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TECHNICAL SPECIFICATIONS FOR
REPLACEMENT AND UPGRADATION
OF;
**FIRE PROTECTION SYSTEM FOR
336MW CHHUKHA HYDROPOWER
PLANT, DGPC, CHHUKHA**

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1. Introduction

This document outlines the requirements for the work of replacement & upgradation of fire suppression system for transformers and hydrogenators at underground powerhouse and switchyard of 336MW, Chhukha Hydropower Plant, DGPC, Chhukha, Bhutan. The system shall be installed in accordance TAC/NFPA Standard, combined with good engineering practices in order to ensure a safe, reliable and effective fire fighting system.

The fire fighting system proposed is planned to timely detect the occurrence of fire & quick extinguishing of fire when it breaks out and prevention to spread fire so as to minimize the extent of damage

2. Scope of work

The work includes the replacement & upgradation of High Velocity Water (HVW) Spray System for power transformers, and Water-mist Spray System for Hydro generators.

Without restricting to the generality of the foregoing, the work to be performed under this contract shall comprises but not limited to the following:

- 2.1 Supply, erection, testing & commissioning of High Velocity Water Spray System (HVWSS) for 12Nos. 35MVA power transformers at Underground Powerhouse including painting, replacement of spray nozzles & quartzoid bulb with necessary fittings & supports and making connection to supply system.
- 2.2 Supply, erection, testing & commissioning of High Velocity Water Spray System (HVWSS) for 2Nos. 20MVA power transformers at Switchyard including painting, replacement of spray nozzles & quartzoid bulb with necessary fittings & supports and making connection to supply system.
- 2.3 Supply, erection, testing & commissioning of Atomized (Water-mist) Water Spray System for protection of 4Nos. Hydro generators at Underground Powerhouse including painting and replacement of spray nozzles with necessary fittings & supports and making connection to supply system. The supply & installation also includes the replacement of control valve station cabinet with automatic fire detection system consisting of solid-state smoke and heat detectors, laying of all cables required for connection of the detection, alarm indicating and other devices along with connections to the power supply, as appropriate.
- 2.4 All machinery tools & tackles and consumables required for erection/testing/ commissioning of the system shall be arranged by the Bidder.
- 2.5 Any other equipment / item not specifically mentioned herein the technical specification but are found necessary and are required completing the job in all respects shall also be included in the scope of supply.
- 2.6 The contractor shall carry out and complete the said work under this contract in every respect and in conformity with the current rules and regulations of the applicable standards and with the directions of and to the satisfaction of the Purchaser.



2.7 Civil Works

2.7.1 All the civil works required for the successful installation of the said fire protection system shall be in the scope of the contractor without any additional cost to the Purchaser.

2.8 Site Visit (Recommended)

2.8.1 Since the existing fire protection system is old, drawings are not available. CHP strongly recommend Bidders to visit the site to assess and examine the site conditions, requirement, the nature and quantum of work so as to prepare a realistic and competitive offer for the execution of the said work. All associated cost related to site visit will be in the scope of contractor.

3. Tentative Work Execution Schedule

SN	Activity	Schedule
1	Supply and delivery of materials at site	Five months
2	Erection, testing & commissioning of fire fighting system for 2Nos. 20MVA transformers at Switchyard and 4 Units (12Nos. 35MVA GT and 4Nos. Generators) at Underground Powerhouse.	Four months from the date if handing over of site

The above completion schedule is considering the availability of generating units and generator transformers during lean season for annual maintenance. Each Unit shall be under shutdown for annual maintenance for a duration of 1 (one) month. Bidders are required to plan the work accordingly and submit detailed work plan.



4. Standards

- 4.1 The above-mentioned fire protection systems shall be designed, installed and commissioned in accordance with the standards of TAC/NFPA/BIS/UL/VDS/FM/NFPA/LPCB, as applicable;
- a) NFPA 13: Standard for the Installation of Sprinkler Systems
 - b) NFPA 14: Standard for the Installation of Standpipes and Hose Systems
 - c) NFPA: Standard for Water Spray Fixed Systems for Fire Protection.
 - d) NFPA 851: Recommended practice for fire protection for Hydroelectric generating plants.
 - e) IS 15105: Design and Installation of Fixed Automatic Sprinkler Fire Extinguishing Systems – Code of Practice.
 - f) IS 3034: Fire Safety of Industrial Building: Electrical Generating and Distributing Stations – Code of Practice.
 - g) IS 15325: Design and Installation of fixed automatic High and Medium Velocity Water Spray System – Code of Practice.
 - h) IS 13039: External Hydrant Systems – provision and maintenance- Code of Practice.
 - i) TAC rules for water spray fixed systems for fire protection.
 - j) IS 3589: ERW Steel pipes for gas, water and sewerage over 150 NB
 - k) IS 1239 (Part-I): ERW Mild Steel Tubes & Tubular and fittings upto 150 NB
 - l) TAC (Tariff Advisory Committee) Publications, India.
 - m) UL (Underwriters Lab) Standards and Certification of Products.
 - n) Standards for Products.
 - SS Hydrant Valve: IS- 5290, Type-A.
 - SS Branch Pipe: IS – 903.
 - RRL Hose: IS – 636, Type –2A.
 - Spray Nozzles: UL/FM/LPCB/VdS/EN
 - C I Valves: IS – 14846 P.N 1.6
 - Deluge Valve: UL/FM/LPCB/VdS/EN
- 4.2 The equipment manufacturer shall operate a quality management system in accordance with ISO 9001:2015. In addition, the equipment shall be manufactured and Third Party Certificated under a recognized factory control procedure.
- 4.3 All the system components of fire protection system shall have the approval / listing from any one of the followings international test laboratory: UL – USA / LPCB –UK / FM – USA / Vds – GERMANY.

Intent of Specification

- 4.4 This specification is intended to specify the requirements for supply, packing forwarding, transportation at site, complete erection of all equipment and accessories, testing of the system, trial run, commissioning of the system., final painting and carrying out acceptance test of fire fighting system.



- 4.5 The system shall be supplied, installed & commissioned in accordance with TAC/NFPA guidelines.
- 4.6 Requirements pertaining to type, make, quality, testing & inspection of equipments as laid down in various clauses of Purchase's Specification shall be full & final. In the event of any contradiction w.r.t. other documents, technical specifications of this document shall prevail.
- 4.7 The Bidder shall be deemed to have understood completely all the requirements of the Purchaser and quoted accordingly.
- 4.8 It is not the intent to specify herein all the details of design and manufacturer. However, the equipment and the system shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to Purchaser, and shall be entitled to reject any work or material which is not in compliance with the standards.
- 4.9 The Bidder to note carefully that the parameters, estimated capacities of equipment indicated in the specification are only for the guidance of the Bidder. The system shall be installed as per relevant standards/codes and exact capacities and quantities are to be assess or examined by the Bidder at the time of site visit.
- 4.10 It is the responsibility of the successful Bidder to obtain necessary approval/clearance from statutory organizations wherever applicable for the equipment /systems under the scope specified.
- 4.11 The term '**Purchaser/Owner**' appearing in this specification shall refer to Chhukha Hydropower Plant, and the term '**Contractor**' shall refer to the successful Bidder.

5. Functional Requirement of the System

5.1 High Velocity Water (HVW) Spray System

- 5.1.1 There are 12 nos. 35 MVA Transformers inside underground power house and 2 nos. 20MVA transformers located outside at Switchyard, which we need to replace their fire protection system. All the transformers are protected by individual deluge systems.
- 5.1.2 The water pressure upto the system control valve (deluge valve) or the pressure available at tap-off points for spray system is maintained at 10kg/cm².
- 5.1.3 The replaced system shall meet the supply of high velocity water spray at the rate of minimum 12.2 liters per minute per sq. mtr. (Lpm/m²) over the transformer external surfaces as per IS: 3034.
- 5.1.4 Minimum running water pressure at any projector/spray nozzle shall be not less than 3.5 kg/cm² and not greater than 5.0 kg/ cm² for HVW spray system.



- 5.1.5 Fast acting butterfly valves shall be provided on both upstream of deluge valve for isolation purposes and one at downstream of deluge valve, so that this valve can be kept closed and can be operated manually, if there is any malfunction of deluge valves (mechanical or electrical operations).
- 5.1.6 Limit switches shall also be provided on isolation valve (butterfly valve) for monitoring its position from remote end.
- 5.1.7 Required number of pressure gauges for monitoring system pressure shall be provided both at upstream and downstream of deluge valves, and the pressure switches for relay of system tripping to exhibit “Fire” and “Spray On” annunciations.
- 5.1.8 The design features and make of all the projectors/ spray nozzles shall be UL/ FM or equivalent approved / listed.
- 5.1.9 The deluge valve shall be automatically actuated by wet pilot type detection system consisting of its piping network with heat sensing Quartzite Bulb (QB) detectors having rated temperature as 79°C. This wet pilot line shall be installed around the Transformers (to be protected) and shall be connected with the deluge through proper trimming connection which, gets charged with pressurized water from the up-stream site. In case of fire, these QB detectors shall be fused due to heat to release water pressure on the deluge valve which in turn shall cause in auto-tripping of the deluge valve, which is normally kept closed, allowing water to flow into the down-stream side and to get discharged from the nozzles.
- 5.1.10 The system shall be provided with various mechanism to release pressurized water by the following methods;
- a) Quartzoid bulb type heat sensors;
 - b) Electrical contacts through a solenoid valve;
 - c) The local manual release valve
 - d) Manually operated by-pass line
- 5.1.11 Each individual deluge system shall be provided with remote electrical and manual operation provision through a deluge valve local control panel. Deluge valve annunciation shall have following indication & switches;
- Transformer identification,
 - ‘Fire On’ indication for each deluge valve,
 - ‘Spray On’ indication for each deluge valve,
 - Manual Push Button for manual activation of each deluge valve from the panel,
- 5.1.12 The system piping shall consist of spray main header of size 100 NB, which shall be tapped from the 150 NB common feeder mains pipeline and mainly comprise of the following;
- a) Automatic deluge valve (DV) assembly suitable size and trims.
 - b) Isolation (butterfly) valve at the upstream & downstream of each DV.
 - c) Y-strainer of suitable size at upstream of each DV.
 - d) S.S Projectors.
 - e) QB Detectors.
 - f) Solenoids valve for each DV.



- g) One (1) no. pressure switch each in detection line & spray discharge.
- h) One (1) no. limit switch for each isolation valve\Butterfly valve.
- i) Deluge Valve Local Control Panel (DVLCP) with relays and interface units for each
- j) 25NB M.S. detection piping network.

5.2 Water Mist System

5.2.1 Functional Requirement

5.2.1.1 There are 4 nos. Hydro Generators inside underground power house for which atomized water spray system (water mist) has been provided for protection of generators. Each hydrogenators are protected by individual deluge systems and has been designed for automatic/manual operation in case of fire inside the generator.

5.2.2 The water pressure upto the system control valve (deluge valve) or the pressure available at tap-off points for spray system is maintained at 10kg/cm².

5.2.2.1 The new replaced system shall meet the supply of medium velocity water spray at the rate of minimum 10.2 liters per minute per sq. mtr. (Lpm/m²) over the protected area. The water mist system for the protection of Hydro Generators shall be as per NFPA-15/NFPA-750 for Auto / Manual operation in case of fire inside the Hydro Generators.

5.2.2.2 The system shall consist of main spray header of size 150NB pipe (to be tapped-off from the hydrant ring), connected to quick actuating differential type control valve known as deluge valve housed in Control valve station cabinet. From the deluge valve is connected to the automatic water spray system located inside the generator pit complete with water distributing mains and two ring headers (50NB), one at the top of the stator overhang (Non-drive end) and other at the bottom (drive end) within the generator having, specially designed nozzles for extinguishing the fire within the generator shall be provided.

5.2.2.3 The distribution system and spray nozzle shall be effective fog particle formation and dispersion over the surface. Nozzles shall be single jet discharge hole with a spiracle inside, arranged in such a manner that the water jet comes in a fog form/fine droplet. Each nozzle shall be provided with inbuilt strainer.

5.2.2.4 Each generator shall be provided with One Deluge Valve Station provided with necessary piping, electrical trim (consisting solenoid valve), and control equipments as required for extinguishing the fire within the generator.

5.2.2.5 Each water mist spray system shall mainly comprise of the following: -

- a) Automatic deluge valve (differential actuating type) trim assembly.
- b) Isolation (gate) valve at the upstream & downstream of each DV.
- c) Y-strainer of at upstream of each DV.
- d) Spray nozzles.
- e) Solenoids valve for each DV.
- f) Pressure switch



- g) Pressure gauge
- h) Water motor gong
- i) Control Valve Station Cabinet with inbuilt solid-state heat/smoke detector control panel.

5.2.3 **Scheme of Operation.**

5.2.3.1 The water mist system shall employ the principle of formation of the fine droplets striking the hot surfaces and absorb the heat and impart cooling and smothering effect thereby extinguishing fire.

5.2.3.2 The control system should be installed in such a way that by the operation of either of detectors (smoke or heat), alarm will be initiated and the system will come into operation instantaneously, if the auto-manual switch is in auto mode. In case the above switch is in manual mode then by operation of heat detector, alarm will be initiated & then by pressing the push button, the system comes into operation instantaneously.

5.2.3.3 The system shall have the provision to reset by any of the following methods;

- a) By turning the “press-to-lock” push button on the panel or on the remote panel following actuation.
- b) Mechanical drain valve lever turned following mechanical actuation.

5.2.3.4 The system shall have a provision to operate from the emergency push button manually from the valve station.

5.2.3.5 The system shall be provided with facility to test the system as and when needed.

5.2.4 **Fire Detection System**

5.2.4.1 The solid-state heat and smoke detectors shall be provided and located at strategic locations inside the generator housing for detection of fire inside the generator. The water spray system shall automatically operate on receiving signal on operation of any of the two devices i.e. heat or smoke detector in cross-zoning principle.

5.2.4.2 All necessary potential free contacts shall be provided for obtaining suitable electrical annunciation of the operation of the system.

6. **Piping & Fittings**

8.1 **Pipe Material**

6.1.1 All pipes shall be factory fabricated and shall be new and as per approved brand in the BOQ.

6.1.2 The pipes to be used for installation shall be of Electric Resistance Welded (ERW) Mild Steel (MS) Heavy Grade (Gr.410) pipes. The pipelines upto 150 NB dia. shall be as IS: 1239 (Part-I), while pipelines above 150NB dia shall be IS: 3589.



6.2 Pipe thickness:

6.2.1 Pipes shall conform to the following schedule:

Size (NB)	Pipe (mm) Min. OD	Thickness	Material
25	33.3	4.05	ERW Heavy grade mild steel tube to IS: 1239 Part-I
40	47.9	4.05	
50	59.7	4.50	
65	75.3	4.50	
80	88.0	4.85	
100	113.1	5.40	
150	163.9	5.40	ERW pipes to IS: 3589
200	219.1	6.00	
250	273.0	6.00	
300	323.9	6.00	

6.2.2 All piping system shall be capable of withstanding the maximum pressure (1.5 times of the working pressure) or arising from any condition of operation and testing including water hammer effects. **The Bidder shall provide all the test certificates of the pipes supplied.**

6.3 Pipe Fittings

6.3.1 The Bidder shall provide all the pipe fittings such as tees, elbows, couplings, flanges, reducers etc. which are not mentioned herein but that are needed to complete the piping work in its totality. All materials and products shall be either Underwriters Laboratories (UL) Listed or Factory Mutual (FM) Approved and installed in accordance with NFPA Standard 13 / equivalent Standard.

6.4 Jointings

6.4.1 Welded Joints; Jointing of pipes upto 50 NB shall be socket-weld fittings with fillet welding.

6.4.2 Flanged joints; For jointing of larger sizes pipes 65 NB dia. and above, flange jointing shall be used. Flanged joints shall be provided to mate with valves and other equipment or at every 30m run of straight pipe for maintenance and repair.

6.4.3 All the welding of pipes shall be carried out by means of special electrodes suitable for the above application. After, welding, welded portions shall be applied with suitable treatment and paintings.

6.5 Flanges;

6.5.1 Flanges shall be slip-on carbon steel with plain faces conforming to I.S. 6392. Flange shall be rated for 2.0 N/mm² or twice the system pressure whichever is higher and drilled to suit the equipment or valve flange if already drilled. All flanges shall conform to the following schedule;



Pipe	Flange Data				Raised Face	Drilling Data		
	OD of Pipe (mm)	OD of Flange (mm)	ID (Bore) of Flange (mm)	Flange Thickness (mm)		Face Dia. (mm)	Nos. of Holes	Hole Dia. (mm)
25NB (2½")	73	177	74.7	22.4	104.5	4	19.1	139.7
80 NB (3")	88.9	190.5	90.7	23.9	127	4	19.1	152.4
100NB (4")	114.3	228.5	116	23.9	157	8	19.1	190.5
150NB (6")	168.3	279	170.7	25.4	216	8	22.4	241.3
200NB (8")	219.1	343	221.5	28.4	270	8	22.4	298.5
300NB (12")	323.8	482	327	31.75	381	12	25.4	431.8

6.5.2 All bolts and nuts shall be carbon steel of reputed make with 3 mm insertion neoprene gasket complete.

6.6 Valves

6.6.1 All valves shall be suitable for 2.0 N/mm² cold non-shock working pressure or twice system pressure whichever is high.

6.6.2 Valves up to 50 mm NB shall be full bore valves with forged body and polished hard chrome plated ball with PTFE seal.

6.6.3 Higher size valves shall be butterfly and gate type valve.

a) **Butterfly valve;** The valve shall be of wafer-type, lever operated with two slip on type pipe flanges as per BS 5155 (PN 16). The body of the valve shall be cast iron body with mirror smooth finished cast steel disc with integrally molded EPDM lining which should be easily replaceable.

b) **Gate valve;** Gate valve shall be C.I gate valve with rising spindle as per IS 14846 (PN 16)

6.7 Supports & Clamps

6.7.1 All pipes shall be adequately supported from the surface/floor, walls and other structure either by concrete structure or steel supports to provide sufficient rigidity against vibration & load during operation. The supports shall be designed to withstand combined weight of pipe, pipes fittings and fluid in pipe.

6.7.2 The external (outside powerhouse) above ground pipelines shall be laid over concrete pedestals fasten with galvanised mild steel clamps at intervals specified (for every standard

length of pipes). The steel inserts or anchor fasteners shall be designed such that the pipes can be removed for future maintenance and repair.

- 6.7.3 The pipelines for tunnels and underground powerhouse shall be laid over pedestals fabricated from galvanised mild steel with duck-foot support at the feet.
- 6.7.4 Additional supports shall also be provided at the bends, at heavy fittings like valves, near equipment and as directed by the Purchaser.
- 6.7.5 Pipe clamps shall be specially fabricated fittings for pipes. All clamps shall be of galvanised mild steel. Clamps shall take into account pipe movement owing to temperature variations & anchors, and in no case shall the clamping arrangement induce stress beyond the safe load limits of the pipe under fully filled conditions. All clamps shall be painted with one coat of primer and two coats of black enamel paint.

6.8 Pipe Protection

- 6.8.1 All the exposed piping shall be distinctly painted with 'Fire Red' shade 536, to protect against external corrosion. The steel surfaces to be applied with painting shall be thoroughly cleaned before painting by wire brushing, air blowing, etc.
- 6.8.2 Pipes shall first receive single coat of red oxide primer uniformly applied and two coats of synthetic enamel paint thereafter. If finish paint was applied in shop, one coat of finish paint shall be applied at site. All pipes support shall be painted with synthetic enamel paint.
- 6.8.3 Wherever underground pipes are laid, it shall be suitably covered with wrapping and coating material.

7. Testing and Commissioning

7.1 Testing

- 7.1.1 Upon completion of the installation, the Contractor shall test all functions of the system, including the equipment, to ensure that it operates in accordance with the requirements of the design specification and relevant standards. The following test/inspection shall be carried out:
 - a) All the system piping shall be tested at 1.5 times the working pressure for four hours at the end of which there shall be no loss in pressure. The test shall be conducted in the presence of Purchaser or their representatives. In case of any leakage or bursting of pipes, defective section shall be rectified and tested again.
 - b) The contractor shall demonstrate the automatic operation of the spray system by using a dummy fire below a sprinkler head.
 - c) The entire system shall be flushed to ensure that any earth/ foreign matters which might have entered during installation are taken out, before commissioning. As soon as the test is complete, the system shall be commissioned & made available for use.



- d) Any defects noticed during the warranty period shall be promptly attended by the contractor and availability of the system at all time is to be ensured.

7.2 Commissioning

- 7.2.1 Following the satisfactory completion of installation & testing, the Contractor shall commission the system by demonstrating to the Purchaser that the system successfully performs all of the functions set out in the technical requirements.
- 7.2.2 The Contractor shall present an Acceptance Certificate of system commissioning from the Purchaser.

8. Handing & Taking Over

- 8.1.1 The Contractor, upon completion of the commissioning activity, shall hand over the system to the Purchaser.
- 8.1.2 It is the responsibility of the Contractor to maintain the fire fighting system till PG test conducted successfully and it is handed over to Purchaser. Any defect noted during the period shall be rectified by the contractor without any financial implication to the Purchaser. Also, suitable PG tests shall be conducted by the contractor to show the achievement of guaranteed parameters in line with the requirements of specification/standards/codes and to the satisfaction of Purchaser/Owner.
- 8.1.3 The Contractor shall provide a complete set of documents describing the system and its design concepts, installation, final testing, commissioning, and required operating and maintenance procedures.
- 8.1.4 As a minimum, the following documentation shall be provided for the system:
- a) Complete set of "As Built" drawings and one re-producible copy of each drawings (Soft Copy).
 - b) System Operation and Maintenance Manual containing;
 - System description and equipment with design particulars.
 - Instruction for erection.
 - Instruction for operation, maintenance and repair.
 - Routine maintenance instructions and inspection schedule.
 - Ordering information for all replaceable parts.
 - Checklist of equipment and components.

9. Training

- 9.1 Necessary training is to be incorporated on Testing, Operation and Maintenance including detailed trouble shooting, at the site. Operation and maintenance training to customer has to be provided at site during erection and commissioning/testing/trail run of the system.
- 9.2 The training sessions shall be given by an experienced and competent engineer familiar with the fire system installed.



10. Scope of Supply & Services

Bidder shall consider the following while submitting the bid;

- 10.1 The Bidder shall include all such items, which although not specifically mentioned in the bid documents, but are required to make the equipment/system complete for its safe, efficient, reliable and trouble-free operation, unless the same is specifically excluded from the Bidder's scope of work. It is for this reason, Bidder have been advised to make a site visit as specified under section 2.6, to prepare a realistic and competitive offer for the execution of the work.
- 10.2 Bidders shall consider makes for various equipments as per 'List of Approved Makes' provided herein, strictly. The make or brand of MS pipes shall be either TATA or Jindal, no other makes will be accepted.
- 10.3 The Purchaser has examined the condition of existing spray pipeline (80NB, 65NB, 50NB) for HVWSS and Upper ring (50NB) and Bottom ring (65NB) for Water-mist system and it was decided to retain those pipelines. Hence, it is not included in the BOQ. However, Bidders shall note that these pipelines are still part of the system, and therefore should take into consideration at the time of submission of bid.
- 10.4 Minor modifications, alterations in system installation as per Purchaser's specific requirements shall be done without any extra cost to Purchaser.
- 10.5 The Contractor shall dismantle and remove the existing system pipelines from the site before laying the new system piping, wherever required.
- 10.6 Bidders to include in their offers the detailed list of recommended spares to be kept at site for the upkeep and maintenance of the system. The Contractor shall guarantee the availability of all system spares for a period of not less than 7 years.
- 10.7 All the commissioning spares for commissioning of the system shall be furnish by the Bidder. The commissioning spares are exclusive from the BOQ. The unused commissioning spares shall be returnable to the Bidder.
- 10.8 Any other service not explicitly illustrated herein but which may be required to complete the system with its desired functionality or in the spirit of contract shall also deemed to be under the scope of Contractor.



11. Bill of Quantity (BOQ)

BILL OF QUANTITIES FOR FIRE PROTECTION WORKS FOR CHHUKHA HYDROPOWER PLANT, CHHUKHA, BHUTAN			
SN	Description of work	Qty.	Unit
PART A - HIGH VELOCITY WATER SPRAY SYSTEM (HVWSS) FOR 12NOS. 35MVA TRANSFORMERS INSIDE POWERHOUSE AND 2NOS. 20MVA TRANSFORMERS AT SWITCHYARD.			
1.0	Supply & Installation of Heavy grade (ERW-Class C) MS pipes conforming to IS: 1239 (Part -1) with all accessories & fittings like tees, elbows, reducers, union, flanges, rubber gaskets, nuts, bolts, washer, including supporting/fixing the pipe on floor/wall/ceiling with clamps, hangers, angles, channels (using anchor fasteners) as per specification complete with paintings. The quoted rate shall also include for chasing/chipping walls, making bore holes in walls/floor and to be made good to the original finish etc. complete.		
a	100 NB	100	M
b	80 NB	50	M
c	25NB	1100	M
2.0	Supplying & Fixing of HVW spray nozzle size	320	Nos
3.0	Supplying & Fixing of QBD [Quartzoid Bulb Detector] of 79°C.	210	Nos
4.0	Supply & Installation of deluge valve of size 100 NB, flanged conforming to ANSI B-16 1, UL Listed having electrical release and wet pilot basis trim assembly with test & alarm drain & drip valves, and with all other accessories.	14	Nos
5.0	Supply & Installation of butterfly valve (wafer-type), size 100 NB, one at upstream and one at downstream of DV with matching flanges, nuts, bolts, gaskets complete as required.	28	Nos
6.0	Supply & fixing of Solenoid valve; 2 way, normally closed (NC), direct acting type, 3/8" female NPT, operating voltage 220 VDC having IP 65% with all other accessories.	14	Nos
7.0	Supply & fixing of digital pressure switches, SPDT type of pressure range from 0-12 kg/cm ² with operating voltage of 220 VDC with all other accessories	14	Nos
8.0	Supply and fixing of pressure gauge having operating range from 0 - 15kg/cm ² , 1/2-inch bottom entry, with ball valves and other accessories.	30	Nos
9.0	Deluge Valve Local Control Panel (DVLCP); Single front & non-compartmentalized, indoor wall mounting type, suitable for 2.5 sq.mm cable having Ingress Protection (IP) of 55%. Operating Voltage 220 VDC. The panel shall have following indication switches & buttons; Power On, Transformer Indication, Fire 'ON' and 'Spray ON' and Manual Push Button for manual activation of each deluge system from the Deluge Valve Control Panel.	5	Nos
10.0	2C x 1.5 sq.mm Cu Armoured PVC insulated cable	200	Mtr.
Sub-Total			

11.0	Mandatory Spares		
	Quartzoid bulb	42	Nos
	Pressure gauge	14	Nos
	Pressure switch	14	Nos
	Solenoid valve	14	Nos
	Discharge Nozzles for HVWSS	14	Nos
	Lamp, Fuses, Relays, Contactor for DV panel	14	Nos. each
	Miscellaneous Electronic card (1No. each type) for DV panel	5	Nos. each
	Total		
	TOTAL FOR HVWSS FOR TRANSFORMERS		
PART B - WATER MIST FIRE EXTINGUISHING SYSTEME FOR GENERATORS			
1.0	Supply & Installation of Heavy grade (ERW-Class C) MS pipes conforming to IS: 1239 (Part -1) & IS: 3589 with all accessories & fittings like tees, elbows, reducers, union, flanges, rubber gaskets, nuts, bolts, washer, including supporting/fixing the pipe on floor/wall/ceiling with clamps, hangers, angles, channels (using anchor fasteners) as per specification complete with paintings. The quoted rate shall also include for chasing / chipping walls, making bore holes in walls/floor and to be made good to the original finish etc. complete.		
	100NB	60	M
2.0	Supply and fixing of atomized water spray nozzle	1500	Nos
3.0	Supply & Installation of Valve Station with Auto Control Drain Valve, Instrumentation, Built-in-charger, Power/Control cables, Solid-State Fire Alarm Panel showing; System 'On' Lamp, System Operated Lamp and Generator 'On' Fire Lamp, with suitable capacity of housing deluge valve assembly. The control valve station cabinet shall have designed for Ingress Protection (IP) of 65%.	4	Nos
4.0	Supply & installation of differential type quick actuating deluge valve, size 100 NB with electrical trim assembly (consisting of solenoid valve), water motor gong, auto control drain valve and test valve, flanged to ANSI B-16 1, UL Listed.	4	Nos
5.0	Supply and installation of C. I. Cut off (Gate) valve rising spindle as per IS 14846 (PN 16) with matching flanges, nut, bolts, gaskets complete as required.		
	Size 100 NB	12	Nos
6.0	Supply and installation of M.S. Fabricated 'Y' type strainer with matching flanges, nut, bolts, gaskets complete as required.		
	Size 100 NB	4	Nos
7.0	Supply & fixing of digital pressure switches, SPDT type of pressure range from 0-12 kg/cm ² with operating voltage of 220 VDC with all other accessories	4	Nos
8.0	Supply and fixing of pressure gauge having operating range from 0 - 15kg/cm ² , 1/2-inch bottom entry, with ball valves and other accessories	8	Nos

9.0	Supply & fixing of Solenoid valve; 2 way, normally closed (NC), direct acting type, 3/8" female NPT, operating voltage 220 VDC having IP 65% with all other accessories.	4	Nos
10.0	Supply & fixing of photo-electric smoke detector with anchor fastener and fixing screw for fixing detector	32	Nos
11.0	Supply & fixing of heat detector probe type with anchor fastener and sixing screw for fixing detector	32	Nos
12.0	Supply & Laying of 2 core x 1.5 sq.mm twisted & sealed armoured FRLS copper cable for instrumentation	400	M
	Sub-Total		
13.0	Mandatory Spares		Nos
	Heat Detector	4	Nos
	Photo electric smoke detector	4	Nos
	Pressure gauge	2	Nos
	Pressure switch	2	Nos
	Solenoid valve	2	Nos
	Discharge Nozzles for water Mist system	10	Nos
	Lamp, Fuses, Relays, Contactor for Fire Alarm panel for Water Mist system	4	Nos. each
	Miscellaneous Electronic card (1No. each type) for Fire Alarm control panel for Water Mist System	4	Nos. each
	Total		
	GRAND TOTAL		
Note: BOQ may vary at the time of actual erection as per site condition. Therefore, any other equipment not specified, but required for safe and operation of the system shall be supplied by the contractor.			

12. List of Approved Makes

SN	Items	Approved Makes/Brand
1	MS ERW Pipes	TATA / Jindal
2	Butterfly Valves, Gate / Sluice Valve and Non-return Valve	Audco / Leader / Kirloskar / Zoloto/Hazra
3	Fittings & Flanges	MS Fittings /Metal Lloyds/Bharat Forge/Tube Products/Nitin Profile/Hazra
4	Gun Metal Valves (Globe Valve)	Audco / Leader / Kirloskar / Zoloto/Hazra
5	Strainer (Y-Type & Basket Type)	Gujarat Autofilt / Jaypee / Strain Well/ Superflo/Hazra
6	Hydrant Valve & Branch Pipe, Nozzle & Couplings	SBJ / Newage / Sukan / Winco/Fireshield
7	Hose Pipe	CRC / Jayshree /Newage/Fireshield
8	Hose reel & Hose Box	SBJ / Newage / Sukan / Winco/Fireshield
9	Coating & wrapping material/tape	IWL / Rushtech/MP Tar Products
10	Sprinklers	Spray safe / HD / Globe / Safex / Newage / UL Listed
11	Deluge Valves	HD Fire
12	HV Spray Nozzle	HD Fire/Kidde (I) LTD./TYCO
13	Quartzoid bulb sprinklers	TYCO/HD Fire/Newage Industries
14	Solenoid valve	ROTEX/AVCON
15	Cast Iron Gate Valve & Air Release Valve	SBJ/Kalpana/Newage/ H.Sarkar/Venus/Sukan/Winco/Hazra
16	Pressure gauge	H. Guru / Fibig/AN INSTRUMENTS
17	Pressure switch	Indfoss / Switzer / Verma Trafag
18	Flow Switch	Honeywell
19	Paint	Shalimar/Asian Paints/Berger
20	Power & Control Cable	Torrent/Polycab/Delton, Paramount
21	Optical fiber cable	Finolex/Polycab

