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PART II: TECHNICAL

SECTION – 5.3.5

DESIGN PHILOSOPHY – FIRE FIGHTING SYSTEM

GRANULATED SINGLE SUPER PHOSPHATE PLANT AT CHITTORGARH, RAJASTHAN

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1.0 PURPOSE

The purpose of this document is to establish the design basis of the complete fire fighting system for the project

2.0 DEFINITIONS

NFPA - National Fire Protection Association
IS - Indian Standards
TAC- Tariff Advisory Committee
UL Underwriter's Laboratories Inc

3.0 SCOPE OF SPECIFICATION

This specification covers design basis and execution requirements for fire protection system for the project. The provisions shall be made as per statutory regulations, NFPA codes and safe engineering practices.

LSTK (lump sum turn key) contractor shall design, supply and erect the complete fire fighting network / system with accessories of fire water system for the project



4.0 GENERAL

4.1 Contractor's design and engineering activities listed below are the minimum requirements to be complied with for preparation of detailed design/engineering & specifications, following the standards and codes for each system based on guidelines given in subsequent clauses of scope of work.

4.2 The term 'Fire Fighting System' referred here generally covers various equipments and facilities being provided for controlling fires. These include facilities such as fire water storage tanks / sump, fire water & Jockey pumps, fire fighting accessories, fire detection & control system with alarms, fire water piping network together with hydrants, monitors, various kinds of portable fire extinguishers like Dry Chemical Powder type, etc., as well as sand and water buckets and sign boards, as required.

4.3 The Fire Fighting System shall be designed to provide adequate facilities for extinguishing any fire in the entire area of the proposed plant. The system shall be designed and installed as per guidelines of TAC / NFPA/ API / IS standards and also as per latest applicable standards/ codes. The system shall be complete in all respects essential for proper installation operation and maintenance, irrespective of whether such systems are specifically mentioned in this specification or not.

4.4 Scope of Contractor :
The scope of LSTK (Lump sum turn key) Contractor shall cover the design, supply , erection, testing, pre-commissioning & commissioning the complete fire fighting network / system with all components of Pumps & accessories of the pumping system, Fire water system with hydrant , monitor, hose boxes & accessories, Water spray/sprinkler system, First aid fire fighting equipments with extinguishers , portable fire fighting equipments & accessories, Addressable Fire detection and alarm system with Gas & smoke detectors & accessories, Communication system, and other system, as applicable to the facilities, for prevention & extinguishing any fire or potential fire hazard, in equipments, structures, buildings and/or facilities, of the entire area of the plant, including ISBL (inside battery limit) & OSBL (outside

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battery limit) areas, taking into consideration codes, standards & stipulations of local Statutory Authorities.



The scope of LSTK Contractor shall cover but not limited to following broad activities :

- i) Providing fire fighting & fire protection facilities as per this specification, and also, taking into consideration all stipulations, practices followed by Statutory Regulations/Authorities for all types of jobs of this package.
- ii) Taking approval from statutory authorities, as applicable.
- iii) Providing Operating & maintenance manual , as applicable.
- iv) Providing spare parts list, as applicable.

5.0 CODES AND STANDARDS & REFERNECE DOCUMENTS

5.1 Latest editions of applicable Codes and standards shall be followed for the Fire Fighting system offered.

S.No.	Stds No.	Title
1	NFPA-1	Uniform Fire Prevention Code
2	NFPA-10	Portable Fire Extinguishers
3	NFPA-11	Low Expansion Foam and Combined agent Systems
4	NFPA-12	Carbon dioxide extinguishing Systems
5	NFPA-12A	Halon 1301 Fire Extinguishing Systems
6	NFPA-13	Installation of Sprinkler Systems
7	NFPA-14	Installation of Stand Pipe & Hose Systems
8	NFPA-15	Water Spray Fixed System for Fire Protection
9	NFPA-16	Installation of deluge foam-water sprinkler and foam water spray systems.
10	NFPA-17	Dry chemical extinguishing systems.
11	NFPA-17A	Wet Chemical Extinguishing Systems
12	NFPA-18	Wetting Agents. Systems.
13	NFPA-18A	Water additives for Fire Control and Vapor Mitigation.
14	NFPA-20	Installation of stationary pumps for fire protection.
15	NFPA-22	Water tanks for private fire protection.
16	NFPA-24	Water tanks for private fire service mains and their appurtenance.
17	NFPA-26	Supervision of valves controlling water supplies for fire protection
18	NFPA-30	Flammable and combustible liquids.
19	NFPA-49	Hazardous chemical data
20	NFPA-52	Vehicular fuel System
21	NFPA-70	National electric code.
22	NFPA-72	National Fire Alarm Code
23	NFPA-77	Recommended Practice on Static Elect.
24	NFPA-174	Fire Protection symbols for risk analysis diagrams.
25	NFPA-291	Recommended Practice for Fire flow testing and marking of hydrants.
26	NFPA-496	Purged and pressurized enclosures for electrical equipment
27	NFPA-2001	Clean Agent Fire Extinguishing Systems
28	TAC	Fire Protection Manual
29	IS 2189	Selection, installation & maintenance of Automatic Fire Detection and Alarm system.

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S.No.	Stds No.	Title
30	IS 15394	Fire Safety in Petroleum Refineries & Fertilizer Plants
31	API 1102	Steel pipelines crossing railroads & highways
32	PII-5.2.3	Design Philosophy Piping

6.0 COMPONENTS OF FIRE PROTECTION SYSTEM

The following fire protection facilities shall be provided by LSTK contractor, depending upon the nature or the installation and risk involved in the facilities..



- a) Fire water hydrant & monitor system, along with Hose cabinets, hoses & branch pipe nozzles. Fixed Hose Reel
- b) Water spray/sprinkler system, as applicable
- c) Portable fire fighting equipment.
- d) Clean Agent Extinguishers, as applicable.
- e) Foam based extinguishers, as applicable.
- f) First aid fire fighting equipments
- g) Fire detection and alarm system
- h) Gas & smoke detectors
- i) Communication with central fire station

7.0 DESIGN BASIS

The Fire Protection Philosophy is based on Loss Preventive and Control. The importance of adequate fire protection facilities for hydrocarbon handling plants need not emphasised as no plant is absolutely safe because of the inherent hazard it carries. A fire in one part/section of the plant can endanger other sections of plant as well. If fire breaks out, it must be controlled / extinguished as quickly as possible to minimise the loss to life and property and to prevent further spread of fire.

The design and layout of fire protection system shall be based on various TAC/ NFPA requirements.

- a) The Fire Protection System design shall be conceived to operate both in prevention & fighting mode, depending on the relevant actions has been selected either manual or automatic mode. The fire fighting system shall be based on the following fighting agents.
Water , CO₂ , Dry Chemical Powder (DCP) & Foam
- b) The proposed plant shall be fully covered by hydrant system as per Tariff Advisory Committee (TAC) guidelines, NFPA standards design requirements, safe engineering practices. The hydrant system shall be capable to fight one single largest fire in the entire complex.
- c) The proposed plant has been considered as Ordinary Hazard as per TAC guidelines.
- d) Based on hazard category, number of hydrants shall be based on providing one hydrant/ water monitor for every 30 m (maximum) of external perimeter of process unit plant area. For non-plant area, hydrant spacing of 45 m (maximum) shall be considered, unless otherwise mentioned in TAC guidelines. Hydrants and/or water monitors shall be located keeping in

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view the different risks within the premises which are to be protected and ensuring effective coverage.

- e) Fire water demand for the proposed plant shall be based on no. of hydrant/monitors in the fire water network of the proposed plant as per TAC guidelines.
- f) Raw water reservoir shall be Fire Water Storage & shall be part of the fire hydrant system of the proposed plant.
- g) Fire Water/Jockey Pumps to be provided as per TAC guidelines.
- h) The hydraulic calculations of fire water network around the plant shall be checked for adequacy to ascertain the pressure at the remotest point tapping as per TAC guidelines.
- i) The maximum velocity in the system 5m/sec with minimum residual pressure at the remotest point as per TAC guidelines.
- j) Fire hydrant shall be located at a minimum distance of 15m and maximum distance of 22.5m from the surface of equipment to be protected. In case of building, the distance from hydrant to the face of building under protection shall be minimum 5m and maximum 15 m. Hydrants/monitors shall be located to have easy accessibility.

Fire Water Monitors (as applicable) to be provided for tall columns, structure, towers and equipment, height of which exceeds 15m and where it may not be possible to provide access staircases with hydrants on landings, and shall be installed between every two hydrants.



The layout and location of hydrants and monitors to be furnished in drawing for layout of fire protection system, showing the coverage of all facilities within plants. The Hydrant shall not be installed directly vertical to the headers. It shall be installed with a branch "L" shape piping.

Vessels / process columns, structures etc. with height up to maximum 15 m and accessible by hydrant shall be covered by hydrant. Standard type monitors within the area for such equipments based on the layout configuration shall also be considered as a part of protection.

Indoor Fire water risers shall be provided for SRR, Sub Station and Technological structures. Fire escapes Hydrants/Landing valves shall be provided on operating platforms of Technological structures and at upper floors of building.

Monitor location shall be given special consideration for protection of cluster of columns and other high structures not fully covered by hydrant. Each monitor connection shall be provided with independent isolation valve. (Type - Gate Valve) The monitor should not be installed less than 15 m and shall not exceed 45 m from hazardous equipment.

- k) Process Units, and Flammable Pump stations
Water Spray /Wet Risers (with hose reels and hose boxes) to be provided for Elevated platforms / tall columns.

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Water/Foam Monitors for furnace and process columns, (minimum of 2 monitors should be available for each such furnace and process column).

Water curtain shall be provided if applicable to cut of the furnace from rest of the plant.

Landing Valves for hydrants to be provided on technological structures and at 30 m distance on floor of process units.

Hose Reels to be provided with each landing valve on staircases.

Automatic fixed high pressure CO₂ system for the cable cellar & sub-stations (unmanned), as applicable.

Clean agent extinguishers for control room, computer room, substations (manned) etc., as applicable.

Hydrant/ landing valves /Hose reels , First aid, fire fighting equipments, for multi-storeyed buildings at first floor and above to be provided as per TAC rules.

Automatic (with deluge valve) Fixed water spray system for transformers having capacity 10MVA or above, as applicable.

Detection and actuation as per NFPA & instrumentation specifications.

l) Water Spray System

Fire water spray system has been envisaged only for Empty Bag Storage.

Automatic fixed water spray system shall be provided, if applicable, for the oil filled transformers (if rating is 10MVA or above, or, if oil capacity is more than 2000 litres) and Diesel Oil Tank. The system shall be designed in accordance with NFPA15.



m) Fire Detection, Actuation, Alarm and Communication System

- i) Fire Alarm System, Independent , self sustainable type, fully addressable, with repeater panel , located at main fire station , with UPS having backup, shall be provided for the proposed plant The design shall be as per NFPA and applicable local requirements.
- ii) Detectors shall be provided in the buildings & strategic locations.
- iii) Manual call points shall be provided at strategic locations.
- iv) Hooter to be provided along with control from main fire station to the plant.
- v) Public Address system (PA system) shall be PLC based and communication system shall be adequate & to be provided to all strategic areas of the plant.



Details of Fire Detection, Actuation, Alarm and Communication System shall be as per Design Philosophy – Instrumentation.

8.0 FIRE HYDRANT PIPING LAYOUT SALIENT DETAILS

- a) Piping layout shall be done taking into consideration other aboveground and underground piping coming in proximity, civil foundations, underground structures , chemical sewer and OWS.

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- b) Aboveground firewater line shall be laid on sleepers. Network shall be laid in closed loops to ensure multidirectional flow. The minimum header size for hydrant and monitor branches shall be as per attached fire hydrant layout drawing.
- c) Above ground fire water piping , fittings , valves & valve equivalents shall be painted red colour, conforming to shade no 536 of IS-5.
- d) The Underground ring main network system shall be laid at minimum one meter earth cushion.
- e) All underground fire water piping shall be externally protected from corrosion by wrapping and coating (by 4mm thk single layer of tape as per IS: 10221 (E.g. PYPEKOTE) and tested by holiday testing. Underground CS pipe shall extend up to min. 500 mm, above / beyond grade on both sides.
- f) At road crossings, fire water line shall be provided with proper wrapping, coating as a anticorrosive treatment by 4mm thk single layer of tape as per IS: 10221 (E.g. PYPEKOTE) and same shall be put under a suitable Hume pipe (NP3) of minimum 2 nominal diameter bigger than carrier pipe,
- g) Alternatively, Firewater piping at road crossing shall be sleeved (wall thickness of sleeve casing pipe, fabricated out of plate material, shall be min. 6mm) with the ends suitably sealed for preventing corrosion within the sleeved portion. The external portion of carrier pipe as well as the sleeve shall be protected from corrosion by wrapping and coating by 4mm thk single layer of tape as per IS: 10221 (E.g. PYPEKOTE). Flushing and pressure gauge points shall be provided on all headers.
- h) There is no Radiography requirement for category D service (like low pressure utility services of air & water) , unless otherwise specified in Fire Protection Manual.
- i) 1.5 to 2.0 m portions of the headers (if above ground) and the entire branch piping near hydrants shall be epoxy painted.
- j) Material for fire water piping shall be outer wrapping/coating carbon steel with cathodic protection for underground piping and carbon steel for aboveground piping.
- k) Fire water pressure at the farthest point shall be a minimum of 7 kg/cm² after installation of headers and sub headers
- l) All fire water piping shall be tested to hydraulic test pressure of 18 kg/ cm²
- m) Indoors hydrants for plant and non-plant buildings shall be provided as required.
- n) Isolation Valves at every 300 m and at crossings (junctions) to ensure easy maintenance and uninterrupted water supply in case of break down.
- o) Isolation valves to be provided at every 300m and at crossings (Junctions) to ensure easy maintenance and uninterrupted water supply in case of break down and shall be planned in such a way that outage of any section of fire water line should not affect other section.

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- p) Isolation valves shall also be provided below monitor , hydrants & tapping points on new firewater headers.
- q) Isolation valve shall also be provided for hydrant having pressure more than 7 Kg/cm².
- r) Landing valves on tech structure, platforms, columns, buildings, shall have individual 4" isolation valve at each hydrant.
- s) Gate Valve shall be used as isolation valve. Only carbon steel valves shall be used. No Cast iron valves shall be used.
- t) Hydrant heads shall be placed at a minimum distance of 15 M. and maximum 30 M from process equipment.
- u) Long range monitors shall be provided to cover the high rise equipments etc. as mentioned in the scope of work.
- v) Each equipment shall be accessible by a fire hose as per the requirements given in fire protection manual.
- w) There may be cases where due to horizontal obstruction, a particular high equipment may not be approachable by ordinary monitor or hydrant. Elevated long range monitors shall be provided to take care of such conditions.
- x) Suitable restriction orifice shall be provided in fixed medium velocity water spray system, if required, to maintain the pressure requirements as per Fire Protection Manual.

9.0 MATERIAL SPECIFICATION

Material used for fire protection system shall be in accordance with Fire Protection Manual requirements. All equipments connected to fire water system shall either be Fire Protection Manual approved or ISI marked from companies which carry ISO certification. General specifications for the materials are as follows:

9.1 Hydrant System :



Pipe IS-1239 Heavy (upto 6"NB) / IS-3589 Gr.410 (8"NB & above)
 Fittings IS-1239 (upto 6"NB) / IS-3589 (8"NB & above)
 Hydrant, Monitors : IS / Fire Protection Manual / specification provided
 Hose Boxes, Hoses & accessories: IS / Fire Protection Manual / specification provided

9.1.1 Hydrant (2-way fire hydrant) shall be BIS approved with following detail

Fire Hydrant Post: IS-908,
 Stand Post: IS-908, Post Pipe Size 4"NB, IS-1239 heavy,
 2 way, branch head pipe size 3"NB, Flanged, ASME B16.5, 150#, IS-1239 heavy.

Landing Valve: IS-5290

Inlet : 3"- 150 # RF as per ANSI B16.5
 Outlet : 63mm
 Capacity : 36 cum/hr

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Type : Oblique angle type as per Fire Protection Manual requirement
Material : SS304

Hose : IS-636, Fabric Hose With Non Percolating Lining, Type-B, 63mm x 15 mtr.

Male/ Female Coupling : IS-903 , 63 mm , SS304

Branch Pipe With Nozzle : IS-903 , 63 mm , SS304

Number of hydrants shall be based on one hydrant/ water monitor for every 30 m of external perimeter of process units and storage tank area.

Hydrants and/or water monitors shall be located keeping in view the different risks within the premises which are to be protected and ensuring effective coverage.

Double headed hydrants type A as per IS:5290 on each hydrant post (i.e. two hydrant valves mounted on each stand post) and at every 30 m centre to centre along the hydrant mains shall be provided.

In case of elevated structures/building, hydrant valve & a fire hose cabinet shall be provided at every landing of the staircase.

Extension of hydrants/monitors for spill fire (as required by Fire Protection Manual) shall also to be provided.

9.1.2 Water Monitor :



Stand Post Type-A Water Monitor (manually operated)

Specification : IS:8442
Nozzle bore size : 38mm (Aqua fog /foam with arrangement of jet and spray).
Capacity : 2580 LPM
Horizontal Range : 50m (approx.).
Material : Body (barrel type)-CS; Swivel Joint- IS318 or SS ; Nozzle-SS304
End Connection : 4" , 150#, Hole drilling as per ANSI B16.5
Operation : 360 deg. horizontal, 90 deg, above horizontal either direction & 45 deg. below horizontal rotation, Lever handle operation.

9.1.3 Water Cum foam Monitor (WFM):

Stand Post Type-B Water Cum Foam Monitor (manually operated)

Specification : IS:8442
Nozzle bore size : 38mm (Aqua fog /foam with arrangement of jet and spray).
Capacity : 2700 LPM
Horizontal Range : 50m (approx.).
Material : Body (barrel type)-CS; Swivel Joint- IS318 or SS ; Nozzle-SS304
End Connection : 4" , 150#, Flange hole drilling as per ANSI B16.5

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Operation : 360 deg. horizontal, 90 deg, above horizontal either direction & 45 deg. below horizontal rotation, Lever handle operation.

9.1.4 Long Range Water cum foam monitor (electro-hydraulically remote operation).

Specification	Manufacturer standard
Capacity	1000 GPM (3785 LPM)
Horizontal Range	60m
Rotation	340 deg
Material	Body SS304; Swivel Joint, LTB Gr.2; Nozzle SS304
Approval	UL
End connection	4" , 150#, Flange hole drilling as per ANSI B16.5
Approval	UL
Hydraulic test :	25 KGF/CM ² , No Leakage
Flow Test :	At capacity rating @ 7kgf/cm ² . Horizontal throw of Water 60mtrs. & 55 Mtr. foam at 30° trajectory. (In still wind condition)

9.1.5 Hose Reel

Fire hose reels shall be considered at strategic locations around block as first aid fire contingency.

These shall be floor mounted type and shall have water connection from hydrant network. Each hose reel shall have 1"x 30 metre long hose with nozzle.

Hose reel shall be provided with each landing valve.

Length of Hose reel shall be 30m with 20mm bore.



Fire hose reel with drum	IS 444 / IS 884
Dimensions	30 m long with 20mm bore
Material	Reinforced rubber hose , mild steel drum, gun metal nozzle

9.1.6 Hose Box

Each hose box shall contain 2nos. fire hose with coupling and accessories to suit connection of two hose on each hydrant post. 1 no. Hose Box shall be provided for each landing valve and hydrant.

Hose box spec.	Manufacturer's standard.
Dimensions	750mm x 600mm x 250mm
Material	Mild steel, glass in front, double door, painted fire red.

Coupling, short branch pipe & nozzle	IS 903
Size	63 mm
Material	SS304

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Flexible Fire Hose
Spec. IS 636 , Type-B
Size 63 mm
Length 15 m
Material Fabric with non percolating lining

9.1.7 Orifice Plates

Suitable size of orifice plates of SS304 material of construction shall be provided before the isolating valves of all hydrants & monitors in order to maintain line pressure in case of hydrant line.

9.1.8 Spray nozzle

Spray nozzle of SS304 material of construction , size 1 /2 “ end connection , orifice of 6 mm (minimum), spray angle.

9.2 Gate valves

All the Gate valves (8”NB and above) shall be gear operated one of approved make. The butterfly valves shall be conforming to BS:5155. The materials composition of the various components of the valve shall be as under:

Body	:	Cast carbon steel ASTM A216 Gr.WCB (≥ 2 ”NB)
Disc	:	13 Cr facing on carbon steel
Stem	:	SS 410
Seat / Seat Ring	:	Stellited
Gasket	:	graphited / Non asbestos
Nuts and Bolts	:	A193-B7 / A194-2H

9.3 Butterfly Valves



All the butterfly valves (8”NB and above) shall be gear operated one of approved make. The butterfly valves shall be conforming to BS:5155. The materials composition of the various components of the valve shall be as under:

Body	:	Cast carbon steel ASTM A216 Gr.WCB
Disc	:	13 Cr facing on carbon steel
Spindles	:	SS 410
Retainer Ring/Seat Ring	:	SS 410
Disc Seal	:	Nitrile Rubber
Body Seat	:	Nitrile Rubber
Gasket	:	graphited / Non asbestos
Nuts and Bolts	:	A193-B7 / A194-2H

9.4 Non Return Valves

All the NRV in water line shall be of approved make and conforming to BS-1868. The material composition of the various components of the valve shall be as under:

Body/Bonnet	:	CS ASTM A216 Gr WCB
Disc/Wedge	:	13 Cr facing on carbon steel
Body seat Rings	:	13 Cr facing on carbon steel
Bonnet-Gasket	:	graphited / Non asbestos

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Nuts and Bolts : A193-B7 / A194-2H

9.5. **Portable Fire Extinguishers**

Portable fire extinguisher shall be provided by LSTK contractor, as below :

All fire extinguishers shall conform to respective IS/UL or Equivalent codes, viz. 4/6/9 Kg DCP Type (IS: 15683 /UL 299), 4.5/6, 8 Kg CO2 Type (IS: 2878/UL 154) & 25/50/75 Kg DCP Type (IS: 10658/UL 299) and bear ISI/UL mark. BIS/UL or Equivalent certificates of all extinguishers shall be maintained at the location.

All the fire extinguishers should be placed in such a way that operators have to run a maximum distance of 15 meters only.

However, contractor shall specify the numbers, capacity and location as per NFPA/TAC requirements for Owner's review and approval.

9.6 **Breathing Apparatus**

Breathing Apparatus shall be provided by LSTK contractor, as below :

a) Shouldered type compressed air cylinders shall be provided by contractor for breathing in the central control room (CCR) and substation buildings , field operators cabins, local control room LCR(s) for emergency use.

Minimum quantities shall be

CCR-4 nos., Substations -2 nos. (each), Field Operator Cabin-1 no (each).

b) **Air mask**

Quantities shall be two nos. air masks (full vision facemasks) each for Control room & laboratory , respectively.

10.0 **FIRST AID FIRE FIGHTING EQUIPMENT**

The selection & providing of equipment, like portable fire extinguishers, hose reels, sand bucket, etc., should be such that it is correctly related to the type of fire expected in the area.



The general guideline for use and selection shall be as per Fire Protection Manual requirements

11.0 **SAFETY IN SYSTEM DESIGN**

Safety shower & eye wash units shall be provided by bidder , at strategic locations, for their scope of work

12.0 **SPACING AND LAYOUT**

Contractor to finalise hydrant layout on plot plan, with all the requirements such as number of Hydrants, Monitors, spray/sprinkler system etc. as applicable, are based on all statutory requirements, considering ease of maintenance and safe approach for fire fighting. Due consideration is to be given for providing Emergency escape routes also. Hydrants are to be strategically located to obtain maximum advantage of layout

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13.0 EXECUTION, INSPECTION AND TESTING

All execution, inspection and testing for completion of fire protection system shall be carried out based on Codes, standards and specifications. LSTK CONTRACTOR shall develop a detail inspection, and testing procedures based on codes, standards and specifications.

LSTK contractor shall meet all requirements for inspection and testing of the system.

LSTK contractor shall supply recommended spares for operation and maintenance and subsequent requirements.

14.0 APPROVAL OF DRAWING

Drawings and documents shall be prepared in all respects and submitted by LSTK CONTRACTOR , who shall also make arrangement for inspection and testing for statutory authorities at various stages of the work, as required by approval authorities

The following drawings & documents shall be prepared for review by owner :

- i) Preparation of PFD/ P&ID's and equipment data sheets, as applicable.
- ii) Water demand calculation of fire water ring main network taking into consideration the requirements for the proposed plant , including finalization of line size, flow rate and pressure scenario at various section of the fire water system.
- iii) Submission of layout & installation drawings of the fire protection systems.
- iv) Preparation of material take-off, material requisitions and purchase requisition of bought out items.
- v) Design calculations for the respective fire protection system.
- vi) Submission of Operation & maintenance manual.
- vii) Submission of spare parts list, as applicable.