SECTION 21 1313 – WET PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 INTRODUCTION

A. The scope of work for the Fire Protection System outlined in this section of the specification includes the systems design verification, supply, installation, testing, commissioning and handing over of Hydrant and Sprinkler section Fire Protection System.

B. The Fire Protection System must comply with the standard acceptable authority requirements TAC, NBC. The local Fire authorities and GPCB authorities, CFO guidelines and subject to approval by the Employer's Representative.

C. The entire work shall be carried out in a manner consistent with good engineering practice. Take into account all site conditions including space allocation for Fire Protection System while designing the system and selecting the equipment.

D. Be responsible for engaging a qualified, competent and experienced Fire Protection System specialist to perform the system design verification, preparation and submission of system proposal, obtaining approvals from relevant authorities and site supervision for installation, testing and commissioning.

E. Perform the system design verification based on the criteria / data and technical requirements specified in this section / drawing and the local Authorities regulations / requirements.

F. Provide system which comprises products of manufacturers who have designed, developed and used these products successfully for a period of at least for last five years.

G. Test reports / certificates/ Handover documents shall be in accordance with the requirements laid down by the Users / local Authorities.

1.2 SCOPE OF FIRE PROTECTION SYSTEM

A. Scope of works listed below shall not be considered as comprehensive description but only as an indication of the extent of works.

B. Provision of Design Verification, detailed calculation, selection of equipment, working drawings, builder work drawings, supply, installation, testing, commissioning and handing over for the complete Fire Protection System to the requirement as stipulated in this specification and local government authority shall be included.

C. Tank and equipment layout shall comply with the space allocated for the same and as allocated in the Tender drawings.

D. Static testing of plant shall be provided.

E. Testing and commissioning of installation under normal operational conditions shall be conducted.

F. Priming and finishing coats painting to all metal pipe work and equipment as per the standards.

G. As-built drawings and operation / maintenance manual as detailed elsewhere in the specification shall be provided.

H. Seal the gaps between pipe sleeves and pipe work / conduit, etc. if any as per fire zoning.

I. Two-year warranty and maintenance service from the date of handover of the works shall be included in the offer.

J. DESIGN CONFIRMATION

1. Confirm the space provided for various equipment in the tender drawings is adequate to install and maintain all equipment.
2. If the spaces provided in the tender drawings are inadequate to install the equipment, it shall be clearly indicated in the tender itself.

K. DESIGN CONFIRMATION

1. Confirm in writing that the design on which this tender is prepared has been verified and it meets with the requirements of all Government. Semi-Government, Municipal and other Authorities, whose permission would become necessary for the completion of the Project.
2. Confirm the design is verified and is shall maintain the specified design condition as per specifications and drawings.

1.3 SYSTEM DESCRIPTION

A. Fire Protection Water Supplies and storage

1. Fire Suppression System will be designed based on most Stringent requirements of TAC & local CFO requirements, NBC-2016 and NFPA, as applicable and shall not contain HCFCs and Halons.
2. The base scheme for the Fire Protection systems will employ the use of the city water service with an additional tap to supply water from a tanker truck if required.
3. All the tanks will be split into at least two sections to provide the ability to maintain the tanks without shutting the system down.

B. Hazard Classification

1. For detail Refer Table indicated on legend drawing.
2. Classification as per NBC Table 07

C. Fire Protection Systems

1. An electrically fed jockey pump (with standby) will maintain system pressure and a diesel fire pump will provide a complete back up to the entire standpipe systems
2. Additional pumps will be required at roof to provide the required system pressures throughout the building.
3. Pressure reducing valves/Orifice plates will be located throughout where the system pressure exceeds normal operating pressures.

1.4 APPLICABLE CODES AND STANDARDS

Tender specifications, drawings, schedules, general and special conditions of the Contract apply to this Section.

Serial No.	Code No.	Code
1	NBC Part – IV	National Building Code of India; Part IV Fire & Life Safety
2	TAC	Tariff Advisory Committee fire protection manual Part-I.
3	IS-1239 / IS 3589	Specification for MS / GI Pipes
4	IS 778	Specifications for Gun Metal gate, globe & check Valves for water supply
5	IS 4927	Specifications for Canvas Hose Pipes.
6	IS 903	Specifications for Branch pipes Fire hose couplings and auxiliary equipment's
7	IS-5290	Specifications for hydrant landing valves.
8	IS-4853	Recommended practice for radiographic inspection of fusion welded butt joints in steel pipes
9	IS-636	Specifications for no-percolating flexible firefighting hose pipes.
10	IS 9137	Specification for horizontal end suction centrifugal pump.
11	BS 1965 Part I	Specification for butt-welded Pipe Fittings.
12	IS 8423	Controlled percolating hose for firefighting.
13	IS 2871	Branch pipe, universal for firefighting purposes
14	IS 884	First aid hose reel for fire fighting
15	IS 5131	Dividing Breeching with Control for Fire Brigade Use
16	IS 2002	Steel plates for pressure vessels for intermediate and high temperature service including boilers
17	IS: 6392	Steel pipe flanges
18	IS 908	Specification for fire hydrant, stand post type
19	IS:8432	Tubes, Tracheotomy (rubber or plastics)
20	IS 903	Specification for fire hose delivery couplings, branch pipe, nozzles and nozzle spanner.
21	IS 11149	Rubber Gaskets
22	IS 6912	Copper and copper alloy forging stock and forgings
23	IS 210	Grey Iron Castings
24	IS 1367	Technical Supply Conditions for Threaded Steel

		Fasteners
25	IS 5312	Swing Check Type Reflux (Non-Return] Valves for Water Works
26	IS 10221	Coating and wrapping of underground mild steel pipelines - Code of practice

1.5 SUBMITTALS

A. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

C. Project Record Documents: Record actual locations of components and tag numbering.

D. Operation and Maintenance Data: Include installation instructions and spare parts lists.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Valve Stem Packings: Two for each type and size of valve.

F. Submit catalogue information, design calculations and samples complete with full technical data and shop drawings for the entire system, test certificates, etc. and any other information required by the Employer’s Representative for acceptance prior to commencement of installation.

G. Detailed shop drawings for sprinkler system shall be prepared and submitted to the Employer’s Representative for approval before starting the work.

H. Samples: Provide samples of various types of pipes valves, pipes, insulation, control wires etc

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.

2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. WORKMANSHIP

1. The workmanship shall be best of its kind and shall conform to the specifications, as below or Indian Standard Specifications in every respect or latest trade practices and shall be subject to approval of the Owner’s Site Representative.

2. All materials and/or Workmanship which in the opinion of the Owner’s Site Representative / Architect / Employer’s Representative is defective or unsuitable shall be removed immediately from the site and shall be substituted with proper materials and/or workmanship forthwith no extra cost to owner.

D. MATERIALS

1. All materials shall be best of their kind and shall conform to the latest Indian Standards.
2. All materials shall be of approved quality as per samples and origins approved by the Owner's Site Representative / Architect / Employer's Representatives.
3. As and when required by the Owner's Site Representative / Employer's Representative, arrange to test the materials and/or portions of works at his own cost to prove their soundness and efficiency.
4. If after tests any materials, work or portions or work are found defective or unsound by the Owner's Site Representative / Employer's Representative, remove the defective material from the site, pull down and re-execute the works at his own cost to the satisfaction of the Owner's Site Representative / Employer's Representative.
5. To prove that the materials used are as specified, provide the Owner's Site Representative with original vouchers on demand.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use hand wheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, specialties and equipment from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.8 COORDINATION WITH AUTHORITIES

Coordinate with CFO/ Local Fire authorities for necessary approvals, preliminary NOC and final NOC.

PART 2 - PRODUCTS

2.1 PIPING WORK

GENERAL REQUIREMENTS

A. All materials shall be of the best quality conforming to the specifications and subject to the approval of the Consultants.

B. Pipes shall be securely fixed to walls and ceilings by suitable for vertical piping supports should be galvanized clamps and supports (galvanized after fabrication) and for horizontal pipes gripple hanger supports shall be provided at intervals specified. Only approved type of anchor fasteners shall be used for RCC slabs and walls / floors etc.

C. The system shall be provided with suitable drainage arrangement with drain valves complete with all accessories.

D. Pipe accessories such as gauges, meters, control devices, etc. shall have the same working pressure rating as the associated pipe work. All pipe work shall be free from burrs, rust and scale and shall be cleaned before installation. All personnel engaged on welding operations must possess a certificate of competence issued by an acceptable / recognized authority.

E. PAINTING

All Hydrant and Sprinkler pipes shall be painted with post office red colour paint. All M S pipes shall first be cleaned thoroughly before application of primer coat. After application of primer coat two coats of enamel paint shall be applied. Each coat shall be given minimum 24 hours drying time. No thinners shall be used. Wherever required all pipe headers shall be worded indicating the direction of the pipe and its purpose such as "TO RISER NO.1" etc. Painting shall be expertly applied; the paint shall not over run on surfaces not requiring painting such as walls, surfaces etc. Nuts, bolts and valves shall be also painted.

F. EXCAVATION

Excavation for pipe lines shall be in open trenches to levels and grades shown on the drawings or as required at site. Pipe lines shall be buried with a minimum cover of 1 meter or as shown on drawings.

Wherever required Contractor shall support all trenches or adjoining structures with adequate timber supports, shoring and strutting.

On completion of testing in the presence of the Project Manager and pipe protection, trenches shall be backfilled in 150 mm layers and consolidated.

Contractor shall dispose off all surplus earth as directed by the Project Manager.

G. ANCHOR / THRUST BLOCK

Contractor shall provide suitably designed anchor blocks in cement concrete/steel support to cater to the excess thrust due to work hammer and high pressure.

Thrust blocks shall be provided at all bends, tees and such other location as determined by the Project Manager.

Exact location, design, size and mix of the concrete blocks/steel support shall be as shown on the drawings or as directed by the Project Manager prior to execution of work.

H. PRESSURE GAUGE

Pressure gauge shall be provided near all individual connections of the hydrant system with isolation valves and near each flow switch assembly of the sprinkler system. Pressure gauge shall be 100 mm dia gunmetal bourdon type with gunmetal isolation ball valve, tapping and connecting pipe and nipple. The gauge shall be installed at appropriate height for easy readability.

I. JOINTING

1. Welded Joints

Joints between MS pipes and fittings shall be Butt joint made with the pipes and fittings having “V” groove and welded with electrical resistance welding in an approved manner. But welding without “V” groove shall not be permitted. (SOCKET WELD FOR X DIA)

2. Flanged joints (For equipments and valves)

Flanged joints with flanges conforming to IS: 6392 shall be provided on

a. Straight runs at intervals not exceeding 25-30m on pipe lines mm of 50 dia and above and as directed by the Project Manager.

b. For jointing all types of valves, appurtenances, pumps, connections with other type of pipes, to water tanks and other places necessary and as required for good engineering practice and as shown/noted on the drawings.

c. Flanges shall be with GI bolts and nuts and 3mm insertion gasket of natural rubber conforming to IS: 11149.

3. Unions (upto 50 mm dia)

Approved type of dismountable unions shall be provided on pipe lines of 40 mm dia and smaller dia, in locations similar to those specified for flanges wherever applicable.

2.2 SPRINKER SYSTEM

A. Pipes and Fittings

1. Underground/Outside pipes shall be Galvanized Steel conforming to IS: 1239
2. (heavy class) duly wrapped and coated as per IS: 10221 with welded joints. The coating / wrapping protection shall be tested.
3. Pipes for risers ,Basements, headers and floor branches inside the building shall be Galvanized Steel conforming to IS:1239 (heavy class) up to 150 mm dia. Pipes 200mm dia. and above shall conform to IS 3589 with 6 mm thick walls.
4. Electro resistant welded pipe to be use pressure exceeding 16kg/cm2.
5. Joints in risers- All risers shall. be installed with grooved couplings with necessary fittings .Horizontal & branch floor piping shall be screwed up to 50mm dia. and grooved joints for Higher pipe sizes shall be used.

6. All pipes above ground and in exposed locations shall be painted with two coat of Etching type primer and two or more coats (each of 75 microns) of synthetic enamel paint of approved shade.
7. Pipes shall be initially brushed to remove all foreign matter before applying paint / primer.
8. Pipes (buried) shall be initially brushed to remove all foreign matter and apply 2 coats of primer over the pipe. Primer shall be allowed to dry until the solvent
9. evaporates and surface becomes tacky. Tape 4mm thick and 150/250mm wide shall then be wound in a spiral fashion and bonded completely to pipe by thermo fusion process. Overlap shall be maintained at 15mm.

Following pressure rating criteria to be followed while selecting the pipes

TABLE: PRESSURE RATING TABLE FOR PIPE, VALVES AND ACCESSORIES

Sr. No.	Description	Pressure Rating
1	Pipes in pump room	PN 16
2	Riser	PN 16
3	All horizontal pipe work after orifice (on each floor level)	PN 10

A. VALVES

1. Valves shall be provided at locations as indicated in drawings and as required.
2. All valves are to be located for easy access. All valves shall be rated properly to suit the pressure rating for the piping system, where the valves are being installed and shall be supported wherever necessary with Hot dipped galvanized MS brackets.
3. Valves shall comply with IS: 14846 (Class I) for C.I sluice valves and IS: 778 for G.M valves and tested.
4. Valves & flanges shall be of same material that of the pipe.
5. All Valves shall be factory tested at 1.5 times the design working pressure for the piping system, where the valves are being installed.

B. Gate Valve/Globe Valve.

1. Gates valves used in high pressure (head) piping shall be made of Stainless Steel 316 / Brass/ GM/ C.I and of suitable class as indicated in specifications, drawings & schematics or higher if required.
2. Supplying, fixing and testing shall correspond to IS: 778-1984, Specifications for Copper Alloy Gate, Globe and Check Valves for Water Works.
3. Valves shall be tagged with permanent label under hand wheel indicating type or duty.
4. All valves shall have manufacturer's test certificate indicating the date of shop test and other quality control tests with the material used for the same.
5. Gate valves shall be of the size as specified in the BOQ.

C. Butterfly Valves:

1. The butterfly valve shall be suitable for waterworks and rated for Pressure requirement as mentioned in the Schedule of quantities.

2. The body shall be of cast iron to IS: 210 in circular shape and of high strength to take the water pressure. The disc shall be heavy duty cast iron with anti corrosive epoxy or nickel coating.
3. Butterfly valves shall be slim seal, short wafer type with standard finish. Valves shall be suitable for mounting between flanges drilled to ANSI 125.
4. Valve shall consist of disc pivot and driving stem shall be in one piece centrally located. Disc shall move in bearings on both ends with 'O' ring to prevent leakage.
5. The valve seat shall be replaceable of high grade elastomer EPDM or nitrile rubber with hard backing. The elastomer rubber shall have a long life and shall not give away on continuous applied water pressure. Spindle shall be AISI 41 steel.
6. The valve is closed position shall have complete contact between the seat and the disc throughout the perimeter
7. Valve for normal application shall be suitable for a working pressure to suit the application and service and shall be complete with flow control lever and notches, factory machined companion flanges and bolts and nuts.
8. Valves shall conform to BS 5155 with electro steel nickel coated SG Iron (N) and seat material EPDM3.
9. The valve shall be fitted between two flanges on either side of pipe flanges. The valve edge rubber shall be projected outside such that they are wedged within the pipe flanges to prevent leakages.

D. Ball Valves

1. The ball valve shall be made forged brass and suitable for test pressure of pipe line. The valve shall be internally threaded to receive pipe connections.
2. The ball shall be made from forged brass and machined to perfect round shape and subsequently chrome plated.
3. The seat of the valve body-bonnet gasket and gland packing shall be of Teflon.
4. The handle shall be provided with PVC jacket. The handle shall also indicate the direction of 'open' and 'closed' situations.
5. The gap between the ball and the teflon packing shall be sealed to prevent water seeping.
6. The handle shall also be provided with a lug to keep the movement of the ball valve within 90°. The lever shall be operated smoothly and without application of any unnecessary force.
7. Normal size of a ball valve shall be that, corresponding to the size of the pipe to which it is fixed

E. Ball Valves with float valve (For Storage Tanks)

1. Ball valves with floats to be fixed in storage tanks shall consist of cast brass lever arm having copper balls (26 SWG) screwed to the arm integrally.
2. The copper ball shall have bronze welded seams. The closing/opening mechanism incorporating the piston and cylinder shall be non-corrosive metal and include washers.
3. The size and construction of ball valves and float shall be suitable for desired working pressure operating the supply system.
4. Brass valves shall be supplied with brass hexagonal back nuts to secure them to the tanks and a socket to connect to supply pipe.

5. Ball valves shall generally conform to IS specification No.1703-1977. Weight of ball cock and the size of the ball cock shall be as per IS specification.

F. GUN METAL VALVES

1. Gun metal Valves shall be used for smaller dia pipes, and for threaded connections. The Valves shall bear certification as per IS:778
2. The body and bonnet shall be of gun metal to IS:318. The stem gland and gland nut shall be of forged brass to IS:6912. The hand wheel shall be of cast iron to IS:210.
3. The Hand wheel shall be of high quality finish to avoid hand abrasions. Movement shall also be easy. The spindle shall be non rising type.

G. Y-Strainers

1. Strainers shall be preferably of the approved 'Y' type with C.I. construction.
2. Strainers shall have a removable stainless steel (24 gauge) screen with 3mm perforations and a permanent magnet.
3. Strainers shall be provided with flanges. They shall be designed so as to enable blowing out accumulated dirt and facilitate removal and replacement of all screens without disconnection of the main pipe.

H. Pressure Relief Valves

Each System shall be provided with a Pressure Relief Valves. The Valve shall be spring actuated and set to operate as per field requirement. The Valve shall be constructed of bronze and provided with an open discharge orifice for releasing the water. The Valve shall be open lift type.

I. Pressure Switch

The pressure switches shall be employed for starting and shutting down operation of pumps automatically, dictated by line pressure. The Pressure Switch shall be diaphragm type. The housing shall be die cast aluminum, with SS 316 movement, pressure element and socket. The set pressure shall be adjustable.

The Switch shall be suitable for consistent and repeated operations without change in values. It shall be provided with IP: 55 water and environment protection.

J. Drain Valves

Provide G.I. Pipe as per IS:1239 heavy class with necessary gate / ball valve for draining water in the system as indicated in the drawing.

2.3 AUTOMATIC SPRINKLER SYSTEM

A. The entire sprinkler installation shall be designed to make it a hydraulically balanced system. The pressure requirement at typical floors shall be designed for 0.5 to 1 bar at each sprinkler outlet.

1. Pipes fittings and support shall be the same as for Fire Hydrant System.
2. Jointing shall be the same as for Fire Hydrant System. All risers shall be installed with flexible joints with necessary fittings

3. Valves shall be the same as for Fire Hydrant System.

B. Auto Air vent:

1. Automatic air release valve with stop cock screwed inlet connection and drain arrangement with 25mm dia shall be provided on every hydrant and sprinkler risers at top most point.

C. Orifice Plates

1. For restricting pressure in the sprinkler system, orifice plates of appropriate sizes shall be fitted at different floor levels, at the branching points from Riser Main.
2. The Diameter of such orifice shall not be less than 50% of the dia of pipe into which it is to be fitted, which shall not be less than 50mm dia.
3. These orifice plates must be of stainless steel with plain central hole without burrs, and the thickness shall be 3mm for pipe size up to 80 mm, 6 mm for pipes from 80 to 125 mm dia and 9 mm for pipes greater than 125 mm dia.
4. Such orifice plate must have a projecting identification tag.
5. The orifice plate shall fitted not less than two pipe internal diameters downstream of the outlet from any elbow or brand.
6. Submit the design for engineer's approval and identify location on drawing before installation.

D. Test Connection

1. Provide 15 mm dia. Gun-Metal Globe Valve / Gate Valve along with flow meter and pressure gauge with G.I. Pipe as per IS 1239 heavy class for testing and draining any water in the system in low pockets wherever required. This item shall be measured similar to the normal piping system.

E. Sprinkler Heads

1. Sprinkler heads shall be of brass/quartzoid bulb type containing liquid having high vapor pressure held in position by forged GM yoke and deflector and sufficiently strong, in compression to withstand any pressure, surge or hammer likely to occur in the
2. The yoke & body shall be made of high quality gun metal brass with arms streamlined to ensure minimum interference with the spread of water.
3. The bulb shall contain a liquid having a freezing point below any natural climatic figure and a high coefficient of expansion.
4. The temperature rating of the sprinkler shall be stamped on the deflector & the colour of the liquid filled in the bulb shall be according to the temperature rating as per NFPA 13 standard.
5. The sprinkler heads shall be of type & quality approved by the local fire brigade authority
6. Sprinklers shall have 15mm nominal size of the orifice.
7. The orifice size shall be marked on the body or the deflector of the sprinkler.
8. Metal guards for protection of sprinkler against accidental or mechanical damage shall be provided as desired by the Project Manager.
9. Temperature rating of sprinkler heads shall be 68 °C for conditioned areas and 75 °C for non-conditioned areas or as specifically mentioned in the areas.
10. False ceiling voids greater than 800 mm are to be provided.

11. The deflector of suitable design shall be fitted to give even distribution of water over the area commanded by the sprinkler.
12. Sprinkler temperature shall match with table indicated on legend drawings.
13. Sprinkler heads shall be provided at appropriate spacing to cover 12 sq.m. per sprinkler head .
14. Spacing's shall be in conformity with the drawings and properly co-coordinated with electrical fixtures and air-conditioning ducts, diffusers and grills and other ceiling services.
15. Detailed shop drawings for sprinkler system shall be prepared and submitted to the Employer's Representative for approval before starting the work.
16. Sprinkler head shall be of type and make approved by the Employer's Representative.
17. The inlet shall be screwed for 15mm dia. as specified. The sprinkler head shall have CFO/TAC/ FOC/ UL approval or listing.
18. Supply 2% spare sprinkler heads and one spanner (not separately payable), neatly installed in a wooden cabinet with glass shutters as approved by the Employer's Representative.

F. FLEXIBLE SPRINKLER DROPS

1. UL Listed, corrugated stainless steel flexible drops made from AISI 304 and AISI 316L with high tensile strength shall be used in architecturally sensitive areas, all suspended ceiling areas, and most congested areas to fix sprinkler at designated place.
2. It shall be complete with snap clamp type end brackets as Manufacturer's product and
3. part of flexible drops.
4. The flexible shall be corrugated type, wrapped with AISI 304 wire of high tensile strength.
5. The technical specifications shall be as follows:

a.	Minimum bending radius	76mm
b.	Maximum working pressure	200 psi
c.	Test pressure	1000 psi (Bursting)
d.	Connection	Branch line-25mm NPT
e.	Sprinkler	1/2 or ¾ NPT
f.	Lengths	0.6, 0.8, 0.9,1.2,1.5 & 1.9 meters
g.	Temperature Rating	300°F

G. Installation Control Valve:

1. Installation Control Valve for sprinkler system shall consist of a vertical alarm valve complete with 50mm dia. drain and 15mm test valve with a provision to install water operated turbine alarm.
2. A Cast Iron Butterfly Valves shall be provided on upstream of alarm valve.
3. The Butterfly Valve shall be strictly as mentioned above.
4. One water operated turbine alarm motor with gong shall be provided for each sprinkler installation control valve on the sprinkler main.

5. The alarm shall operate and sound a gong on the drop of pressure and flow of water in the mains.
6. Turbine alarm shall be approved by the Employer's Representative and installed at approved locations. The alarm shall be provided with suitable test cock. Both alarm valve and turbine alarm must have CFO/TAC/FOC approval/ listing.
7. Installation control valve shall be measured by numbers and shall include upstream C.I. Butterfly Valve, Alarm Valve, Alarm Motor and Gong, Drain Valve, Test Valve, Drain Piping and all fittings including 2 Nos. pressure gauges required to complete the work.

H. Inspection And Test Valve Assembly

1. Inspection and testing of the automatic starting of the sprinkler system shall be done by providing an assembly consisting of gunmetal valves, gunmetal sight glass, bye-pass valve and orifice assembly as per approved drawing.

I. Flow Switch

1. Flow switch shall have a paddle made of flexible and sturdy material of the width to fit within the pipe bore.
2. The terminal box shall be mounted over the paddle/ pipe through a connecting socket.
3. The Switch shall be potential free in either NO or NC position as required.
4. The switch shall be able to trip and make / break contact on the operation of a single sprinkler head.
5. The terminal box shall have connections for wiring to the Annunciation Panel.
6. The flow switch shall have connections for wiring the seat shall be of S.S to the Annunciation Panel.
7. The flow switch shall have IP: 55 protections.
8. The flow switch triggering threshold bandwidth shall work at test orifice K = 5.6
9. GPM / (PSI)1/2. Further, it shall have a 'Retard' to compensate for line leakage or intermitted flows.

J. Alarm valve

1. Alarm Valve is a double seated clapper check valve with grooved seat design, which ensures positive water flow for alarm operation and is designed for installation in wet pipe sprinkler system.
2. External bypass prevents false alarm under all supply pressure condition. In the event of variable pressure condition, false alarms are prevented with the provision of retard chamber, thus the design allows for installation under both variable and constant supply pressure condition.
3. The valve shall have Housing of Cast Iron, Seat of Bronze, Clapper of Bronze, Seat of Neoprene rubber.
4. Following specification is expected:
5. Maximum service pressure: To suit the system working pressure.
6. Threaded opening: NPT
7. Mounting: vertical
8. Flange connection: IS:1538

9. Factory hydrostatic test pressure: 1.5 times the system working pressure.

K. Valve Supervisory Switch:

Provide at each valve in main and riser piping. Mount switch on valve and arrange to detect abnormal open or closed position of valve. This includes necessary wiring and conduiting up to fire command centre.

L. The Main Stop Valve

These shall be of cast iron body of requisite size. When closed, these will shut off supply of water to the installation.

A location plate must be fixed on the outside or an external wall, as near to the main stop valve as possible, bearing the following words on raised letters or other approved type letter.

1. Sprinkler Stop Valve Inside: The word `sprinkler stop valve' shall be in letters of at least 35mm and the word "INSIDE" at least25mm in height. The words shall be painted white on black back ground.
2. All stop valves shall be right handed i.e. they shall be so constructed that in order to shut the valve the spindle shall turn from left to right. There shall be an indicator which will show whether the valve is open or shut.

M. Pipes For Drainage

1. Sprinkler pipes shall be so installed that the system can be thoroughly drained. As far as possible all pipes shall be arranged to drain to the installation drain valve as shown in the drawing for ordinary hazard system.
2. In the case of basement & other areas where sprinkler pipe-work is below the installation drain valve & in other trapped points in the system, Gate valves of the following dia shall be provided:

   a. 20 mm valves for pipes upto 50 mm dia
   b. 25 mm valves for pipes upto 80 mm dia
   c. 50 mm valves for pipes larger than 80 mm dia

N. Pressure reducing Station

1. Valves shall maintain a constant downstream pressure regardless of fluctuations in demand and shall also prevent a pressure rise when demand is zero. Valve shall be suitable for horizontal or vertical installation.
2. No separate chambers shall be allowed between the main valve cover and body. Valve body and cover shall be of cast material. Ductile Iron is standard and other materials shall be available.
3. The valve shall contain a resilient, synthetic rubber disc, with a rectangular cross-Section contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat insert. No O-ring type discs (circular, square, or quad type) shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks. It must have straight edge sides and a radius at the top edge to prevent excessive diaphragm wear

as the diaphragm flexes across this surface. No hourglass-shaped disc retainers shall be permitted and no V-type or slotted type disc guides shall be used.

4. The diaphragm assembly containing a non-magnetic 303 stainless steel stem of Sufficient diameter to withstand high hydraulic pressures, shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. The seat shall be a solid, one-piece design and shall have a minimum of a five-degree taper on the seating surface for a positive, drip-tight shut off. No center guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.

5. The flexible, non-wicking, FDA approved diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber grommet sealing the center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully opened or fully closed position.

6. The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat in 6" and smaller size valves shall be threaded into the cover and body. Valve seat in 8" and larger size valves shall be retained by flat head machine screws for ease of maintenance. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to the flow on all sides to avoid deposits. To insure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No "pinned" covers to the valve body shall be permitted. Cover bearing, disc retainer, and seat shall be made of the same material. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted and components including cast material shall be of approved manufacture.

7. The valve manufacturer shall warrant the valve to be free of defects in material and workmanship for a period of three years from date of shipment, provided the valve is installed and used in accordance with all applicable instructions.

8. The valve manufacturer shall be able to supply a complete line of equipment from 1 1/4" through 24" sizes and a complete selection of complementary equipment. The valve manufacturer shall also provide a computerized cavitations chart which show flow rate, differential pressure, percentage of valve opening, Cv factor, system velocity, and if there will be cavitations damage.

9. Valves shall be single-seated, hydraulically - operated. Valve body and cover shall be cast iron, Class 150, flanged. Trim shall be bronze. Valve seat shall be replaceable. There shall be no external packing glands.

10. Valves shall have integral low flow by-pass line.

11. Main valve and all trim shall be factory- assembled into one unit.

12. PRV shall be complete with station with isolation valve, pressure gauge before after PRV along with bypass line with stand by PRV and isolation valves, pressure gauge before and after PRV

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION AND TESTING OF FIRE PROTECTION SYSTEM

INSTALLATION GENERAL (SPRINKLER, IN APPICABLE)

A. Scope of work under this section comprises of furnishing all equipment, appliances, material, and labor necessary and required to install Automatic Sprinkler System as required by the drawings, specified herein or as given in the bill of quantities.

B. Without restricting to the generality of foregoing, the sprinkler system shall include the following:

1. Galvanized iron Class C (heavy class) main sprinkler distribution piping complete with welded, forged steel fittings, grooved, flanges, supports, hangers all required accessories and appurtenances.
2. Sprinkler heads shall be located in positions shown on the drawings. While slight relocation may result from building construction features or interference from other services, the maximum spacing between sprinkler heads and coverage area shall not exceed those stipulated in the Indian Standards regulations and the NFPA 13-Latest Edition Rules.
3. Allowance shall be made for such relocations within a radius of 1500 mm of the indicated positions without additional cost.
4. The Fire Protection Services Trade shall co-ordinate with the ceiling Trade to set out the sprinkler locations to suit the site location of the unit grid. In general, all sprinklers shall be located at the centre of the ceiling unit and a provision of about 10% more sprinklers and pipe work than required in Fire NOC / NFPA Rules shall be included in this sub-contract
5. Chrome plated wire mesh guards shall be used to protect the sprinkler heads which are liable to accidental or mechanical (at no extra cost) damage.
6. Installation control valves drain valve, test valve and all connecting pipes and fittings.
7. Sprinkler heads, nozzles and spare sprinklers.
8. Connections to risers, pumps and appliances.
9. Sprinklers Pump, Jockey Pump, Booster pump Motors, Control Panels, Air Vessels, Cabling, Instruments and accessories, as specified.
10. Sprinkler Lines for each floor shall be left with complete sprinkler drain arrangement with blanked flange.
11. No jute will be allowed in threaded joints.
12. If header piping is less than 50mm then shoe joints is to be provided.

3.2 JOINTING

A. Welded Joints: Joints of G.I. pipe of size 50 mm and above shall be butt welded or flanged. Joints of G.I. pipes less than 50 mm dia. shall be with conventional heavy class screwed pipe and fittings. Joints between G.I. pipes and fittings shall be made with the pipes and fittings having “V” groove and welded with electrical resistance welding in an approved manner. But welding without “V” groove shall not be permitted. All joints in the pipeline with screwed fittings shall be seal welded after testing and the weld plus the adjoining portion shall be given two coats of zinc rich primer.

B. Flanged joints (50mm dia and above). All flanges shall conform to IS: 6392-2003 Table 17 as applicable. Flanged joint shall be made with 3 mm thick insertion rubber washer/ gaskets, bolts and nuts conforming to IS: 1367 (Galvanized). Straight runs at intervals not exceeding 25-30m on pipe lines of 50 mm dia and above and as directed by the Employer's Representative. For jointing all types of valves, appurtenances, pumps, connections with other type of pipes, to water tanks and other places necessary and as required for good engineering practice and as shown/noted on the drawings. Flanges shall be with GI bolts and nuts and 3mm insertion gasket of natural rubber conforming to IS: 11149.

1. Unions (up to 50 mm dia): Approved type of dismountable unions shall be provided on pipe lines of 40 mm dia and smaller dia, in locations similar to those specified for flanges.
2. Grooved flexible couplings and fittings of approved manufacturer shall be provided for all risers piping.

3.3 GENERAL WELDING REQUIREMENTS.

A. All welding shall be generally in accordance with B.S. 4515: 1965 (Specification for field welding of Carbon steel pipelines.) This will be modified where appropriate for other materials and may be relaxed or varied by order of the Employer's Representative, provided there is a reasonable request for an alternate.

B. Tack welds shall be performed by fully qualified welders and all tack welds shall be of a length equal to twice the pipe thickness and shall fully penetrate the pipe walls.

C. Where welding is carried out in the proximity of inflammable materials special precautions shall be taken to prevent risk of fire or other damage to the building fabric.

D. Where oxyacetylene cutting equipment or any welding plant is being used by an operative for any of the works defined in the contract documents, then fire extinguishers shall be

E. supplied and carried as part of the equipment. The operators of cutting and welding equipment shall be trained in the use of the fire extinguishers which they carry and all extinguishers shall be fully charged and ready for use. In all cases, extinguishers shall be positioned immediately adjacent to the position where cutting and welding is being carried out and shall be readily accessible for use in the event of an emergency.

F. All accommodation, benches, tools, welding plant, acetylene, oxygen or electricity, filler rods and electrodes, which are necessary for installations where welding is required shall be provided as part of this contract.

G. Welding shall not be done at a temperature of 5 degrees Centigrade or below unless the parent metal is preheated by torches or other approved means until it is warm to the hand (about 27 degrees C) for about 150mm either side of the joint. No welding shall be done below minus 18 degrees C. After preheating, the heated portion including the welded joints shall be covered with muffs or suitable insulation materials to allow cooling free from draughts. Any open ends of the pipe or assembly shall be effectively sealed to prevent heat flow by convection

H. All welded pipe assemblies shall be constructed so that individual welded joints do not affect each other. The distance between the centres of adjacent welds shall be not less than twice the bore diameter of the pipe.

I. No welded joints shall be left partially completed. Any joints tacked in position must be promptly finished within the working day. The Employer's Representative will reject all work not done in accordance with this instruction.

J. Where work is rejected, pipes must be machine cut at least 150 mm either side of rejected welds and proper weld preparation must be used on the shortened sector. Where shorter fill-in sections are required because of such rejection and reworking, then new full sized lengths must be supplied.

K. Where pipes with longitudinal seams are specified, pipe seams shall be arranged such that adjacent seams are opposed 45 deg. from each side of top dead centre and branches shall be made only with weldable fittings.

L. All filler metals which are coated shall be protected from excessive moisture changes. Filler materials or flexes which show any sign of deterioration shall not be used. If requested by the Employer's Representative samples of filler rods to be used shall be submitted to him for approval before any work is done on site. These may be submitted, without additional cost, to an independent testing laboratory for verification.

3.4 TESTS FOR WELDER QUALIFICATION

A. The purpose of the welder's qualification tests is to determine the ability of the welders to make sound and acceptable welds. Before any site welding on the contract is allowed, each proposed welder shall carry out the tests required in the presence of the certifying agency.

B. Any weld test specimens which have been suitably marked and approved shall be kept on site by a responsible person, so that they can be produced at any time, at the request of the Employer's Representative.

C. All accommodation, benches, tools, welding plant, acetylene, oxygen, electricity, test pieces, filler rods, electrodes, facilities for cutting and grinding, polishing, bending and examining, which are necessary for welders qualification tests shall be provided. In the absence of any facilities for inspecting the welds, the Employer's Representative may submit the finished samples to an independent laboratory for testing at no additional cost

D. Under no circumstances shall a welder be employed on the contract, either on or off the site for welding operations other than those for which that welder is qualified.

E. Copies and records of all test reports shall be promptly given to and kept by the Employer's Representative.

F. Even welders holding a certificate for welding are to be tested at this job site in full accordance with the specifications.

3.5 TESTING OF WELDED PIPE WORK INSTALLATION

A. Testing of welded pipe work installation shall be by nondestructive test method.

B. If a weld fails the testing requirements, then two additional welds made by the same operative shall be tested, at no cost to the contract. If both additional welds are successful then, in the case of destructive testing, the cost of making good shall be at no cost to the contract.

C. If either of the two additional welds fails the test requirements, then further tests on other or all of the welds made by that operative shall be carried out, at the Employer's Representative's discretion. All costs resulting from either of the two additional welds failing the test requirements shall be at no cost to the Contract.

D. If either of the two additional welds fails, then the operative concerned shall not make any further welds on any service unless approved by the Employer's Representative. The detailed requirements concerning testing shall be as follows:

E. Non-destructive testing (Die penetration testing) shall be carried out by a specialist company approved by the Employer's Representative, at no additional cost.

3.6 WRAPPING PYPKOTE / COATEK

A. Surface Preparation - The pipe surface shall be cleaned by a wire brush.

B. Application of Primer - Primer is to be applied on pipes immediately after cleaning. This is to prevent any further accumulation of rust on the pipe. This is a cold applied primer and is applied by brush.

C. Application of Bitumanistic 4 mm Tape - After the primer is applied on the pipe, it is allowed to dry for about 30 min. till it becomes touch dry. Before adhering the tape to the pipe, it is advisable to gently heat the primer coated pipe by a run of LPG torch. Remove the bottom polyethylene from the tape & then heat bottom surface of the tape by LPG torch or any heat source & start wrapping the tape to the pipe by heating the primer coated pipe & by removing the bottom polyethylene from the tape before wrapping better adhesion between the tape & pipe is obtained. Overlaps are maintained with a minimum of 15.0 mm.

D. Tape coating of weld joints - The tape is applied over the weld joints after the necessary welding & testing methods of the joints is completed. The procedure for application of tape shall be the same as bare pipe procedure. Overlaps on each side of the weld joints shall be 50 mm.

E. A final coat of White wash with water based cement paint is done immediately over the entire coated pipe.

3.7 EXCAVATION

A. Excavation for underground pipe lines shall be as required at site. Pipe lines shall be buried to a minimum depth of 1000 mm. The type of soil to be considered is soft soil.

B. Wherever required, support all trenches of adjoining structures with adequate timber supports.

C. On completion of testing and coating & wrapping trenches shall be refilled and compacted with excavated earth in 15 cms. Layers and consolidated to restore ground condition to original status. Prior to excavation ensure that no adjoining structure or pipeline is affected / damaged.

3.8 PAINTING

A. All Hydrant and Sprinkler pipes shall be painted with post office red color paint. All G.I pipes shall first be cleaned thoroughly before application of primer coat. After application of primer coat two coats of enamel paint shall be applied. Each coat shall be given minimum 24 hours drying time. No thinners shall be used. Wherever required all pipe headers shall be worded indicating the direction of the pipe and its purpose such as "TO RISER NO.1" etc.

B. Painting shall be expertly applied; the paint shall not over run on surfaces not requiring painting such as walls, surfaces etc. Nuts and bolts shall be painted black, while valves shall be painted blue.

3.9 MAINTENANCE

A. General

1. Provide the following free maintenance for a period of twenty four (12) months after handing over the Fire Protection System to client (i.e. during warranty period)
2. Examinations: Bi-Weekly, including adjustments, cleaning and lubrication of equipment.
3. Replacement: Replace components when required, using parts produced by original manufacturer.
4. Spare Parts: Provide necessary spare parts; maintain locally an inventory of all wearing parts of the system.
5. Call Backs: Provide 24-hour emergency call back service at no expense to Owner.
6. Records: Maintain complete maintenance records including check charts, lubrication logs and activity logs; provide check charts and activity logs.

B. Extended Service Contract

1. At time of Bid, submit cost for full maintenance contract i.e. after the expiry of 12 month warrantee and free maintenance period.
2. Service: Provide examinations, logs, replacements and spare parts as specified for maintenance, including cleaning of tanks, equipment and machinery spaces required to maintain the water output quality and quantity as per design.

END OF SECTION 21 1313