Fire Protection for Fume Hoods

“Micro Environment” Protection

FIRETRACE®

AUTOMATIC FIRE SUPPRESSION SYSTEMS

Details on fires in fume hoods and how to suppress them using Firetrace® automatic suppression systems

The Firetrace Companies

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AUTOMATIC FIRE SUPPRESSION SYSTEMS

FIREPANEL™

VEHICULAR FIRE PROTECTION SYSTEMS

Firetrace Aerospace™

HELPING ENSURE A SAFE RETURN

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About Firetrace

FIRETRACE manufactures reliable, cost-effective, automatic fire detection and suppression systems designed to protect "micro-environments" – i.e., any small enclosed space where high value/mission critical assets are located or where an increased risk of fire could be mitigated by an automatic fire suppression system. Firetrace systems are completely self-contained, require no electrical power, and are easy to install and maintain.

FIRETRACE systems are compatible with most commercially available fire-suppressing clean agents, foams, and dry chemicals and are the only systems of their type to carry major listings and approvals from UL, ULC, CE, FM, and more than 20 other international agencies.

FIRETRACE pre-engineered systems are specially designed to protect small enclosures of all kinds. The system type, size and fire extinguishing agent are be determined by the contents of the enclosure.

FIRETRACE low-pressure clean agent options are typically 300 cubic feet (8.5 cubic meters) or smaller, with options for dry chemical and high pressure agents up to 1500 cubic feet (42 cubic meters).

FIRETRACE also manufacturers Engineered 500psi / 34.5 bar Total Flooding Clean Agent Systems which are available with 3M™ Novec™ 1230 Fire Suppression Fluid. Total Flooding systems are available in eight capacities with fill volumes ranging from 8 to 1300 lbs. (4 to 590 kg). The 1300 lbs. / 590 kg cylinder is the largest in the industry, so even the largest of facilities can be effectively protected.

FIRETRACE has facilities in London, Singapore, Sidney, New Delhi, Dubai and Sao Paulo to better serve clients worldwide.

- **FIRETRACE** International is a division of Firetrace USA, a privately held LLC
- **FIRETRACE** USA companies have sold than 250,000 fire suppression systems worldwide
- **FIRETRACE** is an ISO 9001:2008 / AS 9100C Registered company
- **FIRETRACE** maintains a 65,000 sq. ft. USA facility and a 3,500 sq. ft. UK facility
- **FIRETRACE** manufacturers fire suppression systems for commercial and industrial applications

Introduction

While fume hoods and cabinets are ideal for controlling the risk of fume inhalation, they provide little to no protection against the risk of fire. The inherent volatility of various chemical compounds, along with the presence of ignition sources such as hot plates and Bunsen burners, can lead to a serious fire risk.

A fume hood fire can be disastrous. Even a small fume hood fire can cause extensive damage to property, destroy priceless research material, and result in many thousands of dollars in losses. More importantly, a fire in a fume hood can result in serious injuries to lab personnel or even loss of life.

Despite these dangers, may fume hoods are not protected from the risk of fire. Part of the reason why is, until recently, most lab managers believed that protecting individual fume hoods has been too difficult or costly. That thinking has been changed with **FIRETRACE**.

FIRETRACE *provides fast, reliable, cost-effective fire detection and suppression for fume hoods that will safeguard property and lives.*

Unlike most competing fire suppression systems, **FIRETRACE** systems detect a fire inside the fume hood – *right at its source!* – which allows for early detection, thus reducing or eliminating the potential for laboratory damage and downtime.

FIRETRACE systems have been successfully protecting fume hoods from fires for more than two decades and are currently in use on more than 25,000 fume hoods worldwide. We invite you to read on to learn why Firetrace is the industry's number one choice for fume hood fire suppression.

How Firetrace Works

FIRETRACE employs a unique, proprietary detection and delivery system called Firetrace Detection Tubing (FDT). The flexible tubing is manufactured from specially processed polymer materials to achieve the desired heat detection and delivery characteristics.

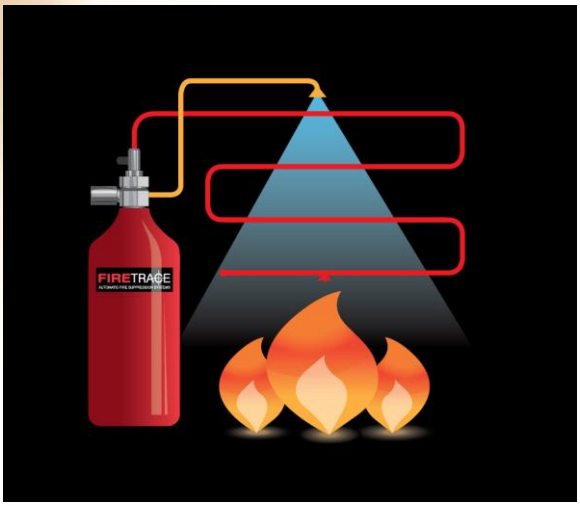
The **FIRETRACE** Detection Tubing, which is pressurized with nitrogen, is placed within an enclosed area above potential fire hazards. In the event of a fire, the FDT bursts at the point of highest heat, triggering the release of the fire extinguishing agent. Extinguishing agents can be matched to the particular application. Various system sizes are available to accommodate the appropriate amount of agent. The systems require no power to operate and require minimum maintenance.

Direct Release System

The Direct Release System utilizes the Firetrace Detection Tubing as both the fire detection device and the fire suppressant delivery system. The portion of the tube nearest the hottest point of the fire ruptures, forming an effective discharge “nozzle”. The pressure drop in the tube releases the entire contents of the cylinder through this nozzle.

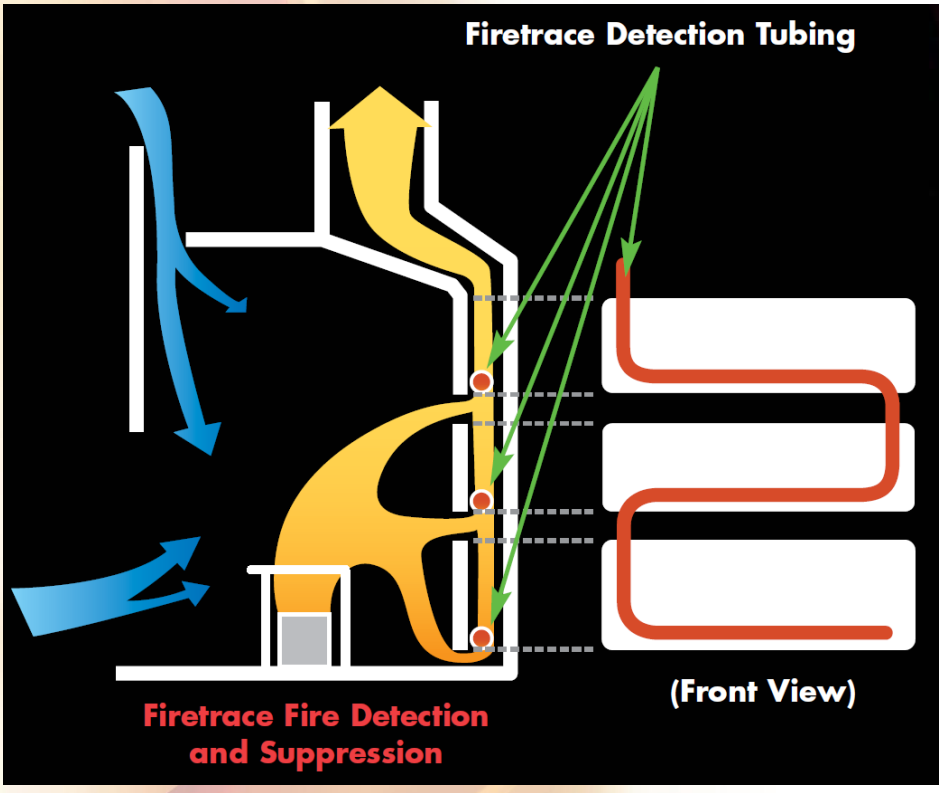
Indirect Release System

With the Indirect Release System, the Firetrace Detection Tubing is used only as a detection device. The fire suppression agent is delivered via copper tubing, stainless steel tubing or braided hose. When the tubing “bursts”, the suppressant is discharged through strategically placed nozzles within the fume cabinet.



Targeting the Application

Historically, fume hoods have been considered difficult if not impossible to adequately protect against the risk of fire. The of heat from Bunsen burners, combined with smoke, fumes and vapours from chemical actions and reagents make it very difficult to determine when an actual fire is taking place.



FIRETRACE solves this problem by locating the flexible, heat detection tubing behind the baffles and across the exhaust duct openings. These areas, by the design, are exactly where the heat from a fire is drawn. When a fire begins, the flames follow the airflow into the cabinet's baffles. When the pressurized Detection Tubing registers heat of approximately 212°F (100°C), it bursts, which automatically triggers the release of the fire suppressing agent.

Placing the FDT in the path of the heat and flame assures extremely quick fire detection and suppression (more than 10 times faster than conventional detection systems), which greatly minimizes the potential for damage to life and property.

A Firetrace suppression system provides immediate, localized fire protection. With nozzles placed strategically within the fume cabinet, the best fire suppressing agent for the application, such as carbon dioxide (CO_2), foam, or dry chemical powder, is administered directly onto the fire automatically.

Fire Suppressing Agents

FIRETRACE systems are compatible with most commercially available fire suppression agents, including:

Carbon Dioxide

The extinguishing agent used in Firetrace pre-engineered automatic high-pressure extinguisher units is CO_2 (Carbon Dioxide). CO_2 is a colourless, odourless, electrically nonconductive inert gas that is an extremely effective fire suppression agent. As it is an inert gas it is also safe to apply to unpredictable chemical reactions without it causing any negative effects. When the CO_2 is released it will suffocate the fire and also cool it at the same time, which leads to the fire being extinguished. CO_2 is clean and leaves no residue, thereby minimizing any after fire clean up, along with keeping expensive downtime to a minimum. Most materials such as steel, aluminium, stainless steel, brass, as well as plastics, rubber and electronic components are not affected by exposure to CO_2. This agent is also environmentally friendly, having an ozone depletion potential (ODP) of 0.00.

Foam Fire Suppressing Agents

Firetrace can offer a range of AFFF foams to cover the fire. When activated nozzles distribute the foam all over the fires source, this creates a barrier between the fuel and the oxygen and starves the fire. Foams are safe for people and safe to use in occupied spaces. They are very efficient and are easy to clean up.

Dry Chemical Agents

The dry chemical extinguishing agent used in Firetrace systems is Mono Ammonium Phosphate ($NH_4H_2PO_4$) also known as ABC or multi-purpose powder. Dry powder will spread over surfaces quickly and creates a barrier between the fuel and the oxygen, in the case of liquid based fires it will also help to absorb the fuel and stop it from burning. When discharged, dry chemical will drift through the air and settle on surrounding surfaces. Pound for pound, ABC powder is one of the most effective fire suppressing agents. ABC Powder is has been evaluated and approved for use in occupied areas, provided the proper safety precautions have been taken.

A Note about Clean Agents

Firetrace systems are also available clean suppressing agents such as DuPont™ FM-200® and 3M™ Novec™ 1230 Fire Protection Fluid. However, we typically do not recommend these agents for fume hood environments. Clean agents are complex chemicals designed to break the bonds that cause combustion, which in a fume hood environment where experimental chemicals are being used it would be difficult to ensure that a negative reaction does not occur.

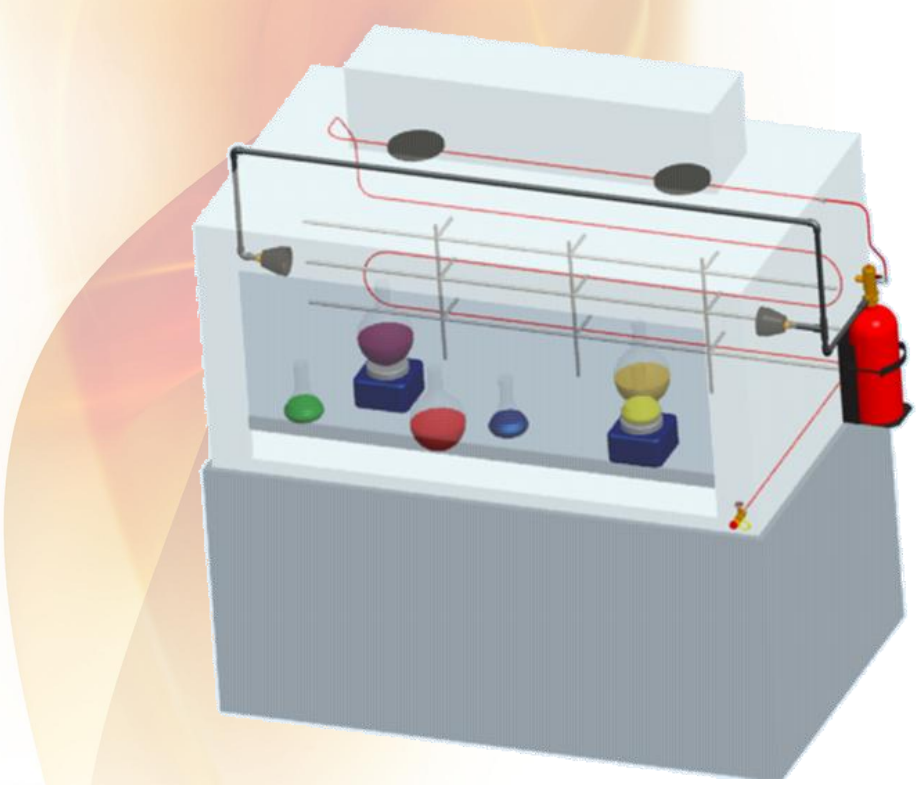
Typical System

The **FIRETRACE** system typically recommended for a fume hood is an indirect high pressure system filled with CO_2. The detection tubing is routed behind the baffle board and also over the extraction ducts putting it in the prime position to detect an abnormally hot airflow. For bench top cabinets we can typically install two nozzles to discharge the agent directly on the work surface, for walk in cabinets we can also fit two extra low level diffusers to fill the whole cabinet more quickly.

In the event of a fire, or high temperature rise, the FDT will burst and activate the valve, now the agent is released through the discharge pipes and onto the fire. The agent quickly fills the cabinet and extinguishes the fire, it leaves no residue and is electrically non conductive so will not cause and damage to the equipment.

The system is also fitted with a pressure switch that constantly monitors the contents of the container and can be used to sound an alarm or be integrated into an existing fire alarm panel. It can also be used to shut powder down to the extractor fan

Firetrace Detection Tubing is ideal for fire detection in these environments as it is unaffected by occasional smoke or chemicals. Also, being pneumatically operated they require no power to run and do not rely on any electronic sensor equipment, this means we only discharge the system if there is a fire, no false alarms.



Detection Tubing (FDT)

The heart of every **FIRETRACE** system is the Firetrace Detection Tubing (FDT). This flexible, pneumatic tubing is the primary fire detection and unit activation method used in all **FIRETRACE** automatic fire suppression systems. The FDT is flexible enough to be used in the most difficult installations, yet durable enough to withstand harsh conditions and continue to perform as intended.

Firetrace Detection Tubing

The FDT is a linear, pneumatic, fire detection device that responds to a combination of heat and radiant energy generated by a fire. When exposed to these conditions, the properties of the FDT in this localized area change. The material becomes softer and weaker than the surrounding areas. In this weakened state, the gas contained inside of the FDT is able to burst through, releasing the pressure in the entire length of FDT. This rupture and depressurization of the FDT is what activates the rest of the system, which discharges the fire suppression agent.

FDT after Detection

The FM Approved Firetrace Detection Tubing (FDT) is non-porous, so it can contain internal pressure for an extended time. The FDT is also resilient to most common chemicals or substances. The FDT is made of an inert, non-conductive blend of proprietary resins, and then extruded using a special process to ensure that the tubing is non-porous. This unique blend of materials gives the FDT the following attributes:

- Excellent Physical Durability and Flexibility
- High Pressure Performance
- Wide Temperature Range
- Good Chemical Resistance*
- Excellent UV Resistance

*Tests on chemical resistivity performed by Oxford University

FIRETRACE provides fast, reliable, automatic fire detection and suppression for fume hoods

FIRETRACE activates only in response to an actual fire; systems will not “false alarm” from smoke or fumes

FIRETRACE is compatible with most commercially available fire extinguishing agents

FIRETRACE tubing is located inside the fume cabinet to assure fast detection and suppression

FIRETRACE will extinguish a fume hood fire even if the sash is left open

FIRETRACE systems provide around-the-clock protection to safeguard lives and property

FIRETRACE can protect laboratory risk areas such as hazardous material storage cabinets

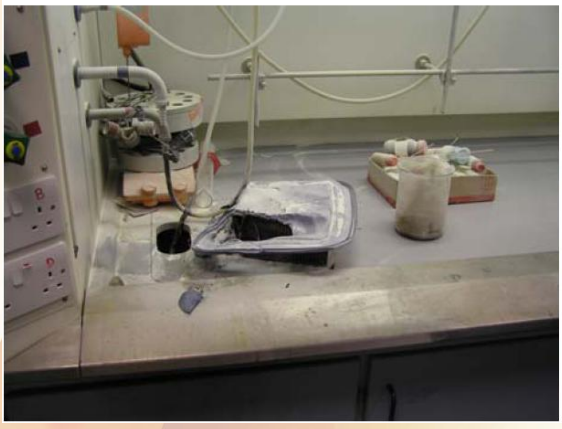
FIRETRACE suppresses a fire in seconds before it can threaten life and property

FIRETRACE systems can be quickly and cost effectively serviced and recharged after a fire

Another Successful Suppression

The chemistry department at the University of Southampton University in England recently had a fire in one of their fume hoods. During an experiment, a diethyl ether still was turned on with no water supply. The ether vapour bubbled, condensed and then instantly ignited after it dripped onto a heating mantle. In seconds the fire completely engulfed the fume hood.

Fortunately the fume hood was one of nearly 100 fume hoods located throughout the department that were protected by Firetrace automatic fire detection and suppression systems. The Firetrace system detected and suppressed the fire in seconds using ABC dry chemical powder.



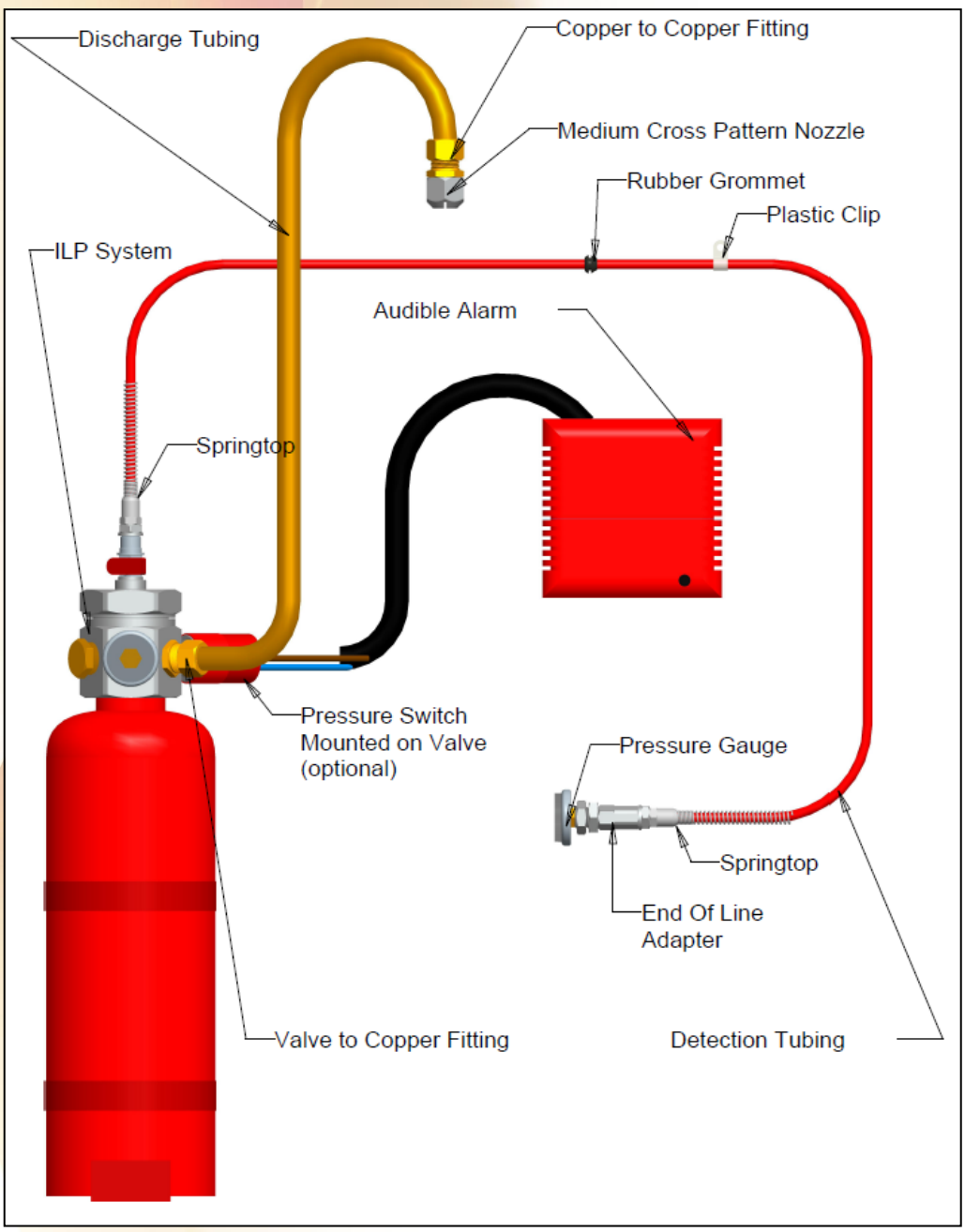
Dr. David Kinnison, Senior Chemist at the University of Southampton said, “We are very pleased with the brilliant performance of the Firetrace system. The fire was out before we had a chance to grab a handheld extinguisher. Left uncontrolled, the fire could have destroyed the entire laboratory. With the exception of some minor clean up, our laboratory was back to normal quickly.”

System Specifications

Cylinder and Mounting Bracket

FIRETRACE systems can utilise both TPED and D.O.T cylinders made from either aluminium or steel. Each cylinder is finished in red and painted to resist corrosion. These cylinders are available in high and low pressure; they also meet all of the local demands for CE and DOT equipment

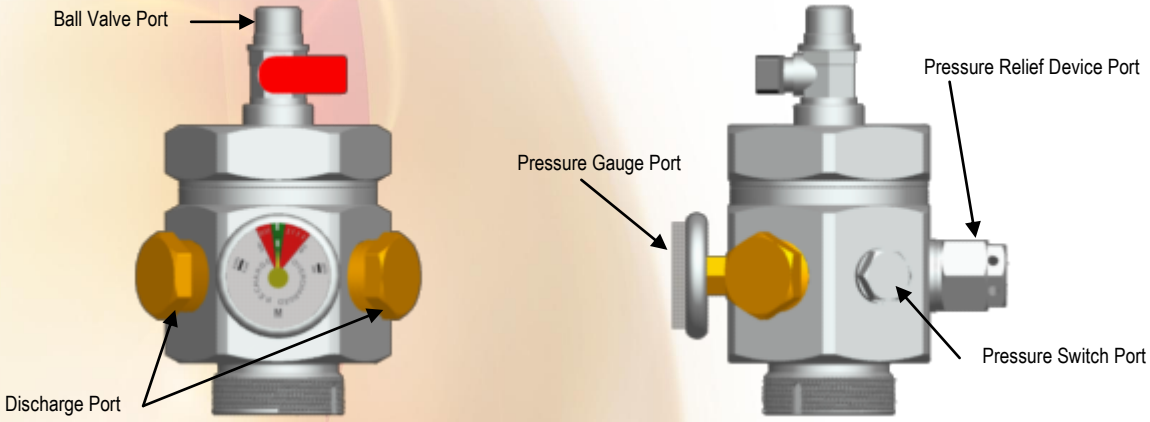
A wall mounted painted steel bracket is used to mount the cylinder/valve assembly in a vertical (upright) position. Each bracket is equipped with integral quick-clamp straps and locking pin.



Low Pressure Valves

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

In addition, all DOT cylinder valves are equipped with a pressure relief (rupture disc) device in compliance with safety requirements



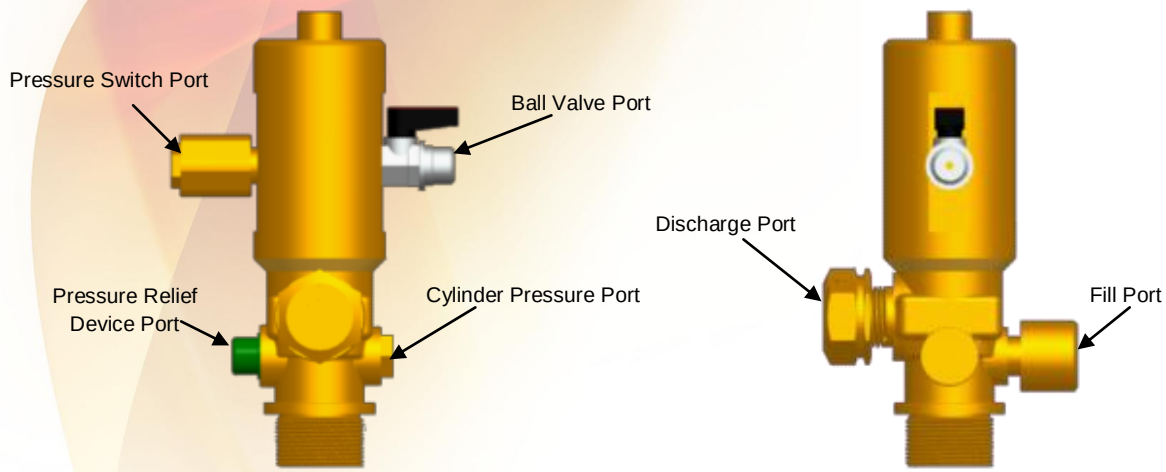
Medium Indirect Low Pressure Valve

(CE Manufactured Systems for the European market do not require a pressure relief device)

High Pressure Valves

Each cylinder is equipped with a nickel plated brass valve for use with high pressure agents, and one ½" discharge port. A quarter turn ball valve interfaces with the Firetrace detector tubing to ensure the system is inactive during transport and maintenance.

In addition, all cylinder valves are equipped with a pressure relief (rupture disc) device in compliance with safety requirements



Indirect High Pressure Valve

System Options

Manual Release

Indirect systems are available with an optional manual release which can be mounted in any convenient location. This will allow the system to be activated manually in the event of a fire.

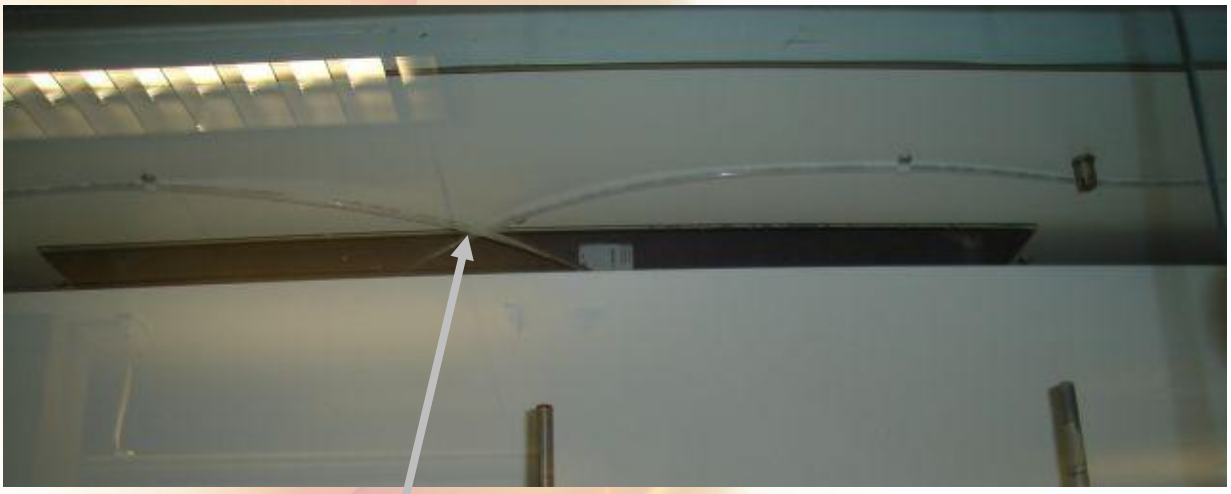
Pressure Switch

A pressure switch is available to monitor system pressure, system actuation and/or to energize or de-energize electrically operated equipment. This unit can be connected at the end of the line of the **FIRETRACE** detector tubing, or on the container valve assembly to provide additional electrical functions as may be required. **FIRETRACE** recommends that all systems use a pressure switch coupled with some device to alert personnel in the event of a system discharge and/or to shut down ventilation to the cabinet.

Clear Detection Tubing

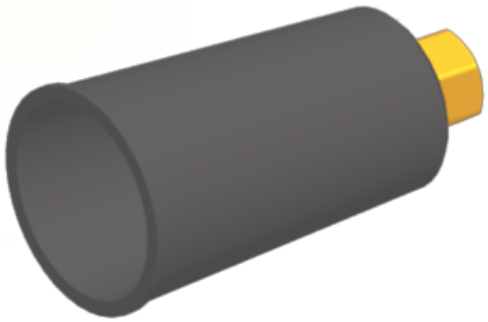
FIRETRACE tubing has been tested by Oxford University to determine its compatibility with common chemicals and solvents over long periods of time. Based on these results for the standard red tubing we noticed that the tube retained its functionality however in some cases the dye in the tube had become discoloured.

We recommend that the Firetrace Detection Tube used in fume cabinet applications is transparent (dye free version) so that it does not become discoloured or faded over time. As an additional benefit this clear transparent tubing is discreet and not easily noticed in the laboratory and is thus more aesthetically pleasing. It provides exactly the same high quality functionality as the standard red tubing but without the dye.



Clear Firetrace detection tubing run over the extractor ducts

Low and high pressure nozzles available dependant on agent



Fire Alarm Integration

The **FIRETRACE** system is available with a normally open / normally closed low pressure switch. This allows the discharge of a **FIRETRACE** system to be monitored and integrated with a fire alarm panel or building management system.

This output signal can perform other functions as required, such as sounding an alarm, shutting down power, activating dampers, closing fire doors, etc.

FIRETRACE systems do not need to be connected to any internal or external power source to operate. Even in the event of a general power failure, the **FIRETRACE** system will always be armed and ready to protect critical assets.

Other Applications

FIRETRACE systems are suited to a large number of laboratory applications including the extraction systems and electrical control cabinets.

One area that will need additional protection is the extraction and dust collection systems, over time dust and fumes can build up in the pipe work and cause large flash fires. A fire here could spread quickly as the extraction system will draw flames and hot air through the entire system.

Above shows CO_2 systems used to protect the extractions system for a large pharmaceutical company

In the event of a fire, the FDT will burst and activate the valve, which directs the agent is through the discharge pipes and onto the fire. Upon activation the integrated pressure switch can be used to shut down the extractor fan and prevent it from drawing flames up into the exhaust and into other areas.

Approvals and Listings

FIRETRACE International systems carry several internationally recognised approvals and listings and have been independently tested by third parties for exposure to many types of chemicals, solvents and UV radiation. As an **ISO 9001** accredited company you can be sure of the fact that all systems are manufactured and tested in a quality environment.

Australia – SSL Listing No. AFP 1368 Scientific Services Laboratory, Victoria, Australia
Austria – Prufstelle fur Brandschutztechnik
Bahrain – State of Bahrain Ministry of the Interior, Protection and Prevention Section
Belgium – ANPI/NVBB Rapport D'essai no. SPT/ME 020/1987.12.08
China – CNACL No. China National Accreditation of Laboratories
Czech Rep – Strojirensky Zkusebni Ustav S.P Engineering Test Institute
Denmark – Danish Institute of Fire Technology
France – CNPP GC01 0017 CNPP IE 99 5585
Germany – BAM/TUEV Approval
Greece – Approval Report 44672 701.6
Hungary – Belugyminiszterium Tuezoltosag Orszagos Parancnoksag Szum 188/31/1999
Israel – The Standards Institution of Israel Test Certificate 8013107171
Italy – TESI No. 094/B Tecnologie Sviluppo Industriale
Netherlands – TNO Netherlands Project Ref 006.10329.01.02
Romania – SC Instal Somet SA Act de Omologare No. 7/2000
Qatar – Civil Defence
Sweden – SBF 128:1 Swedish Bus Approval
United States - Factory Mutual Approval / UL & ULC Listing

Addendum

FIRETRACE Detection Tube Testing

Leakage Rate:

The FDT passed the Underwriters Laboratories and Factory Mutual Research long term leakage tests. Twelve sample systems, each with 52 feet of FDT were weighed and then placed in a secure storage area. The maximum allowable leakage rate was 0.0075 ounces leakage over a period of one year. Each quarter of a year, 4 random samples were selected and weighed. At the end of the full year, all twelve samples were weighed. There was no measurable leakage. The FDT passed the test.

Exposure to UV Radiation:

Samples of FDT, each 12 inches in length, were subjected to the UV Light and Water Test in accordance with ASTM 154 utilizing the UVB 313 Lamp. Test duration was 1000 hours. Following this test, the samples were examined for cracking or deterioration. None was found. These same samples were then subjected to a hydrostatic test of six times the normal operating pressure (150 x 6 = 900 psi) of the tubing for a period of one minute. There was no burst or leakage as a result of this test. Pressure was then raised to 1000 psi for a period of one minute with no burst. Each sample was then raised to burst pressure. Average burst pressure of the twelve samples was 1200 psi.

Aging Test:

A total of twelve samples of FDT, each twelve inches in length, were subjected to an air-oven aging test for 180 days at 212°F (100°C). Following this test, the samples were examined for cracking or deterioration. None was found. These same samples were then subjected to a hydrostatic test of six times the normal operating pressure (150 x 6 = 900 psi) of the tubing for a period of one minute. There was no burst or leakage as a result of this test. Pressure was then raised to 1000 psi for a period of one minute with no burst. Each sample was then raised to burst pressure. Average burst pressure of the twelve samples was 1200 psi.

30 Day Extreme Temperature Leakage Test:

A total of twelve fully charged **FIRETRACE** Indirect systems, charged with FM-200™ Clean Extinguishing Agent and super pressurized with nitrogen to 150 psi and including 24 inches of detection tubing (also charged to 150 psi) were exposed to the temperature extremes, 0°C (32°F) to 54.44°C (130°F), for a period of 30 days. A total of six charged systems were exposed to 0°F and six charged systems were exposed to 130°F. Weight (in grams) was recorded before and after the test. There was no loss of weight noted of any of the samples at the end of the test. Following this test the systems were discharged with a standard propane torch impinging on the FDT. System actuation was within two seconds and in each case, discharged as intended.

Compatibility with Common Chemicals:

Results of chemical testing of Firetrace tubing undertaken by Oxford University

Solvent	Vapor	Liquid
Ether	No Action	Loss of Black Type/Slightly Harder
THF	No Action	Loss of Black Type/Slightly Harder
Toulene	No Action	Slightly Harder
Ethyl Acetate	No Action	No Action
N-methylmorpholine	No Action	Loss of Color
Petrol	No Action	No Action
Acetone	No Action	No Action
Methanol	No Action	No Action
Dichioromethane	No Action	No Action
Triethylamine	No Action	Loss of Black Type
Chloroform	No Action	No Action
Pyridine	No Action	Slight Loss of Color
Acetyl Chloride	No Action	Slight Attack
Sodium Hydroxide	No Action	No Action
Dimethylformamide	No Action	Slight Attack
Acetonitrile	No Action	Loss of Black Type
Butyl Ethyl Ether	No Action	loss of shine on surface
Carbon Tetrachloride	No Action	Loss of Black Type
Benzene	No Action	No Action
Benzyl Bromide	No Action	Pitted the Plastic
T-Butanol	No Action	No Action
Trifluoroacetic Acid	plastic attacked	Soup
Formic Acid	No Action	Soup
Dimethyl Sulphoxide	No Action	Hardened Plastic
Acetic Anhydride	No Action	No Action
Diglyme	No Action	No Action
Trimethylsilyl Chloride	No Action	No Action
Styrene	No Action	Hardened Plastic
Methyl Acrylate	No Action	Hardened Plastic
Disopropylamine	No Action	Hardened Plastic
Nitric Acid 70%	Eaten Away	Soup
Hydrochloric Acid 35%	Eaten Away	Soup
Acetic Acid/Hydrogen Bromide	Eaten Away	Soup
Thionyl Chloride	Eaten Away	Not Quite Soup
Phosgene in Toluene	No Action	Slightly Harder Plastic
Ammonia 35% Aqueous	No Action	No Action
Hydrogen Peroxide	No Action	Plastic Softened

All chemicals were in contact with the tubing for five days (vapour and liquid)

Frequently Asked Questions

What pressure is the system working to?

FIRETRACE low pressure systems are super pressurized with Nitrogen to a pressure between 195psi (13.4bar) and 150psi (10.3bar).

What happens if I have more than one fire simultaneously?

Because the system is design is based on the volume of the enclosure, there is sufficient agent within the container to "total flood" the whole space. Should there be more than one fire, the Fire Detection Tube will burst at the hottest point first and all of the agent will be dispersed throughout the entire cabinet.

How can the operator check if the system is available and functioning?

A **FIRETRACE** system is fitted with two monitoring devices. A pressure gauge for visual inspection and also as described above the systems can be fitted with a set of low pressure switches which change state on 5bar falling pressure and can create "a fault" signal on a fire control panel. (Control panels are normally supplied by 3rd parties but **FIRETRACE** can supply these also).

If the system is activated, do I need to replace the whole system?

No. Should you have the unfortunate incident of a fire, the system will operate as intended and some works will obviously need to be carried out to bring the system back into operation again. This involves re-charging the contents of the container via an approved agent, or for speed purposes, replacing the container with an identical one that is already filled. The Fire Detection Tube will not normally need to be replaced, as the burst point can be cut from the tube and the tube can then be re-connected with a straight adapter. The system can then be pressurized and reset for use.

In theory, your system could be operational again within only a few minutes and at minimal cost.

Will the temperature from a hotplate not activate the system as chemicals are boiling at temperatures over 100°C?

No the temperature of the liquid may be high but it will not be high enough o raise the ambient air temperature to a high enough level to activate a **FIRETRACE** system. The tube is also place at a far enough distance so the air will be much cooler by the time it is drawn behind the baffle board and over the detection tubing.

FIRETRACE®

AUTOMATIC FIRE SUPPRESSION SYSTEMS

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Firetrace currently has more than 20 international approvals and listings, including: UL, CE, FM, ULC & ISO9001. Approvals and listings vary by system type and agent.