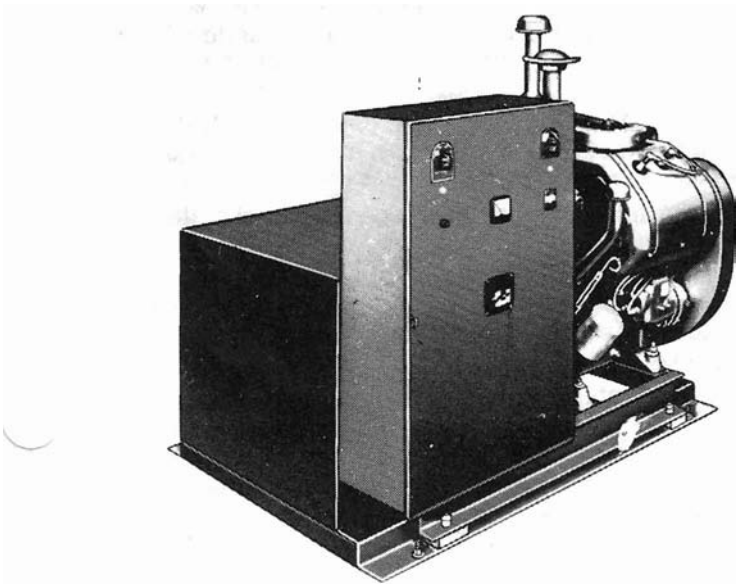
WINCO®
GENERATORS

# AIR COOLED PACKAGE STANDBY 20 KW LPG/NG

## INSTALLATION, OPERATION, and MAINTENANCE INSTRUCTIONS



### *Testing Policy*

Before any generator is shipped from the factory, it is fully checked for performance. The generator is loaded to its full capacity, and the voltage, current, and frequency are carefully checked. A test card with this data is filed by unit serial number for permanent record of performance.

Rated output of generators is based on factory tests of typical units, and is subject to, and limited by, the temperature, altitude, fuel, and other conditions specified by the manufacturer of the applicable engines.

### *Description*

The package standby engine-generator set includes all items necessary for a completely automatic standby power system as standard equipment (except the optional 12 volt engine cranking battery). The components are mounted on one common skid base, connected and wired. The entire package is then tested to insure proper operation of all components and the total system's performance and reliability.

This package power system is designed to automatically provide standby power to unattended loads during electrical outages. Upon an interruption of normal electrical service this packaged power system's electrical control circuits will automatically start the engine. The generator will produce electrical power and the automatic transfer switch (ATS) will automatically transfer the electrical loads to the engine-generator set. Upon restoration of normal electrical service the emergency transfer switch will sense return of the normal commercial power. Fuel supply will be shut off and the engine magneto grounded by the start/run control circuit. The engine will stop and the load control circuit will retransfer the load back to normal commercial power source.

The packaged power system consists of three major parts:

1. A 200 amp automatic transfer switch (ATS).
2. A 20,000 watt (20 KW) two bearing generator.
3. A four cylinder, air cooled, LP/NG fueled engine.

The automatic transfer switch (ATS) consists of two double pole electrically and mechanically interlocked power contactors. The ATS contains the power failure sensing circuitry, engine start/stop controls, and load control/transfer equipment. An overcranking relay stops the start sequence if the engine fails to start in approximately one minute (to protect the battery and starter). A battery trickle charger is provided during normal electrical service. A separate 4-5 amp charging circuit recharges the battery when the generator is operating. A control selector switch has three positions:

1. Stop — used whenever the unit is to be serviced and for emergency shut down.
2. Automatic — normal position for emergency standby service.
3. Check — this position enables the owner/operator to exercise and/or check the engine-generator set without transferring the load, unless a power outage occurs.

The generator is a 20 KW (20,000 watt), 3600 rpm two bearing, belt driven, brush type, revolving armature design. The generator is self excited and inherently regulated to +/– (plus or minus) 7% — no load to fine rated load. It can be operated under any load within its rating without being damaged. The frequency regulation is maintained by the engine governor within 3 cycles variation (61.5 HZ - 58.5 HZ) no load to full rated load.

The engine is equipped with an automotive type starter and a LP/NG vapor fuel carburetor. The fuel system can be adjusted for either LP (propane) vapor or NG (natural gas) operation. The engine operates at 2250 rpm and drives the generator through a matched multi-belt drive system. The generator and belts are shielded with removable safety shrouds.

## Table of Contents



## Specifications

Generator

| Model | Watts | Volts | Amps | HZ | PH | Rpm | Installation |
|---|---|---|---|---|---|---|---|
| | 20,000 | 120/240 | 83.3 | 60 | 1 | 3600 | Class F |

Fuel Consumption

| Natural Gas (1,000 Btu/Cu Ft.) | | | LP Vapor (2,520 Btu/Cu Ft.) | | |
|---|---|---|---|---|---|
| Cu/Hr | Btu/Hr | #/Hr | Gal/Hr | Cu'/Hr | Btu/Hr |
| 465 | 465,000 | 19.4 | 4.6 | 165.9 | 418,264 |

Recommended Tank Size For LP Vapor Operating At Various Temps.

| 60 F/16 C | 30 F/0 C | 0 F/−18 C | −20 F/−29 C |
|---|---|---|---|
| 110 Gal. | 200 Gal. | 500 Gal. | 1,500 Gal. |

A fuel tank smaller than recommended may result in fuel starvation when operated at low temperatures. This will either not allow the generator to operate at all or it will operate but be unable to reach full rated load.

ENGINE SPECIFICATIONS

NOTE: Refer to engine operating and maintenance instructions. This manual covers the generator portion of these units. See the separate engine instruction manual for engine-related problems, detailed engine information and engine warranty.

**CAUTION: Be sure to check the engine oil level frequently, as specified in the engine manual.**

The engine manufacturer has established an excellent world-wide engine service organization; engine service is very likely available from a nearby authorized dealer or distributor; check the Yellow Pages of the Telephone Directory under "Engines," or ask the dealer from whom you purchased the power plant.

The rated power of each engine-generator is subject to, and is limited by, the temperature, altitude and all other ambient conditions specified by the engine manufacturer. Engine power will decrease 3½% for each 1000 ft. above sea level, and will decrease an additional 1% for each 10 degrees fahrenheit above 60 degrees fahrenheit.

## Unpacking

NOTE: When unpacking the generator set, be sure to inspect it carefully for freight loss or damage. If loss or damage is noted at the time of delivery, require that the person making the delivery make note of the loss or damage on the freight bill, or affix his signature under the consigner's memo of the loss or damage. Contact the carrier for claim procedures.

When loss or damage is noted after delivery, segregate the damaged material, and contact the carrier for claim procedures.

"Concealed damage" is understood to mean damage to the contents of a package which is not in evidence at the time of delivery by the carrier, but which is discovered later. The carrier or carriers are responsible for merchandise lost or damaged in transit. The title to goods rests with the consignee when generators are shipped fob factory, and only the consignee can legally file claims.

**CAUTION: This unit is shipped without oil. See engine manufacturer's instruction manual for recommended oil requirements before initial starting.**

1. Remove flex exhaust pipe taped inside of crate.
2. Carefully dismantle crate.
3. After inspecting the engine-generator for external physical damage, check for the following items packed inside the control box.
   a. Owner's manual, and parts list.
   b. Warranty card.
   c. Wiring diagram, located inside the control box door.
   d. Engine manufacturer's instruction manual.
4. Remove main frame hold down bolts (4).
5. Unit can now be lifted from shipping rails.

## General Safety Information

**WARNING: DESPITE THE SAFE DESIGN OF THIS GENERATOR, OPERATING IT IMPRUDENTLY, NEGLECTING ITS MAINTENANCE, OR BEING CARELESS WITH IT CAN CAUSE SERIOUS INJURY OR DEATH. THIS GENERATOR IS POWERFUL ENOUGH TO DELIVER A FATAL ELECTRIC SHOCK. ALLOW ONLY A RESPONSIBLE AND CAPABLE PERSON TO OPERATE THIS GENERATOR.**

1. Installing and wiring a home-standby generator installation is not a "do it yourself" project. Consult a qualified, licensed electrician or contractor. The installation must comply with all national, state, and local codes.
2. Do not allow anyone to operate the generator without proper instruction.
3. Avoid touching live terminals or receptacles.
4. Be extremely careful if operating this generator in rain or snow.
5. This generator must be properly grounded.
6. Hot engine parts, moving parts, and generator electrical output all can seriously injure the generator operator. The operator must use caution and remain alert when using this generator.
7. Keep all safety guards and power shields in position and tightly secured while equipment is operating.

## *General Safety Information (Continued)*

8. When operating this generator, do not wear neckties, loose articles of clothing, or anything else that can be caught in moving parts.
9. Engine exhaust fumes are poisonous. Do not inhale them. Provide adequate ventilation for engine exhaust and fuel vapors that may leak through fittings or damaged pipes. Be sure generator itself is well ventilated for maximum performance and life.
10. The generator manufacturer recommends that only qualified electrical technicians be allowed to service (install, maintain, repair, or replace parts) this generator, and that only factory approved repair parts be used in it.
11. Do not work on this generator (or other potentially hazardous equipment) when fatigued.
12. Use extreme caution when working on electrical components. High generator output voltage can cause serious injury or death.
13. Keep the generator and the area around it clean. Remove all material that can create slippery conditions, such as grease, water, ice, and snow. Also remove oily rags and other flammable material from the area.
14. Keep a fire extinguisher near the generator. Extinguishers rated ABC by the NFPA are appropriate for this use. Consult your local fire department if you have questions regarding fire extinguisher ratings. Keep the extinguisher properly maintained and be familiar with its proper use.

## *Installation*

**WARNING: BEFORE PROCEEDING WITH THE INSTALLATION, BE SURE THE OPERATION SELECTOR SWITCH IS ALWAYS IN THE STOP POSITION.**

Before beginning the installation process recheck the rating of the generator set, associated control panel, and switch/gear. Be certain they can handle the intended load and are compatible with the entrance voltage, phase and current ratings. Plans for installation should be prepared with proper attention to mechanical and electrical engineering detail to assure a satisfactory system installation. The information in this manual is offered as a guide to finalizing your installation plans. The installation sequence is summarized below:

PLAN THE INSTALLATION:

1. Space required for installation and service access.
2. Location — close to fuel, exhaust outlet and electrical connections.
3. Floor loading.
4. Moisture and dirt.
5. Heat and cold.
6. Exhaust.
7. Mounting generator system.
8. Ventilation of room for engine and generator.
9. Engine exhaust system and piping.
10. Fuel installation.
11. Engine service (oil and air cleaner checks)
12. Battery connection.
13. Initial system start-up.
14. Electrical connections.

SPACE REQUIRED AND LOCATION

The space required should allow for ample working room around and in back of engine generator set. A general rule to follow is three (3) feet clearance. This allows service men to repair and remove engine or generator parts if service is needed.

THE ENGINE

Generator should be placed near an outside wall as close to electrical service and fuel source as possible. This will reduce the cost of electrical and fuel runs. Position the unit to keep the exhaust runs as short as possible. Protection from adverse weather conditions must be provided without restricting adequate ventillation for cooling. Planning now will eliminate costly errors that will have to be corrected later at considerably higher expense.

FLOOR LOADING

Floor type and loading should be taken into consideration when installing an engine generator set.

MOISTURE AND DIRT

All electrical equipment should be protected from excessive moisture. Failure to do so will result in deterioration of the insulation and will result in short circuits and grounds.

Foreign materials such as dust, sand, lint and abrasive materials have a tendency to cause excessive wear, not only to the engine parts, but also to the generator parts, particularly the brushes. It is, therefore, important that the unit be installed in a reasonably clean location for best service.

HEAT AND COLD

All engines give off considerable heat when they are running. Since the engines used on these generators are all air-cooled it is important that the temperature of the room in which they are located does not exceed 105 degrees fahrenheit while operating. Automatic louvers in doors, windows and/or walls are required to assist in providing adequate air flow. Where natural cross ventilation is inadequate, a thermostatically controlled fan may be required to boost circulation.

Engines start most easily when they are not subjected to extreme cold. Engine-generators which are installed to operate automatically preferably should be located where the temperature does not fall below freezing (32 F/0 C).

EXHAUST

Exhaust gases from gasoline engines are extremely poisonous. Whenever an engine is installed indoors, the exhaust fumes must be vented to the outside. The engine should be installed at least two feet from any outside wall.

**WARNING: THE DANGER OF DEADLY CARBON MONOXIDE GAS.**

Remember that the exhaust fumes from any gasoline (or any other internal combustion type) engine are very poisonous if discharged in a closed room, but are not dangerous when well mixed in outside air. If the power plant is installed indoors, you must make provisions to carry the engine exhaust gas safely outdoors. As instructed in the following section, "Exhaust Installation."

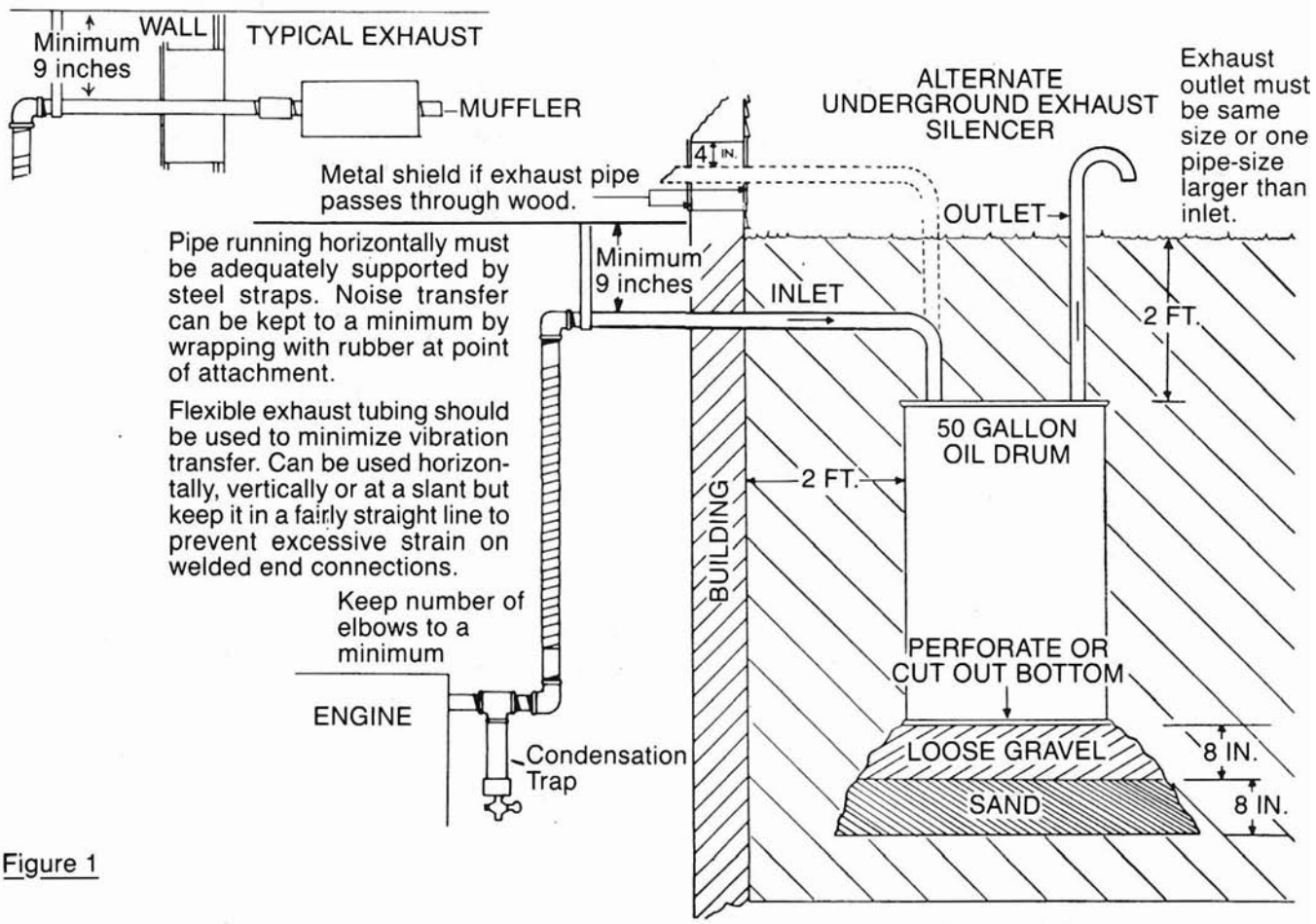



Figure 1

## MOUNTING

**CAUTION: The unit's main frame should be bolted solid to a 4 to 6 inch thick cement pad. The engine-generator is mounted on a sub-frame which is shock mounted with special neoprene pads on the main frame. This allows the engine-generator to vibrate without affecting the control panel which is mounted on the main frame.**

**Do not shock mount the main frame. Engine vibration will be transmitted to the control panel causing erroneous start/stop cycles and premature control failure.**

## VENTILATION OF ROOM, ENGINE AND GENERATOR

The engine is an internal combustion device which is air-cooled. The ventilation should be a sweeping flow. When an engine-generator is installed in a building, it should have an air inlet opening 1½ times the area of the engine inlet screen. The hot air discharge should be above the cool air inlet, as the hotter air will rise.

NOTE: Local weather conditions should be considered when choosing the type of louver.

## ENGINE EXHAUST AND PIPING

**WARNING: PERSONAL DANGER — TOXIC FUMES. ENGINE EXHAUST GASES ARE DEADLY AND MUST BE VENTED TO THE OUTSIDE OF ANY BUILDING.**

**WARNING: POTENTIAL FIRE HAZARD, CONSULT NFPA.**

## EXHAUST INSTALLATION (Refer to Fig. 1)

Use black iron pipe for straight exhaust runs.

**WARNING: PERSONAL DANGER — POISONOUS FUMES.**

Do not use galvanized pipe or electrical conduit. When heated by engine exhaust, these galvanized coatings give off potentially hazardous fumes.

Pipe running horizontally must be adequately supported by steel straps. Noise transfer can be kept to a minimum at the point of attachment.

Flexible exhaust tubing should be used to minimize vibration transfer. It can be used horizontally, vertically, or at a slant, but keep it in a fairly straight line to prevent excessive strain on the welded end connections (do not use it as an elbow).

Exhaust installations must conform to state and local codes. Refer to NFPA (National Fire Protection Association) Manual No. 37 for specific information. If the exhaust pipe passes through a wall or ceiling constructed of combustible material, guarding to prevent fire must be installed around the pipe, as specified in the NFPA Manual.

The size of the exhaust pipe to be used depends upon the length of the run:

The engine exhaust hole is 1¼ inch NPT(F) — if the length of the exhaust run is:

| | Up to 5 Ft. | 5 to 25 Ft. | 25 to 50 Ft. | Over 50 Ft. |
|---|---|---|---|---|
| Use: | 1¼" Pipe | 1½" Pipe | 2" Pipe | Not Recommended |

Exhaust pipe extension diameter must be as large or larger than engine exhaust port. See that the pipe extension is leakproof and runs in a straight line or with a minimum of sharp bends. Always slope the exhaust line downward away from the engine to prevent moisture condensation from entering the engine. If a turn must be made, use of 45 degree elbows is recommended.

If the exhaust pipe rises above the engine, a condensation trap should also be installed to prevent moisture from running into the engine and possibly damaging it. This is easily accomplished by installing an ordinary pipe "T" or "Y" in the exhaust pipe as shown in Fig. 1. At the lowest point of the trap, install a short length of pipe pointing downward, and provide it with a drain plug to permit the accumulated moisture to drain out. Drain the trap at regular intervals to prevent it from becoming full and overflowing into the engine. Support the exhaust pipe two feet from the exhaust opening on the manifold; any length of pipe over two feet, if not supported, may break the manifold casting.

## FUEL INSTALLATION

Size and location of fuel system — The fuel supply should be as close as possible to the engine. This will reduce the installation cost of fuel runs. Refer to fuel section for proper installation requirements.

Propane (LP)/Natural Gas (NG) Fuel

**CAUTION: The information in this manual is offered to assist you in providing the proper fuel for your engine. However, at all times, this information is only provided to inform you of the engine's requirements and assist in making you aware of the decisions you must make. In no case should the instructions or information provided be interpreted to conflict with any local, state or national codes. If in doubt, always consult your local fire marshal or gas supplier.**

**WARNING: FIRE HAZARD. ALL FUEL RUNS SHOULD BE INSTALLED BY QUALIFIED FUEL SUPPLIER.**

Connect the fuel supply to the inlet of the fuel solenoid (see table for recommended line size). The pressure at the secondary demand regulator must be four to six ounces PSI (per square inch) or 7 to 11 inches W.C. (water column).

**CAUTION: Be careful when sealing gas joints. Excessive sealing compound can be drawn into the solenoid, regulator or carburetor causing an engine malfunction.**

## INSTALLING THE FUEL LINE

NOTE: The engine generator sets are properly adjusted before they leave the factory. A tag is attached to the unit that specifies the fuel natural gas (NG) or propane vapor (LP) that the unit was set up and tested on. A slight adjustment may be necessary on NG depending on local BTU content. This adjustment will be discussed later.

## LINE SIZE

**WARNING: PERSONAL DANGER.**

Do not use galvanized pipe in fuel line runs. The galvanized coating can become eroded and flake off, causing possible obstructions in the regulator or fuel valve. The results could range from inoperative engine start to hazardous fuel leaks.

Unit location will determine the size of fuel line that is required to supply the engine with a constant fuel pressure. Refer to Table 1 for fuel line size, fuel consumption and recommended tank size. For distances of 50 feet and over, we recommend a two-regulator fuel system. This is accomplished by installing a regulator at the tank which will reduce the tank pressure down to 10 to 15 lbs. A second regulator is then installed as close as reasonably possible to the generator which reduces the fuel pressure down to 6 oz. It is then possible to use a 3/8 inch line from the tank to the second regulator for distances up to 300 feet. The appropriate line size from Table 1 is then installed from the second regulator to the machine.

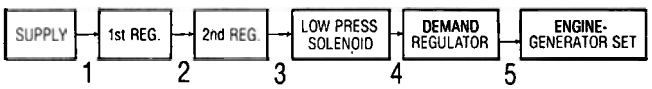
Size of pipe normally required for generators operating on Natural/LP Gas:

| Up to 10 Ft. | 10-30 Ft. | 30-100 Ft. | Over 100 Ft. |
|---|---|---|---|
| 3/4" Pipe | 1" Pipe | 1 1/4" Pipe | Not Recommended — Use Two Regulator System |

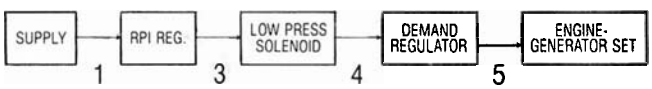
NOTE: Allow an additional 3 feet for each standard elbow. Do not use street ells.

## FUEL PRESSURE

Correct fuel pressure cannot be stressed enough. The most common cause for inoperative systems is an inadequate or incorrect fuel pressure. Performance of the engine is in direct relation to the correctness of the fuel system. Shown below is a block diagram of a typical LP or NG installation.




2 Regulator Fuel System




Single Primary Regulator Fuel System

Ref. Nos. 1 through 3 are fuel lines supplied by customer.

Ref. Nos. 4 through 5 are fuel lines already installed on your engine generator set.

Below is a table of the fuel pressure reading at each reference in the system.

Fuel Pressure Table

Fuel Pressures

| LP Single Reg. | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Unit Off | Tank PSI | NA | 7-11 In. 4-6 Oz. | 7-11 In. 4-6 Oz. | 0 |
| Starting | Tank PSI | NA | 7-11 In. 4-6 Oz. | 7-11 In. 4-6 Oz. | (–) 1½ In. (WC) |
| No Load | Tank PSI | NA | 7-11 In. 4-6 Oz. | 7-11 In. 4-6 Oz. | (–) 1½ In. (WC) |
| Full Load | Tank PSI | NA | 7-11 In. 4-6 Oz. | 7-11 In. 4-6 Oz. | N/A |

## *Installation (Continued)*

| LP 2 Reg. System | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Unit Off | Tank PSI | 10-15 Lbs. | 7-11 In. 4-6 Oz. | 7-11 In. 4-6 Oz. | 0 0 |
| Starting | Tank PSI | 10-15 Lbs. | 7-11 In. 4-6 Oz. | 7-11 In. 4-6 Oz. | (−) 1½ In. (WC) |
| No Load | Tank PSI | 10-15 Lbs. | 7-11 In. 4-6 Oz. | 7-11 In. 4-6 Oz. | (−) 1½ In. (WC) |
| Full Load | Tank PSI | 10-15 Lbs. | 7-11 In. 4-6 Oz. | 7-11 In. 4-6 Oz. | N/A |

| Natural Gas | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Unit Off | Line PSI | NA | 7-11 In. 4-6 Oz. | 7-11 In. 4-6 Oz. | 0 |
| Starting | Line PSI | NA | 7-11 In. 4-6 Oz. | 7-11 In. 4-6 Oz. | (+) 5 In. (WC) 2-2½ Oz. |
| No Load | Line PSI | NA | 7-11 In. 4-6 Oz. | 7-11 In. 4-6 Oz. | (+) 5 In. (WC) 2-2½ Oz. |
| Full Load | Line PSI | NA | 7-11 In. 4-6 Oz. | 7-11 In. 4-6 Oz. | |

Table 1

Notice the table gives two (2) units of measuring fuel pressure. The first is with a pressure gauge calibrated in ounces per square inch. The second and most accurate is the use of a water manometer. This second instrument is calibrated in inches of water column.

**CAUTION: When making gas connections be careful not to get excess sealing compound in the fuel line. Pipe joint compound can be drawn into the carburetor causing poor performance and hard starting.**

LUBRICATION

Before starting the engine, fill the crankcase with the proper weight/grade of oil, as recommended by the engine manufacturer's maintenance instructions. The necessity of using the correct oil, and keeping the crankcase full cannot be over emphasized. Engine failures resulting from inadequate or improper lubricant are considered abuse and are not covered by the engine manufacturer's warranty.

**CAUTION: In the following battery installation procedure, check to be sure the selector switch remains in the "stop" position. (See Fig. 2.)**

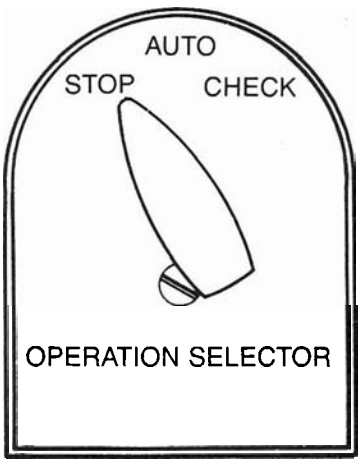



Figure 2

INSTALLING THE BATTERY

A twelve-volt battery rated 70 ampere hour or greater is required for proper starting performance.

Observe polarities: connect the positive (+) battery terminal to the (+) cable from the control panel; the negative (−) battery terminal is connected to the negative cable (ground) from the engine generator assembly.

All connections must be olean and tight. Check the electrolyte (fluid) in the battery periodically to be sure it is above the plates. Never allow the battery to remain in a discharged condition.

An adjustable trickle charger, producing up to 200 MA is built into the control panel to keep the battery in top notch condition during standby periods. The rheostat should be adjusted for a normal setting of 90 MA.

NOTE: The trickle charger will not recharge a battery which has become discharged. It produces just enough current for the battery, if fully charged, to maintain a charged condition.

INITIAL START UP

Prewire system check:

Before wiring the electrical switch (etc.) to the commercial line and load circuits, the installation and operation of the engine generator set should be checked to insure proper fuel, exhaust, engine and generator operation.

Use the following check list to verify correct installation before starting the engine:

Item Check

1 Engine oil. Fill as required grade/qty.
2 Unit mounting base.
3 Ventilation (louver size, inlet/outlet).
4 Clearance on all sides.
5 Proper fuel line material, size and connections.
6 Gas regulator vented to the outside (check for local code requirements).
7 Fuel line protected.
8 LP/NG pressure O.K. 4-6 Oz. (7-11" WC).
9 Proper size and slope on exhaust line.
10 Flexible exhaust connector installed.
11 Condensation trap installed.
12 Muffler installed and properly supported — look closely for potential fire hazards in the mounting system.
13 Exhaust line free of excessive elbows and restrictions.
14 Battery of proper voltage and ampere hour rating — check carefully for negative ground polarity.
15 Battery connections clean and tight.
16 Battery fully charged.

After completing the above checklist, the engine-generator set is ready for the initial start-up test.

1. Set selector switch to the "check" position; the engine-generator will crank and start automatically. If the engine fails to start, return selector switch to the "stop" position and refer to the trouble shooting section of this manual.
2. With the engine running smoothly check the no load voltage and frequency at terminals T1 and T3 of the transfer switch.

   T1 to T3 250-260 VAC Freq. 61 to 61.5 HZ

## *Installation (Continued)*

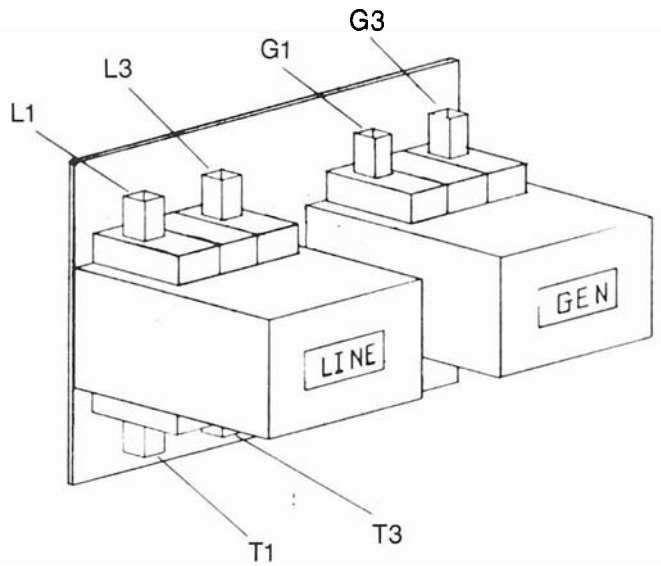



Figure 3

NOTE: Neutral/ground terminal bolt is located in bottom of the control panel.

T1 to N 125-130 VAC
T3 to N 125-130 VAC

NOTE: If for any reason during the checkout procedure the voltage and frequency are not correct, turn the selector switch to the "stop" position and refer to the trouble-shooting procedures.

After verifying the voltage and frequency are correct, turn the selector switch to the stop position. The unit is now ready to be connected to commercial line power and load circuits.

ELECTRICAL CONNECTIONS

**WARNING: ALL WIRING SHOULD BE DONE BY A COMPETENT ELECTRICIAN, AND SHOULD CONFORM TO THE NATIONAL ELECTRICAL CODE AND WITH STATE AND LOCAL REGULATIONS.**

**WARNING: TURN THE OPERATION SELECTOR ON THE FRONT OF THE CONTROL TO THE "STOP" POSITION AND TURN THE MAIN POWER SWITCH OFF BEFORE PROCEEDING.**

It will be observed that the terminals on the power transfer switch are marked as follows: (See Fig. 0)

The load terminals are marked (T): T1 and T3 are "hot" — T2 is connected to the "ground".

The line terminals are marked (L): L1 and L3 are "hot" — L2 is connected to "ground".

The standby generator terminals are marked (G): "Hot" leads G1 and G2 are prewired at the factory to contactor terminals G1 and G3 — G2 is also prewired at the factory (connected to ground). No further electrical connections are required.

The load current carrying wires (L) and (T) must be sized to handle the maximum load current without excessive voltage drop. By code it must be heavy enough to handle the full current rating of the main line circuit-breaker (or fuse) in the entrance (or sub-panel) protecting the contactor switch.

All wires should be installed in rigid or flexible conduit. (Knockouts are provided in the control box).

Because of the many different types of service, feeder, and distribution equipment, no specific wiring instructions can be provided. The one essential is that when the load is connected to the generator there can positively be no feedback from the generator to the power line.

CONNECTING THE TRANSFER SWITCH

The electrical transfer switch connects the load (lights, furnace, outlets, etc.) to the normal power line during standby. When normal power fails, the automatic transfer switch starts the engine generator set, disconnects the power line and then connects the load to the standby generator set. When normal power is restored, the automatic switch stops the engine and retransfers the load.

To wire the automatic transfer panel into the existing wiring, first determine which circuits will be on the emergency load circuit. If the entire load is to be transferred, the transfer switch can be wired in directly after the watt-hour meter.

If only specific circuits are to be powered under emergency power failure conditions, an additional distribution panel designated "emergency distribution panel" must be installed.

All selected emergency circuits are removed from main distribution panels and re-installed in the emergency distribution panel. Suggested circuits — freezer, refrigerator, furnace, emergency lights, sump pump, emergency outlet circuits, etc. Total load must not exceed generator or transfer switch rating.

The emergency distribution panel is wired to the main panel through the automatic transfer switch. L1 and L3 are connected to the main panel 230 volt breaker. L2 is neutral. T1 and T3 are connected to 230V Bus in the emergency distribution panel. T2 is neutral.

The main panel circuit breaker should be large enough to power the entire emergency distribution panel under normal loads, but should not exceed the contact current rating of the automatic transfer switch or generator.

## *Operation*

FUNCTIONAL OPERATION OF ELECTRICAL CONTROL

The explanation of the operation of an automatic emergency transfer control will be explained in three parts:

1. The load transfer circuit.
2. The engine control circuit.
3. The battery charging circuit.

TRANSFER OF THE LOAD

The following sequence of events occurs during the transfer of the load from (A) normal or power line operation to (B) interim period to (C) emergency or standby generator operation and (D) back again to normal operation.

(A) Normal operation with power line energized: standby generator standing idle. The line contactor (left side) is energized by the commercial line holding the line side contacts closed, connecting load to power line.

(B) At the instant a power failure occurs:

1. The load is disconnected from the power line.
2. The stop/start relay (SSR) starts the engine (explained in section 2).

(C) When the engine generator starts, the stop cranking relay (SCR) normally closed (N.C.) contacts operate to automatically disconnect the engine starter. The normally open (N.O.) contacts of the stop cranking relay also allow the engine to reach near full speed before the generator voltage is applied to actuate the generator (right side) contactor and apply generator power to the load.

(D) When the commercial power is restored: The start/stop relay stops the engine and opens the generator side contactor coil. This allows the generator contactor to return to its normal open position and close the electrical interlock (TSG/AUX). This permits the line side contactor to close, transferring the load back to the power line.

## THE ENGINE START/STOP CIRCUIT

The "stop" wire is connected to the engine magneto. The "start" wire is connected to the coil of starting solenoid. By grounding the "stop" wire the engine is stopped; and by grounding the "start" wire it is cranked.

Refer to the simplified schematic diagram (Fig. 4). Note that the revolving contact of the selector switch is grounded. When a contact is in the "stop" position the stop wire is grounded; and when it is turned to the "check" position, the start wire is grounded and the engine is cranked.

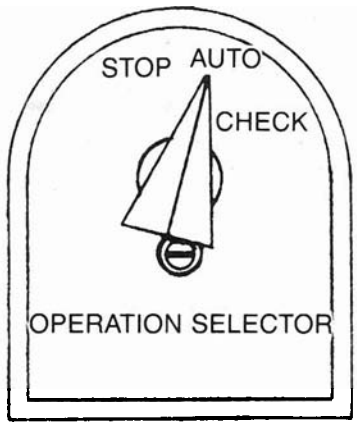



Figure 4 — Wiring connections

When the power line is energized and the selector switch is turned to the "auto" position, the start/stop relay (SSR) coil is energized by the commercial line power. The coil holds the armature (movable contact) in position against the normally open contact (N.O.) and completes the circuit between ground and the "stop" wire. When either leg of the power line fails, spring tension moves the SSR armature so contact is made between ground and the "start" wire and cranks the engine.

Whenever the cranking circuit is energized, a circuit is also completed to the heating coil of the overcranking relay (OCR). If the engine fails to start in about 45 to 75 seconds, this coil becomes hot enough to trip the OCR thermal switch. This closes the fuel valve and disconnects the start solenoid coil and interrupts the cranking. The OCR relay must be reset manually.

## THE BATTERY CHARGING CIRCUITS

This generator system uses two separate battery charging circuits; the first is powered by the transfer switch "load" terminals and provides a small trickle charge to keep good batteries at their peak starting performance. This charger is not intended to recharge a discharged or "dead" battery and may not provide enough current to bring a new "dry-charged" or "quick-charged" battery to a fully charged condition.

**CAUTION: Before completing the installation, be sure the battery has been brought up to a fully charged condition by an external charger or by operating the generator set powered static charger for several hours.**

The second charging circuit is a 4 to 6 amp non-adjustable type powered directly from the transfer switch "generator" terminals. This charging circuit provides an adequate charge rate to restore the energy used in starting the engine.

Load powered adjustable static trickle charging circuit — components mounted on the sub-chassis of the ATS cabinet door — the primary coil of the transformer is connected to the load line through a fuse. The rheostat and the resistor are in series with the rectifier and control the charging rate. The milliammeter is connected to the DC output side of the rectifier and measures the amount of current going to the battery. The meter is connected to the overcranking relay which, in turn, is connected to the positive terminal of the cranking battery. The negative side of the battery circuit is grounded.

Generator powered fixed static battery charging circuit — located in the upper left corner of the ATS cabinet — the primary coil of the transformer is powered by the generator output voltage through a fuse. A resistor in series with the half-wave rectifier limits the charging rate to a safe 4 to 6 amp level. The positive output is connected to the "B"-battery (+) terminal on the interface terminal block in the ATS cabinet. The negative side of this battery charging circuit is grounded.

## ATS OPERATIONAL CHECK

Normal standby position for control "operation selector" function switch is "auto". Unless this switch is in the automatic position, the unit will not start automatically when a power failure occurs.

After all wiring has been completed, recheck all connections to make sure they are all clean and tight. Then test as follows to demonstrate the operation of the controls:

1. Turn on the main power switch. Power should again be available on all distribution circuits.
2. Turn the selector switch to the "auto" (automatic) position. (The engine should not attempt to start at this time).
3. Pull the main line switch to simulate a power failure. The engine generator will start and supply electricity to the emergency load.
4. Restore commercial power (main line switch on). The generator controls will stop the engine and automatically transfer the load back to the power line.

## *Operation (Continued)*

5. With the commercial power left on, turn the ATS selector switch to the "check" position. The engine will start and continue to run but the control will not transfer the load. This feature enables the owner to check the operation of the generator without transferring the load (unless an outage occurs while in the "check" position).
6. With the power left on, turn the selector switch back to "auto". The engine will stop.
7. Again pull the power line switch. The engine will again start and supply electricity to the emergency load. Now turn the selector switch to "stop" and the engine will stop. No power is supplied to the load. The entire panel is 'de-energized'. This feature enables the operator to change oil and check the engine at any time, even during a power failure. Under these conditions, the panel can also be safely serviced by maintenance personnel.

### FUEL ADJUSTMENTS

After the engine is running, apply the total connected electrical load. For proper adjustment of the fuel mixture control on the carburetor, it is necessary to have the generator loaded to its capacity or to the maximum amount for which it will be used. Check the operation of the engine carefully to see that it runs smoothly. If it does not, a slight adjustment may be necessary to compensate for the different fuel or operating conditions. Refer to LP/NG adjustment in maintenance section.

After all operational checks have been completed and the unit is determined operational, turn the selector switch to "auto" position. This will enable your unit to come "on line" automatically should a power failure occur.

## *Maintenance*

### GENERAL INFORMATION

The main components of the generator are: field frame, field coils, armature, brushes, brush holder assembly, end brackets, armature, armature-mounted cooling fan, and control box.

Before performing any maintenance on the engine or generator, place the selector switch on the control panel to the stop position.

### ENGINE MAINTENANCE

Refer to the engine instruction manual for instructions and procedures for normal/routine engine maintenance. Service/maintenance items include regular oil and oil filter changes as well as the prestart or daily oil level checks. Air cleaner must be checked more frequently under dusty conditions. The engine will require the greatest share of the maintenance and service attention, but will give the excellent performance designed into it when properly cared for.

### GENERATOR MAINTENANCE

#### BRUSHES

Under ordinary circumstances, brushes will operate for long periods without requiring replacement. They should be inspected after the first 1000 hours of operation, and after every 100 hours of operation thereafter. Remore brushes one at a time and check for length; be sure that each moves freely in the brush holder. Brushes should be replaced when worn down to 3/8". Replace brushes in complete sets, never singly. When replacing brushes, be careful to reconnect the lead wires properly.

Poor contact (or "skipping") between brush and slip ring is caused by oil and grit, flint, or other hard substance on the brush, or by the brush not being properly shaped to fit the slip rings. Remedy these defects by fitting the brushes to the slip-ring curvature. Place #00 sandpaper under the brushes with the abrasive side to the brushes, and work it back and forth until the brushes are the same shape as the slip-rings.

#### SLIP RINGS

The four continuous copper rings located at the end of the armature are the power collector rings. For proper generator output, the surface of the slip rings must have a highly polished finish. Under sustained use, it is advisable to check and occasionally polish the ring surfaces with a crocus cloth to maintain the finish.

### ELECTRICAL TESTING

#### TESTING GENERATOR FIELD FOR OPENS AND GROUNDS

1. Disconnect field leads from rectifier.
2. Set multimeter to read resistance, and connect the meter leads to the field leads. If field is open, meter will read infinite resistance. Replace field if it is open.
3. Connect one meter lead to the field shell (other lead still connected to one of the field leads).

   If meter indicates continuity (zero ohms or any reading lower than infinite resistance), the field is grounded and should be replaced. If the fields are grounded, cut the connector between the two coils and retest to determine which coil is grounded.

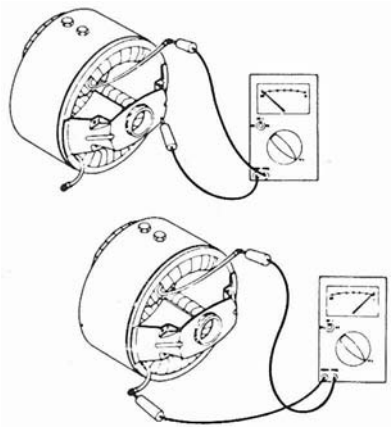


Figure 5

#### TESTING ARMATURE FOR OPENS AND GROUNDS

1. Remove all brushes.
2. Ground test.

   Set multimeter to read resistance, holding one meter lead against a clean spot on the armature shaft. Touch the other lead to each of the four slip rings of the commutator (one at a time) while observing the meter.

   If meter indicates continuity (zero ohms or any reading lower than infinite resistance), the armature is grounded. Dirt on the slip rings bars can cause grounding. Carefully clean the dirt off the slip rings if grounding was indicated, then recheck it. Replace the armature if it is grounded.
3. Testing for opens.

(Meter still set to read resistance). Holding one meter lead on surface of collector ring No. 1, touch other meter lead to surface of collector ring No. 2 while observing the meter. Meter should indicate continuity (low resistance). If not (i.e. if meter indicates infinite resistance) part of armature windings are open and armature should be replaced.

Check for open between collector rings Nos. 3 and 4 in same manner as you did between rings 1 and 2 (previous paragraph).

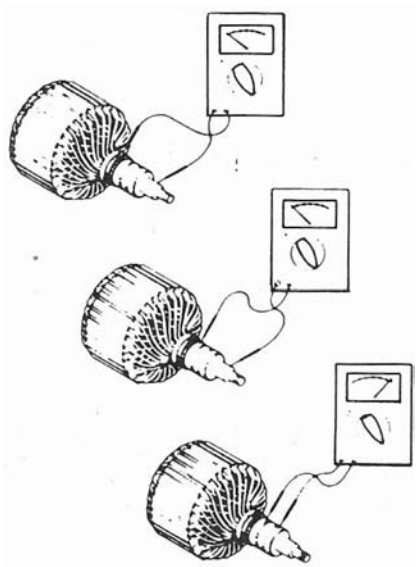


Figure 6

TESTING RECTIFIERS

The field excitation rectifier is a full-wave bridge rectifier. This type of rectifier has four terminals, two AC, a DC positive, and a DC negative. The rectifier is tested in the following manner. Connect one ohmmeter lead to the positive DC terminal, and the other lead to each of the AC terminals in turn. A high or low resistance reading will be obtained. Reverse the meter leads, and an opposite reading should be observed. Now check from the negative terminal each of the AC terminals, using the same procedures as above. Check each terminal to the case, and no resistance reading should be observed.

If a battery-powered test light is used, follow the procedures described above. If the rectifier is good, the light will come on in one direction only.

If the rectifier fails any of the above tests, it should be considered defective and replaced.

CONDENSER TESTING

Condensers are built into the generator circuit to minimize radio interference during operation. If a condenser shorts out, it will also short out the generator output. To determine whether a condenser is shorted, turn off the engine-generator, disconnect the lead wire from the brush holder to which the condenser is connected, turn the engine-generator back on and check the output. If the generator then provides power, the condenser was at fault and should be replaced. (If the generator did not provide power after the lead wire was disconnected, the problem was not caused by that condenser. Reconnect the lead wire).

BATTERY

Check the electrolyte (battery fluid) periodically to insure the fluid level is above the plates. Never allow the battery to remain in a discharged condition.

EXHAUST CONDENSATION TRAP

Drain the trap at regular intervals to prevent exhaust condensation from overflowing into the engine.

NG/LP FUEL ADJUSTMENT

**CAUTION: Do not make any fuel adjustment on carburetor or governor adjustment until all pressure readings are in compliance with Table 1 in the fuel installation section above.**

NATURAL GAS

Natural gas (NG): Due to variations in NG fuel characteristics and BTU levels throughout the country, it will be necessary to readjust the carburetor fuel mixture once it has been installed.

**CAUTION: Never make a carburetor mixture adjustment on a unit when it is stopped or running no load. Mixture adjustment is only effective when the engine is operating under load.**

ADJUSTMENT PROCEDURES — NATURAL GAS (NG)

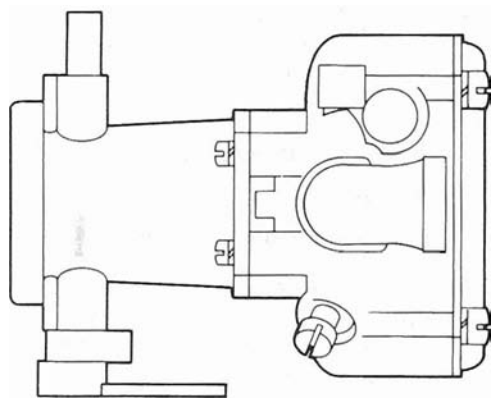


Figure 7

1. Insure the unit is operating under a 80 to 100% load or at the highest anticipated load.
2. Attach a frequency meter to monitor HZ.
3. With an end wrench turn the load adjustment valve either left or right (See Fig. 7). Observe the HZ meter. If it drops, turn the adjustment valve the opposite direction. Adjustments should be made very slowly. Adjust back and forth until the highest HZ can be achieved. If the HZ is out of upper or lower limits, a governor adjustment will be necessary.
4. This can be done by turning the nut in or out of the governor tension rod which is located between the engine head assemblies. This rod runs under the intake/exhaust manifold and is attached to the right hand engine housing. Again watch the HZ meter as you adjust the tension rod. Under a load of 80 to 100% capacity you should achieve a 59 to 60 HZ reading.

**CAUTION: Under full load do not adjust the HZ above 60. If a higher HZ reading is used, as the load is decreased the HZ will go out of upper limits (61 to 62 HZ). This may damage frequently sensitive electronic equipment being powered by the generator. The line voltage will also be too high. This will shorten light bulb life and may damage motors being powered by the generator.**

PROPANE (LP)

Adjustment — Propane (LP) — A generator set fueled by LP will normally require no adjustment. If for some unforeseen reason the machine should require adjustment, follow the same procedure for NG.

FUEL TYPE CONVERSION — NG TO LP OR LP TO NG

Figure 8A

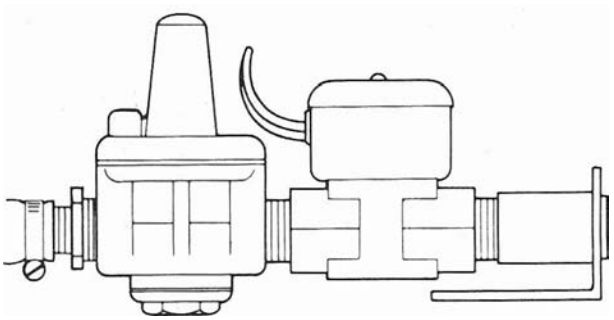
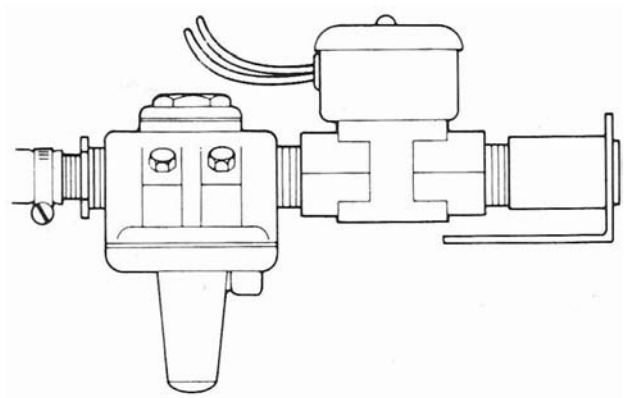


Figure 8B



If after the unit has been purchased it should become necessary to change the type of fuel used, the following procedures are provided.

TO CONVERT FROM NATURAL GAS (NG) TO PROPANE (LP) (Refer to Both Figs. 8A and 8B)

1. Turn off the fuel supply valve.
2. Remove the fuel line from the carburetor at the demand regulator.
3. Remove the cap on the upright column of the regulator. This will expose the pressure spring adjusting screw. Back off the spring adjusting screw so there is just enough room to replace cover. Replace the cover.
4. Invert the regulator so it is positioned as shown in Fig. 0 (Refer to Fig. 8B).
5. Reconnect the fuel line at the regulator.
6. Remove the ⅛ NPT plug (on solenoid side of regulator) and install fuel pressure meter (or monometer). Turn the ATS selector switch to "check". The engine will crank and the fuel solenoid valve will open. Observe the incoming pressure. The pressure reading should be between 4 to 6 ounces (see column 4 of Table 300.542).
7. If pressure is correct, remove meter (or monometer) and ⅛ NPT fitting from the solenoid side of the regulator and install it on the carburetor side of the demand regulator.
8. Turn selector switch on ETC panel to check position. This will enable the starting system. With the engine running at no load, you should read a negative (−) 1½ inch water column (WC) on a manometer (Column 5 of Table 300.542). If you are using a PSI meter with no neg side, you should get no reading at all, or the meter may bounce lightly at zero.
9. You are now ready to make the final fuel adjustments on the carburetor. Refer to adjustment above.

CONVERTING FROM PROPANE (LP) TO NATURAL GAS (NG) (From Figs. 8B to 8A)

Although this is a fairly simple operation, there are procedures that must be followed closely to achieve proper engine performance. This procedure normally requires a manometer or low pressure fuel gauge to make an accurate adjustment. A step by step procedure is provided below:

1. Turn off fuel supply valve.
2. Disconnect fuel line from the carburetor at the demand regulator.
3. Invert the regulator so that it is positioned as shown in Fig. 8A.
4. Reconnect the fuel line to the regulator.
5. Remove the ⅛ NPT plug (on solenoid side of regulator) and install fuel pressure meter or monometer. Turn the ATS selector switch to "check". The engine will crank and the fuel solenoid valve will open. Observe the incoming pressure. The pressure reading should be between 4 to 6 ounces (column 4 of Table 1).
6. If pressure is correct, remove meter (or manometer) and replace plug on ⅛ NPT on the solenoid side of the regulator and install meter on the carburetor side of the demand regulator.
7. Remove cap on the upright column of regulator. This will expose the spring adjusting screw. Turn this screw all the way out (CCW) and back in about 5 turns. The plug will be approximately half way down for the initial starting position.
8. Turn selector switch on ETC panel to "check" position. This will enable the starting system. Although the regulator may not be exactly at the optimum position, the engine should start. Adjust the spring adjusting plug to obtain a positive (+) 5 inch water column (WC) or 2.5 to 3 oz. PSI reading on the carburetor side of the regulator with the engine running at no load (column 5 of Table 1).
9. You are now ready to make the final fuel adjustment on the carburetor. Refer to adjustment procedure above.

## *Trouble Shooting Chart*

| SYMPTOM | CAUSE(S) | CORRECTIVE ACTION |
|---|---|---|
| Generator will not crank when power is off with selector switch in "auto" or "check". | 1. Low or dead battery. | 1. Check fluid level and specific gravity. |
| | 2. Loose or dirty terminal connections. | 2. Clean and tighten connections. |
| | 3. Battery not large enough. | 3. 70 ampere hour (minimum) battery required. |
| | 4. Overcranking relay tripped. | 4. Reset red button on front panel. |
| | 5. Defective overcranking relay. | 5. If relay trips in less than 50 sec. or does not trip after 60 sec. replace relay. |
| | 6. Def. selector (check/auto/stop). | 6. Check for good connections. Replace. |
| | 7. Defective stop cranking relay. | 7. Check for broken wires, dirty or pitted contacts. Repair or replace. |
| | 8. Start/stop relay defective. | 8. Check for broken wires, dirty or pitted contacts. |
| | 9. Def. start solenoid (at starter). | 9. Check and replace. |
| Generator will crank in check but not in "auto". | 1. Start/stop relay defective. | 1. Repair or replace |
| Generator cranks but engine will not start. | 1. Incorrect fuel pressure. | 1. Fuel pressure to the unit must be 4 to 6 oz. or 7 to 11 inches water column. |
| | 2. Dective engine ignition system. | 2. Refer to engine operator's manual. |
| | 3. Defective fuel solenoid valve. | 3. Check for loose/broken connections or open coil. Repair or replace. |
| | 4. Magneto grounded | 4. Check magneto wiring for ground. |
| Engine will not stop with switch in "auto" position. | 1. Loose or open wire between the line and start/stop relay coil. | 1. Set selector switch to the stop position. If engine does not stop short out the spark plug. Use a screwdriver with a well insulated handle. Repair or replace wire. |
| | 2. Defective start/stop relay coil. | 2. Test for 240 volts on coil. Relay should be energized by the commercial line. Replace if defective. |
| | 3. Start/stop relay N.O. contacts dirty or corroded. | 3. Clean contacts or replace relay. |
| Load will not transfer to generator during power line interruption. | 1. Open generator side contactor coil. | 1. Test and replace coil. |
| | 2. Defective LTS/AUX (electrical interlock contacts). | 2. Adjust or replace switch contacts. |
| | 3. Defective stop cranking relay. | 3. Repair or replace. |
| **Engine will not stop cranking or overcranking relay pops out and shuts down engine after it starts.** | 1. Def. stop cranking resistor. | 1. Adjust or replace. |
| | 2. Defective stop cranking relay. | 2. **Repair or replace; relay** should trip between 50 and 75 sec of continuous cranking. |
| | 3. Defective OCR. | 3. Repair or replace. |
| | 4. Loose wire in stop cranking circuit. | 4. Repair. |
| **No output or low output voltage.** | 1. **Open or shorted armature.** | 1. **Replace armature.** |
| | 2. Open or shorted field coil(s). | 2. Replace field coil(s). |
| | 3. Generator operating below correct speed. | 3. Generator must be operated at 3600 RPM +/− 90 RPM for proper output voltage. |
| | 4. Generator overloaded. | 4. Reduce load to generator nameplate. |
| | 5. Short circuit in the load. | 5. Disconnect the load. Check voltage at receptacle. Check motors, appliances and load leads for short circuits. Repair short. |
| | 6. Loose (or broken) wires or connections in the control box. | 6. Remove panel cover and check all wiring and connections. Tighten and/or repair where necessary. |
| | 7. Defective rectifier. | 7. Test rectifier. Replace if defective. |
| | 8. Dirty slip rings. | 8. Clean and polish. Use 00 sandpaper and crocus cloth, never emergy paper. |
| | 9. Brushes binding in holders. | 9. Check brushes for swelling; replace defective brushes; clean brush holders. |
| | 10. Loss of residual magnetism. | 10. Check output voltage with sensitive meter. If very low (e.g. ½ volt) flash fields with 12 VDC battery. |
| Output voltage too high. | 1. Engine speed too high. | 1. See engine manual. |
| Generator overheating. | 1. Generator overloaded. | 1. Reduce load. |
| | 2. Armature rubbing pole shoes. | 2. Check bearing condition. Check field shell bearing bracket alignment. |
| | 3. Poor ventilation. | 3. Clear inlet and outlet air vents of debris. If unit is housed, insure at least 2 ft. clearance on all sides and inlet and outlet vents are of adequate size. |
| | 4. Short circuit in fields. | 4. Repair or replace — open or shorted fields should be replaced. Grounded fields may be repaired by insulating at the point where the ground occurs. |
| | 5. Short turns in armature. | 5. Replace arm. |
| Sparking at the brushes. | 1. Generator overloaded. | 1. Reduce load. |
| | 2. Brushes not seated properly. | 2. Contour brushes (see maintenance). |
| | 3. Slip rings rough or eccentric. | 3. Redress slip rings (see maintenance). |
| | 4. Brushes sticking in brush rack. | 4. Remove brushes and inspect and correct problem. |
| | 5. Brushes worn down shorter than ⅜ inch. | 5. Replace brush — note always replace brushes a full set at a time. |
| No milliammeter charging when engine generator is not running. | 1. Defective fuse (fuseholder is on upper front face of ATS cabinet). | 1. Check and replace if req'd. |
| | 2. Other milliammeter charging components are mounted on the inside of the cabinet door. Check transformer, resistor, rheostat and milliammeter. | 2. Replace defective component. |

## *Trouble Shooting Charts (Continued)*

| SYMPTOM | CAUSE(S) | CORRECTIVE ACTION |
|---|---|---|
| No battery charging when generator is running. | 1. Check charger fuse (fuseholder is located on upper right side of ATS cabinet).<br>2. The charging system is located inside the ATS cabinet in the upper left corner. Check: transformer, rectifier, and resistor. | 1. Check and replace if req'd.<br>2. Replace defective part. |
| Battery discharges when engine generator set is not running. | 1. Shorted battery charger rectifier. Check both static chargers: 4-6 amp unit located above the contactors and trickle charger on door.<br>2. Shorted battery or control wire. | 1. Replace if shorted out.<br>2. Repair or replace. |

## *Replacement Parts List For Engine-Generator*

| Ref No. | Description | Qty. | Part No. |
|---|---|---|---|
| 020 | Nut | 8 | 1744 |
| 021 | Flat Washer | 8 | 9156 |
| 100 | Engine | 1 | 55982 |
| 168 | Sheave | 1 | 56058 |
| 169 | Bushing | 1 | 50657 |
| 174 | V Belt Set | 1 | 56054 |
| 230 | Start Solenoid | 1 | 24061 |
| 300 | ETC Panel | 1 | 55945 |
| 400 | Generator Only | 1 | 55073-001 |
| 605 | Sub Frame | 1 | 55890 |
| 610 | Main Frame | 1 | 55883 |
| 661 | Spacer Plate | 4 | 56060 |
| 663 | Shock Mount | 8 | 56059 |
| 664 | Hose (Spacer) | 4 | 23048-012 |
| 811 | Gas Solenoid | 1 | 42942 |
| 812 | Regulator | 1 | 50248 |
| 816 | Carburetor | 1 | 50852 |
| 900 | Belt Guard | 1 | 55898 |
| 901 | Generator Cover | 1 | 55897 |
| 902 | Screen | 1 | 56104 |
| 920 | Muffler | 1 | 80519-001 |
| 921 | Flex Exhaust | 1 | 80518-001 |

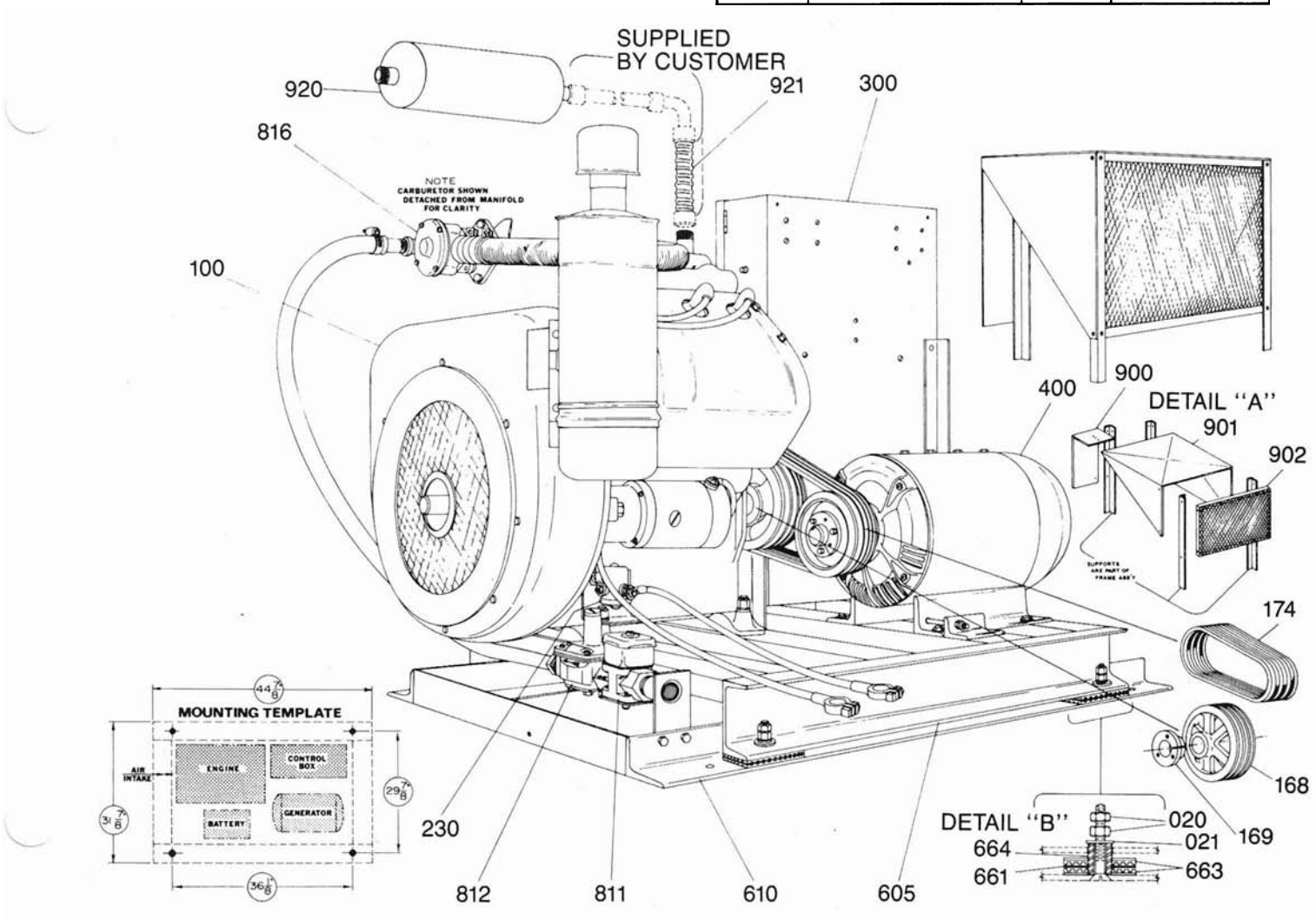



Figure 9

## *Replacement Parts List For ETC Panel (Ref. No. 300)*

| Ref No. | Description | Qty. | Part No. | Ref No. | Description | Qty. | Part No. |
|---|---|---|---|---|---|---|---|
| 301 | Bare Cabinet | 1 | 55928 | 311 | Fuse Holder | 2 | 2489 |
| 302 | Rheostat | 1 | 24786 | 312 | Stop Crank Relay | 1 | 92065-001 |
| 303 | Selector Switch | 1 | 57946 | 313 | Variable Resistor | 1 | 22184 |
| 304 | Mounting Bracket | 1 | 22246 | 314 | Terminal Strip | 1 | 46849 |
| 305 | Transformer | 1 | 24785 | 316 | Contactor Switch Assy. | 1 | 55801-001 |
| 306 | Selenium Rectifier | 1 | 22191 | 317 | Line Side Contactor | 1 | 55802 |
| 307 | Start/Stop Relay | 1 | 50259 | 318 | Gen Side Contactor | 1 | 55803 |
| 308 | Resistor | 1 | 24787 | 320 | Transformer | 1 | 43945 |
| 309 | Overcranking Relay | 1 | 48585 | 321 | Rectifier | 1 | 53646 |
| 310 | Milliammeter | 1 | 22188 | 322 | Resistor | 1 | 53953-002 |

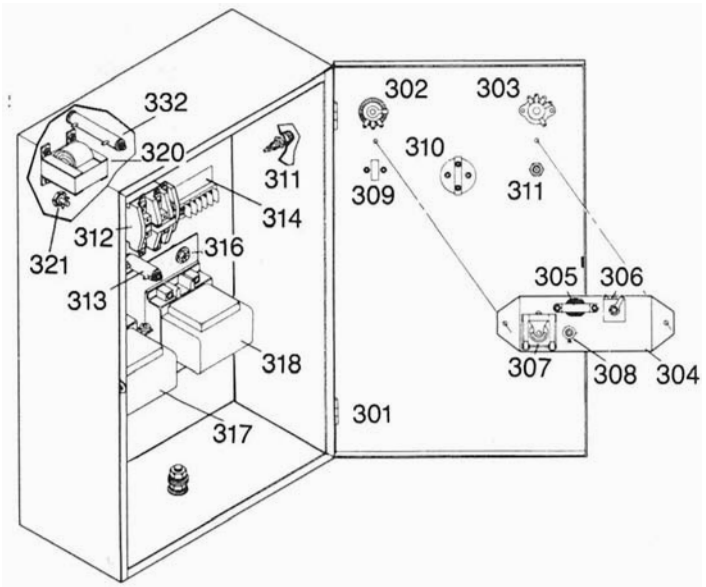



Figure 10

## *Replacement Parts List For Generator Head*

| Ref No. | Descritpion | Qty. | Part No. | Ref. No. | Description | Qty. | Part No. |
|---|---|---|---|---|---|---|---|
| 001 | Capscrew ¼ x 20 x 1¾ | 3 | 20544 | 414 | Retaining Plate | 1 | 50536 |
| 002 | Lockwasher ¼" | 3 | 479 | 419 | Lockwasher | 1 | 50531 |
| 003 | Capscrew 5/16 x 18 x 2¾ | 4 | 51101 | 420 | Locknut | 1 | 50532 |
| 004 | Lockwasher 5/16" | 4 | 480 | 431 | Armature | 1 | 58394 |
| 005 | Int Tooth Lockwasher 11/16" | 1 | 40552 | 432 | Bearing | 1 | 50215 |
| 006 | Flatwasher ½" | 1 | 21867 | 441A | Coil | 1 | 52563 |
| 007 | Ext Tooth Lockwasher ½" | 1 | 20039 | 441B | Coil | 1 | 53563-001 |
| 008 | Hex Nut ½ x 20 | 1 | 9549 | 442 | Pole Shoe | 2 | 43473 |
| 009 | Capscrew 7/16 x 20 x 1¾ | 7 | 43781 | 443 | Pole Shoe Retainer | 2 | 43474 |
| 011 | Capscrew #10 x 24 x ½ | 4 | 3728 | 444 | Fld Shell | 1 | 54784 |
| 012 | Lockwasher #10 | 4 | 484 | 447 | Brush | 12 | 24981 |
| 013 | Hex Nut #10 x 24 | 4 | 456 | 448 | Lead Shield | 1 | 448 |
| 014 | Machine Screw | 28 | 40746 | 449 | Brush | 2 | 53949 |
| 015 | Carriage Bolt 3/8-16 x 5 | 2 | 56056 | 460A | Brush Rack Top | 1 | 54242 |
| 016 | Hex Nut 3/8 x 16 | 2 | 48178 | 460B | Brush Rack Bottom | 1 | 54242-1 |
| 017 | Lockwasher ½" | 2 | 636 | 462 | Brush Holder | 12 | 23500-002 |
| 018 | Hex Nut ½ x 13 | 2 | 48178 | 467 | Rectifier | 1 | 53976 |
| 141 | Key | 1 | 44208 | 468 | Copper Strap | 2 | 41387-001 |
| 171 | Sheave | 1 | 56091 | 469 | Fiber Spacer | 14 | 23532 |
| 172 | Bushing | 1 | 56092 | 470 | Brush Holder Mtg Plate | 2 | 52559 |
| 401 | Fan | 1 | 23404 | 471 | Brush Holder Mtg Plate | 6 | 53975 |
| 409 | Armature & Bracket Assy. | 1 | 58393 | 472 | Brush Holder | 2 | 23500 |
| 411 | End Bracket | 1 | 50517 | 490 | End Cover | 1 | 23634 |
| 413 | Bearing | 1 | 46913 | 650 | Base Assy. | 1 | 55895 |

## PARTS ORDERING INFORMATION REQUIRED.

To fill your order for service parts, please advise the complete Generator model number and serial number, part number(s), and part description. If in doubt, consult the factory prior to placing the order. Send all parts orders to WINCO, Division of Dyna Technology, Inc., 225 South Cordova Ave., Le Center, MN 56057.

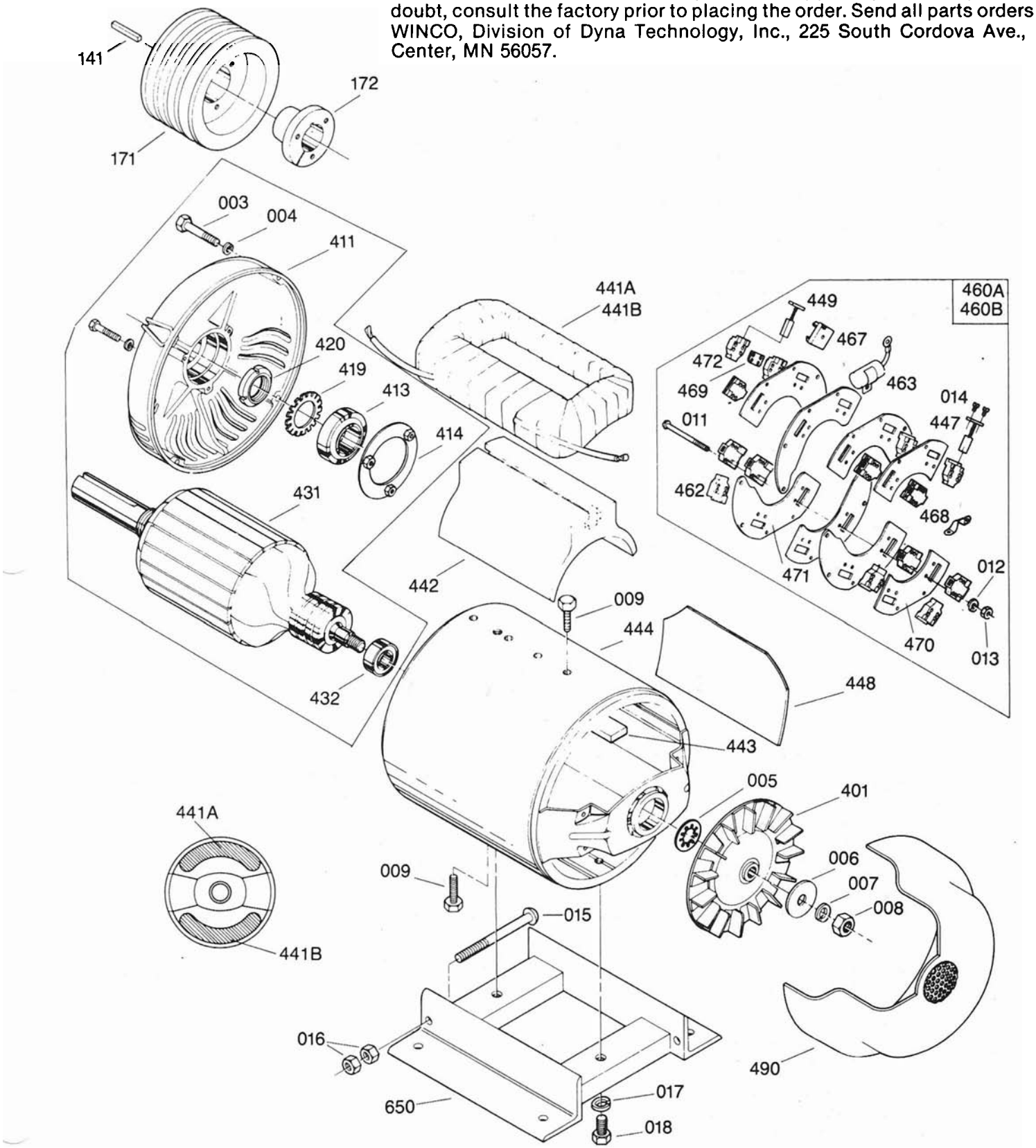



Figure 11

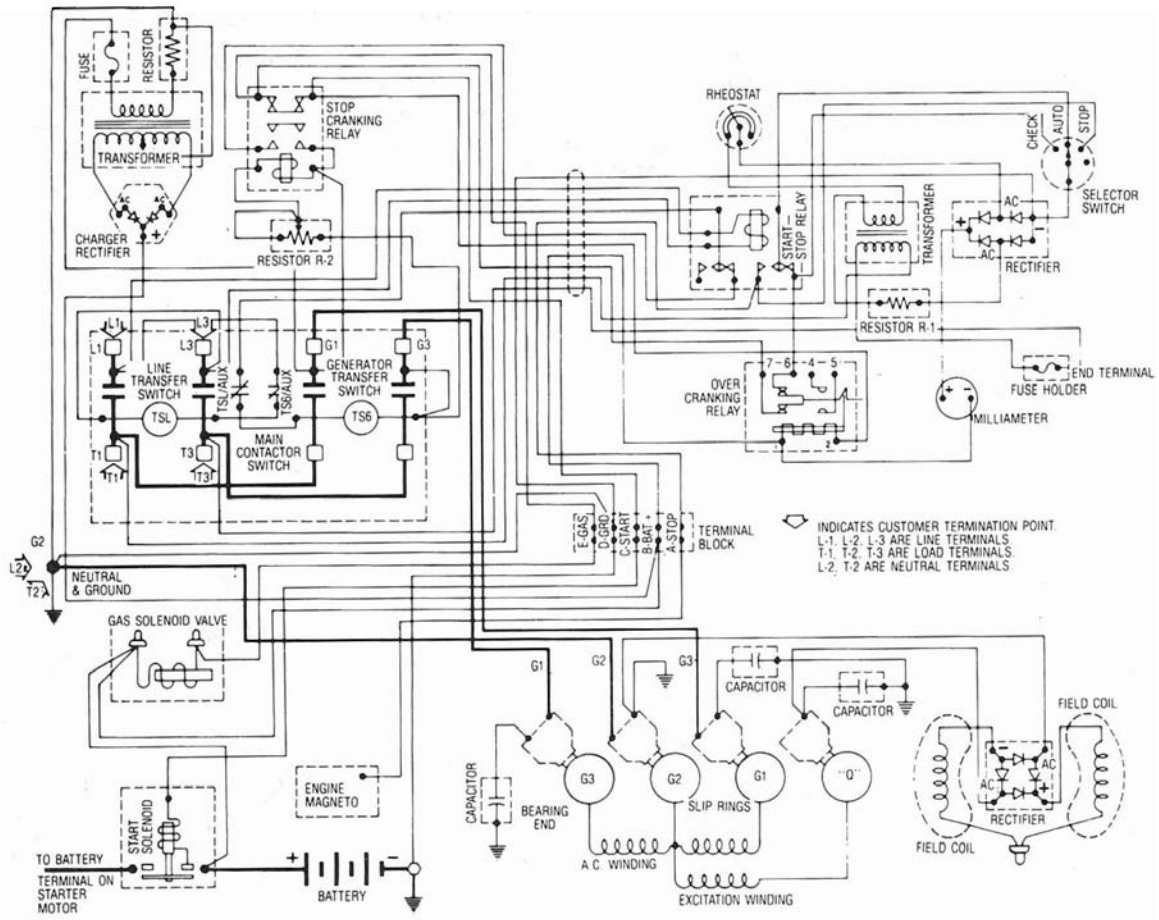



Figure 12

# Limited Warranty

Winco Division of Dyna Technology, Inc., warrants that for one year from date of shipment it will repair or replace for the original user the whole or any part of the product found upon examination by Winco at its factory at 225 South Cordova Street, LeCenter, Minnesota, or by any Factory-Authorized Service Station to be defective in material or workmanship under normal use and service.

For warranty service, please return the product within one year from date of shipment, transportation charges prepaid, to the Winco factory or to your nearest Factory-Authorized Service Station as listed in the 'Yellow Pages' under Generator-Electric.

**THERE IS NO OTHER EXPRESS WARRANTY. TO THE EXTENT PERMITTED BY LAW, ANY AND ALL IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT, AND LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OR EXPENSES IS EXCLUDED.** Some states do not allow limitations on the duration of an implied warranty, and some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights; you may have other rights which vary from state to state.

Winco does not warrant engines, batteries, or certain other component parts of the product since such items are warranted by their manufacturers.

Winco does not warrant alterations or repairs which were made by someone other than the Winco factory or a Factory-Authorized Service Station and which affect the stability or reliability of the product.

Winco does not warrant products which have been exposed to misuse and/or negligence or have been involved in an accident.

Winco reserves the right to change or improve its products without incurring any obligations to make such changes or improvements on products purchased previously.