Specifications, Terms and Conditions

FM200 Clean Agent Total Flooding Fire Suppression System for Control Room

1. Introduction
To protect the control room from fire incidents, installation of clean agent fire suppression system is planned. Installation of FM200 total flooding system is planned for carrying out this operation. The specifications of FM200 system, geographical location of site, layout of control room etc are provided in this specification.

1.1. Geographical Location of ISRO Propulsion Complex
ISRO Propulsion Complex (IPRC), Mahendragiri is situated in Tirunelveli District, Tamil Nadu State, India. It is aside of Kanyakumari – Madurai National Highway (NH7) at a distance of 25km North from Kanyakumari. The nearest major town is Nagercoil, which is 25 km in South and the nearest major city is Tirunelveli, which is 60km in North. The nearest major railway station is at Nagercoil.

1.2. Project Details
The control room is situated in the ground floor of the building. Utility services like AHU room are in the first floor of the building. Control room dimensions are as below.

<table>
<thead>
<tr>
<th>Length (m)</th>
<th>Width (m)</th>
<th>Height (m)</th>
<th>Volume (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room</td>
<td>Ceiling</td>
<td>Floor</td>
<td></td>
</tr>
<tr>
<td>void</td>
<td>Void</td>
<td>Void</td>
<td></td>
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</tbody>
</table>

Please refer drawing no. IPRC/S&FS/CR/FM200/2014000600

4.7 | No false ceiling | 0.5 | To be estimated based on the given inputs.

The vendor may perform pre-bid visit to project site for assessment, with the prior consent obtained from purchaser and on agreed dates.

Hazard Category: Class ‘A’ fire and Electrical Fire.
Design Concentration: 7% by volume (as per NFPA 2001: 2010 or latest edition)
Room Temperature is 21°C.

1.3. Layout of Control Room
Refer attached drawing. (Drawing No.: IPRC/S&FS/CR/FM200/2014000600)
2. **General**

This Specification covers the requirements of design, supply of all materials, fabrication, installation, testing and commissioning of clean agent total flooding fire suppression system (FM200 as per NFPA 2001:2010 or latest edition) for control room.

2.1. Design, materials, manufacturing, examination, testing, and inspection shall conform to the applicable codes and standards. The vendor shall propose applicable codes and/or standards on which the vendor’s design and manufacturing is based.

2.2. All equipments shall be approved by FM/UL with appropriate punch mark/ label on the product and supported with certificates.

2.3. FM200 agent in seamless cylinders along with cylinder valve assemblies shall be got approved by PESO.

2.4. In case of any deviation observed in the tender documents, the vendor shall notify the purchaser and obtain a written clarification. The decision of the purchaser shall be final.

2.5. Vendor shall list any special tools and tackles, which in his opinion are required for regular operation and maintenance.

2.6. Vendor shall list the commissioning spares, which are recommended for the purpose of commissioning.

2.7. Vendor shall list recommended spares for two years, for the normal operation of the system during this period.

2.8. Vendor shall furnish all relevant technical data and drawings along with offer for evaluation. All documents and drawing shall bear the indent number, document name, document number, and revision number.

2.9. Vendor shall be responsible for any discrepancies, errors or omissions in the drawings/documents prepared by vendor, even if these have been reviewed/ approved by the purchaser. Review of vendor’s documents by purchaser does not relieve vendor of his responsibility for correctness of design and supply. If any such errors or omissions are revealed later, that shall be made good by vendor, at his sole expenses.
2.10. All documents, drawings, manuals, reports and written instructions shall be in the English language. Metric System units shall be used, unless otherwise specified.

2.11. The clean agent system to be provided shall meet the requirements of NFPA 2001 latest edition. Hence, anything specified as mandatory in NFPA 2001 although not specifically mentioned in this specification shall form part of this specification.

2.12. The vendor may perform pre-bid visit to project site for assessment, with the prior consent obtained from purchaser and on agreed dates.

2.13. Purchaser will provide electricity and water required for the job at free of cost at a fixed location near the site. However all machinery required for above work like welding, grinding, drilling, cutting tools, consumables, test instruments etc., are to be arranged by vendor along with necessary Junction boxes, fuses, cables, hoses, etc.,

2.14. Conveyance for vendor’s personnel from and to work spot and any other internal movement has to be arranged by the vendor.

2.15. Purchaser will provide a location for storing the supplied items. It is the responsibility of the vendor to keep the supplied items in their custody till completion and handover of system to the purchaser. Vendor is responsible for any negligence, damage, or tampering of system during such period and shall replace the item without any additional cost.

2.16. Vendor shall quote the prices in the format shown in Annexure-A (Format for Quoting Price). Bill of Materials (BOM) mentioned in ‘Annexure-A’ is only suggestive. Vendor may modify BOM, which in his opinion are required for regular operation and maintenance. Applicable codes/ standards/ UL or FM approvals shall be mentioned for all factory made items and it shall be given preference during bid evaluation.

2.17. Annexure-A (Format for Quoting Price) and Checklist for Enclosures with Bid shall be filled and submitted in all respects while bidding. Offers with these forms only will be considered for evaluation.

3
3. **Scope of Work**

The scope of work includes but not limited to Design, Procurement, Supply, Installation, Testing and Commissioning of FM 200 System at Control Room as detailed below.


3.2. Providing detailed design calculations, Bill of Materials (BOM), P&ID and isometric drawings of FM200 system for review and approval.

3.3. Procurement and supply of BOM to site.

3.4. Installation of FM200 system, integrating the system with existing smoke detection panel (Conventional Ravel Panel).

3.5. Filling of FM200 to the required quantity.

3.6. Carrying-out all minor civil and structural works associated with the installation of FM200 system including canopy for placing FM200 cylinders, its foundation (RCC/PCC), core cutting, drilling, chipping, painting etc.

3.7. Carrying-out all electrical works associated with the installation of system including integrating the gas release panel with battery back-up to the existing Distribution Board at site.

3.8. Testing and Commissioning of FM200 system as per relevant code and standards.

3.9. Providing all deliverables such as as-buit drawings, specifications of supplied BOM, test reports and certificates in triplicate, operation, maintenance and troubleshooting manuals, inspection procedure, inspection periodicity etc.

3.10. Providing one time onsite training for employees in operation of the system.

3.11. Carrying-out preventive maintenance on quarterly basis during warranty period.

4. **Design and Engineering**

4.1. FM200 system shall be designed as per NFPA 2001: 2010 or latest editions.

4.2. The system shall be designed to extinguish the fire with a design concentration of 7% by volume at 21°C within 10 seconds.

4.3. The quantity of clean agent shall be worked out by the vendor, as per NFPA 2001 and as per concentration mentioned above. Based on the estimation of
leakage rate in the enclosed volume, quantity variations shall be kept over and above the calculated quantities.

4.4. The entire clean agent quantity shall be designed to be discharged within 10 seconds so as to extinguish the fire in the enclosed volume.

4.5. The charging pressure of FM200 clean agent in the cylinder at 21°C and number of cylinders planned shall be clearly spelt out in the offer.

4.6. The vendor shall carryout the piping isometric designs including Bill of Materials (BOM), hydraulic flow calculations, Process & Instrumentation Diagram (P&ID) and validates the same.

4.7. The vendor shall prepare and submit the detailed design calculations, nozzle design, isometric drawings, Process & Instrumentation Diagram, and the execution plan in form of a report to the purchaser for review and approval.

5. Materials and Equipments
All materials and equipments shall be from approved vendors/ manufacturers and shall be suitable for the performance of their respective functions.

5.1. Authentication
1. Authorization letter/certificate from the Original Equipment Manufacturer (OEM) shall be furnished to ensure the quality of the supplied system.

2. The installing vendor shall be authorised and trained by the OEM to design, supply, install, test, maintain the fire suppression system and refill the clean agent cylinder. He shall submit an authorisation letter from OEM for performing the same along with the offer for evaluation.

5.2. Cylinder Storage Bank
1. FM200 cylinders shall be positioned in the location as shown in the attached drawing or any other suitable location based on pre-bid site visit. Vendor shall determine and propose the area required for positioning the cylinders in the cylinder bank. The area shall include space for working and access.

2. The vendor shall develop the cylinder bank area including its foundation, minor structural works, canopy and suitable enclosure all-around.

5.3. Cylinder
1. FM200 cylinder shall be designed to hold the clean agent at ambient temperature.
2. The cylinders shall be designed to meet the requirement as specified in NFPA 2001.

3. The cylinders shall be a UL listed/ FM approved seamless type and shall be got approved by PESO.

4. Cylinder shall be mounted according to manufacturer’s recommendations.

5. Each clean agent cylinder shall have a permanent nameplate indicating the content, pressurisation level of the container and nominal volume.

6. The cylinder shall be filled with FM200 clean agent of required quantity as per approved design calculations.

5.4. Extinguishing Agent

1. Extinguishing agent must be FM200 as manufactured by M/s. DuPont.

2. The extinguishing agent shall meet the requirements of NFPA 2001 and have the following characteristics:
   - Ozone Depletion Potential of Zero.
   - LC$_{50}$ >800,000 ppm
   - Boiling point of -16.1°C @ 101352 Pa.
   - Electrically nonconductive and noncorrosive
   - Shall be suitable for use in normally occupied spaces.

5.5. Valves

1. The discharge valve shall be FM approved or UL listed for use with FM200 clean agent.

2. All the gaskets, O-ring, sealant and other valve component shall be constructed of materials compatible with the clean agent. This includes main discharge valve, solenoid, check valve / non-return valve and pneumatic actuators.

3. Each valve shall include an integral safety relief device which serves to protect cylinder against excessive internal pressure rise.

5.6. Pipes & Fittings

1. All pipes shall conform to ASTM A106 Gr.B, seamless pipes and the pipe schedule shall be decided based on the calculated thickness and the minimum acceptable pipe schedule number is 40.

2. The design of piping shall be in accordance with ASME B31.1
3. All fittings shall conform to ASTM A234/A105 to the corresponding pressure rating and the minimum acceptable ratings of the fittings shall be Class 3000.

4. Vendor shall submit Manufacturer’s Test Certificates for pipes and fittings duly approved by third party inspection agency like DNV, TUV’s etc.

5.7. Discharge Nozzle

1. Nozzle shall control the flow of clean agent to ensure high velocity, proper mixing in the surrounding air and uniform distribution of the agent throughout the enclosure.

2. The number of nozzles and their positions must be chosen so that the design concentration is uniformly maintained everywhere in the enclosed volume.

3. Nozzle shall be located where they can be adequately supported on walls, ceiling or structural members.

5.8. Control Panel

1. Smoke detectors are already mounted on the ceiling and false floor of the control room and is controlled and monitored by a microprocessor based conventional smoke detection panel (Ravel make). The supply and installation of smoke detectors and the smoke detection control panel is excluded from the scope of the vendor.

2. The vendor shall supply the conventional gas release control panel having control relay module and monitor module.

3. The gas release panel shall be mounted in the location specified by the purchaser and it shall be integrated with smoke detection panel. The gas release panel shall be supported by battery operated standby (UPS) for fail safe operation.

4. The logic sequence and timer delay for activating FM200 system shall be finalised after having review and approval with purchaser.

5. The gas release control panel shall have the provision and circuitry to shutdown the air conditioning system in event of discharge of the FM200 suppression system.

6. Provision shall be available in the panel for extending the gas discharge status to remote control room.
5.9. Cable
1. All interconnection cables shall be copper armoured cables and is in scope of vendor. It includes integrating the gas release panel to the existing Distribution Board at site.

5.10. Battery Backup Power System
1. The entire clean agent system including detection, alarm, actuation and supervisory system shall be supported by battery backup power system of at-least 1hour rating. It is to be designed such that upon main power failure, backup power automatically services the system with system tolerable delay or interruption of any kind.

5.11. Pressure Switch
1. A pneumatically actuated pressure switch is to be used to give positive identification of release of clean agent in the piping system. A potential free contact relay shall be available in the pressure switch for the remote monitoring.

5.12. Manual Call Point
1. Manual call point shall be provided for the release of clean agent in case of an emergency.

5.13. Abort Switch
1. Abort switch shall be provided where investigation of delay is desired between detection and actuation of the system. Clear operating instructions shall be provided by the side of the abort switch.

5.14. Alarm
1. The alarm system shall be in the combination of horn and strobe and shall be functional simultaneously.
2. The sound level of horn (audio alarm) shall be at-least 98 decibels at a distance of 3 meters.
3. The flash rate of strobe (visual alarm) shall be 1 to 3 per second with peak light intensity of 800 candle power.

5.15. Signs, Instruction and Name Plates
1. Warning signs, instruction plates, name plates etc shall be promptly fixed wherever necessary.
6. **Execution Plan**

Vendor shall prepare and submit the execution plan for approval. It shall include the resources to be employed including manpower, the daily schedule from inception to completion of the project, safety procedures to be followed during execution to ensure safety of workmen.

6.1. **Inspection and Supervision**

1. A dedicated project in-charge and a supervisor shall be posted at IPRC, Mahendragiri for execution and till completion of project.

2. Before starting execution inside the control room, area shall be inspected in-order to protect the facility equipment from dust/debris/damage.

6.2. **Installation of pipes, fittings and equipments**

1. All pipes and fitting, relevant supports, cylinder positioning and other equipment erection shall be according to relevant codes and standards.

2. Vendor shall employ well experienced welders, fitters, fabricators, grinders for executing the project.

3. Supply of necessary manpower, machineries, welding and all consumables are in the scope of the vendor.

6.3. **Safety during Project Execution**

1. The vendor shall provided all necessary PPE to their workmen and ensure compliances of wearing necessary PPE by their workmen inside project site.

2. Minimal hot work shall be planned inside the control room and vendor shall arrange and use sufficient fire blankets to avoid falling of welding spatter on the equipments/ floor.

3. All tools and tackles including scaffolds, ladders, safety equipment for confined space entry etc that are required for safe execution of project shall be arranged by the vendor.

4. Vendor shall ensure high standard of housekeeping in the project site. The materials shall be stacked/ positioned properly and the work area shall be cleaned thoroughly on daily basis.

5. Contractor shall comply with prevailing safety norms at site put forth by Department. Safety department shall have full access to project site at any time for inspection.
6.4. Quality Assurance

1. Only qualified welders to a level of 6G as per ASME Sec. IX with proven track record will be permitted to carry out of the welding works. Welder qualification certificates shall be furnished to purchaser to obtain their consent.

2. Manufacture’s Test Certificate of pipes and fittings duly approved by Third Party Inspection Agency shall be submitted to purchaser for review by purchaser.

3. Cutting and edge preparation of pipes and fittings shall be performed only by experienced grinders.

4. For pipeline welding, based on the pipe thickness calculated by vendor, purchaser will inform the type of electrodes to be used for welding.

5. All welding joints shall be tested with dye-penetrant test for root pass and final pass welding.

6. Each pipe section shall be cleaned internally after preparation and before assembly by means of swabbing, utilising a non flammable cleaner.

7. Testing & Commissioning

Vendor shall arrange all necessary equipments required to perform the testing and commissioning activities. He shall submit a "Test Plan" which shall describe how the system will be tested. This shall include a step-by-step description of all tests and shall indicate type and location of test apparatus to be employed. The tests shall demonstrate that the operating and installation requirements of this specification have been met. "Test Plan" shall be approved by the purchaser and all tests shall be conducted in the presence of the purchaser.

7.1. Pressure Testing

1. After per-fabrication, the piping system sections shall be hydro tested for 1.5 times of MEOP in presence of purchaser.

2. Vendor shall arrange pumps, calibrated gauges, instruments, test equipment and the personnel required for performing these tests.

3. After hydro testing, the pipe network shall be cleaned from particulate matter and oil residue before installation of nozzles or discharge devices.

4. The entire piping shall be pneumatically tested at 1.1 times of MEOP in presence of purchaser after complete installation inside the control room.
5. The pressure hold time shall be as specified by the purchaser. Purchaser shall be informed at least one day in advance about performing hydrotest/ pneumatic test.

7.2. Flow and Compliance Test
1. An enclosure integrity test by door fan test procedure shall be carried out as mentioned in NFPA 2001.
2. Functional tests of the entire control system shall be demonstrated to ensure its functions as intended. All circuits shall be tested including automatic actuation, manual actuation, equipment shut-down, and alarm devices.

8. Painting
8.1. Primer
1. All shop fabricated and factory built equipment, devices and apparatus not galvanised or not protected by plating or a baked enamel finish are to be cleaned and given two coats of zinc rich primer.

8.2. Finish painting
1. Two coats of enamel paint of approved colour shall be applied above the primer coating.
2. Name plates, labels, placards, stainless steel tags etc shall not be painted.

9. Submission of Deliverables
9.1. As built drawings
1. Upon completion of installation, the vendor shall submit hard and soft copies of as-built drawings showing actual installation details.
2. The drawing shall show FM200 cylinder positions, equipment locations (manual call points, abort switches, alarms, detectors, control panels) as well as piping and conduit routing details.

9.2. Specifications of supplied BOM
1. Technical datasheets of all supplied and installed material shall be provided.

9.3. Test reports and certificates (In triplicates)
1. Hydrotest certificates and PESO approval of seamless cylinders.
3. UL listed/ FM approved certificates of equipments.

4. Manufacturer’s Test Certificates for pipes and fittings duly approved by third party inspection agency like BVQI, TUV’s etc.

5. Any other test certificates and reports as required by the purchaser.

9.4. **Operation, maintenance and troubleshooting manuals.**

1. Vendor shall submit operation, maintenance and troubleshooting manuals. It shall include written description of system design, electrical schematic of circuits, drawings illustrating control logic and equipment location, and technical bulletins describing equipment.

9.5. **Inspection procedure, inspection periodicity etc in form of a report.**

1. Vendor shall submit an inspection procedure and periodicity of inspection.

2. During warranty period, vendor shall carryout inspection and preventive maintenance on quarterly basis and submits test report on it.

10. **Training Requirements**

1. Prior to final acceptance, the vendor shall provide operational training to purchaser’s personnel at purchaser’s site.

2. The training session shall include control panel operation, manual and abort functions, troubleshooting procedures, supervisory procedures, auxiliary functions and emergency procedures.

3. Training shall be imparted in English language.

11. **Warranty and Preventive Maintenance**

1. All system components furnished and installed under this work shall be warranted against defects in design, materials and workmanship for the full warranty period which is standard with the manufacturer, but in any case not less than one year from the date of system acceptance.

2. Vendor shall carryout preventive maintenance for one year from the date of commissioning and acceptance on quarterly basis. It shall include replacement of manufacturing and technically defective parts, visual and operation checks of system and providing test report.
12. Delivery Schedule
   1. Delivery time is the essence of this contract. The system shall be completely delivered and commissioned within three (3) months from the date of technically and commercially clear Purchase Order.

13. Cylinder Refilling
   1. Vendor shall mention the location of clean agent refill stations in their offer.
   2. The vendor shall provide proof of his ability to refill the FM200 cylinder within 48 hours after a discharge.

14. Attachments
   1. Layout Drawing of Control Room -
      (Drawing No.: IPRC/S&FS/CR/FM200/2014000600)
   2. Format for Quoting Price - Annexure A