

# Fire Protection for Electrical Enclosures

“Micro Environment” Protection

**FIRETRACE**<sup>®</sup>  
AUTOMATIC FIRE SUPPRESSION SYSTEMS

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Details on fires in electrical enclosures and how to suppress them using Firetrace<sup>®</sup> automatic suppression systems

# The Firetrace Companies

**FIRETRACE**<sup>®</sup>  
AUTOMATIC FIRE SUPPRESSION SYSTEMS

**FIREPANEL**<sup>™</sup>  
VEHICULAR FIRE PROTECTION SYSTEMS

**FA** *Firetrace*  
*Aerospace*<sup>™</sup>  
HELPING ENSURE A SAFE RETURN

**REGULUS**  
FIRE SYSTEMS



# 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 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 manufactures 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** manufactures fire suppression systems for commercial and industrial applications

# Introduction

Electrical enclosures can be found in virtually every industrial and commercial space. In some cases there may be little more than a simple fuse box; in other instances it could be a large room filled with electrical panels, machinery control cabinets (MCCs), cable trays, switch gear and power vaults. These electrical cabinets are often vital to the operation of a business and the loss or damage of such a piece of equipment from a fire can result in extensive costs and downtime.



*Just a few causes of fires in electrical panels include electrical arcing, power surges, short circuits, wire fatigue, loose connections and frayed wires.*

**FIRETRACE** offers a reliable and cost-effective means to protect mission critical and/or high value electrical boxes against the risk of fire. And because a Firetrace system detects and suppresses a fire *inside* the electrical cabinet, right where the fire begins, there is far less risk of financial losses due to equipment damage and downtime. Containing a fire to a single box also prevents it from spreading to adjacent areas or the building itself and also stops collateral damages from activation of overhead sprinkler system.

*According to UK national statistics, around 30% of commercial/industrial fires are caused by faulty electrical equipment; and approximately 40% of all organizations that experience a fire never recover.*

# 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.

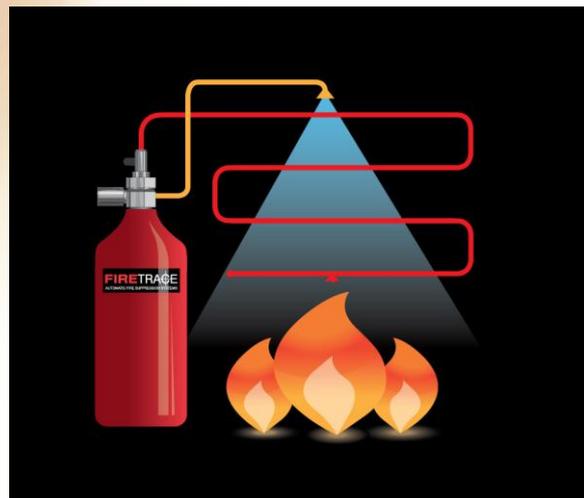


## Direct Release System

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



Risk areas such as electrical panels and cabinets can be protected using a Direct Low Pressure (DLP) system filled with a clean agent such as either DuPont™ FM-200® or 3M™ Novec™ 1230 Fire Protection Fluid.

The DLP system utilizes pressurized Detection Tubing as both a fire detecting sensor and extinguishing agent delivery device. The flexible red tubing can be routed throughout an electrical panel, ensuring 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 time 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 electrical equipment. Most importantly, clean extinguishing agents are safe for people and the environment.

Each electrical cabinet can be protected on an individual or grouped basis (depending on hazard analysis and risk assessment) so that a fire in a given cabinet does not lead to the costly discharge of a large amount of room volume extinguishing agent, which keeps cylinder refill costs low.

Above all, the benefit of **FIRETRACE** systems is in the Detection Tubing which allows detection anywhere inside the cabinet, meaning the fire is detected and extinguished at an early stage – right at the point where the fire starts.



Direct System Example

*The simplicity, reliability and effectiveness of the **FIRETRACE** system makes them ideal for protecting missions critical electrical assets from the risk of fire.*

# 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

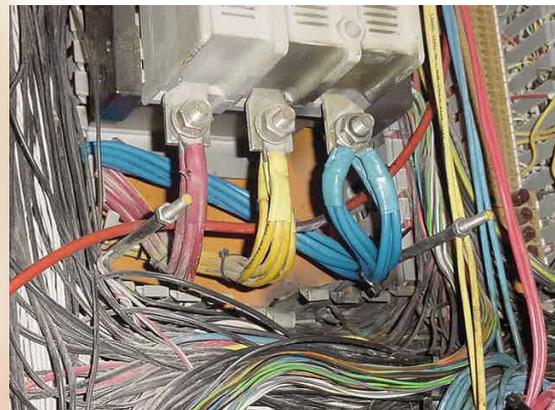
# Why Use Firetrace?

**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 they are high or low-voltage enclosures, 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 container using either DuPont™ FM-200® or 3M™ Novec™ 1230 as the extinguishing agent. This is connected to a length of Firetrace Detection Tube (FDT) that is appropriately routed all around the compartment(s) to provide linear, pneumatic detection in a 360 degree environment.

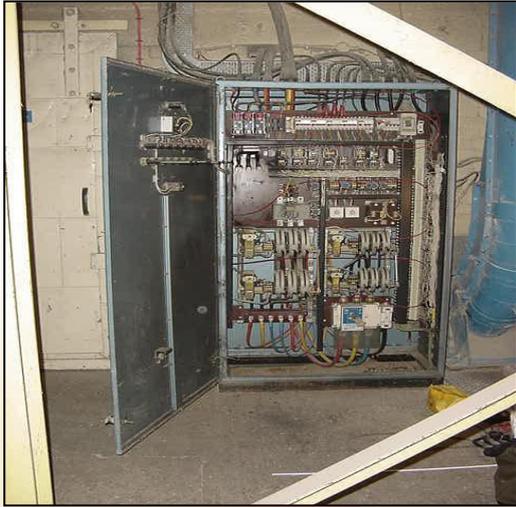
In the event of a fire the FDT will burst and discharge the extinguishing agent directly on to the fire at its source, rapidly knocking down any fire. The clean, non-toxic agent quickly fills the compartment which suppresses the fire in seconds.

Unlike some fire suppression technologies there is no delay in the build-up of an extinguishing concentration or a delay caused because the extinguishing gas must find a way into the cabinet and to the source of the fire from the outside.



Systems that discharge through pipe work and nozzles have the difficulty in delivering the extinguishing agent rapidly onto the fire source. Electrical cabinet manufacturers are hesitant about maintaining warranty and type test certificates on electrical / machinery control cabinets that might be installed with electrically conductive (metal) pipe work.

The Detection Tubing is ideal for fire detection in electrical control cabinets, as it is treated just like another cable. 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, whether clean or dusty, and is not affected by high air-flow or temperature extremes.



**FIRETRACE** provides fast, reliable, automatic detection and suppression for electrical assets

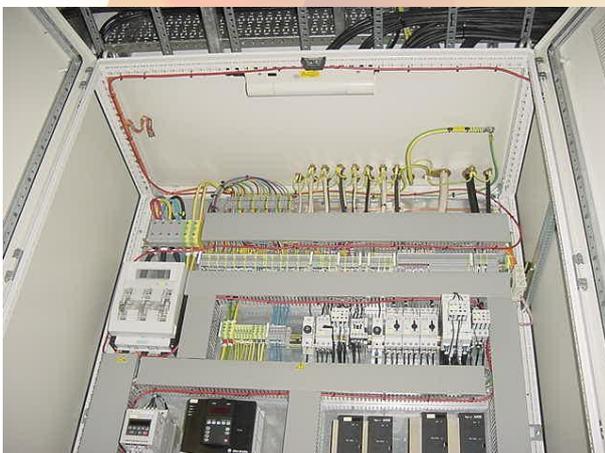
**FIRETRACE** Detection Tubing is installed inside the electrical enclosure to assure the fastest possible detection and suppression

**FIRETRACE** systems require no internal or external electrical power to operate

**FIRETRACE** systems can be “daisy chained” to enable one system to protect multiple enclosures

**FIRETRACE** localized fire suppression provides around-the-clock protection for electrical assets

**FIRETRACE** provides a pressure gauge for quick and easy system “charged and operational” status



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

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

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

# Small Fire – Large Risk

A small fire in an electrical cabinet can have major consequences. The photo below shows a burnt out electrical control cabinet which did not have fire protection. This particular cabinet housed a critical asset that controlled the company's manufacturing line.

The company suffered more than \$100,000 in losses from manufacturing downtime. However, in a sense the company got off easy. A fire in an isolated electrical cabinet in the cargo handling section of Turkey's Ataturk Airport in June 2006 knocked out operations for nearly a week, resulting in tens of millions of dollars in losses to the airport.



*Protecting electrical cabinets with a cost effective **FIRETRACE** fire suppression system can be a responsible part of an organization's fire risk reduction program.*

# Clean Suppressing Agents

## 3M™ Novec™ 1230 Fire Protection Fluid

Once 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; when used as specified under the U.S. Environmental Protection Agency (EPA) SNAP Program rules. Refer to the SNAP Program rules for more information.

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). (*Source: 3M, 2003*)

## 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 FM200. HFC-227ea (1,1,1,2,3,3,3-heptafluoropropane,  $\text{CF}_3\text{CHF}_2\text{CF}_3$ ) is a colourless odourless gas, low in toxicity, electrically non-conductive, leaves no residue, and is an extremely effective fire suppression agent.

HFC227ea has been the standard clean agent for many years and is well know and trusted worldwide.

HFC-227ea is included in NFPA-2001 and has been evaluated and approved for use in occupied areas as a Total Flooding agent.

# 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 need to be connected to an external power supply source so even in the event of a general power failure the system is 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** – Prüfstelle für 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** – CNAACL 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 Parancnokszag 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

## ***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 ( $150 \times 6 = 900$  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 ( $150 \times 6 = 900$  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?

The **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.