

**FK-5-1-12 GAS EXTINGUISHING SYSTEM
TECHNICAL SPECIFICATIONS
(EN 15004 / ISO 14520)**

JANUARY, 2018

1. JOB DEFINITION

FK-5-1-12 Gas Automatic Fire Detection and Extinguishing System will be installed within the scope of the project. The project includes the provision of FK-5-1-12 gas automatic fire detection and extinguishing system products, projecting, assembly of systems, installation and commissioning, application tests and maintenance and repair work during the guarantee period in accordance with the technical specifications.

2. SYSTEM OPERATING PRINCIPLE

- 2.1. For each extinguishing space, the cylinder and / or group of cylinders in which the amount of gas generated result of the hydraulic calculation will be placed shall be determined.
- 2.2. Each extinguishing space shall have a separate fire alarm and extinguishing panel. In case of fire in more than one space, the extinguishing system will be activated that place itself.
- 2.3. Fire detection detectors will be selected considering the first product (smoke, heat, flame etc.) to be chose in case of possible fire risk.
- 2.4. Separate detection and extinguishing equipment will be provided for each of the volumes (room + raised floor + suspended ceiling) at each extinguishing space.
- 2.5. Within each space, detection shall be made by detectors to be connected with each other by cross zone control system. In this way, if an alarm is received from a single detector, the gas extinguishing system cannot be activated, a second alarm from a different zone will always will be expected.
- 2.6. After the first detection of detector in any of the extinguishing spaces, when the siren with fire warning flashers will be activated where indicating extinguishing zone; the buzzer will flash for visual warning together with audible warning. When the detection with the cross zone control system is verified by a second detector, the alarm bell indicating the same zone will start to sound. With the second detection, the extinguishing panel will start the countdown process, which will be calculated considering the evacuation time, and after the countdown is completed, the system valve on the FK-5-1-12 system cylinder connected to the extinguishing zone where the fire is detected will be activated by the extinguishing panel and the FK-5-1-12 gas will be provied to discharged to the volume.

- 2.7. After initial detection and before the panel's countdown time is complete a personnel who can intervene in the fire will be able to deactivate the FK-5-1-12 gas extinguishing system by pressing the manual stop button.
- 2.8. The system can be disengaged manually via the panel and in case of low risk, manual intervention with a portable extinguisher can be used to extinguish the fire by personnel without the evacuation of FK-5-1-12 gas.
- 2.9. In case the fire risk starts rapidly and the system is activated without waiting for the second warning siren or panel countdown time to out, the system will be triggered manually with the yellow "Extinguishing Start Button" situated located on or near the fire extinguishing panel.

3. GENERAL SYSTEM DEFINITION

- 3.1. The purpose of the system is to automatically detect the fire situation that may occur in the space and automatically be extinguished all the gas in the cylinders by discharging it to the environment.
- 3.2. The cylinders of the system should contain Fluoroketone gas known as Fluoroketone with the chemical formula $\text{CF}_3\text{CF}_2\text{C}(\text{O})\text{CF}(\text{CF}_3)_2$.
- 3.3. The system operating pressure must be at least 25 bar @ 21 ° C (360 psi @ 70 ° F).
- 3.4. System design should be made in accordance with the "EN 1500-2: Fixed Fire Fighting Systems -Gas Spraying Systems- Part 2: Design and physical properties of gas spraying systems for F-5-1-12 extinguishing agents or "ISO 14520-6: Gaseous fire-extinguishing systems physical properties and system design- Part5: Fk-5-1-12 extinguishant".
- 3.5. The fire class in the places where the system can be used shall be determined as specified in TS EN 15004 or ISO 14520 standards as shown in the table below.

Fire Class	TS EN 15004
Class A Surface Fire	-After normally catching fire burning in case of ember, generally solid materials with be inorganic materials
Class A High Risk	-Space with high power or cable density above the following limits; -Space with wiring harness over 100mm in diameter -In cable ceilings, spaces where the density of the pan cross-section is more than 20% -The spaces of horizontal and vertical cable trays close to each other close to 250mm -In the event of fire extinguishing,the space in which the equipment draws energy exceeds 5 kw
Class B Fire	Liquid or liquefiable solids

3.6. The system minimum design concentration should be determined as specified in TS EN 15004 or ISO 14520 standards as shown in the table below.

FIRE CLASS	TS EN 15004	ISO 15420
Class A Fire	%5,3	%5,3
Class A High Risk	%5,6	%5,6
Class B Fire	%5.9	%5,9
Class C Fire	-	-

3.7. When the system is used above sea level, for can will be provide diversity in the design the atmospheric correction coefficient specified in the following table shall be taken into consideration and calculations shall be made accordingly.

HEIGHT	ALTITUDE CORRECTION FACTOR
-920	1,11
0	1,00
910	0,89
1220	0,82
1830	0,78
2130	0,75
2450	0,72
2740	0,69
3005	0,66

3.8. All equipment used in the system and the complete system must have UL and / or FM approval or LPCB approval.

3.9. System design should be made with the manufacturer-specific, UL and / or FM approved hydraulic calculation software; calculations for all spaces must be submitted prior to installation. As a result of the hydraulic calculations, the system's isometry project, pipe diameters and lengths, the features related to the nozzles to be used and the acceptance System Acceptance Report showing that the system is in operation will be submitted to the administration for approval. The hydraulic calculations shall be confirmed by the main manufacturer directly by the company's official e-mail. PDF documents alone will not be accepted.

3.10. Extinguishing agent in the cylinder or cylinder groups to be installed in the system, mechanical installation determined as a result of hydraulic calculation and shall be discharged into the respective space by means of discharge nozzles within at least six seconds and at most ten seconds.

4. EXTINGUISHING AGENT

4.1. FK-5-1-12 gas will be used as extinguishing agent in the system.

4.2. The physical properties of the extinguishing agent gas shall be:

Chemical Name	Dodecafluoro-2-methylpentan-3-one
Chemical Formula	CF ₃ CF ₂ C(O)CF(CF ₃) ₂
Molecular Weight	316,04
Boiling point at 1 atm pressure	49 °C
Melting Point	-108 °C
Critical Temperature	168,66 °C
Critical Pressure	18,65 Bar
Critical Density	639,1 kg / m ³
Liquid Density	1,60 g/ml
Gas Density At 1 Atm Pressure	0,0136 g/ml
ODP	0
GWP	≤1

- 4.3. FK-5-1-12 to be used as extinguishing agent; UL and FM will be approved. Current documents indicating that the gas is UL / FM Listed shall be submitted to the contracting entity. Only UL approved FK-5-1-12 gas will not be accepted.
- 4.4. The first filling of FK-5-1-12 gas, which will be used as extinguishing agent, into cylinders shall be performed only at the approved filling facility of the main manufacturer. The cylinders shall be filled in an UL approved filling facility and the filling certificates shall be submitted to the administration.
- 4.5. In the case of the cylinders are discharged, they must be refilled within a maximum of 48 hours in an UL approved filling plant for refilling again.

5. CYLINDERS

- 5.1. The cylinders to be used in the system shall be anti static painted in red color.
- 5.2. The cylinders shall be tested at a pressure of at least 1,5 times the operating pressures (37,5 bar).
- 5.3. The cylinders will be filled with extinguishing agent at the approved filling intervals specified by the manufacturer, will be pressurized by adding nitrogen.

- 5.4. Cylinders, in force in the European Union and Turkey P.E.D. or T.P.E.D. must be manufactured in accordance with pressure equipment directives and marked with Л.
- 5.5. The cylinders should be available in 9 lt, 16 lt, 26 lt, 45 lt, 83 lt and 150 lt capacities; each cylinder type shall have a minimum and maximum gas-containing capacity.
- 5.6. The cylinders shall be supplied with original valve, actuator, pressure gauge, coupling, wall mounting apparatus and protection cover.
- 5.7. If the cylinders are used individually, they shall be able to be activated electrically (automatically) or mechanically (manually). Automatic activation must be ensured by the activation of a 24VDC solenoid on the valve and triggered by the fire detection panel. Mechanical activation must be ensured by a mechanical switch on the valve which is manually actuated.
- 5.8. If more than one cylinder is used for the same volume, the first cylinder shall be able to be activated electrically (automatically) or mechanically (manually). Automatic activation shall be ensured by the activation of a 24VDC solenoid on the valve and triggered by the fire detection panel. Mechanical activation shall be ensured by a mechanical switch located on valve and manually triggered. The other cylinders must be associated with the first cylinder in succession with the hose or pipe and the activation shall be achieved by pressure. In view of the possibility that there may be a problem in electrical activation or pressure activation, a mechanism for mechanical activation must be provided on all cylinders.
- 5.9. The extinguishing agent in the cylinder shall move to the environment as a result of the opening of the explosion disc in the valve by the actuator. After the system has been activated, the equipment inside the valve be able to be refilled by changing by the manufacturer or an UL approved authorized filling facility.
- 5.10. The valve assembly shall be provided with a manometer indicating the cylinder pressure. Operation pressure-low pressure-high pressure gauges shall be located on the manometer. Each will also be coded with colors. The manometer, will be installed in place with a special adapter.
- 5.11. Each cylinder shall be equipped with an UL and / or FM approved "Low-pressure switch" to transmit fault information to the fire detection panel in case of low system pressure and communication with the panel shall be provided.

5.12. The system will be conducted the discharge of gas to the fire detection panel, there shall be an UL and / or FM approved or LPCB approved "Gas Emptied Pressure Switch and it will be connected to the panel.

5.13. Connection coupling shall be has on the valve and the pipe shall be installed easily. The connection coupling shall be originally fitted with a threaded coupling adapter. There must be a buffer disk on the connection coupling for protection.

6. SYSTEM NOZZLES

6.1. In the system, the nozzles to be mounted to the ends of the pipes at the extreme point should be used for discharging the gas to the space.

6.2. The placement of the nozzles in areas where there are horizontal and vertical obstacles should be done by considering the architectural details of the area and the equipment in the room.

6.3. Nozzles to be used in the system must have UL and / or FM approval.

6.4. Nozzles should be manufactured of yellow brass.

6.5. Each nozzle shall have special codes indicating the orifice characteristics determined by UL and/or FM approved hydraulic calculation software.

6.6. Nozzles should be procure in dimensions of 10 mm, 15 mm, 20 mm, 25 mm, 32 mm, 40 mm and 50 mm as determined by UL and / or FM approved hydraulic calculation software.

6.7. Nozzles should be procure in 180 °C or 360 °C according to system design and hydraulic calculation software.

6.8. The coverage area of the nozzles to be used in the system must be at least within the Radius values specified in the table below.

NOZZLE COATING AREAS			
NOZZLE DIAMETER	NOZZLE TYPE	DIAMETER	CEILING HEIGHT
15 – 50 mm	180°	13,69 m	0.4 – 4,1 m
	360°	8,66 m	0.4 – 4,1 m

7. COLLECTORS

- 7.1. In the extinguishant groups consisting of two or more cylinders in the system, the collector shall be manufactured to ensure that the gasflow is healthy and at the same time. Collectors will be used in the places where more than one cylinder shall be used in the case if necessary.
- 7.2. The collectors shall be manufactured of materials of the specifications specified in the manufacturer's installation manual.
- 7.3. The collectors will be tested at a value of at least 15 times the gas pressure valve situated according to the hydraulic calculation.
- 7.4. There will be UL and / or FM approved check valves on the pipe connection from each cylinder on the collector.
- 7.5. In the case of a collector is used, the gas discharge pressure switch will be mounted on the collector and connected to the fire detection panel.

8. PIPE AND PIPE SUSPENSION SYSTEM

- 8.1. Piping of the system shall be done with SCH 40 seamless steel drawing pipe as specified in the approved hydraulic calculations.
- 8.2. In the piping system, pipes below 2 ½" (DN65) should be manufactured with threaded pipes above 2 ½" (DN65) with welded.
- 8.3. In welded manufacturing, suitable component absolutely should be used in elbows, T's and diameter decreases instead of reduction, the pipe should not be crushed T's should not be stubbed.
- 8.4. In the suspension system, heavy load clamp absolutely should not be used pear clamps in diameters below 2 ½".
- 8.5. In the suspension system, the clamp should be used every 1 m on straight lines with tie tij length greater than 30 cm, for straight lines below 30 cm tij length, should be use a clamp at 3 m.
- 8.6. Each bracket should be connected with clamps on both sides and on all three sides.
- 8.7. Each nozzle should be fixed with clamp no more than 25 cm behind.

- 8.8. The first elbow of the respective gas extinguishing systems must be mounted very well (should be clamp to the ceiling or side walls).
- 8.9. Fittings materials to be used in the system should be used as forged steel fittings in accordance with the type of pipe. According to the pafta machines on the construction site, the threads of the fittings should be specified as BSP or NPT.
- 8.10. Pipes should be painted with 2 layers of red paint over 1 layer of antirust primer unless otherwise specified by the contracting entity.

9. DOOR FAN TEST

- 9.1. Measures should be taken against gas leakage of the spaces where gas extinguishing system will be used.
- 9.2. According to international standarts, the room should be provide imperviousness so as to stay at least 10 minutes in order to prevent re-ignition in the gas discharge area.
- 9.3. The redidence time of the gas in the space changes in proportion to whether the existing air conditioning and ventilation systems will operate at discharge. If the A/C system is switched off during discharge, the level of gas in the environment after 10 minutes should not be less than 75% of the minimum room height.If the air conditioners will continue to operate during and after discharge, the concentration value of the gas present in the environment after 10 minutes should not be less than the minimum extinguishing concentration value.
- 9.4. The purpose of the room leakage test; to determine the leaks in the room on the basis of area (m²) and to calculate how long the gas can remain in the room. The test will be carried out with the help of a fan. First the inside of the space will be pressurized, then the air in the space is suctioned and sent out of the environment. Air pressure in the room and which passing through the fan will be measured with the help of manometers. These values will be evaluated by an approved computer program. As a result of the differential difference the room leakage will be calculated by the computer program. If a gas residence time of 10 minutes is obtained after the calculation of room leaks, the room test will be passed. Otherwise, the isolation of the openings will be revised.
- 9.5. Room imperviousness test will be performed by authorized companies and current authority certificates will be presented to management.

10. TESTS

- 10.1. All mechanical equipment pipes and fittings shall be made by the contractor technical personnel immediately after installation and under supervision of the control engineer of the administration.
- 10.2. In the tests, the final reports will be prepared in 3 copies and signed by mechanical engineers of the contractor and the control organization.
- 10.3. Nitrogen test in accordance with ISO 15009 shall be applied in pipes, fittings and welded manufacturing. For this purpose, a 3 bar pressure shall be applied to the piping system, whose nozzle ends to the blinded pipe system by a regulator prepared by the contractor and mounted on a nitrogen tube mounted on a wheeled system. During the 10 minute pressure test, all equipment of the system will be examined one by one and checked for leaks.
- 10.4. After the completion of the whole system, during the temporary acceptance, the tests and checklist to be performed shall be tested to include the details specified in the form 12 a, b, c, d, e, f in the "NFPA Inspection, Test and Maintenance " book. The contractor company shall prepare these forms and keep them ready on field.
- 10.5. Particularly in the preparation of the test reports, the above-mentioned details shall be indicated separately in paragraphs.