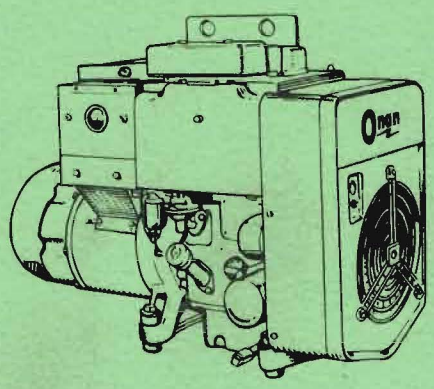
Onan®

# OPERATOR'S MANUAL

FOR

# JB
## SERIES

## ELECTRIC GENERATING SETS

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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.

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

**CAUTION** **This symbol refers to possible equipment damage.**

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.

- **Use Extreme Caution Near Gasoline, Gaseous Fuel And Diesel Fuel. A constant potential explosive or fire hazard exists.**

  Do not fill fuel tank near unit with engine running. Do not smoke or use open flame near the unit or the fuel tank.

  Be sure all fuel supplies have a positive shutoff valve.

  Fuel lines must be of steel piping, adequately secured and free from leaks. Do not use copper piping on flexible lines as copper becomes hardened and brittle. Use black pipe on natural gas or gaseous fuels, not on gasoline or diesel fuels. Piping at the engine should be approved flexible line.

  Have a fire extinguisher nearby. Be sure extinguisher is properly maintained and be familiar with its proper use. Extinguishers rated ABC by the NFPA are appropriate for all applications. Consult the local fire department for the correct type of extinguisher for various applications.

- **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.

  Jewelry is a good conductor of electricity and should be removed when working on electrical equipment.

  Always use an appropriately sized, approved double-throw transfer switch with any standby generator set. DO NOT PLUG PORTABLE OR STANDBY SETS DIRECTLY INTO A HOUSE RECEPTACLE TO PROVIDE EMERGENCY POWER. It is possible for current to flow from generator into the utility line. This creates extreme hazards to anyone working on lines to restore power.

  Use extreme caution when working on electrical components. High voltages cause injury or death.

  Follow all state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician.

- **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.

  Be sure the unit is well ventilated.

- **Keep The Unit And Surrounding Area Clean.**

  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.

  Dispose of oily rags. Keep the floor clean and dry.

- **Protect Against Moving Parts.**

  Avoid moving parts of the unit. Loose jackets, shirts or sleeves should not be permitted because of the danger of becoming caught in moving parts.

  Make sure all nuts and bolts are secure. Keep power shields and guards in position.

  If adjustments *must* be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

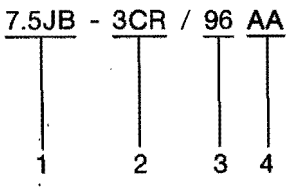
  Do not work on this equipment when mentally or physically fatigued.

# GENERAL INFORMATION

## MODEL IDENTIFICATION

When the 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 Onan nameplate. Electrical characteristics are shown on the lower portion of the set nameplate.

How to interpret MODEL and SPEC NO.




1. Factory code for general identification.
2. Specific Type:
   C — Indicates reconnectible.
   R — REMOTE. Electric starting. For permanent installation, can be connected to optional accessory equipment for remote or automatic control of starting and stopping.
3. Factory code for optional equipment.
4. Specification (Spec) letter (advances when factory makes production modifications).

## TABLE OF CONTENTS





*WARNING*

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

# SPECIFICATIONS

For any abnormalities in operation, unusual noises from engine or generator, loss of power, overheating, etc., contact your ONAN dealer.

## GENERAL

| | |
|---|---|
| Nominal dimension of set (inches) | |
| Height | 26-1/2 (673 mm) |
| Width | 18 (457 mm) |
| Length | 32-11/16 (838 mm) |
| Weight (nominal) | 480 (218 kg) |

## ENGINE DETAILS

| | |
|---|---|
| Number cylinders (vertical inline) | 2 |
| Displacement (cubic inch) | 60 |
| Cylinder bore | 3-1/4 (82.5 mm) |
| Piston stroke | 3-5/8 (96 mm) |
| RPM (for 60 hertz) | 1800 |
| RPM (for 50 hertz) | 1500 |
| Compression ratio | 6.5:1 |
| Compression ratio gas or LPG | 9.2:1 |
| Exhaust connection (pipe tapped) | 1-1/4" (31.8 mm) |
| Governor, Internal Flyball, External Adjustment | Yes |
| Centrifugal start-disconnect switch | Yes |

## CAPACITIES AND REQUIREMENTS

| | |
|---|---|
| Battery voltage (AC set) | 12 volt |
| Battery size | |
| SAE group 1H | Two in Series |
| Amp/hr. SAE rating — 20 hr. (nominal) | *74 |
| Starting by starting motor with solenoid shift and over-run clutch | Yes |
| Battery charge rate amperes | 2-5 |
| Charge ammeter scale | 5-0-5 |
| ★Oil Capacity in U.S. quarts — Refill | 3 (2.84 litre) |
| Ventilation Required (cfm 1800 rpm) | |
| Engine (Pressure Cooling) | 520 (14.7 m³/min) |
| Engine (Vacu-Flo Cooling) | 610 (17.3 m³/min) |
| Generator | 126 (3.6 m³/min) |
| Combustion | 32 (0.9 m³/min) |

## GENERATOR

| | |
|---|---|
| Output rated at unity power factor load | 1 phase |
| Output rated at 0.8 power factor load | 3 phase |
| Rating (output in watts) | |
| 50 hertz AC — General Utility | 6000 |
| 60 hertz AC — General Utility | 7500 |
| Revolving field type generator | Yes |
| 120/240 volt single phase model reconnectible | Yes |
| Broad range 3-phase, 12 lead reconnectible | Yes |
| Solid state voltage regulator | Yes |
| Brushless Exciter | Yes |

* - Mobile or outdoor operation during ambient temperatures below 0° F (-17.8° C), use 105 amp/hr rating.
★ - Plus 1/2 quart (0.47 litre) for new filter.

## TUNE-UP SPECIFICATIONS

| | |
|---|---|
| Cylinder head bolt torque (lbs. ft.) | 28-30 (38-41 N•m) |
| Spark plug gap | .025 (0.64 mm) |
| Centrifugal switch, breaker point adjustment | .020 (0.51 mm) |
| Magneto, Pole shoe gap | .020 (0.51 mm) |
| Breaker point setting gap | .020 (0.51 mm) |
| Tappets* | |
| Gasoline, Intake | .012 (0.30 mm) |
| Exhaust | .015 (0.38 mm) |
| Gas and Gas/Gasoline, Intake | .0131 (0.33 mm) |
| Exhaust | .020 (0.51 mm) |
| Ignition timing spark advance** | |
| (Running) Gas fuel*** | 35° BTC |
| (Stopped) Gas fuel | 5° BTC |
| (Running) Gasoline Fuel | |
| Flywheel magneto | 25° BTC |
| Battery | 25° BTC |
| (Stopped) Gasoline fuel | |
| Flywheel magneto | 5° ATC |
| Battery | 5° ATC |

* - Set valve clearance with flywheel timing mark between 10° ATC and 45° ATC with cylinder being adjusted on power stroke.

** - The JB series has an automatic spark advance of 30°.

*** - Sets with a flywheel magneto must always fire at 25° BTC, regardless of fuel.

**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.**

# DESCRIPTION

## GENERAL

An Onan JB Series electric generating set consists of a two-cylinder, in-line gas or gasoline engine and a 7.5 KW (6.0 KW for 50 Hertz) alternating current generator with standard or optional equipment as ordered.

## ENGINE

The JB engine has 60 cubic inch (983.4 $cm^3$) piston displacement, 6.5:1 (9.2:1 for gas) compression ratio, and is air-cooled. Basic measurements and other details are listed under *SPECIFICATIONS*.

## AC GENERATOR

The YD generators beginning with Spec AA (Figure 1) are four-pole, revolving field, brushless exciter models of drip-proof construction. Generator design includes both single and three-phase, 60 and 50 hertz type generators. The generator rotor connects directly to the engine crankshaft with a tapered shaft and key. The generator is fastened to the engine by the rotor-through-stud which passes through the rotor shaft; it has a nut on the outside of the end bell. A centrifugal blower, on the front end of the rotor shaft, circulates the generator cooling air which is drawn in through the end bell cover, over the rotor, and discharged through an outlet at the blower end.

A ball bearing in the end bell supports the outer end of the rotor shaft. The end bell and generator stator housing are attached by four-through-studs which pass through the stator assembly to the engine-generator adapter. The brushless exciter stator mounts in the end bell while the exciter rotor and its rotating rectifier assemblies mount on the generator rotor shaft.

The basic operation of the generator and voltage regulator involves the stator, voltage regulator, exciter field and armature, a full wave bridge rectifier, and the generator rotor. Residual magnetism in the generator rotor and a permanent magnet embedded in one exciter field pole begin the voltage build-up process as the generator set starts running. Single-phase AC voltage, taken from one of the stator

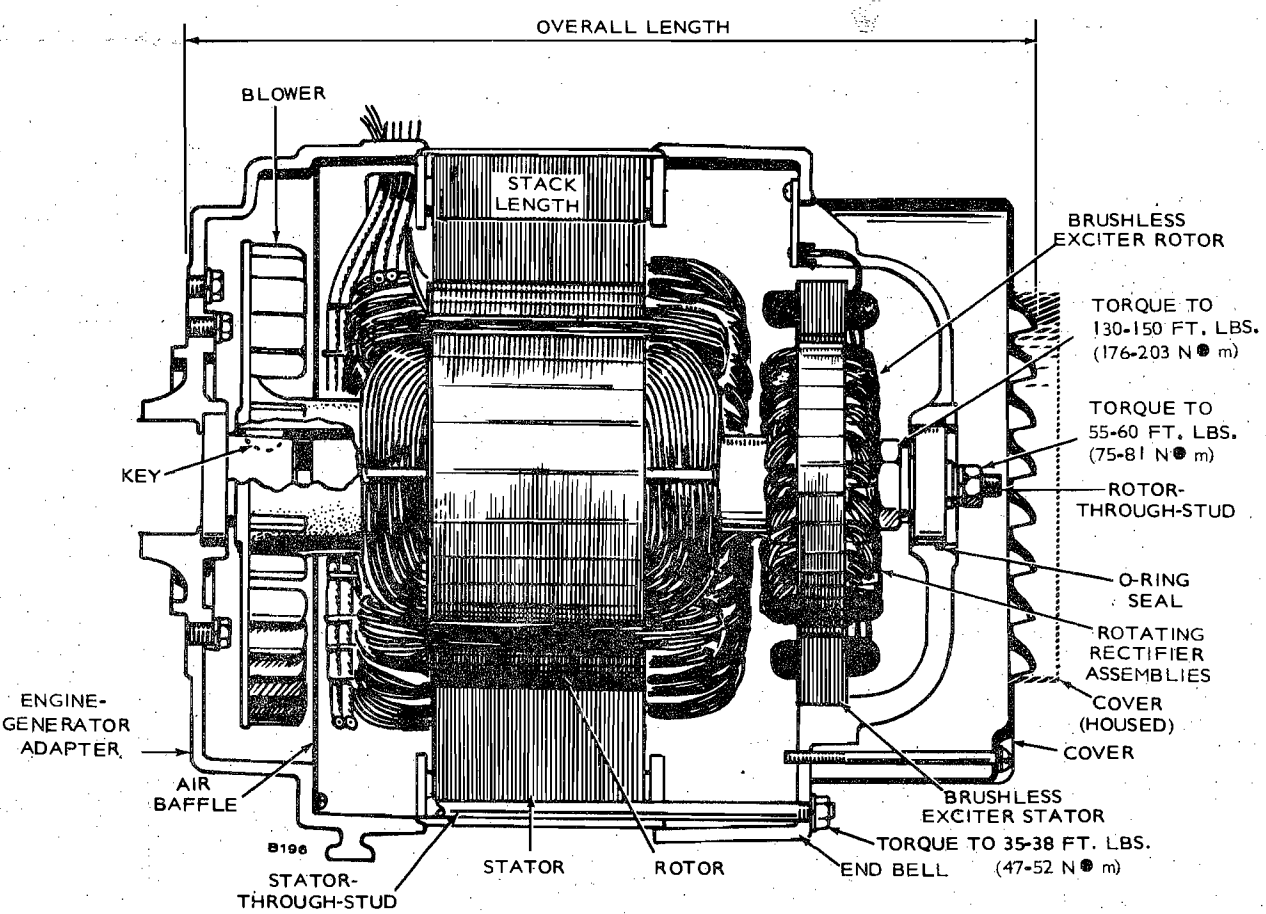



FIGURE 1. GENERATOR (CUTAWAY VIEW)

windings, is fed to the voltage regulator as a reference voltage for maintaining the generator output voltage. The AC reference voltage is converted to DC by a silicon controlled rectifier bridge on the voltage regulator printed circuit board and fed into the exciter field windings. The exciter armature produces three-phase AC voltage that is converted to DC by the rotating rectifier assembly. The resultant DC voltage excites the generator rotor winding to produce the stator output voltage for the AC load.

The generator rotor also produces AC voltage in the charging winding of the stator which is converted to direct current for battery charging.

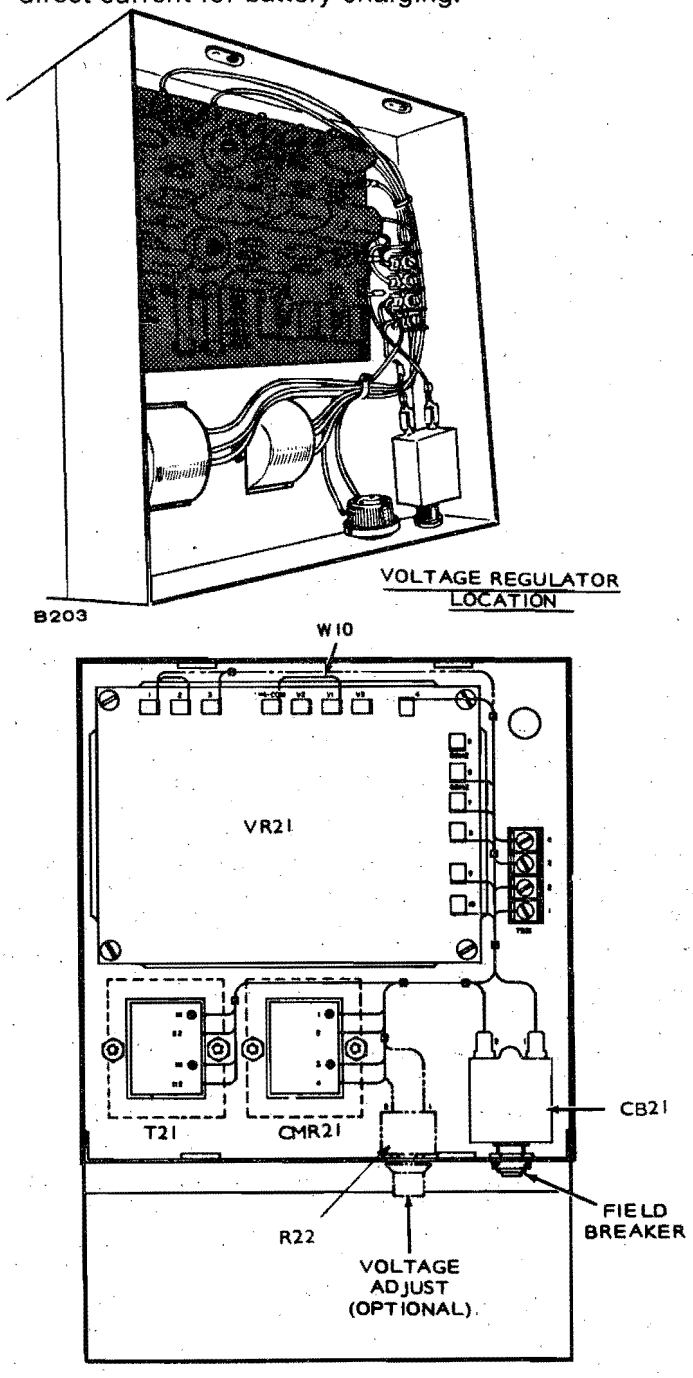



**FIGURE 2. VOLTAGE REGULATOR ASSEMBLY**

## VOLTAGE REGULATOR

The line-voltage regulator on the J-series generator sets is an all solid state device; that is, no relays or tubes are needed. Basic components of the voltage regulator are:

- Printed circuit board VR21
- Voltage reference transformer T21
- Commutating reactor CMR21
- Field circuit breaker CB21
- Voltage adjust rheostat R22 (Optional)

Figure 2 shows the above components in a typical control box, on standard air-cooled electric generating sets.

## CONTROLS

The standard control box has a battery charge rate ammeter, a START-STOP switch, and field circuit breaker on the control panel, Figure 3. Optional controls that may be added on the housed units or separate boards include a fault lamp, a frequency meter, a running time meter, an overspeed indicator, a high temperature indicator, a volt adjust knob, a phase selector, and AC voltmeters.

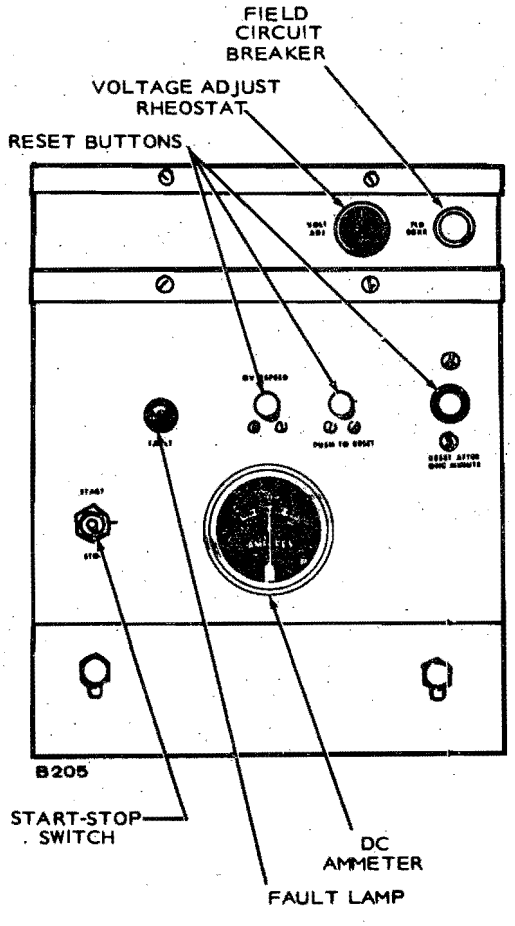



**FIGURE 3. TYPICAL CONTROL PANEL**

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

**Remote Start-Stop Switch:** Starts and stops the unit locally or from another location.

**Oil Pressure Gauge:** Indicates pressure of lubricating oil in engine; unit located on the engine.

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

## Optional (On Housed Units)

**AC Voltmeter:** Indicates AC generator output voltage.

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

**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, to 1/10th that the unit has run. Use it to keep a record for periodic servicing. Time is accumulative, meter cannot be reset.

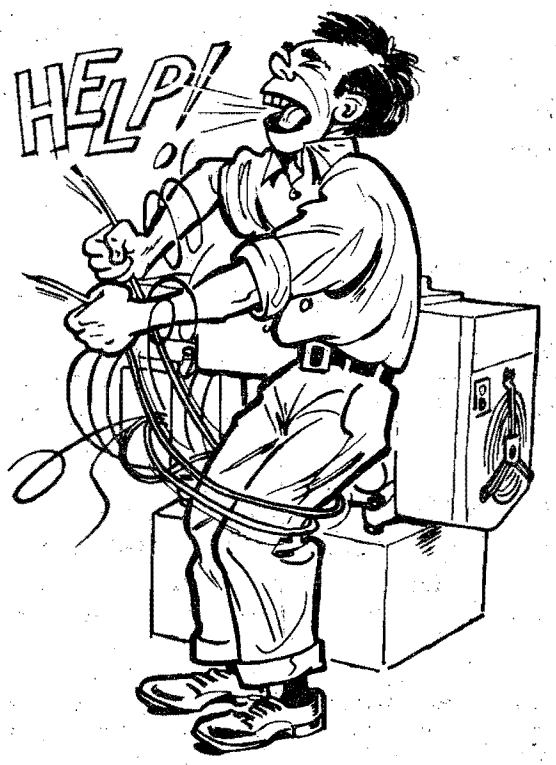
**Frequency Meter:** Indicates the frequency of the generator output in hertz. It can be used to check engine speed. (Each hertz equals 30 rpm.)

**Warning Lights:** Three red indicator lights give warning of:

- Overspeed
- Low oil pressure
- High engine temperature

Three reset pushbuttons permit restarting after trouble is corrected.

**Line Circuit Breaker:** Protects generator from line overloads.




## 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 reconnection 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.**

# INSTALLATION

## GENERAL

Installations must be considered individually, however, the following installation guidelines should be followed. Installations must conform to local building codes, fire ordinances, and other local, state, and federal regulations. See Figure 4.

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 for protection from extremes in weather conditions.

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, a heavy wood or structural steel at least 12 inches (305 mm) high to aid oil changing and operating. Place the 7/16 inch (11 mm) mounting bolts as shown in Figure 4.

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 bolt to avoid puncturing filter.**

For mobile applications (trucks or trailers) install slide-out rails or some other means (such as doors) to provide service space. See Figure 5.

## VENTILATION AND COOLING

Air circulation is needed to dissipate heat produced by the engine and generator in normal operation. *Outdoor* installations (Figure 6) can rely on natural circulation, but *mobile, indoor or housed* installations need proper size and positioned vents for required air flow, Figure 4. See *SPECIFICATIONS* for the air requirements at 1800 rpm.

Vent sizes depend on variable conditions: (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 3-1/2 square feet (3252 $cm^2$) for variables. For discharged air, install separate ducts from the engine and generator (see exception) as follows:

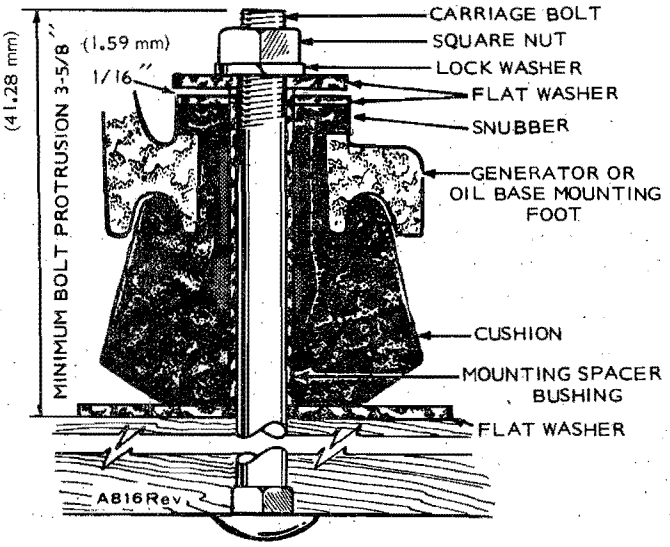
1. The *engine discharge duct* must be the same size as the engine outlet 8 x 10 inches (203 x 254 mm). If a screen is used in the duct, increase the duct size in proportion to the restriction. Consider installing the screen diagonally to limit the restriction and increase duct size for runs over 9 feet (2.74 m). If bends are necessary, use large radius elbows. Use a canvas section at the set to absorb vibration and noise.
2. *Generator outlet* ducts must be used when units are installed in compartments too small for operator to walk. Ducts are recommended for all other indoor installations. The air outlet is 5-5/8 x 3 inches (140 x 76 mm). Follow the same principles of duct design and installation as used for the engine duct. Engine and generator require separate ducts.

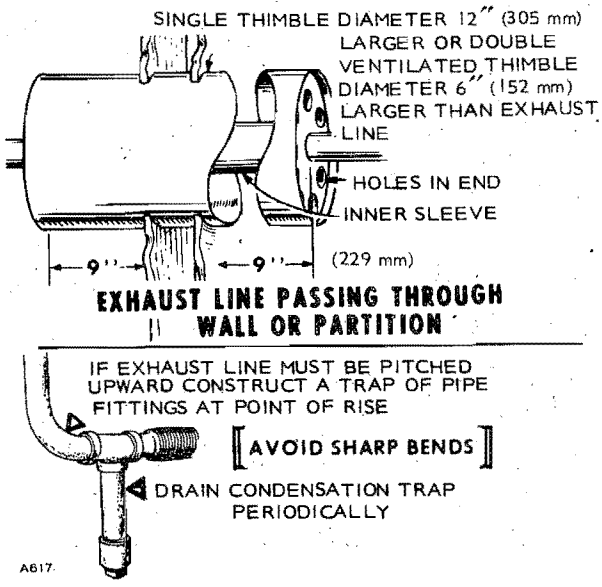
*Vacu-Flo Cooling Inlet Vent* should be at least 1/3 square foot (309 $cm^2$); the duct for discharged air should be at least as large as the scroll outlet. (See *SPECIFICATIONS* for airflow.)

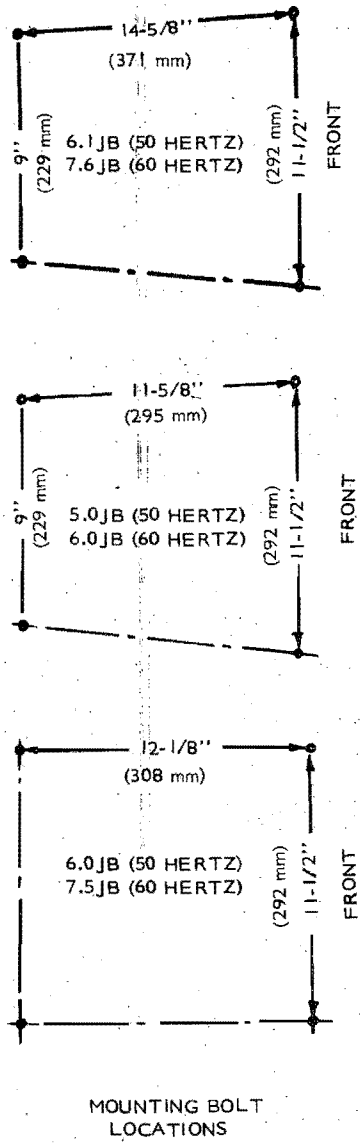
*Auxiliary fans* can be used to increase air flow to units installed in small, poorly ventilated rooms. The fan size and location should be such that the air inlet to the engine doesn't exceed 120° F (49° C) when running at full rated load.

**WARNING** **Utilizing exhaust heat to warm a room or compartment occupied by people is not recommended due to possible leakage of harmful exhaust gases.**

**EXHAUST GASES ARE DEADLY POISONOUS!**



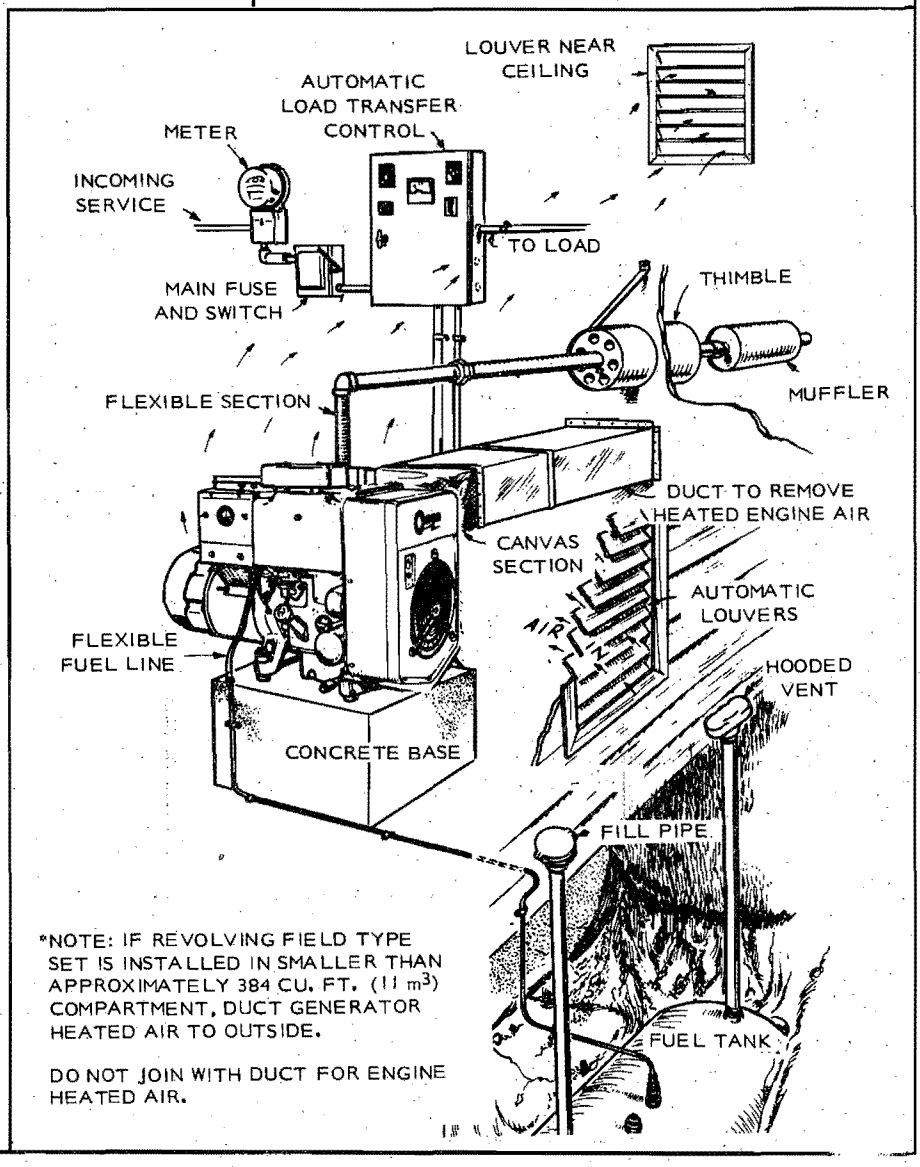




**FIGURE 4. TYPICAL INDOOR INSTALLATION**

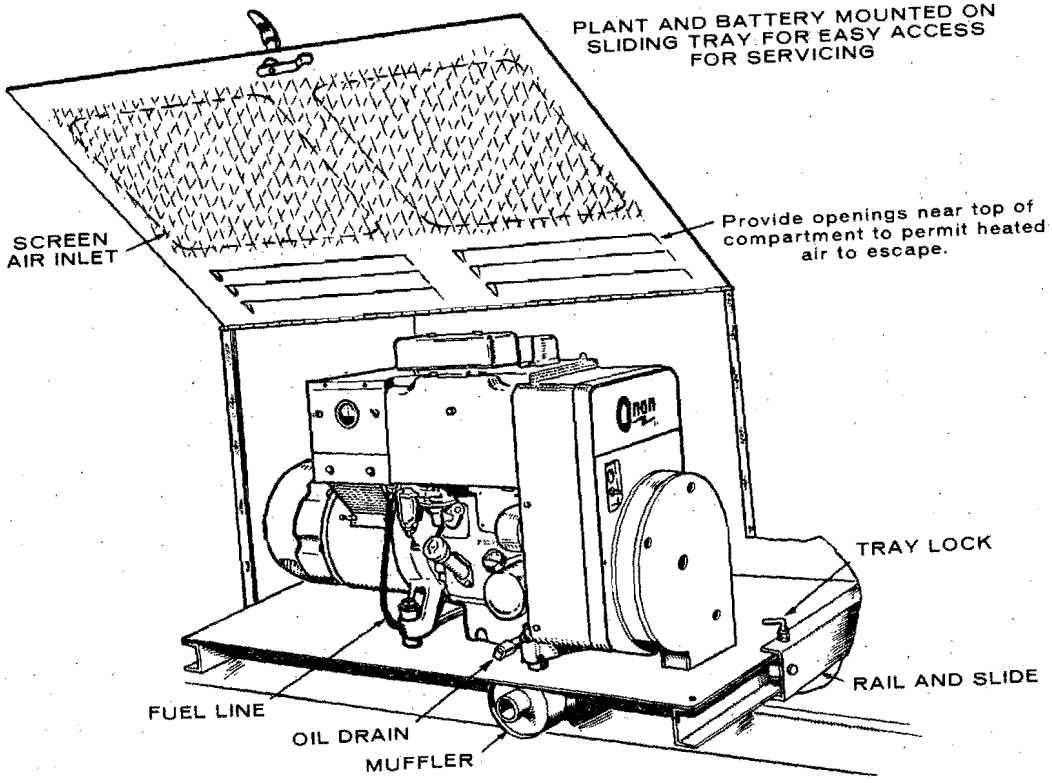



**FIGURE 5. TYPICAL MOBILE INSTALLATION**

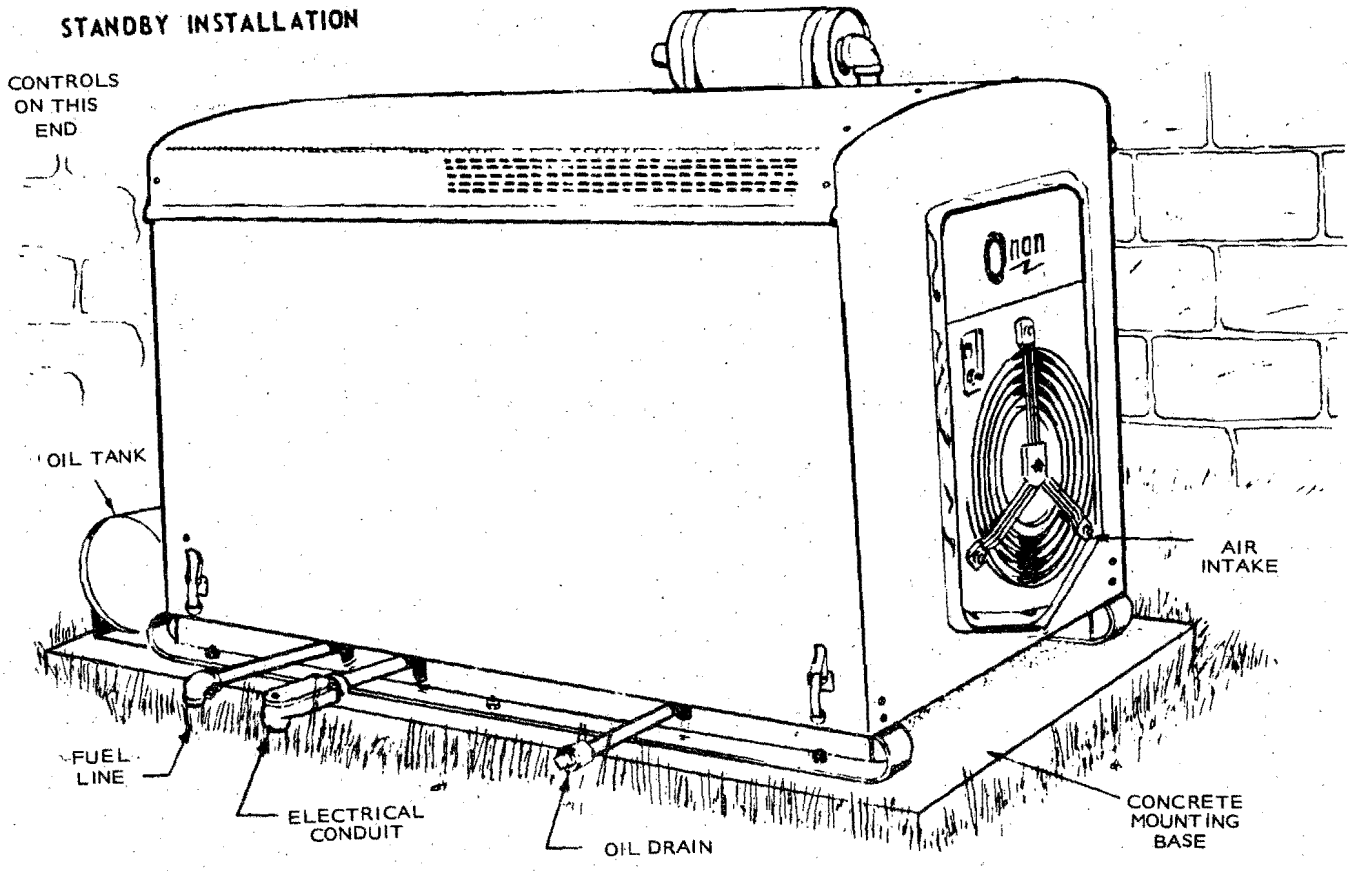



**FIGURE 6. TYPICAL OUTDOOR INSTALLATION**

## EXHAUST

Vent exhaust gases outside. Use flexible tubing between the engine exhaust outlet and rigid piping to accommodate vibration.

**WARNING** **Check exhaust system frequently for leaks. Be sure poisonous exhaust gases are piped to outside. Inhalation of exhaust gases can result in serious personal injury.**

Shield the line with fire retardant material if it passes through a combustible wall or partition. If turns are necessary, use long sweeping type elbows. Use one pipe size larger for each ten feet in length. Position the exhaust outlet away from the engine air intake.

## OIL DRAIN

Extend to suit installation. Oil base has a 1/2 inch (12.7 mm) pipe tapped hole.

## FUEL TANK

If a separate fuel tank is used, install the tank so the bottom is less than 8 feet (2.5 m) below the fuel pump. The tank top must be below fuel pump level to prevent siphoning. Install a shut-off valve at the tank. When the fuel tank is shared with another engine, use a separate fuel line for each to avoid starving the set.

If fuel lift must exceed 8 feet (2.5 m), install an auxiliary electric fuel pump at the fuel supply.

## FUEL CONNECTION

Connect the fuel line to the fuel pump inlet. Pump is threaded 7/16-24 NPTF (American Standard Internal Tapered Pipe Thread).

**WARNING** **Always use flexible tubing between engine and the fuel supply to avoid line failure and fuel leaks due to vibration. Fuel leaks create fire and explosion hazards.**

For gaseous sets (see Figure 7), check with the local fuel supplier for gas regulations and line pressure. Provide a manual gas valve. A filter in the line may be necessary. Electric solenoid shut-off valves in the supply line are usually required for indoor automatic or remote starting installations. Connect solenoid wires to battery ignition circuit to open valve during running. Install a demand type gas regulator according to instructions and position it near the set to aid starting.

**WARNING** **Always use flexible tubing between engine and the gas demand regulator to avoid line failure and leaks due to vibration. Gas-Gasoline sets provide a manual shutoff valve in both fuel supply lines. Fuel leaks create fire and explosion hazards.**

**WARNING** **Do not use galvanized lines, fittings, or fuel tanks in underground portions of the fuel system. Hazardous fuel leaks may be caused by electrolytic corrosion from moisture and chemicals in the soil (galvanism). Some safety ordinances prohibit the use of galvanized materials in fuel systems and the use of threaded cast iron fittings as well. Fuel leaks create fire and explosion hazards.**

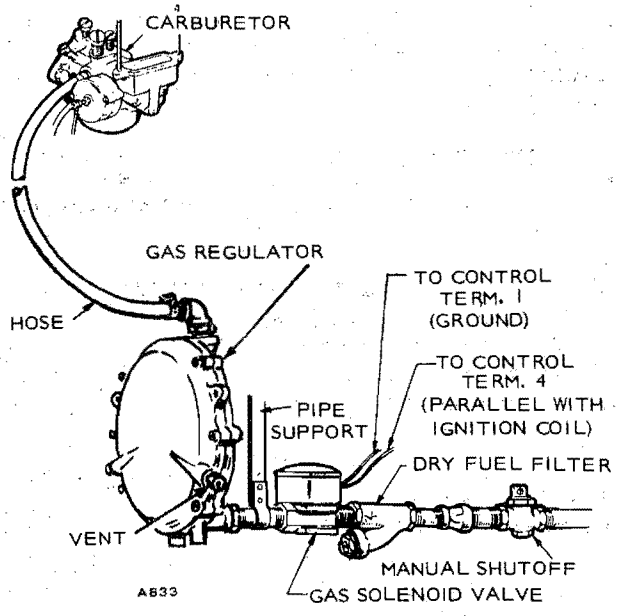



**FIGURE 7. GAS FUEL LINE INSTALLATION**

## 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.

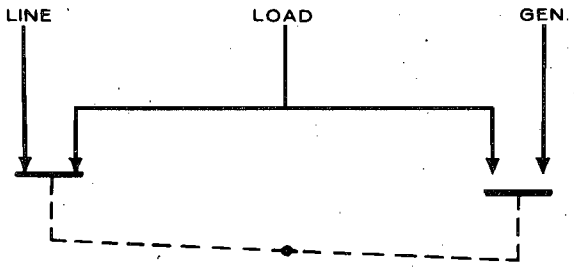
**All electrical connections should be done by a qualified serviceman or electrician to meet the electrical code requirements in your area.**

## 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 absorb vibration. Use sufficiently large insulated wires. Strip insulation from wire ends as necessary for clean connections. Connect each load wire to the proper generator output lead inside the set box. Insulate bare ends of ungrounded wires. Use bolt provided on the control box to connect the generator ground lead and load 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 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 8.

**Balance All Loads:** Divide the loads equally between output leads. Current loads for any one output lead must not exceed nameplate rating.




NOTE: SHOWN WITH LINE CONNECTED TO LOAD.

FIGURE 8. LOAD TRANSFER SWITCH

**CAUTION** **Overloading can damage the generator windings.**

**Single Phase Loads on Three Phase Generators:** Any combination of single phase and three phase loading can be used at the same time as long as the current for any output lead does not exceed the generator nameplate rating.

**Output Lead Markings:** Leads on revolving field generators are marked $T^1$, $T^2$, etc. Older models with revolving armature generators had output leads marked $M^1$, $M^2$, 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 $T^1$-$T^4$ or $T^1$-$T^{12}$ 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 9.

**Code 3C or 53C Reconnectible Generators:** The single phase, 60 and 50 Hertz generators have output leads $T^1$, $T^2$, $T^3$, and $T^4$ available for making the single phase voltage and load connections shown in Figure 9 at the installation site. Grounding procedure should comply with local codes.

**Code 18R or 518R Reconnectible Generators:** The three phase, broad range, 60 and 50 Hertz 12 lead generators have output leads $T^1$ through $T^{12}$ available for making several single and three phase voltage load connections shown in Figure 9. Grounding procedure should comply with local codes.

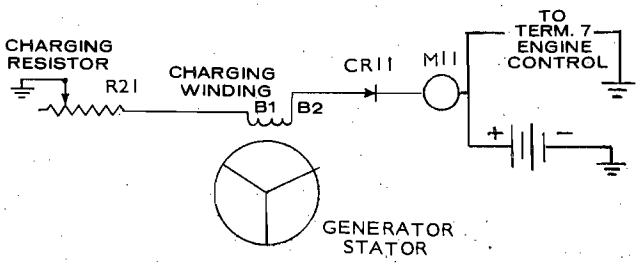
**When connecting the output leads, be sure to connect jumper W10 on the voltage regulator printed circuit board between terminal $V^4$ (common) and $V^1$, $V^2$, or $V^3$ as listed on the reconnection diagram.**

**A broad range generator is capable of generating numerous different output voltages as indicated by 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 $T^1$, $T^2$, $T^3$, and $T^0$ are available for connection to the load wires. See connection diagram. Grounding procedure should comply with local electrical codes.

## BATTERY CHARGE RATE ADJUSTMENT

One generator winding supplies current for the battery charging circuit. The current flows to diode $CR^{11}$, ammeter $M^{11}$, to the battery, and to the ignition-fuel solenoid control circuits, Figure 10.



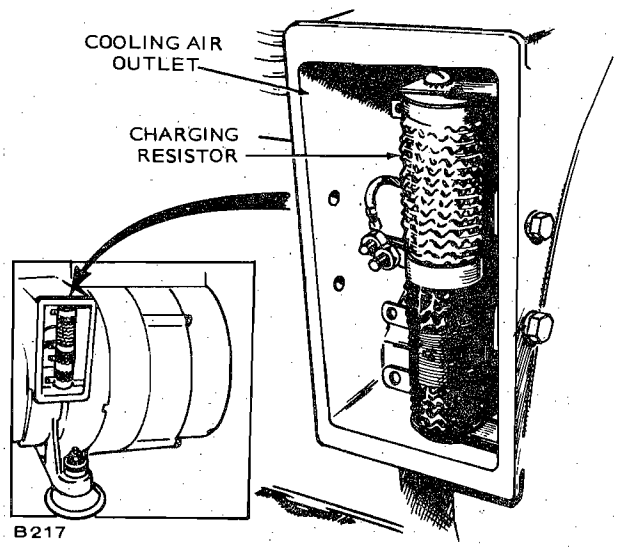
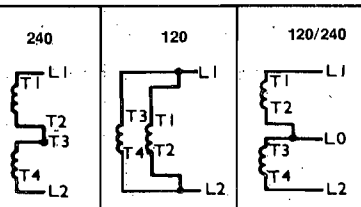
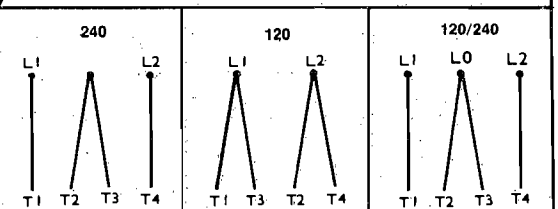
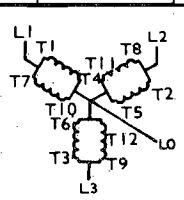
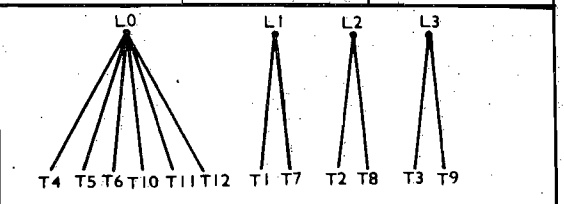
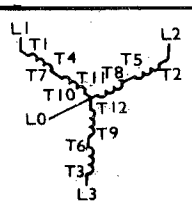
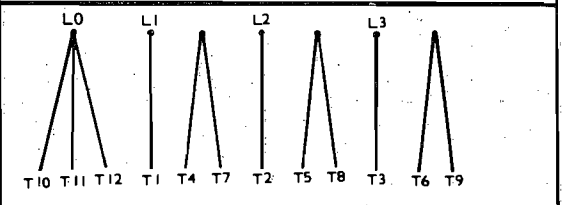
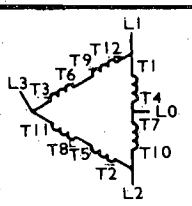
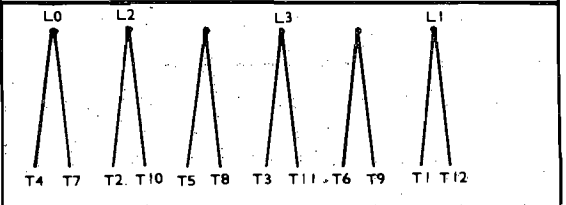
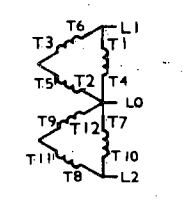
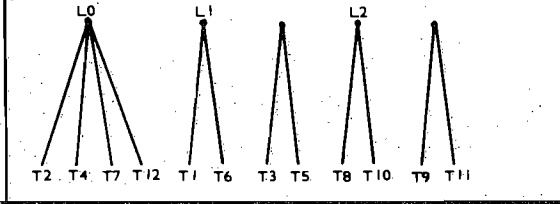
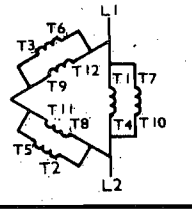
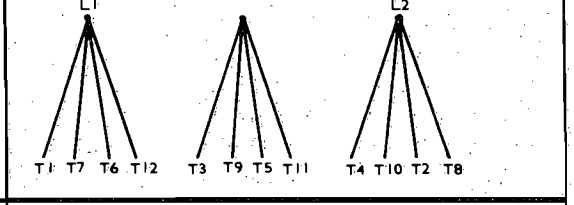
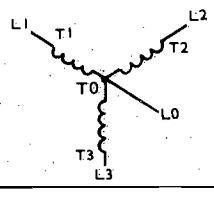
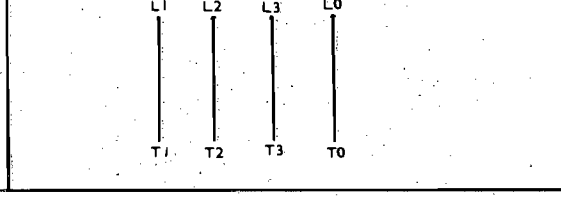




FIGURE 10. CHARGING RESISTOR

**NOTE ●**: When instructed to connect V4 to V4, either remove W10 jumper or insulate one end and leave unconnected.

| NAMEPLATE VOLTAGE CODE | VOLTAGE | PHASE | FREQUENCY | CONNECT W10 JUMPER WIRE FROM V4 TO: | GENERATOR CONNECTION | GENERATOR CONNECTION SCHEMATIC DIAGRAM | LOAD TO GENERATOR CONNECTION WIRING DIAGRAM (CONNECT X1 TO VR21-5 FOR 50 HERTZ AND X1 TO VR21-6 FOR 60 HERTZ GENERATORS.) |
|---|---|---|---|---|---|---|---|
| 3C | 120/240 | 1 | 60 | V1 | |   |   |
| 53C | 120/240 | 1 | 50 | V3 | | | |
| | 115/230 | 1 | 50 | V2 | | | |
| | 110/220 | 1 | 50 | V1 | | | |
| 18 | 120/208 | 3 | 60 | V1 | PARALLEL WYE |   |   |
| | 127/220 | 3 | 60 | V2 | | | |
| | 139/240 | 3 | 60 | V4 ● | | | |
| 518 | 110/190 | 3 | 50 | V1 | | | |
| | 115/200 | 3 | 50 | V2 | | | |
| | 120/208 | 3 | 50 | V3 | | | |
| | 127/220 | 3 | 50 | V4 ● | | | |
| 18 | 240/416 | 3 | 60 | V1 | SERIES WYE |   |   |
| | 254/440 | 3 | 60 | V2 | | | |
| | 277/480 | 3 | 60 | V4 ● | | | |
| 518 | 220/380 | 3 | 50 | V1 | | | |
| | 230/400 | 3 | 50 | V2 | | | |
| | 240/416 | 3 | 50 | V3 | | | |
| | 254/440 | 3 | 50 | V4 ● | | | |
| 18 | 120/240 | 3 | 60 | V1 | SERIES-DELTA |   |   |
| 518 | 110/220 | 3 | 50 | V1 | | | |
| | 115/230 | 3 | 50 | V2 | | | |
| | 120/240 | 3 | 50 | V3 | | | |
| 18 | 120/240 | 1 | 60 | V1 | DOUBLE DELTA |   |   |
| 518 | 110/220 | 1 | 50 | V1 | | | |
| | 115/230 | 1 | 50 | V2 | | | |
| | 120/240 | 1 | 50 | V3 | | | |
| 18 | 120 | 1 | 60 | V1 | PARALLEL DELTA |   |   |
| 518 | 110 | 1 | 50 | V1 | | | |
| | 115 | 1 | 50 | V2 | | | |
| | 120 | 1 | 50 | V3 | | | |
| 9X | 347/600 | 3 | 60 | V4 ● | WYE |   |   |

B200

FIGURE 9. GENERATOR WIRING AND CONNECTION DIAGRAMS

1. The slide tap on adjustable resistor $R^{21}$, located in the generator air outlet, should be set to give about 2 amperes charging rate. For applications requiring frequent starts, check battery charge condition (specific gravity) periodically and if necessary, increase charging rate slightly (slide tap nearer ungrounded lead) until it keeps battery charged. Having engine stopped when readjusting avoids accidental shorts. Avoid overcharging.
2. If charge winding AC output is below 19 volts on 12 volt battery charge models, test the charging circuit for opens or grounds in the leads and charging winding. If leads are defective, replace them. If winding is defective, replace generator stator.
3. If a separate automatic demand control is used for starting and stopping, adjust charge rate for maximum 4.5 amperes. This normally keeps battery charged even if starts occur as often as 15 minutes apart.

## BATTERY CONNECTIONS

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

Battery polarity must agree with the rectifier located in the control box. If battery ground must be changed, reverse the rectifier connection in the control box.

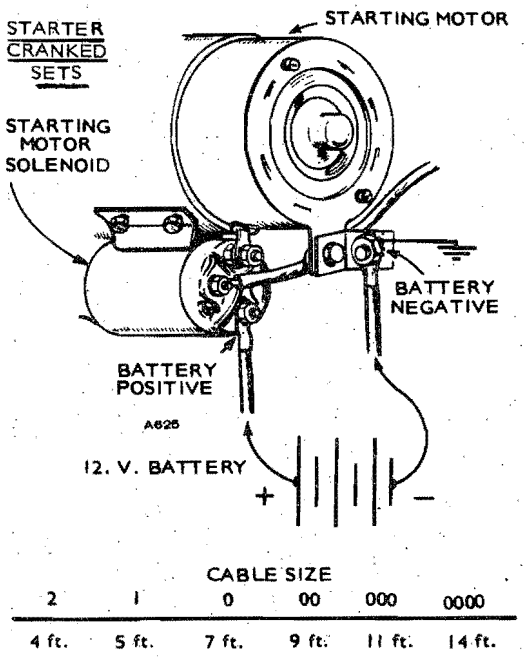
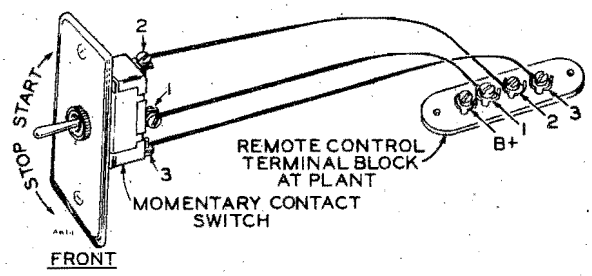



FIGURE 11. BATTERY CONNECTIONS

**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.




| WIRE SIZE | DISTANCE |
|---|---|
| #18 | to 125 ft. (39 m) |
| #16 | to 200 ft. (62 m) |
| #14 | to 300 ft. (93 m) |
| #12 | to 500 ft. (155 m) |

FIGURE 12. REMOTE SWITCH CONNECTIONS

## 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.

# OPERATION

## PRE-STARTING

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

**WARNING** **Check exhaust system frequently for leaks. Be sure poisonous exhaust gases are piped to outside. Inhalation of exhaust gases can result in serious personal injury.**

Before generator set is put in 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. Be sure proper operating procedure is followed.

## CRANKCASE OIL

Use a good quality heavy duty detergent oil that meets the API (American Petroleum Institute) service designations MS, MS/DG, SE or SE/CC. Oil should be labeled as having passed the MS Sequence Tests (also known as the ASTMG-IV Sequence Tests) and the MIL-L-2104B Tests. Recommended SAE oil numbers for expected ambient temperatures are as follows:

Above 32° F (0° C) ..... SAE 30
0° F to 32° F (-18° C to 0° C) .... SAE 10W or 5W-30
Below 0° F (-18° C) ..... SAE 5W-30

When adding oil between oil changes, it is preferable to use the same brand as various brands of oil may not be compatible when mixed together.

Do not use service DS oil. Do not mix brands or grades. Refer to *Maintenance* section for recommended oil changes.

## RECOMMENDED FUEL

Use clean, fresh *regular* grade, automotive gasoline. For new engines, most satisfactory results could be obtained by using nonleaded gasoline. For older engines that have previously used leaded gasoline, heads must be taken off and all lead deposits removed from engine before switching to nonleaded gasoline.

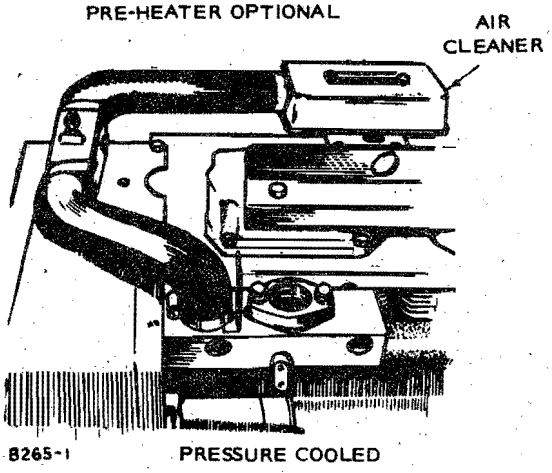
**CAUTION** **If lead deposits are not removed from engine before switching from leaded to nonleaded gasoline, pre-ignition could occur causing severe damage to the engine.**

**CAUTION** **To avoid fire and explosion hazards, never fill the tank when the engine is running. Leave space in tank for expansion to avoid overflow when fuel warms up to engine running temperature.**

## INITIAL START

Check the engine to make sure it has been filled with oil and fuel. Cylinder air housing door must be closed. If engine fails to start at first attempt, rust inhibitor oil used at the factory may have fouled the spark plugs — remove, clean in suitable solvent, dry thoroughly and install. Heavy exhaust smoke when the engine is first started is normal and is caused by the inhibitor oil.

**Carburetor Air Preheater:** The carburetor combustion air preheater (Figure 13) directs engine warmed air to the carburetor when required to prevent carburetor icing. The air inlet is automatically selected by the Vernatherm (thermostatic element) which operates a shutter in the induction air stream. The shutter is fully closed at 80° F (27° C), is half open at 90° F (32° C), and is fully open to ambient air at 100° F (38° C).



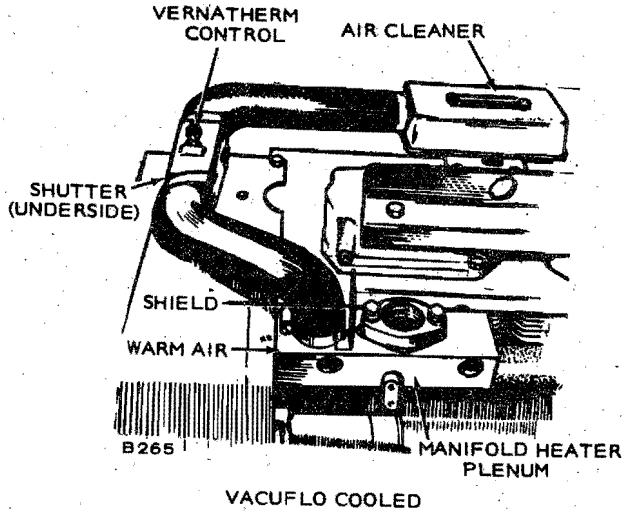




FIGURE 13. CARBURETOR PRE-HEATER

## STARTING SEQUENCE

The starting and stopping (Figure 14) sequence shows the manual, mechanical, and electrical events required for satisfactory start, run and stop cycles.

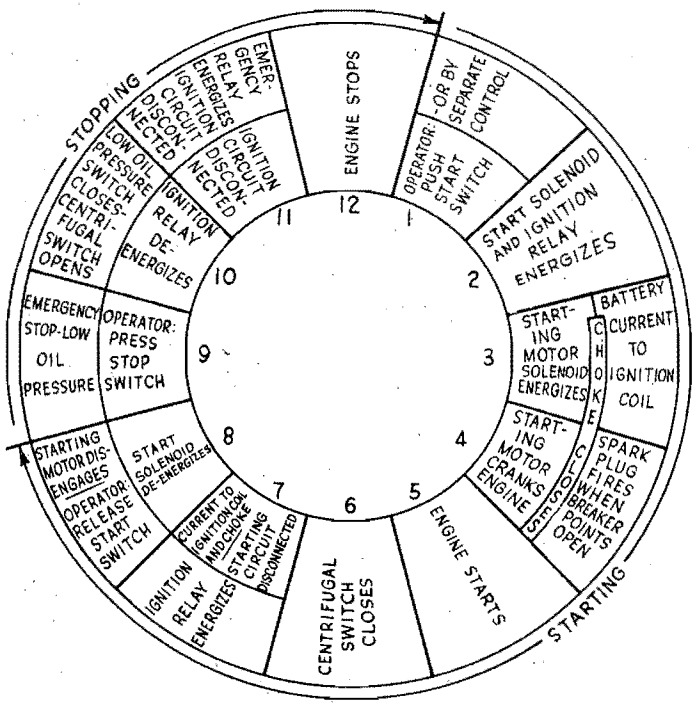



FIGURE 14. STARTING AND STOPPING SEQUENCE

## STARTING

1. Push *start-stop* switch to *start* position.
2. Release the switch after engine starts and reaches speed.
3. Oil pressure gauge should read at least 20 psi (138 kPa). Pressure relief is not adjustable.

If the set 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.

**To prevent false starts, hold on start switch until the centrifugal switch automatically disengages starter motor.**

**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.**

## STOPPING

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

## APPLYING LOAD

If practicable, allow set to warm up before connecting a heavy load. Continuous generator overloading may cause high operating temperatures that can damage the windings. The generator can safely handle an overload temporarily, but for normal operation, keep the load within nameplate rating. 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. Most installations use a line switch that must be closed to connect a portion of the load.

## EXERCISE STANDBY PLANTS

Infrequent use results in hard starting. Operate standby sets at least 30 minutes each week. Run longer if battery needs charging.

## EMERGENCY OPERATION IF BATTERY FAILS

If the battery fails completely and the set must be operated during an emergency, a battery can be shared with other equipment providing the set charging circuit is disconnected.

## 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 50 hours of operation; drain while the engine is still hot.**

## OUT-OF-SERVICE PROTECTION

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 still warm. Refill and attach a warning tag indicating viscosity of oil used.
3. Remove spark plugs. Pour 1-ounce (28 g) of rust inhibitor (or SAE #10 oil) into each cylinder. Crank engine over several times. Install plugs.

4. Service air cleaner. See maintenance schedule.
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 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.**

4. Check that fuel filter and fuel lines are secure, with no leaks.
5. Check carburetor, adjust if necessary.
6. Connect batteries.
7. Verify that no loads are connected to generator.
8. Start engine.

**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. Check all gauges to be reading correctly. Unit is ready for service.

## 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 SAE No. oil for temperature conditions. Change oil only when engine is warm. If an unexpected temperature drop causes an emergency, move the set to a warm location or apply heated air (never use open flame) externally until oil flows freely.
2. Use fresh fuel. Protect against moisture condensation.
3. Keep fuel system clean, and batteries in a well charged condition.
4. Check that fuel filter and fuel lines are secure, without leaks.
5. Check carburetor and adjust if necessary.

## 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 50 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 (310 m) above sea level, after the first 1000 feet (310 m).

## GAS-GASOLINE OPERATION

Engines having a combination gas-gasoline carburetor can be switched to gasoline operation by the following procedure:

1. Close manual fuel shutoff valve in supply line (main fuel adjustment valve is not designed to use as a shutoff valve) for gaseous fuel. Set will not operate smoothly with both fuel supply lines turned on at the same time.
2. Open gasoline fuel shutoff valve.
3. Set spark plug gap at .025 inch (0.64 mm).
4. See that choke is free and works easily (be sure to release choke lock on sets with electric choke).
5. Start engine. If engine runs unevenly under half or full load, due to faulty carburetor adjustment, main jet needs adjusting.

To change back to gaseous fuel, reverse the above procedure. Use all gasoline from the carburetor to avoid stale fuel. If engine is run with one of the fuel supply lines disconnected, plug other outlet to prevent drawing air and dirt into intake manifold.

# ADJUSTMENTS

## CHECK BREAKER POINTS

Replace burned or faulty points. If only slightly burned, dress smooth with file or fine stone. Measure gap with thickness gauge, Figure 15.

1. The centrifugal switch is wide open when engine is stopped. Loosen and move stationary contact to correct gap.
2. Ignition breaker points must be correctly gapped. Crank engine to fully open breaker points (1/4 turn after top center). Loosen and move stationary contact to correct the gap at full separation. Tighten contact and recheck gap.

Ignition points should break contact just when timing mark aligns for degree of spark advance (or retard) as specified. Final timing is corrected by properly rotating the breaker plate at its mounting and using a timing light. If specified timing cannot be obtained by rotation of the breaker plate, check to be sure timing marks on gears are aligned. Timing procedures appear in separate service manual.

## CARBURETOR (Gasoline)

The carburetor (Figure 16) has a main fuel (high speed) adjustment (needle A) and an idle fuel adjustment (needle B). Early models have the main adjustment needle on the top of the carburetor. The main adjustment (needle A) affects operation under heavy load conditions. Idle adjustment affects operation at light or no load. Under normal circumstances, factory carburetor adjustments should not be disturbed. If the adjustments have been disturbed, turn needles off their seats 1 to 1-1/2 turns to permit starting, then readjust them for smooth operation.

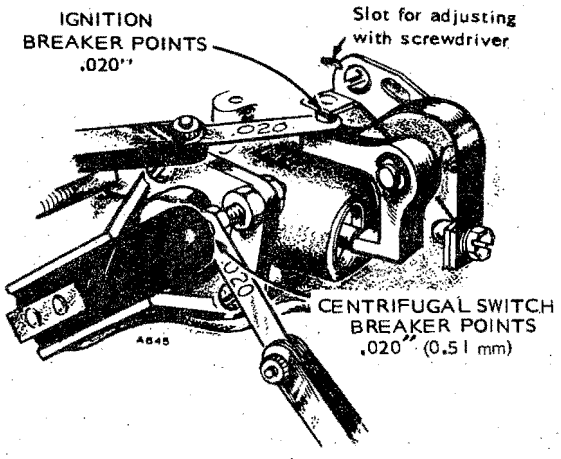



FIGURE 15. BREAKER POINT ADJUSTMENT

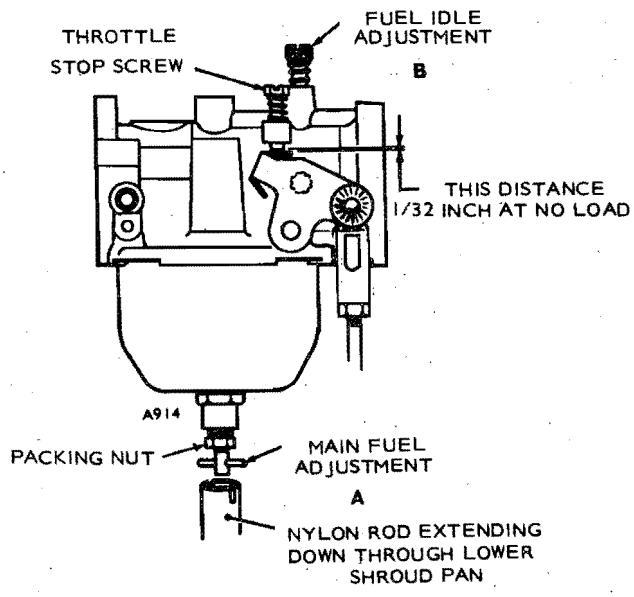



FIGURE 16. CARBURETOR ADJUSTMENTS

**CAUTION** **Loosen packing nut (Figure 16) before turning main fuel adjustment and tighten to a snug fit after adjustment has been made. Hold the adjustment while tightening packing nut. This procedure will make it easier to use the carburetor adjusting tool (420-0169). It will also prevent air entry that causes rough engine operation and fuel leaks. The fuel leaks occur when the engine is not running and cause difficult starting because the float level is lowered.**

**CAUTION** **Forcing the needle against its seat will damage it. The needle does not completely shut off when turned fully in.**

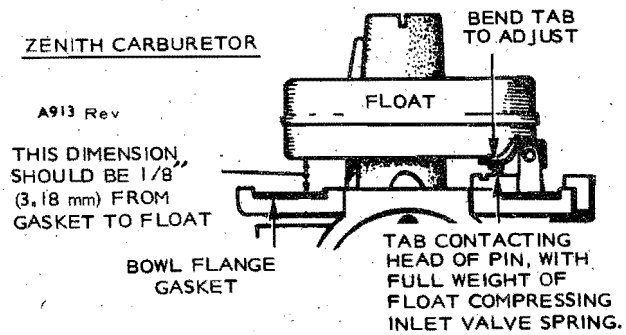



FIGURE 17. CARBURETOR FLOAT ADJUSTMENT

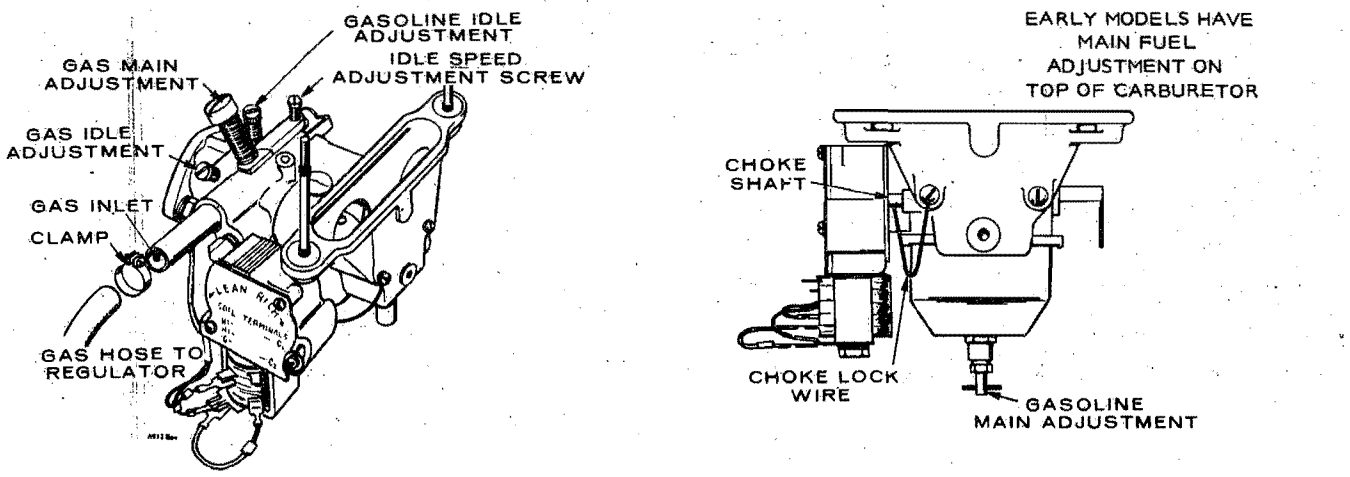



**FIGURE 18. CARBURETOR ADJUSTMENTS**

Before final adjustment, allow the engine to warm up. To set the main fuel adjustment, apply a full electrical load to the generator, carefully turn main adjustment screw in until engine speed (or output frequency) drops slightly below normal. Turn screw back out (richer) approximately 1/4 turn or until engine speed (frequency) returns to normal.

**Carburetor adjustment should be made after the governor is properly adjusted.**

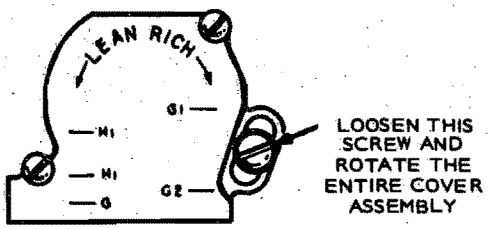
Make idle adjustment with no load connected to the generator. Use a tachometer (or connect a frequency meter) to generator output. Slowly turn idle adjustment out until engine speed (or generator frequency) drops slightly below normal. Then turn needle in until speed (or frequency) returns to normal.

Set throttle stop screw (located on carburetor throttle lever) with no load connected and while running at rated speed. Turn stop screw to give 1/32 inch clearance between the screw and pin (Figure 16).

For correct carburetor float clearance, see Figure 17. Adjustment is made by bending the tab on the float.

## CARBURETOR (Gas-Gasoline)

Gas carburetor adjustment procedure is the same as for gasoline. See Figure 18 for location of adjusting needles.




| AMBIENT TEMPERATURE (°F) | 75 | 70 | 60 | 50 | 40 | 30 | 20 | 10 |
|---|---|---|---|---|---|---|---|---|
| CHOKE OPENING (Inches) | 9/16 | 1/2 | 15/32 | 7/16 | 3/8 | 11/32 | 5/16 | 1/4 |
| AMBIENT TEMPERATURE (°C) | 24 | 21 | 16 | 10 | 4 | -1 | -7 | -12 |
| CHOKE OPENING (mm) | 14.29 | 12.70 | 11.91 | 11.11 | 9.53 | 8.73 | 7.94 | 6.35 |

**FIGURE 19. CHOKE ADJUSTMENT**

During gaseous fuel operation, the choke is locked in the full open position by the choke lock wire, Figure 18.

## ONAN THERMO-MAGNETIC CHOKE

This choke uses a heating element and a heat sensitive bimetal spring to open the choke. The choke solenoid, actuated during engine cranking only, closes the choke according to ambient temperature.

If adjustment is required, use the following instructions. Choke bimetal spring must be at ambient temperature. Allow engine to cool at least one hour before setting. Adjust choke by turning the choke body, which engages a link connected to a bimetal choke spring. Remove air cleaner and adapter to expose the carburetor throat. Loosen the screw which secures the choke body. Rotate choke body clockwise to increase choke and counterclockwise to decrease choke action (leaner mixture). Refer to Figure 19 for correct choke setting according to ambient temperature. Use drill rod or shank of drill bit to measure choke opening.

## GOVERNOR

The governor controls engine speed. Rated speed and voltage appear on the nameplate (see also Specifications). Engine speed equals frequency multiplied by 30, on a 4 pole generator, thus 1800 rpm give 60 hertz frequency. 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 20). Turn the nut clockwise (more spring tension) to increase RPM and counterclockwise to reduce governed speed. Hold a tachometer against flywheel cap screw.

**Sensitivity Adjustment:** To adjust governor sensitivity (no load to full load speed droop) turn the sensitivity adjusting ratchet accessible through a covered access hole on the side of the blower housing. 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, the speed will require readjustment. After adjusting the governor, 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.**

## CHARGE RATE ADJUSTMENT

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

If a separate automatic demand control for starting and stopping is used, 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.

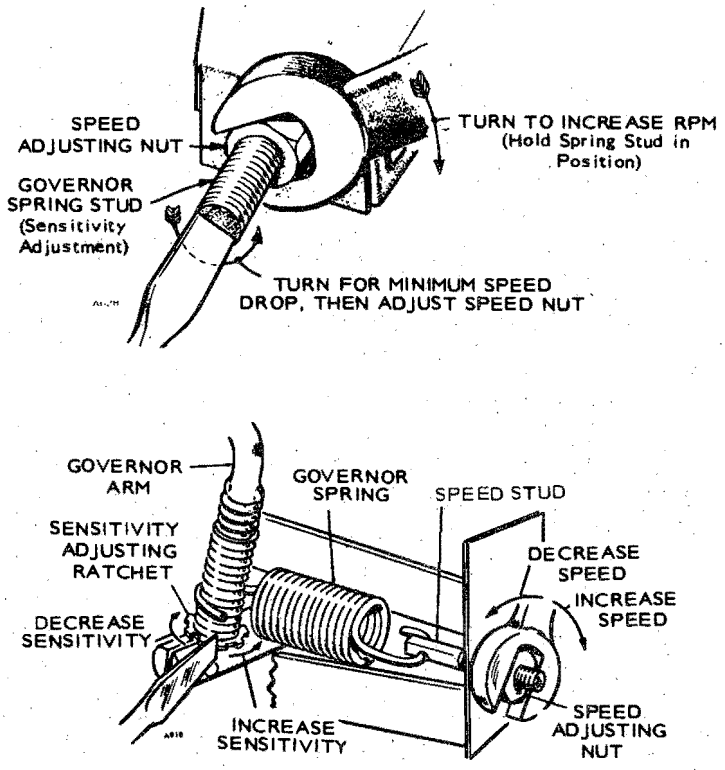



FIGURE 20. GOVERNOR ADJUSTMENT

# GENERAL MAINTENANCE

## GENERAL

Follow a regular schedule of inspection and servicing, based on operating hours (Table 1). 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 operating conditions. For continuous duty, extreme temperature, etc., service more frequently. For infrequent use, light duty, etc., service periods can be lengthened accordingly. Refer to Figures 21 and 22 for engine maintenance information.

**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.**

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.**

## AC GENERATOR

Periodic inspections that coincide with engine oil changes will ensure good performance.

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 25 in. lb. (2.8 N•m) or finger tight plus a quarter turn. See Figure 1.

## 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 1.280.

## MAINTENANCE SCHEDULE

Use this factory recommended maintenance schedule (based on favorable operating conditions) to serve as a guide to get long and efficient set life. Neglecting routine maintenance can result in failure or permanent damage to the set.

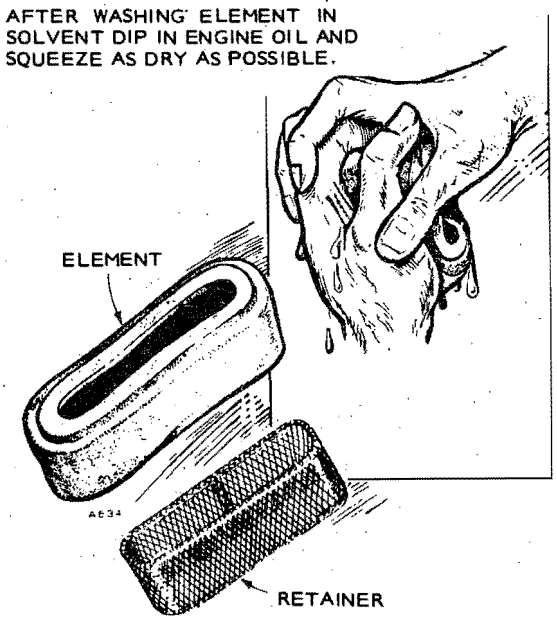
TABLE 1.
OPERATOR AND SERVICE MAINTENANCE SCHEDULE

| HOURS OF OPERATION | MAINTENANCE TASK |
|---|---|
| 8 | • Inspect generator set<br>• Check fuel supply<br>• Check oil level, see Figure 21.<br>• Inspect exhaust system. |
| 50 | • Check air cleaner, see Figure 21. see Note 1. |
| 100 | • Clean governor linkage, see Figure 22.<br>• Change crankcase oil. |
| 200 | • Check breaker points.<br>•Clean crankcase breather,<br>• Clean fuel filter.<br>• Replace oil filter.<br>• Check battery condition. |
| 500 - Call Onan serviceman. | • Replace oil filter.<br>• Check start-disconnect circuit.<br>• Check valve clearances. |
| 1000 - Call Onan serviceman | • Grind valves (if required)<br>• Clean holes in rocker box oil line<br>• Clean generator<br>• Remove and clean oil base. |
| 5000 - Call Onan serviceman | • General overhaul (if required) see Note 2. |

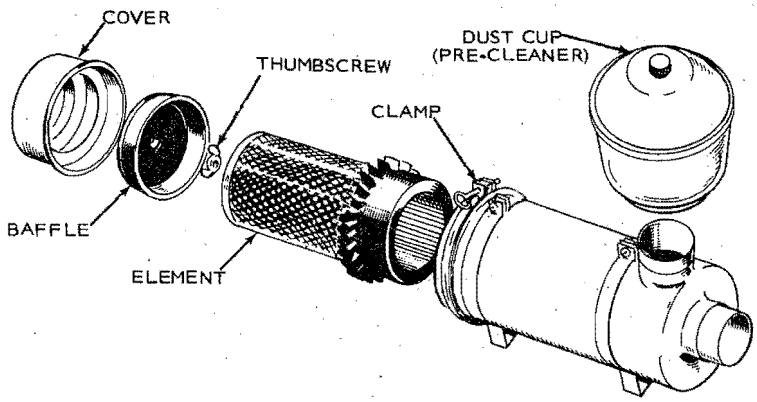
**NOTE** 1. Perform more often in extremely dusty conditions.
2. Tighten head bolts and adjust valve clearance after first 50 hours on a new or overhauled engine.

## OIL FILTER CHANGE

Place a pan under old filter and remove filter by turning counterclockwise. Wipe filter mounting area clean. Before installing new filter, coat the gasket with a light film of oil or grease to aid removal for next replacement. To install filter, turn it clockwise until the gasket touches the mounting base, then tighten it 1/2 more turn.

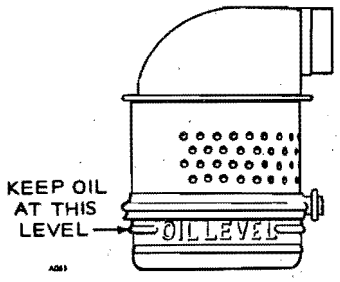



## FOAM ELEMENT TYPE (STANDARD)




## DRY ELEMENT TYPE (OPTIONAL)

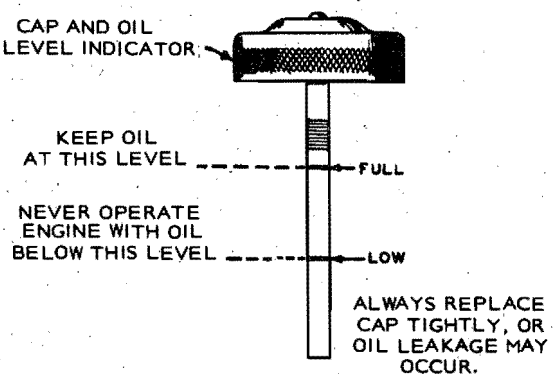
1. Remove pre-cleaner and wash out dirt. Dry and re-install.
2. Loosen clamp and remove end cover.
3. Remove thumbscrew and take out element. Wash element in detergent and water (use new element after 6 washings). Dry and re-install.
4. Remove air cleaner baffle from cover, wash out dirt, and re-install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




## OIL BATH TYPE (OPTIONAL)

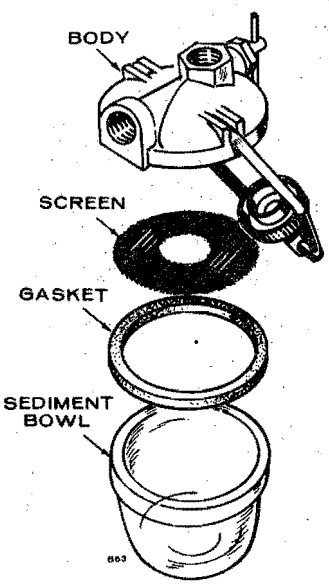
1. Loosen bottom clamp, remove cleaner base and clean.
2. Refill base to oil level mark with fresh oil, same weight as used in engine.

## AIR CLEANERS



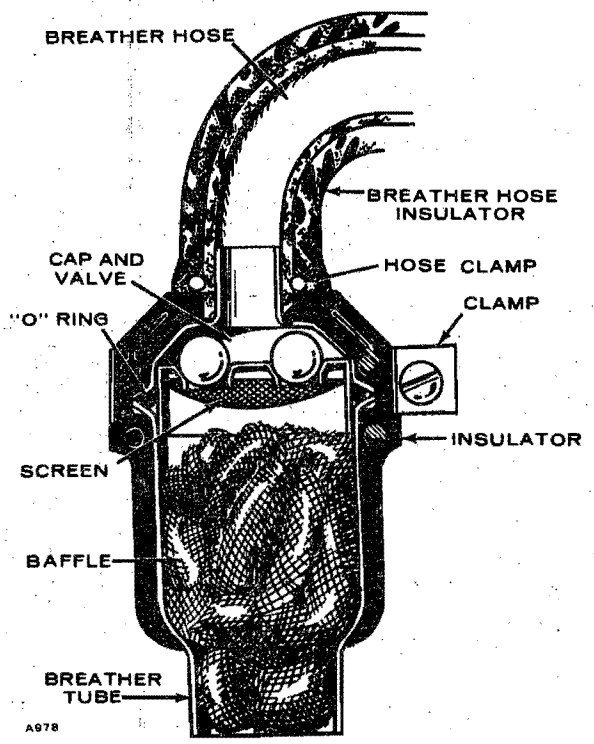

**WARNING** **Never check oil level while engine is running. Hot oil discharged from the engine could cause personal injury.**

OIL LEVEL INDICATOR



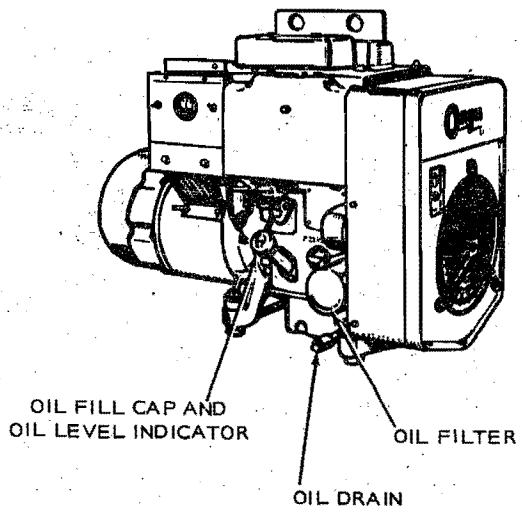

FUEL FILTER

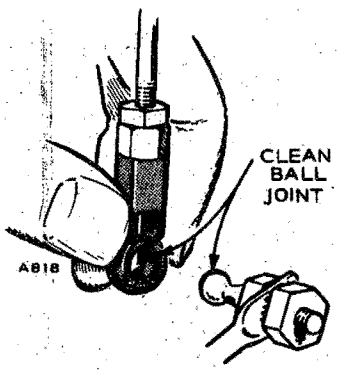
FIGURE 21. MAINTENANCE PROCEDURES




Remove hose clamp, breather hose, breather cap clamp and insulator halves to release breather cap and valve assembly. Wash cap and valve assembly and the baffle in suitable solvent and reinstall.

CRANKCASE BREATHER



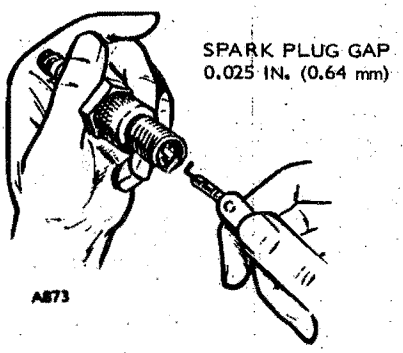
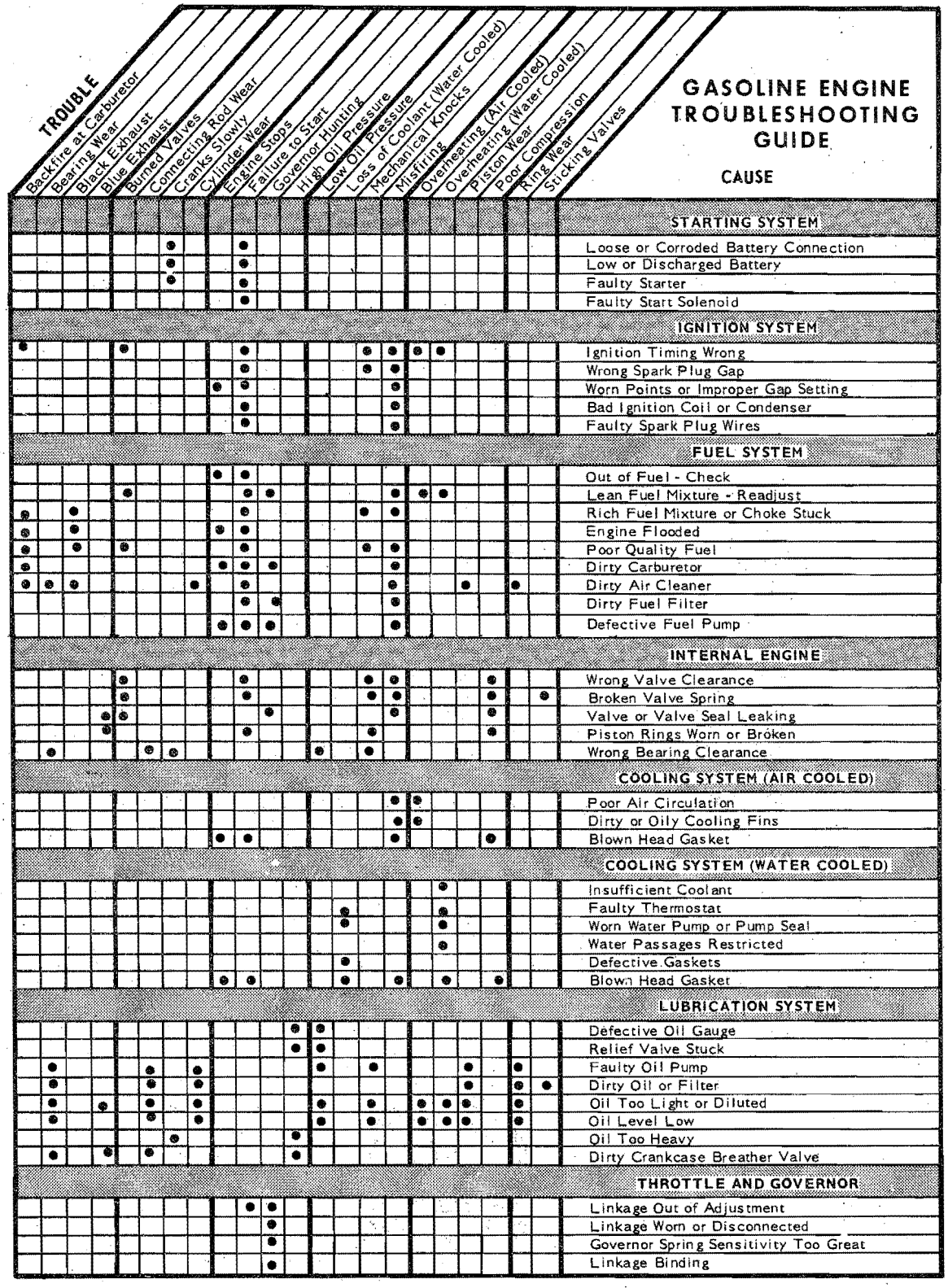




**FIGURE 22. MAINTENANCE PROCEDURES**

# TROUBLESHOOTING GUIDE



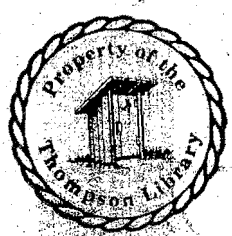
# PARTS INFORMATION

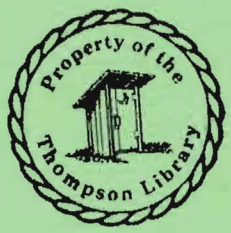
The following Running Replacement Parts List consists of external items which may require replacement due to normal wear and service.

For additional information on parts or service, contact your nearest Onan Parts and Service Center or authorized dealer. A complete parts catalog is available and can be ordered under #967-0223.

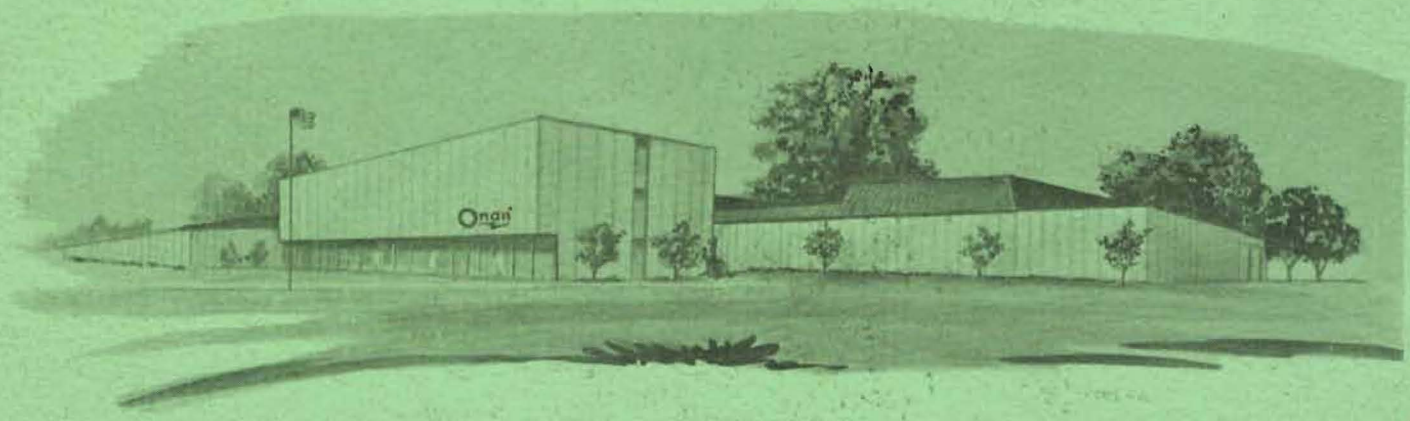
## RUNNING REPLACEMENT PARTS

| Part Number | Description |
|---|---|
| 140-0584 | Air Cleaner Gasket |
| 140-0636 | Air Cleaner Element and Retainer |
| 167-0241 | Spark Plug (2 Non-Resistor Type) |
| 167-0237 | Spark Plug (2 Resistor Type) |
| 160-0002 | Breaker Points |
| 312-0116 | Condenser (Breaker Points) |
| 166-0346 | Ignition Coil |
| 141-0747 | Carburetor Repair Kit |
| 141-0748 | Carburetor Gasket Kit |
| 154-0733 | Carburetor Base Gasket |
| 191-0433 | 12 Volt Solenoid Switch |
| 168-0083 | Gasket Kit Set (overhaul) |
| 154-0463 | Exhaust Manifold Gasket (2) |
| 110-1223 | Head Gasket |
| 155-0077 | Muffler (Unhoused Units) |
| 122-0185 | Oil Filter |
| 308-0154 | Start-Stop Switch |
| 402-0284 | Engine Vibration Cushion (2) |
| 402-0285 | Generator Vibration Cushion (2) |






If you need help with your old Onan, visit the "Smart Guys" at The Stak. They have many years of experience and they are happy to help.
http://www.smokstak.com/forum/forumdisplay.php?f=1

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