

# Amerex Modular Dry Chemical Vehicle Fire Suppression System

**INSTALLATION, OPERATION, AND  
MAINTENANCE MANUAL**

**No. 13980**

**Revision J, January 2015**

**MODELS:**

**V13 ABC & V13 PK**

**V25 ABC & V25 PK**

**VH25 ABC & VH25 PK**

**V30 ABC**

**VH30 ABC**

**V50 ABC & V50 PK**

**VS50 ABC & VS50 PK**

**VSR50 ABC**

**VS75 ABC**

**VSR75 ABC**

**V150 ABC**

**V250 ABC**



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# **Chapter 1: General Information**

This document must be used in conjunction with the following standards:

1. All applicable NFPA standards.
2. All other standards or laws deemed applicable to an installation by local authorities having jurisdiction.

**⚠ IT IS THE RESPONSIBILITY OF INDIVIDUALS WHO INSTALL, OPERATE, INSPECT, RECHARGE AND /OR MAINTAIN THESE SYSTEMS TO READ THIS ENTIRE MANUAL.**

Updated Installation, Operation, and Maintenance Manuals and Technical Bulletins will be available online at [www.amerex-fire.com](http://www.amerex-fire.com). It is important that these updates and additions be added to this manual according to the instructions that will accompany them.

The applications and use of the Amerex Modular Dry Chemical Vehicle Fire Suppression Systems are limited to the applications and uses described in this manual. Technical data contained herein is based on controlled laboratory testing deemed appropriate by Factory Mutual Research Corp. and other listing agencies, and is intended for informational purposes only. The data presented is accurate for the testing performed, but is published with no guarantee relative to a given hazard where factors are different from those encountered during actual tests. Amerex disclaims any liability for any use of the data and information contained herein by any and all other parties. Please direct questions concerning information in this manual to:

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## 1.1 Introduction

Amerex Modular Dry Chemical Fire Suppression Systems are pre-engineered FM Approved systems that are designed specifically for protection of mobile equipment. Each system uses stored pressure Agent Cylinders with predetermined nozzle flow rates, quantities and discharge volumes. The Dry Chemical Agent is discharged into hazard areas via an Agent Distribution Network consisting of flexible hydraulic hose or stainless steel tubing. The available Agent Cylinders with number of supported Nozzles are listed in Table 1.1.

Model	Part Number	Number of Nozzles
V13ABC	11345	2
V25ABC	10103	2, 3, or 4
VH25ABC	12252	2, 3, or 4
VH30ABC	22744	3, 4, or 5
V50ABC	10104	4, 6, or 8
VS50 ABC	16969	4, 6, or 8
V13ABC PRS SW	15647	2
V25ABC PRS SW	15591	2, 3, or 4
VH25ABC PRS SW	15524	2, 3, or 4
V30ABC PRS SW	23251	3, 4, or 5
VH30ABC PRS SW	22743	3, 4 or 5
V50ABC PRS SW	15590	4, 6, or 8
VS50 ABC PRS SW	16979	4, 6, or 8
VSR50 ABC PRS SW	23057	4, 6, or 8
VS75 ABC PRS SW	22373	10 or 12
VSR75 ABC PRS SW	23055	10 or 12
V150 ABC PRS SW	23729	12 or 18
V250 ABC PRS SW	22838	12, 18, or 24
V13PK	11346	2
V25PK	10981	2, 3, or 4
VH25PK	12318	2, 3, or 4
V50PK	10982	4, 6, or 8
VS50 PK PRS SW	16980	4, 6, or 8

ABC = ABC Agent, PK = Purple K Agent      *Table 1.1*  
 PRS SW = Pressure Switch on Valve

## 1.2 What Can Be Protected

A complete hazard analysis must be performed for each piece of equipment being protected to determine the machine components that would require fire suppression by the Amerex Modular Dry Chemical Fire Suppression System. Protection may include but is not limited to:

- Earth Moving Equipment - Dozers, Haul Trucks, Cranes, Shovel Excavators, Drill Trucks, Conveyers
- Forestry / Land Clearing - Brush Cutters, Skidders, Feller Bunchers, Chippers
- Landfill / Refuse - Garbage Trucks, Compactors, Track Dozers
- Farming Equipment - Tractors, Harvesters, Mowers, Spreaders
- Transit - Rail, Bus
- Mobile Equipment - Pumps, Generators, Compressors

### 1.3 Testing Performed

- UL1254 Environmental
- Single Nozzle Fire Tests (See Figure 1.3.a, 1.3.b and Table 1.3)

Total Flooding (Volume)

One Nozzle Equals: 244 ft<sup>3</sup> (6.9 m<sup>3</sup>)

- Wood Crib Fuel "Class A" Fires
- Liquid Fuel Pan "Class B" Fire
- Liquid Fuel Cups "Class B" Fires

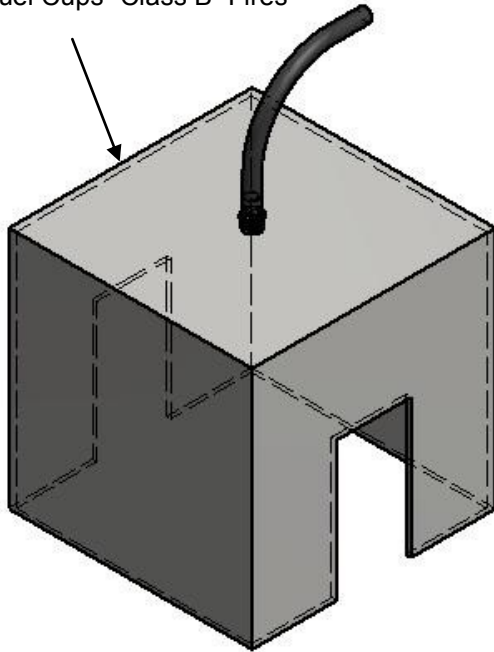


Figure 1.3.a

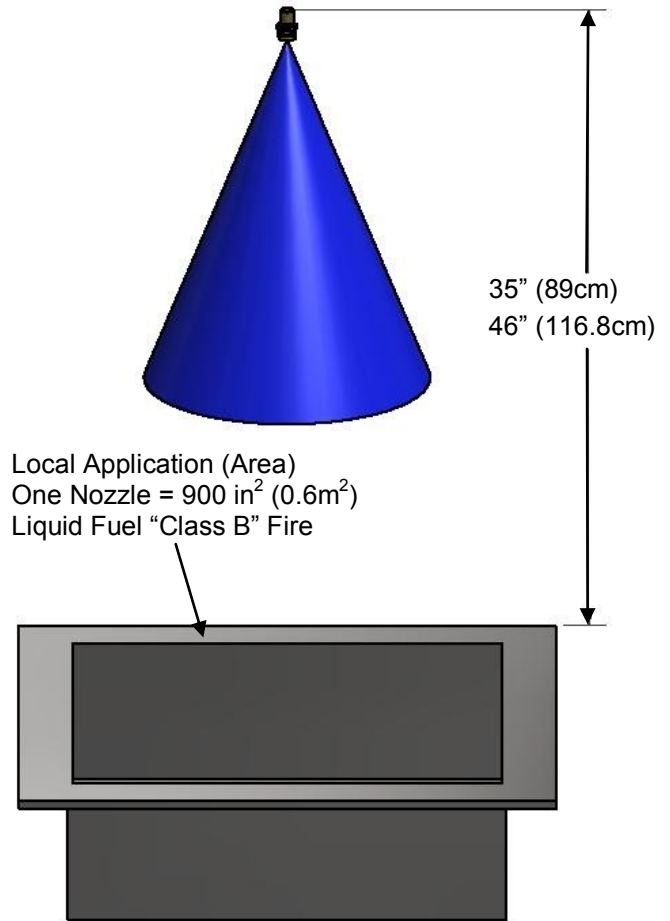


Figure 1.3.b

Coverage Type	Rated Protection	Nozzle Placement
Total Flooding (Volumetric)	244 ft <sup>3</sup> (6.9m <sup>3</sup> )	Center of top plane
Local Application (Area)	900 in <sup>2</sup> (0.6m <sup>2</sup> )	Center of area 35-46 in (89-117 cm) above fuel surface

Table 1.3

## 1.4 Uses & Limitations

The Amerex Modular Dry Chemical Fire Suppression System has two options for agent that can be used for suppressing and extinguishing fires:

- ABC Dry Chemical - is a multipurpose ammonium phosphate based dry chemical which is effective in suppressing and extinguishing class A, B, and C fires. These fires can be involved in ordinary combustible materials, flammable liquids, and fires involving energized electrical equipment.
- Purple K - is a potassium bicarbonate based dry chemical which is effective in suppressing and extinguishing class B and C fires involving flammable liquids and is safe on fires involving energized equipment.

**CAUTION: Unless all sources of ignition have been removed, the system may be ineffective in suppression of flowing flammable liquid fires. Flammable gases present a potential explosion hazard. The flow of fuels and other combustibles must be stopped before or during activation of the fire suppression system.**

Amerex Modular Dry Chemical Fire Suppression System shall not be considered satisfactory protection for the following:

- Chemicals containing their own oxygen supply
- Combustible metals such as sodium, potassium, magnesium, titanium, and zirconium
- Deep seated or burrowing fires in ordinary combustibles where dry chemical cannot reach point of combustion
- Explosions

Amerex Modular Dry Chemical Fire Suppression Systems are useful in protecting major vehicle components such as engines, transmissions, charging systems, hydraulic systems, and brake systems. These systems can also give equipment operators additional time to evacuate the vehicle in the event of a fire.



## Chapter 2: Component Description

The following sections describe the various components available for use with the Amerex Modular Dry Chemical System. These include Agent Cylinders of various size and capacity and the Cylinder Brackets used for mounting each Agent Cylinder. Also included are the components that comprise the Agent Distribution Network, the Nozzles used for dispersing the Dry Chemical Agent, and various control heads and accessories used to actuate and discharge the Agent Cylinders.

### 2.1 Agent Cylinders

The Amerex Modular Dry Chemical System Agent Cylinders are available in multiple sizes, with different mounting options and orientations. The Agent Cylinders are shipped fully charged from the factory. Each Agent Cylinder includes a brass Agent Cylinder Valve with a Pressure Gauge and a safety Rupture Disc with Dust Cap installed. Agent Cylinders are pressurized with nitrogen gas to a pressure of 350 psi (2413 kPa) at 70°F (21°C). V13 through VSR75 Agent Cylinders are equipped with a Shipping Plate (P/N 10099) on top of the Agent Cylinder Valve and Anti-Recoil Plate (P/N 10646) installed on the Agent Cylinder Valve discharge outlet to prevent accidental discharge and to minimize recoil in the unlikely event of an accidental discharge during shipment. (See Figure 2.1.a). V150 and V250 Agent Cylinders are equipped with a Protective Cap (P/N 17990) and Anti-Recoil Plug (P/N 17559) to prevent accidental discharge and to minimize recoil for an accidental discharge during shipment (See Figure 2.1.b). These safety components are removed only when the Agent Cylinder is installed in the Cylinder Bracket and connected to Agent Distribution Network.

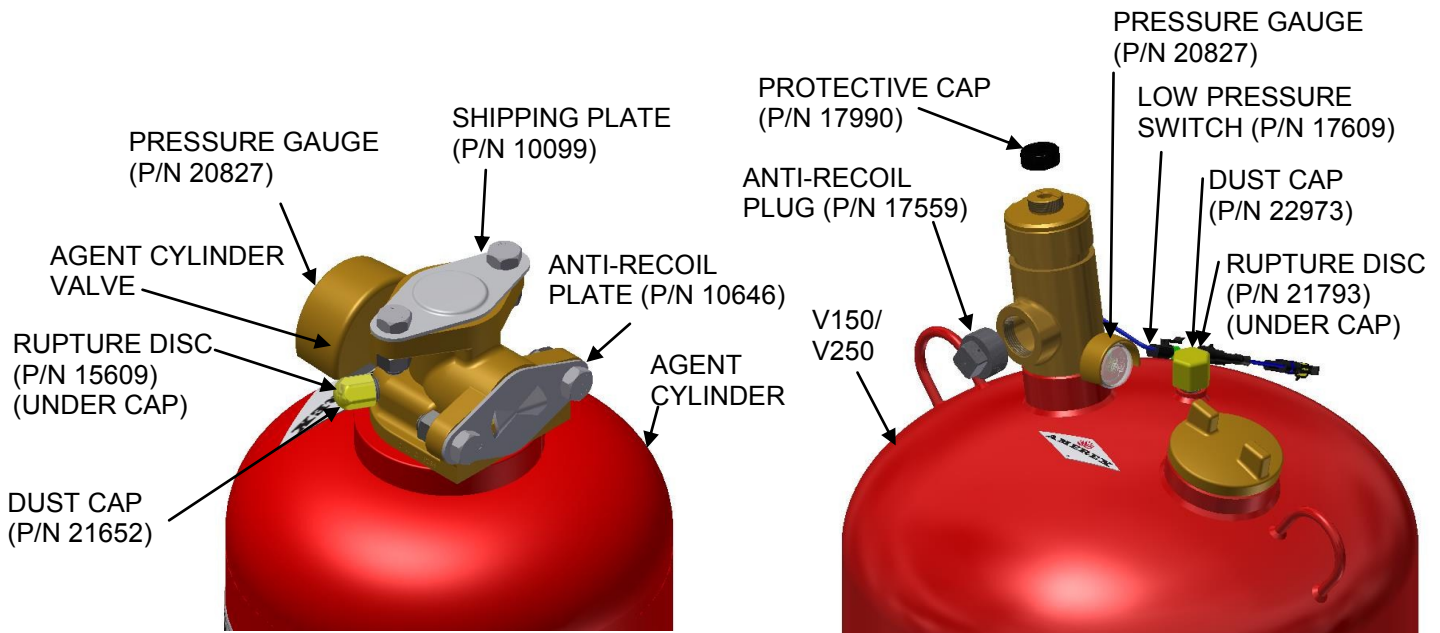


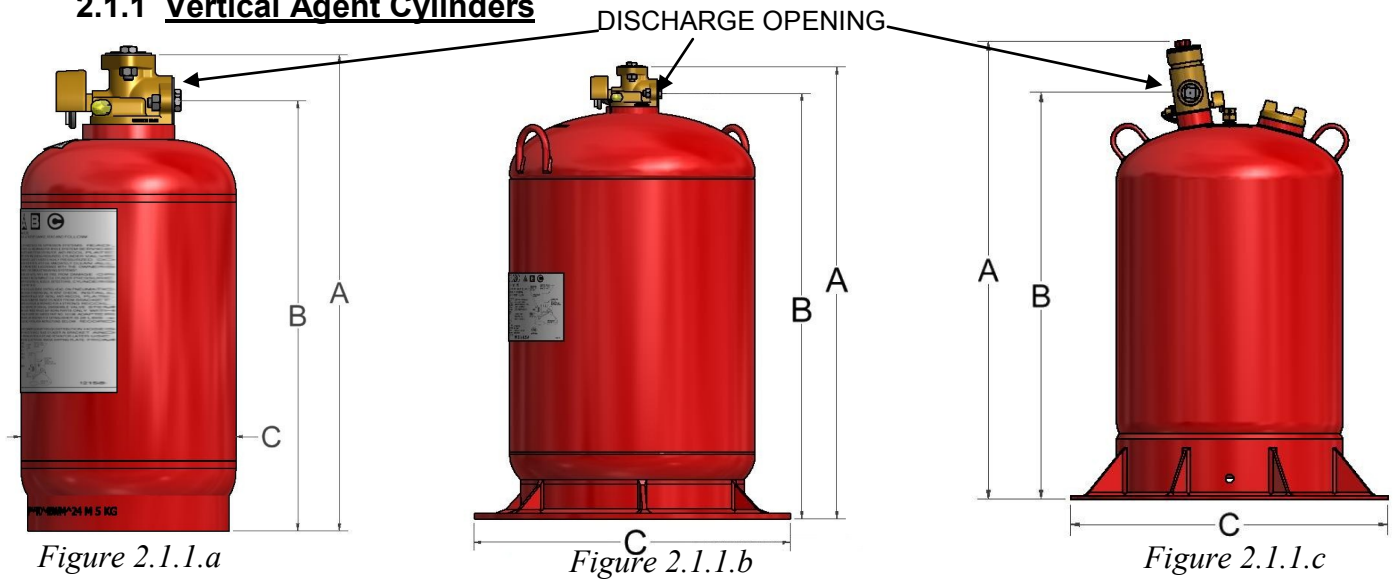
Figure 2.1.a

Figure 2.1.b

**WARNING: PLATES (FIGURE 2.1.a) AND PROTECTIVE CAP AND ANTI RECOIL PLUG (FIGURE 2.1.b) WILL BE REMOVED AT INSTALLATION AND RETAINED FOR LATER USE. DO NOT REMOVE UNTIL DIRECTED TO DO SO.**

Agent Cylinders are DOT 4BW350, tested to 700 psi (4826 kPa) and require a hydrostatic test every twelve years, or more frequent intervals if warranted. The operating temperature range of the Agent Cylinders is -65°F to 150°F (-54°C to 66°C).

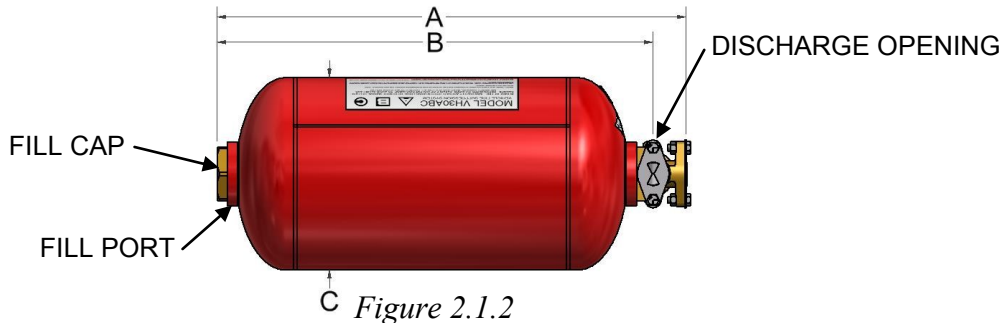
**2.1.1 Vertical Agent Cylinders**



Agent Cylinder	Figure	Overall Height (A) in (mm)	Height to Discharge Opening (B) in (mm)	Diameter (C) in (mm)	Agent Capacity lb (kg)
V13	2.1.1.a	15.5 (394)	14.0 (356)	7.0 (178)	13 (5.9)
V25	2.1.1.a	17.6 (447)	16.0 (406)	9.0 (229)	25 (11.3)
V30	2.1.1.a	21.3 (541)	19.8 (502)	9.0 (229)	32 (14.5)
V50	2.1.1.a	31.3 (795)	30.0 (762)	9.0 (229)	50 (22.7)
VS50	2.1.1.a	16.3 (414)	14.8 (376)	14.0 (356)	50 (22.7)
VSR50	2.1.1.b	16.3 (414)	14.8 (376)	18.0 (457)	50 (22.7)
VS75	2.1.1.a	25.8 (655)	24.2 (615)	14.0 (356)	75 (34)
VSR75	2.1.1.b	25.8 (655)	24.2 (615)	18.0 (457)	75 (34)
V150	2.1.1.c	31.0 (787)	26.6 (676)	28.0 (711)	150 (68)
V250	2.1.1.c	40.4 (1026)	36.0 (914)	28.0 (711)	250 (113.4)

Table 2.1.1

**2.1.2 Horizontal Agent Cylinders**



Agent Cylinder	Overall Length (A) in (mm)	Distance to Discharge Opening (B) in (mm)	Diameter (C) in (mm)	Agent Capacity lb (kg)
VH25	18.1 (460)	16.0 (406)	9.0 (229)	25 (11.3)
VH30	21.8 (554)	20.3 (516)	9.0 (229)	32 (14.5)

Table 2.1.2

## 2.2 Agent Cylinder Mounting Brackets

Cylinder Brackets vary depending on the size and mounting orientation for the corresponding Agent Cylinder. Available Cylinder Brackets for each Agent Cylinder are shown in Table 2.2. Overall dimensions and mounting locations are shown in the following sections. Only the specified Amerex Cylinder Bracket can be used to mount an Agent Cylinder. Use of non Amerex Cylinder Brackets is prohibited. Refer to Section 4.4 for Cylinder Bracket selection and mounting options.

Agent Cylinder	Cylinder Bracket	Part Number
V13	V13 Cylinder Bracket	12156
V25	V25 Cylinder Bracket	10180
VH25	VH25 Cylinder Bracket	11338
V30	V30 Cylinder Bracket	23259
VH30	VH30 Cylinder Bracket	22685
V50	V50 Cylinder Bracket	10181
VS50	VS50 Cylinder Bracket	16974
VS75	VS75 Cylinder Bracket	22260
VSR50/VSR75	VSR50/VSR75 Weld Ring	23406
V150/V250	V150/V250 Weld Ring	22966

Table 2.2

### 2.2.1 V13 Cylinder Bracket (P/N 12156) for V13 Cylinder (P/N 11345, 15647 & 11346)

Dimensions are in inches [mm].

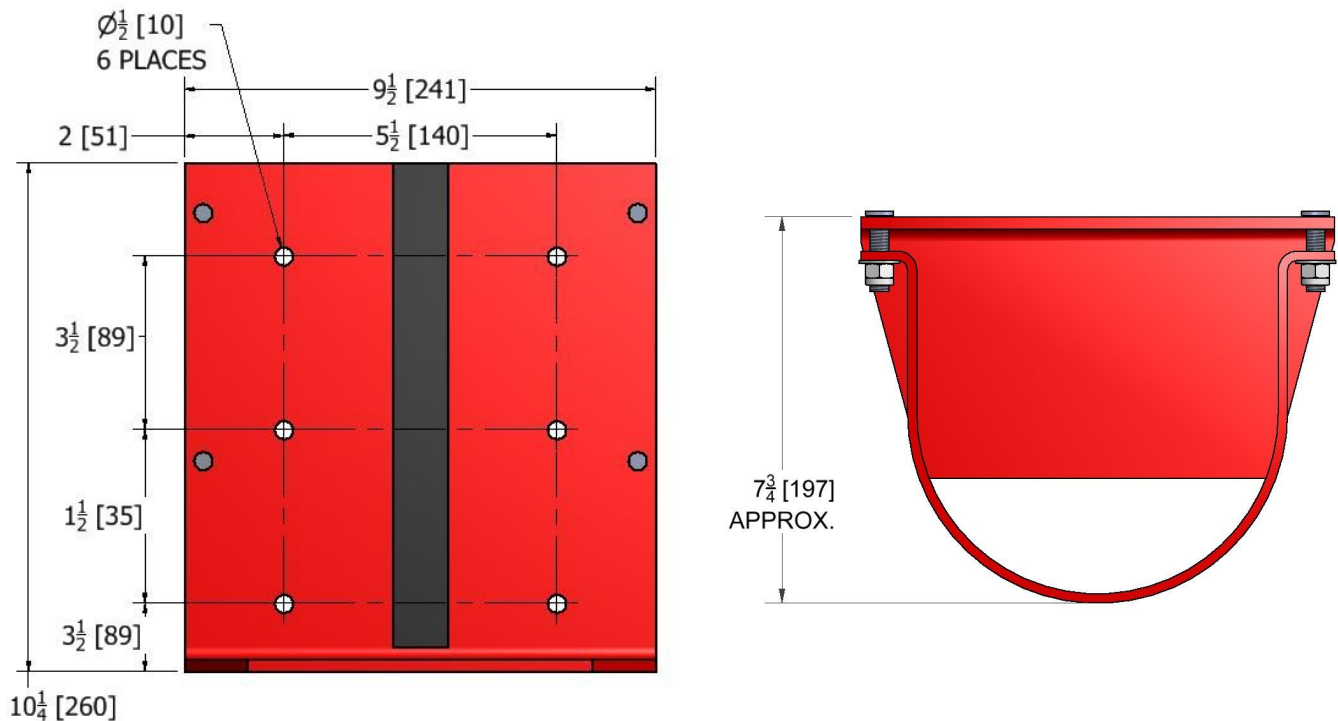


Figure 2.2.1

**2.2.2 V25 Cylinder Bracket (P/N 10180) for V25 Cylinder (P/N 10103, 15591 & 10981)**

Replacement straps for Cylinder Bracket are available (P/N 14782). Dimensions are in inches [mm].

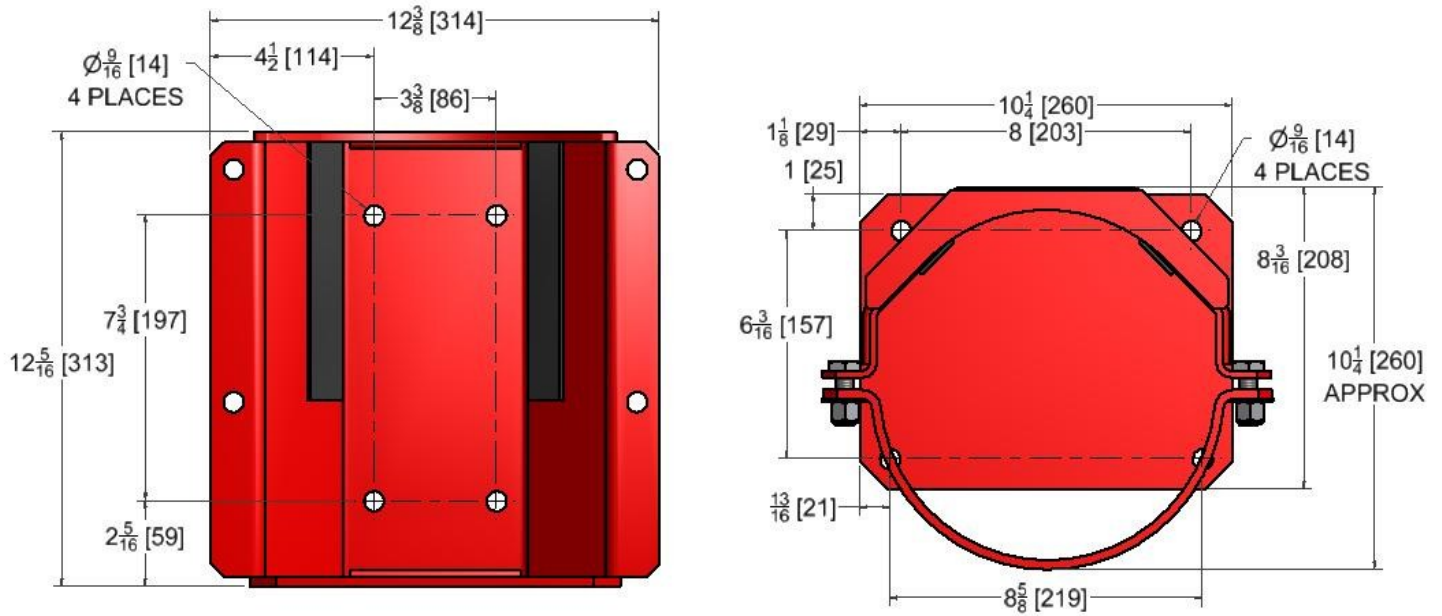


Figure 2.2.2

**2.2.3 VH25 Cylinder Bracket (P/N 11338) for VH25 Cylinder (P/N 12252, 15524 & 12318)**

Replacement straps for Cylinder Bracket are available (P/N 14782). Dimensions are in inches [mm].

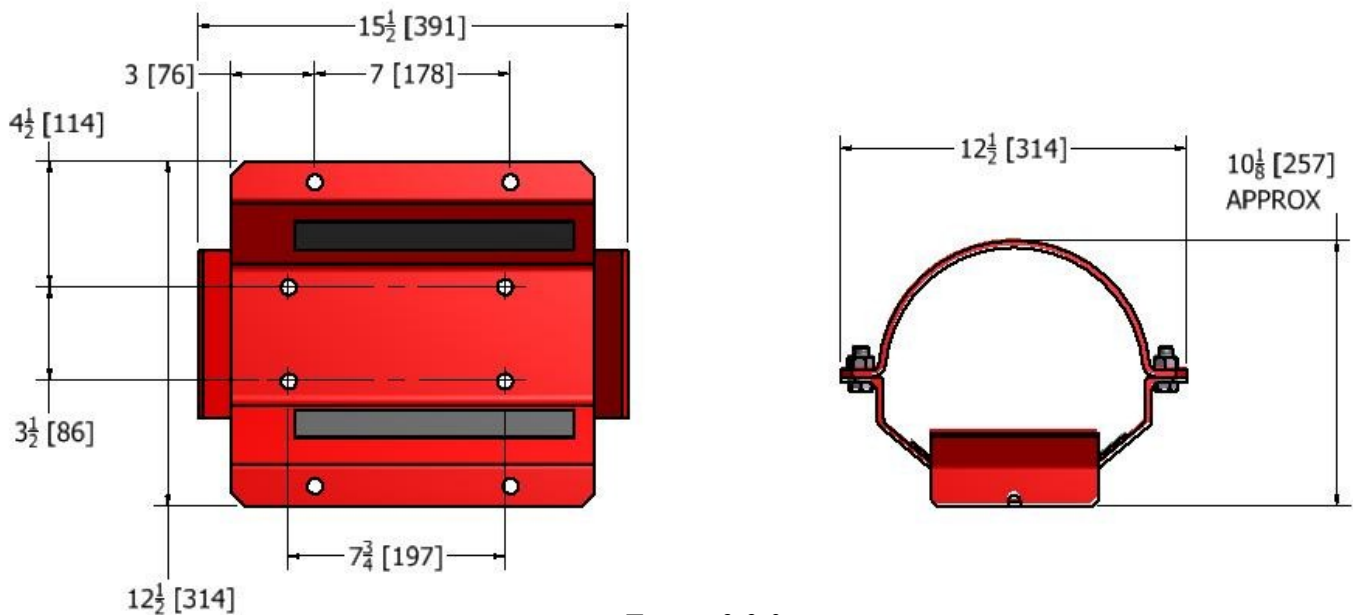


Figure 2.2.3

**2.2.4 V30 Cylinder Bracket (P/N 23259) for V30 Cylinder (P/N 23251)**

Replacement straps for Cylinder Bracket are available (P/N 14782). Dimensions are in inches [mm].

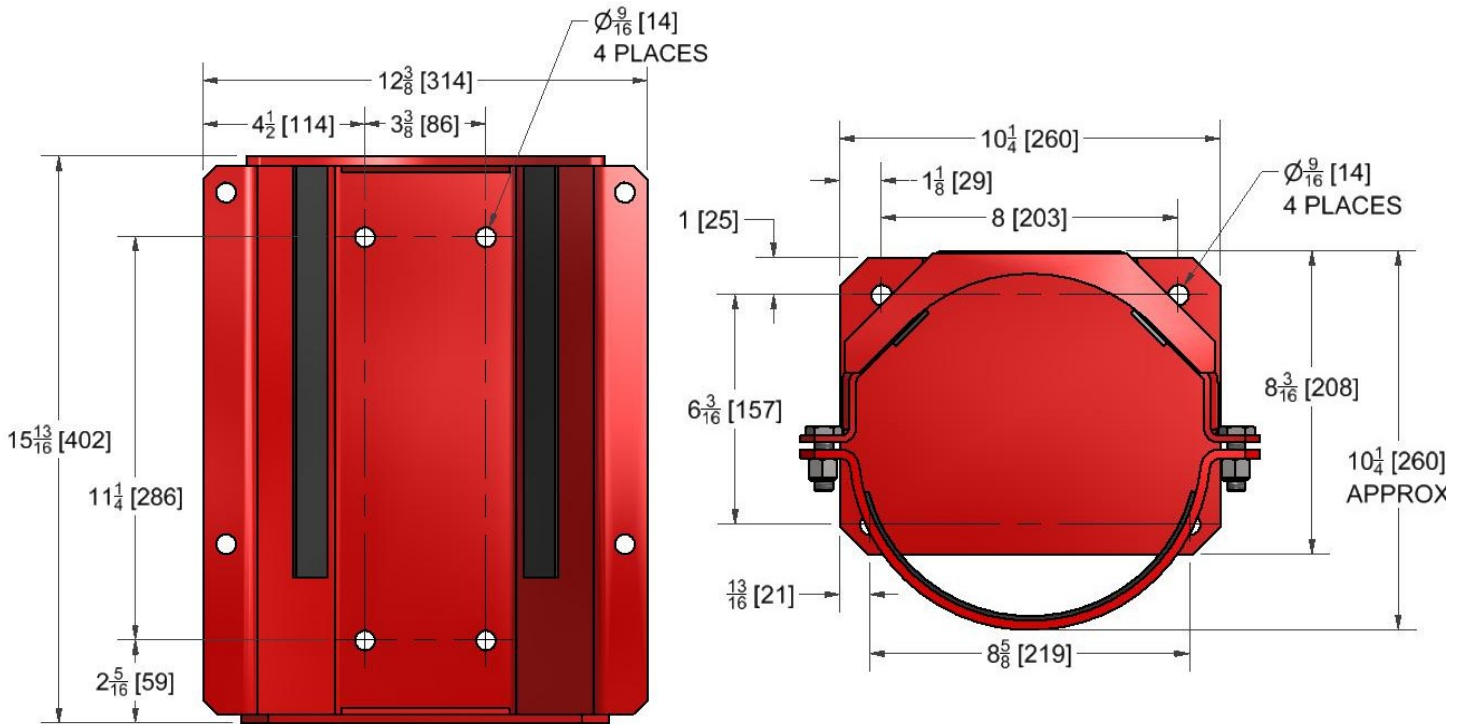


Figure 2.2.4

**2.2.5 VH30 Cylinder Bracket (P/N 22685) for VH30 Cylinder (P/N 22743 & 22744)**

Replacement straps for Cylinder Bracket are available (P/N 14782). Dimensions are in inches [mm].

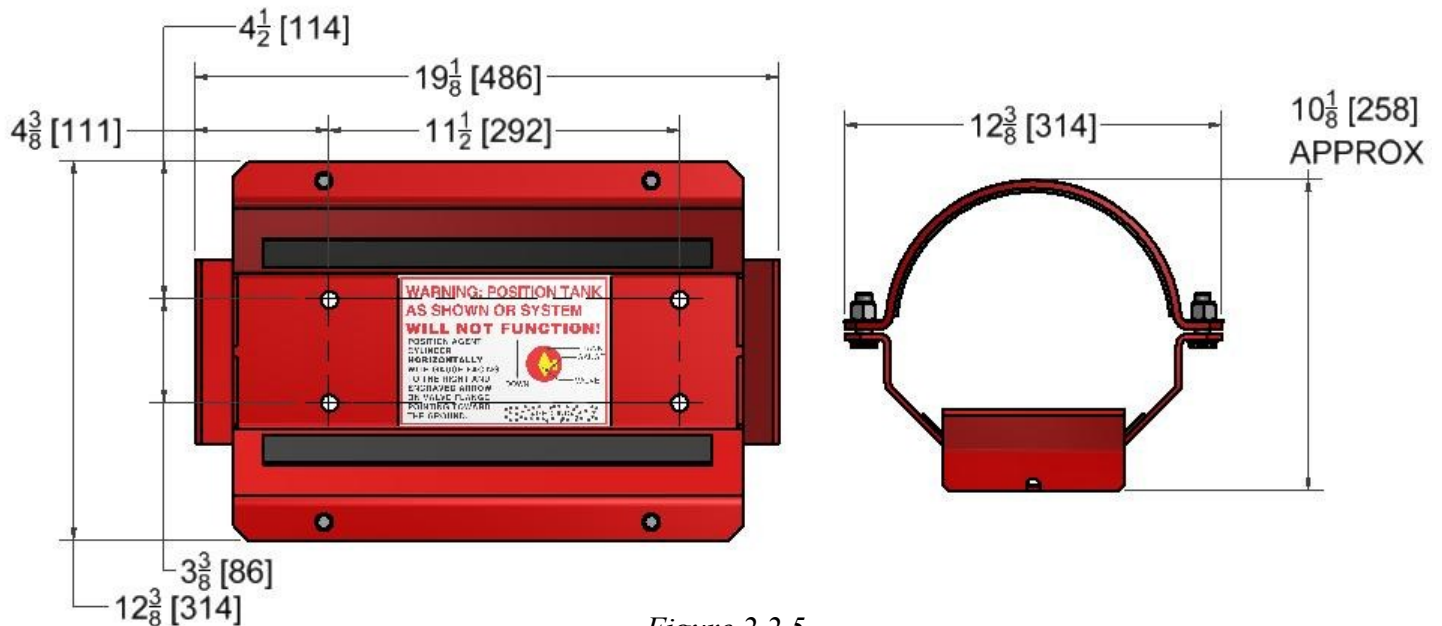


Figure 2.2.5

**2.2.6 V50 Cylinder Bracket (P/N 10181) for V50 Cylinder (P/N 10104, 15590 & 10982)**

Replacement straps for Cylinder Bracket are available (P/N 14782). Dimensions are in inches [mm].

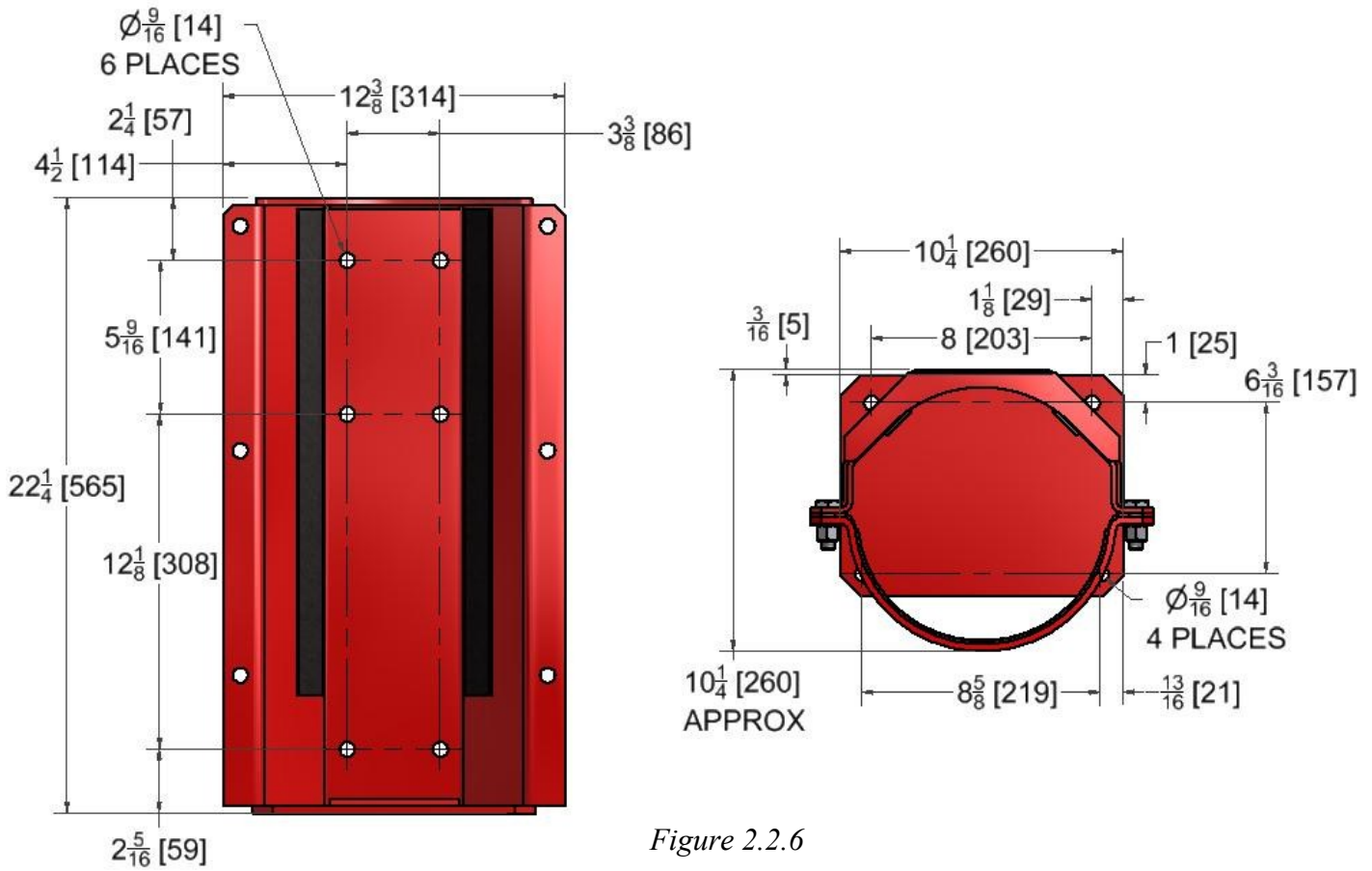


Figure 2.2.6

**2.2.7 VS50 Cylinder Bracket (P/N 16974) for VS50 Cylinder (P/N 16969, 16979 & 16980)**

Dimensions are in inches [mm].

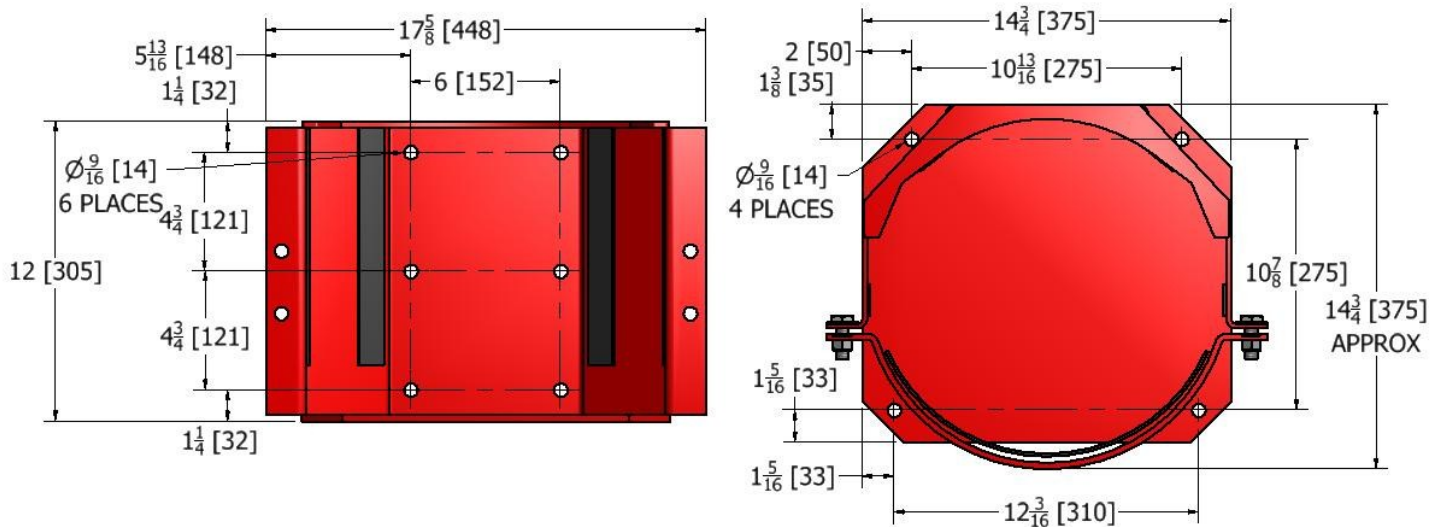


Figure 2.2.7

**2.2.8 VS75 Cylinder Bracket (P/N 22260) for VS75 Cylinder (P/N 22373)**

Dimensions are in inches [mm].

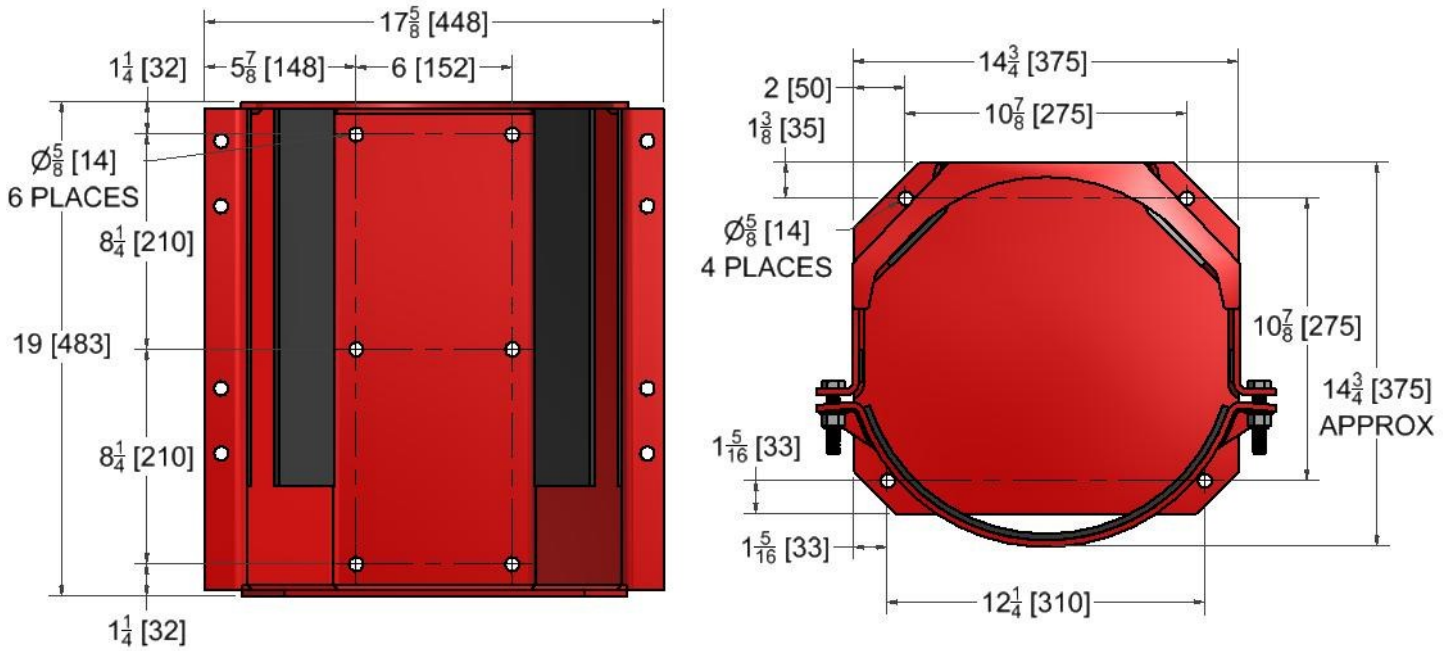


Figure 2.2.8

**2.2.9 VSR50/VSR75 Weld Ring (P/N 23406) for VSR50 & VSR75 Cylinder (P/N 23055 & 23057)**

Dimensions are in inches [mm].

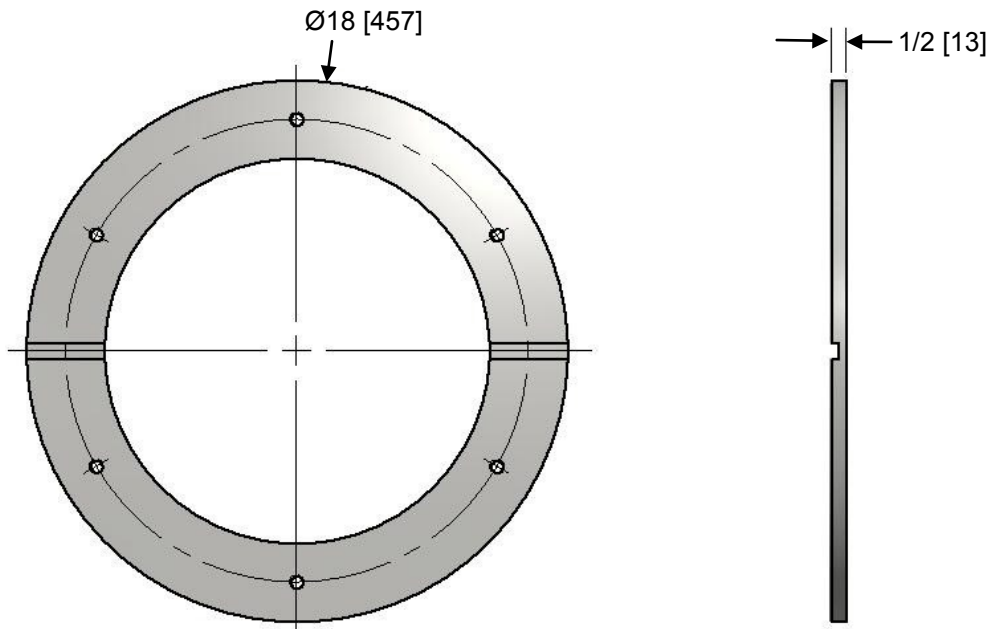
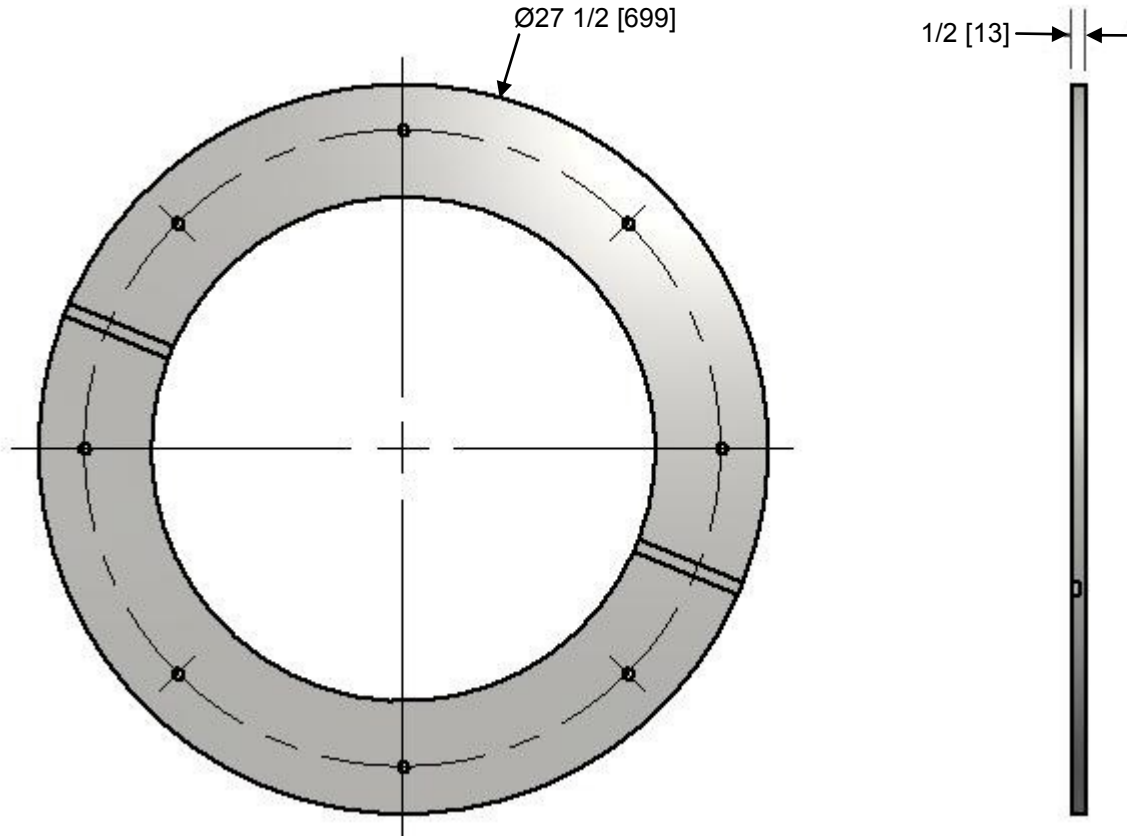


Figure 2.2.9

**2.2.10 V150/V250 Weld Ring (P/N 22966) for V150 & V250 Cylinder (P/N 23729 & 22838)**

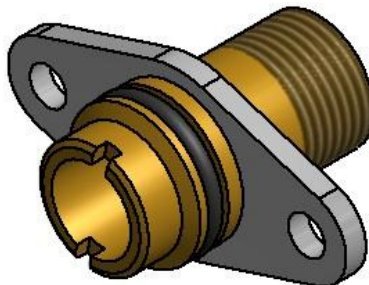
Dimensions are in inches [mm].



*Figure 2.2.10*

**2.3 Agent Distribution Network Accessories****2.3.1 Discharge Fitting Kit (P/N 10199)**

The Discharge Fitting Kit is used to connect the Agent Cylinder Valve to the Agent Distribution Network. It consists of a brass fitting with an o-ring seal on one end and 3/4" NPT male pipe threads on the other, and a stainless steel flange for locking the fitting in place. The flange is placed over the threaded end of the fitting before connection to the Agent Distribution Network. See Section 4.5.1 for installation instructions.



*Figure 2.3.1*



### 2.3.2 Agent Distribution Network Plumbing

The Agent Distribution Network carries the Dry Chemical Agent from the Discharge Fitting Kit to the Nozzles. The network consists of 1/2" (12.7 mm), 3/4" (19.1 mm) and 1-1/4" (31.75 mm) ID, wire braided rubber hydraulic hose, and/or stainless steel tubing and the corresponding fittings. Distribution hose/tubing and fittings are installer supplied. Detailed specifications for these hoses/tubing by manufacturer are given in Section 4.5. Care must be taken to always use only the brand of fittings specified by each hose manufacturer for their hose. Substitution of unapproved hose/tubing or that of a different size will void Factory Mutual Approvals, AMEREX warranty, and will adversely affect system performance. See Section 4.5 for installation instructions.

### 2.3.3 Distributor Blocks

#### 2.3.3.1 Distributor Block 3/4" X 1/2" (P/N 10178)

The Distributor Block 3/4" X 1/2" is used in the Agent Distribution Network to distribute the flow of Dry Chemical Agent to multiple nozzles. It has one inlet with 3/4" NPT threaded port, and four outlets with 1/2" NPT threaded ports. The Distributor Block is painted black to inhibit corrosion. See Section 4.5 for the proper Agent Distribution Network to be used with this Distributor Block.

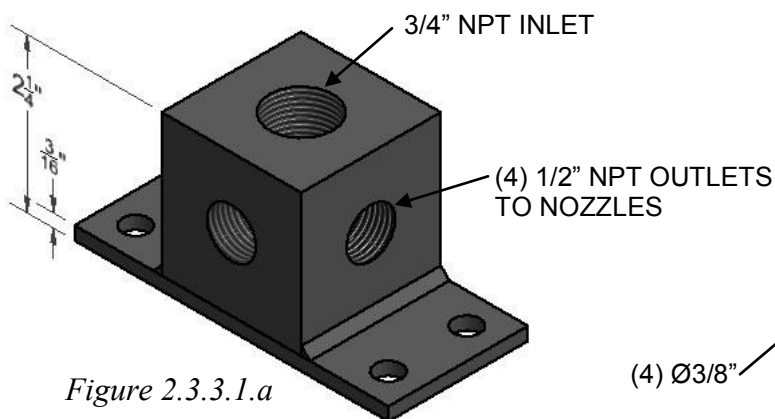


Figure 2.3.3.1.a

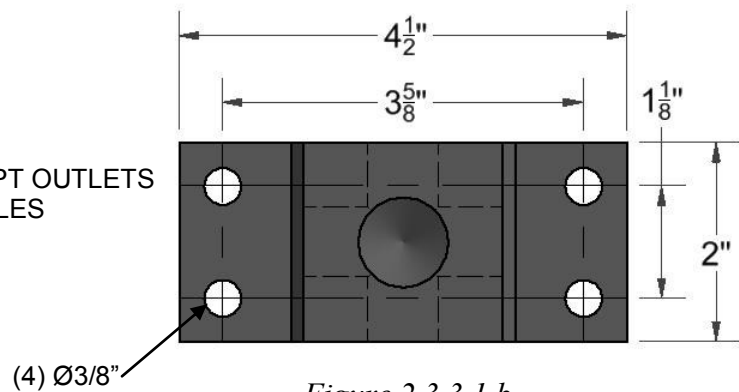


Figure 2.3.3.1.b

#### 2.3.3.2 Distributor Block 3/4" X 3/4" (P/N 22517)

The Distributor Block 3/4" X 3/4" is used in the Agent Distribution Network to distribute the flow of Dry Chemical Agent. It has one inlet with 3/4" NPT threaded port, and four outlets with 3/4" NPT threaded ports. The Distributor Block is painted black to inhibit corrosion. See Section 4.5 for the proper Agent Distribution Network to be used with this Distributor Block.

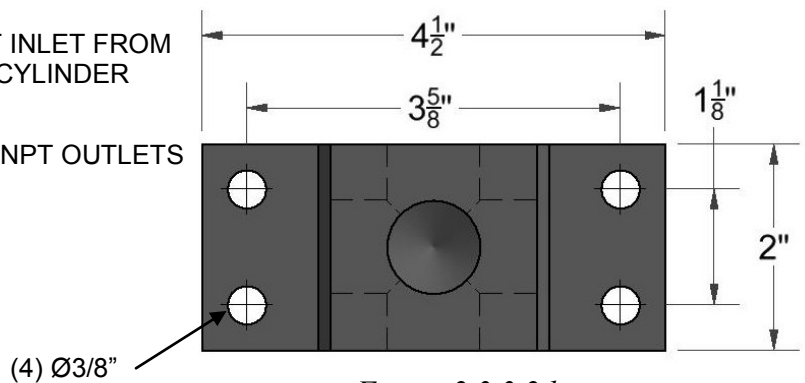
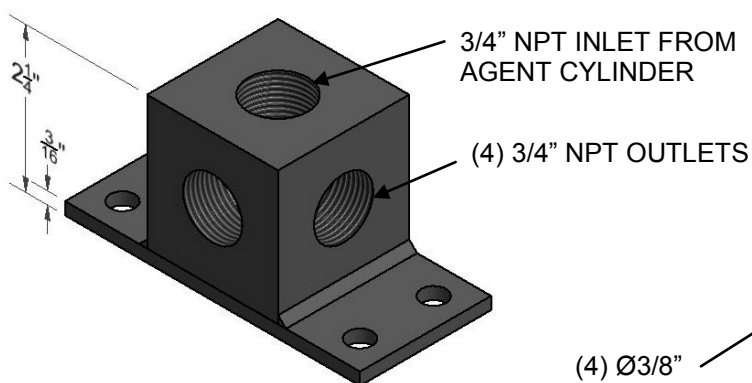


Figure 2.3.3.2.b

### 2.3.3.3 Distributor Block 1-1/4" X 3/4" (P/N 22853)

The Distributor Block 1-1/4" X 3/4" is used in the Agent Distribution Network to distribute the flow of Dry Chemical Agent. It has one inlet with 1-1/4" NPT threaded port, and three outlets with 3/4" NPT threaded ports. The Distributor Block is painted black to inhibit corrosion. See Section 4.5 for the proper Agent Distribution Network to be used with the Distributor Block.

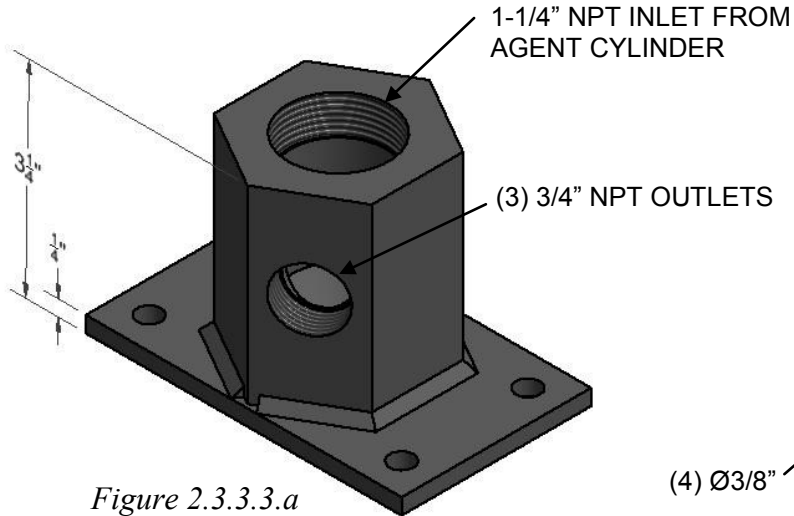


Figure 2.3.3.3.a

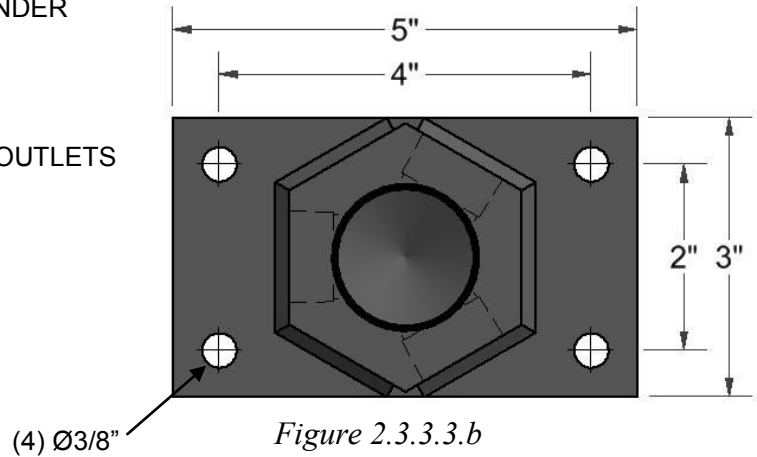


Figure 2.3.3.3.b

### 2.3.3.4 Distributor Block 1-1/4" X 3/4" (P/N 22856)

The Distributor Block 1-1/4" X 3/4" is used in the Agent Distribution Network to distribute the flow of Dry Chemical Agent. It has one inlet with 1-1/4" NPT threaded port, and four outlets with 3/4" NPT threaded ports. The Distributor Block is painted black to inhibit corrosion. See Section 4.5 for the proper Agent Distribution Network to be used with this Distributor Block.

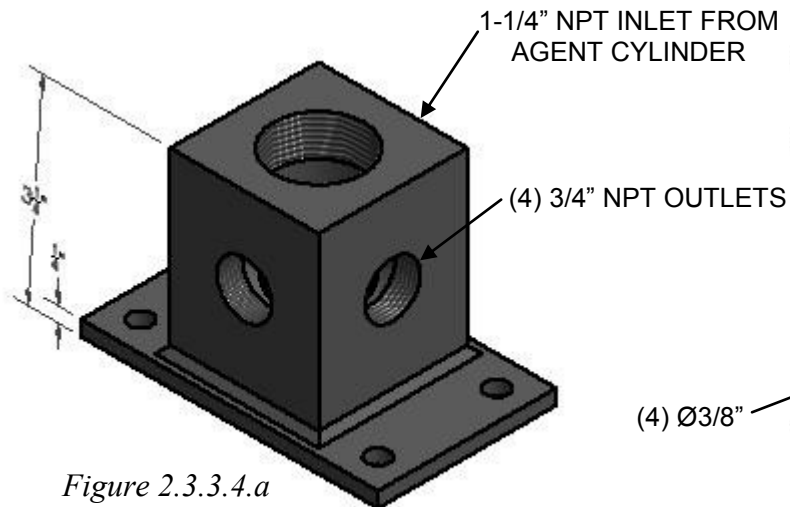


Figure 2.3.3.4.a

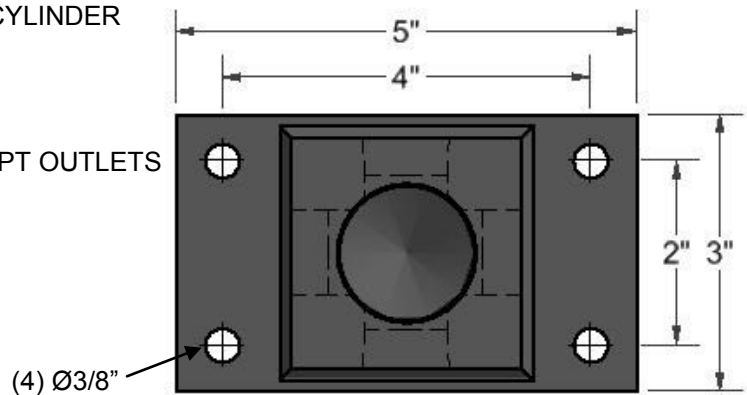


Figure 2.3.3.4.b

### 2.3.3.5 Distributor Block 3/4" X 1/2" (P/N 22698)

The Distributor Block 3/4" X 1/2" is used in the Agent Distribution Network to distribute the flow of Dry Chemical Agent. It has one inlet with 3/4" NPT threaded port, and six outlets with 1/2" NPT threaded ports. The Distributor Block is painted black to inhibit corrosion. See Section 4.5 for the proper Agent Distribution Network to be used with this Distributor Block.

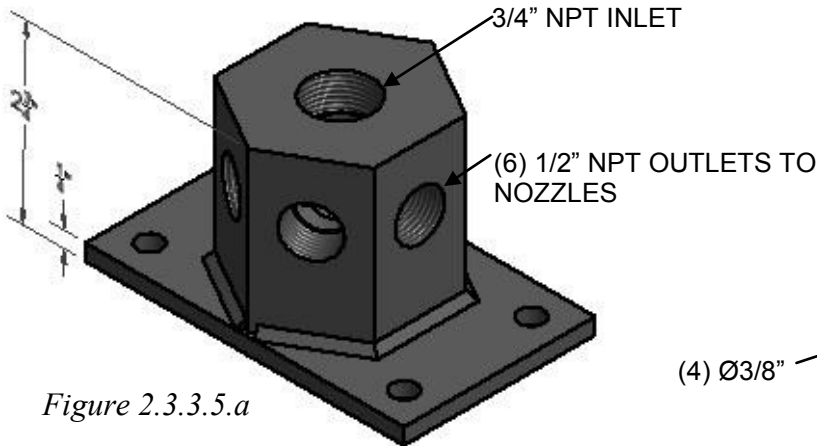


Figure 2.3.3.5.a

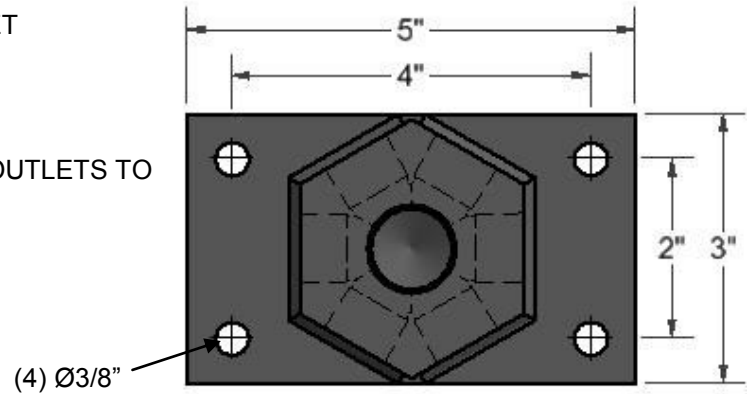


Figure 2.3.3.5.b

### 2.3.4 Nozzle Bracket (P/N 10780)

Nozzle Brackets are used to connect the Agent Distribution Network to the Nozzles as well as support the Nozzles once mounting locations are determined. Nozzle Brackets are a 90° angle with a welded 1/2" NPT coupler. Overall dimensions and mounting locations are shown in Figure 2.3.4. Dimensions are in inches. All Nozzle Brackets are painted black to inhibit corrosion. See Section 4.3 for installation instructions.

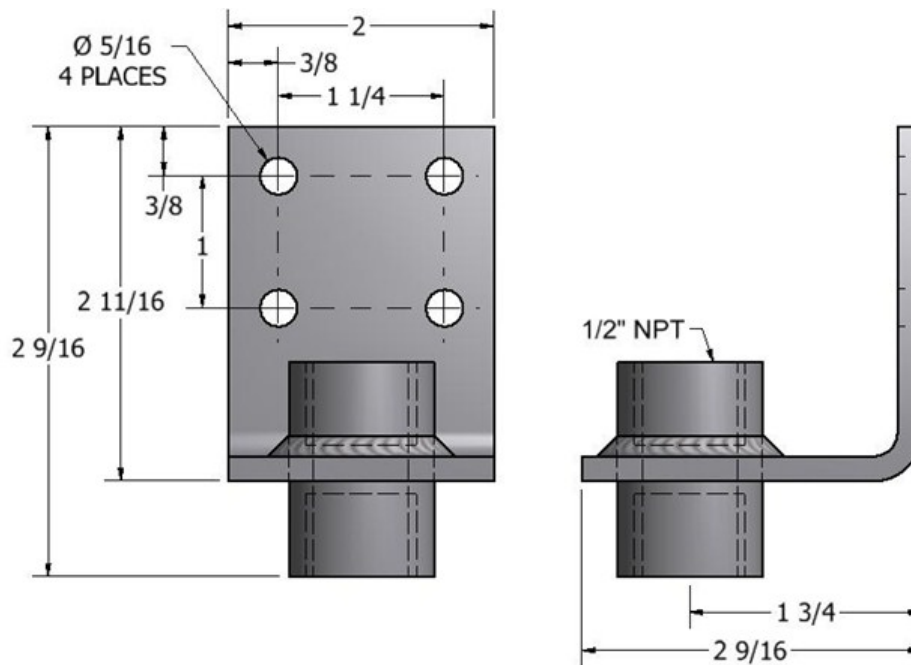
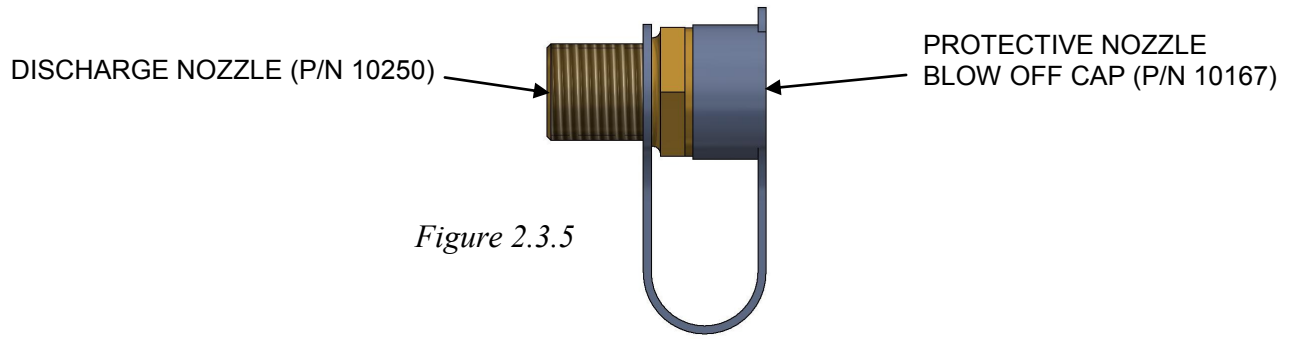


Figure 2.3.4

### 2.3.5 Discharge Nozzle (P/N 10250)

The Discharge Nozzle is used for dispersing Dry Chemical Agent in a cone shaped pattern into the hazard area. It is constructed of brass and is machined with a 1/2" NPT male thread. It is shipped with a heat and weather resistant rubber Protective Nozzle Blow-Off Cap (P/N 10167) that prevents debris from lodging in the Nozzle outlet. The blow off cap is molded with a retaining loop that assembles over the 1/2" NPT threads before the Nozzle is installed (See Figure 2.3.5). Replacement Nozzle Blow Off Caps are available (P/N 10167). See Section 4.2 for installation instructions.



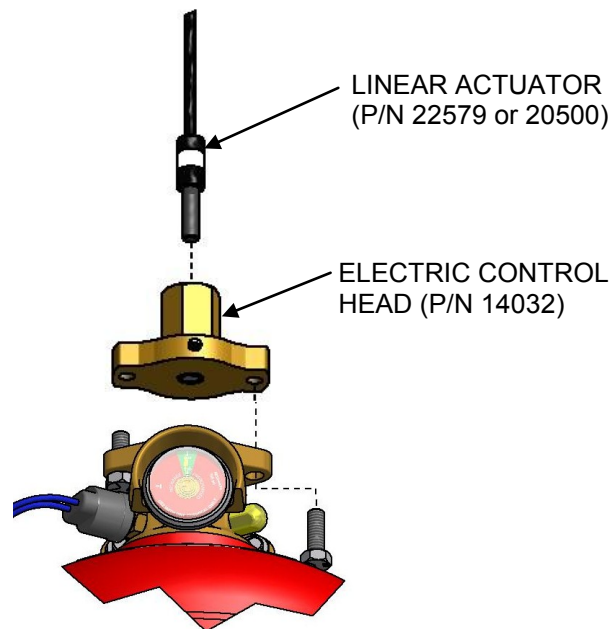
*Figure 2.3.5*

## 2.4 System Actuation Control Heads

The following control heads can be used for actuation of the Agent Cylinder Valve, releasing the Dry Chemical Agent from the Agent Cylinder.

### 2.4.1 Electric Control Head (P/N 14032)

The Electric Control Head is used in all electrically only actuated Amerex Dry Chemical System installations. This device is constructed of machined brass and bolts directly to the top of the Agent Cylinder Valve. The body of the Electric Control Head is threaded to accept a Linear Actuator (P/N 22579 or 20500). The base retains the actuator piston and locking ring. The Linear Actuator, when activated, will force the piston inside the Electric Control Head down to depress the Agent Cylinder Valve stem, releasing the Dry Chemical Agent. See Section 4.6.2 for installation instructions.



*Figure 2.4.1*

### 2.4.2 Electric / Pneumatic Control Head (P/N 17068)

The Electric / Pneumatic Control Head offers two methods to actuate the Amerex Dry Chemical System. One method is to manually discharge the system using pressure from a Nitrogen Cylinder of a remote Manual Actuator through the Pneumatic Actuation Network. The second method is to discharge the system with use of an electrically actuated Linear Actuator. The Electric / Pneumatic Control Head is constructed of extruded brass and bolts directly to the top of the Agent Cylinder Valve. When supplied with nitrogen pressure from the Pneumatic Actuation Network through 1/4" NPT female ports on either side, the piston inside the Electric / Pneumatic Control Head extends and depresses the Agent Cylinder Valve stem, releasing the Dry Chemical Agent. The top of the Electric / Pneumatic Control Head has a threaded hole that accepts the Linear Actuator (P/N 22579 or 20500). The Linear Actuator, when activated, will force the piston inside the Electric / Pneumatic Control Head down to depress the Agent Cylinder Valve stem, releasing the Dry Chemical Agent. See Section 4.6.5 for installation instructions.

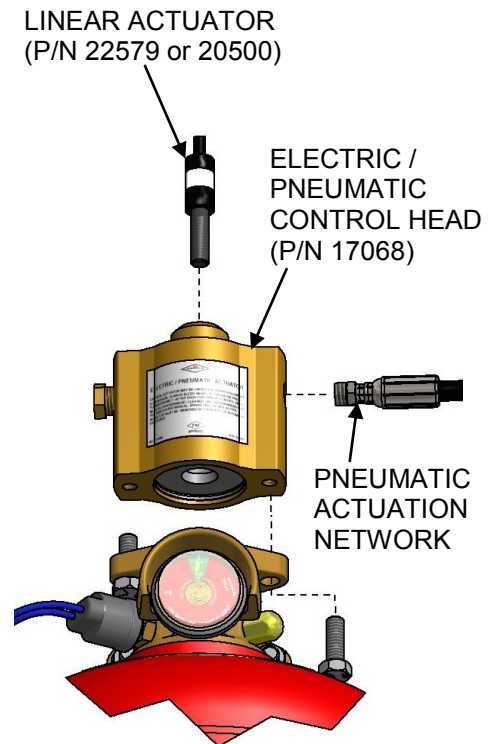


Figure 2.4.2

### 2.4.3 Electric / Pneumatic Control Head, V150/V250 Agent Cylinder (P/N 22868)

The V150/V250 Electric / Pneumatic Control Head offers two methods to actuate the Amerex Dry Chemical System. One method is to manually discharge the system using pressure from a Nitrogen Cylinder of a remote Manual Actuator through the Pneumatic Actuation Network. The second method is to discharge the system with use of an electrically actuated Linear Actuator. The Electric / Pneumatic Control Head is constructed of extruded brass and threads directly on the top of the Agent Cylinder Valve. When supplied with nitrogen pressure from the Pneumatic Actuation Network through 1/4" NPT female ports on either side, the piston inside the V150/V250 Electric / Pneumatic Control Head extends and depresses the Schrader valve in the Agent Cylinder Valve, releasing the Dry Chemical Agent. The top of the V150/V250 Electric / Pneumatic Control Head has a threaded hole that accepts a Linear Actuator (P/N 22579 or 20500). The Linear Actuator, when activated, will force the piston inside the V150/V250 Electric / Pneumatic Control Head down, releasing the Dry Chemical Agent. See Section 4.6.6 for installation instructions.

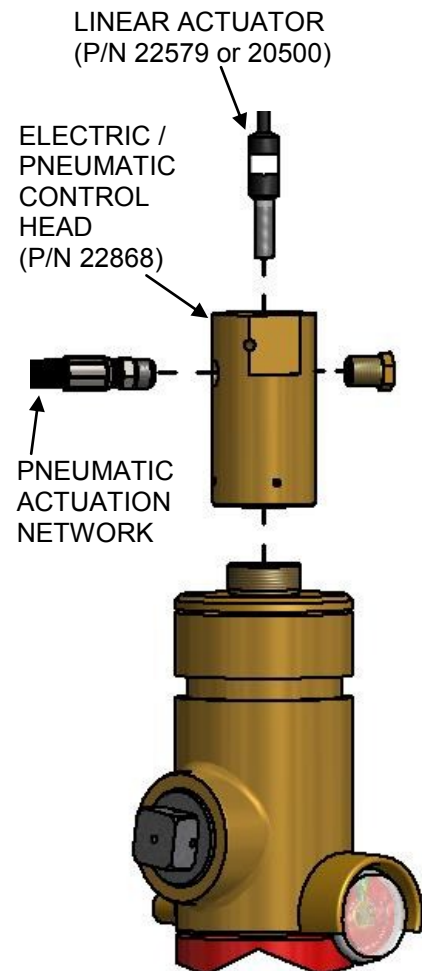


Figure 2.4.3

#### 2.4.4 Pneumatic Control Head (P/N 10147)

The Pneumatic Control Head is used in all pneumatic only actuated Dry Chemical System installations using a remote Manual, Electric Nitrogen or Manual/Electric Actuator through the Pneumatic Actuation Network. This device is constructed of extruded brass and bolts directly to the top of the Agent Cylinder Valve. When supplied with nitrogen actuation pressure from the Pneumatic Actuation Network through 1/4" NPT female ports on either side, the piston inside the Pneumatic Control Head extends and depresses the Agent Cylinder Valve stem, releasing the Dry Chemical Agent. See Section 4.6.3 for installation instructions.

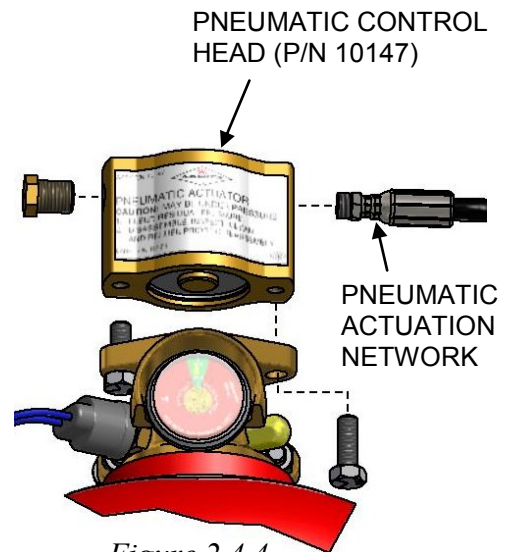


Figure 2.4.4

#### 2.4.5 Pneumatic Control Head, V150/V250 Agent Cylinder (P/N 22869)

The V150/V250 Pneumatic Control Head is used in all pneumatic only actuated Dry Chemical System installations using a remote Manual, Electric Nitrogen or Manual/Electric Actuator through the Pneumatic Actuation Network. This device is constructed of extruded brass and threads directly to the top of the Agent Cylinder Valve. When supplied with nitrogen actuation pressure from the Pneumatic Actuation Network through 1/4" NPT female ports on either side, the piston inside the V150/V250 Pneumatic Control Head extends and depresses the Schrader Valve in the top of the Agent Cylinder Valve, releasing the Dry Chemical Agent. See Section 4.6.4 for installation instructions.

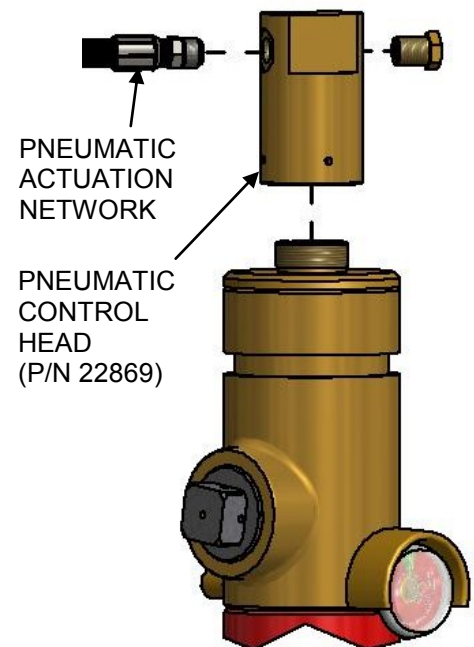


Figure 2.4.5

#### 2.4.6 Tee Handle (P/N 10134)

On installations where neither automatic nor remote actuation is selected, the manually activated Tee Handle can be used. This device is constructed of brass and stainless steel and bolts directly to the top of the Agent Cylinder Valve. The handle is locked in the safety position by a ring pin, which is pulled out at the time of actuation. The Tee Handle is designed to lock in place only in the FULL OPEN or FULL CLOSED position to discourage incomplete valve opening in a fire situation. The Tee Handle is also used as a service tool to open the Agent Cylinder Valve during agent cylinder recharging. See Section 4.6.1 for installation instructions.

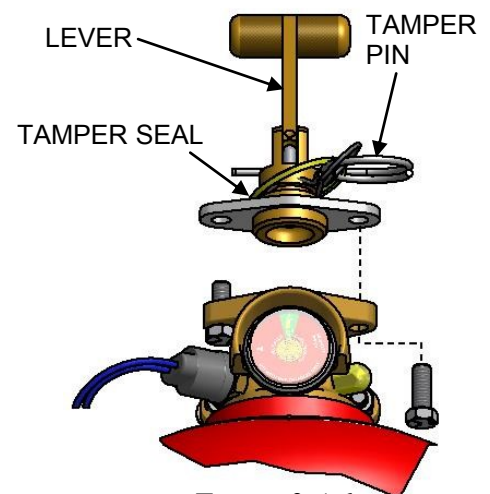


Figure 2.4.6

## 2.5 System Actuation Accessories

### 2.5.1 Vent Check (P/N 10173)

The Vent Check is a safety device that installs in the Pneumatic Control Head or the Electric / Pneumatic Control Head. Its function is to relieve any slowly accumulating pressure that could cause the control head to open the Agent Cylinder Valve prematurely. A Vent Check must be used on all systems that utilize nitrogen pressure for activation of the Amerex Modular Dry Chemical Fire Suppression System. The body of the Vent Check is constructed of machined brass. The inside of the Vent Check contains a spring and nylon ball. The Vent Check is supplied with a plastic Dust Cap (P/N 13761), which must be installed on the Vent Check after installation into the Pneumatic Control Head and/or the Electric / Pneumatic Control Head. See Section 4.6 for installation instructions.

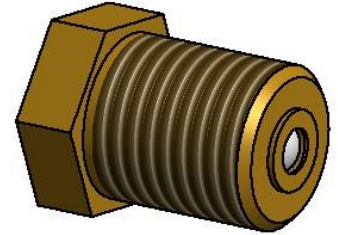


Figure 2.5.1

### 2.5.2 Linear Actuator (P/N 22579 or 20500)

The Linear Actuator (P/N 22579 w/ AMP connector; P/N 20500 w/ Deutsch connector) is a device when electrically activated extends a metal shaft which mechanically opens the Agent Cylinder Valve when used in a control head or opens a Nitrogen Cylinder when used in an Electric Nitrogen Actuator. Once activated it cannot be reused and must be replaced. Service life of the Linear Actuator is 6 years after which it must be replaced. Shelf life of the Linear Actuator is 10 years after which it must be replaced whether it has been placed in service or not. Each Linear Actuator is supplied with a Mylar style label for identifying date of manufacture. An O-RING (P/N 17137) is provided with each Linear Actuator, and must be used each time that a Linear Actuator is installed. Select the appropriate Linear Actuator for use with the vehicle's Amerex Modular Electronics System (See Section 4.9). See Sections 4.6 and 4.7 for installation instructions.

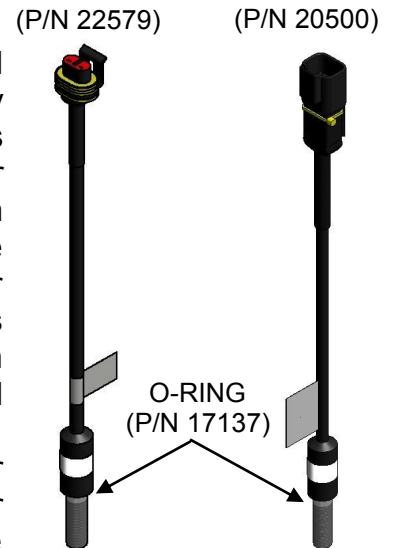


Figure 2.5.2

### 2.5.3 Electric Nitrogen Actuator (P/N 20775)

The Electric Nitrogen Actuator is used to release nitrogen gas pressure from a Nitrogen Cylinder to pneumatically activate a control head through a Pneumatic Actuation Network. The body of the Electric Nitrogen Actuator is constructed of chrome plated brass and contains a stainless steel puncture point and a 1/4" NPT female port to connect to the Pneumatic Actuation Network. A brass adapter is threaded into the top that accepts a Linear Actuator (P/N 22579 or 20500). The Electric Nitrogen Actuator is supplied with two 1/4"-20 stainless steel cap screws for securing the assembly to an Actuator Bracket. See Section 4.7.4 for installation instructions.

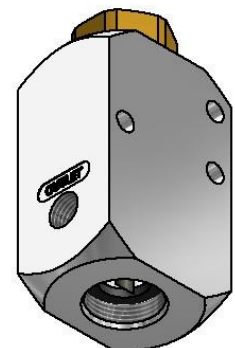


Figure 2.5.3

### 2.5.4 Manual Actuator (P/N 10210)

The Manual Actuator is used to manually release nitrogen gas pressure from a Nitrogen Cylinder to pneumatically activate a control head through a Pneumatic Actuation Network. The body of the Manual Actuator is chrome plated brass and contains a stainless steel puncture point that is connected to a palm button and locked in place by a stainless steel ring pin. It also contains a 1/4" NPT female port to connect to the Pneumatic Actuation Network. The exposed shaft of the stem is shielded from the elements by a rubber dust boot. The Manual Actuator is supplied with two 1/4"-20 stainless steel cap screws for securing the assembly to an Actuator Bracket. See Section 4.7.4 for installation instructions.



Figure 2.5.4

### 2.5.5 Manual/Electric Actuator (P/N 23600)

The Manual/Electric Actuator is used to manually or electrically release nitrogen gas pressure from a Nitrogen Cylinder to pneumatically activate a control head through a Pneumatic Actuation Network. The body of the Manual Actuator is chrome plated brass and contains a stainless steel puncture point and upper shaft. This upper shaft contains a palm button, locked in place by a stainless steel ring pin, and also accepts a Linear Actuator (P/N 22579 or 20500). A 1/4" NPT female port is used to connect to the Pneumatic Actuation Network. The Manual/Electric Actuator is supplied with two 1/4"-20 stainless steel cap screws for securing the assembly to an Actuator Bracket. See Section 4.7.4 for installation instructions.

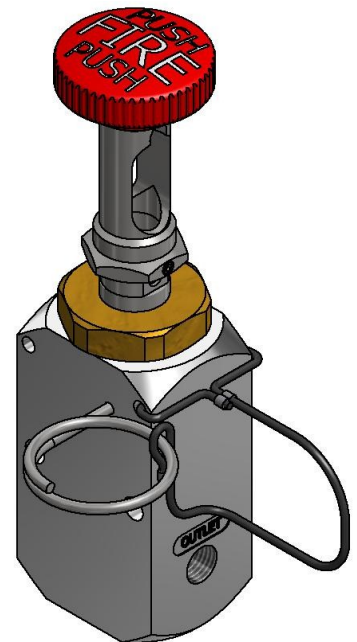


Figure 2.5.5

### 2.5.6 Actuator Brackets (P/N 10354 & 10355)

The Manual Actuator, Electric Nitrogen Actuator, and Nitrogen Cylinder can be mounted to the vehicle with use of an Indoor Actuator Bracket (P/N 10355) or an Outdoor Actuator Bracket (P/N 10354). Both brackets are constructed of steel and painted to inhibit corrosion. The Outdoor Actuator Bracket includes a steel guard to protect the actuator and Nitrogen Cylinder. See Section 4.7.3 for installation instructions.

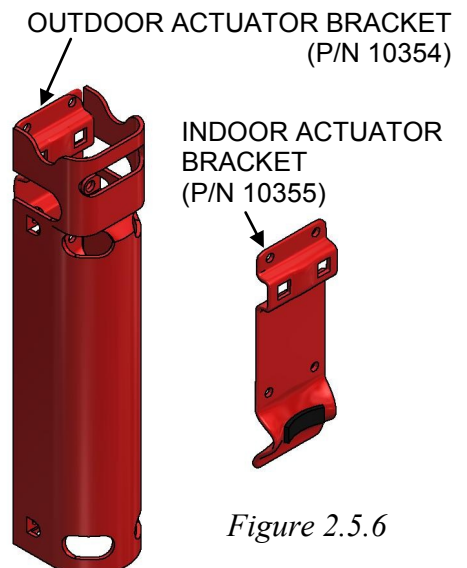


Figure 2.5.6



### 2.5.7 Nitrogen Cylinder (P/N 09956)

The Nitrogen Cylinder supplies nitrogen gas pressure to a control head through the Pneumatic Actuation Network to open the Agent Cylinder Valve. The Nitrogen Cylinder is charged to 1800 psi (12410 kPa) at 70°F (21°C). A pressure gauge is used to identify proper charge pressure of the Nitrogen Cylinder, and is located on the bottom of the Nitrogen Cylinder. The pressure gauge is protected by an impact resistant plastic gauge guard. The Nitrogen Cylinder is shipped fully charged from the AMEREX factory with a protective shipping cap installed on the outlet threads. The cap must be removed at installation but must remain in place at all other times. Retain the shipping cap to reuse when recharging a Nitrogen Cylinder. Construction of the Nitrogen Cylinder is per DOT 3E. The cylinder is rechargeable by certified AMEREX installers and does not require periodic hydro testing. See Section 4.7.4 for installation instructions.



Figure 2.5.7

### 2.5.8 Check Valve (P/N 10262)

The Check Valve is made of brass material and is required in various locations of the Pneumatic Actuation Network to ensure that the nitrogen gas flows along the correct path to the control head(s). Although more than one actuation circuit can converge in the Pneumatic Actuation Network, each circuit must have an independent path from either a Manual, Electric Nitrogen, or Manual/Electric Actuator to the Agent Cylinder control head. This can be accomplished with use of the Check Valve. Direction of flow must be with nitrogen going into the 1/4" NPT female port and out of the 1/4" NPT male port. See Section 4.8.1 for installation instructions.

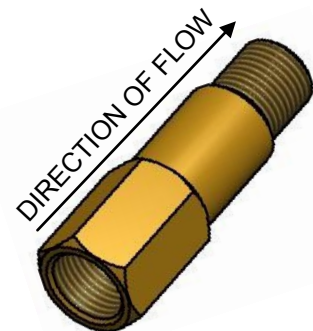


Figure 2.5.8

### 2.5.9 100 PSI Pressure Switch (P/N 22573, 22574 or 23850)

The 100 PSI Pressure Switch is designed to be used in the Pneumatic Actuation Network of a vehicle system. The Switch (P/N 22573 non-terminated version; P/N 22574 w/ AMP connectors; P/N 23850 w/ Deutsch connectors) is normally in the open position and closes when subjected to nitrogen pressure in excess of 100 PSI. The Switch is threaded with a 1/4" NPT male port. The Switch must be installed in a tee in the Pneumatic Actuation Network just before the first Pneumatic (P/N 10147), or Electric / Pneumatic (P/N 17068) Control Head. The Switch can be utilized to send a signal such as "system discharge" back to the associated electronics panel, or to an external relay for sounding an auxiliary alarm or illuminating a light in the event of system discharge. For terminated Switches, select the appropriate Switch for use with the vehicle's Amerex Modular Electronics System (See Section 4.9). See Section 4.7.2 for installation instructions.



Figure 2.5.9

**2.6 Parts List**

<b>Parts List</b>			
<b>Item</b>	<b>Part Number</b>	<b>Description</b>	<b>Ref. Section</b>
1	11345	Agent Cylinder, V13ABC	1.1 / 2.1 / 4.4
	10103	Agent Cylinder, V25ABC	
	12252	Agent Cylinder, VH25ABC	
	22744	Agent Cylinder, VH30ABC	
	10104	Agent Cylinder, V50ABC	
	16969	Agent Cylinder, VS50 ABC	
	15647	Agent Cylinder, V13ABC PRS SW	
	15591	Agent Cylinder, V25ABC PRS SW	
	15524	Agent Cylinder, VH25ABC PRS SW	
	23251	Agent Cylinder, V30ABC PRS SW	
	22743	Agent Cylinder, VH30ABC PRS SW	
	15590	Agent Cylinder, V50ABC PRS SW	
	16979	Agent Cylinder, VS50 ABC PRS SW	
	23057	Agent Cylinder, VSR50 ABC PRS SW	
	22373	Agent Cylinder, VS75 ABC PRS SW	
	23055	Agent Cylinder, VSR75 ABC PRS SW	
	23729	Agent Cylinder, V150 ABC PRS SW	
	22838	Agent Cylinder, V250 ABC PRS SW	
	11346	Agent Cylinder, V13PK	
	10981	Agent Cylinder, V25PK	
12318	Agent Cylinder, VH25PK		
10982	Agent Cylinder, V50PK		
16980	Agent Cylinder, VS50 PK PRS SW		
2	12156	Cylinder Bracket, V13	2.2.1 / 4.4
	10180	Cylinder Bracket, V25	2.2.2 / 4.4
	11338	Cylinder Bracket, VH25	2.2.3 / 4.4
	23259	Cylinder Bracket, V30	2.2.4 / 4.4
	22685	Cylinder Bracket, VH30	2.2.5 / 4.4
	10181	Cylinder Bracket, V50	2.2.6 / 4.4
	16974	Cylinder Bracket, VS50	2.2.7 / 4.4
	22260	Cylinder Bracket, VS75	2.2.8 / 4.4
	23046	Weld Ring, VSR50/VSR75	2.2.9 / 4.4
	22966	Weld Ring, V150/V250	2.2.10 / 4.4
3	10199	Discharge Fitting Kit	2.3.1 / 4.5
4	-	Network Plumbing	2.3.2 / 4.5
5	10178	Distributor Block, 3/4" X 1/2" (4)	2.3.3.1 / 4.5
	22517	Distributor Block, 3/4" X 3/4" (4)	2.3.3.2 / 4.5
	22853	Distributor Block, 1-1/4" X 3/4" (3)	2.3.3.3 / 4.5
	22856	Distributor Block, 1-1/4" X 3/4" (4)	2.3.3.4 / 4.5
	22698	Distributor Block, 3/4" X 1/2" (6)	2.3.3.5 / 4.5
6	10780	Nozzle Bracket	2.3.4 / 4.3
7	10250	Nozzle	2.3.5 / 4.2

Table 2.6.a

Item	Part Number	Description	Ref. Section
8	14032	Control Head, Electric	2.4.1 / 4.6 / 6.2.1
	17068	Control Head, Electric / Pneumatic	2.4.2 / 4.6 / 6.2.1
	22868	Control Head, Electric / Pneumatic, V150/V250	2.4.3 / 4.6 / 6.2.1
	10147	Control Head, Pneumatic	2.4.4 / 4.6 / 6.2.1
	22869	Control Head, Pneumatic, V150/V250	2.4.5 / 4.6 / 6.2.1
	10134	Control Head, Tee Handle	2.4.6 / 4.6 / 6.2.1
9	10173	Vent Check	2.5.1 / 4.6 / 4.7 / 4.8
10	22579	Linear Actuator (AMP Connector)	2.5.2 / 4.6 / 4.7 / 4.9
	20500	Linear Actuator (Deutsch Connector)	
11	20775	Actuator, Electric	2.5.3 / 4.7 / 6.2.7
	10210	Actuator, Manual	2.5.4 / 4.7 / 6.2.7
	23600	Actuator, Manual/Electric	2.5.5 / 4.7 / 6.2.7
12	10354	Actuator Bracket, Outdoor	2.5.6 / 4.7
	10355	Actuator Bracket, Indoor	
13	09956	Nitrogen Cylinder	2.5.7 / 4.7 / 6.2.9
14	10262	Check Valve	2.5.8 / 4.8
15	22573	Pressure Switch, 100 PSI, Non-terminated	2.5.9 / 4.7 / 4.8 / 4.9
	22574	Pressure Switch, 100 PSI, Terminated (AMP Conn.)	
	23850	Pressure Switch, 100 PSI, Terminated (Deutsch Conn.)	

Table 2.6.a (cont'd)

Service Tools				
Item	Part Number	Description	Qty. for Service	Ref. Section
1	10136	Recharge Adapter	1	6.1.1 / 6.2.6.1
	23065	Recharge Adapter, V150/V250		6.1.8 / 6.2.6.2
2	05152	Hydrotest Adapter	1	6.1.2 / 5.5
	23450	Hydrotest Adapter, V150/V250		
3	12129	Blowout Adapter, Distribution Hose	1*	6.1.3 / 6.2.2.1
	22999	Blowout Adapter, Distribution Hose, V150/V250	1	6.1.4 / 6.2.2.2
	23001	Blowout Adapter, Distribution Hose, V150/V250	1	
4	10134	Tee Handle	1*	6.1.5 / 6.2.6.1
5	-	Wrench, 2-1/2" Tight Access	Installer Supplied	6.1.6 / 6.2.4.1 / 6.2.6.1
6	10895	Adapter, Pneumatic Actuation Network Test	1	6.1.7 / 6.2.8
7	10270	Nitrogen Fill Adapter	1	6.2.9

\*Not Used for V150 or V250 Service

Table 2.6.b

Recharge/Rebuild Parts			
Item	Part Number	Description	Ref. Section
1	10095	Recharge Valve Stem	6.2.4.1
	23009	Recharge Kit, V150/V250	6.2.4.2
2	09781	Agent Recharge Pail, ABC Dry Chemical	6.2.5
	04214	Agent Recharge Pail, Purple K	
3	10939	Actuator Rebuild Kit	6.2.7.1 / 6.2.7.2
	23761	Actuator Rebuild Kit, Manual/Electric	6.2.7.3
4	10712	Rupture Disc, Nitrogen Cylinder	6.2.9

Table 2.6.c

# **Chapter 3: Hazard Analysis**

## **3.1 Introduction**

When performing a hazard analysis, some helpful tools that can be useful are:

- Flashlights – for those hard to see places.
- Cameras and note pads – for helping with documenting the construction of the vehicle fire suppression system and creating a bill of materials. Installers must document and retain all system designs.
- Temperature measuring devices – Thermocouples work well in helping to identify vehicle operating temperatures. Knowing the vehicle operating temperature details is crucial in selecting appropriate hardware when doing a hazard analysis and system layout.
- Access to all Amerex Installation, Operation, & Maintenance Literature – System may require hardware not located in this manual.

**NOTE: On all installations, consult the vehicle manufacturer and property owner before making any modifications to equipment.**

## **3.2 Hazard Analysis**

A hazard analysis is used as the first step in a process used to assess risk of fire. The result of a hazard analysis is the identification of fire risks. The National Fire Protection Association (NFPA) offers a series of standards with guidelines for a particular product or system being installed. When conducting a hazard analysis, all applicable standards must be observed. Examples of such standards include, but are limited to: NFPA 17, 17A, 52, 120, and 122. Below are some additional considerations to be evaluated when doing a hazard analysis.

### **3.2.1 Identify the Ignition Source(s)**

The potential for hot surfaces such as exhaust manifolds, muffler compartments, hydraulic pumps, and turbochargers can be ignition sources. Other hot surface ignition sources can be friction buildup from bearings, brakes, and gears. Electrical shorts from vehicle electronics and batteries can also be ignition sources.

### **3.2.2 Identify the Fuel Source(s)**

Fuels can be found in many different forms including, but not limited to:

- Class A Material - Wood, paper, coal dust, rags, hoses, tires, combustible refuse buildup.
- Class B Material - Flammable and combustible liquids such as gasoline, diesel fuel, cleaning fluids, hydraulic fluids, brake fluids, transmission fluids.
- Class C Material - Class C items describe sources of electrical current that can energize an area where a fire is present.

### **3.2.3 Consulting Vehicle Owner and/or Original Equipment Manufacturer**

Previous experience with machinery may indicate where special hazards exist. Knowing the history about a particular model of vehicle/machine may help with decisions in protection.

### **3.2.4 Potential Workplace Hazards for the Equipment**

Refuse vehicles frequently work in landfills. Some landfills carry substantial class A fuel sources. Machines working in steel refineries can be exposed to external ignition sources. These types of external hazards will have to be considered when determining the right protection required for the particular machine.

### **3.2.5 Considerations to be Evaluated**

- Is the hazard in an open area or closed compartment? In an open area, each hazard must be treated as a local application with direct aim of Nozzles. Open area hazards are more difficult to contain, and will require a more conservative approach for selecting agent and Nozzle quantities. Closed compartments can aid in keeping Dry Chemical Agent in the hazard area longer allowing for better coverage.
- Are there many obstructions? Although dry chemical can act as a total flooding agent in enclosed hazard areas, obstructions can limit the force of the agent discharge for direct application on a fire. Direct application of agent is a very effective way to extinguish many fires. It may be necessary to use additional Nozzles to compensate for obstructions.
- How much air flows through the hazard? Airflow can adversely affect aim of nozzles and dispersion of Dry Chemical Agents. It may be necessary to use additional Nozzles to compensate for air flow.
- What are the dimensions of the hazard? Determining hazard dimensions allows for Agent Cylinder size(s) and Nozzle quantities to be calculated.
- What is the potential for the hazard to spread to other areas of the vehicle/machine? Additional protection may be required for those areas as well.
- Does the vehicle/machine have additional hand portable extinguishers? Hand portable fire extinguishers are necessary to be used as a backup to an automatic fire suppression system. Appropriate type and rating of hand portable fire extinguishers must be considered.

### **3.2.6 Selecting the Appropriate Agent**

After identifying ignition and fuel sources (see Sections 3.2.1 and 3.2.2), the appropriate fire suppression agent must be selected.

- ABC Dry Chemical - Works well on all Class A, B, and C fires.
- Purple K Dry Chemical - Works well on Class B fires.
- ICE Liquid Agent - Works well on Class A and B fires and is good for cooling hot surfaces (turbochargers, exhaust manifolds), but must not be used on electrically energized equipment (batteries, alternators, starters). See the latest version of the ICE System Manual (P/N 22012) located on the Amerex website at [www.amerex-fire.com](http://www.amerex-fire.com).

### **3.2.7 Selecting the Appropriate Method of Detection**

After identifying vehicle hazard areas, it is necessary to select the appropriate form of detection for those areas. See the applicable electronics manual located on the Amerex website at [www.amerex-fire.com](http://www.amerex-fire.com).

- Spot Heat Detectors - Localized area devices that react to “set point” temperatures of 280°F (138°C), 350°F (177°C) or 450°F (232°C).
- Programmable Heat Detectors - Localized area devices that react to “set point” temperatures and can be effectively programmed to a temperature between 140°F (60°C) and 550°F (288°C) with rapid response to heat.
- Linear Heat Detectors - Broad area “linear wire” devices of various lengths, that have large surface area for heat detection with a “set point” of 356°F (180°C).
- Optical Flame Detectors - Rapid response devices that react to a visual flame signature. These must have visible line of sight to flame to be effective.

### **3.2.8 Selecting Methods of Actuation**

If automatic actuation of any Agent Cylinders in the Amerex Modular Dry Chemical Vehicle Fire Suppression System is selected, a manual means of actuation is also required. At least one manual means of actuation must be located within reach of the vehicle operator during normal vehicle operation. Additional manual means of actuation should be located conveniently in accessible areas along paths of egress. Such manual actuation devices include:

- Manual Actuation Button - An electronic button located in the drivers area or other locations accessible in the event of a fire. This button is used in conjunction with the Amerex Modular Electronics System. See the applicable electronics manual located on the Amerex website at [www.amerex-fire.com](http://www.amerex-fire.com).
- Manual or Manual/Electric Actuator (P/N 10210 or 23600) - Pneumatic actuation device located in the drivers area or other locations accessible in the event of a fire (See Section 2.5.4 or 2.5.5).

## **Chapter 4: System Design & Installation**

This Chapter describes system design and installation of the Amerex Modular Dry Chemical System. The addition of electronics, detection, additional agent selection, and any other components required to complete the Amerex Fire Suppression System can be found in technical literature section of the Amerex website at [www.amerex-fire.com](http://www.amerex-fire.com).

### **4.1 Steps to System Design**

- The appropriate selection of fire suppression agent(s) should be made after a hazard analysis has been completed.
- After selecting the ideal fire suppression agent(s), the designer must identify the associated Nozzle types and Nozzle quantities that work with the particular fire suppression agent(s) selected (See Section 4.2)
- Nozzle locations must be selected and Nozzles installed (See Section 4.3).
- Agent Cylinder(s) must be located and installed to support Nozzle location and selection. Limitations and requirements (See Section 4.4) should be followed as well as Agent Distribution Network limitations (See Section 4.5).
- Agent Distribution Network(s) must be constructed and installed (See Section 4.5).
- System actuation methods and control heads must be selected (See Section 4.6). Fire detection methods and the appropriate Amerex Modular Electronics System must be selected and considered when choosing system actuation methods. See the applicable electronics manual located on the Amerex website at [www.amerex-fire.com](http://www.amerex-fire.com).
- If Pneumatic actuation is chosen, Nitrogen Cylinders and the desired actuator must be located and installed to support Agent Cylinder location and control head selection. Location and mounting limitations and requirements should be followed as well as Pneumatic Actuation Network limitations (See Section 4.7 and 4.8).
- Pneumatic Actuation Network must be constructed and installed (See Section 4.7 and 4.8).
- System should be put into service (See Section 4.9)
- Proper owner/operator training should be provided (See Section 4.10)

### **4.2 Nozzles**

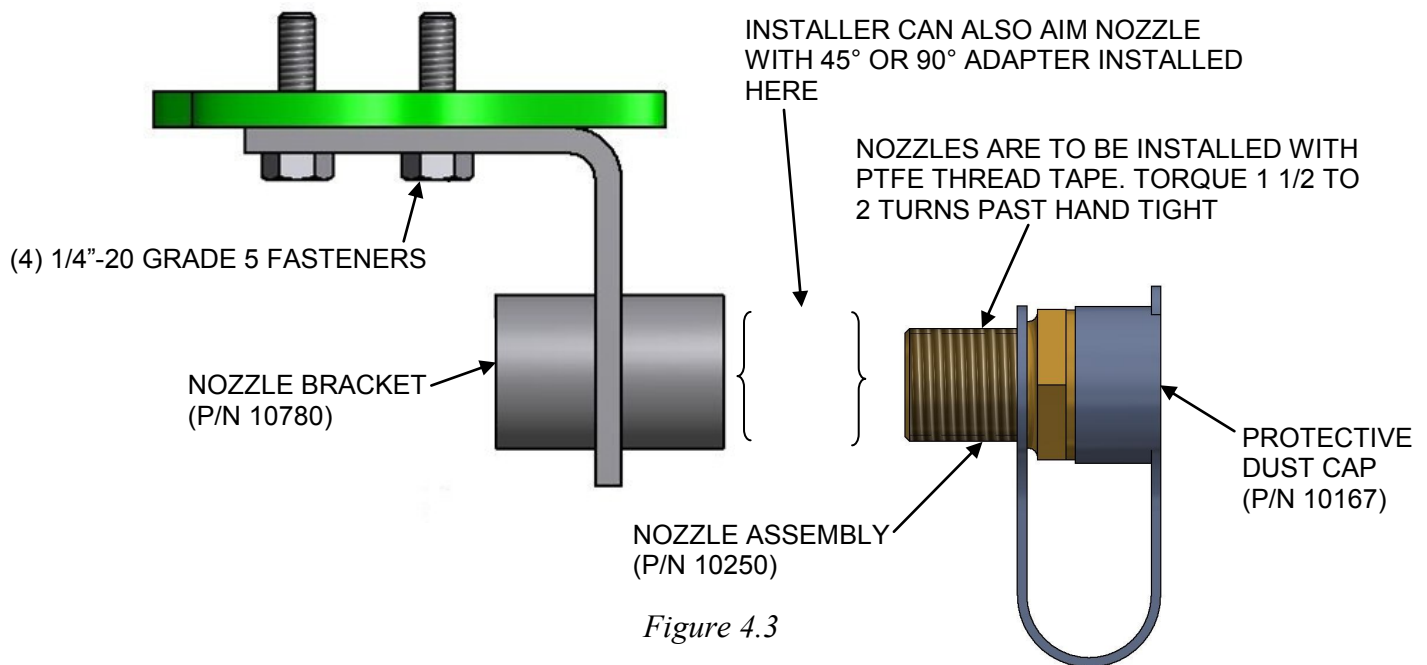
Nozzles are designed for and should be installed with two methods for consideration:

- Local Application Method
  - \* Must be used for direct agent application when limited or no external enclosures are surrounding the hazard (See Figure 1.3.b for specific dimensions).
  - \* Must be considered when protecting a hazard that has air flow.
  - \* Must be considered for obstructions that do not allow direct application.
  - \* Multiple nozzles may be used to protect larger surface areas. (See Figure 1.3.b for single nozzle coverage).
- Total Flood Application Method
  - \* Can be used when the hazard has external walls (See Figure 1.3.a for specific dimensions).
  - \* Multiple nozzles may be used to protect larger volumes (See Figure 1.3.a for single nozzle coverage).

Nozzles can be aimed with 0°, 45°, or 90° fittings. Use PTFE thread tape for all connections. Each defined hazard must have a minimum of one nozzle for protection. If a hazard is too large for one nozzle, carefully aim multiple nozzles at the hazard area to ensure coverage. Nozzles should be aimed to cover the items identified in the hazard analysis from Chapter 3.

#### 4.3 **Nozzle Brackets (P/N 10780)**

Nozzle Brackets can be bolted to the vehicle with a minimum of SAE grade 5 bolts or welded to the vehicle. Do not weld on or drill into fuel tanks or vehicle Roll Over Protection System (ROPS). Consult equipment manufacturer and property owner prior to modification of the vehicle.



#### 4.4 **Agent Cylinder & Agent Cylinder Bracket Selection**

Agent Cylinders and their associated Cylinder Brackets can be selected after first determining the quantity of Nozzles required to protect the hazard(s). Table 1.1 shows the appropriate quantity of Nozzles to be selected for any Agent Cylinder. At no time should the Agent Cylinder be utilized with more than the appropriate quantity of Nozzles as depicted in Table 1.1. Doing so will adversely affect system performance and will void the FM Approval.

##### Installation Requirements:

- Do not locate Cylinder Brackets in hazard areas where heat or fire can damage the Agent Cylinder.
- Do not locate Cylinder Brackets in areas where risk of damage can occur to the Agent Cylinder or Cylinder Bracket.
- Mount the Agent Cylinder in a location that only experiences a temperature range of -65°F (-54°C) to 150°F (66°C).
- Locate the Agent Cylinder such that the Agent Distribution Network lengths will remain within the parameters specified in the network limitations. (See Section 4.5)
- Mount Agent Cylinders in an area easily accessible for inspection and maintenance. Cylinder Brackets can be bolted or welded to vehicle structure. If bolted, use SAE Grade 8 fasteners to mount Cylinder Brackets to vehicle structure. Required torque values are given in the following Sections. If welded, consult equipment manufacturer and property owner prior to modification of the vehicle. Do not weld on or drill into fuel tanks or vehicle Roll Over Protection System (ROPS).



- Mount the Agent Cylinder and Cylinder Bracket where it can be secured to a surface capable of dynamically supporting the total weight of the two assemblies (See Table 4.4). Consult the vehicle manufacturer and property owner for approval of any location.

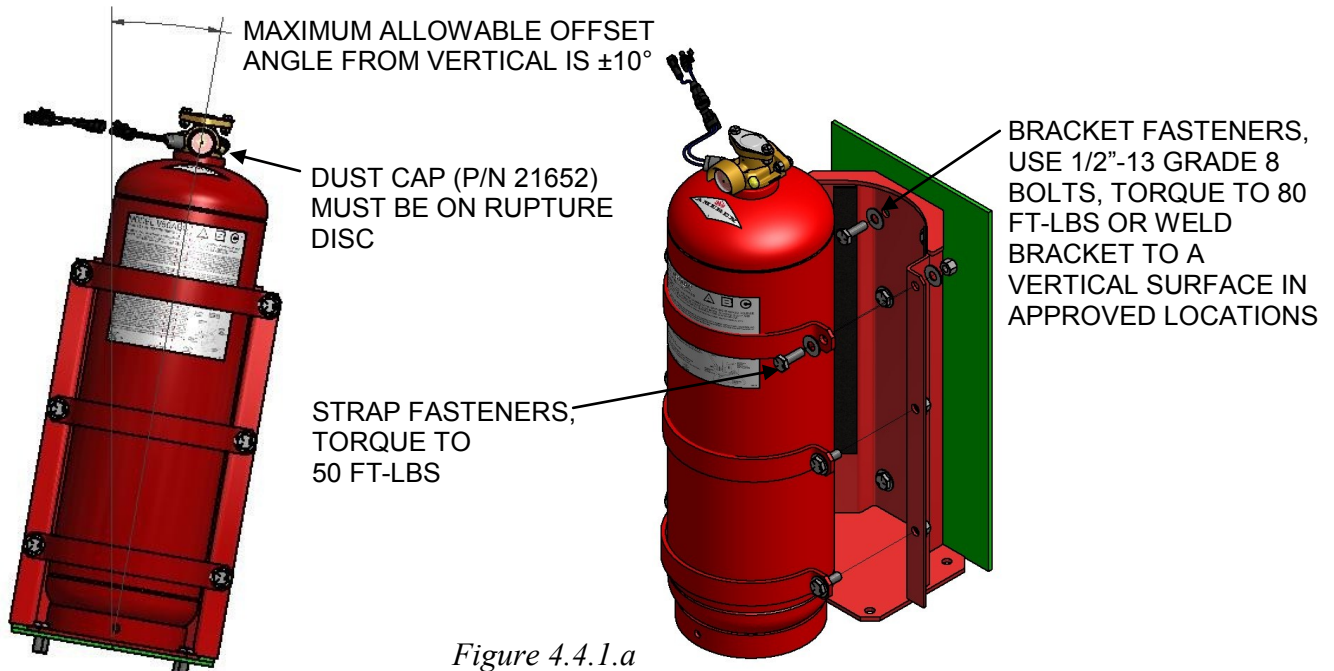
Agent Cylinder	Cylinder Bracket	Maximum Total Weight*, lb (kg)
V13	V13 Cylinder Bracket	45 (20.4)
V25	V25 Cylinder Bracket	74 (33.6)
VH25	VH25 Cylinder Bracket	72 (32.7)
V30	V30 Cylinder Bracket	90 (40.8)
VH30	VH30 Cylinder Bracket	88 (39.9)
V50	V50 Cylinder Bracket	138 (62.6)
VS50	VS50 Cylinder Bracket	144 (65.3)
VS75	VS75 Cylinder Bracket	205 (93.0)
VSR50	VSR50/VSR75 Weld Ring	139 (63.0)
VSR75	VSR50/VSR75 Weld Ring	188 (85.3)
V150	V150/V250 Weld Ring	428 (194.1)
V250	V150/V250 Weld Ring	575 (260.8)

\*Maximum total combined weight of Agent Cylinder and Cylinder Bracket shown. Actual total weight may be less. *Table 4.4*

- Bracket Strap fasteners are supplied with Cylinder Brackets. V150/V250 fasteners are supplied with the Weld Ring. Required torque values are given in the following Figures.

**4.4.1 Vertical Agent Cylinder & Cylinder Bracket**

Several styles of the vertical Agent Cylinders (V25, V30, V50, VS50 and VS75) will all be mounted similarly to that shown in Figure 4.4.1.a. Note: The actual number of bracket straps varies per Agent Cylinder (See Section 2.2). The Agent Cylinder must be mounted on a vertical surface. Maximum allowable offset from vertical is +/-10°.



*Figure 4.4.1.a*

The V13 Agent Cylinder will be mounted as shown in Figure 4.4.1.b. The Agent Cylinder must be mounted on a vertical surface. Maximum allowable offset from vertical is +/-10° as shown.

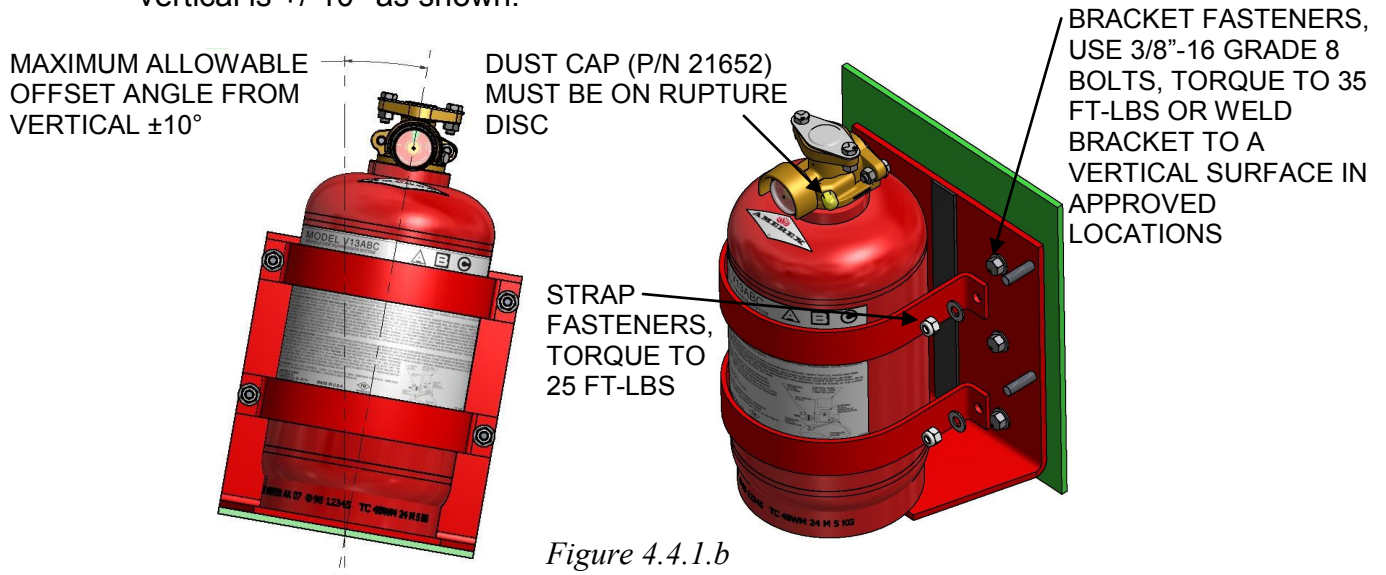


Figure 4.4.1.b

#### 4.4.2 Horizontal Agent Cylinder & Cylinder Bracket

The horizontal Agent Cylinders will all be mounted similarly to that shown in Figure 4.4.2. The Agent Cylinder can be mounted on a vertical or horizontal surface. Maximum allowable offset angle from horizontal is +/-5°.

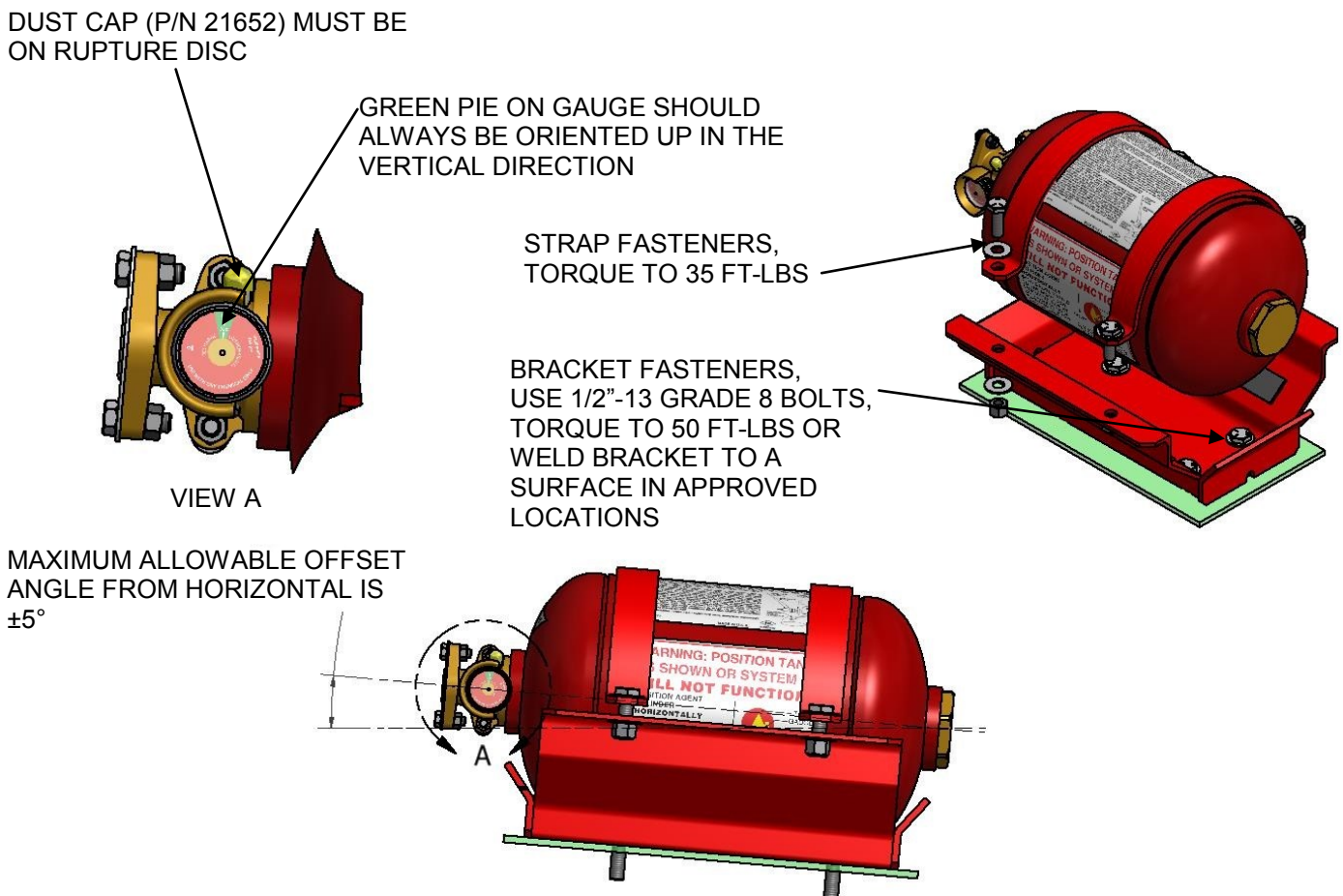


Figure 4.4.2

### 4.4.3 VSR50/VSR75 Agent Cylinder & Weld Ring

The Amerex VSR50 and VSR75 Agent Cylinders are constructed with heavy gauge steel and are designed with a bolting flange on the foot ring. The bolting flange allows for securing the VSR50 or VSR75 Agent Cylinder to a horizontal surface with use of the Weld Ring (P/N 23406). The Weld Ring must be welded to a horizontal surface and oriented such that a drain hole is on the lowest point of the horizontal surface. Fillet weld all around entire outer edge of Weld Ring, EXCEPT across the drain holes (See Figure 4.4.3.c). VSR50/VSR75 Fasteners (P/N 23404) to secure the VSR50 or VSR75 Agent Cylinder to the Weld Ring are supplied with the Weld Ring (See Figure 4.4.3.a).

(6) VSR50/VSR75 FASTENERS (P/N 23404) INCLUDE BOLT, LOCK WASHER, AND FLAT WASHER. TORQUE TO 80 FT-LBS. INSTALL AS SHOWN

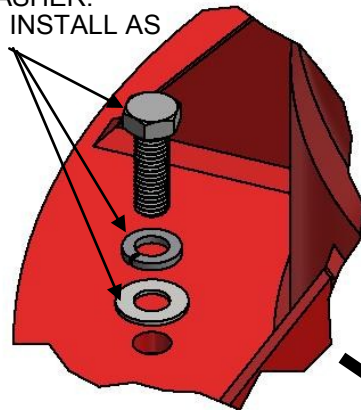


Figure 4.4.3.a

DUST CAP (P/N 21652) MUST BE ON RUPTURE DISC

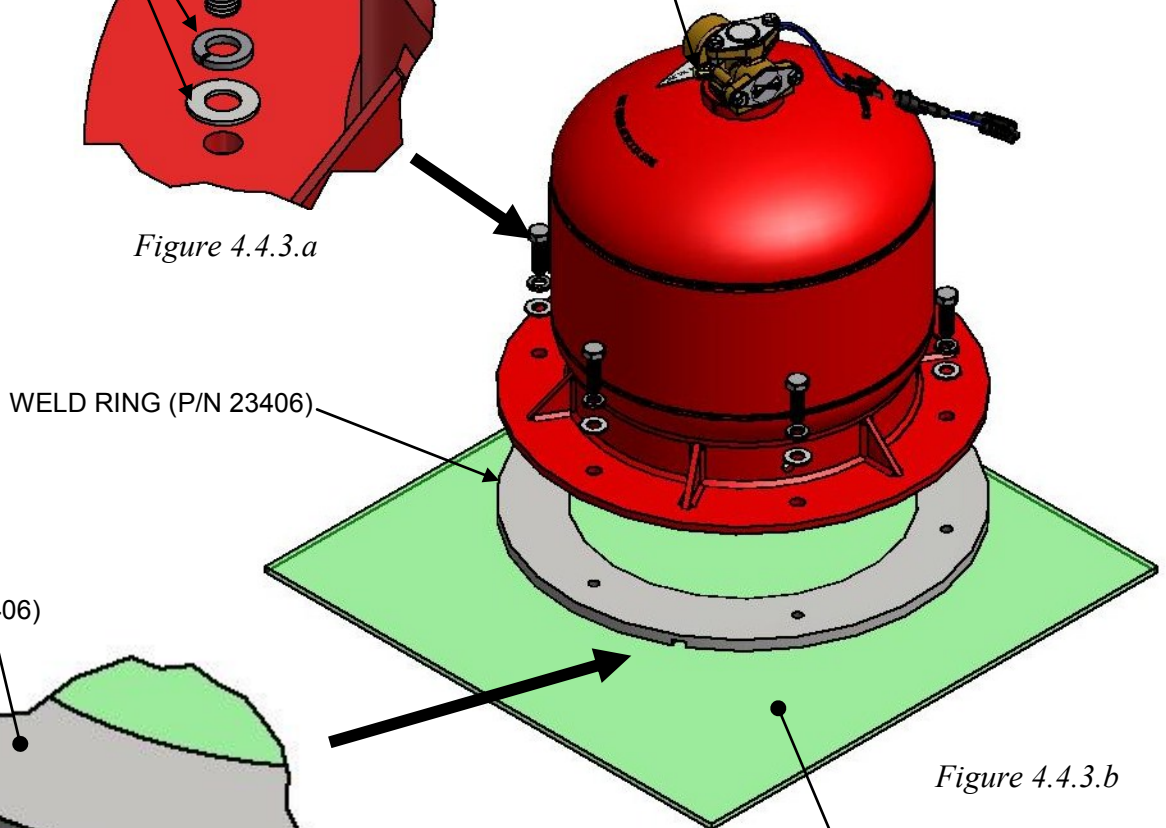
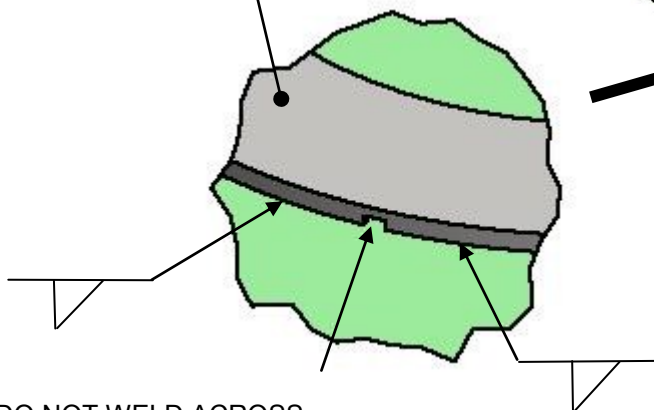


Figure 4.4.3.b

WELD RING (P/N 23406)



DO NOT WELD ACROSS DRAIN HOLES

Figure 4.4.3.c

**4.4.4 V150/V250 Agent Cylinder & Weld Ring**

The Amerex V150 and V250 Agent Cylinders are constructed with heavy gauge steel and are designed with a bolting flange on the foot ring. The bolting flange allows for securing the V150 or V250 Agent Cylinder to a horizontal surface with use of the Weld Ring (P/N 22966). The Weld Ring must be welded to a horizontal surface and oriented such that a drain hole is on the lowest point of the horizontal surface. Fillet weld all around entire outer edge of Weld Ring, EXCEPT across the drain holes (See Figure 4.4.4.c). V150/V250 Fasteners (P/N 22925) to secure the V150 or V250 Agent Cylinder to the Weld Ring are supplied with the Weld Ring (See Figure 4.4.4.a).

(8) V150/V250 FASTENERS (P/N 22925) INCLUDE BOLT, LOCK WASHER, AND FLAT WASHER. TORQUE TO 80 FT-LBS. INSTALL AS SHOWN

DUST CAP (P/N 22973) MUST BE ON RUPTURE DISC

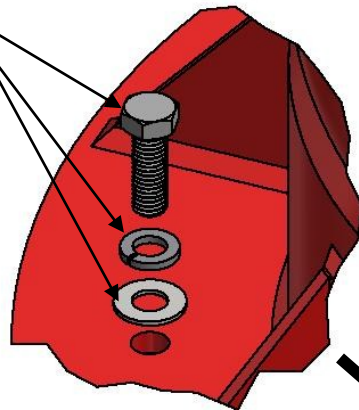


Figure 4.4.4.a

WELD RING (P/N 22966)

WELD RING (P/N 22966)

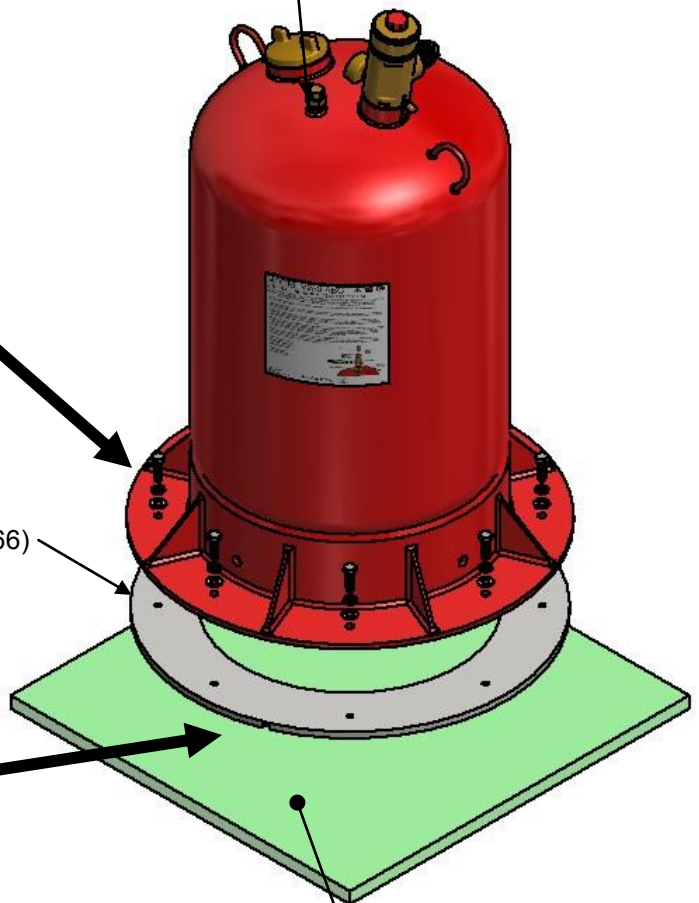
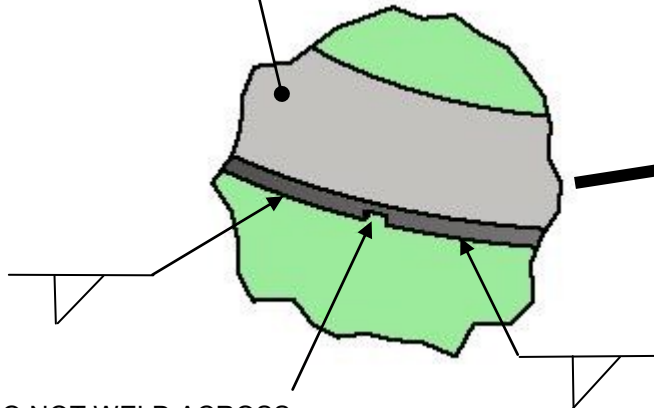


Figure 4.4.4.b

DO NOT WELD ACROSS DRAIN HOLES

Figure 4.4.4.c

SELECT A GOOD MOUNTING SURFACE THAT WILL SUPPORT THE WEIGHT OF THE V150 OR V250 AGENT CYLINDER AND WELD RING



#### **4.5 Agent Distribution Network, Specifications & Limitations**

After determining Nozzle location(s) and Agent Cylinder location(s), the Agent Distribution Network must be constructed for transferring the Dry Chemical Agent to the Nozzles. This is done using hydraulic hoses, fittings, tees, and/or Distributor Blocks. Rigid tubing can also be used and is explained in Section 4.5.18. Use the following requirements for constructing the Agent Distribution Network. **After the Agent Distribution Network is complete and assembled, purge the network using dry air or nitrogen ONLY per instructions in Section 6.2.2 to remove any debris that may have entered the network during assembly.**

**NOTE: The following requirements are applicable to the Agent Distribution Network ONLY. Refer to Section 4.7 for Pneumatic Actuation Network requirements.**

- After the Cylinder Bracket is installed, vertical Agent Cylinders must be installed with the discharge outlet facing the direction that will allow the Discharge Fitting Kit to be easily connected to the Agent Distribution Network (See Figure 4.5.1). For V150/V250 Agent Cylinders, orient the Agent Cylinder on the Weld Ring such that the Agent Distribution Network can be easily connected to the Agent Cylinder Valve discharge outlet.
- Horizontal Agent Cylinders must have the discharge outlet oriented such that the pressure gauge has the green pie area pointing in the vertical position.
- The Agent Distribution Network must be secured to the vehicle at a maximum of 18" intervals with use of padded "P" clamps.
- The Agent Distribution Network must be routed in such a manner that the network does not interfere with routine vehicle maintenance.
- The installer must be aware of maximum ambient temperature ratings for hose selection and not to exceed those temperature ratings during normal vehicle operation.
- When installing the Agent Distribution Network, the installer must comply with the hose manufacturer's minimum hose bend radius requirements. Avoid pinch points or possible chafing of the network.
- The number of Nozzles used in the Agent Distribution Network must match what is specified in Table 1.1 for the Agent Cylinder used.
- The installer must not exceed the Agent Distribution Network limitations as shown in this section. See Sections 4.5.2 thru 4.5.18 for Agent Distribution Network configurations.
- Use PTFE thread tape for NPT connections in the Agent Distribution Network.
- Elbows may be used in a 45° or 90° configuration but cannot exceed quantities as shown in the Tables in Sections 4.5.2 thru 4.5.18.
- All hoses used must meet or exceed SAE 100 R5 or 100 R1 (minimum) hose specifications. Hoses must have operating temperatures of -65°F to + 200°F (-54°C to +93°C). In addition to SAE hose specification requirements, hoses used for underground mining applications must meet USBM specified flame resistance acceptance.
- All hose end fittings must be only those specified by the hose manufacturer.
- All fittings (elbows, tees, reducers, couplers...etc.) used for connection of the Agent Distribution Network must be minimally rated for use at the maximum Agent Cylinder operating pressure. If fittings are located in a corrosive environment, appropriate fitting material must be considered.
- The following list of appropriate standards is for reference:
  - \* SAE J1273
  - \* SAE J516
  - \* SAE J517
  - \* SAE J343

**4.5.1 Discharge Fitting Kit**

The Discharge Fitting Kit (P/N 10199) is used to connect the Agent Distribution Network to the Agent Cylinder. Remove the Anti-Recoil Plate (P/N 10646) from the Agent Cylinder valve and attach the Discharge Fitting Kit in its place using the same (2) 5/16" bolts and nuts. Use medium grade thread locking compound and torque to 10 ft-lbs. Connect the threaded end of the Discharge Fitting Kit to the Agent Distribution Network. The Discharge Fitting Kit is not used on the V150 or V250 Agent Cylinder.

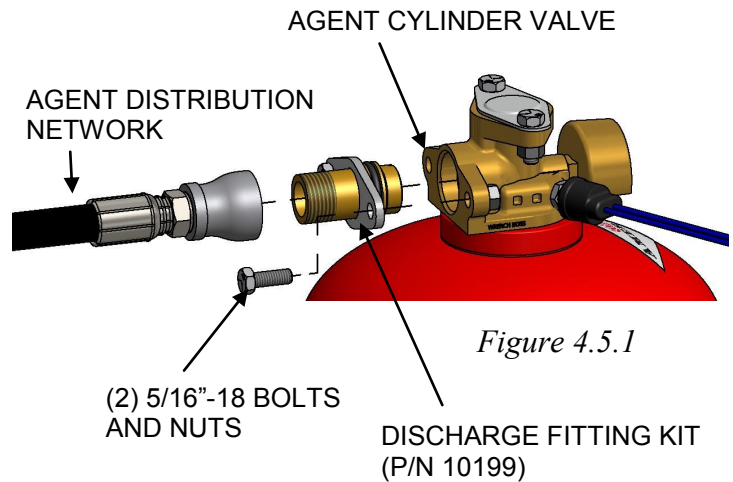


Figure 4.5.1

**4.5.2 V13 Agent Distribution Network (2 Nozzle)**

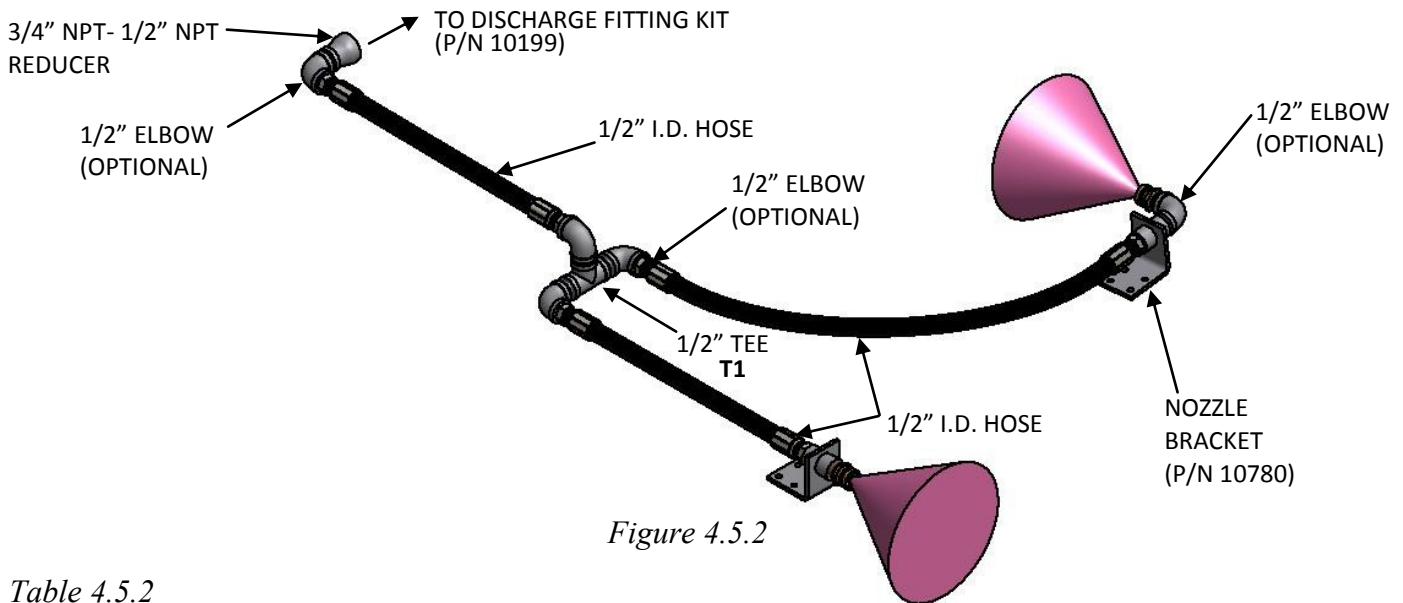


Figure 4.5.2

Table 4.5.2

LOCATION	HOSE I.D. in (mm)	HOSE LENGTH FEET (METERS)		NUMBER OF ELBOWS PER SECTION OF HOSE	
		MAXIMUM	MINIMUM	MAXIMUM	MINIMUM
Cylinder to T1	1/2 (12.7)	40 (12.2)	0	2	0
T1 to Nozzle	1/2 (12.7)	15 (4.6)	0	2	0
Cylinder to any Nozzle	1/2 (12.7)	50 (15.2)	3 (0.9)	—	—
All 1/2" hose	—	65 (19.8)	3 (0.9)	—	—

**Note:** Hose length may be unbalanced in a maximum ratio of 3:1 where the Agent Distribution Network splits (T1 to Nozzle). However, this ratio must be observed for the minimum versus maximum hose length. Example: If the longest 1/2 inch I.D. hose leading from where the network splits (T1 to Nozzle) is 15 feet, the shortest 1/2 inch I.D. hose leading from the same network split location cannot be less than 5 feet, and all 1/2 inch I.D. hoses together must fall within the length specified.

### 4.5.3 V25 / VH25 Agent Distribution Network (2 Nozzle)

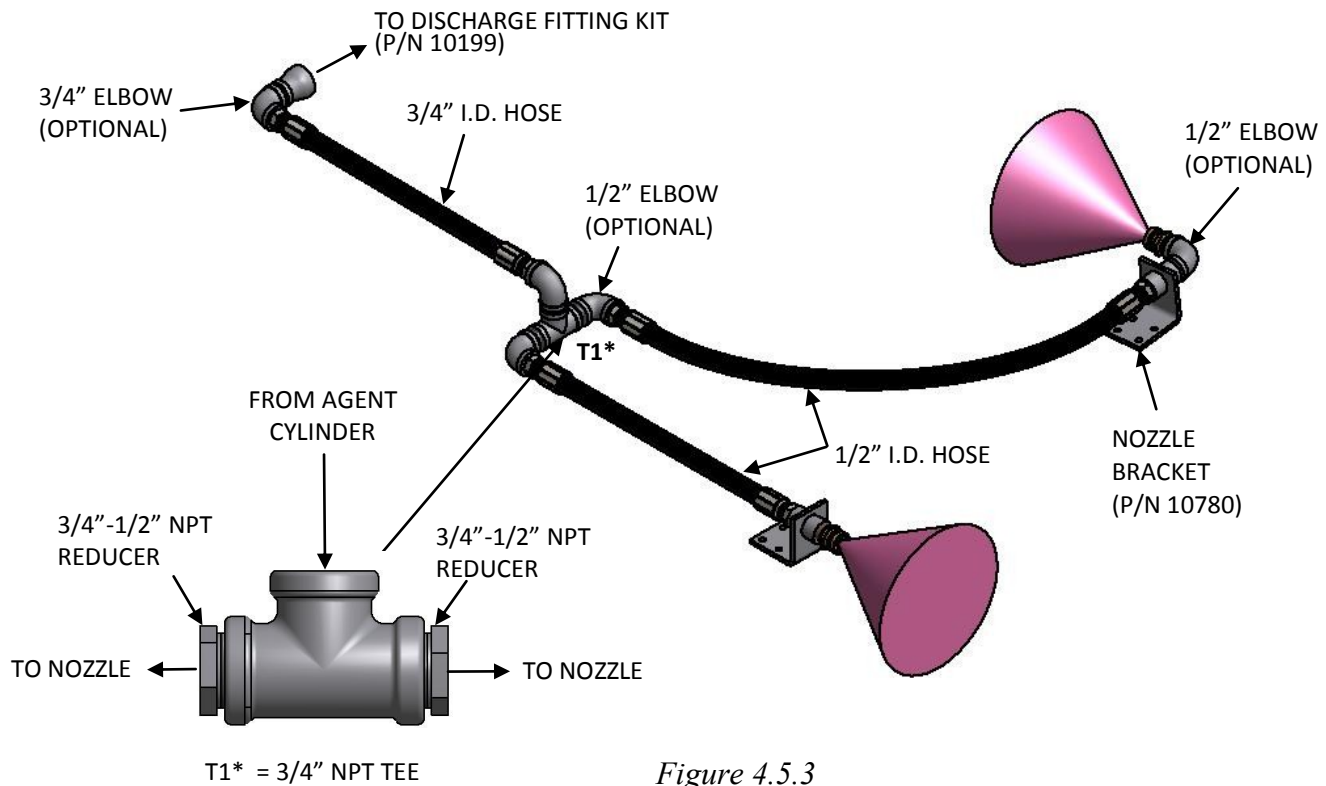


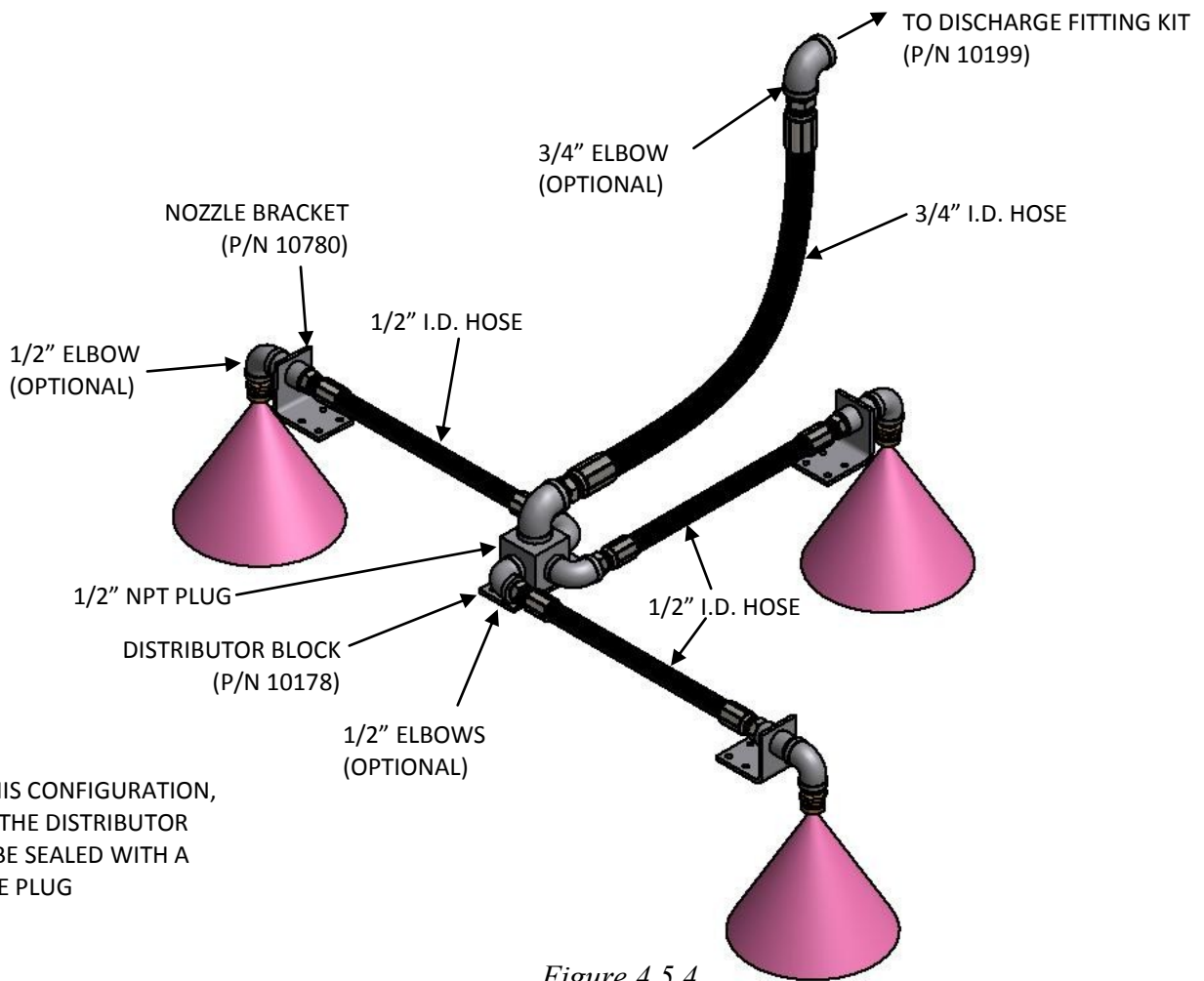
Figure 4.5.3

Table 4.5.3

LOCATION	HOSE I.D. in (mm)	HOSE LENGTH FEET (METERS)		NUMBER OF ELBOWS PER SECTION OF HOSE	
		MAXIMUM	MINIMUM	MAXIMUM	MINIMUM
Cylinder to T1	3/4 (19.1)	45 (13.7)	5 (1.5)	2	0
T1 to each Nozzle	1/2 (12.7)	15 (4.6)	0	2	0
Cylinder to any Nozzle	—	60 (18.3)	5 (1.5)	—	—
All 1/2" hose	—	30 (9.1)	0	—	—
All 3/4" hose	—	45 (13.7)	5 (1.5)	—	—

**Note:** Hose length may be unbalanced in a maximum ratio of 3:1 where the Agent Distribution Network splits (T1 to Nozzle). However, this ratio must be observed for the minimum versus maximum hose length. Example: If the longest 1/2 inch I.D. hose leading from where the network splits (T1 to Nozzle) is 15 feet, the shortest 1/2 inch I.D. hose leading from the same network split location cannot be less than 5 feet, and all 1/2 inch I.D. hoses together must fall within the length specified.

#### 4.5.4 V25 / VH25 / V30 / VH30 Agent Distribution Network (3 Nozzle)



NOTE: FOR THIS CONFIGURATION, ONE PORT OF THE DISTRIBUTOR BLOCK MUST BE SEALED WITH A 1/2" NPT MALE PLUG

Figure 4.5.4

Table 4.5.4

LOCATION	HOSE I.D. in (mm)	HOSE LENGTH FEET (METERS)		NUMBER OF ELBOWS PER SECTION OF HOSE	
		MAXIMUM	MINIMUM	MAXIMUM	MINIMUM
Cylinder to Distributor	3/4 (19.1)	45 (13.7)	5 (1.5)	2	0
Distributor to each Nozzle	1/2 (12.7)	15 (4.6)	0	2	0
Cylinder to any Nozzle	—	60 (18.3)	5 (1.5)	—	—
All 1/2" hose	—	45 (13.7)	0	6	0
All 3/4" hose	—	45 (13.7)	5 (1.5)	2	0

**Note:** Hose length may be unbalanced in a maximum ratio of 3:1 where the Agent Distribution Network splits (Distributor to Nozzle). However, this ratio must be observed for the minimum versus maximum hose length. Example: If the longest 1/2 inch I.D. hose leading from where the network splits (Distributor to Nozzle) is 15 feet, the shortest 1/2 inch I.D. hose leading from the same network split location cannot be less than 5 feet, and all 1/2 inch I.D. hoses together must fall within the length specified.



**4.5.5 V25 / VH25 / V30 / VH30/ V50 / VS50 / VSR50 Agent Distribution Network with Tees (4 Nozzle)**

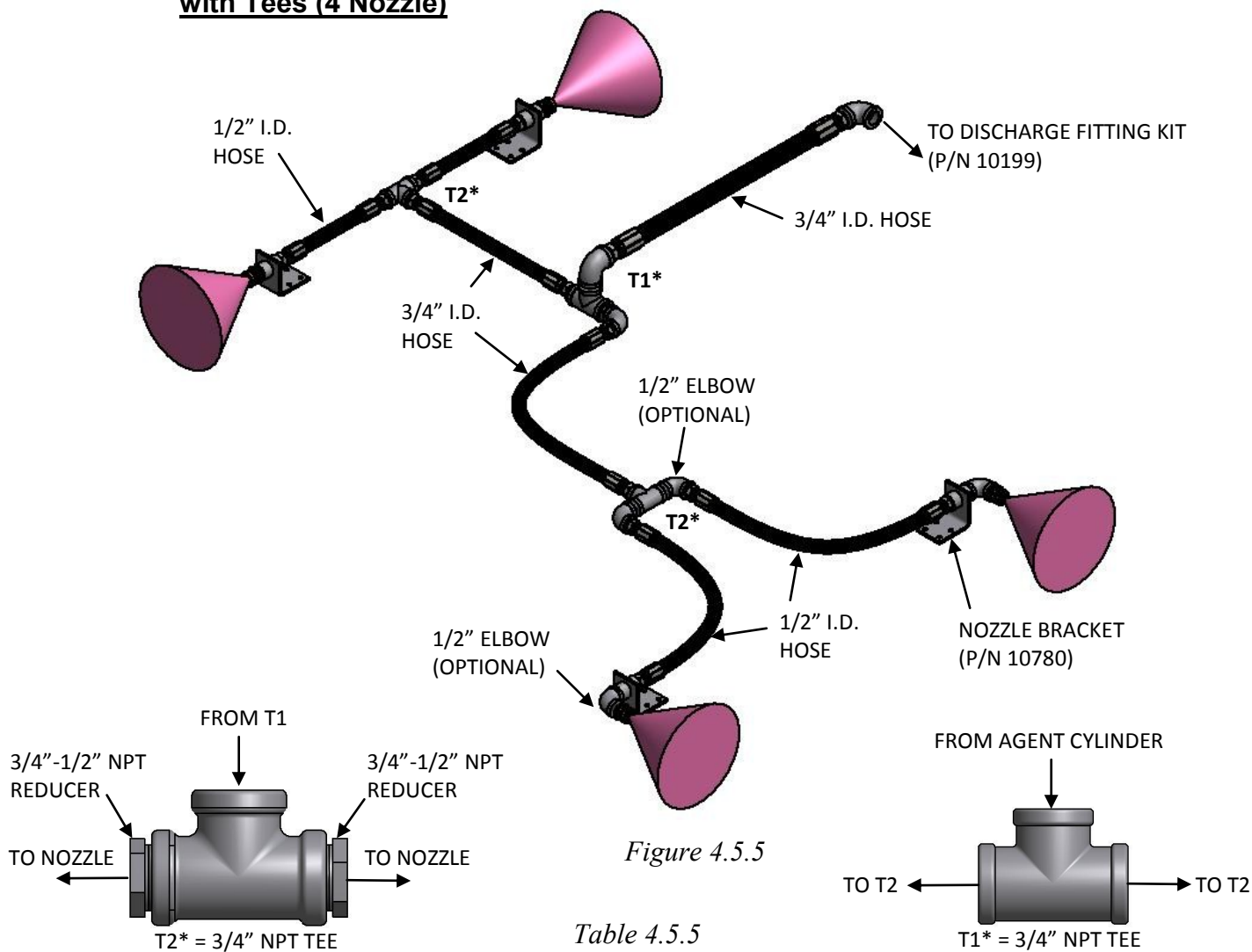


Figure 4.5.5

Table 4.5.5

LOCATION	HOSE I.D. in (mm)	HOSE LENGTH FEET (METERS)		NUMBER OF ELBOWS PER SECTION OF HOSE	
		MAXIMUM	MINIMUM	MAXIMUM	MINIMUM
Cylinder to T1	3/4 (19.1)	45 (13.7)	0	2	0
T1 to T2	3/4 (19.1)	20 (6.1)	0.5 (0.15)	2	0
T2 to each Nozzle	1/2 (12.7)	15 (4.6)	1 (0.3)	2	0
Cylinder to any Nozzle	—	60 (18.3)	5 (1.5)	—	—
All 1/2" hose	—	60 (18.3)	0	—	—
All 3/4" hose	—	45 (13.7)	3 (0.9)	—	—

**Note:** Hose length may be unbalanced in a maximum ratio of 3:1 where the Agent Distribution Network splits (T1 to T2, or T2 to Nozzle). However, this ratio must be observed for the minimum versus maximum hose length. Example: If the longest 1/2 inch I.D. hose leading from where the network splits (T1 to T2) is 15 feet, the shortest 1/2 inch I.D. hose leading from the same network split location cannot be less than 5 feet, and all 1/2 inch I.D. hoses together must fall within the length specified.

#### 4.5.6 V25 / VH25 / V30 / VH30 / V50 / VS50 / VSR50 Agent Distribution Network with Distributor (4 Nozzle)

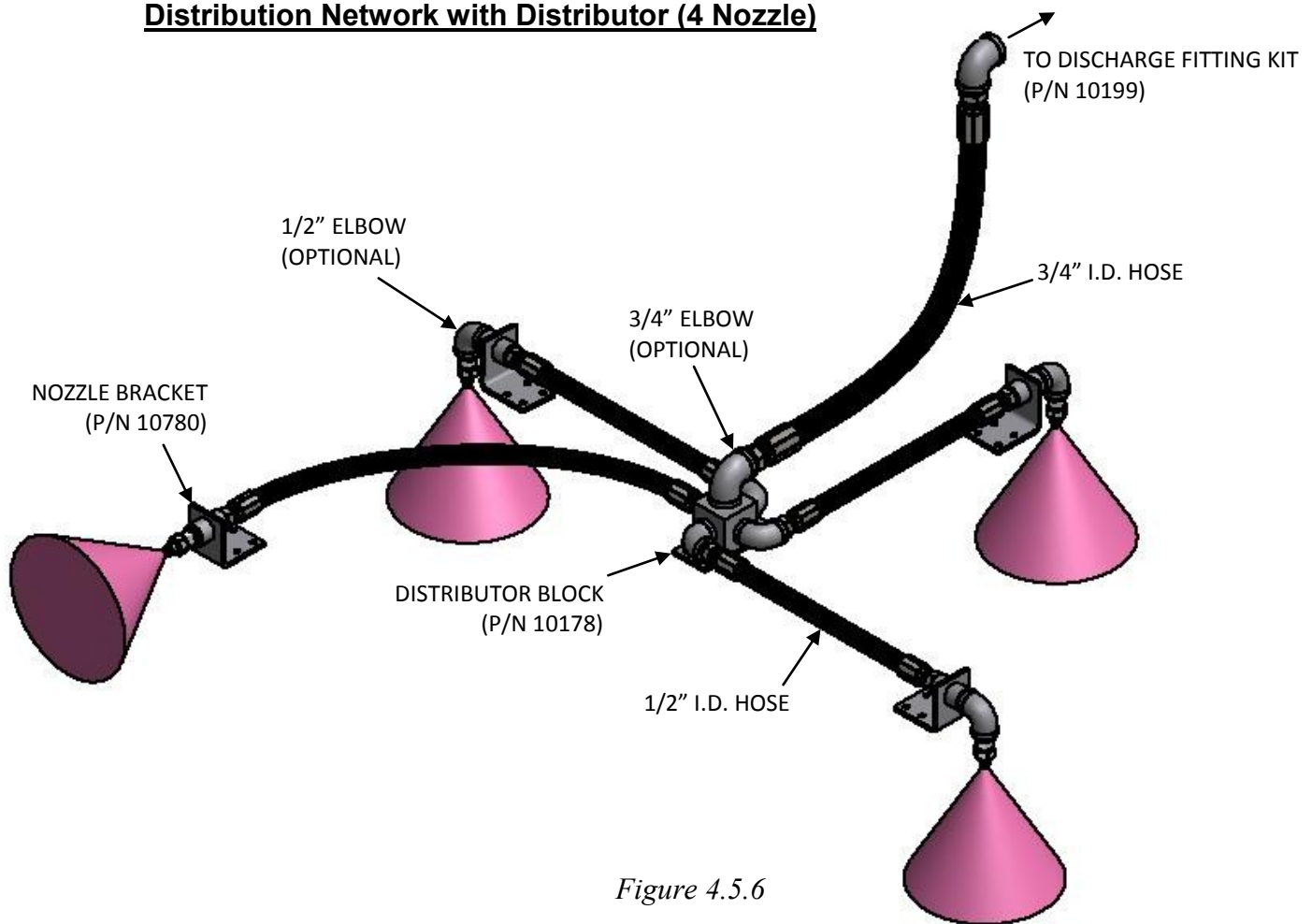


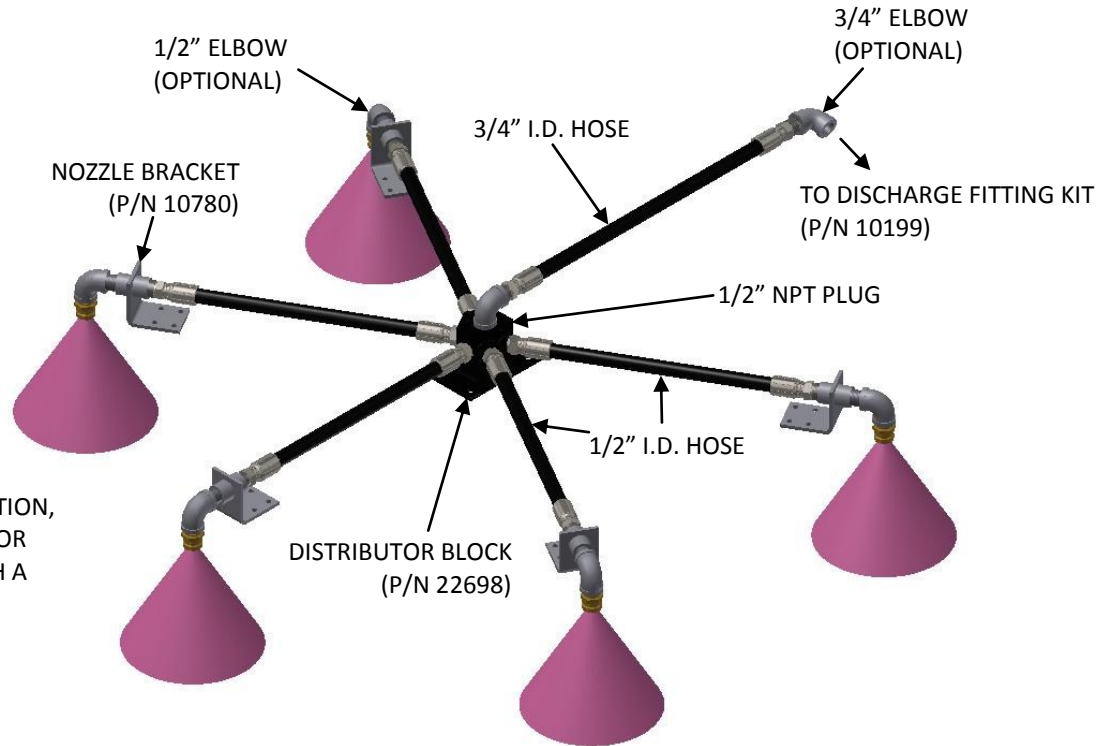
Figure 4.5.6

Table 4.5.6

LOCATION	HOSE I.D. in (mm)	HOSE LENGTH FEET (METERS)		NUMBER OF ELBOWS PER SECTION OF HOSE	
		MAXIMUM	MINIMUM	MAXIMUM	MINIMUM
Cylinder to Distributor	3/4 (19.1)	45 (13.7)	5 (1.5)	2	0
Distributor to each Nozzle	1/2 (12.7)	15 (4.6)	0	2	0
Cylinder to any Nozzle	—	60 (18.3)	5 (1.5)	—	—
All 1/2" hose	—	60 (18.3)	0	—	—
All 3/4" hose	—	45 (13.7)	5 (1.5)	—	—

**Note:** Hose length may be unbalanced in a maximum ratio of 3:1 where the Agent Distribution Network splits (Distributor to Nozzle). However, this ratio must be observed for the minimum versus maximum hose length. Example: If the longest 1/2 inch I.D. hose leading from where the network splits (Distributor to Nozzle) is 15 feet, the shortest 1/2 inch I.D. hose leading from the same network split location cannot be less than 5 feet, and all 1/2 inch I.D. hoses together must fall within the length specified.

**4.5.7 V30 / VH30 / V50 / VS50 / VSR50 Agent Distribution Network with Distributor (5 Nozzle)**



NOTE: FOR THIS CONFIGURATION, ONE PORT OF THE DISTRIBUTOR BLOCK MUST BE SEALED WITH A 1/2" NPT MALE PIPE PLUG

Figure 4.5.7

Table 4.5.7

LOCATION	HOSE I.D. in (mm)	HOSE LENGTH FEET (METERS)		NUMBER OF ELBOWS PER SECTION OF HOSE	
		MAXIMUM	MINIMUM	MAXIMUM	MINIMUM
Cylinder to Distributor	3/4 (19.1)	50 (15.2)	2 (0.61)	2	0
Distributor to each Nozzle	1/2 (12.7)	30 (9.14)	0	2	0
Cylinder to any Nozzle	—	80 (24.3)	2 (0.61)	—	—
All 1/2" hose	—	150 (45.7)	0	—	—
All 3/4" hose	—	50 (15.2)	2 (0.61)	—	—

**Note:** Hose length may be unbalanced in a maximum ratio of 3:1 where the Agent Distribution Network splits (Distributor to Nozzle). However, this ratio must be observed for the minimum versus maximum hose length. Example: If the longest 1/2 inch I.D. hose leading from where the network splits (Distributor to Nozzle) is 15 feet, the shortest 1/2 inch I.D. hose leading from the same network split location cannot be less than 5 feet, and all 1/2 inch I.D. hoses together must fall within the length specified.

### 4.5.8 V50 / VS50 / VSR50 Agent Distribution Network with Distributor to Tees (6 Nozzle)

NOTE: FOR THIS CONFIGURATION, ONE PORT OF THE DISTRIBUTOR BLOCK MUST BE SEALED WITH A 1/2" NPT MALE PIPE PLUG

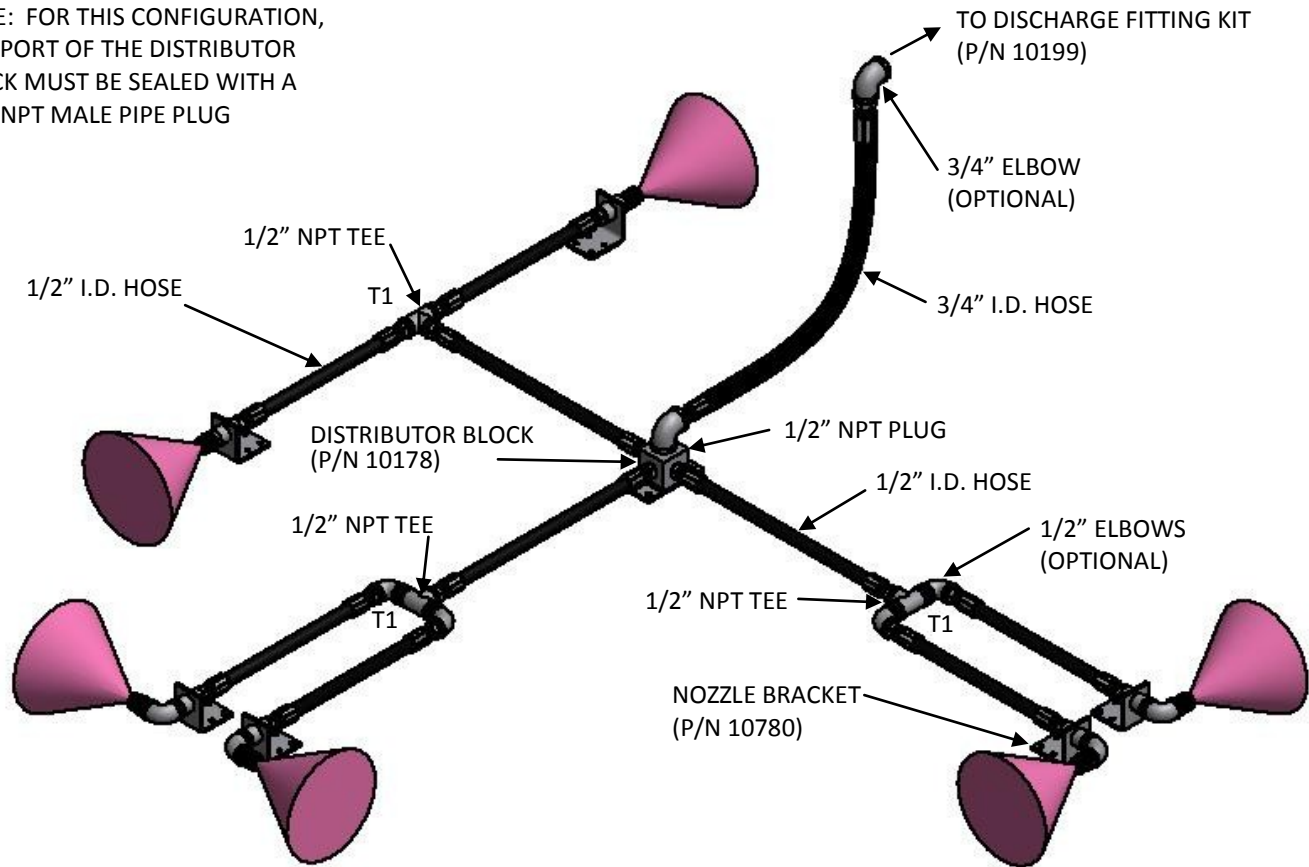


Figure 4.5.8

Table 4.5.8

LOCATION	HOSE I.D. in (mm)	HOSE LENGTH FEET (METERS)		NUMBER OF ELBOWS PER SECTION OF HOSE	
		MAXIMUM	MINIMUM	MAXIMUM	MINIMUM
Cylinder to Distributor	3/4 (19.1)	45 (13.7)	2 (0.61)	2	0
Distributor to T1	1/2 (12.7)	15 (4.6)	0.5 (0.15)	2	0
T1 to Nozzle	1/2 (12.7)	11 (3.4)	1 (0.3)	2	0
Cylinder to any Nozzle	—	56 (17.1)	5 (1.9)	—	—
All 1/2" hose	—	66 (20.1)	0.5 (.15)	—	—
All 3/4" hose	—	45 (13.7)	2 (0.61)	—	—

**Note:** Hose length may be unbalanced in a maximum ratio of 3:1 where the Agent Distribution Network splits (Distributor to T1, or T1 to Nozzle). However, this ratio must be observed for the minimum versus maximum hose length. Example: If the longest 1/2 inch I.D. hose leading from where the network splits (Distributor to T1) is 15 feet, the shortest 1/2 inch I.D. hose leading from the same network split location cannot be less than 5 feet, and all 1/2 inch I.D. hoses together must fall within the length specified.

**4.5.9 V50 / VS50 / VSR50 Agent Distribution Network with Distributor (6 Nozzle)**

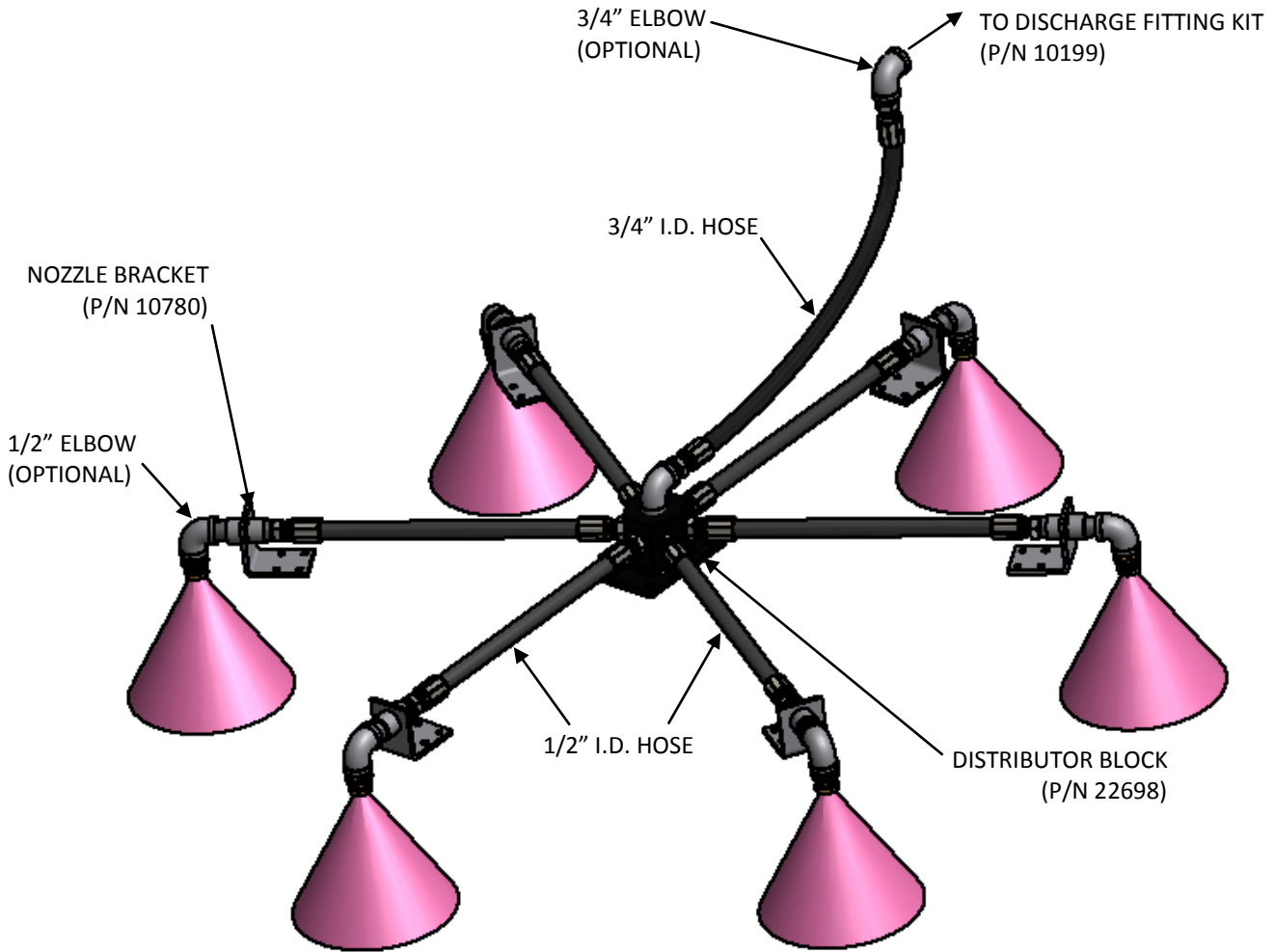


Figure 4.5.9

Table 4.5.9

LOCATION	HOSE I.D. in (mm)	HOSE LENGTH FEET (METERS)		NUMBER OF ELBOWS PER SECTION OF HOSE	
		MAXIMUM	MINIMUM	MAXIMUM	MINIMUM
Cylinder to Distributor	3/4 (19.1)	50 (15.2)	2 (0.61)	2	0
Distributor to each Nozzle	1/2 (12.7)	30 (9.14)	0	2	0
Cylinder to any Nozzle	—	80 (24.3)	2 (0.61)	—	—
All 1/2" hose	—	180 (54.9)	0	—	—
All 3/4" hose	—	50 (15.2)	2 (0.61)	—	—

**Note:** Hose length may be unbalanced in a maximum ratio of 3:1 where the Agent Distribution Network splits (Distributor to Nozzle). However, this ratio must be observed for the minimum versus maximum hose length. Example: If the longest 1/2 inch I.D. hose leading from where the network splits (Distributor to Nozzle) is 15 feet, the shortest 1/2 inch I.D. hose leading from the same network split location cannot be less than 5 feet, and all 1/2 inch I.D. hoses together must fall within the length specified.

#### 4.5.10 V50 / VS50 / VSR50 Agent Distribution Network with Tee to Distributors (8 Nozzle)

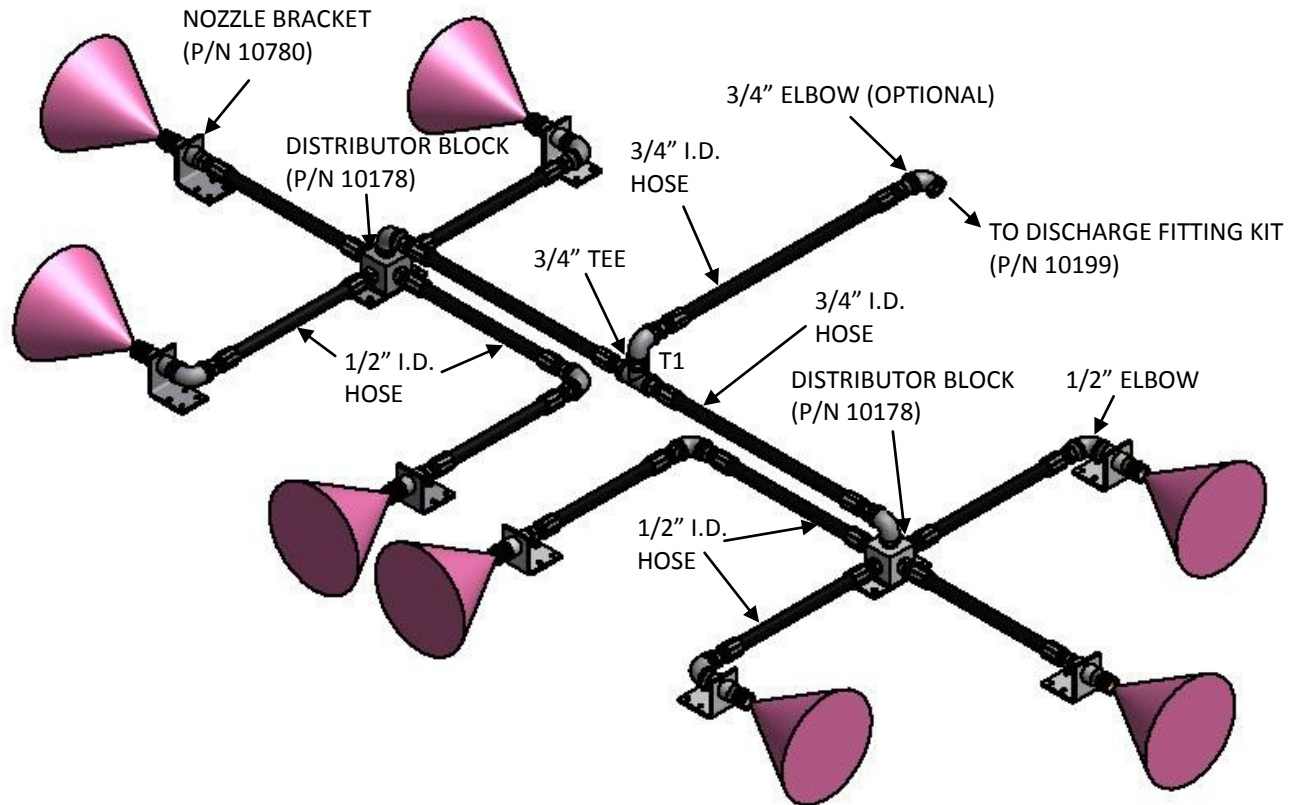


Figure 4.5.10

Table 4.5.10

LOCATION	HOSE I.D. in (mm)	HOSE LENGTH FEET (METERS)		NUMBER OF ELBOWS PER SECTION OF HOSE	
		MAXIMUM	MINIMUM	MAXIMUM	MINIMUM
Cylinder to T1	3/4 (19.1)	40 (12.2)	0	2	0
T1 to Distributor	3/4 (19.1)	20 (6.1)	0	2	0
Distributor to each Nozzle	1/2 (12.7)	11 (3.4)	0	2	0
Cylinder to any Nozzle	—	60 (18.3)	5 (1.5)	—	—
All 1/2" hose	—	88 (26.8)	0	—	—
All 3/4" hose	—	45 (13.7)	3 (0.9)	—	—

**Note:** Hose length may be unbalanced in a maximum ratio of 3:1 where the Agent Distribution Network splits (T1 to Distributor, or Distributor to Nozzle). However, this ratio must be observed for the minimum versus maximum hose length. Example: If the longest 1/2 inch I.D. hose leading from where the network splits (T1 to Distributor) is 15 feet, the shortest 1/2 inch I.D. hose leading from the same network split location cannot be less than 5 feet, and all 1/2 inch I.D. hoses together must fall within the length specified.

### 4.5.11 VS75 / VSR75 Agent Distribution Network with Distributor to Tees (10 Nozzle)

Figure 4.5.11

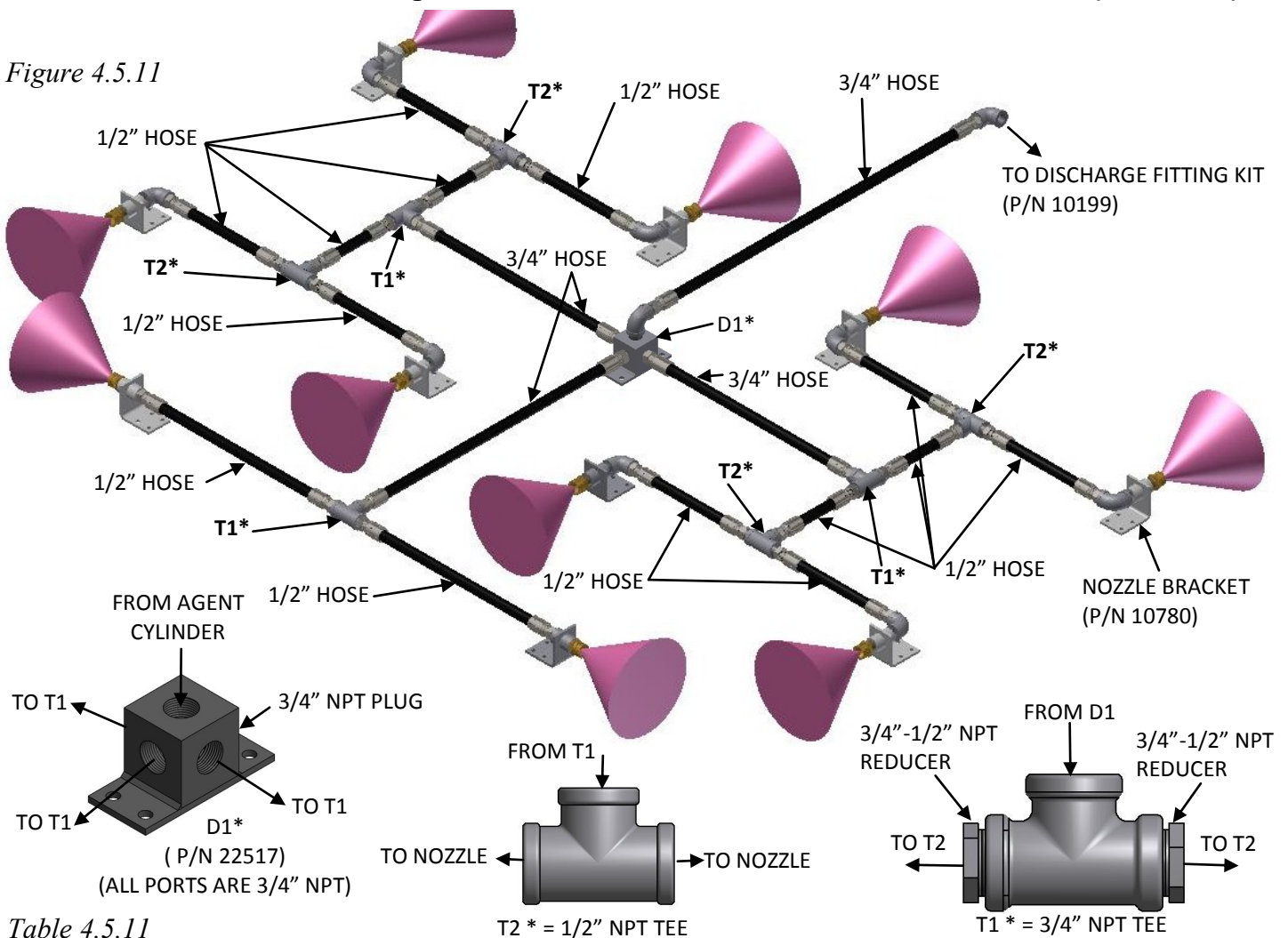


Table 4.5.11

LOCATION	HOSE I.D. in (mm)	HOSE LENGTH FEET (METERS)		NUMBER OF ELBOWS PER SECTION OF HOSE	
		MAXIMUM	MINIMUM	MAXIMUM	MINIMUM
Cylinder to D1	3/4 (19.1)	45 (13.7)	2 (0.61)	2	0
D1 to T1	3/4 (19.1)	15 (4.6)	2 (0.61)	2	0
T1 to T2	1/2 (12.7)	10 (3.0)	2 (0.61)	2	0
T2 to Nozzle	1/2 (12.7)	10 (3.0)	2 (0.61)	2	0
Cylinder to any Nozzle	—	70 (21.3)	6 (1.8)	-	0
All 3/4" hose	—	60 (18.3)	8 (2.4)	-	0
All 1/2" hose	—	80 (24.4)	28(8.5)	-	0

**Note:** Hose length may be unbalanced in a maximum ratio of 3:1 where the Agent Distribution Network splits (D1 to T1, T1 to T2, or T2 to Nozzle). However, this ratio must be observed for the minimum versus maximum hose length. Example: If the longest 1/2 inch I.D. hose leading from where the network splits (D1 to T1) is 15 feet, the shortest 1/2 inch I.D. hose leading from the same network split location cannot be less than 5 feet, and all 1/2 inch I.D. hoses together must fall within the length specified.

**4.5.12 VS75 / VSR75 Agent Distribution Network with Distributor to Distributors**

**(10 Nozzle)**

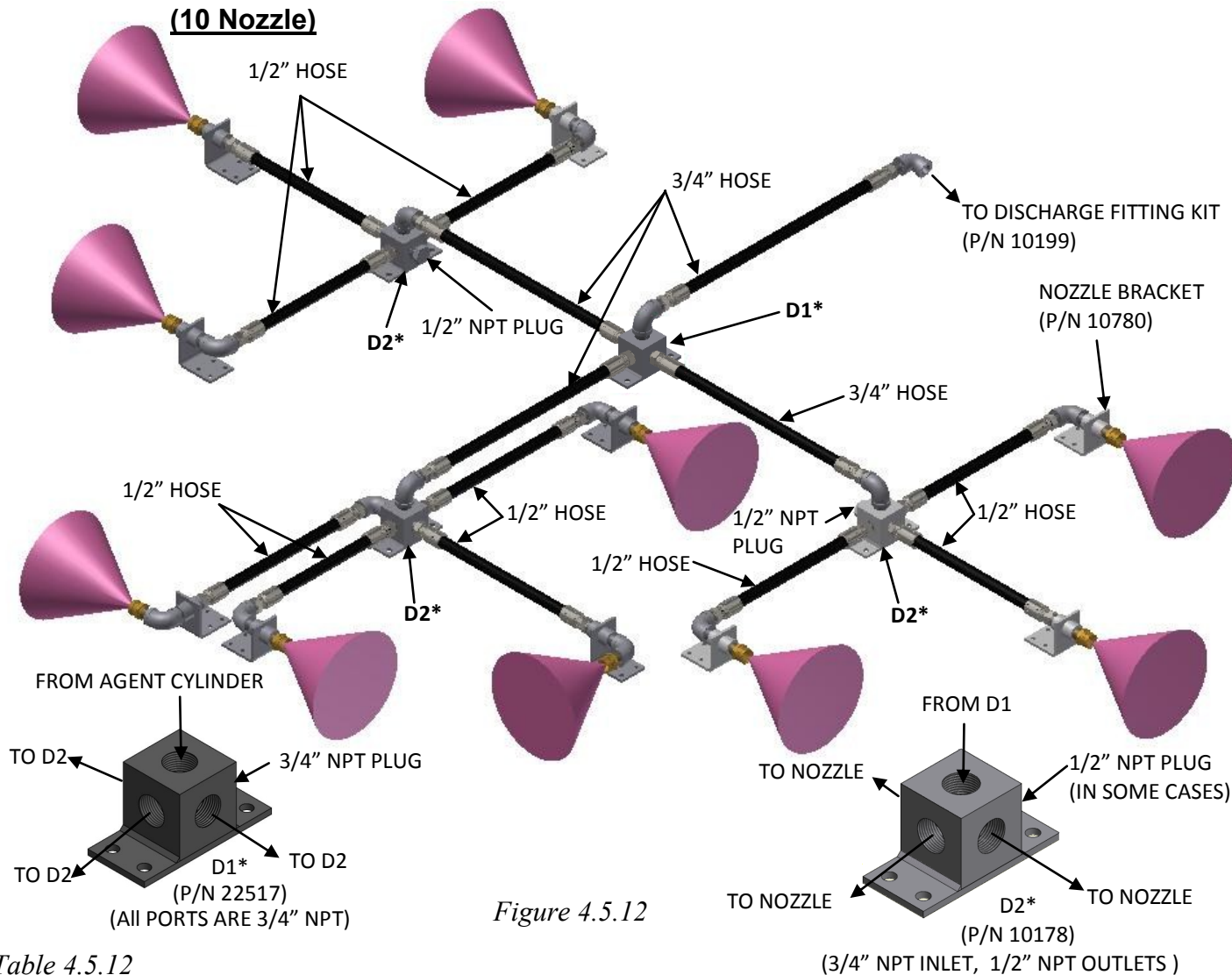


Figure 4.5.12

Table 4.5.12

LOCATION	HOSE I.D. in (mm)	HOSE LENGTH FEET (METERS)		NUMBER OF ELBOWS PER SECTION OF HOSE	
		MAXIMUM	MINIMUM	MAXIMUM	MINIMUM
Cylinder to D1	3/4 (19.1)	45 (13.7)	2 (0.61)	2	0
D1 to D2	3/4 (19.1)	15 (4.6)	2 (0.61)	2	0
D2 to Nozzle	1/2 (12.7)	10 (3.0)	2 (0.61)	2	0
Cylinder to any Nozzle	—	70 (21.3)	6 (1.8)	-	0
All 3/4" hose	—	60 (18.3)	8 (2.4)	-	0
All 1/2" hose	—	80 (24.4)	20 (6.1)	-	0

**Note:** Hose length may be unbalanced in a maximum ratio of 3:1 where the Agent Distribution Network splits (D1 to D2, or D2 to Nozzle). However, this ratio must be observed for the minimum versus maximum hose length. Example: If the longest 1/2 inch I.D. hose leading from where the network splits (D1 to D2) is 15 feet, the shortest 1/2 inch I.D. hose leading from the same network split location cannot be less than 5 feet, and all 1/2 inch I.D. hoses together must fall within the length specified.



### 4.5.13 VS75 / VSR75 Agent Distribution Network with Distributor to Tees (12 Nozzle)

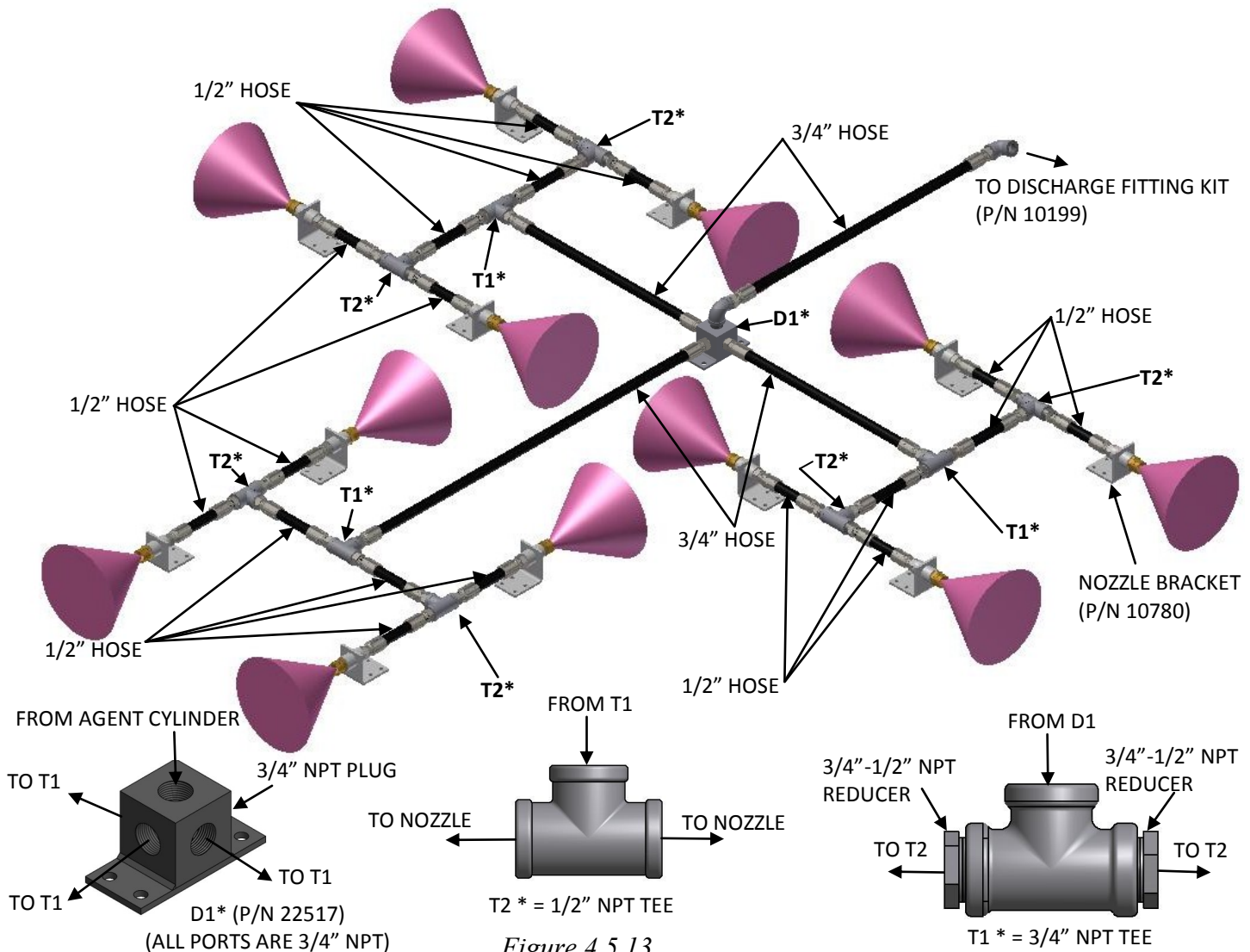


Figure 4.5.13

Table 4.5.13

LOCATION	HOSE I.D. in (mm)	HOSE LENGTH FEET (METERS)		NUMBER OF ELBOWS PER SECTION OF HOSE	
		MAXIMUM	MINIMUM	MAXIMUM	MINIMUM
Cylinder to D1	3/4 (19.1)	45 (13.7)	2 (0.61)	2	0
D1 to T1	3/4 (19.1)	15 (4.6)	2 (0.61)	2	0
T1 to T2	1/2 (12.7)	10 (3.0)	2 (0.61)	2	0
T2 to Nozzle	1/2 (12.7)	10 (3.0)	2 (0.61)	2	0
All 3/4" hose	—	60 (18.3)	8 (2.4)	-	0
All 1/2" hose	—	80 (24.4)	36 (11)	-	0

**Note:** Hose length may be unbalanced in a maximum ratio of 3:1 where the Agent Distribution Network splits (D1 to T1, T1 to T2, or T2 to Nozzle). However, this ratio must be observed for the minimum versus maximum hose length. Example: If the longest 1/2 inch I.D. hose leading from where the network splits (D1 to T1) is 15 feet, the shortest 1/2 inch I.D. hose leading from the same network split location cannot be less than 5 feet, and all 1/2 inch I.D. hoses together must fall within the length specified.

**4.5.14 VS75 / VSR75 Agent Distribution Network with Distributor to Distributors**

**(12 Nozzle)**

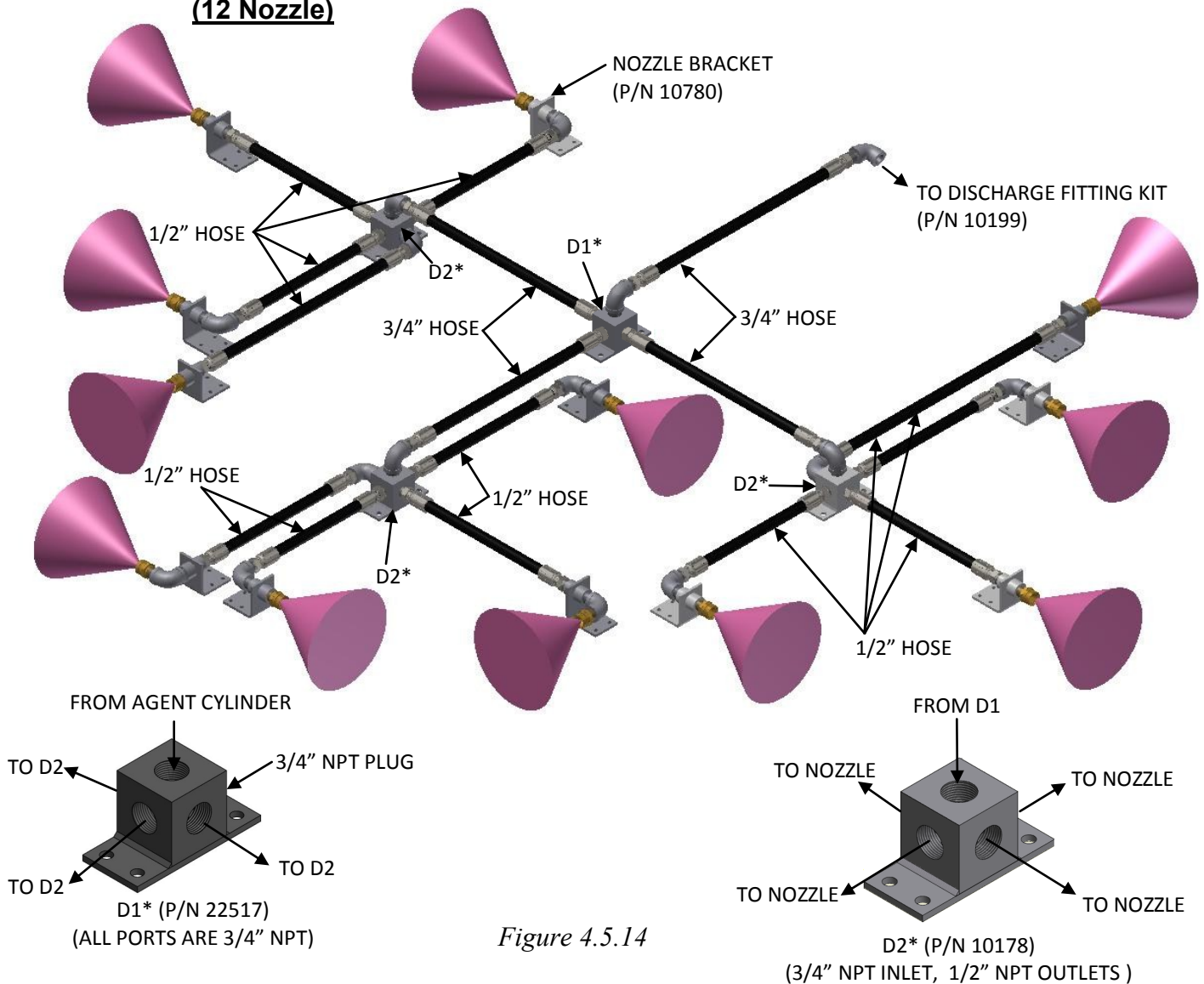


Figure 4.5.14

Table 4.5.14

LOCATION	HOSE I.D. in (mm)	HOSE LENGTH FEET (METERS)		NUMBER OF ELBOWS PER SECTION OF HOSE	
		MAXIMUM	MINIMUM	MAXIMUM	MINIMUM
Cylinder to D1	3/4 (19.1)	45 (13.7)	2 (0.61)	2	0
D1 to D2	3/4 (19.1)	15 (4.6)	2 (0.61)	2	0
D2 to Nozzle	1/2 (12.7)	10 (3.0)	2 (0.61)	2	0
All 3/4" hose	—	60 (18.3)	8 (2.4)	-	0
All 1/2" hose	—	80 (24.4)	24 (7.3)	-	0

**Note:** Hose length may be unbalanced in a maximum ratio of 3:1 where the Agent Distribution Network splits (D1 to D2, or D2 to Nozzle). However, this ratio must be observed for the minimum versus maximum hose length. Example: If the longest 1/2 inch I.D. hose leading from where the network splits (D1 to D2) is 15 feet, the shortest 1/2 inch I.D. hose leading from the same network split location cannot be less than 5 feet, and all 1/2 inch I.D. hoses together must fall within the length specified.

### 4.5.15 V150/V250 Agent Distribution Network with Distributor to Distributors (12 Nozzle)

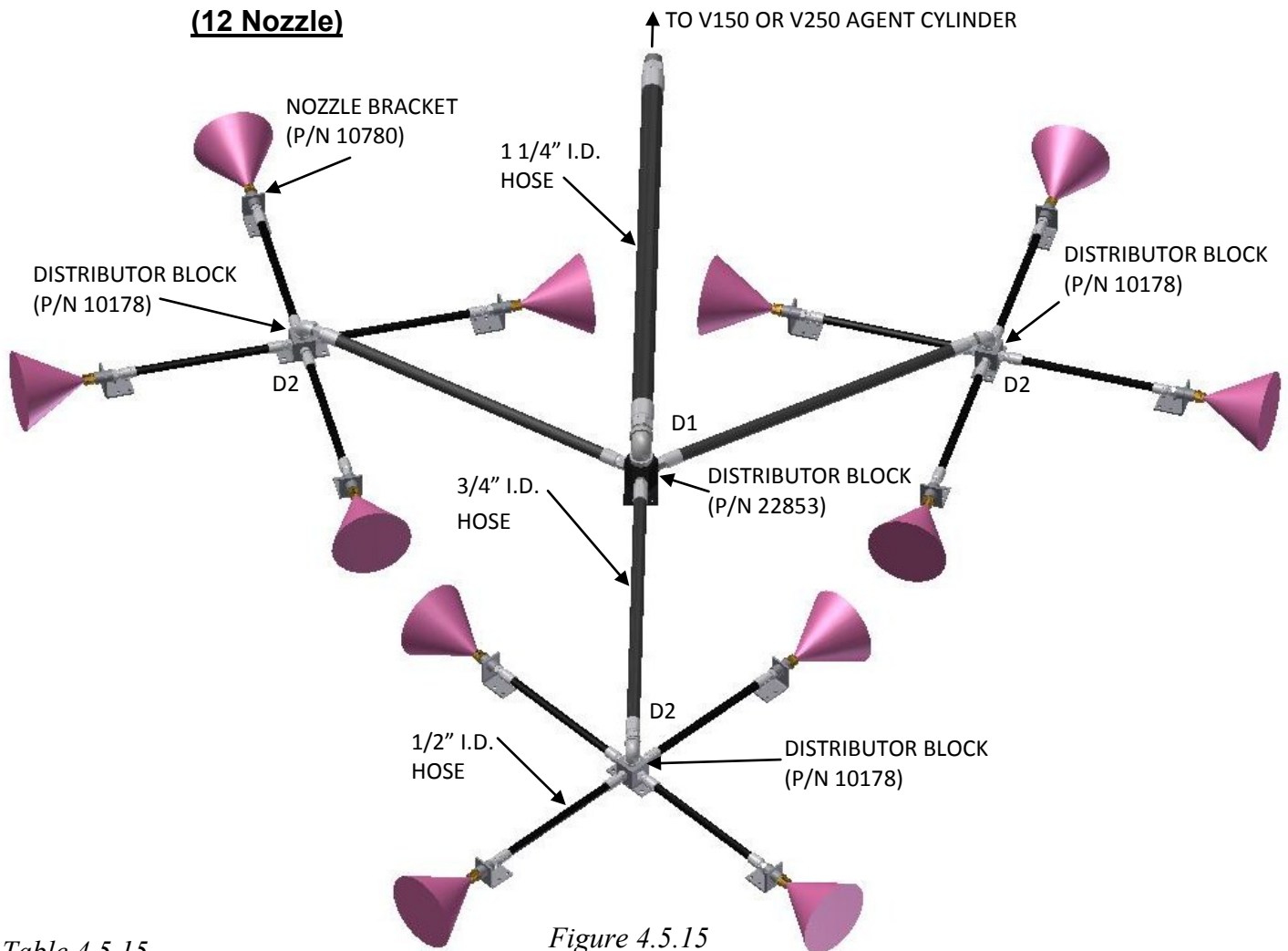


Table 4.5.15

Figure 4.5.15

LOCATION	HOSE I.D. in (mm)	HOSE LENGTH FEET (METERS)		NUMBER OF ELBOWS PER SECTION OF HOSE	
		MAXIMUM	MINIMUM	MAXIMUM	MINIMUM
Cylinder to D1	1 1/4 (31.8)	20 (6.1)	2 (0.61)	2	0
D1 to D2	3/4 (19.1)	50 (15.2)	2 (0.61)	2	0
D2 to Nozzle	1/2 (12.7)	30 (9.1)	2 (0.61)	2	0
Cylinder to any Nozzle	—	80 (24.4)	6 (1.8)	2	0
All 1 1/4" hose	—	20 (6.1)	2 (0.61)	2	0
All 3/4" hose	—	150 (45.7)	6 (1.8)	6	0
All 1/2" hose	—	360 (109.7)	24 (7.3)	24	0

**Note:** Hose length may be unbalanced in a maximum ratio of 3:1 where the Agent Distribution Network splits (D1 to D2, or D2 to Nozzle). However, this ratio must be observed for the minimum versus maximum hose length. Example: If the longest 1/2 inch I.D. hose leading from where the network splits (D1 to D2) is 15 feet, the shortest 1/2 inch I.D. hose leading from the same network split location cannot be less than 5 feet, and all 1/2 inch I.D. hoses together must fall within the length specified.

### 4.5.16 V150/V250 Agent Distribution Network with Distributor to Distributors

#### (18 Nozzle)

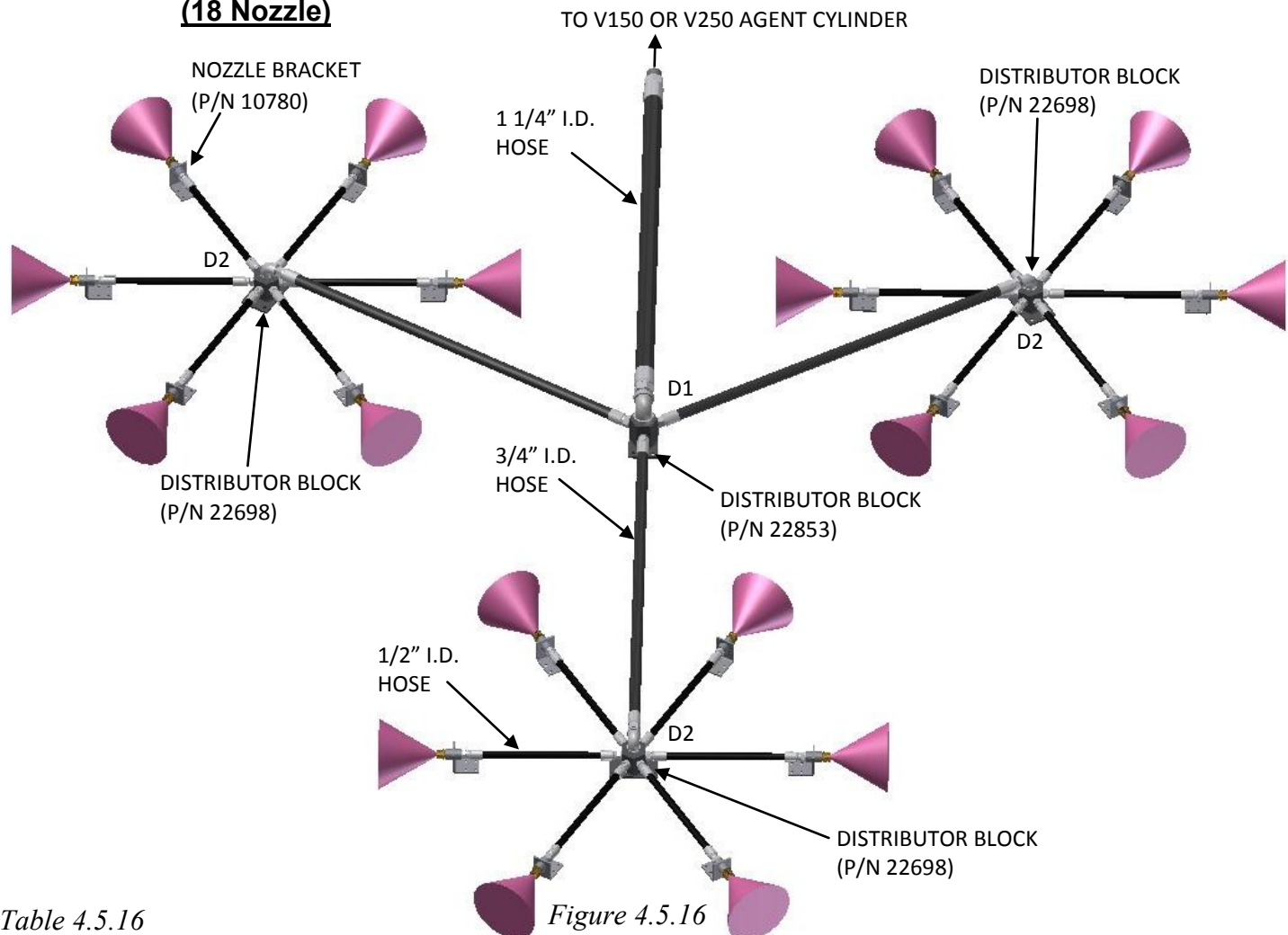


Table 4.5.16

Figure 4.5.16

LOCATION	HOSE I.D. in (mm)	HOSE LENGTH FEET (METERS)		NUMBER OF ELBOWS PER SECTION OF HOSE	
		MAXIMUM	MINIMUM	MAXIMUM	MINIMUM
Cylinder to D1	1 1/4 (31.8)	20 (6.1)	2 (0.61)	2	0
D1 to D2	3/4 (19.1)	50 (15.2)	2 (0.61)	2	0
D2 to Nozzle	1/2 (12.7)	30 (9.1)	2 (0.61)	2	0
Cylinder to any Nozzle	—	80 (24.4)	6 (1.8)	2	0
All 1 1/4" hose	—	20 (6.1)	2 (0.61)	2	0
All 3/4" hose	—	150 (45.7)	6 (1.8)	6	0
All 1/2" hose	—	540 (164.6)	36 (11.0)	36	0

**Note:** Hose length may be unbalanced in a maximum ratio of 3:1 where the Agent Distribution Network splits (D1 to D2, or D2 to Nozzle). However, this ratio must be observed for the minimum versus maximum hose length. Example: If the longest 1/2 inch I.D. hose leading from where the network splits (D1 to D2) is 15 feet, the shortest 1/2 inch I.D. hose leading from the same network split location cannot be less than 5 feet, and all 1/2 inch I.D. hoses together must fall within the length specified.

#### 4.5.17 V250 Agent Distribution Network with Distributor to Distributors (24 Nozzle)

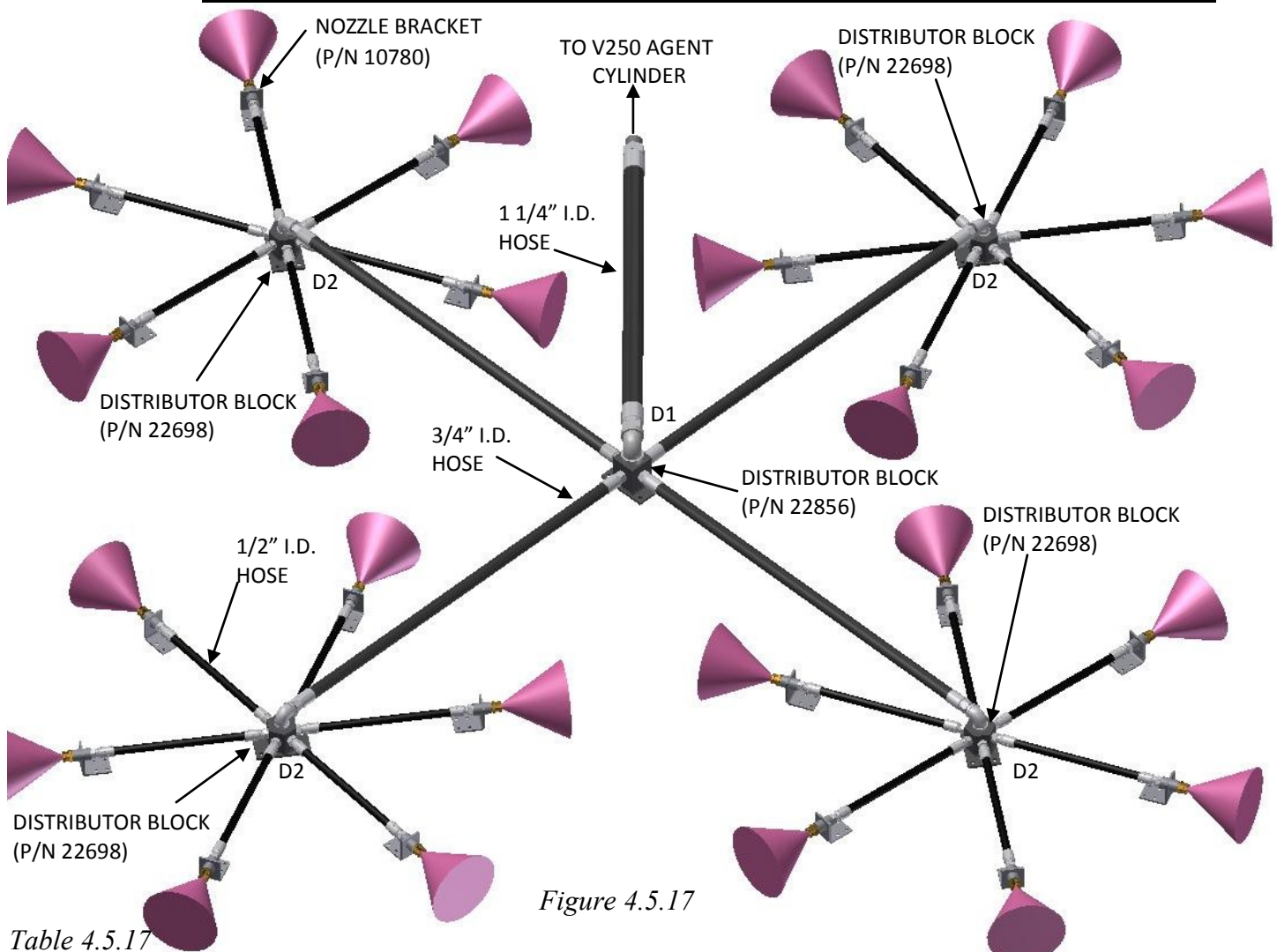


Table 4.5.17

LOCATION	HOSE I.D. in (mm)	HOSE LENGTH FEET (METERS)		NUMBER OF ELBOWS PER SECTION OF HOSE	
		MAXIMUM	MINIMUM	MAXIMUM	MINIMUM
Cylinder to D1	1 1/4 (31.8)	20 (6.1)	2 (0.61)	2	0
D1 to D2	3/4 (19.1)	50 (15.2)	2 (0.61)	2	0
D2 to Nozzle	1/2 (12.7)	30 (9.1)	2 (0.61)	2	0
Cylinder to any Nozzle	—	80 (24.4)	6 (1.8)	2	0
All 1 1/4" hose	—	20 (6.1)	2 (0.61)	2	0
All 3/4" hose	—	200 (61)	8 (2.4)	8	0
All 1/2" hose	—	720 (219.5)	48 (14.6)	48	0

**Note:** Hose length may be unbalanced in a maximum ratio of 3:1 where the Agent Distribution Network splits (D1 to D2, or D2 to Nozzle). However, this ratio must be observed for the minimum versus maximum hose length. Example: If the longest 1/2 inch I.D. hose leading from where the network splits (D1 to D2) is 15 feet, the shortest 1/2 inch I.D. hose leading from the same network split location cannot be less than 5 feet, and all 1/2 inch I.D. hoses together must fall within the length specified.

#### 4.5.18 Stainless Steel Rigid Tubing in Agent Distribution Network

The Agent Distribution Network of the Amerex Modular Dry Chemical System may be constructed using certain types of rigid stainless steel tubing in place of some sections of hose. Use of rigid stainless steel tubing in areas of a hazard area subjected to extreme heat may be necessary. To design an Agent Distribution Network using portions of rigid tubing, observe the following rules:

- The design must comply fully with the specifications for overall hose lengths, hose diameters, number of elbows and imbalances shown in Section 4.5.
- Flexible hose must be connected to the Discharge Fitting Kit.
- A change from flexible hose to rigid stainless steel tubing (or from stainless steel tubing to hose) may be made only once per hose section. A hose section is defined as that length connecting any two flow dividing fittings.
- Tables for hose limitations found in Section 4.5 specify a maximum allowable imbalance of 3:1 for the lengths of sections of hose exiting from any given tee or Distributor Block. When using a combination of hose and tubing, within one network, two additional imbalance requirements must be met:
  - \* The individual lengths of each piping material (tubing and hose) used to connect a section on one branch of any tee or Distributor Block must be within a 3:1 ratio of the length of the same piping material used to connect each of the sections on the other branches of that tee or Distributor Block. As with the overall 3:1 imbalance, these individual imbalances must be determined for a Distributor Block using the minimum vs. maximum piping lengths.
  - \* If a section of rigid tubing is used on one branch of a Distributor Block or tee, then a section of rigid tubing must be used on all branches to keep the number of flow restrictions created by the transition from flexible hose to tubing equal on all side of the Distributor Block or tee.
- The illustration below shows proper observance of these rules. The example Agent Distribution Network is designed for a V25 using a Distributor Block. Note the following: The 15 foot (4.6 meters) maximum length for each section has been observed. The imbalance between the longest section of 15 feet (4.6 meters) and the shortest section of 5 feet (1.5 meters) is within 3:1. The imbalance between the longest flexible hose section of 6 feet (1.8 meters) and the shortest hose section of 2 feet (.61 meters) is within 3:1. The imbalance between the longest section of rigid tubing of 9 feet (2.7 meters) and the shortest length of tubing of 3 feet (.91 meters) is also within the required 3:1 imbalance ratio.

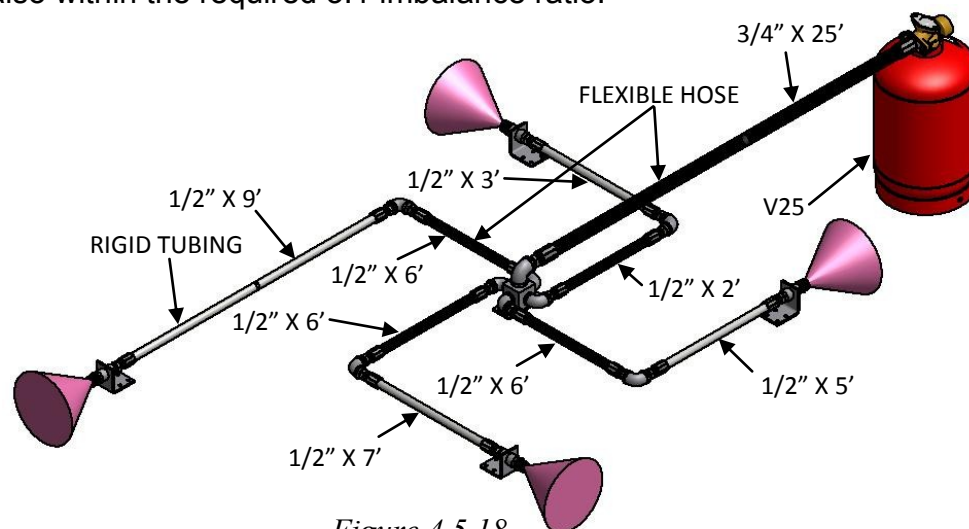


Figure 4.5.18

### 4.5.19 Distributor Block

When using an Agent Distribution Network that requires a Distributor Block, the Distributor Block can be bolted to the vehicle with a minimum of SAE Grade 5 bolts or welded to the vehicle. Do not weld on or drill into fuel tanks or vehicle Roll Over Protection System (ROPS). Consult equipment manufacturer and property owner prior to modification of the vehicle (See Section 2.3.3 for Distributor Block descriptions). See previous Sections in this Chapter for the proper Distributor Blocks to be used with selected Agent Distribution Networks.

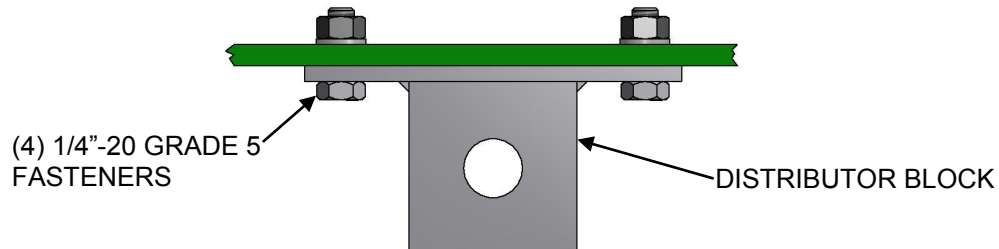


Figure 4.5.19

## 4.6 System Actuation Control Head Installation

The Amerex Modular Dry Chemical System has four different options available for system actuation including the Tee Handle, the Electric Control Head, the Pneumatic Control Head, and the Electric / Pneumatic Control Head. The following section explains how to install each of the options. Systems using V150 or V250 Agent Cylinders have two options including the Pneumatic Control Head and the Electric / Pneumatic Control Head.

### 4.6.1 Tee Handle (P/N 10134)

#### Installation:

1. Remove Shipping Plate (P/N 10099) from top of Agent Cylinder Valve. Retain the (2) 5/16"-18 bolts and nuts (See Figure 2.1.a).
2. Locate Tee Handle on top of the Agent Cylinder Valve as shown. Verify the lever and plunger are in the FULL UP position shown. Rotate handle to position so that lever is pulled, not pushed to activate Agent Cylinder per the "In Case of Fire" label included with Tee handle.
3. Install (2) bolts and nuts retained from step 1 as shown. Use medium grade thread locking compound and torque to 10 ft-lbs.
4. Install pull pin through hole connecting the lever to head portion of the Tee Handle.
5. Install Tamper Seal (P/N 01387) indicator securely as shown. (Note: Tamper Seal must be rated for approximately 8 pounds for removal) .
6. Apply "In Case of Fire" label in close proximity of Tee Handle.

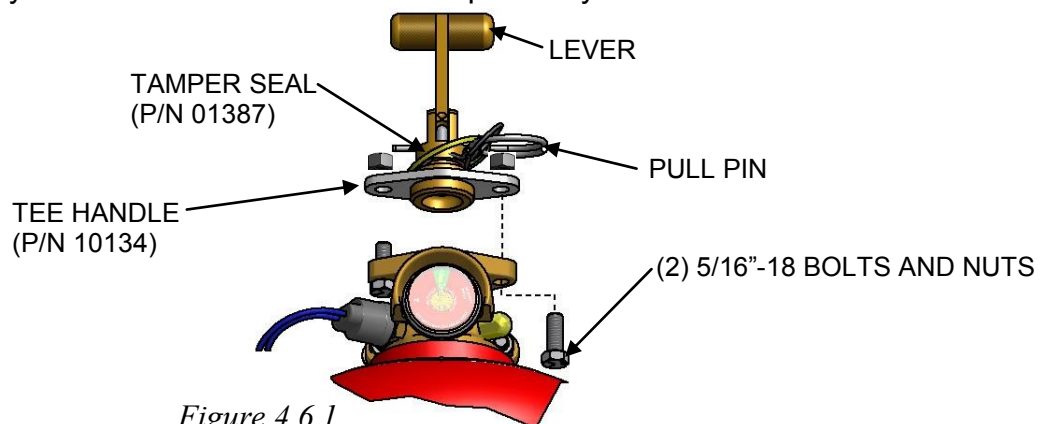


Figure 4.6.1

#### 4.6.2 Electric Control Head (P/N 14032)

##### Installation:

1. Remove Shipping Plate (P/N 10099) from top of Agent Cylinder Valve. Retain the (2) 5/16"-18 bolts (See Figure 2.1.a).
2. Verify that the tapered end of the stainless steel piston is loosely captive at bottom of Electric Control Head.
3. Locate Electric Control Head on top of Agent Cylinder Valve as shown.
4. Install (2) bolts retained from step 1 as shown. Use medium grade thread locking compound and torque to 10 ft-lbs.
5. Verify that Linear Actuator O-ring (P/N 17137) is in place. Install Linear Actuator (P/N 22579 or 20500) and tighten hand tight. **Do not over tighten. Do not use PTFE thread tape. Ensure Linear Actuator body makes full contact with control head.** The Linear Actuator will be connected to the vehicle's Amerex Modular Electronics System (See Section 4.9).
6. Secure Linear Actuator lead to the Agent Cylinder Valve body with a cable tie allowing a 1" minimum bend radius for strain relief of the Linear Actuator lead.

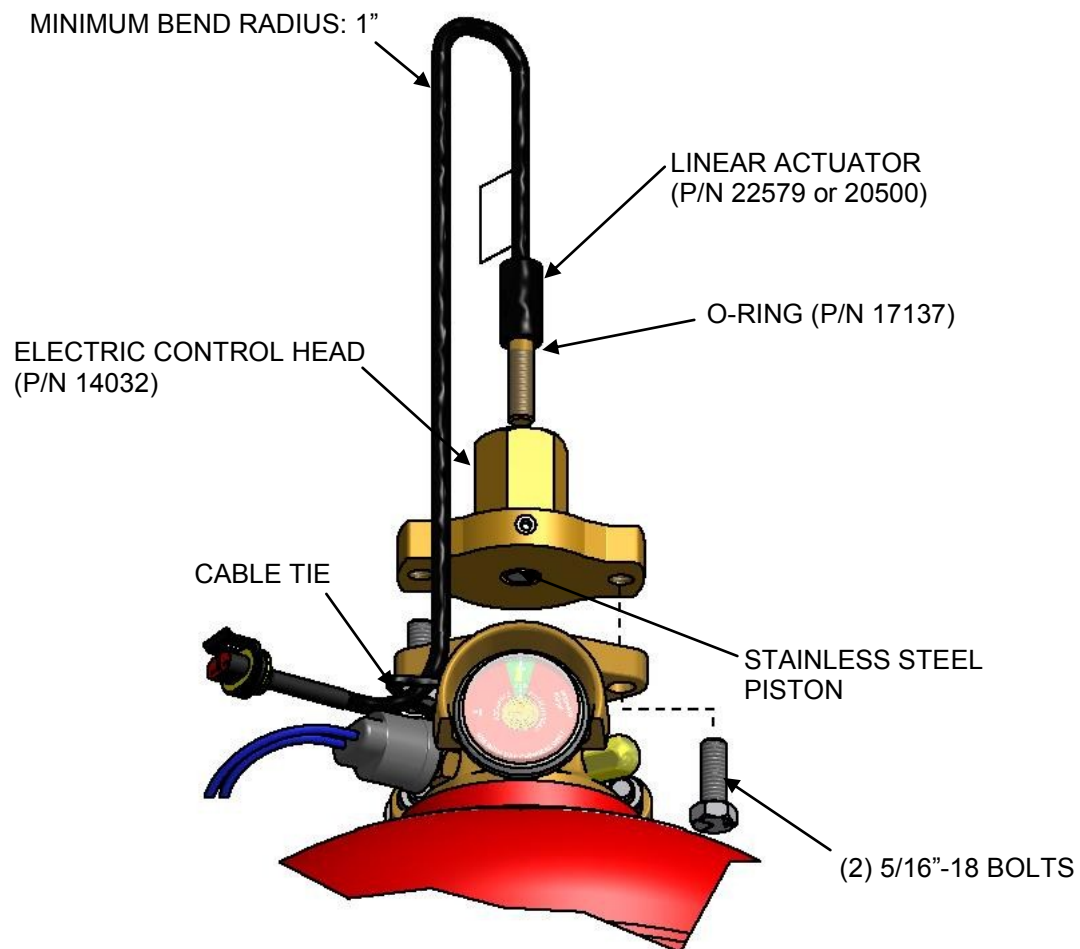


Figure 4.6.2



### 4.6.3 Pneumatic Control Head (P/N 10147)

#### Installation:

1. Remove Shipping Plate (P/N 10099) from top of Agent Cylinder Valve. Retain the (2) 5/16"-18 bolts (See Figure 2.1.a).
2. Verify piston is fully recessed into Pneumatic Control Head body as shown.
3. Locate Pneumatic Control Head on top of Agent Cylinder Valve as shown.
4. Install (2) bolts retained from step 1 as shown. Use medium grade thread locking compound and torque to 10 ft-lbs.
5. Install 1/4" NPT Pneumatic Actuation Network (See Section 4.7). Use PTFE thread tape. Tighten a minimum of two turns past hand tight. For Pneumatic Control Heads using a Pneumatic Piston Assembly with locking Spring Plunger, a Check Valve is not required (See Note under Figure 4.6.3).
6. Install Vent Check (P/N 10173). For multiple Control Heads, a Vent Check may not be required at each Control Head. (See Section 4.7.1 & 4.8.4). Use PTFE thread tape. Tighten a minimum of two turns past hand tight.
7. Install Dust Cap (P/N 13761) on Vent Check.

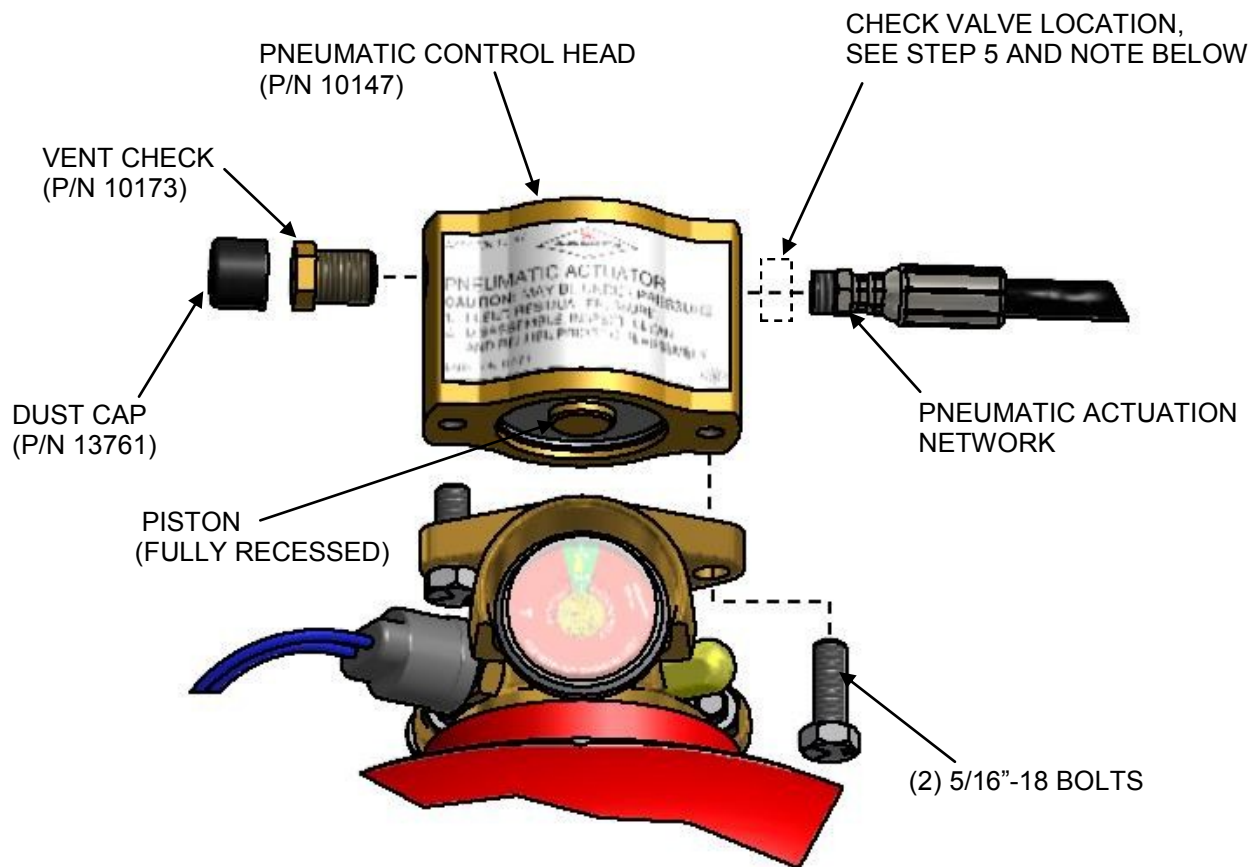


Figure 4.6.3

**NOTE:** Earlier versions of Pneumatic Control Heads (P/N 10147) were NOT equipped with a locking Spring Plunger on the internal Pneumatic Piston Assembly (See Figure 6.2.1.1). When using these older versions, a Check Valve (P/N 10262) is required at the inlet of EVERY Pneumatic Control Head used in an Amerex Dry Chemical System where shown in Figure 4.6.3. The only way to verify that a newer version control head is being used, which contains a locking Spring Plunger, is to perform the test described in Section 6.2.1.1, Step 16. If the locking Spring Plunger exists and locks the deployed piston when performing the test, no Check Valve is required at the control head inlet.

#### 4.6.4 Pneumatic Control Head, V150/V250 Agent Cylinder (P/N 22869)

##### Installation:

Ensure Anti-Recoil Plug (P/N 17559) is in place or Agent Distribution Network is connected prior to proceeding! Protective Cap (P/N 17990) must be in place anytime the Agent Cylinder is not in service and connected to a Control Head, or being recharged (See Figure 2.1.b)!

1. Remove Protective Cap (P/N 17990) from top of the Agent Cylinder Valve.  
**WARNING: Do not depress Valve Core Stem located under Protective Cap, as a system discharge will occur (See Figure 4.6.4.a)!**
2. Verify piston is fully recessed into Pneumatic Control Head body. A fully recessed piston measures approximately .28" (7.1mm) from the base of the control head (See Figure 4.6.4.b).
3. Locate Pneumatic Control Head on top of Agent Cylinder Valve as shown.
4. Screw Pneumatic Control Head onto the top of the Agent Cylinder Valve and torque to 25 ft-lbs.
5. Install 1/4" NPT Pneumatic Actuation Network (See Section 4.7). Use PTFE thread tape. Tighten a minimum of two turns past hand tight.
6. Install Vent Check (P/N 10173). For multiple Control Heads, a Vent Check may not be required at each Control Head (See Section 4.7.1 & 4.8.4). Use PTFE thread tape. Tighten a minimum of two turns past hand tight.
7. Install Dust Cap (P/N 13761) on Vent Check.

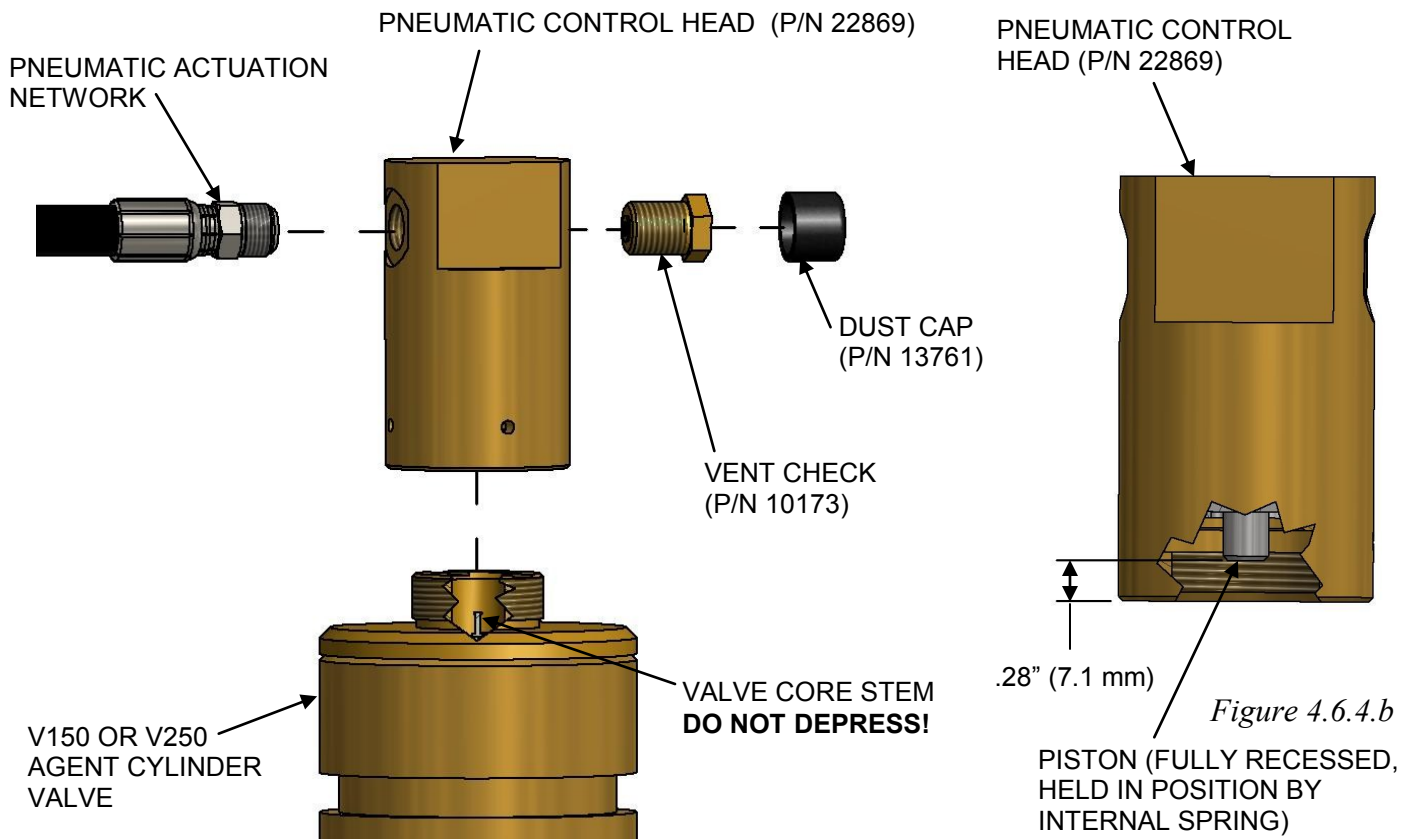


Figure 4.6.4.a

Figure 4.6.4.b

#### 4.6.5 Electric / Pneumatic Control Head (P/N 17068)

##### Installation:

1. Remove Shipping Plate (P/N 10099) from top of Agent Cylinder Valve. Retain the (2) 5/16"-18 bolts (See Figure 2.1.a).
2. Verify piston is fully recessed into Electric / Pneumatic Control Head body as shown.
3. Locate Electric / Pneumatic Control Head on top of Agent Cylinder Valve as shown.
4. Install (2) bolts retained from step 1 as shown. Use medium grade thread locking compound and torque to 10 ft-lbs.
5. Install 1/4" NPT Pneumatic Actuation Network (See Section 4.7). Use PTFE thread tape. Tighten a minimum of two turns past hand tight.
6. Install Vent Check (P/N 10173) . For multiple control heads, a Vent Check may not be required at each control head. (See Section 4.7.1 & 4.8.3). Use PTFE thread tape. Tighten a minimum of two turns past hand tight.
7. Install Dust Cap (P/N 13761) on Vent Check.
8. Verify that Linear Actuator O-ring (P/N 17137) is in place. Install Linear Actuator (P/N 22579 or 20500) and tighten hand tight. **Do not over tighten. Do not use PTFE thread tape. Ensure Linear Actuator body makes full contact with control head.** The Linear Actuator will be connected to the vehicle's Amerex Modular Electronics System (See Section 4.9).
9. Secure the Linear Actuator lead to the Agent Cylinder Valve body with a cable tie allowing a 1" minimum bend radius for strain relief of the Linear Actuator lead.

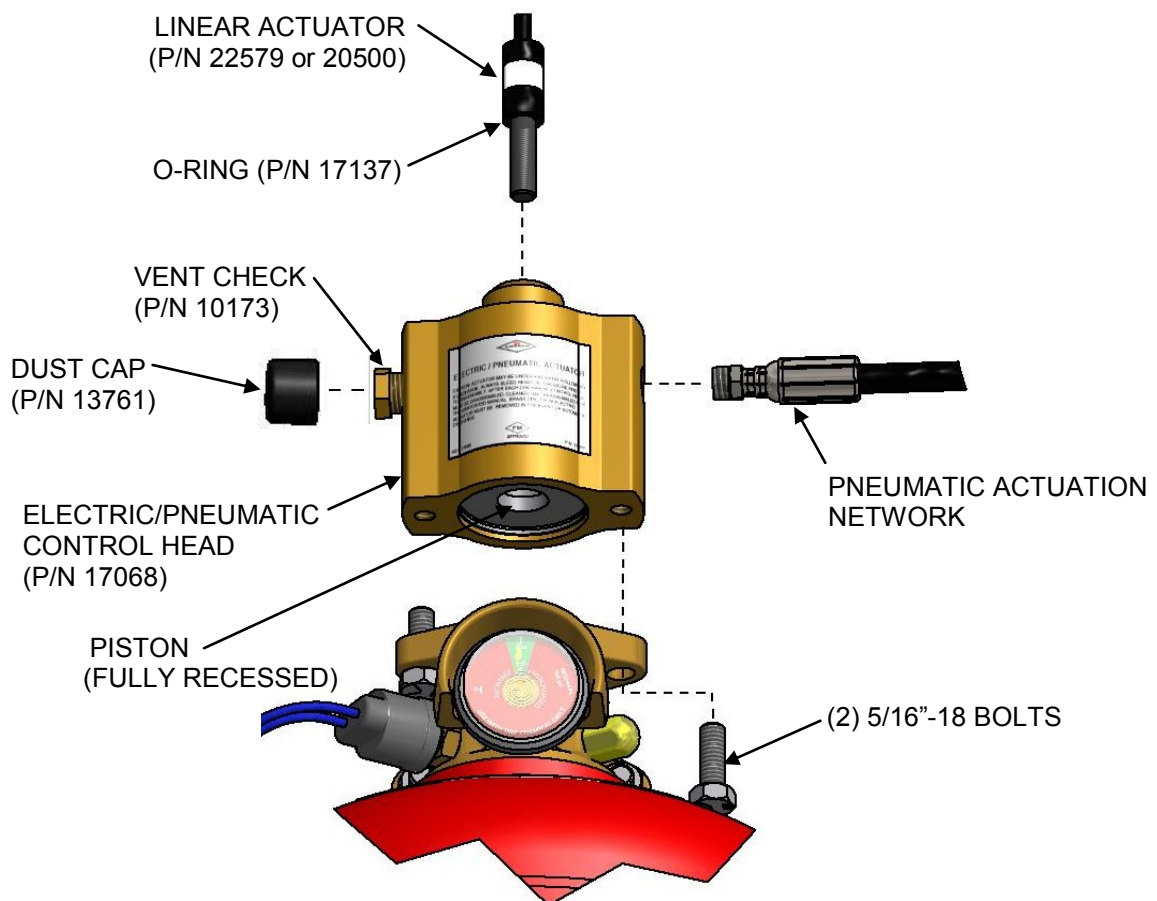


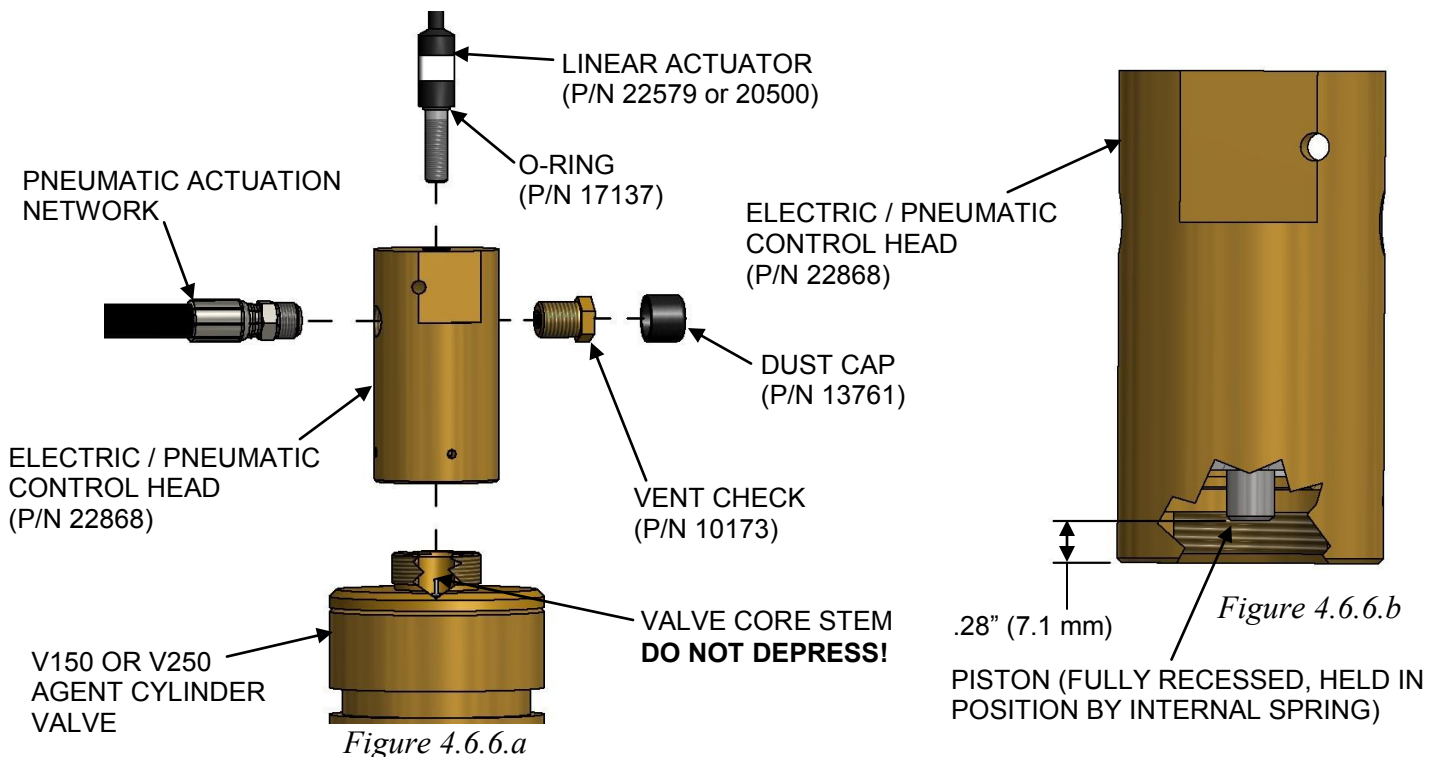
Figure 4.6.5

#### 4.6.6 Electric / Pneumatic Control Head, V150/V250 Agent Cylinder (P/N 22868)

##### Installation:

Ensure Anti-Recoil Plug (P/N 17559) is in place or Agent Distribution Network is connected prior to proceeding! Protective Cap (P/N 17990) must be in place anytime the Agent Cylinder is not in service and connected to a Control Head, or being recharged (See Figure 2.1.b)!

1. Remove Protective Cap (P/N 17990) from top of the Agent Cylinder Valve.  
**WARNING: Do not depress Valve Core Stem located under Protective Cap, as a system discharge will occur (See Figure 4.6.6.a)!**
2. Verify piston is fully recessed into Electric / Pneumatic Control Head body. A fully recessed piston measures approximately .28" (7.1mm) from the base of the control head (See Figure 4.6.6.b).
3. Locate Electric / Pneumatic Control Head on top of Agent Cylinder Valve as shown.
4. Screw Electric / Pneumatic Control Head onto the top of the Agent Cylinder Valve and torque to 25 ft-lbs.
5. Install 1/4" NPT Pneumatic Actuation Network hose (See Section 4.7). Use PTFE thread tape. Tighten a minimum of two turns past hand tight.
6. Install Vent Check (P/N 10173). For multiple Control Heads, a Vent Check may not be required at each Control Head (See Section 4.7.1 & 4.8.3). Use PTFE thread tape. Tighten a minimum of two turns past hand tight.
7. Install Dust Cap (P/N 13761) on Vent Check.
8. Verify that Linear Actuator O-ring (P/N 17137) is in place. Install Linear Actuator (P/N 22579 or 20500) and tighten hand tight. **Do not over tighten. Do not use PTFE thread tape. Ensure Linear Actuator body makes full contact with control head.** The Linear Actuator will be connected to the vehicle's Amerex Modular Electronics System (See Section 4.9).
9. Secure Linear Actuator wire to the valve body with a cable tie allowing a 1" minimum bend radius for strain relief of the Linear Actuator cable.



#### **4.7 Pneumatic Actuation Network Installation**

If the Amerex Modular Dry Chemical System requires a Pneumatic Control Head or Electric / Pneumatic Control Head for system actuation, a Pneumatic Actuation Network must be installed. The Pneumatic Actuation Network is a series of high pressure 1/4 inch (6mm) I.D. hydraulic hoses used to carry nitrogen pressure from a Nitrogen Cylinder (P/N 09956) equipped with a Manual Actuator (P/N 10210), Electric Nitrogen Actuator (P/N 20775), or Manual/Electric Actuator (P/N 23600) to the control head located on the Agent Cylinder Valve. A basic Pneumatic Actuation Network is explained in Section 4.7.1. The use of multiple actuators and/or control heads is allowed and explained in Section 4.8. Use the following requirements for constructing the Pneumatic Actuation Network. **After the Pneumatic Actuation Network is complete and assembled, test the network per instructions in Section 6.2.8 for functionality.**

- All actuation hose sections must be 1/4" (6.4 mm) I.D. hose. All hoses used must meet or exceed SAE 100 R5 or 100 R1 (minimum) hose specifications. Hoses must have operating temperatures of -65°F to +200°F (-54°C to +93°C). In addition to the SAE hose specification requirements, hoses used for underground mining applications must meet USBM specified flame resistance acceptance.
- All hose end fittings must be 1/4" NPT and only those specified by the hose manufacturer.
- Purge each hose section with dry air or nitrogen before assembly to remove any debris from inside each hose.
- All adapters used to connect network hoses shall be rated for use at 1800 psi (12410 kPa) minimum.
- The hose length along a direct path from any actuator to the last Control Head must not exceed 125 ft (38 meters).
- The installer must avoid routing any component related to the Pneumatic Actuation Network through hazard areas.
- The installer must comply with minimum hose bend radius requirements. Avoid pinch points or possible chafing of Pneumatic Actuation Network.
- The Pneumatic Actuation Network must be secured to the vehicle at a maximum of 18" intervals with the use of padded "P" clamps.
- The Pneumatic Actuation Network must be routed in such a manner that the network does not interfere with routine vehicle maintenance.
- The installer must not exceed the hose network limitations as shown in this section or Section 4.8 for multiple actuators or Agent Cylinders.
- Use PTFE thread tape for NPT connections.
- Elbows may be used in a 45° or 90° configuration.
- The following list of appropriate standards is for reference:
  - \* SAE J1273
  - \* SAE J516
  - \* SAE J517
  - \* SAE J343
- The following sections explain installation of each available option.

### 4.7.1 Pneumatic Actuation Network

The Pneumatic Actuation Network contains a Nitrogen Cylinder (P/N 09956) equipped with a Manual Actuator (P/N 10210), Electric Nitrogen Actuator (P/N 20775) or Manual/Electric Actuator (P/N 23600). These components are attached to vehicle structure using the Indoor Actuator Bracket (P/N 10355) or Outdoor Actuator Bracket (P/N 10354). 1/4" I.D. hydraulic hose(s) connects the actuator to the control head. A Vent Check (P/N 10173) must be used on the control head. An optional 100 PSI Pressure Switch (P/N 22573, 22574 or 23850) may be used in the network. Figure 4.7.1 shows a basic Pneumatic Actuation Network using a single actuator and control head. The use of multiple actuators and/or control heads is allowed and explained in Section 4.8. The following sections describe the installation of each component in the Pneumatic Actuation Network.

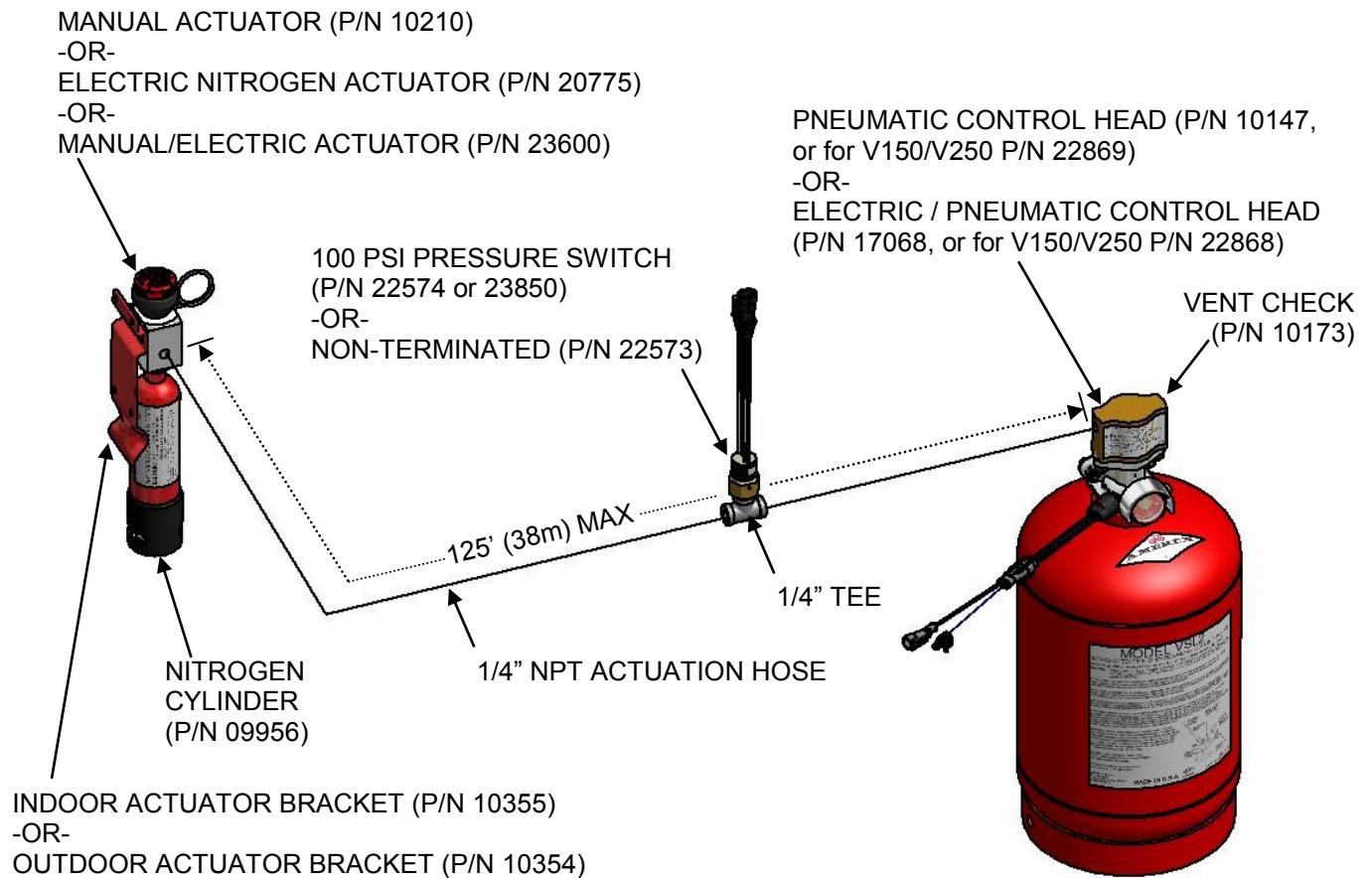


Figure 4.7.1

#### 4.7.2 100 PSI Pressure Switch Installation (P/N 22573, 22574 & 23850)

The 100 PSI Pressure Switch is installed using an installer supplied 1/4" NPT tee in the Pneumatic Actuation Network just before the first Pneumatic Control Head or Electric / Pneumatic Control Head (See Figure 4.7.2). Use PTFE thread tape on all connections at the tee. The 100 PSI Pressure Switch has a temperature rating of -40°F to +150°F (-40°C to +65°C) and must be located accordingly. The Switch will be connected to the vehicle's Amerex Modular Electronics System (See Section 4.9).

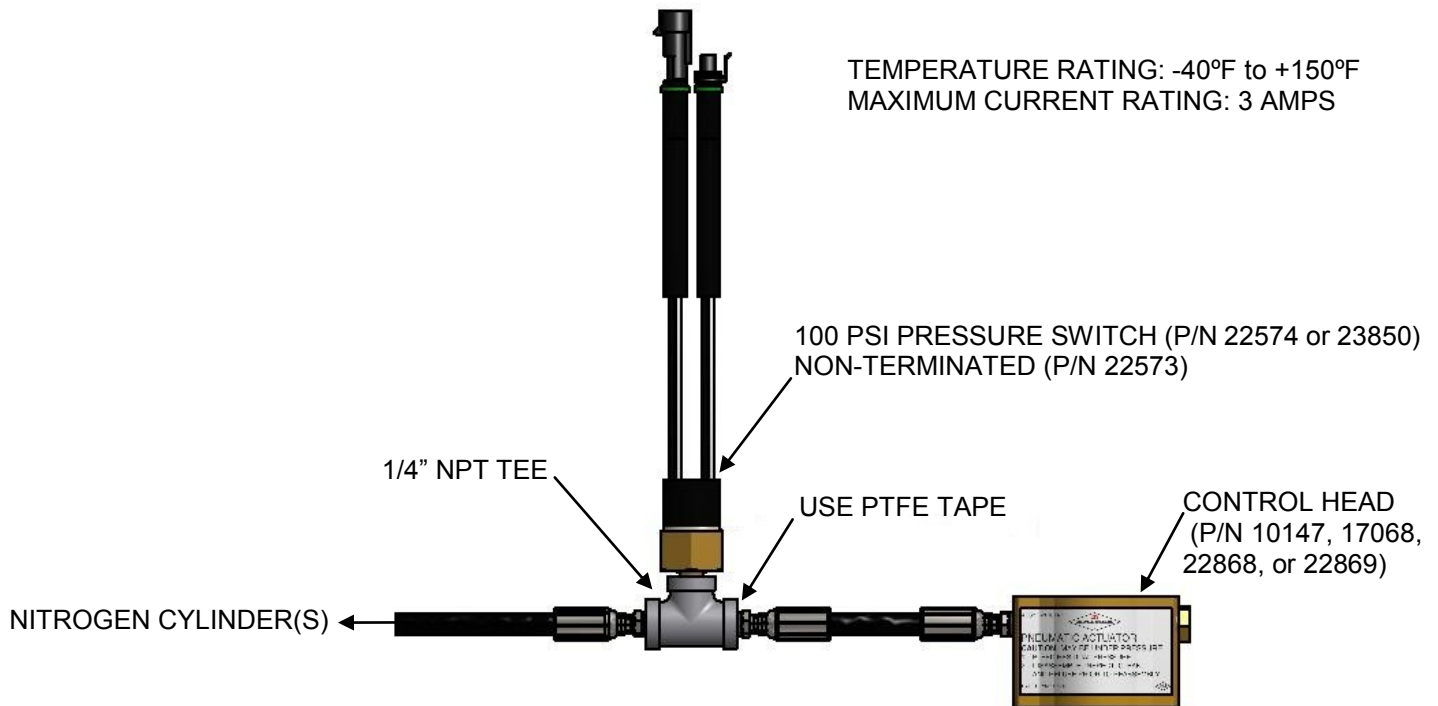


Figure 4.7.2

#### 4.7.3 Actuator Bracket Installation, Indoor & Outdoor (P/N 10355 & 10354)

Find a surface suitable for support of the Indoor or Outdoor Actuator Bracket and all components located away from any hazard area. This location must be easily accessible for maintenance and Nitrogen Cylinder pressure gauge visibility. If a Manual Actuator (P/N 10210) or Manual/Electric Actuator (P/N 23600) is used, it must be easily reached. The Indoor Actuator Bracket (See Figure 4.7.4.a) and Outdoor Actuator Bracket Back (See Figure 4.7.4.b) can be secured to a mounting surface in 3 ways:

- Qty 4 (for Indoor Bracket) or Qty 6 (for Outdoor Bracket) 1/4" SAE Grade 8 bolts and Nylock (locking) nuts installed in through holes in mounting surface
- Qty 4 (for Indoor Bracket) or Qty 6 (for Outdoor Bracket) 1/4" SAE Grade 8 bolts installed with locking washers into blind tapped holes in mounting surface
- The Indoor Bracket or Outdoor Bracket Back can be welded to mounting surface.

Do not weld on or drill into fuel tanks or vehicle Roll Over Protection System (ROPS). Consult equipment manufacturer and property owner prior to modification of the vehicle. If an Outdoor Actuator Bracket is used, install the actuator and components per Section 4.7.4 prior to installing the Bracket Cover. Then, install (4) Bracket Screws (P/N 10567) through mounting holes securing the Bracket Cover over the actuator/ Nitrogen Cylinder to the Bracket Back.

#### **4.7.4 Actuator Installation (P/N 10210, 20775 & 23600)**

The Actuator (Manual, Electric Nitrogen, or Manual/Electric) is installed on the Actuator Bracket per the following instructions (See Figure 4.7.4.a for Indoor Bracket or Figure 4.7.4.b for Outdoor Bracket).

##### For Manual Actuator (P/N 10210):

1. Install (2) Mounting Screws (P/N 10573) securing Manual Actuator to Bracket.
2. Ensure the Safety Pin is inserted into the actuator and the Tamper Seal (P/N 01387) is installed to hold the Safety Pin in place.
3. Install Nitrogen Cylinder (P/N 09956) into the Manual Actuator and torque to hand tight.
4. Install Pneumatic Actuation Network into 1/4" NPT nitrogen outlet port (See Section 4.7.1) located on the side of the actuator. Use PTFE thread tape to seal connection.

##### For Electric Nitrogen Actuator (P/N 20775):

1. Install (2) Mounting Screws (P/N 10573) securing Electric Nitrogen Actuator to Bracket.
2. Verify Puncture Stem Assembly inside Electric Nitrogen Actuator is fully retracted (See Figure 6.2.7.2). Install Nitrogen Cylinder (P/N 09956) into the Electric Nitrogen Actuator and torque to hand tight.
3. Verify that Linear Actuator O-ring (P/N 17137) is in place. Install Linear Actuator (P/N 22579 or 20500) and tighten hand tight. **Do not over tighten. Do not use PTFE thread tape. Ensure Linear Actuator body makes full contact with Electric Nitrogen Actuator.**
4. Secure the Linear Actuator lead with included cable tie where shown.
5. Install Pneumatic Actuation Network into 1/4" NPT nitrogen outlet port (See Section 4.7.1) located on the side of the actuator. Use PTFE thread tape to seal connection.

##### For Manual/Electric Actuator (P/N 23600):

1. Install (2) Mounting Screws (P/N 10573) securing Manual/Electric Actuator to Bracket.
2. Ensure the Safety Pin is inserted into the actuator and the Tamper Seal (P/N 01387) is installed to hold the Safety Pin in place.
3. See Figure 4.7.4.c. Unscrew and remove Upper Piston from Lower Piston. Verify that Linear Actuator O-ring (P/N 17137) is in place. Slide Linear Actuator (P/N 22579 or 20500) through Upper Piston slot on either side. Install Linear Actuator in Lower Piston and tighten hand tight. **Do not over tighten. Do not use PTFE thread tape. Ensure Linear Actuator body makes full contact with mating surface using sight hole in Lower Piston.** Reinstall Upper Piston onto Lower Piston hand tight until fully bottomed. Tighten Set Screw in Upper Piston.
4. Secure the Linear Actuator lead with included cable tie where shown.
5. Verify Puncture Stem Assembly inside Manual/Electric Actuator is fully retracted (See Figure 6.2.7.3). Install Nitrogen Cylinder (P/N 09956) into the Manual/Electric Actuator and torque to hand tight.
6. Install Pneumatic Actuation Network into 1/4" NPT nitrogen outlet port (See Section 4.7.1) located on the side of the actuator. Use PTFE thread tape to seal connection.



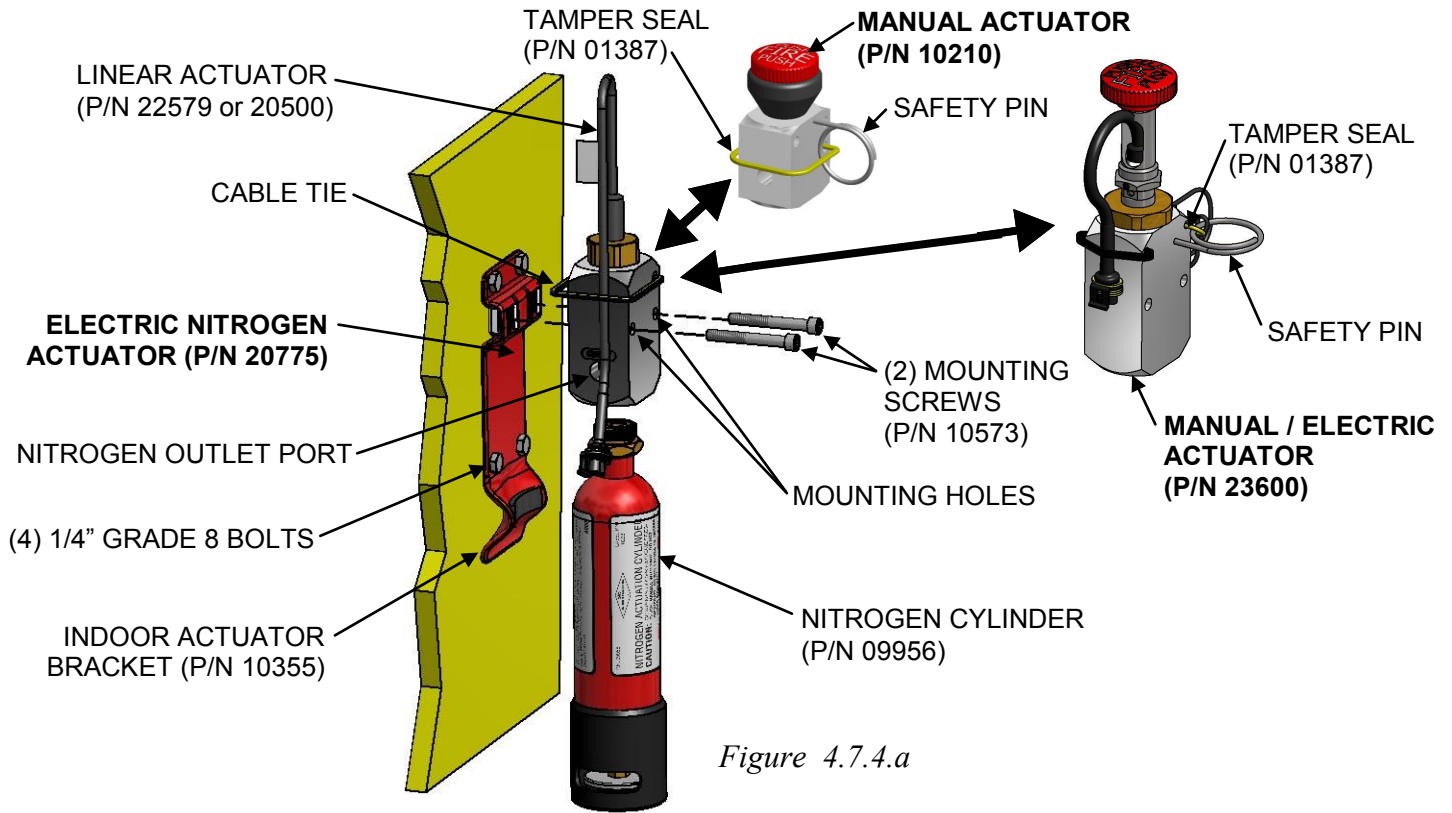


Figure 4.7.4.a

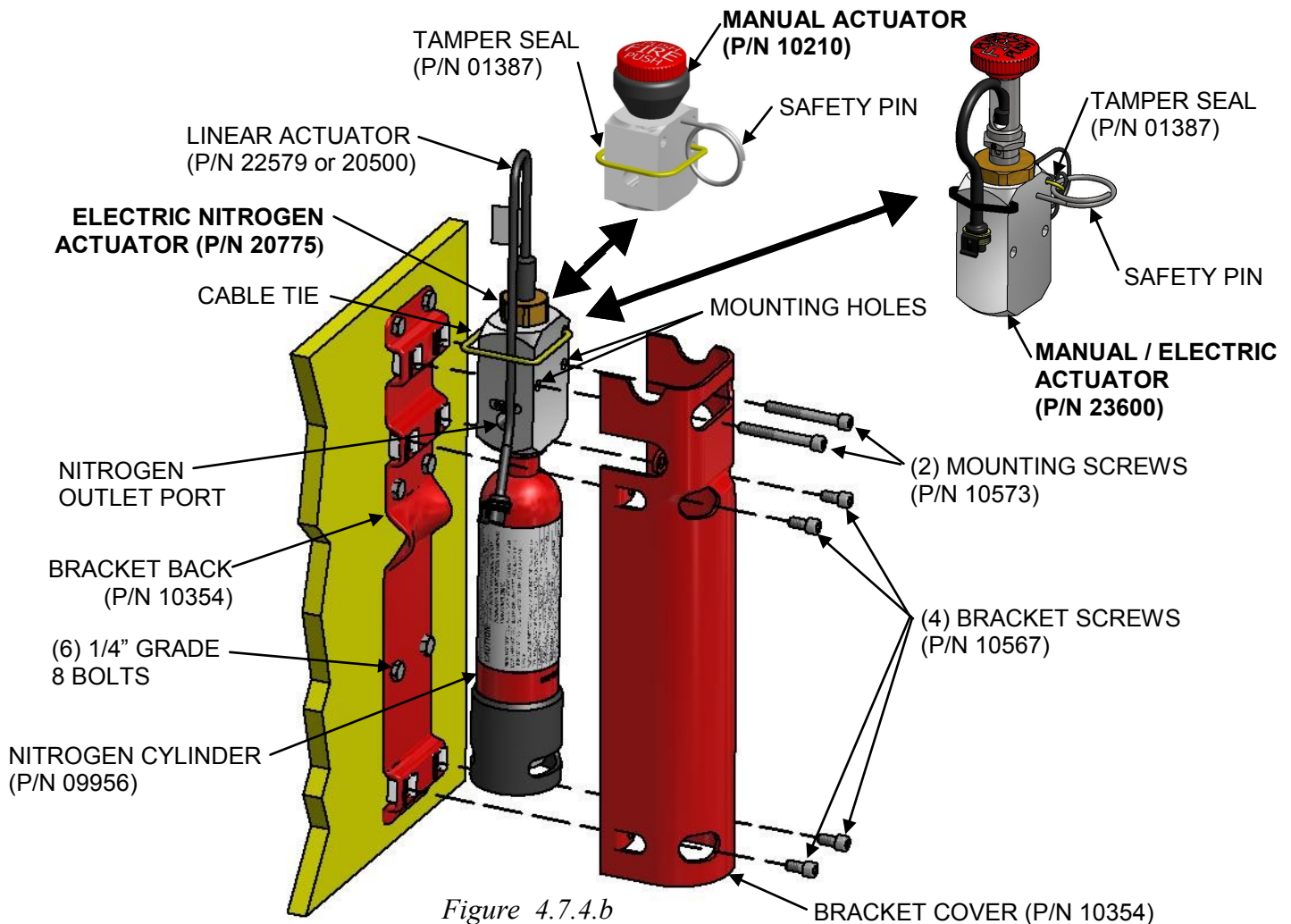


Figure 4.7.4.b

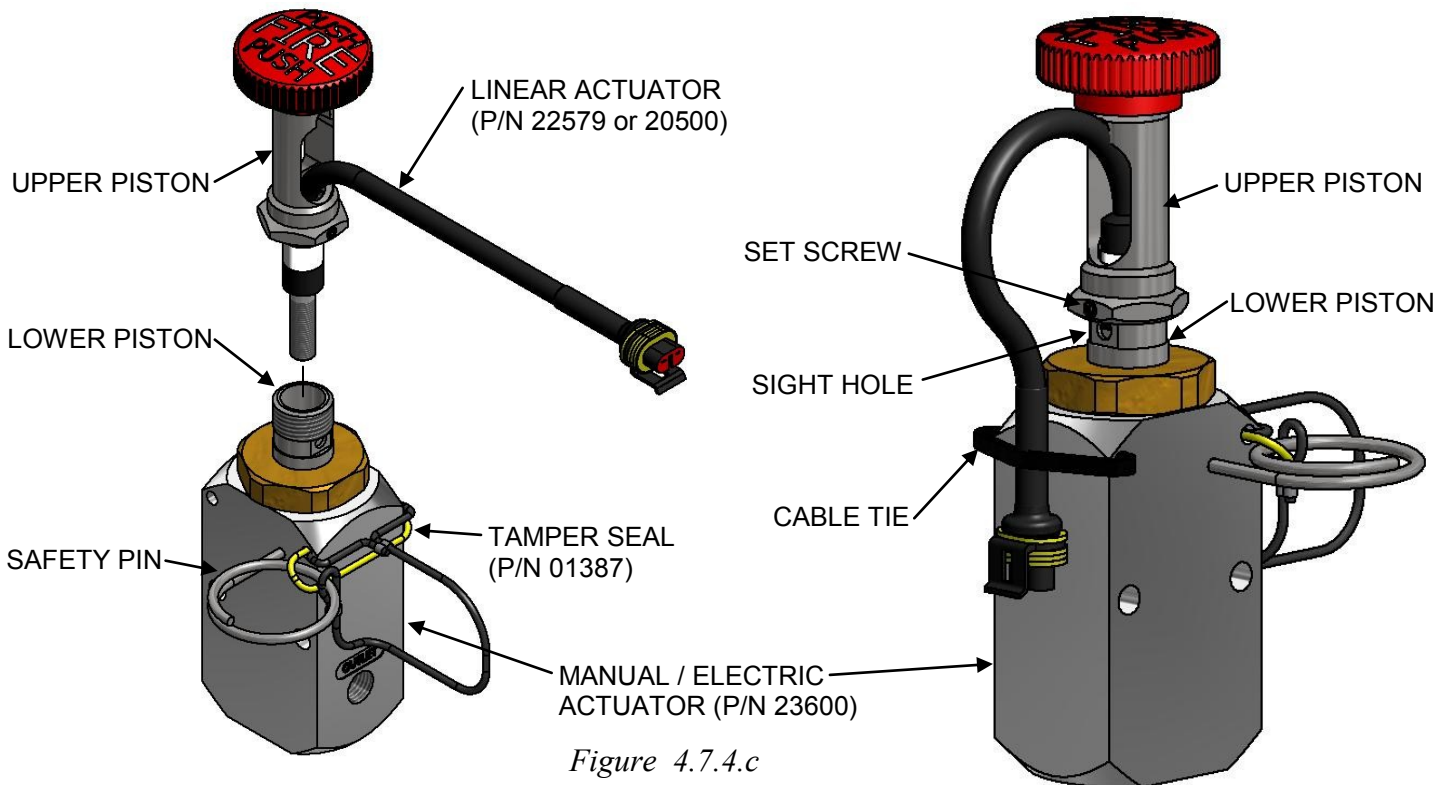


Figure 4.7.4.c

#### 4.8 Multiple Agent Cylinder and/or Nitrogen Cylinder Networks

The size of the vehicle and its hazards often require that more than one Agent Cylinder and/or Nitrogen Cylinder to be used. All of the Amerex Modular Dry Chemical System cylinders can be used in multiples and in any combination. The number of Agent Cylinders allowed depends on the type of control head that is used as specified in Table 4.8. Regardless, the following rules must be strictly observed:

- The Agent Distribution Network for each individual Agent Cylinder must be installed completely independent of all other Agent Distribution Networks, and each must comply with the hose limitations as specified in Section 4.5.
- All Pneumatic Actuation Networks must meet the requirements of Section 4.7.
- If a Pneumatic Actuation Network is used in a multiple Agent Cylinder application, the hose length in the network along a direct path from any one actuator to the last Control Head must not exceed 125 ft (38 meters). A Vent Check (P/N 10173) is installed in only the last Control Head in the network.
- For multiple Nitrogen Cylinder applications, each path of nitrogen from either a Manual Actuator, Electric Nitrogen Actuator or Manual/Electric Actuator must be independent of any other path. The use of Check Valves (P/N 10262) is required at tees to join paths for independence as described in Section 4.8.1.
- For Electrically actuated applications, see the applicable electronics manual located on the Amerex website at [www.amerex-fire.com](http://www.amerex-fire.com).

Table 4.8

Control Head Used	Maximum # of Agent Cylinders Used in a System	Reference
Tee Handle (P/N 10134)	No Max	-
Electric (P/N 14032)	4	Section 4.8.2
Electric / Pneumatic (P/N 17068 or 22868)	4 (2 Recommended)	Section 4.8.3
Pneumatic (P/N 10147 or 22869)	8	Section 4.8.4

### 4.8.1 Multiple Nitrogen Cylinder Pneumatic Actuation Networks

When constructing a Pneumatic Actuation Network using more than one Nitrogen Cylinder (P/N 09956), the following guidelines must be observed (See Figure 4.8.1):

- The Manual Actuator (P/N 10210), Electric Nitrogen Actuator (P/N 20775) or Manual/Electric Actuator (P/N 23600) can be used in multiples or in combination with each other in the Pneumatic Actuation Network. Each actuator shall be independently routed to a junction location consisting of 1/4" NPT tee that leads to the control head. If more than two actuators are used, each additional actuator shall also be routed to a junction tee that connects that actuator to the previous junction tee and also to the control head.
- A Check Valve (P/N 10262) shall be used at each inlet only of any junction tee from two actuators or any previous junction. This ensures that only the direct route from an actuator to the control head is pressurized by the activated Nitrogen Cylinder. Without the check valves, the entire Pneumatic Actuation Network would have to be pressurized before the control head(s) could activate the Agent Cylinder(s).
- The total hose length from any one actuator to the control head must not exceed 125 ft (38 meters). If multiple agent cylinders are used, the total hose length from any one actuator to the last control head in the Pneumatic Actuation Network must not exceed 125 ft (38 meters).
- If a 100 PSI Pressure Switch (P/N 22573, 22574 or 23850) is used in the Pneumatic Actuation Network, it must be located between the last junction tee and the first control head. This will ensure that the switch will be pressurized regardless of which actuator/Nitrogen Cylinder is activated.

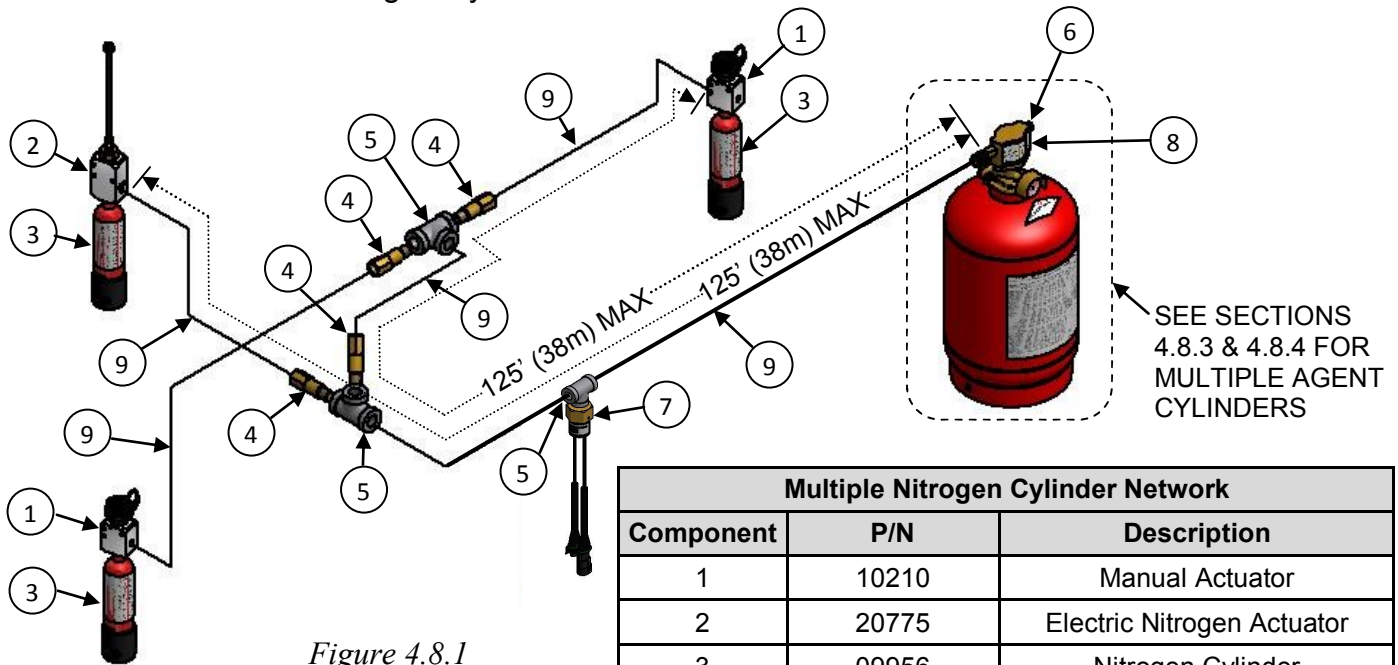
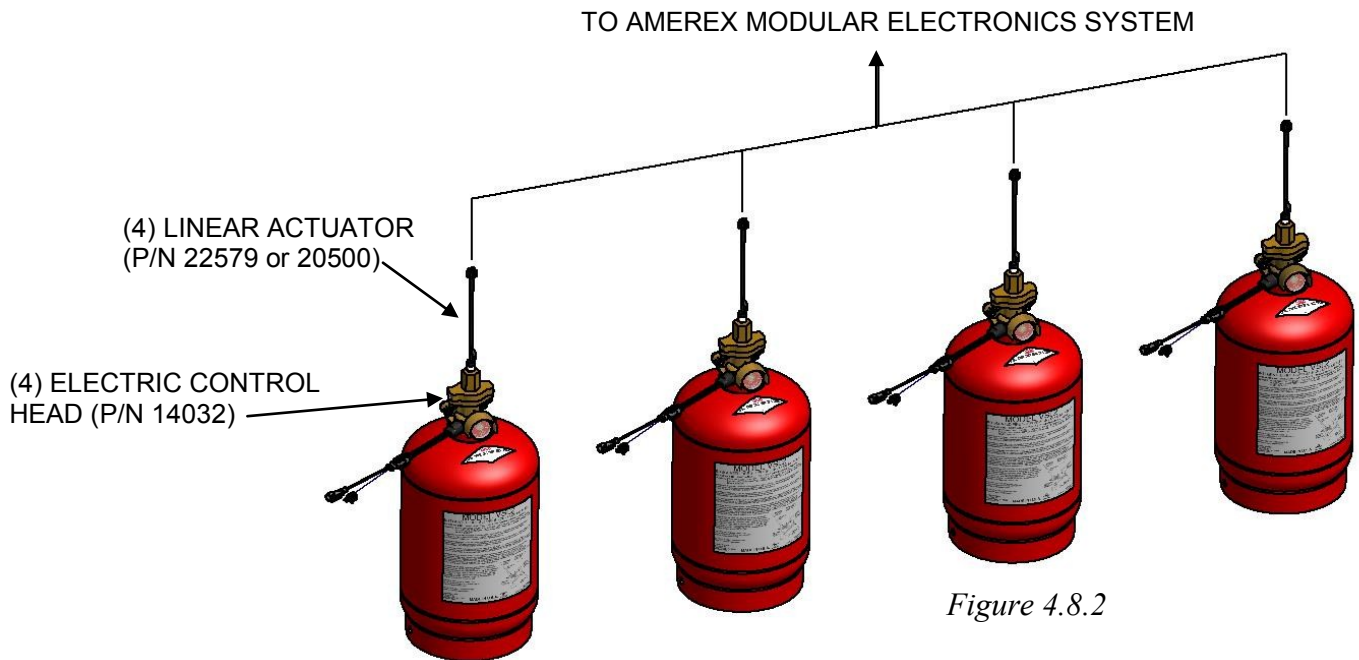


Figure 4.8.1

Multiple Nitrogen Cylinder Network		
Component	P/N	Description
1	10210	Manual Actuator
2	20775	Electric Nitrogen Actuator
3	09956	Nitrogen Cylinder
4	10262	Check Valve
5	-	1/4" NPT Tee
6	10173	Vent Check
7	22574, 22573 or 23850	100 PSI Pressure Switch
8	10147, 17068, 22868, or 22869	Control Head
9	-	Pneumatic Actuation Network

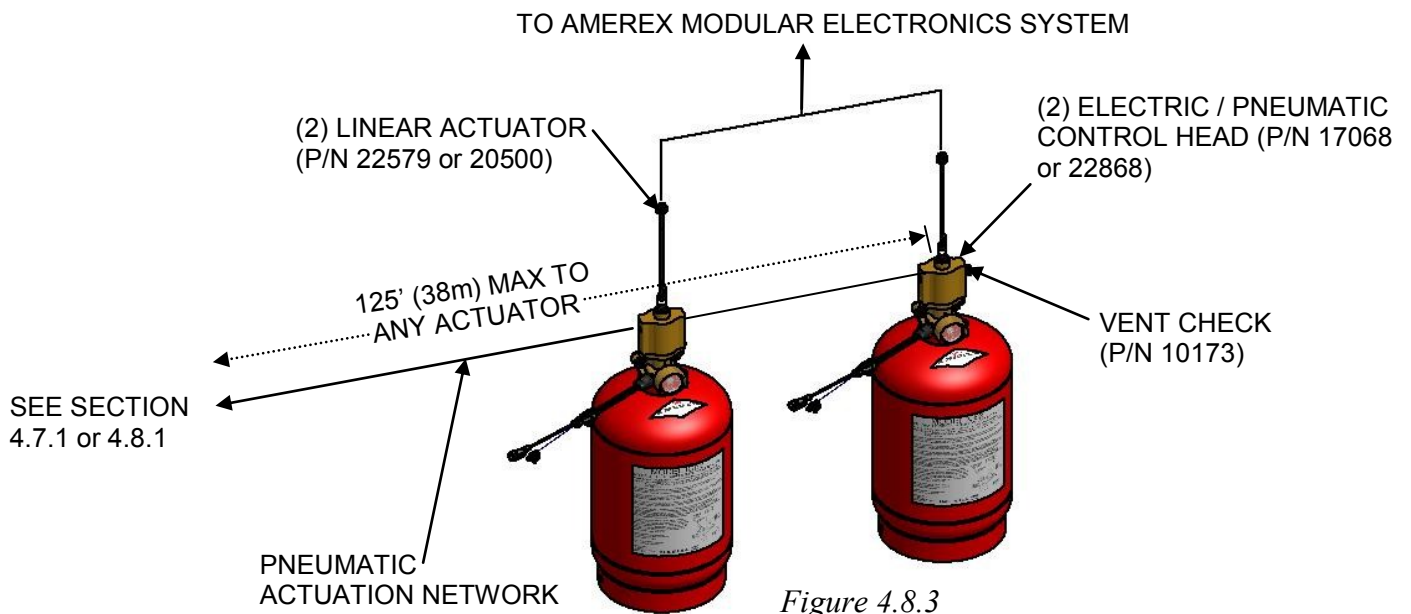
**4.8.2 Multiple Agent Cylinder Networks using Electric Control Heads (P/N 14032)**

For multiple Agent Cylinder networks using Electric Control Heads (P/N 14032), a maximum of (4) four Agent Cylinders may be used in a single system. Each Linear Actuator (P/N 22579 or 20500) in each control head will be connected to the vehicle's Amerex Modular Electronics System (See Section 4.9).



**4.8.3 Multiple Agent Cylinder Networks using Electric / Pneumatic Control Heads (P/N 17068 or 22868)**

For multiple Agent Cylinder networks using Electric / Pneumatic Control Heads (P/N 17068 or 22868), a maximum of (4) Linear Actuators may be used in a single system. However, Amerex recommends that only (2) Agent Cylinders be used for maximum efficiency. Each control head will be connected in series to the Pneumatic Actuation Network. The last control head will contain the Vent Check (P/N 10173). Each Linear Actuator (P/N 22579 or 20500) in each control head will be connected to the vehicle's Amerex Modular Electronics System (See Section 4.9).



**4.8.4 Multiple Agent Cylinder Networks using Pneumatic Control Heads (P/N 10147 or 22869)**

For multiple Agent Cylinder networks using Pneumatic Control Heads (P/N 10147 or 22869), a maximum of (8) eight cylinders may be used in a single system. Each control head will be connected in a “series” (Figure 4.8.4.a) or “parallel” (Figure 4.8.4.b) arrangement to the Pneumatic Actuation Network. “Parallel” arrangements will be connected using a 1/4” NPT tee. The last control head in each leg of the circuit will contain the Vent Check(s) (P/N 10173).

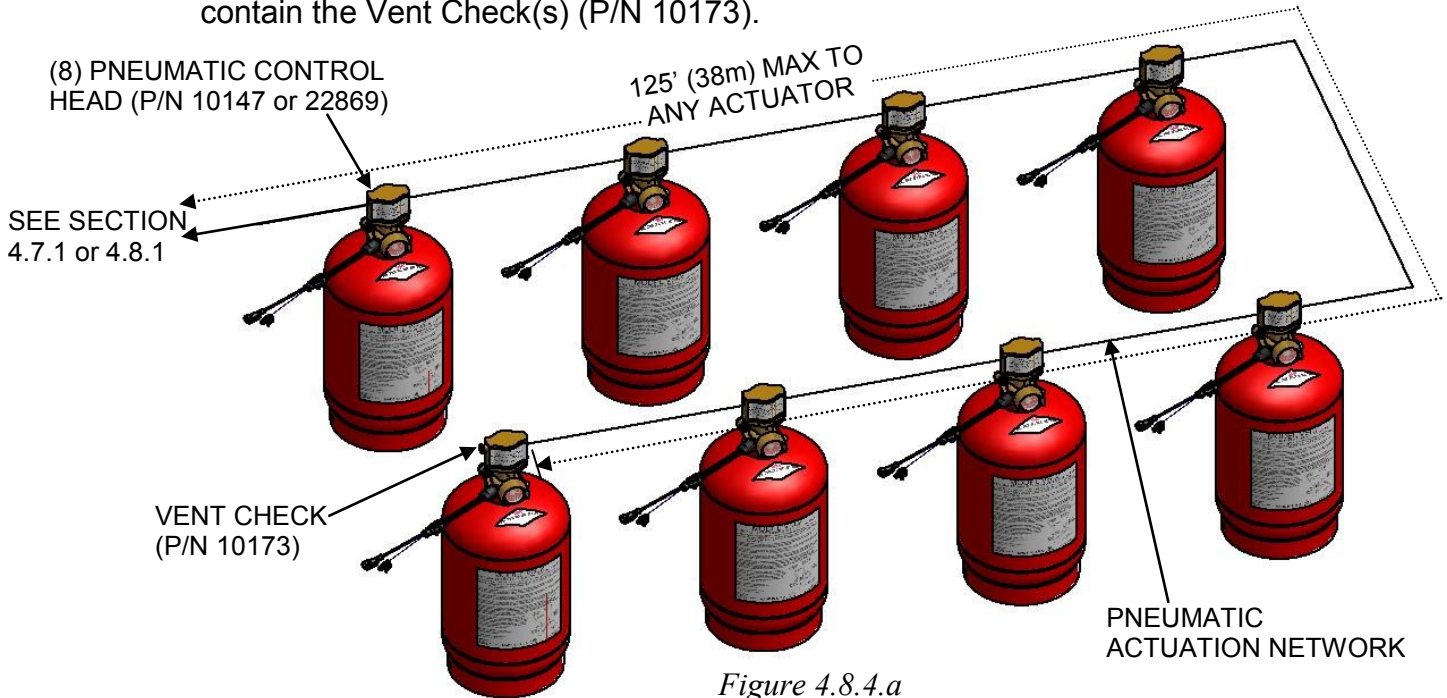


Figure 4.8.4.a

For “parallel” arrangements (Figure 4.8.4.b), the Pneumatic Actuation Network total length including each leg (LEG A & LEG B) of the arrangement plus the length from the tee to any actuator (LEG C) must not exceed 125 ft (38 meters).

$$(LEG A + LEG B + LEG C \leq 125 \text{ ft})$$

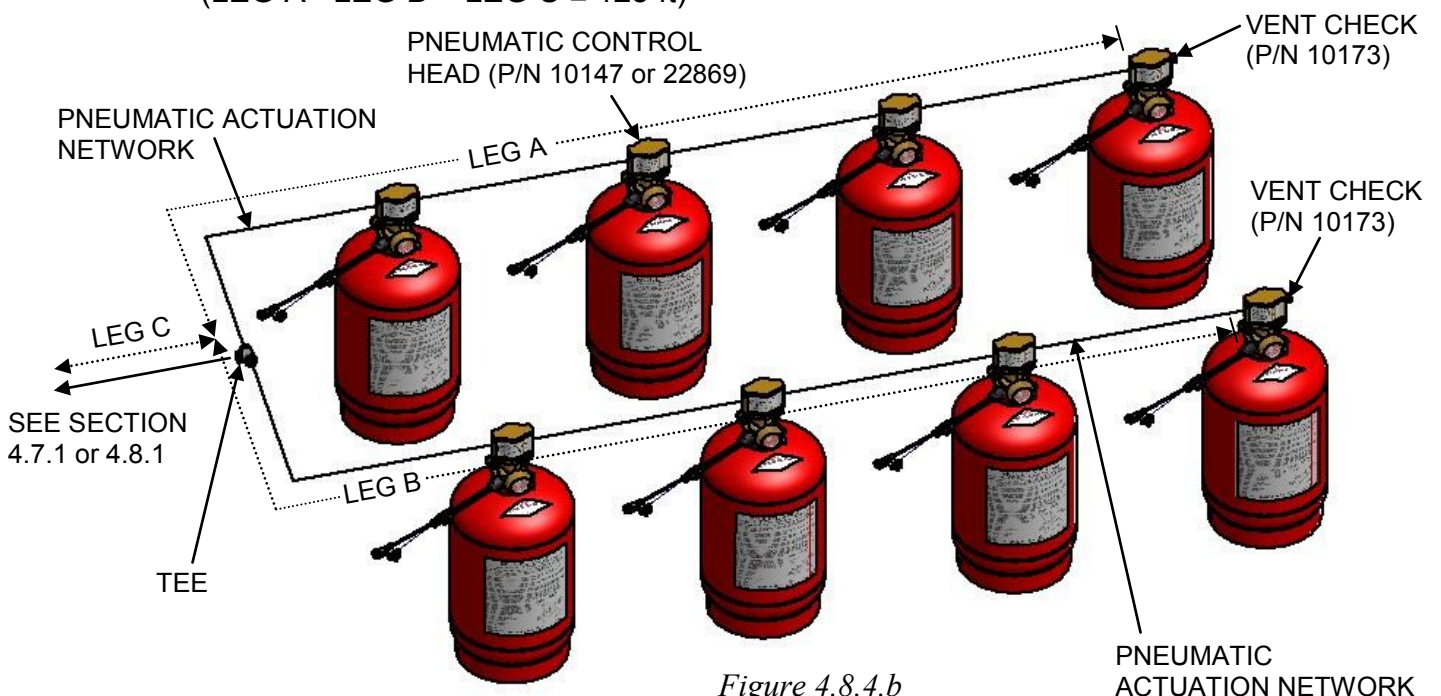


Figure 4.8.4.b

#### **4.9 Placing the System in Service**

Once the installation instructions from the previous Sections are complete, perform the following steps in order to place the Amerex Modular Dry Chemical System into working service:

- Connect any Agent Distribution Networks to Agent Cylinder(s) and Nozzles.
- Connect any Pneumatic Actuation Network(s).
- Locate any Agent Cylinder Low Pressure Switches if applicable. Each Switch will be connected to the vehicle's Amerex Modular Electronics System. See the applicable electronics manual located on the Amerex website at [www.amerex-fire.com](http://www.amerex-fire.com) for connection instructions.
- Locate any other electrical components used in the system including any Linear Actuators (P/N 22579 or 20500) used in actuators or control heads and any 100 PSI Pressure Switches (P/N 22573, 22574 or 23850) used in a Pneumatic Actuation Network. Each component will be connected to the vehicle's Amerex Modular Electronics System. See the applicable electronics manual located on the Amerex website at [www.amerex-fire.com](http://www.amerex-fire.com) for connection instructions.
- Test electrical networks in accordance with the type of electronics selected and used in the vehicle's Amerex Modular Electronics System. See the applicable electronics manual located on the Amerex website at [www.amerex-fire.com](http://www.amerex-fire.com).
- Make final documentation confirming all details of the complete installation compared to the hazard analysis from Chapter 3.
- Perform the monthly inspection as described in Chapter 5.

#### **4.10 Provide Owner / Operator Training**

The Owner's Manual (shipped with each Agent Cylinder) contains operating instructions, system descriptions, housekeeping requirements, and system routine inspection requirements. It is the Amerex installer's / servicing distributor's responsibility to explain those details to the owner / operator.

After finishing a system installation, the installer must do an installation review with the equipment owner and operator. This review should include:

- Disclose all system components and functionality of each component.
- Disclose all hazard/high risk areas and emphasize the necessity of good house keeping measures for those areas.
- Explain how the system can activate automatically (if automatic detection is used), and how to use any manual actuation stations.
- If the system is connected through a relay that powers the engine down, explain the details to the vehicle operator.
- Give a brief explanation of role play for daily and monthly inspection requirements for the vehicle owner / operator.
- Complete the warranty registration with the equipment owner. Explain the terms and conditions of the warranty and the service that must be performed on the system in order to keep the warranty valid.

## **Chapter 5: Inspection & Maintenance**

Amerex Modular Dry Chemical Systems require periodic care to provide maximum assurance that the system will operate effectively and safely. Inspection frequency should be based on the requirements of the equipment on which the fire suppression system will operate. Inspection and maintenance schedules are shown in this manual and must be followed to ensure reliable system performance. Equipment operating continually and/or in harsh environments will require more frequent inspection and maintenance.

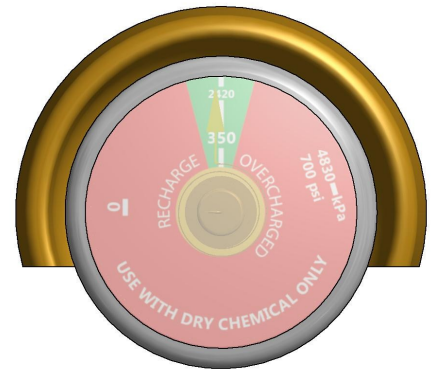
The latest revisions of any Amerex Installation, Operation, and Maintenance Manuals referenced in this Chapter can be found at [www.amerex-fire.com](http://www.amerex-fire.com).

### **5.1 Daily Inspection: OPERATOR / OWNER**

- On systems with electronic display panels, verify that a green “OK” status LED is illuminated.

### **5.2 Monthly Inspection: OPERATOR/ OWNER**

- Verify that all components are present and in their original location and securely fastened.
- Verify that ring pins are in place and secured with proper break away tamper indicator seals.
- Verify that all mechanical actuation devices are unobstructed by vehicle modifications or clutter.
- Verify that the maintenance tag or certificate is in place and up to date. Record the date of inspection and initials of inspector.
- Verify the physical condition of all components. Inspect for damage or conditions that may prevent operation.
- Inspect the Agent Cylinder Pressure Gauge(s). The yellow pointer on the Agent Cylinder Pressure Gauge must be in the green pie area (See Figure 5.2.a).
- Inspect any Nitrogen Cylinders. The yellow pointer on the pressure gauge of the Nitrogen Cylinder must be in the green pie area (See Figure 5.2.b).
- Verify that Dust Cap (P/N 21652 or 22973) is installed on safety Rupture Disc on Agent Cylinder or Valve (See Figure 2.1.a or 2.1.b).
- All Protective Caps must be in place on Nozzle tips. Nozzle outlets must be unobstructed and properly aimed at the hazard(s) which are intended to be protected.
- Verify that all “IN CASE OF FIRE” instruction labels and Nitrogen Cylinder labels are intact, clean and legible.



*Figure 5.2.a*



*Figure 5.2.b*

**If any service is required as a result of monthly inspections, it should be done only by an Amerex Certified and Authorized Servicing Technician.**

### 5.3 Semi-Annual Maintenance : AUTHORIZED AMEREX TECHNICIAN

**The Amerex Modular Dry Chemical System must be serviced by an Authorized Amerex Technician that is trained and certified on the Amerex Modular Dry Chemical System and in accordance with NFPA and any federal, state, and/or local code requirements. Service and maintenance shall be done at intervals of six (6) months or more frequent if deemed necessary.**

- Perform the monthly inspection procedure.
- Verify that hazards have not changed. Look for changes in vehicle operation or cleaning procedures that may have increased the hazard. Compare with the original vehicle hazard analysis.
- Examine and test all heat detection devices per guidelines in the latest version of applicable Amerex Installation, Operation and Maintenance Manual found at the Amerex website ([www.amerex-fire.com](http://www.amerex-fire.com)).
- Inspect the Agent Cylinder(s) and Nitrogen Cylinder(s) on systems so equipped. If Pressure Gauge is bent or damaged, depressurize Cylinder(s) and replace. Clean Cylinder(s) to remove dirt, grease and foreign material. Make sure that instruction nameplates are securely fastened and legible. Inspect the Cylinder(s) for corrosion, abrasion, and dents or damage. Replace Nitrogen Cylinder(s) with new ones and hydro-test Agent Cylinder(s) if any of these conditions are found. If Agent Cylinder(s) are found to be faulty, replace.
- Remove and inspect control heads for damaged, missing, or substituted parts. Instructions for control head (P/N 10147, 14032, 22868, 22869, or 17068) disassembly, cleaning and reassembly can be found in Chapter 6.
- Inspect and clean the top of the Agent Cylinder Valve.
- Disconnect Discharge Fitting Kit or Agent Distribution Network (V150/V250 only) from Agent Cylinder Valve (**make sure that actuation method(s) are removed or disabled when performing this step!**). Inspect Agent Cylinder Valve discharge port for contaminants and clean if necessary. Note: Chemical residue found in the Agent Cylinder Valve discharge port can be a sign of an unreported system discharge. If a system has discharged, go to appropriate section for recharge procedures in Chapter 6.
- Examine the Agent Distribution Network. Look for signs of wear or chafing on network hoses. Replace any damaged hose sections.
- Examine Nozzles (P/N 10250) and protective Dust Caps (P/N 10167). If protective Dust Caps are missing from Nozzles, re-install new ones.
- Purge the Agent Distribution Network with air or nitrogen only (See Section 6.2.2).
- If a Pneumatic Actuation Network is used, unscrew Nitrogen Cylinders from actuators. Cycle each actuator several times verifying free travel of Puncture Stem Assembly inside of each actuator. If any defects are found, rebuild actuator (See Section 6.2.7). Verify that the Pneumatic Actuation Network is functioning properly by performing the Pneumatic Actuation Network Testing (See Section 6.2.8).
- Document all work completed during service for record retention. Disclose any anomalies, deficiencies to the property owner for corrective action requirements.



**5.4 (6) Six Year Maintenance: AUTHORIZED AMEREX TECHNICIAN**

- Perform semi-annual inspection.
- Per NFPA 17 guidelines, stored pressure Dry Chemical Agent Cylinders must be depressurized for inspecting the inside of the Agent Cylinder, and the Agent. Agent must be free flowing. Inspect Agent Cylinders for damage, dents, abrasions or corrosion. If any of these conditions are found, replace the Agent Cylinder. See Chapter 6 for recharge instructions.
- Inspect the inside of adapters and hose end fittings of the Agent Distribution Network(s) and on so equipped Pneumatic Actuation Network(s). Replace any corroded adapters and hose end fittings.
- Replace Linear Actuators if in service for 6 years.

**5.5 (12) Twelve Year Maintenance: AUTHORIZED AMEREX TECHNICIAN**

- Perform (6) six year maintenance.
- The Agent Cylinder and all hose assemblies must be hydrostatically tested at a minimum of every 12 years in accordance with CGA Pamphlet C-6, NFPA 17, and DOT requirements. Test pressure can be found either in the latest version of 13980 Installation Operation, and Maintenance Manual (See Section 2.1), or on the Agent Cylinder nameplate. Date of Agent Cylinder manufacture is stamped on the Agent Cylinder dome. **Hydrostatic testing may only be done by individuals certified to perform hydrostatic testing by those having jurisdiction in the particular area.**

When hydrostatically testing Agent Cylinders, replace Agent Cylinder Valve with the Hydrotest Adapter (P/N 05152 or 23450). Connect a pressurization hose or network rated at or above the test pressure to the Hydrotest Adapter (See Section 6.1.2). Note: For V150/V250 Agent Cylinders, the Rupture Disc (P/N 21793), located on the Agent Cylinder dome, must be removed and replaced with a 1/2" NPT plug rated at or above the test pressure (See Figure 6.1.2.b). After hydrostatic testing is complete, a new Rupture Disc (P/N 21793) MUST be reinstalled in its original location. Seal threads with a 24 hour epoxy. Reinstall a Dust Cap (P/N 22973) over Rupture Disc.

# Chapter 6: Recharge

## 6.1 Service / Recharge Tools

Only genuine Amerex service/recharge tools should be used for servicing Amerex Modular Dry Chemical Systems. Proper protective equipment must be used (safety glasses, steel toe shoes, hard hats... etc.) when servicing or recharging Amerex Modular Dry Chemical Systems.

### 6.1.1 Recharge Adapter (P/N 10136)

The Recharge Adapter is used to pressurize the Agent Cylinder after a discharge or maintenance and is used in conjunction with Tee Handle (P/N 10134) (See Section 6.1.5).

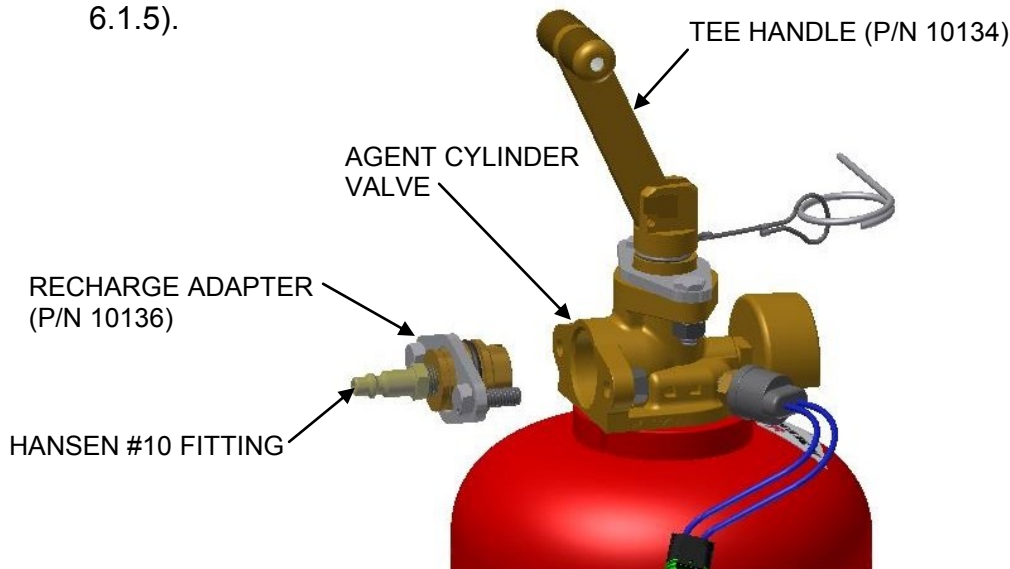


Figure 6.1.1

### 6.1.2 Hydrotest Adapters (P/N 05152 & P/N 23450)

The Hydrotest Adapter is used to pressurize the Agent Cylinder to perform DOT requirements for (12) year maintenance (See Section 5.5). V13 through VS75 Agent Cylinders use P/N 05152 (See Figure 6.1.2.a) and V150/V250 Agent Cylinders use P/N 23450 (See Figure 6.1.2.b).

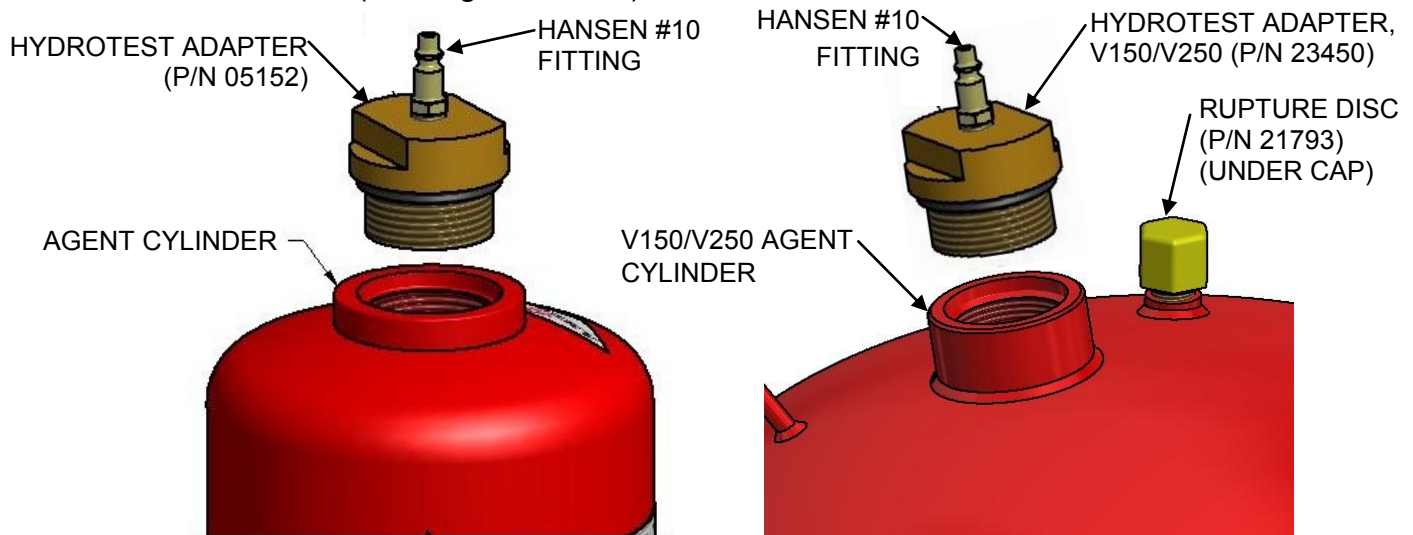


Figure 6.1.2.a

Figure 6.1.2.b

### 6.1.3 Distribution Hose Blowout Adapter (P/N 12129)

When commissioning the Amerex Modular Dry Chemical System, upon initial installation, and at each (6) six month service, the Agent Distribution Network must be purged with dry air or nitrogen at a minimum of 90 psi (620 kPa) by using the Distribution Hose Blowout Adapter.

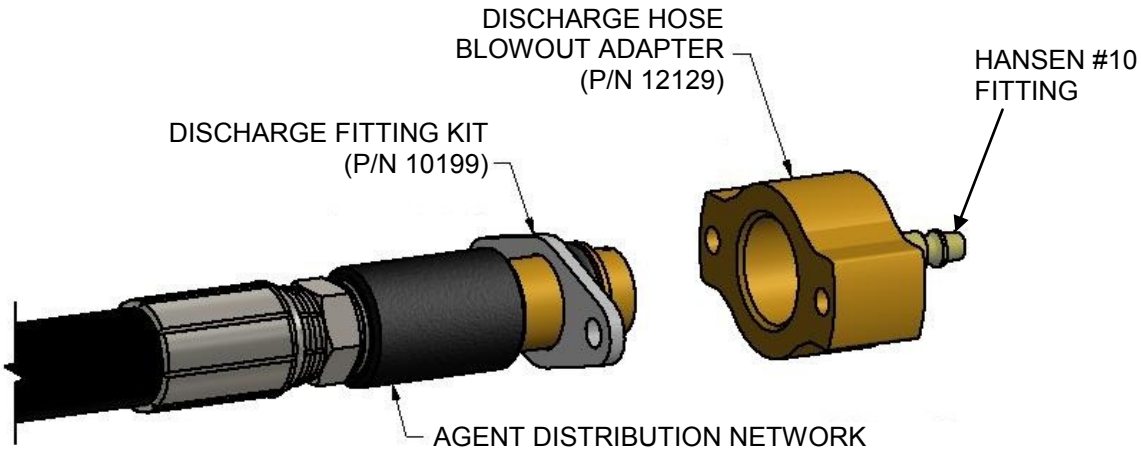


Figure 6.1.3

### 6.1.4 Distribution Hose Blowout Adapter 1 1/4" (P/N 22999) & Distribution Hose Blowout Adapter 3/4" (P/N 23001), V150/V250 Agent Cylinder

When commissioning the Amerex Modular Dry Chemical System, upon initial installation, and at each (6) six month service, the V150/V250 Agent Distribution Network must be purged with dry air or nitrogen at approximately 90 PSI using the Distribution Hose Blowout Adapters.

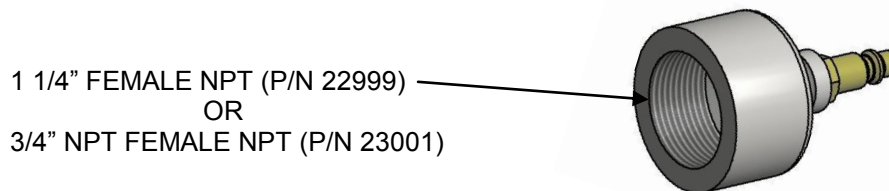


Figure 6.1.4

### 6.1.5 Tee Handle (P/N 10134)

The Tee Handle is used to manually actuate the Agent Cylinder. The Tee Handle is also used to open the Agent Cylinder Valve for recharging.

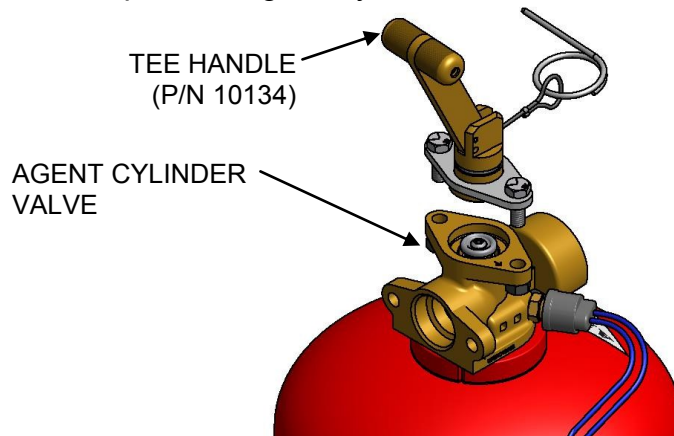


Figure 6.1.5

### 6.1.6 2 1/2" Tight Access Open End Pump Wrench

The 2 1/2" Pump Wrench is used to remove or reinstall the Agent Cylinder Valve In the Agent Cylinder. It can be purchased from McMaster-Carr or other hardware supply stores. The Pump Wrench should be less than .30" in thickness for proper fit on the Agent Cylinder Valve.

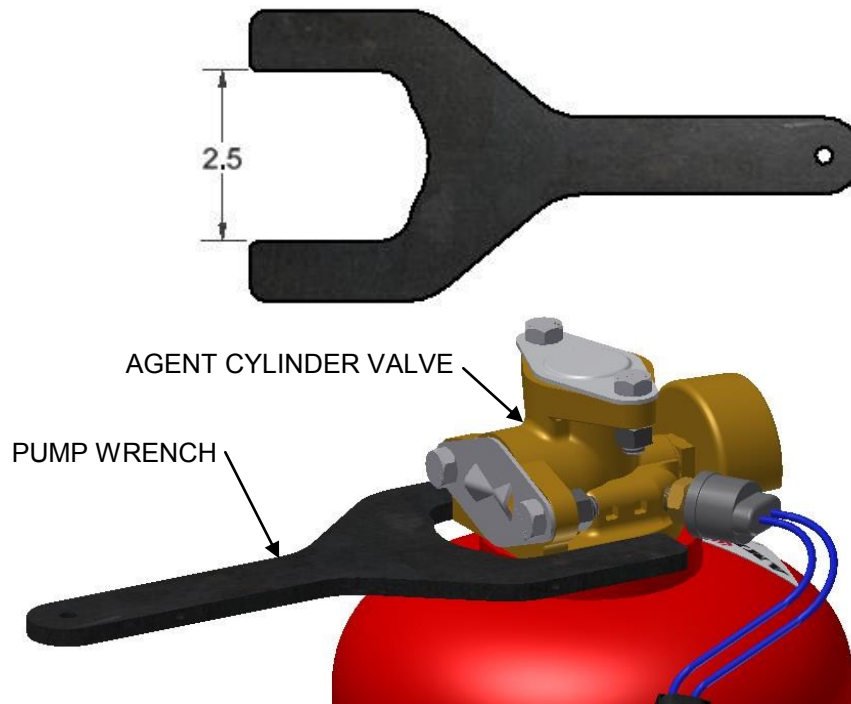


Figure 6.1.6

### 6.1.7 Pneumatic Actuation Network Test Adapter (P/N 10895)

The Actuation Network Test Adapter is used in place of a Nitrogen Cylinder to purge the Pneumatic Actuation Network with dry air or nitrogen at each Manual Actuator, Electric Nitrogen, or Manual/Electric Actuator location. It is also use to leak check the actuation network and to verify that the control heads will activate as designed.

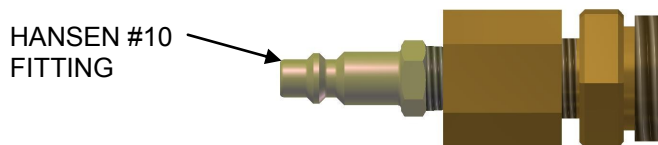


Figure 6.1.7

### 6.1.8 Recharge Adapter, V150/V250 Agent Cylinder (P/N 23065)

The V150/V250 Recharge Adapter is used to pressurize the V150 or V250 Agent Cylinder after a discharge or maintenance.

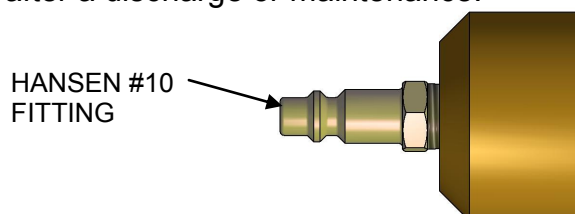


Figure 6.1.8

## **6.2 Recharge Instructions**

**WARNING! BEFORE ATTEMPTING ANY RECHARGE PROCEDURES, FIRST CONFIRM THE REASON FOR THE DISCHARGE AND CORRECT ANY CONDITIONS THAT CAUSED THE SYSTEM TO DISCHARGE. IF RECHARGE CANNOT BE ACCOMPLISHED IMMEDIATELY, DO NOT LEAVE THE SYSTEM INCAPACITATED FOR ANY REASON WITHOUT GIVING WRITTEN NOTIFICATION TO THE OWNER, OWNER'S AGENT, AND OR LOCAL AHJ. ALSO, DOCUMENT THE INCIDENT IN THE PERMANENT JOB FILE BEFORE LEAVING THE SCENE. ANY SYSTEM COMPONENTS SUBJECTED TO FIRE OR OVERHEAT CONDITIONS MUST BE REPLACED, INCLUDING, BUT NOT LIMITED TO CYLINDERS, BRACKETS, DETECTORS, DETECTOR CIRCUITS, NOZZLES, AND AGENT DISTRIBUTION NETWORKS AND PNEUMATIC ACTUATION NETWORKS.**

**WARNING! ENSURE THAT ALL PRESSURE HAS BEEN RELIEVED FROM AGENT CYLINDER BEFORE PROCEEDING. CONSULT MATERIAL SAFETY DATA SHEET (MSDS) FOUND ON AMEREX WEBSITE WWW.AMEREX-FIRE.COM.**

Remove all sources of power that are involved with the fire suppression system. Immediately clean all surfaces contacted by Dry Chemical Agent. Methods for cleaning:

1. If the Dry Chemical Agent has not been heated to its melting point, it may be swept and vacuumed from all surfaces it has contacted.
2. Use shop air to blow residual chemical away from surfaces. Note: Amerex Dry Chemical Agent is considered a nuisance dust and is non-toxic. See MSDS on Amerex website at [www.amerex-fire.com](http://www.amerex-fire.com).
3. Additionally, power spraying or steam cleaning can be done to remove any additional Dry Chemical Agent. Mild soapy water can sometimes be utilized. Contact vehicle owner/operator for permission to use water prior to taking this step.

### **6.2.1 Agent Cylinder Control Head Removal & Cleaning**

Reference the appropriate subsection for control head removal, disassembly, cleaning and reassembly instructions.

#### **6.2.1.1 For Systems Using Pneumatic Control Head (P/N 10147)**

For systems using a Pneumatic Control Head (P/N 10147) along with a Pneumatic Actuation Network, perform the following steps. The Control Head must be disassembled, cleaned, and reassembled after each use.

##### **Control Head Removal (See Figure 4.6.3):**

1. Relieve any residual nitrogen pressure in the Pneumatic Actuation Network by slowly unseating the Vent Check (P/N 10173). Remove Vent Check.
2. Remove Pneumatic Actuation Network at Control Head inlet/exit.
3. Carefully remove Pneumatic Control Head from Agent Cylinder Valve by removing (2) 5/16"-18 bolts.
4. Install Shipping Plate (P/N 10099) in place of Pneumatic Control Head (See Figure 2.1.a)

##### **Control Head Disassembly (See Figure 6.2.1.1):**

5. Use retaining ring pliers to remove the Retaining Ring (P/N 10149) (Note: Always use eye protection when doing this step).
6. Remove the Safety Lock Washer (P/N 17637) and Pneumatic Piston Assembly (P/N 17635) with O-ring (P/N 10148).

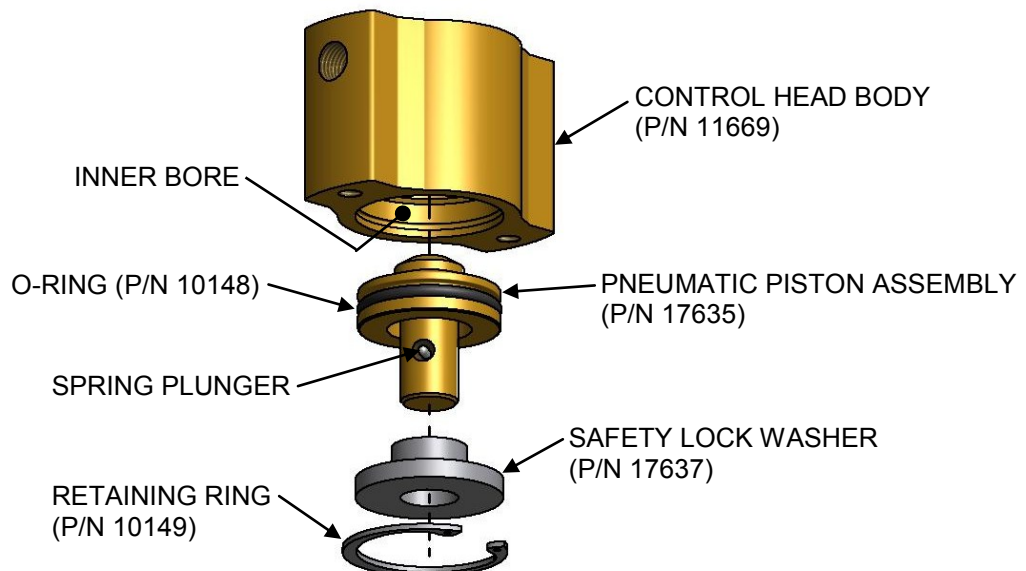
7. In order to remove the Safety Lock Washer (P/N 17637) from the Pneumatic Piston Assembly (P/N 17635), use a flat head screwdriver to depress the Spring Plunger located on the piston shaft.

Control Head Cleaning (See Figure 6.2.1.1):

8. Inspect and clean the inner bore of Control Head Body (P/N 11669). If any scarring or damage has occurred in the inner bore, replace the Control Head Body (P/N 11669).
9. Inspect and clean the Pneumatic Piston Assembly (P/N 17635), the O-ring (P/N 10148), the Safety Lock Washer (P/N 17637), and the Retaining Ring (P/N 10149). Inspect the O-Ring (P/N 10148) for any cuts/nicks. Replace any damaged components.
10. Make sure the Spring Plunger is spring-loaded and can be forced in and out of the piston shaft. Note: Do not remove Spring Plunger from Piston! If this part is compromised, replace the entire Pneumatic Piston Assembly (P/N 17635).

Control Head Reassembly (See Figure 6.2.1.1 & 4.6.3):

11. Lubrication: O-Ring (P/N 10148) must be lightly lubricated with Visilox (P/N L0172) or equivalent silicone style lubricant. Inner bore of the Control Head Body (P/N 11669) is to be lightly lubricated as well.
12. Insert Pneumatic Piston Assembly (P/N 17635) with O-Ring (P/N 10148) into Control Head Body (P/N 11669). Make sure piston is fully recessed.
13. Insert Safety Lock Washer (P/N 17637). Do not insert past Spring Plunger!
14. Reinstall Retaining Ring (P/N 10149) (Note: Always use eye protection when performing this step).
15. Reinstall Vent Check (P/N 10173).
16. Test the assembly by using 70-90 psi at the inlet of the 1/4" NPT port opposite of the Vent Check port to force the piston through the Safety Lock Washer. After it is acknowledged that the piston locks, use a flathead screwdriver to depress the Spring Plunger so that the Pneumatic Piston Assembly can be fully recessed into the Control Head Body again.



*Figure 6.2.1.1*

### **6.2.1.2 For Systems Using Electric / Pneumatic Control Head (P/N 17068)**

For systems using an Electric / Pneumatic Control Head (P/N 17068) along with a Pneumatic Actuation Network, perform the following steps. The control head must be disassembled, cleaned, and reassembled after each use.

#### **Control Head Removal (See Figure 4.6.5):**

1. Relieve any residual nitrogen pressure in the Pneumatic Actuation Network by slowly unseating the Vent Check (P/N 10173). Remove Vent Check.
2. Remove Pneumatic Actuation Network at Control Head inlet/exit.
3. Unplug Linear Actuator (P/N 22579 or 20500) from Linear Actuator circuit and unscrew Linear Actuator from Control Head Body (P/N 17064).
4. Carefully remove Electric / Pneumatic Control Head from Agent Cylinder Valve by removing (2) 5/16"-18 bolts.
5. Install Shipping Plate (P/N 10099) in place of Electric / Pneumatic Control Head (See Figure 2.1.a)

#### **Control Head Disassembly (See Figure 6.2.1.2):**

6. Use retaining ring pliers to remove the Retaining Ring (P/N 10149) (Note: Always use eye protection when performing this step).
7. Remove the Safety Lock Washer (P/N 17065) and Electric / Pneumatic Piston Assembly (P/N 17067) with O-ring (P/N 10148).
8. In order to remove the Safety Lock Washer (P/N 17065) from the Electric Pneumatic Piston Assembly (P/N 17067), use a flat head screwdriver to depress the Spring Plunger located on the piston shaft.

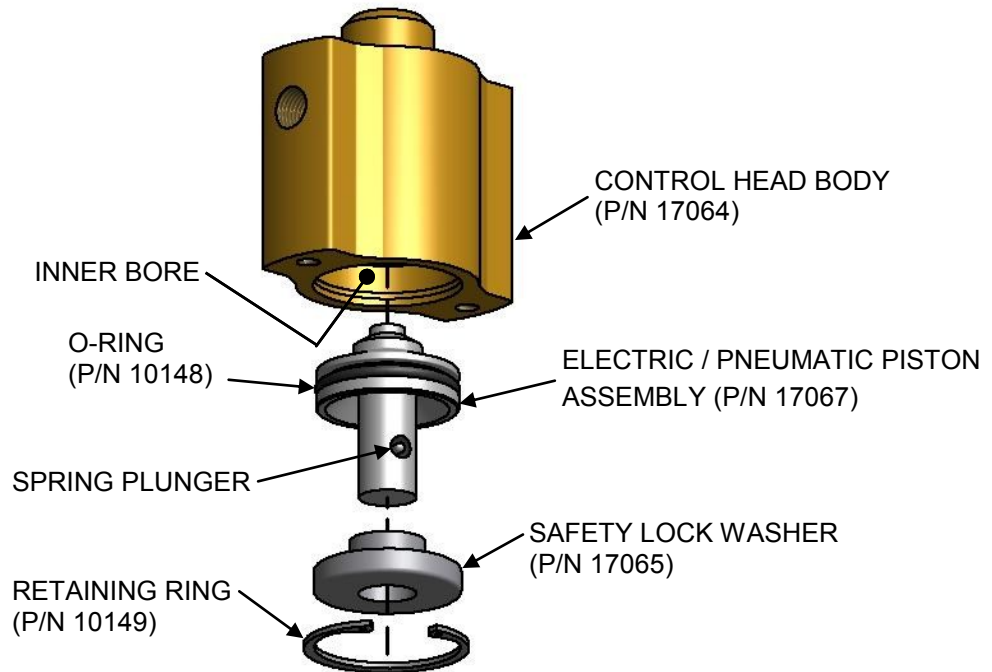
#### **Control Head Cleaning (See Figure 6.2.1.2):**

9. Inspect and clean the inner bore of Control Head Body (P/N 17064). If any scarring or damage has occurred in the inner bore, replace the Control Head Body (P/N 17064). Stainless steel disc punched from spent Linear Actuator (P/N 22579 or 20500) must always be removed in the event of an automatic actuation.
10. Inspect and clean the Electric / Pneumatic Piston Assembly (P/N 17067), the O-ring (P/N 10148), the Safety Lock Washer (P/N 17065), and the Retaining Ring (P/N 10149). Inspect the O-Ring (P/N 10148) for any cuts/nicks. Replace any damaged components.
11. Make sure the Spring Plunger is spring-loaded and can be forced in and out of the piston shaft. Note: Do not remove Spring Plunger from Piston! If this part is compromised, replace the entire Electric / Pneumatic Piston Assembly (P/N 17067).

#### **Control Head Reassembly (See Figure 6.2.1.2 & 4.6.5):**

12. Lubrication: O-Ring (P/N 10148) must be lightly lubricated with Visilox (P/N L0172) or equivalent silicone style lubricant. Inner bore of the Control Head Body (P/N 17064) is to be lightly lubricated as well.
13. Insert Electric / Pneumatic Piston Assembly (P/N 17067) with O-Ring (P/N 10148) into Control Head Body (P/N 17064). Make sure piston is fully recessed.
14. Insert Safety Lock Washer (P/N 17065). Do not insert past Spring Plunger!
15. Reinstall Retaining Ring (P/N 10149) (Note: Always use eye protection when performing this step).

16. Reinstall Vent Check (P/N 10173).
17. Carefully test the assembly by using a Phillips head screwdriver inserted through the Linear Actuator port to force the piston through the Safety Lock Washer. After it is acknowledged that the piston locks, use a flathead screwdriver to depress the Spring Plunger so that the Electric / Pneumatic Piston Assembly can be fully recessed into the Control Head Body again.



*Figure 6.2.1.2*

### **6.2.1.3 For Systems Using Electric Control Head (P/N 14032):**

For systems using an Electric Control Head (P/N 14032), perform the following steps. The control head must be disassembled, cleaned, and reassembled after each use.

#### **Control Head Removal (See Figure 4.6.2):**

1. Unplug Linear Actuator (P/N 22579 or 20500) from Linear Actuator circuit and unscrew Linear Actuator from Control Head Body.
2. Carefully remove Electric Control Head from Agent Cylinder Valve by removing (2) 5/16"-18 bolts.
3. Install Shipping Plate (P/N 10099) in place of Electric Control Head (See Figure 2.1.a).

#### **Control Head Disassembly (See Figure 6.2.1.3):**

4. Remove the Set Screw (P/N 14038) from the Base (P/N 14034) using a 1/8" Allen Head wrench.
5. Unscrew the Body (P/N 14033) from the Base (P/N 14034).
6. Remove the Piston (P/N 14035) and Retaining Ring (P/N 14037). Remove the Retaining Ring from the Piston groove.

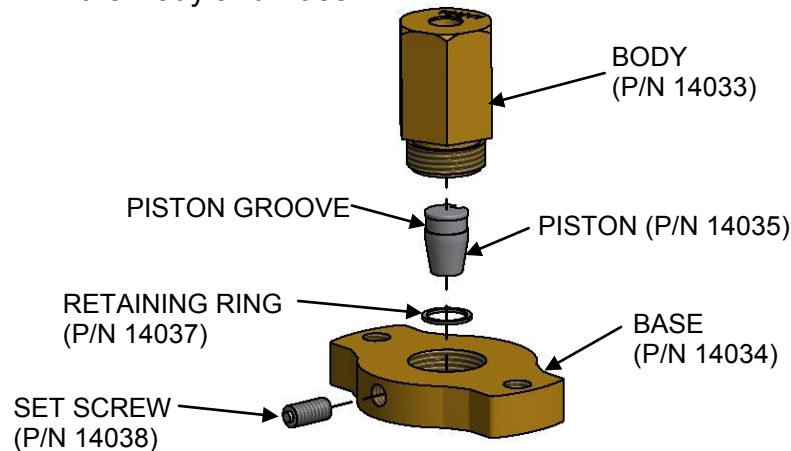


**Control Head Cleaning (See Figure 6.2.1.3):**

7. Inspect and clean all components of the Control Head. If any scarring or damage has occurred, replace the component. Stainless steel disc punched from spent Linear Actuator (P/N 22579 or 20500) must always be removed in the event of an automatic actuation.

**Control Head Reassembly (See Figure 6.2.1.3):**

8. Place Retaining Ring (P/N 14037) into Base (P/N 14034), followed by the Piston (P/N 14035) in orientation shown.
9. Before adding any thread lock, screw the Body (P/N 14033) into the Base and test the assembly by using a Phillips head screwdriver inserted through the Linear Actuator port to force the Piston through the Retaining Ring. Verify the Retaining Ring locks into the Piston groove.
10. After testing the control head, disassemble the components by repeating steps 5 and 6. Repeat step 8.
11. Apply one drop of medium grade thread lock to threads of the Body (P/N 14033). Torque Body into Base to 200 in-lb (17 ft-lb).
12. Apply one drop of medium grade thread lock to threads of the Set Screw (P/N 14038). Thread screw into Base until resistance is met. Do not over-tighten!
13. Invert assembly and confirm that the piston floats freely within the assembly. Ensure the Retaining Ring (P/N 14037) is not pinched between the Body and Base.



*Figure 6.2.1.3*

**6.2.1.4 For Systems Using Tee Handle (P/N 10134):**

For systems using a Tee Handle (P/N 10134), perform the following steps. The Tee Handle must be inspected and cleaned after each use (See Figure 4.6.1).

1. Carefully remove Tee Handle from Agent Cylinder Valve by removing (2) 5/16"-18 bolts and nuts.
2. Install Shipping Plate (P/N 10099) in place of Tee Handle (See Figure 2.1.a).
3. Inspect and clean all exposed components. If any components are damaged, replace entire Tee Handle. Test the function of the Tee Handle. If not functioning properly, replace entire Tee Handle. Do not attempt to disassemble Tee Handle.

### 6.2.1.5 For Systems Using Pneumatic Control Head (P/N 22869), V150/V250 Agent Cylinder

For V150 and V250 systems using a Pneumatic Control Head (P/N 22869) along with a Pneumatic Actuation Network, perform the following steps. The Control Head must be disassembled, cleaned, and reassembled after each use.

#### Control Head Removal (See Figure 4.6.4.a):

1. Relieve any residual nitrogen pressure in the Pneumatic Actuation Network by slowly unseating the Vent Check (P/N 10173). Remove Vent Check.
2. Remove Pneumatic Actuation Network at Control Head inlet/exit.
3. Carefully remove Pneumatic Control Head from Agent Cylinder Valve by unscrewing it from the top of the Valve.
4. Install Protective Cap (P/N 17990) in place of Pneumatic Control Head (See Figure 2.1.b)

#### Control Head Disassembly (See Figure 6.2.1.5):

5. Use retaining ring pliers to remove the Retaining Ring (P/N 17020) (Note: Always use eye protection when performing this step).
6. Remove the Washer (P/N 22864), Spring (P/N 22865) and Piston (P/N 22863) with O-ring (P/N 17018).

#### Control Head Cleaning (See Figure 6.2.1.5):

7. Inspect and clean the inner bore of Control Head Body (P/N 22861). If any scarring or damage has occurred in the inner bore, replace the entire control head.
8. Inspect and clean the Piston (P/N 22863), O-ring (P/N 17018), Washer (P/N 22864), Spring (P/N 22865) and the Retaining Ring (P/N 17020). Replace any damaged components.

#### Control Head Reassembly (See Figure 6.2.1.5 & 4.6.4.b):

9. Lubrication: O-Ring (P/N 17018) must be lightly lubricated with Visilox (P/N L0172) or equivalent silicone style lubricant. Inner bore of the Control Head Body (P/N 22861) is to be lightly lubricated as well.
10. Insert Piston (P/N 22863) with O-Ring (P/N 17018) into Control Head Body (P/N 22861). Make sure piston is fully recessed.
11. Insert Spring (P/N 22865).
12. Insert Washer (P/N 22864) in the direction as shown on Figure 6.2.1.5.
13. Reinstall Retaining Ring (P/N 17020) (Note: Always use eye protection when performing this step).

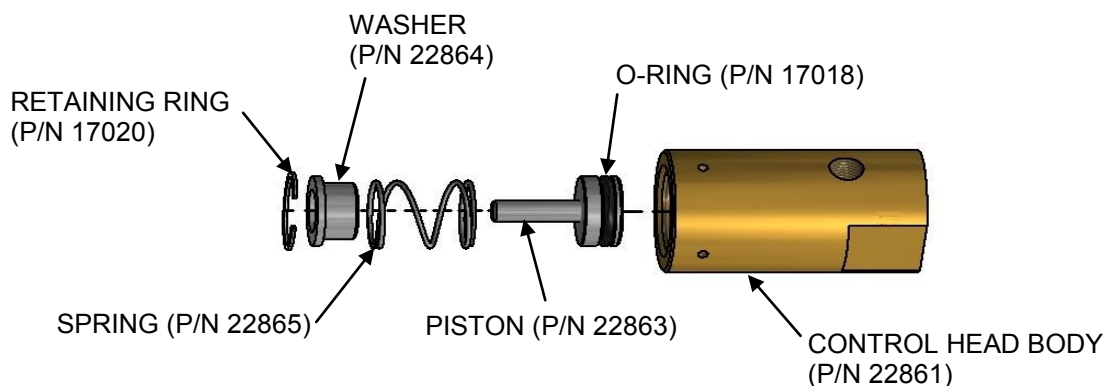


Figure 6.2.1.5

### 6.2.1.6 For Systems Using Electric / Pneumatic Control Head (P/N 22868), V150/V250 Agent Cylinder

For V150 and V250 systems using an Electric / Pneumatic Control Head (P/N 22868) with a Pneumatic Actuation Network, perform the following steps. The Control Head must be disassembled, cleaned, and reassembled after each use.

#### Control Head Removal (See Figure 4.6.6.a):

1. Relieve any residual nitrogen pressure in the Pneumatic Actuation Network by slowly unseating the Vent Check (P/N 10173). Remove Vent Check.
2. Remove Pneumatic Actuation Network at Control Head inlet/exit.
3. Unplug Linear Actuator (P/N 22579 or 20500) from Linear Actuator circuit and unscrew it from the Control Head Body (P/N 22862).
4. Carefully remove Electric / Pneumatic Control Head from Agent Cylinder Valve by unscrewing it from the top of the Valve..
5. Install Protective Cap (P/N 17990) in place of Electric / Pneumatic Control Head (See Figure 2.1.b)

#### Control Head Disassembly (See Figure 6.2.1.6):

6. Use retaining ring pliers to remove the Retaining Ring (P/N 17020) (Note: Always use eye protection when performing this step).
7. Remove the Washer (P/N 22864), Spring (P/N 22865) and Piston (P/N 22863) with O-ring (P/N 17018).

#### Control Head Cleaning (See Figure 6.2.1.6):

8. Inspect and clean the inner bore of Control Head Body (P/N 22862). If any scarring or damage has occurred to inner bore, replace the entire Control Head. Stainless steel disc punched from spent Linear Actuator (P/N 22579 or 20500) must always be removed in the event of an automatic actuation.
9. Inspect and clean the Piston (P/N 22863), O-ring (P/N 17018), Washer (P/N 22864), Spring (P/N 22865) and Retaining Ring (P/N 17020). Replace any damaged components.

#### Control Head Reassembly (See Figure 6.2.1.6 & 4.6.6.b):

10. Lubrication: O-Ring (P/N 17018) must be lightly lubricated with Visilox (P/N L0172) or equivalent silicone style lubricant. Inner bore of the Control Head Body (P/N 22862) is to be lightly lubricated as well.
11. Insert Piston (P/N 22863) with O-Ring (P/N 17018) into Control Head Body (P/N 22862). Make sure piston is fully recessed.
12. Insert Spring (P/N 22865).
13. Insert Washer (P/N 22864) in the direction as shown on Figure 6.2.1.6.
14. Reinstall Retaining Ring (P/N 17020) (Note: Always use eye protection when performing this step).

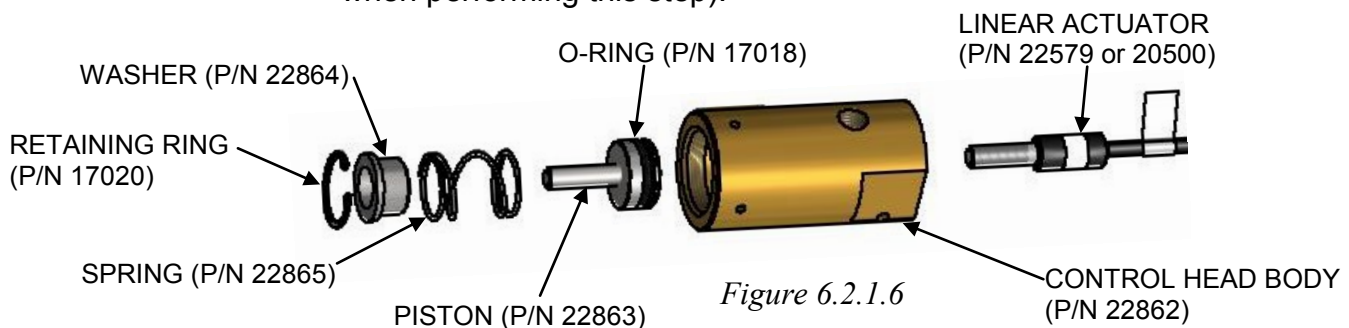


Figure 6.2.1.6

## **6.2.2 Purging the Agent Distribution Network:**

Reference the appropriate subsection for Agent Distribution Network purging instructions. The Agent Distribution Network must be purged following a system discharge or during routine maintenance.

### **6.2.2.1 Purging the Agent Distribution Network, V13 thru VSR75 Agent Cylinder**

1. Remove the Discharge Fitting Kit (P/N 10199) from the Agent Cylinder Valve (See Figure 4.5.1). Install Anti-Recoil Plate (P/N 10646) in place of Discharge Fitting Kit (See Figure 2.1.a).
2. Inspect and clean the Discharge Fitting Kit (P/N 10199). Inspect O-ring for cuts/nicks. Replace the entire Discharge Fitting Kit if any damage is found.
3. Attach the Discharge Hose Blowout Adapter (P/N 12129) to the Discharge Fitting Kit using 1/4" or 5/16" bolts/nuts (See Figure 6.1.3). Purge the Agent Distribution Network with dry air or nitrogen at a minimum of 90 psi (620 kPa). Continue to purge the system until all Dry Chemical Agent or any debris is free from the network and only air or nitrogen is free flowing from each Nozzle in the network. If any section is found to be blocked, disconnect and either unblock obstructions or replace the section of the Agent Distribution Network.
4. Reinstall all Protective Nozzle Blow Off Caps (P/N 10167).

### **6.2.2.2 Purging the Agent Distribution Network, V150/V250 Agent Cylinder**

Reference Section 4.5.14 thru 4.5.16 for V150 and V250 Agent Distribution Network Configurations.

1. Disconnect the 1 1/4" I.D. hose from the Agent Cylinder Valve and install Anti-Recoil Plug (P/N 17559) on valve (See Figure 2.1.b).
2. Disconnect the 1 1/4" I.D. hose from the first Distributor (D1) in the Agent Distribution Network (See Figure 6.2.2.2).
3. Install Distribution Hose Blowout Adapter 1 1/4" (P/N 22999) into inlet of the 1 1/4" hose (See Figure 6.2.2.2). Purge the 1 1/4" I.D. hose with dry air or nitrogen at a minimum of 90 psi (620 kPa). Continue to purge the 1 1/4" I.D. hose until all Dry Chemical Agent or any debris is free from the hose and only air or nitrogen is free flowing from the opposite hose end.
4. Disconnect each of the 3/4" I.D. hoses from the first Distributor (D1)(See Figure 6.2.2.2).
5. Install Distribution Hose Blowout Adapter 3/4" (P/N 23001) in one of the 3/4" ID hoses that is disconnected from the first Distributor (D1) in the network. Purge the network section with dry air or nitrogen at a minimum of 90 psi (620 kPa). Continue to purge the section of the network until all Dry Chemical Agent or any debris is free from the hose section and only air or nitrogen is free flowing from each Nozzle in that network section. If any section is found to be blocked, disconnect and either unblock obstructions or replace the section of the Agent Distribution Network.
6. Repeat step 5 for all remaining 3/4" I.D. network sections that were disconnected in step 4.
7. Reinstall all Protective Nozzle Blow Off Caps (P/N 10167).
8. Reconnect all hoses and distributors in the Agent Distribution Network.

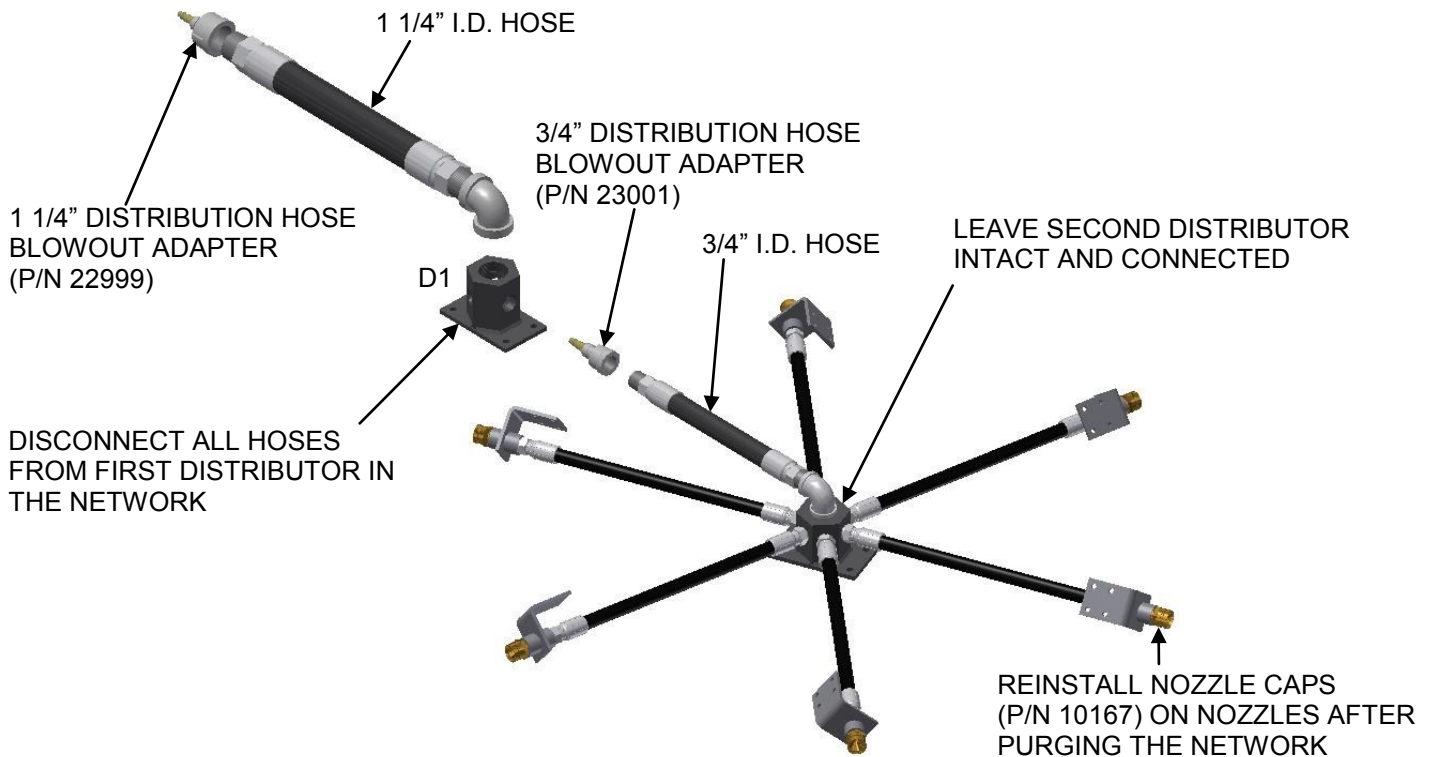


Figure 6.2.2.2

### 6.2.3 Agent Cylinder Removal

1. If a Low Pressure Switch is used, disconnect it from the Agent Cylinder Valve (See Figures 2.1.a and 2.1.b). Do not attempt to remove Low Pressure Switch from Agent Cylinder Valve.
2. Ensure Shipping and Anti-Recoil Plates are installed on Agent Cylinder Valve. For V150/V250 Agent Cylinders, ensure Protective Cap and Anti-Recoil Plug are installed on Agent Cylinder Valve. (See Figures 2.1.a and 2.1.b).
3. Remove Agent Cylinder from its Cylinder Bracket or Weld Ring.
4. Cap Agent Distribution Network to prevent contamination if the recharge can not be done immediately.

### 6.2.4 Agent Cylinder Valve Removal & Cleaning

Reference the appropriate subsection for Agent Cylinder Valve removal, disassembly, cleaning, and reassembly instructions.

#### 6.2.4.1 Agent Cylinder Valve Removal & Cleaning, V13 thru VSR75 Agent Cylinder Valve Removal:

1. If any pressure remains, depressurize the Agent Cylinder by slowly unscrewing the Agent Cylinder Valve using the 2 1/2" Pump Wrench until the collar O-ring seal releases (See Figure 6.1.6).
2. After any pressure in the Agent Cylinder is relieved, finish removing the Agent Cylinder Valve from the Agent Cylinder.
3. Empty the Agent Cylinder of any remaining Dry Chemical Agent.
4. Vacuum any remaining Dry Chemical Agent from the inside bottom and sidewalls of the Agent Cylinder.
5. Inspect the Agent Cylinder and Agent Cylinder threads for any damage.

Valve Disassembly (See Figure 6.2.4.1.a):

6. Unscrew and remove Downtube from Agent Cylinder Valve using a 1 ½" open end wrench on hex section of Downtube.
7. Using a 5/16" open end wrench to hold the Valve Stem Cup on bottom, carefully remove the Valve Stem (P/N 10095) by unscrewing the Valve Stem Screw (P/N 10732) on top using a 1/8 inch hex wrench. Use caution, as the Valve Stem Screw and Washer are spring loaded.
8. Inspect and clean the Spring (P/N 10097), Valve Stem Screw (P/N 10732), and Washer (P/N 10102). Replace any damaged components.
9. Remove and discard Valve Stem. Replace with a new Valve Stem (P/N 10095).
10. Clean and rinse entire Agent Cylinder Valve with water and dry all parts.

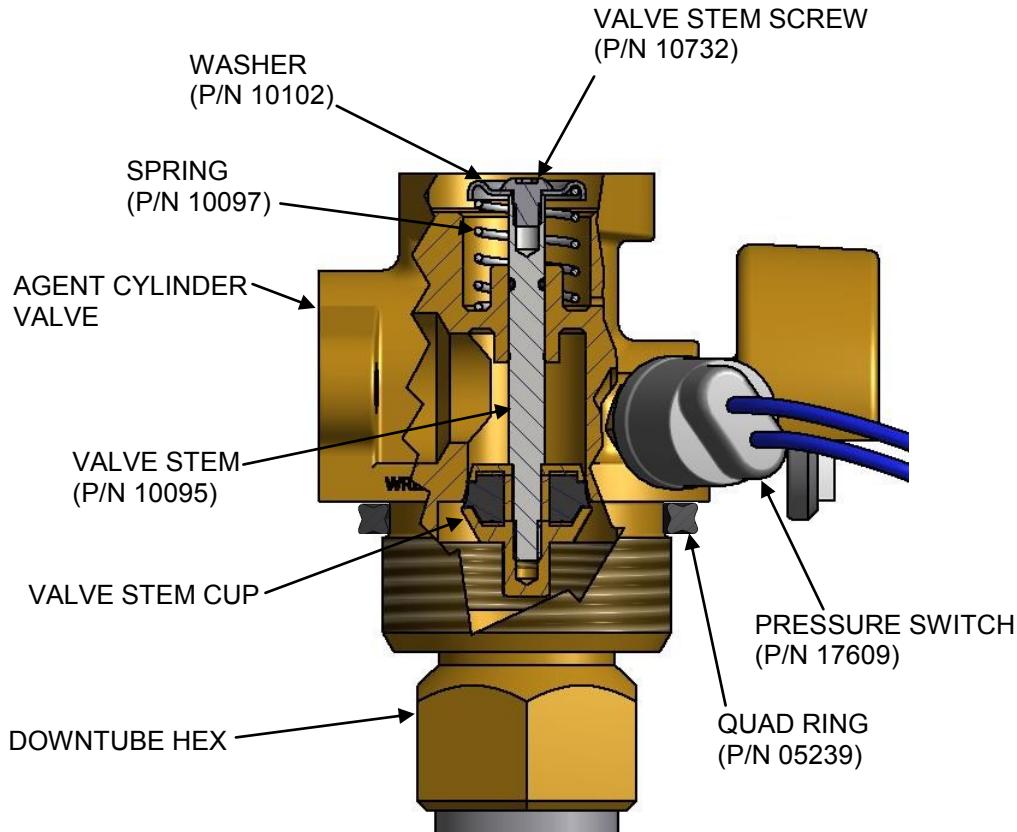


Figure 6.2.4.1.a

11. Inspect all external components of the Agent Cylinder Valve including the Pressure Gauge (P/N 08714), Gauge Guard (P/N 08680), Pressure Switch (P/N 17609), and Rupture Disc (P/N 15609) (See Figure 6.2.4.1.b). If any components are damaged, remove and replace. Seal threads with a 24 hour epoxy.

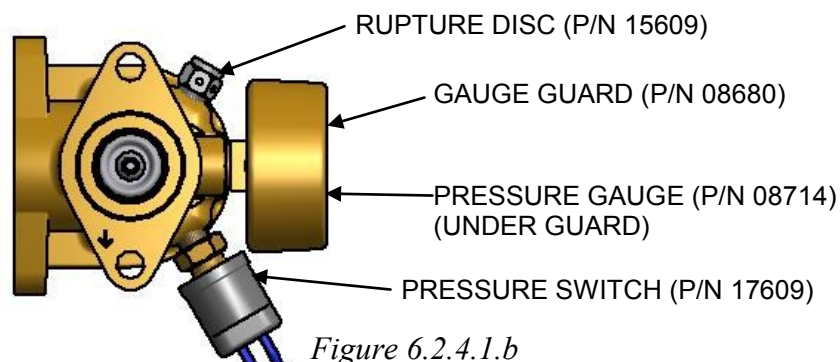


Figure 6.2.4.1.b

Valve Reassembly:

12. On new Valve Stem (P/N 10095), lubricate the small O-ring with Visilox (P/N L0172) or equivalent silicone style lubricant (See Figure 6.2.4.1.c).

**WARNING: Do not lubricate the Valve Stem seal!**

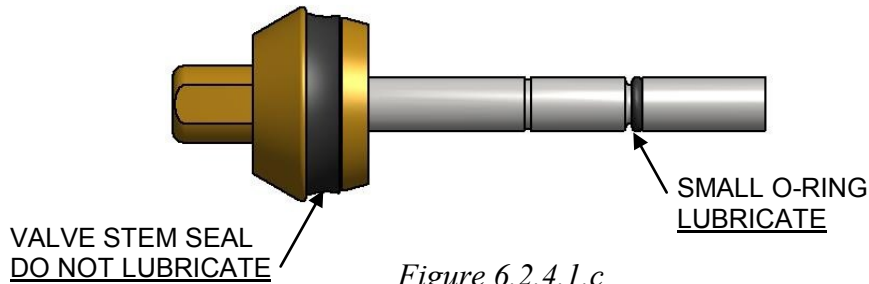


Figure 6.2.4.1.c

13. Reinstall Valve Stem, Spring (P/N 10097) and Washer (P/N 10102) (See Figure 6.2.4.1.a). Apply one drop of medium grade thread locking compound to Screw threads (P/N 10732). Compress washer well below top of Agent Cylinder Valve while holding the bottom of the Valve Stem Cup with a 5/16" open end wrench and install Valve Stem Screw using a 1/8 inch hex wrench. Release spring and washer and torque Valve Stem Screw securely to 25 in-lbs. Press down on the stem assembly verifying that it travels freely to open/close the Agent Cylinder Valve.

14. Reinstall Downtube into Agent Cylinder Valve:

- A. For Vertical Agent Cylinder Downtubes (See Section 2.1.1), apply medium grade thread locking compound to Downtube retainer threads. Thread the Downtube retainer into the valve and torque to 75 ft-lbs.
- B. For Horizontal Agent Cylinder Downtubes (See Section 2.1.2), apply medium grade thread locking compound to Downtube retainer threads. Thread the Downtube retainer into the Agent Cylinder Valve and torque to 130 ft-lbs. Alignment of down tube and Agent Cylinder Valve must be as shown (See Figure 6.2.4.1.d) with pickup opening facing away from the green pie area in Pressure Gauge, and Downtube alignment arrows (stamped on side of Downtube and under valve discharge opening) pointing to each other. If Downtube and valve alignment is not correct, loosen Downtube nut, realign down tube as specified, and retighten Downtube nut into Downtube retainer to 120 ft-lbs.

15. Remove Quad Ring (P/N 05239) and replace with a new one. Lubricate the Quad Ring with Visilox (P/N L0172) or equivalent silicone style lubricant (See Figure 6.2.4.1.a).

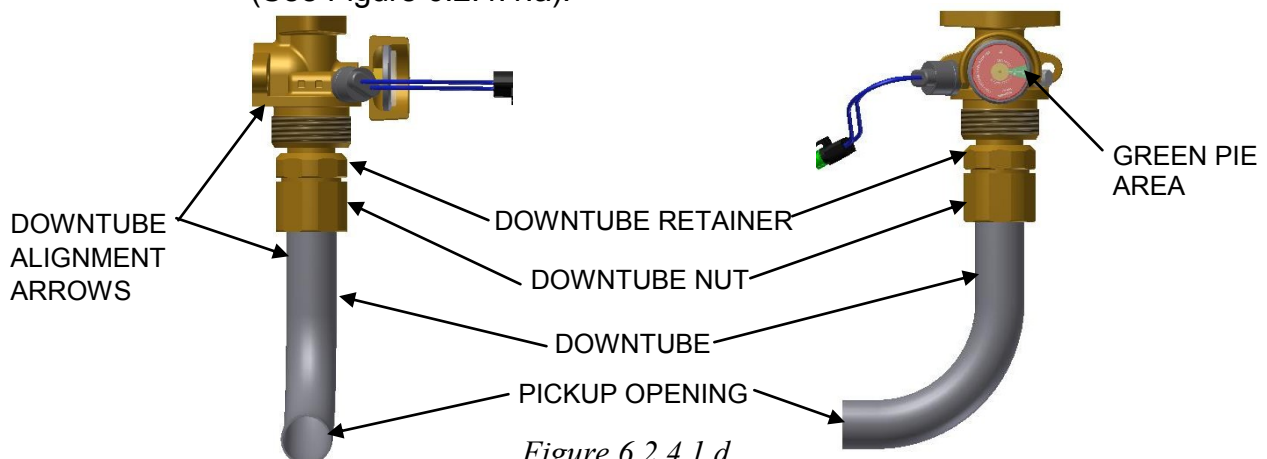


Figure 6.2.4.1.d

### 6.2.4.2 Agent Cylinder Valve Removal & Cleaning, V150/V250 Agent Cylinder

**WARNING! Check the pressure gauge and tank weight to verify the tank is empty and at atmospheric pressure before attempting to remove the Agent Cylinder Valve. Failure to comply could result in personal injury or death from violent tank movement!**

The V150/V250 Recharge Kit Assembly (P/N 23009) will be required for recharge of the V150 or V250 Agent Cylinder Valve.

#### Valve Removal:

1. If pressure remains in Agent Cylinder, the Agent Cylinder must be secured to a horizontal surface using the 8 bolts and Foot Ring (See Section 4.4.4).
2. Leave the Protective Cap (P/N 17990) and Anti-Recoil Plug (P/N 17559) installed on top of the Agent Cylinder Valve.
3. **Do not depress the Valve Core Stem located on top of the Agent Cylinder Valve!** Relieve any pressure from the Agent Cylinder by removing the Schrader Valve Cap and depressing the Schrader Valve (P/N 07309) located on the side of the valve (See Figure 6.2.4.2.a).
4. After all pressure in the Agent Cylinder is relieved, slowly remove the Anti-Recoil Plug (P/N 17559).
5. Install a 1 1/4" I.D. by approximately 12" long NPT nipple into the Agent Cylinder Valve outlet in place of Anti-Recoil Plug (See Figure 6.2.4.2.a).
6. Using a mallet or hammer to strike the pipe nipple, unscrew the Agent Cylinder Valve counterclockwise until loosened from the Agent Cylinder.
7. Remove the Fill Cap and discard Fill Cap O-Ring (a new one will be supplied with V150/V250 Recharge Kit (P/N 23009) (See Figure 6.2.6.2).
8. Empty the Agent Cylinder of any remaining Dry Chemical Agent. Vacuum any remaining Dry Chemical from the inside bottom and sidewalls of the Agent Cylinder.
9. Inspect the Agent Cylinder and Agent Cylinder threads for any damage. If damaged, replace entire Agent Cylinder.

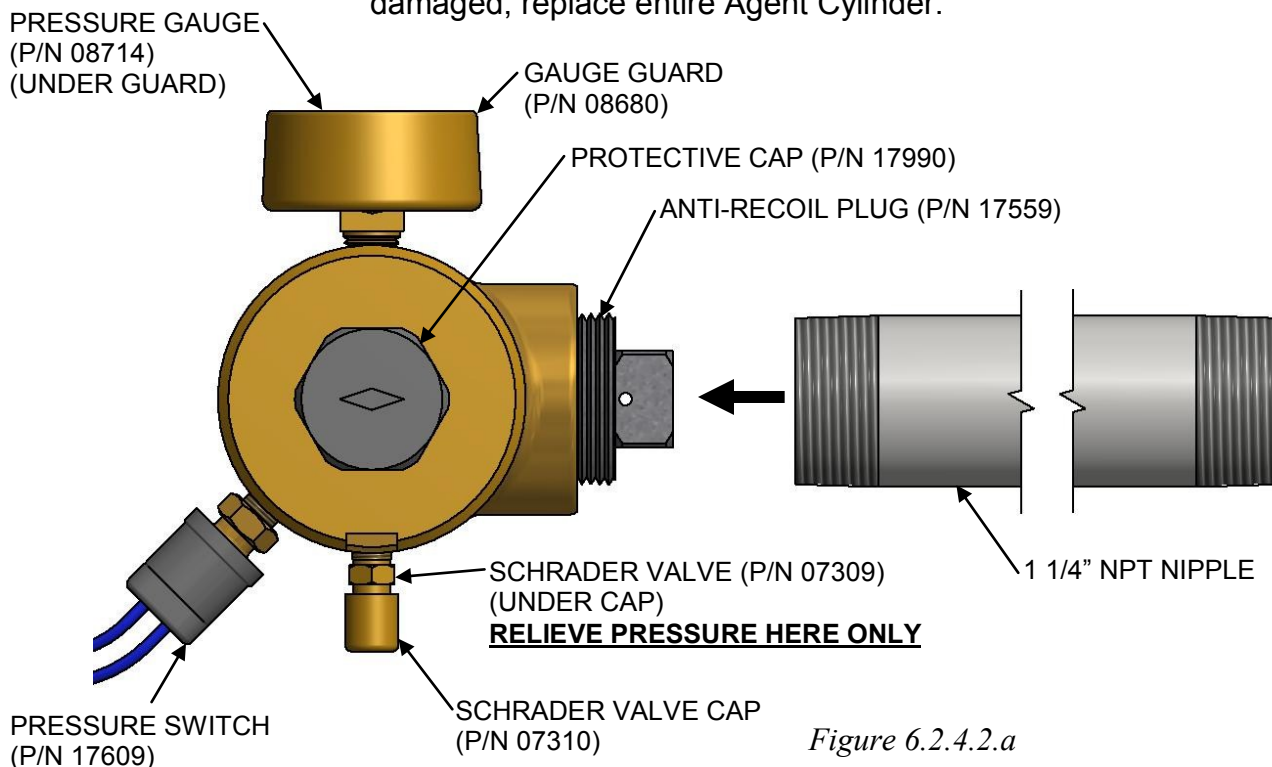


Figure 6.2.4.2.a



Valve Disassembly:

10. Remove and discard the Collar O-Ring (See Figure 6.2.4.2.b).
11. Remove Protective Cap (P/N 17990) from top of Agent Cylinder Valve. Unscrew and remove the Top Cap using a spanner wrench. Remove and discard Top Cap O-Ring (See Figure 6.2.4.2.b).
12. Remove and discard the Valve Core from the Top Cap using a Schrader valve removal tool (See Figure 6.2.4.2.d).
13. Slide the Piston Assembly up and out of the top of the Agent Cylinder Valve body using the (2) 8-32 threaded rods supplied in V150/V250 Recharge Kit (P/N 23009). The Piston Assembly has two female 8-32 threaded holes into which the rods can be threaded (See Figure 6.2.4.2.c). Discard the entire Piston Assembly.
14. If any Agent Cylinder pressure was relieved through the Schrader Valve (P/N 07309) from step 3, replace Schrader Valve (See Figure 6.2.4.2.a). Seal threads with a 24 hour epoxy.
15. Inspect all external components of the valve including the Pressure Gauge (P/N 08714), Gauge Guard (P/N 08680), Pressure Switch (P/N 17609), and Schrader Valve (P/N 07309) (See Figure 6.2.4.2.a). If any components are damaged, remove and replace. Seal threads with a 24 hour epoxy.
16. Clean all internal valve surfaces using caution not to scratch or nick the internal surfaces (See Figure 6.2.4.2.e). Remove any Dry Chemical Agent or lubricant residue from all internal surfaces.

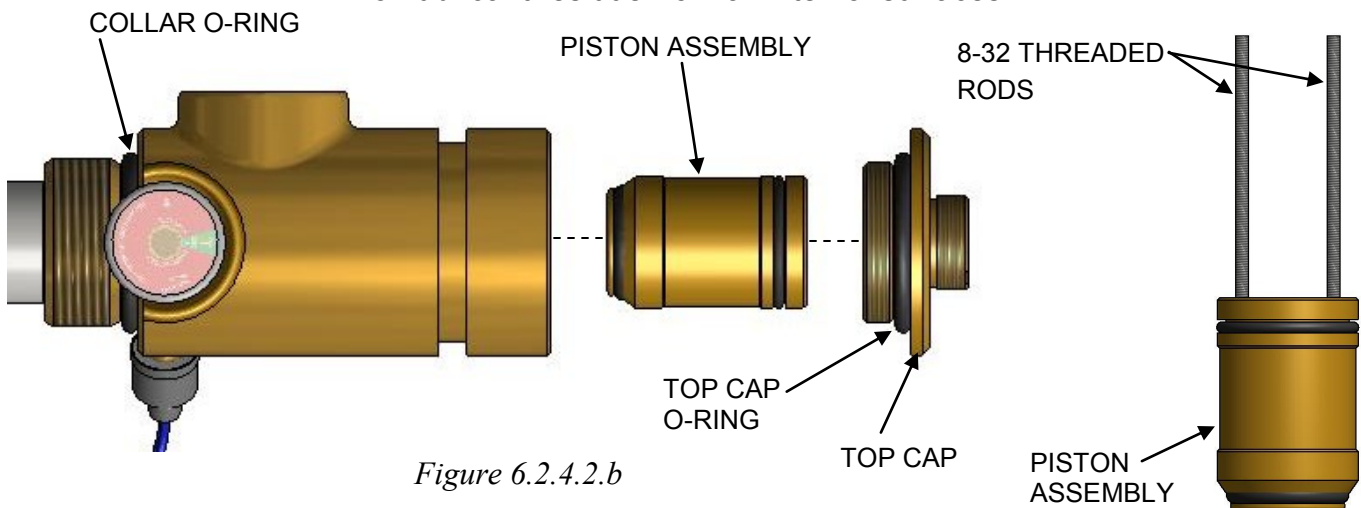


Figure 6.2.4.2.b

Figure 6.2.4.2.c

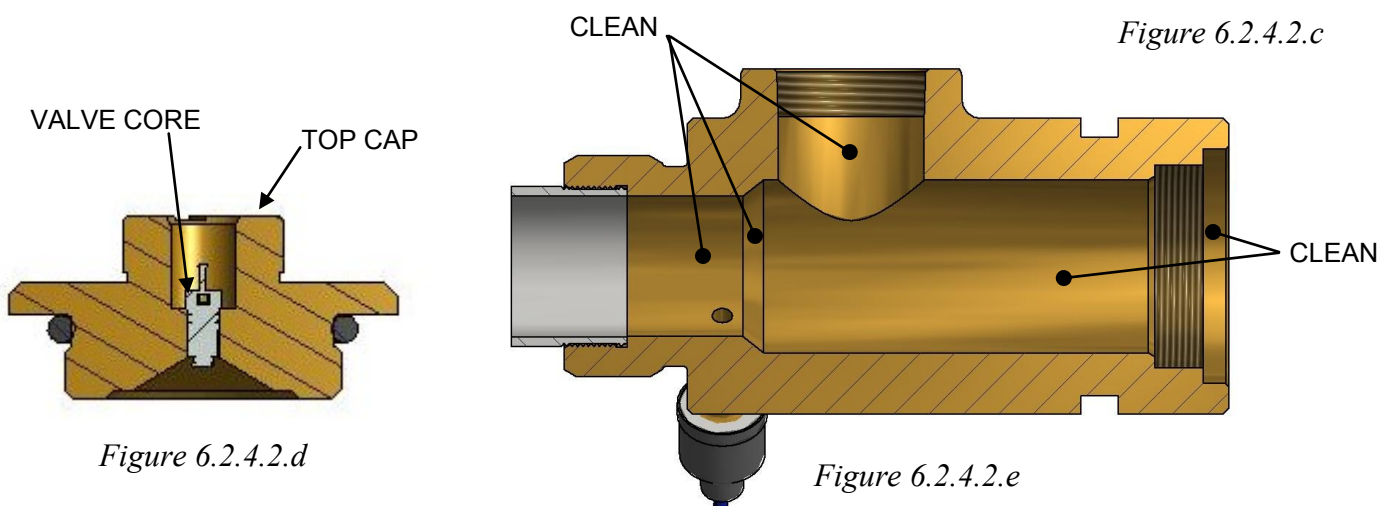


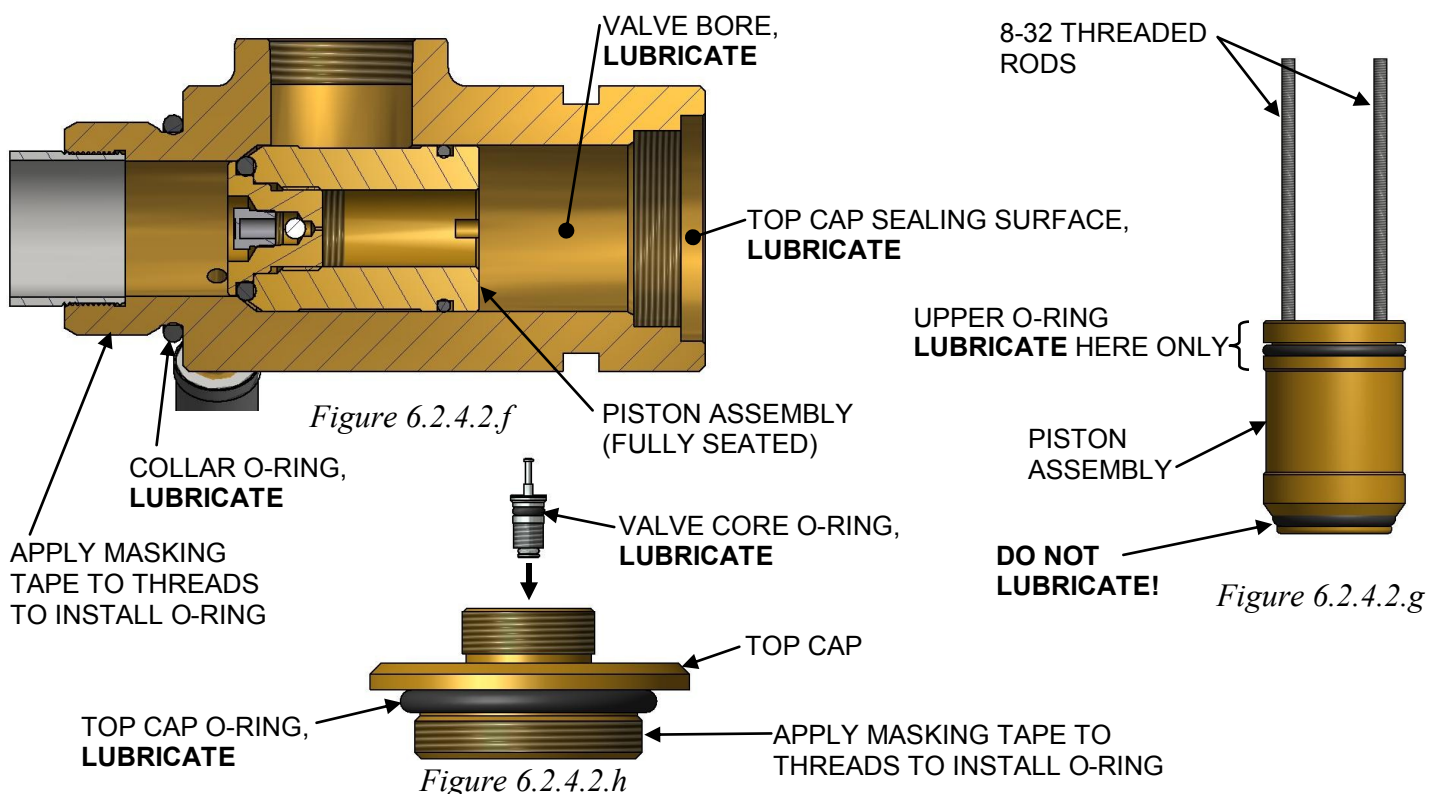
Figure 6.2.4.2.d

Figure 6.2.4.2.e

Valve Reassembly:

**All parts required for valve reassembly are supplied in a V150/V250 Recharge Kit (P/N 23009) including O-Rings, Piston Assembly, and Valve Core.**

17. Lightly lubricate the new upper Piston Assembly O-Ring and piston top with Dow Corning No. 4 or equivalent as shown. Use the (2) 8-32 threaded rods also included in the V150/V250 Recharge Kit to hold the Piston Assembly for lubrication (See Figure 6.2.4.2.g). **DO NOT lubricate the bottom O-Ring!**
18. Holding the (2) threaded rods from the previous step, insert Piston Assembly into the top of Agent Cylinder Valve body pushing it all the way down to the Agent Cylinder Valve sealing surface, which is the fully seated position. (See Figure 6.2.4.2.f).
19. Lightly but thoroughly lubricate internal Agent Cylinder Valve bore above the Piston Assembly and Top Cap sealing surface (See Figure 6.2.4.2.f).
20. Lightly lubricate the upper, larger Valve Core O-ring. Install the new Valve Core into the Top Cap and torque to 5 inch-pounds (See Figure 6.2.4.2.h).
21. Lightly lubricate new Top Cap O-Ring with Dow Corning No. 4 or equivalent. Install O-Ring on Top Cap. To prevent damage during installation, use masking tape on threads of the Top Cap. After O-Ring is in place, remove masking tape and clean threads (See Figure 6.2.4.2.h).
22. Carefully thread the Top Cap into the Agent Cylinder Valve and tighten securely using a spanner wrench.
23. Lightly lubricate new Collar O-ring with Dow Corning No. 4 or equivalent. Install Collar O-Ring. To prevent damage during installation, use masking tape on threads of the Agent Cylinder Valve collar. After O-Ring is in place, remove masking tape and clean Agent Cylinder Valve collar threads (See Figure 6.2.4.2.f).
24. Reinstall the Protective Cap (P/N 17990) on Top Cap.



### **6.2.5 Agent Cylinder Refill**

**DO NOT MIX FIRE SUPPRESSION AGENTS WITH EACH OTHER OR WITH ANY OTHER AGENTS OR CHEMICALS! FAILURE TO FOLLOW THESE GUIDELINES COULD RESULT IN ADVERSE SYSTEM PERFORMANCE, PROPERTY DAMAGE, SERIOUS BODILY INJURY AND POSSIBLE DEATH! CONSULT MATERIAL SAFETY DATA SHEET (MSDS) FOUND ON AMEREX WEBSITE WWW.AMEREX-FIRE.COM FOR THE PARTICULAR AGENT BEING USED.**

After completely emptying and vacuuming the Agent Cylinder (See Section 6.2.4), fill the Agent Cylinder with the appropriate volume of Dry Chemical Agent (See Table 2.1.1 and 2.1.2). Fill only with amount shown in these tables! ABC Dry Chemical Recharge Pail (P/N 09781) and Purple K Recharge Pail (P/N 04214) are approximately 50 pounds each in weight and should be used for Agent Cylinder refill. Filling operation depends on the type of Agent Cylinder used:

- Vertical Agent Cylinders (See Figure 2.1.1.a): Vertical Agent Cylinders must be filled through the Agent Cylinder Collar.
- Horizontal Agent Cylinders (See Figure 2.1.2): Agent Cylinders must have the Agent Cylinder Valve installed prior to refill. Perform step 1 of Section 6.2.6.1 prior to refill. Horizontal Agent Cylinders must be filled through the Fill Port on opposite side of Agent Cylinder (See Figure 2.1.2). After refilling Agent Cylinder with the appropriate amount of Dry Chemical, clean any residual Dry Chemical from the Fill Port. Reinstall brass Fill Cap (P/N 13700) in Fill Port. Ensure that a new, lubricated Quad Ring (P/N 05239) is in place on Fill Cap. Torque Fill Cap to 30-40 ft-lbs.
- V150/V250 Agent Cylinders (See Figure 2.1.1.b): Agent Cylinders must have the Agent Cylinder Valve installed prior to refill. Perform step 1 of Section 6.2.6.2 prior to refill. The V150 and V250 Agent Cylinder can be filled through the Fill Port (See Figure 6.2.6.2).

### **6.2.6 Agent Cylinder Valve Installation & Agent Cylinder Charging**

Reference the appropriate subsection for Agent Cylinder Valve installation and Agent Cylinder charging instructions.

#### **6.2.6.1 Agent Cylinder Valve Installation & Agent Cylinder Charging, V13 thru VSR75 Agent Cylinder**

1. Clean any residual Dry Chemical from the Agent Cylinder Collar. Reinstall the reworked and assembled Agent Cylinder Valve into the Agent Cylinder with use of the 2 ½" Pump Wrench. Ensure that a new, lubricated Quad Ring (P/N 05239) is in place on bottom of Agent Cylinder Valve. Torque Agent Cylinder Valve to 30-40 ft-lbs.
2. Remove the Anti-Recoil Plate (P/N 10646) from the Agent Cylinder Valve discharge port (See Figure 2.1.a). Attach the Recharge Adapter (P/N 10136) in its place using same bolts/nuts (See Figure 6.1.1).
3. Remove the Shipping Plate (P/N 10099) from the top of the Agent Cylinder Valve (See Figure 2.1.a). Attach the Tee Handle (P/N 10134) in its place using same bolts/nuts (See Figure 6.1.5).

4. Connect the Recharge Adapter to a regulated source of nitrogen. Depress the Valve Stem by pulling the Tee Handle down into its locked position. Pressurize Agent Cylinder with a regulated nitrogen source to 350 psi (2413 kPa) @ 70°F. Confirm proper pressurization by using a calibrated pressure gauge on the low pressure side of the pressure regulator. Verify that the valve Pressure Gauge is reading in the green pie. After correct pressure is reached, raise the Tee Handle, closing the Agent Cylinder Valve. Relieve the pressure in the nitrogen source and disconnect the nitrogen source from the Recharge Adapter. Remove the Recharge Adapter and Tee Handle from the Agent Cylinder Valve.
5. Use leak detect fluid to check for any leaks.
6. Reinstall Shipping Plate and Anti-Recoil Plate (See Figure 2.1.a) until the Agent Cylinder can be placed back into service.

#### **6.2.6.2 Agent Cylinder Valve Installation & Agent Cylinder Charging, V150/V250 Agent Cylinder** (See Figure 6.2.6.2)

1. Clean any residual Dry Chemical from the Valve Collar and lubricate the Valve O-Ring groove with Dow Corning No. 4 or equivalent lubricant. Reinstall the reworked, assembled Agent Cylinder Valve into the Agent Cylinder. Ensure that a new, lubricated Collar O-Ring is in place on bottom of Agent Cylinder Valve. Torque Agent Cylinder Valve to 40 ft-lbs.
2. After refilling the V150 or V250 Agent Cylinder with the appropriate amount of Dry Chemical, clean any residual Dry Chemical from the Fill Port and lubricate O-Ring groove with Dow Corning No. 4 or equivalent lubricant.
3. Lightly lubricate new Fill Cap O-Ring included in V150/V250 Recharge Kit (P/N 23009) with Dow Corning No. 4 or equivalent. Install new Fill Cap O-Ring on Fill Cap. To prevent damage during installation, use masking tape on threads of the Fill Cap. After O-Ring is in place, remove masking tape and clean Fill Cap threads.
4. Install Fill Cap into Fill Port and torque securely.

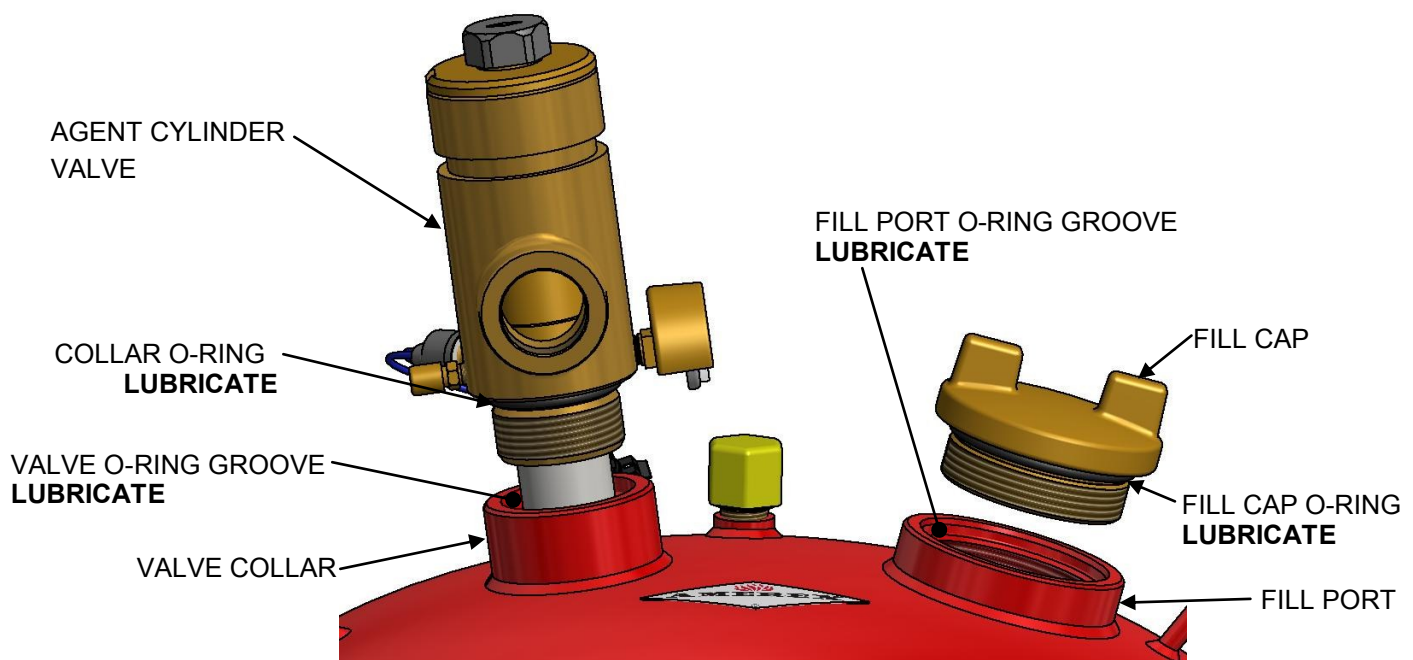


Figure 6.2.6.2

5. Install a 1 1/4" NPT plug in the discharge outlet of the Agent Cylinder Valve and tighten securely.
  6. Remove Protective Cap (P/N 17990) from top of Agent Cylinder Valve and replace with V150/V250 Recharge Adapter (P/N 23065). Torque to hand tight.
  7. Connect the V150/V250 Recharge Adapter to a regulated source of nitrogen. Pressurize Agent Cylinder with a regulated nitrogen source to 350 psi (2413 kPa) @ 70°F. Confirm proper pressurization by using a calibrated pressure gauge on the low pressure side of the pressure regulator. Verify that the valve Pressure Gauge is reading in the green pie. After correct pressure is reached, relieve pressure in the nitrogen source and disconnect the nitrogen source from V150/V250 Recharge Adapter.
  8. Remove the V150/V250 Recharge Adapter from the top of Agent Cylinder Valve and replace with Protective Cap (P/N 17990). Tighten securely.  
**WARNING: Do not depress Valve Core Stem located under Protective Cap, as a system discharge will occur (See Figure 4.6.4.a)! Ensure Protective Cap is in place and tightened securely before proceeding.**
  9. SLOWLY AND CAREFULLY remove the 1 1/4" NPT plug from the Agent Cylinder Valve discharge port, ensuring that the Agent Cylinder Valve is closed with no leakage from the discharge port. Reinstall Anti-Recoil Plug (P/N 17559) in its place and tighten securely.
  10. Use leak detect fluid to check for any leaks.
- Protective Cap and Anti-Recoil Plug must be in place until Agent Cylinder can be placed back into service.**

### **6.2.7 Actuator Removal & Cleaning**

For systems using a Pneumatic Actuation Network with a Manual Actuator (P/N 10210), Electric Nitrogen Actuator (P/N 20775), or Manual/Electric Actuator (P/N 23600), the actuator must be removed, disassembled, cleaned, and reassembled after each use.

#### **Actuator Removal (See Section 4.7.4):**

1. If using and Outdoor Nitrogen Bracket (P/N 10354) remove Bracket Cover by removing the (4) Bracket Screws using a 3/16" hex head wrench.
2. Slowly remove Nitrogen Cylinder (P/N 09956) from actuator, allowing any residual pressure to escape. See Section 6.2.9 for Nitrogen Cylinder recharge instructions.
3. Disconnect the Pneumatic Actuation Network from the nitrogen outlet port.
4. Remove the actuator from the Bracket Back by removing the (2) Mounting Screws (P/N 10573) using a 3/16" hex head wrench.

Reference the appropriate subsection for actuator disassembly, cleaning, and reassembly instructions:

#### **6.2.7.1 For Systems Using Manual Actuator (P/N 10210)**

##### **Actuator Disassembly (See Figure 6.2.7.1):**

5. Using a deep walled 1/2" socket to hold bottom of Puncture Stem Assembly (P/N 10259), unscrew the Palm Button (P/N 10205).
6. Remove the Dust Boot (P/N 09988) and Puncture Stem Assembly with O-ring (P/N 12616) and back-up O-ring (P/N 10208) from the Manual Actuator Body (P/N 10245). Remove Gasket (P/N 07247).

**Actuator Cleaning (See Figure 6.2.7.1):**

7. Inspect and clean the inner bore of Manual Actuator Body (P/N 10245). If any scarring or damage has occurred in the inner bore, replace the Manual Actuator Body.
8. Inspect and clean the Puncture Stem Assembly (P/N 10259). Replace the O-ring (P/N 12616) and back-up O-ring (P/N 10208) with new rings. These are included in the Actuator Rebuild Kit (P/N 10939). Lubricate both O-rings with Visilox (P/N L0172) or equivalent silicone style lubricant .
9. Inspect and clean the Dust Boot (P/N 09988) and Gasket (P/N 07247). Replace any damaged components.

**Actuator Reassembly (See Figure 6.2.7.1):**

10. Insert Puncture Stem Assembly (P/N 10259) into Manual Actuator Body (P/N 10245). Apply one drop of medium grade thread locking compound to the Stem threads and install Dust Boot (P/N 09988) and Palm Button (P/N 10205). Firmly torque the Palm Button to hand tight. Function test the assembly to verify it works properly.
11. Install the Gasket (P/N 07247) and Pull Pin (P/N 10993).

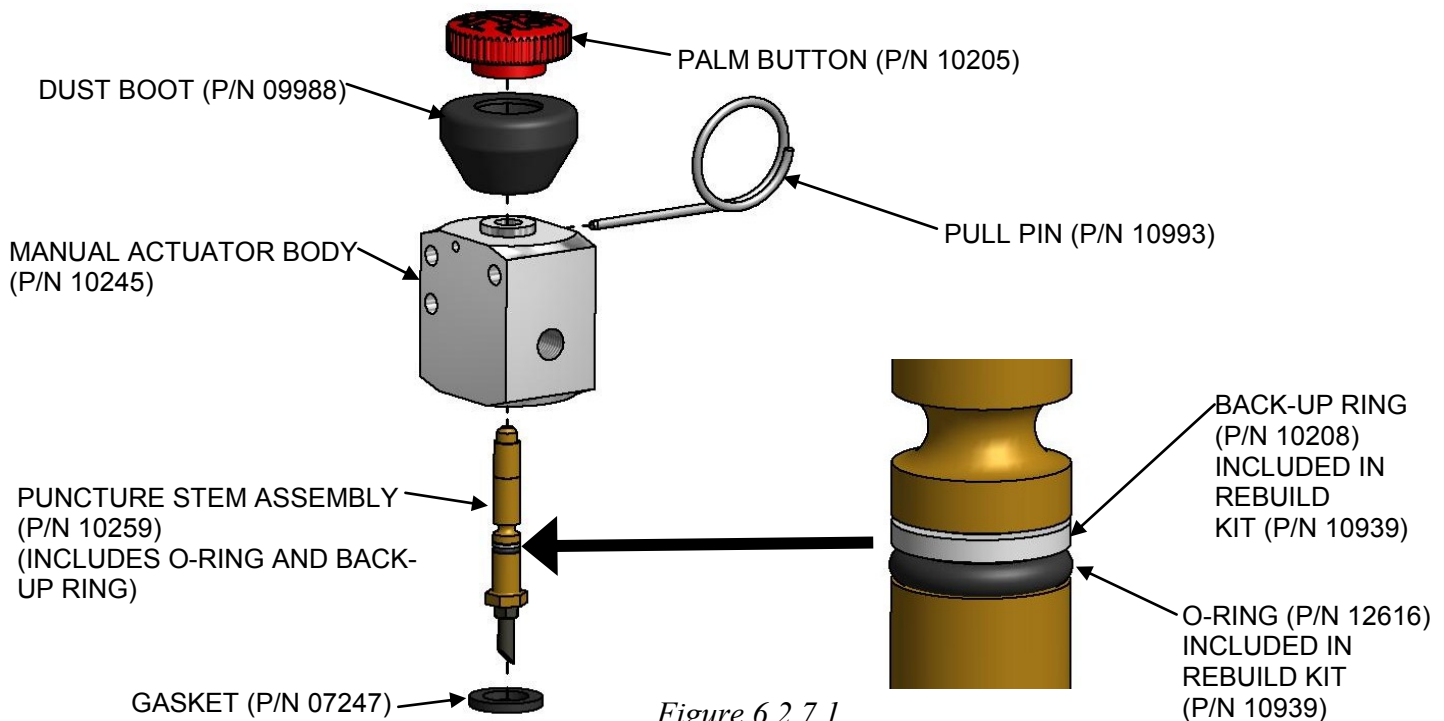


Figure 6.2.7.1

**6.2.7.2 For Systems Using Electric Nitrogen Actuator (P/N 20775)****Actuator Disassembly (See Figure 6.2.7.2):**

5. Remove spent Linear Actuator (P/N 22579 or 20500). Locate and discard the small stainless steel disc which was displaced from the end of the Linear Actuator upon actuation. It is normally found on top of the Puncture Stem Assembly.
6. Using an 1 1/8" wrench, remove the Adapter (P/N 20458) with O-ring (P/N 10513) from the top of the Actuator Body (P/N 20774).
7. Remove the Puncture Stem Assembly (P/N 22873) with O-ring (P/N 09989) and (2) back-up Rings (P/N 09993) from the Actuator Body (P/N 20774). Remove Spring (P/N 10097) and Gasket (P/N 07247).

Actuator Cleaning (See Figure 6.2.7.2):

8. Inspect and clean the inner bore of Actuator Body (P/N 20774). If any scarring or damage has occurred to inner bore, replace the Actuator Body.
9. Inspect and clean the Puncture Stem Assembly (P/N 22873). Replace the O-ring (P/N 09989) and (2) back-up Rings (P/N 09993) with new rings. These are included in the Actuator Rebuild Kit (P/N 10939). Lubricate O-rings with Visilox (P/N L0172) or equivalent silicone style lubricant .
10. Inspect and clean the Adapter (P/N 20458). Replace O-ring (P/N 10513) with a new one. This is also included in the Actuator Rebuild Kit (P/N 10939). Inspect and clean the Gasket (P/N 07247). Replace any damaged components.

Actuator Reassembly (See Figure 6.2.7.2):

11. Insert Spring (P/N 10097) then Puncture Stem Assembly (P/N 22873) into Actuator Body (P/N 20774). Install the Adapter (P/N 20458) with O-ring (P/N 10513) and torque to 50 ft-lbs. Function test the assembly using a Philips head screw driver inserted through the Linear Actuator port in the Adapter to verify it works properly.
12. Install the Gasket (P/N 07247).

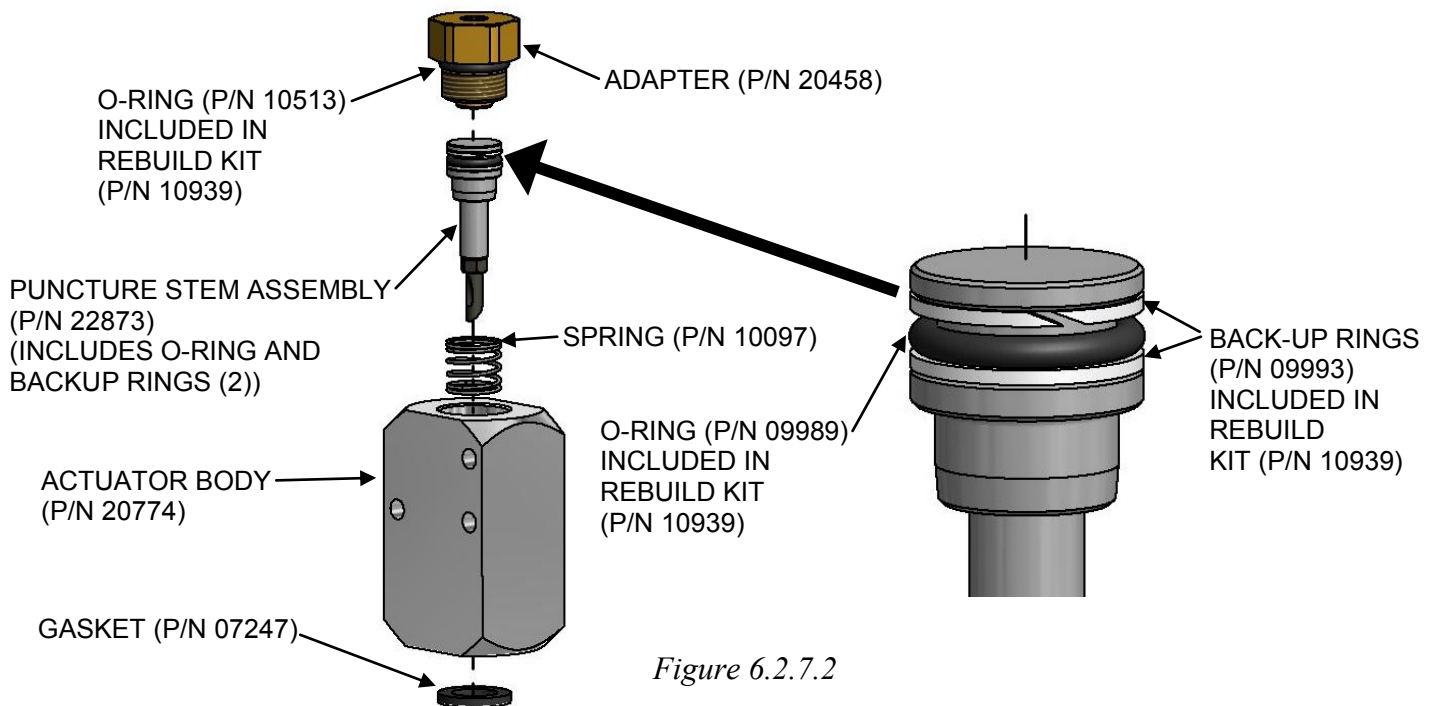


Figure 6.2.7.2

**6.2.7.3 For Systems Using Manual/Electric Actuator (P/N 23600)**

A rebuild kit is available (P/N 23761) which includes a replacement Puncture Stem Assembly and replacement O-rings used in the actuator. **Replacement of the Puncture Stem Assembly is required after each use.**

Actuator Disassembly (See Figure 4.7.4.c & 6.2.7.3):

5. Loosen Set Screw (P/N 23607) on Upper Piston (P/N 23601) and unscrew Upper Piston from Lower Piston (P/N 23602). Unscrew Linear Actuator from Lower Piston. If the Linear Actuator (P/N 22579 or 20500) was used for actuation, it must be replaced. Locate and discard the small stainless steel disc which was displaced from the end of the Linear Actuator upon actuation. It is normally found on top of the Puncture Stem Assembly.

6. Using an 1 1/2" wrench, remove the Adapter (P/N 23598) with O-ring (P/N 11260) from the top of the Actuator Body (P/N 23596).
7. Remove and discard the Puncture Stem Assembly (P/N 23761) from the Actuator Body (P/N 23596). Remove Spring (P/N 10097) and remove Gasket (P/N 07247) from the opposite side of the Actuator Body.

Actuator Cleaning (See Figure 6.2.7.3):

8. Inspect and clean the inner bore of Actuator Body (P/N 23596). If any scarring or damage has occurred to inner bore, replace the Actuator Body.
9. Inspect and clean the Adapter (P/N 23598) and replace O-ring (P/N 11260) with a new one from kit (P/N 23761). Lubricate O-ring with Visilox (P/N L0172) or equivalent silicone style lubricant .
10. Inspect and clean the Upper and Lower Piston. Replace O-ring (P/N 09989) on Lower Piston with a new one from kit (P/N 23761). Lubricate O-ring with Visilox (P/N L0172) or equivalent silicone style lubricant .
11. Replace the Gasket (P/N 07247). Replace any damaged components.

Actuator Reassembly (See Figure 6.2.7.3):

12. Locate new Puncture Stem Assembly with O-ring (P/N 09989) and (2) back-up Rings (P/N 09993) from kit (P/N 23761). Lubricate O-rings with Visilox (P/N L0172) or equivalent silicone style lubricant. Lubricate inner bore of Actuator Body (P/N 23596) and Adapter (P/N 23598).
13. Insert Spring (P/N 10097) then Puncture Stem Assembly (P/N 23761) into Actuator Body (P/N 23598) being careful not to pinch back-up O-rings on Puncture Stem Assembly. Install the Lower Piston (P/N 23602) into Adapter (P/N 23598). Install Adapter into Actuator Body and torque to 50 ft -lbs. Function test the assembly by pressing the Lower Piston into the Actuator Body to verify it works properly and returns to original position.
14. Install Linear Actuator and Upper Piston (See Section 4.7.4).

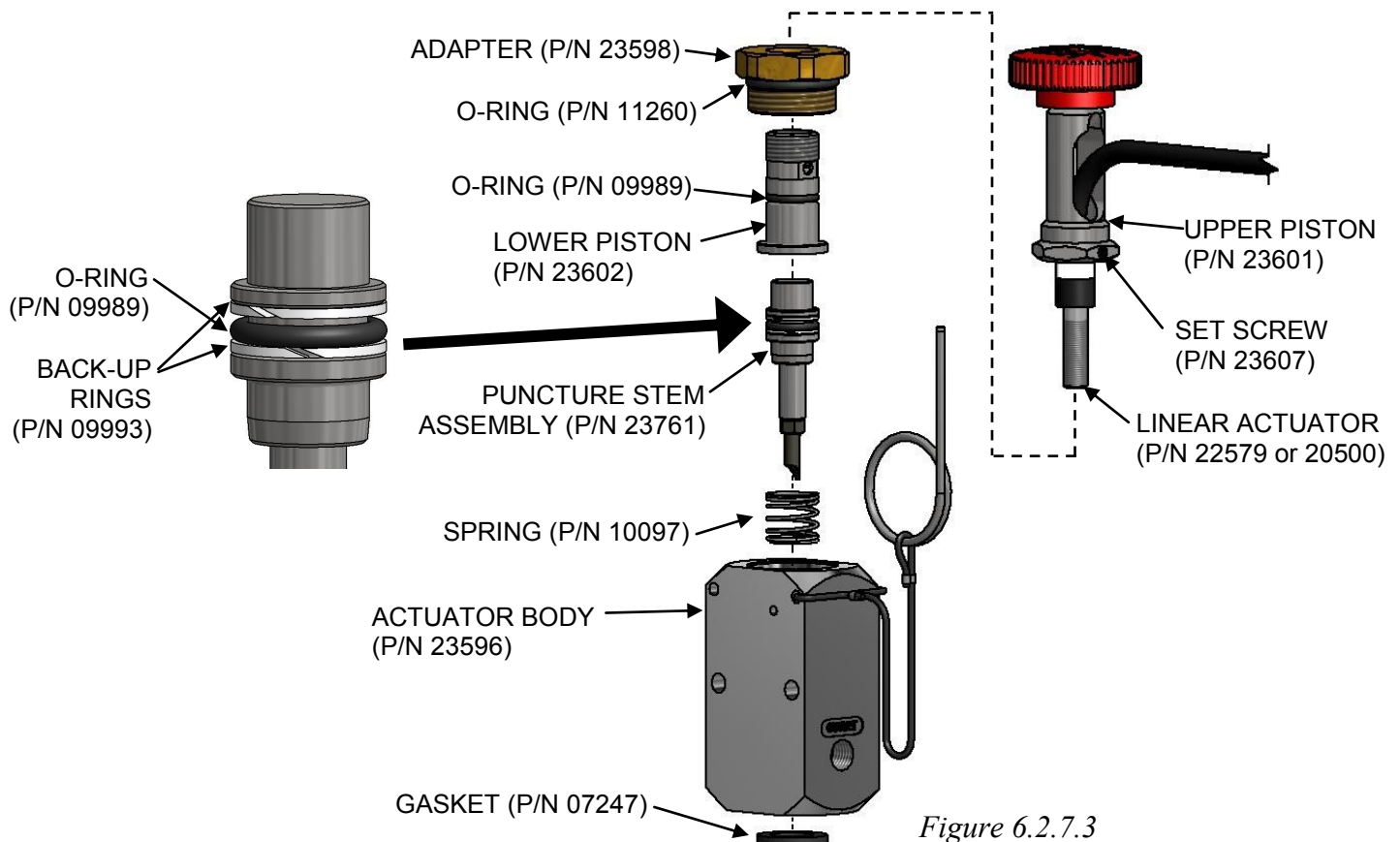


Figure 6.2.7.3



### **6.2.8 Pneumatic Actuation Network Testing**

For systems using a Pneumatic Actuation Network, perform the following steps. After connecting all control heads and actuators to the Pneumatic Actuation Network, the network must be tested for functionality and leaks. If multiple actuators are used along with Check Valves, each actuator and independent leg of the Pneumatic Actuation Network must be tested separately.

- 1. Before proceeding, all control heads must be removed from Agent Cylinders, and all Nitrogen Cylinders must be removed from actuators. Disconnect the electrical connector for any 100 PSI Pressure Switches.**
2. Install the Actuation Network Test Adapter (P/N 10895) into the actuator body in place of the Nitrogen Cylinder (See Figure 6.1.7).
3. Pressurize the Pneumatic Actuation Network through the Actuation Network Test Adapter using dry air or nitrogen at 80-90 psi (551-620 kPa).
4. Verify that each piston in each control head actuates. Pistons equipped with a Locking Plunger should lock in the open or actuated position.
5. Verify that each component and connection in the Pneumatic Actuation Network has no leaks.
6. To relieve pressure in the Pneumatic Actuation Network, unseat the Vent Check(s) (P/N 10173) on the control head(s). After all pressure is relieved, reinstall Vent Check.
7. Reset all control head pistons to their fully recessed positions. If equipped, depress the Spring Plungers per Section 6.2.1.
8. If multiple actuators are used in a Pneumatic Actuation Network, repeat steps 2 through 7 for each actuator.
9. After verifying that all components are functioning properly and no leaks are present, reinstall control heads on Agent Cylinders per Sections 4.6.3 thru 4.6.6 and Nitrogen Cylinders in actuators per Section 4.7.4. Reconnect the electrical connector for any 100 PSI Pressure Switches per Section 4.7.2.

### **6.2.9 Nitrogen Cylinder Recharge**

**WARNING: NITROGEN CYLINDERS OPERATE AT EXTREMELY HIGH PRESSURE (1800 psi). HANDLE WITH EXTREME CAUTION. PERFORM ALL RECHARGING WITH NITROGEN CYLINDER CONTAINED INSIDE A SUITABLE SAFETY CAGE**

1. Slowly remove Nitrogen Cylinder(s) (P/N 09956) from actuator as described in Section 6.2.7.1, 6.2.7.2 or 6.2.7.3, allowing any residual pressure to escape. Install shipping cap(s) on Nitrogen Cylinder(s).
2. Clean Nitrogen Cylinder(s) to remove dirt, grease, and foreign material (use mild soap and water for cleaning process, no harsh solvents). Verify that the nameplate for each Nitrogen Cylinder is in place and fully legible. Inspect the Nitrogen Cylinders for corrosion, abrasion, or dents. Relieve any pressure and discard if integrity of the Nitrogen Cylinder has been compromised.

- Remove old Rupture Disc (P/N 10712) and discard by fully screwing the Nitrogen Cylinder into a Nitrogen Cylinder Recharge Adapter (P/N 10270) (See Figure 6.2.9.a). Hold Nitrogen Cylinder in place using a 1-1/8 inch wrench on the Nitrogen Cylinder hex fitting. Loosen Rupture Disc by turning the recharge adapter wrench 1/4 turn counterclockwise. On Nitrogen Cylinders that have not been actuated and still have Rupture Disc intact, a technician must carefully allow residual pressure to vent. Unscrew cylinder from the Recharge Adapter. Unscrew old rupture disc assembly and discard (See Figure 6.2.9.b).

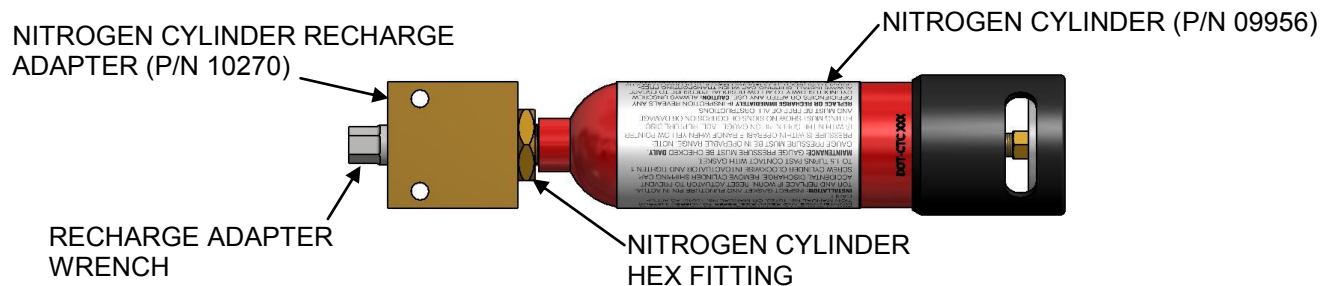


Figure 6.2.9.a

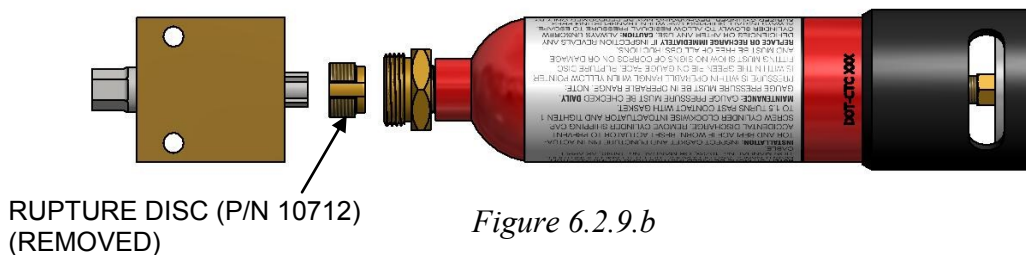


Figure 6.2.9.b

- Inspect sealing seat on Nitrogen Cylinder hex fitting. Discard Nitrogen Cylinder if seat is damaged (See Figure 6.2.9.c)

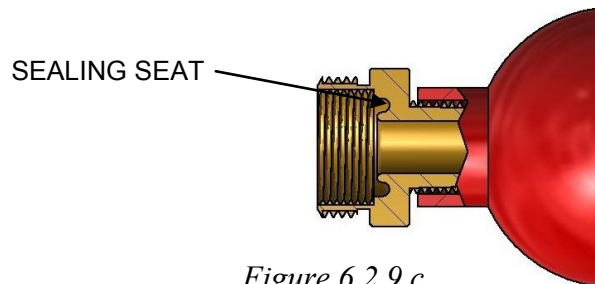
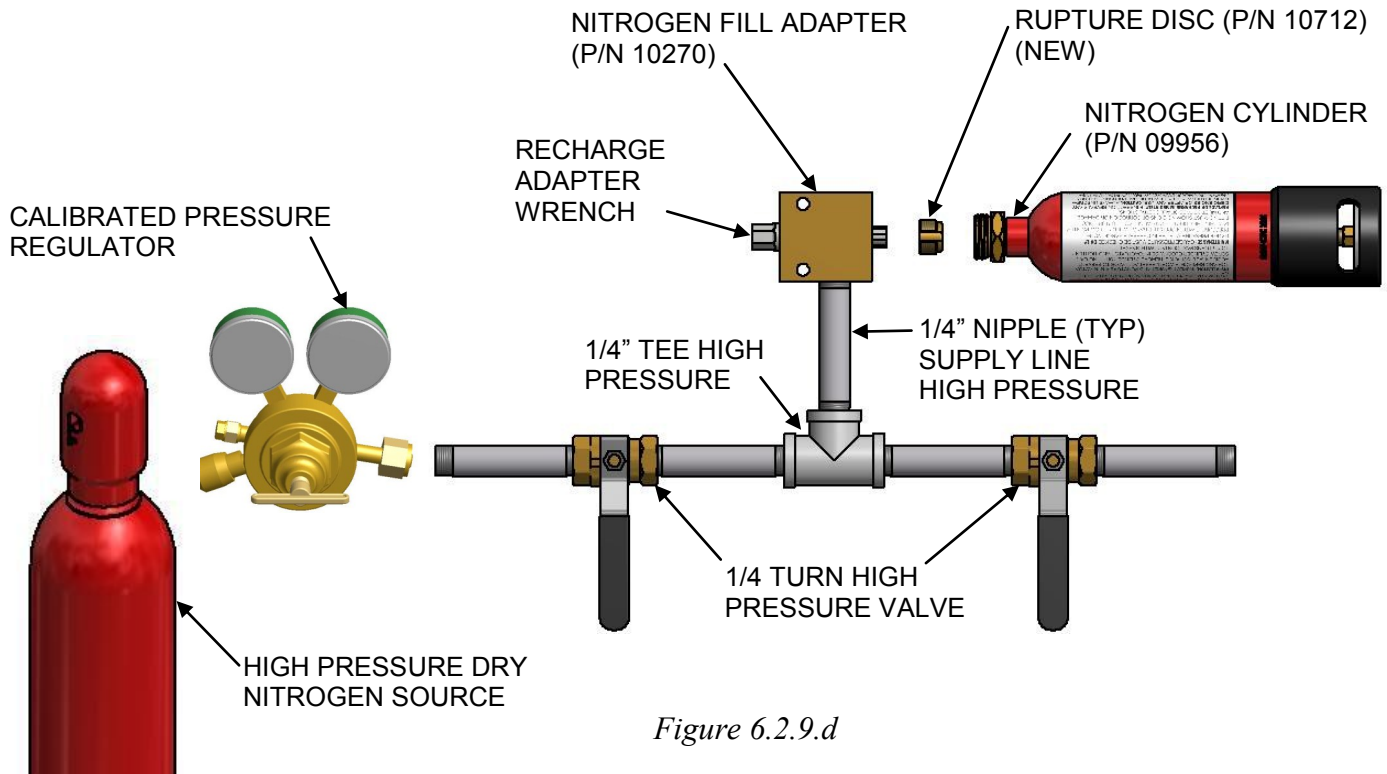
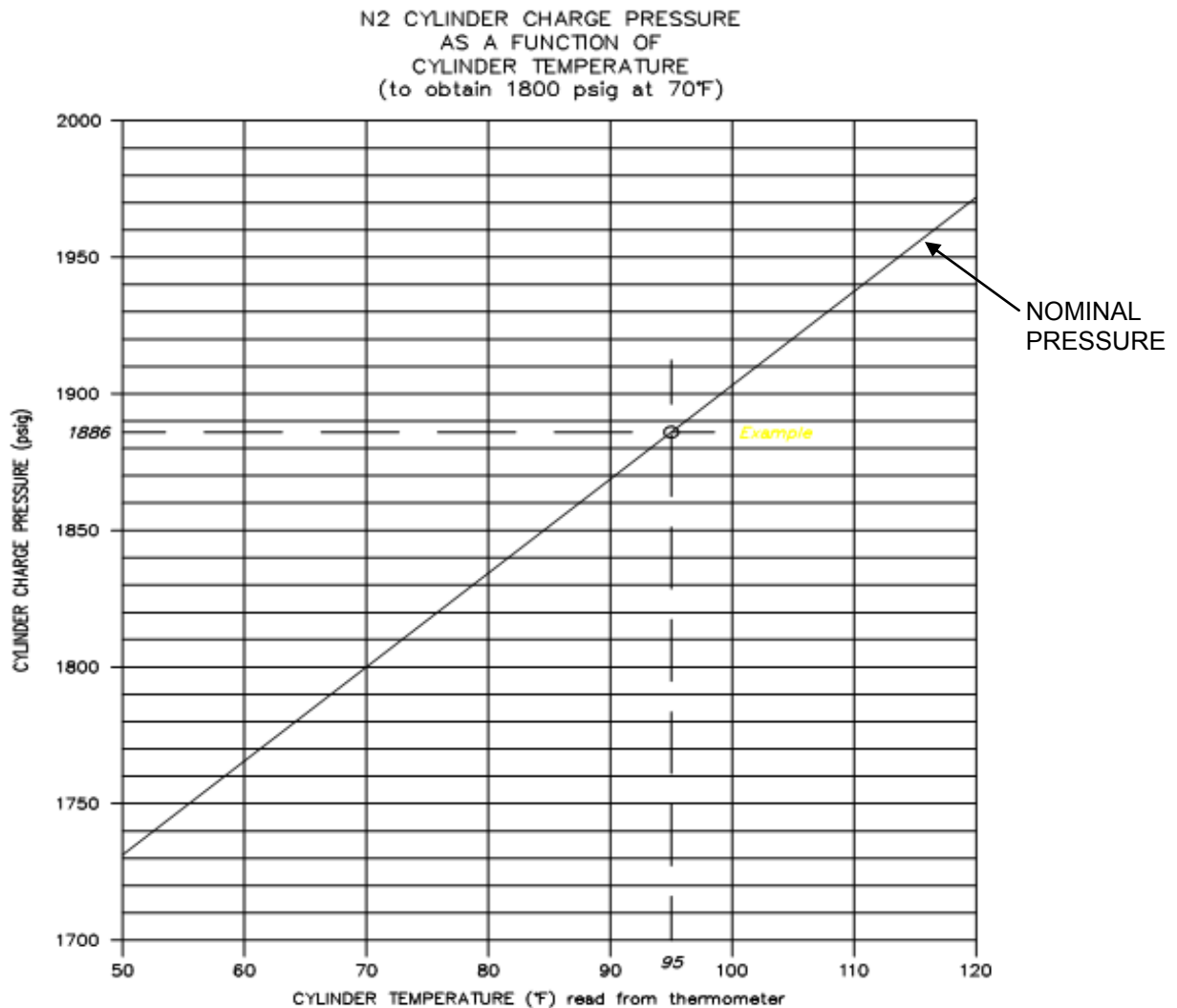


Figure 6.2.9.c

- Install a new Rupture Disc. The Rupture Disc on Nitrogen Cylinders may be replaced only with P/N 10712. Substitute parts will void manufacturer's warranty. Wipe sealing seat on Nitrogen Cylinder and copper gasket on new Rupture Disc with a clean damp cloth. Apply a small amount of Visilox V-728 or synthetic motor oil to copper gasket on new Rupture Disc and spread across entire gasket. Screw Rupture Disc into Nitrogen Cylinder hand tight.
- To pressurize the Nitrogen Cylinder, reinstall Nitrogen Cylinder in Nitrogen Cylinder Recharge Adapter (P/N 10270). Tighten Nitrogen Cylinder by hand 1 to 1-1/2 turns past contact with sealing gasket in Recharge Adapter. Hold Nitrogen Cylinder in place using a 1-1/8 inch wrench on the Nitrogen Cylinder hex fitting. Loosen Rupture Disc by turning the Recharge Adapter wrench 1/8 turn counterclockwise. Connect a regulated nitrogen supply to the Nitrogen Cylinder Recharge Adapter (See Figure 6.2.9.d for a typical pressurization network).



7. Pressurize the Nitrogen Cylinder to 1800 psi at 70°F. NOTE: The nitrogen, as it compresses into the 15 cu. in. Nitrogen Cylinder, may experience a significant temperature rise. This temperature rise must be compensated for by pressurizing to the value corresponding to 1800 psi at the higher temperature. The best method to accomplish proper pressurization is to attach a commercially available magnetic base thermometer to the side of the Nitrogen Cylinder. Pressurize and hold the Nitrogen Cylinder at 1800 psi (Make sure there are no leaks in the nitrogen supply plumbing). Let the apparatus sit for 2 minutes minimum undisturbed to allow the temperature to stabilize. Read the temperature on the thermometer. Locate the temperature on the "CYLINDER TEMPERATURE" (horizontal) axis of the graph (See Figure 6.2.9.e). Draw a line vertically upward from that temperature until it crosses the "NOMINAL PRESSURE" line. Draw a second line horizontally from the point of intersection to the "CYLINDER CHARGE PRESSURE" (vertical) axis of the graph. Increase the pressure from the regulated nitrogen supply to match the value read from the "CYLINDER CHARGE PRESSURE" axis. NOTE: Nitrogen used for pressurizing must be dry with a dew point of -70°F (-57°C) or lower.



*Figure 6.2.9.e*

8. When the determined pressure is reached, tighten the Rupture Disc (P/N 10712) by applying a torque wrench to the Recharge Adapter wrench and tightening clockwise to 40 ft-lbs. Shut off nitrogen supply. Relieve the pressure in the supply line. Remove Nitrogen Cylinder (P/N 09956) from the Recharge Adapter (P/N 10270)
9. Check for leaks by applying leak detect fluid or soapy water to the Rupture Disc (P/N 10712), the Nitrogen Cylinder hex fitting threads, and the Nitrogen Cylinder pressure gauge threads. Look for bubbles in the leak detect fluid. Bubbles may take several minutes to appear. Dry any leak detect fluid from all surfaces and inside of rupture disc following leak detect. Reinstall Shipping Cap on Nitrogen Cylinder.

# **Chapter 7: Warranty**

## **Warranty Statement:**

### **Warranty and Limitation of Liabilities, Buyers Remedies, and Indemnification**

Amerex Corporation (Seller) warrants that Vehicle Fire Suppression System components (Goods) delivered are free from defects in material and workmanship under conditions of normal use for a period of three (3) years from the date of purchase except Small Vehicle Fire Suppression System components and AMGADS gas sensors which are warranted for a period of one (1) year. Non-standard products manufactured by Seller to customer specifications are warranted for a period of one (1) year. Contact Amerex Corporation for warranty statements for other Amerex Corporation products. Seller reserves the right to make any modifications required by production conditions to the information set forth in the Seller's catalogues and advertising literature. Seller shall not be liable or responsible, however, for (A) any defects attributed to normal wear and tear, erosion or corrosion or improper storage, use or maintenance, or (B) defects in any portion or part of the Goods manufactured by others. If (B) above is applicable, Seller will, as an accommodation to Buyer, assign to Buyer any warranties given to it by any such other manufacturers. Any claim by Buyer with reference to the Goods for any cause shall be deemed waived by Buyer unless submitted to Seller in writing within ten (10) days from the date Buyer discovered, or should have discovered, any claimed breach. Buyer shall give Seller an opportunity to investigate.

Provided that Seller is furnished prompt notice by Buyer of any defect and an opportunity to inspect the alleged defect as provided herein, Seller shall, at its option and in its sole discretion either: (i) repair the defective or non-conforming Goods, (ii) replace the nonconforming Goods, or part thereof, which are sent to Seller by Buyer within sixty days after receipt of the Goods at Buyer's plant or storage facilities, or (iii) if Seller is unable or chooses not to repair or replace, return the purchase price that has been paid and cancel any obligation to pay unpaid portions of the purchase price of nonconforming Goods. In no event shall any obligation to pay or refund exceed the purchase price actually paid. This warranty does not cover defects resulting from modification, alteration, misuse, exposure to corrosive conditions or improper installation or maintenance. Repair and/or replacement as provided above shall be at Seller's plant and shipped F.O.B. Plant unless otherwise agreed to by Seller. Transportation charges for the return of the Goods or part thereof to Seller shall be prepaid by Buyer, unless otherwise agreed to in writing by Seller. Seller shall, in no event, be responsible for any labor, removal or installation charges that may result from the above-described repair and/or replacement of any Goods. The foregoing warranty does not cover failure of any part or parts manufactured by others, the failure of any part or parts from external forces, including but not limited to earthquake, installation, vandalism, vehicular or other impact, application of excessive torque to the operating mechanism or frost heave. The exclusive remedy of Buyer and the sole liability of Seller, for any loss, damage, injury or expense of any kind arising from the manufacture, delivery, sale, installation, use or shipment of the Goods and whether based on contract, warranty, tort or any other basis of recovery whatsoever, shall be, at the election of Seller, the remedies described above.

The foregoing is intended as a complete allocation of the risks between the parties and Buyer understands that it will not be able to recover consequential damages even though it may suffer such damages in substantial amounts. Because this Agreement and the price paid reflect such allocation, this limitation will not have failed of its essential purpose even if it operates to bar recovery for such consequential damages.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED BY LAW. THERE IS NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT, WHETHER AS A RESULT OF BREACH OF CONTRACT, WARRANTY, TORT (INCLUDING NEGLIGENCE) OR STRICT LIABILITY, SHALL SELLER BE LIABLE FOR ANY PUNITIVE, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFIT, LOSS OF USE OF THE GOODS OR OTHER PROPERTY EQUIPMENT, DAMAGE TO OTHER PROPERTY, COST OF CAPITAL, COST OF SUBSTITUTE GOODS, DOWNTIME, OR THE CLAIMS OF BUYER'S CUSTOMERS FOR ANY OF THE AFORESAID DAMAGES. SELLER SHALL NOT BE LIABLE FOR AND BUYER AGREES TO DEFEND AND INDEMNIFY SELLER AGAINST ALL CLAIMS OR LOSSES (INCLUDING ATTORNEYS' FEES), INCLUDING PERSONAL INJURY, PROPERTY DAMAGE OR OTHER LIABILITY, RESULTING IN WHOLE OR IN PART FROM (1) THE NEGLIGENCE OF BUYER OR ITS CUSTOMERS; (2) BUYER'S OR ITS CUSTOMER'S MISUSE, damage, alteration or modification of Seller's Goods; (3) Buyer's OR ITS CUSTOMER'S use of the Goods in any product or system designed, manufactured or sold by Buyer OR ITS CUSTOMERS; OR (4) ANY BREACH OF THIS AGREEMENT; provided, however, that Buyer shall have no obligation to indemnify Seller for claims or losses that arise solely from the negligence or misconduct of Seller.

In any contract by Buyer for resale of the Goods, Buyer shall effectively disclaim, as against Seller, any implied warranty of merchantability and all liability for property damage or personal injury resulting from the handling, possession or use of the Goods, and shall exclude, as against Seller, any liability for special or consequential damages.