Fire Protection for Gensets and Power Generators

“Micro Environment” Protection

FIRETRACE®

AUTOMATIC FIRE SUPPRESSION SYSTEMS

Details on fires in gensets and power generators and how to suppress them using FIRETRACE® automatic suppression systems

The Firetrace Companies

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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

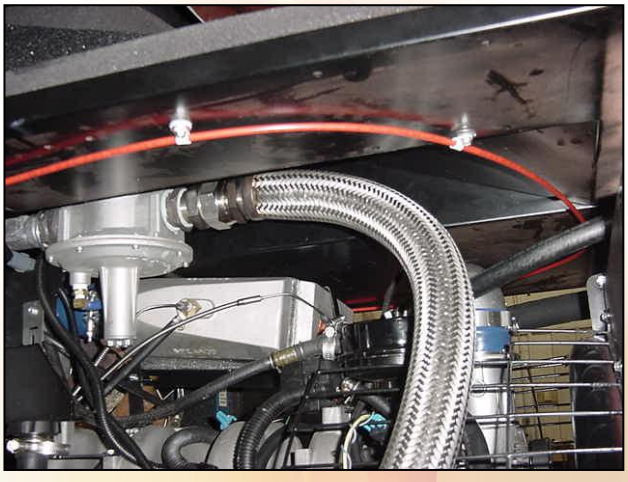
Introduction

Power generators present a fire risk because of the fuels used to run the generator (diesel, oil, natural gas) and the electricity generated by the machinery. A fire in a power generator is a significant business risk, not only because power generators are a major capital investment, but also because downtime can have serious repercussions for those who depend on an uninterrupted supply of electricity.

Firetrace takes the fire detection and suppression inside the risk area of a power generator so a growing fire can be caught quickly, preventing the spread of fire to other parts of the building that would require a fire brigade or water sprinklers to extinguish.

Should a genset fire occur it would typically destroy the generator; left unchecked the fire could destroy the room or even the building, resulting in massive expense and downtime. By containing the damage to the genset, damage is limited to that enclosure and the collateral damage often caused by traditional fire suppression is avoided. Moreover, Firetrace systems react to a fire so quickly that in many cases any damages to the power generator is minimized or eliminated.

The physical loss of a genset from a fire is substantial but pales in comparison to the collateral costs from loss of power for mission critical equipment in businesses, hospitals and industry.



FIRETRACE provides fast, reliable, detection and suppression for power generating assets

FIRETRACE Detection Tubing is installed inside the genset enclosure to assure the fastest possible detection and suppression

FIRETRACE systems require no internal or external electrical power to operate

FIRETRACE systems are compatible with “clean” extinguishing that require no clean up

FIRETRACE fire suppression provides around-the-clock protection for power generating assets

FIRETRACE systems can to fit a wide range of assets from switchgear to diesel generators

FIRETRACE systems only activate in the event of an actual fire, there are no “false alarms”

FIRETRACE provides a pressure gauge for easy check of system “charged and operational” status

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

How Firetrace Works

FIRETRACE systems employ 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.

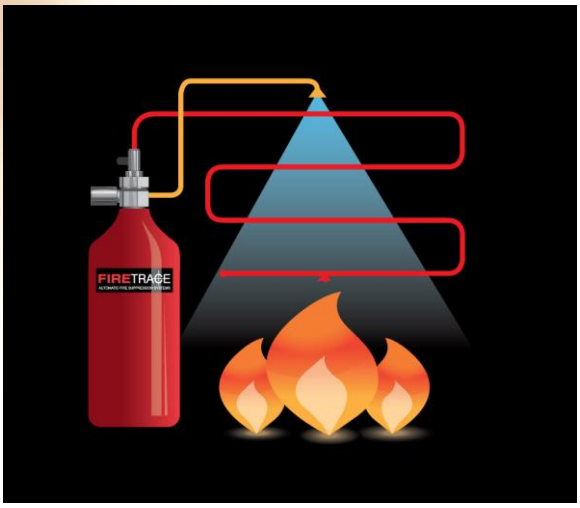
The **FIRETRACE** Detection Tubing, which is pressurized with nitrogen, is placed within an enclosed area above potential fire hazards. In the event of a fire, the FDT bursts at the point of highest heat, triggering the release of the fire extinguishing agent. Extinguishing agents can be matched to the 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

FIRETRACE systems can utilise both high and low pressure systems depending on the hazard type and location. Risk areas such as generator enclosures, UPS's and cable tunnels can be protected using a Direct Low Pressure (DLP) system filled with a clean agent such as DuPont™ FM-200® or 3M™ Novec™ 1230 Fire Protection Fluid.

The DLP system utilizes pressurized Firetrace Detection Tubing as both a fire detecting sensor and extinguishing agent delivery device. The flexible red tubing can be routed throughout the generator enclosure, ensuring fast detection and suppression of a fire right at its source.

The tubing is designed to burst at the point of highest heat, forming an effective discharge nozzle. This allows for the fastest possible detection and suppression and minimizes the potential for equipment damages and downtime.

Clean extinguishing agents leave no residue and require no clean up. The agents are electrically non-conductive and are safe to use on energized power generating equipment. Most importantly, clean extinguishing agents are safe for people and the environment.

Direct System Example

Pressure switches can be integrated into both high and low pressure systems to signal an alarm or alert the operator in the event of a fire.

Firetrace Detection Tubing is ideal for fire detection in generators, it is pneumatically operated so has none of the shortfalls of false alarms due to smoke or vibration. The tube will resist dirt and grime exceptionally well to ensure that it only operates during a fire. As the systems require no power to run they are suitable for the most remote of locations or offshore backup generators.

*The simplicity, reliability and effectiveness of the **FIRETRACE** system makes it ideal for protecting mission critical power generating assets from the risk of fire.*

Extinguishing Agents

3M™ Novec™ 1230 Fire Protection Fluid

One clean extinguishing agent used in **FIRETRACE** pre-engineered automatic fire suppression units is Dodecafluoro-2-methylpentan-3-one, more commonly known as 3M Novec 1230 Fire Protection Fluid. Novec 1230 is a colourless low odour fluid, low in toxicity, is 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. 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, aluminium, 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 ozone depletion potential (ODP) of 0.00 and an atmospheric lifetime of 5 days – the closest halocarbon alternative is 33 years.

HFC-227ea Extinguishing Agent

Another clean suppressing agent used in **FIRETRACE** pre-engineered automatic direct fire suppression units for electrical enclosures is Heptafluoropropane, more commonly known as HFC-227ea, or FM-200. HFC-227ea (1,1,1,2,3,3,3-heptafluoropropane, CF_3CHFCF_3) is a colourless odourless gas, low in toxicity, electrically non-conductive, leaves no residue, and is an extremely effective fire suppression agent. Like Novec 1230, HFC227ea is clean and leaves no residue, thereby minimizing after fire clean up along with keeping expensive downtime to a minimum. HFC227ea has been the standard clean agent for many years and is well known and trusted worldwide. It has been evaluated and approved for use in occupied areas as a Total Flooding agent.

Carbon Dioxide (CO_2)

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.

Dry Chemical Extinguishing Agents

The dry chemical extinguishing agent used in the **FIRETRACE** dry chemical pre-engineered automatic fire suppression units shall be Mono Ammonium Phosphate ($NH_4H_2PO_4$) also known as ABC or multi-purpose powder. ABC powder is one of the most common agents used in hand held fire extinguishers and, pound for pound, is a particularly effective fire suppression agent. ABC Powder has been evaluated and approved for use in occupied areas, provided the proper safety precautions have been taken. When discharged, dry chemical will drift through the air and settle on surrounding surfaces.

System for Generators

FIRETRACE systems used on generators typically consist of a small, pressurized cylinder using clean agent, dry chemical, or CO2 as the extinguishing medium. This is connected to a length of Firetrace Detection Tube (FDT) that is appropriately routed around the generator, dynamo, and fuel lines to provide linear, pneumatic detection. Nozzles will be placed in strategic locations around the hazard area to flood the space as quickly as possible.

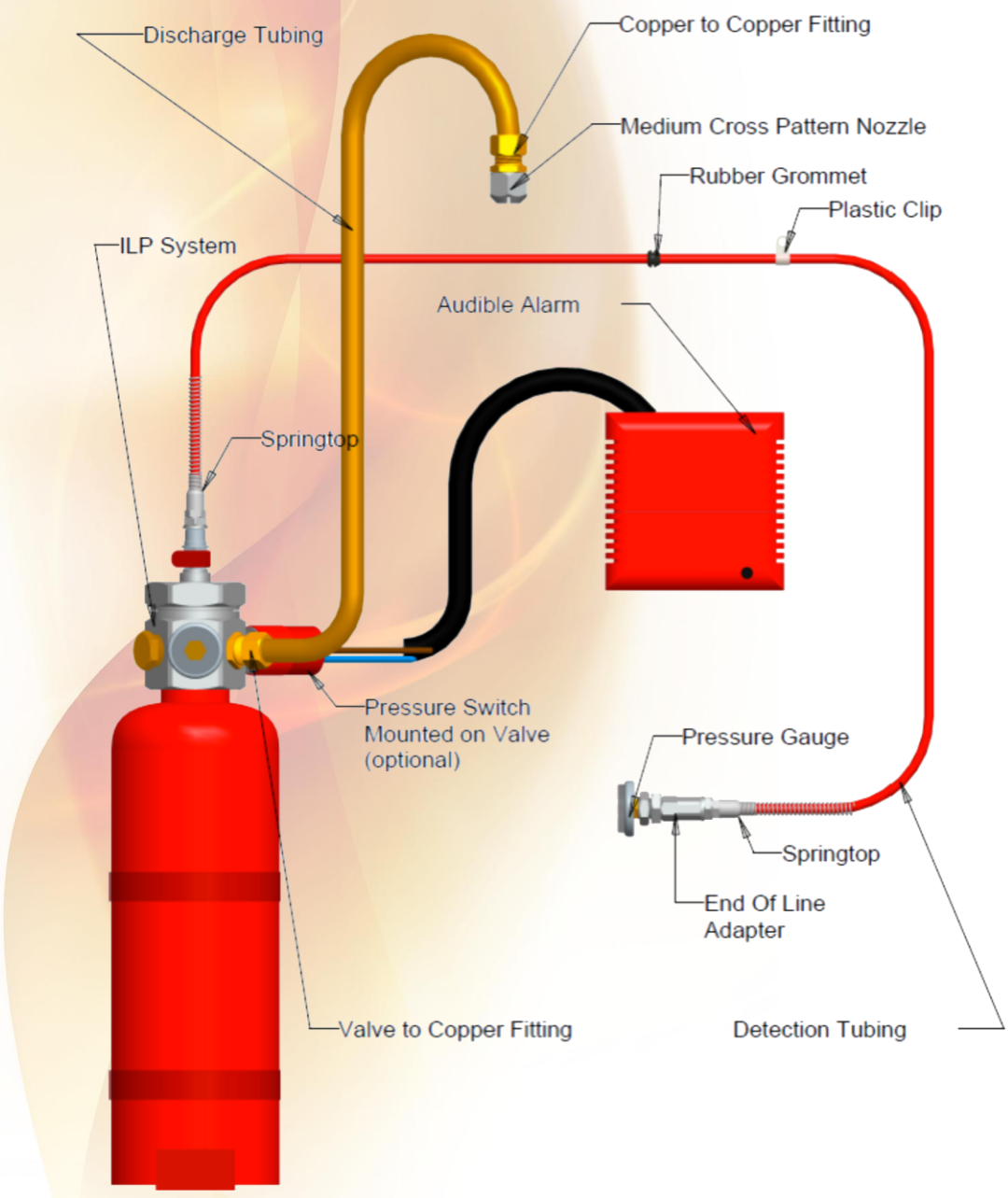
In the event of a fire, the FDT will burst and activate the valve, releasing the agent through the discharge pipes and onto the fire. The agent quickly fills the enclosure, extinguishing the fire. Systems can be fitted with a pressure switch that, upon discharge, can sound an alarm or be integrated into a fire alarm panel. It can also be used to shut power down to the whole unit or just the extraction fan to help retain the fire fighting agents.

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.

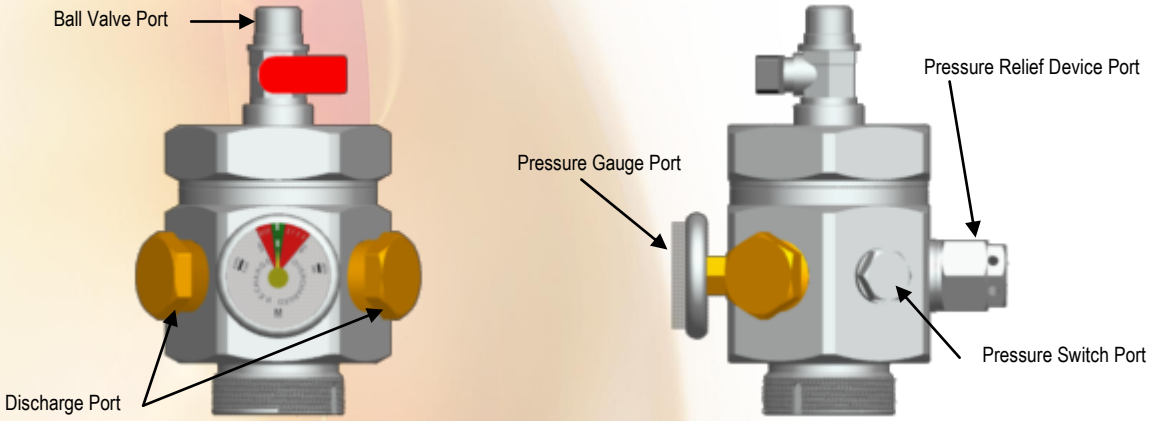
A wall mounted painted steel bracket is used to mount the cylinder/valve assembly in a vertical (upright) position. Each bracket is equipped with integral quick-clamp straps and locking pin.



Valve Assembly

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 Detection 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)

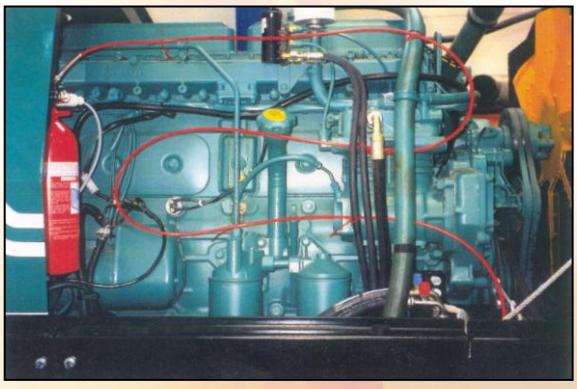
Manual Release

All indirect systems come equipped with a manual release device which can be mounted in the front of the machine. This will allow the system to be activated manually in the event of an emergency

Pressure switch

A pressure switch is provided 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.

System for Mobile Equipment



FIRETRACE automatic fire detection and suppression systems are ideal for protecting mobile power generating equipment from the risk of fire. Once installed, the system is ready to go wherever the generator goes. And because Firetrace systems require no electrical power to operate, they are ideal for protecting power generating equipment stationed in remote locations

FIRETRACE also provides dedicated systems for electrical cabinets, (MMC's, MVC's) high- and low-voltage equipment as well as fuel store/pumps, vehicles, construction machinery, production equipment, filters, HVAC, and small enclosures / fire hazards either open or closed, lifts, escalators, conveyor belts, airport applications, offshore, marine, oil and gas, and military.

Systems for UPS's

FIRETRACE Systems have been installed on thousands of electrical control cabinets all over the world, from pumping stations in Qatar to airport control cabinets in Delhi. Whether involving high or low-voltage equipment, **FIRETRACE** systems are ideal for the early detection and protection against fire in these environments, being automatic, clean and safe for use on electrical equipment and with a choice of system sizes available, able to protect many different types of application.

FIRETRACE Systems used on electrical control cabinets consist of a small, pressurized cylinder using either FM-200 or Novec1230 as the extinguishing medium. This is connected to a length of Firetrace Detection Tubing (FDT) that is appropriately routed all around the compartment(s) to provide linear, pneumatic detection in a 360 degree environment.

In the event of a fire, the FDT will burst and discharge the extinguishing agent, suppressing the fire in a matter of seconds. The fire suppressing agents are clean, non-toxic and suitable for use on electrical fires.

Firetrace Detection Tubing is ideal for fire detection in electrical control cabinets. It is electrically non-conductive, flexible/easy to install and will not affect any rating of the cabinets and their compartments. It is also suitable for use in all environments, be they clean or dusty and is not affected by high air-flow or low temperatures. No clean-up of the agent is required, as they are dispersed as clean, non-toxic gases.

System for Cable Trays

FIRETRACE systems can be applied to cable tunnels and trenches under machinery to complete the protection in a power generation facility. Cables are often a source of fire situations in confined spaces such as tunnels. Often tightly packed together and in large quantities, they can generate a lot of heat which can cause the cable to burn at any point along its length, which makes detection and extinguishment of a cable fire particularly tricky.

Installation consists of unning the Firetrace Detection Tubing along the cable length. In the event of a fire it will n “burst” at the point of highest, delivering the fire suppressing agent is right at the source of the fire. A conventional fixed nozzle system would require masses of pipework and multiple nozzles to cover a long distance, whereas the simple yet effective Firetrace Detection Tubing is capable of forming a agent-dispersing nozzle anywhere along its length.

Fire Alarm Integration

The **FIRETRACE** system is available with a normally open / normally closed low pressure switch. This allows the discharge of a 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 require an external power supply source so even in the event of a total power failure the system is armed and ready to protect critical assets against the risk of fire.*

Approvals and Listings

FIRETRACE International's 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

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.

Frequently Asked Questions

What pressure is the system working to?

FIRETRACE systems are super pressurized with Nitrogen between 10.3bar to 13.4bar

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 from that point. The whole area however, will rapidly fill with a cloud of dry chemical agent which will quickly suppress any other fires that there may be.

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

FIRETRACE systems are 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 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 service will be needed 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 Detection Tubing 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.

I've heard about HF, will this cause damage to my equipment?

The agents themselves are described as "Clean Agents" as they will not damage any equipment, or leave any residue, should they come into contact with any electrical components. However, they decompose at high temperatures and it is therefore important to avoid applications involving hazards where continuously hot surfaces are involved. Upon exposure to flame these agents will breakdown to form halogen acids. Their presence will be readily detected by a sharp, pungent odour long before maximum hazardous exposure levels are reached. It has been concluded from fire toxicity studies that decomposition products from the fire itself especially carbon monoxide, smoke, oxygen depletion and heat may create a greater hazard.

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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.