

## DESIGN, INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

FOR

## PRE-ENGINEERED AUTOMATIC DIRECT LOW PRESSURE CLEAN AGENT EXTINGUISHER UNIT

DESIGNED FOR USE WITH: 3M<sup>™</sup> Novec<sup>™</sup> 1230 Fire Protection Fluid

**CE DLP Systems:** 

898201 – CYLINDER ASSEMBLY, CE, DLP, NOVEC, 1KG 898202 – CYLINDER ASSEMBLY, CE, DLP, NOVEC, 2KG 898203 – CYLINDER ASSEMBLY, CE, DLP, NOVEC, 5KG

DOT DLP Systems:

920225 – CYLINDER ASSEMBLY, DOT, DLP, NOVEC, 2.5LB 920525 – CYLINDER ASSEMBLY, DOT, DLP, NOVEC, 5LB 921025 – CYLINDER ASSEMBLY, DOT, DLP, NOVEC, 10LB

Document: DIOM 800090 (DLP 3M<sup>™</sup> Novec<sup>™</sup> 1230)

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(3M™ Novec™ 1230 Fire Protection Fluid)						
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## 1 FOREWORD

This manual is written for the fire protection professional that designs, installs, and maintains Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher Systems with 3M<sup>™</sup> Novec<sup>™</sup> 1230 Clean Agent. Those systems include:

CE DLP Systems:

- 898201 CYLINDER ASSEMBLY, CE, DLP, NOVEC, 1KG
- 898202 CYLINDER ASSEMBLY, CE, DLP, NOVEC, 2KG
- 898203 CYLINDER ASSEMBLY, CE, DLP, NOVEC, 5KG

DOT DLP Systems:

- 920225 CYLINDER ASSEMBLY, DOT, DLP, NOVEC, 2.5LB
- 920525 CYLINDER ASSEMBLY, DOT, DLP, NOVEC, 5LB
- 921025 CYLINDER ASSEMBLY, DOT, DLP, NOVEC, 10LB

Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher Systems 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 (DIOM #: 800090)
- All information contained on the agent cylinder nameplate(s)
- Applicable parts of NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems
- Local Authority Having Jurisdiction (AHJ)

## 1.1 Warnings

Safety precautions are essential when any electrical or mechanical equipment is involved. These precautions should be followed when handling, servicing, and recharging Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher Systems with 3M<sup>™</sup> Novec<sup>™</sup> 1230 Clean Agent 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.

## 1.2 Safety Precautions

\rm MARNING

Pressurized (charged) cylinders are extremely hazardous and if not handled properly can cause property damage, bodily injury, or death. Always wear safety glasses and make sure the discharge port ball valve is in the close/disarmed position and any safety/shipping plug(s) are properly in place before system installation, servicing, or other general handling.

The following safety precautions should always be followed:

- 1. Read and understand this manual and the other documents referenced herein.
- The valve discharge outlet ball valve <u>MUST</u> be closed/disarmed, and any safety/shipping plug(s) <u>MUST</u> 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. Follow all the safety procedures included on the cylinder nameplate and in this manual.
- 5. 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:

Firetrace International, LLC 8435 N. 90<sup>TH</sup> St, Suite 2 Scottsdale, AZ 85258 USA

Telephone: 480-607-1218 www.firetrace.com

## 2 INTRODUCTION

The Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher Systems with 3M<sup>™</sup> Novec<sup>™</sup> 1230 Fire Protection Fluid are designed to be used in a Total Flooding manner provided that the system is designed within the limitations outlined in this manual.

The pre-engineered concept minimizes the amount of engineering involved in system design. When the enclosure meets the specifications outlined in this manual and the Firetrace Detection Tubing (FDT) is 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. Each (DLP) extinguisher unit, when installed, is a self-contained unit, meaning that it is equipped with all the components necessary to detect and extinguish Class A, B, and C (Class E for Europe) fires.

Each installed Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher System is used in tandem with its own pneumatic (FDT).

Upon direct flame impingement of the (FDT), the tubing will rupture forming a burst hole. This burst hole will act as a nozzle directly applying the agent onto the flame source, extinguishing the fire, and flooding the enclosure to prevent re-flash.

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 (1) hazard. These extinguisher units cannot be combined to protect a larger size hazard, since they are not designed to provide for simultaneous actuation of two (2) or more units.

Local Authorities Having Jurisdiction (AHJ) should be consulted as to the acceptability for hazards and requirements covering installation.

## 2.1 3M<sup>™</sup> Novec<sup>™</sup> 1230 Suppression Agent

3M<sup>™</sup> Novec<sup>™</sup> 1230 suppression agent used in the Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher System which is dodecafluoro-2-methylpentan-3-one, more commonly known as 3M<sup>™</sup> Novec<sup>™</sup> 1230.

 $3M^{TM}$  Novec<sup>TM</sup> 1230, depicted by the chemical formula  $CF_3CF_2C(O)CF(CF_3)_2$ , is a colorless low odor fluid, low in toxicity, electrically non-conductive, and leaves no residue. It is a clean and effective fire suppression agent that can be used on type A, B, and C fires.

3M<sup>™</sup> Novec<sup>™</sup> 1230 is included in NFPA 2001, under the generic name FK-5-1-12, and has been evaluated and approved for use in occupied areas as a Total Flooding agent, when used as specified under the U.S. Environmental Protection Agency (EPA) SNAP Program rules. Refer to the SNAP Program rules for more information.

### 2.1.1 Cleanliness

3M<sup>™</sup> Novec<sup>™</sup> 1230 is clean and leaves no residue, thereby minimizing clean up after discharge along with keeping expensive downtime to a minimum. Additionally, 3M<sup>™</sup> Novec<sup>™</sup> 1230 is non-corrosive therefore sensitive electronics and materials such as steel, aluminum, stainless steel, brass, plastics, and rubber are not affected by exposure to 3M<sup>™</sup> Novec<sup>™</sup> 1230. This agent is also environmentally friendly, having an ozone depletion potential (ODP) of 0.00 and an atmospheric lifetime of 5 days (the closest halocarbon alternative is 33 years).

### 2.1.2 Decomposition

Hazardous Decomposition or By-Products:

Substance Carbon Monoxide Carbon Dioxide Hydrogen Fluoride **Condition** During Combustion During Combustion During Combustion

### 2.1.3 Properties of 3M<sup>™</sup> Novec<sup>™</sup> 1230

For hazard information, decomposition information, and physical properties of 3M<sup>™</sup> Novec<sup>™</sup> 1230 please refer to the Material Safety Data sheet located in **APPENDIX C**.

## **3 SYSTEM DESCRIPTION**

The Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher Systems with 3M<sup>™</sup> Novec<sup>™</sup> 1230 Clean Agent noted is this manual include:

CE Systems:

- 898201 CYLINDER ASSEMBLY, CE, DLP, NOVEC, 1KG
- 898202 CYLINDER ASSEMBLY, CE, DLP, NOVEC, 2KG
- 898203 CYLINDER ASSEMBLY, CE, DLP, NOVEC, 5KG

DOT Systems:

- 920225 CYLINDER ASSEMBLY, DOT, DLP, NOVEC, 2.5LB
- 920525 CYLINDER ASSEMBLY, DOT, DLP, NOVEC, 5LB
- 921025 CYLINDER ASSEMBLY, DOT, DLP, NOVEC, 10LB

3M<sup>™</sup> Novec<sup>™</sup> 1230 is a gaseous fire-suppression agent that is effective for use on:

- Class A Ordinary Combustibles surface fires
- Class B Flammable liquid fires
- Class C Energized equipment fires

3M<sup>™</sup> Novec<sup>™</sup> 1230 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 auto thermal decomposition, such as certain organic peroxides and hydrazine
- Deep Seated or burrowing fires in ordinary combustibles where the clean agent cannot reach the point of combustion

The Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher Systems can be used, but are not limited, to protect the following:

- Electrical and Electronic Cabinets
- Telecommunication Areas
- Data Processing Areas and Cabinets
- Laboratory Fume / Exhaust Cabinets
- Pump Enclosures
- UPS Units

- Flammable Chemicals Storage Cabinets
- Generator Enclosures
- Transformer Cabinets
- Computer/Data Storage Cabinets
- CNC & VMC Machining centers

For hazards beyond the scope described above, it is recommended that the designer consult with Firetrace and the Local Authority Having Jurisdiction (AHJ) as to the suitability on the use of these agents for particular hazards, for personnel exposure effects from the design concentration, and for installation requirements.

Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher Systems with 3M™ Novec™ 1230 Clean Agent consists of the following major components:

- Cylinder/Valve assembly
- Cylinder Mounting Bracket (Heavy Duty Bracket Optional)
- Firetrace Detection Tubing (FDT) & Fittings (No Substitute)
- Pressure Supervisory Switch
- Pressure Operated Switch (Optional)
- EU Pressure Operated Switch (Optional)

Once installed, the Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher System becomes a self-contained, self-actuating unit that does not require an external power source.

The unit utilizes a UL recognized (per UL Standard 521) linear heat detector (see Certificate of Compliance 20140705-S35465) known as Firetrace Detection Tubing (FDT). This tubing is pressurized with dry nitrogen, is temperature sensitive, and acts as a continuous linear thermal detector that ruptures upon direct flame impingement or at temperatures above 383 °F [195 °C]. Once the (FDT) is ruptured, it forms a pseudo-discharge nozzle at the rupture point, allowing the 3M<sup>™</sup> Novec<sup>™</sup> 1230 clean agent to flow through, distributing the agent through the rupture point and into the protected area.

Upon system actuation, the pressure switch can be used to indicate system discharge, sound an alarm, shutdown ventilation, shutoff electrical power, or provide additional electrical functions as may be required.

## 3.1 Component Descriptions

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

### 3.1.1 Cylinder / Valve Assemblies

The 3M<sup>™</sup> Novec<sup>™</sup> 1230 clean agent is stored in aluminum or steel cylinders and is super-pressurized with nitrogen. Each cylinder is equipped with a nickel-plated brass valve assembly.

Each valve assembly is equipped with a pressure gauge to monitor cylinder pressure, and a quarter turn ball valve that interfaces with the Firetrace Detection Tubing (FDT). The valve assembly utilizes a straight siphon tube only for the unit to only be mounted in a vertical (upright) position.

NOTE: The ball valve must be kept closed at all times when the cylinder is not in service.

### 3.1.2 Firetrace Detection Tubing

The Firetrace Detection Tubing (FDT) is available in a 4/6 mm (P/N: 200005) size. The (FDT) is a linear, pneumatic, fire detection device that responds to a combination of the heat and radiant energy from a fire. The tubing is a UL recognized component per UL Standard 521 (see Certificate of Compliance 20140705-S35465). The (FDT) performs three functions: heat detection, system activation, and agent discharge. One end of the tubing is installed to the top of the cylinder valve. The tubing is then installed throughout the hazard volume and finally pressurized with nitrogen.

The (FDT) is heat sensitive and in a fire situation is designed to rupture at any point along its length upon direct flame impingement or when the temperature reaches above 383 °F [195 °C]. The rupture of the tubing releases the nitrogen pressure causing the unit to actuate. The portion of the tubing nearest the fire ruptures, resulting in a formation of a pseudo-discharge nozzle that will perform a complete discharge of the  $3M^{\text{TM}}$  Novec<sup>TM</sup> 1230 clean agent. For additional information on tubing properties and material compatibility, please see **Table 1** - Firetrace Detection Tubing Properties and **APPENDIX B**.

Hydrostatic Burst	Minimum Burst Pressure	1100 psi [75 bar]	
Pressure	Typical Burst Pressure	1300 psi [88 bar]	
Electrical Dranartica	Volume Resistivity	1014 (per DIN 53481)	
Electrical Properties	Dielectric Strength	40k V/mm (per DIN 53481)	

Table 1: Firetrace Detection Tubing Properties

### 3.1.3 Firetrace Tubing Cutter

The Firetrace Tubing Cutter (P/N: 600210) is used to ensure that the Firetrace Detection Tubing (FDT) is cut with a square, clean finish, free of debris.

### 3.1.4 Filling Adapter

The filling adapter (P/N: 900007) is used for the pressurization of the Firetrace Detection Tubing (FDT). One end of the filling adapter is equipped with M10 x 1 threads, allowing for easy installation to the End of Line (EOL) Adapter. The opposite end of the filling adapter is equipped with G1/8 threads.

### 3.1.5 Pressure Supervisory Switch

The pressure supervisory switch (P/N: 400150) is used to monitor the pressure inside the unit cylinder. The pressure supervisory switch is factory installed into the pressure switch port located on the valve assembly. If the unit loses pressure and reaches a pressure of 150 psig  $\pm$  10 psi [10.3  $\pm$  0.7 bar] or below, the switch contacts will activate, providing a signal to indicate that the unit has lost pressure.

The pressure supervisory switch is single pole, double throw (SPDT) and can be wired in either the normally open (NO) or normally closed (NC) configurations, where the normal condition is at atmospheric pressure. When the unit is pressurized, the contacts switch over. The pressure supervisory switch shall be installed in accordance with NFPA 70 and NFPA 72.

### 3.1.6 Pressure Operated Switch

The pressure operated switch (P/N: 400004) is available as an optional part for the DOT system detection line. The pressure operated switch is installed into an End of Line (EOL) Adapter. The pressure operated switch is used to monitor unit actuation. Additionally, the pressure operated switch can be wired to energize electrically operated equipment, shut down electrically operated equipment, sound an alarm, or provide additional electrical functions as may be required. If the detection line reaches a pressure of  $70 \pm 10$  psig [ $4.8 \pm 0.7$  bar] or below, the switch contacts will activate, providing a signal to indicate that the unit has been activated.

The pressure operated switch is single pole, double throw (SPDT) and can be wired in either the normally open (NO) or normally closed (NC) configurations, where the normal condition is at atmospheric pressure. The pressure switch shall be installed in accordance with NFPA 70 and NFPA 72.

### 3.1.7 EU Pressure Operated Switch

The EU pressure operated switch (P/N: 400034) is available as an optional part for the CE system detection line. It is also available as an alternate for DOT system detection line. The EU pressure operated switch set point is factory set during production. The EU pressure operated switch is installed into an End of Line (EOL) Adapter. The EU pressure operated switch is used to monitor unit actuation. Additionally, the EU pressure operated switch can be wired to energize electrically operated equipment, shut down electrically operated equipment, sound an alarm, or provide additional electrical functions as may be required. If the detection line reaches a pressure below the set point of the EU pressure operated switch, the switch contacts will activate, providing a signal to indicate that the unit has been activated.

The EU pressure operated switch is single pole, double throw (SPDT) and can be wired in either the normally open (NO) or normally closed (NC) configurations, where the normal condition is at atmospheric pressure. The pressure switch shall be installed in accordance with NFPA 70 and NFPA 72.

Firetrace recommends that all units use a pressure switch coupled with a device to alert personnel in the event of discharge.

NOTE: Extended discharge is to be expected due to the nature of the Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher System. Pressure within the system can slowly drop, which could provide a delay in the actuation of the pressure switch due to this extended discharge. The pressure switch shall be installed as part of the detection line, at the end of the detection network.

Operating	Pressure Supervisory Switch	Pressure Operated Switch		EU Pressure Operated Switch
Parameters	P/N: 400150	P/N: 400004		P/N: 400034
		28 VDC – 15 AMP		
Electrical Rating	36 VDC – 6 AMP 240 VAC – 3 AMP	NO: 120 VAC – 10 AMP 240 VAC – 5 AMP	NC: 120 VAC – 25 AMP 240 VAC – 25 AMP	250 V – 5 AMP – 50 Hz
Temperature Range	-5 °F to 175 °F	-20 °F to 150 °F		14 °F to 176 °F
	[-20.6 °C to 79.4 °C]	[-28.9 °C to 65.6 °C]		[-10 °C to 80 °C]

#### Table 2: Pressure Switch Properties

<u>NOTE: Do not use the pressure supervisory switch as a handle when handling the extinguishing unit. Doing so can result in pressure leakage, damage to the pressure switch, and/or system discharge.</u>

## **4 SYSTEM DESIGN AND LIMITATIONS**

The pre-engineered system concept minimizes the amount of engineering required when evaluating a design for a specific application. Provided that the volume of the hazard, surface area coverage, agent quantity, and Firetrace Detection Tubing (FDT) is installed within the limitations outlined in this manual, no calculations are required for pressure drop, flow rates, or discharge time.

#### <u>NOTE: The basis for determining the agent quantity and concentration levels is derived from NFPA 2001 and is deemed</u> to be compliant with the standard in this aspect.

## 4.1 Specifications

## 4.1.1 Storage and Operating Temperature Range

The Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher Systems with 3M<sup>™</sup> Novec<sup>™</sup> 1230 Clean Agent and equipment are designed to be stored and operated at the ambient temperature range of -4°F to +140°F (-20°C to +60°C)

### 4.1.2 System Operating Pressure

The normal operating pressure of the control cabinet and converter cabinet systems is 195 psig at 70°F. **Table 3** shows the cylinder gauge pressure-temperature relationship for systems pressurized to 195 psig at 70°F.

Gauge Pressure vs Temperature Chart					
Temperature		Pressure			
°F	٥C	psig	bar		
-4	-20.0	136	9.4		
0	-17.8	139	9.6		
5	-15.0	143	9.9		
10	-12.2	147	10.1		
15	-9.4	151	10.4		
20	-6.7	155	10.7		
25	-3.9	159	11.0		
30	-1.1	163	11.2		
35	1.7	167	11.5		
40	4.4	171	11.8		
45	7.2	175	12.1		
50	10.0	179	12.3		
55	12.8	183	12.6		
60	15.6	187	12.9		
65	18.3	191	13.2		
70	21.1	195	13.5		
75	23.9	199	13.7		
80	26.7	203	14.0		
85	29.4	207	14.3		
90	32.2	211	14.5		
95	35.0	215	14.8		
100	37.8	219	15.1		
105	40.6	223	15.4		
110	43.3	227	15.6		
115	46.1	231	15.9		
120	48.9	235	16.2		
125	51.7	239	16.5		
130	54.4	243	16.7		
135	57.2	247	17.0		
140	60.0	251	17.3		

Table 3: Pressure vs Temperature Chart for Systems Pressurized to 195 psig at 70°F

## 4.2 Design Procedure

The following procedures should be used to design a Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher System with 3M<sup>™</sup> Novec<sup>™</sup> 1230 Clean Agent:

- 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.)
- c. Determine the anticipated minimum and maximum ambient temperatures expected within the enclosure to be protected. (These must be within the recommended minimum and maximum service temperatures of the system.)
- d. Determine the integrity of the enclosure and if any openings must be closed at the time of agent discharge.
- e. Determine the cylinder size required based on the hazard volume limitations.
- f. Based on the total quantity of agent being used at the maximum ambient temperature expected within the enclosure, evaluate personnel safety exposure limits.
- g. Determine the location of the system cylinder.
- h. Determine the arrangement and placement of the Firetrace Detection Tubing (FDT).
- i. Determine any auxiliary equipment requirements such as a pressure switch(es) to sound alarms, shut down ventilation, shut off electrical power, etc.

## 4.3 Minimum Design Concentrations

The minimum design concentration to be used with Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher System with 3M<sup>™</sup> Novec<sup>™</sup> 1230 Clean Agent include a minimum safety factor (SF), as specified in NFPA 2001.

A minimum design concentration of 6.7% was established using the minimum design concentration of commercial grade heptane. Minimum design concentrations will vary for different Class B fuels.

It is recommended that the designer consult with Firetrace, NFPA 2001, and the Local Authority Having Jurisdiction (AHJ), as to the suitability on the use of 3M<sup>™</sup> Novec<sup>™</sup> 1230 for a particular hazard, for personnel exposure effects from the design concentrations, and for installation requirements.

## 4.4 System Limitations

- A single container heat detection tube installation run protecting a maximum volume of 2 m<sup>3</sup>\*.
- A maximum of <u>four</u> heat detection tube runs connected to a single container where no single protected volume exceeds a <u>2 m<sup>3</sup> \*</u> volume.
- A maximum individual heat detection tube length of <u>50ft [15.24m]</u> from the container outlet to the end of any single detection tube run.

<u>\*The 2 m<sup>3</sup> volume limitation applies only to 5 lb. [2 kg] and 10 lb. [5 kg] systems. For the 2.5 lb. [1 kg] system, the volume is limited to 1 m<sup>3</sup>.</u>

### 4.4.1 Enclosure Volume Limitations

The Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher System with 3M<sup>™</sup> Novec<sup>™</sup> 1230 Clean Agent is designed to enable a single cylinder heat detection tube installation run to protect an enclosure of any size or shape, provided that the volume does not exceed the maximum volume limitations. Additionally, the overall height of the enclosure shall not exceed 12 ft [3.65 m]. **Table 4** below lists the maximum enclosure volume for each unit size.

Model Number	Agent Amount	Maximum Enclosure Volume
920225 / 898201	2.5 lb. [1 ka]	35.31 ft³ [1 m³]
920525 / 898202	5 lb. [2 kg]	70.63 ft <sup>3</sup> [2 m <sup>3</sup> ]
921025 / 898203	10 lb. [5 kg]	70.63 ft³ [2 m³]

### 4.4.2 Ventilation 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, if feasible. If openings are determined to be unclosable or ventilation is unable to be shut down, the volume of airflow for a reasonable amount of time due to these impediments must be included in the overall volume calculations/survey.

In the event of a discharge, the hazard enclosure must have sufficient structural strength and integrity to contain the agent discharge. If the pressure difference across the enclosure boundaries presents a threat to the hazard enclosure, venting shall be provided to prevent excessive pressures.

### 4.4.3 Firetrace Detection Tubing Limitations

The Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher Systems with 3M<sup>™</sup> Novec<sup>™</sup> 1230 Clean Agent are designed to detect and extinguish fires within small enclosures using Firetrace Detection Tubing (FDT). The tubing is used to perform three functions, heat detection, system activation, and agent discharge.

To ensure that the entire height of an enclosure is protected, the tubing must be installed in layers. The maximum height between layers shall not exceed 1.64 ft [0.5 m].

To ensure that the entire area of each layer is protected, the tubing must be installed in passes. The maximum distance between each pass shall not exceed 10.22 in [25.96 cm].

The maximum distance from any wall to the tubing shall not exceed 5.11 in [12.98 cm]. The maximum bend radius shall not exceed 6 in [15.24 cm].

The tubing may be installed in runs to protect segmented areas within an enclosure. The maximum tube length from the container outlet to the end of any single tube run shall not exceed 50ft [15.24 m]. Up to 4 tube runs may be connected to a single cylinder, provided that the volume of each segmented area does not exceed the maximum volume limitations.

The MAH is the maximum activation height of the tubing above the protected risk. The MAH for 4/6 mm tubing is 3.94 in [100 mm]. For better response time in the event of a fire, the tubing should be placed at a height less than the MAH above the hazard.

### 4.4.3.1 Tubing Limitations Example

An example of a system configuration is shown below:



Figure 1 – Example System Configuration

The tubing is installed in three different runs to protect the segmented sections within the enclosure. The total length of Run 1 is 9.28 ft [2.83 m]. The total length of Run 2 is 11.28 ft [3.44 m]. The total length of Run 3 is 13.28 ft [4.05 m]. Each tubing run is less than the maximum tube run length of 50ft [15.24m].

The tubing is also installed in layers to protect the overall height of the enclosure. Each layer does not exceed the maximum height between layers of 1.64 ft [0.5 m].

The tubing is fastened on the sides of the walls, ensuring the distance between the tubing to any wall does not exceed 5.11 in [12.98 cm].

## **5 INSTALLATION INSTRUCTIONS**

## WARNING

3*M*<sup>™</sup> Novec<sup>™</sup> 1230 cylinder/valve assemblies must be handled, installed, and serviced only by qualified and trained personnel in accordance with the instruction contained in this manual, on the cylinder nameplate, and any other regulations and codes that may apply. Failure to follow these instructions could result in property damage, severe injury, or death.

## 🚹 WARNING

During transportation, ensure the ball valve, located on the top of the cylinder valve, is maintained in the "OFF" position. Failure to follow these instructions will result in actuation and discharge of the cylinder contents.

#### 

Pressurized (charged) cylinders are extremely hazardous and if not handled properly can cause property damage, bodily injury, or death. Never handle the systems by the pressure switches, electric solenoids, or pressure gauges. Always wear safety glasses and make sure the discharge port ball valve is in the close/disarmed position and any safety/shipping plug(s) are properly in place before system installation, servicing, or other general handling.

## 

This unit is designed 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 two (2) or more units.

## 5.1 Extinguisher Unit Installation

The extinguisher unit should be installed as close as possible to the protected enclosure. In some cases, the extinguisher unit can be mounted inside the protected enclosure. The unit shall be installed in a readily accessible location to allow for ease of inspection, service, and maintenance. The unit shall be located in an environment protected from the weather and where the temperature range is -4 °F to 140 °F [-20 °C to 60 °C]. Additionally, a label shall be affixed to the enclosure, stating that the enclosure is fitted with a pre-engineered extinguisher unit.

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

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

- 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 Component Installation

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 should be installed in accordance with the instructions in this Manual.

### 5.2.1 Firetrace Detection Tubing

Location and spacing of the tubing are critical to the response time in the event of a fire. The tubing should be placed above the hazard areas being protected. It is recommended that the tubing be placed in a manner such that it is situated horizontally above potential fire sources. It is not recommended that the (FDT) is oriented vertically adjacent to a potential fire source. Tubing installation should always be inspected to ensure the tubing is not kinked, crushed, or vulnerable to damage. Tubing shall not be installed on any galvanic surfaces.

- 1. Secure the detection tubing using Mounting Tabs at no more than 12-18 in [30.48-45.72 cm] intervals.
- 2. All (FDT) fittings at joints must be secured.
- 3. (FDT) must be secured within 6 in [15.24 cm] of all joints or fittings to prevent leakage due to bends near joints.
- 4. Use the appropriate rubber/plastic grommets when the detection tubing is routed through sharp holes, to prevent damage to the tubing.
- 5. When mounting to metal surfaces, rubber P-clips or a small piece of copper/rubber hosing is required to mount to the metal surface.
- 6. All (FDT) fittings and joints are to be inspected for leaks with a solution of liquid soap and water.

## 

Do not kink, bend, or crush Firetrace tubing to prevent leakage which could result in accidental unit discharge. Do not install tubing in a hazardous environment where the maximum ambient temperature exceeds 300 °F [148.9 °C].

### 5.2.2 Slip-On Fittings

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

- 1. Cut the tube end (using a Firetrace Detection Tube (FDT) cutter P/N: 600210), ensuring the cut is square, clean, and free from burrs. Verify that no debris is left in the tube.
- 2. Thoroughly clean the tubing with a clean cloth (no cleaning agent) to a distance of at least 2 in [5.08 cm] from 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 comprehensive list of Slip-On Fittings, refer to **APPENDIX A**.

### 5.2.3 End of Line Accessories

All the following accessories will connect to an End of Line (EOL) Adapter. The (EOL) Adapter can be installed by following the appropriate procedures in **Section 5.2.2**.

(EOL) Adapters are not designed to provide a lasting seal without the use of one of the following items:

#### Pressure Gauge:

The Pressure Gauge must be installed with its included O-ring. Thread the pressure gauge into the (EOL) Adapter so that the gauge indicates the tubing pressure.

#### Pressure Operated Switch:

The Pressure Operated Switch must be installed in the (EOL) Adapter with its included O-ring and washer. Insert the washer into the (EOL) Adapter, and then thread the Pressure Operated Switch until an audible "click" can be heard. The Pressure Operated Switch is now active.

# <u>NOTE: Without installation of the included washer, the Operational Pressure Switch will not be active. For rapid activation, Pressure Operated Switch shall be installed as part of the detection line, at the end of the detection network.</u>

#### EU Pressure Operated Switch:

The EU pressure operated switch must be installed in the (EOL) Adapter with its included O-ring. Thread the EU pressure operated switch until an audible "click" can be heard. The EU pressure operated switch is now active.

#### End of Line Adapter Plug:

The (EOL) Adapter Plug must be installed with its included O-ring. Thread the plug into the (EOL) Adapter.

## 5.3 System Activation

- 1. Ensure the detection tubing, fittings, and accessories are installed according to the procedures specified in **Section 5.2** of this manual.
- 2. Attach the filling adapter to the End of Line (EOL) Adapter
- 3. Using a regulated dry nitrogen supply, pressurize the detection tubing through the filling adapter. It is recommended to have a portable dry nitrogen cylinder or Firetrace Nitrogen Fill Kit for on-site use.
- 4. Remove the filling adapter and thread the pressure gauge into the (EOL) Adapter. Verify that the tubing is pressurized to the correct pressure reading.
- 5. With the gauge still installed to the (EOL) Adapter, test for leakage:
  - Apply soapy water solution to the cylinder valve connection, (EOL) Adapter connection, and the pressure gauge connection. Observe for bubble leaks.
  - After 30 minutes, check the pressure gauge reading. Any decrease in pressure is an indication of a leak.
  - In the event of a leak go back to **Section 5.2** and verify the installation of all fittings and accessories.
- 6. If the pressure operated switch is to be installed, remove the pressure gauge, and install the pressure switch according to the procedures in **Section 5.2.3**.
  - a. Check pressure switch connection for bubble leaks using soapy water solution.
  - b. Ensure proper electrical connections are made to annunciate unit discharge, shut down ventilation, etc., as may be required by the end user or the Local Authority Having Jurisdiction (AHJ). (All electrical connections are to be in accordance with NFPA 70 National Electric Code and NFPA 72 National Fire Alarm and Signaling Code.)

#### <u>NOTE: It shall not be possible for the user to isolate any power supply or alarm connections to the unit without also</u> <u>isolating the power supply to the enclosure or placing the system into an alarm status.</u>

- Ensure the pressure supervisory switch electrical connections are properly installed to annunciate low pressure within the extinguisher unit. (All electrical connections are to be in accordance with NFPA 70 National Electric Code and NFPA 72 National Fire Alarm and Signaling Code.)
- 8. With the system fully installed and all components properly affixed within the hazard area, **<u>SLOWLY</u>** rotate the lever on the ball valve counterclockwise to the "ON" position.
- 9. Remover the ball valve lever with a small Phillips head screwdriver.
- 10. Install the Anti-Tamper device (P/N: 201132) in accordance with **APPENDIX B**.

## **6 SERVICE AND MAINTENANCE INSTRUCTIONS**

## 🚹 WARNING

 $3M^{\mathbb{M}}$  Novec<sup> $\mathbb{M}$ </sup> 1230 cylinder/valve assemblies must be handled, installed, inspected, and serviced only by qualified personnel in accordance with the instructions contained in this Manual, the cylinder nameplate, NFPA 2001, and any other regulations and codes that may apply.

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 can cause bodily injury, death, or property damage. Always wear safety glasses and make sure the discharge port ball valve is in the close/disarmed position and any safety/shipping plug(s) are properly in place before system installation, servicing, or other general handling.

## 6.1 General

A regular program of systematic maintenance must be established for continuous, proper operation of all 3M<sup>™</sup> Novec<sup>™</sup> 1230 systems 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.

The following includes the Firetrace recommendations for service and inspection of fire suppression systems. Local Authorities Having Jurisdiction (AHJ) may have additional service and maintenance requirements based on local codes and/or regulations. The requirements of the local AHJ must be followed.

<u>NOTE: Operational shutdown during equipment maintenance is not required. It shall not be possible for</u> the user to isolate any electrical power supply or alarm connections to the system without also isolating power supply to the enclosure or placing the system into an alarm status.

## 6.2 Periodic Service and Maintenance Procedures

## 6.2.1 Monthly Inspection

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

- 1. The Extinguisher Unit is in its proper location.
- 2. The Tamper Indicator is intact.
- 3. The Maintenance Tag or Certificate is in place and legible.
- 4. The Extinguisher Unit shows no physical damage or degradation that might prevent operation such as:
  - i. Cuts or abrasions to the Firetrace Detection Tubing (FDT)
  - ii. Color distortion of the (FDT) or extinguisher unit
  - iii. Dirt accumulation along the (FDT)
  - iv. Dirt accumulation along any of the fittings
- 5. The Pressure Gauge is in the operable range.
- 6. Verify the Protected Equipment nor the Hazard has been replaced, modified, or relocated.
- 7. If the pressure operated switch is installed:
  - i. Check pressure switch connection for bubble leaks using soapy water solution.
  - ii. Ensure the proper electrical connections are made. (All electrical connections are to be in accordance with NFPA 70 National Electric Code and NFPA 72 National Fire Alarm and Signaling Code.)
- 8. Ensure the pressure supervisory switch electrical connections are properly installed to annunciate low pressure within the extinguisher unit. (All electrical connections are to be in accordance with NFPA 70 National Electric Code and NFPA 72 National Fire Alarm and Signaling Code.)

### 6.2.2 Semiannual Visual Inspection

Semiannual Inspection is to be performed only by a Certified Firetrace Distributor. Inspection should include a repetition of the monthly inspection as well as verification of extinguisher unit weight. Extinguisher unit weight should be verified using the following steps:

- 1. Close the ball valve by turning the ball valve lever clockwise to the "OFF" position.
- 2. Depressurize the Firetrace Detection Tubing (FDT) by removing any components installed into the End of Line (EOL) Adapter and threading the fill kit adapter into the (EOL) Adapter.
- 3. Disconnect the Firetrace Detection Tubing (FDT) from the ball valve.
- 4. Remove the cylinder from the cylinder bracket.
- 5. Weigh the extinguisher unit. Compare the measured weight with the weight found on the nameplate. If the extinguisher unit shows a loss in agent quantity of more than 5 percent or a loss in pressure (adjusted for temperature) of more than 10 percent, the unit shall be refilled or replaced.
- 6. Reinstall the extinguisher unit and pressurize the detection tubing with nitrogen, see **Section 5** for instructions.

### 6.2.3 Five Year Inspection

3M<sup>™</sup> Novec<sup>™</sup> 1230 cylinders continuously in service without discharging shall be given a complete external visual inspection in place, every 5 years or more frequently if required.

Follow external visual inspection guidelines detailed in Section 6.2.2.

## 6.3 Hydrostatic Testing

### 6.3.1 DOT Systems

Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher Systems with 3M<sup>™</sup> Novec<sup>™</sup> 1230 Clean Agent DOT cylinders are built to DOT-4B specifications and therefore fall under DOT CFR Title 49 & NFPA 2001 regulations for retest and reinspection.

All DOT-4B, 4BA and 4BW cylinders used exclusively in 3M<sup>™</sup> Novec<sup>™</sup> 1230 service are to be retested and reinspected per DOT CFR Title 49, Section 180.205 & 180.209 as well as NFPA 2001, Container Test Section at the prescribed intervals for the cylinder/agent type used. All retest/reinspection 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 follow the test procedures as described in the applicable CGA pamphlet.

A complete visual inspection can be used in lieu of hydrostatic testing if cylinders are undamaged following the guidelines in DOT CFR Title 49, Section 180.205 & 180.209 as well as NFPA 2001, Container Test Section. Subsequent inspections as described in DOT CFR Title 49, Section 180.205 & 180.209, NFPA 2001, Container Test Section, as well as the local regulating authority will be required. The visual inspection shall be conducted only by competent persons and in conformance with the applicable CGA pamphlet. Inspections must be made only by persons holding a current RIN and the results recorded and maintained in conformance with DOT CFR Title 49, Section 180.215 & NFPA 2001, Container Test Section. Where external visual inspection indicates that the container has been damaged, additional strength tests shall be required in accordance with applicable transportation regulations.

### 6.3.2 CE Systems

Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher Systems with 3M<sup>™</sup> Novec<sup>™</sup> 1230 Clean Agent CE cylinders built to either BS EN 1928 or BS EN 1802 specifications fall under CE regulations for retest prior to refill.

BS EN 1928 or BS EN 1803 cylinders used exclusively in 3M<sup>™</sup> Novec<sup>™</sup> 1230 service are required to be retested and restamped prior to recharge and shipment if the last retest date has expired.

Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher Systems with 3M<sup>™</sup> Novec<sup>™</sup> 1230 Clean Agent (BS EN 1928/BS EN 1803) containers requiring retest must be hydrostatically tested in accordance per BS EN 1928/BS EN 1803 as applicable. This periodic retest must be performed by an authorized retester who is certified to the Transportable Pressure Equipment Directive (TPED) requirements and any additional applicable requirements per Annex A.

### Intervals Between Periodic Inspection and Test

In order to ensure continued safe operation, cylinders shall be periodically submitted to inspection and test in accordance with annex B. A cylinder shall fall due for a periodic inspection and test on its first receipt by a filler after the expiry of the interval in annex B.

NOTE Table B.1 gives a list of the intervals between periodic inspections for some gases which complies with the current RID/ADR regulations and also gives recommendations which could be subsequently adopted by the RID/ADR regulations.

Provided the cylinder has been subjected to normal conditions of use and has not been subjected to abusive and abnormal conditions rendering the cylinder unsafe, there is no general requirement for the user to return a gas cylinder before the contents have been used even though the test interval may have lapsed. However it is suggested that cylinders are retested within a period not exceeding twice the time interval.

In the case of cylinders used for emergency purposes (e.g. fire extinguishers, breathing apparatus), it is the responsibility of the person in possession (owner or user) to submit it for a periodic inspection within the interval specified in annex B or as specified in the relevant cylinder design standard/regulation, if this is shorter.

### List of Procedures for Periodic Inspection and Test

The inspection and test shall be carried out only by competent persons who shall ensure that the cylinders are fit for continued safe use.

NOTE A competent person is a person who has the necessary technical knowledge, experience and authority to assess and approve materials for use with gases and to define any special conditions of use that are necessary. Such a person will also normally be formally qualified in an appropriate technical discipline. Each cylinder shall be submitted to periodic inspection and test. The following procedures form the requirements for such inspection and test, and are explained more fully in later clauses:

- Identification of cylinder and preparation for inspection and test (clause 5);
- External visual inspection (clause 6);
- Inspection of welds (6.2);
- Internal visual inspection (clause 7);
- Supplementary tests (clause 8);
- Inspection of cylinder neck (clause 9);
- Pressure test, proof test only (clause 10);
- Repair of cylinders (clause 11);
- Inspection of valve (clause 12);
- Final operations (clause 13);
- Rejection and rendering cylinders unserviceable (clause 14).

Where cylinders are manufactured according to National Regulations and are intended to be qualified under the Transportable Pressure Equipment Directive (TPED) for free movement and use between member states of the European Union, additional requirements are specified in annex A.

It is recommended that the above listed tests are performed in the suggested sequence. In particular the internal visual examination (clause 7) should be carried out before the pressure test (clause 10).

Cylinders which fail the inspection or tests shall be rejected (see clause 13). When, after the above tests, doubts still exist as to the extent of a defect or the condition of a cylinder, then additional tests may be performed in accordance with clause 8, until such doubts are positively resolved or the cylinder shall be rendered unserviceable.

Some cylinders rejected during periodic inspection and test may be recovered in accordance with annex C.

## Annex B

(normative)

## **Inspection periods**

Table B.1 — Intervals between periodic inspections and test <sup>a</sup>					
Description	Gas type (examples)	Normative intervals <sup>°</sup> Period	Informative recommendations for next revision of ADR		
		years	Period		
			years		
Compressed	Ar, N <sub>2</sub> , He etc.	10	10		
gases	$H_2^{d}$	10	10		
	Air, O <sub>2</sub>	10	10		
	Self-contained breathing Air, O <sub>2</sub> , etc	e	5		
	Gases for underwater breathing apparatus	e	2,5 (internal visual) and 5 (full) <sup>f</sup>		
	CO <sup>g</sup>	5	5		
Liquefied gases	CO <sub>2</sub> , N <sub>2</sub> O etc.	10	10 <sup>h</sup>		
Corrosive gases	i	3	3 (internal visual) and 5 (full) <sup>k</sup>		
Toxic gases	CH₃Br	5	10		
Very toxic gases	$AsH_3$ , $PH_3$ etc.	5	5		
Gas mixtures	a) all mixtures except b) below	3, 5 or 10 years according to classification	a) Lowest test period of any component		
	b) mixtures completely in the	3 years for groups TC, TFC, TOC	b) For such mixtures, if the toxicity of the final mixture is such that $LC_{50} \ge a$ volume		
	gaseous state containing toxic	5 years for groups T, TF, TO	fraction of $200 \times 10^{-6}$ , a 10 year period applies, and if the toxicity of the final		
	and/or very toxic components.	10 years for groups A, O, F	mixture is such that $LC_{50} \le a$ volume fraction of 200 × 10 <sup>-6</sup> a 5 year period applies		

а At all times certain requirements may necessitate a shorter time interval e.g. the dew point of the gas, polymerization reactions and decomposition reactions, cylinder design specification, change of gas service.

b This list of gases is not exhaustive. A full list of gases can be found in RID/ADR.

These intervals conform to the 1999 edition of RID/ADR.

d Pay particular attention to the requirements of clause 5 and possible additional testing in accordance with EN 1795 for change of service.

е Not currently listed in RID/ADR.

For cylinders used for self-contained underwater breathing apparatus in addition to the full retest period of 5 years, an internal visual inspection need to be performed every 2,5 years.

g This product requires very dry gas (see EN ISO 11114-1).

h This test period may be used provided the dryness of the product and that of the filled cylinder are such that there is no free water, and that this condition is proven and documented within a quality system of the filler. If these conditions cannot be fulfilled alternative or more frequent testing may be appropriate.

For RID/ADR purposes, corrosivity is with reference to human tissue and NOT cylinder material, as per annex I.

<sup>k</sup> For gas mixtures shown to be corrosive for the cylinder material, the time period for single corrosive gases applies.

Figure 2 – ANNEX B (EN 1928/1803)

## 7 SYSTEM DEPRESSURIZATION AND CHARGING

## WARNING

3*M*<sup>™</sup> Novec<sup>™</sup> 1230 cylinder/valve assemblies must be handled, installed, and serviced only by qualified and trained personnel in accordance with the instruction contained in this manual, on the cylinder nameplate, and any other regulations and codes that may apply. 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 can cause property damage, bodily injury, or death. Never handle the systems by the pressure switches, electric solenoids, or pressure gauges. Always wear safety glasses and make sure the discharge port ball valve is in the close/disarmed position and any safety/shipping plug(s) are properly in place before system installation, servicing, or other general handling.

Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher Systems with 3M<sup>™</sup> Novec<sup>™</sup> 1230 Clean Agent must be handled, installed, inspected, and serviced only by qualified and trained personnel in accordance with the instructions contained in the appropriate manual, unit nameplate, and any other regulations and codes that may apply.

## 7.1 Depressurizing the Unit

## 

Do not kink, bend, or crush Firetrace tubing to prevent leakage which could result in accidental unit discharge. Do not install tubing in a hazardous environment where the maximum ambient temperature exceeds 300 °F [148.9 °C].

- 1. Turn the ball valve lever to the "OFF" position (perpendicular to the valve.)
- 2. Depressurize the Firetrace Detection Tubing (FDT) by removing any components installed into the End of Line (EOL) Adapter and threading the fill kit adapter (P/N: 200173) into the (EOL) Adapter.
- 3. Remove the Firetrace Detection Tubing (FDT) from the top of the ball valve.
- 4. SLOWLY, open the ball valve SLIGHTLY so only a small amount of nitrogen can be heard being released from the unit.
- 5. Ensure the unit is depressurized by verifying the pressure gauge reads 0 psig.
- 6. SLOWLY open the ball valve completely.

## 7.2 System Recharge

Use the following steps to recharge an empty Firetrace Pre-Engineered Automatic Direct Low Pressure (DLP) Clean Agent Extinguisher System with 3M<sup>™</sup> Novec<sup>™</sup> 1230 Clean Agent:

- 1. Weigh and record the empty weight of the cylinder and valve assembly.
- 2. Install the Firetrace Detection Tubing (FDT) to the top of the valve assembly.
- 3. Connect the filling adapter to the End of Line (EOL) Adapter.
- 4. Connect the 3M<sup>™</sup> Novec<sup>™</sup> 1230 fill line to the fill adapter and record the weight shown on the scale.
- 5. Zero the scale.
- 6. Ensure the ball valve is open and open the 3M<sup>™</sup> Novec<sup>™</sup> 1230 fill line.
- 7. Once the required weight is reached, close the 3M<sup>™</sup> Novec<sup>™</sup> 1230 fill line.
- 8. Close the ball valve.
- 9. Open the valve vent to bleed the excess 3M<sup>™</sup> Novec<sup>™</sup> 1230 from the fill line and disconnect the 3M<sup>™</sup> Novec<sup>™</sup> 1230 fill line from the fill adapter.
- 10. Connect the dry nitrogen fill line to the fill adapter. Ensure it is regulated to 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).
- 11. Open the ball valve and pressurize the cylinder with dry nitrogen.
- 12. Close the ball valve and shake the cylinder to allow the nitrogen to be absorbed by the 3M<sup>™</sup> Novec<sup>™</sup> 1230. (Some pressure loss will be observed.)
- 13. Open the ball valve and pressurize back up to 195 psig at 70 °F, as will be indicated on the system pressure gauge.
- 14. Repeat steps 11 thru 13 until shaking of the system does not result in any pressure loss (i.e., no further nitrogen absorption) and a pressure of 195 psig is reached.
- 15. Disconnect the dry nitrogen fill line.
- 16. Verify the system gross weight by checking it against what is printed on the label.
- 17. Leak test the unit by using a calibrated leak detector.
- 18. The unit is now ready to be transported to the installation site.

## WARRANTY

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

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## 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 FITNESS 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 affect 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 3M<sup>™</sup> Novec<sup>™</sup> 1230 and/or CO<sub>2</sub>, 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 into 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

## System Parts List: DOT System

MODELS:
2.5 lb Novec 1230 DLP
5 lb Novec 1230 DLP
10 lb Novec 1230 DLP

ITEM	P/N	DESCRIPTION	SYSTEM	
1	300109	DOT DLP Valve	All Systems	
2	400002	O-Ring, Gauge/Transport Cap	All Systems	
3	400029	Gauge, Generic	All Systems	
4	300200	O-Ring, Cylinder Connection	All Systems	
5	600029	Siphon Tube	All Systems	
6	100301	Small DLP Cylinder	2.5 LB	
6	100601	Medium DLP Cylinder	5 LB	
6	101201	Large DLP Cylinder	10 LB	
7	600033	Bonded Seal	All Systems	
8	400150	Pressure Supervisory Switch, Novec 1230 (Optional)	All Systems	
9	200103	Transport Cap	All Systems	
NP	200179	Slip-on Union	All Systems	
10	100003	Small Bracket	2.5 LB	
10	100006	Medium Bracket	5 LB	
10	111206	Large Bracket	10 LB	
NP – PARTS NOT PICTURED				



## System Parts List: CE System

	MODELS:
898201	1 kg Novec 1230 DLP
898202	2 kg Novec 1230 DLP
898203	5 kg Novec 1230 DLP

ITEM	P/N	DESCRIPTION	SYSTEM	
1	831211	CE DLP Valve	All Systems	
2	400002	O-Ring, Gauge/Transport Cap	All Systems	
3	400029	Gauge, Generic CE	All Systems	
4	860010	1 kg Siphon Tube	1 kg	
4	600029	2 kg Siphon Tube	2 kg	
4	860012	5 kg Siphon Tube	5 kg	
5	810100	1 kg Cylinder	1 kg	
5	810200	2 kg Cylinder	2 kg	
5	810500	5 kg Cylinder	5 kg	
NP	200179	Slip-On Union	All Systems	
6	600033	Bonded Seal	All Systems	
7	400150	Pressure Supervisory Switch, Novec 1230 (Optional)	All Systems	
8	200103	Transport Cap	All Systems	
9	810101	1 kg bracket	1 kg	
9	810202	2 kg Bracket	2 kg	
9	810505	5 kg Bracket	5 kg	
	NP – PARTS NOT PICTURED			



## **Detection Line Parts List**

ITEM	P/N	DESCRIPTION
NP	200005	Firetrace Detection Tubing (4/6)
NP	200150	Rubber Grommets (Qty. 2)
NP	200151	Plastic Grommets (Qty. 2)
NP	200171	Mounting Tabs (4/6) (Qty. 12)
NP	201006	Magnetic Mounting Clips (4/6) (Qty. 6)
1	200157	Tube Tee (4/6)
2	200158	Tube Union (4/6)
NP	200159	Tube to Threads Elbow (4/6)
3	200168	Tube to End of Line Adapter (4/6)
NP	200169	Tube Tee to In Line Adapter (4/6)
4	200177	Tube Tee to Threads (4/6)
5	200178	Tube Elbow (4/6)
6	200179	Tube to Threads Union (4/6)
7	200203	Tube Plug (4/6)
NP	310303	End of Line Adapter Plug with O-Ring
NP	400004	Pressure Operated Switch
NP	400028	Pressure Gauge with O-Ring
NP	400034	EU Pressure Operated Switch
NP	900007	Filling Adapter
	NP –	PARTS NOT PICTURED



## APPENDIX B TAMPER PROOF INSTRUCTIONS

## **Tamper Proof Instruction**



- 1. Verify that the ball lever is in the "ON" position
- 2. Remove the lever
- 3. Install the sleeve (as pictured above)
- 4. Apply the plastic tie wrap and record the serial number stamped on the wrap.

# APPENDIX C SAFETY DATA SHEETS

## 3M<sup>™</sup> NOVEC<sup>™</sup> 1230 FIRE PROTECTION FLUID

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## **COMPRESSED NITROGEN**



#### Safety Data Sheet

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Document Group:	16-3425-2	Version Number:	31.00
Issue Date:	04/20/22	Supercedes Date:	10/05/21

#### **SECTION 1: Identification**

**1.1. Product identifier** 3M<sup>TM</sup> Novec <sup>TM</sup> 1230 Fire Protection Fluid

#### **Product Identification Numbers**

98-0212-3203-2, 98-0212-3217-2, 98-0212-3414-5 7100010142, 7100024956, 7010321413

#### 1.2. Recommended use and restrictions on use

**Recommended use** Streaming and Flooding Fire Protection

#### 1.3. Supplier's details

MANUFACTURER	:
DIVISION:	
ADDRESS:	
Telephone:	

3M Electronics Materials Solutions Division 3M Center, St. Paul, MN 55144-1000, USA 1-888-3M HELPS (1-888-364-3577)

**1.4. Emergency telephone number** 1-800-364-3577 or (651) 737-6501 (24 hours)

#### **SECTION 2: Hazard identification**

#### 2.1. Hazard classification

Not classified as hazardous according to OSHA Hazard Communication Standard, 29 CFR 1910.1200.

**2.2. Label elements Signal word** Not applicable.

Symbols Not applicable.

Pictograms Not applicable.

#### **SECTION 3: Composition/information on ingredients**

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Ingredient	C.A.S. No.	% by Wt
1,1,1,2,2,4,5,5,5-NONAFLUORO-4-	756-13-8	>= 99.5
(TRIFLUOROMETHYL)-3-PENTANONE		

#### **SECTION 4: First aid measures**

#### 4.1. Description of first aid measures

#### Inhalation:

No need for first aid is anticipated.

#### Skin Contact:

No need for first aid is anticipated.

#### Eye Contact:

No need for first aid is anticipated.

#### If Swallowed:

No need for first aid is anticipated.

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

No critical symptoms or effects. See Section 11.1, information on toxicological effects.

#### 4.3. Indication of any immediate medical attention and special treatment required

Not applicable

#### **SECTION 5: Fire-fighting measures**

#### 5.1. Suitable extinguishing media

Use a fire fighting agent suitable for the surrounding fire.

#### 5.2. Special hazards arising from the substance or mixture

Exposure to extreme heat can give rise to thermal decomposition.

#### Hazardous Decomposition or By-Products

Substance Carbon monoxide Carbon dioxide Toxic Vapor/Gas Condition During Combustion During Combustion During Combustion

#### 5.3. Special protective actions for fire-fighters

Wear full protective clothing, including helmet, self-contained, positive pressure or pressure demand breathing apparatus, bunker coat and pants, bands around arms, waist and legs, face mask, and protective covering for exposed areas of the head.

#### **SECTION 6:** Accidental release measures

#### 6.1. Personal precautions, protective equipment and emergency procedures

Ventilate the area with fresh air. Refer to other sections of this SDS for information regarding physical and health hazards, respiratory protection, ventilation, and personal protective equipment.

#### 6.2. Environmental precautions

Avoid release to the environment. For larger spills, cover drains and build dikes to prevent entry into sewer systems or bodies of water.

#### 6.3. Methods and material for containment and cleaning up

Contain spill. Working from around the edges of the spill inward, cover with bentonite, vermiculite, or commercially

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3М <sup>тм</sup> Novec <sup>тм</sup> 1230 Fir	e Protection Fluid	04/20/2
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available inorganic absorbent material. Mix in sufficient absorbent until it appears dry. Remember, adding an absorbent material does not remove a physical, health, or environmental hazard. Collect as much of the spilled material as possible. Place in a closed container approved for transportation by appropriate authorities. Clean up residue with an appropriate solvent selected by a qualified and authorized person. Ventilate the area with fresh air. Read and follow safety precautions on the solvent label and SDS. Seal the container. Dispose of collected material as soon as possible in accordance with applicable local/regional/national/international regulations.

#### **SECTION 7: Handling and storage**

#### 7.1. Precautions for safe handling

Contents may be under pressure, open carefully. Do not breathe thermal decomposition products. For industrial/occupational use only. Not for consumer sale or use. Do not use in a confined area with minimal air exchange. Avoid release to the environment.

#### 7.2. Conditions for safe storage including any incompatibilities

Protect from sunlight. Store in a well-ventilated place. Store at temperatures not exceeding 38C/100F Store away from strong bases. Store away from amines.

#### **SECTION 8: Exposure controls/personal protection**

#### 8.1. Control parameters

#### **Occupational exposure limits**

If a component is disclosed in section 3 but does not appear in the table below, an occupational exposure limit is not available for the component.

Ingredient	C.A.S. No.	Agency	Limit type	Additional Comments
1,1,1,2,2,4,5,5,5-	756-13-8	Manufacturer	TWA:150 ppm(1940 mg/m3)	
NONAFLUORO-4-		determined		
(TRIFLUOROMETHYL)-3-				
PENTANONE				

ACGIH : American Conference of Governmental Industrial Hygienists

AIHA : American Industrial Hygiene Association

CMRG : Chemical Manufacturer's Recommended Guidelines

OSHA : United States Department of Labor - Occupational Safety and Health Administration

TWA: Time-Weighted-Average

STEL: Short Term Exposure Limit CEIL: Ceiling

8.2. Exposure controls

#### 8.2.1. Engineering controls

For those situations where the material might be exposed to extreme overheating due to misuse or equipment failure, use with appropriate local exhaust ventilation sufficient to maintain levels of thermal decomposition products below their exposure guidelines. Use general dilution ventilation and/or local exhaust ventilation to control airborne exposures to below relevant Exposure Limits and/or control dust/fume/gas/mist/vapors/spray. If ventilation is not adequate, use respiratory protection equipment.

#### 8.2.2. Personal protective equipment (PPE)

#### Eye/face protection

Eye protection not required.

#### Skin/hand protection

Select and use gloves and/or protective clothing approved to relevant local standards to prevent skin contact based on the results of an exposure assessment. Selection should be based on use factors such as exposure levels, concentration of the

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3M <sup>TM</sup> Novec <sup>TM</sup> 1230 Fire Protection Fluid	04/20/22	
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substance or mixture, frequency and duration, physical challenges such as temperature extremes, and other use conditions. Consult with your glove and/or protective clothing manufacturer for selection of appropriate compatible gloves/protective clothing.

Gloves made from the following material(s) are recommended: Neoprene Nitrile Rubber

If this product is used in a manner that presents a higher potential for exposure (eg. spraying, high splash potential etc.), then use of protective coveralls may be necessary. Select and use body protection to prevent contact based on the results of an exposure assessment. The following protective clothing material(s) are recommended: Apron - Neoprene Apron - Nitrile

#### **Respiratory protection**

For those situations where the material might be exposed to extreme overheating due to misuse or equipment failure, use a positive pressure supplied-air respirator.

#### **SECTION 9: Physical and chemical properties**

#### 9.1. Information on basic physical and chemical properties

Appearance			
Physical state	Liquid		
Color	Colorless		
Specific Physical Form:	Liquid		
Odor	Low Odor		
Odor threshold	No Data Available		
рН	Not Applicable		
Melting point	-108 °C		
Boiling Point	49 °C [@ 760 mmHg]		
Flash Point	No flash point		
Evaporation rate	> 1 Units not avail. or not appl. [ <i>Ref Std</i> :BUOAC=1]		
Flammability (solid, gas)	Not Applicable		
Flammable Limits(LEL)	None detected		
Flammable Limits(UEL)	None detected		
Vapor Pressure	40.4 kPa [@ 25 °C]		
Vapor Density	11.6 [ <i>Ref Std</i> :AIR=1]		
Density	1.6 g/ml		
Specific Gravity	1.6 [@ 68 °F] [ <i>Ref Std</i> : WATER=1]		
Solubility in Water	Nil		
Solubility- non-water	No Data Available		
Partition coefficient: n-octanol/ water	No Data Available		
Autoignition temperature	Not Applicable		
Decomposition temperature	No Data Available		
Viscosity	0.6 centipoise [@ 25 °C ]		
Molecular weight	No Data Available		
Volatile Organic Compounds	1600 g/l [Test Method:calculated SCAOMD rule 443.1]		
Percent volatile	100 %		
VOC Less H2O & Exempt Solvents	1600 g/l [ <i>Test Method</i> :calculated SCAQMD rule 443.1]		
L L			

#### **SECTION 10:** Stability and reactivity

#### 10.1. Reactivity

This material may be reactive with certain agents under certain conditions - see the remaining headings in this section.

#### 10.2. Chemical stability

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Stable.

**10.3. Possibility of hazardous reactions** Hazardous polymerization will not occur.

**10.4. Conditions to avoid** Light

**10.5. Incompatible materials** Strong bases Amines Alcohols

10.6. Hazardous decomposition products <u>Substance</u> Hydrogen Fluoride

<u>Condition</u> At Elevated Temperatures - extreme conditions of heat

Refer to section 5.2 for hazardous decomposition products during combustion.

If the product is exposed to extreme condition of heat from misuse or equipment failure, toxic decomposition products that include hydrogen fluoride and perfluoroisobutylene can occur. Extreme heat arising from situations such as misuse or equipment failure can generate hydrogen fluoride as a decomposition product.

#### **SECTION 11: Toxicological information**

The information below may not be consistent with the material classification in Section 2 if specific ingredient classifications are mandated by a competent authority. In addition, toxicological data on ingredients may not be reflected in the material classification and/or the signs and symptoms of exposure, because an ingredient may be present below the threshold for labeling, an ingredient may not be available for exposure, or the data may not be relevant to the material as a whole.

11.1. Information on Toxicological effects

Signs and Symptoms of Exposure

Based on test data and/or information on the components, this material may produce the following health effects:

#### Inhalation:

No health effects are expected.

#### Skin Contact:

Contact with the skin during product use is not expected to result in significant irritation.

#### Eye Contact:

Contact with the eyes during product use is not expected to result in significant irritation.

#### Ingestion:

No known health effects.

#### **Toxicological Data**

If a component is disclosed in section 3 but does not appear in a table below, either no data are available for that endpoint or the data are not sufficient for classification.

#### Acute Toxicity

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Name	Route	Species	Value
1,1,1,2,2,4,5,5,5-NONAFLUORO-4-(TRIFLUOROMETHYL)-3-	Dermal	Professio	LD50 estimated to be $> 5,000 \text{ mg/kg}$
PENTANONE		nal	
		judgeme	
		nt	
1,1,1,2,2,4,5,5,5-NONAFLUORO-4-(TRIFLUOROMETHYL)-3-	Ingestion	Professio	LD50 estimated to be $> 5,000 \text{ mg/kg}$
PENTANONE		nal	
		judgeme	
		nt	
1,1,1,2,2,4,5,5,5-NONAFLUORO-4-(TRIFLUOROMETHYL)-3-	Inhalation-	Rat	LC50 > 1,227 mg/l
PENTANONE	Vapor (4		
	hours)		

ATE = acute toxicity estimate

#### Skin Corrosion/Irritation

Name	Species	Value
1,1,1,2,2,4,5,5,5-NONAFLUORO-4-(TRIFLUOROMETHYL)-3-PENTANONE	Rabbit	No significant irritation

#### Serious Eye Damage/Irritation

Name	Species	Value
1,1,1,2,2,4,5,5,5-NONAFLUORO-4-(TRIFLUOROMETHYL)-3-PENTANONE	Rabbit	No significant irritation

#### **Skin Sensitization**

Name	Species	Value
1,1,1,2,2,4,5,5,5-NONAFLUORO-4-(TRIFLUOROMETHYL)-3-PENTANONE	Guinea	Not classified
	pig	

#### **Respiratory Sensitization**

For the component/components, either no data are currently available or the data are not sufficient for classification.

#### Germ Cell Mutagenicity

Name	Route	Value
1,1,1,2,2,4,5,5,5-NONAFLUORO-4-(TRIFLUOROMETHYL)-3-	In Vitro	Not mutagenic
PENTANONE		
1,1,1,2,2,4,5,5,5-NONAFLUORO-4-(TRIFLUOROMETHYL)-3-	In vivo	Not mutagenic
PENTANONE		

#### Carcinogenicity

For the component/components, either no data are currently available or the data are not sufficient for classification.

#### **Reproductive Toxicity**

#### **Reproductive and/or Developmental Effects**

Name	Route	Value	Species	Test Result	Exposure
					Duration
1,1,1,2,2,4,5,5,5-NONAFLUORO-4-	Inhalation	Not classified for female reproduction	Rat	NOAEL 38.7	premating &
(TRIFLUOROMETHYL)-3-PENTANONE				mg/l	during
					gestation
1,1,1,2,2,4,5,5,5-NONAFLUORO-4-	Inhalation	Not classified for male reproduction	Rat	NOAEL 38.7	premating &
(TRIFLUOROMETHYL)-3-PENTANONE				mg/l	during
					gestation
1,1,1,2,2,4,5,5,5-NONAFLUORO-4-	Inhalation	Not classified for development	Rat	NOAEL 39.5	during
(TRIFLUOROMETHYL)-3-PENTANONE				mg/l	gestation

#### Target Organ(s)

#### Specific Target Organ Toxicity - single exposure

Name	Route	Target Organ(s)	Value	Species	Test Result	Exposure

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						Duration
1,1,1,2,2,4,5,5,5-	Inhalation	nervous system	Not classified	Rat	NOAEL	2 hours
(TRIFLUOROMETHYL)-					100,000 ppm	
3-PENTANONE						
1,1,1,2,2,4,5,5,5-	Inhalation	cardiac sensitization	Not classified	Dog	Sensitization	17 minutes
NONAFLUORO-4-					Negative	
(TRIFLUOROMETHYL)-						
3-PENTANONE						

#### Specific Target Organ Toxicity - repeated exposure

Name	Route	Target Organ(s)	Value	Species	Test Result	Exposure
						Duration
1,1,1,2,2,4,5,5,5-	Inhalation	liver kidney and/or	Not classified	Rat	NOAEL 38.6	90 days
NONAFLUORO-4-		bladder   heart			mg/l	
(TRIFLUOROMETHYL)-		endocrine system			-	
3-PENTANONE		hematopoietic				
		system   muscles				
		nervous system				
		respiratory system				
		vascular system				

#### **Aspiration Hazard**

For the component/components, either no data are currently available or the data are not sufficient for classification.

Please contact the address or phone number listed on the first page of the SDS for additional toxicological information on this material and/or its components.

#### **SECTION 12: Ecological information**

#### **Ecotoxicological information**

Please contact the address or phone number listed on the first page of the SDS for additional ecotoxicological information on this material and/or its components.

#### Chemical fate information

Please contact the address or phone number listed on the first page of the SDS for additional chemical fate information on this material and/or its components.

#### **SECTION 13: Disposal considerations**

#### 13.1. Disposal methods

Dispose of contents/ container in accordance with the local/regional/national/international regulations.

Dispose of waste product in a permitted industrial waste facility. As a disposal alternative, incinerate in a permitted waste incineration facility. Proper destruction may require the use of additional fuel during incineration processes. Combustion products will include HF. Facility must be capable of handling halogenated materials. Empty drums/barrels/containers used for transporting and handling hazardous chemicals (chemical substances/mixtures/preparations classified as Hazardous as per applicable regulations) shall be considered, stored, treated & disposed of as hazardous wastes unless otherwise defined by applicable waste regulations. Consult with the respective regulating authorities to determine the available treatment and disposal facilities.

#### EPA Hazardous Waste Number (RCRA): Not regulated

### **SECTION 14: Transport Information**

For Transport Information, please visit http://3M.com/Transportinfo or call 1-800-364-3577 or 651-737-6501.

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#### **SECTION 15: Regulatory information**

#### **15.1. US Federal Regulations**

Contact 3M for more information.

#### EPCRA 311/312 Hazard Classifications:

Physical Hazards Not applicable

#### Health Hazards

Not applicable

#### 15.2. State Regulations

Contact 3M for more information.

#### **15.3.** Chemical Inventories

The components of this product are in compliance with the new substance notification requirements of CEPA.

The components of this material are in compliance with the China "Measures on Environmental Management of New Chemical Substance". Certain restrictions may apply. Contact the selling division for additional information.

The components of this material are in compliance with the provisions of the Korean Toxic Chemical Control Law. Certain restrictions may apply. Contact the selling division for additional information.

The components of this material are in compliance with the provisions of Japan Chemical Substance Control Law. Certain restrictions may apply. Contact the selling division for additional information.

The components of this product are in compliance with the chemical notification requirements of TSCA. All required components of this product are listed on the active portion of the TSCA Inventory.

Contact 3M for more information.

#### **15.4. International Regulations**

Contact 3M for more information.

This SDS has been prepared to meet the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200.

#### **SECTION 16: Other information**

#### NFPA Hazard Classification

Health: 3 Flammability: 1 Instability: 0 Special Hazards: None

National Fire Protection Association (NFPA) hazard ratings are designed for use by emergency response personnel to address the hazards that are presented by short-term, acute exposure to a material under conditions of fire, spill, or similar emergencies. Hazard ratings are primarily based on the inherent physical and toxic properties of the material but also include the toxic properties of combustion or decomposition products that are known to be generated in significant quantities.

The NFPA Health code of 3 is due to emergency situations where the material may thermally decompose and release Hydrogen Fluoride. During normal use conditions, please reference Section 2 and Section 11 of the SDS for additional health hazard information.

#### **HMIS Hazard Classification**

Health: 0 Flammability: 1 Physical Hazard: 0 Personal Protection: X - See PPE section.

Hazardous Material Identification System (HMIS® IV) hazard ratings are designed to inform employees of chemical hazards

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in the workplace. These ratings are based on the inherent properties of the material under expected conditions of normal use and are not intended for use in emergency situations. HMIS® IV ratings are to be used with a fully implemented HMIS® IV program. HMIS® is a registered mark of the American Coatings Association (ACA).

Document Group:	16-3425-2	Version Number:	31.00
Issue Date:	04/20/22	Supercedes Date:	10/05/21

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#### 3M USA SDSs are available at www.3M.com

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## Nitrogen, compressed Safety Data Sheet P-4631

Making our planet more productive" 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

	ION: 1. Product and compare	hy identification		
1.1.	Product Identifier			
Produc	:: form	Substance		
Name CAS No Formula		Nitrogen, compressed		
		7727-37-9		
		N2		
Other	means of identification	Dinitrogen, Refrigerant R728, Nitrogen, Medipure Nitrogen, Extendapak Nitrogen, Nitrogen - Diving Grade		
1.2. Relevant identified uses of the		ubstance or mixture and uses advised against		
Use of	the substance/mb/ture	Industrial use Medical applications. Food applications. Diving Gas (Underwater Breathing)		
1.3.	Details of the supplier of the saf	ety data sheet		
Praxal 39 Old Danbu T 1-80 Motor P	r, Inc. Ridgebury Road ry, CT 06810-5113 - USA 0-772-9247 (1-800-PRAXA R) - F 1-7 raxa r.com	16-879-2148		
1.4.	Emergency telephone number			
-meig	ancy number	Onsite Emergency: 1-800-845-4633		
		CHEMTREC, 24hr/day 7days/week — Within USA: 1-900-424-9300, Outside USA: 001-703- 527-3887 (collect calls accepted, Contract 17729)		
SECT	ION 2: Hazards identificatio	n		
84.	Classification of the substance	or mixture		
Classi	fication (GHS-US)			
Compr	essed gas	H280		
2.2	Label elements			
HS-L	IS labeling			
Hazzro	l pictograms (GHS-US)	$\diamond$		
		WARNING		
linnat		H280 - CONTAINS GAS UNDER PRESSURE: MAY EXPLODE IF HEATED		
Signal Hazaro	1 statements (GHS-US)	H283 - CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED OSHA-H01 - MAY DISPLACE OXYGEN AND CAUSE RAP D SUFFOCATION		
Signal Hazaro Precau	rionary statements (GHS-US)	H280 - CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED OSHA-H01 - MAY DISPLACE OXYGEN AND CAUSE RAP D SUFFOCATION. 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-PG06 - Use a back flow preventive device in the piping. CGA-PG06 - 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).		
Signal Hazaro Precal	d statements (GHS-US) clonary statements (GHS-US) Other hazards	H280 - CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED OSHA-H01 - MAY DISPLACE OXYGEN AND CAUSE RAP D SUFFOCATION. 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-PG06 - 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).		
Signal Hazaro Precal 2.3.	other hazards	<ul> <li>H280 - CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED OSHA-H01 - MAY DISPLACE OXYGEN AND CAUSE RAPID SUFFOCATION.</li> <li>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.</li> <li>CGA-PG00 - Use a back flow preventive device in the piping.</li> <li>CGA-PG10 - Use only with equipment rated for cylinder pressure.</li> <li>CGA-PG06 - Close valve after each use and when empty.</li> <li>CGA-PG02 - Protect from sunlight when ambient temperature exceeds 52°C (125°F).</li> <li>No additional information available</li> </ul>		

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Making our planet more productive according to U.S. Code of Federal Regulations 23 CFR 1910.1200, Hazard Communication. Date of issue: 01/01/1980 Revision date: 05/24/2015 Supersedes: 04/23/2015

24 Unknown acute toxicity (GHS-US) No data available SECTION 3: Composition/information on ingredients 3.1. Substance Name : Nitrogen, compressed 7727-37-9 CAS No Name Product identifier X (CAS No) 7727-37-9 29.5 - 100 Nitrogen 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 incestion : Ingestion is not considered a potential route of exposure. 42 Most Important symptoms and effects, both acute and delayed No additional information available Indication of any immediate medical attention and special treatment needed 4.3. None. SECTION 5: Firefighting measures Extinguishing media 51 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 23 CFR 1910.156 and applicable standards under 29 CFR 1910 Subpart L-Fire Protection Protect on 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 co so. Use water spray or fog to knock down fire furnes if possible.

6.1. Personal precautions,	1. Personal precautions, protective equipment and emergency procedures						
Ceneral measures	Evacuate area. Ensure adequate air ventilation. Wear self-contained entering area unless atmosphere is proven to be safe. Stop leak if sa	oreathing apparatus when ife to do so.					
EN (English US)	SDS ID: P-4631	2/8					

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6.1.1.	For non-emergency personnel	
		No additional information available
6.1.2.	For emergency responders	
		No additional information available
8.2	Environmental precautions	
		No additional information available
5,3,	Methods and material for contain	ment and cleaning up
		No additional information available
i.4.	Reference to other sections	
		See also sections 8 and 13.
SECT	ION 7: Handling and storage	
M	Precautions for safe handling	
Precau:	ions for sate handling	Wear leader safety goves and safety shoes when handling cylinders. Protect cylinders from physical damage; do not drag, roll, side 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 (trollay, 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 applier. Close the container valve after each use, keep closed even when empty. Never apply fame 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 us	e 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, inclu	iding 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 sufficient on because of cxygen 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 a Linternational, 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

 Nifrogen, compressed (7727-37-9)
 ACGIH

 ACGIH
 Not established

 USA OSHA
 Not established

 Nifrogen (7727-37-9)
 ACGIH

 ACGIH
 Not established

 USA OSHA
 Not established

 USA OSHA
 Not established

 USA OSHA
 Not established

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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 25 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).

8.1. Information on basic physical and	I chemical properties	
Physical state	: Gas	
Appearance	: Coloriess gas.	
Molecular mass	: 28 g/mol	
Color	: Coloriess	
Odor	: No odor warning properties.	
Odor threshold	: No data available	
pH	: Not applicable.	
Relative evaporation rate (butyl acetate=1)	: No data ava liable	
Relative evaporation rate (ether-1)	: Not applicable	
Melting point	: -210 °C	
Freezing point	: No data available	
Boiling coint	: -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 ava lable	
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/m <sup>1</sup>	
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	
Oxid zing properties	: None,	
Explosion limits	: No data ava lable	
9.2. Other Information		
Gas group	: Compressed gas	
Additional Information	: None.	
EN (English (19)	CDC ID: D.4634	410

EN (English US)

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SECT	ON 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	
	100	May occur.
10.4.	Conditions to avoid	
14101		None under recommenced storage and handling conditions (see section 7).
10.5	Incomposible motorials	e e e e
10.0.	incompaniate inaterials	None
		316178
10.6.	Hazardous decomposition products	
		None.
SECT	ON 11: Toxicological informat	lon
11.1.	Information on toxicological effects	
100.000	12:47.5	
Acute to	xicity	: Not classified
Skin corresionérritation		Not classified
		all ble and a ble
arious a	ne democraticitation	PH Not applicable.
enous e	ye camagerinizatin	oH: Nationalicable
wenitate	ry or skin sensitization	Not classified
erm ce	mutagenicity	Not classified
arcinog	enicity	Not classified
Report	where to visitly	Not classified
Specific	target organ toxicity (sincle exposure)	/ Not classified
Onesie	target organization basis the income stard	· Nationality
exposur	e)	. Not dessined
Appirette	n haram	. Not closeflad
- aprian	an nazaro	, Hol dispanee
SECT	ON 12: Ecological information	
12.1.	Toxicity	
Ecology	- general	No ecological damage caused by this product.
12.2.	Persistence and degradability	
Nitrog	en, compressed (7727-37-8)	
Persis	ence and degradability	No ecological damage caused by this product
Nitrod	en (7727-37-9)	
Persis	ence and degradability	No ecological damage caused by this product.
12.3.	Bloaccumulative potential	
Nitrod	en, compressed (7727-37-9)	
Log Po	nw .	Not applicable
Log Ka	nw	Not applicable
Binaco	umulative potential	No ecological damage caused by this product

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Nitrogen (7727-37-9)		
Log Pow	Not applicable for inorganic gases.	
Log Kow	Not applicable.	
Bioaccumulative potential	No ecological damage caused by this product.	
2.4. Mobility in soil		
Nitrogen, compressed (7727-37-8)		
Mobility in soil	No data available.	
Ecology - sol	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.	
2.5. Other adverse effects		
Effect on ozone layer	None,	
Effect on the clobel warming	Nona	
Energi dir the global war ning	None	
SECTION 13: Disposal consideratio	ns	
13.1. Waste treatment methods		
Waste disposal recommendations	Dispose of contents/container in accordance with local/regions/instions/international regulations Contact supplier for any special requirements	
SECTION 14: Transport information		
n accordance with DOT		
fransport document description	UN1066 Nitrogen, compressed, 2.2	
IN-No (DOT)	UN1066	
Proper Shipping Name (DOT)	Nitrogen, compressed	
Fransport hazard class(es) (DOT)	2.2 - Class 2.2 - Non-flammable compressed gas 49 CFR 173.115	
Hazard labels (DOT)	22 - Non-fammable 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 hansporting product container. - 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		
JN No. (IMDG)	1086	
roper Shipping Name (IMDG)	NITROGEN, COMPRESSED	
Jass (MUG)	V - (583%5	
MPAG-NO	121	
Air transport		
UN-No.(IATA)	1066	
Proper Shipping Name (IATA)	Nitrogen, compressed	
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Class (IATA) Civil Aeronautics Law

: Gases under pressure/Gases nonflammable nontoxic under pressure

SECTION 1	5: Regu	latory information
The second s	فالتوشية والمتعاولين	2000a112

#### 15.1. US Federal regulations 100

Listed on the United States TSCA (Toxic Substances Control Act) Inventory SARA Section 311/312 Hazard Classes Sudden release of pressure hazard	wirogen, compressed (1/2/-0/-a)		
SARA Section 311/312 Hazard Classes Sudden release of pressure hazard	Listed on the United States TSCA (Toxic Sub-	stances Control Act; inventory	
	SARA Section 311/312 Hazard Classea 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 FICCS (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 55 - Developmental Toxicity	No	
U.S California - Proposition 65 - Reproductive Toxichy - Female	No	
U.S California - Proposition 55 - 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 Pennsylvanis - RTK (Right to Know) List	

#### Nitrogen (7727-37-8) U.S. - California -Proposition 65 -U.S. - California -U.S. - California -U.S. - California -No significance risk level Proposition 65 -Proposition 65 -Proposition 65 -(NSRL) Developmental Toxicity Reproductive Toxicity - Male Carcinogens List Reproductive Toxicity -Female 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

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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.
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	PRAXAIR and the Flowing Airstream dealgn are trademarks or registered trademarks of Praxair Technology, Inc. in the United States and/or other countries.
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 ourn.
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	: O 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 innuiseage and is intended to describe the product for the purposes of bealth, safely and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

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