



## **REQUEST FOR PROPOSAL FOR**

**Establishment of Automatic Deluge Sprinkler Water System at  
Integrated Assembly and Testing Facility (IATF) and LTET-V Test  
Facility, Valiamala**

**Technical Specifications and Scope of Work**

**Liquid Propulsion Systems Centre  
Indian Space Research Organization  
Department of Space, Government of India  
Valiamala-695-547  
Thiruvananthapuram**

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Request for Proposal for Establishment of Automatic deluge sprinkler water system at IATF & LTET-V Facilities

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## Request for Proposal for Establishment of Automatic deluge sprinkler water system at IATF & LTET-V Facilities

### 1. Introduction:

Liquid Propulsion systems centre (LPSC), Indian Space Research Organization (ISRO), Department of Space, Government of India, Valiamala, Thiruvanthapuram District, and Kerala State, India (hereinafter referred to as "Department" intends to establish "Automatic Deluge Sprinkler Water Based Fire Protection System" at Integrated Assembly and Testing Facility-Spacecraft Thrusters (IATF-ST) Facility and LTET-V Test Facility". The IATF-ST and LTET-V facilities are intended to perform high altitude and sea level testing for performance evaluation of spacecraft thrusters of ISRO's satellite thrusters. Propellant MMH and  $N_2O_4$  are used for testing and realization of these thrusters. Different propellant tanks from low volumetric capacity to medium capacity are used for servicing, transfer and storage of the propellant at the test facilities. Even though storage capacity is less, these propellants are hypergolic and hazardous in nature and hence need to be protected with automatic deluge sprinkler water system as per the ISRO safety protocol. Towards it, "Automatic Deluge Sprinkler Water based Fire protection system is to be established at 11 (eleven) identified locations in IATF and LTET facility.

In order to accomplish the target, it is decided to execute the work on **Lump-Sum Turn-Key (LSTK) basis** through **Engineering, Procurement and Construction (EPC) Contract**. The Department will organize a pre-bid meeting with the Bidders to facilitate proper understanding of the requirements and assessing the site conditions. **The potential Bidders shall participate in the pre-bid meeting, if required.** The Bidders shall submit the bids in 2 (Two) parts viz. (i) Techno-commercial (non-priced) bid and (ii) Price bid. The Department will initially open the techno-commercial bids and, if necessary at their own discretion, organize post-bid techno-commercial meeting with the Bidders. The Department will initially evaluate the techno-commercial bids and shortlist the suitable Bidders whose techno-commercial bids are compliant with the RFP specification and place them on equal footing. The Department will open the price bids of the Qualified Bidders only, hold post-bid price discussion, if necessary at their own discretion, and award the Contract based on the lowest priced bid.

The Department hereby issues this Request for Proposal (RFP) document to the Capable Bidders. This RFP document gives detailed technical specifications, scope of work and other specification/ requirement for the proposed Automatic deluge sprinkler water system at IATF and existing LTET-V facilities.

### 2. Instruction to Bidders:

- I. Interested bidders should participate for the pre- bid meeting and do the site visit before submitting the quotation.
- II. Quotation shall be submitted in two-part basis viz. (i) Techno-commercial (non-priced) bid and (ii) Price bid.
- III. Detailed cost break up (with respect to Material cost, Engineering, civil, erection & Fabrication, instrumentation, testing etc.) must be provided in the price bid. Lump sum quote for the whole system is not accepted. The template given as Enclosure -1 shall be used for quoting the price bid.



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- IV. List of spares parts must be included in the quotation. Spares and consumables required shall be supplied as part of the system.
- V. Party has to enter a Non-comprehensive AMC for the duration of three years after the completion of warranty period. Periodicity of the AMC visit shall be twice in year. AMC charge and the necessary spare charges shall be quoted separately on pro rata basis.
- VI. Quotation must be accompanied with full details of the sub systems like make, model no., and catalogue wherever applicable.
- VII. Party can quote optional items, components with different materials etc. with  $\pm 10\%$  quantity variation depending upon the site condition & layout in the price bid.
- VIII. Bidder must have enough experience in successful execution of similar type EPC projects. Bidder should submit documentary evidence in support of their successful job in the form of purchase order and completion certificate with clear address of the clients.

### **3. General Scope of work:**

The scope of work involves:

- I. Supply and installation of automatic medium velocity water spray system (wet type) at eleven locations as per the detailed specification and lay out drawing attached. (Annexure-I).
- II. Interconnecting the medium velocity water spray system with the nearest existing underground fire hydrant system with necessary isolation valves.
- III. Providing pedestal platform for mounting Deluge Valve assembly and roof over it for rain protection.
- IV. Installation of pipes and sprinkler system with proper support fixture and bracket wherever required.
- V. Laying of cables of approx. 2000 m from the respective system to the junction boxes for which Department will provide the required cables. The cable connection from junction box to control room shall be provided by Department as part of overall facility requirement.
- VI. Interfacing of the output relay signal of the existing Flame detector to the solenoid valve for automatic opening of deluge valve by electrical means.
- VII. Testing and commissioning the total system to ensure total deluge system works properly.
- VIII. Painting the pipeline as per the colour coding.

### **4. Location and tank details for the installation Automatic sprinkler system:**

Automatic Deluge sprinkler water system is proposed to be installed at 11 location comprising of three zones:

**Zone-1:** IATF facility which consists of  $N_2O_4$  transfer, MMH transfer room,  $N_2O_4$  run tank bay, MMH run tank bay and Sea level test bay.

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**Zone-2:** LTET-V facility which consists of N<sub>2</sub>O<sub>4</sub>, MMH transfer room, HAT test bay and Sea level test bay.

**Zone-3:** Main propellant storage yard which consists of N<sub>2</sub>O<sub>4</sub> and MMH storage areas.

### I. Propellant tank Details:

There are three categories of propellant tanks for either MMH or N<sub>2</sub>O<sub>4</sub> service. Category A type will be either fixed type or mobile type depending on the functional service.

Sl.no	Tank Description / capacity	Dimension (outer) (mm) Height/length x diameter	Surface area (m <sup>2</sup> )	Tank type & Mounting	Category
1	Run & Transfer tanks – 16 litre	700 x 300	0.582	Ellipsoidal, vertical	Type - A
2	Catch tank - 25 litres	692 x 360	0.745	Ellipsoidal, vertical	Type - B
3	Storage tank – 600 Litre	1690 x 900	4.986	Ellipsoidal, Horizontal	Type - C

### II. Locations for installation of Automatic Deluge Sprinkler water system:

Sl. No	Zonal Area	Area of location	Loc.No	No. of tanks	Type of tanks /capacity			Deluge Valve tag Nos.
					Type A (16 L)	Type B (25 L)	Type C (600 L)	
1	Zone-1 IATF Facility	Transfer Room-N <sub>2</sub> O <sub>4</sub>	Loc-1	3	1	2		IATF/OX/DV-01
		Transfer Room -MMH	Loc-2	3	1	2		IATF/FU/DV-02
		Run Tank Bay-N <sub>2</sub> O <sub>4</sub>	Loc-3	4	4	--		IATF/OX/DV-03
		Run Tank Bay-MMH	Loc-4	4	4	-		IATF/FU/DV-04
		Sea Level (S/L) Test Bay (MMH& N <sub>2</sub> O <sub>4</sub> )	Loc-5	4	2	2		IATF/SL/DV-05
2	Zone-2 LTET-V Facility	Transfer Room-N <sub>2</sub> O <sub>4</sub>	Loc-6	2	2	--		LTET/OX/DV-06
		Transfer Room -MMH	Loc-7	2	2	--		LTET/FU/DV-07
		HAT Test Bay –MMH	Loc-8	4	2	2		LTET/FU/DV-08
		Sea Level (S/L) Test Bay (MMH& N <sub>2</sub> O <sub>4</sub> )	Loc-9	4	2	2		LTET/SL/DV-09
3	Zone-3 Propellant Storage yard	Storage Area -N <sub>2</sub> O <sub>4</sub>	Loc-10	4	3	--	1	SA / OX / DV-10
		Storage Area -MMH	Loc-11	4	3	--	1	SA / FU / DV-11
Total Number of Deluge valve system			11					



### **III. Water Reservoir & Interconnection:**

The water required for the system is catered by an overhead tank (OHT) of 35 m<sup>3</sup> located at an elevation of 50 m and 40 m above the ground level of IATF (Zone-1) and LTET-V (Zone -2&3) respectively. The facilities are also provided with fire hydrant system, where the water supply lines of 100 mm diameter to fire hydrant stand pipe are connected in the form of a loop shown in layout drawing No. LPSC/IATF&LTET-V/AUTOMATIC DELUGE SPRINKLER WATER SYSTEM (Annexure-1). The water for the Automatic deluge sprinkler water system shall be tapped from the nearest existing fire hydrant connecting the water supply line by provision of isolation valve at a convenient position with an adequate spacing.

### **5. Design of Medium Velocity Water Spray System Operated by Deluge Valve:**

Medium Velocity Water Spray System (MVWSS) operated by Automatic Deluge Valve is planned for protecting different types of propellant tanks from any external fire. Water spray nozzles shall be provided to protect the surface area of tanks which provide cooling to the tanks, avoiding structural destruction in the event of fire. The deluge valve actuation shall be controlled by Hydraulic, Electric, Relay command & Manual release mode.

Sprinklers (Quartzoid bulb – Temperature rating 68°C) shall be provided around the areas to be protected for deluge valve actuation in hydraulic release mode. In electric release mode, manual command using solenoid ON / OFF switch from remotely located control panel (PXI console) operates the integral solenoid valve which actuates the Deluge valve. In relay command based mode, the command output signal from the flame detectors(UV/IR2) located in the hazardous areas are to be interfaced with the solenoid valve for automatic actuation of deluge valve in the event of flame detection. In manual release mode, local needle valve which is the integrated part of deluge valve assembly actuates the operation of deluge valve.

All the signal command is communicated to two dedicated command console (PXI console) provided by the Department in the command room of LTET and IATF facility. The signal from pressure switch which is provided at the downstream of Deluge Valve gives status of deluge valve and the alarm annunciation to the command console.

The entire deluge system shall be provided with necessary flow components like filters, isolation valves, pressure gauges/ transmitters, etc. as per the relevant P&I diagram. Based on pressure drop calculations, the outlet pressure of deluge valve shall be suitably set in pressure reducing deluge valve to meet the minimum pressure required at the farthest nozzle in the circuit. The arrangement of the spray nozzles/deluge valves shall be in such a way they do not pose any hindrance to the operating personnel during day-to-day operations in the work area as well as protect the equipment during operation of the Automatic Deluge Sprinkler water system.

## I. Design Guidelines:

Medium Velocity Water Spray System shall be designed based on the following criteria based on the hazard nature of the propellant:

S. No	Propellant tank Fuel/Oxidizer	Hazard Group	Storage Group	Design Water Density	Duration of operation
1	Mono Methyl Hydrazine (MMH)	III	C	25 lpm / m <sup>2</sup>	1 Hour
2	Dinitrogen Tetroxide (N <sub>2</sub> O <sub>4</sub> )	I	A	10 lpm / m <sup>2</sup>	

- Each zone shall be so designed that the maximum pressure at the most favourable sprayer/sprinkler shall not be more than 3.5 bars and at the hydraulically most unfavourable sprayer/sprinkler the pressure shall be 1.4 bar.
- Design velocity in water circuit shall be limited to 2 m/sec.
- Medium velocity water sprayer system is to be designed in such a way that the spray nozzles protecting the storage tanks/transfer/run tanks shall be necessarily installed at 0.45 m (minimum) from the surface of the tank vessels and the nozzles shall be located suitably to ensure no hindrance to the movement of the movable tanks.
- Pressure of 5.0 and 4.0 bar is available at the existing water supply lines (Diameter 100 mm) of nearest fire hydrant point at IATF facility (Zone-1) and LTET-V facility (Zone-2 & 3) respectively.
- Provision of water spray nozzle shall be as per the guidelines of IS 15325:2003 'Design and Installation of Fixed Automatic High and Medium Velocity Water Spray System. The sprayers shall not be less than 6 mm in orifice size and shall normally have cone angles between 60° and 125°. Water is only used in the detection network, and the bursting of quartzoid bulb which triggers the deluge valve operation, thereby resulting in the flow of water from open medium velocity water spray nozzles.

## 6. Department's Scope of Work:

In this RFP document, the following Front-End Engineering Design (FEED) documents are given which shall be the input for establishment of Automatic Deluge sprinkler water system at IATF & LTET-V facility.

- Location and layout drawing of Automatic deluge sprinkler water system to be installed.
- Process & Instrumentation diagram of the Systems
- Process Design Basis
- Material specification and scope of work

The above-mentioned details are considered adequate for the party for bidding. However, the inputs are subject to changes during design review & detail engineering review and shall be mutually agreed between the Department and the party.



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In addition to the above technical inputs, the Department shall provide the following requirements.

- I. The Department will review the Detail engineering to be done by the Contractor and clearance shall be issued.
- II. The Department will provide process water for testing and commissioning of automatic deluge sprinkler water system and water supply for logistical purpose at free of cost.
- III. Department will supply temporary electrical power supply for onsite fabrication/erection activities at free of cost.
- IV. Department will provide required cable for laying from Deluge valve assembly to field junction box, cable connection from junction box to the control room, Two control console in each facility control room.
- V. The Department will review the operating procedures, preparedness of systems and trial results.
- VI. Department's representative shall inspect the worksite at any time during work execution to ensure Safety & Quality at the worksite.

### **7. Contractor's Scope of Work:**

The scope of work to be done by the Contractor for the realization of Automatic Deluge Sprinkler Water System at IATF (Zone-1) and LTET-V (Zone-2 & 3) is given in this section. The bidder shall submit a complete quotation in the pattern attached in the annexure.

#### **I. Process Design (FEED) Review:**

- a. Upon award of the contract, the contractor shall submit their detailed engineering design document which includes details such as calculations for sizing of the fluid circuits, sizing of flow components, details of instruments, estimation of pressure drop etc. The department shall review the design calculations submitted by the contractor in a design review meeting that shall be organized with the contractor's representative at LPSC'S office, Valiamala.
- b. The objective of the design review shall address the details such as Verification of P&I Diagrams to comply with the specified functional requirements, Adequacy of the sizes of fluid circuits comprising pipelines, flow components, instruments, etc. to comply with the specified process parameters, Adequacy of the in-built safety features, and design calculations.
- c. The outcome of the meeting between the Department and the Contractor on the design of Fluids System of Automatic Deluge Sprinkler water system shall be used to freeze the input data for the detail engineering to be done by the Contractor.

The design calculations shall be based on the codes/ standards mentioned in various sections of this document. In case the Contractor prefers to employ the alternative codes/ standards, the Department may agree, provided the alternative codes/standards shall be equal to or superior than those specified in the contract. Once the process design review is completed, the Contractor has to jointly own responsibility for the process design.



## **II. Detailed Engineering:**

Based on the approved design evolved during design review, the Contractor shall carry out detailed engineering, which shall comprise the following:

- a) Preparation of the detailed layout drawings and P& I diagrams for each separate zone showing the flow components, instruments, pipe supports, etc. The drawings shall be prepared by using AutoCAD based software only.
- b) Designing of Medium Velocity Water Spray Systems for the designed flow rates. It includes design of deluge system, sizing calculations of water spray nozzles and drawings for spray nozzle coverage details.
- c) Estimation of pressure drop based on the pipeline layout for each location shall be made independently.
- d) Preparation of the purchase specification of the materials such as equipment, flow components, instruments, pipes, pipe fittings etc.
- e) Preparation of the detailed Quality Assurance Plan (QAP) for the materials such as pipes, pipe fittings, flow components, instruments, etc.
- f) The QAP shall address factors such as object tested, characteristics sought for, sample size, test procedure/ standard, acceptance criteria, form of record, performing agency, reviewing agency, etc.
- g) Preparation of detailed procedure and acceptance criteria for fabrication, Installation, testing and commissioning.
- h) Preparation of execution plan and safety plan to be followed during erection & commissioning phase.
- i) The above said detail engineering outputs shall be documented and the documents shall be submitted to Department in advance for perusal.

## **III. Civil Works:**

- a. Digging of earth for tapping of water from existing fire hydrant water supply lines.
- b. Civil work for Laying of underground pipe and cable wherever required.
- c. Providing pedestal platform (0.5 m approx.) for DV assembly and canopy roof over it for rain protection.
- d. Core cutting of wall for connecting the deluge valve outlet line to the area where the sprinklers and spray nozzles are to be installed.

## **IV. Procurement of Materials:**

All the materials such as equipment, flow components, instruments, pipes, pipe fittings etc. are to be purchased from the reliable and reputed source by the Contractor. The deluge valve assembly, Sprinklers and spray nozzles, flow components shall be procured from the suppliers confronting to UL listed certifications only. The general specifications

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of the systems are given in Enclosure –II of this RFP document. The detailed purchase specifications for the individual items to be purchased shall be made available by the Contractor.

### **V. Supply of Spares:**

Quotation must be accompanied with a list spares which are required for the smooth functioning of the system. The cost of these spares shall be included as part of the supply of system.

### **VI. Non-Comprehensive AMC :**

Party has to enter a Non-Comprehensive Annual maintenance contract (AMC) for three years after the completion of one year warranty period. Periodicity of the AMC shall be twice in a year. Party has to quote for three years AMC indicating the spares charge separately. Quote for the spares shall be on pro rata basis and all the necessary items such as Sprinkler head with Quartzoid bulb, spray nozzle, pressure gauge, pressure switch, solenoid valves etc. shall be included. The price of the spares items shall remain firm and fixed for the entire period of the AMC.

### **VII. Fabrication, Installation and Testing:**

The fabrication, installation and testing includes cutting, welding of pipelines and making of foundations, fixing & installation of equipment, pipelines & platforms. The pipelines shall be securely anchored to the supports with suitable U-Clamps/ anchor blocks and packing materials. DP test and radiography test shall be done for weld joint and hydraulic testing at 10 bar (twice the MOP) for pipe lines shall be done after the installation, and all the bolts & fasteners shall be Stainless steel grade.

### **VIII. Application of Painting**

The scope of work includes supply of paint materials & consumables and painting of all carbon steel pipes.

All the pipe lines supplied and erected by the party are to be painted with one coat of epoxy mastic primer coating and two coats of aliphatic polyurethane coating paint as per the following specifications.

EPOXY MASTIC COATING: Epoxy mastic coating should conform to following requirements:

- a. Aluminium pigmented.
- b. Specially intended for use over mechanically cleaned steel.
- c. Two component catalysts cured.

ALIPHATIC POLYURATHANE COATING: Aliphatic polyurethane coating should have:

- a. High gloss finish.
- b. Catalyst isocyanate cured.

The thickness of the primer coat should be 100-110 microns and final coat not less than 40 microns. The paint colour scheme shall be red for Carbon Steel Pipes and white for Detecting lines.



## **IX. Application of Wrapping and Coating Materials for Underground Piping:**

The scope of work includes supply of synthetic primer coating for application on the underground pipes and wrapping shall be done as per code of practice IS 10221. One coat of synthetic primer shall be applied on pipes immediately after cleaning either by brush or spray. Over the weld joints, after necessary inspections, the procedure for coating and wrapping shall be of a bare pipe. In wrapping application, care shall be taken that there are no air pockets or bubbles beneath tape and tape shall be in intimate contact with the primed steel.

## **X. Delivery Schedule:**

The overall execution period of the Contract reckoned from the effective date of placing the purchase order to the date of final acceptance of Automatic deluge sprinkler water Systems established shall be 6 (six) months. Party has to strictly adhere the delivery schedule for the timely completion of the work. For it, review meeting at regular interval shall be conducted for monitoring the work progress, taking appropriate action wherever necessary, resolving the outstanding issues, if any, etc.

### **The detailed duration schedule for the smooth execution of work is as follows:**

Submission of Design document, Lay out plan, P & I : Within one month from PO date

Procurement of materials : Within Two months from date of Design approval

Fabrication & Installation : Within Four months from date of Design approval

Testing & commissioning : Within Five months from date of Design approval

## **8. Quality control**

The quality assurance is a unified approach that attempts to control the quality right from design stage to commissioning stage, which includes the checking of the adequacy of the equipment/ components for materials, fabrication, erection, & testing.

- a. All the items are to be procured from the reliable supplier conforming to its relevant standards and the material test certificates shall be provided wherever applicable.
- b. Welding shall be performed by the qualified welders.
- c. Radiographic Test for the welded joints shall be carried out on randomly selected 10% of the total butt-welded joints.
- d. 100% DP testing shall be carried out for all the joints.
- e. Hydraulic pressure test shall be carried out with water at two times the MOP. The test procedure and acceptance criteria shall be as per applicable Standards.
- f. Cleaning shall be done on all the interior flow surfaces of the components (Deluge valves, pressure gauges, filters etc.)

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- g. Assigned tag numbers for isolation ball valves, deluge valves & filters shall be legibly and indelibly engraved on the body of the valves/filters for identification.
- h. Painting shall be done with fire red shade RAL 3000 on filters, deluge valves, carbon steel pipelines, fittings, detecting lines etc. whichever applicable.

Contractor has to prepare a comprehensive Quality Assurance Plan (QAP) as given in the Enclosure- III for the review and approval of the Department. This can be included in then detailed engineering document to be submitted after placing the PO.

### **9. Commissioning**

After completion of installation and testing of all the system circuits, the Automatic deluge sprinkler water system established at LTET-V & IATF shall be jointly commissioned by the Department and the Contractor. The contractor shall prepare system wise Standard Operating Procedure. The readiness of the systems and the procedure would be reviewed and approved by the department.

Commissioning tests includes functional tests and performance tests.

- a. Verification of all command and instruments system.
- b. Functional check of all flow components and solenoid valves.
- c. Functional check of individual automatic deluge sprinkler system at each location.
- d. Functional check of Deluge valve assembly in different actuation mode.
- e. Performance evaluation of the Automatic deluge sprinkler water system with respect to the flow characteristics& pressure drop, nozzle coverage, minimum pressure requirement at farthest nozzles etc.

### **10. General Terms and Conditions:**

- a. The system shall comply with IS/TAC/NFPA regulations.
- b. Machinery, equipment, tools etc required for doing the erection and commissioning job at site are to be brought by the party.
- c. Oil and lubricants required for commissioning are to be provided by the party.
- d. Department shall not be responsible for loss of material/ damages or injuries to erection personnel. However, the supplier shall be responsible for any damage/ loss to the buyer's property arising out of the negligence of the seller's personal.
- e. The contractor shall make their own arrangements for lodging and boarding of their staff during transportation, erection, testing and commissioning of the System.



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- f. As the supplier has to execute the job on turnkey basis, he may bring excess pipes, fittings to complete the work, balance quantity, if any, will be permitted to be taken by the party after completing the contractual obligations.
- g. Scaffoldings required for the installation work are to be arranged by the party. Cost of these works to be absorbed in the total price.

### **11. Final Documentation**

After erection, commissioning and testing of the deluge system/sprinkler system, the Contractor shall provide two set of consolidated master Document. The Master documentation shall include FEED review report, detail engineering documents & review reports, general arrangement drawings of equipment, Final Lay out plan, flow components & instruments, invoices, manufacturer's instruction manuals for installation, operation, maintenance & trouble-shooting, guarantee/ warranty certificates.

### **12. Warranty**

The fire protection system shall be guaranteed for a period of 18 months from the date of dispatch or 12 months from the date of commissioning whichever is later. During the period of guarantee, the contractor shall be responsible for the performance of the fire protection system, parts and components and/ or for the defects that may arise from the use of faculty planning, designing, materials or workmanship or from faculty erection but not otherwise ( i.e. on account of the normal wear and tear ) and shall remedy such defects at their cost when called upon by the purchaser, who shall state in writing as soon as such defects are noticed in the equipment in what respect the fire protection system faulty or defective. The contractor shall rectify all such defects and set right the equipment including replacement of parts, if any, free of cost to the purchaser within the reasonable time.

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**Enclosure – I**

**Template for submitting price bid**

Sl.no.	Item	Qty	Rate	Total
1.	Materials			
a	Pipe	Lot		
b	DV assembly	11		
c	Pipe fittings	Lot		
d	Y strainer	10		
e	Manual operated Ball Valves	39		
f	Sprinklers & water spray nozzles	50 each		
2.	Detailed engineering	lumpsum		
3.	Civil work	lumpsum		
4.	Fabrication & installation	lumpsum		
5.	AMC	lumpsum		
6.	Testing	lumpsum		
7.	Commercial taxes	lumpsum		
GRAND TOTAL				



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## Enclosure – II

### Material Specifications

#### 1. Pipes and fittings:

S. No	Item	Specification		Quantity (m)	Standards
1.	Main feed line pipe	MOC: Carbon steel Pressure rating :16 bar(min)		DN100 – 50 DN50 –100	IS 1239/ASTM A.53 Grade.B/ASTM A106 Grade-B/API 5L
2.	Distribution line pipe	Schedule Number: 40 (min) Pipe Type: Seamless		DN40 –200 DN25 –300	
3.	Pilot line pipe			DN15 –300	
4.	Pipe Fittings Such as Elbows, reducers, Equal Tee, unions, flanges, coupling, end caps, nipples, blind flange etc.	MOC	Carbon steel		IS 1239/ASTM A234 WPB /ASTM 105
		Pressure Rating	16 bar (min)		
		Pipe Type	Seamless, Forged, Welded		

Note: Quantity of Pipe & pipe fittings are subjected to change based on the actual P&I diagram. Contractor shall prepare isometric drawings and estimate the actual quantity.

#### 2. Deluge Valve Assembly:

S. No	Item	Specification		Quantity (Nos)	Standards & Approvals
1.	Deluge Valve Assembly (Pressure Rating class -150)	Nominal Size	DN50	11	Manufacturer's standard/ UL Listed / FM/ASME16.34/ASME 16.14/ ANSI – FCI 70-2
		Mounting Type	Horizontal		
		Body	Carbon steel/Ductile Iron		
		Control Trim Actuation	Hydraulic, Electric & Manual		
		Trim Type	Wet pilot trim with test & alarm & drain trim.		
		End connections	Raised face flanged		ASME B16.5
	Accessories to be included per Deluge Valve assembly	a. Pressure Gauges	Dial: 150mm, range: 0-10 bar.	2	UL/FM/ Equivalent
		b. Water Motor Gong	Dia-100mm MOC: Brass/bronze	1	
		c. Release Valve (Manual Actuation-Needle)	Compatible material	2	
		d. Strainer – Y Type		2	
		e. Non-Return Valve		2	
		f. Flow Control Device		2	
		g. Pressure Switch	MOC: Aluminum casing	1	Weather proof IP65 Explosion Proof Zone 1, Gr.II A
		h. 2 Way 24VDC Solenoid Valve-NC	2-way pilot operated	1	

Note: The typical assembly of the DV is attached in the Annexure.

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**3. Manual Operated Ball Valve:**

S. No	Item	Specification		Quantity (Nos)	Standards /codes/ Approvals
1.	Manually Operated Isolation Ball Valve (Pressure rating class-150)	Nominal Size	DN50, DN40, DN25	50 NB -5 40 NB -6 25 NB-27	Testing Standards: API 6D/ ISO 17292 API 598/ API 607/ ISO 10/UL Listed/ FM Approved/ Equivalent ASME B16.5
		Pattern and Port	Ball & 2 Way (full bore)		
		Actuation	Manual Lever Operated		
		Body (MOC)	Stainless Steel		
		MAWP	1 MPA		
		End connections	Flanged		

**4. Inline Y-type strainer:**

S. No	Item	Specification		Quantity (Nos)	Standards /codes/ Approvals
1.	Inline Y type strainer (mesh & perforated sheet type) (Pressure rating class-150)	Nominal Size	DN50	9	Manufacturer's standard/ SAE ARP 901/ IS 3624
		Flow rate (LPM)	50-250		
		Fineness of Filtration	2000 Microns		
		Permissible Pressure Drop	0.25 bar at clean condition		
		Material of Construction	Strainer Body & cover: carbon steel Filter element: SS 304/ 316		
		End connections	Flanged		ASME B16.5

**5. Sprinkler & water spray Nozzles:**

S. No	Item	Specification		Quantity (Nos)	Standards /codes/ Approvals
1.	Sprinklers	Type	Quartzoid Bulb (Pendant Type)	50	ISRO: SP:102/ IS15325/ NFPA15 (Medium Velocity & High Velocity Water Spray System)
		Bulb Temperature Rating	68°C ± 3°C		
		Response time	Quick Response 3mm glass bulb		
		Material of Construction	Body: Bronze/ Brass/ Deflector: Bronze/Brass Finish: Chrome Plated		
		Discharge Coefficient, K	Not less than 18 lpm/bar <sup>0.5</sup> at 3bar		
2.	Water Spray Nozzles	Type	Medium velocity water spray Nozzles (Pendant Type)	50 (Nos) K18 – 40 K30 – 10	
		Discharge Coefficient, K	Not less than 18 lpm/bar <sup>0.5</sup> at 3 bar Not less than 30 lpm/bar <sup>0.5</sup> at 3 bar		
		Material of Construction	Body: Bronze/ Brass/ Deflector: Bronze/Brass Finish: Chrome Plated		

Note: K-Factor and actual quantity shall vary based on detail engineering.



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## Enclosure-III

### Tentative Quality Assurance Plan (QAP):

S. No	Test	Object Tested	Characteristic Sought for	Sample Size	Test Procedure	Acceptance Criterion	Form of record	Pre-Delivery Inspection	
								Test Performed by	Record reviewed by
A. Quality Assurance Plan for Deluge valve									
1	Material Test	Specimen from raw materials	Chemical composition and physical properties	1 per heat lot	Relevant standard	Relevant Material specification	Material Certificate	Manufacturer or any third-party laboratory	Contractor & department
3	Hydraulic shell pressure test	Valve in partially open position	Structural integrity under stress	100 %	1.5 times maximum rated working pressure	ASME B16.34	Test certificate	Manufacturer or Third Party Laboratory	Contractor & department
4.	Hydraulic seat pressure test	Valve in closed position	Structural integrity of seat under stress	100 %	1.1 times maximum rated working pressure	ANSI-FCI 70-2	Test certificate	Manufacturer or Third Party Laboratory	Contractor & department
Quality Assurance Plan for Manual Ball Valves									
1.	Material Test	Specimen from raw materials	Chemical composition and physical properties	1 per heat lot	Relevant standard	Relevant Material specification	Material Certificate	Manufacturer or any third-party laboratory	Contractor & department
2.	Hydraulic shell pressure test	Valve in partially open position	Structural integrity under stress	100 %	API 598	API 598	Test certificate	Manufacturer or Third Party Laboratory	Contractor & department
3.	Hydraulic seat pressure test	Valve in closed position	Structural integrity of seat under stress	100 %	API 598	API 598	Test certificate	Manufacturer or Third Party Laboratory	Contractor & department
Quality Assurance Plan for Filters									
1.	Material Test	Specimen from raw materials	Chemical composition and physical properties	1 per heat lot	Relevant standard	Relevant Material specification	Material Certificate	Manufacturer or any third-party laboratory	Contractor & department
Quality Assurance Plan for Pressure Gauges									
1.	Material Test	Specimen from raw materials	Chemical composition and physical properties	1 per heat lot	Relevant standard	Relevant Material specification	Material Certificate	Manufacturer or any third-party laboratory	Contractor & department
2.	Calibration	Pressure gauge	Accuracy	100 %	IS 3624	IS 3624	Calibration certificate	Manufacturer	Contractor & department
Quality Assurance Plan for carbon steel Pipes									

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1.	Visual examination	Pipes	OD & ID free from corrosion, pitting & surface irregularities	100%	Visual examination	Free from Dent & surface irregularities	Inspection report	Inspection report	Contractor & department
2.	Material Test	Specimen from raw materials	Chemical composition and physical properties	1 per heat lot	Relevant standard	Relevant Material specification	Material Certificate	Manufacturer or any third-party laboratory	Contractor & department
3.	Bend Test	Specimen from pipes	Ductility and soundness	5%	Relevant Standard	Respective pipe standard	Test certificate	Manufacturer or Third Party Laboratory	Contractor & department
Quality Assurance Plan for Fittings									
1.	Visual examination	Pipes	OD & ID free from corrosion, pitting & surface irregularities	100%	Visual examination	Free from Dent & surface irregularities	Inspection report	Inspection report	Contractor & department
2.	Material Test	Specimen from raw materials	Chemical composition and physical properties	1 per heat lot	Relevant standard	Relevant Material specification	Material Certificate	Manufacturer or any third-party laboratory	Contractor & department