A) General information

1. Introduction

According to the European Community standard 2037/2000, it is prohibited in Europe, to employ extinguishing equipment using halogenated hydrocarbons as an extinguishing agent other than for critical uses.

With regards to the high halon efficiency, it is not easy to find an equivalent substitution. One of them is the **Fixed aerosol extinguishing system FIRE JACK®**, which has already been on offer from the BESY CO Ltd. company (hereinafter only referred as BESY CO) for nineteen years.

The fixed aerosol extinguishing system FIRE JACK® – hereafter referred to as **AHZ FJ** - is an extinguishing equipment, which operates with an efficiency ten times higher than a halon equipment, when the amounts of extinguishing medium (expressed in kilograms) needed for quenching the same fires under the same conditions are examined. Moreover AHZ FJ has a number of other advantages compared to the water, foam, powder, and the gas extinguishing equipment used nowadays.

**Ideally, fixed extinguishing** equipment should be as simple and as effective as possible, mechanically and electrically as reliable as possible, and it should keep its extinguishing efficiency for a very long time, characteristics should not depend on ambient temperature, atmospheric pressure, eventually on other environmental influences.

A fixed extinguishing system should also be visually unobtrusive, should require the minimum of space for containers or control centres, should be easy to install and implement also during the investor’s operation, and should not be power consuming (in standby regime or during operation). It should be able to extinguish even after long-term outage of electric power, and should be easily controlled - ideally under permanent control in on-line regime – as well as easily maintainable with the highest possible resistance against operational errors by staff. At the same time, it should be as resistant as possible against damage, both intentional and unintentional.

**Extinguishing medium** for fixed extinguishing equipment should be easily transportable to the premises affected by fire should not be toxic – harmful to human health and environment, and should be inexpensive.

Considering that there is no ideal solution, the following table concludes advantages of the AHZ FJ:
AHZ FJ function parameter | Parameter value
---|---
Weight | Low
Efficiency | High
Maintenance | Minimal
Pipe distribution and terminal elements | No
Defective ability, inadvisability | Minimal
Residue after extinguishing | Minimal
Immunity against environmental influences | High
Installation visibility | Low
Containers, special premises for them | No
Construction adaptations | Minimal
Energy consumption | Minimal
Investor’s control over the system | Permanent
Extinguishing under voltage | Up to 22 kV
Disturbance of the investor during installation | Negligible

The electronic control system BEFIS® governing the AHZ FJ complies with all valid and applicable European technical standards EN 12094-1

The electronic control system BEFIS® together with fire detection devices and BR extinguishing aerosol generators represents simple and cost-effective fixed extinguishing system, which complies with all the valid and applicable European technical standards: P CEN/TR 15 276-1,2

2. Designation of AHZ FJ

AHZ FJ is designated above all for the protection of manufacturing plants in a wide range of industries, and particularly where it is impossible or unsuitable to use water for fire extinguishing. AHZ FJ can also be used for the protection of electrical distribution points up to 22kV, various manufacturing plants, warehouses, archives, garages, computing centres and also manufacturing plants where the explosive hazard is imminent.

3. AHZ FJ Functional principle and composition

AHZ FJ is an extinguishing system, which uses the so-called inhibitory effect of the extinguishing aerosol on fire flames. The basic components of AHZ FJ are the BR extinguishing aerosol generators - hereafter called only generators - that must be completed at the installation with a suitable initiator. The generators are pressure-less sheet-metal cylindrical vessel containing source mixture used to create extinguishing aerosol. This extinguishing aerosol is distributed from the generators exclusively to the protected premises affected by the fire.
The generators are fixed onto walls and, by means of fire-resistant cable, connected with electronic control system BEFIS®. **The extinguishing aerosol** is generated by the thermal decomposition of the source mixture, embedded into the generator at production.

The electronic control system BEFIS® was specially developed for generators state checking, reporting on various failures, communication with the detection equipment and with the central building control system, and for initiation of the generator network in the premises affected by fire. The electronic control system BEFIS® is equipped with a power supply, including backup power supply (accumulator batteries), so that it is able to function even in cases of power supply outage. The storage capacity of the accumulator battery is determined individually after agreement with the investor and with the Local Authority.

If there is not any detection device installed in the protected premises, or existing device does not meet requirements, eventually previous experience shows that it isn't sufficiently reliable, BESY CO can supply its own detection device.

**4. Advantages of AHZ FJ:**

**Installation** of the complete FIRE JACK® extinguishing system is simple, fast, and does not require any special tools - including scaffold, within the premises. Disturbance to the investor’s operation is minimal or none. AHZ FJ does not require special premises or other storage capacity for the extinguishing agent, nor pipelines for its distribution. Thanks to the sophisticated BEFIS® system, permanent state check of the whole equipment is possible, namely in cooperation with the superior system of the building. **The source mixture**, composed of pressed inorganic salts, is impregnated against environmental influence by organic resins, so that it does not lose weight or efficiency. In the common environment it has unlimited durability.

Neither the source mixture nor the extinguishing aerosol are toxic or harmful to the environment (ODP=0). Aerosol emission into the protected space when a fire arises is accompanied only by a small over-pressure, and a decrease in the oxygen content does not take place. After the fire, the thin film of settled aerosol is removed together with the sediment combustion products.

**B) More detailed technical information**

**1. Extinguishing**

**An extinguishing aerosol** is a phase heterogeneous mixture of ultra-fine extinguishing powder and inert gases, which expel the powder from the generators during thermal decomposition of the source mixture. Extinguishing aerosols have a significantly higher extinguishing efficiency than common extinguishing agents: common concentrations are between 50- 100 g/m³.
Thanks to its negligible material size, the aerosol hovers in the space for tens of minutes and for this entire time inhibits burning. Comparable to a gas extinguishing system, it is possible to install the AHZ FJ extinguishing system for efficient fire extinguishing in an enclosed area only where all its volume can be filled up. If there is air conditioning being used, either for hygienic or technological reasons, it will be shut down by the electronic control system BEFIS® before the start of any fire extinguishing.

Aerosol, similar to all other extinguishing agents (with the exception of water), hasn't a cooling ability. So, similar to other voluminous extinguishing agents, it safely extinguishes combustible liquid fires, while in the case of solid substances, it generally prevents flame combustion, and therefore prevents the spreading of fire to the remainder of the building. Fires involving solid materials are in this way controlled or extinguished.

Because fire extinguishing success of all extinguishing systems is generally dependent upon timely discharge of the extinguishing medium, it is necessary to pay attention to the design of the automatic fire detection system while considering specific circumstances in the investor's premises.

2. Extinguishing aerosol generators

At present BESY CO can supply three generator types. All are manufactured from steel sheet of a standard quality and fitted with three coats of paint. Where the generators are to be installed in a corrosive atmosphere, they are delivered made of corrosion-resistant steel sheets.

BR1 and BR2 type generators are specified for installation into premises with no explosive hazards. For installation into a potentially explosive atmosphere, the generator BR4 was developed, which can be placed into zone 2 according to parameters of the certificate: Ex II 2 G 194°C

BR 1 generators are specified for premises protection. It is possible to assembly them into sets of up to five pieces, and they are usually hung onto a simple steel construction put on the premises wall.

BR 2 generators are specified for protecting technological areas, where they stand freely in a suitable place, or hang similarly to BR1. They are not adapted for assembly into sets.

BR 4 generators can be installed in rooms where a hazardous explosive atmosphere may arise, the danger of explosion equal to, or less than the afore-mentioned parameters of the certificate Ex II 2 G 194°C. They are not adapted for assembly into sets.

Generators are characterised by their nominal extinguishing ability, which for all generator types amounts to 50g/m3 of the extinguishing aerosol, namely for extinguishing combustible liquids or localised solid substance fires. If there are leakages in the particular protected space that cannot be closed in the case of fire, or protected space is of extraordinary
configuration, it may be necessary to increase the aerosol concentration and the required number of the generators is determined by the project after a detailed calculation.

The following simple table shows the nominal extinguishing ability to the nominal protected volume.

<table>
<thead>
<tr>
<th>Generator type</th>
<th>Weight (kg)</th>
<th>Diameter D (mm)</th>
<th>Height h (mm)</th>
<th>Nom. protected volume (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BR 1</td>
<td>3.7</td>
<td>D = 162</td>
<td>h = 113</td>
<td>20</td>
</tr>
<tr>
<td>BR 2</td>
<td>1.2</td>
<td>D = 92</td>
<td>h = 88</td>
<td>4</td>
</tr>
<tr>
<td>BR 4</td>
<td>7</td>
<td>D = 180</td>
<td>h = 334</td>
<td>20</td>
</tr>
</tbody>
</table>

The generator is put into operation by the initiator, which is assembled during installation.

3. Initiators

The initiators are sources of initial warmth for the source mixture thermal decomposition. An electrochemical initiator is triggered into operation by an electrical pulse from the electronic control system BEFIS®. A thermo-chemical initiator is triggered into operation by the external source of heat, e.g. fire flame.

4. Automatic electronic control machines

4.1 Electronic control system BEFIS®

Both hardware and software for the electronic control system BEFIS® were developed with regard to the highest immunity against outside sources of electromagnetic disturbances and other environmental influences. The solution of BEFIS® at the same time ensures maximum immunity against faulty manipulation. It is secured by the software, that under no condition will a false triggering of generators take place owing to both an internal fault of an electronic control system BEFIS® and an operator error.

As standard, the electronic control system BEFIS® comprises of BAK control station and ESA releasers. The final composition of the BEFIS® is always designed individually according to needs of the investor.

The electronic control system BEFIS® may be activated by both a fully automatic fire detection system, and by a manual operating device – usually implemented as a button under a protective glass.

It is also possible to monitor the state of AHZ FJ on Control panel Fire alarm which controls other building technical equipment. In this case, the state of AHZ FJ is displayed graphically as a diagram of the specific installation. It is also possible to monitor the state of AHZ FJ via the Internet.
For each protected premises, a number of BAK stations are installed, proportional to the quantity of installed releasers. BAK stations are technically implemented as boards with a microprocessor and other electronic parts. They are equipped with a connector, by which they are inserted into the baseboard, so that they may be repaired with simple replacement. The baseboard is a printed circuit board with separate power supply, terminal block for connecting external cables, bases for BAK stations, and a connector for a service notebook.

BAK stations together with baseboards create the units, which are concentrated into steel switchboards, completed with a 24V DC source and an accumulator. One BAK station is able to send orders for fire extinguishing to up to eighteen connected electronic releasers for generators in the protected area. If there is a need for a specifically large protected area, with a large number of generators, the stations are grouped into two or more elements (these groups are called operators).

ESA electronic releaser is a simple electronically addressable device that is the source of the necessary electric pulse for the initiator activation. The releaser also permanently checks the initiator connection and its state. Part of the releaser is also the sensor for the ambient temperature.

Communication: all control blocks and all of the electronic releasers communicate together through a two-wire cable via RS 485 line. The electronic control system BEFIS® communicate with the external environment through binary signals. It is especially concerned with receiving signals from fire detectors, signals from the manual buttons, and sending signals to interrupt the operation of air conditioning and other technical processes.

5. Detection device

The detection device is composed of an automatic detection system completed with automatic fire detector. An autonomous aspiration system or autonomous linear thermal system can also be used. For automatic initiation of AHZ FJ the fire signals from at least two detectors of diverse types on two separated lines are always required.