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# DESIGN, INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

FOR

# CLEAN AGENT SELF-CONTAINED AUTOMATIC EXTINGUISHER UNIT

Models: 940205 – 2.5 lbs 940505 – 5 lbs 941005 – 10 lbs

P/N 800025 U.L. EX5323 FM Approvals Project 3026082

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# 1 FOREWORD

# 1.1 General

This manual is written for the fire protection professional that designs, installs, and maintains Firetrace Self-Contained Automatic Indirect Novec 1230 Clean Agent Extinguisher Unit.

Firetrace Novec 1230 Automatic Indirect Fire Suppression Units are to be designed, installed, inspected, tested, maintained, and recharged by qualified trained personnel in accordance with the following:

- All instructions, limitations, etc. contained in this manual P/N 800025
- All information contained on the agent cylinder nameplate(s)
- NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems
- Underwriters Laboratories Inc. Listing
- FM Approvals Listing (please refer to Appendix B for the FM Approval system specifications and limitations)
- Local Authority having jurisdiction

# 1.2 Warnings

Safety precautions are essential when any electrical or mechanical equipment is involved. These precautions should be followed when handling, servicing, and recharging Firetrace Novec 1230 Fire Suppression Unit cylinders 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.

# \land WARNING:

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

# **A** CAUTION:

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

# 1.3 Safety Precautions

The following safety precautions should always be followed:



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

- 1. Read and understand this manual and the other documents referenced herein.
- The valve discharge outlet safety plugs MUST be installed on the cylinder valve at all times and only removed when connected into the discharge tubing or when performing charging, testing, or salvaging operations in accordance with the procedures contained in this manual.
- 3. Wear safety glasses when working with pressurized cylinders and charging equipment. It is recommended to wear leather gloves to avoid any cryogenic burns if Novec 1230 is accidentally discharged on or near the skin.
- 4. Make sure that the ball valve (attached to the top of the cylinder valve) is closed (lever is in "OFF" position), the detection tubing has been removed from the cylinder valve and the safety caps installed before removing the cylinder from the installation and before performing any charging, leak tests or salvage operations.
- 5. Follow all of the safety procedures included on the cylinder nameplate and in this manual.
- 6. Never assume that a cylinder is empty. Treat all cylinders as if they are fully charged.

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

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The following web site should be visited for frequent technical announcements

www.firetrace.com

# 2 INTRODUCTION

The Firetrace Indirect Novec 1230 Clean Agent Automatic Fire Extinguisher Unit is UL Listed by Underwriters Laboratories Inc, ULC Listed by Underwriters Laboratories of Canada, and approved with FM Approvals (please refer to Appendix B for the FM Approval system specifications and limitations). These units are designed for total flooding applications using Novec 1230 Clean Agent in accordance NFPA 2001: *Standard on Clean Agent Fire Extinguishing Systems*.

The Firetrace Self-Contained Automatic Units have been tested to limits established by UL/ULC/FM (please refer to Appendix B for the FM Approval system specifications and limitations) in compliance with the requirements specified in UL 2166, *Standard for Halocarbon Clean Agent Extinguishing System Units* and as detailed in this Manual.

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

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

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

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

# 2.1 Novec 1230 Extinguishing Agent

The extinguishing agent used in Firetrace self-contained automatic indirect fire suppression units is Dodecafluoro-2-methylpentan-3-one, more commonly known as Novec 1230.

Novec 1230 (1,1,1,2,2,4,5,5,5-NONAFLUORO-4-(TRIFLUOROMETHYL)-3-PENTANONE) is a colorless low odor fluid, low in toxicity, electrically non-conductive, leaves no residue, and is an extremely effective fire suppression agent.

Novec 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

Novec 1230 is clean and leaves no residue, thereby minimizing after fire clean up along with keeping expensive downtime to a minimum. Most materials such as steel, aluminum, stainless steel, brass, as well as plastics, rubber and electronic components are not affected by exposure to Novec 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:

<b>During Combustion</b>
During Combustion
During Combustion

### 2.1.3 Properties of Novec 1230

For hazard information, decomposition information, and physical properties of Novec 1230 please refer to the Safety Data sheet located in Appendix C.

# **3 SYSTEM DESCRIPTION**

# 3.1 General

The Firetrace Novec 1230 Automatic Indirect Units are available in 3 sizes, namely:

940205	Charged with 2.5 Lbs (1.13 Kg) of Novec 1230
940505	Charged with 5 lbs (2.27 Kg) of Novec 1230
941005	Charged with 10 lbs (4.54 Kg) of Novec 1230

These units are designed for use in Total Flooding applications only, where the hazard is normally unoccupied. (See NFPA 2001, Section 1-6 for personnel safety exposure limits for Novec 1230)

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

- Electrical and electronic cabinets
- Telecommunication areas
- Data Processing areas and cabinets
- Other high value assets
- Laboratory fume /exhaust cabinets
- Pump enclosures
- UPS units
- Flammable Chemicals storage cabinets
- Generator Enclosures
- Transformer Cabinets
- Computer/Data Storage Cabinets
- CNC & VMC Machining centers
- Many other applications

Novec 1230 is a gaseous fire-extinguishing agent that is effective for use on:

- Class A Surface type fires
- Class B Flammable liquid fires
- Class C Electrical equipment fires

Novec 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 autothermal decomposition, such as certain organic peroxides and hydrazine

For hazards beyond the scope described above it is recommended that the designer consult with Firetrace, NFPA 2001, and the local authority having jurisdiction as to the suitability on the use of Novec 1230 for a particular hazard, for personnel exposure effects from the design concentration, and for installation requirements.

Firetrace Novec 1230 Automatic Indirect Units consists of the following major components:

- Cylinder/Valve assembly
- Cylinder Mounting Bracket
- Firetrace detector/actuation tubing and fittings (No substitute)
- Discharge nozzles
- Pressure switch (Optional)
- Discharge piping and fittings (Furnished by others)

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

The unit utilizes a UL recognized component (per UL standard 521), a Linear Heat Detector (See Certificate of Compliance 20140705-S35465) known as Firetrace Automatic Fire Detection Tubing, which when pressurized with Dry Nitrogen, will allow the fire suppression valve to remain in the closed position. This tubing acts as a continuous linear thermal detector that ruptures upon direct flame impingement or at temperatures above 383°F (195°C). Once the detection tubing is ruptured, the valve automatically opens, allowing the Novec 1230 agent to flow through the discharge piping, distributing the extinguishing agent through the nozzle(s) into the protected volume. Upon actuation, the pressure switch can be used to indicate discharge, shutdown ventilation, close all openings, shut-off electrical power, etc. as may be required.

# **3.2** Component Descriptions

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

### 3.2.1 Novec 1230 Cylinder/Valve Assemblies

Novec 1230 is stored in steel cylinders pressurized with nitrogen to 195 psig at 70°F (13.4 bar at 21°C). Table 3-1 describes the 2.5, 5, and 10 Lb system assemblies. Each cylinder is equipped with a straight siphon tube and can only be mounted in a vertical (upright) position.

Nom	Asm	Asm Outside Dia		Height		Volume		Agent	
Size	Part #	ln.	Cm	ln.	Cm	ln <sup>3</sup>	Cm <sup>3</sup>	Lb	Kg
2.5	940205	3.0	7.62	17.38	44.15	75	1229	2.5	1.13
5	940505	4.25	10.80	17.49	44.42	145	2376	5	2.27
10	941005	6.32	16.05	17.68	44.91	300	4,916	10	4.54

Table 3-1: Novec 1230 Cylinder / Valve Assemblies

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

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

# 

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

Table 3-2 describes the Specifications used for the manufacturing of the Novec 1230 cylinders.

Nominal	Cylinder Specification	Cylinder Service	Cylinder Sp Test Pr	ecification essure
Size	Specification	Pressure (psig)	psig	kPa
2.5	DOT 4B240	240	480	3,310
5	DOT 4B240	240	480	3,310
10	DOT 4B360	360	720	4,964

Table 3-2:

Cylinder Specifications

## 3.2.2 Firetrace Flexible Detection/Actuation Tubing

The Firetrace detection/activation tubing is a UL recognized component per UL standard 521 (See Certificate of Compliance 20140705-S35465). The tubing is used as a combination linear heat detector and unit activation device to cause actuation of the Novec 1230 unit. It is installed throughout the hazard volume with one end connected to the top of the cylinder valve, then pressurized with nitrogen to 195 psig. The detection tubing is heat sensitive and in a fire situation is designed to rupture at any point along its length upon direct flame impingement or when the temperature reaches 383°F (195°C). The rupture of the tube releases the nitrogen pressure causing the Novec 1230 system valve to actuate, resulting in complete discharge of the Novec 1230 agent through the nozzles.

### 3.2.3 Manual Release

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

### 3.2.4 Pressure Switch

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

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

# **4 SYSTEM DESIGN AND LIMITATIONS**

# 4.1 General

The Firetrace series of Novec 1230 Self-Contained Automatic Indirect Units' design limits were established and tested by Firetrace. The Units are Listed by Underwriters Laboratories Inc, Underwriters' Laboratories of Canada, and Approved by FM Approvals (please refer to Appendix B for the FM Approval system specifications and limitations).

These units were subjected to numerous performance and fire tests (as specified in UL 2166), in order to verify their suitability and to establish design limitations for:

- Hazard volume
- Nozzle area coverage and heights
- Nozzle placement
- Discharge time and flow rates
- Design concentrations & design factors
- Detector tubing placement

The self-contained automatic unit concept minimizes the amount of engineering required when evaluating a design for a specific application. So long as the discharge piping and nozzles are installed within the limits prescribed in this Manual, no calculations are required for pressure drop, flow rates, or discharge time. When the additional limitations of hazard volume, area coverage, maximum height, design concentration, agent quantity, detector arrangement, etc., are also met, the unit installation can be understood to comply with the design requirements, NFPA 2001, the UL/UL-C Listings, and FM Approvals (please refer to Appendix B for the FM Approval system specifications and limitations). Therefore, no discharge tests or concentration measurements should be required.

## 4.2 Specifications

### 4.2.1 Storage and Operating Temperature Range

The Firetrace Novec 1230 Units and equipment are designed to be stored and operated at the ambient temperature range of  $0^{\circ}$ F to +130°F (-17.8°C to +54.4°C).

### 4.2.2 System Operating Pressure

The normal operating pressure for the unit is 195 psig at 70°F (13.4 bar at 21°C).

The Firetrace Novec1230 Units are designed for an operating temperature range of 0°F to +130°F. Table 4-1 shows the cylinder gauge pressure-temperature relationship based on a charging pressure of 195 psig at 70°F.

Cylinder Pressure						
Tempe	rature	Press	ure			
°F	۵°	psig	bar			
0	-17.8	139	9.6			
10	-12.2	147	10.1			
20	-6.7	155	10.7			
30	-1.1	163	11.2			
40	4.4	171	11.8			
50	10.0	179	12.3			
60	15.5	187	12.9			
70	21.1	195	13.4			
80	26.7	203	14.0			
90	32.2	211	14.5			
100	37.8	219	15.1			
110	43.3	227	15.7			
120	48.9	235	16.2			
130	54.4	243	16.8			

#### Table 4-1: Cylinder Pressure-Temperature Relationship

# 4.3 Design Procedure

The following procedures should be used to design a Firetrace Novec 1230 Self-Contained Automatic Indirect Fire Suppression Unit. In addition, the applicable requirements specified in Chapter 5 of NFPA 2001, 2015 Edition should be followed.

- a. Conduct a survey and analysis of the hazard to be protected.
- b. Determine the height, length, and width of the enclosure. Calculate the volume. All of these parameters must be within the dimensional limits specified in this Manual. (See Section 4.4.1)
- c. Determine the anticipated minimum and maximum ambient temperatures expected within the enclosure to be protected. (See Section 4.2.1)
- d. Determine the minimum design concentration required for the hazard. (See Section 4.5 and Tables 4-3 and 4-4).
- e. Determine the integrity of the enclosure and if any openings must be closed at the time of agent discharge. (See Section 4.4.2)
- f. Determine the cylinder size required based on the hazard volume limitations and enclosure size. Remember, as cautioned in Section 2 of this Manual, only one (1) extinguisher unit can be used to protect one (1) hazard.
- g. Based on the total quantity of Novec 1230 agent being used at the maximum ambient temperature expected within the enclosure, evaluate personnel safety exposure limits as specified in NFPA 2001.
- h. Determine the location of the Novec 1230 cylinder.
- i. Determine the location and quantity of nozzles required based on the size and configuration of the enclosure. (See Section 4.6)
- j. Determine the routing and quantity of discharge pipe required. The discharge pipe and fitting limitations must not be exceeded. (See Section 4.6)
- k. Determine the arrangement and placement of the Firetrace detection tubing. (See Section 4.7)
- I. Determine any auxiliary equipment requirements such as a pressure switch(s) to sound alarms, shut-down ventilation, shutoff electrical power, etc.
- m. Prepare system drawings, bill of materials list, etc.; following the applicable sections of Chapter 5 of NFPA 2001, 2015 Edition, as needed.

# 4.4 Hazard Enclosure Limitations

### 4.4.1 Enclosure Size

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

Model	Novec 1230	Discharge Ports Used (DP)	Nozzles Per DP	Total Number of Nozzles Per Unit	Max. Area Coverage Per Nozzle	Total Area Coverage Per Unit	Maximum Height	Total Volume Coverage Per Unit				
		1	1	1	5'x5' = 25 Ft <sup>2</sup> (1.52x1.52 = 2.32m <sup>2</sup> )							
940205	2.5 lb (1.13 Kg)	2.5 lb (1.13 Kg)	1	2	5'x2.5' = 12.5 Ft <sup>2</sup> (1.52 x0.76 = 1.16 m <sup>2</sup> )	25 Ft <sup>2</sup> 2.32m <sup>2</sup> )	10 Ft (3.05 m)	(a)				
					2	2	4	2.5'x2.5' = 6.25 Ft <sup>2</sup> (0.76 x0.76 = 0.58m <sup>2</sup> )				
040505	5 lb (2.27 Kg)	5 lb	5 lb	0505 5 lb	05 5 lb 2	0	1	2	5'x2.5' = 12.5 Ft <sup>2</sup> (1.52 x0.76 = 1.16 m <sup>2</sup> )	25 Ft <sup>2</sup>	10 Ft	
940000		2	2	4	2.5'x2.5' = 6.25 Ft <sup>2</sup> (0.76 x0.76 = 0.58m <sup>2</sup> )	2.32m <sup>2</sup> )	(3.05 m)	(a)				
0401005	10 lb (4.54 Kg)	10 lb	0	1	2	5'x2.5' = 12.5 Ft <sup>2</sup> (1.52 x0.76 = 1.16 m <sup>2</sup> )	25 Ft <sup>2</sup>	10 Ft	(-)			
9401005		4.54 Kg) 2 2 4 2. (0.7	2.5'x2.5' = 6.25 Ft <sup>2</sup> (0.76 x0.76 = 0.58m <sup>2</sup> )	2.32m <sup>2</sup> )	(3.05 m)	(a)						
(a) The main for the enc	(a) The maximum volume varies as a function of the minimum design concentration and minimum anticipated design temperature requirement for the enclosure being protected. Refer to Table 4-3.											

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

Table 4-2: Enclosure Size and Nozzle Limitations

### 

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

## 4.4.2 Ventilation Shut-Down and Unclosable Openings

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

The total area of Unclosable openings should not exceed one percent of the total surface area of the enclosure.

# 4.5 Required Amounts of Agent

## 4.5.1 Minimum Design Concentrations

The minimum design concentrations to be used with Firetrace Novec 1230 units include a minimum safety factor (SF), as specified in NFPA 2001, Year 2015 Edition.

The maximum volume limitations and minimum temperature specifications MUST be followed in order to maintain the correct safety factor. Table 4-3 lists the adjusted design concentrations

Consult the Firetrace website, or contact Firetrace if the hazard you desire to protect is not listed.

Fuel	Extinguishing Concentration %	Minimum Safety Factor	Minimum Design Concentration %
Class A (surface fires) <sup>(a)</sup> Including plastic materials typically found in electrical/electronic equip.	4.5	1.2	5.40
Class B fuels <sup>(b)</sup>		≥1.3	
Acetone <sup>(c)</sup>	4.3		5.85
Ethanol	5.5		7.2
n- heptane	4.5		5.85
Methanol	6.5		8.5
1-propanol	5.4		7.0
Toluene (c)	3.5		5.85
Notes:			

(a) The value for the Class A surface fuels and Class B commercial grade heptane are based upon requirements of UL 2166

(b) The Class B extinguishing concentration values were derived using the cup burner test method and data received from 3M.

(c) The Minimum Design Concentration shall be no less that 5.85% for any Class B Fuel.

#### Table 4-3

Novec 1230 extinguishing and design concentrations

#### Maximum Volume Coverage 4.5.2

The maximum volume that can be protected by the Firetrace Novec 1230 units is dependent on the design concentration and the minimum ambient design temperature specified for a given hazard.

Table 4-4 lists the maximum volumes that can be protected by each size units.

Model	Agent Amount	Minimum Anticipated Design Temp.	Max System Volume	Concentration
Number	lbs	°F	ft <sup>3</sup>	%
		0	34	
		10	35	
		20	36	
940205	25	30	37	6 74
540200	2.5	40	37	0.74
		50	38	
		60	39	
		70	40	
	5	0	70	
		10	72	
		20	74	
940505		30	76	6 5 5
540000		40	77	0.00
		50	79	
		60	81	
		70	83	
		0	141	
		10	144	
		20	148	
941005	10	30	151	6 55
571000		40	155	0.00
		50	158	
		60	162	
		70	165	

Table 4-4

Maximum Volumes That Can Be Protected By the Firetrace Novec 1230 ILP System Units

### 4.5.3 Minimum Volume

Care must be taken to see that the calculated concentration of Novec 1230 at the highest anticipated ambient temperature in the protected space does not exceed the values specified in Section 1-6.1.2 and Table 1-6.1.2.1(c) of NFPA 2001 (2015 edition)

To check the actual concentration ( $C_{tmax}$ ) of Novec 1230 achieved in the protected space, at the maximum anticipated ambient temperature, use the following equation:

 $C_{tmax} = 100/[(V/W \times 1/S) + 1]$ 

where: **W** = agent being used (lbs)

**V** = volume of the protected space (ft<sup>3</sup>)

S = specific volume of superheated Novec 1230 vapor (ft<sup>3</sup>/lb)

S can be approximated by use of the following formula: S = 0.9856 + 0.002441t

Where: **t** = maximum temperature of the enclosure (°F)

# 4.6 Nozzle and Discharge Pipe Requirements

### 4.6.1 Discharge Nozzle Limitations

Two size nozzles are available for use with the Firetrace ILP Novec 1230 Units.

The small nozzle, P/N 500015, is only used with the 2.5 Lb (940205) units. The small unit can be designed using 1, 2, or 4 nozzles to suit the hazard configuration.

The medium nozzle, P/N 500016 and P/N 500017, is only used with the 5 Lb (940505) and 10 Lb (941005) units. The 5 & 10 Lb. units can be designed using 2 or 4 nozzles to suit the hazard configuration.

The maximum enclosure height for nozzle installation is 10 feet. The minimum enclosure height for nozzle installation is 1.6 feet. Each nozzle is to be installed at the top of the hazard enclosure facing down in a pendant position and centered in the area to be protected by that particular nozzle

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

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

### 4.6.2 Nozzle Area Coverage

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



O= 1 Nozzle ⊕ = 2 Nozzles X = 4 Nozzles ILP Small, Medium and Large

FIGURE 4-1 Typical Examples of Enclosure Configurations That Meet the Area Coverage Limitations (all dimensions in feet)

## 4.6.3 Discharge Piping and Fitting Specifications

All Firetrace ILP Units shall use copper tubing for the Novec 1230 distribution system. The following tubing and fittings shall be used. Refer to NFPA 2001, 2015 Edition - Section 4.2 for alternate discharge network options.

ervice.

**Note:** The AS B-280 soft annealed copper tubing, in the sizes and wall thickness specified for use in the Firetrace Novec 1230 units, complies with the ASME B-31.1 Power Piping Code requirements of NFPA-2001.

### **Tubing Fitting Specifications:**

Material: Brass

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

### 4.6.4 Maximum Discharge Piping and Fitting Limitations

The maximum piping and fitting limitations are shown in Table 4-5.

Unit Size	No. of Cyl. Valve Discharge Ports Used (DP)	Total Nozzles Used	Quantity Of Nozzles Per DP	Max. Length Of Piping Per DP	Max. No. Of Elbows Per DP	Max. No. Of Tees Per DP
	1	1	1	4 Ft	1	0
2.5 Lb	2	2	1	8 Ft	2	0
		4	2	8 Ft	3	1
5 & 10 l b	2	2	1	8 Ft	2	0
5 & 10 LD.	2	4	2	8 Ft	3	1

Table 4-5: Maximum Piping and Fitting Limitations

### 4.6.5 Piping Bends

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

Pipe OD	Min. Bend Radius To Pipe Centerline	Equiv. Length Of Piping For 90º Bend (a), (b)			
<sup>5</sup> / <sub>16</sub> "	<sup>11</sup> / <sub>16</sub> " R	1-1/8"			
1/2"	1-1/2" R	2-3/8"			
Notes:					
(a) The equiva	(a) The equivalent length of pipe is to be counted as part of the maximum length of pipe shown in				
Table 4-5.	Table 4-5.				
(b) 90° pipe bends are not required to be subtracted from the maximum number of elbows allowed in					
Table 4-5.					
(c) Min. Bend F	Radii were taken from Parker Industrial Tube F	Fittings Catalog 4300 March 1991			

Table 4-6: Minimum Pipe Bend Radius and Equivalent Length

# 4.7 Firetrace Detection/Actuation Tubing

The Firetrace detection/activation tubing is a UL recognized component per UL standard 521 (See Certificate of Compliance 20140705-S35465). For the Indirect Novec 1230 Units, the Firetrace tubing is used as a combination heat detector and unit activation device to cause actuation of the Novec 1230 System.

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

The maximum length of tubing that can be used for any ILP unit is 120 feet (36.58 m). Refer to Section 5.3 for installation instructions.

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

# **5 INSTALLATION INSTRUCTIONS**

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

All components should be installed to facilitate proper inspection, testing, recharging, and any other required service or maintenance as may be necessary. Equipment must not be subjected to severe weather conditions or mechanical, chemical, or other damage which could render the equipment inoperative. The equipment must be installed in accordance with instructions in this Manual and NFPA 2001.

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Novec 1230 cylinder/valve assemblies must be handled, installed, and serviced in accordance with the instruction contained in this Manual and on the cylinder nameplate. Failure to follow these instructions could result in property damage, severe injury, or death.

# 🕰 WARNING

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

# 5.1 Novec 1230 Cylinder/Valve and Bracket Assemblies

The Novec 1230 cylinders should be located as close as possible to the protected enclosure. In some cases the cylinder can be mounted inside the protected enclosure. The assemblies shall be located in a readily accessible location to allow for ease of inspection, service, and maintenance. The cylinders shall be located in an environment protected from the weather and where the temperature range is between 0°F to +130°F (-17.8°C to +54.4°C).

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

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

# 🛕 WARNING

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

1. Securely mount the cylinder bracket to structural support using 2 or more mounting holes.

2. Position the cylinder in the bracket with the pressure gauge facing out. Secure the cylinder in place using the bracket straps or band clamps.

# 5.2 Discharge Piping and Nozzles

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

# 5.3 Firetrace Detection/Actuation Tubing

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

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- 1. Do not kink, bend, or crush Firetrace tubing in order to prevent leakage which could result in accidental unit discharge.
- 2. Do not install tubing in a hazardous environment where the maximum ambient temperature exceeds 176°F (80°C)
- 3. Maximum length of detection tubing shall not exceed 120 Feet (36.58 m).
- 1. Secure the detection tubing using Mounting Tabs at 1.5 Ft (0.46 m) intervals.
- 2. Use the appropriate rubber/plastic grommets when the detection tubing is routed through sharp holes in order to prevent damage to the tubing.

# **5.4** Detection Tubing Fittings and Accessories

# 5.4.1 Spring Top Support Fittings

All compression fittings must be secured in the following manner:

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

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

## 5.4.2 Slip-On Fittings

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

1. Cut the tube end, ensuring the cut is square, clean, and free from burrs. Check that no debris is left in the tube.

- 2. Thoroughly clean the tubing to a distance of at least 2 in. (5.08 cm) above the cut end, removing all dirt, grease, or grime. This will ensure a good seal inside the fitting.
- 3. Slide the tubing into the opening until it butts up against the inner wall. Pull lightly on the tubing and the brass outer ring should move outward slightly.

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

### 5.4.3 End of Line Accessories

All of the following accessories will connect to an End of Line Adapter. The End of Line Adapter can be installed by following the appropriate procedures in Section 5.4.1 or Section 5.4.2.

NOTE: End of Line Adapters are not designed to provide a lasting seal without the use of one of the following items:

#### Novec 1230 195 psig Pressure Gauge (P/N 400028):

The 195 psig Pressure Gauge must be installed with its included o-ring. Thread the pressure gauge into the End of Line Adapter so that the gauge indicates the tubing pressure.

### Pressure Switch for End of Line Adapter (P/N 400004):

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

#### End of Line Adapter Plug (P/N 310303):

The End of Line Adapter Plug must be installed with its included o-ring. Thread the plug into the End of Line Adapter.

### 5.5 System Activation

- 1. Install the detection tubing, fittings, and accessories according the procedures specified in Section 5.3 and Section 5.4.
- 2. With the system ball valve still closed, connect the detection tubing to the system using the appropriate procedure in Section 5.4.1 or Section 5.4.2.
- 3. Attach the filling adapter (P/N 600023 or 600028) to the End of Line Adapter. Refer to Section 5.4.3.
- 4. Using a regulated dry nitrogen supply, pressurize the detection tubing through the filling adapter to 195 psig (10.3 bar). It is recommended to have a portable dry nitrogen cylinder or Firetrace Nitrogen Fill Kit for on-site use.
- Remove the filling adapter and thread the pressure gauge & 0-ring (Firetrace P/N 400027) into its place to verify that the tubing is pressurized to at least 195 psig at 70°F (10.3 bar at 21°C) (pressure may have to be adjusted for temperatures higher or lower than 70°F). Refer to Section 5.4.3 for further instructions.
- 6. With the gauge still attached to the filling adapter, test for leakage:
  - Apply soapy water solution to the cylinder valve connection, end of line adapter connection, and the pressure gauge connection. Observe for bubble leaks.
  - Wait 30 minutes, and then observe the pressure gauge. Any decrease in pressure is an indication of a leak.
  - In the event of a leak go back to Section 5.5 and check the installation of all fittings and accessories.
- 7. If an optional pressure switch is to be installed in the EOL adapter, remove the pressure gauge and install the pressure switch according to the procedures in Section 5.4.3. Check pressure switch connection for bubble leaks using soapy water solution.
- After confirming that there is no leakage within the detector tubing, <u>SLOWLY</u> rotate the ball valve lever counter clock wise to the "ON" position.



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

- 9. Tamper proof the unit by removing the ball valve lever face and securing the lever in the "ON" position with a zip tie. Refer to the Tamper Proof Instruction in Appendix B.
- 10. If the optional Pressure Switch is installed on the valve or on the EOL, ensure that the proper electrical connections are made to annunciate unit discharge, shut down ventilation, etc., as may be required by the end user or the AHJ. (All electrical connections are to be in accordance to NFPA 70 National Electric Code)
- 11. The unit is now fully armed and ready for use.

# 6 SERVICE AND MAINTENANCE INSTRUCTIONS

# 🛕 WARNING

- 1. Novec 1230 cylinder/valve assemblies must be handled, installed, inspected and serviced only by qualified and trained personnel in accordance with the instructions contained in this Manual, the cylinder nameplate, NFPA 2001, and any other regulations and codes that may apply.
- 2. Before performing maintenance or refilling procedures refer to the safety data sheets in Appendix C.

# 🛕 WARNING

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

# ATTENTION

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

# 6.1 General

A regular program of systematic maintenance must be established for continuous, proper operation of all Novec 1230 units and to avoid violating the warranty. A periodic maintenance schedule must be followed and an inspection log maintained for ready reference. As a minimum, the log must record: (1) inspection interval, (2) inspection procedure performed, (3) maintenance performed, if any, as a result of inspection, and (4) name of inspector performing task.

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

## 6.2 Periodic Service and Maintenance Procedures

### 6.2.1 Monthly Inspection

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

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

## 6.2.2 Semiannual Inspection

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

- 1. Remove the cylinder from the installation as follows:
  - Close the ball valve, by turning the ball valve lever clockwise to the "OFF" position
  - Disconnect the detection tubing at the ball valve.
    - Note: There will be a loss of nitrogen pressure out of the tubing
  - Disconnect the copper tubing and fittings from the cylinder valve discharge ports(s)
  - Immediately install the safety plugs(s) into the valve discharge port(s)
  - Remove the cylinder from the bracket
- 2. Weigh the cylinder. Compare the measured weight with the weight found on the cylinder nameplate. If the container 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 cylinder shall be refilled or replaced.
- 3. Remove the nozzle(s) and inspect for obstructions. Reinstall the nozzles.
- 4. Reinstall the cylinder and re-pressurize the detection tubing with nitrogen following the applicable procedures outlined in Section 5.

### 6.2.3 Five Year Inspection

Novec 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 7 of NFPA 2001 (2015 Edition)

### 6.2.4 Hydrostatic Testing

Firetrace Novec 1230 cylinders are built to DOT-4B specifications and therefore fall under DOT regulations for retest prior to refill.

DOT-4B, 4BA and 4BW cylinders used exclusively in Novec 1230 service are required to be retested and restamped prior to recharge and shipment if the last retest date has expired.

Firetrace Novec 1230 (DOT-4B) containers requiring retest must be hydrostatically tested in accordance with DOT CFR Title 49, section 173.34(e). This periodic retest must be performed by an authorized retester having a current identification number issued by the Associated Administrator for Hazardous Material Safety of DOT and must include an internal and external examination in accordance with CGA pamphlet C-6, C-6.1, C-6.2, or C-6.3, as applicable. The test procedures are described in CGA pamphlet C-1. Because volumetric expansion of the container must be measured, only the water jacket volumetric expansion method or the direct expansion method are acceptable.

As an alternate option, Novec 1230 agent containers may be given a complete external visual inspection, as detailed in section 173.34(e)(13), in lieu of hydrostatic test. The visual inspection shall be made only by competent persons. A person who performs the visual examination specified in 173.34(e)(13) is not required to have a retester's identification number.

Retest can be performed by either of the following methods:

Retest Method	First Retest Due (Yrs)	Subsequent Retest Due (Yrs)	Special Marking
Full hydrostatic test including determination of cylinder expansion.	5	5	Retest Date Month/Year
External visual inspection per paragraph 173.34(e)(13) and CGA pamphlet C-6, section 3.	5	5	Retest Date followed by "E"

# 7 SYSTEM DISSASSEMBLY, ASSEMBLY, AND CHARGING



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

# ATTENTION

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

## 7.1 Depressurizing the Unit

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



Opening the ball valve too far, or too fast, will unseat the piston and bring Novec 1230 into the valve assembly.

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

# 7.2 System Recharge

- 1. Fill the cylinder with the appropriate amount of Novec 1230. Refer to Table 3-1 for the correct amounts for each system.
- 2. Clean the threads of the cylinder with a small brush or dry cloth.
- 3. Thread the siphon tube into the valve. See Appendix A for the part numbers appropriate for each system.
- 4. Thread the valve and siphon tube assembly onto the cylinder. Ensure a tight fit so that the valve is seated completely on top of the cylinder collar.
- 5. With the discharge port plugs in place, pressurize the system to 195 psi (at 70°F) through the system ball valve. Shake system thoroughly to ensure complete absorption of the nitrogen into the Novec 1230.
- 6. Close the system ball valve and leak test system around the valve. If a leak detector is unavailable, a 48 hour holding period should be used to evaluate whether the system has a slow leak.

# WARRANTY

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

# LIMITED WARRANTY & PURCHASER'S EXCLUSIVE REMEDY

### Purchaser's Limited Warranty

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

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

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

### Purchaser's Exclusive Remedy

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

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

### Non-Assignability of Warranty

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

### Disclaimer of Consequential Damages

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

### Use of Non-Firetrace Components

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

### SOME FACTORS INFLUENCING ENGINEERING DESIGN AND PRODUCT APPLICATION OF FIRETRACE UNITS

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

- 1. The Firetrace unit has been designed to provide protection against fire, both existing and imminent, for a limited duration of time when: the unit is fully operational; used in its normal, expected environment; the unit and its component parts are properly installed, maintained, and operated in *complete* accordance with written instructions supplied with the unit.
- 2. The duration of the protection against fires dependent upon a sufficient concentration of agent being maintained in the protected hazard area for a pre-determined period of time. This duration will be shortened by conditions or circumstances which may ventilate, cause the agent concentration dilution within the protected hazard area thereby causing an insufficient concentration of agent as is needed to extinguish or prevent the existence or re-ignition of combustion or fire. All hazard areas have different rate of ventilation, leakage, or agent dilution that, in many cases, may be impossible to predict or determine. Air vents, air conditioning units, gaps and cracks in the enclosure, windows, cable and pipe penetrations, etc., all may effect the agent concentration and the duration of the protection against fire. Also, unforeseen changes in the configuration of a hazard area such as removal of a wall, an explosion or fire external to the protected space, changes in the enclosures configuration, etc. can influence the duration of the fire protection. It is because of these many, and varied, circumstances and conditions that Firetrace makes *no* warranty as to the duration of the protection against fire.
- 3. The effectiveness of an agent, such as Novec 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 in to the protected area. If unforeseen circumstances such as an explosion, failure of the detection system to activate the Firetrace unit, failure to Manually activate the unit, etc. occur, they can prevent the unit discharge from being accomplished in a timely manner, and the fire may become deep seated or out of control and completely destroy the hazard area. Since Firetrace has no control over these circumstances, there are *no* warranties as to the effectiveness of extinguishment of the fire other than those specifically stated in this Limited Warranty.
- 5. Even if the Firetrace unit is completely effective in suppressing a fire, failure to remove the ignition source of the fire could result in a re-ignition of the fire. If possible, the source of the fire should immediately be eliminated to prevent re-ignition. Protection against re-ignition only exists when a sufficient concentration of agent remains in the hazard area, as stated above.

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

# **APPENDIX A**

System Parts List

**Discharge Line Parts List** 

**Detection Line Parts List** 

# System Parts List

2.5, 5, & 10 LB. SELF-CONTAINED AUTOMATIC INDIRECT NOVEC 1230 EXTINGUISHER UNIT

 MODELS
 940205 2.5 LB. NOVEC 1230 ILP

 940505
 5 LB. NOVEC 1230 ILP

 941005
 10 LB. NOVEC 1230 ILP

ITEM	PART NO.	DESCRIPTION	SYSTEM		
1	300112	Small 195 PSI ILP Valve	2.5 LB.		
1	300118	Medium 195 PSI ILP Valve	5, 10 LB.		
2	300220	Collar O-Ring Small ILP	2.5 LB.		
2	300221	Collar O-Ring Medium ILP	5, 10 LB.		
3	600022	Siphon Tube 5/8"x11.75"	2.5 LB.		
3	600003	Siphon Tube 1"x12"	5, 10 LB.		
4	100300	Small Cylinder	2.5 LB.		
4	100600	Medium Cylinder	5 LB.		
4	101200	Large Cylinder	10 LB.		
5	310300	Small Discharge Port Plug	2.5 LB.		
5	310301	Medium Discharge Port Plug	5, 10 LB.		
6	600033	Bonded Seal	All Systems		
7	600081	Pressure Switch Port Plug	All Systems		
8	100003	Small Bracket	2.5 LB.		
8	100006	Medium Bracket	5 LB.		
8	111206	Large Bracket	10 LB.		
9	400002	O-Ring, M1x10	All Systems		
10	200103	Yellow Ball Valve Transport Cap	All Systems		
11*	400005	Pressure Switch	All Systems (OPTIONAL)		
12*	111404	ASM, Small Heavy Duty Bracket	2.5 LB. (OPTIONAL)		
12*	111403	ASM, Medium Heavy Duty Bracket	5 LB.		
12*	111402	ASM, Large Heavy Duty Bracket	10 LB. (OPTIONAL)		
NP	600120	Nameplate: ILP Novec 1230	All Systems		
NP	600106	Label: Novec 1230 Approvals	All Systems		
NP	800100	Warranty/Registration Card	All Systems		
* OPTIONAL PARTS NP NOT PICTURED					



# Discharge Line Parts List

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYSTEM
*	200143	Valve to 5/16" Copper Compression Fitting	2.5 LB.
*	200101	5/16" Copper Compression Bulkhead	2.5 LB.
*	200111	<sup>5/</sup> 16" Copper Compression Elbow	2.5 LB.
*	200121	<sup>5/</sup> 16" Copper Compression Tee	2.5 LB.
1	500015	Small Clean Agent Total Flooding Nozzle	2.5 LB.
3	200144	Valve to 1/2" Copper Compression Fitting	5, 10, 20 LB.
6	200145	1/2" Copper Compression Bulkhead	5, 10, 20 LB.
*	200147	1/2" Copper Compression Union	5, 10, 20 LB.
5	200112	1/2" Copper Compression Elbow	5, 10, 20 LB.
4	200122	1/2" Copper Compression Tee	5, 10, 20 LB.
*	500016	Medium Clean Agent Total Flooding Nozzle (1/2" Compression)	5, 10, 20 LB.
2	500017	Medium Clean Agent Total Flooding Nozzle (1/2" NPT)	5, 10, 20 LB.
* PART NOT PICTUR	ED		













# **Detection Line Parts List**

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYSTEM
*	200005	Firetrace Detection/Actuation Tubing (by the foot)	All Systems
*	200125	Tube Union With Spring Tops	All Systems
1	200126	Tube Tee With Spring Tops	All Systems
*	200136	Bulkhead With Spring Tops	All Systems
4	200155	Tube Elbow With Spring Tops	All Systems
*	200160	Spring Top	All Systems
*	200158	Tube Union Slip On Fitting	All Systems
2	200157	Tube Tee Slip On Fitting	All Systems
5	200178	Tube Elbow Slip On Fitting	All Systems
*	200179	Tube to Threads Union Slip On Fitting	All Systems
*	200177	Tube to Threads Tee Slip On Fitting	All Systems
*	200159	Tube to Threads Elbow Slip On Fitting	All Systems
*	200133	Tube Plug	All Systems
3	600064	Manual Release 195 PSI With Slip-On Union	All Systems
*	200168	End Of Line Adapter With Slip-On Union	All Systems
*	200169	In Line Adapter With Slip-On Tee	All Systems
*	310303	Plug With O-Ring For End Of Line Adapter	All Systems
*	400028	195 PSI Pressure Gauge	All Systems
*	400004	Pressure Switch With Washer for End Of Line Adapter	All Systems
*	600090	Audible Alarm (Battery Operated) (Not part of FM/UL/ULC Approvals)	All Systems
*	200171	Mounting Tabs (Qty. 12)	All Systems
*	200150	Rubber Grommets (Qty. 2)	All Systems
*	200151	Plastic Grommets (Qty. 2)	All Systems
* PART NOT PICTUR	RED		



# **APPENDIX B**

**Typical Tubing Placement** 

**Tamp Proof Options** 

FM Approval Guide Listing

# **Typical Tubing Placement**



# **Tamper Proof Instruction**



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

# **FM Approval Guide Listing**

## Pre-Engineered, Automatic Indirect NOVEC<sup>™</sup> 1230 Fire Detection and Extinguishing System

System Designation:	Models 940205, 940505, and 941005 Automatic Indirect Fire Detection and Extinguishing Systems		
System Type:	Pre-Engineered for the Protection of Class B Hazards		
Agent Identification:	3M™ NOVEC™ 1230		
Ambient Temperature Installation Range:	0°F to 130°F (-18°F to 54°C)		
Amount of Agent per System:	940205: 2.5 lb (1.13 kg) of NOVEC <sup>™</sup> 1230 940505: 5.0 lb (2.27 kg) of NOVEC <sup>™</sup> 1230 941005: 10.0 lb (4.54 kg) of NOVEC <sup>™</sup> 1230		
Maximum Area of Coverage:	25 ft <sup>2</sup> (2.3 m <sup>2</sup> )		
Minimum and Maximum Enclosure Heights:	1.6 ft (0.5 m) to 10 ft (3.0 m)		
Maximum Enclosure Volume Protection per Unit:	940205: 40 ft <sup>3</sup> (1.2 m <sup>3</sup> ) 940505: 83 ft <sup>3</sup> (2.3 m <sup>3</sup> ) 941005: 165 ft <sup>3</sup> (4.7 m <sup>3</sup> )		
Maximum Height Above Hazard for Detection Tubing:	3.3 ft (1 m)		
Maximum Length of Detection Tubing:	120 ft (36.6 m)		
Design, Installation, Operation, and Maintenance Manual:	Design, Installation, Operation, and Maintenance Manual for Pre-Engineered Automatic Indirect NOVEC <sup>™</sup> 1230 Clean Agent Extinguisher Unit, P/N 800025, Rev 00, May 18, 2009		
Approved Filling Stations:	Firetrace International LLC 8435 N. 90 <sup>th</sup> Street, Suite 2 Scottsdale, AZ 85258 USA Firetrace International Ltd Unit 12, Fairlawn Enterprise Park Bonehurst Road Salfords, Redhill, Surrey RH1 5GH United Kingdom		

Company Name:	Firetrace International LLC
Company Address:	8435 N. 90th Street, Suite 2, Scottsdale, Arizona 85258, USA
Company Website:	http://www.firetrace.com
Listing Country:	United States of America
Certification Type:	FM Approved

# **APPENDIX C**

# SAFETY DATA SHEETS

Novec 1230

Nitrogen

#### 3MTM Novec TM 1230 Fire Protection Fluid 06/06/16



#### Safety Data Sheet

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Document Group :	16-3425-2	Version Number:	28.03	
Issue Date:	06/06/16	Sup erced es Date:	11/02/15	

ID Number

98-0212-3217-2

UPC

0 00 51135 71645 8

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

1.1. Product identifier

3MTM Novec TM 1230 Fire Protection Fluid

**Product Identification Numbers** ID Number UPC

98-0212-3203-2

98-0212-3414-5

1.2. Recommended use and restrictions on use

Recommended use Streaming and Flooding Fire Protection

l 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.

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#### 3M<sup>TM</sup> Novec <sup>TM</sup> 1230 Fire Protection Fluid 06/06/16

#### 2.3. Hazards not otherwise classified

None.

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

Ingredient	C.A.S. No.	% by Wt	
1,1,1,2,2,4,5,5,5-Nonafluoro-4-(trifluoromethyl)-3-	756-13-8	> 99.5	
pentanone			

#### SECTION 4: First aid measures

#### 4.1. Description of first aid measures

#### Inhalation:

Remove person to fresh air. If you are concerned, get medical advice.

#### Skin Contact:

Wash with soap and water. If signs/symptoms develop, get medical attention.

#### Eye Contact:

Flush with large amounts of water. Remove contact lenses if easy to do. Continue rinsing. If signs/symptoms persist, get medical attention.

#### If Swallowed:

Rinse mouth. If you feel unwell, get medical attention.

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

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

Product is a fire-extinguishing agent. Material will not burn. 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 **<u>Condition</u>** During Combustion During Combustion During Combustion

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

When fire fighting conditions are severe and total thermal decomposition of the product is possible, 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

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#### 3M<sup>TM</sup> Novec <sup>TM</sup> 1230 Fire Protection Fluid 06/06/16

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

Evacuate area. Ventilate the area with fresh air. For large spill, or spills in confined spaces, provide mechanical ventilation to disperse or exhaust vapors, in accordance with good industrial hygiene practice. 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 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. Seal the container. Dispose of collected material as soon as possible.

#### **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 or professional use only. Do not use in a confined area with minimal air exchange. Do not eat, drink or smoke when using this product. Wash thoroughly after handling. 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 other materials. 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-Nonafluoro-4- (trifluoromethyl)-3-pentanone	756-13-8	Manufacturer determined	TWA:150 ppm(1940 mg/m3)	

CGIH : 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

Provide appropriate local exhaust when product is heated. 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)

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#### 3MTM Novec TM 1230 Fire Protection Fluid 06/06/16

#### Eye/face protection

Eye protection not required.

Skin/hand protection No protective gloves required.

#### **Respiratory protection**

Use a positive pressure supplied-air respirator if there is a potential for over exposure from an uncontrolled release, exposure levels are not known, or under any other circumstances where air-purifying respirators may not provide adequate protection. If thermal degradation products are expected, use a full facepiece supplied-air respirator.

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

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

General Physical Form:	Liquid
Specific Physical Form:	Liquid
Odor, Color, Grade:	Clear colorless liquid with low odor
Odor threshold	No Data Available
pH	Not Applicable
Melting point	-108 °C
Boiling Point	49 ℃ [@ 760 mmHg]
Flash Point	No flash point
Evaporation rate	> 1 [ <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]
Specific Gravity	1.6 [@ 68 °F] [Ref Std: 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 SCAQMD rule 443.1]
Percent volatile	100 %
VOC Less H2O & Exempt Solvents	1600 g/l [Test Method: calculated SCAQMD rule 443.1]

### 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 Stable.

#### 10.3. Possibility of hazardous reactions

Hazardous polymerization will not occur.

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#### 3M<sup>TM</sup> Novec <sup>TM</sup> 1230 Fire Protection Fluid 06/06/16

**10.4. Conditions to avoid** Light

10.5. Incompatible materials Strong bases Amines Alcohols

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

Condition 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 known health effects.

#### 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:

May be harmful if swallowed.

#### **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

Name	Route	Species	Value
1,1,1,2,2,4,5,5,5-Nonafluoro-4-(trifluoromethyl)-3-pentanone	Dermal	Rat	LD50 > 2,000 mg/kg
1,1,1,2,2,4,5,5,5-Nonafluoro-4-(trifluoromethyl)-3-pentanone	Inhalation- Vapor (4 hours)	Rat	LC50 > 1,227 mg/l

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#### 3MTM Novec TM 1230 Fire Protection Fluid 06/06/16

1,1,1,2,2,4,5,5,5-Nonafluoro-4-(trifluoromethyl)-3-pentanone Ingestion Rat LD50 > 2,000 mg/kg 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

1,1,1,2,2,4,5,5,5-Nonafluoro-4-(trifluoromethyl)-3-pentanone Rabbit	bit No significant irritation

#### Skin Sensitization

Name	Species	Value
1,1,1,2,2,4,5,5,5-Nonafluoro-4-(trifluoromethyl)-3-pentanone	Guinea pig	Not sensitizing

#### **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-pentanone	In Vitro	Not mutagenic
1,1,1,2,2,4,5,5,5-Nonafluoro-4-(trifluoromethyl)-3-pentanone	In vivo	Not mutagenic

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- (trifluoromethyl)-3-pentanone	Inhalation	Not toxic to female reproduction	Rat	NOAEL 3,000 ppm	premating & during gestation
1,1,1,2,2,4,5,5,5-Nonafluoro-4- (trifluoromethyl)-3-pentanone	Inhalation	Not toxic to male reproduction	Rat	NOAEL 3,000 ppm	premating & during gestation
1,1,1,2,2,4,5,5,5-Nonafluoro-4- (trifluoromethyl)-3-pentanone	Inhalation	Not toxic to development	Rat	NOAEL 3,000 ppm	premating & during gestation

#### Target Organ(s)

#### Specific Target Organ Toxicity - single exposure

Name	Route	Target Organ(s)	Value	Species	Test Result	Exposure Duration
1,1,1,2,2,4,5,5,5- Nonafluoro-4- (trifluoromethyl)-3- pentanone	Inhalation	nervous system	All data are negative	Rat	NOAEL 100,000 ppm	2 hours
1,1,1,2,2,4,5,5,5- Nonafluoro-4- (trifluoromethyl)-3- pentanone	Inhalation	cardiac sensitization	All data are negative	Dog	Sensitization Negative	17 minutes

Specific Target Organ	Toxicity -	<ul> <li>repeated exposur</li> </ul>	e			
Name	Route	Target Organ(s)	Value	Species	Test Result	Exposure

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#### 3MTM Novec TM 1230 Fire Protection Fluid 06/06/16

						Duration
1,1,1,2,2,4,5,5,5- Nonafluoro-4- (trifluoromethyl)-3- pentanone	Inhalation	liver   kidney and/or bladder	Some positive data exist, but the data are not sufficient for classification	Rat	NOAEL 3,000 ppm	90 days
1,1,1,2,2,4,5,5,5- Nonafluoro-4- (trifluoromethyl)-3- pentanone	Inhalation	heart   endocrine system   hematopoietic system   muscles   nervous system   respiratory system   vaccular system	All data are negative	Rat	NOAEL 3,000 ppm	90 days

#### **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

#### **Test Organism**

Green algae, Selenastrum capricornutum Zebra Fish, Brachydanio rerio Water flea, Daphnia magna Green algae, Selenastrum capricornutum Test Type 72 hours Effect Concentration 50% 96 hours Lethal Concentration 50% 48 hours Effect Concentration 50% 72 hours No obs Effect Conc Result 7.7 mg/l >1200 mg/l >1200 mg/l 1.2 mg/l

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.

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

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#### 15.1. US Federal Regulations

Contact 3M for more information.

#### 311/312 Hazard Categories:

Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No Immediate Hazard - No Delayed Hazard - No

#### 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 material are in compliance with the provisions of Philippines RA 6969 requirements. 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.

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: 0 Instability: 1 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.

#### HMIS Hazard Classification

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

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

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#### 3M<sup>TM</sup> Novec <sup>TM</sup> 1230 Fire Protection Fluid 06/06/16

**Issue Date:** 

06/06/16

Supercedes Date:

11/02/15

Reason for Reissue Conversion to GHS format SDS.

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# Nitrogen MSDS



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

SECTION: 1. Product and company ide	entification
1.1. Product identifier	
Product form :	Substance
Name	Nitrogen, compressed
CAS No :	7727-37-9
Formula	N2
Other means of identification :	Dinitrogen, Refrigerant R728, Nitrogen, Medipure Nitrogen, Extendapak Nitrogen, Nitrogen - Diving Grade
1.2. Relevant identified uses of the substar	nce or mixture and uses advised against
Use of the substance/mixture	Industrial use Medical applications. Food applications. Diving Gas (Underwater Breathing)
1.3. Details of the supplier of the safety dat	a sheet
Praxair, Inc. 39 Old Ridgebury Road Danbury, CT 06810-5113 - USA T -800-772-9247 (1-800-PRAXAIR) - F 1-716-879- www.praxair.com	-2146
1.4. Emergency telephone number	
Emergency number	Onsite Emergency: 1-800-645-4633
	CHEMTREC, 24hr/day 7days/week — Within USA: 1-800-424-9300, Outside USA: 001-703- 527-3887 (collect calls accepted, Contract 17729)
SECTION 2: Hazards identification	
2.1 Classification of the substance or mixt	
	uic
Classification (GHS-US)	
Compressed gas	H280
2.2. Label elements	
GHS-US labeling	
Hazard pictograms (GHS-US)	GH544
Signal word (GHS-US)	WARNING
Hazard statements (GHS-US)	H280 - CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED OSHA-H01 - MAY DISPLACE OXYGEN AND CAUSE RAPID SUFFOCATION.
Precautionary statements (GHS-US)	<ul> <li>P202 - Do not handle until all safety precautions have been read and understood</li> <li>P271+P403 - Use and store only outdoors or in a well-ventilated place.</li> <li>CGA-PG05 - 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> </ul>
2.3. Other hazards	
	No additional information available
EN (English US)	SDS ID: P-4631 1/8



Making our pl

lanet more productive"	according to U.S. Code of F	ederal Regulations 29 CFR 19	10.1200, Hazard Communication.
	Date of issue: 01/01/1980	Revision date: 06/24/2015	Supersedes: 04/23/2015

2.4.	Unknown acute toxicity (GHS-US)		
		No data available	
SECTIO	ON 3: Composition/information	on ingredients	
3.1.	Substance		
Name		Nitrogen, compressed	
CAS No	1	7727-37-9	
Name		Product identifier	%
Nitrogen		(CAS No) 7727-37-9	99.5 - 100
3.2.	Mixture		
Not appli	cable		
SECTIO	ON 4: First aid measures		
4.1.	Description of first aid measures		
First-aid	measures after inhalation	Immediately remove to fresh difficult, qualified personnel n	air. If not breathing, give artificial respiration. If breathing is ay 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 plenty of water. Consult an o	from this product. In case of eye irritation: Rinse immediately with hthalmologist if irritation persists.
First-aid	measures after ingestion	Ingestion is not considered a	potential route of exposure.
4.2.	Most important symptoms and effects	, both acute and delayed	
		No additional information ava	lable
4.3.	Indication of any immediate medical a	ttention and special treatmer	it needed
None.			
SECTIO	ON 5: Firefighting measures		
5.1.	Extinguishing media		
Suitable	extinguishing media	Use extinguishing media app	ropriate for surrounding fire.
5.2.	Special hazards arising from the subs	tance or mixture	
Reactivit	у :	Under certain conditions, nitro 1472°F/800°C), and magnesi oxygen and hydrogen.	ogen can react violently with lithium, neodymium, titanium (above um to form nitrides. At high temperature, it can also combine with
5.3.	Advice for firefighters		
Firefighti	ng instructions :	Evacuate all personnel from 1 and protective clothing. Imm flow of gas if safe to do so, w safe to do so. Remove contai comply with OSHA 29 CFR 1 L—Fire Protection.	he danger area. Use self-contained breathing apparatus (SCBA) ediately cool containers with water from maximum distance. Stop hile continuing cooling water spray. Remove ignition sources if ners from area of fire if safe to do so. On-site fire brigades must 910.156 and applicable standards under 29 CFR 1910 Subpart
Protectio	n during firefighting	Compressed gas: asphyxiant	. Suffocation hazard by lack of oxygen.
Special p	protective equipment for fire fighters	Standard protective clothing a fighters.	and equipment (Self Contained Breathing Apparatus) for fire
Specific I	methods :	Use fire control measures ap radiation may cause gas cont from a protected position. Pre drainage systems.	propriate for the surrounding fire. Exposure to fire and heat ainers to rupture. Cool endangered containers with water spray jet event water used in emergency cases from entering sewers and
		Stop flow of product if safe to	do so.
		Use water spray or fog to kno	ck down fire fumes if possible.
SECTIO	ON 6: Accidental release measu	ires	
6.1.	Personal precautions, protective equi	pment and emergency proce	dures
General	measures :	Evacuate area. Ensure adeq entering area unless atmospl	ate air ventilation. Wear self-contained breathing apparatus when lere is proven to be safe. Stop leak if safe to do so.

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6.1.1. For non-eme	gency personnel	No additional information available
6.1.2. For emergen	cy responders	No additional information available
6.2. Environment	al precautions	No additional information available
6.3. Methods and	material for containmen	t and cleaning up No additional information available
6.4. Reference to	other sections	See also sections 8 and 13.
SECTION 7: Hand	ing and storage	
7.1. Precautions	or safe handling	
Precautions for safe har	dling	: Wear leather safety gloves and safety shoes when handling cylinders. Protect cylinders from physical damage; do not drag, roll, slide or drop. While moving cylinder, always keep in place removable valve cover. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Never insert an object (e.g., wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Slowly open the valve. If the valve is hard to open, discontinue use and contact your supplier. Close the container valve after each use; keep closed even when empty. Never apply flame or localized heat directly to any part of the container. High temperatures may damage the container contents. For other precautions in using this product, see section 16.
Safe use of the product		The suitability of this product as a component in underwater breathing gas mixtures is to be determined by or under the supervision of personnel experienced in the use of underwater breathing gas mixtures and familiar with the physiological effects, methods employed, frequency and duration of use, hazards, side effects, and precautions to be taken.
7.2. Conditions fo	r safe storage, including	any incompatibilities
Storage conditions		: Store in a cool, well-ventilated place. Store and use with adequate ventilation. Store only where temperature will not exceed 125°F (52°C). Firmly secure containers upright to keep them from falling or being knocked over. Install valve protection cap, if provided, firmly in place by hand. Store full and empty containers separately. Use a first-in, first-out inventory system to prevent storing full containers for long periods.
		OTHER PRECAUTIONS FOR HANDLING, STORAGE, AND USE: When handling product under pressure, use piping and equipment adequately designed to withstand the pressures to be encountered. Never work on a pressurized system. Use a back flow preventive device in the piping. Gases can cause rapid suffocation because of oxygen deficiency; store and use with adequate ventilation. If a leak occurs, close the container valve and blow down the system in a safe and environmentally correct manner in compliance with all international, federal/national, state/provincial, and local laws; then repair the leak. Never place a container where it may become part of an electrical circuit.
7.3. Specific end	use(s)	
		None.
SECTION 8: Expo	sure controls/perso	nal protection
8.1. Control para	neters	
Nitrogen, compresse	d (7727-37-9)	
ACGIH	Not established	
USA OSHA	Not established	
Nitrogen (7727-37-9)		
ACGIH	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 sup the worker's breathing zone. Mechanical (general): General exhaust ventilation ma acceptable if it can maintain an adequate supply of air.	
Eye protection	: Wear safety glasses with side shields.
Skin and body protection	Wear metatarsal shoes and work gloves for cylinder handling, and protective clothing where needed. Wear appropriate chemical gloves during cylinder changeout or wherever contact with product is possible. Select per OSHA 29 CFR 1910.132, 1910.136, and 1910.138.
Respiratory protection	When workplace conditions warrant respirator use, follow a respiratory protection program that meets OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable). Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure that the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure (e.g., an organic vapor cartridge). For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus (SCBA).



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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		
		May occur.	
10.4	Conditions to avoid		
10.4.	conditions to droid	None under recommended storage and handling conditions (see section 7)	
10 5	1		
10.5.	Incompatible materials	News	
		None.	
10.6.	Hazardous decomposition products		
		None.	
SECT	ON 11: Toxicological informa	ion	
11.1.	Information on toxicological effects		
Acute to	xicity	: Not classified	
Skin corr	osion/irritation	: Not classified	
		pH: Not applicable.	
Serious e	ye damage/irritation	Not classified	
		pH: Not applicable.	
Respirato	ry or skin sensitization	Not classified	
Germ cel	mutagenicity	Not classified	
Carcinog	enicity	: Not classified	
Reproductive to visity		Not classified	
Specific	target organ toxicity (single exposure)	Not classified	
One	tanget organ toxicity (angle exposure)		
exposur	target organ toxicity (repeated e)	; Not classified	
Aspiratio	on hazard	: Not classified	
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 (7727-37-9)		
Persis	ence and degradability	No ecological damage caused by this product.	
Nitrog	en (7727-37-9)		
Persistence and degradability No ecological damage		No ecological damage caused by this product.	
12.3.	12.3. Bioaccumulative potential		
Nitrogen, compressed (7727-37-9)			
Log Po	W	Not applicable.	
Log Kow		Not applicable.	
Bioaco	umulative potential	No ecological damage caused by this product.	

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Nitrogen (7727-37-9)		ī
Log Pow	Not applicable for inorganic gases.	1
Log Kow	Not applicable.	1
Bioaccumulative potential	No ecological damage caused by this product.	]
12.4. Mobility in soil		
Nitrogen, compressed (7727-37-9)		1
Mobility in soil	No data available.	1
Ecology - soil	No ecological damage caused by this product.	1
Nitrogen (7727-37-9)		1
Mobility in soil	No data available.	1
Ecology - soil	No ecological damage caused by this product.	
12.5. Other adverse effects		
Effect on ozone layer	: None.	
Effect on the global warming	: None.	
SECTION 13: Disposal consideratio	ns	
13.1. Waste treatment methods		
Naste disposal recommendations	: Dispose of contents/container in accordance with local/regional/national/international regulations. Contact supplier for any special requirements.	
SECTION 14: Transport information		
n accordance with DOT		
ransport document description	: UN1066 Nitrogen, compressed, 2.2	
JN-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)	2.2 - Non-flammable gas	
Additional information		
Emergency Response Guide (ERG) Number	: 121 (UN1066);120 (UN1977)	
Other information	No supplementary information available.	
Special transport precautions	: Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers: - Ensure there is adequate ventilation Ensure that containers are firmly secured Ensure cylinder valve is closed and not leaking Ensure valve outlet cap nut or plug (where provided) is correctly fitted Ensure valve protection device (where provided) is correctly fitted.	
Transport by sea		
JN-No. (IMDG)	: 1066	
Proper Shipping Name (IMDG)	: NITROGEN, COMPRESSED	
Class (IMDG)	2 - Gases	
//FAG-No	: 121	
Air transport		
JN-No.(IATA)	: 1066	
Proper Shipping Name (IATA)	: Nitrogen, compressed	
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Class (IATA) Civil Aeronautics Law 2 3 Gases under pressure/Gases nonflammable nontoxic under pressure

SECTION 15: Regulatory information

15.1. US Federal regulations

Nitrogen, compressed (7727-37-9) Listed on the United States TSCA (Toxic Substances Control Act) inventory

SARA Section 311/312 Hazard Classes Sudden release of pressure hazard

#### 15.2. International regulations

CANADA

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

#### **EU-Regulations**

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

15.2.2. National regulations

#### Nitrogen, compressed (7727-37-9)

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

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

Nitrogen (7727-37-9)				
U.S California - Proposition 65 - Carcinogens List	U.S California - Proposition 65 - Developmental Toxicity	U.S California - Proposition 65 - Reproductive Toxicity - Female	U.S California - Proposition 65 - Reproductive Toxicity - Male	No significance risk level (NSRL)
No	No	No	No	
Nitrogen (7727-37-9)				
U.S Massachusetts - F U.S New Jersey - Righ U.S Pennsylvania - RT	Right To Know List it to Know Hazardous Substance "K (Right to Know) List	List		

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SECTION 16: Other information Revision date 6/24/2015 12:00:00 AM Other information When you mix two or more chemicals, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture Consult an industrial hygienist or other trained person when you evaluate the end product. Before using any plastics, confirm their compatibility with this product. Praxair asks users of this product to study this SDS and become aware of the product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this SDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information. The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Safety Data Sheet. Since the use of this information and the conditions of use are not within the control of Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product. Praxair SDSs are furnished on sale or delivery by Praxair or the independent distributors and suppliers who package and sell our products. To obtain current SDSs for these products, contact your Praxair sales representative, local distributor, or supplier, or download from www.praxair.com. If you have questions regarding Praxair SDSs, would like the document number and date of the latest SDS, or would like the names of the Praxair suppliers in your area, phone or write the Praxair Call Center (Phone: 1-800-PRAXAIR/1-800-772-9247; Address: Praxair Call Center, Praxair, Inc., P.O. Box 44, Tonawanda, NY 14151-0044). PRAXAIR and the Flowing Airstream design 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 burn. NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water NFPA specific hazard : SA - This denotes gases which are simple asphyxiants. HMIS III Rating Health : 0 Minimal Hazard - No significant risk to health Flammability : 0 Minimal Hazard Physical : 3 Serious Hazard

SDS US (GHS HazCom 2012) - Praxair

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

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