

Installation and Operator's Manual HydraStar Generator Sets

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Safety Precautions

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

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

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

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

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

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Keep your hands, clothing and jewelry away from moving parts.
- Before starting work on the generator set, be sure to disconnect it from hydraulic lines. This will prevent accidental starting.
- Make sure that the fasteners on the generator set are secure. Tighten supports and clamps, keep guards in position over fans, etc.
- Do not wear loose clothing or jewelry in the vicinity of moving parts, or while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts and cause shock or burning.
- If adjustment must be done while the unit is running, use extreme caution around moving and hot parts, etc.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Remove electric power before removing protective shields or touching electrical equipment. On a metal or concrete floor, stand on rubber insulative mats placed on dry wood platforms when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surface to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages can cause injury or death. DO NOT tamper with interlocks.
- Follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag all open switches to avoid accidental closure.
- DO NOT CONNECT GENERATOR SET DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM. Hazardous voltages can flow from the generator set into the utility line. This creates the potential for electrocution or property damage. Connect only through an approved isolation switch or an approved paralleling device.

GENERAL SAFETY PRECAUTIONS

- Provide appropriate fire extinguishers and install them in convenient locations. Consult the local fire department for the correct type of extinguisher to use in your installation. Do not use foam on electrical fires. Use extinguishers rated ABC by NFPA.
- Make sure that rags are not left on or near the genset.
- Remove all unnecessary grease and oil from the unit. Accumulated grease or hydraulic fluid can cause overheating and hydraulic motor damage, presenting a fire hazard.
- Keep the generator set and the surrounding area clean and free from obstructions. Remove any debris from the set and keep the floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.

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ABOUT THIS MANUAL

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This manual provides general information for operating and maintaining an Onan Hydrastar hydraulic generator set. Study this manual carefully, and observe all warnings and cautions. Using this generator set properly and following a regular maintenance schedule will contribute to longer unit life, better performance, and safer operation.

A service manual for this generator set is available (Onan publication # 943-0500). To obtain this manual, contact an Onan distributor.

HOW TO OBTAIN SERVICE

When the generator set requires service, supply the complete model number and serial number to the Onan distributor, to obtain assistance.

AWARNING mesent hazards which can result in severe personal injury or death. Only qualified service personnel with knowledge of electrical and mechanical hazards should perform service procedures. Review the safety precautions on the inside cover page.



FIGURE 1-1. HYDRASTAR GENERATOR SET

Section 2. Specifications and Torques

Weight	 	
Dimensions	 	
		(25.43 in x 12.60 x 14.07 in) (5 kW set)

Generator

Туре		0	nan YK revolving field, 4-pole brushless
Phase			1 or 3
Rating: 60 Hz			5 kW, 7.5 kW, 10 kW, 12.5 kW, 15 kW
50 Hz			4.5 kW
Generator Speed			
	•		50 Hz: 1500 rpm

Hydraulic Motor (5 kW set)

TypeBent-axis conical piston, fixed displacement rotary group,	40° swivel angle hydraulic motor
Displacement (max)	
Pressure rating (max)	488 bar (6500 psi)
Torque constant (theoretical)	0.25 nm/bar (1.3 ft-lb/100 psi)
Allowable shaft torque (max) at 488 bar (6500 psi)	
Moment of inertia	0.0004 kg-m ² (1.36 lb-in ²)
Shaft: Direction of rotation	CCW (viewed from shaft end)
Seal	Buna-n or better
Mounting flange	SAE B (2 bolt)
Port connections:	
Pressure and return ports	-ring fitting, SAE -08 for 1/2" pipe

Hydraulic Motor (7.5 kW, 10 kW, 12.5 kW, 15 kW Sets)

TypeBent-axis conical piston, fixed dis	placement rotary group, 40° swivel angle hydraulic motor
Displacement (max)	
Speed rating (max)	
Pressure rating (max)	
Torque constant (theoretical)	0.51 nm/bar (2.56 ft-lb/100 psi)
Allowable shaft torque (max) at 488 bar (6500 psi)	
Moment of inertia	0.0012 kg-m ² (4.09 lb-in ²)
Shaft: Direction of rotation	CCW (viewed from shaft end)
Seal	Buna-n or better
Mounting flange	SAE C (4 bolt)
Port connections:	

Pressure and return ports.1-5/16-12 UNF-28 straight thread O-ring fitting, SAE -12 for 3/4" pipe

Hydraulic System

Hydraulic fluid	Petroleum base, 81-145 SSU viscosity (Mobile DTE25 or equivalent)
Filtering	
Hydraulic line	type SAE 100R, 3000 psi normal pressure,
•	5000 psi burst pressure

	TOR	QUES
	ft-lbs	N●m)
Generator rotor through-stud bolt	45	60
Generator adapter to hydraulic motor adapter bolts	19	26
Stator to adapter through-stud bolts	28	38
End bell cover screws	3	4

GENERAL

Read this entire manual before installing the generator set. Note and follow all warnings and cautions.

AWARNING Incorrect installation, service, or parts replacement can result in severe personal injury, death, and/or equipment damage. Service personnel must be qualified to install electrical and mechanical components.

The hydraulic generator set may be mounted either in a vehicle or in a fixed installation. Installation considerations include:

Adequate cooling air

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- Electrical connections
- Hydraulic connections
- Accessibility for operation and servicing
- Vibration isolation

MOUNTING

The Hydrastar generator set is highly flexible in its mounting requirements: it is suitable for mobile or fixed installations, and can be mounted in horizontal and vertical positions. If mounted vertically, the hydraulic motor must be pointed down.

A vertical installation presents the possibility of dripping hydraulic fluid. Generally speaking, a horizontal mounting position is preferred. If the set is mounted vertically, the compartment in which it is mounted must be drip-proof against petroleum-based hydraulic fluid.

This section describes typical generator set mounting procedures. Consult an Onan distributor for information and advice on your particular installation needs.

Mobile Installation

Before installing this generator set in a mobile application, there are several factors to keep in mind. These include:

Generator set support area: The mounting area must be able to support the weight of the generator set (approximately 160.06 pounds [72.6 kg] for the 5 kw version). The vehicle manufacturer and the installer must provide a structurally sound support area. Figure 3-1 is an out-

Generator set mounting hole configuration: The mounting area must be able to accept the mounting hole arrangement found on the set. The mounting feet are illustrated in Figure 3-2.

Genset vibration mounts: Rubber/plastic vibration mounts should be used between the generator set and the mounting surface in a mobile installation. The genset must be protected from potentially harmful vibration and flexing transmitted through the vehicle frame.

Generator set cooling air: A generator set compartment should be constructed with an inlet duct to separate cooling air from exhaust air, to prevent recirculation of the heated exhaust air from the set. An air inlet should have an area of at least 28.0 square inches. The outlet should have an area of 33.0 square inches.

Hydraulic line routing and clearance: The hydraulic lines to and from the generator set must be protected from heat, friction and severe bending. There must be sufficient clearance around the hydraulic lines and fittings for using wrenches to tighten and loosen them.

A generator set compartment must be constructed according to the safety recommendations on the inside front cover of this manual. Line the walls of the compartment with 26-gauge galvanized steel or a material of comparable strength, durability and fire resistance (see NFPA 70 and NEC for details). Construct the compartment floor to prevent oil, fluid or water accumulation. Cover the back, top and sides (not the compartment base) with fiberglass or another self-extinguishing acoustical material, rated for use at 200° F (90° C) minimum.

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AWARNING The ignition or burning of insulation materials can cause severe personal injury or death. Insulation must not reduce the specified minimum clearances.

Fixed Installation

Most of the mobile installation requirements apply to a fixed installation. Provide a location that is dry, clean, dust-free, well-ventilated and protected from weather. Use a sturdy, level mounting base of concrete, heavy wood or structural steel, preferably raised for easy operation.



millimeters (inches)

	DIM "A"	DIM "B"	DIM "Ç"	DIM "D"	DIM "E"	DIM "F"
5 kW Sets	645.9 (25.43)	463.5 (18.25)	202.0 (7.95)	173.7 (6.84)	107.7 (4.24)	42.5 (1.67)
7.5 kW Sets	705.9 (27.79)	498.5 (19.63)	227.0 (8.94)	191.7 (7.55)	93.5 (3.68)	59.9 (2.36)
10 kW Sets	740.9 (29.17)	533.5 (21.00)	227.0 (8.94)	191.7 (7.55)	93.5 (3.68)	59.9 (2.36)
12.5 kW Sets	776.9 (30.59)	569.5 (22.42)	227.0 (8.94)	191.7 (7.55)	93.5 (3.68)	59.9 (2.36)
15 kW Sets	811.9 (31.96)	604.5 (23.80)	227.0 (8.94)	191.7 (7.55)	93.5 (3.68)	59.9 (2.36)

	PORT A (RETURN)		PORT B (PRESSURE)		
	THREAD	SAE FITTING SIZE	THREAD	SAE FITTING SIZE	
5 kW Sets	3/4-16UNF-28 (IN.)	-08	3/4-16UNF-28 (IN.)	-08	
7.5 kW Sets	1 5/16-12 UN 28 (IN)	-16	1 5/16-12 UN 28 (IN)	-16	
10 kW Sets	1 5/16-12 UN 28 (IN)	-16	1 5/16-12 UN 28 (IN)	-16	
12.5 kW Sets	1 5/16-12 UN 28 (IN)	-16	1 5/16-12 UN 28 (IN)	-16	
15 kW Sets	1 5/16-12 UN 28 (IN)	-16	1 5/16-12 UN 28 (IN)	-16	

FIGURE 3-1. OUTLINE DRAWING, HYDRASTAR GENERATOR SET

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GENERATOR SET	DIMENSION L LENGTH		
5 kW	463.5 mm (18.25 in.)		
7.5 kW	498.5 mm (19.63 in.)		
10 kW	533.5 mm (21.0 in.)		
12.5 kW	569.5 mm (22.42 in.)		
15 k₩	604.5 mm (23.8 in.)		

FIGURE 3-2. GENERATOR SET MOUNTING FEET

If the set is mounted in a compartment, location of the air openings must permit airflow while the set is running. On shutdown, the openings must allow convection cooling of the compartment. Plan the location with an access opening permitting set removal, and an opening for cooling air. The air inlet should be at least 28.0 square inches in size. The outlet should be at least 33.0 square inches. Allow clearance for maintenance access to the genset.

The air discharge sides of the set require 3 inches (76 mm) clearance. Provide enough clearance around the other sides for service access.

Because the hydraulic motor must be filled with fluid at all times, position the generator set level with the hydraulic fluid storage tank, or lower than the tank. If this is not possible, use S-shaped inlet and outlet lines to the motor, to keep it immersed in fluid. See Figure 3-3.

VENTILATION AND COOLING SYSTEMS

The Hydrastar generator set needs only a small amount of ventilation. Because the generator is powered by a hydraulic motor, it has none of the air intake or exhaust requirements of a combustion engine.

The hydraulic motor itself is completely sealed, and needs no ventilation. The motor is self-cooling to temperatures of 150° F (65.5° C). Above this temperature, a separate oil cooler in the hydraulic system may be necessary to cool the hydraulic fluid.

The generator itself has minimal cooling and airflow requirements. Generator cooling is provided by a centrifugal blower on the generator hub. The blower draws air from the generator end of the compartment through the generator, then discharges the heated air out the blower outlet. If, compartment-mounted, an air inlet should have an area of at least 28.0 square inches. The outlet should have an area of 33.0 square inches.



FIGURE 3-3. HYDRAULIC LINE ROUTING

HYDRAULIC SYSTEM

Hydraulic Connections and Hose

On the 5 kw generator set, the high-pressure inlet and outlet ports (ports A and B; see Figure 3-4) require SAE -08 fittings for 1/2" pipe, with 3/4-16 UNF-28 threading. Straight thread 0-ring male connectors which conform to standard SAE J514j must be used.

On the 7.5 kW to 15 kW generator sets, the highpressure inlet and outlet ports (ports A and B; see Figure 3-5) require SAE -12 fittings for 3/4" pipe, with 1 5/16-12 UNF-28 threading. Straight thread 0-ring male connectors which conform to standard SAE J514j must be used.

If an angled approach is required, a female short drop angle hose fitting (SAE J516b) may be used on the hose to mate with the straight connectors. Figures 3-4 and 3-5 illustrate the hydraulic motor with its inlet and outlet.

The 5 kw generator set requires 4-braid high-pressure hydraulic hose which conforms to standard SAE 100R. A standard installation requires 1/2 inch diameter hose; long runs require 3/4 inch diameter hose.

The 7.5 kW through 15 kW generator sets require at least 3/4 inch diameter hose.

Hydraulic Circuit

Before installing the Onan Hydrastar generator set, make certain that the hydraulic circuit has been correctly designed. Points that must be considered include:

- Adequate hose diameter
- Hydraulic fluid temperature
- Flow potential of main hydraulic pump
- Generator set mounting position
- Hydraulic fluid filtration
- On-off valves (genset control): position, type and size
- Needle valves (speed control): position, type and size
- Load sense line and restrictors (if necessary)

An example of a typical hydraulic circuit using the Hydrastar generator set is illustrated in Figure 3-6.

The system depicted in Figure 3-6 is intended to represent a typical Hydrastar installation. A system relief valve must be used as part of the installation; this valve should be rated to open at 3000 psi or lower. Supplementary equipment that may be required in a system which supports a hydraulic generator includes:

- Generator on/off valve
- Generator speed control needle valve
- Oil cooler
- Oil cooler bypass valve
- 3-micron hydraulic fluid filter

Onan does not supply hydraulic lines, valves, pumps or other equipment. Onan cannot supply specific advice or information on hydraulic systems, applications or equipment.

The hydraulic motor inlet and outlet ports must remain below the fluid level in the reservoir to prevent oil from draining out of the motor when the generator set is shut down.

Routing Hydraulic Lines

The best hydraulic installation is one having the shortest and straightest lines. If lines must be bent, make sure they sweep between points to prevent sharp turns. Use rigid hydraulic lines wherever possible, except at points of flexing; rigid lines provide the most accurate control response. Secure lines at points of contact with surrounding surfaces, to prevent chafing.

Follow these guidelines when installing the hydraulic lines.

- 1. Never force a hose into a bend that is tighter than the minimum recommended by the manufacturer.
- 2. Provide an angled elbow fitting at the point of connection, rather than bending the hose at an angle. Recommended: female short drop angle hose fitting (SAE J516b).
- 3. Never stretch a hose between connections. Always provide enough slack for pressure expansion and contraction.







FIGURE 3-5. HYDRAULIC MOTOR, SAE C (7.5 - 15 kW SETS)





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- 4. Use hose of the same pressure rating throughout the installation.
- 5. Prevent hose contact with surrounding parts wherever possible.
- 6. Use clamps that fit tightly around the outside diameter of the hose, to prevent chafing.
- 8. Provide thermal shielding to a hose that must run near any hot areas (vehicle engine, exhaust pipe, etc.). This prevents damage to the hose, and prevents heating the hydraulic fluid.
- 8. Never twist the hose when installing it.
- 9. Use the rigid line mounting hardware recommended by the hydraulic line manufacturer.
- 10. Follow the pump manufacturer's recommendations for tuning a load-sensing hydraulic system.

AC WIRING

General

Installing the generator set electrical system includes connecting the load. The hydraulic system should be disconnected to avoid accidentally starting the unit during installation.

AWARNING Accidental starting of the generator set during installation can cause severe personal injury or death. Do not activate the hydraulic system until all electrical wiring is complete.

Control Box

Onan provides no separate electrical controls for the Hydrastar generator set. The installer must provide circuit breakers and on-off switches for the electrical portion of the generator set.

The control box contains a potentiometer for controlling the output voltage level, and a voltage regulator. A terminal block provides access to the generator set output voltage. Figure 3-7 illustrates the components inside the control box.

A generator set schematic can be found on the inside of the control box cover.

Wiring must be protected from sharp edges (screw heads, burrs, fins, moving parts), hot engine parts, or any other objects that might damage the insulation.

Wiring must meet all applicable electrical codes. Have a qualified electrician install and inspect the wiring. All remote controls and switches must be vibration-proof and securely mounted to prevent accidental closing or opening when the vehicle is moving.

Conduit

Route load conductors from the generator set control to the junction box in approved flexible conduit. See Figure 3-8. Make sufficient slack in the conduit to allow the unit free movement, and for maintenance.

WARNING Sonal injury or death. It is extremely important that bonding and equipment grounding be properly done. All metallic parts which could become energized under abnormal conditions must be properly grounded.

Connecting the Load

See Figure 3-9 for load connections on the singlephase generator set. Figures 3-10 and 3-11 show the schematic and wiring diagrams for the single-phase and three-phase generator sets. Generator output voltage(s) and maximum current rating(s) are specified on the generator nameplate. Line-to-neutral voltage is always the lower voltage shown on the nameplate and line-to-line voltage is the higher rating.

Install the generator output conductors in approved flexible conduit. Cut conduit to desired length, leaving extra wire in the junction box for making connections to the load. Always use a strain relief at the junction box. Route conduit so movement of the generator set is not interfered with.

Use stranded wire for all load connections. Load wiring must be appropriately sized and insulated for the specified current rating. Grounding procedure must comply with codes.

A lead to be connected to an output feeder conductor shall be not more than two AWG sizes smaller than the output feeder conductor and the insulation shall be:

- Rubber (with a braid), neoprene, or thermoplastic, with a wall thickness of at least 0.030 inch (0.76 mm)
- Other material having the same or better electrical and mechanical properties.

AWARNING *Electrical shock can result in severe personal injury or death. Be careful when connecting leads to the terminal block that no stray strands of wire stick out from the block, where they could short out or shock the operator or installer.*

AWARNING Improper wiring can result in fire and severe personal injury or death. Do not allow contact between electrical wiring and the fuel line.

AWARNING *Electrical shock can result in severe personal injury or death. Properly applied and maintained ground fault interrupters can afford additional protection against the hazard of electrical shock. Equip the vehicle with adequate ground fault protection devices.*



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SINGLE-PHASE CONTROL BOX

FIGURE 3-7. CONTROL BOX COMPONENTS

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FIGURE 3-8: TYPICAL WIRING AND POWER SWITCHING DEVICES



FIGURE 3-9. SINGLE-PHASE GENERATOR RECONNECTION DIAGRAM



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SCHEMATIC 110/220V, 115/230V & 120/240V AS SHOWN SEE RECONNECTION CHART FOR OTHER VOLTAGES





WIRING DIAGRAM 110/220V, 115/230V & 120/240V AS SHOWN SEE RECONNECTION CHART FOR OTHER VOLTAGES

FIGURE 3-10. SCHEMATIC/WIRING DIAGRAM SINGLE-PHASE HYDRASTAR GENERATOR SET





WIRING DIAGRAM

FIGURE 3-11. SCHEMATIC/WIRING DIAGRAM, THREE-PHASE HYDRASTAR GENERATOR SET

GENERAL

This section describes starting and operating the generator set. Read through this entire section before starting the set. The operator must be completely familiar with the set to operate it safely.

Prestart Preparations

Before starting the generator set the first time, be sure it is serviced and ready for operation. Make certain to use the recommended hydraulic fluid and the correct type of hydraulic hose, as listed in Section 2 of this manual.

Filling the Hydraulic Motor

Hydraulic fluid is drained from the hydraulic motor before shipment. Before starting the genset, fill the hydraulic motor with fluid, as follows.

- 1. Remove the plug from port T1.
- 2. Pour clean hydraulic fluid into the motor, to the level of the port threads.
- 3. Replace the plug in port T1.

Do not transfer fluid from its shipping container to an open can to facilitate filling the system since such an operation can contaminate otherwise clean fluid. Do not allow fluid to be stored in opened cans. Fluid contamination can ruin a hydraulic system rapidly. A recommended fluid is Mobil DTE25 or the equivalent.

Figures 3-4 and 3-5 illustrate the ports on the hydraulic motor.

STARTING PROCEDURE

The installer must provide all hydraulic valves or switching devices needed to control the generator set independently. An example of a hydraulic system may be found in Figure 3-6. Before running the motor at full speed, the main hydraulic system should be operated to provide 10-20% flow, until all lines have been filled and motor operation has been checked.

Have a frequency meter attached to the AC output at all times when adjusting the generator set. Do not run the unit at over speed; 2250 RPM and 75 hz are the maximum values.

Bleeding and Inspecting the System

When the hydraulic system is filled, run the hydraulic pump five to ten minutes to remove trapped air from the lines. Continue to check the fluid level, and refill if necessary. Make certain all air escapes, because trapped air causes noisy and erratic system operation. At first startup, and during air bleeding operations, check fluid level in the reservoir often, to assure a completely filled hydraulic circuit.

Check for line and fitting leaks. If leaks are noted, first attempt to tighten the connection (do not overtighten). Also check the O-rings on the fittings for damage. If this does not stop the leak, replace the part. Fluid leakage from a hydraulic system is also an indication of air entering a system. Prevent fluid leakage.

Operational Check

After making sure that the hydraulic system is filled, perform an electrical check of the generator. It should produce full rated output at 1800 RPM (60 hz). A generator driven slower than the rated RPM will produce a corresponding under-voltage.

If the generator set is run faster than the correct speed, the voltage regulator will cap the voltage, limiting over-voltage. Always use a frequency meter to determine correct generator speed, rather than solely measuring voltage.

If a chattering, popping noise is noted, air is trapped in the system, which may cause erratic generator operation. (A properly designed reservoir has baffles to remove air, and is vented to the atmosphere.) If air in the system cannot be relieved in normal operation, wrap the fitting with rags to prevent the escape of high-pressure fluid, loosen the pump or motor outlet port fitting (whichever is higher) just enough to allow fluid to escape (air will escape too), then tighten the fitting and replenish the fluid supply. Do not loosen the pump inlet fitting, since the pump will draw in air.

AWARNING *injury.* Perform the air-release procedure described above only as a last resort. Make sure to wrap rags around the fitting to be loosened before beginning, and wear goggles and gloves.

VOLTAGE REGULATION

Under-voltage/under-frequency regulation is almost entirely a function of hydraulic flow regulation. There is no "governor" as such on the generator set. Hydraulic flow regulates generator output. The voltage regulation is only as good as the hydraulic flow regulator.

To adjust voltage, use a VOM and a frequency meter. Put the frequency meter across the voltage output and check the frequency. Bring the hydraulic flow up (open the flow control valve dedicated to the generator) to a point where 60 Hz is being generated at full load. This means that the genset is running at 1800 rpm.

When the frequency output of the genset is correct, adjust the voltage output up or down by means of the potentiometer in the control box. Remove the load from the output while still, checking the frequency. There should be no more than 4 hz rise in frequency.

STOPPING PROCEDURE

Stopping the generator set can be done in one of two ways:

- 1. Stopping hydraulic flow in the entire system.
- 2. Removing hydraulic flow from the generator set alone, by means of an external valve.

Stopping the generator set means halting the flow of hydraulic fluid through the hydraulic motor inlet and outlet. This would be harmful to the generator set if it were decelerated from 1800 rpm to zero instantly. For this reason, Onan has added an internal check valve to the hydraulic motor. When the system is stopped, it allows the outlet to draw excess hydraulic pressure from the inlet, allowing the hydraulic motor to slowly reduce speed:

Section 5. Troubleshooting

SAFETY CONSIDERATIONS

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This troubleshooting section is intended for the generator set installer or operator, rather than the service technician. More troubleshooting information is included in the Hydrastar Service Manual, publication # 943-0500.

High voltages are present within the control box when the generator is running. Do not open the control box while the set is running.

AWARNING Contacting high voltage components can cause serious personal injury or death. Keep control and output box covers in place during troubleshooting. Remove power from the hydraulic system before attempting to troubleshoot the system.

AWARNING Accidental starting of the generator set during troubleshooting can cause severe personal injury or death. Disable the generator set before troubleshooting.

TROUBLESHOOTING

The following chart covers the most obvious forms of trouble. It assumes that the main system hydraulic pump is supplying sufficient pressure and flow to keep a correctly maintained system operating adequately.

WARNING Many troubleshooting procedures present hazards which can result in severe personal injury or death. Only qualified service personnel with knowledge of electrical and mechanical hazards should perform service procedures. Review safety precautions on inside cover page.

AWARNING

Untrained personnel should not attempt repair due to hazards which can result in personal injury or death. Troubleshooting information is provided for qualified repair personnel only.

Problem: Generator will not produce AC voltage.				
SYMPTOMS	SOLUTIONS			
1. Generator rotor is stopped or not rotating fast enough. Generator should be driven at 1800 RPM	1a. Troubleshoot entire hydraulic system.			
to produce rated voltage.	 b. Check the inlet and outlet connections at the hydraulic motor, and make sure they are not swapped. 			
	c. Check the setting of the flow control needle valve.			
	 d. Check the generator set "on" value for malfunctions. 			
	Always use a frequency meter when adjusting the hydraulic flow: 60 hz = 1800 rpm, and 50 hz = 1500 rpm.			
2. No output in load or line.	 If a circuit breaker or a fuse is used for generator protection, check for condition which caused breaker to trip or fuse to burn. 			
Problem: Generator is overheating.				
SYMPTOMS	SOLUTIONS			
1. Air intake or exhaust outlet is plugged.	1. Remove obstruction.			
2. Generator is electrically overloaded.	2. Remove part of electrical load.			
Problem: High or low voltage output.				
SYMPTOMS	SOLUTIONS			
 Low voltage at no load: Generator is rotating slower than RPM. Generator should be driven at 1800 RPM to produce rated voltage. 	 Low voltage at no load: Verify that the entire hyraulic system functions adequately. 			
	 b. Check the setting of the flow control needle valve with a frequency meter, then adjust the voltage adjusting rheostat. 			
 Low voltage with load: Generator is rotating at full 1800 RPM, but is putting out low voltage. 	2. Low voltage with load: Check rectifier assembly.			
3. <i>High voltage:</i> Generator is running at rated RPM or below, but is putting out higher than rated voltage.	3. <i>High voltage:</i> Use a frequency meter to adjust the no-load frequency to 62-63 hz, then adjust the voltage to 117-118 volts. If voltage remains high, or does not adjust, then replace the voltage regulator.			

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WARNING Untrained personnel should not attempt repair due to hazards which can result in personal injury or death. Troubleshooting information is provided for qualified repair personnel only.

Problem: Low or no hydraulic fluid flow. SVMPTOMS 1. No hydraulic fluid in reservoir or hydraulic lines. Sector of hydraulic fluid in reservoir or hydraulic lines. 2. Shutoff valve is not allowing oil flow. Generator set is damaged, preventing free rotation of rotor shaft and causing. hydraulic pressure to build up. Refer to Operation section for proper filling and bleeding procedures. 2. Shutoff valve is not allowing oil flow. Replace shutoff valve. Replace shutoff valve. 3. Generator set is damaged, preventing free rotation of rotor shaft. Remove the generator to check fuid supply in system. Hydraulic system overheating. SYMPTOMS 1. Check fluid supply in system. Hydraulic system is normally self-cooling, and depends upon fluid flow between system pupp and motor. Maintain adequate fluid flow in hydraulic system. 2. Check availability of water/air cooling flow to (optional) heat exchanger. Maintain adequate cooling water/air flow to (optional) heat exchanger. 3. Generator overloaded. Reneve part of the electrical load. 4. Excess heat generated by other devices in the system. Renove part of the electrical load. 5. Excess heat generated by other devices in the system. Solutions 6. Excess heat generated by other devices in the system. Disable any other device and run the generator alone. 7. Check for leakage at the hydraulic fittings and at the inlet and outlet of the hydraulic motor. Disable any other device a		
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Installation and Operator's Manual HydraStar Generator Sets

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Safety Precautions

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

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

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

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

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

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Keep your hands, clothing and jewelry away from moving parts.
- Before starting work on the generator set, be sure to disconnect it from hydraulic lines. This will prevent accidental starting.
- Make sure that the fasteners on the generator set are secure. Tighten supports and clamps, keep guards in position over fans, etc.
- Do not wear loose clothing or jewelry in the vicinity of moving parts, or while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts and cause shock or burning.
- If adjustment must be done while the unit is running, use extreme caution around moving and hot parts, etc.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Remove electric power before removing protective shields or touching electrical equipment. On a metal or concrete floor, stand on rubber insulative mats placed on dry wood platforms when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surface to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages can cause injury or death. DO NOT tamper with interlocks.
- Follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag all open switches to avoid accidental closure.
- DO NOT CONNECT GENERATOR SET DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM. Hazardous voltages can flow from the generator set into the utility line. This creates the potential for electrocution or property damage. Connect only through an approved isolation switch or an approved paralleling device.

GENERAL SAFETY PRECAUTIONS

- Provide appropriate fire extinguishers and install them in convenient locations. Consult the local fire department for the correct type of extinguisher to use in your installation. Do not use foam on electrical fires. Use extinguishers rated ABC by NFPA.
- Make sure that rags are not left on or near the genset.
- Remove all unnecessary grease and oil from the unit. Accumulated grease or hydraulic fluid can cause overheating and hydraulic motor damage, presenting a fire hazard.
- Keep the generator set and the surrounding area clean and free from obstructions. Remove any debris from the set and keep the floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.

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ABOUT THIS MANUAL

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This manual provides general information for operating and maintaining an Onan Hydrastar hydraulic generator set. Study this manual carefully, and observe all warnings and cautions. Using this generator set properly and following a regular maintenance schedule will contribúte to longer unit life, better performance, and safer operation.

A service manual for this generator set is available (Onan publication # 943-0500). To obtain this manual, contact an Onan distributor.

HOW TO OBTAIN SERVICE

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When the generator set requires service, supply the complete model number and serial number to the Onan distributor, to obtain assistance.

AWARNING Many troubleshooting procedures present hazards which can result in severe personal injury or death. Only qualified service personnel with knowledge of electrical and mechanical hazards should perform service procedures. Review the safety precautions on the inside cover page.



FIGURE 1-1. HYDRASTAR GENERATOR SET

Section 2. Specifications and Torques

Weight	
Dimensions	645.9 mm x 320 mm x 357.3 mm .
	(25.43 in x 12.60 x 14.07 in) (5 kW set)

Generator

Туре	Onan YK revolving field, 4-pole brushless
Phase	1 or 3
Rating: 60 Hz	
50 Hz	4.5 kW
Generator Speed	
•	50 Hz: 1500 rpm

Hydraulic Motor (5 kW set)

TypeBent-axis conical piston, fixed displ	acement rotary group, 40° swivel angle hydraulic motor
Displacement (max)	16 cm³/rev (.98 in³/rev)
Pressure rating (max)	
Torque constant (theoretical)	0.25 nm/bar (1.3 ft-lb/100 psi)
Allowable shaft torque (max) at 488 bar (6500 psi)	
Moment of inertia	0.0004.kg-m² (1.36 lb-in²)
Shaft: Direction of rotation	CCW (viewed from shaft end)
Seal	Buna-n or better
Mounting flange	SAE B (2 bolt)
Port connections:	
Pressure and return ports	-28 straight thread O-ring fitting, SAE -08 for 1/2" pipe

Hydraulic Motor (7.5 kW, 10 kW, 12.5 kW, 15 kW Sets)

TypeBent-axis conical piston, fixed displacement	ent rotary group, 40° swivel angle hydraulic motor-
Displacement (max)	
Speed rating (max)	
Pressure rating (max)	
Torque constant (theoretical)	0.51 nm/bar (2.56 ft-lb/100 psi)
Allowable shaft torque (max) at 488 bar (6500 psi)	
Moment of inertia	0.0012 kg-m² (4.09 lb-in²)
Shaft: Direction of rotation	CCW (viewed from shaft end)
Seal	Buna-n or better
Mounting flange	SAE C (4 bolt)
Port connections:	

Pressure and return ports.1-5/16-12 UNF-28 straight thread O-ring fitting, SAE -12 for 3/4" pipe

Hydraulic System

Hydraulic fluid	Petroleum base, 81-145 SSU viscosity (Mobile DTE25 or equivalent)
Filtering	
Hydraulic line"	type SAE 100R, 3000 psi normal pressure,
•	5000 psi burst pressure

	TORQUES	
	ft-lbs	N●m)
Generator rotor through-stud bolt	45	60
Generator adapter to hydraulic motor adapter bolts	19	26
Stator to adapter through-stud bolts	28	38
End bell cover screws	3	4

Section 3. Installation

GENERAL

Read this entire manual before installing the generator set. Note and follow all warnings and cautions.

AWARNING Incorrect installation, service, or parts replacement can result in severe personal injury, death, and/or equipment damage. Service personnel must be qualified to install electrical and mechanical components.

The hydraulic generator set may be mounted either in a vehicle or in a fixed installation. Installation considerations include:

- Adequate cooling air
- Electrical connections
- Hydraulic connections
- Accessibility for operation and servicing
- Vibration isolation

MOUNTING

The Hydrastar generator set is highly flexible in its mounting requirements: it is suitable for mobile or fixed installations, and can be mounted in horizontal and vertical positions. If mounted vertically, the hydraulic motor must be pointed down.

A vertical installation presents the possibility of dripping hydraulic fluid. Generally speaking, a horizontal mounting position is preferred. If the set is mounted vertically, the compartment in which it is mounted must be drip-proof against petroleum-based hydraulic fluid.

This section describes typical generator set mounting procedures. Consult an Onan distributor for information and advice on your particular installation needs.

Mobile Installation

Before installing this generator set in a mobile application, there are several factors to keep in mind. These include:

Generator set support area: The mounting area must be able to support the weight of the generator set (approximately 160.06 pounds [72.6 kg] for the 5 kw version). The vehicle manufacturer and the installer must provide a structurally sound support area. Figure 3-1 is an outline drawing of the generator set.

Generator set mounting hole configuration: The mounting area must be able to accept the mounting hole arrangement found on the set. The mounting feet are illustrated in Figure 3-2.

Genset vibration mounts: Rubber/plastic vibration mounts should be used between the generator set and the mounting surface in a mobile installation. The genset must be protected from potentially harmful vibration and flexing transmitted through the vehicle frame.

Generator set cooling air: A generator set compartment should be constructed with an inlet duct to separate cooling air from exhaust air, to prevent recirculation of the heated exhaust air from the set. An air inlet should have an area of at least 28.0 square inches. The outlet should have an area of 33.0 square inches.

Hydraulic line routing and clearance: The hydraulic lines to and from the generator set must be protected from heat, friction and severe bending. There must be sufficient clearance around the hydraulic lines and fittings for using wrenches to tighten and loosen them.

A generator set compartment must be constructed according to the safety recommendations on the inside front cover of this manual. Line the walls of the compartment with 26-gauge galvanized steel or a material of comparable strength, durability and fire resistance (see NFPA 70 and NEC for details). Construct the compartment floor to prevent oil, fluid or water accumulation. Cover the back, top and sides (not the compartment base) with fiberglass or another self-extinguishing acoustical material, rated for use at 200° F (90° C) minimum.

AWARNING The ignition or burning of insulation materials can cause severe personal injury or death. Insulation must not reduce the specified minimum clearances.

Fixed Installation

Most of the mobile installation requirements apply to a fixed installation. Provide a location that is dry, clean, dust-free, well-ventilated and protected from weather. Use a sturdy, level mounting base of concrete, heavy wood or structural steel, preferably raised for easy operation.



millimeters (inches)

	DIM "A"	DIM "B"	DIM "C"	DIM "D"	DIM "E"	DIM "F"
5 kW Sets	645.9 (25.43)	463.5 (18.25)	202.0 (7.95)	173.7 (6.84)	107.7 (4.24)	42.5 (1.67)
7.5 kW Sets	705.9 (27.79)	498.5 (19.63)	227.0 (8.94)	191.7 (7.55)	93.5 (3.68)	59.9 (2.36)
10 kW Sets	740.9 (29.17)	533.5 (21.00)	227.0 (8.94)	191.7 (7.55)	93.5 (3.68)	59.9 (2.36)
12.5 kW Sets	776.9 (30.59)	569.5 (22.42)	227.0 (8.94)	191.7 (7.55)	93.5 (3.68)	59.9 (2.36)
15 kW Sets	811.9 (31.96)	604.5 (23.80)	227.0 (8.94)	191.7 (7.55)	93.5 (3.68)	59.9 (2.36)

	PORT A (RETURN)		PORT B (PRESSURE)	
	THREAD SAE FITTING SIZE		THREAD	SAE FITTING SIZE
5 kW Sets	3/4-16UNF-28 (IN.)	-08	3/4-16UNF-28 (IN.)	-08
7.5 kW Sets	1 5/16-12 UN 28 (IN)	-16	1 5/16-12 UN 28 (IN)	-16
10 kW Sets	1 5/16-12 UN 28 (IN)	-16	1 5/16-12 UN 28 (IN)	-16
12.5 kW Sets	1 5/16-12 UN 28 (IN)	-16	1 5/16-12 UN 28 (IN)	-16
15 kW Sets	1 5/16-12 UN 28 (IN)	-16	1 5/16-12 UN 28 (IN)	-16

FIGURE 3-1. OUTLINE DRAWING, HYDRASTAR GENERATOR SET

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M-1824

GENERATOR SET	DIMENSION L LENGTH	
5 kW	463.5 mm (18.25 in.)	
7.5 kW	498.5 mm (19.63 in.)	
10 kW	533.5 mm (21.0 in.)	
12.5 kW	569.5 mm (22.42 in.)	
15 kW	604.5 mm (23.8 in.)	

 If the set is mounted in a compartment, location of the air openings must permit airflow while the set is running. On shutdown, the openings must allow convection cooling of the compartment. Plan the location with an access opening permitting set removal, and an opening for cooling air. The air inlet should be at least 28.0 square inches in size. The outlet should be at least 33.0 square inches. Allow clearance for maintenance access to the genset.

The air discharge sides of the set require 3 inches (76 mm) clearance. Provide enough clearance around the other sides for service access.

Because the hydraulic motor must be filled with fluid at all times, position the generator set level with the hydraulic fluid storage tank, or lower than the tank. If this is not possible, use S-shaped inlet and outlet lines to the motor, to keep it immersed in fluid. See Figure 3-3.

VENTILATION AND COOLING SYSTEMS

The Hydrastar generator set needs only a small amount of ventilation. Because the generator is powered by a hydraulic motor, it has none of the air intake or exhaust requirements of a combustion engine.

The hydraulic motor itself is completely sealed, and needs no ventilation. The motor is self-cooling to temperatures of 150° F (65.5° C). Above this temperature, a separate oil cooler in the hydraulic system may be necessary to cool the hydraulic fluid.

The generator itself has minimal cooling and airflow requirements. Generator cooling is provided by a centrifugal blower on the generator hub. The blower draws air from the generator end of the compartment through the generator, then discharges the heated air out the blower outlet. If compartment-mounted, an air inlet should have an area of at least 28.0 square inches. The outlet should have an area of 33.0 square inches.



FIGURE '3-3. HYDRAULIC LINE ROUTING

HYDRAULIC SYSTEM

Hydraulic Connections and Hose

On the 5 kw generator set, the high-pressure inlet and outlet ports (ports A and B; see Figure 3-4) require SAE -08 fittings for 1/2" pipe, with 3/4-16 UNF-28 threading. Straight thread 0-ring male connectors which conform to standard SAE J514j must be used.

On the 7.5 kW to 15 kW generator sets, the highpressure inlet and outlet ports (ports A and B; see Figure 3-5) require SAE -12 fittings for 3/4" pipe, with 1 5/16-12 UNF-28 threading. Straight thread 0-ring male connectors which conform to standard SAE J514j must be used.

If an angled approach is required, a female short drop angle hose fitting (SAE J516b) may be used on the hose to mate with the straight connectors. Figures 3-4 and 3-5 illustrate the hydraulic motor with its inlet and outlet.

The 5 kw generator set requires 4-braid high-pressure hydraulic hose which conforms to standard SAE 100R. A standard installation requires 1/2 inch diameter hose; long runs require 3/4 inch diameter hose.

The 7.5 kW through 15 kW generator sets require at least 3/4 inch diameter hose.

Hydraulic Circuit

Before installing the Onan Hydrastar generator set, make certain that the hydraulic circuit has been correctly designed. Points that must be considered include:

- Adequate hose diameter
- Hydraulic fluid temperature
- Flow potential of main hydraulic pump
- Generator set mounting position
- Hydraulic fluid filtration
- On-off valves (genset control): position, type and size
- Needle valves (speed control): position, type and size
- Load sense line and restrictors (if necessary)

An example of a typical hydraulic circuit using the Hydrastar generator set is illustrated in Figure 3-6.

The system depicted in Figure 3-6 is intended to represent a typical Hydrastar installation. A system relief valve must be used as part of the installation; this valve should be rated to open at 3000 psi or lower. Supplementary equipment that may be required in a system which supports a hydraulic generator includes:

- Generator on/off valve
- Generator speed control needle valve
- Oil cooler
- Oil cooler bypass valve
- 3-micron hydraulic fluid filter

Onan does not supply hydraulic lines, valves, pumps or other equipment. Onan cannot supply specific advice or information on hydraulic systems, applications or equipment.

The hydraulic motor inlet and outlet ports must remain below the fluid level in the reservoir to prevent oil from draining out of the motor when the generator set is shut down.

Routing Hydraulic Lines

The best hydraulic installation is one having the shortest and straightest lines. If lines must be bent, make sure they sweep between points to prevent sharp turns. Use rigid hydraulic lines wherever possible, except at points of flexing; rigid lines provide the most accurate control response. Secure lines at points of contact with surrounding surfaces, to prevent chafing.

Follow these guidelines when installing the hydraulic lines.

- 1. Never force a hose into a bend that is tighter than the minimum recommended by the manufacturer.
- 2. Provide an angled elbow fitting at the point of connection, rather than bending the hose at an angle. Recommended: female short drop angle hose fitting (SAE J516b).
- 3. Never stretch a hose between connections. Always provide enough slack for pressure expansion and contraction.







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FIGURE 3-5. HYDRAULIC MOTOR, SAE C (7.5 - 15 kW SETS)





- 4. Use hose of the same pressure rating throughout the installation.
- 5. Prevent hose contact with surrounding parts wherever possible.
- 6. Use clamps that fit tightly around the outside diameter of the hose, to prevent chafing.
- 8. Provide thermal shielding to a hose that must run near any hot areas (vehicle engine, exhaust pipe, etc.). This prevents damage to the hose, and prevents heating the hydraulic fluid.
- 8. Never twist the hose when installing it.
- 9. Use the rigid line mounting hardware recommended by the hydraulic line manufacturer.
- 10. Follow the pump manufacturer's recommendations for tuning a load-sensing hydraulic system.

AC WIRING

General

Installing the generator set electrical system includes connecting the load. The hydraulic system should be disconnected to avoid accidentally starting the unit during installation.

AWARNING Accidental starting of the generator set during installation can cause severe personal injury or death. Do not activate the hydraulic system until all electrical wiring is complete.

Control Box

Onan provides no separate electrical controls for the Hydrastar generator set. The installer must provide circuit breakers and on-off switches for the electrical portion of the generator set.

The control box contains a potentiometer for controlling the output voltage level, and a voltage regulator. A terminal block provides access to the generator set output voltage. Figure 3-7 illustrates the components inside the control box.

A generator set schematic can be found on the inside of the control box cover.

Wiring must be protected from sharp edges (screw heads, burrs, fins, moving parts), hot engine parts, or any other objects that might damage the insulation.

Wiring must meet all applicable electrical codes. Have a qualified electrician install and inspect the wiring. All remote controls and switches must be vibration-proof and securely mounted to prevent accidental closing or opening when the vehicle is moving.

Conduit

Route load conductors from the generator set control to the junction box in approved flexible conduit. See Figure 3-8. Make sufficient slack in the conduit to allow the unit free movement, and for maintenance.

AWARNING Sonal injury or death. It is extremely important that bonding and equipment grounding be properly done. All metallic parts which could become energized under abnormal conditions must be properly grounded.

Connecting the Load

See Figure 3-9 for load connections on the singlephase generator set. Figures 3-10 and 3-11 show the schematic and wiring diagrams for the single-phase and three-phase generator sets. Generator output voltage(s) and maximum current rating(s) are specified on the generator nameplate. Line-to-neutral voltage is always the lower voltage shown on the nameplate and line-to-line voltage is the higher rating.

Install the generator output conductors in approved flexible conduit. Cut conduit to desired length, leaving extra wire in the junction box for making connections to the load. Always use a strain relief at the junction box. Route conduit so movement of the generator set is not interfered with.

Use stranded wire for all load connections. Load wiring must be appropriately sized and insulated for the specified current rating. Grounding procedure must comply with codes.

A lead to be connected to an output feeder conductor shall be not more than two AWG sizes smaller than the output feeder conductor and the insulation shall be:

- Rubber (with a braid), neoprene, or thermoplastic, with a wall thickness of at least 0.030 inch (0.76 mm)
- Other material having the same or better electrical and mechanical properties.

AWARNING *Electrical shock can result in severe personal injury or death. Be careful when connecting leads to the terminal block that no stray strands of wire stick out from the block, where they could short out or shock the operator or installer.*

AWARNING Improper wiring can result in fire and severe personal injury or death. Do not allow contact between electrical wiring and the fuel line.

AWARNING *Electrical shock can result in severe personal injury or death. Properly applied and maintained ground fault interrupters can afford additional protection against the hazard of electrical shock. Equip the vehicle with adequate ground fault protection devices.*



FIGURE 3-7. CONTROL BOX COMPONENTS



FIGURE 3-8. TYPICAL WIRING AND POWER SWITCHING DEVICES

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FIGURE 3-9. SINGLE-PHASE GENERATOR RECONNECTION DIAGRAM



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SCHEMATIC 110/2207. 115/2307 & 120/2407 AS SHOWN SEE RECONNECTION CHART FOR OTHER VOLTAGES

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WIRING DIAGRAM 110/220V, 115/230V & 120/240V AS SHOWN SEE RECONNECTION CHART FOR OTHER VOLTAGES

FIGURE 3-10. SCHEMATIC/WIRING DIAGRAM SINGLE-PHASE HYDRASTAR GENERATOR SET





WIRING DIAGRAM

FIGURE 3-11. SCHEMATIC/WIRING DIAGRAM, THREE-PHASE HYDRASTAR GENERATOR SET



This section describes starting and operating the generator set. Read through this entire section before starting the set. The operator must be completely familiar with the set to operate it safely.

Prestart Preparations

Before starting the generator set the first time, be sure it is serviced and ready for operation. Make certain to use the recommended hydraulic fluid and the correct type of hydraulic hose, as listed in Section 2 of this manual.

Filling the Hydraulic Motor

Hydraulic fluid is drained from the hydraulic motor before shipment. Before starting the genset, fill the hydraulic motor with fluid, as follows.

- 1. Remove the plug from port T1.
- 2. Pour clean hydraulic fluid into the motor, to the level of the port threads.
- 3. Replace the plug in port T1.

Do not transfer fluid from its shipping container to an open can to facilitate filling the system since such an operation can contaminate otherwise clean fluid. Do not allow fluid to be stored in opened cans. Fluid contamination can ruin a hydraulic system rapidly. A recommended fluid is Mobil DTE25 or the equivalent.

Figures 3-4 and 3-5 illustrate the ports on the hydraulic motor.

STARTING PROCEDURE

The installer must provide all hydraulic valves or switching devices needed to control the generator set independently. An example of a hydraulic system may be found in Figure 3-6. Before running the motor at full speed, the main hydraulic system should be operated to provide 10-20% flow, until all lines have been filled and motor operation has been checked.

Have a frequency meter attached to the AC output at all times when adjusting the generator set. Do not run the unit at over speed; 2250 RPM and 75 hz are the maximum values.

Bleeding and Inspecting the System

When the hydraulic system is filled, run the hydraulic pump five to ten minutes to remove trapped air from the lines. Continue to check the fluid level, and refill if necessary. Make certain all air escapes, because trapped air causes noisy and erratic system operation. At first startup, and during air bleeding operations, check fluid level in the reservoir often, to assure a completely filled hydraulic circuit.

Check for line and fitting leaks. If leaks are noted, first attempt to tighten the connection (do not overtighten). Also check the O-rings on the fittings for damage. If this does not stop the leak, replace the part. Fluid leakage from a hydraulic system is also an indication of air entering a system. Prevent fluid leakage.

Operational Check

After making sure that the hydraulic system is filled, perform an electrical check of the generator. It should produce full rated output at 1800 RPM (60 hz). A generator driven slower than the rated RPM will produce a corresponding under-voltage.

If the generator set is run faster than the correct speed, the voltage regulator will cap the voltage, limiting over-voltage. Always use a frequency meter to determine correct generator speed, rather than solely measuring voltage.

If a chattering, popping noise is noted, air is trapped in the system, which may cause erratic generator operation. (A properly designed reservoir has baffles to remove air, and is vented to the atmosphere.) If air in the system cannot be relieved in normal operation, wrap the fitting with rags to prevent the escape of high-pressure fluid, loosen the pump or motor outlet port fitting (whichever is higher) just enough to allow fluid to escape (air will escape too), then tighten the fitting and replenish the fluid supply. Do not loosen the pump inlet fitting, since the pump will draw in air.

AWARNING *injury.* Perform the air-release procedure described above only as a last resort. Make sure to wrap rags around the fitting to be loosened before beginning, and wear goggles and gloves.

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VOLTAGE REGULATION

Under-voltage/under-frequency regulation is almost entirely a function of hydraulic flow regulation. There is no "governor" as such on the generator set. Hydraulic flow regulates generator output. The voltage regulation is only as good as the hydraulic flow regulator.

To adjust voltage, use a VOM and a frequency meter. Put the frequency meter across the voltage output and check the frequency. Bring the hydraulic flow up (open the flow control valve dedicated to the generator) to a point where 60 Hz is being generated at full load. This means that the genset is running at 1800 rpm.

When the frequency output of the genset is correct, adjust the voltage output up or down by means of the potentiometer in the control box. Remove the load from the output while still checking the frequency. There should be no more than 4 hz rise in frequency.

STOPPING PROCEDURE

Stopping the generator set can be done in one of two ways:

- 1. Stopping hydraulic flow in the entire system.
- 2. Removing hydraulic flow from the generator set alone, by means of an external valve.

Stopping the generator set means halting the flow of hydraulic fluid through the hydraulic motor inlet and outlet. This would be harmful to the generator set if it were decelerated from 1800 rpm to zero instantly. For this reason, Onan has added an internal check valve to the hydraulic motor. When the system is stopped, it allows the outlet to draw excess hydraulic pressure from the inlet, allowing the hydraulic motor to slowly reduce speed.

Section 5. Troubleshooting

SAFETY CONSIDERATIONS

This troubleshooting section is intended for the generator set installer or operator, rather than the service technician. More troubleshooting information is included in the Hydrastar Service Manual, publication # 943-0500.

High voltages are present within the control box when the generator is running. Do not open the control box while the set is running.

WARNING *Contacting high voltage components can cause serious personal injury or death. Keep control and output box covers in place during troubleshooting. Remove power from the hydraulic system before attempting to troubleshoot the system.*

AWARNING Accidental starting of the generator set during troubleshooting can cause severe personal injury or death. Disable the generator set before troubleshooting.

TROUBLESHOOTING

The following chart covers the most obvious forms of trouble. It assumes that the main system hydraulic pump is supplying sufficient pressure and flow to keep a correctly maintained system operating adequately.

AWARNING Many troubleshooting procedures present hazards which can result in severe personal injury or death. Only qualified service personnel with knowledge of electrical and mechanical hazards should perform service procedures. Review safety precautions on inside cover page.

AWARNING

Untrained personnel should not attempt repair due to hazards which can result in personal injury or death. Troubleshooting information is provided for qualified repair personnel only.

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Problem: Generator will not produce AC voltage.	
SYMPTOMS	SOLUTIONS
1. Generator rotor is stopped or not rotating fast enough. Generator should be driven at 1800 RPM	1a. Troubleshoot entire hydraulic system.
to produce rated voltage.	 b. Check the inlet and outlet connections at the hydraulic motor, and make sure they are not swapped.
	c. Check the setting of the flow control needle valve.
	 d. Check the generator set "on" valve for malfunctions.
	Always use a frequency meter when adjusting the hydraulic flow: 60 hz = 1800 rpm, and 50 hz = 1500 rpm.
2. No output in load or line.	 If a circuit breaker or a fuse is used for generator protection, check for condition which caused breaker to trip or fuse to burn.
Problem: Generator is overheating.	······································
SYMPTOMS	SOLUTIONS
1. Air intake or exhaust outlet is plugged.	1. Remove obstruction.
2. Generator is electrically overloaded.	2. Remove part of electrical load.
Problem: High or low voltage output.	
SYMPTOMS	SOLUTIONS
 Low voltage at no load: Generator is rotating slower than RPM. Generator should be driven at 1800 RPM to produce rated voltage. 	 Low voltage at no load: Verify that the entire hyraulic system functions adequately.
	 b. Check the setting of the flow control needle valve with a frequency meter, then adjust the voltage adjusting rheostat.
2. Low voltage with load: Generator is rotating at full 1800 RPM, but is putting out low voltage.	2. Low voltage with load: Check rectifier assembly.
 High voltage: Generator is running at rated RPM or below, but is putting out higher than rated voltage. 	3. <i>High voltage:</i> Use a frequency meter to adjust the no-load frequency to 62-63 hz, then adjust the voltage to 117-118 volts. If voltage remains high, or does not adjust, then replace the voltage regulator.

AWARNING

Untrained personnel should not attempt repair due to hazards which can result in personal injury or death. Troubleshooting information is provided for qualified repair personnel only.

Problem: Low or no hydraulic fluid flow.	·
SYMPTOMS	SOLUTIONS
1. No hydraulic fluid in reservoir or hydraulic lines.	 Refer to Operation section for proper filling and bleeding procedures.
2. Shutoff valve is not allowing oil flow.	2. Replace shutoff valve.
3. Generator set is damaged, preventing free rotation of rotor shaft and causing hydraulic pressure to build up.	 Excessive torque is required to rotate the rotor shaft. Remove the pressure hydraulic lines at the motor and the fan guard at the opposite end of the generator to check for this condition. It should be possible to rotate the shaft by hand, although a degree of resistance will be present.
 Pump control failure and/or load sense line problem. 	 Examine and replace/repair parts as needed.
Problem: Hydraulic system overheating.	
SYMPTOMS	SOLUTIONS
 Check fluid supply in system. Hydraulic system is normally self-cooling, and depends upon fluid flow between system pump and motor. 	1. Maintain adequate fluid flow in hydraulic system.
 Check availability of water/air cooling flow to (optional) heat exchanger. 	 Maintain adequate cooling water/air flow to (optional) heat exchanger. Make certain that heat exchanger and hydraulic lines are isolated from other sources of heat.
3. Generator overloaded.	3. Remove part of the electrical load.
4. Motor/generator damaged, preventing free rotation of rotor shaft.	4. Excessive torque required to rotate the motor/generator shaft. Remove the pressure hydraulic lines at the motor and the fan guard at the opposite end of the generator to check for this condition. It should be possible to rotate the shaft by hand, although a degree of resistance will be present.
 Excess heat generated by other devices in the system. 	5. Disable any other device and run the generator alone.
Problem: External hydraulic system leakage.	
SYMPTOMS	SOLUTIONS
1. Check for leakage at the hydraulic fittings and at the inlet and outlet of the hydraulic motor.	 Attempt to stop the leak by tightening the fitting (do not overtighten). If this does not stop the leak, replace fittings as necessary. Check the O-rings for damage.
2. Cracked hydraulic lines.	2. Replace lines as necessary.

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