

VOLUME-III E

SECTION-II

**TECHNICAL SPECIFICATION
FOR
FIRE PROTECTION SYSTEM**

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	GENERAL INFORMATION
2.00.00	CODES & STANDARDS
3.00.00	SYSTEM DESCRIPTION
4.00.00	OPERATIONAL PHILOSOPHY
5.00.00	SCOPE OF WORK
6.00.00	DESIGN BASIS AND INPUT
7.00.00	DESIGN AND CONSTRUCTION
8.00.00	INSPECTION AND TESTING
9.00.00	DRAWINGS, DATA & MANUALS TO BE SUBMITTED BY THE BIDDER

ATTACHMENT

ANNEXURE-I	FIRE WATER PUMPS
ANNEXURE-II	DIESEL ENGINE
ANNEXURE-III	AIR COMPRESSOR
ANNEXURE-IV	FIRE WATER STORAGE TANKS & HYDROPNEUMATIC TANK
ANNEXURE-V	PIPES, FITTINGS, VAVES AND SPECIALTIES
ANNEXURE-VI	HOSE HOUSE
ANNEXURE-VII	DELUGE VALVE SHED
ANNEXURE-VIII	DETECTORS
ANNEXURE-IX	TECHNICAL SPECIFICATION FOR NITROGEN GAS INJECTION SYSTEM FOR OIL FILLED TRANSFORMER
ANNEXURE-X	FIRE TENDER

VOLUME: IIIE

SECTION-II

**TECHNICAL SPECIFICATIONS
FOR
FIRE DETECTION, ALARM AND PROTECTION SYSTEM**

1.00.00 GENERAL INFORMATION

This section covers the requirements envisaged for Fire Detection and Protection System including Alarm and Communication which will be used to control any outbreak of fire in the proposed 1 x 800 MW Sri Kothagudem Thermal Power Station (KTPS), Stage-VII, Unit-12 for Telangana State Power Generation Corporation Limited (TSGENCO) at Kothagudem, Telangana to reduce consequential damages by containing and extinguishing the same. This section of the Specification shall have two parts – Fire Extinguishing System and Fire Detection & Alarm System. Bidder's scope of work covers supply, erection, commissioning and testing of the entire fire detection, alarm and protection system including supply of all fire extinguishing equipment and systems, fire detectors, manual call points, linear heat sensing cables, all local, remote Fire detection alarm cum MIMIC panels, repeater fire alarm panels, PCs and peripherals, hardware and licensed versions of software as detailed hereunder, meeting all code requirements to make the system complete.

2.00.00 CODES AND STANDARDS

The system shall be designed keeping in view the recommendations of Tariff Advisory Committee (TAC) of Insurance Companies of India/LPA India/NFPA USA. Any other International Standard having equivalent stringent codes may also be considered. However, the system shall be approved by statutory authorities.

3.00.00 SYSTEM DESCRIPTION

For protection against fire, all yard equipment will be protected by a combination of hydrant system, automatic sprinkler spray system (emulsifier system), fixed foam system for oil handling areas, automatic high velocity and medium velocity sprinkler spray system, auto-modular clean agent system for control rooms apart from portable and mobile fire extinguishers located at strategic areas of plant buildings and adequate Passive Fire Protection measures.

Fire extinguishing system is broadly divided into following sub-systems:

3.01.01

Hydrant System

The Hydrant System of Fire Protection essentially consists of a large network of pipe, both underground and over ground which feeds water to a number of hydrants valves – indoor as well as outdoor and to a number of outdoor type fixed installations. Water in the pipe network is kept pressurized by hydro-pneumatic tank and jockey pump arrangement. These hydrant valves are located in the entire power station including all the auxiliaries and buildings in the plant area. Hosepipes of suitable lengths fitted with standard accessories like branch pipes, nozzles etc. are kept in “Hose Houses” (for outdoor hydrants) and in “Hose Boxes” (for indoor hydrants). When the fire hoses are coupled to the hydrant valves through the instantaneous coupling, jet of water is directed towards the fire. Hydrant system protects the following building/facilities.

- a) Raw Water Pump House
- b) Entire Power House including Boiler Area and Turbine House.
- c) Mill Building.
- d) Mill reject system compressor house.
- e) ESP Control Building.
- f) Generator & Unit transformer, Station Transformers in transformer Yard, switchyard area.
- g) CW Pump House including chlorination plant and dosing pump house.
- h) DG & Compressor building.
- i) HFO & LDO/ HSD unloading and transfer pump house, pressurizing pump house area, HFO, LDO/HSD Day tank area.
- j) DM plant
- k) Coal Handling Plant including conveyors, TPs, Coal stack yard etc.
- l) Ash water pump house.
- m) Ash Slurry Pump House
- n) Ash Handling Plant Electrical cum Control Room
- o) Ash Handling Plant Compressor Room
- p) Fly Ash Vacuum Pump House
- q) AHP Chemical House in AHP Clarifier Area
- r) Effluent treatment Plant.
- s) Stores.

- t) Clarified Water Pump House
- u) Filtered water Reservoir and Pump House
- v) Sludge Sump & Pump House
- w) Filter Backwash Waste Sump & Pump House
- x) Chemical House
- y) Chlorination Building

Note: Buildings not specifically identified above but required to be covered by hydrant system shall also be included in the scope of the Bidder.

3.01.02 High Velocity Water Spray System (HVWS System)

- a) Category- A

This system shall automatically detect, control and extinguish any out-break of fire and simultaneously give audible alarm. The system shall also be designed for remote operation. Water line forms a ring around the equipment to be protected with projected outlets at various selected points fitted with the specially designed nozzles. The water supply to the HVW spray system is controlled by deluge valve, which shall be operated hydraulically. This valve is normally closed by water pressure in the water piping. The same water pipe forms a ring around the equipment to be protected and frangible bulb type detectors are mounted on this water line at selected places. When the surrounding temperature rises more than the rated temperature of the detector, detector quartzoid bulb collapses releasing water and consequently pressure in water line will fall sharply. This fall of pressure opens the deluge valve and water starts projecting out from the projectors. Local audible alarm shall be produced by water motor alarm gong. The operation of the Deluge Valve shall be annunciated in the Local Zonal Fire Alarm Panel as well as in the Central Fire detection alarm cum MIMIC panel.

The system shall also have a manual over riding facility along with regular testing facility

Category – A type HVW Spray Protection shall be provided for the following equipment:

- Three (3) nos. single phase generator transformer.
- Two (2) nos. Unit transformers.
- Unit and Station Auxiliary transformers as per design requirement.

- Spare Generator Transformer

b) Category- B

In this system fire shall be detected by use of heat detectors, flame detectors depending upon the area. Upon detection of fire, HVW Spray System shall be brought in operation automatically by opening deluge valves.

Category – B type HVW Spray System shall be provided for the following areas:

- Turbine oil tanks and purifiers.
- Boiler Firing Floors.
- Lube oil piping in turbine areas.
- Generator seal oil system.
- Lube oil system for turbine driven boiler feed pumps.
- All oil filled transformer below 10 MVA.

3.01.03 **Medium Velocity Water Spray System**

This system essentially consists of a network of sprayers fitted with a special deflector to give required angle of discharge for the water around the area to be protected. The sprayers discharge a cone of water spray consisting of medium size droplets of water. The droplet size shall be so designed to achieve efficient cooling of the flame zone by evaporation and sufficiently large to penetrate the flame so as to reach and cool surfaces heated by the fire. The operation of the deluge valves in MVW Spray System shall be annunciated in the respective local zonal panels and in the central Fire detection alarm cum MIMIC panel with repeat alarm at fire station buildings. For avoiding overall flooding of the area, in the event of fire, only the two adjacent zones on either side shall only operate.

The Medium Velocity Water Spray System shall be provided for the protection of following areas:

- All conveyor galleries, transfer points, and bunker bay conveyors in coal handling plant. In this connection, it may be noted that full length of each conveyor both top and bottom belt shall be protected with MVW Spray System.

Spray system for coal conveyor galleries shall be divided in several zones fed through individual deluge valves. Spray system for each zone shall consist of spray nozzles mounted, on a water network. Spray system shall cover both forward and return belts of conveyor including hoppers, feeders & head end pulley. Detection system shall consist of quartz bulb detectors, IR detectors, LHS cables.

- Cable vault and cable galleries of main plant, switchyard control room, and ESP control room. Detection system shall consist of smoke detectors, LHS cables.
- Fuel oil storage and day tank area, DG set diesel tanks.

3.01.04 **Fixed Foam Protection System**

Water based automatic activated low expansion foam protection system shall be provided for HFO & LDO/ HSD storage and day tanks.

Foam protection systems are based on the principle of blanketing the burning surface of oil stored inside the tanks by pouring foam mixed with water, enabling to cut-off the oxygen to the burning fuel thus achieving immediate Extinguishments of fire.

Foam concentrate will be pumped from the foam concentrate storage tank by two (1W + 1S) foam pumps to foam proportioner skids one provided for each fuel oil (FO) tank. Pressurized water connection is provided to the eductor of each foam proportioner skid. In the event of fire, the foam system for respective tank shall be automatically activated on detection of fire by ROR/Probe type heat detectors provided inside the FO tanks. Water will start flowing through the eductor where foam concentrate is induced and mixed with the flowing water in definite proportion.

This foam water mixture flows to tank, where the foam solution expands by sucking air from the atmosphere and foam thus formed fills the oil surface inside tank by suitably designed deflectors.

3.01.05 **Inert gas flooding system / Auto modular clean agent system**

One centralized total flooding type clean inert gas extinguishing system shall be provided for the following areas as a protection for fire damage.

- Control room, Control equipment room, computer room and other electrical and electronic equipment rooms.

The inert gas flooding system for the above areas shall consist of battery of inert gas storage cylinders of adequate capacity, which shall be located suitably at a centralized location. Discharge nozzles shall be provided on the gas distribution pipe network suitably located on the areas to be protected.

In the event of fire, the fire detectors initiate an alarm in the local panel, and main fire alarm panel. Simultaneously, the detection signal opens the valves automatically and the protected area is filled up by rapid injection of required quantity of inert gas through the pipe network and discharge nozzles to create a homogenous air/inert gas atmosphere within.

The pipe network shall be connected to a gas manifold, through a manually operated valve. The manifold shall be connected to a group of inert gas cylinders

- 3.01.06 Portable and mobile (wheel mounted) fire extinguishers, such as soda acid type, pressurized water type, carbon-dioxide type, foam type , dry chemical powder type shall be located at strategic locations throughout the plant area.
- 3.02.00 Microprocessor based addressable analog type multi criteria smoke detectors connected in cross-zoning principle as per NFPA recommendation and in two wires circuitry shall be provided in the following areas:
- All cable Spreader Rooms & Cable Vaults, cable gallery in powerhouse and in all ancillary plant buildings.
 - All Electrical Switchgear/MCC Rooms located in Power House and in all ancillary plant buildings.
 - Central Control Rooms, Control equipment room housing DDCMIS, UPS etc. and in all ancillary plant building control rooms.
- 3.03.00 Heat detection system (microprocessor based analogue addressable based heat detector) shall be provided in the following areas in order to avoid spurious operation of the smoke detectors due to fumes, smoke & dust which are present in these areas:
- Battery and battery charger rooms.
 - Turbine oil tanks and purifiers.
 - Boiler Firing Floors.
 - Lube oil piping in turbine areas.
 - Generator seal oil system.
 - Lube oil system for turbine driven boiler feed pumps.
 - All oil filled transformer below 10 MVA.
- 3.04.00 Quartzoid bulb detector shall be used in all transformers rated more than 10 MVA.
- 3.05.00 Heat sensing cable, as detector shall be used for coal conveyor gallery including bearings and both drive pulley and non-drive pulley, transfer points. This shall be used in whole length of top belt and bottom belt (in a zig-zag fashion). These detectors shall also be used for tripping the conveyor drives.
- 3.06.00 Solar Blind Infra-red detectors with inbuilt air purging unit shall be used in coal conveyor gallery for detection of moving fire. Rate of rise cum fixed

temperature heat detectors shall be used for Boiler burner fronts, turbine oil tanks and HFO and LDO/HSD storage day tank inside. Heat detectors shall be analogue addressable type.

3.07.00 The entire Power House Building and the outdoor yard of plant have been divided into a number of zones with a few addressable manual call points in each zone. The outdoor call points shall be installed on approximately 1M high angle iron supports for ease of operation. The manual call points inside the Power House Building shall be suitable for wall mounting. Manual call points of "break glass push button station type" or "lever type" shall be provided specifically in the following areas:

- a) Switch gear and MCC room in Power house.
- b) Outdoor transformer yard.
- c) All floors in power House, including Boiler House.
- d) All areas of boiler house.
- e) Coal bunker and coal mill area.
- f) Transfer points.
- g) All pump houses namely CW Pump House, Ash Water Pump House, Fire Water Pump House etc.
- i) All buildings like Compressor and DG area etc.

Adequate number of manual call points along with automatic fire alarm system shall be provided for the respective areas. Location of the manual call points shall be near to the respective areas. Annunciations from the manual call points shall be received to the nearest satellite fire alarm panel and directly on the fire alarm panels located in the Control room and fire station.

3.08.00 All detectors shall be located and spaced as per NFPA-72E and shall be UL/FM approved. On receipt of impulse from the detectors, in the event of fire, suitable annunciation signals shall be exhibited in the respective repeater fire panels as well as Main and Master Fire Panels. The areas including electrical control rooms, switchgear rooms, cable vault, coal conveyors etc shall be suitably sectionalized as far as the fire detection is concerned and as such the affected Zone can also be spotted.

3.09.00 Passive Fire Protection System for all outdoor transformers and indoor transformers having rating more than 10 MVA, Cable Vault, Cable Spreader Room & Enclosed Cable Risers (Cable Shafts) shall be provided.

3.09.01 The Transformer to be protected by automatic High Velocity Water Spray System shall be separated from each other by explosion proof barrier walls of 120 minutes fire rating so that fire in one does not affect the adjacent Transformers.

3.09.02 The Cable Spreader Room and Cable Vault shall be divided into a smaller

- risk zones. These zones shall be separated by 120 minutes rating fire barrier walls.
- 3.10.00 For containment of fire and preventing it from spreading in cable galleries, unit wise fire barriers with self-closing fire doors will be provided. In addition, all cable entries / openings in the cable galleries, tunnels, floors will be sealed with non-inflammable / fire resistant sealing materials to prevent fire propagation for at least three (3) hour. Fire protection cable coating compound over cables at switchgear entry points, power station building entry points and trays shall be provided to prevent damage from fire for at least thirty (30) minutes. The number of fire doors as prescribed by the TAC/LPA shall be provided. Atleast two fire escape exit openings to the open areas shall be provided for the TG area as prescribed by the TAC/LPA.
- 3.11.00 Back Lit maintained type emergency "exit light" shall be provided in control room, control equipment rooms, switchgear and MCC rooms, battery charger rooms, escape stair case in power house and transfer points in coal conveyor area and other buildings in the plant. These shall be switched on upon detection of fire.
- 3.12.00 Addressable analog smoke detector shall also be provided in all false ceiling in power house i.e. Control room, Control equipment room, ESP control room.
- 3.13.00 "First aid fire protection system" shall be provided for Power house.
- 3.14.00 Gas sensing fire detectors working on air sampling shall be provided for all control rooms, and control equipment room.
- 3.15.00 Provision should be kept for automatic closing of fire dampers in ventilation ducts or tripping of related ventilation fans as required on detection of fire.
- 3.16.00 The main source of water to the fire pumps and jockey pumps shall be from steel made fire water storage tank which is to be sized by the EPC contractor based on TAC/LPA guideline. However, the minimum capacity of the steel tank shall be 5000 m³ with two compartments . The Water for both hydrant and High/Medium Velocity Water Spray System shall be supplied by six (6) nos. automatic firewater pumps. Out of six (6) pumps two (2) nos. motor driven working hydrant pumps and one (1) no. diesel engine driven standby hydrant pumps for hydrant system and one (1) no. motor driven and one (1) no. diesel engine driven (both are working) spray pumps for HVW & MVW spray water system and one (1) no. diesel engine driven pump is common standby for spray system. Out of these six (6) nos. fire water pumps three nos. (3) will be motor driven and three (3) nos. will be diesel engine driven. The pumps will be started automatically in proper sequence when a large quantity of water flows out from pressurized water circuit. There shall be adequate arrangement of meeting up system leakages and at the same time the system pressure shall be maintained by providing a hydro pneumatic tank along with two (2) nos. motor driven jockey pumps, one (1) working and one (1) standby and two (2) nos., one (1) working & one (1) standby compressors. Booster Pumps shall be provided as per the TAC/LPA guidelines. However, the no. of pumps and their capacity, head etc. are to be finally decided by the Contractor during detail engineering stage.

- 3.17.00 If water pressure in the hydrant pipe network is not adequate to maintain minimum 3.5 kg/cm² (g) at the hydraulically furthest hose station at elevated floors of boiler houses and turbine building, then 2x100% motor driven booster pumps shall be provided for individual areas for supplying pressurized water to the hose stations. Booster pumps are installed online to the branch header to riser pipes. The booster pumps if required shall start through pressure switch when pressure on their discharge side falls below the set pressure.
- 3.18.00 Adequate separating distances will be maintained between different process blocks and hazardous equipment. To prevent fire from spreading through ventilation & air conditioning ducts, dampers with auto closing arrangements will be provided at appropriate locations. FRLS power and control cables will be used.
- 3.19.00 **Nitrogen Injection System**
- Nitrogen Injection Fire Prevention and extinguishing system designed for oil filled transformer (for Generator Transformer) shall prevent tank explosion and the fire during internal faults resulting in the arc where tank explosion will normally take few seconds after arc generation and also to extinguish the external oil fires on transformer top cover due to tank explosion and/ or external failures like bushing fires, due to OLTC fires and fire from surrounding equipments.
- Nitrogen Injection System shall be provided along with the emulsifiers for the transformers.
- The system shall work on the principle of DRAIN and STIR and on activation, shall drain a pre determined quantity of oil from the tank top through outlet valve, to reduce the tank pressure and inject nitrogen gas at high pressure from the lower side of the tank through the inlet valves to create stirring action and reduce the temperature of top oil surface below flash point to extinguish the fire.
- Conservator tank oil shall be isolated during the bushing bursting, tank explosion and oil fire, to prevent aggravation of oil fire.
- Transformer isolation shall be an essential pre condition for activation of the system.
- The system shall be designed to operate manually, in case of failure of power source.
- The details including Design, description, control, scope, etc. of this system are attached with Annexure-IX of this specification.
- 3.20.00 Two (2) nos. Mobile Fire tenders shall be envisaged for this project. However as no fire station is envisaged, these two (2) nos. mobile fire tenders shall be placed in the new fire Station of the unit of this project. For details of Fire Tender, refer to Annexure-X of this Volume.

4.00.00 **OPERATIONAL PHILOSOPHY**

4.01.00 **Hydrant System**

4.01.01 Operation of hydrant system shall be semi-automatic. A pressurized hydrant main shall be maintained through the combination of hydro pneumatic tank, jockey pumps and compressors. When the header pressure of fire water pumps falls below a preset limit, diesel engine driven fire water pump placed in "auto mode" shall be automatically cut-in. If the header pressure is not built-up even after the running of diesel engine driven pump and falls further down, this low pressure shall actuate another pressure switch which in turn shall cut in automatically the standby Diesel Engine driven hydrant pump. In each case above, if any of the above pumps is not started even after the signal from pressure switch is through, "pump fails to start" alarm shall be annunciated in the local control panel.

4.01.02 Hydro-pneumatic tank shall be filled up with water up to 2/3rd portion of its height. Air space shall be kept above the water- filled portion. The hydro-pneumatic tank will be equipped with necessary level switches and pressure switches. Minor leakage in the pressurized fire water system shall be replenished from hydro-pneumatic tank. When the level of hydro pneumatic tank is low, jockey pump shall be started automatically to replenish the level of water in the tank. Jockey pump shall be cut-out automatically when the level of water in the hydro pneumatic tank reaches its higher limit. Pressure switches provided in the hydro pneumatic tank shall be interlocked with the cut-in/cut-out operation of compressor which is used to maintain a constant pressure in the hydro pneumatic tank and there by to the whole fire fighting system.

4.02.00 **Spray Water System**

4.02.01 Operation of Spray Water System shall be automatic.

4.02.02 Header pressure of spray water system shall be maintained at a constant value with the help of hydro pneumatic tank as stated earlier in case of hydrant system.

4.02.03 When the pressure of spray water system falls down to a preset value, it will actuate a pressure switch which in turn shall send starting signal to the motor/ diesel engine driven HVW/ MVW spray water pump for automatic starting. If the pressure falls further below, common standby Diesel Engine driven pump shall be started automatically from the signal of it's pressure switch. Further, if necessary to arrest the falling pressure pumps for hydrant system shall also be started automatically and deliver water to the spray water system.

In each case above, "pumps fail to start" alarm shall be annunciated in LCP if any pump does not start even the start-up of signal from it's pressure switch is through.

4.02.04 Any Fire water pump, if started automatically, shall not be stopped without manual intervention.

- 4.02.05 In case of detection of fire in HT transformer, "deluge valve" in spray water line shall be opened automatically and spray water system shall come into operation fully automatically. Operation shall be annunciated.
- 4.02.06 In all other areas of spray water system, detection of fire shall produce annunciation in the respective local fire panel and the spray water system shall be brought into operation by opening automatically the deluge valves of the particular area.
- 4.03.00 **Inert Gas Flooding System**
- Nitrogen Injection Fire Prevention and extinguishing system designed for oil filled transformer (for Generator Transformer) shall prevent tank explosion and the fire during internal faults resulting in the arc where tank explosion will normally take few seconds after arc generation and also to extinguish the external oil fires on transformer top cover due to tank explosion and/ or external failures like bushing fires, due to OLTC fires and fire from surrounding equipments.
- 4.04.00 Fire Alarm Panel
- Bidder shall provide necessary local control panels for the fire protection system, which shall contain the following components and perform the following functions as minimum.
- 4.04.01 Fire water pumping and pressurizing system
- Hot redundant PLC based system shall be provided for control and monitoring of hydrant system and spray water system. The system shall be provided with Graphic User Interface (GUI) with LCD screen based display unit , control switches and other operational keys and hardwired annunciation system. Necessary hardwired interface along with cables shall be provided for remote Operation & monitoring in the Main Fire Alarm Panel & workstations to be located in CCR .
- 4.04.03 Fire alarm detection and protection system
- Hot redundant Microprocessor based Fire detection alarm cum MIMIC panels shall be provided in the following locations
- i) Master Fire detection alarm cum MIMIC panel along with PC based operator station, 24 inch TFT LCD monitor, A3/A4 color laser jet printer , in fire station.
- ii) Main Fire detection alarm cum MIMIC panel along with PC based operator station , 24 inch TFT LCD monitor , A3/A4 color laser jet printer , in CCR
- iii) Repeater Fire detection alarm cum MIMIC panels , one each , in local area rooms eg , DM plant , AHP , CHP , CW pump house etc.
- 4.04.04 Volume VI of this specification shall be referred for technical requirements of different items eg. operator station, printer , panel , field instruments , cable

etc.

5.00.00 **SCOPE OF WORK**

5.01.00 **Mechanical**

- a) One (1) no. automatic electric motor driven horizontal centrifugal fire water pumps with accessories for hydrant service.
- b) Two (2) no. automatic diesel engine driven horizontal centrifugal fire water pumps with accessories for hydrant service.
- c) One (1) no. automatic electric motor driven horizontal centrifugal fire water pumps with accessories for high velocity spray service.
- d) One (1) no. automatic diesel engine driven horizontal centrifugal fire water pumps with accessories for medium velocity spray service.
- e) One (1) no. automatic diesel engine driven horizontal centrifugal fire water pumps with accessories for common standby service for both HVW and MVW spray service.
- f) Two (2) nos. (1 working + 1 standby) automatic electric motor driven vertical centrifugal jockey pumps.

However, the no. of hydrant and spray pumps shall be finalized by the EPC bidder during detail engineering.

- g) Two (2) nos. electric motor driven vertical centrifugal type booster pumps (1W+1S) with accessories, as required, for individual area.
- h) One (1) no hydro pneumatic tank and one (1) fire water storage tank of 5000 m³ capacity with two (2) compartments.
- i) Two (2) nos. (1 working + 1 standby) air compressor.

The capacity and head of hydrant, spray and jockey pumps and the sizing of compressors and hydro-pneumatic tank shall be finalized by the EPC bidder during detail engineering.

- j) One centralized inert gas flooding system for the areas specified, complete with cylinder rack, gas manifold, pressure reducing stations, detection system components and panel, nozzles, piping, fittings and valves.
- k) Foam tank skids for foam concentrate storage, complete with foam concentrate feed pumps, piping, fittings, valves, tank sludge trap and sludge disposal arrangement, safety valves, pressure gauges, level transmitter, level indicator and other required accessories.
- l) Foam proportional skids, complete with skid base frame, foam and water piping, deluge valve, adductor, foam nozzles, ROR heat

detector and alarm system, local alarm panel and other required accessories for the protected areas as specified elsewhere in the specification.

- m) Required nos. of portable fire extinguisher.
- n) Outdoor hydrant valves with hoses, solid jet/triple purpose/fog type branch pipes with nozzles and quick coupling as required for the entire outdoor hydrant system specified. The equipment shall be as per specification.
- o) Indoor hydrants (landing valves) with hoses, triple purpose branch pipe with nozzles and quick coupling end & "hose boxes" as required for the entire indoor hydrant system specified as per TAC/LPA rules.
- p) Out of total nozzles provided in indoor & outdoor hydrant system, at least 10% shall be "fog type" and balance shall be of ordinary type.
- q) The number of hose houses and hoses shall be as per TAC/LPA stipulations.
- r) 32 mm NB connections for first aid hose reels, first aid hose reels along with branch pipe fitted with nozzles and quick coupling ends and isolating valves, hose boxes as required for the entire first aid fire protection system specified.
- s) Sets of hydraulically operated deluge valves with bypass valve, isolating valve & test valve for all HT transformers as specified.
- t) Sets of solenoid operated deluge valves with bypass valve, isolating valve & test valve for entire spray system for coal conveyors, turbine lub oil tank, boiler burner front and cable vault/spreader rooms.
- u) Two (2) nos. of basket type strainers to be located at the discharge of spray water pumps.
- v) Sets of Chrome plated frangible bulb type detectors for areas identified elsewhere in the specification.
- w) Sets of addressable analog optical type of smoke detection arranged in X-zoning fashion for areas identified in the specification.
- x) Sets of addressable analog multi criteria smoke detectors arranged in X-zoning fashion for areas identified in the specification.
- y) Sets of Analogue Addressable type heat detectors for the areas identified in specification.
- z) Solar blind Infrared detectors with inbuilt air purging unit for each conveyor. Dual wavelength Infrared flame detectors for boiler burner fronts and turbine oil tanks.

- aa) Lot of linear heat sensing cables (non-electrically operated Fibre Optic LHSC) for the areas mentioned in the specification.
- bb) Gas sensing fire detectors working on air sampling for all control rooms and control equipment room.
- cc) Required nos. of addressable manual call points for the areas mentioned in the specification.
- dd) Lot of open sprayers for HVW & MVW spray system.
- ee) For periodic testing of deluge valve, one frangible bulb detector with GI pipe & isolating valve connected to detector network shall be provided for each of HT transformers.
- ff) One (1) no. of siren of 10 KM range (minimum diametric).
- gg) Complete lot of pipelines including all fittings for
 - Entire hydrant system.
 - Entire spray water (both HVW & MVW) system including network of sprayers.
 - Entire compressed air piping for pressurising hydro pneumatic tank.
- hh) Lot of cut-off gate valves, globe type instrument root valves and discharge valves for pumps & also for compressors. NRV's as required for firewater & compressed air lines.
- ii) RCC Pipe enclosures/hume pipes of appropriate class for buried pipelines for all road crossings, rail crossing & for all places where bulldozer may operate.
- jj) Vents and drains as required. Vent and drain valves shall be lockable type and drain lines shall be terminated to nearest surface drain.
- kk) Pressure break-down orifices as required for hydrant system, spray system and first-aid-fire protection system.

5.02.00 Civil

For civil works refer to Volume VII.

5.03.00 Electrical

All electrical equipment and accessories as required for this system shall be supplied. These equipment and accessories shall meet the technical requirements of individual equipment specification covered under "Electrical Equipment & Accessories - Volume V" of this Bid Document.

5.04.00 Control and Instrumentation

Scope of supply shall not be limited to the following:

- 5.04.01 All field mounted instruments viz. process transmitters, local indicators / gauges, process switches, sensors, converters, etc. along with accessories as per specification and approved P & ID. All process transmitters shall be smart type with HART protocol.
- 5.04.02 All type of analogue addressable Fire sensors / detectors and associated detector loop cable and addressable interface modules.
- 5.04.03 Floor mounted vertical Fire detection alarm cum MIMIC panel & repeater panels complete with panel, racks, redundant electronic modules, redundant power supply units, battery & battery charger, redundant CPU module, zone modules, redundant communication modules, display units, indicating lamps, relays, communication / networking & interconnection cables, prefabricated cables, network components etc. in fully wired condition with all accessories viz, terminal blocks, gland plates, base channel, anti-vibration mountings etc.
- 5.04.04 PC based Operator station
- 5.04.05 A3 / A4 Laser Jet type Printer .
- 5.04.06 Hot redundant PLC.
- 5.04.07 Industrial grade Laptop based engineering station loaded with all latest version licensed software required for programming, troubleshooting and analysis for Fire detection alarm cum MIMIC panel & Repeater panel. This laptop shall also have licensed Office documentation software and Antivirus software.
- 5.04.08 Licensed version of all software for the Fire detection alarm cum MIMIC panels , PLC systems, MMI & Peripherals etc.
- 5.04.09 Ergonomically designed Control desks complete with all accessories and operator's chair for all Operator stations.
- 5.04.10 24V DC (2X12V DC) Battery and Battery charging units for each Fire detection and alarm panel & repeater panel .
- 5.04.11 240V AC, 50Hz, +/- 1% Mini UPS system for Operator station of Fire detection alarm cum MIMIC panel & Repeater Panels.
- 5.04.12 Optical fiber cable, networking hardware comprising of LIU & Media converter to establish communication link in between the Fire detection alarm cum MIMIC panel & Repeater panel.
- 5.04.13 Complete process hook up materials such as. Impulse pipes & tubes of different grades, pneumatic tubing, stub, root valves, instrument isolation & blow down drain valves, valve manifolds, gauge valves, fittings, stands, brackets, supports, stanchions, frames, racks, foundation bolts, nuts and others erection hardware as applicable for installation of all field instruments /

racks.

- 5.04.14 All instrument racks, gauge board, Junction boxes and enclosure complete with all accessories. Canopy shall be provided for all outdoor applications.
- 5.04.15 All safety grounding cable
- 5.04.16 All instrumentation signals, control, power, detector loop cable, special, prefabricated cable, fiber optic cable , Linear heat sensing cable and grounding cable with all accessories such as cable glands, lugs, ferrules etc. as required for interconnecting Bidder's supplied Instruments, panels, annunciators, junction box or any other equipments within Bidder's scope of supply.
- 5.04.17 All perforated trays, flexible & rigid conduits, cable tray supports and hangers, cable accessories including pull / cable boxes, inspection covers, lugs, ferrules, fittings etc for the above cables.
- 5.04.18 All special tools and tackle viz. Copper cable splicing & crimping tool, Optical fiber splicing & jointing tool kit, Hand held programmer / calibrator (HART) for configuration of smart Transmitter, Fire detector testing kits as required for erection, commissioning & maintenance.
- 5.04.19 Supply of all start-up / commissioning spares.
- 5.04.20 All consumables like lubricants, tapes, markers, printer papers etc. up to handing over of I&C system.
- 5.04.21 Any other hardware / software, not mentioned explicitly, but essential for successful completion of work shall be considered in the scope of the Bidder.
- 5.04.22 Scope of Works

All items supplied by Bidder shall be erected, tested and commissioned by Bidder The quality of erection work shall conform to industry standards and shall take into cognizance of dust & water ingress.
- 5.04.23 Volume VII of this specification shall be referred for technical requirements of different items eg. operator station, printer , panel , field instruments , cable etc.

6.00.00 **DESIGN BASIS AND INPUT**

6.01.00 **Mechanical**

6.01.01 **Hydrant System**

- a) Provision of "double headed hydrants" as per the configuration of "risk area" shall be acceptable.
- b) Spacing of hydrant (outdoor) shall be 45 M in general and for internal

hydrant/landing valves spacing shall be 30 M (max.)

- c) Pressure at each hydrant point (both outdoor & indoor) shall be minimum 3.5 Kg/Sq.cm(g).
- d) Based on total nos. of hydrants (outdoor), nos. of branch pipes, triple purpose nozzles & hoses shall be determined as per guideline of TAC/LPA.
- e) Based on total nos. of indoor hydrants (landing valves), nos. of hoses branch pipe, triple purpose nozzles & hose boxes shall be determined as per guideline of TAC/LPA.

6.01.02

Spray Water System (HVW & MVW System)

- a) Minimum pressure at HVW nozzles and MVW nozzles shall be 3.5 bar and 1.4 bar respectively. Maximum pressure at HVW nozzles and MVW nozzles shall be 5 bar and 3.5 bar respectively. However, for cable vaults, same shall be as per TAC/LPA regulations.
- b) Water density for top & bottom conveyor belt shall be 10.2 lpm/sq.m.(min.)
- c) Water density for all surfaces of Transformer shall be 10.2 lpm/Sq.m only.
- d) Water density for Cable Spreader Room/ Cable Vault shall be 12.2 lpm/sq.m. (min.) of cable tray area.
- e) For turbine oil tank and purification area, burner front water density shall be 10.2 lpm/sq.m. (min.).
- f) Chrome plated nozzles shall be arranged in the form of ring to all transformers and nos. of such rings/tiers shall be decided considering maximum gaps between two (2) consecutive tier of rings as 3.0 M. The distance of the deluge valves from the transformers shall be approx. 6 metres.
- g) All nozzles shall be open sprayer type and chrome plated.
- h) No. of nozzles for any particular risk shall be selected considering the characteristic of nozzles provided by the bidder and also the density of water needed to protect completely the risk as per sl. no. (b) to (e) above/NFPA.
- i) Cable vaults/cable spreader rooms shall be suitably zoned. Total water requirement for each zone shall be limited to one-third the capacity of each spray water pump.
- j) Conveyor belt shall be suitably zoned. Length of each zone shall be so selected such that water requirement of each zone shall be limited to one-third the capacity of each spray water pump and in case of fire, three (3) zones (one forward and one backward and the zone under

fire) shall be flooded.

6.01.03 Inert gas flooding system

- a) Proprietary inert gas shall be used for inert gas flooding system.
- b) The centralized inert gas flooding system shall be designed considering the single largest protected volume.
- c) Required number of pressure reducing stations shall be provided in the gas manifold for gas pressure reduction from cylinder pressure to required gas flooding pressure.
- d) The inert gas flooding system and its components shall be designed as per NFPA 2001 recommendations.
- e) The cylinder rack shall be designed to accommodate sufficient number of inert gas cylinders so that the largest protected volume can be flooded.

6.01.04 Detection System (Microprocessor Based)

- a) Coverage of Frangible bulb type detectors, Infra red type heat detectors and multi criteria smoke detectors shall be considered. One smoke detector for every 100 m² or one heat detector for every 50m² of the compartment area shall be considered.
- b) Solar blind IRD with inbuilt air purging unit shall be 3 nos. minimum for each conveyor, 1 no. each at a distance of 1-2 M from tail end and head end and 1 no. at middle. However, same shall be verified with the covering range indicated by the manufacturer.
- c) Linear heat sensing cable shall be provided along the whole length of the top belt and bottom belt of each conveyor and on bearing and pulley of driving and non driving ends.

6.01.05 General

- a) Each zone of cable spreader room shall be provided with one (1) no. cut-off quick opening type Deluge valve.
- b) Each zone of conveyor belt shall be provided with one (1) no. Solenoid operated deluge valve.
- c) Water velocity in Fire water pipes shall be as per TAC/LPA recommendation.
- d) Frictional drop shall be calculated based on Hazen-Williams equation considering "C" as 120. Hardy-cross Method shall be applied to find out total frictional drop during selection of pump head. 10% margin in frictional head shall be considered during pump head selection.

- e) Actual pipe size & TDH of pumps shall be selected by Bidder based on "design basis & inputs" specified herein and as approved by the Owner/Consultant.
- f) Cut-off gate valves shall be provided for each small and big loops on as required basis.
- g) Pressure break-down orifice shall be provided as necessary to restrict pressure of all hydrant point upto 3.5 Kg/cm.sq.(g).
- h) Water sprayer shall be placed in such a way so that the "spray cone" overlaps each other. This is applicable for all transformers, cable vaults, conveyor belts and other areas where MVW or HVW spray system has been asked for.

6.02.00 Fire Detection Panel and repeater panel ,Linear Heat sensing cable

6.02.01 Fire Detection, Alarm and Protection system proposed through the Fire detection and Repeater panels shall provide continuous surveillance against fire in the areas of plant. All Fire detection and repeater panels shall be colored MIMIC based.

6.02.02 The Main Objectives of the of these panels are as follows:

- a) To detect fire in its early stages and activate or alert for implementation of Emergency action, thus protecting personnel and equipment.
- b) To provide an appropriate level of monitoring in the event of fire and audiovisual annunciation at respective Fire detection alarm cum MIMIC panel Repeater panel and the PC based operator station.
- c) Opening of the deluge valve in case of fire detection.
- d) The sensing of fire is accomplished through various types of fire detectors / LHS cable.
- e) To ensure high reliability and availability of the system with quick and exact identification of the fire location without false alarm.
- f) To provide contact output in the loop / from fire detection and protection panel & repeater panel for fire protection & other systems viz. opening of deluge valves, tripping of Ventilation System Fans / Dampers / Air Handling Units / tripping of belt conveyor / activating foam system / inert gas flooding system on detection of fire in specific area for effective fire protection.

6.02.03 Fire detection and alarm & Repeater cum MIMIC panel shall be provided in accordance with all codes and standards to annunciate fire alarm signals from fire protection and detection systems provided for the facility, annunciate system / device fault and to provide supervisory functions as required.

6.02.04 In case of fire, the audio-visual fire alarm shall be generated at Fire detection

- and alarm & Repeater panel and also initiate a signal to operate hooter(s) in the area where the fire signal is detected.
- 6.02.05 Indication (bright LED type) and Graphic Display (LCD type) shall be provided in each Fire detection and alarm & Repeater panel. Information / data from these Fire detection alarm cum MIMIC panels shall also be available in a dedicated computer based operator station in.. This computer shall be an UL/FM Listed PC used to display event information from the network in a text and graphical format. Graphic screens shall be created with a built-in drawing utility of the protected area and are linked to fire alarm devices. Should a device go into alarm, the appropriate graphic floor plan is displayed along with operator instructions. This shall provide a quick and easy way to inform operators of a fire's location in the buildings. The computer shall have features including event logging, event history tracking, fire panel programming and control.
- 6.02.06 Each Fire detection alarm cum MIMIC panel shall be capable of operating in stand-alone mode. All Fire detection alarm cum MIMIC panel, Repeater panels and PC based operator stations shall be connected by a dedicated fault tolerant Local Area Network (LAN) through redundant Fiber optic communication cable.
- 6.02.07 Fire detection alarm cum MIMIC panel shall have multiple loop processing capability. Each area / zone shall be monitored by one independent loop and a loop shall not be shared between different zones. Each Fire detection alarm cum MIMIC panel shall have additional capacity of handling at least ten alarms per zone, requiring only field wiring, as a spare for future modification or expansion.
- 6.02.08 The Fire detection alarm cum MIMIC panel shall continuously monitor the status of the detectors and connecting lines. The panel shall evaluate the analogue information received from each addressable detector and compare with set value to check for alarm condition.
- 6.02.09 Fire detection alarm cum MIMIC panel comprises of loop interface boards with specified loop capacity. The individual elements (detectors / sensors / control / fault isolation modules / interface modules) are looped together and connected to the loop interface board on the Fire detection alarm cum MIMIC panel on a 2-wire circuit (class B wiring).
- 6.02.10 Minimum indications to be provided on the Fire detection alarm cum MIMIC panel shall be Fire , Fault , Isolate , Pre-alarm, Multiple alarms.
- 6.02.11 Minimum controls to be provided on the Fire detection alarm cum MIMIC panel shall be Push button -Acknowledge , Push button- Reset , Push button -Test ,Push button - switch -Isolate.
- 6.02.12 Minimum information to be provided on the panel shall be Detector identification number, Connecting line identification number, Zone / Area description, Detector in isolated condition
- 6.02.13 Display of the status of the detector, sequence of the events, alarm and trouble summary etc. shall be displayed on the display unit of Fire detection

alarm cum MIMIC panel and as well as on the operator station and printer.

6.02.14 Alarms and indications of Fire detection alarm cum MIMIC panel s are repeated in the repeater panel. Repeater panels shall be provided with a 24" LCD display unit indicating major events, alarm, trouble etc., which shall repeat the information related to sector / area,zone, floor Elevation, room no. and detector no. etc., which are being displayed in the related Fire detection alarm cum MIMIC panel. Repeater panels shall allow acknowledgement of all alarm signals generated by fire alarm system.

6.02.15 The fire detection and alarm system shall be in normal operation even during mains 240V AC power failure. The stand by DC power supply from the battery in Fire detection alarm cum MIMIC panel shall be capable of maintaining the system in normal operation & in alarm condition for a period of not less than 48 hours after the failure of mains supply.

6.03.00 Electrical

6.03.01 The automatic fire detection and alarm system shall be designed with electronics having built-in redundancy to ensure availability at all times.

6.03.02 Bidder shall offer microprocessor based Intelligent/ analogue addressable type fire detection and alarm system. Fire alarm system working on microprocessor based system shall have dual redundant fibre optic data highway.

The fire detection and alarm system shall essentially consist of Fire detection alarm cum MIMIC panels with respective CRT Key Board Stations located in CCR, Fire detection alarm cum MIMIC panel, Master Fire Alarm Panel with CRT Key Board Station located in Fire Station, Satellite Fire Alarm panels located in various Plant areas, detectors, Manual Call stations, alarm devices, accessories, wiring and all connections to devices.

6.03.03 The Fire detection alarm cum MIMIC panels in CCR and the Satellite Fire Alarm Panels shall be used for fire detection, associated annunciation system, power supply distribution etc. of the fire protection system. Satellite Fire Alarm panels shall be strategically located in different areas of the Power Plant considering zone-wise detection.

The Fire detection alarm cum MIMIC panels in CCR and the Satellite Fire Alarm Panels shall be microprocessor based and their primary function shall be to raise an effective alarm by visual and audible means upon receipt of an alarm signal from any of its detection circuit(s) and to activate any device(s) that may be connected to the system(s).

Each detection circuit shall be continuously monitored for fire and fault. Alphanumeric indications shall be provided for fire and fault. Facility shall also be provided for simulation, for test purposes, of these conditions by operation of a control switch, which shall also have a facility to isolate and reset the alarm-receiving group.

6.03.04 The Fire detection alarm cum MIMIC panels located in CCR shall be used to

hook-up with each Satellite Fire Alarm Panel to indicate group zone-wise fire annunciation from Satellite Fire Alarm Panels. Fire detection alarm cum MIMIC panels shall also supervise, monitor and annunciate the abnormal condition of the circuitry of the fire detection system through local panels.

6.03.05 External circuit supervision shall not require additional wires other than the pair used for detection or alarm. These two wires shall provide both supervision and alarm signals.

6.03.06 Upon activation of any detection device installed in the circuit, the system shall automatically report the status and initiate the sequence of operations with the following functions as minimum :

- a) Sound an alarm on audible devices.
- b) Notify automatically central fire station.
- c) Light an indicating lamp on device initiating the alarm.
- d) Display "zone" and / or device no. on the panel with defined message.
- e) Activate the output relays for shutdown of ventilation/air- conditioning system, coal conveyor etc. as per requirement.
- f) Actuate in fire protection devices & deluge valves etc.

6.03.07 Alarm shall have priority over trouble. All trouble conditions shall be reported to include the zone / device no., location etc.

6.03.08 In the event of detection of fire, auxiliary systems like ventilation, air-conditioning may require shutdown. For this purpose potential free contacts from the output of the fire protection system shall be made available in the local / main fire panel and terminated in the terminal block

6.03.09 The Fire detection alarm cum MIMIC panels as well as Master Fire Alarm Panel shall have provision and facilities for connection to Intel i5 (or latest version at the time of supply) WIN NT (or latest at the time of supply) based Personal Computer with SVGA Monitor and dot matrix printer to be provided by the Bidder. Fire response program shall be furnished on screen and automatic action shall be initiated by keyboard / mouse operation.

6.04.00 **Civil**

6.04.01 Buried piping shall be laid generally at a depth of 1.0 M below grade. In case of road crossing, same shall be 1.5 M minimum.

6.04.02 Construction of Valve chamber for under ground pipes, Hose house and shed for deluge valves and compressor as per good engineering practice.

7.00.00 **DESIGN AND CONSTRUCTION**

7.01.00 **Fire Water and Jockey Pumps**