

Engine-Driven Generators

XCR | **contractor/rental**

XDR | **diesel**

XSD | **standard-duty**

XAF | **alternative fuels**

XTP | **three-phase**

Owner's Manual

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VOLTMASTER

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1 Introduction

1.1 Read before using



WARNING

Improper use of equipment could cause serious injury or death.

Prior to using this equipment, carefully read, understand, and observe all instructions in this manual and the engine manual.

This is an industrial-type electric generator. This equipment is potentially hazardous and could cause physical injury or even death if improperly used. Before attempting to operate this equipment:

- Check to ensure no damage has occurred in transit
- Read this manual thoroughly
- Follow all instructions carefully
- Read engine manufacturer's instructions

By following these instructions, you will enjoy safe and trouble-free operation of your generator.

1.2 EPA certification

Model XCR, XSD, and XTP gasoline-fueled generators are EPA certified. Copies of the certificate may be obtained from the factory (see Section 1.5, page 4) or at www.voltmaster.com.

Model XDR diesel generators use EPA-certified Tier 4 engines.

1.3 Generator models

This instruction manual covers the following generator models:

Series	Models
XCR contractor/rental	XCR30
	XCR55
	XCR70
	XCR80
	XCR105
	XCR150
	XCR180
XDR diesel	XDR50
	XDR60
	XDR130
XSD standard-duty	XSD30
	XSD50
	XSD55
	XSD70
	XSD80
	XSD105
XAF alternative fuels	XAF105
	XAF150
XTP three-phase	XTP50
	XTP80
	XTP120
	XTP180

1.4 Specifications

1.4.1 XCR contractor/rental generators

Model	Max. watts	Rated watts	Rated voltage	Rated amps	Fuel capacity (gal.)	Run time 1/2 load (hrs.)*	Run time full load (hrs.)*
XCR30	3000	2400	120	20	3	8.3–9.0	7.9–8.6
XCR55	5500	4500	120/240	37.5/18.8	5	8.3–10.9	5.7–8.3
XCR70	7000	6500	120/240	54.2/27.1	10	11–15	9–11.5
XCR80	8000	7500	120/240	62.5/31.3	10	11	8.5
XCR105	10,000	9500	120/240	79.2/39.6	10	11	8.5
XCR150	15,000	12,000	120/240	100/50	10	10	8
XCR180	18,000	15,000	120/240	125/62.5	18	11.5	7.2

*Depending on engine model.

1.4.2 XDR diesel generators

Model	Max. watts	Rated watts	Rated voltage	Rated amps	Fuel capacity (gal.)	Run time 1/2 load (hrs.)	Run time full load (hrs.)
XDR50	5000	4000	120/240	33.3/16.7	5	14	10.5
XDR60	6000	5500	120/240	45.8/22.9	5	14	10.5
XDR130	13,000	12,000	120/240	100/50	8	9.6	8

1.4.3 XSD standard-duty generators

Model	Max. watts	Rated watts	Rated voltage	Rated amps	Fuel capacity (gal.)	Run time 1/2 load (hrs.)*	Run time full load (hrs.)*
XSD30	3000	2400	120	20	0.75–1*	2.5–3	2.2–2.8
XSD50	5000	4000	120/240	33.3/16.7	1	1.7	1.2
XSD55	5500	4500	120/240	37.5/18.8	5	10.8–10.9	7.6–8.3
XSD70	7000	6500	120/240	54.2/27.1	8	9.5–13.4	7.7–10.3
XSD80	8000	7500	120/240	62.5/31.3	8	6	6
XSD105	10,000	9500	120/240	79.2/39.6	8	8.5–9	5.8–6

*Depending on engine model.

1.4.4 XAF alternative-fuel generators

Model	Fuel type*	Max. watts	Rated watts	Rated voltage	Rated amps	Run time 1/2 load	Run time full load
XAF105	LP	9000	8500	120/240	70.8/35.4	1.2 gal./hr.	1.6 gal./hr.
	NG	8500	8000	120/240	66.7/33.3	145 CFH	200 CFH
XAF150	LP	12,000	11,000	120/240	91.7/45.8	1.6 gal./hr.	2.2 gal./hr.
	NG	11,000	10,500	120/240	87.5/43.8	190 CFH	264 CFH

*LP=liquid propane NG=natural gas

1.4.5 XTP three-phase generators

Model	Rated watts	KVA	Rated voltage	Rated amps	Fuel capacity (gal.)	Run time 1/2 load (hrs.)*	Run time full load (hrs.)*
XTP50 208	5000	6.2	208	17.4	5	10.4–14	7.6–10.5
XTP50 480	5000	6.2	480	7.5	5	10.4–14	7.6–10.5
XTP80 208	8000	10	208	27.8	8	9.9	6
XTP80 480	8000	10	480	12	8	9.9	6
XTP120 208	12,000	15	208	41.6	8	6.9–9.6	6–8
XTP120 480	12,000	15	480	18	8	6.9–9.6	6–8
XTP180 208	15,000	18	208	52	18	11.5	7.2
XTP180 480	15,000	18	480	23	18	11.5	7.2

*Depending on engine model.

1.5 Where to obtain service

Before calling for service, please have the generator model, product code, and serial number ready. This information is displayed on the serial number tag, which is adhered to the generator.

Contact our service department using the following information:

Wanco Inc.

5870 Tennyson Street
Arvada, Colorado 80003

800-730-3927
fax 303-427-5725

www.voltmaster.com
sales@voltmaster.com

2 Safety

2.1 Operating safety



DANGER

Explosion hazard.

- NEVER operate generator in an explosive atmosphere or near combustible materials.
- Keep generator, engine, fuel, and other combustibles away from sparks, open flame, and burning objects.
- Do not smoke near engine.
- Never use generator to jump-start a vehicle.
- Before filling or draining fuel, stop engine and allow it to cool.
- Use correct fuel.
- Replace fuel tank cap after refueling.
- Do not mix lubricating oil with fuel.
- Check oil level while filling and do not overfill.
- For electric-start models:
 - Lead acid batteries emit a colorless explosive hydrogen gas. Keep batteries away from sparks, open flame, and burning objects.
 - Do not smoke near batteries.
 - Do not connect or disconnect battery cables from the battery or engine while the unit is cranking or operating.



⚠ DANGER



Asphyxiation hazard.

Engine exhaust contains carbon monoxide, a poison gas you cannot see or smell.

- NEVER operate engine indoors, EVEN IF doors and windows are open.
- Operate the engine OUTSIDE, far away from doors, windows, and vents.
- Refill and drain fuel tank only in a well ventilated area.
- Perform maintenance in a well ventilated area.



⚠ WARNING



Shock hazard.

- Use extreme caution when working on or with electrical components.
- Avoid contact with live terminals and receptacles.
- Ensure the generator is properly grounded in accordance with all applicable electrical codes.
- Do not operate generator in rain, snow, or wet conditions.
- Installation as a standby generator must comply with all applicable electrical codes, and requires a suitable power-transfer device to isolate generator from power utility.



WARNING

Fire hazard.



- Before transporting generator, drain fuel and close fuel-shutoff valve.
- A hot muffler can ignite flammable materials. Keep area around muffler free of debris such as leaves, paper, and cartons.
- Remove all unnecessary grease and oil from generator surfaces.
- Do not leave any flammable material on generator while it is running.



CAUTION

Risk of severe burn.



Do not touch engine, exhaust pipes, or any engine component until cool.

- Before using this equipment, carefully read, understand, and observe all instructions in this manual and the engine manual.
- Before using this equipment for the first time, visually inspect the generator for loose or missing parts and damage that may have occurred in shipment.
- This equipment should not be operated by persons under 18 years of age.
- ALWAYS wear appropriate protective clothing, shoes, and other protective devices, as required by the job.
- ALWAYS wear appropriate respiratory, hearing, and eye protection.
- NEVER operate this equipment when not feeling well due to fatigue, illness, or medication.

Safety: Operating safety

- NEVER operate this equipment under the influence of drugs or alcohol.
- When fueling electric-start engines, do not touch battery cables or posts to gasoline supply can.
- Before operating, know the location of the nearest fire extinguisher, first aid kit, and emergency telephone.
- Keep a fire extinguisher nearby and know its proper use. Extinguishers rated ABC by the NFPA are appropriate for all applications. For more information, consult your local fire department.
- Store fuel only in approved containers and in a well ventilated area. Exhaust fumes are poisonous; do not inhale.
- Be sure the generator is well ventilated on all four sides.
- Do not operate this equipment in an enclosed area, such as a recreational vehicle, marine vehicle, under the hood of a car or truck, or inside a truck or van even with the windows and doors open. All warranties are voided if the unit is operated in such an area.
- Keep generator and surrounding areas clean. Remove oily rags and other material that could create a fire hazard.
- NEVER use the generator with a cover over the unit. The generator must operate in an open-air environment.
- NEVER service generator or its components while generator is running. Do not perform service or maintenance while generator is hot.
- When using generator for backup power, use a suitable power-transfer device to isolate generator from power utility. Failure to isolate generator could cause serious injury or death.
- Only a qualified technician should perform repairs on this equipment, including the installation or replacement of parts and accessories.
- Use ONLY accessories or attachments that are recommended by the manufacturer. Unauthorized equipment modifications will void all warranties.

2.2 Engine safety

2.2.1 Operator safety

Before using the generator, refer to engine manufacturer's documentation for additional engine safety and operating information.

2.2.2 California Proposition 65



WARNING

Health hazard.

Engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

2.2.3 Spark arresters

IMPORTANT!

State and local safety codes specify that, in certain locations, internal combustion engines that use hydrocarbon fuels must be used with spark arresters.

A spark arrester is a device constructed of nonflammable materials specifically for the purpose of removing and retaining carbon and other flammable particles from the exhaust flow of an internal combustion engine.

Spark arresters are qualified and rated by the United States Forest Service. To comply with all applicable laws regarding spark arresters, consult your local Health and Safety Administrator.

2.3 Maintenance and storage safety



DANGER

Explosion hazard.

Do not use gasoline, other fuels, or flammable solvents to clean parts.



DANGER

Corrosive material.

Battery acid will cause severe burns and blindness.

- Use extreme care when handling or servicing batteries.
- Never service batteries while generator is operating.
- Wear appropriate eye and hand protection.
- Upon contact with skin or eyes, immediately flush with water and seek medical help.



CAUTION

Moving parts can cause injury.

- Prior to servicing, disconnect spark plug wire to prevent accidental starting.
- Prior to servicing electric-start models, disconnect negative (-) cable from starter battery, then disconnect the positive (+) cable.
- Keep hands, hair, and tools away from moving parts.
- Do not wear jewelry or loose fitting clothing while performing maintenance.
- Use extreme caution if making adjustments while generator is operating.

Safety: Maintenance and storage safety

- Before servicing, ensure power cannot be started inadvertently during service.
- ALWAYS keep the generator in proper running condition.
- ALWAYS fix damage to the generator immediately. Repair or replace broken or worn parts. Only use parts from original manufacturer.
- Replace operation and safety decals when they become difficult to read.
- When not in use, store equipment in a clean, dry location out of the reach of children.
- Before storing, drain fuel.

3 Operation

3.1 Before starting

3.1.1 Safety

Before operating the generator:

- Read and be familiar with this instruction manual.
- Read and follow all safety instructions (see Section 2, page 5).
- Read and follow instructions in the engine manufacturer's documentation.

3.1.2 Fuel

- For gasoline-powered models, use unleaded gasoline, 87 octane or higher
- For diesel-powered models:
 - In normal ambient temperatures, use No. 2 diesel fuel (DF2)
 - In cold weather, use No. 1 diesel fuel (DF1)
 - JP5 or JP8 turbine fuel may be used with engine derations

Fuel additive

If left to stand in the engine for periods of more than 6 months, gasoline will tend to form a varnish-like substance that will clog the fuel system and the carburetor. The result will be a hard-to-start engine. Check the engine manual or your local dealer for a recommended gasoline additive that will prevent varnish formation.

Fuel shutoff valve

If the generator is equipped with a fuel shutoff valve, the valve is located under the fuel tank. When using the generator, be sure the valve is open (turned counterclockwise) to permit the flow of fuel from the tank. During transport, the valve must be closed.

3.1.3 Oil

CAUTION

Crankcase pressure can blow hot engine oil out the fill tube, causing severe burns.

- Before removing oil cap, stop engine.
- Loosen cap slowly and with great care.

CAUTION

Overfilling oil will damage diesel engine beyond repair.

- Fill the oil sump to the full mark on the dipstick.
- Check oil level while filling and DO NOT overfill.
- If accidentally overfilled, drain extra oil.

To avoid engine damage, always check oil level and refill oil if necessary before starting engine. DO NOT overfill oil.

Keep oil level between the minimum and maximum marks on the dipstick. Engine damage caused by overfilling oil and low oil level are not covered by the engine manufacturer's warranty.

To avoid air bubbles pour oil slowly.

Low-oil shutdown

Most generator models are equipped with automatic low-oil shutdown systems. Insufficient oil volume (on low-volume systems) or pressure (on low-pressure systems) will cause the engine to stop. For more information, see the engine manual.

Oil type

To select the proper oil:

- For diesel engines, see the engine manual.
- For all other engines, see Table 3.1 for oil grade.
- For gasoline engines, use API Class SG or SH oil (also SG/CD, SG/CE, SH/CD or SH/CE).

Table 3.1 Recommended oil grade

Expected ambient temperature	SAE viscosity grade
32°F (0°C) or higher	30
10 to 100°F (-12 to 38°C)	15W-40
0 to 80°F (-18 to 27°C)	10W-30 or 10W-40
-20 to 50°F (-28 to 10°C)	5W-30

Changing the oil

Change the engine oil as specified in the engine manual. Oil should be drained while the engine is slightly warm.

3.1.4 Battery for electric-start models

For electric-start models, the starter battery is user-supplied. The generator has space for the battery, and battery cables are included with the generator.



DANGER



Explosion hazard.

When connecting battery cables, first connect the positive (red) cable and then connect the negative (green) cable.

Use only a 12-volt DC battery. Other battery requirements are listed in Table 3.2.

Table 3.2 Battery type

Generator	Battery
Gasoline-powered models, except XCR180	12VDC, Type U1 300 CCA, max. 5" width
Diesel-powered models and XCR180 models	12VDC, 24BCI, 26BCI or 34/78, 400 CCA, max. 6 7/8" width
XAF alternative-fuel models	12VDC, Type U1 300 CCA, max. 5" width

3.1.5 Location

Avoid placing the generator in locations where it will be exposed to high humidity, dust, high ambient temperature, or corrosive fumes. Moisture can condense on electrical components, causing corrosion and short circuits. Accumulation of dirt on components will retain moisture, accelerating wear on moving parts.

Provide at least 2 feet (61 cm) of space on all sides of generator, for ventilation and servicing. Ensure that the ventilator openings are not obstructed.

Place the generator on a flat, level surface and ensure that it will not shift or slide during use. Do not use the generator at an angle of more than 15 degrees from horizontal.

3.1.6 Alternative fuels

Model XAF generators

XAF alternative-fuel-powered generators feature a special vapor fuel carburetor with a vacuum safety shutdown and an electric solenoid fuel shutdown.

XAF generators are derated, because the liquid propane (LP) and natural gas (NG) fuel reduces engine output slightly versus gasoline.

Safety

- Only a qualified LP or NG installer should work with LP and NG fuel lines, connections, and components. Installing the fuel line for an XAF generator is not a do-it-yourself job.
- Propane gas is heavier than air and may settle in low places. Avoid cutting, welding, and any activity that might ignite low-lying gas near fuel lines or fuel tanks.

Fuel regulator

The regulator on the generator is a secondary regulator. Incoming fuel supplies require an external, primary fuel regulator with output of 11 inches of water column pressure. Fuel pressure that is too high or too low will adversely affect generator performance.

Do not adjust the generator's fuel regulator, which is preset at the factory. To adjust the fuel mixture, see "Fuel mixture for Model XAF generators" on page 24.

Fuel shutoff valve

An external, manual fuel-shutoff valve is also required. The valve must be installed using the flexible fuel line included with the generator, which isolates the generator vibration from rigid pipeline.

The shutoff valve must be installed within sight of the generator.

Fuel line

The incoming fuel line should be a 1-inch line. Fuel connections on the generator are 3/4-inch NPT.

To protect the flexible fuel line against rupture, route the fuel line away from the engine muffler and manifold. Do not remove the cover from the solenoid valve until you are ready to make pipe connections.

Before the flexible fuel connection is connected to the hard fuel pipe connections, and after all other fuel line connections have been made:

1. Ventilate the area.
2. Ensure there are no open flames, no smoking, no pilot lights and no sparks.
3. While wearing eye protection, turn on the fuel line for about 5 to 10 seconds, to blow out any remaining pipe tape or pipe dope out of the line. This will prevent debris from entering the generator's fuel regulator.
4. Check all connections for leaks with soap and water, and stop all leaks before using the generator.

3.1.7 Standby installations

WARNING



Shock hazard.

Failure to isolate generator from power utility can result in death or serious injury.

When using the generator for backup power:

- Never connect the generator output to any live home or commercial electric circuits.
- Use a suitable power-transfer device to isolate the generator from the power utility.
- Use a licensed electrician or electrical contractor to install the power-transfer device.

If the generator will be connected to existing electric circuits during a commercial power outage, the installation must provide a positive means of isolating the commercial and generator power. The most common means for isolation protection is to incorporate a suitably rated double-throw, double-pole manual transfer switch.

The National Electrical Code, the state of California, many state and local codes, and Canadian Hydro all require an isolation switch between the generator and the utility line. Consult all applicable national and your codes prior to installation.

A potential hazard exists during a power outage if the generator output is connected to the dead home or commercial electric circuits and no means is provided to isolate the electric circuits from the commercial power source. A power utility lineman working to return electric service to normal has every reason to believe that the line is dead. If your electric circuits are not isolated, the generator output will back feed to the power line and the lineman may be electrocuted when he attempts repairs.

Furthermore, if the utility and generator are not isolated, and utility power is restored while the generator is still powering the electric circuits, severe damage to the generator will occur and the possibility exists for an electrical fire.

Always employ a licensed electrician or electrical contractor to install the power-isolation switch. This is not a do-it-yourself job.

Operation: Before starting

3.1.8 Preparing for use

1. Ensure the generator is in proper working order:
 - Check the generator for damage and wear.
 - Secure all fuel and wiring connections.
 - Tighten loose screws, nuts, and bolts.
 - If applicable, ensure the starter battery is fully charged (see Section 3.3.3, page 28). If a trickle charger was used when the generator was not in use, disconnect the charger.
2. Read tags and labels, and follow all directions. Remove hanging and loose tags and labels; keep with generator for future reference.
3. Ensure oil drain plug is closed. Fill engine with the correct oil type as specified in the engine manual.
4. Clean the generator before use. Do not allow dust, dirt, rain, or snow to accumulate on the generator. Remove all oil deposits and other foreign matter from the generator.
5. Ensure all air passages and cooling fins are free from foreign matter. Use clean, dry compressed air at a maximum pressure of 25 psi (172kPa) to blow dirt and dust out of cooling passages and control cabinet.
6. For cold-weather starting, if possible, keep the generator in a warm location until needed, then move it to the cold location and start it immediately.
7. For Model XAF alternative-fuel generators, ensure the generator is properly grounded.

3.1.9 After long-term storage

Before restarting the generator after it has been stored for 6 months or longer:

1. Remove protective cover
2. Remove spark plug or plugs
3. Crank the engine slowly
4. Replace the spark plugs and tighten them

If the generator worked before being put into long-term storage but no longer works, see the see the Voltmaster troubleshooting manual, available at www.voltmaster.com.

3.2 Operating the generator

3.2.1 Ground-fault protection

The generator features total ground-fault protection. When a ground fault occurs on any receptacle:

- The ground-fault circuit interrupter (GFCI) fault-sensing module trips the generator's main circuit breaker
 - Power to all receptacles is disengaged
 - A red LED on the control panel lights up, indicating a ground fault
- If a ground fault occurs:

1. With the engine running, remove all loads.
2. Push the reset button on the GFCI fault-sensing module
3. Switch the main circuit breaker to the on position.
4. If the ground-fault condition continues with no load on the generator, contact an authorized service center.
5. If the condition continues after putting a load on the generator:
 - a. Repeat steps 1 through 3.
 - b. Try a different load using any receptacle.
 - c. If the ground-fault condition does not reoccur, the problem is likely with the equipment or cord that was connected when the fault reoccurred.
 - d. If the ground-fault condition reoccurs, contact an authorized service center.

Test the GFCI module at least once a month, and more regularly if the generator is being used often, by starting the generator and pushing the test button on the GFCI module. The test is successful if the reset button pops with an audible "click" and the red LED indicator lights up. To reset the generator after a successful test, follow steps 1 through 3, above.

3.2.2 Electrical loads

Ratings

Complete ratings for the generator are listed on the generator serial number tag, which is attached to the generator housing.

Large power tools and large electric motors require additional amperage for starting, as much as two to three times the ampere rating listed on their nameplates.

NEVER increase the generator engine speed to get more output from the generator. Engines operate at either 3600 RPM (for 60 Hz models) and 3000 RPM (for 50 Hz models). Increasing the engine speed could damage the generator and any equipment being powered by the generator.

Do not exceed the ampere ratings on the outlet receptacles. Overloading will damage the receptacles and could cause internal damage to the generator.

Load requirements

- Keep loads within the generator and receptacle ratings. Overloading could damage the generator.
- Loads should be applied gradually, not all at once.
- Large electric motors should be started one at a time, beginning with the largest motor, then the next largest, and so on.
- When removing loads from the generator, voltage-sensitive items such as televisions and computers should be removed first.
- The generator is inherently self-regulating and its output automatically adjusts to the load. Although diesel models have a minimum load requirement (see “Model XDR diesel generators” on page 22), other generators will not be damaged if operated with no load.

Appendix A, page 33, provides information that can help in determining your load requirements.

Model XDR diesel generators

CAUTION

Operating a diesel generator without the proper load will permanently damage the engine.

Always operate the diesel engine under load, using at least 25% of its rated capacity.

Diesel generators require a load of at least 25% of the generator's rated output. Operating a diesel generator with insufficient load (referred to as "wet stacking") will irreparably damage the engine and void the warranty.

Model XTP three-phase generators

When checking the no-load voltage on an XTP three-phase generator, the voltage will be about 10% below the rating listed on the generator serial number tag. When a load is placed on the generator, the reactor transformer inside the generator activates, and the voltage immediately increases to the generator's rated voltage.

If relays, electric controls, etc., are used with a three-phase motor, an automatic voltage regulator is required. If an automatic voltage regulator is installed, the voltage regulation is $\pm 1.5\%$.

XTP generators feature a three-phase circuit breaker that is rated for the amperage load of the generator. If the circuit breaker trips under load, you must remove some of the load to prevent overloading the generator. All three-phase circuit breakers are designed for motor load starting, permitting momentary overload conditions associated with three-phase motors.

Receptacles

The ratings on the generator serial number tag can be met by using the receptacles in combination or individually, as long as the generator and receptacle ampere ratings are not exceeded.

Receptacles are protected by ground-fault circuit interrupters (GFCI). Consult the National Electrical Code, Underwriters Laboratories or Canadian Standards Association code for ground-fault protection requirements for temporary installations.

Plugs and connected equipment

Use only 3-prong grounded plugs, 3-wire extension cords, and 3-wire or double-insulated power tools with the generator.

Full-power switch

Some models are equipped with a switch that allows selection of 120-volt power only or both 120- and 240-volt power.

- When using the generator to power only 120-volt equipment, put the full-power switch in the 120V position. In this position:
 - The generator windings are connected in parallel
 - The output of the generator is 120 volts
 - The 240-volt receptacles are not functional
 - The voltmeter indicates 120V
- When using the generator to power 240-volt equipment, put the power switch in the 120/240V position. In this position:
 - Each 120-volt receptacle has half the power output of the generator
 - The 240-volt receptacles are functional
 - The voltmeter indicates 240V
- Before changing the switch position, remove all electrical loads from the generator.

Idler

Some models are equipped with an idler switch. When the idler is on, the engine will slow down when there is no electrical load on the generator, improving fuel usage and generator life.

The generator should be started with the idler turned off. After the engine has warmed up for 2 to 3 minutes, turn the idler on. If there is no load on the generator, the engine speed will decrease. On some models there will be a delay of 10 to 12 seconds before the engine slows down.

With the idler turned on, when an electrical load is applied, the engine speed will automatically return to normal and produce the generator's rated voltage.

For the idler to function, a battery must be connected to the engine.

3.2.3 First-time use

Break-in period

Controlled break-in helps to ensure satisfactory service from the generator.

Model XDR diesel generators

During the first 5 to 10 hours of operation, operate the generator with electrical loads from 25 to 50 percent of the generator's rated capacity (indicated on the generator serial number tag). This will ensure the valves are properly seated. After the first 10 hours of operation, change the oil and oil filter.

Operating the diesel generator with insufficient load, referred to as "wet stacking," will damage the engine and void the warranty (see "Model XDR diesel generators" on page 22).

All other models

During the first 2 to 3 hours of operation, do not apply heavy electrical loads to the generator.

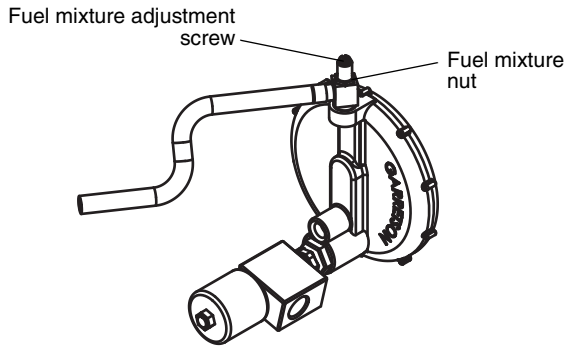
Change the oil after the first 3 hours of operation.

Fuel mixture for Model XAF generators

Before using an XAF alternative-fuel-powered generator for the first time, adjust the fuel mixture for proper engine performance. Refer to Figure 3.1 and follow these steps:

1. Start the engine.
2. Set a multimeter to measure hertz (Hz) and insert its probes into one of the generator's 120VAC receptacles.
3. Loosen the fuel mixture nut.
4. Rotate the fuel mixture adjustment screw:
 - Counterclockwise for richer mixture (lower altitudes)
 - Clockwise for leaner mixture (higher altitudes)
5. Adjust the fuel mixture screw until the multimeter reads 60 Hz, which ensures optimal generator performance at full speed and maximum load.
6. After adjusting the fuel mixture, tighten the fuel mixture nut to lock the adjustment screw in place.

Figure 3.1 Fuel mixture adjustment screw



3.2.4 Starting the generator

Diesel recoil start

Some diesel generators feature electric-start engines with auxiliary recoil starter. Before starting the engine on these models, if a battery is not available, move the red or black lever near the fuel pump to the up position. If a 12-volt battery is installed, the lever must be in the down position at all times.

Air in fuel line

Air pockets in the fuel line will cause difficulty in starting and operating the generator. Diesel generators are particularly susceptible to air in the fuel line; Model XAF alternative-fuel generators are not affected.

- Before starting, pump the fuel lever 20 times or more.
- Do not allow the generator to run out of fuel or to the bottom of the fuel tank.

Starting procedure

CAUTION

Load on generator at startup or shutdown can damage equipment.

Remove all electric loads from the generator before starting or stopping the engine.

1. Before operating the generator, follow all instructions in Section 3.1 and Section 3.1.9.
2. Start the generator:
 - a. Disconnect all loads.
 - b. For models with an idler switch, turn the idler off.
 - c. If the generator has a fuel shutoff valve (located under the fuel tank), open the valve fully (turn it counterclockwise) to permit the flow of fuel from the tank to the engine.
 - d. Adjust the carburetor choke as necessary.
 - Cold-starting requires full choke.
 - LP- and NG-powered generators do not require a choke for starting.
 - Diesel-powered generators do not have a choke.
 - e. Start the engine using the electric starter or recoil cord, referring to engine manufacturer's instructions if necessary.
 - f. When the engine starts, close the choke.
 - g. For models with a ground-fault sensing module on the control panel, ensure the green light on the panel is lit.
3. Apply loads:
 - a. Before connecting any load to the generator, run the engine for 2 to 3 minutes, allowing it to reach normal operating temperature.
 - b. Apply loads by inserting plugs into the proper receptacles and turning on connected equipment.
 - c. See Section 3.2.2 for details about applying loads.

3.2.5 Stopping the generator

Gradually remove all loads from the generator before stopping the generator engine.

To stop the engine:

- On models with an electric starter, rotate the key to the off position.
- On all diesel models, you must keep pressure on the stop lever until the engine comes to a complete stop.
- On diesel generators with an electric-start engine and auxiliary recoil starter, if the generator does not have a battery, move the red or black lever near the fuel tank to the down position.
- On other models, move the start/stop switch on the engine to the stop position.

Always wait for the engine to come to a complete stop.

Runaway diesel engine

If the diesel engine does not stop when the start/stop switch is moved to the stop position, the oil in the engine sump has been overfilled and the engine is using over-pressurized sump oil as fuel.

To stop the engine with this condition you must block the air intake flow until the engine stops.

If this situation has occurred, the air filter will be saturated with oil and must be replaced before restarting the engine.

3.3 General maintenance

The generator should be run at least once a month for a few minutes to keep all components in proper operating condition.

For engine maintenance requirements, see the engine manual.

For troubleshooting, see the Voltmaster troubleshooting manual, available at www.voltmaster.com.

3.3.1 Gasoline-fueled generators

Model XCR, XSD, and XTP gasoline-fueled generators are EPA certified and require the following maintenance.

- The fuel cap includes a rubber gasket that can become worn over time. The gasket is important for keeping the fuel system sealed, and must be replaced if damaged. Check the gasket once a year. Use only a gasket that provides a vapor-proof seal. Use only manufacturer-approved replacement parts.
- The EPA-approved fuel lines are made from rubber that can degrade over time. The fuel lines are vital for proper operation, and must be replaced if damaged. Check the fuel lines once a year. Use only EPA-approved fuel lines.

3.3.2 Model XAF alternative-fuel generators

When servicing an XAF generator, shut off all fuel lines and eliminate all possible outside sources of ignition.

Only qualified personnel should service liquid propane and natural gas generators.

3.3.3 Changing the oil

Change the engine oil as specified in the engine manual. Oil should be drained while the engine is slightly warm.

3.3.4 Storage

Store the generator in a warm, dry location.

If the generator is used infrequently, the engine could become difficult to start. For gasoline-powered generators, a fuel additive can help prevent this situation from occurring. See "Fuel additive" on page 13.

Before putting the generator into storage for 6 months or longer, follow these steps:

1. Run the generator until it reaches normal operating temperature (about 10 minutes) and then shut it down.
2. For gasoline-powered generators, drain the fuel from the carburetor bowl.
3. While the engine is still warm, drain the oil from the engine base, then fill with fresh oil.
4. For gasoline-powered generators, remove the spark plug or plugs, pour 1 ounce of engine oil into the cylinder or cylinders, crank the engine slowly, and replace but do not tighten the spark plugs.
5. Service the air cleaner.
6. Plug the exhaust outlet to prevent moisture, bugs, and dirt from entering.
7. Clean off dirt and grease.
8. Put a cover over the unit and store to avoid extreme heat or cold.

3.3.5 Battery

For generator models that have a battery, regular maintenance is necessary for the battery to function properly and for long battery life.

Safety

DANGER



Explosive gases can cause blindness and severe injury.

When working on or near batteries:

- Wear eye protection.
- Prevent sparks and open flames.
- No smoking anywhere in the vicinity.
- Keep children clear of the area.

DANGER



Sulfuric acid can cause blindness and severe burns.

- Use caution when working on or near batteries.
- Never service batteries while generator is operating.
- Do not tilt generator or batteries.
- Avoid contact with skin, face, and eyes.
- Wear appropriate eye and hand protection.
- Upon contact with skin or eyes, immediately flush with water and seek medical help.
- Keep batteries out of reach of children.

Operation: General maintenance

- Even when batteries are not in operation, self-discharge generates hydrogen gas that can explode. Always store and work on batteries in a well ventilated area.
- Always wear proper eye, face, and hand protection when working on or near batteries. Battery acid will cause severe eye damage and skin burns. If contact with battery acid occurs, immediately flush with water and seek medical help.
- Keep all sparks, flames, and cigarettes away from batteries at all times.
- Never lean over batteries when testing or charging.
- Keep battery vent caps tight and level, except when watering batteries.
- Avoid tilting the generator with a battery installed.
- To prevent short circuits and sparks, exercise caution when working with metallic tools or conductors near batteries.
- To reduce the risk of sparks, ensure connectors make good contact with battery terminals. Replace cables that appear suspicious or have visible cracks or bare wires.
- NEVER connect or disconnect battery cables from batteries or the generator while the engine is cranking or operating.
- ALWAYS ensure battery connections are the correct polarity. The red cable is positive (+) and the green cable is negative (-).
- Keep battery terminals clean and terminal connections tight.
- After making connections at the battery terminals, coat the terminals with a light application of petroleum jelly or grease to retard corrosion.

Charging

- Observe battery safety precautions (see “Safety” on page 30).
- To lengthen battery life and to prevent freezing, always keep batteries fully charged.
- The charging circuit is operational during engine cranking and running. The charging circuit is not designed to recharge a dead battery but only to maintain the charge in the battery. If the generator is not in regular, daily use, check battery voltage once a week.
- Charge the battery and keep it fully charged if any of the following conditions exist:
 - If the generator will be run infrequently
 - If the battery will be stored for a long period of time
 - If the battery will be located in an unheated room

Cleaning

- Observe battery safety precautions (see “Safety” on page 30).
- Keep batteries clean and dry, avoiding accumulation of dust, dirt, grime, and moisture.
- To clean batteries, use a solution of 50% baking soda and 50% water. Do not allow cleaning solution or other material to enter battery cells. Rinse batteries with clean water and allow to dry thoroughly.
- At least once a year, visually inspect terminals and cables for signs of corrosion, especially in hot temperatures.

Appendix A

Power requirements

The information provided in this appendix is for reference only. Values presented here are not necessarily representative of all such equipment.

A.1 Sizing the generator

In most applications, the generator will provide power to devices that use a total wattage rating up to the rated wattage output of the generator. For example, to power ten 100 watt light bulbs, the generator rated wattage output would need to be 1000 watts ($10 \times 100 = 1000$).

In order to operate an appliance that has an electric motor, such as a compressor, pump, freezer, saw, or drill, you must calculate the wattage required to start the appliance motor. The rule of thumb is to multiply the wattage requirement by three. For example, to run a drill with a rated wattage requirement of 300 watts, the wattage requirement to start the electric motor would be 900 watts ($300 \times 3 = 900$).

- To calculate wattage, use the formula in Figure A-1.
- For the approximate starting wattage for appliances with motors, see Table A-1.
- When using extension cords, refer to Table A-2.
- For approximate equipment power requirements, see Table A-3.

Figure A-1 Formula for calculating wattage

$$\text{Volts} \times \text{Amps} = \text{Watts}$$

Table A-1 Approximate current requirements for electric motors

Horsepower	Running watts	Starting watts			
		Universal motor*	Induction motor	Capacitor motor	Split-phase motor
1/6	275	400	600	850	1200
1/4	400	500	850	1050	1700
1/3	450	600	950	1350	1950
1/2	600	750	1300	1800	2600
3/4	850	1000	1900	2600	—
1	1000	1250	2300	3000	—
1 1/2	1600	1750	3200	4200	—
2	2000	2350	3900	5100	—
3	3000	—	5200	6800	—
5	4800	—	7500	9800	—

*Small appliance

NOTE: For pumps, air compressors, air conditioners, and inverters, add at least 25% to starting wattage.

Table A-2 Minimum extension cord gauge

Amps	Continuous load		Minimum gauge		
	Watts		0–50 foot length	50–100 foot length	100–150 foot length
	@ 120 volts	@ 240 volts			
2	240	480	22	20	18
3	360	720	22	18	16
4	480	960	20	16	16
5	600	1200	18	16	14
6	720	1440	18	16	14
8	960	1920	16	14	12
10	1200	2400	16	12	12
12	1440	2880	16	12	10
14	1680	3360	14	12	10
16	1920	3840	14	10	10
18	2160	4320	14	10	8
20	2400	4800	12	10	8
22	2640	5280	12	10	8
25	3000	6000	12	10	6
30	3600	7200	10	8	6
35	4200	8400	10	8	4
40	4800	9600	8	6	2
50	6000	12,000	6	4	2
60	7200	14,400	4	2	—

Table A-3 Approximate equipment power requirements*

Household and RV equipment		Running watts	Starting watts
Central air conditioner	10,000 BTU	1500	2200
Clothes dryer, electric		5200	5750
Clothes dryer, gas		700	1800
Clothes washing machine		1150	2300
Coffee maker		1750	—
Computer, desktop		600–800	—
Computer, laptop		200–250	—
Computer monitor		200–250	—
Computer printer		400–600	—
Dishwasher, cool dry		700	1400
Dishwasher, hot dry		1450	1400
Frying pan, electric		1300	—
Furnace fan, gas or oil	1/8 HP	300	500
	1/6 HP	500	750
	1/4 HP	600	1000
	1/3 HP	700	1400
	1/2 HP	875	2350
Hair dryer		300–1200	—
Iron		1200	—
Lights	bulb wattage	bulb wattage	—
Microwave oven	650 watts	1000	1000
	1000 watts	1500	1500
Radio		50–200	—
Refrigerator or freezer		700	2200
RV air conditioner	7,000 BTU	600	1700
	10,000 BTU	700	2000
	13,500 BTU	1250	2750
	15,000 BTU	1500	3500
Stove, electric	6-inch element	1500	—
	8-inch element	2100	—
Sump pump	1/3 HP	800	1300
	1/2 HP	1050	2150
Television		300	—
Toaster, 2-slice		1050	—
Toaster, 4-slice		1650	—
Well pump	1/2 HP	1000	2100
Vacuum cleaner		800–1100	—

Table A-3 Approximate equipment power requirements* (continued)

Contractor equipment		Running watts	Starting watts
Air compressor (see Table A-1)	1/2 HP	975	1600
	1 HP	1600	4500
	1 1/2 HP	2200	6000
	2 HP	2800	7700
Bench grinder	8 inch	1400	2500
Circular saw	6 inch	950	2200
	7 1/4 inch	1200	2600
	8 1/2 inch	1500	3000
	10 inch	2000	3900
Drill	1/4 inch	300	400
	3/8 inch	475	650
	1/2 inch	750	900
	1 inch	1000	1250
Impact wrench	1/2 inch	600	750
	3/4 inch	750	900
	1 inch	1200	1400
Jig saw		300	400
Miter saw	10 amp	1100	2000
	15 amp	1650	3000
Mixer	3 1/2 cubic ft.	1000	2300
Pressure washer	5/8 HP	900	2700
	1 HP	1200	3600
Reciprocating saw, heavy-duty		750	1400
Sander, belt, disc or orbital		1200	2600
Table saw	10 inch	1800	4500
Water pump, non-submersible	3000 gph	600	2250
	5000 gph	750	2850
	10,000 gph	1100	4100
	15,000 gph	1600	5250
Water pump, submersible	3000 gph	500	1750
	5000 gph	650	2500
	10,000 gph	1000	3750
	15,000 gph	1500	5000
Welder, electric	70 amp AC	2800	—
	200 amp AC	9000	—
	230 amp AC @100 amps	7800	—
	250 amp AC/DC @75 amps	9800	—

Table A-3 Approximate equipment power requirements* (continued)

Farm equipment		Running watts	Starting watts
Battery charger	4 amp	90	—
	15 amp	380	—
	60 amp with 240-amp boost	1500/5750	—
	100 amp with 300-amp boost	2400/7800	—
Electric fence	25 mile	250	—
Grain cleaner	1/4 HP	650	1000
Grain conveyor, portable	1/2 HP	1000	2400
Heater, portable liquid-fuel type	50,000 BTU	400	675
	100,000 BTU	500	1260
	150,000 BTU	625	1875
Heater, portable radiant type		1300	—
Milk cooler		1100	1800
Milker (vacuum pump)	2 HP	1000	2300
Stock tank de-icer		1000	—

**The power requirements listed here are estimates. To determine actual wattage for the items you wish to power, refer to owner's manuals or the data plate on the equipment.*

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