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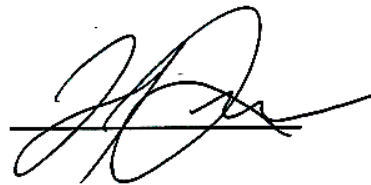
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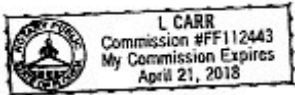

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Assessment of the functionality of the Proteng fire extinguishing system

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1. INTRODUCTION

Commissioned by D & S bvba, Zulte, Belgium, the Efectis Netherlands Fire Safety Center carried out an assessment of the extinguishing capacity of the Proteng extinguishing system. The purpose of the assessment is to record the operation of this extinguishing system under a number of practical conditions. The operation of the extinguishing system was assessed during a number of fire tests carried out. These fire tests were carried out at a fire station in the Netherlands under the direction of the client. An employee from Efectis Nederland attended the fire tests and recorded the test results.

2. PROTENG EXTINGUISHING SYSTEM

The Proteng extinguishing system consists of a plastic hose with a diameter of 18 mm which is filled with the extinguishing agent FM200 (heptafluoropropane). The hose is pressurized and then sealed with end plugs. The hose is then placed in a compartment to be secured with fastening means and the compartment is closed.

If a fire starting occurs, the temperature in the compartment will rise. This will also increase the temperature of the Proteng extinguishing hose. With this increasing temperature, the internal pressure in the extinguishing hose will also increase. At any time at a local temperature of 120 °C the hose will collapse and the FM200 extinguishing agent will be released.

This will usually take place at the location of the thermally highest temperature which as a rule will be the seat of the fire. The extinguishing pressure will release the extinguishing agent with some force and the seat of the fire will be extinguished. The Proteng extinguishing system has four products of which the length of the extinguisher hose and thus the amount of extinguishing agent varies. The quantity of extinguishing agent then has a relationship with the maximum volume to be protected.

In table 1 the four Proteng products are described. Only hose lengths 40, 100 and 210 cm were evaluated in the tests performed. This was in, respectively, a desktop computer, an electrical distribution box and a motor compartment of a passenger car.

Table 1: Proteng products

Extinguishing unit	Length of extinguishing hose [cm]	Amount of extinguishing agent [g]	Maximum protected volume [m ³]
Proteng IT	40	100	0.25
Proteng Electro	100	250	0.5
Proteng Engine	210	500	1
Proteng Tir Agro ^{a)}	400	1000	2

^{a)} product not involved in the tests

The specifications of the various products are shown in appendix A.

3. TEST PROGRAM

The test program consisted of three test setups in which, in particular, the volume of the test area was chosen in relation to the Proteng product. As a source of ignition, the choice was always made for a fire pit with white spirits (class B) supplemented with spruce wood strips (class A).

The product Proteng Tir Agro is not involved in the tests.

The tests are all conducted in the open air. The temperature was 13 °C at an average wind speed of 7 m / s.

3.1 PROTENG IT

This product with a hose length of 40 cm is placed at the top of the housing of a Dell desktop computer. On the bottom of the housing the fire tray was placed with white spirits. The side panel remained open. The spirit was ignited and the time measurement started.

Test result test 1.1: after 2'45 "the system started and the firebox was immediately extinguished. The fire tray still contained liquid white spirits.

A second test was carried out in which the side panel was closed and ignition of the fire tray via removed rear panels took place.

Test result test 1.2: after 1'50 "the system started and the firebox was immediately extinguished. The fire tray still contained liquid white spirits.



Test 1.1 Proteng in desktop



test 1.1: activated system

3.2 PROTENG ELECTRO

This product with a hose length of 100 cm is placed at the top of a steel electrical box. The cabinet has a revolving door at the front. The internal dimensions of the cabinet are: 100 x 60 x 25 cm (h x w x d).

At a height of 60 cm from the bottom of the cupboard, the fire tray was placed with white spirit. The door was left open ajar to maintain oxygen supply. The spirit was ignited and the time measurement started.

Test result test 2.1: after 2'45 "the system started and the firebox was immediately extinguished. The fire tray still contained liquid white spirits.

A second test was carried out in which the fire pit was placed on the bottom of the cupboard and in which spruce wood strips were placed on the fire pit. The spirit was ignited and the door was again ajar.

Test result test 2.2: after 4'45 "the system started and the firebox, including the wooden strips lying on it, was immediately extinguished. The fire tray still contained liquid white spirits.



Test 2.1



Test 2.2

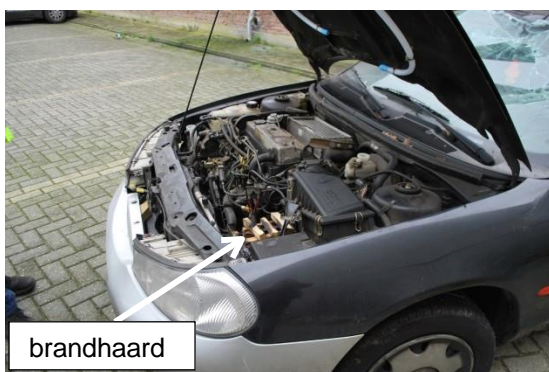
3.3 PROTENG ENGINE

This product with a hose length of 210 cm is placed against the inside of a bonnet of a passenger car. The battery has been disassembled from the engine block. In this the fire pit with white spirit and wooden strips was placed. The bonnet was left open ajar to maintain oxygen supply. The spirit was ignited and the time measurement started.

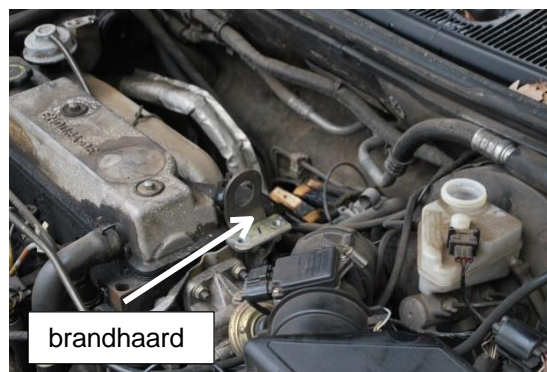
Test result test 3.1: after 0'45 "the system started and the firebox including the wooden strips was immediately extinguished. The fire tray still contained liquid white spirits.

A second test was carried out in which the fire pit was placed more deeply in the engine block and in which firewood strips were also placed on the fire pit. The spirit was ignited and the bonnet once again was ajar.

Test result test 3.2: after 6'30 "the system started and the firebox, including the wooden strips lying on it, was immediately extinguished. The fire tray still contained liquid white spirits. The white arrows indicate the location of the firepits.



Test 3.1



Test 3.2

4. CONCLUSION

In summary, it can be concluded that the Proteng extinguishing system is capable of effectively extinguishing incipient fires in somewhat compartmentalized spaces. The spaces concerned need not be hermetically sealed.

It was proven that the extinguishing system is effective on both Class A and Class B fires.

It should be noted that although the tests carried out show an effectively operating extinguishing system, the tests have an orienting character in which not all system boundaries have already been investigated.



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ANNEX A: SPECIFICATIES PROTENG BLUSSYSTEEM

PROTENG IT

A revolutionary automatic gas extinguishing system that serves the protection of small closed spaces containing computers, servers, Rackmount PCs, distributors for electricity, electrical equipment and the like. The size of the internal space is limited to approx. 0.25 m³.

How many users switch off their computers? Computers are often on continuously in offices and households and nobody realizes what can happen and what can be lost. At the moment when it comes to a fire, nobody is often present to intervene in the offices, objects or households as quickly as possible. For such a moment it is sufficient to have the Proteng IT within the PC and there is then no risk of the fire expanding.

The entire operating principle is based on one polyamide hose with a diameter of 18 mm and a length of 40 cm in which the effective extinguisher FM-200, with the exact name heptafluoropropane, is under pressure. At a normal temperature, up to 100 g of extinguishing agent is stored in this relatively small space, thanks to a pressure of 5 bar. When heating up the environment by fire, the pressure is increased to 15 bar at a temperature of 100 ° C. The actual start of the system is activated by a temperature above 120 ° C when the softening polyamide wall of the hose bursts exactly at the location of the highest thermal load and the extinguishing gas is released into the room. This gas reliably and effectively burns the fire in the bud, during the extinguishing no electrical parts are damaged, nor during use. The entire system is fully automatic, requires no operation and starts immediately if it comes to a fire. The system protects you and your property 24 hours a day.

Technical parameters:

Weight Proteng IT 240 g
Weight of the extinguishing agent 100 g FM200
(heptafluoropropane)
The material of the detection tube is polyamide
Dimensions of the tube: length 40 cm / diameter 18 mm
Pressure of natural vapors at 20 ° C 5 bar
Pressure of natural vapors at 100 ° C 15 bar

PROTENG ELECTRO

A revolutionary automatic gas extinguishing system that serves the protection of small enclosed spaces in which the distributors for electricity, electrical equipment, ventilation technology and the like. The size of the internal space is limited to approx. 0.5 m³.

Nowadays there is electrical equipment all around us. It is important to realize that many fires are caused by a short circuit and this at times when no one is present to intervene immediately. Proteng ELECTRO is a fully automatic and simple system that can monitor both you and your property 24 hours a day.

The entire working principle is based on one polyamide hose with a diameter of 18 mm and a length of 100 cm in which the effective extinguisher FM-200, with the exact name heptafluoropropane, is under pressure. At a normal temperature, up to 250 g of extinguishing agent is stored in this relatively small space, thanks to a pressure of 5 bar. When heating up the environment by fire, the pressure is increased to 15 bar at a temperature of 100 ° C. The actual start of the system is activated by a temperature above 120 ° C when the softening polyamide wall of the hose bursts exactly at the location of the highest thermal load and the extinguishing gas is released into the room. This gas reliably and effectively burns the fire in the bud, during the extinguishing no electrical parts are damaged, nor during use. The entire system is fully automatic, requires no operation and starts immediately if it comes to a fire. The system protects you and your property 24 hours a day.

Technical parameters:

Weight Proteng ELECTRO 430 g
Weight of the extinguishing agent 250 g FM200 (Heptafluoropropane)
The material of the detection tube is polyamide
Dimensions of the tube: length 100 cm / diameter 18 mm
Pressure of natural vapors at 20 ° C 5 bar
Pressure of natural vapors at 100 ° C 15 bar

PROTENG ENGINE

A revolutionary automatic gas extinguishing system that serves the protection of enclosed engine compartments for cars, buses, trucks and other motor vehicles and machines.

On the road every day of the year several cars and other vehicles burn, not only because of an accident, but also often due to a bad technical condition of a vehicle. The Proteng ENGINE system is an original automatic extinguishing system that can protect your car from the start of a fire. At the moment of fire, the crew of the vehicle is in direct danger (people can not get out of the vehicle and burns) or one is in shock and acts short-circuited (you do not know how to use a fire extinguisher, the fire extinguisher can not be found, one opens the engine compartment and therefore does not stimulate the fire anymore, everything takes too long).

Proteng ENGINE is installed in the engine compartment and carries out the extinguishing process for you. It is a fully automatic system that does not depend on energy, operation or other aspects and protects you 24 hours a day and not only during driving but also during parking. A big advantage of this system is an exceptionally simple and flexible assembly.

The entire operating principle is based on one polyamide hose with a diameter of 18 mm and a length of 210 cm in which the effective extinguisher FM-200, with the exact name heptafluoropropane, is under pressure. At a normal temperature, up to 500 g of extinguishing agent is stored in this relatively small space, thanks to a pressure of 5 bar. When heating up the environment by fire, the pressure is increased to 15 bar at a temperature of 100 ° C. The actual start of the system is activated by a temperature above 120 ° C when the softening polyamide wall of the hose bursts exactly at the location of the highest thermal load and the extinguishing gas is released into the room. This gas reliably and effectively burns the fire in the bud, during the extinguishing no electrical parts are damaged, nor during use. The entire system is fully automatic, requires no operation and starts immediately if it comes to a fire. The system protects you and your property 24 hours a day.

Technical parameters:

Weight Proteng ENGINE 800 g
Weight of the extinguishing agent 500g FM200 (Heptafluoropropane)
The material of the detection tube is polyamide
Dimensions of the tube: length 210 cm / diameter 18 mm
Pressure of natural vapors at 20 ° C 5 bar
Pressure of natural vapors at 100 ° C 15bar

PROTENG AGRO TIR

A revolutionary automatic gas extinguishing system that serves the protection of larger enclosed engine rooms for agricultural machinery, buses, trucks and other motor vehicles and machines. On the road every day of the year several cars and other vehicles burn, not only because of an accident, but also often due to a bad technical condition of a vehicle. The Proteng AGRO TIR system is an original automatic extinguishing system that can protect your car from the start of a fire. At the moment of fire, the crew of the vehicle is in direct danger (people can not get out of the vehicle and burns) or one is in shock and acts short-circuited (you do not know how to use a fire extinguisher, the fire extinguisher can not be found, one opens the engine compartment and thereby neither stimulates the fire, it takes too long).

Proteng AGRO TIR is installed in the engine compartment and carries out the extinguishing process for you. It is a fully automatic system that does not depend on energy, operation or other aspects and protects you 24 hours a day and not only during driving but also during parking. A big advantage of this system is an exceptionally simple and flexible assembly.

The entire working principle is based on one polyamide hose with a diameter of 18 mm and a length of 400 cm in which the effective fire extinguisher FM200, with the exact name heptafluoropropane, is under pressure. At a normal temperature, up to 1000 g of extinguishing agent is stored in this relatively small space, thanks to a pressure of 5 bar. When heating up the environment by fire, the pressure is increased to 15 bar at a temperature of 100 ° C. The actual start of the system is activated by a temperature above 120 ° C when the softening polyamide wall of the hose exactly at the location of the highest thermal load bursts and the extinguishing gas is released into the room. This gas reliably and effectively burns the fire in the bud, during the extinguishing no electrical parts are damaged, nor during use. The entire system is fully automatic, requires no operation and starts immediately if it comes to a fire. The system protects you and your property 24 hours a day.

Technical parameters:

Weight Proteng AGRO TIR 1440 g

Weight of the extinguishing agent 1000g FM200 (Heptafluoropropane)

The material of the detection tube is polyamide

Dimensions of the tube: length 400 cm / diameter 18 mm

Pressure of natural vapors at 20 ° C 5 bar

Pressure of natural vapors at 100 ° C 15bar