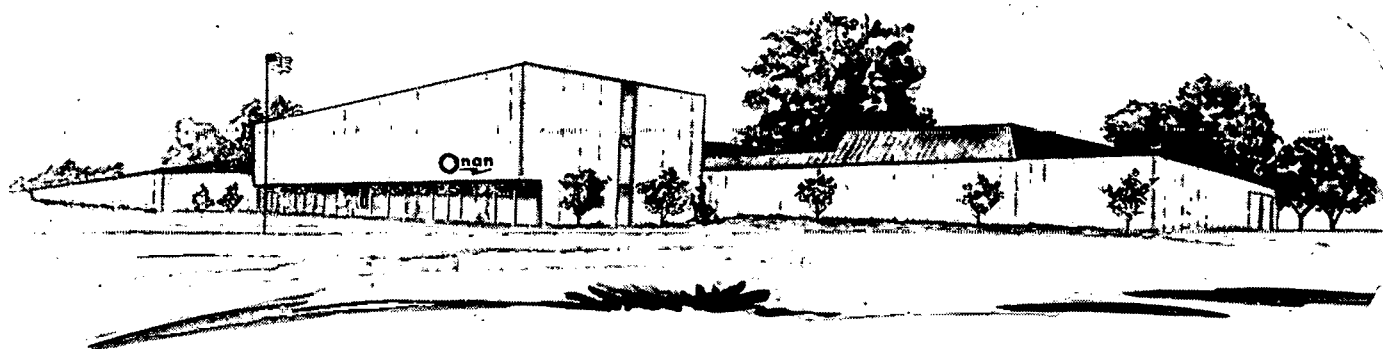
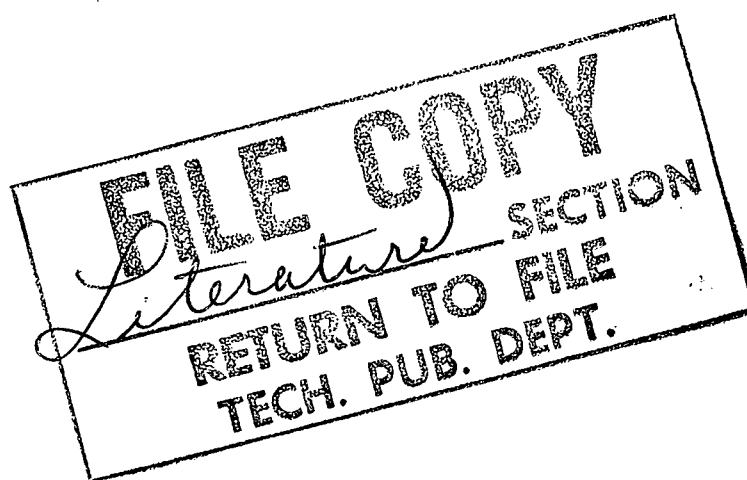




INSTALLATION GUIDE FOR 4.0 CCK, SPEC. 16000 SERIES RV ELECTRIC GENERATING SET



ONAN

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

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. 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 of leaks. A flexible section of fuel line must be used between the generator set and stationary fuel line in the vehicle. This flexible section must be 100% NON-METALIC to prevent electrical currents from using it as a conductor.

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.

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.

Do NOT store anything in the generator compartment such as oil cans, oily rags, chains, wooden blocks etc. A fire could result or the generator set operation may be adversely affected. 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.

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FORM NO.

DATE ORDERED 10-23-75 FORM NO. 927-0610
DATE REQUIRED 10-31-75 DATED Oct 1975
DESCRIPTION Installation Guide for 4.0 CCK Spec 1600 Series
RV Sets - UL Approved

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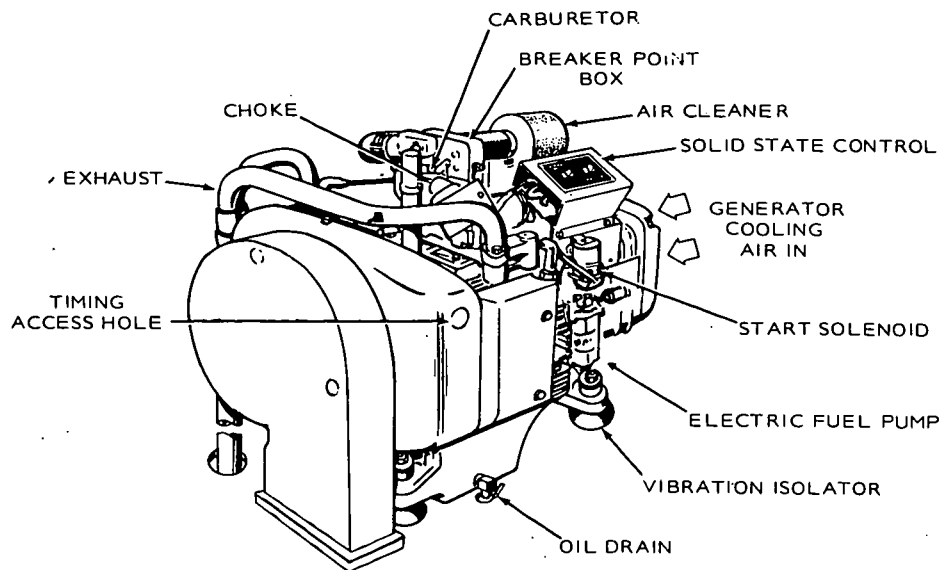
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TYPICAL CCK FOR RECREATIONAL VEHICLES

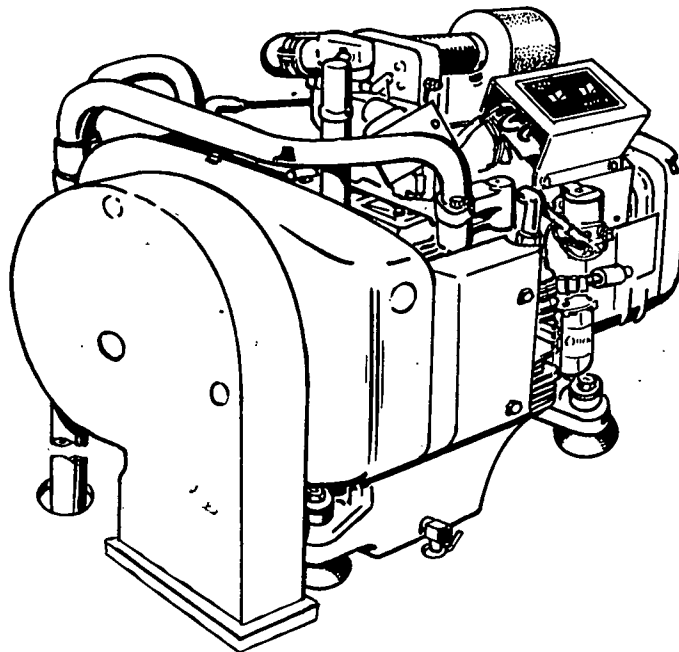
INTRODUCTION

This manual covers installation procedures for the UL approved Onan model 4.0 CCK-3CR Spec 16000 recreational vehicle electric generating sets. Each Onan RV electric generating set **MUST** be installed properly if it is to operate reliably, quietly and most important safely, even though the set itself meets or exceeds all UL Listing Requirements. Being UL listed means this electric generating set meets or exceeds all requirements of ANSI A 119.2.

Besides requirements such as those of the National

Electric Code (NEC), Recreational Vehicle Institute, Inc. (ANSI A 119.2), National Fire Protection Association (NFPA 501C); follow all applicable state and local codes for mobile or recreational vehicles. All recommendations are used in conjunction with the requirements of various Motor Home Manufacturers.

This manual provides detailed installation guidelines for the Onan 4.0 CCK model only. For operation and maintenance procedures, refer to the individual operator's manual which accompanies each set. The operator's manual is #927-0120.



WARNING

*TO PREVENT FIRE OR ACCIDENT HAZARD . . .
THIS UNIT MUST BE INSTALLED ACCORDING
TO THE MANUFACTURER'S DETAILED IN-
STALLATION PROCEDURES OBSERVING ALL
MINIMUM CLEARANCES.*

*TO AVOID POSSIBLE PERSONAL INJURY OR
EQUIPMENT DAMAGE, ANY INSTALLATION
AND ALL SERVICE MUST BE PERFORMED BY
QUALIFIED PERSONNEL.*

GENERAL SPECIFICATIONS

ENGINE

Onan opposed 2-cylinder, 4-cycle air cooled gasoline fueled engine rated 10.2 bhp at 1800 rpm. Remote start, negative ground, 12-volt motorized alternator cranking.

ALTERNATOR

Onan built four-pole, revolving armature permanently aligned to engine. Generator produces 120 volts, 33.3 amps. 60 Hz single phase AC 4000 watt output.

CONTROL

Solid state top mounted Printed Circuit Board featuring automatic electric choke and fuel pump, fused battery charging and Start Stop controls with remote start capability.

RV ELECTRIC GENERATING SET

Some general specifications are listed below for reference purposes.

SPECIFICATIONS

Height	22-7/16 in. (570 mm)
Weight	290 lbs. (132 kg)
Length	29-3/4 in. (756 mm)
Width	19-1/2 in. (495 mm)
Air Requirements	
Total (CFM)	857 (24.27 m ³ /min)
Fuel Inlet Connection	
Size	1/2 NPTF
Battery Voltage	12 Volts
Battery AMP-HR	
Minimum	74 (266.40 kC)
Battery Ground	Negative
RPM (At rated load 60 Hz)	1800

NOTE: Metric values are shown in parentheses.

PRE-START CHECKS

The 4.0 CCK RV unit is complete as received except for exhaust components and any other optional accessory items which are shipped loose with each set for installation later. After the initial installation is completed the following steps are necessary before actually starting the generator set for the first time.

1. Install the exhaust system.
2. Add oil to the engine.
3. Connect fuel line to engine from fuel supply tank.
4. Connect electrical leads to load circuits.
5. Connect the start stop remote switches (if used).
6. Connect battery leads between set and battery. Connect ground lead last.

Vehicle chassis (frame) ground and the battery and generator set ground should all be electrically connected to be at 0 ground potential. All Onan units are designed for negative ground application.

FUEL SYSTEM

With set running, check for leaks. Raw fuel will cause fumes which could EXPLODE. Check around carburetor and fuel pump inlets. Make sure fuel lines are not rubbing against anything which could cause breakage.

ELECTRICAL

AC Output

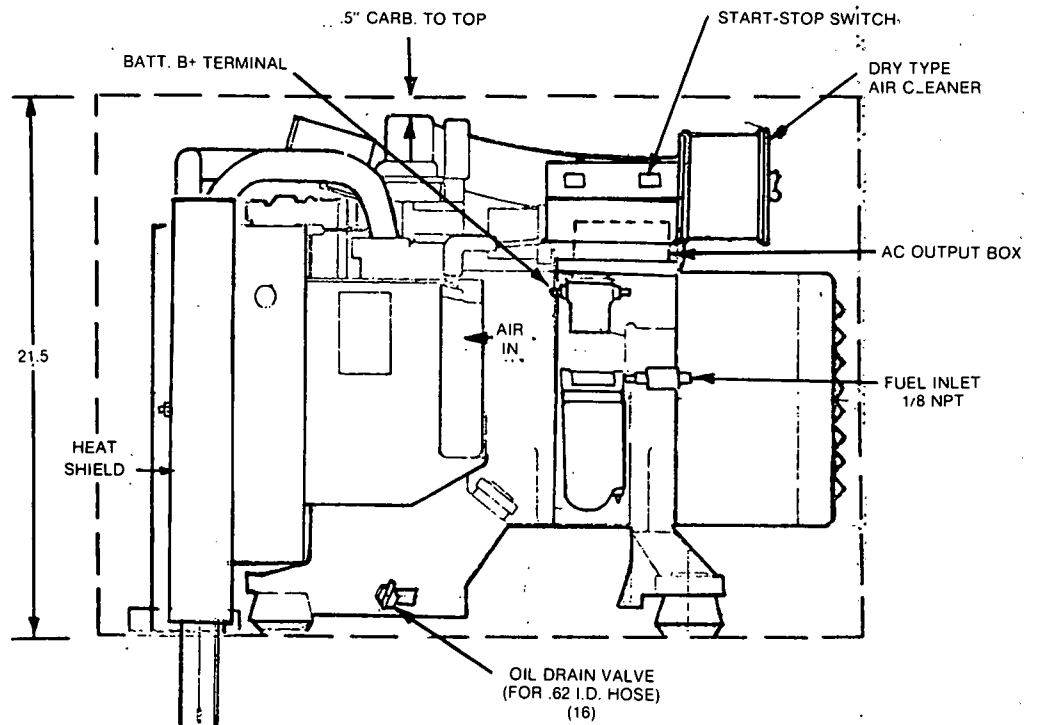
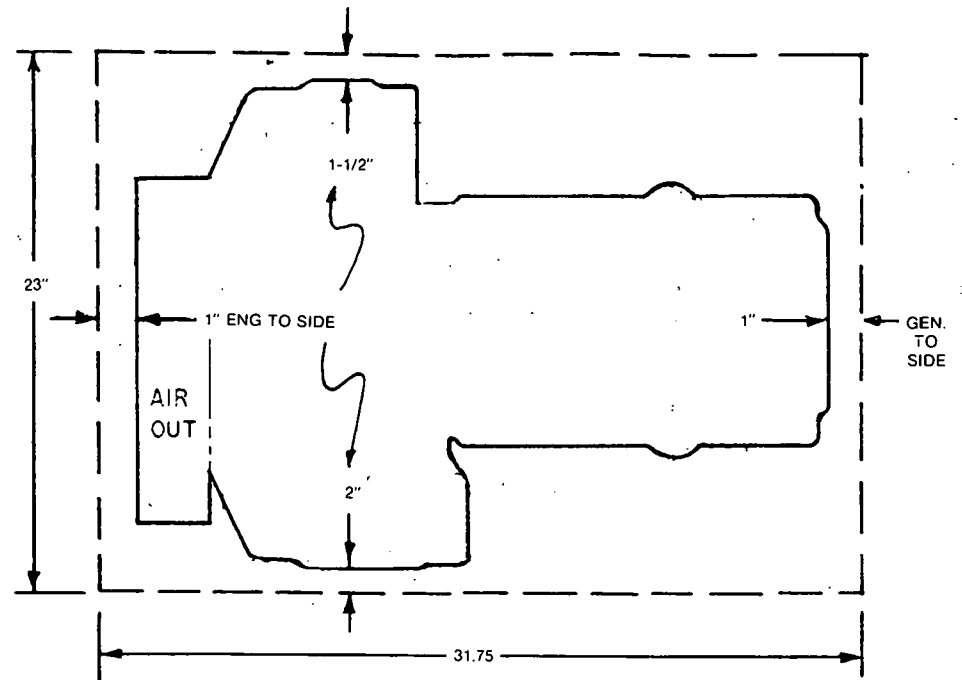
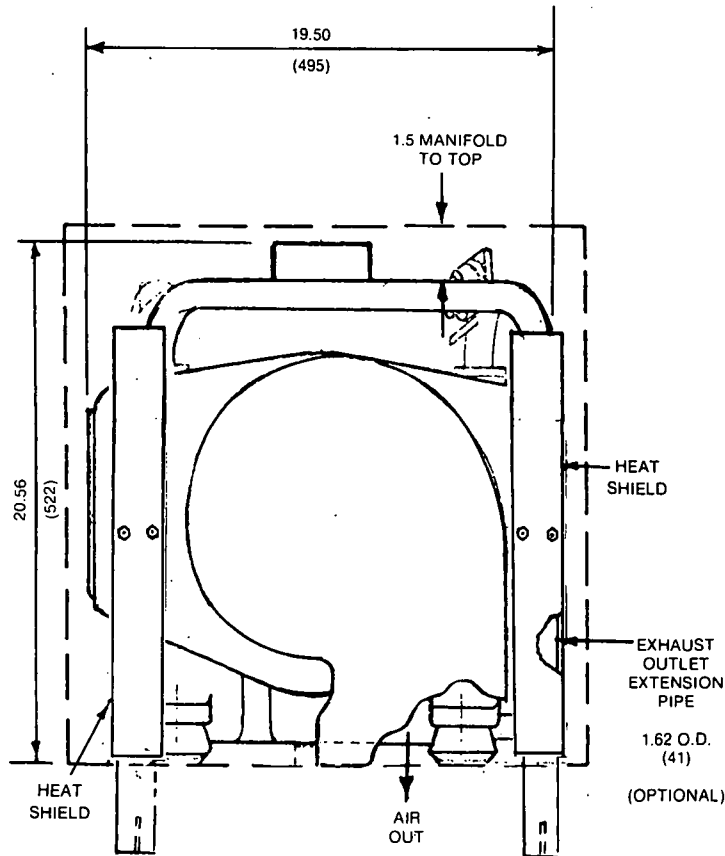
All AC leads (M1, M2, M3 and M4) terminate in generator set's junction box. These wires should be connected to distribution box with multistrand wire enclosed in a flexible conduit. Check all wires (to and from the generator set) for fraying and loose connections. For information on load connections refer to *ELECTRICAL LOADS AND CONNECTIONS* section following.

Battery Connections

Battery positive (+) connects to start solenoid. Battery negative (-) connects to location on rear of generator. Check terminals on set for clean and tight connections.

FIGURE 1. TYPICAL INSTALLATION COMPARTMENT SIZE AND MINIMUM DIMENSIONS

DRY WEIGHT
OF UNIT — 290 LBS. (131 kg)



DIMENSIONS IN () ARE MILLIMETRES

COMPARTMENT SIZE AND LOCATION

COMPARTMENT SIZE AND LOCATION

Compartment location is determined largely by:

1. Physical size.
2. Access opening.
3. Mounting support—most important of all.

Physical Size

The area in the vehicle for the electric generating set must be large enough for the compartment, with specified minimum clearance between the electric generating set and compartment walls or ceiling (and acoustical material, if used). See Figure 1.

ACCESS OPENING

Plan the location for an access opening large enough to permit set removal. Compartment door should be designed for easy removal or for easy access for operator or serviceman.

MOUNTING SUPPORT

Because of compartment weight, the most desirable mounting location is between the main frame members of the recreational vehicle. However, this is seldom possible. Most common installations are on the side of the vehicle and most difficult to reinforce. One side of the compartment is fastened to the frame and the opposite side secured to the body.

Channel, box or angle iron can be used for a compartment frame with a sheet metal cover.

COMPARTMENT

1. Compartment or installation area must be separated from living quarters by a vapor-tight wall.
2. Line the compartment or separate from living quarters with a fire barrier of sheet metal or other noncombustible material. The compartment can also be readily sealed and lends itself easily to sound or acoustical treatment.

WARNING

Do not use flammable material directly above or around the electric generating set compartment. Heat transferred through the sheet metal compartment structure or other material can be HOT enough to discolor, char or ignite fiberboard, seat cushions, etc. Use of asbestos or other noncombustible temperature insulating material in high temperature areas may be necessary.

3. See Figure 1 for minimum clearances and compartment size.

4. Compartment floor must be constructed of non-combustible, nonabsorbent material with adequate strength to support unit's weight. The floor should also have minimal openings to reduce entrance of road dirt.

Equip base with an oil drain hole to outside of compartment.

Onan has a solid mounting plate which is available if not standard with the set. The set is mounted on the plate at the factory.

MOUNTING

Before actual mounting of the electric generating set takes place, read this entire manual. Additional allowances should be made to allow easy access to the oil fill, drain and oil dip stick as well as the air cleaner element for service purposes.

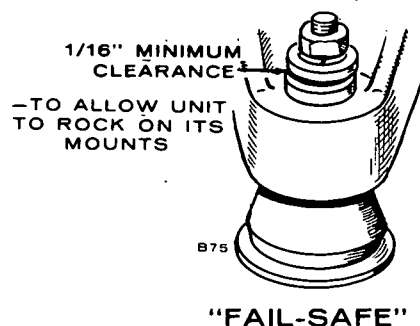


FIGURE 2. VIBRATION ISOLATORS

VIBRATION ISOLATORS

Rubber vibration isolators are furnished with all Onan recreational vehicle models.

CAUTION

Use only the vibration isolators provided with the electric generating set, as they are designed to support unit's weight.

1. Onan mounts are a "fail safe" type which prevent the set from breaking loose if they are damaged.
2. Vibration isolators of the type shown (with snubbing washers) in Figure 2 must be installed properly to minimize vibration. Leave 1/16-inch minimum clearance between the snubbing washers as shown in Figure 2.

VENTILATION AND ACOUSTICS

The most important factors of ventilation for an air-cooled mobile electric generating set are sufficient incoming cooling air and exhausting heated air. Before considering the installation problems, knowledge of how an Onan unit cools itself is needed.

VACU-FLO COOLING

All Onan electric generating sets for recreational vehicles use Vacu-Flo cooling, a centrifugal fan in a scroll housing on the engine end (Figure 3).

1. It draws air from the generator end of the compartment, through the generator and over the cooling surfaces of the engine, then discharges the heated air out through the Vacu-Flo discharge opening.
2. All standard sets for recreational vehicles have the Vacu-Flo scroll positioned downward. Be sure nothing obstructs or restricts discharged airflow.

WARNING

gases.

Never use discharged cooling air for heating since it can contain poisonous

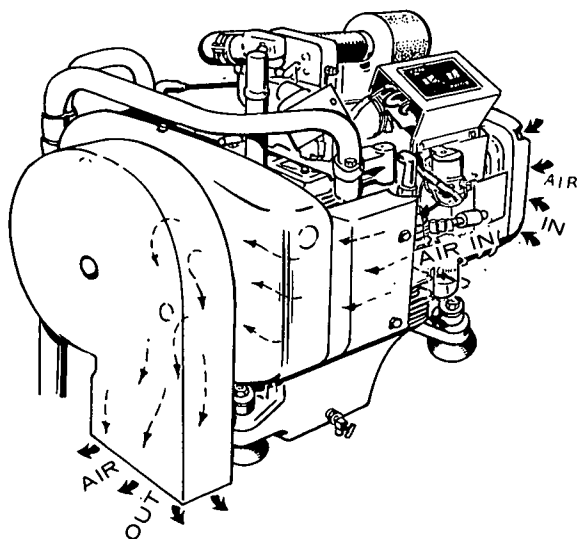


FIGURE 3. TYPICAL ONAN MOBILE COOLING SYSTEM

Allow for ducts or obstructions of airflow. Position of the air openings must permit airflow while the unit is running to purge the compartment of heated air. But on shutdown, the openings must allow for convection cooling of the compartment for heated air to escape.

AIR REQUIREMENTS

Cooling air requirements for Onan electric generating sets vary with type and size. Special equipment is needed to measure it. Since the discharge area can't be changed, air inlet opening is *critical!* The 4.0 kW CCK running at 1800 rpm requires a minimum free air inlet area of 100 square inches with no restrictions and the air discharge is 550 cubic feet per minute.

The Onan UL tested air cleaner element is specifically designed to meet the combustion air requirements of the 4.0 CCK. This element should be replaced each 200 hours of operation and more often in extremely dusty conditions.

RESTRICTED AIR OPENINGS

Sheet metal with louvers can be used over inlet areas. However, some provide only 60 percent free inlet area per square foot. Even the most efficient grille only provides about 90 percent free inlet area per square foot. The free inlet area of the material can be obtained from the manufacturer. Calculate the inlet area needed using the following example as a guide. See Figure 4.

EXAMPLE: Unrestricted air inlet requirements for an electric set is 100 square inches. The compartment door louvers provide 70 percent free inlet area per square foot. Divide 100 square inches by 0.70 (70 percent) to determine necessary inlet area.

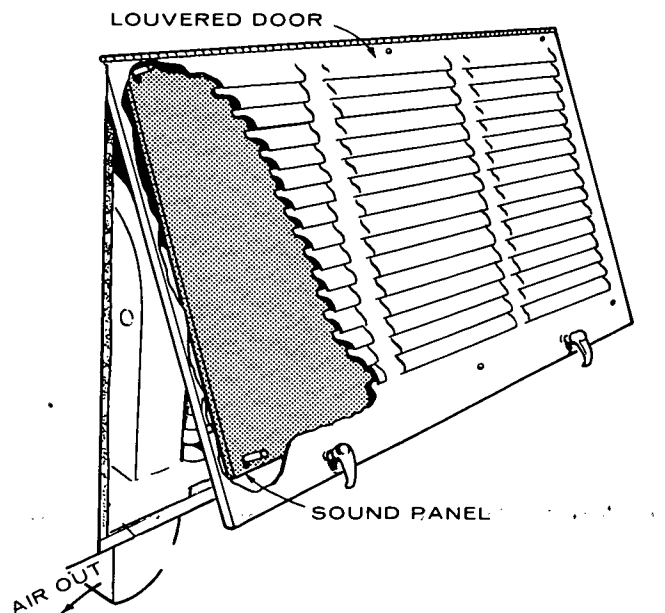


FIGURE 4. TYPICAL LOUVERED DOOR AIR INLET

COMPARTMENT ACOUSTICAL LINING

1. Be sure all joints and corners of the compartment are vapor tight to coach interior before lining with acoustical material.

Lining the compartment does little if opening, cracks, door and joints are not sealed. Also make sure compartment door edge is sealed to eliminate noise-air leaks around the door perimeter.

2. Cover the sound reflective surfaces, back, top and sides (not compartment base) with fiberglass or other noncombustible acoustical material. It should be no less than one inch thick and approximately two pounds per square foot in density. Be sure adhesive used is also noncombustible. Test acoustical material and adhesive for heat effects before using.
3. Rather than using fiberglass or like material of two pound per square foot density, a combination of materials can reduce noise even more. For example, a sheet of lead or viscoelastic material of one-half to one pound per square foot density and a layer of one inch acoustical material of two pound per square foot density, respectively, is far more superior.
4. To prevent line of sight noise indication, a sound panel (baffle) may be added behind lowered air inlet. The panel must be spaced to allow for minimum free air inlet of 100 square inches. See Figure 4.

WARNING

Separate installation area or compartment from living quarters by a vapor-tight wall to prevent entrance of noxious fumes to interior.

FUEL SYSTEM

RECOMMENDED FUEL

All Onan AC electric generating sets for recreational vehicles use gasoline fuel. Because AC electric generating sets run at a constant speed, lead deposits tend to build up in the combustion chambers. For this reason, use clean, fresh, lead free or low-lead gasoline. Regular grade gasoline may also be used, but **DO NOT** use highly leaded premium types of fuel.

For new engines, the most satisfactory results are obtained by using unleaded gasoline. For older engines that have previously used leaded gasoline, the cylinder heads must be taken off and all lead deposits removed from engine before switching to unleaded gasoline.

CAUTION

Lead deposits must be removed from an engine before switching from leaded to unleaded gasoline. If not, preignition can occur causing engine damage.

WARNING

Leakage of gasoline in or around the compartment is a serious fire hazard. The ventilation system should provide a constant flow of air to expel any accumulation of fuel vapor while the vehicle is in transit. Compartments must be vapor tight to the interior to keep fumes from within the vehicle.

SHARING FUEL TANK SUPPLY

Most electric generating set installations are designed to share the vehicle fuel supply tank with the vehicle engine. But do not tee off the vehicle fuel supply line for the set unless absolutely necessary.

Teed lines often result with the more powerful vehicle fuel pump starving the electric set when both are running. When the vehicle engine is not running, a common problem is the set draws all the gasoline from the vehicle engine's fuel line and, in some instances, the carburetor. This results in hard starting of the vehicle and extra demands on the starting battery.

Onan suggests sharing the fuel tank supply either of two ways:

1. Installing a special fitting at the tank outlet so two dip tubes can be fitted into the tank (Figure 5).
2. Installing a new outlet in the vehicle fuel tank.

Installing a second dip tube in the original fuel tank outlet is possible if the tank outlet fitting is large enough to accommodate two dip tubes. A machine shop can make the required fittings. A separate fuel outlet from the tank means removing the tank to braze or weld a new fitting in place.

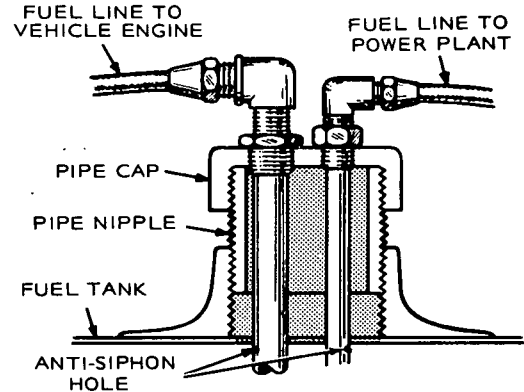


FIGURE 5. INSTALLATION OF SECOND DIP TUBE IN TANK OUTLET

WARNING

Attempting to weld on a fuel tank, empty or not, is dangerous due to gasoline fumes being present!

For either type dip tube installation, make the set's dip tube shorter than the vehicle's dip tube. This insures the set does not consume the total fuel supply.

USING VEHICLE TANK AND SHARING FUEL LINE

If a tee in the main vehicle fuel line is the only solution, locate it as near as possible to the fuel tanks. Some manufacturers use this system exclusively but they design the complete fuel system around the combined fuel draw requirements of both electric generating set and vehicle engines.

Operating the electric generating set from a tee in the main fuel line can cause erratic operation. The set's fuel pump has neither the capacity nor the power to overcome the draw of vehicle engine fuel pump.

To determine if the set will starve for fuel, test the unit after installation, first with the set and vehicle engines running alone. If the set starves with the vehicle engine running under heavy load and high temperatures, the difficulty can sometimes be corrected by installing larger fuel lines between the tank and tee.

FUEL LINES AND FUEL FILTERS

Fuel Lines

1. Use seamless steel tubing and flared connections.
2. Run fuel lines at the top level of tank to a point as close to the engine as possible to reduce danger of fuel siphoning out of tank if the line should break.
3. Keep fuel lines away from hot engine or exhaust areas. This reduces chance of vapor lock.
4. Line must be long enough to prevent binding or stretching because of set movement.
5. Install an approved flexible nonmetallic and non-organic fuel line between the solid fuel line and engine to absorb vibration.
6. Install lines so they are accessible and protected from damage.

7. Use metal straps without sharp edges to secure the fuel lines.

Fuel Filters

Onan electric generating sets with electric fuel pumps have phenolic or screen filters within the fuel pump itself. Additional filters in the fuel line are unnecessary unless unusual operating conditions exist.

FUEL SOLENOID

Evaporative control systems on late model motor homes require a positive fuel shutoff valve to prevent the generator set from flooding when not in use. It connects to the fuel pump inlet terminal, or may be integral with the fuel pump.

EXHAUST SYSTEM

Plan each individual exhaust system carefully. A proper installation is not only gas tight, but usually quieter, too. Be sure to check all applicable recreational vehicle standards, local codes and regulations.

WARNING

Plan the exhaust system carefully. Exhaust gases are deadly!

CAUTION

Do not connect the electric generating set exhaust to the vehicle exhaust system. Water vapor from one engine can damage the other engine.

1. Where the exhaust system passes through the base or floor, leave adequate clearance as protection against exhaust pipe damage from vibration (Figure 6).
2. The exhaust system must be no closer than 1-1/2 inches from any combustible material, or be so located, insulated or shielded so it does not raise the temperature of any combustible material by more than 117F degrees above the ambient air inlet temperature.

3. The exhaust system must terminate aft of the electric generating set compartment and extend to the perimeter of vehicle.

WARNING

Do not terminate exhaust under vehicle, as carbon monoxide gas is poisonous.

4. Exhaust pipe must terminate a minimum of three feet from the vehicle gasoline filler spout (more distance if required by local codes).
5. Use automotive type tail pipe hangers for hanging the exhaust system from vehicle undercarriage.

CAUTION

If tail pipe deflector is used, be sure it is large enough to prevent excessive back pressure.

EXHAUST SPARK ARRESTERS

Exhaust spark arresters are necessary for SAFE OPERATION. All require periodic clean-out (every 50 to 100 operating hours) to maintain maximum efficiency. Some state and federal parks require them.

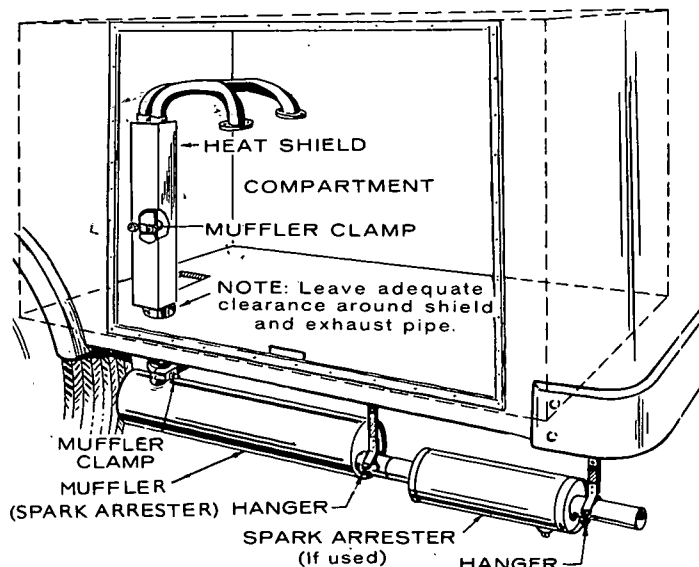


FIGURE 6. TYPICAL EXHAUST SYSTEM INSTALLATION

ELECTRICAL LOADS AND CONNECTIONS

All of the following description pertains to alternating current Onan electric generating sets for recreational vehicles.

1. All wiring must meet applicable local electrical codes. Have a qualified electrician install and inspect the wiring.
2. Wires must be adequate size, properly insulated and supported in an approved manner.
3. Mount switches and controls securely to prevent damage from vibration and road shocks. All switches must be vibration-proof to prevent accidental opening or closing while the vehicle is in motion.
4. Install an approved junction box for feeder conductors from the electric generating set. It must have a blank cover and be inside compartment (not on set).

WARNING

To prevent noxious gases from entering vehicle interior, seal any openings made in the set's compartment for conduit, wiring, etc.

WIRE TYPES

Use multistrand wire which meets all applicable codes as feeder conductors, from electric generating set to compartment junction box. Many installers use multistrand wire throughout the vehicle to reduce the danger of breakage from vibration.

The conductors of the electric generating set shall have an ampacity not less than 115 percent of the nameplate current rating of the generator. Neutral conductors shall be the same size as the conductors of the outside legs.

Supply conductors from the electric generating set to the junction box on the compartment wall must be installed in flexible conduit.

CAUTION

Do not use solid metal conductors in compartment. They may develop metal fatigue from set movement and eventually break.

WARNING

Because of fire hazard, do not tie electrical wiring to fuel line.

DISCONNECT SWITCH

The feeder conductors from the set compartment must terminate in a double-pole, double-throw positive off switch device for 120 volt operation before the vehicle distribution panel. This assures the outside power source cannot be connected simultaneously with the electric generating set. For 120/240 volt operation, a 3-pole, double-throw,

positive off, switching device must be used. Neutral must be switched.

WARNING

Use only approved power supply assemblies. Never remove grounding pin from power supply assembly. Incorrect or no ground may cause the recreational vehicle to be electrically "hot."

RECONNECTIBLE, SINGLE-PHASE GENERATOR

Voltage selection on reconnectible single-phase generators is for use as 120/240 volts, 3 wire; or 120 volts, 2 wire. Use the connection for two wire service when used for motor starting such as air conditioning. Balance the load when connecting for three wire service. Current for any one output lead must not exceed nameplate rating. When two or more single-phase circuits are available, divide the load equally between them. See Figure 7.

STARTING CONTROLS

Remote control Onan electric generating sets are designated by an "R" in the model number and allow the operator to start the set inside the vehicle, etc. See operator's manual for more specific information.

LOAD CONNECTIONS

Generator set load wires M1, M2, M3 and M4 terminate within the junction box. Connect and join wires within junction box in an approved manner for desired voltage code. See Figure 7.

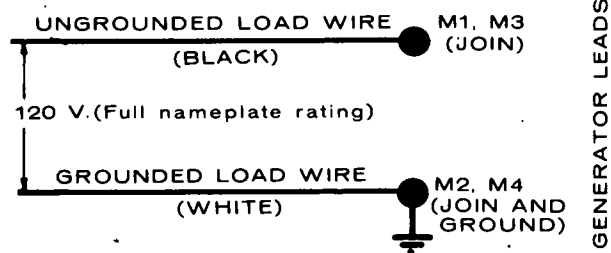
On motor homes which have provisions for using outside AC utility power (separate from the electric generating set) the neutral as well as the "Hot" lead MUST be completely isolated from the motor home when load or power is switched.

The operation of a typical transfer device is shown in Figure 8. In addition to the transfer device, an over current protection device (circuit breaker or fuse) shall be provided between the transfer device and the AC circuit in the motor home. The generator set field has inherent overload protection when any overload is applied; frequency will sag which causes output voltage to drop and in turn the generator set field drops to zero voltage. A ground fault circuit interrupter should be installed in the wiring system to protect all branch circuits.

POWER REQUIREMENTS FOR APPLIANCES

Appliance or Tool	Approximate Running Wattage
Refrigerator	600-1000
Electric broom	200-500
Coffee percolator	550-700
Electric frying pan	1000-1350
Hair dryer	350-500
Electric stove (per element)	350-1000
Electric iron	500-1200
Radio	50-200
Electric water heater	1000-1500
Space heater	1000-1500
Electric blanket	50-200
Television	200-600
Electric drill	250-750
Battery charger	Up to 800
Electric water pump	500-600
Air Conditioner	1400-2000
Converter	300-350

120 VOLT, 2 WIRE



120/240 VOLT, 3 WIRE

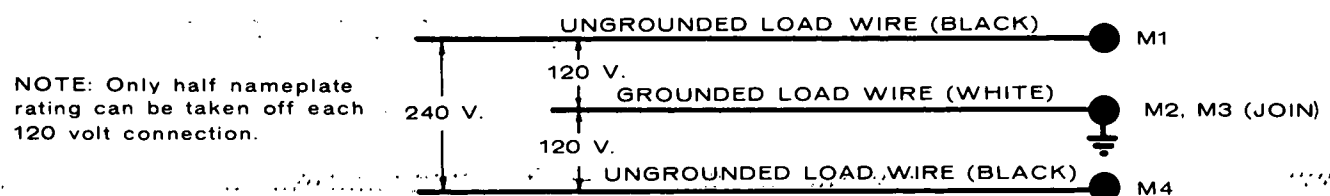


FIGURE 7. SINGLE-PHASE, "3C" VOLTAGE CODE GENERATOR CONNECTIONS

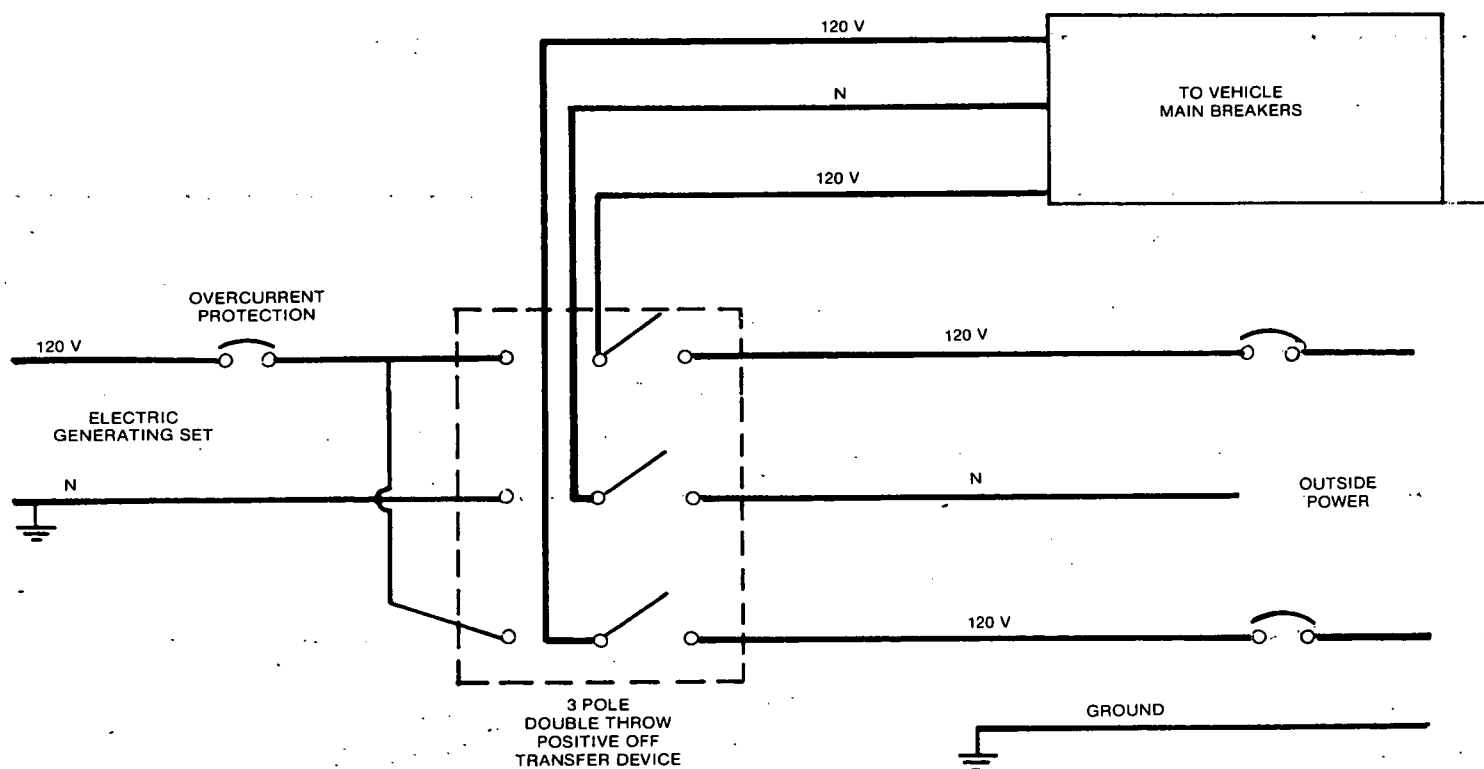
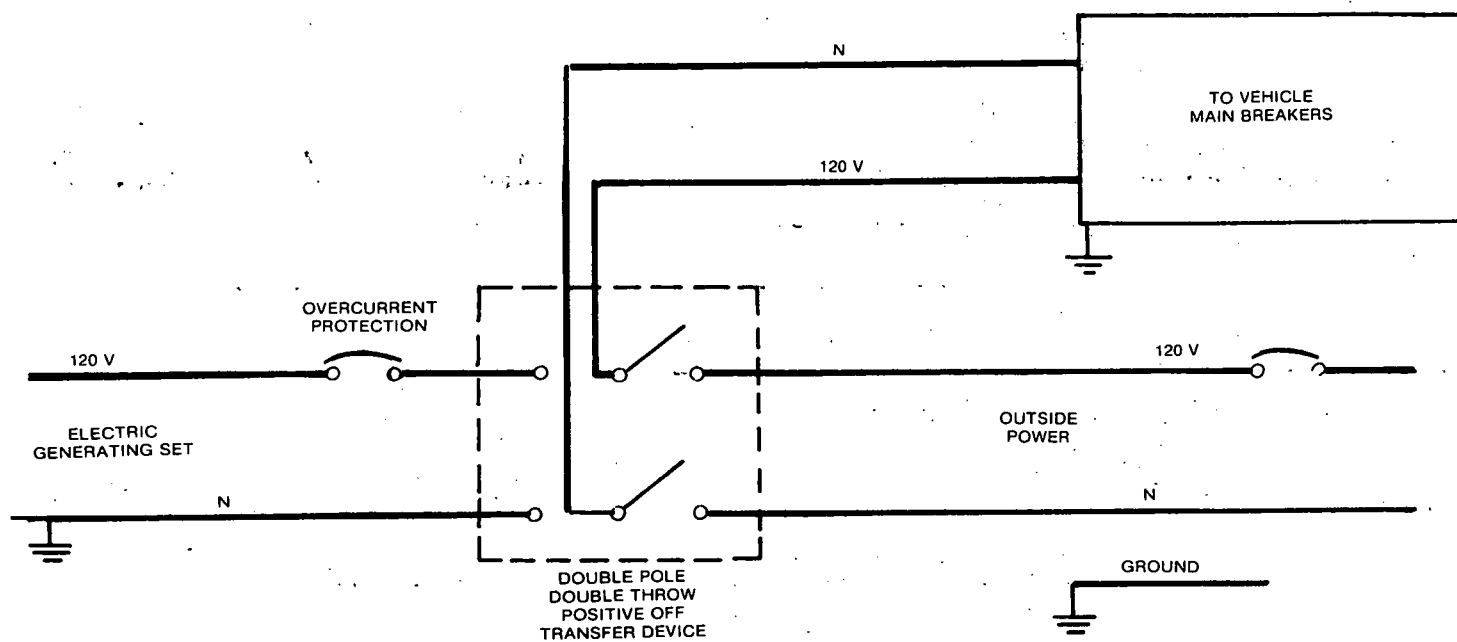


FIGURE 8. SCHEMATIC OF TRANSFER DEVICE AND OVERLOAD PROTECTION

REMOTE ACCESSORIES

INSTALLING STANDARD REMOTE CONTROL ASSEMBLY (300-0942)

This control includes a start-stop switch with an indicator lamp. Install as follows:

1. Select switch location. Using Figure 9 as a guide, drill screw holes and cut holes in RV panel for remote switch.
2. Open the generator set compartment and thread leads from the compartment (cut small hole if needed) into the inside of motor home; run lead ends from inside through hole cut in panel. Caulk or seal any openings made in the compartment for cable entrance to prevent outside air from entering motor home.

Follow national and local electrical codes and use five insulated wires of predetermined length (#18 or larger). Connect remote switch to terminals on generator control. See Figure 10.

CAUTION Don't route DC wires for remote control through conduit containing AC load wiring. Induced voltages may cause erratic operation.

Terminal numbers are stamped on raised portion on the back of remote control switch. Figure 10 schematic shows actual layout of terminals looking at the rear of remote control switch.

3. Insert remote switch in hole cutout and secure with two #5 woodscrews supplied with switch.

WARNING

Seal all holes that might allow noxious gases from generator set into motor home.

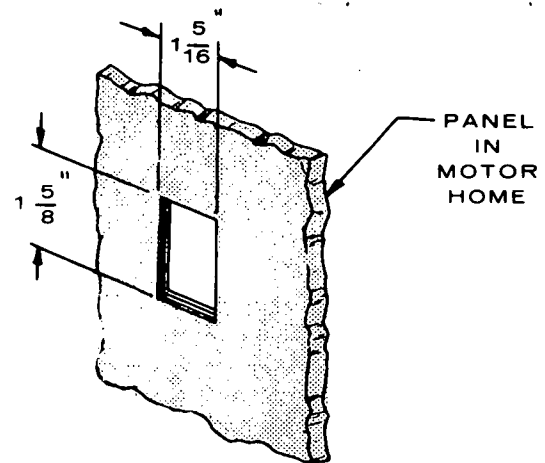


FIGURE 9. MOTOR HOME CUTOUT

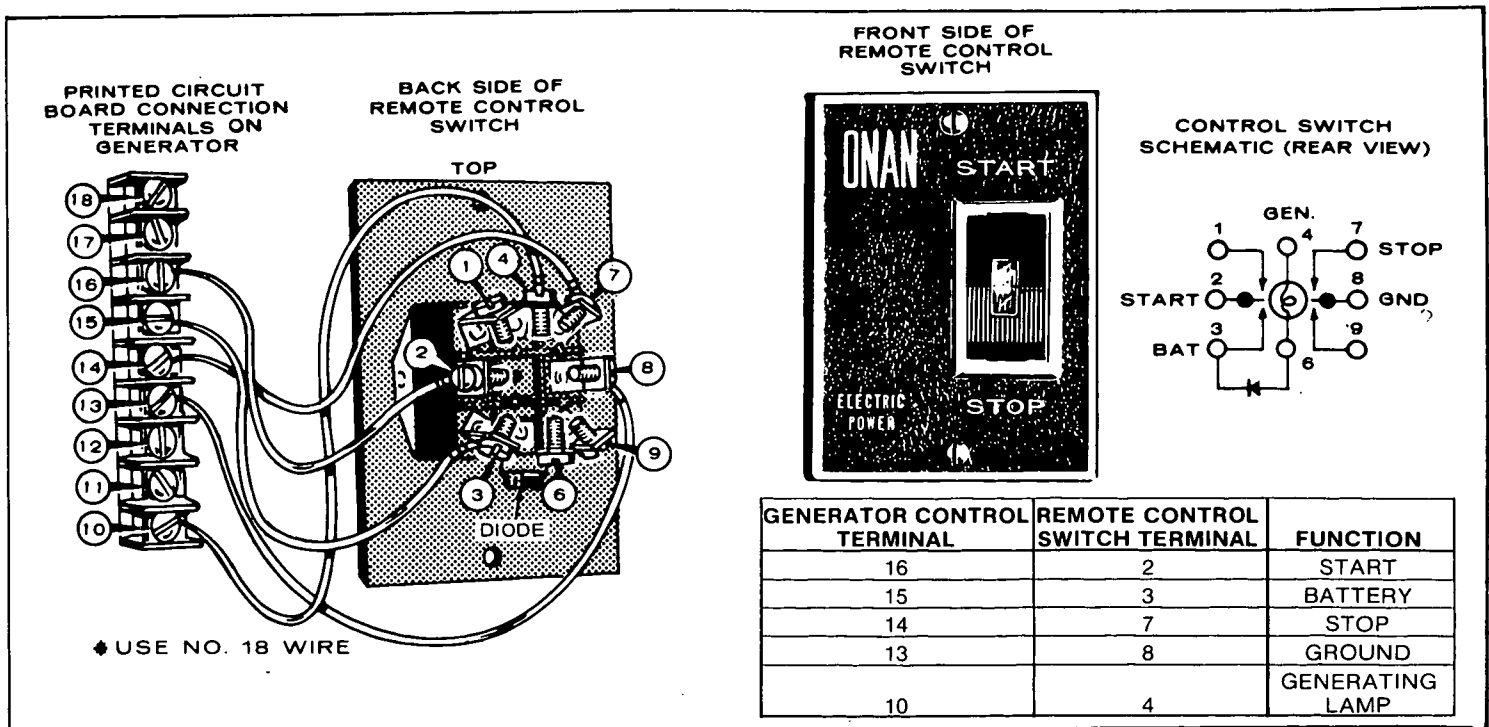


FIGURE 10. CONNECTING REMOTE CONTROL

INSTALLING DELUXE REMOTE CONTROL ASSEMBLY (300-0943)

This control includes a start-stop switch with an indicator lamp, a running time meter and a battery condition meter. Install as follows:

1. Select control location. Using Figure 11 as a guide, drill screw holes and cut hole to accommodate remote switch in panel.
2. Open the generator set compartment and thread leads from the compartment (cut small hole if needed) into the inside of motor home; run lead ends from inside through hole cut in panel. Caulk or seal any openings made in the compartment for cable entrance to prevent outside air from entering motor home.

Follow national and local electrical codes and use five insulated wires of predetermined length (#18 or larger). Connect remote switch to terminals on generator control. See Figure 12.

CAUTION Don't route DC wires for remote control through conduit containing AC load wiring. Induced voltages may cause erratic operation.

Terminal numbers are stamped on raised portion on the back of remote control switch. Figure 12 schematic shows actual layout of terminals looking at the rear of remote control switch.

3. Insert remote switch in hole cutout and secure with two #5 woodscrews supplied with switch.

WARNING Seal all holes that might allow noxious gases from generator set into motor home.

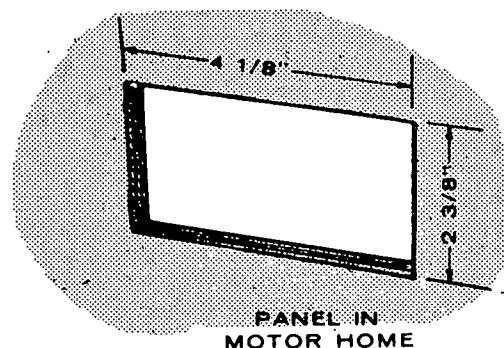


FIGURE 11. MOTOR HOME CUTOUT

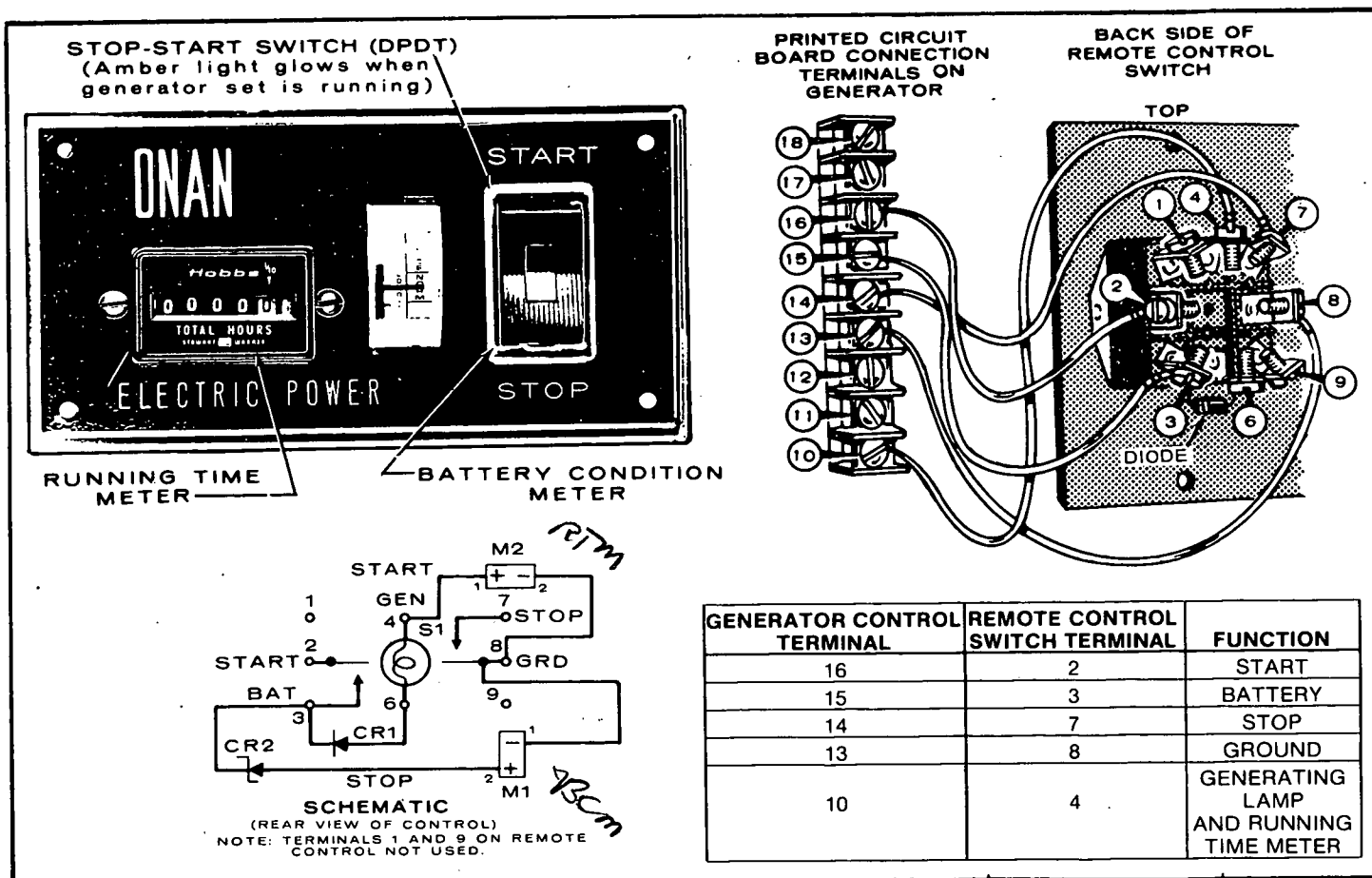


FIGURE 12. CONNECTING DELUXE REMOTE CONTROL

BATTERIES

BATTERY CARE

To increase battery life, the operator can perform a number of routine checks and some preventive maintenance.

1. Keep the battery case clean and dry.
2. Make sure the battery cable connections are clean and tight. Use a terminal puller when removing cables for any reason.
3. Coat the battery terminals with a mineral grease or petroleum jelly to reduce corrosion and oxidation.
4. Identify each battery cable to be positive or negative before making any connection. Always connect the ground (negative) cable last.
5. Maintain the electrolyte level by adding water (drinking quality or better) as needed for filling to split level marker. (The water ingredient of the electrolyte evaporates, but the sulphuric acid ingredient remains. Therefore, add water, not electrolyte.)
6. Avoid overcharging when recharging. Stop the boost charge when the specific gravity is 1.260 and the electrolyte is 80°F (26.7°C).

WARNING Do NOT use unvented batteries with this generator set. Malfunction of the starting-charging system can produce high charging currents, causing excessive gassing. An unvented battery can build up sufficient pressure to explode.

BATTERIES AND BATTERY CABLES

In order for the electric generating set to crank efficiently under various operating conditions, the battery and battery cables must be correctly chosen and installed. Before selecting a battery, be sure the installation area is compatible and properly designed. The compartment for the battery must provide:

1. Rigid mounting support.
2. A location where accidental acid spills or leaks won't damage set, battery cables, etc.
3. Provide a minimum of 2 square inches at top and 2 square inches at bottom of battery for ventilation purposes.

WARNING Do not disconnect battery cables from battery while generator set is cranking or running; sparks may cause an explosion.

WARNING Mount the battery in a separate compartment from the set or any spark-producing device to prevent fire or explosion.

CAUTION Never disconnect the battery with either engine running and never crank both engines simultaneously.

BATTERY CABLES

For reliable starting, voltage drop from the battery terminals to the exciter cranking windings of the generator should not exceed 0.2 volts per 100 amperes of break-away current. The battery cables in Table 1 will meet this condition if the grounding system is adequate. Connect the battery negative to ground with the same size cable as used for battery positive.

Be sure the frame connection (major frame member if possible) is sufficient to minimize resistance. Try to avoid a connection at a weld or mechanical joint.

For short distances, one negative battery cable can be used between set and battery rather than separate cables to chassis ground.

The 4.0 CCK draws 75-100 amperes of cranking current.

The break-away current is 300 to 400 amperes.

The charging current varies from 1-4 amperes depending on battery condition (state of charge).

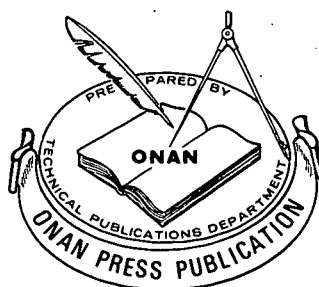
For additional information on installation contact your Onan Service Representative or request *Technical Bulletin T-012* from Onan.

TABLE 1. BATTERY CABLE RECOMMENDATIONS

Model	CABLE SIZE						CABLE LENGTH (FT.) *
	2	1	0	00	000	0000	
CCK	0-8	8-11	11-14	14-17	17-20	20-24	

* - Distance from battery to set.

Onan manufactures a complete line of electric power systems from 1 to 500 KW (generator sets • automatic transfer switches • industrial engines), gas-, gasoline- or diesel-driven. For standby power in homes, industrial plants, commercial buildings and institutions. For auxiliary or portable power in boats, recreational vehicles, service trucks and construction equipment.

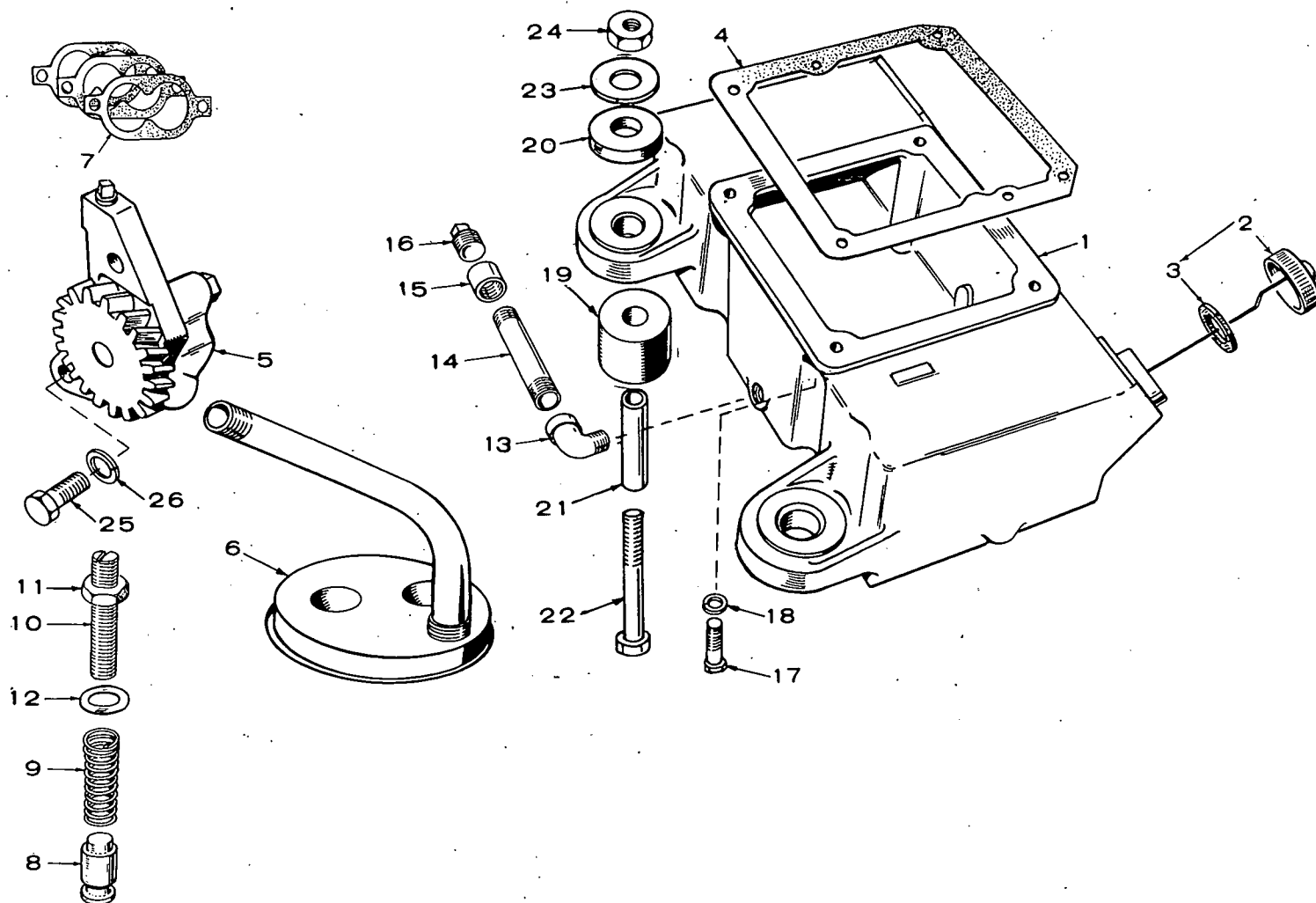


CYLINDER BLOCK GROUP

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION	REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	110-0915	1	Block Assembly, Cylinder (Includes Parts Marked *)	19	VALVE		
2	BEARING KIT, CRANKSHAFT and Lock Pins)			110-0881	2	Intake	
	101-0420	2	Standard	110-0880	2	Exhaust	
	101-0420-02	2	.002" Undersize	20	*INSERT, EXHAUST VALVE SEAT		
	101-0420-10	2	.010" Undersize	110-0872	2	Standard	
	101-0420-20	2	.020" Undersize	110-872-02	2	.002" Oversize	
	101-0420-30	2	.030" Undersize	110-0872-05	2	.005" Oversize	
3	104-0575	2	*Washer, Crankshaft Bearing Thrust	110-0872-10	2	.010" Oversize	
4	516-0072	4	*Pin, Thrust Washer Stop	110-0872-25	2	.025" Oversize	
5	101-0115	1	*Gasket Kit, Rear Bearing Plate	21	110-0904	2	Rotorcap, Exhaust Valve
6	101-0316	1	*Plate, Rear Bearing (Less Bearing)	22	110-0902	4	Guide, Valve
7	101-0367	2	*Bearing, Camshaft (Front & Rear)	23	110-0539	4	Spring, Valve
8	120-0386	1	*Tube, Oil - Crankcase	24	110-0893	2	Washer, Retainer - Intake
9	517-0048	1	*Plug, Camshaft Expansion - Spec F and Begin Spec L	25	110-0639	8	Lock, Rotocap or Spring Retainer Washer
10	110-1283	1	*Cover, Timing Control (Spec H and L)	26	TAPPET, VALVE		
11	509-0041	1	Seal, Oil - Rear Bearing Plate	115-0006	4	Standard	
12	123-0293	1	Cup, Breather Tube	115-0006-05	4	.005" Oversize	
13	123-0129	1	Tube, Breather (Includes Steel Baffles)	27	520-0114	5	Stud, Rear Bearing Plate Mounting (5/16 x 1-5/16")
14	123-0104	1	Valve, Breather Tube	28	110-0445	5	Nut, Hex - Rear Bearing Plate Mounting
15	110-0666	2	Cover, Valve Compartment	29	850-0045	5	Washer, Lock - Spring - Rear BEaring Plate Mtg. (5/16")
16	110-0667	2	Gasket, Valve Compartment Cover	30	520-0020	1	Elbow, Street - Oil Line to Block
17	110-0892	2	Gasket, Cylinder Head	31	800-0012	2	Screw, Cap - Hex Head - Valve Compartment Cover Mounting (1/4-20 x 2-1/4")
18	HEAD, CYLINDER			32	110-0879	8	Screw, Cap - Hex Head - Cylinder Head Mtg. (5/16-18 x 1-1/4")
	110-0890	1	Right Hand (Spec F Only)	33	114-0022	10	Screw, Cap - Hex Head - Cylinder Head Mtg. (5/16-18 x 1-3/4")
	110-0891	1	Left Hand (Spec F Only)	34	526-0122	18	Washer, Flat - Cylinder Head Mtg. (11/32 ID x 23/32 OD x .1345 THK)
	110-0884	1	Right Hand (Begin Spec H) - Hi-Compression				
	110-0883	1	Left Hand (Begin Spec H) - Hi-Compression				

* - Parts Included in Cylinder Block Assembly.

OIL BASE GROUP



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	102-0418	1	Base, Oil
2	123-0489	1	Cap and Indicator, Oil Fill
3	123-0191	1	Gasket, Oil Fill Cap
4	102-0158	1	Gasket, Oil Base Mounting
5	120-0491	1	Pump, Oil - Complete (Internal Parts not sold separately)
6	120-0400	1	Cup, Oil Pump Intake (Includes Cup, Screen & Pipe)
7	120-0161	1	Gasket Kit, Oil Pump
8	120-0398	1	Valve, By Pass
9	120-0140	1	Spring, By Pass Valve
10	120-0145	1	Stud, Oil By Pass Adjustment
11	868-0003	1	Nut, Oil By Pass Stud Adjustment
12	526-0066	1	Washer, Flat - Copper - Oil Pressure Relief Valve Adjusting Screw (25/64" ID x 9/16" OD x 1/16" THK)
13	ELBOW, OIL DRAIN (45") - Key 2 Only		
	505-0119	1	Early Models (3/8")
	505-0248	1	Later Models (1/2")
14	NIPPLE, OIL DRAIN		
	505-0240	1	Early Models (3/8" x 3-1/2")
	505-0176	1	Later Models (1/2" x 3-1/2")

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
15	COUPLING, OIL DRAIN		
	505-0028	1	Early Models (3/8")
	505-0014	1	Later Models (1/2")
16	PLUG, OIL DRAIN		
	505-0110	1	Early Models (3/8")
	505-0056	1	Later Models (1/2")
17	102-0445	4	Screw, Cap - Hex Head - Oil Base Mtg. (3/8-16 x 1-1/4")
18	850-0050	4	Washer, Lock - Spring - Oil Base Mtg. (3/8")
	402-0226	2	Cushion Assy., Engine End Mtg. (Includes Parts Marked *)
19	402-0038	2	*Cushion, Mtg.-Lower - Engine End
20	402-0131	2	*Cushion, Mtg.-Upper - End End
21	402-0137	2	*Bushing, Spacer - Engine End
22	800-0037	2	*Screw, Cushion Mtg. - Engine End (5/16-18 x 3")
23	526-0076	2	*Washer, Flat - Cushion Mtg. - Engine End (11/32" ID x 1-1/2" OD x 1/16" THK)
24	870-0048	2	*Nut, Hex - Cushion Mtg. - Engine End (5/16-18)
25	800-0007	2	Screw, Cap - Hex Head - Oil Pump Mtg. - (1/4-20 x 1")
26	850-0040	2	Washer, Lock - Spring - Oil Pump Mtg. (1/4")

* - Parts Included in Mounting Cushion Assy. - Engine End.