earth safe
Fuel Systems for Critical Power

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

Model M300
Filtration Polisher

Earthsafe Systems, Inc.
7320 S. Madison
Willowbrook, IL 60527

T: (630) 794-5100
F: (630) 794-5106

info@earthsafe.com
www.earthsafe.com

Updated: October 2012

The information contained herein is proprietary and is provided for the sole purpose of the owner's installation, operation, and maintenance of the system. Reproduction of this information for other purposes is prohibited without the prior consent of Earthsafe Systems, Inc.

Notice

Earthsafe makes no warranty of any kind with regard to this publication, including but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Earthsafe shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance or use of this publication. Earthsafe reserves the right to change system options or features, or the information contained in this publication. This publication contains proprietary information which is protected by copyright. All rights reserved. No part of this publication may by photocopied, reproduced, or translated to another language without the prior written consent of Earthsafe.

Damage Claims

Thoroughly examine all components and units as soon as they are received. If damaged, write a complete and detailed description of the damage on the face of the freight bill. The carriers agent must verify the inspection and sign the description. Immediately notify the delivering carrier of damage or loss. This notification may be given either in person or by telephone. Written confirmation must be mailed within 48 hours. Risk of loss, or damage to merchandise belongs with the buyer. It is the buyers responsibility to file a claim with the carrier involved. Immediately advise Earthsafe of the problem so that we may assist you.

Safety Information

UL Listed. The Earthsafe CentraPlex Control Module is UL listed.

Intended Use. The Earthsafe CentraPlex Control Module is intended for use with diesel fuel systems for emergency power generators. The control module and any connected sensors or devices are intended for operation only within ordinary electrical areas. Use of the module and connected sensors or devices within hazardous electrical areas is prohibited.

Intellectual Property

The equipment and software described herein are the property of Earthsafe Systems, Inc. and are protected by various trademarks and patents.

Table of Contents

Safety Information 4

General Description 6

Planning the Installation 8

Installation 10

Startup 11

Testing 12

Operation 13

Maintenance 13

Troubleshooting 14

Spare Parts 15

Warranty and Service 16

Appendix: Viking Pump Manual 16

Appendix: Racor Filter Parts 16

Safety notices – General Safety Rules – Symbols (danger-warning-caution)

SAFETY INFORMATION AND INSTRUCTIONS

Danger — Failure to follow the indicated instruction may result in serious injury or death.

Warning — In addition to possible serious injury or death, failure to follow the indicated instruction may cause damage to pump and/or other equipment.

IMPROPER INSTALLATION, OPERATION OR MAINTENANCE OF PUMP MAY CAUSE SERIOUS INJURY OR DEATH AND/OR RESULT IN DAMAGE TO PUMP AND/OR OTHER EQUIPMENT. EARTHSAFE'S WARRANTY DOES NOT COVER FAILURE DUE TO IMPROPER INSTALLATION, OPERATION OR MAINTENANCE.

THIS INFORMATION MUST BE FULLY READ BEFORE BEGINNING INSTALLATION, OPERATION OR MAINTENANCE OF PUMP AND MUST BE KEPT WITH PUMP. PUMP MUST BE INSTALLED, OPERATED AND MAINTAINED ONLY BY SUITABLY TRAINED AND QUALIFIED PERSONS.

THE FOLLOWING SAFETY INSTRUCTIONS MUST BE FOLLOWED AND ADHERED TO AT ALL TIMES.

Symbol Legend:

Danger — Failure to follow the indicated instruction may result in serious injury or death

Warning — In addition to possible serious injury or death, failure to follow the indicated instruction may cause damage to pump and/or other equipment.

BEFORE opening any liquid chamber (pumping chamber, reservoir, relief valve adjusting cap fitting, etc.) be sure that:

- Any pressure in the chamber has been completely vented through the suction or discharge lines or other appropriate openings or connections.
- The pump drive system means (motor, turbine, engine, etc.) has been "locked out" or otherwise been made non-operational so that it cannot be started while work is being done on the pump.
- You know what material the pump has been handling, have obtained a material safety data sheet (MSDS) for the material, and understand and follow all precautions appropriate for the safe handling of the material.

DO NOT operate pump if the suction or discharge piping is not connected.

DO NOT place fingers into the pumping chamber or its connection ports or into any part of the drive train if there is **any possibility** of the pump shafts being rotated.

Continued

Safety notices – General Safety Rules – Symbols (danger-warning-caution)

DO NOT exceed the pumps rated pressure, speed, and temperature, or change the system/duty parameters from those the pump was originally supplied, without confirming its suitability for the new service.

BEFORE operating the pump, be sure that:

- It is clean and free from debris
- All valves in the suction and discharge pipelines are fully opened.
- All piping connected to the pump is fully supported and correctly aligned with the pump.
- Pump rotation is correct for the desired direction of flow.

INSTALL pressure gauges/sensors next to the pump suction and discharge connections to monitor pressures.

USE extreme caution when lifting the pump. Suitable lifting devices should be used when appropriate.

DO NOT attempt to dismantle a pressure relief valve that has not had the spring pressure relieved or is mounted on a pump that is operating.

AVOID contact with hot areas of the pump and/or drive. Certain operating conditions, temperature control devices, improper installation, improper operation, and improper maintenance can all cause high temperatures on the pump and/or drive.

THE PUMP must be provided with pressure protection. This may be provided through a relief valve mounted directly on the pump. Relief valve adjusting screw caps must always point towards suction side of the pump.

THE PUMP must be installed in a matter that allows safe access for routine maintenance and for inspection during operation to check for leakage and monitor pump operation.

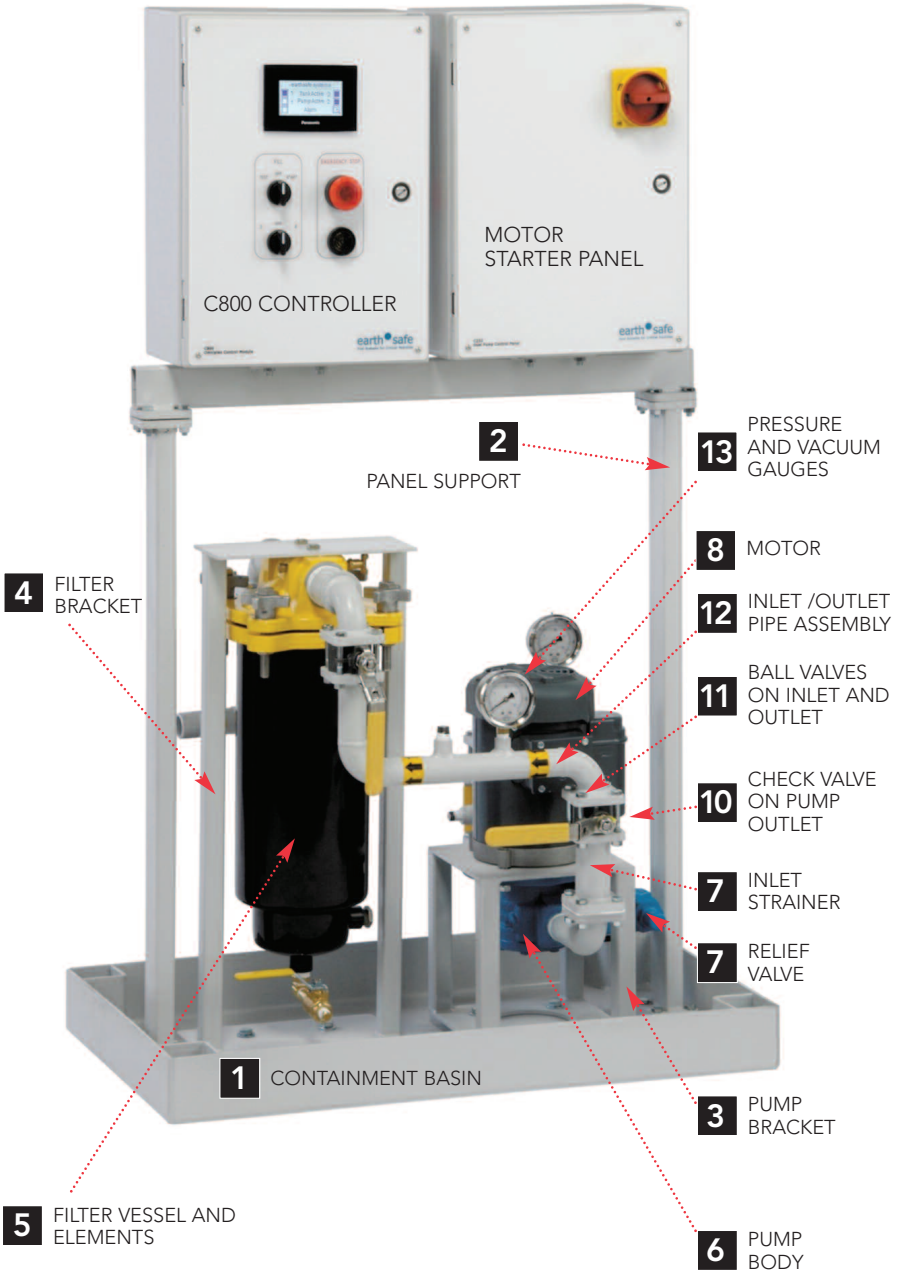
General Description

The PowerPlex Filtration / Polisher is designed to circulate and clean fuel stored diesel fuel at critical facilities. Filtration / Polishing has become an important aspect of emergency power reliability: (a) critical facilities store increasing amounts of fuel onsite to assure continuity of operation and this fuel has low turnover in operation, (b) as diesel fuel ages, particulates form which can increase the wear on generator engine parts, (c) fuel storage tanks accumulate water through vapor condensation and this water can encourage bacterial growth, and (d) newer diesel engines with improved emissions technology require higher purity fuel to prolong engine life.

The M300 Filtration / Polisher has an innovative compact design has a minimal footprint for Filtration / Polishing of tanks from 500 to 50,000 gallon capacity. The mechanical design is based on Viking pumps and Racor filters and is complete with strainers, check valves, ball, valves, pressure / vacuum gauges, relief valves. The unit is mounted on an integral containment with leak detection monitoring.

The Filtration / Polisher includes a motor starter panel, or optional VFD drive, with disconnect switch. The OmniPlex Controller provides Filtration / Polisher operation and monitoring with HOA switches and an emergency stop.

The OmniPlex or CentraPlex screen provides a summary of operating parameters and allows selection of special operating modes. The Controller networks with other system controllers using Ethernet, and directly to Building Management Systems with an option



Physical Description

1. Containment Base: Rigid support for pump set with liquid tight containment of leaks.
2. Control panel support: Support for OmniPlex Controller and pump motor starter panels.
3. Pump support bracket: Support pump and motor for vertical mounting
4. Filter support bracket: Support filter vessel and allow for filter element change.
5. Filter Vessel and Elements: racor FBO filter vessel and particulate / coalescing elements.
6. Pump : Viking positive displacement pump.
7. Pump internal relief valve: Adjustable pressure relief on pump form discharge to suction side. Protects downstream piping from over-pressure, and limits pump operation to within its power range.
8. Motor: TEFC motor. 120-240 VAC single phase or 240-480 VAC three phase.
9. Inlet strainer / screen: Located on pump inlet to protect pump from inlet piping debris. Threaded drain / cleanout port is provided.
10. Outlet check valve: Located on pump discharge to maintain pressure in pipeline, and allow alternate pump operation without backflow. Check valve is an in-line wafer style with 3 PSI cracking pressure to prevent chatter.
11. Inlet and outlet ball valves: carbon steel ball valves with Teflon seats, to allow isolation of pumps for maintenance.
12. Inlet and outlet pipe assembly: Welded steel pipe with 1" MNPT connection for field piping. Connect at either end of pump set.
13. Pressure and vacuum gauges: To confirm pump operation and assist troubleshooting. Standard Liquid filled, ¼" NPT bottom port, 2.5" diameter gauges. Vacuum 0 to -30 IN-Hg. Pressure 0-100 PSI.

Planning the Installation

Location

1. **Location** — always locate the pump as close as possible to the supply of liquid to be pumped. Locate it below the liquid supply if at all practical. Viking pumps are self priming but the better the suction conditions the better the performance.
2. **Accessibility** — the pump should be located where it is accessible for inspection, maintenance, and repair.

Pressure Relief

Pressure Protection — Viking pumps are positive displacement. This means that when the pump is rotated, liquid will be delivered to the discharge side of the pump. If there is no place for this liquid to go — discharge line is blocked or closed — pressure can build up until the motor stalls, the drive equipment fails, a pump part breaks or ruptures, or the piping bursts. Because of this, an integral pressure relief valve is mounted directly on the pump head.

Piping

The cause of many pumping problems can be traced to suction piping. It should always be as large and short as practical. Before starting layout and installation of your piping system, consider the following points:

1. Never use piping smaller than the pump port connections.
2. Be sure the inside of the pipe is clean before hooking it up.
3. Foot valve — When pumping a light liquid with a suction lift, a foot valve at the end of the suction piping or a check valve in the first horizontal run will hold the liquid in the line and make it easier for the pump to prime. Be sure the foot or check valve is big enough so that it doesn't cause excessive line loss.
4. When approaching an obstacle in the suction or discharge line, go around the obstacle instead of over it. This minimizes air pockets air pockets which make it hard for the pump to prime.
5. For a suction line with a long horizontal run keep the horizontal portion below the liquid level if possible. This keeps the pipe full so the pump does not have to remove so much air when starting.
6. Be sure allowance is made for expansion and contraction of the piping. Loops, expansion joints, or unsecured (this does not mean unsupported) runs should be used so the pump casing is not stressed by the piping.
7. Strainer — The pump inlet strainer will keep foreign objects from going into the pump. The strainer is particularly important at start up to help clean the system of weld beads, pipe scale, and other foreign objects.
8. The pump should not be used to support the piping. The weight of the pipe should be carried by hangers, supports, stands, etc.
9. When fastening the piping to the pump it should not be necessary to impose any strain on the pump casing. "Springing" or "drawing" the piping up to the pump will cause distortion, possible misalignment, and probable rapid wear of the pump. Do not use the pump to correct errors in piping layout or assembly.
10. All joints of the piping system should be tight; pipe sealer will help assure leak-free threaded joints. Leaks in the suction line reduction in capacity.
11. Provide a pressure relief device in any part of a pump and piping system that can be valved off and, thus, completely isolated. The rise in temperature causes the liquid to expand; if there is no provision for pressure relief in the closed off section, there is a chance that the pump or piping will rupture.

Installation

1. Remove packaging and inspect for shipping damage. Note any shipping damage on the shipping ticket and notify Earthsafe within 24 hours of receipt.
2. Set unit at installation location. Use proper handling procedures to avoid damage to the unit.
3. Install anchor bolts at 4 corners. Use ½" diameter expansion anchors with 3" embedment or as required for local code compliance.
4. Connect power to motor starters and controller. Reference specific installation instructions and wiring diagrams for the controller and motor starter panels.
5. Check tightness of all bolts, which may have loosed during shipment. Tighten 4 bolt flanges by gradually tightening across the bolt pattern.
6. Pressure test the pump set to 50 PSI or in accordance with project design requirements. Correct any loose bolts or threaded joints if required.
7. Connect piping to inlet and outlet (inlet piping considerations). Confirm that field piping is independently supported to avoid stress on the pump set piping.
8. Check pump rotation. Energize the pump momentarily to observe direction of motor fan rotation. The pump inlet and outlet are offset from the centerline of the pump head, so that there is a long arc or short arc from the inlet to the outlet. The pump rotation should be that it progresses along the long arc from the inlet to the outlet.

Startup

1. Prime the suction line. Remove the threaded plug on the pump inlet piping and place diesel fuel into the piping until full. Reinstall the threaded plug. Operate the pump for 60 seconds maximum. Observe the inlet and outlet gauges to confirm pump rotation and progress of eliminating any remaining air from the suction piping. A fully primed suction pipe will be demonstrated by a steady vacuum gauge reading on the pump inlet.
2. Open all inlet and outlet valves and confirm that there is a clear flow path from the fuel source to the destination.
3. Manually start pump to confirm pump prime. Operate the pump for 60 seconds maximum. Observe the inlet and outlet gauges to confirm pump rotation and progress of eliminating any remaining air from the suction piping. A fully primed suction pipe will be demonstrated by a steady vacuum gauge reading on the pump inlet.
4. If the pump still does not deliver, the cause may be one or more of the following:
   a. Suction line air leaks
   b. Suction line obstructions
   c. Suction tube or foot valve in tank is not installed.
   d. Suction lift is too great or the suction piping is too small.
   e. Anti-siphon or check valve setting in suction line is excessive.
5. Adjust pressure relief valve to required setting. Adjust the pump pressure relief valve to the maximum design pressure of the system. This is done by removing the cap from the valve and adjusting the spring bolt. The valve adjustment should result in the pump being able to operate against closed discharge valves, without overload trip to the motor.
6. Check pressure and vacuum operating ranges. Confirm that the vacuum and pressure gauge readings are in conformance with the design requirements.
7. Check for leaks and correct any loose flanges or threaded fittings.
8. Check motor starter overload settings. Confirm that the motor starter overload settings match the full load amps indicated on the pump motor.
9. Clean inlet strainer. Close the inlet valve to isolate the strainer. Remove the threaded plug. Clean any debris from the strainer screen.
10) Use air vent on top of filter to remove any air in the filter vessel.

Testing

Perform testing in accordance with the procedure described in the checklist.

Duplex Pump Startup and Test Checklist				
` 1	Power to control panel			
2	Power to pump			
3	Initial display is accurate			
4	Pump Manual mode start and display			
5	Pump suction PSI at static run			
6	Pump discharge PSI at static run			
7	Pump Man mode disable on leak			
8	Pump Man mode disable on estop			
9	Set Filter Cycle for 1 Min ON and 1 Min OFF			
10	Set Pump to AUTO mode			
11	Select Filter Cycle Manual mode			
12	Confirm pump start and run for 1 Mi			
13	Confirm pump stop after 1 Min			
14	Select OFF then MAN and confirm 1 Min recycle			
15	Pump Auto mode disable on leak			
16	Pump Auto mode disable on estop			
17	Select Filter Cycle Auto mode			
18	Confirm pump start and run for 1 Min			
19	Confirm pump stop after 1 Min			
20	Confirm 1 Min OFF cycle			
21	Confirm recycle			
Simulate DP or High Pressure input and display				
20	Simulate High Water input and display			
21	Confirm Output Relay on Active			
22	Confirm Output relay and horn on Alarm			
23	Alarm modes: Leak, DP, Water			

Operation

1. Filter Polisher controller operation.
   Refer to Controller manual for details of filter polisher operations.

2. Pump motor starter operation.
   Refer to Motor Starter manual for details of motor starter operation.

Maintenance

1. Inspect for leaks at regular intervals, weekly as a minimum.

2. Operate pump manually to confirm prime at regular intervals, monthly as a minimum.

3. Check strainers after initial use and clean if required. Check strainers if an increase in vacuum gauge readings is observed.

Cartridge Replacement Procedures

Replace the filter element when the differential pressure exceeds 15 PSI, after 1 year of service, or when flow is significantly reduced.

1. Close the inlet and outlet isolation valves to isolate the filter from the system.
2. Open the drain lines on the housing bottom and allow all fluid to drain from the unit.
3. Open the vent valve on the cover of the housing and allow the unit to throughly vent before loosening the cover.
4. Loosen the four (4) knobs attaching the head to the housing flange.
5. Remove the head gasket and discard.
6. Remove and discard the expended cartridge in accordance with local and national regulations.
7. Use an absorbant pad to clean any particulates from the inside surface of the filter vessel.
8. Lightly lubricate new head gasket with vaseline or diesel fuel.
9. Insert a new filter cartridge into the housing. Position the housing, with cartridge, underneath filter head. Push / trist cartridge onto head spigot. The head conical spring will seat / seal the cartridge in the housing.
10. Rotate the housing onto the collar bolts. Hand tighten knobs until head is snug to housing. Use a torque wrench to tighten all collar bolts to 50 IN-LBS.
11. Close the drain valve on the bottom of the housing.
12. Slowly open the inlet and outlet valves and allow the unit to fill completely with fuel.
13. Leave the vent valve on the top of the unit open, to allow entrapped air to escape while filling.
14. When a small amount of fuel flows from the vent valve, close it tightly.
15. During the initial filling and after the above maintenance, and while th eunit is in operation, examine housing and all connections for leaks including head flange junction.
16. Assure that any and all leaks are identified and repaired before allowing fuel to flow through the housing.

Troubleshooting — General

1. **Pump does not start:**
   Check power to motor starters and controllers,
   check emergency stop,
   check motor overloads.

2. **Overload trips:**
   Check relief valve settings.
   Check for debris in pump head.

3. **Excessive noise / vibration:**
   Cavitation due to inlet conditions.

4. **Excessive inlet suction:**
   Check and clean strainer.
   Check foot valve at tank.
   Check suction pipe size and vertical lift.

5. **Insufficient inlet suction:**
   Check for prime in suction piping.
   Test inlet piping for leaks.

6. **Fluttering Suction reading:**
   Check for prime in suction piping.
   Test inlet piping for leaks.
   Confirm inlet conditions to avoid pump cavitation.

7. **Excessive Discharge pressure:**
   Check for closed valve or other blockage.
   Check pipe relief valve settings.
   Check for thermal expansion relief in discharge piping.

Spare Parts:

1. Inlet / Outlet Gauges
   Commercially available 2.5" diameter, liquid filled gauge, ¼" MNPT bottom connection
2. Pump Parts
   Viking pump parts are referenced in the appendix.
3. Motors
   Baldor motors are available from local distributers worldwide.
4. Controllers / Motor Starters
   See Eartthsafe Controller manuals for specific information.

Technical Support / Warranty Service

Technical Support

Contact Earthsafe at

(630) 794-5100
(630) 794-5106 Fax

www.earthsafe.com

7320 S. Madison
Willowbrook, IL 60527

Warranty Statement

Earthsafe Systems, Inc. warrants the tank level controls to be the kind and quality described in specification provided herein and to be free from defects in material or workmanship under normal service for a period of 1 year after shipment. Earthsafe obligations under this warranty shall be limited to repair or replacement, at the option of Earthsafe, of parts deemed to be defective upon inspection by Earthsafe. User is responsible for transportation of parts or assemblies to Earthsafe or its authorized repair location where the repairs are to be performed.

The provisions of the warranty shall not apply to any equipment, part, or accessory which (a) has been improperly specified by buyer, (b) has been improperly stored or handled prior to placing in service, (c) has been damaged or loosened during shipment, (d) has been improperly mounted or connected, (e) has not been operated within the equipment specifications, or (f) has been improperly maintained.

Earthsafe reserves the right to reject warranty claims of any kind for equipment for which it has not received full payment.

This warranty is in lieu of all other warranties, express or implied, and all other obligations or liabilities on the part of Earthsafe. Earthsafe assumes no responsibility or liability for any special, incidental, or consequential damage.

Appendix

1. Viking Pump Manual
2. Racor Filter Parts