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Model ESFR-25™ Freezer Storage System: Suppression Mode Fire Sprinkler Protection For Storage In Refrigerated Areas

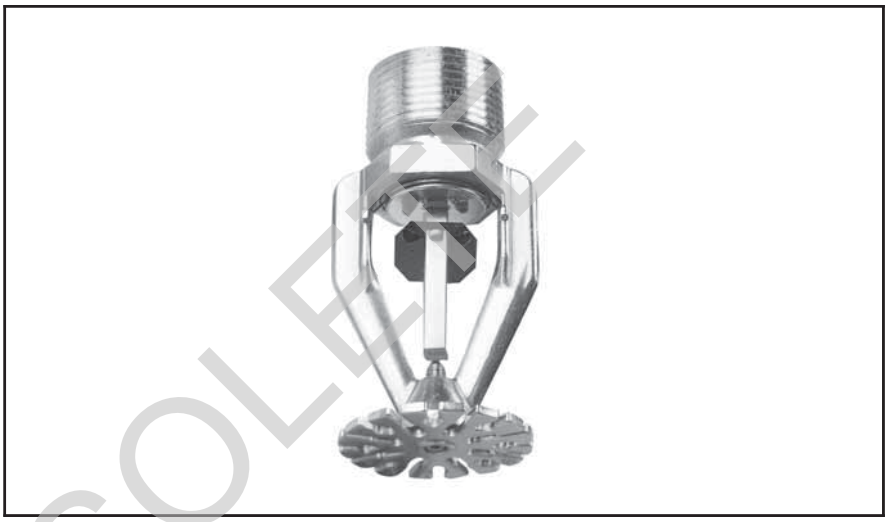
General Description

The Model ESFR-25 Freezer Storage System is the outcome of a collective technological effort between Factory Mutual Research Corporation, JRW Technologies, Inc., and Tyco Fire Products. The system (Ref. Figure 1) is intended for use in protecting high-piled storage (e.g., palletized, solid piled, or rack) within refrigerated areas. Without the need for a dry-pipe system and/or in-rack sprinkler requirements, the ESFR-25 Freezer Storage System provides "suppression mode" versus "control mode" fire protection, which had not previously been available for refrigerated areas.

This system utilizes Model ESFR-25 Early Suppression Fast Response Sprinklers with a nominal K-factor of 25.2 GPM/psi$^{1/2}$ (362.9 LPM/bar$^{1/2}$) in conjunction with sprinkler pipe that is filled with a patented non-freezing fluid ("JRW Technologies, Inc." — WilFlow™ Fluid "B") that has been specifically tested and approved for use with the Model ESFR-25 Sprinklers. The WilFlow Fluid "B" remains in a liquid state to temperatures as low as -20°F/-29°C and is maintained at a pressure of 172 psi (11,9 bar) in the system piping above of the Model F200 Alarm Check Valve.

The automatic pressure maintenance of the WilFlow Fluid "B" is accomplished by the use of the Maintenance Pump and Tank Unit ("General Air Products" — Model PLPS300-4B) located adjacent to the riser. Maintenance of the WilFlow Fluid "B" at a higher pressure than the incoming water supply helps assure that the system piping remains free of water that could compromise the effectiveness of the WilFlow Fluid "B".

Upon operation of the ESFR-25 Sprinklers during a fire event, the WilFlow Fluid "B" is immediately discharged



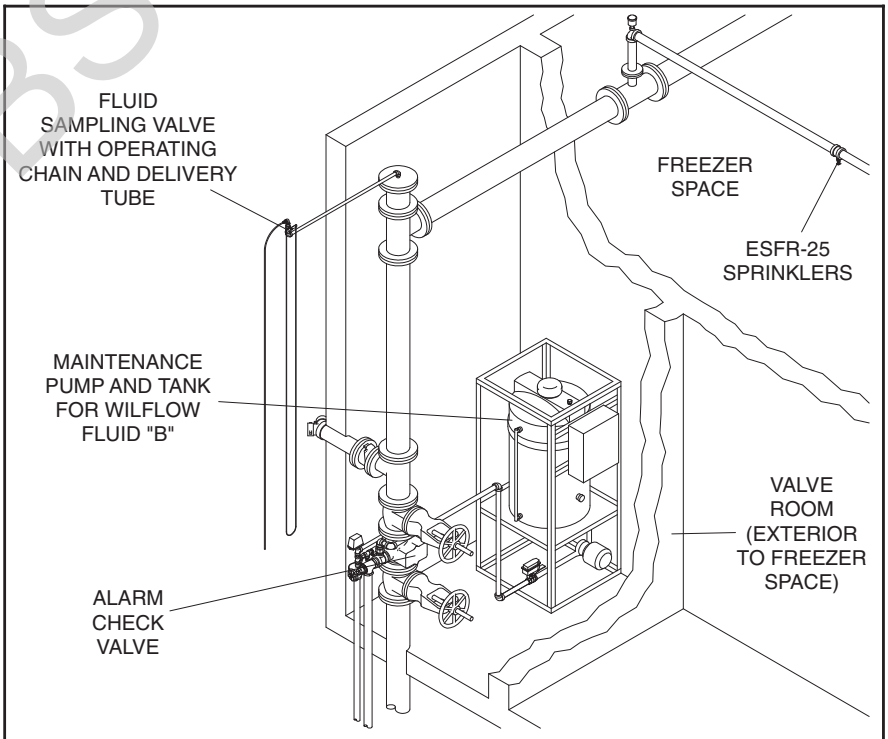


FIGURE 1
MODEL ESFR-25 FREEZER STORAGE SYSTEM
— TYPICAL SYSTEM ARRANGEMENT —

1 - Frame
2 - Deflector
3 - Compression Spring
4 - Hook
5 - Strut
6 - Link Assembly
7 - Button
8 - Sealing Assembly
9 - Ejection Spring

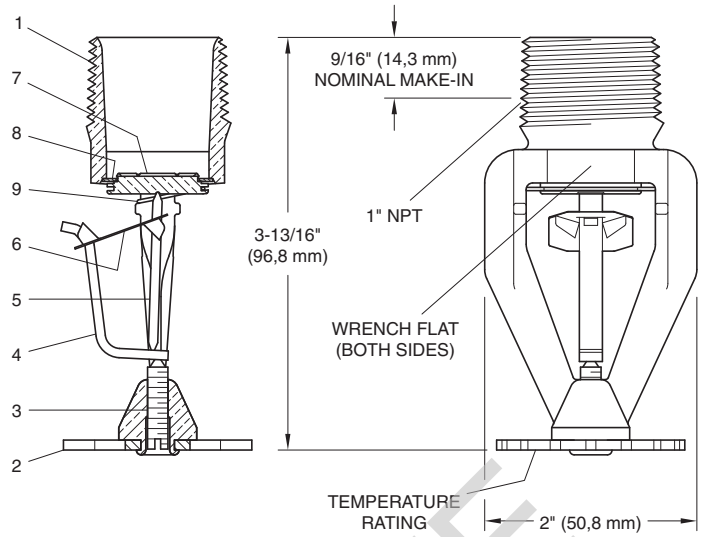


FIGURE 2
MODEL ESFR-25 FREEZER STORAGE SYSTEM
— MODEL ESFR-25 EARLY SUPPRESSION FAST RESPONSE PENDENT SPRINKLER ASSEMBLY —

from the operated ESFR-25 Sprinklers, followed by water from the system water supply delivered through the F200 Alarm Check Valve.

The F200 Alarm Check Valve and Trim provide for fire alarms upon system operation, as well as help with the preventing of backflow of the WilFlow Fluid "B". The continuous groove of the F200 Alarm Check Valve seat ring provides an open-to-atmosphere air gap between the WilFlow Fluid "B" and the system water supply.

Major advantages provided by the Model ESFR-25 Freezer Storage System are as follows:

- Provides a suppression mode sprinkler system at low ESFR pressure requirements.
- Permits the use of an ESFR type system in a refrigerated area (an ESFR system that requires the use of water-filled pipe is not otherwise an option for refrigerated areas).
- Allows for the protection of cold storage over 25 feet (7,6 m) high without the requirement for "in-rack" sprinklers.
- Eliminates the need for dry pipe or preaction valves.
- Eliminates the possibility of ice-plug formation within piping system.
- Eliminates the water delivery delay times associated with dry pipe or preaction systems.

WARNING

The Model ESFR-25 Freezer Storage System described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction (e.g. Factory Mutual). Failure to do so may impair the integrity of this system.

Fluid contraction (resulting from a temperature decrease) can result in water inadvertently entering the sprinkler system, compromising the effectiveness of the fluid , freezing, and rendering the system inoperative. This condition would occur as a result of fluid contracting more than the available volume of make-up fluid on hand. A low level switch is provided with the PLPBS300-4B Tank and Pump Unit to alert maintenance personnel to refill the tank.

Fluid expansion (resulting from a temperature increase) can result in overpressurization. Failure to relieve the pressure in this condition can result in mechanical damage to sprinklers and pipe, as well as rendering the system inoperative. This condition could occur after initial pressurization of the sprinkler system, if the temperature of any portion of the refrigerated area is to be increased for maintenance purposes and increasing pressure is not relieved accordingly.

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or manufacturer should be contacted relative to any questions.

Technical Data

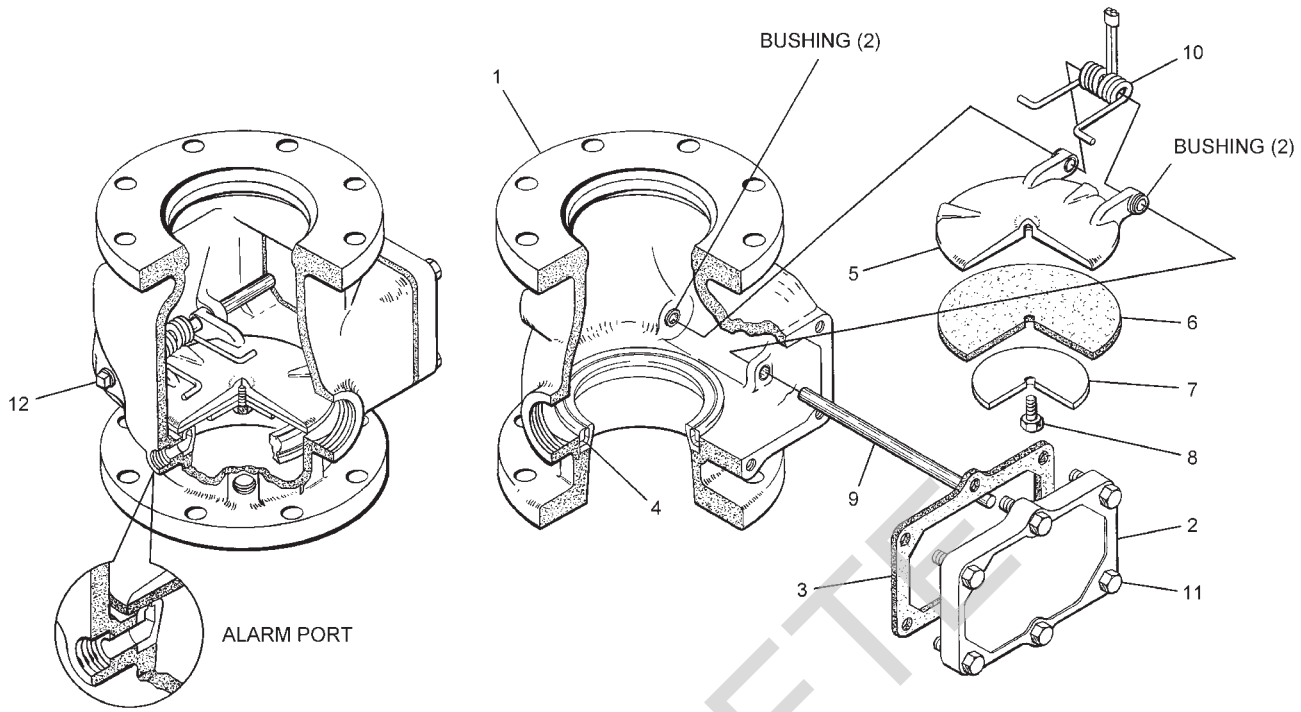
Approvals
WilFlow Fluid "B" is FM Approved under the name of JRW Technologies, Inc. FM Approval is based on the WilFlow Fluid "B being utilized in accordance with the applicable FM Loss Prevention Data Sheets.

The ESFR-25 Freezer Storage System, when installed in accordance with this technical data sheet, meets the FM Approval requirements for use of WilFlow Fluid "B".

Refrigerated Area Temperature Range
+10°F to -20°F (-12°C to -29°C).

Maximum Water Supply Pressure
165 psi (11,4 bar).

WilFlow Fluid "B"
The WilFlow Fluid "B" non-freezing solution for use within the parameters called for with the ESFR-25 Freezer Storage System has been specifically tested and approved by Factory Mutual. Use of any other types of fluids is not permitted within the design guidelines of this system. WilFlow Fluid "B" is derived from FDA approved food additive technology. It is non-toxic; biodegradable; non-flammable; not classified dangerous for transport; soluble in water; anti-microbial (used as food additive); and, non-carcinogenic. It may be disposed of as wastewater



No.	Description	No.	Description	No.	Description	No.	Description
1	Valve Body	4	Seat Ring	7	Clapper Washer	10	Spring
2	Handhole Cover	5	Clapper w/Bushings	8	Self-Locking Cap Screw	11	Handhole Cover Bolts
3	Handhole Cover Gasket	6	Clapper Facing	9	Hinge Pin	12	3/8" NPT Plug

FIGURE 3
MODEL ESFR-25 FREEZER STORAGE SYSTEM
— MODEL F200 ALARM VALVE ASSEMBLY —

when in conformance with local regulations.

ESFR-25 Sprinkler
The ESFR-25 Sprinkler (Ref. Figure 2) has a bronze frame with teflon sealing assembly for the discharge orifice that has a nominal K-factor of 25.2 GPM/psi$^{1/2}$ (362.9 LPM/bar$^{1/2}$).

F200 Alarm Check Valve and Trim
The F200 Alarm Check Valve (Ref. Figure 3) has a cast iron body with annular grooved bronze seat ring and an EPDM clapper facing. When used in the ESFR-25 Freezer Storage System, the F200 Alarm Valve is trimmed with galvanized “Freezer Trim” (Ref. Figure 4). The trim provides all of the appropriate connections for pressure gauges, main drain, alarms, and WilFlow Fluid “B” maintenance. The annular groove of the F200 Alarm Check Valve provides an open-to-atmosphere air gap between the WilFlow Fluid “B” and the system water supply.

Model PLPS300-4B Maintenance Pump and Tank Unit
The Maintenance Pump and Tank Unit (Ref. Figure 5) is provided as an assembled unit with all appropriate connections and controls.

The pump is a regenerative turbine type pump. It is rated to supply 7 to 8 GPM at 165 psi (26,5 to 30,3 LPM at 11,4 bar). Pump voltage is 460 VAC/3 phase/60 Hz. The pump controls are 120 VAC/single phase/60 Hz. The controls include dry contacts for supervisory valve position switch and tank low-level switch. The pressure switch for the pump discharge is set for a nominal shut off pressure of 172 psi (11,9 bar).

The tank is a 60 gallon (230 litres) vertical tank constructed of a high density Polyethylene and is equipped with an outside and visible fluid level sight indicator as well as an internal low fluid level switch. The switch contains contacts, which open when the tank level drops to approximately 7 gallons (26,5 litres) remaining. The opening of these contacts inhibits pump operation. A set of dry contacts is provided at the panel to activate a supervisory condition that the pump has been shut down. The tank is equipped with a 1 inch NPT outlet at the base for connection to the suction piping to the pump. The tank is also equipped with a vent fitting as appropriate; a 7 inch threaded cap; and a 1 inch NPT threaded connection for the tank fill line.

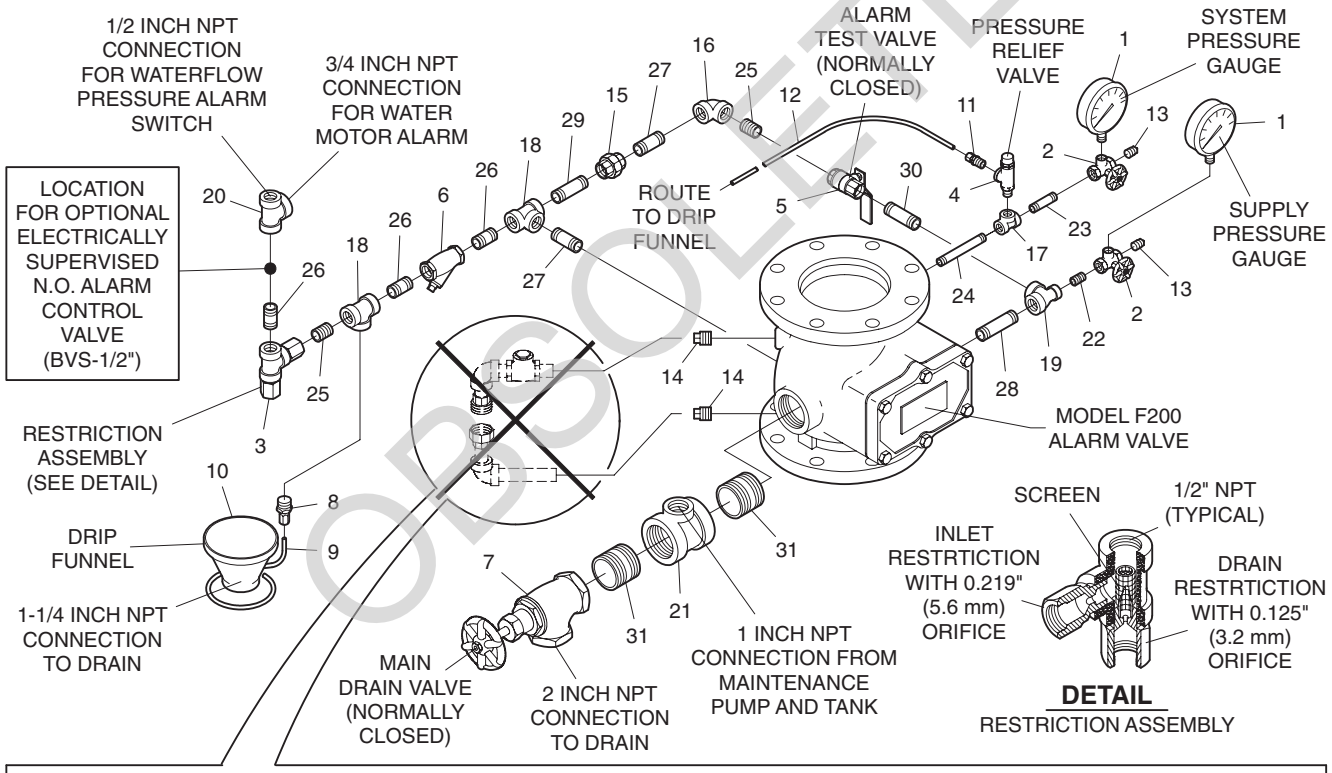
NO.	DESCRIPTION	QTY.	P/N
1	300 psi/ 2000 kPa Water Pressure Gauge	2	92-343-1-005
2	1/4" Gauge Test Valve	2	46-005-1-002
3	Restriction Assembly	1	92-210-1-005
4	1/4" 185 psi Pressure Relief Valve	1	92-343-1-026
5	1/2" Ball Valve	1	46-050-1-004
6	1/2" Y-Strainer	1	52-353-1-005
7	2" Angle Valve	1	46-048-1-009
8	Drip Funnel Connector	1	92-211-1-005
9	Drip Funnel Bracket	1	92-211-1-003
10	Drip Funnel	1	92-343-1-007
11	1/4" Tubing Connector	1	CH
12	1/4" Tube, 36" Long	1	CH

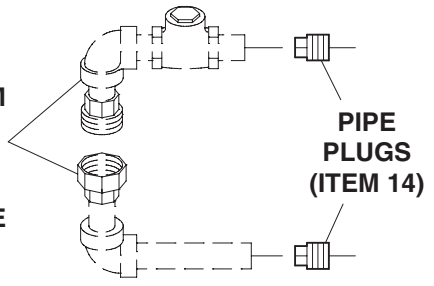
NO.	DESCRIPTION	QTY.	P/N
13	1/4" Plug	2	CH
14	1/2" Plug for 4 inch and 6 inch valves	2	CH
	3/4" Plug for 8 inch valves	2	CH
15	1/2" Union	1	CH
16	1/2" 90° Elbow	1	CH
17	1/4" Tee	1	CH
18	1/2" Tee	2	CH
19	1/2" x 1/4" x 1/2" Reducing Tee	1	CH
20	1/2" x 1/2" x 3/4" Reducing Tee	1	CH
21	2" x 2" x 1" Reducing Tee	1	CH
22	1/4" x Close Nipple	1	CH
23	1/4" x 2" Nipple	1	CH
24	1/4" x 4" Nipple	1	CH
25	1/2" x Close Nipple	2	CH

NO.	DESCRIPTION	QTY.	P/N
26	1/2" x 1-1/2" Nipple	3	CH
27	1/2" x 2" Nipple	2	CH
28	1/2" x 3" Nipple	1	CH
29	1/2" x 1-1/2" Nipple for 4 inch valves	1	CH
	1/2" x 2-1/2" Nipple for 6 inch valves	1	CH
	1/2" x 4" Nipple for 8 inch valves	1	CH
30	1/2" x 2" Nipple for 4 inch valves	1	CH
	1/2" x 3" Nipple for 6 inch valves	1	CH
	1/2" x 4-1/2" Nipple for 8 inch valves	1	CH
31	2" x Close Nipple	2	CH

All Fittings and Nipples are Galvanized

CH: Common Hardware





DISCARD BY-PASS TRIM PACKAGED WITHIN THE MODEL F200 ALARM VALVE

PIPE PLUGS (ITEM 14)

Pre-assembled By-pass Trim is packaged with the Model F200 Alarm Valve within the Valve Body.

If installed, the By-pass Trim defeats the function of the Alarm Valve Seat Ring Groove as it applies to the ESFR-25 Freezer Storage System.

Discard the By-pass Trim and, as indicated, plug the Valve By-pass Ports with the Pipe Plugs, Item 14, that are provided with the Freezer Trim.

FIGURE 4
MODEL ESFR-25 FREEZER STORAGE SYSTEM
— MODEL F200 ALARM VALVE "FREEZER TRIM" ARRANGEMENT —

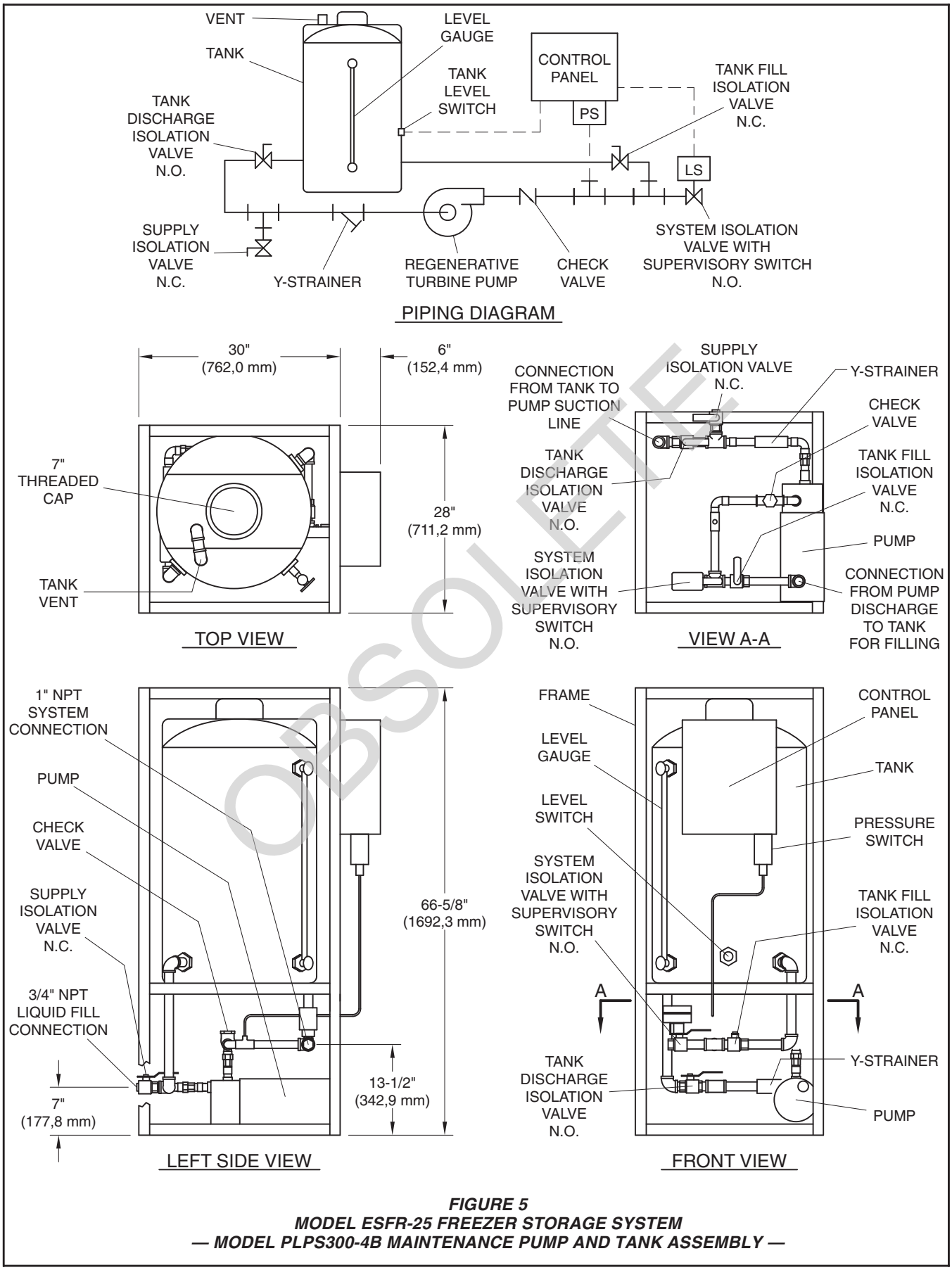


FIGURE 5
MODEL ESFR-25 FREEZER STORAGE SYSTEM
— MODEL PLPS300-4B MAINTENANCE PUMP AND TANK ASSEMBLY —

Maximum Building Height, Ft. (m)	Maximum Storage Height, Ft. (m)	Minimum Design Pressure, PSI (Bar)
45 (13,7)	40 (12,2)	50 (3,5)
40 (12,2)	35 (10,7)	40 (2,8)
35 (10,7)	30 (9,1)	30 (2,1)
30 (9,1)	25 (7,6)	20 (1,4)

TABLE A
HYDRAULIC DESIGN PRESSURES
(To protect Class I, II, III, IV and cartoned unexpanded plastics)

Maximum Building Height, Ft. (m)	Maximum Storage Height, Ft. (m)	Minimum Design Pressure, PSI (Bar)
40 (12,2)	35 (10,7)	50 (3,5)

TABLE B
HYDRAULIC DESIGN PRESSURES
(To protect uncartoned unexpanded plastics)

INITIAL FLUID VOLUME (GAL.)	TEMPERATURE CHANGE			
	20°F	40°F	60°F	80°F
	APPROXIMATE FLUID EXPANSION/CONTRACTION (GAL.)			
50	0.244	0.488	0.735	0.979
100	0.488	0.978	1.470	1.958
500	2.442	4.884	7.348	9.790
1000	4.884	9.768	14.696	19.580
1500	7.326	14.652	22.044	29.370
2000	9.768	19.536	29.392	39.160
2500	12.210	24.420	36.740	48.950
3000	14.652	29.304	44.088	58.740

TABLE C
WILFLOW FLUID "B" EXPANSION/CONTRACTION

Design Criteria

NOTE
The ESFR-25 Freezer Storage Protection System is a variation of the "Anti-freeze System" defined in NFPA 13 or FM's Data Sheet 2-8N. However, this system has distinctly different design criteria as described as follows; consequently, the design criteria for "Anti-freeze Systems" defined in NFPA 13 or FM's Data Sheet 2-8N do not apply and must not be utilized.

Installation - Layout and Design
Flow rates, pipe sizing, sprinkler spacing, hanging methods, and system design for the ESFR-25 Freezer Storage System must be in accordance with Factory Mutual guidelines for ESFR Sprinklers (Data Sheets 2-2, 8-9, and 8-31).

Special consideration must be taken when utilizing ESFR sprinklers near air handling units. Refer to FM Data Sheet 2-2 for guidelines and recommendations.

Commodity Classification
The Model ESFR-25 Freezer Storage System may be used to protect Class I, II, III, IV and cartoned unexpanded plastics (excluding open top combustible containers in racks, uncartoned unexpanded plastics, and all expanded plastics) commodities in open-frame racks or solid piled/palletized (open or closed array). Refer to Table A for maximum building and ceiling heights.

The system may also be used to protect uncartoned unexpanded plastic commodities (excluding open-top combustible containers in racks) in open frame racks or solid-piled/palletized (open or closed array). Refer to Table B for maximum building and ceiling heights.

Minimum Calculated Pressures
Refer to Table A or B, as applicable.

Pipe Type and Sizing
The pipe must be black, minimum schedule of 10 or greater. Pipe sizing must be determined using a hydraulic calculation program utilizing the Hazen-Williams formula to determine friction loss in piping, as well as utilizing the Darcy-Weisbach method to account for the friction loss through the piping system when flowing viscous fluids. The calculation program must be the FM recognized Tyco Fire Products SprinkCalc™ Hydraulic Program. (Also see "Hydraulic Calculations" below.)

Grooved Piping Products
Central Grooved Piping Products have been specifically tested with WilFlow Fluid "B" and are compatible with the ESFR-25 Freezer Storage System. Rigid couplings with Tri-Seal Grade "E" gaskets. A petroleum free silicone based lubricant should be used for all cold/freezer environments.

NOTE
Use of flexible couplings with standard type gaskets and standard lube is not recommended for freezer applications and may cause leakage.

Hydraulic Calculations
Hydraulic calculations shall be based on both sets of the following calculations:

1) The hydraulically most demanding 12 ESFR sprinklers operating, 4 each on three separate branch-lines, supplying minimum pressures per Table A or B. This calculation (assuming flow of water) must use the Hazen-Williams

formula for friction loss, with a C-Factor of 120 or the "Darcy-Weisbach" formula.

2) The hydraulically most demanding 6 ESFR sprinklers; 3 sprinklers each on 2 branch lines, supplying minimum pressures per Table A or B. This calculation (assuming flow of WilFlow Fluid "B") must use the FM recognized Tyco Fire Products SprinkCalc Hydraulic Program that is capable of automatically adjusting the pressures to accommodate for the increases in pressure requirements to maintain the required flow for the viscosity of WilFlow Fluid "B".

Low Point Drains
All piping must be pitched to drain back to the riser. Low point drains shall be installed where drainage back to the riser cannot be accomplished. All fluid is to be completely removed from low points before a new batch of fluid is loaded into the system.

Venting of Air
The system piping shall be vented of air from trapped high points. Venting may be accomplished by individual vent valves or by a common line connecting high points and piped to a common vent valve located at the highest point.

Fluid Sampling Valve Connection
A Fluid Sampling Valve Connection (Ref. Figure 6) must be located at the top of each system riser. The sampling connection will facilitate implementing the service requirements outlined in the Care and Maintenance section.

Sprinklers
Sprinklers are to be 165°F/74°C temperature rated Model ESFR-25 Pendent Sprinklers. The ESFR-25 Sprinklers are to be connected to the system piping via dielectric connections (Ref. Figure 7).

Riser Arrangement
The Riser Arrangement (Ref. Figure 8) must be installed in an area not subject to freezing (minimum temperature of 40°F/4°C). The Riser Arrangement is to include a supervised System Control Valve; an F200 Alarm Check Valve with ESFR-25 "Freezer Trim"; a supervised System Shut-off Valve installed immediately above of the F200 Alarm Check Valve; and, a Model PLPS300-4B Maintenance Pump and Tank Unit. Pipe from the Maintenance Pump and Tank Unit to the Alarm Check Valve shall be 1 inch, brass or copper.

The use of a supervised System Shut-off Valve installed immediately above of the F200 Alarm Check Valve will facilitate implementing the service re-

MINIMUM ACCUMULATOR SIZE	
RISER SIZE, INCHES	DIM. A MINIMUM, INCHES
4	23
6	9
8	4

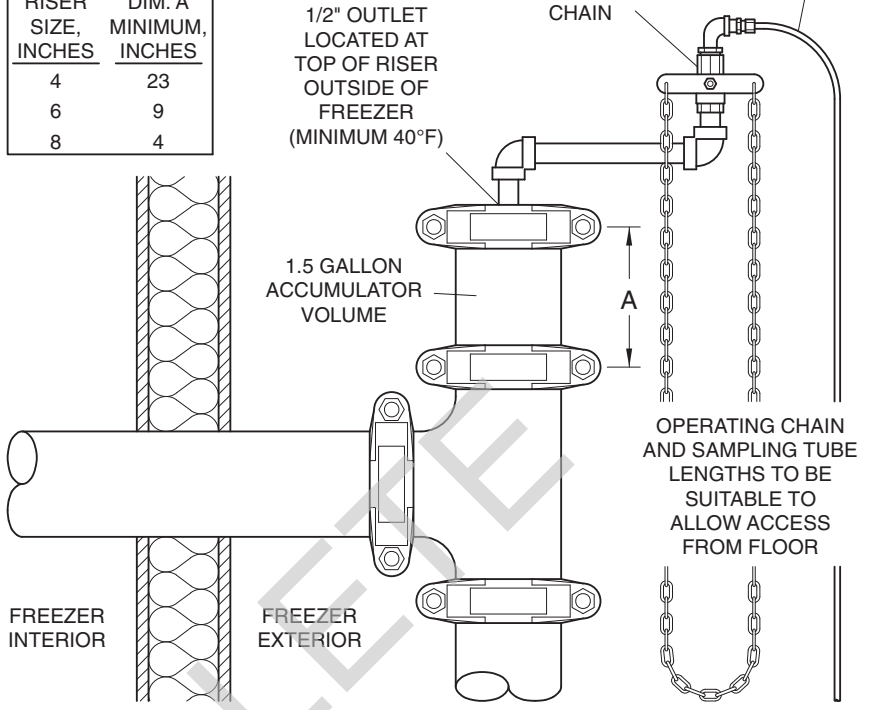


FIGURE 6
MODEL ESFR-25 FREEZER STORAGE SYSTEM
— FLUID SAMPLING VALVE CONNECTION —

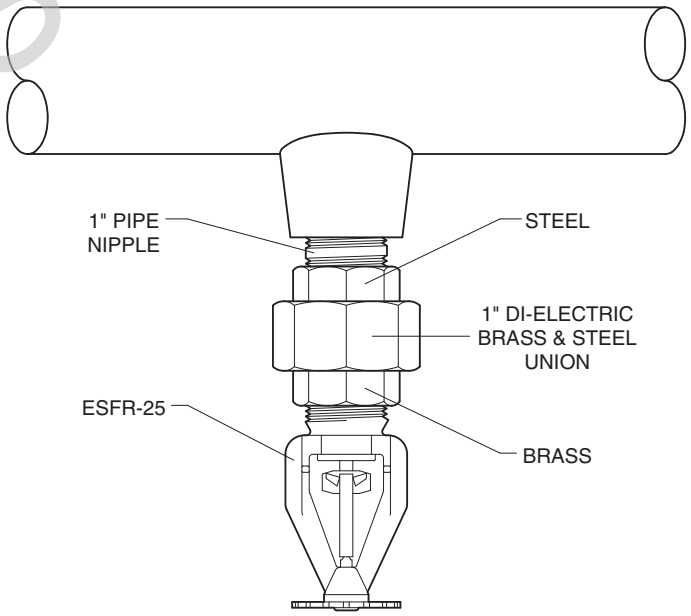


FIGURE 7
MODEL ESFR-25 FREEZER STORAGE SYSTEM
— TYPICAL SPRINKLER CONNECTION ARRANGEMENT —

quirements outlined in the Care and Maintenance section.

Maintenance Pump and Tank Unit
Refer to the Maintenance Pump and Tank Unit "Installation and Maintenance Instructions" prepared by General Air Products for additional information.

It is recommended that one Maintenance Pump and Tank Unit be provided per riser header, assuming that there are no more than five systems supplied by this header.

NOTE

In the event that the water supply static pressure exceeds 165 psi (11,4 bar) at the Alarm Check Valve, a pressure-reducing valve shall be installed in the water supply to the riser.

Inspector's Test Connection
An alarm test connection for this system is provided as part of the Alarm Check Valve "Freezer" trim. A remotely located Inspector's Test Connection for the function of performing alarm tests is not required per NFPA and must not be installed, since its use would introduce water that would compromise the effectiveness of the WilFlow Fluid "B". Provisions for performing alarm tests without affecting the integrity of the WilFlow Fluid "B" are provided in the Care and Maintenance section.

WilFlow Fluid "B" Considerations

Fluid Contraction. Table C shows approximate WilFlow Fluid "B" expansion/contraction volumes for various temperature changes. *(For example: If a sprinkler system with a volume of 2000 gallons is filled with WilFlow Fluid "B" when the temperature is 60F and the facility is later brought down to its operating condition of -20F (a difference of 80F), the temperature drop results in the fluid contracting by approximately 39 gallons.)* Therefore, during a facility "cool-down" period, a sufficient supply of fluid must be available to accommodate this contraction.

It is recommended that a 260 gallon Intermediate Bulk Container (IBC) be connected via the PLPS300-4B Unit, with the Unit in the "AUTO" mode, during this "cool-down" period to assure that adequate fluid is available during contraction. This recommendation is especially critical when the fluid pressure in multiple systems is maintained by one PLPS300-4B Unit.

Fluid Expansion. As noted within this data sheet, fluid expansion can occur during temperature increases. As an option, the relief port of the Pressure Relief Valve (Fig. 4 - Item 4) located on the Alarm Check Valve can be piped to a reservoir so that the fluid may be captured during expansion and reused as necessary. This option can be utilized to encompass temperature changes in the temperature surrounding the riser, wherein a small amount of expansion can be anticipated. The reservoir is to be a closed top, clean container. *Use of a closed top container will prevent the WilFlow Fluid' "B" from absorbing moisture out of the air.*

NOTE

Expansion resulting from increasing the temperature in the freezer may not be able to be handled by the Pressure Relief Valve. Consequently, it is recommended that the Pressure Relief Valve itself not be relied on for large amounts of fluid expansion as can be anticipated by Table C.

Installation

NOTES

Proper operation of the ESFR-25 Freezer Storage System depends upon its trim being installed in accordance with the instructions given in this Technical Data Sheet. Failure to follow the appropriate trim diagram may prevent the ESFR-25 Freezer Storage System from functioning properly, as well as void listings, approvals, and the manufacturer's warranties.

The ESFR-25 Freezer Storage System Riser Arrangement must be installed in a readily visible and accessible location and must be maintained at a minimum temperature of 40°F/4°C.

The ESFR-25 Freezer Storage System is to be installed in accordance with the following criteria:

Step 1. With reference to Figure 6, assemble the Riser Arrangement.

Step 2. With reference to Figure 4, assemble the "Freezer Trim". All nipples, fittings, and devices must be clean and free of scale and burrs before installation. Use pipe thread sealant sparingly on male pipe threads only.

Step 3. Complete the drain connections from the Main Drain Valve and Drip Funnel, as appropriate.

Step 4. Install a water motor alarm and/or waterflow pressure alarm switch, as applicable.

Step 5. With reference to the Maintenance Pump and Tank "Installation and Maintenance Instructions", install the Maintenance Pump and Tank, and complete the 1 inch copper or brass pipe connections from the Maintenance Pump and Tank to the "Freezer Trim".

Step 6. Make certain that the system piping has been outfitted with Air Vent Valve(s) and Fluid Sampling Valve Connection per the plans provided by the system designer.

Step 7. Make certain that the ESFR-25 Sprinklers are outfitted with dielectric connections.

Step 8. Conduit and electrical connections are to be made in accordance with the requirements of the authority having jurisdiction and/or the National Electric Code.

Step 9. The system is to be pressure tested as follows:

NOTES

Do not use water to perform a hydrostatic pressure test. *The use of water will require the undesirable need for draining each sprinkler drop as would be necessary to avoid the formation of ice plugs that could adversely affect the system performance.*

When performing the hydrostatic pressure tests, the Pressure Relief Valve (Fig. 4 - Item 4) must be removed, the tee (Fig. 4 - Item 17) must be plugged, and the System Isolation Valve (Fig. 8 - Item 9) must be closed.

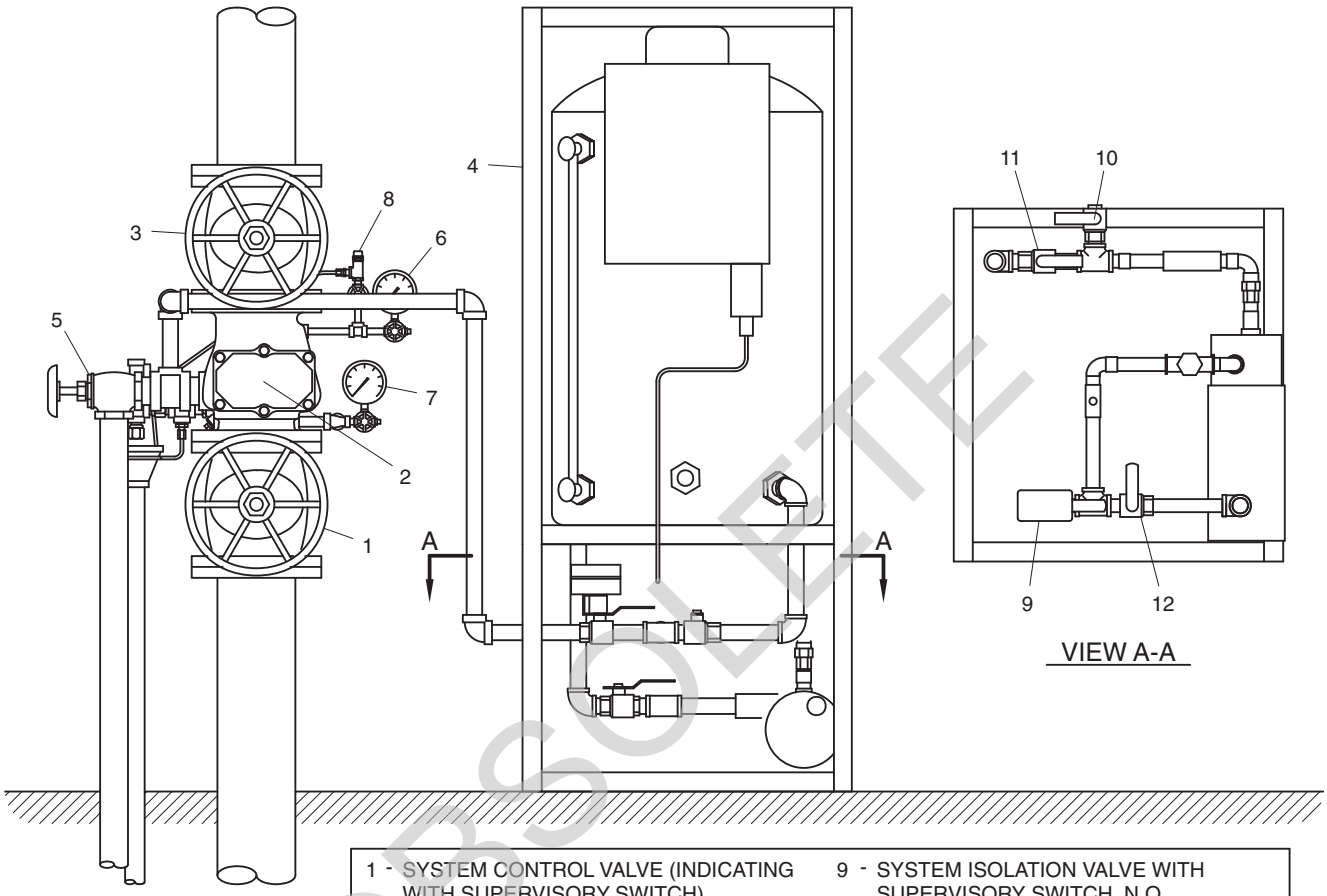
A. Before filling the system with WilFlow Fluid "B", it is recommended that a pneumatic pressure test be performed.

The system should initially be pressurized to 40 psi (2,8 bar) using nitrogen. The system must not have a pressure loss of more than 1 psi after 3 hours.

In lieu of using nitrogen pressure, compressed air may be used provided that the air has been dried. Caution must be taken to assure that the air is sufficiently dry for the temperature conditions that exist during the pressure test so as to avoid the introduction of any moisture into the system.

After a satisfactory pneumatic pressure test, relieve the pneumatic pressure.

B. After the system piping is filled with WilFlow Fluid "B" following the System Setting Procedure, temporarily pressurize the system to 222 psi (15,3 bar). The system must be able to maintain this pressure for 2 hours with no leakage. Loss shall be determined by drop in gauge pressure or visual leakage. The test pressure must be read from the System Pressure Gauge located at the Alarm Check Valve. *A test pressure of 222 psi (15,3 bar) is utilized since this meets the requirements of NFPA by testing at 50 psi (3,4 bar) in excess of the 172 psi (11,9 bar) working pressure provided by the Maintenance Pump and Tank.*



1 - SYSTEM CONTROL VALVE (INDICATING WITH SUPERVISORY SWITCH)	9 - SYSTEM ISOLATION VALVE WITH SUPERVISORY SWITCH, N.O.
2 - MODEL F200 ALARM CHECK VALVE	10 - SUPPLY ISOLATION VALVE, N.C.
3 - SYSTEM SHUT-OFF VALVE (INDICATING WITH SUPERVISORY SWITCH)	11 - TANK DISCHARGE ISOLATION VALVE, N.O.
4 - MAINTENANCE PUMP AND TANK	12 - TANK FILL ISOLATION VALVE, N.C.
5 - SYSTEM MAIN DRAIN VALVE	
6 - SYSTEM PRESSURE GAUGE	NOTE:
7 - SUPPLY PRESSURE GAUGE	ALL PIPE AND FITTINGS FROM STORAGE TANK TO ALARM VALVE SHALL BE BRASS OR COPPER.
8 - 1/2" PRESSURE RELIEF VALVE	

FIGURE 8
MODEL ESFR-25 FREEZER STORAGE SYSTEM
— RISER ARRANGEMENT —

System Setting Procedure

The setup and filling of the system should be performed in accordance with the following procedures:

Step 1. Confirm that the System Control Valve (Fig. 8 - Item 1) is closed and that the the System Shut-off Valve (Fig. 8 - Item 3) is open.

Step 2. Confirm that the "On-Off-Auto" Switch on the Pump and Tank Unit is in "Off" position.

Step 3. Confirm that the system is completely drained and that the Main Drain Valve (Fig. 8 - Item 5) is closed. Refer to the "Sprinkler System Drain-Down" procedure in the Care and Maintenance section.

Step 4. Confirm that the 1/4 inch gauge test valves (Fig. 4 - Item 2) for the supply and system pressure gauges are open.

Step 5. Open the air vent valve located on the remote cross main.

NOTE

If multiple vent/bleeder valves are installed, i.e. one in each bay of construction, it is recommended that only the valve most remote from the riser be opened while filling the system with WilFlow Fluid "B".

Step 6. Close the System Isolation Valve (Fig. 8 - Item 9), Tank Discharge Isolation Valve (Fig. 8 - Item 11), Supply Isolation Valve (Fig. 8 - Item 10), and Tank Fill Isolation Valve (Fig. 8 - Item 12).

Step 7. Connect the Intermediate Bulk Container (IBC) of WilFlow Fluid "B" to the Supply Isolation Valve (Fig. 8 - Item 10). Use of a flexible hose is permitted; however, do not restrict the flow from the WilFlow IBC.

NOTE

Positive head pressure must be maintained at the pump inlet connection.

Step 8. Open the valve on the IBC, and open the Supply Isolation Valve (Fig. 8 - Item 10) on the PLPS300-4B Unit.

Step 9. Open the System Isolation Valve (Fig. 8 - Item 9).

Step 10. Switch the "On-Off-Auto" Switch on the Pump and Tank Unit control panel to the "On" position. Liquid will begin to fill the system.

As each IBC is emptied and before the flexible hose connection is emptied, switch the the "On-Off-Auto" Switch on the Pump and Tank Unit control panel to the "Off" position.

NOTE

Positive head pressure must be maintained at the pump inlet connection.

Repeat Steps 6 through 10 until the system is filled and discharge of aerated fluid ceases at the remote vent valve in the system. At this time, switch the "On-Off-Auto" Switch on the Pump and Tank Unit control panel to the "Off" position and close the remote vent valve.

Step 11. Close the System Isolation Valve (Fig. 8 - Item 9).

Step 12. Fill the tank of the Pump and Tank Unit by first opening the Tank Fill Isolation Valve (Fig. 8 - Item 12).

Step 13. Switch the "On-Off-Auto" Switch on the Pump and Tank Unit control panel to the "On" position. Liquid will begin to fill the tank of the Pump and Tank Unit.

Step 14. When the tank of the Pump and Tank Unit is filled, switch the "On-Off-Auto" Switch on the Pump and Tank Unit control panel to the "Off" position, close the Tank Fill Isolation Valve (Fig. 8 - Item 12), close the Supply Isolation Valve (Fig. 8 - Item 10), open the Tank Discharge Isolation Valve (Fig. 8 - Item 11), and open the System Isolation Valve (Fig. 8 - Item 9).

Step 15. Switch the "On-Off-Auto" Switch to the "Auto" position. The system will pressurize to approximately 172 psi. Systematically open and close each vent valve in the system piping, working from the remote vent valve to the vent valve nearest to the riser. Close each vent valve after discharge of aerated fluid ceases.

NOTES

The PLPS300-4B Maintenance Pump incorporates a "built-in" 15 minute delay between starts when in the "auto" mode.

It is possible for air pockets/bubbles to exist within a piping system even after initial venting of air. It can, however, take time for these pockets/bubbles to migrate through a system-piping network. The venting procedure is to be performed again at least 24 hours after the initial venting and then repeated every 24 hours until air no longer discharges from vent valves.

Step 16. Slowly open the System Control Valve (Fig. 8 - Item 1). Determine the static pressure reading as indicated on the Supply Pressure Gauge (Fig. 8 - Item 7). Verify that reading is a minimum of 7 psi (0,5 bar) below the System Pressure Gauge reading (Fig. 8 - Item 6).

Step 17. Perform an "Alarm Test" per the alarm test procedures noted in The Care and Maintenance section.

Step 18. Using the Fluid Sampling Valve Connection (Fig. 6), confirm that the specific gravity of the WilFlow Fluid "B" is within tolerance of that published by JRW Technologies, Inc. (See "Fluid Inspection" in the Care and Maintenance section for methods and procedures for sampling of the WilFlow Fluid "B").

Upon confirming the required specific gravity of the WilFlow Fluid "B", the system is now set for service.

NOTE

Refer to Step 15 regarding complete air venting of the system.

Care and Maintenance

The following procedures are to be performed as indicated, in addition to any specific requirements of the NFPA, and any impairment must be immediately corrected.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any authority having jurisdiction. The installing contractor or product manufacturer should be contacted relative to any questions.

It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service.

NOTES

It is recommended that individuals responsible for care and maintenance of the ESFR-25 Freezer Storage System develop an overall understanding of the system prior to performing inspection and service procedures. The instructions of this technical data sheet as well as individual instructions for the Alarm Valve, Switches, Maintenance Pump and Tank, etc. should be reviewed.

The alarm test and main drain test procedures, as well as performing the service to determine the cause for leakage from the alarm line drain, will result in operation of the associated alarms. Consequently, notification must first be given to the owner and the fire department, central station, or other signal station to which the alarms are connected.

When optional electrically supervised alarm control valve is installed on Alarm Valve Trim, and it was silenced during operation, it must be re-opened immediately after the fire protection system is restored to service

Before closing a fire protection system System Control Valve for maintenance work on the fire protection system that it controls, permission to shut down the affected fire protection systems must first be obtained from the proper authorities and all personnel who may be affected by this decision must be notified.

The following procedures refer to the ESFR-25 Freezer Storage System and are not all inclusive of normal system maintenance. For other system devices, such as main control and shut-off valves, supervisory devices, sprinklers, etc. refer to NFPA 25 and individual manufacturers instruction for information on appropriate maintenance procedures and frequency recommendations.

SYSTEM INSPECTION AND TEST PROCEDURES

Leakage From Alarm Line Drain Inspection

At least quarterly, inspect for leakage from the Restriction Assembly (Fig. 4 - Item 3) to determine the integrity of the Alarm Check Valve Clapper Facing as it relates to maintaining the WilFlow Fluid “B” excess pressure over the water supply pressure. If leakage is present, refer to “Fluid Inspection” and then determine the cause of leakage by referring to the “Leakage from Alarm Line Drain” under Service Procedures.

Alarm Test

At least quarterly, perform an alarm test. Notify the proper authorities and all personnel who may be affected, that an alarm test is to be performed.

Step 1. Open the Alarm Test Valve. (Fig. 4 - Item 5). Verify that the water motor alarm and/or the pressure alarm switch properly actuate and within the elapsed time required by the authority having jurisdiction.

Step 2. Verify that water is flowing out of the alarm line drain at a rate consistent with the 0.125-inch (3,2 mm) diameter orifice in the Drain Restriction. If the alarm line drain appears to be clogged, determine the cause by referring to the “Clogged Alarm Line Drain” under Service Procedures.

Step 3. Close the Alarm Test Valve.

Step 4. Verify that water ceases to flow from the alarm line drain.

Step 5. Clean the 1/2-inch Y-Strainer (Fig. 4 - Item 6). If a Water Motor Alarm is being utilized, also clean the 3/4-inch Strainer located at the connection to the water motor alarm. Be sure to replace the strainer baskets and tighten the caps securely.

NOTE

Cleaning of the Strainers after each operation of the alarms is especially important in the case of water supplies (such as lakes and rivers) having a large quantity of suspended matter. A clogged alarm line can prevent operation of the alarms.

Step 6. Notify all authorities responsible for monitoring the installation that the fire protection system has been returned to service.

Main Drain Test

At least annually perform a main drain test. A main drain test (flow test) must be performed as recommended by NFPA 25. The following procedure must be followed when performing a main drain test for the ESFR-25 Freezer Storage System.

Step 1. Close the System Shut-off Valve (Fig. 8 - Item 3) located above the Alarm Check Valve.

Step 2. Record the pressure as indicated on the Supply Pressure Gauge (Fig. 8 - Item 7).

Step 3. Close the System Isolation Valve (Fig. 8 - Item 9).

Step 4. Fully open the Main Drain Valve (Fig. 8 - Item 5).

Step 5. After flow has stabilized, record the residual pressure as indicated on the Supply Pressure Gauge (Fig. 8 - Item 7). Compare this reading to previous readings, and correct any impairments as necessary.

Step 6. Close the Main Drain Valve (Fig. 8 - Item 5).

Step 7. Close the System Control Valve (Fig. 8 - Item 1) located below the Alarm Check Valve.

Step 8. Open Main Drain Valve (Fig. 8 - Item 5) again to drain the water between Alarm Check Valve clapper and System Shut-off Valve located above the Alarm Check Valve.

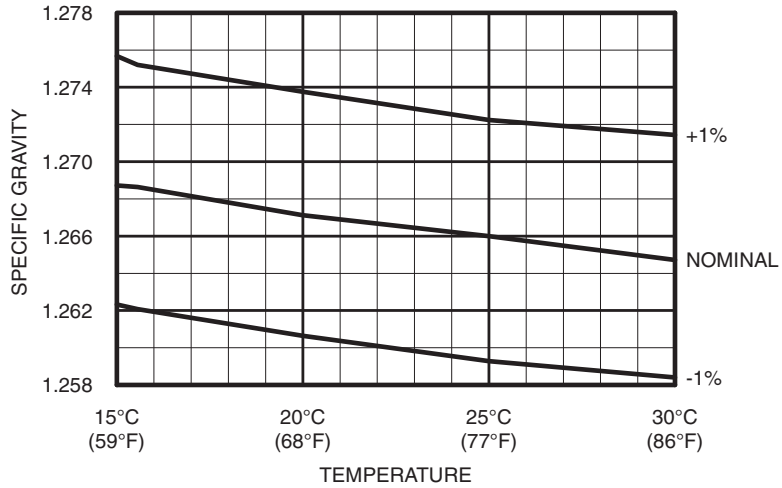
Step 9. Remove the Handhole Cover (Fig. 3 - Item 2) from the F200 Alarm Check Valve and remove any standing water from inside the Alarm Check Valve. While the Handhole Cover is removed, take this opportunity to wipe clean the Seat Ring (Fig. 3 - Item 4) and Clapper Facing (Fig. 3 - Item 6) with a clean cloth. After cleaning the Clapper Facing and Seat Ring, replace the Handhole Cover.

Step 10. Close Main Drain Valve (Fig. 8 - Item 5).

Step 11. Open the System Isolation Valve (Fig. 8 - Item 9). (The Maintenance Pump should momentarily operate, re-pressurizing the system side of the Alarm Check Valve.)

Step 12. Open System Shut-off Valve (Fig. 8 - Item 3) located above the Alarm Check Valve. (The Maintenance Pump may momentarily operate, re-pressurizing the system side of the Alarm Check Valve)

Step 13. Slowly open the System Con-



GRAPH A
NOMINAL SPECIFIC GRAVITY FOR WILFLOW FLUID "B"
AS A FUNCTION OF TEMPERATURE
(ACCEPTABLE TOLERANCE OF PLUS OR MINUS ONE PERCENT)

trol Valve (Fig. 8 - Item 1) located below the Alarm Check Valve.

S**tep 14.** Notify all authorities responsible for monitoring the installation that the fire protection system has been returned to service.

Fluid Inspection

NOTE

This system utilizes an FM Approved non-freezing solution specifically tested and approved by FM for use within the strict parameters and requirements as called for within this data sheet. Proper periodic fluid inspection as recommended herein must be performed to ensure system integrity and performance, and is the responsibility of the owner. It is recommended that a qualified inspection service perform these inspections.

At least quarterly, sampling of the WilFlow Fluid "B" shall be taken from the Fluid Sampling Valve Connection(s) and a measurement performed on the specific gravity of the fluid shall be taken.

If the specific gravity deviates from that originally supplied (within the allowed tolerance) for all three samples, the fluid must be replaced.

If the specific gravity deviates from that of the supplied fluid for any of the three samples, proper steps to inspect and repair the Alarm Check Valve must be taken.

NOTE

The Fluid Sampling Valve Connection (Ref. Figure 6) acts as an accumulator to trap any possible leakage of water past the Alarm Check Valve. The volume of the Fluid Sampling Valve Connection is such that it allows for up to three samplings so as to not needlessly replace the WilFlow Fluid "B" should a deviation of specific gravity have been detected in the first one or two samples.

The procedure for fluid sampling and measuring must be performed as follows:

Step 1. Discharge a 1/2 gallon (1,9 litre) of fluid from the Fluid Sampling Valve Connection (Ref. Figure 6). The sample is to be collected into a clean, dry, 3/4 gallon (2,8 litre) or larger container and then sealed. *Use of a closed top container will prevent the WilFlow Fluid "B" from absorbing moisture out of the air, preventing an erroneous reading.*

Step 2. Allow sample to warm until reaching a minimum temperature of 59F/15C in order to utilize Graph A.

Step 3. Perform a specific gravity test using a Combined Form Hydrometer and 500 ml Calibrated Graduated Cylinder as outlined in Steps 4 through 6.

Step 4. After filling the 500 ml calibrated cylinder with WilFlow Fluid "B", gently insert the Combined Form Hydrometer into the cylinder and allow the Hydrometer to float. *If necessary add fluid to the cylinder until the Hydrometer is floating.*

Step 5. Note the temperature showing on the thermometer portion of the Hydrometer. Also note the specific gravity reading as shown on the Hydrometer at the top of the fluid.

Step 6. Using Graph A, find the point on the graph representing the temperature and specific gravity readings. This point must lie within the +1% and -1% of the nominal curves shown.

Step 7. If the test results for the first sample are within the allowed tolerance, the inspection has been completed. Otherwise proceed to Step 8.

Step 8. If the test results are not within the allowed tolerance, Steps 1 through 6 may be repeated up to two additional attempts. Appropriate specific gravity measurement in any of the three samples confirms fluid integrity.

Pipe/Fittings/Sprinkler Inspection

Pipe, fittings, and sprinklers must be inspected at minimum frequencies as called for by NFPA 25. They shall be free of mechanical damage, leakage, and corrosion. Corrective action must be taken immediately if any of these conditions exist.

SERVICE PROCEDURES

Sprinkler System Drain-Down

Draining the sprinkler system must be done in accordance with the following procedures.

NOTES

If the system is being drained after a system operation, as in the case of a fire, and when the system has been infiltrated with water, the water/fluid drained from the system must be discarded. Special consideration must be given to draining all of the sprinkler drops, as well as any low points. In addition, inspect for and clear all ice plugs, where system piping has been exposed to freezing conditions and when there has been a flow of water into the system.

If the system is being drained for service and water has not entered the system, the WilFlow Fluid "B" may be drained into a closed top, "clean, dry and odorless" container, and used to re-fill the system. It is the responsibility of the container supplier to certify that the container being used is "clean, dry and odorless." The use of containers that do not meet these criteria could introduce substances (including moisture) back into the WilFlow Fluid "B" that would be detrimental to the fluid and system.

Step 1. Close the System Control Valve (Fig. 8 - Item 1)

Step 2. Close the System Isolation Valve (Fig. 8 - Item 9).

Step 3. Open vent valve(s) located at the high points.

Step 4. Open the Main Drain Valve (Fig. 8 - Item 5).

Step 5. After drainage has completely ceased from Main Drain Valve, open and completely drain any low point drains.

Step 6. Replace any sprinklers which may have activated.

Leakage From Alarm Line Drain

Follow the steps indicated below until water ceases to flow from the alarm line drain. Check for the discontinuation of the leakage after each step is complete. Keep in mind however, that alarms will sound during this procedure.

Close the System Shut-off Valve (Fig. 8 - Item 3) to prevent drain-back of WilFlow Fluid "B" during the following steps.

Step 1. Close the System Isolation Valve (Fig. 8 - Item 9).

Step 2. Open the Main Drain Valve (Fig. 8 - Item 5). Let the water flow for about 5 seconds before tightly re-closing the valve. This should flush any loose debris that may have become trapped between the Alarm Check Valve Clapper Facing and the Seat Ring.

Step 3. Repeat Steps 1 and 2 if the rate of continued flow out of the drain was noticeably reduced. If leakage continues, proceed to Step 4. If leakage stops, reset the system by opening the System Isolation Valve (Fig. 8 - Item 9) followed by the System Shut-off Valve (Fig. 8 - Item 3). The system is now reset.

Step 4. Open the Alarm Test Valve (Fig. 4 - Item 5) and allow the water to flow for about 5 seconds before re-closing the valve. This should flush out any loose debris that may have become trapped in the seating area of the Alarm Test Valve.

Step 5. Repeat Step 4 if the rate of continued flow out of the drain was noticeably reduced. If leakage continues, proceed to Step 6. If leakage stops, reset the system by opening the System Isolation Valve (Fig. 8 - Item 9) followed by the System Shut-off Valve (Fig. 8 - Item 3). The system is now reset.

Step 6. Slowly loosen the union in the Alarm Test valve by-pass and determine whether the water is flowing from the Alarm Port (Fig. 3) or past the Alarm Test Valve. If the leakage is past the Alarm Test Valve, close the System Control Valve (Fig 8 -Item 1), and then repair or replace the Alarm Test Valve as necessary. Re-assemble the union and reset the system by opening the System Isolation Valve (Fig. 8 - Item 9), opening the System Shut-off Valve (Fig. 8 - Item 3), and opening the System Control Valve (Fig 8 -Item 1). The system is now reset.

Step 7. If it appears the leakage noted in Step 6 is from the Alarm Port, the Clapper Facing in the Alarm Check Valve is to be replaced and the Seat Ring inspected as follows:

(A) Close the System Control Valve (Fig. 8 - Item 1) and open the Main Drain Valve (Fig. 8 - Item 5).

(B) Remove the Handhole Cover. While holding the spring down by the coils, remove the Hinge Pin. Remove the Spring and Clapper Assembly (Fig 3 - Items 5, 6, 7, 8, and 10).

(C) Using a light, check for and remove any debris that may have become lodged within the Seat Ring groove. Inspect the Seat Ring seat for any damage. If the Seat Ring has become dented across the seat, the valve must be replaced. It is impractical to re-face a Seat Ring in the field.

(D) Check for and remove any debris which may have become lodged in the Clapper Facing. If a minor imperfection remains in the Clapper Facing, then turn it over after thoroughly cleaning both surfaces with a clean cloth. Replace the Clapper Facing if necessary. Be sure to securely re-tighten the retaining screw for the Clapper Washer.

(E) Replace the spring and Clapper Assembly as shown in Figure 3 and then while holding the coils of the Spring down, re-insert the Hinge Pin. Be sure that the Hinge Pin is pushed all the way to the rear of the valve.

(F) Replace the Handhole Cover.

(G) Close the Main Drain Valve.

(H) Open the System Isolation Valve (Fig. 8 - Item 9). (The Maintenance Pump should momentarily operate, re-pressurizing the system side of the Alarm Check Valve.)

(I) Open System Shut-off Valve (Fig. 8 - Item 3) located above the Alarm Check Valve. (The Maintenance Pump may momentarily operate, re-pressurizing the system side of the Alarm Check Valve)

(J) Slowly open the System Control Valve (Fig. 8 - Item 1) located below the Alarm Check Valve.

The system is now reset.

Clogged Alarm Line Drain

If water either does not flow or only dribbles out of the alarm line drain during an alarm test, then it is likely that the screen protecting the drain restriction orifice (Fig. 4 - Item 3) has become clogged. Unscrew the Drain Restriction from the Restriction Assembly and clean the screen by back flushing.

NOTE

A clogged alarm line drain will increase the likelihood of a false alarm in the case of a variable pressure system.

Limited Warranty

Products manufactured by Tyco Fire Products are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by Tyco Fire Products. No warranty is given for products or components manufactured by companies not affiliated by ownership with Tyco Fire Products or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by Tyco Fire Products to be defective shall be either repaired or replaced, at Tyco Fire Products' sole option. Tyco Fire Products neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. Tyco Fire Products shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

IN NO EVENT SHALL TYCO FIRE PRODUCTS BE LIABLE, IN CONTRACT, TORT, STRICT LIABILITY OR UNDER ANY OTHER LEGAL THEORY, FOR INCIDENTAL, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LABOR CHARGES, REGARDLESS OF WHETHER TYCO FIRE PRODUCTS WAS INFORMED ABOUT THE POSSIBILITY OF SUCH DAMAGES, AND IN NO EVENT SHALL TYCO FIRE PRODUCTS' LIABILITY EXCEED AN AMOUNT EQUAL TO THE SALES PRICE.

THE FOREGOING WARRANTY IS MADE IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Ordering Procedure

All orders for ESFR-25 Freezer Storage System components must include the description and Part Number (P/N), where applicable.

WilFlow Fluid "B":
Specify: (Quantity in U.S. Gallons) of WilFlow Fluid "B", P/N 540244.

NOTES

WilFlow Fluid "B" is shipped in an IBC containing approximately 260 gallons.

Minimum order of 53 gallons is required.

WilFlow Fluid "B" is subject to expansion and contraction with temperature changes. Consideration must be given to fluid contraction, which will occur when the temperature in the refrigerated area is decreased to its eventual operating condition. An adequate supply of spare WilFlow Fluid "B" must be available on site to accommodate this expected contraction. Refer to the Design Criteria section for appropriate expansion/contraction volumes.

ESFR-25 Sprinklers:
Specify: 165° F, Model ESFR-25 Pendent Sprinkler, P/N 58-441-1-165.

ESFR-25 Sprinkler Wrench:
Specify: W-Type 1 Sprinkler Wrench, P/N 56-872-1-025.

Alarm Check Valve:
Specify: (size), (FxF, FxG, or GxG) Model F200 Alarm Check Valve , P/N (specify).

4 Inch FxF	P/N 52-200-1-013
6 Inch FxF	P/N 52-200-1-015
8 Inch FxF	P/N 52-200-1-016
4 Inch FxG	P/N 52-200-1-413
6 Inch FxG	P/N 52-200-1-615
8 Inch FxG	P/N 52-200-1-816
4 Inch GxG	P/N 52-200-1-113
6 Inch GxG	P/N 52-200-1-115

Freezer Trim:
(Ref. Figure 4):
Specify: Galvanized Freezer Trim for 4, 6, or 8 Inch Model F200 Alarm Check Valve, P/N 52-201-2-049.

Maintenance Pump and Tank:
Specify: Model PLPS300-4B Maintenance Pump and Tank,
P/N 54025.

Combined Form Hydrometer Kit:
Specify: Combined Form Hydrometer Kit including 500 ml Calibrated Graduated Cylinder and Carrying Case,
P/N 54026.

Di-electric Union:
Specify: 1 inch FxF Brass x Steel Di-electric Union, P/N 54027.

Weights:
The following are the nominal weights for the valves and trim:

4 Inch (100 mm) Model F200 F x F Alarm Check Valve	62 lbs. (28,1 kg)
6 Inch (150 mm) Model F200 F x F Alarm Check Valve	93 lbs. (42,2 kg)
8 Inch (200 mm) Model F200 F x F Alarm Check Valve	167 lbs. (75,8 kg)
4 Inch (100 mm) Model F2001 F X G Alarm Check Valve	51 lbs. (23,1 kg)
6 Inch (150 mm) Model F2001 F x G Alarm Check Valve	78 lbs. (35,4 kg)
8 Inch (200 mm) Model F2001 F x G Alarm Check Valve	148 lbs. (67,1 kg)
4 Inch (100 mm) Model F20 G X G Alarm Check Valve	45 lbs. (20,4 kg)
6 Inch (150 mm) Model F20 G x G Alarm Check Valve	68 lbs. (30,9 kg)
Freezer Trim	24 lbs. (10,9 kg)
260 Gallon Shipping Container Of WilFlow Fluid "B"	2759 lbs. (1250 kg)
Maintenance Pump and Tank Unit	429 lbs. (195 kg)