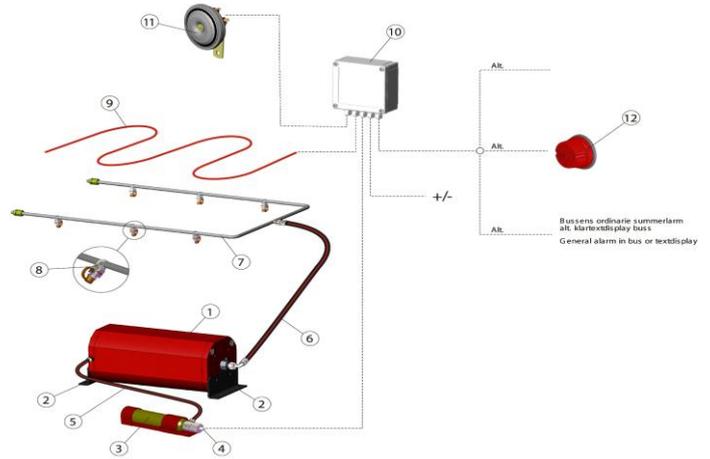




## Why Dafo's Fire Fighting Systems?



DAFO have been developing and installing fire fighting systems for more than 30 years and tested a huge range of detection methods, different extinguish agents and containers. Behind the DAFO extinguishing system that we now offer to you today, are many years of experience. We have made many extinguishing tests that have taught us how the conditions in the hazardous area affects our extinguish products.

Our robust system is adapted to endure high demands in surroundings with a lot of vibration and huge temperature changes, and chemical and mechanical strain.

The discharge time for the container is approximately 20 seconds. To beat the fire it takes mostly less than one second.

Sometimes customers only look at the price when acquiring fire fighting systems and this is understandable. But there is need to look further as well. If the fire fighting system creates trouble and the vehicle is ending up in the work shop, it will create more costs. Therefore it is important to look at the technical qualities of the system.

Please invest some minutes to take a look at the:

### Benefits of the Dafo System

- Robust detector line
- Effective extinguishing agent
- Pressure less container
- Easy maintenance
- Independent system
- Following Swedish guideline SBF 128 + 127
- TÜV and other approvals
- Prefabricated system kits

## Robust Detector line

In the 90:s we used a system with name "Fire trace" (pressurized hose as if fire, breaks, release of pressure and activate the extinguish system). After installing thousands of systems we stopped using this kind of detection, because the plastic hose is too sensible for the tuff engine environment. All vibration, heat and chemical influences create cracks in the plastic material. Very often we lost the pressure in this pipes and a false release was the result.

Since approx 10 years we use a line detector.

The line detector is a twisted cable that when heat is 180°C it will release the system.

This way to detect the fire is very reliable and reduces the risk for unwanted release of the system.

The line detector have a good resistant against vibration, temperature variation, normal high working temperature of the engine and chemical influences as comes from diesel, oil also.



## Effective Extinguishing Agent

There are lots of possibilities to use extinguishing agents for engine compartments. But in the end there are several requirements!

The used agent should:

- Be effective
- Have a strong cooling effect
- Prevent re-ignition
- Be non corrosive
- Have an impregnating effect
- Be environment friendly
- Have freeze protection
- Be easy to clean up
- Be certificated



Forrex includes all these qualities!

Forrex is an extinguishing liquid – especially developed to beat fire in engine compartments.

Forrex have basically same function as water fog, but in addition to this you get a very good protection against re-ignition, because of the

extraordinary good cooling effect, the impregnating and film forming effect.

To put out the fire in the air (by pushing away the oxygen) is one task, but really important as well is, to cool down overheated engine parts.

Difference between Water fog and Forrex:

**Water fog** is effective to put out the fire in by pushing away the oxygen and cooling the air in closed areas. Water fog is – comparable to gas - sensitive to ventilation.

**Forrex** do basically the same, but because of the little bit bigger drops, the agent reach the hot parts more effectively.

Especially in areas with hot climate is this cooling effect really important.

## Pressure less Container

In former times we were using pressurized container (likely hand portables hand extinguisher). But our experience is, that those pressurized container easily loose pressure because of the harsh engine conditions as for example temperature variations and vibration.

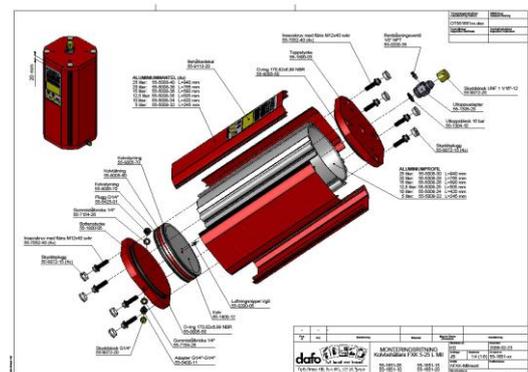
To reduce problems and rich a higher step of reliability, we developed a pressure less extinguishing agent container.

To press the extinguishing agent out of the piston container, we use cartridge with the propellant gas Nitrogen. This cartridge is sealed with a metal membrane. No manometer control I necessary, because the gas is either in the cartridge or the extinguishing system is triggered. The nitrogen cartridge is unsensitive for vibration and temperature changes.

Our pressure less extinguish container makes maintenance, service, re-fill and repair of the system very easy. The extinguish agent is very suitable for countries with a hot climate. There is no risk when the container is exposed to sun. Furthermore there is no risk of reduce of pressure in the container because it is a pressure less container and therefore it is possible to place the container in any position.

Benefits of a pressure less Container:

- Especially suitable for countries with hot climate
- High reliability (no lost of pressure)
- Maintenance friendly
- Personnel safety
- Easy to refill on site



## Easy Maintenance

After many years developing the system have become more simple, more effective and easier to handle.

This had a positive effect even on the maintenance.

The first 4 years you have nothing to change on the system, except the backup battery in the control unit.

This first 4 years you only have to check the system after the maintenance protocol. For this check you need no special tools and it takes not much time.

After 4 years the electronic activation pin has to be changed.

After 10 years, the propellant cartridge and the piston in the container has to be changed. We recommend changing the extinguishing agent in connection with this procedure.

## Independent System

The Dafo system is an independent system.

As we using a battery backup, the system still will be active, even if the vehicle battery is not working or removed. The extinguish system is in that way completely independent of the bus electrical or mechanical system.

But nevertheless we connect the system directly to the vehicle battery before the main switch, because:

- To have a possibility to activate acoustic and optical alarm, even when the main switch is off. This is important in case the vehicle catch fire when it is parked in the depot and the main switch is off. People get attended and can react as necessary.
- To create an even higher security and not only relies on the battery back up in the control unit.

Power consumption when attached to the bus battery is 15 mA.

## Following Swedish Guideline SBF 128 + 127

We always follow the Swedish guidelines for extinguishing systems on vehicles SBF 128 and SBF 127.

This guideline contains all details about:

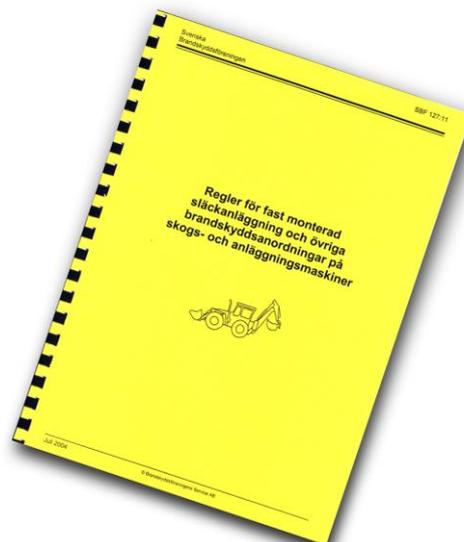
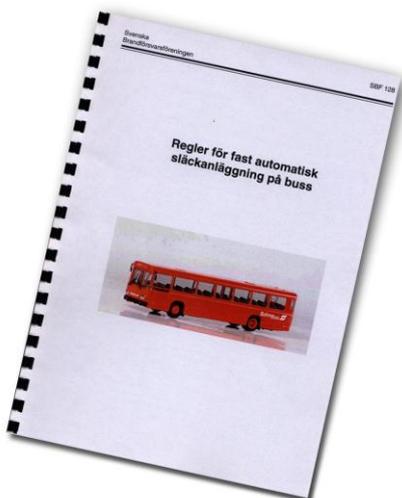
- how to design a extinguishing system
- how many extinguishing agent to use
- how to do extinguishing tests
- how to do maintenance

For example:

All Dafo systems are calculated with right amount of extinguish agent – according to Swedish guidelines SBF 128, 3L for each m<sup>3</sup> engine compartment space.

It means, for the most vehicles you need around 12 to 15l extinguishing agent. But if it comes to countries with hot climate, we often use even more liquid (20l), to ensure a 100% cooling effect on all hot engine parts. Cooling down the hot parts effectively is important to avoid re-ignition.

By not following this Swedish standard (by using less extinguishing agent) means, that you sometimes can get a cheaper system that needs less space and are a bit lighter – but at the same time you will get a system that is not as reliable and secure according to SBF standard. If you want an optimal designed extinguish system, you should follow the Swedish recommendation. Those recommendations are based on a high degree of experience and knowledge.



# TÜV and other Approvals

The Dafo System is approved by certain certification bodies and tested in many fire extinguishing trails.

Some of the approvals:

- TÜV (system approval achieved by TÜV Nord)
- SBF (Swedish Fire Fighting Organisation leaded by Swedish insurance companies) → SBF created the well known and accepted guideline for extinguishing systems on vehicles SBF 128 and SBF 127
- VdS (this approval is still under process)
- SP (Swedish Approval Organisation)
- MPA (Approval of the extinguishing agent Forrex)
- SWEDAC (Accredited Laboratory – EMC test)
- SWEDAC (Accredited Laboratory – Vibration test)
- CE marking
- ISO certification

The extinguish system has been tested and verified under real conditions and many of those tests has been documented.



**EXPERT OPINION**  
concerning the suitability of the  
DAFO Forrex FX-K system  
for suppressing fires in engine compartments  
of motorbuses (KOM)

Client:  
DAFO BHAND AB  
Radiövägen 20  
SE - 135 26 Tyreso

Commission-No.: Beställning TUF 070419

This document has been prepared by our expert:  
Dipl.-Ing. Volker Thiel  
TÜV NORD Systems GmbH & Co. KG  
Technical Center  
Competence Center for Fire Fighting  
Große Bahnstraße 31, D-22525 Hamburg  
Phone: 0049 40 8557 2323  
File-No.: 6937BS53170

Hamburg, November 19, 2007



<small>© TÜV NORD Systems GmbH &amp; Co. KG TÜV NORD Systems GmbH &amp; Co. KG Große Bahnstraße 31 D-22525 Hamburg Phone: +49 (0) 40 8557 2323 Fax: +49 (0) 40 8557 2324 www.tuev-nord.de</small>	<small>TÜV NORD System GmbH &amp; Co. KG Dipl.-Ing. Volker Thiel Am Ende der Straße 10 D-22525 Hamburg Phone: +49 (0) 40 8557 2323 Fax: +49 (0) 40 8557 2324 www.tuev-nord.de</small>	<small>TÜV NORD System GmbH &amp; Co. KG Dipl.-Ing. Volker Thiel Am Ende der Straße 10 D-22525 Hamburg Phone: +49 (0) 40 8557 2323 Fax: +49 (0) 40 8557 2324 www.tuev-nord.de</small>	<small>© TÜV NORD Systems GmbH &amp; Co. KG TÜV NORD Systems GmbH &amp; Co. KG Große Bahnstraße 31 D-22525 Hamburg Phone: +49 (0) 40 8557 2323 Fax: +49 (0) 40 8557 2324 www.tuev-nord.de</small>
---	---	---	---

8/2014 1.06.11

## Prefabricated System Kits

Producer of vehicles can choose to buy our extinguishing system as prefabricated kit for each model.

According to customers it has been obvious that it is an advantage to buy prefabricated fire extinguish system.

We will visit you and do prototype installation for different kind of vehicle models. We will also document all those installations so we can set an article number that is connected to a special vehicle type.

When you later order a system, all you need is to provide us with the article number and the system will be delivered individual packaged with all components marked. With the included documentation it will be very easy to install the extinguish system in production.

Changes because of new vehicle types or changes in old vehicle type can then be done by any of your assemblers. Then you just inform us of the changes and we can continue to deliver an extinguish system that fit your special vehicle type.

Prefabricated systems saves times, reduce the risk for installation problems and minimize the numbers of components that makes the installation part more easy and perspicuous.

Preinstalled system is a little more expensive to buy, but in the end it will be cheaper for the manufacturer of the vehicle due to less installation costs.

Advantage with prefabricated kits:

- Low risk for installation faults → always the same design guarantees functionality and spare parts available.
- No need to put all small components together → save time
- As few components as possible → smaller risk that parts will disappear
- All components are marked → easy to install
- Documentation follows with all system → assemble after attached drawing plan → save time
- Individually packed – box beside the vehicle - the right amount of components are ready to use in the box → save time



## Dafo -Think smart, think safe!

By choosing Dafo Extinguishing System you decide to protect your vehicle, people, your customer's interests and the environment with a reliable fire fighting system that works in different climatic areas.

## Dafo - Nothing is left to chance!



Dafo Brand AB  
Box 683  
135 26 Tyresö SWEDEN  
Phone: +46(0)150-181 21  
Mobile: +46(0)70-620 21 07  
Fax: +46(0) 150-336 20  
walle.andersson@dafo.se