MAINTENANCE MANUAL

SIEX-HC 227

360 & 610 psi
(25 & 42 bar)

SIEX-HC 227 S-FLOW

465, 490, 725, 780 psi
(32, 34, 50 & 55 bar)

SIEX-HC-227

HALOCARBON GAS at
360, 465, 490, 610, 725 and 780 psi
(25, 32, 34, 42, 50 and 55 bar)

UL LISTED EX15547

FM APPROVED 3053302

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References to other manuals of the system

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1. Introduction

This section provides the user with guidelines for the inspection and maintenance of HFC-227ea systems. These guidelines must be performed regularly in accordance with regulations. If problems arise, corrective must be taken.

CAUTION

ALWAYS BEAR IN MIND AND COMPLY WITH THE FIRE PROTECTION REGULATIONS

Take note of the following precautions:

- This extinguishing system must be maintained by qualified personnel only.
- Any environmental or operating condition which causes shorting or grounding of system components can cause system malfunctions or actual discharge.
- Before servicing any component, disarm the protection system.

Agent storage cylinders, approved by the Department of Transportation (DOT), are pressurized vessels containing HFC-227ea fluid super-pressurized with nitrogen to 360, 460, 490, 610, 725 or 780 psi (25, 32, 34, 42, 50 or 55 bar) at 70ºF (21º C). This pressure causes considerable thrust if the discharge valve is actuated, thus, the safety cap supplied with the cylinder must be installed when handling or storing the cylinder, or whenever it is not securely fastened down. The safety cap prevents objects from striking the burst disc valve, and reduces and redirects the thrust if the cylinder is accidentally discharged.

Handle the cylinder carefully to prevent damaging the gauge and other attached fixtures. The cylinder must not be subjected to temperatures above 122ºF (50º C), or the pressure relief device may operate, releasing the agent.

2. Maintenance procedures

CAUTION

THE CYLINDER VALVE ASSEMBLIES MUST BE HANDLED, INSTALLED, INSPECTED AND SERVICED ONLY BY QUALIFIED AND TRAINED PERSONNEL IN ACCORDANCE WITH THE INSTRUCTIONS CONTAINED IN THIS MANUAL.

A regular program of systematic maintenance is essential for continuous, proper operation of the extinguishing system. A periodic maintenance schedule must be followed and an inspection log maintained for ready reference. As a minimum, the log must record:

- Inspection interval.
- The inspection procedure performed.
- Maintenance performed, if any, as a result of inspection.
- The name of inspector performing the task.

3. Inspection programme

- Daily

Agent cylinder

Check the agent cylinder pressure gauges for proper operating pressure. If the pressure gauge indicates a pressure loss (adjusted for temperature) of more than 5%, or loss in agent quantity shown on cylinder valve of more than 5%, it shall be refilled.

Pilot bottle

Check the pilot bottle pressure gauge for proper operating pressure. If the pressure gauge indicates a pressure loss (adjusted for temperature) of more than 5%, it shall be refilled. Remove and recharge the cylinder with nitrogen.

Check the status of the Tamper Seal

Inspect the Tamper Seal the see if it is broken, damaged, or has been removed.

- Weekly

Inspect the hazard area and check that it is protected from its natural medium to ensure that any changes do not affect the correct working of the fire protection system. The following changes at least must be included:

Contents of the area.

Use of the area.

Ventilation systems in the area.

Openings into the area.

Changes to the floor or ceiling.

Subdivisions.

To be checked: Stored liquid or mass levels. If the cylinder has been fitted with an electrical pressure supervising device (pressure switch), check the fault indicating light. Any cylinder showing a net weight loss of 5% or more must be refilled or replaced.

Check that the pressure gauges show the correct pressure, as displayed on the cylinder label.

Carry out: a visual inspection of all components and the condition of the system pipe work and hangers. A visual check that none of the equipment has suffered accidental damage.

Inspect the protected area, access routes, hazard, floor and ceilings, to ensure that the maintenance is correct and there have been no incidents. Make sure that neither direct access to the system nor the remote control have any obstructions.

- Monthly

Inspect the system and the protected spaces to ensure that all warning signals, safety precautions and operating instructions remain clearly visible. Make a general inspection survey of all cylinders and equipment for damaged or missing parts.

Check that all personnel who may need to work with the equipment or system are correctly trained and authorised to do so, and in particular that new employees have been instructed in its use. Every person who may be involved in an inspection, examination, maintenance or other work on the fire extinguishing system must be instructed and up to date regarding all operations to be carried out.
Personnel who work in an area protected by an HFC-227ea extinguishing system must receive instructions regarding its proper operation.

Ensure access to hazard areas, manual pull stations, discharge nozzles, and cylinders are unobstructed and that nothing obstructs the operation of the equipment.

Inspect flexible release hoses for loose fittings, damaged threads, cracks, distortion, cuts, dirt and frayed wire braid. Tighten loose fittings and replace hoses with stripped threads or other damage. If necessary, clean parts. Inspect the adapters, couplings and tees at the pilot bottle outlets and tighten couplings if necessary. Replace any damaged parts.

Inspect the pressure operated switches for physical damage, deterioration, corrosion, distortion, cracks, dirt and loose couplings. Tighten loose couplings. Replace damaged caps. Replace the control head if damaged.

Inspect the electrical actuators for damage, corrosion, and dirt. Check the actuator for loose coupling and tighten if necessary. Replace the electrical actuator if damaged.

Inspect the cylinder and container valve assembly for leakage and physical damage such as cracks, dents, distortion and worn parts. Check the burst disc and pressure gauges for damage. Replace damaged gauges or bust disc.

Inspect the cylinder brackets, straps, cradles and mounting hardware for loose, damaged or broken parts. Check the cylinder brackets, straps and associated parts for corrosion, oil, grease and grime. Tighten any loose hardware. Replace damaged parts.

Inspect discharge nozzles for dirt and physical damage. Replace damaged nozzles.

Inspect pressure switches for deformations, cracks, dirt or other damage. Replace the switch if damaged.

Check the status of the Re-assembled Electrical Actuator:
Inspect the Re-assmebled Electrical Actuator for damage, corrosion, and dirt. Check the Electrical Actuator for loose coupling and tighten if necessary. Replace the Electrical Actuator if damaged.

Check the status of the Releasing Circuit Device Switch:
Inspect the Releasing Circuit Disable Switch for deformations, cracks, dirt or other damage. Replace the RCDS if damaged.

4. Service and maintenance (by specialised personnel)

○ Quarterly

Inspection of all systems in operation.
Inspection of any detection and alarm equipment in the system in accordance with the recommendations of the applicable fire protection regulations.

○ Every six months

Inspection of the cylinders by outside personnel for unauthorised changes or any sign of damage.
Check that the pressure gauges show the correct pressure, in accordance with the cylinder label.
Check that the amount of HFC-227ea in the cylinders is correct, by using a liquid level detector or by weighing the bottle.

- Cylinder weighing

If the client does not wish to have a service and maintenance contract with SIEX, the HFC-227ea content may be determined by weighing the cylinders.

- Inspection of seals to clean them in case of possible dirt or dust.

A check that all manual or pneumatic actuation devices operate freely. Replace the entire component if necessary.

External inspection of all piping to establish its condition. Replace or thoroughly inspect all pipes which show signs of corrosion or mechanical damage.

-Pressure switch test

1.- Ensure that the hazard area operations controlled by the pressure switch are operative.

2.- Disassemble the pressure switch from it place.

3.- Manually operate the switch by pulling up and verify that the hazard area operations controlled by the pressure switch shut down.

4.- Return the pressure switch to the ON position.

5.- Reactivate all systems that were shut down by the pressure switch.

-Electrical actuator test

This test must be performed without discharging the extinguishing system.

CAUTION

ALL ELECTRICAL ACTUATORS MUST BE REMOVED FROM THE CYLINDERS AND PILOT BOTTLES PRIOR TO TESTING TO PREVENT ACCIDENTAL CYLINDER DISCHARGE

1.- Remove all the electrical actuators from the extinguishing system. Leave all pneumatic or pneumatic-manual actuators and release hoses attached to the cylinders.

2.- Operate the extinguishing electrically. This can be accomplished by actuation of the control panel or by manual operation of an electric pull station.

3.- Ensure that all electrical actuators have operated, that is the pointer has moved to the actuated position. If any electrical actuator has not operated, check the circuit for electric continuity to these particular actuator and repeat the rest. Replace all damaged actuators. Repeat the test if any actuator have been replaced.

CAUTION

ELECTRICAL ACTUATORS MUST BE REST MANUALLY BEFORE RECONNECTING TO THE CONTAINER VALVES

Replace any damaged electric actuator which fail to reset properly before reconnecting to cylinders. Reattach all electric actuator to the actuation port. Tighten the revolving nut securely. Make sure that each electric actuator is in ON position before assembling to cylinders. Failure to follow this procedure will result in accidental discharge.

- Check the functioning of the Releasing Circuit Device Switch & Re-assembled Electrical Actuator:

This test must be performed without discharging the extinguishing system. All electrical actuators must be removed from the cylinders and pilot bottles prior to testing to prevent accidental cylinder discharge:

1.- In the Releasing Circuit Disable Switch, turn the key to position “System Inactive” or “Releasing Circuit Disabled”. This allows us to safely do the maintenance working. Also, this switch on the red or amber led in the RCDS and sends an alarm to the Fire Alarm Control Panel.

2.- Remove out the Tamper Seals from the Container Valves and Electrical Actuators. Unscrew the Re-assembled Electrical Actuators from the Container Valves.

3.- With the Electrical Actuators in hand, turn the key of the RCDS to position “System Armed” or “System Normal”, this stop the alarm in the FACP and the green led lights. Send the activation signal from the FACP to the Electrical Actuators.

4.- Ensure that all Electrical Actuators have operated, that is the pointer has moved to the actuated position. If any Electrical Actuator has not operated, check the circuit for electric continuity to this particular actuator and repeat the test. Replace all damaged actuators. Repeat the test if any actuator have been replaced.

5.- With the Electrical Actuators in hand, turn the key of the RCDS to position “System Inactive” or Releasing Circuit Disabled”, this starts the alarm in the FACP.

6.- Manually, reset the Electrical Actuator with its reset screw. Replace any damaged electric actuator which fails to reset properly before reconnecting to cylinders. Reattach all Electric Actuators to the actuation port of the Container Valves. Tighten the revolving nut securely. Make sure that each Electric Actuator is in ON position before assembling to cylinders. Failure to follow this procedure will result in accidental discharge.

7.- Install the Tamper Seals in its place according to chapter 5 of this document. Also, turn the key of the RCDS to position “System Armed” or “System Normal”, this stop the alarm in the FACP and the green led lights. The system is Active again.

- Annually

In accordance with NFPA 2001, all systems with flexible hoses must be examined to assess possible damage. If visual examination reveals any defects in the hoses, they must be replaced.

A complete examination must be carried out every 12 months in the entire enclosed area to determine whether the exit route has changed significantly since the system was installed.

- Every two years

CAUTION

DO NOT USE WATER OR OXYGEN TO BLOW OUT PIPE LINES. USING OXYGEN IS SPECIALLY DANGEROUS.

1.- Remove any nozzles from the piping to allow foreign matter to blow clear.

2.- Remove all pneumatic or pneumatic-manual actuators from the container valves.

CAUTION

DO NOT DISCONNECT THE RELEASE HOSE FROM THE PNEUMATIC OR PNEUMATIC-MANUAL ACTUATORS. IF THE SYSTEM ACCIDENTALLY DISCHARGES, THE UNATTACHED RELEASE HOSES COULD CAUSE SERIOUS INJURY TO THE PERSONS HANDLING THEM AND DAMAGE TO THE SURROUNDING AREA.

3.- Open the directional valves and keep them open long enough to ensure the pipes are clean.

4.- Blow out all distribution piping with air or nitrogen to ensure it is not obstructed.

5.- Reconnect all pneumatic or pneumatic-manual actuators.

5. Hydrostatic pressure test of the cylinder

A hydrostatic pressure test of the cylinder is required. Provided there has been no discharge in that period and the cylinders have been subjected to complete inspections every 6 months since entering service. In all cases it is obligatory to subject the cylinders to an inspection to determine whether they may be refilled and whether they are still suitable for use. The interval time between inspections are shown in the following table:

Cylinder Specification	Retest period (years)
DOT-3, DOT-3AX, DOT-3AAX, DOT-3D, DOT-3T,	5
DOT-3A, DOT-3AA, DOT-3B, DOT-3BN	5, 10, or 12 (173.34 (e)(14)(12)(16) and (19)
DOT-3HT	3 (see (e)(15))
DOT-4, DOT-4A, DOT-4AA480	5 or 10 (see (e)(12) (14)
4B, 4BA, 4BW, 4B-240ET	5, 10, or 12 (173.34 (e)(12) and (19))
DOT-4D, DOT-4DA, DOT-4DS, DOT-4E	5
DOT-8, DOT-8AL	10 or 20 (173.34 (e)(18))
DOT-9, DOT-25, DOT-26, DOT-33, DOT-38	5
26 filling at 450 psi or less	5 or 10 (173.34(e)(11))
ISO 4705, ISO 4706, ISO 9809	10
2010/35/EU, 1999/36/CE, 97/23/CE	10

6. Service

-Cleaning

Remove dirt from metallic parts using a lint-free cloth moistened with dry cleaning solvent. Dry parts with a clean, dry, lint-free cloth, or air blow dry. Wipe non-metallic parts with a clean, dry lint-free cloth. Remove corrosion with a crocus cloth.

-Nozzle service

Service nozzles after use as follows:

1.- Clean the outside of the nozzles with a rag or soft brush.

2.- Examine the discharge orifices for damage or blockage. If the nozzles appear to be obstructed, unscrew the nozzles and clean by immersing them in cleaning solvent. Dry thoroughly with lint-free cloth. Replace damaged nozzles. Nozzles must be replaced with the same calibrated plate in the same location.

-Repairs

Replace all damaged parts found during inspection. Since replacement for other system components are similar, refer to the installation drawings and assembly drawings for guidance.

Cylinders must be recharged when the cylinder pressure gauge indicates the pressure is below normal, immediately after discharge, when a loss in weight is in excess of 5% of the original charged net weight or when there is a loss of pressure (adjusted for temperature) of more than 5%.

7. Removing a single cylinder from a modular system

CAUTION

DO NOT DISCONNECT THE FLEXIBLE DISCHARGE HOSE PRIOR TO REMOVING ACTUATORS FROM THE SYSTEM CYLINDERS.

-Modular system

1.- Remove the pressure switch (if installed) by disconnecting the electrical connection at the switch.

2.- Unscrew the ¼" G elbow from the pilot port of the container valve and screw the protective cap in the valve pilot port.

3.- Disconnect the revolving nut of the actuator from the container valve actuation port. Remove the actuator from the container valve.

4.- Install the protective cap on the actuation port.

5.- Loose the revolving nut and remove the discharge hose from the outlet port of the container valve.

6.- Immediately install the protective cap on the outlet port.

7.- Install the protective cap in the protective flange of the cylinder.

8.- Remove the cylinder strap and remove the cylinder from the bracket.

8. Nitrogen pilot bottle service and maintenance

-Nitrogen pilot bottle hydrostatic pressure test

A hydrostatic test must be performed in accordance with the point 5 of this manual.

Nitrogen bottles shall not be recharged and shipped without hydrostatic test if more than five or ten years has elapsed from the date of the last test, (see point 5 of this manual).

Nitrogen bottles continuously in service without discharging can be retained in service for a maximum of five or ten years from the date of the last hydrostatic test (five years for DOT cylinders and ten years for ISO and TPED cylinders). At the end of this time the cylinder shall be visually inspected.

Cylinders must also be hydrostatic pressure tested immediately if the cylinder shows evidence of distortion, cracking, corrosion or mechanical or fire damage.

-Nitrogen cylinder replacement

CAUTION

WHEN REMOVING A PRESSURIZED CYLINDER DUE TO PRESSURE LOSS, THE ACTUATOR MUST BE IN OFF POSITION. AN ACTUATOR IN THE RELEASED POSITION WILL CAUSE THE REMAINING CONTENTS OF THE CYLINDER TO DISCHARGE RESULTING IN A SYSTEM ACTIVATION WHICH MAY DAMGE PROPERTY AND CAUSE BODILY INJURY.

Replace the nitrogen cylinder when loss of pressure occurs, as follow:

1.- Remove the actuators from the nitrogen pilot bottle valve.

2.- Immediately install the protection cap on the nitrogen cylinder actuation port.

3.- Remove the flexible release hose or tubing and adapter from the container valve outlet.

4.-Place the safety cap in the outlet cylinder valve.

5.- Remove the clamps that secure the nitrogen cylinder to the mounting brackets.

-Nitrogen pilot bottle installation

1.- Install the nitrogen pilot bottle in the mounting bracket.

2.- Tighten sufficiently to hold cylinder in place while allowing cylinder enough free play to be manually rotated.

3.- Turn the cylinder until the container valve discharge outlet is in the desired position.

4.- Securely tighten the mounting bracket clamps and hardware.

5.- Remove the safety cap, reconnect the adapter and flexible release hose or tubing to the cylinder container valve outlet port.

6.- Remove the protective cap from the container valve actuation port.

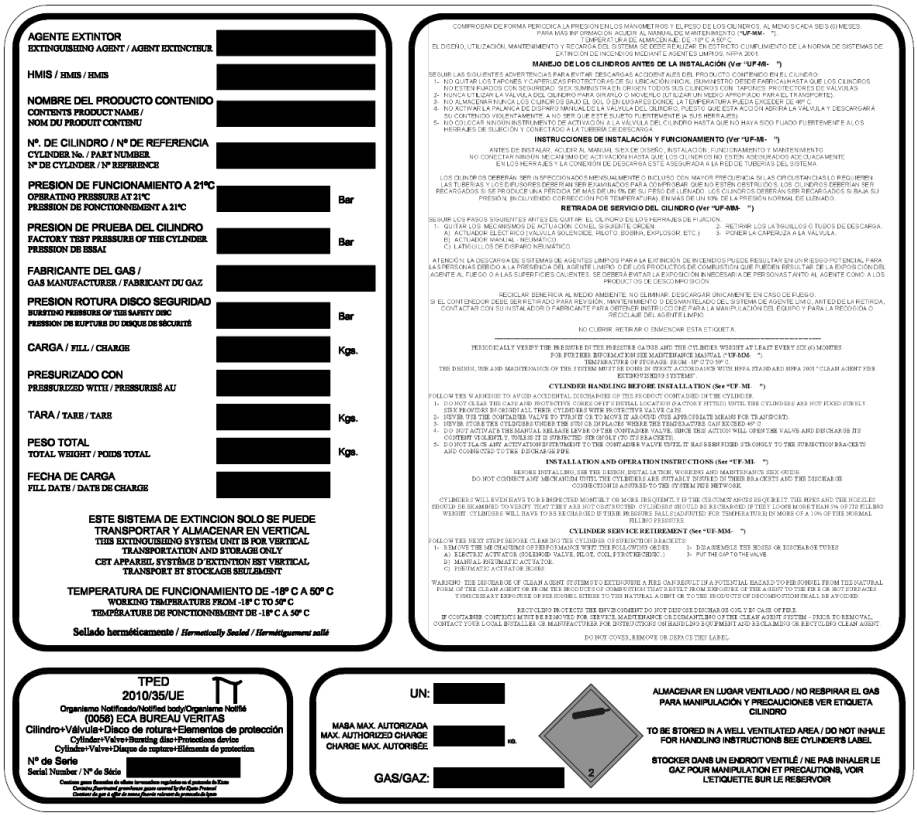
CAUTION

ENSURE THE ACTUATOR MUST BE IN OFF POSITION. AN ACTUATOR IN THE RELEASED POSITION WILL CAUSE THE CONTENTS OF THE CYLINDER TO DISCHARGE RESULTING IN A SYSTEM ACTIVATION WHICH MAY DAMAGE PROPERTY AND CAUSE BODILY INJURY.

7.- Install the control head to the cylinder valve and tighten securely.

ANNEX A: GUIDE FOR INSPECTION OF SYSTEM AFTER INSTALLATION.

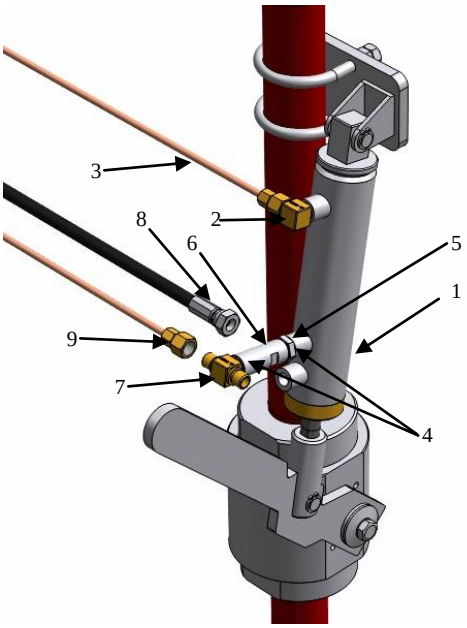
- ✓ All cylinders shall include a sticker with its number, tare, total weight, date of filling, pressure, quantity of agent, pressure of the bursting disc...



✓ Each cylinder battery shall be identified by two signs that indicates: Protected area, Caution, Manual discharge.

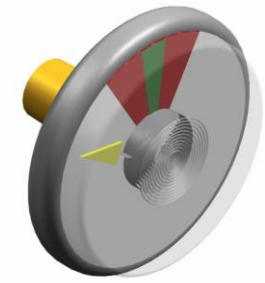
✓ Check that the paint of the cylinders and the manifold are in good condition. The colour used for SIEX-HC systems are red (RAL 3000).

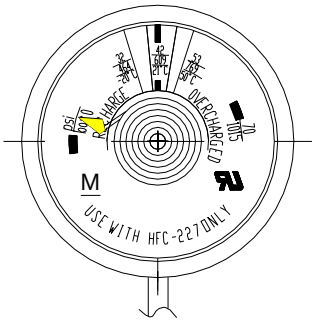
✓ If the system has selector valves installed, they should be in closed position. Also check that the connections between the pilot bottle and the pneumatic cylinder of the selector valves are correct.



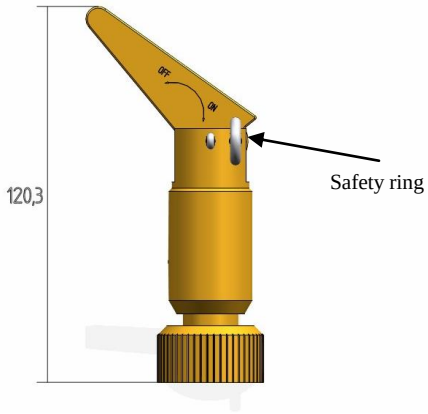
1 Pneumatic cylinder
2 Elbow 1/4 "G
3 Copper tubing
4 Metaloplastic washer 1/4 "
5 Adaptor male to male 1/4 "G
6 Check valve 1/4 "G
7 "T" or elbow 1/4 "G, as appropriate
8 Teflon hose 1/4 "G
9 Bi-cone adapter 1/4 "G

✓ All pressure gauges will indicate the correct pressure for each cylinder, including the pilot bottle. They have to be orientated to make easier their monitoring.

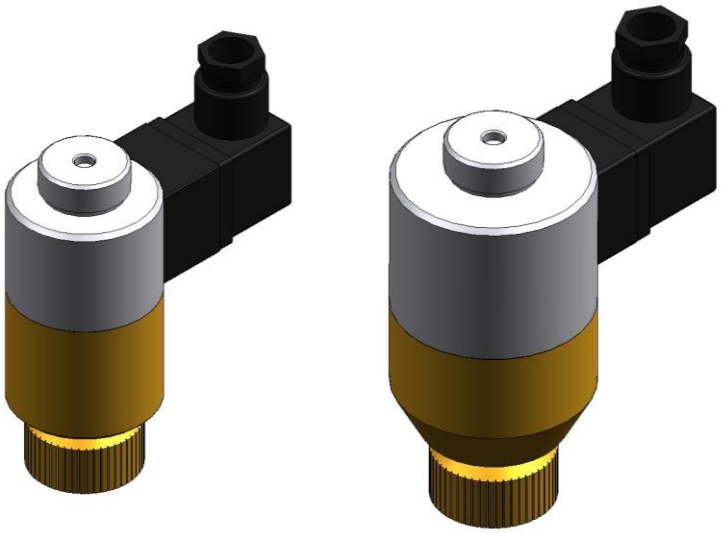




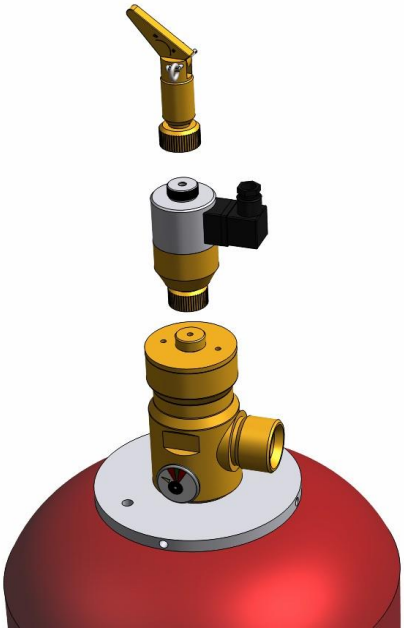
✓ The manual actuator head 227DM shall have inserted its security pin.



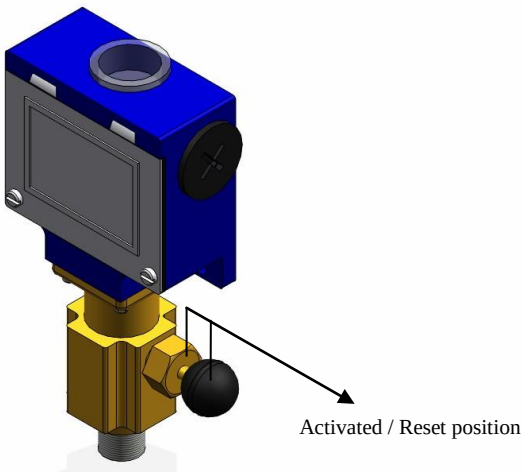
✓ The electrical actuator head 227SOL should be correct electrically connected.



✓ All the actuator heads should be connected correctly, if not, review their tightening with the hand until you can not screwing them more. Do not use any type of tool for their installation.



✓ The pressure switch should be reset, for do that, pull out the plastic ball.

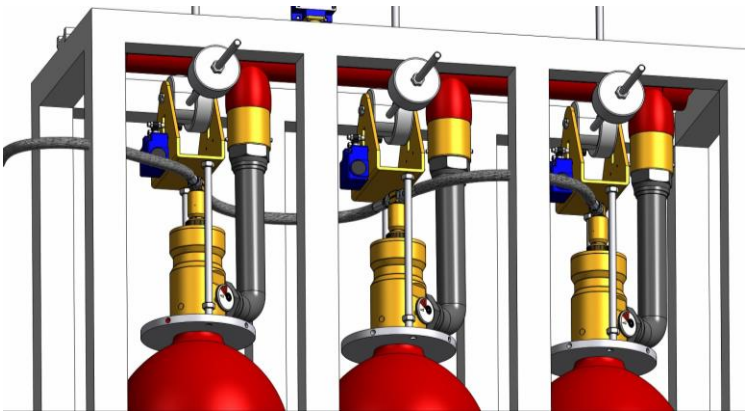


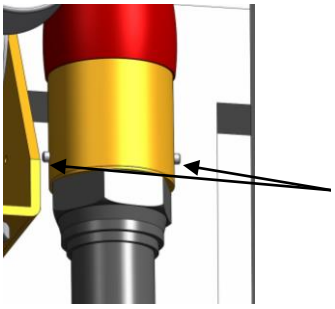
✓ The weighing device (in case we use it) shall be in its correct position for all cylinders (horizontal).

"ON" POSITION = FILLED CYLINDER

"OFF" POSITION = EMPTY CYLINDER

✓ Make sure that in case we use the weighing device in our installation, the check valves have their telescopic system free by their prisoner screws.

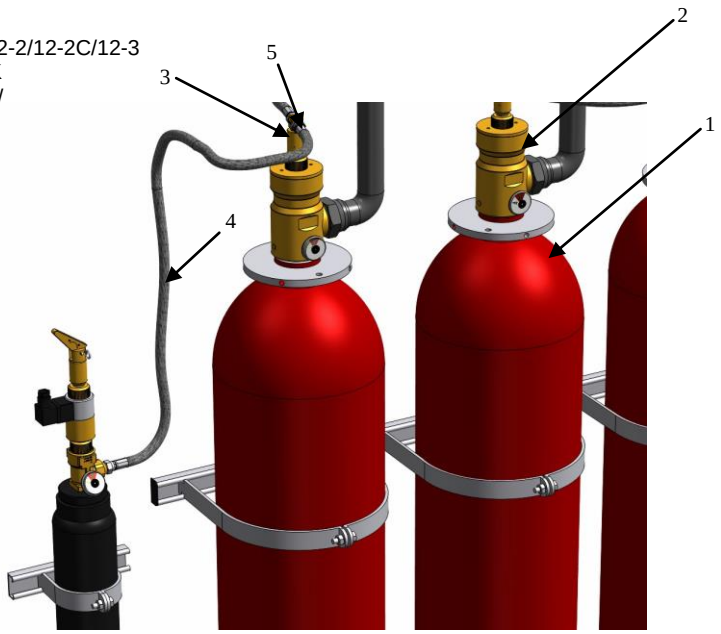




Prisoner screws
(VALAN-50-125 & VALAN-40-25)

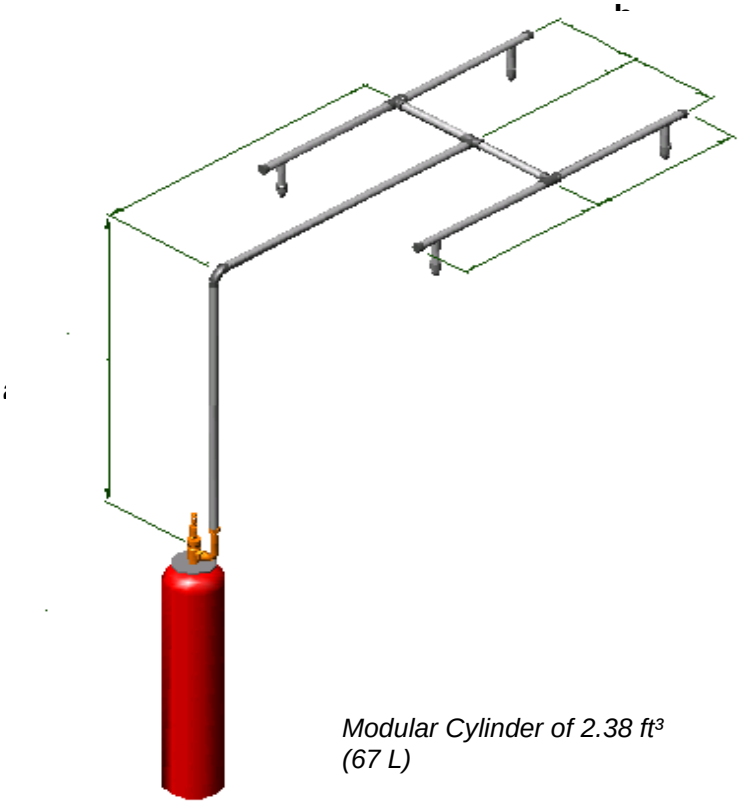
✓ Confirm that the connection between the pilot bottle (in case we use it) and the pilot line are well done.

1 Cylinder
2 Cylinder valve RGS-MAM-11-2/12-2/12-2C/12-3
3 Actuator head 227CN / 227CNTK
4 Flexible hose FH-6PO / FH-7PO / DH-10 / DH-10I / DH-11 / DH-11I
5 Tee or elbow 1/4" G



✓ Check again all connections of the discharge hoses and the activation hoses, verifying that all nuts are well tightened with the help of a fixed spanner.

✓ The nozzles shall be located according to the isometric drawings supplied by SIEX, complying also with the restrictions of diameters and lengths of the pipe web.



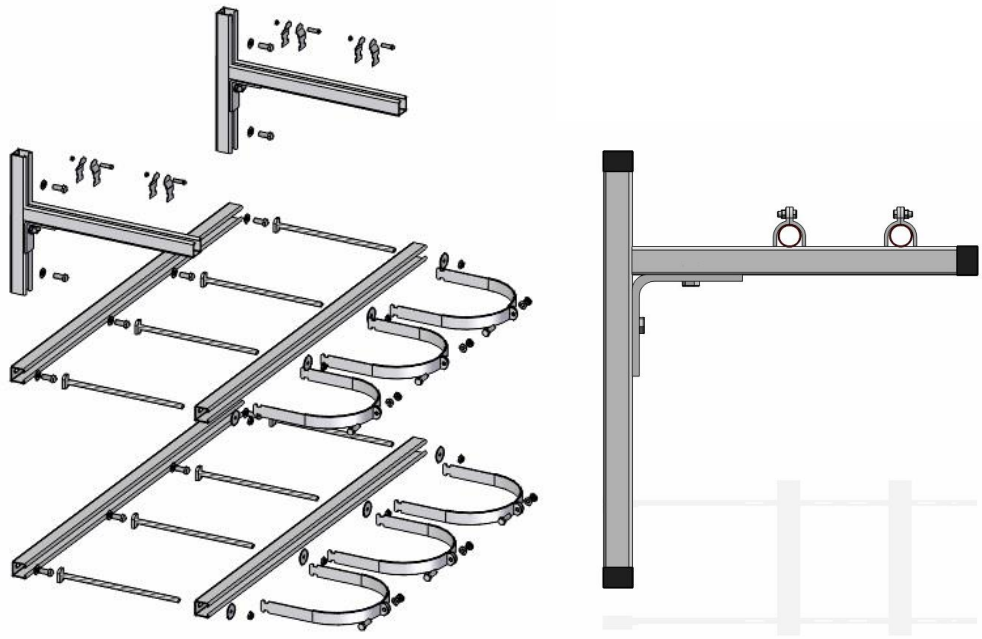
Modular Cylinder of 2.38 ft³ (67 L)

✓ The pipe web should maintain a security distance with the nearest tension conduit not isolated.

SECURITY DISTANCE

Maximum nominal tension (KV)	**Until the nearest tension conduit not isolated ft (m)**	To the nearest part not at earth potential of an insulator[b] supporting a live conductor (ground clearance) **ft (m)**
15	8.5 (2.59)	-
33	8.99 (2.74)	-
44	9.48 (2.89)	-
66	10.01 (3.05)	-
88	10.5 (3.20)	8.2 (2.5)
110	10.99 (3.35)	8.2 (2.5)
132	11.48 (3.50)	8.2 (2.5)
165	12.5 (3.81)	8.2 (2.5)
220	14.01 (4.27)	8.2 (2.5)
275	14.99 (4.57)	8.2 (2.5)

✓ The cylinder or battery system brackets shall be adjusted and fixed correctly in the way that the cylinders do not move. Also, check that the manifold brackets are well fixed.



ANNEX B: REFILLING PROCEDURE.

CAUTION

YOU ARE HANDLING PRESSURISED EQUIPMENT

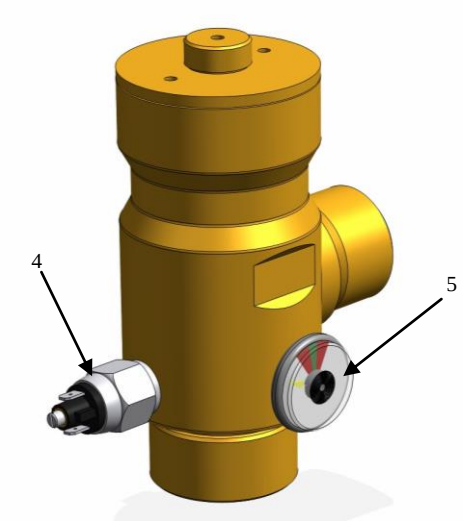
SIEX-HC CYLINDERS AND CYLINDER VALVE ASSEMBLIES MUST BE REFILLED AND HANDLING IN ACCORDANCE WITH THE CONTENTS OF THIS MANUAL.

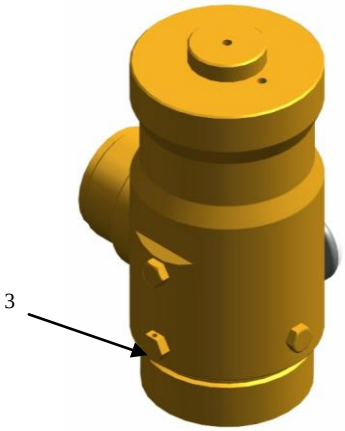
FAILURE TO FOLLOW THESE INSTRUCTIONS MAY CAUSE THE CYLINDERS DISCHARGING VIOLENTLY, WHICH COULD CAUSE SERIOUS INJURY TO THE PERSONS HANDLING THEM AND DAMAGE TO THE SURROUNDING AREA.

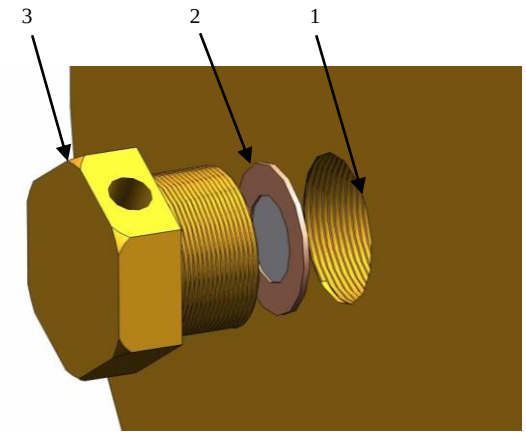
After an operation of the system, the cylinders shall be refilled with the correct amount of gas. All the information needed for the correct refilling (quantity of gas, pressure…), appears in the stickers of the cylinders. In case of doubt, please contact SIEX. Follow the next steps to refill the cylinders correctly:

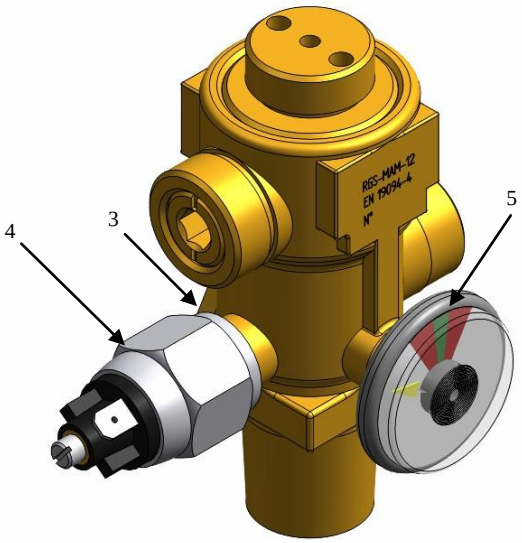
1º- Check if there is not any rest of gas in the cylinders to be refilled, if it is not the case, empty the cylinders completely.

2º- Check the connections to the pressure gauge, pressure switch, bursting or actuation disc in the valve. And if it is necessary replace them.







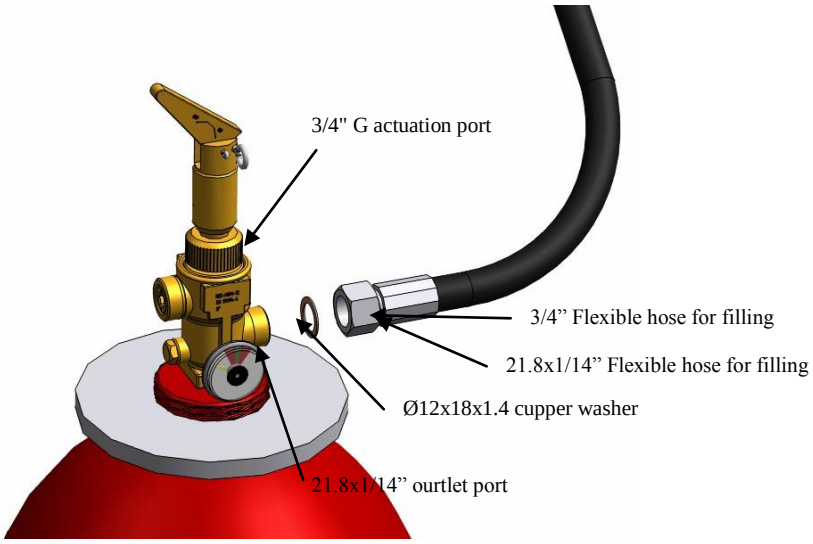


The burst disc assembly consists of:

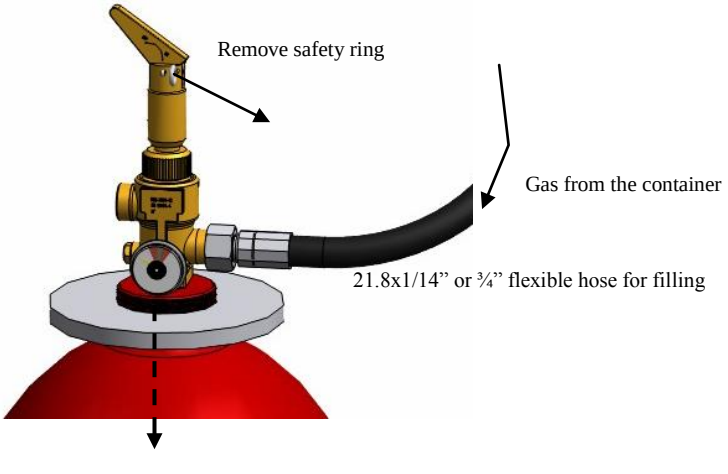
1- Disc housing in the valve
2- Burst disc
3- Exhaust plug
4- Pressure gauge
5- Pressure switch

3º- Proceed to fill the cylinder with the gas as follow. Note that is not permitted to use the pressure gauge of the cylinder as a master gauge to determine the correct charges pressures. If a high pressure gas tank is used to pressurize the cylinder, then a pressure regulator shall be used:

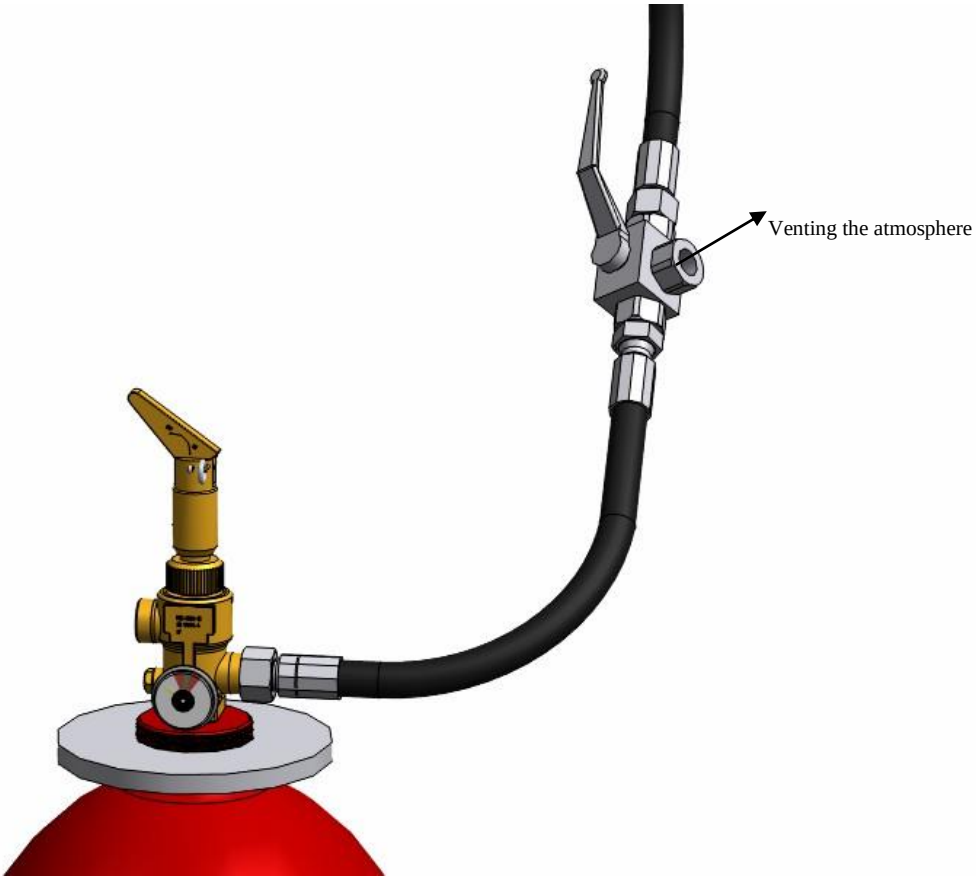
a) For filling the cylinder through valves **RGS-MAM-11-4 or 12-4,** connect a flexible hose to the outlet port of the valve and as well to the manual actuator 227DM to the ¾" upper actuation port in the valve.



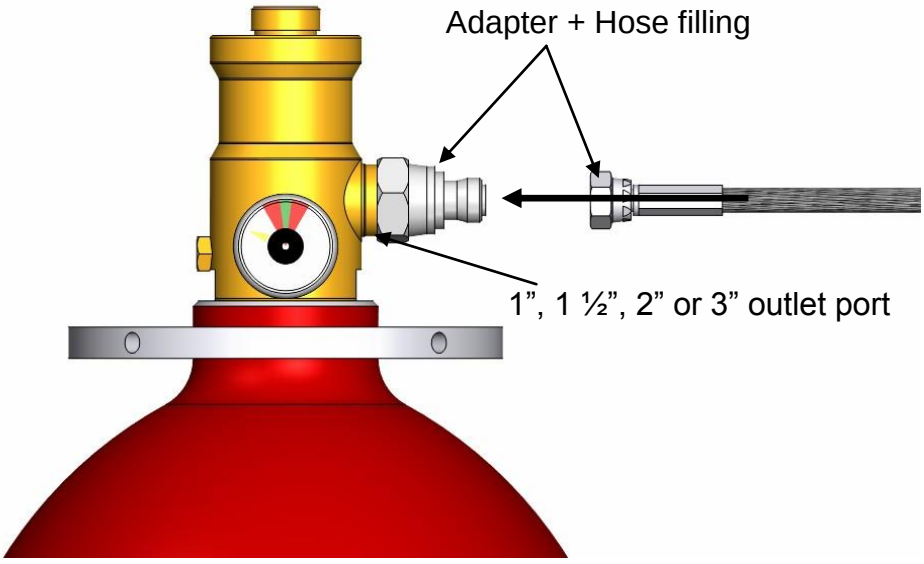
b) Remove the safety pin from the manual actuator 227DM, then actuate the lever by turning it and place it in position ON (triggered position). At this point fill the extinguishing agent up to complete the filling of the cylinder controlling the pressure by means for the pressure gauge.



c) Once the filling of the cylinder is completed, return the lever of the manual actuator 227DM to OFF position (stand-by position) and install the safety pin and remove the actuator from the upper port. Then open the 3-way valve in order to release the gas from the flexible hose in a controlled way, check if there is any leakage by means of soapy water and disconnect the flexible hose for filling.

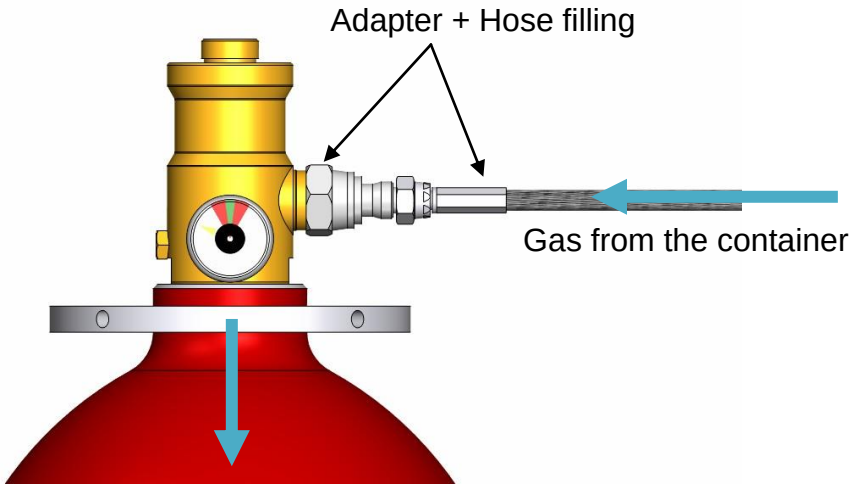


d) For filling through **RGS-MAM-20, 40, 50 or 80 valves**. Connect an adapter + hose to the 1", 1 ½", 2" or 3" outlet port of the valve.



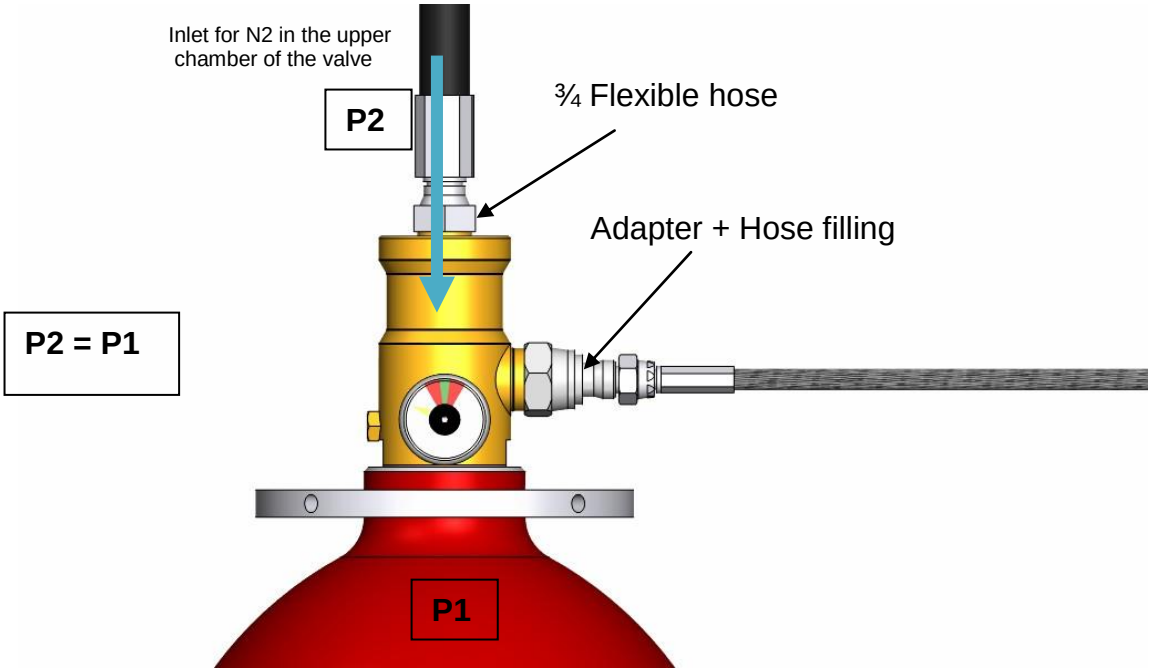
RGS-MAM-20, 40, 50 or 80 Valve

e) At this point fill the extinguishing agent up to complete the filling of the cylinder controlling the pressure by means for the pressure gauge.



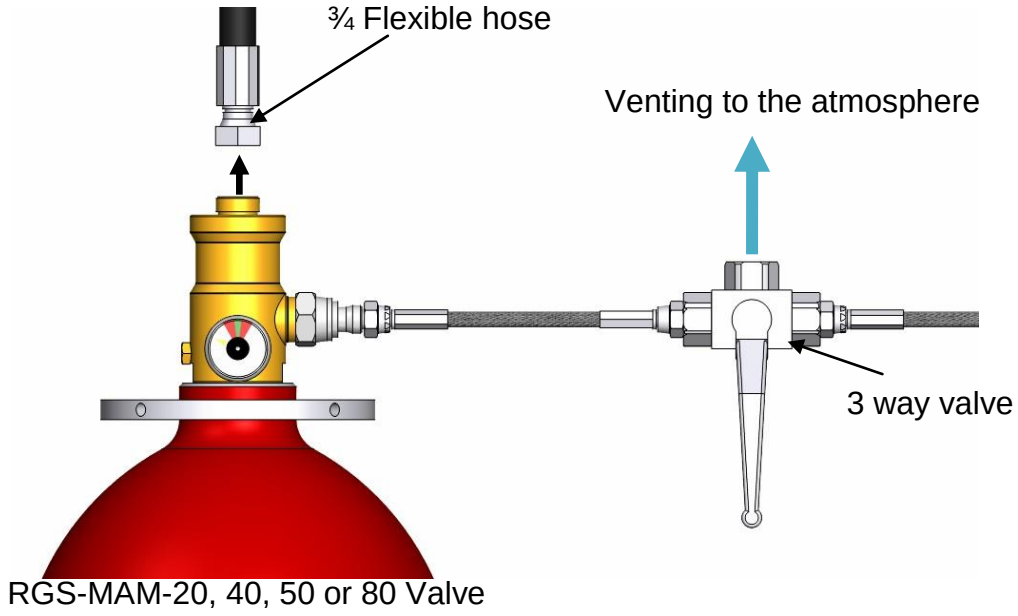
RGS-MAM-20, 40, 50 or 80 Valve

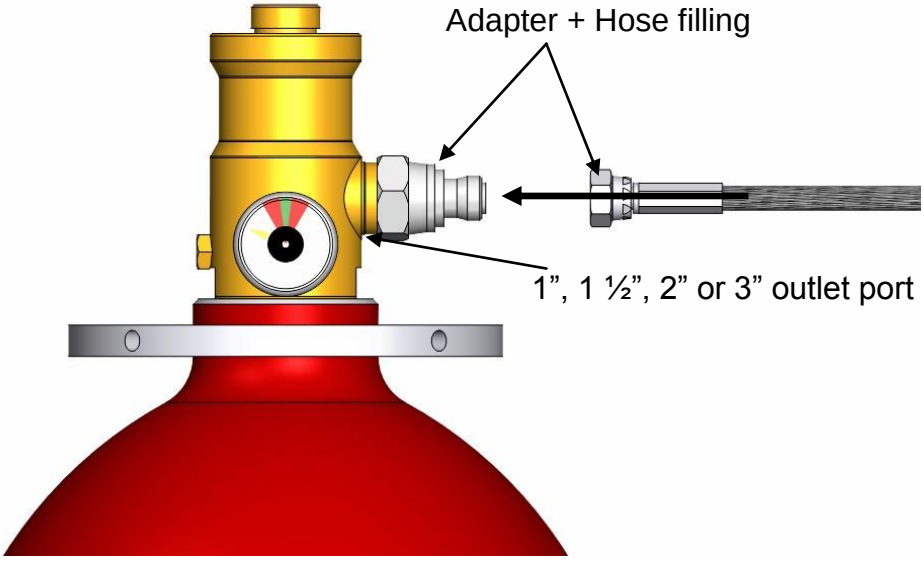
Once the filling of the cylinder is completed, connect the ¾" G flexible hose to the nitrogen inlet which will seal completely the valve by means of the valve core placed in the upper part, **exerting the same filling pressure than the pressure for the filling of the cylinder.**



RGS-MAM-20, 40, 50 or 80 Valve

f) Then disconnect the flexible hose from the upper port and open the 3-way valve in order to release the gas from the flexible hose in a controlled way, check if there is any leakage by means of soapy water and disconnect the flexible hose for filling.





Now, the cylinders are refilled. Screw the cap in the outlet of the container valve and the protective cap in the bridle so the cylinder will be protective during its transport and storage. Fill up the stickers carefully with the new date and all required information.

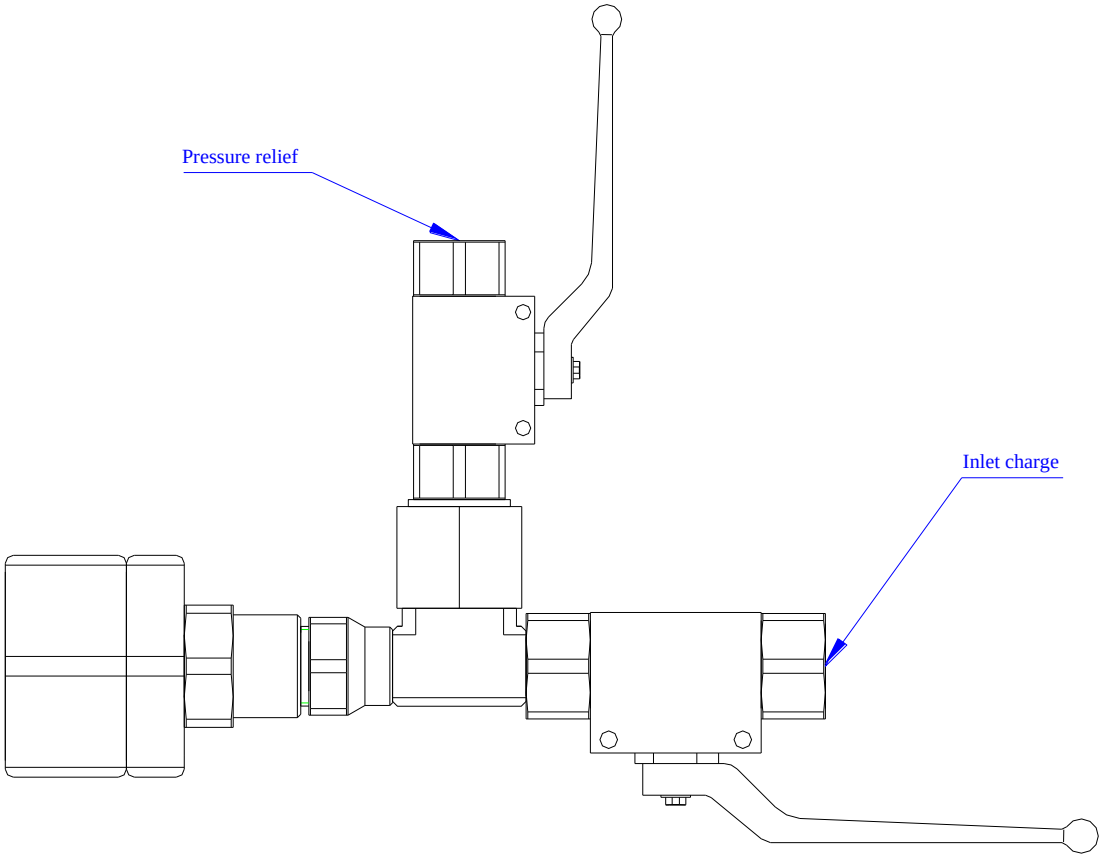
ANNEX C: List of replacement parts.

The following list shows the possible replacement pieces that we can supply to maintain the system correctly. After a refilling procedure is necessary to check some points of the system to check that everything is correct, that there is no leakage in the container valve, that the pressure gauge and pressure switch are good for use it...

1.- Adapters for filling cylinders

They make easier the filling procedure. It is used with all types of container valves.

ADAPTERS FOR FILLING CYLINDERS	
Part number	**Container valves**
CGAC21	RGS-MAM-11-4 / 12-4
CGAC20	RGS-MAM-20
CGAC25	RGS-MAM-40
CGAC40	RGS-MAM-40
CGAC50	RGS-MAM-50
CGAC80	RGS-MAM-80



2.- Pressure gauge

In case they are broken or not monitoring the pressure correctly, they should be changed.

PRESSURE GAUGES	
Part number	**Working pressure**
UF40H-P25	362 psi *(25 Bar)*
UF40H-P32	464 psi *(32 Bar)*
UF40H-P34	493 psi *(34 Bar)*
UF40H-P42	609 psi *(42 Bar)*
UF40H-P50	725 psi *(50 Bar)*
UF40H-P55	798 psi *(55 Bar)*
UF40I-P150	2170 psi (150 Bar)
UF40I-P200	2900 psi (200bar)
UF40I-P0-XXX	variable
UF40H-E25	362 psi *(25 Bar)*
UF40H-E32	464 psi *(32 Bar)*
UF40H-E34	493 psi *(34 Bar)*
UF40H-E42	609 psi *(42 Bar)*
UF40H-E50	725 psi *(50 Bar)*
UF40H-E55	798 psi *(55 Bar)*
UF40I-E150	2170 psi (150 Bar)
UF40I-E200	2900 psi (200 bar)
UF40I-E0-XXX	variable

3.- Pressure switch

In case they are broken or not monitoring the pressure correctly, they should be changed.

PRESSURE SWITCH	
Part number	**Regulation field**
POPRENA20	145-290 psi *(10-20 bar)*
POPRENA50	290-725 psi *(20-50 bar)*
POPRENA80	725-1160 psi *(50-80 bar)*
POPRENC250	1450-3625 psi *(100-250 bar)*
POPRENC20	145-290 psi *(10-20 bar)*
POPRENC50	290-725 psi *(20-50 bar)*
POPRENC80	725-1160 psi *(50-80 bar)*
POPRENC250	1450-3625 psi *(100-250 bar)*
APRESA20	145-290 psi *(10-20 bar)*
APRESA50	290-725 psi *(20-50 bar)*
APRESA80	725-1160 psi *(50-80 bar)*
APRESC250	1450-3625 psi *(100-250 bar)*
APRESC20	145-290 psi *(10-20 bar)*
APRESC50	290-725 psi *(20-50 bar)*
APRESC80	725-1160 psi *(50-80 bar)*
APRESC250	1450-3625 psi *(100-250 bar)*
POPRECO-AD 24,1	100.08-349.54 psi (6,9-24,1 bar)
POPRECO-AD 48,3	249.46-700.53 psi (17,2 – 48,3 bar)
POPRECO-AD 103,4	400.3-1499.69 psi (27,6 – 103,4 bar)
POPRECO-AD 413,7	2000.07-6000.21 psi (137,9 – 413,7 bar)

POPRENAXX & POPRENCXX

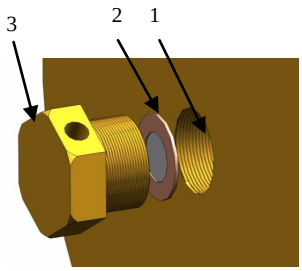
POPRECO-ADXX

4.- Bursting disc

Sometimes, the burst disc can broke due to an overpressure caused, for example, by an excess of temperature. Always that we refill a cylinder, we have to check that the bursting disc is in good conditions before start with the refilling. We have to replace the bursting disc in these cases.

The burst disc assembly consists of:

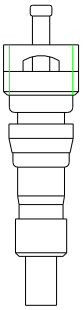
1- Disc housing in the valve
2- Burst disc
3- Exhaust plug



BURSTING DISC					
Part number	**Size of disc**	**Burst disc Pressure**	**Torque of the burst disc cap**	**Container pressure**	**Container valve**
UFBD-06X40-8749	0.43 x 0.24 in (11 x 6 mm)	580 psi (40 Bar)	20 Nm	360 psi (25 Bar)	RGS-MAM-11-4
UFBD-06X50-8777		725 psi (50 Bar)	20 Mn	360–460–490 psi (25 – 32 - 34 Bar)	
UFBD-06X60-8563		870 psi (60 Bar)	20 Nm	360–460–490 psi (25 – 32 - 34 Bar)	
UFBD-06X110-7971		1595 psi (110 Bar)	20 Nm	610-725-780 psi (42 – 50 – 55 Bar)	
UFBD-06X40-8749	0.43 x 0.24 in (11 x 6 mm)	580 psi (40 Bar)	20 Nm	360 psi (25 Bar)	RGS-MAM-12-4
UFBD-06X50-8777		725 psi (50 Bar)	20 Nm	360–460–490 psi (25 – 32 - 34 Bar)	
UFBD-06X60-8563		870 psi (60 Bar)	20 Nm	360–460–490 psi (25 – 32 - 34 Bar)	
UFBD-06X110-7971		1595 psi (110 Bar)	20 Nm	610-725-780 psi (42 – 50 – 55 Bar)	
UFBD-06X40-8749	0.43 x 0.24 in (11 x 6 mm)	580 psi (40 Bar)	20 Nm	360 psi (25 Bar)	RGS-MAM-20
UFBD-06X50-8777		725 psi (50 Bar)	20 Nm	360–460–490 psi (25 – 32 - 34 Bar)	
UFBD-06X60-8563		870 psi (60 Bar)	20 Nm	360–460–490 psi (25 – 32 - 34 Bar)	
UFBD-06X110-7971		1595 psi (110 Bar)	20 Nm	610-725-780 psi (42 – 50 – 55 Bar)	
UFBD-08X40-8770	0.55 x 0.31 in (13.9 x 8 mm)	580 psi (40 Bar)	60 Nm	360 psi (25 Bar)	RGS-MAM-40 RGS-MAM-50
UFBD-08X50-8780		725 psi (50 Bar)	60 Nm	360–460–490 psi (25 – 32 - 34 Bar)	
UFBD-08X60-8502		870 psi (60 Bar)	60 Nm	360–460–490 psi (25 – 32 - 34 Bar)	
UFBD-08X110-7973		1595 psi (110 Bar)	60 Nm	610-725-780 psi (42 – 50 – 55 Bar)	
UFBD-11X40-8771	0.71 x 0.43 in (18 x 11 mm)	580 psi (40 Bar)	90 Nm	360 psi (25 Bar)	RGS-MAM-50
UFBD-11X50-8781		725 psi (50 Bar)	90 Nm	360–460–490 psi (25 – 32 - 34 Bar)	
UFBD-11X60-8564		870 psi (60 Bar)	90 Nm	360–460–490 psi (25 – 32 - 34 Bar)	
UFBD-11X110-8073		1595 psi (110 Bar)	90 Nm	610-725-780 psi (42 – 50 – 55 Bar)	
UFBD-08X50-8780	0.55 x 0.31 in (13.9 x 8 mm)	725 psi (50 Bar)	60 Nm	360–460–490 psi (25 – 32 - 34 Bar)	RGS-MAM-80
UFBD-08X60-8502		870 psi (60 Bar)	60 Nm		
UFBD-18X50-8782	0.93 x 0.71 in (23.5 x 18 mm)	725 psi (50 Bar)	60 Nm	360–460–490 psi (25 – 32 - 34 Bar)	RGS-MAM-80 (Cylinder)
UFBD-18X60-8503		870 psi (60 Bar)	60 Nm		
UFBD-arand-23X17X1		-	-		
UFBD-08X60-8502	0.55 x 0.31 in (13.9 x 8 mm)	870 psi (60 Bar)	60 Nm	-	Manifold
UFBD-08X110-7973	0.55 x 0.31 in (13.9 x 8 mm)	1595 psi (110 Bar)	60 Nm	-	Manifold
UFBD-08X210-8610	0.55 x 0.31 in (13.9 x 8 mm)	3045 psi (210 Bar)	40 Nm	-	Manifold
UFBD-08X310-8611	0.55 x 0.31 in (13.9 x 8 mm)	4496 psi (310 Bar)	40 Nm	-	Manifold
UFBD-08X350-8613	0.55 x 0.31 in (13.9 x 8 mm)	5076 psi (350 Bar)	40 Nm	-	Manifold
UFBD-08X430-8612	0.55 x 0.31 in (13.9 x 8 mm)	6236 psi (430 Bar)	40 Nm	-	Manifold

5.- VALVE CORE

The valve core is a device which allows to activate the container valve and not permits that the gas goes out in its normal position. During its activation (made by the actuator heads) or during the refilling procedure the valve core can broke. In that case, we will proceed to replace it.



Valve core: UFOB-T1-41071-06D

Tool for valve core: UFOB-T1-TOOL

6.- PISTON ASSEMBLY OF THE CONTAINER VALVE

The piston of the container valve is the piece which makes the sealing of the valve and activates it by its vertical movement depending on the pressure of the upper chamber. If we see a leakage during its refilling, it should be changed.

PISTON ASSEMBLY	
Part number	**Container valves**
UFPA-11-4	RGS-MAM-11-4 / 12-4
UFPA-20	RGS-MAM-20
UFPA-40	RGS-MAM-40
UFPA-50	RGS-MAM-50
UFPA-80	RGS-MAM-80