EDMS 30-308-1

SPECIFICATION

FOR

CLEAN AGENT

FIRE SUPPRESSION SYSTEM

(HFC-227ea, FK-5-1-12)

Issue: August-2024 / Rev- 1

- This revision contains option items that must be selected by EDC before bidding.

EEHC DISTRIBUTION MATERIALS SPECIFICATION	EDMS 30-308-1
Clean Agent Fire Suppression System	06-08-2024

CONTENTS

EEHC DISTRIBUTION MATERIALS SPECIFICATION	EDMS 30-308-1
Clean Agent Fire Suppression System	06-08-2024

1- SCOPE

This specification describes the minimum technical requirements for design, engineering, installation, testing, inspection and performance of clean agent system (HFC-227ea / FK-5-1-12) for fire suppression. The required system is intended to protect normally occupied spaces and indoor network components of the Egyptian Electricity Distribution Companies (EDCs) against fire propagation.

2- APPLICABLE CODES and STANDARDS

Unless otherwise specified in this specification, the offered system should be designed, manufactured, and tested according to the latest editions of the relevant applicable codes and standards given in Table (1).

Table (1)

Standard No.	Description
NFPA2001	Standard on clean agent fire extinguishing system
NFPA 70	National Electrical Code.
NFPA 72E	National Fire Alarm.
ISO 14520	Gaseous – extinguishing systems-physical properties and system design – part 5-1-12 extinguishing.
ASME Publications American Society of Mechanical Engineering.	
IEEE Publication	
UL Publication Under Laboratories INC.	
The Egyptian Code for Design Basic and Implementation –Requirements to protect Facilities from Fire.	
Clean agent shall be replacement according to DOT (Department of Transportation) or similar requirements acceptable to the authority having jurisdiction.	

3- APROVAL AND LISTING

- Fire suppression system should be approved from the governmental authorities that certify compliance of the system with common engineering rules and the requirements of fire suppression systems.
- Typical approval / listing for fire suppression system shall be :
  - UL LISTED / FM APPROVED

4- DEFINITIONS

- The required clean agent, fire suppression system is a network of pipes distributed in places that need to be protected from the risk of fire. This network is fed from compressed (HFC-227ea, FK-5-1-12) gas cylinder, which upon operation; rush through spray nozzle under a certain pressure. Its particles disperse at a certain concentration in the protected space to suppress fire and prevent its spread.
- **Class A Fire:** A fire in ordinary combustible materials, such as wood, cloth, paper, rubber, and many plastics.
- **Class B Fire:** A fire in flammable liquids, combustible liquids, petroleum greases, tars, oils, oil-based paints, solvents, lacquers, alcohols, and flammable gases.
- **Class C Fire:** A fire that involves energized electrical equipment.
- **Control Room and Electronic Equipment Space:**

  A space containing electronic or electrical equipment, such as that found in control rooms or electronic equipment rooms, where only Class A surface fires or Class C electrical hazards are present.
- **Agent Concentration:**

  The portion of agent in an agent- air mixture expressed in volume percent.
- **Sea Level Equivalent of Agent:**

  The agent concentration (volume percent) at sea level for which the partial

pressure of agent matches the ambient partial pressure of agent at a given altitude.

- **Clean Agent:** Volatile or gaseous fire extinguishing that is electrically non-conducting and that does not leave a residue upon evaporation.
- **Halocarbon Agent:** An agent that contains as primary components one or more organic compounds containing one or more of the elements fluorine, chlorine, bromine, or iodine.

5- LIMITATION OF USE

- All pre-engineered systems shall be installed to protect hazards within the limitations that have been established by the listing. Pre-engineered systems shall be listed to one of the following types:
  - Those consisting of system components designed to be installed according to pre-tested limitations by a testing laboratory. These pre-engineered systems shall be permitted to incorporate special nozzles, flow rates, methods of application, nozzle placement, and pressurization levels that could differ from those detailed elsewhere in this standard. All other requirements of the standard shall apply.
  - Automatic extinguishing units incorporating special nozzles, flow rates, methods of application, nozzle placement, actuation techniques, piping materials, discharge times, mounting techniques, and pressurization levels that could differ from those detailed elsewhere in this standard.

- Clean agents shall not be used on fires involving the following materials unless the agents have been tested to the satisfaction of the authority having jurisdiction:
  - Certain chemicals or mixtures of chemicals, such as cellulose nitrate and gunpowder, which are capable of rapid oxidation in the absence of air.

- Reactive metals such as lithium, sodium, potassium, magnesium, titanium, zirconium, uranium, and plutonium.
- Metal hydrides
- Chemicals capable of undergoing auto thermal decomposition, such as certain organic peroxides, pyrophoric materials, and hydrazine.

6- ENVIRONMENTAL CONDITIONS

– The performance of the offered clean agent should be guaranteed under the environmental and operational conditions given in Table (2). Any differences in the guaranteed performance should be clearly set out in the offer.

Table (2)

Minimum ambient temperature	-20°C
Maximum ambient temperature	100°C
Maximum relative humidity	95%
Maximum wind pressure	150 kg/mm
Storage temperature	10 to 60°C
System Lifetime	5 years
Battery Lifetime	5 years

7- TECHNICAL REQUIREMENTS

7.1 Electrical Operation Units:

– **Actuating Mechanism:**

A mechanism whose automatic or manual operating leads to the discharge of extinguished agent.

– **Abort Switch:**

A system control that, when operated during the releasing panels release delay count down, extends the delay in accordance with predetermined effect, provided that has UL Approval, and work includes the accessories necessary to install the switch and

connect to the panel this and the work includes the accessories necessary to install the switch and connect to the panel.

- **Manual Release:**

  A means of manual release of the system shall be provided.

- **Control panel:**

  Control equipment shall be specifically for the number utilized, and their compatibility listed. Normal type Conventical consisted of 2 fire zones, provided that it has UL Listed and FM Approval, and the work includes all fires retardant wires and EMT pipes necessary to connect the panel to all its component, to work efficiently.

- **Automatic detector:**

  It is any listed method or device capable of detecting and indicating heat, smoke, or an abnormal condition in the hazard such as process trouble that is likely to produce fire. LPCB certificated. smoke and heat detectors provides that it is at least LPCB Approved.

- **Alarm Bell:**

  Installation 6-inch bell operating on voltages of 24 volts. It shall has LPCB. The work shall include all accessories necessary to install the switch and connect to the panel.

- **Congenital strobe / flasher buzzer:**

  It shall be LPCB. The work shall include all accessories necessary to install the switch and connect to the panel.

7-2-Agent Storage Containers.

- Agent shall be stored in containers designed to hold that specific agent at ambient temperature.
- Containers shall be charged to a fill density or super pressurization level within the range specified in the manufacturer's listed manual.

- Each agent container shall have a permanent name- plate or other permanent marking that indicates the following:
    - For halocarbon agent containers, the agent, tare and gross weights, and super pressurization level (where applicable) of the container.
    - For inert gas agent containers, the agent, pressurization level of the container, and nominal agent volume.
    - Agent container and gas must be UL LISTED & FM APPROVED.
    - Cylinder shall be filled in the factory not Locally.

7-3 Agent Supply.

- **Primary Agent Supply:**
- The quantity of agent in the system primary agent supply shall be at least sufficient for the largest single hazard to be protected or group of hazards to be protected simultaneously.
- **Reserve Agent Supply:**
- Where required, a reserve agent supply shall consist of as many multiples of the primary agent supply as the authority having jurisdiction considers necessary?

7-4 Storage Container Arrangement.

- Storage containers and accessories shall be located and arranged so that inspection, testing, recharging, and other maintenance activities are facilitated, and interruption of protection is held to a minimum.
- Storage containers shall be permitted to be located within or outside the hazard or hazards they protect.
- Agent storage containers shall not be located where they can be rendered inoperable or unreliable due to mechanical damage, exposure to chemicals or harsh weather conditions, or any other foreseeable cause. Where container exposure to such

conditions is unavoidable, suitable enclosures or protective measures shall be employed.

8- SYSTEM DESIGN

8-1 Time Delays

– For clean agent extinguishing systems, a pre discharge alarm and time delay, sufficient to allow personnel evacuation prior to discharge, shall be provided. For hazard areas subject to fast growth fires, where the provision of a time delay would seriously increase the threat to life and property, a time delay shall be permitted to be eliminated.

8-2 Discharge Time

– For halocarbon agents, the discharge time required to achieve 95 percent of the minimum design concentration for flame extinguishment based on a 20 percent safety factor shall not exceed **10 seconds** or as otherwise required by the authority having jurisdiction.
– The minimum design discharge time shall be determined by dividing the design quantity by the design rate.
– The discharge time shall be increased to compensate for any hazard condition that would require a longer cooling period or for mechanical rundown time associated with ventilation equipment present to prevent resignation.
– Where there is a possibility that metal or other material can become heated above the ignition temperature of the fuel, the effective discharge time shall be increased to allow adequate cooling time.
– Where the fuel has an auto-ignition point below its boiling point, such as paraffin wax and cooking oils, the effective discharge time shall be increased to permit cooling of the fuel to prevent resignation

8-3 Agent Quantity

– **Total Flooding Quantity.**

The quantity of halocarbon agent required to achieve the design concentration shall be calculated from the following equation:

$$W = \frac{V}{s}\left(\frac{C}{100 - C}\right) = V \times Flooding\ Factor,$$

$$Flooding\ Factor = \frac{1}{s}\left(\frac{C}{100 - C}\right)$$

where: W = quantity of clean agent (kg)

V = net volume of hazard, calculated as the gross volume minus the volume of fixed structures impervious to clean agent vapor (m^3)

C = agent design concentration (vol %)

s = specific volume of the superheated agent vapor at 1 atm and the minimum anticipated temperature (°C) of the protected volume (m^3/kg)

EEHC

8-4 Agent Concentration

– Agent concentration shall be as given in Table (3).

Table (3)

Δ Table A.5.4.2.2(b) Class A Flame Extinguishing and Minimum Design Concentrations Tested to UL 2166 and UL 2127

Agent	Class A MEC	Class A Minimum Design Concentration	Class C Minimum Design Concentration
FK-5-1-12	3.3	4.5	4.5
HFC-125	6.7	8.7	9.0
HFC-227ea	5.2	6.7	7.0
HFC-23	15.0	18.0	20.3
IG-541	28.5	34.2	38.5
IG-55	31.6	37.9	42.7
IG-100	31.0	37.2	41.9

Note: Concentrations reported are at 70°F (21°C). Class A design values are the greater of (1) the Class A extinguishing concentration, determined in accordance with 5.4.2.2, times a safety factor of 1.2; or (2) the minimum extinguishing concentration for heptane as determined from 5.4.2.1.

8-5 Flooding Factor

– Flooding factor for FK5-1-12 shall be as given in Table (4)

Table (4)

Table A.5.5.1(b) FK-5-1-12 Total Flooding Quantity (SI Units)[a]

Temp (t) (°C)[c]	Specific Vapor Volume (s) (m^3/kg)[d]	Weight Requirements of Hazard Volume, W/V (kg/m^3)[b] Design Concentration (% by Volume)[a]							
		3	4	5	6	7	8	9	10
−20	0.0609140	0.5077	0.6840	0.8640	1.0479	1.2357	1.4275	1.6236	1.8241
−15	0.6022855	0.4965	0.6690	0.8450	1.0248	1.2084	1.3961	1.5879	1.7839
−10	0.0636570	0.4859	0.6545	0.8268	1.0027	1.1824	1.3660	1.5337	1.7455
−5	0.0650285	0.4756	0.6407	0.8094	0.9816	1.1575	1.3372	1.5209	1.7087
0	0.0664000	0.4658	0.6275	0.7926	0.9613	1.1336	1.3096	1.4895	1.6734
5	0.0677715	0.4564	0.6148	0.7766	0.9418	1.1106	1.2831	1.4593	1.6395
10	0.0691430	0.4473	0.6026	0.7612	0.9232	1.0886	1.2576	1.4304	1.6070
15	0.0705145	0.4386	0.5909	0.7464	0.9052	1.0674	1.2332	1.4026	1.5757
20	0.0718860	0.4302	0.5796	0.7322	0.8879	1.0471	1.2096	1.3758	1.5457
25	0.0732575	0.4222	0.5688	0.7184	0.8713	1.0275	1.1870	1.3500	1.5167
30	0.0746290	0.4144	0.5583	0.7052	0.8553	1.0086	1.1652	1.3252	1.4888
35	0.0760005	0.4069	0.5482	0.6925	0.8399	0.9904	1.1442	1.3013	1.4620
40	0.0773720	0.3997	0.5385	0.6802	0.8250	0.9728	1.1239	1.2783	1.4361
45	0.0787435	0.3928	0.5291	0.6684	0.8106	0.9559	1.1043	1.2560	1.4111
50	0.0801150	0.3860	0.5201	0.6570	0.7967	0.9395	1.0854	1.2345	1.3869
55	0.0814865	0.3795	0.5113	0.6459	0.7833	0.9237	1.0671	1.2137	1.3636
60	0.0828580	0.3733	0.5029	0.6352	0.7704	0.9084	1.0495	1.1936	1.3410
65	0.0842295	0.3672	0.4947	0.6249	0.7578	0.8936	1.0324	1.1742	1.3191
70	0.0856010	0.3613	0.4868	0.6148	0.7457	0.8793	1.0158	1.1554	1.2980
75	0.0869725	0.3556	0.4791	0.6052	0.7339	0.8654	0.9998	1.1372	1.2775
80	0.0883440	0.3501	0.4716	0.5958	0.7225	0.8520	0.9843	1.1195	1.2577
85	0.0897155	0.3447	0.4644	0.5866	0.7115	0.8390	0.9692	1.1024	1.2385
90	0.0910870	0.3395	0.4574	0.5778	0.7008	0.8263	0.9547	1.0858	1.2198
95	0.0924585	0.3345	0.4507	0.5692	0.6904	0.8141	0.9405	1.0697	1.2017
100	0.0938300	0.3296	0.4441	0.5609	0.6803	0.8022	0.9267	1.0540	1.1842

[a]The manufacturer's listing specifies the temperature range for operation.
[b]W/V [agent weight requirements (kg/m^3)] = kilograms of agent required per cubic meter of protected volume to produce indicated concentration at temperature specified.

– Flooding factor for HFC-227ea shall be as given in Table (5)

Table (5)

Table A.5.5.1(j) HFC-227ea Total Flooding Quantity (SI Units)[a]

Temp (t) (°C)[c]	Specific Vapor Volume (s) (m^3/kg)[d]	Weight Requirements of Hazard Volume, W/V (kg/m^3)[b] Design Concentration (% per Volume)[e] 6	7	8	9	10	11	12	13	14	15
−10	0.1215	0.5254	0.6196	0.7158	0.8142	0.9147	1.0174	1.1225	1.2301	1.3401	1.4527
−5	0.1241	0.5142	0.6064	0.7005	0.7987	0.8951	0.9957	1.0985	1.2038	1.3114	1.4216
0	0.1268	0.5034	0.5936	0.6858	0.7800	0.8763	0.9748	1.0755	1.1785	1.2839	1.3918
5	0.1294	0.4932	0.5816	0.6719	0.7642	0.8586	0.9550	1.0537	1.1546	1.2579	1.3636
10	0.1320	0.4834	0.5700	0.6585	0.7490	0.8414	0.9360	1.0327	1.1316	1.2328	1.3264
15	0.1347	0.4740	0.5589	0.6457	0.7344	0.8251	0.9178	1.0126	1.1096	1.2089	1.3105
20	0.1373	0.4650	0.5483	0.6335	0.7205	0.8094	0.9004	0.9934	1.0886	1.1859	1.2856
25	0.1399	0.4564	0.5382	0.6217	0.7071	0.7944	0.8837	0.9750	1.0684	1.1640	1.2618
30	0.1425	0.4481	0.5284	0.6104	0.6943	0.7800	0.8676	0.9573	1.0490	1.1428	1.2388
35	0.1450	0.4401	0.5190	0.5996	0.6819	0.7661	0.8522	0.9402	1.0303	1.1224	1.2168
40	0.1476	0.4324	0.5099	0.5891	0.6701	0.7528	0.8374	0.9230	1.0124	1.1029	1.1956
45	0.1502	0.4250	0.5012	0.5790	0.6586	0.7399	0.8230	0.9080	0.9950	1.0840	1.1751
50	0.1527	0.4180	0.4929	0.5694	0.6476	0.7276	0.8093	0.8929	0.9784	1.0660	1.1555
55	0.1553	0.4111	0.4847	0.5600	0.6369	0.7156	0.7960	0.8782	0.9623	1.0484	1.1365
60	0.1578	0.4045	0.4770	0.5510	0.6267	0.7041	0.7832	0.8641	0.9469	1.0316	1.1183
65	0.1604	0.3980	0.4694	0.5423	0.6167	0.6929	0.7707	0.8504	0.9318	1.0152	1.1005
70	0.1629	0.3919	0.4621	0.5338	0.6072	0.6821	0.7588	0.8371	0.9173	0.9994	1.0834
75	0.1654	0.3859	0.4550	0.5257	0.5979	0.6717	0.7471	0.8243	0.9033	0.9841	1.0668
80	0.1679	0.3801	0.4482	0.5178	0.5890	0.6617	0.7360	0.8120	0.8898	0.9694	1.0509
85	0.1704	0.3745	0.4416	0.5102	0.5803	0.6519	0.7251	0.8000	0.8767	0.9551	1.0354
90	0.1730	0.3690	0.4351	0.5027	0.5717	0.6423	0.7145	0.7883	0.8638	0.9411	1.0202

[a]The manufacturer's listing specifies the temperature range for operation.
[b]W/V [agent weight requirements (kg/m^3)] = kilograms of agent per cubic meter of protected volume to produce indicated concentration at temperature specified.

9- ENCLOSURE

– In the design of a total flooding system, the characteristics of the protected enclosure shall be considered.

– The area of enclosable openings in the protected enclosure shall be kept to a minimum.

– The authority having jurisdiction shall be permitted to require pressurization / depressurization of the protected enclosure or other tests to ensure performance that meets the requirements of this standard.

– To prevent loss of agent through openings to adjacent hazards or work areas, openings shall be permanently sealed or equipped with automatic closures. Where reasonable confinement of agent is not practicable, protection shall be expanded to include the adjacent connected hazards or work areas, or additional agent shall be introduced into

the protected enclosure using an extended discharge configuration Where a clean agent total flooding system is being provided for the protection of a room with a raised or sunken floor, the room and raised or sunken floor shall be simultaneously protected.

- If only the space under the raised floor is to be protected by a total flooding system. an inert gas shall be used to protect that space. Each volume, room, and raised or sunken floor to be protected shall be provided with detectors, piping network, and nozzles other than the ventilation system.
- Forced-air ventilating systems, including self-contained air recirculation systems, shall be shut down or closed automatically. Where their continued operation would adversely affect the performance of the fire extinguishing system or result in properly.

10- NOZZLE

- Discharge Nozzles shall be from the same manufacture of cylinders , Not Locally and the type listed for the intended purpose and shall be placed within the protected enclosure in compliance with listed limitations with regard to spacing, floor coverage, and alignment.
- The type, number and placement of nozzles shall be such that the design concentration will be established in all parts of the hazard enclosure and such that the discharge will not unduly splash flammable liquids or create dust clouds that could extend the fire, create an explosion, or otherwise adversely affect the contents or integrity of the enclosure.

10-1 Nozzle Selection

- The basis for nozzle selection shall be listed performance data that clearly depict the interrelation- ship of agent quantity, discharge rate, discharge time, area coverage, and the distance of the nozzle from the protected surface.

– The diameter of the nozzle is the same in hydraulic calculation .
    - The maximum permitted time to extinguish a fire with a halocarbon agent shall be 10 seconds.
    - The maximum permitted time to extinguish a fire with an inert gas agent shall be 30 seconds.
    - Where flammable liquid fires of appreciable depth [over 1⁄4 in. (6 mm)] are to be protected, a minimum freeboard of 6 in. (152 mm) shall be provided unless otherwise noted in approvals or listings of nozzles.

10-2 Nozzle Discharge Rates

– The design discharge rate through individual nozzles shall be determined based on location or projection distance in accordance with specific approvals or listings.
– The system discharge rate shall be the sum of the individual rates of all the nozzles and discharge devices used in the system.

11- PIPE

– Pipe shall be of material having physical and chemical characteristics such that its integrity under stress can be predicted with reliability. Special corrosion-resistant materials or coatings shall be required in severely corrosive atmospheres. The thickness of the piping shall be calculated in accordance with ASME B31.1. The internal pressure used for this calculation shall not be less than the greater of the following values:
    - The normal charging pressure in the agent container at (21°C)
    - Eighty percent of the maximum pressure in the agent container at a maximum storage temperature of not less than (55°C), using the equipment manufacturer’s maximum allowable fill density, if applicable Pipe Connections

- Pipe joints other than threaded, welded, brazed, flared, compression, or flanged type shall be listed or approved.
- Fittings shall have a minimum rated working pressure equal to or greater than the minimum design working pressure specified, for the clean agent being used, or as other- wise listed or approved.
- For systems that employ the use of a pressure reducing device in the distribution piping, the fittings downstream of the device shall have a minimum rated working pressure equal to or greater than the maximum anticipated pressure in the downstream piping.
- Cast-iron fittings shall not be used.
- Class 150 fittings shall not be used.

12- TESTING, INSPECTION and MAINTENANCE

12-1 Preliminary Function Tests

- If the system is connected to an alarm receiving office, the alarm receiving office shall be notified that the fire system test is to be conducted and that an emergency response by the fire department or alarm station personnel is not desired.
- All personnel in areas that could be affected by the testing at the end user's facility shall be notified that a test is to be conducted.
- All personnel in areas that could be affected by the testing at the end user's facility shall be instructed as to events that could occur during testing of the fire extinguishing system.
- Each agent storage container release mechanism shall be disabled or replaced with a functional device so that activation of the release circuit will not release agent.

12-2 Routine Test:

- Control panel shall be tested during manual release operation and detector.

– Each detector shall be tested for operation.

– All polarized alarm devices and auxiliary relays shall be checked for polarity in accordance with the manufacturer's instructions.

– Initiating and notification circuits shall be checked for end-of-line devices, if required.

– All supervised circuits shall be tested for trouble response.

12-3 Remote Monitoring Operation

– Each type of initiating device shall be operated while on standby power to verify that an alarm signal is received at the remote panel after the device is operated.

12-4 Functional operation test

– Each detection initiating circuit shall be operated to verify that all alarm functions occur according to design specifications.

– Each manual release shall be operated to verify that manual release functions occur according to design specifications.

– Each abort switch circuit shall be operated to verify that abort functions occur according to design specifications and that visual and audible supervisory signals are announced at the control panel.

– All automatic valves shall be tested to verify operation unless testing the valve will release agent or damage the valve (destructive testing).

– Pneumatic equipment, where installed, shall be tested for integrity to ensure operation.

– Integrity test must provide (if required).

13- NAMEPLATE

– Clean agent cylinder and accessories shall have a permanent nameplate that indicate the mass of agent – forming compound contained with manufacturer date, and date of mandatory replacement of generator based on useful life limit established in the listing. Certificate obtained such as:

- CYLINDER –GAS UL- listed and FM Approved
- Approved by EPA for normal occupied spaces.
- Any other certificate.
- D.O.T (Department of Transport) or T.P.E.D (Transportable Pressure Equipment Directive).
- All of the alarm systems must be LPCB.

14- GENERAL REQUIREMENTS

– The supplier acknowledges that he has fully inspected the work sites before bidding.

– The supplier shall provide the hydraulic calculations that confirm the requirements of this specification. The supplier shall submit all data tables furnished by the manufacturer to verify the adequacy of cylinders volume, nozzle type, pipes diameters and pipes distributions.

– The supplier shall submit all the catalogues and technical data of cylinders, nozzles and pipes.

– The supplier must submit battery calculation.

– The supplier must submit filling ratio for EMT conduit.

– The supplier must submit clean agent software shall be UL LISTED & FM APPROVED.

- The supplier shall provide approval certificates of the system in accordance to the requirements of TPED, UL, FM and DOT.
- The supplier shall provide a reference list of similar projects.
- The supplier shall furnish CAD drawings describe the proposed network of fire suppression system and the distribution of all cylinders, nozzles and pipes.
- The contractor is responsible for supplying, installing and testing the system with all accessories necessary to complete the works. The contractor shall deliver the system in an acceptable manner in accordance to this contract and installation principles.
- The contractor shall return the working site to its original state before digging.
- All materials, equipment and devices shall meet the requirements of Egyptian civil defense, standards and the Egyptian Code.
- All network pipes shall be designated for fire networks (seamless, Table 40).
- All thermal cables shall be approved for fireworks. It shall be made of copper of $2\times1.5\ mm^2$ covered with Shield filaments to protect the wire from tension.
- All fire alarm pipes shall be EMT.
- All items shall be implemented in accordance with this technical specification, approved shop drawings, industry principles and instructions of _ _ EDC supervisors.
- The contractor guarantees the supplied system, materials and all accessories against any defects or malfunctions for a period of one year at least from the date of final delivery. The system should be monitored and maintained periodically during the warranty period.
- The contractor shall provide a certificate of origin of all part of the system.
- The system must operate in the presence of the agent of the brand provided .

– Approval certificate from Egyptian Electricity Holding Company should be submitted.

Alarm Bell

Abort switch

Ansorl

Flasher buzzer

Manual release

EEHC

Detector

Wires fire resistance

Control panel

Definitions:

- NOAEL = *No Observed Adverse Effect Level*
  Highest concentration at which there was not an observe
  toxic or adverse effect.
- LOAEL = *Lowest Observed Adverse Effect Level*
  Lowest concentration at which there was an observed
  toxic or adverse effect.

Adverse Health Effect
A change in body function or cell structure that might lead to disease or health problems.

Design concentration vs. NOAEL

	Design concentration[1)]	NOAEL	LOAEL	Ranking
Novec™ 1230	4,5% - 5,8%	10%	>10%	
FM-200®	6,4% - 8,4%	9%	10,5%	
Inergen®	34,2% - 41,2%	43%	52%	
IG-55	40,3% - 47,5%	43%	52%	
CO_2	50% - 65%	5%	n.a.	

Ranking + -

Properties

MEP MASTERS

Trade name	3M Novec™ 1230 Fire Protection Fluide	FM-200®
Product designation	FK-5-1-12	HFC-227ea
Chem. formula	$CF_3CF_2C(O)CF(CF_3)_2$	CF_3CHFCF_3

- Contains no Bromine or Chlorine (ODP=0)
- Colorless and odourless
- Safe for people
- No electric conductivity
- No residues
- Cause no damage to
  - electronic equipment
  - books / papers
  - paintings / objects of art

Application

- Telecommunication
  - switch rooms
  - UPS / power rooms
  - battery rooms

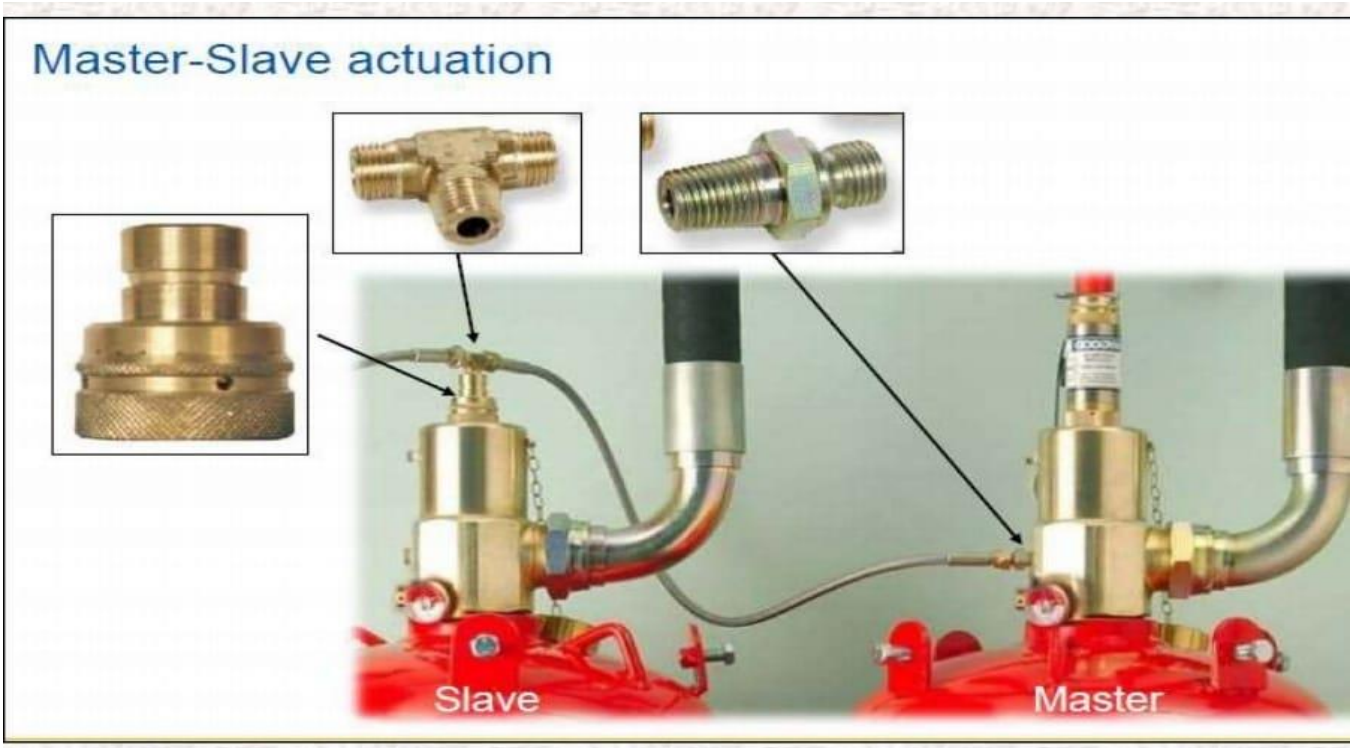
- Power plants
  - control rooms
  - cable vaults
  - turbine enclosures

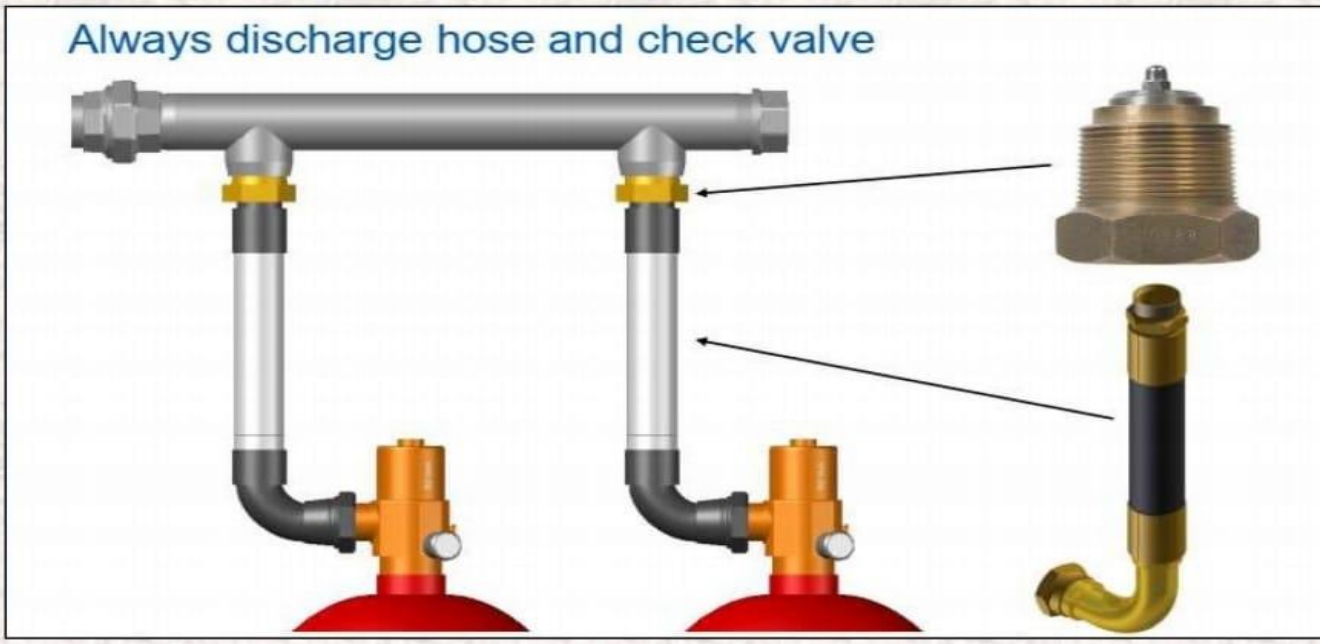
- Museum store rooms
- Archive rooms

Valve Actuation

System Hardware

- Agent
- Agent storage
  - Container Assembly
  - Brackets
- Agent Delivery System
  - Discharge Hose
  - Manifold & Check Valves
  - Nozzles
- Actuation System
  - Valve Actuators
  - Connection components
- Accessories
  - Pressure Switches
  - Caution Plates


Master-Slave actuation
Slave
Master


Always discharge hose and check valve