



INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

Model M20
Duplex Fuel Pump

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Updated: October 2019

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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 carrier's 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 buyer's 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 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.

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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 manner that allows safe access for routine maintenance and for inspection during operation to check for leakage and monitor pump operation.

General Description

The Duplex Pump Set is designed for reliable fuel transfer in emergency power systems at critical facilities. Its innovative compact design has a minimal footprint while delivering 5 to 30 GPM of fuel to serve emergency generators and boilers.

The mechanical design is based on Viking positive displacement pumps 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 Duplex Pump Set includes a motor starter panel, or optional VFD drive, with disconnect switch. The motor starter / drive includes current sensors for performance feedback to the duplex pump controller.

The Controller provides duplex pump operation and monitoring with HOA switches and an emergency stop. The OmniPlex 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 of BACnet, Modbus, Metasys N2, or Lon protocols.

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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. Pump : Viking positive displacement pump.
5. 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.
6. Motor: TEFC motor. 120-240 VAC single phase or 240-480 VAC three phase.
7. Inlet strainer / screen: Located on pump inlet to protect pump from inlet piping debris. Threaded drain / cleanout port is provided.
8. 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.
9. Inlet and outlet ball valves: carbon steel ball valves with Teflon seats, to allow isolation of pumps for maintenance.
10. Inlet and outlet pipe assembly: Welded steel pipe with 1" MNPT connection for field piping. Connect at either end of pump set.
11. Pressure and vacuum gauges: To confirm pump operation and assist troubleshooting. Standard Liquid filled, 1/4" 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 loosened 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.

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Testing

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

Duplex Pump Startup and Test Checklist

Item	Description	Check	Date	Comments
1	Power to control panel			
2	Power to Pump 1			
3	Power to Pump 2			
4	Initial display is accurate			
5	Pump 1 Manual mode start and display			
6	Pump 2 Manual mode start and display			
7	Pump 1 current sensor or flow input			
8	Pump 2 current sensor or flow input			
9	Pump 1 suction PSI at static run			
10	Pump 1 discharge PSI at static run			
11	Pump 2 suction PSI at static run			
12	Pump 2 discharge PSI at static run			
13	Setup Auto mode fuel request input			
14	Pump 1 Auto mode start and display			
15	Pump 2 Auto mode start and display			
16	Pump 1 Auto mode disable on leak			
17	Pump 2 Auto mode disable on leak			
18	Pump 1 Auto mode disable on estop			
19	Pump 2 Auto mode disable on estop			
20	Select Pump 1 as lead			
21	Confirm Pump 1 Auto start			
22	Disable Pump 1 by change to Off Mode			
23	Confirm Pump 2 Auto start			
24	Pump 1 trouble by no CS, no Flow, or DT Low			
25	Confirm Pump 2 Auto start			
26	Select Pump 2 as lead			
27	Confirm Pump 2 Auto start			
28	Disable Pump 2 by change to Off Mode			
29	Confirm Pump 1 Auto start			
30	Pump 2 trouble by no CS, no Flow, or DT Low			
31	Confirm Pump 1 Auto start			
32	Confirm Output relay and horn on Alarm			
33	Alarm modes: Leak, Pump 1 Fail, Pump 2 Fail			

Operation

1. Pump controller operation.
Refer to Controller manual for details of duplex pump set 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.

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.

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Spare Parts:

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

Technical Support / Warranty Service

Technical Support

Contact Earthsafe at

(312) 226-7600

www.earthsafe.com

Warranty Statement

Earthsafe Systems, Inc. warrants **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