A large yellow mining truck is shown from a side-rear perspective. The truck's cab is heavily damaged, with the roof and side panels missing or crushed. A person in a blue uniform and orange safety vest stands near the front wheel for scale. The truck is parked on a dirt surface under a cloudy sky.

Fatality #7 -  
September 7, 2018

# FIRE SUPPRESSION SYSTEM INSPECTION

For MSHA internal use only  
Photos are from ANSUL and various sources  
Ref. ANSUL Maintenance Manual



**SYSTEM DISCHARGE**

# Fire Suppression System Owner's Manual

- Request from Mine Operator
- Owner's manual will contain system inspection procedures
- This training is based on the ANSUL fire suppression system
- AFEX or Amerex systems may have different checks which will be detailed in the Manual
- Request most recent inspection report- should be within last 6 months

# ANSUL FIRE SUPPRESSION SYSTEM

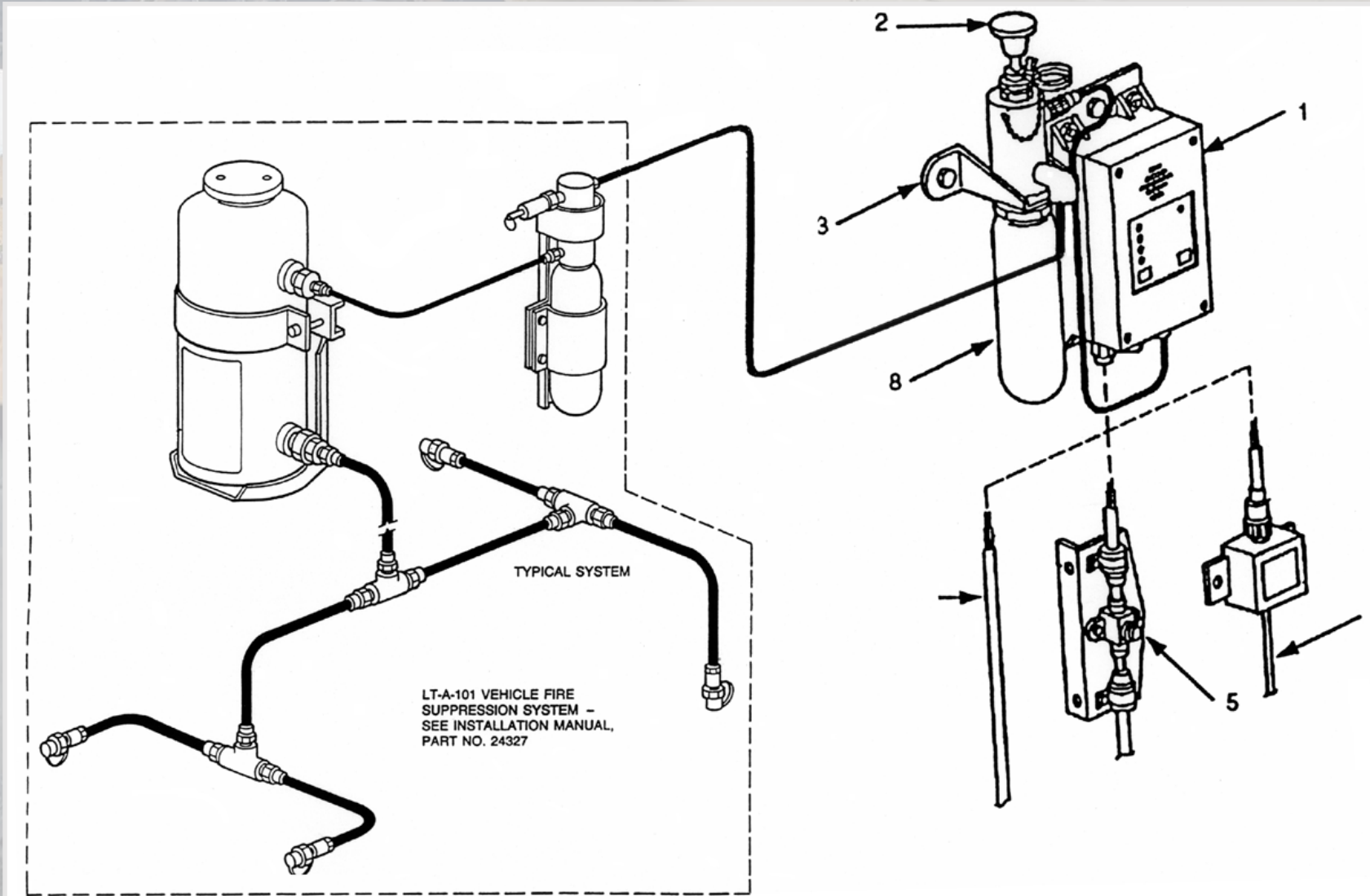


Dry Chemical Agent Tanks



Wet Chemical (LVS)  
Agent Tanks

# BASIC SYSTEM LAYOUT



# BASIC SYSTEM COMPONENTS



- Actuator Button
- Ring pin and chain with taper indicator
- Maintenance tag
- Actuator bottles
- Actuator hose
- Check valves
- Expellant gas bottle(s)
- Expellant gas hose
- Chemical agent tank(s)
- Chemical distribution hoses
- Nozzles and caps

## Check Manual Actuators

- Actuators are easily accessible- nothing blocking activation for a full arc hit with the palm
- Red actuator button must not be missing or damaged



# Check Manual Actuators

- Ring pin with chain and tamper indicators are in place
- A manual actuator will be in the operator's compartment
- A second actuator will be accessible from ground level





## Check Manual Actuators

- Maintenance tag is present and current - system must have been inspected within the last 6 months
- The maintenance tag may also be on the chemical agent tank or provided by the operator

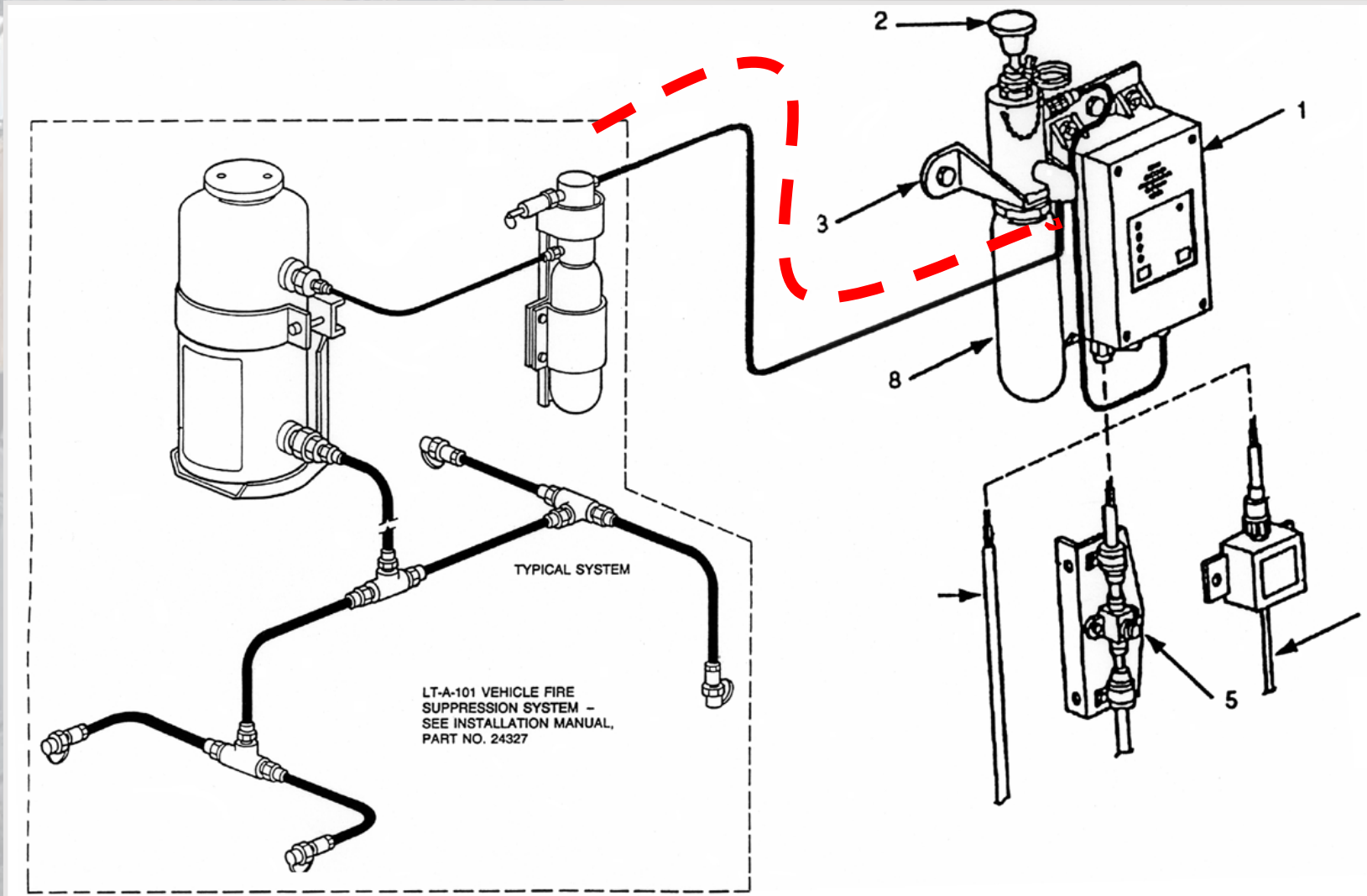


# Check Manual Actuators

- Request mine personnel remove actuation cartridge for inspection
- Cartridge should not be loose – hand tight only
- Check for rust, rupture of seal, or other damage



# 1/4" Actuator Hose



# 1/4" Actuator Hose

- Connects actuator bottle to expellant gas bottle(s)
- Routing of hose must position it away from heat generated by sources of fire, electrical wires, and moving parts
- Not routed through engine compartment
- Clamped at least every 5 ft., no loose connections
- Check for holes, abrasion, or other damage

# All Hoses

All hose assemblies, including actuation lines, expellant gas lines and agent distribution hose that will be normally exposed to or located in areas with temperatures exceeding 200 °F (93 °C) should be sleeved with an extreme temperature heat-resistant fire jacket. (Do not route actuation hose through fire hazard areas. If this cannot be avoided, the hose must be fire jacketed.)



## FyreJacket® Industrial Grade

Silicone-coated sleeve with good resistance to high temperatures

Ends of fire jacket should be clamped over the hose's metal fitting at each end

# All Hoses

## Hose Specifications

To ensure proper performance of the ANSUL A-101/LT-A-101 system, the hose used must meet either SAE 100 R5 or 100 R1 hose specifications as a **minimum**. The hose must have an operating temperature of -40 °F to +200 °F (-40 °C to +93 °C).



# All Hoses

SAE standard hydraulic hose type / application	Hydraulic fluids	Temperature range (°F)	Diameter range (I.D. in)	Max. Operating pressure range (psi)	Proof pressure range (psi)	Min. burst pressure range (psi)	Min. bend radius (in)
<b>100R1</b> Steel wire reinforced, rubber coated	Petroleum & water based	-40 to +212	3/16 to 2	575 to 3,250	1150 to 6,500	2,300 to 13,000	3.5 to 25
<b>100R5</b> Single wire braid, textile cover – Transportation/DOT hose	Petroleum & water based	-40 to +212	3/16 to 3-1/16	200 to 3,000	400 to 6,000	800 to 12,000	3 to 33

# All Hoses

<u>Size</u>	<u>Operating Pressure</u>	<u>Bend Radius</u>
-------------	---------------------------	--------------------

## SAE 100R1 Hose

1/4 in.	2750 psi	4.0 in.
1/2 in.	2000 psi	7.0 in.
3/4in.	1250 psi	9.5 in.
7/8in.	1250 psi	11.0 in.

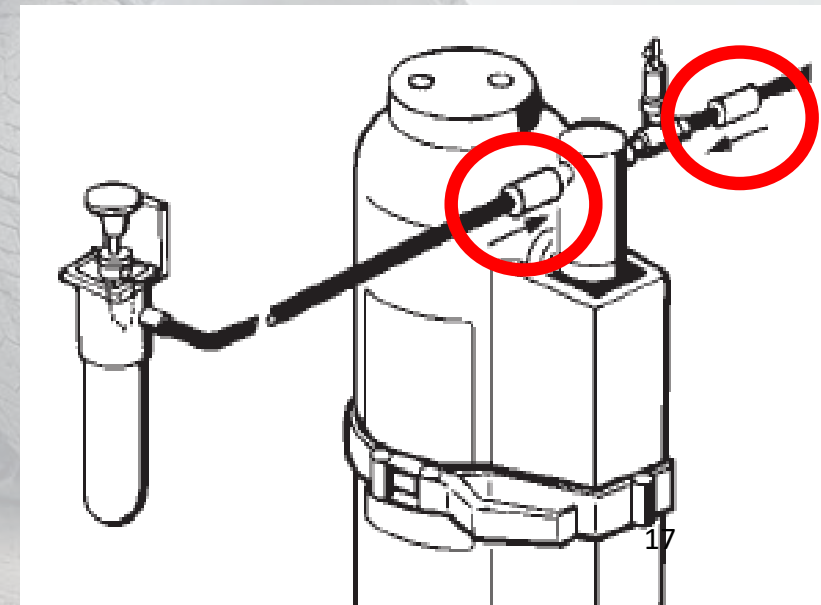
## SAE 100R5 Hose

1/4 in.	3000 psi	3.4 in.
1/2 in.	1750 psi	5.5 in.
7/8 in.	800 psi	7.4 in.

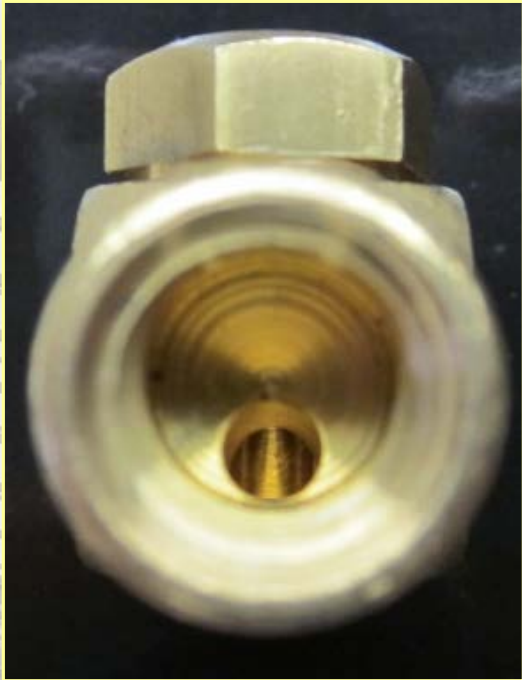


# Check Valves

The 1/4 in. actuation line check valve, Part No. 25627, is used at the branch lines to each actuation device (whether manual or automatic). The check valve blocks the flow of actuation gas from the actuator that was actuated to the actuator(s) that was not actuated. This prevents actuation gas from escaping from an open actuator which may have had the cartridge removed. The check valve also keeps the gas from pressurizing all branch actuation lines thus allowing the main line to be of maximum length.



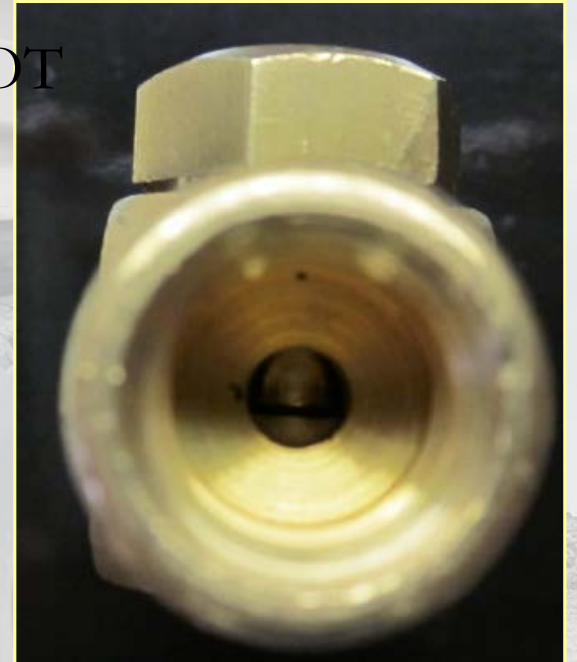
# Check Valves



**Inlet Side is located low**



**FLOW** →

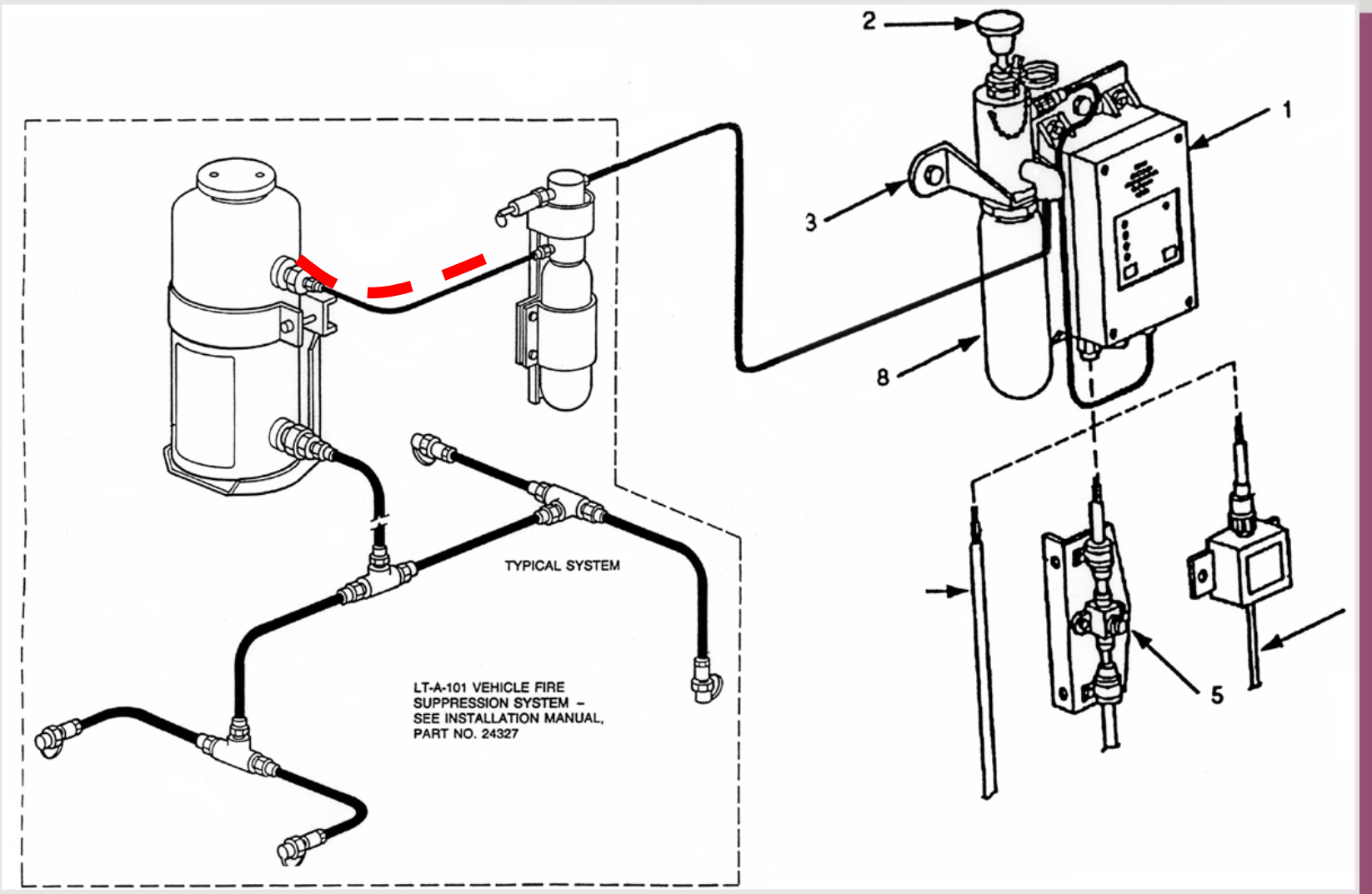


**Outlet Side is located in center**



GENNAN  
5000-4-BB  
3000 PSI

# Expellant Gas Hose



# Expellant Gas Bottle and Hose

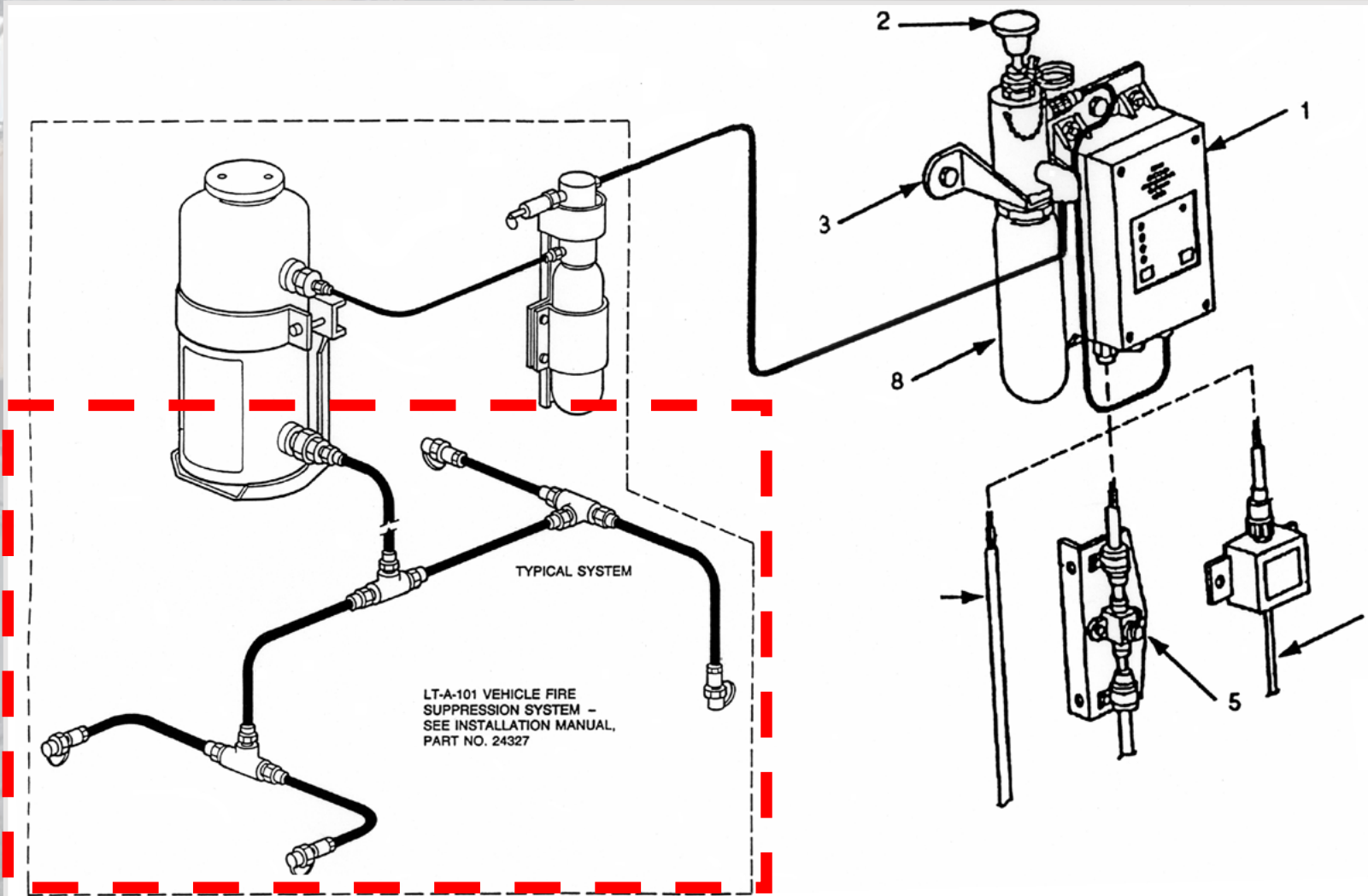
- Expellant bottle(s) may be attached directly to chemical tanks without a hose
- Bottle should not be loose – hand tight only
- Routing of hose must position it away from heat generated by sources of fire, electrical wires, and moving parts
- Not routed through engine compartment
- Clamped at least every 5 ft., no loose connections
- Check for holes, abrasion, or other damage

# Chemical Agent Tank

- Check for rust, dents, or other significant damage
- ANSUL does not recommend opening the tank for routine inspection since moisture will cause the chemical to harden
- If there are signs of discharge, check for chemical in the tank



# Chemical Distribution Hoses



# Chemical Distribution Hose

- Routing of hose must position it away from electrical wires, and moving parts
- Hose should not be routed near heat sources (exhaust manifold, pipe or turbocharger)
- Clamped at least every 5 ft., no loose connections
- Check for holes, abrasion, or other damage

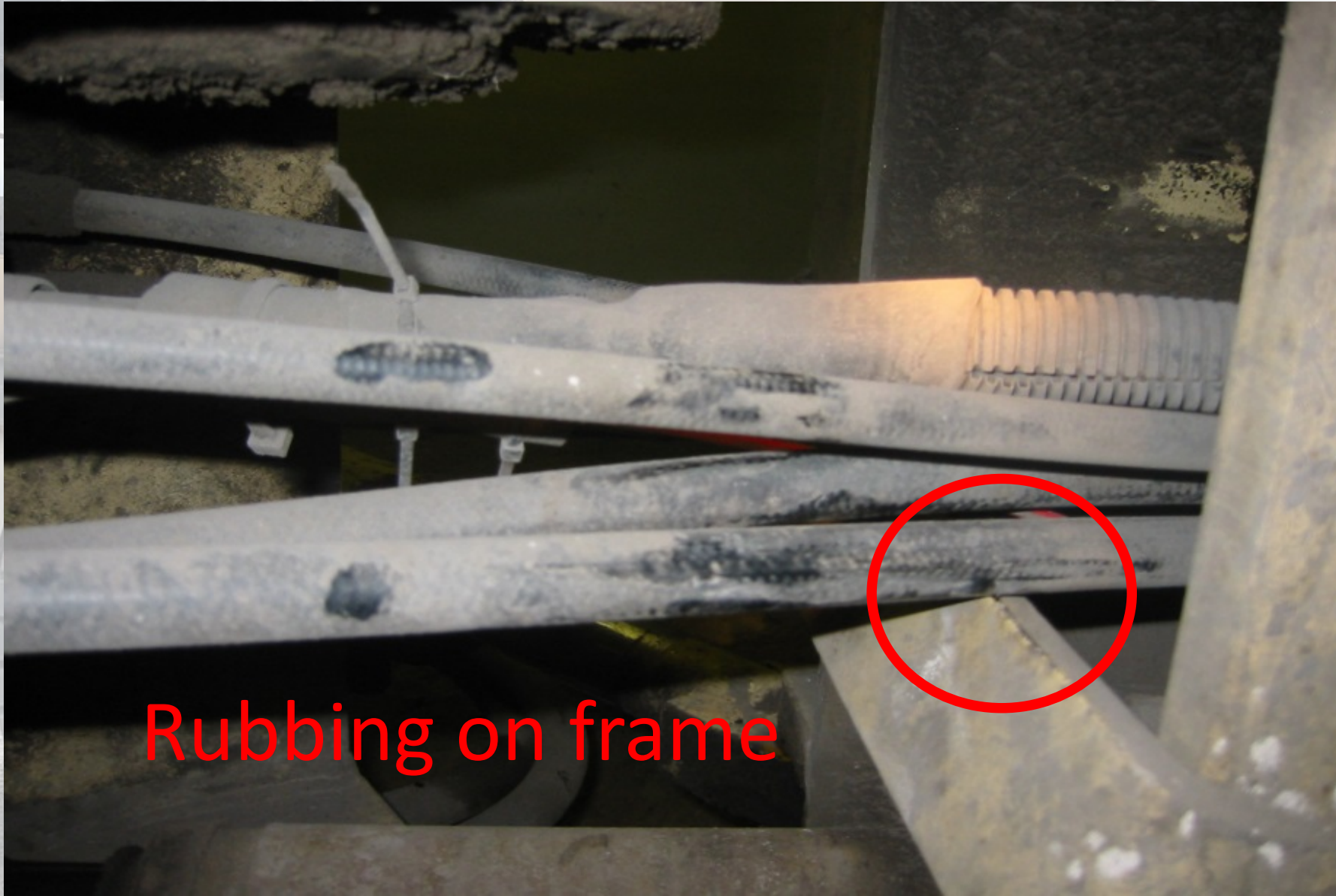


# Chemical Distribution Hose

Broken  
hose



# Chemical Distribution Hose



Rubbing on frame



**Rubbing on passage through bulkhead**

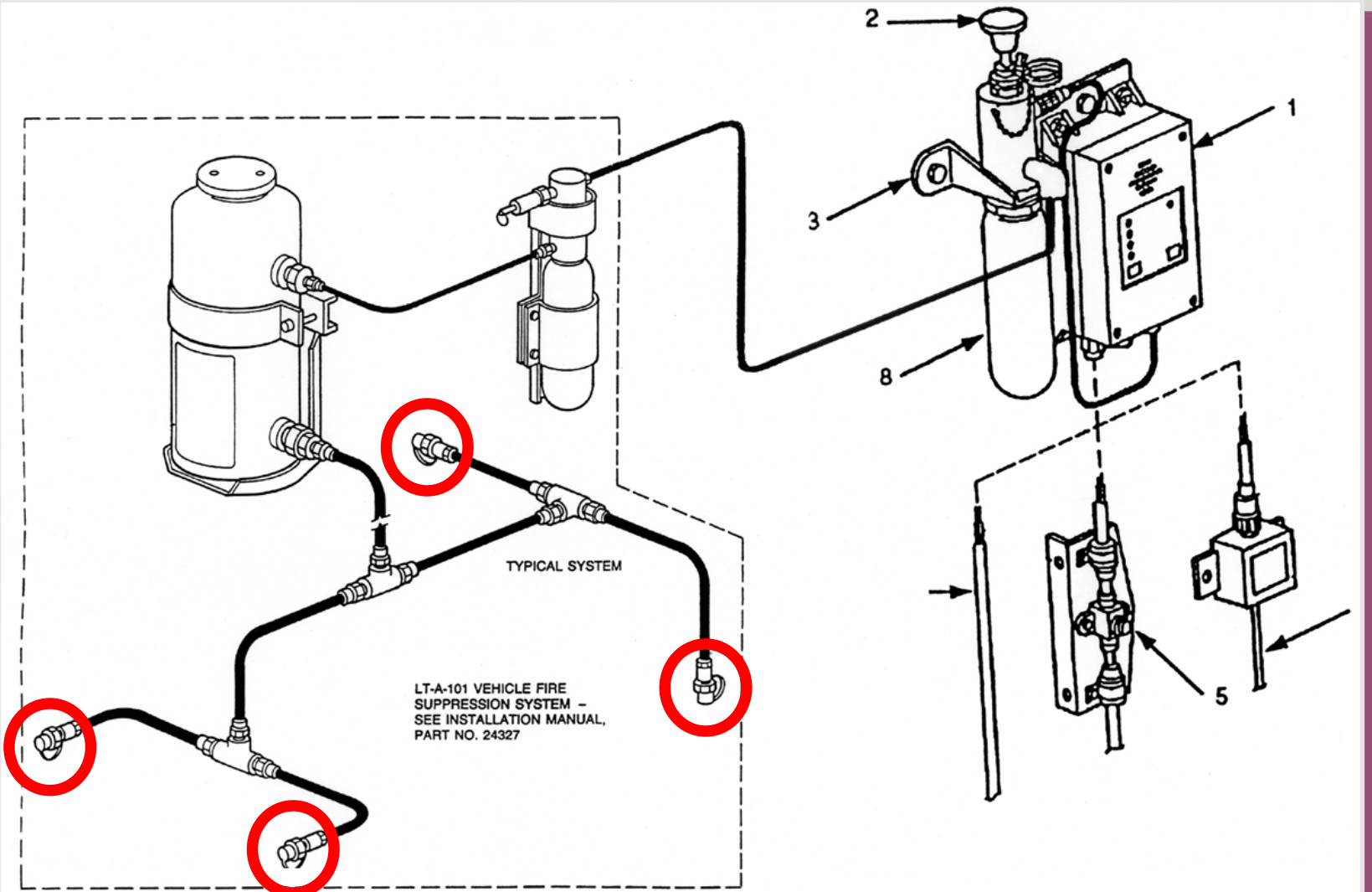
Dry rot



# Hydraulic Hose Failure

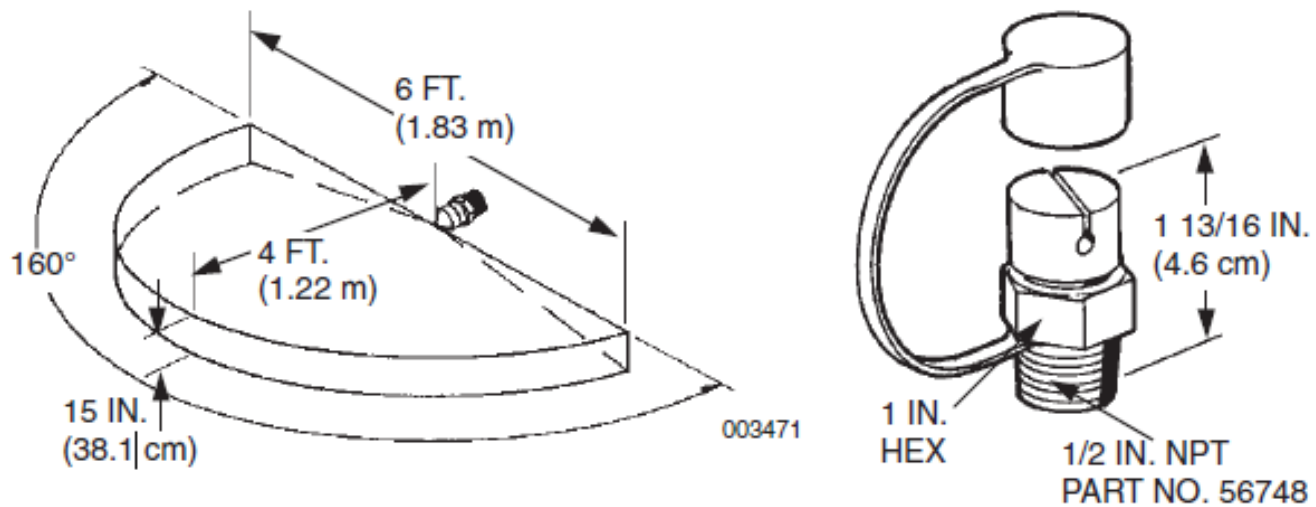
- Machine hydraulic hose failure and spray of fluid on turbochargers is the leading cause of fires
- While checking fire suppression system hoses, also check machine hydraulic hoses for leaks and abrasion
- Hoses with exposed steel braid must be replaced

# Nozzles and caps

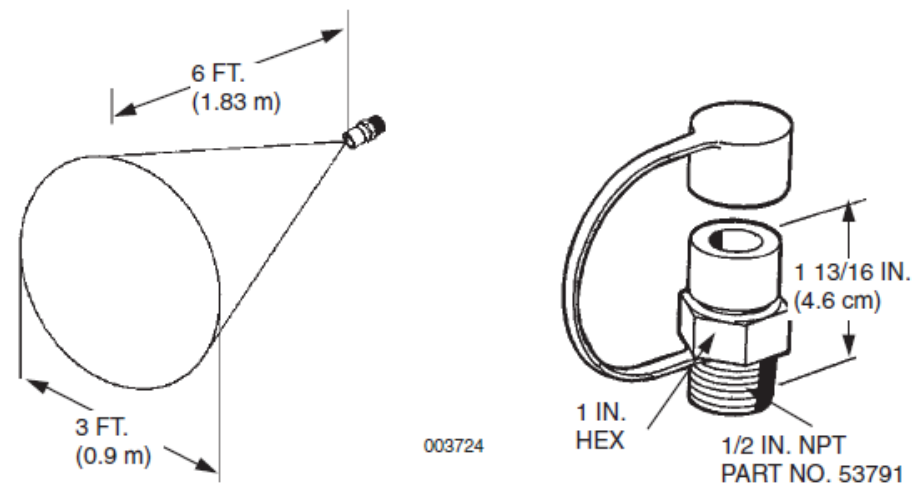


# Nozzles and caps

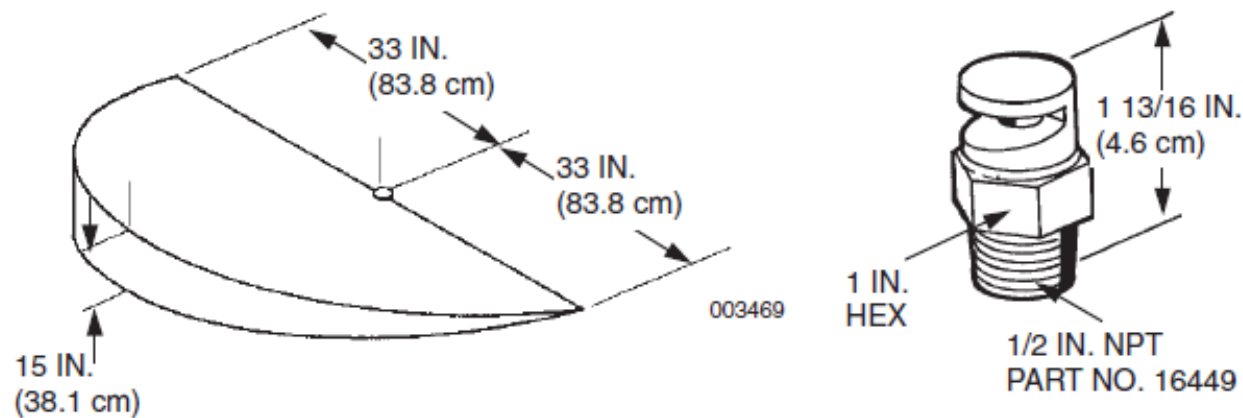
V-1/2 NOZZLE EFFECTIVE DISCHARGE PATTERN PART NO. 56748



C-1/2 NOZZLE EFFECTIVE DISCHARGE PATTERN PART NO. 53791



F-1/2 NOZZLE EFFECTIVE DISCHARGE PATTERN PART NO. 16449



# Nozzles and caps

- Discharge pattern of nozzle must not be blocked, check for non-OEM added components
- Check nozzles for caps and for dirt blocking nozzle orifice



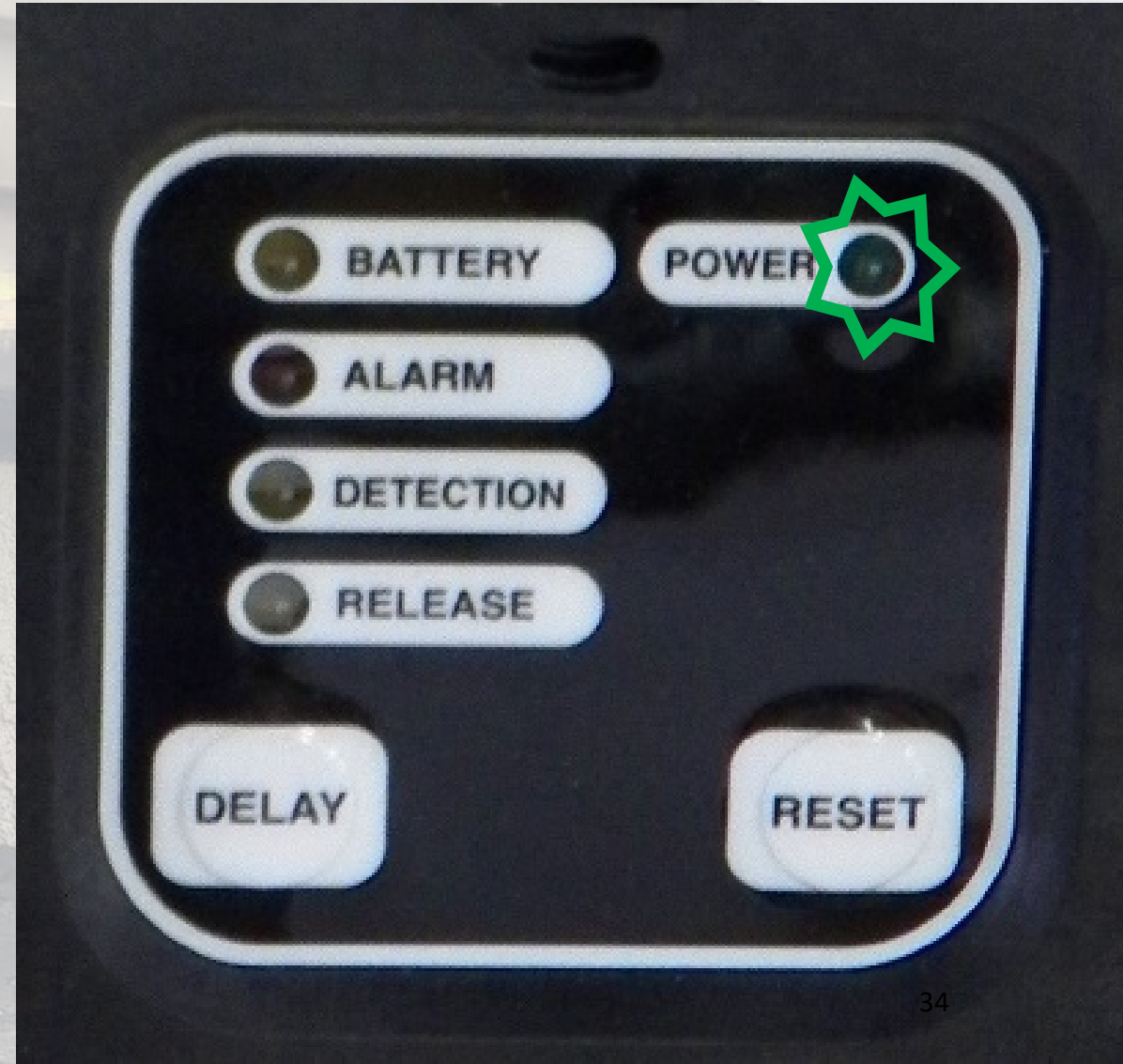
# Nozzles and caps

- If system is discharged, supply lines must be cleaned of all dry chemical to prevent plugging of lines
- All nozzles must be protected from the entrance of mud, coal dust, or rock dust
- Blow off caps must be in place
- LVS (liquid) nozzles will have blue caps



# Automatic Actuation

- Green “Power” LED must be blinking
- Any other lights or a chirping sound indicate service is required



# Automatic Actuation

## Power LED

- Internal power only:  
pulses **Green** once every  
3 seconds
- Equipment power:  
steady on **Green** under  
normal conditions  
12/24 VDC nominal  
and is supervised for low  
power



# Fire Hazard Evaluation

## Examples of ignition (heat) sources:

- Engines
- Exhaust manifolds and piping
- Turbochargers
- Power source compartments
- Electrical system equipment
- Torque converters
- Transmissions
- Hydraulic pumps
- Parking brakes (engaged while moving)
- Bearings, clutches or gears
- Malfunctioning components
- Friction from debris packed around parts

## CLASS A MATERIALS

- Electric wiring insulation
- Plastic parts
- Rubber
- Debris (wood chips, coal dust, landfill material, etc.)

## CLASS B MATERIALS

- Leaking fuel (gasoline, diesel, engine oil, hydraulic oil, glycol, steering fluid, etc.)
- Broken fuel lines/fittings
- Slow leaks – fuel or hydraulic fluid
- Broken hydraulic lines or pumps
- High pressure hoses
- Belly pan (fuel and debris accumulation)
- Ruptured fuel or hydraulic tank
- Greases

# Fire Hazard Evaluation

## Equipment Shutdown

Plan for the shutdown of components that could add to the intensity of the fire, re-ignite the fire, or negatively impact the discharge of fire suppression agent such as:

- Fuel pumps
- Hydraulic pumps
- Engine
- Power source
- Electrical system
- Fans

# Fire Hazard Evaluation

- A typical OEM 100 ton haul truck may require a minimum of 16 to 20 nozzle depend upon system type and configuration.
- A 240 ton haul truck may require up to 30 nozzles
- A 400 ton haul truck may require up to 60 nozzles

# Manual or Automatic Actuation

<u>Model Capacity</u>	<u>Nozzle Quantity</u>	<u>Effective Discharge Time</u>	<u>Agent per Nozzle</u>
10	2	8.5 sec	4 1/4 lb (1.9 kg)
20	4	8.5 sec	4 1/4 lb (1.9 kg)
20	6	5.7 sec	2 7/8 lb (1.3 kg)
30	4	12.5 sec	6 1/4 lb (2.8 kg)
30	6	8.3 sec	4 1/8 lb (1.9 kg)

▶ The LVS system allows a maximum number of LVS-9.5 nozzles for each tank, depending on the application.

<u>Tank</u>	<u>Agent Qty.</u>		<u>Max. Noz.</u>	<u>Avg. Noz. Discharge Time-Sec.</u>	<u>Single Nozzle Coverage Area</u>	
	<u>gal</u>	<u>(L)</u>			<u>ft<sup>2</sup></u>	<u>(m<sup>2</sup>)</u>
LVS-3	3	(11.4)	6	20	3	(0.28)
LVS-5	5	(18.9)	4	30	7	(0.65)
LVS-10	10	(37.9)	8	40	7	(0.65)
LVS-15	15	(56.8)	10	60	7	(0.65)
▶ LVS-30	30	(113.6)	20	60	7	(0.65)

# Escape

**Egress** – Ensure miners are trained to understand and use the primary, secondary, and alternate (emergency) means of egress. Fire shielding may be needed in areas where persons must travel during escape.





<http://www.ansul.com/en/us/Pages/Education.aspx?ProductSegment=Vehicle+Systems&VxID=40>

## **SYSTEM DISCHARGE**

# QUESTIONS

