HALE

09/15/96

MST

MANUAL SINGLE TANK FLUSH SELECTOR

INSTALLATION MANUAL

All Hale products are quality components: ruggedly designed, accurately machined, precision inspected, carefully assembled and thoroughly tested. In order to maintain the high quality of your unit, and to keep it in a ready condition, it is important to follow the instructions on care and operation. Proper use and good preventive maintenance will lengthen the life of your unit. ALWAYS INCLUDE THE UNIT SERIAL NUMBER IN CORRESPONDENCE.

HALE PRODUCTS, INC. ● A Unit of IDEX Corporation ● 700 Spring Mill Avenue ● Conshohocken, PA 19428 ● TEL: 610-825-6300 ● FAX: 610-825-6440

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IDEX CORPORATION

HALE PRODUCTS INC.
ISO 9001
Certificate A4026

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NOTE TO SYSTEM INSTALLER
IMPORTANT: Please provide two copies of the Hale FoamMaster MST manual to the end user of the equipment. For additional manuals, contact Hale Products, Inc. at (610) 825-6300.
Ask for Manual P/N 029-0020-48-0.

1 SAFETY

Before attempting to install a Hale FoamMaster MST, read all of the following safety precautions and follow carefully.

1. **WARNING:** Do not supply flushing water at pressures higher than the maximum recommended pressure. (500 PSI (34 BAR))
2. **WARNING: Always disconnect the power source** before attempting to service any part of the system.
3. **WARNING: Release all pressure** within the system before servicing any of its components.
4. **WARNING: Drain all concentrate and water** from the system before servicing any of its component parts.
5. **WARNING:** Check all hoses for weak or worn conditions after each use. Ensure that all connections and fittings are tight and secure.
6. **WARNING:** Use only pipe, hose, and fittings from the foam pump outlet to the injector fitting, which are rated at or above the maximum pressure (500 PSI (34 BAR) minimum) rating at which the water pump system operates.
7. **WARNING:** Any electrical system has the potential to cause sparks during service. Take care to eliminate explosive or hazardous environments during service/repair.
8. **CAUTION:** Periodically inspect the pump and the system components.
9. **CAUTION:** Read and understand these installation instructions before proceeding with the equipment installation.
10. **CAUTION:** The foam tank low level sensor must be utilized to protect the foam pump from dry running. Failure to do so will void warranty.
11. **CAUTION:** The Hale FoamMaster MST flush selector is not recommended for use on top mount pump panels due to gravity feed from foam tank to foam pump requirement.
12. **CAUTION:** When selecting fittings make sure they are compatible with all foam concentrates that will be used. Some stainless steel fittings are not compatible with some Class B foam concentrates.
13. **CAUTION:** DO NOT connect the drain from the Hale FoamMaster MST to the apparatus multi drain system or do not tee onto single drain. Individual drain valves are recommended for foam system drains. If a multiple drain must be used Hale recommends the use of a Hale DV7 multiple drain valve (Hale P/N 529-5420-00-0) or equivalent that isolates each drain port.
14. **CAUTION:** The Hale FoamMaster MST flush selector handle must be in the **FOAM TANK** position. If the Hale FoamMaster MST flush selector handle is in the **FLUSH** position when the Hale FoamMaster foam pump is started the foam pump will only run for 20 seconds and shut down.
15. **CAUTION:** When shutting down the apparatus leave the Hale FoamMaster MST flush selector handle in the **FOAM TANK** position.

2 EQUIPMENT DESCRIPTION

The Hale FoamMaster MST flush selector is a simple and reliable valve that adds NFPA compliant flush capabilities to the Hale FoamMaster line of automatic rotary gear pump foam proportioners.

The Hale FoamMaster MST flush selector is a panel mounted valve that provides a mechanical means of flushing the Hale FoamMaster system. The major component of the Hale FoamMaster MST is a ball type selector valve. The valve has 3 ports and is operated manually. There is one ¾ inch NPT foam concentrate inlet with swing check valve attached and one ¾ inch NPT foam concentrate outlet. The remaining port is reduced to ¼ inch NPT for the flushing water connection. The flushing water connection is fitted with a ¼ inch NPT swing check valve to prevent contamination of the water supply with foam concentrate.

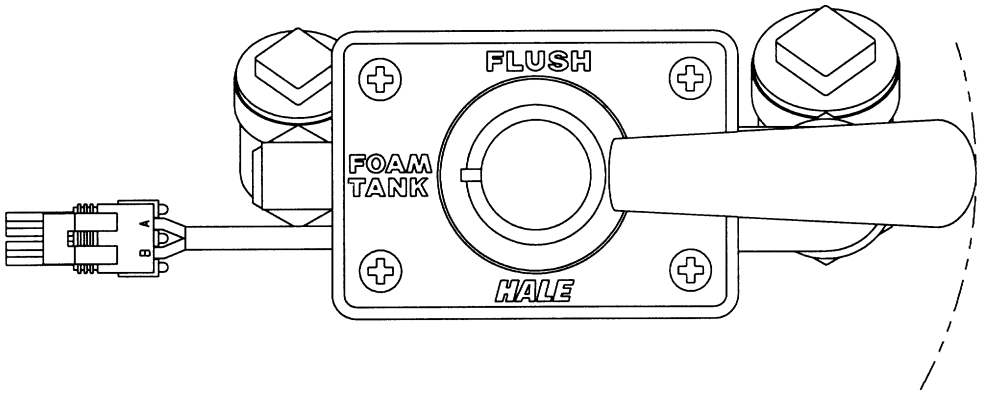
The valve has a FLUSH and FOAM TANK position.

A switch mounted on the Hale FoamMaster MST flush selector interlocks with the Hale Foammaster system to indicate when the selector is in the flush position.

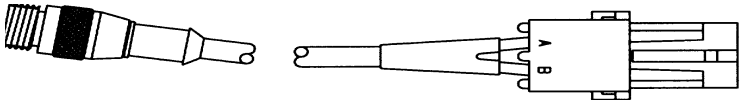
CAUTION: The Hale FoamMaster MST is not recommended for use on top mount pump panels due to gravity feed from foam tank to foam pump requirements.

NOTE: This manual details installation and use of the Hale FoamMaster MST flush selector only. Refer to the Hale FoamMaster foam system manual for information on complete foam system installation instructions.

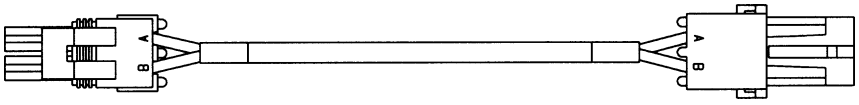
3 WHAT YOU GET



MST Flush Selector Assembly with Check Valves and Switch Attached
(Hale P/N 538-1490-02-0)



Hale MST Wiring Harness
(Hale P/N 513-0320-04-0)



Optional Wiring Harness Extension
72 inches (1829 mm) long
(Hale P/N 513-0320-07-0)

4 Hale MST Flush Selector Installation

INSTALLATION NOTES:
Before installing the Hale FoamMaster MST thoroughly read the installation instructions contained in this manual. The following notes provide background information to aid in the installation. Refer to Figures 1 and 2 to identify component parts and connections. Figure 3 shows a typical plumbing arrangement.

1. Threads for the foam concentrate inlet and outlet connections are ¾ inch NPT.

2. Fittings and hoses used with the Hale FoamMaster MST must be compatible with all foam concentrates that are to be used in the system. The fittings must be made of brass, 300 series stainless steel or nylon.

CAUTION: When selecting fittings make sure they are compatible with all foam concentrates that will be used. Some stainless steel fittings are not compatible with some Class B foam concentrates.

3. To meet NFPA requirements and to monitor foam concentrate priming, clear hoses must be used from the foam tank to the foam inlet swing check valves on the Hale FoamMaster MST. For Class A and low viscosity Class B foam concentrates use minimum ¾ inch inside diameter hose. High viscosity Class B foam concentrates require minimum 1 inch inside diameter hose. The hoses must be capable of withstanding 23 inches (584 mm) Hg vac/50 PSI (3 BAR) working pressure (Kuriyama, Kuri-tec K-7130 series or equal).

4. Hose from the Hale FoamMaster MST outlet port must have minimum ¾ inch

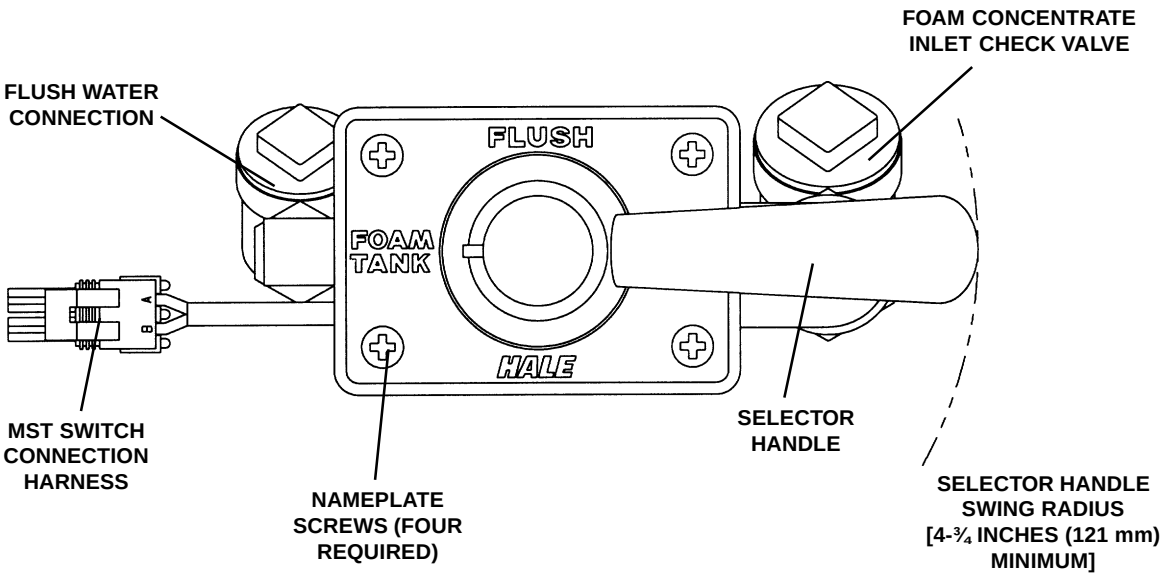


Figure 1. Hale FoamMaster MST Flush Selector Valve Assembly (Front View)

inside diameter and be capable of withstanding 23 inches (584 mm) Hg vac and the maximum discharge pressure of the fire pump (500 PSI (34 BAR) minimum) due to system flush requirements.

5. Flush water must be provided from the fire pump to the Hale FoamMaster MST. Hose for the flush connection should be minimum ½ inch outside diameter and capable of withstanding the maximum discharge pressure of the fire pump. The swing check valve at the flushing water connection on the Hale FoamMaster MST has ¼ inch NPT threads.

NOTE: A shutoff valve is recommended for this line to enable isolation of the Hale Foammaster MST for service.

6. Plan installation and determine location of the Hale FoamMaster MST on the operator panel. The following must be kept in mind when locating the Hale FoamMaster MST flush selector valve:

a.) Foam concentrate must gravity feed from the foam tanks to the Hale FoamMaster MST.

CAUTION: The Hale FoamMaster MST is not recommended for use on top mount pump panels due to gravity feed from foam tanks to foam pump requirements.

b.) Foam concentrate must gravity feed from the Hale FoamMaster MST to the Hale FoamMaster rotary gear pump or FS Series strainer.

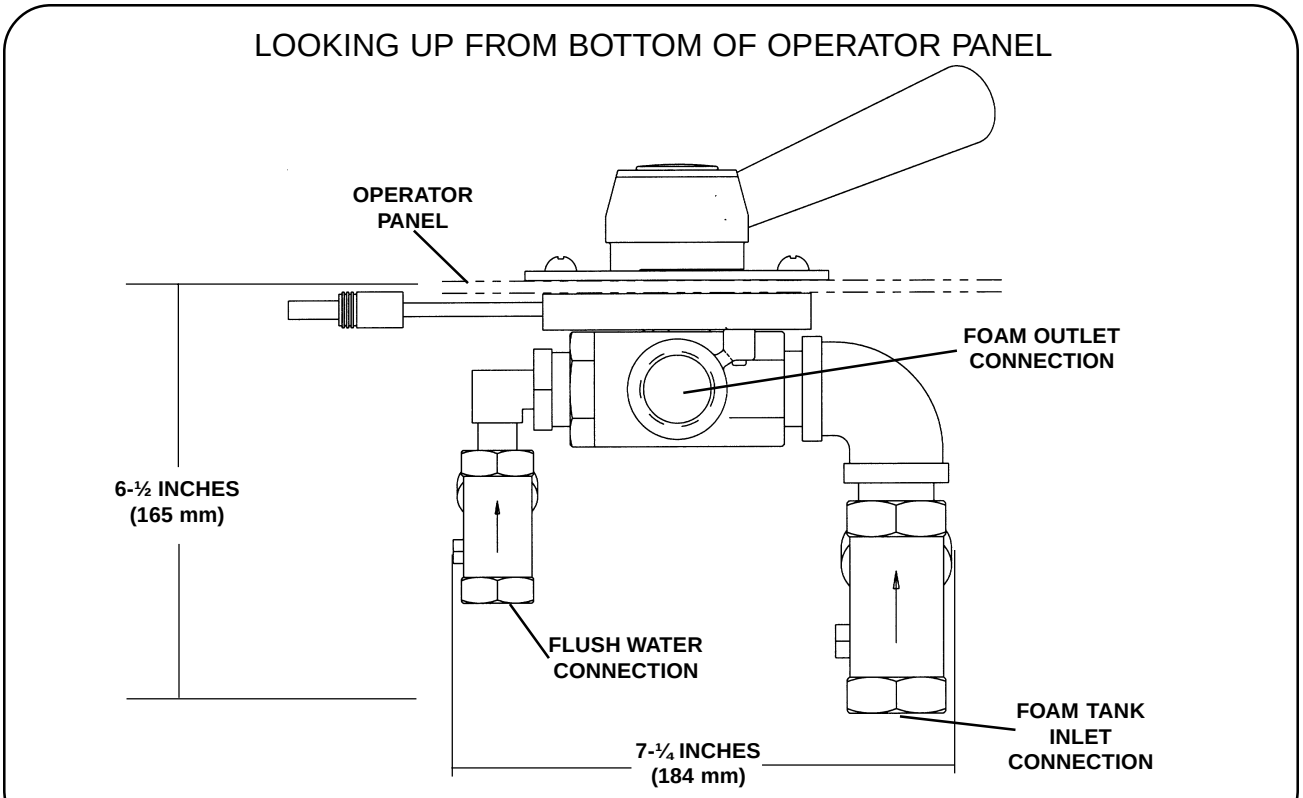


Figure 2. Clearance Required Behind Operator Panel for Hale FoamMaster MST

c.) A minimum of 6-½ inches (165 mm) plus allowance for the hoses and fittings behind the operator panel is required for Hale FoamMaster MST installation.

d.) The selector handle requires a swing radius of 4-¾ inches (121 mm) on the panel for unrestricted operation.

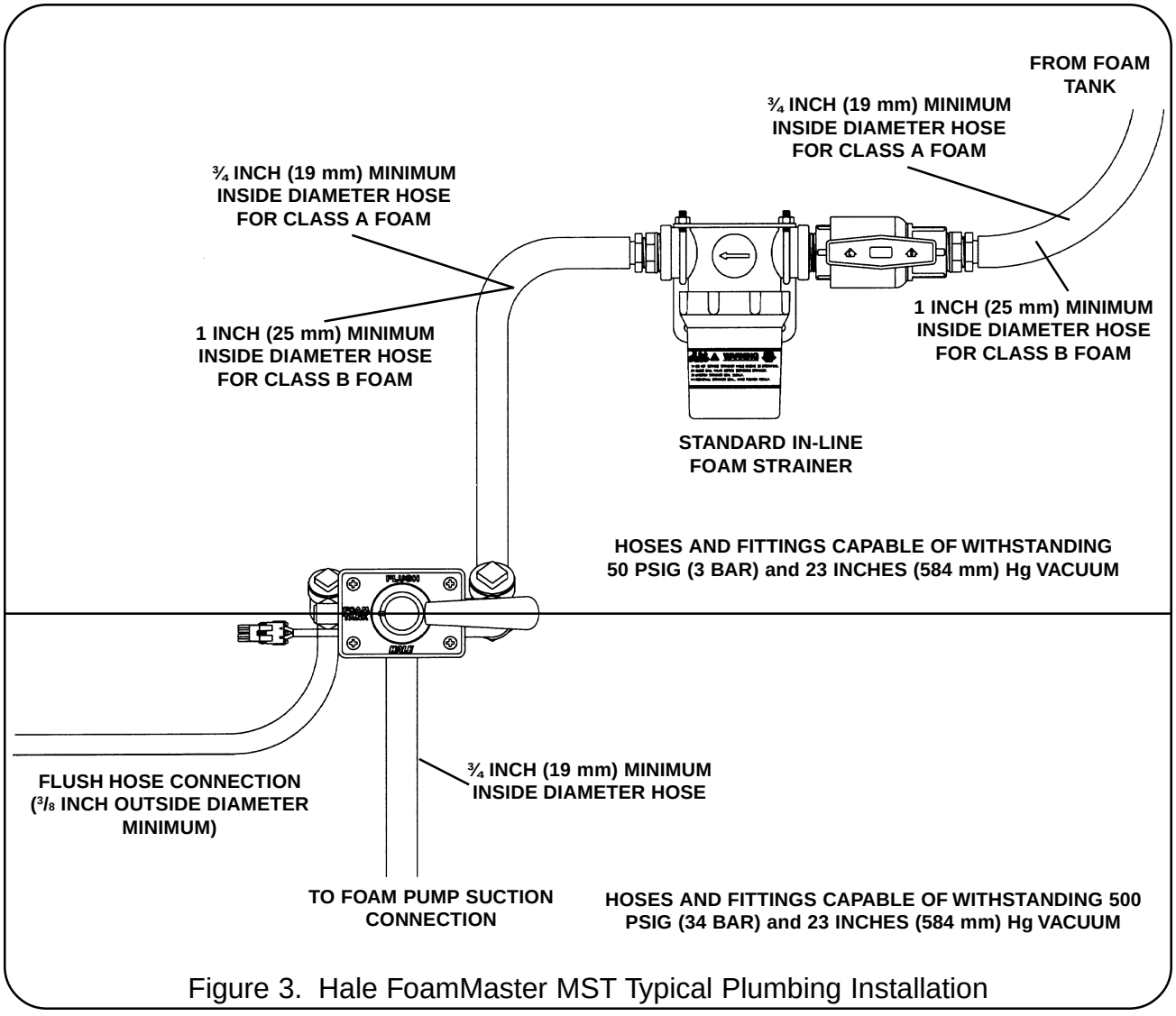


Figure 3. Hale FoamMaster MST Typical Plumbing Installation

VALVE INSTALLATION:
The following procedures shall be followed when installing the Hale FoamMaster MST flush selector in the Hale FoamMaster system:

> **NOTE:** The Hale FoamMaster MST is shipped assembled. Some disassembly is required to mount the Hale FoamMaster MST. Note the position of components as they are removed to allow for reassembly.

1. Unscrew and remove the selector handle from the Hale FoamMaster MST flush selector valve handle mount assembly. (See figure 1)

2. Remove the four ¼-20 UNC x 5/8 inch long screws holding the foam selector nameplate to the selector valve assembly and remove the nameplate.

3. Using the nameplate as a template mark the location of mounting holes on the operator panel. Make sure there is sufficient clearance behind the operator panel where the Hale FoamMaster MST is to be mounted (Refer to figure 2). Verify mounting hole location and size using figure 4.

4. Cut one 2-¾ inch (70 mm) diameter hole and drill four 9/32 inch (7 mm) diameter holes as marked on the operator panel.

5. Position the selector valve on the back of the operator panel by placing the selector handle mount assembly through the 2-¾ inch (70 mm) diameter hole. Make sure the foam outlet connection is orientated towards the bottom of the selector valve.

6. Position the nameplate on the panel front and align the screw holes with those on the panel and selector valve. Install the four ¼-20 UNC x 5/8 inch long screws that were removed in step 2.

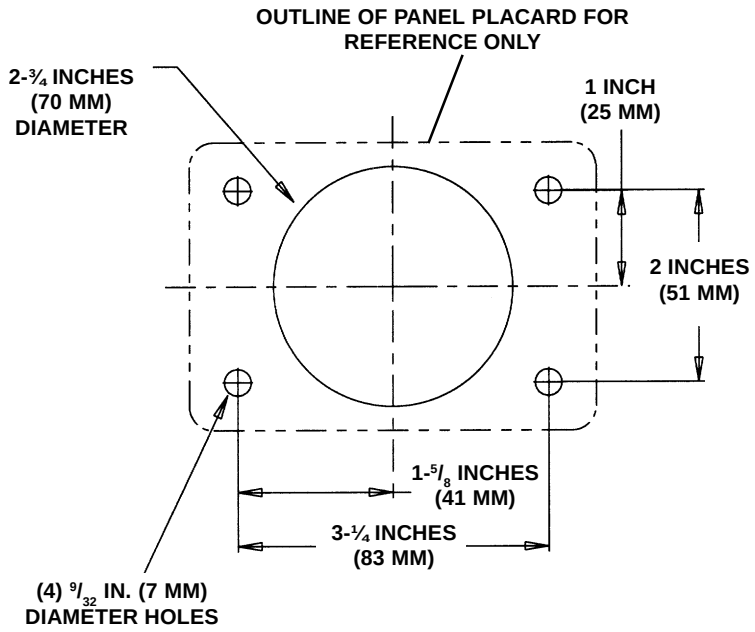


Figure 4. Hale FoamMaster MST Flush Selector Valve Mounting Template

7. Apply Loctite 242 or equal thread locking compound on the setscrew threads and reinstall the selector handle on the selector valve handle mount assembly.

NOTE: Some high viscosity Class B foam concentrates require 1 inch (25 mm) inside diameter hose for proper system operation. Class A, Class B AFFF, and low viscosity Class B AFFF/AR foam concentrates can use ¾ inch (19 mm) inside diameter hose.

8. Install brass, 300 series stainless steel or nylon hose barb fitting for the hose from the foam concentrate tank to the inlet of the check valve. (See figure 5) The check valve inlet has ¾ inch female NPT threads. Use clear hose with ¾ or 1 inch (19 or 25 mm) minimum inside diameter that is capable of withstanding 23 inches (584 mm) Hg vac/50 PSI (3 BAR) working pressure (Kuriyama, Kuri-Tec K-7130 series or equal).

9. Using 3/8 inch (10 mm) minimum outside diameter tubing capable of withstanding the maximum fire pump discharge pressure (500 PSI (34 BAR) minimum), connect flush water line from one of the pressure taps on the fire pump to the ¼ inch NPT inlet of the flushing water swing check valve.

10. Using 3/8 inch (10 mm) minimum outside diameter tubing capable of withstanding the maximum fire pump discharge pressure (500 PSI (34 BAR) minimum), connect a drain hose from the flushing water hose to a suitable drain valve.

CAUTION: DO NOT connect the drain from the Hale FoamMaster MST to the apparatus multi drain system or do not tee on single drain due to crosstalk. Individual drain valves are recommended for foam system drains. If a multiple drain must be used Hale recommends the use of a Hale DV7 multiple drain valve (Hale P/N 529-5420-00-0) or equivalent that isolates each drain port.

11. Install ¾ inch (19 mm) minimum inside diameter hose from the Hale FoamMaster MST flush selector to the inlet of the Hale FoamMaster rotary gear pump or FS Series Strainer. The hose and

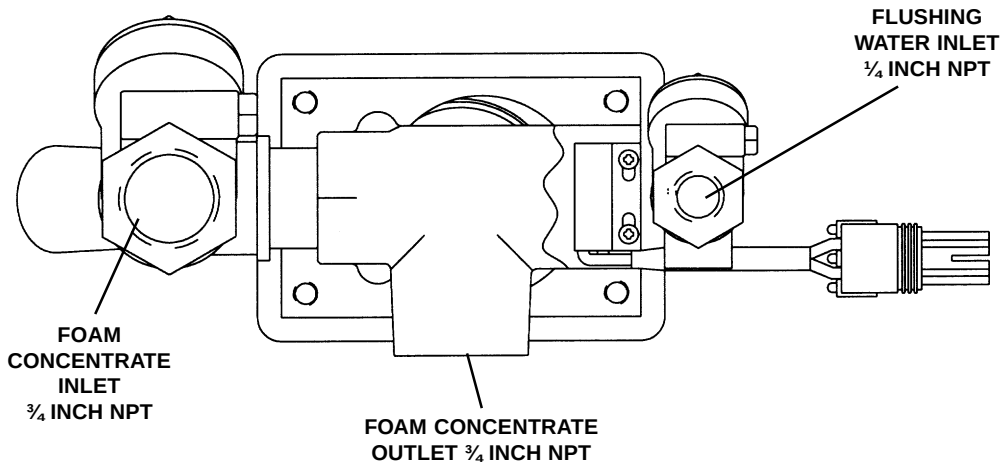


Figure 5. Hale FoamMaster MST Flush Selector Valve (Back View)

fittings from the foam outlet on the MST must be capable of withstanding 23 inches (584 mm) Hg vacuum, maximum fire pump discharge pressure (500 PSI (34 BAR) minimum), and be compatible with the foam concentrates to be used (Aeroquip 2580 series or equivalent reinforced hydraulic hose). Use brass or 300 series stainless steel fittings (reusable or crimp type Aeroquip 412 series or equal fittings) for the hose from the foam concentrate outlet on the Hale FoamMaster MST.

FOAM TANK LOW LEVEL SENSOR INSTALLATION:

After the Hale FoamMaster MST flush selector is installed and hoses are connected, the low tank level sensor must be installed and wired to monitor foam concentrate level. A low tank level sensor is included with the Hale FoamMaster foam proportioner system when the Hale FoamMaster MST option is ordered. Mount the low tank level sensor in the foam tank as follows. Refer to figure 6 for low tank level sensor mounting options.

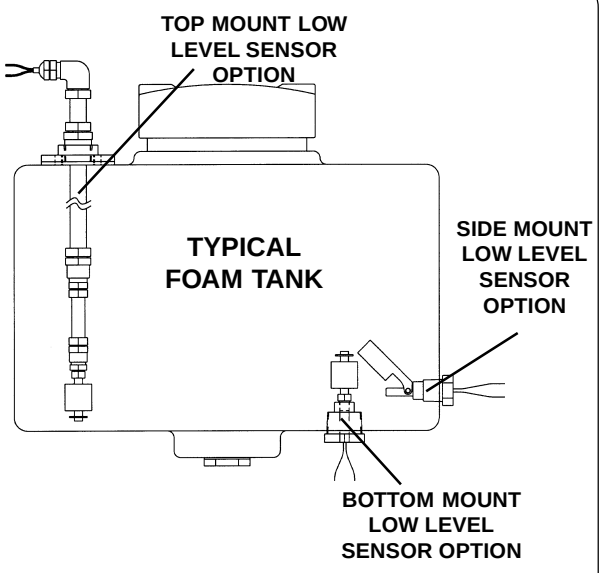


Figure 6. Foam Tank Low Level Sensor Mounting Options

CAUTION: A foam tank low level sensor must be utilized to protect the Hale FoamMaster from dry running. Failure to use a low level sensor with the Hale FoamMaster system will void warranty.

SIDE MOUNT LOW LEVEL SENSOR INSTALLATION

1. A side mount low tank level sensor is available to be used if the bottom of the foam tank is not accessible. The side mount low tank level sensor has ½ inch NPT threads and is mounted on the foam tank using a bulkhead fitting with ½ inch FNPT threads (see figure 7). The center of the switch must be located approximately 1-½ to 2 inches (38 to 51 mm) from the bottom of the foam tank with the float positioned on top of the switch to move up and down.

NOTE: When the side mount low tank level sensor senses a low concentrate condition the system will operate for one minute unless the foam concentrate level is restored. If the foam concentrate level is not restored the Hale FoamMaster system will shut down. When locating the side mount low tank level sensor on the foam tank sufficient foam concentrate should be present for one minute of operation at rated flow.

2. Coat the threads of the low tank sensor with suitable sealant and insert into bulkhead fitting. Tighten sensor making sure the float is on the top of the sensor.

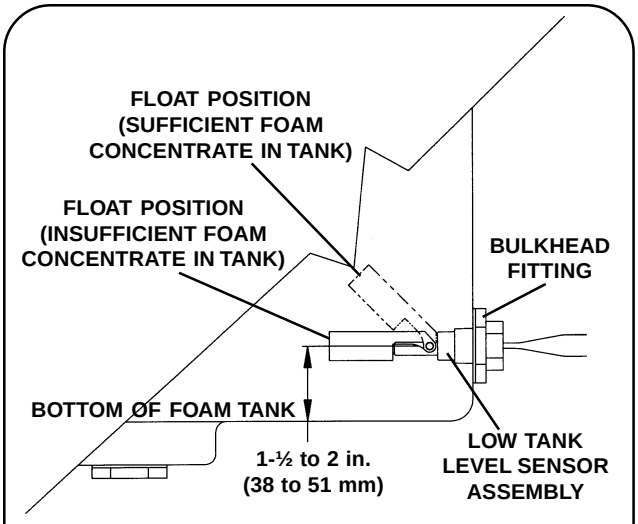


Figure 7. Side Mount Foam Tank Low Level Sensor Installation

3. After installation, check operation of the side mount low tank level sensor with a powered test light. With no foam in the tank, the light should be on. If light does not illuminate, rotate the side mount low tank level sensor until the test light is on.

BOTTOM MOUNT LOW LEVEL SENSOR INSTALLATION

1. The bottom mount foam tank low level sensor must be mounted into the bottom of the foam tank. The sensor, as supplied, is threaded into a bushing that has 1 inch NPT threads. The sensor is designed to be installed from the outside of the foam tank through a bulkhead fitting or boss with 1 inch FNPT threads. Mount the sensor in the bottom of the foam tank in an upright position. Use suitable sealant to prevent concentrate leakage.

NOTE: There must be sufficient space under the foam tank for the low tank level sensor wires to be routed to the foam pump/motor assembly. Be sure not to remove the float from the shaft on the low tank level sensor assembly. If the float is installed in the reverse position, "*lo A*" will appear on the control unit and the system will automatically shut down even if there is foam in the tank.

2. Check low tank level sensor operation with a powered test light. With no foam in the tank, the light should be on. If this is not the case, remove the clip from the end of the sensor. Remove float and reinstall 180° out of position. Reinstall clip.

TOP MOUNT LOW LEVEL SENSOR INSTALLATION

A top mount low level sensor assembly is available for installations where the sides or bottom of the foam tank are not accessible or sensor service is required without draining the foam tank. The sensor assembly is flange mounted in an access hole at the top of the foam tank. The two section telescoping assembly permits adjustment of low tank level sensor position for various foam tank depths from 31-½ to 60 inches (800 to 1524 mm). Flange cutout dimensions shown in figure 8.

a. Using dimensions in figure 8, layout and drill holes in the top of the foam tank. The center of the sensor should be located at least 1-½ to 2 inches (38 to 51 mm) from the sides of the foam tank.

NOTE: The minimum depth of foam tank for installation of the top mount sensor without cutting the tube sections is 31-½ inches (800 mm). If the tank depth is less than 31-½ inches (800 mm) cut the tubing as described in step c.

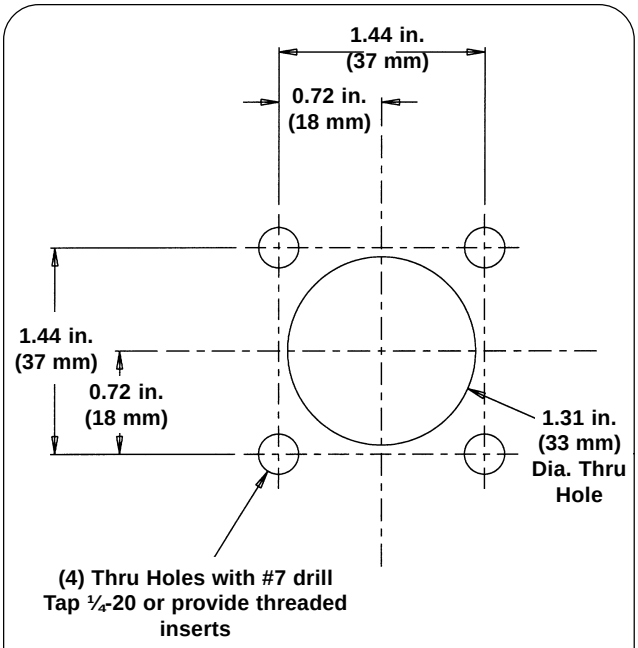


Figure 8. Top Mount Low Tank Switch Mounting Flange Template

b. Determine the approximate length of the top mount low tank sensor extension by measuring from the top of the foam tank at the flange opening to the bottom of the tank. When properly installed the center of the sensor float should be 1-½ to 2 inches (38 to 51 mm) above the bottom of the foam tank.

c. Slide the flange to the top of the 5/8 inch diameter tube and adjust the telescoping section until the desired length is achieved as measured from the bottom of the flange to the bottom of the sensor. Tighten the compression fittings on the union to lock length.

NOTE: If telescoping section will not get short enough it can be disassembled and cut. Take care to deburr the ends of the tubes after they are cut. Cut an equal amount from each section of tubing.

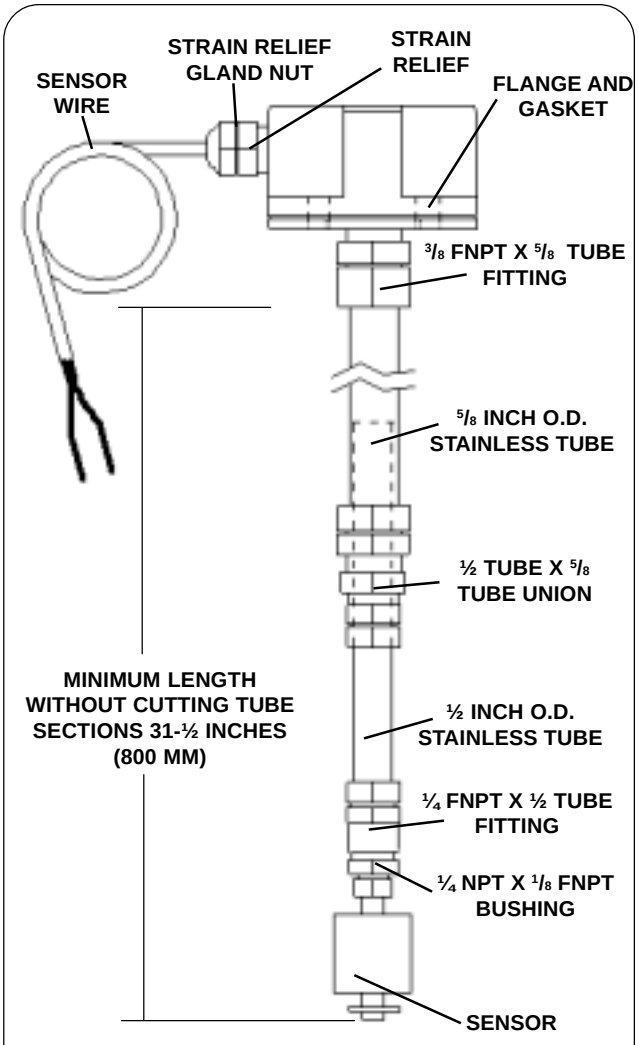


Figure 9. Top Mount Low Tank Switch Assembly Component Identification

IMPORTANT: Use the following procedure only if the tube sections are too long otherwise proceed to step d.

Refer to figure 9, disassemble and cut the tube sections as follows:

1) Loosen and remove the 3/8 FNPT x 5/8 tube fitting and strain relief from the top of the sensor assembly. Carefully slide the sensor wire out of

the strain relief gland.

2) Loosen and remove the ¼ FNPT x ½ tube fitting and sensor from the bottom of the sensor assembly. DO NOT remove the ½ inch tube from the 5/8 inch tube.

3) Using a tubing cutter remove the required length of tube from the end of each tube. Deburr the cuts when complete.

4) Install a new ½ compression ferrule on the end of the tube. Carefully thread the sensor wire through the tube assembly and attach the ¼ FNPT x ½ tube fitting with sensor attached to the end of the tube. Tighten the ½ tube compression nut.

5) Install a new 5/8 compression ferrule on the end of the tube. Carefully thread the sensor wire through the 3/8 FNPT x 5/8 tube fitting and strain relief gland. Attach the 3/8 FNPT x 5/8 tube fitting and strain relief to the end of the tube. Tighten the 5/8 tube compression nut.

6) Slide the flange to the top of the 5/8 inch diameter tube and adjust the telescoping section until the desired length is achieved as measured from the bottom of the flange to the bottom of the sensor. Tighten the compression fittings on the union to lock length.

CAUTION: Use mounting hardware that is compatible with all foam concentrates to be used in the system. Use washers, lockwashers and capscrews made of brass or 300 series stainless steel.

d. Insert sensor assembly through the 1.31 inch (33 mm) hole and align the screw holes on the flange and gasket with the holes on the tank. Secure the assembly in place using four ¼-20 UNC x 1 inch long cap screws, ¼ inch washers and ¼ inch lockwashers.

e. Make final adjustment to the sensor position by pulling the tubing sections up through the flange until sensor is 1-½ to 2 inches (38 to 51 mm) from the bottom of the tank. Tighten the 5/8 tube compression nut on the flange.

f. Close strain relief to the 90^0 position making sure it snaps shut. Tighten strain relief gland nut to seal out water and contamination.

ELECTRICAL INSTALLATION
Refer to figure 10 for an electrical diagram and proceed with the following steps:

1. If the Hale FoamMaster MST is being installed as a retrofit, remove the plug from the Hale FoamMaster foam pump distribution box.

> **CAUTION:** Use the silicone sealer provided with the Hale FoamMaster system to insulate the terminal strip connection screws and prevent corrosion.

2. Use minimum 16 AWG Type SXL or GXL (SAE J1128) wire to connect the low tank level sensor to the terminal block on the distribution box. The low tank level sensor is not polarity sensitive therefore terminal connections are not specific. When making splices to extend the low tank sensor wires make sure the splices are sealed using an adhesive filled heat shrink tubing. Where two wires exit the heat shrink tubing pinch the tubing while heating the tubing to make sure the adhesive seals around both wires. Insulate and seal the terminal strip connections using the silicone sealer provided.

3. Connect the two wire Packard WeatherPack connector on the Hale FoamMaster MST to the MST wiring harness. Route the MST wiring harness to the Hale FoamMaster location. Secure cable extension to apparatus. Connect the 4-pin male cable connector from the MST wiring harness to the connection point labeled **ACCESSORY** on the distribution box.

If the MST wiring harness will not reach the Hale FoamMaster distribution box an extension harness is available to extend this cable.

To more accurately monitor foam concentrate level, separate foam concentrate tank level gauges, that show the actual level of foam concentrate in the foam tank, can also be installed.

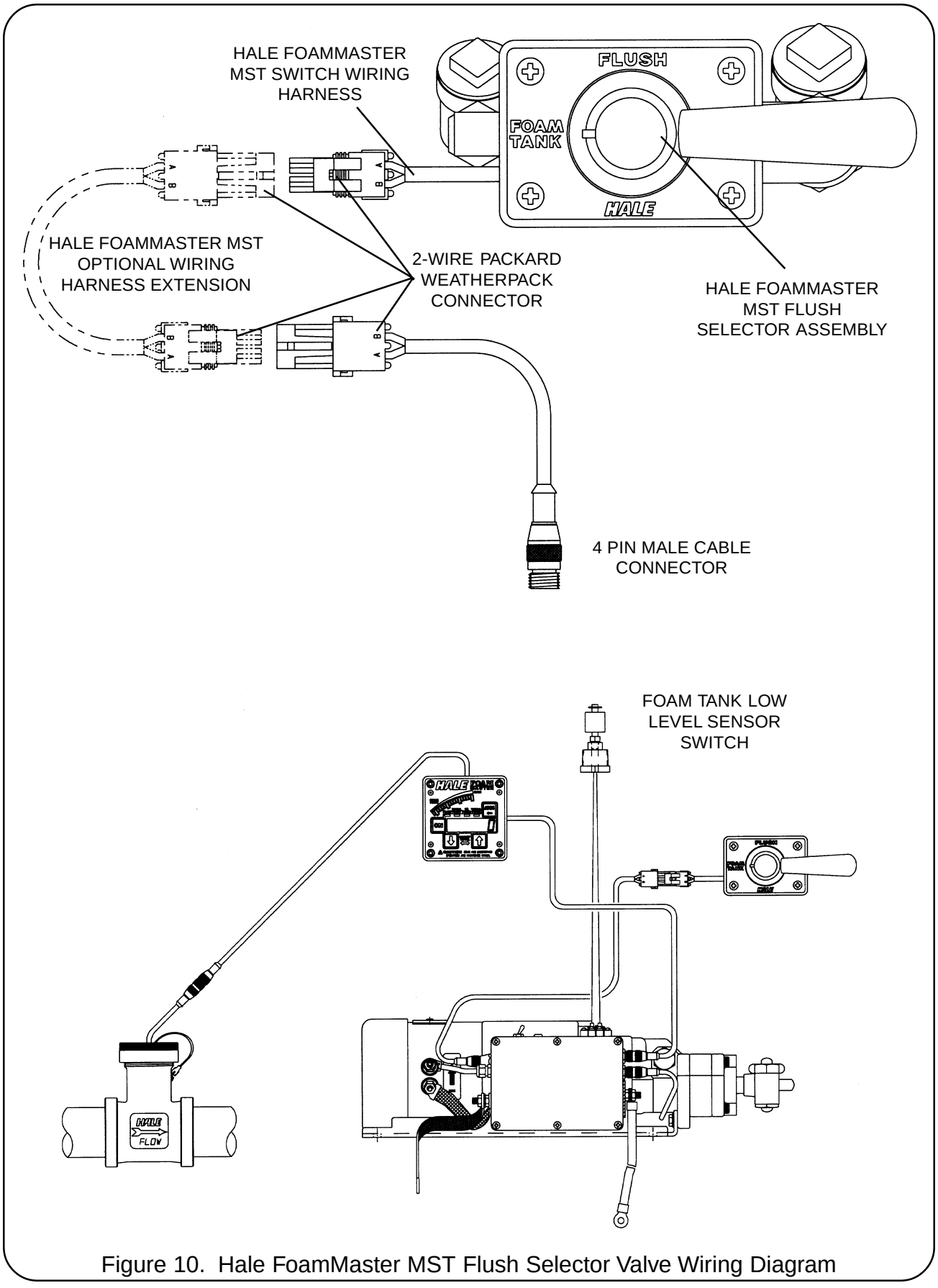


Figure 10. Hale FoamMaster MST Flush Selector Valve Wiring Diagram

5 OPERATION

FLUSHING HALE FOAMMASTER
When returning the apparatus to ready condition after foam operations using class B foam, the Hale FoamMaster foam pump must be flushed because some Class B foam concentrates deteriorate rapidly.

NOTE: Approved class A foam concentrates do not deteriorate rapidly like class B foam concentrates. As long as an approved class A foam concentrate is used and the system will be used within 10-12 weeks no flushing will be required. When class B foam concentrate is used flush system then switch back to **FOAM TANK** position.

The following procedures shall be used to flush the foam pump. Refer to figure 11 for MST operation:

1. Energize apparatus and establish water flow through a foam capable discharge. Set fire pump for a low discharge pressure, 50 to 75 PSI (3.4 to 5.2 BAR).

2. Energize Hale FoamMaster by depressing the red **ON** button allowing foam solution to discharge.

   NOTE: When the Hale MST is in the **FLUSH** position the Hale FoamMaster foam injection system will only run for 20 seconds.

3. Place the Hale MST to the **FLUSH** position.

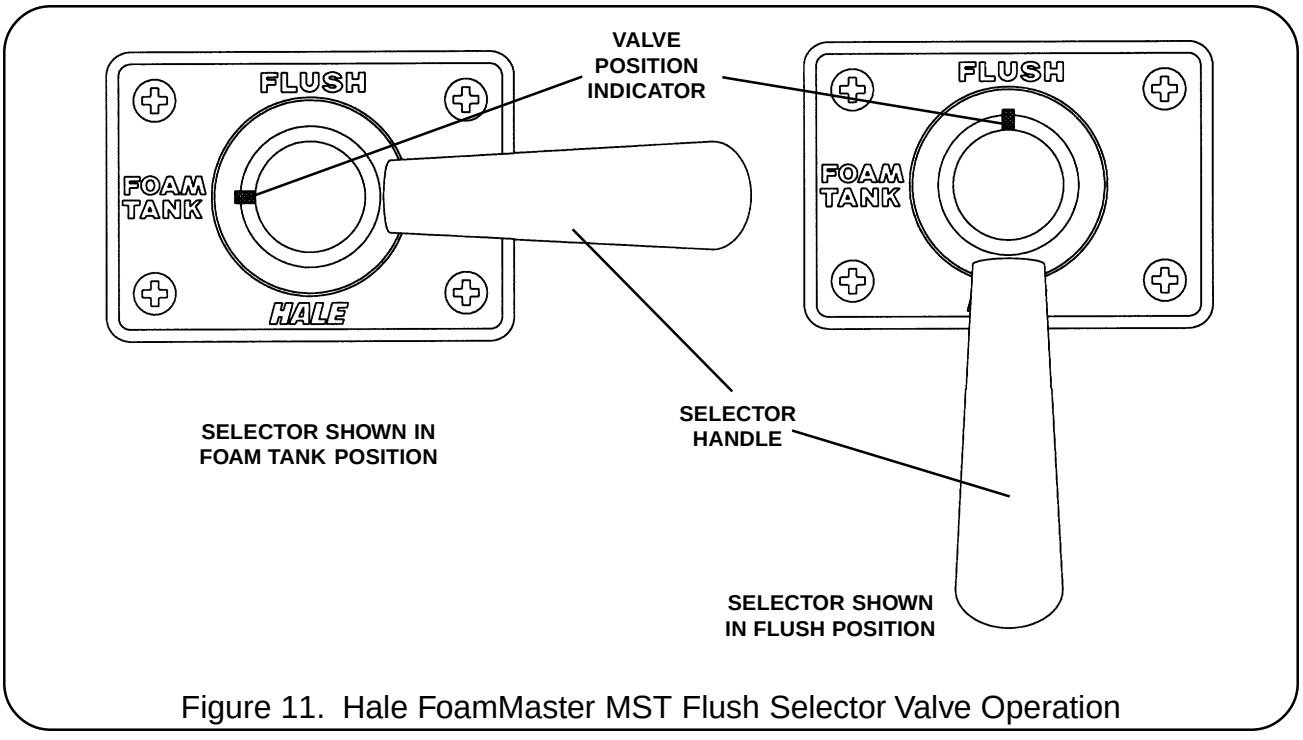


Figure 11. Hale FoamMaster MST Flush Selector Valve Operation

4. Observe discharge hose and allow Hale FoamMaster and discharge to run for several seconds.

   NOTE: When the Hale MST is used in systems for Class B foam concentrates DO NOT allow the foam pump to run in the **FOAM TANK** position after flushing foam pump.

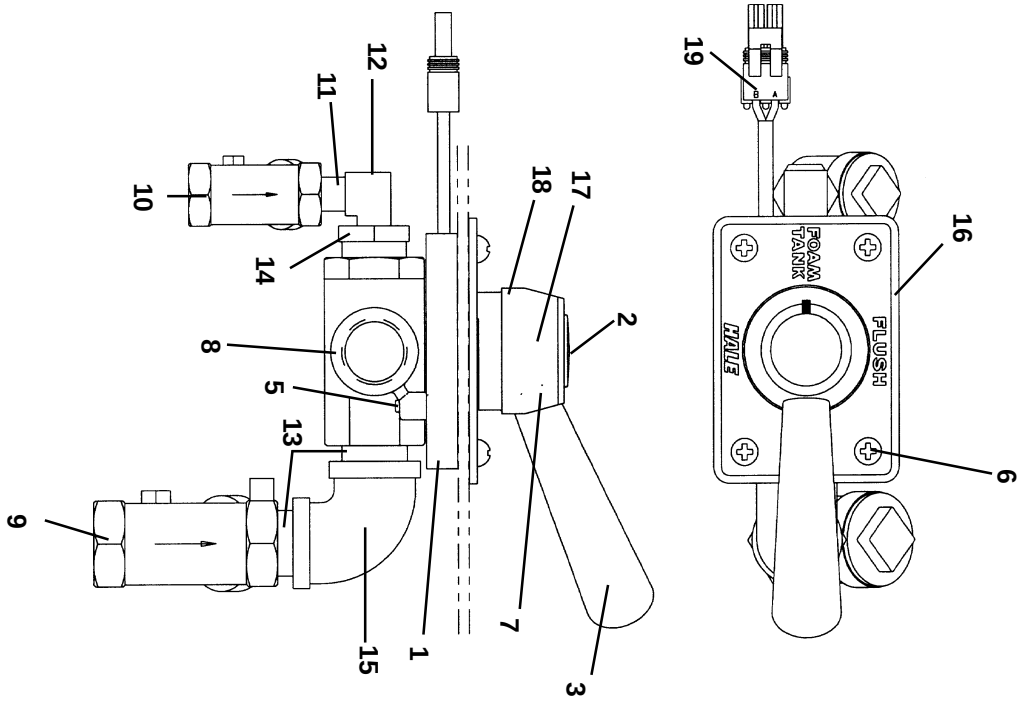
5. Place the Hale MST to the **FOAM TANK** position and allow Hale FoamMaster to run until Class A foam solution is discharged through the foam capable hose line. If Class B foam concentrate is used shut down Hale FoamMaster immediately after switching to **FOAM TANK** position.

6. Shut down Hale FoamMaster allowing foam capable discharge to run to flush out the fire pump discharge manifold as required. Once clear water flows, close foam capable discharge and shut down apparatus.

7. Perform required maintenance checks on the Hale FoamMaster and apparatus to return the apparatus to ready condition.

   IMPORTANT: Make sure the Hale MST is in the **FOAM TANK** position when apparatus is placed in ready condition.

6 PARTS LIST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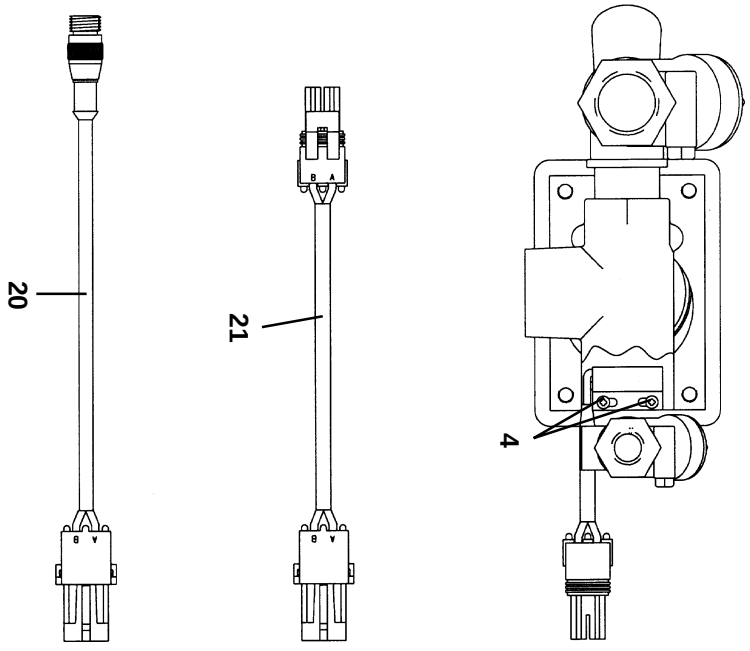
FOAM TANK
FLUSH
HALE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Item	Part Number	Qty	Name of Part
1	007-3400-00-0	1	MST MOUNTING ADAPTER
2	008-0720-00-0	1	HANDLE MOUNT CAP
3	012-1330-00-0	1	TAPERED HANDLE
4	018-0402-78-0	2	SCREW #4-40 UNF X ¼ INCH LONG
5	018-1006-80-0	2	SCREW #10-24 UNC X ¾ INCH LONG
6	018-1205-44-0	4	SCREW ¼-20 UNC X 5/8 INCH LONG
7	018-1706-57-0	1	SET SCREW 3/8-24 UNF X ¾ INCH LONG STAINLESS
8	038-1450-01-0	1	3-WAY VALVE
9	038-1620-00-0	1	BRASS SWING CHECK VALVE ¾ INCH NPT
10	038-1620-01-0	1	BRASS SWING CHECK VALVE ¼ INCH NPT
11	082-0210-02-0	1	BRASS CLOSE NIPPLE ¼ INCH NPT
12	082-0257-02-0	1	BRASS SERVICE ELBOW ¼ INCH NPT
13	082-0501-02-0	2	BRASS CLOSE NIPPLE ¾ INCH NPT
14	082-0513-02-0	1	BRASS BUSHING ¾ INCH NPT X ¼ INCH NPT
15	082-0516-02-0	1	BRASS 90 DEGREE ELBOW ¾ INCH NPT
16	101-1340-25-0	1	MST PLACARD
17	110-7560-00-0	1	COUPLING NUT 7/16-20 UNF STAINLESS
18	512-0460-00-0	1	HANDLE MOUNT ASSEMBLY
	012-1330-02-0	1	HANDLE MOUNT
	029-0470-00-0	1	SWITCH ACTUATOR MAGNET
19	513-0320-03-0	1	MST SWITCH WIRING HARNESS
20	513-0320-04-0	1	MST WIRING HARNESS
21	513-0320-07-0	1	OPTIONAL WIRE HARNESS EXTENSION 72 INCHES (1829 MM) LONG

7 WARRANTY

LIMITED WARRANTY

EXPRESS WARRANTY. Hale Products Inc. ("Hale") hereby warrants to the original buyer that products manufactured by it are free of defects in material and workmanship for one (1) year. The "Warranty Period" commences on the date the original buyer takes delivery of the product from the manufacturer.

LIMITATIONS. HALE'S obligation is expressly conditioned on the Product being.

- Subjected to nominal use and service;
- Properly maintained in accordance with HALE'S Instruction Manual as to recommended services and procedures;
- Not damaged due to abuse, misuse, negligence or accidental causes;
- Not altered, modified, serviced (non-routine) or repaired other than by an Authorized Service Facility;
- Manufactured per design and specifications submitted by the original Buyer.

THE ABOVE EXPRESS LIMITED WARRANTY IS EXCLUSIVE. NO OTHER EXPRESS WARRANTIES ARE MADE. SPECIFICALLY EXCLUDED ARE ANY IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATIONS, THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE; QUALITY; COURSE OF DEALING; USAGE OF TRADE; OR PATENT INFRINGEMENT FOR A PRODUCT MANUFACTURED TO ORIGINAL BUYER'S DESIGN AND SPECIFICATIONS.

EXCLUSIVE REMEDIES. If Buyer promptly notifies HALE upon discovery of any such defect (within the Warranty Period), the following terms shall apply:

- Any notice to HALE must be in writing, identifying the Product (or component) claimed defective and circumstances surrounding its failure;
- HALE reserves the right to physically inspect the Product and require Buyer to return same to HALE'S plant or other Authorized Service Facility;
- In such event, Buyer must notify HALE for a Returned Goods Authorization number and Buyer must return the Product F.O.B. within (30) days thereof;
- If determined defective, HALE shall, at its option, repair or replace the Product, or refund the purchase price (less allowance for depreciation),
- Absent proper notice *within* the Warranty Period, HALE shall have no further liability or obligation to Buyer therefore.

THE REMEDIES PROVIDED ARE THE SOLE AND EXCLUSIVE REMEDIES AVAILABLE. IN NO EVENT SHALL HALE BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDING, WITHOUT LIMITATION, LOSS OF LIFE; PERSONAL INJURY; DAMAGE TO REAL OR PERSONAL PROPERTY DUE TO WATER OR FIRE; TRADE OR OTHER COMMERCIAL LOSSES ARISING, DIRECTLY OR INDIRECTLY, OUT OF PRODUCT FAILURE.