

TECHNICAL PRE QUALIFICATION REQUIREMENT

Name of Project :- **1X660MW TPS extension project Unit-5, Phase-III at Sagardighi- 400KV Switchyard**
Name of Customer :- **THE WEST BENGAL POWER DEVELOPMENT CORPORATION LIMITED (WBPDC)**
Name of Consultant :- **DEVELOPMENT CONSULTANTS PRIVATE LIMITED**
Name of Item :- **Fire Fighting System**

TECHNICAL PRE QUALIFICATION REQUIREMENT

1. The bidder should have designed, supplied, erected, tested and commissioned Fire Fighting Systems in at least two (2) separate thermal power projects of Unit rating not less than 500MW within seven (7) years as on 01.07.2020.
Fire Fighting System shall comprise of:
 - a) Fire Hydrant system, Fire Extinguisher
 - b) Addressable Fire Detection and Alarm System
2. The systems mentioned above should have been in **successful operation for a minimum period of two (2) years as on 01.07.2020.**

SUPPORTING DOCUMENTS TO BE ATTACHED

Sr	Required Criteria	Supporting Documents to be submitted by bidder along with technical bid
1	Design	Approved drawings/GTP etc.
2	Supply	Copy of Two nos. of POs/Material receipt certificate at site, etc.
3	Commissioning/ETC	Pre commissioning report / commissioning report etc.
4	Successful operation	Successful operation means certificate issued by the Customer certifying the operation without any adverse remark.

Notes (General points):

1. Consideration of offer shall be subject to customer's approval of bidder's, if applicable.
2. Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self- attested English translated document should also be submitted.
3. Notwithstanding anything stated above, BHEL reserves the right to assess the capabilities and capacity of the bidder to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL.
4. After satisfactory fulfilment of all the above criteria / requirement, offer shall be considered for further evaluation as per NIT and all the other terms of the tender.



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BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

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TYPE OF DOC.	TECHNICAL SPECIFICATION			NAME	SK	AR	AR
TITLE FIRE-FIGHTING SYSTEM				SIGN			
				DATE	28.03.2022	28.03.2022	28.03.2022
				GROUP	TBEM	W.O. No	
CUSTOMER	THE WEST BENGAL POWER DEVELOPMENT CORPORATION LIMITED						
CONSULTANT	Development Consultants Private Ltd. Kolkata						
CONTRACTOR	BHARAT HEAVY ELECTRICALS LIMITED						
PROJECT	1X660MW TPS extension project Unit-5,Phase-III at Sagardighi- 400KV Switchyard						

CONTENTS

<u>SECTION</u>	<u>DESCRIPTION</u>	<u>No. of Pages</u>
SECTION 1	Intent, System requirement and Scope	23
SECTION 2	Customer specification	87
SECTION 3	General Technical Requirement	12
SECTION 4	List of Documents	01
SECTION 5	Enclosures to Specification Annexure: Drawings	09

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CLIENT: The West Bengal Power Development Corporation Ltd.
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PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
**TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA**

TB-445-552-001

Rev. 00

Page | 1

SECTION 1

INTENT, SYSTEM REQUIREMENT, DESIGN CRITERIA AND SCOPE

INTENT OF SPECIFICATION

- 1.0.0 This specification is intended to cover following activities and services in respect of all the equipment of the **Fire detection and protection System to be provided for 1X660MW TPS extension project Unit-5, Phase-III at Sagardighi- 400KV Switchyard.**
- i) **Detailed design of all the equipment and equipment system(s).**
 - ii) **Complete manufacturing including shop testing.**
 - iii) **Providing engineering data, drawings, and O & M manuals as per specified format etc. for owner's/purchaser's review, approval and records.**
 - iv) **Packing and transportation from the manufacturer's works to the site including customs clearance/port clearance, if required.**
 - v) **Fabrication, pre-assembly, if any, erection testing and putting into satisfactory operation all the equipment including successful completion of trial operation.**
 - vi) **Performance and Guarantee tests after successful completion of trial operation.**
 - vii) **The system shall be designed, erected & commissioned in accordance with TAC/ NFPA guidelines.**
- 1.0.1 The requirements specified under SECTION 2, SECTION 3, SECTION 4 & SECTION 5 of the specification shall be considered as part of this section. In the event of any conflict between the various sections/sub-sections of this specification, SECTION 1 shall prevail. *Customer's contract specification attached with SEC 2 shall be referred strictly for equipment specification.*
- 1.0.2 It is not the intent to specify herein all the details of design and manufacture. However, the equipment and the system shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to Purchaser/ Owner, who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material, which in his judgment is not in full accordance herewith.
- 1.0.3 During contract stage, quantities of various items of BOQ may vary to any extent and same rates will be applicable so far the resultant variation in total contract value is within $\pm 20\%$. Variations beyond $\pm 20\%$ shall be negotiated mutually.
- 1.0.4 The Bidder shall deem to have understood completely all the tender drawings and documents and quoted accordingly.
- 1.0.5 **Deviation:** There shall preferably be no deviation on technical specification. The bidder shall sign and stamp the "Certificate for No Deviation" enclosed in Schedule-1, Section-5



CLIENT: The West Bengal Power Development Corporation Ltd.
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PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA

TB-445-552-001

Rev. 00

Page | 2

towards confirmation. Except for these deviations/variations covered under Deviation Schedules which are accepted by the Purchaser before the award of the Contract, it will be the responsibility of the Bidder to fully meet the intent and the requirements of the specification within the quoted price. *Deviations in any other form including clarifications / assumptions / etc will not be considered and it will be construed that the bid conforms strictly to the specification.*

- 1.0.6 The Bidder to note carefully that the parameters, estimated capacities of equipment indicated and the tender drawings in the specification are only for the guidance of the Bidder. The system shall be designed as per relevant standards/ codes and exact capacities and quantities are to be estimated by the Bidder. All such estimations and design calculations shall be submitted for Purchaser's approval.
- 1.0.7 It is the responsibility of the successful Bidder to obtain necessary approval/ clearance from statutory organizations wherever applicable for the equipment/ systems under the scope specified.
- 1.0.8 **The term 'Owner' appearing in this specification shall refer to The West Bengal Power Development Corporation Ltd. (WBPDC), the term consultant shall refer to Development Consultants Private Ltd. (DCPL), the term 'Purchaser' shall refer to BHEL and the term 'Contractor' shall refer to the successful Bidder.**



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PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA

TB-445-552-001

Rev. 00

Page | 3

SYSTEM REQUIREMENT, DESIGN CRITERIA AND SCOPE FOR FIRE DETECTION CUM PROTECTION ARRANGEMENT

1.0 Function

This system shall be designed to provide fire detection and protection services for 400kV Switchyard area. Design criterion shall be based on **"Ordinary Hazard Occupancies"** classification as described in Tariff Advisory Committee's (TAC) guidelines. The complete Fire detection and protection system shall be as per the guidelines/ codes/ standards / rules of TAC/ NFPA / IS: 3034 / OISD etc. and all the systems, equipments and installation shall have to be approved from TAC India or TAC accredited agency.

2.0 Scope & Design requirements

The makes/models and technical features offered for various components/ equipment shall comply with the standards of TAC/ BIS/ UL/ VDs and FM / NFPA/ LPCB as applicable. The key elements of fire protection cum detection scheme and the related areas are presented as under:

System	Areas Protected
Hydrant System	i. Outdoor 400 kV Switchyard-New ii. Baharampur Switchyard-Existing iii. Farraka – Jeerat (LILO)-Existing
Addressable Fire Detection & Alarm System	i. Bay control Room (with false ceiling) ii. LT switchgear Room (without false ceiling) iii. Battery and battery charger cum DCDB room (without false ceiling)
Portable Fire Extinguishers	i. Bay control Room ii. LT switchgear Room iii. Battery and battery charger cum DCDB room



CLIENT: The West Bengal Power Development Corporation Ltd.
CONSULTANT: Development Consultants Private Ltd. Kolkata
PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
**TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA**

TB-445-552-001

Rev. 00

Page | 4

3.0 Design Features

3.1 Detection System

- a. The Fire Detection and Alarm System will comprise of a network of Addressable intelligent multisensor Detectors (fire/smoke), Microprocessor based Fire Alarm Control Panel, Manual Call Points, Modules, Notification Appliances, Cables and other accessories required to form a complete addressable network (Terminal Boxes and Junction Boxes if required shall also be included in the scope).
- b. All equipment such as fire detectors, panels, notification appliances shall be approved or listed by UL/FM/LPCB/VDs.
- c. The fire detectors will be wired on a common connecting line called loop. Each loop consists of about 100 to 250 detectors / devices based on OEM standard. The number of loops and location of detectors to be installed in the various areas will be finalized during detailed engineering stage based on standards mentioned above.
- d. Automatic Fire Detection and Alarm System detect fire / over-heating by means of the attendant phenomena of fire, such as smoke or heat. It initiates alarm in fire alarm control panel and actuates pre-programmed control actions. Detection of fire at an early stage permits rapid intervention by fire fighting forces. Thus the automatic fire detection and alarm system reduces damage to property and risk to human lives.
- e. In case of fire, the detector or device envisaged in respective area will pick up appropriate signal and conveys to fire alarm panel located in respective areas. These signals trigger visual and audio alarms. The system initiates operation of extinguishing systems such as deluge system, sprinklers and transmits alarm and fault signals to predetermined points. The system must ensure that more number of detectors / devices can be connected in a loop and there will be a facility for additional loop modules for future expansion.
- f. The fire detectors are inherently addressable, which provide continuous surveillance in an area. The dedicated Microprocessor based Fire Alarm Control Panel will process the input signals from detectors at various locations of the switchyard and actuate the respective protection system.
- g. The system will have following self-diagnostic features:
 - Detector cabling will be completely supervised for open circuit and short circuit.
 - Unauthorized removal of a detector head from its base will be supervised to give a fault alarm on the connected control panel.
 - Annunciation will be provided for battery low voltage, battery earth fault, fuse blown and loss of main AC supply.
 - Alarm verification features.
- h. **Manual call points shall be located at the exit of every building.**
- i. The number of Detectors and their location will be so selected such that the internal area of the building is completely covered by the detectors. The zones of individual Detectors will overlap and no blind zone will be left. **The design coverage area for detectors shall not exceed 25 sq. m for each detector.**



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Sagardighi- 400KV Switchyard
TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA

TB-445-552-001

Rev. 00

Page | 5

- j. Detector shall not be mounted within 500 mm of obstruction. However, in case of minor obstruction, like light fittings etc. the distance may be reduced to 250 mm. wherever beam depth exceeds 450 mm and center to center of beam exceeds 2500 mm, separate detector shall be provided for each pocket.
- k. For Detectors mounted above false ceiling, a separate Response Indicator shall be mounted directly below the detector (on the false roof). When the detector is mounted below the false floor or in inaccessible position, response indicator for each of the detector shall be mounted on a separate box which shall be suitable for mounting on the wall.
- l. Addressable multi-sensor type smoke detectors shall be provided below false ceiling areas of buildings except for the Battery rooms where Addressable corrosion proof rate of rise of heat detector with fixed temperature element shall be provided.
- m. Two loop Fire Alarm Panel (1 working + 1 spare loop) of analogue addressable type shall be dedicated to Switchyard control room building and other areas where FDA system gets installed within switchyard area which shall further evaluate the signals received from the detectors, transmit the fire or trouble alarms (audio-visual) to prearranged points, supervise and monitor the complete fire detection circuits.
- n. Fire alarm control panel shall have filters to ignore false alarm and increase sensitivity to real fire from sensors and provision for automatic re-calibration of sensitivity levels of over/ under sensitive detectors. The sensitivity of each detector should be automatically raised if detectors are gradually polluted due to dust and dirt entering inside the detector. If detectors are more polluted the control panel shall give a warning. The trouble report shall indicate the location of device requiring service.
- o. All devices shall be individually identifiable for its type, its zone location, and alarm set value, alarm and trouble indication by a unique alpha numerical label. The detectors shall be self-compensating for ambient temperature and humidity. The detectors shall display a steady LED when in the alarm state. The LED shall flash when in standby or normal mode.
- p. One set of 24 V DC power supply system for fire alarm panel consisting of the following:
 - i) 2x100% Battery Chargers
 - ii) 1x100% batteries with battery backup of 24 hours (standby) and 30 minutes (in alarm conditions)
- q. Battery set shall be of adequate capacity to supply fire detection and alarm system and as well actuating devices such as solenoid valves etc. for a period of 24 hours and 30 min from the instant of charger/ AC failure (in alarm conditions). At least 25% of the devices shall be considered to be active in alarm conditions. Each of the redundant chargers shall be sized to meet connected load requirements and keep the connected batteries full charged (Float Mode). Furthermore, the charger shall be sized to enable the boost charge of a fully discharged battery in 10 hours while feeding the load.
- r. Necessary redundant transformers shall be provided by the contractor to derive the power supply from 415V, 3 phase, 3 wire incomers for above.



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PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA

TB-445-552-001

Rev. 00

Page | 6

- s. The detector cable and other control cable shall be armoured, screened and twisted, PVC Cu. FRLS cables type "S" in external areas and for inside building. Type "S" cable shall satisfy requirements of Article 760 NFPA 70.
- t. The wiring shall be of style 7 as per NFPA - 72 with loop/ short circuit isolators.
- u. Fire alarm panel of the switchyard will be in ring topology with FAP of the main plant. All the panels will be in a ring, when there will be fire anywhere, all the panels will get signal.
- v. Adequate no. of Back-lit maintained type emergency exit signs as per TAC shall be provided in all staircases of the building.
- w. Sounder cum flashers shall be required at the exit gates along with the hooters/ sounders along with Manual call points. With each Manual Call Point, hooter/Sounder flashers shall be considered.
- x. It shall be possible to replace any type of detector head by a different type detector without requiring change in cabling/panel wiring and condition of the zone, originally covered by the detector.

Notes: Fire alarm panel of the switchyard will be in ring topology with nearest FAP of the main plant through optical Fiber Cable. All the FAP of plants shall be in a ring and whenever there will be fire anywhere in plant, all the panels will get signal. Contractor shall make all necessary arrangement including supply of additional card for two-way communication in switchyard FAP under ring topology. **The make of FDA equipment for switchyard area shall be same as that of main plant FDA (SCHRACK SECONET/Autronica/Edward/BOSCH/Esser or Honeywell).**

Note: Make of FDA shall be finalized during detailed engineering with customer. Customer has already clarified to have FDA equipments for complete plant including switchyard of same make. Hence make finalized by customer shall be binding to contractor and there shall not be any price implication on account of FDA make considered by bidder at tender stage and during detailed engineering. Hence bidder may prepare their estimate and quote accordingly to full fill above requirement.

Contractor shall supply and lay this optical Fiber Cable for wiring of switchyard FAP with termination end of main plant nearest fire alarm panels for making it work under ring topology. Optical fiber cable shall be used to wire switchyard FAP with nearest FAP's under ring. Bidder may consider 750 meter FO cable for estimation purpose alongwith FO convertor in switchyard FAP and nearest two nos. FAP's, however actual length of the FO cable required to be worked out after detailed engineering and same shall be supplied and erected by contractor.

Panels shall be networked integrated through Dual Redundant Optical Fiber Data Highway connected in dual ring topology. Hence bidder shall ensure supply of two-way communication card/suitable convertor/hardware in the switchyard FAP as well as in the other FAP's to enable it to accommodate under ring and get all the communication done. Network interface items necessary to interface switchyard FAP with nearest FAP's shall be provided by contractor.

In the event of detection of fire, auxiliary systems like ventilation, air-conditioning may require shutdown. For this purpose, 10 nos. potential free contacts (Control relay module) from the output of the fire protection system shall be made available in the switchyard fire panel and terminated in the terminal block for further use



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PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA

TB-445-552-001

Rev. 00

Page | 7

in Respective AC unit and ventilation fan PDB. Automatic tripping of Ventilation fans, Air conditioner shall be interlocked with fire Detection System in case of fire in their respective installed areas.

- y. Microprocessor based Intelligent/ analogue addressable type fire detection and alarm system working on microprocessor based system shall have dual redundant fiber optic data highway.
- z. FAP shall have provision of Emergency Fire Alarm SMS through Mobile Network.

3.2 Protection System

3.2.1 Hydrant System

- a. Hydrant systems for the switchyard area shall be tapped off from main hydrant header for main plant. Single feed will be provided to the switchyard hydrant ring mains from the tap-off points. Tap-off coordinate (near switchyard fence) for switchyard hydrant system have been indicated in the GA of switchyard. ***This tap-off point (GV-2) of size 200NB for switchyard hydrant system has been indicated on Layout Plan of 400KV Switchyard (Drg. No: TB-DG-445-316-E002, Rev-06) provided under enclosures in section-5 of this technical specification.***

Available pressure at tap-off point shall be 12kg/cm² (approx.) and necessary orifice shall be design and supplied by contractor to reduce the required pressure of 7kg/cm² as per design requirement for switchyard area.

- b. **Hydrant system is designed for Ordinary Hazard Classification.**

- c. Hydrant system shall consist of Hydrant pumps, pressurization arrangement, water mains network, hydrant valves, landing valve, water monitors, hoses, branch pipes, nozzle, hose boxes, central hose houses etc. in switchyard area.
- d. Hydrant piping network in switchyard shall consist of hydrants valves & water monitors (if required) and will be provided preferably on the periphery of the switchyard area alongside of the road as per hazard condition and relevant TAC guidelines to have complete coverage. Applicability of water monitor shall be decided during detailed engineering.
- e. Suitable tapping shall be done from main network around periphery of switchyard to cover all areas as described in this section in line with relevant standard.
- f. Isolation valve shall be provided at suitable places so that a portion of the loop can be taken out for maintenance without any loss of system in the balance part.
- g. System shall be designed in a way so that minimum terminal pressure of 3.5 kg/ cm² can be maintained at the farthest/ remotest hydrant point of the switchyard.
- h. All the outdoor hydrants shall be provided with a front glass type hose box carrying 2 nos. 15 mtrs. hose along with branch pipe coupling and nozzle.
- i. Hydrants shall not be located less than 2m from building. No building shall be deemed to be protected by a hydrant unless such hydrant is within 15 m of the building. When height of the structure, tower exceeds 15 mtr, the concerned hydrant shall be replaced by water monitor.



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PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
**TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA**

TB-445-552-001

Rev. 00

Page | 8

- j. The hydrant pipe lines shall be overground. It shall be laid either on pedestals, trestles etc. However, if the layout does not permit laying of overground pipe in that case it shall be laid underground with the approval of Engineer.
- k. Any hydrant pipe lines if routed underground, shall be equipped with suitable coating and wrapping. Road, Rail or pipe trench crossing shall be through RCC Hume pipes duly covered with coating and wrapping as per specification. Hume pipe for road crossing shall be NP3 class. These Hume pipes shall be supplied by contractor.

Specific Data:

- a. All hydrant valves shall be of 63 NB dia. Single headed, oblique type having Stainless steel construction (MOC: Body/bonnet/stop valve/valve seat/trim: SS304/SS316) conforming to IS: 5290 or equivalent.
- b. **Water monitor** as per IS:8442 Type-I, Size: 75mm, Nozzle dia: 38mm. MOC: Water barrel/reducer/elbow: CS (seamless) /SS & Nozzle: Copper alloy / SS confirm in to IS:3444
- c. Hoses shall be of RRL type as per IS: 636 (Type-A) or Equivalent.
- d. Branch pipes shall be constructed of stainless steel SS-316 at both ends. One end of the branch pipe will receive the quick coupling while the nozzles will be fixed to the other end as per IS: 903 / IS: 2871. MOC: Branch pipe: SS316 (Gr 4 of IS: 3444) (both ends) & Nozzle: SS316 (Gr 4 of IS: 3444), Size: min 16mm & max 25mm.
- e. Hose cabinets shall have a 6 mm thick glass panel in front door with the word 'FIRE' painted on it with 150 mm (6") red letters. Hose cabinets shall be made of 16 gauge or thicker M.S. Sheets shall have rubber bushings to prevent ingress of water and dust.

3.2.4 Piping and Valves

General Data for Pipes etc.

- i) Mild steel (M.S. ERW) pipes as per IS: 1239 (Part-I) heavy grade (upto 150 NB) & IS: 3589 Gr 410 ERW (for sizes 200 NB and above) or Equivalent for pipes normally filled with water.
- ii) Pipe protection shall be as follows:
- iii) To prevent soil corrosion buried pipes / pipes in trench shall be properly lagged with corrosion protective tapes of coal tar type as per IS: 15337 or AWWA C 203. The total thickness of protective tapes to be applied on buried pipes / pipes in trench shall be 4.0mm. This can be achieved by using 4.0mm thick tape in single layer or 2.0mm thick tape in double layer.
- iv) Pipe thickness:
- a) For Pipe sizes upto 150 NB and above: As per IS: 1239 Part-I heavy grade.
- v) All valves shall be as per applicable IS/BS codes & approved by TAC for specific fire protection system and shall be provided with locking arrangement (with locks) in open or close condition. Further, all gate/butterfly valves of size 200 mm & above shall be provided with spur gear reduction unit.
- vi) All the flanges and counter flanges shall conform to ANSI B 16.5 Cl 150.



CLIENT: The West Bengal Power Development Corporation Ltd.
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PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
**TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA**

TB-445-552-001

Rev. 00

Page | 9

vii) Strainer Body as per IS: 2062 (tested).

viii) Pipe Fittings

Ratings/Wall thickness Minimum thickness to match with that of pipe for pipe size 65 NB and above. For pipe size above 150 NB, minimum thickness shall be 6 mm. For pipe size 50 NB & below rating shall be 3000 lbs or wall thickness matching with that of corresponding pipe. Material The material shall conform to ASTM A234 Gr. WPB or ASTM A105 or equivalent.

Note:

- 1) All fittings and flanges for galvanized pipes shall be galvanized.
- 2) Unless otherwise specified, all elbows/bends shall be long radius type.
- 3) The fittings shall be galvanized as per IS: 4736 for galvanized pipe application. In case of branching connections from GI mains for spray piping network socket may be welded for more than two pipe reductions instead of standard tees.
- 4) Working and test pressure of piping & fittings shall be as per IS or relevant international standards.

ix) PIPING THICKNESS:

Pipes for sizes 200 NB & above shall confirm to IS: 3589 Grade 410. The final thickness shall not be less than that specified as per IS: 3589 as indicated below.

Nominal pipe Size (mm)	Outside Diameter (mm)	Wall Thickness (mm)
200	219.1	6.3
250	273	6.3
300	323.9	7.1

- f. For MS pipeline, welded construction should be adopted unless specified otherwise.
- g. All piping system shall be capable of withstanding the maximum pressure (1.5 times of the maximum working pressure) arising from any condition of operation and testing including water hammer effects.
- h. **Water line Gate / Sluice Valve** - Design Code: a) IS:14846 or BS:5150 (for valves coming inside fire water pump house) b) BS:5150 (for valves at other locations)- Pressure rating: PN1.6 (as per IS:14846) / PN16 (as per BS:5150) -Working Pr. :12Kg/cm² & MOC: Body/bonnet/Yoke/Wedge : CI to IS:210 FG-200 Spindle: SS to ASTM-A-276 type 410.

3.2.5 Fire Extinguishers

- Fire extinguishers shall be installed in all the buildings within switchyard boundary as per TAC requirement
- **Portable type:**



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PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
**TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA**

TB-445-552-001

Rev. 00

Page | 10

a. Carbon dioxide of 4.5 kg capacity portable fire extinguisher conforming to IS 15683.

b. Dry chemical powder type 6 kg capacity portable fire extinguishers conforming to IS 15683.

- **Selection of type and location of installation of fire extinguishers for the various rooms of the switchyard buildings as described in relevant section of this specification shall be done in accordance with TAC guidelines.**

3.3 Painting

- All the Equipments shall be protected against external corrosion by providing suitable painting.
- The surfaces of stainless steel, Gunmetal, brass, bronze and non-metallic components shall not be applied with any painting.
- **All Steel Surfaces (external) exposed to atmosphere (outdoor installation)**
 - (i) **Surface Preparation:** The steel surfaces to be applied with painting shall be thoroughly cleaned before painting by wire brushing, air blowing, etc.
 - (ii) **Painting:** One (1) Coat of red oxide primer of thickness 30 to 35 microns followed up with three (3) coats synthetic enamel paint, with 25 microns as thickness of each coat. For plant at coastal area, epoxy resin based zinc phosphate primer followed by epoxy resin based paint pigmented with titanium di-oxide shall be used in place of enamel paints.
- **All Steel Surfaces (external) inside the building (indoor installation)**
 - (i) **Surface Preparation:** The steel surfaces to be applied with painting shall be thoroughly cleaned before painting by wire brushing, air blowing, etc.
 - (ii) **Painting:** One (1) Coat of red oxide primer of thickness 30 to 35 microns followed up with two (2) coats synthetic enamel paint, with 25 microns as thickness of each coat. For plant at coastal area, epoxy resin based zinc phosphate primer followed by epoxy resin based paint pigmented with titanium di-oxide shall be used in place of enamel paints.
- **Deluge Valves, Alarm Valves, Water monitors, etc.**

Painting of all equipments /components of FDPS package shall be as per manufacturer's standard practice or as detailed below whichever is superior in quality.

Environment	Paint scheme	Total DFT
Normal / Mild Corrosive Environment	Primer- zinc filled epoxy Finish – Aliphatic Polyurethane (shade RAL3000)(P.O Red)	Min 125 microns
Corrosive Environment (as in coastal areas)	Primer- zinc filled epoxy Intermediate – Epoxy MIO Finish – Aliphatic Polyurethane (shade RAL3000)(P.O Red)	Min 200 microns

- **Other requirements**

	CLIENT: The West Bengal Power Development Corporation Ltd. CONSULTANT: Development Consultants Private Ltd. Kolkata PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at Sagardighi- 400KV Switchyard TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR 400KV- SWITCHYARD AREA	TB-445-552-001
		Rev. 00
		Page 11

- Paint manufacturer's instructions shall be followed in method of application, handling, drying time etc.
- The color of the finish paint shall be as per approved color-coding.
- If finish paint was applied in shop, one coat of finish paint shall be applied at site.
- The dry film thickness of paint shall not be less than 0.15 mm.

• **Color code for identification**

The pipes shall be color painted/banded for identification as per the approved color-coding scheme and shall be generally as per IS-9404.

Enclosure:

- LAYOUT PLAN OF 400 KV SWITCHYARD (Drg. No TB-DG-445-316-E002, Rev-06)**
- Drg. of Battery room building (Drg. No. TB-DG-445-607-C628 & TB-DG-445-607-C630)**
- Drg. of Bay control room building (Drg. No. TB-DG-445-607-C638)**
- Drg. of LT switchgear room building (Drg. No. TB-DG-445-607-C618)**

4.0 SCOPE OF SUPPLY & SERVICES

- Exact requirements shall be worked out during detailed engineering after award of contract. The scope of the work under the contract shall be deemed to include all such items, which although not specifically mentioned in the bid documents and/or in the bidder's proposal, but are required to make the equipment/system complete for its safe, efficient, reliable and trouble free operation, unless the same is specifically excluded from the Bidder's scope of work under clause 5.0 of this section.
- Bidders shall consider makes for various equipments as per Annexure A which shall be subjected to Owner's approval during design engineering stage. Price implication to BHEL later on account of non-acceptance of proposed vendors by Owner shall not be considered.
- Bidder shall also consider the following while quoting for the system:**
 - Power & Control cables for fire protection system (except, cables for detection and alarm system & FO cable for the connection of switchyard FAP to the nearest main plant FAPs) will be supplied on free issue basis to contractor. Contractor shall have to choose their cables from the available sizes only and necessary modifications in their equipment for termination of these cables shall be made by contractor.
 - Since laying & termination of all power & control cables is in contractor's scope, supply of cable accessories such as lugs, glands, cable tags & markers etc. shall be included by the bidders in their offers alongwith supply of cable (power and control of suitable size, FRLS, twisted pair, armored Cu cable) for fire detection and alarm system.



CLIENT: The West Bengal Power Development Corporation Ltd.
CONSULTANT: Development Consultants Private Ltd. Kolkata
PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA

TB-445-552-001

Rev. 00

Page | 12

- iii) Necessary cable trays will be supplied on free issue basis to the contractor, however necessary hardware for fixing the same on walls or elsewhere shall be included by the bidders in their offers.
- iv) Earthing material viz. GS flat & wire will also be supplied on free issue basis to contractor; however, requirement shall be given by the bidders in their respective bids.
- v) Bidder shall ensure that sufficient quantities of commissioning spares are made available for timely completion of commissioning of the system. The bidder shall furnish a list of Commissioning spares that will be brought by him. The unused commissioning spares shall be returnable to the bidder.
- vi) The contractor shall lay the above ground piping required for hydrant system in the switchyard also shall construct RCC pedestals supports for these above ground pipes of adequate size. The size of pedestal shall be decided during detailed engineering with customer. Sufficient margin should be provided on both the side of pedestals and minimum distance should be considered between two pipes if laid over common RCC pedestals, wherever required.
- vii) Conducting performance guarantee tests as per approved procedure to the satisfaction of Owner / Purchaser and handing over an operational system to the owner. Procedure for performance guarantee test shall be submitted by contractor for customer review and approval.
- viii) Contractor shall submit valid Type test report for approval by owner. Fresh type test of equipment is not envisaged. It is presumed that equipment offered is duly type tested.

Type Test Certificate for degree of protection shall be submitted for all the electrical panels shall be as per customer specification.

In case the type test reports are found un-satisfactory, tests shall be carried out afresh by contractor without any additional cost implication to BHEL.

4.4. Scope of services

A. Erection, Testing & Commissioning (ETC) requirements

- i) The scope of ETC shall include handling of equipment/ material at site from safe storage, erection of equipment /material at site including fabrication, equipment and system testing, commissioning of the entire system, conducting performance guarantee tests to the satisfaction of Owner / Purchaser and final handing over to the owner of the entire system.
- ii) Furnishing technical calculations in support of equipment selection or sizing as and when required.

B. Electrical System



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PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA

TB-445-552-001

Rev. 00

Page | 13

- i) Preparations of cable interconnection diagram for equipment supplied under this contract and accordingly offer guidance to the purchaser for laying necessary cables. Termination details shall also be furnished in the said interconnection table.
 - ii) Laying & Termination of Power/ Control cables/FO Cables for the equipment under the scope of this specification. Bidders shall include all cable accessories like lugs, glands, cable tags, markers etc. in their respective bids.
 - iii) Earthing of all installations (to the nearest earth mat/ earthing pad) supplied under the scope of this specification.
- C. All machinery tools & tackles and consumables required for erection/testing / commissioning of the system shall be arranged by the Bidder.
- D. Minor modifications, alterations in system installation as per customer's specific requirements shall be done without any extra cost to purchaser.
- E. Bidders to ensure that sufficient quantity of spares are made available for timely completion of commissioning of the system. The bidder shall furnish a list of commissioning spares that will be brought by him. The unused commissioning spares shall be returnable to the bidder.
- F. **Obtaining approval from TAC/ TAC accredited agency on documents & installations.**
- i) Obtaining, "As Built" certification from purchaser or owner on applicable drawings. Completing documentation as per specification requirement.
 - ii) Obtaining customer's written acceptance of satisfactory completion of job. (Acceptance of PG + handing over of system and mandatory spares (if any)).
 - iii) Any other service not explicitly illustrated herein but which may be required to complete the system with its desired functionality or in the spirit of contract shall also deemed to be under the scope of bidder.

G. Civil Works

The Bidder shall however supply foundation bolts & hardware and undertake minor civil works such as grouting, filling up of crevices/ cut outs etc. Any damage caused to civil works during ETC work of the equipment/system shall have to be made good to the original finish by the Contractor at no extra cost to the Purchaser.

In addition, the following shall be in the scope of Contractor:

- i) Hydrant pipes, if laid underground (wherever as per site condition) shall be duly covered with coating and wrapping as per specification, if required on paved area etc. Road, Rail or pipe trench crossing shall be through RCC Hume pipes duly covered with coating and wrapping as per specification. Hume pipe for road crossing shall be NP3 class and same shall be supplied by contractor.



CLIENT: The West Bengal Power Development Corporation Ltd.
CONSULTANT: Development Consultants Private Ltd. Kolkata
PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA

TB-445-552-001

Rev. 00

Page | 14

- ii) Laying of aboveground piping on RCC pedestals to support the hydrant pipes wherever required.
- iii) Civil pedestals for above ground yard piping is under contractor scope. Contractor shall also supply all fixing hardware like plate, angle, U bolts etc. for laying aboveground yard pipes over pedestals.
- iv) Underground pipes, if any, shall be suitably covered with wrapping and coating material supplied and laid by contractor.
- v) Hume pipe (NP3) for road crossing.

5.0 Exclusions

- a) Receipt of material at site and safe storage of all material.
- b) Supply of power & control cables except for detection cable & FO cable. However, laying and termination of these cables shall be in contractor's scope. ***The bidder shall furnish quantity and type of cables required for complete system in their respective bids. Laying & termination is in contractor scope.*** Refer Annexure-B for list power and control cables procured by BHEL.
- c) Supply of necessary cable trays for laying power and control cables, however hardware for fixing the same on wall trenches or elsewhere shall be included by the bidder in his bid.
- d) Supply of GI flat for earthing of equipment.
- e) Supply & installation of false ceiling.

6.0 Utilities Available

Construction water and electricity shall be available at one point each. Contractor shall be required to make own arrangement for taking supplies from there. However, bidder may see the detailed scope of electricity/water supply for construction work in NIT terms and conditions.

7.0 Engineering Drawings/ Documents

Engineering shall start immediately after the award of the contract.

Submission & approval of all drg. / data sheet – as per tender requirement.

7.1 OPERATION & MAINTENANCE (O&M) MANUAL

Operation and Maintenance manuals shall be specifically compiled for the project by the bidders. The draft O&M manual shall be submitted along with the supply of the items. The O&M manual shall contain the following information:

- a. Description of the system and equipment with design particulars.
- b. Instruction for erection.
- c. Instruction for operation, maintenance and repair.
- d. Recommended inspection practices and inspection schedule.



CLIENT: The West Bengal Power Development Corporation Ltd.
CONSULTANT: Development Consultants Private Ltd. Kolkata
PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at Sagardighi- 400KV Switchyard
TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR 400KV- SWITCHYARD AREA

TB-445-552-001

Rev. 00

Page | 15

- e. Ordering information for all replaceable parts.
- f. Recommendation for type of lubricants and frequency of lubrication.

8.0 Handing & Taking Over

It is the responsibility of the contractor to maintain the firefighting system for switchyard till PG test conducted successfully and it is handed over to customer. Any defect noted during the period shall be rectified by the contractor without any price implication to BHEL. Also suitable PG tests shall be conducted by the contractor to show the achievement of guaranteed parameters in line with the requirements of specification/ standards/ codes and to the satisfaction of Purchaser/ Owner.

9.0 Bill of Quantity

Firefighting system for switchyard 1 x 660 MW TPS Extension Project Unit-5 at Sagardighi- 400kV Switchyard (AS PER TECHNICAL SPECIFICATION):

<u>Supply and ETC of Main Items as listed below:</u>			
Sl. No.	Item Description	Unit	Qty.
1.0	Single headed external hydrant valve SS construction (IS:5290, Type-A) 63NB	Nos.	20
2.0	RRL fire hose 63 mm dia. x 15 mtrs long with SS coupling (IS: 636 Type-A)	Nos.	40
3.0	Branch pipe with nozzle (SS-304) as per IS:2871	Nos.	20
4.0	MS fabricated glass fronted external hose cabinet	Nos.	20
5.0	Above ground MS pipe (as per IS:1239 part-1, heavy gr.) - 150NB	Meters	550
6.0	Above ground MS pipe (as per IS:1239 part-1, heavy gr.) - 100NB	Meters	210
7.0	Above ground MS pipe (as per IS:1239 part-1, heavy gr.) - 80NB	Meters	250
8.0	CI gate valve - 150NB	Nos.	6
9.0	CI gate valve - 100NB	Nos.	2
10.0	Hume Pipe (250NB) NP3	Meters	30
11.0	Addressable Multisensor Smoke Detector	Nos.	30



CLIENT: The West Bengal Power Development Corporation Ltd.
CONSULTANT: Development Consultants Private Ltd. Kolkata
PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
 Sagardighi- 400KV Switchyard
**TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
 400KV- SWITCHYARD AREA**

TB-445-552-001

Rev. 00

Page | 16

12.0	Addressable Manual Call Point	Nos.	8
13.0	Addressable Hooter cum strobe	Nos.	4
14.0	Addressable Fire Alarm Panel	Nos.	1
15.0	Isolator Module	Nos.	4
16.0	Addressable Control Module (Relay Mode)	Nos.	10
17.0	Addressable Control Module (NAC Mode)	Nos.	5
18.0	Twisted pair Armored Screened FRLS cable, 2CX1.5 sqmm.	Meters	1500
19.0	FO cable along with accessories	Meters	750
20.0	Carbon Dioxide type Portable Extinguisher (4.5 kg Capacity) as per IS:15683	Nos.	4
21.0	Dry Chemical Powder type Portable Extinguisher (6.0 kg Capacity) as per IS:15683	Nos.	4
22.0	Special Tools and tackles (as per cl. 11 of Section-1)	Set	1

Supply of Mandatory Spares of Fire Protection & Detection System

Sl. No.	Item Description	Unit	Qty.
1.0	Valves		
i.	Complete Hydrants Valves	Nos.	4
ii.	Set of Seat & Rubber Ring of Hydrants Valves	Set	3
2.0	Gate Valves (Isolating Valves)	Nos.	2
3.0	Branch pipe with Nozzle	Nos.	4
4.0	Fire Hose with SS Fittings Complete Assembly	Nos.	4
5.0	Manual call points	Nos.	1



CLIENT: The West Bengal Power Development Corporation Ltd.
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PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA

TB-445-552-001

Rev. 00

Page | 17

6.0	Detectors (Analog Addressable Type)		
i.	Photo-electric Type Smoke Detectors	Nos.	2
ii.	Combined Smoke & Heat Detector	Nos.	4
7.0	Fire Alarm & Detection Panel Items		
i.	Power Supply Module	Nos.	4
ii.	Zone Control Card/Module	Nos.	1
iii.	Audio Control Modules	Nos.	2
iv.	Input / Output Control Modules	Nos.	4
v.	Relay Module	Nos.	4
vi.	Battery	Nos.	2

a) The equipment and services to be furnished under this contract are detailed here under Cl. No.9.0 of this section is for reference. Contractor shall work out the actual requirement based on the building & switchyard layout enclosed with this specification during detailed engineering stage.

b) The Bill of Quantities shall be read in conjunction with the Instructions to Bidders, General and Special Conditions of Contract, Technical Specifications, and Drawings.

c) The quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Purchaser and valued at the rates and prices bid in the priced Bill of Quantities.

d) A rate or price shall be entered against each item in the priced Bill of Quantities. The cost of Items against which the Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.

e) The whole cost of complying with the provisions of the Contract shall be included in the Items provided in the priced Bill of Quantities, and where no Items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related Items of work.



CLIENT: The West Bengal Power Development Corporation Ltd.
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PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA

TB-445-552-001

Rev. 00

Page | 18

f) General directions and descriptions of work and materials are not necessarily repeated nor summarized in the Bill of Quantities. References to the relevant sections of the Contract documentation shall be made before entering prices against each item in the priced Bill of Quantities.

g) Miscellaneous items like hardware, fixtures, fittings etc. shall be deemed to be included under the relevant BOQ items and bidders shall consider the same while quoting for BOQ items.

h) Exact requirements shall be worked out during detailed engineering after award of contract.

i) Bidders shall consider makes for various equipments as per Annexure-A, which shall be subjected to customer's (end client) approval during detailed engineering stage.

No additional price implication shall be made to BHEL on account of customer's non-acceptance on any proposed makes/sub vendor provided by contractor during detailed engineering.

10.0 Inspection & Testing

All the equipments shall be inspected prior to dispatch in line with relevant IS, approved GTP/ drawing and technical specification, BHEL/ customer approved QAP.

11.0 Special Tools and Tackles

The supplier shall supply all necessary tools and instruments etc. for installation, repair and maintenance etc. of each item of the equipment supplied. List of such tools including their make and detailed specification, shall be submitted for acceptance.

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. All the special tools & tackle as required for fixing, removal and testing of the sensor shall be furnished by the manufacturer and which shall not be limited to the following:

(I) Detector Removal Tool

(II) Tool shall be universal type to remove / replacement of different size detectors mounted on the ceiling.

(III) Telescopic Pole

(IV) To access detectors fitted upto 6 m above floor level. Removable tool can be fixed on the top of the pole for removal of detector.

(V) Heat Detector Tester

(VI) The heat source is directed at the detector sensor, not the plastic components. This will be 240V AC, 50 Hz and battery operated. Adequate cable length not less than 5 m shall be supplied.

(VII) Smoke Detector Tester

(VIII) Aerosol shall be suitable for all makes and models of detector, whilst not harming the detector, its components, the user or the environment.



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PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA

TB-445-552-001

Rev. 00

Page | 19

(IX) A Laptop computer for engineering configuration with both FAP Software and PLC Software loaded to be provided at the Common Centralised Fire water Room .

(X) Addressing Tool

(XI) Address and mode setting tool for all analog detectors and other addressable units.

(XII) Portable UV / IR Test Lamp

(XIII) Portable battery operated explosion-proof source of UV / IR radiation that will be used for UV, IR, UV/IR flame detection systems.

(XIV) Any other tools and tackle as deemed necessary by the contractor for his supplied system.

12.0 Sub-Vendor List

Bidder shall choose make of materials strictly from list enclosed in Annexure-A to this section.

However final applicable make is subject to ultimate customer approval. Bidder can provide any other make that is not included in the list below under special circumstances only if it is acceptable to ultimate customer without any cost implication to BHEL.



CLIENT: The West Bengal Power Development Corporation Ltd.
CONSULTANT: Development Consultants Private Ltd. Kolkata
PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
**TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA**

TB-445-552-001

Rev. 00

Page | 20

ANNEXURE- A

SUB-VENDOR LIST FOR FIRE FIGHTING SYSTEM

S.N.	ITEMS	APPROVED SUB-VENDOR	PLACE	REMARK
1	HYDRANT VALVES & BRANCH PIPE, NOZZLES & COUPLINGS	SHAH BHOGILAL	AHMEDABAD	ISI MARKED
		SUKAN	AHMEDABAD	ISI MARKED
		NEWAGE	SURENDRA NAGAR	ISI MARKED
		WINCO	AHMEDABAD	ISI MARKED
		VENUS		
3	FITTINGS & FLANGES	M S FITTINGS	KOLKATA	
		METAL LLOYDS	MUMBAI	
		BHARAT FORGE	PUNE	
		TUBE PRODUCTS	BARODA	
		NITIN PROFILE	BARODA	
4	MS/ GI ERW PIPES	JINDAL	GHAZIABAD	
		SURYA ROSHINI	BAHADUR GARH	
		INDUS TUBES		
		TATA	JAMDESHPUR	
		SAIL		
5	FIRE HOSES	NEWAGE	SURENDRA NAGAR	ISI MARKED
		CHATTARIA RUBBER	BARUCH	ISI MARKED
11	MICROPROCESSOR BASED FIRE ALARM PANEL, DETECTORS & OTHER ALARM DEVICES	SCHRACK SECONET/ Autronica/ Simplex/ Edward/BOSCH/ Esser or Honeywell / Detectomat/ Secutron		UL/FM / LPCB/VDS APPROVED
12	COATING & WRAPPING MATERIAL/TAPE	MP TAR PRODUCTS	BHILAI	
		RUSTECH	MUMBAI	
		IWL Ltd.		



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PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA

TB-445-552-001

Rev. 00

Page | 21

13	CAST IRON GATE VALVE	H.SARKAR KBL LEADER KALPANA VENUS	KOLKATA KIRLOSKARWADI JALLANDAR KOLKATA KOLKATA	
14	BATTERY	EXIDE AMAR RAJA AMCO	KOLKATA TIRUPATI	
15	AIR RELEASE VALVE	H.SARKAR LEADER KALPANA VENUS A.V VALVES LTD. WINCO	KOLKATA JALLANDAR KOLKATA KOLKATA AHMEDABAD	
16	PRESSURE GAUGE	AN INSTRUMENTS H GURU MANOMETER FORBES MARSHALL (HYD)	KOLKATA KOLKATA THANE HYDERABAD	
18	PAINT	SHALIMAR ASIAN PAINTS BERGER		
19	BATTERY CHARGER	EXIDE AMARA RAJA AMCO HBL NIFE CHHABI ELECTRICALS	KOLKATA TIRUPATI BANGALORE HYDERABAD JALGAON	
20	POWER & CONTROL CABLE	CORDS CABLE NICCO TORRENT POLYCAB DELTON		



CLIENT: The West Bengal Power Development Corporation Ltd.
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PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
**TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA**

TB-445-552-001

Rev. 00

Page | 22

		PARAMOUNT		
21	FIRE EXTINGUISHER	KANEX SAFEX NITIN		ISI MARKED ISI MARKED ISI MARKED

*Please refer the list of sub vendors attached below in section-2 for the items which are not covered in Annexure-A.



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PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
**TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA**

TB-445-552-001

Rev. 00

Page | 23

ANNEXURE- B

LIST OF POWER & CONTROL CABLES

Power cable:

S. No	Item Description
1	2C X 25 sq.mm XLPE/Cu Power cable
2	2C X 16 sq.mm XLPE/Cu Power cable
3	4 CX70 sq.mm XLPE/AI Power cable
4	3.5CX300 sq.mm XLPE/AI Power cable
5	3.5CX185 sq.mm XLPE/AI Power cable
6	4CX35 sq.mm XLPE/AI Power cable
7	4CX16 sq.mm XLPE/AI Power cable
8	2CX16 sq.mm XLPE/AI Power cable

Control Cable:

S. No	Item Description
1	5 C X 4 sq.mm PVC/CU Control cable
2	2C X 2.5 sq.mm PVC/CU Control cable
3	5C X 2.5 sq.mm PVC/CU Control cable
4	7C X 2.5 sq.mm PVC/CU Control cable
5	9C X 2.5 sq.mm PVC/CU Control cable
6	12C X 2.5 sq.mm PVC/CU Control cable



CLIENT: The West Bengal Power Development Corporation Ltd.
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PROJECT: 1X660MW TPS extension project Unit-5 at Sagardighi- 400KV Switchyard
TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR 400KV- SWITCHYARD AREA

TB-445-552-001

Rev. 00

Page | 1

SECTION - 2

CUSTOMER SPECIFICATION

(Equipment Details and customer's sub vendor list)

Customer technical specification of Fire Detection and Protection System is attached in this section.
Total Pages- 87



WBPDCL

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

VOLUME: II-J1

SECTION: III

**TECHNICAL SPECIFICATION
FOR
FIRE DETECTION PROTECTION SYSTEM**



Development Consultants Pvt. Ltd.

**Volume: II-J1
Section: III
Fire Detection Protection System**



CONTENTS

CLAUSE NO.	DESCRIPTION	PAGE NO.
1.00.00	GENERAL INFORMATION	1
2.00.00	CODES & STANDARDS	1
3.00.00	SYSTEM DESCRIPTION	2
4.00.00	OPERATIONAL PHILOSOPHY	12
5.00.00	SCOPE OF WORK	20
6.00.00	DESIGN BASIS AND INPUT	25
7.00.00	DESIGN AND CONSTRUCTION	38
8.00.00	INSPECTION AND TESTING	65
9.00.00	DRAWINGS, DATA & MANUALS TO BE SUBMITTED BY THE BIDDER	69

ATTACHMENT

ANNEXURE-I	DATA SHEET OF MECHANICAL ITEMS	73
ANNEXURE-II	DATA SHEET OF HOSE HOUSE	86
ANNEXURE-III	DATA SHEET OF DELUGE VALVE SHED	87
ANNEXURE-IV	DATA SHEET OF DETECTORS	88
ANNEXURE-V	LIST OF FIXED FIRE PROTECTION AND DETECTION SYSTEM	94

**SECTION-III****FIRE DETECTION 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 1x660 MW Sagardighi Thermal Power Station, Phase-III, Unit-5 for The West Bengal Power Development Corporation Limited (WBPDCL) at Sagardighi, Murshidabad District, West Bengal 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 water pumping system, hydrant and spray piping network, fire detection, alarm and protection system including supply of all fire extinguishing equipment and systems, fire detectors, manual call points, linear heat sensing cables/ Intelligent addressable type heat sensing cable, all local, remote fire detection & 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 design, construction, testing and operation of the equipment or any item under Fire protection and detection system shall comply with the requirements of the latest revisions of one or more of the following standards as applicable:

High Voltage Direct Current Converter Stations Electric Generating Plants

IS: 3034 - Fire Safety of Industrial Buildings: Electrical Generating and Distributing Stations – Code of Practice.

NFPA 10: Portable fire extinguishers

NFPA 11 - Standard for Low-Expansion Foam

NFPA 12: Carbon Dioxide extinguishing system

NFPA 13 - Standard for the Installation of Sprinkler Systems

NFPA 14 - Standard for the installation of Standpipe, Private Hydrant and Hose systems

NFPA 15 - Standard for Water Spray Fixed Systems for Fire Protection





NFPA 20: Centrifugal fire pumps, installation

NFPA 2001 - Standard for Clean Agent extinguishing system

NFPA 22: Water storage tanks

NFPA 24: Private fire service mains and their appurtenances, installation

NFPA 37: Standard for the installation and use of stationary combustion engines and gas turbines

NFPA 72: National fire alarm code

NFPA 850 - Recommended Practice for Fire Protection for Electric Generating Plants and

OISD- 117 - Fire protection facilities for Petroleum depots, terminals and pipeline installations

Fire Protection Manual of TAC

Rules for Fire Alarm System of TAC

Rules for Hydrant System of TAC

Rules for Sprinkler System of TAC

Rules for Water Spray System of TAC

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), 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 over ground pipe 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 shall be 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) Entire Power House including Boiler Area and Turbine House.
- b) Baharampur Switchyard (2No. Bays) & Farraka – Jeerat (LILO) - 2 No Bays built by M/s PGCIL(1350N to 1500N) & other switchyard areas
- c) Mill Building
- d) ESP Control Building
- e) Generator & Unit transformer, Station Transformers in transformer Yard, switchyard area
- f) CW & ACW Pump House including chlorination plant and dosing pump house
- g) HVR transformer at ESP roof top
- h) Wagon Tippler (WT) with Sub-station building, Pent house, Crushers houses with Sub-station building, connecting conveyors and Transfer points (TP)
- i) Coal conveyor from existing TP-19 to Boiler including tripper floor
- j) Fly Ash Vacuum Pump cum Transport Air Compressor House
- k) FGD & SCR area
- l) Ammonia storage and handling area
- m) DG Building
- n) CPU regeneration building
- o) 2 Nos. of Hydrant & Spray Water tapping points with isolation valves from Header for future use shall be considered

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 outbreak 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. All deluge valves shall be provided with manual Override with Bypass line (with Isolating valve). 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 Main Fire Alarm Panel to be located in Central control room & Fire water Pump House. All Fire Alarm Panels are Main.

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.
- One (1) no. Station transformers.
- Unit and Station Auxiliary transformers as per design requirement.
- Spare Generator Transformer
- Any other transformer having capacity above 10 MVA.

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:

- All oil filled transformers having capacity less than equal to 10 MVA.
- Turbine Lub oil tanks and purifiers.



- Boiler Burner Fronts.
- Central Lub Oil & Control oil Tanks (both clean oil and dirty oil tanks) and purifier units.
- Drain Oil Tank of Boiler area
- Generator seal oil system.
- Lube oil & control oil system for turbine driven boiler feed pumps.
- Turbine oil canal pipe lines in main plant.
- Diesel Tank of DG set

The operation of the Deluge Valve shall be annunciated in the Main Fire Alarm Panel as well as in Sub-Fire Alarm Panel. The system shall also have a manual over riding facility along with regular testing facility.

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 Valve shall be annunciated in Main Fire Alarm Panel to be located in Central control room & Fire water Pump House. All Fire Alarm Panels are Main. 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, bunker bay conveyors and tripper floor area in coal handling plant. 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.

High sensitive Linear Heat Sensing (LHS) Cable/ Intelligent addressable type heat sensing cable and solar blind infra-red



amber detector shall be provided to detect fire in coal conveyor. Upon detection of fire, drive motor shall automatically stop and annunciation shall be provided in the Main Fire Alarm Panel as well as in Sub-Fire Alarm Panel. Simultaneously, the MVW spray system shall be automatically brought into operation by opening the solenoid operated deluge valve actuated from the detection circuit. The spray system shall be designed to spray water on the three zones of Conveyors (one forward & one preceding zone and the zone under fire).

LHS cable/Thermal sensor based addressable Heat sensing Cable shall be provided along the complete length of conveyor suitably covering both top, bottom & side of belt and including the head end drive & tail end drive.

Amber detector shall be provided one at head end, one at tail end and one at middle of each conveyor section. Solar Blind Infra-red amber detectors shall be provided with air purging unit.

- All Cable vaults & cable spreader rooms of Phase-III.

The entire area of cable spreader room and cable vaults is to be sectionalized into suitable number of zones and each zone shall be protected by automatic operation of MVW Spray System.

Addressable, analogue multi criteria (smoke & heat) type detectors in cross zoning principle shall be provided in all cable vaults and cable spreader rooms. In addition linear heat sensing cable/Intelligent addressable type heat sensing cable shall also be provided on each cable tray to detect the fire. Upon detection of fire and actuation of zone annunciation, MVW Spray System will be brought into operation by automatically opening deluge valve, which will allow the projectors located in that zone to direct water in the form of spray which will cut-off oxygen supply and extinguish the fire.

3.01.04 Sprinkler System

Wet pipe sprinkler systems are most commonly installed sprinkler systems. They are the most reliable, because they are simple, with the only operating components being the automatic sprinklers. And automatic water supply provides water under pressure to the system piping.

Each closed-head sprinkler is held closed by either a heat-sensitive glass bulb or a two-part metal link held together with fusible alloy. The glass bulb or link applies pressure to a pipe cap which acts as a plug which prevents water from flowing until the ambient temperature around the sprinkler reaches the design activation temperature of the individual sprinkler head. In a standard wet-pipe sprinkler system, each sprinkler activates independently when the predetermined heat level is reached.

- a) Each Silo fill gallery (bunker bay)





- b) Each Turbine Generator area under-floor (Ground floor, including all areas subject to spread of oil)
- c) Each Turbine Generator area under-floor (Mezzanine floor and turbine lagging, including all areas subject to spread of oil)
- d) Locker rooms, corridors, laboratories and office spaces shall be protected by closed head sprinkler systems.

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.

- (a) Above false ceiling and below raised floor (if required) of Common Control room (CCR), Electronic Equipment Room (EER), Shift-in Charge Room & Record room and Computer Room.

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 Main Fire Alarm Panel in central control room. 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. Inert gas canister type fire extinguisher shall be installed in all UPS & HUB room.

- 3.02.00 Fire water and Jockey pumps along with all drives and accessories shall be located in CW-ACW pump house of Phase-III. Suitable dedicated water storage as per statutory guidelines shall be provided in CW sump for fire water pumps. Water for both hydrant and Spray System shall be supplied by means of dedicated sets of hydrant/spray water pumps. The pumps will be started automatically in proper sequence when a large quantity of water flows out from pressurized water circuit. All the pumps used in the Fire Protection System shall be of vertical, centrifugal type.

Necessary arrangement for proper continuous circulation of water shall be provided. The sump shall have two (2) nos. (Redundant) Level Transmitter (Non-contact radar Type) for continuous level measurement for monitoring



and control. The 4-20 mA output from the level transmitter shall be hardwired to the PLC for monitoring and control.

In addition to above, two (2) nos. tap-off points for hydrant and spray network each has been provided for Phase-III from pressurized headers of Phase-II. For details of existing pumping system, please refer section-III of Volume-IIA.

3.03.00 Fire Detection Alarm System

- a) Fire detection and Alarm system proposed shall provide continuous surveillance against fire in the areas of plant including the main plant TG Building and other in site plants & buildings.
- b) The Main Objectives of the Fire Detection system are as follows:
 - i) To detect fire in its early stages and activate or alert for implementation of Emergency action, thus protecting personnel and equipment.
 - ii) To provide an appropriate level of monitoring in the event of fire and audiovisual annunciation at respective Fire Alarm Panel (FAP) and the PC based operator station.
 - iii) The sensing of fire is accomplished through various types of fire detectors / LHS cable //Intelligent addressable type heat sensing cable/ IR & Amber detector / Air sampling type detector depending upon application.
 - iv) To ensure high reliability and availability of the system with quick and exact identification of the fire location without false alarm.
 - v) To provide contact output from FAP to fire protection systems viz. opening of deluge valves, tripping of Ventilation System Fans / Dampers / Air Handling Units / tripping of belt conveyor / / Clean Agent flooding system on detection of fire in specific area for effective fire protection.
- c) Fire detection and Alarm System shall broadly consist of individual Fire detectors; Fire Alarm Panel (FAP) with system control terminal & annunciation system and PC based operator station & printer.
- d) FAP (consisting of alarms, acknowledge, troubles, and supervisory) 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, to annunciate system / device fault and to provide supervisory functions as required.
- e) On receipt of impulse from the detectors, in the event of fire, suitable annunciations signal shall be exhibited in the main Fire Alarm Panel as well as sub- Fire alarm panel. The complete 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 to identify the affected zone quickly in the FAP.



- f) The FAP & their locations shall be as follows:

S/N	DESCRIPTION	LOCATION OF FAP & OPERATOR STATIONS
1.	FIRE ALARM PANEL-1	CW Pump house
2.	FIRE ALARM PANEL-2	Central Control Room
3.	Microprocessor based Fire Detection and Alarm panel (FAP) with PC based OWS, LED Monitor & Printer shall be provided and to be located in Control Room of Coal Handling Plant, if required during detail engineering.	

FAP shall have provision of Emergency Fire Alarm SMS through Mobile Network.

- g) The Fire Alarm System consists of multiple Fire sensors distributed throughout the plant buildings in various areas of the plant and these detectors are connected to the Fire Alarm Panel. This system shall automatically detect the presence of Smoke / Heat /Fire phenomena round the clock.
- h) There shall be a centralized Fire Water Control Room at CW pump house of phase III. FAP network of phase III at Centralized Fire Water Control Room shall have connectivity to phase II FAP Network so that both stage II and Stage III fire alarm system can be monitored from the new Fire Water Control Room of phase III. Necessary hardware/software required for this integration shall be in bidder's scope
- i) The Fire detector shall determine whether a fire condition exists in the room / area where the detector is located. In case of fire, the audio-visual fire alarm shall be generated at Fire Alarm Panel (FAP) and also initiate signal to operate Hooters located at convenient places in the plant. Alarms will be displayed at both the fire alarm panels and. No new Siren is required for phase III system. The new system to be hooked up with existing (phase-II) system. Necessary hardware required for interfacing shall be in the scope of bidder.

3.04.00 Type of detectors to be provided shall be as follows:



- a) Multi criteria (smoke & heat) type detectors shall be provided in the following areas:
- i) All cable Spreader Rooms & Cable Vaults in powerhouse (TG Building) and in all other building Cable Vaults.
 - ii) All Electrical Switchgear /MCC Rooms located in Power House (TG Building) and in all Switchgear /MCC Rooms of other buildings.
 - iii) Main plant Central Control Room, Control equipment room equipped with DDCMIS & other electrical/electronic panels, computer rooms, UPS & battery charger room, SWAS analyzer room, CPU control room, ESP control room, etc. and in all in site plant building control rooms.

Cross-zoning of detectors shall be provided for release of clean agent and MVW spray.

- b) Fixed cum Rate of rise (ROR) Heat detectors shall be provided in the following areas.
- i) Battery rooms.
 - ii) Smaller capacity LT transformer (less than 10 MVA).
 - iii) Main and unit Turbine oil tank and purifier.
 - iv) Boiler Firing Floors.
 - v) Inside turbine acoustic enclosure.
- c) Linear heat sensing cable/ intelligent addressable type heat sensing cable shall be provided for coal conveyor and cable rack inside all cable Spreader Rooms & Cable Vaults in the plant boundary.
- d) Solar blind infra-red amber detectors in each coal conveyor to detect presence of fire (glowing coal).
- e) Air sampling type smoke detector shall be provided for above false ceiling area in the Central control room and control equipment room.

3.05.00 Entire Power House Building and the outdoor yard of plant shall be divided into a number of zones with addressable manual call points in each zone. The outdoor call points shall be installed on approximately 1.4 M +/- 0.2m above floor level 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, CW Treatment building, Vacuum Pump cum AHP Compressor house etc.
- h) All buildings like ESP Control building, FGD control building etc.

Number of manual call points shall be decided during detailed engineering.

- 3.06.00 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.
- 3.06.01 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.
- 3.06.02 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.
- 3.07.00 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. At least two fire escape exit openings to the open areas shall be provided for the TG area as prescribed by the TAC/LPA.
- 3.08.00 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.
- 3.09.00 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.



- 3.10.00 "First aid fire protection system" shall be provided for Power house.
- 3.11.00 Gas sensing fire detectors working on air sampling shall be provided for all control rooms and control equipment room.
- 3.12.00 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.
- 3.13.00 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% booster pumps (one (1) no. motor driven+ one (1) no. diesel engine driven) shall be provided for individual areas for supplying pressurized water to the hydrant points. Booster pumps shall be installed online to the branch header to riser pipes. The booster pumps, if required, shall be started through pressure switch when pressure on their discharge side falls below the set pressure.
- 3.14.00 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. Fire Survival Cables will be used as per Electrical specification –section-IV of vol. II-F/2.
- 4.00.00 **OPERATIONAL PHILOSOPHY**
- 4.01.00 **Hydrant System**
- 4.01.01 Operation of hydrant system shall be semi-automatic. A pressurised 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, 1st motor 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 1st pump and falls further down, this low pressure shall actuate another pressure switch which in turn shall cut in automatically the second motor driven pump in hydrant system. Similarly the standby Diesel Engine driven pump will come into operation based on the system requirement sequentially. 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 pressurised 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 thereby to the whole firefighting system.



- 4.01.03 Hydrant network of Phase-III shall have provision for interconnection with pressurized hydrant network system of Phase-II through two (2) manual valves. In case of persisting low pressure annunciation in the hydrant network in spite of starting of both the hydrant pumps of Phase-III, these interconnection valves will be opened & Vice Versa.
- 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 driven spray water pump for automatic starting. If the pressure falls further below, stand-by 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 through opening of motorised interconnection (fast opening type) Valve.
- 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.
- In case of detection of fire in coal conveyor, alarm shall be annunciated in the local fire panel located in the CHP control room and the solenoid operated deluge valve in spray water line shall be opened automatically and the spray water system shall be brought into operation.
- 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 **Clean Agent Flooding System**
- 4.03.01 The system shall consist of two (2) nos 100% capacity batteries of gas cylinders, discharge nozzles, associated piping & valves, actuators, etc. The cylinders shall be permanently connected to the piping and arranged for easy changeover. The gas cylinders shall be DOT/CCE approved UL/FM listed.



- 4.03.02 The quantity of extinguishment agent and the no. of cylinders shall be designed for the largest area, specified in 3.01.05, to be flooded. One zone valve shall be provided for each separate fire protected area, specified in 3.01.05. In case of fire only the Zone Valve for that particular area shall be actuated.
- 4.03.03 The system shall be modular in construction and shall work on master-slave principle with pneumatic actuation. The inert gas cylinder shall be connected to the manifold through high pressure, double wire braided hoses. The manifold shall be connected to a pipe network having strategically located nozzles. The master cylinder shall be opened by a pilot solenoid valve through electrical actuation from fire alarm panel.
- 4.03.04 In the event of fire, the fire detectors (either cross-zoned or two detectors) shall be provided to sense fire and initiate an alarm in the local panel, and main fire alarm panel. Simultaneously, the detection signal opens the deluge valve automatically and the protected area is filled up by rapid injection of required quantity of Clean Agent through the pipe network and discharge nozzles to create a homogenous air/Clean Agent atmosphere within.

4.04.00 **Functional Requirement of Various Panels in Fire detection Protection System**

- 4.04.01 Dual hot redundant Programmable Logic controller (PLC) based Fire Water Pump Control Panel, located in Common Centralised Fire Water Control Room. Detailed PLC Panel description as per Volume II E. The fire pumps controllers shall be UL labeled, FM approved or equivalent. The system shall be complete with dual redundant CPU & memory, dual redundant power supply modules, dual redundant communication modules and dual redundant network communication processors and necessary input output devices and termination units as per the PLC specification in Control & Instrumentation specification Vol. II-E, Section VI, Clause no. 6.00.00. Connections from all. Connections from all field devices and interfacing signals with MCC / SWGR related to the fire protection system shall be terminated in the Termination & Relay cabinet. Fire water pumps and its associated systems shall be operated from two PC based work stations each with 23" LED monitor in local control room of FW Pumps House. No Control of associated system is envisaged from Central Control Room. Control of Fire water Pumping System is envisaged from Common Centralised Fire Water Control Room. The PLC system shall have interface with DCS. Necessary hardware and software for the interface shall be in bidder's scope.

Diesel Engine Driven & Motor Driven Hydrant Pumps & Spray pumps, Jockey Pumps, Air Compressor Hydro pneumatic pumps shall be controlled from PLC system at fire water control room.

Control of Fire water Pumping System is envisaged from Common Centralised Fire Water Control Room through PLC & SCADA/OWS of Unit#5. Control of all pumps etc. of Unit# 3, 4 shall also be carried out from the Centralised Fire Water Control Room. Hence, OWS & EWS of Unit #3 & #4 Fire Water system PLC shall be relocated to Common Centralised Fire Water



Control Room. Necessary arrangements (both Hardware & Software) for the above are in the bidder's scope.

Fire men's Telephone/ Voice Communications which will be connected to Stage III and as well as FAP Stage - II FAP is to be located in Common Centralised Fire Water Control Room. Necessary Speaker/ Announcement/ Output System of Stage III Fire men's telephone system is to be provided at UCR Stage I, II, III, Stage I Fire Station & Critical areas of Stage III.

New Fire Water System Control Room for Stage II & Stage III shall be located in the Common Centralised Fire Water Control Room. Both Stage II & Stage III Fire Water Systems shall be controlled, Monitored from dedicated OWS located in the Common Centralised Fire Water Control Room. Bidder shall provide FO Connectivity from Stage II PLC (Ethernet Switch) to the Network Enclosure (Ethernet Switch) located in the Common Centralised Fire Water Control Room.

The Common Centralised Fire Water Control Room shall have OWS, EWS for Stage III Fire Water Systems. It shall also house Stage III Fire Water PLC & UPS

Control & monitoring function not limited to the following shall be provided for Fire water pumps.

- a) Start/Stop push buttons and indicating lamps for motor driven fire water pumps.
- b) Local Remote Selector Switch for Local/ Remote Operation of the Fire Water Pumps.
- c) Start /Stop push buttons for "starting DC motor" of Diesel engine driven pumps.
- d) Start/Stop push button switch and indicating lamps for jockey pumps.
- e) Start/Stop push button switch and indicating lamps for compressor.
- f) Opening / Closing of motorized valves on fire water main header and fire water tanks with indication.
- g) Auto/ Manual selector switch for fire water pumps, jockey pumps & air compressors.
- h) Ammeter for motors.
- i) Vibration & Temperature Monitoring of all Fire Water Pumps & Motors to be provided. Vibration monitoring at each bearing in both X and Y direction shall be provided. Duplex type RTD shall be provided for each bearing and winding for temperature monitoring.
- j) Annunciation system
- k) A Laptop computer for engineering configuration with both FAP Software and PLC Software loaded to be provided at the Common Centralised Fire water Room. Regarding PLC system , Specification Volume II E to be followed.



- 4.04.02 NOT IN USE
- 4.04.03 Microprocessor based Fire Detection and Alarm panel (FAP) shall be provided and to be located in Central Control Room (CCR) at main Plant TG Building. One (1) PC based OWS with LED Monitor & Printer in CCR for sector / zone wise alarm, graphic display & logs. Each Fire Detection and Alarm Panel (FAP) shall receive signals from the fire detectors & Manual call points of the respective area and shall also issue command to the deluge valves.
- 4.04.04 Microprocessor based Fire Detection and Alarm panel (FAP) with PC based OWS, LED Monitor & Printer shall be provided (if required to be decided during detailed engineering) for New CHP areas. Otherwise New CHP areas will be hooked up with existing Stage II FAP located at CHP Control Room. Fire Alarm Panel shall receive signals from the fire detectors & Manual call points of the respective area and shall also issue command to the deluge valves.
- 4.04.05 The new FAP in the Common Centralised Fire water Control Room of unit # 5 shall be hooked up with the Stage II FAP network. In case this interface is not feasible, then a new Fire Alarm Panel for unit#5 shall be provided along with OWS, LED Monitor in the existing Fire Station Building (under the discretion of owner/consultant).
- 4.04.06 Indication (bright LED type) and Graphic Display (LED type) shall be provided in each FAP. Information / data from these Fire Alarm Panels shall also be available in a dedicated computer based operator station in unit control room. This computer will be an UL/FM Listed PC used to display event information from the network in a text and graphical format. Graphic screens will 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 will 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.
- 4.04.07 Display of the status of the detector, sequence of the events, alarm and trouble summary etc. shall be displayed on the display unit of FA panel and as well as on the operator station and printer.
- 4.04.08 NOT USED
- 4.04.09 Operation under Normal Condition
- During normal condition of operation of detection system, quiescent current shall flow through each connecting line. Local indication of individual detector shall be continuously ON and all indications of fire alarm panel except 'MAINS ON' shall be in "off" condition.



4.04.10 Operation under Shutdown Condition

The fire detection and alarm system shall be in normal operation even during 2 Nos of mains 240V ac power failure. The stand by DC power supply from the battery in FAP 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. The operation of trigger devices in further zones must not result in cancellation of fire alarms existing at that time.

4.04.11 Operation under "OFF Normal" Condition

Fire Condition

Whenever the fire occurs in any area, the following sequence of events will take place.

- a) One of the detectors located in the area after sensing the fire, shall send an alarm signal to the fire alarm panel.
- b) The fire alarm panel verifies the signal by sending a reset signal to the detector or comparing with reference level set in the panel. After a predetermined time (the time is field settable) if the detector is still in alarm condition the panel confirms it as a fire alarm.
- c) Once the fire alarm panel has reported the fire condition, following sequence of annunciation take place on the fire alarm panel. i.e. fire indication. If one more fire incident takes place immediately before the first incident is set off, 'new fire' indication comes. The electronic hooters located at convenient places shall give audible alarm in case of fire alarm. Response indicators will be provided at strategic locations. The detector and the connecting line identification numbers, area and zone description shall be displayed on the fire alarm panel. FAP faulty signal comes if any fire alarm panel becomes faulty.
- d) Simultaneously LED mounted on the detector shall light up.
- e) The alarm status shall also be reported to the respective operator station. Display shall contain area description, zone, the type of detector and detector identification number and time.
- f) The audible alarm can be silenced by the acknowledge push button provided on panel as well as from the keyboard of OWS.
- g) Main control panel visual indication shall be reset like other annunciation only after initiating contact in Fire alarm panel is reset.
- h) In case of multiple alarms, the multiple alarm indication shall be 'ON'. The indicated alarm can be displayed on the fire alarm panel in chronological order by pressing the push button provided on the fire alarm panel.

**Pre-alarm**

The sensitivity of the detector changes if the detector gets gradually polluted due to dust and other particles entering inside the detector. This shall be indicated on the fire alarm panel as pre Alarm condition. This condition indicates that detector needs servicing. The indication should appear in the connected fire alarm panel and operator station.

Test Condition

The healthiness of the system including connecting lines shall be continuously monitored by the fire alarm panel. Facility to test the line shall be provided. The healthiness of the lamps and the detectors shall be checked from the fire alarm panel. The performance of the detector and its base shall be tested in its location by the test equipment supplied by the manufacturer.

Isolation of one

Facility to isolate any zone/loop shall be provided on the fire alarm panel. The details of isolation shall be available on the FAP & monitor.

Audible Alarm

The audible alarm for fire shall be distinctive and different from any other plant alarm. The minimum sound level shall be 65 db or 5 db above background sound level whichever is more.

Power Supply Failure

One number of redundant power supply unit for FA panel shall be provided with adequate backup facility for 48 hours of normal operation and operation in alarm condition, in case of failure of power. Failure of mains supply and backup power shall be alarmed.

Fault in the fire alarm panel

All the alarm and protection equipment of fire alarm panel shall be monitored. Facility for auto scanning shall be provided for each electronic card / module. The fault in the fire alarm panel shall be indicated by 'FAULT' indication on the fire alarm panel.

Fault in Detector and Detector Line

An open circuit or short circuit condition of the detector lines, defect in detector or its base by the way of component or internal circuit failure and removal of detector shall be indicated on the FA Panel as 'FAULT' alarm.. The fault alarms shall also be communicated to Computer System. Even when Computer System is out of action, fire alarm panel shall indicate the loop under fault. For any failure of computer system in the main computer, the FA panel shall operate in standalone mode. Indication of failure of communication amongst FA panels and computer system shall be annunciated on the fire alarm panels.



- 4.05.00 Annunciations not limited to the following shall be provided:
- 4.05.01 Fire water Pumping & Pressurizing System:
- a) Running / Tripping of fire water pumps both Hydrant and Spray pumps
 - b) Running / Tripping of jockey pumps
 - c) Running / Tripping of compressors
 - d) Fire water pumps "fails to start"
 - e) Jockey pump "fails to start"
 - f) Compressor "fails to start"
 - g) Low level in fuel oil tank of DE driven fire water pumps
 - h) Low/High water level of hydro pneumatic tank
 - i) Low/High pressure of air in hydro pneumatic tank
 - j) Lube oil pressure low of Diesel engine
 - k) Diesel engine over speed
 - l) High temperature of Diesel engine
 - m) Fire water header pressure low
 - n) Power supply trouble
 - o) Motorized valves "fail to open".
- 4.05.02 Alarms from all the Fire Detectors and Manual Call Points (MCP) in the respective Fire Alarm Panels.
- 4.05.03 Alarms from all the Deluge Control Panels for Deluge Valve Opened indicating sector / Zone.
- 4.05.04 Alarms for power supply supervision of all control panels in the Fire Alarm system.
- 4.05.05 Alarm for all fault condition
- 4.05.06 Detector connections shall be supervised to indicate fault condition in case of removal of one or more fire detectors from the detector base.
- 4.05.07 Cable in between detector and the panel shall be supervised so as to indicate fault condition in case of open/short in detector or in cable with a direct fault condition.



4.05.08 Annunciation System

- a) Sequence of Annunciation System shall be as per the following Table:

Status	Visual Display	Audio Signal
NORMAL	OFF	OFF
FAULT	ON WITH BLINKING	ON
ACCEPT	ON (STEADY)	OFF
NORMAL BEFORE ACCEPT	ON WITH BLINKING	ON
FAULT CLEAR BUT NOT RESET (after ACCEPT)	ON (STEADY)	OFF
RESET WHEN FAULT IS CLEARED	OFF	OFF
RESET WHEN FAULT IS	ON (STEADY)	OFF

5.00.00 **SCOPE OF WORK**5.01.00 **Mechanical**

- Three (3) nos. vertical centrifugal type fire water pumps of 410 m³/hr capacity with drive motors and all other accessories as specified.
- Two (2) nos. vertical centrifugal type fire water pumps of 410 m³/hr capacity with diesel engines along with all accessories required for automatic starting of diesel engine, including fuel oil system, lub oil system etc.
- Hydro-pneumatic tank along with two (2) nos. electric motor driven jockey pumps and two (2) nos. compressors with drive motors. Jockey pumps & compressors shall be provided with all regular accessories.
- Two (2) nos. booster pumps (one (1) electric motor driven + one (1) diesel engine driven) horizontal centrifugal type booster pumps with accessories, if required during detail engineering stage, for elevated floors of boiler and Power House.
- One centralized inert gas flooding system for the areas specified, complete with cylinder rack, gas manifold, pressure reducing stations, detection system components, panel, nozzles, piping, fittings and valves.



- f) Required nos. of portable fire extinguisher.
- g) 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. The required no. of hydrant valves shall be decided during details engineering stage abiding by all stipulations of TAC/other relevant codes & Standards.
- h) 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.
- i) Out of total nozzles provided in indoor & outdoor hydrant system, at least 10% shall be "fog type" and balance shall be of ordinary type.
- j) The number of hose hoses and hoses shall be as per TAC/LPA stipulations.
- k) 32 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.
- l) "Water monitors" on as required basis for the areas identified in the specification.
- m) Sets of hydraulically operated deluge valves with bypass valve, isolating valve & test valve for all HT transformers as specified.
- n) Sets of solenoid operated deluge valves with bypass valve, isolating valve & test valve for entire spray system for coal conveyors, Transfer points (TP), turbine lub oil tank, boiler burner front and cable vault/spreader rooms etc.
- o) Sets of Chrome plated frangible bulb type detectors for areas identified elsewhere in the specification.
- p) Sets of addressable analog optical type of smoke detection arranged in X-zoning fashion for areas identified in the specification.
- q) Sets of addressable analog multi criteria smoke detectors arranged in X-zoning fashion for areas identified in the specification.
- r) Sets of Analogue Addressable type heat detectors for the areas identified in specification.
- s) Three (3) nos. 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.



- t) Lot of linear heat sensing cables (non-electrically operated Fibre Optic LHSC/ Thermal sensor based addressable Heat sensing Cable) for the areas mentioned in the specification.
- u) Gas sensing fire detectors working on air sampling for all control rooms and control equipment room.
- v) Required nos. of addressable manual call points for the areas mentioned in the specification.
- w) Lot of open sprayers for HVW & MVW spray system.
- x) 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.
- y) Complete lot of pipelines including all fittings for
 - a. Entire hydrant system.
 - b. Entire spray water (both HVW & MVW) system including network of sprayers.
 - c. Lot of cut-off gate valves, globe type instrument root valves.
- z) RCC Pipe encasement/hume pipes of appropriate class for buried pipelines for all road crossings, rail crossing & for all places where bulldozer may operate.
- aa) Vents and drains as required. Vent and drain valves shall be lockable type and drain lines shall be terminated to nearest surface drain.
- bb) Pressure break-down orifices as required for hydrant system, spray system and first-aid-fire protection system.
- cc) Pipe pedestal for over ground pipes where pipe racks not available.

5.02.00**Civil**

- a) Design and construction of FW pump house (extension of CW pump house) including foundation of fire water system equipment (viz, pumps & motors, diesel engine, HP Tank, compressor etc.)
- b) Excavation, preparation of bed and backfilling with compaction for laying underground pipelines and underground cables (wherever accepted by Owner).
- c) Construction of RCC valve chamber as required.
- d) Construction of shed for deluge valve for spraying system as per specification.





- e) Design & construction of hose houses as specified.
- f) Construction of pylon support including foundation for spray water ring and water circuit for detection of H.T. Transformer.
- g) Adequate no. of staircases as per TAC.
- h) Fire stops below switchgear /MCC / Switchboards, junction boxes/panels/cabinets etc. which are floor-mounted type.
- i) Fire barrier / baffle wall in transformer yard, fire barriers for compartmentalizing the cable spreader rooms, fire proof door.
- j) Materials for fire barrier walls/baffle wall in Transformer Yard.
- k) Materials for fire barrier for compartmentalizing the cable spreader rooms.
- l) Materials for fire proof doors.
- m) Fire stops in wall / floors.

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 II-F/1 & II-F/2" of this specification.

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 and alarm panel 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 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 and alarm panel. This laptop shall also have licensed Office documentation software and Antivirus software only EWS to be provided at Common centralised Fire water Station.
- 5.04.08 Licensed version of all software for the Fire detection and alarm 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.
- 5.04.11 240V AC, 50Hz, +/- 1% Mini UPS system for Operator station of Fire detection and alarm panel.
- 5.04.12 Optical fiber cable, networking hardware comprising of LIU & Media converter to establish communication link in between the fire detection and alarm 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 II-E of this specification shall be referred for technical requirements of different items eg. PLC, operator station, printer, panel, field instruments, cable etc.

6.00.00 **DESIGN BASIS AND INPUT**

6.01.00 **General**

- i) All equipment/system components of complete fire protection & detection system should have the approval from one of the following:
- a) BIS
 - b) Underwriters Laboratories (UL) of USA
 - c) VDS - Germany
 - d) FM – USA
 - e) LPCB – UK
- ii) The complete fire detection and protection systems shall be designed in conformity with TAC/NFPA/IS-3034/OISD. Fire protection system shall be designed as per the guidelines of Tariff Advisory Committee (TAC) established under Insurance Act 1938 and NFPA.

6.02.00 **Hydrant System**

- a) Two (2) nos. motor driven fire pumps and one (1) no diesel engine driven fire pump shall be provided for supplying pressurized water to the hydrant system piping network.
- b) All the landings of boiler staircases, turbine buildings, and other multistoried structures, transfer points, Crusher house in the coal Handling plant, etc shall be provided with hydrant landing valves. All the landings of boiler staircases, turbine buildings, and other multistoried structures, transfer points, Crusher house in the coal Handling plant, etc shall be provided with hydrant landing valves. Provision of "double headed hydrants" as per the configuration of "risk



area" shall be acceptable. Provision of Hydrants for ESP Roof Tops on both sides to be provided.

- c) Spacing of hydrant (outdoor) shall be 45 M in general and for internal hydrant/landing valves spacing shall be 30 M (max.). For buildings etc., at least one hydrant shall be provided for every 45 meter of external wall measurement.
- d) Minimum terminal pressure of 3.5 kg/cm^2 shall be maintained at the farthest / remotest hydrant point.
- e) Three hydrant ring mains shall be provided and entire power plant area shall be suitably divided amongst these ring mains. These ring mains shall be interconnected with isolation valves. It shall be possible to enable to take up part of any of the ring mains for maintenance without any loss of system in the balance part.
- f) All hydrant pipe mains/ pipe lines shall be routed over-ground on pipe racks. Where pipe rack is not feasible, the pipes shall be routed on concrete sleepers. In main plant area, pipes shall be laid on RCC pedestals.
- g) Hydrants shall not be located less than 2M from building. No building shall be deemed to be protected by a hydrant unless such hydrant is within 15M of the building. When height of structure, tower exceeds 15M, the concerned hydrants shall be replaced by water monitors.
- h) All hydrant valves should be of stainless steel conforming to IS:5290
- i) Based on total nos. of hydrants (outdoor), nos. of branch pipes, tripple purpose nozzles & hoses shall be determined as per guideline of TAC.
- j) Based on total nos. of indoor hydrants (landing valves), nos. of hoses branch pipe, tripple purpose nozzles & hose boxes shall be determined as per guideline of TAC.
- k) First aid fire protection system for power house floors and service building as per guide line of TAC.

6.03.00

Spray Water System HVW MVW System

- a) For HVW spray system the water pressure at any projector/spray nozzle shall be not less than 3.5 kg/cm^2 and not greater than 5.0 kg/cm^2 . For MVW spray system minimum water density and minimum pressure shall be as under:

Area	Minimum water density	Minimum pressure
Cable galleries	12.2 LPM/m ²	2.8 kg/cm ²
Coal conveyors	10.2 LPM/m ²	1.4 kg/cm ²



- b) Water density for all surfaces of Transformer shall be 10.2 lpm/Sq.m only.
- c) For turbine oil tank and purification area, burner front water density shall be 10.2 lpm/sq.m. (min.).
- d) Wet type fire detection system using quartzoid bulb detectors shall be provided for HVW / MVW spray system employed for coal conveyors, transformers, etc. In case of fire, QB detector shall break due to heat and pressure in wet detector network resulting in fall in pressure, which shall actuate the respective deluge valve resulting in water spray on the protected equipment.
- e) Each deluge valve shall be suitable for automatic actuation. Each deluge valve shall also be provided with a LCP from which valve may be operated remote manually. In addition, each deluge valve shall also be provided with an operational latch / hand lever.
- f) All spray pipe mains/ pipe lines shall be routed over-ground on pipe racks. Where pipe rack is not feasible, the pipes shall be routed on concrete sleepers. In main plant area, pipes shall be laid on RCC pedestals.
- g) 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 2.5 M. The distance of the deluge valves from the transformers shall be approx. 10 metres.
- h) All nozzles shall be open sprayer type and chrome plated.
- i) 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.
- j) In cable galleries the water spray shall cover the exposed area of all the trays and racks. As far as possible fire compartmentalization shall be done in case of cable galleries, cable vaults, cable spreader rooms, electrical equipment rooms etc. 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.
- k) The spray system for the coal conveyor system shall cover the exposed area of both the forward and return conveyors and idlers. In transfer points etc., the water spray shall cover the drive equipments, pulleys, chutes, other equipment of the floor and at various elevations. 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.

- I) The spray system for the boiler burner front shall cover all the fuel oil and coal burner elevations, its adjacent piping structures, floors etc.

6.04.00 Inert gas flooding system

- i) Complete design shall be approved and listed by UL/FM /VDS /LPCB.
- ii) Design, manufacture and installation of Clean Agent fire extinguishing system shall be in accordance with NFPA-2001 standard and all the system components / equipment shall be certified by UL/FM/VDS /LPCB.
- iii) The complete volume of the rooms including the above false ceiling shall be considered for estimation of quantity of gas and containers.
- iv) When determining the gas quantity, the leakage losses from the enclosure shall be taken into account. Further volume of re-circulating type air conditioning system and its duct work (at least upto the automatic fire dampers of the ducts) shall be considered as a part of the total volume so that the design concentration is achieved throughout the hazard area. Further gas quantity shall be adjusted for ambient pressure & temperature conditions.
- v) Centralised Clean Agent system along with 100% standby / reserve gas quantity and cylinders shall be provided for each of the areas specified in 3.01.05.
- vi) The discharge time period shall be such that the design concentration is achieved within 60 seconds. The flow calculations shall establish this criteria.
- vii) Operating devices shall be by mechanical, electrical and pneumatic means conforming to NFPA-2001. The power supply to electrical actuators shall be backed up with reliable battery supply. Such batteries shall be charged automatically by battery chargers.
- viii) Facility for manual release of gas through push buttons shall be provided. In addition, local manual release through lever operation shall also be provided near the cylinder banks. Further, manual abort switches shall be provided for each of the area/zone.
- ix) Appropriate warning signs shall be fixed outside of those areas protected by the system and also in areas where the gas may spread indicating the hazard clearly. Apart from written warning signs, audio-visual type warning signs i.e. hooters & strobe lights shall be provided for pre-discharge and post- discharge activity.



- x) To prevent the loss/release of gas automatically or manually during maintenance, the system shall have the facility of "LOCKOUT"

6.05.00 **Portable Fire Extinguishers**

- i) Bidder shall establish the requirement of Portable Fire Extinguishers based on the fire hazard, access. The final requirement shall be subject to approval by the TAC and by the Purchaser.
- ii) The portable fire extinguishers shall be selected according to the type of fire that may be encountered.

6.06.00 **Fire Alarm Detection System Microprocessor Based**

- i) Codes & Standards

FAP and associated equipment shall be designed and tested in full accordance with the latest issues of all codes specified as below :

Fire detection system equipment/ components	NFPA, FM*, UL*, ANSI, ASME, ASTM, National Electrical Manufacturers Association (NEMA), IEEE
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Smoke detection	:	NFPA 70, 72, 90A, and 850
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Heat detection	:	NFPA 70, 72, and 850, IS: 2175
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Manual Call Point	:	NFPA 70, 72, 101 and other applicable codes
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Indicating devices	:	NFPA 70, 72, and 850
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Control panel initiating and indicating devices	:	NFPA 70, 72, and 850
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Fire alarm system wiring (Initiating devices, notification appliances, solenoids, signaling line circuits)	:	NFPA and applicable codes
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Code of Practice for selection installation and maintenance of automatic fire detection and alarm system.	:	IS: 2189
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Wiring and installation work	:	NEC
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- ii) The FAP shall be listed as a Proprietary Control Panel. The FAP, associated equipment and detectors shall be included in the Approval



Guide as published by Factory Mutual Engineering./VDS Approved /UL Listed test certificates of detectors shall be furnished by the manufacturer along with the datasheet for Owner's acceptance.

FAP to be provided for Centralised Fire Water Control Room with connectivity to both Stage II & Stage III FAP Network. Location of other FAP will be CCR(Unit #5), CW Pump House & if required (to be decided during detailed engineering) separate FAP to be provided for the CHP Area. If Stage II & Stage III FAP network interface is not feasible, a separate FAP at Fire Station Building to be provided (under the discretion of owner/consultant).

- iii) Fire Alarm System envisaged for the plant is "2-Wire Analog Addressable" type. All fire Detectors are incorporated with microprocessor and shall provide linear output corresponding to the quantity of smoke or fire, it encounters. The communication between the detectors and the control unit is by means of digital addressing and analog data communication over supervised 2-wire zone wise loop cable. The address shall be set by means of a DIP switch on the addressable base or stored in non-volatile memory. The non-addressable sensors like probe type heat detector, Ember detector & Potential free contacts will be interfaced with the FAP through the addressable interface module into a supervised two-wire zone as per manufacturer's standard range of control units for wiring.

iv) **Fire Detectors**

The fire detector shall detect the fire in the early stage by sensing one of its characteristic phenomena like combustion gases in fire, rise of temperature due to fire and convert the same into an electrical signal for initiating the alarm.

- a) The electronic circuit shall be of solid state and of fail-safe design and virtually hermetically sealed to have resistance to humidity and corrosion and to prevent its operation from being impaired by dust and dirt.
- b) The circuit shall be protected against usual electrical transients, electromagnetic and radio frequency interference (EMI & RFI) normally present.
- c) Reverse polarity or fault in the field wiring shall not damage the detector.
- d) No moving parts subject to wear and tear shall be provided.
- e) The sensitivity of the detector shall be field adjustable and also from fire panel over a wide range to suit site conditions. It shall be possible to test the sensitivity of a detector in the field.



- f) The visual (alarm) response of a detector (by a local LED) shall be clearly visible from the outside by a steady / flashing light of sufficient brightness. Separate Response indicator clearly visible from the outside shall be considered for above false ceiling detector.
- g) The base plate of the detector shall be suitable for mounting on single junction box for terminating directly the field cable run. The field terminals shall be suitable for field wires of core size 1.5 sq. mm (minimum).
- h) The detector shall be suitable to connect to the control unit via a two-wire circuit (Class-B wiring) as per UL standard. The system shall be a Class X system in accordance with NFPA 72.
- i) The fire detectors shall be plug in type. Suitable locking device shall be supplied along with each detector. It shall be inserted into or removed from the standard base by simple push twist mechanism to facilitate easy exchange for cleaning and maintenance.
- j) All types of detectors offered shall have in built electronic circuit for addressing capability for individual address on the fire alarm panel.
- k) All types of detectors shall be suitable for connection in any particular loop / circuit with any other type of detector.
- l) All detector listed above shall fit into the common plug in type standard base.
- m) The following types of detectors shall be provided in the plant.
 - i) Heat detectors of rate of rise type.
 - ii) Multi – criteria type combined smoke & heat detectors
 - iii) Infrared Ember Detector.
 - iv) IR /UV Flame detectors
 - v) Manual call points (MCP)
 - vi) Linear Heat Sensing cables.
 - vii) Aspiration / Air sampling type detector for central control room.

Choice of a particular type of detector for protected areas will be as per the specification.

- n) Detectors shall be located in accordance to the spacing requirement between the detectors as per NFPA-72.and listing such as UL.



- o) Detectors performance shall not be affected by the environmental temperature, humidity, air flow conditions.

v) **Fire Alarm Panels**

- a) The Fire alarm Panel (FAP) shall be intelligent microprocessor based system. Fire alarm panels shall be provided on per unit basis and as well as for the in site common plants. All FAP shall be interlinked for an IP based network configuration.
- b) FAP shall broadly comprise of its Power Supply Module (PSM), Central Processing Unit (CPU) Module, Signal / Loop Module (LM) and Networking Interface Modules (NIM). Redundancy shall be incorporated for the critical modules like PSM, CPU and NIM.
- c) The network configuration shall be IP based in Dual Fiber Optic cables and peer to peer communication shall be established amongst the nodes i.e all FAP, Operator work stations (OWS) and Printers.
- d) Fiber optic cable shall be routed through LIU unit. Media converter and shielded twisted pair cable as required shall be provided.
- e) Regarding OWS (Except printer), Please refer Volume IIE Specification.
- f) Individually addressable type detector, which has detected the fire, can be identified on the fire alarm panel. Each individually addressable detector shall transmit its address and analogue value in terms of voltage signal which is normally proportional to the smoke concentration or temperature inside the detector chamber, corresponding to the smoke / temperature, to the fire alarm panel. Non-addressable detectors / devices like MCP will be made addressable by incorporating addressable interface module and will be displayed on the FAP in case of detection.
- g) The communication between detectors and the control unit is by means of digital communication over 2-wire, which further provides power to the detectors. The sensitivity of sensors (for applicable sensors like Photoelectric, Multi criteria, UV / IR etc.) can be individually adjusted from the FAP to suit the conditions of each location. Each detector shall have self-test facility, which is monitored in the FAP. The Panel shall also check each sensor for contamination of dust / dirt and give signal for "Service" in case of accumulation of dust / dirt reaches a preset limit.
- h) The fire alarm 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.



- i) FAP 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 FA panel on a 2-wire circuit (class B wiring).
 - j) Each Fire Alarm Panel shall be capable of operating in stand-alone mode. All FAPs and PC based operator stations will be connected by a dedicated fault tolerant Local Area Network (LAN).
 - k) FAP will have multiple loop processing capability. Each zone will be monitored by one independent loop and a loop shall not be shared between different zones. Each FAP shall have additional capacity of handling at least ten alarms per zone, requiring only field wiring, as a spare for future modification or expansion.
 - l) The FAP will be installed as a vertical floor mounted panel in the above areas.
 - m) Except for the system executive software which will be ROM based, all configuration software shall be stored in non volatile, reprogrammable Flash ROM. In addition to the FAP integral keypad programming, a laptop computer will be provided for on /off line programming & downloading of the system configuration. Laptop will be used/located only at Common Centralised Fire water Control Room.
- vi) Following indications shall be provided on the fire alarm panel.
- (a) Fire.
 - (b) Fault.
 - (c) Isolate.
 - (d) Pre-alarm.
 - (e) Multiple alarms.
- vii) Following controls shall be provided on the FAP.
- (a) Push button -Acknowledge.
 - (b) Push button- Reset.
 - (c) Push button -Test.
 - (d) Push button - switch -Isolate.



- viii) Following information shall be displayed on the panel.
- (a) Detector identification number.
 - (b) Connecting line identification number.
 - (c) Zone/ Area description.
- ix) Potential free contacts shall be provided for use in control of ventilation system, coal conveyor system. Potential free contact per loop/zone for use in extinguishing /deluge system will also be provided. In addition spare contacts shall be provided for each of the loop/zone.
- x) PLC Systems
- Dual hot redundant PLC based controls shall be considered for the following areas
- xi) The Fire Alarm System panels & enclosure shall be as follows or as per the manufacturer standard when no special requirements are indicated.

Control panels (local)	IEC 56 (NEMA 4)
Fire Alarm Panels [FAP] (to be located in AC control room)	IEC 52 (NEMA 12)

The panel will operate on specified volts ac, and will be FM approved/ VDS Approved.

- xii) Local Control Panel / Enclosure

Sprinkler and Spray Systems

A local control panel shall be furnished for each of the sprinkler/spray system valve stations. All local control panels shall be capable of operation as a stand-alone system. For automatic operation (in case of fire) there shall be protective relay interlocking system with the FAP.

- xiii) System Other Requirements:
- a) Guidelines in various standards such as NFPA-72, IS: 2189 standards etc. shall be followed.
 - b) Each zone shall be monitored by two independent loops.
 - c) Control of individual elements of the system is possible from the fire alarm panel. The FA panel shall be functionally independent and operates in standalone mode. It shall be in operation even when there is failure of communication with computer system.



- d) The locations of the individual detectors in the system shall be such that total area under consideration is covered under the fire alarm detection system, without any blind zone.
 - e) The loop size shall be designed such that 20% spare capacity is available in each loop for connecting any device in future.
 - f) Aspiration / Air sampling type detector system installed in major control room equipped with false ceiling shall be interconnected with FA panel in the respective area via addressable interface module or by any other suitable method. The main purpose of connecting so is to consider aspiration system also as part of main detection system and all alarm signals in aspiration system shall be made to known to main panel and appropriate actions shall be initiated by main panel like other alarm signals.
 - g) Detector self test / diagnostic message shall be annunciated in the FA panel.
 - h) Two (2) AC power feeders to each Fire Alarm Panels along with Separate DC Power supply of 48 Hours Battery Back Up. Two Nos of power feeder to PLC Panel shall be through UPS.
- xiv) Cable & Cabling Accessories
- Supply, install, test / commission of all cables including special cables, loop cables as required for interconnecting fire alarm panel, detectors, manual call points, PC, printer, fire extinguishing / deluge system control panels, etc. for the complete fire detection, alarm and protection system shall be considered.
- xv) Bidder shall refer to Vol. II-E of the technical specification for "Control & Instrumentation" for the design basis and technical specification for Field instruments, PLC system and Control & Instrumentation cable .

6.07.00

Miscellaneous issues

- a) Each zone of cable spreader room shall be provided with one (1) no. cut-off BFV.
- 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 recommendation. However, Velocity of water thru' pipelines at pump's suction and discharge shall be limited to 1.5 M/sec and to 2.5 M/sec respectably.



- 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 Consultant.
- f) Cut-off gate valves shall be provided for each small and big loops on as required basis.
- g) 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.

6.08.00 Civil

6.08.01 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.

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

6.09.00 General Requirements of Fire Detection System

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

6.09.02 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 fiber optic data highway.

The fire detection and alarm system shall essentially consist of Fire Detection and Alarm Panels with respective OWS & Printer located in CCR, CW Pump House, CHP (If Required) & Other Areas (if required), detectors, Manual Call stations, Alarm devices, accessories, wiring and all connections to devices.

6.09.03 The Fire Detection and Alarm 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 and Alarm 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.

- 6.09.04 The Fire Detection and Alarm 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 and Alarm Panels shall also supervise, monitor and annunciate the abnormal condition of the circuitry of the fire detection system through local panels.
- 6.09.05 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.
- 6.09.06 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.
- 6.09.07 Alarm shall have priority over trouble. All trouble conditions shall be reported to include the zone / device no., location etc.
- 6.09.08 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
- 6.09.09 All Fire detection & Alarm Panels shall be Main Fire Alarm Panel. All Panels shall have the 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 23" LED Monitor and A3 Laser 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. For OWS specification, please refer Volume II-E.

**7.00.00 DESIGN AND CONSTRUCTION****7.01.00 Fire Water and Jockey Pumps****7.01.01 Performance Requirement**

- a) Performance requirement for the pumps shall be guided by the 'Data Sheet' enclosed in this section and TAC recommendation.
- b) Pumps shall deliver not less than 150% of rated capacity at a head of not less than 65% of total head. The shut-off head shall not exceed 140% of total head of the pump.
- c) Pump sets shall be capable of continuously delivering the rated output for the voltage variation of ($\pm$) 10% and frequency variation of ($\pm$) 5% occurring separately or combined voltage and frequency variation of ($\pm$) 10% (absolute sum).

7.01.02 Constructional Features

- a) The design and Testing Standards of the Pumps shall conform to the standards as indicated in the Data sheet of Vertical Pumps and TAC recommendation.
- b) The pumps shall comply with the regulations of Tariff Advisory Committee (TAC) and National Fire Protection Association (NFPA), USA as applicable.
- c) Drive Unit Power rating for the fire water pumps shall be selected such that it is equal to higher of the two conditions :
 - i) 110% of the duty point power requirement.
 - ii) Motor input power required at 150% of the duty point capacity of pump.

7.01.03 For technical requirements of Electrical drive motors, Diesel Engine Vol.II-F/1 & 2 shall be referred to.

7.02.00 Diesel Engine

7.02.01 Performance requirement of the diesel engine shall be guided by TAC recommendations.

7.02.02 The engine shall be capable of operating continuously on full load at the site conditions for a period of at least Eight (8) hours.

7.02.03 The engine shall be naturally aspirated, super charged or turbo-charged as recommended by the manufacturer. (Ref. Fire Protection Manual by TAC).





7.02.04 The continuous engine brake horse power rating (after accounting for all auxiliary power consumption) at the site conditions shall be at least 20% greater than the brake horse power required to drive the pump at its duty point at rated R.P.M. and in no case less than the brake horse power required to drive the pump at 150% of rated discharge or at any condition of operation of pump. De-rating Factors considered by the manufacturer to arrive at the shaft power of the diesel engine at site, shall not be less than the following for normally aspirated engines only:

- a) 3% for each 305 metre elevation above MSL (Ref. NFPA, Volume-2, 1978).
- b) 1% for each 5.6° C rise in air temperature above 15.6° C (Ref. NFPA, Volume-2, 1978).

The base power rating of the diesel engine shall be referred to any accepted datum like BS/SAE Standard condition or equivalent. In any case, horsepower rating shall not be higher than the limit set by Tariff Advisory Committee.

7.02.05 Design and construction of the diesel engine shall be guided by the TAC recommendations.

7.02.06 Starting

- a) The engine shall be capable of both automatic and manual start.
- b) Automatic cranking shall be effected by a battery driven D.C. motor having high starting torque to overcome full engine compression. Starting power shall be supplied from two (2) sets of storage batteries. One (1) set of battery is for automatic starting of the engine and the other provided for manual starting. A selector switch shall be provided at the automatic starting control panel to select any of the two (2) sets of battery for manual/auto starting of the engine.

The automatic starting arrangement shall include, as a safeguard, a "Repeat Start" feature so that if the pinion of the starting motor does not engage the flywheel at the first attempt, it is automatically retracted and after a short pause again will advance towards the flywheel. This repeat start cycle will continue until five (5) kicks after which there will be suitable annunciation. The battery capacity shall be adequate for ten (10) consecutive starts without recharging with a cold engine under full compression.

- c) Arrangement for both trickle and booster charge of the batteries shall be provided. When the engine starts running, provision should be kept to ensure that the charger is automatically disconnected and the battery is charged by engine dynamo. Battery Charger shall comply UL certified tests.

Each diesel engine shall be provided with two (2) battery charger units of air cooled design. Each charger unit shall be capable of charging one



(1) set of battery at a time. Provision shall, however, be kept so that any of the charger units of a particular engine can be utilised for charging any one of the two (2) batteries of that engine.

7.02.07 Governing System

- a) The engine shall be fitted with a speed control device which will control the speed under all conditions of load.
- b) The governor shall offer following features:
 - i) Engine should be provided with an adjustable governor capable of regulating engine speed within 10% of it's rated speed under any condition of load up to the full load rating. The governor shall be set to maintain rated pump speed at maximum pump load. (Refer Fire Protection Manual by TAC).
 - ii) Engine shall be provided with an over speed shut-down device. It shall be arranged to shut-down the engine at a speed approximately 20% above rated speed and for manual reset, such that the automatic engine controller will continue to show an over speed signal until the device is manually reset to normal operating position. (Refer NFPA).
- c) The governor shall be suitable for operation without external power supply.

7.02.08 Fuel System

- a) The diesel engine will run on High Speed diesel oil, analysis of which has been indicated elsewhere in specification.
- b) Each engine shall be provided with fuel oil tank having storage capacity sufficient to run the engine at full load for at least eight (8) hours as per NFPA-20.
- c) For each compression ignition engine driven pump set, there shall be individual fuel tank and fuel feed pipes.
- d) A suitable 1 phase 230 Volt fuel pump (portable) to be provided to fill up diesel oil from Diesel Drum received from supplier of Diesel. This pump should also have facility to be operated by hand, in case electricity fails.

7.02.09 Lubricating Oil System

Automatic pressure lubrication shall be provided by a crankshaft driven oil pump.

**7.02.10 Cooling Water System**

The cooling water system shall conform to any one of the systems specified in Fire Protection Manual of the Regional committee of the Tariff Advisory Committee/NFPA.

7.02.11 Instrumentation & Control

Instrumentation shall not be limited to the following:

- a) Temperature indicator at cooling water inlet and outlet.
- b) Temperature indicator at lubricating oil outlet from the oil cooler.
- c) Pressure gauges for lubricating oil system.
- d) Differential pressure gauges across strainers/ filters.
- e) Process switches
- f) Speed indicator.
- g) Running hour meter.
- h) Dip. stick type lubricating oil sump level indicator.
- i) Gauge glass type Fuel Oil Tank level indicator.
- j) Voltmeter & Ammeter.

7.03.00 Air Compressors

7.03.01 Air Compressors shall be designed for intermittent operation with high efficiency to satisfy the requirement as specified in the data sheets.

7.03.02 The design, manufacture of air compressors shall comply with the Specification data sheet enclosed with this section.

7.03.03 Compressor shall be mounted on an air receiver of ample size so that delivery air pressure is kept within (+) 5% of rated pressure without excessive start-stop operations in the working cycle.

7.03.04 Instrumentation and Miscellaneous Equipment &Accessories:

The package air compressor and drive shall be supplied complete with the following instrumentation and accessories as a minimum.

- a) Discharge air pressure gauge.
- b) Pressure switch for compressor control.



- c) Starter for drive motor.
- d) Pressure relief valve.
- e) Drain valve.
- f) Delivery valve.

7.04.00 Hydro-pneumatic Tank

- 7.04.01 Design of Hydro-pneumatic tank shall conform to IS-2825/ASME Section-VIII, Div.1. Design pressure should be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for vessel placed in the discharge line of pumps shall be based on the shut off head of the pump plus static head at pump suction, if any.
- 7.04.02 Design temperature of vessel shall be 10°C higher than the maximum temperature that any part of the vessel is likely to attain in course of operation.
- 7.04.03 Corrosion allowance of 2 mm (minimum) on shell and dished ends shall be considered while designing the tank. Suitable mill-allowance shall also be considered for shell and dished ends. Thinning/scaling allowance of 2 mm (minimum) shall be considered for dished ends.
- 7.04.04 Tank Connections
- a) Bidder shall furnish all pipe material required for vessel connections. All flanged connections should be supplied complete with matching counter flanges, nuts, bolts and gasket materials.
 - b) Bolts and nuts shall be of hexagonal head conforming to IS-1367 or equal.
 - c) Gaskets shall be full-face type.
 - d) Level gauge with isolating valve shall be provided.
 - e) All connection as required for pressure gauge, pressure switch, level switch etc.
 - f) Manholes/inspection hole shall be provided in the tank for providing easy access into the same.
 - g) Suitable ladders attached to the tank shall be provided for easy access to various instruments mounted there on.



- 7.05.00 Piping, Fittings, Valves and Specialties**
- 7.05.01 All pipelines under Bidder's scope of work shall be sized considering flow velocities as indicated in "Design Basis and Inputs".
- 7.05.02 Design condition of piping and material of construction, galvanization etc. for pipes and fittings, handling different fluid shall conform to piping data sheet enclosed.
- 7.05.03 Pipes shall be provided with vent connection and vent valves at all high points and drain connection & drain valves at all low points. Drain valves shall be lock-closed type.
- 7.05.04 All pipe bends shall be long radius forged elbow and having bend radius $R=1.5D$.
- 7.05.05 Hangers and supports shall be capable of carrying the sum of all concurrently acting loads. They shall be designed to provide the required supporting effects and allow pipe lines movements as necessary. All guides, anchors, braces, dampener, expansion joint and structural steel to be attached to the building/structure/ trenches etc. shall be provided. Type of hangers and components for all piping shall be selected by Bidder and approval of the same shall be obtained from the Purchaser.
- 7.05.06 All piping system shall be capable of withstanding the maximum pressure arising from any condition of operation and testing, including water hammer effects.
- 7.05.07 Gate, Globe and check valves shall be used respectively for isolation, regulation and water line upto a certain size as indicated in valve data sheet. Suitable size of drain valves shall be used in drain lines.
- 7.05.08 All valves shall be suitable for service conditions i.e. flow, temperature and pressure under which they are required to operate.
- 7.05.09 Gate valves shall be outside screw rising spindle type
- 7.05.10 Gate valves shall be provided with hand wheel, position indicator, pressure-equaliser for valves 350 mm NB and above and drainage arrangement. Locking facility shall also be required where necessary. Gate valve shall be provided with back seating bush to facilitate gland renewal during full open condition. Globe valve shall have adequate profile for controlling action, check valve shall be swing check type and shall have arrow inscription to show the direction of flow.
- 7.05.11 Whenever any valve is found to be so located that it cannot be approached manually from the nearest floor/gallery/platform, hand wheel with floor stand or chain operator shall be provided for the same.
- 7.05.12 For the operation of valves located in the valve pits, suitable arrangement shall be provided to operate the valves from the ground level (i.e. from the top of Valve Pit). For this purpose wrench-operated valve may be looked for.

**7.06.00 Safety Relief Valves**

Design and construction shall be as per Volume :II-J1, Section-VI.

7.07.00 Deluge Valves

Deluge valves shall be used for automatic HVW spray system and MVW spray system. In automatic HVW Spray System, deluge valve in spray water line shall be kept closed normally by water pressure. Same water line will form the water circuit of fire detector. When the detector quartzoid bulb collapses in the event of fire, the water pressure in the deluge valve will fall resulting in the opening of deluge valve.

But the deluge valves, which will be used in the MVW spray system shall be of solenoid-operated type, will remain normally closed but in the event of fire, the solenoid will be energised to open the valve.

For further details of Specification of all valves mentioned above, Data Sheet shall be referred to.

7.08.00 Hydrant Valve Outdoor Stand Post Assembly

The general design of hydrant valve shall conform to IS:5290 type A and shall be suitable for outdoor operation and for further details data sheet shall be referred to.

The general arrangement of outdoor stand post assembly, consisting of a column pipe and a hydrant valve with a quick coupling end shall be as approved by the Regional Committee of the Tariff Advisory Committee/NFPA.

7.09.00 Indoor Hydrant Valves Internal landing valves

The general arrangement of the indoor hydrant valves (also known as internal landing valves) shall be as approved by the Regional Committee of the Tariff Advisory Committee/NFPA.

The general design of hydrant valve shall conform to IS:5290 Type-A and shall be suitable for indoor operation. It shall be identical with hydrant valves (outdoor) as outlined above to facilitate interchangeability.

7.10.00 Hydrant Valves for First Aid Fire Protection System

The Water Supply connection for the first aid hose reels shall be taken/tapped from the closest hydrant riser.

The general design and construction of the hydrant valves for first aid fire protection system shall conform to IS: 5290 Type-A and shall be suitable for indoor operation.

**7.11.00 Hoses, no les, ranch pipes and hose oxes**

- a) The first aid hose shall be provided with cotton-reinforced hoses as per IS: 884 with corrugated external surfaces. Each fire hose shall be provided with quick coupling, branch pipes, nozzles, spanners, etc. The hoses for the internal and external hydrant system should be Rubber impregnated woven jacketed type conforming to IS:636 Type-II.
- b) Branch pipes shall be constructed of Stainless steel (SS-304) and have rings at both the ends. One end of the branch pipe will receive the quick coupling while the nozzle will be fixed to the other end.
- c) The nozzle sizes shall be of not less than 16mm (or 5/8 inch.) in diameter, nor more than 25 mm (or 1 inch.) in diameters for indoor and outdoor hydrants and 6.35 mm (or 1/4 inch) for first aid fire protection system.
- d) 2 Nos. 15m long Hose pipe fitted with quick coupling ends, branch pipes, nozzles, spanner etc. shall be kept in a hose box, which shall be located near point of use. The furnished design must meet the approval of the Regional Committee of the Traffic Advisory Committee/NFPA. The general design and construction of instantaneous couplings, branch pipes and nozzles shall comply with IS:903 (latest revision).
- e) All instantaneous couplings, shall be of identical design (both male and female designs shall be utilised) so that anyone can be interchanged with another. One male/female combination shall get locked in by mere pushing of the two valves together but will provide leak tightness at a pressure of 21 Kg/sq.cm. Designs employing screwing or turning to have engagement shall not be accepted.

7.12.00 First Aid Hose Reels Small Bore Hose Reels

- a) First aid hose reels shall be provided inside the power house building only to provide facilities of preliminary fire fighting by people other than fire personnel.
- b) At each floor 32 mm (or 1 and 1/4 inch) diameter first aid hose connection shall be provided from the hydrant risers. The first aid hose reels shall comprise of one no. SS (AISI- 304) isolation valve, reinforced (cotton) rubber hose pipe and one no. SS (AISI-304) nozzle (with isolation arrangement) duly mounted on a swing type (90 deg. min) hose reel.
- c) The number and distribution of hose reels shall be such that the whole or each floor is protected and that no part of the floor is more than 6m (or 20 ft.) distant from a hose nozzle when the hose is fully extended.



7.13.00 All instrument root valves shall be stainless steel Gr. 316 globe type.

7.14.00 Potable Fire Extinguisher

- a) Design and manufacture of the extinguishers shall conform to the latest editions of Indian and other equivalent International Standards and shall be suitable for respective design pressure, temperature and service conditions.
- b) All the extinguishers along with accessories shall be guaranteed for satisfactory and trouble-free operation.
- c) Portable extinguishers shall be complete with brackets/fittings suitable for mounting on wall and a carrying handle of ample strength.
- d) Mobile extinguishers shall be provided with a wheeled trolley for movement. Trolley mounted extinguishers shall be provided with 6 or 9 meter long high pressure discharge hose with horn/ telescopic applicator.
- e) Spanner and other accessories as required shall be supplied with each fire extinguisher.
- f) Each extinguisher shall be designed, constructed, tested and painted in accordance with respective Indian/International Standard and marked with BIS Certification.
- g) First charge of chemicals in each extinguisher shall be provided. All chemical charges shall be refilled after testing at site.
- h) Fire extinguishers shall be fitted with pressure gauges as applicable to indicate whether the extinguisher is charged or in need of a recharge.
- i) The discharge horn of the CO₂ extinguishers shall be made of a material non-conducting to electricity.
- j) As required by Tariff Advisory Committee, 10% spare charge of the total no. of extinguishers installed, with a minimum of six recharges, shall be supplied for each type of extinguishers.
- k) All extinguishers shall be mounted at strategic locations in bunches and/or individually to TAC approval. These extinguisher cylinders shall have the approval of Chief Inspector of Explosive (CIE), Nagpur.
- l) Fire proof entry suits (at least 2 nos.) and oxygen masks with cylinder and other accessories (at least 4 nos.) should be furnished.

7.15.00 Detectors Microprocessor Based

7.15.01 Detectors shall be intelligent analogue addressable type. Detectors shall be housed or mounted in suitable enclosures in such a way that their performance is in no way affected. Special maintenance procedures, if any,



required for the satisfactory operation of the detectors shall be clearly described.

- 7.15.02 In case detectors having electrical contact signal output on sensing fire, it shall be noted that the contact shall be "NC" type so that under fire conditions, this contact will open to initiate fire alarm system.
- 7.15.03 Normally the detectors, which has sensed fire and operated to give fire alarm could be easily located by the numbering scheme both on the detectors and zone-panel, for fire alarm system.
- 7.15.04 The various fire detectors serving a particular area/zone of plant may be wired-up in group and one common signal for each area or zone is transmitted to the zone indicating panel. The number of detectors to be installed shall be governed by total area to be protected, type of building construction, air movement, ceiling construction and sensitivity required.
- 7.15.05 The detectors shall be located where the largest combustion gas concentration can be expected.
- 7.15.06 It shall be possible to replace any type of detector head by a different type detector without requiring change in cabling/panel wiring and condition of the zone originally covered by the detector, thereby making it possible for a smoke detector to be replaced by either heat or flame type or vice versa.
- 7.15.07 All detectors shall be provided with built-in response indicating Lamp/LED which shall give local visual indication, in dense smoke condition when it will operate. The failure of lamps shall not prevent the function of detector.
- 7.15.08 The exact location of detectors shall be coordinated with other services like air-conditioning grills, light fittings, cable trays etc. to provide aesthetically pleasing appearance. The return air paths of air conditioning shall be avoided for detector location.
- 7.15.09 In such areas where detectors themselves are not easily accessible, the remote response indicators outside the enclosed areas shall be provided to indicate the fire condition.
- 7.15.10 Make and type of detectors shall be subject to Purchaser's approval.
- 7.15.11 The indigenous detectors shall have the approval of ISI/ISO in addition to the approval of FM approved/UL listed/VDS approved. Detectors and panels shall be preferably from the same manufacturer for compatibility.
- 7.15.12 The detectors shall not be effected by temperature, humidity, air flows.
- 7.15.13 **Multi Criteria Smoke Detectors**
- a) The multi criteria smoke detectors shall be capable of sensing the fire in the incipient or smoldering stage itself, long before the fire matures to a visible flame. For achieving this requirement, the detector shall be



capable of sensing visible combustion gases (in the form of smoke) or invisible combustion gases, which are the only clues for a long time in smoldering fires.

- b) The detectors shall be sensitive to very low smoke densities of the order of 0.05 gm/cu.m.
- c) The detectors shall be of Multisensor type with a combination of photoelectric and heat sensing elements. The multicriteria smoke detector provides photoelectric sensing and heat sensing combined in a single sensor/base assembly. The multisensor base provides two sequentially addressable points, automatically assigned with one address selection.
- d) The sensitivity of multicriteria smoke detectors shall be selected depending upon the environmental condition.
- e) For further specification of multicriteria smoke detector, data sheet shall be referred to.

7.15.14

Rate-of-Rise and Fixed Temperature Heat Detector IC Type

- a) The detector shall be solid thermal detector.
- b) It shall operate on electronic-principle to provide precise fire detection.
- c) The detector shall be of integrated circuit design enclosed in a robust moulded base.
- d) It shall be completely moisture proof and air tight with exposed metal part specially treated to allow the device to be used in particularly corrosive atmospheres.
- e) The detector should work on rate-of-rise and fixed temperature modes of operation.
- f) It shall have no moving mechanical parts.
- g) The detector shall be either surface mounted or with the body concealed above the ceiling and only the detecting element in view.
- h) The rate-of-rise detector shall function when the rate of temperature increase exceeds a pre-determined value, around 7°C to 8°C per min. This detector shall be designed to compensate with the normal changes in ambient temperature, less than 6.7°C per min., which are expected under non-fire conditions.
- i) For further details, data sheet shall be referred to.

7.15.15

Detection System y Linear Heat Sensing Cable

- a) Linear Heat sensing cable shall be non-electrically operated optical fibre type / Intelligent addressable type.





- b) The Linear Heat Sensing cable shall be designed as per international/national standard & approved by FOC/ FM/ UL/ TAC/ LPA/ NFPA/ VDS/ LPCB. The cable shall be suitable for fire/ temperature detection in very harsh & dusty environment for indoor as well outdoor applications. The cable shall be immune to Electromagnetic Interference of all kinds and shall be rugged enough to resist most environmental influences like temperature and pressure.
- c) The cable shall be programmable as per site requirements between - 20°C to +150°C with the temperature resolution of 0.1°C.
- d) The detector system shall consist of an optical fibre sensor and the detection unit. The detector unit shall house the electronic circuitry that interfaces with the optical fiber sensor. Any other technology for Linear Heat Sensing cables shall be subject to Owner's approval.
- e) There shall be at least one controller for every 1000 meters monitoring length. There shall be redundancy in controller & cable in such a way that if there is any single fault in cable or in controller, system shall keep working without losing any function.
- f) The fire or excessive temperature condition shall be sensed by the fibre. The detector unit shall recognize the change in optical transmittance of the fiber and cable breaker Fire/Alarm condition shall be identified within 1 mtrs locational accuracy.
- g) The control system shall be microprocessor based and shall provided with GUI based operator interface for calibration, configuration etc. It shall be interfaced with the Fire Alarm Panels via TCP/IP or Modbus or any other industry standard protocol. The controller shall provide at least 16 nos relay output in the form of potential free contact for alarm reporting to Main Fire Alarm Panel.
- h) The controller shall have individual password-protected access levels for operators, maintenance and service personnel, as well as for commissioning personnel.
- i) In addition to Detection by Linear Heat Sensing Cable as described above, Detection by Thermal sensor based addressable Heat sensing Cable shall obey the following:
 - 1. The Linear Heat sensing cable shall be a resettable type, reusable, flame retarding, halogen free sealed structure (IP66) fire detection system designed as per international/ national standard & approved by VdS/ UL/ FM.
 - 2. The microprocessor based sensor element is completely encapsulated in the heat sensing cable at a suitable distance as per NFPA/ EN54/ IS2189 standard to protect sensors from environmental influences. Sensor element shall detect both fixed temperature as well as rate of rise of temperature. The sensor elements shall be



addressable & programmable to pin point the location of fire or temperature monitoring via individual address. The sensor cable shall be suitable for fire/ temperature detection in very harsh & dusty environment for indoor as well outdoor applications. Each sensor in the cable shall be programmable as per site requirements between -40°C to +85°C with the temperature resolution of 0.1°C. It shall be free from false alarms caused by natural ambient temperature fluctuations.

3. System architecture shall be decentralised type to minimise the effect in case of any fault in a controller. There shall be minimum one controller for each zone measuring upto 1000 meter cable each. Controller shall check the temperature values from the sensor cable on a cyclical basis. The thresholds used to create pre-signals or alarms shall be stored in the processor unit. The alarm shall be triggered by using both an absolute temperature value (maximum temperature evaluation i.e. fixed temperature) and a temperature rise within a set period of time (differential temperature evaluation i.e. rate of rise in temperature). Controller shall have individual password-protected access levels for operators, maintenance and service personnel, as well as for commissioning. Relay module providing potential free contacts shall be used to provide interface with 3rd party items. It shall provide MODBUS output for integration with SCADA or any other 3rd party centralised system.

A Laptop of latest configuration with necessary Licensed Software for programing Controller of Addressable LHS cable/Controller of FOLHS Cable to be provided.

For details of linear heat sensing cable, data sheet shall be referred to.

7.15.16 **Frangible Quartz Bulb Type Detector**

- a) In frangible bulb type detectors a small amount of gas along with heat sensitive liquid (colored) is entrapped and hermetically sealed. This detector shall generally be mounted on the pressurized water line which forms a ring around the equipment to be protected. When the surrounding temperature rises more than the rated temperature of the detector, the gas inside the detector shall expand and as a result the quartzoid bulb shall collapse releasing water and consequently pressure in the water line shall fall sharply. This fall in pressure will give signal/annunciation in the Panel.
- b) The frangible bulb shall be capable of withstanding the hydraulic test pressure as per latest applicable norms/standards/Rules.
- c) Type and make of frangible bulb shall be of Owner's choice /approval.
- d) For further details data sheet shall be referred to.

**7.15.17 Infra Red Spark/Emitter Detector**

- a) The detector must respond satisfactorily even when the lens, through which the detection is sensed are covered with coal dust or oily dust substance.
- b) The detectors shall be designed to work satisfactorily in the event of vibration in any axis.
- c) To prevent false alarms, the detectors shall be provided with purge air facility to keep the lines clean.
- d) Facility for remote response indication shall be envisaged in each detector.

7.15.18 Infra Red Flame Detector

The Dual wavelength Infrared Flame Detector shall be provided in Boiler Burner front and Turbine Oil tanks to provide an alarm in case of fire.

7.15.19 Gas Sensing Fire Detector

Gas sampling type fire detectors working on the principle of air sampling shall be provided for early detection of fire in the high value control rooms.

7.16.00 Manual Call System of Fire Alarm Intelligent Addressable Type

7.16.01 Each Manual Call point unit shall comprise of a push button of reputed make enclosed in a ABS Box. The push button shall have minimum 1 NO and 1NC contact. The push button shall not be shrouded and the same shall be projected out from the surface the ABS box. This whole assembly of push button in ABS box shall again be enclosed in an external ABS enclosure with all sides covered except the front side. The front side shall be sealed with breakable glass cover using neoprene or equivalent gasket.

The glass cover shall be fixed in such a way that the actuating push button is kept depressed (with NC contact closed and NO contact Open) so long as the glass cover is intact. In case of fire, when glass cover is broken to give fire warning, the push button shall be released due to spring action hence giving remote fire alarm through NC contact which is now changed over. The status of the changeover of contact may be conveyed digitally also.

7.16.02 The ABS Box and the external ABS enclosure shall be completely dust, weather and vermin proof. The housing of the electronic circuitry shall have minimum IP 65 protection.

7.16.03 The complete unit shall be suitable for wall/column mounting with necessary mounting accessories.

7.16.04 Clear inscription reading (in English) "FIRE ALARM - IN CASE OF FIRE BREAK GLASS" shall be provided for each manual call point unit, either on



the ABS enclosure or on a separate metal plate mounted behind the glass cover. The metal plate for inscription shall not tarnish under the atmospheric conditions

7.16.05 Each manual call point unit shall be provided with the following accessories:

- i) An iron hammer of sufficient weight, which could be used to break the glass cover. The iron hammer shall be suspended on a hook fixed to the external ABS enclosure by means of a non-corrodible iron chain of sufficient length and play to facilitate easy breaking of the glass cover
- ii) Two numbers diametrically opposite earthing studs located on the outside surface of the external ABS enclosure.
- iii) An identification number (on a number plate) which will be invariably same as the number given to the fire alarm, indicating point on the Zonal and Main Fire Alarm panel. The identification number shall match with the address of the intelligent addressable Manual call point for easy identifying the Call Point unit.
- iv) A dust sealing gland or equivalent on the external ABS enclosure for outgoing cable from the unit.
- v) A compression type cable terminating brass gland of reputed make for outgoing cable from the internal ABS enclosure.
- vi) In addition to this a red lamp Response Indicator shall be provided which will light up on actuation of manual call point to locate the manual call point station, which is operated.

7.17.00 **Control and Instrumentation**

For features and requirements of the control and instrumentation items including field instrument, Panels and Panel mounted instruments, relays, annunciators, selector switches, PLCs and other hardware and peripherals under scope of supply for the Fire Detection and Protection system. Bidder shall also refer the relevant clauses of the Volume II-E of this Specification.

7.18.00 **Battery and Battery Charger**

7.18.01 **Battery**

- a) All controls, interlocks, indications, annunciation system etc. for each of the Fire Detection and Alarm Panels (located in Central Control room, CW Pump House, & any Other Areas if required), shall have power supply from 24 V (2 X 12V) Battery and Battery Charging Units. The Battery of each of the above Panels shall be located in the bottom portion of the same Panel. The PC with Printer in the central control room shall be powered up by the respective UPS Power of the Plant Instrumentation and Control System.



- b) The Battery driven Power supply shall be available to main fire alarm panel shall be designed to provide supply for a minimum period of 48 hours.
- Bidder shall compute the ampere hour capacity at suitable discharge rate based on above duty and furnish the calculation along with the Bid which shall consider the duty cycle and 25% & 15% compensation for ageing & unforeseen future growth respectively of each battery unit. The maximum and minimum ambient shall be 50°C and 5°C respectively.

The minimum voltage at the end of the load cycle shall not be less than 1.8 volts per cell.

7.18.02 **Battery Charger**

For design and construction of Battery Charger refer Volume V.

7.18.03 **Layout of Battery Battery Charger**

- a) The battery and charger of the respective panels shall be an integral part of each of the main fire panel..
- b) Bidder shall indicate his own layout of 24 volt Battery and Charger to suit the space available.

7.18.04 **Fittings Accessories - Battery**

Each battery shall be furnished with necessary accessories required.

7.19.00 **Fire Alarm Detection Protection System**

7.19.01 **Fire Alarm Panels FAP**

- (i) FAP shall be microprocessor based, where the major functionality of the FAP has been distributed across multiple cards, each major component shall be microprocessor based. Microprocessor based fire alarm panel shall comprise of the processors, various functional modules, adequate number of loop modules for detector loops, display devices, output modules for alarm, control & interlocks, keyboard, amplifier modules, modules for communication with the local area network, two sets of battery; battery chargers & power modules etc. as required by the system to incorporate all the features called for in the specification. The FAP shall be designed to provide a high level of tolerance to lightning and interference from other systems. FAP will be powered through two normal AC mains of 240V AC, 50Hz.

Except for the system executive software which will be ROM based, all configuration software shall be stored in non volatile, reprogrammable Flash ROM. In addition to the FAP integral keypad programming, a laptop computer shall be provided for on /off line programming & downloading of the system configuration.



- (II) FAP shall be scalable for future expansion or modification by at least 10 alarms per zone, requiring only field wiring, as a spare without degradation of the response time. Loss of any one module shall not affect the functionality of the rest of the system.
- (III) FAP shall be designed for ambient condition of 50°C and 95% RH (non condensing).
- (IV) For the purpose of easy identification and location of the fire, the entire building area is divided into zones. Zones correspond to the protective areas will be identified on the panel.
- (V) Fire alarm panel shall receive signals from compatible addressable field devices viz. fire detectors, manual call points, etc. connected in each loop. FAP shall meet the standard NFPA 72 requirements, UL listed and FM approved or VDS approved.
- (VI) The microprocessor based, intelligent addressable fire alarm panel shall incorporate the following features:
 - a) Continuous supervision of the detector connecting lines, individual detector performance / operation and disconnection / removal of detectors.
 - b) The system shall automatically reset on clearance of a fault.
 - c) Discrimination between a real fire alarm and false fire conditions by incorporating signal verification and other features.
 - d) Individual detector addressing capability.
 - e) Detection of over / under sensitive detectors and automatic recalibration by increasing or decreasing their sensitivity levels based on environmental conditions like air movement, fumes, humidity, etc.
 - f) Pre alarm in case of any detector / detectors requiring maintenance.
 - g) Facilities shall be provided such that for alteration or access to the stored program the relevant codes are to be entered. The system should be protected against interference by unauthorised personnel.
 - h) Compatibility with all detectors / devices connected to the fire alarm panel.
 - i) Logging of alarms with times and action text on printers and Operator station.



- j) Programmed activation of various interlocks with fire extinguishing / protection system i.e activation of deluge valve and other associated systems such as coal conveyor, ventilation and air conditioning etc.
 - k) Programmed activation of sequence of events to be carried out in case of fire in any particular protective area of the plant including activation of fire alarm sounders and evacuation alert signal. History SOE shall be provided.
 - l) The circuits shall be arranged such that a fault in the detector or an open circuit in the connecting line does not affect the operation / performance of other detectors in that connecting line and does not prevent receipt of fire alarm signals on the fire alarm panel.
 - m) Alarm verification features for smoke detectors shall be such that the detector activates the alarm, if the detector is in activated condition for 60s. In case of other type of detectors the alarm shall be initiated within 15s.
 - n) The fire alarm panel shall have adequate number of detector circuits / loops so as to cover all the areas to be protected. Provision shall also be made in the fire alarm panel to add additional detector loop modules for further expansion.
 - o) The fire alarm panel and the field devices shall be suitable for Class – B wiring to meet all the requirements specified for the system.
 - p) The fire alarm panel shall have provision to transmit annunciations to the PC based operator station.
 - q) The fire alarm panel shall provide contacts to all the fire protection/extinguishing panels for actuation of protection device and also activity signals to isolation dampers and shutdown signal for the coal belt.
 - r) The annunciation scheme provided on the fire alarm panel shall have the following features :
- (VII) The annunciation system shall have visual and audible alarms with accept, reset and lamp test facilities.
- a) The fire alarm panel shall have a separate alphanumeric display area for visual annunciation of fire alarm, system faults and to indicate the address of the detector, connecting line, the zone description and the action text, if any. The display should be clearly visible even in the dark. The fire alarm shall be displayed with bold big red letters and shall flash at a frequency of about 90 cycles per minute.



- b) Hooters provided for audio annunciation in the buildings shall be clearly audible even at the ambient noise level in the area installed. The minimum sound level of the hooter shall be either 65 dB or 5dB above the other noise likely to persist for a period longer than 30 s, whichever is greater.
 - c) Fire alarm panel normal power supply failure shall be annunciated audio – visually.
 - d) Use of earth as a return circuit shall not be allowed for any annunciation system.
 - e) Accept and reset facility of audiovisual alarms shall be possible either from the fire alarm panel or OWS. Normally acknowledgement will be performed from OWS at CCR.
 - f) In case of multiple alarms, the multiple alarm indication shall be 'ON'. The multiple alarm indication shall be displayed & scrolled on the fire alarm panel in chronological order through push buttons provided on the panel.
 - g) The fire alarm panel shall have provision for programmed activation of required annunciations on the main control panel, control and interlocks with fire protection systems.
- (VIII) The fire alarm panel shall have provision for necessary control and interlocking functions where the following systems / equipment are provided on occurrence of a fire in corresponding zones :
- a) To switch off the air conditioning
 - b) To close dampers in ventilation ducts.
 - c) Initiating the required alarms on the main annunciation panel / PC station.
 - d) To stop coal conveyor
 - e) To operate the deluge valves.
 - f) To operate inert gas system
- (IX) **FA Panel Construction details**
- a) Fire alarm panel shall have a degree of protection of IP: 54.
 - b) Fire alarm panel shall be fabricated out of sheet steel having a minimum thickness of 2 mm, with adequate bracing and stiffeners.
 - c) All sheet steel shall be degreased, pickled, phosphated and then applied with two coats of chlorinated rubber based primer and two coats of finishing paint, both inside and outside with colour shade.



- d) All doors, removable covers and plates shall be gasketed all around with neoprene gaskets.
- e) Suitable removable undrilled cable gland plates shall be gasketed all around with neoprene gaskets.
- f) The panel shall be completely factory wired, absolutely ready in all respects for installation at site and termination of all external cabling. The internal wiring of the panel shall be carried out with 1100 V grade, stranded copper wires of size rated for the current in the corresponding circuit. The minimum size of the wire shall not be less than 0.75 sq. mm for electronic circuits and 2.5 sq. mm for electrical circuits & 14 AWG for grounding.
- g) Non-flammable Terminal blocks of 1100V grade and of adequate size and current rating shall be provided for terminating all external cables. Spare terminals shall be provided on the terminal blocks for future expansion.
- h) Adequate space shall be provided for termination of external cables. The minimum distance between two rows of terminal blocks shall be 175 mm. The minimum distance between the lowest terminal and the gland plate shall be 250 mm.
- i) All wiring termination shall be done using ferrules having indelible marking.
- j) All floor mounted, free standing panels shall be provided with 240V, 1 – phase AC, fluorescent lighting fixture for interior illumination controlled by a door switch. A 240V, 1phase, 5A, 3 pin receptacle shall be provided on the fire alarm panels.

7.19.02 Operator Stations

- a) Operator stations shall be furnished in the Control rooms for the central monitoring of all the functions of the fire alarm system.
- b) Operator stations shall have provision for communicating / interfacing with various components of the microprocessor based fire alarm system viz. Fire alarm panels, Monitor, printer etc.
- c) The system software shall be specifically designed for fire detection and alarm system application, which includes alarm processing, control, status monitoring and various other functions to meet all the requirements of the system specified.
- d) The capacity of the processor shall be adequately designed to include all input/output signals and various functional requirements of the system.
- e) The processor offered shall be of 64 bit configuration (minimum) and shall support multi-tasking functions.



- f) The processor shall be designed to meet the following requirements.
- g) Updating of analog parameters display on the Monitor shall be less than 1s.
- h) In case of graphic display, time for display on VDU screen on operators request shall be less than 3s.
- i) Operator Station shall be of Latest Standard as specified in Volume II-E.

7.19.03 **Monitor and key board**

Monitor shall have the following features:

- a) 23" Color LED monitor (TFT based) with graphic display facility
- b) Data retrieval
- c) Alarm annunciation, accept and reset facility.
- d) Display of individual detector status sensitivity and setting of detector sensitivity
- e) Commands and programming facility for performing various functions
- f) The software used shall be provided with brief user's guide menu to enable the operator for proper use of various menu functions.
- g) Access to various programs and operation shall be through password to restrict the use to authorized personnel.
- h) Any other features necessary for proper functioning of the system.

7.19.04 **Operator station software**

- a) The system and fire alarm panel in general shall be suitable to be operated from PC.
- b) The system shall be upgradeable.
- c) Operator Station (OS) software shall include as a minimum the operating System, Data Base Manager, Communications Control, Operator Interface (OI) Trend and History Files, Report Generator and Support Utilities, Scheduler and Time and Event Support Programs, layout view of the detectors and protection device in room / building. Detectors & protection device will have colour changing with the normal, pre alarm and fire condition.
- d) Real Time operating system shall be true multi-tasking providing concurrent execution of multiple real time programs and custom program development.



- e) Data Base Manager is to manage all data on an integrated and non-redundant basis. It shall allow additions and deletions to the data base without detriment to the existing data. Cross linkages are to be provided such that no data required by a software program may be deleted by the operator until that data has been deleted from its respective program.

7.19.05 **Printer**

- a) Separate A3 Laser Printers shall be provided in CCR Unit #5, CW Pump House, CHP & other areas (If required). Printer shall provide all outputs of status, alarms, events, acknowledgement, reset, commands, selection etc. with time and create records.
- b) Alarms shall be highlighted differently than other messages, including type, location, time, date, address of alarm point etc. Multiple alarm shall be recorded in chronological order. If an alarm is received during the preparation of the reports, the printer shall interrupt the report to record the alarm received and resume automatically on receipt of alarm.
- c) All changes to system programming shall be recorded automatically.
- d) Communication with CPU shall be monitored and faults displayed on the monitor.
- e) The printer shall be suitable for 240V, 1 pH AC power supply.

7.19.06 **Local Control Panel / Enclosure**

A. **Sprinkler and Spray Systems**

A local control panel installed in a hut shall be furnished for each of the sprinkler/spray system valve stations. All local control panels shall be capable of operation as a stand-alone system. For automatic operation (in case of fire) there shall be protective relay interlocking system with the FAP.

B. **Enclosures**

Enclosures for each local control panel shall meet the International Electro-technical Commission (IEC) /NEMA requirements. When a NEMA rated enclosure is required, the system will maintain its listings and/or approvals. Sufficient space shall be allocated to conveniently locate the terminal blocks on the back or bottom of the enclosure. Enclosure shall be UL listed.

C. **Lamps Switches**

Indicating lamps and switches shall be furnished for the local control panels. Indicators and switches shall be face mounted for external access or viewable through a window kit. When a window is provided,



the fire protection equipment will be easily and quickly accessible with no tools except the key. Fire alarm indicators will be red, and trouble and supervisory alarm indicators will be amber. System normal indicators will be green. The enclosure will be located in such a manner to protect it from tampering by installing a lock on the panel door that is accessible only to authorized personnel.

7.19.07 Cable and cable Accessories

Supply, install, test / commission of all cables including special cables, loop cables as required for interconnecting fire alarm panel, detectors, manual call points, CPU, main control panel for annunciation purpose, PC, printer, fire extinguishing / deluge system control panels, etc. for the complete fire detection, alarm and protection system shall be supplied by the Bidder.

Cables for the fire detection, alarm and protection system shall be as follows:

- (I) Only Mineral Insulated Steel Clad Cables /Fire Survival cables(2CX1.5 Sq.mm - Control Cable & 3CX2.5 Sq.mm Power Cable) will be considered as per Electrical Specification Volume IIF1 & IIF2.
- (II) Communication cables for Local Area Networking (LAN) interconnecting the FA panels and Operator station through two redundant Fiber optic communication cable. The network shall be fault tolerant so that a single break or short-circuit anywhere in the communication loop shall not degrade the operation of the system. Two cores shall be kept as spare for future use.
- (III) All cables supplied shall bear the relevant ISI certification mark.
- (IV) Installation / wiring of detectors, laying of cables in various areas etc. shall be done in coordination with other Bidder in the respective areas. After installation, each core of the cable shall be tested for continuity and insulation resistance to earth and between cores.
- (V) The cables used for fire detection system are exclusive and are not shared with any other system. The cables are routed away from other system cables.
- (VI) Conduits, Pipes and Ducts.
 - (a) Cable wherever laid in the conduit shall conform to latest revision of IS: 9537 Part I. The size of the conduit shall be 25 mm.
 - (b) The routings, laying and fixing of conduits and pulling of cables shall be done by the Bidder based on the various layout drawings.
 - (c) The fabrication and installation of supports and the clamping or fastening of conduits to racks and supports shall be included in the scope of work of Bidder.



- (d) Cable termination will include making the requisite holes in the gland plate of the equipment, fixing the cable glands, terminating the cables in the gland, fixing of crimping type cable lugs on each core with necessary ferruling and dressing of cable cores inside the panel and connection to the equipment terminals.
- (e) Conduits, pipes and ducts will be embedded in walls. All accessories / fittings required for making the installation complete, including but not limited to ordinary and inspection tees and elbows, check nuts, brass or galvanized steel end caps, PVC / brass bell mouths for water - proof / fire - proof sealing, pull boxes, saddles, spacers and required steel supporting work shall be supplied by the Bidder on as required basis.
- (f) Conduit fittings shall be of the same materials as conduits. Conduits / pipes running horizontally above false ceiling and other exposed conduit running along the walls / structural members wherever necessary shall be under Bidder's scope. All conduits / pipes shall have their ends closed by caps until cables are pulled.
- (g) Each conduit run shall be marked with its designation. Identification shall be by means of painting so located that each run of conduit is readily identified at each end. Where conduits terminate at flush mounted boxes, cabinets or other enclosures, the designations shall also be marked on the inside of the enclosure adjacent to the conduits.
- (h) Dies for threading pipe or conduit of diameters and threads corresponding to the standards shall be provided by the Bidder. Bidder shall thread or cut off and rethread pipe / conduit and shall install adapters or reducers when required to connect sections conforming to different standards or specifications. All field threaded ends of metallic conduits / pipes shall be reamed after threading and anticorrosive paint applied. Exposed conduit (if, any) shall be adequately supported by racks, clamps, straps or by other approved means. Conduit supports shall be erected square and true to line and grade with an average spacing between as given below, except where details give closer spacing. Nominal Bore (dia) - 16 to 25 mm -1.2M. Drilled and tapped holes for screw fastening for conduits on galvanized or painted steel shall be touched up with red lead and same finishing paint before making up the connections.
- (i) Conduit shall be entered into terminal boxes at locations as per manufacturer guideline. In general, all equipment enclosures, cabinets and housings requiring conduit or cable entry shall be provided with terminal boxes designed for terminating and



sealing the ends of cable with compound or will have conduit terminating above level of emergence from floor concrete, with a wiped joint required between lead sheath and wiping sleeve on terminal box. However, a reasonable amount of drilling cutting, reaming and relocating holes shall be considered as normal part of the work.

- (j) Pull boxes, junction boxes, outlet boxes and terminal boxes other than standard items and standard pull sleeves and floor plates, plates terminating conduit runs at cable trays and other plates in the path of conduit runs should be initially furnished without conduit or cable entry holes. The Bidder will later be required to cut entry holes located to meet actual conduit locations as installed after which boxes and plates shall be hot dip galvanized / painted as required.
- (k) For long conduit wiring runs, inspection / pull boxes shall be provided at intervals not exceeding 10 m. Such facilities shall also be provided at conduit bends.

7.19.08 Special Tools

All the special tools & tackle as required for fixing, removal and testing of the sensor shall be furnished by the manufacturer and which shall not be limited to the following:

- (I) Detector Removal Tool:
- (II) Tool shall be universal type to remove / replacement of different size detectors mounted on the ceiling.
- (III) Telescopic Pole:
- (IV) To access detectors fitted upto 6 m above floor level. Removable tool can be fixed on the top of the pole for removal of detector.
- (V) Heat Detector Tester:
- (VI) The heat source is directed at the detector sensor, not the plastic components. This will be 240V AC, 50 Hz and battery operated. Adequate cable length not less than 5 m shall be supplied.
- (VII) Smoke Detector Tester:
- (VIII) Aerosol shall be suitable for all makes and models of detector, whilst not harming the detector, its components, the user or the environment.
- (IX) A Laptop computer for engineering configuration with both FAP Software and PLC Software loaded to be provided at the Common Centralised Fire water Room . Regarding PLC System follow Volume II E Specification.



- (X) Addressing Tool:
- (XI) Address and mode setting tool for all analog detectors and other addressable units.
- (XII) Portable UV / IR Test Lamp:
- (XIII) Portable battery operated explosion-proof source of UV / IR radiation that will be used for UV, IR, UV/IR flame detection systems.
- (XIV) Any other tools and tackle as deemed necessary by the Bidder for his supplied system.

7.20.00 Fire proof sealing/Fire Stop/Fire Protection Coating System

The fire-proof sealing/fire stop system/fire protection coating system is required to prevent spreading of fire from one place to another (or one zone to another) through the openings in wall/floor, cables laid in trays/racks and openings below Electrical Switchgear/MCC/Distribution Boards/Cabinets/Panels etc.

7.21.00 Fire-proof Sealing System

The material/components used for fire-proof sealing system shall be provided to meet the following requirements:

- a) Life expectancy should not be less than 30 years from the date of installation.
- b) Free from shrinkage or cracking or asbestos in composition and should achieve smoke and gas tightness during fire and should be modifiable.
- c) Not to generate toxic gas and harmless to the personnel handling the system.
- d) Prohibition of production of acid or alkali during gas generation.
- e) Will not produce suffocating/corrosive gas.
- f) Repellant to pest/ rodent/ termite.
- g) Expansion co-efficient - very low, which is to be comparable with masonry concrete.
- h) Not soluble/reactive to acid, water, alkali.
- i) Thermal conductivity - low.
- j) The material in contact with the cables in the fire-proof sealing system shall be compatible with the material used for outer sheath of cables.



- k) It should not have any adverse effect on the cables and should not alter the current carrying capacity of the cables.
- l) Retrofit in design to accommodate not less than 15% more addition of cables depending upon the size of cables, physically and chemically stable.
- m) Capable of withstanding vibrations, drop-loads, foot traffics, mechanical loads, etc.
- n) Non-hygroscopic, non-inflammable and shall not get affected over a period of time due to humidity, moisture and ozone etc. and should not contain volatile solvents which may cause a fire hazard during application.
- o) The fire rating shall not be less than three (3) hours and the system shall be stable after application of water jet in the exposed side in order to extinguish fire.

7.22.00**Fire Protection Coating to Be Applied On Installed Cables**

- a) The cables shall be coated with fire protection material of 2 mm dry thickness at the strategic locations as follows so as to limit the spread of fire :
 - i) At fire stops in walls and floors on either side upto 500 mm length.
 - ii) At fire stops below Electrical Switchgears/MCCs/Panels/ Cabinets etc. on one side coating of 500 mm length i.e. on the cable vault side/cable trench side.
 - iii) Length of 500 mm on all sides of the junction/crossing of cabling work in open cable routes/cable trench.
 - iv) In fire risk areas and where specified at suitable intervals as decided upon site conditions in open cable routes.
 - v) Where necessary and specified at site at intervals along cable routes in cable trenches.
 - vi) The coating shall be applied evenly on the cables only.
- b) The fire protection coating shall have the following properties/ composition:
 - i) Asbestos free, non-volatile, not eatable by vermin, harmless and non-irritant to skin of human.
 - ii) Not affecting the current carrying capacity of the cables and the properties of the installed cables.



- iii) It shall delay fire damage to cables and prevent flame spreading meeting the requirement of IEC-332-1 & IEEE- 383.
- iv) Coating material shall show no signs of cracking and peeling when the coated cable is bent to the radius of minimum 12 times the diameter of the maximum sized cable at 180°C.
- v) The limiting oxygen index of the material shall not be less than 35% as per ASTM D-2863.
- vi) Life expectancy equivalent to the cable installations.

7.23.00 The various openings in the cable vault, vertical/horizontal raceways of cables penetrating walls/floors and the bottom of Electrical Switchgears/MCCs/ Distribution Boards/Cabinets/Panels shall be provided with fire stop systems. Cables passing through the openings at various locations are laid on various tiers of the cable trays/racks in the bunch formation. In case, for the purpose of installation of seal system, steel frames are required to be fabricated and fixed in the openings, the fabrication of frame and fixing of the same shall have to be done by the Bidder. Any, civil works required to be done in the openings shall be carried out by the Bidder. Bidder shall also include one set of tools and accessories required for addition or removal of cables after the seal is made. This shall include special tools, compound injection guns, spray guns, etc.

7.24.00 **Power and Control Cables**

7.24.01 Fire survival Power and Control Cables shall be of following types:

- a) Power Cables

Please refer section-IV of Volume-II-F/2 of this specification.

- b) Control Cables (for fire detection)

Survival cables shall be similar to the above. In addition the cables shall have high degree of immunity from electromagnetic interference.

7.24.02 **FRLSH Power and Control Cables**

- a) Power Cables

Please refer section-IV of Volume-II-F/2 of this specification.

- b) Control Cables

1100 V grade 70°C continuous rating under normal condition and 160°C short time rating under short circuit condition PVC insulated FRLSH outer sheathed control cable conforming to following requirement and in line with IS:1554, IS:8130, IS:5831 and IS:3975.

**8.00.00 INSPECTION AND TESTING****8.01.00 Fire Water and Jockey Pumps**

8.01.01 All pumps shall be tested at the shop at rated speed for capacity, head, efficiency and brake horse power. The tests are to be done according to the requirements of the "Hydraulic Institute, USA".

8.01.02 Shaft forgings shall be subjected to ultrasonic testing and checks for hardness and microstructure in addition to chemical and mechanical properties.

8.01.03 MPI/DP test shall be carried out on impellers and shafts to ensure freedom from defects.

DP test shall be carried out on casing.

8.02.00 Diesel Engine

8.02.01 DPT on machined parts of piston and cylinder.

8.02.02 Ultrasonic testing of casting and forgings.

8.02.03 Determination of capacity, efficiency and characteristic curves of all engines.

8.02.04 Calibration tests of all fuel pumps, injectors, standard orifices, nozzles, instruments etc.

8.02.05 Over-speed test of the assembly at 120% of rated speed.

8.02.06 Power run test.

8.02.07 Performance test of the diesel engine to determine its torque, power and specific fuel consumption as function of shaft speed. Performance test of the engine shall be carried for 12 hours out of which 11 hours at full load and one hour at 110% overload.

8.02.08 Functional checks and adjustments of speed governor.

8.03.00 Hydro-pneumatic Tank

8.03.01 Hydro-pneumatic tank shall be hydraulically tested at 1.5 times the design pressure or two times the working pressure whichever is higher for a period not less than one (1) hour. The tank also be subjected to pneumatic testing at design pressure.

8.03.02 DPT shall be carried out on all final weldments including fillet joints.



- 8.04.00 **Air Compressors and Receiver**
- 8.04.01 All rotating components of the system shall be subjected to static as well as dynamic balancing testing.
- 8.04.02 Assembled receiver shall be hydrostatically tested at 150% of the design pressure and the test pressure shall be maintained for at least 30 minutes. All joints shall be gently hammered during the test.
- 8.04.03 Pneumatic test at design pressure shall also be carried out.
- 8.05.00 **Pipes/Fittings**
- 8.05.01 Hydraulic test or Eddy Current test shall be carried out at manufacturer works on pipes as per IS: 1239 Part 1/ IS: 3589. Fittings (bends, elbow, etc.) shall be as per IS 1239 Part 2 or equivalent specification.
- 8.05.02 Butt welds joints on buried as well as on above ground pipes shall be subjected to radiographic inspection as per TAC/LPA's manual.
- 8.06.00 **Water and Air Line Valves**
- 8.06.01 All valves shall be tested as per relevant design code of valve.
- 8.06.02 Valve trim material shall be subjected to NDT if diameter is equal to or greater than 50 mm.
- 8.06.03 Air tests shall be conducted as per applicable codes to detect seat leakages.
- 8.06.04 As cast heat marks shall be provided on castings and must be co-related with test certificates.
- 8.07.00 **Hydrant Valves and Stand Post Assembly**
- 8.07.01 The stand post assembly along with the hydrant valve (valve being open and outlet closed) shall be pressure tested to detect any leakage.
- 8.07.02 Flow test shall be conducted on the hydrant valves. The flow through the valve shall not be less than 900 liters/min. Vender may submit type test report of similar size of valves duly certified by ISI.
- 8.07.03 Leak tightness test of the valve seat shall be conducted.
- 8.08.00 **Indoor Hydrant Valves Internal landing valves**
- Each internal landing valve shall be tested for pressure, flow and leak tightness as per latest applicable standards & norms.

**8.09.00 Hydrant Valves for First Aid Fire Protection System**

Each hydrant valve for first aid fire protection system shall be tested for pressure, flow and leak tightness as per latest applicable standards & norms.

8.10.00 Fire Water Monitors

Tests shall be done on Fire Water Monitor as per Code and Data Sheet.

8.11.00 Hoses, Nozzles, Branch Pipes and Hose Boxes

8.11.01 Rubber lined impregnated woven jacketed hoses shall be tested as per IS-636, Type-II and first aid fire protection hose shall be tested as per IS-444. In both cases, following tests shall be included.

- a) Percolation test b) Pressure test c) Burst test

The branch pipe, coupling and nozzles shall be subject to a hydrostatic test pressure to detect any leakage.

8.12.00 Strainers

Pressure drop test shall be carried out for basket strainers as well as Y-type line strainers.

8.13.00 Battery and Battery Charger

All equipment and components thereof shall be subject to shop tests as per relevant IS/IEC standards. The tests shall also include dielectric tests on Battery Charger.

8.14.00 Fire Detection and Alarm Panels

8.14.01 All equipment shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standards.

8.14.02 Routine Tests

The tests for the panels shall include but not necessarily limited to the following :

- a) Operation under simulated service condition to ensure accuracy of wiring, correctness of control schemes/annunciation system and proper functioning of the equipment/devices and continuity test of printed circuit cards.
- b) All wiring and current carrying part shall be given appropriate High Voltage Test.
- c) Routine test shall be carried out on all equipment such as contactors, relays, switch, fuse, instrument transformers, meters etc.



- d) Power frequency withstand test shall be performed on control/secondary wiring.

8.14.03 Type Test

Type test on typical section of a panel consisting of Transformer Panel, Power pack module unit, Control and operation unit, Annunciation unit etc. shall be performed as per relevant IEC/Fire codes.

8.14.04 Auxiliary Equipment

All component parts and auxiliary equipment such as space heater, insulator etc. shall be routine tested as per relevant IS/IEC.

8.15.00 **Type Tests on Fire Proof Sealing System and Fire Stop System**

The type tests for fireproof sealing system for floor/wall opening/fire stop system for bottom of Electrical Switchgear MCCs/Panel are as under:

- a) Fire rating test
- b) Hose stream test
- c) Accelerated ageing test
- d) Fire rating test on the penetration seal system built of accelerated aged components followed by Hose Stream Test.
- e) Temperature rise test for cable in the fire stop.
- f) Water absorption test followed by fire rating test.
- g) Flame resistance test for fire protection coating material.
- h) Anti-rodent Test.

The detailed test procedures for each of these tests are to be submitted by the bidder and is subject to approval by Owner/ Consultant.

9.00.00 **DRAWINGS, DATA AND MANUALS TO BE SUBMITTED BY THE BIDDER**

9.01.00 **Drawings to be Submitted by the Bidder**

9.01.01 Flow diagram showing the complete fire protection scheme with associated controls for the following :

- i) Hydrant System both Indoor and Outdoor.
- ii) Automatic type High Velocity Water Spray System with quartzoid bulb detection system in pressurized water loop.



- iii) Automatic type Medium Velocity water spray system with Linear heat sensing cable as detector.
 - iv) Multi-criteria smoke detection system arranged in cross-zoning principle.
 - v) Heat Detection System (IC type).
 - vi) Diagram showing the lubricant system etc.
- 9.01.02 Schematic and wiring diagram for Battery Charger.
- 9.01.03 Layout arrangement of battery with catalogues.
- 9.01.04 Mounting arrangement of battery charger.
- 9.01.05 Typical general arrangement drawing showing constructional features, space required in front & back, Power/Control/Signal Cable entry points, etc. of local fire panels, main fire panel and local control panel.
- 9.01.06 Typical Control Schematic diagram for solenoid operated valves, drive motors, Fire-detector circuits.
- 9.01.07 Contact multiplication diagram for hook-up with Air-conditioning System, Ventilation System, Coal Handling System.
- 9.01.08 Typical Annunciation System Schematic Diagram along with control and instrumentation scheme of the Fire Protection System.
- 9.01.09 Layout arrangement of Battery Charger inside.
- 9.01.10 Typical drawings for Fireproof Sealing System indicating fixing details and dimensions.
- 9.01.11 Write up on control and operating philosophy of complete Fire Fighting System.
- 9.01.12 System configuration of Fire water pumping & pressurizing system, Fire alarm detection & protection system etc. along with interface technique of other systems.
- 9.01.13 Proposed GA drawing of different panels.
- 9.01.14 I/O list
- 9.01.15 Technical data sheets
- 9.01.16 Bill of Materials
- 9.01.17 P&I diagrams
- 9.01.18 Details of Spares





- 9.01.19 Details of Training
- 9.01.20 Filled up Bid Proposal Sheets
- 9.01.21 Deviation Sheet.
- 9.02.00 **Data and Curves**
- 9.02.01 Battery cell voltage characteristics and data for different discharge rates.
- 9.02.02 Schedule of projectors in MVW spray system and various types of detectors i.e. quartzoid bulb, smoke detector, heat detectors & fire sensing cable, indicating nos. selected for each type of equipment/area.
- 9.02.03 Technical Leaflets on fireproof sealing system and Fire Protection Coating System.
- 9.02.04 Type Test Certificate for all the tests specified elsewhere in the specification.
- 9.03.00 **Design Basis Back-up Calculations to be submitted by Bidder after award of contract**
- 9.03.01 Head calculation of pumps selected for :
- i) Hydrant system,
 - ii) Spray water system &
 - iii) Pressurisation of fire water system (i.e. jockey pump). Design calculation and basis of equipment/system selection.
- 9.03.02 Hydraulic calculation for hydrant and spray system.
- 9.03.03 Capacity and pressure rating for compressors selected for Hydro pneumatic tank. Capacity sizing & thickness calculation of hydro pneumatic tank.
- 9.03.04 Back-up calculation for no. of quartzoid bulb detectors provided for detection of fire in transformers.
- 9.03.05 Back-up calculation for no. of multi criteria smoke detectors (optical type arranged in X-zoning fashion), provided for cable spreader room/cable vault/switchgear room/ control room etc.
- 9.03.06 Back-up calculation of IC type heat detectors provided for Indoor/outdoor type LT Transformers (Rating less than 10MVA).
- 9.03.07 Back-up calculation of heat sensing cable provided for detection in coal conveyor.
- 9.03.08 Basis of selecting no. of high velocity spray nozzles in LT transformer. One typical calculation each type of transformer shall be furnished.



- 9.03.09 Basis of selecting no. of medium velocity sprayer nozzles in coal conveyor, cable spreader room etc. One typical calculation in each case shall be furnished.
- 9.03.10 Pipe sizing calculation including thickness calculation considering allowable velocity of fluid in pipe line as furnished in "Design basis and input".
- 9.03.11 All civil/structural design calculations as applicable within civil scope of work.
- 9.03.12 Calculation for sizing of Battery and Battery chargers for each category of service.
- 9.03.13 Detail dimensional drawings of various panels , cabinets , equipment , components / sub assemblies with internal views.
- 9.03.14 Complete layout diagrams with foundation details of all panels , cabinets etc.
- 9.03.15 Junction Box / Rack GA & schedule and Instrument / JB location drawing.
- 9.03.16 Complete interconnection and cable schedule
- 9.03.17 JB / Panel Wiring drawings
- 9.03.18 Power Distribution Drawing
- 9.03.19 Pneumatic / Process Hookup drawing.
- 9.03.20 Complete loop and Logic diagrams
- 9.03.21 Logs and Graphics
- 9.03.22 List of special tools and tackle
- 9.03.23 List of consumables
- 9.03.24 Erection drawings and documents
- 9.03.25 Calibration and shop test certificates
- 9.03.26 QAP



DATA SHEET FOR PIPING, FITTINGS, VALVES AND SPECIALTIES

A. PIPING AND FITTINGS

1.00.00	Type	Overground pipes normally full of water (i)	Overground pipes normally empty but periodically charge with water (ii)
2.00.00	Material	M. S. ERW pipes as per IS-1239, Part – 1 heavy grade (for pipes of sizes 150 NB or below) and IS-3589 Gr.410 ERW (For sizes 200 NB and above) or equivalent and galvanized as per IS 4736 for pipes normally empty and periodically charged with water system application.	
3.00.00	Piping Thickness	Pipes for sizes 200 NB & above shall conform to IS: 3589 Grade Fe410. The final thickness shall not be less than that specified as per IS: 3589 as indicated below.	

Nominal Pipe Size (mm)	Outside Diameter (mm)	Wall Thickness (mm)
200 NB	219.1	6.3
250 NB	273	6.3
300 NB	323.9	7.1
350 NB	355.6	7.1
400 NB	406.4	8.0
450 NB	457	8.0
500 NB	508	8.0
600 NB	610	8.0

- Note :
- Generally Pipes shall be over ground. If Over ground Pipe is not feasible (Road Crossing etc.), then under-ground/buried Pipe lines may be accepted. However, Final decision of Client/Consultant in this regard will be final. To prevent soil corrosion buried pipes shall be properly lagged with two coat and two wrap coal tar enamel and fibre glass/kraft paper as per IS : 10221 or corrosion protective tapes of minimum thickness of 4 mm (in two layers) of coal tar type as per AWWA C 203 / IS : 15337.
 - For detail of painting, please refer Section-XI of Volume-IIA. The shade of paint shall be Fire Red.



4.00.00	Size	As per final design and engineering by Bidder and approved by Owner. However Bidder shall consider velocity of fluid in the pipeline & other criteria as indicated elsewhere for selection of pipe size.	
5.00.00	Construction	←----- ERW -----→ (i) (ii) (iii) (iv)	
6.00.00	Joints	Butt-welded for size 65 mm NB & higher as per ANSI B 16.9 and socket welded for sizes up to 50 NB as per ANSI B16.11	Screwed flange as required for dismantling purposes for sizes 65 NB & above as per ANSI B 16.5 and screwed socket for sizes 50 NB & below. Welding on GI Pipes/fittings would be permitted provided the same is carried out by means of special electrodes suitable for the above application and the same shall be approved by the employer. After welding, welded portions shall be applied with three coats of zinc silicate treatment/rich paint over one coat of suitable primer. Further the Bidder shall provide proper zinc paint at the point of welding.
7.00.00	Fittings		
	Ratings/Wall thickness	Minimum thickness to match with that of pipe for pipe size 65 NB and above. For pipe size above 150 NB, minimum thickness shall be 6 mm. For pipe size 50 NB & below rating shall be 3000 lbs or wall thickness matching with that of corresponding pipe.	
	Material	The material shall conform to ASTM A234 Gr. WPB or ASTM A 105 or equivalent.	

Note:

- 1) All fittings and flanges for galvanized pipes shall be galvanized.
- 2) Unless otherwise specified, all elbows/bends shall be long radius type.
- 3) The fittings shall be galvanized as per IS: 4736 for galvanized pipe application. In case of branching connections from GI mains for spray piping network socket may be welded for more than two pipe reductions instead of standard tees.





- 4) Fabricated fittings shall not be acceptable up to pipe size of 300 NB. For sizes 350 NB & above, fittings may be fabricated as per BS: 2633/BS: 534.
- 5) Working and test pressure of piping & fittings shall be as per IS or relevant international standards.

B. VALVES**I. Gate, Globe & Check Valve****1. Basic Design Code**

- a) Gate Valve : i) IS-14846 for sizes 65 mm NB to 300 mm NB
ii) IS-2906 for sizes 350mm NB and above

b) Globe Valve : BS EN-13789

c) Check Valve : BS-1868

2. Construction : Cast body and bonnet/cover.

3. Material of Construction for Gate and Globe Valve

a) Body and bonnet Material for Gate and Globe valve cover IS-210 Gr. FG 260.

b) Trim/disc. : IS-210 Gr. FG 260.

c) Stem : Stainless steel to AISI-410 13% Cr. St.

4. Material of Construction of Check Valve shall be as given below:

a) Body, Bonnet & Cover: ASTM-A-216 Gr. WCB

b) Trim/Disc : 13% Cr. Steel as per ASTM-A-182 Gr. F6 Heat treated and Hardened, min. Hardness-250 HB.

c) Back seat & Hinge Pin: 13% Cr. Steel as per ASTM-A-182 Gr. F6.

Note: Gate, globe and check valve of size 50 mm NB & below shall be of forged CS body as per API 602(Gate valve), BS 1868(Check valve) and BS 1873(Globe valve). These valves shall have socket welded ends. Valves will be provided with locking arrangements.



II. Deluge Valve

1. Type : Differential pressure type with diaphragm & clapper assemblies.
2. Code/Standard : As applicable.
3. Material of construction
 - a) Body : CI conforming to IS-210 Gr. FG-260
 - b) Valve internal : Brass/bronze
4. Water motor alarm gong shall be provided for hydraulically operated Deluge valve. For solenoid operated deluge valve, same is not required.

C. **HYDRANT VALVE OUT DOOR /LANDING VALVE INTERNAL HYDRANT VALVE / HYDRANT VALVE FOR FIRST AID FIRE PROTECTION SYSTEM**

1. Type : Female oblique type with the outlets angled towards ground.
2. Code/Standard : IS-5290 Type-A
3. Material of Construction
 - a) Body : SS-304
 - b) Stop valve : SS-304
 - c) Spindle : SS-304
 - d) Seat : SS-304

D. **WATER MONITORS**

1. Type : Fixed type
2. Code/Standard : IS: 8442
3. Flow : 2580 litre/min at 7 Kg/Sq.cm
4. Rotation of body
 - a) Horizontal : 360°
 - b) Vertical : minimum 125 Deg (80° upward and 45° downward)



5. Throw of monitors

Horizontal : 55 - 60 M

Vertical : 25 - 30 M

6. Material of construction

a) Base flange : M.S. conforming to IS: 6392

b) Reducer : M.S. conforming to IS: 1239 Part-II

c) Water nozzle : SS304

E. **FIRE HOSE FOR INTERNAL AND OUTDOOR HYDRANTS**

1. Type : Impregnated woven jacketed
2. Code/Standard : IS-636 Type II
3. Wt. (gm/M) : Not more than 250
4. Coil diameter : Not more than 44 Cm. (for 30 M long)

F. **FIRE HOSE FOR FIRST AID FIRE PROTECTION SYSTEM**

1. Manufacturer : As per approved make
2. Type : Corrugated external surface, reinforced rubber hose pipe.
3. Code/Standard : IS-884

G. **BRANCH PIPES AND NOZZLES**

1. Manufacturer : As per approved make
2. Type : Triple purpose, solid jet and Fog type
3. Code/Specification : IS-2871 for branch pipe and IS- 952 for Fog Nozzles.
4. Material of construction
 - a) Branch pipe : SS AISI-304 & Construction as per IS-2871
 - b) Nozzle : SS-304
 - c) Diffuser : SS-304 & Construction as per IS-2871
 - d) Fog Nozzle : SS-304 & Construction as per IS-952.

**H. HOSE BOXES/CABINET INDOOR**

1. Manufacturer : As per approved make.
2. Material of construction : MS 16 SWG & 3 mm thick glass panel in front door with lock & two keys.
3. Size : To accommodate a pair of hoses one branch pipe, nozzles, spanner etc.
4. Mounting : Wall/Column/Pedestal mounted

I. HOSE BOXES/CABINET FIRST-AID FIRE PROTECTION

1. Manufacturer : As per approved make.
2. Material of construction : MS 16 SWG & 3 mm thick glass panel in front door with lock & two keys.
3. Size : To accommodate One (1) no. of hose with end fittings, one branch pipe, nozzles, spanner etc.
4. Mounting : Wall/Column/ Pedestal mounted

J. STRAINERS

1. Type : Simplex basket type
2. Material of construction
 - a) Body : MS fabricated IS:2062 tested quality
 - b) Internal : SS (AISI 316), 30 mesh suitably reinforced

K. SPRAY NOZZLES FOR HWV AND MVW SPRAY SYSTEM

1. Manufacturer : As per approved make
2. Type : Open head type / open nozzle solid cone
3. Discharge angle : 60°-150°
4. K - factor : Bidder to indicate
5. Flow rate : Bidder to indicate
6. Material of construction
 - a) Body : SS-304
 - b) Insert : SS-304



ANNEXURE-II

DATA SHEET
FOR
HOSE HOUSE

1.00.00	Service	:	To accommodate the hoses for outdoor hydrants with nozzles, branch pipes, spanner etc.
2.00.00	Location	:	Outdoor, to be strategically located in the entire plant area.
3.00.00	Number	:	As per TAC/LPA requirement



ANNEXURE-III

DATA SHEET
FOR
DELUGE VALVE SHED

1.00.00	Service	:	To accommodate deluge valves of transformers rating more than 10 MVA, deluge Valves of coal conveyor and cable galleries etc. fire protection system.
2.00.00	Location	:	Outdoor. Bidder to select the suitable locations based on piping layout.
3.00.00	Number	:	Bidder to indicate



ANNEXURE-IV

DATA SHEET
FOR
DETECTORS

A. MULTI CRITERIA SMOKE DETECTORS

1.00	Manufacturer	:	As per approved make
2.00	Type	:	Combination of Photo electric sensing and heat sensing, intelligent Analogue Addressable.
3.00	Code/Specification	:	NFPA-72E/BS-5839/IS
4.00	Sensitivity	:	Preset at factory/Adjustable at site (as per UL-268).
5.00	Temperature range	:	1.6°C to + 60°C
6.00	Humidity range	:	15% to 90% RH
7.00	Air velocity	:	0 to 300 ± 25 feet/minute
8.00	Plug in type detector to be provided	:	Yes
9.00	No. of terminals on detector on mounting base	:	Bidder to indicate
10.00	Area covered by single detector	:	Bidder to indicate
11.00	Operating voltage	:	24 volt D.C.
12.00	Inbuilt indicating lamp to indicate operation of the detector provided	:	Yes [Separate response indicators mounted on false ceiling to be provided for smoke detectors mounted above false ceiling]
13.00	Material of detector body	:	Metallic/Plastic
14.00	Detector is approved by UL/FOC/FM/TAC/LPA/VDS	:	Yes
15.00	Detector Base	:	Mounting box (if applicable) Double Compression gland.
16.00	Coverage area	:	Considering maximum spacing as per IS: 2189



**B. HEAT DETECTORS**

1.00.00	Manufacturer	:	As per approved make
2.00.00	Type	:	Fixed temperature cum rate of rise type, intelligent Addressable Analog
3.00.00	Sensitivity	:	Preset at factory/Adjustable at site
4.00.00	Operating temperature range	:	54°C. to 60°C.
5.00.00	Humidity range	:	5% to 90% RH
6.00.00	Detector automatically resets after actuation	:	Yes
7.00.00	Area covered by single detector	:	Bidder to indicate
8.00.00	Operating voltage	:	24V DC
9.00.00	Type of contacts	:	Silver
10.00.00	Principle of operation	:	As per Specification
11.00.00	Detector approved by UL/FOC/FM/TAC/LPA/VDS	:	Yes
12.00.00	Detector Base	:	Mounting box (if applicable) Double compression gland.
13.00.00	Coverage area	:	50 Sq.m per detector (Max.) / Maximum spacing as per IS-2189
14.00.00	Special cable	:	To be provided

C. QUARTZOID BULB DETECTORS

1.00.00	Manufacturer	:	As per approved make
2.00.00	Type	:	Frangible bulb type
3.00.00	Operating temperature	:	79°C





Sl. No.	Item Description	Vendor Name	
		10	BHARAT HEAVY ELECTRICALS LTD.
		11	EXCEL HYDRO – PHEUMATICS PVT. LTD.
		12	INSTRUMENTATION LTD.
		13	METPRESS ENGINEERING WORKS
		14	MAHALAKSHMI SEAMLESS
		15	RATNAMANI METALS & TUBES LTD.
59	INSTRUMENT VALVES / MANIFOLDS	1	BHARAT HEAVY ELECTRICALS LTD.
		2	BALDOTA VALVE AND FITTING CO PVT LTD.
		3	INSTRUMENTATION LIMITED
		4	METPRESS ENGINEERING WORKS
		5	EXCEL HYDRO-PNEUMATICS PVT. LTD.
		6	METPRESS ENGINEERING WORKS
		7	FLOWTECH
60	COMPRESSION FITTINGS	1	PARKER HANNIFIN
		2	PRECISION ENGG INDUSTRIES
		3	TROUVAY & CAUVIN
		4	HOKE (TECHNICAL PARTS CO. MUMBAI)
		5	SWAGELOCK
		6	METPRESS ENGINEERING WORKS
61	SOCKET WELD FITTINGS	1	EXCEL HYDRO-PNEUMATICS PVT. LTD.
		2	METPRESS ENGINEERING WORKS
		3	V.K. INDUSTRIES
		4	VIKAS INDUSTRIAL PRODUCTS
		5	BALDOTA VALVE AND FITTING CO PVT LTD.
		6	FLOWTECH
FIRE DETECTION AND HYDRANT SYSTEM VENDORS			
1	HYDRANT VALVES	1	SHAH BHOGILAL
		2	SUKAN
		3	NEWAGE
		4	VENUS
		5	WINCO
2	FIRE HOSES	1	NEWAGE
		2	CHATTARIA RUBBER
3	WATER MONITOR & WATER-	1	SHAH BHOGILAL



Sl. No.	Item Description	Vendor Name	
	CUM FOAM MONITORS	2	HD FIRE
		3	NEW AGE
		1	SUKAN
		2	VENUS
4	BRANCH PIPE, NOZZLES, COUPLINGS & FIRE BRIGDAE CONNECTIONS	3	NEW AGE
		4	WINCO
		1	HD FIRE
		2	TYCO (GRINELL)
5	DELUGE VALVES	3	KIDDE (I) LTD.
		1	KIDDE (I) LTD.
		2	TYCO
6	HVW/ MVW SPRAY NOZZLE	3	HD FIRE
		1	TYCO(GRINELL)
		2	HD FIRE
7	QUARTZOID BULB SPRINKLERS/DETECTORS	3	NEWAGE INDUSTRIES
		1	ARC WELD ENGINEERS
		1	SIMPLEX
9	MICROPROCESSOR BASED FIRE ALARM PANEL	2	SCHRACK
		3	ESSER HONEYWELL
		4	DETECTOMAT
		5	SECUTRON
		6	GENT
		1	AP SENSING, Germany
10	LHS CABLE (FO Type)	2	SENSA, UK
		1	Listec (Schrack)
11	LHS CABLE (Intelligent Addressable Thermal Sensor Based)	1	DEL PD PUMPS & GEARS
12	FOAM PUMP	1	ARC WELD ENGINEERS
13	FOAM TANKS	1	SIMPLEX
		2	SCHRACK
		3	ESSER HONEYWELL
		4	DETECTOMAT
		5	SECUTRON
		6	GENT
14	ADDRESSABLE MULTISENSOR TYPE DETECTORS	1	SIMPLEX
		2	SCHRACK
		3	ESSER HONEYWELL
		4	DETECTOMAT
		5	SECUTRON



Sl. No.	Item Description	Vendor Name	
		6	GENT
15	ADDRESSABLE HEAT DETECTORS	1	SIMPLEX
		2	SCHRACK
		3	ESSER HONEYWELL
		4	DETECTOMAT
		5	SECUTRON
		6	GENT
16	INFRA RED DETECTORS	1	PATOL
		2	SYSTEM SENSOR
17	COATING & WRAPPING MATERIAL/ TAPE (COAL TAR BASED)	1	IWL LTD.
		2	RUSTECH
18	INERT GAS SYSTEM	1	GINGEKERR
		2	ANSUL
		3	SRI
		4	SIEMENS
19	BATTERY	1	EXIDE
		2	AMCO
20	FIRE SURVIVAL CABLES	1	POLYCAB
		2	RRKABEL
		3	KEI
		4	DELTON
21	HOSE REEL	1	SIEMENS
		2	WINCO
23	FIRE EXTINGUISHER	1	BIS APPROVED SOURCES WITH VALID LICENSE
24	PROBE TYPE HEAT DETECTOR	1	KIDDE
		2	TYCO
	HVAC SYSTEM VENDORS		
1	AIR WASHER & UAF	1	HYDERABAD POLLUTION CONTROL
		2	ADVANCE VENTILATION
		3	DRAFT AIR
		4	BLUE STAR
		5	VOLTAS
		6	STERLING WILSON
		7	ROOTS COOLING SYSTEM
		8	C DOCTOR
2	CENTRIFUGAL FAN	1	FLAKT
		2	KRUGER

**BHARAT HEAVY ELECTRICALS LIMITED**

Doc. No.

TB-445-552-001

**1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard**

Part No.

SECTION -3**Fire Fighting System****SECTION-3****GENERAL TECHNICAL REQUIREMENT****3.0 GENERAL**

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipments and services covered under other respective sections and are not exclusive. However, in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS:

a)	Customer/ Purchaser/ Owner	The West Bengal Power Development Corporation Ltd.
b)	Consultant/Owner's Engineer	Development Consultants Private Ltd. Kolkata
c)	Project Title	1X660MW thermal power extension project Unit-5 at Sagardighi- 400KV Switchyard
d)	Location	Site is located at Manigram village of Murshidabad district in West Bengal and around 240km from Kolkata. 13km north of Sagardighi town by the side of the SMGR (Sagardighi Manigram –Gankar –Raghunathganj) road at a distance of 20km from National Highway 34 . Nearest railway station is Manigram adjacent to the site on Bandel-Barhawara branch line and 6.5km from Sagardighi railway station on Sainthia-Azimhunj line of eastern railway. Nearest Airport –Kolkata. Nearest Seaport-Kolkata/Haldia
e)	Altitude	34 m above MSL
f)	Transport Facilities	Road/Rail
g)	Postal Address	To follow
<u>SITE CONDITIONS</u>		
a)	Maximum Design ambient dry bulb temperature	50°C
b)	Minimum Design ambient dry bulb temperature	5°C
c)	Average Relative humidity (for design)	73 %
d)	Maximum relative humidity	84%
e)	Pollution Severity	Heavily Polluted
f)	Seismic zone	III

**BHARAT HEAVY ELECTRICALS LIMITED**

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Part No.

SECTION -3**Fire Fighting System**

g)	Wind velocity	47m/sec.
h)	Wind pressure	150kg/sq.mts
i)	Terrain category	2
j)	Risk coefficient (K1)	1.07
k)		
l)	Average rainfall	1389mm

SYSTEM PARAMETERS

Nominal system voltage	400 kV
Highest system voltage	420 kV
System voltage variation	-5% to +5%
Basic Impulse level(dry /wet)	1425kVp
Power frequency withstand voltage dry/wet	630kVrms
Switching Impulse withstand voltage (Phase to Earth)	1050kVp
Switching Impulse withstand voltage (Phase to Phase)	1575kVp
Lightning impulse withstand voltage (kVp between live terminals and earth.)	1425kVp
Lightning impulse withstand voltage (kVp impulse on one terminal and other terminal earthed) (across isolating distance).	1665kVp
Maximum radio interference voltage at 320kV rms phase to ground voltage	1000 micro volts for frequency between 0.5 MHz and 2.0 MHz
Rated short time current	50 kA for 1 sec
Frequency	50 Hz, +3% to -5%
Creepage distance	31 mm/kV
System Earthing	Effectively earthed

AUXILIARY POWER SUPPLY

3 phase A.C power supply	415V $\pm 10\%$, 50 Hz $\pm 5\%$, 3-phase 4 wire, 50kA, solidly earthed, combined voltage and frequency variation $\pm 10\%$
1 phase A.C power supply	240V $\pm 10\%$, 50 Hz +3% to -5%, 1-phase AC supply
D.C. power supply	220V +10% to -15%, 2-wire , ungrounded 48V $\pm 10\%$, 2 wire system positively earthed

	BHARAT HEAVY ELECTRICALS LIMITED	Doc. No.	TB-445-552-001
	1X660MW TPS extension project Unit-5, Phase-III at Sagardighi- 400KV Switchyard	Part No.	SECTION -3
	Fire Fighting System		

3.2 GENERAL TECHNICAL REQUIREMENT

3.2.1 TYPE TESTS

All equipment/systems to be supplied shall conform to type tests as per relevant standards and proven type. The Bidder / Contractor shall furnish the reports of all the type tests carried out in within last **five years from date of bid opening i.e. 18.03.2018.** as listed in relevant clauses in respective electrical specification and relevant standards for all components / equipment / systems. These reports should be for the tests conducted on identical/similar components/equipment/systems to those offered/proposed to be supplied under this contract.

Type tests done in an independent government laboratory or in the presence of representative of State Electricity Board or other reputed public undertakings, the type test reports of the same shall be submitted for scrutiny /approval. If these are found suitable and technically acceptable, conducting of type tests shall be waived off.

In case Contractor is not able to submit report of type test(s) conducted in last five years, or in case type test report(s) are not found to be meeting the specification/relevant standard requirements, then all such tests shall be conducted under this contract by the Bidder free of cost to Employer/Purchaser, and reports shall be submitted for approval. No charges shall be paid under this contract. All acceptance and routine tests as per relevant standards and specification shall be deemed to be included in the bid price.

3.2.2 CODES AND STANDARDS

All materials and equipment shall generally comply in all respect with the latest edition of relevant international electro-technical commission (IEC) or any other internationally accepted standard which ensure equal or better quality or relevant Indian standard(IS) mentioned against each equipment and this specification.

3.3 MATERIAL/WORKMANSHIP

3.3.1 General Requirements

Where the specification does not contain characteristics with reference to workmanship, equipment, materials and components of the covered Equipment it is understood that the same must be new, of highest grade of the best quality of their kind conforming to best engineering practice and suitable for the purpose for which they are intended.

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements and shall be used throughout the design. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill their required function. In general screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from purchaser.

**BHARAT HEAVY ELECTRICALS LIMITED**

Doc. No.

TB-445-552-001**1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard**

Part No.

SECTION -3**Fire Fighting System**

Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall be interchangeable with, and shall be made of the same materials and workmanship as the corresponding parts of the Equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modern practices will be accepted. Installation shall be constructed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, leveling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances and instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacture's limits suitable guards shall be provided for the protection of personal on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

The Contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Contractor shall apply all operational lubricants to the equipment installed by him.

All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Contractor has any special requirement for the specific application of a type of oil or grease not available in India. In such is the case he shall declare in the proposal, where such oil or grease is available. He shall help purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

3.3.2 Provisions For Exposure to Hot and Humid climate

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favorable to the growth of fungi and mildew. The indoor equipments located in non-air conditioned areas shall also be of same type.

3.4 PAINTING

The painting of equipment shall be as follows:

Epoxy based with suitable additives. The thickness of finish coat shall be minimum 80 microns (minimum total DFT shall be 100 microns). However, in case electrostatic process of painting is offered for any electrical equipment, minimum paint thickness of 80 microns shall be acceptable for finish coat.

Painting process shall be of powder coating type. All surface shall be cleaned , phosphated and given two coats of rust –resistant primer followed by two coats of finish paints . The interior of all panels

**BHARAT HEAVY ELECTRICALS LIMITED**

Doc. No.

TB-445-552-001**1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard**

Part No.

SECTION -3**Fire Fighting System**

cabinets and enclosures shall be finished with gloss white enamel. Two final powder coats of synthetic enamel paint of light grey shade (631 of IS-5) shall be given to exterior surface of all the panels.

Sufficient quantities of touch paint shall be furnished for application at site. All The indoor cubicles shall be of same colour scheme and for other miscellaneous items, **colour scheme will be approved by the purchaser.**

3.5 PROTECTION

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves, piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner. Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.

3.6 FUNGISTATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on the parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interface with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application to the varnish.

3.7 SURFACE FINISH

All interiors and exteriors of tanks, control cubicles and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible, shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or otherwise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling. All external painting shall be as per shade no. 631 of IS:5.

3.8 GALVANIZING

All ferrous parts including all sizes of nuts, bolts, Plain and spring washers, support channels, structures, shall be hot dip galvanized conforming to latest version of IS:2629 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electro-galvanized. Minimum weight of zinc

**BHARAT HEAVY ELECTRICALS LIMITED**

Doc. No.

TB-445-552-001**1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard**

Part No.

SECTION -3**Fire Fighting System**

coating shall be 610 gm/sq.m and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6 mm thickness, requirement of coating shall be as per relevant ASTM.

3.9 PACKING

The following details are to be clearly indicated in the material forwarding documents:

- a) Name and address of the consignee.
- b) Purchase order number.
- c) Name of supplier/s.
- d) Description of equipment / material.
- e) Net weight.
- f) Gross weight.

Each package shall be accompanied by a packing note (in weather proof paper).

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the purchaser, the Contractor shall also submit packing details/associated drawing for any equipment material under his scope of supply, to facilitate the purchaser to repack any equipment/ material at a later date, in case the need arises. Any material found short inside the packing cases shall be supplied by the supplier without any extra cost. The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbol i.e. fragile, handle with care, use no Hooks etc.

3.10 HANDLING, STORING AND INSTALLATION

Contractor may engage manufacturer's Engineers to supervise if required for unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the purchaser. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

Where assemblies are supplied in more than one section, contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning.

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. The Contractor shall be fully responsible, for the equipment/material until the same is handed over to the purchaser in an operating condition after commissioning.

The minimum phase to earth, phase to phase and section clearance along-with other technical parameters for the various switchyard voltage levels to be maintained shall be strictly as per the approved drawings.

The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it

**BHARAT HEAVY ELECTRICALS LIMITED**

Doc. No.

TB-445-552-001**1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard**

Part No.

SECTION -3**Fire Fighting System**

is observed that the erected equipment(s) do not meet the above minimum clearances, the Contractor shall immediately proceed to correct the discrepancy at his risks and costs.

3.11 DEGREE OF PROTECTION

The enclosures to be installed shall be provided with degree of protection as detailed here under:

- a) Installed out door: IP-55
- b) Installed indoor in air conditioned area: IP-31
- c) Installed in covered area IP:52
- d) Installed indoor-in non-air-conditioned area where possibilities of entry of water is limited: IP-41
- e) For LT switchgear (AC & DC distribution Boards): IP-54
- f) 11kV & 3.3kV Switchgears: IP4X
- g) 415V MCC / DBs / Fuse Board IP52 for indoor and IP65 for outdoor.
- h) Motor (Indoor/Outdoor): IP55
- i) Motor Actuator: IP65
- j) Control and Relay Panel in AC area: IP3X
- k) Control and Relay Panel in normal area: IP42
- l) Pushbutton Station/Kiosk/Panel - Indoor IP55
- m) Pushbutton Station/Kiosk/Panel -Outdoor IP65
- n) Indoor Junction boxes for cables / wires: IP55
- o) Outdoor lighting fixtures: IPW65
- p) Battery Charger Panel: IP42

The degree of protection shall be in accordance with IS:13947, (Part-1)/IEC-947(Part-1). Type test report/or degree of protection test on each type of the box shall be submitted for approval.

3.12 RATING PLATES, NAME PLATES AND LABELS

Type or serial number together with details of the loading conditions under which the item of the substation in question has designed to operate and such diagram plates as may require by the Purchaser. The rating plate of each equipment shall be according to IEC requirements.

All such nameplate instruction plates, rating plates shall be bilingual with Hindi inscription first followed by English. Alternately two separate plates one with Hindi and other with English inscriptions may be provided. All measurements shall be in M.K.S units.

**BHARAT HEAVY ELECTRICALS LIMITED**

Doc. No.

TB-445-552-001**1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard**

Part No.

SECTION -3**Fire Fighting System****3.13 EARTHING**

Equipment shall be provided with two grounding pads suitable for connection to galvanized steel flat. Control panels, Relay panel, outdoor marshalling boxes, Junction boxes, lighting panels and distribution board shall be provided with two grounding pads, for connection to galvanized steel flat. The two pads shall be provided, one each at the middle of the two opposite sides of the bottom frame of the equipment. Earthing of hinged door shall be done by using a separate earth wire.

3.14 TERMINAL BLOCKS AND WIRING

Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All Inter-phase and external connections to equipment or to control cubicles will be made through terminal blocks.

Terminal blocks shall be 1100 V grade box –clamp type and have continuous rating to carry the maximum expected current on the terminals. Those shall be of molded piece complete with insulated barriers stud type terminals, washers nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But preferably the terminal blocks shall be non-disconnecting stud type equivalent to Elmex type CATM4, Phoenix cage clamp type of Wedge or equivalent. The Insulating material of terminal block shall be nylon 6.6 which shall be free of halogens, fluorocarbons etc.

Terminal block for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.

The terminal shall be that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally. The conducting part in contact with cable shall preferably be tinned or silver plated however Nickel plated copper or zinc plated steel shall also be acceptable. The terminal blocks shall be of extensible design. The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

The terminal blocks shall be fully enclosed with removable covers of transparent, non-deteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.

Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

All circuits except CT circuits :

Minimum of 2 nos. of 2.5 sq.mm, copper flexible.

All CT circuits :

Minimum of 4 nos. of 2.5 sq.mm, copper flexible.

The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live. At least 20 % spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.

	BHARAT HEAVY ELECTRICALS LIMITED	Doc. No.	TB-445-553-035
	2X500MW TPS EXTENSION PROJECT UNIT-5 AT SAGARDIGHI- 400KV SWITCHYARD	Part No.	SECTION -3
	Fire Fighting System		

There shall be a minimum clearance of 250mm between the first bottom row of terminal block and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be a minimum of 150 mm. The Supplier shall furnish all wire, conduits and terminals for the necessary inter-phase electrical connection (where applicable) as well as between phases and common terminal boxes or control cabinets.

All input and output terminals of each control cubicle shall be tested for surge withstand capability in accordance with the relevant IEC Publications, in both longitudinal and transverse modes. The supplier shall also provide all necessary filtering, surge protection, interface relays and any other measures necessary to achieve an impulse withstand level at the cable interfaces of the equipment.

3.15 CONTROL CABINETS, JUNCTION BOXES, TERMINALS BOXES AND MARSHALLING BOXES FOR OUTDOOR EQUIPMENTS

All types of boxes, cabinets etc. shall generally conform to and be tested in accordance with IS-5039, IS-8623 or IEC-439, as applicable and the clause given below.

Control cabinet, Junction boxes, Marshalling boxes & Terminal boxes shall be made of **CRCA sheet** steel of minimum 2 mm thickness. The thickness of door s/covers shall not be less than 1.6 mm. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements.

Cabinet /boxes shall be provided with double hinged doors with padlocking arrangements. The distance between two hinges shall be adequate to ensure uniform sealing pressure against atmosphere. The quality of gaskets shall be such that it does not get damaged/cracked during the operation of the equipment.

All door, removable covers and plates shall be gasketed all around with suitably profiled **Neoprene gaskets**. The gasket shall be tested in accordance with approved quality plan. The quality of gasket shall be such that it does not get damaged /cracked during the years of the equipment or its major overhaul whichever is earlier. All gasketed surfaces shall be smooth, straight and reinforced if necessary to minimize distortion and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass.

All boxes/cabinets shall be designed for the entry of cables from bottom by means of weather proof and dust-proof connections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable gland plate projecting at least 150 mm above from the base of the Marshalling Kiosk/box shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland. The gland shall project at least 25mm above gland plate to prevent entry of moisture in cable crutch. Gland plate shall have provision for some future glands to be provided later, if required.

3.16 SPACE HEATERS

	BHARAT HEAVY ELECTRICALS LIMITED	Doc. No.	TB-445-553-035
	2X500MW TPS EXTENSION PROJECT UNIT-5 AT SAGARDIGHI- 400KV SWITCHYARD	Part No.	SECTION -3
	Fire Fighting System		

The heater shall be suitable for continuous operation at 240 V AC supply voltage and shall be provided with on – off switch and fuse shall be provided for heater.

One or more adequately rated, thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heater shall be installed in the lower portion of the compartment and electrical connections shall be made from below the heater to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

The heaters shall be suitably designed to prevent any contact between the heater wire and air and shall consist of coiled resistance wire centered in metal sheath and completely encased in a highly compacted powder of Magnesium Oxide or other material having equal heat conduction and electrical insulation properties, or they shall consist of a resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and air. Alternatively, they shall consist of resistance wire mounted into a tubular ceramic body built into an envelope of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in glaze the surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments.

3.17 QUALITY

BHEL quality plan to be followed subject to TBEM / customer's approval.

3.18 DOCUMENTATION

3.18.1 LIST OF DOCUMENTS

The bidder shall submit a detailed list of drawings / documents along with the bid proposal which he intends to submit to the Employer after award of the contract.

The supplier shall necessarily submit all the drawings / documents unless anything is waived.

All engineering data submitted by the Contractor after final process including review and approval by the Employer shall form part of the Contract Document and the entire works performed under this specification shall be performed in strict conformity, unless otherwise expressly requested by the Employer in Writing.

3.18.2 DRAWINGS

All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required, the dimensions required for installation and interconnections with other equipment and materials, clearances and spaces required for installation and interconnection between various portions of equipment and any other information specifically requested in the specifications.

	BHARAT HEAVY ELECTRICALS LIMITED	Doc. No.	TB-445-553-035
	2X500MW TPS EXTENSION PROJECT UNIT-5 AT SAGARDIGHI- 400KV SWITCHYARD	Part No.	SECTION -3
	Fire Fighting System		

Each drawing submitted by the Contractor shall be clearly marked with the name of the Employer, name of consultant, the unit designation, contract no., and the name of the Project. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

Further work by the Contractor shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Employer if so required.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Employer. Approval of Contractor's drawing or work by the Employer shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

3.18.3 APPROVAL PROCEDURE

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Employer would be discussed and finalized at the time of award. The supplier shall also submit required no. of copies as mentioned in this specification of all drawings/design documents/test reports for approval by the Employer. The following schedule shall be followed generally for approval.

i.	Initial submission of drawings and data sheet	Within 2 (two) weeks from PO date.
ii.	Approval/comments/by employer on Initial submission	Within 2 (two) weeks of receipt
iii.	Resubmission	Within 1 (one) weeks (whenever from date of comments required) Including both ways postal time.
iv.	Approval or comments	Within 1 week of receipt of resubmission
v.	Furnishing of distribution copies	1 week from the date of last approval.

Note: The contractor may please note that all resubmissions must incorporate, all comments given in the submission by the Employer failing which the submission of documents is likely to be returned. Every revision shall be a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.

The title block of drawings shall contain the following information incorporated in all contract drawings. Please refer enclosed sheet for details of Title block.

3.18.4 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

- 1) Drawings
- 2) Guaranteed Technical Particulars
- 3) Type Test Reports
- 4) Manufacturing Quality Plan

	BHARAT HEAVY ELECTRICALS LIMITED	Doc. No.	TB-445-553-035
	2X500MW TPS EXTENSION PROJECT UNIT-5 AT SAGARDIGHI- 400KV SWITCHYARD	Part No.	SECTION -3
	Fire Fighting System		

3.18.5 DOCUMENTATION SCHEDULE

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
				Prints	CDs
1	Drawings and Data Sheets	1	6	7	4 nos of all drawings/documents
2	Drawings "As Built "	-	-	7	
3	Type Test Reports	1	6	7	
4	Erection Manuals	-	6	7	
5	Operation and Maintenance Manuals	-	6	7	
6	Manufacturing Quality Plan	1	6	7	
7	Field Quality Plan	1	6	7	
8	Inspection Test Reports	-	-	7	

O & M Manuals shall be submitted 3 months' prior start of unit commissioning.
The manual shall be submitted as follows-

1. 1 soft copy + 12 sets of hard copy to WBPDC Sagardighi site.
2. 1 soft copy + 3 sets of hard copy to WBPDC Corporate office.

Soft copies of drawings at contract stage shall also be submitted in **PDF format**.

Drawings will also be submitted in mini cartridges in AUTOCAD Release -14 package or any other CAD package along with conversion files for all major items.

Final Documentation shall be submitted in bound volumes with Customer & Project etc. written on top.



CLIENT: The West Bengal Power Development Corporation Ltd.
CONSULTANT: Development Consultants Private Ltd. Kolkata
PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
**TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA**

TB-445-552-001

Rev. 00

Page | 1

SECTION-4

LIST OF DOCUMENTS

1.0 LIST OF TECHNICAL DATASHEETS/DRAWINGS

In this section Technical Datasheets (TDS) of various equipment/items and system drawings that are required to be generated is furnished herewith. List of datasheets/drawings and numbers to be accorded is also given below.

The list furnished here is tentative and additional documents may be required during detailed engineering. Document no. shall be provided against each during detailed engineering stage.

Sl. No.	Item Description
A	DATA SHEETS
01.	TDS for M.S Pipes & Fittings
02.	TDS for Hydrant Valves/ Branch pipe with nozzle/Hose pipe/ Hose box
03.	TDS for Wrapping Coating
04.	TDS for Gate Valves
05.	TDS for extinguisher
06.	TDS for Twisted Pair Control Cable
07.	TDS for FO Cable
08.	TDS for Main Fire Alarm Panel
09.	TDS for Fire Detection items
10.	TDS for Pressure Gauge & Pressure Switch
B.	DRAWINGS
01.	P & I Diagram
02.	Fire Water hydrant and Piping Layout
07.	Distribution of Extinguisher inside control room
08.	Schematic of Fire detection system
09.	Fire Alarm & Detection system inside control room
C.	OTHER DOCUMENTS
01.	Operation & Maintenance Manual



CLIENT: The West Bengal Power Development Corporation Ltd.
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PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
**TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA**

TB-445-552-001

Rev. 00

Page | 1

SECTION- 5

ENCLOSURES TO SPECIFICATION

SCHEDULES TO BE FILLED UP BY THE BIDDER

- | | |
|------------|--|
| Schedule 1 | Schedule of makes of Equipments |
| Schedule 2 | Schedules of Deviations |
| Schedule 3 | Enclosures to Specification |



CLIENT: The West Bengal Power Development Corporation Ltd.
CONSULTANT: Development Consultants Private Ltd. Kolkata
PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
**TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA**

TB-445-552-001

Rev. 00

Page | 2

SCHEDULE-1

MAKES OF IMPORTANT ITEMS / COMPONENTS OF EQUIPMENTS AND THEIR DETAILS

ITEM NAME	NAME OF MANUFACTURER	PLACE OF MANUFACTURE OF ITEM	PLACE OF TESTING AND INSPECTION	COMPLIANCE WITH ISO 9001 (YES/NO)

Place:

Signature of the authorized representative of Bidder

Name -----

Date:

Designation-----

Company seal-----



CLIENT: The West Bengal Power Development Corporation Ltd.
CONSULTANT: Development Consultants Private Ltd. Kolkata
PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA

TB-445-552-001

Rev. 00

Page | 3

SCHEDULE-2

SCHEDULE OF TECHNICAL DEVIATION

The following are the deviations / variations / exceptions from the specification:

Section	Clause No. / Page No.	Statement of deviation/ Variations/Exceptions
---------	--------------------------	--

- 1) In case, this schedule is not submitted, it will be presumed that the equipment /material to be supplied under this contract are deemed to be in compliance with the specification.
- 2) If there is NIL deviation, even then the format to be filled as **NIL DEVIATION**
- 3) Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

Place:

Signature of the authorized representative of Bidder

Name -----

Date:

Designation-----

Company seal-----



CLIENT: The West Bengal Power Development Corporation Ltd.
CONSULTANT: Development Consultants Private Ltd. Kolkata
PROJECT: 1X660MW TPS extension project Unit-5, Phase-III at
Sagardighi- 400KV Switchyard
**TECHNICAL SPECIFICATION OF FIRE FIGHTING SYSTEM FOR
400KV- SWITCHYARD AREA**

TB-445-552-001

Rev. 00

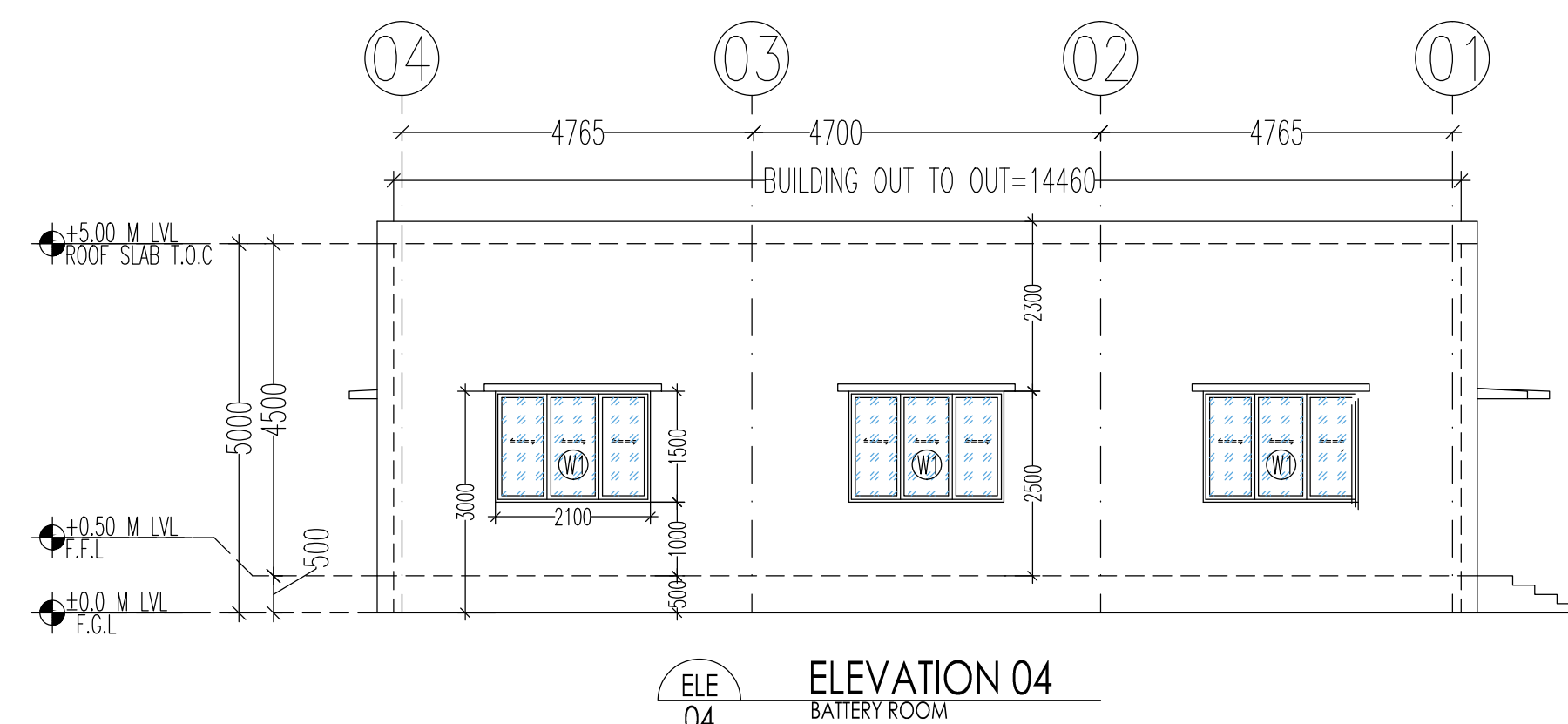
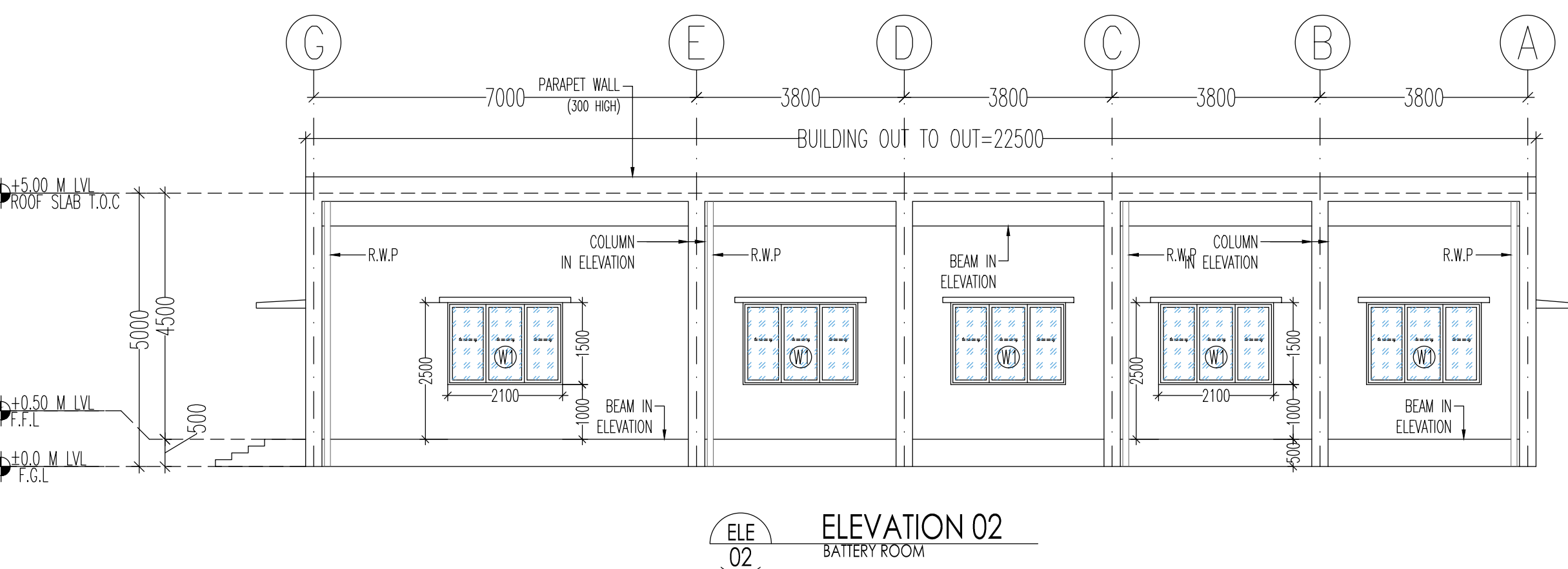
Page | 4

SCHEDULE –3

ENCLOSURES TO SPECIFICATION

LIST OF DRAWINGS:

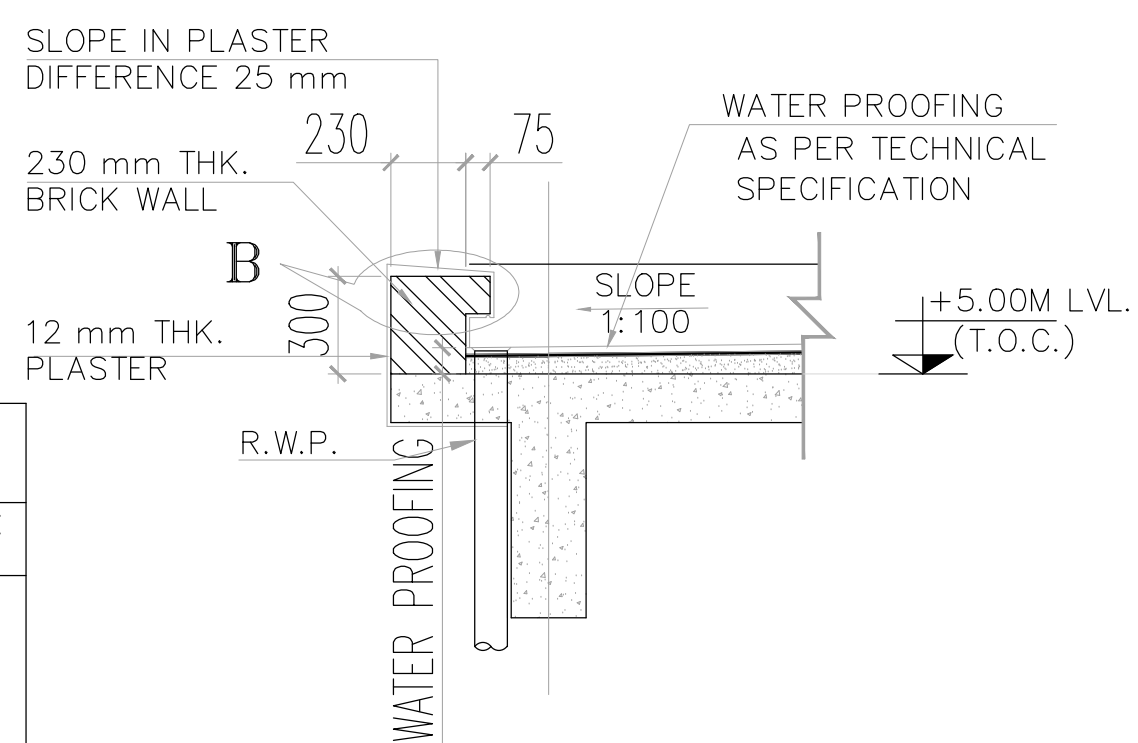
- 1. Layout Plan for 400kV Sagardighi Substation/TB-DG-445-316-E002**
- 2. Drg. of Battery Room building**
 - a) TB-DG-445-607-C630**
 - b) TB-DG-445-607-C628**
- 3. Drg. of Bay Control Room building/Tb-DG-445-607-638**
- 4. Drg. of Switchgear Room building/TB-DG-445-607-C618**



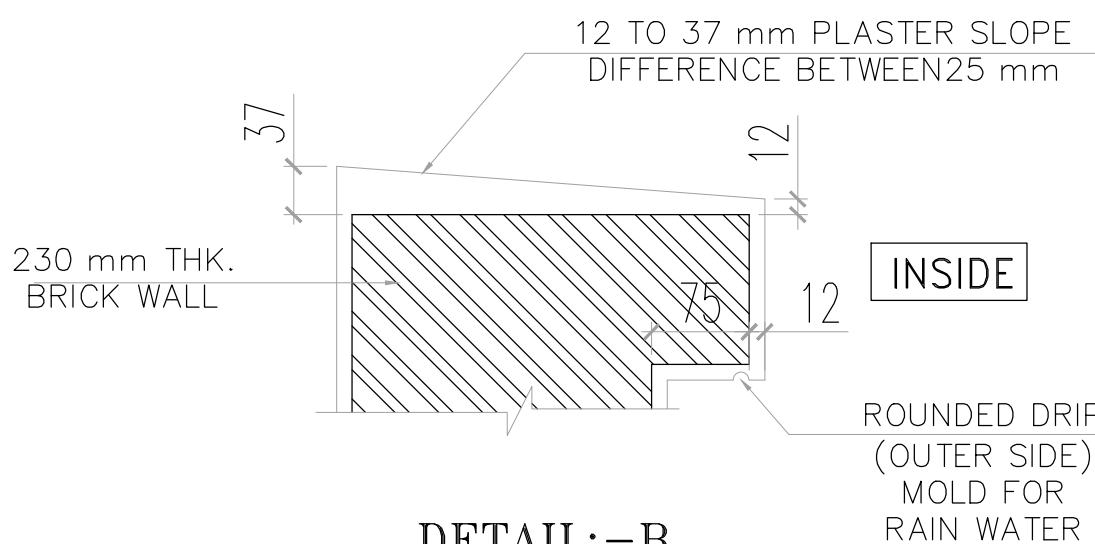
SCHEDULE OF FINISHES						
SR. NO.	NAME OF AREA	FLOORING	SKIRTING/DADO	INTERNAL SURFACE (PAINT)	CEILING (PAINT)	EXTERNAL SURFACE (PAINT)
01	ENTRANCE RAMP/STEPS	ROUGH OR BROOM IPS FINISH	-----	-----	-----	EXTERNAL QUALITY ACRYLIC EMULSION PAINT
02	BATTERY ROOM	ACID ALKALI RESISTANT TILES	ACID ALKALI RESISTANT TILES	ACID/ALKALI RESISTANT PAINT	ACRYLIC EMULSION PAINT	
03	DCDB ROOM	VITRIFIED TILE	VITRIFIED TILE	ACRYLIC EMULSION PAINT	ACRYLIC EMULSION PAINT	

SCHEDULE OF OPENING						
S.NO.	TYPE	SIZE	SILL LVL.	INTEL LVL	NOS.	REMARK
1	DOOR D4	1250x2500	+0.50 M	+3.0 M	00	ALUMINUM SINGLE LEAF GLAZED DOOR
1	DOOR D6	2500x2500	+0.50 M	+3.0 M	02	ALUMINUM DOUBLE LEAF GLAZED DOOR
3	WINDOW W1	2100x1500	+1.50 M	+3.0 M	12	ALUMINUM GLAZED OPENABLE SLIDING WINDOWS/AS SPECS

<u>FINISHES OF PLASTER</u>	
01. CEILING PLASTER – 6mm THK. IN CM (1:4)	
02. INTERNAL PLASTER – IN SINGLE COAT 12mm THK. IN CM (1:6)	
03. EXTERNAL PLASTER – IN TWO COATS 20mm THK. IN (1:6)	
04. TERRACE – WATER PROOFING TREATMENT AS PER TECHNICAL SPECIFICATION.	
<u>LEGENDS:-</u>	
FFL =	FINISHED FLOOR LEVEL
FGL =	FINISHED GROUND LEVEL
T.O.C. =	TOP OF CONCRETE



DETAIL:-A
TYP. DETAIL OF PARAPET
N.T.S



DETAIL:-B
N.T.S

1. ALL DIMENSIONS ARE IN "MM" UNLESS OTHERWISE SPECIFIED
2. DRAWING IS TO BE READ AND NOT TO BE SCALED, ONLY FIGURED DIMENSION SHALL BE FOLLOWED,
3. ALL ARCHITECTURAL DRAWINGS TO BE READ IN CONJUNCTION WITH RELEVANT STRUCTURAL DRAWINGS/ VENDOR DRAWINGS
4. $\pm 0.500M$ REFERS TO THE FINISHED FLOOR LEVEL.
5. $\pm 0.000M$ REFERS TO THE FINISHED GROUND LEVEL.
6. DOOR & WINDOW OPENING SHOWN IS CLEAR MASONRY OPENING
7. BUILDINGS LOCATIONS SHALL BE IN LINE WITH DETAILS SHOWN IN LAYOUT DRAWING.

PROJECT :
THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.
(1 x 660 MW) SAGARDIGHI THERMAL
POWER EXTENSION PROJECT (UNIT

OWNER :

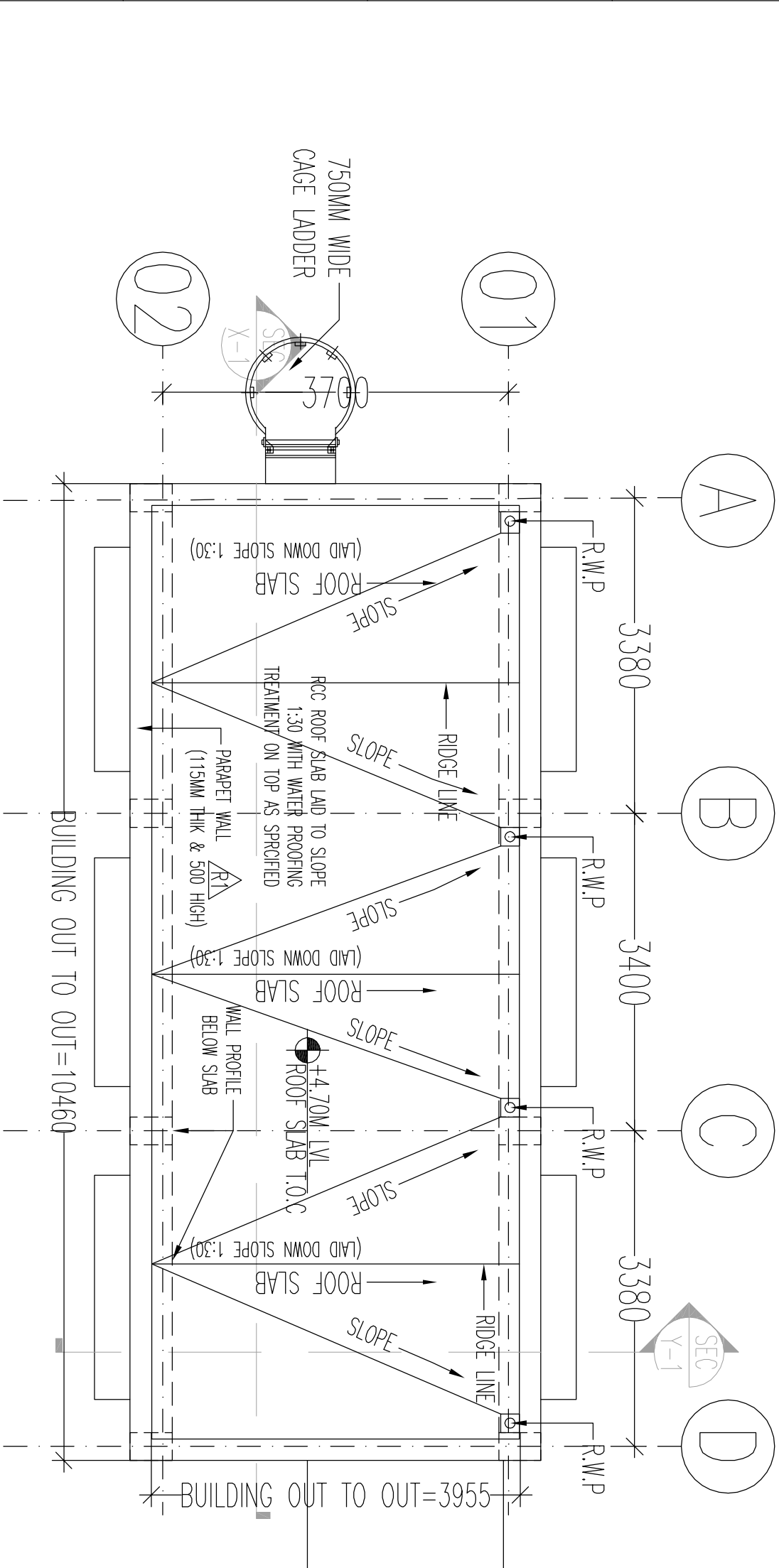
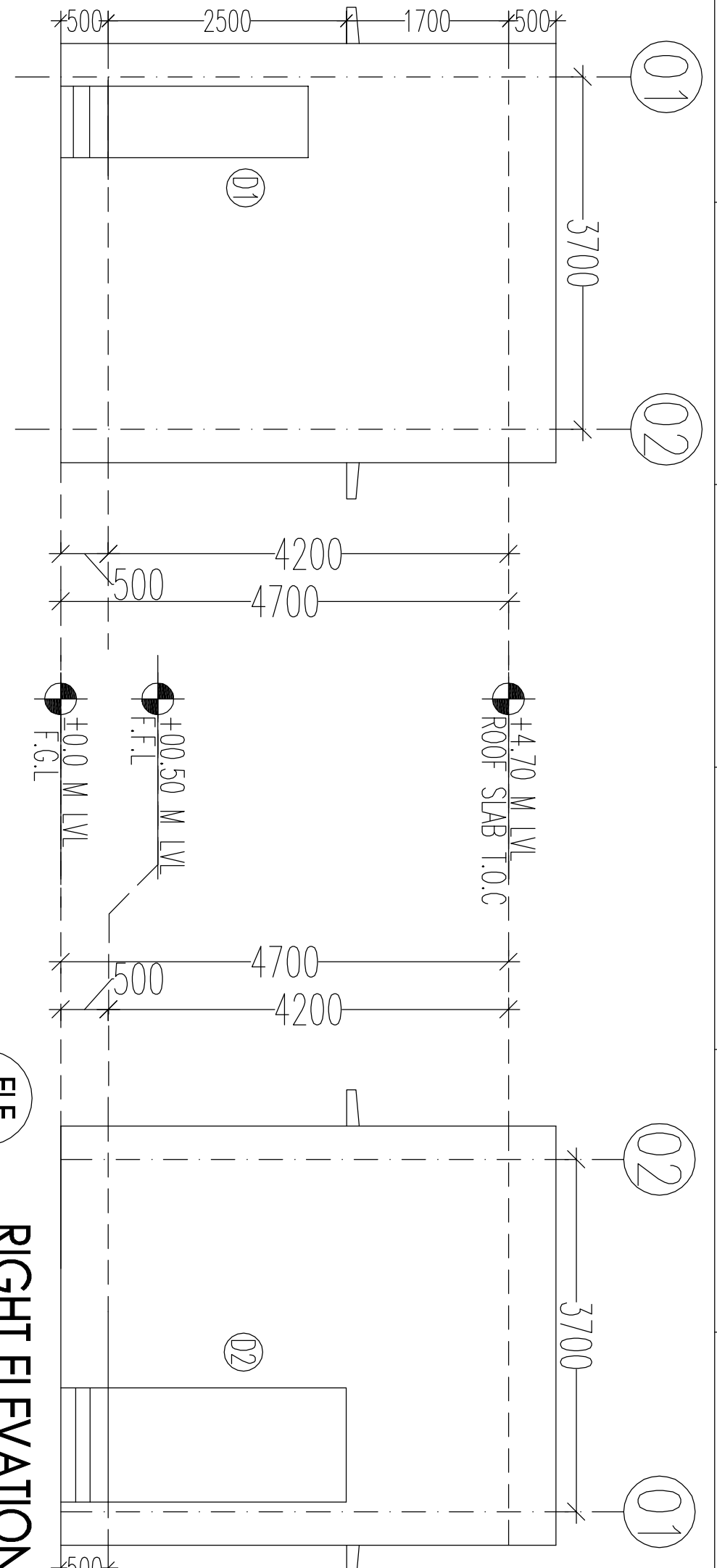
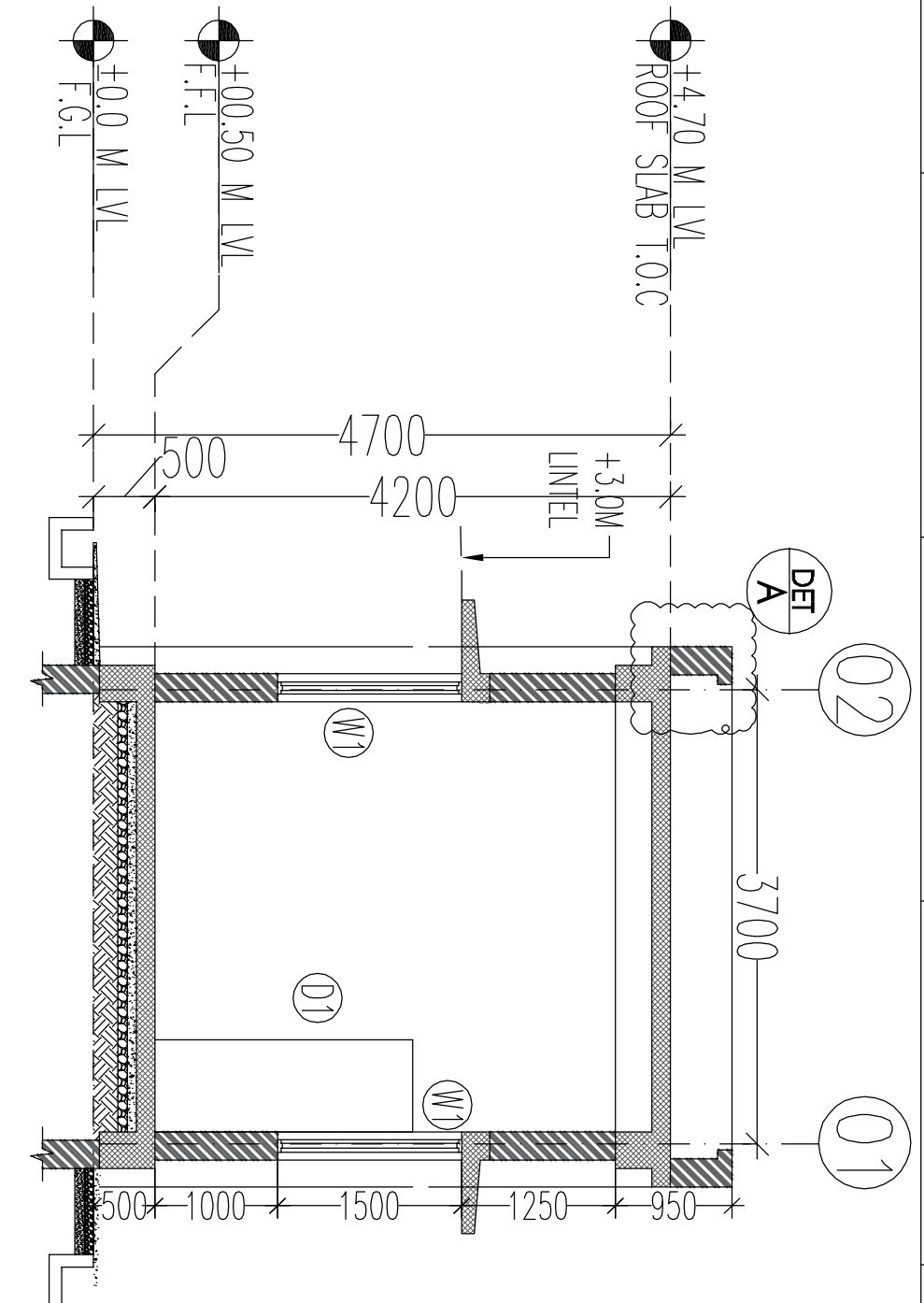
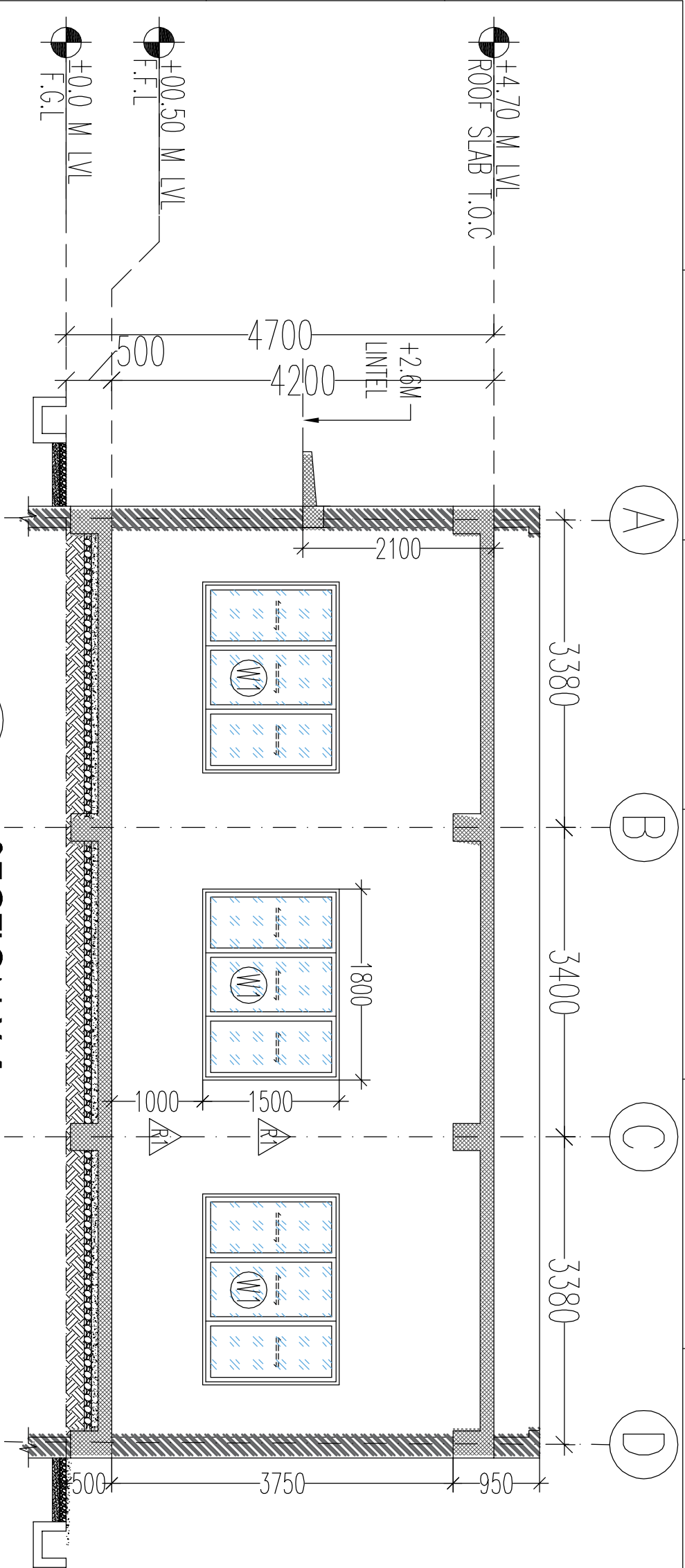
 THE WEST BENGAL POWER
DEVELOPMENT CORPN LTD

CONSULTANT :  DEVELOPMENT CONSULTANT
PRIVATE LIMITED KOLKATA


 भारत हेवी इलेक्ट्रिकल्स लिमिटेड
 ट्रांसमिशन परियोजना विभाग
 BHARAT HEAVY ELECTRICALS LTD.
 TRANSMISSION PROJECTS DIVISION

RENAISSANCE
ARCH CONSULTANT PVT LTD
ARCHITECTS • ENGINEERS • INTERIORS DESIGNERS • URBAN PLANNERS
611-B, E-BLOCK, GREATER KAILASH-2, NEW DELHI-110048 TEL: +91-11-41624488
FAX: +91-11-41634488 EMAIL: RENAISSANCE.ARCH@GMAIL.COM, WEB: WWW.RENAISSANCE.NE

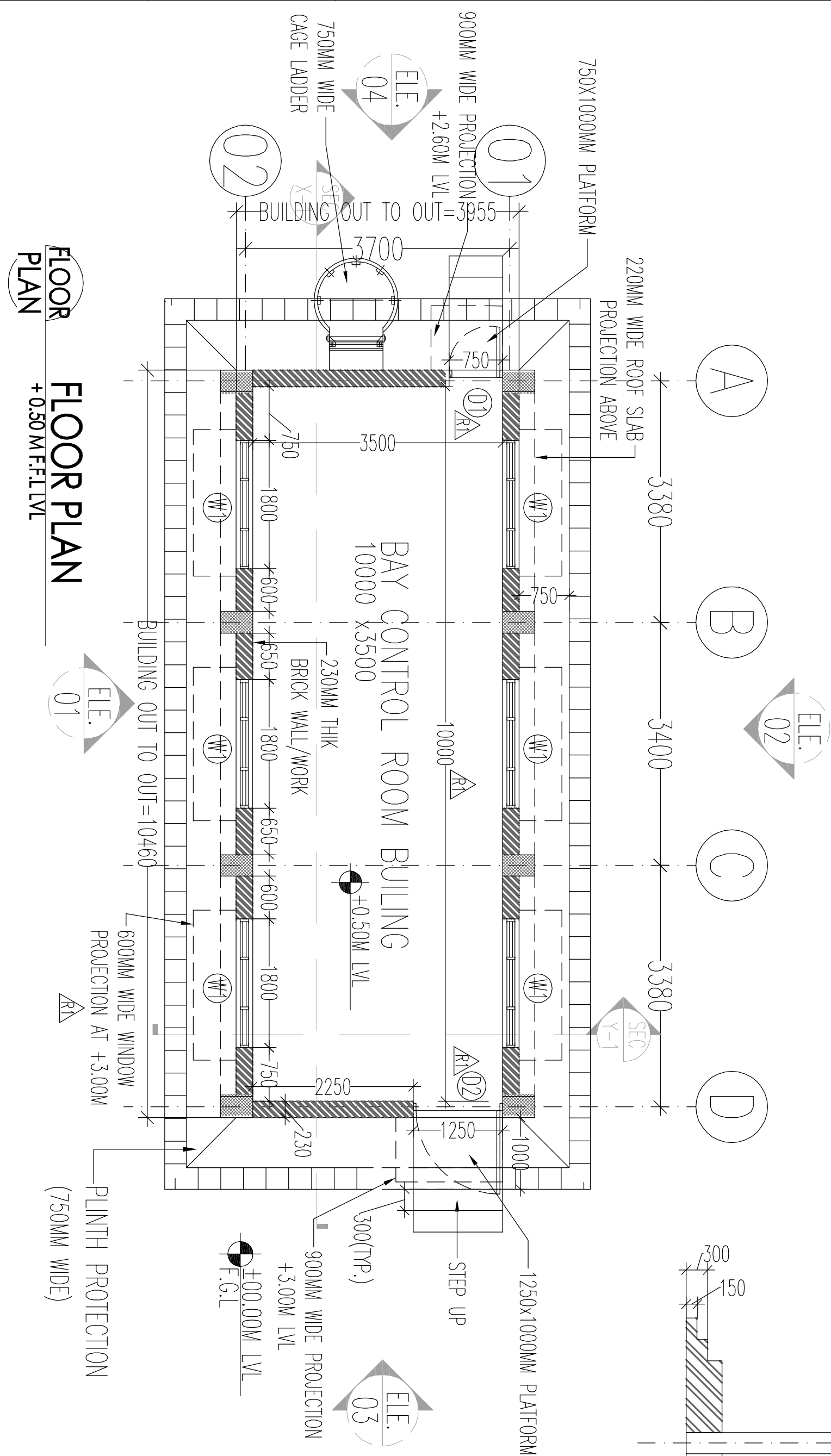
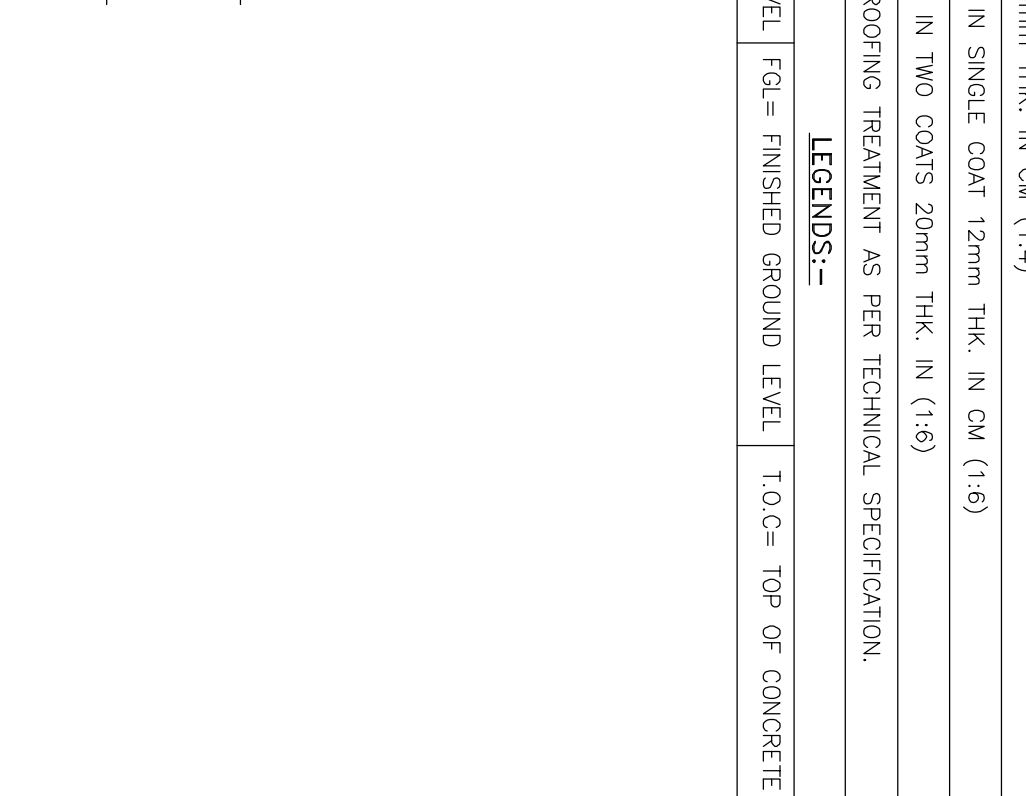
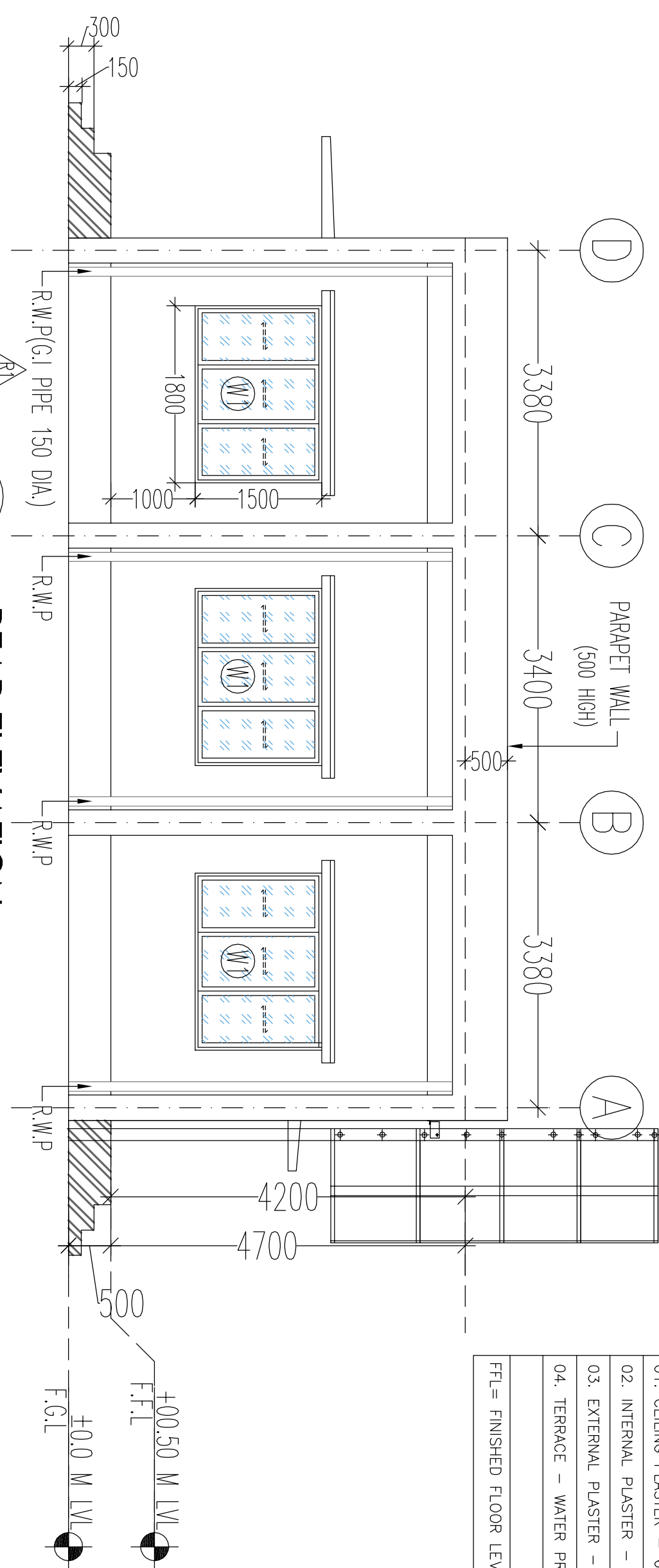
PROJECT TITLE:				NAME		SIGN		DATE	
BATTERY ROOM BUILDING				DRN.					
				CHD.		ARMEDREA		10/12	
				APPR.		ARMEDREA		10/12	
DEPT.		PROJ.		SCALE		WEIGHT		REFER TO ASY DWG.	
CODE								FIRM NO.	
DRAWING TITLE:				DRAWING/ DOCUMENT NO.					
ELEVATION DETAILS				TB-DG-445-607-C630					
				SHT NO. 1		NO. OF SHEET			



ROOF TERRACE PLAN
+4.70 M ROOF SLAB T.O.C. SCALE: 1:100

DETAIL:-A
TYP. DETAIL OF PARAPET
N.T.S

DETAIL:-B
N.T.S



FLOOR PLAN
+0.50 M.F.F.LVL

SCHEDULE OF FINISHES				
Sr. NO.	NAME OF AREA	FLOORING	SKIRTING/DADO	INTERNAL SURFACE (PAINT)
01	ENTRANCE RAMP/STEPS	ROUGH OR BROOD	IPS FINISH	---
02	BAY CONTROL ROOM	NON SKD	VITRIFIED TILES	ACRYLIC EMULSION PAINT
				EXTERNAL QUALITY ACRYLIC EMULSION PAINT

SCHEDULE OF OPENING			
S.NO.	TYPE	SIZE	REMARK
1	WINDOW W1	1800X200	+3.00 M.F.F.L. ALUMINUM GLAZED OPERABLE SLIDING WINDOWS/JS SHECS
2	DOOR D1	750X2100	+0.50 M.F.F.L. ALUMINUM SINGLE LEAF GLAZED DOOR
3	DOOR D2	1250X2500	+0.50 M.F.F.L. ALUMINUM SINGLE LEAF GLAZED DOOR

FINISHES OF PLASTER			
01.	CEILING PLASTER	6mm THK. IN CM (1:4)	
02.	INTERNAL PLASTER	IN SINGLE COAT 12mm THK. IN CM (1:6)	
03.	EXTERNAL PLASTER	IN TWO COATS 20mm THK. IN (1:6)	
04.	TERRACE	WATER PROOFING TREATMENT AS PER TECHNICAL SPECIFICATION.	

LEGENDS:-			
F.F.L	= FINISHED FLOOR LEVEL	F.G.L	= FINISHED GROUND LEVEL
T.O.C	= TOP OF CONCRETE		

- GENERAL NOTES:
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
 - DRAWINGS ARE TO BE READ AND NOT TO BE SCALED.
 - ONLY FIGURED DIMENSION SHALL BE FOLLOWED.
 - ALL ARCHITECTURAL DRAWINGS TO BE READ IN CONJUNCTION WITH RELEVANT STRUCTURAL DRAWINGS/ VENDOR DRAWINGS.
 - FOR FLOOR & WALL OPENING / CUTOUT SERVICES & DOOR & WINDOW OPENING SHOWN IS CLEAR.
 - REASON FOR OPENING / CUTOUT SERVICES & DOOR & WINDOW OPENING SHOWN IS CLEAR.
 - REF. DRAWINGS: 15-DG-445-316-F013

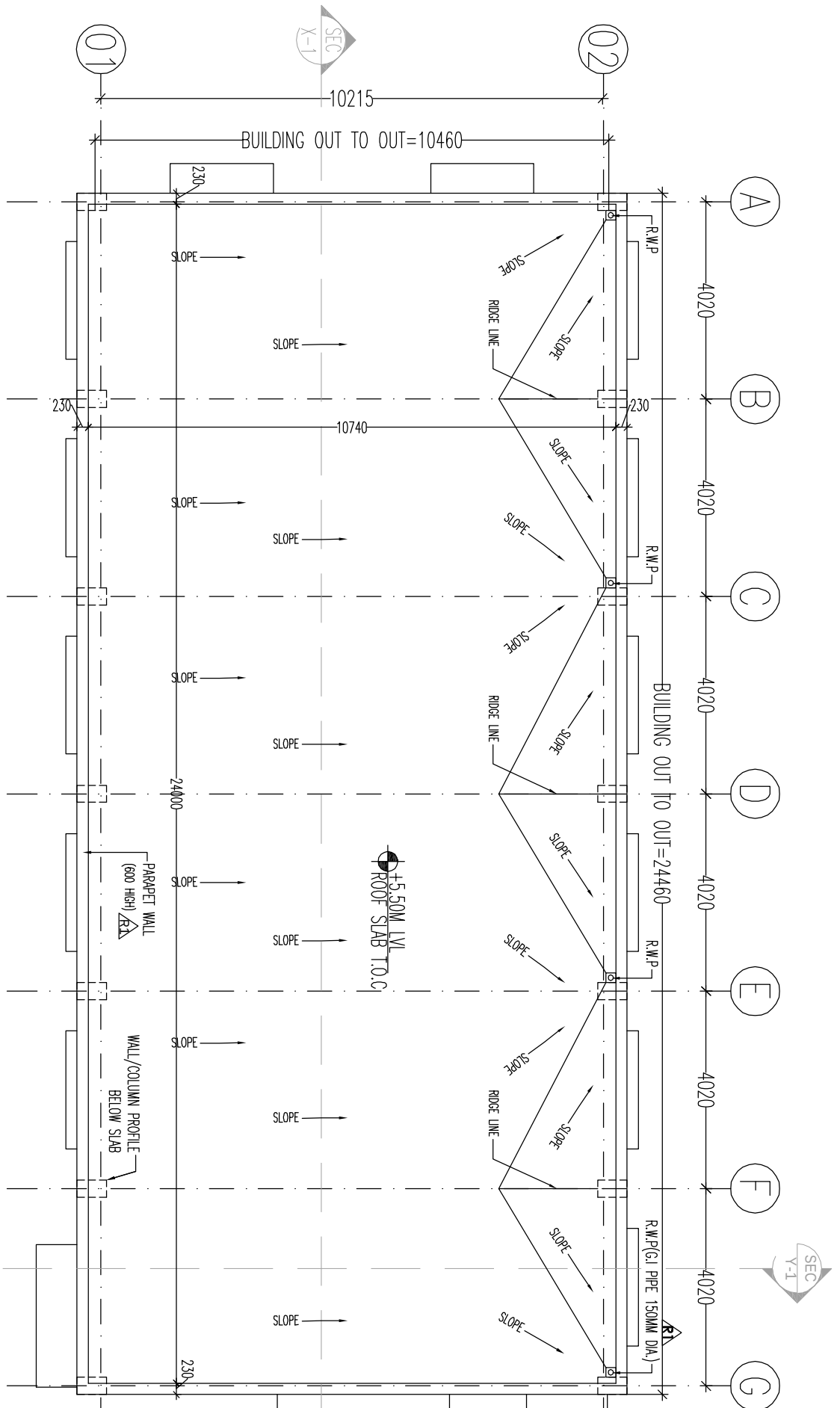
REV.	DATE	ALTERED BY	APPROVED BY
01	20.01.2022	CHD	PKK
ZONE	REVISED AS PER CUSTOMER COMMENTS		

PROJECT:
THE WEST BENGAL POWER DEVELOPMENT CORPN LTD
(1 x 660 MW) SAGARGIRI THERMAL
POWER EXTENSION PROJECT (UNIT 5)
OWNER:
THE WEST BENGAL POWER
DEVELOPMENT CORPN LTD

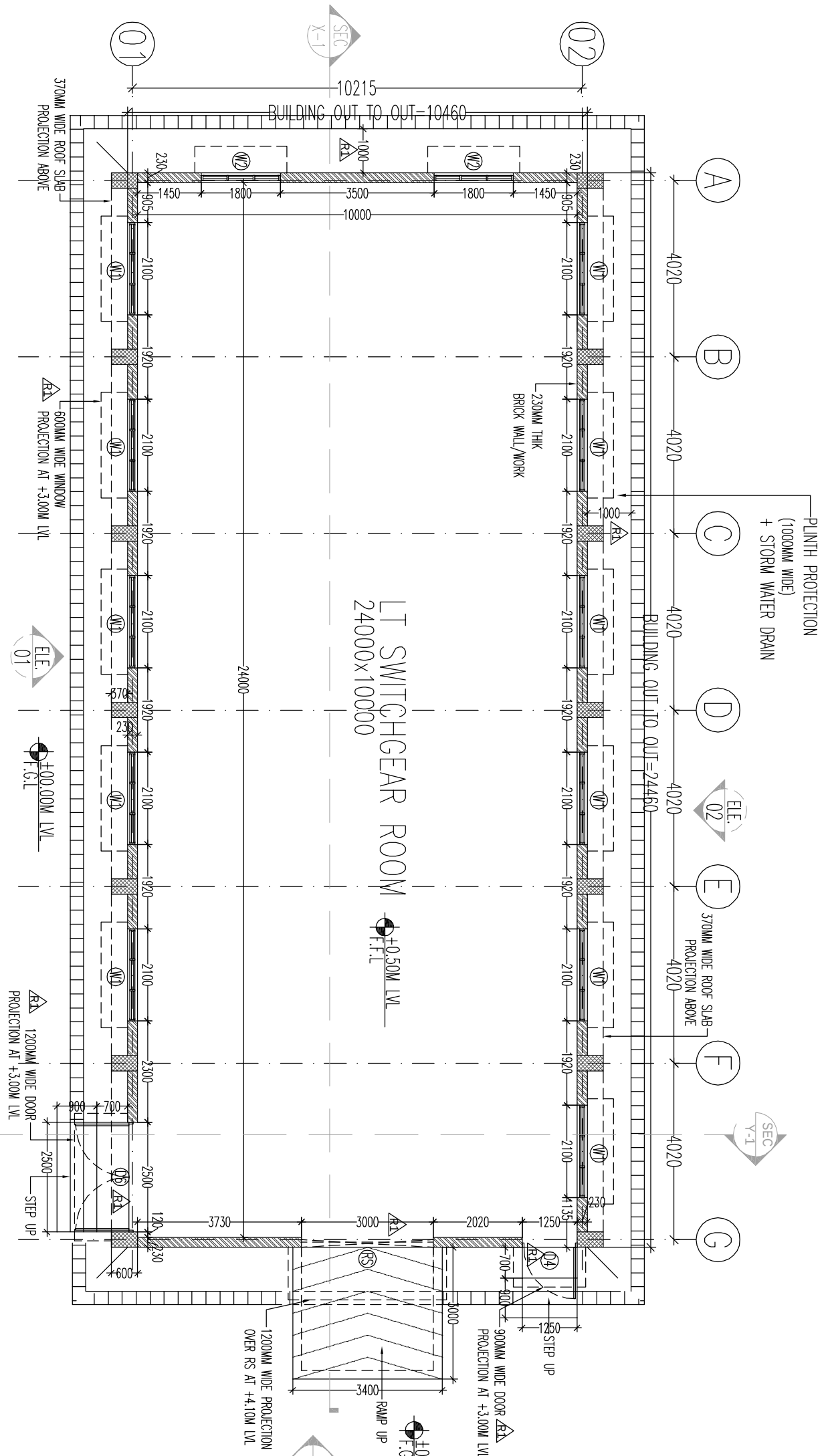
CONSULTANT:
DEVELOPMENT CONSULTANTS
PRIVATE LIMITED KOLKATA

PROJECT NAME:
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

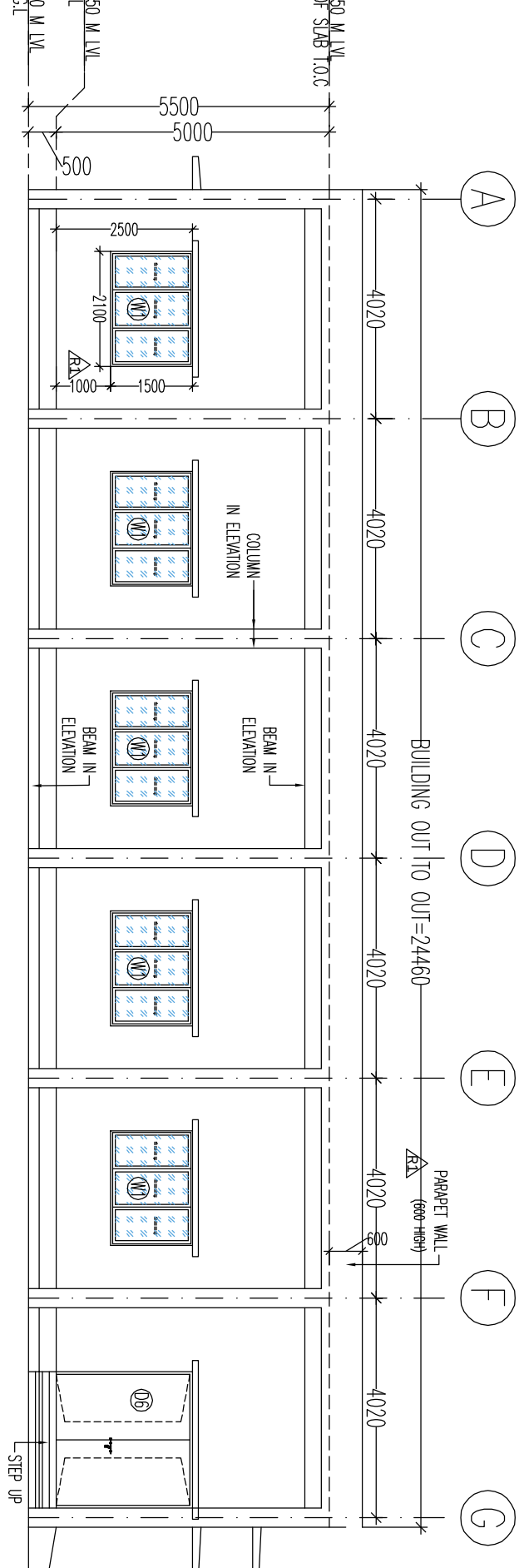
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BAT CONTROL ROOM
BUILDING
FLOOR PLAN, SECTION, 01
DRAWING TITLE:
FLOOR PLAN, SECTION, 01
PROJECT NO.:
BAT CONTROL ROOM
BUILDING
FLOOR PLAN, SECTION, 01
DRAWING TITLE:
FLOOR PLAN, SECTION, 01



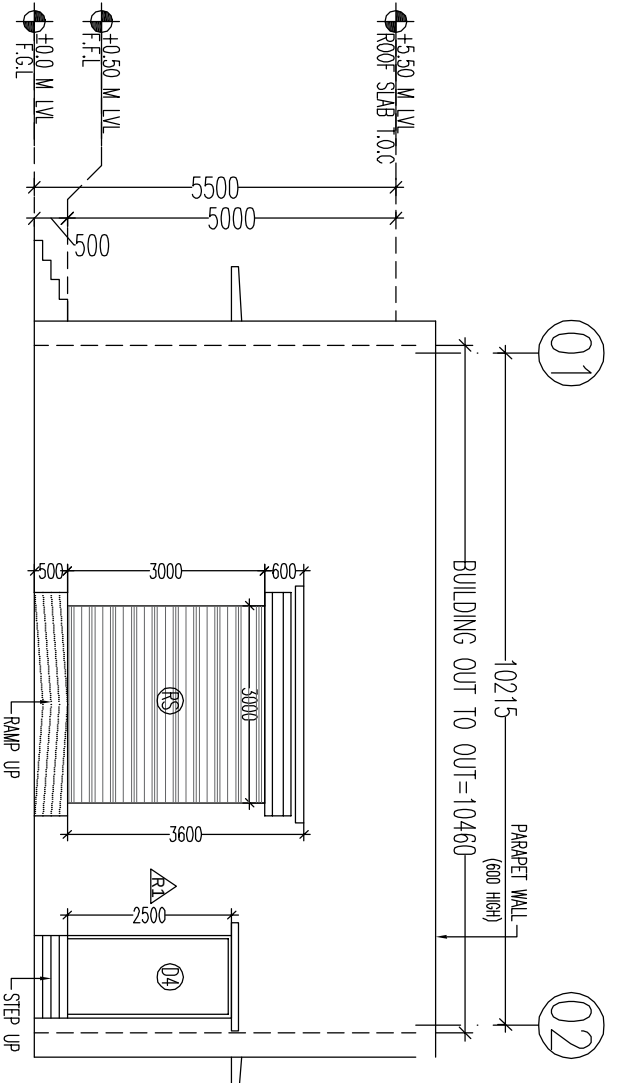
TERRACE PLAN
SCALE:1:100



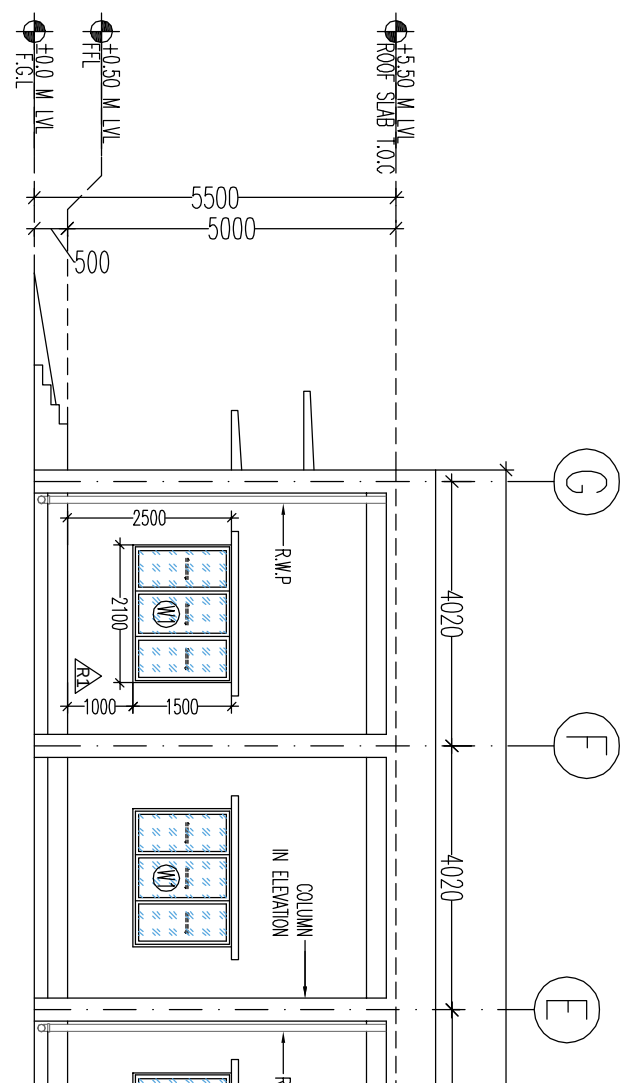
FLOOR PLAN
+0.30 M LV SCALE:1:100



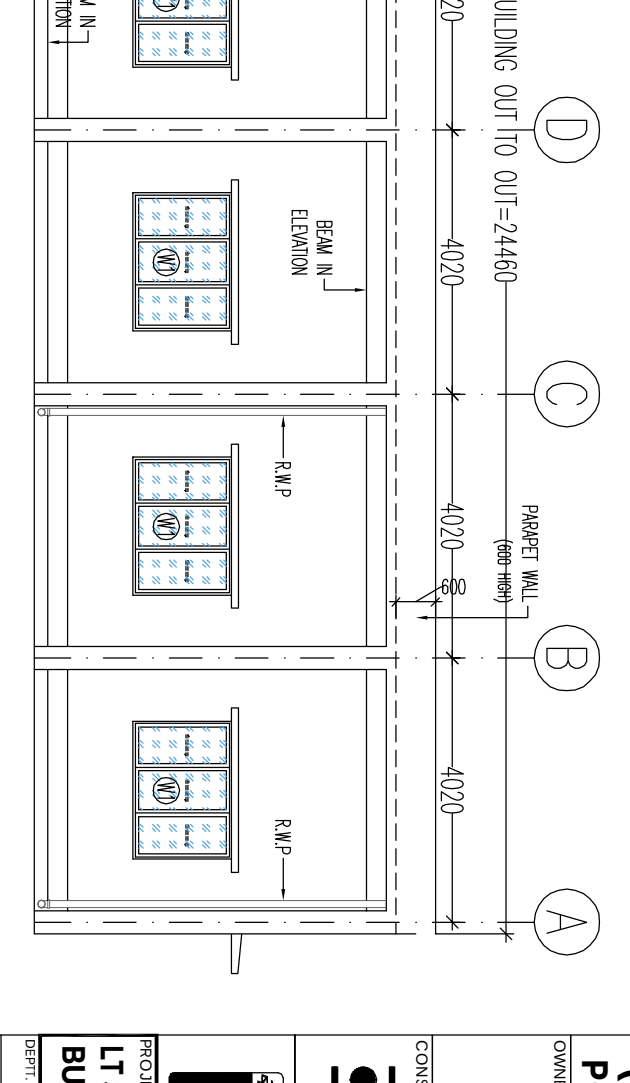
ELEVATION 01
LT SWITCHGEAR ROOM



ELEVATION 03
LT SWITCHGEAR ROOM



ELEVATION 02
LT SWITCHGEAR ROOM



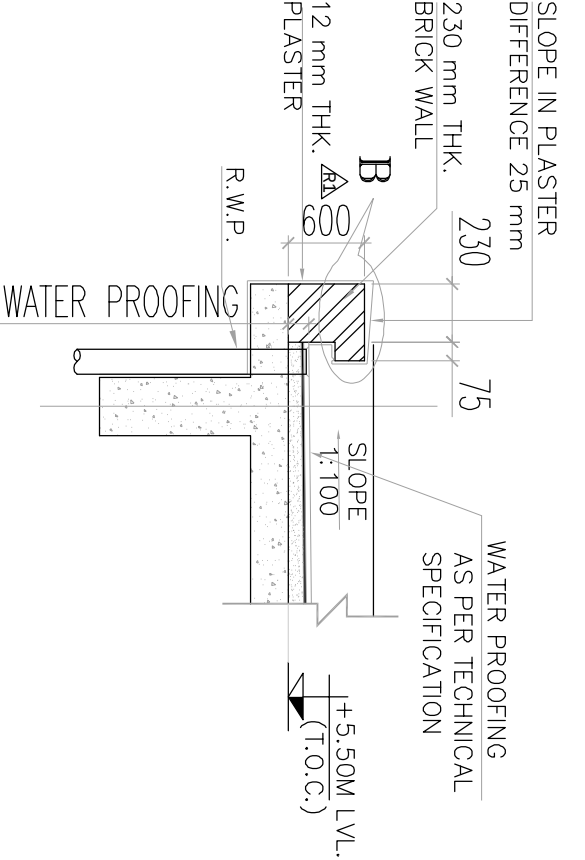
ELEVATION 04
LT SWITCHGEAR ROOM

SCHEDULE OF FINISHES				
SR. NO.	NAME OF AREA	FLOORING	SKIRTING/DADO	INTERNAL SURFACE (PAINT)
01	ENTRANCE RAMP/STEPS	ROUGH OR BROOM	---	---
02	LT SWITCHGEAR ROOM	NON-SKID VINYL TILES	VINYL TILES	ACRYLIC EMULSION PAINT

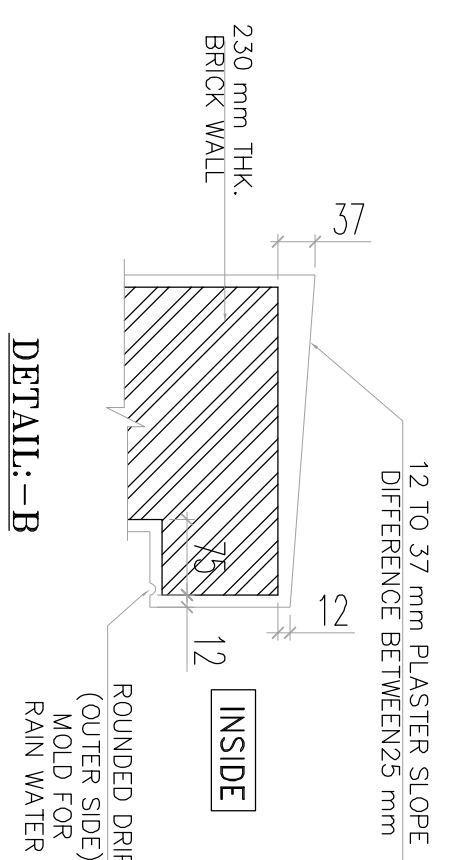
SCHEDULE OF OPENING			
S.NO.	TYPE	SIZE	REMARK
1	DOOR D4	1200X2000	+0.50 M
1	DOOR D6	2000X2000	+0.50 M
3	WINDOW W1	2100X1500	+1.40 M
4	WINDOW W2	1800X1500	+1.40 M
5	ROLLING SHUTTER	3000X3000	+0.50 M

FINISHES OF PLASTER	
01.	CEILING PLASTER - 6mm THK. IN CM (1:4)
02.	INTERNAL PLASTER - IN SINGLE COAT 12mm THK. IN CM (1:6)
03.	EXTERNAL PLASTER - IN TWO COATS 20mm THK. IN (1:6)
04.	TERRACE - WATER PROOFING TREATMENT AS PER TECHNICAL SPECIFICATION.

LEGENDS:-
FFL = FINISHED FLOOR LEVEL
FGL = FINISHED GROUND LEVEL
T.O.C. = TOP OF CONCRETE

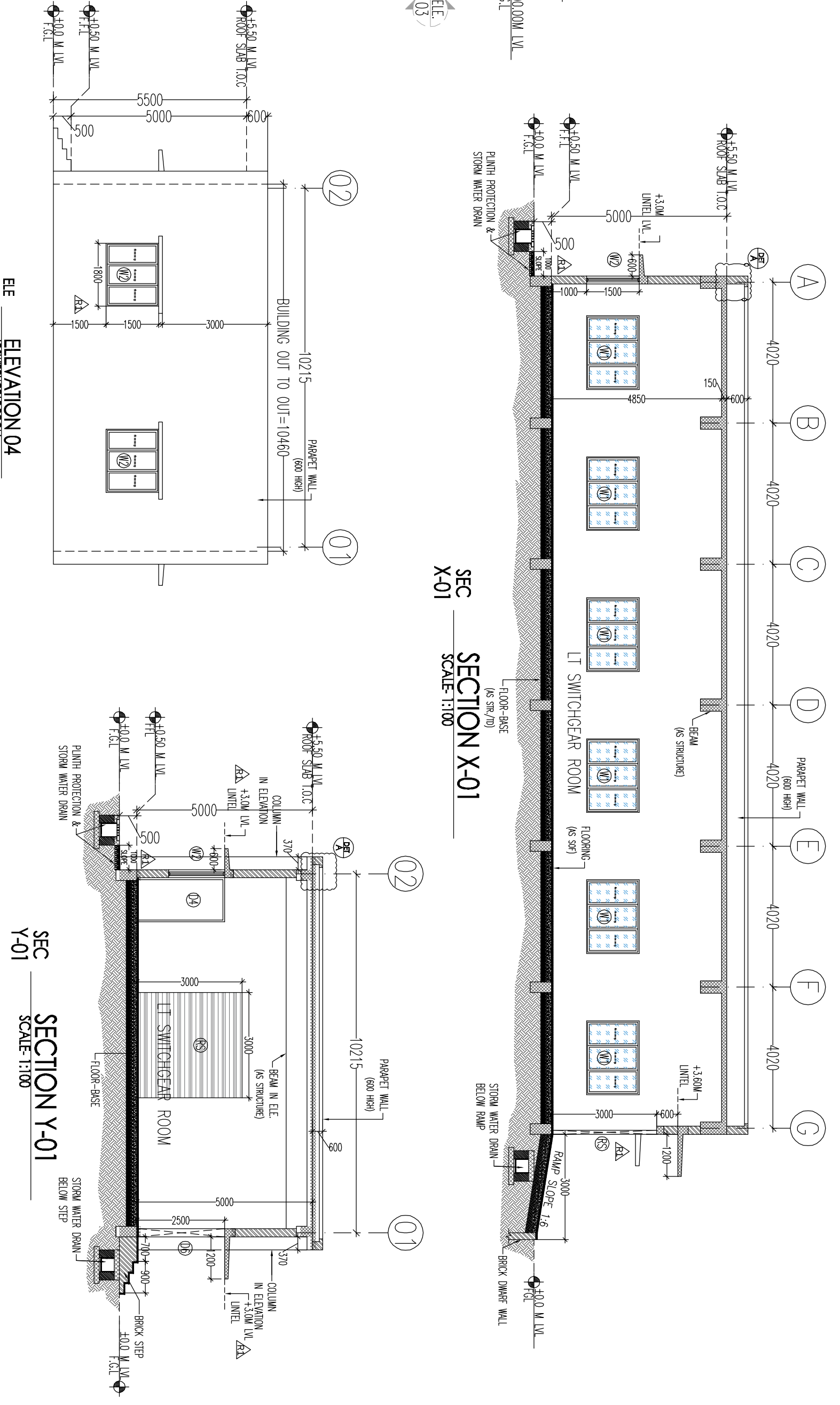


DETAIL:-A
TYP. DETAIL OF PARAPET
N.T.S

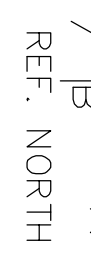
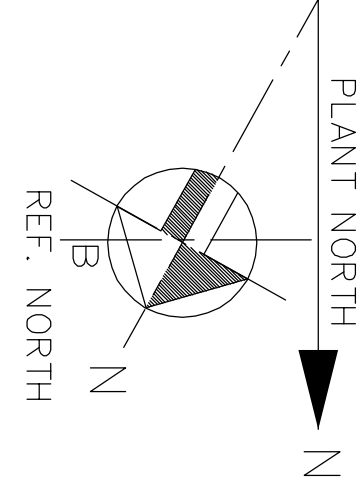
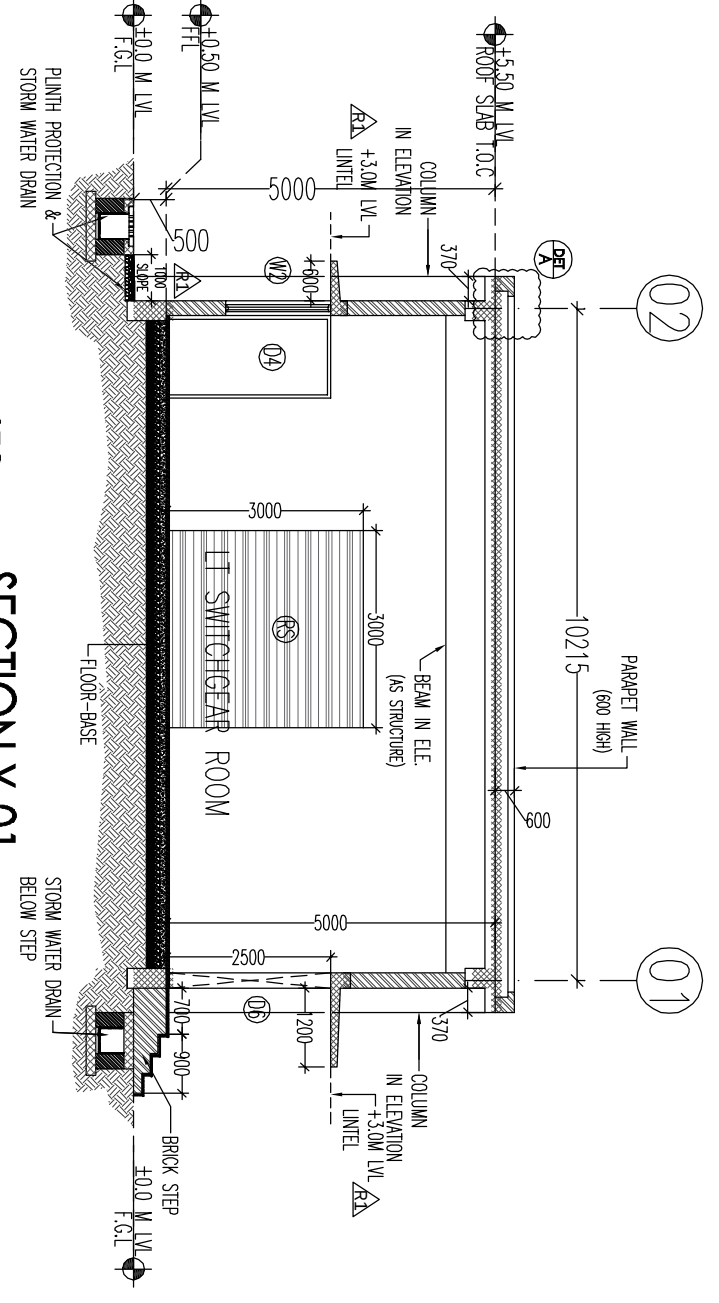


DETAIL:-B
N.T.S

SECTION X-01
SCALE:1:100



SECTION Y-01
SCALE:1:100



KEY PLAN

4000 MM WIDE ROAD

LT SWITCHGEAR BUILDING

N-1379.363
E-1432.44

- GENERAL NOTES:
- ALL DIMENSIONS ARE IN 'MM' UNLESS OTHERWISE SPECIFIED
 - DRAWING IS TO BE READ AND NOT TO BE SCALED.
 - ONLY FIGURED DIMENSION SHALL BE FOLLOWED.
 - CONJUNCTION WITH RELEVANT STRUCTURAL DRAWINGS/ VENDOR DRAWINGS
 - DOOR & WINDOW OPENING SHOWN IS CLEAR
 - REF. DRAWING NO-BG-445-316-6108

REV	DATE	ALTERED	BY
01	31.01.2022	CHECKED	PK

PROJECT:
THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD
(1 x 660 MW) SAGARDIGHI THERMAL
POWER EXTENSION PROJECT (UNIT 5)
OWNER:
THE WEST BENGAL POWER
DEVELOPMENT CORPN LTD
CONSULTANT:
DEVELOPMENT CONSULTANTS
PRIVATE LIMITED KOLKATA

REV	DATE	ALTERED	BY
01	31.01.2022	CHECKED	PK