earth safe
Fuel Systems for Critical Power

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

Earthsafe M5 - M500 Series
Generator Day Tank

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Notice

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 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 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 MAY CAUSE SERIOUS INJURY OR DEATH AND/OR RESULT IN DAMAGE TO UNIT 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 EQUIPMENT AND MUST BE KEPT WITH EQUIPMENT. EQUIPMENT 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 pipe system, pump, or valve 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 electrical system system means has been "locked out" or otherwise been made non-operational so that it cannot be started while work is being done on the equipment.
- You have obtained appropriate material safety data sheet (MSDS) and understand and follow all precautions appropriate for the safe handling of the material.

INSTALL pressure gauges/sensors at piping and pump connections to the equipment 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 or equipment. Certain operating conditions, temperature control devices, improper installation, improper operation, and improper maintenance can all cause high temperatures on the pump or equipment.

Pumps and piping systems must be provided with pressure protection.

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

General Description

Safe Fuel Storage Inside Buildings.
Earthsafe day tanks safely store fuel for generator engine consumption within the building. Day tanks are designed with integral secondary containment. Fuel transfer equipment and controls are designed for safe and reliable re-filling.

Reliable Refill Systems.
Day Tanks are designed and furnished with pre-assembled and tested fuel transfer equipment and controls. Inlet control valves, transfer pumps, level sensors, leak sensors, and other equipment are all monitored and controlled by the Earthsafe OmniPlex or CentraPlex control panels.

Integrated Building Management Systems.
Earthsafe advanced controllers allow for the communication of vital day tank operating information to other building systems. These systems may include Building Automation Systems, generator controls, switchgear and other power controls, security and fire alarm systems.

Readily Adaptable for Special Operation.
Earthsafe day tanks can be readily adapated for special operation characteristics such as: dual inlet valves, monitored valve positions, high level / overflow pumping, emergency evacuation, auto-commissioning, fluid metering, high temperature control.

NOT SHOWN IN PHOTO PERSPECTIVE

6. Inlet Valve Assembly
8. Engine Inlet and Outlet
9. Standard Vent
10. Emergency Vent
11. Direct Read Gauge
12. Inspection Port
13. Leak Sensor

Physical Description

1. Primary Fuel Tank: UL 142 Steel Tank
2. Containment: Rated welded steel containment basin – double wall tank
3. Control panel support: Support for OmniPlex Controller and pump motor starter panels
4. Control Panel: PLC based control panel
5. Motor Starter: Motor starter for return flow pump
6. Inlet Valve Assembly: Inlet solenoid valves, manual valves, and strainers.
7. Pump and Motor for Return Flow: Viking positive displacement pump
8. Engine Inlet and Outlet: Suction pipe on engine supply
9. Standard Vent: 2" tank opening
10. Emergency Vent: 4-6" tank opening
11. Direct Read Gauge
12. Inspection Port
13. Leak Sensor

Planning the Installation

Location

1. Location — locate the day tank as close as practical to the engine generator.
2. Accessibility — the day tank should be located where it is accessible for inspection, maintenance, and repair.

Piping

Before starting layout and installation of your piping system, consider the following points:

1. Size the fuel supply piping to minimize frictional head loss based on the design flow.
2. Size gravity overflow piping to assure adequate flow capacity. It should be at least one size larger than the inlet piping of the day tank – for a single day tank installation. Where multiple day tanks share a return flow line, the line should be adequately sized and sloped to assure required capacity.
3. Install gravity overflow pipe so that it slopes continuously from the day tank back to the main storage tank.
4. Be sure the inside of the pipe is clean before connecting to the day tank.
5. Be sure allowance is made for expansion and contraction of the piping so the day tank connections are not stressed by the piping.
6. The day tank should not be used to support the piping. The weight of the pipe should be carried by hangers and supports.
7. When fastening the piping to the day tank it should not be necessary to impose any strain on the day tank fittings. Do not use the day tank to correct errors in piping layout or assembly.
8. All joints of the piping system should be tight; pipe sealer will help assure leak-free threaded joints.
9. 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. The day tank is not rated for pressure over 5 PSI, so piping to be tested must be isolated from the tank using valves or other means.
7. Clean field installed piping. Clean all dirt and debris from field installed piping prior to connecting to the day tank.
8. Connect piping to inlet and outlet (inlet piping considerations). Confirm that field piping is independently supported to avoid stress on the pump set piping.
9. 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.
10. Engine supply and return piping should include rated hoses or flexible connectors to isolate vibration from the day tank.
11. Vent piping shall be installed to terminate to the building exterior. The vent piping should slope continuously from the termination point back to the day tank.
12. Where a return flow pump is used, and the main fuel tank is below the day tank, an anti-siphon valve must be installed on the return flow pump discharge.

Startup

Remote Fuel Supply Pumps

1. Close the inlet piping valve to the day tank.
2. Check that the overflow pipe (or overflow pump discharge piping) is open to provide a return flow path back to the day tank.
3. Check that the remote fuel supply pump is primed with fuel and ready for operation in the automatic mode.
4. Energize the fuel system controller. Confirm that the remote fuel pump is energized to deliver fuel to the day tank. Confirm that the day tank inlet solenoid valve is energized to open.
5. Confirm that the day tank inspection port is available to observe fuel levels in the day tank.
6. Open the manual valve at the day tank inlet to allow fuel flow into the tank.
7. Record the tank level at which the critical low level alarm ceases. Record the tank level at which the low level alarm ceases.
8. Monitor the fuel flow into the day tank, until the fill stop level is reached. Record the tank level for fill stop. Confirm that the inlet solenoid valve closes, and the remote fuel supply pumps are stopped.
9. Perform additional requirements under testing.

Startup

Day Tank Pumps as Suction Supply Method or Overflow Pump

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.

Fuel Supply to Engine

1. Use a vacuum pump to prime the fuel piping and remove all air from the day tank to the engine connection.

Testing

The day tank testing requires fuel transfer to lower the day tank level to check operating points. Day tanks equipped with return flow pumps, may use the on-board pump for this fuel transfer. Day Tanks without return flow pumps should be operated with a temporary pump to lower fuel levels for testing.

Perform the testing procedure in accordance with the startup checklist.

Day Tank Startup and Test Checklist

Item	Description	Check	Date	Comments
1	Power to control panel			
2	Power to return flow pump			
3	Initial display is accurate			
4	Critical low sensor input and display			
5	Low level input and display			
6	Pump start level input and display			
7	Pump stop level input and display			
8	High level input and display			
9	Leak input and display			
10	Manual mode fill inlet solenoid energize			
11	Manual mode fill pump start			
12	Manual mode fill disable on high level			
13	Manual mode fill disable on estop			
14	Manual mode return flow pump energize			
15	Manual mode pump flow confirmed			
16	Manual mode pump disable on estop			
17	Auto mode fill start level inlet solenoid energize			
18	Auto mode fill start level pump start			
19	Auto mode fill start level disable on estop			
20	Auto mode fill start level disable on high level			
21	Auto mode fill start level disable on leak			
22	Auto mode fill stop level inlet valve de-energize			
23	Auto mode fill stop level pump stop			
24	High level return pump start			
25	High level return pump time out after clear			
26	Confirm Output relay and horn on Alarm			
27	Alarm modes: Leak, Low, Clow, High			

Operation

1. Day Tank controller operation.

Refer to Controller manual for details of day tank operations.

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.
4. Periodically check the day tank refill function by lowering the day tank fuel level and observing the re-fill function.
5. On annual basis also check the day tank high, low, and leak alarms.

Troubleshooting — General

1. Low Level Alarm
   Check controller emergency stop
   Check that manual inlet valves are open
   Check that remote fuel supply pump is operating properly
   Check that inlet solenoid valve is energized. If not check for loose wires or fuse issue.
   Check that level sensor pump start signal is active on controller.
   Check inlet strainer for debris.
   Check main tank fuel levels
   Check PLC normal operating status.

2. High Level
   Check that the inlet solenoid valve is de-energized
   Check that the level sensor pump stop signal is energized
   Check the solenoid valve for leakage

3. High Level Return Flow Pump does not start:
   Check power to motor starters and controllers,
   check emergency stop,
   check motor overloads

4. High Level Return Flow Pump Low Flow rate:
   Check discharge piping between pump and main tank
   Check pump prime and tightness of suction side connections.

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 Earthsafe Controller manuals for specific information.
5. Solenoid Valves
   ASCO solenoid valves are available from local distributers worldwide.
6. Level Sensors
   Gems level sensors are available from Gems worldwide.

Technical Support / Warranty Service

Technical Support

Contact Earthsafe at

www.earthsafe.com

Warranty Statement

Earthsafe Systems, Inc. warrants the product 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