1 phase loads, connect the neutral (white) load wire to the L0 terminal. Connect the black load wire to any one of the other three terminals — L1, L2 or L3. Three separate 1 phase circuits are available, with not more than 1/6 the rated capacity of the set from any one circuit.

If using 1 phase and 3 phase current at the same time, use care to properly balance the 1 phase load, and not to exceed rated line current.

Figure 17 shows load connections for 120/208 voltage. Other voltages are available from either parallel wye or series wye illustration in Figure 13.

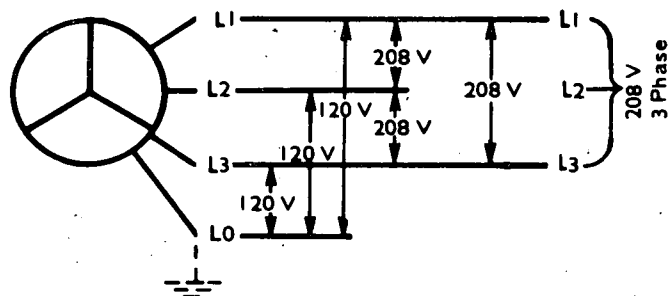


FIGURE 17. 3 PHASE, WYE CONNECTION, 12 LEAD

GROUNDING

Typical requirements for bonding and grounding are given in the National Electrical Code, 1975, Article 250.

Periodic inspection is recommended, especially after service work has been performed on equipment anywhere in the electrical system.

Generator Set Bonding and Equipment Grounding

Bonding is defined as: (Reference National Electrical Code, 1975, Article 100) The permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and capacity to conduct safely any current likely to be imposed.

WARNING

It is extremely important for life safety that bonding and equipment grounding be properly done, and that all metallic parts likely to become energized under abnormal conditions be properly grounded.

Circuit and System Grounding

This refers to the intentional grounding of a circuit conductor or conductors. The design and installation of grounding system encompasses many considerations, such as multiple transformers, standby generators, ground fault protection, physical locations of equipment and conductors, just to mention a few.

Although the consulting engineer and installer are responsible for the design and wiring of each particular grounding application, the basic grounding requirements must conform to national and local codes.

OPERATION

GENERAL

ONAN DDA Series electric generating sets are given a complete running test under various load conditions and are thoroughly checked before leaving the factory. Inspect your unit closely for loose or missing parts and damage which may have occurred in transit. Tighten loose parts, replace missing parts and repair any damage before putting set into operation.

PRESTART SERVICING

Lubrication System: Engine oil was drained prior to shipment. Fill engine to capacities shown. After engine has been run, check dipstick, add oil to bring level to full mark. Record total capacity for future oil changes. Do not mix brands or grades of lubricating oils.

AMBIENT TEMPERATURE	SINGLE VISCOSITY	MULTI-VISCOSITY
Below -10°F (-23°C)	SAE 5W	SAE 5W20
Between -10°F and 32°F (-23°C and 0°C)	SAE 10W	SAE 10W30
Above 32°F (0°C)	SAE 30	Not Recommended
Use oil conforming to these specifications	API CD/SD MIL-L-2104C* Series 3* *API CC or CD	API CC/SE, CC/SD or SD MIL-L-46152

Oil capacities (nominal)

Oil Pan and Filter — 9 quarts (8.6 litres)

Cooling System: Cooling system was drained prior to shipment. Fill cooling system before starting. Nominal capacity is 4.25 gallons (16.1 litres). For units using either a radiator or heat exchanger (city water cooled), fill the system with clean soft water. Use a good rust and scale inhibitor additive. If a possibility exists of a radiator cooled set being exposed to freezing temperatures use anti-freeze with an ethylene-glycol base. During initial engine run, check the coolant level several times and replenish if necessary to compensate for air pockets which may have formed during filling. Refer to John Deere engine manual for additional information.

CAUTION

1. Verify that the electric solenoid valve used with city water cooled plants is open before initial starting of plant to allow coolant chambers to fill. Overheating and damage to the engine could result from non-compliance.

2. If engine is equipped with a cooling system filter, do not use antifreeze with an anti-leak formula. The stop leak element can prevent or retard the coolant flow through the filter, thereby eliminating the filtering process completely.

3. Be careful when checking coolant under pressure. It is advisable to shut engine down and bleed off pressure before removing pressure cap. Severe burns could result from contact with hot coolant.

Fuel System: Refer to the John Deere engine manual for fuel oil specifications. Check with fuel supplier and ensure that fuel supplied meets the specifications. Filter or strain fuel when filling tank. Fuel supply tanks should be kept as nearly full as possible by topping up each time engine is used. Warm fuel returning from the injector pump heats the fuel in the supply tank. If the fuel level is low in cold weather, the upper portion of the tank not heated by returning fuel tends to increase condensation. In warm weather both the supply tank and fuel are warm. Cool night air lowers the temperature of the tank more rapidly than the temperature of the fuel. Again this tends to increase condensation.

Condensate mixing with the sulphur in the fuel forms a sulphurous acid which will corrode and damage the engine. KEEP FUEL CLEAN.

WARNING

DO NOT SMOKE while handling fuel. Diesel fuel is flammable.

Priming Fuel System: Verify that all connections in the fuel system are secure and no leaks exist. Proceed with priming as follows:

1. Loosen bleed plug on top of fuel filter. Pump primer lever (Figure 18) until a solid stream of fuel, free of air bubbles, flows from bleed plug.
2. Secure bleed plug.
3. Loosen inlet fuel line on injector pump. Operate primer lever on fuel transfer pump until a solid stream of fuel, free of air bubbles, flows from inlet line opening.
4. Secure injector pump fuel inlet line.
5. Leave fuel transfer pump priming lever at lowest point of stroke.

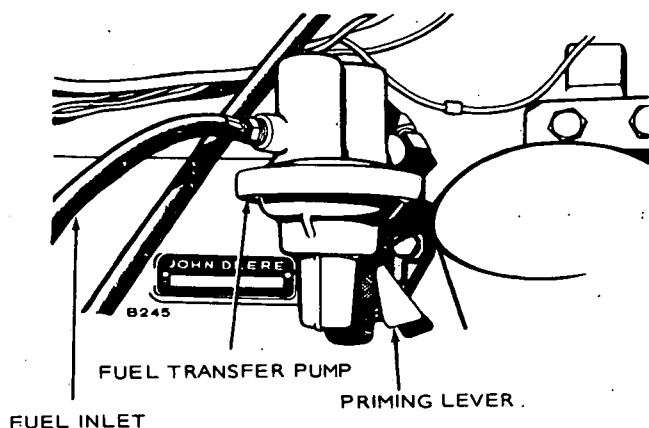


FIGURE 18. PRIMING FUEL SYSTEM

If the primer lever will not pump and no resistance is felt at upper end of stroke, turn engine over with starter to change position of fuel pump drive lobe on camshaft.

Check all connections in fuel system for security, to ensure that pressure will not bleed off when engine is not in use. Pressure should be maintained for immediate starting if unit is on standby service.

BATTERIES

Ensure that the cable connections to the batteries are secure. Coat connections with petroleum based or non-conductive grease to retard formation of corrosive deposits.

Check level of electrolyte to be at split ring mark. Measure specific gravity of electrolyte: SG 1.260 at 80°F (26.7°C). If distilled water has been added or specific gravity is less than 1.260, place batteries on charge until desired reading is reached. Do not over charge.

STARTING

When the preceding service functions have been performed, recheck to verify unit is ready to start.

1. Crankcase filled.
2. Cooling system filled — input solenoid valve open.
3. Batteries charged and connected.
4. Fuel solenoid valve open.

To start, move the "run-stop/reset-remote" switch to the "run" position. The engine should start after a few seconds of cranking. Immediately after start, observe the oil pressure gauge. Normal oil pressure is between 45 and 65 psi (310.5 and 448.5 kPa). Check the following gauges:

1. DC Ammeter — 10 to 30 amperes.
2. AC Voltmeter — AC generator output voltage.
3. Frequency Meter — AC generator output frequency.

After running 10 minutes under load the water temperature gauge should have stabilized at 180° to 195°F (82.2°C to 90.6°C). On city water cooled units an adjustable valve is connected in the water supply line. Adjust the hand wheel valve to provide a water flow that will keep the water temperature gauge reading within the range of 180°F to 220°F (82.2°C to 104.4°C).

STOPPING

To reduce and stabilize engine temperatures, run the engine at no load for three to five minutes before shutting down.

Move the run-stop/reset-remote switch to stop position to shut down the set.

Break-In Note: Run set at 50 percent rated load for the first half-hour of initial operation after reaching operating temperature.

Non-Start: If after a few seconds of cranking engine fails to start, or starts and runs then stops and fault lamp lights, refer to appropriate troubleshooting chart, Table 3 or Table 4.

NO LOAD OPERATION

Periods of no load operation should be held to a minimum. If it is necessary to keep the engine running for long periods of time when no electric output is required, best engine performance will be obtained by connecting a "dummy" electrical load. Such a load could consist of heater elements, etc.

EXERCISE PERIOD

Generating sets on continuous standby service are required to be operative at essential loads from a cold start in a short period of time in the event of a power outage.

This imposes severe conditions on the engine. Friction of dry piston rings upon dry cylinder walls causes scuffing and rapid wearing. These can be relieved by exercising the set at least once a week for a minimum time of 30-minutes per exercise period. Preferably, run the set under at least 50 percent load to allow the engine to reach normal operating temperature. This will keep engine parts lubricated, maintain fuel prime, prevent electrical relay contacts from oxidizing and insure easy emergency starts. ONAN automatic transfer switches contain an optional exercise switch which, by pre-selection, will start, determine run period and shut down a set on a weekly frequency. For example, the switch can be set for time of start, length of run, A.M. or P.M. and day of week.

After each exercise period, top up fuel tank, check engine for leaks and unit for general condition. Locate cause of leaks (if any) and correct.

TABLE 3.
TROUBLESHOOTING ENGINE SHUTDOWN SYSTEM
(Engines with only one fault lamp)

SYMPTOM	CORRECTIVE ACTION
1. Engine stops cranking and fault lamp lights, after cranking approximately 75 seconds.	1. See engine service manual for troubleshooting fuel system. After correcting problem, reset engine monitor relay by placing Run-Stop/Reset-Remote switch to Stop/Reset, then back to the required running position.
2. Fault lamp lights immediately after engine starts.	2. Check for: Overspeed condition as engine starts.
3. Fault lamp lights and engine shuts down after running for a period.	3. Check the following: a. Oil level. Engine will shut down if sensor is closed. b. Check engine manual for troubleshooting oil system. c. High engine temperature. Check coolant level; check water flow (city water cooled systems); check radiator for free air flow, and fan belts for tightness. See engine manual for troubleshooting cooling system. d. Check for faulty oil pressure sensor or faulty high engine temperature sensor.
4. Engine runs, shuts down and cranks for 75-seconds. Cranking cycle stops; fault lamp lights.	4. Check fuel supply.
5. Fault lamp lights, no fault exists.	5. To check a no-fault condition, disconnect leads from TB11 terminals 29, 30 and 31. If fault lamp lights with leads disconnected, replace engine monitor board. Reconnect leads.

TABLE 4.
TROUBLESHOOTING ENGINE SHUTDOWN SYSTEM
(Units with five fault lamps)

SYMPTOM	CORRECTIVE ACTION
1. Overcrank fault lamp lights and engine stops cranking after approximately 75-seconds.	1. See engine service manual for troubleshooting fuel system. After correcting fault, reset engine monitor relay by placing Run-Stop/Reset-Remote switch to Stop/Reset position, depressing Reset button, then to the required running position.
2. Engine runs, shuts down, cranks for 75-seconds, cranking cycle stops, overcrank light ON.	2. Check fuel supply.
3. *Low oil pressure shutdown.	3. Check— a. Oil level. Replenish if necessary. b. Sensor. Faulty sensor will shut down engine. c. Refer to engine service manual for troubleshooting guide for oil system.
4. *High engine temperature shutdown.	4. Check— a. Coolant level. Replenish if necessary. b. City water cooled sets. Check water flow, valves, etc. c. Check sensor; check thermostat. d. Radiator model, check fan belts, radiator for obstructions, etc.
5. Overspeed shutdown.	5. Check governor and throttle linkages for freedom of movement. Check overspeed switch.
6. Overspeed light on, no shutdown.	6. Disconnect wire at TB11-29. Light on after reset; replace engine monitor board.
7. *Low oil pressure light ON. No shutdown.	7. Disconnect wire at TB11-30. Light ON after relay reset. Replace engine monitor board.
8. *High engine temperature light ON. No shutdown.	8. Disconnect wire at TB11-31. Light ON after relay reset. Replace engine monitor board.

*NOTE: Not applicable on Pennsylvania State models.

HIGH ALTITUDE

Ratings apply to altitudes up to 1000 feet (305 metres), standard cooling, normal ambients and with No. 2 Diesel fuel. Consult factory or nearest authorized Onan distributor for operating characteristics under other conditions.

Engine horsepower loss is approximately 3 percent for each 1000 feet of altitude above sea level for a naturally aspirated engine. Use lower power requirement at high altitudes to prevent smoke, over-fueling and high temperatures.

HIGH TEMPERATURES

1. See that nothing obstructs air flow to-and-from the set.
2. Keep cooling system clean.
3. Use correct SAE No. oil for temperature conditions.

LOW TEMPERATURES

1. Use correct SAE No. oil for temperature conditions. Change oil only when engine is warm.
2. Use fresh fuel. Protect against moisture condensation.
3. Keep fuel system clean and batteries in a well charged condition.
4. Partially restrict cool air flow but use care to avoid overheating.
5. Connect water jacket heater when set is not running.
6. Refer to John Deere manual for further information.

Water Jacket Heater: The function of this optional heater is to keep the engine warm enough to assure starting under adverse weather conditions. Connect the heater to a source of power that will be on during the time the engine is not running. Be sure the voltage rating is correct for the heater element rating (Figure 19).

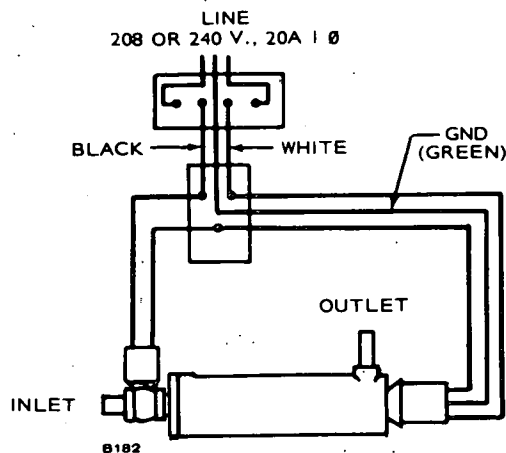


FIGURE 19. ENGINE HEATER

OUT OF SERVICE PROTECTION

For storage of all durations, refer to the John Deere engine manual.

GENERAL MAINTENANCE

GENERAL

Follow a definite schedule of inspection and servicing, based on operating hours. Keep an accurate logbook of maintenance, servicing, and operating time. Use the running time meter to keep a record of operation and servicing. Service periods outlined in Table 5 are recommended for normal service and operating conditions. For continuous duty, extreme temperature, etc., service more frequently.

A set on stand-by duty will need servicing at times other than those recommended by Onan and the engine manufacturer. These maintenance service periods will vary according to set site or location and

application. Consult with your Onan distributor or dealer for a schedule of maintenance and service more suitable to the unique environment and application of your set.

CAUTION When changing oil filters, it is important that the replacement filter is a bypass type. Failure to use a bypass filter could cause the filter material to rupture during heavy pressures on cold starts, resulting in non-filtered oil and subsequent engine damage.

WARNING Before commencing any maintenance work on the engine, generator, control panel, automatic transfer switch or associated wiring, disconnect batteries. Failure to do so could result in damage to the unit or serious personal injury in the event of inadvertent starting.

TABLE 5. OPERATOR MAINTENANCE SCHEDULE

MAINTENANCE ITEMS	MAINTENANCE PERIOD						
	10 hrs.	50 hrs.	100 hrs.	200 hrs.	500 hrs.	1000 hrs.	6 mths.
Inspect plant	x						
Check coolant level	x						
Check oil level	x						
Air cleaner	x1						
Fuel filter	x						
Batteries		x					
Alternator and fan belt			x2				
Engine crankcase - drain - refill			x1				
Crankcase oil filter			x1				
Crankcase vent tube					x		
Valve tappets					x		
Hoses					x		
Injection pump - check timing						x	
Injection nozzles						x	
Fuel filter - change						x	
Starter						x	
Cooling system - drain, flush, refill							x3
Clean and inspect battery charging alternator				x			
Air cleaner - replace			x				

x1 - or every 3 months, perform more often in extremely dusty conditions.

x2 - or every 3 months. Adjust to 3/4 depression with 20 pounds force.

x3 - More often in extremely dusty conditions.

NOTE: The above schedule is a minimum requirement for your engine. Refer to the John Deere service manual for recommended service periods.

ENGINE SPEED

Generator frequency is in direct ratio to engine speed, which is controlled by the Governor.

A Roosa-Master governor is standard equipment on the DDA generator set. High speed and low speed limit stops are set at the ONAN testing facility and normally do not require further adjustment, therefore if your set is used on continuous standby service, the governor may never need to be touched. If however the unit is used frequently, adjustment may be required due to wear of internal components. This adjustment is achieved by backing off the high speed stop screw. Screw in the low speed adjusting screw until the generator output frequency meter reads 60 Hz (generator on load). Turn in the high speed adjusting screw until it bottoms; secure the locknuts.

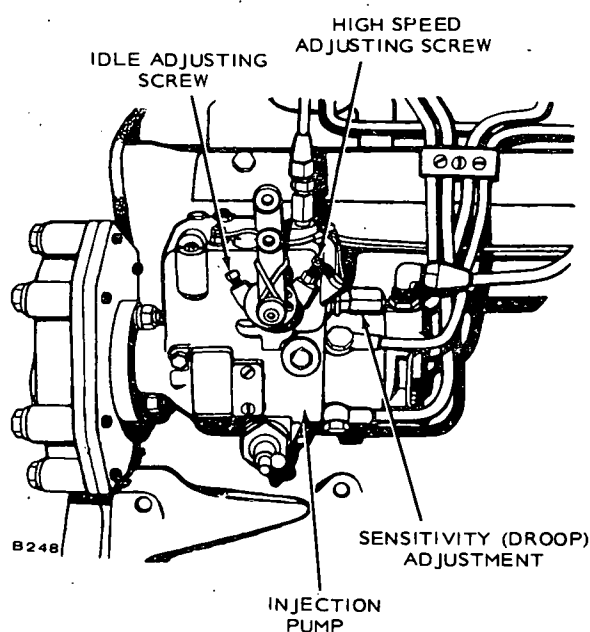


FIGURE 20. ROOSA-MASTER GOVERNOR

Governor sensitivity is adjusted by rotating an external knurled knob at the rear of the injector pump housing. Turning inward (clockwise) shortens governor control spring making it less sensitive, thereby increasing speed droop. Turning outward (counterclockwise) has opposite effect. Adjustment can be made with engine running. The speed droop is set at the ONAN plant to give a regulation of 3 percent to 5 percent from no-load to full-load.

When using the generator frequency meter to determine engine speed, multiply frequency by 30 to calculate engine speed.

Example: $30 \times 61 \text{ (Hz)} = 1830 \text{ rpm}$.

Adjust engine speed to 1800 rpm for 60 Hertz sets and 1500 rpm for 50 Hertz sets.

AC GENERATOR

There are no brushes, brush springs or collector rings on these generators, therefore they require very little servicing. Periodic inspections, to coincide with engine oil changes, will ensure good performance.

Generator Bearing: Inspect the bearing every 1000 hours with the unit running.

If using the unit for "prime power", replace the bearing every 10,000 hours or two years. If using the set for "standby", replace the bearing every five years.

Check generator voltage. It may be necessary to make a slight readjustment of the voltage rheostat to obtain the preferred voltage at average load.

INSPECTION AND CLEANING

When inspecting the rotating rectifier assembly, make sure diodes are free of dust, dirt and grease. Excessive foreign matter on these diodes and heat sinks will cause the diodes to overheat and will result in their failure. Blow out the assembly periodically, with filtered, low pressure air. Also check to see that diodes and leadwires are properly torqued. The diodes should be torqued to 30 in. lb. (3.39 N•m) or finger tight plus a quarter turn. Blow dust out of control panel.

BATTERIES

Check the condition of the starting batteries at least every two weeks. See that connections are clean and tight. A light coating of non-conductive grease will retard corrosion at terminals. Keep electrolyte at the proper level above the plates by adding distilled water. Check specific gravity, recharge if below 1.260.

CONNECTIONS (Fuel, Exhaust, etc.)

Operator should periodically make a complete visual inspection of the set while running at rated load. Some of the things to check for are as follows:

1. Check all fuel and oil lines for possible leakage.
2. Inspect exhaust lines and mufflers for possible leakage and cracks.
3. Periodically or daily, drain moisture from condensation traps.
4. Inspect water lines and connections for leaks and security.
5. Inspect electrical wires and connections for security and fray damage.

If generator requires major repair or servicing, contact an authorized Onan dealer or distributor.

TANK HEATERS (Optional)

A Kim Tank Heater is optional equipment on the DDA generator set. For efficient operation and optimum product life, perform the following procedure at least once a year (Figure 21):

1. Remove head and valve assembly.
2. Clean foreign matter out of the tank.
3. Remove element and scrape off scale accumulated on the sheathing.

CAUTION

When reassembling threaded aluminum parts, be sure to use anti-seize compound.

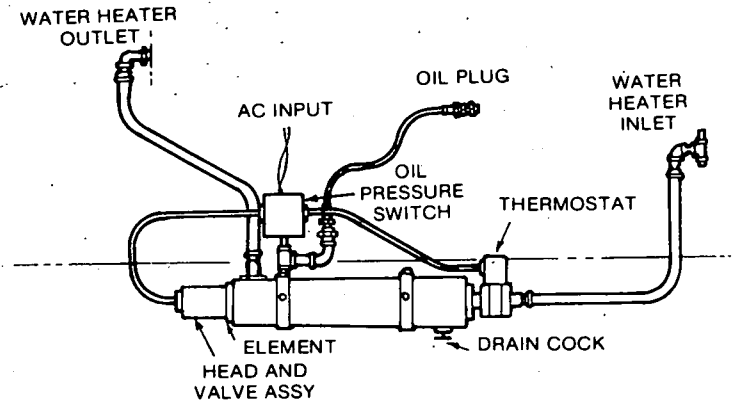
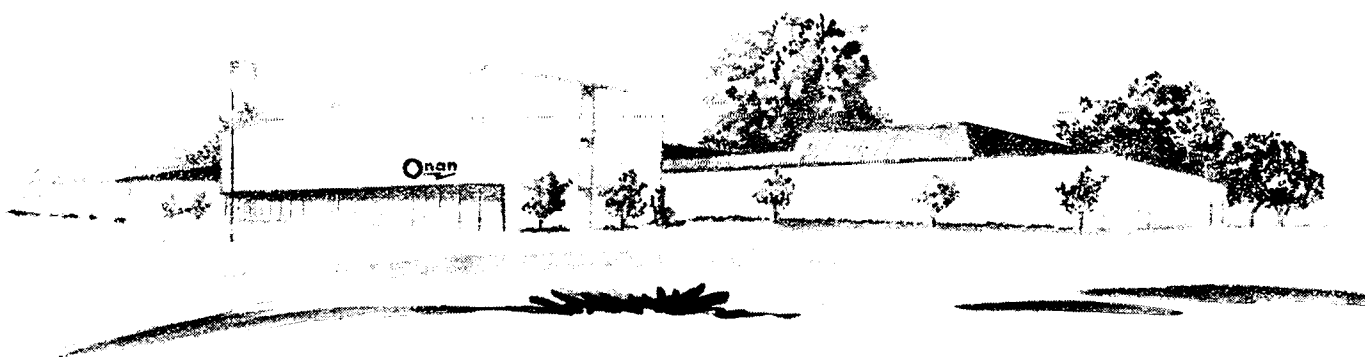
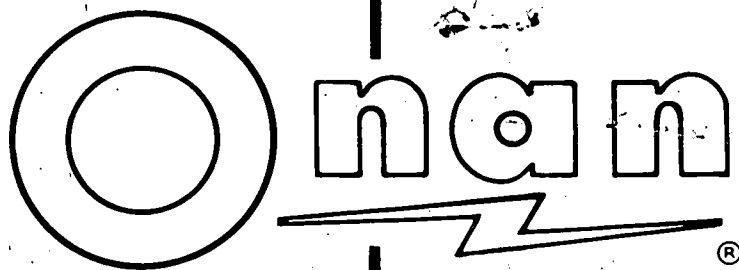


FIGURE 21. ENGINE HEATER



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A DIVISION OF ONAN CORPORATION





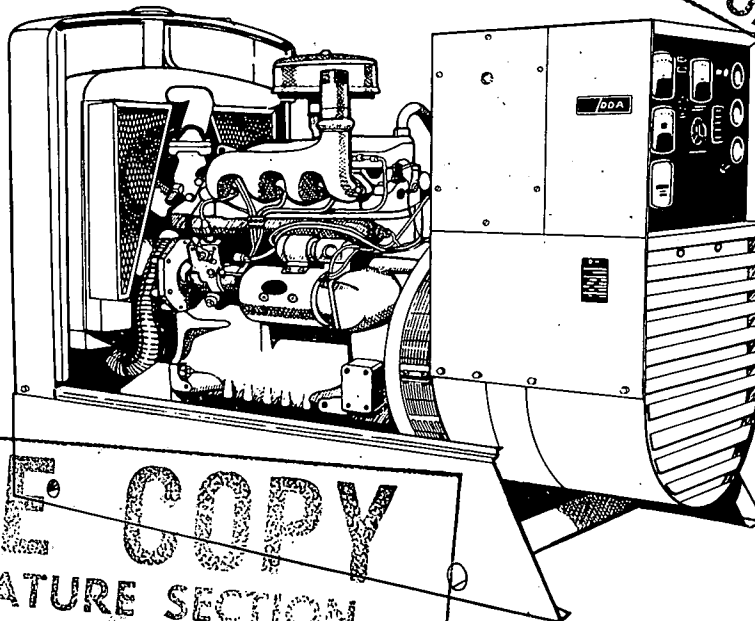
OPERATOR'S MANUAL

FOR
ELECTRIC GENERATING SETS

SERIES
DDA

*add
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4-0121

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SAFETY PRECAUTIONS

The following symbols in this manual signal potentially dangerous conditions to the operator or equipment. Read this manual carefully. Know when these conditions can exist. Then, take necessary steps to protect personnel as well as equipment.

ONAN recommends that you read your manual and become thoroughly acquainted with it and your equipment before you start your unit. These recommendations and the following safety precautions are for your protection.

Fuels, electrical equipment, batteries, exhaust gases and moving parts present potential hazards that could result in serious, personal injury. Take care in following these recommended procedures.

WARNING Onan uses this symbol throughout this manual to warn of possible serious personal injury.

CAUTION This symbol refers to possible equipment damage.

General

- Keep your electric generating set and the surrounding area clean and free from obstructions. Remove any debris from set and keep the floor clean and dry.
- Provide appropriate fire extinguishers and install them in convenient locations. Consult your local fire department for the correct type of extinguisher to use. Do not use foam on electrical fires. Use extinguisher rated ABC by NFPA.
- Make sure that all fasteners on the generating set are secure. Tighten supports and clamps, keep guards in position over fans, driving belts, etc.
- Do not wear loose clothing in the vicinity of moving parts, or jewelry while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts; cause shock or burning.
- If adjustment *must* be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.
- Do not work on this equipment when mentally or physically fatigued.
- Coolants under pressure have a higher boiling point than water. DO NOT open a radiator or heat exchanger pressure cap while the engine is running. Bleed the system pressure first.

Protect Against Moving Parts

- Keep your hands away from moving parts.

- Before starting work on the generating set, disconnect batteries. This will prevent starting the set accidentally.

Fuel System

- DO NOT fill fuel tanks while engine is running, unless tanks are outside engine compartment. Fuel contact with hot engine or exhaust is a potential fire hazard.
- DO NOT SMOKE OR USE AN OPEN FLAME in the vicinity of the generator set or fuel tank. Internal combustion engine fuels are highly flammable.
- Fuel lines must be of steel piping, adequately secured, and free from leaks. Piping at the engine should be approved flexible line. Do not use copper piping on flexible lines as copper will work harden and become brittle.
- Be sure all fuel supplies have a positive shutoff valve.

Guard Against Electric Shock

- Remove electric power before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages cause injury or death. DON'T tamper with interlocks.
- Follow all state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches.
- DO NOT SMOKE while servicing batteries. Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.

Exhaust Gases Are Toxic

- Provide an adequate exhaust system to properly expel discharged gases. Check exhaust system regularly for leaks. Ensure that exhaust manifolds are secure and not warped. Do not use exhaust gases to heat a compartment.
- Be sure the unit is well ventilated.

Keep the Unit and Surrounding Area Clean

- Make sure that oily rags are not left on or near the engine.
- Remove all oil deposits. Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and subsequent engine damage and may present a potential fire hazard.

FORM NO.

DATE ORDERED 2-8-78 FORM NO. 944-0121
 DATE REQUIRED Rush OUT-OF-STOCK DATED 2-78
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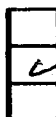
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115	12/1/18			944-121	1	45	3490	
1	3	4	8	10	11	15	16	
					25	33	49	50
						52		57
								60

PART NAME Thermal

W. O. NO.	EXP. NO.	MACH. NO.
	135-400	
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	73	74
		78

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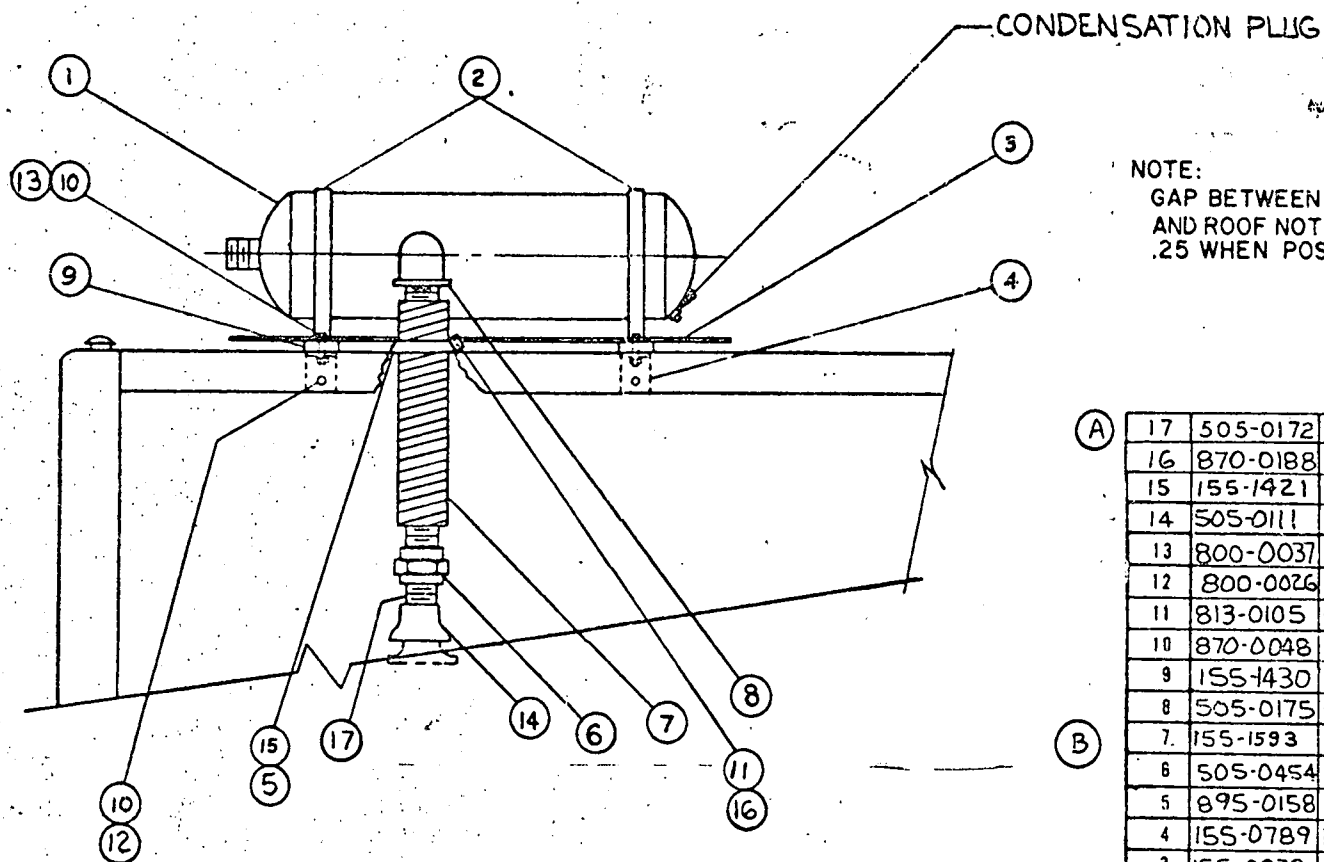
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179-1521

SIZE
B

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REV	REVISIONS	ZONE	ENGINEER	DATE
SPS	DS DWG SAME	DATE	3-29-74	CHC
A	ITEM 17 ADDED	2-C	HP	11-4-76
B	ITEM 7 WAS 155-1484	2-B	HP	11-15-77
B	ITEM 7 WAS 155-1591	2-B	HP	6-21-78



NOTE:

GAP BETWEEN RAIN SHIELD
AND ROOF NOT TO EXCEED
.25 WHEN POSSIBLE.

A	17	505-0172	1	NIPPLE - CLOSE (2x2)
	16	870-0188	2	NUT-LK (10-32)
	15	155-1421	1	SHIELD-RAIN (2 1/2 ID)
	14	505-0111	1	COUPLING-REDUCER (2 1/2 X 2)
	13	800-0037	4	SCREW (5/16-18 x 3)
	12	800-0026	8	SCREW (5/16-18 x 3/4)
	11	813-0105	2	SCREW-RHM (10-32 x 1 LG)
	10	870-0048	10	NUT-LKH (5/16-18)
	9	155-1430	4	SPACER-MUFFLER
	8	505-0175	1	ELBOW-PIPE 2" X 90°
	7	155-1593	1	TUBE ASSY-EXHAUST
	6	505-0454	1	UNION-2
	5	895-0158 A	1	ASBESTOS
	4	155-0789 B	2	SUPPORT
	3	155-0978	1	HEAT SHIELD
	2	140-0649 B	2	BAND
	1	155-0988 P	1	MUFFLER
	ITEM	PART NO.	QTY	DESCRIPTION

LIST OF MATERIAL

SEPIA FROM 179-1520 (B)

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TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONS DECIMALS ANGLES		DIVISION OF STUDEBAKER CORPORATION Minneapolis, Minnesota	
MATERIAL SEE LIST OF MATERIAL		DATE 7-15-76	DR. GJC
PROD TOOLING RELEASE		NAME INSTALLATION-MUFFLER	
SAMPLE RELEASE		PART. NO.	DWG NO
PROD RELEASE 14083 9-29-76		50 DDB	179-1521
			SIZE B

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Description	6
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Operation	19
General Maintenance	24

WARNING

TO AVOID POSSIBLE PERSONAL INJURY OR EQUIPMENT DAMAGE, A QUALIFIED ELECTRICIAN OR AN AUTHORIZED SERVICE REPRESENTATIVE MUST PERFORM INSTALLATION AND ALL SERVICE.

INTRODUCTION

FOREWORD

This manual is applicable to the DDA Series electric generating set, consisting of an Onan UR 30.0KW AC generator, driven by a John Deere 4219D diesel engine. Information is provided on installation, operation, troubleshooting and parts ordering for the set. The manual should be used in conjunction with the John Deere engine manual, as your specific engine may have variations due to optional equipment available.

MODEL IDENTIFICATION

Identify your model by referring to the MODEL and SPECIFICATION NO. as shown on the Onan nameplate. Electrical characteristics are shown on the lower portion of the nameplate.

30.0	DDA	15R	/	1	C
1	2	3		4	5

1. Indicates kilowatt rating.
2. Factory code for SERIES identification.
3. 15 = 60 Hz. Reconnectible
515 = 50 Hz. Reconnectible
R—Indicates remote starting feature.
4. Factory code for designating optional equipment.
5. Specification letter. (Advances when factory makes production modifications.)

If it is necessary to contact a dealer or the factory regarding the set, always mention the complete Model, Spec No. and Serial No. as given on the Onan nameplate. This nameplate information is necessary to properly identify your unit among the many types manufactured. Refer to the engine nameplate when requesting information from its manufacturer. The Onan nameplate is located on the right side of the generator; the John Deere nameplate is on the left side, on the engine block.

Left side and right side are considered when viewed from the engine or front end of the generating set.

WARNING

ENGINE EXHAUST GAS (CARBON MONOXIDE) IS DEADLY!

Carbon monoxide is an odorless, colorless gas formed by incomplete combustion of hydrocarbon fuels. Carbon monoxide is a dangerous gas that can cause unconsciousness and is potentially lethal. Some of the symptoms or signs of carbon monoxide inhalation are:

- Dizziness
- Intense Headache
- Weakness and Sleepiness
- Vomiting
- Muscular Twitching
- Throbbing in Temples

If you experience any of the above symptoms, get out into fresh air immediately.

The best protection against carbon monoxide inhalation is a regular inspection of the complete exhaust system. If you notice a change in the sound or appearance of exhaust system, shut the unit down immediately and have it inspected and repaired at once by a competent mechanic.

SPECIFICATIONS

ENGINE DETAILS

Engine Manufacturer	John Deere
Engine Series	300-4219D
Number of Cylinders	4
Displacement	219 cu. inch (3.59 litres)
BHP @ 1800 rpm	58 (43.27 kW)
Compression Ratio	16.3:1
Bore	4.02-inches (102.11 mm)
Stroke	4.33-inches (109.98 mm)
Fuel	ASTM No. 2 Diesel
Battery Voltage	12
Battery Group (Two 6-Volt, 135-A.H. [486 kC])	2H
Starting Method	Solenoid Shift
Governor Regulation	5% No Load—Full load
Battery Charging Current	35

GENERATOR DETAILS

Type	UR 15, 60 Hz UR 515, 50 Hz UR 3, 60 Hz
Rating (Watts)	
60 Hertz Continuous Standby	30,000 (37.5 kVA)
50 Hertz Continuous Standby	25,000 (31.25 kVA)
AC Voltage Regulation	±2%
60 Hertz	1800 rpm
50 Hertz	1500 rpm
Output Rating	0.8 PF
AC Frequency Regulation	3 Hz

CAPACITIES AND REQUIREMENTS

Cooling System (Includes Radiator)	4.25 gal. (16.1 litre)
Engine Oil Capacity (Filter, Lines, Crankcase)	9 qt. (8.6 litre)
Exhaust Connection (inches pipe thread)	2

AIR REQUIREMENTS (1800 r/m)

Engine Combustion	135 CFM (0.06 m ³ /s)
Radiator Cooled Engine	3875 CFM (1.83 m ³ /s)
Total for Radiator Cooled Model	4010 CFM (1.9 m ³ /s)
Alternator Cooling Air	
(1800 rpm)	1000 CFM (0.47 m ³ /s)
(1500 rpm)	834 CFM (0.4 m ³ /s)
Fuel Consumption at Rated Load	2.50 Gallon/Hr. (9.5 lit/hr)

GENERAL

Height	45.5-inches (1.16 m)
Width	33.0-inches (0.838 m)
Length	66.0-inches (1.8 m)
Approx. Weight (Mass)	1780 lbs. (799 kg)

TABLE 1. UR GENERATOR VOLTAGE/CURRENT OPTIONS

VOLTS	FREQ.	PHASE	AMPERES	DOUBLE DELTA	SERIES DELTA	PARALLEL WYE	SERIES WYE	REF. VOLTAGE WIRE (W12) TAP
110/220	50 Hz	1	142*	x				H6
115/230	50 Hz	1	136*	x				H6
120/240	60 Hz	1	156*	x				H5
110/190	50 Hz	3	94			x		H3
115/200	50 Hz	3	90			x		H4
120/208	60 Hz	3	104			x		H4
110/220	50 Hz	3	82		x			H6
127/220	60 Hz	3	98			x		H4
115/230	50 Hz	3	78		x			H6
120/240	60 Hz	3	90		x			H5
139/240	60 Hz	3	90			x		H5
220/380	50 Hz	3	47				x	H3
230/400	50 Hz	3	45				x	H4
240/416	60 Hz	3	52				x	H4
254/440	60 Hz	3	49				x	H5
277/480	60 Hz	3	45				x	H5
9X 347/600	60 Hz	3	36					H5 — Not Reconnectible
3 120/240	60 Hz	1	156					Not Reconnectible
53 115/230	50 Hz	1	136					Not Reconnectible

30.0 kW 37.5 kVA 60 Hz
25.0 kW 31.25 kVA 50 Hz

* - These current values are available only from special long stack units. When standard 3-phase unit is reconnected into Double Delta configuration, maximum current is 2/3 that of value given.

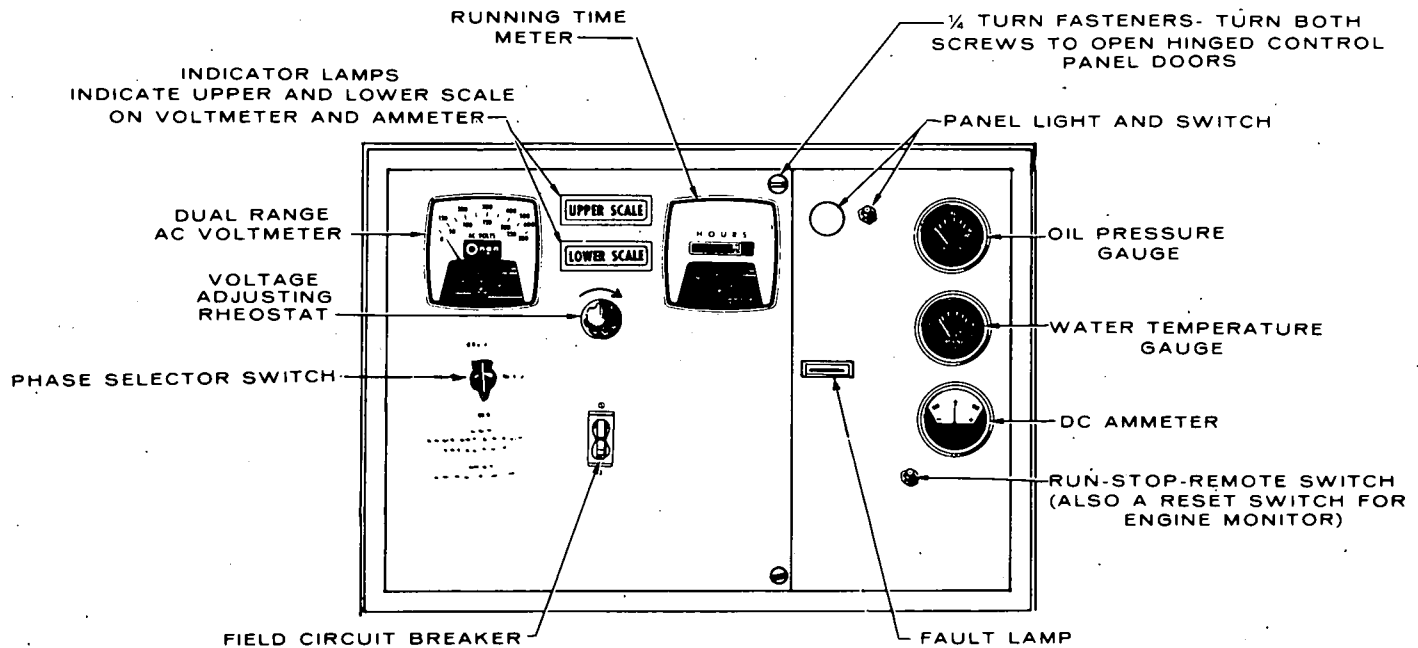


FIGURE 1. TYPICAL CONTROL PANEL (ONE FAULT LAMP)

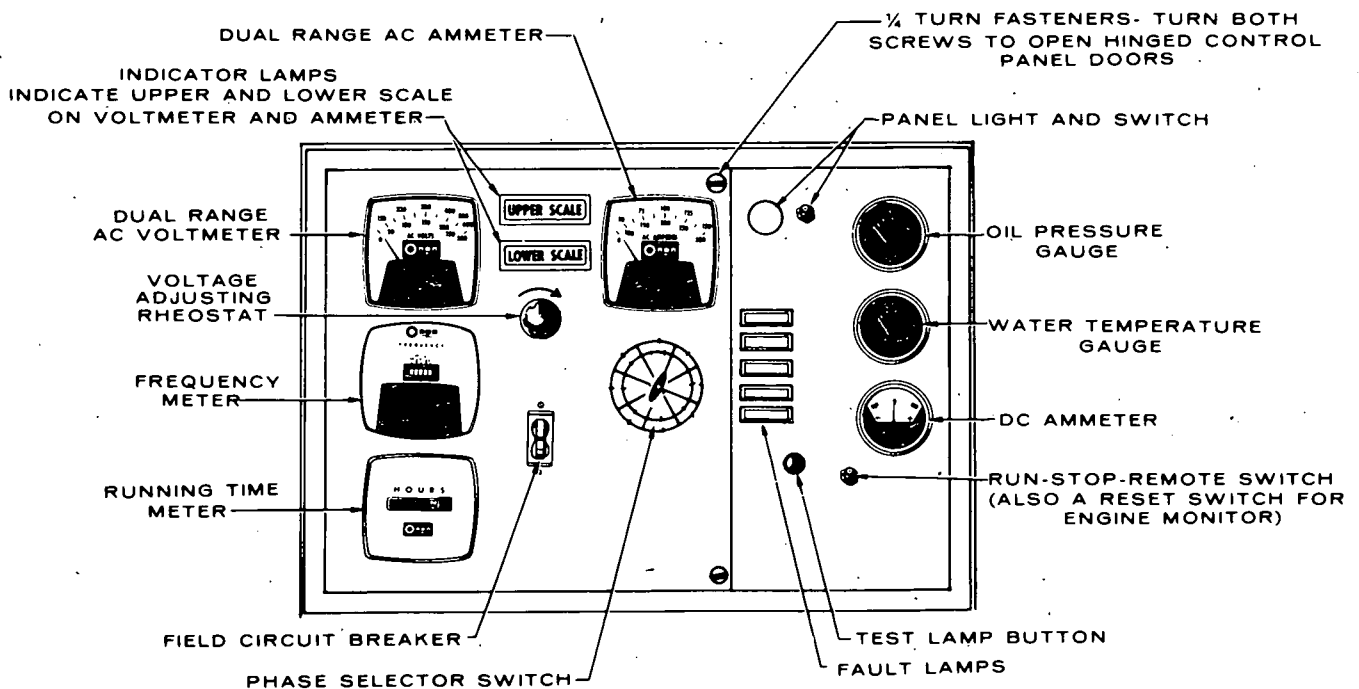


FIGURE 2. OPTIONAL CONTROL PANEL (FIVE FAULT LAMPS)

DESCRIPTION

GENERAL

An Onan DDA series electric generating set is a complete unit consisting of an engine driven AC generator, with standard and optional controls and accessories as ordered.

ENGINE

The engine on the DDA is a John Deere 4219 D as described in the engine manual. Basic measurements and requirements will be found under *Specifications*. For operation, maintenance and service information, consult the John Deere manual.

AC GENERATOR

The generator is an ONAN Type UR, 12 lead 4-pole revolving field, reconnectible, brushless unit. The main rotor is attached directly to the engine flywheel, therefore engine speed determines generator output frequency. The 60 Hz set operates at 1800 rpm, the 50 Hz at 1500 rpm. Excitation is achieved as follows—

Residual alternating current from the stator winding is applied to the voltage regulator, where it is compared with a reference voltage, rectified and returned to the field winding of the exciter. Current then induced in the exciter rotor is rectified and fed into the generator rotor. This induces a current in generator stator which is applied to the load.

CONTROL PANEL

The following is a brief description of each of the standard controls and instruments located on the face of the panel. See Figure 1.

DC Panel

Panel Light and Switch: Illuminates control panel.

Oil Pressure Gauge: Indicates pressure of lubricating oil in engine (wired to a sensor unit located on the engine).

Water Temperature Gauge: Indicates temperature of circulating coolant in engine. (Wired to a sensor unit located on the engine.)

Battery Charge Rate DC Ammeter: Indicates the battery charging current.

Run-Stop/Reset-Remote Switch: Starts and stops the unit locally or from a remote location.

Warning Light: Indicates "Fault" in engine operation.

AC Panel

AC Voltmeter: Indicates AC generator output voltage. Dual range instrument: measurement range in use shown on indicator light.

Voltmeter Phase Selector Switch: Selects phases of generator output to be measured by AC voltmeter.

Voltage Regulator: Rheostat, provides approximately plus or minus 5% adjustment of the rated output voltage.

Exciter Circuit Breaker: Provides generator exciter and regulator protection from overheating in the event of certain failure modes of the generator, exciter and voltage regulator.

Running Time Meter: Registers the total number of hours, to 1/10th that the unit has run. Use it to keep a record for periodic servicing. Time is accumulative, meter cannot be reset.

OPTIONAL EQUIPMENT

DC Panel

Warning Lights: Eliminates the one "Fault" light and substitutes five indicator lights to give warning of —

- a. Overcrank (failed to start)
- b. Overspeed
- c. Low oil pressure
- d. High engine temperature
- e. Low engine temperature

Operation of these lights will be discussed in conjunction with engine monitor panel.

AC Panel

AC Ammeter: Indicates AC generator output current. Dual range instrument: measurement range in use shown on indicator lights.

Voltmeter-Ammeter Phase Selector Switch: Selects the phases of the generator output to be measured by the AC voltmeter and AC ammeter.

Reset Switch: Manual reset for engine monitor after shut-down.

Lamp Test: Press to test warning lamp bulbs (when engine is running only).

Frequency Meter: Indicates the frequency of the generator output in hertz. It can be used to check engine speed. (Each hertz equals 30 rpm.)

CONTROL PANEL INTERIOR

The only equipment discussed in this section will be that which the operator may have reason to adjust or inspect for service.

Terminal Board (TB) 21: Connection of wire W12 to terminals H3, H4, H5, and H6 is made at this point, to change reference voltage when reconnecting generator for different voltages. Refer to Figure 14.

Voltage Regulator: Solid state unit, consisting of VR21, CR21 and L21. Controls AC output from generator at predetermined level regardless of load. Regulation plus or minus 2% from no load to full load, 0.8 P.F.

Engine Monitor: Printed circuit plug-in modules provide the following functions:

1. A 75 second cranking period.
2. Approximately a 12.5-second time delay for oil pressure buildup.
3. An external alarm contact to light a fault lamp and shut down the set for alarm conditions such as:
 - a. Overcrank (failed to start after cranking 75 seconds).
 - b. Overspeed (engine speed reaches 2100 rpm).
 - c. Low oil pressure (14 psi: 96.6 kPa).
 - x d. High engine temperature (215 °F: 102° C).

On standard control panels, all four alarms are wired into one common fault lamp; on units with five fault lamps, four have shutdown alarms, the fifth (low engine temperature) lights a fault lamp only. Refer to Table 2.

Standard Cranking Module: Limits engine cranking time to 75 seconds. If engine fails to start after 75 seconds the engine monitor lights a fault lamp and opens the cranking circuit.

OPTIONAL MODULES

Cycle Cranker: Plug-in module replaces standard cranking circuit. Automatically provides a 15-second crank time and a 10-second rest time for three ON and two OFF cycles in 65 seconds. If engine fails to start after 75-seconds the engine monitor lights a fault lamp and opens the cranking circuit.

Pre-Alarm: Gives advance warning for low oil pressure or high engine temperature. Requires two sensors each for engine temperature and oil pressure.

↑ Add caution for p9 (ENOP) (over)

Engine Sensors

TABLE 2. FAULT LAMP OPTIONS

SYSTEM	FAULT	FAULT LAMP	STOP ENGINE	EXTERNAL ALARM	PRE- ALARM
PENN STATE. SINGLE LIGHT	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x		x	
	High Engine Temperature	x		x	
STANDARD SINGLE LIGHT	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x	x	x	
	High Engine Temperature	x	x	x	
5 LIGHT	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x	x	x	
	High Engine Temperature	x	x	x	
	Low Engine Temperature	x			
5 LIGHT PRE-ALARM	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x	*	x	x
	High Engine Temperature	x	*	x	x
	Low Engine Temperature	x			

* - With additional optional sensors.

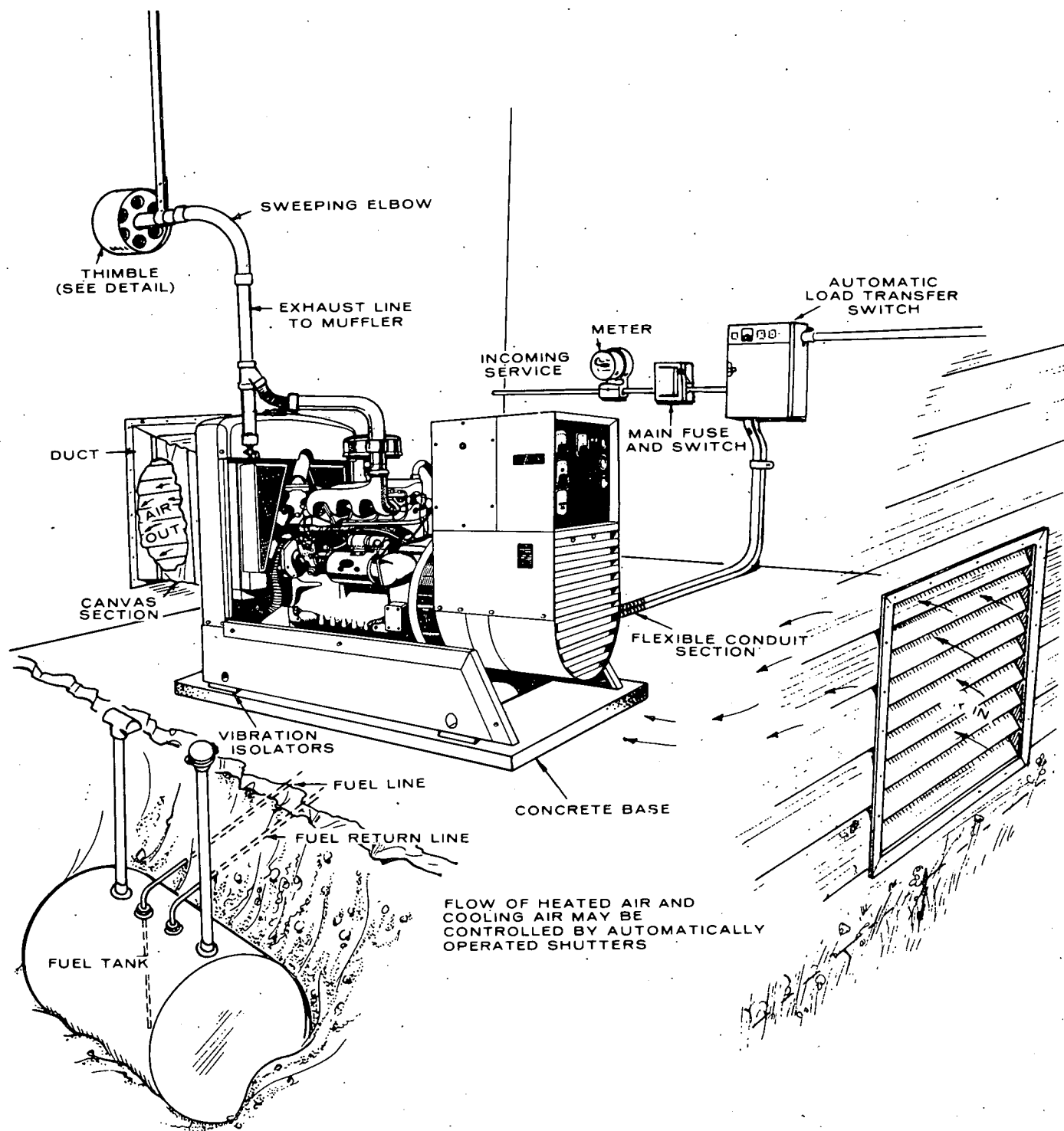


FIGURE 3. TYPICAL INSTALLATION

INSTALLATION

GENERAL

Installations must be considered individually. Use these instructions as a general guide. Meet regulations of local building codes, fire ordinances, etc., which may affect installation details. See Figure 3.

Installation points to consider include:

1. Level mounting surface.
2. Adequate cooling air.
3. Adequate fresh induction air.
4. Discharge of circulated air.
5. Discharge of exhaust gases.
6. Electrical connections.
7. Fuel connections.
8. Water connections.
9. Accessibility for operation and servicing.
10. Vibration isolation.
11. Noise levels.

LOCATION

Provide a location that is protected from the weather and is dry, clean, dust free and well ventilated. If practical, install inside a heated building for protection from extremes in weather conditions.

MOUNTING

Generating sets are mounted on a rigid skid base which provides proper support. Install vibration isolators between skid base and foundation. For convenience in draining crankcase oil and general servicing, mount set on raised pedestals (at least 6 inches high). If mounting in a trailer, or for other mobile applications, bolt securely in place. Extra support for the vehicle flooring may be necessary. Bolting down is recommended for stationary installations.

VENTILATION

Generating sets create considerable heat which must be removed by proper ventilation. Outdoor installations rely on natural air circulation but mobile and indoor installations need properly sized and positioned vents for the required air flow. See *Specifications* for the air required to operate with rated load under normal conditions at 1800 rpm.

Radiator set cooling air travels from the rear of the set to the front end. Locate the room or compartment air inlet where most convenient, preferably to the rear of the set. Make the inlet opening at least as large as the radiator area (preferably 1-1/2 times larger).

Engine heat is removed by a pusher fan which blows cooling air out through the front of the radiator. Locate the cooling air outlet directly in front of the radiator and as close as practical. The opening size should be at least as large as the radiator area. Length and shape of the air outlet duct should offer minimum restriction to air flow. Use a duct of canvas or sheet metal between the radiator and the air outlet opening. The duct prevents recirculation of heated air.

Provide a means of restricting the air flow in cold weather to keep the room or compartment temperature at a normal point.

A shelter housing with electrically operated louvres is available as an option. Transformers connected across the generator output supply current to the motors.

When the generator is operating, current in the transformers actuate the motors and open the louvres. The louvres are held open for the duration of the set operation, then are closed by return springs when the set is shut down.

City water cooled sets do not use the conventional radiator. A constantly changing water flow cools the engine. Ventilation is seldom a problem, but sufficient air movement and fresh air must be available to properly cool the generator, disperse heat convected off the engine and support combustion in the engine.

For small compartments, a duct of equal or larger area than generator outlet is recommended to remove the heated air from the generator air outlet to the outside atmosphere. Limit bends and use radius-type elbows where needed. A larger, well ventilated compartment or room does not require a hot air duct.

Installations made in a small room may require installation of an auxiliary fan (connected to operate only when the plant is running) of sufficient size to assure proper air circulation.

CITY WATER COOLING

An optional method of engine cooling, in place of the conventional radiator and fan, uses a constant pressure water supply. This is referred to as CITY WATER COOLING. There are two varieties of city water cooling: the HEAT EXCHANGER SYSTEM and STANDPIPE SYSTEM. See Figures 4 and 5.

The HEAT EXCHANGER provides for a closed engine cooling system. Engine coolant flows through a tubed chamber, keeping the coolant separate from the cool "raw" water supply. The coolant chamber must be filled for operation, as for a radiator cooled set.

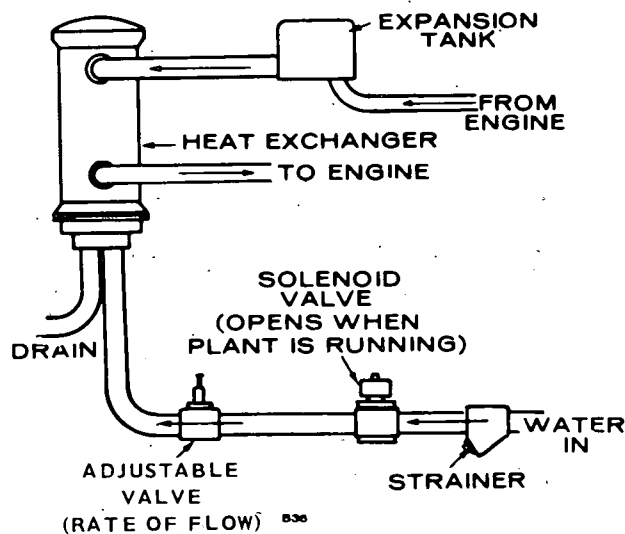


FIGURE 4. TYPICAL HEAT EXCHANGER SYSTEM

The STANDPIPE SYSTEM uses a mixing or tempering tank. Cooling water that circulates through the engine-mixes with a source of cool "raw" water. The "raw" water supply must be free of scale forming lime or other impurities.

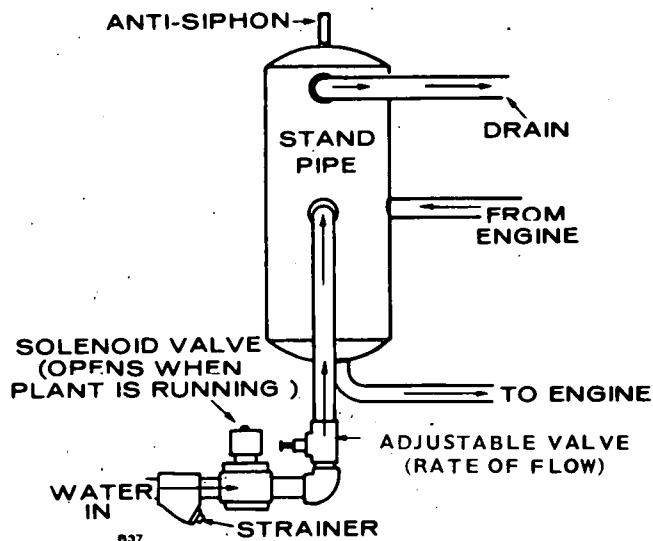


FIGURE 5. TYPICAL STANDPIPE SYSTEM

On both systems use flexible pipe for connecting water supply and outlet flow pipes to engine. Pipe the outlet flow to a convenient drain. Install an electric solenoid valve and a rate of flow valve in the water supply line. The electric solenoid valve opens and allows water flow through the system only when the plant operates. The rate of flow valve, either automatic or manual, provides for the proper flow rate to the engine. Adjust the flow to maintain water temperature between 165° F and 195° F (74° C to 91° C) while viewing the water temperature gauge.

Before filling cooling system check all hardware for security. This includes hose clamps, capscrews, fittings and connections. Use flexible coolant lines with heat exchanger, standpipe or remote mounting radiator.

WATER JACKET HEATER (Optional)

This heater is installed to maintain an elevated engine temperature in lower ambient temperature applications. It heats and circulates engine coolant, and is thermostatically controlled (Figure 19).

EXHAUST

WARNING

Inhalation of exhaust gases can result in death.

Engine exhaust gas must be piped outside building or enclosure. Do not terminate exhaust pipe near inlet vents or combustible materials. An approved thimble (Figure 6) must be used where exhaust pipes pass through walls or partitions. Pitch exhaust pipes downward or install a condensation trap (Figure 7) at the point where a rise in the exhaust system begins. Avoid sharp bends; use sweeping long radius elbows. Provide adequate support for mufflers and exhaust pipes. Refer to Figure 3 for a typical exhaust installation. Shield or insulate exhaust lines if there is danger of personal contact. Allow at least 9-inches (230 mm) of clearance if the pipes run close to a combustible wall or partition. Use a pipe at least as large as the 2-inch pipe size outlet of the engine with a flexible portion between the engine and the muffler. Do not connect a flexible line to the exhaust manifold. Minimum diameters and maximum lengths of pipe (with critical muffler) are as follows:

Single Exhaust system:

2½-inch pipe	58-feet (17.68 m)
3-inch pipe	191-feet (58.2 m)
3½-inch pipe	419-feet (128 m)

Maximum permissible exhaust restriction (back pressure is 25-inches H₂O (1.84-inches Hg: [6.23 kPa])).

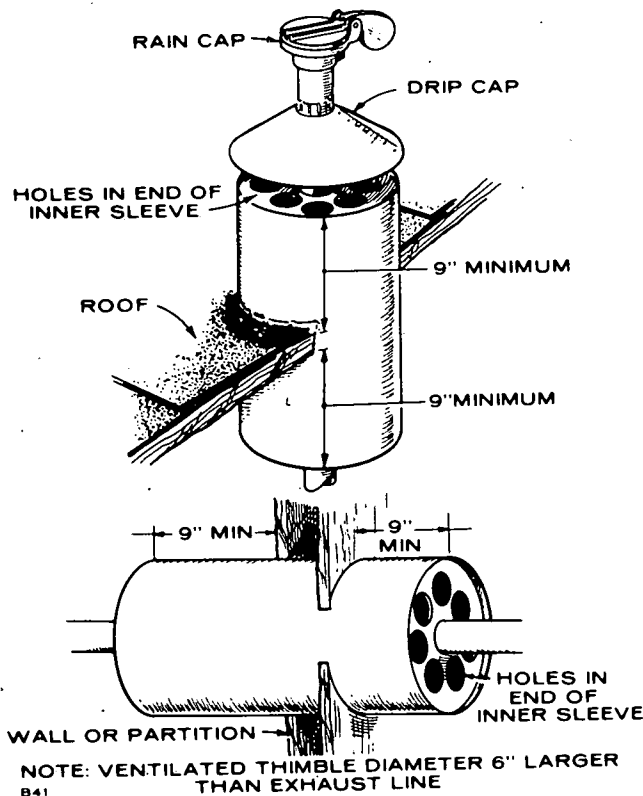


FIGURE 6. EXHAUST THIMBLE

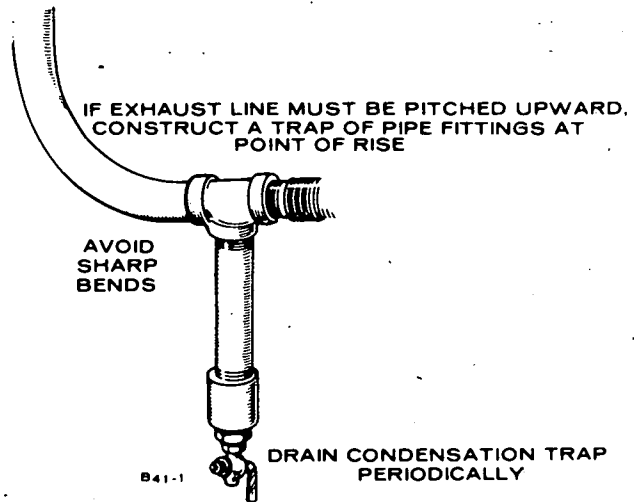


FIGURE 7. EXHAUST CONDENSATION TRAP

FUEL SYSTEM

The John Deere engines used on the DDA sets are designed for use with ASTM No.2 Diesel fuel. They will however, operate on diesel fuels within the specifications delineated in the John Deere engine manual.

FUEL CONNECTIONS

Check local regulations governing the installation of a fuel supply tank.

In any diesel engine installation, fuel system cleanliness is of utmost importance. Make every effort to prevent entrance of moisture or contaminants of any kind. Do not use lines or fittings of galvanized material.

A fuel lift in excess of 10-feet (3 m) is not recommended without a day tank installation, because of fuel drainage. Horizontal run, if the supply tank is level with the fuel pump should not exceed 25-feet (7.62 m). However, a day tank is again recommended.

The fuel inlet is to the transfer pump and is threaded for 1/8-inch pipe. Injector pump return line is common with the injectors' return line, and requires a 1/8-inch low pressure hose connection.

DAY TANK

Generator set installations may be equipped with an optional integral fuel Day tank. A float operated valve controls fuel flow into the fuel tank. The correct level is maintained to assure a constant source of fuel. It is necessary to install an overflow line between the Day tank and the main fuel tank. Refer to the installations included with the tank. See Figure 8 for an example of a Day tank installation.

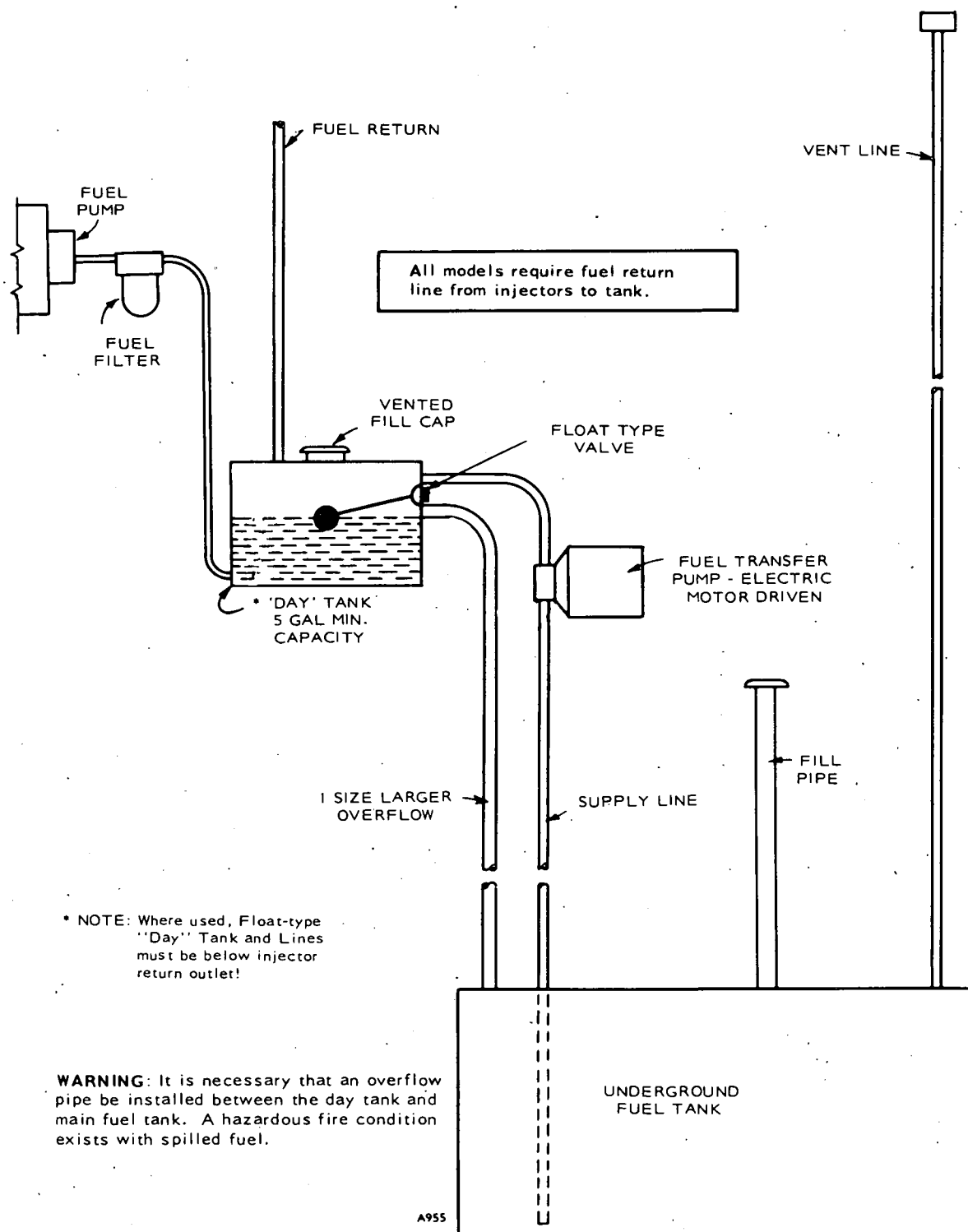


FIGURE 8. DAY TANK INSTALLATION

BATTERY

Starting the plant requires 12-volt battery current. Use two 6-volt (see specification) batteries for a normal installation. Connect the batteries in series (negative post of first battery to positive post of second) as in Figure 9. Necessary battery cables are on unit. Service the batteries as necessary. Infrequent plant use (as in emergency standby service) may allow the batteries to self-discharge to the point where they cannot start the plant. If installing an automatic transfer switch that has no built-in charge circuit, connect a separate trickle charger. Onan automatic transfer switches include such a battery charging circuit.

WARNING

Do not smoke while servicing batteries. Lead acid batteries give off explosive gases while being charged.

BATTERY, HOT LOCATION

Batteries will self discharge very quickly when installed where the ambient temperature is consistently above 90° F (32.2° C), such as in a boiler room. To lengthen battery life, dilute the electrolyte from its normal 1.260 specific gravity reading at full charge to a 1.225 reading. The cranking power is reduced slightly when the electrolyte is so diluted, but if the temperature is above 90° F (32.2° C), this should not be noticed. The lengthened battery life will be worth the effort.

1. Fully charge the battery.
2. With the battery still on charge, draw off the electrolyte above the plates in each cell. **DO NOT ATTEMPT TO POUR OFF**; use a hydrometer or filler bulb and dispose of electrolyte in a safe manner. Avoid skin or clothing contact with the electrolyte.
3. Refill each cell with distilled water, to normal level.
4. Continue charging for 1 hour at 4 to 6 amperes.
5. Test each cell. If the specific gravity is still above 1.225, repeat steps 2, 3, and 4 until the reading is reduced to 1.225. Usually, repeating steps twice is sufficient.

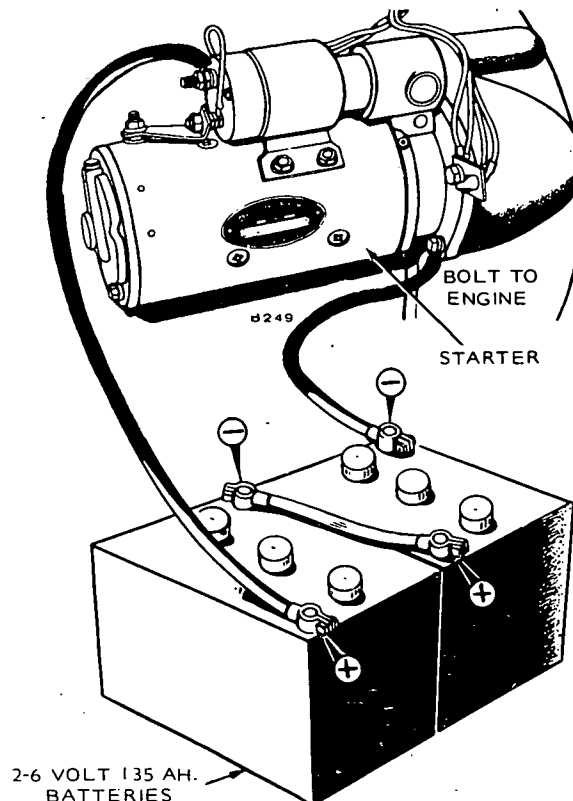


FIGURE 9. BATTERY CONNECTION

REMOTE CONTROL CONNECTIONS

Provision is made for addition of remote starting. This is accomplished on a 4 place terminal block situated within the control box. Connect one or more remote switches across remote terminal and B+ terminal as shown in Figure 10. If the distance between the set and remote station is less than 1000-feet (300 m), use No. 18 AWG wire; between 1000- and 2000-feet (600 m), use No. 16 AWG wire.

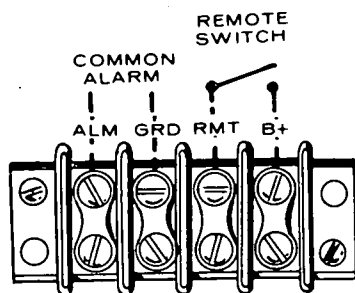
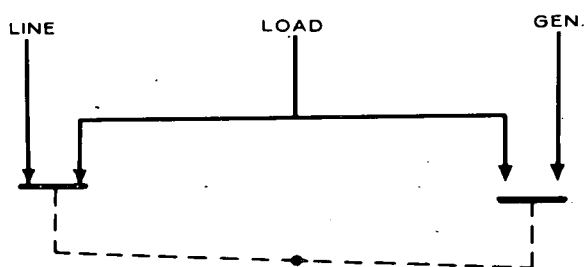


FIGURE 10. REMOTE STARTING

WIRING CONNECTIONS

Most local regulations require that wiring connections be made by a licensed electrician and that the installation be inspected and approved before operation. All connections, wire sizes, etc. must conform to requirements of electrical codes in effect at the installation site.

If the installation is for standby service, a double throw transfer switch must always be used. Connect this switch (either automatic or manual) so that it is impossible for commercial power and generator current to be connected to the load at the same time. Instructions for connecting an automatic load transfer control are included with such equipment.



NOTE: SHOWN WITH LINE CONNECTED TO LOAD.

FIGURE 11. LOAD TRANSFER SWITCH

Control Box Connections: The factory ships these 12 lead generators with load connection wires NOT connected together in the control box. These 12 wires are labeled T1 through T12 and must be brought together before making load connections. Proceed as follows:

1. Remove either right, left or top panel from control box. See Figure 12.
2. Connect wires together as shown on panel and in Figure 13 according to voltage desired.
3. Open hinged control panel doors. Connect lead from terminal 63 to correct terminal for voltage desired. These terminals are labeled H2, H3, H4, H5 and H6. See Figure 14.
4. Close front panel and secure with 1/4 turn fasteners.
5. Connect load wires to generator leads.

Preceding instructions do not apply to models with a 347/600 voltage (designated 9X) or a 120/240 voltage (designated 3R); these connections are made at the factory. The installer must only connect load wires.

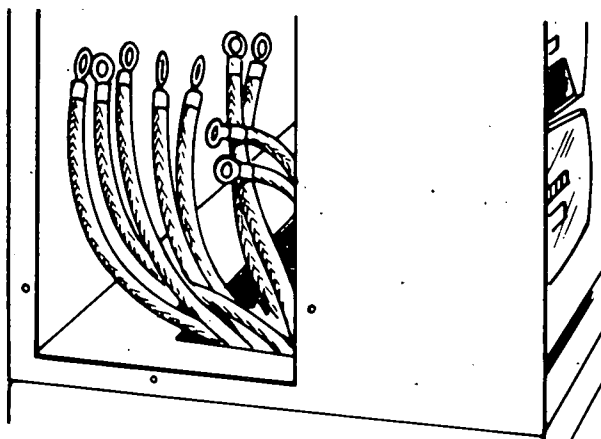


FIGURE 12. CONTROL BOX (SIDE PANEL REMOVED)

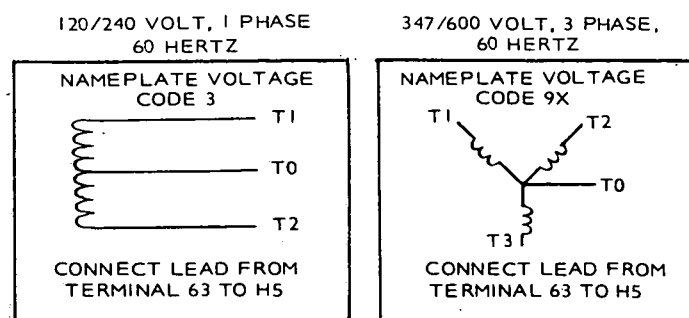
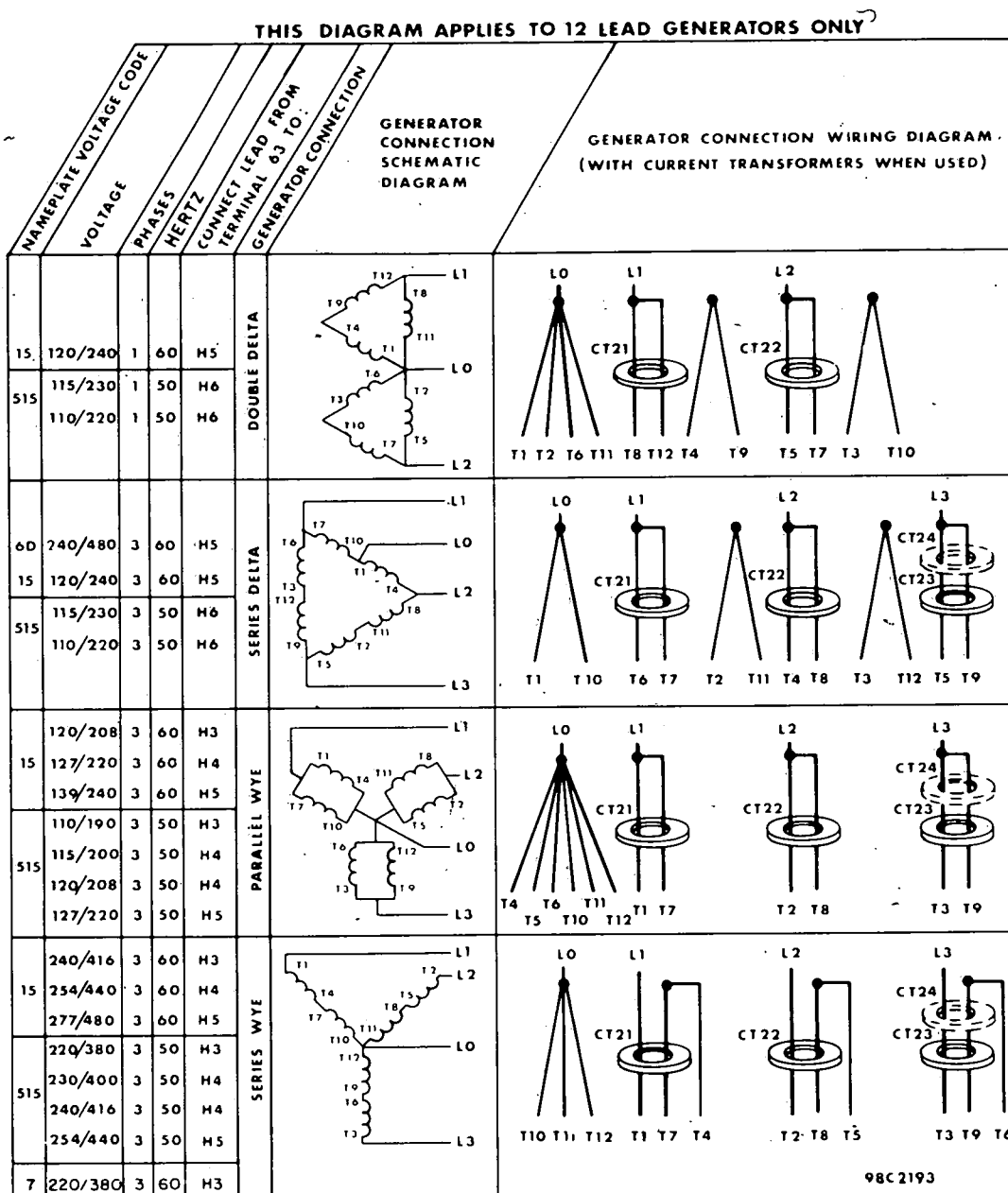


FIGURE 13. VOLTAGE CONNECTIONS

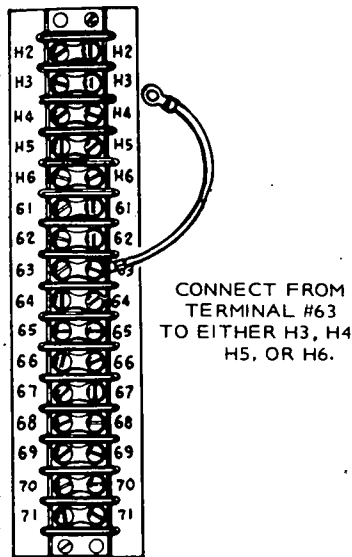


FIGURE 14. CONNECTING LEAD FROM TERMINAL 63

120/240 Volt, Single Phase, 12 Lead: Terminal connection L0 can be the ground (neutral). For 120 volts, connect the hot load wires to either the L1 or L2 connection, Figure 15. Connect the neutral load wire to the L0 connection. Two 120 volt circuits are thus available, with not more than 1/3 the rated capacity of the set available on either circuit. If using both circuits, be sure to balance the load between them.

For 240 volts, connect one load wire to the L1 connection and the second load wire to the L2 connection. Terminal connection L0 is not used for 240 volt service.

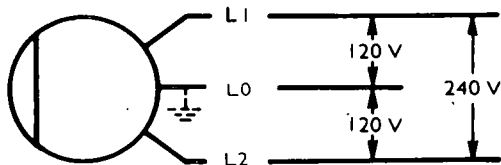


FIGURE 15. 120/240 VOLT, SINGLE PHASE, 12 LEAD

120/240 Volt, 3 Phase, 4 Wire Delta Connected Set; 12 Lead: The 3 phase Delta connected set is designed to supply 120- and 240 volt, 1 phase current and 240 volt, 3 phase current, Figure 16. For 3 phase operation, connect the three load wires to generator terminals L1, L2 and L3 — one wire to each terminal. For 3 phase operation the L0 terminal is not used.

For 120/240 volt, 1 phase, 3 wire operation, terminals L1 and L2 are the "hot" terminals. The L0 terminal is the neutral, which can be grounded if required. For 120 volt service, connect the black load wire to either the L1 or L2 terminal. Connect the neutral (white) wire to the L0 terminal. Two 120 volt circuits are available.

Any combination of 1 phase and 3 phase loading can be used at the same time as long as no terminal current exceeds the NAMEPLATE rating of the generator. If no 3 phase output is used, usable 1 phase output is 2/3 of 3 phase KVA.

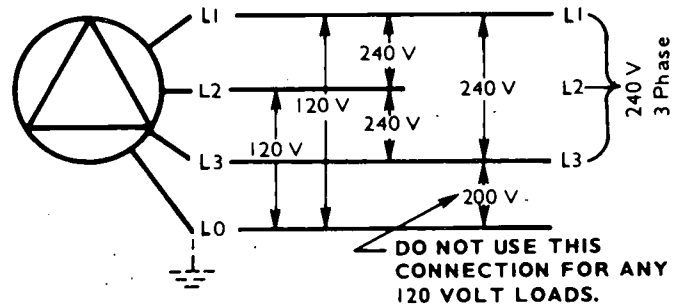


FIGURE 16. 3 PHASE, DELTA CONNECTION, 12 LEAD

3 Phase, 4 Wire, Wye Connected Set; 12 Lead: The 3 phase, 4 wire set produces line to neutral voltage and line to line voltage. The line to neutral voltage is the lower voltage as noted on the unit nameplate, and the line to line voltage is the higher nameplate voltage.

For 3 phase loads, connect separate load wires to each of the set terminals L1, L2 and L3. Single phase output is obtained between any two 3 phase terminals.

The terminal marked L0 can be grounded. For 1 phase loads, connect the neutral (white) load wire to the L0 terminal. Connect the black load wire to any one of the other three terminals — L1, L2 or L3. Three separate 1 phase circuits are available, with not more than 1/6 the rated capacity of the set from any one circuit.

If using 1 phase and 3 phase current at the same time, use care to properly balance the 1 phase load, and not to exceed rated line current.

Figure 17 shows load connections for 120/208 voltage. Other voltages are available from either parallel wye or series wye illustration in Figure 13.

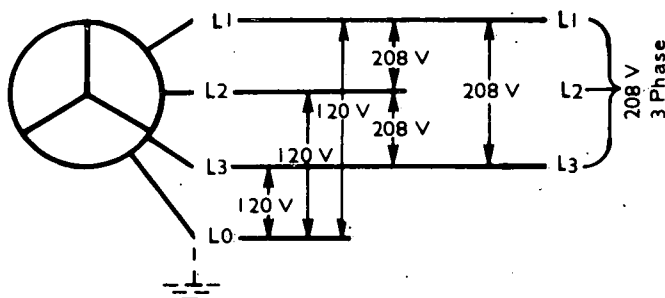


FIGURE 17. 3 PHASE, WYE CONNECTION, 12 LEAD

GROUNDING

Typical requirements for bonding and grounding are given in the National Electrical Code, 1975, Article 250.

Periodic inspection is recommended, especially after service work has been performed on equipment anywhere in the electrical system.

Generator Set Bonding and Equipment Grounding

Bonding is defined as: (Reference National Electrical Code, 1975, Article 100) The permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and capacity to conduct safely any current likely to be imposed.

WARNING

It is extremely important for life safety that bonding and equipment grounding be properly done, and that all metallic parts likely to become energized under abnormal conditions be properly grounded.

Circuit and System Grounding

This refers to the intentional grounding of a circuit conductor or conductors. The design and installation of grounding system encompasses many considerations, such as multiple transformers, standby generators, ground fault protection, physical locations of equipment and conductors, just to mention a few.

Although the consulting engineer and installer are responsible for the design and wiring of each particular grounding application, the basic grounding requirements must conform to national and local codes.

OPERATION

GENERAL

ONAN DDA Series electric generating sets are given a complete running test under various load conditions and are thoroughly checked before leaving the factory. Inspect your unit closely for loose or missing parts and damage which may have occurred in transit. Tighten loose parts, replace missing parts and repair any damage before putting set into operation.

PRESTART SERVICING

Lubrication System: Engine oil was drained prior to shipment. Fill engine to capacities shown. After engine has been run, check dipstick, add oil to bring level to full mark. Record total capacity for future oil changes. Do not mix brands or grades of lubricating oils.

AMBIENT TEMPERATURE	SINGLE VISCOSITY	MULTI-VISCOSITY
Below -10°F (-23°C)	SAE 5W	SAE 5W20
Between -10°F and 32°F (-23°C and 0°C)	SAE 10W	SAE 10W30
Above 32°F (0°C)	SAE 30	Not Recommended
Use oil conforming to these specifications	API CD/SD MIL-L-2104C* Series 3*	API CC/SE, CC/SD or SD MIL-L-46152

*API CC or CD

Oil capacities (nominal)

Oil Pan and Filter — 9 quarts (8.6 litres)

Cooling System: Cooling system was drained prior to shipment. Fill cooling system before starting. Nominal capacity is 4.25 gallons (16.1 litres). For units using either a radiator or heat exchanger (city water cooled), fill the system with clean soft water. Use a good rust and scale inhibitor additive. If a possibility exists of a radiator cooled set being exposed to freezing temperatures use anti-freeze with an ethylene-glycol base. During initial engine run, check the coolant level several times and replenish if necessary to compensate for air pockets which may have formed during filling. Refer to John Deere engine manual for additional information.

CAUTION

1. Verify that the electric solenoid valve used with city water cooled plants is open before initial starting of plant to allow coolant chambers to fill. Overheating and damage to the engine could result from non-compliance.

2. If engine is equipped with a cooling system filter, do not use antifreeze with an anti-leak formula. The stop leak element can prevent or retard the coolant flow through the filter, thereby eliminating the filtering process completely.

3. Be careful when checking coolant under pressure. It is advisable to shut engine down and bleed off pressure before removing pressure cap. Severe burns could result from contact with hot coolant.

Fuel System: Refer to the John Deere engine manual for fuel oil specifications. Check with fuel supplier and ensure that fuel supplied meets the specifications. Filter or strain fuel when filling tank. Fuel supply tanks should be kept as nearly full as possible by topping up each time engine is used. Warm fuel returning from the injector pump heats the fuel in the supply tank. If the fuel level is low in cold weather, the upper portion of the tank not heated by returning fuel tends to increase condensation. In warm weather both the supply tank and fuel are warm. Cool night air lowers the temperature of the tank more rapidly than the temperature of the fuel. Again this tends to increase condensation.

Condensate mixing with the sulphur in the fuel forms a sulphurous acid which will corrode and damage the engine. KEEP FUEL CLEAN.

WARNING

DO NOT SMOKE while handling fuel. Diesel fuel is flammable.

Priming Fuel System: Verify that all connections in the fuel system are secure and no leaks exist. Proceed with priming as follows:

1. Loosen bleed plug on top of fuel filter. Pump primer lever (Figure 18) until a solid stream of fuel, free of air bubbles, flows from bleed plug.
2. Secure bleed plug.
3. Loosen inlet fuel line on injector pump. Operate primer lever on fuel transfer pump until a solid stream of fuel, free of air bubbles, flows from inlet line opening.
4. Secure injector pump fuel inlet line.
5. Leave fuel transfer pump priming lever at lowest point of stroke.

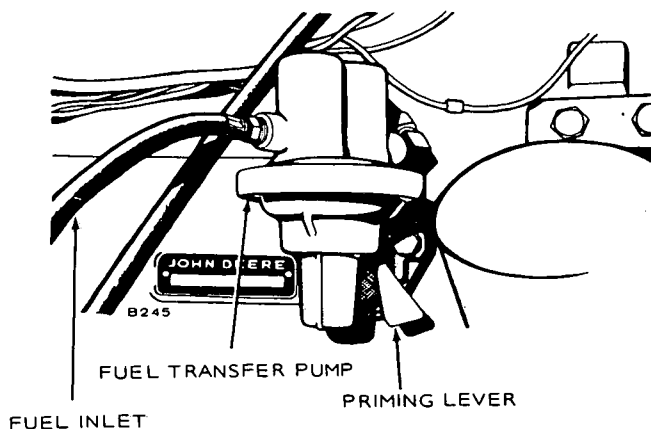


FIGURE 18. PRIMING FUEL SYSTEM

If the primer lever will not pump and no resistance is felt at upper end of stroke, turn engine over with starter to change position of fuel pump drive lobe on camshaft.

Check all connections in fuel system for security, to ensure that pressure will not bleed off when engine is not in use. Pressure should be maintained for immediate starting if unit is on standby service.

BATTERIES

Ensure that the cable connections to the batteries are secure. Coat connections with petroleum based or non-conductive grease to retard formation of corrosive deposits.

Check level of electrolyte to be at split ring mark. Measure specific gravity of electrolyte: SG 1.260 at 80°F (26.7°C). If distilled water has been added or specific gravity is less than 1.260, place batteries on charge until desired reading is reached. Do not over charge.

STARTING

When the preceding service functions have been performed, recheck to verify unit is ready to start.

1. Crankcase filled.
2. Cooling system filled — input solenoid valve open.
3. Batteries charged and connected.
4. Fuel solenoid valve open.

To start, move the "run-stop/reset-remote" switch to the "run" position. The engine should start after a few seconds of cranking. Immediately after start, observe the oil pressure gauge. Normal oil pressure is between 45 and 65 psi (310.5 and 448.5 kPa). Check the following gauges:

1. DC Ammeter — 10 to 30 amperes.
2. AC Voltmeter — AC generator output voltage.
3. Frequency Meter — AC generator output frequency.

After running 10 minutes under load the water temperature gauge should have stabilized at 180° to 195° F (82.2° C to 90.6° C). On city water cooled units an adjustable valve is connected in the water supply line. Adjust the hand wheel valve to provide a water flow that will keep the water temperature gauge reading within the range of 180° F to 220° F (82.2° C to 104.4° C).

STOPPING

To reduce and stabilize engine temperatures, run the engine at no load for three to five minutes before shutting down.

Move the run-stop/reset-remote switch to stop position to shut down the set.

Break-In Note: Run set at 50 percent rated load for the first half-hour of initial operation after reaching operating temperature.

Non-Start: If after a few seconds of cranking, engine fails to start, or starts and runs then stops and fault lamp lights, refer to appropriate troubleshooting chart, Table 3 or Table 4.

NO LOAD OPERATION

Periods of no load operation should be held to a minimum. If it is necessary to keep the engine running for long periods of time when no electric output is required, best engine performance will be obtained by connecting a "dummy" electrical load. Such a load could consist of heater elements, etc.

EXERCISE PERIOD

Generating sets on continuous standby service are required to be operative at essential loads from a cold start in a short period of time in the event of a power outage.

This imposes severe conditions on the engine. Friction of dry piston rings upon dry cylinder walls causes scuffing and rapid wearing. These can be relieved by exercising the set at least once a week for a minimum time of 30-minutes per exercise period. Preferably, run the set under at least 50 percent load to allow the engine to reach normal operating temperature. This will keep engine parts lubricated, maintain fuel prime, prevent electrical relay contacts from oxidizing and insure easy emergency starts. ONAN automatic transfer switches contain an optional exercise switch which, by pre-selection, will start, determine run period and shut down a set on a weekly frequency. For example, the switch can be set for time of start, length of run, A.M. or P.M. and day of week.

After each exercise period, top up fuel tank, check engine for leaks and unit for general condition. Locate cause of leaks (if any) and correct.

TABLE 3.
TROUBLESHOOTING ENGINE SHUTDOWN SYSTEM
(Engines with only one fault lamp)

SYMPTOM	CORRECTIVE ACTION
1. Engine stops cranking and fault lamp lights, after cranking approximately 75 seconds.	1. See engine service manual for troubleshooting fuel system. After correcting problem, reset engine monitor relay by placing Run-Stop/Reset-Remote switch to Stop/Reset, then back to the required running position.
2. Fault lamp lights immediately after engine starts.	2. Check for: Overspeed condition as engine starts.
3. Fault lamp lights and engine shuts down after running for a period.	3. Check the following: a. Oil level. Engine will shut down if sensor is closed. b. Check engine manual for troubleshooting oil system. c. High engine temperature. Check coolant level; check water flow (city water cooled systems); check radiator for free air flow, and fan belts for tightness. See engine manual for troubleshooting cooling system. d. Check for faulty oil pressure sensor or faulty high engine temperature sensor.
4. Engine runs, shuts down and cranks for 75-seconds. Cranking cycle stops; fault lamp lights.	4. Check fuel supply.
5. Fault lamp lights, no fault exists.	5. To check a no-fault condition, disconnect leads from TB11 terminals 29, 30 and 31. If fault lamp lights with leads disconnected, replace engine monitor board. Reconnect leads.

TABLE 4.
TROUBLESHOOTING ENGINE SHUTDOWN SYSTEM
(Units with five fault lamps)

SYMPTOM	CORRECTIVE ACTION
1. Overcrank fault lamp lights and engine stops cranking after approximately 75-seconds.	1. See engine service manual for troubleshooting fuel system. After correcting fault, reset engine monitor relay by placing Run-Stop/Reset-Remote switch to Stop/Reset position, depressing Reset button, then to the required running position.
2. Engine runs, shuts down, cranks for 75-seconds, cranking cycle stops, overcrank light ON.	2. Check fuel supply.
3. *Low oil pressure shutdown.	3. Check— a. Oil level. Replenish if necessary. b. Sensor. Faulty sensor will shut down engine. c. Refer to engine service manual for troubleshooting guide for oil system.
4. *High engine temperature shutdown.	4. Check— a. Coolant level. Replenish if necessary. b. City water cooled sets. Check water flow, valves, etc. c. Check sensor; check thermostat. d. Radiator model, check fan belts, radiator for obstructions, etc.
5. Overspeed shutdown.	5. Check governor and throttle linkages for freedom of movement. Check overspeed switch.
6. Overspeed light on, no shutdown.	6. Disconnect wire at TB11-29. Light on after reset; replace engine monitor board.
7. *Low oil pressure light ON. No shutdown.	7. Disconnect wire at TB11-30. Light ON after relay reset. Replace engine monitor board.
8. *High engine temperature light ON. No shutdown.	8. Disconnect wire at TB11-31. Light ON after relay reset. Replace engine monitor board.

*NOTE: Not applicable on Pennsylvania State models.

HIGH ALTITUDE

Ratings apply to altitudes up to 1000 feet (305 metres), standard cooling, normal ambients and with No. 2 Diesel fuel. Consult factory or nearest authorized Onan distributor for operating characteristics under other conditions.

Engine horsepower loss is approximately 3 percent for each 1000 feet of altitude above sea level for a naturally aspirated engine. Use lower power requirement at high altitudes to prevent smoke, over-fueling and high temperatures.

HIGH TEMPERATURES

1. See that nothing obstructs air flow to-and-from the set.
2. Keep cooling system clean.
3. Use correct SAE No. oil for temperature conditions.

LOW TEMPERATURES

1. Use correct SAE No. oil for temperature conditions. Change oil only when engine is warm.
2. Use fresh fuel. Protect against moisture condensation.
3. Keep fuel system clean and batteries in a well charged condition.
4. Partially restrict cool air flow but use care to avoid overheating.
5. Connect water jacket heater when set is not running.
6. Refer to John Deere manual for further information.

Water Jacket Heater: The function of this optional heater is to keep the engine warm enough to assure starting under adverse weather conditions. Connect the heater to a source of power that will be on during the time the engine is not running. Be sure the voltage rating is correct for the heater element rating (Figure 19).

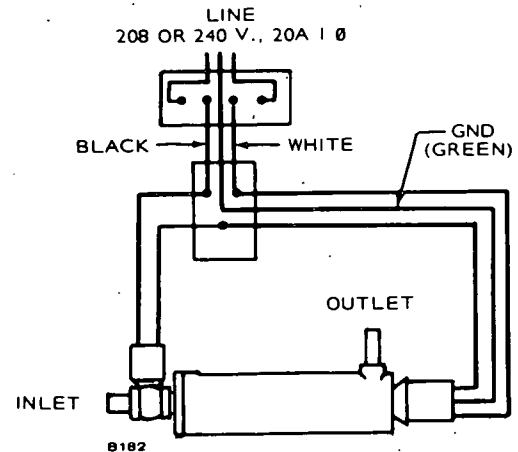


FIGURE 19. ENGINE HEATER

OUT OF SERVICE PROTECTION

For storage of all durations, refer to the John Deere engine manual.

GENERAL MAINTENANCE

GENERAL

Follow a definite schedule of inspection and servicing, based on operating hours. Keep an accurate logbook of maintenance, servicing, and operating time. Use the running time meter to keep a record of operation and servicing. Service periods outlined in Table 5 are recommended for normal service and operating conditions. For continuous duty, extreme temperature, etc., service more frequently.

A set on stand-by duty will need servicing at times other than those recommended by Onan and the engine manufacturer. These maintenance service periods will vary according to set site or location and

application. Consult with your Onan distributor or dealer for a schedule of maintenance and service more suitable to the unique environment and application of your set.

CAUTION

When changing oil filters, it is important that the replacement filter is a bypass type. Failure to use a bypass filter could cause the filter material to rupture during heavy pressures on cold starts, resulting in non-filtered oil and subsequent engine damage.

WARNING

Before commencing any maintenance work on the engine, generator, control panel, automatic transfer switch or associated wiring, disconnect batteries. Failure to do so could result in damage to the unit or serious personal injury in the event of inadvertent starting.

TABLE 5. OPERATOR MAINTENANCE SCHEDULE

MAINTENANCE ITEMS	MAINTENANCE PERIOD						
	10 hrs.	50 hrs.	100 hrs.	200 hrs.	500 hrs.	1000 hrs.	6 mths.
Inspect plant	x						
Check coolant level	x						
Check oil level	x						
Air cleaner	x1						
Fuel filter	x						
Batteries		x					
Alternator and fan belt			x2				
Engine crankcase - drain - refill			x1				
Crankcase oil filter			x1				
Crankcase vent tube					x		
Valve tappets					x		
Hoses					x		
Injection pump - check timing						x	
Injection nozzles						x	
Fuel filter - change						x	
Starter						x	
Cooling system - drain, flush, refill							x3
Clean and inspect battery charging alternator				x			
Air cleaner - replace			x				

x1 - or every 3 months, perform more often in extremely dusty conditions.

x2 - or every 3 months. Adjust to 3/4 depression with 20 pounds force.

x3 - More often in extremely dusty conditions.

NOTE: The above schedule is a minimum requirement for your engine.

Refer to the John Deere service manual for recommended service periods.

ENGINE SPEED

Generator frequency is in direct ratio to engine speed, which is controlled by the Governor.

A Roosa-Master governor is standard equipment on the DDA generator set. High speed and low speed limit stops are set at the ONAN testing facility and normally do not require further adjustment, therefore if your set is used on continuous standby service, the governor may never need to be touched. If however the unit is used frequently, adjustment may be required due to wear of internal components. This adjustment is achieved by backing off the high speed stop screw. Screw in the low speed adjusting screw until the generator output frequency meter reads 60 Hz (generator on load). Turn in the high speed adjusting screw until it bottoms; secure the locknuts.

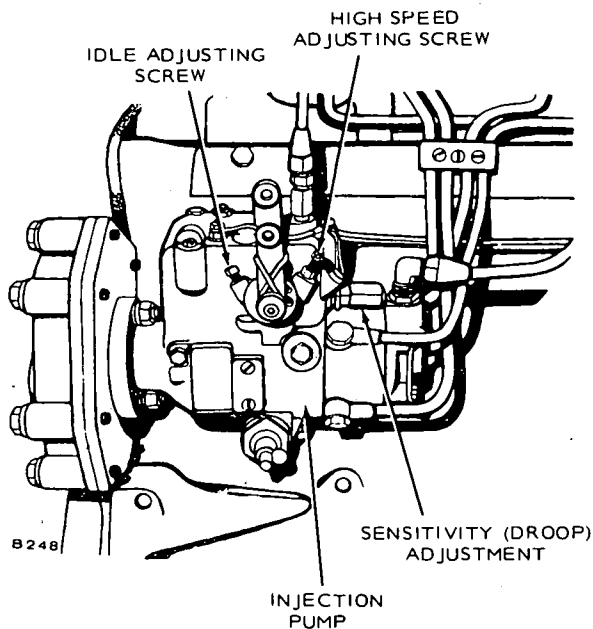


FIGURE 20. ROOSA-MASTER GOVERNOR

Governor sensitivity is adjusted by rotating an external knurled knob at the rear of the injector pump housing. Turning inward (clockwise) shortens governor control spring making it less sensitive, thereby increasing speed droop. Turning outward (counterclockwise) has opposite effect. Adjustment can be made with engine running. The speed droop is set at the ONAN plant to give a regulation of 3 percent to 5 percent from no-load to full-load.

When using the generator frequency meter to determine engine speed, multiply frequency by 30 to calculate engine speed.

Example: $30 \times 61 \text{ (Hz)} = 1830 \text{ rpm}$.

Adjust engine speed to 1800 rpm for 60 Hertz sets and 1500 rpm for 50 Hertz sets.

AC GENERATOR

There are no brushes, brush springs or collector rings on these generators, therefore they require very little servicing. Periodic inspections, to coincide with engine oil changes, will ensure good performance.

Generator Bearing: Inspect the bearing every 1000 hours with the unit running.

If using the unit for "prime power", replace the bearing every 10,000 hours or two years. If using the set for "standby", replace the bearing every five years.

Check generator voltage. It may be necessary to make a slight readjustment of the voltage rheostat to obtain the preferred voltage at average load.

INSPECTION AND CLEANING

When inspecting the rotating rectifier assembly, make sure diodes are free of dust, dirt and grease. Excessive foreign matter on these diodes and heat sinks will cause the diodes to overheat and will result in their failure. Blow out the assembly periodically, with filtered, low pressure air. Also check to see that diodes and leadwires are properly secured.

BATTERIES

Check the condition of the starting batteries at least every two weeks. See that connections are clean and tight. A light coating of non-conductive grease will retard corrosion at terminals. Keep electrolyte at the proper level above the plates by adding distilled water. Check specific gravity, recharge if below 1.260.

CONNECTIONS (Fuel, Exhaust, etc.)

Operator should periodically make a complete visual inspection of the set while running at rated load. Some of the things to check for are as follows:

1. Check all fuel and oil lines for possible leakage.
2. Inspect exhaust lines and mufflers for possible leakage and cracks.
3. Periodically or daily, drain moisture from condensation traps.
4. Inspect water lines and connections for leaks and security.
5. Inspect electrical wires and connections for security and fray damage.

If generator requires major repair or servicing, contact an authorized Onan dealer or distributor.

TANK HEATERS (Optional)

A Kim Tank Heater is optional equipment on the DDA generator set. For efficient operation and optimum product life, perform the following procedure at least once a year (Figure 21):

1. Remove head and valve assembly.
2. Clean foreign matter out of the tank.
3. Remove element and scrape off scale accumulated on the sheathing.

CAUTION

When reassembling threaded aluminum parts, be sure to use anti-seize compound.

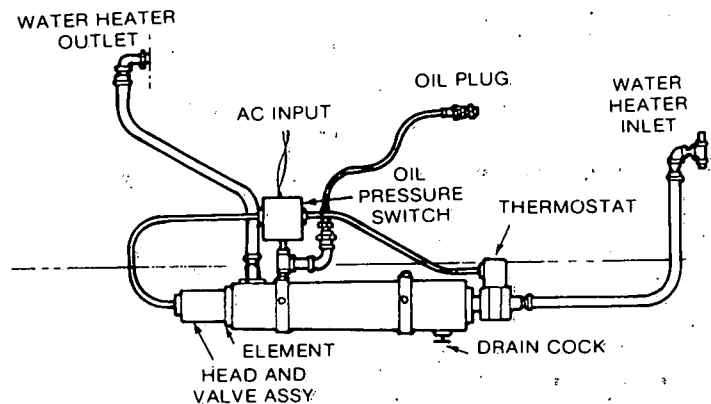
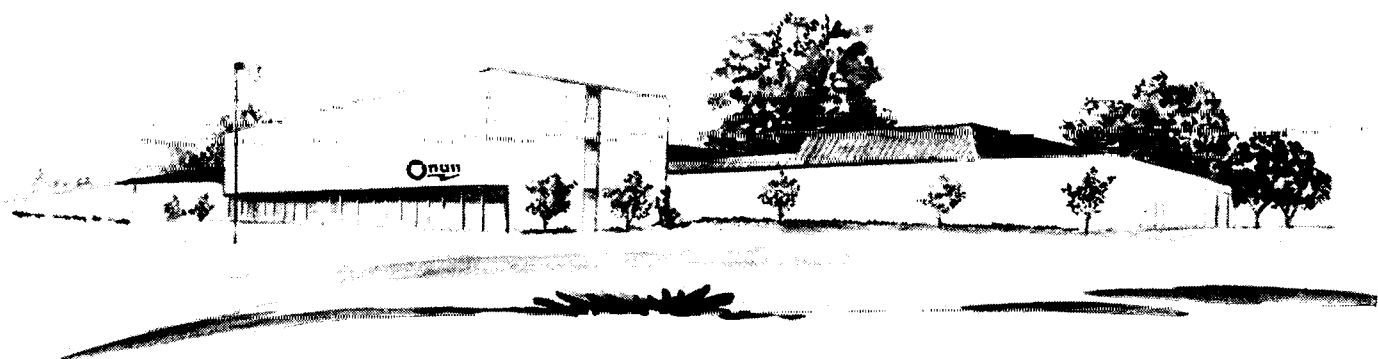


FIGURE 21. ENGINE HEATER



ONAN 1400 73RD AVENUE N.E. • MINNEAPOLIS, MINNESOTA 55432
A DIVISION OF ONAN CORPORATION



McGRAW-EDISON

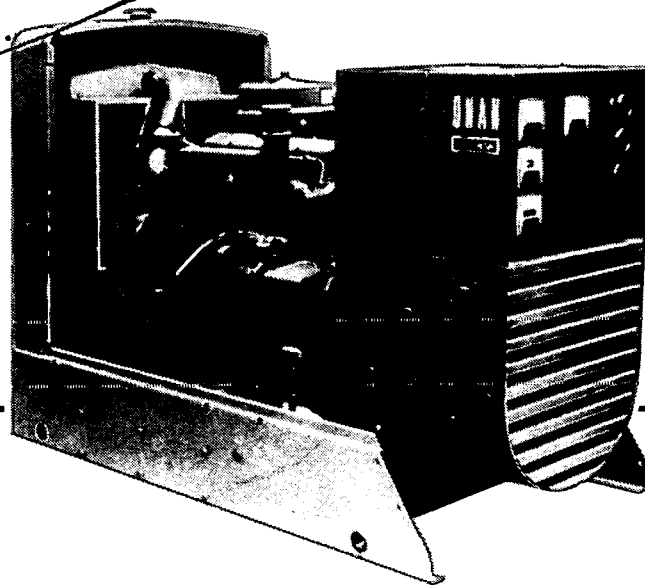
Onan

Operators Manual

SERIES

DDA
GenSet

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LITERATURE SECTION
RETURN TO FILE
TECH. PUB. DEPT.



944-0121
12-80
(SPEC D)

Printed in U.S.A.

Safety Precautions

The following symbols in this manual signal potentially dangerous conditions to the operator or equipment. Read this manual carefully. Know when these conditions can exist. Then, take necessary steps to protect personnel as well as equipment.

Read your manual and become thoroughly acquainted with it and your equipment before you start your unit. These recommendations and the following safety precautions are for your protection.

Fuels, electrical equipment, batteries, exhaust gases and moving parts present potential hazards that could result in serious, personal injury. Take care in following these recommended procedures.

WARNING

This symbol is used throughout this manual to warn of possible serious personal injury or death.

CAUTION

This symbol refers to possible equipment damage.

General

- Keep your electric generating set and the surrounding area clean and free from obstructions. Remove any debris from set and keep the floor clean and dry.
- Provide appropriate fire extinguishers and install them in convenient locations. Consult your local fire department for the correct type of extinguisher to use. Do not use foam on electrical fires. Use extinguisher rated ABC by NFPA.
- Make sure that all fasteners on the generating set are secure. Tighten supports and clamps, keep guards in position over fans, driving belts, etc.
- Do not wear loose clothing in the vicinity of moving parts, or jewelry while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts; cause shock or burning.
- If adjustment *must* be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.
- Do not work on this equipment when mentally or physically fatigued.
- Coolants under pressure have a higher boiling point than water. DO NOT open a radiator or heat exchanger pressure cap while the engine is running. Bleed the system pressure first.

Protect Against Moving Parts

- Keep your hands away from moving parts.

- Before starting work on the generating set, disconnect batteries. This will prevent starting the set accidentally.

Fuel System

- DO NOT fill fuel tanks while engine is running, unless tanks are outside engine compartment. Fuel contact with hot engine or exhaust is a potential fire hazard.
- DO NOT SMOKE OR USE AN OPEN FLAME in the vicinity of the generator set or fuel tank. Internal combustion engine fuels are highly flammable.
- Fuel lines must be of steel piping, adequately secured, and free from leaks. Piping at the engine should be approved flexible line. Do not use copper piping on flexible lines as copper will work harden and become brittle.
- Be sure all fuel supplies have a positive shutoff valve.

Guard Against Electric Shock

- Remove electric power before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages cause injury or death. DON'T tamper with interlocks.
- Follow all state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches.
- DO NOT SMOKE while servicing batteries. Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.

Exhaust Gases Are Toxic

- Provide an adequate exhaust system to properly expel discharged gases. Inspect exhaust system daily for leaks per the maintenance schedule. Ensure that exhaust manifolds are secure and not warped. Do not use exhaust gases to heat a compartment.
- Be sure the unit is well ventilated.

Keep the Unit and Surrounding Area Clean

- Make sure that oily rags are not left on or near the engine.
- Remove all oil deposits. Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and subsequent engine damage and may present a potential fire hazard.

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WARNING

ENGINE EXHAUST GAS (CARBON MONOXIDE) IS DEADLY!

Carbon monoxide is an odorless, colorless gas formed by incomplete combustion of hydrocarbon fuels. Carbon monoxide is a dangerous gas that can cause unconsciousness and is potentially lethal. Some of the symptoms or signs of carbon monoxide inhalation are:

- Dizziness
- Intense Headache
- Weakness and Sleepiness
- Vomiting
- Muscular Twitching
- Throbbing in Temples

If you experience any of the above symptoms, get out into fresh air immediately.

The best protection against carbon monoxide inhalation is a regular inspection of the complete exhaust system. If you notice a change in the sound or appearance of exhaust system, shut the unit down immediately and have it inspected and repaired at once by a competent mechanic.

Introduction

FOREWORD

This manual is applicable to the DDA Series electric generating set, consisting of an Onan UR 30.0KW AC generator, driven by a John Deere 4219D diesel engine. Information is provided on installation, operation, troubleshooting and parts ordering for the set. The manual should be used in conjunction with the John Deere engine manual, as your specific engine may have variations due to optional equipment available.

MODEL IDENTIFICATION

Identify your model by referring to the MODEL and SPECIFICATION NO. as shown on the Onan nameplate. Electrical characteristics are shown on the lower portion of the nameplate.

30.0	DDA	15R	/	1	D
1	2	3		4	5

1. Indicates kilowatt rating.
2. Factory code for SERIES identification.
3. 15 = 60 Hz. Reconnectible
515 = 50 Hz. Reconnectible
R—Indicates remote starting feature.
4. Factory code for designating optional equipment.
5. Specification letter. (Advances when factory makes production modifications.)

If it is necessary to contact a dealer or the factory regarding the set, always mention the complete Model, Spec No. and Serial No. as given on the Onan nameplate. This nameplate information is necessary to properly identify your unit among the many types manufactured. Refer to the engine nameplate when requesting information from its manufacturer. The Onan nameplate is located on the right side of the generator; the John Deere nameplate is on the left side, on the engine block.

Left side and right side are considered when viewed from the engine or front end of the generating set.

Specifications

ENGINE DETAILS

Engine Manufacturer	John Deere
Engine Series	300-4219D
Number of Cylinders	4
Displacement	219 cu. inch (3.59 litres)
BHP @ 1800 rpm	58 (43.27 kW)
Compression Ratio	16.3:1
Bore	4.02 inches (102.11 mm)
Stroke	4.33 inches (109.98 mm)
Fuel	ASTM No. 2 Diesel
Battery Voltage	12
Battery Group (Two 6-Volt, 135-A.H. [486 kC])	2H
Starting Method	Solenoid Shift
Governor Regulation	5% No Load—Full load
Battery Charging Current	35

GENERATOR DETAILS

Type	UR 15, 60 Hz UR 515, 50 Hz UR 3, 60 Hz
Rating (Watts)	
60 Hertz Continuous Standby	30,000 (37.5 kVA)
50 Hertz Continuous Standby	25,000 (31.25 kVA)
AC Voltage Regulation	±2%
60 Hertz	1800 rpm
50 Hertz	1500 rpm
Output Rating	0.8 PF
AC Frequency Regulation	3 Hz

CAPACITIES AND REQUIREMENTS

Cooling System (Includes Radiator)	4.25 gal. (16.1 litre)
Engine Oil Capacity (Filter, Lines, Crankcase)	9 qt. (8.6 litre)
Exhaust Connection (inches pipe thread)	2

AIR REQUIREMENTS (1800 rpm)

Engine Combustion	135 CFM (0.06 m ³ /s)
Radiator Cooled Engine	3875 CFM (1.83 m ³ /s)
Total for Radiator Cooled Model	4010 CFM (1.9 m ³ /s)
Alternator Cooling Air	
(1800 rpm)	1000 CFM (0.47 m ³ /s)
(1500 rpm)	834 CFM (0.4 m ³ /s)
Fuel Consumption at Rated Load	2.50 Gallon/Hr. (9.5 lit/hr)

GENERAL

Height	45.5 inches (1.16 m)
Width	33.0 inches (0.838 m)
Length	66.0 inches (1.8 m)
Approx. Weight (Mass)	1780 lbs. (799 kg)

TABLE 1. UR GENERATOR VOLTAGE/CURRENT OPTIONS

VOLTS	FREQ.	PHASE	AMPERES	DOUBLE DELTA	SERIES DELTA	PARALLEL WYE	SERIES WYE	REF. VOLTAGE WIRE (W12) TAP
110/220	50 Hz	1	142*	x				H6
115/230	50 Hz	1	136*	x				H6
120/240	60 Hz	1	156*	x				H5
110/190	50 Hz	3	94			x		H3
115/200	50 Hz	3	90			x		H4
120/208	60 Hz	3	104			x		H4
110/220	50 Hz	3	82		x			H6
127/220	60 Hz	3	98			x		H4
115/230	50 Hz	3	78		x			H6
120/240	60 Hz	3	90		x			H5
139/240	60 Hz	3	90			x		H5
220/380	50 Hz	3	47				x	H3
230/400	50 Hz	3	45				x	H4
240/416	60 Hz	3	52				x	H4
254/440	60 Hz	3	49				x	H5
277/480	60 Hz	3	45				x	H5
9X 347/600	60 Hz	3	36					H5 — Not Reconnectible
3 120/240	60 Hz	1	156					Not Reconnectible
53 115/230	50 Hz	1	136					Not Reconnectible

30.0 kW 37.5 kVA 60 Hz
25.0 kW 31.25 kVA 50 Hz

- These current values are available only from special long stack units. When standard 3-phase unit is reconnected into Double Delta configuration, maximum current is 2/3 that of value given.

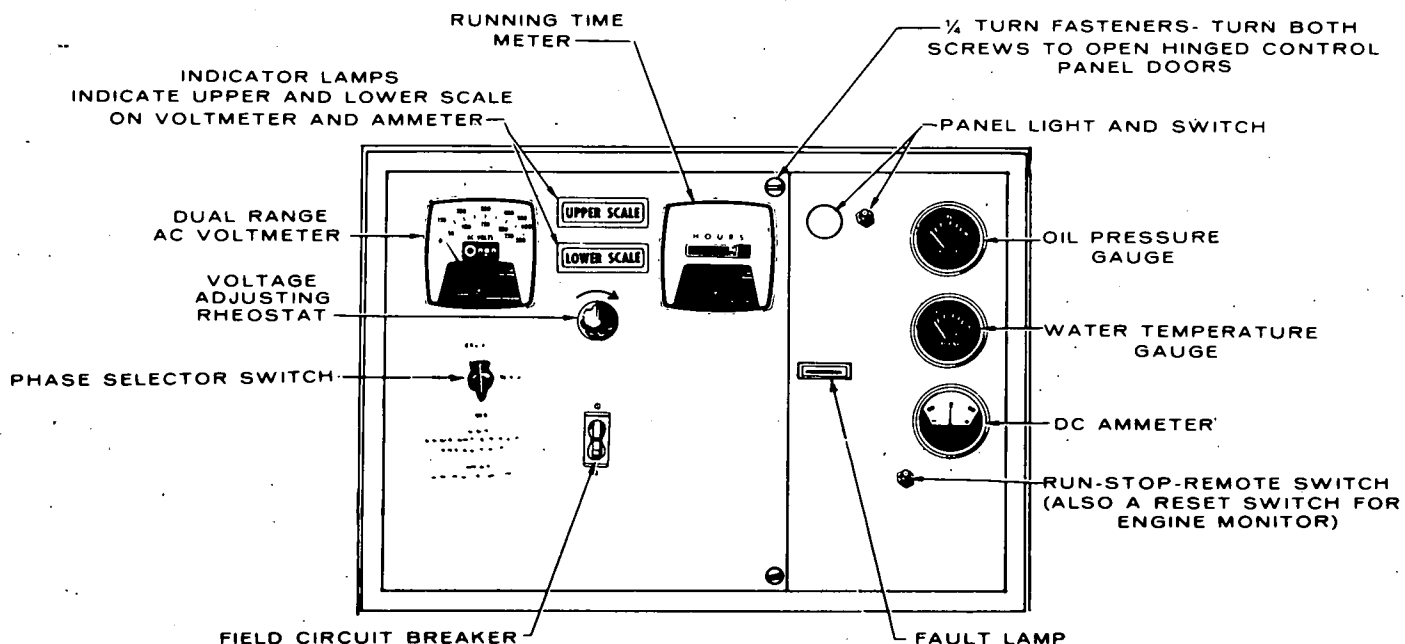


FIGURE 1. TYPICAL CONTROL PANEL (ONE FAULT LAMP)

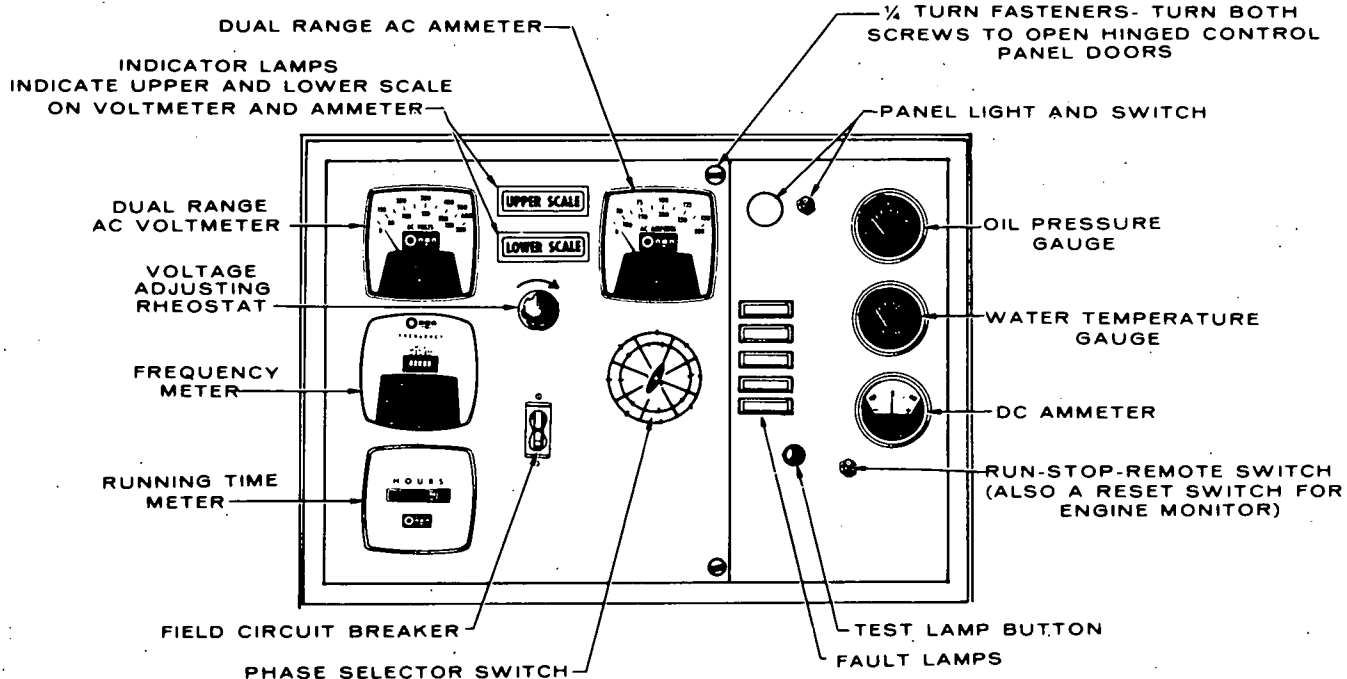


FIGURE 2. OPTIONAL CONTROL PANEL (FIVE FAULT LAMPS)

Description

GENERAL

An Onan DDA series electric generating set is a complete unit consisting of an engine driven AC generator, with standard and optional controls and accessories as ordered.

ENGINE

The engine on the DDA is a John Deere 4219 D as described in the engine manual. Basic measurements and requirements will be found under *Specifications*. For operation, maintenance and service information, consult the John Deere manual.

AC GENERATOR

The generator is an ONAN Type UR, 12 lead 4 pole revolving field, reconnectable, brushless unit. The main rotor is attached directly to the engine flywheel, therefore engine speed determines generator output frequency. The 60 Hz set operates at 1800 rpm, the 50 Hz at 1500 rpm. Excitation is achieved as follows—

Residual alternating current from the stator winding is applied to the voltage regulator, where it is compared with a reference voltage, rectified and returned to the field winding of the exciter. Current then induced in the exciter rotor is rectified and fed into the generator rotor. This induces a current in generator stator which is applied to the load.

CONTROL PANEL

The following is a brief description of each of the standard controls and instruments located on the face of the panel. See Figure 1.

DC Panel

Panel Light and Switch: Illuminates control panel.

Oil Pressure Gauge: Indicates pressure of lubricating oil in engine (wired to a sensor unit located on the engine).

Water Temperature Gauge: Indicates temperature of circulating coolant in engine. (Wired to a sensor unit located on the engine.)

Battery Charge Rate DC Ammeter: Indicates the battery charging current.

Run-Stop/Reset-Remote Switch: Starts and stops the unit locally or from a remote location.

Warning Light: Indicates "Fault" in engine operation.

AC Panel

AC Voltmeter: Indicates AC generator output voltage. Dual range instrument: measurement range in use shown on indicator light.

Voltmeter Phase Selector Switch: Selects phases of generator output to be measured by AC voltmeter.

Voltage Regulator: Rheostat, provides approximately plus or minus 5% adjustment of the rated output voltage.

Exciter Circuit Breaker: Provides generator exciter and regulator protection from overheating in the event of certain failure modes of the generator, exciter and voltage regulator.

Running Time Meter: Registers the total number of hours, to 1/10th that the unit has run. Use it to keep a record for periodic servicing. Time is accumulative, meter cannot be reset.

OPTIONAL EQUIPMENT

DC Panel

Warning Lights: Eliminates the one "Fault" light and substitutes five indicator lights to give warning of —

- a. Overcrank (failed to start)
- b. Overspeed
- c. Low oil pressure
- d. High engine temperature
- e. Low engine temperature

Operation of these lights will be discussed in conjunction with engine monitor panel.

AC Panel

AC Ammeter: Indicates AC generator output current. Dual range instrument: measurement range in use shown on indicator lights.

Voltmeter-Ammeter Phase Selector Switch: Selects the phases of the generator output to be measured by the AC voltmeter and AC ammeter.

Reset Switch: Manual reset for engine monitor after shut-down.

Lamp Test: Press to test warning lamp bulbs (when engine is running only).

Frequency Meter: Indicates the frequency of the generator output in hertz. It can be used to check engine speed. (Each hertz equals 30 rpm.)

CONTROL PANEL INTERIOR

The only equipment discussed in this section will be that which the operator may have reason to adjust or inspect for service.

Terminal Board (TB) 21: Connection of wire W12 to terminals H3, H4, H5, and H6 is made at this point, to change reference voltage when reconnecting generator for different voltages. Refer to Figure 15.

Voltage Regulator: Solid state unit, consisting of VR21, CR21 and L21. Controls AC output from generator at predetermined level regardless of load. Regulation plus or minus 2% from no load to full load, 0.8 P.F.

Engine Monitor: Printed circuit plug-in modules provide the following functions:

1. A 75 second cranking period.
2. Approximately a 12.5 second time delay for oil pressure buildup.
3. An external alarm contact to light a fault lamp and shut down the set for alarm conditions such as:
 - a. Overcrank (failed to start after cranking 75 seconds).
 - b. Overspeed (engine speed reaches 2100 rpm).
 - c. Low oil pressure (14 psi: 96.6 kPa).
 - d. High engine temperature (215 °F: 102° C).

CAUTION

High Engine Temperature Cutoff will shut down engine in an overheat condition only if coolant level is sufficiently high to physically contact shutdown switch. Loss of coolant will allow engine to overheat without protection of shutdown device, thereby causing severe damage to the engine. It is therefore imperative that adequate engine coolant levels be maintained, to ensure operational integrity of cooling system and engine coolant overheat shutdown protection.

On standard control panels, all four alarms are wired into one common fault lamp; on units with five fault lamps, four have shutdown alarms, the fifth (low engine temperature) lights a fault lamp only. Refer to Table 2.

Standard Cranking Module: Limits engine cranking time to 75 seconds. If engine fails to start after 75 seconds the engine monitor lights a fault lamp and opens the cranking circuit.

OPTIONAL MODULES

Cycle Cranker: Plug-in module replaces standard cranking circuit. Automatically provides a 15 second

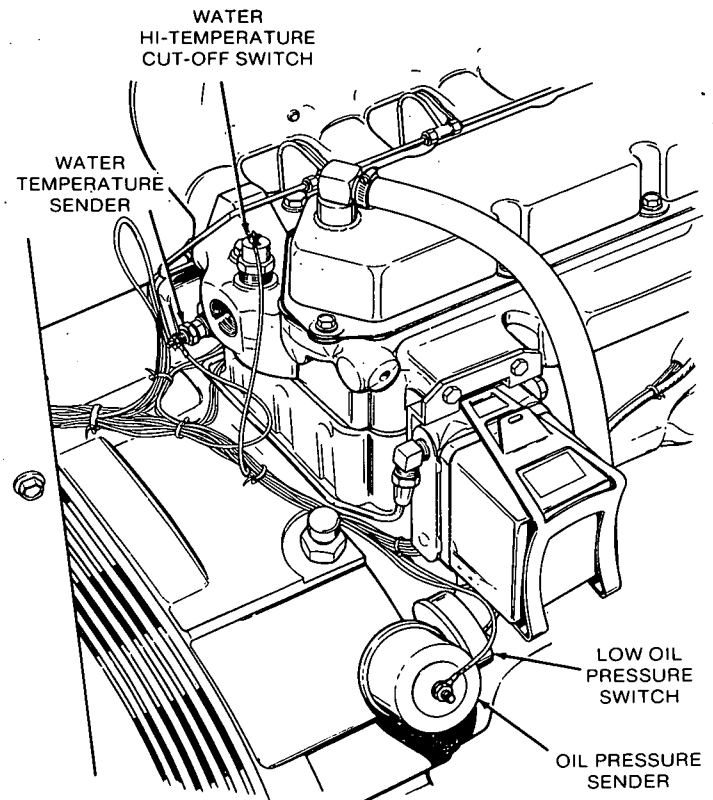
crank time and a 10 second rest time for three ON and two OFF cycles in 65 seconds. If engine fails to start after 75 seconds the engine monitor lights a fault lamp and opens the cranking circuit.

Pre-Alarm: Gives advance warning for low oil pressure or high engine temperature. Requires two sensors each for engine temperature and oil pressure.

ENGINE SENSORS

Resistance units and switches in the engine temperature and oil pressure monitoring and shutdown systems are sealed units and are not repairable.

For location, refer to Figure 3. When replacing a sensor, do not substitute, use recommended items. Resistance units are matched to the gauge they supply, and cut-off switches are close-tolerance actuation parts, made for a specific application.



XSC-1136

FIGURE 3. ENGINE SENSORS

TABLE 2. FAULT LAMP OPTIONS

SYSTEM	FAULT	FAULT LAMP	STOP ENGINE	EXTERNAL ALARM	PRE- ALARM
PENN STATE. SINGLE LIGHT	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x		x	
	High Engine Temperature	x		x	
STANDARD SINGLE LIGHT	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x	x	x	
	High Engine Temperature	x	x	x	
5 LIGHT	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x	x	x	
	High Engine Temperature	x	x	x	
	Low Engine Temperature	x			
5 LIGHT PRE-ALARM	Overcrank	x	x	x	
	Overspeed	x	x	x	
	Low Oil Pressure	x	*	x	x
	High Engine Temperature	x	*	x	x
	Low Engine Temperature	x			

* - With additional optional sensors.

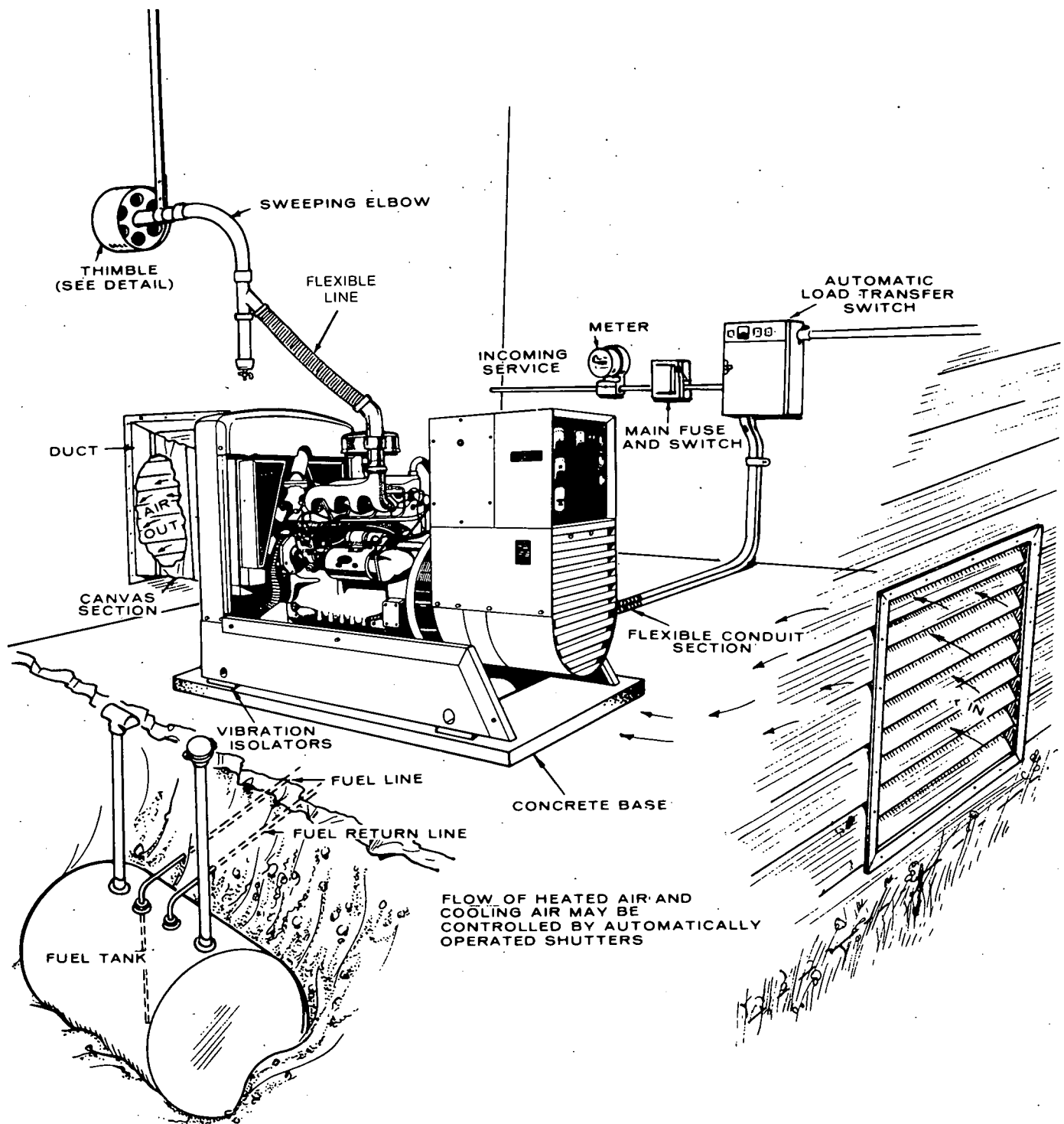


FIGURE 4. TYPICAL INSTALLATION

Installation

GENERAL

Installations must be considered individually. Use these instructions as a general guide. Meet regulations of local building codes, fire ordinances, etc., which may affect installation details. See Figure 4.

Installation points to consider include:

1. Level mounting surface.
2. Adequate cooling air.
3. Adequate fresh induction air.
4. Discharge of circulated air.
5. Discharge of exhaust gases.
6. Electrical connections.
7. Fuel connections.
8. Water connections.
9. Accessibility for operation and servicing.
10. Vibration isolation.
11. Noise levels.

LOCATION

Provide a location that is protected from the weather and is dry, clean, dust free and well ventilated. If practical, install inside a heated building for protection from extremes in weather conditions.

MOUNTING

Generating sets are mounted on a rigid skid base which provides proper support. Install vibration isolators between skid base and foundation. For convenience in draining crankcase oil and general servicing, mount set on raised pedestals (at least 6 inches high). If mounting in a trailer, or for other mobile applications, bolt securely in place. Extra support for the vehicle flooring may be necessary. Bolting down is recommended for stationary installations.

VENTILATION

Generating sets create considerable heat which must be removed by proper ventilation. Outdoor installations rely on natural air circulation but mobile and indoor installations need properly sized and positioned vents for the required air flow. See *Specifications* for the air required to operate with rated load under normal conditions at 1800 rpm.

Radiator set cooling air travels from the rear of the set to the front end. Locate the room or compartment air inlet where most convenient, preferably to the rear of the set. Make the inlet opening at least as large as the radiator area (preferably 1-1/2 times larger).

Engine heat is removed by a pusher fan which blows cooling air out through the front of the radiator. Locate the cooling air outlet directly in front of the radiator and as close as practical. The opening size should be at least as large as the radiator area. Length and shape of the air outlet duct should offer minimum restriction to air flow. Use a duct of canvas or sheet metal between the radiator and the air outlet opening. The duct prevents recirculation of heated air.

Provide a means of restricting the air flow in cold weather to keep the room or compartment temperature at a normal point.

A shelter housing with electrically operated louvers is available as an option. Transformers connected across the generator output supply current to the motors.

When the generator is operating, current in the transformers actuate the motors and open the louvers. The louvers are held open for the duration of the set operation, then are closed by return springs when the set is shut down.

City water cooled sets do not use the conventional radiator. A constantly changing water flow cools the engine. Ventilation is seldom a problem, but sufficient air movement and fresh air must be available to properly cool the generator, disperse heat convected off the engine and support combustion in the engine.

For small compartments, a duct of equal or larger area than generator outlet is recommended to remove the heated air from the generator air outlet to the outside atmosphere. Limit bends and use radius type elbows where needed. A larger, well ventilated compartment or room does not require a hot air duct.

Installations made in a small room may require installation of an auxiliary fan of sufficient size (connected to operate only when the generator set is running) to assure proper air circulation.

CITY WATER COOLING

An optional method of engine cooling, in place of the conventional radiator and fan, uses a constant pressure water supply. This is referred to as CITY WATER COOLING. There are two varieties of city water cooling: the HEAT EXCHANGER SYSTEM and STANDPIPE SYSTEM. See Figures 5 and 6.

The HEAT EXCHANGER provides for a closed engine cooling system. Engine coolant flows through a tubed chamber, keeping the coolant separate from the cool "raw" water supply. The coolant chamber must be filled for operation, as for a radiator cooled set.

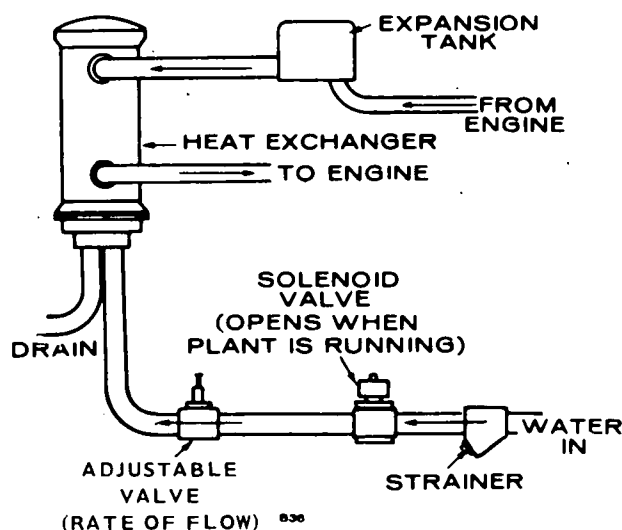


FIGURE 5. TYPICAL HEAT EXCHANGER SYSTEM

The STANDPIPE SYSTEM uses a mixing or tempering tank. Cooling water that circulates through the engine-mixes with a source of cool "raw" water. The "raw" water supply must be free of scale forming lime or other impurities.

On both systems use flexible pipe for connecting water supply and outlet flow pipes to engine. Pipe the outlet flow to a convenient drain. Install an electric solenoid valve and a rate of flow valve in the water supply line. The electric solenoid valve opens and allows water flow through the system only when the generator set operates. The rate of flow valve, either automatic or manual, provides for the proper flow rate to the engine. Adjust the flow to maintain water temperature between 165°F and 195°F (74°C to 91°C) while viewing the water temperature gauge.

Before filling cooling system check all hardware for security. This includes hose clamps, capscrews, fittings and connections. Use flexible coolant lines with heat exchanger, standpipe or remote mounting radiator.

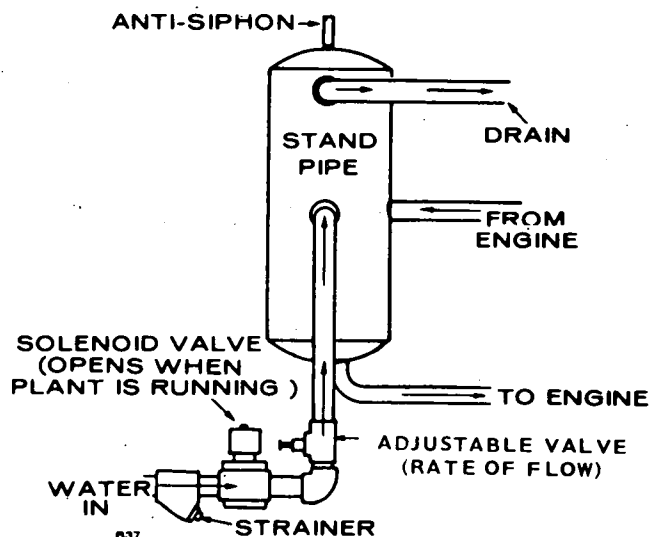


FIGURE 6. TYPICAL STANDPIPE SYSTEM

WATER JACKET HEATER (Optional)

This heater is installed to maintain an elevated engine temperature in lower ambient temperature applications. It heats and circulates engine coolant, and is thermostatically controlled (Figure 20).

EXHAUST

WARNING

Inhalation of exhaust gases can result in death.

Engine exhaust gas must be piped outside building or enclosure. Do not terminate exhaust pipe near inlet vents or combustible materials. An approved thimble (Figure 7) must be used where exhaust pipes pass through walls or partitions. Pitch exhaust pipes downward or install a condensation trap (Figure 8) at the point where a rise in the exhaust system begins. Avoid sharp bends; use sweeping long radius elbows. Provide adequate support for mufflers and exhaust pipes. Refer to Figure 4 for a typical exhaust installation. Shield or insulate exhaust lines if there is danger of personal contact. Allow at least 9 inches (230 mm) of clearance if the pipes run close to a combustible wall or partition. Use a pipe at least as large as the 2 inch pipe size outlet of the engine with a flexible portion between the engine and the muffler. Do not connect a flexible line to the exhaust manifold. Minimum diameters and maximum lengths of pipe (with critical muffler) are as follows:

Single Exhaust system:

2½ inch pipe	58 feet (17.68 m)
3 inch pipe	191 feet (58.2 m)
3½ inch pipe	419 feet (128 m)

Maximum permissible exhaust restriction (back pressure is 25 inches H₂O (1.84 inches Hg: [6.23 kPa])).

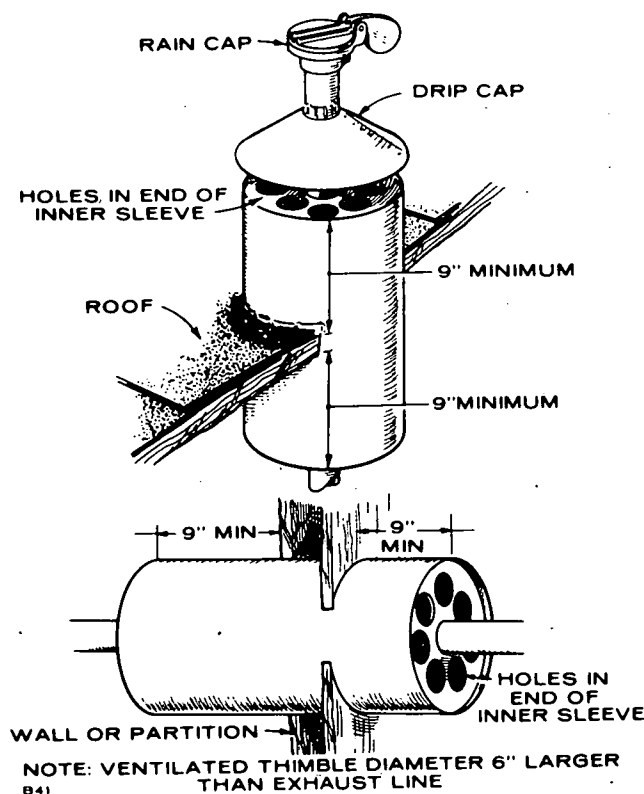


FIGURE 7. EXHAUST THIMBLE

FUEL SYSTEM

The John Deere engines used on the DDA sets are designed for use with ASTM No.2 Diesel fuel. They will however, operate on diesel fuels within the specifications delineated in the John Deere engine manual.

FUEL CONNECTIONS

Check local regulations governing the installation of a fuel supply tank.

In any diesel engine installation, fuel system cleanliness is of utmost importance. Make every effort to prevent entrance of moisture or contaminants of any kind. Do not use lines or fittings of galvanized material.

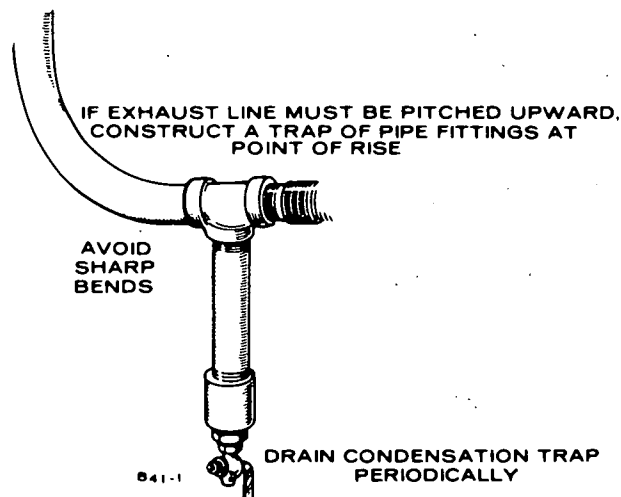


FIGURE 8. EXHAUST CONDENSATION TRAP

A fuel lift in excess of 10 feet (3 m) is not recommended without a day tank installation, because of fuel drainage. Horizontal run, if the supply tank is level with the fuel pump should not exceed 25 feet (7.62 m). However, a day tank is again recommended.

The fuel inlet is to the transfer pump and is threaded for 1/8-inch pipe. Injector pump return line is common with the injectors' return line, and requires a 1/8-inch low pressure hose connection.

DAY TANK

Generator set installations may be equipped with an optional integral fuel Day tank. A float operated valve controls fuel flow into the fuel tank. The correct level is maintained to assure a constant source of fuel. It is necessary to install an overflow line between the Day tank and the main fuel tank. Refer to the installations included with the tank. See Figure 9 for an example of a Day tank installation.

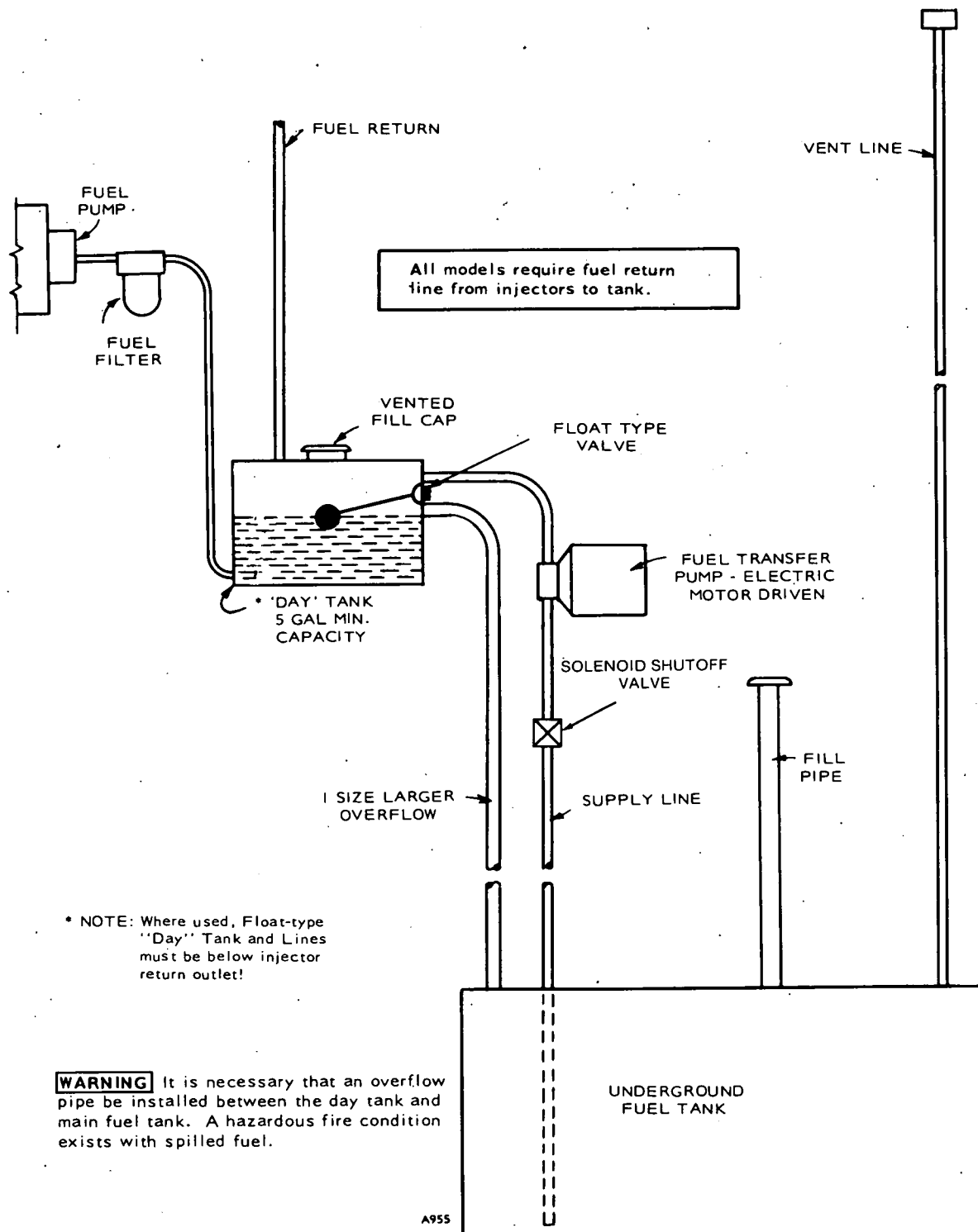


FIGURE 9. DAY TANK INSTALLATION

BATTERY

Starting the generator set requires 12 volt battery current. Use two 6 volt (see specifications) batteries for a normal installation. Connect the batteries in series (negative post of first battery to positive post of second) as in Figure 10. Necessary battery cables are on unit.

Connect battery positive before connecting battery negative, to prevent the possibility of arcing.

Service the batteries as necessary. Infrequent generator set use (as in emergency standby service) may allow the batteries to self-discharge to the point where they cannot start the set. If installing an automatic transfer switch that has no built-in charge circuit, connect a separate trickle charger.

WARNING Do not smoke while servicing batteries. Lead acid batteries give off explosive gases while being charged. Ignition of these gases may cause serious personal injury or death.

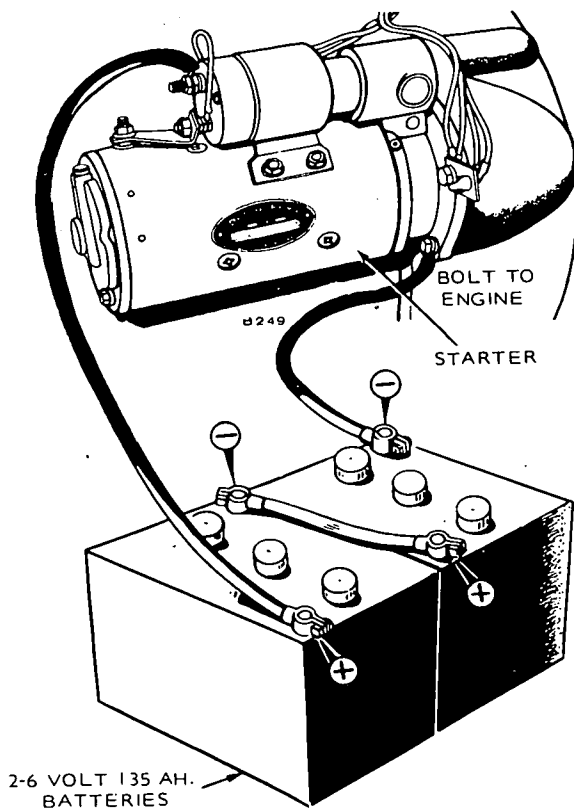


FIGURE 10. BATTERY CONNECTION

BATTERY, HOT LOCATION

Batteries will self discharge very quickly when installed where the ambient temperature is consistently above 90° F (32.2° C), such as in a boiler room. To lengthen battery life, dilute the electrolyte from its normal 1.260 specific gravity reading at full charge to a 1.225 reading. The cranking power is reduced slightly when the electrolyte is so diluted, but if the temperature is above 90° F (32.2° C), this should not be noticed. The lengthened battery life will be worth the effort.

1. Fully charge the battery.
2. With the battery still on charge, draw off the electrolyte above the plates in each cell. **DO NOT ATTEMPT TO POUR OFF**; use a hydrometer or filler bulb and dispose of electrolyte in a safe manner. Avoid skin or clothing contact with the electrolyte.
3. Refill each cell with distilled water, to normal level.
4. Continue charging for 1 hour at 4 to 6 amperes.
5. Test each cell. If the specific gravity is still above 1.225, repeat steps 2, 3, and 4 until the reading is reduced to 1.225. Usually, repeating steps twice is sufficient.

REMOTE CONTROL CONNECTIONS

Provision is made for addition of remote starting. This is accomplished on a 4 place terminal block situated within the control box. Connect one or more remote switches across remote terminal and B+ terminal as shown in Figure 11. If the distance between the set and remote station is less than 1000 feet (300 m), use No. 18 AWG wire; between 1000 and 2000 feet (600 m), use No. 16 AWG wire.

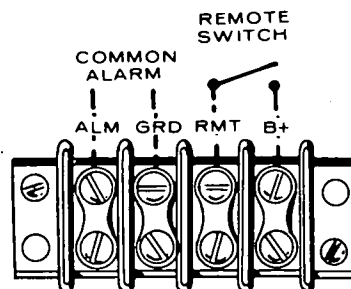
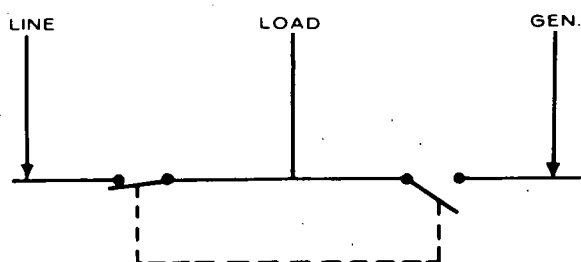


FIGURE 11. REMOTE STARTING

WIRING CONNECTIONS

Most local regulations require that wiring connections be made by a licensed electrician and that the installation be inspected and approved before operation. All connections, wire sizes, etc. must conform to requirements of electrical codes in effect at the installation site.

If the installation is for standby service, a double throw transfer switch must always be used (Figure 12). Connect this switch (either automatic or manual) so that it is impossible for commercial power and generator current to be connected to the load at the same time. Instructions for connecting an automatic load transfer control are included with such equipment.



NOTE: SHOWN WITH LINE CONNECTED TO LOAD.

FIGURE 12. LOAD TRANSFER SWITCH

Control Box Connections: The factory ships these 12 lead generators with load connection wires NOT connected together in the control box. These 12 wires are labeled T1 through T12 and must be brought together before making load connections. Proceed as follows:

1. Remove either right, left or top panel from control box. See Figure 13.
2. Connect wires together as shown on panel and in Figure 14 according to voltage desired.
3. Open hinged control panel doors. Connect lead from terminal 63 to correct terminal for voltage desired. These terminals are labeled H2, H3, H4, H5 and H6. See Figure 15.
4. Close front panel and secure with 1/4 turn fasteners.
5. Connect load wires to generator leads.

Preceding instructions do not apply to models with a 347/600 voltage (designated 9X) or a 120/240 voltage (designated 3R); these connections are made at the factory. The installer must only connect load wires.

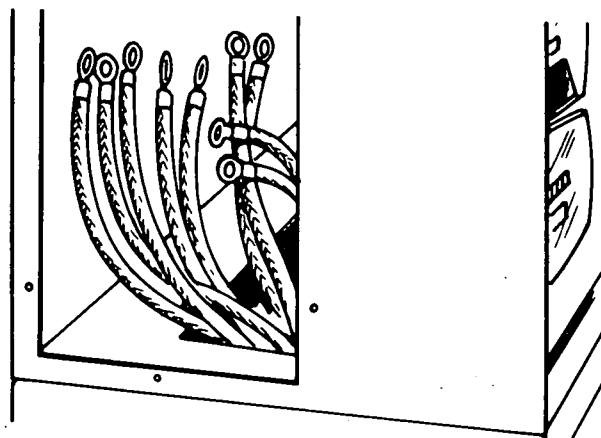


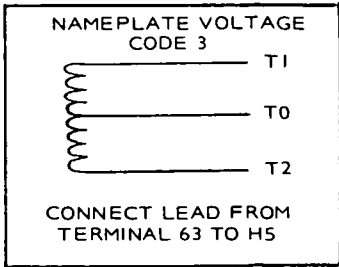
FIGURE 13. CONTROL BOX (SIDE PANEL REMOVED)

THIS DIAGRAM APPLIES TO 12 LEAD GENERATORS ONLY

NAMEPLATE VOLTAGE CODE	VOLTAGE	PHASES	HERTZ	CONNECT LEAD FROM TERMINAL 63 TO:	GENERATOR CONNECTION	GENERATOR CONNECTION SCHEMATIC DIAGRAM	GENERATOR CONNECTION WIRING DIAGRAM (WITH CURRENT TRANSFORMERS WHEN USED)
15	120/240	1	60	H5	DOUBLE DELTA		
515	115/230	1	50	H6			
15	110/220	1	50	H6			
60	240/480	3	60	H5	SERIES DELTA		
15	120/240	3	60	H5			
515	115/230	3	50	H6			
15	120/208	3	60	H3	PARALLEL WYE		
15	127/220	3	60	H4			
15	139/240	3	60	H5			
15	110/190	3	50	H3	SERIES WYE		
15	115/200	3	50	H4			
15	120/208	3	50	H4			
15	127/220	3	50	H5	SERIES WYE		
15	240/416	3	60	H3			
15	254/440	3	60	H4			
15	277/480	3	60	H5			
15	220/380	3	50	H3	SERIES WYE		
15	230/400	3	50	H4			
15	240/416	3	50	H4			
15	254/440	3	50	H5			
7	220/380	3	60	H3			

98C2193

120/240 VOLT, 1 PHASE
60 HERTZ



347/600 VOLT, 3 PHASE,
60 HERTZ

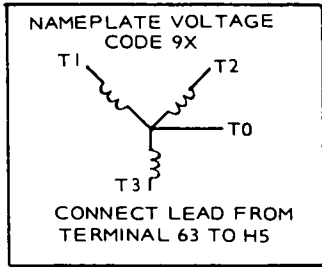


FIGURE 14. VOLTAGE CONNECTIONS

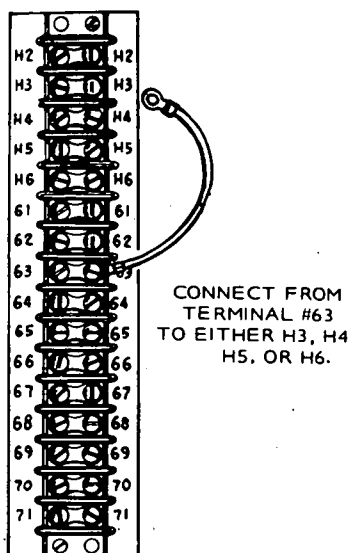


FIGURE 15. CONNECTING LEAD FROM TERMINAL 63

120/240 Volt, Single Phase, 12 Lead: Terminal connection L0 (neutral) can be grounded if required. For 120 volts, connect the hot load wires to either the L1 or L2 connection, Figure 16. Connect the neutral load wire to the L0 connection. Two 120 volt circuits are thus available, with not more than 1/3 the rated capacity of the set available on either circuit. If using both circuits, be sure to balance the load between them.

For 240 volts, connect one load wire to the L1 connection and the second load wire to the L2 connection. Terminal connection L0 is not used for 240 volt service.

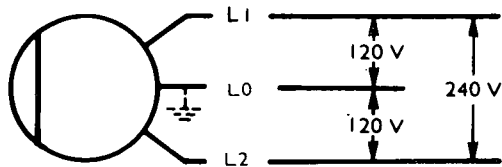


FIGURE 16. 120/240 VOLT, SINGLE PHASE, 12 LEAD

120/240 Volt, 3 Phase, 4 Wire Delta Connected Set; 12 Lead: The 3 phase Delta connected set is designed to supply 120- and 240 volt, 1 phase current and 240 volt, 3 phase current, Figure 17. For 3 phase operation, connect the three load wires to generator terminals L1, L2 and L3 — one wire to each terminal. For 3 phase operation the L0 terminal is not used.

For 120/240 volt, 1 phase, 3 wire operation, terminals L1 and L2 are the "hot" terminals. The L0 terminal is the neutral, which can be grounded if required. For 120 volt service, connect the black load wire to either the L1 or L2 terminal. Connect the neutral (white) wire to the L0 terminal. Two 120 volt circuits are available.

Any combination of 1 phase and 3 phase loading can be used at the same time as long as no terminal current exceeds the NAMEPLATE rating of the generator. If no 3 phase output is used, usable 1 phase output is 2/3 of 3 phase KVA.

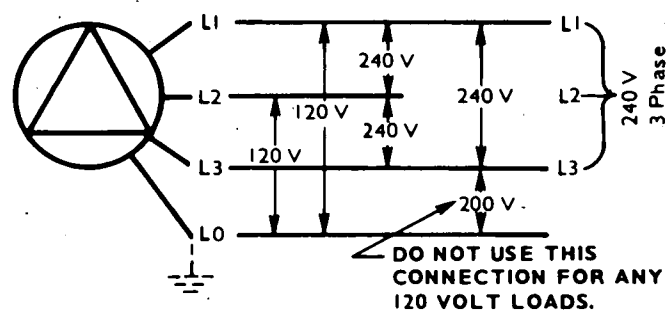


FIGURE 17. 3 PHASE, DELTA CONNECTION, 12 LEAD

3 Phase, 4 Wire, Wye Connected Set; 12 Lead: The 3 phase, 4 wire set produces line to neutral voltage and line to line voltage. The line to neutral voltage is the lower voltage as noted on the unit nameplate, and the line to line voltage is the higher nameplate voltage.

For 3 phase loads, connect separate load wires to each of the set terminals L1, L2 and L3. Single phase output is obtained between any two 3 phase terminals.

The terminal marked L0 can be grounded if required. For 1 phase loads, connect the neutral (white) load wire to the L0 terminal. Connect the black load wire to any one of the other three terminals — L1, L2 or L3. Three separate 1 phase circuits are available, with not more than 1/6 the rated capacity of the set from any one circuit.

If using 1 phase and 3 phase current at the same time, use care to properly balance the 1 phase load, and not to exceed rated line current.

Figure 18 shows load connections for 120/208 voltage. Other voltages are available from either parallel wye or series wye illustration in Figure 14.

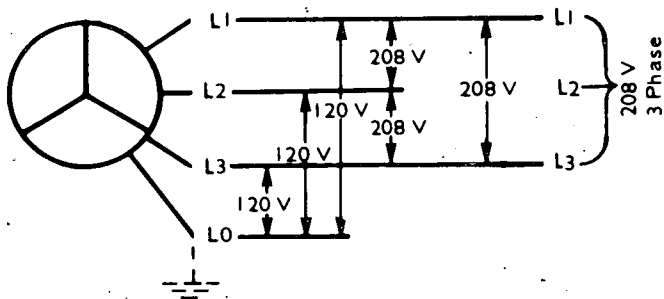


FIGURE 18. 3 PHASE WYE CONNECTION, 12 LEAD

GROUNDING

Typical requirements for bonding and grounding are given in the National Electrical Code, 1978, Article 250.

Periodic inspection is recommended, especially after service work has been performed on equipment anywhere in the electrical system.

Generator Set Bonding and Equipment Grounding

Bonding is defined as: (Reference National Electrical Code, 1978, Article 100) The permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and capacity to conduct safely any current likely to be imposed.

WARNING

It is extremely important for life safety that bonding and equipment grounding be properly done, and that all metallic parts likely to become energized under abnormal conditions be properly grounded.

Circuit and System Grounding

This refers to the intentional grounding of a circuit conductor or conductors. The design and installation of grounding system encompasses many considerations, such as multiple transformers, standby generators, ground fault protection, physical locations of equipment and conductors, just to mention a few.

Although the consulting engineer and installer are responsible for the design and wiring of each particular grounding application, the basic grounding requirements must conform to national and local codes.

Operation

GENERAL

ONAN DDA Series electric generating sets are given a complete running test under various load conditions and are thoroughly checked before leaving the factory. Inspect your unit closely for loose or missing parts and damage which may have occurred in transit. Tighten loose parts, replace missing parts and repair any damage before putting set into operation.

PRESTART SERVICING

Lubrication System: Engine oil was drained prior to shipment. Fill engine to capacities shown. After engine has been run, check dipstick, add oil to bring level to full mark. Record total capacity for future oil changes. Do not mix brands or grades of lubricating oils.

AMBIENT TEMPERATURE	SINGLE VISCOSITY	MULTI-VISCOSITY
Below -10°F (-23°C)	SAE 5W	SAE 5W20
Between -10°F and 32°F (-23°C and 0°C)	SAE 10W	SAE 10W30
Above 32°F (0°C)	SAE 30	Not Recommended
Use oil conforming to these specifications	API CD/SD MIL-L-2104C* Series 3*	API CC/SE, CC/SD or SD MIL-L-46152

*API CC or CD

Oil capacities (nominal)

Oil Pan and Filter — 9 quarts (8.6 litres)

Cooling System: Cooling system was drained prior to shipment. Fill cooling system before starting. Nominal capacity is 4.25 gallons (16.1 litres). For units using either a radiator or heat exchanger (city water cooled), fill the system with clean soft water. Use a good rust and scale inhibitor additive. If a possibility exists of a radiator cooled set being exposed to freezing temperatures use anti-freeze with an ethylene-glycol base. During initial engine run, check the coolant level several times and replenish if necessary to compensate for air pockets which may have formed during filling. Refer to John Deere engine manual for additional information.

CAUTION

1. Verify that the electric solenoid valve used with city water cooled plants is open before initial starting of plant to allow coolant chambers to fill. Overheating and damage to the engine could result from non-compliance.

2. If engine is equipped with a cooling system filter, do not use antifreeze with an anti-leak formula. The stop leak element can prevent or retard the coolant flow through the filter, thereby eliminating the filtering process completely.

WARNING

Avoid removing the pressure cap on the radiator until unit has cooled. If this is impractical, the system may be opened while hot if certain precautions are taken. While wearing rubber insulated gloves for protection, slowly open the cap allowing the pressure to vent. This is necessary to avoid personal injury from contact with hot coolant or steam.

Fuel System: Refer to the John Deere engine manual for fuel oil specifications. Check with fuel supplier and ensure that fuel supplied meets the specifications. Filter or strain fuel when filling tank. Fuel supply tanks should be kept as nearly full as possible by topping up each time engine is used. Warm fuel returning from the injector pump heats the fuel in the supply tank. If the fuel level is low in cold weather, the upper portion of the tank not heated by returning fuel tends to increase condensation. In warm weather both the supply tank and fuel are warm. Cool night air lowers the temperature of the tank more rapidly than the temperature of the fuel. Again this tends to increase condensation.

Condensate mixing with the sulphur in the fuel forms a sulphurous acid which will corrode and damage the engine. KEEP FUEL CLEAN.

WARNING

DO NOT SMOKE while handling fuel. Diesel fuel is flammable.

Priming Fuel System: Verify that all connections in the fuel system are secure and no leaks exist. Proceed with priming as follows:

1. Loosen bleed plug on top of fuel filter. Pump primer lever (Figure 19) until a solid stream of fuel, free of air bubbles, flows from bleed plug.
2. Secure bleed plug.
3. Loosen inlet fuel line on injector pump. Operate primer lever on fuel transfer pump until a solid stream of fuel, free of air bubbles, flows from inlet line opening.
4. Secure injector pump fuel inlet line.
5. Leave fuel transfer pump priming lever at lowest point of stroke.

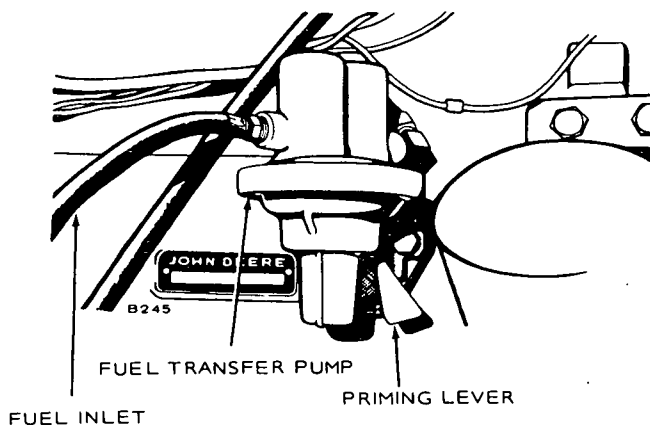


FIGURE 19. PRIMING FUEL SYSTEM

If the primer lever will not pump and no resistance is felt at upper end of stroke, turn engine over with starter to change position of fuel pump drive lobe on camshaft.

Check all connections in fuel system for security, to ensure that pressure will not bleed off when engine is not in use. Pressure should be maintained for immediate starting if unit is on standby service.

BATTERIES

Ensure that the cable connections to the batteries are secure. Coat connections with petroleum based or non-conductive grease to retard formation of corrosive deposits.

Check level of electrolyte to be at split ring mark. Measure specific gravity of electrolyte: SG 1.260 at 80°F (26.7°C). If distilled water has been added or specific gravity is less than 1.260, place batteries on charge until desired reading is reached. Do not over charge.

STARTING

When the preceding service functions have been performed, recheck to verify unit is ready to start.

1. Crankcase filled.
2. Cooling system filled — input solenoid valve open.
3. Batteries charged and connected.
4. Fuel solenoid valve open.

To start, move the "run-stop/reset-remote" switch to the "run" position. The engine should start after a few seconds of cranking. Immediately after start, observe the oil pressure gauge. Normal oil pressure is between 45 and 65 psi (310.5 and 448.5 kPa). Check the following gauges:

1. DC Ammeter — 10 to 30 amperes.
2. AC Voltmeter — AC generator output voltage.
3. Frequency Meter — AC generator output frequency.

After running 10 minutes under load the water temperature gauge should have stabilized at 180° to 195°F (82.2°C to 90.6°C). On city water cooled units an adjustable valve is connected in the water supply line. Adjust the hand wheel valve to provide a water flow that will keep the water temperature gauge reading within the range of 180°F to 220°F (82.2°C to 104.4°C).

STOPPING

To reduce and stabilize engine temperatures, run the engine at no load for three to five minutes before shutting down.

Move the run-stop/reset-remote switch to stop position to shut down the set.

Break-In Note: Run set at 50 percent rated load for the first half-hour of initial operation after reaching operating temperature.

Non-Start: If after a few seconds of cranking, engine fails to start, or starts and runs then stops and fault lamp lights, refer to appropriate troubleshooting chart, Table 3 or Table 4.

NO LOAD OPERATION

Periods of no load operation should be held to a minimum. If it is necessary to keep the engine running for long periods of time when no electric output is required, best engine performance will be obtained by connecting a "dummy" electrical load. Such a load could consist of heater elements, etc.

EXERCISE PERIOD

Generating sets on continuous standby service are required to be operative at essential loads from a cold start in a short period of time in the event of a power outage.

This imposes severe conditions on the engine. Friction of dry piston rings upon dry cylinder walls causes scuffing and rapid wearing. These can be relieved by exercising the set at least once a week for a minimum time of 30 minutes per exercise period. Preferably, run the set under at least 50 percent load to allow the engine to reach normal operating temperature. This will keep engine parts lubricated, maintain fuel prime, prevent electrical relay contacts from oxidizing and insure easy emergency starts. ONAN automatic transfer switches contain an optional exercise switch which, by pre-selection, will start, determine run period and shut down a set on a weekly frequency. For example, the switch can be set for time of start, length of run, A.M. or P.M. and day of week.

After each exercise period, top up fuel tank, check engine for leaks and unit for general condition. Locate cause of leaks (if any) and correct.

TABLE 3.
TROUBLESHOOTING ENGINE SHUTDOWN SYSTEM
(Engines with only one fault lamp)

SYMPTOM	CORRECTIVE ACTION
1. Engine stops cranking and fault lamp lights, after cranking approximately 75 seconds.	<p>1. See engine service manual for troubleshooting fuel system.</p> <p>After correcting problem, reset engine monitor relay by placing Run-Stop/Reset-Remote switch to Stop/Reset, then back to the required running position.</p>
2. Fault lamp lights immediately after engine starts.	2. Check for: Overspeed condition as engine starts.
3. Fault lamp lights and engine shuts down after running for a period.	<p>3. Check the following:</p> <ul style="list-style-type: none"> a. Oil level. Engine will shut down if sensor is closed. b. Check engine manual for troubleshooting oil system. c. High engine temperature. Check coolant level; check water flow (city water cooled systems); check radiator for free air flow, and fan belts for tightness. See engine manual for troubleshooting cooling system. d. Check for faulty oil pressure sensor or faulty high engine temperature sensor.
4. Engine runs, shuts down and cranks for 75 seconds. Cranking cycle stops; fault lamp lights.	4. Check fuel supply.
5. Fault lamp lights, no fault exists.	5. To check a no-fault condition, disconnect leads from TB11 terminals 29, 30 and 31. If fault lamp lights with leads disconnected, replace engine monitor board. Reconnect leads.

TABLE 4.
TROUBLESHOOTING ENGINE SHUTDOWN SYSTEM
(Units with five fault lamps)

SYMPTOM	CORRECTIVE ACTION
1. Overcrank fault lamp lights and engine stops cranking after approximately 75 seconds.	1. See engine service manual for troubleshooting fuel system. After correcting fault, reset engine monitor relay by placing Run-Stop/Reset-Remote switch to Stop/Reset position, depressing Reset button, then to the required running position.
2. Engine runs, shuts down, cranks for 75 seconds, cranking cycle stops, overcrank light ON.	2. Check fuel supply.
3. *Low oil pressure shutdown.	3. Check— a. Oil level. Replenish if necessary. b. Sensor. Faulty sensor will shut down engine. c. Refer to engine service manual for troubleshooting guide for oil system.
4. *High engine temperature shutdown.	4. Check— a. Coolant level. Replenish if necessary. b. City water cooled sets. Check water flow, valves, etc. c. Check sensor; check thermostat. d. Radiator model, check fan belts, radiator for obstructions, etc.
5. Overspeed shutdown.	5. Check governor and throttle linkages for freedom of movement. Check overspeed switch.
6. Overspeed light on, no shutdown.	6. Disconnect wire at TB11-29. Light on after reset; replace engine monitor board.
7. *Low oil pressure light ON. No shutdown.	7. Disconnect wire at TB11-30. Light ON after relay reset. Replace engine monitor board.
8. *High engine temperature light ON. No shutdown.	8. Disconnect wire at TB11-31. Light ON after relay reset. Replace engine monitor board.

*NOTE: Not applicable on Pennsylvania State models.

HIGH ALTITUDE

Ratings apply to altitudes up to 1000 feet (305 metres), standard cooling, normal ambients and with No. 2 Diesel fuel. Consult factory or nearest authorized Onan distributor for operating characteristics under other conditions.

Engine horsepower loss is approximately 3 percent for each 1000 feet of altitude above sea level for a naturally aspirated engine. Use lower power requirement at high altitudes to prevent smoke, over-fueling and high temperatures.

HIGH TEMPERATURES

1. See that nothing obstructs air flow to-and-from the set.
2. Keep cooling system clean.
3. Use correct SAE No. oil for temperature conditions.

LOW TEMPERATURES

1. Use correct SAE No. oil for temperature conditions. Change oil only when engine is warm.
2. Use fresh fuel. Protect against moisture condensation.
3. Keep fuel system clean and batteries in a well charged condition.
4. Partially restrict cool air flow but use care to avoid overheating.
5. Connect water jacket heater when set is not running.
6. Refer to John Deere manual for further information.

Water Jacket Heater: The function of this optional heater is to keep the engine warm enough to assure starting under adverse weather conditions. Connect the heater to a source of power that will be on during the time the engine is not running. Be sure the voltage rating is correct for the heater element rating (Figure 20).

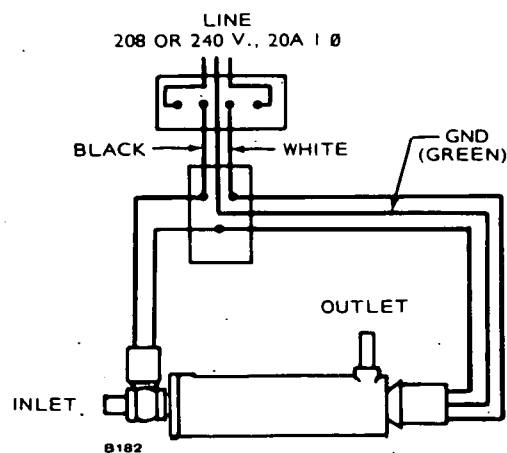


FIGURE 20. ENGINE HEATER

OUT OF SERVICE PROTECTION

For storage of all durations, refer to the John Deere engine manual.

General Maintenance

GENERAL

Follow a definite schedule of inspection and servicing, based on operating hours. Keep an accurate logbook of maintenance, servicing, and operating time. Use the running time meter to keep a record of operation and servicing. Service periods outlined in Table 5 are recommended for normal service and operating conditions. For continuous duty, extreme temperature, etc., service more frequently.

A set on stand-by duty will need servicing at times other than those recommended by Onan and the engine manufacturer. These maintenance service periods will vary according to set site or location and

application. Consult with your Onan distributor or dealer for a schedule of maintenance and service more suitable to the unique environment and application of your set.

CAUTION

When changing oil filters, it is important that the replacement filter is a bypass type. Failure to use a bypass filter could cause the filter material to rupture during heavy pressures on cold starts, resulting in non-filtered oil and subsequent engine damage.

WARNING

Before commencing any maintenance work on the engine, generator, control panel, automatic transfer switch or associated wiring, disconnect batteries. Failure to do so could result in damage to the unit or serious personal injury in the event of inadvertent starting.

TABLE 5. OPERATOR MAINTENANCE SCHEDULE

MAINTENANCE ITEMS	MAINTENANCE PERIOD						
	10 hrs.	50 hrs.	100 hrs.	200 hrs.	500 hrs.	1000 hrs.	6 mths.
Inspect generator set	x						
Check Exhaust System for leaks	x						
Check coolant level	x						
Check oil level	x						
Air cleaner	x1						
Fuel filter	x						
Batteries		x					
Alternator and fan belt			x2				
Engine crankcase - drain - refill			x1				
Crankcase oil filter			x1				
Crankcase vent tube					x		
Valve tappets					x		
Hoses					x		
Injection pump - check timing						x	
Injection nozzles						x	
Fuel filter - change						x	
Starter						x	
Cooling system - drain, flush, refill							x3
Clean and inspect battery charging alternator				x			
Air cleaner - replace			x				

x1 - or every 3 months, perform more often in extremely dusty conditions.
 x2 - or every 3 months. Adjust to 3/4 depression with 20 pounds force.
 x3 - More often in extremely dusty conditions.

NOTE: The above schedule is a minimum requirement for your engine. Refer to the John Deere manual for recommended service periods.

ENGINE SPEED

Generator frequency is in direct ratio to engine speed, which is controlled by the Governor.

A Roosa-Master governor is standard equipment on the DDA generator set. High speed and low speed limit stops are set at the ONAN testing facility and normally do not require further adjustment, therefore if your set is used on continuous standby service, the governor may never need to be touched. If however the unit is used frequently, adjustment may be required due to wear of internal components. This adjustment is achieved by backing off the high speed stop screw. Screw in the low speed adjusting screw until the generator output frequency meter reads 60 Hz (generator on load). Turn in the high speed adjusting screw until it bottoms; secure the locknuts.

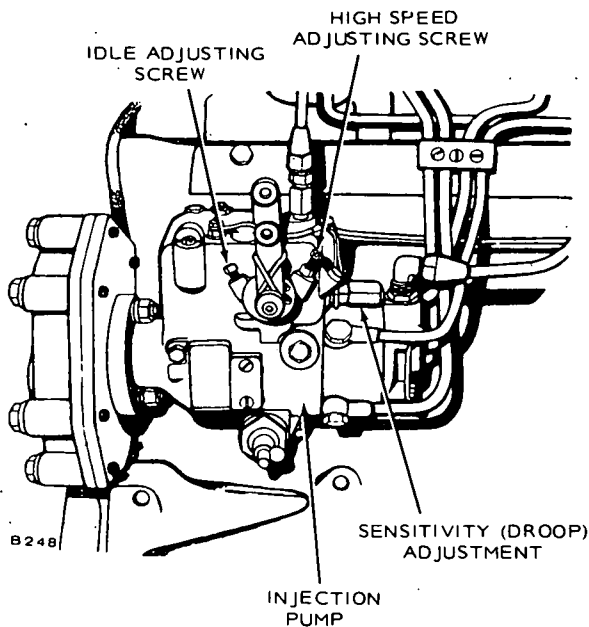


FIGURE 21. ROOSA-MASTER GOVERNOR

Governor sensitivity is adjusted by rotating an external knurled knob at the rear of the injector pump housing. Turning inward (clockwise) shortens governor control spring making it less sensitive, thereby increasing speed droop. Turning outward (counterclockwise) has opposite effect. Adjustment can be made with engine running. The speed droop is set at the ONAN plant to give a regulation of 3 percent to 5 percent from no-load to full-load.

When using the generator frequency meter to determine engine speed, multiply frequency by 30 to calculate engine speed.

Example: $30 \times 61 \text{ (Hz)} = 1830 \text{ rpm}$.

Adjust engine speed to 1800 rpm for 60 Hertz sets and 1500 rpm for 50 Hertz sets.

AC GENERATOR

There are no brushes, brush springs or collector rings on these generators, therefore they require very little servicing. Periodic inspections, to coincide with engine oil changes, will ensure good performance.

Generator Bearing: Inspect the bearing every 1000 hours with the unit running.

If using the unit for "prime power", replace the bearing every 10,000 hours or two years. If using the set for "standby", replace the bearing every five years.

Check generator voltage. It may be necessary to make a slight readjustment of the voltage rheostat to obtain the preferred voltage at average load.

INSPECTION AND CLEANING

When inspecting the rotating rectifier assembly, make sure diodes are free of dust, dirt and grease. Excessive foreign matter on these diodes and heat sinks will cause the diodes to overheat and will result in their failure. Blow out the assembly periodically, with filtered, low pressure air. Also check to see that diodes and leadwires are properly secured.

BATTERIES

Check the condition of the starting batteries at least every two weeks. See that connections are clean and tight. A light coating of non-conductive grease will retard corrosion at terminals. Keep electrolyte at the proper level above the plates by adding distilled water. Check specific gravity, recharge if below 1.260.

CONNECTIONS (Fuel, Exhaust, etc.)

Operator should periodically make a complete visual inspection of the set while running at rated load. Some of the things to check for are as follows:

1. Check all fuel and oil lines for possible leakage.
2. Inspect exhaust lines and mufflers for possible leakage and cracks.
3. Periodically or daily, drain moisture from condensation traps.
4. Inspect water lines and connections for leaks and security.
5. Inspect electrical wires and connections for security and fray damage.

If generator requires major repair or servicing, contact an authorized Onan dealer or distributor.

TANK HEATERS (Optional)

A Kim Tank Heater is optional equipment on the DDA generator set. For efficient operation and optimum product life, perform the following procedure at least once a year (Figure 22).

1. Remove head and valve assembly.
2. Clean foreign matter out of the tank.
3. Remove element and scrape off scale accumulated on the sheathing.

CAUTION

When reassembling threaded aluminum parts, be sure to use anti-seize compound.

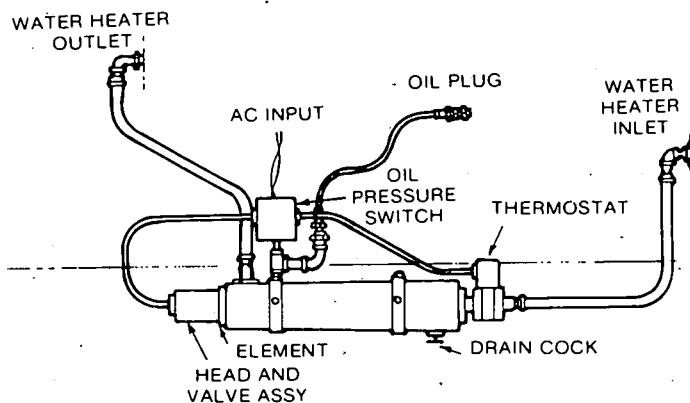


FIGURE 22. ENGINE HEATER

Onan Corporation
A Subsidiary of
McGraw-Edison Company
1400 73rd Avenue N.E.
Minneapolis, MN 55432

612 574-5000
Telex 29 0476 (U.S.)
Telex 29 0856 (outside U.S.)
TWX 910 576-2833
Cable ONAN