

U. S. Department of Homeland Security
United States Coast Guard
Certificate of Approval

Coast Guard Approval Number: 162.161/6/0

Expires: 22 March 2010

ENGINEERED HALOCARBON FIRE EXT. SYSTEM

ANSUL INCORPORATED
ONE STANTON STREET
MARINETTE WI 54143

ANSUL marine "Sapphire" NOVEC 1230 engineered clean agent fire extinguishing system.

Total flooding systems for the protection of machinery spaces, cargo pump rooms, and other enclosed spaces with Class B and C hazards. Tested to IMO MSC/Circ.848. Not acceptable for cargo hold protection.

Identifying data: Underwriters Laboratories, Inc. (UL) Report Project 03NK36058, File Ex4510, issued 27 June 2003 and revised 21 September 2004, UL report Project 01NK35596, File Ex6263, dated 23 September 2002, ANSUL Marine Design, Installation, Operation, and Maintenance Manual Part No. 433036, UL File Ex4510, dated 1 December 2004, revised 25 October 2005 and 1 June 2006, Ansul flow calculation software ANSL3.60, and USCG letters dated 7 April 2005 and 16 October 2006.

Follow-up Program: UL

Approval valid only for products from above factory location.

Supersedes Appr. No. 162.161/6/0 dated 22 March 2005 to show instruction manual revisions.

*** END ***

THIS IS TO CERTIFY THAT the above named manufacturer has submitted to the undersigned satisfactory evidence that the item specified herein complies with the applicable laws and regulations as outlined on the reverse side of this Certificate, and approval is hereby given. This approval shall be in effect until the expiration date hereon unless sooner canceled or suspended by proper authority.



GIVEN UNDER MY HAND THIS 16th DAY OF
OCTOBER 2006, AT WASHINGTON D.C.

K. J. HEINZ
Acting Chief, Lifesaving and Fire Safety Standards Division
BY DIRECTION OF THE COMMANDANT

SECTION I – COMPONENTS

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AGENT TANK BRACKETS

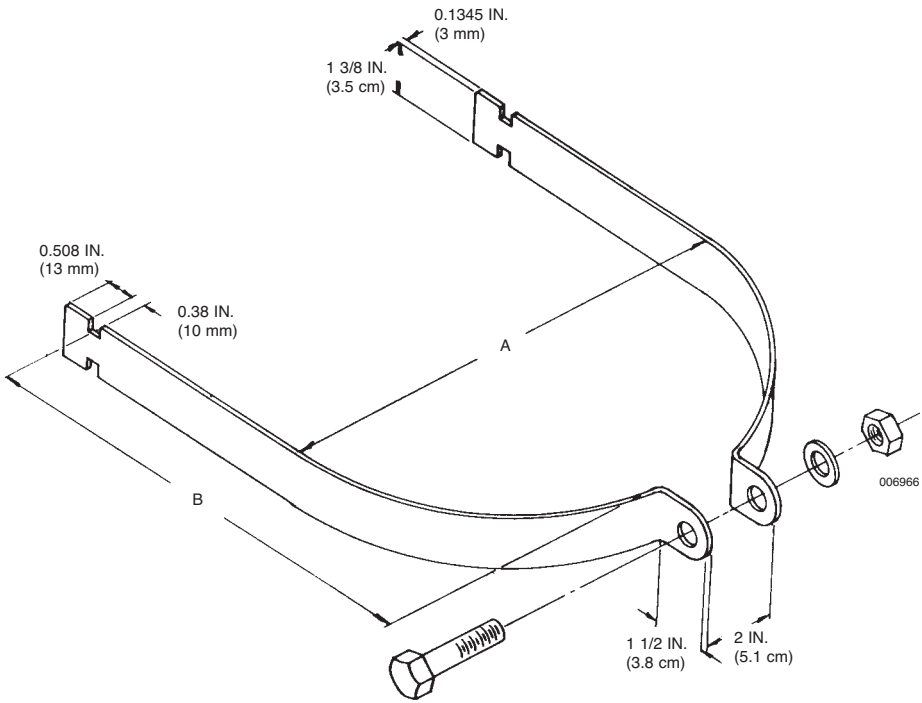
Each tank must be secured with two brackets. Each bracket assembly includes two bracket halves with fastening nut, bolt, and washer. Brackets are designed to be used in conjunction with continuous slot channel.

Bracket assemblies are manufactured from 304 stainless steel with S.S. nut, bolt, and washer.

Nominal Tank Size (lbs.)	Bracket Part No.	Tank Diameter in. (cm)	Bracket Dimension A and B in. (cm)	Approximate Weight lb. (kg)
20, 50, 90	57700	10 (25)	10.38 (26)	2 (.9)
140, 280, 390, 450	57702	16 (41)	16.12 (41)	3 (1.4)
850	433131	24 (61)	24.5 (62)	4 (1.8)

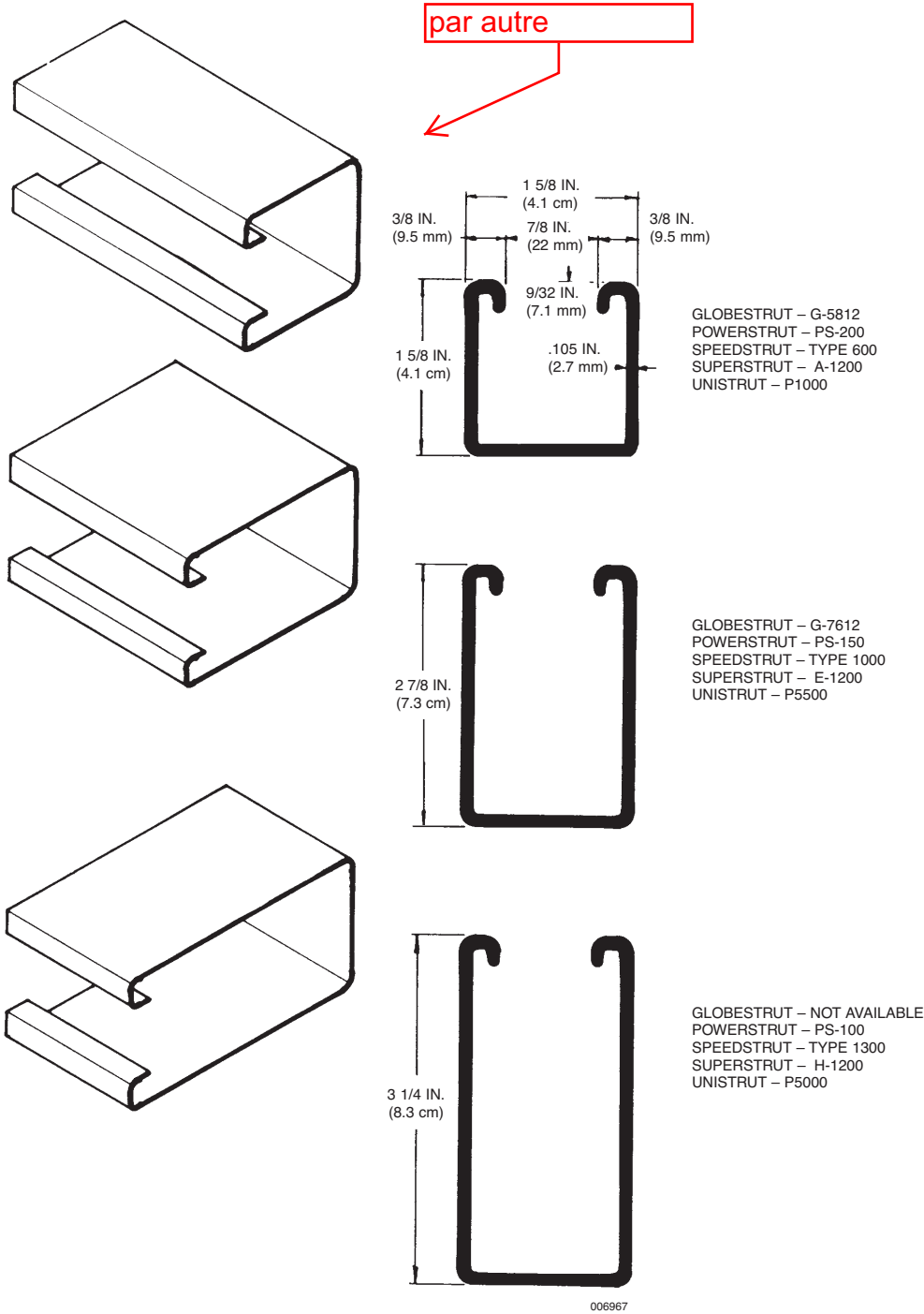


Back channel is not supplied with the bracket and must be ordered separately. Refer to Components Section, Page 1-5, for description of acceptable channel.



BRACKET CHANNEL

Bracket channel shall be of the modular type, formed from 12 gauge, .105 in. (2.7 mm) steel. The channel shall be painted, or otherwise protected from corrosion. Approved channel sizes and manufacturers are listed below. Channel is to be ordered direct from manufacturer or manufacturer's dealers.



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FLEXIBLE DISCHARGE HOSE

The flexible discharge hose is used to connect the tank valve outlet to rigid distribution piping. On single tank systems, a check valve is not required. Three sizes of flexible discharge hoses are available: 1 in. (for 20, 50, and 90 lb. tank sizes), 2 in. (for 140, 280, 390, and 450 lb. tank sizes), and 3 in. (for 850 lb. tank sizes).

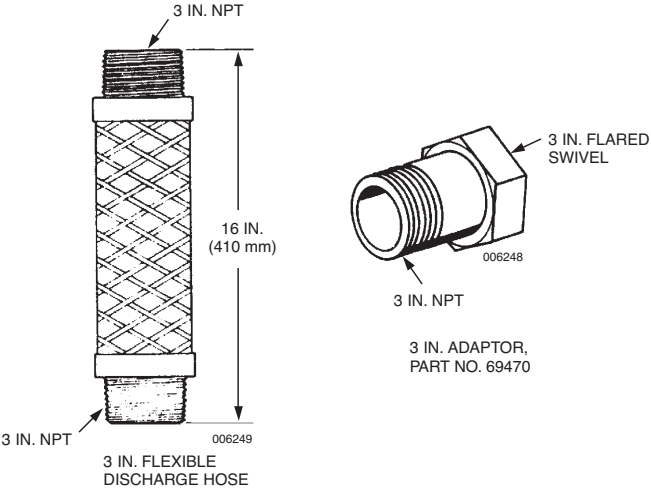
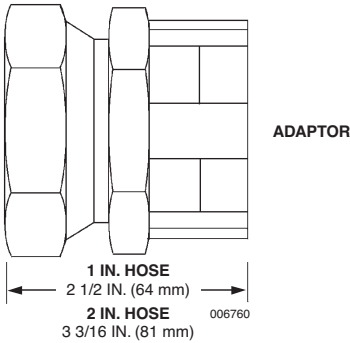
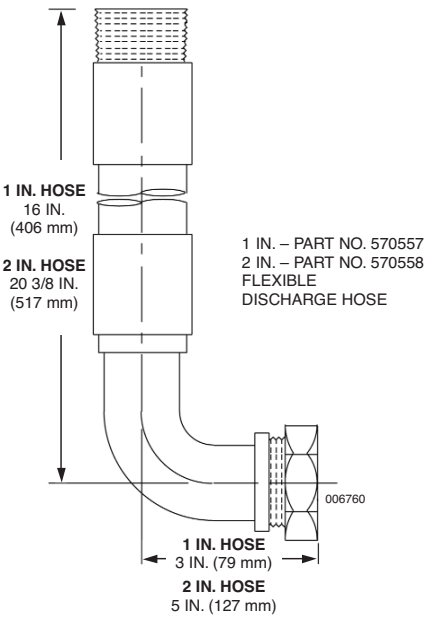
For 1 in. flexible hose, adaptor, Part No. 570557, is required to connect the valve outlet to rigid pipe.

For 2 in. flexible hose, adaptor, Part No. 570558, is required to connect the valve outlet to rigid pipe.

When using a 3 in. flexible discharge hose (without a manifold), three single tank swivel adaptors are available for connection from the valve outlet to the flexible discharge hose.

Component	Material
1, 2, 3 in. Flexible Discharge Hose	Stainless Steel Tubing with Stainless Steel Braid Cover

Shipping Assembly Part No.	Description
570539	1 in. Flexible Discharge Hose
570538	2 in. Flexible Discharge Hose
69990	3 in. Flexible Discharge Hose
570557	1 in. Single Tank Swivel Adaptor
570558	2 in. Single Tank Swivel Adaptor
69470	3 in. Flared to 3 in. NPT Single Tank Swivel Adaptor



DISCHARGE NOZZLES

The discharge nozzles are available in a 360° pattern and are designed to uniformly distribute the Novec™ 1230 agent throughout the hazard area.

The 360° nozzle has sixteen ports. Six sizes of nozzles are available, 1/2 through 2 in.

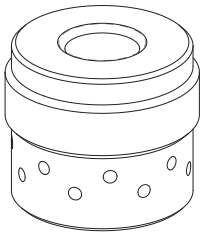
The hydraulic flow program will determine the nozzle size and orifice size required.

Note: When ordering nozzles, orifice size must be specified when ordered.

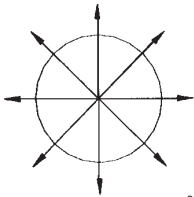
<u>Component</u>	<u>Material</u>	<u>Threads</u>
1/2 in. Nozzle	Brass	1/2 in. NPT
3/4 in. Nozzle	Brass	3/4 in. NPT
1 in. Nozzle	Brass	1 in. NPT
1 1/4 in. Nozzle	Brass	1 1/4 in. NPT
1 1/2 in. Nozzle	Brass	1 1/2 in. NPT
2 in. Nozzle	Brass	2 in. NPT

Shipping Assembly
Part No.

<u>Description</u>
1/2 in. Nozzle – 360°
3/4 in. Nozzle – 360°
1 in. Nozzle – 360°
1 1/4 in. Nozzle – 360°
1 1/2 in. Nozzle – 360°
2 in. Nozzle – 360°



004823



360° NOZZLE
PATTERN

004840

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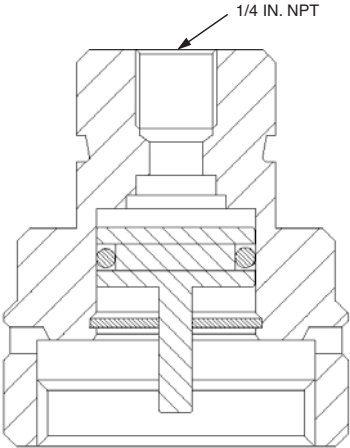
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PNEUMATIC ACTUATOR

The pneumatic actuator is required to pneumatically actuate the agent tanks. The actuator operates from pressure received from the nitrogen pilot cylinders. When the pneumatic actuator is pressurized, the internal actuator piston pushes down on the valve stem, opening the tank valve, allowing the agent to discharge.

<u>Component</u>	<u>Material</u>
Pneumatic Actuator	Brass

<u>Shipping Assembly Part No.</u>	<u>Description</u>
570550	Pneumatic Actuator ←

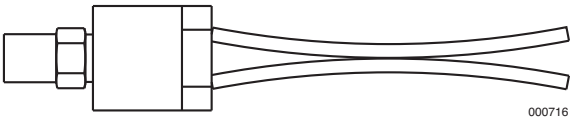


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LOW PRESSURE SWITCH

The low pressure switch is used to indicate a pressure drop within the SAPPHIRE tank. The switch is factory mounted (must be specified when ordering tank) in the 1/8 in. switch port of the tank valve. The switch continuously monitors the tank pressure and in the event of the pressure dropping below 290 psi (20 bar), the switch operates, enabling the condition to be signaled at the control panel.

The low pressure switch is optional and must be ordered separately when ordering the SAPPHIRE tank.



Shipping Assembly

Part No.	Description
570585	Low Pressure Switch



Component	Material	Switch Point/Type	Electrical Rating
Low Pressure Switch	Hermetically Sealed Stainless Steel Body	Opens on fall at 290 psi +/- 10 psi (20 bar +/- .7 bar)	Maximum Current: 2.9A
	6 ft. (1.8 m) Wire Leads	Closes on rise at 350 psi +/- 10 psi (24 bar +/- .7 bar)	Voltage Range: 5-28 VDC

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NITROGEN PILOT CYLINDER

The Nitrogen Pilot Cylinder is factory filled with nitrogen. The quantity of pilot cylinders required is based on the number of agent tanks in the system.

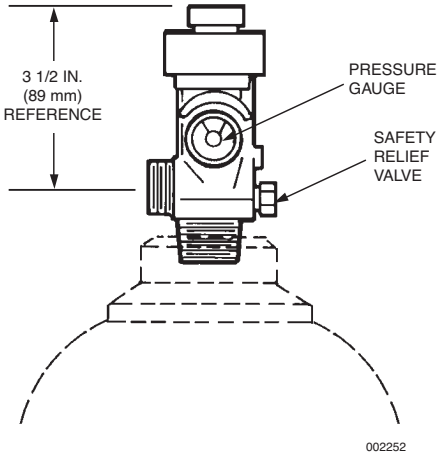
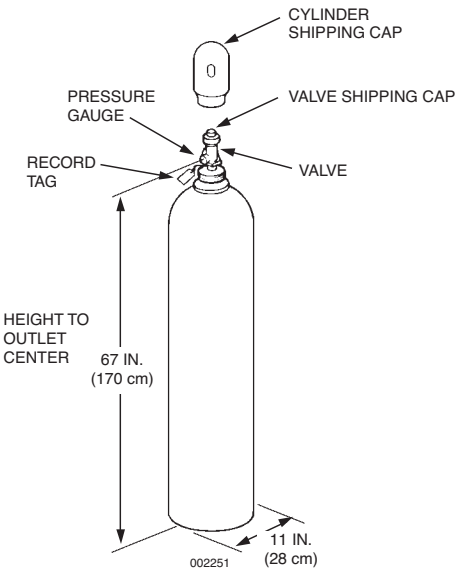
The cylinders can be actuated pneumatically, manually, or by remote cable pull.

Component	Material
Cylinder	Steel
Valve	Brass
Safety Relief Valve	Brass
Shipping Cap	Steel

Shipping
Assembly
Part No.

Description

433098 Nitrogen Pilot Cylinder ←



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PILOT VALVE LEVER RELEASE ACTUATOR

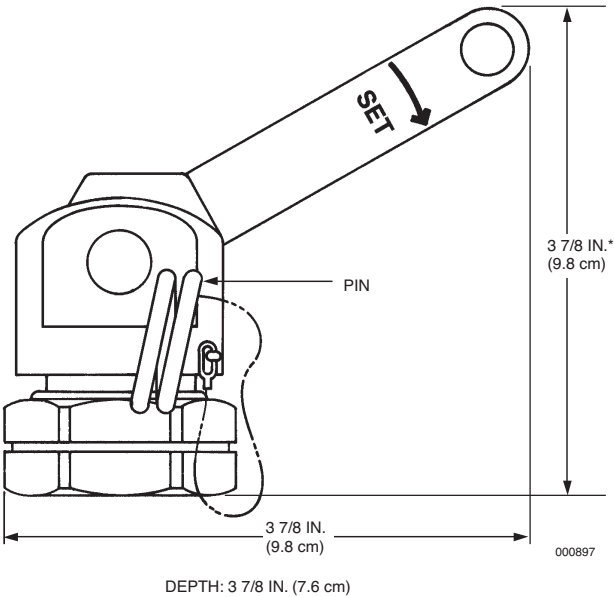
The manual lever release actuator provides a manual means of actuating pilot cylinder valves and selector valves. This can be accomplished by direct manual actuation of its pull lever or cable actuation when used in conjunction with a remote manual pull station. When used with a remote manual pull station, the pull station must contain the components necessary to meet the actuator lever traveling requirements of 7 in. (178 mm).

The actuator is shipped with ring pin and chain attached. If the ring pin is not required, it must be removed. Failure to remove the ring pin/chain assembly will prevent system actuation if a remote cable pull actuation system is employed and the ring pin is accidentally installed in the actuator.

Three actuators are available. Each is designed for a specific component.

Component	Material
All Manual Cable-pull Actuators	Brass with Stainless Steel Pin

Shipping Assembly Part No.	Description
423309	Lever Release (1 1/8-18 mounting thread) – Mounts directly to a CV-98 pilot cylinder valve.
427207	Lever Release (1 1/8-18 mounting thread) – Mounts directly to the 1 in. selector valves. Mounts directly to pressure operated stackable actuator for 1 in. selector valves. Actuator has the handle painted red.



*Add 1 9/16 in. (3.9 cm) to height when lever is in the straight up position.

MANUAL PULL BOX

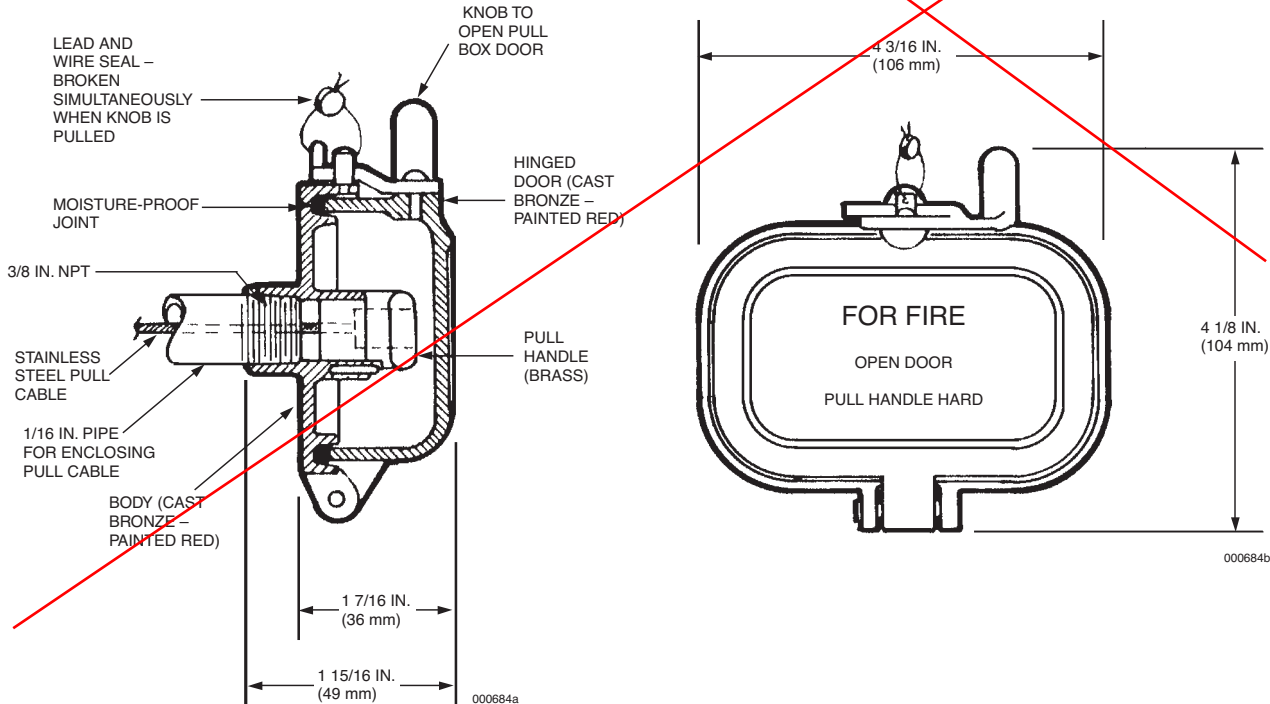
The pull box on a SAPPHIRE system is used to provide mechanical release of the system from a manually operated remote station. Two types of pull boxes are available. The latched door type has a solid cast brass door which must be opened to reach the pull handle. The second type has a break glass window and a spring mounted handle which rotates forward for use when the glass is broken. A 3/8 in. female NPT opening is provided at the back of each enclosure for connection of the cable housing. Both types are painted red.

A pulley elbow may be attached directly to the back of the pull box, if necessary, to provide immediate changes in pull cable direction. With this option, the pull box can be extended an additional 3 1/2 in. (89 mm) from the mounting surface by using support legs attached to the back of the pull box (one set for latched door type, two sets for break-glass type).

Component	Material
Latch door pull box	Brass (painted red)
Break glass window pull box	Brass (painted red)
Support legs	Brass (painted red)

Shipping Assembly Part No.	Description
45062	Latch Door Type Pull Box
41527	Break-Glass Window Pull Box
41542	Support Legs

Manual Pull Box Latched Door Type – Part No. 45062



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ENCLOSED DOUBLE CABLE PULL BOX WITH MICROSWITCH

The double pull box on a SAPPHIRE system provides mechanical release of the pilot cylinders and the stop valve from a manually operated remote station. To reach the pull handles, release the cover latch and open the door. When the door opens, the microswitch activates the system alarm and system indicators or devices. Pull the CYLINDER RELEASE handle to open the pilot cylinders. Pull the VALVE RELEASE handle to open the selector valve to the protected space.

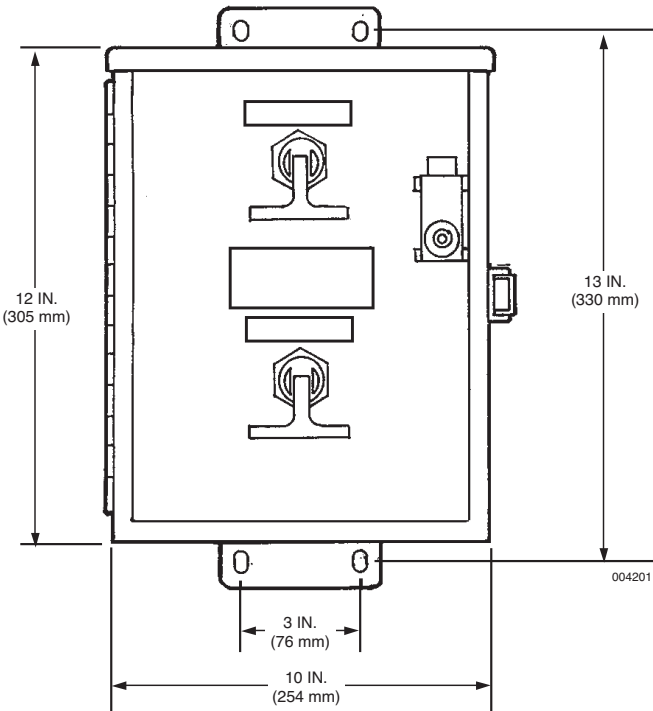
Component	Material
Double Pull Box	Steel
Cable Pull	Brass
Enclosed Assembly	

Shipping
Assembly
Part No.

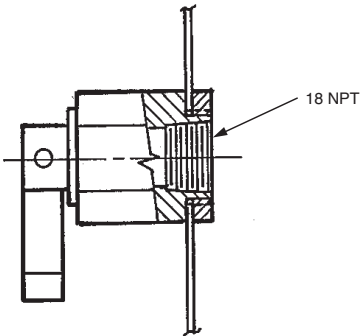
426312

Description

Enclosed Double Cable Pull Box
with Microswitch



INSIDE VIEW SHOWING CABLE PULLS AND MICROSWITCH
6 IN. (152 mm) DEEP



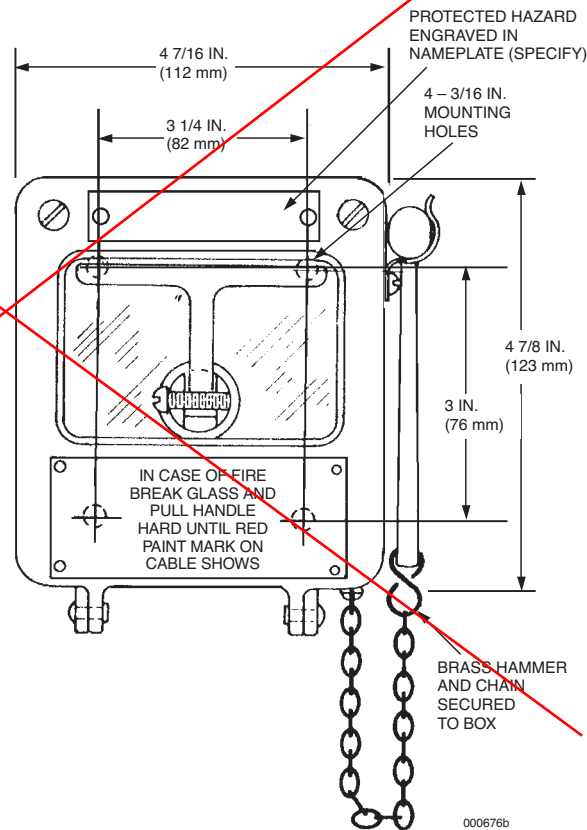
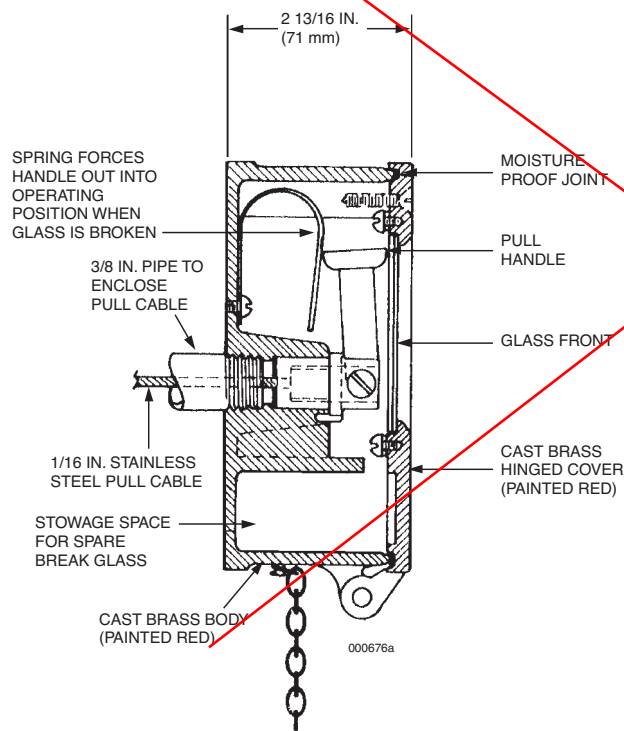
SIDE VIEW OF CABLE PULL

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MANUAL PULL BOX (Continued)

Manual Pull Box Break Glass Type “A” – Part No. 41527



CABLE WITH SWAGED END FITTING

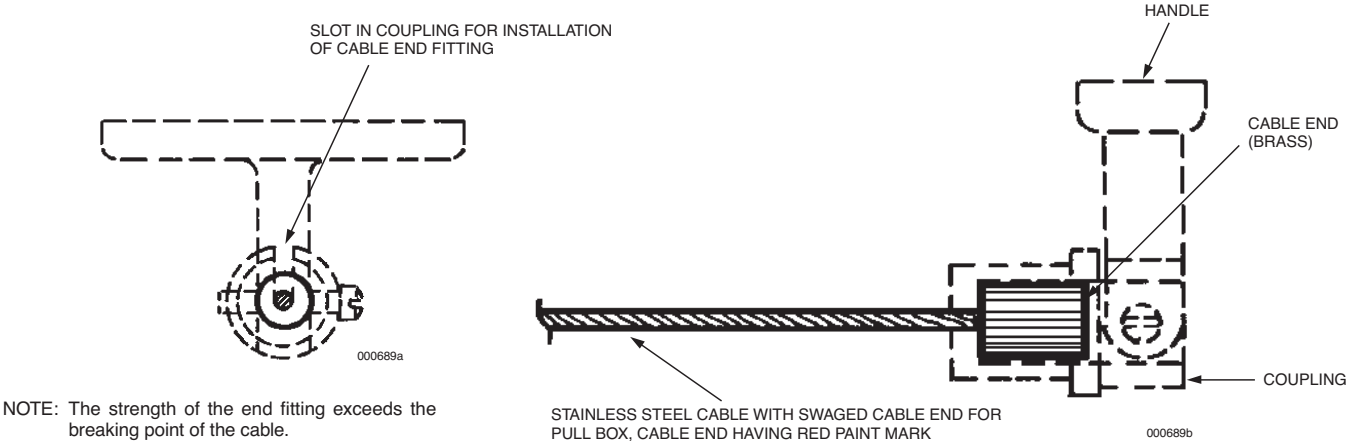
The 1/16 in. diameter cable is used to attach remote manual pull boxes to cylinder valves, pull equalizers and control boxes. The cable is constructed of stranded, stainless steel wire. The cable is available in lengths of 50, 100, and 150 ft. (15.2, 30.5, and 45.7 m). The cable assemblies include a brass swaged end fitting for attaching to the remote pull box.

The cable clamp is used to create a loop in the wire rope for attachment of the wire rope to a lever release actuator.

The Flared End Fitting provides a smooth transition on the end of a pipe run for the pull cable. When the wire rope exits the pipe to connect to lever actuators on pilot cylinders, selector valves, or globe valves the fitting prevents chaffing of the wire rope due to sharp edges on the end of the pipe. Use the flared end fitting on pipe ends any time the wire rope extends beyond the piping.

Component	Material
Cable	Stainless Steel
Swaged Fitting	Brass
Cable Assembly	

Shipping Assembly Part No.	Description
42104	50 ft. (15.2 m) 1/16 in. (16 mm) Cable with Swaged End Fitting
42109	100 ft. (30.5 m) 1/16 in. (16 mm) Cable with Swaged End Fitting
42113	150 ft. (45.7 m) 1/16 in. (16 mm) Cable with Swaged End Fitting
45333	1/16 in. (16 mm) Cable Clamp
40060	Flared End Fitting



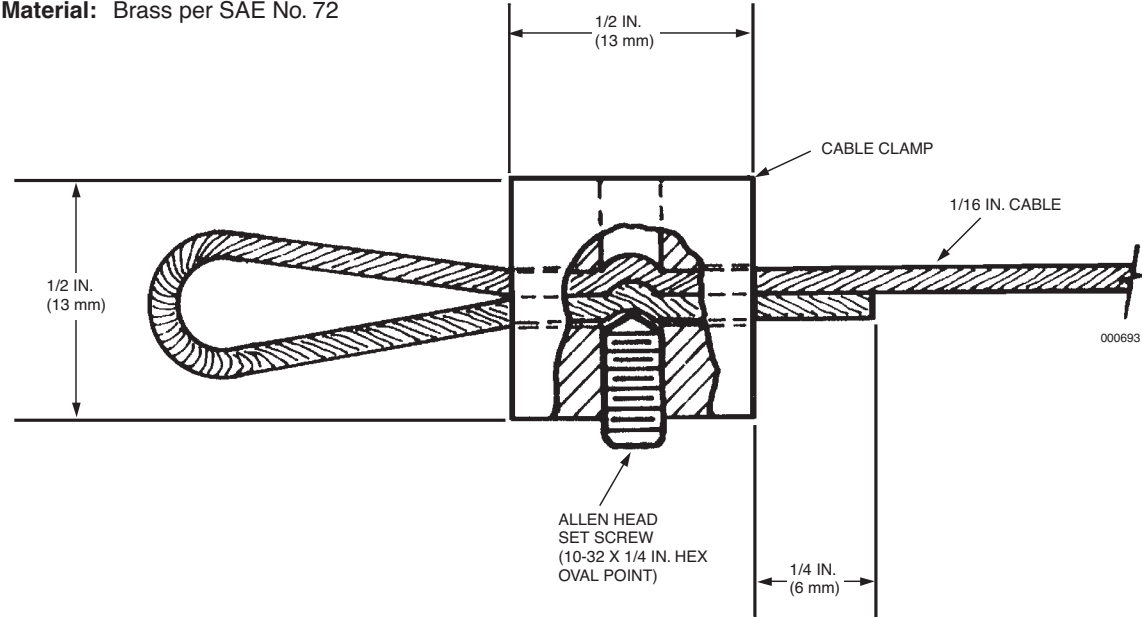
SECTION I – COMPONENTS

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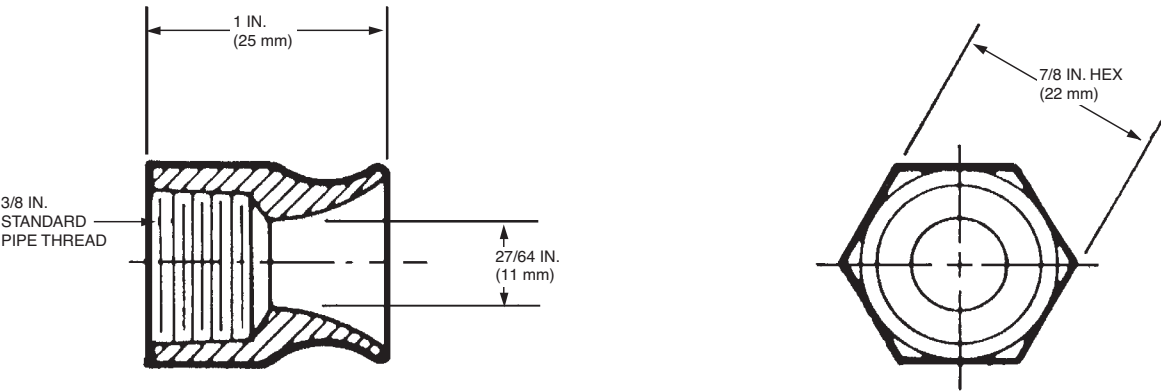
CABLE WITH SWAGED END FITTING (Continued)

CABLE CLAMP (PART NO. 45333)

Material: Brass per SAE No. 72



FLARED END FITTING (PART NO. 40060)





System Components

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REV. 1



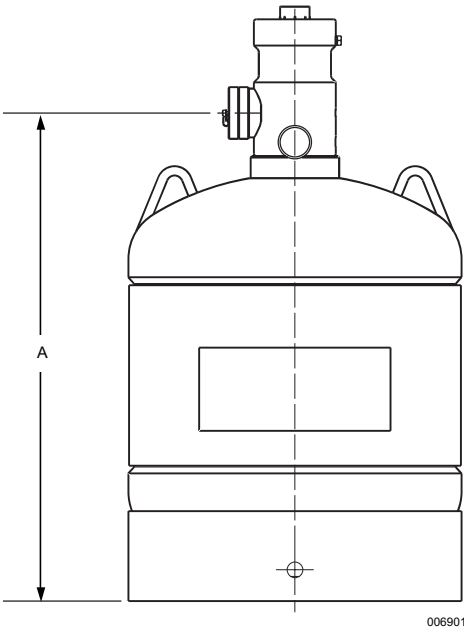
Agent Tank Shipping Assembly

The agent tank assemblies are manufactured in accordance with DOT 4BW450 and consist of a tank fitted with a valve and internal siphon tube. Eight partial filled tank sizes are available. A nameplate is adhered to the tank displaying the agent weight and gross weight. Tanks are superpressurized with dry nitrogen to 360 psi (25 bar) at 70 °F (21 °C). All tanks are available in multiple fill increments.

Note: Quantity of agent will have to be specified on customer P.O. when ordering factory filled tank shipping assemblies.

Also, when low pressure switch and liquid level indicator installed options are required, they must be specified when ordering.

Component	Material	Approvals
Tank	Steel	DOT4BW450
Valve	Brass	
Valve/Tank Assembly		UL Listed ULC Listed FM Approved



Shipping Assembly Part No./TC	Nominal Tank Size lbs. (kg)	Agent Quantity lbs. (kg)	Approximate Empty Weight lbs. (kg)	Dimension "A" in. (cm)	Diameter in. (cm)	Valve Size
570635	20 (9.1)	10 to 21 (4.5 to 9.5)	33 (15)	12 (30.4)	10 (25.4)	1 in.
570633	50 (22.7)	20 to 46 (9.1 to 21)	41 (18.6)	19.8 (50.2)	10 (25.4)	1 in.
570634	90 (40.8)	37 to 88 (17 to 40)	57.5 (26)	32.8 (83.3)	10 (25.4)	1 in.
570638	140 (63.5)	58 to 138 (26 to 62.6)	108 (49)	23.5 (59.6)	16 (40.6)	2 in.
570639/570657	280 (127)	116 to 280 (52.6 to 127)	158 (71.7)	40.2 (102)	16 (40.6)	2 in.
570640/570652	390 (177)	161 to 388 (73 to 176)	198 (90)	53.3 (135)	16 (40.6)	2 in.
570641/570653	450 (204)	194 to 459 (88 to 204)	233 (106)	64.3 (163)	16 (40.6)	2 in.
570586/570654	850 (386)	375 to 851 (170 to 386)	456 (207)	57.7 (146.6)	24 (61)	3 in.

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CABLE WITH SWAGED END FITTING

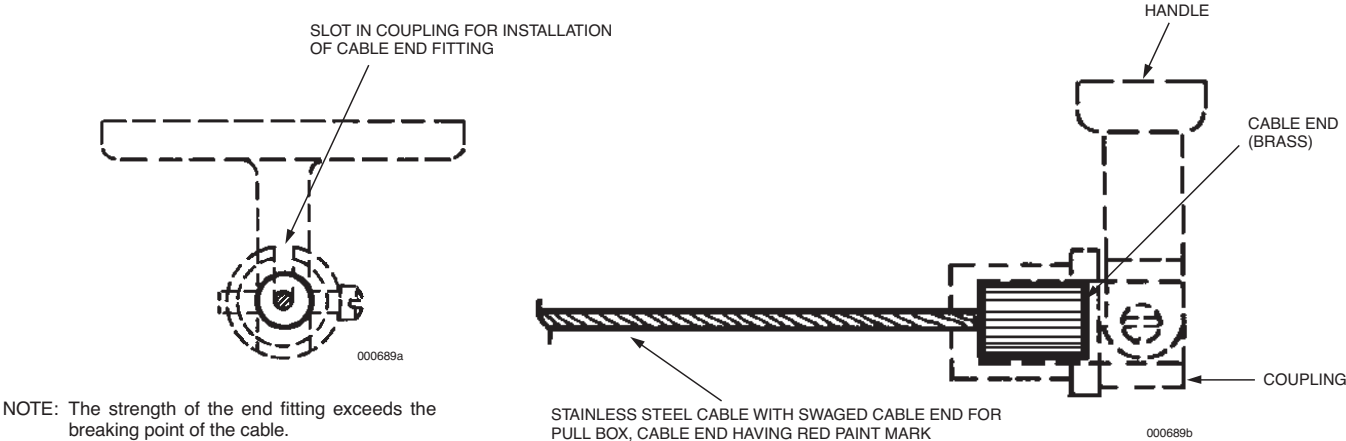
The 1/16 in. diameter cable is used to attach remote manual pull boxes to cylinder valves, pull equalizers and control boxes. The cable is constructed of stranded, stainless steel wire. The cable is available in lengths of 50, 100, and 150 ft. (15.2, 30.5, and 45.7 m). The cable assemblies include a brass swaged end fitting for attaching to the remote pull box.

The cable clamp is used to create a loop in the wire rope for attachment of the wire rope to a lever release actuator.

The Flared End Fitting provides a smooth transition on the end of a pipe run for the pull cable. When the wire rope exits the pipe to connect to lever actuators on pilot cylinders, selector valves, or globe valves the fitting prevents chaffing of the wire rope due to sharp edges on the end of the pipe. Use the flared end fitting on pipe ends any time the wire rope extends beyond the piping.

Component	Material
Cable	Stainless Steel
Swaged Fitting	Brass
Cable Assembly	

Shipping Assembly Part No.	Description
42104	50 ft. (15.2 m) 1/16 in. (16 mm) Cable with Swaged End Fitting
42109	100 ft. (30.5 m) 1/16 in. (16 mm) Cable with Swaged End Fitting
42113	150 ft. (45.7 m) 1/16 in. (16 mm) Cable with Swaged End Fitting
45333	1/16 in. (16 mm) Cable Clamp
40060	Flared End Fitting



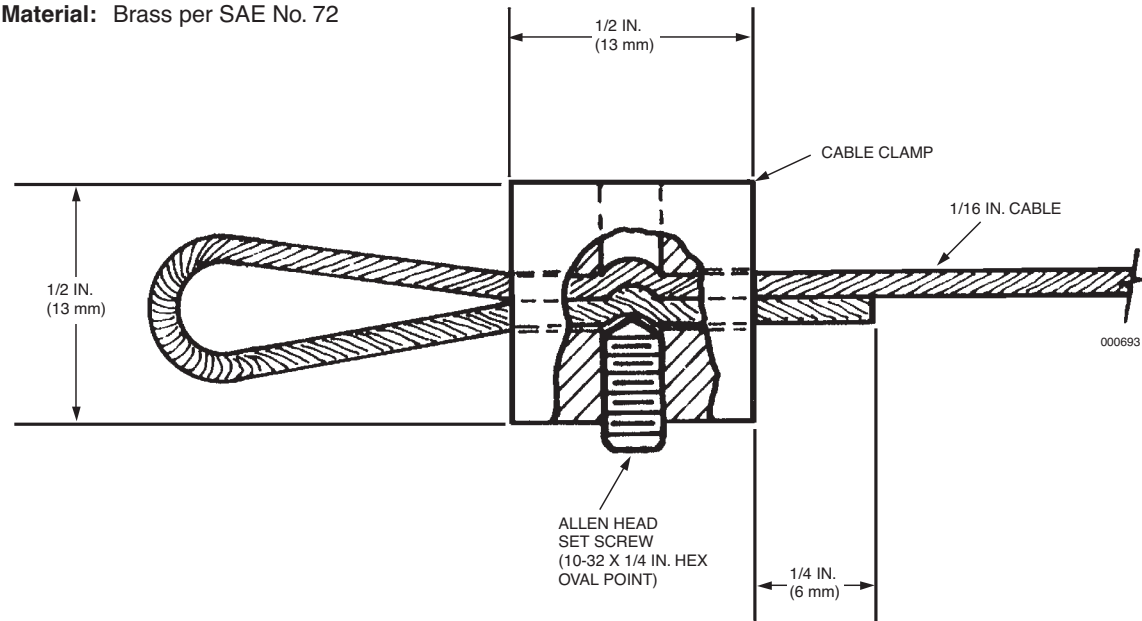
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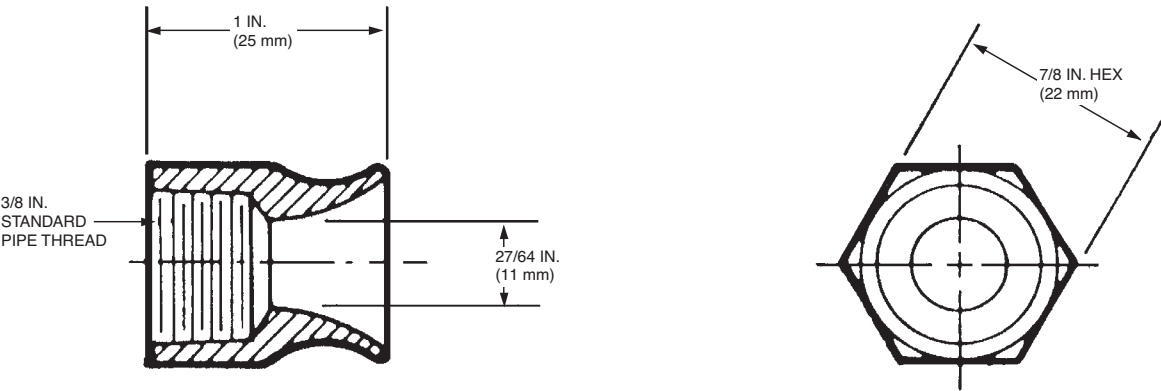
CABLE WITH SWAGED END FITTING (Continued)

CABLE CLAMP (PART NO. 45333)

Material: Brass per SAE No. 72



FLARED END FITTING (PART NO. 40060)



CORNER PULLEY

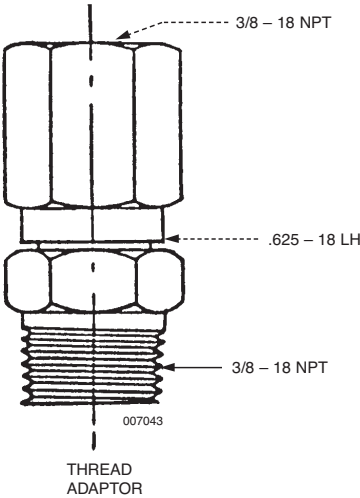
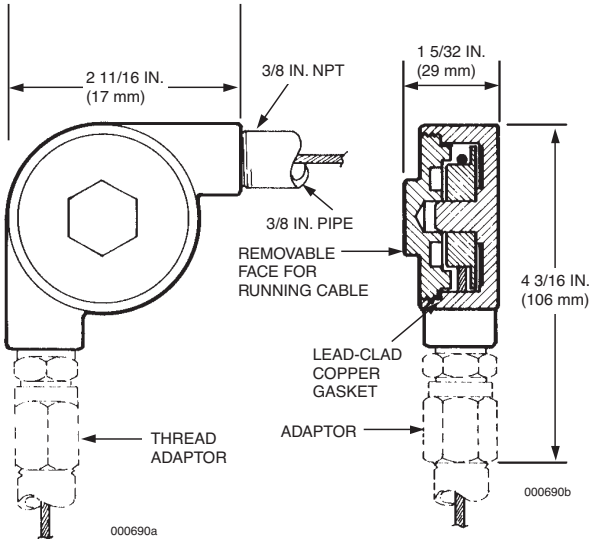
The corner pulley is required on a SAPPHIRE system whenever a mechanical release pull cable run involves a change in direction. Corner pulleys are installed as part of the cable housing (pipe) and provide 90° direction changes with minimal force loss and no induced kinking.

The corner pulley is made of forged brass and is threaded for 3/8 in. NPT pipe. The pulley is watertight and is designed for location inside or outside the protected space. Thread adaptors are available to simplify the installation.

Component	Material	Thread Size/Type
Corner Pulley – Brass	Brass	3/8 in. NPT
Thread Adaptor	Brass	—

Shipping Assembly Part No.	Description
45515	Brass Corner Pulley (brass wheel)
40696	Thread Adaptor – right/left hand

Forged Brass Watertight Corner Pulley, Sheave Type, Part No. 45515



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DUAL/TRIPLE CONTROL BOXES

The dual/triple control boxes allow manual actuation of a cylinder valve from two or three remote pull stations. Two styles of control boxes are available. Part No. 42784 is 13 3/4 in. (349 mm) and Part No. 43166 is 20 3/4 in. (527 mm) long. Both styles can be used for cylinder valve actuation. Only the longest control box, Part No. 43166, can be used for valves utilizing sectors (globe valves). The inlet and outlet connections are threaded for 3/8 in. pipe.

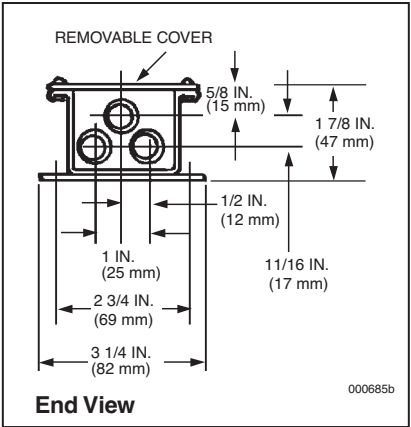
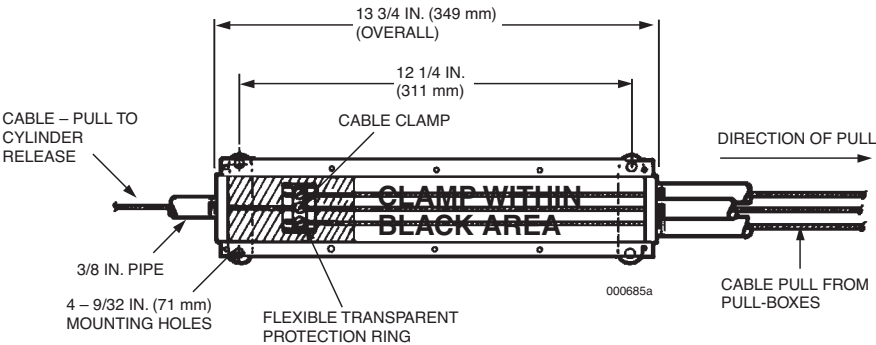
Component	Material	Thread Size/Type
Control Box (short)	Steel	3/8 in. NPT Female
Control Box (long)	Steel	3/8 in. NPT Female

Shipping
Assembly
Part No.

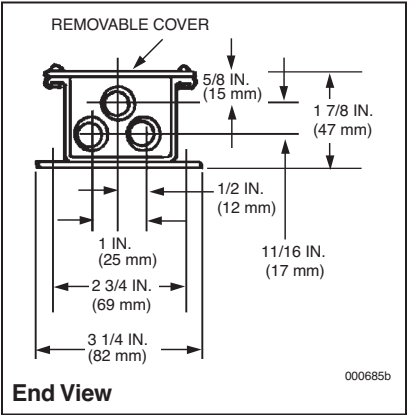
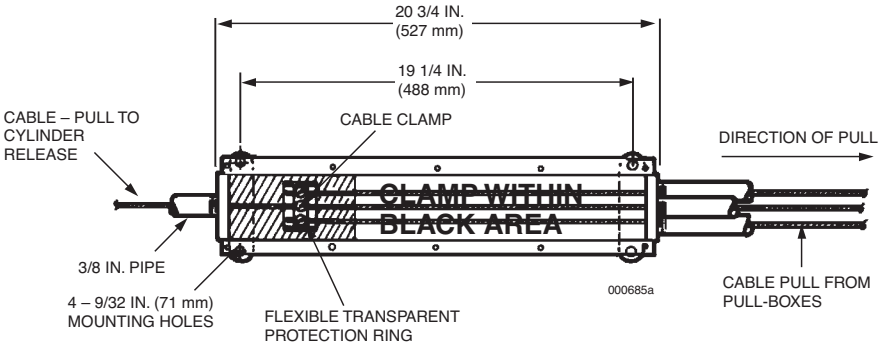
Description

→ 42784	Dual/Triple Control Box (short)
→ 43166	Dual/Triple Control Box (long)

Short Control Box (Shown Without Cover), Part No. 42784



Long Control Box (Shown Without Cover), Part No. 43166



STAINLESS STEEL ACTUATION HOSE

The Stainless Steel Actuation Hose is used to connect the actuation line compression tees between each agent tank. The hose has the same thread, 7/16-20, as the compression tees. The actuation hose allows flexibility between the rigid actuation piping and the tank valve.

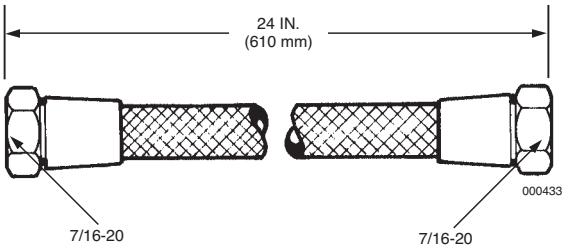
Component	Material	Thread Size/Type
Stainless Steel Hose	Stainless Steel	Female 7/16-20 (Both ends)

Shipping
Assembly

Part No.	Description
31809	16 in. (406 mm) Stainless Steel Hose
32335	20 in. (508 mm) Stainless Steel Hose
→ 32336	24 in. (609 mm) Stainless Steel Hose

Additional actuation fittings are available:

Part No.	Description
→ 31810	Male Elbow (7/16-20 x 1/4 in. NPT)
31811	Male Tee (7/16-20 x 7/16-20 x 1/4 in. NPT)
→ 32338	Male Straight Connector (7/16-20 x 1/4 in. NPT)
418359	Flared Tee (7/16 – 20 x 7/16 – 20 x 1/8 in. NPT)
73236	Pilot Valve Actuation Adaptor
32334	Male Elbow (7/16 – 20 Flare x 1/8 in. NPT)
570342	Male Adaptor (1/4 in. male BSP x 1/4 in. male NPT)



HEADER VENT PLUG

The header vent plug is used to release low pressure buildup that may occur in a closed system utilizing stop valves or check valves. The header vent plug should also be installed on the cylinder sides of the check valves on both main and reserve systems to relieve any pressure that may leak past the check valve and accidentally actuate the reserve system while the main system is discharging.

Closing pressure is 30 psi (2.1 bar).

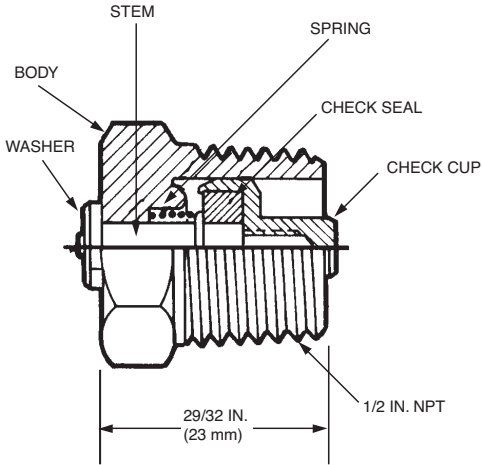
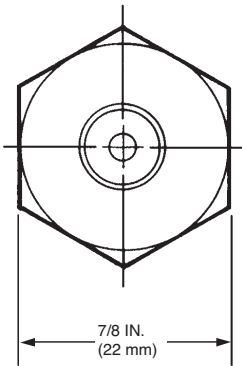
Component	Material	Thread Size/Type
Vent Plug	Body: Brass	1/2 in. NPT Male
	Spring: Bronze	
	Seal: Neoprene	

Shipping
Assembly
Part No.

Description
Header Vent Plug



40309



000707

SECTION I – COMPONENTS

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1/2 IN. MANIFOLD PILOT RELIEF VALVE

The manifold pilot relief valve will release pressure buildup in the manifold line. This slow release of pressure does not affect the function of the manifold line.

Burst Pressure: 2,900 – 3,360 psi (200 – 232 bar)

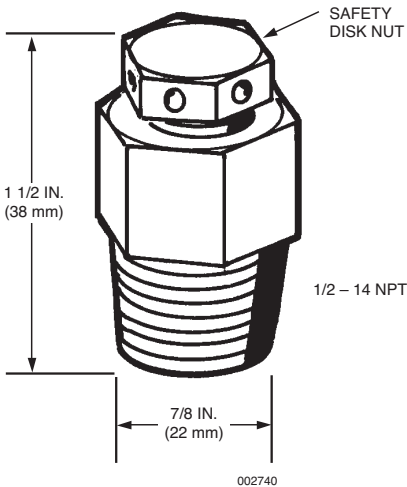
<u>Component</u>	<u>Material</u>
1/2 in. Manifold Relief Valve	Brass

Shipping
Assembly
Part No.
418378

Description
1/2 in. Pilot Manifold Relief Valve



1/2 In. Manifold Pilot Relief Valve



PRE-DISCHARGE TIME DELAY (PART NO. 417504)

The system discharge must be delayed for a short time following actuation. This is usually in areas where it is necessary to evacuate personnel prior to discharge. A manual release is incorporated on the time delay valve to allow instant override of the time delay. The length of delay is factory set and is not adjustable.

The time delay assembly uses nitrogen pressure to power the factory-set delay mechanism. Install the assembly in the discharge piping, either directly after the control (pilot) cylinder or further along the piping. The assembly is reversible to accommodate right and left hand configurations and will operate in any mounting orientation. After the discharge is complete, pressure in the assembly slowly returns to normal and closes the time delay valve.

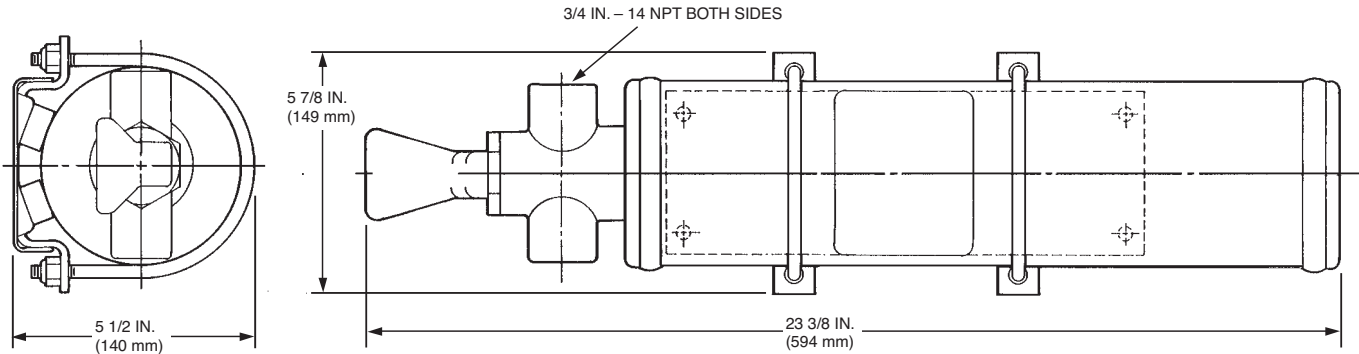
Shipping Assembly Part No.
426170
54169

Description
60 Second time delay
30 Second time delay

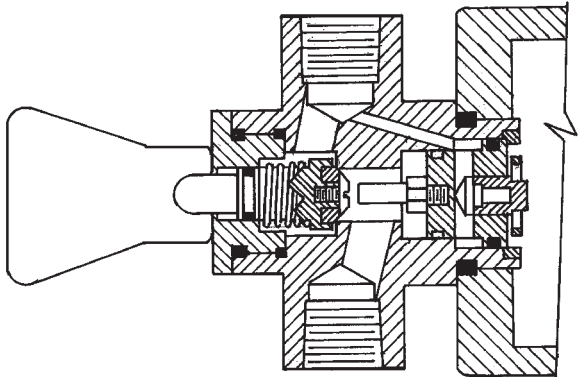


Component	Material
Valve	Brass
Accumulator	Steel
	(Sch. 80 Pipe)

Time Delay Assembly



000699



CROSS SECTION OF VALVE

004372

SECTION I – COMPONENTS

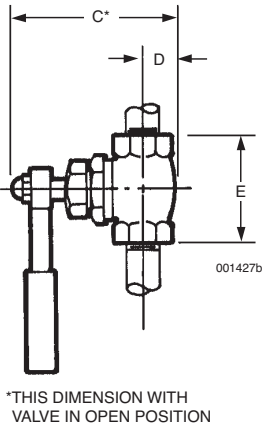
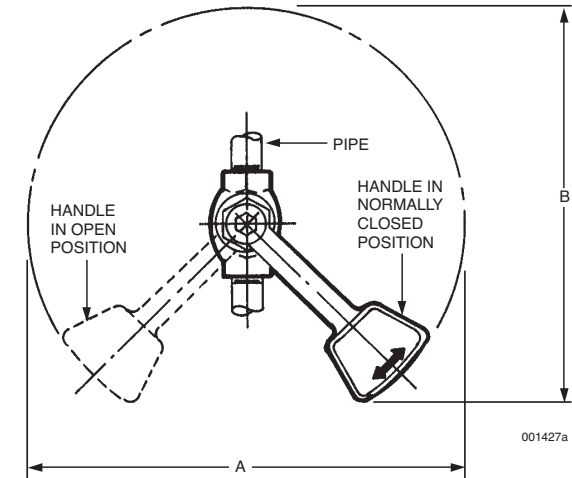
U.S.C.G. APPROVAL NO. 162.161/6/0 REV. 0
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GLOBE VALVES AND CONTROLS

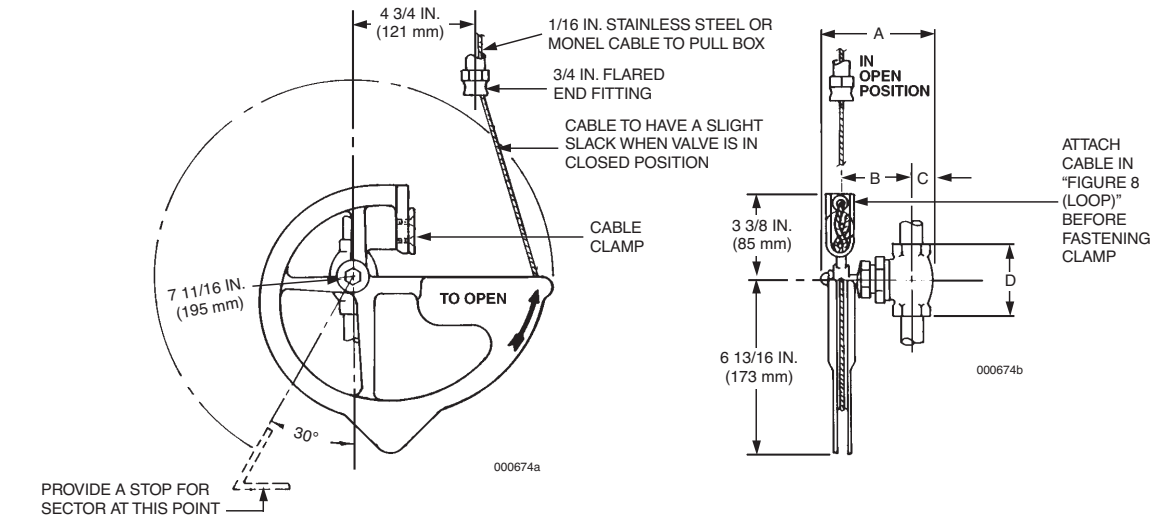
Globe valves are used to either manually control the flow of SAPPHIRE System agent into a hazard area or to manually control the flow into one of several hazards being protected by a common bank of SAPPHIRE System cylinders. These valves are operated manually, either by the use of a hand lever attached directly to the valve or by means of a remote manual pull box which will operate a sector attached to the valve. Globe valves can be used as a safety feature, keeping the flow of agent from entering a hazard area, either because of a false discharge or to allow the occupants enough time to exit the area prior to the valve being manually opened. The valves are available in 1/2 in. and 3/4 in. sizes. Each size can be used with a hand lever or a sector. **Globe valves are installed in pilot lines only.**

Component	Material	Thread Size/Type
Globe Valve	Forged Brass	1/2 in. NPT Female
Globe Valve	Forged Brass	3/4 in. NPT Female

Shipping Assembly Part No.	Description
41451	1/2 in. direction/stop valve (valve only)
41102	3/4 in. direction/stop valve (valve only)
40248	Handle – normally open (for use with 1/2 in. valve)
40267	Handle – normally open (for use with 3/4 in. valve)
40238	Handle – normally closed (for use with 1/2 in. valve)
40239	Handle – normally closed (for use with 3/4 in. valve)
40276	Sector (for use with 1/2 in. valve)
40279	Sector (for use with 3/4 in. valve)



Valve Size	A		B		C		D		E	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)
1/2 in.	10	(254)	9 3/8	(238)	4 3/4	(121)	7/8	(22)	2 15/16	(74)
3/4 in.	14	(355)	12 3/4	(323)	5 5/8	(142)	1 1/8	(28)	3 5/8	(92)



Valve Size	A		B		C		D	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)
1/2 in.	4 3/4	(121)	3	(76)	7/8	(22)	2 15/16	(74)
3/4 in.	5 5/8	(142)	3 5/8	(93)	1 1/8	(28)	3 5/8	(92)

SECTION I – COMPONENTS

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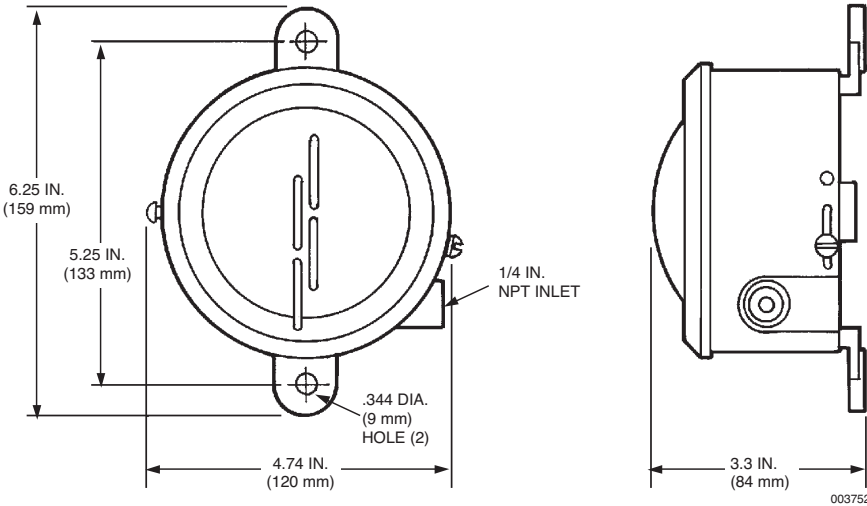
PRESSURE OPERATED SIREN

The pressure operated siren is used to warn personnel of a system discharge. The siren is operated with the nitrogen pressure from the pilot cylinder. The siren will operate at the start of the SAPPHIRE System discharge and will continue through most of the discharge time. The minimum decibel level at 10 ft. (3 m) is 90 dB with a flow rate of 100 cu. ft./minute (2.83 cu. m/minute). A pipe hanger or bracket must be installed within one foot of the siren.

Component	Material	Specifications
Siren	Body: Brass	Required Pipe: 1/4 in., Schedule 40
	Grill: Steel	Maximum Sirens: 4
	Screen: Stainless Steel	Maximum Pipe Length: 200 ft. (61 m) minus 1 ft. (0.3 m) for every elbow used
		Flow Rate: 100 cu. ft./min.
		Design of system must include agent used through siren if siren is not located in hazard area

Shipping
Assembly
Part No.

Description
Pressure Operated Siren



PRESSURE SWITCH – DPST

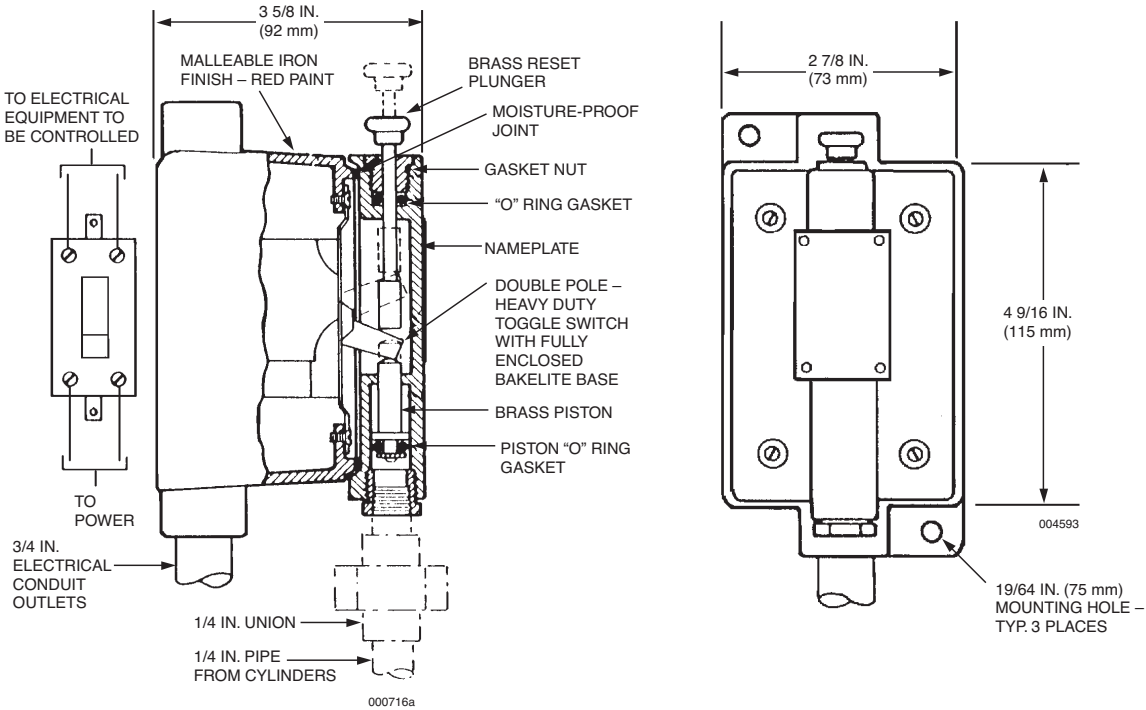
The pressure switch is operated by the nitrogen pressure when the system is actuated. The pressure switch can be used to open or close electrical circuits to either shut down equipment or ventilation systems and turn on lights or alarms. The double pole, single throw (DPST) pressure switch is constructed with a gasketed, water tight housing. The housing is constructed of malleable iron, painted red. A 1/4 in. NPT pressure inlet is used to connect the 1/4 in. pipe from the pilot system.

Minimum operating pressure is 50 psi (3.5 bar).

Component	Material	Thread Size/ Type	Electrical Rating
Pressure Switch	Switch:	Conduit Inlet:	2 HP –
DPST	BAKELITE	3/4 in. NPT Female	240 VAC/480 VAC
			2 HP – 250 VDC
	Housing:	Pressure Inlet:	30A –
	Malleable	1/4 in. NPT	250V AC/DC
	Iron	Female	5A – 480V AC/DC
	Piston:	Brass	
	Cover:	Brass	

Shipping
Assembly
Part No.
46250

Description
Pressure Switch – DPST



WARNING SIGNS

Two warning signs are available for warning personnel that the space is protected by a SAPPHIRE system and no one should enter after a discharge without being properly protected. Each sign is made of aluminum and contains four mounting holes for ease of installation.

Component	Material
Warning Sign	Aluminum

Shipping Assembly Part No.	Description
570580	Warning Sign ←
570581	Agent Discharge Warning Sign ←



WARNING SIGNS

Two warning signs are available for warning personnel that the space is protected by a SAPPHIRE system and no one should enter after a discharge without being properly protected. Each sign is made of aluminum and contains four mounting holes for ease of installation.

Component	Material
Warning Sign	Aluminum

Shipping Assembly Part No.	Description
570580	Warning Sign
570581	Agent Discharge Warning Sign



INSTALLATION

All installations are to be performed in accordance with the parameters of this manual and all appropriate codes and standards from the local, state, and federal authority having jurisdiction.

Equipment should be per this manual. Other materials should be in accordance with industry standards and practices and acceptable to the authority having jurisdiction. Installation should be by personnel experienced in this type of work.

Before the SAPPHIRE system is installed, the qualified installer should develop installation drawings in order to locate the equipment, to determine an actuation and distribution piping routing. Installation drawings shall be submitted for approval to the appropriate authority having jurisdiction (AHJ, Flag State, Classification Society) prior to system installation.

For successful system performance, the SAPPHIRE system components and the hazard area must be within a temperature range of 0 °F to 130 °F (–18 °C to 54 °C).

Note: For hazards larger than 6000 cu. ft. (170 cu. m), the tanks should be located outside the protected space. For those few cases where the tanks need to be located inside the protected space, the following requirements must be met:

- Dual (looped) actuation lines for simultaneous actuation.
- Stainless steel welded piping rather than tubing for pneumatic actuation lines.
- Tank pressure must be monitored through a supervisory pressure switch (in addition to the usual pressure gauge and liquid level indicator).
- Concentration calculations must be based on maximum (gross) hazard volume, i.e. no deductions are to be taken for installed equipment.

MOUNTING COMPONENTS

Tank/Bracket Assembly

SAPPHIRE tanks may be located inside or outside the protected space, although it is preferable to locate them outside of the space. They must not be located where they will be exposed to a fire or explosion in the hazard. When they are installed within the space they protect, a remote manual pull station must be installed outside the hazard area to actuate the system.

The tanks should be installed so that they can be easily removed for recharging. Tanks must be installed indoors. Do not install the tanks where they are exposed to direct sun rays. See the following table for dimensions of bracket location.

 **CAUTION**

Do not remove the outlet safety shipping cap until tank is securely mounted in the bracket. Failure to comply could result in personal injury, death, or property damage from violent tank movement or overexposure to high concentrations of Novec 1230 agent.

1. Mount the back channels (supplied by others) for the mounting brackets to a rigid, vertical surface at the appropriate height. See Table 1. Make certain to use suitable fastening hardware. **Note: If manifolding is being utilized, make certain tank brackets are spaced properly to accommodate the manifold inlet spacing.**
2. Position the tank(s) against the back channel, with the valve outlet pointing to the left.

3. Insert the tank straps into the top and bottom back channel and secure with the bolts provided. See Figure 1.
4. If a connected reserve system is required, mount the reserve tanks directly next to the main system tanks.

Tank Size	No. of Unistrut Channels	Height From Floor to Bracket	
		in.	(mm)
10 to 21 lbs. (4.5 to 9.5 kg)	1	5.0	(130)
20 to 46 lbs. (9 to 21 kg)	2	2.5, 13.0	(60, 330)
37 to 88 lbs. (17 to 40 kg)	2	6.25, 23.5	(160, 595)
58 to 138 lbs. (26 to 63 kg)	2	4.25, 13.5	(110, 343)
116 to 280 lbs. (53 to 127 kg)	2	11.75, 29.5	(300, 750)
161 to 388 lbs. (73 to 176 kg)	2	11.75, 39.25	(300, 1000)
194 to 459 lbs. (88 to 204 kg)	2	11.75, 47.25	(300, 1200)
375 to 851 lbs. (170 to 386 kg)	2	11.75, 43.25	(300, 1100)

Table 1. Bracket Mounting Heights

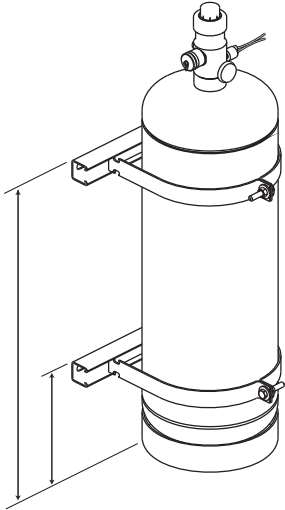


FIGURE 1
004833

SECTION VI – INSTALLATION

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INSTALLING DISTRIBUTION PIPING**General Piping Requirements (Including Manifolding)**

- Use Schedule 40 black iron, galvanized, chrome-plated, or stainless steel pipe conforming to ASTM A53, or A106. All fittings must be a minimum Class 300, malleable or ductile iron.
- Pipe unions are acceptable.
- Reducing bushings only are allowed when reducing pipe size.
- Cast iron pipe and fittings are **not** acceptable.
- PTFE (Teflon) tape is the only acceptable pipe sealant and must be applied to male threads only.

NOTICE

Do not allow tape to overlap the pipe opening, as this could cause possible blockage of the agent. **Thread sealant or compound must not be used.**

- Before assembling the pipe and fittings, make certain all ends are carefully reamed and blown clear of chips and scale. The inside of pipe and fittings must be free of oil and dirt.
- All pipe lengths are measured center to center of fittings.
- Hangers must be placed within 12 in. (30.5 cm) of the discharge nozzle.
- Hangers must be UL listed or FM approved and mounted to a structure capable of supporting the weight of the pipe and agent.
- All dead end pipe lines to be provided with a capped nipple, 2 in. long. See Figure 2.
- Vertical drops on the end of line are acceptable.

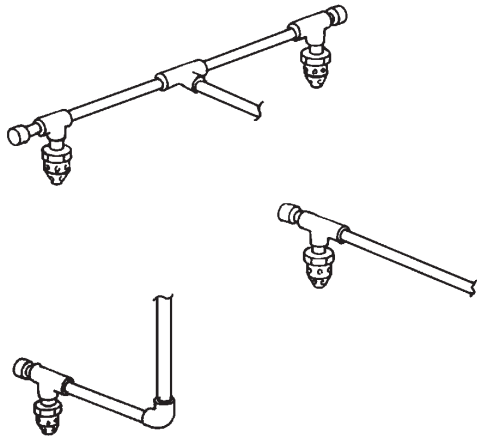


FIGURE 2
001876

Piping and Nozzle Installation

1. With the tank properly secured in the bracket, remove the discharge outlet safety shipping cap.
2. If utilizing a discharge hose, connect the hose directly to the valve outlet. If rigid piping directly to the valve, first attach the appropriate union adaptor to the valve outlet.
3. Continue piping the remainder of distribution piping, following the piping sketch completed in System Design Section.
4. Verify that the nozzle locations are correct and rigidly mount the nozzles and connect to the distribution piping. Make certain not to exceed the piping limitations as stated in "Design/Flow Calculation Limitations" in Section III.

INSTALLING ACTUATION PIPING**General Actuation Piping Requirements**

1. Use only 1/4 in. Schedule 40 black iron, hot-dipped galvanized, chrome-plated, or stainless steel pipe/braided hose and fittings conforming to ASTM A120, A53, or A106.
2. Before assembling the pipe and fittings, make certain all ends are carefully reamed and blown clear of chips and scale. Inside of pipe and fittings must be free of oil and dirt.
3. The piping and fitting connections must be sealed with pipe tape. When applying pipe tape, start at the second male thread and wrap the tape (two turns maximum clockwise around the thread), away from the pipe opening.

NOTICE

Do not allow tape to overlap the pipe opening, as this could cause possible blockage of the gas pressure. **Thread sealant or compound must not be used.**

4. Cast iron pipe and fittings are not acceptable.
5. Actuation piping must be rigidly supported by UL listed hangers.
6. Refer to "Actuation Requirements – Option 1 and Option 2" in Design Section for detailed piping limitations.

SAPPHIRE FIRE SUPPRESSION SYSTEM WITH NITROGEN
PILOT CYLINDERS AND PULL CABLE ACTUATION

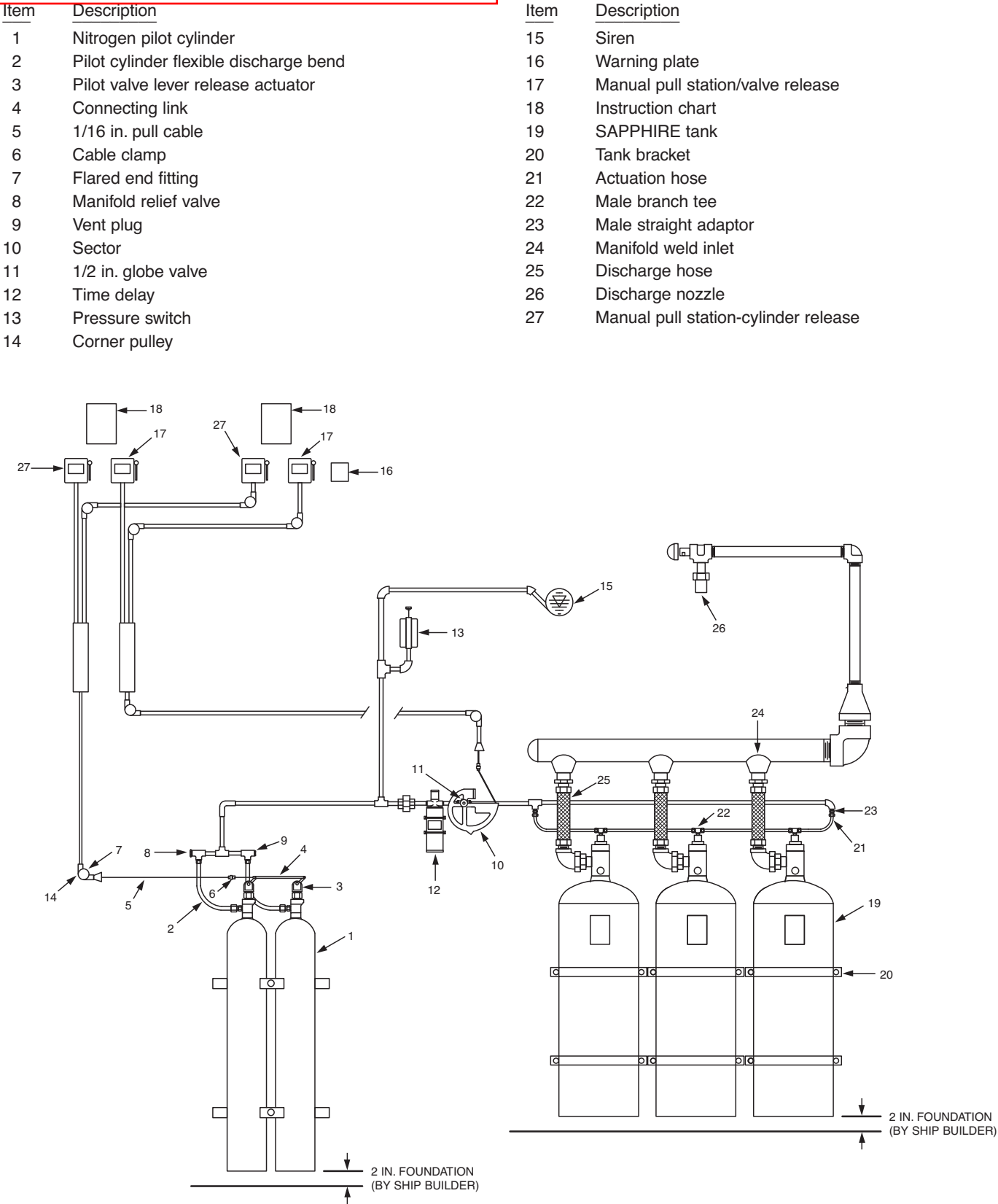


FIGURE 6
006987

SECTION VII – TESTING AND PLACING IN SERVICE

U.S.C.G. APPROVAL NO. 162.161/6/0 REV. 0

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DISTRIBUTION PIPING PRESSURE TESTING

After completion of all distribution piping installation, pressure testing (using a gas) must be completed to test the piping network for tightness. The test pressure is to be 540 psi (37 bar) and held for two minutes. The pressure drop is not to be more than 150 psi (10 bar) per minute.

TESTING CABLE PULL STATION

To test a remote cable pull station to pilot cylinder lever release(s), complete the following steps:

CAUTION

Make certain lever actuator(s) are removed from pilot cylinder valves prior to testing pull station. Failure to do so will cause cylinder discharge.

1. Remove lever actuator(s) from cylinder valve.

NOTICE

After removing actuator(s) from cylinder valve, securely support actuator(s) in order for it to operate when pull station is pulled.

2. Pull remote cable pull station. Lever actuator should move to the tripped position.

If lever actuator does not trip, remove each pulley elbow cover to make certain wire rope is resting on the pulley sheave. If this does not correct the problem, there is too much slack in the cable and it must be retightened.

3. If retightening or realignment was necessary, retry pull station.
4. When pull station operates properly, reset lever actuator.

CAUTION

Make certain lever actuator is in the "SET" position before reinstalling on cylinder valve. Failure to do so will cause actuation when reinstalling.

5. Reinstall lever actuator on cylinder valve. Wrench tighten.

TESTING SELECTOR VALVE

When utilizing selector valves in the distribution piping network, make certain all selector valve actuators are in the "SET" position.

TESTING TIME DELAY

To determine if the time delay is functioning properly, test per the following steps:

CAUTION

Disconnect all system cylinders from actuation and distribution piping before running time delay test. Failure to disconnect system cylinders could cause cylinder actuation during time delay test.

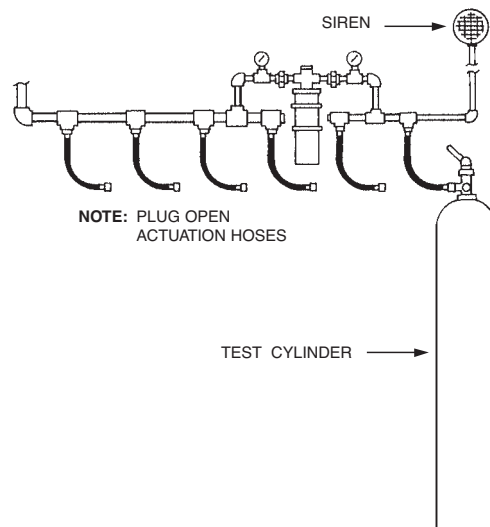
NOTICE

The nitrogen test cylinder should be a minimum of 250 cu. ft. for the delay plus an additional 100 cu. ft./min. for each siren in the system.

CAUTION

Notify proper personnel that alarms will sound and which devices will start-up and/or shut-down.

1. Disconnect all pneumatic actuators from all SAPPHIRE tanks and plug all actuation lines.
2. Disconnect all non-test pilot cylinders from the pilot cylinder manifold.
3. Install the nitrogen test cylinder in the end pilot cylinder position and plug all open actuation hoses.
4. Install a pressure gauge between the test cylinder and the time delay device. The gauge should be calibrated with a capability of at least 3000 psi (20.69 bar) with increments of 50 psi (3.45 bar).
5. Disconnect the piping from the outlet of the time delay and install another pressure gauge, similar to the type specified in Step 1. See Figure 1.

**FIGURE 1**

000927

NOTICE

The timing cycle should begin when agent is introduced into the time delay device inlet and should end when the pressure gauge in the outlet of the time delay reads 50 psi (3.45 bar).

6. Open the test cylinder to allow flow into the inlet of the time delay and simultaneously begin timing.
7. Observe the inlet pressure gauge approximately 2-3 seconds after opening the test cylinder and record the pressure reading.
8. Observe the pressure gauge on the outlet of the time delay. When the gauge reads 50 psi (3.45 bar), stop timing. Record the time delay period measured.

SECTION VII – TESTING AND PLACING IN SERVICE

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TESTING FOR COMMISSIONING

Testing shall be done according to the requirements of the appropriate marine authority.

Actuation Test**NOTICE**

Inspect system before testing.

1. Check pilot cylinder pressure. Recharge if pressure loss exceeds 5 percent of charge.
2. Actuation test. Remove all cylinders from the system excluding those pilot cylinders required for the hazard being tested.

NOTICE

Do not remove discharge hoses from the manifold.

Actuation tests are normally performed by actuating the furthest remote actuation station from the pilot cylinder in order to ensure the integrity of the pilot tubing and the quantity of pressure in the line. This will normally require two or more personnel due to the distance involved.

3. When the system is actuated, the following items should be verified:
 - a. Immediately upon actuation of the pilot cylinders, the audible alarms located in the protected space should sound.
 - b. Pressure operated switches (if provided) shall activate.
 - c. The time delay immediately downstream from the pilot cylinders shall operate after the designed delay (30 or 60 seconds).
 - d. Depending upon the system design; after time delay period, the time delay valve will open allowing gas from the pilot cylinders to:
 - Flow through the manifold and out the open stop/directional valve.
 - Supply pressure to each pneumatic actuator(s). The pin in each actuator will be pushed to the “down” position.
 - e. Time delay should reset itself once the pressure is bled from the manifold.
4. After the system test, reset pneumatic actuators, pressure switches, and pull station. Globe valves should be reset to the closed position. If pneumatic actuation is used, remaining pressure should be bled from the actuation lines, and the LT-20-L nitrogen cartridges should be replaced after ensuring that the puncture pins in the actuator assemblies are in the full upright and set position.
5. Recharge nitrogen pilot cylinders according to manufacturer's instructions and procedures, and replace according to installation instructions.

INSPECTION

Inspection is a “quick check” that a system is operable. It is intended to give reasonable assurance that the system is fully charged and will operate. This is done by seeing that the system has not been tampered with and there is no obvious physical damage, or condition, to prevent operation. The value of an inspection lies in the frequency, and thoroughness, with which it is conducted. Systems should be inspected at regular monthly intervals, or at more frequent intervals when circumstances require.

The following visual checks should be performed during a SAPPHIRE system inspection:

- Visually inspect the hazard area to verify that it has not changed. Look for different fuels, new equipment, blocked open doors or dampers.
- Check detectors to make certain they are in place, not damaged or coated with dirt, grease, paint, or any contaminating substance.
- Check all manual pull stations to assure they have not been tampered with and are not blocked from use.
- Check all alarm devices for damage, dirt, corrosion, etc.
- Check that the piping is secure and nozzles are in place. Make certain the nozzles are not covered with dirt, grease, or paint and that there is nothing structural blocking the discharge.
- Visually inspect all components for signs of damage, such as disconnected or loose parts, corrosion, twisted or dented components, etc.
- Check each SAPPHIRE tank gauge to determine that tank pressure is in the operable range.
- Visually verify that the control panel and/or releasing device is functioning properly.
- Perform any other checks that may be required by the authority having jurisdiction.
- Record that the system has been inspected and inform the proper personnel.