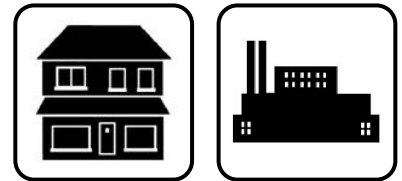


# Maintenance

## Industrial Generator Set



Models:

**KG80, KG80R, KG100, KG125, KG125R,  
KG150, KG150R, KG180, KG200**

**⚠ WARNING:** This product can expose you to chemicals, including carbon monoxide and benzene, which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to [www.P65warnings.ca.gov](http://www.P65warnings.ca.gov)

## Product Identification Information

Product identification numbers determine service parts. Record the product identification numbers in the spaces below immediately after unpacking the products so that the numbers are readily available for future reference. Record field-installed kit numbers after installing the kits.

### Generator Set Identification Numbers

Record the product identification numbers from the engine nameplate(s).

Model Designation \_\_\_\_\_

Specification Number \_\_\_\_\_

Serial Number: \_\_\_\_\_

### Controller Identification

Record the controller description from the generator set operation manual, spec sheet, or sales invoice.

Controller Description \_\_\_\_\_

### Engine Identification

Record the product identification information from the engine nameplate.

Manufacturer \_\_\_\_\_

Model Designation \_\_\_\_\_

Serial Number \_\_\_\_\_

| Accessory Number | Accessory Description |
|------------------|-----------------------|
|                  |                       |
|                  |                       |
|                  |                       |
|                  |                       |
|                  |                       |

| Accessory Number | Accessory Description |
|------------------|-----------------------|
|                  |                       |
|                  |                       |
|                  |                       |
|                  |                       |
|                  |                       |

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# Safety Precautions and Instructions

**IMPORTANT SAFETY INSTRUCTIONS.** Electromechanical equipment, including generator sets, transfer switches, switchgear, and accessories, can cause bodily harm and pose life-threatening danger when improperly installed, operated, or maintained. To prevent accidents be aware of potential dangers and act safely. Read and follow all safety precautions and instructions. **SAVE THESE INSTRUCTIONS.**

This manual has several types of safety precautions and instructions: Danger, Warning, Caution, and Notice.



**DANGER**

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.



**WARNING**

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.



**CAUTION**

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

## **NOTICE**

NOTICE is used to address practices not related to physical injury.

Safety decals affixed to the equipment in prominent places alert the operator or service technician to potential hazards and explain how to act safely. The decals are shown throughout this publication to improve operator recognition. Replace missing or damaged decals.

## **Accidental Starting**



**WARNING**



**Accidental starting.  
Can cause severe injury or death.**

Disconnect the battery cables before working on the generator set. Remove the negative (–) lead first when disconnecting the battery. Reconnect the negative (–) lead last when reconnecting the battery.

**Disabling the generator set. Accidental starting can cause severe injury or death.** Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (–) lead first. Reconnect the negative (–) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

## Battery

|                                                                                                  |                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>WARNING</b> | <b>Sulfuric acid in batteries.</b><br><b>Can cause severe injury or death.</b><br>Wear protective goggles and clothing. Battery acid may cause blindness and burn skin.                                                        |
|                 |                                                                                                                                                                                                                                |
|  <b>WARNING</b> | <b>Explosion.</b><br><b>Can cause severe injury or death.</b><br><b>Relays in the battery charger cause arcs or sparks.</b><br>Locate the battery in a well-ventilated area. Isolate the battery charger from explosive fumes. |
|                 |                                                                                                                                                                                                                                |

**Battery electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death.** Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. If battery acid splashes in the eyes or on the skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

**Battery acid cleanup. Battery acid can cause severe injury or death.** Battery acid is electrically conductive and corrosive. Add 500 g (1 lb.) of bicarbonate of soda (baking soda) to a container with 4 L (1 gal.) of water and mix the neutralizing solution. Pour the neutralizing solution on the spilled battery acid and continue to add the neutralizing solution to the spilled battery acid until all evidence of a chemical reaction (foaming) has ceased. Flush the resulting liquid with water and dry the area.

**Battery gases. Explosion can cause severe injury or death.** Battery gases can cause an explosion. Do not smoke or permit flames or sparks to occur near a battery at any time, particularly when it is charging. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects. Remove all jewelry before servicing the equipment. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface away from the battery. To avoid sparks, do not disturb the battery charger connections while the battery is charging. Always turn the battery charger off before disconnecting the battery connections. Ventilate the compartments containing batteries to prevent accumulation of explosive gases.

**Battery short circuits. Explosion can cause severe injury or death.** Short circuits can cause bodily injury and/or equipment damage. Disconnect the battery before generator set installation or maintenance. Remove all jewelry before servicing the equipment. Use tools with insulated handles. Remove the negative (–) lead first when disconnecting the battery. Reconnect the negative (–) lead last when reconnecting the battery. Never connect the negative (–) battery cable to the positive (+) connection terminal of the starter solenoid. Do not test the battery condition by shorting the terminals together.

## Engine Backfire/Flash Fire

|                                                                                                  |                                                                        |
|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
|  <b>WARNING</b> | <b>Risk of fire.</b><br><b>Can cause severe injury or death.</b>       |
|                 | Do not smoke or permit flames or sparks near fuels or the fuel system. |

**Servicing the fuel system. A flash fire can cause severe injury or death.** Do not smoke or permit flames or sparks near the carburetor, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuels or fuel vapors. Catch fuels in an approved container when removing the fuel line or carburetor.

**Servicing the air cleaner. A sudden backfire can cause severe injury or death.** Do not operate the generator set with the air cleaner removed.

**Combustible materials. A fire can cause severe injury or death.** Generator set engine fuels and fuel vapors are flammable and explosive. Handle these materials carefully to minimize the risk of fire or explosion. Equip the compartment or nearby area with a fully charged fire extinguisher. Select a fire extinguisher rated ABC or BC for electrical fires or as recommended by the local fire code or an authorized agency. Train all personnel on fire extinguisher operation and fire prevention procedures.

**Combustible materials. A fire can cause severe injury or death.** If using generator heaters during storage, remove combustible materials such as covers from contact with the heater or from areas where heat could potentially cause a fire.

## Exhaust System

|                                                                                                  |                                                                                |
|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
|  <b>WARNING</b> | <b>Carbon monoxide.</b><br><b>Can cause severe nausea, fainting, or death.</b> |
|                | The exhaust system must be leakproof and routinely inspected.                  |

**Generator set operation. Carbon monoxide can cause severe nausea, fainting, or death.** Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Avoid breathing exhaust fumes when working on or near the generator set. Never operate the generator set inside a building unless the exhaust gas is piped safely outside. Never operate the generator set where exhaust gas could accumulate and seep back inside a potentially occupied building.

**Carbon monoxide symptoms. Carbon monoxide can cause severe nausea, fainting, or death.** Carbon monoxide is a poisonous gas present in exhaust gases. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Carbon monoxide poisoning symptoms include but are not limited to the following:

- Light-headedness, dizziness
- Physical fatigue, weakness in joints and muscles
- Sleepiness, mental fatigue, inability to concentrate or speak clearly, blurred vision
- Stomachache, vomiting, nausea

If experiencing any of these symptoms and carbon monoxide poisoning is possible, seek fresh air immediately and remain active. Do not sit, lie down, or fall asleep. Alert others to the possibility of carbon monoxide poisoning. Seek medical attention if the condition of affected persons does not improve within minutes of breathing fresh air.

## Fuel System

|                                                                                                  |                                                                           |
|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
|  <b>WARNING</b> | <b>Explosive fuel vapors.</b><br><b>Can cause severe injury or death.</b> |
|                 | Use extreme care when handling, storing, and using fuels.                 |

**The fuel system. Explosive fuel vapors can cause severe injury or death.** Vaporized fuels are highly explosive. Use extreme care when handling and storing fuels. Store fuels in a well-ventilated area away from spark-producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running because spilled fuel may ignite on contact with hot parts or from sparks. Do not smoke or permit flames or sparks to occur near sources of spilled fuel or fuel vapors. Keep the fuel lines and connections tight and in good condition. Do not replace flexible fuel lines with rigid lines. Use flexible sections to avoid fuel line breakage caused by vibration. Do not operate the generator set in the presence of fuel leaks, fuel accumulation, or sparks. Repair fuel systems before resuming generator set operation.

**Explosive fuel vapors can cause severe injury or death.** Take additional precautions when using the following fuels:

**Propane (LPG)**—Adequate ventilation is mandatory. Because propane is heavier than air, install propane gas detectors low in a room. Inspect the detectors per the manufacturer's instructions.

**Natural Gas**—Adequate ventilation is mandatory. Because natural gas rises, install natural gas detectors high in a room. Inspect the detectors per the manufacturer's instructions.

**Gas fuel leaks. Explosive fuel vapors can cause severe injury or death.** Fuel leakage can cause an explosion. Check the LPG vapor or natural gas fuel system for leakage by using a soap and water solution with the fuel system test pressurized to 6–8 ounces per square inch (10–14 inches water column). Do not use a soap solution containing either ammonia or chlorine because both prevent bubble formation. A successful test depends on the ability of the solution to bubble.

## Hazardous Noise

|                                                                                                    |                                                                                    |
|----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|  <b>CAUTION</b> | <b>Hazardous noise.</b><br><b>Can cause hearing loss.</b>                          |
|                 | Never operate the generator set without a muffler or with a faulty exhaust system. |

**Engine noise. Hazardous noise can cause hearing loss.** Generator sets not equipped with sound enclosures can produce noise levels greater than 105 dBA. Prolonged exposure to noise levels greater than 85 dBA can cause permanent hearing loss. Wear hearing protection when near an operating generator set.

## Hazardous Voltage/Moving Parts

|                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>  <b>DANGER</b> </div> <div>  </div>  | <p><b>Hazardous voltage.</b><br/> <b>Will cause severe injury or death.</b><br/>           Disconnect all power sources before opening the enclosure.</p>                                                                                                                                                            |
| <div>  <b>DANGER</b> </div> <div>  </div>  | <p><b>Hazardous voltage. Moving parts.</b><br/> <b>Will cause severe injury or death.</b><br/>           Operate the generator set only when all guards and electrical enclosures are in place.</p>                                                                                                                  |
| <div>  <b>WARNING</b> </div> <div>  </div> | <p><b>Hazardous voltage. Backfeed to the utility system.</b><br/> <b>Can cause property damage, severe injury, or death.</b><br/>           If the generator set is used for standby power, install an automatic transfer switch to prevent inadvertent interconnection of standby and normal sources of supply.</p> |

**Grounding electrical equipment. Hazardous voltage will cause severe injury or death.** Electrocutation is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set, transfer switch, and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

**High voltage test. Hazardous voltage will cause severe injury or death.** Follow the instructions of the test equipment manufacturer when performing high-voltage tests on the rotor or stator. An improper test procedure can damage equipment or lead to generator set failure.

**Connecting the battery and the battery charger. Hazardous voltage will cause severe injury or death.** Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

**Short circuits. Hazardous voltage/current will cause severe injury or death.** Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

**Engine block heater. Hazardous voltage will cause severe injury or death.** The engine block heater can cause electrical shock. Remove the engine block heater plug from the electrical outlet before working on the block heater electrical connections.

**Electrical backfeed to the utility. Hazardous backfeed voltage can cause severe injury or death.** Install a transfer switch in standby power installations to prevent the connection of standby and other sources of power. Electrical backfeed into a utility electrical system can cause severe injury or death to utility personnel working on power lines.

**Testing live electrical circuits. Hazardous voltage or current will cause severe injury or death.** Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically. (600 volts and under)

|                                                                                                  |                                                                                             |
|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
|  <b>WARNING</b> | <b>Airborne particles.</b><br><b>Can cause severe injury or blindness.</b>                  |
|                 | Wear protective goggles and clothing when using power tools, hand tools, or compressed air. |

**Servicing the generator set when it is operating. Exposed moving parts will cause severe injury or death.** Keep hands, feet, hair, clothing, and test leads away from the belts and pulleys when the generator set is running. Replace guards, screens, and covers before operating the generator set.

## Heavy Equipment

|                                                                                                  |                                                                                                                    |
|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
|  <b>WARNING</b> | <b>Unbalanced weight.</b><br><b>Improper lifting can cause severe injury or death and equipment damage.</b>        |
|                 | Do not use lifting eyes. Lift the generator set using lifting bars inserted through the lifting holes on the skid. |

## Hot Parts

|                                                                                                    |                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>WARNING</b>   | <b>Hot coolant and steam.</b><br><b>Can cause severe injury or death.</b>                                                                                          |
|                  | Before removing the pressure cap, stop the generator set and allow it to cool. Then loosen the pressure cap to relieve pressure. Fill system before starting unit. |
|  <b>WARNING</b> | <b>Hot engine and exhaust system.</b><br><b>Can cause severe injury or death.</b>                                                                                  |
|                 | Do not work on the generator set until it cools.                                                                                                                   |

**Servicing the alternator. Hot parts can cause severe injury or death.** Avoid touching the alternator field or exciter armature. When shorted, the alternator field and exciter armature become hot enough to cause severe burns.

**Servicing the exhaust system. Hot parts can cause severe injury or death.** Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.

This manual provides the maintenance schedule and general maintenance procedures for the Kohler generator set models listed on the front cover. For engine or alternator related maintenance schedules and procedures, refer to the engine or alternator operation manuals. Refer to the Appendix, Operating Hours Service Log, for a means to document maintenance.

**Note:**

Have maintenance work, including battery service, performed by appropriately skilled and suitably trained maintenance personnel familiar with generator set operation and service.

Information in this publication represents data available at the time of print. Kohler Co. reserves the right to change this publication and the products represented without notice and without any obligation or liability whatsoever.

Read this manual and carefully follow all procedures and safety precautions to ensure proper equipment operation and to avoid bodily injury. Read and follow the Safety Precautions and Instructions section at the beginning of this manual. Keep this manual with the equipment for future reference.

**Abbreviations**

This publication makes use of numerous abbreviations. Typically, the word(s) are spelled out along with the abbreviation in parentheses when shown for the first time in a section. Refer to the Abbreviations section in the Appendices for abbreviation definitions.

**Related Literature**

| Manual Description                               | Literature Part No. |
|--------------------------------------------------|---------------------|
| KG6208 Engine Operation Manual                   | TP-7095             |
| KG10V08T Engine Operation and Maintenance Manual | TP-7172             |
| Engine Diagnostic and Troubleshooting Manual     | TP-7097             |
| Alternator Service Manual, FRX                   | TP-6783             |
| Alternator Service Manual, FRII                  | TP-6353             |
| APM402 Controller Operation Manual               | TP-6694             |
| APM603 Controller Operation Manual               | TP-7165             |
| Generator Set Installation Manual                | TP-5700             |
| Wiring Diagram, Ind (KG40-KG125)                 | TP-7112             |
| Wiring Diagrams, Resi (KG80R-KG125R)             | TP-7130             |
| Wiring Diagrams, Ind (KG150, KG180, KG200)       | TP-7174             |
| Wiring Diagrams, Resi (KG150R)                   | TP-7175             |

Figure 1 Related Literature

## Service Assistance

---

For professional advice and conscientious service, please contact your nearest Kohler distributor or dealer.

- Visit the Kohler Co. website at KOHLERPower.com.
- Look at the labels and decals on your Kohler product or review the appropriate literature or documents included with the product.
- Call toll free in the US and Canada 1-800-544-2444.
- Outside the US and Canada, call the nearest regional office.

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### Japan, Korea

North Asia Regional Office  
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Fax: (813) 3440-2727

### 1.1 Safety Precautions

|                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>WARNING</b>                                                                                                                                                      | <b>Accidental starting.</b><br><b>Can cause severe injury or death.</b><br>Disconnect the battery cables before working on the generator set. Remove the negative (–) lead first when disconnecting the battery. Reconnect the negative (–) lead last when reconnecting the battery. |
|    |                                                                                                                                                                                                                                                                                      |

**Disabling the generator set. Accidental starting can cause severe injury or death.** Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (–) lead first. Reconnect the negative (–) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

**Testing live electrical circuits. Hazardous voltage or current will cause severe injury or death.** Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically. (600 volts and under)

**Grounding electrical equipment. Hazardous voltage will cause severe injury or death.** Electrocutation is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

**Short circuits. Hazardous voltage/current will cause severe injury or death.** Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

|                                                                                                    |                                                                                                                                       |
|----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
|  <b>WARNING</b> | <b>Hot engine and exhaust system.</b><br><b>Can cause severe injury or death.</b><br>Do not work on the generator set until it cools. |
|                 |                                                                                                                                       |

**Servicing the exhaust system. Hot parts can cause severe injury or death.** Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.

**Servicing the alternator. Hot parts can cause severe injury or death.** Avoid touching the alternator field or exciter armature. When shorted, the alternator field and exciter armature become hot enough to cause severe burns.

|                                                                                                                                                                     |                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
|  <b>DANGER</b>                                                                     | <b>Hazardous voltage. Moving parts.</b><br><b>Will cause severe injury or death.</b>   |
|   | Operate the generator set only when all guards and electrical enclosures are in place. |

**Servicing the generator set when it is operating. Exposed moving parts will cause severe injury or death.** Keep hands, feet, hair, clothing, and test leads away from the belts and pulleys when the generator set is running. Replace guards, screens, and covers before operating the generator set.

## 1.2 Generator Set Service

The prestart checklist in the controller operation manual lists main areas of the generator set that require attention. Some procedures may also require using the generator set service manual or engine service manual.

### Note:

Have maintenance work, including battery service, performed by appropriately skilled and suitably trained maintenance personnel familiar with generator set operation and service.

**Kohler recommends the use of Kohler Genuine oil, filters, and coolant for maintenance and service.**

### 1.2.1 Alternator Service

Under normal operating conditions, the generator set's alternator requires no routine service.

When operating the generator set under dusty or dirty conditions, use dry compressed air to blow dust out of the alternator while the generator set is running. Direct the stream of air through openings in the generator set end bracket.

Refer to the alternator maintenance manual (listed in Related Literature) for typical engine maintenance procedures and maintenance intervals.

### 1.2.2 Engine Service

Perform engine service at the intervals specified in the engine operation manual. Contact an authorized Kohler distributor/dealer to obtain engine literature. Refer to the engine operation manual (listed in Related Literature) for typical engine maintenance procedures and maintenance intervals such as:

- Break-in service
- Checking or changing the engine oil and oil filter(s)
- Replacing the air filter
- Valve lash adjustment

| System—Component                                                                                                                                                                                                                                                                                                                                                                                                                        | Action           |       |        |       |      | Interval   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------|--------|-------|------|------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                         | Visually Inspect | Check | Change | Clean | Test |            |
| Daily                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |       |        |       |      |            |
| Oil level                                                                                                                                                                                                                                                                                                                                                                                                                               | ●                | ●     |        |       |      | Daily      |
| Coolant level                                                                                                                                                                                                                                                                                                                                                                                                                           | ●                | ●     |        |       |      | Daily      |
| Leakage                                                                                                                                                                                                                                                                                                                                                                                                                                 | X                | X     |        |       |      | Daily      |
| Any condition of vibration, leakage, noise, temperature, or deterioration                                                                                                                                                                                                                                                                                                                                                               | X                | X     |        | X     |      | Daily      |
| Clean and tighten battery terminals                                                                                                                                                                                                                                                                                                                                                                                                     | X                | X     |        |       |      | Daily      |
| Weekly                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |       |        |       |      |            |
| Flexible lines and connections                                                                                                                                                                                                                                                                                                                                                                                                          | X                |       | R      |       |      | Weekly     |
| Air cleaner to room/enclosure                                                                                                                                                                                                                                                                                                                                                                                                           |                  | X     |        |       |      | Weekly     |
| Block heater operation                                                                                                                                                                                                                                                                                                                                                                                                                  |                  | X     |        |       |      | Weekly     |
| Flexible hoses and connectors                                                                                                                                                                                                                                                                                                                                                                                                           | X                | X     |        |       |      | Weekly     |
| Water pump(s)                                                                                                                                                                                                                                                                                                                                                                                                                           | ●                |       |        |       |      | Weekly     |
| Drain condensate trap                                                                                                                                                                                                                                                                                                                                                                                                                   |                  | X     |        |       |      | Weekly     |
| Controller lamp test                                                                                                                                                                                                                                                                                                                                                                                                                    | X                |       |        |       | R    | Weekly     |
| General Inspection                                                                                                                                                                                                                                                                                                                                                                                                                      | X                |       |        |       |      | Weekly     |
| Compartment condition                                                                                                                                                                                                                                                                                                                                                                                                                   | X                |       |        | X     |      | Weekly     |
| Ensure that system is set for automatic operation                                                                                                                                                                                                                                                                                                                                                                                       | X                |       |        |       |      | Weekly     |
| Interior of equipment room or outdoor weather housing                                                                                                                                                                                                                                                                                                                                                                                   | X                |       |        | X     |      | Weekly     |
| Monthly                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |       |        |       |      |            |
| Fan and alternator belts                                                                                                                                                                                                                                                                                                                                                                                                                | ●                | ●     | R      |       |      | Monthly    |
| Battery charger operation, charge rate                                                                                                                                                                                                                                                                                                                                                                                                  | X                |       |        |       |      | Monthly    |
| Battery electrolyte level                                                                                                                                                                                                                                                                                                                                                                                                               |                  | X     |        |       |      | Monthly    |
| Battery specific gravity, charge state                                                                                                                                                                                                                                                                                                                                                                                                  |                  |       |        |       | X    | Monthly    |
| Recharge after engine start                                                                                                                                                                                                                                                                                                                                                                                                             |                  | X     |        |       |      | Monthly    |
| Remove corrosion, clean and dry battery and rack                                                                                                                                                                                                                                                                                                                                                                                        | X                |       |        | X     |      | Monthly    |
| Circuit breakers, fuses (Do not break manufacturer's seals or internally inspect.)                                                                                                                                                                                                                                                                                                                                                      | X                | X     | R      | X     | X    | Monthly    |
| Remote control                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |       |        |       | X    | Monthly    |
| Run generator set                                                                                                                                                                                                                                                                                                                                                                                                                       |                  |       |        |       | X    | Monthly    |
| Quarterly                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |       |        |       |      |            |
| Crankcase breather                                                                                                                                                                                                                                                                                                                                                                                                                      | ●                |       | ●      |       |      | Quarterly  |
| Insulation, fire hazards                                                                                                                                                                                                                                                                                                                                                                                                                | X                |       |        |       |      | Quarterly  |
| Wire abrasions where subject to motion                                                                                                                                                                                                                                                                                                                                                                                                  | X                | X     |        |       |      | Quarterly  |
| Six Months                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |       |        |       |      |            |
| Safety and alarm operation                                                                                                                                                                                                                                                                                                                                                                                                              |                  | X     |        |       | X    | Six Months |
| Coolant temperature protection level                                                                                                                                                                                                                                                                                                                                                                                                    |                  |       |        |       | ●    | Six Months |
| Flexible connector(s)                                                                                                                                                                                                                                                                                                                                                                                                                   | X                |       |        |       |      | Six Months |
| Tighten DC electrical connections                                                                                                                                                                                                                                                                                                                                                                                                       |                  | X     |        |       |      | Six Months |
| ● Follow procedures and frequencies indicated in the engine manufacturer's maintenance manual. If not indicated, follow this service schedule. Some items may not apply to all generator sets.<br>R Replace as necessary.<br>X Action.<br>* Service more frequently if operated in dusty areas.<br><b>Note:</b> For the Voltage-sensing device/relay adjustment, do not break manufacturer's seals or internally inspect these devices. |                  |       |        |       |      |            |

## Service Schedule, continued

| System—Component                                                                                                                                                                                                                                                                                                                                                                                                                        | Action           |       |        |       |      | Interval                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------|--------|-------|------|-----------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                         | Visually Inspect | Check | Change | Clean | Test |                                                                             |
| Yearly                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |       |        |       |      |                                                                             |
| Tighten control and power wiring connections                                                                                                                                                                                                                                                                                                                                                                                            |                  | X     |        |       |      | Yearly                                                                      |
| Air ducts, louvers                                                                                                                                                                                                                                                                                                                                                                                                                      |                  | X     |        | X     |      | Yearly                                                                      |
| Fuel piping                                                                                                                                                                                                                                                                                                                                                                                                                             | X                |       |        |       |      | Yearly                                                                      |
| Louver motors and controls                                                                                                                                                                                                                                                                                                                                                                                                              | X                |       |        | X     | X    | Yearly                                                                      |
| Radiator exterior                                                                                                                                                                                                                                                                                                                                                                                                                       |                  | X     |        | X     |      | Yearly                                                                      |
| Water supply to the heat exchanger                                                                                                                                                                                                                                                                                                                                                                                                      |                  | X     |        |       |      | Yearly                                                                      |
| Excessive back pressure                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |       |        |       | X    | Yearly                                                                      |
| Hangers and supports                                                                                                                                                                                                                                                                                                                                                                                                                    | X                |       |        |       |      | Yearly                                                                      |
| Battery load testing                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |       |        |       | X    | Yearly                                                                      |
| Two Years                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |       |        |       |      |                                                                             |
| APM603 RTC battery                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |       | R      |       |      | When indicated by the controller, 2–10 Years                                |
| Three Years                                                                                                                                                                                                                                                                                                                                                                                                                             |                  |       |        |       |      |                                                                             |
| Wire-cable insulation breakdown                                                                                                                                                                                                                                                                                                                                                                                                         | X                |       |        |       | X    | 3 Years or 500 Hrs.                                                         |
| Refer to Engine Operation Manual                                                                                                                                                                                                                                                                                                                                                                                                        |                  |       |        |       |      |                                                                             |
| General engine inspection                                                                                                                                                                                                                                                                                                                                                                                                               | ●                |       |        |       |      | Refer to engine operation manual for service intervals and instructions.    |
| Air cleaner service                                                                                                                                                                                                                                                                                                                                                                                                                     |                  | ●     | ●      |       |      |                                                                             |
| Ignition components                                                                                                                                                                                                                                                                                                                                                                                                                     | ●                |       |        | ●     |      |                                                                             |
| Bolt torque                                                                                                                                                                                                                                                                                                                                                                                                                             |                  | ●     |        |       | ●    |                                                                             |
| Change oil                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |       | ●      |       |      |                                                                             |
| Replace filter(s)*                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |       | ●      |       |      |                                                                             |
| Coolant                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |       | ●      |       |      |                                                                             |
| Tightness of the oil cooler and charge air cooler couplers.                                                                                                                                                                                                                                                                                                                                                                             |                  | X     |        | X     |      |                                                                             |
| Refer to Alternator Operation Manual                                                                                                                                                                                                                                                                                                                                                                                                    |                  |       |        |       |      |                                                                             |
| General alternator inspection                                                                                                                                                                                                                                                                                                                                                                                                           | X                |       |        |       |      | Refer to alternator operation manual for service intervals and instructions |
| Rotor and stator                                                                                                                                                                                                                                                                                                                                                                                                                        | X                |       |        | X     |      |                                                                             |
| Bearing condition                                                                                                                                                                                                                                                                                                                                                                                                                       | X                | X     | R      |       |      |                                                                             |
| Exciter                                                                                                                                                                                                                                                                                                                                                                                                                                 | X                | X     |        | X     |      |                                                                             |
| Blow dust out of alternator*                                                                                                                                                                                                                                                                                                                                                                                                            | X                |       |        | ●     |      |                                                                             |
| Measure and record resistance readings of windings with insulation tester (Megger®, with SCR assembly or rectifier disconnected)                                                                                                                                                                                                                                                                                                        |                  |       |        |       | X    |                                                                             |
| ● Follow procedures and frequencies indicated in the engine manufacturer's maintenance manual. If not indicated, follow this service schedule. Some items may not apply to all generator sets.<br>R Replace as necessary.<br>X Action.<br>* Service more frequently if operated in dusty areas.<br><b>Note:</b> For the Voltage-sensing device/relay adjustment, do not break manufacturer's seals or internally inspect these devices. |                  |       |        |       |      |                                                                             |

● Follow procedures and frequencies indicated in the engine manufacturer's maintenance manual. If not indicated, follow this service schedule. Some items may not apply to all generator sets.

R Replace as necessary.

X Action.

\* Service more frequently if operated in dusty areas.

**Note:** For the Voltage-sensing device/relay adjustment, do not break manufacturer's seals or internally inspect these devices.

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## Section 2. Controller Maintenance

### APM402

The APM402 controller does not use a Real Time Clock (RTC) battery.

### APM603

The APM603 controller uses a CR1220 internal battery to preserve the time, date, and generator set events. If battery power is low, an alarm, "Replace Clock Battery," appears on the controller. The Real Time Clock (RTC) battery has an expected lifespan of ten years when the controller is powered by an engine battery or two years when the controller is not powered by an engine battery. Have an authorized Kohler service representative service the controller.

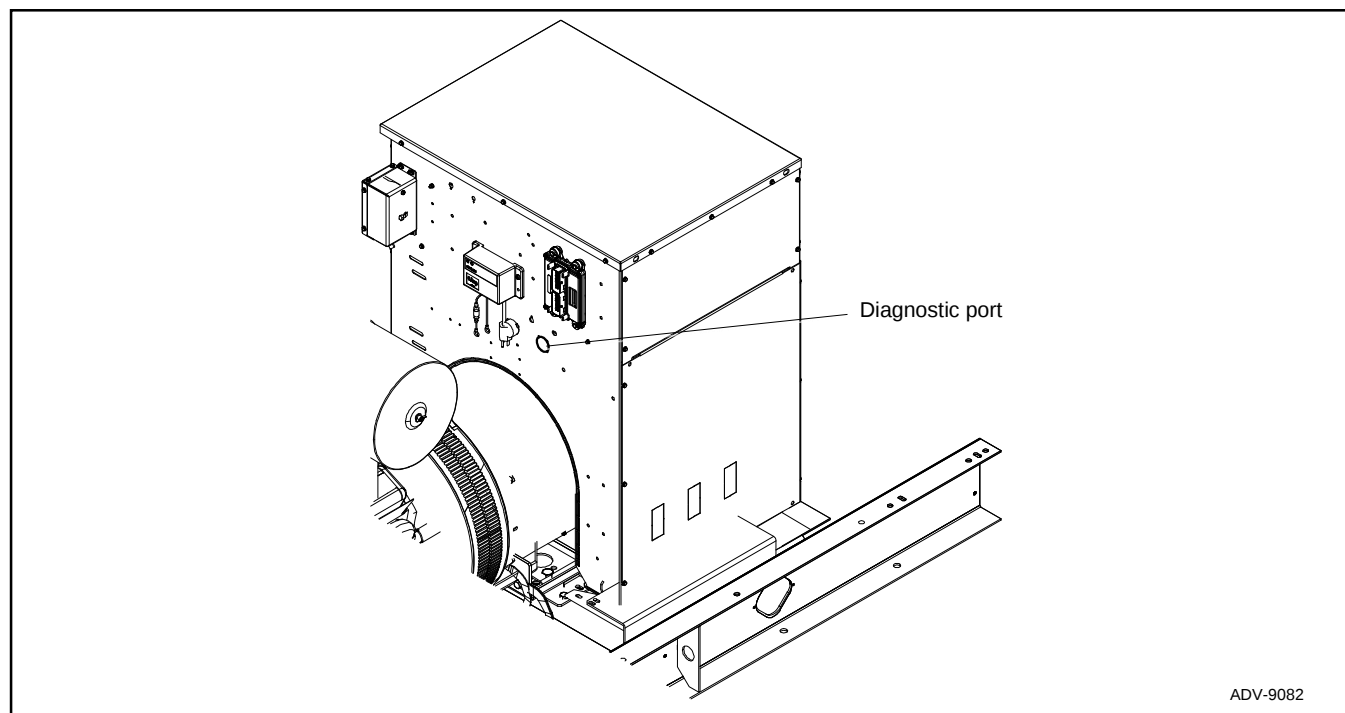
## Section 3. ECU Diagnostic Port

KG80-KG200 generator sets have a diagnostic port located on the junction box. Use the following for general informational purposes only. Contact an authorized service distributor/dealer for service or diagnostic equipment.

### Note:

For diagnostic and troubleshooting purposes, the ECM/ECU can be powered ON and OFF with the following methods:

- The engine ECM/ECU is typically powered ON and OFF with SiteTech™. See the SiteTech™ Software Manual for details.
- With the APM402 controller, the operator can also power the ECM/ECU ON and OFF through the controller menus. See the controller operation manual for details.
- With the APM603 controller, the operator can also power the ECU ON and OFF through the controller menus. The operator password is required. See the controller operation manual for details.
- The engine ECM/ECU can also be powered ON by cranking the engine.



ADV-9082

Figure 2 ECU Diagnostic Port, Typical



## Section 4. Alternator Maintenance

This section covers alternator maintenance for several different types of alternators. Refer to the instructions that correspond to the relevant alternator models.

- Refer to the generator set specification sheet for alternator models.
- Have an authorized distributor/dealer perform service.

|                                                                                                                                                                                                                                                       |                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>WARNING</b>                                                                                                                                                      | <b>Accidental starting.</b><br><b>Can cause severe injury or death.</b>                                                                                                                                   |
|    | Disconnect the battery cables before working on the generator set. Remove the negative (–) lead first when disconnecting the battery. Reconnect the negative (–) lead last when reconnecting the battery. |

**Disabling the generator set. Accidental starting can cause severe injury or death.** Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (–) lead first. Reconnect the negative (–) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

**Testing live electrical circuits. Hazardous voltage or current will cause severe injury or death.** Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically. (600 volts and under)

**Grounding electrical equipment. Hazardous voltage will cause severe injury or death.** Electrocution is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

**Short circuits. Hazardous voltage/current will cause severe injury or death.** Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

|                                                                                                    |                                                                                   |
|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
|  <b>WARNING</b> | <b>Hot engine and exhaust system.</b><br><b>Can cause severe injury or death.</b> |
|                 | Do not work on the generator set until it cools.                                  |

**Servicing the alternator. Hot parts can cause severe injury or death.** Avoid touching the alternator field or exciter armature. When shorted, the alternator field and exciter armature become hot enough to cause severe burns.

|                                                                                                                                                                         |                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
|  <b>DANGER</b>                                                                       | <b>Hazardous voltage. Moving parts.</b><br><b>Will cause severe injury or death.</b>   |
|   | Operate the generator set only when all guards and electrical enclosures are in place. |

**Servicing the generator set when it is operating. Exposed moving parts will cause severe injury or death.** Keep hands, feet, hair, clothing, and test leads away from the belts and pulleys when the generator set is running. Replace guards, screens, and covers before operating the generator set.

## **4.1 Check the Operation**

- Check the operation at regular intervals (no abnormal noise or vibration).
- Check the tightness of all nuts and bolts. Pay particular attention to the electrical connections.

## **4.2 Check the Ventilation**

- Ensure that air flow is not reduced by partial blocking of the air inlet and discharge grids by mud, fiber, grease, etc.
- Check for corrosion or abrasion on the air outlet grids.

## **4.3 Check the Windings**

Have an authorized distributor/dealer perform service. Refer to the appropriate alternator service manual. See the Related Literature.

When operating the generator set under dusty or dirty conditions, use dry compressed air to blow dust out of the alternator while the generator set is running. Direct the stream of air through openings in the generator set end bracket.

## **4.4 Check the Bearings**

Have an authorized service distributor/dealer perform service.

Replace the end bracket bearing every 10,000 hours of operation. Service the bearing more frequently if the annual inspection indicates excessive rotor end play or bearing damage. The sealed end bracket bearing requires no additional lubrication.

## Section 5. Gaseous Fuel Systems

Gaseous fuel systems apply to Kohler-powered generator set models.

This section describes natural gas and liquefied petroleum gas (LPG) fuel systems that are not covered in the engine operation manual or engine service manual.

|                                                                                                                                                                     |                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
|  <b>WARNING</b>                                                                    | <b>Explosive fuel vapors.</b><br><b>Can cause severe injury or death.</b> |
|   | Use extreme care when handling, storing, and using fuels.                 |

**The fuel system. Explosive fuel vapors can cause severe injury or death.** Vaporized fuels are highly explosive. Use extreme care when handling and storing fuels. Store fuels in a well-ventilated area away from spark-producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running because spilled fuel may ignite on contact with hot parts or from sparks. Do not smoke or permit flames or sparks to occur near sources of spilled fuel or fuel vapors. Keep the fuel lines and connections tight and in good condition. Do not replace flexible fuel lines with rigid lines. Use flexible sections to avoid fuel line breakage caused by vibration. Do not operate the generator set in the presence of fuel leaks, fuel accumulation, or sparks. Repair fuel systems before resuming generator set operation.

**Explosive fuel vapors can cause severe injury or death.** Take additional precautions when using the following fuels:

**Propane (LPG)**—Adequate ventilation is mandatory. Because propane is heavier than air, install propane gas detectors low in a room. Inspect the detectors per the manufacturer's instructions.

**Natural Gas**—Adequate ventilation is mandatory. Because natural gas rises, install natural gas detectors high in a room. Inspect the detectors per the manufacturer's instructions.

**Gas fuel leaks. Explosive fuel vapors can cause severe injury or death.** Fuel leakage can cause an explosion. Check the LPG vapor or natural gas fuel system for leakage by using a soap and water solution with the fuel system test pressurized to 6–8 ounces per square inch (10–14 inches water column). Do not use a soap solution containing either ammonia or chlorine because both prevent bubble formation. A successful test depends on the ability of the solution to bubble.

## 5.1 Gaseous Fuel System Concept (Single Fuel)

The gaseous fuel system uses a fuel solenoid valve to control the fuel flow to the direct acting electronic pressure regulator (DEPR). The generator set-mounted DEPR reduces the fuel pressure as fuel passes to the fuel mixer.

The fuel mixer controls the ratio of fuel to air under varying load and speed conditions. Because the air-fuel mixer receives fuel in a gaseous state, the air-fuel mixer does not have to vaporize the fuel.

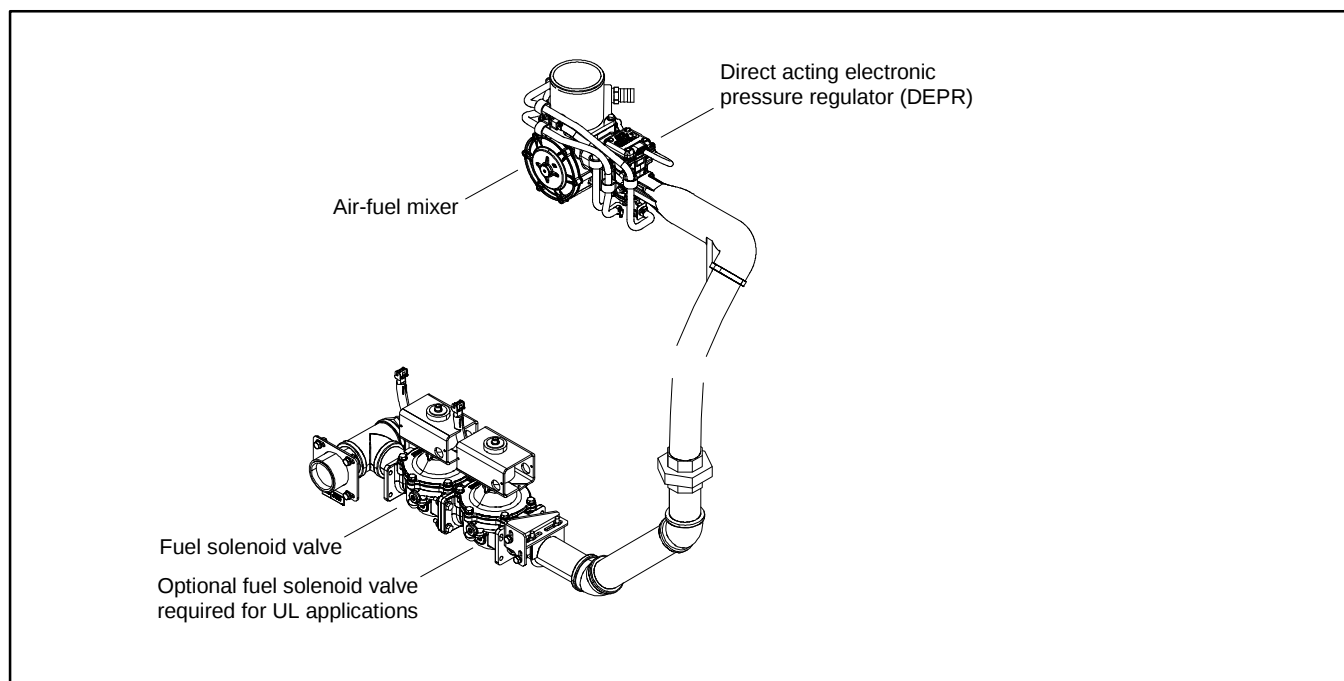


Figure 3 Fuel Regulator and Valve, Typical

### 5.1.1 Natural Gas and LPG Conversion

Most gaseous-fueled models can be converted to operate on either natural gas or LPG fuel. The engine ECM has fuel tables and spark advance curves programmed for both natural gas and LPG. To change the fuel type, change the electrical connections between the fuel system and the engine ECM as shown in the following instructions and connection diagrams. A hang tag on the fuel regulator may provide additional conversion setup information. Fuel conversion may decrease generator set output. Refer to the respective generator set spec sheet for ratings based on fuel selection. Changing fuel does not alter the emissions compliance of the generator set engine. Consult your local generator set distributor/dealer for additional information.

**Note:**

If a gaseous-fueled model has the fuel type changed (LPG to natural gas or natural gas to LPG), order a new nameplate from an authorized distributor/ dealer with the updated ratings and attach to the generator set.

Be sure to review the respective wiring diagram for your specific model for possible special applications.

**Note:**

KG150 engines ordered for use with natural gas cannot be converted to operate with LPG fuel.

### 5.1.1.1 Fuel Conversion Connections

For KG80–KG125, KG80R–KG125R (Kohler Engines KG6208TSD and KG6208THD), use the following:

See Figure 4 and Figure 5.

#### Natural Gas Operation

- Disconnect the black fuel connector (J7).
- Disconnect 49 and N17.
- Connect the white fuel connector (J8).
- For UL applications, connect the optional UL fuel blocking valve (J30).

#### LPG Vapor Operation

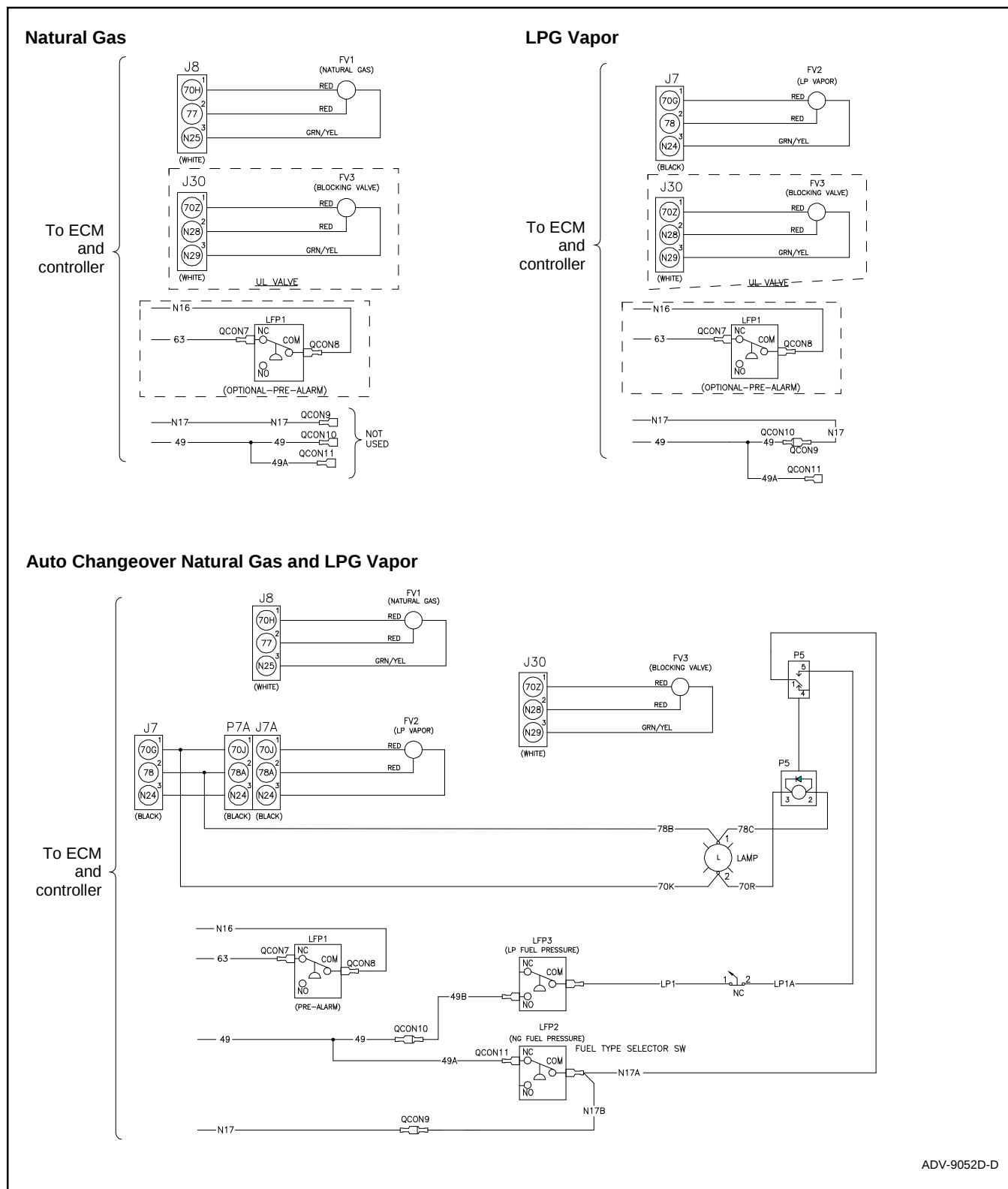
- Disconnect the white fuel connector (J8).
- Connect the black fuel connector (J7).
- Connect 49 and N17.
- For UL applications, connect the optional UL fuel blocking valve (J30).

#### Auto Changeover Natural Gas/LPG Vapor Operation

- Connect the white fuel connector (P8 to J8)
- Connect the black fuel connectors together in series (P7 to J7, P7A to J7A).
- Connect 49 to 49B (QCON10).
- Connect 49B to LFP3, Normally Open terminal.
- Connect LP1 to LFP3, Common Terminal.
- Connect 49A to LFP2, Normally Closed terminal.
- Connect N17 to N17B (QCON9).
- Connect N17B and N17A to LFP2 Common terminal.
- Connect the UL fuel blocking valve (J30).

| Harness               | Natural Gas                                      | LPG Vapor           | Auto Changeover                                  |
|-----------------------|--------------------------------------------------|---------------------|--------------------------------------------------|
| White Connector (P8)  | NG fuel valve (J8)                               | not used            | NG fuel valve (J8)                               |
| N17                   | not used                                         | 49 (QCON 10)        | N17B (QCON 9)                                    |
| 49                    | not used                                         | N17 (QCON 9)        | 49B (QCON 10)                                    |
| 49a                   | not used                                         | not used            | LFP2-NC                                          |
| Black Connector (P7)  | not used                                         | LPG fuel valve (J7) | LPG fuel valve (J7)                              |
| 63                    | LFP1- NC, Optional alarm                         |                     | LFP1-NC                                          |
| N16                   | LFP1- COM, Optional alarm                        |                     | LFP1-COM                                         |
| White Connector (P30) | Optional blocking fuel valve for UL requirements |                     | Required blocking fuel valve for UL requirements |
| 49B                   | not used, Auto Changeover Only                   |                     | 49 (QCON 10), LFP3 (NO)                          |
| LP1                   | not used, Auto Changeover Only                   |                     | LFP3-COM                                         |
| N17A                  | not used, Auto Changeover Only                   |                     | LFP2-COM                                         |
| N17B                  | not used, Auto Changeover Only                   |                     | N17 (QCON 9), LFP2-COM                           |

Figure 4 Gaseous Fuel Electrical Connections, KG80–KG1250/KG80R–KG125R



ADV-9052D-D

Figure 5 Gaseous Fuel Connections Wiring Diagram, KG80–KG125/KG80R–KG125R

**For KG150, KG180, and KG200 (Kohler Engine KG10V08T), use the following:**

To change the fuel type, change the wiring harness connections. The engine ECM has fuel tables and spark advance curves programmed for both natural gas and LPG. Use the following fuel connection tables and wiring diagrams to determine the applicable connections for your generator set model. Be sure to review the wiring diagram for special applications.

**Note:**

KG150 engines ordered for use with natural gas cannot be converted to operate with LPG fuel.

**For Single Fuel Connections with either APM402 or APM603, use the following:**

See Figure 6 and Figure 7.

**Natural Gas Operation**

- Disconnect the black fuel connector (J7).
- Disconnect 49 and N17.
- Connect the white fuel connector (J8).
- For UL applications, connect the optional UL fuel blocking valve (J30).

**LPG Vapor Operation**

- Disconnect the white fuel connector (J8).
- Connect the black fuel connector (J7).
- Connect 49 and N17.
- For UL applications, connect the optional UL fuel blocking valve (J30).

| Harness               | Natural Gas                                      | LPG Vapor           |
|-----------------------|--------------------------------------------------|---------------------|
| White Connector (P8)  | NG fuel valve (J8)                               | not used            |
| N17                   | not used                                         | 49 (QCON 10)        |
| 49                    | not used                                         | N17 (QCON 9)        |
| 49a                   | not used                                         | not used            |
| Black Connector (P7)  | not used                                         | LPG fuel valve (J7) |
| 63                    | LFP1- NC, Optional alarm                         |                     |
| N16                   | LFP1- COM, Optional alarm                        |                     |
| White Connector (P30) | Optional blocking fuel valve for UL requirements |                     |
| 49B                   | not used, Auto Changeover Only                   |                     |
| LP1                   | not used, Auto Changeover Only                   |                     |
| N17A                  | not used, Auto Changeover Only                   |                     |
| N17B                  | not used, Auto Changeover Only                   |                     |

Figure 6 Gaseous Fuel Electrical Connections, Single Fuel

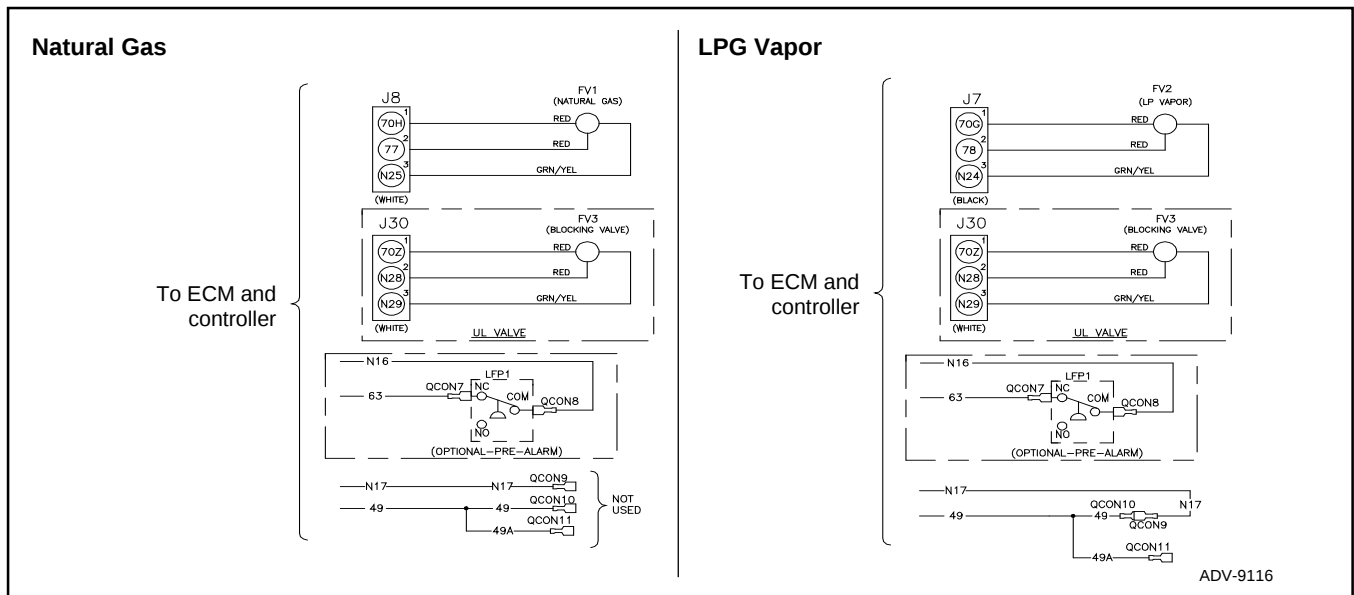


Figure 7 Gaseous Fuel Connections Wiring Diagram, Single Fuel

## 5.2 Fuel System Changeover Kits (Dual Fuel)

A changeover fuel system kit provides automatic changeover from natural gas to LPG vapor. The primary and secondary fuels each have a fuel solenoid valve. The primary fuel is natural gas; the secondary fuel is LPG vapor. Before starting, both fuel solenoid valves are closed. When the generator set starts, the primary fuel solenoid valve opens. The primary fuel line has a pressure switch in series with a relay connected to the start/run circuit.

When the primary fuel pressure drops below 1.1 kPa or 4.5 in. water column, a relay opens the secondary fuel solenoid valve and closes the primary fuel solenoid valve. When the primary fuel pressure rises above 1.1 kPa or 4.5 in. water column, the generator set uses the primary fuel. Contact an authorized service distributor/dealer for kit availability.

Emissions certified models use a single direct acting electronic pressure regulator (DEPR) for both fuels.

### 5.2.1 Dual Fuel Reset Box

#### KG80–KG125, KG80R–KG125R Dual Fuel Operation

The dual fuel system for the KG80–KG125 and KG80R–KG125R includes an LPG indicator light and a reset switch. This LPG indicator light turns on when the NG fuel valve closes and the LPG fuel valve opens, indicating that the fuel source has switched. The reset switch resets the fuel source to natural gas. See the operation summary below.

When NG fuel is lost or insufficient

- NG fuel valve closes.
- LPG fuel valve opens.
- Indicator light turns on indicating the unit is running on LPG vapor.
- Low fuel pressure warning activates (due to loss of primary fuel supply).

The unit will return to NG fuel if:

- The reset switch is activated (separate box with a switch and light).

**Note:**

The reset switch can be activated while the unit is running.

- LPG fuel supply is lost or insufficient.

**Note:**

If NG fuel supply has still not returned, the unit will shut down due to not having an available fuel source.

- The generator set is shut down and restarted.
  - Utility returns.
  - Off button is manually pressed.
  - E-Stop is pressed.

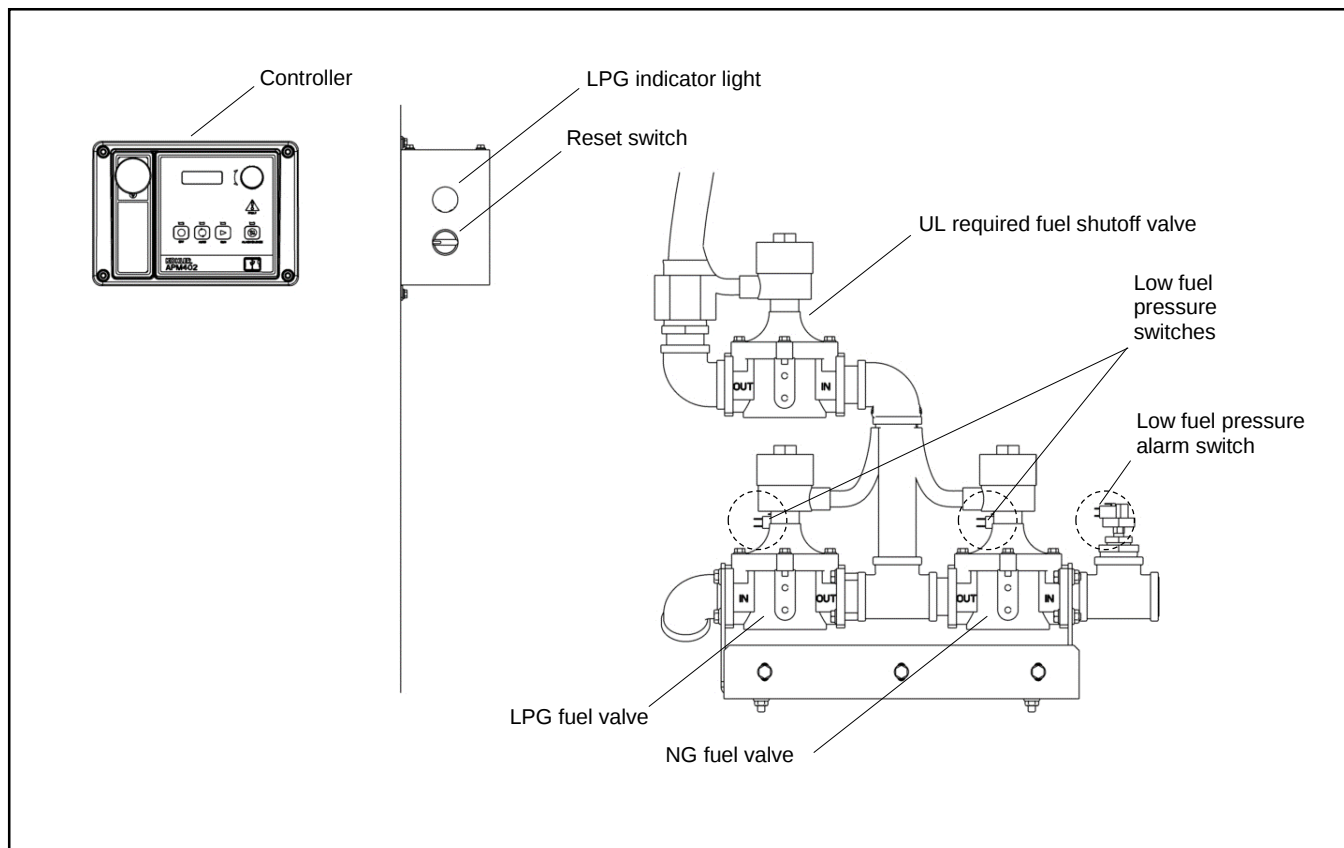


Figure 8 Dual Fuel System, KG80–KG125/KG80R–KG125R

## KG150, KG180, and KG200 (Kohler Engine KG10V08T) Dual Fuel Operation

The automatic changeover dual fuel systems that include a dual-fuel reset box allow the system to switch to LPG fuel automatically if the natural gas supply is not available. If the natural gas fuel supply is sufficient, the fuel system will change back to natural gas automatically when the LPG fuel supply runs low or when the generator set stops and restarts.

The dual-fuel reset box contains an LPG indicator light and a reset switch. The LPG indicator light turns on when the NG fuel valve closes and the LPG fuel valve opens, indicating that the fuel source has switched. The manual reset switch allows manual return to natural gas, if available. See the operation summary below.

- The system switches over to LPG.
- LPG fuel valve opens.
- Indicator light turns on indicating the unit is running on LPG vapor.
- Low fuel pressure warning activates (due to loss of primary fuel supply).

### The unit will return to NG fuel if:

- The NG fuel pressure is at a sufficient level and the manual reset switch is activated (separate box with a switch and light).

### Note:

The manual reset switch can be activated while the unit is running.

- LPG fuel supply is lost or insufficient.

### Note:

If NG fuel supply has still not returned, the unit will shut down due to not having an available fuel source.

- The generator set is shut down and restarted.
  - Utility returns.
  - Off button is manually pressed.
  - E- Stop is pressed.

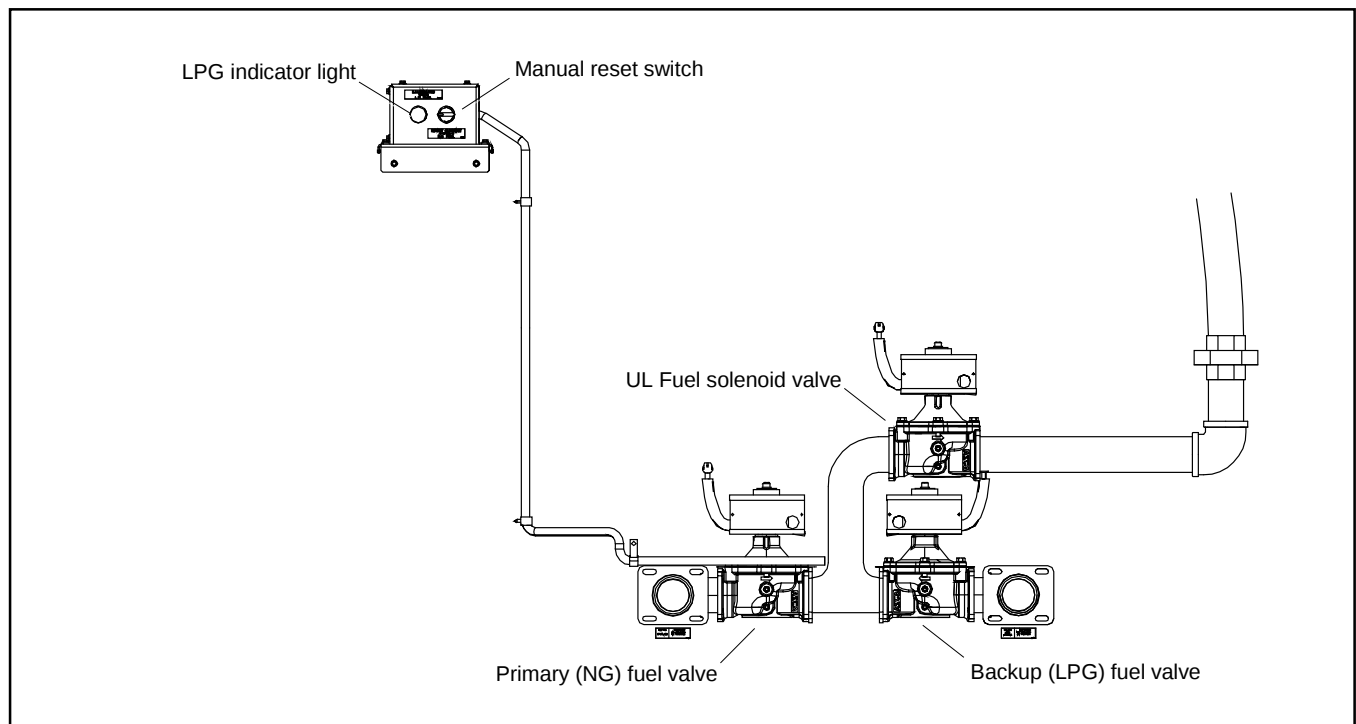


Figure 9 Dual Fuel System with Reset Box, KG150/180/200

## 5.2.2 Dual Fuel Connections

### KG150, KG180, and KG200 (Kohler Engine KG10V08T) Dual Fuel Connections

See the following dual-fuel connections with the APM603. Be sure to review the wiring diagram for special applications. The dual fuel kits are factory installed. Use the following fuel connection tables and wiring diagrams to determine the applicable connections for your generator set model. Be sure to review the wiring diagram for special applications. See Figure 10.

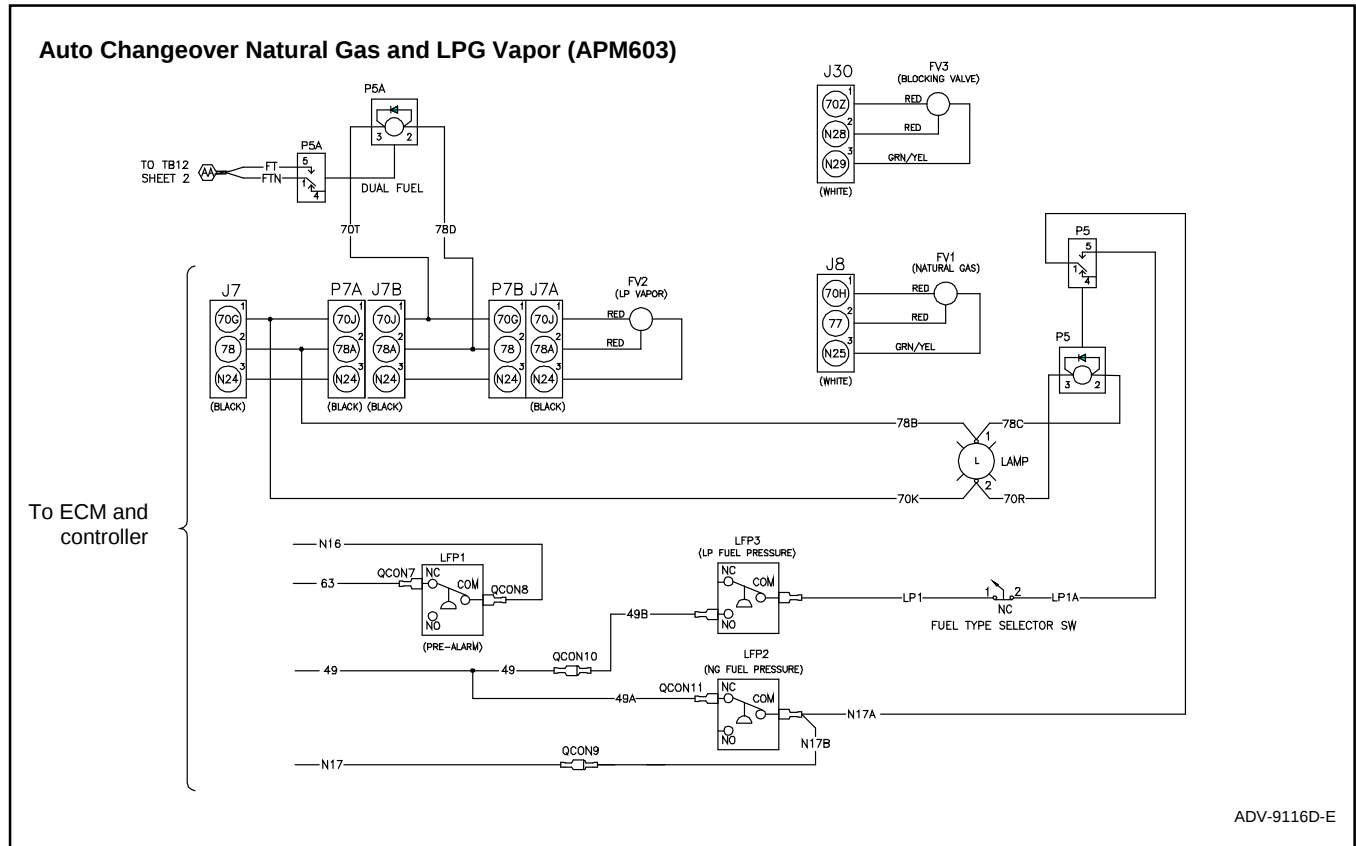


Figure 10 Gaseous Fuel Connections Wiring Diagram, KG150/180/200 Dual Fuel (APM603 only)

## 5.3 Fuel System Maintenance

Routine service items include draining water/sediment from piping at petcock or pipe end cap, checking for fuel leakage at pipe connections, checking flexible sections for cracking or chafing, and keeping components clean including fuel regulator vent holes.

A grease or wax residue tends to accumulate in the piping and fuel regulators over time. If fuel system problems persist, disassemble the fuel system components and check for residue buildup. Remove any residue with a brush and mild detergent.

Additional service for LPG liquid withdrawal systems includes servicing the LPG gas filter, which is supplied by the fuel supplier or the customer.

### Cleaning the Gas Filter Element

Some models use an optional gas filter with a reusable filter element that requires periodic cleaning. See Figure 12 and use the following procedure to clean the gas strainer.

1. Close the fuel supply valve, if not already closed.
2. Remove screws holding the cover on the assembly, and remove the cover.
3. Remove the filter, clean in solvent, and air dry. Inspect the screen for damage and replace if damage is noted.
4. Reinstall the filter element and cover.

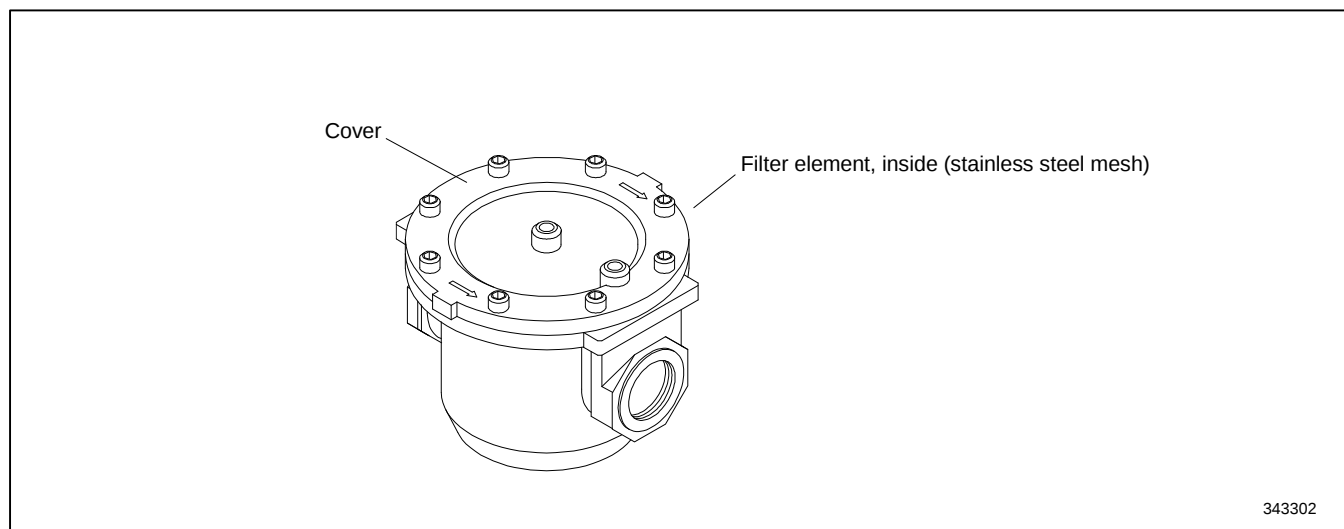


Figure 11 Gas Filter Assembly

## Section 6. Lubrication System

---

### 6.1 Oil Change

Refer to the Engine Operation and Maintenance Manual for oil change intervals and oil specifications. Kohler recommends the use of Kohler Genuine oil and filters.

## Section 7. Air Cleaner System

---

The air cleaner requires periodic maintenance. See the maintenance schedule. A dusty environment or conditions may require the use of a heavy duty air filter and/or more frequent maintenance.

### 7.1 Air Filter Element

Follow this procedure to replace the air filter element.

1. Read and follow the safety precautions at the beginning of the section.
2. Before working on the generator set or connected equipment, remove the generator set from service. Refer to the safety precautions for preventing accidental starts and disabling the generator set.
  - a. Remove the load from the generator set.
  - b. Shut down the generator set.
  - c. Place the generator set controller into Out-of-Service mode and press the emergency stop button.
  - d. Disconnect the power to the battery charger.
  - e. Remove the battery cables negative (-) lead first to disable the generator set.
3. Loosen the filter clamp and remove the filter element from the air intake elbow. See Figure 12.
4. Replace the filter and tighten the filter clamp

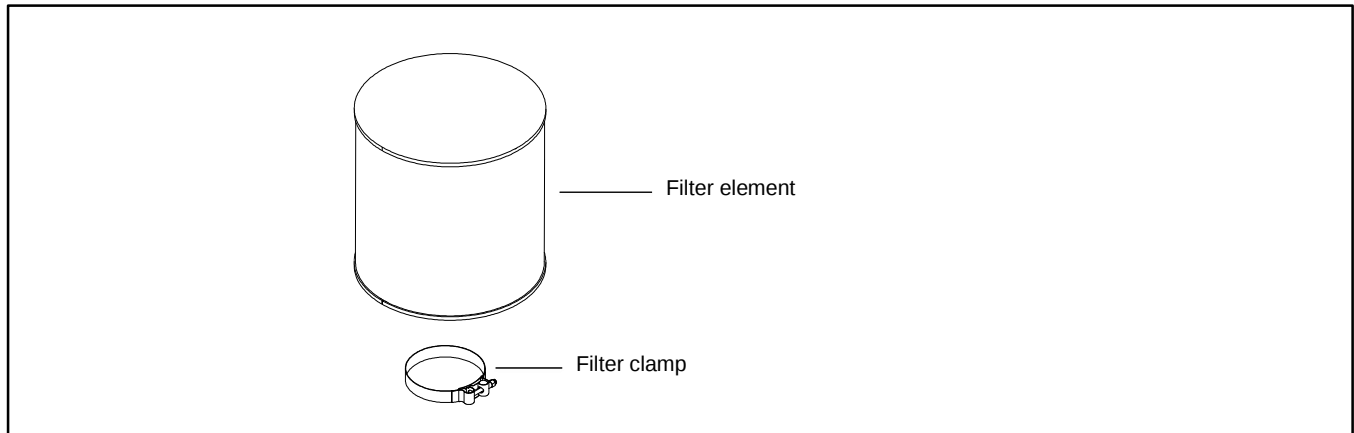


Figure 12 Air Filter

## 7.2 Air Cleaner Restrictor Indicator

The air cleaner restriction gauge mounted on the air cleaner(s) helps determine the air cleaner change interval.

The air cleaner restriction gauge monitors air flow and continuously displays restriction readings indicated as vacuum (see Figure 13). Increased restriction indicates a clogged air cleaner element.

As maximum allowable restriction is reached, the gauge window turns red indicating the air cleaner element needs replacement. To reset the gauge, push the gauge top down and release.

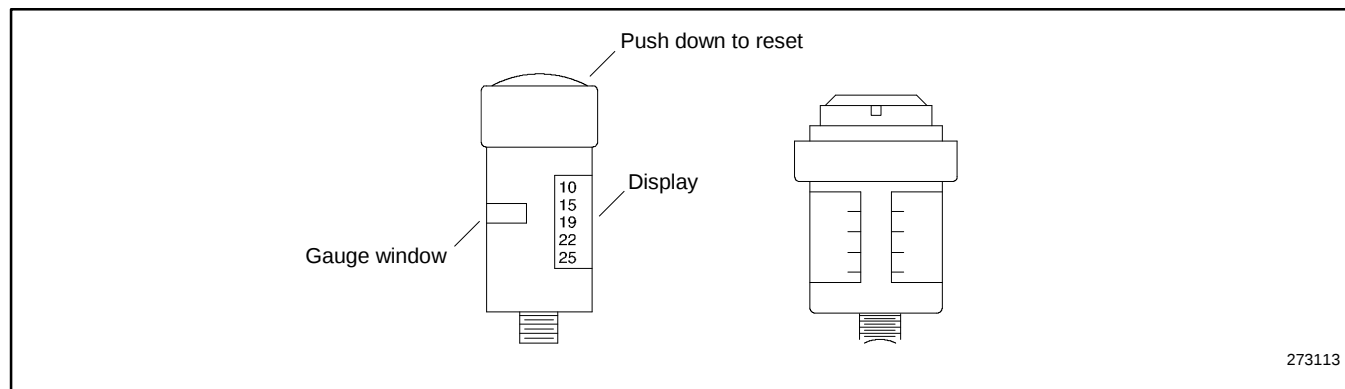


Figure 13 Restriction Indicators (styles vary)

## Section 8. Cooling System

|                                                                                                                                                                                                                                                       |                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>WARNING</b>                                                                                                                                                      | <b>Accidental starting.</b><br><b>Can cause severe injury or death.</b>                                                                                                                                   |
|    | Disconnect the battery cables before working on the generator set. Remove the negative (–) lead first when disconnecting the battery. Reconnect the negative (–) lead last when reconnecting the battery. |

**Disabling the generator set. Accidental starting can cause severe injury or death.** Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (–) lead first. Reconnect the negative (–) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

|                                                                                                  |                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>WARNING</b> | <b>Hot coolant and steam.</b><br><b>Can cause severe injury or death.</b>                                                                                          |
|                 | Before removing the pressure cap, stop the generator set and allow it to cool. Then loosen the pressure cap to relieve pressure. Fill system before starting unit. |

|                                                                                                                                                                       |                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
|  <b>DANGER</b>                                                                       | <b>Hazardous voltage. Moving parts.</b><br><b>Will cause severe injury or death.</b>   |
|   | Operate the generator set only when all guards and electrical enclosures are in place. |

**Servicing the generator set when it is operating. Exposed moving parts will cause severe injury or death.** Keep hands, feet, hair, clothing, and test leads away from the belts and pulleys when the generator set is running. Replace guards, screens, and covers before operating the generator set.

Allow the engine to cool. Release pressure from the cooling system before removing the pressure cap. To release pressure, cover the pressure cap with a thick cloth and then slowly turn the cap counterclockwise to the first stop. Remove the cap after pressure has been completely released and the engine has cooled. Check the coolant level at the tank if the generator set has a coolant recovery tank.

**Note:**

**Engine damage.** Bleed the air from the cooling system to prevent overheating and subsequent engine damage. Refer to the engine operation manual for coolant bleed locations.

**Note:**

**Block heater damage.** The block heater will fail if the energized heater element is not immersed in coolant. Fill the cooling system before turning on the block heater. Run the engine until it is warm, and refill the radiator to purge the air from the system before energizing the block heater.

### 8.1 Coolant Level Check

Check the coolant level in the coolant recovery tank (if equipped). Maintain the coolant level between the high and low marks. Use the sight glass on the radiator to check the coolant level.

**Note:**

Periodically check the coolant level by removing the pressure cap. Do not rely solely on the level in the coolant recovery tank (if equipped). Add fresh coolant until the level is just below the overflow tube opening of the filler neck.

## 8.2 Cooling System Component Inspection

To prevent generator set shutdown or damage caused by overheating:

- Keep the cooling air inlets clean and unobstructed.
- Test antifreeze before cold weather periods.
- Inspect the radiator's exterior for obstructions. Remove dirt and foreign material using a soft brush or cloth to avoid damaging the radiator fins.
- Check the hoses and connections for leaks. Replace any cracked, frayed, or spongy hoses.
- Check the condition and tension of the radiator fan and water pump belt(s).
- Check the pressure cap seal and replace a cracked or deteriorated cap. Remove dirt and other debris from the pressure cap and filler neck. The pressure cap raises the boiling point of the coolant, enabling higher operating temperatures. Replace a leaking pressure cap with one rated for the same pressure. The pressure cap rating usually appears on the pressure cap.

## 8.3 Procedure to Drain Cooling System

|                                                                                                  |                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>WARNING</b> | <b>Hot coolant and steam.</b><br><b>Can cause severe injury or death.</b>                                                                                          |
|                 | Before removing the pressure cap, stop the generator set and allow it to cool. Then loosen the pressure cap to relieve pressure. Fill system before starting unit. |

### 8.3.1 Procedure to Drain Cooling System

For optimum protection, drain, flush, and refill the cooling system at the intervals listed in the service schedule.

**Note:**

Dispose of all waste materials (oil, fuel, coolant, filters, and gaskets) in an environmentally safe manner.

1. Before removing the pressure cap, stop the generator set and allow it to cool.
2. Deenergize the block heater, if equipped.

**Note:**

Use a rag to cover the radiator cap during removal.

3. Remove the pressure cap to prevent air pockets from restricting coolant flow through the engine block.
4. Open the radiator and/or engine block coolant drain valve(s) and allow the system to drain.
5. If the inside of the radiator has mineral deposits or the used coolant contains dirt or grease, refer to the following section, Procedure to Flush and Clean the Cooling System. If the cooling system does not have mineral deposits, go to the following section, Procedure to Refill the Cooling System.

## 8.4 Procedure to Flush and Clean Cooling System

Use the instructions in the engine operation manual when available to flush and clean the cooling system. Otherwise, use the following procedure and the cooling system cleaner manufacturer's instructions.

1. Flush the cooling system with distilled or deionized water.
2. If the inside of the radiator still has mineral deposits, use a radiator cleaner to remove the remaining deposits following the manufacturer's instructions.
3. Drain, clean, and flush the coolant recovery tank.

## 8.5 Procedure to Refill Cooling System

See the generator set spec sheet for coolant capacity.

**Note:**

Do not add coolant to a hot engine. Adding coolant to a hot engine can cause the cylinder block or cylinder head to crack. Wait until the engine has cooled.

1. While covering the pressure cap with a rag, remove the pressure cap.
2. Close the radiator and/or engine block coolant drain valve(s) and tighten the cooling system hose clamps.

**Note:**

If possible, fill the radiator from the bottom to avoid air pockets.

3. Fill the cooling system with the recommended Kohler coolant mixture. Refer to the engine operation manual for specifications.
4. Replace the pressure cap.
5. Operate generator set until the thermostat opens when the upper cooling system hose warms.
6. Stop the engine and allow it to cool.
7. Check and repair any coolant leaks.
8. Remove the pressure cap.
9. Add coolant to bring the coolant level to just below the overflow tube opening of the filler neck.
10. Replace the pressure cap.
11. Maintain the coolant level between the high and low marks. Check the coolant level in the radiator sight glass at the radiator fill.

Air pockets often form in the engine water jacket when the coolant system is refilled. Check the coolant level after each generator set operation and add coolant as necessary until the coolant level stabilizes. Then check the coolant at the interval specified in the service schedule.

12. Reenergize the block heater, if equipped.

## 8.6 Radiator Maintenance

Use the following list for radiator maintenance:

- Periodically check for leakage from the core or tank connections.
- Inspect the liquid level at regular intervals using the top tank sight glass.
- Test antifreeze before cold weather periods.
- If the unit is on stand-by for long periods of time, check the interior of the top tank through the fill neck for signs of scale or rust every one to three months. If necessary, the radiator should be cleaned, flushed, and treated.
- Dirt and debris can be removed from the core face with compressed air, steam, or water, if required. If water is used, slowly increase the pressure and stand at least 0.9 m (3 feet) away from the core. Keep the water stream parallel with the fins in order to avoid damaging them.

**Note:**

Ensure that fins and tubes are not damaged from rough brushing or excessive jet pressure of the steam, air, or water.

- Clean fan blades once per year. Use a stiff brush or an air nozzle for loose dirt and a nonflammable solvent with brush for solid deposits. Care must be taken not to damage the fan blades as a resulting out-of-balance condition might cause vibration and damage to fan bearings or motor bearings.



## Section 9. Battery system

|                                                                                   |                                                                                              |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| <p><b>! WARNING</b></p>                                                           | <p><b>Sulfuric acid in batteries.</b><br/><b>Can cause severe injury or death.</b></p>       |
|  | <p>Wear protective goggles and clothing. Battery acid may cause blindness and burn skin.</p> |

**Battery electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death.** Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. If battery acid splashes in the eyes or on the skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

**Battery acid cleanup. Battery acid can cause severe injury or death.** Battery acid is electrically conductive and corrosive. Add 500 g (1 lb.) of bicarbonate of soda (baking soda) to a container with 4 L (1 gal.) of water and mix the neutralizing solution. Pour the neutralizing solution on the spilled battery acid and continue to add the neutralizing solution to the spilled battery acid until all evidence of a chemical reaction (foaming) has ceased. Flush the resulting liquid with water and dry the area.

**Battery gases. Explosion can cause severe injury or death.** Battery gases can cause an explosion. Do not smoke or permit flames or sparks to occur near a battery at any time, particularly when it is charging. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects. Remove all jewelry before servicing the equipment. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface away from the battery. To avoid sparks, do not disturb the battery charger connections while the battery is charging. Always turn the battery charger off before disconnecting the battery connections. Ventilate the compartments containing batteries to prevent accumulation of explosive gases.

**Battery short circuits. Explosion can cause severe injury or death.** Short circuits can cause bodily injury and/or equipment damage. Disconnect the battery before generator set installation or maintenance. Remove all jewelry before servicing the equipment. Use tools with insulated handles. Remove the negative (–) lead first when disconnecting the battery. Reconnect the negative (–) lead last when reconnecting the battery. Never connect the negative (–) battery cable to the positive (+) connection terminal of the starter solenoid. Do not test the battery condition by shorting the terminals together.

Refer to this section for general battery information and maintenance. All generator set models use a negative ground with a 12-volt electrical system. Consult the generator set nameplate for the engine electrical system voltage. Consult the generator set spec sheet for battery capacity recommendations for replacement purposes. The wiring diagrams provide battery connection information. See Figure 14 and for typical battery connections, including multiple battery configurations.

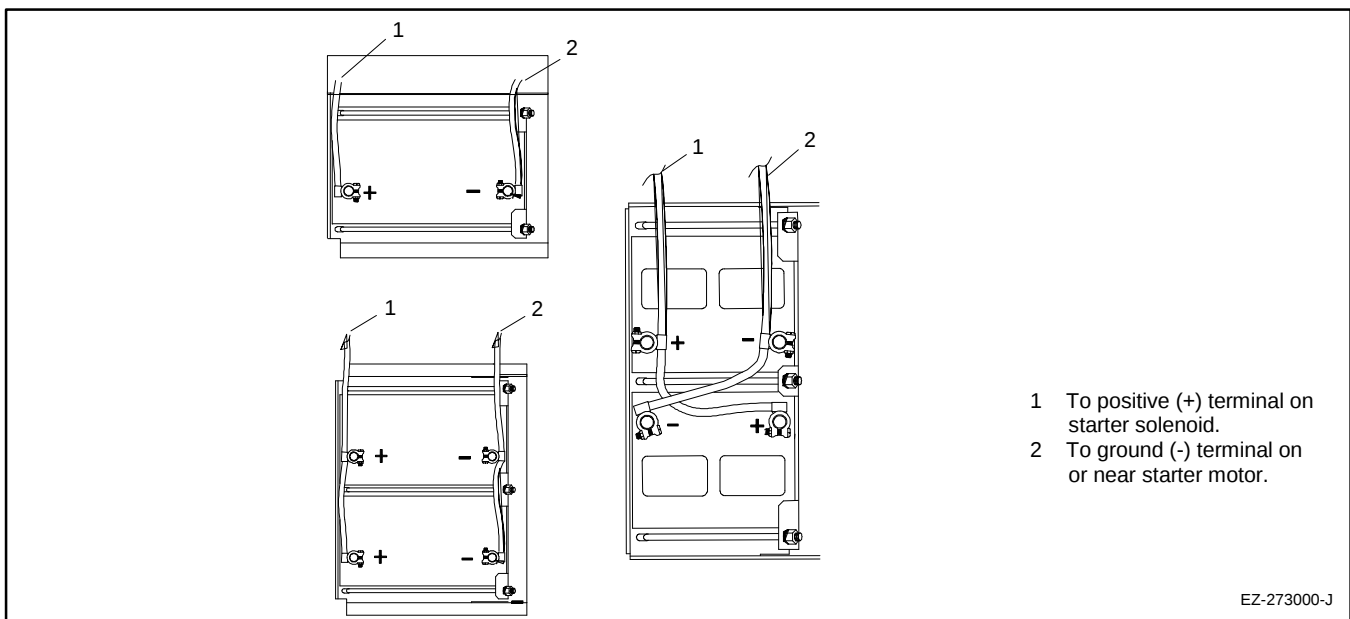


Figure 14 12 V Engine Electrical System Single Starter Motor, Typical Battery Connection

## 9.1 Clean Battery

Clean the battery and cables and tighten the battery terminals according to the service schedule recommendations. Clean the battery by wiping it with a damp cloth. Keep the electrical connections dry and tight.

If corrosion exists, disconnect the cables from the battery and remove the corrosion with a wire brush. Clean the battery and cables with a solution of baking soda and water. Do not allow the cleaning solution to enter battery cells. Flush the battery and cables with clean water and wipe the battery with a dry cloth.

After reconnecting the battery cables, coat the terminals with petroleum jelly, silicon grease, or other nonconductive grease.

## 9.2 Electrolyte Level Inspection

Check the electrolyte level and specific gravity of batteries that have filler caps. Maintenance-free batteries do not require electrolyte level checking or specific gravity testing.

Check the electrolyte level at the specified interval. Remove the filler caps and verify that the electrolyte level reaches the bottom of each filler hole. See Figure 15. Refill as necessary with distilled water. Do not add fresh electrolyte. Tighten the filler caps. After adding water during freezing temperatures, run the generator set 20-30 minutes to mix the electrolyte and the water to prevent battery damage from freezing.

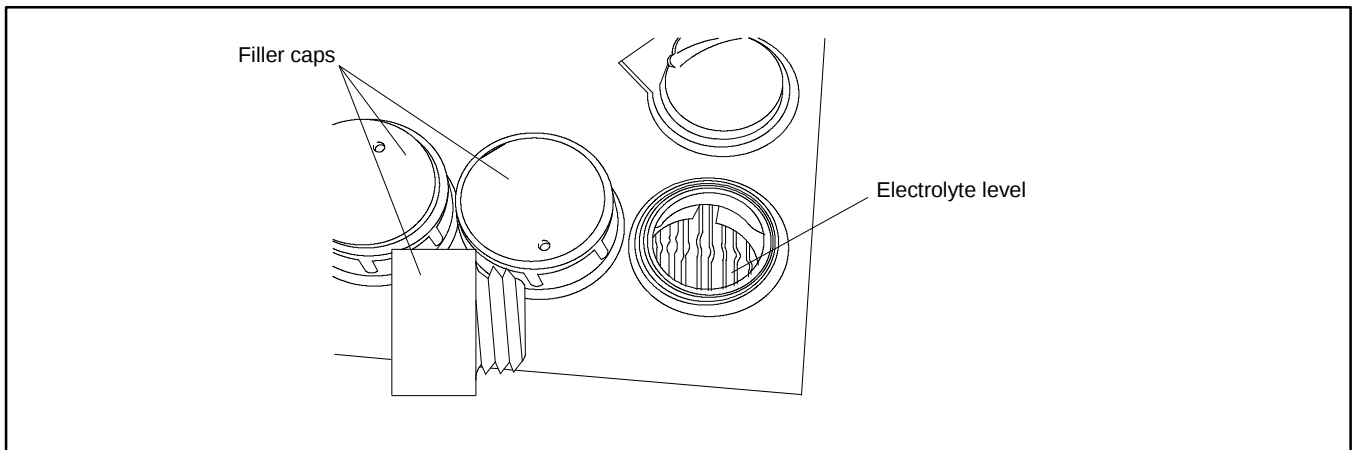


Figure 15 Battery Electrolyte Level Inspection

## 9.3 Specific Gravity Check

Use a battery hydrometer to check the specific gravity of the electrolyte in each battery cell of batteries with filler caps. Holding the hydrometer vertically, read the number on the glass bulb at the top of the electrolyte level or the number adjacent to the pointer. If the hydrometer used does not have a correction table, consult Figure 16.

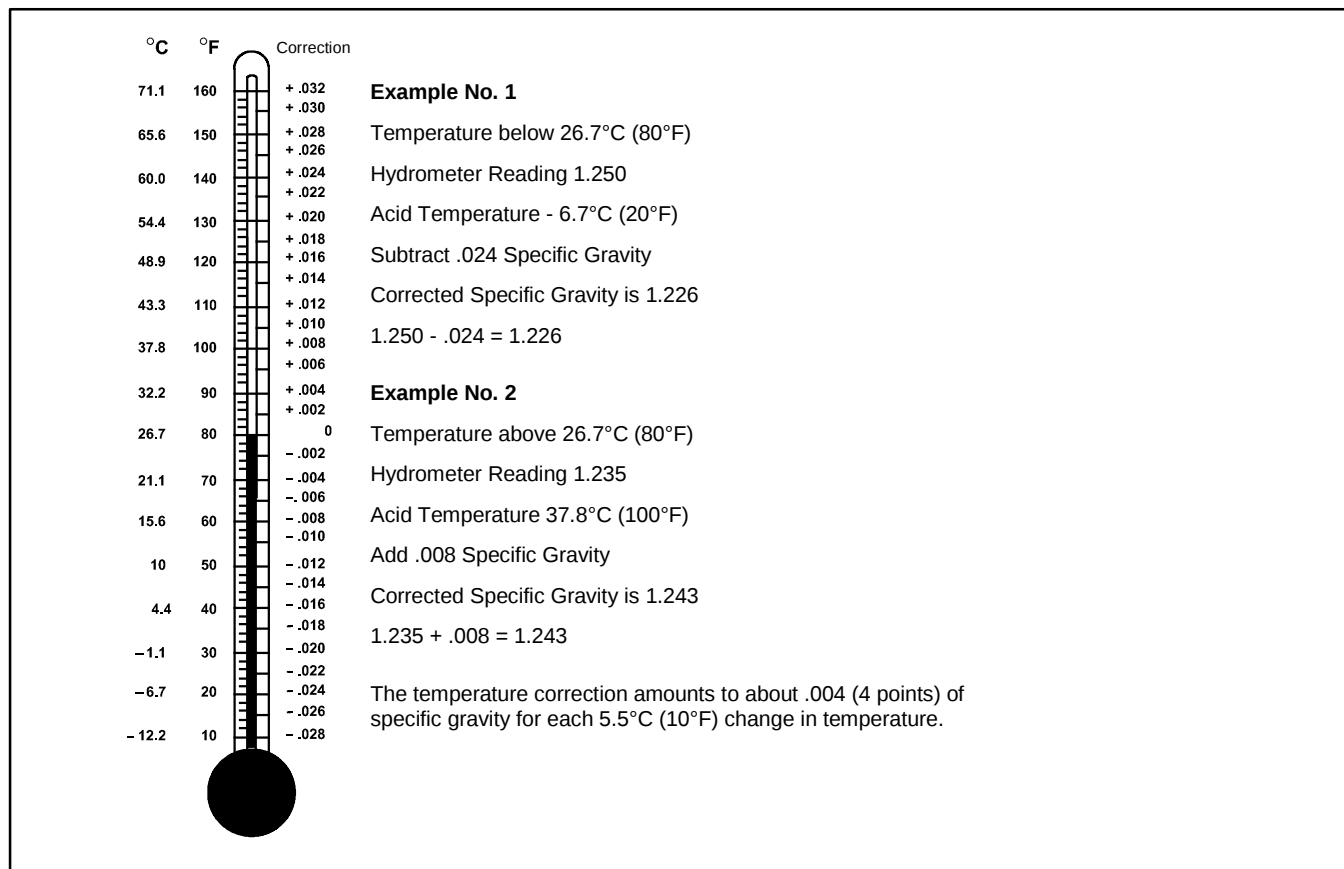


Figure 16 Specific Gravity Temperature Correction

Determine the specific gravity and electrolyte temperature of the battery cells. Locate the temperature in Figure 16 and correct the specific gravity by the amount shown. The battery is fully charged if the specific gravity is 1.260 at an electrolyte temperature of 26.7°C (80°F). Maintain the specific gravities between cells within  $\pm 0.01$  of each other. Charge the battery if the specific gravity is below 1.215 at an electrolyte temperature of 26.7°C (80°F).

### Note:

Some battery testers have four or five beads in a test tube. Draw electrolyte into the tube as with the battery hydrometer described in this section or use the manufacturer's instructions. Use Figure 17 to interpret typical test results.

| Number of Floating Beads | Battery Condition |
|--------------------------|-------------------|
| 5                        | Overcharged       |
| 4                        | Fully Charged     |
| 3                        | A good charge     |
| 1 or 2                   | A low charge      |
| 0                        | A dead charge     |

Figure 17 Bead-Type Test Interpretation

## **9.4 Charge Battery**

Use a battery charger to maintain a fully charged battery when the generator set is used in a standby application. The engine battery-charging alternator charges the battery while the generator set is running. Refer to the battery charger operation manual for installation, operation, and service procedures.

Perform the following storage procedure before taking a generator set out of service for three months or longer. Follow the engine manufacturer's recommendations, if available, for fuel system and internal engine component storage.

|                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>WARNING</b>                                                                                                                                                      | <b>Accidental starting.</b><br><b>Can cause severe injury or death.</b><br>Disconnect the battery cables before working on the generator set. Remove the negative (–) lead first when disconnecting the battery. Reconnect the negative (–) lead last when reconnecting the battery. |
|    |                                                                                                                                                                                                                                                                                      |

**Disabling the generator set. Accidental starting can cause severe injury or death.** Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (–) lead first. Reconnect the negative (–) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

|                                                                                                  |                                                                                                                                       |
|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
|  <b>WARNING</b> | <b>Hot engine and exhaust system.</b><br><b>Can cause severe injury or death.</b><br>Do not work on the generator set until it cools. |
|                 |                                                                                                                                       |

**Servicing the exhaust system. Hot parts can cause severe injury or death.** Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.

|                                                                                                                                                                         |                                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>DANGER</b>                                                                       | <b>Hazardous voltage. Moving parts.</b><br><b>Will cause severe injury or death.</b><br>Operate the generator set only when all guards and electrical enclosures are in place. |
|   |                                                                                                                                                                                |

**Servicing the generator set when it is operating. Exposed moving parts will cause severe injury or death.** Keep hands, feet, hair, clothing, and test leads away from the belts and pulleys when the generator set is running. Replace guards, screens, and covers before operating the generator set.

### 10.1 Lubrication System

Prepare the engine lubricating system for storage as follows.

**Note:**

Kohler recommends the use of Kohler genuine oil and filters.

1. Run the generator set for a minimum of 30 minutes to bring it to normal operating temperature.
2. Stop the generator set.
3. With the engine still warm, drain the oil from the crankcase.
4. Remove and replace the oil filter.
5. Refill the crankcase with oil suited to the climate.
6. Run the generator set for two minutes to distribute the clean oil.
7. Stop the generator set.
8. Check the oil level and adjust, if needed.

## 10.2 Cooling System

Prepare the cooling system for storage as follows:

1. Check the coolant freeze protection using a coolant tester.
2. Add or replace coolant as necessary to ensure adequate freezing protection. Use the guidelines included in the engine operation manual.
3. Run the generator set for 30 minutes to redistribute added coolant.

## 10.3 Exterior

1. Clean the exterior surface of the generator set.
2. Seal all engine openings except for the air intake with non absorbent adhesive tape.
3. To prevent impurities from entering the air intake and to allow moisture to escape from the engine, secure a cloth over the air intake.
4. Mask electrical connections.
5. Spread a light film of oil over unpainted metallic surfaces to inhibit rust and corrosion.

## 10.4 Alternator

|                                                                                                  |                                                                                                                                            |
|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>WARNING</b> | <b>Risk of fire.</b><br><b>Can cause severe injury or death.</b><br>Do not smoke or permit flames or sparks near fuels or the fuel system. |
|                |                                                                                                                                            |

**Combustible materials. A fire can cause severe injury or death.** If using generator heaters during storage, remove combustible materials such as covers from contact with the heater or from areas where heat could potentially cause a fire.

Humidity, moisture, and dust can damage the alternator during storage. Store the generator set in a clean, dry area and protect the alternator from inclement weather. Keep room temperatures relatively constant to prevent condensation on the windings. Cover ventilation and other entry points to prevent damage by rodents, birds, and insects.

Before returning the alternator to service, have an authorized service distributor/dealer, perform the following alternator service:

- Clean the ventilation circuit.
- Blow dust off the windings.
- Check the rotor and stator winding insulation.
- Check the rotor and stator winding resistance and continuity.
- On units with regreasable bearings, grease the bearings and rotate the shaft to distribute grease on the bearings.

## 10.5 Battery

|                                                                                                  |                                                                                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>WARNING</b> | <b>Explosion.</b><br><b>Can cause severe injury or death.</b><br><b>Relays in the battery charger cause arcs or sparks.</b><br><br>Locate the battery in a well-ventilated area. Isolate the battery charger from explosive fumes. |
|                 |                                                                                                                                                                                                                                    |

Perform battery storage after all other storage procedures.

1. Confirm that the generator set is stopped.
2. Disconnect the battery(ies), negative (-) lead first.
3. Clean the battery. Refer to the battery cleaning procedure.
4. Place the battery in a cool, dry location.
5. Connect the battery to a float/equalize battery charger or charge it monthly with a trickle battery charger. Refer to the battery charger manufacturer's recommendations.

Maintain a full charge to extend battery life.

**Note:**

If the battery is an absorbed glass mat (AGM) type, ensure that the battery charger is compatible with AGM type batteries before charging



## Appendix A. Abbreviations

|         |                                                                                            |           |                                                        |                                |                                                                                      |
|---------|--------------------------------------------------------------------------------------------|-----------|--------------------------------------------------------|--------------------------------|--------------------------------------------------------------------------------------|
| A, amp  | ampere                                                                                     | blk.      | black (paint color), block (engine)                    | D/A                            | digital to analog                                                                    |
| ABDC    | after bottom dead center                                                                   | blk. htr. | block heater                                           | DAC                            | digital to analog converter                                                          |
| AC      | alternating current                                                                        | BMEP      | brake mean effective pressure                          | dB                             | decibel                                                                              |
| A/D     | analog to digital                                                                          | bps       | bits per second                                        | dB(A)                          | decibel (A weighted)                                                                 |
| ADC     | advanced digital control;<br>analog to digital converter                                   | br.       | Brass                                                  | DC                             | direct current                                                                       |
| adj.    | adjust, adjustment                                                                         | BTDC      | before top dead center                                 | DCR                            | direct current resistance                                                            |
| ADV     | advertising dimensional drawing                                                            | Btu       | British thermal unit                                   | DEF                            | diesel exhaust fluid                                                                 |
| AGM     | absorbent glass mat                                                                        | Btu/min.  | British thermal units per minute                       | deg., °                        | degree                                                                               |
| Ah      | amp-hour                                                                                   | C         | Celsius, centigrade                                    | dept.                          | department                                                                           |
| AHWT    | anticipatory high water<br>temperature                                                     | cal.      | Calorie                                                | dia.                           | Diameter                                                                             |
| AISI    | American Iron and Steel Institute                                                          | CAN       | controller area network                                | DI/EO                          | dual inlet/end outlet                                                                |
| ALOP    | anticipatory low oil pressure                                                              | CARB      | California Air Resources Board                         | DIN                            | Deutsches Institut für Normung e.<br>V. (also Deutsche Industrie<br>Normenausschuss) |
| alt.    | alternator                                                                                 | CAT5      | Category 5 (network cable)                             | DIP                            | dual inline package                                                                  |
| Al      | aluminum                                                                                   | CB        | circuit breaker                                        | DPDT                           | double-pole, double-throw                                                            |
| ANSI    | American National Standards<br>Institute (formerly American<br>Standards Association, ASA) | CC        | crank cycle                                            | DPST                           | double-pole, single-throw                                                            |
| AO      | anticipatory only                                                                          | cc        | cubic centimeter                                       | DS                             | disconnect switch                                                                    |
| APDC    | Air Pollution Control District                                                             | CCA       | cold cranking amps                                     | DVR                            | digital voltage regulator                                                            |
| API     | American Petroleum Institute                                                               | ccw.      | Counterclockwise                                       | E <sup>2</sup> PROM,<br>EEPROM | electrically-erasable<br>programmable read-only memory                               |
| approx. | approximate, approximately                                                                 | CEC       | Canadian Electrical Code                               | E, emer.                       | emergency (power source)                                                             |
| APU     | Auxiliary Power Unit                                                                       | cert.     | certificate, certification, certified                  | ECM                            | electronic control module, engine<br>control module                                  |
| AQMD    | Air Quality Management District                                                            | cfh       | cubic feet per hour                                    | EDI                            | electronic data interchange                                                          |
| AR      | as required, as requested                                                                  | cfm       | cubic feet per minute                                  | EFR                            | emergency frequency relay                                                            |
| AS      | as supplied, as stated, as<br>suggested                                                    | CG        | center of gravity                                      | e.g.                           | for example (exempli gratia)                                                         |
| ASE     | American Society of Engineers                                                              | CID       | cubic inch displacement                                | EG                             | electronic governor                                                                  |
| ASME    | American Society of Mechanical<br>Engineers                                                | CL        | centerline                                             | EGSA                           | Electrical Generating Systems<br>Association                                         |
| assy.   | Assembly                                                                                   | cm        | centimeter                                             | EIA                            | Electronic Industries Association                                                    |
| ASTM    | American Society for Testing<br>Materials                                                  | CMOS      | complementary metal oxide<br>substrate (semiconductor) | EI/EO                          | end inlet/end outlet                                                                 |
| ATDC    | after top dead center                                                                      | com       | communications (port)                                  | EMI                            | electromagnetic interference                                                         |
| ATS     | automatic transfer switch                                                                  | coml      | commercial                                             | emiss.                         | Emission                                                                             |
| auto.   | Automatic                                                                                  | Coml/Rec  | Commercial/Recreational                                | eng.                           | Engine                                                                               |
| aux.    | auxiliary                                                                                  | conn.     | Connection                                             | EPA                            | Environmental Protection Agency                                                      |
| avg.    | average                                                                                    | cont.     | continued                                              | EPS                            | emergency power system                                                               |
| AVR     | automatic voltage regulator                                                                | CPVC      | chlorinated polyvinyl chloride                         | ER                             | emergency relay                                                                      |
| AWG     | American Wire Gauge                                                                        | crit.     | Critical                                               | ES                             | engineering special, engineered<br>special                                           |
| AWM     | appliance wiring material                                                                  | CSA       | Canadian Standards Association                         | ESD                            | electrostatic discharge                                                              |
| bat.    | Battery                                                                                    | CT        | current transformer                                    | est.                           | estimated                                                                            |
| BBDC    | before bottom dead center                                                                  | Cu        | copper                                                 | E-Stop                         | emergency stop                                                                       |
| BC      | battery charger, battery charging                                                          | cUL       | Canadian Underwriter's<br>Laboratories                 | etc.                           | et cetera (and so forth)                                                             |
| BCA     | battery charging alternator                                                                | cu. in.   | cubic inch                                             | exh.                           | exhaust                                                                              |
| BCI     | Battery Council International                                                              | cw.       | Clockwise                                              | ext.                           | external                                                                             |
| BDC     | before dead center                                                                         | CWC       | city water-cooled                                      | F                              | Fahrenheit, female                                                                   |
| BHP     | brake horsepower                                                                           | cyl.      | Cylinder                                               | FHM                            | flat head machine (screw)                                                            |

|           |                                                   |                      |                                                |                      |                                                      |
|-----------|---------------------------------------------------|----------------------|------------------------------------------------|----------------------|------------------------------------------------------|
| fl. oz.   | fluid ounce                                       | in.                  | inch                                           | Lph                  | liters per hour                                      |
| flex.     | flexible                                          | in. H <sub>2</sub> O | inches of water                                | Lpm                  | liters per minute                                    |
| freq.     | frequency                                         | in. Hg               | inches of mercury                              | LOP                  | low oil pressure                                     |
| FS        | full scale                                        | in. Lb.              | inch pounds                                    | LP                   | liquefied petroleum                                  |
| ft.       | foot, feet                                        | Inc.                 | incorporated                                   | LPG                  | liquefied petroleum gas                              |
| ft. lb.   | foot pounds (torque)                              | ind.                 | Industrial                                     | LS                   | left side                                            |
| ft./min.  | feet per minute                                   | int.                 | internal                                       | L <sub>wa</sub>      | sound power level, A weighted                        |
| ftp       | file transfer protocol                            | int./ext.            | internal/external                              | LWL                  | low water level                                      |
| g         | gram                                              | I/O                  | input/output                                   | LWT                  | low water temperature                                |
| ga.       | gauge (meters, wire size)                         | IP                   | internet protocol                              | m                    | meter, milli (1/1000)                                |
| gal.      | gallon                                            | ISO                  | International Organization for Standardization | M                    | mega (10 <sup>6</sup> when used with SI units), male |
| gen.      | generator                                         | J                    | joule                                          | m <sup>3</sup>       | cubic meter                                          |
| genset    | generator set                                     | JIS                  | Japanese Industry Standard                     | m <sup>3</sup> /hr.  | cubic meters per hour                                |
| GFI       | ground fault interrupter                          | k                    | kilo (1000)                                    | m <sup>3</sup> /min. | cubic meters per minute                              |
| GND,<br>⊕ | ground                                            | K                    | kelvin                                         | mA                   | milliampere                                          |
| gov.      | governor                                          | kA                   | kiloampere                                     | man.                 | manual                                               |
| gph       | gallons per hour                                  | KB                   | kilobyte (2 <sup>10</sup> bytes)               | max.                 | maximum                                              |
| gpm       | gallons per minute                                | KBus                 | Kohler communication protocol                  | MB                   | megabyte (2 <sup>20</sup> bytes)                     |
| gr.       | grade, gross                                      | kg                   | kilogram                                       | MCCB                 | molded-case circuit breaker                          |
| GRD       | equipment ground                                  | kg/cm <sup>2</sup>   | kilograms per square centimeter                | MCM                  | one thousand circular mils                           |
| gr. wt.   | gross weight                                      | kgm                  | kilogram-meter                                 | meggar               | megohmmeter                                          |
| H x W x D | height by width by depth                          | kg/m <sup>3</sup>    | kilograms per cubic meter                      | MHz                  | megahertz                                            |
| HC        | hex cap                                           | kHz                  | kilohertz                                      | mi.                  | mile                                                 |
| HCHT      | high cylinder head temperature                    | kJ                   | kilojoule                                      | mil                  | one one-thousandth of an inch                        |
| HD        | heavy duty                                        | km                   | kilometer                                      | min.                 | minimum, minute                                      |
| HET       | high exhaust temp., high engine temp.             | kOhm, kΩ             | kilo-ohm                                       | misc.                | miscellaneous                                        |
| hex       | hexagon                                           | kPa                  | kilopascal                                     | MJ                   | megajoule                                            |
| Hg        | mercury (element)                                 | kph                  | kilometers per hour                            | mJ                   | millijoule                                           |
| HH        | hex head                                          | kV                   | kilovolt                                       | mm                   | millimeter                                           |
| HHC       | hex head cap                                      | kVA                  | kilovolt ampere                                | mOhm, mΩ             | milliohm                                             |
| HP        | horsepower                                        | kVAR                 | kilovolt ampere reactive                       | MOhm, MΩ             | megohm                                               |
| hr.       | hour                                              | kW                   | kilowatt                                       | MOV                  | metal oxide varistor                                 |
| HS        | heat shrink                                       | kWh                  | kilowatt-hour                                  | MPa                  | megapascal                                           |
| hsg.      | Housing                                           | kWm                  | kilowatt mechanical                            | mpg                  | miles per gallon                                     |
| HVAC      | heating, ventilation, and air conditioning        | kWth                 | kilowatt-thermal                               | mph                  | miles per hour                                       |
| HWT       | high water temperature                            | L                    | liter                                          | MS                   | military standard                                    |
| Hz        | hertz (cycles per second)                         | LAN                  | local area network                             | ms                   | millisecond                                          |
| IBC       | International Building Code                       | L x W x H            | length by width by height                      | m/sec.               | meters per second                                    |
| IC        | integrated circuit                                | lb.                  | pound, pounds                                  | mtg.                 | mounting                                             |
| ID        | inside diameter, identification                   | lbm/ft <sup>3</sup>  | pounds mass per cubic feet                     | MTU                  | Motoren-und Turbinen-Union                           |
| IEC       | International Electrotechnical Commission         | LCB                  | line circuit breaker                           | MW                   | megawatt                                             |
| IEEE      | Institute of Electrical and Electronics Engineers | LCD                  | liquid crystal display                         | mW                   | milliwatt                                            |
| IMS       | improved motor starting                           | LED                  | light emitting diode                           | μF                   | microfarad                                           |

|           |                                                                  |           |                                               |         |                                                                                              |
|-----------|------------------------------------------------------------------|-----------|-----------------------------------------------|---------|----------------------------------------------------------------------------------------------|
| N, norm.  | normal (power source)                                            | PMG       | permanent magnet generator                    | SCR     | silicon controlled rectifier (electrical), selective catalytic reduction (exhaust emissions) |
| NA        | not available, not applicable                                    | pot       | potentiometer, potential                      | s, sec. | second                                                                                       |
| nat. gas  | natural gas                                                      | ppm       | parts per million                             | SI      | <i>Système international d'unités</i> , International System of Units                        |
| NBS       | National Bureau of Standards                                     | PROM      | programmable read-only memory                 | SI/EO   | side in/end out                                                                              |
| NC        | normally closed                                                  | psi       | pounds per square inch                        | sil.    | Silencer                                                                                     |
| NEC       | National Electrical Code                                         | psig      | pounds per square inch gauge                  | SMTP    | simple mail transfer protocol                                                                |
| NEMA      | National Electrical Manufacturers Association                    | pt.       | pint                                          | SN      | serial number                                                                                |
| NiCd      | nickel cadmium                                                   | PTC       | positive temperature coefficient              | SNMP    | simple network management protocol                                                           |
| NFPA      | National Fire Protection Association                             | PTO       | power takeoff                                 | SPDT    | single-pole, double-throw                                                                    |
| Nm        | newton meter                                                     | PVC       | polyvinyl chloride                            | SPST    | single-pole, single-throw                                                                    |
| NO        | normally open                                                    | PVC       | polyvinyl chloride                            | spec    | specification                                                                                |
| no., nos. | number, numbers                                                  | PWM       | pulse width modulated, pulse width modulation | specs   | specification(s)                                                                             |
| NPS       | National Pipe, Straight                                          | qt.       | quart, quarts                                 | sq.     | square                                                                                       |
| NPSC      | National Pipe, Straight-coupling                                 | qty.      | quantity                                      | sq. cm  | square centimeter                                                                            |
| NPT       | National Standard taper pipe thread per general use              | R         | replacement (emergency) power source          | sq. in. | square inch                                                                                  |
| NPTF      | National Pipe, Taper-Fine                                        | rad.      | radiator, radius                              | SMS     | short message service                                                                        |
| NR        | not required, normal relay                                       | RAM       | random access memory                          | SS      | stainless steel                                                                              |
| Ns        | nanosecond                                                       | RDO       | relay driver output                           | std.    | standard                                                                                     |
| OC        | overcrank                                                        | ref.      | reference                                     | stl.    | Steel                                                                                        |
| OD        | outside diameter                                                 | rem.      | Remote                                        | tach.   | Tachometer                                                                                   |
| OEM       | original equipment manufacturer                                  | Res/Co ml | Residential/Commercial                        | TB      | terminal block                                                                               |
| OF        | overfrequency                                                    | RFI       | radio frequency interference                  | TCP     | transmission control protocol                                                                |
| opt.      | option, optional                                                 | RH        | round head                                    | TD      | time delay                                                                                   |
| OS        | oversize, overspeed                                              | RHM       | round head machine (screw)                    | TDC     | top dead center                                                                              |
| OSHA      | Occupational Safety and Health Administration                    | rly.      | Relay                                         | TDEC    | time delay engine cooldown                                                                   |
| OSHPD     | Office of Statewide Health Planning and Development (California) | rms       | root mean square                              | TDEN    | time delay emergency to normal                                                               |
| OV        | overvoltage                                                      | rnd.      | Round                                         | TDES    | time delay engine start                                                                      |
| oz.       | ounce                                                            | RO        | read only                                     | TDNE    | time delay normal to emergency                                                               |
| p., pp.   | page, pages                                                      | ROM       | read only memory                              | TDOE    | time delay off to emergency                                                                  |
| PC        | personal computer                                                | rot.      | rotate, rotating                              | TDON    | time delay off to normal                                                                     |
| PCB       | printed circuit board                                            | rpm       | revolutions per minute                        | temp.   | temperature                                                                                  |
| pF        | picofarad                                                        | RS        | right side                                    | term.   | Terminal                                                                                     |
| PF        | power factor                                                     | RTDs      | resistance temperature detectors              | THD     | total harmonic distortion                                                                    |
| ph., ø    | phase                                                            | RTU       | remote terminal unit                          | TIF     | telephone influence factor                                                                   |
| PHC       | Phillips® head Crimptiter (screw)                                | RTV       | room temperature vulcanization                | tol.    | Tolerance                                                                                    |
| PHH       | Phillips® hex head (screw)                                       | RW        | read/write                                    | turbo.  | Turbocharger                                                                                 |
| PHM       | pan head machine (screw)                                         | SAE       | Society of Automotive Engineers               | typ.    | typical (same in multiple locations)                                                         |
| PLC       | programmable logic control                                       | scfm      | standard cubic feet per minute                | UF      | underfrequency                                                                               |

|       |                                        |
|-------|----------------------------------------|
| UHF   | ultrahigh frequency                    |
| UIF   | user interface                         |
| UL    | Underwriter's Laboratories, Inc.       |
| UNC   | unified coarse thread (was NC)         |
| UNF   | unified fine thread (was NF)           |
| univ. | universal                              |
| URL   | uniform resource locator (web address) |
| US    | undersize, underspeed                  |
| UV    | ultraviolet, undervoltage              |
| V     | volt                                   |
| VAC   | volts alternating current              |
| VAR   | voltampere reactive                    |
| VDC   | volts direct current                   |
| VFD   | vacuum fluorescent display             |
| VGA   | video graphics adapter                 |
| VHF   | very high frequency                    |
| W     | watt                                   |
| WCR   | withstand and closing rating           |
| w/    | with                                   |
| WO    | write only                             |
| w/o   | without                                |
| wt.   | weight                                 |
| xfmr  | transformer                            |

## Appendix B. Common Hardware Application Guidelines

Use the information below and on the following pages to identify proper fastening techniques when no specific reference for reassembly is made.

**Bolt/Screw Length:** When bolt/screw length is not given, use Figure 18 as a guide. As a general rule, a minimum length of one thread beyond the nut and a maximum length of  $\frac{1}{2}$  the bolt/screw diameter beyond the nut is the preferred method.

**Washers and Nuts:** Use split lock washers as a bolt locking device where specified. Use SAE flat washers with whiz nuts, spirallock nuts, or standard nuts and preloading (torque) of the bolt in all other applications.

See the Torque Specifications in the appendix and other torque specifications in the service literature.

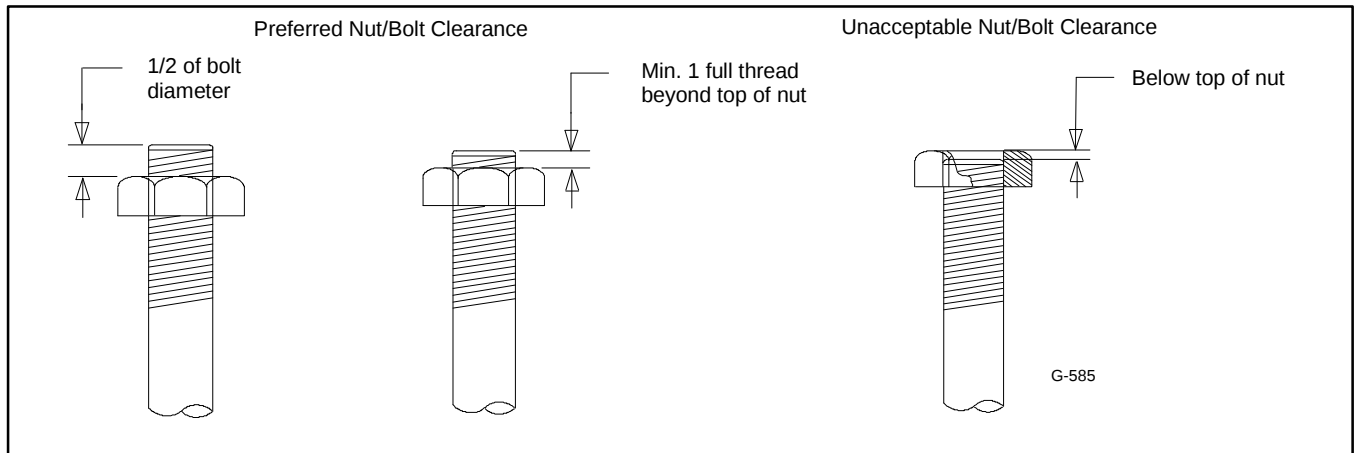


Figure 18 Acceptable Bolt Lengths

Steps for common hardware application:

1. Determine entry hole type: round or slotted.
2. Determine exit hole type: fixed female thread (weld nut), round, or slotted.
3. For round and slotted exit holes, determine if hardware is greater than  $\frac{1}{2}$  inch in diameter, or  $\frac{1}{2}$  inch in diameter or less. Hardware that is greater than  $\frac{1}{2}$  inch in diameter takes a standard nut and SAE washer. Hardware  $\frac{1}{2}$  inch or less in diameter can take a properly torqued whiz nut or spirallock nut. See Figure 19.
4. Follow these SAE washer rules after determining exit hole type:
  - a. Always use a washer between hardware and a slot.
  - b. Always use a washer under a nut (see 2 above for exception).
  - c. Use a washer under a bolt when the female thread is fixed (weld nut).
5. Refer to Figure 19, which depicts the preceding hardware configuration possibilities.

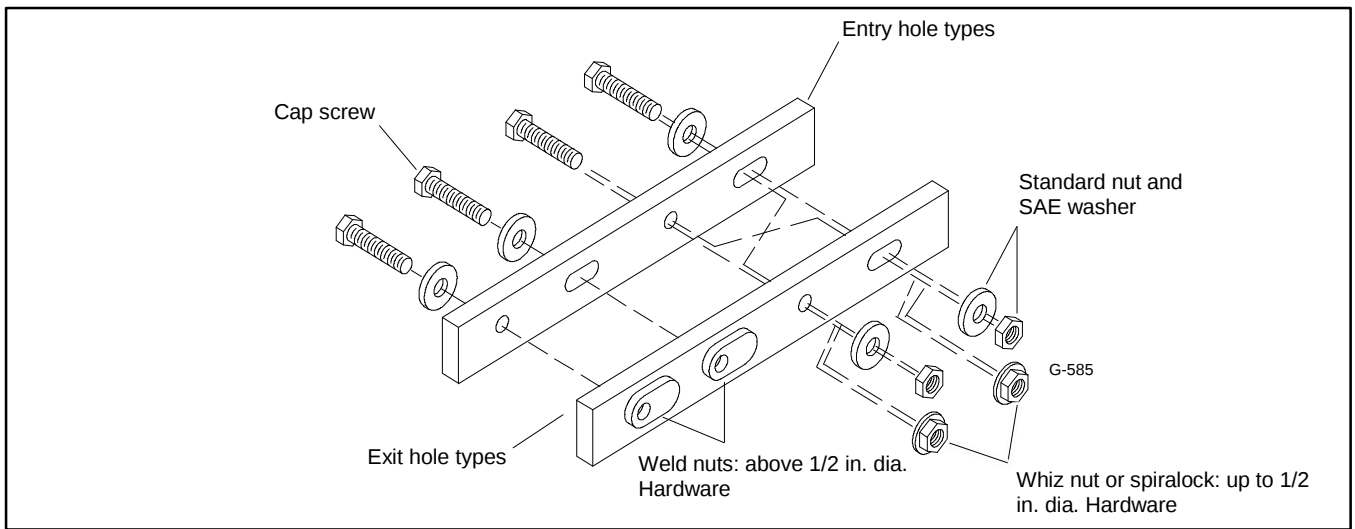


Figure 19 Acceptable Hardware Combinations

## Appendix C. Torque Specifications

| American Standard Fasteners Torque Specifications                |                                    |       |               |         |            |               |            |        |                         |                |
|------------------------------------------------------------------|------------------------------------|-------|---------------|---------|------------|---------------|------------|--------|-------------------------|----------------|
| Size                                                             | Assembled into Cast Iron or Steel  |       |               |         |            |               |            |        | Assembled into Aluminum |                |
|                                                                  | Grade 2                            |       |               | Grade 5 |            |               | Grade 8    |        |                         |                |
| 8-32                                                             | 2.0                                | Nm    | (18 in. lb.)  | 3.1     | Nm         | (27 in. lb.)  | -          |        | See Note 3              |                |
| 10-24                                                            | 3.2                                | Nm    | (28 in. lb.)  | 4.9     | Nm         | (43 in. lb.)  | -          |        |                         |                |
| 10-32                                                            | 3.6                                | Nm    | (32 in. lb.)  | 5.5     | Nm         | (49 in. lb.)  | -          |        |                         |                |
| 12-24                                                            | 5.0                                | Nm    | (44 in. lb.)  | 7.7     | Nm         | (68 in. lb.)  | -          |        |                         |                |
| 1/4-20                                                           | 7.6                                | Nm    | (67 in. lb.)  | 11.6    | Nm         | (103 in. lb.) | 16.5       | Nm     |                         | (146 in. lb.)  |
| 1/4-28                                                           | 8.6                                | Nm    | (76 in. lb.)  | 13.2    | Nm         | (117 in. lb.) | 18.8       | Nm     |                         | (166 in. lb.)  |
| 5/16-18                                                          | 15.5                               | Nm    | (137 in. lb.) | 24.0    | Nm         | (212 in. lb.) | 33.9       | Nm     |                         | (300 in. lb.)  |
| 5/16-24                                                          | 17.1                               | Nm    | (151 in. lb.) | 26.4    | Nm         | (234 in. lb.) | 40         | Nm     |                         | (28 ft. lb.)   |
| 3/8-16                                                           | 27                                 | Nm    | (243 in. lb.) | 42      | Nm         | (31 ft. lb.)  | 60         | Nm     |                         | (44 ft. lb.)   |
| 3/8-24                                                           | 31                                 | Nm    | (274 in. lb.) | 47      | Nm         | (35 ft. lb.)  | 68         | Nm     |                         | (50 ft. lb.)   |
| 7/16-14                                                          | 43                                 | Nm    | (32 ft. lb.)  | 68      | Nm         | (50 ft. lb.)  | 96         | Nm     |                         | (71 ft. lb.)   |
| 7/16-20                                                          | 49                                 | Nm    | (36 ft. lb.)  | 76      | Nm         | (56 ft. lb.)  | 107        | Nm     |                         | (79 ft. lb.)   |
| 1/2-13                                                           | 66                                 | Nm    | (49 ft. lb.)  | 103     | Nm         | (76 ft. lb.)  | 146        | Nm     |                         | (108 ft. lb.)  |
| 1/2-20                                                           | 75                                 | Nm    | (55 ft. lb.)  | 117     | Nm         | (86 ft. lb.)  | 164        | Nm     |                         | (121 ft. lb.)  |
| 9/16-12                                                          | 96                                 | Nm    | (71 ft. lb.)  | 149     | Nm         | (110 ft. lb.) | 210        | Nm     |                         | (155 ft. lb.)  |
| 9/16-18                                                          | 107                                | Nm    | (79 ft. lb.)  | 165     | Nm         | (122 ft. lb.) | 235        | Nm     |                         | (173 ft. lb.)  |
| 5/8-11                                                           | 133                                | Nm    | (98 ft. lb.)  | 206     | Nm         | (152 ft. lb.) | 290        | Nm     |                         | (214 ft. lb.)  |
| 5/8-18                                                           | 150                                | Nm    | (111 ft. lb.) | 232     | Nm         | (171 ft. lb.) | 328        | Nm     |                         | (242 ft. lb.)  |
| 3/4-10                                                           | -                                  |       |               | 365     | Nm         | (269 ft. lb.) | 515        | Nm     |                         | (380 ft. lb.)  |
| 3/4-16                                                           | -                                  |       |               | 405     | Nm         | (299 ft. lb.) | 572        | Nm     |                         | (422 ft. lb.)  |
| 1-8                                                              | -                                  |       |               | 881     | Nm         | (650 ft. lb.) | 1245       | Nm     |                         | (918 ft. lb.)  |
| 1-12                                                             | -                                  |       |               | 961     | Nm         | (709 ft. lb.) | 1357       | Nm     |                         | (1001 ft. lb.) |
| Metric Fasteners Torque Specifications, Measured in Nm (ft. lb.) |                                    |       |               |         |            |               |            |        |                         |                |
| Size (mm)                                                        | Assemblies into Cast Iron or Steel |       |               |         |            |               |            |        | Assembled into Aluminum |                |
|                                                                  | Grade 5.8                          |       | Grade 8.8     |         | Grade 10.9 |               | Grade 12.9 |        |                         |                |
| Mxxx-04xxx-xx                                                    | 1.9                                | (1.4) | 2.9           | (2.1)   | 4.3        | (3.2)         | 4.3        | (3.2)  | See Note 3              |                |
| Mxxx-05xxx-xx                                                    | 3.8                                | (2.8) | 5.8           | (4.3)   | 8.5        | (6.3)         | 8.5        | (6.3)  |                         |                |
| Mxxx-06xxx-xx                                                    | 6.5                                | (4.8) | 10.4          | (7.7)   | 14.7       | (11)          | 17.6       | (13)   |                         |                |
| Mxxx-08xxx-xx                                                    | 16                                 | (12)  | 25            | (17)    | 36         | (26)          | 43         | (31)   |                         |                |
| Mxxx-08xxx-xxF                                                   | 17                                 | (13)  | 27            | (20)    | 38         | (28)          | 46         | (34)   |                         |                |
| Mxxx-10xxx-xx                                                    | 31                                 | (23)  | 50            | (37)    | 70         | (52)          | 85         | (62)   |                         |                |
| Mxxx-10xxx-xxF                                                   | 33                                 | (24)  | 53            | (39)    | 74         | (55)          | 89         | (66)   |                         |                |
| Mxxx-12xxx-xx                                                    | 55                                 | (40)  | 87            | (64)    | 123        | (91)          | 147        | (109)  |                         |                |
| Mxxx-12xxx-xxF                                                   | 60                                 | (44)  | 95            | (70)    | 134        | (99)          | 161        | (119)  |                         |                |
| Mxxx-14xxx-xx                                                    | 87                                 | (64)  | 135           | (103)   | 196        | (145)         | 236        | (174)  |                         |                |
| Mxxx-14xxx-xxF                                                   | 94                                 | (69)  | 151           | (111)   | 212        | (156)         | 254        | (188)  |                         |                |
| Mxxx-16xxx-xx                                                    | 135                                | (100) | 217           | (160)   | 305        | (225)         | 365        | (270)  |                         |                |
| Mxxx-16xxx-xxF                                                   | 145                                | (107) | 231           | (171)   | 325        | (240)         | 390        | (288)  |                         |                |
| Mxxx-18xxx-xx                                                    | 187                                | (138) | 299           | (221)   | 421        | (310)         | 505        | (373)  |                         |                |
| Mxxx-18xxx-xxF                                                   | 210                                | (155) | 336           | (248)   | 473        | (349)         | 567        | (419)  |                         |                |
| Mxxx-20xxx-xx                                                    | 264                                | (195) | 423           | (312)   | 595        | (439)         | 714        | (526)  |                         |                |
| Mxxx-20xxx-xxF                                                   | 293                                | (216) | 469           | (346)   | 660        | (487)         | 792        | (584)  |                         |                |
| Mxxx-22xxx-xx                                                    | 360                                | (266) | 576           | (425)   | 811        | (598)         | 973        | (718)  |                         |                |
| Mxxx-22xxx-xxF                                                   | 396                                | (292) | 633           | (467)   | 890        | (657)         | 1068       | (788)  |                         |                |
| Mxxx-24xxx-xx                                                    | 457                                | (337) | 731           | (539)   | 1028       | (758)         | 1233       | (910)  |                         |                |
| Mxxx-24xxx-xxF                                                   | 498                                | (367) | 797           | (588)   | 1121       | (827)         | 1345       | (992)  |                         |                |
| Mxxx-27xxx-xx                                                    | -                                  | -     | 1072          | (790)   | 1507       | (1112)        | 1809       | (1334) |                         |                |
| Mxxx-27xxx-xxF                                                   | -                                  | -     | 1156          | (853)   | 1626       | (1199)        | 1952       | (1439) |                         |                |
| Mxxx-30xxx-xx                                                    | -                                  | -     | 1453          | (1072)  | 2043       | (1507)        | 2452       | (1809) |                         |                |

### Notes:

1. The torque values above are general guidelines. Always use the torque values specified in the service manuals and/or assembly drawings when they differ from the above torque values.
2. The torque values above are based on new plated threads. Increase torque values by 15% if non-plated threads are used.
3. At minimum, hardware threaded into aluminum must have two diameters of thread engagement. Hardware threaded into steel and cast iron must have 1.25 diameters of thread.
4. Torque values are calculated as equivalent stress loading on American hardware with an approximate preload of 75% of proof strength and a friction coefficient of 0.2.



## Appendix D. Operating Hours and Service Log

Use the log below to keep a cumulative record of operating hours on your generator set and the dates required services were performed. Enter hours to the nearest quarter hour.

[illegible]





## **TP-7173 10/20a**

*Original Instructions (English)*

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