



## Engineering Specifications



**SAPPHIRE PLUS FIRE SUPPRESSION SYSTEM  
ENGINEERING SPECIFICATION  
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**PART 1 – GENERAL 1.1 DESCRIPTION OF WORK**

This specification outlines the requirements for a "Total Flood" SAPPHIRE PLUS Clean Agent Fire Suppression System. The work described in this specification includes all engineering, labour, materials, equipment, design and service: necessary and required to complete and test the suppression system.

**1.2 APPLICABLE STANDARDS AND PUBLICATIONS** The design, equipment, installation, testing, and maintenance of the SAPPHIRE PLUS Clean Agent Fire Suppression System shall be in accordance with the applicable requirements set forth in the latest edition of the following codes and standards (as applicable to the project requirements):

**EUROPEAN STANDARDS**

- EN 15004-1: Fixed firefighting systems – Gas extinguishing systems: Design, installation and maintenance.
- EN 15004-2: Fixed firefighting systems – Gas extinguishing systems: Physical properties and system design of gas extinguishing systems for FK-5-1-12 extinguishant.
- EN 12094: Fixed firefighting – Components for gas extinguishing systems. INTERNATIONAL STANDARDS.
- ISO 14520-1: Fixed firefighting systems – Gas extinguishing systems: Design, installation and maintenance.
- ISO 14520-5: Fixed firefighting systems – Gas extinguishing systems: Physical properties and system design of gas extinguishing systems for FK-5-1-12 extinguishant.
- NFPA 2001 – Standard on Clean Agent Fire Extinguishing Systems.

**1.3 APPROVALS**

The complete system shall have the following applicable listings and approvals:

- UL Listed
- FM Approved

The standards listed, as well as all other applicable codes and good engineering practices, shall be used as "minimum" design standards.

## **1.4 QUALITY ASSURANCE**

### **1.4.1. MANUFACTURER:**

1. The manufacturer of the suppression system hardware components shall be ISO 9001 registered and all components shall meet fully the requirements of EN 12094 as applicable.
2. The manufacturer's identification and CE mark as applicable shall appear on all major components.
3. All devices, components and equipment shall be supplied by the same manufacturer.
4. All devices, components and equipment shall be new, standard products of the manufacturer's latest design and suitable to perform the functions intended.

### **1.4.2. INSTALLER:**

1. The installing contractor shall be trained by the supplier to design, install, test and maintain SAPPHIRE PLUS Clean Agent Fire Suppression Systems.
2. The installing contractor must have a minimum of five years' experience in the design, installation, testing and maintenance, of SAPPHIRE PLUS Clean Agent Fire Suppression System. A list of systems of a similar nature and scope shall be provided on request.
3. The installing contractor shall maintain, or have access to, a Clean Agent refill station. The installing contractor shall provide proof of ability to recharge the largest SAPPHIRE PLUS Clean Agent Fire Suppression System within the period of time specified in the contract after a discharge including holding an appropriate quantity of Clean Agent.
4. The installing contractor shall be an authorised distributor of the SAPPHIRE PLUS Clean Agent Fire Suppression System equipment so that immediate replacement parts are available from inventory. 5. The installing contractor shall show proof of emergency service available 24-hours-a-day, 7-days-a-week.

## **1.5 DESIGN DOCUMENTATION**

The installing contractor shall submit the following design information and drawings for approval prior to starting installation work on this project:

1. Installation layout drawings having an appropriate scale detailing the location of all agent storage containers, nozzles, pipe runs, including pipe sizes and lengths, and electrical control panel(s) and associated devices.
2. Separate layouts, or drawings, shall be provided for the mechanical and electrical work in the room, floor and ceiling voids.
3. Drawing to provide legend identifying all symbols used.
4. Complete hydraulic flow calculations, from the UL/FM approved software, shall be provided for all SAPPHIRE PLUS Clean Agent Fire Suppression System. Calculation sheet(s) must include the manufacturer's name and approving agency. The individual sections of pipe and each fitting to be used, as shown on the isometrics, must be identified and included in the calculation. Total agent discharge time must be shown and detailed by hazard.

## **PART 2 – SYSTEM REQUIREMENTS**

### **2.1 SYSTEM DESCRIPTION AND OPERATION**

1. The system shall be a Total Flood SAPPHIRE PLUS Clean Agent Fire Suppression System supplied by Tyco Fire Protection Products (hereinafter referred to as "TFPP").
2. The system shall provide a 3M™ NOVEC™ 1230 agent minimum design concentration of 4.5% by volume for Class A hazards (according to NFPA 2001) or 5.3% to 5.6% (according to EN 15004 / ISO 14520) and a minimum of 5.85% by volume for Class B hazards in all areas and / or protected spaces, at the minimum anticipated temperature within the protected area. System design shall not exceed 10% concentration for normally occupied spaces, adjusted for maximum hazard temperature anticipated, with provisions for room evacuation before agent release.
3. The system shall be complete in all ways. It shall include a mechanical and electrical installation, all detection and control equipment, agent storage containers, 3M™ NOVEC™ 1230 agent, discharge nozzles, pipe and fittings, manual release and delay or abort devices, audible and visual alarms, auxiliary devices and controls, shutdowns, alarm interface, advisory signs, functional checkout and testing, training and any other operations necessary for a SAPPHIRE PLUS Clean Agent Fire Suppression System.
4. Provide two inspections during the first year of service: Inspections shall be made at 6-month intervals thereafter.
5. The general contractor shall be responsible for sealing and securing the hazard areas against agent loss and / or leakage during the "hold" period, which is a minimum period of 10 minutes or a time period sufficient to allow for response by trained personnel.
6. Automatic operation of each protected area shall be as follows:
  - a). Actuation of one detector, within the hazard area, shall:
    - Illuminate the "ALARM" lamp on the control panel face.
    - Sound an alarm.
    - Transfer auxiliary contacts, which can perform auxiliary system functions such as: Operate door holder / closures on access doors; Transmit a signal to a fire alarm system; Shutdown HVAC (Heating Ventilation Air Conditioning) equipment.
    - Light an individual lamp on a status unit (optional). Note: The shutdown of electrical equipment will be optional based on requirements of the authority or applicable standards.
  - b). Actuation of a second detector on a second zone, within the hazard area, shall:
    - Illuminate the "PRE-DISCHARGE" lamp on the control panel face.
    - Sound a pre-discharge alarm which shall be distinct from the alarm raised on operation of the first detector.
    - Shut down the HVAC system and / or close dampers if not shut down upon operation of first detector.
    - Start time-delay sequence (not normally to exceed 30 seconds).
    - System hold or abort sequence is enabled at this time.
    - Light an individual lamp on a status unit (optional).
  - c). After completion of the time-delay sequence, the SAPPHIRE PLUS Clean Agent Fire Suppression System shall discharge and the following shall occur:
    - Illuminate a "SYSTEM RELEASED" lamp on the control panel face.
    - Energize a visual indicator(s) outside the hazard area in which the discharge occurred.

- Energise a "System Fired" audible device. (Optional)

d). The system shall be capable of being actuated by manual discharge devices located at each hazard exit. Operation of a manual device shall duplicate the sequence description above. The manual discharge station require two distinct actions to effect release.

e). The system may be provided with a hold or abort device which shall interrupt the discharge sequence. Hold devices shall stop the discharge sequence when pressed and held. Upon release the discharge time delay shall start again from zero. Abort devices are not normally recommended, but if fitted, shall cause the discharge sequence to be stopped and shall reset the control panel to manual control.

## **2.2 MATERIAL AND EQUIPMENT**

### **2.2.1. GENERAL REQUIREMENTS:**

1. The SAPPHIRE PLUS Clean Agent Fire Suppression System materials and equipment shall be standard products of the supplier's latest design and suitable to perform all intended functions.
2. All relevant devices and equipment shall be approved according to EN 12094.
3. Each hazard area shall have sufficient agent to provide a minimum concentration required by the applicable design standard.
4. The system design can be modular, central storage, or a combination of both design criteria.
5. Systems shall be designed in accordance with the manufacturer's guidelines.
6. The Clean Agent shall be stored in SAPPHIRE PLUS Clean Agent Fire Suppression System storage containers. Containers shall be super-pressurised with dry nitrogen to an operating pressure of 70 bar at 20°C. Containers shall be of seamless high-strength low alloy steel construction and meeting the requirements of the Transportable Pressure Equipment Directive (TPED).
7. Containers (master) shall be actuated by either an electrical actuator fitted with an integrated placement indicator switch to show correct fitment of the actuator or by pneumatic means from a nitrogen pilot container. The nitrogen pilot container electrical actuator shall be fitted with a placement indicator switch. Explosive devices shall not be permitted.
8. Each container shall have a pressure gauge or contacted pressure gauge (optional) to provide visual and electrical supervision of the container pressure. The contacted pressure gauge shall be wired to the control panel to provide audible and visual alarms in the event the container pressure drops below 63 bar (for temperature range -20 to 50C) or 65 bar (for temperature range 0 to 65C). The pressure gauge shall be colour coded to provide an easy, visual indication of container pressure.
9. Containers shall have a pressure relief device that automatically operates before the internal nominal pressure exceeds 180 bar.
10. Engineered discharge nozzles shall be provided within the manufacturer's guidelines to distribute the 3M™ NOVEC™ 1230 agent throughout the protected spaces. The nozzles shall be designed to provide proper agent quantity and distribution. Nozzles shall be available in 15mm (1/2 in.) through 50mm (2 in.) pipe sizes. Each size shall be available in 180° and 360° distribution patterns.

11. Distribution piping and fittings shall be installed in accordance with the manufacturer's requirements, EN 15004 / ISO 14520 /NFPA 2001, and approved piping standards and guidelines. All distribution piping shall be installed by qualified individuals using accepted practices and quality procedures. All piping shall be adequately supported and anchored at all directional changes and nozzle locations.
12. a) All piping shall be reamed, blown clear and swabbed with suitable solvents to remove burrs, mill varnish, and cutting oils before assembly.  
b) All pipe threads shall be sealed with a suitable pipe sealant applied to the male thread only.
13. For systems protecting multi hazards using a central container bank and selector valves, the appropriate full bore selector valve shall be fully opened before the system containers are operated.

#### 2.2.2. AGENT:

1. The fire suppression agent shall be 3M™ NOVEC™ 1230 Fire Protection Fluid, supplied by a 3M™ approved OEM partner.
2. Agent shall not contain any Hydrofluorocarbons (HFC).

#### 2.2.3. CAUTION SIGNS:

1. Entrance signs: are required at each entrance to a protected space.
2. Manual discharge signs: are required at each manual release station.

### **PART 3 – TESTING AND DOCUMENTATION**

#### **3.1 SYSTEM INSPECTION AND CHECKOUT**

After the system installation has been completed, the entire system shall be checked, inspected, and functionally tested by qualified, trained personnel, in accordance with the manufacturer's recommended procedures and applicable standards.

1. All containers and distribution piping shall be checked for proper mounting and installation.
2. All electrical wiring shall be tested for proper connection, continuity and resistance to earth.
3. The complete system shall be functionally tested, in the presence of the owner or his representative, and all functions, including system and equipment interlocks, must be operational during the acceptance tests.

#### **3.2 TRAINING REQUIREMENTS**

Prior to final acceptance, the installing contractor shall provide operational training to each shift of the owner's personnel. Each training session shall include control panel operation, manual release and (optional) hold or abort functions, supervisory and emergency procedures.

#### **3.3 OPERATION AND MAINTENANCE**

Prior to final acceptance, the installing contractor shall provide complete operation and maintenance instruction manuals to the owner. All aspects of system operation and maintenance shall be detailed, including piping isometrics, wiring diagrams of all circuits, a written description of the system design,

sequence of operation and drawing(s) illustrating control logic and equipment used in the system. Checklists and procedures for emergency, maintenance shall be included in the manual.

### **3.4 AS-BUILT DRAWINGS**

Upon completion of each system, the installing contractor shall provide copies of system. As fitted drawings to the owner. The drawings shall show actual installation details including all equipment locations (i.e. Control panel(s), agent container(s), detectors, alarms, manual release unit(s), and abort / hold switch(s), etc.), as well as piping and conduit routing details. Show all room or facilities modifications, including door and / or damper installations completed. One copy of reproducible engineering drawings shall be provided reflecting all actual installation details.

### **3.5 ACCEPTANCE TEST**

1. A room pressurisation test shall be conducted in each protected space to determine the presence of openings, which would affect the agent concentration levels. The test(s) shall be conducted using a Door Fan Pressurisation Equipment System, or equivalent, with integrated computer program. All testing shall be in accordance with EN 15004 / ISO 14520 or NFPA 2001 as applicable.
2. If room pressurisation testing indicates that openings exist which would result in leaks and / or loss of the Clean Agent, the installing contractor shall be responsible for coordinating the proper sealing of the protected space(s) by the general contractor or their sub-contractor or agent. The general contractor shall be responsible for adequately sealing all protected space(s) against agent loss or leakage. The installing contractor shall inspect all work to ascertain that the protected space(s) have been adequately and properly sealed. If the first door fan pressurisation test is not successful, in accordance with these specifications, the installing contractor shall direct the general contractor to determine, and correct, the cause of the test failure. The installing contractor shall conduct additional room pressurisation tests, until a successful test result is obtained. Copies of successful test results shall be submitted to the owner for their record. Upon acceptance by the owner, the completed system(s) shall be placed into service.

### **3.6 SYSTEM INSPECTIONS**

1. During the one-year warranty period, the installing contractor shall provide two inspections of each system installed under this contract. The first inspection shall be at the 6-month interval, and the second inspection at the 12-month interval. Inspections shall be conducted in accordance with the manufacturer's guidelines and the recommendations of EN 15004 / ISO 14520 or NFPA 2001.
2. Documents certifying satisfactory system(s) inspection shall be submitted to the owner upon completion of each inspection.

### **3.7 WARRANTY**

1. Environmental: The manufacturer (TFPP) shall offer a 20-year environmental warranty covering regulations banning or restricting use of the SAPPHIRE PLUS Clean Agent Fire Suppression System due to environmental issues.
2. Components / System: Limited one year warranty shall be offered for defects in workmanship and material.