



## TECHNICAL DATA

### CS-1 TANK AND PUMP PACKAGE ESFR COLD STORAGE SYSTEM

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

#### 1. PRODUCT DESCRIPTION

The Viking CS-1 Tank and Pump Package is an integrated storage tank and pumping system designed for use with the Viking ESFR Cold Storage System. This is a pre-primed preaction system with electric release providing fixed fire protection for refrigerated or cold warehouse storage and is also appropriate for unheated storage applications in areas subject to freezing, to a minimum temperature of -21 °F (-29.4 °C).

The Viking ESFR Cold Storage System utilizes a deluge valve with conventional and electric release trims. The riser consists of two Easy Riser Check Valves, one with special cold trim including connection for antifreeze inlet, and the second with by-pass trim to isolate the antifreeze in the system from hydrodynamic thermal circulation. The additional Easy Riser Check is installed above the main Check valve and is required to prevent thermal transfer of cold antifreeze from freezer area onto the clapper surface of the primary Check valve and minimize frost on riser assembly and below the clapper of the primary check.

The tank and pump system automatically maintains the supervisory solution pressure in the piping system above the supervisory alarm pressure until the detection system and sprinkler is activated. The pump uses antifreeze in the storage tank to maintain system pressure and make up for minor system leaks.

The system is designed to accept up to 50% propylene glycol and water premix solution. It is recommended that certified premix be used. Do not mix different antifreeze solutions within the system.



**WARNING: MOTORS, ELECTRICAL EQUIPMENT, AND CONTROLS CAN CAUSE ELECTRICAL ARCS THAT WILL IGNITE A FLAMMABLE GAS OR VAPOR. NEVER OPERATE OR REPAIR IN OR NEAR A FLAMMABLE GAS OR VAPOR. NEVER STORE FLAMMABLE LIQUIDS OR GASES NEAR THE UNIT.**

#### SAFETY:

This equipment is designed to be safe in the use for which it was planned, provided it is installed, started- up, operated, and maintained in accordance with the instructions in this data page. Therefore, all personnel who install, use, or maintain the equipment must understand this manual. The unit contains electrical components that operate at line voltage and moving parts. Before working on the unit, isolate and lock it out from the electrical supply. All maintenance operations must be performed by qualified persons who have knowledge in the necessary precautions.

**NOTE: THE VIKING ESFR COLD STORAGE SYSTEM SHALL BE DESIGNED BY QUALIFIED FIRE PROTECTION TECHNICIANS, IN CONJUNCTION WITH REQUIREMENTS OF THE AUTHORITIES HAVING JURISDICTION. THESE SYSTEMS ARE DESIGNED TO MEET THE UL LISTING REQUIREMENTS DESCRIBED IN VIKING TECHNICAL DATA FOR ESFR K25.2 SPRINKLER VK510 FOR USE WITH PROPYLENE GLYCOL/WATER SOLUTION, AND THE STANDARDS OF NFPA 13 OR OTHER ORGANIZATIONS, AND ALSO WITH THE PROVISIONS OF GOVERNMENTAL CODES, ORDINANCES, AND STANDARDS WHERE APPLICABLE.**

#### 2. LISTINGS AND APPROVALS

There are no listings or approvals for the CS-1 Tank and Pump Package.

#### 3. TECHNICAL DATA

##### Specifications

Pump and Storage Tank by:  
General Air Products  
604 Jeffers Circle  
Exton, PA 19341 U.S.A.

##### Ordering Information

Viking CS-1 Tank and Pump Packages are available as follows:

Base P/N 13050-1: Single (1) riser, 65 gallon tank, single solenoid valve, and single control incl. all PLC options.

Base P/N 13050-2: (2) risers, 65 gallon tank, (2) solenoid valves, and control panel with (2) relays and all PLC options for expansion.

Base P/N 13050-3: (3) risers, 160 gallon tank, (3) solenoid valves, and control panel with (3) relays and PLC options.

Base P/N 13050-4: (4) risers, 160 gallon tank, (4) solenoid valves, and control panel with (3) relays and PLC options.

Base P/N 13050-5: (5) risers, 160 gallon tank, (5) solenoid valves, and control panel with (5) relays and PLC option.

Base P/N 13050-6: (6) risers, 160 gallon tank, (6) solenoid valves, and control panel with (6) relays and PLC option.

The pump furnished in all units is 3 HP, 3 Phase. Electrical power supply to the unit is available with 208, 230, 460, or 575 VAC - 3 Phase - 60 Hz. Specify the voltage required by adding one of the following suffixes to the end of the Base Part No: A = 208 V, B = 230 V, C = 460 V, D = 575 V.

(i.e., complete Part No. 13050-6A)

Controls and solenoid valves are 120 VAC - 1 Phase - 60 Hz.

Viking Technical Data may be found on  
The Viking Corporation's Web site at  
<http://www.vikingcorp.com>.  
The Web site may include a more recent  
edition of this Technical Data Page.



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**NOTE: THE PRESSURE SWITCH ON THE CS-1 PUMP UNIT IS FACTORY SET AT 165 PSI CUT-IN, 175 PSI CUT-OUT. THE PRESSURE SHOULD BE ADJUSTED IN THE FIELD TO MAINTAIN ANTIFREEZE PRESSURE DOWNSTREAM OF THE EASY RISER CHECK VALVE AT 50 PSI MAX TO 35 PSI MIN. (3.4 BAR - 2.4 BAR). ELEVATION MUST BE TAKEN INTO ACCOUNT WHEN SETTING PRESSURE SWITCHES AT PROPER PERFORMANCE POINT. THE SYSTEM PRESSURE SWITCH IS TO MAINTAIN THE SUPERVISORY PRESSURE AT THE RECOMMENDED PRESSURE OF 50 PSI 3.4 BAR).**

The pump unit pressure switch must be set to shut off at a higher pressure than the system pressure switch. Head pressure needs to be taken into account by multiplying the (difference in height measured in feet from the system pressure switch and the pump pressure switch x .433) x (specific gravity of propylene glycol). This additional pressure plus 10 PSI (.69 bar) must be added to the system pressure switch cut-out setting and included in the pump unit pressure switch setting for cut-out pressure.

Formula	Example Calculation
$P_{\text{pump pres. switch cut out}} = (\Delta h \times .433 \times G) + 10 + P_{\text{supply}}$	Given: $\Delta h = 10\text{ft.}$ ; $G$ (for 50% solution at 0°F) = 1.056 ; $P_{\text{supply}} = 50$ psi $P_{\text{pump pres. switch cut out}} = (10 \times .433 \times 1.056) + 10 + 50$ $P_{\text{pump pres. switch cut out}} = 65 \text{ PSI}$

### International Power Supply Option

A standard International power supply option of 380 - 400/ 50 Hz/ 3 phase is also available as follows:

P/N 13051-1E for single (1) riser, 65 gallon tank, single solenoid valve, and single control including all PLC options, with international power supply option.

P/N 13051-2E for (2) risers, 65 gallon (246 L) tank, (2) solenoid valves, and control panel with (2) relays and all PLC options for expansion, with international power supply option.

P/N 13051-3E: (3) risers, 160 gallon (606 L) tank, (3) solenoid valves, and control panel with (3) relays and PLC options, with international power supply option.

P/N 13051-4E: (4) risers, 160 gallon (606 L) tank, (4) solenoid valves, and control panel with (3) relays and PLC options, with international power supply option.

P/N 13051-5E: (5) risers, 160 gallon (606 L) tank, (5) solenoid valves, and control panel with (5) relays and PLC option, with international power supply option.

P/N 13051-6E: (6) risers, 160 gallon (606 L) tank, (6) solenoid valves, and control panel with (6) relays and PLC option, with international power supply option.

## 4. INSTALLATION

### A. Receiving and Inspection

When the equipment is received, immediately inspect it for shortages or visible or concealed damage. If the equipment has been damaged in shipment or shortages are noticed, immediately notify the carrier and file a claim.

### B. Handling

Move the CS-1 on the shipping pallet as close to the final location as possible. Always lift the unit from underneath. Never lift the unit when it is full of liquid. Personal injury and/or equipment damage could result.

Ensure that all equipment used to lift the CS-1 is capable of lifting the weight. Nylon straps and soft rigging devices should be used whenever possible to protect the components and finish.

If the unit is being transported overhead, be sure that all personnel are alerted and safety procedures are followed.

### C. Location

**WARNING! DO NOT INSTALL THE CS-1 IN AN ENVIRONMENT OF CORROSIVE CHEMICALS, EXPLOSIVE GASES, POISONOUS GASES, STEAM HEAT, AREAS OF HIGH AMBIENT CONDITIONS, OR EXTREME DUST AND DIRT.**

Install the CS-1 indoors in a clean, dry, non-corrosive environment. This equipment is not to be installed outdoors exposed to the weather. Position the CS-1 in an upright position on a solid, level, vibration-free surface capable of supporting the weight of the unit and liquid in the tank. Bolt the unit to the floor using the bolt holes provided in the frame. Always shim the unit level before bolting it to the floor. Install the CS-1 in a protected, well-ventilated area where the ambient temperatures are between 40 °F and 100 °F (4.4°C to 37.8°C).

Locate the CS-1 to allow access to supply and discharge connections. Clearance around the unit should be at least 24" (610 mm) on all sides for maintenance. Some jurisdictions require specific clearances around equipment. Check with all local Authorities to ensure compliance with applicable state, local, and national codes.



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#### D. Piping and Connections

A slight downward slope from the supply container to the CS-1 supply valve connection is recommended to maintain positive head on the pump inlet.

Always use a backup wrench when making piping connections to avoid damage to the unit's piping.

Size piping between the CS-1 and the system to minimize pressure drop. Too small of a line size restricts pump flow, lowering capacity when filling the system. Lower capacity while filling the system requires longer fill times. The sprinkler system must contain air vent/bleed valves at all local high points. These are used to let air out of the system while filling with antifreeze. Consult the system instructions for specifics.

Individual check valves and isolation valves are required for each system. This allows system maintenance without disturbing other systems the CS-1 is connected to.

Piping and/or hoses from the antifreeze supply containers to the unit should be sloped downhill slightly to provide positive head on the pump suction connection. These lines should be as large as possible and as short as possible to provide unrestricted flow to the pump while filling. A separate shut-off valve in the supply line is required.

Unit piping is copper, brass and bronze. An aluminum manifold is included for mounting multiple system solenoids. Use dielectric unions to isolate copper piping from iron piping, if used, to reduce the possibility of electrolytic action on pipes and other components.

All pipes should be de-burred and threaded to a proper depth and length before installation. Threads should be inspected for cleanliness and depth of cut. Good quality pipe compound should be used to ensure a good, leak tight fit of piping components.

**NOTE: PIPE MUST BE SUPPORTED SEPARATELY FROM THE CS-1. AT NO TIME SHOULD THE CS-1 SUPPORT THE WEIGHT OR LOAD OF THE PIPE. ACCEPTABLE PIPE MOUNTING DEVICES WOULD BE UNISTRUT SUPPORTS ANCHORED TO WALLS, HANGERS SUSPENDED FROM CEILINGS, OR PEDESTALS MOUNTED FROM THE FLOOR. BE SURE ALL PIPE INSTALLATION CONFORMS TO ALL BUILDING & FIRE CODES.**

#### E. Electrical Connections (Refer to Figure 1)

**SERIOUS PERSONAL INJURY AND DAMAGE TO THE CS-1 WILL OCCUR IF IT IS CONNECTED TO A POWER SOURCE OTHER THAN THE VOLTAGE LISTED ON THE DATA TAG. THE MANUFACTURER IS NOT LIABLE FOR DAMAGE DUE TO IMPROPER WIRING, PROTECTION, OR ELECTRICAL SERVICE INSTALLATION.**

When installing electrical service to this machine, comply with the National Electric Code as well as state and local building codes.

Failure to install the proper electrical protection can result in personal injury, fire, equipment damage or death. The manufacturer is not responsible for damage or injury caused by lack of or improperly installed electrical protection.

Electrical connection to the unit is made in the control enclosure. Connect appropriate supply power to the terminals provided. The supply wire must be of adequate size and no other equipment should be connected to the same circuit. An arrow on the pump indicates the correct direction of rotation. If the pump rotates in the opposite direction, reverse the rotation of the motor. Interchanging any two incoming 3 phase supply wires reverses rotation of three phase motors.

**WARNING: OPERATING THE PUMP IN THE WRONG DIRECTION MAY DAMAGE THE PUMP. VERIFY PUMP ROTATION IS CORRECT BEFORE PLACING THE UNIT IN SERVICE. MAKE SURE THERE IS LIQUID ON THE SUCTION SIDE OF THE PUMP BEFORE CHECKING ROTATION.**

Connect system inputs to the proper terminals in the CS-1 control enclosure. Each system pressure switch and alarm flow switch are connected as shown on the electrical schematic.

**NOTE: ALL SYSTEM INPUTS MUST BE CONNECTED BEFORE OPERATING THE UNIT. SYSTEM VALVES WILL NOT RESPOND UNLESS THE SYSTEM PRESSURE SWITCH AND FLOW ALARM SWITCH ARE CONNECTED CORRECTLY.**

#### F. Start-Up

The following points must be verified before putting the unit into service. Correct any discrepancies before operating the unit.

1. The unit is bolted to a firm level surface.
2. Area temperature will always remain between 40 °F and 100 °F (4.4 °C to 37.8 °C).
3. Dielectric unions, if needed, are installed between the pump station piping and system piping.
4. All piping to and from the pump station is independently supported and does not place any strain on the unit's piping.
5. Power supplied to the unit is appropriate (refer to Figure 1).
6. Pump rotation has been checked and is correct.
7. System inputs are connected according to the electrical schematic. All pressure switches are set or programmed correctly.
8. Air can be vented from the system when filling with antifreeze.



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## 5. OPERATION

The tank and pump system maintains pressurized antifreeze in sprinkler system piping at pressures of 50 PSI (3.4 bar) above the Easy Riser Check Valve. A pressure switch on the unit senses the CS-1's discharge manifold pressure and turns the pump on as the unit pressure drops to a preset, and then stops the pump as unit pressure rises to a higher preset. A level switch mounted in the storage tank opens when the liquid level is low. When the level switch opens, pump operation is inhibited and a set of dry contacts changes state for the user's supervisory system of the unit. Terminals 21, 22, and 23 are for connection of low alarm devices.

Up to six (6) individual risers are connected to the CS-1 Tank and Pump system through normally closed solenoid valves. The supervisory pressure switch and flow alarm switch for each system are connected on site to the CS-1 system control. As system supervisory pressure drops, the corresponding solenoid valve opens, allowing flow from the CS-1 system to that system. When system pressure reaches the system set point, the system supervisory pressure switch opens and the CS-1 control closes that solenoid valve. In the case of flow due to a system operation, the normally closed contacts of that system's flow alarm pressure switch open, and the CS-1 control prevents that system's solenoid valve from opening, regardless of system pressure.

A suitable portable pump can be utilized to fill the system to the required supervisory pressure. (The CS-1 pump can be used for filling the system initially at 15 GPM (56 l/min) to 100 ft. head pressure or system static pressure, however, it is a less efficient pump for filling the system because of the duration of time required to do so. To fill the system, the CS-1 is connected to the antifreeze supply. The system to be filled is selected using two toggle switches on the CS-1 control enclosure. Antifreeze from the supply is pumped to the system piping. Pump operation is manually controlled during the fill process. The CS-1 pump is to be utilized to bring the solution to maintenance pressure, [normally a minimum of 50 PSI (3.4 bar) pressure] at the Easy Riser Check Valve and is designed to maintain system pressure once the system is initially filled.

Two modes of electrical control are available. Manual operation allows the user to operate the pump motor by means of a switch. Automatic operation uses the unit's pressure switch to operate the pump based unit pressure. Flow to each riser is controlled by that system's pressure switch and flow alarm switch. In "Automatic" mode, pump operation is limited to 6 times per hour. Also, pump operation is inhibited at low liquid level in the tank.

**WARNING: THE CS-1 SYSTEM MUST BE ATTENDED AT ALL TIMES IN MANUAL MODE. THE PUMP CAN OPERATE WITHOUT LIQUID IN MANUAL MODE, WHICH WILL DAMAGE THE PUMP. RUNNING THE CS-1 WITHOUT FLUID IN MANUAL MODE VOIDS THE WARRANTY. THIS PUMP IS NOT SELF- PRIMING.**

The storage tank is opaque to allow visual indication of the antifreeze leveling. A Y-Strainer is included on the pump suction line. A locking valve is included on discharge line. Lock in the open position. This valve is used to isolate the antifreeze storage tank for maintenance. A check valve in pump discharge piping prevents antifreeze backflow from the system, which would damage the pump. An adjustable pressure relief valve is included to protect the pump discharge piping. This relief valve must be set at 10 PSI (.7 bar) above the pump system pressure switch. All components of the pump unit are compatible with the antifreeze solution and rated to a maximum pressure of 225 PSI (15.5 bar).

### A. CS-1 Control Scheme

#### 1. General

The CS-1 Tank and Pump system maintains pressure for up to (6) six risers with individual control to each riser. A two-way normally closed solenoid valve is connected to each riser. The pressure switch on each riser controls the corresponding solenoid valve. At a low riser pressure condition, the solenoid opens, allowing flow from the CS-1 to that riser. In the case of operation of a riser due to flow from a sprinkler, the riser's alarm pressure switch opens, interrupting the signal from system switch to the CS-1 control panel, and keeps the corresponding solenoid valve from opening. A drop in pressure operates the CS-1 pump. Pump operation is controlled by the pressure switch and level switch mounted on the CS-1. There are (2) two normal operating modes for the CS-1 Pump and Tank, "Manual" and "Automatic". The Manual mode is used for filling the unit's tank and filling systems through the CS-1, using the unit's pump. The Automatic mode maintains supervisory pressure(s) after filling is complete.

#### 2. Pump Operation

The pressure switch mounted on the CS-1 controls pump operation. When the pressure at the CS-1 drops, the pump will turn on until the pressure at the CS-1 rises above a set level. In "Automatic" mode, pump operation is inhibited if the level of liquid in the unit's storage tank drops below the level switch height.

In "Manual" mode, the pump operates when CS-1 pressure drops, a system valve is selected, if that system pressure is not met, and there is no alarm condition. The pump can also fill the tank in Manual mode. For tank filling, the level switch position is not used and the operator must start and stop the pump, using the "Man" position of the Man- Off-Auto Switch on the control panel.

In Automatic mode, there is a 10-minute time delay between pump operations. After the 10 minute delay, the pump operates if the CS-1 pressure drops and tank fluid level is above the level switch height. When the pump shuts off, the 10-minute timer starts again and the pump will not operate until 10 minutes is complete.

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### 3. System Solenoid Valve Operation

Each system (riser) pressure switch and alarm pressure switch contacts are connected in series to one input on the PLC. The system pressure switch closes on falling pressure. The alarm pressure switch normally closed contacts are used and open in the alarm condition.

In Automatic mode, each system solenoid valve opens if its system pressure drops to a low-pressure condition and there is no alarm pressure signal. In manual mode, each system valve is selected by means of two selector switches and the solenoid valve opens as long as system pressure is below the set-point value and there is no system alarm. Note: To operate in manual mode, all switches must be wired.

### 4. Level Switch Relay Coil Operation

The level switch relay coil is energized when the tank level is above the level switch height. This is when tank level is satisfied. The switch relay coil de-energizes when tank level drops to the level switch height, at low tank level.

INPUTS AND OUTPUTS - See Tables 1 and 2

Table 1 - Input Descriptions	
Input	Description
1	"Man" position of Hand-Off- Auto Switch
2	"Auto" position of Hand-Off- Auto Switch
3	Pressure Switch of Pumping Unit
4	Tank Level Switch
5	System 1 Inputs
6	System 2 Inputs
7	System 3 Inputs
8	System 4 Inputs
9	System 5 Inputs
10	System 6 Inputs
11	Switch A – Down Position
12	Switch A – Up Position
13	Switch B – Down Position
14	Switch B – Up Position

Table 2 - Output Descriptions		
Output	Description	Control Logic
1	"Power On" light	Output 1 on when: Input 1 or Input 2 are on.
2	Pump Motor Starter Coil and "Pump" light	Output 2 on when: <b>(Manual Mode System and Tank Filling)</b> Input 1 on + Input 3 on. <b>OR</b> <b>(Automatic Mode)</b> Input 2 on + Input 3 on + Input 4 on and Internal Timer times to 10 minutes. The timer begins when Manual or Automatic mode is started and is reset when pump turns off in Automatic Mode.
3	System 1 Solenoid Valve	Output 3 on when: <b>(Manual Mode)</b> Input 1 on and Input 5 on and Input 12 on and Input 13 off and Input 14 off. <b>OR</b> <b>(Automatic Mode)</b> Input 2 on and Input 5 on.
4	System 2 Solenoid Valve	Output 4 on when: <b>(Manual Mode)</b> Input 1 on and Input 6 on and Input 11 on and Input 13 off and Input 14 off. <b>OR</b> <b>(Automatic Mode)</b> Input 2 on and Input 6 on.
5	System 3 Solenoid Valve	Output 5 on when: <b>(Manual Mode)</b> Input 1 on and Input 7 on and Input 11 off and Input 12 off and Input 14 on. <b>OR</b> <b>(Automatic Mode)</b> Input 2 on and Input 7 on.
6	System 4 Solenoid Valve	Output 6 on when: <b>(Manual Mode)</b> Input 1 on and Input 8 on and Input 11 off and Input 12 off and Input 13 on. <b>OR</b> <b>(Automatic Mode)</b> Input 2 on and Input 8 on.
7	System 5 Solenoid Valve	Output 7 on when: <b>(Manual Mode)</b> Input 1 on and Input 9 on and Input 12 on and Input 14 on. <b>OR</b> <b>(Automatic Mode)</b> Input 2 on and Input 9 on.
8	System 6 Solenoid Valve	Output 8 on when: <b>(Manual Mode)</b> Input 1 on and Input 10 on and Input 11 on and Input 13 on. <b>OR</b> <b>(Automatic Mode)</b> Input 2 on and Input 10 on.
9	Level Switch Relay Coil	Output 9 on when: Input 4 on.

### B. Filling the Reservoir Tank (Refer to Figure 3)

The CS-1 has been designed to fill the reservoir tank using either of two methods: gravity fill or pumped fill. NOTE: This is not a self-priming pump. Manually prime or fill the reservoir for prime.

**NOTE: NEVER LEAVE THE UNIT UNATTENDED WHEN FILLING THE SYSTEM OR TANK. RUNNING THE PUMP DRY, WITHOUT LIQUID, WILL DAMAGE PUMP SEALS AND POSSIBLY DAMAGE PUMP IMPELLER.**

Follow the steps below:

#### 1. Gravity Fill:

1. Turn off and isolate the electrical supply to the unit.
2. Close Supply Isolation valve.
3. Connect the antifreeze supply container to the supply isolation valve. A flexible hose may be used, but must not restrict the flow from the supply container to the valve. An additional isolation valve must be installed in the line between the supply container and unit's supply isolation valve.
4. Open the shut off valve on the supply container and supply isolation valve on the CS-1.
5. Open the pump suction isolation valve and allow liquid to enter the reservoir tank. If there is enough liquid in the supply container, the tank may be filled completely using this method. The tank is full when the liquid level rises to the top of the straight section of the tank.



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#### 2. Pump Assist Fill:

1. If there is not sufficient liquid in the supply container to fill the tank or the tank fills too slowly, the pump on the CS-1 may be manually operated to speed up this process. Follow steps 1 to 4 above and 2 to 6 below to fill the storage tank using the pump. A slight downward slope from the supply container to the valve connection is required to prime the pump and maintain positive head on the pump inlet. Always use a backup wrench when making piping connections to avoid damage to the unit's piping.
2. Close the tank discharge isolation valve and open the tank fill isolation valve.
3. With the CS-1's "OFFON" switch in the "OFF" position, turn on power supply to the unit.
4. Position switches "A" and "B" in the center/off position. Switch the "Man-O-AUTO" switch on the unit control panel to "Man" and the "OFF-ON" switch to "ON". Liquid will begin to fill the storage tank at the fill connection.
5. Be careful to observe the liquid level to prevent over filling. When the liquid level reaches the top of the straight section of tank, switch the unit's "Man-O-AUTO" switch to "O".
6. Close the liquid supply isolation and tank fill isolation valves. Open the tank discharge isolation valve.

#### C. Filling Systems

A suitable portable pump can be utilized to fill the system. (The CS-1 pump can be used for filling the system initially at 15 GPM (56 l/min) to 100 ft. head pressure or system static pressure, however, it is a less efficient pump for filling the system because of the duration of time required to do so. To fill the system, the system solenoid on the CS-1 is connected to the liquid supply isolation valve of the EZ Riser for that system. All pressure switches must be installed and set. The system to be filled is selected using two toggle switches on the CS-1 control enclosure. Antifreeze from the supply is pumped to the system piping. Pump operation is manually controlled during the fill process. The CS-1 pump is to be utilized to bring the solution to maintenance pressure, and is designed to maintain system pressure once the system is initially filled. Appropriate vent/bleed valves must be installed on each system's piping at all local high points to allow air to escape while liquid fills the system.

**NOTE: NEVER LEAVE THE UNIT UNATTENDED WHEN FILLING THE SYSTEM. RUNNING THE PUMP DRY, WITHOUT LIQUID, WILL DAMAGE PUMP SEALS AND POSSIBLY DAMAGE THE PUMP IMPELLER.**

Follow the steps below:

1. Turn off and isolate the electrical supply to the unit.
2. Close the liquid supply valve and Tank Fill isolation valves.
3. If not already connected to fill the storage tank, connect the antifreeze supply container to the liquid supply valve. A flexible hose may be used, but must not restrict the flow from the supply container to the valve. An additional isolation valve must be installed in the line between the supply container and unit's liquid supply valve. A slight downward slope from the supply container to the unit's valve connection is required to prime the pump and maintain positive head on pump inlet. Always use a backup wrench when making piping connections to avoid damage to the unit's piping.
4. Open the shut off valve on the supply container and liquid supply valve on the CS-1.
5. Open high point vent/bleed valves on the system.
6. Select system to be filled using switches "A" and "B" (refer to Figure 1). Use Table 3 or the table on the CS-1 Panel to determine switch "A" and "B" position.

Table 3 - Switch Settings	System Selected	Switch A Position	Switch B Position
	No System - Tank Fill	Centered	Centered
	System 1	Up	Centered
	System 2	Down	Centered
	System 3	Centered	Up
	System 4	Centered	Down
	System 5	Up	Up
	System 6	Down	Down

7. With the CS-1's "OFFON" switch in the "OFF" position turn on the power supply to the unit.
8. Switch the "Man-O-AUTO" switch on the unit control panel to "Man". Turn the "Off-On" switch to "ON". Liquid will begin to fill the selected system.
9. As the system fills, monitor the system vent/bleed valves. Close each valve when liquid leaks from it.
10. When the liquid leaks from the uppermost vent/bleed valve, close the vent valve. The system pressure switch will close that system's solenoid valve when set pressure is established. The pump pressure switch will turn the pump off when set pressure is established.
11. If another system is to be filled, turn the "Man-O-AUTO" switch to "O" and select the next system using switches A and B.



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12. Turn the "Man-O-AUTO" switch to "Man" and repeat steps 8 through 10.
13. After filling all systems and the CS-1 tank, close the liquid supply valve.
14. All air must be out of the system before switching the unit to maintenance mode. Follow the system manufacturer's recommendations to ensure all air is removed.

#### D. Operating in Maintenance Mode: Automatic

As previously stated, the CS-1 is designed to maintain the antifreeze pressure in the sprinkler system at a supervisory pressure of 50 PSI (3.4 bar). A pressure switch installed in the pump discharge line operates the pump between two pressures sensed in the unit's piping. A pressure switch on each system sends a signal to the CS-1 to open and close that systems solenoid valve.

1. Ensure all air is removed from system piping before placing the unit in automatic operation.
2. Liquid level in the storage tank must be above the level switch height or pump operation is inhibited.
3. Close the liquid supply and tank fill isolation valves. Open the tank discharge isolation valve and system liquid supply isolation valve.
4. With the "ON-OFF" switch "ON", switch the "Man-O-AUTO" switch to the "AUTO" position. The CS-1 is now operating in Maintenance mode.

**NOTE: THE CS-1 CONTROL SYSTEM USES A TIME DELAY RELAY, SET AT 10 MINUTES, TO LIMIT PUMP OPERATION TO SIX TIMES PER HOUR MAXIMUM. WHEN THE UNIT IS FIRST ENERGIZED IN "AUTO", PUMP OPERATION IS DELAYED FOR 10 MINUTES.**

5. After 10 minutes, if the CS-1 piping is below the unit's pressure switch setting, the pump motor will operate, raising CS-1 manifold pressure.
6. The pump will turn off at the pressure switch cutout pressure.
7. Each system's solenoid valve will open in response to system pressure switch.

## 6. INSPECTIONS, TESTS AND MAINTENANCE

**Table 4 - Troubleshooting Guide**

Problem	Possible Causes	Remedies
Unit will not turn on.	<ol style="list-style-type: none"> <li>1) Power disconnected.</li> <li>2) Blown fuse.</li> </ol>	<ol style="list-style-type: none"> <li>1) Check power at supply and unit, and correct.</li> <li>2) Check fuses, replace as required, and determine cause of blown fuse.</li> </ol>
Pump does not operate in Automatic mode when CS-1 pressure drops.	<ol style="list-style-type: none"> <li>1) No power to unit.</li> <li>2) Liquid level in tank low.</li> <li>3) Magnetic starter overload tripped.</li> <li>4) Time delay active.</li> <li>5) Pump motor defective.</li> </ol>	<ol style="list-style-type: none"> <li>1) Verify power at unit terminal block.</li> <li>2) Fill tank to proper height.</li> <li>3) Verify and fix cause of overload. Press reset button on starter.</li> <li>4) Wait 10 minutes for time delay to time out. Correct leaks in system.</li> <li>5) Replace.</li> </ol>
Pump does not operate in Automatic mode when system valve opens.	<ol style="list-style-type: none"> <li>1) Pump operates on manifold pressure, not system pressure. System pressure switch setting is higher than the CS-1 pressure switch setting.</li> </ol>	<ol style="list-style-type: none"> <li>1) Verify system pressure switch setting is correct. The CS-1 pressure switch setting must not be adjusted higher. Adjust CS-1 switch setting lower if approved by factory.</li> </ol>
Failure to pump.	<ol style="list-style-type: none"> <li>1) Supply container empty.</li> <li>2) Incorrect valve position.</li> <li>3) Pump rotation backward.</li> <li>4) Insufficient head pressure to pump inlet.</li> <li>5) Pump not up to speed.</li> <li>6) Clogged suction line.</li> <li>7) Air in suction line.</li> </ol>	<ol style="list-style-type: none"> <li>1) Connect full supply container.</li> <li>2) Correct valve position per instructions.</li> <li>3) Correct pump rotation.</li> <li>4) Raise supply container.</li> <li>5) Check voltage.</li> <li>6) Inspect and clean Y-Strainer.</li> <li>7) Check for air in pump suction line.</li> </ol>
Excessive power consumption.	<ol style="list-style-type: none"> <li>1) Pump not fully broken in.</li> <li>2) Mechanical damage.</li> </ol>	<ol style="list-style-type: none"> <li>1) Pump normally draws higher current during break-in period. This condition will work itself out after several weeks.</li> <li>2) Turn pump over by hand. If there are tight spots after break-in, call Technical Services.</li> </ol>
Other pump-related problems.	If other pump related problems are suspected, call the Viking Technical Services Department at 1-877-384-5464.	

## 7. AVAILABILITY

The Viking CS-1 Tank and Pump Package is available through a network of domestic and international distributors. See the Viking Corp. Web site for closest distributor or contact The Viking Corporation.

## 8. GUARANTEES

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.



# TECHNICAL DATA

## CS-1 TANK AND PUMP PACKAGE ESFR COLD STORAGE SYSTEM

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services 877-384-5464 Fax: 269-945-4495 Email: techsvcs@vikingcorp.com

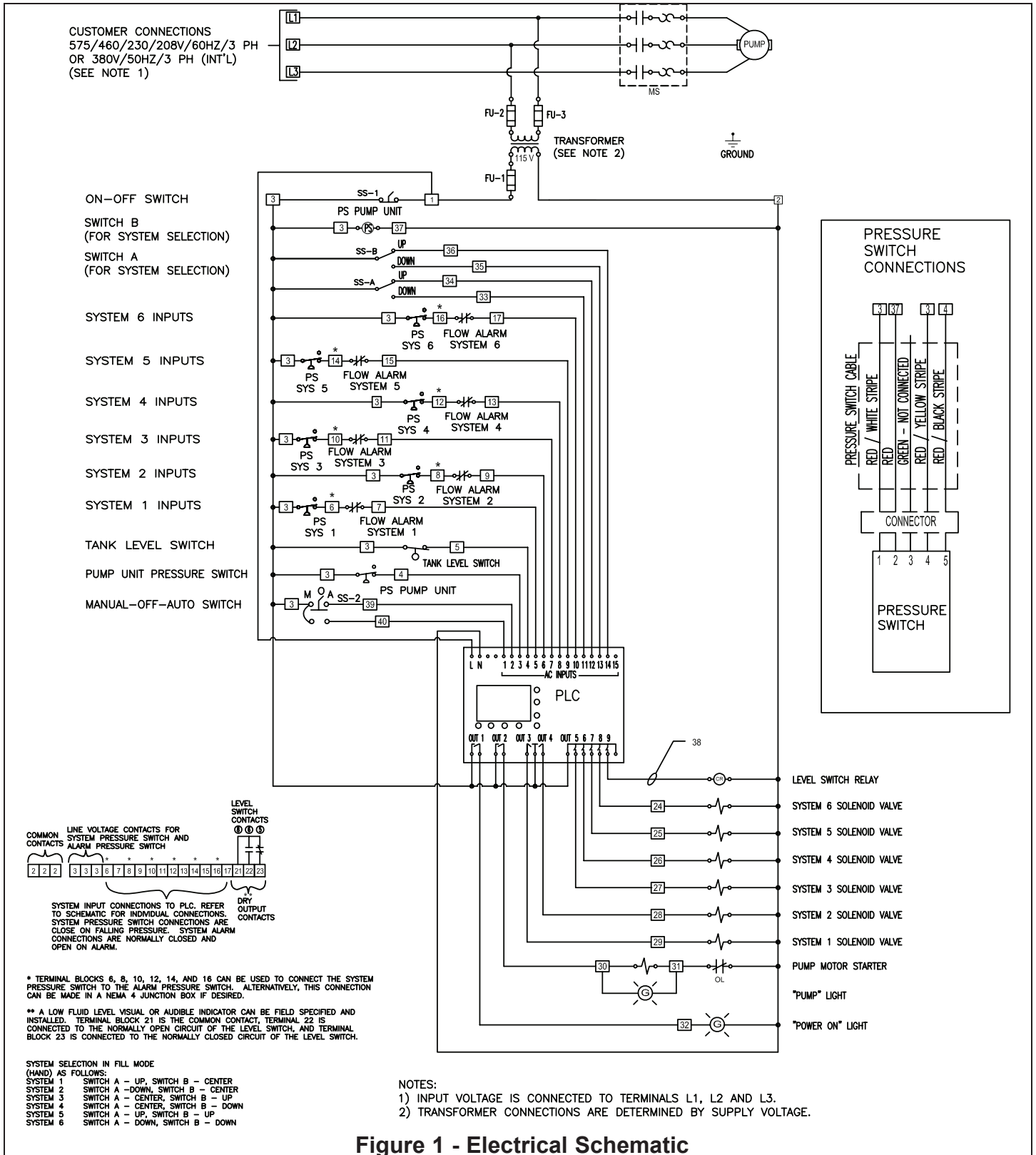


Figure 1 - Electrical Schematic



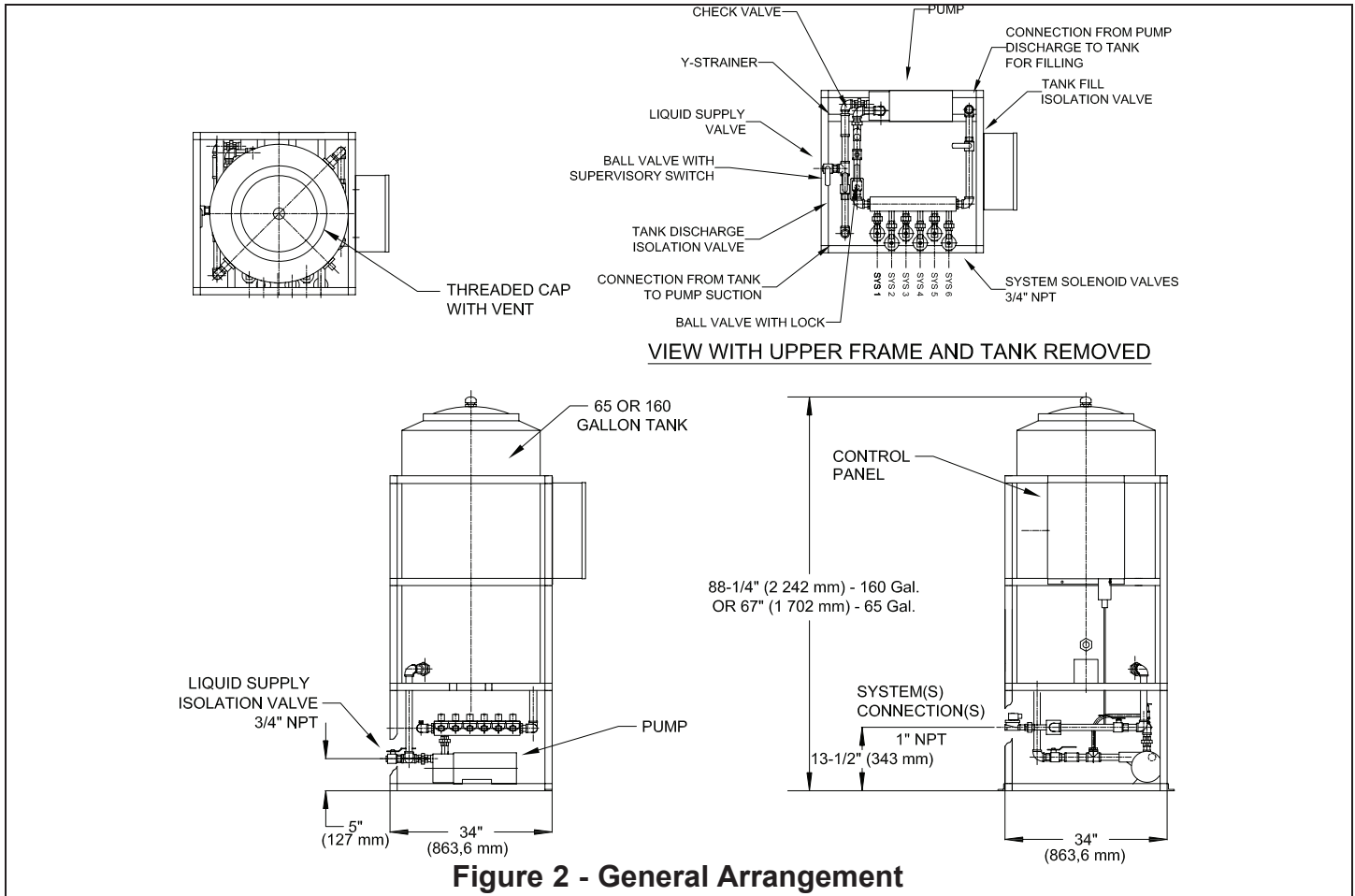


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**Figure 2 - General Arrangement**

**Table 5 - Recommended Spare Parts List**

DESCRIPTION	REC. QTY.	P/N	DESCRIPTION	REC. QTY.	P/N
Pump Basic Repair Kit - Includes Seal Stationary Element, Seal Stationary Seat, Casing O-Ring, Impeller (Type "L")	1	13052	Overload Heater (Indicate Unit Voltage for Correct Selection) 208V-60 HZ-3 PH	3	13059
Level Switch, Stainless Steel Wetted Components, 1/2" NPT External Side Mounting, 1/2" NPT Conduit Connection	1	13054	230V-60 HZ-3 PH		13060
Solenoid Valve, 3/4" Normally Closed 120V-60 HZ	1	12955	460V-60 HZ-3 PH		13061
Solenoid Valve, 3/4" Normally Closed 110V-50 HZ	1	13194	575V-60 HZ-3 PH		13062
Ball Valve, 1"	1	13055	Control Relay	1	13063
Double Spring Check Valve, Brass	1	13056	Transformer Primary Fuse, 1/2 AMP	2	13064
Pressure Switch, Factory Set at 165 cut-in, 175 psig cut-out. Should be field adjusted.	1	13057	Transformer Secondary Fuse, 1 AMP	1	13065
Pressure Switch Cable	1	13231	Pilot Light, Green LED, 120V, NEMA 4X	1	13066
Magnetic Starter	1	13058			



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