EXPLOSION & FIRE PROTECTION

A COMPREHENSIVE SOLUTION

FOR THE ENERGY INDUSTRY

FIRESTOPPER®
Industrial - Commercial
Government

FireStopper® EXP FFC

January 30, 2017

FireStopper® Marketing Department

FIRESTOPPER

"Bringing Firefighting Into The 21st Century"℠

Preface

FireStopper International Limited, a transnational Registered Company, is the developer of the most advanced and powerful firefighting and anti-explosion technology in the "World". It devoted the first 25-years of its existence to R&D and the recipient of subsequent stand alone testing results in ratings and certifications by the most recognized and respected third-party testing and listing facilities in the world.

Moreover, this unique Technology has rendered the only available all fire class effective and anti-explosive products, which are non-toxic, non-irritant, environmentally safe and non-hazardous per the most demanding environmental and life exposure testing over all other existing and available products in the explosion, fire and safety channel of business.

In the explosion amelioration technology channel, FireStopper® branded anti explosion systems exclusively deploy EXP FFC. This FireStopper® FFC (*Fire Fighting Catalyst*) is an environmentally safe liquid formula that has garnered the great distinction of being the only product in over 20-years of search for a product capable of suppressing hydrogen/methane explosive environment. This breakthrough discovery became apparent during its initial demonstrative testing at Gexcon, AS Norway.

Having proven the former statement through the outstanding results of the products testing, rating, and certifications thus received, FireStopper®, in tandem with its novel firefighting and anti-explosion products (the "software"), developed the most durable and reliable supporting hardware and detection systems available today, which also meet and exceed the relative standards used to certify said product lines.

With the advent of this technological breakthrough, FireStopper® can now provide Government, Industry, and by way of innovation, the consumer with a never before wider dimension of safety and protection.

Notwithstanding the above, the FireStopper® lines of products reach across the full spectrum of safety application including environmental remediation post spills both onshore and offshore.

In the International arena, the FireStopper® brand is the recipient of the highest certifications in all categories of Governmental requirements to market such as defined below:

Anti-Explosion:

Initial Stage Testing - Gexcon[1], AS (Norway)

Handheld Portable Extinguishers:

ANSI/UL711, ULC – Southwest Research Institute (San Antonio, TX)
Defense Logistics Agency (DLA) US Gov. NSN Approval #s'

EN3-7; EN3-8[2] – MPA, Dresden (Germany)

[1] A world leader in explosion testing and certification
[2] This Standard refers to hardware durability, reliability and efficacy

CE[3] – DNV

Firefighting Foam Concentrate Certifications:

EN1568 – MPA Dresden
ICAO – CNPP (France)
IMO – MPA Dresden, Lloyds Registry, DNV, MED
CE

Environmental Testing:

NAMSA[4], USA
Associated Laboratories, CA USA
Environmental Medicine, Inc., USA
OPUS[5], Ltd., UK

Executive Summary

Every new technology has barriers to entry. Often times these barriers are based on myth or inaccurate facts that have been presented in the media or established competitors and some times the barriers are based on real world experience of customers using purported similar technologies.

In this instance, a truly new technology is here that addresses the need for protection in a different way. In all cases, it is incumbent upon the vendor to educate the end user, analysts, and the press about the technology or a new approach to solving continuing problems.

The Electrical Energy Producers, Oil Refineries, Petrochemical Processing Plants and even Coal Mines among many other industries, operate in the presence of combustible gases and vapors, which are the precursors of explosion. The objective of this document is to introduce and describe the now available, fully automated and redundant manually activated FireStopper® anti explosive and fire suppression systems. This document does not cover barriers placed in safe areas, and focuses only on devices placed in hazardous areas to ameliorate or vastly diminish the devastating effects of explosion and fire.

FireStopper® Anti-Explosion & Fire Suppression

"TODAY'S COMMERCIALLY AVAILABLE ANTI-EXPLOSION PRODUCT DO NOT PREVENT EXPLOSIONS"

Demonstration of explosion suppression by FireStopper® Performed at the Gexcon Testing Facilities, Norway

[3] This Mark assures manufacturing quality through yearly inspections
[4] NAMSA is a world leader in medical testing
[5] The world leader in environmental testing for the Petrochemical Industry

Objective

In the 21-years of searching for a product that could have an effect on an explosion event, no commercially available or experimental products have shown any effect on lab size explosions. The first such product showing effect is FireStopper® as reported below and based upon said performance, Gexcon AS, sponsored by industry, has submitted a proposal to further investigate and certify FireStopper® EXP FFC as an anti-explosive agent.

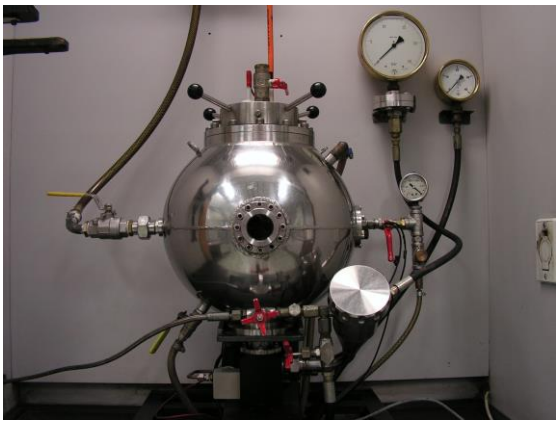
Demonstrative Test Result

Tests were performed in a 20 l sphere using 5 % propylene-air mixtures. The mixture was prepared by introducing propylene in a partially evacuated vessel followed by injection of air. The mixture was ignited 60ms after injection using a chemical igniter.

To investigate the effect of FireStopper the suppressant was injected continuously after introduction of the propylene and while injecting air. The injection of the suppressant occurred via a fishhook nozzle.

The reference test resulted in a maximum rate of pressure rise of 2807 bar/s and a maximum pressure of 9.4 bar/s. Introduction of FireStopper resulted in a reduction of the maximum rate of pressure rise to 1686 bar/s and a maximum pressure of 8.3-bar/s. This test was conducted twice with identical results.

Lab Testing Equipment



Conclusion

FireStopper® EXP FFC clearly exhibited an impressive effect on the explosive environment making it the only product to date able to show effectiveness on an explosive environment under the most general application conditions.

(The below extract was generated as a direct result of recognition that FireStopper® EXP FFC is "the only viable comprehensive explosion and fire suppressant" capable of delivering the most reliable anti-explosive and fire protected environment for all applicable uses.)

MINUTES OF MEETING[6]:

Suppression of transformer explosions

[6] Gexcon, AS's proposal to Industry to uptake the cost of testing and certification based on the stand-alone efficacy of the FireStopper® technology producing said advancement. Industry has accepted their participation in the project.

Place: GexCon AS
Date: 15.03.2013
Participants: Per Olav Hetland, Statkraft
Geir Vårdal, SiraKvina
Ranjit Bedi, CEO Firestopper International Ltd.
Teis Kvilhaug, FireStop AS
Olaf R. Sigmundsson, FireStop AS
Several other participants from FireStop AS and FireStopper International Limited
From Iceland, Norway and USA
Gisle Enstad, GexCon AS
Kees van Wingerden, GexCon AS

Copy: Brian Wilkins, GexCon AS
Prepared by: Kees van Wingerden
Project: 44229
MM No.: 1

Background

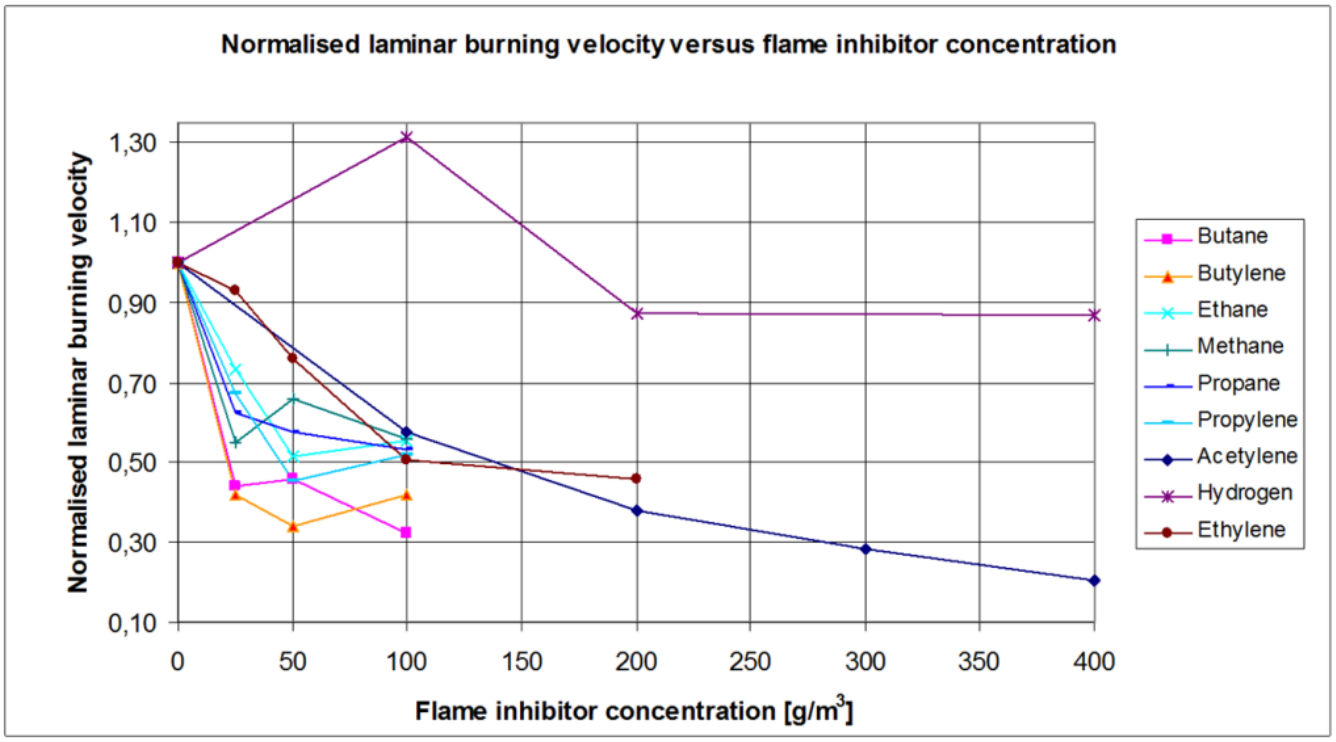
The main aim of the meeting was to investigate whether there is an interest in the Norwegian power industry to support a project aiming at finding alternatives to Halon, which are still used to suppress fires and explosions in transformer rooms. Norwegian power companies still have dispensation for the use of Halon (which are forbidden in connection with these compounds causing depletion of the ozone layer). A project proposal has been sent to several power companies and one producer of transformers regarding the testing of a new suppressant called FireStopper®.

Experiments performed during a project performed in 2001 showed that several suppressants failed when the concentration of hydrogen (of oil mist-hydrogen mixtures) was increased (hydrogen is one of the flammable gases resulting from cracking in case of short circuit in mineral insulating oil in a transformer). The suppressants used were water mist, sodium bicarbonate and an aqueous solution with chemical additives (salts). The limited effect of salts such as sodium bicarbonate and potassium carbonate on hydrogen explosions was also demonstrated in tests in a 20 l sphere involving mixtures of hydrogen, potassium carbonate and air and various hydrocarbons mixed with air and potassium carbonate. A strong reduction of combustion rates was seen when relatively small amounts of potassium carbonate were added to hydrocarbon-air mixtures; for hydrogen this was not the case (see Figure below; from “Van Wingerden, K. and Hoorelbeke, P. (2011) On the potential of mitigating vapor cloud explosions using flame inhibitors, Proceedings of the 7th Global Congress on Process Safety, Chicago, Illinois, March 13-16”).

Although several companies who were invited to the meeting and could not attend a genuine interest was expressed among many of the invited companies (some did participate via telecommunication).

Below is a chart expressing the expansion of different explosive media:

Fig 1. Suppression of transformer explosions MoM



MM No.: 2

Introduction of FireStopper International

At the start of the meeting, Ranjit Bedi, CEO and Kees van Wingerden, Technical Director introduced the companies. PowerPoint presentations[7] presenting the companies have been attached to this MoM. During the presentation also properties of FireStopper (the suppressant) were presented. FireStopper is water based, is PH-neutral, can be applied for a wide range of temperatures, can be applied for all types of fire: A, B, C, D and F (C = Electric) and will be effective against all hydrocarbons and hydrogen. A report showing it can be used against electric fires (according to UL 711; electrical conductivity test)[8] has been enclosed.

MM No.: 3

Presentation of Gexcon Proposal

Kees van Wingerden presented the instant proposal. It is proposed to test the properties of FireStopper in a 1.2 m3 vessel following the guidance given in the European standard EN 14373. The experiments would be performed with methane and methane-hydrogen mixtures. The first would allow for comparison to experiments published for Halon (Bartknecht, W. “Explosionsschutz; Grundlagen and Anwendungen; Springer; Berlin; Heidelberg; 1993”) the second to represent oil mist-cracking products mixtures. The tests would involve variations of the following parameters:

- _Activation pressure (varied from 0.05 to 0.2 bar)
- _Amount of FireStopper® introduced to suppress explosion
- _Gas type (methane and hydrogen-methane)
- _Gas concentration

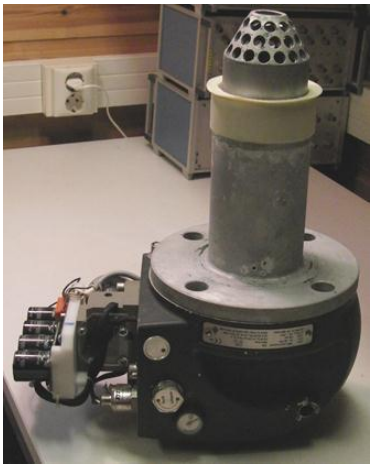
[7] Available upon request

[8] Available upon request

The specific FireStopper® that would be used in the proposed work is referred to as FireStopper® PFE-FR FFC.

The tests would be performed with a standard (powder based) suppression system (see pictures below): Suppression of transformer explosions MoM

Fig 2.



Nozzle Commercial Suppression System

Fig 3.

Valve Commercial Suppression System

Fig 4

Container For Suppressant Mounted on to Valve

PRODUCT AND APPLICATION

- **FireStopper® EXP FFC** (a premix exclusively available with for use in conjunction with FireStopper® trademarked systems)

Advantages:

- The only proven product effective on Hydrogen/Methane explosions (at Gexcon, Norway)
- Non-toxic, non hazardous and non-corrosive
- Biodegradable/Environmentally Safe
- Super anti-explosive properties
- No unpleasant odor
- Great temperature reduction i.e. (>1500°F in < 40 sec.)
- Freeze Resistant: -100°F (-73.33°C)
- pH Neutral
- Post blast all fire class effective agent (A-B-C-D- (F)-K) and all sub-classes of flammable materials

APPLICATIONS THROUGH SYSTEMS:

- Petrochemical Operations
- Government
- Mining
- Shipping
- Tanking
- Fueling
- Transportation
- Military
- Aerospace
- Aviation
- *And any other applications requiring explosion and fire protection*

FireStopper® provides full systems in the portable and fixed range with the full capability to supply specially designed systems to fit the purpose. It will also provide full service from design to installation and training should the need arise.

In concert with this great technological leap, FireStopper® will provide the most advanced and durable detection and activation systems, ***capable of detecting <4-microsecs and deploying in <40-msecs***, to complement the intended application results. All wet materials are supplied in the most durable stainless steel available to insure quality and reliability.

FireStopper® is the only manufacture to provide its customers with a 20-year limited warranty on all wearable parts.

In the economy of time, we will address one major application as an exemplar use that can be modified to any size or application of this category of FireStopper® products:

Conclusion

Economic, Medical and Environmental concerns necessitate changes in how industry protect against explosion and fire occurring in electrical generating equipment. Until now, the deployment of streaming agents such as Novec 1230, FM 200, FE 25 or 36 and other dry chemical applications do not produce the desired results. The ever-present explosion and fire danger has always resulted in total devastation to the equipment and infrastructure. Moreover, contingent liability continues to grow due to the threat of lawsuits due to environmental contamination, injury to personnel and loss of use.

FireStopper® EXP FFC is designed to deliver both anti explosion protection and post event fire prevention through its application. Additionally, with the current lineup of available products, special handling is required during its use. We challenge any end user to independently compare their present product with EXP FFC should there be a need.

Notwithstanding the above, FireStopper®'s EXP FFC and PFE-FR agents are easy to handle during the required maintenance of the system therefore reducing the need for highly trained personnel in time of need. Also, their obvious advantage over the tired old technology products

currently employed both in efficacy and environmental requirements, make these products the most desirable options going forward. FireStopper® is providing this advance line of products without limitation in quantity within acceptable standard delivery time.

Responsibility to provide safety is owed to the public by both Government and Industry. In current profound social and economic conditions, Government, Industry and the consumer cannot afford the risk of loss both materially and always risk to life. FireStopper® offers the only real security against the always present danger of serious environmental degradation, catastrophic fire and or worst, explosion.