Extinguishing agents HFC-227ea and FE-13



aguilera extinción



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STANDARDS

The standards regulating the use of HFC-227ea and FE-13 are EN 15004-1, EN 15004-5 and EN 15004-6.

Total flooding systems can be used to put out fires of all kinds.

The standards set the minimum design concentrations as follows:

Concentration		
Risk	**HFC-227ea**	**FE-13 ***
Class B	**9**	**16,4**
Class A superficial	**7,9**	**16,3**
Risk higher than class A	**8,5**	**16,3**

*Another factor must be included in calculations as well as this required amount. This factor is to compensate for the amount of residual agent that remains in the containers after the discharge time (10 seconds). The minimum factor should be 11%.



What is HFC-227ea?

HFC-227ea or heptafluoropropane is the most used halon replacement gas. Its NOAEL means it can be applied using a total flooding system in occupied areas.

HFC-227ea extinguishes fire through the absorption and extraction of flame heat; when the gas decomposes, the flame's temperature is reduced and the chemical reaction involved in combustion slows down.

What is FE-13?

FE-13 or trifluoromethane is a clean, low-pressure extinguishing agent that puts out fires essentially through heat absorption. Its low toxicity makes it the safest gas for protecting areas used by people.

Thanks to its high vapour pressure at room temperature (41 Bars at 20ºC), FE-13 does not require nitrogen pressurisation.

The low boiling point of FE-13 means that any container holding it can be stored in a remote area, far from the protected space, as well as in other places at room temperature.

Application systems

Total flooding

Storage of a cylinder or battery of cylinders of the extinguishing agent needed to achieve the concentration required for extinction by means of discharge in the space concerned. This will be connected to a network of pipes and a series of discharge and gasification diffusers that distribute the extinguishing agent inside the space to be protected.

To ensure the extinction is effective with the calculation carried out, it is vital that the design concentration be maintained for at least 10 minutes.

System types

Modular systems

Made up of a single bottle with a small network of pipes and a minimum number of diffusers that discharge the extinguishing agent uniformly within the space to be protected.

Centralised systems

Made up of a set of storage cylinders with the same pressure and amount of extinguishing agent, connected via a common outflow pipe to a distribution network of pipes and a series of nozzles that are properly laid out and sized so that the extinguishing agent is distributed uniformly.

Fire types

Superficial fires

Fires involving the combustion of inflammable liquids and vapours that are extinguished through total flooding of the space with a concentration of extinguishing agent according to each material and the volume of the space.

Smouldering fires

Fires involving the combustion of inflammable solids like cotton, cardboard, paper, wood, electrical materials... that require a longer cooling period and maintenance of the external atmosphere.

Toxicological information HFC-227ea	
	Valor %
NOAEL	9,0
LOAEL	>10,5

Toxicological information FE-13	
	Valor %
NOAEL	30
LOAEL	>30

NOAEL (No Observable Adverse Effect Level). Highest data point at which there was not an observed toxic or adverse effect.

LOAEL (Lowest Observed Adverse Effect Level). Lowest data point at which there was an observed toxic or adverse effect.

Personal safety

The risk to people is caused by the discharge of the extinguishing agent in the space. This can be caused by the extinguishing agent itself, products of the combustion or products that arise through decomposition of the extinguishing agent resulting from exposure to the fire.

Minimum safety measurements for occupied areas for HFC-227ea

Maximum concentration	Time delay	Automatic/manual switch	Blocking device
Concentration - NOAEL	yes	Not required	Not required
NOAEL > Concentration > LOAEL	yes	yes	Not required
Concentration > LOAEL	yes	yes	yes

Table A

HFC-227ea	
Nominal diameter	Discharge flow Kg/Sec
DN10 (3/8”)	0.3
DN15 (1/2”)	1.35
DN20 (3/4”)	2.5
DN25 (1”)	3.8
DN32 (1 1/4”)	5.7
DN40 (1 1/2”)	9
DN50 (2”)	13.6
DN65 (2 1/2”)	24.9
DN80 (3”)	40.8
DN100 (4”)	56.7
DN115 (5”)	90.7
DN150 (6”)	136.1

Table B

FE-13	
Nominal diameter	Discharge flow Kg/Sec
DN10 (3/8”)	0.3
DN15 (1/2”)	1.2
DN20 (3/4”)	2
DN25 (1”)	4
DN32 (1 1/4”)	6
DN40 (1 1/2”)	9
DN50 (2”)	18
DN65 (2 1/2”)	25
DN80 (3”)	40
DN100 (4”)	65
DN115 (5”)	95
DN150 (6”)	140

Discharge pipe sizes

In general, pipes and accessories to be used for the distribution network for HFC-227ea and FE-13 systems should be able to withstand the pressures created inside them.

According to the applicable standard: EN 15004-1, the system’s pipes should be able to withstand the pressure that the agent will create at 50 ºC.

For HFC-227ea, it is recommended that ASTM A 106 Grade B Sch 40 pipes, or similar, be used. The recommended accessories would be ANSI 3000 high-pressure forged pieces or similar.

For FE-13, it is recommended that ASTM A106 Grade B Sch 40. For diameter below 25 (1") and for larger diameter SCH80. The recommended accessories would be ANSI 3000 high-pressure forged pieces or similar.

The calculation of the sizes of pipes and the gauging of the diffusers is done using computer programs. However, tables A and B can be checked for an approximate pre-sizing of pipes.

HFC-227ea and FE-13	
Pipe diameter	Maximum separation between supports
DN10 (3/8”)	1 m
DN15 (1/2”)	1,5 m
DN20 (3/4”)	1,8 m
DN25 (1”)	2,1 m
DN32 (1 1/4”)	2,4 m
DN40 (1 1/2”)	2,7 m
DN50 (2”)	3,4 m
DN65 (2 1/2”)	3,5 m
DN80 (3”)	3,7 m
DN100 (4”)	4,3 m

Pipe supports

Supports for the distribution network should withstand the dynamic and static loads created, as well as the changes in pipe length due to thermal effects.

The table gives an indication of the maximum separation between the supports depending on the pipe diameter.

HFC-227ea y FE-13



Modular cylinders

FE-13

High-pressure cylinders made of heat-treated, alloyed weldless steel, with an operating pressure of 60 Bars, test pressure of 250 Bars, operating temperature of -20ºC to +50ºC, engraved and painted red.

HFC-227ea

High-pressure cylinders made of heat-treated, alloyed weldless steel, with an operating pressure of 42 Bars, test pressure of 250 Bars, operating temperature of -20ºC to +50ºC, engraved and painted red.



Centralised systems

FE-13

High-pressure batteries composed of cylinders each with a 67, 80 or 120 L capacity. Made of heat-treated, weldless steel. With an operating pressure of 60 Bars, test pressure of 250 Bars, operating temperature of -20ºC to +50ºC. Engraved and painted red.

HFC-227ea

High-pressure batteries composed of cylinders each with a 67, 80 or 120 L capacity. Made of heat-treated, weldless steel. With an operating pressure of 42 Bars, test pressure of 250 Bars, operating temperature of -20ºC to +50ºC. Engraved and painted red.



Continuous weighing system

The continuous weighing system has been developed and patented by the R&D department of Aguilera Electrónica. It is based on traction and electronic circuit extensometric load cell technology with a microprocessor and display.

The display shows the weight of the cylinder (tare + load). The device has lights and alarms that draw attention to any weight loss greater than 200 grams, faults in the equipment and signals from another connected weight control device.

at a glance

Modular cylinders with continuous weighing



FE-13

High-pressure cylinders made of heat-treated, alloyed weldless steel, with an operating pressure of 60 Bars, test pressure of 250 Bars, operating temperature of -20ºC to +50ºC, engraved and painted red.

HFC-227ea

High-pressure cylinders made of heat-treated, alloyed weldless steel, with an operating pressure of 42 Bars, test pressure of 250 Bars, operating temperature of -20ºC to +50ºC, engraved and painted red.

In both systems, the cylinders are equipped with a continuous weighing device, whereby the weight of each cylinder is individually controlled by a device. The cylinders are assembled in a special metal frame that allows continuous weighing. The discharge collector has a thread to connect it to the facility and a decompression valve.

Centralised continuous weighing systems



FE-13

High-pressure batteries made up of cylinders each with a 67, 80 or 125 L capacity. Made of heat-treated, weldless steel. With a test pressure of 250 Bars, operating temperature of -20ºC to +50ºC. Engraved and painted red. The weight of each cylinder is individually controlled by an analogue continuous weighing device Mod. AEX/CPC. Supplied with a turnbuckle that allows the cylinders to be lifted easily, connectors with attached hoses for connection and all other necessary accessories.

HFC-227ea

High-pressure batteries made up of cylinders each with a 67, 80 or 120 L capacity. Made of heat-treated, weldless steel. With a test pressure of 250 Bars, operating temperature of -20ºC to +50ºC. Engraved and painted red.

The weight of each cylinder is individually controlled by an analogical continuous weighing device Mod. AEX/CPC. Supplied with a turnbuckle that allows the cylinders to be lifted easily, connectors with attached hoses for connection and all other necessary accessories.

Applications

The use of fluorinated gases in Protection Against Fire (in total flooding systems) is, technically-speaking, a quality, efficient and safe option. It is of course necessary to take into consideration all the design conditions that ensure these systems are reliable. For this purpose there are frameworks of Spanish and international standards that help with the establishment of correct protection. Typically, these systems protect sites like telecommunications centres, museums, processing centres and many critical facilities in industry and services.

Hydrofluorocarbons (HFC) are reliable and proven solutions for the problems tackled by the Montreal and Kyoto Protocol processes. They are energy efficient, have low toxicity, show value for money and can be used safely.

Governments and industries support use of these in applications that satisfy important environmental and social needs.

Control towers





Archives

Server rooms
and data centres





Radio/radar stations



Cold stores

Facility characteristics

To achieve optimum discharge of the extinguishing agent through the diffusers, and so a uniform concentration of the agent is released in the space to be protected, it is necessary to bear in mind the following points:

- The minimum discharge volume for liquid gases must be enough to maintain the velocity needed for turbulent flow, so the liquid phase does not separate from the gaseous phase, which would cause unpredictable flow characteristics.

- The pressure reached in the discharge diffuser inlet after subtracting losses due to friction and height changes should be the minimum needed to allow gasification of the extinguishing agent at this point and also the desired coverage of the agent.

- The geometry of the facility and the location of the storage cylinders should be set in such a way that the system is balanced and does not cause unnecessary losses due to long distances between the storage area and the discharge points.

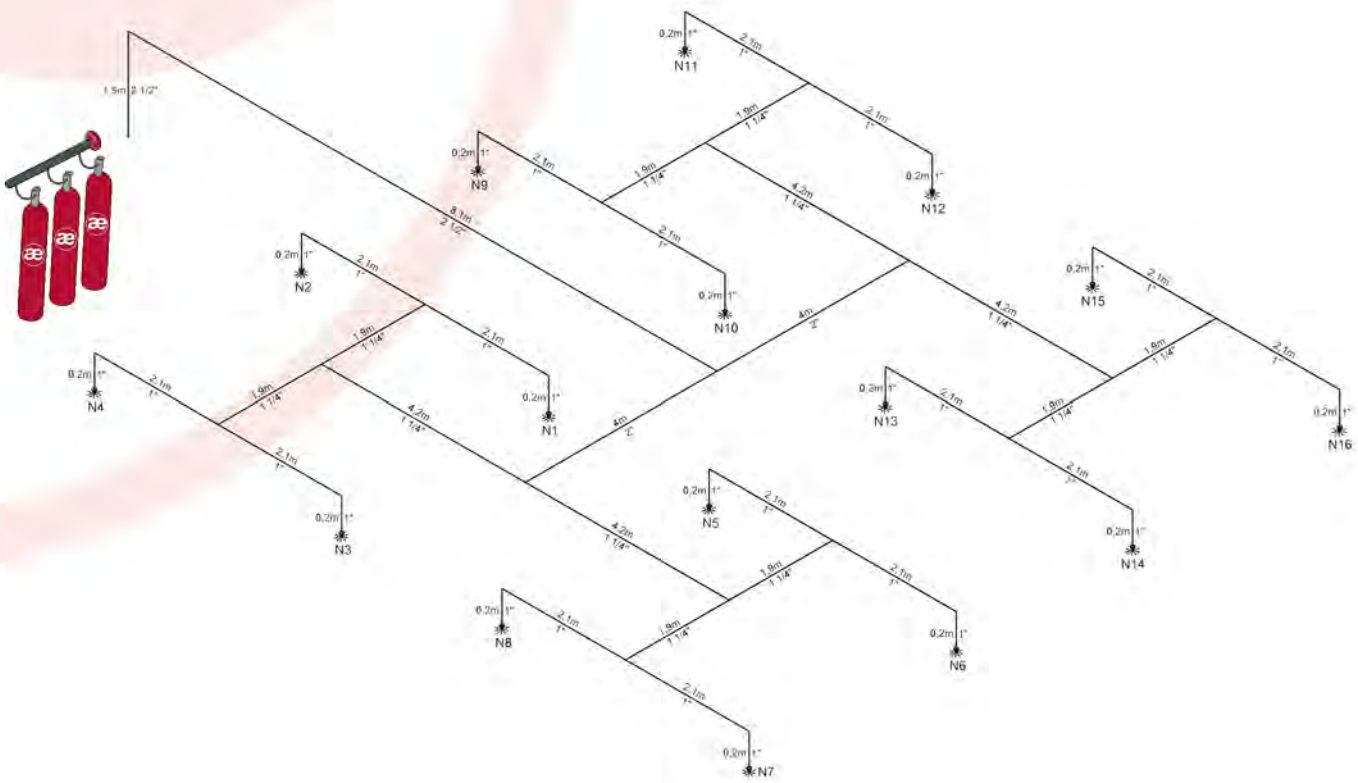
- In nitrogen overpressure gases (HFC-227ea), the energy that propels the extinguishing agent comes from the added nitrogen and so there should be a balance between the amounts of nitrogen and extinguishing agent. That is why, depending on the total amount of extinguishing agent to be discharged and on the distances in the facility, the density to which the storage cylinders are filled with extinguishing agent should be varied (ratio between amount of extinguishing agent-amount of propelling nitrogen).

- The discharge of the extinguishing agent must be carried out in a short time interval (10 sec.) so that the fire cannot reach a size and temperature that causes the extinguishing agent to decompose, which would harm those inside the protected space.

- Any variation in the original design would require changes to the calibration of the diffusers and size of the pipes in the network for distributing the extinguishing agent.

To guarantee that the diffusers discharge appropriately, the user must have a suitable hydraulic calculation program that can calculate the necessary reiterations, bearing in mind the limitations stated above and the variables introduced.

Aguilera Extinción has the best hydraulic calculation program on the market for the calculation of pipe sizes and diffuser calibrations for facilities using the extinguishing agents HFC-227ea and FE-13.





Our commitment: service and guarantees

Projects

Grupo Aguilera offers its assistance to engineers when it comes to projects for the detection, control and extinction of fires, providing advice regarding systems and coverage for each built space. The projects department carries out system design and sizing, hydraulic calculations, the calibration of diffusers and the facility's isometrics, advising on the effectiveness of the equipment in each at-risk space and suggesting operations for installation.

Training

Aware that we all want to know about and take responsibility for what we do, independently of the technical support that we provide for facilities carried out with our products, Grupo Aguilera gives training courses regarding the operation of our equipment, its installation and programming.

Personal attention

For Grupo Aguilera, each customer is important. We are aware that not everyone has the same needs, and so our team of professionals provides personal attention that is suitable for your requirements.

Maintenance

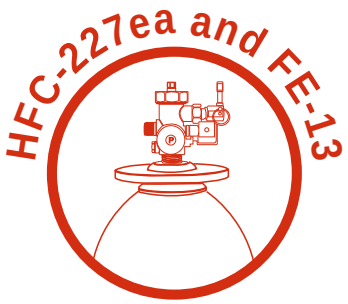
Grupo Aguilera promises to guarantee the following services: repair, reprogramming and the supply of spare parts, after the guarantee period.

Technical service

With the aim of guaranteeing the smooth running of facilities, the Grupo Aguilera technical department carries out operating and commissioning tests on the equipment. Furthermore, it works with the installer throughout the installation process. Once the system is in place, with appropriate water and electricity supplies, and with the hydraulic test having been carried out, Grupo Aguilera's technical staff carry out the operating and commissioning tests on the equipment.

Equipment guarantee

Grupo Aguilera guarantees sound operation of its equipment for 2 years starting from the delivery date; we take responsibility for the replacement or repair of any equipment in which manufacturing anomalies or faults are detected, and which is delivered to our factory in Madrid.



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Edición 03/11