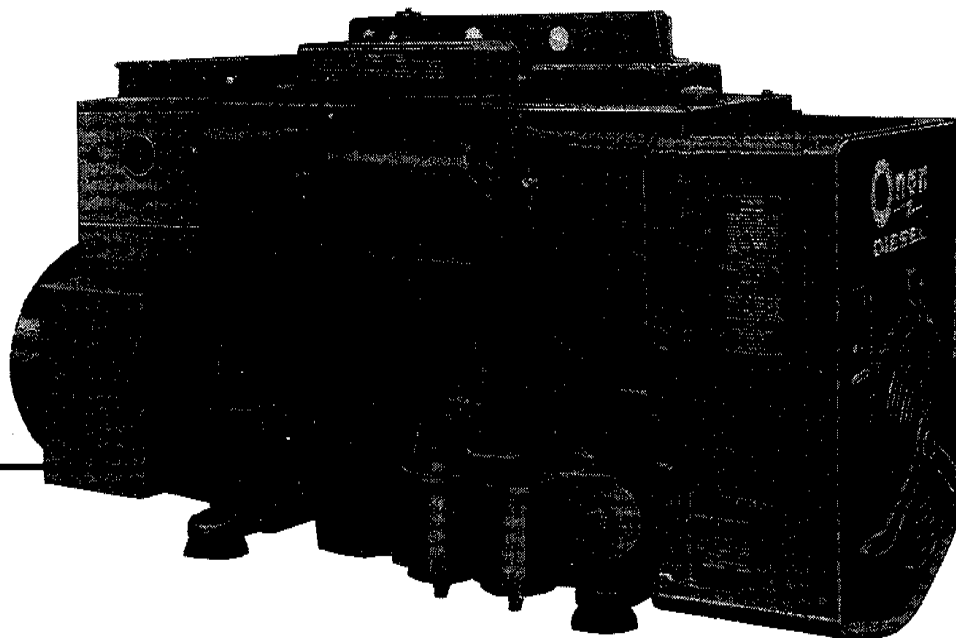


Onan

Operator's Manual

**DJC
GenSet**



967-0122
(SPEC AD)
10/93
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Safety Precautions

Before operating the generator set, read the Operator's Manual and become familiar with it and the equipment. **Safe and efficient operation can be achieved only if the equipment is properly operated and maintained.** Many accidents are caused by failure to follow fundamental rules and precautions.

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator, service personnel, or the equipment.

⚠ DANGER This symbol warns of immediate hazards which will result in severe personal injury or death.

⚠ WARNING This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.

⚠ CAUTION This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.

FUEL AND FUMES ARE FLAMMABLE. Fire and explosion can result from improper practices.

- DO NOT fill fuel tanks while engine is running, unless tanks are outside the engine compartment. Fuel contact with hot engine or exhaust is a potential fire hazard.
- DO NOT permit any flame, cigarette, pilot light, spark, or other ignition source near the generator set or fuel tank.
- Fuel lines must be adequately secured and free of leaks. Fuel connection at the engine should be made with an approved flexible line. Do not use copper piping on flexible lines as copper will become brittle if continuously vibrated or repeatedly bent.
- Be sure all fuel supplies have a positive shutoff valve.
- Do not smoke while servicing lead acid batteries. Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.

EXHAUST GASES ARE DEADLY

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

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Keep your hands, clothing, and jewelry away from moving parts.
- Before starting work on the generator set, disconnect starting batteries, negative (-) cable first. This will prevent accidental starting.
- Make sure that fasteners on the generator set are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.

- Do not wear loose clothing or jewelry in the vicinity of moving parts, or while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts and cause shock or burning.
- If adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- 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 surface to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages can cause injury or death. DO NOT tamper with interlocks.
- Follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches to avoid accidental closure.
- DO NOT CONNECT GENERATOR SET DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM. Hazardous voltages can flow from the generator set into the utility line. This creates a potential for electrocution or property damage. Connect only through an approved isolation switch or an approved paralleling device.

GENERAL SAFETY PRECAUTIONS

- 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. Allow the generator set to cool and bleed the system pressure first.
- Benzene and lead, found in some gasoline, have been identified by some state and federal agencies as causing cancer or reproductive toxicity. When checking, draining or adding gasoline, take care not to ingest, breathe the fumes, or contact gasoline.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.
- Provide appropriate fire extinguishers and install them in convenient locations. Consult the local fire department for the correct type of extinguisher to use. Do not use foam on electrical fires. Use extinguishers rated ABC by NFPA.
- Make sure that rags are not left on or near the engine.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage which present a potential fire hazard.
- Keep the generator set and the surrounding area clean and free from obstructions. Remove any debris from the set and keep the floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.

LS-9

GENERAL INFORMATION

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MODEL IDENTIFICATION

When instructions in this manual refer to a specific model of generating set, identify the model by referring to the MODEL and SPECIFICATION NO. as shown on the unit nameplate. Electrical characteristics are shown on the lower portion of the unit nameplate.

WARNING

EXHAUST GAS IS DEADLY!

Exhaust gases contain carbon monoxide, an odorless and colorless gas. Carbon monoxide is poisonous and can cause unconsciousness and death. Symptoms of carbon monoxide poisoning can include:

- **Dizziness**
- **Nausea**
- **Headache**
- **Weakness and Sleepiness**
- **Throbbing in Temples**
- **Muscular Twitching**
- **Vomiting**
- **Inability to Think Coherently**

IF YOU OR ANYONE ELSE EXPERIENCE ANY OF THESE SYMPTOMS, GET OUT INTO THE FRESH AIR IMMEDIATELY. If symptoms persist, seek medical attention. Shut down the unit and do not operate until it has been inspected and repaired.

Protection against carbon monoxide inhalation includes proper installation and regular, frequent visual and audible inspections of the complete exhaust system.

SPECIFICATIONS

MODEL SERIES

9.0DJC
12.0DJC

GENERAL

Nominal dimensions of set (inches)	
Height	26.06 (662 mm)
Width	19.50 (495 mm)
Length	46.81 (1189 mm)
Weight	710 Pounds (322 kg)

ENGINE DETAILS

Number of Cylinders (vertical in line)	4
Displacement (cubic inches)	120 (2 litre)
Cylinder Bore	3.25 inch (82.55 mm)
Piston Stroke	3.625 inch (92.07 mm)
Compression Ratio	19:1
Engine Speed	
50 Hertz Operation	1500 RPM
60 Hertz Operation	1800 RPM
Injection Order	1,2,4,3

CAPACITIES AND REQUIREMENTS

Battery Voltage	12 Volt
Battery Size	
SAE Group 1H	Two in Series
SAE Rating - 20 Hr. (nominal)	*120 Amp/hr. (432 kC)
Battery Charge Rate	2 to 5 Amperes
† Oil Capacity - Refill	6 U.S. Quarts (5.68 litres)
Exhaust Outlet (pipe tapped)	1.5 inch
Maximum Exhaust Back Pressure	27.2 inches (691 mm) H ₂ O
Fuel Pump Inlet and Fuel Return Line Thread Size	7/16-24 NPTF
Fuel Pump Maximum Lift	6 ft. (1.83 m)
Ventilation Required (1800 RPM)	
Engine	750 cfm
Generator	160 cfm
Combustion	52 cfm
Fuel Consumption (at 60 Hz load)	
Full Load	1.05 gph (3.98 L/h)
3/4 Load	0.88 gph (3.29 L/h)
1/2 Load	0.72 gph (2.67 L/h)
1/4 Load	0.55 gph (1.11 L/h)

GENERATOR DETAILS

Rating	
50 Hertz AC General Utility	9.0 kW
60 Hertz AC General Utility	12.0 kW

ADJUSTMENT SPECIFICATIONS

Cylinder Head Bolt Torque (lbs. ft.)	44-46 (59.7-62.4 N•m)
Valve Clearance	
Intake009 inch (.229 mm)
Exhaust007 inch (.178 mm)
Centrifugal Switch Breaker Point Gap020 inch (0.508 mm)

* - Mobile or outdoor operation during ambient temperatures below 0°F (-18°C), use 168 amp/hr (605 kC) rating.

† - Plus 1/2 quart (0.473 litre) for new filter.

DESCRIPTION

CONTROLS

The following is a brief description of typical controls and instruments on the face of the panels; these may vary according to the customer requirements.

Standard

Start-Stop Switch: Starts and stops the unit locally.

Battery Charge Rate DC Ammeter: Indicates charging current supplied to battery.

Exciter Field Circuit Breaker: Provides protection for exciter and alternator, if voltage regulator develops a malfunction.

Pre-Heater Switch: Provides control for manifold heater and glow plugs for diesel engine cold starting.

Oil Pressure Gauge: Indicates pressure of lubricating oil in engine.

Fuse: Provides protection for fuel solenoid and general control components including wiring harness.

Optional on Housed Units

AC Voltmeter: Indicates output voltage.

Voltmeter Phase Selector Switch: Selects the phases of the generator output to be measured.

Voltage Adjust Rheostat: Provides approximately plus or minus 5 percent adjustment of the rated output voltage.

Running Time Meter: Registers the total number of hours. Use as an indicator for periodic servicing.

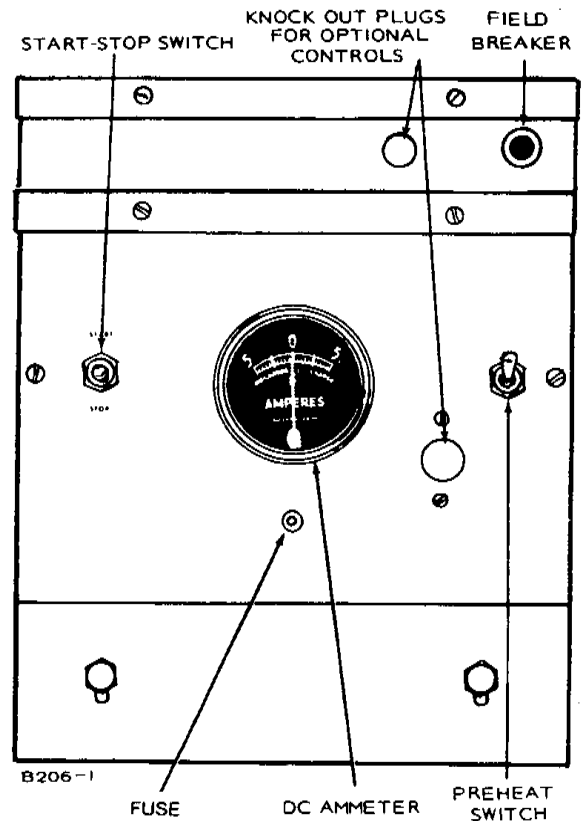


FIGURE 2. STANDARD CONTROL PANEL

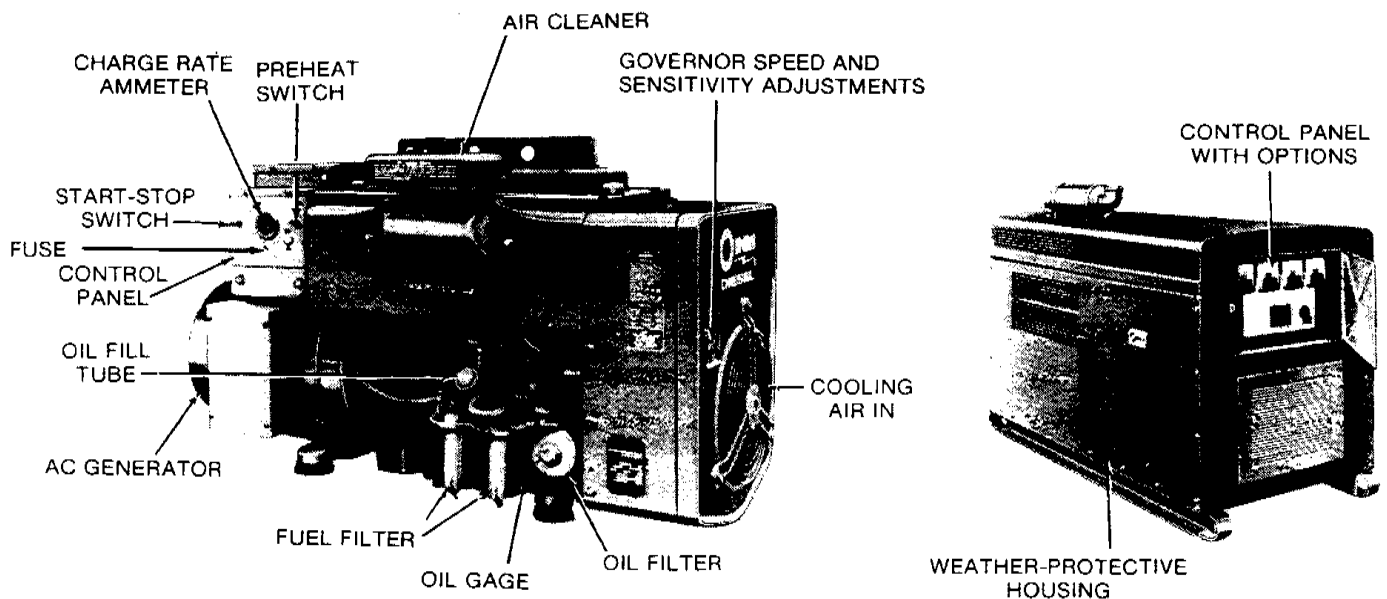


FIGURE 1. GENERATOR SETS

Frequency Meter: Indicates the frequency of the output voltage in hertz. It can be used to check engine speed (30 rpm—produces one hertz).

Warning Lights: Red indicator lights give warning of:

- Overspeed
- Low oil pressure
- High engine temperature

Reset pushbuttons permit restarting after trouble is corrected.

Line Circuit Breaker: Protect generator from line overloads.

Cranking Limiter: Thermally actuated device limits cranking time to between 45 and 90 seconds depending on the ambient temperature. Red pushbutton pops out and cannot be reset until one minute has elapsed.

VOLTAGE RECONNECTION WITH OPTIONAL INSTRUMENTS

The optional AC instruments on the control panel (such as voltmeters and running time meters) are installed for use with specific nameplate voltages. Control components may have to be changed to match new current ratings when field reconnections for other voltages are made.

CAUTION To prevent instrument damage, contact your Onan Service Center for required instrument changes, new wiring diagrams, proper specification number, and voltage before attempting to re-connect a generator with instruments on the control panel.



WARNING

INCORRECT SERVICE OR REPLACEMENT OF PARTS MIGHT RESULT IN SEVERE PERSONAL INJURY AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE QUALIFIED TO PERFORM ELECTRICAL AND/OR MECHANICAL SERVICE.

INSTALLATION

GENERAL

Installations must conform to local building codes, fire ordinances, and other local, state, and federal regulations. See Figure 3.

Installation requirements 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. Accessibility for operation and servicing.
9. Vibration isolation.
10. 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.

The air discharge side of set requires 3 inches (76 mm) clearance from wall to permit set to rock on its mounts; at least 24 inches (610 mm) clearance is required around all other sides for service accessibility.

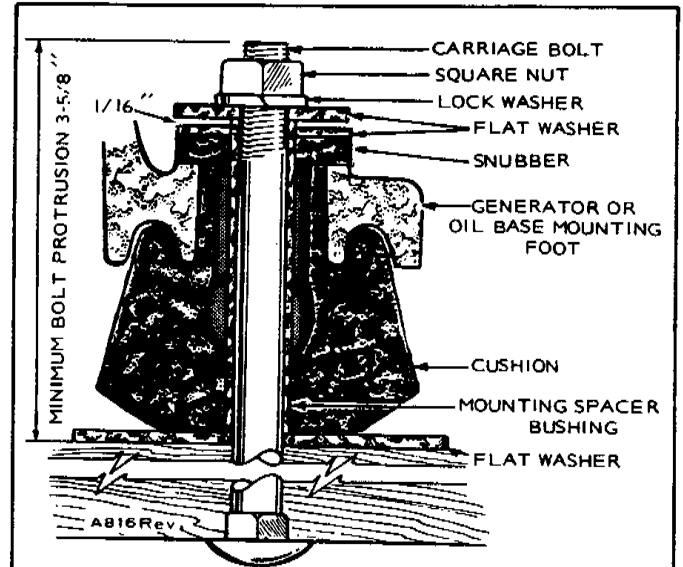
MOUNTING

A permanent type installation needs a sturdy, level, mounting base of concrete or structural steel at least 12 inches (305 mm) high to aid oil changing and operation. Place the 7/16 inch (11 mm) mounting bolts as shown in Figure 3.

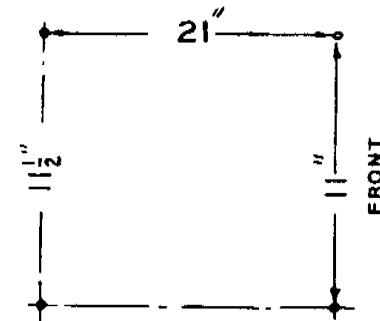
Carefully assemble the mounting cushions, washers and spacer bushing on the mounting bolts. The spacer bushing prevents compression of the snubber (upper rubber cushion).

CAUTION

One-half inch clearance is required between oil filter and mounting bolts to avoid puncturing filter. Allow 1/16 inch (1.6 mm) clearance between flat washers at upper end of mounting cushion bolts to prevent damage to the mounting spacer bushing, Figure 3. Do not over tighten.



MOUNTING CUSHIONS



MOUNTING BOLT LOCATIONS

INCHES TO MILLIMETERS CONVERSION

1/16"	1.588 mm
3-5/8"	92.075 mm
9"	228.6 mm
11"	279.4 mm
11-1/2"	292.1 mm
12"	304.8 mm
21"	533.4 mm

FIGURE 3. MOUNTING CUSHION INSTALLATION

EXHAUST

Pipe exhaust gases outside any enclosure. The exhaust outlet is 1-1/2-inch pipe size. Locate the exhaust outlet far from the air inlet to avoid gases re-entering the enclosure. Use flexible seamless tubing to connect between the engine exhaust and any rigid pipe extension to prevent transmission of vibration.

WARNING Pipe POISONOUS exhaust gas outside enclosure. Inhalation of exhaust gases can result in serious injury or death.

Exhaust installations are subjected to various detrimental conditions, such as extreme heat, infrequent operation, light operating loads, etc. Therefore, regular and frequent inspections are necessary to ensure that the exhaust system remains fume-tight and safe for operation.

WARNING Utilizing exhaust manifold heat to warm a room or compartment occupied by people is not recommended due to possible leaking of harmful exhaust gases which may result in personal injury or death.

An approved thimble must be used (Figure 4) where exhaust pipes pass through walls or partitions. Build the thimble according to codes (see National Fire Protection Association bulletin, Volume 4, section 211 on "Standards for Chimneys, Fireplaces and Vents").

As the exhaust pipe length and number of bends increases, larger pipe is required to eliminate excessive exhaust restriction and back pressure.

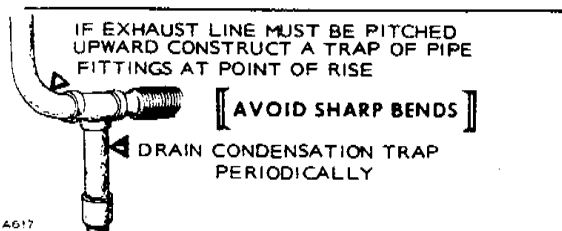
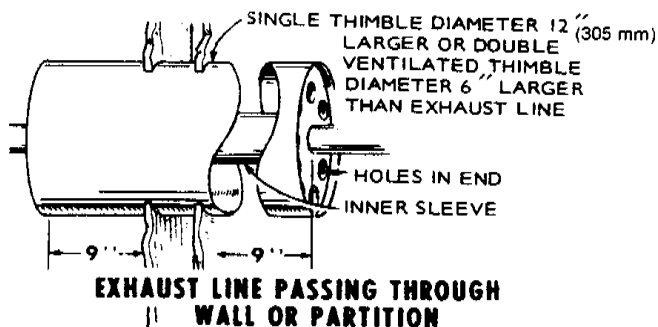


FIGURE 4. EXHAUST

Table 1 shows the maximum equivalent exhaust pipe length for exhaust systems using 1-1/2 inch through 3 inch pipe. Also shown are the equivalent lengths of various pipe fittings. The TOTAL exhaust system equivalent length (including all fittings and muffler) must NOT exceed the length shown in Table 1 for the size of pipe used. Exceeding the maximum length will create excessive back pressure in the system. The maximum allowable back pressure (measured at exhaust manifold) for the exhaust system is 27.2 inches (691 mm) H₂O.

MAXIMUM EQUIVALENT EXHAUST PIPE LENGTH—ONE CRITICAL MUFFLER INCLUDED

PIPE SIZE (INCHES)	1.25	1.5	2.0	2.5	3
MAXIMUM PIPE LENGTH IN FEET	10	20	80	180	483
	(3.1)	(6.1)	(24.38)	(54.86)	(147.2)

(Metres in Parentheses)

Max. Allowable Back Pressure is 27.2 inches (691 mm) H₂O.

EQUIVALENT LENGTHS OF PIPE FITTINGS

TYPE OF FITTING	1.5	2	2.5	3
Inches				
STANDARD ELBOW	4.4	5.3	6.4	8.1
Feet (Metres)	(1.34)	(1.62)	(1.95)	(2.47)
LONG RADIUS ELBOW	2.8	3.5	4.2	5.2
Feet (Metres)	(0.85)	(1.07)	(1.28)	(1.58)
MED. RADIUS ELBOW	3.6	4.6	5.4	6.8
Feet (Metres)	(1.10)	(1.40)	(1.64)	(2.07)
STANDARD TEE	9.3	13	14	17
Feet (Metres)	(2.83)	(3.96)	(4.27)	(5.18)

TABLE 1. EXHAUST LENGTH

VENTILATION AND COOLING

Air circulation is needed to dissipate heat produced by the engine and generator in normal operation. Outdoor installations can rely on natural circulation, but mobile, indoor or housed installations need properly sized and positioned vents for required air flow at about 960 cfm (27.2 m³/min), Figure 5.

Vent sizes depend on: (1) size of enclosure, (2) ambient temperature, (3) electrical load, (4) running time, (5) restrictions imposed by screens, louvers, shutters, or filters, and (6) prevailing wind direction.

A required volume of air must reach the unit, absorb the heat, and be discharged away from the installation.

Pressure cooled units need an inlet vent with an unrestricted opening of at least 5 square feet (4645 cm²) for variables. For discharged air, install separate ducts from the engine and generator (see exception) as follows:

1. The *engine discharge duct* must be 8 x 20 inches (203 x 508 mm). If a screen is used in the duct, increase the duct size in proportion to the restriction. Install the screen at a slant to reduce the restriction and increase duct size for runs over 9 feet (2.74 m). If bends are necessary, use large radius elbows. Use a canvas section at the set to isolate vibration and noise.
2. Use separate *generator outlet ducts* in compartments too small for operator to walk in. Ducts are recommended for all indoor installations. The air outlet is 5-5/8 x 3 inches (143 x 76 mm) Follow the

same principles of duct design and installation as used for the engine duct. Engine and generator require separate ducts.

Use *auxiliary fans* to increase air flow to units installed in small, poorly ventilated rooms. The fan size and location should be such that the air inlet to the engine doesn't exceed 120°F (49°C) when running at full rated load.

Onan *thermostatically controlled shutters* can be used to aid warm-up after starting and keep cold air out during shutdown. When the discharged air reaches 120°F (49°C), shutters begin to open; at 140°F (60°C), the shutters completely open.

WARNING Utilizing exhaust manifold heat to warm a room or compartment occupied by people is not recommended due to possible leaking of harmful exhaust gases which may result in personal injury or death.

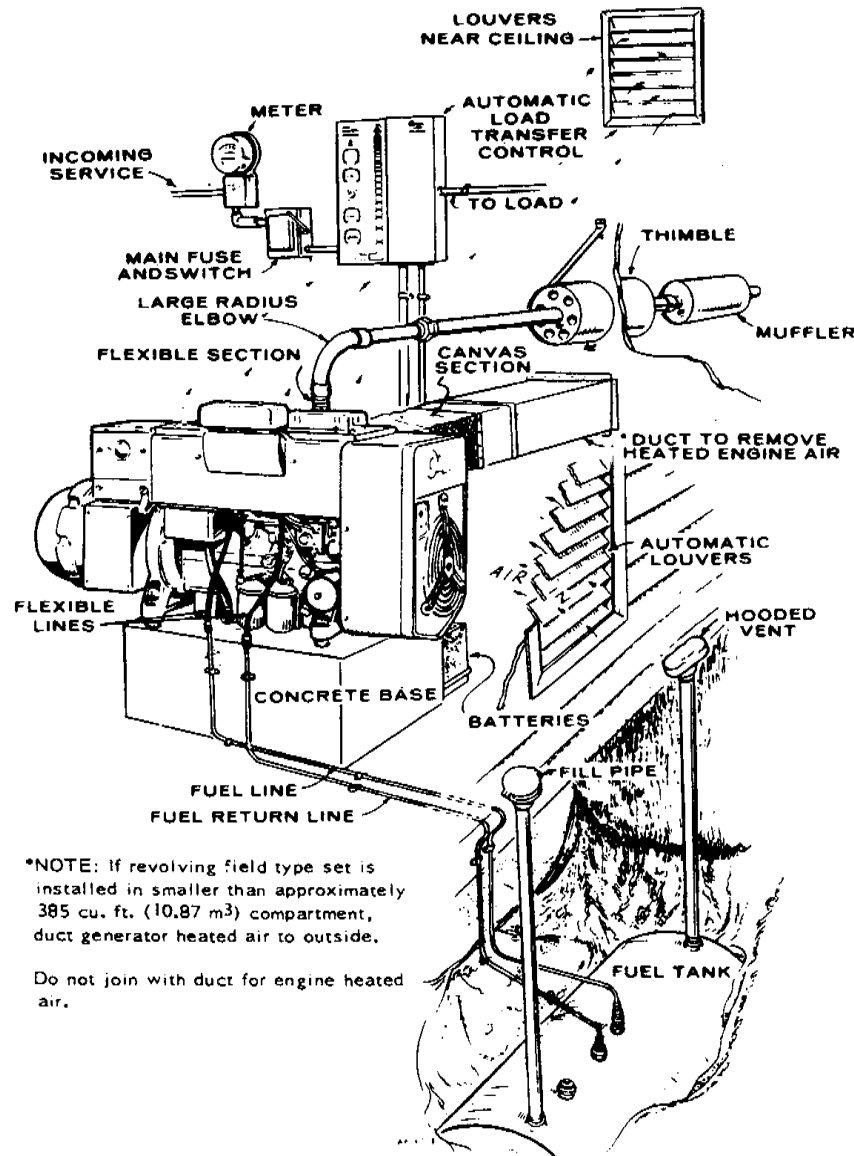


FIGURE 5. TYPICAL INSTALLATION

OIL DRAIN

The oil base has a 1/2 inch pipe size tapped hole for draining the oil. This may be fitted with a drain valve as required to suit installation.

FUEL TANK

If using a separate fuel tank, install the tank so the bottom is less than 6 feet (1.8 m) below the fuel pump. The tank top must be below fuel pump level to prevent putting a static head on the fuel pump inlet. Install a shut-off valve at the tank. When sharing the fuel tank with another engine, use a separate fuel line for each to avoid starving one of the engines.

If fuel lift must exceed 6 feet (1.8 m), install an auxiliary electric fuel pump at the fuel supply.

FUEL CONNECTION

Connect fuel line to fuel pump inlet. Pump is threaded 7/16-24 (SAE 45° inverted flare fitting).

WARNING Always use flexible tubing between engine and the fuel supply to avoid line failure due to vibration.

The engine requires a fuel supply line and a separate fuel return line. Install fuel return line from the 7/16-24 size opening in the overflow fitting located on injection pump (where nozzle fuel return line is also connected) to the top of the fuel supply tank (Figure 5).

WARNING Do not use galvanized fuel lines, fittings, or fuel tanks in the fuel system. Corrosion (galvanism) could cause hazardous leaks. Use black iron pipe if possible. While copper fuel lines have been used for years, the fuel could polymerize (thicken) during long periods of standby.

Carefully clean all fuel system components before putting the set into operation. Any dirt or contamination may cause major damage to the fuel injection system.

KEEP FUEL CLEAN!

•
DIRTY FUEL IS ONE OF THE MAJOR CAUSES
OF ENGINE FAILURE

•
REMEMBER—EVEN A TINY PARTICLE OF DIRT IN THE INJECTION SYSTEM MAY STOP YOUR ENGINE!

ELECTRICAL CONNECTIONS

The nameplate on the generator set shows the electrical output rating of the generator in watts, volts, and hertz. The wiring diagram, shipped with the generator set, shows the electrical circuits and connections needed during installation.

All electrical connections should be done by a qualified serviceman or electrician to meet the electrical code requirements in your area.

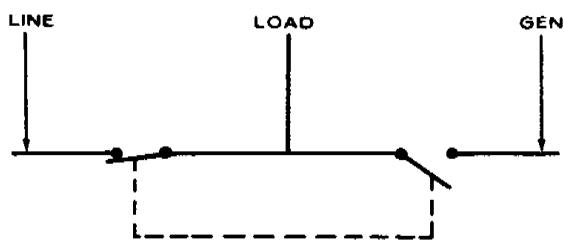
Load Wires

The control box (junction box) has knock out sections to accommodate load wires. Use flexible conduit and stranded load wires near the set to isolate vibration. Use suitable size insulated wires for the load rating applied.

Connect each load wire to the proper generator output lead inside the control box. Insulate bare ends of ungrounded wires. Use bolt provided on the control box to connect the generator ground lead or earth wire. Install a fused main switch (or circuit breaker) between the generator and load. If a test-run indicates wrong rotation of 3 phase motors in the load circuit, switch the connections at any two of the generator terminals.

Standby

If the installation is for standby service, install a double-throw transfer switch (either manual or automatic type) to prevent feeding generator output into the normal power source lines and to also prevent commercial power and generator output from being connected to the load at the same time. Instructions for connecting an automatic load transfer switch is included with such equipment. See Figure 6.



NOTE: SHOWN WITH LINE CONNECTED TO LOAD.

FIGURE 6. LOAD TRANSFER SWITCH
(TYPICAL FUNCTION)

BALANCING LOAD

120/240 Volt, Single Phase: 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 7. Connect the neutral load wire to the L0 connection. Two 120 volt circuits are thus available, with not more than 1/2 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.

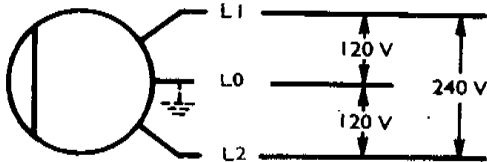


FIGURE 7. 120/240 VOLT, SINGLE PHASE

120/240 Volt, 3 Phase, 4 Wire Delta Connected Set: The 3 phase Delta connection is designed to supply 120 and 240 volt, 1 phase current and 240 volt, 3 phase current, Figure 8. 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.

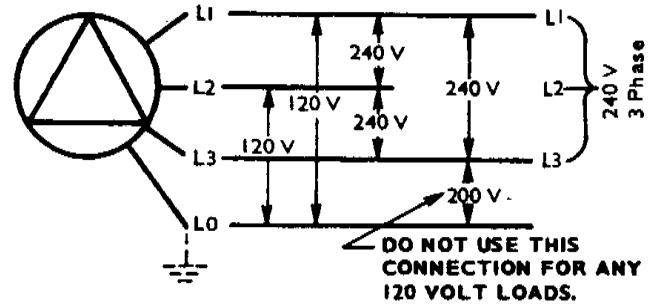


FIGURE 8. 3 PHASE, DELTA CONNECTION

3 Phase, 4 Wire, Wye Connected Set: The 3 phase, 4 wire connection 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 of the higher nameplate voltage is obtained between any two 3 phase terminals as shown in Figure 9.

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 1/3 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 9 shows load connections for 120/208 voltage. Other voltages are available from either parallel wye or series wye illustration in Figure 10.

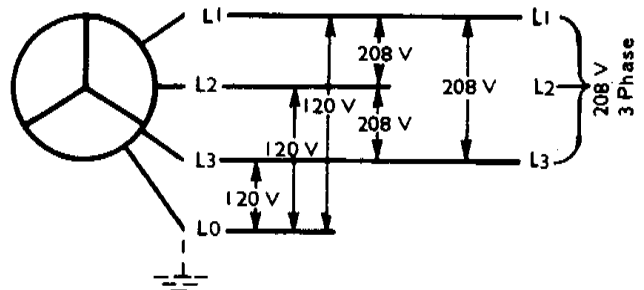


FIGURE 9. 3 PHASE, WYE CONNECTION

NAMEPLATE VOLTAGE CODE	VOLTAGE	PHASE	FREQUENCY	CONNECT W/O JUMPER WIRE FROM V4 TO:	GENERATOR CONNECTION	GENERATOR CONNECTION SCHEMATIC DIAGRAM			LOAD-TO-GENERATOR CONNECTIONS		
						A-240	B-120	C-120/240	A-240	B-120	C-120/240
3C	120/240	1	60	V1				CONNECT X1 TO TERMINAL 5 OF PRINTED CIRCUIT BOARD FOR 50 Hz, TO TERMINAL 6 FOR 60 Hz.			
53C	120/240	1	50	V3							
	115/230	1	50	V2							
	110/220	1	50	V1							
18	120/208 127/220 139/240	3	60	V1 V2 V4	PARALLEL WYE						
518	110/190 115/200 120/208 127/220	3	50	V1 V2 V3 V4							
18	240/416 254/440 277/480	3	60	V1 V2 V4	SERIES WYE						
518	220/380 230/400 240/416 254/440	3	50	V1 V2 V3 V4							
18	120/240	3	60	V1	SERIES DELTA						
518	110/220	3	50	V1							
	115/230 120/240	3	50	V2 V3							
18	120/240	1	60	V1	DOUBLE DELTA						
518	110/220	1	50	V1							
	115/230 120/240	1	50	V2 V3							
18	120	1	60	V1	PARALLEL DELTA						
518	110	1	50	V1							
	115 120	1	50	V2 V3							
9X	347/600	3	60	V4	WYE						

FIGURE 10. GENERATOR WIRING AND CONNECTION DIAGRAMS

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 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.

Output Lead Markings

Leads on revolving field generators are marked T¹, T², etc. These identifying marks also appear on the wiring diagram.

SWITCHBOARD

A wall mounted switchboard containing ammeters, a voltmeter, and circuit breakers is optional. When used, the following connections apply:

1. Connect one ungrounded (hot) generator lead to the unused terminal on each ammeter.
2. Connect the generator lead and load wires which are to be grounded to the ground stud on the switchboard.
3. Connect one ungrounded (hot) load wire to the unused terminal on each circuit breaker.
4. On sets that generate more than one voltage (example: 120/240), the voltmeter should be wired to indicate the higher of the two voltages.

RECONNECTIBLE GENERATORS

The factory ships all special order sets with instruments on the control panels completely wired for the voltage code or voltage specified on the customers purchase order. Standard sets without instruments are shipped with the T¹-T⁴ or T¹-T¹² output leads separated in the output box. These single phase and broad range generators are connectible or later reconnectible to provide any of the output voltages shown in Figure 10. Grounding or earthing procedure should comply with local electrical codes.

Code 3C or 53C Reconnectible Generators: The single phase, 60 and 50 Hertz generators have output leads T¹, T², T³, and T⁴ available for making the single phase voltage and load connections shown in Figure 10 at the installation site.

Code 18 or 518 Reconnectible Generators: The three phase, broad range, 60 and 50 Hertz 12 lead generators have output leads T¹ through T¹² available for making several single and three phase voltage load connections shown in Figure 10.

When connecting the output leads, be sure to connect jumper W10 on the voltage regulator printed circuit board between terminal V⁴ (common) and V¹, V², or V³ as listed on the reconnection diagram.

Code 9X Generators: These special order three phase, 60 Hertz, 4 wire, generators are prewired at the factory to provide 347/600 VAC. Output leads T¹, T², T³, and T⁰ are available for connection to the load wires. See connection diagram (Figure 10).

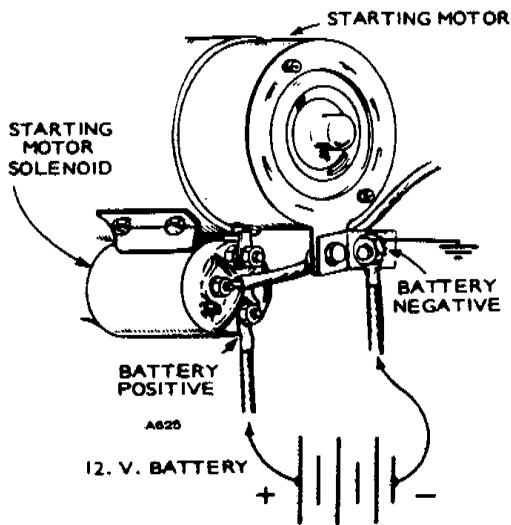
BATTERY CONNECTIONS

The battery is connected for negative (-) ground (Figure 11). Be sure all battery connections are secure.

CAUTION If battery polarity is reversed, damage will occur within 3 minutes while stopped or 5 seconds while running. Alternator windings will be damaged almost instantly if battery charging circuit is shorted between resistor R21 and the B1 end of the charging winding.

See *Specifications* for minimum 12-volt battery requirements. Connect battery positive (+) to starter engaging solenoid terminal post, Figure 11. Connect battery negative (-) to a good ground on the engine.

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



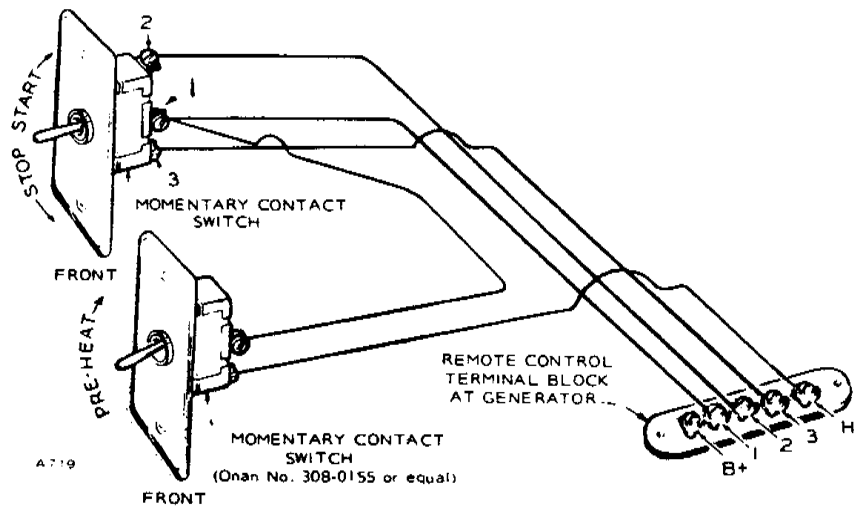
CABLE SIZE

mm	6.5	7.3	8.3	9.3	10.5	11.6
INCH	.258	.289	.325	.365	.410	.460
WIRE SIZE	2	1	0	00	000	0000
LOOP	4 ft.	5 ft.	7 ft.	9 ft.	11 ft.	14 ft.
	1.24 m	1.55 m	2.17 m	2.79 m	3.41 m	4.34 m

FIGURE 11. BATTERY CONNECTIONS AND CABLE DIMENSIONS

REMOTE START-STOP SWITCH (Optional)

For remote control starting and stopping, use 3 wires to connect the remote switch (single pole, double throw, momentary contact, center-off type) to the terminal block marked B+, 1,2,3, in the set control box using wire sizes as listed in Figure 12. Preheat circuit requires an extra wire to terminal H and momentary contact switch (SPST) connection. Remove jumper between terminals 3 and H before installing remote wiring.



WIRE SIZE	DISTANCE
#18 (1.02 mm)	to 65 ft. (20 m)
#16 (1.29 mm)	to 100 ft. (31 m)
#14 (1.63 mm)	to 150 ft. (47 m)
#12 (2.05 mm)	to 280 ft. (87 m)

FIGURE 12. REMOTE CONTROL

OPERATION

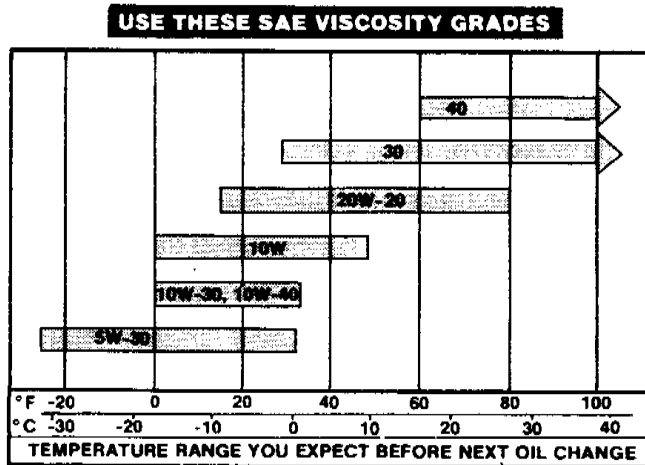
PRE-STARTING

Preparations for the initial and each additional starting operation include careful checks of the oil, fuel, cooling, and electrical systems. Close the cylinder air housing door with all air shrouds in place.

Before generator set is put into operation, check all components for mechanical security. If an abnormal condition, defective part, or operating difficulty is detected, repair or service as required. The generator set should be kept free of dust, dirt, and spilled oil or fuel.

Crankcase Oil

Use an oil with the API classification CD/SE (all grades) or CC/SE (10W-30, 10W-40, or 5W-30). However, to reduce oil consumption to a normal level in the shortest time possible on a new or rebuilt engine, use CC oil for the first fill only (50 hours). CD is the API classification for severe duty diesel lube oil.



Multi-grade oils should not be used when ambient temperatures are warmer than approximately 32°F (0°C). Use only specified single-grade oils (SAE 20W-20 is an exception and should be used).

When adding oil between oil changes, it is preferable to use the same brand, as various brands of oil may not be compatible together. Refer to *Maintenance* section for recommended oil change intervals and procedures.

WARNING

Never check oil level while engine is running. Hot oil discharged from the engine could cause personal injury.

Recommended Fuel

Use ASTM 2-D or 1-D fuel with a minimum Cetane number of 45*. Number 2 diesel fuel gives the best economy for most operating conditions; however, use ASTM 1-D fuel during the following conditions:

1. When ambient temperatures are below 32°F (0°C);
2. During long periods of light engine load; or no load.

*NOTE: Fuels with Cetane numbers higher than 45 may be needed in higher altitudes or when extremely low ambient temperatures are encountered to prevent misfires and resultant excessive smoke.

Use low sulfur content fuel having a pour point (ability to filter) of at least 10°F (6°C) below the lowest expected temperature. Keep the fuel clean and protected from adverse weather. Leave some room for expansion when filling the fuel tank.

CAUTION

Due to the precise tolerances of diesel injection systems, it is extremely important the fuel be kept clean. Dirt in the system can cause severe damage to both the injection pump and the injection nozzles.

Bleeding Fuel System

Bleed air from fuel system as follows: Disconnect fuel return line, Figure 13. Operate hand priming lever on fuel transfer pump until fuel flowing from fuel return line is free of air bubbles. Then reconnect the fuel return line.

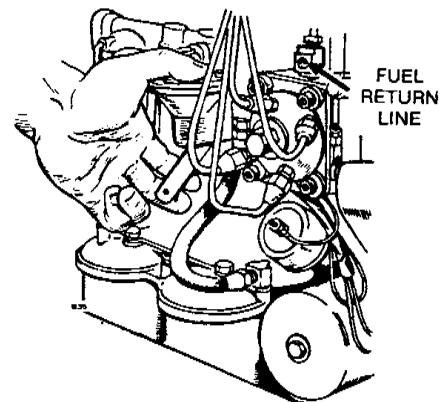


FIGURE 13. FUEL SYSTEM

If the camshaft's pump lobe is up, crank engine one revolution to permit hand priming. When finished, return priming lever inward (disengaged position) to permit normal pump operation.

COLD WEATHER STARTING

Preheating for 60 seconds is recommended on all DJ-Series Diesels at 55°F (13°C) or lower, and 30 seconds for temperatures above 55°F (13°C). Refer to Onan Diesel Starting Guide, page 23.

WARNING Do not use ether as a cold weather starting aid. The heat from the glow plugs or manifold heater may cause a sudden ignition of the ether vapor. This can result in personal injury and damage to the engine.

1. Engage PREHEAT switch for 1 minute. On contractor models, turn OFF-RUN switch to RUN.
2. Engage START switch. On contractor models, continue to hold PREHEAT switch until engine comes up to speed. On all other models, hold START switch to START until engine comes up to speed. (This will maintain heater operation until START switch is disengaged.)
3. If engine fails to start after 15-20 seconds, repeat steps 1 & 2 above. Absence of blue/white exhaust smoke during cranking indicates no fuel being delivered. Determine cause.
4. In extreme cold it may be necessary to maintain preheating up to 2 minutes after the engine starts to obtain firing or to smooth out all cylinders, especially at no load or light loads.

CAUTION Do not exceed the one minute preheat periods to prevent heater burn out and conserve the battery. Longer preheating time prior to cranking the engine can ruin the manifold heater and glow plugs because there is no incoming air flow to cool them. Additional operation of the preheaters for a few seconds during cranking in cold weather may help to preheat the incoming combustion air and prevent misfires as the engine starts running.

STARTING

1. Push START-STOP switch to its START position.
2. Release switches after engine starts and reaches speed.
3. Oil pressure should read at least 20 psi (pressure relief valve is not adjustable).

On "standard" model, depress preheat switch for one minute and then push start switch. Both switches must be engaged for starting.

If the control has a reset button, push it to reset only after a shutdown resulting from oil pressure failure occurs. Find the cause before restarting the engine.

CAUTION Do not apply overvoltage to the starting circuit at any time. Overvoltage will destroy the glow plugs and air heater in 2 to 3 seconds. If it becomes necessary to use an additional source of power to start the set — use a 12 volt battery connected in parallel.

AUTOMATIC STARTING

The automatic control has a time delay relay to preheat glow plugs and the manifold heater for about 20 seconds before cranking occurs. The time delay relay prevents immediate engagement of the starter in case the load is reapplied before the engine stops.

STOPPING

1. Push fuel solenoid switch to stop position.
2. Release switch when set stops. If stop circuit fails, close fuel valve.

APPLYING LOAD

If practicable, allow engine to warm up before connecting a heavy load. Continuous overloading causes high operating temperatures that can damage the engine. The exhaust system may form carbon deposits during operation at light loads; apply full load occasionally before shut-down to prevent excessive carbon accumulations.

Try to connect the load in steps instead of full load at one time.

EXERCISING UNIT

Infrequent use of units can result in the following: Water condensing in engine fuel and lubrication system causing contamination and/or corrosion, loss of protective oil film on moving engine parts, loss of engine fuel prime due to drain-back and/or evaporation, battery discharge due to internal and external current leakage, and breakdown of generator insulation due to water absorption.

Proper exercising does the following: Elevates engine oil temperature to at least 180°F (82.2°C) evaporating water from engine lubrication system, re-establishes a protective oil film on engine parts, recharges battery to full normal potential, and brings generator up to normal operating temperature through actual application of load. The engine oil temperature should be held at 180°F (82.2°C) for at least 20 minutes and the unit should be exercised at least once each month.

Proper exercising can usually be accomplished by observing the following procedures.

1. Perform all specified maintenance checks, start unit and apply load by creating a simulated power failure.* This exercises the control and switch-gear systems.
2. Apply not less than 50 percent load and use thermostatic shutters** if needed, to heat up engine and generator as described above.
3. Exercise unit long enough to provide at least 20 minutes running time at normal operating temperatures. This will require at least 60 minutes total running time. Running time for a particular installation may be established by checking engine oil temperature during acceptance tests after the unit is first installed.

4. Shutdown unit by simulating return of normal power.* Provide approximately 10 minutes of operation at no load to allow the engine to cool down.

***This applies to standby units only. Other units should be started and loaded by control and load application systems normally associated with operation of the unit.**

****Some Onan air cooled diesels will not warm up to 180° F oil temperature when ambient temperatures are approximately 0° F. This is acceptable.**

Improper exercising may cause more damage than no exercising at all because of the following: Significant amounts of water and raw fuel will remain in the lubrication oil if the unit is not at the specified operating temperature; operating engine at no load or at temperatures below those specified causes carbon build-up, exhaust system fouling, and inadequate charging of battery. Continued operation in this manner may cause starting failure and/or engine damage. Exercising a generator set without exercising associated controls and switchgear does not ensure operating integrity of the controls and switchgear. If the associated equipment is not fully functional, the system may fail to provide power when required.

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

BREAK-IN PROCEDURE

The unit should be run in the following sequence:

1. One half hour at 1/2 load.
2. One half hour at 3/4 load.
3. Full load.

Continuous running under one half load during the first few hundred hours usually results in poor piston ring seating, causing higher than normal oil consumption and blowby.

Drain and replace the crankcase oil after first 50 hours of operation; drain while the engine is still hot.

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 the electrolyte at the proper level above the plates by adding distilled water. Check specific gravity; recharge if below 1.260.

EMERGENCY OPERATION IF BATTERY FAILS

If the battery fails completely and the set must be operated during an emergency, borrow a 12 volt battery from a truck or other equipment.

OUT-OF-SERVICE PROTECTION

The natural lubricating qualities of No. 2 diesel fuel should protect a diesel engine for at least 30-days when unit is not in service. To protect a set that will be out of service for more than 30 days, proceed as follows:

1. Run set until thoroughly warm; generator under at least 50 percent load.
2. Shut down engine and drain oil base while warm. Refill and attach a warning tag indicating viscosity of oil used.
3. Remove glow plugs. Pour 1 ounce of rust inhibitor (or SAE #10 oil) into each cylinder. Crank engine over several times. Reinstall glow plugs.
4. Service air cleaner.
5. Clean throttle and governor linkage and protect by wrapping with a clean cloth.
6. Plug exhaust outlets to prevent entrance of moisture, bugs, dirt, etc.
7. Clean and wipe entire unit. Coat parts susceptible to rust with a light coat of grease or oil.
8. Disconnect battery and follow standard battery storage procedure.
9. Provide a suitable cover for the entire unit.

Returning a Unit to Service

1. Remove cover and all protective wrapping. Remove plug from exhaust outlet.
2. Check warning tag on oil base and verify that oil viscosity is still correct for existing ambient temperature.
3. Clean and check battery. Measure specific gravity (1.260 at 77° F [25° C]) and verify electrolyte level to be at split ring. If specific gravity is low, charge until correct value is obtained. If level is low, add distilled water and charge until specific gravity is correct. **DO NOT OVERCHARGE.**

WARNING Do not smoke while servicing batteries. Explosive gases are emitted from batteries in operation. Ignition of these gases can cause severe personal injury or death.

4. Check that fuel injectors and fuel lines are secure, correctly torqued without leaks.
5. Clean cooling fin areas.
6. Connect batteries.
7. Verify that no loads are connected to generator.
8. Start engine and observe oil pressure gauge and charge rate ammeter.

After engine has started, excessive blue smoke will be exhausted until the rust inhibitor or oil has burned away.

9. After start, apply load to at least 50 percent of rated capacity.
10. Unit is ready for service and load may be applied.

HIGH TEMPERATURES

1. See that nothing obstructs air flow to and from the set.
2. Keep cooling fins clean. Air housing should be properly installed and undamaged.

LOW TEMPERATURES

1. Use correct viscosity oil for temperature conditions. Change oil only when engine is warm. If an unexpected temperature drop causes an emergency, apply heated air externally until oil flows freely. Never use open flame.
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. Refer to Onan Diesel Starting Guide, page 23.

DUST AND DIRT

1. Keep set clean. Keep cooling fins free of dirt, etc.
2. Service air cleaner as frequently as necessary.
3. Change crankcase oil every 100 operating hours.
4. Keep oil and fuel in dust-tight containers.
5. Keep governor linkage clean.

HIGH ALTITUDE

Maximum power will be reduced approximately 4 percent for each 1000 feet (305 m) above sea level, after the first 1000 feet (305 m).

ADJUSTMENTS

CENTRIFUGAL SWITCH

The start-disconnect centrifugal switch (Figure 14) is located on the side of the engine above the oil filter. The switch opens when the engine stops and closes when engine speed reaches about 900 rpm. If necessary, loosen the stationary contact and adjust the point gap at .020 inch (.508 mm). Replace burned or faulty points.

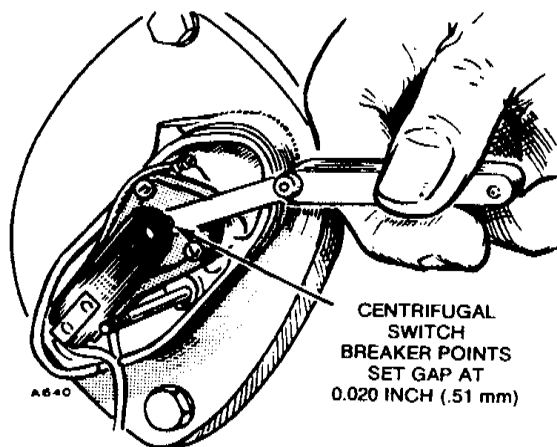


FIGURE 14. CENTRIFUGAL SWITCH ADJUSTMENT

GOVERNOR

The governor controls engine speed. Engine speed equals frequency multiplied by 30, on a 4 pole generator, thus 1800 rpm generates 60 hertz; 1500 rpm generates 50 hertz. Preferred speed does not vary more than 3 hertz from no-load to full-load operation. Be sure throttle, linkage, and governor mechanism operate smoothly.

Speed Adjustment

To change the governor speed, change the spring tension by turning the governor spring nut (Figure 15). Turn the nut clockwise (more spring tension) to increase rpm and counterclockwise to reduce governed speed. Hold a tachometer against flywheel-crankshaft cap screw or observe frequency meter.

Sensitivity Adjustment

To adjust governor sensitivity (no load to full load speed droop), turn the sensitivity adjusting ratchet. Counterclockwise gives more sensitivity (less speed drop when full load is applied), clockwise gives less sensitivity (more speed drop). If the governor is too sensitive, a rapid hunting condition occurs (alternate increasing and decreasing speed). Adjust for maximum sensitivity without hunting. After sensitivity adjustment is made, speed readjustment will be required. When governor adjustment is completed, replace the knockout plug in the blower housing and secure speed stud lock nut.

Excessive droop may be caused by engine misfiring. Correct this condition before adjusting governor.

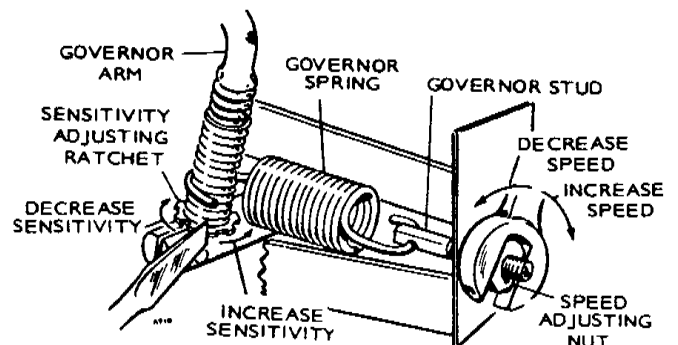
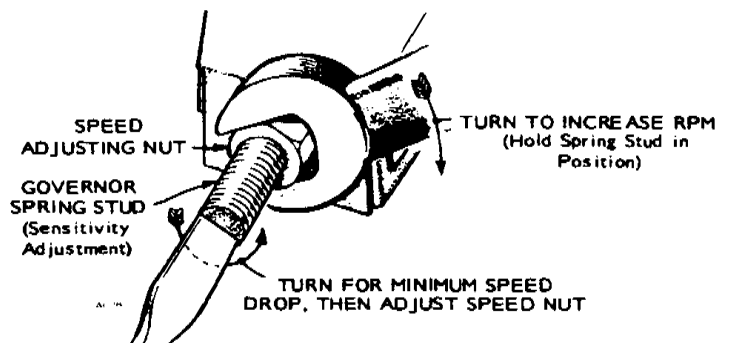


FIGURE 15. GOVERNOR ADJUSTMENT

CHARGE RATE ADJUSTMENT

The adjustable resistor slide tap (in the charging circuit) is set to give approximately 2 ampere charging rate. The resistor is located in the generator air outlet. For applications requiring frequent starts, check battery specific gravity periodically and, if necessary, increase the charging rate slightly (move slide tap up). Adjust only when engine is stopped. Avoid overcharging.

If using a separate automatic demand control for starting and stopping, adjust the charge rate for its maximum 4.5 amperes. This normally keeps battery charged even if starts occur as often as 15 minutes apart.

VALVE CLEARANCE

Check valve clearance when the engine is at room temperature, about 70°F (21°C).

1. Turn the flywheel until the cylinder which is to have its valve adjusted is on its compression stroke. On engines without a hand crank use a socket wrench on the flywheel screw hex head.

To determine if the cylinder is in its compression stroke, observe the action of the push rods as the engine is rotated in a clockwise direction. The exhaust valve push rod will be in its lowest position and the intake valve push rod will be moving downward. As the piston reaches top dead center, the flywheel timing mark should be aligned with the timing pointer and the valve push rods stationary.

2. Turn the flywheel clockwise for an additional 10 to 45 degrees. There is no timing mark for this position so it must be estimated. With the piston located in this position, it will be in its power stroke with both valves completely closed.
3. Check cylinder head-bolt torque prior to valve clearance adjustment. Torque should be 44-46 foot-pounds (59.7-62.4 N•m). Valve clearance is adjusted with the locknut which secures rocker arm to the cylinder head (see Figure 16). Loosen the locknut to increase clearance and tighten to reduce clearance.
4. Using a feeler gauge, check the clearance between the rocker arm and the valve (see Figure 17). Increase or decrease the clearance until the proper gap is established. Valve clearances are given in the *Specifications* section.
5. Always adjust the valve clearances in the firing order (1-2-4-3) sequence. After positioning #1 cylinder, adjust the valve clearance according to steps 3 and 4.
6. To adjust the valve clearance of #2 cylinder, turn the flywheel in a clockwise direction 180 degrees (one half revolution) from the position used when timing #1 cylinder. The flywheel position should be between 10 and 45 degrees past the BC (bottom center) flywheel mark.

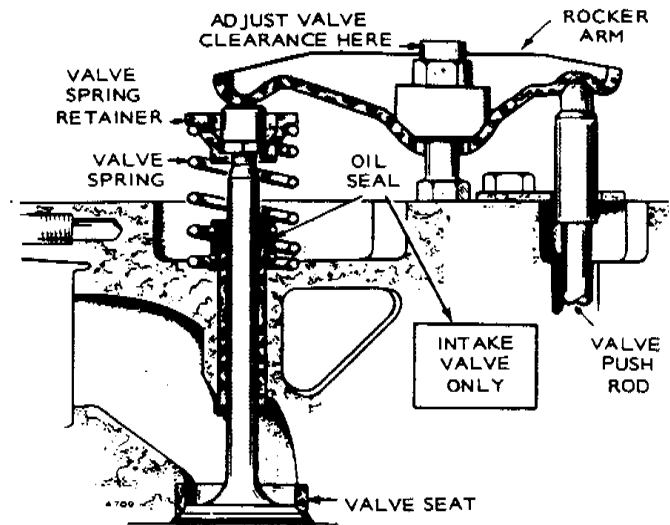


FIGURE 16. VALVE CLEARANCE ADJUSTMENTS

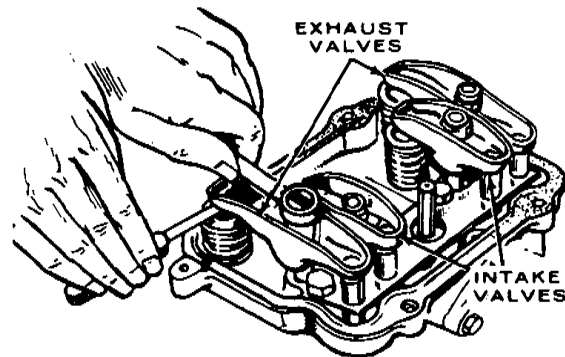


FIGURE 17. CHECK VALVE CLEARANCE

7. After positioning #2 cylinder, adjust the valve clearance according to steps 3 and 4.
8. To adjust the valve clearance for #4 cylinder, turn the flywheel in a clockwise direction 180 degrees (one half revolution). The flywheel should be between 10 and 45 degrees past the TC (top center) flywheel mark.
9. After positioning #4 cylinder, adjust the valve clearance according to steps 3 and 4.
10. To adjust the valve clearance for #3 cylinder, turn the flywheel in a clockwise direction 180 degrees (one half revolution). The flywheel should be between 10 and 45 degrees past the BC (bottom center) flywheel mark.
11. After positioning #3 cylinder, adjust the valve clearance according to steps 3 and 4.

GENERAL MAINTENANCE

GENERAL

Follow a regular schedule of inspection and servicing, based on operating hours (Table 2). Keep an accurate logbook of maintenance, servicing, and operating time. Use the running time meter (optional equipment) to keep a record of operation and servicing. Regular service periods are recommended for normal service and operation conditions. For continuous duty, extreme temperature, etc., service more frequently. For infrequent use, light duty, etc., service periods can be lengthened accordingly.

WARNING Before beginning 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 equipment or serious personal injury in the event of inadvertent starting.

PERIODIC CHECKS

Operator should periodically make a complete visual inspection with set 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 air shrouds for leaks and security. Be sure cooling fins are clean.
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.

OIL FILTER CHANGE

Place pan under oil filter and remove filter by turning counterclockwise. Clean filter mounting area. Oil filter gasket and install new filter. Turn filter on clockwise until gasket touches mounting base, then tighten 1/2 turn. See Figure 18.

OIL CHANGE

Stop the engine and drain the crankcase oil while the engine is still hot. Place a pan under the drain outlet and remove the oil drain plug or open the oil drain valve. After the oil is completely drained, replace the drain plug or close the drain valve. Refill with oil of the correct API designation and the appropriate SAE viscosity grade for the temperature conditions (refer to *Operation* section).

TABLE 2.
OPERATOR AND SERVICE MAINTENANCE SCHEDULE

HOURS OF OPERATION	MAINTENANCE TASK
8	<ul style="list-style-type: none"> • Inspect exhaust system • Inspect generator set • Check fuel supply; see Note 1. • Check oil level
50 (more often in dusty conditions)	<ul style="list-style-type: none"> • See Note 3. • Check air cleaner.
100	<ul style="list-style-type: none"> • Clean governor linkage • Change crankcase oil • Clean sediment bowl and filter on fuel transfer pump. See Note 1.
200	<ul style="list-style-type: none"> • Replace oil filter • Check battery condition
500	<ul style="list-style-type: none"> • Check start-disconnect circuit • Check valve clearances
600	<ul style="list-style-type: none"> • Change primary fuel filter
2000	<ul style="list-style-type: none"> • Grind valves (if required) • Clean holes in rocker box oil line • Check nozzle spray pattern; see Note 2 • Clean generator
3000	<ul style="list-style-type: none"> • Change secondary fuel filter
5000	<ul style="list-style-type: none"> • General overhaul (if required) See Note 3.

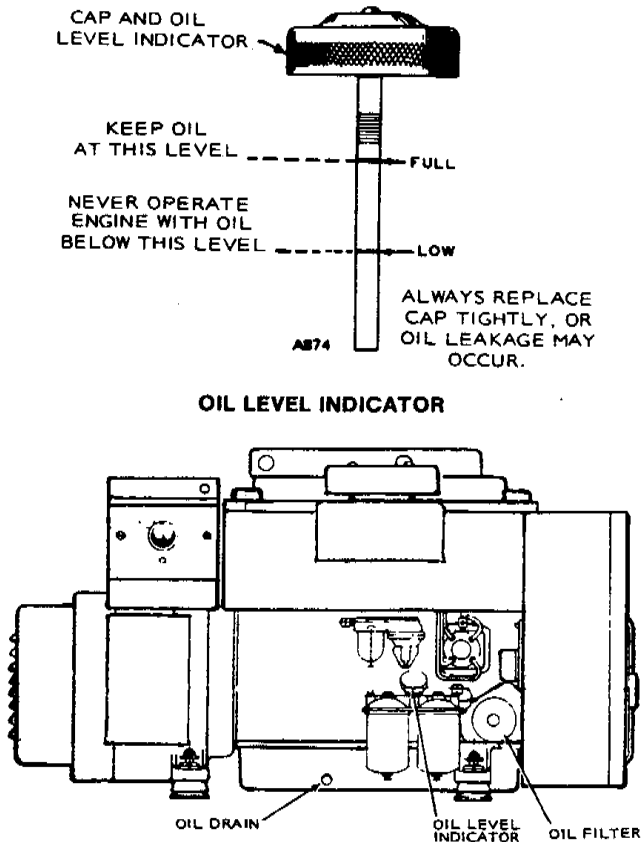
NOTE 1. Water or foreign material in fuel can ruin the injection system. If daily inspection shows water or excessive dirt in sediment bowl, fuel handling and storing facilities should be checked and situation corrected. Primary and secondary fuel filters can be replaced following correction of fuel contamination problem.

2. This service must be conducted by trained diesel injection equipment personnel with suitable test facilities. Omit this service until these conditions can be met.

3. Tighten head bolts and adjust valve clearance after first 50 hours on new and overhauled engines, and then adjust valve clearance each 500 hours thereafter.

Check the oil level indicator after every 8 hours of operation and maintain the oil level at the full mark (Figure 18). The oil should be changed after every 100 hours of operation. Refer to the *Specifications* section for crankcase and filter capacity.

WARNING Never check oil level while engine is running. Hot oil discharged from the engine could cause personal injury.



LOCATION OF OIL DRAIN, OIL LEVEL INDICATOR, AND OIL FILTER

FIGURE 18. OIL CHANGE

AC GENERATOR

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 fail. Blow off the assembly periodically, with filtered, low pressure air.

BATTERIES

Check 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 the electrolyte at the proper level above the plates by adding distilled water. Check specific gravity; recharge if below 1.260.

WARNING Discharged batteries are subject to severe damage if exposed to freezing temperatures. Store all batteries in a fully charged condition and maintain charge during storage.

AIR CLEANER

After every 50 hours of operation remove and clean filter element, Figure 19.

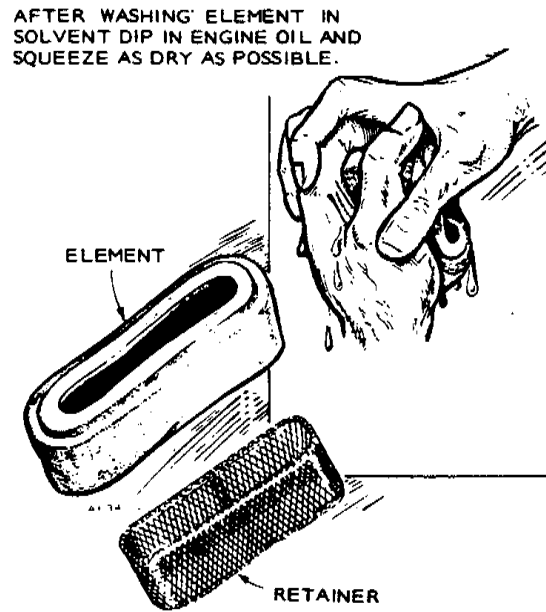


FIGURE 19. POLYURETHANE FOAM AIR CLEANER

OPTIONAL OIL BATH AIR CLEANER

1. Loosen bottom clamp, remove cleaner base and clean, Figure 20.
2. Refill base to oil level mark with fresh oil, same weight as used in engine.

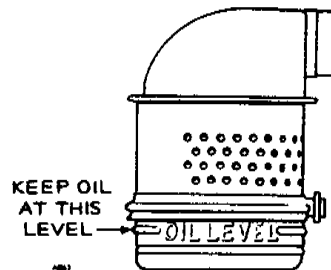


FIGURE 20. OIL BATH AIR CLEANER

CONTRACTOR MODEL AIR CLEANER

1. Remove pre-cleaner and wash out dirt, Figure 21.
2. Loosen clamp and remove end cover.
3. Remove thumbscrew and take out element. Wash element in detergent and water (use new element after 6 washings). Dry and re-install.
4. Remove air cleaner baffle from cover, wash out dirt, and re-install in cover.
5. Install cover with "TOP" up and tighten clamp.

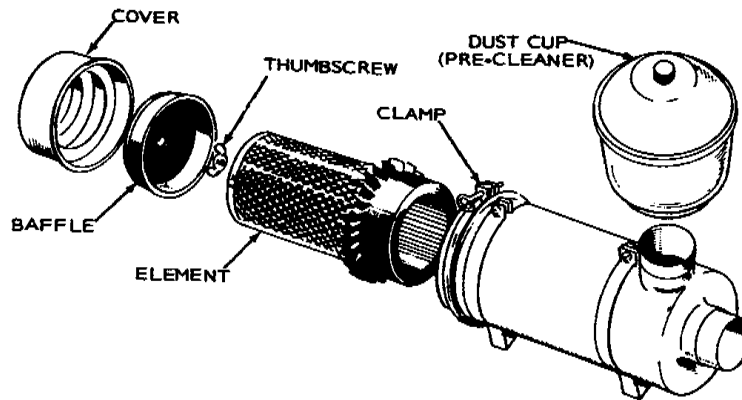


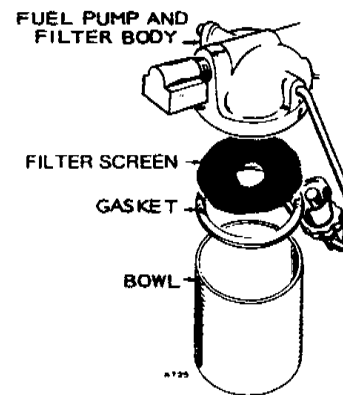
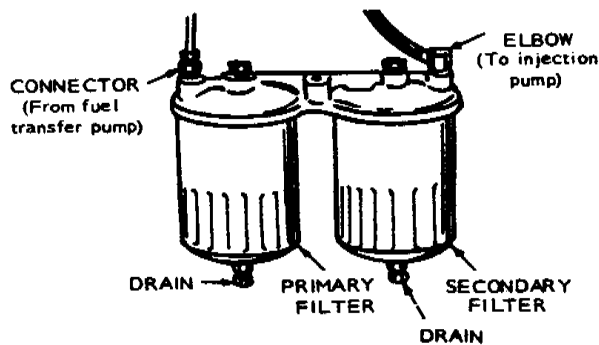
FIGURE 21. CONTRACTOR MODEL AND CLEANER

FUEL FILTERS

Change primary fuel filter after every 600 hours of operation. Change secondary fuel filter after every 3000 hours of operation. See Figure 22.

FUEL PUMP SEDIMENT BOWL

Remove the sediment bowl from the fuel filter body, Figure 22. Clean out any contaminants from sediment bowl. When re-installing the sediment bowl, make sure that gasket and screen are in place.



FUEL PUMP

CAUTION Drain plug on fuel filters can tolerate only a limited amount of torque. Use two wrenches in combination for breaking plug loose and for final tightening.

B208

FIGURE 22. FUEL FILTERS AND SEDIMENT BOWL

CRANKCASE BREATHER

The crankcase breather tube must be cleaned after every 500 hours of operation. Do not remove tube for cleaning. Insert a soft wire through the breather tube to ensure the hole is open. See Figure 23.

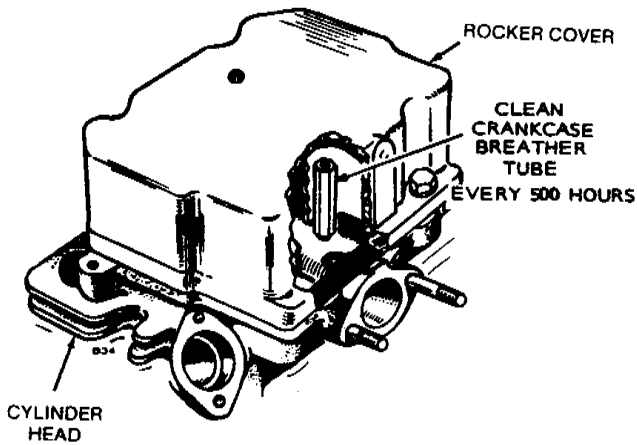


FIGURE 23. CRANKCASE BREATHER

CRANKCASE BREATHER CAP

Remove the breather cap from the breather tube. At same time, pull the baffle out of the breather tube and clean it. See Figure 24.

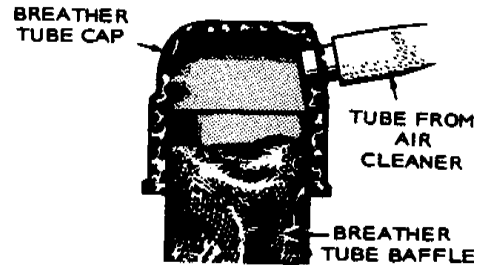


FIGURE 24. BREATHER CAP

ONAN DIESEL STARTING GUIDE

IMPORTANT!

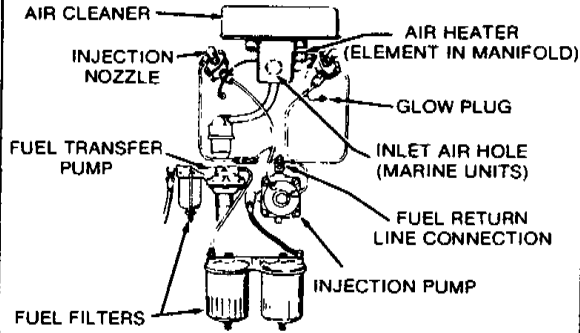
KEEP ENTIRE FUEL SYSTEM CLEAN AND FREE FROM WATER

- DIESEL INJECTION PUMPS WILL FAIL IF SYSTEM CLEANLINESS IS NEGLECTED

INJECTION PUMPS AND NOZZLES ARE NOT FIELD REPAIRABLE

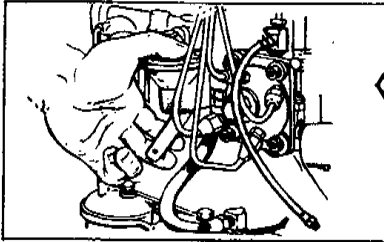
- WHEN TROUBLESHOOTING, CHECK ALL OTHER COMPONENTS FIRST

WARNING DO NOT USE ETHER STARTING AIDS! ETHER IS EXTREMELY EXPLOSIVE AND MAY CAUSE SERIOUS PERSONAL INJURY. ENGINE DAMAGE IS ALSO LIKELY.



BEFORE STARTING:

CHECK FUEL SUPPLY. BE SURE SHUTOFF VALVES ARE OPEN.



PRIME FUEL SYSTEM IF: FUEL FILTERS WERE DRAINED OR CHANGED, SYSTEM WAS JUST INSTALLED, FUEL TANK RAN DRY.

TO PRIME PUMP, MOVE PRIMING LEVER UP AND DOWN UNTIL FUEL FLOWS STEADILY FROM RETURN LINE (DISCONNECTED).

PREHEAT



PREHEAT COLD ENGINE: PUSH PREHEAT SWITCH AND HOLD —

- 30 SECONDS IF ABOVE 55°F (13°C);
- 60 SECONDS IF BELOW 55°F (13°C).

TO START:

PREHEAT



RELEASE PREHEAT

START



ENGAGE START SWITCH

STOP

LIMIT CRANKING TO 15 TO 20 SECONDS TO CONSERVE BATTERY. ALLOW 1 MINUTE BEFORE RE-CRANKING.

IF ENGINE DOES NOT START:

IF ENGINE FIRED, REPEAT ABOVE PROCEDURES, INCLUDING PRE-HEAT. IF IT STILL DOES NOT START, PROCEED AS FOLLOWS:

TEMPERATURES BELOW 32°F (0°C):

USE NUMBER 1 DIESEL FUEL. USE CORRECT VISCOSITY OIL. KEEP BATTERIES FULLY CHARGED. DO NOT USE ETHER STARTING AID.

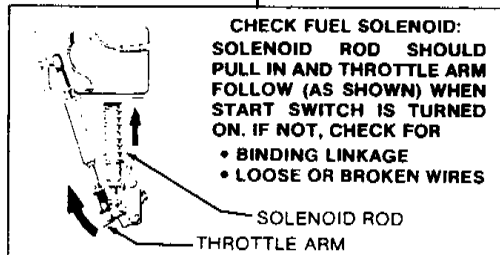
OBSERVE ENGINE EXHAUST "SIGNALS":

BLUE-WHITE EXHAUST SMOKE:
ENGINE IS GETTING FUEL

1. OBSERVE AIR HEATER THRU AIR INLET HOLE OR BY REMOVING AIR CLEANER.
2. ENGAGE PREHEAT.
3. IF HEATER ELEMENT DOES NOT GLOW RED WITHIN 30 SECONDS, CHECK AIR HEATER AND GLOW PLUG WIRING:
 - CONNECTIONS TIGHT?
 - FREE FROM CORROSION?

LITTLE OR NO EXHAUST SMOKE: ENGINE IS NOT GETTING FUEL.
• PRIME FUEL SYSTEM AS SHOWN ABOVE:
OBSERVE FUEL FLOW FROM RETURN LINE

FUEL FLOWS STEADILY



CHECK FUEL SOLENOID:
SOLENOID ROD SHOULD PULL IN AND THROTTLE ARM FOLLOW (AS SHOWN) WHEN START SWITCH IS TURNED ON. IF NOT, CHECK FOR

- BINDING LINKAGE
- LOOSE OR BROKEN WIRES

LITTLE OR NO FUEL FLOW

CHECK FUEL SUPPLY SYSTEM:

- FUEL TANK EMPTY?
- SHUTOFF VALVES CLOSED?
- FUEL LINES KINKED?
- LOOSE CONNECTIONS?
- CLOGGED FUEL FILTERS?

IF ENGINE IS STILL NOT GETTING FUEL, CHECK TRANSFER PUMP:
1. CRANK ENGINE AND OBSERVE FUEL FLOW FROM RETURN LINE.
2. IF FUEL DOES NOT SPURT OUT, PUMP MAY BE DEFECTIVE.

IF ENGINE STILL DOES NOT START, CONTACT AUTHORIZED ONAN SERVICE REPRESENTATIVE

2-79 900-0217

TROUBLE

DIESEL ENGINE TROUBLESHOOTING GUIDE

CAUSE

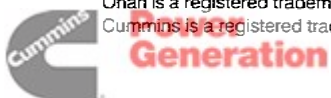
Trouble	Starting System	Fuel System	Lubrication System	Governor System	Cooling System	Internal Engine	Cause
COMPRESSION POOR							
CONNECTING ROD BUSHINGS BEARINGS WORN							
COOLANT TEMPERATURE TOO HIGH (FRESH WATER SYSTEM)							
COOLANT TEMPERATURE TOO LOW (FRESH WATER SYSTEM)							
ENGINE OVERHEAT							
ENGINE SPEED TOO LOW							
FUEL CONSUMPTION EXCESSIVE							
FUEL CONSUMPTION EXCESSIVE - LIGHT BLUE SMOKE EXHAUST							
GOVERNOR CONTROL LOSS							
HUNTING							
INJECTION PUMP TIMING INCORRECT							
MECHANICAL KNOCKS							
OIL CONSUMPTION EXCESSIVE							
OIL CONSUMPTION EXCESSIVE - LIGHT BLUE SMOKE EXHAUST							
OIL DILUTED							
PIL PRESSURE HIGH							
PIL PRESSURE LOW							
PISTON CYLINDER AND RING WEAR							
STARTER SPEED SLOW							
STARTING MOTOR DOES NOT TURY							
STARTING HARD OR FAILURE TO START							
SENSITIVITY POOR							
VALVE BREAKAGE							
VALVE BURNING							
VALVE STICKING							
STARTING SYSTEM							
							Discharged or Defective Battery
							Defective Glow Plug or Lead
							Load Connected When Starting
							Defective Solenoid
							Defective Starter
							Defective Control Circuit
FUEL SYSTEM							
							Defective Fuel System
							Air in Fuel System
							Incorrect Timing
							Restricted Air Intake - Dirty Air Filter
							Poor Quality Fuel
							Dirty Fuel Filters
							Out of Fuel or Shut Off Closed
							Worn or Damaged Transfer Pump, Leaking Diaphragm
							Faulty Injection Pump, Nozzles or Gaskets
							Fuel Line Leaks
							Wrong Timing Button in Injection Pump
							Wrong Thickness Pump Mounting Gaskets
							Run For Long Periods of Time at NO LOAD
LUBRICATION SYSTEM							
							Low Oil Supply
							Excess Oil in Crankcase
							Oil Leaks From Engine Base or Connections
							Light or Diluted Crankcase Oil
							Leaky Oil Seals
							Improper Lubrication
							Faulty Oil By-Pass
							Worn Oil Pump
							Heavy Oil or Clogged Passages
							Dirty Oil Filter
GOVERNOR SYSTEM							
							Loose or Disconnected Linkage
							Binding Linkage
							Excessive Wear in Linkage
							Incorrect Governor Adjustment
							High Spring Sensitivity
							Incorrectly Installed Governor Yoke or Cup
							Overloaded Generator
COOLING SYSTEM							
							Blown Head Gasket
							Overheating
							Dirt on Cooling Fins (Air Cooled)
							Inadequate Air Circulation (Air Cooled)
INTERNAL ENGINE							
							Poor Compression
							Loose Piston
							Loose Connecting Rod or Crankshaft Bearing
							Incorrect Valve Clearance
							Broken or Weak Valve Spring
							High Exhaust Back Pressure
							Valves Not Seating Properly
							Worn Bearings
							Worn Cylinder Walls, Pistons, Rings
							Sticking Valves
							Worn or Dirty Valve Guides



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