Gujarat University

TECHNICAL SPECIFICATIONS

FIRE FIGHTING WORK

Tender No: GU/ESTATE/CDMHFC/2019-20/04

TENDER DOCUMENT
FOR
RENOVATION, RETROFITTING, UPGRADATION OF MOBILE & IT, CANTEEN, DAY CARE AND DEVELOPMENT OF DISABLE FRIENDLY CAMPUS PROCUREMENT AND INSTALLATION OF CAMPUS SIGNAGES AT GUJARAT UNIVERSITY.

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SECTION A – TECHNICAL SPECIFICATION Firefighting and alarm System and Plumbing System at Gujarat university

1. General

a) This section specifies the manufacture, installation and material requirements of pipe work Systems. Areas of commonality to all pipe work systems are described first, followed by the specific requirements for particular pipe work materials and applications.
b) Standards
c) Relevant Codes and Standards

2. Common Standards

a) ANSI B16.9: Factory-Made Wrought Steel Butt welding Fittings
b) ANSI B16.21: Nonmetallic Gaskets for Pipe Flanges
c) ANSI B16.1: Cast Iron Pipe Flanges and Flanged Fittings
d) ANSI B16.5: Pipe Flanges and Flanged Fittings

3. Standards for Plumbing Pipe work

a) IS:554 Dimensions for pipe threads where pressure tight joints are required on the threads.
b) IS:782 Specification for caulking lead.
c) IS:800 Code of Practice for general construction in steel.
d) IS:1367 Technical Supply conditions for threaded steel fasteners: (Part I) Introduction and general information.
e) IS:1367 Technical supply conditions for threaded steel fasteners: (Part 2) Product grades and tolerance
f) IS:3114 Code of practice for laying of cast iron pipes (Pipe work)
g) IS:4111 Code of practice for ancillary structures in sewerage system: (Part-I) Manholes.
h) IS:5329 Code of practice for sanitary pipe work above ground for Buildings.
i) IS:12251 Code of Practice for drainage of building basements.
j) BS:6700 Specification for design, installation, testing and maintenance of Services, Supplying water for domestic use within buildings and their cartilages.
k) BS:8301 Code of practice for building drainage.
l) IS:458 Specification for precast concrete pipes (with and without reinforcement)
m) IS:1239 Mild steel tubes, tubular and other wrought steel fittings: (Part 1) Mild steel tubes
n) IS:1239 Mild steel tubes, tubular and other wrought steel fittings: (Part 2) Mild steel tubular and other wrought steel pipe fittings.
o) IS:1536 Centrifugally cast (spun) iron pressure pipes for water, gas and sewage
p) IS:1537 Vertically cast iron pressure pipes for water, gas and sewage
q) IS:1538 Cast iron fittings for pressure pipes for water, gas and sewage
r) IS:1879 Malleable cast iron pipe fittings
s) IS:3468 Pipe nuts
t) IS:4.0889 Steel pipes for water and sewerage (168.3 mm to 2540 mm outside diameter)
u) IS: 3989 centrifugally cast (Spun) iron spigot and socket soils waste and ventilating pipes, fittings and accessories.
v) IS:14333 High Density Polyethylene pipes for sewerage pipes

4. TECHNICAL AND INSTALLATION REQUIREMENTS

a) Installation- General

(i) Design and construction of pipelines shall be in accordance with relevant British, Indian and other standards, as specified. Water pipes, soil and waste pipes below 50mm shall be of galvanized pipes

(ii) The installation shall be neat and tidy, with accurate spacing between pipes, valves and joints, whether running in straight routes or turning through bends.

(iii) Particular care shall be taken that all pipe work is erected and secured truly parallel with the building structure, clear of obstructions, preserving headroom and keeping passageways clear and that all vertical drops are plumb.

(iv) No bends or curves in any pipe shall be made so as to diminish the waterway or alter the internal diameter of the pipe.

(v) Wherever possible, horizontal pipes shall be fixed to 'fall' to aid venting and draining down of the pipe work. Eccentric reducing sockets shall be used on horizontal runs of pipe to prevent the formation of air pockets. On vertical pipes, concentric reducing sockets shall be used.

(vi) Drain outlets shall be provided at all low points of the system to enable emptying and to facilitate maintenance of the pipe work.

(vii) Automatic or manual air vents shall be placed at each high point of each water line and discharge pipe shall be terminated at 50 mm above floor drain.

(viii) All pipes shall be fitted clear of the floor to permit cleaning beneath the pipes. Where possible, a 125 mm clearance shall be provided between the underside of the pipe and the finished level of the floor and in no case shall the pipe be less than 100 mm clear of the floor.

(ix) All pipe runs when not buried underground shall be concealed as far as possible by careful positioning or shall be chased into walls, or laid in screeds except inside plant rooms. All pipes which are to be concealed shall be tested and Approved before being covered.

(x) All pipes passing through the roof shall be provided with at least 2.00 mm lead flashing sandwiched between the layers of waterproofing roofing membrane, and secured to the pipe with a galvanized spring clip.

(xi) Pipe work shall rest freely upon supports and be carefully aligned prior to final connection.

(xii) The Engineer reserves the right to reject any material deemed to be unsuitable for installation and such material shall be removed from the Site and be replaced with approved material by the contractor at his own cost.

(xiii) Site welding shall be applied with pipe work unrestrained and each joint hydraulically tested at 1.5 times working pressure plus 4.080 kPa for 60 minutes without loss of pressure

(xiv) Followed by application of appropriate protective coating, both internally and externally, prior to final installation.

(xv) Following the welding and hydro testing the complete Fire Protection Piping System shall be wire brushed and applied with two coats of red oxide primer and then painted with 2 coats of Post office Red enamel paint. The fittings will have wall thickness not less than those of the pipes.

b) Cleaning Procedures

(i) Precautions shall be taken to avoid introducing foreign matter such as welding beads and slag or dirt into the piping system. Completed welds shall be hammered to loosen debris. Prior to assembly, all piping, valves and fittings shall be internally cleaned of oil, grease and dirt by wire brush and swabs.

(ii) Following fabrication and installation, all piping of 150 mm and smaller shall be cleaned by flushing with clean water, run to waste, until thoroughly free of all dirt, oil etc. Generally, each size of pipe shall be flushed separately before being joined with larger size piping.

(iii) Piping of 200 mm and larger shall be cleaned by pulling through a steel brush for the entire length of each pipe size, followed by fibre brush or swabs. Brushes and swabs shall be slightly larger than the inside diameter of pipe being cleaned.

(iv) All cleaning operations shall be continuous throughout the piping system, except at joints required for final jointing of various sections of cleaned piping. After cleaning and until final joints are made, the end of sections of piping shall be tightly sealed off to prevent any dirt, water and other foreign matter from entering the pipes.

c) Gaskets

(i) Gaskets shall be suitable for the temperature, service and pressure of the system and shall be, installed in accordance with the manufacturer's recommendations. Made up flanged joints shall be fabricated from one-piece ring gaskets, 3 mm thick, neoprene rubber.

(ii) For flanged joints between dissimilar metals or insulating flange joints; insulating gaskets, sleeves and washers between flanges, bolts and nuts respectively shall be used. Insulating material shall be "Teflon" or approved equivalent material.

(iii) Joint rings and gaskets shall comply with the requirements of BS 7874 but other materials may be used if they have been proved to be more suitable for their duty as recommended by the manufacturer, and approved by the Engineer.

d) Jointing-Particular

(i) Where flanged joints are required for jointing galvanized steel pipes, galvanized steel screwed boss flanges complying with IS: 6392 shall be used.

(ii) Screw joints shall be made with tapered threads properly cut. Joints shall be made tight with a stiff mixture of litharge and glycerin, or poly tetra fluoro ethylene tape, or other Approved thread joint compound applied to the male threads only. Not more than three threads shall show after the joint is made up.

(iii) Welded joints shall be fusion-weld in accordance with ANSI B 31.1, unless otherwise stated. Welded fittings shall be used when changing direction of piping. Mitering or notching pipe to form elbows and tees or other similar construction will not be permitted.

(iv) Branch connections shall be made with welding tees or forged welding branch outlets.

(v) Site and shop bevels shall be in accordance with the recognized standards and shall be carried out by mechanical means or flame cutting. Where work is carried out by flame cutting, the metal surfaces shall be cleaned of scale and oxidation prior to welding.

(vi) Before welding, the component parts to be welded shall be aligned so that no strain is placed on the weld when finally positioned. Align the height so that no part of the pipe wall is offset by more than 20 % of the wall thickness. Flanges and branches shall be set true.

(vii) Alignment shall be preserved during the welding operation.

(viii) All defective welds shall be removed and replaced at no additional cost to the Employer. Repairing of defective welds by adding new material over the defective welds or by peeling will not be permitted.

(ix) Electrodes shall be stored in a dry area and kept free of moisture or dampness. During fabrication operations the electrodes shall be stored in a heated container. Electrodes that have lost part of their coating shall not be used.

(x) Flanges and unions shall be faced true. Flanges with Approved gaskets shall be provided and made square and tight. Union or flange joints shall be provided in each line immediately preceding the connection to each place of equipment or material requiring maintenance such as pumps, control valves, and other similar items. Gaskets shall conform to ANSI B16.21 and ASTM D 2000.

(xi) Flanges

(xii) Welded piping: Steel, welding neck pattern, 150 (104.08 kPa) or 300 (2070 kPa) WSP class, complying with ASME B-16.5, ASTM A 181 Grade 1, or BS 4504 shall be used.

(xiii) Screwed piping; Flanges and flanged fittings on screwed and wrought iron piping shall be cast iron, standard weight, complying with ASME B-16.1.

e) Supports General

(i) Unless otherwise specified or indicated, all brackets, stays, frames, fixed and roller supports and hangers necessary to carry and support all pipes and valves shall be provided.

(ii) Structural steel required for proper installation shall be provided. All pipe supports shall be steel, adjustable for height and hot dipped galvanized.

(iii) Supports shall only be attached to structural framing members. Where supports are required between structural framing members, a suitable intermediate metal framing shall be provided.

(iv) Piping shall be supported independently from all equipment so that equipment is not stressed by the weight of the pipe or expansion.

(v) Valves or other heavy items of pipe work equipment shall be fitted as near as practicable to a point of support, or fitted with their own supports.

(vi) Hangers, supports, guides and anchors shall be designed to allow expansion and contraction within stress limits of codes for pressure piping in accordance with Section 1 on Power Piping of ANSI B

(vii) Supports shall be located to ensure that pipe work branches of fittings are not restrained by the support during expansion or contraction of the pipe work service.

(viii) Contact of dissimilar materials shall be avoided. Steel piping shall have steel supporting member actually in contact with the pipe. Pipes shall be supported on either side of changes of direction and pipeline mounted equipment.

(ix) Vertical piping shall be guided or supported in the centre of each riser with Approved brackets to prevent swaying, sagging, vibration and resonance. Strain that causes lines to shake or buckle between supports or anchors shall be avoided.

(x) Where piping is subject to a vertical movement due to thermal expansion of 3 mm or more, hangers shall be of variable spring design. Variation of hanger force during operation shall range between 85 % and 120 % of the actual load.

(xi) Pipes fixed to walls or floors both vertically and horizontally shall be supported by bracket fixed to walls or supported from the floor. All pipes in ducts shall rest on rollers and chairs, or hangers and be suitably arranged and supported to allow for expansion and contraction. All supports shall be fixed so that the full thickness of lagging can be applied in all places.

(xii) Pipe work supports and hangers shall be in accordance to relevant IS codes. Details of all supports, hangers and accessories shall be submitted for approval before installation.

(xiii) In general, all supports, hangers, anchors and fixing accessories shall be hot-dipped galvanized.

(xiv) Design of the hangers shall be compatible with pipe or tubing to be supported.

(xv) The supports shall be of sound construction and shall be adequate for the weight to be carried and shall permit free expansion and good appearance and also permit piping runs to be readily dismantled where appropriate.

(xvi) Generally supports shall be equally spaced. Unless otherwise specified, pipe supports shall be provided at intervals in accordance with the following table:

(a) Steel Pipe (Black or galvanized)

Size of pipe (mm.)	**Maximum Interval for Vertical Run (m.)**	**Maximum Interval for Horizontal Run (m.)**
15	2.5	1.8
20-25	3.0	2.4
32	3.0	2.7
40-50	3.6	3.0
65-80	4.5	3.6
100	4.5	4

150 and above	55	4.5

(b) Ductile Iron Pipe

Size of pipe (mm.)	Maximum Interval for Vertical Run (m.)	Maximum Interval for Horizontal Run (m.)
All	3.0	1.75

Also for each length of pipe minimum 2 supports should be provided.

f) Hanger Rods

(i) Hanger rods of steel, threaded and fitted with two removable nuts at each end for positioning rod and hanger and locking each in place shall be provided

(ii) Unless otherwise specified, hanger rods shall be of the following sizes :

Size of Pipe(mm.)	Single Rod Dia. (mm)	Double Rod Dia.(mm)
15 to 50, Inclusive	10	10
65 and 80	13	10
100 and 125	15	13
150	20	15
200,250 and 300	22	20

(iii) Secure hangers from metallic inserts cast into concrete. When these inserts are not available, attachment by anchor bolts to be placed with fast setting high strength grout shall be used.

(iv) Hanger shall be placed close to the point of change of direction of a pipe in either a horizontal or vertical plane.

(v) Supports and hangers for galvanized iron pipe shall be placed as close as possible to joints. When hangers or supports are not within 300mm or a branch line fitting, additional hangers or supports shall be provided at the fitting.

g) Protective Coatings and Linings

(i) For buried pipes complying with BS EN 598, / IS10211 bituminous coating against corrosion shall be provided for the pipes .

(ii) Pipes and fittings shall be coated by either dipping in a bath containing a composition having a tar base or dipping in a bath containing a cold solution consisting of a mixture of natural bitumen with a suitable hardener and natural asphalt.

(iii) The external surface of all pipes and fittings for surface water pumping systems, including pipes and fittings shall be coated with a bituminous compound.

h) Pipe Materials for Fire Fighting & Suppression Systems

The following pipe work material shall be used for systems listed below:

SYSTEM	DIAMETER OF PIPE (mm)	PIPE WORK MATERIALS	
Hose Reel Pipes	25mm	Mild Steel to IS 1239 Class C (For all size)	**Or** GI Pipes of Class C (Heavy Class) ISI marked and of approved make hot dip galvanized to Grade 1 of IS: 4736-1968, including accessories such as MS bracket, U Clamps with Anchor fasteners, hot dipped tees/elbows/reducers/couplings/unions/ bends/ flanges etc. & laying on the surface including painting with two coats of anti- corrosive
Wet Main Pipe	Up to 200mm	Mild Steel to IS 1239 Class C (For all size)	

Sprinkler Pipe	25mm – 200mm dia	Mild Steel Class C to IS 1239	primer, two coats of approved red enamel paint after laying & testing to 13.5 Kg/sq.cm hydraulic pressure after installation etc. as per specifications complete as required
Clean Gas Piping	Downstream of pressure reducer	Carbon Steel Pipes A106 Grade – B Schedule 40	
	Upstream of pressure reducer	Carbon Steel Pipes A106 Grade – B Schedule 40	
Underground Pipes	All Size	Ductile Iron Cement Lined BS EN 545 Class K12	

(i) Pipe joints for fire system

(ii) For steel pipe work all joints up to and including 50mm diameter shall be made by means of screwed socket connections. Pipes above 50mm diameter shall be joined by means of mechanical groove coupling.

(iii) All pipe works within pump rooms shall be of flanged joints or mechanical groove coupling only. Joints shall not be closer than 3000mm except where necessitated by fittings. Flanges shall be

wrought iron or annealed steel, machined full face, suitable for the working pressures to which they will be subjected. Flanges shall conform to the relevant ANSI Standard and pressure rating.

i) Gaseous Suppression Pipe Work

(i) Gaseous suppression pipe work shall be threaded to satisfy relevant ASTM requirements as per table above. Piping shall be of non-combustible material having physical and chemical characteristics such that its integrity under stress can be predicted with reliability. The thickness of the pipe wall shall be calculated in accordance with the relevant standard.

(ii) Flexible tubing or hoses (including connections) shall be of approved materials and shall be suitable for service at the anticipated extinguishing pressure and maximum and minimum temperatures

5. Piping Ancillaries General

a) This Section specifies the manufacture and installation requirements for gate valves, check valves, butterfly valves, motorized valves, gauge cocks, automatic air valves, strainers, stopcocks, pressure reducing valves, ball float valves, safety and pressure relief valves, pressure gauges, pipe sleeves, expansion loops, expansion joints, pipe anchors, gaskets for pipe separation and water closet connector.

b) All valves, taps and cocks shall be of the types and working pressures suitable for the systems to which they are connected and shall be approved by the Engineer. Valves shall be rated to withstand the system hydraulic test pressure.

c) Brass, bronze or cast iron valves shall generally be of 16 bar working pressure rating type. In addition, all valves at discharge side of transfer water pumps shall be of minimum 16 bar pressure rating.

d) Where valves are provided at the discharge side of 2 or more pumps, each valve shall be so selected to withstand effectively the anticipated system pressure under the worst case scenario.

e) All valves shall comply with Indian Standards and where I.S not available, refer British Standards in respect of tests and working pressures, dimensions and materials of construction.

f) Wheel head valves shall be arranged for clockwise operation of the handle to close the valve.

g) Screwed valves shall have taper threads to BS 21. Flanged valves shall have dimensions and bolting in accordance with BS 4504: 3.1.

h) Connections shall be made between each valve and the adjoining pipe work or equipment with flanges for 65mm size pipe work and above. Flanges shall be selected to suit working pressure and temperature.

i) Screwed connections shall be made between each valve and the adjoining pipe work or equipment for 50 mm size pipe work and below. A union shall be fitted on each side of all screwed valves.

j) All valves shall be suitably located in accessible positions for operation and maintenance purposes.

k) All drain outlets and manual air vents shall have connection pipes leading to the nearest drain.

l) Valve packing shall be suitable for the service intended. Valve packing consisting of asbestos or asbestos based materials shall not be used.

m) Inverted mounting of valves shall not be permitted without prior approval of Engineer in-charge.

n) All valves provided for manual operation shall have a hand wheel or other suitable device which shall be fixed to the valve. Hand wheels shall be rotated clock-wise to close the valves and shall be clearly marked with the words "OPEN" and "CLOSE" and arrows pointing in the appropriate directions. The rims of hand wheels shall be machined to a smooth finish.

o) Valves of identical make, size, type and duty shall be fully interchangeable.

6. Standards

Relevant Codes and Standards:

(i) BS 21: Pipe Threads for Tubes and Fittings where Pressure-Tight Joints are made on the Threads (Metric Dimensions)
(ii) BS 1010: Draw off Taps and Stop valves for Water Services (Screw down Pattern)
(iii) BS 1212: Float Operated Valves (Excluding Floats)
(iv) BS 2456: Floats (Plastics) for Floated Operated Valves for Cold Water Services
(v) BS 5150: Cast Iron Gate Valves / Sluice valve
(vi) BS EN 13789:2002: Cast Iron Globe and Globe Stop and Check Valves for General purposes.
(vii) BS 5154: Copper Alloy Globe ,Globe Stop and Check, Check and Gate Valves
(viii) BS 5155: Butterfly Valves
(ix) BS 2879: Draining Traps (Screw Down Pattern)
(x) BS 4504: Circular Flanges for Pipes, Valves and Fittings (PN Designated)
(xi) BS 5163: Predominantly Key – Operated Cast Iron Gate Valves for Water Work purposes.
(xii) BS EN 1982: Copper and Copper alloy ingots and casting.
(xiii) API-594: Double Plate Check Valve

7. Technical Specifications

7.1 Globe Valves

(i) Globe valves generally shall be used on service pipe work as specified.
(ii) Globe valves up to and including 50 mm nominal diameter shall be generally rated, manufactured and tested to BS 5154. Valves over 50 mm nominal diameter shall be to BS EN 13789:2002. Valves shall be of the same nominal bore as the pipe work in which they are installed.
(iii) Bronze bodied valves shall be cast to BS EN 1982. Valves with cast iron bodies shall be made to BS EN 1561. The bodies shall be of an even thickness throughout, clean and free from scale and flaws. Generally, valves up to and including 50 mm nominal bore shall have bronze bodies and valves of 65 mm bore and larger shall have cast iron bodies, though bronze bodied valves may be used at any size.
(iv) Globe valves when used for circuit regulation shall have characterized plug discs. The discs shall be free to rotate, readily removable from the valve stem and renewable. Discs may be manufactured using proprietary composition type materials if approved.
(v) Valves shall have packed stuffing boxes or alternatively shall be fitted with 'O' rings.
(vi) Valves up to and including 50mm nominal bore shall have BS 21 taper screwed ends, valves of 65 mm nominal bore and larger shall have BS 4504:3.1 flanged connections.
(vii) Regulating valves shall be fitted with a lockable indicator on the spindle to show the proportional opening.

7.2 Gate Valves

(i) Gate valves generally shall be used on service pipe work, and shall be fitted a necessary. Valves shall be rated, designed and tested in accordance with BS 5154 for bronze valves and BS 5150 or BS 5163 for those of cast iron manufacture. Valves shall be of non-rising stems and same size as the nominal bore of pipeline in which they are installed.
(ii) Bronze bodied valves shall be cast to BS EN 1982. Valves with cast iron bodies shall be made to BS EN 1561. The bodies shall be of an even thickness throughout, clean and free from scale flaws. Valves up to and including 50 mm nominal bore shall be bronze bodied, 65 mm nominal bore and larger may be bronze or cast iron.

(iii) Valve wedges may be of cast iron, bronze, nickel alloy or stainless steel. Cast iron wedges shall have bronze trim and seating. Slide valves shall be fitted with stainless steel springs. Wedges shall be renewable and free to rotate on the valve spindle.

(iv) Valves shall have packed stuffing boxes, or alternatively shall be fitted with 'O' rings.

(v) Gate valves of 80 mm nominal bore and above for use in water supply system shall be of cast iron body with nickel alloy faces and stainless steel spindle or with nitrite resilient facing wedge gate and aluminum bronze stem and shall be entirely suitable for use with sea water.

(vi) Gate valves shall be tested as follows at the place of manufacture prior to dispatch to site:

Body Test: With both ends closed and the gate in the open position, the body shall be tested to 1.5 times the maximum working pressure for a minimum of 30 minutes. There shall be no visible leakage.

Seat Test: With one end open to the atmosphere and the gate in the closed position, the seat of the valve shall be tested for tightness when 1.5 times the maximum working pressure is applied to the other end of the valve for a minimum of 30 minutes. The seat test shall be carried out in both directions. There shall be no visible leakage past the gate.

7.3 Check Valves

(i) Check Valves shall be installed in the specified locations. Care shall be taken to ensure that the valves provided are suitable for installation in the plant required. In general, double plate check valve conforming to API 594 Specifications shall be used unless otherwise specified. Disc shall be centre guided and operated with stainless steel spring and trim to ensure smooth, positive opening and closing of valves with minimal pressure drop. Check valves shall not be installed in vertical pipes with downward flow.

(ii) Check valves generally shall be of 16 bar nominal pressure rating (working pressure).

(iii) Bronze bodied valves shall be cast to BS EN 1982. Valves with cast iron bodies shall be made to BS EN 1561. The bodies shall be of an even thickness throughout, clean and free from scale and flaws. Valves up to and including 50 mm nominal bore shall be of bronze. Valves on 65 mm nominal bore and larger shall be of cast iron.

(iv) Check valves shall be tested as follows at the place of manufacture prior to dispatch to site:- Body Test

With both ends closed the body shall be tested to 1.5 times the maximum working pressure for a minimum of 30 minutes. The pressure shall be applied to the inlet side of the body. There shall be no visible leakage.

Seat Test

With the inlet open to atmosphere, the seat of the valve shall be tested for tightness when 1.5 times the maximum working pressure is applied to the outlet end of the valve for a minimum of 30 minutes. There shall be no visible leakage.

(v) Inverted mounting of valves shall not be permitted without prior Approval by the Engineer.

(vi) Valves of identical make, size, type and duty shall be fully interchangeable.

7.4 Butterfly Valve

(i) General: 16 Bar tight closing, wafer type, with resilient seats. Provide seats that cover inside surface of body and extend over body ends; or provide O-rings so that the valve body may be bolted and sealed between raised faced flanges with minimum bolt loading and without additional gaskets; or provide integral pipe ends to suit piping used, with pipe end faces concentrically grooved to seal against concentric protrusions in seat.

(ii) Butterfly valves shall comply with BS 5155.

(iii) Bodies: Ductile iron, cast steel, aluminum, or cast iron.

(iv) Seats: Material EPDM and shall be suitable for the temperature rating of the systems served. Discs: Ductile iron or stainless steel grade 316 for fresh water.

(v) Shaft Stems: Stainless Steel to ASTM A167, Type 316 for fresh water.

(vi) Control Handles / Levers: Suitable for locking in any position, or with 10 degree or 15 degree notched throttling plates to hold valve in selected position. Provide worm gear operators with large sized hand wheels for size 150 mm and larger.
(vii) A short piece of pipe work with flanged ends shall be coupled to the butterfly valve to facilitate future isolation and dismantling of equipment for servicing.

7.5 Gauge Cocks

(i) Gauge instruments shall be fitted with a gauge cock between the instrument and the service pipe.
(ii) Gauge cocks bodies shall be constructed from bronze and have a polished finish.
(iii) Gauge cocks shall be of the straight pattern ground plug type with lever handle.
(iv) All gauge cocks shall be of the 3 port type with the pipework on the drain / vent port extended to discharge clear of all equipment and insulation.
(v) Gauge cock connections shall be in accordance with BS 21.

7.6 Automatic Air Vents

(i) Automatic air vents shall be provided at all high points of the system as directed by the Engineer or as indicated on the Drawing. Connections to the service pipes shall be made at the highest point to ensure complete venting. Automatic air vents shall be mounted so that the inlet connection is in an exact vertical plane. A lock shield valve shall be located between the service pipe and the automatic air vent.
(ii) Automatic air vents for water systems shall have bodies of brass, gunmetal or malleable iron, non-ferrous or stainless steel floats and guides, and non-corrodible valves and rubber seats.
(iii) All automatic air vents shall be 20 mm diameter unless otherwise specified and shall be of the single large-orifice type suitable for the release or admission of air during system filling or draining. Automatic air vents bodies shall be constructed of cast iron to BS 1452 Grade 14 and float guides from grade 316 stainless steel. Connections to the pipe work shall be via a screwed BSP connection.
(iv) A gate valve shall be provided between the automatic air vent and the connected pipe work to enable isolation of the automatic air vent for maintenance.
(v) Units shall be designed to facilitate dirt removal while in service.
(vi) Automatic air vents shall be designed to open to discharge air or air / fluid mixture and to close firmly against fluid.

7.7 Strainers

(i) Strainers shall be provided in pump suction pipes, water tank outlets and in the locations specified in the drawing. Strainers shall be of the same nominal bore as the pipeline in which they are fitted. Strainers shall be installed in a plane to ensure that filtered matter is retained within the screen.
(ii) Strainers shall be full line size, "Y" or "BASKET" type as specified and readily removable for cleaning.
(iii) Strainers of up to and including 50 mm shall be bronze bodied and have screwed end caps with a brass drain plug. Strainers of 65 mm and over shall be cast iron bodied to the requirements of BS 1452 with cast iron cover and mild steel stud bolts. The cover shall be complete with a 25 mm bronze drain valve, the outlet of which shall be capped with a brass plug.
(iv) Strainer connections shall be as for the pipeline in which they are installed.
(v) Screens and baskets shall be of brass or stainless steel to suit the service intended. The total free area of the installed screen shall not be less than 5 times of the internal cross sectional area of the inlet pipe. Openings in the screen or basket shall be less than 1.2 mm in diameter.
(vi) Strainers for flushing water systems shall be of cast iron body and filtering medium of the strainer of stainless steel grade 316.
(vii) Strainers shall be of adequate strength to withstand the working pressure.

(viii) Strainers at the pump suction inlet shall be fitted with removable channel magnets, secured to the screen or basket by stainless steel retaining lugs and threaded rods, and placed to provide a continuous magnetic field around the entire circumference of the screen. They shall be fitted with a breech-locking arrangement to maintain the screen in place when removing the cover plate. The screen cover plate shall be bolted using studs with hexagonal headed nuts and shall be fitted with a special hinge. Initially each strainer shall be fitted with mesh lined baskets, reinforced on both sides with an open bottom. After initial cleaning, the baskets shall be replaced with a standard basket, suitable for the service required. All Y type strainers shall be complete with screw plug for drain or blow-off.

8 Paint Finish Schedule

Unless otherwise specified in the particular specification, a paint finish to a color to be approved by the Engineer and shall be applied to all exposed services including but not limited to supporting rods and brackets, cable ladders, cable trays, trunking, paperwork, surface conduits and accessories and other equipment installed in the building areas. The requirements of paint finish shall be as follows:-

(i) There shall be at least one coat of corrosion resistant primer, one undercoat and two finish coats to suit the intended duty and operating requirements. Details of pretreatment shall be submitted to the Engineer for approval prior to application.
(ii) If damage to paint is found during transportation, storage or installation, the contractor shall repaint the whole equipment without extra cost.
(iii) Replace all damaged parts or components and repaint the whole equipment without extra cost if rust is found on any equipment due to inadequate painting material or poor workmanship or incorrect handling during transportation, storage or installation. Removal of all the existing paint, chemical cleaning, rinsing and other necessary pretreatment shall be included in repainting before applying primer, undercoats and top coats. Details shall be submitted to the Engineer for approval.

8.1 Materials

(i) Primer Paint
(ii) For synthetic finishing paints on internal and external metalwork, paint shall be zinc Chromate primer or metallic zinc-rich primer to BS 4652, Type 2.
(iii) For synthetic or non-toxic paints on galvanized metal, use an etching primer with a zinc chromate base.

8.2 Undercoat Paint

(i) For metal work installed internally, paint shall be a linseed oil modified alkyd based undercoat highly pigmented to appropriate shade.
(ii) For metal work installed externally and exposed to weather, paint shall be a polyamide epoxy pigmented with titanium oxide.

8.3 Finish Paint

(i) For metal work installed internally paint shall be a linseed oil modified alkyd with glossy finish and fungus resistant characteristics.
(ii) For metal work installed externally and exposed to weather, paint shall be a polyamide epoxy.

8.4 Identification Colors

All finish coat color shall be to BS 381C and hall be agreed with the Engineer.

8.5 Valves

All valves shall be painted as the same colour as the pipe to which it is fixed.

9 Air Vessel

The air vessel shall be fabricated from MS plate conforming to IS: 2002 grade 2A with minimum 8 mm thickness for the shell and the dished ends and suitable supporting legs. The air vessel shall be provided with a 100 mm diameter, flanged connection from the fire pump, one 25 mm diameter drain with valve, 15 mm diameter sockets for Pressure switches and pressure gauge. The vessel shall of suitable size as specified in Bill of Quantities. The vessel shall be designed, fabricated & tested as per IS: 2825.

10 Technical Specifications for Water Gel Fire Blanket

(a) General Properties

(i) Heat Shield burn therapy & Firefighting blankets shall have pure wool base soaked in sterile protective water based gel.
(ii) The blankets shall be non-toxic & non-irritant having positive anti-bacterial action.
(iii) Sizes are: 96" x 72" and 72" x 60"
(iv) Shelf life: 4 years (min).
(v) Each blanket shall be packed in sturdy plastic barrels having handled for easy portability.

(b) Healing/Medical Properties

(i) The blanket shall give relief to a burn victim through its cooling, moistening and trauma reducing properties.
(ii) The blanket shall be impregnated with sterile water based gel. Gel should not be harmful.
(iii) For the first three years it could be utilized for both medical First Aid and fire-fighting purposes. For next one year it can be utilized for Fire Fighting only.
(iv) The technical literature / leaflets provided shall mention above properties.

(c) Approvals

(i) The item offered shall be approved by at least one of the following agencies :-
(ii) Defense Institute of Fire Research (DIFR),
(iii) Directorate General of Health Services (DGHS).

(d) Packing

(i) Necessary information regarding usage and operation should be pasted on the container.
(ii) Each Water Gel Blanket container should be packed separately, suitably for transportation by sea.

11 Automatic clean gas total flooding system fully integrated with analogue addressable fire alarm system

11.1 General

11.1.1 This Section specifies the construction and installation of automatic gas flooding system.
11.1.2 The automatic gas flooding system shall be complete with gas storage cylinders, extinguishing agent, pipe work, discharge heads, valves, control equipment and cables and all necessary accessories and fittings to form a complete and working installation to protect the specified area to the approval of the Engineer.
11.1.3 The type of clean gas selected shall have the following characteristics:
11.1.4 Zero ozone depletion potential.
11.1.5 Minimum global warming potential.
11.1.6 Suitable for use in human occupied rooms i.e. the gas at its designed fired concentration shall be safe to human in the fired room.

11.1.7 The gas is widely used and around the world.
11.1.8 The clean gas total flooding system shall be Modular cylinder bank system.
11.1.9 Pressure monitoring device shall be provided to monitor leakage at all the cylinders and send status signals to the nearest CGP / SAPs / MAP.
11.1.10 Unless otherwise specified, automatic gas flooding systems shall be of the total flooding type with open-ended piping installation on the distribution side. The automatic gas release mechanism shall be operated by means of fire detection units in the protected compartment or manually by a pull handle or push button as described below and / or shown on the Drawings. Clean Inert Gas based Clean Agent system shall conform to NFPA 2001-2008 for total flooding systems. Selected gas agent shall have past proven references.
11.1.11 The installation shall fully comply with NFPA Code 2001.
11.1.12 Enclosure Integrity
11.1.13 All total flooding systems shall have the enclosure examined and tested to locate and then effectively seal any significant air leaks that could result in a failure of the enclosure to hold the concentration level for the specified holding period.

11.2 Standards

11.2.1 Relevant Codes and Standards
11.2.2 US Deptt. of Transportation or Canadian Transport Commission - Requirements for Transportable Gas Containers.
11.2.3 NFPA-70, BS 6387, BS 5839 Part 8: Performance Requirements for Cable Required to Maintain Circuit Integrity Under Fire Condition.
11.2.4 NFPA-72: Fire Alarm Code, 2010 Edition.
11.2.5 NFPA 2001: Clean Agent Fire Extinguishing Systems
11.2.6 Codes and regulations of Delhi Fire Services and latest National Building Code of India.
11.2.7 The whole gas flooding system shall be provided by a single FM / UL listed manufacturer.
11.2.8 Locally assembly system shall not be accepted.

11.3 Technical and Installation Requirements (Approval to be taken from Gujarat university authority before placing the Purchase Order)

11.3.1 **Quality Control:** System Pressure:- The system pressure for the automatic clean gas total flooding system shall be as per NFPA -2001.

11.3.2 **Design Requirements:** Total gas flooding systems shall be, unless otherwise specified, designed to achieve retained required Oxygen concentrations conforming to NFPA-2001.

11.3.3 Design Calculations

(i) The Contractor shall justify the selection of components and pipe sizes for the system and shall submit full calculation for approval. Where computer program is used, but does not show all calculation steps, it will be necessary for the Contractor to submit evidence that the computer program produces a design that will perform in accordance with the specification as indicated by UL listing or approved by any similar widely recognized independent regulatory body. The same must be approved by Engineer.

(ii) The calculation shall be based on the equipment offered. Valves, distribution valves as well as bends and junctions shall be represented in the calculations as equivalent lengths of pipe. The actual size and location of pipes and nozzles and the number of nozzles shall be designed on the basis of the calculated flow rates and terminal pressures required to ensure successful operation. The calculation or computer programme shall provide all the information necessary to complete the installation including the quantity of gas used to flood to the required concentration, the allowance for losses, the total quantity required, the flow rate, start and end pressure of each section of pipe and the orifice size for each nozzle.

(iii) Gas cylinders, distribution pipework, valves, nozzles and fittings shall be manufactured to withstand the maximum pressure of stored agent allowing for variations in ambient temperature.

11.4 System Operation and Equipment

The system shall be operated automatically and manually, and shall comprise the following equipment:-

(i) Control panel with built-in maintenance free battery, trickle charger, visible warning indicator and supervisory buzzer;
(ii) Interface with Smoke / Heat detectors;
(iii) Audible warning - alarm bells and hooters;
(iv) Visible warning - flashing and warning signs;
(v) Manual release units;
(vi) Discharge nozzle and pipework;
(vii) Automatic / Manual control unit;
(viii) Time delay unit;
(ix) Gas bottles, associated equipment and accessories.
(x) The installation shall operate on a 24 V DC source connected to the control panel.

11.5 Safety Features

The system shall incorporate the following safety features so as to protect persons entering the protected areas:-

(a) Suitable sign plates and warning labels in English, Hindi and Kannada shall be installed at the entrance door.

(b) A visible warning indication lock - off device shall be provided at the entrance of the protected area showing the following status of the system:

(a)

Green Lamp	-	System on manual control with automatic control lock off. (Safe to enter).
Amber Lamp	-	System on automatic control. (Not safe to enter).
Red Lamp	-	System being operated. (Danger - do not enter, gas discharged).

11.6 Control Panel: The control unit shall include the following:-

(a) "Mains On" indication;
(b) "System Fault" indications;
(c) Separate "Zone Fire / Fault" indications;
(d) Indication of "Gas Discharge";
(e) Power unit;
(f) Battery and charger; and
(g) Switches for bell silencing, testing and resetting of the system.

11.7 Battery Charger and Batteries:

11.7.1 A 24 V DC trickle type battery charger and batteries shall be provided with the following components:-

1 Trickle and boost charger assembly;
2 Rotary type selector switch;
3 One incoming double pole control fuse; and
4 Maintenance Free batteries.

11.7.2 The unit shall be suitable for use on single phase supply voltage as specified in the General and Technical specifications and shall automatically maintain the 24 V batteries in a state approximate to full charge and at the same time compensate for the standing load.

11.7.3 Batteries shall be of maintenance free sealed Ni-Cd type requiring no maintenance throughout the normal life of the battery and shall be of capacity capable of maintaining the system in normal working condition for at least 24 hours without recharging and subsequently to operate in the "alarm" condition continuously for at least one hour.

12 Smoke Detectors/ Heat Detectors

Refer to Section 4.08.0 for “Fire Alarm and Detection System” of this Technical Specification.

13. Discharge Nozzle: The discharge nozzles shall be conical type made of hot pressed stainless steel bodies with chromium plated finish complying with BFS requirements. A sample of the nozzle shall be submitted for approval prior to ordering the equipment. The orifice size of each nozzle shall be carefully calculated and submitted for approval before ordering. Nozzles shall be furnished with ceiling plate if they are installed under false ceilings.

13.1 Manual and Automatic Operation Mechanism:

13.1.1 The unit shall be of flush pattern, consisting of manual mode, automatic mode and discharge mode, operated by key switch together with indicating lights for the following:-

" Red" - System being operated
"Green" - System in manual mode
"Amber"- System in automatic mode

13.1.2 A manual release unit shall be provided in a suitable position outside each entrance to the protected compartment. The manual release unit shall consist of a pull handle or push button mounted in a box with “break glass” cover. The box shall be so designed that its glass front may be readily replaced and that its front cover can be opened with a key for the purpose of operating the switch without breaking the glass.

13.1.3 An emergency release handle with direct mechanism shall be provided in an accessible position at or near the gas cylinders. The emergency release shall require no power supply to operate and it shall be provided with a removable pin to prevent accidental release of gas. Provision shall be made for operation of the emergency release to activate the relays or Electro Thermal Link (ETL) to cause simultaneous shutdown of ventilation, air-conditioning equipment etc. and to sound the alarms.

13.1.4 The operation of the gas release mechanism shall require minimum power from an external electrical, pneumatic or mechanical source and shall preferably be operated by a falling weight device. No springs shall be used in any position where their failure or fracture would prevent the correct operation of the gas release mechanism or cause the inadvertent release of the gas.

13.1.5 All release devices and mechanisms shall be designed for the designed working conditions and shall not readily be rendered inoperative or susceptible to accidental operation. The system shall be properly designed against mechanical, chemical or other damage that would render them inoperative.

13.1.6 Flashing Sign / Warning Sign: Flashing sign and warning sign shall be of flush pattern complete with red indicating light together with clear indications in English, Hindi and Kannada characters. The flashing sign shall carry the following messages: "DANGEROUS, DO NOT ENTER” and "EVACUATE IMMEDIATELY”. A sample of this sign shall be submitted for approval before ordering. The sign shall be installed above exit sign level. At the entrance of the

protected area, a notice shall be posted on the door with the following message:-" Warning: Inert gas flooding system in operation, switch to manual mode before entering."

13.1.7 Warning Notice and Instruction Plate: Suitable warning notices and instruction plates shall be put up at doorway position and within the gas protected area and store to give warning to maintenance personnel. Full details of system operation, reset procedure and procedure to follow during an emergency situation shall be displayed. Warning notices and instruction plates shall be in the form of red perspex sheet of minimum 4 mm thick, with letters and characters engraved in white. The main gas identification symbol shall be spray painted.

14. System of Wiring

The system wiring shall be of Fire Survival Circuit Integrity Armored Cables of 600/1000V rated with **Aluminium** Circular conductors having Glass Mica (Fire barrier) tape covered by an extruded layer of crosslinkable halogen free insulation and LSZH inner & outer sheath. Basic design as per BS 7846 for copper cables, IEC-60502-1 for aluminium cables. Should retain circuit integrity as per Category-3 of BS: 8519. Type test reports of each lot from 3rd party inspection agency required prior to despatch.

15. Pipe work

(a) All the pipe work, fittings and the associated works for the gas flooding system shall conform to the relevant sections of this Technical Specification.

(b) Pipe shall be pressure tested after erection by means of nitrogen gas to 90 bar for 30 minutes. Pressure loss of more than 3% of the initial pressure will not be acceptable. Test certificate issued by an approved surveyor shall be submitted for record. Only Teflon tape shall be used as sealant for threaded joints.

(c) All the pipe work shall be purged by means of compressed air before installation.

(d) All the pipe work and conduit for this system shall be painted with the colour as specified by the Engineer after installation is completed.

(e) The whole gas discharge system including cylinders, pipework and nozzles shall be securely fixed to the structure with saddles or brackets correctly spaced so that all components will remain in

place when subjected to the pressures and forces produced during discharge. Fixings shall allow for movement due to thermal expansion.

(f) The system shall be guarded so that it shall be impossible to obstruct the operation of any moving parts.

16. Quality of Extinguishing Agents

(i) Inert Gas used shall be of good commercial grade, free of water and other contaminants that might cause container corrosion or interfere with free discharge through nozzle orifices. Its purity should meet with the requirements of NFPA-2001:2008.

(ii) Special Note: The bidder shall be of an Authorized agent or distributor or installer of the OEM and the bidder need to submit the copy of the document along with the tender for this compliance.

17. Fire Alarm and Detection System components

17.1 Multi-Sensor Detectors

17.1.1 The multi sensor detector shall be a microprocessor based and operate on light scattering principle, containing an emitter and photo sensor. The scattered light reaching the photo sensor shall be proportional to the smoke density inside the detection chamber. It will combine both optical smoke and heat detector technology to detect clear burning fire products, which hitherto could only be easily detected by ion-chamber detectors. The detectors will not operate on a rate of rise of temperature alone. It shall meet the UL 862 9 th edition and comply with BS EN: 54 Part 15.

17.1.2 The detector shall utilize advanced algorithms with time based analysis to provide early warning and an accurate analysis of alarm situations.

17.1.3 Under normal ambient conditions, the optical detector will behave as a normal optical detector. Only when a rapid rise in temperature is detected, the sensitivity of the detector shall increase together with the presence of smoke shall confirm a fire condition, which will be transmitted as a fire alarm level.

17.1.4 The detector will be fully compensated for temperature, humidity and barometric changes in the environment. All electronic components shall be hermetically sealed to prevent their operation from being impaired by dust, dirt, humidity, corrosion or mechanical shock. All circuitry must be protected against typical electrical transients and electromagnetic interference according to BS 6667: Part 3. The detector will be fully operable between -20oC and + 70oC and up to 95% relative humidity non-condensing.

17.1.5 The Sensitivity shall be adjustable by means of a pre-set control only accessible by use of a special tool. Built-in wind-shields will be provided to ensure that air velocity of up to 10 meters / second do not affect the proper operation of the detector. The Combined Optical smoke & Heat detectors will be installed in the Mechanical Plant room areas.

18.2 Heat Detectors

18.2.1 Heat detector shall be an analogue addressable type designed to raise an alarm when the temperature is at a rate-of-rise of 8 °C per minute or higher or at a fixed alarm temperature of 57 °C. It shall comply with BS 5445: Part 5 Grade 1, UL 862, 9th Edition listed and Bangalore Fire and Emergency Services approved.

18.2.2 The detector shall employ two matching thermal sensing elements in a bridge configuration to give a response, which depends both on absolute temperature and rate of change of temperature. The reference and sensing thermal sensors shall be fabricated under identical conditions to ensure good matching and tracking with both temperature and ageing.