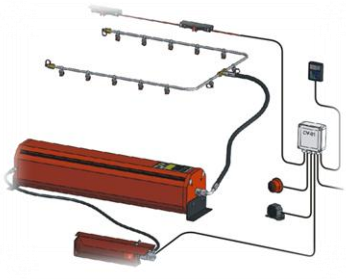
FORREX Suppression system


CEO
Administration Quality & Environment
Design Dept CAD
General Fire & Safety Products
Fire & Rescue Equipment
Fixed Installations
Training & Service
SKUMSLÄCKARE
TITAN EXTRA
TITAN 42mm
TITAN 76mm
SBA

Service & Maintenance



Agenda

1. Fire protection
2. Function
3. Requirements & Approvals
4. Components
5. Service & Maintenance
6. Recharge
7. Handover

1. Fire Protection

1. Fire Protection

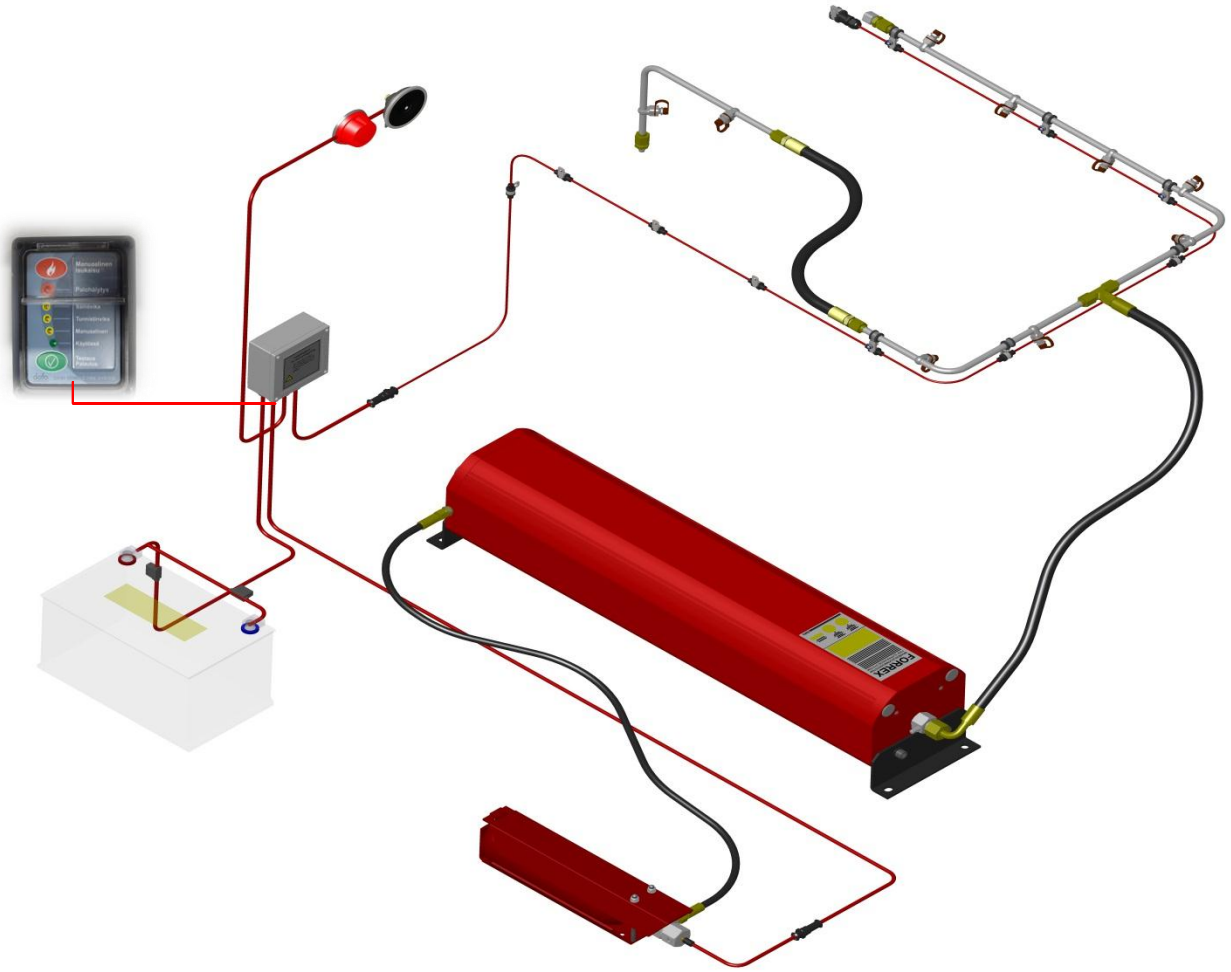
- **Protect people, property, business…**
- **Number of fires in vehicles at a daily basis**
- **General safety knowledge**
- **Care of the enviroment**
- **Demands from insurance companies**

1. Fire Protection

- **Financial effects**
- **Secure Production**
- **Reduce risk of business interruption**

2. Function

- **Custom made, using proven components, meets demands of authorities and insurance companies**
- **Manual, semi automatic or fully automatic systems**
- **Dafo Forrex systems use a wet chemical which is easy to clean after activation**
- **Operational temperature down to -30° C/-22 F**
- **System size from 5 up to 200 liters**
- **6 different agent tank sizes**
- **Can be combined with CO_2 systems**

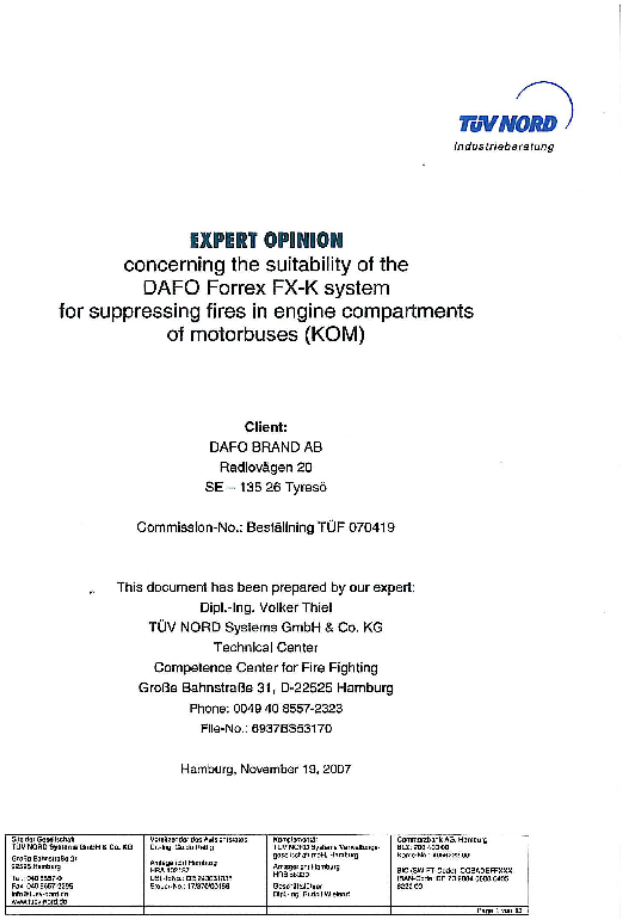


2. Function

- **In case of a fire the system will make visual and audible alarm**
- **The driver can actuate the system manually if needed**
- **When actuated (manually or automatically) the agent tank will be pressurized from the cartridge and the agent will be distributed through the pipeline and the nozzles to the protected area**
- **Release time appr. 20-40 seconds**
- **Extinguish the fire usually in 1 second**

3. Requirments & Approvals

- **FK 127:2011-4(fin) SBF127(swe)**
- **ECE 10.3 EU standard for vehicles in traffic**
- **TÜV / VDS**
- **Russia N 123-03**
- **EN 60529**
- **EN 60068-2-64**
- **EN 10305**
- **EN 853**
- **97/23/EY**
- **FM (expected in March 2013)**



TÜV NORD
Industrieberatung

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

Client:
DAFO BRAND AB
Radiovägen 20
SE – 135 26 Tyresö

Commission-No.: Beställning TÜF 070419

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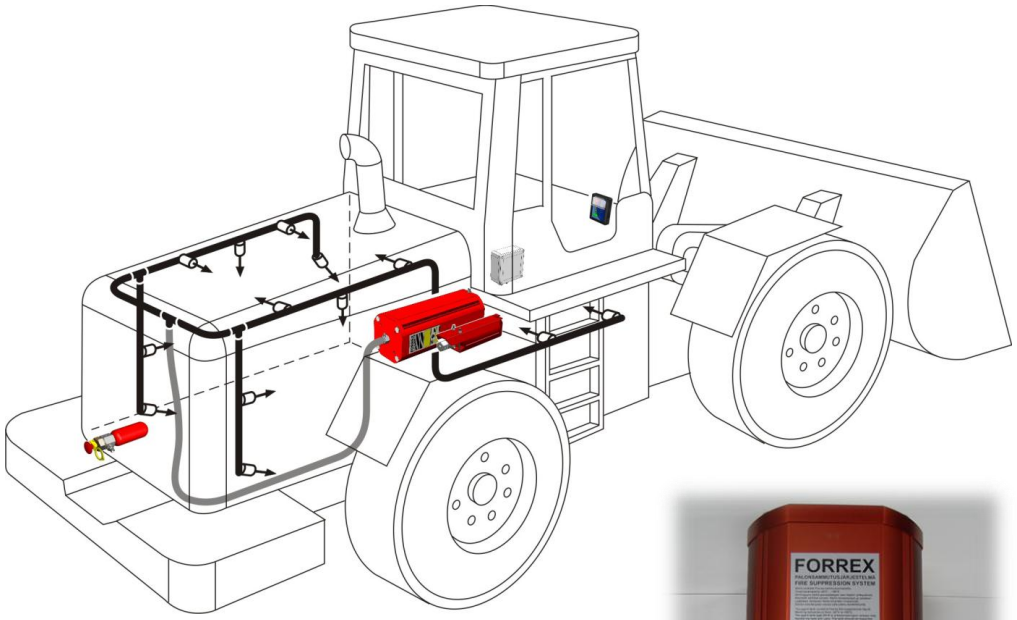
File-No.: 6937BS53170

Hamburg, November 19, 2007

3. Requirements & Approvals

- **All systems need to be tested and approved**
- **Extinguishing agent (wheel loaders, forrest machines, forklifts): minimum 3 liters per protected m^3**
- **Extinguishing agent (chip machinery/crushers): 6 litres per protected m^3**
- **The system must release min. 80% of the agent in 20 seconds (systems calculated for 3 litres/m^3)**
- **Maintenance interval every 12 months or by local requirements**
- **Should be protected from frost down to - 30° C**
- **The nozzles should be approved according to flow, angle and throw distance**
- **For approval validity, only orginal parts shall be used**

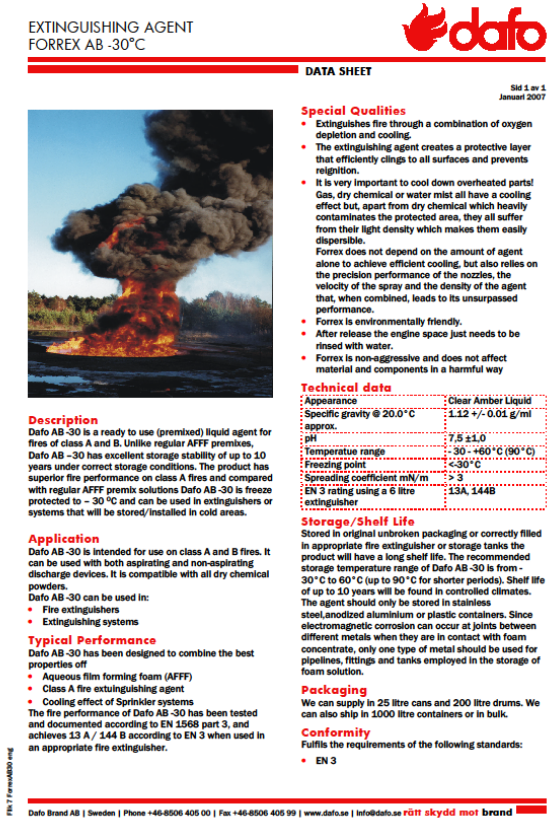
4. Components



Forrex - makes the difference

4. Components - Wet Chem Agent

- **Forrex AB -30**
- **EN3 (1568 part 3) approved**
- **Specific gravity 1.12kg/liter**
- **Lifetime: 10 years**
- **Biodegradable**
- **Certified**



EXTINGUISHING AGENT
FORREX AB -30°C

dafo

DATA SHEET

Sid 1 av 1
Januari 2007

Special Qualities

- Extinguishes fire through a combination of oxygen depletion and cooling.
- The extinguishing agent creates a protective layer that efficiently clings to all surfaces and prevents reignition.
- It is very important to cool down overheated parts! Gas, dry chemical or water mist all have a cooling effect but, apart from dry chemical which heavily contaminates the protected area, they all suffer from their light density which makes them easily dispersible.
  Forrex does not depend on the amount of agent alone to achieve efficient cooling, but also relies on the precision performance of the nozzles, the velocity of the spray and the density of the agent that, when combined, leads to its unsurpassed performance.
- Forrex is environmentally friendly.
- After release the engine space just needs to be rinsed with water.
- Forrex is non-aggressive and does not affect material and components in a harmful way

Technical data

Appearance	Clear Amber Liquid
Specific gravity @ 20.0°C approx.	1.12 +/- 0.01 g/ml
pH	7,5 ±1,0
Temperatue range	- 30 - +60°C (90°C)
Freezing point	<-30°C
Spreading coefficient mN/m	> 3
EN 3 rating using a 6 litre extinguisher	13A, 144B

Description

Dafo AB -30 is a ready to use (premixed) liquid agent for fires of class A and B. Unlike regular AFFF premixes, Dafo AB –30 has excellent storage stability of up to 10 years under correct storage conditions. The product has superior fire performance on class A fires and compared with regular AFFF premix solutions Dafo AB -30 is freeze protected to – 30 °C and can be used in extinguishers or systems that will be stored/installed in cold areas.

Application

Dafo AB -30 is intended for use on class A and B fires. It can be used with both aspirating and non-aspirating discharge devices. It is compatible with all dry chemical powders.
Dafo AB -30 can be used in:

- Fire extinguishers
- Extinguishing systems

Typical Performance

Dafo AB -30 has been designed to combine the best properties off

- Aqueous film forming foam (AFFF)
- Class A fire extuinguishing agent
- Cooling effect of Sprinkler systems

The fire performance of Dafo AB -30 has been tested and documented according to EN 1568 part 3, and achieves 13 A / 144 B according to EN 3 when used in an appropriate fire extinguisher.

Storage/Shelf Life

Stored in original unbroken packaging or correctly filled in appropriate fire extinguisher or storage tanks the product will have a long shelf life. The recommended storage temperature range of Dafo AB -30 is from -30°C to 60°C (up to 90°C for shorter periods). Shelf life of up to 10 years will be found in controlled climates. The agent should only be stored in stainless steel,anodized aluminium or plastic containers. Since electromagnetic corrosion can occur at joints between different metals when they are in contact with foam concentrate, only one type of metal should be used for pipelines, fittings and tanks employed in the storage of foam solution.

Packaging

We can supply in 25 litre cans and 200 litre drums. We can also ship in 1000 litre containers or in bulk.

Conformity

Fulfils the requirements of the following standards:

- EN 3

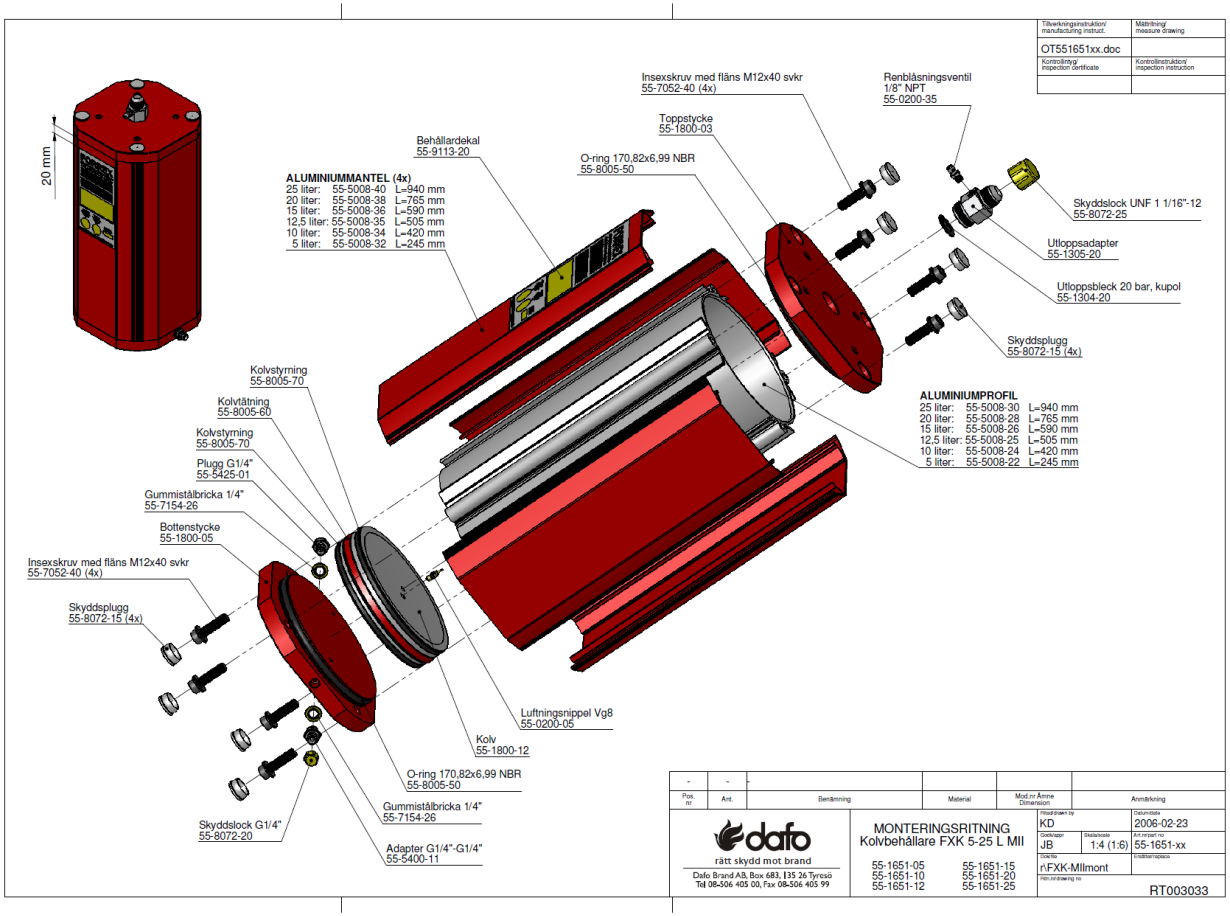
Dafo Brand AB | Sweden | Phone +46-8506 405 00 | Fax +46-8506 405 99 | www.dafo.se | info@dafo.se rätt skydd mot brand

"Extinguish process based on film coating, impregnating and cooling properties. Protects against reignition."

4. Components – Agent tank

- **Type SV-K**
- **Aluminum**
- **Patented**
- **Working pressure 20 bars**
- **Sizes from 5 to 25 liters, can be multiplied**
- **Un-pressurized**
- **Horizontal or vertical positioning**
- **Service and maintenance friendly**

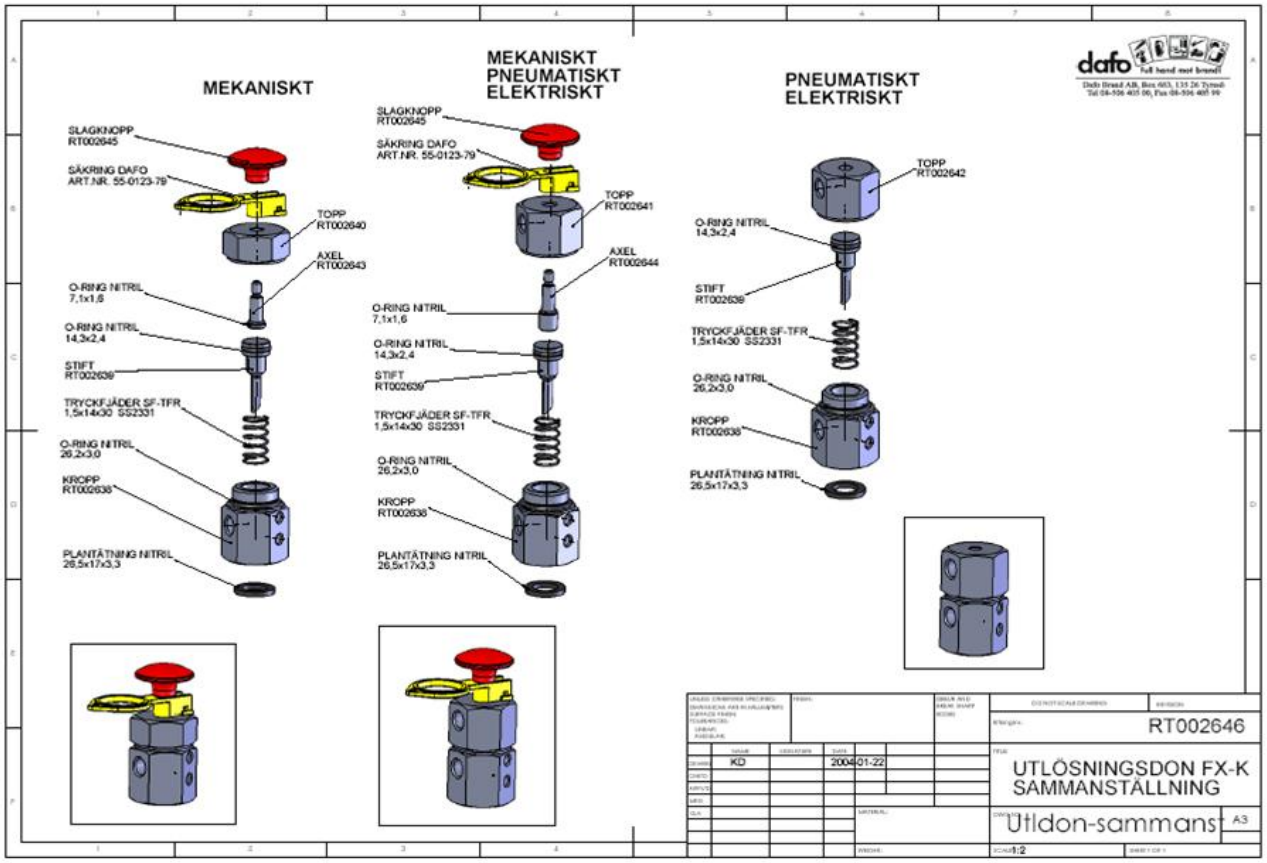
4. Components – Agent tank



4. Components – Release mechanism

- **3 different versions;**
  - **mechanical**
  - **pneumatic/electric**
  - **mechanical/pneumatic/electric**

4. Components – Release mechanism

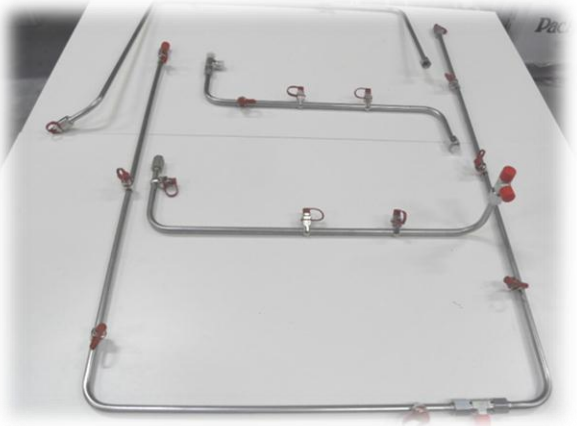


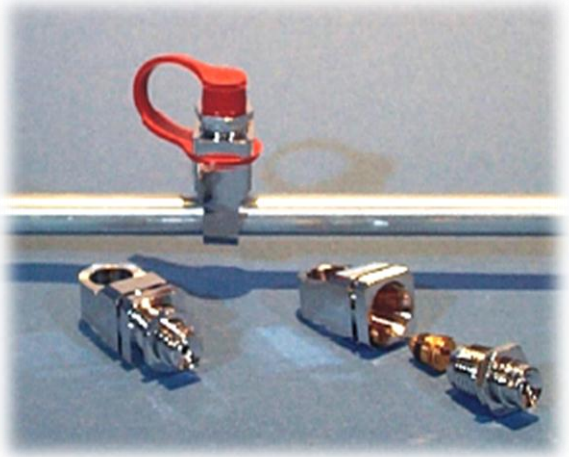
3. Components – Cartrigde

- **Pressure vessel, handle with care!**
- **Propellant – Nitrogen N_2**
- **Pressure 124 - 145 bar**
- **Different sizes**
- **Pressure test every 10th year (EN pressure vessel directive)**

4. Components – Distribution piping & Nozzles

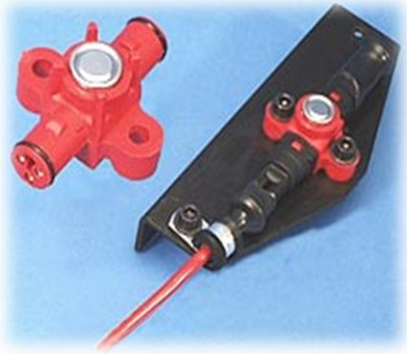
- **Stainless steel 12x1mm**
- **Total length of max. 20 meters**
- **JIC connections**
- **Number of nozzles depends on agent tank volume (see design manual)**

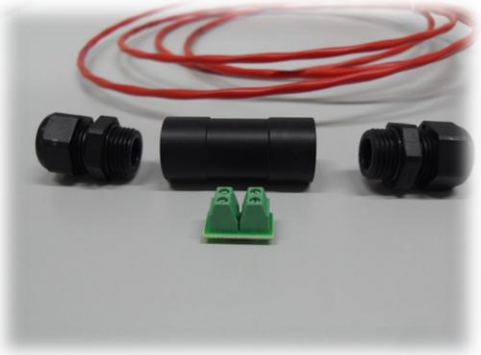




4. Components – Detection

- **Two (2) options; *spot detection *linear detection**
- **Temperature range from 60-186° C/140-366 F**
- **Supervised circuit**
- **Number and/or type of detection will be chosen based on the protected area (see design manual)**





4. Components – Control panel

- **Located in cabin or protected area**
- **5 leds indicates system status**
- **Two (2) push buttons *Activate system *Test/Reset**
- **Protective cover over actuation button**
- **Different lanquage options**

4. Components – Control unit

- **Controls & operates system**
- **Microprocessor controlled**
- **Voltage 12-30 VDC**
- **Consumption 25 mA**
- **Colour coded plug-in connections**
- **IP 69K classified**

5. Service & Maintenance

5. Service & Maintenance - Safety

Warning! During service, use personal safety protection goggles

Warning! Cartrige are high pressured cylinder, handle with care

Caution! Pressure vessels (cartridge) must always be handled with the protective cap installed

Caution! Before any welding, and/or auxiliary start-up, the control unit must be disconnected

Caution! Service must be followed in the consecutive order, according to the test protocol and service instructions

5. Service & Maintenance - Safety

Note! Service and repairs may only be performed by authorized personnel using parts and equipment for the applicable system

Note! Some service action will activate alarms

Note! Testing of system may only be performed by test unit

Note! Secure safe working conditions

Before service of semi-automatic systems (at control panel)

Check which devices change system to the manual mode

This can be connected to:

- **Main switch**
- **Parking brake**
- **Ignition key**
- **Seat sensor**

Before Service (at control panel)

1. **Check green LED is on**

2. **Switch system to manual mode (if that is an option)**

3. **Press Test/Reset button at least 1 second and check that all LEDs ligth up and the fire alarm will activate**

Checking function of control unit

1. **Disconnect the connector from actuator (squib) cable. Disconnect the detector cable connector (blue) from the control unit**

2. **Check control panel that ”fault detector” and ”fault actuator” LEDs are on**

3. **Connect test unit cables to the control units cable in following order:**

   - Blue connector to control unit´s connection (blue ring)
   - Blue connector to detector cable´s connection
   - Test unit connector to actuator (squib) cable
   - If needed use adaptercable (pn. 55-1742-02)

Checking function of control unit

4. **Check that LEDs for ”fault actuator” and ”fault detector” are NOT activated on the control panel.**

5. **Connect multimeter to test unit and measure resistance in the circuit. The resistance should be 1.8 kohm (double detection line 2x5.6kohm=2.8kohm) Check that there are no connection between either pole and ground of the machine**

6. **Press the test unit´s button at least 1 second to check function of the system. One of the two red LEDs on the test unit should flash. On the control panel green LED ON should be on and red LED ”Fire Alarm” should flash.**

Checking function of control unit

7. **Reset system with TEST/RESET button on the control panel**

8. **Push activation button (red) at at least 1 second and check that the red LED on test unit will activate. Reset by pushing green TEST/RESET button.**

9. **Disconnect red connector for five (5) seconds and reconnect it. Check control panel that only green LED is on**

7. **Close the protective cover on the control panel and seal it**

Checking and Inspection of Agent Tank

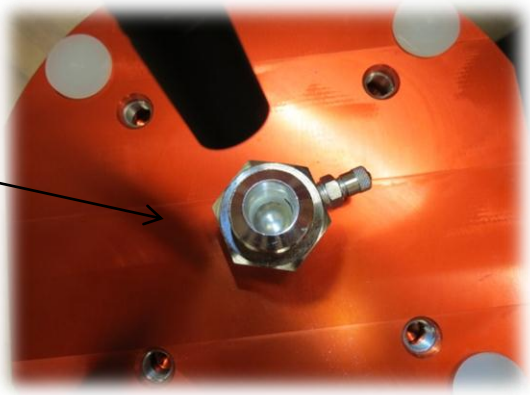
11. Inspect agent tank visually for any damage. Damaged tank shall be replaced.

The agent tank is marked with manufacturing year and volume. At an age of 10 years, revision of tank should be performed (see recharge and revision instruction).

Checking and Inspection of Agent Tank

12. **Remove the outlet hose connection from top of tank.**

13. **Check that burst disc is not damaged and is leakage free.**



Checking and Inspection of Agent Tank

14. Disconnect propellant gas hose at the bottom of the agent tank and check that agent does not flow out and there is no leakage.

Note; a small amount of agent may remain after filling.

Checking Nitrogen cartrigde and Release Mechanism

15. **Remove Nitrogen cartrigde and release mechanism by loosening the hoses and clamps**

16. **Unscrew cartrigde from release mechanism and install protection cap**

NOTE: protection cap should always be installed when cartridge is handled

17. **Check that weigth of cartrigde corresponds to the weigth stated on the label. Max, deviation is – 14 grams.**

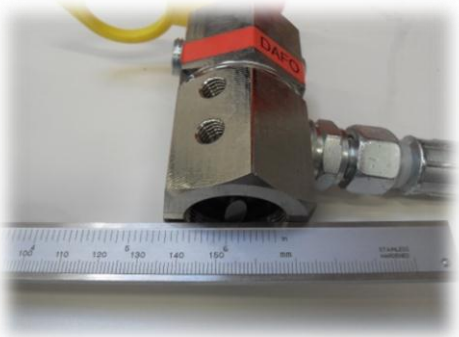
The cap weigth is 20grams and should be added to cartridge weigth.

Checking Nitrogen Cartrigde and Release Mechanism

18. **Dismantle the release mechnism. Clean and lube the gaskets with waterproof vaseline**

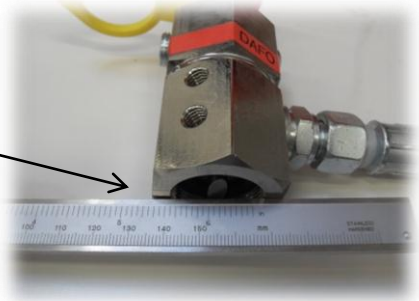
19. **Assemble the release mechanism**

20. **Check the level of the puncture pin tip. The measurement shall be in line with sliding calibers +/- 1 mm from the egde of mechanism**



Checking Nitrogen Cartrigde and Release Mechanism

21. **Check the level of the puncture pin tip. The measurement shall be in line with sliding calibers +/- 1 mm from the egde of mechanism.**



22. **Check that pulling pin (yellow) is unbroken and put a new tag on it.**

Checking Detection circuit

23. **Visually inspect the detectors/detectionline for any damage. In case of damages, replace items**

24. **Check that at all detectors or linear detector are clean , clean it**

Checking Detection circuit

25. **Check that all connections are tight and corrosion free, replace if necessary.(Note; secure that all connectors are tight and that all washers under clamps will be at place.)**

26. **Clean and check that O-rings are damage free, lube it with waterproof vaselin.**

27. **If system equipped by linear detection , check that minimiun radius is not exceeded**

NOTE; Checking function of control unit also confirm operational condition of detection circuit.

Checking central unit CV-01 BK

Addition while using spot detector type BD-P

Using spot detector type BD-P

Connect multimeter with the buzzer connected.

Heat a detector at a time and check that the buzzer on the multimeter is activated.

All detectors shall be tested.

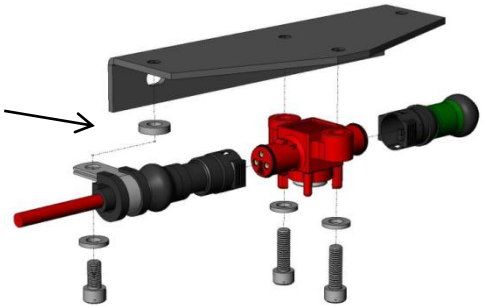
NOTE! Cigarette lighters can not be used!

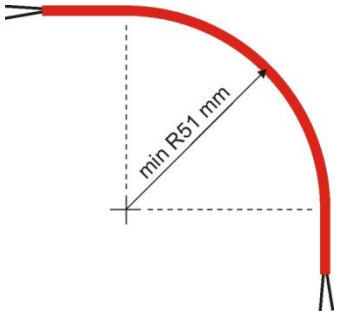
Check that all detectors are free from any damage and that clamps are mounted on the wire.

Checking Detection circuit

Detector must be dust free

Spot detector installation need to be complete with all washers





Minium radius for linear detection wire

Note; see installation manual

Checking Distribution system & Nozzles

28. **Inspect hoses , pipelines and nozzles for any damage.**

29. **Check that all nozzles are equipped with protective caps**

Checking Distribution system & Nozzles

30. **Connect air hose to the outlet hose from agent tank**

31. **Start blowing and check that all protective caps comes off from nozzles. Check that flow is satisfactory in all nozzles. If needed, remove nozzles and clean them.**

32. **Follow distribution line and check that there are no leakage or cracks on hoses and pipes**

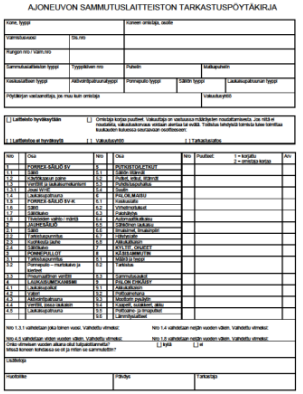
33. **Reinstall protective caps**

Checking Signs and Labels

34. **Check that all signs and labels are in a place and that they are readable**

35. **Put on an actual service sticker**

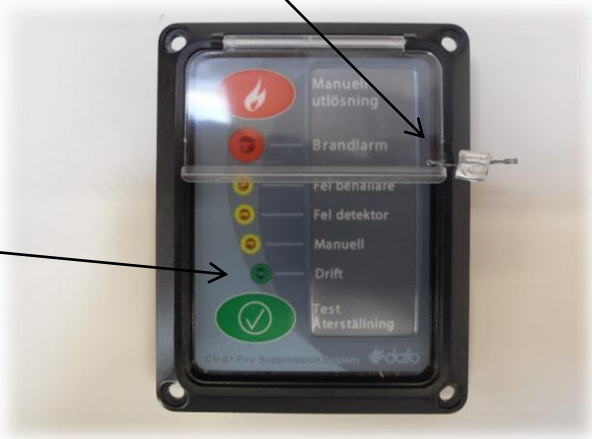
Finishing


AJONEUVON SAMMUTUSLAITTEISTON TARKASTUSPÖYTÄKIRJA

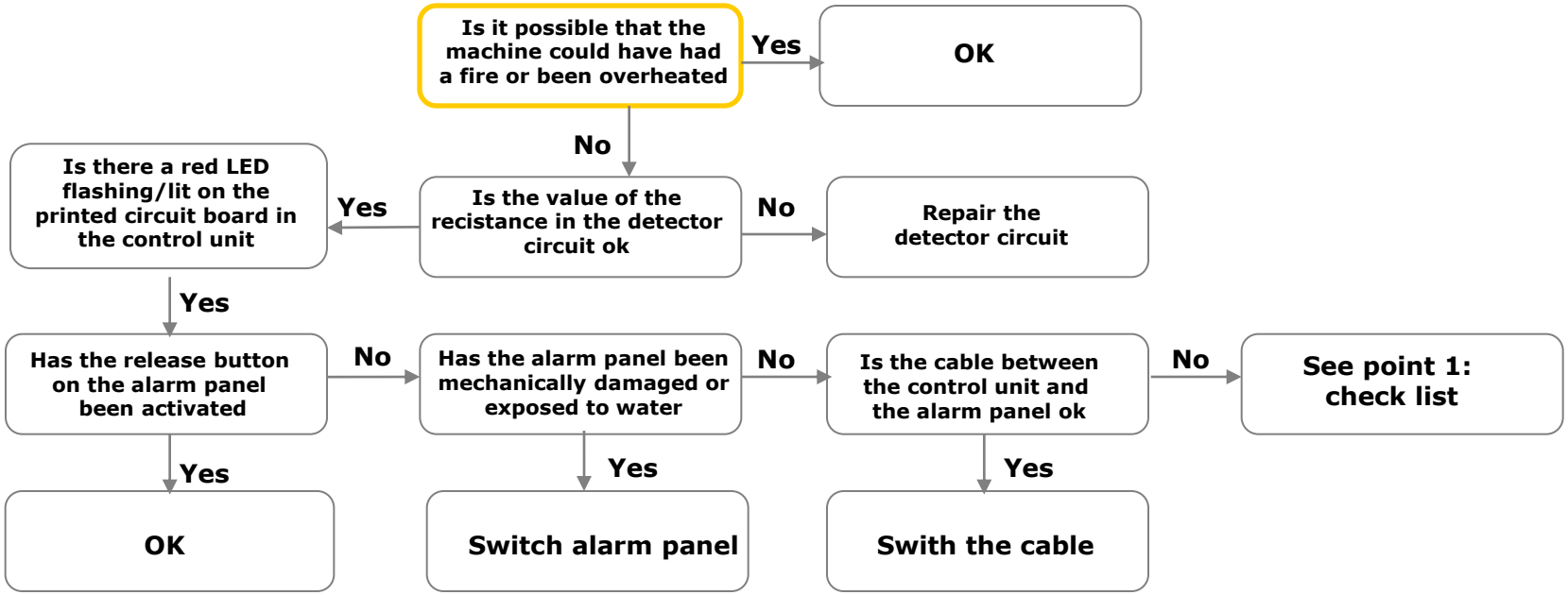
36. **Fill in service protocol, give copy to the machine owner**

37. **Check that safety pin and control panel are affixed by seal**

38. **Check that control panel green LED is on**



Flow chart for error processing for released system
1. The system did alarm at system release

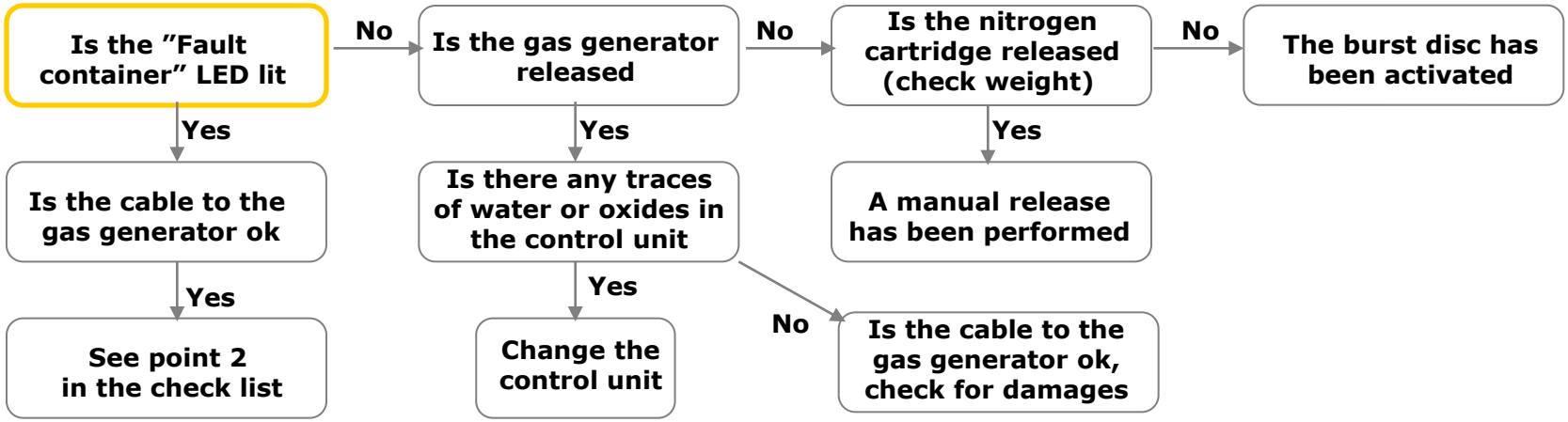


1: If the system has released with an alarm there are two options:

1:1 The control unit has recieved an alarm from the detector circuit due to mechanical damages or moist. On the CV-01 B there is a flashing red LED on the printed circuit board (not valid for CV-01 A).

1:2 The control unit recieves a signal from the cable between alarm panel and the control unit due to mechanical damage or moist. On the CV-01-A/B there flashing red LED if the control unit has not been reset (the power has been disabled).

Flow chart for error processing for released system
2. The system did not alarm at system release



2: If the system has released without any alarm there are two options:

2:1 An electronic spike has occured in the system. A flash-over in the system though the gas generator has occured. Chech taht there is a plastic adaptor between the release mechanism and the gas generator

2:2 The cable to the gas generator is damaged and there has been a short circuit. (The system uses constant plus-feed and the outputs is controlled by minus-feed.)

Replacement Intervals

- **Actuator (squib) 5 years, from installation date**
- **Forrex agent 10 years, from filling date**
- **Cartridge 10 years or according to local regulations**
- **Sealings in agent tank 10 years**
- **O-rings & sealings in release mechanism 10 years**

6. Recharge - after system activation

6. Recharge - after system activation

1. **Check out reason for system activation**
2. **Unplug actuator cable from control unit (green)**
3. **Remove the outlet hose connection from top of agent tank**

6. Recharge - after system activation

4. **Clean distribution pipeline with water, let water run through**

5. **Connect compressed air to outlet hose (dry air)**

6. **Blow distribution pipeline clean with compressed air for appr. 30 seconds until no fluid comes out from nozzles.**

7. **Install the caps on the nozzles**

8. **Clean engine compartment**

6. Recharge - after system activation

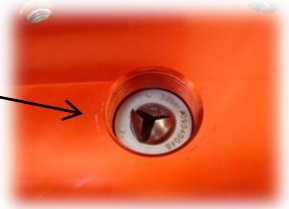
9. **Check if the system is damaged (see service instruction)**

10. **Repair or replace any equipment that has been damaged**

6. Recharge - after system activation

11. **Remove the adapter from the tank and clean it**

12. **Remove the broken burst disc**



13. **Disconnect propellant gas hose at the bottom of the agent tank**

6. Recharge - after system activation

14. **Disconnect agent tank from brackets (if neccassery)**

15. **Inspect agent tank for a any damage**

16. **Press back piston to bottom with compressed air**

Check distance from top to pistons (see instruction manual)

No any mechnical devices inside cylinder

6. Recharge - after system activation

19. **Fill the tank by Forrex AB-30 agent. Use a funnel with a hose in the end that reches to the bottom of tank, this will prevent the agent from ”foaming”. Fill it slowly.**

NOTE; The agent tank should be 100% full of liquid

6. Recharge - after system activation

Refilling tool 59-3000-20

- **Easy to use**
- **Less foaming**

6. Recharge - after system activation

20. **Install new burst disk , installed with convex side up**

21. **Tighten the adaptor. Torgue 40Nm**
Note ; Lubricate the treads with grease.

22. **Fill in signs with refill(recharge) date.**

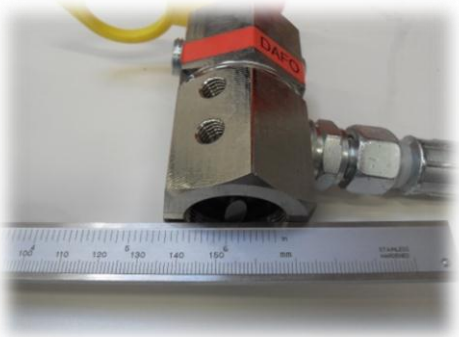
23. **Install the agent tank.**

24. **Connect propellant gas hose at the bottom of agent tank.**

Note: If the agent tank is older than 5 years , change seals (see instructions)

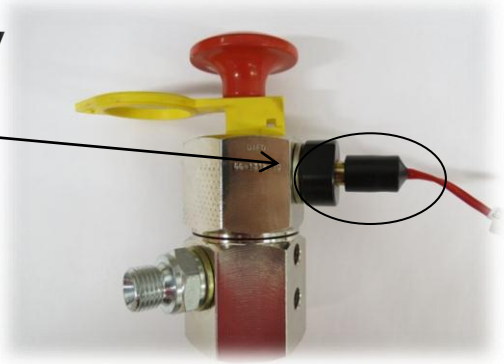
6. Recharge - after system activation

25. Expose the expellant gas cartrigde and actuator by loosening hoses and clamps. Spin off the expellant gas cartridge from the actuator and install the protective nut
26. Dismantle the actuator. Clean and lube the gaskets with vaseline
27. Assemble the actuator
28. Check the pins level. The measurement shall be in line with sliding puncturing pin +/- 1 mm from the egde of mechanism is accepted

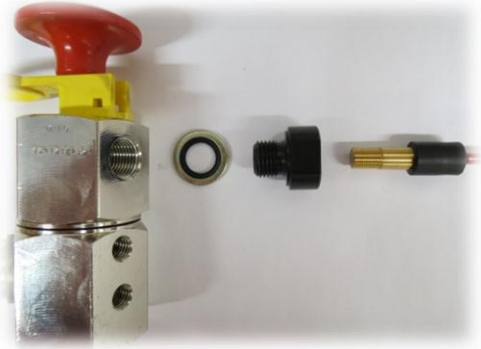


6. Recharge - after automatic activation

1. **Replace actuator (squib). Tighten by hand only**



2. **Check adaptor for damages (black, plastic)**



6. Recharge - after system activation

29. Replace expellant gas cartrigde. Check that it is fully pressurized by weighing it. Correct weigth is stated on the label.

Max. deviation from the weight is – 14 grams. The cap weight is 20 grams and should be added to total weigth

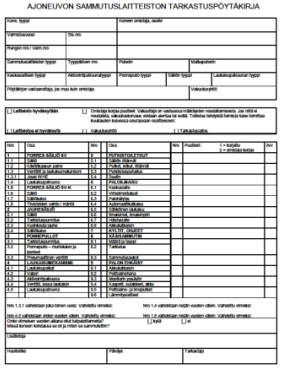
6. Recharge - after system activation

30. **Assemble release mechanism to cartrigde**

31. **Connect hose to realese mechanism**

32. **Assemble cartridge to bracket**

6. Recharge - after system activation

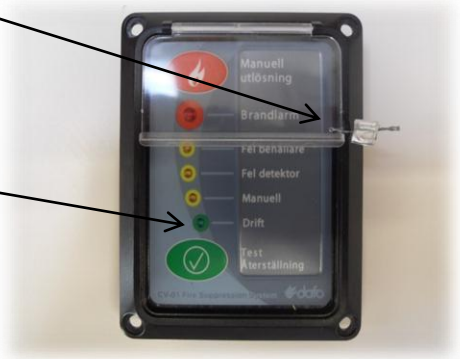

AJONEUVON SAMMUTUSLAITTEISTON TARKASTUSPÖYTÄKIRJA

33. **Follow system function checking procedure**

34. **Fill in service protocol, give a copy to the machine owner.**

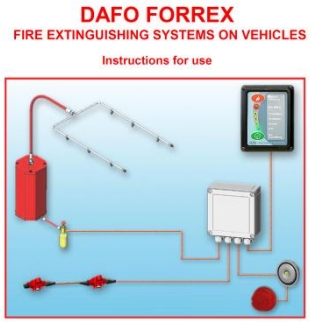
35. **Check that pulling pin and control panel are equipped by seal**

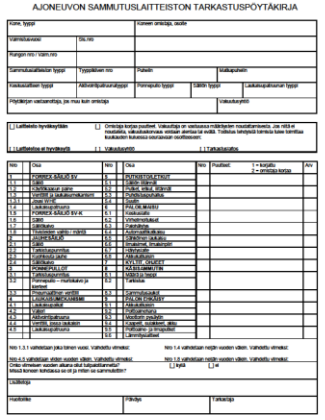
36. **Check that control panel green LED is on**



7. Hand over

- ✓ **A final check must be carried out in accordance with the instructions in the ”Check list of Forrex installations for machines” document**
- ✓ **Make sure that driver/owner are aware of fire system function**
- ✓ **Check if the machine is equipped with user manual**

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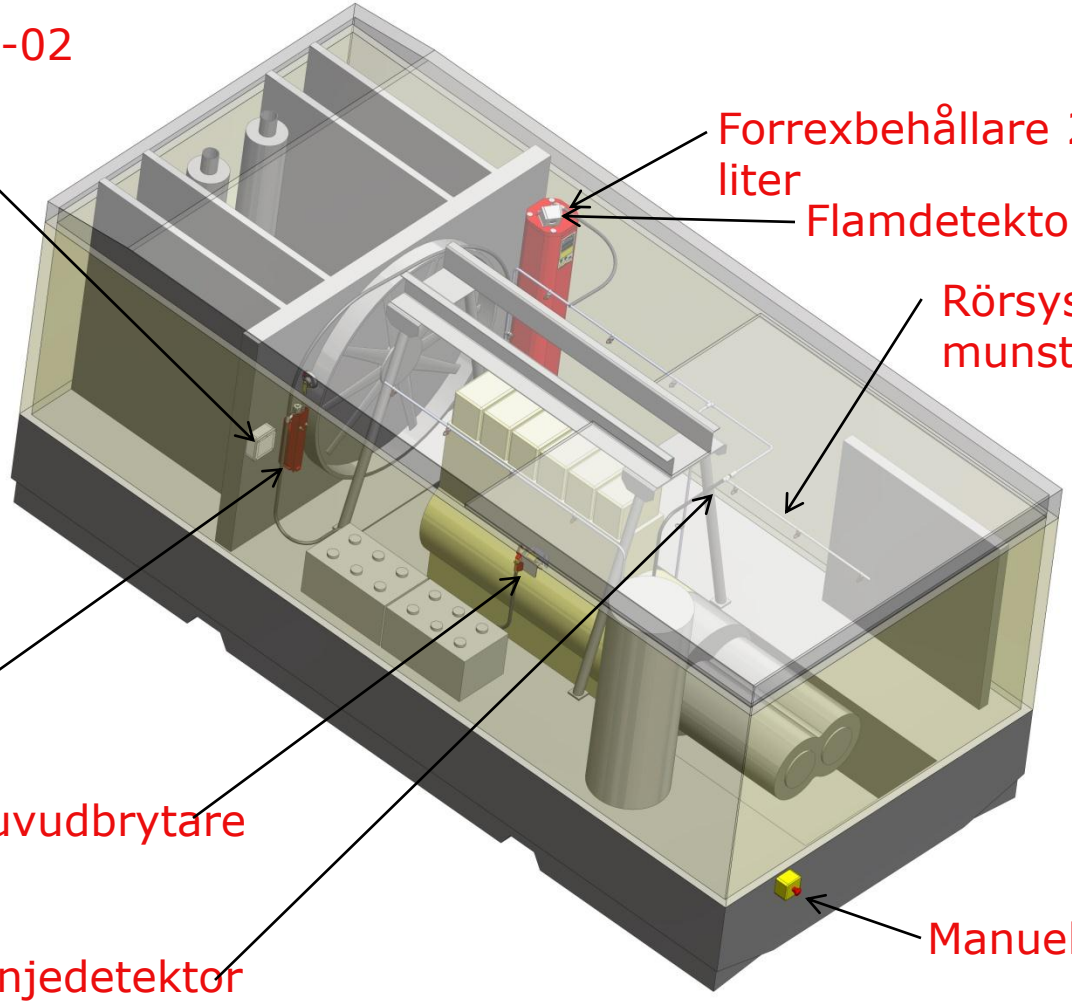
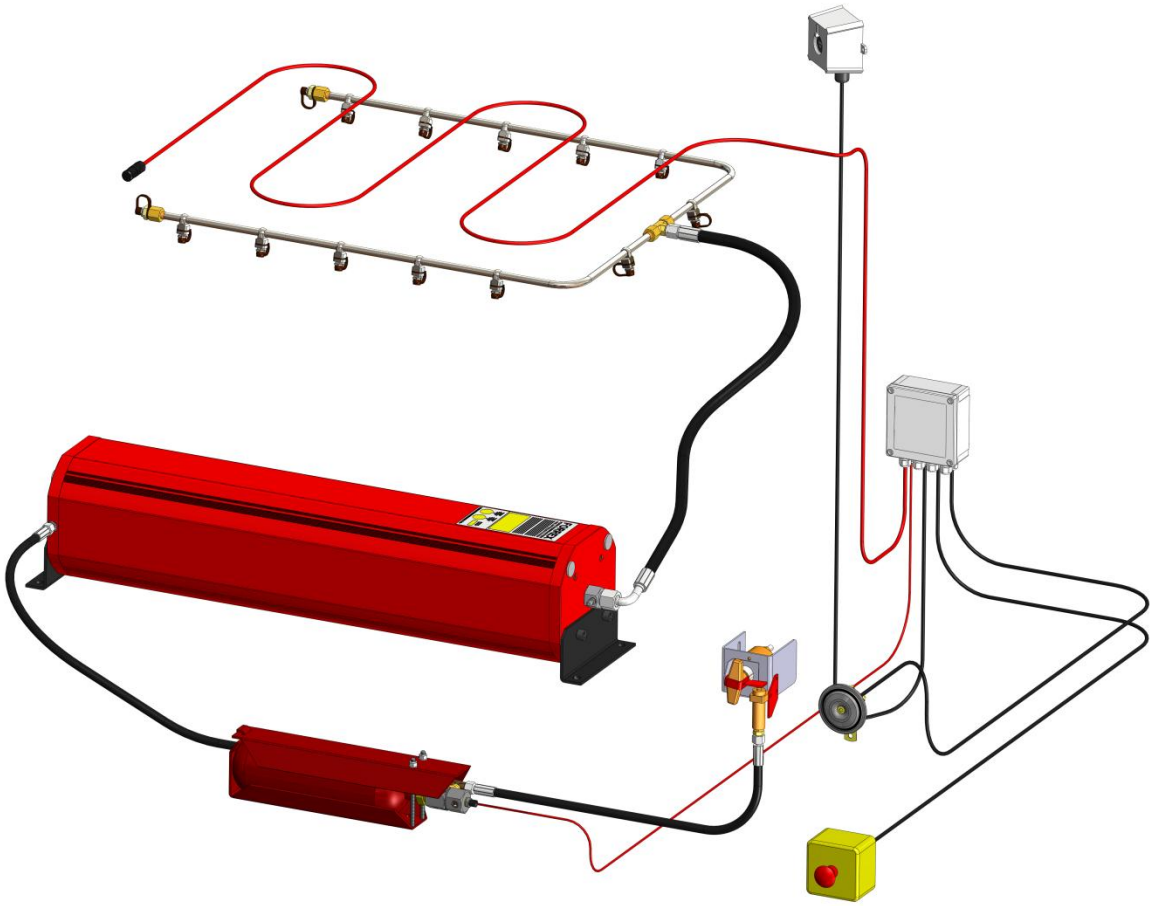
Compressor for Atlas Copco

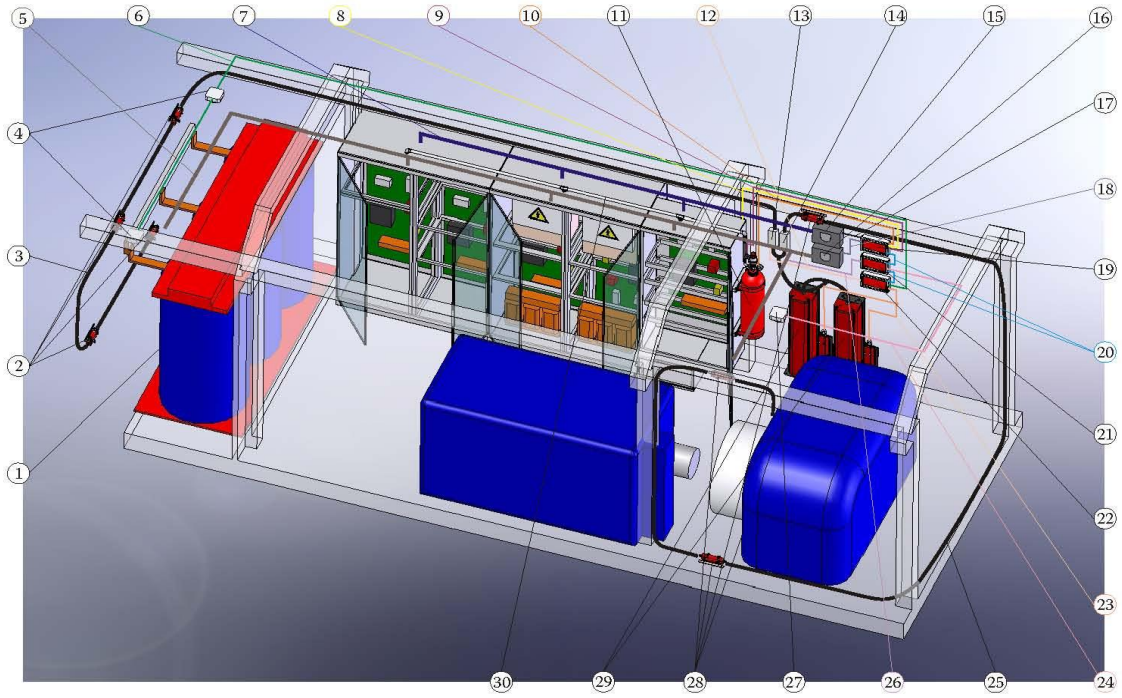


Compressor Atles Copco System Layout



Wind Power - Nacelle

Fire extinguishing system overview model D



1. Transformer
2. Forrex nozzle modules Transformer area
3. Forrex feedingline Transformer area
4. Flame detectors Transformer area
5. Smoke detection Normal system lining
6. Flame detector lining Transformer area
7. Smoke detection Sensible system lining
8. WEA system information lining
9. IG-55 release lining
10. IG-55 pressure monitor lining
11. IG-55 Bottle
12. Forrex valve lining Transformer area
13. Forrex valve Transformer area
14. Forrex valve Brake area
15. Focus RAS laser sensible
16. Focus RAS laser normal
17. Focus RAS laser sensible lining
18. Focus RAS laser normal lining
19. Control unit IG-55 Focus RAS lasers
20. CAN BUS linings control units
21. Control unit Brake area system
22. Control unit Transformer area
23. Forrex release linings
24. Flame detector lining Brake area
25. Forrex feeding line Brake area
26. Forrex valve lining Brake area
27. Flame detector Brake area
28. Forrex nozzle modules Brake area
29. Forrex containers
30. IG-55 pipe system electrical cabinetts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