

4,000 Hour Maintenance Manual

for the
microCHP

Valid for North American Series “C” Models:

Natural Gas: 336016

Propane Gas: 336017



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Safety Guidelines

This manual provides Warnings and Cautions to alert readers of possible dangers or safety hazards associated with maintenance, operation, or servicing of the microCHP.

The  **WARNING** symbol identifies special instructions or procedures, which if not correctly followed could result in serious injury, or the loss of life.

The  **CAUTION** symbol identifies special instructions or procedures, which if not strictly observed, could result in personal injury, damage to, or destruction of equipment, or may be a violation of a law, ordinance, standard, or code requirement.

Read Section 1, Safety, prior to maintaining or operating the equipment. Observe all safety instructions for safe and reliable operation.

Forward

The microCHP has a unique engine as a prime mover, designed and developed by the Gas Research Institute (GRI) and Briggs & Stratton Corporation for extended duration operation on gaseous fuels.

To meet the continuous duty requirements and long service interval durations, the engine was designed with high reliability design features. These features are intended to reduce sliding friction and wear of moving engine and valve train components, which helps to improve the engine efficiency and reduce lubricating oil contamination. These features allow the engine to operate up to 4,000 hours before routine maintenance is required, and provide a longer life expectancy before engine overhaul or replacement is required.

This manual serves as a guide for the 4,000 hour maintenance point. Refer to the microCHP Maintenance Manual for other maintenance and repair instructions.



WARNING: Exhaust gases contain CARBON MONOXIDE which is an odorless, colorless, and deadly poison.

Install a carbon monoxide alarm according to the manufacturer's and UL/NFPA guidelines.

DO NOT place hands near moving or rotating parts (engine - flywheel coupling).

To prevent accidental starting when servicing the engine or equipment, always first disconnect electrical power from the unit.

Mortal danger is present due to electric shock hazard at live electrical parts! Dangerous voltage exists at the power supply connections of the microCHP even if the main cabinet switch is in the off position. Before working on the microCHP, disconnect the electrical power at the external circuit breaker/disconnect and secure (lock out/tag out) the microCHP against switching on again. Wait five minutes for the capacitors to discharge.

Ensure that no liquids come in contact with the electrical components.

INTRODUCTION

This manual is divided into sections as follows.

Section 1 Important Safety Instructions

Health and safety information.

Section 2 Maintenance and Inspection

Procedures for maintaining and inspecting the microCHP

The maintenance instructions in this Manual are based on good commercial practices and the requirements, recommendations, and guides of applicable International and US National Codes, Standards, and Equipment Listings. These Codes, Standards, and Equipment Listings include the National Fire Protection Association (NFPA), which include the National Electrical Code (NEC), and Underwriters Laboratories Inc., (UL) Standards, as well as the Code of Federal Regulations (CFR). There may be other state and local codes, ordinances, restrictions, and safety requirements that apply to this type of equipment.



WARNING: Failure to follow the instructions and recommendations in this Manual or the restrictions and requirements of the Codes, Standards, or Equipment Listing Standards referenced in this Manual, or other Country, State, and local Codes, may result in Safety Hazards. These Safety Hazards could cause personal injury or death and could result in damage to the microCHP or components. Failure to follow the instructions or recommendations of this Manual may also void the microCHP Warranty on workmanship and materials.



CAUTION: It is the responsibility of the Contractor to ensure that the microCHP equipment is maintained in compliance with all Federal, State, and Local Codes and Ordinances.

TRADEMARKS

References are made to Codes, Standards, Recommended Practices, and Guides in this Manual. These Codes, Standards, Recommended Practices, and Guides are copyrighted and all rights are reserved by the holder.

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1 - Important Safety Instructions

Read the safety instructions prior to maintaining the microCHP.



SAVE THESE INSTRUCTIONS - This manual contains important instructions for microCHP Models 336016 (natural gas ECP2416NG) and 336017 (propane gas ECP2416LP) that shall be followed during the maintenance of the microCHP.

Signs, Symbols, and Notes



Alternating Current



Protective Earth Ground



Electrical Shock Hazard



Safety Instruction



1.1 Installation Notes

Ambient Temperature Range: 32 – 104 °F (0 – 40 °C). Note: Optimum ambient temperature is 70 °F (21 °C).

Input power wiring: Use No. 10 AWG, 194 °F (90 °C) copper wire.

The installer is responsible for installing the branch circuit protection. A 30 amp, two-pole breaker shall be installed on the building side of the provided distribution transformer, as near to the microCHP as possible.

Natural gas minimum methane number: 59

Propane gas minimum octane number: MOZ 92 (EN 589)

The overall installation shall comply with standards ANSI/NFPA standards:

NFPA 30, Flammable and Combustible Liquids Code for information regarding fuel tanks and piping on installation site.

ANSI/NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines regarding mounting, fuel tanks, and lines on installation site.

NFPA 54, National Fuel Gas Code, regarding piping and control equipment, and installation of fuel burning equipment.

NFPA 58, Liquefied Petroleum Gas Code regarding LP gas equipment, appliances, and engine fuel systems.

NFPA 59, Standard for the Storage and Handling of Liquid Petroleum Gases at Utility Gas Plants regarding LP Handling.

ANSI/NFPA 70, National Electrical Code, regarding electrical equipment design and installation.

Observe all applicable state and local building codes.

Canada: For installations in Canada the installation shall comply with CSA C22.2, No. 0, Canadian National Electrical Code, CAN/CSA B149.1, Natural Gas and Propane Installation Code, and any applicable local codes.

This unit or system is provided with fixed trip limits and must not be aggregated above 30 kW on a single point of common connection.

Only qualified personnel shall perform maintenance.

Use only the supplied flexible water pipe connections to reduce noise and prevent damage from vibration.

A manual gas supply shut-off valve shall be installed between the microCHP and the main gas supply in a location that is easily accessible to emergency and service personnel.

Within this manual all references made to “propane” actually refer to “propane gas” and not to “liquefied propane.”

Use the supplied flexible gas supply hose that is provided with the microCHP.

Use only flexible electrical conduit to prevent damage from vibration.

The electrical, water, and gas supply connections must be free of tension in order to prevent damage due to vibration.

The distribution transformer that is provided with the microCHP must be installed between the microCHP and the main disconnect device.

A separate earth ground conductor must be installed between the building’s earth ground and the microCHP.



WARNING: A proper ground connection is essential for safety.

The input power and ground connections must be connected to the terminal block and ground terminal connector located inside the electrical power connection section located in the back of the microCHP cabinet.

The electrical wiring for the microCHP buffer tank water circulation pump, temperature sensors, and the 3-way valve actuator (240 VAC service) must be conduit-connected to the microCHP cabinet. The wires should be fed through and terminated at the appropriate Pro-E terminal block connection under the back cover. Special attention should be given to the temperature sensor wires to be sure that they are shielded for a minimum of six feet (1.83 m) from the back of the microCHP. This ensures that the sensor wires will not act as antennas in the presence of strong EMI fields.



WARNING: The microCHP neutral and earth ground circuits are bonded together by the factory to meet UL safety requirements. This connection must not be altered.

1.2 Safety Instructions microCHP



WARNING: The exhaust from the engine in this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.



WARNING: Components in this product and accessories contain chemicals known to the State of California to cause cancer, birth defects or other reproductive harm. Wash your hands after handling.

1.2.1 Assembly and Maintenance

Only trained specialists shall perform assembly and maintenance of the microCHP.

1.2.1.1 Tune-up

No adjustments needed.

1.2.2 Gas odor



WARNING: In case of gas odor, the following safety instructions shall be followed:

Evacuate everyone from the hazard area.

Do not activate any electric switches in the hazard area.

Do not smoke in the hazard area.

Do not use any telephones in the hazard area.

Shut the gas stop valve.

Ventilate the jeopardized area.

Notify your gas utility via their emergency contact method.

1.2.3 Modifications of the microCHP

Do not modify the following fixtures and fittings:

- microCHP,
- Pipes for gas, intake supply air, water, and power,

- Exhaust gas pipe,
- Drain pipe and the safety valve for the heating-circuit water,
- Structural conditions, which may have an influence on the operational safety of the unit.



WARNING: The gas control multiblock maximum input pressure is .94 psi (65 mbar) . Maximum output pressure from the gas control multiblock is 6 w.c. in./22 psi (15 mbar).

1.2.4 Startup



CAUTION: Use 50% antifreeze (DOWTHERM SR-1)/50% distilled water mixture. Do not enrich the cooling circuit water with more antifreeze or anticorrosives. Use of higher percentages of antifreeze or anticorrosives may cause changes to the seals and also lead to noises when the engine is running. It also will reduce efficiency of the system. For these cases, (as well as for potential consequential damage) Axiom Energy Group will not assume liability. Please inform the user about the restrictions regarding coolant.

Use distilled water only in the cooling circuit.



WARNING: If the microCHP is operated with an empty condensation water drain trap, there is risk of intoxication by effusing exhaust gas. Exhaust gases contain CARBON MONOXIDE which is an odorless, colorless, and deadly poison. Make sure the drain trap is filled with water before operating.

Install a carbon monoxide alarm according to the manufacturer's and UL/ NFPA guidelines.



CAUTION: Maximum inlet gas pressure: The propane and natural gas models are supplied with a pre-regulator with a maximum input gas pressure of 2 psi (140 mbar). If the supply pressure is higher than the rated pressure, do not install or make any adjustments to the gas train and do not operate the microCHP.



CAUTION: The gas control multiblock maximum input pressure is .94 psi (65 mbar). Maximum output pressure from the gas control multiblock is 6 w.c. in. (15 mbar).

Typical input pressure to the gas multiblock from the pre-regulator (factory setting) is 7 w.c. in. (17 mbar).

1.2.5 Inspection and maintenance

Only recognized specialists trained by Axiom Energy Group shall perform inspection, maintenance, and repair work. There are no user servicable parts.



WARNING: Omitted inspections or maintenance works may lead to personal injury and property damage and may void your warranty.



WARNING: Mortal danger is present due to electric shock hazard at live electrical parts! Dangerous voltage exists at the power supply connections of the microCHP even if the main cabinet switch is in the off position. Before working on the microCHP, switch off the electrical power at the external circuit breaker/disconnect and secure (lock out/tag out) the microCHP against switching on again. Wait 5 minutes for capacitors to discharge.

Keep liquids away from the electrical components and cabinet.



WARNING: Explosion hazard due to gas leakage! Only qualified specialists who have been trained by Axiom Energy Group shall exchange the internal gas safety hose.

After maintenance, perform a leakage test.



WARNING: At all water-bearing components there is risk of injury and scald. Do not work on components before they have cooled down.

1.2.6 Troubleshooting:

Disconnect the microCHP (by means of the dedicated circuit breaker) and any optional, installed peak load tank or backup heater unit from the grid power supply before starting work. Close the gas valve and the maintenance valves. Drain the microCHP if you plan to replace water-bearing components of the microCHP.



WARNING: Mortal danger is present due to electric shock hazard at live electrical parts! Dangerous voltage exists at the power supply connections of the microCHP even if the main cabinet switch is in the off position. Before working on the microCHP, switch off the electrical power at the external circuit breaker/disconnect and secure (lock out/tag out) the microCHP against switching on again. Wait 5 minutes for capacitors to discharge.

Keep liquids away from the electrical components and cabinet.

Use new seals only. Perform an operational test after finishing work and fill in the service or maintenance report. Observe safety instructions.

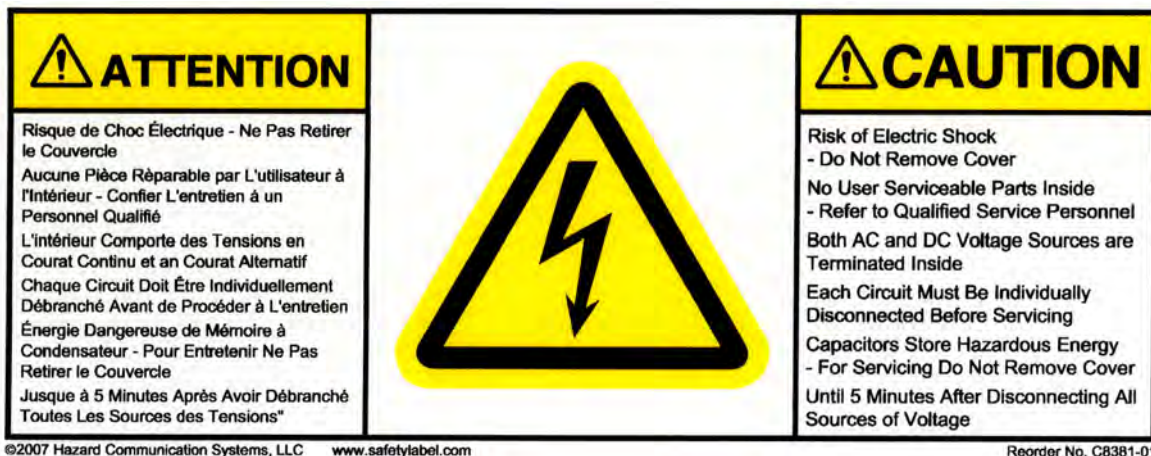


Figure 1.1 Equipment Caution Label, Electrical Hazard

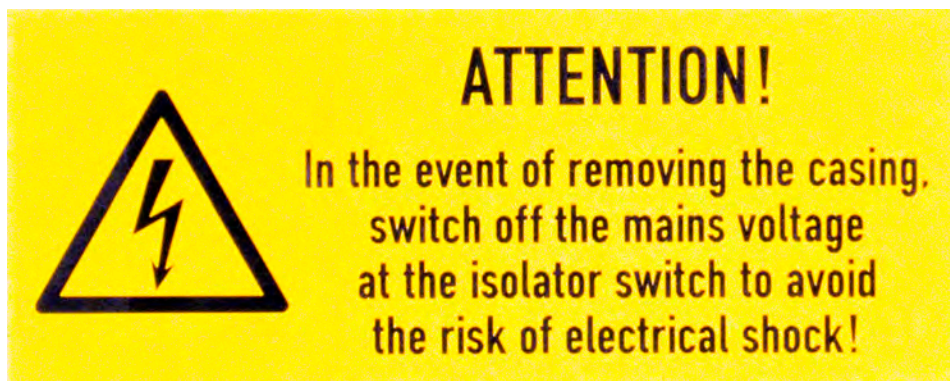


Figure 1.2 Warning Label, Electrical Hazard for Case Removal



Figure 1.3 Warning Label for the Engine ON / OFF Switch (Electrical Connection in the microCHP even when the Engine Switch is in OFF position)

2 - Maintenance and Inspection

2.1 General

Observe the maintenance schedule so that the microCHP Combined Heat and Power (CHP) unit has a long economic lifetime. Qualified service personnel shall perform maintenance. This manual documents the microCHP service requirements for a 4,000 hour service interval. The service requirements vary somewhat over the life of the equipment (see Table 2.1 at the end of this section). Refer to the microCHP Maintenance Manual for service and repair instructions.

Use original spare parts (Maintenance Kit Part No. 41-113). If inferior components or operating fluids are used, the economic lifetime can be reduced considerably and void the warranty. After completion of maintenance, fill out the microCHP Maintenance Record (MR) and send a copy for reference to Axiom Energy Group.



WARNING: Mortal danger is present due to electric shock hazard at live electrical parts! Dangerous voltage exists at the power supply connections of the microCHP even if the main cabinet switch is in the off position. Before working on the microCHP, disconnect the electrical power at the external circuit breaker/ disconnect and secure (lock out/tag out) the microCHP against switching on again. Wait 5 minutes for capacitors to discharge.

Protect the electrical components and cabinet from contact with liquids.

2.2 Preparation

Shut down the microCHP engine at least 2 hours before maintenance, otherwise the engine may be too hot to touch and perform maintenance.

It is possible to remotely lock out microCHP operation for maintenance cool down purposes through an internet connection with a connected computer. If locked out by this method, the microCHP engine is shut down and cannot be started by the customer, although live current will still be present at the microCHP until it is physically disconnected via the external circuit breaker.

- The microCHP Operating Manual and the ecoServ Operating Manual describe how to shut down the microCHP.
- After shutting down, disconnect the microCHP from the grid (mains) supply by means of the 30 amp, 2-pole breaker/disconnect located between the microCHP and the building distribution panel. Lock out the switch and tag it. Wait at least 5 minutes for the capacitors to discharge. Allow time for engine cool off, as well.
- Close the gas supply valve.
- Use the supplied wrench (key) to turn the bolts to unlatch the side panels. Remove the left and right side panels. Carefully set the panels aside, away from the microCHP.

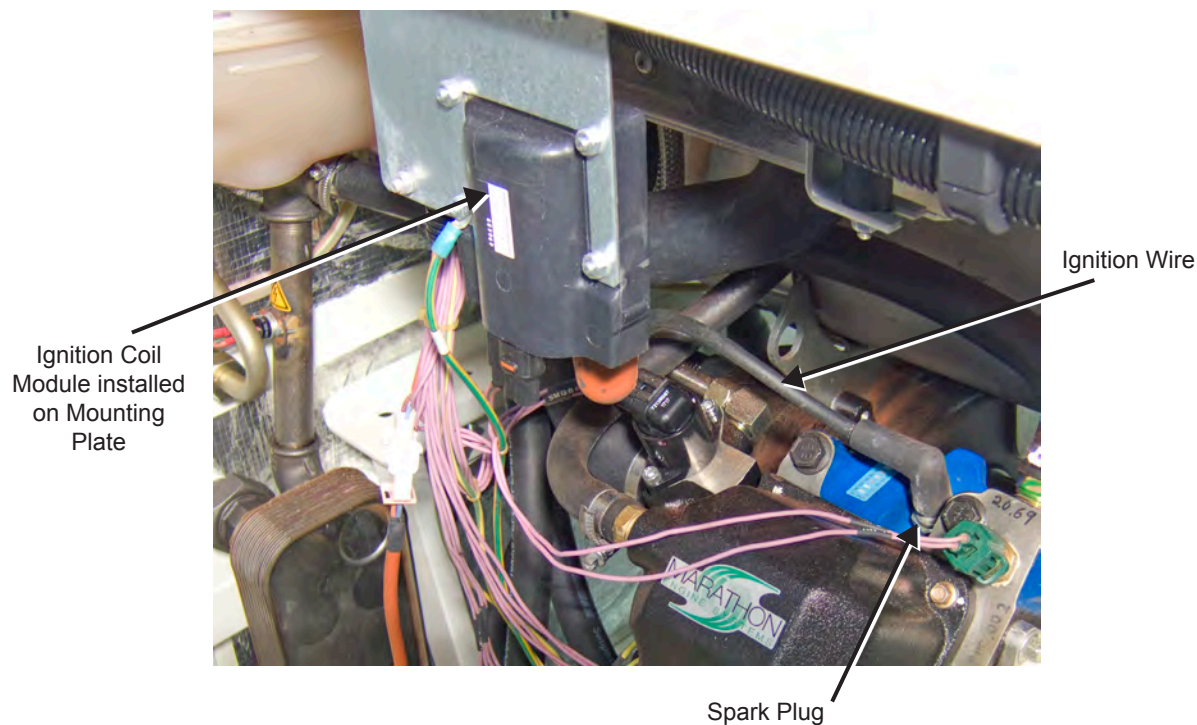


Figure 2.1 Spark Plug, Ignition Wire, and Ignition Coil Module



CAUTION: When removing the left side panel, take care to not bump and break off the engine On/Off switch, located behind the panel on the front left side.

2.3 Engine Maintenance

At the 4,000 hour maintenance interval, the following engine components are replaced:

- Ignition wire
- Spark plug
- Air Filter
- Oil
- Oil Filter

2.3.1 Ignition Wire and Spark Plug

2.3.1.1 Tools and Material

- Spark plug wrench
- Ignition wire
- Beru spark plug

2.3.1.2 Procedure

1. Remove (unplug) the old ignition wire from the spark plug and ignition coil (see Figure 2.1).

2. Using a spark plug wrench, unscrew the spark plug. Observe and note the condition of the spark plug.
3. Check the new spark plug gap with a spark plug gapper. The gap should be .001 - .014 in. (.25 - .35 mm). The plug is normally supplied from the factory at the correct gap. If necessary, adjust the gap.
4. Screw in the new spark plug manually as far as it will go. Then tighten with a torque wrench up to 17 Nm (150 lbf-in.).
5. Install the new ignition wire on the spark plug, seating it firmly on the plug.
6. Push the other end of the wire onto the ignition coil connector. Make sure the wire is seated firmly. Position the wire so it does not rub against other parts during engine operation.

2.3.2 Engine Air Filter

Replace the engine air filter element at every maintenance interval. A clean air filter will assist correct combustion and extend the life of the engine.

2.3.2.1 Tools and Material

- Air Filter Element
- Screwdriver No. 4
- ½ in. wrench

2.3.2.2 Procedure

1. Using a screwdriver, loosen the metal retaining bands and detach the engine air intake and crankcase breather hoses (Figure 2.2) at the intake air damper lid. Push the hoses aside.
2. Unscrew the ½ in. nut securing the round lid of the intake air damper. Remove the nut and two washers, and lower the lid.

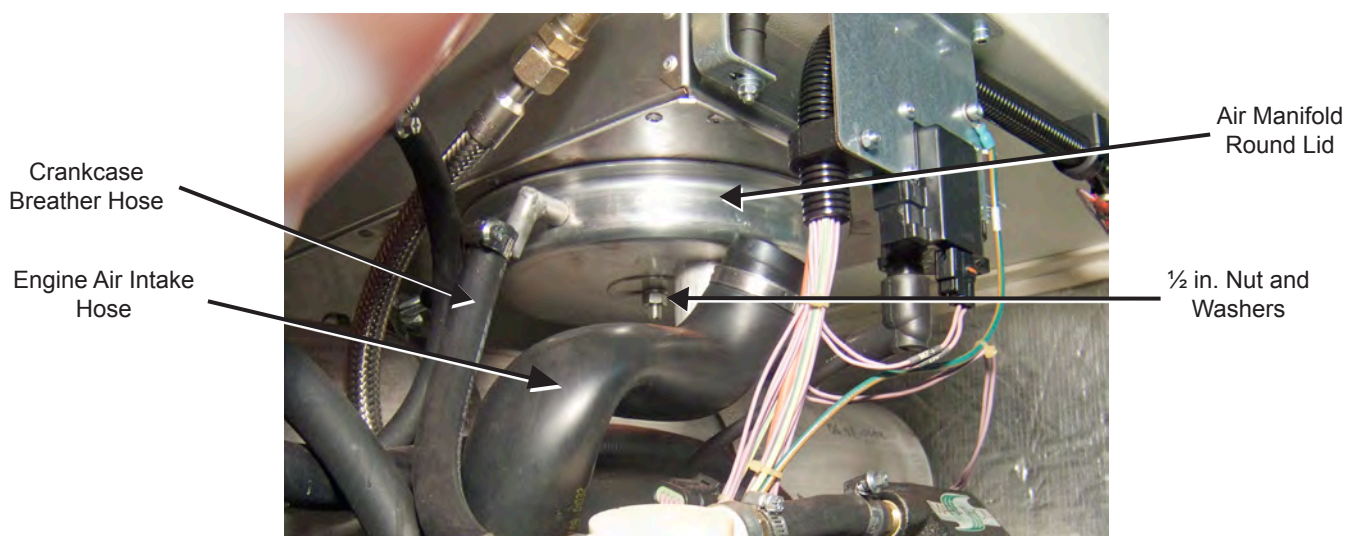


Figure 2.2 Engine Air Intake and Crankcase Breather Hoses Removed from the Air Intake Housing Round Lid

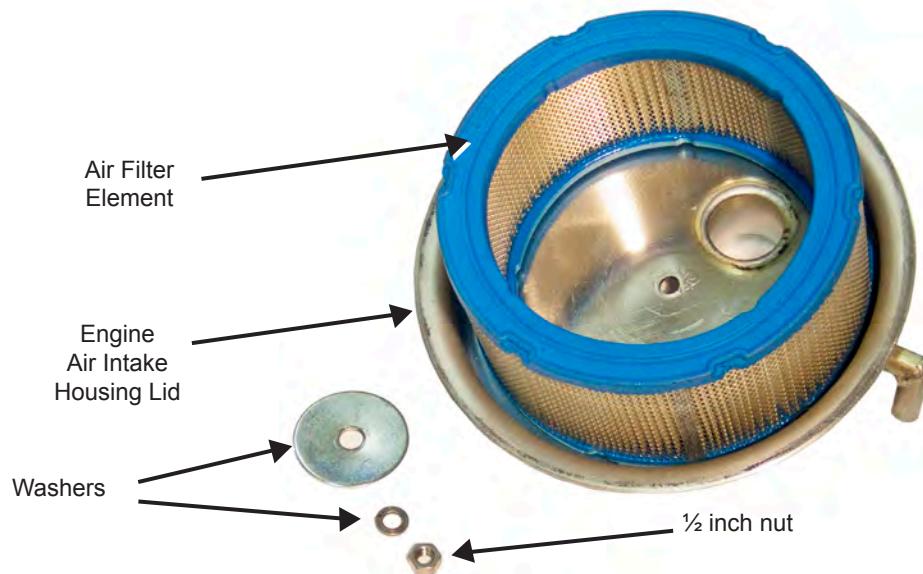


Figure 2.3 Engine Air Filter Element in Air Intake Housing Round Lid

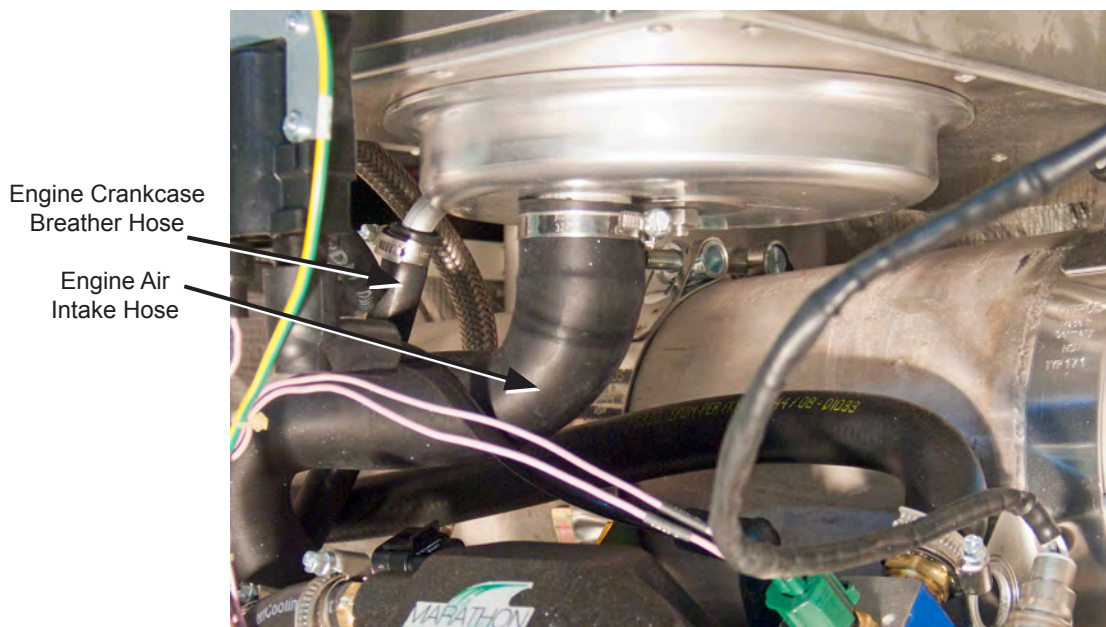


Figure 2.4 Engine Air Intake Filter Housing Reassembled

3. Remove the air filter element. Inspect the intake air damper and round lid for fouling. Clean out all dirt and debris.
4. Place the new air filter element on the round lid (Figure 2.3).
5. Reinstall the round lid of the intake air damper. Secure it air tight with the washers and 1/2 in. nut to 4 Nm (35 lbf-in.). Do not overtighten.
6. Check the hoses for proper fit, defective spots, cracking, chafe marks, kinking, buckling or bulging. Replace the hoses as necessary. Attach the hoses to the lid and secure them with the metal retaining bands (Figure 2.4).

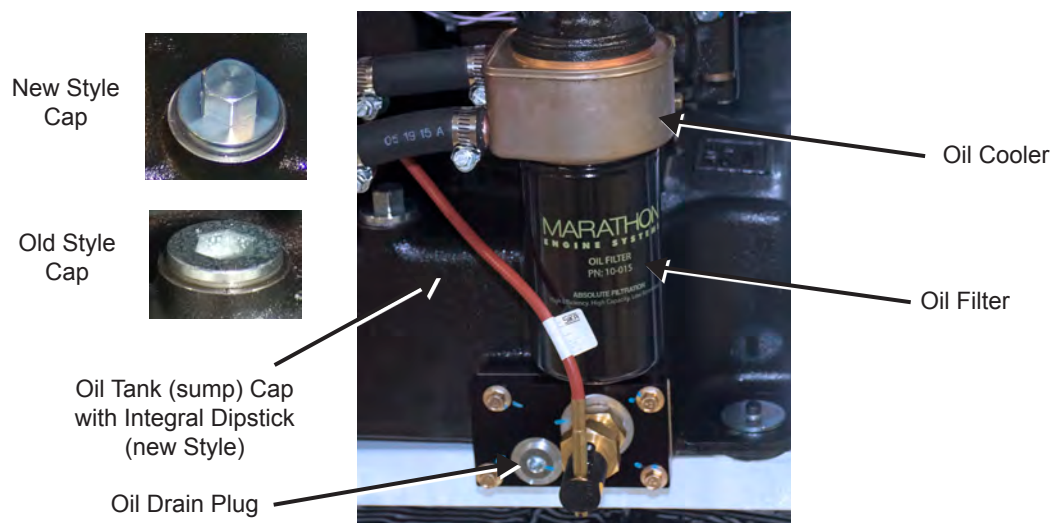


Figure 2.5 Engine Oil Cooler, Oil Filter, and Tank

2.3.3 Oil, and Oil Filter

Before changing the oil and oil filter, measure the oil level in the engine oil tank. Record the old oil level in the diagram in the maintenance report (Form MR).



CAUTION: Use the Axiom Energy Group oil to prevent engine wear and damage.

2.3.3.1 Tools and Materials

18 mm socket wrench or adjustable wrench (for new style dipstick) (see Figure 2.5) (17 mm hex wrench for old style dipstick)

8 mm or $\frac{5}{16}$ inch hex wrench

Oil filter removal tool

Funnel and oil catch basin (11 L (11.6 Quarts) capacity)

Clean cloth rags and absorbent towels

Oil Filter

Screwdriver No. 4

Oil - 11 liters (11.6 quarts) included with the maintenance kit (41-113).

Oil Evacuating Pump (optional)

2.3.3.2 Procedure

1. Unscrew the socket cap screw with integral oil dipstick out of the oil tank (see Figure 2.5). Use a 18 mm socket or an adjustable wrench (for new style dipstick). (17 mm hex wrench for old style dipstick).

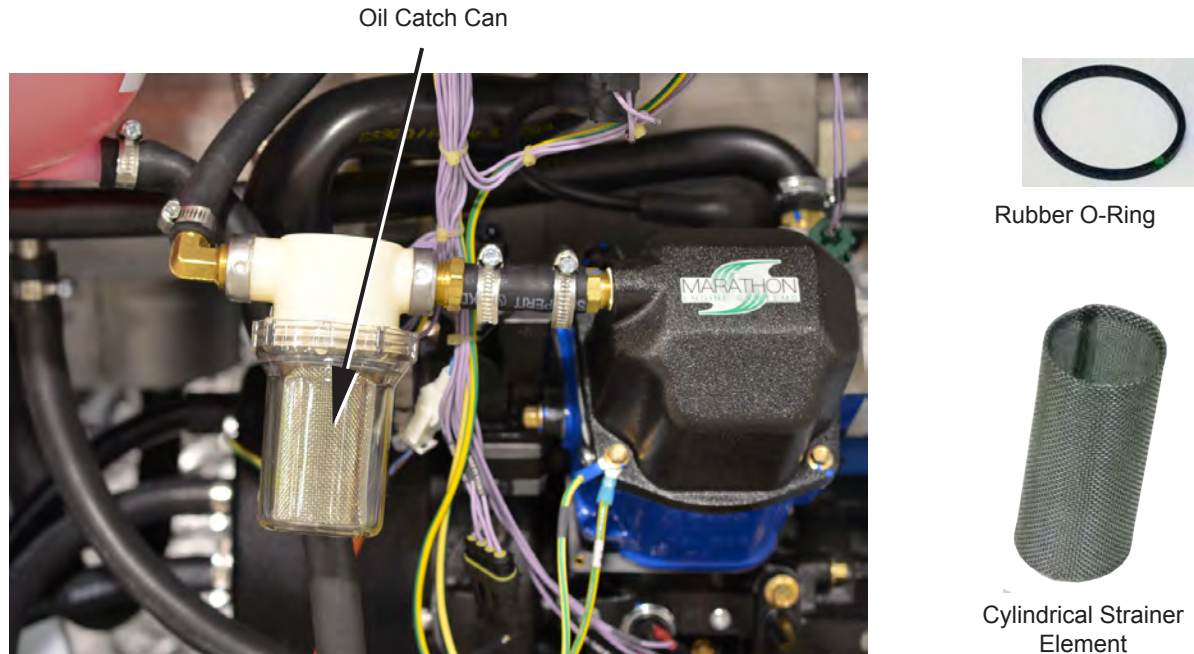


Figure 2.6 Crankshaft Breather Strainer and Plastic Container (Oil Catch Can)

2. Clean the oil dipstick with a clean cloth.
3. Insert the oil dipstick into the oil-filler neck (do not screw in). Draw the oil dipstick out of the oil-filler neck and note in the maintenance record the old oil level (the amount of oil is specified in liters).
4. Use an oil evacuation pump to remove the oil from the sump. Place the oil pump intake tube at the lowest point near the drain plug. Alternatively, place a funnel, absorbent towels, and oil catch basin at the oil drain plug and unscrew the drain plug with the 8 mm ($\frac{5}{16}$ inch) hex wrench. Completely drain the old oil into an environmentally suitable container.
5. Place a large number of absorbent towels and a container beneath the oil filter and cooler assembly. The oil cooler assembly is filled with oil. Unscrew the oil filter from the oil cooler assembly. Dispose of the filter in an environmentally suitable container.
6. Check the lip of the oil cooler assembly for any residue from the old oil filter sealing gasket. Scrape off any residue and clean the sealing surface.
7. Fill the new oil filter with new Axiom Energy Group Oil to about $\frac{1}{2}$ inch from the top of the filter. Apply a light film of oil on the sealing surface of the new oil filter. Screw in the oil filter and tighten it until it just seats on the gasket. Hand tighten an additional $\frac{3}{4}$ to full turn.
8. Screw the drain plug back onto the oil tank and tighten to 22.6 Nm (200 lbf-in.).
9. Place the oil container on top of the microCHP cabinet with the cap facing up (on top). Replace the oil container cap with closed fill tap. Rotate the container to lower the tap

so oil can flow out of the tap when it is opened. Attach one end of the hose to the tap nozzle and the other end into the dipstick hole. Open the tap and fill the oil sump with new oil (11 liters/11.6 quarts): using the specified original oil included in the maintenance kit.

10. Reinsert the socket cap screw (with oil dipstick) together with the seal and tighten to 13.6 Nm (120 lbf-in.).
11. Unscrew the clear plastic housing (oil catch can) that contains the crankshaft breather strainer (see Figure 2.6). Remove the rubber O-Ring from the housing. Wipe it clean with a dry cloth and set the O-Ring aside for later reinstallation. Remove the cylindrical metal strainer from the housing and clean the strainer of any debris. Environmentally dispose of any oil captured. Use a dry towel to wipe clean the inside of the plastic housing. Insert the strainer in the housing. Install the rubber O-Ring in the plastic housing. Re-install the housing to the cover, making sure the metal strainer is centered in the catch can. Hand tighten the housing securely so that the O-Ring has a tight seal. Do not over tighten.
12. Start the engine and perform test run; let the engine warm up and run full speed. Check for leaks.
13. Shut the engine down and let it sit idle for a few minutes.
14. Measure the oil level again. The oil level should be at the F (Full) mark.



CAUTION: Do not overfill the oil sump. An overfilled engine can lead to engine damage. If overfilled, remove the excess oil.

15. If the oil level is low, add more oil to bring it up to the F (Full) mark. If excess oil is in the crankcase, pump out the excess oil. If any leakage was found, repair as needed (consult with the factory and refer to the microCHP Maintenance Manual).

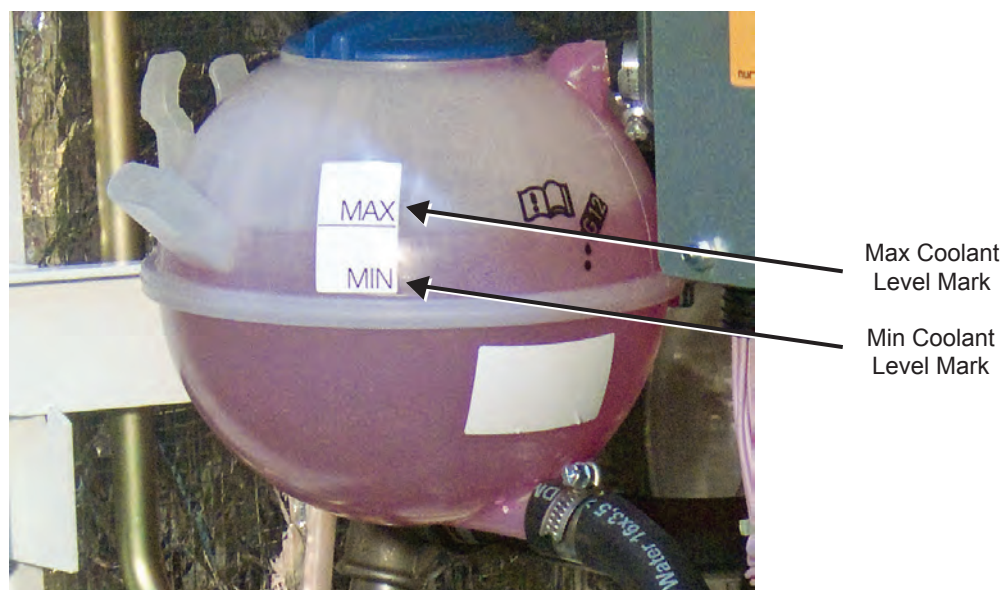


Figure 2.7 microCHP Coolant Expansion Tank

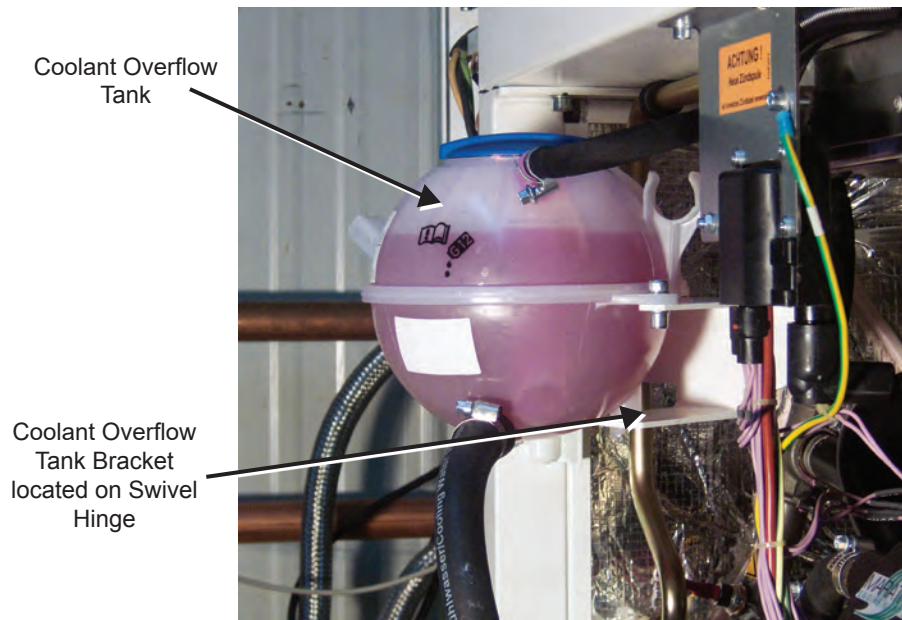


Figure 2.8 Coolant Overflow Tank in the Swiveled Out Position from microCHP

2.3.4 Checking the Coolant

2.3.4.1 Procedure

During every maintenance cycle, the coolant level must be checked and the coolant replenished, if necessary. The liquid level must be between the “MAX” and “MIN” marks on the expansion tank (see Figure 2.7). Note: Prior to adding coolant, check the coolant hoses (see section 2.3.7) and replace as needed.



CAUTION: Use 50% antifreeze (DOWTHERM SR-1)/50% distilled water mixture. Do not enrich the cooling circuit water with a higher percentage antifreeze or anti-corrosives. Use of high percentages of antifreeze or anti-corrosives may cause changes to the seals and also lead to noises when the engine is running. It also will reduce efficiency of the system. For these cases, (as well as for potential consequential damage) Axiom Energy Group cannot assume liability. Please inform the user about the requirements regarding coolant.

NOTE: Coolant supplied by Axiom Energy Group is premixed 50-50 coolant-distilled water mixture.

MES Coolant part number MIN5001-001. Use distilled water in the cooling circuit.



WARNING: Do not allow the microCHP to operate with an empty condensation water drain trap, there is risk of intoxication by effusing exhaust gas. Exhaust gases contain CARBON MONOXIDE which is an odorless, colorless, and deadly poison. Make sure the drain trap is filled with water before operating.

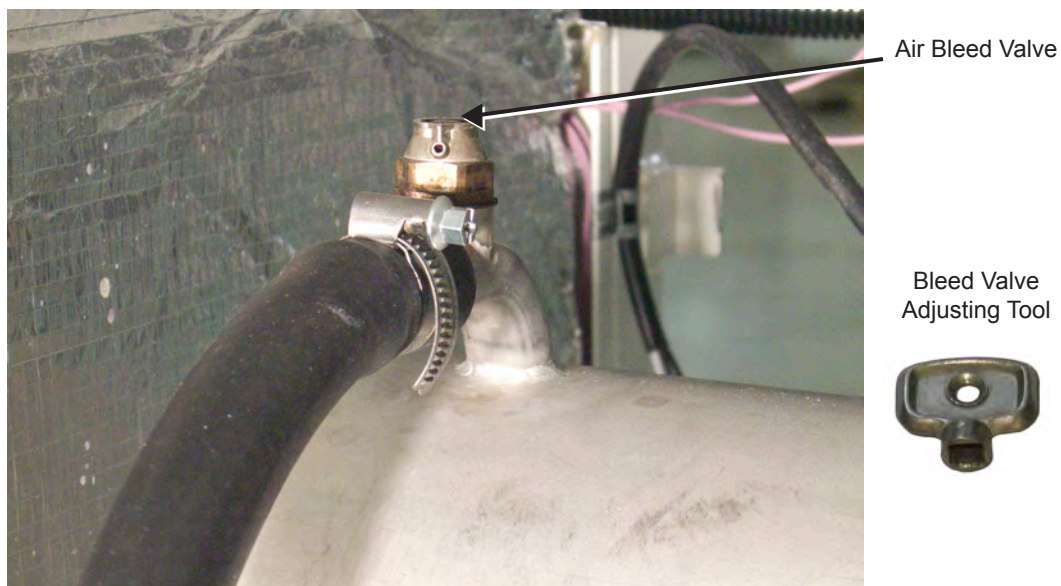


Figure 2.9 Heat Exchanger Coolant Bleed Valve

Visually inspect the coolant for impurities at every maintenance cycle. Especially, look for the following problems.

- Darkened coolant, caused by overheating
- Brown or black coolant: corrosion in the engine (caused by insufficient coolant)

In the case of impurities as described above, the coolant must be flushed. The mixing ratio is: 50% DOWTHERM SR-1 (high quality coolant)/50% distilled water.

Exchanging coolant: refer to the microCHP Maintenance Manual instructions for details.



WARNING: Avoid skin and eye contact with the coolant, do not inhale the vapors. Always dispose of coolant according to regulations (for more detailed specifications concerning regulations and handling, see the Material Safety Data Sheet DOWTHERM SR-1 coolant).

Use distilled water in the cooling system.

2.3.5 Replenishing the Coolant

Replenish low coolant level with 50% DOWTHERM SR-1/50% distilled water mixture.

2.3.5.1 Tools and Material

- Tool for bleeding (see Figure 2.9)
- Coolant drain hose with $\frac{3}{4}$ in. coupling nut, flat sealing
- Empty container with minimum capacity of 13 L (13.7 quarts) (if exchange of

coolant)

- Containers with new coolant: 1 Gallon L (3.8 L) (mixture: 50% DOWTHERM SR-1 /50% distilled water) (part number MIN5001-001). Contact Axiom Energy Group for supplies. Complete flushing requires 12.5 L (13.2 quarts). Refer to the Maintenance Manual.
- Cloth rags

2.3.5.2 Procedure

1. Slightly lift the metal bracket holding the expansion tank and swing the tank out from the cabinet.



WARNING: The expansion tank could be under pressure. Loosen the cap cautiously and slowly! Wear eye protection and gloves or cloth insulation.

2. Carefully unscrew (loosen) the large cap of the expansion tank (Figure 2.8) to relieve any pressure.
3. Using the bleed valve adjusting tool (Figure 2.9), open the air bleed valve. Remove the expansion tank cap from the tank and set aside.
4. Fill the closed cycle cooling system at the expansion tank up to the MAX indicator with 50% DOWTHERM SR-1 (high quality coolant)/50% distilled water.

When reaching the maximum liquid level the coolant will flow out of the air bleed valve. Lift the expansion tank bracket slightly to let gravity assist the flow. Be careful to set it back correctly on the hinge.



CAUTION: Use an approved coolant resistant container for coolant.

5. As soon as coolant leaks out of the air bleed valve, close the valve.
6. Check the liquid level of coolant in the expansion tank again, then close the lid of the expansion tank.

2.3.6 Bleeding of the CHP Coolant

NOTE: Bleeding is required after every new coolant filling or major replenishment to avoid air lock and engine overheating.



WARNING: When opening the air bleed valve after running the engine, steam may escape at high pressure. Burn hazard. Wear eye protection and gloves.

After starting up the unit and a test run at a high temperature level (engine ≥ 80 °C (176 °F)), shut down the engine and bleed the coolant circuit again for a short time by opening the air bleed (needle) valve (Figure 2.9). Only bleed the system at engine standstill, otherwise air can be sucked in through the open air bleed valve.

NOTE: In order to avoid malfunctions the system must be professionally filled and bled.

When the microCHP is running, observe that coolant is flowing through the expansion tank. If it is not, “air lock” has occurred and air bubbles are trapped in the system. Further bleeding is required. Air lock will cause an overheating condition and must be corrected.

2.3.7 Checking the Coolant Hoses

Perform a visual inspection of all coolant hoses.

- Check for bulging, fissures, buckling, chafe marks, blockage, and leak tightness.
- Check the areas around the fastening clamps.
- Check the leak tightness of the coolant hoses while the engine is running.
- Replace leaking and worn hoses and defective clamps as necessary, flushing the coolant during replacement procedure. Refer to the Maintenance Manual.

2.4 Inspections



WARNING: Omitted inspections or maintenance work may lead to personal injury and property damage and may void the warranty.

Refer to the microCHP Maintenance Manual for further information on recuperator and catalytic converter servicing. Typically, replacement is not required at earlier maintenance cycles. If incorrect readings or errors are observed in the ecoServ software, first check for other causes, such as stepper motor failure, or stuck throttle plate. Consult with the factory.

2.4.1 Mechanical Inspections



WARNING: Shock hazard, 240V wiring. Dangerous voltage exists at the power supply connections of the microCHP even if the main cabinet switch is in the off position. Disconnect the microCHP from electrical power with the external disconnect/circuit breaker before inspecting or cleaning the power electronics and all other wiring. Secure (lock out/tag out) the microCHP against switching on again. Wait at least 5 minutes for the capacitors to discharge.

The following visual inspections must be performed during every maintenance cycle.

1. Engine vibration absorber/mounts (four) (see Figure 2.10).
Check for damage, dirt, and debris. Clean, if necessary. A damaged engine vibration absorber/mount must be replaced (see the microCHP Maintenance Manual).
2. Vibration isolators (four) on the intake air damper (see Figure 2.11).
Visually inspect the vibration isolators of the intake air damper for cracks and brittleness. If defective or damaged, replace them (see the microCHP Maintenance Manual).

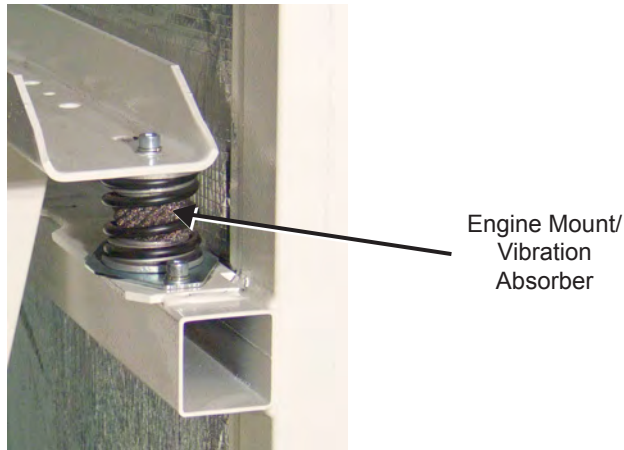


Figure 2.10 Engine Mount/Vibration Absorber



Figure 2.11 Air Intake Damper Vibration Isolators

3. Inspect the microCHP cabinet insulation for cleanliness and dryness. Check to see that the mountings have not loosened.
4. Inspect the panel seals of the side panels. The panels must seal tightly all around.



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5. Check sensor and switch wiring and connectors (Figure 2.12, Figure 2.14, and Figure 2.15).



Oxygen sensor with built in exhaust temperature sensor and heater mounted on exhaust manifold



Differential Pressure Switch mounted on back of microCHP cabinet



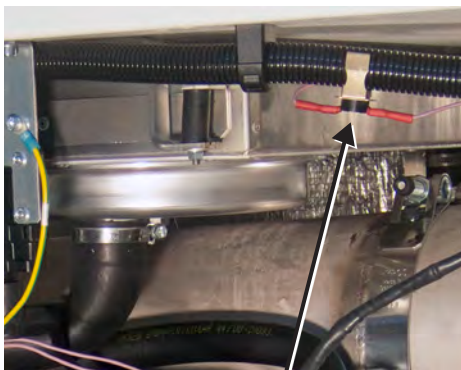
Gas Pressure Switch on multiblock gas valve



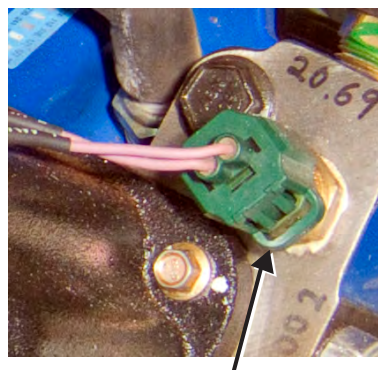
Exhaust gas temperature cut off switch mounted beneath the exhaust muffler



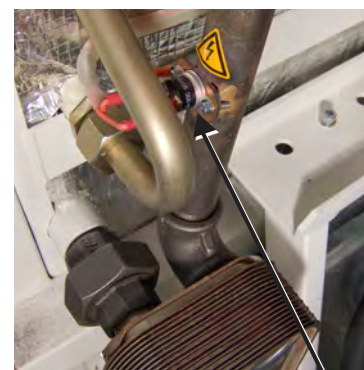
Buffer tank return line temperature sensor mounted near rear wall of microCHP cabinet



Cabinet air temperature cut off switch located beneath microCHP cabinet ceiling



Engine coolant temperature sensor (at cylinder head)



Coolant temperature cut off switch (located above plate heat exchanger)

Figure 2.12 Sensors and Switches (also see Figure 2.14 and Figure 2.15)

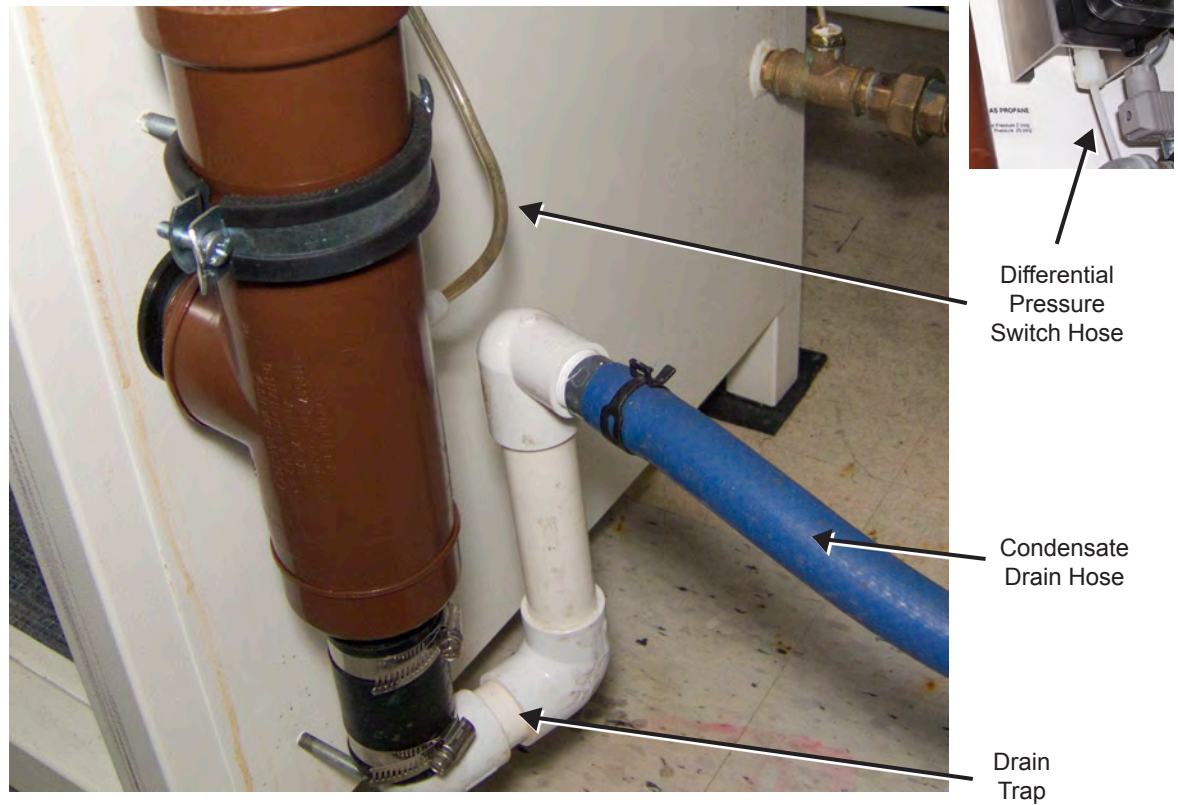


Figure 2.13 Differential Pressure Switch Hose and Condensate Drain Pipe

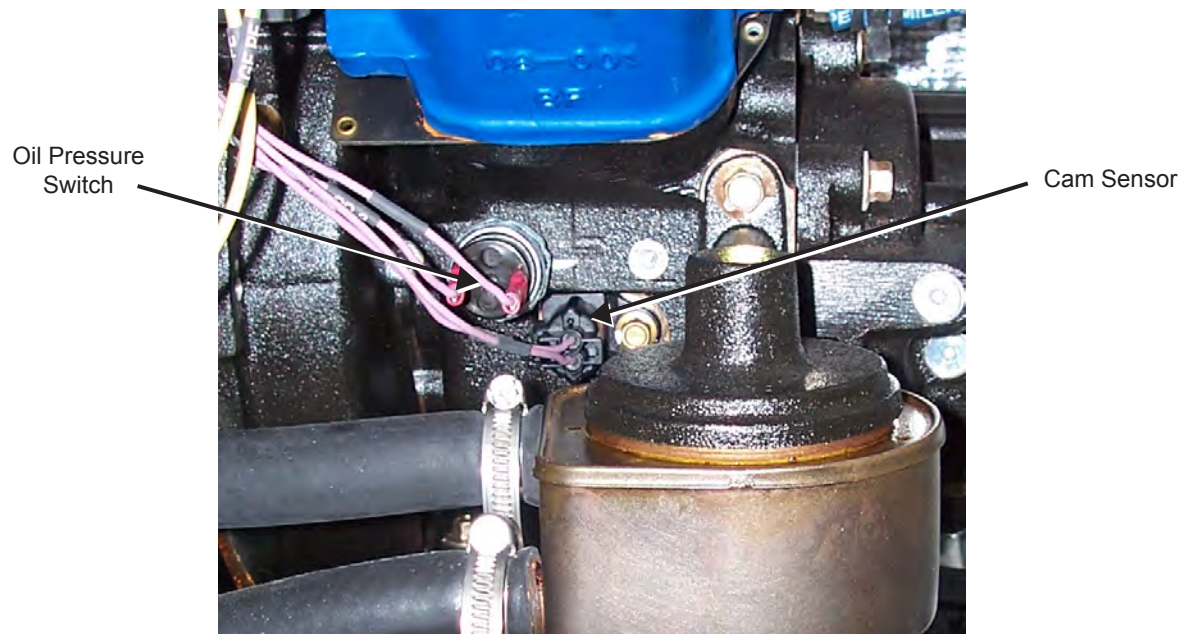


Figure 2.14 Oil Pressure Switch and Cam Sensor

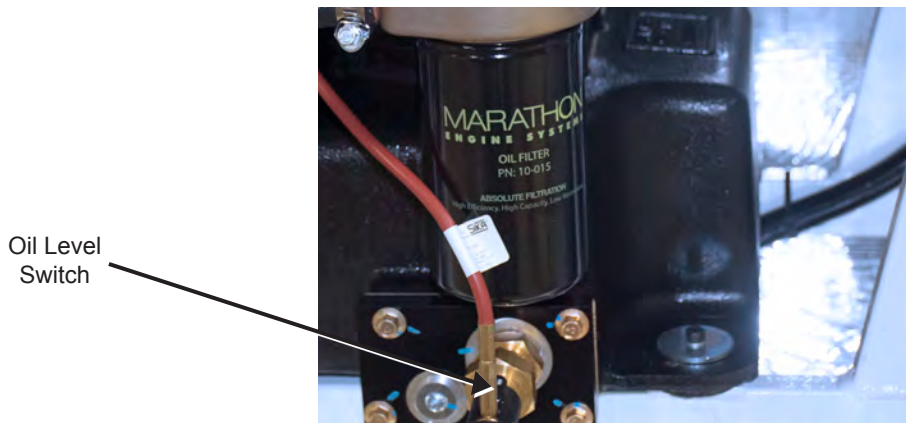


Figure 2.15 Oil Level Switch



WARNING: Shock hazard, 240V wiring. Dangerous voltage exists at the power supply connections of the microCHP even if the main cabinet switch is in the off position. Disconnect the microCHP from electrical power with the external disconnect/circuit breaker before inspecting or cleaning the power electronics and all other wiring. Secure (lock out/tag out) the microCHP against switching on again. Wait 5 minutes for the capacitors to discharge.



CAUTION: Be careful of electrostatic discharge. Do not touch electronics, including with equipment or tools.

6. Inspect the electronics for fouling or dust. Watch for dust collecting in the heat sinks, especially where fans are drawing in air. If necessary, clean the electronics using compressed air. Use a brush to loosen dust buildup beneath the fans and on the heat sink. Use compressed air to blow out and vacuum any debris.
7. Inspect all wiring. Check for breaks and signs of abrasion.
8. Inspect all connectors for secure connection.
9. Inspect the cabinet floor for dust, debris, and particles. Clean the cabinet using compressed air, a small vacuum, or dry cloth rags.



CAUTION: Clean the cabinet interior. If the cabinet interior is dirty, dust and particles are drawn into the air intake and can shorten the air filter and engine life.

10. Inspect the differential pressure switch and hose (Figure 2.13). Replace if any signs of wear or tear or clogging are evident.



WARNING: Do not operate the microCHP with an empty condensation water drain trap. There is risk of intoxication by effusing exhaust gas. Exhaust gases contain CARBON MONOXIDE which is an odorless, colorless, and deadly poison. Make sure the drain trap is filled with water before operating.

11. Inspect the condensation drain piping. Make sure no clogging is occurring and the water drain trap is filled with water.

Table 2.1 microCHP Maintenance Schedule

Maintenance Item	Maintenance Standards	Reference	Maintenance Schedule (Operating Hours)									
CHANGE:	Quantity	(Notes)	4000	8000	12000	16000	20000	24000	28000	32000	36000	40000
Oil Filter	1		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Engine Oil	11.6 Qt. (11 L)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Air Filter	1		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Spark Plug	1		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Spark Plug (Ignition) Wire	1		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Coolant Flush 50% DOWTHERM-SR 150% distilled water	14 Qt. (13.25 L)	MIN5001-001 = 4 qts.	O	O	O	O	O	O	O	O	O	O
Hoses	As required.		O	O	O	O	O	O	O	O	O	O
Recuperator, catalytic converter	1		O	O	O	O	O	O	O	O	O	O
Water pump	1		O	O	O	O	O	O	O	O	O	O
Oxygen Sensor	1	EC-2000-014	O	O	O	X	O	O	O	X	O	O
CLEAN:												
Engine Compartment			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
VERIFY:												
Cables, hoses, hardware properly attached.			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Note: ✓ indicates the item (or activity) is included in standard maintenance kit at the various maintenance intervals.	Maintenance Kit Ref. Order Number.	41-113	41-113	41-113	41-113	41-113	41-113	41-113	41-113	41-113	41-113	41-113
	Maintainer Initials											
Date Serviced												
Total Unit Operating Hours at Service Date												
O = inspect for wear or damage, test as necessary X = replace												

IMPORTANT NOTE: The engine oil used in the microCHP engine is a specially formulated natural gas engine oil that has been tested for longevity to last the entire 4,000 hour maintenance cycle of the engine. It is very strongly suggested that all oil and maintenance components for the engine are supplied by the manufacturer. Each of these components has undergone several years of endurance testing to make sure the part will outlive the necessary maintenance cycle. **Any damage caused to the engine by using inferior or untested engine components may void the engine warranty.**