FIRETRACE®

POWER TO INNOVATE. FLEXIBILITY TO ADAPT.

DESIGN, INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

FOR

DRY CHEMICAL SELF-CONTAINED AUTOMATIC EXTINGUISHER UNIT

Models: 940202 - 2.5 lbs
940502 - 5 lbs
941002 - 10 lbs
942002 - 20 lbs

P/N 800010
UL EX5323
FM Approvals Project 3026042

Firetrace USA LLC.

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1 FOREWORD

1.1 General

This Manual is written for the fire protection professional that designs, installs, and maintains Firetrace Pre - Engineered Automatic Indirect Dry Chemical Extinguisher Units.

Firetrace Dry Chemical Automatic Indirect Fire Suppression Units are to be designed, installed, inspected, tested, maintained, and recharged by qualified trained personnel in accordance with the following:

- All instructions, limitations, etc. contained in this Manual P/N 800010
- All information contained on the agent cylinder nameplate(s)
- NFPA-17, *Standard for Dry Chemical Extinguishing Systems*
- Underwriters Laboratories Inc. Listing
- FM Approvals Listing
- Local Authority having jurisdiction

1.2 Warnings

Safety precautions are essential when any electrical or mechanical equipment is involved. These precautions should be followed when handling, servicing, and recharging Firetrace Dry Chemical Fire Suppression Units and Equipment. If safety precautions are overlooked or ignored, personal injury or property damage may occur.

The following symbols are used throughout this Manual. Always heed these precautions. They are essential to the safe use of the equipment described in this Manual.

DANGER:

This danger symbol identifies immediate hazards and provides specific instructions or procedures, which if not correctly followed **WILL** result in severe personal injury or death.

WARNING:

This warning symbol identifies specific instructions or procedures, which if not correctly followed, **COULD** result in severe personal injury or death.

CAUTION:

This caution symbol identifies specific instructions or procedures, which if not correctly followed, **COULD** result in minor personal injury or equipment or property damage.

1.3 Safety Precautions

The following safety precautions should always be followed:

WARNING

Pressurized (charged) cylinders are extremely hazardous and if not handled properly are capable of causing property damage, bodily injury, or death. Always wear safety glasses and make sure the discharge plugs are properly in place before unit installation, servicing, or other general handling.

1. Read and understand this Manual and the other documents referenced herein.
2. The valve discharge outlet safety plugs **MUST** be installed on the cylinder valve at all times and only removed when connected into the discharge tubing, or when performing charging, testing, or salvaging operations in accordance with the procedures contained in this Manual.
3. Wear safety glasses when working with pressurized cylinders and charging equipment.
4. Make sure that the ball valve (attached to the top of the cylinder valve) is closed (lever is in "OFF" position), the detection tubing has been removed from the cylinder valve, and the safety caps installed before removing the cylinder from the installation and before performing any charging, leak tests, or salvage operations.
5. Follow all of the safety procedures included on the cylinder nameplate and in this Manual.
6. Never assume that a cylinder is empty. Treat all cylinders as if they are fully charged.

Any questions concerning the information contained in this Manual should be addressed to:

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www.firetrace.com

2 INTRODUCTION

The Firetrace Indirect Dry Chemical Automatic Fire Extinguisher Unit is UL and ULC Listed by Underwriters Laboratories Inc and approved by Factory Mutual Approvals (FM). These units are designed for total flooding and local applications, using ABC Dry Chemical Powder, in accordance with NFPA-17: *Standard for Dry Chemical Extinguishing Systems.*

The Firetrace Dry Chemical Self-Contained Automatic Extinguisher Units have been tested to limits established by UL/ULC/FM in compliance with the requirements specified in UL 1254: *Standard for Pre-Engineered Dry Chemical Extinguishing System Units* and as detailed in this Manual.

Each installed unit is equipped with detection tubing, discharge piping, and nozzles. The pre-designed concept minimizes the amount of engineering involved in the application design. When the discharge piping and nozzles are installed within the limitations stated in this Manual, no hydraulic calculations are required to determine pressure drop, agent flow, or discharge time.

The hazard being protected can be any size, shape, or volume provided that the hazard being protected is within the limitations described in this Manual. When installed, each extinguisher unit is a self-contained unit, meaning that it is equipped with its own automatic (non-electric) detection system. This system, when actuated, automatically releases the suppression agent into the hazard area.

Since the units are listed as automatic units (e.g. no simultaneous Manual or electric actuation means is provided), only one (1) extinguisher unit can be used to protect one hazard. These extinguisher units **cannot** be combined to protect a larger size hazard, since they are not designed to provide for simultaneous actuation of (2) or more units.

Local authorities having jurisdiction should be consulted as to the acceptability for particular hazards and requirements covering installation.

2.1 Dry Chemical Extinguishing Agent

The dry chemical extinguishing agent used in Firetrace Dry Chemical Self-Contained Automatic Indirect Fire Suppression Units is Mono Ammonium Phosphate ($NH_4H_2PO_4$), also known as ABC or multi-purpose powder.

ABC Powder is included in NFPA-17 and has been evaluated and approved for use in occupied areas, provided the proper safety precautions have been taken.

Dry Chemical is a finely divided powder that has been treated to be water repellent and capable of being fluidized and free flowing so that it can be discharged through hoses and piping under the influence of an expellant gas. When discharged, dry chemical will drift through the air and settle on surrounding surfaces.

2.2 Cleanliness

ABC powder is slightly acidic and in the presence of moisture can stain or corrode some types of metal surfaces (refer to NFPA 17). To minimize possible staining or corrosion, the exposed areas should be cleaned off immediately. ABC Powder can be cleaned up by one of the following methods; wiping, vacuuming, or washing the exposed areas. In some cases, the powder will have to be scraped off a surface if that surface was hot at the time of discharge.

2.2.1 Properties of ABC Dry Chemical Powder

For hazard information, decomposition information, and physical properties of ABC Powder please refer to the Safety Data sheet located in Appendix C.

3 SYSTEM DESCRIPTION

3.1 General

The Firetrace Dry Chemical Indirect Extinguisher Units are available in 4 sizes

940202:	Charged with 2.5 Lbs (1.13 Kg) of Dry Chemical
940502:	Charged with 5 lbs (2.27 Kg) of Dry Chemical
941002:	Charged with 10 lbs (4.54 Kg) of Dry Chemical
942002:	Charged with 20 lbs (9.07 Kg) of Dry Chemical

These systems are designed for use in total flooding applications.

The Firetrace Indirect Units can be used, but are not limited, to protect the following:

- Laboratory fume /exhaust cabinets
- Pump enclosures
- Flammable Chemicals storage cabinets
- Generator Enclosures
- CNC & VMC Machining centers
- Many other applications

ABC Powder is a finely divided powder that has been approved in Firetrace Systems for use on:

- Class B – Flammable liquid fires

Dry Chemical Powder should not be used where the following materials may be present.

- Pyrotechnic chemicals containing their own oxygen supply
- Reactive metals such as lithium, sodium, potassium, magnesium, titanium, zirconium, uranium and plutonium
- Metal hydrides
- Chemicals capable of undergoing autothermal decomposition, such as certain organic peroxides and hydrazine
- Deep Seated or burrowing fires in ordinary combustibles where the dry chemical cannot reach the point of combustion

For hazards beyond the scope described above it is recommended that the designer consult with Firetrace, NFPA-17, and the local authority having jurisdiction as to the suitability on the use of dry chemical powders for a particular hazard, for personnel exposure effects from the design concentration, and for installation requirements.

Firetrace Dry Chemical Automatic Indirect Units consists of the following major components:

- Cylinder/Valve assembly
- Cylinder Bracket
- Heavy duty cylinder bracket (Optional)
- Firetrace detection/actuation tubing and fittings (No substitute)
- Discharge nozzles
- Pressure switch (Optional)
- Discharge piping and fittings (Furnished by others)

Once installed, the Firetrace Automatic Unit becomes a self-contained, self-actuating unit that does not require an external source of power or electricity.

The unit utilizes a UL recognized component (per UL standard 521), a Linear Heat Detector (See Certificate of Compliance 20140705-S35465) known as Firetrace Automatic Fire Detection Tubing, which when pressurized with Dry Nitrogen, will allow the fire suppression valve to remain in the closed position. This tubing acts as a continuous linear thermal detector that ruptures upon direct flame impingement or at temperatures above 383°F (195°C). Once the detection tubing is ruptured, the fire suppression valve automatically opens, allowing the dry chemical to flow through the discharge piping, distributing the extinguishing agent through the nozzle(s) into the protected area.

Upon actuation the optional pressure switch can be used to indicate discharge, shutdown ventilation, close all openings, shut-off electrical power, etc. as may be required.

3.2 Component Descriptions

For a more comprehensive list of technical illustrations and part numbers, please see Appendix A.

3.2.1 Dry Chemical Cylinder/Valve Assemblies

Dry chemical powder is stored in steel cylinders pressurized with nitrogen to 195 psig at 70°F (13.5 bar at 21°C). Table 3-1 describes the 2.5, 5, 10, and 20 Lb system assemblies. Each cylinder is equipped with a straight siphon tube and can only be mounted in a vertical (upright) position.

Nom Size	Asm Part #	Outside Dia		Height		Volume		Agent	
		In.	Cm	In.	Cm	In^3	Cm^3	Lb	Kg
2.5	940202	3.0	7.62	17.38	44.15	75	1229	2.5	1.13
5.0	940502	4.25	10.80	17.49	44.42	145	2376	5	2.27
10	941002	6.32	16.05	17.68	44.91	300	4,916	10	4.54
20	942002	7.08	17.98	25.00	63.5	676	11077	20	9.07

Table 3-1: Dry Chemical Cylinder / Valve Assemblies

Each cylinder is equipped with a nickel plated brass valve, a pressure gauge to monitor cylinder pressure, and a quarter turn ball valve that interfaces with the Firetrace detector tubing. The ball valve must be kept closed at all times when the cylinder is not in service.

Each valve is also equipped with (2) discharge outlet ports. Each outlet port is provided with a safety plug that must be installed in the discharge outlet whenever a system is not in service. These plugs are safety devices designed to prevent uncontrolled discharge of the system in the event that the valve is accidentally actuated.

WARNING

The safety plugs must be installed in the valve discharge outlets at all times, except when connected into the units discharge tubing or when filling. Failure to follow these instructions could result in property damage, personal injury, or death.

Table 3-2 describes the Specifications used for the manufacturing of the dry chemical cylinders.

Nominal Size	Cylinder Specification	Cylinder Service Pressure (psig)	Cylinder Specification Test Pressure	
			psig	kPA
2.5	DOT 4B240	240	480	3,310
5	DOT 4B240	240	480	3,310
10	DOT 4B360	360	720	4,964
20	UL 299/DOT Non-Spec	195	585	4,033

Table 3-2: Cylinder Specifications

3.2.2 Firetrace Flexible Detection/Actuation Tubing

The Firetrace detection/activation tubing is a UL recognized component per UL standard 521 (See Certificate of Compliance 20140705-S35465). The Firetrace Detection/Actuation Tubing is used as a combination linear heat detector and unit activation device to cause actuation of the dry chemical unit. The tubing is installed throughout the hazard volume, with one end connected to the top of the cylinder valve. The tubing is pressurized with nitrogen to 195 psig while maintaining the ball valve in the "OFF" position. The detection tubing is heat sensitive and in a fire situation is designed to rupture at any point along its length upon direct flame impingement or at any point along the tube when the temperature reaches 383°F (195°C). The rupture of the tubing releases the nitrogen pressure causing the dry chemical cylinder valve to actuate, resulting in complete discharge of the dry chemical through the nozzles.

3.2.3 Manual Release

An optional Manual Release can be used with every system. This device consists of a yellow pull tab and a red plunger. Located on this device is a port for pressurizing the tubing and monitoring tubing pressure via the included Pressure Gauge.

3.2.4 Pressure Switch

A pressure switch is available as an optional part of the cylinder valve assembly and is connected directly into the pressurized portion of the cylinder valve (P/N 400001). This pressure switch is used to monitor unit pressure, unit actuation, or to energize or de-energize electrically operated equipment.

An additional pressure switch (P/N 400004) is available and can be connected to an End of Line Adapter to provide additional electrical functions as may be required. Firetrace recommends that all units use a pressure switch coupled with some device to alert personnel in the event of discharge.

4 SYSTEM DESIGN AND LIMITATIONS

4.1 General

The Firetrace series of Dry Chemical Self-Contained Automatic Indirect Units' design limits were established and tested by Firetrace. The Units are Listed by Underwriters Laboratories Inc, Underwriters' Laboratories of Canada, and Approved by Factory Mutual Approvals.

These units were subjected to numerous performance tests (as specified in UL 1254) in order to verify their suitability and to establish design limitations for:

- Hazard Volume
- Operating Temperature Range
- Percentage of Unclosable Openings
- Detection Tubing Placement
- Nozzle Area Coverage and Heights
- Nozzle Placement
- Maximum Length/Size of Piping and Number of Fittings
- Discharge Time and Flow Rates

The pre-designed automatic unit concept minimizes the amount of engineering required when evaluating a design for a specific application. So long as the discharge piping and nozzles are installed within the limits prescribed in this Manual, no calculations are required for pressure drop, flow rates, or discharge time. When the additional limitations of hazard volume, area coverage, maximum height, design concentration, agent quantity, detector arrangement, etc., are also met, the unit installation can be understood to comply with the design requirements, NFPA-17, the UL/ULC Listings, and FM Approvals. Therefore, no discharge tests or concentration measurements should be required.

4.2 Specifications

4.2.1 Storage and Operating Temperature Range

The Firetrace Dry Chemical Units and equipment are designed to be stored and operated at the ambient temperature range of 0°F to +130°F (-17.8°C to +54.4°C).

4.2.2 System Operating Pressure

The normal operating pressure for the unit is 195 psig at 70°F (13.5 bar at 21°C).

The Firetrace Dry Chemical Units are designed for an operating temperature range of 0°F to +130°F. Table 4-1 shows the cylinder gauge pressure-temperature relationship based on a charging pressure of 195 psig at 70°F.

Cylinder Pressure			
Temperature		Pressure	
°F	°C	psig	kPa
0	-17.8	169	1165
10	-12.2	173	1193
20	-6.7	177	1220
30	-1.1	180	1241
40	4.4	184	1267
50	10.0	188	1296
60	15.5	191	1317
70	21.1	195	1344
80	26.7	199	1372
90	32.2	202	1393
100	37.8	206	1420
110	43.3	210	1448
120	48.9	213	1469

Table 4-1: Cylinder Pressure-Temperature Relationship

4.3 Design Procedure

The following procedures should be used to design a Firetrace Dry Chemical Self-Contained Automatic Indirect Fire Suppression Unit. In addition, the applicable requirements specified in NFPA-17 should be followed.

a. Conduct a survey and analysis of the hazard to be protected.
b. Determine the height, length, and width of the enclosure. Calculate the volume. All of these parameters must be within the dimensional limits specified in this Manual. (See Section 4.4.1)
c. Determine the anticipated minimum and maximum ambient temperatures expected within the enclosure to be protected. (See Section 4.2.1)
d. Determine the integrity of the enclosure and if any openings must be closed at the time of agent discharge. (See Section 4.4.2)
e. Determine the amount of Dry Chemical needed for the enclosure volume. (See Section 4.5)
f. Determine the cylinder size required based on the hazard volume limitations and enclosure size. **Remember, as cautioned in Section 3.1 of this Manual, only one (1) extinguisher unit can be used to protect one (1) hazard.**
g. Determine the location of the Dry Chemical cylinder.
h. Determine the location and quantity of nozzles required, based on the size and configuration of the enclosure. (See Section 4.6)
i. Determine the routing and quantity of discharge pipe required. The discharge pipe and fitting limitations must not be exceeded. (See Section 4.6)
j. Determine the arrangement and placement of the Firetrace detection tubing. (See Section 4.7)
k. Determine any auxiliary equipment requirements, such as a pressure switch(s) to sound alarms, shut-down ventilation, shut-off electrical power, etc.

4.4 Hazard Enclosure Limitations

4.4.1 Enclosure Size

The maximum dimensions and area coverage for each size unit are shown in Table 4-2. The protected enclosure can be any size, shape, or volume, provided that the dimensions do not exceed the limitations shown in Table 4-2.

Model	ABC Dry Chemical	Discharge Ports Used (DP)	Nozzles Per DP	Total Number of Nozzles Per Unit	Max. Area Coverage Per Nozzle	Total Area Coverage Per Unit	Maximum Height	Total Volume Coverage Per Unit
940202	2.5 lb (1.13 Kg)	1	1	1	5.6'x5.6' = 31.36 Ft^2 (1.71x1.71 = 2.91m^2)	31.36 Ft^2 (2.91m^2)	6 Ft (1.83 m)	188.16 Ft^3 (5.33 m^2)
		2	1	2	2.8'x5.6' = 15.68 Ft^2 (0.86 x1.71 = 1.46 m^2)			
			2	4	2.8'x2.8' = 7.84 Ft^2 (0.86 x0.86 = 0.73m^2)			
940502	5 lb (2.27 Kg)	1	1	1	6.5'x6.5' = 42.25 Ft^2 (1.98x1.98 = 3.93m^2)	42.25 Ft^2 (3.93 m^2)	9 Ft (2.74 m)	380.25 Ft^3 (10.77 m^3)
		2	1	2	3.25'x6.5' = 21.125 Ft^2 (0.99x1.98 = 1.96m^2)			
			2	4	3.25'x3.25' = 10.56 Ft^2 (0.99x0.99 = 0.98^2)			
941002	10 lb (4.54 Kg)	2	1	2	6.5'x6.5' = 42.25 Ft^2 (1.98x1.98 = 3.93m^2)	84.5 Ft^2 (7.85m^2)	9 Ft (2.74 m)	760.50 Ft^3 (21.54 m^3)
			2	4	3.25'x6.5' = 21.125 Ft^2 (0.99x1.98 = 1.96m^2)			
942002	20 lb (9.07 Kg)	2	1	2	6.5'x6.5' = 42.25 Ft^2 (1.98x1.98 = 3.93m^2)	84.5 Ft^2 (7.85m^2)	9 Ft (2.74 m)	760.50 Ft^3 (21.54 m^3)
			2	4	6.5'x6.5' = 42.25 Ft^2 (1.98x1.98 = 3.93m^2)	169 Ft^2 (15.7m^2)		1521 Ft^3 (43.08 m^3)
See Figure 4-1 for typical examples of configurations that meet the maximum area coverage limitations.								

Table 4-2: Enclosure Size and Nozzle Limitations

CAUTION

This unit is designed and Listed as an Automatic unit. No Manual or electric means is provided for simultaneous actuation of multiple units. Only one (1) unit can be used to protect one hazard. These extinguisher units cannot be combined to protect a larger size hazard since they are not designed to provide for simultaneous actuation of (2) or more units.

4.4.2 Ventilation Shut-Down and Unclosable Openings

Provisions must be made to provide means to close all openings in the hazard enclosure and shut-off ventilation at the time of discharge.

The total area of Unclosable openings shall not exceed 1 percent of the total area of the sides, top, and bottom of the enclosure.

4.5 Required Amounts of Agent

4.5.1 Volume

One pound of ABC Dry Chemical from a small system will protect 75.3 cubic feet (2.13 m^3). One pound of ABC Dry Chemical from a medium, large or extra large system will protect 76.05 cubic feet (2.15 m^3) of enclosure volume. Please refer to Table 4-2 for the maximum volume able to be protected by each system.

4.6 Nozzle and Discharge Pipe Requirements

4.6.1 Discharge Nozzle Limitations

Two nozzle sizes are available for use with the Firetrace ILP Units.

The Small Dry Chemical Total Flooding Nozzle (P/N 500001) is only used with the 2.5 Lb. units. The 2.5 Lb. unit can be designed using 1, 2, or 4 nozzles to suit the hazard configuration.

The Medium Dry Chemical Total Flooding Nozzle (P/N 500002) is only used with the 5 Lb., 10 Lb., and 20 Lb. units. The 5 Lb. unit can be designed using 1, 2, or 4 nozzles to suit the hazard configuration, while the 10 and 20 Lb. units can only be designed using 2 or 4 nozzles.

Refer to Table 4-2 for maximum enclosure heights for nozzle installation. Each nozzle is to be installed at the top of the hazard enclosure facing down in a pendant position and centered in the area to be protected by that particular nozzle

Each cylinder valve is equipped with 2 discharge ports (DP). Whether 1 or 2 discharge ports are used is dependent on the size and shape of the enclosure and the number of nozzles required to cover the specific hazard.

See Figure 4-1 for typical examples of configurations that meet the maximum area coverage limitations.

4.6.2 Nozzle Area Coverage

Please refer to Table 4-2 for the maximum area coverage (regardless of the number of nozzles used) and maximum nozzle arrangement limitations, respectively, for each size system. Figure 4-1 displays some typical examples of configurations that meet these limitations.

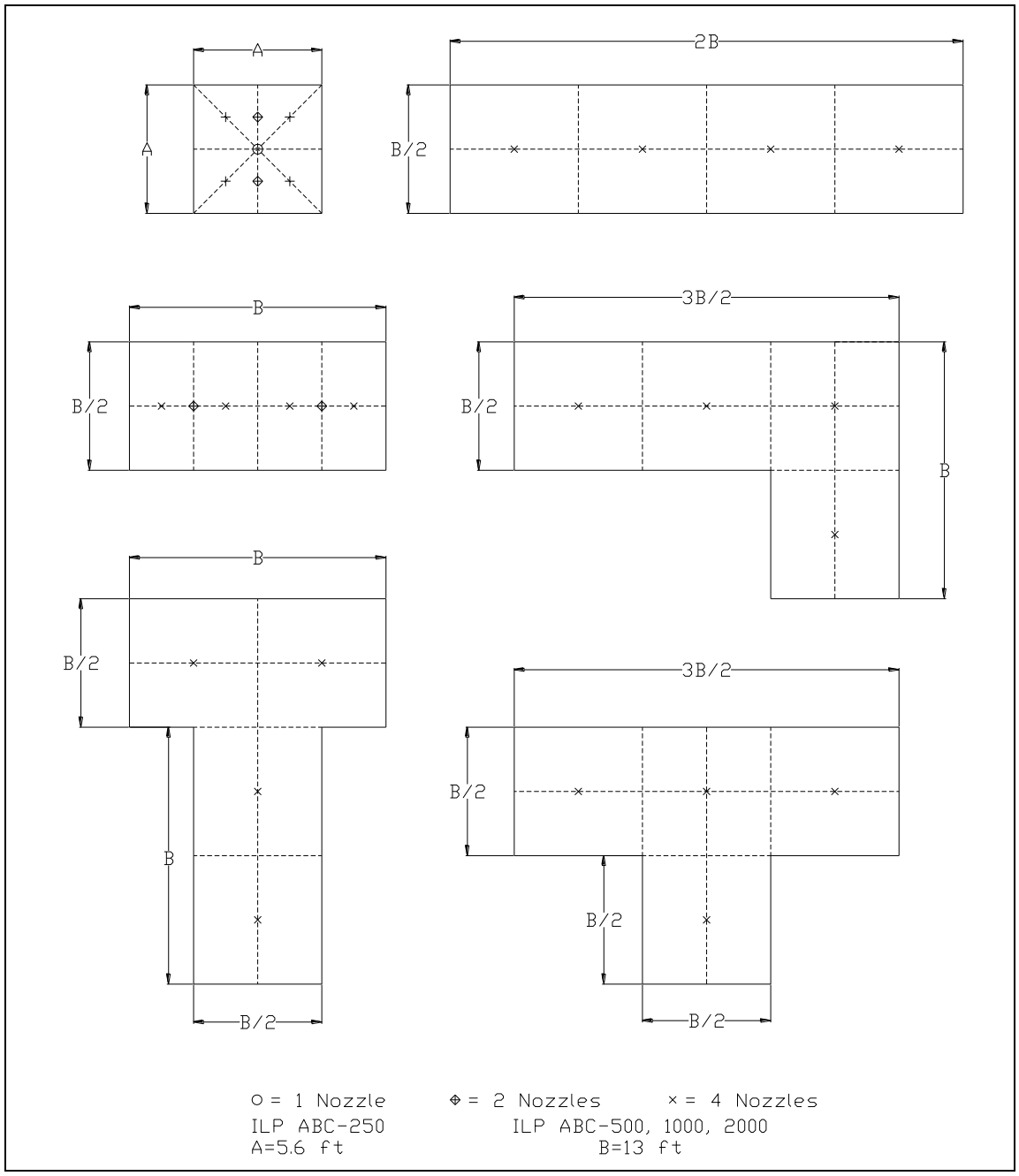


Figure 4-1
Typical Examples of Enclosure Configurations That Meet the Area Coverage Limitations

4.6.3 Discharge Piping and Fitting Specifications

All Firetrace ILP Units shall use copper tubing for the Dry Chemical distribution system. The following tubing and fittings shall be used.

Tubing Specifications:

Material: Soft Annealed Copper Tubing (in coils)
AS B-280, for air conditioning and refrigeration service.

Size: 5/16" OD x .032" wall, for the 2.5 lb. unit.
½" OD x .032" wall, for the 5, 10, & 20 lb. units.

Note: The AS B-280 soft annealed copper tubing, in the sizes and wall thickness specified for use in the Firetrace Dry Chemical units, complies with the ASME B-31.1 Power Piping Code requirements.

Note: For other options consult NFPA 17 2002 Edition Section 4.5

Tubing Fitting Specifications:

Material: Brass
Type: Flareless Bite Type (Parker Intru-Lok, Camozzi, or equivalent)
Manufacturer's Pressure Rating: Parker Intru-Lok Fittings (1500 PSI in all sizes thru ½".)
Min Pressure Rating for Use with Firetrace Units: 1000 psig

4.6.4 Maximum Discharge Piping and Fitting Limitations

The maximum piping and fitting limitations are shown in Table 4-3.

Unit Size	Discharge Ports Used (DP)	Nozzles Per DP	Total Number of Nozzles Per Unit	Max. Length Of Piping Per DP	Max. No. Of Elbows Per DP	Max. No. Of Tees Per DP
2.5 Lb.	1	1	1	7 Ft (2.13 m)	1	0
	2	1	2	7 Ft (2.13 m)	1	0
		2	4	7 Ft (2.13 m)	3	1
5 Lb.	1	1	1	10 Ft (3.05 m)	2	0
	2	1	2	10 Ft (3.05 m)	2	0
		2	4	15 Ft (4.57 m)	3	1
10 & 20 Lb.	2	1	2	10 Ft (3.05 m)	2	0
		2	4	15 Ft (4.57 m)	3	1

Table 4-3: Maximum Piping and Fitting Limitations

4.6.5 Piping Bends

Wherever possible, pipe bends should be used in lieu of 90° pipe elbows. It is recommended that a pipe bender be used when forming the 90° bends. The following minimum bend radii should be used when forming the pipe bends in order to minimize the chance of flattening the pipe.

Pipe OD	Min. Bend Radius To Pipe Centerline	Equiv. Length Of Piping For 90° Bend (a), (b)
5/16"	11/16" R	1-1/8"
½"	1-1/2" R	2-3/8"

Notes:

(a) The equivalent length of pipe is to be counted as part of the maximum length of pipe shown in Table 4-3.

(b) 90° pipe bends are not required to be subtracted from the maximum number of elbows allowed in Table 4-3.

(c) Min. Bend Radii were taken from Parker Industrial Tube Fittings Catalog 4300 March 1991

Table 4-4: Minimum Pipe Bend Radius and Equivalent Length

4.7 Firetrace Detection/Actuation Tubing

The Firetrace detection/activation tubing is a UL recognized component per UL standard 521 (See Certificate of Compliance 20140705-S35465). For the indirect Dry Chemical Units, the Firetrace tubing is used as a combination heat detector and unit activation device to cause actuation of the Dry Chemical System.

The detection/actuation tubing is heat sensitive and in a fire situation is designed to rupture at any point along the tube upon direct flame impingement or at a temperature above 383°F (195°C).

The maximum length of tubing that can be used for any ILP unit is 120 feet (36.58 m). Refer to Section 5.4 for installation instructions.

NOTE: It is recommended that the tubing **not** be placed horizontally adjacent to potential fire sources as this may significantly delay response time.

5 INSTALLATION INSTRUCTIONS

This section provides installation instructions covering components and limitations described in Section 3 and Section 4 of this Manual.

All components should be installed to facilitate proper inspection, testing, recharging, and any other required service or maintenance as may be necessary. Equipment must not be subjected to severe weather conditions or mechanical, chemical, or other damage which could render the equipment inoperative. The equipment must be installed in accordance with instructions in this Manual and the NFPA Standard 17.

WARNING

Dry Chemical cylinder/valve assemblies must be handled, installed and service in accordance with the instruction contained in this Manual and on the cylinder nameplate. Failure to follow these instructions could result in property damage, severe injury, or death.

WARNING

Pressurized (charged) cylinders are extremely hazardous and if not handled properly are capable of causing property damage, bodily injury, or death. Always wear safety glasses and make sure the discharge plugs are properly in place before unit installation, servicing, or other general handling.

5.1 Dry Chemical Cylinder/Valve and Bracket Assemblies

The Dry Chemical cylinders should be located as close as possible to the protected enclosure. In some cases, the cylinder can be mounted inside the protected enclosure. The assemblies shall be located in a readily accessible location to allow for ease of inspection, service, and maintenance. The cylinders shall be located in an environment protected from the weather and where the temperature range is between 0°F to +130°F (-17.8°C to +54.4°C).

The cylinder and bracket must be mounted in the vertical plane with the cylinder valve facing up and oriented so that the pressure gauge is facing out and away from the mounting wall to facilitate visual inspection.

Mount the cylinder where it will not be subjected to accidental damage or movement. Suitable protection must be installed where necessary to prevent damage or movement.

WARNING

Make sure that the ball valve, located on the top of the cylinder valve, is maintained in the "OFF" position and the discharge port safety plugs are kept in place until the system is secured in place and ready for connection of the discharge piping. Failure to follow these instructions will result in actuation and discharge of the cylinder contents.

1. Securely mount the cylinder bracket to structural support using 2 or more mounting holes.
2. Position the cylinder in the bracket with the pressure gauge facing out. Secure the cylinder in place using the bracket straps or band clamps.

5.2 Discharge Piping and Nozzles

1. Locate the nozzle(s) following the guidelines and limitations described in Section 4.6.
2. Determine the routing of the discharge pipe and whether one (1) or two (2) discharge ports will be used following the guidelines and limitations described in Section 4.6. If two (2) discharge ports are used, verify that the pipe length from each discharge port does not exceed a 10% imbalance.
3. Remove one or two safety plugs from the valve discharge ports as required. Attach male connection fittings (Firetrace P/N 310300 or P/N 310301 as applicable) into each discharge port.
4. Install the discharge pipe and fittings between the cylinder and nozzle(s). Secure the pipe with the appropriate size pipe clamps as required.

For a more comprehensive list of Discharge Pipe Fittings, refer to Appendix A.

5.3 Discharge Line Tees

Changes in direction of flow cause separation of expellant gas and dry chemical. To provide proper distribution of dry chemical upon splitting the stream special attention must be given to the method in which an approach is made to a tee after a change in direction. Certain acceptable methods are shown in Figure 5-1.

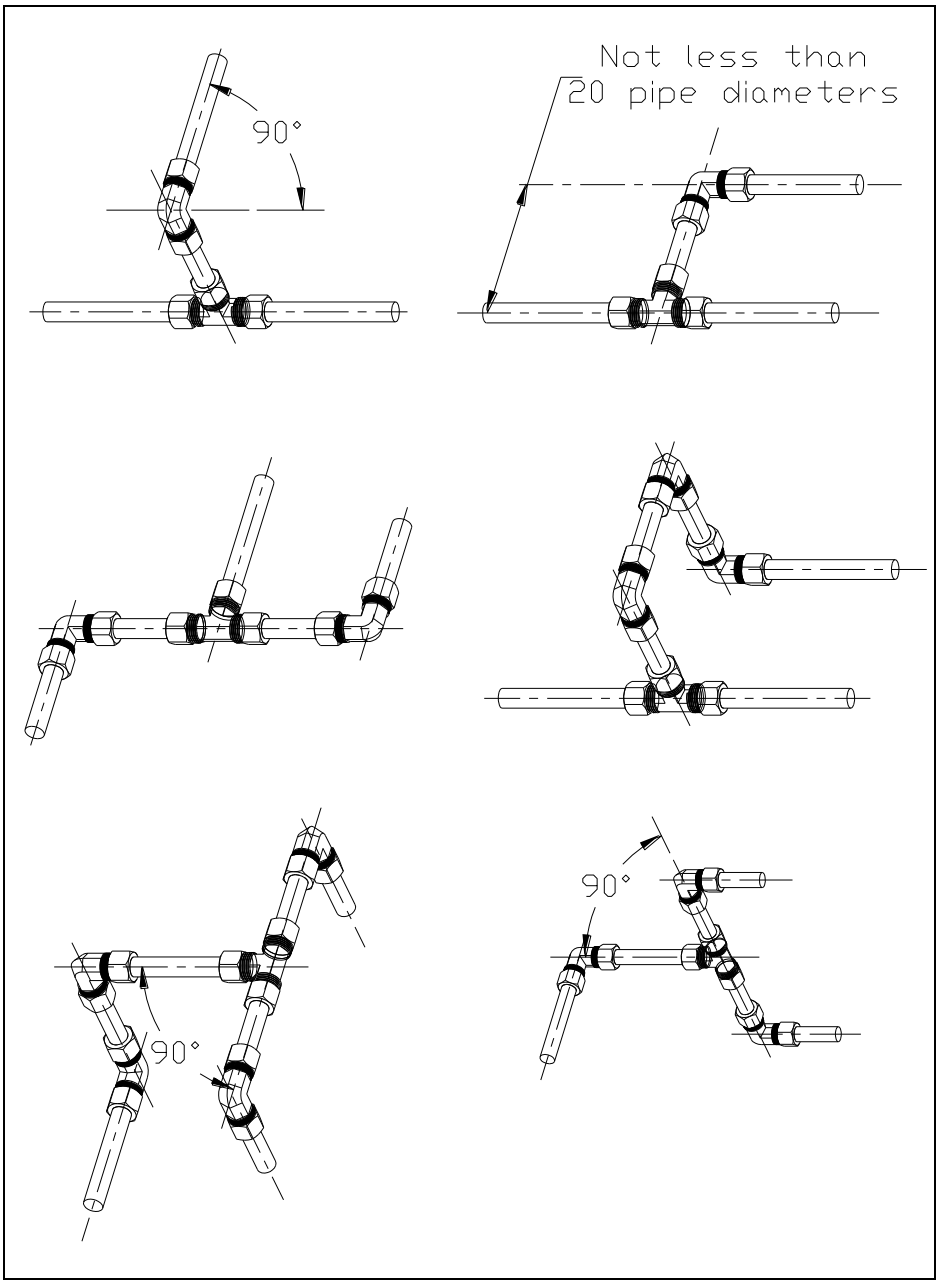


Figure 5-1
Illustrations of Acceptable Means of Piping
Into a Tee in a Dry Chemical System

5.4 Firetrace Detection/Actuation Tubing

Location and spacing of the tubing is critical to the response time in the event of a fire. The tubing should be placed above the hazard areas being protected. The Typical Tubing Placement diagram, located in Appendix B, provides general guidelines for placement of the detection tubing along with the maximum spacing and height limitations. Depending on the configuration of specific hazards, the guidelines shown in the Typical Tubing Placement diagram may, or may not, be applicable. The maximum height that is allowed between layers is 3.28 feet (1 m), the maximum distance between passes is 21.12 inches (53.34 cm), and the maximum distance allowed from any wall to the tubing is 10.56 inches (26.82 cm). Refer to the Typical Tubing Placement diagram in Appendix B for further clarification.

CAUTION

1. **Do not kink, bend, or crush Firetrace tubing in order to prevent leakage which could result in accidental unit discharge.**
2. **Do not install tubing in a hazardous environment where the maximum ambient temperature exceeds 176°F (80°C)**
3. **Maximum length of detection tubing shall not exceed 120 Feet (36.58 m).**

1. Secure the detection tubing using Mounting Tabs at 1.5 Ft (0.46 m) intervals.
2. Use the appropriate rubber/plastic grommets when the detection tubing is routed through sharp holes in order to prevent damage to the tubing.

5.5 Detection Tubing Fittings and Accessories

5.5.1 Spring Top Support Fittings

All compression fittings must be secured in the following manner:

1. Cut the tube end, ensuring the cut is square, clean, and free from burrs. Check that no debris is left in the tube.
2. Place the nut/spring top over the end of the tube with its threaded section towards the end of the tube.
3. Push the tube fully home onto the nipple fitting.
4. The nut should then be fastened finger tight and then using a 12mm wrench, fastened to a torque of 3-4.5 lbf*ft (4-6 N*m).
5. Loosen the connection and inspect the end to ensure a proper flange has formed. Reconnect and tighten down to ensure an effective seal.

For a more comprehensive list of Spring Top Support Fittings, refer to Appendix A.

5.5.2 Slip-On Fittings

All high pressure slip-on fittings must be secured in the following manner:

1. Cut the tube end, ensuring the cut is square, clean, and free from burrs. Check that no debris is left in the tube.
2. Thoroughly clean the tubing to a distance of at least 2 in. (5.08 cm) above the cut end, removing all dirt, grease, or grime. This will ensure a good seal inside the fitting.
3. Slide the tubing into the opening until it butts up against the inner wall. Pull lightly on the tubing and the brass outer ring should move outward slightly.

For a more comprehensive list of Slip-On Fittings, refer to Appendix A.

5.5.3 End of Line Accessories

All of the following accessories will connect to an End of Line Adapter. The End of Line Adapter can be installed by following the appropriate procedures in Section 5.5.1 or Section 5.5.2.
NOTE: End of Line Adapters are not designed to provide a lasting seal without the use of one of the following items:

Dry Chemical 195 psig Pressure Gauge (P/N 400013):
The Dry Chemical 195 psig Pressure Gauge must be installed with its included o-ring. Thread the pressure gauge into the End of Line Adapter so that the gauge indicates the tubing pressure.

Pressure Switch for End of Line Adapter (P/N 400004):
The Pressure Switch for the End of Line Adapter must be installed with its included o-ring and washer. Insert the washer into the End of Line Adapter, and then thread the Pressure Switch in until an audible “click” can be heard. The Pressure Switch is now active.
NOTE: Without installation of the included washer, the Pressure Switch will not be active.

End of Line Adapter Plug (P/N 310303):
The End of Line Adapter Plug must be installed with its included o-ring. Thread the plug into the End of Line Adapter.

5.6 System Activation

1. Install the detection tubing, fittings, and accessories according the procedures specified in Section 5.4 and Section 5.5.

2. With the system ball valve still closed, connect the detection tubing to the system using the appropriate procedure in Section 5.5.1 or Section 5.5.2.

3. Attach the filling adapter (P/N 600023 or 600028) to the End of Line Adapter. Refer to Section 5.5.3.

4. A regulator and calibrated pressure gauge shall be used to pressurized the detection tubing with dry nitrogen through the filling adapter to 195 psig (13.5 bar). It is recommended to have a portable dry nitrogen cylinder or Firetrace Nitrogen Fill Kit for on-site use.

5. Remove the filling adapter and thread the pressure gauge & 0-ring (Firetrace P/N 400013) into its place to verify that the tubing is pressurized to at least 195 psig at 70°F (13.5 bar at 21°C) (pressure may have to be adjusted for temperatures higher or lower than 70°F). Refer to Section 5.5.3 for further instructions.

6. With the gauge still attached to the filling adapter, test for leakage:
   - Apply soapy water solution to the cylinder valve connection, end of line adapter connection, and the pressure gauge connection. Observe for bubble leaks.
   - Wait 30 minutes, then observe the pressure gauge. Any decrease in pressure is an indication of a leak.
   - In the event of a leak go back to Section 5.5 and check the installation of all fittings and accessories.

7. If an optional pressure switch is to be installed in the EOL adapter, remove the pressure gauge and install the pressure switch according to the procedures in Section 5.5.3. Check pressure switch connection for bubble leaks using soapy water solution.

8. After confirming that there is no leakage within the detector tubing, **SLOWLY** rotate the ball valve lever counter clock wise to the "ON" position.

CAUTION

If the ball valve lever is opened abruptly, activation of the cylinder valve may occur, causing the unit to discharge.

9. Tamper proof the unit by removing the ball valve lever face and securing the lever in the "ON" position with a zip tie. Refer to the Tamper Proof Instruction in Appendix B.

10. If the optional Pressure Switch is installed on the valve or on the E.O.L, ensure that the proper electrical connections are made to annunciate unit discharge, shut down ventilation, etc., as may be required by the end user or the AHJ. (All electrical connections are to be in accordance to NFPA 70 National Electric Code)

11. The unit is now fully armed and ready for use.

6 SERVICE AND MAINTENANCE INSTRUCTIONS

WARNING

1. **Dry Chemical cylinder/valve assemblies must be handled, installed, inspected and serviced only by qualified and trained personnel in accordance with the instructions contained in this Manual, the cylinder nameplate, NFPA-17, and any other regulations and codes that may apply.**
2. **Before performing maintenance or refilling procedures refer to the material safety data sheets in** Appendix C**.**

WARNING

Pressurized (charged) cylinders are extremely hazardous and if not handled properly are capable of causing bodily injury, death or property damage. Always wear safety glasses and make sure the discharge plugs are properly in place before unit installation, servicing, or other general handling.

ATTENTION

Any maintenance requiring depressurization, filling, or pressurization should only be performed at an Authorized Firetrace Service Location. Service at any other location will void the FM Approval and UL/ULC Listing. Please contact Firetrace directly for a list of Authorized Firetrace Service Locations.

6.1 General

A regular program of systematic maintenance must be established for continuous, proper operation of all Dry Chemical units, and to avoid violating the warranty. A periodic maintenance schedule must be followed and an inspection log maintained for ready reference. As a minimum, the log must record: (1) inspection interval, (2) inspection procedure performed, (3) maintenance performed, if any, as a result of inspection, and (4) name of inspector performing task.

For any deficiencies that are found, appropriate corrective actions shall be taken immediately.

6.2 Recharge Agents

6.2.1 Dry Chemical

Only ABC Dry Chemical Powder provided by Firetrace may be used in any Firetrace Dry Chemical Self-Contained Automatic Indirect Fire Suppression Unit.

6.2.2 Nitrogen

Only commercial grade nitrogen with a dew point of -60°F (-52.2°C) may be used in any Firetrace Dry Chemical Self-Contained Automatic Indirect Fire Suppression Unit.

6.3 Periodic Service and Maintenance Procedures

6.3.1 Monthly Inspection

Inspection by the owner or end user should verify the following:

1. The Suppression Unit is in its proper location.
2. The Manual Actuators are unobstructed.
3. The Tamper Indicator is intact.
4. The Maintenance Tag or Certificate is in place.
5. The Suppression Unit shows no physical damage or condition that might prevent operation.
   a. This includes inspecting the detection tubing in the hazard area for abrasion, distortion, cuts, or dirt accumulation.
6. The Pressure Gauge is in the operable range.
7. The Nozzle Blowoff Caps are intact and undamaged.
8. Neither the Protected Equipment nor the Hazard has been replaced, modified, or relocated.

6.3.2 Semiannual Inspection

Semiannual Inspection is to be performed only by a Certified Firetrace Distributor

1. Check to see that the hazard has not changed.
2. Inspect detection/actuation tubing, Manual releases, discharge piping, nozzles, signals, and all other auxiliary equipment.
3. Verify that the agent distribution piping is not obstructed.

6.3.3 Dry Chemical Powder

Examination of the Dry Chemical shall be conducted at an Authorized Firetrace Service Location at least once every 6 years. The powder will be examined for caking and may require replacement.

6.3.4 Hydrostatic Testing

The Dry Chemical Cylinder shall be subject to a hydrostatic pressure test at intervals not exceeding 12 years.

Carefully depressurize the system following the procedures in Section 7.1. Discard the Dry Chemical Powder.

DOT-4B Firetrace Dry Chemical containers requiring retest must be hydrostatically tested in accordance with DOT CFR Title 49, section 173.34(e). This periodic retest must be performed by an authorized retester having a current identification number issued by the Associated Administrator for Hazardous Material Safety of DOT, and must include an internal and external examination in accordance with CGA pamphlet C-6, C-6.1, C-6.2, or C-6.3, as applicable. The test procedures are described in CGA pamphlet C-1. Because volumetric expansion of the container must be measured, only the water jacket volumetric expansion method or the direct expansion methods are acceptable.

Refer to Table 3-2 for testing pressures.

Rebuild and recharge the system, referring to Section 7.2 and Section 7.3.

7 SYSTEM DISSASSEMBLY, ASSEMBLY, AND CHARGING

WARNING

Pressurized (charged) cylinders are extremely hazardous and if not handled properly are capable of causing bodily injury, property damage, or death. Always wear safety glasses and make sure the discharge plugs are properly in place before unit installation, servicing, or other general handling.

ATTENTION

Any maintenance requiring depressurization, filling, or pressurization should only be performed at an Authorized Firetrace Service Location. Service at any other location will void the FM Approval and UL/ULC Listing. Please contact Firetrace directly for a list of Authorized Firetrace Service Locations.

7.1 Depressurizing the Unit

1. Turn the ball valve lever to the "off" position (perpendicular to the valve).
2. Depressurize the detection/actuation tubing by depressing the Schrader valve inside of the End of Line Adapter.
3. Remove the detection/actuation tubing from the top of the ball valve.
4. Remove the discharge piping from the discharge ports.
5. Install discharge plugs into both discharge ports.
6. Slowly, slightly open the ball valve so only a small amount of nitrogen can be heard leaving the unit.

CAUTION

Opening the ball valve too far, or too fast, will unseat the piston and bring Dry Chemical into the valve assembly.

7. Once the pressure gauge has reached 0 psig, slowly open the ball valve completely
8. Carefully remove the discharge plugs from the valve to ensure system depressurization.

7.2 Valve Rebuild

For valve rebuilding instructions, please refer to Tech Bulletin 009 located in Appendix B.
Tech Bulletin 009, along with all other bulletins, is also available at www.firetrace.com

7.3 System Recharge

1. Fill the cylinder with the appropriate amount of dry chemical. Refer to Table 3-1 for the correct amounts for each system.
2. Clean the threads of the cylinder with a small brush or dry cloth.
3. Thread the siphon tube into the valve. See Appendix A for the part numbers appropriate for each system.
4. Thread the valve and siphon tube assembly onto the cylinder. Ensure a tight fit so that the valve is seated completely on top of the cylinder collar.
5. Install the detection/actuation tubing. Refer to Section 5.4.
6. Pressurize the detection/actuation tubing and the cylinder through the End of Line Adapter or Manual Release. Refer to Section 5.6.

WARRANTY

Firetrace USA, LLC.
Limited Warranty & Purchaser's Exclusive Remedy

****

LIMITED WARRANTY & PURCHASER'S EXCLUSIVE REMEDY

Purchaser's Limited Warranty

Firetrace USA, LLC (hereafter referred to as Firetrace) provides the following **Limited Warranty** only to the original purchaser, who purchases the Firetrace unit from an Authorized Firetrace Distributor. The **Limited Warranty** includes all Firetrace units and its component parts supplied by Firetrace. Hereafter these products will be referred to as "Firetrace Products". When the Firetrace Products are properly installed by an authorized Firetrace distributor, ***in complete*** accordance with the written instructions contained in the instruction Manuals, or other data supplied with Firetrace products, and when the Firetrace products have not subsequently been modified or altered, unless by express written instructions from Firetrace, then the Firetrace products are warranted to be free of defects in materials and workmanship for a period of three (3) years from the date of shipment from Firetrace, Scottsdale Arizona, as long as the following conditions are met:

(1) The ***original*** purchaser must maintain a semi-annual maintenance service agreement with an authorized Firetrace distributor, commencing with the date the Firetrace product was accepted by the purchaser and placed into service. The service agreement **shall** remain in effect for the duration of the warranty.
(2) The Firetrace Warranty Registration Card (P/N 800100) must be completed and returned to Firetrace within thirty (30) days of the installation of the Firetrace unit.

Firetrace products that are not certified, as specified in the paragraphs 1 and 2 above, will carry a maximum limited warranty of one (1) year from the date of shipment from Firetrace.

Purchaser's Exclusive Remedy

The original purchaser's sole and exclusive remedy, unless varied by express written agreement with Firetrace, is as follows: Repair or replacement, at Firetrace's option, of any defective part which is returned to Firetrace within ninety (90) days of discovery of the defect.

Because of the deleterious effects of corrosion, heat, rust, dirt, debris and other factors of use and installation over which Firetrace has no control, **FIRETRACE MAKES NO OTHER WARRANTIES OF ANY KIND, WHETHER EXPRESSED OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITTNESS FOR A PARTICULAR PURPOSE, BEYOND THOSE EXPRESSLY PROVIDED FOR IN THIS *LIMITED* WARRANTY**. These warranties shall be void where defects occur due to improper maintenance, installation, service, alterations and/or modifications subsequent to installation, not expressly authorized in writing by Firetrace or due to intentional or negligent acts of the original purchaser or third parties.

Non-Assignability of Warranty

The limited warranty set forth herein may not be assigned, transferred or sold in any way and extends only to the *original* purchaser.

Disclaimer of Consequential Damages

In no event shall Firetrace be liable for any consequential or incidental damages arising from the purchase and/or use of Firetrace products, including but not limited to: damages resulting from loss of use of Firetrace products, the costs of replacing discharged suppression agent, damages for lost profits or income, or damages for resulting harm to property other than the Firetrace products.

Use of Non-Firetrace Components

All Firetrace units must exclusively use Firetrace components, especially for connections made to the Firetrace tubing. Failure to exclusively use Firetrace components will void this limited warranty and release Firetrace of any and all liability on the performance of the Firetrace components and unit.

SOME FACTORS INFLUENCING ENGINEERING DESIGN AND PRODUCT APPLICATION OF FIRETRACE UNITS

The following are some of the factors that influence engineering design and application of Firetrace units. In many cases, these factors are difficult to accurately estimate, and it is for these reasons that Firetrace makes ***no*** warranties other than those specifically stated in this **Limited Warranty**.

1. The Firetrace unit has been designed to provide protection against fire, both existing and imminent, for a limited duration of time when: the unit is fully operational; used in its normal, expected environment; the unit and its component parts are properly installed, maintained, and operated in ***complete*** accordance with written instructions supplied with the unit.

2. The duration of the protection against fires dependent upon a sufficient concentration of agent being maintained in the protected hazard area for a pre-determined period of time. This duration will be shortened by conditions or circumstances which may ventilate, cause the agent concentration dilution within the protected hazard area thereby causing an insufficient concentration of agent as is needed to extinguish or prevent the existence or re-ignition of combustion or fire. All hazard areas have different rate of ventilation, leakage, or agent dilution that, in many cases, may be impossible to predict or determine. Air vents, air conditioning units, gaps and cracks in the enclosure, windows, cable and pipe penetrations, etc., all may effect the agent concentration and the duration of the protection against fire. Also, unforeseen changes in the configuration of a hazard area such as removal of a wall, an explosion or fire external to the protected space, changes in the enclosures configuration, etc. can influence the duration of the fire protection. It is because of these many, and varied, circumstances and conditions that Firetrace makes ***no*** warranty as to the duration of the protection against fire.

3. The effectiveness of an agent, such as Dry Chemical® and/or CO_2, as a fire extinguishant is directly related to the concentration of the agent required to extinguish various substances. Not all substances require the same agent concentration to be extinguished. Therefore, Firetrace can only assume that the customer has properly defined the hazard area(s) being protected.

4. The effectiveness of the Firetrace unit is dependent upon the timely discharge of the agent fire extinguishant in to the protected area. If unforeseen circumstances such as an explosion, failure of the detection system to activate the Firetrace unit, failure to Manually activate the unit, etc. occur, they can prevent the unit discharge from being accomplished in a timely manner, and the fire may become deep seated or out of control and completely destroy the hazard area. Since Firetrace has no control over these circumstances, there are ***no*** warranties as to the effectiveness of extinguishment of the fire other than those specifically stated in this **Limited Warranty**.

5. Even if the Firetrace unit is completely effective in suppressing a fire, failure to remove the ignition source of the fire could result in a re-ignition of the fire. If possible, the source of the fire should immediately be eliminated to prevent re-ignition. Protection against re-ignition only exists when a sufficient concentration of agent remains in the hazard area, as stated above.

Since the effectiveness of the Firetrace unit depends on when, under what circumstances, it is used, the judgment of operating personnel as to when to activate a Firetrace unit, in an emergency, affects the protection provided by the unit. Because of the widely carrying conditions and circumstances under which the Firetrace unit can be used, some conditions can cause its effectiveness to be unpredictable. Therefore, evacuation of personnel from the protected areas ***must*** be accomplished without delay.

APPENDIX A

System Parts List
Discharge Line Parts List
Detection Line Parts List

System Parts List

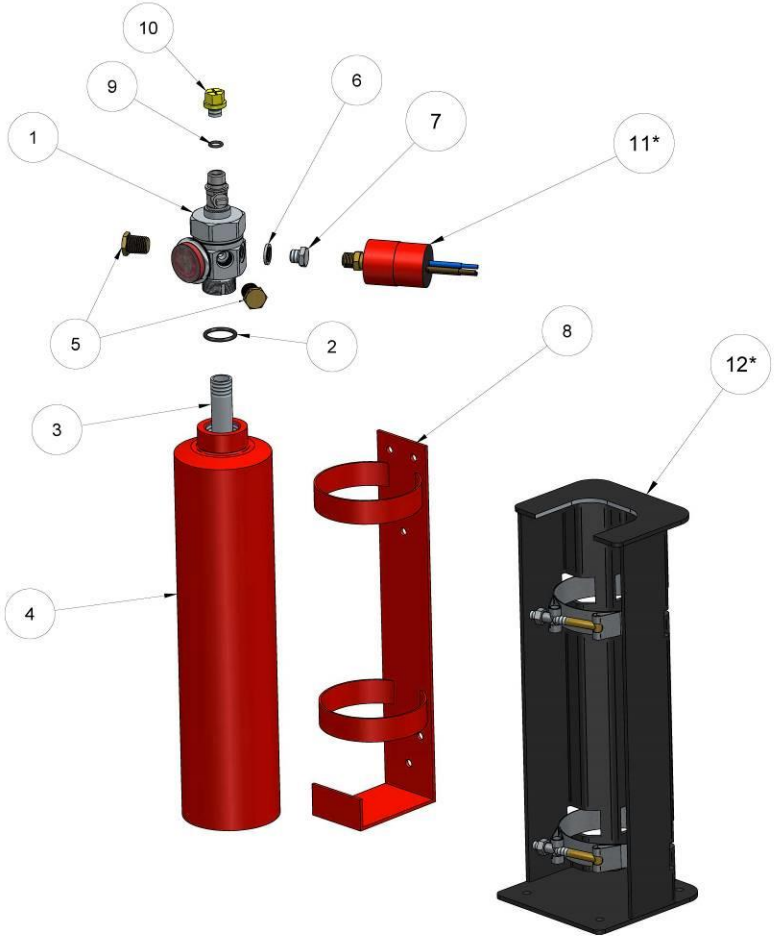
2.5, 5, 10, & 20 LB.

AUTOMATIC INDIRECT
DRY CHEMICAL EXTINGUISHER UNIT

MODELS 940202 2.5 LB. ABC DRY CHEMICAL ILP
940502 5 LB. ABC DRY CHEMICAL ILP
941002 10 LB. ABC DRY CHEMICAL ILP
942002 20 LB. ABC DRY CHEMICAL ILP

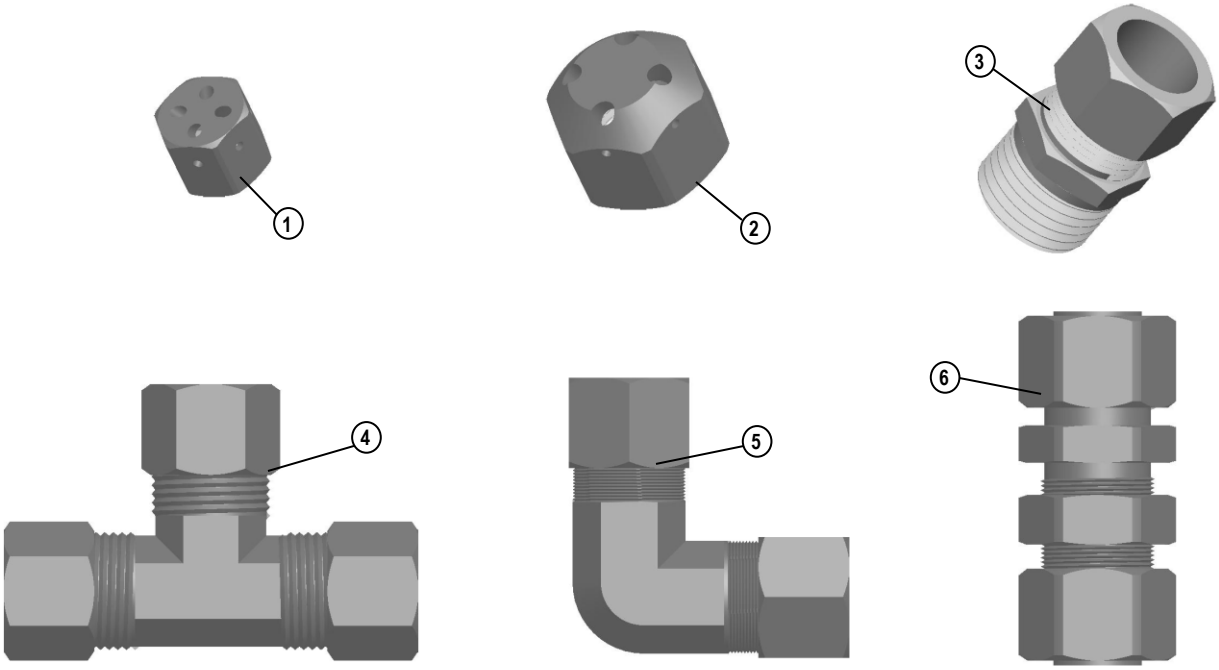
ITEM	PART NO.	DESCRIPTION	SYSTEM
1	300111	Small Dry Chemical ILP Valve	2.5 LB.
1	300117	Medium Dry Chemical ILP Valve	5, 10, 20 LB.
2	300220	Collar O-Ring Small ILP	2.5 LB.
2	300221	Collar O-Ring Medium ILP	5, 10, 20 LB.
3	600022	Siphon Tube 5/8"x11.75"	2.5 LB.
3	600003	Siphon Tube 1"x12"	5, 10 LB.
3	600009	Siphon Tube 1"x19.5"	20 LB.
4	100300	Small Cylinder	2.5 LB.
4	100600	Medium Cylinder	5 LB.
4	101200	Large Cylinder	10 LB.
4	120020	Extra Large Cylinder	20 LB.
5	310300	Small Discharge Port Plug	2.5 LB.
5	310301	Medium Discharge Port Plug	5, 10, 20 LB.
6	600033	Bonded Seal	All Systems
7	600081	Pressure Switch Port Plug	All Systems
8	100003	Small Bracket	2.5 LB.
8	100006	Medium Bracket	5 LB.
8	111206	Large Bracket	10 LB.
8	111020	Extra Large Bracket	20 LB.
9	400002	O-Ring, M1x10	All Systems
10	200103	Yellow Ball Valve Transport Cap	All Systems
11*	400005	Pressure Switch	All Systems (OPTIONAL)
12*	111404	ASM, Small Heavy Duty Bracket	2.5 LB. (OPTIONAL)
12*	111403	ASM, Medium Heavy Duty Bracket	5 LB. (OPTIONAL)
12*	111402	ASM, Large Heavy Duty Bracket	10 LB. (OPTIONAL)
12*	111400	ASM, Extra Large Heavy Duty Bracket	20 LB. (OPTIONAL)
NP	600116	Nameplate: ILP Dry Chem	All Systems
NP	600105	Label: Dry Chem Approvals	All Systems
NP	800100	Warranty/Registration Card	All Systems

* OPTIONAL PARTS
NP NOT PICTURED



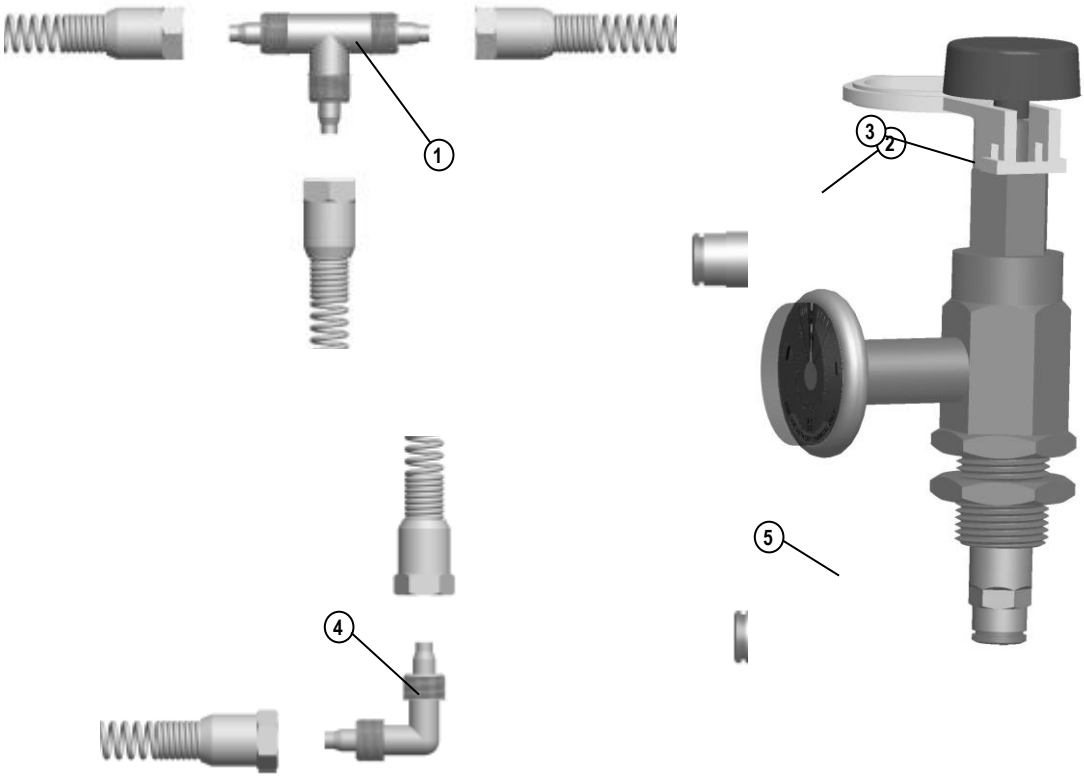
Discharge Line Parts List

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYSTEM
*	200143	Valve to 5/16" Copper Compression Fitting	2.5 LB.
*	200101	5/16" Copper Compression Bulkhead	2.5 LB.
*	200111	5/16" Copper Compression Elbow	2.5 LB.
*	200121	5/16" Copper Compression Tee	2.5 LB.
1	500001	Small Dry Chemical Total Flooding Nozzle	2.5 LB.
3	200144	Valve to ½" Copper Compression Fitting	5, 10, 20 LB.
6	200145	½" Copper Compression Bulkhead	5, 10, 20 LB.
*	200147	½" Copper Compression Union	5, 10, 20 LB.
5	200112	½" Copper Compression Elbow	5, 10, 20 LB.
4	200122	½" Copper Compression Tee	5, 10, 20 LB.
2	500002	Medium Dry Chemical Total Flooding Nozzle	5, 10, 20 LB.
* PART NOT PICTURED			



Detection Line Parts List

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYSTEM
*	200005	Firetrace Detection/Actuation Tubing (by the foot)	All Systems
*	200125	Tube Union With Spring Tops	All Systems
1	200126	Tube Tee With Spring Tops	All Systems
*	200136	Bulkhead With Spring Tops	All Systems
4	200155	Tube Elbow With Spring Tops	All Systems
*	200160	Spring Top	All Systems
*	200158	Tube Union Slip On Fitting	All Systems
2	200157	Tube Tee Slip On Fitting	All Systems
5	200178	Tube Elbow Slip On Fitting	All Systems
*	200179	Tube to Threads Union Slip On Fitting	All Systems
*	200177	Tube to Threads Tee Slip On Fitting	All Systems
*	200159	Tube to Threads Elbow Slip On Fitting	All Systems
*	200133	Tube Plug	All Systems
3	600063	Manual Release Dry Chemical With Slip-On Union	All Systems
*	200168	End Of Line Adapter With Slip-On Union	All Systems
*	200169	In Line Adapter With Slip-On Tee	All Systems
*	310303	Plug With O-Ring For End Of Line Adapter	All Systems
*	400013	Dry Chemical Pressure Gauge	All Systems
*	400004	Pressure Switch With Washer for End Of Line Adapter	All Systems
*	600090	Audible Alarm (Battery Operated) (Not part of FM/UL/ULC Approvals)	All Systems
*	200171	Mounting Tabs (Qty. 12)	All Systems
*	200150	Rubber Grommets (Qty. 2)	All Systems
*	200151	Plastic Grommets (Qty. 2)	All Systems
* PART NOT PICTURED			



APPENDIX B

Technical Bulletin 009
Dry Chemical Valve
Rebuild Procedures

Technical Bulletin 030
Additional Dry Chemical Maintenance Reccommendations

Typical Tubing Placement

Tamp Proof Options

TECHNICAL BULLETIN

TB009

Figure 1:
Med. ILP Valve

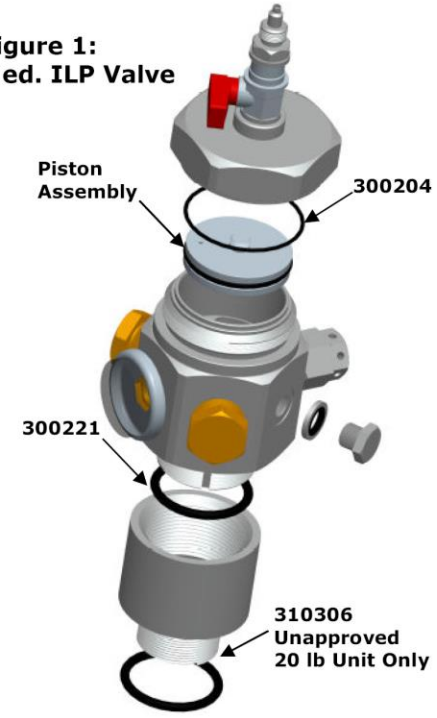
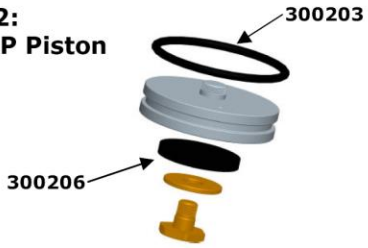


Figure 2:
Med. ILP Piston



Dry Chemical Rebuild Procedure:

I. Medium UL/FM Approved ILP Valve

1) Verify that the unit is not pressurized by looking at the pressure gauge and then very slowly opening the ball valve.
2) Remove the valve from the cylinder and siphon tube.
3) Unthread the top of the valve from the valve base, remove and discard the O-Ring from inside.
4) Remove the piston assembly from the valve body.
   a) Carefully remove and discard O-Ring from around the piston assembly.
   b) Unscrew the small bolt from the bottom of the piston assembly.
   c) Remove the washer.
   d) Carefully remove and discard the Seat Seal from the bottom of the piston assembly.
5) Carefully remove and discard the Collar O-Ring from the bottom threads of the valve.

Note: An Unapproved 20lb system will also require the removal of the collar adapter (P/N 310306) in order to remove the collar O-Ring.

6) Thoroughly clean all valve surfaces and collar adapter if applicable. Verify the small hole in the Piston is clear of Dry Chemical.
7) Reassemble the valve following these steps. Lightly lubricate each O-Ring with Parker O Lube before installing.
   a) Carefully place P/N 300221 around the neck of the valve threads.

   Note: For an unapproved 20lb system, carefully place P/N 310306 around the neck of the Collar Adapter threads, then fasten the Collar Adapter (P/N 600052) to the valve.

   b) Carefully place P/N 300206 into the bottom of the piston assembly and install the washer and the bolt. NOTE: Do not lubricate the Seat Seal (P/N 300206).
   c) Carefully place P/N 300203 into the slotted region of the piston assembly.
   d) Carefully place the piston assembly back into the valve with the bolt facing down into the valve.
   e) Carefully place P/N 300204 into the valve top then fasten the valve cap to the valve body.

Approved 5, 10, & 20 lb. Dry Chemical Rebuild Kit P/N: 300248		
Part Number	Quantity	Description
300204	1	Cap O-ring Med. ILP FM/UL
300203	1	Piston O-ring Med. ILP FM/UL
300206	1	Seat Seal Med. ILP FM/UL
300221	1	Collar O-ring Med. ILP FM/UL

Unapproved 20 lb. Dry Chemical Rebuild Kit P/N: 300250		
Part Number	Quantity	Description
300204	1	Cap O-ring Med. ILP FM/UL
300203	1	Piston O-ring Med. ILP FM/UL
300206	1	Seat Seal Med. ILP FM/UL
300221	1	Collar O-ring Med. ILP FM/UL
310306	1	O-ring, 20 LB Dry Chem

FIRETRACE
AUTOMATIC FIRE SUPPRESSION SYSTEMS
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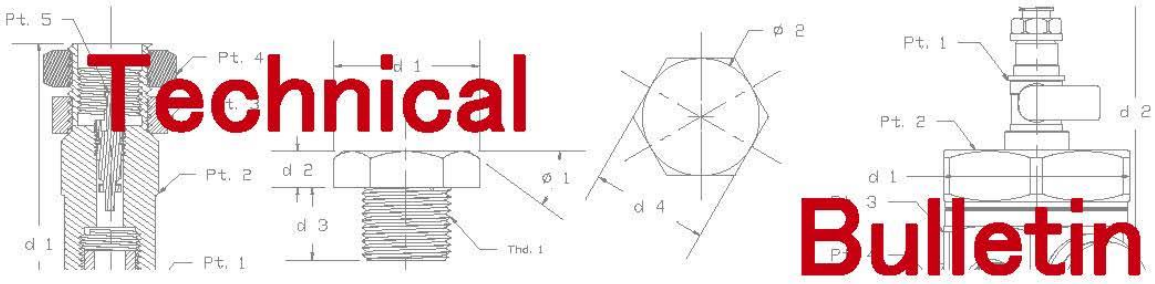


TB030

Additional Dry Chemical Maintenance Recommendations

Each of the respective ABC Dry Chemical System Manuals contains the specific requirements for periodic system maintenance. These requirements refer to, and are required by, NFPA 17: Standard for Dry Chemical Extinguishing Systems and UL 1254: Standard for Pre-Engineered Dry Chemical Extinguishing System Units. In addition to these requirements, the following is **recommended**:

Prior to installation and semi-annually

1. The Fire Suppression System Indication Module functionality should be tested.

2. The Fire Suppression System Assembly should be disconnected from the detection and discharge networks and the powder agitated.

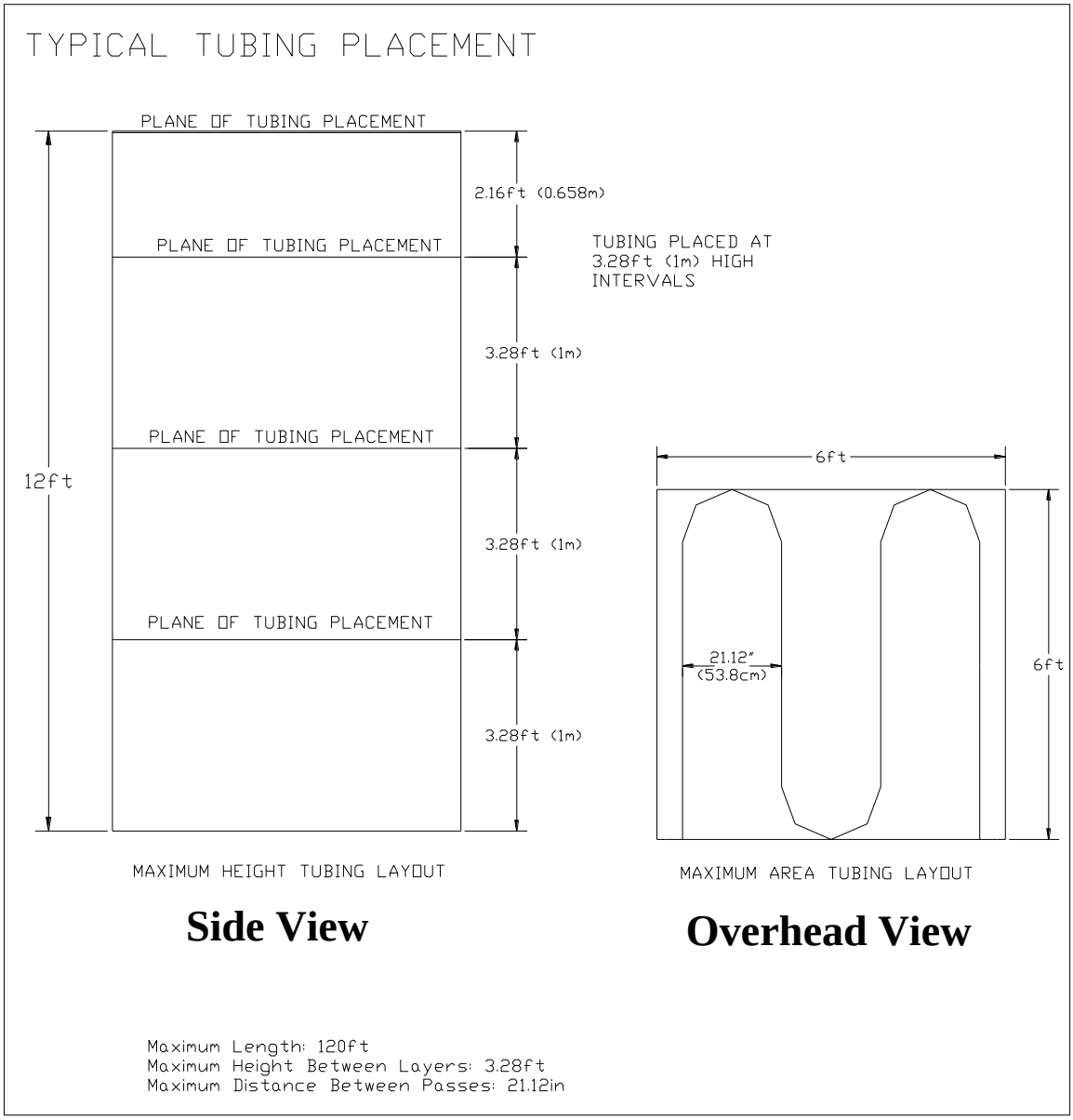
To accomplish these, the subsequent steps should be followed:

1. Deactivate the system by closing the System Ball Valve.
2. Partially depressurize the detection network by removing the auxiliary gauge found on the End of Line Adapter and slowly depressing the schrader valve until the service light on the Indication Module is activated.
3. Completely depressurize the detection network by fully depressing the schrader valve until no pressure remains. The activation light and alarm on the Indication Module should now be activated.
4. Remove the Fire Suppression System Assembly from the detection and discharge networks.
5. Place the Discharge Port Plugs into the Discharge Ports.
6. Carefully invert the assembly and gently knock the bottom and sides of the cylinder with a rubber mallet 5-10 times.
7. Verify that the cylinder pressure is within the operable range.
8. Place the System Assembly back into the System Bracket and reinstall the detection and discharge networks.
9. Repressurize the detection network.
10. Reactivate the system by opening the System Ball Valve.

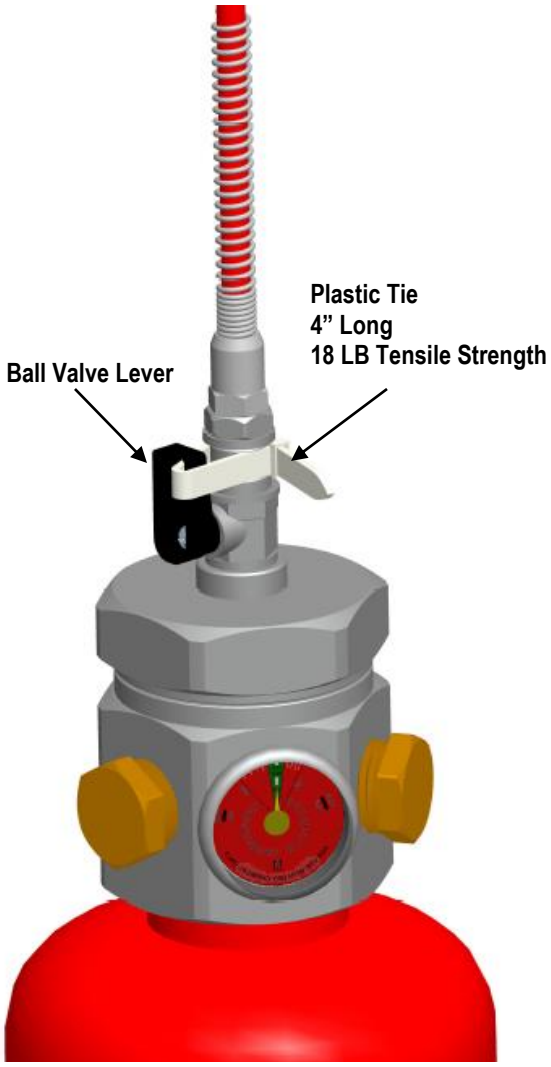
This additional maintenance should be logged along with the previously required maintenance items.

FIRETRACE
AUTOMATIC FIRE SUPPRESSION SYSTEMS
8435 N. 90th Street, Suite 2 • Scottsdale, AZ 85258 USA • Ph: (480) 607-1218 • Fax: (480) 315-1316
www.firetrace.com

Typical Tubing Placement



Tamper Proof Instruction



1. Check to see that the ball valve lever is set to the "ON" position.
2. Remove the ON/OFF faceplate.
3. Pull the tie through the hole in the ball valve lever.
4. Wrap the tie around the ball valve assembly.
5. Firmly pull on the tie to tighten and secure the lever.
6. If desired, cut off the excess tie.

APPENDIX C

SAFETY DATA SHEETS

ABC Dry Chemical

Nitrogen

ABC Dry Chemical SDS

Quality is Behind the Diamond.

SAFETY DATA SHEET

Section 1. PRODUCT AND COMPANY IDENTIFICATION

Product Name:	ABC Dry Chemical Fire Extinguishant
Other Identifiers:	Multi-purpose Dry Chemical
Product Code(s):	CH550, F15, F18
Model Code(s) for Extinguishers:	411, 417, 419, 423, 424, 425, 441, 443, 450, 456, 461, 464, 467, 470, 473, 476, 481, 487, 488, 491, 495, 500, 564, 567, 573, 581, 589, 592, 594, 668, 692, 720, 760, 763, 781.
Recommended Use:	Fire suppression, not for human or animal drug use.
Manufacturer:	AMEREX CORPORATION
Internet Address:	www.amerex-fire.com
Address:	7595 Gadsden Highway, P.O. Box 81 Trussville, AL 35173-0081
Company Telephone:	(205) 655-3271
E-mail Address:	info@amerex-fire.com
Emergency Contacts:	Chemtrec 1(800) 424-9300 or (703) 527–3887
Revised:	January 2015

Section 2. HAZARDS IDENTIFICATION

GHS – Classification

Health	Environmental	Physical
Acute Toxicity: Category 5	None	None
Skin Corrosion/Irritation: Category 2	None	None
Skin Sensitization: NO	None	None
Eye: Category 2B	None	Warning
Carcinogen: Category None	None	None

GHS – Label Symbol(s): None

GHS – Signal Word(s): **Warning**

Other Hazards Not Resulting in Classification: None

GHS – Hazard Phrases

GHS Hazard	GHS Codes(s)	Code Phrase(s)
Physical	None	
Health	H303	May be harmful if swallowed
	313	May be harmful in contact with skin
	320	Causes eye irritation
	333	May be harmful if inhaled
Environmental	None	
Precautionary:		
General	P101	If medical advice is needed, have product container or label at hand
	102	Keep out of reach of children
Prevention	234	Keep in original container
	251	Pressurized container; do not pierce or burn, even after use
	261	Avoid breathing dust
	264	Wash hands and face thoroughly after handling
	270	Do not eat, drink, or smoke when using this product
	281	Use personal protective equipment as required
	285	In case of inadequate ventilation, wear respiratory protection
Response	P301+322+331	If swallowed, drink 2-3 glasses of water and do not induce vomiting
	302+352	If on skin, wash with soap and water
	304+313+341	If inhaled, and if distress occurs, remove victim to fresh air and keep at rest in a position comfortable for breathing. Seek medical advice/attention
	305+351+338	If in eyes, rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do, and continue to rinse
	308+313	If exposed or concerned, get medical advice/attention
	337+313	If eye irritation persists; get medical advice/attention
Storage	P401+402+403	Store in original container or extinguisher in a dry, well ventilated place

Section 3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	EC No.	REACH Reg. No.	CAS-No.	Weight %
Mono-ammonium phosphate	NA	NA	7722-76-1	55-75
Ammonium sulfate	231-984-1	NA	7783-20-2	20-40
Fullers earth magnesium aluminum silicate	NA	Not Available	8031-18-3	<3
Mica-potassium aluminum silicate	NA	Not Available	12001-26-2	1-2
Silicone oil methyl hydrogen polysiloxane	NA	Not Available	63148-57-2	<1
Calcium carbonate	215-279-6	Not Available	1317-65-3	<1
Amorphous silica precipitated synthetic zeolite	262-373-8	Not Available	112926-00-8	<1
Yellow 14 pigment – diazo dye	228-767-9	Not Available	5468-75-7	<1

Emergency overview: Light yellow, fine solid powder, odorless.

Adverse health effects and symptoms: Irritant to the respiratory system; Irritating to eyes and skin. Symptoms may include coughing, shortness of breath, and irritation of the lungs, eyes, and skin.

Ingestion, although unlikely, may cause cramps, nausea and diarrhea.

Cut-off Levels

Chemical Name	Reproductive Toxicity	Carcinogenicity	Mutagenicity	Other Hazard Classes
Mono-ammonium Phosphate	NA	NA	NA	NA
Ammonium Sulfate	NA	NA	NA	NA
Fullers earth magnesium aluminum silicate	NA	NA	NA	NA
Mica-potassium aluminum silicate	NA	NA	NA	NA
Silicone oil methyl hydrogen polysiloxane	NA	NA	NA	NA
Calcium carbonate	NA	NA	NA	NA
Amorphous silica precipitated synthetic zeolite	NA	NA	NA	NA
Yellow 14 pigment – di-azo dye	NA	NA	NA	NA

Section 4. FIRST AID MEASURES

Eye Exposure: May cause irritation. Irrigate eyes with water and repeat until pain free. Seek medical attention if irritation develops, or if vision changes occur.

Skin Exposure: May cause skin irritation. In case of contact, wash with plenty of soap and water. Seek medical attention if irritation persists.

Inhalation: May cause irritation, along with coughing. If respiratory irritation or distress occurs, remove victim to fresh air. Seek medical attention if irritation persists.

Ingestion: Overdose symptoms may include numbness or tingling in hands or feet, uneven heart rate, paralysis, feeling faint, chest pain or heavy feeling, pain spreading to the arm or shoulder, nausea, diarrhea, sweating, general ill feeling, or seizure (convulsions). If victim is conscious and alert, give 2-3 glasses of water to drink. If conscious, do not induce vomiting. Seek immediate medical attention. Do not leave victim unattended. To prevent aspiration of swallowed product, lay victim on side with head lower than waist.

Medical conditions possibly aggravated by exposure: Inhalation of product may aggravate existing chronic respiratory problems such as asthma, emphysema, or bronchitis. Skin contact may aggravate existing skin

disease. Chronic overexposure may cause pneumoconiosis ("dusty lung" disease).

Section 5. FIRE-FIGHTING MEASURES

Flammable Properties:	Not flammable
Flash Point:	Not determined
Suitable Extinguishing Media:	Non-combustible. Use extinguishing media suitable for surrounding conditions.
Hazardous Combustion Products:	Carbon and sulfur oxides
Explosion Data:	
Sensitivity to Mechanical Impact:	Not sensitive
Sensitivity to Static Discharge:	Not sensitive
Unusual fire/explosion hazards:	In a fire this material may decompose, releasing oxides of carbon, sulfur, potassium and nitrogen (see Section 10).
Protective Equipment and Precautions for Firefighters:	As in any fire, wear self-contained breathing apparatus in pressure-demand, NIOSH approved or equivalent and full protective gear.

Section 6. ACCIDENTAL RELEASE MEASURES

Personal Precautions:	Avoid contact with skin, eyes, and clothing.
Personal Protective Equipment:	Minimum - safety glasses, gloves, and a dust respirator.
Emergency Procedures:	NA
Methods for Containment:	Prevent further leakage or spillage if safe to do so.
Methods for Clean Up:	Avoid dust formation; clean up released material using vacuum or wet sweep and shovel to minimize generation of dust. Bag and transfer to properly labeled containers. Ventilate area and wash spill site after material pickup is complete.
Environmental Precautions:	Prevent material from entering waterways.
Other:	If product is contaminated, use PPE and containment appropriate to the nature of the most toxic chemical/material in the mixture.

Section 7. HANDLING AND STORAGE

Personal Precautions:	Use appropriate PPE when handling or maintaining equipment, and wash thoroughly after handling (see Section 8).
Conditions for Safe Storage/Handling:	Keep product in original container or extinguisher. Contents may be under pressure – inspect for extinguisher rust periodically to ensure container integrity.
Incompatible Products:	Do not mix with other extinguishing agents, particularly potassium bicarbonate and sodium bicarbonate. Incompatible with strong oxidizing agents and strong acids. Do not store in high humidity. Do not combine with chlorine compounds.

Section 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Chemical Name	OSHA PEL	ACGIH TLV	DFG MAK *	EU BLV
Mono-ammonium phosphate	PNOC** Total dust, 15 mg/m^3 Respirable fraction, 5 mg/m^3	PNOC Total dust, 10 mg/m^3 Respirable fraction, 3 mg/m^3	PNOC Total dust, 4 mg/m^3 Respirable fraction, 1.5 mg/m^3	NA
Ammonium Sulfate	PNOC** Total dust, 15 mg/m^3 Respirable fraction, 5 mg/m^3	PNOC Total dust, 10 mg/m^3 Respirable fraction, 3 mg/m^3	PNOC Total dust, 4 mg/m^3 Respirable fraction, 1.5 mg/m^3	NA
Mica	6 mg/m^3	3 mg/m3	NR	NA
Fullers Earth	PNOC** Total dust, 15 mg/m^3 Respirable fraction, 5 mg/m^3	PNOC Total dust, 10 mg/m^3 Respirable fraction, 3 mg/m^3	PNOC Total dust, 4 mg/m^3 Respirable fraction, 1.5 mg/m^3	
Silicone oil	NR**	NR	NR	NA
Calcium carbonate	PNOC Total dust, 15 mg/m^3 Respirable fraction, 5 mg/m^3	PNOC Total dust, 10 mg/m^3 Respirable fraction, 3 mg/m^3	-------	NA
Amorphous silica	80 mg/m^3 % silica	10 mg/m^3	4 mg/m^3	NA
Yellow 14 pigment	NR	NR	NR	NA

*German regulatory limits **PNOC = Particulates not otherwise classified (ACGIH) also known as Particulates not otherwise regulated (OSHA) *** NR = Not Regulated. All values are 8 hour time weighted average concentrations.

Engineering Controls:	Showers Eyewash stations Ventilation systems

Personal Protective Equipment – PPE Code E:




Eye/Face Protection:	Tightly fitting safety goggles
Skin and Body Protection:	Wear protective gloves/coveralls
Respiratory Protection:	If exposure limits are exceeded or irritation is experienced, NIOSH approved respiratory protection should be worn. Use N95 dust mask for limited exposure; use air-purifying respirator (APR) with high efficiency particulate air (HEPA) filters for prolonged exposure. Positive-pressure-demand supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations. The need for respiratory protection is not likely for short-term use in well ventilated areas.
Hygiene Measures:	Good personal hygiene practices essential, such as avoiding food, tobacco products, or other hand-to-mouth contact when handling. Wash thoroughly after handling.

Section 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Light yellow powder, finely divided odorless solid
Molecular Weight:	NH4H2PO4: 115.03; (NH4)2SO4: 132.14
Odor:	Odorless
Odor Threshold:	No information available
Decomposition Temperature ^{o}C:	100 - 120
Freezing Point ^{o}C:	No information available
Initial Boiling Point ^{o}C:	No information available
Physical State:	Crystalline Powder

pH:	Mixture approximately 4 to 5; $NH_4H_2PO_4$: 4.2 in 0.2 molar solution; $(NH_4)_2SO_4$: 5.5 in 0.1 molar solution
Flash Point ^{o}C:	None
Auto-ignition Temperature ^{o}C:	None
Boiling Point/Range ^{o}C:	Not Applicable
Melting Point/Range ^{o}C:	$NH_4H_2PO_4$: 190; $(NH_4)_2SO_4$: 280
Flammability:	Not Flammable
Flammability Limits in Air ^{o}C:	Upper – Not Flammable; Lower-Not Flammable
Explosive Properties:	None
Oxidizing Properties:	None
Volatile Component (%vol)	Not Applicable
Evaporation Rate:	Not Applicable
Vapor Density:	Not Applicable
Vapor Pressure:	Not Applicable
Specific gravity at 25 C:	$NH_4H_2PO_4$: 1.80; $(NH_4)_2SO_4$:: 1.77
Solubility:	Coated-Not Immediately Soluble in Water
Partition Coefficient:	$NH_4H_2PO_4$ Est: -4.11; $(NH_4)_2SO_4$: Est: -0.48
Viscosity:	Not Applicable

NOTE: $NH_4H_2PO_4$ – Monoammonium Phosphate; $(NH_4)_2SO_4$: – Ammonium Sulfate

Section 10. STABILITY AND REACTIVITY

Stability:	Stable under recommended storage and handling conditions.
Reactivity:	
Incompatibles:	Strong alkalis (bases), magnesium, strong oxidizers, isocyanuric acids and chlorine compounds.
Conditions to Avoid:	Storage or handling near incompatibles.
Hazardous Decomposition Products:	Heat of fire may release carbon monoxide, carbon dioxide, and sulfur dioxide. Also ammonia, oxides of phosphorous and nitrogen oxides may be released during decomposition.
Possibility of Hazardous Reactions:	Slight
Hazardous Polymerization	Does not occur

Section 11. TOXICOLOGICAL INFORMATION

Likely Routes of Exposure:	Inhalation, skin, and eye contact.

Symptoms:

Immediate:	
Inhalation:	Irritation, coughing.
Eyes:	Irritation.
Skin:	Irritation.
Delayed:	Symptoms appear to be relatively immediate
Acute Toxicity:	Relatively non-toxic.
Chronic Toxicity:	
Short-term Exposure:	None known.
Long-term Exposure:	As with all dusts, pneumoconiosis, or "dusty lung" disease, may result from chronic exposure.

Acute Toxicity Values - Health

Chemical Name	LD50		LC50 (Inhalation)
	Oral	Dermal	
Mono-ammonium phosphate	5750 mg/kg (rat)	>7940 mg/kg (rabbit)	Not available
Ammonium Sulfate	2840 mg/kg (rat)	Not available	Not available
Mica	None	None	None
Fullers Earth	None	None	None
Silicone oil	None	None	None
Calcium carbonate	6450 mg/kg (rat)	500 mg/24 hr (rabbit)	Not available
Amorphous silica	>5000 mg/kg (rat)	>2000 mg/kg (rabbit)	>2.2 mg/L (rat)
Yellow 14 pigment	>17000 mg/kg (rat)	>3000 mg/kg (rat)	>4448 mg/m3 (rat)

Reproductive Toxicity:	This product's ingredients are not known to have reproductive or teratogenic effects.
Target Organs and Effects (TOST):	Respiratory system irritant). This product is a mild irritant to epithelial tissue, (eyes, mucous membranes, skin) and may aggravate dermatitis. No information was found indicating the product causes sensitization.

Other Toxicity Categories

Chemical Name	Germ Cell Mutagenicity	Carcino-genicity	Repro-ductive	TOST Single Exp	TOST Repeated Exp	Aspiration
Mono-ammonium phosphate	None	None	None	Cat 3	None	None
Ammonium Sulfate	None	None	None	Cat 3	None	None
Fullers earth	None	None	None	None	None	None
Mica	None	None	None	None	None	None
Silicone oil	None	None	None	None	None	None
Calcium carbonate	None	None	None	None	None	None
Amorphous silica	None	None	None	None	None	None
Yellow 14 pigment	None	None	None	None	None	None

Section 12. ECOLOGICAL INFORMATION

Ecotoxicity:	Negative effects unknown. Provides nutrient nitrogen and phosphorus to plant life.
Persistence/Degradability:	Degrades rapidly in humid/wet environment.
Probability of rapid biodegradation:	NH4H2PO4 Est: 0.693 (Rapid); (NH4)2SO4: Est: 0.684 (Rapid)
Anaerobic biodegradation probability:	NH4H2PO4 Est: 0.398 (Slow); (NH4)2SO4: Est: 0.398 (Slow)
Bioaccummulation potential:	Low.
Bioconcentration factor:	NH4H2PO4: 3.16 L/kg; (NH4)2SO4: 3.16 L/kg (wet weight)
Bioaccummulation:	Extent unknown.
Mobility in soil:	Slow evaporation rate; water soluble, may leach to groundwater
Log Koc:	NH4H2PO4 Est: -1.25: (NH4)2SO4: Est: 1.35
Log Koa:	NH4H2PO4 Est: 16.72; (NH4)2SO4: Est: 20.10
Log Kaw:	NH4H2PO4 Est: -20.86; (NH4)2SO4: Est: -19.62

NOTE: NH4H2PO4 – Monoammonium Phosphate; (NH4)2SO4: – Ammonium Sulfate

Other Adverse Ecological Effects: No other known effects at this time

Aquatic Toxicity Values – Environment – Research

Chemical Name	Acute (LC50)	Chronic (LC50)
Monoammonium phosphate	N/A	N/A
Ammonium Sulfate	N/A	N/A
Mica	N/A	N/A
Fullers Earth	N/A	N/A
Silicone oil	N/A	N/A
Calcium carbonate	N/A	N/A
Amorphous silica	N/A	N/A
Yellow 14 pigment	N/A	N/A

Aquatic Toxicity Values – Environment – Estimates

Chemical Name	Acute (LC50)	EC50
Monoammonium phosphate	2,91e+07 mg/L Fish 96 hr; 9.4e+06 mg/l Daphnid 48 hr;	6.70e+05 mg/L Gr. Algae 96 hr
Ammonium Sulfate	2521 mg/L Fish 96 hr; 1244 mg/l Daphnid 48 hr;	518 mg/L Gr. Algae 96 hr
Mica	N/A	N/A
Fullers Earth	N/A	N/A
Silicone oil	N/A	N/A
Calcium carbonate	N/A	N/A
Amorphous silica	N/A	N/A
Yellow 14 pigment	N/A	N/A

Section 13. DISPOSAL CONSIDERATIONS

Safe Handling	Use appropriate PPE when handling, and wash thoroughly after handling (see Section 8).
Waste Disposal Considerations	Dispose in accordance with federal, state, and local regulations.
Contaminated Packaging	Dispose in accordance with federal, state, and local regulations.

NOTES:
This product is not a RCRA characteristically hazardous or listed hazardous waste. Dispose of according to state or local laws, which may be more restrictive than federal laws or regulations. Used product may be altered or contaminated, creating different disposal considerations.

Section 14. TRANSPORT INFORMATION

UN Number:	NA
UN Proper Shipping Name:	NA
Transport Hazard Class:	NA
Packing Group:	NA
Marine Pollutant?:	NO
IATA	Not regulated
DOT	Not regulated

NOTES:
This product is not defined as a hazardous material under U.S. Department of Transportation (DOT) 49 CFR 172, or by Transport Canada "Transportation of Dangerous Goods" regulations.

Special Precautions for Shipping:
If shipped in a stored pressure-type fire extinguisher, and pressurized with a non-flammable, non-toxic inert expellant gas, the fire extinguisher is considered a hazardous material by the US Department of Transportation and Transport Canada. The proper shipping name shall be FIRE EXTINGUISHER and the UN designation is UN 1044. The DOT hazard class is Limited Quantity when pressurized to less than 241 psig and when shipped via highway or rail. Use a Non-Flammable Gas label (class 2.2) when shipping via air.

Section 15. REGULATORY INFORMATION

International Inventory Status: All ingredients are on the following inventories

Country(ies)	Agency	Status
United States of America	TSCA	Yes
Canada	DSL	Yes
Europe	EINECS/ELINCS	Yes
Australia	AICS	Yes
Japan	MITI	Yes
South Korea	KECL	Yes

REACH Title VII Restrictions: No information available

Chemical Name	Dangerous Substances	Organic Solvents	Harmful Substances Whose Names Are to be Indicated on Label	Pollution Release and Transfer Registry (Class II)	Pollution Release and Transfer Registry (Class I)	Poison and Deleterious Substances Control Law
Monoammonium Phosphate	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Ammonium Sulfate	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Component	ISHA – Harmful Substances Prohibited for Manufacturing, Importing, Transferring, or Supplying	ISHA – Harmful Substances Requiring Permission	Toxic Chemical Classification Listing (TCCL) – Toxic Chemicals	Toxic Release Inventory (TRI) – Group I	Toxic Release Inventory (TRI) – Group II
Monoammonium Phosphate 7722-76-1	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Ammonium Sulphate	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Fullers earth magnesium aluminum silicate 8031-18-3 (>4)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Mica-potassium aluminum silicate 120001-26-2 (>2)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Calcium carbonate 471-34-1	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Amorphous silica 69012-64-2	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Yellow 14 pigment 5468-75-7	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

European Risk and Safety phrases:

EU Classification:	Irritant	
R Phrases:	20	Harmful by inhalation.
	36/37	Irritating to eyes, respiratory system.
S Phrases:	22	Do not breath dust.
	24/25	Avoid contact with skin and eyes
	26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
	36	Wear suitable protective clothing.

U.S. Federal Regulatory Information:

SARA 313:
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA) - This product does not contain and chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.
None of the chemicals in this product are under SARA reporting requirements or have SARA threshold planning quantities (TPQs) or CERCLA reportable quantities (RQs), or are regulated under TSCA 8(d).

SARA 311/312 Hazard Categories:

Acute Health Hazard	Yes
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard-*	Yes
Reactive Hazard	No

* - Only applicable if material is in a pressurized extinguisher.

Clean Water Act:
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)
Clean Air Act, Section 112 Hazardous Air Pollutants (HAPs) (see 40 CFR 61)
This product does not contain any substances regulated as hazardous air pollutants (HAPs) under Section 112 of the Clean Air Act Amendments of 1990.

U.S. State Regulatory Information:

Chemicals in this product are covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: None
California – Permissible Exposure Limits for Chemical Contaminants: None

Florida – Substance List: Mica Dust **Illinois** – Toxic Substance List: None **Kansas** – Section 302/303 List: None **Massachusetts** – Substance List: Mica Dust
Minnesota – List of Hazardous Substances: None
Missouri – Employer Information/Toxic Substance List: None
New Jersey – Right to Know Hazardous Substance List: None
North Dakota – List of Hazardous Chemicals, Reportable Quantities: None
Pennsylvania – Hazardous Substance List: None
Rhode Island – Hazardous Substance List: Mica Dust
Texas – Hazardous Substance List: No
West Virginia – Hazardous Substance List: None
Wisconsin – Toxic and Hazardous Substances: None

California Proposition 65: No component is listed on the California Proposition 65 list.

Other:

Mexico – Grade	No component listed
Canada – WHMIS Hazard Class	No component listed

Section 16. OTHER INFORMATION

This SDS conforms to requirements under U.S., U.K., Canadian, Australian, and EU regulations or standards, and conforms to the proposed 2003 ANSI Z400.1 format.

Issuing Date	17-June-2012
Revision Date	17-October-2013
Revision Date	06-January-2015
Revision Notes	None

The information herein is given in good faith but no warranty, expressed or implied, is made.
Updated by William F. Garvin, CIH.

Nitrogen, compressed

Safety Data Sheet P-4631

according to U.S. Code of Federal Regulations 29 CFR 1910.1200, Hazard Communication.

Date of issue: 01/01/1980 Revision date: 06/24/2015 Supersedes: 04/23/2015

SECTION: 1. Product and company identification

1.1. Product identifier

Product form	:	Substance
Name	:	Nitrogen, compressed
CAS No	:	7727-37-9
Formula	:	N2
Other means of identification	:	Dinitrogen, Refrigerant R728, Nitrogen, Medipure Nitrogen, Extendapak Nitrogen, Nitrogen - Diving Grade

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture	:	Industrial use Medical applications. Food applications. Diving Gas (Underwater Breathing)

1.3. Details of the supplier of the safety data sheet

Praxair, Inc.
39 Old Ridgebury Road
Danbury, CT 06810-5113 - USA
T 1-800-772-9247 (1-800-PRAXAIR) - F 1-716-879-2146
www.praxair.com

1.4. Emergency telephone number

Emergency number	:	Onsite Emergency: 1-800-645-4633 CHEMTREC, 24hr/day 7days/week — Within USA: 1-800-424-9300, Outside USA: 001-703-527-3887 (collect calls accepted, Contract 17729)

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification (GHS-US)

Compressed gas H280

2.2. Label elements

GHS-US labeling

Hazard pictograms (GHS-US) :

GHS04

Signal word (GHS-US)	:	WARNING
Hazard statements (GHS-US)	:	H280 - CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED OSHA-H01 - MAY DISPLACE OXYGEN AND CAUSE RAPID SUFFOCATION.
Precautionary statements (GHS-US)	:	P202 - Do not handle until all safety precautions have been read and understood P271+P403 - Use and store only outdoors or in a well-ventilated place. CGA-PG05 - Use a back flow preventive device in the piping. CGA-PG10 - Use only with equipment rated for cylinder pressure. CGA-PG06 - Close valve after each use and when empty. CGA-PG02 - Protect from sunlight when ambient temperature exceeds 52°C (125°F).

2.3. Other hazards

No additional information available

2.4. Unknown acute toxicity (GHS-US)

No data available

SECTION 3: Composition/information on ingredients

3.1. Substance

Name : Nitrogen, compressed

CAS No : 7727-37-9

Name	Product identifier	%
Nitrogen	(CAS No) 7727-37-9	99.5 - 100

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures after inhalation : Immediately remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Call a physician.

First-aid measures after skin contact : Adverse effects not expected from this product.

First-aid measures after eye contact : Adverse effects not expected from this product. In case of eye irritation: Rinse immediately with plenty of water. Consult an ophthalmologist if irritation persists.

First-aid measures after ingestion : Ingestion is not considered a potential route of exposure.

4.2. Most important symptoms and effects, both acute and delayed

No additional information available

4.3. Indication of any immediate medical attention and special treatment needed

None.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Use extinguishing media appropriate for surrounding fire.

5.2. Special hazards arising from the substance or mixture

Reactivity : Under certain conditions, nitrogen can react violently with lithium, neodymium, titanium (above 1472°F/800°C), and magnesium to form nitrides. At high temperature, it can also combine with oxygen and hydrogen.

5.3. Advice for firefighters

Firefighting instructions : Evacuate all personnel from the danger area. Use self-contained breathing apparatus (SCBA) and protective clothing. Immediately cool containers with water from maximum distance. Stop flow of gas if safe to do so, while continuing cooling water spray. Remove ignition sources if safe to do so. Remove containers from area of fire if safe to do so. On-site fire brigades must comply with OSHA 29 CFR 1910.156 and applicable standards under 29 CFR 1910 Subpart L—Fire Protection.

Protection during firefighting : Compressed gas: asphyxiant. Suffocation hazard by lack of oxygen.

Special protective equipment for fire fighters : Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters.

Specific methods : Use fire control measures appropriate for the surrounding fire. Exposure to fire and heat radiation may cause gas containers to rupture. Cool endangered containers with water spray jet from a protected position. Prevent water used in emergency cases from entering sewers and drainage systems.

Stop flow of product if safe to do so.

Use water spray or fog to knock down fire fumes if possible.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Evacuate area. Ensure adequate air ventilation. Wear self-contained breathing apparatus when entering area unless atmosphere is proven to be safe. Stop leak if safe to do so.

6.1.1. For non-emergency personnel

No additional information available

6.1.2. For emergency responders

No additional information available

6.2. Environmental precautions

No additional information available

6.3. Methods and material for containment and cleaning up

No additional information available

6.4. Reference to other sections

See also sections 8 and 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Wear leather safety gloves and safety shoes when handling cylinders. Protect cylinders from physical damage; do not drag, roll, slide or drop. While moving cylinder, always keep in place removable valve cover. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Never insert an object (e.g., wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Slowly open the valve. If the valve is hard to open, discontinue use and contact your supplier. Close the container valve after each use; keep closed even when empty. Never apply flame or localized heat directly to any part of the container. High temperatures may damage the container and could cause the pressure relief device to fail prematurely, venting the container contents. For other precautions in using this product, see section 16.

Safe use of the product : **The suitability of this product as a component in underwater breathing gas mixtures** is to be determined by or under the supervision of personnel experienced in the use of underwater breathing gas mixtures and familiar with the physiological effects, methods employed, frequency and duration of use, hazards, side effects, and precautions to be taken.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Store in a cool, well-ventilated place. Store and use with adequate ventilation. Store only where temperature will not exceed 125°F (52°C). Firmly secure containers upright to keep them from falling or being knocked over. Install valve protection cap, if provided, firmly in place by hand. Store full and empty containers separately. Use a first-in, first-out inventory system to prevent storing full containers for long periods.

OTHER PRECAUTIONS FOR HANDLING, STORAGE, AND USE: When handling product under pressure, use piping and equipment adequately designed to withstand the pressures to be encountered. Never work on a pressurized system. Use a back flow preventive device in the piping. Gases can cause rapid suffocation because of oxygen deficiency; store and use with adequate ventilation. If a leak occurs, close the container valve and blow down the system in a safe and environmentally correct manner in compliance with all international, federal/national, state/provincial, and local laws; then repair the leak. Never place a container where it may become part of an electrical circuit.

7.3. Specific end use(s)

None.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Nitrogen, compressed (7727-37-9)	
ACGIH	Not established
USA OSHA	Not established

Nitrogen (7727-37-9)	
ACGIH	Not established
USA OSHA	Not established

8.2. Exposure controls

Appropriate engineering controls	: Use a local exhaust system with sufficient flow velocity to maintain an adequate supply of air in the worker's breathing zone. Mechanical (general): General exhaust ventilation may be acceptable if it can maintain an adequate supply of air.
Eye protection	: Wear safety glasses with side shields.
Skin and body protection	: Wear metatarsal shoes and work gloves for cylinder handling, and protective clothing where needed. Wear appropriate chemical gloves during cylinder changeout or wherever contact with product is possible. Select per OSHA 29 CFR 1910.132, 1910.136, and 1910.138.
Respiratory protection	: When workplace conditions warrant respirator use, follow a respiratory protection program that meets OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable). Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure that the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure (e.g., an organic vapor cartridge). For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus (SCBA).

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	: Gas
Appearance	: Colorless gas.
Molecular mass	: 28 g/mol
Color	: Colorless.
Odor	: No odor warning properties.
Odor threshold	: No data available
pH	: Not applicable.
Relative evaporation rate (butyl acetate=1)	: No data available
Relative evaporation rate (ether=1)	: Not applicable.
Melting point	: -210 °C
Freezing point	: No data available
Boiling point	: -195.8 °C
Flash point	: No data available
Critical temperature	: -149.9 °C
Auto-ignition temperature	: Not applicable.
Decomposition temperature	: No data available
Flammability (solid, gas)	: No data available
Vapor pressure	: Not applicable.
Critical pressure	: 3390 kPa
Relative vapor density at 20 °C	: No data available
Relative density	: No data available
Density	: 1.16 kg/m³
Relative gas density	: 0.97
Solubility	: Water: 20 mg/l
Log Pow	: Not applicable.
Log Kow	: Not applicable.
Viscosity, kinematic	: Not applicable.
Viscosity, dynamic	: Not applicable.
Explosive properties	: Not applicable.
Oxidizing properties	: None.
Explosion limits	: No data available

9.2. Other information

Gas group	: Compressed gas
Additional information	: None.

SECTION 10: Stability and reactivity

10.1. Reactivity

Under certain conditions, nitrogen can react violently with lithium, neodymium, titanium (above 1472°F/800°C), and magnesium to form nitrides. At high temperature, it can also combine with oxygen and hydrogen.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

May occur.

10.4. Conditions to avoid

None under recommended storage and handling conditions (see section 7).

10.5. Incompatible materials

None.

10.6. Hazardous decomposition products

None.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Skin corrosion/irritation : Not classified

pH: Not applicable.

Serious eye damage/irritation : Not classified

pH: Not applicable.

Respiratory or skin sensitization : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Reproductive toxicity : Not classified

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : Not classified

Aspiration hazard : Not classified

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : No ecological damage caused by this product.

12.2. Persistence and degradability

Nitrogen, compressed (7727-37-9)	
Persistence and degradability	No ecological damage caused by this product.

Nitrogen (7727-37-9)	
Persistence and degradability	No ecological damage caused by this product.

12.3. Bioaccumulative potential

Nitrogen, compressed (7727-37-9)	
Log Pow	Not applicable.
Log Kow	Not applicable.
Bioaccumulative potential	No ecological damage caused by this product.

Nitrogen (7727-37-9)	
Log Pow	Not applicable for inorganic gases.
Log Kow	Not applicable.
Bioaccumulative potential	No ecological damage caused by this product.

12.4. Mobility in soil

Nitrogen, compressed (7727-37-9)	
Mobility in soil	No data available.
Ecology - soil	No ecological damage caused by this product.

Nitrogen (7727-37-9)	
Mobility in soil	No data available.
Ecology - soil	No ecological damage caused by this product.

12.5. Other adverse effects

Effect on ozone layer : None.

Effect on the global warming : None.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Dispose of contents/container in accordance with local/regional/national/international regulations. Contact supplier for any special requirements.

SECTION 14: Transport information

In accordance with DOT

Transport document description : UN1066 Nitrogen, compressed, 2.2

UN-No.(DOT) : UN1066

Proper Shipping Name (DOT) : Nitrogen, compressed

Transport hazard class(es) (DOT) : 2.2 - Class 2.2 - Non-flammable compressed gas 49 CFR 173.115

Hazard labels (DOT) : 2.2 - Non-flammable gas

Additional information

Emergency Response Guide (ERG) Number : 121 (UN1066);120 (UN1977)

Other information : No supplementary information available.

Special transport precautions : Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers: - Ensure there is adequate ventilation. - Ensure that containers are firmly secured. - Ensure cylinder valve is closed and not leaking. - Ensure valve outlet cap nut or plug (where provided) is correctly fitted. - Ensure valve protection device (where provided) is correctly fitted.

Transport by sea

UN-No. (IMDG) : 1066

Proper Shipping Name (IMDG) : NITROGEN, COMPRESSED

Class (IMDG) : 2 - Gases

MFAG-No : 121

Air transport

UN-No.(IATA) : 1066

Proper Shipping Name (IATA) : Nitrogen, compressed

Class (IATA)	: 2
Civil Aeronautics Law	: Gases under pressure/Gases nonflammable nontoxic under pressure

SECTION 15: Regulatory information

15.1. US Federal regulations

Nitrogen, compressed (7727-37-9)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
SARA Section 311/312 Hazard Classes	Sudden release of pressure hazard

15.2. International regulations

CANADA

Nitrogen, compressed (7727-37-9)
Listed on the Canadian DSL (Domestic Substances List)

Nitrogen (7727-37-9)
Listed on the Canadian DSL (Domestic Substances List)

EU-Regulations

Nitrogen, compressed (7727-37-9)
Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)

15.2.2. National regulations

Nitrogen, compressed (7727-37-9)
Listed on the AICS (Australian Inventory of Chemical Substances) Listed on IECSC (Inventory of Existing Chemical Substances Produced or Imported in China) Listed on the Korean ECL (Existing Chemicals List) Listed on NZIoC (New Zealand Inventory of Chemicals) Listed on PICCS (Philippines Inventory of Chemicals and Chemical Substances)

15.3. US State regulations

Nitrogen, compressed(7727-37-9)	
U.S. - California - Proposition 65 - Carcinogens List	No
U.S. - California - Proposition 65 - Developmental Toxicity	No
U.S. - California - Proposition 65 - Reproductive Toxicity - Female	No
U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No
State or local regulations	U.S. - Massachusetts - Right To Know List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List

Nitrogen (7727-37-9)				
U.S. - California - Proposition 65 - Carcinogens List	U.S. - California - Proposition 65 - Developmental Toxicity	U.S. - California - Proposition 65 - Reproductive Toxicity - Female	U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No significance risk level (NSRL)
No	No	No	No	

Nitrogen (7727-37-9)
U.S. - Massachusetts - Right To Know List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List

SECTION 16: Other information

Revision date : 6/24/2015 12:00:00 AM

Other information : When you mix two or more chemicals, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Before using any plastics, confirm their compatibility with this product.

Praxair asks users of this product to study this SDS and become aware of the product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this SDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Safety Data Sheet. Since the use of this information and the conditions of use are not within the control of Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product.

Praxair SDSs are furnished on sale or delivery by Praxair or the independent distributors and suppliers who package and sell our products. To obtain current SDSs for these products, contact your Praxair sales representative, local distributor, or supplier, or download from www.praxair.com. If you have questions regarding Praxair SDSs, would like the document number and date of the latest SDS, or would like the names of the Praxair suppliers in your area, phone or write the Praxair Call Center (Phone: 1-800-PRAXAIR/1-800-772-9247; Address: Praxair Call Center, Praxair, Inc., P.O. Box 44, Tonawanda, NY 14151-0044).

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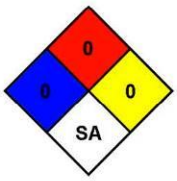
NFPA health hazard : 0 - Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.

NFPA fire hazard : 0 - Materials that will not burn.

NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.

NFPA specific hazard : SA - This denotes gases which are simple asphyxiants.



HMIS III Rating

Health : 0 Minimal Hazard - No significant risk to health

Flammability : 0 Minimal Hazard

Physical : 3 Serious Hazard

SDS US (GHS HazCom 2012) - Praxair

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.