Operator Manual

Cummins **Onan**

Performance you rely on.™

Marine Generator Set

MDDCA (Spec A–B)
MDDCB (Spec A–B)
MDDCC (Spec A–B)
MDDCD (Spec A–B)
MDDCE (Spec A–B)
MDDCF (Spec A–B)
MDDCG (Spec A–B)
MDDCH (Spec A–B)
MDDCJ (Spec A–B)
MDDCK (Spec B)

English – Original Instructions 10–2010 981–0172 (Issue 4)

California

Proposition 65 Warning

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

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SAFETY PRECAUTIONS

Thoroughly read the OPERATOR'S MANUAL before operating the genset. Safe operation and top performance can only be achieved when equipment is properly operated and maintained.

Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards shall remove, dismantle and dispose of the generator set. See service manual.

Some generator set installation procedures present hazards that can result in severe personal injury or death. Only trained and experienced personnel with knowledge of fuels, electricity, and machinery hazards should perform generator set installation procedures.

The following symbols in this manual alert you to potential hazards to the operator, service person and equipment.

⚠ DANGER ***Used to alert you to a lethal hazard against which you must take steps to prevent severe personal injury or death, as when you are in the vicinity of High Voltage equipment.***

⚠WARNING ***Used to alert you to a hazard or unsafe practice that can result in severe personal injury or death.***

⚠ CAUTION ***Used to alert you to a hazard or unsafe practice that can result in personal injury or equipment damage.***

Electricity, fuel, exhaust, moving parts and batteries present hazards that can result in severe personal injury or death.

GENERAL PRECAUTIONS

- Keep children away from the genset.
- Do not use evaporative starting fluids. They are highly explosive.
- Do not step on the genset when entering or leaving the generator room. Parts can bend or break leading to electrical shorts or to fuel, coolant or exhaust leaks.
- To prevent accidental or remote starting while working on the genset, always disconnect the negative (–) battery cable at the battery.
- Let the engine cool down before removing the coolant pressure cap or opening the coolant drain. Hot coolant under pressure can spray and cause severe burns.
- Keep the genset, drip pan and compartment clean. Oily rags can catch fire. Gear stowed in the compartment can restrict cooling.
- Make sure all fasteners are secure and properly torqued.
- Do not work on the genset when mentally or physically fatigued or after consuming alcohol or drugs.
- Used engine oil has been identified by some U. S. state and federal agencies as causing cancer or reproductive toxicity. Do not ingest, inhale, or contact used oil or its vapors.
- Ethylene glycol, used as engine antifreeze, is toxic to humans and animals. Clean up spills and dispose of used engine coolant in accordance with local environmental regulations.
- Keep multi-purpose fire extinguishers handy. Multi–purpose fire extinguishes are used for fires that involve ordinary combustible materials such as wood and cloth; combustible and flammable liquid fuels and gasous fuels; live electrical equipment. (North Americal or US: (ref. NFPA No. 10)
- Genset installation and operation must comply with all applicable local, state and federal codes and regulations.
- Generator sets with a sound shield shall not be run with the service doors removed/missing.
- Engine components can be hot and cause severe burns. Hot coolant under pressure can spray and cause severe burns.
- Use personal protective equipment when maintaining or installing the generator set such as gloves, safety glasses, etc.

GENERATOR VOLTAGE IS DEADLY

- Generator electrical output connections must be made by a trained and experienced electrician in accordance with applicable codes.

⚠WARNING ***Interconnecting the generator set and shore power can lead to electrocution of utility line workers, equipment damage and fire. Use an approved switching device to prevent interconnections.***

- Use caution when working on live electrical equipment. Remove jewelry, make sure clothing and shoes are dry, stand on a dry wooden platform or rubber insulating mat and use tools with insulated handles.

ENGINE EXHAUST IS DEADLY

- Never sleep in the boat while the genset is running unless the boat is equipped with properly working carbon monoxide detectors.
- The exhaust system must be installed in accordance with the genset Installation Manual and be free of leaks.
- Make sure the bilge is adequately ventilated with a power exhauster.
- Inspect for exhaust leaks at every startup and after every eight hours of operation.
- For more information about carbon monoxide poisoning see the American Boat and Yacht Council (ABYC) publication TH-22—*Educational Information About Carbon Monoxide.*

DIESEL FUEL IS COMBUSTIBLE

- Do not smoke or turn electrical switches ON or OFF where fuel fumes are present or in areas sharing ventilation with fuel tanks or equipment. Keep flames, sparks, pilot lights, arc-producing equipment and all other sources of ignition well away.
- Fuel lines must be secured, free of leaks and separated or shielded from electrical wiring.

BATTERY GAS IS EXPLOSIVE

- Wear splash–proof safety glasses.
- Do not smoke or permit flames or sparks to occur near the battery at any time.
- To reduce arcing when disconnecting or reconnecting battery cables, always disconnect the negative (–) battery cable first and reconnect it last.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not wear loose clothing or jewelry near moving parts such as PTO shafts, fans, belts and pulleys.
- Keep hands away from moving parts.
- Keep guards in place over fans, belts, pulleys, and other moving parts.

FLAMMABLE VAPOR CAN CAUSE A DIESEL ENGINE TO OVERSPEED

⚠WARNING ***Do not operate a diesel-powered genset where a flammable vapor environment can be created by fuel spill, leak, etc. The owners and operators of the genset are solely responsible for safely operating the genset.***

Flammable vapor can cause a diesel engine to overspeed and become difficult to stop, possibly resulting in fire, explosion, severe personal injury or death.

THE HAZARDS OF CARBON MONOXIDE

Engine–driven generators can produce harmful levels of carbon monoxide that can injure or kill you. The nature of boating is such that you can be harmed by the poisonous gas despite good generator set maintenance and proper ventilation.

ONLY YOU CAN PROTECT YOURSELF FROM CO POISONING!

- Watch constantly for swimmers when the generator set is running.
- Make sure exhaust cannot get under the deck, between hulls or enter the living quarters through a windown, vent or door.
- Make sure all CO detectors and audible alarms are working properly.
- Pay attention to the signs of CO poisoning.
- Check the exhaust system for corrosion, obstruction and leaks each time you start the generator set and every eight hours if you run it continuously.

M-10

SUBSTANCE HAZARDOUS TO HEALTH

Generator sets use substances, and emit and create wastes that can cause health risks. Generator set operators must use appropriate personal protective equipment (such as clothing, gloves, protective glasses/goggles, and respiration equipment) when exposed to fuel, oil, coolant, wet batteries, grease, cleaning agents, or other substances exposed to lungs, eyes, or skin. Use appropriate containers for transport, storage, and disposal of waste substances. Follow local regulations for disposal and recycling.

ANTIFREEZE (FLEETGUARD – ES COMPLEAT/EG PREMIX)

This antifreeze is also know as an ethylene glycol based coolant; summer coolant; coolant additive. It is purple coloured, viscous liquid, with a mild chemical odour, is soluble in water and harmful. It contains ethylene glycol, and diethylene glycol. Ethylene glycol is a potentially hazardous constituent.

The substance has a boiling point of 107° C, and a flash point of 121° C.

It is used as an engine coolant additive, and can be found in engine cooling systems, and heat exchangers. Installers, operators and maintainers are likely to encounter this substance.

HAZARDOUS REACTIONS

Ethylene glycol is combustible when exposed to heat or flame and can react vigorously with oxidants. Moderate explosive hazard in form of vapour when exposed to heat or flame. Hazardous products resulting from combustion or decomposition include carbon monoxide, carbon dioxide and acrid smoke. Self–contained breathing apparatus must be worn in the event of fume build up.

Avoid strong oxidizing agents – incompatible with sulfuric acid, nitric acid, caustics and aliphatic amines.

It may cause neurological signs and symptoms, and kidney damage. It is also a skin and eye irritant.

Very toxic in particulate form upon inhalation. Harmful if swallowed, lethal dose for humans reported to be 100ml.

PROTECTIVE MEASURES

Refrain from eating, drinking or smoking when using the product. Adopt a high standard of personal hygiene. In case of skin contact, wash immediately with soap and water.

Ensure good ventilation and avoid heat sources. Avoid breathing mist, if there is a risk of vapour, or particulate, use a suitable organic vapour mask.

Eye protection, gloves, overalls, impervious apron should be used. Avoid contamination inside the gloves. If overalls become contaminated, discontinue use and clean thoroughly.

STORAGE/TRANSPORT

Store and transport only in correctly marked containers. Keep containers closed when not in use. Keep cool, out of sunlight, away for naked flames and strong acids, do not freeze. Store well away from food–stuffs and drinking water. Take special care to avoid discharge into drains, sewers and water–courses.

Contain leak/spill with sand, earth or non–combustible, absorbent material to prevent entry of substance into drainage/sewerage system, water–courses and land. Eliminate all ignition sources, use plastic shovel to transfer to suitable container and dispose of unwanted or absorbed substance through and authorised contractor to a licensed site.

EMERGENCY ACTION

- Fire
  Extinguishing media: CO_2, alcohol resistant foam, dry powder, or water spray.
  Fire fighters to use self contained breathing apparatus. Keep fire exposed containers cool. Prevent run–off from entering waterways, drains and drinking water supplies.
- Ingestion
  Toxic by ingestion. If swallowed induce vomiting only under the advice of a Doctor or poison control centre. Delayed treatment may result in fatality.
- Inhalation (of vapour)
  Remove from further exposure. In case of irritation to lungs or throat, seek medical advice.
- Aspiration (inhalation of liquid)
  Obtain immediate medical assistance.
- Eyes
  Flush copiously with water or preferably eye–

wash solution for at least five minutes. Seek medical advice.

- Skin
  Wash thoroughly with soap and water, and seek medical attention if irritation develops. Change clothing if necessary and wash before re–use.
- Spillage
  Soak–up using an absorbent material and dispose of this as directed under Storage/Transport.

GAS OIL

This product is also known as Red Diesel, Fuel Oil, and type A1 or A2. It can be pale red or a clear liquid with a characteristic mild odour. It contains catalytically cracked oil, petroleum distillates, quinizarin, and gas oil maker dye red. The catalytically cracked oil and petroleum distillates are potentially hazardous constituents.

The substance has an initial boiling point of 180°C, a flash point greater than 56°C, and a vapour pressure less than 0.7mm Hg at 20°C and has negligible solubility in water.

It is used as a fuel for off–road diesel powered vehicles and stationary engines, and can be found in fuel tanks, pipes and injection systems. The substance should not be used for any other purpose without contacting the manufacturer or supplier. Installers, operators and maintainers are likely to encounter this substance.

HAZARDOUS REACTIONS

This liquid is flammable. Avoid smoking, heat sources, such as welding and naked flames, sparks and static electricity build–up. Thermal decomposition products are hazardous, containing CO_X, NO_X and SO_X compounds.

The vapour is explosive. High vapour concentrations can cause respiratory irritation, dizziness, nausea, and loss of consciousness. Excessive and prolonged exposure to the mist can cause chronic inflammatory reaction of the lungs and a form of pulmonary fibrosis.

Avoid strong oxidising agents, e.g. chlorates which may be use in agriculture.

Gas oil is slightly irritating to the skin and has a de–fatting action. Toxicity following single exposure to high level of gas oil is of low order. Prolonged, repeated skin contact may de–fat the skin resulting in possible skin irritation and dermatitis. In some cases warty, cancerous growths have occurred.

PROTECTIVE MEASURES

Ensure good ventilation and avoid heat sources. Observance of good housekeeping rules will ensure general safety. Do not smoke. Avoid breathing mist.

When working on, or testing, injection equipment, special care is required to avoid perforation of skin by high pressure fuel. Use eye protection in the event of suspected high pressure leak.

Adopt a high standard of personal hygiene. In the case of skin contact, wash well with soap and water.

Use glove and overalls, and eye protection goggles if there is a risk of splashing. Use oil impervious gloves and avoid contamination inside the gloves. If overalls become contaminated, discontinue use and clean thoroughly. Contaminated clothing should be removed, soaked with water, and laundered before re–use.

No special respiratory precautions are necessary in normal use.

DO NOT use as a solvent for removing dirt/grease etc, from skin.

STORAGE/TRANSPORT

Store and transport only in correctly marked containers. Keep containers closed when not in use. Keep cool, out of sunlight and away from naked flames. Electrical continuity is required between the transport and storage vessels during product transfer.

Contain leak/spill with sand, earth or other suitable material, and prevent entry of substance into drainage/sewerage system, water–courses and land. Dispose of unwanted or absorbed substance through an authorised contractor to a licensed site.

Inform local and fire authorities should the product reach waterways, drains etc.

EMERGENCY ACTION

- Fire
  Extinguishing media:
  Large fire – Foam/water fog. Never use water jet.
  Small fire – foam/dry powder, AAAF, CO_2, sand, earth.
  Avoid making sparks. Fire fighters to use self–contained breathing apparatus. Keep fire exposed containers cool, using water fog/spray. Prevent run–off from entering waterway, drains and drinking water supplies.
- Ingestion
  Do not induce vomiting. Wash the mouth out with water, and send to hospital immediately.
- Inhalation (of vapour)
  Remove from further exposure. Obtain medical assistance immediately.
- Aspiration (inhalation of liquid)
  If, following ingestion of gas oil, vomiting occurs, there is danger of aspiration into the lungs. This would cause intense local irritation and chemical pneumonitis that can be fatal. Obtain immediate medical assistance.
- Eyes
  Irrigate copiously with water or preferably eye–wash solution for at least five minutes. If irritation persists seek medical advice.
- Skin
  Wash thoroughly with soap and water. Change clothing if necessary.
  If high pressure injection has occurred prompt surgical attention is required.
- Spillage
  Absorb using sand, earth or other suitable material. Dispose of unwanted or absorbed flammable material as directed under Storage/ Transport.

LUBRICATION OIL – PREMIUM BLUE E 15W40

Also known as oil, lube oil, sump oil, new oil is dark, viscous liquid with a slight, characteristic odour. The base oil contains: distillates (petroleum), solvent–dewaxed heavy paraffinic. It is not classified as dangerous according to Directive 1999/45/EC and its amendments, and is not classified according to the EU regulations.

It has a boiling point greater than 150°C, a flash point Open Cup of 220°C (Cleveland), and is insoluble in cold water.

It is used in engine lubricant oil systems, sump pan and filters, make–up tanks and piping systems as a lubrication oil for use in wide range of diesel engines operating under severe conditions. Installers, operators and maintainers are likely to encounter this product.

HAZARDOUS REACTIONS

This product is stable although slightly re–active with oxidising agents. Results of decomposition are carbon oxides (CO, CO_2) and water.

Although harmful if swallowed or aspirated (breathed in), repeated or prolonged exposure is not known to aggravate medical conditions.

Used oil may contain harmful combustion by–products and unburnt fuel that will cause skin reactions as detailed for fuel. Particular care must be taken if oil form a severely overheated engine is handled – use impervious gloves, lab coat and safety glasses.

Do not breathe vapour/spray.

PROTECTIVE MEASURES

Ensure good ventilation and avoid heat sources.

Adopt a high standard of personal hygiene. In case of skin contact, wash thoroughly with soap and water.

Use safety glasses, impervious gloves and lab coat. Avoid contamination inside the gloves. If overalls become contaminated, discontinue use and clean thoroughly.

No special respiratory precautions are necessary in normal use. Do no breathe vapour/spray when handling hot materials.

STORAGE/TRANSPORT

Store and transport only in correctly marked containers. Keep containers tightly sealed when not in use. Keep in a cool, well ventilated area, out of sunlight and away from naked flames. Store well away from food–stuffs and drinking water.

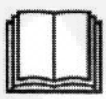
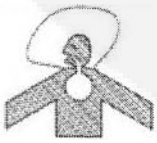
Wear splash goggles, full suit, boots and gloves. Absorb leak/spill with an inert material and dispose of unwanted or absorbed substance through an authorised contractor to a licensed site. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

EMERGENCY ACTION

- Fire
  Extinguishing media:
  Large fire – Use water spray, fog or foam. Do not use water jet.
  Small fire – Use dry chemical powder or CO_2
  Fire–fighters to use self contained breathing apparatus and full turnout gear. Keep fire exposed containers cool.
- Ingestion
  Do not induce vomiting, Obtain medical advice immediately.
- Inhalation (of vapour)
  Remove from further exposure. Obtain medical attention.
- Aspiration (inhalation of liquid)
  Obtain immediate medical assistance.
- Eyes
  Flush copiously with water or preferably eye–wash solution for at least fifteen minutes. Obtain medical advice.
- Skin
  Wash thoroughly with soap and water. Obtain medical advice if irritation develops. Change clothing if necessary and wash before re–use.
- Spillage
  Absorb with an inert material and dispose of this as directed under Storage/Transport.

Generator Set Warning Labels

Warning signs are provided on the generator set at or near the point of risk. To avoid injury, always take the necessary precautions – as indicated on the sample signs shown below:

	Caution / Warning. Indicates a risk of personal injury.
	Caution / Warning of Temperature Hazard. Indicates a risk of personal injury from high temperature.
	Caution / Warning of High Voltage Hazard. Indicates a risk of personal injury from electric shock/electrocution.
	Caution / Warning of Engine Coolant Pressure Hazard. Indicates a risk of personal injury from hot pressurized engine coolant.
	Caution / Warning. Indicates to read Operator manual for additional information.
	Caution / Warning of No Step. Indicates a risk of personal injury or equipment damage from stepping on equipment.
	Caution / Warning of Combustion/Explosion Hazard. Indicates a risk of personal injury from explosion.
	Caution / Warning of Belt and Rotating Part Hazard. Indicates a risk of personal injury from entanglement in moving parts.
	Caution / Warning of Chemical (ingestion/burn) Hazard. Indicates a risk of personal injury or asphyxiation from poisonous fumes or toxic gases.
	Caution / Warning of High Voltage or Current Source Hazard. Indicates a risk of personal injury from electrical shock/electrocution.

1. Introduction

ABOUT THIS MANUAL

This is the Operator's Manual for the generator sets (gensets) listed on the front cover. Each operator should study this manual carefully and observe all of its instructions and safety precautions. Keep this manual close at hand for reference.

⚠WARNING ***This genset is not a life support system. It can stop without warning. Children, persons with physical or mental limitations, and pets could suffer personal injury or death. A personal attendant, redundant power or alarm system must be used if genset operation is critical.***

⚠WARNING ***This generator set is not "ignition proteced" and shall not be used in flammable vapor environment.***

⚠WARNING ***This generator set shall not be the main source of power for communication and steering systems. It can stop without warning.***

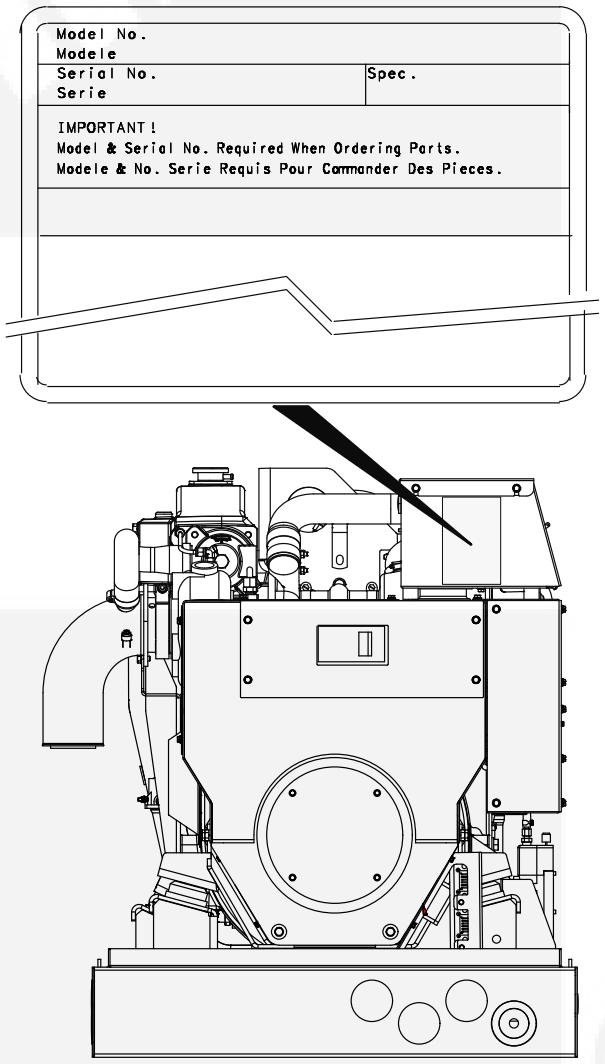
Operation, Periodic Maintenance and *Troubleshooting* provide the instructions necessary for operating the genset and maintaining it at top performance. The owner is responsible for performing maintenance in accordance with the PERIODIC MAINTENANCE SCHEDULE (p. 4-1). This manual also includes genset specifications and information regarding compliance with emissions regulations.

See the Parts Manual for part identification numbers and required quantities. Genuine Onan® replacement parts are recommended for best results.

⚠WARNING ***Within the Parts Manual, MC parts are MACHINE CRITICAL and must comply with boating safety ignition protection, backfire, fire resistance, exhaust system integrity, or other requirements established by regulatory agencies, such as the US Coast Guard, ABYC, and ISO. When MACHINE CRITICAL parts are replaced for any reason, use Onan parts that are identified with the part numbers in the appropriate Parts Manual.***

MODEL IDENTIFICATION

Be ready to provide the genset model and serial numbers on the nameplate when contacting Onan for parts, service and product information. Figure 1–1 illustrates the nameplate and its location on the side of the control box. Every character in these numbers is significant. (The last character of the model number is the specification letter, which is important for obtaining the right parts.) Record the genset model and serial numbers on the lines designated in the figure so that they are easy to find when you need them.



MODEL NUMBER: _____

SERIAL NUMBER: _____

FIGURE 1-1. TYPICAL NAMEPLATE

NOISE

Generator sets emit noise. As noise level and time of exposure increase, risk of hearing damage increases. The Specifications page in the Operator manual states noise level for this generator set. Select and use personal hearing protection appropriate for your exposure to generator set noise.

Note for use in countries where compliance to the EU Noise directive is required: This generator set has not been evaluated and is not marked for use in open air. Install the generator set in accordance with the Installation manual. Obey local noise restrictions when you operate the generator set.

ELECTROMAGNETIC COMPATIBILITY

Generator sets emit and receive electromagnetic (radio frequency) energy. If the generator set affects operation of nearby devices, or nearby devices affect generator set operation, increase the distance between them.

Note for use in countries where compliance to the EMC directive is required: This generator set has been evaluated for use in residential, commercial, and light industrial environments.

HOW TO OBTAIN SERVICE

⚠WARNING ***Improper service or replacement of parts can lead to severe personal injury or death and to damage to equipment. Service personnel must be trained and experienced in performing electrical and mechanical service.***

For genset parts, service, and product information (such as the Service Manual), contact the nearest Onan distributor. Internet site ***www.onan.com*** has information for contacting our distributors worldwide.

In North America

Call 1-800-888-ONAN for the nearest Cummins/ Onan distributor in the United States or Canada. Press 1 (OPTION 1) to be automatically connected.

If you are unable to contact a distributor using the automated service, consult the Yellow Pages. Typically, our distributors are listed under:

GENERATORS – ELECTRIC

Outside North America

Call Onan Corporation at 1–763–574–5000 from 7:30 AM to 4:00 PM (Central Standard Time), Monday through Friday, or fax 1–763–528–7229.

Information To Have Available

1. *Model Number, including Spec Letter, and Serial Number*
2. *Date of purchase*
3. *Nature of problem (Section 5. Troubleshooting).*

U. S. FEDERAL EMISSIONS LABEL

The label that states compliance with applicable EPA emissions regulations is located on the side of the valve cover (Figure 1-2). Refer also to the FEDERAL EMISSION DESIGN AND DEFECT LIMITED WARRANTY FOR C. I. ENGINES (DIESELS) that was shipped in the same package as the genset Operator's Manual.

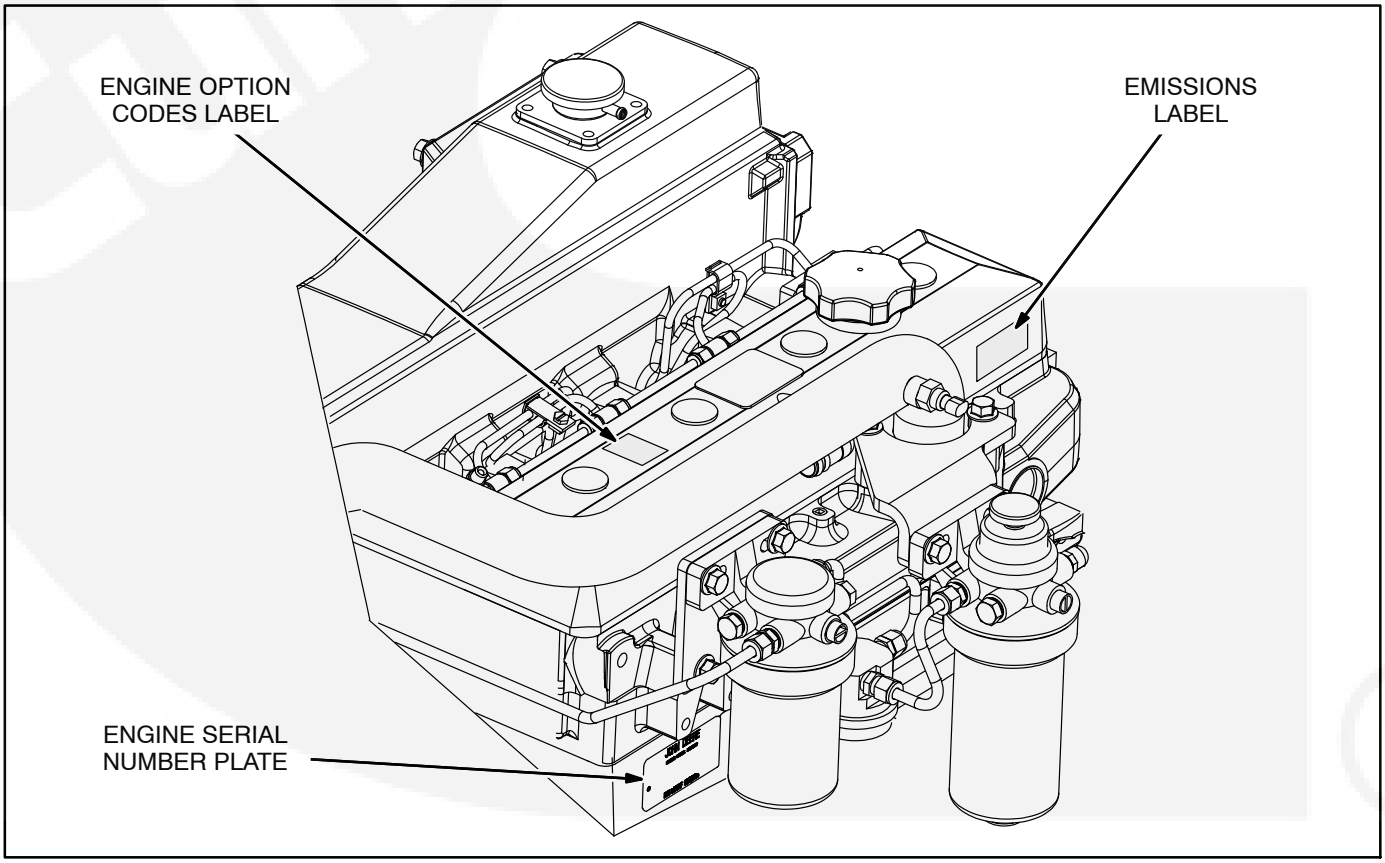


FIGURE 1-2. ENGINE LABELS

BUILD STANDARDS

The generator set and its control system have been designed, constructed and tested generally in accordance with the following Standards where applicable refer to Table 1–1.

TABLE 1-1. BUILD STANDARS

BS EN 1037:1995+A1:2008	Safety of machinery – Prevent of unexpected start up.
BS EN ISO 14121–1:2007	Safety of machinery. Risk assessment. Principles
BS EN ISO 13857:2008	Safety of machinery. Safety distance to prevent hazard zones being reached by upper and lower limbs.
BS EN 349:1993+a1:2008	Safety of machinery – Minimum gaps to avoid crushing parts on the human body.
BS EN 547–1: 1996+A1:2008	Safety of machinery – Human body dimensions – Part 1: Principles of determining the dimensions required for openings for whole body access into machinery.
BS EN 547–2:1996+A1:2008	Safety of machinery – Human body dimensions – Part 2: Principles for determining the dimensions required for access openings.
BS EN 547–3:1996+A1:2008	Safety of machinery – Human body dimensions – Part 3: Anthropomorphic data.
BS EN 60204–1:2006+A1:2009	Safety of machinery. Electrical equipment of machines. General requirements
BS EN 614–1:2006+A1:2009	Safety of machinery. Ergonomic design principles. Terminology and general principles
BS EN 953:1997+A1:2009	Safety of machinery – Guards – General requirements for the design and construction of fixed and movable guards.
BS EN ISO 12100–1:2003+A1:2009	Safety of machinery. Basic concepts, general principles for design. Basic terminology, methodology
BS EN ISO 12100–2:2003+A1:2009	Safety of machinery. Basic concepts, general principles for design. Technical principles
BS EN ISO 13732–1:2008	Ergonomics of the thermal environment. Methods for the assessment of human responses to contact with surfaces. Hot surfaces
BS EN ISO 13849–1:2008	Safety of machinery – Safety related parts of control systems
BS EN ISO 13850:2006	Safety of machinery – Emergency stop. Principles for design.
BS EN 61310–1:2008	Safety of machinery – Indication, marking and actuation – Part 1: Requirements for visual, auditory and tactile signals.

BS EN 61310−2:2008	Safety of machinery − Indication, marking and actuation − Part 2: Requirements for marking.
BS EN 61000−6−1:2007	Electromagnetic compatibility (EMC). Generic standards. Immunity standard for residential, commercial and light−industrial environments
BS EN 61000−6−3:2007	Electromagnetic compatibility (EMC). Generic standards. Emission standard for residential, commercial and light−industrial environments
BS EN 1299:1997+A1:2008	Mechanical vibration and shock − Vibration isolation of machines − Information for the application of source isolation
BS EN 1679−1:1998	Reciprocating internal combustion engines − Saftey − Part 1: Compression ignition engines
BS EN 12601:2001	Reciprocating internal combustion engine driven generating sets − Safety

2. Genset Control Panel

LOCAL CONTROL PANEL

The genset control panel either has an Digital Display or a control switch with status lamps. A genset equipped for operation in parallel with other gensets may have a single/parallel operation selector switch. It may also have a manual voltage regulator. If the genset has a housing, remove the front panel for access to the selector switches and manual voltage adjusting knob. See Figure 2-1.

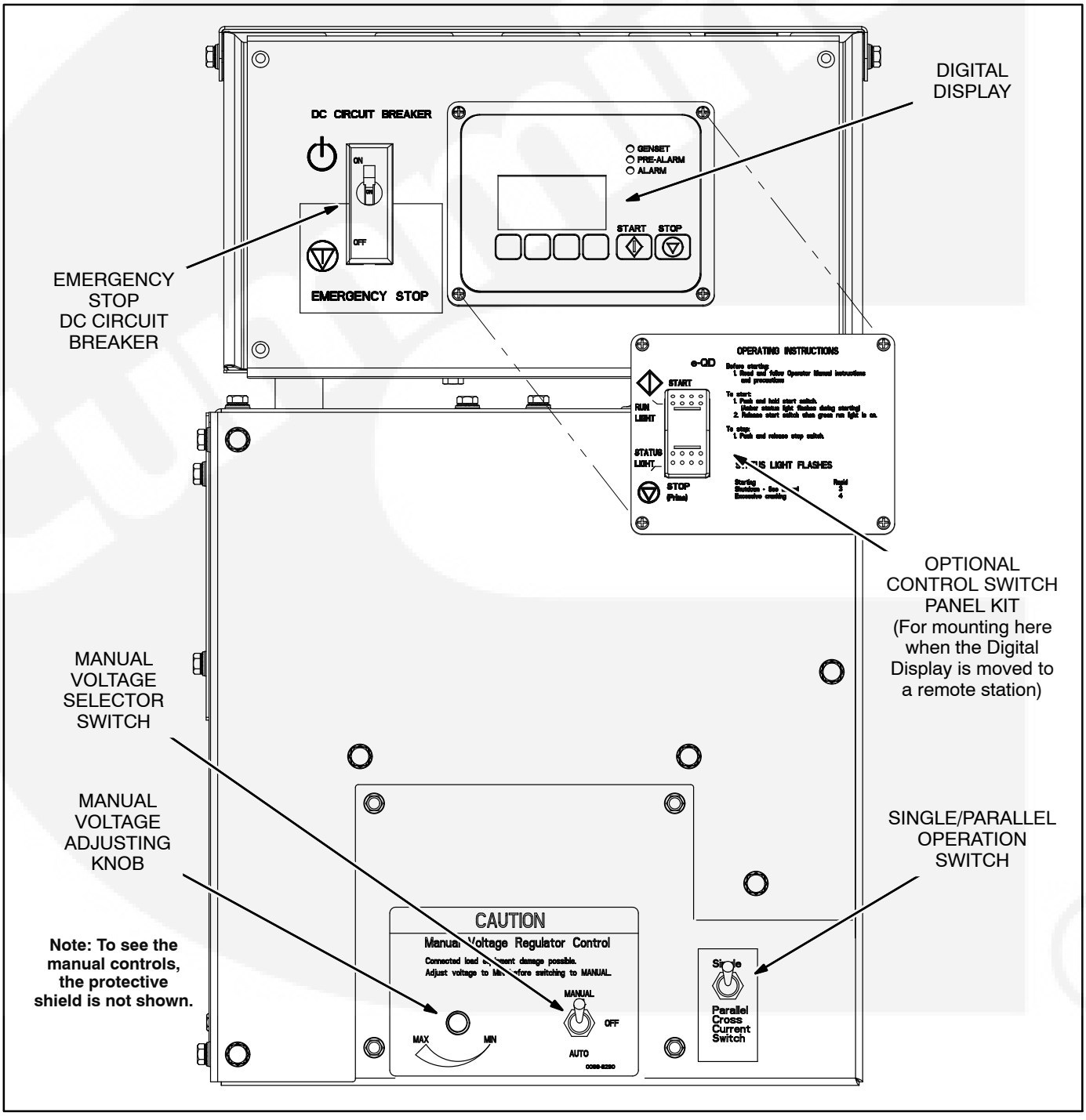


FIGURE 2-1. GENSET CONTROL PANEL

EMERGENCY STOP SWITCH

This is a 20 amp circuit breaker that protects the genset control circuits from shorts to ground. Push the red handle down to stop the genset.

CONTROL SWITCH

Control Switch: This switch is used to start and stop the genset and prime fuel (if the genset is equipped with an auxiliary electric fuel pump).

- *Push* and *Hold* **START** until the genset starts (green lamp comes on).
- *Push* and *Release* **STOP (Prime)** to stop the genset.
- *Push* and *Hold* **STOP (Prime)** to prime the fuel system (amber lamp comes on in 2 seconds to indicate priming).

Status Lamps: The control switch has two status lamps. The *amber* status lamp comes on during priming, blinks rapidly during cranking and goes out when the engine is up to speed. If the genset shuts down abnormally, this lamp will slowly blink a numerical code to indicate the cause of shutdown. See *Section 5. Troubleshooting*. The *green* status lamp comes on to indicate that the genset is running.

DIGITAL DISPLAY

The Digital Display has an LCD screen with 4 navigation buttons, 3 status lamps, a START button and a STOP button (Figure 2-2).

Turning On the Display

Touch any button to turn on the Display, which will initialize and attempt to establish communications with the genset controller. All connected Displays will turn on automatically when the genset is started at any station. They will all turn off 5 minutes after the genset has received a normal command to stop. They will stay on indefinitely until a fault shutdown is cleared by touching any button on any Display.

Start Button

Starting the Genset: *Push* and *Hold* **START** until the genset starts. The GENSET status lamp blinks while the engine is cranking. It comes on when the genset starts and stays on while it runs. The status displayed on the LCD changes from *Starting* to *Running* (Figure 2-3). See STARTING THE GENSET (p. 3-3).

Stop Button

Stopping the Genset: *Push* and *Release* **STOP**. The GENSET status lamp will go out. The status displayed on the LCD will change from *Running* to *Stopped* (Figure 2-3). See STOPPING THE GENSET (p. 3-4).

Priming the Fuel System: *Push* and *Hold* **STOP**. The GENSET status lamp will blink. The status displayed on the LCD will change to *Priming* in 2 seconds (Figure 2-3). See PRIMING THE FUEL SYSTEM (p. 3-3).

Genset Status Lamps

GENSET – This status lamp (green) blinks while the engine is cranking or the fuel system is being primed. It stays on while the genset is running.

PRE-ALARM – This status lamp (amber) comes on when an engine Pre-Alarm condition exists (p. 2-7). It blinks rapidly while the genset is running in fault bypass mode (p. 2-10).

ALARM – This status lamp (red) blinks during fault shutdown (p. 2-5).

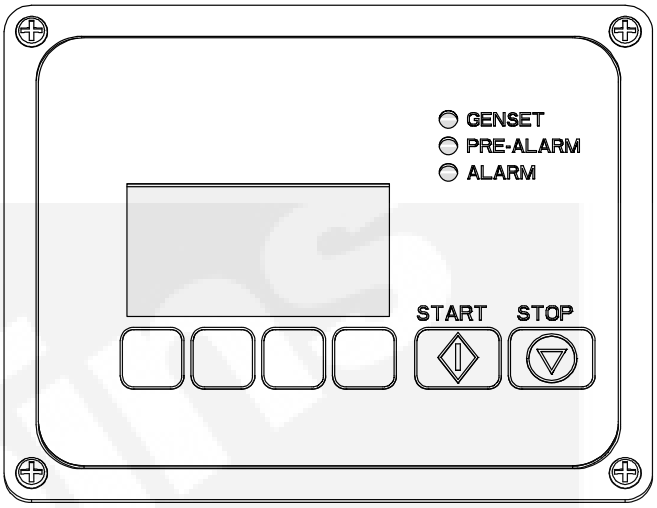


FIGURE 2-2. DIGITAL DISPLAY

Genset Status

Genset status is displayed on 4 screen pages (Figure 2-3). GEN STATUS PG1 appears when the Display is turned on. Press the double arrows [⏬] to toggle between the 4 screen pages.

The *Status* line on PG1 will display the word *Priming*, *Starting*, *Running, Stopped, Volt Adj.* or *Fault Override*. The rest of the lines on the 4 status screen pages display AC output voltage, AC frequency, percentage of full load in 10 percent increments (bar graph), engine coolant temperature, engine oil pressure, engine RPM, engine air intake manifold temperature, fuel temperature, fuel rate (consumption), starting battery voltage and total genset running time.

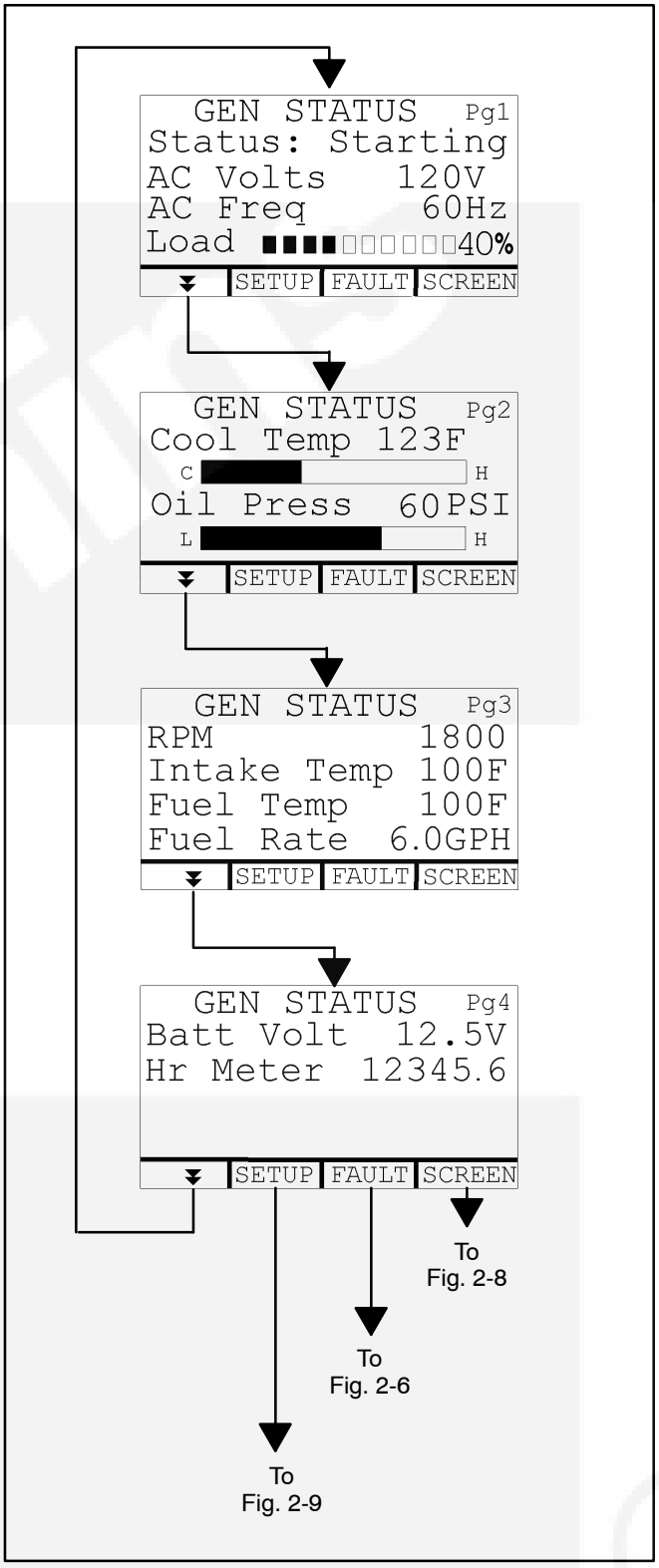


FIGURE 2-3. TYPICAL GENSET STATUS SCREENS

Fault Screen

When Fault Occurs: If a fault shutdown occurs the ALARM status lamp will blink and the LCD screen will display the Fault Number, a description of the Fault and the hour in total genset running time when the Fault occurred (Figure 2-4). Refer to TABLE 5-1. TROUBLESHOOTING GENSET FAULTS to diagnose and correct the problem.

The *e*-Series Digital Display will display the fault indefinitely. Touch any button to clear the fault. The display will turn off in 5 minutes after the fault has been cleared.

Engine Fault—No. 16: If this fault occurs, press the INFO button (which appears only for this fault) to display the engine FAULT INFO screen for a description of the engine fault (Figure 2-5). If this fault occurs see TABLE 5-2. TROUBLESHOOTING ENGINE FAULT—NO. 16.

The SPN and FMI numbers displayed on the FAULT INFO screen are the diagnostic code numbers used in the SAE J1939 engine data network protocol supported by the genset.

Press [◂BACK] to go back to the GEN STATUS screen.

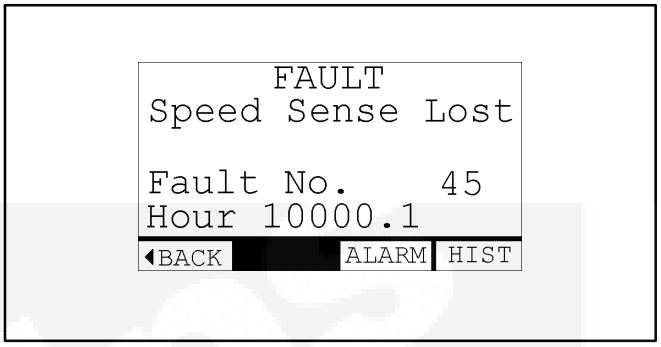


FIGURE 2-4. TYPICAL FAULT SCREEN

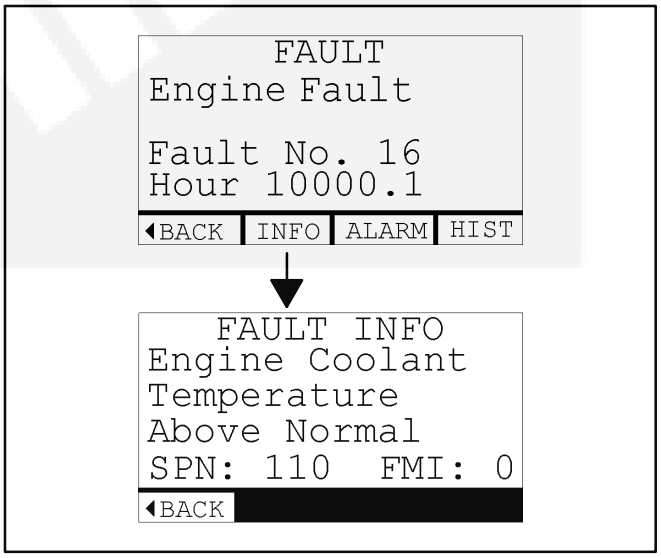


FIGURE 2-5. TYPICAL ENGINE FAULT SCREENS

Fault History

To display any of the last five faults, press the FAULT button on any GEN STATUS screen. Then press the HIST button on the FAULT screen (Figure 2-6).

The FAULT HISTORY screen will display the last Fault Number, a description of the Fault and the hour in total genset running time when the fault occurred. Press the double arrows [⏬⏫] to toggle between the last 5 faults. If there are no faults, the FAULT HISTORY screen will display *No Stored Faults*.

Press [◀BACK] to go back to GEN STATUS.

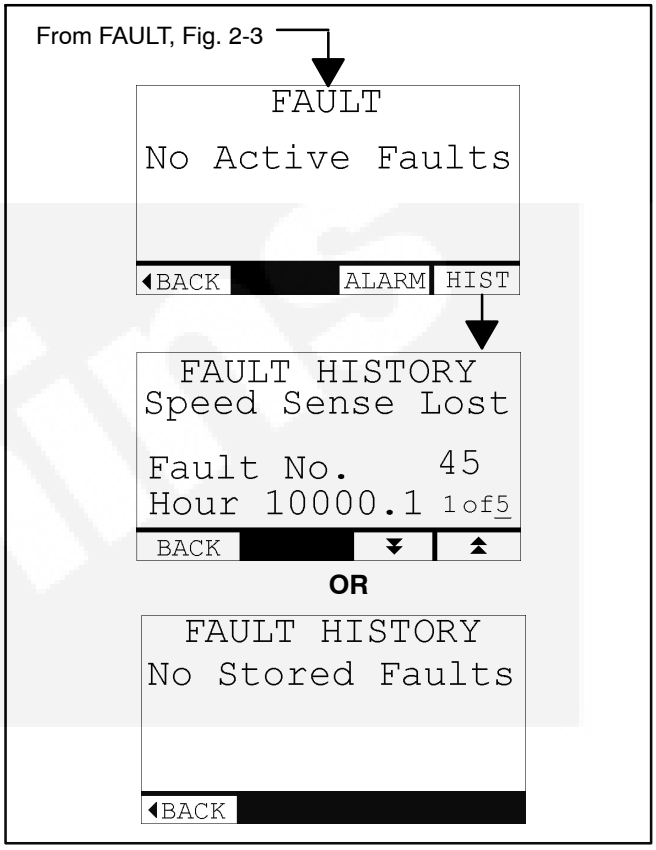


FIGURE 2-6. FAULT HISTORY

Engine Pre-Alarms

The PRE-ALARM status lamp will start to blink as certain engine running conditions approach their limits for engine shutdown. To display information about the pre-alarm condition, press the FAULT button on any GEN STATUS screen. Then press the ALARM button to display the PRE-ALARM screen (Figure 2-7).

The PRE-ALARM screen will display a brief description of the condition and the SPN and FMI numbers, which are the diagnostic code numbers used in the SAE J1939 engine data network protocol supported by the genset.

Refer to TABLE 5-3. TROUBLESHOOTING ENGINE PRE-ALARMS to diagnose and correct the problem.

Press [◂BACK] to go back to GEN STATUS.

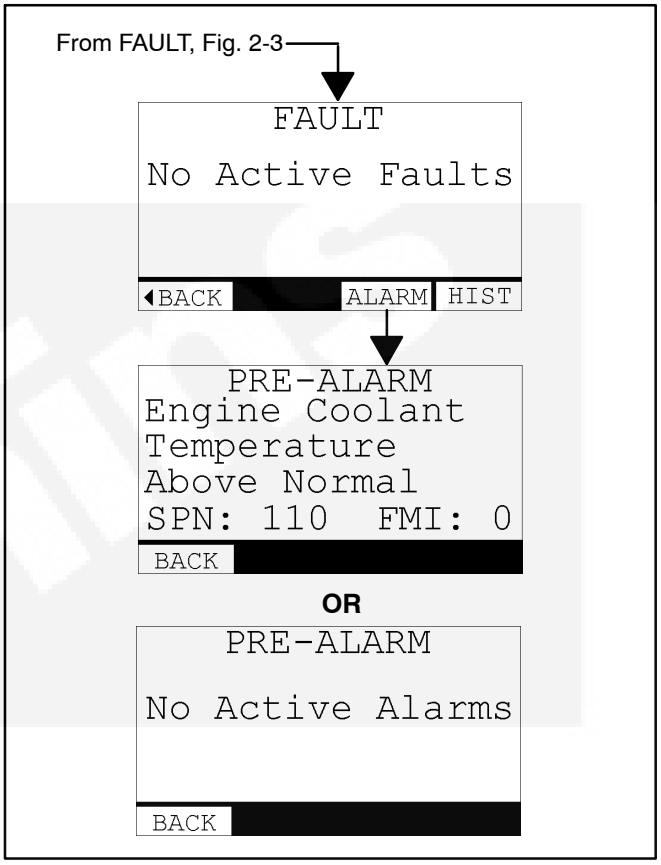


FIGURE 2-7. ENGINE PRE-ALARMS

Brightness and Contrast

To adjust the brightness and contrast of the LCD screen and status lamps, go to the SCREEN ADJUST screen by pressing SCREEN on any GEN STATUS screen. Press NEXT to select *Brightness* or *Contrast* . Increase or decrease the selected item by pressing the increase-decrease buttons [◀ ▶]. See Figure 2-8. (“Contrast” applies only to the LCD screen.)

Press [◀BACK] to save the settings and go back to GEN STATUS.

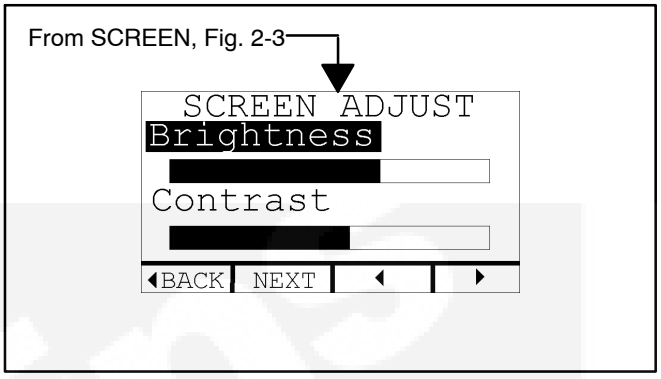


FIGURE 2-8. SCREEN BRIGHTNESS & CONTRAST

Display Setup

Go to the SETUP screen by pressing SETUP on any GEN STATUS screen. Press the up-down arrows [▼ ▲] to select *Display Setup* and press ENTER. See Figure 2-9.

Units: To change the units of measure on the GEN STATUS screens, press NEXT to select Units. Then press the up-down arrows [▼ ▲] to toggle between Metric and SAE units.

Press [◀BACK] to save the selection and go back to GEN STATUS.

AC Voltmeter Calibration: To calibrate the Display Voltmeter, press NEXT to select AC Voltmeter Calibration. Then press the up-down arrows [▼ ▲] to increase or decrease the voltage displayed to correspond to an accurate AC output voltmeter (line-to-line or line-to-neutral, as desired).

Press [◀BACK] to save the selection and go back to GEN STATUS.

Note: This procedure does not change AC output voltage.

⚠WARNING Have a trained and experienced person adjust AC output voltage, if necessary, before calibrating the Display Voltmeter.

Genset and Display Information

Go to the SETUP screen by pressing SETUP on any GEN STATUS screen. Press the up-down arrows [▼ ▲] to select *Genset Info* or *Display Info* and press ENTER. See Figure 2-9. This information may be requested by the service technician.

Keep pressing [◀BACK] to get back to GEN STATUS.

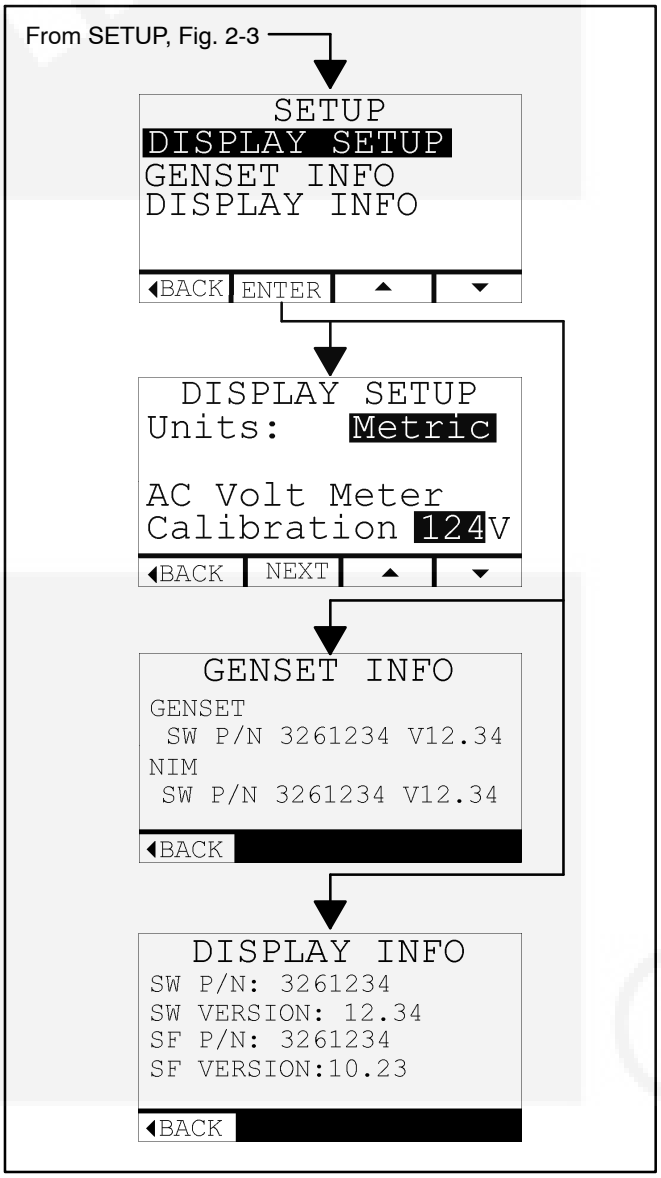


FIGURE 2-9. SETUP, GENSET & DISPLAY INFO

Configuring a replacement genset controller

A replacement genset controller must be configured to match the genset configuration. Otherwise, an INVALID GENSET CONFIGURATION –CODE NO.37 shutdown will occur at startup (p. 8–6). Also, the Digital Display hour meter should be reset to match the master hour meter (p. 5–5).

Setting Configuration: Stop the genset and then press STOP 6 times to display the configuration screen (Figure 2–10). Press NEXT to select *Genset Config.* Press the up–down arrows [▼ ▲] to select the configuration number marked on the genset nameplate. Also see Table 2–1.

Press [◀BACK] to save the selection and get back to GEN STATUS.

Resetting Digital Display Hour Meter: Press NEXT to select *Set Hour Meter.* Then press the up–down arrows [▼ ▲] to match the number or hours on the master hour meter (p.5–5).

Press [◀BACK] to save the selection and get back to GEN STATUS.

TABLE 2-1. GENSET CONFIGURATION NUMBERS

GENSET MODEL	CONFIGURATION NUMBER
MDDCA & MDDCK – 1–Phase	27
MDDCA & MDDCK – 3–Phase	34
MDDCB & MDDCG – 1–Phase	28
MDDCB & MDDCG – 3–Phase	35
MDDCC – 1–Phase	29
MDDCC – 3–Phase	36
MDDCD & MDDCH – 1–Phase	31
MDDCD & MDDCH – 3–Phase	37
MDDCE & MDDCJ – 1–Phase	32
MDDCE & MDDCJ – 3–Phase	38

SINGLE / PARALLEL GENSET OPERATION SWITCH

A PMG-excited generator is designed for paralleling applications. A current transformer (CT) is provided to detect reactive current so that excitation can be regulated between the generators. The switch shorts the CT circuit for single generator operation. See Figure 2-1.

Parallel Operation

To prepare the gensets for parallel operation, push the switch on ***each*** genset to ***Parallel*** (down).

⚠WARNING ***The generator could overheat from high reactive currents if the switch is left in the Single operation position during parallel generator operation.***

Single Operation

To prepare a genset for single operation, push the switch to ***Single*** (up).

⚠CAUTION ***Voltage regulation could be unstable if the switch is left in the Parallel operation position during single generator operation.***

MANUAL VOLTAGE CONTROL

AUTO POSITION: The manual voltage control switch must be in **AUTO** for normal, automatic voltage regulation. See Figure 2-1.

OFF POSITION: When the switch is **OFF** there will be no field current to build up AC output voltage.

MANUAL POSITION: You must be trained and use proper voltage metering to manually control AC output voltage. Always turn the voltage adjusting rheostat fully counterclockwise to **MIN** before turning the switch to **MANUAL**.

⚠CAUTION ***Improper manual voltage control can lead to equipment damage. You must be trained and use proper voltage metering. Always turn the voltage adjusting rheostat fully counterclockwise (MIN) before turning the switch to MANUAL.***

REMOTE CONTROL AND MONITORING

Remote Digital Displays and Control Switches

The boat may be equipped with several remote genset control stations having either an Digital Display or control switch.

SAE J1939 Data Link

The boat may be equipped to monitor genset operation on an integrated monitoring system through the SAE J1939 data connector in the genset control box.

Fault Bypass Switch

⚠CAUTION ***Damage to the genset as a result of bypassing fault shutdown protection is not covered under Warranty.***

The boat may be equipped with a switch to bypass genset fault shutdown. This feature is available for applications that require the genset to be kept running to supply a critical load, *regardless of possible damage to the genset*.

The PRE-ALARM status lamp blinks rapidly while the genset is running in fault bypass mode (p. 2-3).

3. Operation

FUEL

⚠WARNING ***Diesel fuel is combustible and can cause severe personal injury or death. Do not smoke near fuel tanks or fuel-burning equipment or in areas sharing ventilation with such equipment. Keep flames, sparks, pilot flames, electrical arcs and switches and all other sources of ignition well away. Keep a multi-class fire extinguisher close at hand.***

High quality Grade 2-D diesel fuel is necessary for good performance and long engine life. Diesel fuels specified by EN 590 or ASTM D975 are recommended. Use Grade 1-D diesel fuel if the fuel tank is exposed to temperatures below 40° F (5° C).

The Cetane number should not be less than 45 and sulfur content not more than 0.5 percent (by weight). Where fuel is exposed to cold ambient temperatures, use fuel that has a cloud point (temperature at which wax crystals begin to form) at least 10° F (6° C) degrees below the lowest expected fuel temperature.

Fuel lubricity should pass a minimum load level of 3100 grams as measured by ASTM D6078 or maximum scar diameter of 0.45 mm as measured by ASTM D6079 or ISO 12156-1.

ENGINE OIL

Use API (American Petroleum Institute) Service Category **CH-4** engine oil or better after the first 100 hours of engine break-in. See CARE OF NEW OR RE-BUILT ENGINE (p. 3-5) for oil to use during break-in.

Also look for the SAE (Society of Automotive Engineers) viscosity grade. Referring to Figure 3-1, choose the viscosity grade appropriate for the ambient temperatures expected until the next scheduled oil change. Multi-grade oils such as SAE 15W-40 are recommended for year-round use.

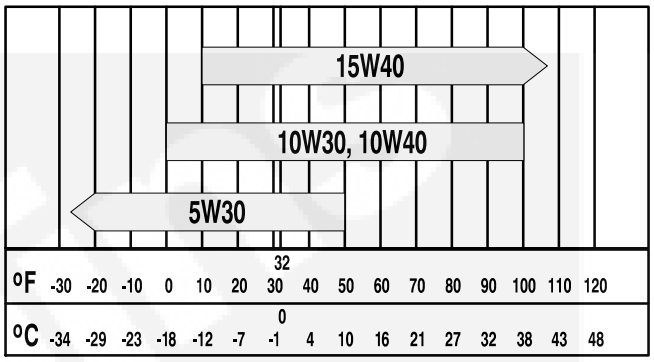


FIGURE 3-1. OIL VISCOSITY VS. TEMPERATURE

ENGINE COOLANT

Use the best quality ethylene glycol antifreeze solution available. It should be a fully formulated low-silicate coolant for heavy-duty engines meeting the ASTM D6210 specification. A 50/50 mixture of water and ethylene glycol is recommended to provide protection down to -34°F (-37°C).

Use fresh water that is low in minerals and corrosive chemicals for the coolant mixture. Distilled water is best.

See *Section 6. Specifications* regarding coolant capacity.

⚠WARNING ***Ethylene Glycol antifreeze is considered toxic. Dispose of it according to local regulations for hazardous substances.***

BATTERIES

Reliable genset starting and starter service life depend upon adequate battery system capacity and maintenance. See MAINTAINING THE BATTERY AND BATTERY CONNECTIONS (p. 4-5) and *Section 6. Specifications*.

FIRE EXTINGUISHER PORT

The boat must have a fire extinguisher readily available for putting out a fire in the gneset. It must be approved for both liquid fuel and electrical equipment.

A genset with an enclosure has a fire extinguisher port accessible by breaking through the circle on the warning label located as shown in Figure 3-2.

⚠ CAUTION ***Make sure that the nozzle of the fire extinguisher that will be used in the event of fire is smaller than the circle so that it will fit through the port. The fire extinguisher must be of the gaseous type.***

In the event of fire:

1. DO NOT open the genset enclosure.
2. Shut down engines, generators and blowers.
3. Break through the circle on the label with the nozzle and discharge the full contents of the fire extinguisher.

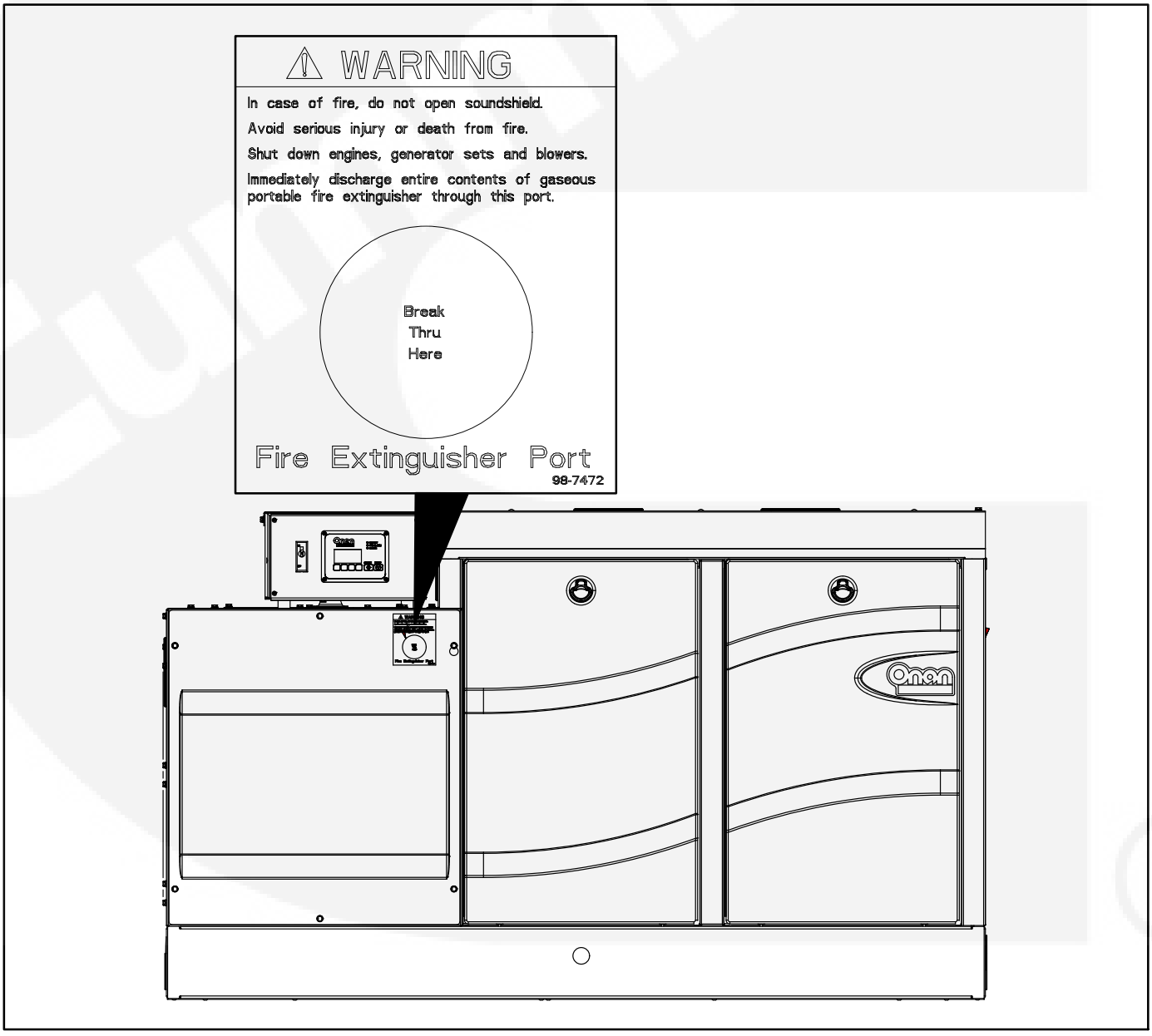


FIGURE 3-2. FIRE EXTINGUISHER PORT

⚠WARNING ***EXHAUST GAS is deadly. All engine exhaust contains carbon monoxide; an odorless, colorless, poisonous gas that can cause unconsciousness and death. Symptoms of carbon monoxide poisoning include:***

- ***Dizziness***
- ***Headache***
- ***Nausea***
- ***Weakness and Sleepiness***
- ***Vomiting***
- ***Inability to Think Coherently***

GET EVERYONE OUT INTO FRESH AIR IMMEDIATELY IF ANYONE EXPERIENCES ANY OF THESE SYMPTOMS. Seek medical attention if symptoms persist. Never sleep in the boat when the genset is running unless the cabin has a working carbon monoxide detector.

Look over the entire exhaust system and listen for leaks each time you start up the genset and after every eight hours of operation. Shut down the genset immediately if there is a leak. Do not run the genset until the leak has been repaired. The exhaust system must be installed in accordance with the genset Installation Manual.

PRE-START CHECKS

Inspect the genset before the first start of the day and after every eight hours of operation as instructed under GENERAL INSPECTION (p. 4-5). Keep a log of maintenance and the hours run and perform any maintenance that may be due. See Returning the Genset to Service (p. 3-5) if the boat has been in storage. Before each start:

1. Make sure all CO detectors on board are working properly.
2. Check for swimmers that might be exposed to the engine exhaust.
3. Disconnect all electrical loads and disengage the PTO (if so equipped).

PRIMING THE FUEL SYSTEM

The fuel system should be primed after replacing fuel filters or running the genset out of fuel. Prime using the priming lever on the engine-mounted pump (p. 4-8). If equipped with an electric auxiliary pump, *Push* and *Hold* **STOP** on the Digital Display or **STOP (Prime)** on the control switch for at least 30 seconds.

STARTING THE GENSET

The genset can be started and stopped from the genset control panel or remote control panel.

1. Check for water, coolant, fuel and exhaust leaks. Stop the genset immediately if there is a leak. Repair fuel leaks immediately.

2. *Push* and *Hold* **START** on the Digital Display or control switch until the genset starts. The genset status lamp blinks when the engine is cranking and comes on and stays on when the genset starts and runs. The status displayed on the Digital Display changes from *Starting* to *Running* (Figure 2-3).

3. For longer engine life, let the engine warm up for two minutes before connecting air conditioners and other large electrical loads or engaging the PTO.

4. Monitor genset status using the *e*-Series Digital Display (p. 2-4). Perform maintenance or service as necessary if the Display indicates a **Pre-Alarm** condition (p 2-3).

5. ***If the genset fails to start***, cranking will discontinue in 20 to 60 seconds, depending on ambient temperature. The *e*-Series Digital Display and/or control switch status lamp will indicate Fault Code No. 4. See *Section 5. Troubleshooting* if the genset does not start after several tries.

   ⚠CAUTION ***Excessive cranking can burn out the starter or flood the muffler and engine (exhaust flow during cranking is too low to expel water from a wet exhaust system). Find out why the genset does not start and make necessary repairs.***

6. ***If the genset shuts down***, the *e*-Series Digital Display and/or control switch status lamp will indicate the numeric fault code. See *Section 5. Troubleshooting*.

STOPPING THE GENSET

Disconnect all electrical loads and disengage the PTO (if so equipped) to let the genset run without load and cool down. After 2 minutes *Push* and *Release* **STOP** on the Digital Display or control switch. The genset status lamps will go out.

⚠CAUTION ***"After Boil" can force large amounts of coolant out through the pressure cap and coolant recovery tank. Always let the engine cool down before stopping the generator set. Check for loss of coolant after every emergency stop or fault shutdown. Refill and clean up as necessary.***

EMERGENCY STOP

Push the **EMERGENCY STOP SWITCH** down to **OFF** (p. 2-2). After all necessary repairs have been made, push the switch to **ON** so that the genset can be operated.

LOADING THE GENSET

How much equipment load can be powered depends upon the genset power rating. The genset will shut down or its AC output circuit breakers (if so equipped) will trip if the sum of the loads exceeds genset power or circuit breaker rating.

The genset may shut down due to overload when a large motor or air conditioner is started or cycles off and then on again, even though the sum of the loads is less than genset rating. The reason for this is that a motor's startup load is much larger than its running load. ***It may be necessary to run fewer loads when large motors and air conditioners are cycling on and off.***

The PTO can take full engine power on gensets so equipped. The boat builder may have made provisions to automatically disconnect all or most electrical loads when the PTO is engaged. ***It may be necessary to run fewer electrical loads—or none at all—when the PTO is engaged.***

The genset is rated at standard barometric pressure, humidity and temperature (ref. ISO 3046). Either low barometric pressure (high altitude) or high ambient temperature will decrease engine power. ***It may be necessary to run fewer loads under such conditions.***

NO-LOAD OPERATION

Keep no-load operation to a minimum. During no-load operation cylinder temperatures drop to the point where fuel does not burn completely causing fuel wetting and white smoke. It is best to run the genset at 1/4 to 3/4 load.

RESETTING LINE CIRCUIT BREAKERS

If a genset or AC distribution panel circuit breaker trips, either a circuit shorted or too many loads were connected. Note that the genset will continue to run after a line circuit breaker trips.

If a circuit breaker trips, disconnect or turn off as many loads as possible and reset the circuit breaker. If the circuit breaker trips right away, either the electrical distribution system has a short or the circuit breaker is faulty. Call a qualified electrician.

If the circuit breaker does not trip, reconnect loads one-by-one up to a total load that does not overload the genset or cause circuit breakers to trip. A circuit probably has a short if the circuit breaker trips right away when it is connected.

Electrical equipment must be used and maintained properly and be properly grounded to cause the line circuit breakers to trip when short circuits occur.

⚠WARNING ***Short circuits in electrical equipment can cause fire and electrocution. Electrical equipment and its grounding must be maintained properly to protect against short circuits.***

CONNECTING TO SHORE POWER

When provisions have been made for connecting shore power, the boat must have an approved device to keep the genset and shore power from being interconnected.

⚠WARNING ***Interconnecting the generator set and shore power can lead to electrocution of utility line workers, equipment damage and fire. Use an approved switching device to prevent interconnections.***

COLD TEMPERATURE OPERATION

Do not let raw water freeze in the heat exchanger during cold weather when the genset is not operating. Freezing water can damage the raw water tubes in the heat exchanger. Engine coolant, but not raw water, is protected from freezing. If freezing temperatures are expected, see Protecting the Heat Exchanger From Freezing During Storage. Also drain the muffler.

CARE OF NEW OR RE-BUILT ENGINE

The genset is shipped from the factory with engine break-in oil. During break-in use API Service Category **CE**, **CD** or **CC** oil. Avoid no-load operation as much as possible during break-in.

Change the oil and oil filter after the first 50 hours of operation (p. 4-6).

⚠ CAUTION ***Using normally specified CH-4 or equivalent oils will not allow a new or re-built engine to break-in properly.***

EXERCISING THE GENSET

Exercise the genset at least 1 hour every month if use is infrequent. Run the genset at 1/4 to 3/4 load. A single exercise period is better than several shorter periods. Exercising a genset drives off moisture, re-lubricates the engine, uses up fuel before it becomes stale and removes oxides from electrical contacts. The result is better starting, longer engine life and greater reliability.

STORING THE GENSET

Proper storage is essential for preserving top genset performance and reliability when the genset cannot be exercised regularly and will be idle for more than 120 days.

Storing the Genset

1. Disconnect the genset by turning off the line circuit breaker on the genset (if so equipped) or AC distribution panel.
2. Change the engine oil and filter and attach a tag indicating oil viscosity. See ENGINE OIL RECOMMENDATIONS (p. 3-1).
3. Crank the engine several revolutions but do not let it start. This will fill the oil passages with the new oil.
4. Disconnect the battery cables (negative [–] cable first) from the starting battery and store the battery according to the battery manufacturer's recommendations. See MAINTAINING THE BATTERY AND BATTERY CONNECTIONS (p. 4-5).
5. Check coolant level and add as necessary (p. 4-12). Test the coolant mixture if freezing temperatures are possible and change if necessary.

   ⚠WARNING ***Hot coolant is under pressure and can cause severe burns when loosening the pressure cap. Let the engine cool before loosening the pressure cap.***

6. If freezing temperatures are expected, see Protecting the Heat Exchanger From Freezing During Storage (Service Manual). Also drain the muffler.
7. Disengage a PTO clutch if so equipped.
8. Loosen or remove the serpentine belt (see Service Manual).
9. Clean and lightly oil parts that can rust.

Returning the Genset to Service

1. Check the oil tag on the genset and change the oil if the viscosity indicated is not appropriate for the temperatures expected. See ENGINE OIL RECOMMENDATIONS (p. 3-1).
2. Reconnect the starting battery (negative [–] cable last). See MAINTAINING THE BATTERY AND BATTERY CONNECTIONS (p. 4-5).
3. Replace the raw water pump impeller if it was installed more than a year ago (p. 4-14).
4. Service the air filter element if it is dirty (p. 4-11).
5. Re-install the serpentine belt (see Service Manual).
6. Perform the maintenance required (p. 4-1), conduct the pre-start checks and prime the fuel system.
7. Start and run the genset.
8. Reconnect the genset by turning on the line circuit breaker on the genset (if so equipped) or AC distribution panel.

4. Periodic Maintenance

Periodic maintenance is essential for top performance and long genset life. Use Table 4-1 as a guide for normal periodic maintenance. Figures 4-1 and 4-2 illustrate the service points.

Maintenance, replacement or repair of emission control devices and systems may be performed by any engine repair establishment or individual. However, warranty work must be completed by an authorized Onan service representative.

To help you keep genset maintenance regular and provide a basis for warranty claims, record maintenance performed in *Maintenance Record* (p. 7-1).

WARNING ***Accidental or remote starting can cause severe personal injury or death. Disconnect the negative (–) cable at the battery to prevent starting while working on the genset.***

TABLE 4-1. PERIODIC MAINTENANCE SCHEDULE

MAINTENANCE OPERATION	MAINTENANCE FREQUENCY								
	After First 50 Hrs	Every Day / 8 Hrs	Monthly	Yearly	Every 350 Hrs	Every 700 Hrs	Every 1050 Hrs	Every 2100 Hrs	Page
General Inspection[1]		•							4-5
Check Engine Oil Level		•							4-6
Drain Water from Fuel Filter			•						4-10
Inspect Battery and Battery Connections[2]			•						4-5
Inspect Siphon Break				•	•				4-12
Change Engine Oil and Oil Filter	•			•	•				4-6
Inspect Serpentine Belt and Tensioner[9]				•	•				4–17
Replace CCV Filter[4]				•	•				4-10
Replace Fuel Filters				•	•				4-9
Inspect Air Filter[5]				•		•			4-11
Inspect Zinc Anodes[9]				•	•				4–15
Inspect Raw Water Impeller[8]				•			•		4-14
Replace Coolant, Pressure Cap & Thermostats[6]								•	4-12
Adjust Engine Valve Lash[9]								•	–
Replace Fuel Injectors[9]								•	–
Inspect Generator Bearing[7, 9]				•					–

1 – Includes inspection of Oil Level, Coolant Level, Fuel System, Exhaust System, Batteries and Battery Connections.
2 – See battery manufacturer's recommendations.
3 – Inspect tensioner and belt for slippage, cracking and wear and replace as necessary.
4 – Shut down engine for 2 minutes every 24 hours to allow for auto drainage of crankcase oil.
5 – Clean and oil if restriction is greater than 25 inches (635 mm) WC. The air cleaner housing has a 1/4 inch NPT gauge tap.
6 – Replace every 2 years.
7 – Replace every 5 years.
8 – Replace every 1050 hours.
9 – Must be performed by a qualified mechanic (authorized Onan dealer).

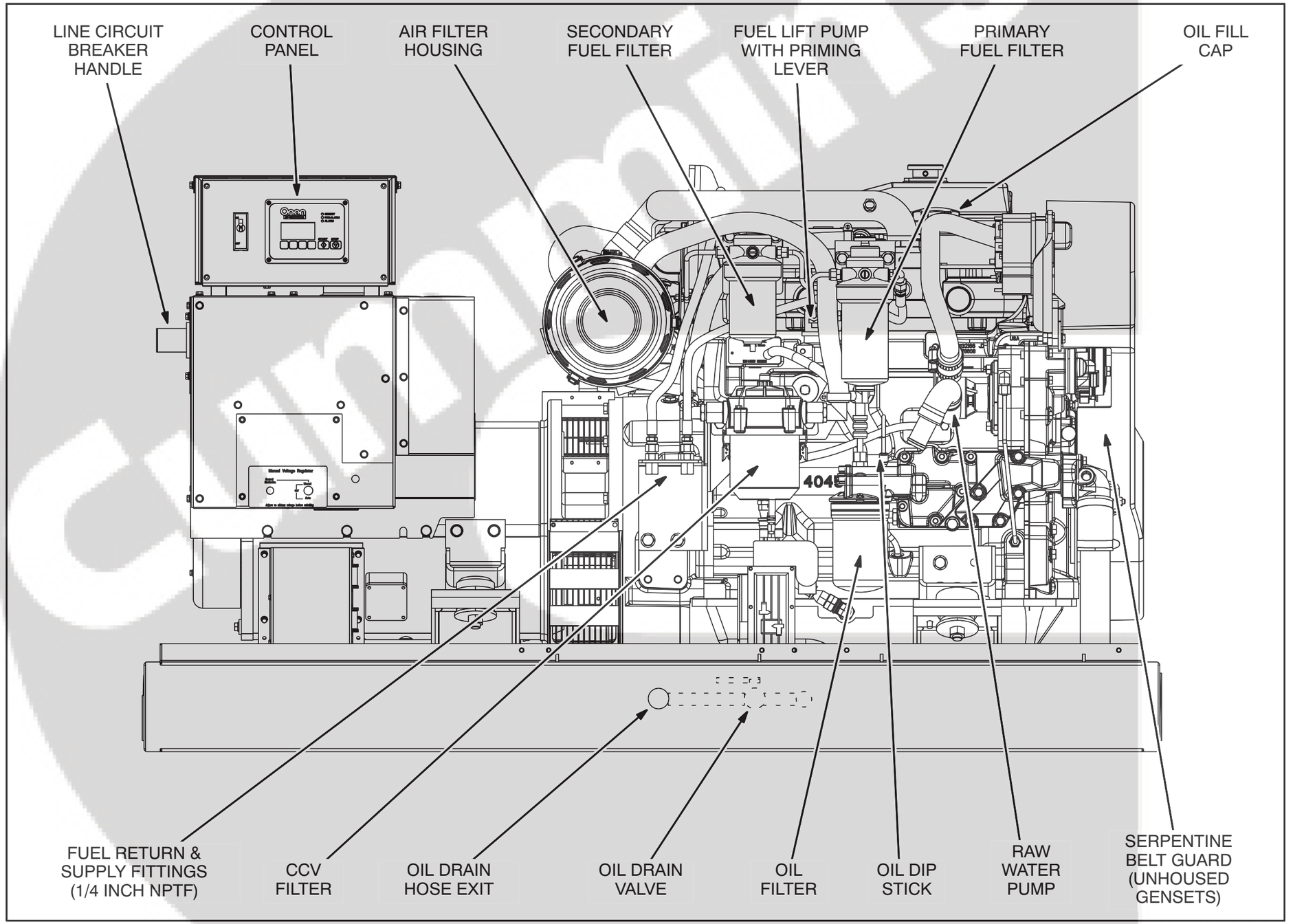


FIGURE 4-1. TYPICAL SERVICE SIDE (4-CYLINDER MODEL—REPRESENTATIVE ALSO OF 6-CYLINDER MODELS)

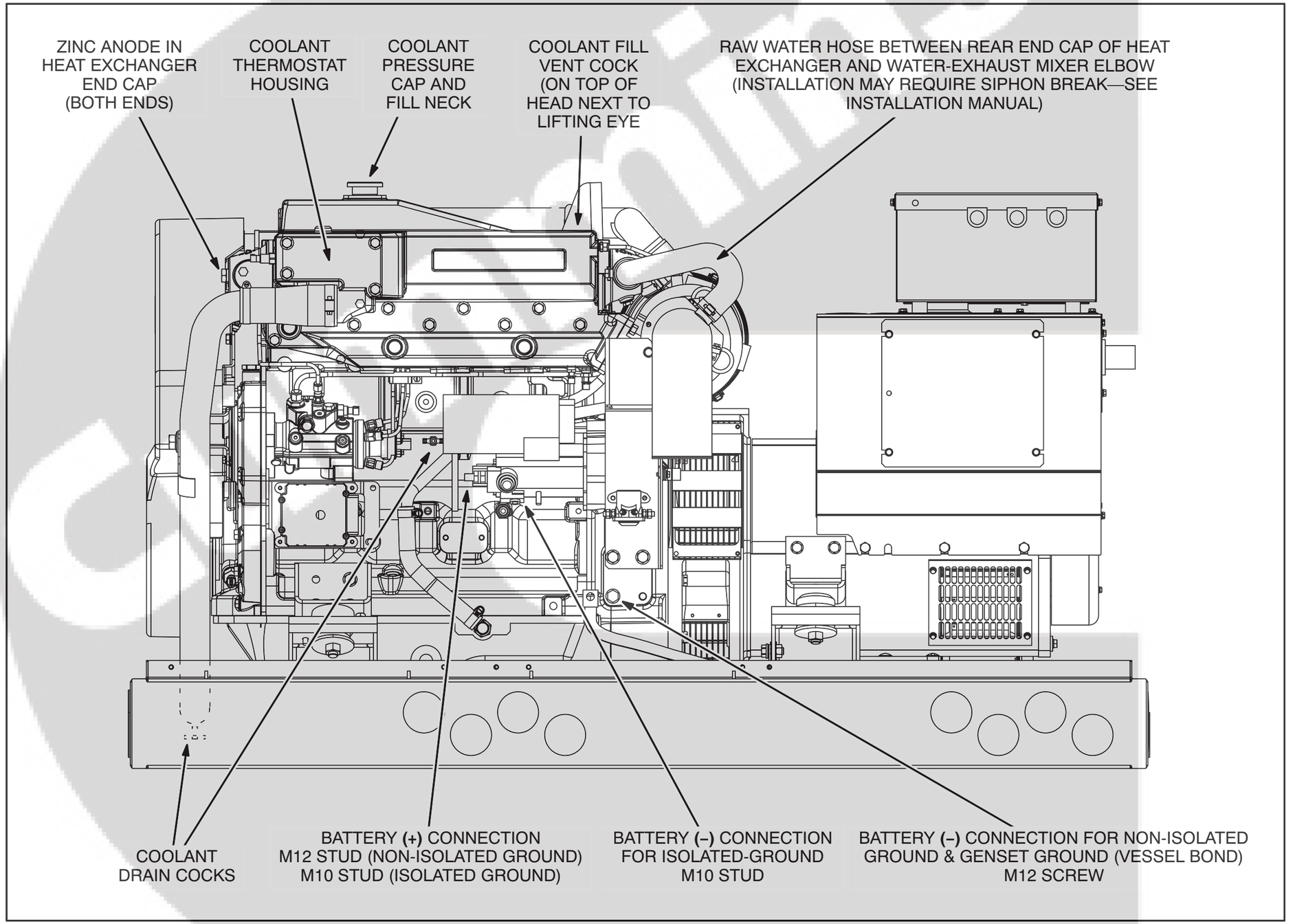


FIGURE 4-2. TYPICAL NON-SERVICE SIDE (4-CYLINDER MODEL—REPRESENTATIVE ALSO OF 6-CYLINDER MODELS)

GENERAL INSPECTION

Inspect the genset before the first start of the day and after every eight hours of operation.

Oil Level

Check engine oil level (p. 4-6).

Exhaust System

Inspect the exhaust system for leaks and loose hose clamps at the exhaust manifold, exhaust elbow, muffler, water separator and hull fittings. Replace damaged sections of exhaust hose.

Check that all CO monitors are working properly.

⚠WARNING ***EXHAUST GAS IS DEADLY! Do not operate the genset until all exhaust leaks have been repaired.***

Fuel System

Check for leaks at hose, tube and pipe fittings in the fuel supply and return systems while the genset is stopped. Check flexible fuel hose for cuts, cracks, abrasions and loose hose clamps. Make sure fuel lines do not rub against other parts. Replace worn or damaged fuel line parts before leaks occur. Replace hose with a USCG TYPE A1 or ISO 7840-A1 fuel hose.

Prime the fuel system if the genset ran out of fuel.

⚠WARNING ***Fuel leaks can lead to fire. Repair leaks immediately. Do not run the genset if it causes fuel to leak.***

Coolant Level

Check coolant level in the recovery tank and if necessary refill to COLD when the engine is cold or to HOT when it is running. The recovery tank is designed to maintain coolant level, not to fill the system. If the tank is empty, check for and repair any coolant leaks and refill the system through the fill neck on the engine. See Refilling the Cooling System (p. 4-13). Use the recommended antifreeze mixture (p. 3-1).

Raw Water System

Clean out the sea water strainer if necessary and make sure the sea cock is open for genset operation. Also, when a water/exhaust separator is provided (see Installation Manual), open the sea cock for the water drain hose.

Check for hoses that leak or are damaged. Have a qualified service person replace any leaking or damaged hoses.

Battery Connections

See MAINTAINING THE BATTERY AND BATTERY CONNECTIONS.

Mechanical

Monitor generator set status using the *e*-Series Digital Display (p. 2-4).

Visually inspect genset for mechanical damage. For generator sets with a sound shield, install service doors before running the generator set to listen for unusual noises. Check the genset mounting bolts. Check to see that the genset air inlet and outlet openings are not clogged with debris or blocked. Keep the genset compartment clean.

MAINTAINING THE BATTERY AND BATTERY CONNECTIONS

⚠WARNING ***Arcing at battery terminals or in light switches or other equipment, and flames or sparks, can ignite battery gas causing severe personal injury—Ventilate battery area before working on or near battery—Wear safety glasses—Do not smoke—Switch work light ON or OFF away from battery—Stop genset and disconnect charger before disconnecting battery cables—Disconnect negative (–) cable first and reconnect last.***

Refer to Table 4-1 for scheduled battery maintenance, and follow the battery manufacturer's instructions. Have the battery charging system serviced if DC system voltage is consistently low or high.

Check the battery terminals for clean, tight connections. Loose or corroded connections have high electrical resistance which makes starting harder. Always:

1. Keep the battery case and terminals clean and dry and the terminals tight.
2. Remove battery cables with a battery terminal puller.
3. Make sure which terminal is positive (+) and which is negative (–) before making battery

connections. Always remove the negative (–) cable first and reconnect it last to reduce arcing. Refer to Figure 4-2 for battery cable connections at the genset.

CHECKING ENGINE OIL LEVEL

⚠WARNING ***U. S. federal and state agencies have determined that contact with used engine oil can cause cancer or reproductive toxicity. Avoid skin contact and breathing of vapors. Use rubber gloves and wash exposed skin.***

⚠CAUTION ***Too little oil can cause severe engine damage. Too much oil can cause high oil consumption.***

⚠WARNING ***Engine components (drains, filters, hoses, etc) will be hot and can cause severe burns. The use of protective gloves is recommended.***

Shut off the genset and check the oil level with the dip stick (Figure 4-3). Add or drain oil as necessary. Add 1 quart (0.9 liters) when the level falls to the ADD mark. Drain oil if the level is above the cross-hatch area.

See ENGINE OIL RECOMMENDATIONS (p. 3-1).

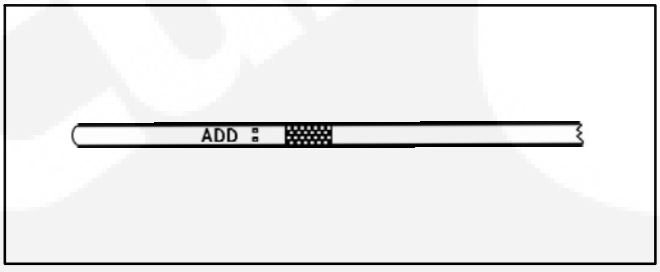


FIGURE 4-3. OIL LEVEL DIP STICK

CHANGING ENGINE OIL AND FILTER

⚠WARNING ***U. S. federal and state agencies have determined that contact with used engine oil can cause cancer or reproductive toxicity. Avoid skin contact and breathing of vapors. Use rubber gloves and wash exposed skin.***

Refer to Table 4-1 for scheduled engine oil change.

1. Run the genset under load until it is up to operating temperature. Then stop it and disconnect the negative (–) battery cable at the battery.

   ⚠WARNING ***Accidental or remote starting can cause severe personal injury or death. Disconnect the negative (–) cable at the battery to prevent the engine from starting.***

   ⚠WARNING ***Engine components (drains, filters, hoses, etc) will be hot and can cause severe burns. The use of protective gloves is recommended.***

2. Have a suitable container ready and open the drain valve (Figure 4-1). Follow the instructions for an oil pump-out system if provided.
3. *Close the oil drain valve.*
4. Unscrew the oil filter element (Figure 4-4) using a suitable filter wrench and discard the filter.
5. Wipe the *two* O-ring sealing surfaces clean.
6. Oil the *two* O-ring seals and threads of the new filter element.
7. Make sure the notches in the dust seal and filter header mate properly.
8. Hand tighten the filter firmly against the dust seal. DO NOT USE A FILTER WRENCH AND DO NOT TURN IT FARTHER THAN HAND TIGHT.
9. Refill the engine with the proper type and amount of engine oil. See ENGINE OIL RECOMMENDATIONS (p. 3-1) and *Section 6. Specifications*. Check the oil level and add or drain oil as necessary.
10. Dispose of the used oil and oil filter according to local environmental regulations.

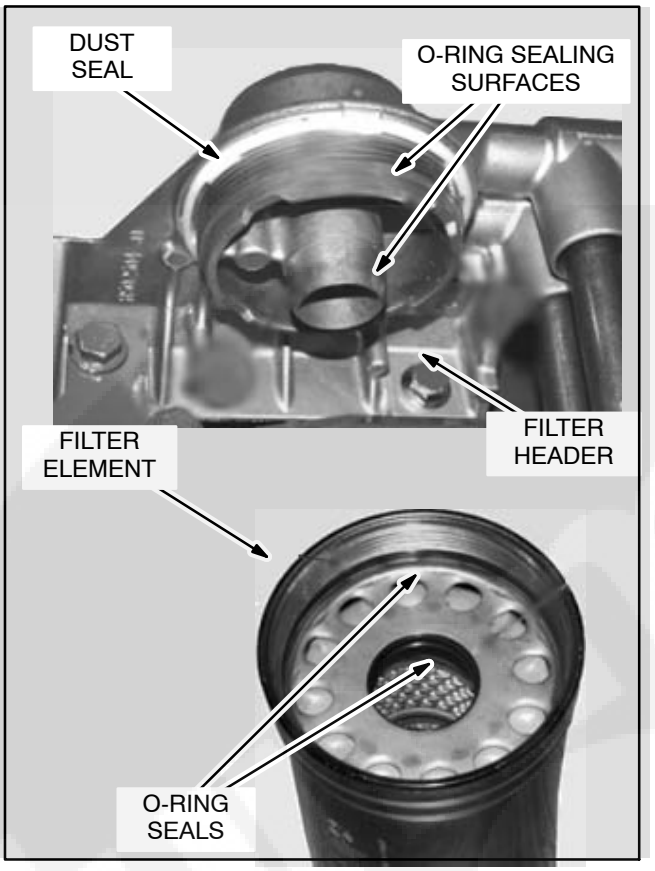


FIGURE 4-4. OIL FILTER

PRIMING THE FUEL SYSTEM

⚠WARNING ***Diesel fuel is combustible and can cause severe personal injury or death. Do not smoke near fuel tanks or fuel-burning equipment or in areas sharing ventilation with such equipment. Keep flames, sparks, pilot flames, electrical arcs and switches and all other sources of ignition well away. Keep a multi-class fire extinguisher close at hand.***

⚠WARNING ***Engine components (drains, filters, hoses, etc) will be hot and can cause severe burns. The use of protective gloves is recommended.***

Priming with Mechanical Fuel Pump

The engine is equipped with a cam-driven mechanical pump with a manual priming lever that is pushed up and down to pump fuel (Figure 4-5). If the priming lever cannot be pushed down, crank the engine over once to turn the internal cam lobe to the low side and thus free up the lever.

Before priming, loosen the secondary filter vent to allow air to escape while priming. Close the vent when the filter is full.

Priming with Optional Electric Fuel Pump

If the genset is equipped with a supplementary electric fuel pump, *Press* and *Hold* the control switch or Digital Display **Stop**/**Prime** button to fill the fuel lines and filters. The fuel pump starts in about 2 seconds.

If both filters need to be filled, loosen both filter vents (Figure 4-5) to allow air to escape while priming. Close the primary filter vent when the primary filter is full and the secondary filter vent when its filter is full.

BLEEDING THE INJECTOR LINES

⚠WARNING ***Engine components (drains, filters, hoses, etc) will be hot and can cause severe burns. The use of protective gloves is recommended. Wear safety glasses.***

It may be necessary after replacing parts or running out of fuel to bleed the air trapped in the fuel lines between the injection pump and nozzles. To bleed air from the fuel line, loosen the connection at the injection nozzle (Figure 4-6) using two open-end wrenches to avoid damaging the nozzle assembly. Have towels and containers ready to wipe up, collect and properly dispose of the purged fuel. Then crank the engine, without letting it start, until fuel free of bubbles flows out of the loosened connection. Retighten the connection to 20 lb-ft (27 N-m). If necessary, repeat the procedure for the remaining nozzles.

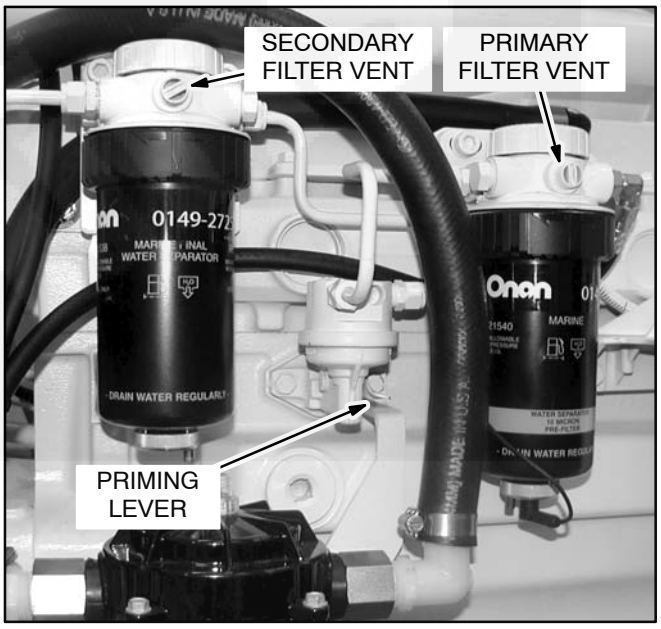


FIGURE 4-5. PRIMING FUEL

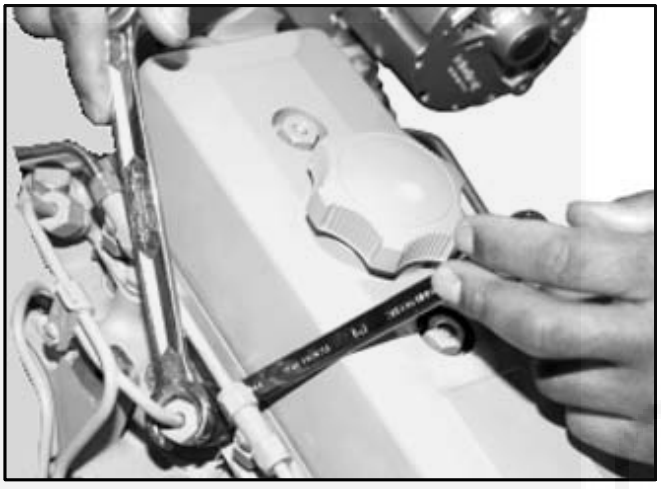


FIGURE 4-6. BLEEDING INJECTOR LINES

REPLACING THE FUEL FILTERS

⚠WARNING ***Diesel fuel is combustible and can cause severe personal injury or death. Do not smoke near fuel tanks or fuel-burning equipment or in areas sharing ventilation with such equipment. Keep flames, sparks, pilot flames, electrical arcs and switches and all other sources of ignition well away. Keep a multi-class fire extinguisher close at hand.***

See Table 4-1 for scheduled filter change. The genset has a primary and a secondary fuel filter. The primary filter has a water separator and sensor (Figure 4–7). Check for up-stream filters which may also need to be replaced.

Keep dirt, water and other contaminants from entering the fuel system and corroding or clogging fuel injection components.

To replace the fuel filters:

1. Disconnect the negative (–) cable at the battery to prevent the engine from starting and close any fuel supply and return valves.

   ⚠WARNING ***Accidental or remote starting can cause severe personal injury or death. Disconnect the negative (–) cable at the battery to prevent the engine from starting.***

   ⚠WARNING ***Engine components (drains, filters, hoses, etc) will be hot and can cause severe burns. The use of protective gloves is recommended.***

2. Disconnect the water sensor.
3. Clean the area surrounding each filter assemblies to keep debris out of the fuel system and drain the fuel in each filter into a suitable container by loosening its vent and drain screws. Dispose of the water, sediment and fuel in accordance with local environmental regulations.
4. Firmly grasp each filter retaining ring, lift it up and rotate it counterclockwise 1/4 turn (as viewed from below). Remove the ring with its filter element.
5. Install the new filters, properly indexing the raised locators with the mounting base slots.
6. Install the retaining rings, making sure the dust seals are in place. Hand tighten about 1/3 turn until it audibly snaps (clicks) into its detent.
7. Reconnect the water sensor.
8. Manually prime engine with priming lever on mechanical fuel pump to fill the new filters (p.4–7). If generator set has optional electric fuel pump, prime engine for at least 30 seconds (p. 4–7) to fill new filters. Run the generator for a few minutes and check for leaks, shut down the generator immediately if there is a leak. Repair leak before starting generator set.

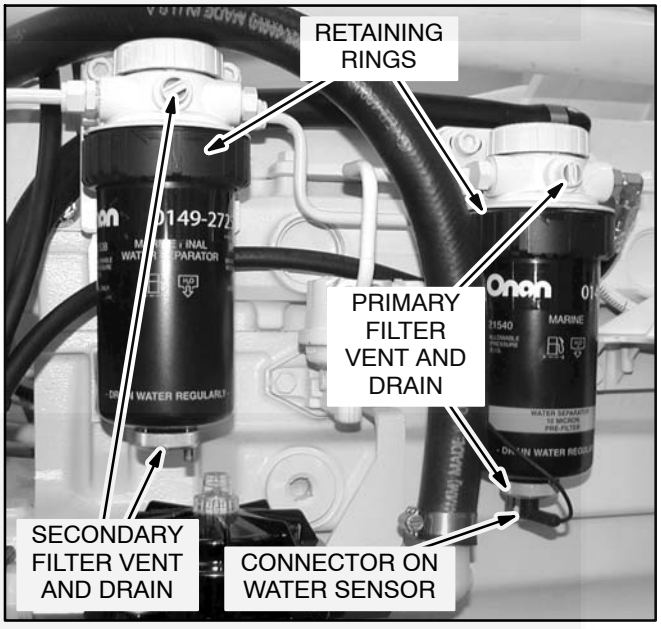


FIGURE 4-7. PRIMARY AND SECONDARY FUEL FILTERS

DRAINING WATER FROM THE FUEL FILTER

⚠WARNING ***Engine components (drains, filters, hoses, etc) will be hot and can cause severe burns. The use of protective gloves is recommended.***

Drain water and sediment more often than scheduled (Table 4-1) if fuel quality is poor or condensation cannot be avoided or when a WATER IN FUEL WARNING is being displayed. Check for upstream filters which may also need to be replaced.

1. Disconnect the water sensor connector (Figure 4–7). Loosen the vent and drain screws and drain the water and sediment into a suitable container (about 1/2 cup or 120 ml).
2. Close the drains and reconnect the water sensor connector.
3. Dispose of the water, sediment and fuel in accordance with local environmental regulations.

REPLACING THE CCV FILTER ELEMENT

Refer to Table 4-1 for scheduled CCV (Crankcase Vent) filter element replacement. Replace the filter whenever the red service indicator in the filter header pops up.

1. Disconnect the negative (–) cable at the battery to prevent the engine from starting.

   ⚠WARNING ***Accidental or remote starting can cause severe personal injury or death. Disconnect the negative (–) cable at the battery to prevent the engine from starting.***

   ⚠WARNING ***Engine components (drains, filters, hoses, etc) will be hot and can cause severe burns. The use of protective gloves is recommended.***

2. Remove the CCV housing and withdraw the filter element and discard it.
3. Install the new filter element making sure the inner and outer O-ring seals seat properly.
4. Reset the red service indicator if it popped up by unscrewing the clear plastic cap, pushing the indicator back down and re-installing the cap.

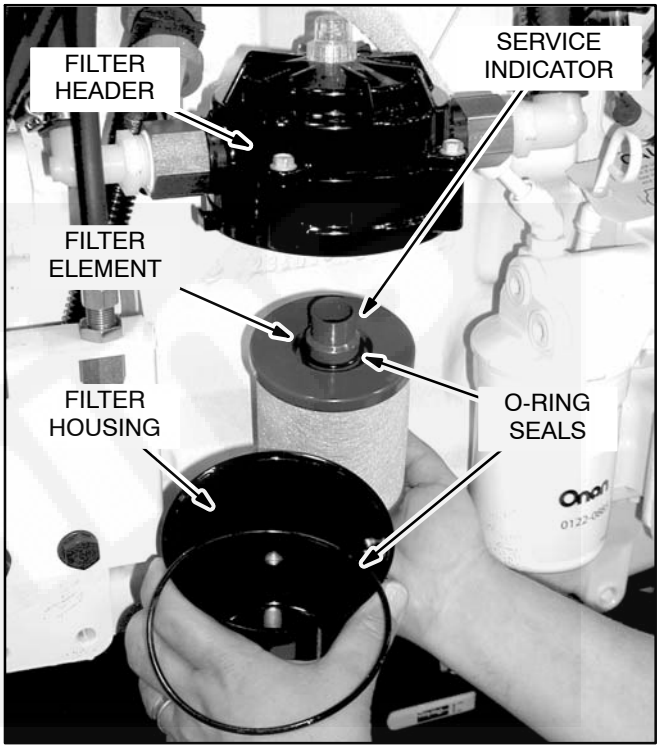


FIGURE 4-8. CCV FILTER ELEMENT

REPLACING THE AIR FILTER ELEMENT

The engine is equipped with a washable air filter element (Figure 4-9). Refer to Table 4-1 for scheduled air filter element cleaning. Inspect and clean the element more often in dusty environments. To service the filter element:

1. Disconnect the negative (–) cable at the battery to prevent the engine from starting.

   ⚠WARNING ***Accidental or remote starting can cause severe personal injury or death. Disconnect the negative (–) cable at the battery to prevent the engine from starting.***

   ⚠WARNING ***Engine components (drains, filters, hoses, etc) will be hot and can cause severe burns. The use of protective gloves is recommended.***
2. Release the end cap latches and withdraw the filter element.
3. Replace the filter element if the filter media or rubber seals are damaged.

   ⚠CAUTION ***Fuels, solvents, cleaners and detergents can damage the filter media and rubber seals. Only use hot soapy water to clean the filter element.***
4. Wash the filter element in hot soapy water and let it dry thoroughly.
5. Oil the filter element with a suitable air filter oil.
6. Reinstall the filter element.

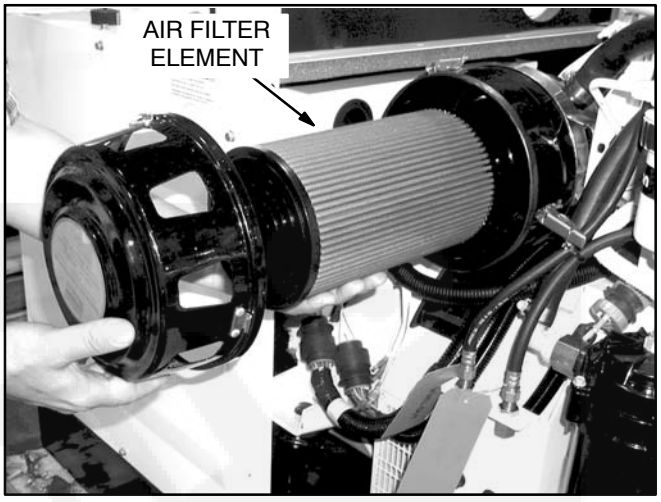


FIGURE 4-9. AIR FILTER ELEMENT

MAINTAINING THE ENGINE COOLING SYSTEM

Refer to Table 4-1 for scheduled maintenance.

Cooling System Overview

The engine is cooled by a pressurized, closed-loop liquid cooling system. Coolant is pumped through passages in the engine block, head, exhaust manifold and turbocharger housing. The exhaust manifold also serves as the engine coolant reservoir. The engine coolant is cooled by a keel cooler or by a heat exchanger mounted inside the exhaust manifold.

Keel Cooler: A keel cooler, when provided, is part of the pressurized, closed-loop liquid cooling system through which the coolant flows.

Heat Exchanger: When a heat exchanger is mounted inside the exhaust manifold, raw water (the floatation water) is pumped through tubes in the heat exchanger to cool the engine coolant. The water is then passed through a hose into the exhaust-water mixer to cool the exhaust gases. The raw water is expelled from the boat along with the exhaust gases.

Recommended Coolant Mixture

See ENGINE COOLANT (p. 3-1) for recommendations.

Replenishing Normal Coolant Loss

Check coolant level in the recovery tank before the first startup of each day and if necessary refill to COLD when the engine is cold or to HOT when it is running. The recovery tank is designed to maintain coolant level, not to fill the system. If the tank is empty, check for and repair any coolant leaks and refill the system through the fill neck on the engine.

Pressure Cap

⚠WARNING ***Let the engine cool down before removing the coolant pressure cap or opening the coolant drain. Hot coolant under pressure can spray and cause severe burns. Wear safety glasses.***

Replace the pressure cap every two years (seals deteriorate and leak). Proper cooling system pressure (10 psi) is essential for optimal engine cooling and minimal coolant loss.

Coolant Hoses

⚠WARNING ***Engine components (drains, filters, hoses, etc) will be hot and can cause severe burns. The use of protective gloves is recommended.***

Check for and replace hoses that leak or are damaged. Have a qualified service person replace any leaking or damaged hoses.

Siphon Break

See Table 4-1 for scheduled maintenance. A siphon break is installed when the siphon point at the exhaust-water mixer is below the water line. If of a spring-loaded valve design, check for free movement of the plunger. Replace the device if the plunger does not move freely or the body is encrusted with deposits from leakage past the valve seat. If of the bleed-vent type, check that the vent hose is properly connected on both ends. If the vent is connected to a through-hull fitting, check for normal water flow whenever the engine is running. See the Installation Manual for more information regarding siphon break installation.

⚠WARNING ***Engine damage due to flooding as a result of failing to install or maintain a required siphon break is not covered by Warranty.***

Draining and Cleaning Cooling System

Have towels and containers ready to wipe up, collect and properly dispose of the coolant. Disconnect the negative (–) cable at the battery to prevent the engine from starting and let the engine cool before removing the pressure cap.

⚠WARNING ***Accidental or remote starting can cause severe personal injury or death. Disconnect the negative (–) cable from the battery to prevent the engine from starting.***

⚠WARNING ***Let the engine cool down before removing the coolant pressure cap or opening the coolant drain. Hot coolant under pressure can spray and cause severe burns. Wear safety glasses.***

⚠WARNING ***Engine components (drains, filters, hoses, etc) will be hot and can cause severe burns. The use of protective gloves is recommended.***

Remove the pressure cap and open the block and crossover tube drain cocks (Figure 4-2). Drain the coolant into suitable containers for disposal in accordance with the local regulations for hazardous substances.

Drain or flush a keel cooler in accordance with the manufacturer's instructions.

Use radiator cleaning chemicals to clean and flush the cooling system before refilling with fresh coolant. Follow the cleaner manufacturer's instructions.

⚠CAUTION ***Filling a hot engine with cold water can cause cracks in the manifold, head and block. Follow the manufacturer's instructions for cleaning and flushing.***

Refilling Cooling System

Close the block and crossover tube drain cocks (Figure 4-2) and open the coolant fill vent cock located by the lifting eye (Figure 4-10). Fill the system through the engine fill neck. The system will fill only as fast as air can escape. Close the vent cock when coolant comes out and continue filling up to the rim of the fill neck. Start and run the engine for a minute or two to dislodge air pockets. Stop the engine and refill coolant to the rim of the fill neck. Repeat the procedure until the engine can be run for at least 10 minutes without the coolant level dropping. Secure the pressure cap and refill the recovery tank up to the HOT mark.

⚠CAUTION ***Low coolant level can cause severe engine damage. Make sure the system is full.***

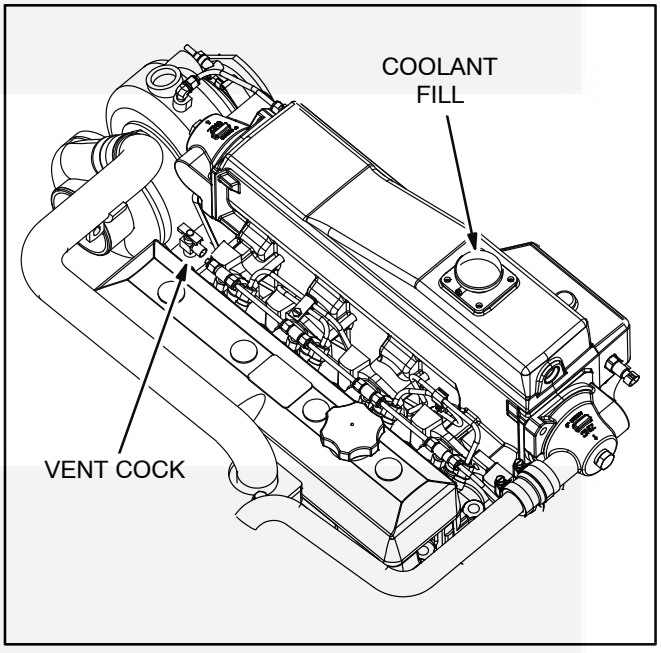


FIGURE 4-10. COOLANT FILL VENT COCK

Replacing the Raw Water Pump Impeller

See Table 4-1 for scheduled replacement. Referring to Figure 4-11, replace the impeller as follows:

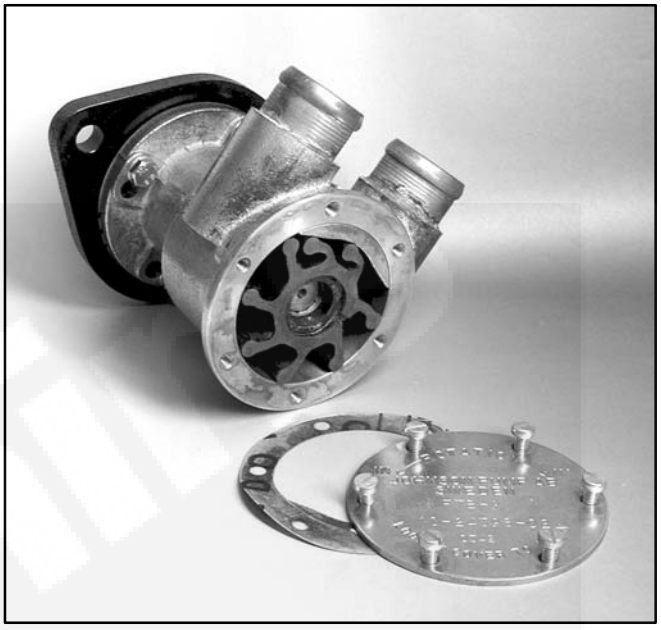


FIGURE 4-11. RAW WATER PUMP

1. Close the sea cock.
2. Disconnect the negative (–) cable at the battery to prevent the engine from starting.

   ⚠WARNING ***Accidental or remote starting can cause severe personal injury or death. Disconnect the negative (–) cable at the battery to prevent the engine from starting.***

   ⚠WARNING ***Engine components (drains, filters, hoses, etc) will be hot and can cause severe burns. The use of protective gloves is recommended.***

3. Remove the impeller cover and gasket using a short flat-bladed screwdriver.
4. Use an impeller removal tool to pull the impeller out of the pump. *It will be necessary to check for and cleanout pieces of the impeller from the heat exchanger if vanes have broken off.*
5. Install the new impeller. It helps to twist the impeller clockwise (the way it turns) while squeezing it into the housing.
6. To provide initial lubrication and better pump suction before water reaches the pump, wet the inside of the pump and impeller with water, soap solution or a silicone lubricant.

   ⚠CAUTION ***Do not lubricate the impeller with grease or oil or other petroleum products because they known to chemically attack the impeller material.***

7. Secure the cover using a new gasket.
8. *If the sea water strainer is above the water line fill it for faster priming.*
9. Open the sea cock, reconnect the battery cables (negative [–] last) and start the genset. The genset will shut down within 8 seconds if there is no raw water flow. Fault Code No. 7 (p. 5-3) will be declared. If it shuts down, find out why, remove any blockage and restart the genset.

Replacing the Thermostats

See Table 4-1 for scheduled replacement. *The two thermostats (Figure NO TAG) are a matched pair and must be replaced as a pair.* Replace the thermostats as follows:

1. Disconnect the negative (–) cable at the battery to prevent the engine from starting and let the engine cool down.

   ⚠WARNING ***Accidental or remote starting can cause severe personal injury or death. Disconnect the negative (–) cable from the battery to prevent the engine from starting.***

   ⚠WARNING ***Hot coolant is under pressure and can cause severe burns when loosening the pressure cap. Let the engine cool before loosening the pressure cap.***

   ⚠WARNING ***Engine components (drains, filters, hoses, etc) will be hot and can cause severe burns. The use of protective gloves is recommended.***

2. Remove the rear door if the genset has an enclosure.
3. Remove the coolant pressure cap after letting the engine cool down.
4. Drain enough coolant so that it does not spill out when the thermostat housing is loosened.
5. Remove the four thermostat housing screws and pull off the housing and gasket.
6. Clean off the gasket area.
7. Replace the two thermostats. Make sure location and orientation are as shown.
8. Secure the thermostat housing using a new gasket.
9. Replenish any lost coolant and secure the pressure cap and rear door.

Protecting Pump, Heat Exchanger and Muffler from Freezing

Freezing water can damage the pump, heat exchanger and muffler. Engine coolant, but not raw water, is protected from freezing.

To protect the pump and heat exchanger during storage in freezing weather, it is recommended that the residual raw water in the heat exchanger be displaced by pumping a 60/40 solution of Propylene Glycol and water through it. To do this, connect the raw water pump to the container of the soluction by means of a short hose and crank the engine. Shut the engine down immediately if it starts. About 1/2 gallon (2 liters) is required. Solutions formulated for this purpose are available from Marine and RV service centers.

Drain the muffler to protect it from freezing.

⚠WARNING ***Ethylene Glycol is considered toxic. Do not use it to protect the raw water passages in the heat exchanger because it will be expelled into the environment when the genset is started.***

5. Troubleshooting

Use TABLE 5-1. TROUBLESHOOTING GENSET FAULTS in conjunction with the *e*-Series Digital Display or blinking control switch status lamp to troubleshoot the genset. Perform the step-by-step corrective actions suggested. If you are still unable to resolve the problem, contact an authorized Onan service representative. See *How to Obtain Service* (p. 1-3).

Many genset shutdowns can be avoided by performing periodic maintenance on schedule (TABLE 4-1. PERIODIC MAINTENANCE SCHEDULE) and by *not* running the genset out of fuel. Note that when gensets and propulsion engines draw from the same fuel tanks, the fuel dip tubes are usually arranged so that the gensets run out of fuel first. By marking the genset empty points on the fuel gauges, it will be easier to tell when to stop the gensets before running them out of fuel.

TROUBLESHOOTING WITH DIGITAL DISPLAY

If a fault shutdown occurs the ALARM status lamp on the *e*-Series Digital Display will blink and the LCD screen will display the Fault Number, a description of the Fault and the hour in total genset running time when the Fault occurred (Figure 2-4).

The fault will be displayed indefinitely. Touch any button to clear the fault. The display will turn off in 5 minutes after the fault has been cleared.

Engine Fault Code No. 16

If this engine fault occurs, refer to TABLE 5-2. TROUBLESHOOTING ENGINE FAULT CODE NO. 16.

Engine Pre-Alarms

If an engine pre-alarm condition is displayed, refer to TABLE 5-3. TROUBLESHOOTING ENGINE PRE-ALARMS.

Last Five Faults

See Page 2-6 to display any of the last five faults in fault history.

TROUBLESHOOTING WITH STATUS LAMP

Status Lamp Blink Code

If a fault shutdown occurs, the amber status lamp on the control switch will repeatedly blink sets of 3, 4, 5, 6 or 7 blinks.

- **Three blinks** indicate a service fault. Press **Stop** once to cause the two-digit code to blink. (Pressing **Stop** again will stop the blinking.) The two-digit code consists of 1 to 7 blinks, a brief pause, and then 1 to 9 blinks. The first set of blinks represents the tens digit and the second set of blinks the units digit of the shutdown code number. For example, **fault code No. 36** appears as:

  blink-blink-blink—*pause*—blink-blink-blink-blink-blink-blink—*long pause*—repeat

- **Four blinks** indicate shutdown due to a failure to start within the time allowed for cranking.
- **Five blinks** indicate shutdown due to high levels of Carbon Monoxide (CO) in the vessel.
- **Six blinks** indicate shutdown due to low or high engine oil level.
- **Seven blinks** indicate shutdown due to a loss of raw water flow for engine and exhaust cooling.

The fault code stops blinking after five minutes. Press **Stop** three times within three seconds to restore fault code blinking.

Note: The last fault logged will blink even though the condition that caused the shutdown may have been corrected.

Engine Pre-Alarms and Fault Code No. 16

An *e*-Series Digital Display is required to display further information regarding engine pre-alarms and faults.

TABLE 5-1. TROUBLESHOOTING GENSET FAULTS

⚠WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions (p. iv).***

Accidental or remote starting can cause severe personal injury or death. Before removing a panel or access door, disconnect the negative (–) cable from the battery to prevent the engine from starting.

NO RESPONSE AT DIGITAL DISPLAY OR CONTROL SWITCH

(Faulty switch or Display, poor or missing connections, dead battery)

Corrective Action:

1. At the genset control panel, push the emergency stop switch On.
2. Try the local Digital Display or control switch if there is no response at the remote Display or control switch, and vice versa.
3. If neither local nor remote control works, service the battery as necessary by cleaning and tightening connections, recharging or replacing the battery or replacing damaged battery cables (p. 4-5).

THE STARTER ENGAGES AND DISENGAGES

(Low cranking voltage)

Corrective Action: Service as necessary by cleaning and tightening battery cable connections, recharging or replacing the battery or replacing damaged battery cables (p. 4-5).

THE STARTING BATTERIES DO NOT MAINTAIN A CHARGE

(Marginal battery, battery connections or charging system)

Corrective Action:

1. Service the battery as necessary by cleaning and tightening connections, recharging or replacing the battery or replacing damaged battery cables (p. 4-5).

NO AC POWER WHEN GENSET IS RUNNING

(A Circuit Breaker is OFF, tripped or malfunctioning or the generator is not connected properly)

Corrective Action:

1. Reset or turn ON the genset circuit breaker if OFF or tripped.
2. Reset or turn ON any other circuit breaker in the AC power supply system if OFF or tripped.
3. If the genset has a manual voltage regulator (Figure 2-1), push the manual voltage selector switch to **AUTO**.

SERVICE CHECK—CODE NO. 3

(A fault with a 2-digit fault code number occurred)

Corrective Action: Check the 2-digit fault code by *Pushing* and *Releasing* **Stop**. The 2-digit fault will be one of the following in this table. (Does not apply to *e*-Series Digital Display.)

TABLE 5-1. TROUBLESHOOTING GENSET FAULTS (CONT.)

⚠WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions (p. iv).***

Accidental or remote starting can cause severe personal injury or death. Before removing a panel or access door, disconnect the negative (–) cable from the battery to prevent the engine from starting.

OVERCRANK—CODE NO. 4

(First-level fault code—Cranking time exceeded 20 to 60 seconds, depending on ambient temperature)

Corrective Action:

1. Disconnect the PTO.
2. Check fuel level and refill as necessary. (Note: The genset fuel pickups are probably higher than the propulsion engine fuel pickups.)
3. Open any closed fuel supply and return valves.
4. Prime the engine fuel system for at least 30 seconds (p. 3-3).
5. Service the battery as necessary by cleaning and tightening connections, recharging or replacing the battery or replacing damaged battery cables (p. 4-5).
6. Check all fuel fittings for fuel and air leaks, tighten as necessary and reprime.
7. Replace the fuel filters and reprime (p. 4-9).
8. Check the engine air filter and remove any blockage (p. 4-11).
9. Change the engine oil to oil of the proper viscosity for the ambient temperature. High oil viscosity can slow down cranking speed.

WARNING—SHUTDOWN DUE TO VESSEL CO—CODE NO. 5

(First-level shutdown—Dangerous levels of Carbon Monoxide in Vessel)

Corrective Action: Get everyone out into fresh air immediately and seek medical attention.

OIL LEVEL HIGH OR LOW—CODE NO. 6

(First-level shutdown—Engine oil level is too low or too high)

Corrective Action: Add or drain oil as necessary and check for leaks.

1. Contact an authorized Onan service representative if oil level was too high and contains water and coolant.

LOSS OF RAW WATER FLOW—CODE NO. 7

(First-level shutdown—Low raw water pressure in heat exchanger)

Corrective Action:

1. Open the sea cock.
2. Check for and clean a blocked sea water strainer. If the strainer is above the water line, fill it with water to assist priming.
3. Check for kinked or leaking hoses and reconnect, reroute or replace.
4. Check for a worn raw water impeller and replace as necessary (p. 4-14).
5. Check the bottom of the hull for any blockage at the through-hull fitting.

TABLE 5-1. TROUBLESHOOTING GENSET FAULTS (CONT.)

⚠WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions (p. iv).***

Accidental or remote starting can cause severe personal injury or death. Before removing a panel or access door, disconnect the negative (–) cable from the battery to prevent the engine from starting.

HIGH AC VOLTAGE—CODE NO. 12

(After voltage regulation was enabled Output Voltage jumped to more than 125% of rated for 75 milliseconds or to more than 115% of rated for 3 seconds)

Corrective Action: Does not apply when genset has PMG excitation.See an authorized Onan service representative.

LOW AC VOLTAGE—CODE NO. 13

(After voltage regulation was enabled Output Voltage fell to less than 90% of rated for 5 seconds)

Corrective Action: Does not apply when genset has PMG excitation. Push the genset line circuit breaker OFF and disconnect the PTO. If the genset now runs, reduce the number of electrical and mechanical (PTO) loads.

HIGH AC FREQUENCY—CODE NO. 14

(After the starter was engaged Frequency jumped to more than 70 Hz for 40 milliseconds or to more than 2% over nominal for 6 seconds)

Corrective Action:

1. Check for a tripped genset circuit breaker, reset it if necessary, and run with fewer connected loads . (A breaker tripping under load can cause genset frequency to overshoot.)
2. Check all fuel fittings for fuel and air leaks, tighten as necessary and reprime. (Air bubbles can disrupt frequency.)

LOW AC FREQUENCY—CODE NO. 15

(During normal operation Frequency fell to less than 90% of nominal for more than 8 seconds)

Corrective Action:

1. Push the genset line circuit breaker OFF and disconnect the PTO. If the genset now runs, reduce the number of electrical and mechanical (PTO) loads, especially those with high motor starting loads such as air conditioners.
2. Check fuel level and fill as necessary.
3. Prime the engine fuel system for at least 30 seconds (p. 3-3).
4. Check all fuel fittings for fuel and air leaks, tighten as necessary and reprime. (Air bubbles can disrupt frequency.)
5. Replace the fuel filters and reprime (p. 4-9).
6. Check the engine air filter and remove any blockage (p. 4-11).

ENGINE FAULT—CODE NO. 16

(The genset Controller shut down the genset due an engine fault)

Corrective Action: See TROUBLESHOOTING ENGINE FAULT CODE NO. 16 on Page 5-8.

TABLE 5-1. TROUBLESHOOTING GENSET FAULTS (CONT.)

⚠WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions (p. iv).***

Accidental or remote starting can cause severe personal injury or death. Before removing a panel or access door, disconnect the negative (–) cable from the battery to prevent the engine from starting.

LOSS OF AC VOLTAGE SENSE—CODE NO. 27

(The genset Controller lost VAC sensing during normal voltage regulation when the field was functioning normally and frequency was at least 40 Hz)

Corrective Action: See an authorized Onan service representative.

HIGH BATTERY VOLTAGE—CODE NO. 29

(During startup the genset Controller sensed that battery system voltage was greater than 19.2 volts if 12 VDC system or 32.2 volts if 24 volt system)

Corrective Action:

1. Check battery bank connections and reconnect if necessary for 12 volts or 24 volts, depending on genset model.
2. Select a lower battery booster charge rate.

STARTING FAULT—CODE NO. 32

(The genset Controller could not detect cranking speed [quadrature zero crossings] for 3 seconds)

Corrective Action:

1. Disconnect the PTO.
2. Have the propulsion engines running while trying to start the genset. Their charging alternators may be able to maintain a high enough battery terminal voltage to start the genset.
3. Service the battery as necessary by cleaning and tightening connections, recharging or replacing the battery or replacing damaged battery cables (p. 4-5).
4. Change the engine oil to oil of the proper viscosity for the ambient temperature. High oil viscosity can slow down cranking speed.

CONTROL CARD FAILURE–EE—CODE NO. 35

(During startup the genset Controller detected a EE memory error)

Corrective Action: See an authorized Onan service representative.

UNKNOWN SHUTDOWN—SEE MANUAL—CODE NO. 36

(The genset Controller declared this fault because engine speed fell below 1000 RPM for 0.5 seconds, though not by genset or engine control action)

Corrective Action:

1. Reduce the number of electrical and mechanical (PTO) loads on the genset.
2. Check fuel level and refill as necessary. (Note: The genset fuel pickups are probably higher than the propulsion engine fuel pickups.)
3. Prime the engine fuel system for at least 30 seconds (p. 3-3).
4. Check all fuel fittings for fuel and air leaks, tighten as necessary and reprime.
5. Replace the fuel filters and reprime (p. 4-9).
6. Check the engine air filter and remove any blockage (p. 4-11).

TABLE 5-1. TROUBLESHOOTING GENSET FAULTS (CONT.)

⚠WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions (p. iv).***

Accidental or remote starting can cause severe personal injury or death. Before removing a panel or access door, disconnect the negative (–) cable from the battery to prevent the engine from starting.

INVALID GENSET CONFIGURATION—CODE NO. 37

(The genset Controller is not configured properly for the genset)

Corrective Action: See an authorized Onan service representative.

CONTROL CARD FAILURE–RAM—CODE NO. 43

(During startup the genset Controller detected a RAM memory error)

Corrective Action: See an authorized Onan service representative.

SPEED SENSE LOST—CODE NO. 45

(After start disconnect the genset Controller lost speed sense [quadrature zero crossings] for 0.25 seconds)

Corrective Action: See an authorized Onan service representative.

GENSET OVERLOAD—CODE NO. 46

(The genset Controller shutdown the genset because engine load exceeded 135 percent of genset rating for 10 seconds)

Corrective Action: Reduce the number of electrical and mechanical (PTO) loads on the genset.

OVERPRIME—CODE NO. 57

(A local or remote control switch was held in the Prime position for more than 5 minutes)

Corrective Action: Check for and remove any object that may be holding either control switch (remote or local) in the prime position.

HIGH EXHAUST TEMPERATURE—CODE NO. 58

(Exhaust temperature exceeded design limits due to lack of water delivered to the exhaust/water mixer)

Corrective Action:

1. Check for and clean a blocked sea water strainer. If the strainer is above the water line, fill it with water to assist priming.
2. Check for kinked or leaking hoses and reconnect, reroute or replace.
3. Inspect the siphon break (if provided) for proper operation.
4. Check for a worn raw water impeller and replace as necessary (p. 4-14).

LOW COOLANT LEVEL—CODE NO. 59

(The engine coolant level fell below the coolant level sensor)

Corrective Action: Add coolant as necessary and repair leaks.

TABLE 5-1. TROUBLESHOOTING GENSET FAULTS (CONT.)

⚠WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions (p. iv).***

Accidental or remote starting can cause severe personal injury or death. Before removing a panel or access door, disconnect the negative (–) cable from the battery to prevent the engine from starting.

EXTERNAL SHUTDOWN—CODE NO. 61

(Genset was shut down by a fire suppression system or other external control)

Corrective Action: Make all necessary repairs to the genset and connected equipment and reset the external control which shut down the genset.

LOST NIM COMMUNICATIONS—CODE NO. 72

(The genset Controller lost communication with the NIM [Network Interface Module] for 15 seconds)

Corrective Action: See an authorized Onan service representative.

TROUBLESHOOTING ENGINE FAULT CODE NO. 16

If this fault occurs, press the INFO button (which appears only for this fault) to display the engine FAULT INFO screen for a description of the engine fault (Figure 5-1). Find the corresponding fault in Table 5-2 and perform the step-by-step corrective actions.

If you are unable to resolve the problem after taking the corrective actions suggested, contact an authorized Onan service representative. See *How to Obtain Service* (p. 1-3).

Record the fault SPN and FMI numbers so that the service representative can have a better idea of which tools and parts to bring along.

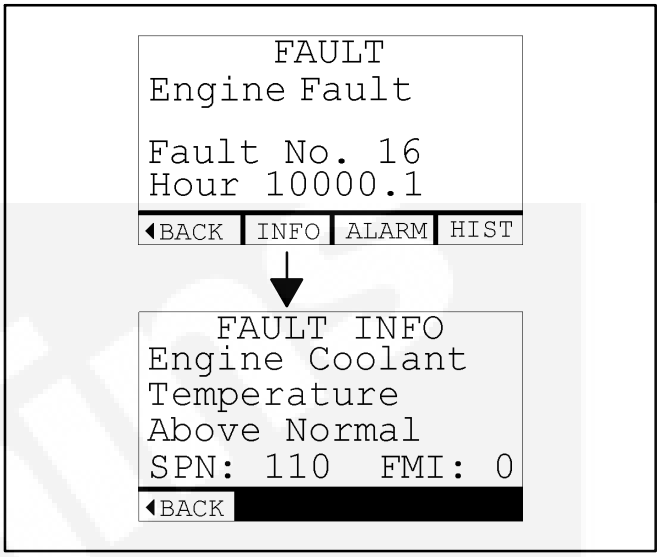


FIGURE 5-1. TYPICAL FAULT SCREEN

TABLE 5-2. TROUBLESHOOTING ENGINE FAULT CODE NO. 16

WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions (p. iv).***

Accidental or remote starting can cause severe personal injury or death. Before removing a panel or access door, disconnect the negative (–) cable from the battery to prevent the engine from starting.

ENGINE FAULT, ABOVE NORMAL—SPN: 1, FMI: 0

(Engine Controller not in communication with NIM)

Corrective Action: See an authorized Onan service representative.

WATER IN FUEL INDICATOR, ABOVE NORMAL—SPN: 97, FMI: 0

(Water is present in the fuel separator)

Corrective Action: Drain the water from the fuel separator (p. 4-10).

ENGINE OIL PRESSURE, BELOW NORMAL—SPN: 100, FMI: 1

(Engine oil pressure is below 20 to 41 psi [135 to 280 kPa]—depending on engine speed)

Corrective Action: Check engine oil level, add or drain oil as necessary and repair any leaks (p. 4-6).

ENGINE COOLANT TEMPERATURE, ABOVE NORMAL—SPN: 110, FMI: 0

(Engine coolant temperature is above 244°F [118°C])

Corrective Action:

1. Check for and clean a blocked sea water strainer. If the strainer is above the water line, fill it with water to assist priming.
2. Check engine coolant level and add coolant as necessary.
3. Check for kinked or leaking hoses and reconnect, reroute or replace.
4. Inspect the siphon break (if provided) for proper operation.
5. Check for a worn raw water impeller and replace as necessary (p. 4-14).
6. Check the bottom of the hull for any blockage at the through-hull fitting.

TABLE 5-2. TROUBLESHOOTING ENGINE FAULT CODE NO. 16(CONT.)

⚠WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions (p. iv).***

Accidental or remote starting can cause severe personal injury or death. Before removing a panel or access door, disconnect the negative (–) cable from the battery to prevent the engine from starting.

ENGINE SPEED, ABOVE NORMAL—SPN: 190, FMI: 0
(Engine speed exceeded 3400 rpm)

Corrective Action: See an authorized Onan service representative.

CONTROLLER # 1, OUT OF CALIB.—SPN: 629, FMI: 13
(The engine Controller requires recalibration)

Corrective Action: See an authorized Onan service representative.

AUXILIARY ENGINE SHUTDOWN SWITCH—SPN: 970, FMI: 31
(An external controller sent a shutdown signal to the engine Controller)

Corrective Action: Investigate the cause of shutdown, make necessary adjustments and repairs and reset the external controller.

FUEL INJECTION PUMP VALVE, VOLT. OUT/ RANGE—SPN: 1076, FMI: 3
(Sensor or wiring shorted or open)

Corrective Action: See an authorized Onan service representative.

FUEL INJECTION PUMP VALVE, CUR. OUT/ RANGE—SPN: 1076, FMI: 5
(The fuel injection pump fuel control valve open)

Corrective Action: See an authorized Onan service representative.

FUEL INJECTION PUMP VALVE, CUR. OUT/ RANGE—SPN: 1076, FMI: 6
(The fuel injection pump fuel control valve open or grounded)

Corrective Action: See an authorized Onan service representative.

FUEL INJECTION PUMP VALVE, ABNORMAL RT/CHG—SPN: 1076, FMI: 10
(The fuel injection pump fuel control valve circuit resistance)

Corrective Action: See an authorized Onan service representative.

FUEL INJECTION PUMP VALVE, OUT OF CALIB.—SPN: 1076, FMI: 13
(The fuel injection pump fuel control valve circuit resistance due to connector)

Corrective Action: See an authorized Onan service representative.

APPROACHING SHUTDOWN—SPN: 1109, FMI: 31
(Engine Controller protection circuit approaching shutdown [30 seconds]—condition not available)

Corrective Action: See an authorized Onan service representative.

TABLE 5-2. TROUBLESHOOTING ENGINE FAULT CODE NO. 16(CONT.)

⚠WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions (p. iv).*** ***Accidental or remote starting can cause severe personal injury or death. Before removing a panel or access door, disconnect the negative (–) cable from the battery to prevent the engine from starting.***
ENGINE HAS SHUT DOWN—SPN: 1110, FMI: 31 (Engine Controller protection circuit has shutdown—condition not available) **Corrective Action:** See an authorized Onan service representative.
ENGINE TORQUE DERATE—SPN: 1569, FMI: 31 (A derate condition exists—Check Coolant Temperature, Oil pressure, Fuel Temperature) **Corrective Action:** See an authorized Onan service representative.
ECU FAILURE, CUR. OUT/RANGE—SPN: 2000, FMI: 06 (ECU failure) **Corrective Action:** See an authorized Onan service representative.

TROUBLESHOOTING ENGINE PRE-ALARMS

The PRE-ALARM status lamp will start to blink as certain engine running conditions approach their limits for engine shutdown. To display information about the pre-alarm condition, press the FAULT button on any GEN STATUS screen. Then press the ALARM button to display the PRE-ALARM screen (Figure 5-2). Find the corresponding fault in Table 5-3 and perform the step-by-step corrective actions.

If you are unable to resolve the problem after taking the corrective actions suggested, contact an authorized Onan service representative. See *How to Obtain Service* (p. 1-3).

Record the pre-alarm SPN and FMI numbers so that the service representative can have a better idea of which tools and parts to bring along.

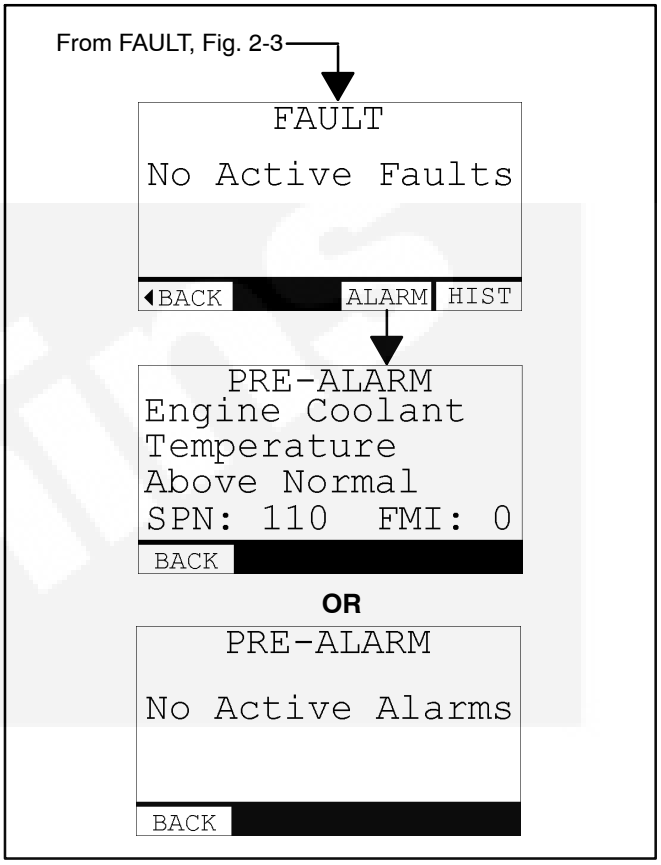


FIGURE 5-2. TYPICAL PRE-ALARM SCREEN

TABLE 5-3. TROUBLESHOOTING ENGINE PRE-ALARMS

WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions (p. iv).*** ***Accidental or remote starting can cause severe personal injury or death. Before removing a panel or access door, disconnect the negative (–) cable from the battery to prevent the engine from starting.***
WATER IN FUEL INDICATOR, ABOVE NORMAL—SPN: 97, FMI: 16 (Water is present in the fuel separator) **Corrective Action:** Drain the water from the fuel separator (p. 4-10).
ENGINE OIL PRESSURE, VOLT. OUT/RANGE—SPN: 100, FMI: 3 (Sensor or wiring shorted or open) **Corrective Action:** See an authorized Onan service representative.
ENGINE OIL PRESSURE, VOLT. OUT/RANGE—SPN: 100, FMI: 4 (Engine oil pressure sensor or wiring open or grounded) **Corrective Action:** See an authorized Onan service representative.

TABLE 5-3. TROUBLESHOOTING ENGINE PRE-ALARMS(CONT.)

⚠WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions (p. iv).***

Accidental or remote starting can cause severe personal injury or death. Before removing a panel or access door, disconnect the negative (–) cable from the battery to prevent the engine from starting.

ENGINE OIL PRESSURE, BELOW NORMAL—SPN: 100, FMI: 18

(Engine oil pressure is below 24 to 51 psi [165 to 350 kPa]—depending on engine speed)

Corrective Action: Check engine oil level, add or drain oil as necessary and repair any leaks (p. 4-6).

INTAKE MANIFOLD TEMPERATURE, VOLT. OUT/RANGE—SPN: 105, FMI: 3

(Sensor or wiring shorted or open)

Corrective Action: See an authorized Onan service representative.

INTAKE MANIFOLD TEMPERATURE, ABOVE NORMAL—SPN: 105, FMI: 16

(Intake manifold temperature above 302°F [150°C])

Corrective Action: See an authorized Onan service representative.

ENGINE COOLANT TEMPERATURE, VOLT. OUT/RANGE—SPN: 110, FMI: 3

(Sensor or wiring shorted or open)

Corrective Action: See an authorized Onan service representative.

ENGINE COOLANT TEMPERATURE, VOLT. OUT/RANGE—SPN: 110, FMI: 4

(Sensor or wiring shorted to ground)

Corrective Action: See an authorized Onan service representative.

ENGINE COOLANT TEMPERATURE, ABOVE NORMAL—SPN: 110, FMI: 15

(Engine coolant temperature is above 226°F [108°C])

Corrective Action:

1. Check for and clean a blocked sea water strainer. If the strainer is above the water line, fill it with water to assist priming.
2. Check engine coolant level and add coolant as necessary.
3. Check for kinked or leaking hoses and reconnect, reroute or replace.
4. Inspect the siphon break (if provided) for proper operation.
5. Check for a worn raw water impeller and replace as necessary (p. 4-14).
6. Check the bottom of the hull for any blockage at the through-hull fitting.

TABLE 5-3. TROUBLESHOOTING ENGINE PRE-ALARMS(CONT.)

⚠WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions (p. iv).***

Accidental or remote starting can cause severe personal injury or death. Before removing a panel or access door, disconnect the negative (–) cable from the battery to prevent the engine from starting.

ENGINE COOLANT TEMPERATURE, ABOVE NORMAL—SPN: 110, FMI: 16

(Engine coolant temperature is above 235°F [113°C])

Corrective Action:

1. Check for and clean a blocked sea water strainer. If the strainer is above the water line, fill it with water to assist priming.
2. Check engine coolant level and add coolant as necessary.
3. Check for kinked or leaking hoses and reconnect, reroute or replace.
4. Inspect the siphon break (if provided) for proper operation.
5. Check for a worn raw water impeller and replace as necessary (p. 4-14).
6. Check the bottom of the hull for any blockage at the through-hull fitting.

BATTERY POTENTIAL, BELOW NORMAL—SPN: 158, FMI: 17

(ECU cannot power down)

Corrective Action: See an authorized Onan service representative. See an authorized Onan service representative.

FUEL TEMPERATURE, VOLT. OUT/RANGE—SPN: 174, FMI: 3

(Sensor or wiring shorted or open)

Corrective Action: See an authorized Onan service representative.

FUEL TEMPERATURE, VOLT. OUT/RANGE—SPN: 174, FMI: 4

(Sensor or wiring shorted or open)

Corrective Action: See an authorized Onan service representative.

FUEL TEMPERATURE, ABOVE NORMAL—SPN: 174, FMI: 16

(Return fuel temperature is above 248°F [120°C])

Corrective Action: See an authorized Onan service representative.

ENGINE SPEED, ABOVE NORMAL—SPN: 190, FMI: 16

(Engine speed exceeded 3000 rpm)

Corrective Action: See an authorized Onan service representative.

5 VOLTS DC SUPPLY, VOLT. OUT/RANGE—SPN: 620, FMI: 3

(5V supply shorted to battery voltage)

Corrective Action: See an authorized Onan service representative.

TABLE 5-3. TROUBLESHOOTING ENGINE PRE-ALARMS(CONT.)

⚠WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions (p. iv).*** ***Accidental or remote starting can cause severe personal injury or death. Before removing a panel or access door, disconnect the negative (–) cable from the battery to prevent the engine from starting.***
5 VOLTS DC SUPPLY, VOLT. OUT/RANGE—SPN: 620, FMI: 4 (5V supply shorted to ground) **Corrective Action:** See an authorized Onan service representative.
TIMING (CRANK) SENSOR, DATA ERRATIC—SPN: 637, FMI: 2 (Excessive signal noise) **Corrective Action:** See an authorized Onan service representative.
TIMING (CRANK) SENSOR, ABNORMAL RT/CHG—SPN: 637, FMI: 10 (Improper signal pattern) **Corrective Action:** See an authorized Onan service representative.
ENGINE DERATE SWITCH—SPN: 971, FMI: 31 (An external derate input has been activated) **Corrective Action:** See an authorized Onan service representative.
FUEL INJECTION PUMP VALVE, ABOVE NORMAL—SPN: 1076, FMI: 0 (Closure too long) **Corrective Action:** See an authorized Onan service representative.
FUEL INJECTION PUMP VALVE, ABOVE NORMAL—SPN: 1076, FMI: 1 (Closure too short) **Corrective Action:** See an authorized Onan service representative.
FUEL INJECTION PUMP VALVE, ABOVE NORMAL—SPN: 1076, FMI: 1 (Closure too short) **Corrective Action:** See an authorized Onan service representative.
FUEL INJECTION PUMP VALVE, ABOVE NORMAL—SPN: 1076, FMI: 7 (ECU failed to detect closure) **Corrective Action:** See an authorized Onan service representative.
FUEL INJECTION PUMP VALVE, ABOVE NORMAL—SPN: 1076, FMI: 7 (ECU failed to detect closure) **Corrective Action:** See an authorized Onan service representative.

6. Specifications

	60 HERTZ MODELS				
	MDDCA	**MDDCB**	**MDDCC**	**MDDCD**	**MDDCE**
Genset Output Ratings – See Nameplate					
General Genset Data					
Size without Sound Shield – inches (mm)					
Length	68.3 (1734)	70.0 (1779)		84.3 (2142)	
Width	32.4 (822)				
Height	39.1 (994)				
Size with Sound Shield – inches (mm)					
Length	68.4 (1738)	70.2 (1783)		84.5 (2146)	
Width	33.1 (840)				
Height	40.9 (1039)				
Weight – Lbs (kg)					
Weight of Base Unit – Dry	2143 (972)	2352 (1067)	2352 (1067)	2910 (1320)	2910 (1320)
Weight of Base Unit – Wet	2200 (998)	2410 (1093)	2410 (1093)	3019 (1370)	3019 (1370)
Additional Weight for Various Options:					
Sound Shield	220 (100)	220 (100)	220 (100)	251(113)	251(113)
Single Phase Alternator	57 (26)	55 (25)	55 (25)	0	84 (38)
Sound Level – Housed (1 meter)					
Sound Level	72 dB(A)	72 dB(A)	72 dB(A)	72 dB(A)	72 dB(A)
Engine Detail					
Engine	4-Stroke Cycle Diesel, Direct Injection, Turbocharged, Microprocessor Controlled				
Operating Speed	1800 rpm				
10% Overload Engine Power	107 hp (80 kW)			162 hp (121 kW)	
Number of Cylinders (in-line)	4			6	
Firing Order	1–3–4–2			1–5–3–6–2–4	
Compression Ratio	17.6 : 1			17.0 : 1	
Displacement	275 in^3 (4.5 L)			415 in^3 (6.8 L)	
Bore	4.2 in (106.5 mm)				
Stroke	5.0 in (127 mm)				
Maximum Angularity, any direction	30 Degrees				
Lubrication System					
Lube Oil Capacity, including filters	13.3 qt (12.6 L)			20.5 qt (19.4 L)	
Lube Oil Drain Connection	3/8 inch NPT				
DC Electrical System					
Recommended Battery Capacity @ 32° F (0°C)	12V – 640 CCA / 24V – 570 CCA			12V – 800 CCA / 24V – 570 CCA	
Starter Rolling Current @ 32° F (0° C)	12V – 780 Amps / 24V – 600 Amps			12V – 920 Amps / 24V – 600 Amps	
Maximum Starting Current Resistance	12V – 0.0012 Ohm / 24V – 0.002 Ohm				
Battery Charging Output – Neg Gnd	12V – 60 Amps / 24V – 40 Amps				
Battery Charging Output – Iso Gnd	12V – 70 Amps / 24V – 45 Amps				

	60 HERTZ MODELS (CONTINUED)				
	MDDCA	**MDDCB**	**MDDCC**	**MDDCD**	**MDDCE**
Air Flow					
Combustion Air Flow	184 ft^3/min (m^3/min)			378 ft^3/min (m^3/min)	
Maximum Air Intake Restriction	Clean Element – 12 inches H_20 (3.0 kPa) Dirty Element – 25 inches H_20 (6.25 kPa)				
Alternator Cooling Air Flow ft^3/min (m^3/sec)	530 (0.25)	1090 (0.514)	1090 (0.514)	1090 (0.514)	1090 (0.514)
Heat Radiated to Room Btu/min (kW)	965 (17.0)	1116 (19.6	1216 (21.4)	1651 (29.0)	1842 (32.4)
Fuel System					
Recommended Fuel	No. 2 Diesel Fuel specified to EN 590 or ASTM D975				
Minimum Required Fuel Line ID	0.25 inch (6 mm)				
Fuel Supply and Return Connection Size	1/4 – 18 NPTF				
Total Fuel Flow	212 lb/hr (96 kg/hr) 30 gal/hr (113 L/hr)				
Maximum Leak–off Line Pressure	3 psi (20 kPa)				
Maximum Leak–off Return Height	8 ft (2.5 m)				
Maximum Fuel Height above Inj. Pump	10 ft (3 m)				
Maximum Fuel transfer pump suction	8 in Hg (27 kPa)				
Max. Fuel transfer suction with Auxiliary Pump	18 in Hg (60 kPa)				
Fuel consumption: Gal/hr (L/hr)					
1/4 load	1.2 (4.5)	1.4 (5.5)	1.5 (5.8)	2.0 (7.6)	2.4 (9.2)
1/2 load	1.9 (7.2)	2.4 (9.3)	2.8 (10.7)	3.5 (13.2)	4.1 (15.5)
3/4 load	2.6 (9.9)	3.4 (13.0)	4.0 (14.3)	4.9 (18.7)	6.0 (22.9)
full load	3.4 (12.7)	4.4 (16.8)	5.2 (19.7)	6.4 (24.2)	7.8 (29.4)
Cooling System					
Coolant Flow Rate	25 gal/min (94 L/min)			33 gal/min (125 L/min)	
Heat Rejection to Coolant	3523 Btu/min (62 kW)			5863 Btu/mind (103 kW)	
Coolant Capacity – engine only	15 qt (14 L)			32 qt (30 L)	
Recommended Pressure Cap	10 psi (70 kPa)				
Thermostat Start To Open	180 F (82 C)				
Thermostat Fully Open	203 F (95 C)				
Max. Pressure Drop Across Keel Cooler	4 psi (30 kPa)				
Sea Water System					
Raw Water Inlet Connection Size (OD)	1.25 in (31.8 mm)				
Sea Water Pump Flow	22 gal/min (84 L/min)				
Maximum Pump Inlet Restriction	120 inches H_20 (30 kPa)				
Maximum Pump Suction Lift	10 ft (3 m)				
Maximum Outlet Pressure	20 psi (135 kPa)				
Exhaust System					
Exhaust Gas Flow	463 ft^3/min (13.1 m^3/min)			848 ft^3/min (24 m^3/min)	
Exhaust Temperature	889° F (476° C)			745° F (396° C)	
Maximum Back Pressure	30 inches H_20 (7.5 kPa)				

	50 HERTZ MODELS				
	MDDCF	**MDDCG**	**MDDCH**	**MDDCJ**	**MDDCK**
Genset Output Ratings – See Nameplate					
General Genset Data					
Size without Sound Shield – inches (mm)					
Length	68.3 (1734)	70.0 (1779)	84.3 (2142)		68.3 (1734)
Width	32.4 (822)				
Height	39.1 (994)				
Size with Sound Shield – inches (mm)					
Length	68.4 (1738)	70.2 (1783)	84.5 (2146)		68.4(1738)
Width	33.1 (840)				
Height	40.9 (1039)				
Weight – Lbs (kg)					
Weight of Base Unit – Dry	2200 (998)	2352 (1067)	2910 (1320)	2910 (1320)	2183 (990)
Weight of Base Unit – Wet	2213 (1004)	2430 (1102)	3019 (1370)	3019 (1370)	2196 (996)
Additional Weight for Various Options:					
Sound Shield	220 (100)	220 (100)	251(113)	251 (113)	220 (100)
Single Phase Alternator	0	55 (25)	0	84 (38)	0
Sound Level – Housed (1 meter)					
Sound Level	72 dB(A)	72 dB(A)	70 dB(A)	70 dB(A)	72 dB(A)
Engine Detail					
Engine	4-Stroke Cycle Diesel, Direct Injection, Turbocharged, Microprocessor Controlled				
Operating Speed	1500				
10% Overload Engine Power	82 hp (61 kW)		131 hp (98 kW)		82 hp (61kW)
Number of Cylinders (in-line)	4		6		4
Firing Order	1–3–4–2		1–5–3–6–2–4		1–3–4–2
Compression Ratio	17.6 : 1		17.0 : 1		17.6 : 1
Displacement	275 in3 (4.5 L)		415 in3 (6.8 L)		275 in3 (4.5 L)
Bore	4.2 in (106.5 mm)				
Stroke	5.0 in (127 mm)				
Maximum Angularity, any direction	30 Degrees				
Lubrication System					
Lube Oil Capacity, including filters	13.3 qt (12.6 L)		20.5 qt (19.4 L)		13.3 qt (12.6 L)
Lube Oil Drain Connection	3/8 inch NPT				
DC Electrical System					
Recommended Battery Capacity @ 32° F (0° C)	12V – 640 CCA / 24V – 570 CCA		12V – 800 CCA / 24V – 570 CCA		12V –640 CCA / 24V – 570 CCA
Starter Rolling Current @ 32° F (0° C)	12V – 780 Amps / 24V – 600 Amps		12V – 920 Amps / 24V – 600 Amps		12V –780 Amps / 24V – 600 Amps
Maximum Starting Current Resistance	12V – 0.0012 Ohm / 24V – 0.002 Ohm				
Battery Charging Output – Neg Gnd	12V – 60 Amps / 24V – 40 Amps				
Battery Charging Output – Iso Gnd	12V – 70 Amps / 24V – 45 Amps				

	50 HERTZ MODELS (CONTINUED)				
	MDDCF	**MDDCG**	**MDDCH**	**MDDCJ**	**MDDCK**
Air Flow					
Combustion Air Flow	124 ft^3/min (m^3/min)		244 ft^3/min (m^3/min)		124 ft^3/min (m^3/min)
Maximum Air Intake Restriction	Clean Element – 12 inches H_20 (3.0 kPa) Dirty Element – 25 inches H_20 (6.25 kPa)				
Alternator Cooling Air Flow ft3/min (m3/sec)	530 (0.25)	1090 (0.514)	1090 (0.514)	1090 (0.514)	530(0.25)
Heat Radiated to Room Btu/min (kW)	805 (14.2)	906 (15.9)	1290 (22.7)	1441 (25.3)	805 (14.2)
Fuel System					
Recommended Fuel	No. 2 Diesel Fuel specified to EN 590 or ASTM D975				
Minimum Required Fuel Line ID	0.25 inch (6 mm)				
Fuel Supply and Return Connection Size	1/4 – 18 NPTF				
Total Fuel Flow	205 lb/hr (93 kg/hr) 29 gal/hr (109 L/hr)				
Maximum Leak–off Line Pressure	3 psi (20 kPa)				
Maximum Leak–off Return Height	8 ft (2.5 m)				
Maximum Fuel Height above Inj. Pump	10 ft (3 m)				
Maximum Fuel transfer pump suction	8 in Hg (27 kPa)				
Max. Fuel transfer suction with Auxiliary Pump	18 in Hg (60 kPa)				
Fuel consumption: Gal/hr (L/hr)					
1/4 load	1.0 (3.9)	1.2 (4.6)	1.5 (5.7)	1.8 (6.7)	1.0 (3.9)
1/2 load	1.7 (6.4)	2.0 (7.6)	2.6 (9.9)	3.1 (11.8)	1.7 (6.4)
3/4 load	2.4 (9.0)	2.9 (10.8)	3.7 (14.1)	4.5 (16.9)	2.4(9.0)
full load	3.0 (11.5)	3.7 (14.1)	4.9 (18.4)	5.9 (22.4)	3.0 (11.5)
Cooling System					
Coolant Flow Rate	14 gal/min (53 L/min)		31 gal/min (116 L/min)		14 gal/min (53 L/min)
Heat Rejection to Coolant	2681 Btu/min (47 kW)		4554 Btu/min (80 kW)		2681 Btu/min (47 kW)
Coolant Capacity – engine only	15 qt (14 L)		32 qt (30 L)		15 qt (14 L)
Recommended Pressure Cap	10 psi (70 kPa)				
Thermostat Start To Open	180 F (82 C)				
Thermostat Fully Open	203 F (95 C)				
Max. Pressure Drop Across Keel Cooler	3 psi (20 kPa)				
Sea Water System					
Raw Water Inlet Connection Size (OD)	1.25 in (31.8 mm)				
Sea Water Pump Flow	18 gal/min (70 L/min)				
Maximum Pump Inlet Restriction	100 inches H_20 (25 kPa)				
Maximum Pump Suction Lift	10 ft (3 m)				
Maximum Outlet Pressure	20 psi (135 kPa)				
Exhaust System					
Exhaust Gas Flow	300 ft^3/min (9.0 m^3/min)		558 ft^3/min (16 m^3/min)		300 ft^3/min (9.0 m^3/min)
Exhaust Temperature	851° F (455° C)		772° F (411° C)		851° F (455° C)
Maximum Back Pressure	30 inches H_20 (7.5 kPa)				

7. Maintenance Record

Record all periodic and unscheduled maintenance and service. See *Periodic Maintenance* (Sec. 4).

DATE	HOUR METER READING	MAINTENANCE OR SERVICE PERFORMED

Record the name, address, and phone number of your authorized Onan service center.

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