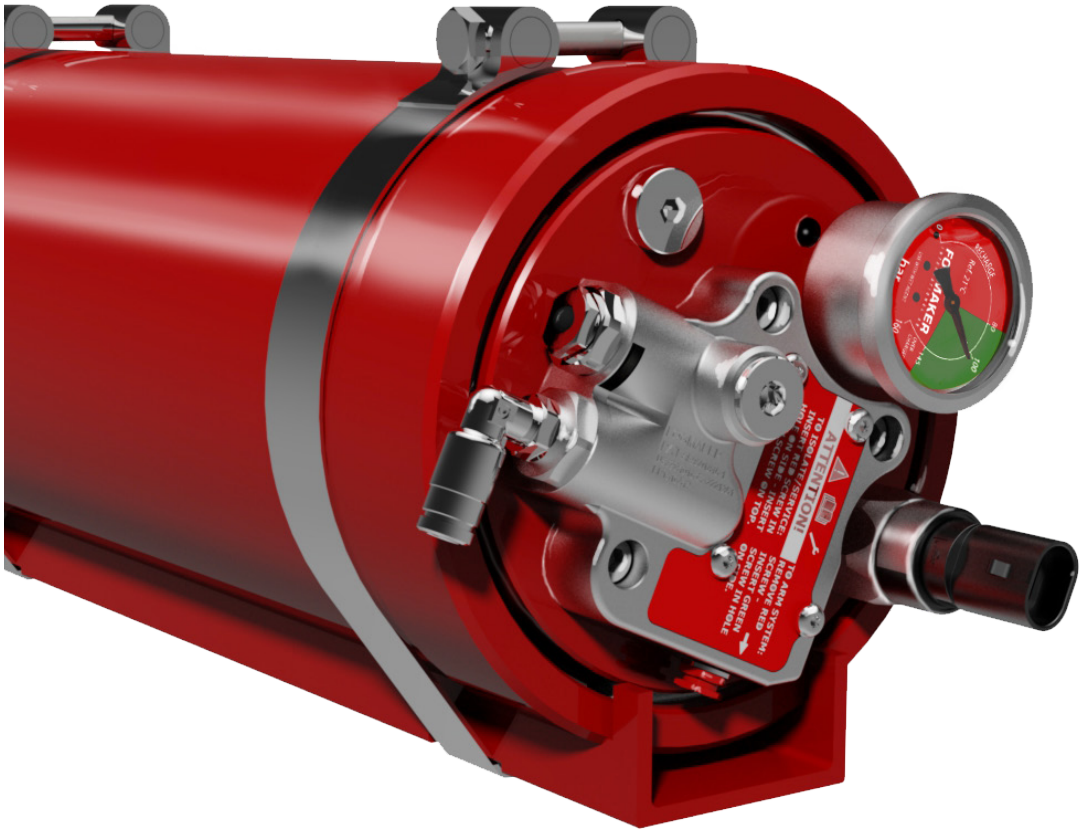
FOGMAKER
INTERNATIONAL AB



SERVICE MANUAL

Guidelines for annual control and service
of Fogmaker fire suppression systems

Fogmaker International AB

Service manual - Annual control and service

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Summary

Fogmaker® is a registered trademark of fixed fire suppression systems for extinguishing fires in engine rooms or other enclosed spaces. Fogmaker Fire suppression systems are used in buses, construction and forestry machines, mining vehicles and racing cars.

Fogmaker Fire suppression system spreads a fine water mist over the fire, which cools the fire very effectively, but also displaces the air, so that oxygen content drops. The fire suppression efficiency increases when the extinguishing liquid evaporates.

The suppressant is water based and contains antifreeze additives, as well as a film-forming chemical, which prevents re-ignition.

- **A control is performed annually and with a longer time interval a service of Fogmaker Fire suppression systems is performed.**
- **This manual describes all the steps in an annual control and service, as well as resetting of Fogmaker Fire suppression systems.**

The service manual is a support for the trained and certified service personnel and is part of the training package belonging to Fogmaker International AB.

Fogmaker Fire suppressions system have several external approvals, see our web page: www.fogmaker.com

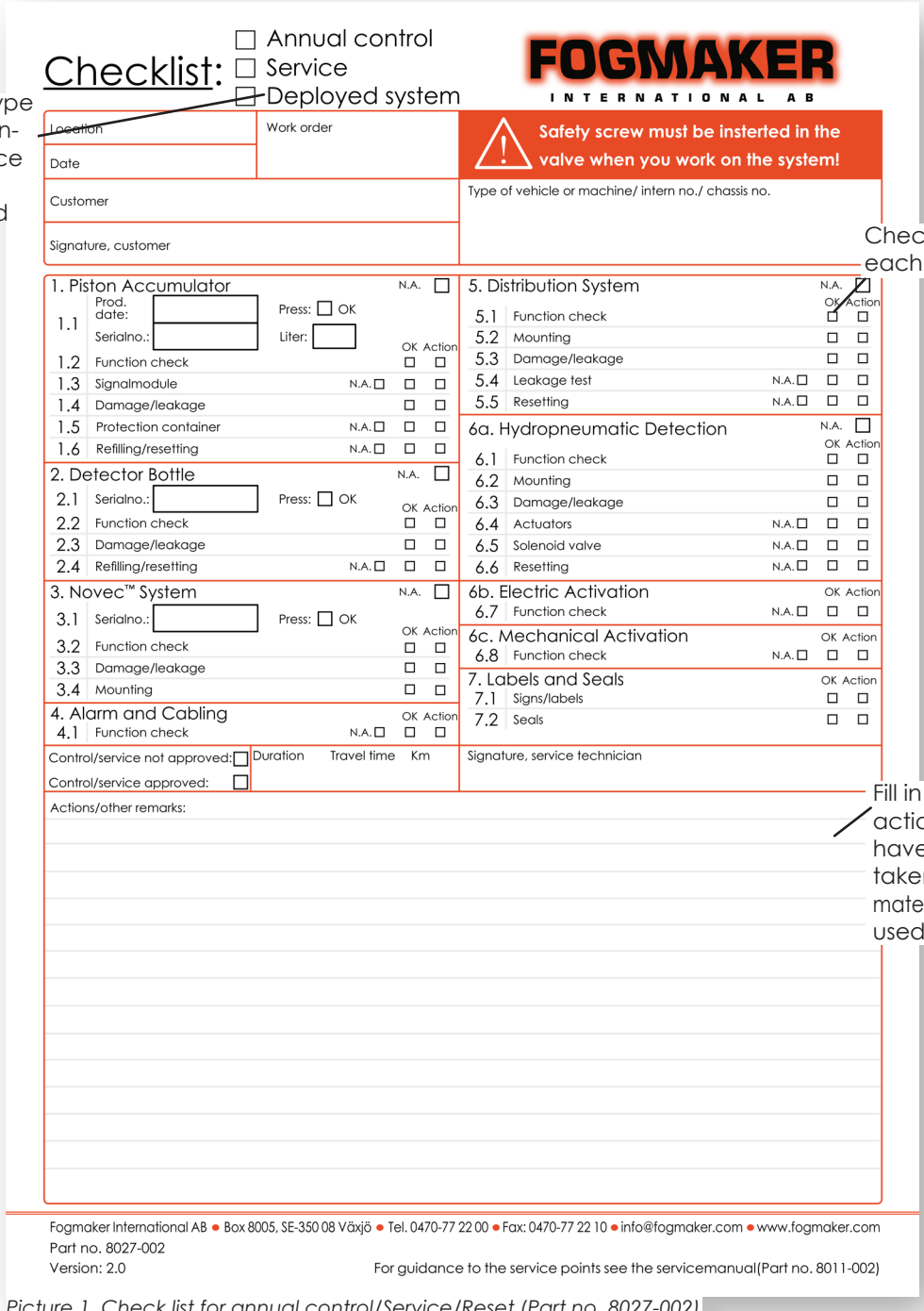
NOTE

Only Fogmaker certified personnel may check,
service and restore Fogmaker Fire suppression systems

Contents

Introduction

The Service manual explains all steps in an annual control and service. The Service manual and check list have the same structure to simplify completion of the checklist. For example: Section 1 on page 6 in this manual concerns all steps for the piston accumulator, in the same way as on the check list (Part no. 8027-002), see Picture 1.



Picture 1. Check list for annual control/Service/Reset (Part no. 8027-002)

Protective measures

All persons responsible for maintenance of this product shall...

... be certified.
... follow the instructions in this manual.
... take into account that this manual is part of Fogmaker Fire suppression system.
... keep this manual intact and available throughout the active life of this product.
... follow the control plan, see Table 1, in order for Fogmaker to be able to guarantee the functionality of the system.
... continuously maintain all the tools and calibrate all measuring equipment used for inspection, service and action.

Control plan			
Time intervals	Annual control	Service	Action
1 year	•		
5 years	•	•	
If needed	•	•	•
Ten-year overhaul	Performed by Fogmaker		

Table 1. Control plan

The warning triangle marks the instructions that are important for your personal safety and/or affect the system's basic function. Accompanying text in bold next to the warning triangle.

NOTE **The NOTE-box draws attention to instructions that could affect system performance. Accompanying text in bold next to the NOTE-box**

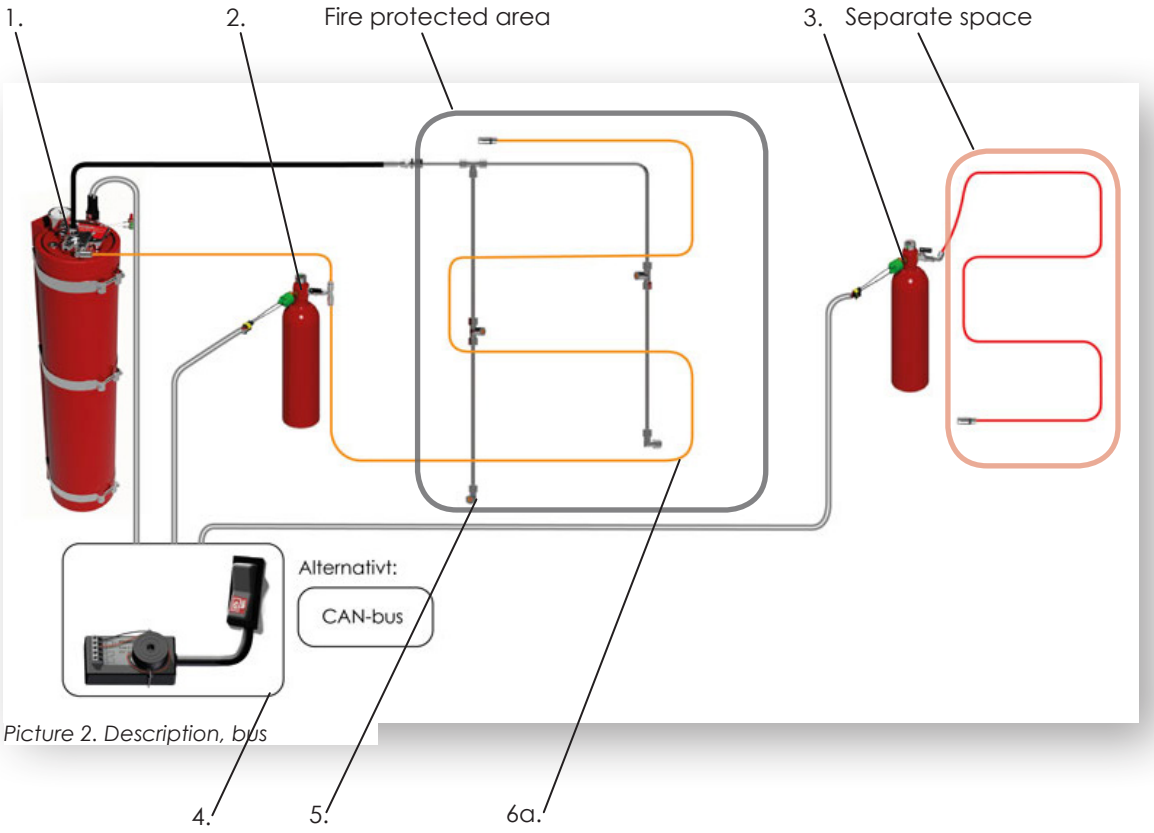
Safety glasses shall be used during all work with Fogmaker Fire suppression systems.

WARNING!

When transporting or maintaining Fogmaker Fire suppression system, the safety screw shall always be mounted, see "1.2 The functionality of the piston accumulator" on page 6, otherwise the system may be activated accidentally.

The valve must not be dismounted when the piston accumulator is pressurized. If the valve or any of its fittings is removed when the container is pressurized, a powerful jet of liquid (100 bar) may flow out and cause serious personal injury.

Fogmaker Fire Suppression system, description Bus

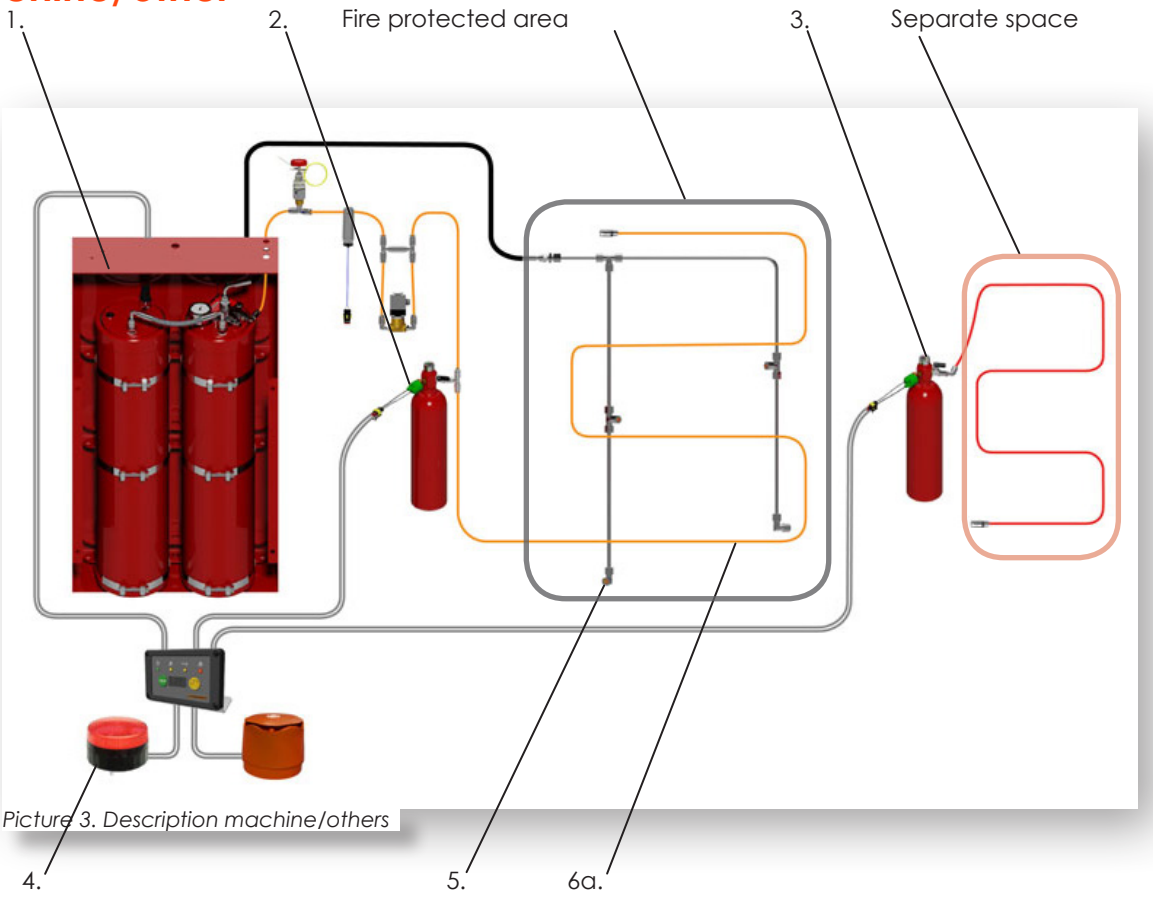


Picture 2. Description, bus

Description for bus, see Picture 2:

1. The piston accumulator - single type
2. Detector bottle connected to piston accumulator.
3. Novec™system may be mounted in a separate space.
4. Pressure switch is connected to the bus alarm or directly to the bus CAN bus system.
5. Distribution system with spray nozzle for suppressant is connected to the piston accumulator.
6. Hydropneumatically activated system, detector tube bursts in case of fire.

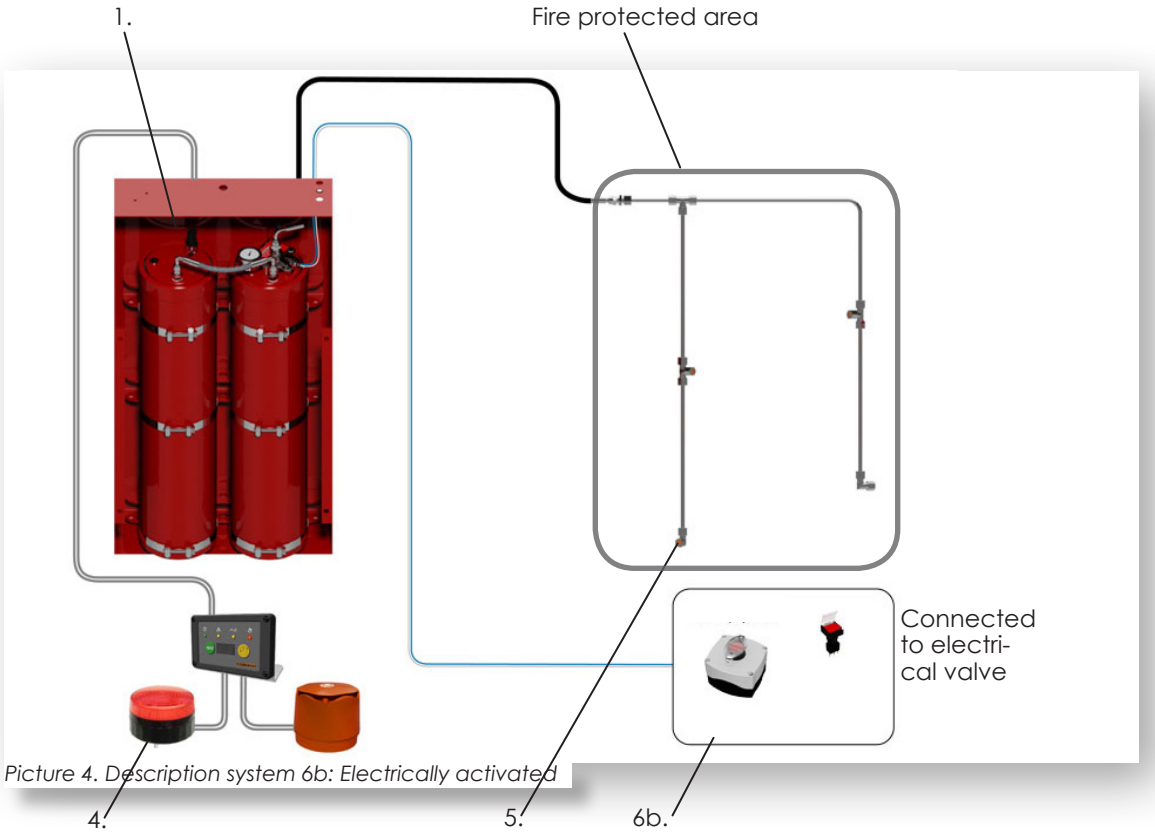
Fogmaker Fire suppression system, description of machine/other



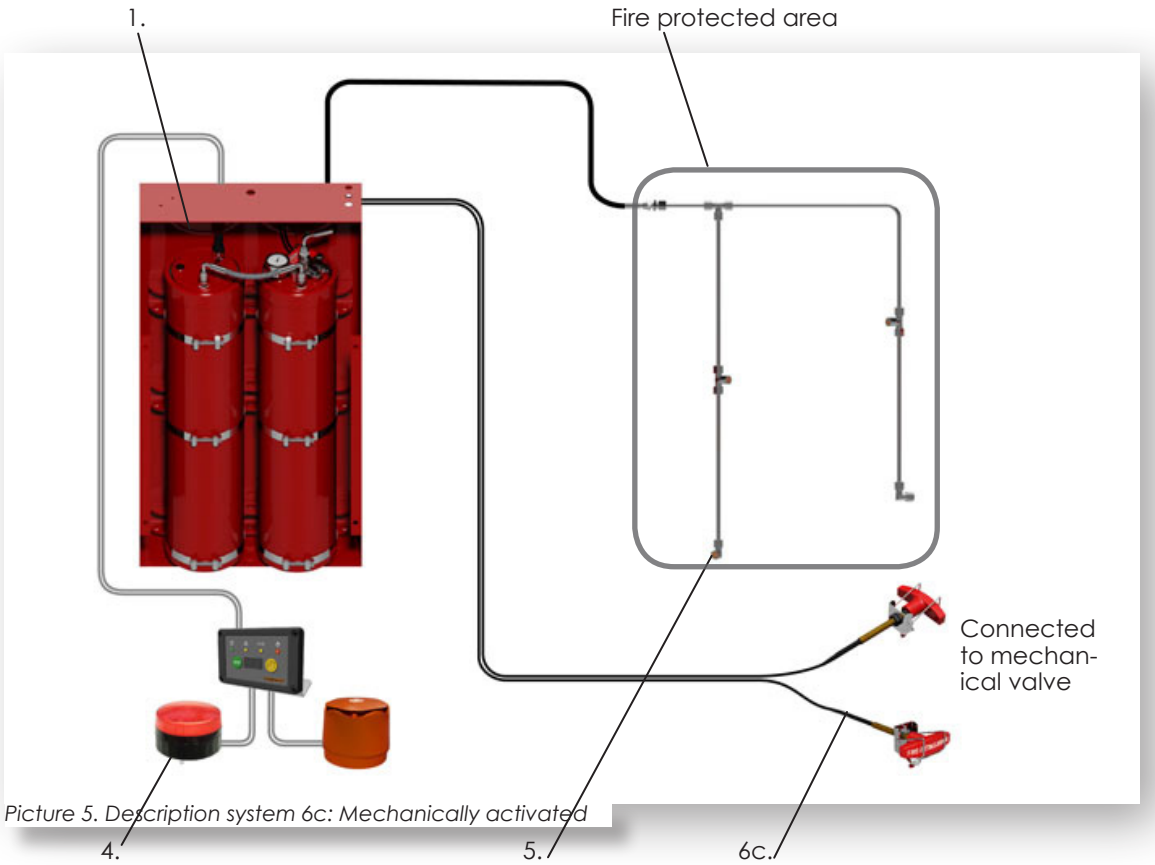
Picture 3. Description machine/others

Description for machine and other installations, see Picture 3

1. The piston accumulator - several cylinders and protective case.
2. Detector bottle connected to piston accumulator.
3. Novec™system may be mounted in separate space.
4. Pressure switch connected to the alarm panel and separate audible and visual alarm.
5. Distribution system with spray nozzle for suppressant is connected to the piston accumulator.
6. Hydropneumatically (Picture 3), electrically (Picture 4) or mechanically activated system (Picture 5), they are described under section 6a, 6b and 6c, respectively. Different punches and magnet valve/semi automation can be mounted on the detector tube, see section 6a (Picture 3).



Picture 4. Description system 6b: Electrically activated



Picture 5. Description system 6c: Mechanically activated

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Items for Annual Control and Service

1. Piston Accumulator

Fogmaker piston accumulator is a cylindrical container made by anodized aluminium, with one gas side and one liquid side, and a valve on the cylinder cover.

NOTE **The piston accumulator is pressurized at 100 - 105 bar at 20°C.**

Piston accumulators are mounted outside the fire-protected area. In buses, they are often placed behind the ceiling panel or in the luggage compartment. On machines, they are usually placed in protection containers on the outside of the machine. Follow the hoses and check the size of the system.

1.1 Production date/serial number/pressure/volume

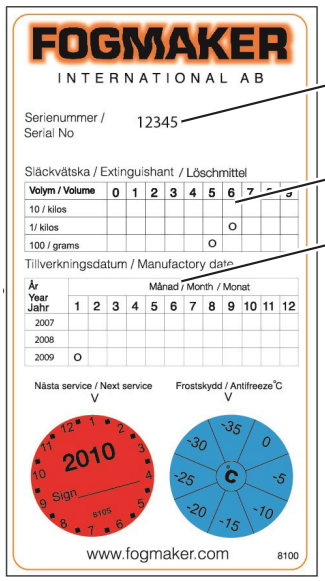
a. Note the production year and serial number for the piston accumulator, found on the service decal (Part no. 8100) on the outside of the cylinder. The serial number can be found on top expressed in numbers and production date is punched in a table, see Picture 6. If the serial number cannot be read, the chassis number stamped on the bottom of the piston accumulator can be given instead, see Picture 7.
b. Read the pressure in the piston accumulator on the manometer, see Picture 8.
c. Note volume/number of suppressant in liters on the check list, mentioned on safety decal (Part no. 8100), see Picture 6.

1.2 The functionality of the piston accumulator

The valve opens and closes the piston accumulator and the safety screw locks the valve mechanism.

The safety screw must always be installed so that the fire suppression system is not triggered by mistake during an annual control or service.

- On valve, generation 1 (Part no. 6090-/6091-/6092-010), the safety screw locks the valve latch through a hole on top of the valve straight through the latch, see Picture 9-11.
- On valve, generation 2 (Part no. 6090-/6091-/6092-020), the red screw locks the valve latch by inserting it in the hole on the side of the valve case, see Picture 12 and Picture 14. The green cover screw shall be put on the left side of the valve and protect from dirt when the system is activated, see Picture 13.
- The safety screw hinders the valve latch to move - and activate the piston accumulator.

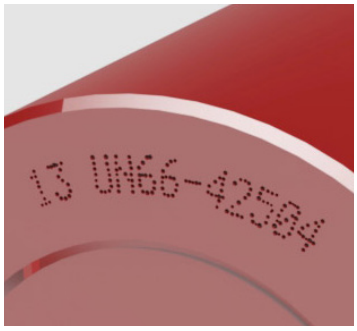


Serial number

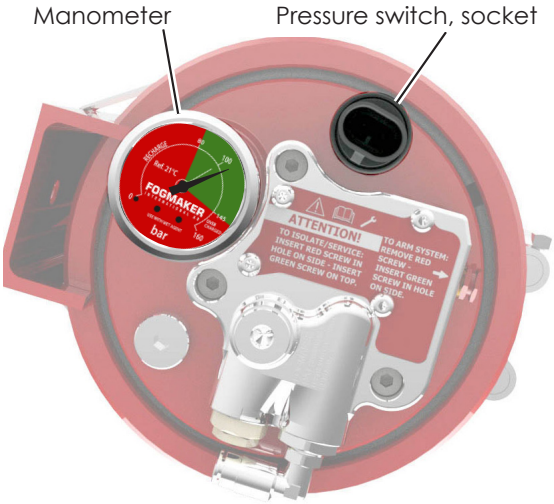
Volume

Production date

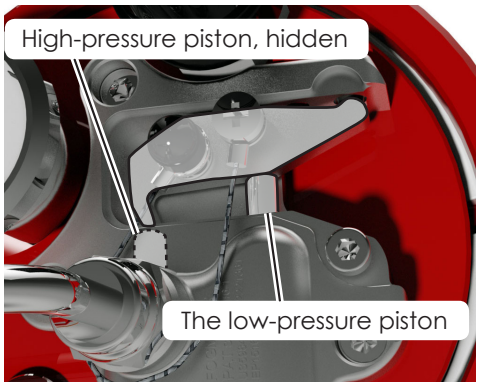
Picture 6. Service label (part no. 8100)



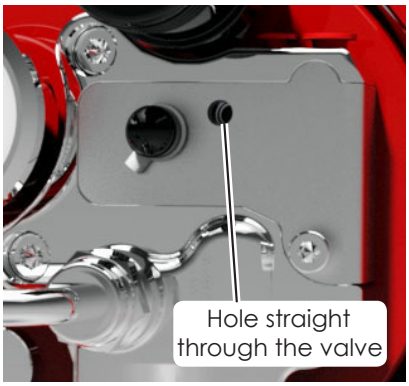
Picture 7. Chassisnumber



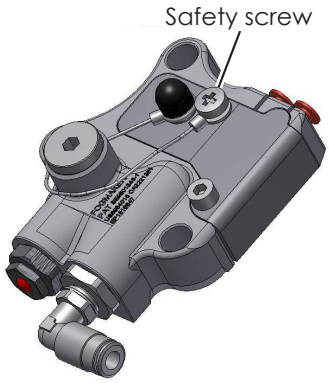
Picture 8. Top view, piston accumulator



Picture 9. Valve latch, generation 1

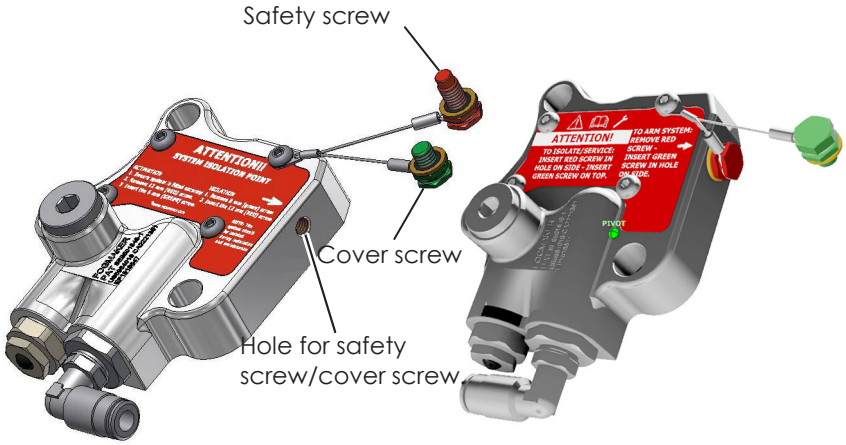


Picture 10. Safety screw not mounted



Picture 11. Safety screw mounted

Picture 12. Valve latch, generation 2



Picture 13. Safety screw not mounted

Picture 14. Safety screw mounted

1.3 Signal module/micro switch

a. A micro switch may be mounted on valve, generation 1 (Part no. 6009-020), see Picture 15. Perform a functionality test of the micro switch by dismounting the safety screw and check that an alarm is activated.
b. A signal module may be mounted on valve, generation 2 (Part no. 6009-030), see Picture 16. Perform a functionality test of the signal module by dismounting the magnet screw and check that an alarm is activated.
c. Check that the micro switch/signal module is mounted correctly and not damaged, and that the magnet is still inside the green safety screw, see Picture 17.

1.4 Damage/leakage

Visual control of piston accumulator, brackets and back mounts, see Picture 18-20. Great abrasion, crushing or dents are not allowed.

Depending on the extent and depth of the damage, contact authorized partner for replacement of the piston accumulator. A damaged cylinder must be scrapped.

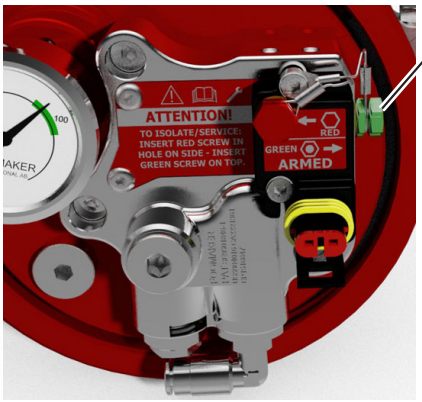
Check for leaks:
a. Dismantle distribution hose/tube, connected to the nipple on the valve
b. Check if there is fluid on the inside of the coupling, see Picture 21.
c. Check nipple, washer and valve outlet.

If there is no leakage of suppressant, the whole system can be assumed free from leakage and thus operational. If suppressant is leaking from the valve, continue to section 1.6.

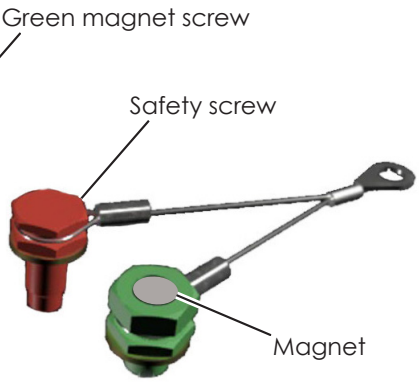
1.5 The Protection Container

Check protection container condition.
a. Protection container must be properly installed and not have any damage that might have damaged the content or reduce the protection of the contents, see Picture 22-24.
b. Check the mounting of the protection container and the assembly of the piston accumulator in the protection container.
c. Check that labels are readable and fully visible, see section 7.

Picture 15. Microswitch (part no. 6009-020)



Picture 16. Signal module (part no. 6009-030)

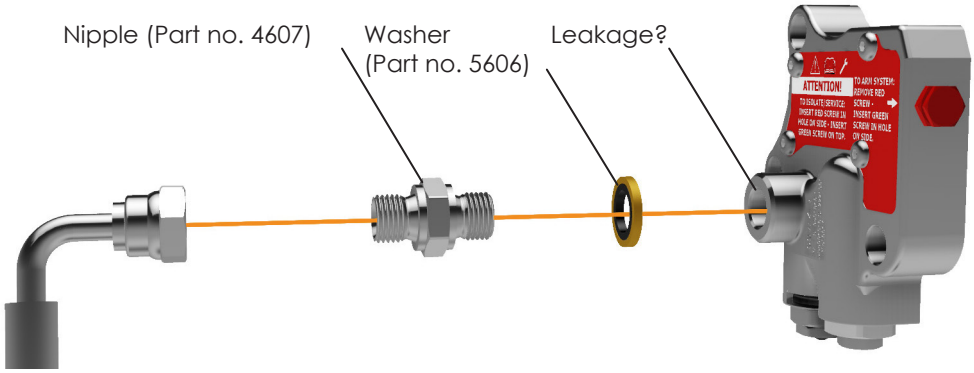


Picture 17. Safety screw and magnet screw (Part no. 5902-020-M)

Picture 18. Piston accumulator, single

Picture 19. Double acccumulator

Picture 20. Triple accumulator



Picture 21. Dismantle distribution hose, nipple and washer

Picture 22. Protective case, single

Picture 23. Protective case, double

Picture 24. Protective case, triple

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1.6 Service/reset of piston accumulator

With longer time interval, a service of Fogmaker Fire suppression system shall be performed, where suppressant is refilled and o-rings are replaced, if necessary. If the system was deployed, it shall be reset according to this section. See picture 25 for an overview of the piston accumulator.

NOTE **Check the pressure in piston accumulator and detector bottle - if both are without pressure, the system has been deployed.**

Always perform these steps before commencement of service/reset:

- **Check that the safety screw is mounted, see Picture 26 - 27.**
- **Close the valve on the detector bottle, see Picture 28.**
- **Disconnect the detector tube from the valve, see Picture 29.**
- **Disconnect the distribution hose from the valve, see Picture 30.**
- **Disconnect the piston accumulator from the mounting brackets - only applicable to piston accumulator, single type. Double and triple accumulators must have the mounting brackets left.**

If it is possible and there is room for the filling tool, the piston accumulator may be serviced while still mounted in the vehicle. The piston accumulator however has to be dismounted if there is suspicion of leakage. If the piston accumulator is hard to reach and/or there is no room for the filling tool, the whole piston accumulator must be dismounted from the vehicle.

The following steps are included in a service/reset of piston accumulator:

1.6.1 Empty suppressant

1.6.2 Disconnect valve/manometer
1.6.3 Empty nitrogen gas
1.6.4 Replace o-rings
1.6.5 Refill nitrogen gas

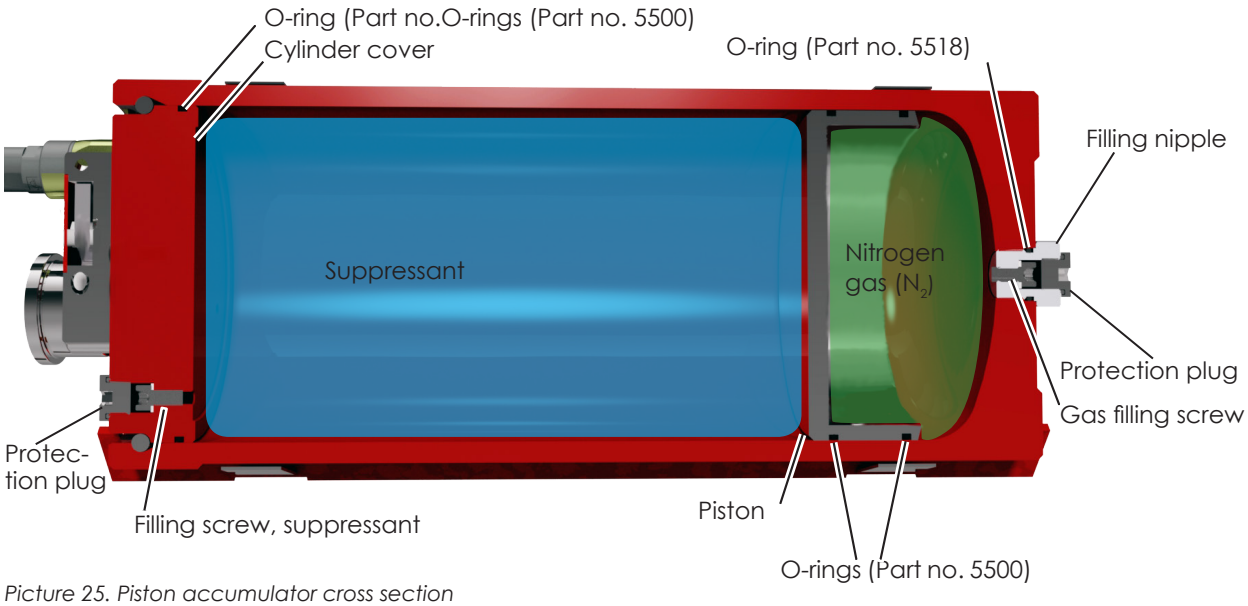
Performed if there are signs of leakage, see page 14.

1.6.6 Service/restore valve

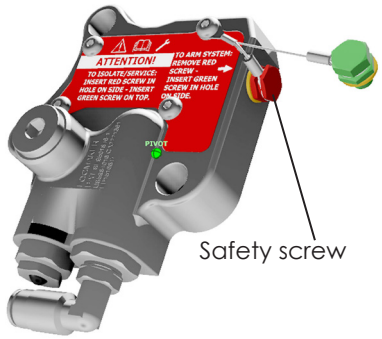
1.6.7 Refill suppressant

Tools needed for service/reset

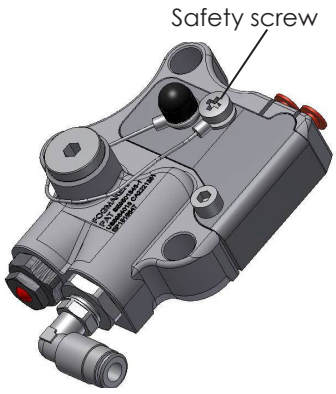
- Allen key: 4 mm, 5 mm, 6 mm
- U-shaped ring wrench: 8 mm, 14 mm
- Torque wrench
- Wrench
- Rubber mallet
- Gas filling tool (Part no. 1975)
- Screwdriver
- Filling tool (Part no. 1800)
- Filling pump (Part no. 1811)
- Tool for cylinder cover (Part no. 1820)
- Brass rod (Ø=max 16 mm)



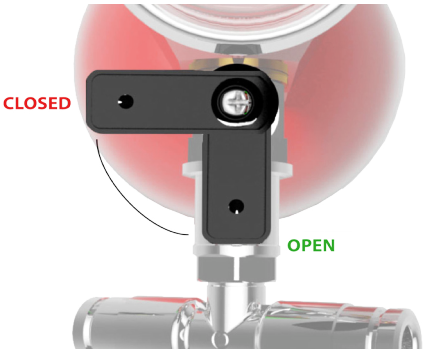
Picture 25. Piston accumulator cross section



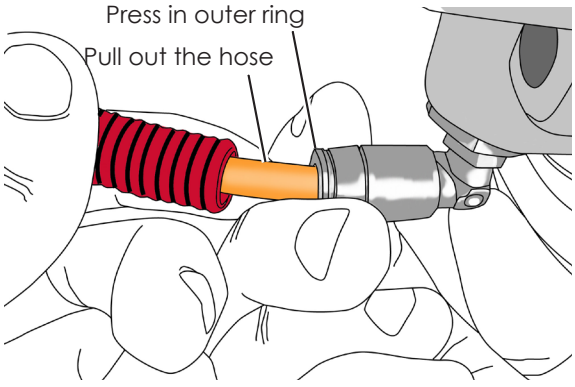
Picture 26. Safety screw in valve



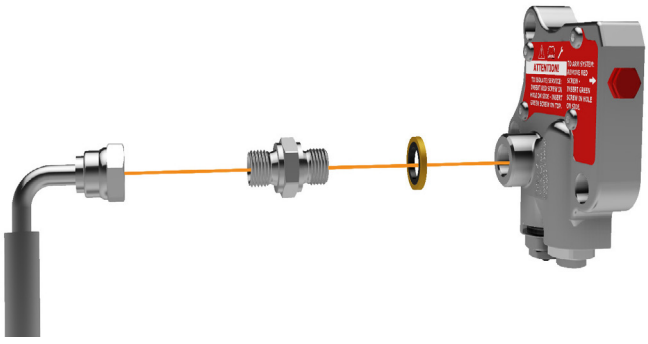
Picture 27. Safety screw in valve



Picture 28. Open/closed detector bottle



Picture 29. Dismantle detector tube



Picture 30. Dismantle distribution hose, nipple and washer

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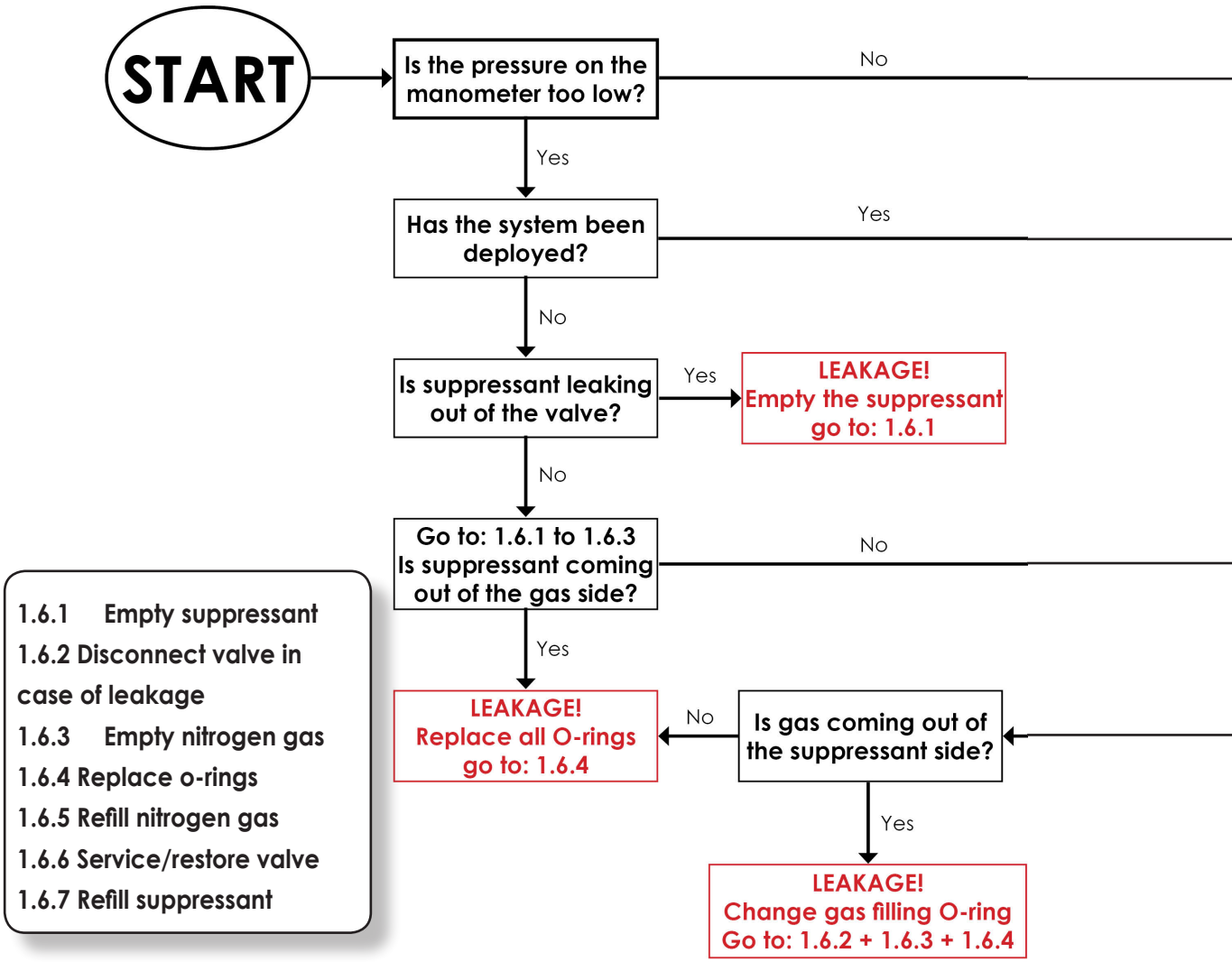
1.6 Cont. Service/reset of piston accumulator

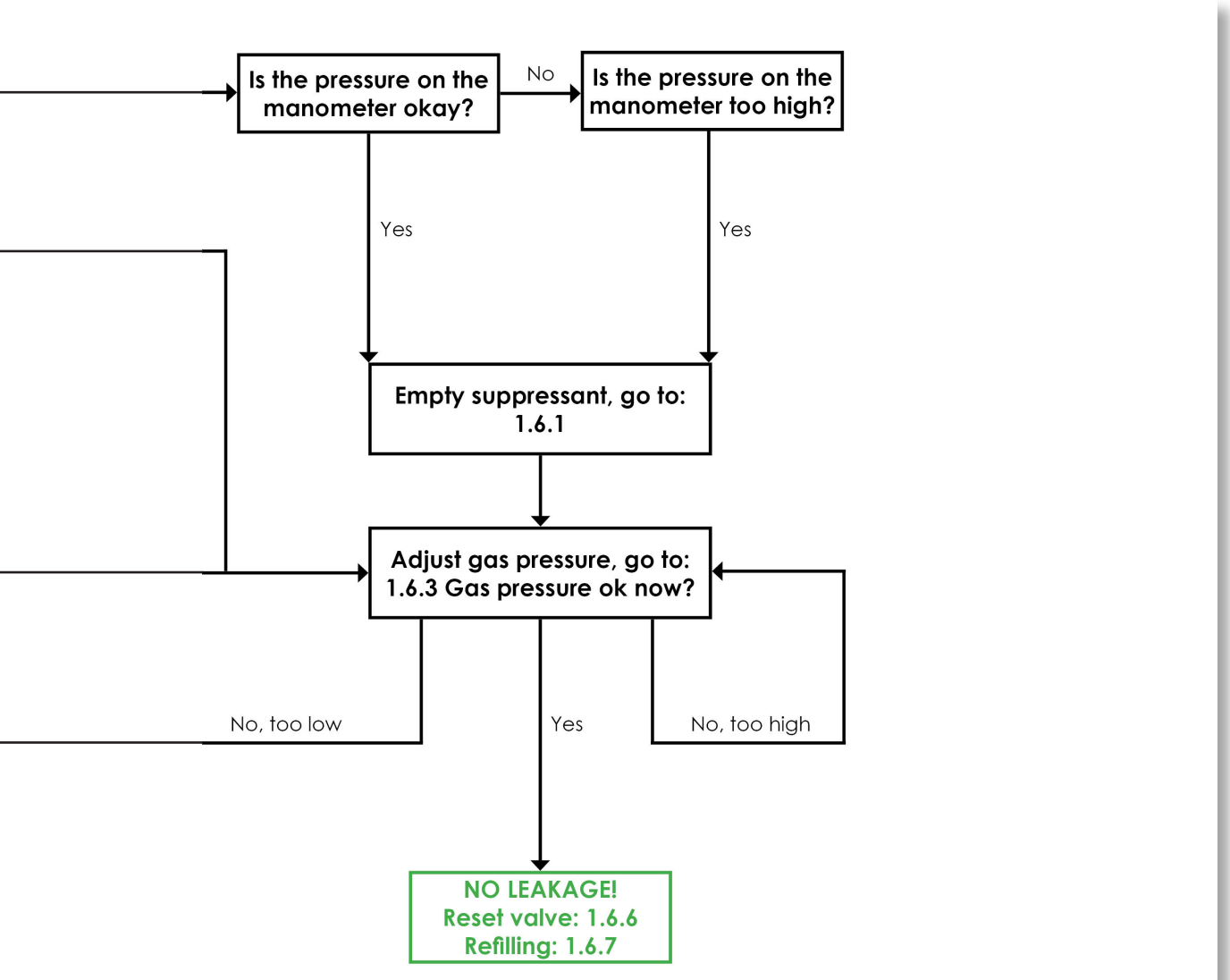
Check the pressure in the piston accumulator and in the detector bottle, start the service according to the steps in the service schedule, Picture 31. Follow the arrows and see the section recommended in each box. After recommended section, continue until last section 1.6.7: Refill suppressant.



Picture 31. Checking for signs of leakage during service

Picture 32. Manometer (part no. 6200-20

Picture 33. Manometer (part no. 6200-30



1.6.1 Empty suppressant from piston accumulator

Check that the safety screw is mounted.

a. Disconnect the detector tube and distribution hose from the valve, see Picture 29 and 30.
b. Dismantle the protection plug carefully in order to gain access to the filling screw, see Picture 34.
c. Check that the filling tool (Part no. 1800) is functional, see "Appendix 1: Filling tool". See instruction movie on our web page: www.fogmaker.com.
d. Mount the filling tool on the filling screw for suppressant, see Picture 35.
e. Connect the filling pump with the filling tool. See separate manual (Part no. 8026-001) for handling of the pump.
f. Empty the suppressant by carefully opening the filling screw with the filling tool. The piston accumulator is emptied from suppressant when the manometer is down to 20 and then falls to 0 bar.
g. Disconnect the pump and dismount the filling tool.

NOTE **Used suppressant shall be sent for destruction at a recycling facility.**

NOTE **Use a transparent hose when emptying the suppressant, as bubbles can be detected during emptying - indicating leakage between gas and liquid sides.**

1.6.2 Dismantle valve, manometer and pressure switch (in case of leakage)

If there is suspected leakage in the piston accumulator, all components on the cylinder cover must be removed, see Picture 36.

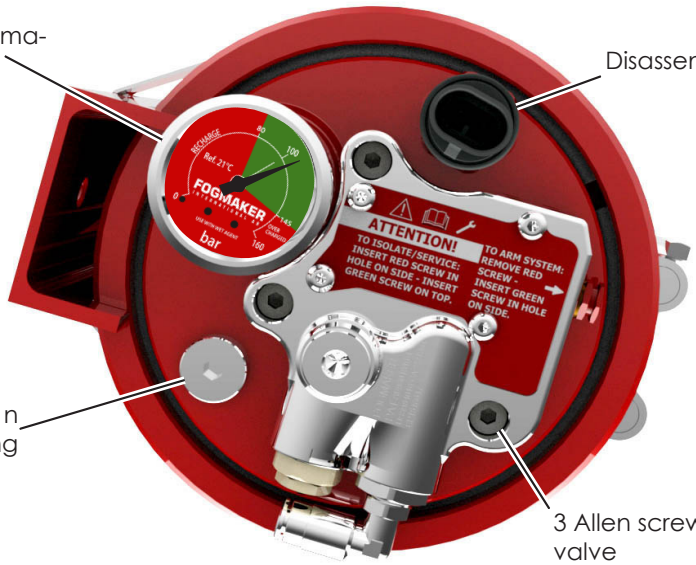
NOTE **Gas pressure shall still be in the piston accumulator for easy removal.**

a. Disconnect the three Allen screws on the valve. Put the valve with screws in a safe place.
b. Disassemble manometer Put the manometer in a safe place.
c. Disassemble pressure switch (optional). Put the pressure switch in a safe place.
d. Disconnect the metal hose (Part no. 4117) between the double and triple accumulators, see Picture 37.
e. Check the threads visually on each of the dismantled items to ensure possible future use. If that is not the case, send the parts for recycling. Washers shall not be re-used.
f. Cylinder covers without components, see Picture 38.

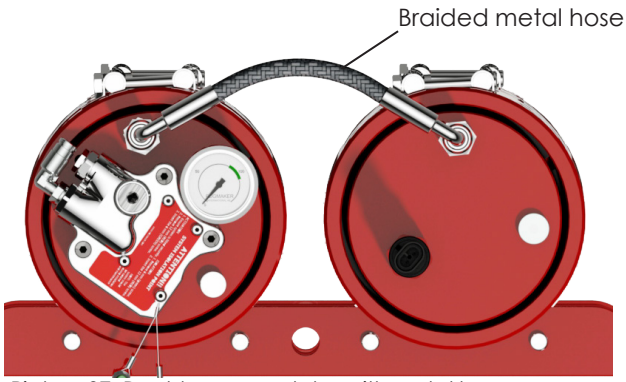
Picture 34. Gently loosen the protection plug

See instruction movie: www.fogmaker.com

Picture 35. Filling tool mounted on filling screw



Picture 36. Top view piston accumulator



Picture 37. Double accumulator with metal hose

Picture 38. Clean cylinder cover

1.6.3 Empty/adjust nitrogen gas

The propellant is nitrogen gas (N2), ensure good ventilation during emptying.

a. Disconnect the protection plug in the bottom of the cylinder to gain access to the gas filling screw, see Picture 39.
b. After that, loosen carefully the gas filling screw inside the filling nipple so the gas evaporates slowly, see Picture 40. This is normally done with an Allen key. Use the filling tool in order to be able to cut off the gas supply when adjusting gas pressure.
c. A bang may be heard when the gas filling screw is opened. Towards the end, it may be needed to loosen the screw a bit more to empty all the gas. Never remove the screw fully until all gas has evaporated.

NOTE **Check possible leakage while you release the gas.**

An indication of leakage is that liquid is released together with the gas, in that case the o-rings must be replaced on the piston and on the cylinder cover.
Dismantle the gas filling nipple, Picture 41, and keep the cylinder upside-down when gas has been removed to ensure no liquid leaks out.

1.6.4 Replace o-rings (in case of leakage)

In order to replace the o-rings on the piston and the cylinder cover, the piston accumulator has to be dismantled:

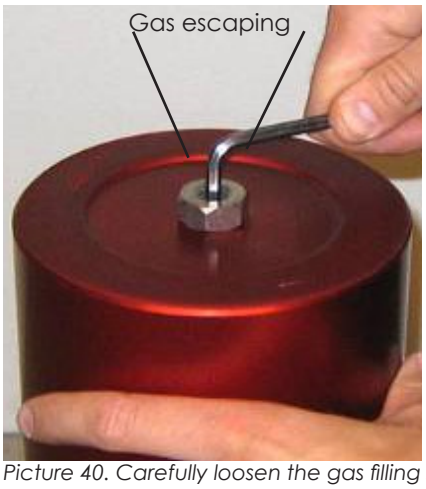
a. Press down the cylinder cover, use tools for cylinder cover (Part no. 1820). Mount the tool and press/wiggle down the cover 4-5 cm, see Picture 42. If needed, use a rubber mallet and tap down the cover.
b. When the cylinder cover has been pushed down far enough, the lock segments on the inside of the cylinder are exposed - remove these. The number of lock segments depends on the model - earlier generation has one segment, whereas the later generation has three separate segments, see Picture 43.
c. Pull up the cylinder cover and put it aside once the lock segments are removed, see Picture 44.
d. Now the piston down in the piston accumulator is visible, see Picture 45. To remove the piston, push a brass rod (up to Ø 16 mm) through the hole in the bottom of the cylinder and gently push out the piston, see Picture 46.

NOTE **It is important that the piston does not overturn inside the cylinder.**

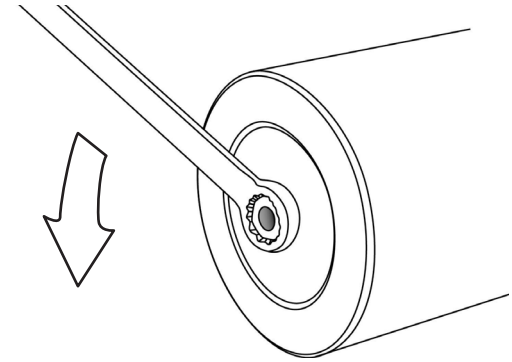
Compressed air cannot be used to remove the piston.

e. Check the interior of the cylinder. If the cylinder looks good, rinse the inside /clean the inside with a wet cloth and then wipe dry. Also clean the lock segments. If the cylinder is damaged on the inside, Fogmaker should be contacted for evaluation.

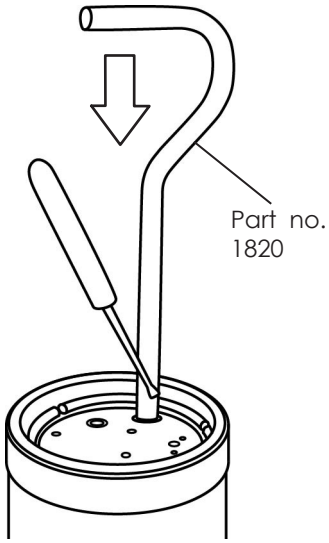
Picture 39. Dismantle the protection plug



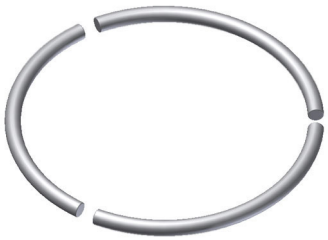
Picture 40. Carefully loosen the gas filling screw



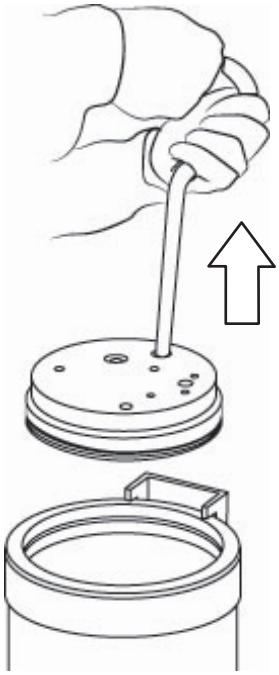
Picture 41. Disconnect gas filling nipple



Picture 42. Press down



Picture 43. Locking segment (part no. 2118)



Picture 44. Remove cylinder-cover

Picture 45. Piston down in cylinder

Picture 46. Remove piston from cylinder

f. Remove the old o-rings from the piston (2 units) and the cylinder cover (1 unit), see Picture 47 - 49.
g. Clean the piston and the cylinder cover and mount new o-rings on them. Use another o-ring (Part no. 5501) on previous generation piston, see Picture 48.
h. Grease the inside of the cylinder around 5 cm from the top and down on the whole surface with Dow Corning® 200 silicon oil, 350 CST (Part no. 7900), as well as the outside of the piston and the cylinder cover.
i. Mount the piston into the cylinder by carefully placing it over the cylinder with the hands and then gently press and tap it down with a rubber mallet, see Picture 50. Tap the piston down to 10 cm under the locking grooves in order to make space for the cylinder cover. Do not tap the piston all the way to the bottom.

NOTE **Be careful until the piston/cylinder cover are fully placed down in the cylinder! There is a risk that the o-ring is pushed out of its track and squeezed towards the inside of the cylinder.**

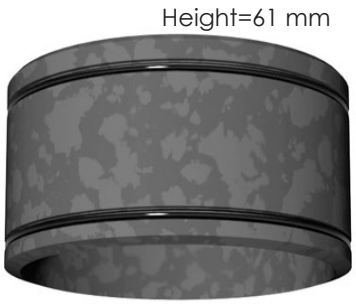
j. Remount the cylinder cover to the cylinder by first mounting the tool (Part no. 1820) on the cylinder cover, see Picture 51, and pressing/wiggling it down and then tapping it down carefully with a rubber mallet. Tap the cover down 4-5 cm under the locking grooves in order to mount the locking segments.
k. Place the locking segments in the locking groove.
l. Pull the tool upwards (Part no. 1820) so the cylinder cover ends up level with the edge of the cylinder.

Replace o-ring on the gas filling nipple and gas filling screw:

a. Remove the old o-ring on the gas filling nipple, see Picture 52.
b. Clean the nipple. Grease a new o-ring (Part no. 5518) with Dow Corning® 200 silicon oil, 350 CST (Part no. 7900) and mount o-ring on the filling nipple.
c. Check and clean the threaded hole in the bottom of the cylinder.
d. Apply thread sealant Loctite® 577 (Part no. 7904) on the nipple thread and mount the filling nipple in the threaded hole in the bottom of the cylinder.
e. Mount a new aluminium washer (Part no. 5011) under the gas filling screw (Part no. 2132), see Picture 53.

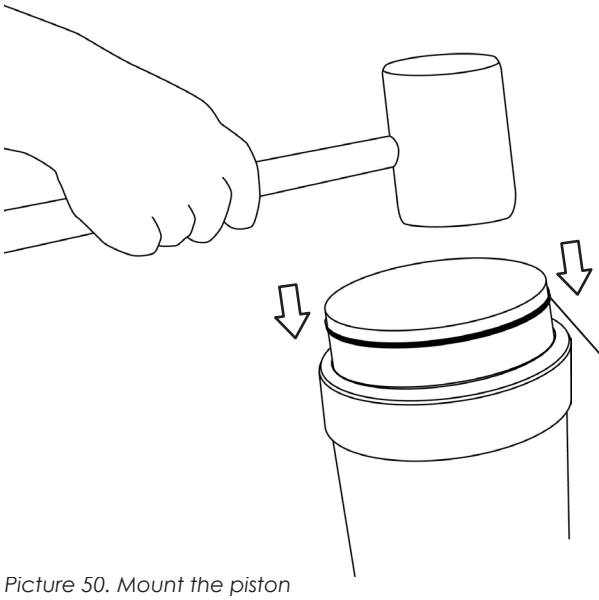
NOTE **Tighten the gas filling screw until firm, then unscrew it 6 turns, see Picture 54. This is done in order to later be able to easily attach the filling tool (Part no. 1800).**

Picture 47. Piston (Part no. 2102-03), o-ring (Part no. 5500)

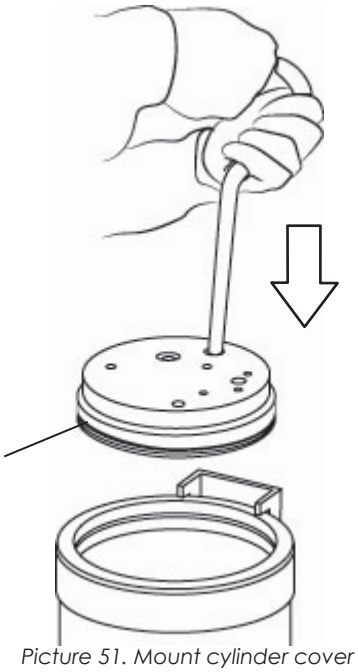


Picture 48. Piston (Part no. 2102-01), o-ring (Part no. 5501)

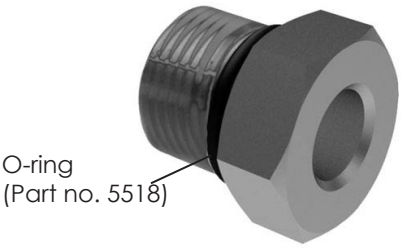
Picture 49. Cylinder cover (Part no. 2111-13), o-ring (Part no. 5500)



Picture 50. Mount the piston



Picture 51. Mount cylinder cover



Picture 52. Gas filling nipple (part no. 3130-10

Picture 53. Washer (Part no. 5011) with Screw (Part no. 2132)

Picture 54. Tighten gas filling screw

1.6.5 Pressurize piston accumulator/check gas pressure

In order to fill with gas, a filling tool (Part no. 1800) only intended for use with gas is used, alternatively a filling tool also used for liquid can be blown clean before gas filling. If there is still gas left in the cylinder: release the gas carefully, see section 1.6.3.

Only nitrogen gas (N_2) may be used for gas filling.

a. Mount a new aluminium washer (Part no. 5011) under the gas filling screw (Part no. 2132).

NOTE **Tighten the gas filling screw until firm, then unscrew it 6 turns, see previous section.**

b. Mount the filling tool (Part no. 1800) on the gas-filling nipple, see Picture 55 and screw the hexagonal rod into the tool so it grips the gas filling screw inside the nipple, see "Appendix 1: Filling tool" and the website: www.fogmaker.com for further instructions.
c. Connect gas filling tool (Part no. 1975) to the filling tool socket, see Picture 56.
d. Then loosen the gas filling screw 2 - 3 turns with the filling tool.
e. Ensure that the pressure relief valve is closed, see Picture 56.
f. Adjust the gas regulator on the gas bottle in accordance to Table 2, see also Picture 56. Before serial number 17607 on the piston accumulator, the piston height is 61 mm, thereafter the piston height is 45 mm, and the gas pressure is adjusted accordingly.

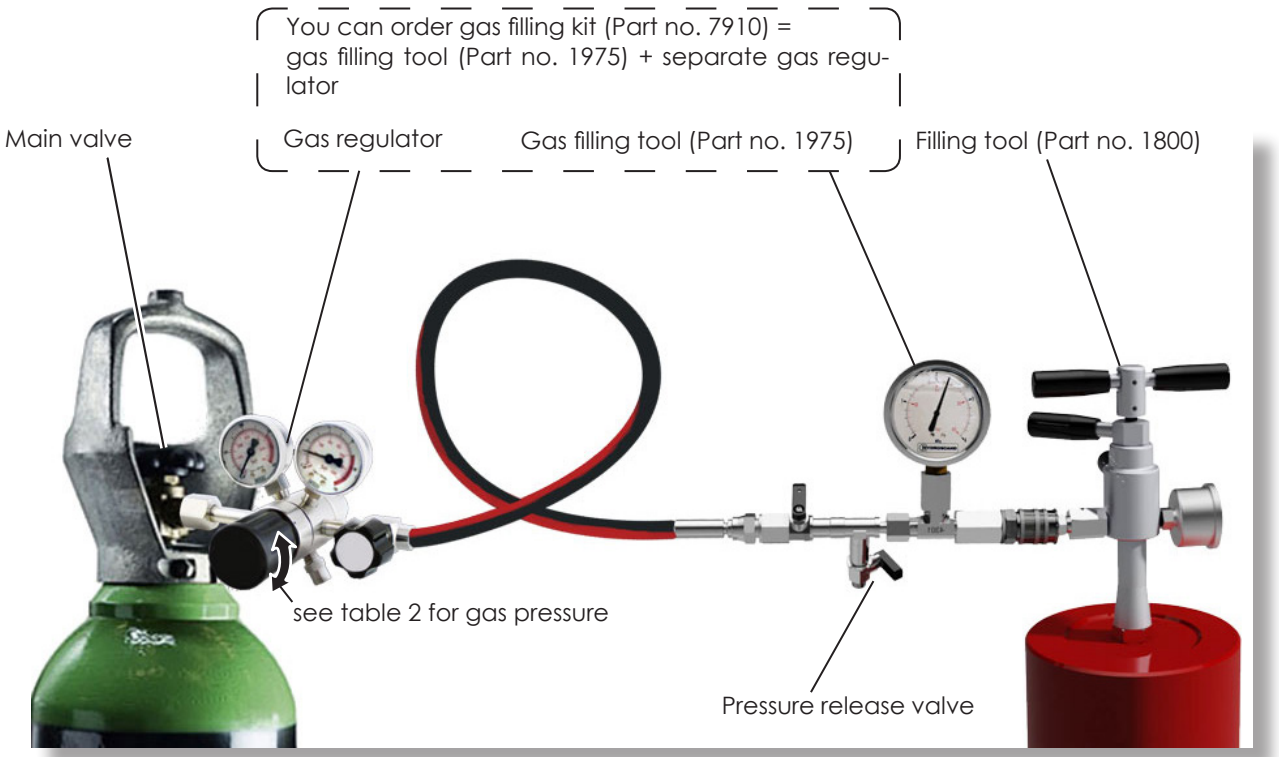
Breakpoint gas pressure	Piston accumulator volume (litres)			
	3.3	4	6.5	7.5
Piston accumulator serial number	Gas pressure (bar)			
0-17607	20	20	20	Not existing
17608--->	20	18	18	16.5

Table 2. Breakpoint gas pressure

g. Open the main valve on the gas bottle, see Picture 56. When the gas is connected, you may hear a "plop" when the piston is pushed upwards in the cylinder by the pressure. Continue the filling until the cylinder has obtained the correct gas pressure, check the manometer.
h. When the gas pressure is correct according to Table 2, tighten the gas filling screw with the filling tool (Part no. 1800).
i. Close the main valve of the gas bottle.
j. Open the pressure release valve on the gas filling tool and release the pressure in the hose, see Picture 56.
k. Dismantle the filling tool (Part no. 1800) and the gas filling tool (Part no. 1975).
l. Tighten the gas filling screw with a torque wrench 7±1 Nm.
m. Mount the protection plug (Part no. 5050-10) on the gas filling nipple with a torque wrench 15±1 Nm.

See the web page www.fogmaker.com for instructions.

Picture 55. Mount (part no. 1800) to gas filling nipple



Picture 56. Mount gas filling tool and gas regulator

1.6.6 Service & resetting of valve

There are three types of valves:

- The hydropneumatically activated valve.
- The electrically activated valve.
- The mechanically activated valve.

They are featured in two different executions: generation 1 and generation 2. Generation 2 is fully enclosed and has a different design/locking function, see Picture 57 and Picture 58.

NOTE **Service of valve can only be performed with the valve mounted on the piston accumulator, but only if the piston accumulator is emptied from liquid and pressurized with gas.**

Service of hydropneumatic valve (Part no. 6092-010/-020):

a. Dismount the membrane plug, take away used membrane, see Picture 60.

NOTE **For membrane plug with safety valve, do NOT remove 13 mm hexagon screw, see Picture 59.**

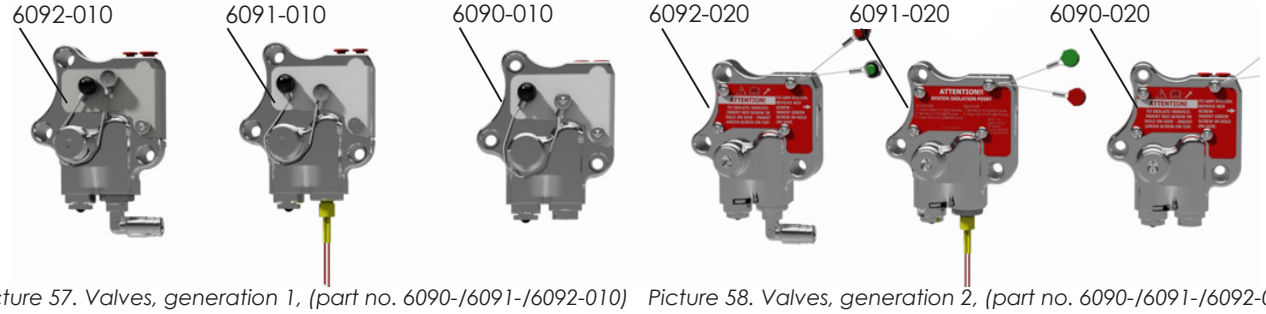
b. Clean membrane plug and replace o-ring (Part no. 5517).
c. Check generation on membrane plug, see Picture 61. If the membrane plug has a flat bottom surface, it is of generation 1 and it is recommended to replace it to generation 2 with a border around the bottom surface (Part no. 6035).
d. Mount new membrane on the membrane plug: Generation 1 has membranes with diameter 14 mm (Part no. 5520). Generation 2 has membranes with diameter 13mm (Part no. 5520-13). Grease the membrane with silicon fat Molykote® compound 111 (Part no. 7907), on both sides and place the end face of the membrane plug.
e. Apply thread sealant Loctite® 577 (Part no. 7904) on the threads of the membrane plug. Generation 1 membrane plugs shall be mounted in the valve and tightened with **7±1 Nm**. Generation 2 membrane plugs shall be mounted in the valve and tightened with **14±1 Nm**. The membrane plug shall be mounted in the left hole of the valve, see Picture 60.

Service of Electrically activated valve (Part no. 6091-010/-020):

a. Replace the membrane as described above.
b. Replace the electrical plug/metron with its powder charge into the right hole in the valve with a new complete plug (Part no. 6033/6033M), see Picture 60, 62, 63 & 64. Apply thread sealant Loctite® 577 (Part no. 7904) on the threads of the adaptor and mount.

Service of Mechanically activated valve (Part no. 6090-010/-020):

a. Replace the membrane in accordance with "Service of hydropneumatic valve", see above.



Picture 57. Valves, generation 1, (part no. 6090-/6091-/6092-010)

Picture 58. Valves, generation 2, (part no. 6090-/6091-/6092-020

Picture 59. Security valve on membrane plug

Picture 60. Exploded view of valve (part no. 6092-020)

Picture 61. Membrane plugs

Resetting of hydropneumatic valve (Part no. 6092-010/-020):

If the system has been deployed, the valve on the piston accumulator needs to be restored.

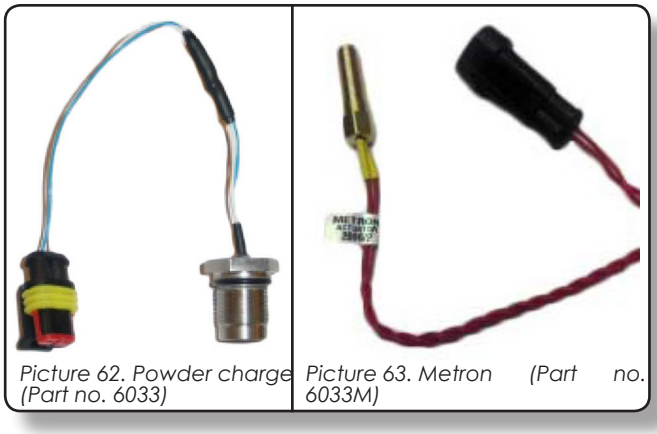
a. Replace the membrane according to instructions on page 22.
b. Restore the valve latch and insert the security screw, see Picture 65 - hydro-pneumatic valve.

Resetting of Electrically activated valve (Part no. 6091-010/-020):

a. Replace the membrane according to instructions on page 22.
b. Dismount the electrical plug and replace for a new complete plug according to instructions on page 22.
c. Put the valve latch in restored position, see Picture 65 - electrical valve.

Resetting of Mechanically activated valve (Part no. 6090-010/-020):

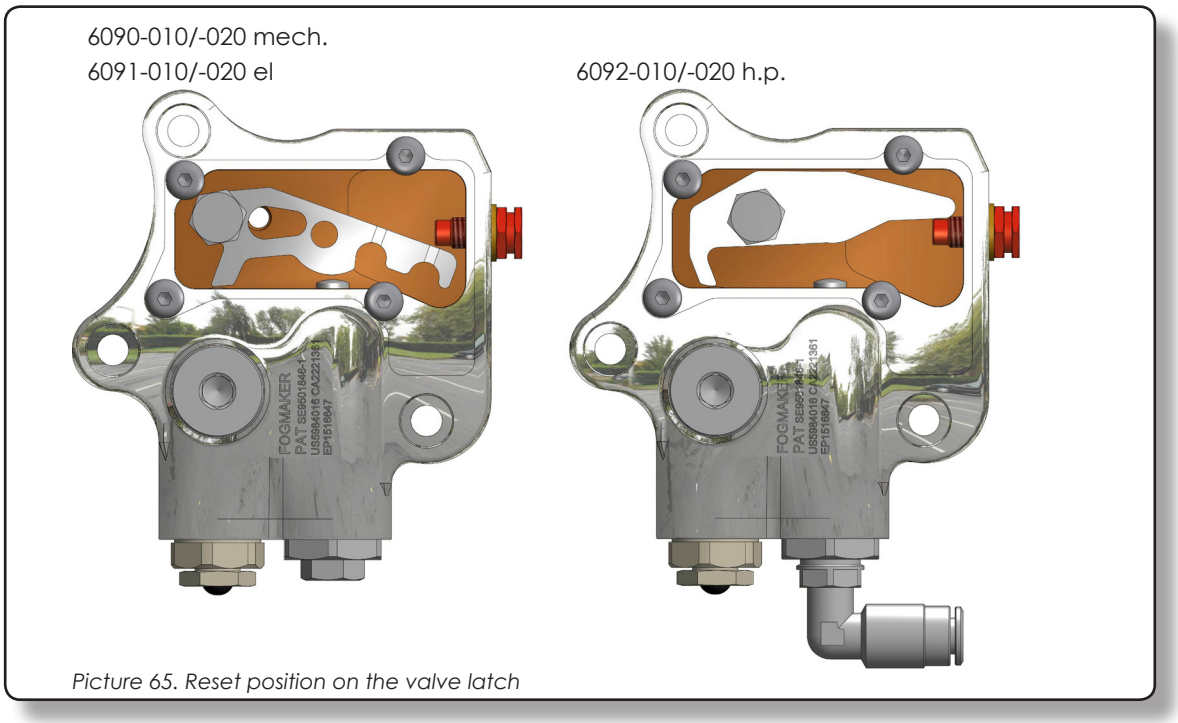
a. Replace the membrane according to instructions on page 22.
b. Check wires and seals on handles, see section “6c. Mechanical activation” on page 60.
c. Put the valve latch in restored position, see Picture 65 - mechanical valve.



Picture 62. Powder charge (Part no. 6033)

Picture 63. Metron (Part no. 6033M)

Picture 64. Exploded view electrically activated valve (Part no. 6091-010)

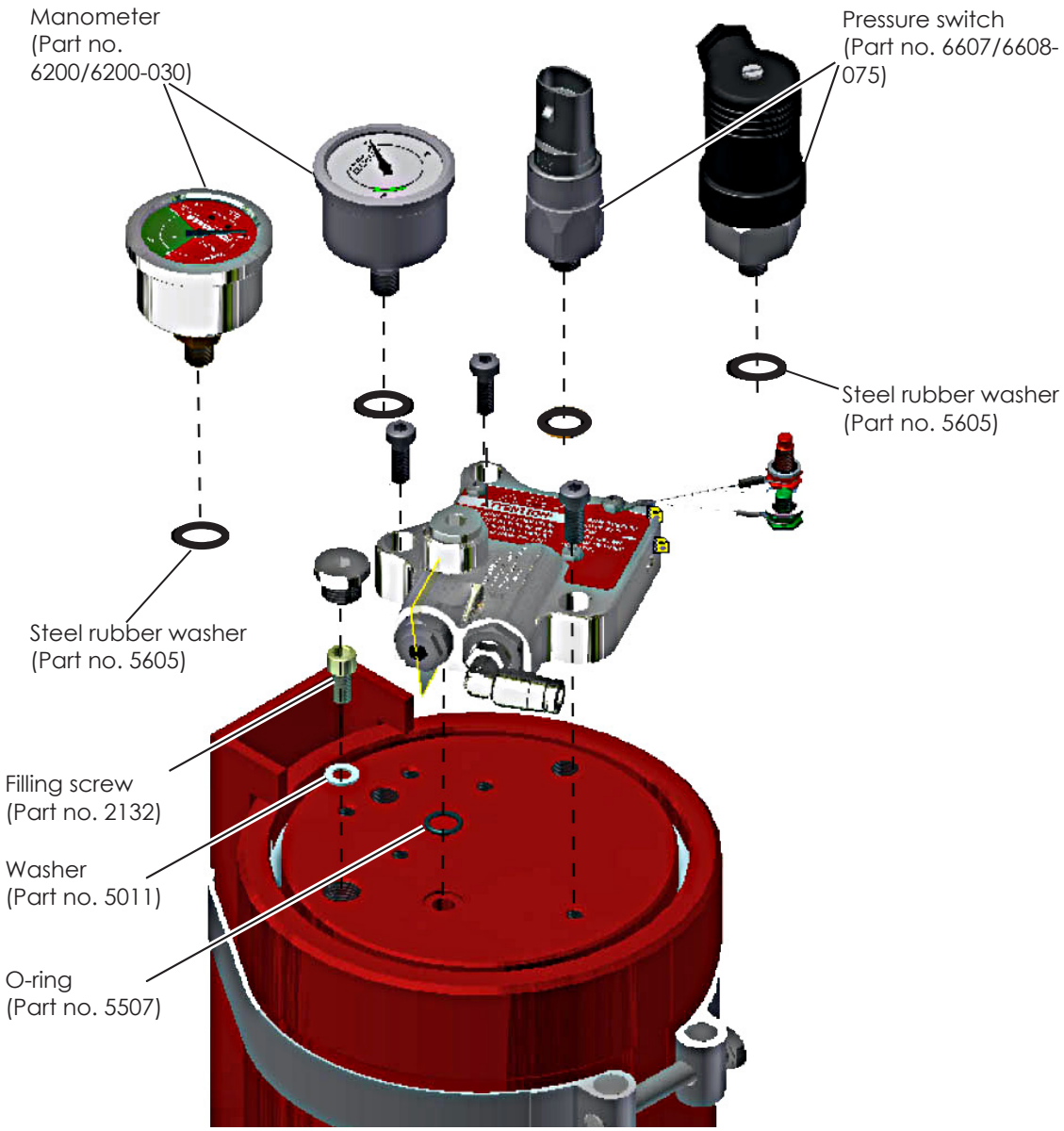


Picture 65. Reset position on the valve latch

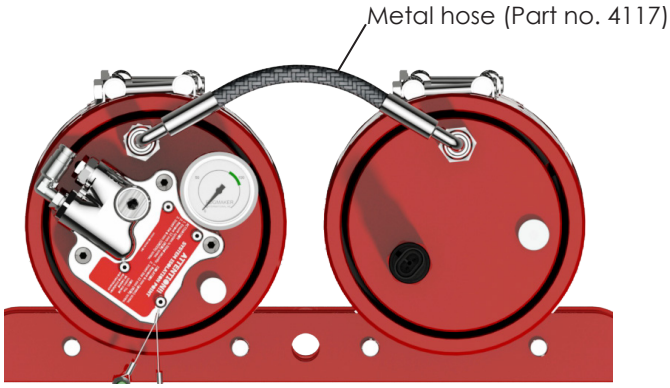
1

Remounting of valve, manometer and pressure switch (if previously dismounted, otherwise continue to section 1.6.7)

a. Place a new o-ring (Part no. 5507) under the valve, see Picture 66. Mount the valve with three Allen screws
b. Re-mount the manometer (Part no. 6200/6200-30), or if not functional, replace with a new manometer (Part no. 6200-30). Apply thread sealant Loctite® 577 (Part no. 7904) on the thread of the manometer. Tightening torque: 11±1 Nm with torque wrench. If the manometer is mounted on a used cylinder cover, a steel rubber washer shall be used when re-mounting (Part no. 5605), see Picture 66.
c. Re-mount pressure switch, if any (Part no. 6607/6608-075) with a new steel rubber washer underneath (Part no. 5605). Replace the pressure switch with a new one if it is no longer functional.
d. Mount a new aluminium washer (Part no. 5011-10), under the filling screw (Part no. 2132).
e. In case of double/triple accumulator, re-mount the metal hose (Part no. 4117) between the containers, tightening torque 58±2 Nm, see Picture 67.



Picture 66. Exploded drawing, cylinder cover with components



Picture 67. Double accumulator with metal hose

1.6.7 Refill suppressant

a. Dismantle the protection plug if it is attached, Picture 68.
b. Mount the filling tool (Part no. 1800) on the filling screw, Picture 69, see instruction movie on the website: www.fogmaker.com.
c. In order to fill the piston accumulator, a Fogmaker filling pump is used, see manual (Part no. 8026-001). Mount the high-pressure, re-circulation and low-pressure hoses in accordance with Picture 70. There are different types of suppressants, check which type of suppressant that shall be used, see label (Part no. 8106) on the service decal, Picture 71.

NOTE **Only use suppressant from Fogmaker.**

c. Fill the piston accumulator.

NOTE **Fill the piston accumulator until the manometer shows a pressure of 100-105 bar at 20°C.**

d. Shut off the filling pump, release pressure from the high-pressure hose and remove it according to Filling pump manual (Part no. 8026-001).
e. Disconnect the filling tool.

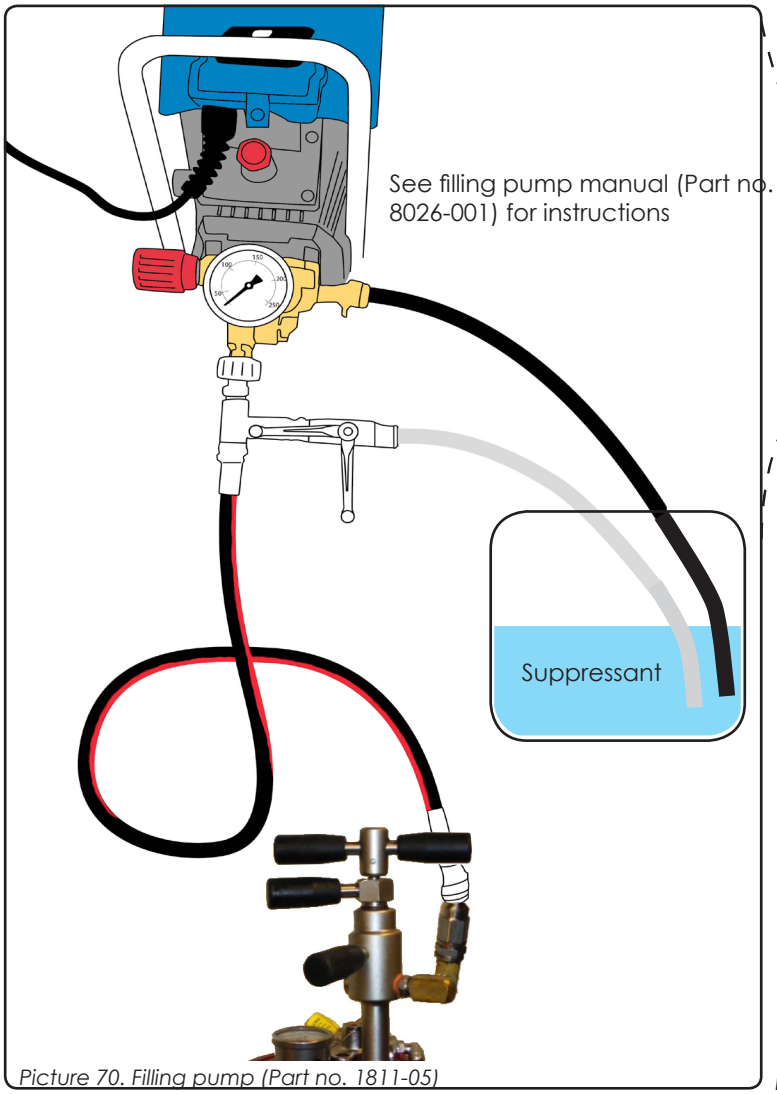
Final steps:

a. Wipe the piston accumulator dry after filling it with liquid.
b. Replace damaged labels, see section “7. Labels and Seals” on page 62.

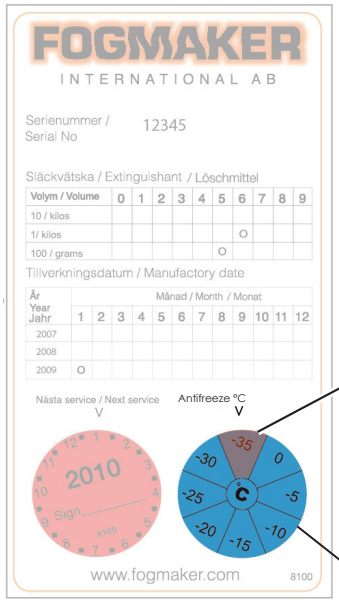
Picture 68. Dismantle the protection plug

See instruction movie on our web page: www.fogmaker.com

Picture 69. Filling tool mounted on filling screw



Picture 70. Filling pump (Part no. 1811-05)



Type of suppressant

Part no. 8106

Picture 71. Service label (part no. 8100)

2. Detector Bottle

The detector bottle contains liquid and nitrogen gas and is pressurized at around 24 bar after installation, see Picture 72 and 75. The detector bottle has one or two pressure switches which indicates if the pressure is under 14 bar (and 5 bar, respectively, optional) in the system. The detector bottle has a ball valve which shall be open when the system is active.

2.1 Serial number and pressure

a. Note the serial number found on the label of the detector bottle (Part no. 8191), see Picture 73. If the number is not visible, note the chassis number that is punched on the bottleneck, see Picture 74.
b. Also check the rest of the labels, see section 7.
c. The bottle pressure can be checked on the manometer on the top of the bottle and should be within the green area, see varieties of the manometer on Picture 76 and 77.

NOTE **Pressure in the detector bottle should be 22 ±2 bar at 20°C.**

If the pressure is too low - under 20 bar at 20°C - go to section 2.4 and refill the bottle.
If the pressure is too high - over 24 bar at 20°C - go to Appendix 2 and adjust the pressure in the bottle.

2.2 Check functionality

There is a riser pipe in the detector bottle, Picture 75, which means that the bottle must be placed according to the instructions for normal function.

The detector bottle should be mounted standing up with an angle of maximum 90°, mounting over 90° is not allowed, see Picture 78.

If a detector bottle with the wrong angle is detected during annual control / service, the bottle should be refitted with the correct angle.

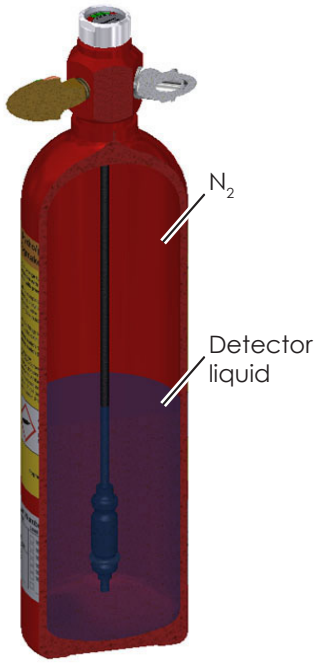
The ball valve on the detector bottle opens or closes the bottle, see Picture 79. The valve shall always be open when the system is activated, apart from during system service.

NOTE **If the valve is closed, check that the safety screw is mounted in the valve on the piston accumulator and that the detector hose is undamaged before the valve is opened.**

Picture 72. Detector bottle(part no. 1656)

Picture 73. Information label Part no. 8191

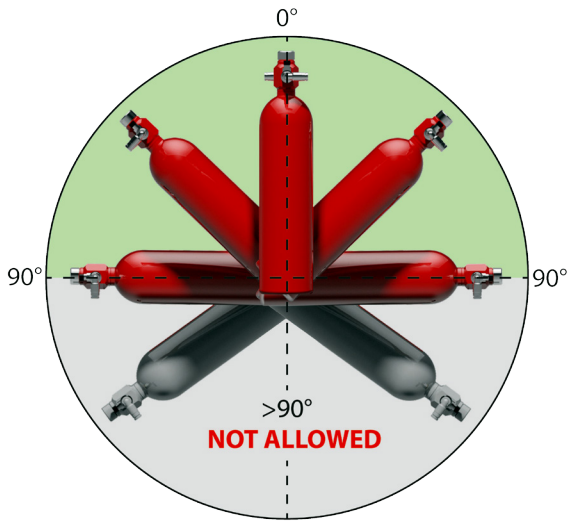
Picture 74. Chassinummer



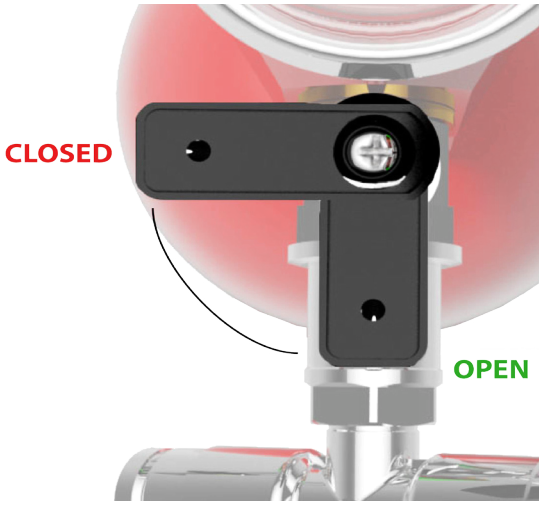
Picture 75. Detector bottle, sectional

Picture 76. Manometer (part no. 6203-05)

Picture 77. Manometer (part no. 6203-06)



Picture 78. Approved mounting of detector bottle



Picture 79. Open/closed detector bottle

2.3 Damage/leakage, detector bottle

Check that the bottle is not damaged and is tightly fastened. If the bottle pressure is OK, no leakage is assumed, see Picture 80.

2.4 Refilling/resetting of detector bottle

If the detector bottle is not filled before, please refer to Fogmaker installation manual (Part no. 8010-001). The manual only concerns refilling of detector bottle if the system has been deployed. Only refill the detector bottle when the manometer shows a pressure under 20 bar, following these steps:

2.4.1. Empty the bottle before refilling it.
2.4.2. Create vacuum inside the bottle
2.4.3. Refill the bottle
2.4.4. Pressurize the detector bottle

2.4.1. Empty the bottle before refilling it

After deployment, a detector bottle has a residual 50 ml liquid left in the bottle due to the design.

a. Compare the weight of the bottle with the values in table 3. If the weight exceeds the values in the table, there is extra liquid remaining that needs to be emptied in order to ensure that the correct amount of liquid is refilled in the detector bottle. There are two different volumes on detector bottles, 0.9 l and 0.8 l. The actual volume is printed on the bottleneck, see Picture 81 and 82.
b. Pressurize the bottle with 3 - 7 bar with nitrogen gas, see section 2.4.4.
c. After that, keep the detector bottle with the manometer upwards.
d. Place one end of the connected detector tube in an empty container and carefully open the ball valve in order to release excess liquid, see Picture 83.

2.4.2. Create vacuum inside the bottle:

Mount the parts that are parts of tools for refilling of detector bottle (Part no. 1970), see Picture 84, 85 and 86 depending on L- or T-coupling on the detector bottle. Use enclosed end plug to the T-coupling in Part no. 1970. If end plug is missing, temporarily use a standard pneumatic blind plug Ø 6 mm. Check the direction of the vacuum ejector, see Picture 87.

a. Connect the blue hose to compressed air (at least 6 bar).
b. Open the ball valve on the detector bottle
c. Wait 10 - 15 seconds in order to create vacuum in the bottle.
d. Close the ball valve on the detector bottle and disconnect the compressed air.
e. Disconnect the vacuum ejector from orange hose: press the outer ring and pull the orange hose outwards.

Picture 80. Damage, leakage, mounting

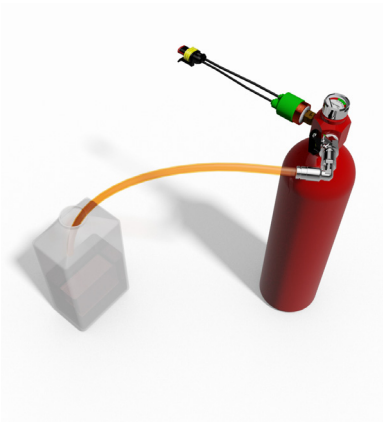
Type of detector bottle 0.9 l	Part no.	50 ml liquid
1 pressure switch w L-coupling	1657	740 g
2 pressure switches w L-coupling	1655	780 g
1 pressure switch w T-coupling	1656	750 g
2 pressure switches w T-coupling	1654	790 g

Type of detector bottle: 0.8 l	Part no.	50 ml liquid
1 pressure switch w L-coupling	1675	980 g
2 pressure switches w L-coupling	1655	1020 g
1 pressure switch w T-coupling	1656	990 g
2 pressure switches w T-coupling	1654	1030 g

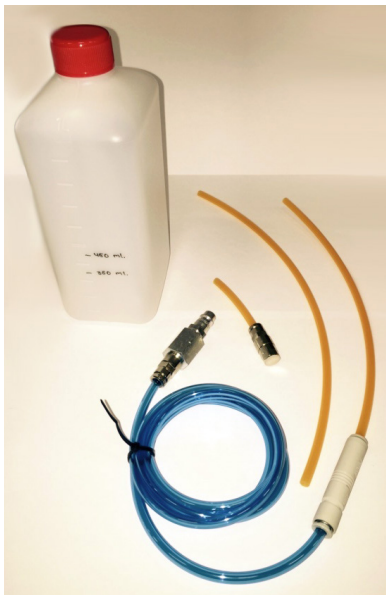
Table 3. Detector bottle with weights

Picture 81. 0,9 liter detector bottle

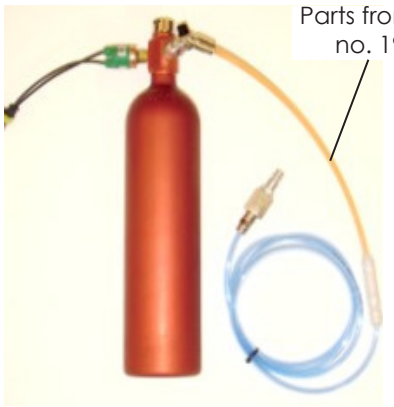
Picture 82. 0,8 liter detector bottle



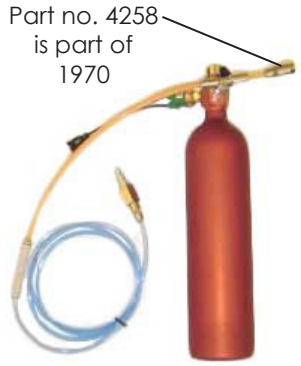
Picture 83. Emptying of detector bottle



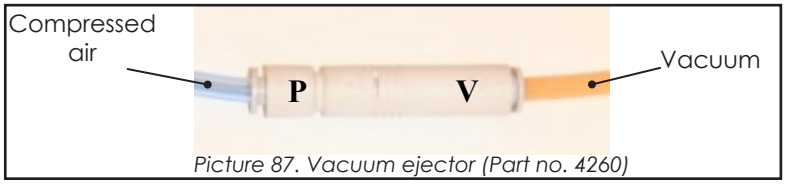
Picture 84. Detector filling tool (Part no. 1970)



Picture 85. L-coupling



Picture 86. T-koppling



Picture 87. Vacuum ejector (Part no. 4260)

2

2.4.3. Refilling:

a. There are two different types of detector liquid. Standard is propylene glycol, which is red coloured. Ethylene glycol is blue coloured, check designation on the information label, see Picture 88.
b. For refill, use the amount of liquid stated in table 4. Fill a container with the correct amount of liquid.
c. Place the detector tube in the container with liquid and ensure that it reaches the bottom of the container, see Picture 89.
d. Open the ball valve on the detector bottle and wait until the content in the plastic bottle has been sucked in to the detector bottle. When the vacuum is gone, close the ball valve on the detector bottle.

2.4.4. Pressurize the detector bottle:

Only use nitrogen gas (N2). The gas pressure is determined by the length of the detector tube in the fire suppression system and whether the detector tube is pre-filled or not, the gas pressure in the detector bottle should be:

NOTE

- **24 bar if the detector tube is pre-filled.**
- **24 bar if the detector tube is under 8 m and not pre-filled.**
- **31 bar if the detector tube is 8 -14 m and not pre-filled.**

Use the gas filling tool (Part no. 1975), see Picture 90:

a. Connect the gas filling tool to the detector bottle with detector tube a. Then connect the other end of the gas filling tool via the high-pressure hose to the gas regulator on the nitrogen gas bottle, see Picture 91.

NOTE **Be careful with the manometer on the gas filling tool.**

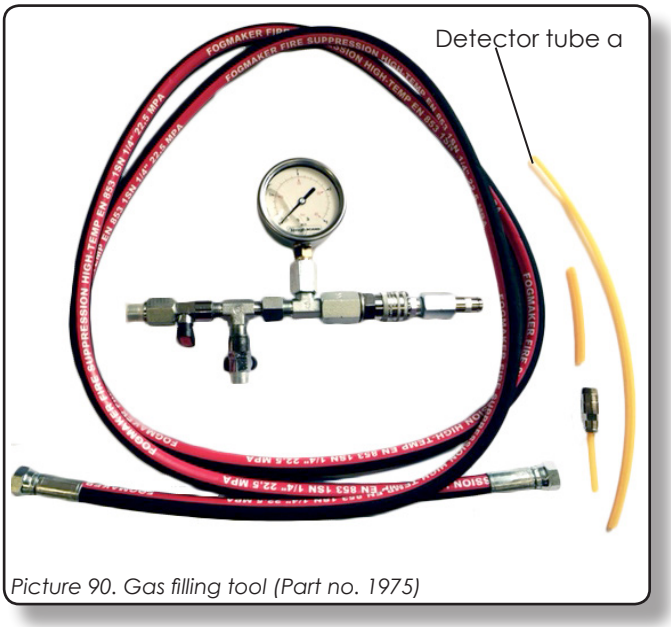
b. Adjust the gas regulator on the nitrogen gas bottle until desired pressure (24 or 31 bar, see above) and open the flow.
c. Open the ball valve on the gas filling tool.
d. Open the ball valve on the detector bottle carefully Gas filling begins. Wait until the pressure is equalized and there is no more sound of any flow.
e. Close the ball valve on the detector bottle
f. Close the ball valve on the filling tool
g. Close the valve on the gas bottle
h. Open the pressure release valve on the gas filling tool to release residual pressure in the hose
i. Dismantle all equipment from the detector bottle, which is now ready for use. To disconnect hoses from the couplings, press the outer ring inwards and disconnect the detector tube. This also applies to the quick coupling on the detector bottle, see Picture 92.

Picture 88. Designation on the information label for ethylene glycol

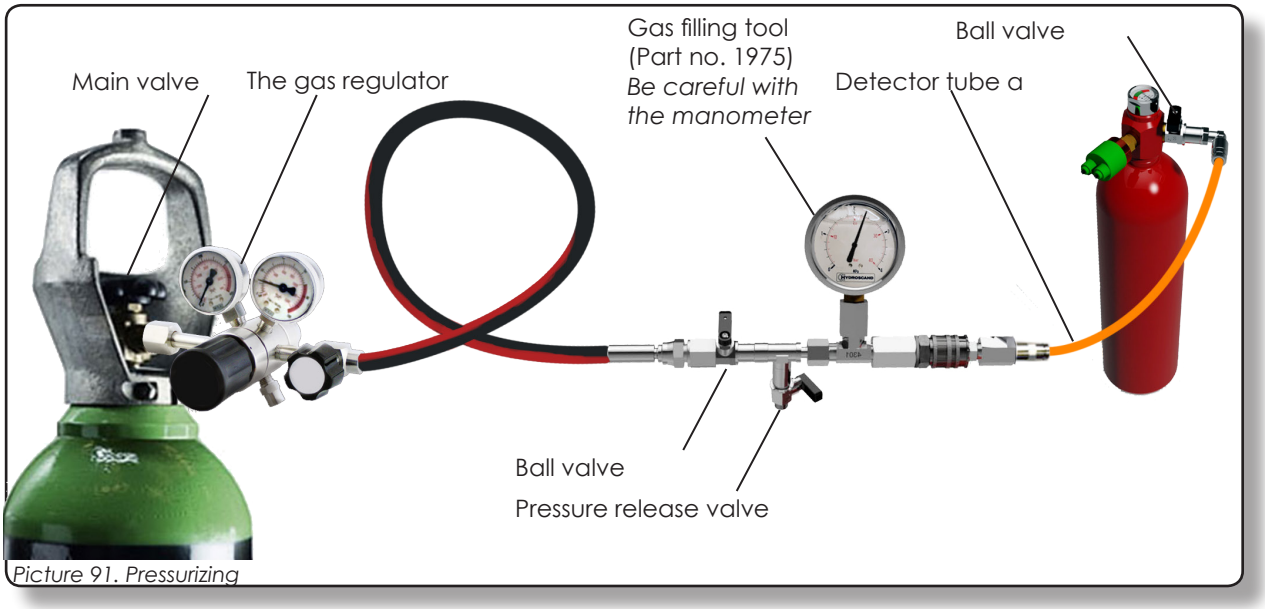
Refill the bottle with detector liquid:	Amount of liquid (ml)
Type of detector bottle: 0.9 l	400
Type of detector bottle: 0.8 l	300

Table 4. Detector liquid amount, refilling

Picture 89. Refilling of detector bottle



Picture 90. Gas filling tool (Part no. 1975)



Picture 91. Pressurizing

Picture 92. Dismount coupling from detector tube

Service of vacuum ejector

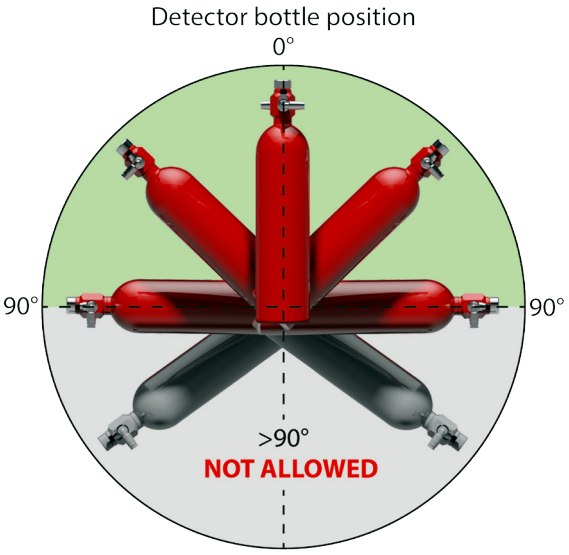
The vacuum ejector does not work if there is liquid inside it.
To clean the ejector, rinse thoroughly in water, blow it dry with compressed air to ensure it is really dry, see Picture 93.

Resetting the detector bottle after system deployment:

a. If the bottle is not damaged, restore it in accordance with the instructions in section 2.4.
b. Re-mount the detector bottle with the right angle, see Picture 94.

For resetting the complete fire detection system, see section “6.6 Resetting the fire detection system” on page 56.

Picture 93. Vacuum ejector (Part no. 4260)



Picture 94. Correct mounting position detector bottle

3. Novec™ System

The Novec™system consists of a bottle of the same type as the detector bottle and a red detector tube, the bottle can be equipped with one or two pressure switches (Part no. 1008 and 1008-02). In case of fire (around 120°C), the red detector tube bursts and the Novec™liquid spreads out, see the system on Picture 95.

NOTE **The bottle is pressurized at 22 ±2 bar at 20°C after installation with 0.6 m tube.**

- The Novec™bottle contains 585/700 gram Novec™ 1230 fire suppressant (Part no. 7015) and the remaining part nitrogen gas (N_2).
- The Novec™bottle is equipped with one or two pressure switches which indicates with an alarm if the pressure drops under 14 bar (and 5 bar, respectively, optional) in the system.
- The Novec™system is installed in spaces of up to 0.8m^3.

3.1 Serial number and pressure, Novec™ bottle

a. Note the serial number found on the label of the Novec™bottle (Part no. 8191), see Picture 96 and 97. If the number is not visible, note the chassis number that is punched on the bottleneck, see Picture 98.
b. Also check the remaining labels, “7. Labels and Seals” on page 62. The red detector tube (Part no. 4024) shall be marked with a warning sign (Part no. 8220), see Picture 99.
c. Check the pressure inside the bottle on the manometer that is placed on top of the bottle. See varieties of the manometer on Picture 100 and 101.

NOTE **The manometer shall indicate within the green area, 20-24 bar at 20°C.**

Picture 95. Novec™system (Part no. 1008)

Picture 96. Information label (Part no. 8191)

Picture 97. Novec™ bottle

Picture 98. Chassis number

Picture 99. Detector label (Part no. 8220)

Picture 100. Manometer (part no. 6203-05)

Picture 101. Manometer (part no. 6203-06)

3.2 Check functionality of Novec™bottle

There is a riser pipe in the Novec™bottle, Picture 102, which means that the bottle must be placed according to the instructions for normal function, see Picture 103.

a. Check the inclination of the Novec™bottle where it is installed.

Novec™ bottle should be mounted standing up with an angle of maximum 20° when the protected volume is up to 0.8 m³. Mounting up to maximum 45° is allowed only if the protected volume is less than 0.5 m³.

A ball valve on the outgoing connection allows the red detector tube to be pressurized and thus the system is activated, see Picture 104.

b. Check the valve of the Novec™bottle.

NOTE **If the valve is closed, check that the red detector tube is undamaged and then open the valve carefully.**

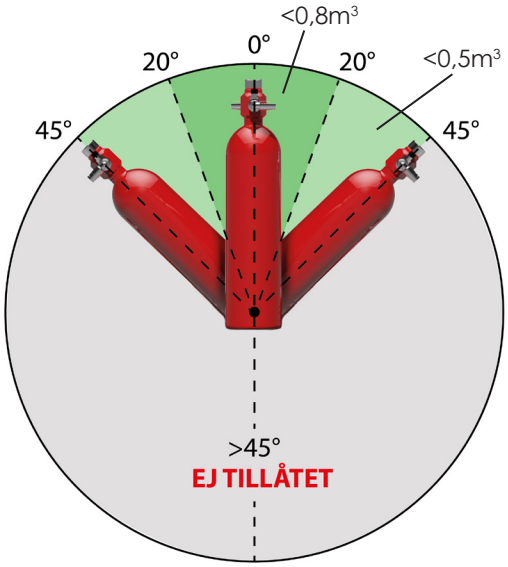
3.3 Damages/leakage Novec™bottle

a. Check that the bottle is not damaged and is tightly fastened.
b. Check couplings and the bottle for possible leakage, see Picture 105. If the manometer shows pressure within the green area, the bottle can be assumed free from leakage, see Picture 100 and 101.

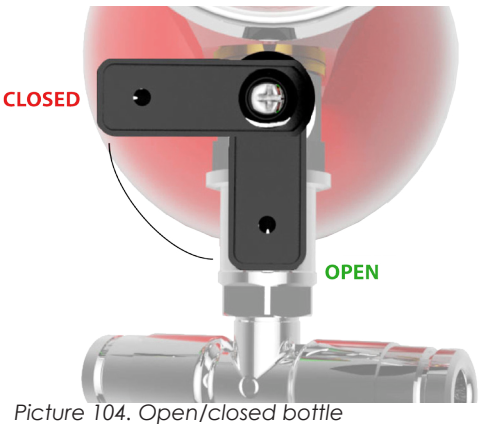
3.4 Red detector tube of Novec™bottle

a. Check that the red detector tube (Part no. 4024) is placed at least 500 mm away from hot surfaces as the hose has a working temperature on maximum 90°C and bursts at around 120°C.
b. Check the hose for damages, see Picture 106.

Picture 102. Novec™ bottle sectional view

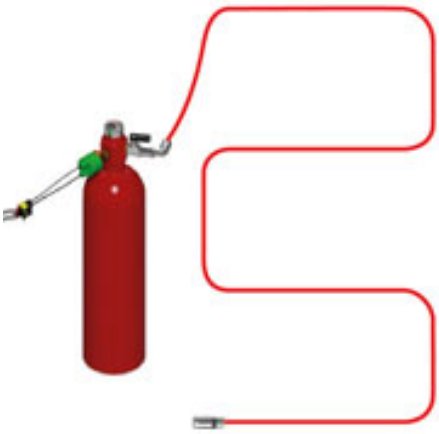


Picture 103. Novec™ bottle mounting



Picture 104. Open/closed bottle

Picture 105. Check for damage and attachment



Picture 106. Novec™ red detector tube

Resetting the Novec™ System

The Novec™bottle may show too low pressure due to deployment of the system, Picture 107. In that case, check the detector tube.
To restore the system: dismount the Novec™ bottle:

a. Close the ball valve on the Novec™ bottle, Picture 108.
b. Disconnect the detector tube from the coupling on the Novec™ bottle, Picture 109, and dismantle the bottle.

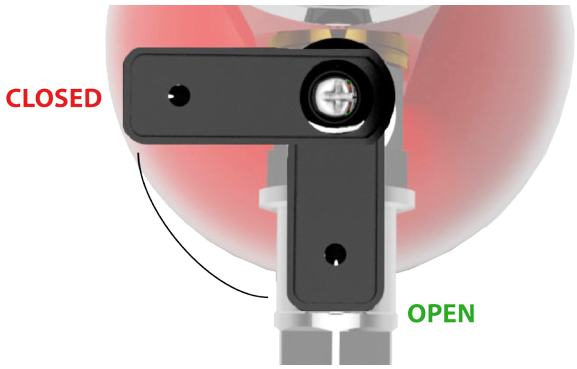
NOTE **Send back the Novec™ bottle to Fogmaker for resetting.**

Mount a new Novec™ system:

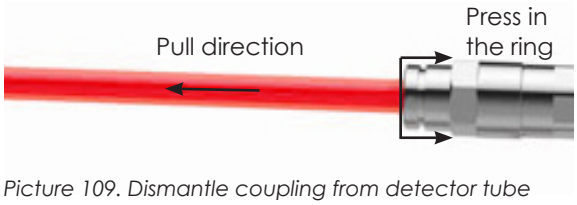
a. Remove the damaged detector tube and clamps.
b. Mount a new bottle from Fogmaker with the right angle, see Picture 103.
c. Mount a new red detector tube (Part no. 4024) with the same tightening in the space as before. Replace steel rubber clamps if necessary. Check that no sharp edges can damage the detector tube.
d. Couple the detector tube to the Novec™ bottle.

Activate the system by carefully opening the ball valve on the bottle, Picture 110.

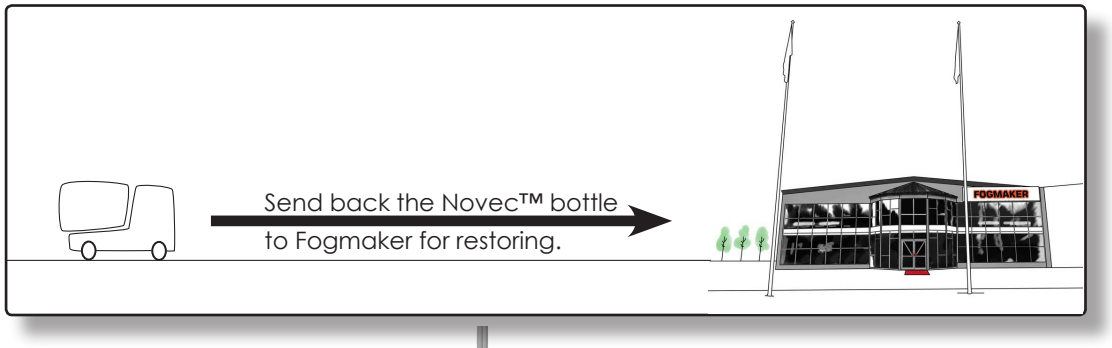
Picture 107. Low pressure

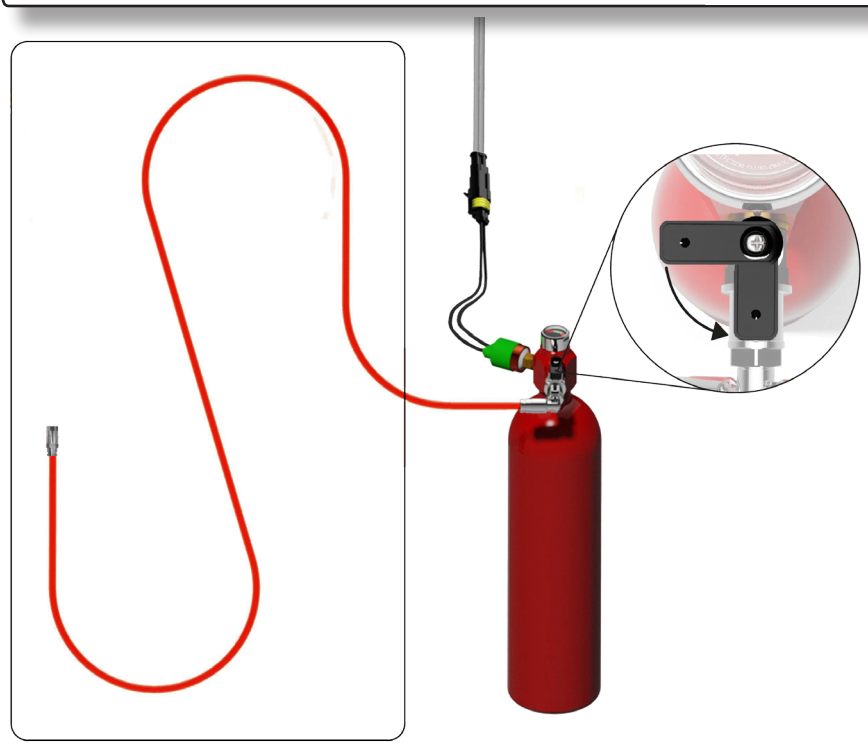


Picture 108. Open/closed bottle



Picture 109. Dismantle coupling from detector tube





Picture 110. Activate the Novec™ system

4. Alarm and Cabling

A pressure switch on the piston accumulator gives an alarm if the pressure falls below 80 bar (optional).

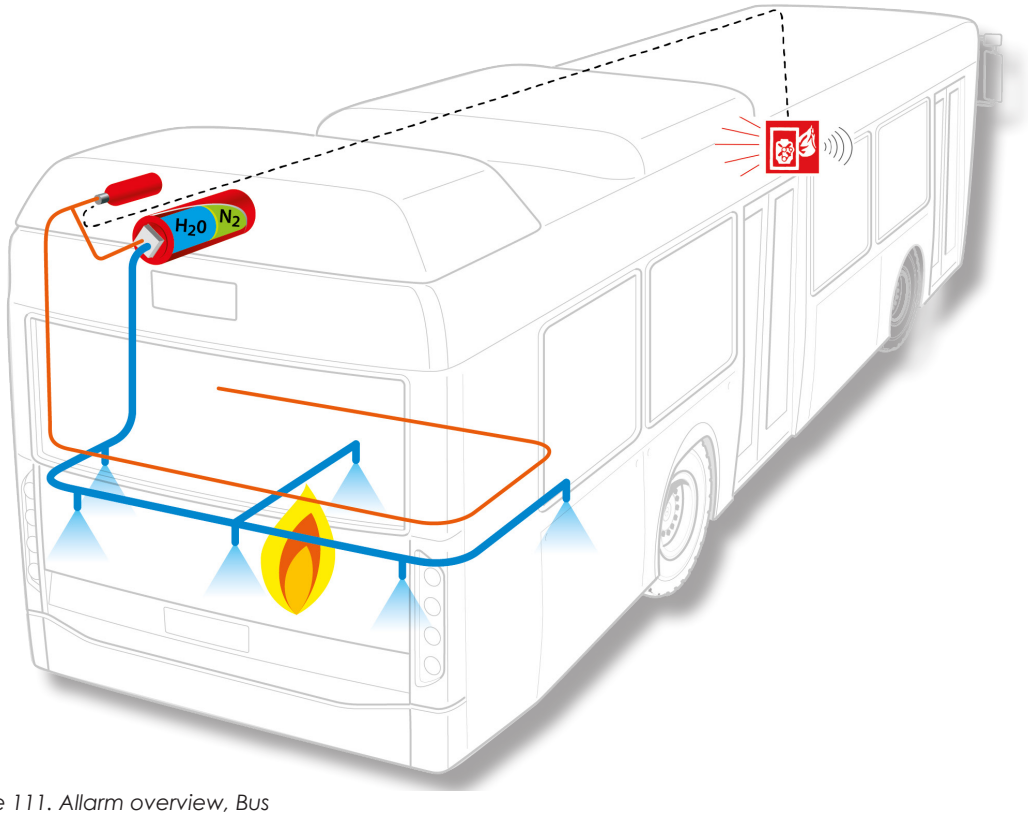
Pressure switch(es) on the detector bottle gives an alarm if the pressure falls below 14 bar and 5 bar (optional).

These are connected to the alarm panel or the CAN-bus in the driver environment and sound and light signals, if featured. For the system to alarm in case of a fire, the requirement is that the cables are undamaged and functional, which is checked at annual controls.

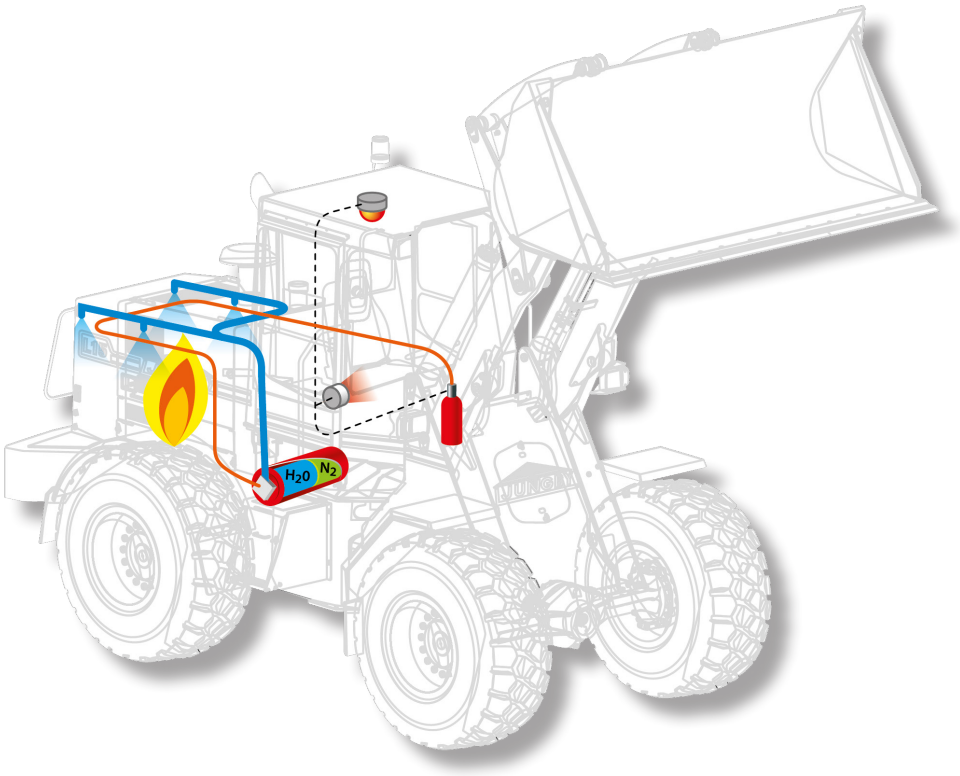
4.1 Check functionality, general

Check that cables and cable protection are undamaged. See Picture 111 and 112 for where cables can be located in the vehicle.

See next pages for checking of alarm panels.



Picture 111. Allarm overview, Bus



Picture 112. Alarm overview, machine

Check functionality, alarm panels

Perform systems test by pushing the test button on the central unit or alarm panel, see pictures of Fogmaker alarm panels, Picture 113-116. For machine installations, acoustic and visual alarm can also be installed, see Picture 117 and 118.

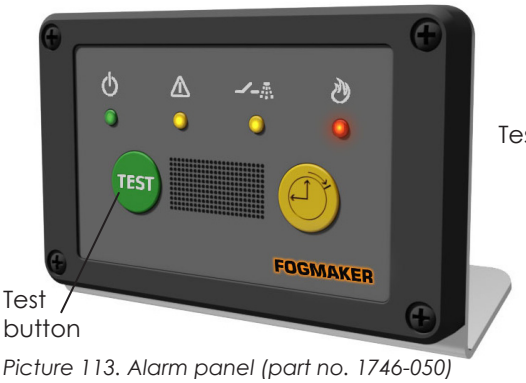
If the test button is missing: In order to test the alarm function, disconnect a coupling to a pressure switch on detector bottle or piston accumulator, see Picture 119 and 120. The pressure switches are type NO, which means that the alarm indicates at a certain pressure when the circuit is closed. If signal is given when connector is disconnected, the alarm circuit is OK.

Pressure switch on the piston accumulator and a second pressure switch on the detector bottle is optional so the number of pressure switches installed may vary. Alarm or error signal is emitted depending on which panel is installed and the different number of pressure switches. See wiring diagram for each part.

NOTE **Remember to refit pressure switches on the detector bottle and piston accumulator after control.**

Reset of alarm after discharge of the fire suppression system:

- Replace all damaged components.
- Check all wires.
- Test the function of the alarm system



Picture 113. Alarm panel (part no. 1746-050)
Included in alarm kit (Part no. 1746-071/-072/-074

Picture 114. Alarm button (part no. 6970)
Included in alarm kit (Part no. 1747-020/-00/-12)

Picture 115. Alarm panel (part no. 1748) "heavy duty"

Picture 116. Alarm panel (Part no. 1745/1746)

Picture 117. Acoustic alarm (part no. 1751)

Picture 118. Visual alarm (part no. 1760)

Picture 119. Pressure switch on detector-/Novec™bottle

Picture 120. Pressure switch on piston accumulator

5. Distribution System

The distribution system consists of distribution hoses, pipes and couplings, and spray nozzles. Their task is to distribute the suppressant from the piston accumulator out into the fire protected area, see Picture 121.

5.1 Check functionality/spray nozzles

a. All spray nozzles shall be free from coating and deemed to be able to spray suppressant, see Picture 122.
b. Check that all spray nozzles in the system are equipped with protective cap/nozzle cap. Picture 123 shows the three different designs of spray nozzles, and what they look like with and without nozzle cap.

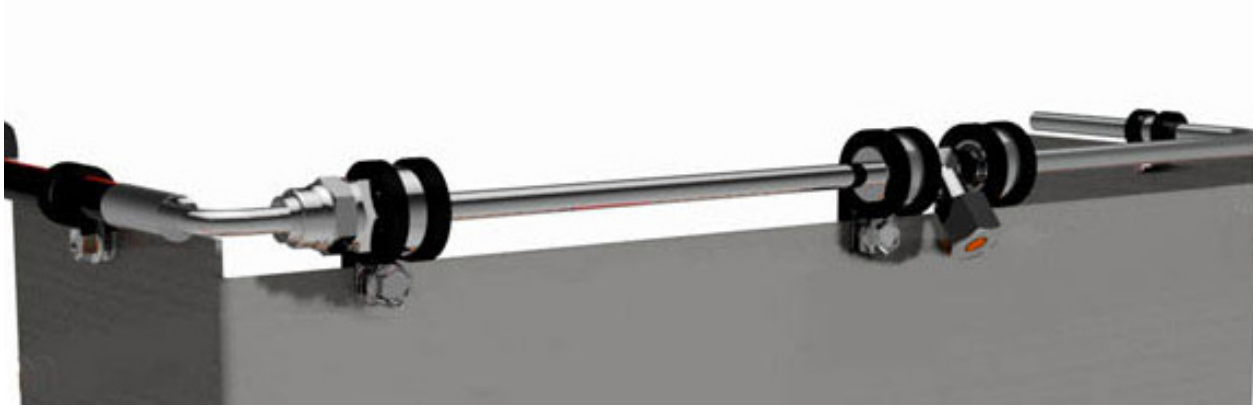
All spray nozzles shall have nozzle caps. Nozzle caps are not to be re-used.

NOTE **If a nozzle cap is missing, the spray nozzle shall be dismantled and replaced with a new**.

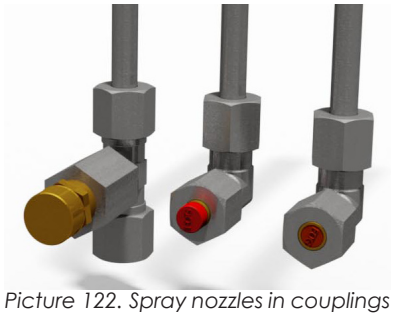
Check that the correct type of spray nozzle is re-mounted: see designation or shape of the nozzle, see Picture 124. The previous generation with brass cap has a different shape on the nozzle body, see Part no. 1500 (smooth), 1501 (turned groove) and 15010 (hexagon).

The later generations with nozzle caps have a designation punched along the edge: ”F4-2” is for example punched into pink nozzles (Part no. 1502), see Picture 124.

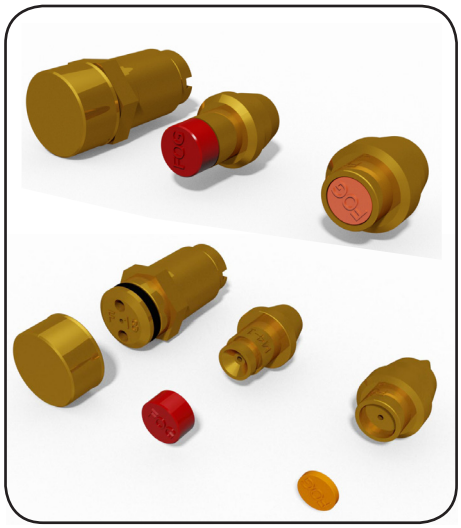
Dismantle the nut affirming the nozzle and remove the old nozzle. Use tools (Part no. 1819 for spray nozzles Part no. 1500/1501/15010). Blow clean with compressed air and mount a new spray nozzle, see Picture 125.



Picture 121. Distribution system

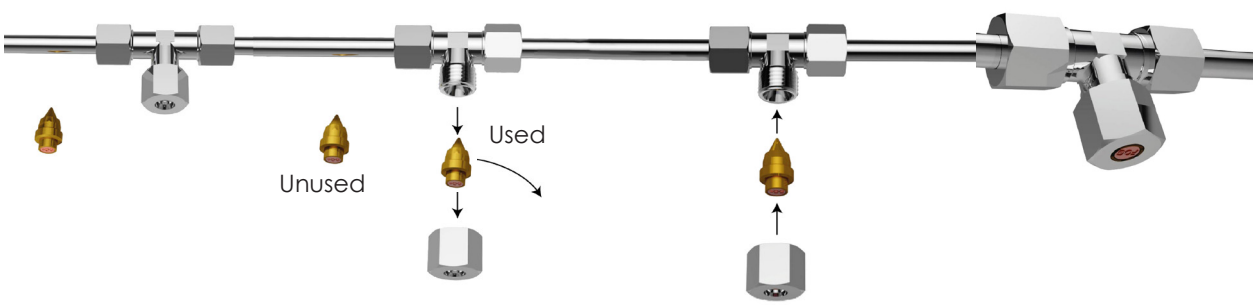


Picture 122. Spray nozzles in couplings



Picture 123. Spray nozzle caps

Picture 124. Spray nozzles, designations



Picture 125. Changing spray nozzles

5

5.2 Mounting

All couplings shall have tightening torque: 20±1 Nm.
Pipes shall be fastened with steel rubber clamps. The distribution hose shall be fixated with steel rubber clamps or cable ties, see Picture 126 - 129.
Minimum distance between steel rubber clamps is 300 mm, maximum distance from the end part to clamp is 100 mm, see Picture 126 and 129.
If worn and/or torn - replace steel rubber clamps.

5.3 Damage and leakage

a. Clamps keeping pipes and hoses in place shall be tightened, but there should be no abrasions on distribution hoses or pipes, check that they still have the rubber protection intact.
b. Check that pipes and hoses are not exposed against a hot or sharp surface that can damage.
c. Check distribution hoses for damages generated from sunlight, age and similar, see Picture 130 and 131. Pay extra attention to hoses on the exterior of machinery, which are exposed to the elements.

5.4 Leakage test of distribution system

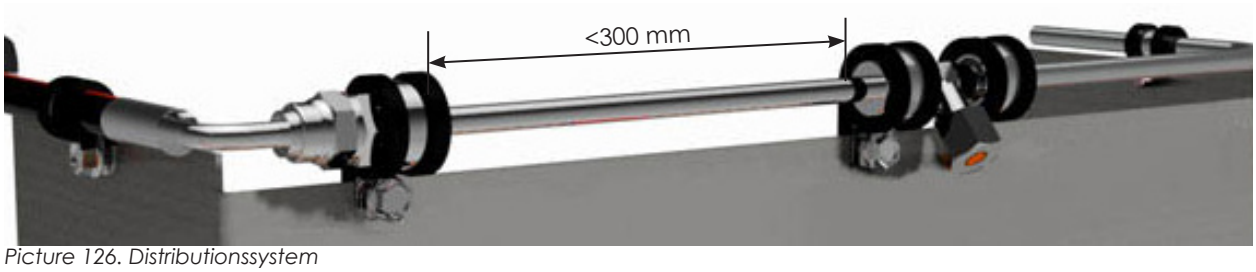
Leakage testing is only required when leakage is suspected.
a. Replace nozzles with plugs (Part no. 1510).
b. Compressed air is connected to the piston accumulator connector, see Picture 132
c. Spray couplings with leakage spray
d. Spray compressed air through the system. Check for bubbles around the couplings.

5.5 Resetting after deployment

Rinse with water as soon as possible after system deployment. If the system has been left without rinsing after deployment for more than 24 - 48 hours, depending on external factor, a functionality test shall be performed as follows:

NOTE **Check that the system has been deployed before commencing resetting.**

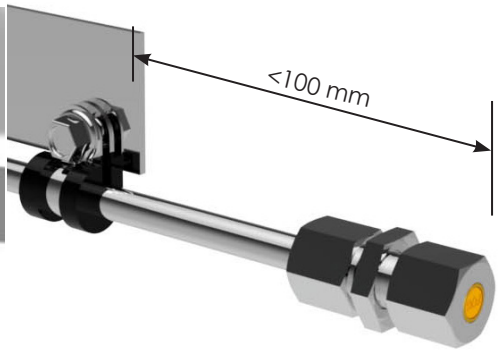
a. Dismantle the distribution hose from the piston accumulator to the distribution system.
b. Disconnect the spray nozzles and rinse the pipe system with water, use rinsing tool (Part no. 1977-010), see Picture 133.
c. After that, sprat compressed air through the pipe system.
d. Mount new spray nozzles.



Picture 126. Distributionssystem

Picture 127. Clamps (Part no. 5318)

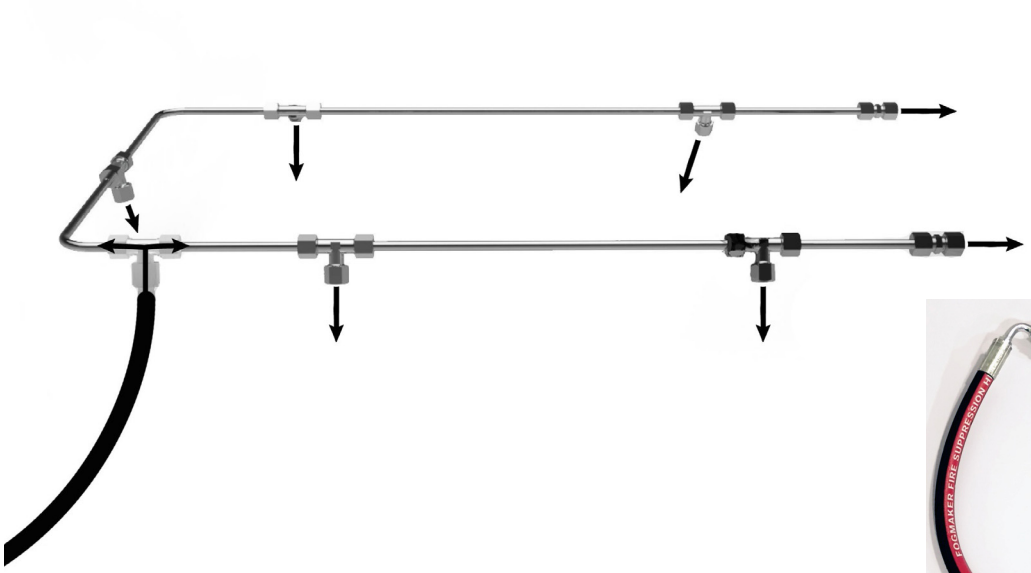
Picture 128. Clamps (part no. 5314)



Picture 129. Sprau nozzle with clamp (part no. 5303)

Picture 130. Distribution hose (part no. 41XX)

Picture 131. Distribution hose with protective conduit



Picture 132. Tightness control/cleaning of distribution system

Picture 133. Rinsing tool (Part no. 1977-010)

6a. Hydropneumatic Detection

Hydropneumatic detection means fully automated activation of the fire suppression system in case of fire. The detector tube filled with liquid and pressurized to 24 bar bursts at a temperature of 170°C. Detector tubes are protected by a protective conduit or coil if needed, to avoid damage, see Picture 134.

NOTE **If detector tube is mounted to couplings in hot areas where the air temperature can reach 65°C, a support sleeve shall be mounted, see Picture 135.**

6.1 Control functionality hydropneumatic activation

a. Check that the security hose (Part no. 47132) is mounted where it is supposed to protect the detector tube from damage.

NOTE **Protective conduit must be undamaged and cover the detector tube the outside fire protected area** see Picture 136.

b. Check that the spiral is attached to the whole detector tube in the fire protected area. Check the protective spiral and its cut ends so it is bent upwards according to Picture 137 so there is no risk of damage to the detector tube.

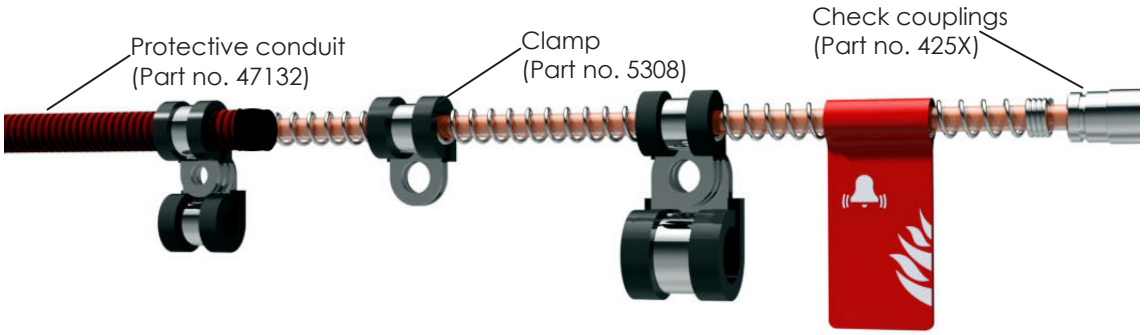
NOTE **Protective coil (Part no. 4291-4298) shall cover the detector tube inside the fire protected area,** see Picture 137.

6.2 Check mounting of detector tube

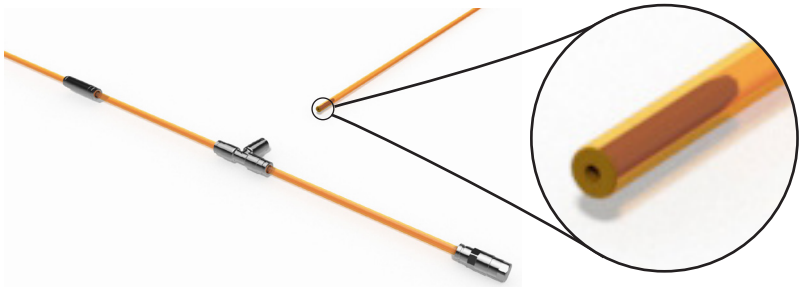
a. Check that the detector tube is placed high up in the engine room and fasten with clamps or cable ties. Cable ties should be 10mm wide or more. If thinner cable ties are used, a piece of protective conduit (at least 50 mm in length), always needs to be placed between the detector tube and the cable tie, see Picture 138.
b. Check couplings so the detector tube is attached to these, and that support sleeves are mounted, see Picture 134 and 135.
c. Detector loop shall be marked so it is easily identifiable, with labels as in this Picture 139. Replace if needed. Check labels and seals, see section 7.

6.3 Check for damage/leakage

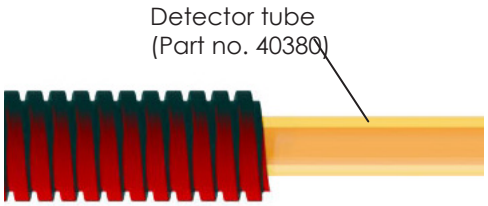
Check that the detector tube is intact. A damaged detector tube will burst at a lower temperature than intended, which increases the risk of unintentional activation. Replace damaged protective conduit or coil, see section 6.6.



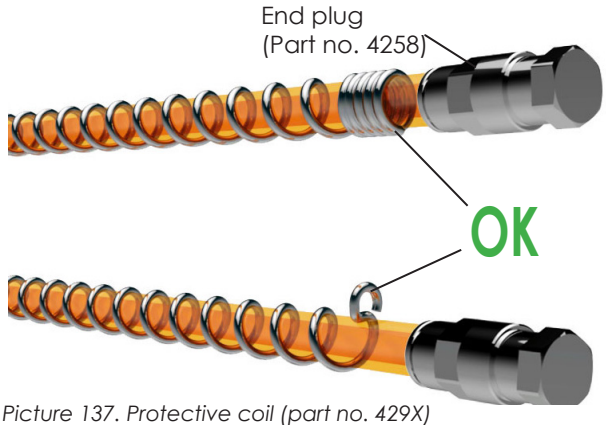
Picture 134. Detector tube mounting



Picture 135. Mount detector tube with support sleeve (Part no. 4249)



Picture 136. Protective conduit (part no. 47132)



Picture 137. Protective coil (part no. 429X)

Picture 138. Cable tie smaller than 10 mm

Picture 139. Detector label Part no. 8206 and 8220

6 a

6.4 Electrical/mechanical punch on the detector loop.

The electrically activated punch and the mechanical punch, see Picture 140 and 143, are used to create a manual activation option for the fire suppression system's hydropneumatic detection. They are complementary to the fully automatic feature.

The electrically activated punch (Part no. 1318) on Picture 140, is mounted on the detector tube and connected to an activation button (Part no. 6992) placed by the driver's seat, see Picture 141. By pressing the button the punch punctures the detector tube and the fluid leaks.

The manual punch exists in three generations:

- Generation 1 (Part no. 1317) on Picture 142.
- Generation 2 & 3 (Part no. 1316), same appearance, on Picture 143.
- As well as the "Heavy-duty punch" (Part no. 1315-025) on Picture 144.

They are all mounted on the detector tube. By pulling out the safety pin and pressing down the pressure, detector liquid leaks and the system is activated.

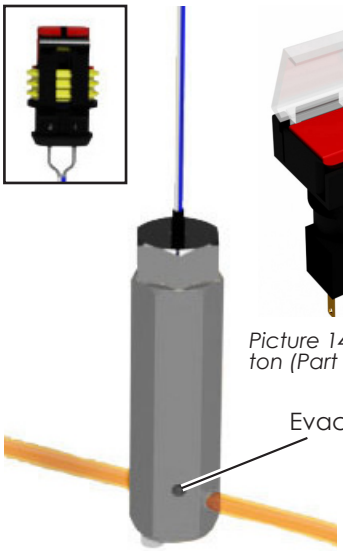
An evacuation hose is connected to all punches, and it leads away the detector liquid if the punch is installed in the passenger/driver's area.

a. Check that the evacuation hose is not blocked, see Picture 145.
b. Check holder for the mechanical punch, see Picture 145.
c. Check that cables and mechanical parts are undamaged and that the seal is unbroken, see Picture 146.

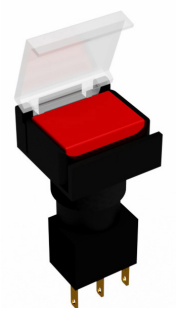
6.5 Solenoid valve/semi-automatic

The magnet valve allows for semi-automation for Fogmaker hydropneumatic automation. When ignition is on, the solenoid valve is closed and the system only gives signal for alarm, no activation of system. When ignition is switched off, the magnetic valve is activated and opens the detector system all the way until the piston accumulator. The system can then be deployed in case of fire.

a. Check magnetic valve - it should appear nice and clean, see Picture 147.
b. The check valve looks like this Picture 148, check that the arrow on the check valve indicates alongside the detector tube pointing from the piston accumulator, see Picture 149.
c. Check electric cables
d. Perform a functionality check as follows: switch on the ignition and touch the solenoid valve, it is working if it "clicks" when the power is turned on/off.

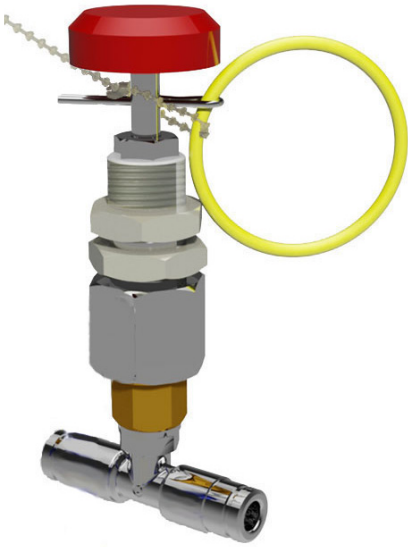


Picture 140. Electric punch (part no. 1318)

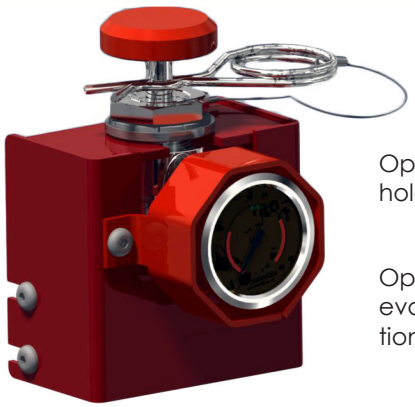


Picture 141. Pushbutton (Part no. 6992)

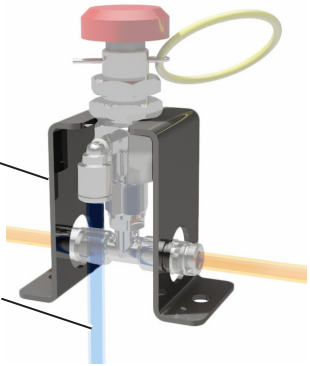
Picture 142. Mechanical punch, generation 1 (Part no. 1317)



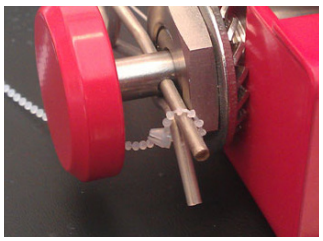
Picture 143. Mechanicalpunch, generation 2 & 3 (Part no. 1316)



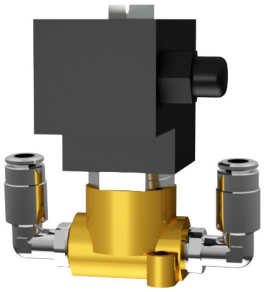
Picture 144. Heavy-duty punch (Part no. 1315-025)



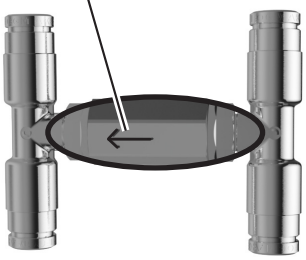
Picture 145. Holder (part no. 1317-07)



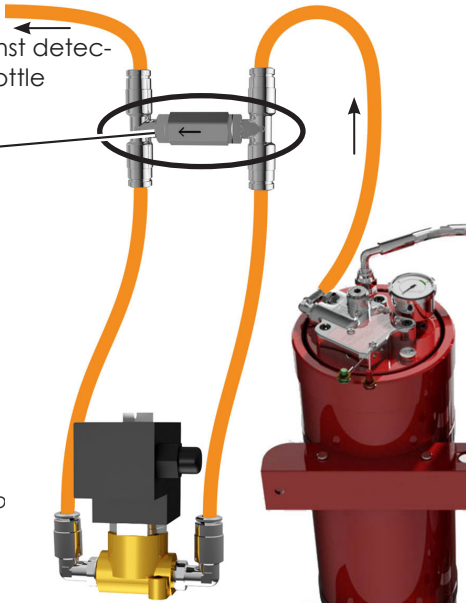
Picture 146. Sealing punch



Picture 147. Solenoid valve (part no. 4926)



Picture 148. Check valve (part no 4924-010)



Picture 149. Mounting solenoid valve

6 a

6.6 Resetting the fire detection system

NOTE **Check that the system has been deployed before commencing resetting.**

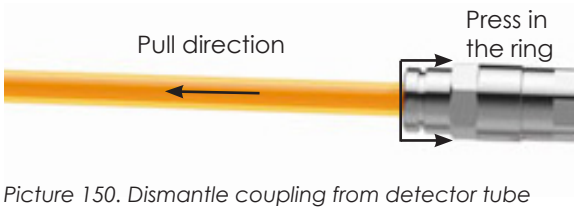
Replace the whole detector tube or only one part. If so, splice with a straight detector coupling (Part no. 4255) and support sleeve if installed in hot areas:

a. Remove the old detector tube, Picture 150.
b. Cut the hose in the right length with the detector tube cutter (Part no. 1809), see Picture 151 - ensure that the edges are straight.
c. Mount a support sleeve in each end of the detector tube, as well as straight detector coupling where needed, see Picture 152 and 153.
d. Re-mount the detector tube with protective conduit and/or coil with steel rubber clamps and/or cable ties in the fire protected area, see Picture 154.
e. Detector tube must be pre-filled if it is over 14 m and detector bottle has 24 bar pressure, according to the prefilling manual (Part no. 8025-001), see Picture 155.
f. Finally, connect the detector tube to the coupling on the detector bottle/valve on the piston accumulator. Draw a control line at 22 mm from the end of the detector tube and press/twist the hose into the couplings, see Picture 156.
g. Check the mechanical punches: When the mechanical punch, generation 1 (Part no. 1317) is activated: Pull up the button if it is stuck in down position. Dismantle and check the needle inside for any residues from the detector tube. When generation 2/3 (Part no. 1316) is activated, the button gets stuck in down position:
   - Unscrew the top nut.
   - Pull out the button with axis.
   - Replace o-ring (Part no. 5510, 4.1 mm x 1.6 mm) on the mechanical punch (Part no. 1316 generation 2 of 3) The o-ring shall be mounted in the lower groove, see Picture 157. Generation 3 has an o-ring that does not need replacement.
   - Grease the o-ring and axis with silicon fat Molykote® compound 111 (Part no. 7907).
   - Re-mount the button with axis and o-ring.
h. Replace the complete electrical punch (Part no. 1318).

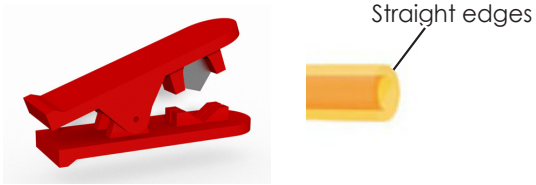
NOTE **Activate the fire detection system by gently turn the ball valve on the detector bottle until open position,** see Picture 158.

i. Check labels and seals, see section 7.

6 a



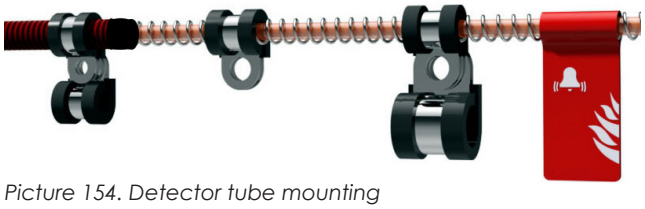
Picture 150. Dismantle coupling from detector tube



Picture 151. Detector tube cutter (Part no. 1809)

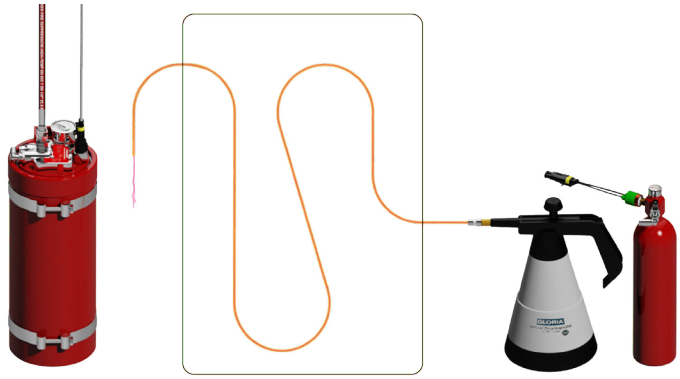
Picture 152. Support sleeve (Part no. 4249)

Picture 153. Straight coupling (Part no. 4255)

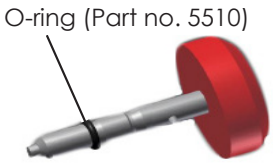


Picture 154. Detector tube mounting

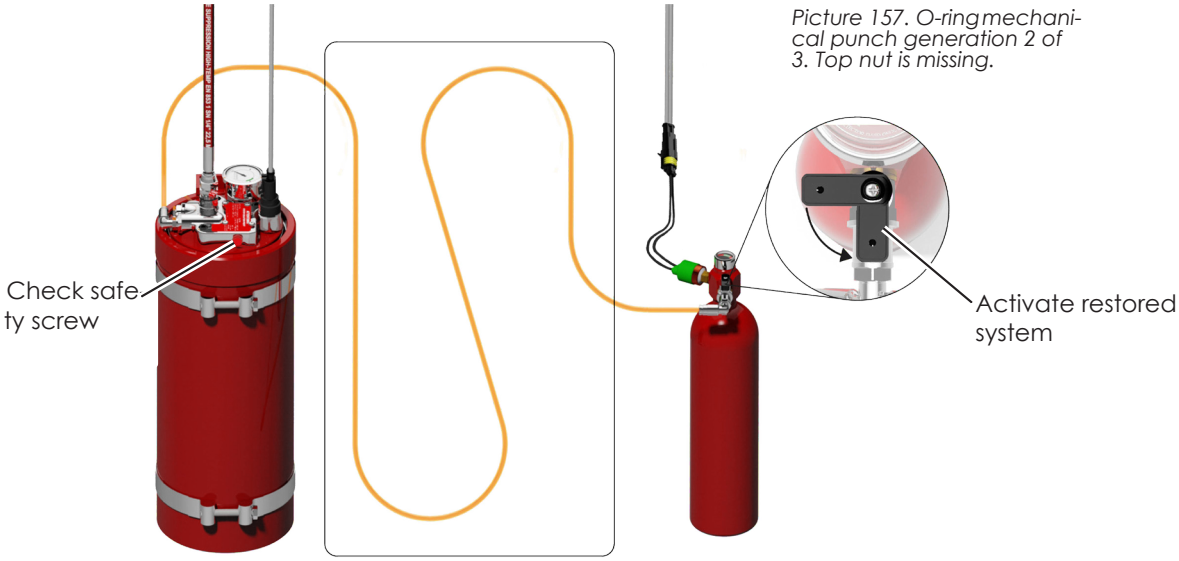
Picture 156. Connecting detector tube



Picture 155. Prefill detector tube with Gloria pump (part no. 1012-01)



Picture 157. O-ring mechanical punch generation 2 of 3. Top nut is missing.



Picture 158. Activate Fire detection system

6 a

6b. Electric Activation

A Fogmaker fire suppression system can be electrically activated, when the piston accumulator has an electrically activated valve (Part no. 6091-010/-020), see Picture 159. Activation of the system is done by pressing the activation button, where the button is connected with cables to the powder charge/metron in the valve, see Picture 160 and 161.
Either the button (Part no. 6955) or (Part no. 6992) are used, and they are mounted close to the driver's environment or on the side of the machine, see Picture 162 and 163.
Electrical activation can be combined with mechanical activation, see section 6c.

6.7 Check functionality

a. Check cables to and from the valve, and that the buttons are undamaged. (Part no. 6955) is used on more exposed places on vehicles, see Picture 162. (Part no. 6992) is used on the dashboard in the cabin, see Picture 163.
b. To check functionality, either test method A or B is applicable:

NOTE **Check that the safety screw is mounted in the valve on the piston accumulator before checking functionality!**

- **Test method A:**

Loosen the connector to the valve on the piston accumulator and press the activation button. Measure with a multimeter to ensure that there is power to the valve on the piston accumulator, at least 12V.

- **Test method B:**

To measure the current, switch an audible or visual alarm (see section 4) temporarily to the electric valve of the piston accumulator. This gives a sound or light signal when the activation button is pushed.

Resetting the electrically activated system

NOTE **Check that the system has been deployed before commencing resetting.**

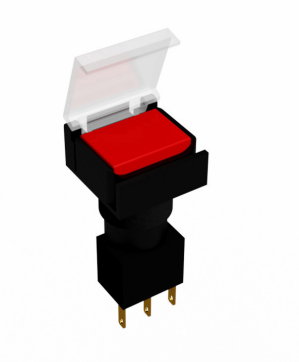
a. Mount the safety screw to the valve on the piston accumulator, with the valve latch in restored position, see Picture 164.
b. Reset the piston accumulator.
c. Replace the powder charge, see resetting of valve, section 1.6.6.
d. Check all cables
e. Check labels and seals, see section 7.

Picture 159. Electrically activated valve (part no. 6091-010/020)

Picture 160. Powder charge (part no. 6033)

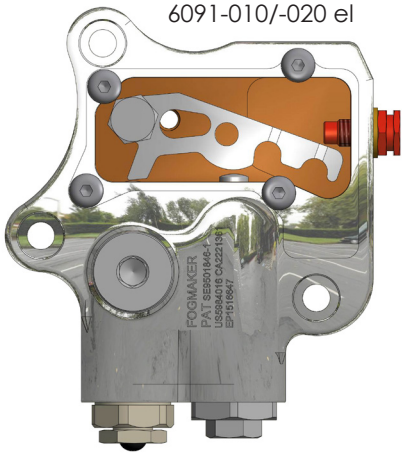
Picture 161. Metron (Part no. 6033M)

Picture 162. Push button box (Part no. 6955)



Picture 163. Push button (part no. 6992)

6091-010/-020 el



Picture 164. Reset positoin of valve latch

6c. Mechanical Activation

Piston accumulators with mechanical activation are equipped with a mechanically activated valve, see Picture 165. This valve is connected to one or several wires with pull handles, see Picture 166. When mounted in vehicles, one handle is often placed by the operator/driver's seat and the other on the outside of the vehicle. Up to four handles can be mounted on the same machine.
The handles are equipped with shackle locks, which are sealed, see Picture 167.

Wires are clamped with steel rubber clamps at a distance of 300 mm alongside the casing of the wire.

6.8 Check functionality

NOTE **Check that the safety screw is mounted in the valve before the functionality test - so the system is not deployed unintentionally.**

Dismantle the wire from the valve latch. This is done by pulling the wire stop out of the groove of the latch, see Picture 168.

a. Check that the mechanical wires runs freely from valve to activation handle by breaking the seal and pulling the handle(s).
b. Check the wire so it is not broken or bent. The minimum radius of the wire should be more than 150 mm.

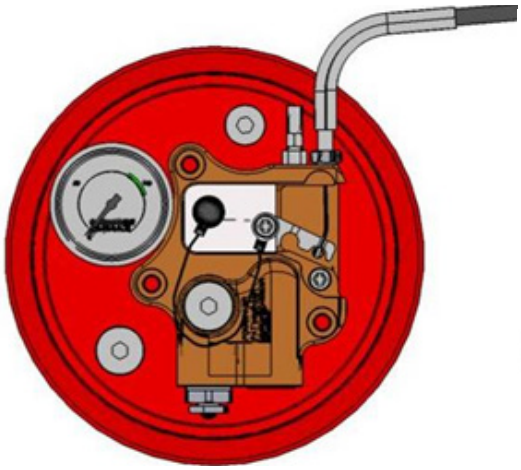
Check the clamping of the wire case. The last clamp should be attached as close to the valve as possible so the wire case is fixated.

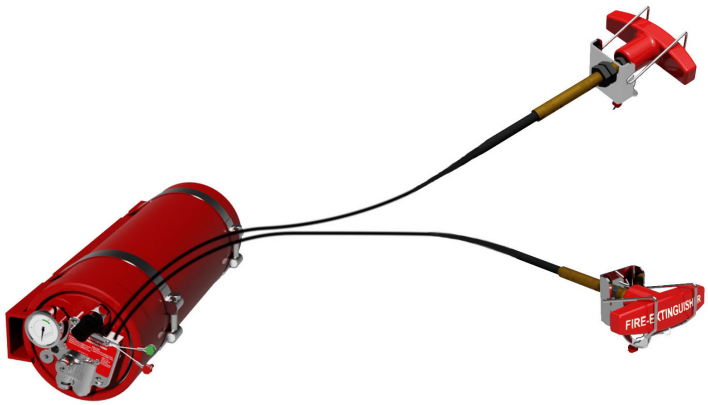
d. Check that safety locks on the handles can be opened with enough resistance.
e. Check that the wire runs easily - if not, replace it: see Installation guide (Part no. 8010-001).
f. Check labels and put new seal, see section 7.

Resetting of mechanically activated system

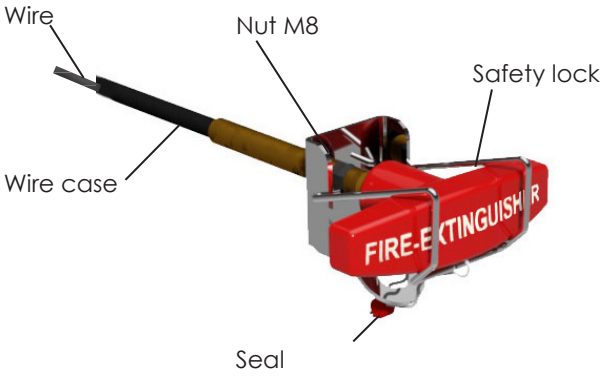
NOTE **Check that the system has been deployed before commencing resetting.**

a. Fasten the safety screw in the valve with the valve latch in the reset position, see Picture 169, and dismantle mechanical wires to be able to reset the piston accumulator.
b. Reset the valve in accordance to section 1.6.6.
c. Check the functionality of mechanical parts as per above.
d. Check labels and seals, section 7.

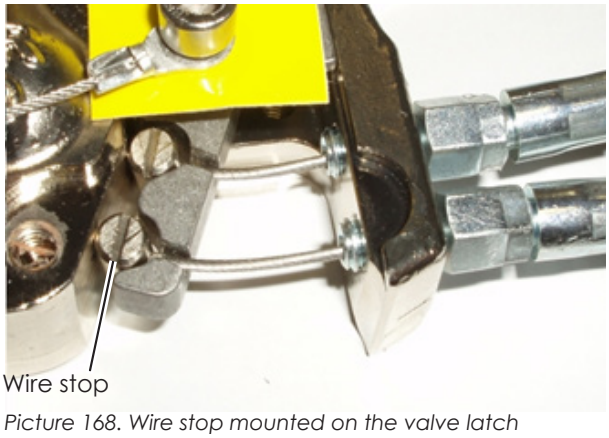




Picture 165. Mechanical attachment to the valve *Picture 166. Mechanically activated valve (part no. 6090-010/020)*

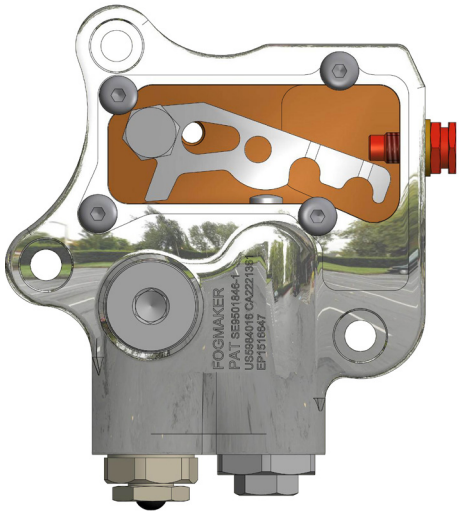


Picture 167. Activation handle (part no. 1309-1313)



Picture 168. Wire stop mounted on the valve latch

6090-010/-020 mech.



Picture 169. Reset position of valve latch

7. Labels and Seals

7.1 Signs/labels

Do a review of labels and signs. Add and replace if needed:

Labels on piston accumulator/protective case:

Check all labels so they are undamaged and readable:

a. Service decal (Part no. 8100) with service marker (Part no. 8105) and suppressant marker (Part no. 8106). Contact Fogmaker if the service decal needs replacement as it has a printed serial number, Picture 170.

NOTE **Mount a new service marker after each annual control and service.**

b. Test label (Part no. 8190). Contact Fogmaker if this needs replacement as it is signed by Fogmaker, Picture 171.
c. Information label (Part no. 8104). Replace if needed, can also be found on the protective case, Picture 172.
d. Warning label (Part no. 8207). Replace if needed, can also be found on the protective case, Picture 173.
e. Revision label (Part no. 8101). Indicate when the next revision is due, Picture 174.
f. Warning label (Part no. 8223), should be placed on the metal hose between double and triple cylinders, replace if needed, see Picture 175.
g. Safety label (Part no. 8107), Picture 176. Replace if needed. Cut the outer part of the label and place above the hole after the safety screw in the valve (generation 1).

Labels on detector bottle:

Check that all labels are undamaged and readable:

a. Information label (Part no. 8120-01), replace if needed, see Picture 177.
b. Information label (Part no. 8192), replace if needed, see Picture 178.
c. Information label (Part no. 8191, contact Fogmaker if this needs replacement as it has a printed serial number, Picture 179.

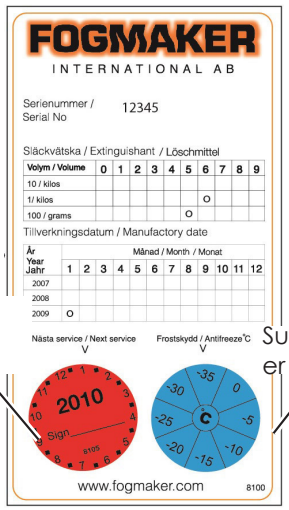
Labels on Novec™ bottle/system

Check all labels so they are undamaged and readable:

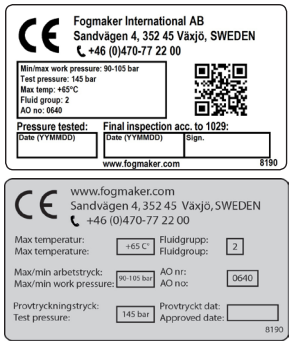
a. Information label (Part no. 8108-02), replace if needed, see Picture 180.
b. Information label (Part no. 8191, contact Fogmaker if this needs replacement as it has a printed serial number, Picture 179.
c. Novec™ label (Part no. 8112), replace if needed, see Picture 181.
d. Detector label (Part no. 8220), should be placed on the detector tube, replace if needed, see Picture 182.

Service marker (Part no. 8105)

Suppressant marker (Part no. 8106)



Picture 170. Service label (part no. 8100)



Picture 171. Proof label (part no. 8190)

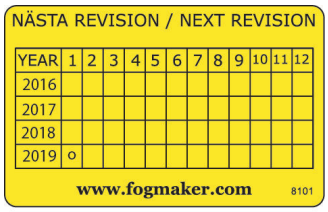
Label also on the protective case:

Picture 172. Information label (Part no. 8104)

Label also on the protective case:

Picture 173. Utskrift

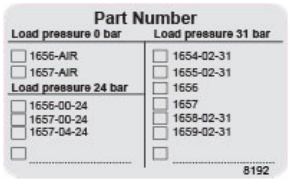
Picture 175. Warning label (Part no. 8223)



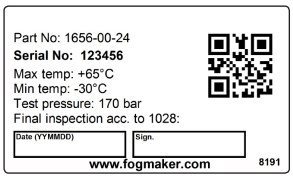
Picture 174. Revision label (Part no. 8101)

Picture 176. The security label (Part no. 8107)

Picture 177. Information label (part no. 8120-01)



Picture 178. Informationlabel (Part no. 8192)



Picture 179. Information label (part no. 8191)

Picture 180. Information label (part no. 8108-02)

Picture 181. Novec™ label (part no. 8112)

Picture 182. Detector label (part no. 8220)

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Labels on/beside alarm panels, driver information

Check all labels/signs so they are undamaged and readable:

a. Information label (Part no. 8432), replace if needed, see Picture 183.
b. Driver information sign (Part no. 8301/8306/8422-01-A1), replace if needed Picture 184, 185.
c. Driver information label (Part no. 8422/8426), replace if needed Picture 186, 187.

Hydropneumatic activation:

Check all labels/signs so they are undamaged and readable:

a. Detector label (Part no. 8220), replace if needed, see Picture 182.

Check signs/labels beside the manual punch, and signs/labels beside the activation button in the driver's area:

b. Information label (Part no. 8201), replace if needed, see Picture 188.
c. Information signs (Part no. 8221/8300), replace if needed Picture 189-190.

Electrical activation:

Check all labels/signs so they are undamaged and readable: Check signs/labels beside the activation button in the driver's area, see above.

Mechanical activation:

Check all labels/signs so they are undamaged and readable: Check signs/labels beside the activation handles:

a. Information label (Part no. 8201), replace if needed, see Picture 188.

General:

Mount Information label (Part no. 8204/8470-001) in a suitable place, Picture 191 and 192.

7.2 Check seals

NOTE **Check that the safety screw is dismantled from the valve on the piston accumu lator - this in order for the system to be activated.**

a. Check the seals on detector bottle and Novec™ bottle ball valve in open position, Picture 193.
b. Check that there is a seal on the manual punch, Picture 194.
c. Check seals on activation buttons, Picture 195.
d. Check that there are seals on mechanical pull handles, Picture 196.

Picture 183. Information label (part no. 8432)

Picture 184. Driver information sign, manual system (Part no. 8301)

Picture 185. Driver information sign, fully automated (Part no. 8422-01-A1)

Picture 186. Driver information label, semi-automated system (Part no. 8426)

Picture 187. Driver information label, fully automated system (Part no. 8422)

Picture 188. Information label (part no. 8201)

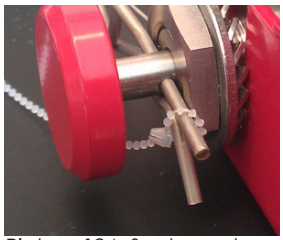
Picture 189. Information sign (part no. 8221)

Picture 190. Information sign (part no. 8300)

Picture 191. Information label (Part no. 8204)

Picture 192. Information label (Part no. 8470-001)

Picture 193. Sealdetectorbottle and Novec™ bottle



Picture 194. Seal punch

Picture 195. Seal activation buttons

Picture 196. Sealmechanicalpull handles

Other

Annual control and service is performed on the vehicles and other installations that have Fogmaker Fire suppression system installed. After each inspection, a check list is filled in which lists all the points outlined in this manual. The check list is handed to the customer and to Fogmaker.
The check list shall include basic information such as work order, date, location, customer, vehicle type, signatures and contact details.
Finally, the service staff shall state if the service is approved, time taken to implement, travel time to get to and from the place of service and the number of kilometres that have been driven.

Index

Appendix 1: Filling tool

Control and service of filling tool (Part no. 1800) and (Part no. 1800_L), Picture 197. The filling tool is used when:

- Filling and emptying suppressant in the piston accumulator.
- Filling of gas in the piston accumulator, see Picture 198.
- Filling of gas in the detector bottle and the Novec™ bottle.

It is recommended to have one filling tool intended for liquid and one for gas, if not, blow filling tool clean before gas filling.
See movie for a description of how the filling tool is used: www.fogmaker.com.

Check before each use:

a. That the hexagon rod has sharp edges at least 5 mm from the end and is tightly fastened, see Picture 200.
b. That all four handles are firmly attached.
c. That external screw thread ¼" is not damaged and looks unbroken.

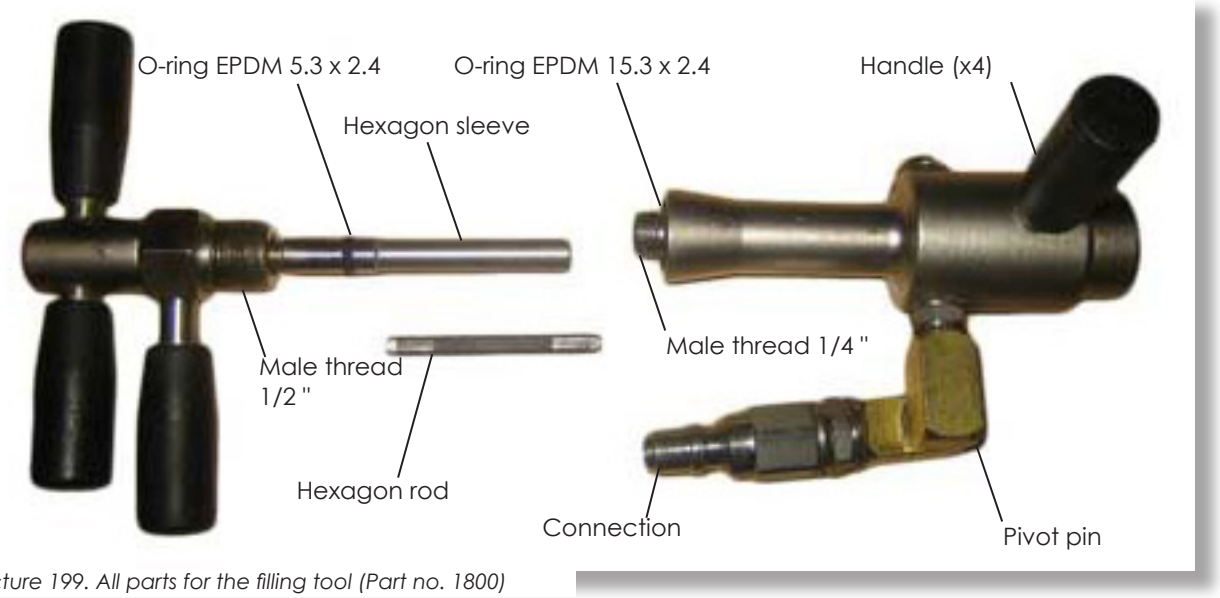
If the filling tool does not comply with all of the above, it cannot be used.

Service (shall be performed after every fifty fillings):

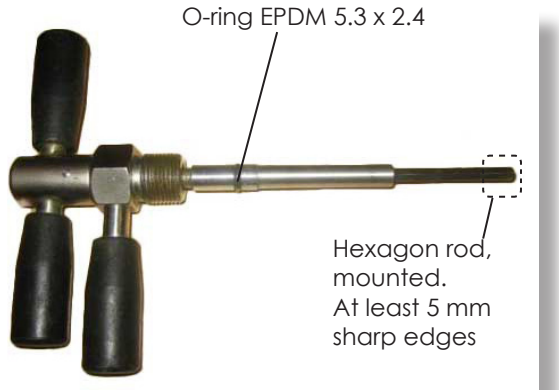
a. Replacement of o-rings, see Picture 199 - 201. Material: EPDM Dimension: 5.3 x 2.4 and 15.3 x 2.4.
b. Check that the hexagon rod has sharp edges at least 5 mm upwards from the end in accordance with Picture 200, if the rod is loose, it needs to be pulled out, cleaned and degreased. After that, apply thread sealant Loctite® 577 (Part no. 7904).
c. Hexagon hole shall be cleaned and degreased.
d. All four handles shall be firmly attached - if needed, tighten them.
e. Pivot pin with connection shall be leak tested. If leaking, this needs to be corrected.
f. Outer thread ¼" shall be checked with thread gauge (go/stop gauge), if worn out, the thread needs repair/replacement.

Picture 197. Filling tool (Part no. 1800 and 1800_L)

Picture 198. Filling tool mounted on the gas side



Picture 199. All parts for the filling tool (Part no. 1800)



Picture 200. Upper part of filling tool (Part no. 1800)

Picture 201. Filling tool seen from below (Part no. 1800)

Appendix 2: Adjust pressure in the detector bottle

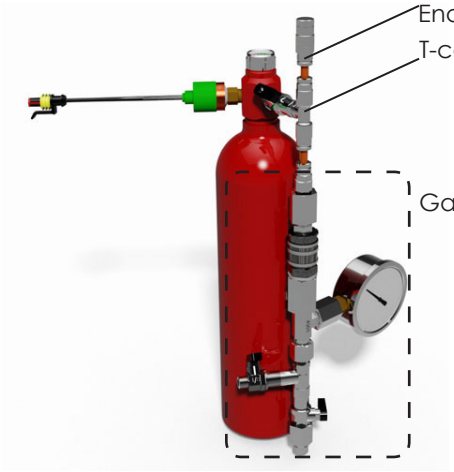
Use gas filling tool (Part no. 1975).

a. Connect the gas filling tool with the detector bottle according to Picture 202 and 203 with two pieces of detector tube (around 5 cm, included in gas filling tool kit).

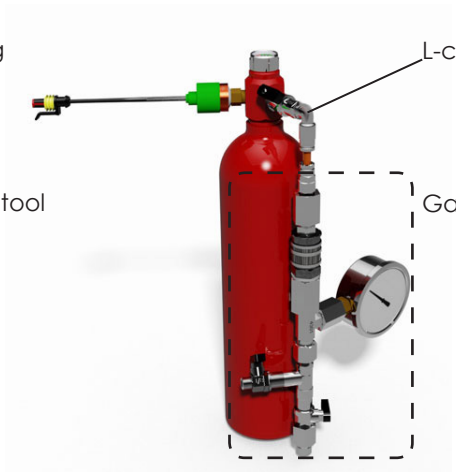
NOTE **Attach endplug (Part no. 4258) to T-coupling.**

b. Keep the detector bottle upside down, Picture 204. Ensure that the ball valve (B) is closed.
c. Open the ball valve (A) carefully. Read pressure level on the manometer (C). The manometer has a tolerance of ±1,6%.
d. After that, open ball valve (B) slightly and carefully for around 0.5 seconds, and then close ball valve (B).
e. Wait for 3 - 5 seconds for the pressure to equalize.
f. Read the pressure from the manometer located on the gas filling tool (C).
g. Repeat 3 - 5 times until the desired pressure has been obtained.
h. Close ball valve (A).
i. Open ball valve (B) to release pressure.
j. To disconnect hoses from the couplings, press the outer ring inwards and disconnect the hose (this also applies to the coupling on the detector bottle), see Picture 205.

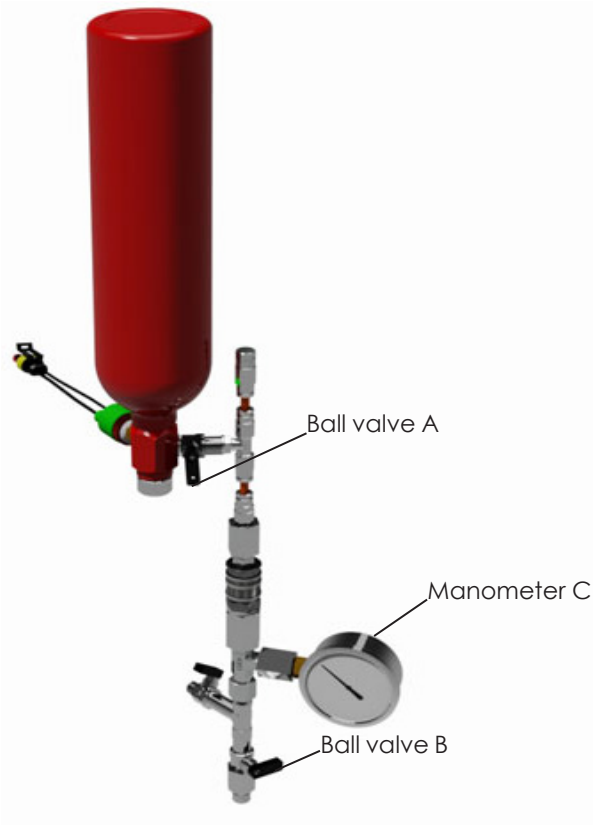
B2



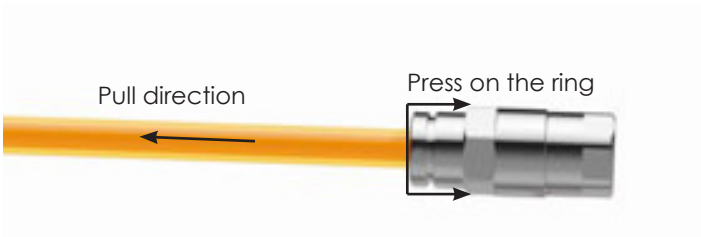
Picture 202. T-coupling with gas filling tool



Picture 203. L-coupling with gas filling tool



Picture 204. Adjust pressure with gas filling tool



Picture 205. Dismantle coupling from detector tube

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