

TECHNICAL PRE- QUALIFICATION REQUIREMENT

Name of customer: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SJVN LTD.))

Name of consultant: SJVN ARUN POWER DEVELOPMENT COMPANY LTD. (SAPDC LTD.)

Name of Project: 4X225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL

Name of Item: FIRE FIGHTING SYSTEM

Sr. No	PQR Description	Supporting Document to be attached
1.	The bidder shall have designed, supplied, erected, tested and commissioned at least one number of each of the below mentioned Fire Protection and Detection System designed to the recommendations of Tariff Advisory Committee of India or Oil Industry Safety Directorate (OISD) or any other International reputed authority (like LPC-UK or NFPA, USA) in Power Plant or Sub-stations or Industrial Complex etc. in last 20 years and supplied equipment should be in (#)successful operation for at least 2 years in last 10 years as on the date of Bid opening of this tender. a. Fire Detection comprising of smoke detection or air sampling system. b. Fire Alarm system comprising of audio/visual alarm and control panels. c. Fire protection system comprising of Inert Gas Clean agent. d. Fire protection system comprising of water based system (HVWS or MVWS or Sprinkler System). Above Fire Fighting Systems could have been executed under single or multiple purchase orders /projects. (#) Successful operation means certificate issued by the Customer certifying the operation without any adverse remark.	a) Copy of Purchase Orders / Work Orders for Firefighting systems supplied. b) Performance Certificate/ Letter/ MOM from customer for satisfactory/successful operation for the same projects for which PO/WO are being submitted. c) The above documents must have information about the type of system designed, supplied and erected and date of work completion wherefrom one (1) year successful operation as required in PQR description sr. no.-1 could be established. Also it must be mentioned that system have been designed as per TAC/OISD/NFPA or any other international reputed make.

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BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

DOCUMENT No.	TB-405-552-002	Rev. No.	00		Prepared	Checked & Approved
TYPE OF DOC.	TECHNICAL SECIFICATION	NAME	AJ	AR		
TITLE	FIRE FIGHTING SYSTEM (400KV-Gas Insulated Switchyard)					
			DATE	31.03.22	31.03.22	
			GROUP	TBEM		
CUSTOMER	SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)					
CONSULTANT	SJVN LTD.					
PROJECT	4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL					

विषय-सूचि /CONTENTS

Section	विवरण /Description	No of Pages
1	Intent, System and Scope	29
2	Customer Equipment Specification	13
3	Project Details and General Technical Specifications	35
4	List of Drawings & Documents	02
5	Enclosures to Specification Annexures	21 50

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS			

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CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)

TB-405-552-002

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Rev. 00

PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL

Page | 1 of 29

TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM

SECTION-1

INTENT, SYSTEM REQUIREMENT, DESIGN CRITERIA AND SCOPE

1.0. INTENT OF SPECIFICATION

1.0.1. This specification is intended to cover following activities and services in respect of all the equipment of the **Fire Protection and Detection System to be provided for Gas Insulated Switchyard (GIS) and GIS Control Building of 4X225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL.**

- 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 site as specified in NIT including customs clearance/port clearance, if required.
- v) Receipt, storage, preservation and conservation of equipment at site.
- vi) Fabrication, pre-assembly, if any, supervision of erection testing and putting into satisfactory operation all the equipment including successful completion of trial operation.
- vii) Performance and Guarantee tests after successful completion of trial operation and warrantee for two years for the fire fighting system in scope.
- viii) The system shall be designed, erected & commissioned in accordance with TAC/ NFPA guidelines.

Receipt, Unloading and Storage of material at Arun-3 site and Erection Testing and Commissioning shall be in BHEL scope, however **Supervision of ETC shall be in Contractor's scope.*

1.0.2. 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 Technical specification is attached with SECTION 2 shall be referred strictly and contractor shall provide requirements of the same regarding systems applicable for Switchyard portion of the project without any deviation.*

In case of any discrepancy arising between this job specification & its enclosures, the most stringent of all (as determined by purchaser) shall be followed. In all cases, end customer's (M/s SJVN) specification requirement enclosed in various annexures are binding and are to be followed by bidder.

1.0.3. 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.

1.0.4. The Contract shall be on unit rate basis for the quantities furnished by BHEL. The quantities furnished in Price bid (BOQ) are as per preliminary design only. BHEL reserves the right for quantity variation (upward/ downward) due to any reason upto $\pm 30\%$ of total contract value at same unit rate and terms & conditions during execution of contract.

1.0.5. The Bidder shall deem to have understood completely all the tender drawings and documents and quoted accordingly.

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 2 of 29

- 1.0.6. **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 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.*
- 1.0.7. 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.
- 1.0.8. 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.
- 1.0.9. The term 'Owner' appearing in this specification shall refer to SAPDC, the term 'Purchaser' shall refer to BHEL and the term 'Contractor' shall refer to the successful Bidder.

1.1. FIRE FIGHTING REQUIREMENTS FOR VARIOUS AREAS

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. GIS Building with Ventilation room ii. Pothead Yard iii. 80MVar Reactors
HVW Spray System	80MVar Reactors-3 Nos.
MVW Spray System	Cable Trench Room in GIS Building
Inert Gas Extinguishing System	Control Protection Room, Control Room, HT Panel Room
Addressable Fire Detection & Alarm System	i. Switchyard Control Building ii. GIS Hall Building and it's ventilation room
Portable Fire Extinguisher	i. Switchyard Control Building ii. GIS Hall Building and it's ventilation room
Sand & water buckets	Outside the Control building.

1.1.0. CODES & STANDARDS

The design and installation of complete fire protection system will comply with the following standards:

- FP Manual regulations, Spray & Fire Alarm system of Tariff Advisory Committee (TAC)/NFPA.
- Wherever TAC is not applicable following National Fire Protection Association (NFPA) guidelines shall be followed:
 - NFPA-1 (Fire Prevention Code)
 - NFPA-10 (Portable Fire Extinguishers)

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 3 of 29

- NFPA-14 (Standpipe and Hose System)
- NFPA-15 (Water Spray Fixed System)
- NFPA-16 (Deluge Foam Water Systems)
- NFPA-25 (Water based Fire Protection Systems)
- NFPA-72 (National Fire Alarm Code)
- NFPA-72A (Local Protective Signaling System)
- NFPA-72E (Automatic Fire Detectors)
- NFPA-101 (Life Safety Code)
- NFPA-2001 (Inert gas extinguishing system)

c. Indian Standards (IS)

- i. IS 1239 (Steel Tubes, Tubular and Other Wrought Steel Fittings - Specification - Part 1: Steel Tubes)
- ii. IS 3589 Gr 410 (Steel Pipes for Water and Sewage (168.3 to 2540 mm Outside Diameter)
- iii. IS 4736 (Specification for Hot-dip Zinc Coatings on Mild Steel Tubes)
- iv. IS 15337 (Coal Tar Based Anticorrosion Tape for Protection of Underground Mild Steel Pipelines)
- v. IS 14846 (Sluice Valve for Water Works Purposes, 50 to 1200 mm Size)
- vi. IS 5290 Type A (Specification for landing valves)
- vii. IS 636 (Non-percolating flexible firefighting delivery hose)
- viii. IS 884 (Specification for first-aid hose reel for firefighting)
- ix. IS 2871 (Specification for branch pipe, universal for firefighting purposes)
- x. IS 15683 (Portable Fire Extinguishers - Performance and Construction)
- xi. IS 3844 - Code of Practice for Installation & Maintenance of Internal Fire Hydrants and Hose Reels on Premises
- xii. IS 2189 – Code of practice for selection, installation and maintenance of automatic fire detection and alarm system.
- xiii. IS 2190 - Code of Practice for selection, installation & Maintenance of first- aid -fire extinguishers.
- xiv. IS 9668 - Code of Practice for Provision & Maintenance of Water Supplies for firefighting.
- xv. NFPA 2001 for Standard on Clean Agent Fire Extinguishing Systems

1.2. DESIGN FEATURES

This system shall be designed to provide fire detection and protection services for Switchyard and its control Building. Design criterion shall be based on "Light Hazard Occupancies" classification as described in Tariff Advisory Committee's (TAC) guidelines. All equipment or systems in the designed fire detection cum protection arrangement shall be completely in compliance with the regulations of Tariff Advisory Committee (TAC) of India/ Loss Prevention Association (LPA) / National Fire Protection Association (NFPA)/ LPCB/ VDs.

1.2.1. FIRE DETECTION AND ALARM SYSTEM

1.2.1.1. Scope of fire detection & alarm system

Fire detection and alarm system shall consist of the following major devices: -

- I. Fire Alarm Panel located at Switchyard Control room
- II. Detectors
- III. Air Sampling Detector for Control Room, Control Protection Room & HT Room
- IV. Manual call points

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 4 of 29

- V. Notification appliances (hooter)
- VI. Interface modules
- VII. Cables

Miscellaneous Items:-

- I. Self-Illuminating exit signs shall be provided in control room and 400 kV GIS building.
- II. Isolator modules shall be provided as per IS 2189.
- III. An emergency fire telephone system shall be installed based on a two-way communication system connecting the individual locations with the control room.

All equipment such as fire detectors, panels, notification appliances shall be approved or listed by UL(Underwriters Laboratory)/FM(Factory Mutual)/LPCB(Loss Prevention Control Board) /VdS (Verband der Sachversicherer).

1.2.1.2. General Description of the System

- I. This system is provided for the buildings and closed spaces within the scope of BHEL.
- II. The Fire Detection and Alarm System will comprise of a network of Air Sampling Detectors, Addressable Detectors (fire/smoke), Manual Call Points, Modules, Notification Appliances, Cables and other accessories required to form a network (i.e. Terminal Boxes and Junction Boxes).
- III. In view of very large height of GIS building Beam smoke detectors shall be provided there because regular spot type smoke detectors will not be effective in detecting the smoke to the required sensitivity levels.
- IV. 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. Based on fire affected area – spray system (HVWS or MVWS) will be actuated. 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.
- V. 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.
- VI. Proposed detectors/devices for Fire detection and alarm system for areas are given below:

Sl. No.	Area	Type of Detection
i.	GIS Building	Beam Detectors and Manual Call Points
ii.	Control & Protection Room, Control Room & HT Panel Room	Air Sampling Detectors and Manual Call Points
iii.	Ventilation Room, LT Switch Gear Room, Inert gas Room, Office Room	Multi Sensor Detectors and Manual Call Points
iv.	Reactors	QB Detectors
v.	Cable Trench Room	Multi Sensor Detectors, LHS Cable and Manual Call Points

- VII. In case of fire, the detector or device envisaged in respective area will pick up appropriate signal and conveys it to fire alarm panels located in Switchyard control room. These signals triggers two types of actions, (1) audio alarms in Control room and affected area, and (2) actuates firefighting

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 5 of 29

process. It initiates tripping of AHU for a/c system, fans in ventilation system, fire dampers, etc. related to the affected area. The system must ensure that more number of detectors / devices can be connected in a loop.

- VIII. The fire detectors are inherently addressable, which provide continuous surveillance in an area. The Microprocessor based Fire Alarm Control Panel located in Control Room will process the input signals from detectors at various locations of the switchyard and actuate the respective protection system.
- IX. The Microprocessor based Fire Alarm Control Panel located in Switchyard Control Room will be connected with Main Fire alarm panel of CCR. All the switchyard fire alarm signals will be annunciated in the main fire alarm panel located in central control room which will further be duplicated in main plant SCADA system.

1.2.1.3. Layout and Coverage of detectors/devices in Switchyard areas shall be as mentioned below:-

Automatic Fire Detectors

- I. Spacing of detectors shall be as per cl. No. 6 of IS 2189.
- II. Manual call points shall be located as per cl. no. 6.3.8 of IS 2189. The call points will normally be provided for every 30m distance in indoor areas and for every 45 m in outdoor areas. **Manual call points shall be break glass type or lever type.**
- III. Hooter cum strobe shall be located as per cl. no. 4.3 of IS 2189.
- IV. Detectors will be installed at the highest point of the ceiling (as per IS 2189) and coverage indicated by OEM will be considered.
- V. 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.
- VI. 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.
- VII. The number of detectors and their location will be finalized during detailed engineering stage as per provisions of contract and statutory requirements.
- VIII. Linear Heat sensing cable (LHSC) shall be digital type.

Air Sampling System:

The system shall include but not be limited to the following:

1. Sampling Pipe Network
2. Detector
3. Filter
4. Aspirating Fan
5. Detector Control Assembly
6. Chart Recorder/Data Log Output
7. Digital Communication Port
8. Remote Annunciator Display Panel
9. Power Supplies

Each detection system shall have the capacity to analyze samples of air taken from up to 20,000 sq.ft. of floor area and detector shall be capable of continuous sampling of air from sampling ports located as

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 6 of 29

defined by NFPA72, shall provide very early smoke pre-alarm and alarm levels and shall report any fault on the unit by a general fault output relay.

Digital Communication Port of the system shall comply with RS232 Protocol.

The common detector fault relay contacts shall be connected into the appropriate alarm indicating zone on the fire alarm panel in such a way that the detector fault or air flow fault would register a trouble signal on the alarm indicating zone and a common trouble signal on the Fire Alarm Control Panel (FACP).

Air Sampling Network Calculations shall be provided from a registered Computerized sampling pipe aspiration modeling program. The detailed calculations shall be given during detailed engineering.

1.2.1.4. Switchyard Fire Alarm Panel

- I. The microprocessor based Fire Alarm Control Panel comprise of processor, loop cards for detector loops, display unit, modules for alarm control & interlocks, communication modules for interfacing etc., as required by the system to incorporate all the features required.
- II. All the fire alarm circuits will be of modular design using electronic printed card circuits to facilitate easy replacement of faulty circuits with spare cards. All the electronic components and cards will be compatible to non-air-conditioned environment for working satisfactorily.
- III. The Microprocessor based Fire Alarm Control Panel will incorporate the following features:
 - Continuous supervision of the detector connecting lines, individual detector performance / operation and disconnection / removal of Detectors. The system will automatically reset on clearance of a fault.
 - Programmed activation of various interlocks with fire protection system and other associated system such as ventilation and air conditioning, etc.
 - The Fire Alarm Control Panels will have adequate number of loops so as to cover all the areas to be protected.

1.2.1.5. Power supply system for fire alarm panel:

- I. The system shall be provided with main power supply (230V AC power supply) and a standby power supply (24V DC power supply from inbuilt battery). The standby power supply shall takeover automatically incase failure of main power supply without affecting the transmission of the signal.
- II. The fire detection and alarm system normally operates on 230 V AC power supply. Two (2) sets (1 working & 1 standby, 100% capacity) of 24 volts (2 x 12 V) SMF Lead Acid battery with charger has been provided as standby power source which will cut-in automatically in the event of AC power failure.
- III. Float cum-boost charger of adequate capacity shall be provided to trickle charge the battery from AC supply during normal operation. The standby power source has been provided with a battery bank to power fire detection and alarm system for 24 hours of normal operation and 30 minutes of alarm condition.
- IV. Generally, Cable required for complete Fire Alarm System for interconnecting Fire Alarm Control Panels, Detectors, Manual Call Point, other field devices, Microcomputer, Repeater Panel, VDU, Printer, etc. shall be 1.1 kV – Low Voltage Copper Conductor Cables.

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 7 of 29

- V. Control cables used for FDA system 2 core 1.5 sq.mm copper conductor HRPVC insulated twisted, armored, overall screened, and overall sheathed ST-2 type.
- VI. Power cables used for FDA system 2 core 2.5 sq.mm copper conductor HRPVC insulated armored, overall sheathed ST-2 type.
- VII. FRLS type cables of temperature rating 85 deg C.
- VIII. All detectors, junction boxes, manual call points and cable marshalling boxes shall be earthed with 8 SWG GI wire in case the operating voltage of the system is greater than 24 V.
- IX. Optical fiber cable shall be used to wire switchyard FAP with Main Fire Alarm Panel of Central Control Room. Bidder may consider FO cable alongwith FO convertor in switchyard FAP and MFAP, actual length of the FO cable required to be worked out after detailed engineering and same shall be supplied by contractor. Network interface items necessary to interface switchyard FAP with MFAP shall be provided by contractor.

Note: The make of FDA equipment for switchyard area shall be same as that of main plant FDA. Make of FDA shall be finalized during detailed engineering with customer. Hence make finalized by customer/purchaser 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. No deviation from bidder shall be acceptable on this point.

1.2.1.6. Interfacing Requirement

Provision of sufficient potential free contacts in FAP to repeat all the fire-fighting system alarms in **SCADA**. All the necessary inputs for SCADA shall be in the form of potential free contacts only.

Since we have microprocessor type FDA system under present scope, contractor need to consider sufficient control relay module to repeat the fire annunciation in a particular zone as may be defined during detailed engineering. All necessary programming shall be done by contractor accordingly. Also make of the microprocessor based FDA system shall be finalized during detailing engineering with customer and the same shall be binding on the contractor without any commercial implication.

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 fire panel and terminated in the terminal block.

Fire detection & alarm system shall have following interfaces.

- i) **Interface with Ventilation system of GIS building to shut down the equipment in case of fire.**
- ii) **Interface with fire dampers to close it in case of fire.**
- iii) **Interface with Air Sampling System in case of detection of smoke.**
- iv) **Interface with Main Fire Alarm Panel in Central Control Room.**
- v) **Interface with SCADA.**
- vi) **Interface with Public Addressable System for main plant.**

1.2.2. FIRE PROTECTION SYSTEM

Fire Water will be sourced from one no. tap- off point of size 200NB for hydrant and HVWS system to be provided by BHEL PE&SD unit in the vicinity of Switchyard area. Further distribution and any necessary

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 8 of 29

orifice plate (if required) shall be in contractor's scope. Refer the document **P&ID of Fire Hydrant and Spray System-PYDP1M110866101-Rev02** attached in section-5 of this specification.

1.2.2.1. HVWS System for Reactors

HVW Spray system is envisaged for 2 nos. 80 MVA line reactors with NGR and 1 no. 80 MVA bus reactor without NGR.

Design Guidelines:

1	Design Standard	Section -3 of rules for water spray systems (TAC)	
2	Water application rate	10.2 LPM/M2 of the surface area of the entire Transformer including the bottom surface, radiators, conservators etc.	CI no 3.2.3.6.1 of rules for water spray systems (TAC)
3	Pressure Guidelines	The pressure at the remotest nozzle shall not be less than 3.5 kg/cm ² (g) and not exceeding 5.0 kg/cm ² (g).	
4	Maximum allowable velocity of water in the ring main	Shall be limited to 10 m/sec.	
5	Detection System	QBD /Wet Trim	

Description of the System:

- System shall be pressurized continuously to normal working pressure up to the Deluge valves.
- It shall consist of spray main tapped from the main spray header of power plant, Deluge valve, Isolation valves, Y-type strainer, spray nozzles/ projectors, spray nozzles piping network, detection system, instrumentation, junction boxes, cables etc
- The deluge valve system shall consist of Wet Trim Deluge valve, Solenoid Valve, Manual Isolation gate valve at Inlet and outlet of the deluge valve, Y type strainer at the Inlet of the Deluge valve, Deluge valve local Control Panel (DVLCP). Bypass line arrangement of deluge valve shall be provided based on functional requirement.
- Each protected equipment shall be surrounded by ring fitted with open high velocity water spray nozzles.
- The supply for water to the ring main will be tapped from the hydrant header line. The ring main will be connected to spray system header through wet pilot deluge valve with gate valves in upstream and downstream.
- The header will remain charged with water under pressure up to the inlet of deluge valve. Wet detection system using Quartzoid Bulb Detectors (QBD), rated at 79°C; fitted on the ring mains is envisaged. This line will be pressurized with water and will be connected to deluge valve.
- In the event of fire, the quartered bulb near the fire breaks, causing the pressure drop in the detection line. The loss of pressure causes the deluge valve to open, spraying the water through nozzles.
- Provision for draining of the Water in the event of Operation / testing of Deluge valve shall be provided by Customer while designing the drainage arrangement of the Plant.
- Gate valves shall be provided in the upstream and downstream of each deluge valve.
- Deluge valve & DVLCP shall be located near to respective reactor.

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 9 of 29

k) The Spray & Detection Piping from the deluge valve shall be routed around the respective reactor.

l) The Spray System & detection rings around the reactors shall be supported from floor / wall.

Local audible alarm shall be produced by water motor alarm gong. The operation of the Deluge Valve shall be annunciated in the Local Zonal Fire Alarm Panel as well as in the Central Fire Detection and Alarm Panel.

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

Placing of spray nozzles shall be such that their spray cones overlap each other. 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 mentioned above/NFPA.

Water motor gong shall form part of accessories to be provided with deluge valve.

A pressure switch shall be provided at the down streamside of the deluge valve for remote annunciation of "Deluge Valve Open" alarm in the main Fire Alarm panel in central Control Room. Another pressure switch shall be provided in the detection line of the system for remote annunciation of "Detection circuit operated" alarm in the main Fire Alarm panel in central Control Room.

Local control panel shall be provided for each deluge valve.

HVWS Spray pipe lines that will be laid underground shall be duly covered with coating and wrapping if required on paved area etc. Road or pipe trench crossing shall be through RCC Hume pipes.

Push button station/local control panel for deluge valve is required for DV local operation manually in case it fails to operate automatically. Suitable interfacing by providing sufficient CRM (Control Relay Module) and MM (Monitor Module) for taking feedback of "DV operated" to FAP under this situation should be taken care of by contractor during detailed engineering.

Facility for remote actuation of deluge valves, through a push-button shall be made available. Suitable terminal blocks with necessary electrical wiring should be made available in the DVLCP for remote actuation of deluge valves from control building. For each deluge valve of HVWS system, module shall be provided in the circuit in similar to Fire Detection System with the audio-visual alarm for (a) Detector circuit water pressure low, (b) Fire Water pressure high (c) Deluge valve operated (i.e. FIRE) etc.

All necessary cable and it's accessories supply (for equipments to DVLCP and necessary annunciation in the switchyard FAP) shall be under contactor scope.

Each of the outdoor deluge valves and its accessories will be housed in a deluge valve housing (As per TAC).

1.2.2.2. MVWS System for Reactors

MVW Spray system is envisaged for cable trench room in GIS building.

General:

- System shall be pressurized continuously to normal working pressure up to the Deluge valves.
- For switchyard cable trench area, suitable zones of MVW spray system operation shall be adopted and same shall be finalized during detailed engineering.

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 10 of 29

- c. It shall consist of spray main tapped from the main hydrant header of power plant, Deluge valve, Isolation valves, Y-type strainer, spray nozzles/ projectors, spray nozzles piping network, detection system, instrumentation, junction boxes, cables etc.

Design Guidelines:

1	Design Standard	Section -4 of rules for water spray systems (TAC)	
2	Water application rate	12.2 LPM/M2 of the Exposed area of the cable racks	CI no 4.8.2 of rules for water spray systems (TAC)
3	Pressure Guidelines	The pressure at the 2.8 bars shall be achieved at the hydraulically remotest point.	CI no 4.8.3 of rules for water spray systems (TAC)
4	Maximum allowable velocity of water in the ring main	Shall be limited to 10 m/sec.	
5	Detection System	Multi Sensor Detectors / QBD / Digital LHS	

Description of the System:

- The deluge valve system shall consist of Wet Trim Deluge valve, Solenoid Valve, Manual Isolation gate valve at Inlet and outlet of the deluge valve, Y type strainer at the Inlet of the Deluge valve, Deluge valve local Control Panel (DVLCP). Bypass line arrangement of deluge valve shall not be provided as per contract.
- Each protected equipment shall be surrounded by ring fitted with open medium velocity water spray nozzles.
- The supply for water to the ring main will be tapped from the hydrant header line. The ring main will be connected to spray system header through wet pilot deluge valve with gate valves in upstream and downstream.
- The detection in MVWS system is through multi sensor detectors. In the event of fire, the multi sensor detectors gives a signal to main fire alarm panel. With the receipt of fire signal from multi sensor detectors, the main fire alarm panel opens the solenoid valve placed in the detection line of deluge valve. As the solenoid valve opens, the water in detection line to flow out. This creates a pressure drop in the detection line. The pressure drop in detection line will open the deluge valve and water starts projecting out from the spray nozzles.
- Provision for draining of the Water in the event of Operation / testing of Deluge valve shall be provided by Customer while designing the drainage arrangement of the Plant.
- Gate valves shall be provided in the upstream and downstream of each deluge valve.

Local audible alarm shall be produced by water motor alarm gong. The operation of the Deluge Valve shall be annunciated in the Local Zonal Fire Alarm Panel as well as in the Central Fire Detection and Alarm Panel.

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

Water motor gong shall form part of accessories to be provided with deluge valve.

A pressure switch shall be provided at the down streamside of the deluge valve for remote annunciation of "Deluge Valve Open" alarm in the main Fire Alarm panel in central Control Room. Another pressure switch shall be provided in the detection line of the system for remote annunciation of "Detection circuit operated" alarm in the main Fire Alarm panel in central Control Room.

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 11 of 29

Local control panel shall be provided for each deluge valve.

Digital LHS cable is used for detection in MVW spray system in the cable vault. This shall be laid on alternate cable trays in zig-zag fashion. The complete area shall be covered by cross zoning method. Zones of protection & detection shall match in cable vault where MVWS system is used. FAP shall process the signal from smoke detectors & LHS cable of the cable vault & actuates the DV in case of any fire. This process signal is given only if both smoke detector & LHS activated.

Water sprayer of MVW spray system shall be placed in such a way so that the "spray cone" overlaps each other.

The cable galleries shall have number of rows of cable trays and each row shall have number of tiers of cable trays. Each of the cable tray rows shall be provided with a network of water distribution piping and nozzles. The distribution network shall be as per TAC.

All Spray pipe on road or pipe trench crossing shall be through RCC Hume pipes duly covered with coating and wrapping.

Push button station/local control panel for deluge valve is required for DV local operation manually in case it fails to operate automatically. Suitable interfacing by providing sufficient CRM (Control Relay Module) and MM (Monitor Module) for taking feedback of "DV operated" to FAP under this situation should be taken care of by contractor during detailed engineering.

The cable vault shall be equipped with solenoid type Deluge Valve (SDV) to be operated automatically through fire detection system. Each SDV shall be provided with limit switch contacts to indicate actual operation of the solenoid operated valve in the local panel as FAP by using addressable CRM/MM. Since these connecting cables are to be run with other cables, the signal interference shall be avoided. All necessary cable and it's accessories supply (for equipments to DVLCP and necessary annunciation in the switchyard FAP) shall be under contactor scope.

Provision (terminal blocks with all electrical connection) in the DVLCP for remote actuation of deluge valves, through a push-button shall be made available.

Each of the outdoor deluge valves and its accessories will be housed in a deluge valve housing (As per TAC).

1.2.2.3. Hydrant System

- I. This system is in accordance with the clause no 7.6 of the FP manual of TAC.
- II. Hydrant system shall be designed so that a minimum running pressure of 3.5 kg/cm² (g) is available at the remotest hydrant point.
- III. The velocity of flow of water is generally not exceeding 2.5 m/sec in delivery header and anywhere in the system (as per Cl. 7.5.10 of FP Manual-TAC).
- IV. The Hydrant system shall be provided throughout the Switchyard area.
- V. A common Header for the Complete Water based System is provided. Tapping for the High Velocity Water Spray System, Medium Velocity Water Spray System shall be taken from the main Hydrant Header.

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 12 of 29

- VI. Fire Water Piping shall be laid in switchyard area to distribute the water for Hydrant system. Fire water requirement shall be as per TAC requirements.
- VII. The hydrant system shall consist of the following:
- Single headed stand post type yard hydrants of 63 mm size as per IS: 5290 type-A, distributed all around the switchyard.
 - Type-I hose cabinet for each external hydrant consisting of two no. of 15 m long RRL hose as per IS: 636 type-A, one no. of SS branch pipe &/or stream jet type nozzle as per IS: 903. The dimensions of the hose boxes shall be as per manufacturer's standard.
 - Isolation valves at suitable places shall be provided in the ring mains for easy maintenance.
 - Hydrant pipes
 - Inside the building the pipes shall be supported from the roof of the building/ supported on the floor as per layout considerations.
 - At approach roads where it shall be laid underground, in Hume pipes.
 - Design calculations, drawings etc. shall be supplied.
 - Routing of hydrant pipe shall be finalized during detailed engineering. However minor change (if any) shall be done during installation as per site conditions.

1.2.2.4. Inert Gas Extinguishing System

- Inert Gas extinguishing system shall be provided for CRP Room, Control Room and HT Room of Switchyard Control building.
- The inert gas system shall employ any of the proven inert gas specified as in NFPA-2001.
- IG-541 shall be used as inert gas in the inert gas system.
- The gas release panel of the cylinder bank shall be connected to the fire alarm panel located in control room for actuating the inert gas system through modules.
- The main equipment in the system consists of gas release panel, cylinders, nozzles, directional valves, check valves and manifolds.
- The gas release panel shall be powered by 230 V normal AC power supply. Standby power supply shall be catered by Ni-Cd batteries.
- Common cylinder bank with directional valve systems are provided for each protected area. Main cylinders will be calculated based on the single largest risk in each protected area and these cylinders will be located in the cylinder storage room near the protected area.
- A reserve battery bank (100% standby) of inert gas cylinders (duly filled) with manifold, directional valves with manual changeover shall be provided.

Operation of Inert Gas Extinguishing System

- Fire detectors used in these areas (areas where inert gas is provided) are cross zoned. Upon receipt of signal from any detector in the protected enclosure a fire signal shall be sent to the fire alarm panel. Upon receipt of signal from second detector in the same protected enclosure a discharge signal shall be sent to the gas release panel to activate the solenoid valve on the master cylinder of inert gas

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 13 of 29

system. Manual mechanical actuation of the inert cylinder is also possible using the Manual mechanical actuator of the master cylinder.

- b. Every zone does have one master cylinder (which can operate slave cylinders) which has release unit consist of solenoid actuator, manual actuator and contact gauge, mounted on the cylinder valve. When the solenoid valve opens, propellant from the gauge port on the cylinder valve trips the internal actuating device opening the cylinder valve. The cylinder valve will remain open until internal cylinder pressure reaches approx. 1 bar. A high-pressure pilot hose(s) inter-connect the cylinder valves. The interconnected cylinder valves open simultaneously as the internal actuators are pressurized at the same time. Thus releases inert gas to the protected room area through a restrictor, Selector Valve, the distribution pipe work and the discharge nozzles.
- c. In Automatic operation, the detectors will send the fire signal to the main fire alarm panel. Then the signal is sent to the Pre-Discharge Audio/Video Signal Unit to allow personnel evacuation prior to discharge. This alarm is for Personnel evacuation prior to system discharge takes place normally after a specified time delay of 0-3 minutes which is adjustable. Simultaneously, the solenoid valve on the manifold gets energized through a signal from gas release panel. This in turn will open the Inert Gas Cylinders.

1.2.2.5. Portable Fire Extinguishers

- I. Portable fire extinguishers are provided as per TAC guidelines for indoor and outdoor areas.
- II. Following type of fire extinguishers shall be provided.
 - Portable Carbon Dioxide type.
 - Portable Dry Chemical Powder type.
 - Portable Foam type.
- III. Distribution of these extinguishers in various locations shall be as per the guidelines of TAC. (Separate document shall be submitted for Portable & Mobile Fire extinguishers titled as "Fire Extinguisher Distribution Schedule").
- IV. Sand and water buckets shall also be provided. However, the quantity and locations shall be finalized during detailed engineering.

Design, Construction and Specific requirements:

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.

All the extinguishers along with accessories shall be guaranteed for satisfactory and trouble-free operation.

Portable extinguishers shall be complete with brackets/fittings suitable for mounting on wall and a carrying handle of ample strength.

Spanner and other accessories as required shall be supplied with each fire extinguisher.

Each extinguisher shall be designed, constructed, tested and painted in accordance with respective Indian/International Standard and marked with BIS Certification.

First charge of chemicals in each extinguisher shall be provided. All chemical charges shall be refilled after testing at site.

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 14 of 29

As required by Tariff Advisory Committee, 20% spare charge of the total no. of extinguishers installed, with a minimum of six recharges, shall be supplied for each type of extinguishers.

Fire extinguishers shall be fitted with pressure gauges as applicable to indicate whether the extinguisher is charged or in need of a recharge.

The discharge horn of the Carbon-Dioxide Extinguishers shall be made of a material non-conducting to electricity.

All extinguishers shall be mounted at strategic locations in bunches and/or individually to TAC approval.

1.2.3. Safety Devices

One (1) set of Safety kits comprising of safety masks, first aid box, artificial breathing apparatus, resuscitators etc. complete as per NFPA/Equivalent Standards. The kits are required to be placed in Control room.

A Lot of fluorescent directional signals to direct the personnel trapped inside to the escape route and stair cases to be decided during detailed engineering.

1.2.4. Painting

For painting Annexure-P to section-1 to be followed.

All the equipment furnished and installed by the Contractor shall be completely painted for final use, with the exception of those parts or surfaces that are expressly designated as unpainted. Surfaces to be painted shall receive the preparatory treatment and required number of coats. The Contractor shall perform all painting work in the shop, before shipment, followed by a final coat of paint at site after installation as per the standard procedure.

All materials, supplies, and articles furnished shall be the standard products of recognized reputable manufacturers.

Colour schedule of equipment supplied shall be finalized during detailed design stage.

For ready identification of different piping system functions, each piping system shall be painted near all operating points and also on each separate section, with two bands of colour, the wide band twice the width of the narrow one. An arrow showing the direction of flow shall also be marked. Generally, the narrow band shall be in the direction of flow. The colour coding for the ground colour, the wide band and the narrow band on different pipes shall be as recommended in Indian or International standards.

All operating valves on a piping shall be painted with the colour mentioned above. Each valve shall have, suitably fitted to it, a name plate indicating the function of the valve.

1.2.5. Material of Construction (MOC) of Major Equipments

The major items of FPS system and their MOC are listed in the table below: -

SL. NO.	ITEM	MOC
i.	Fire Water Pipes	Mild steel, Black, ERW to IS: 1239 Part-1 Medium & IS: 3589
ii.	Fire Water Pipes (Downstream of Deluge Valve)	MS ERW Galvanized to IS:1239, Part-1, Medium grade; Galvanized as per IS: 4736
iii.	Hose Pipe	Reinforced Rubber Lined Fire Hose as per IS 636, Type – A

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 15 of 29

iv.	Hose Reel	Rubber braided as per IS 884
v.	Valves	
a.	Gate Valves	C.I as per IS 14846
b.	Hydrant Valve	SS 304 as per IS 3444
c.	Deluge Valve	CI, IS-210 FG-260
vi.	Y-Strainer	Body: MS as per IS: 2062 Wire Mesh of SS 316
vii.	HVWS Nozzle	SS 304
viii.	Branch Pipe	SS 304, IS: 903
ix.	Air Release Valve	Gun Metal as per IS 318
x.	Flanges	Fabricated from Plate conforming to IS: 2062 Gr. B
xi.	Fittings	IS:1239, Part-II
xii.	Hydrant Nozzle	As per IS 8090

- ❖ *Firefighting system shall be designed as per the latest drawing during the detailed engineering stage.*
- ❖ *Specification/ data sheets of various items of this package shall be submitted to customer/ consultant for approval during the detailed engineering stage.*

1.3. MANDATORY SPARES

Following mandatory spares items shall be provided:

S. No.	Description	Qty.
1.	Detectors a) Multi sensor detectors b) Long-range beam smoke detectors (For GIS Building) c) QB Detectors	10 % of total quantity.
2.	Linear heat sensing cable along with interface modules	10 % of total quantity.
3.	Manual pull station / Manual call point	10 % of total quantity.
4.	Audio visual combination devices	10 % of total quantity.
5.	Strainers, pipes and fittings, valves and specialties and expansion joints	10 % of total quantity.
6.	Butterfly Valve, Deluge valve, nozzles, Hydrant valves and Hose pipe connectors, air release valves	10 % of total quantity.
7.	Hose pipes and branch pipes	10 % of total quantity.
8.	Kits for filling up the portable fire extinguishers	50% of total capacity
9.	All type of cards used in FACP & air sampling system	1 No. each
10.	Inert gas cylinders	10 % of total quantity.
11.	Automatic and Manual Release System	10 % of total quantity.
12.	Cylinder Valve with Safety pressure relief Device	10 % of total quantity.
13.	Inert gas Nozzles	10 % of total quantity.
14.	Inert gas Release Push Button	10 % of total quantity.
15.	Pressure switches, pressure gauge, Solenoid Valves	10% of installed capacity

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 16 of 29

1.4. SCOPE OF SUPPLY & SERVICES

- 1.4.2.** The equipments and services to be furnished under this contract are detailed here under Cl. No. 1.10 of this section is for reference. Bidders shall work out the actual requirement based on the building layout enclosed with this specification. The items though not specifically mentioned but required for safe and satisfactory operation of the system will also be treated as included and the same shall be supplied at NO EXTRA COST to BHEL.
- 1.4.3.** The Bill of Quantities shall be read in conjunction with the Instructions to Bidders, General and Special Conditions of Contract, Technical Specifications, and Drawings.
- 1.4.4.** 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.
- 1.4.5.** 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.
- 1.4.6.** 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.
- 1.4.7.** 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.
- 1.4.8.** Price of items like pipe fittings, hardware items etc. shall be considered along with price of the respective pipes/ items in the price schedule.
- 1.4.9.** Miscellaneous items like hardware, fixtures etc. shall be deemed to be included under the relevant BOQ items and bidders shall consider the same while quoting for BOQ items.
- 1.4.10.** 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 1.5 of this section.
- 1.4.11.** Bidders shall consider makes for various equipments as per Annexure M, 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.
- 1.4.12. Bidder shall also consider the following while quoting for the system:**
- Power & Control cables for fire protection system (except for cable for detection and alarm system & FO cable) will be supplied on free issue basis to contractor. BHEL shall procure various sizes of cables (as per Annexure 'A' of this section) for the complete requirement of sub-station. Contractor shall have to

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 17 of 29

choose their cables from the available sizes only and necessary modifications in their equipment for termination of these cables shall be made by contractor.

- ii) Laying & termination of all power & control cables is in purchaser's scope, however 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 cable of suitable size, FRLS, twisted pair, armoured Cu cable) for fire detection and alarm system.
- 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) RCC pedestals shall be provided by customer. However, pylon supports to be provided by contractor for HVWS.
- vii) Pipe size for pylon, size of Anchor fasteners etc. shall be adequate for the support to provide sufficient rigidity against vibration & load during operation. The whole arrangement shall be in bidder's scope. The contractor shall justify adequacy of design during engineering.
- viii) 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.

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.

1.4.13. Scope of services

Supervision of erection and commissioning is in bidder's scope. Bidder shall familiarize themselves with site prior to preparation of drawings for piping layout, equipment placement etc. Erection drawings/procedure, pre-commissioning, commissioning checklist/procedure shall be provided by bidder.

A. Supervision Erection, Testing & Commissioning (ETC) requirements

- i) The scope of Supervision of ETC shall include supervision of 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.

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 18 of 29

B. Electrical System

- 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) Supervision in 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) Supervision in Earthing of all installations (to the nearest earth mat/ earthing pad) supplied under the scope of this specification.

C. Civil Works

Major Civil works such as foundations, cut outs etc. shall be in purchaser's scope however, Bidder shall supply necessary foundation bolts & hardware.

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

- i) Providing location of pipes crossing the road & trenches and supervision in laying of adequately sized Hume pipes.
 - ii) The contractor shall supervise in laying of aboveground and underground piping and making of RCC pedestals for above ground piping wherever required for hydrant and spray system in the switchyard.
 - iii) Underground pipes, if any, shall be suitably covered with wrapping and coating material and is to be supplied by contractor.
 - iv) Hume pipe shall be supplied and laid by BHEL. Contractors shall provide such requirement of hume pipes in the piping layout drawing.
 - v) All hardware such as fixing plate, U bolt etc. for pipes laying on the pedestal shall be supplied by contractor
- D. 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.

E. 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 plant 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.

1.5. EXCLUSIONS

- a) Receipt of material, Unloading and safe storage of all material/components at site.
- b) Erection, Testing and Commission at site, **however supervision of ETC shall be in contractor's scope.**

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 19 of 29

- c) Supply, laying and termination of power & control cables (supply of detection cable & FO cable shall be in contractor's scope). *The bidder shall choose from the BHEL procured cables listed in Annexure-C and furnish quantity and type of cables required for complete system in their respective bids.*
- d) 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.
- e) Supply of GI flat for earthing of equipments.
- f) Provision of RCC pedestals for piping.
- g) Provision of deluge valve housing.
- h) Supply and laying of hume pipe for road and rail crossing.

1.6. ENGINEERING DRAWINGS/DOCUMENTS

Engineering shall start immediately after the award of the contract.

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

Drawings, documents, design calculations literatures, manuals etc as mentioned below shall be submitted during detailed engineering.

For Approval:

- Fire Fighting Hydrant system design for pressure requirement at farthest point and pressure input to emulsifiers etc.
- Fire Fighting design for inert gas
- Fire Fighting design for HV Water Spray for Reactor
- Fire Fighting Design for Detection System (selection, zoning etc.)
- Sizing of Piping Network including valve sizing, de aeration, pressure reducer etc.
- Loading on foundations
- Foundation, embedment, Bracket & Pedestal etc. for Piping Network
- OGA Drawings
- Isometric drawing for complete Hydrant System
- Sub assembly drawings of valves, filters, reducers, Hydrant, Hydrant box etc.
- Sub assembly drawings of Fire Fighting system of Reactor, including piping network, deluge valve etc.
- Sub assembly drawing of inert gas system including battery bank, piping network, detection system etc.
- Sub assembly drawing for fire detection system - Zone wise, elevation wise etc. including repeaters, strobes, hooters etc.
- Interlocking scheme for Fire Dampers, louvers etc. (cross ref. - input to HVAC)
- Layout arrangement drawing for Portable fire extinguishers including sand stand, sand bucket, safety signs/ indicators etc.
- All Electrical & Control Drawings such as Electrical Panels OGA, Cable Block & Termination Diagram, Schematic Diagram, JB/MB/Kiosk Diagram etc. in respect of Fire Fighting System
- Technical Datasheet & Catalogue of every component used under this specification
- GTP as in Schedule-II

Fore Reference:

- Component wise weight schedule, lifting arrangement & safety arrangement
- Earthing arrangement drawings of panels / electrical installations etc.
- Erection Procedure documents along with all the drawings pertaining to this section

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 20 of 29

1.7. 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:

- Description of the system and equipment with design particulars.
- Instruction for erection.
- Instruction for operation, maintenance and repair.
- Recommended inspection practices and inspection schedule.
- Ordering information for all replaceable parts.

1.8. HANDING AND TAKING OVER

It is the responsibility of the contractor to maintain the plant till it is handed over. 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.

1.9. INSPECTION AND 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.

1.10. VARIOUS HEADS TO BE QUOTED FOR

Based on the above input it is recommended that the bidders shall submit their offers in the prescribed format only.

It may be noted that BOQ furnished by the bidder against main heads as per below table in Cl. 1.10 shall not be considered as limits to scope of supply and ETC.

MAIN SUPPLY

Sl. No.	Item Description	Unit	Qty.	Item Description Remarks
1	MS PIPE 200NB (FE410 GRADE)	Meter	200	As per IS 3589 Gr 410
2	MS ERW PIPE 150NB (MEDIUM GRADE)	Meter	400	As per IS: 1239 (Part-I)
3	MS ERW PIPE 100NB (MEDIUM GRADE)	Meter	80	As per IS: 1239 (Part-I)
4	MS ERW PIPE 80NB (MEDIUM GRADE)	Meter	30	As per IS: 1239 (Part-I)
5	WRAPING & COATING MATERIAL	SqMtr	10	
6	SINGLE HEADED HYDRANT VALVE	Nos.	13	
7	HOSE BOX	Nos.	13	
8	HOSE PIPE - 15M LONG	Nos.	26	
9	HOSE REEL - 30 METER LONG WITH DRUM	Nos.	1	
10	BRANCH PIPE WITH NOZZLE	Nos.	13	
11	AIR RELEASE VALVE	Nos.	1	
12	GATE VALVE 200NB	Nos.	2	
13	GATE VALVE 150NB	Nos.	2	
14	GATE VALVE 100NB	Nos.	11	
15	GATE VALVE 80NB	Nos.	2	
16	BUTTERFLY VALVE - 100NB	Nos.	1	



CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)

TB-405-552-002

CONSULTANT: SJVN LTD.

Rev. 00

PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL

Page | 21 of 29

TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM

17	DELUGE VALVE - 100NB	Nos.	4	
18	Y-TYPE STRAINER - 100NB	Nos.	4	
19	SOLENOID VALVE	Nos.	4	
20	Q.B DETECTOR	Nos.	78	
21	HVW SPRAY NOZZLE	Nos.	177	
22	MVW SPRAY NOZZLE	Nos.	70	
23	PRESSURE SWITCH	Nos.	8	
24	PRESSURE GAUGE	Nos.	8	
25	LOCAL CONTROL PANEL FOR DELUGE VALVE	Nos.	4	
26	PYLON PIPE 50NB (MEDIUM GRADE)	Meter	198	
27	GI PIPE 100NB (MEDIUM GRADE)	Meter	42	As per IS: 1239 (Part-I), Galvanized as per IS 4736
28	GI PIPE 80NB (MEDIUM GRADE)	Meter	18	As per IS: 1239 (Part-I), Galvanized as per IS 4736
29	GI PIPE 65NB (MEDIUM GRADE)	Meter	45	As per IS: 1239 (Part-I), Galvanized as per IS 4736
30	GI PIPE 50NB (MEDIUM GRADE)	Meter	132	As per IS: 1239 (Part-I), Galvanized as per IS 4736
31	GI PIPE 40NB (MEDIUM GRADE)	Meter	198	As per IS: 1239 (Part-I), Galvanized as per IS 4736
32	GI PIPE 32NB (MEDIUM GRADE)	Meter	72	As per IS: 1239 (Part-I), Galvanized as per IS 4736
33	GI PIPE 25NB (MEDIUM GRADE)	Meter	329	As per IS: 1239 (Part-I), Galvanized as per IS 4736
34	CO2 TYPE EXTINGUISHER -4.5 KG	Nos.	5	
35	CO2 TYPE EXTINGUISHER - 22.5 KG	Nos.	1	Trolley Mounted
36	DRY CHEMICAL POWDER TYPE EXTINGUISHER - 6 KG	Nos.	3	
37	DRY CHEMICAL POWDER TYPE EXTINGUISHER - 25 KG	Nos.	1	Trolley Mounted
38	MECHANICAL FOAM TYPE EXTINGUISHER - 9 LITER	Nos.	2	
39	MECHANICAL FOAM TYPE EXTINGUISHER - 60 LITER	Nos.	1	Trolley Mounted
40	SAND BUCKET	Set	4	Each set comprises of two sand buckets with stand
41	IGES PIPE 80NB	Meter	22	
42	IGES PIPE 50NB	Meter	76	
43	IGES PIPE 40NB	Meter	22	
44	IGES PIPE 25NB	Meter	76	
45	IG-541 -CYLINDERS 140 LTRS. 300 BAR	Nos.	40	
46	IG-541 CYLINDER VALVE (IG-541) - CYLINDERS VALVE	Nos.	40	
47	6 CYLINDER -MANIFOLD 300 BAR M400 (140 LITRE CYLINDER)	Nos.	5	
48	5 CYLINDER -MANIFOLD 300 BAR M400 (140 LITER CYLINDER)	Nos.	2	
49	IGES PRESSURE RELIEF DAMPER	Nos.	4	
50	IGES HOSE	Nos.	40	



CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)

CONSULTANT: SJVN LTD.

PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL

TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM

TB-405-552-002

Rev. 00

Page | 22 of 29

51	IGES CHECK VALVE	Nos.	40	
52	IGES CONTACT PRESSURE GAUGE	Nos.	40	Contact pressure gauge cum Switch
53	IGES RELEASE DEVICE ELECTRICAL	Nos.	6	
54	IGES RELEASE DEVICE MANUAL	Nos.	6	
55	IGES RELEASE DEVICE PNEUMATIC	Nos.	36	
56	IGES ADAPTER	Nos.	76	
57	IGES PILOT PIPES CYLINDER RACK BAS STRAIGHT	Nos.	36	
58	IGES SAFETY VALVE	Nos.	6	
59	IGES PNEUMATIC LIMIT SWITCH	Nos.	3	
60	IGES NOZZLES	Nos.	43	
61	MULTI SENSOR DETECTOR	Nos.	35	
62	HEAT DETECTOR	Nos.	2	
63	AIR SAMPLING DETECTION ASSEMBLY	Set	3	Complete with sampling pipe network, detectors, detector control assembly chart recorder/data log output, remote annunciation display panel, spares and tools etc., as described in the detailed specification
64	BEAM DETECTOR SET	Nos.	8	
65	HOOTER CUM STROBE	Nos.	3	
66	RESPONSE INDICATOR	Nos.	8	
67	MONITOR MODULE	Nos.	18	
68	CONTROL MODULE	Nos.	15	
69	MANUAL CALL POINT	Nos.	6	
70	LHS CABLE	Meter	80	Digital LHS Cable along with interface modules
71	EXIT SIGN	Nos.	10	
72	MANUAL ABORT SWITCHES	Nos.	3	
73	MANUAL RELEASE SWITCHES	Nos.	3	
74	DISCHARGE INDICATOR	Nos.	3	
75	PRE DISCHARGE INDICATORS	Nos.	3	
76	IGES GAS RELEASE PANEL	Nos.	1	
77	DETECTION CABLE 2C X 1.5 SQ.MM	Mtrs	600	
78	FO CABLE	Mtrs	100	
79	SAFETY KIT	Set	1	
80	ADDRESSABLE FIRE ALARM PANEL	Nos.	1	
81	FIRE DETECTION SYSTEM ACCESSORIES	Set	1	
82	IGES ACCESSORIES	Set	1	
83	PIPE FITTINGS & ACCESSORIES	Set	1	

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 23 of 29

84	SUPERVISION OF ERECTION TESTING AND COMMISSIONING FOR FIRE FIGHTING SYSTEM	Mandays	50	Supervision of Erection Testing & Commissioning for Fire Fighting System on per day basis for the days present at site on certification by BHEL site incharge. Price shall be inclusive of charges for lodging, boarding, medical, insurances etc.
85	TO & FRO TRAVEL CHARGES	Visit	1	To & Fro travel charges on per visit basis for all visits as per site requirement. Local transportation between hotel and site to be arranged by contractor.

MANDATORY SPARES

Sl. No.	Item Description	Unit	Qty.	Item Description Remarks
1	MULTI SENSOR DETECTOR	Nos.	4	10% of total quantity.
2	HEAT DETECTOR	Nos.	1	10% of total quantity.
3	BEAM DETECTOR SET	Nos.	1	10% of total quantity.
4	Q.B DETECTORS	Nos.	8	10% of total quantity.
5	LHS CABLE	Meter	8	Digital LHS Cable along with interface modules. 10% of total quantity.
6	MANUAL CALL POINT	Nos.	1	10% of total quantity.
7	HOOTER CUM STROBE	Nos.	1	10% of total quantity.
8	HWV SPRAY NOZZLE	Nos.	18	10% of total quantity.
9	MVW SPRAY NOZZLE	Nos.	7	10% of total quantity.
10	EXIT SIGN	Nos.	1	10% of total quantity.
11	Y-TYPE STRAINER - 100NB	Nos.	1	10% of total quantity.
12	MS PIPE 200NB (FE410 GRADE)	Meter	20	10% of total quantity.
13	MS ERW PIPE 150NB (MEDIUM GRADE)	Meter	40	10% of total quantity.
14	MS ERW PIPE 100NB (MEDIUM GRADE)	Meter	8	10% of total quantity.
15	MS ERW PIPE 80NB (MEDIUM GRADE)	Meter	3	10% of total quantity.
16	PYLON PIPE 50NB (MEDIUM GRADE)	Meter	20	10% of total quantity.
17	GI PIPE 100NB (MEDIUM GRADE)	Meter	5	10% of total quantity.
18	GI PIPE 80NB (MEDIUM GRADE)	Meter	2	10% of total quantity.
19	GI PIPE 65NB (MEDIUM GRADE)	Meter	5	10% of total quantity.
20	GI PIPE 50NB (MEDIUM GRADE)	Meter	14	10% of total quantity.
21	GI PIPE 40NB (MEDIUM GRADE)	Meter	20	10% of total quantity.
22	GI PIPE 32NB (MEDIUM GRADE)	Meter	8	10% of total quantity.
23	GI PIPE 25NB (MEDIUM GRADE)	Meter	33	10% of total quantity.
24	IGES PIPE 80NB	Meter	3	10% of total quantity.
25	IGES PIPE 50NB	Meter	8	10% of total quantity.
26	IGES PIPE 40NB	Meter	3	10% of total quantity.
27	IGES PIPE 25NB	Meter	8	10% of total quantity.
28	PIPE FITTINGS & ACCESSORIES	Set	1	10% of total quantity.
29	GATE VALVE 200NB	Nos.	1	10% of total quantity.
30	GATE VALVE-150NB	Nos.	1	10% of total quantity.

767269/2022/TBG-TB ENG SR



CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)

CONSULTANT: SJVN LTD.

PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL

TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM

TB-405-552-002

Rev. 00

Page | 24 of 29

31	GATE VALVE-100NB	Nos.	1	10% of total quantity.
32	GATE VALVE-80NB	Nos.	1	10% of total quantity.
33	BUTTERFLY VALVE-100NB	Nos.	1	10% of total quantity.
34	DELUGE VALVE-100NB	Nos.	1	10% of total quantity.
35	EXPANSION JOINTS	Nos.	4	10% of total quantity.
36	SINGLE HEADED HYDRANT VALVE	Nos.	2	10% of total quantity.
37	HOSE PIPE CONNECTOR	Nos.	3	10% of total quantity.
38	AIR RELEASE VALVE	Nos.	1	10% of total quantity.
39	HOSE PIPE - 15M LONG	Nos.	3	10% of total quantity.
40	BRANCH PIPE WITH NOZZLE	Nos.	2	10% of total quantity.
41	KITS FOR FILLING UP PORTABLE FIRE EXTINGUISHERS	Nos.	5	50% of total capacity
42	CARDS	Set	1	All type of cards used in FACP & Air Sampling System. 1 no. each.
43	IGES GAS CYLINDER	Nos.	4	10 % of total quantity.
44	IGES RELEASE DEVICE ELECTRICAL	Nos.	1	10% of total quantity.
45	IGES RELEASE DEVICE MANUAL	Nos.	1	10% of total quantity.
46	IGES RELEASE DEVICE PNEUMATIC	Nos.	4	10% of total quantity.
47	IGES CYLINDER VALVE WITH SAFETY PRESSURE RELIEF DEVICE	Nos.	4	10% of total quantity.
48	IGES NOZZLES	Nos.	5	10% of total quantity.
49	INERT GAS RELEASE PUSH BUTTON	Nos.	1	10% of total quantity.
50	PRESSURE SWITCH	Nos.	1	10% of installed capacity
51	PRESSURE GAUGE	Nos.	1	10% of installed capacity
52	SOLENOID VALVE	Nos.	1	10% of installed capacity

767269/2022/TBG-TB ENG SR



CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)

TB-405-552-002

CONSULTANT: SJVN LTD.

Rev. 00

PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL

Page | 25 of 29

TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM

ANNEXURE-P

PAINTING SCHEDULE FOR FIRE PROTECTION SYSTEM

1. Paint requirement For Over-ground (GI Pipe) pipes normally empty but periodically charged with water .

SL No	Name of the item	Type	Number of coat	DFT of each layer in micron	Remark
1	Primer	Etch Primer: micaceous iron oxide (MIO)	2	6	
2	Final Paint	Synthetic Enamel paint (Long Oil Alkyd) to IS2932.	3	25	shade : RAL3000 PO RED
		Total DFT in micron		87	
Note: Surface preparation shall be done either by manually or by any other approved method.					

2. Paints for external surfaces protection of piping / fittings/ Structural steel, etc. (Carbon steel /Mild Steel) to be installed indoor and outdoor.

SL No	Name of the item	Type	Number of coat	DFT of each layer in micron	Remark
1	Primer	Red Oxide Zinc Phosphate primer to IS 12744 (Alkyd base)	1	30	
2	Final Paint	Synthetic Enamel paint (Long Oil Alkyd) to IS2932.	3	25	Shade: RAL3000 PO RED shade for structural steel: Dark Admiralty Grey colour shade 632
		Total DFT in micron		105	

3. Paints for external surfaces protection of Deluge valve and other Hydrant components etc. to be installed indoor and outdoor.

SL No	Name of the item	Type	Number of coat	DFT of each layer in micron	Remark
1	Primer	Zinc filled epoxy Primer	1	35	
2	Final Paint	Aliphatic Polyurethane	3	30	Shade : RAL3000 PO RED
		Total DFT in micron		125	
Note:					
1 Paint shall be as per IS 2932.					
2 Surface preparation shall be done by means of Degreasing and Mech. Cleaning with wire brushing/hand tool (SP6 as applicable).					

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 26 of 29

ANNEXURE- M**SUB-VENDOR LIST**

Bidder shall choose make of materials from list enclosed in Annexure-M to this section only. However, final applicable make is subject to ultimate customer approval. Bidder can provide another make that is not included in the list only if it is acceptable to ultimate customer without any cost implication to BHEL.

S.N.	ITEMS	APPROVED SUB-VENDOR	PLACE	REMARK
1	HYDRANT VALVES & BRANCH PIPE, NOZZLES & COUPLINGS	SHAH BHOGILAL JETHALAL & BROTHERS KALPANA VALVES MFG. CO. PVT. LTD. NEWAGE FIRE FIGHTING CO. LTD. SUKAN H SARKAR & COMPANY VENUS PUMP & ENGINEERING WORKS WINCO ASHOKA ENGINEERING COMPANY ASCO STRUMECH PVT. LTD.	AHMEDABAD KOLKATA SURENDRA NAGAR AHMEDABAD KOLKATA	ISI MARKED
2	STRAINERS (Y-TYPE & BASKET TYPE)	SAROJNI ENTERPRISES JAYPEE INDUSTRIES	NEW DELHI MUMBAI	ISI MARKED
3	FITTINGS & FLANGES	M S FITTINGS METAL LLOYDS BHARAT FORGE TUBE PRODUCTS NITIN PROFILE	KOLKATA MUMBAI PUNE BARODA BARODA	
4	MS/ GI ERW PIPES	JINDAL PIPES LTD. SURYA ROSHINI LTD. GOOD LUCK TUBES TATA GAJANAN TIJBES PVT. LTD. UTKARSH TUBES & PIPE LTD. NEZONE TUBES LIMITED APL APOLLO TUBES LIMITED DADU PIPES PVT. LTD. BHARAT TUBES CORPORATION SAIL MKK METAL SECTIONS PVT. LTD. MADRAS STEEL AND TUBES BHAWANI INDUSTRIES LIMITED TUBES INDIA LLOYDS LINE PIPES LTD. MOKSHI INDUSTRIES PVT. LTD. MUKAT TANKS & VESSELS PVT. LTD. MAHARASHTRA SEAMLESS LTD. SWASTIK PIPE LIMITED NAVRATAN PIPE AND PROFILE LTD. INDUS TUBES LTD. FUTNANI STEELS PVT. LTD.	GHAZIABAD BAHADUR GARH SIKANDRABAD JAMDESHPUR	ISI MARKED
5	FIRE HOSES	NEWAGE FIRE FIGHTING CO. LTD. CHATTARIA RUBBER SHAH BHOGILAL JETHALAL & BROTHERS ASHOKA ENGINEERING COMPANY ASCO STRUMECH PVT. LTD.	SURENDRA NAGAR BARUCH AHMEDABAD	ISI MARKED
6	HOSE REEL	NEWAGE FIRE FIGHTING CO. LTD.	SURENDRA NAGAR	

767269/2022/TBG-TB ENG SR

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 27 of 29

7	HOSE CABINET	NEWAGE FIRE FIGHTING CO. LTD. SHAH BHOGILAL JETHALAL & BROTHERS ASCO STRUMECH PVT. LTD. ASHOKA ENGINEERINGCOMPANY	SURENDRA NAGAR AHMEDABAD	
8	COATING & WRAPPING MATERIAL/TAPE	MP TAR PRODUCTS RUSTECH IWL	BHILAI MUMBAI	
9	DELUGE VALVES	HD FIRE PROTECT PVT. LTD.	THANE	UL/FM
10	SPRAY NOZZLES	HD FIRE PROTECT PVT. LTD. KIDDE (I) LTD. TYCO SHAH BHOGILAL JETHALAL & BROTHERS NEWAGE FIRE FIGHTING CO. LTD. FIRETECH EQUIPMENT & SYSTEMS ASCO STRUMECH PVT. LTD.	THANE MUMBAI USA AHMEDABAD SURENDRA NAGAR	UL/FM / LPCB/VDS APPROVED
11	QUARTZOID BULB SPRINKLERS	TYCO HD FIRE PROTECT PVT. LTD. NEWAGE FIRE FIGHTING CO. LTD	USA THANE SURENDRA NAGAR	UL/FM/ LPCB/ VDS
12	SOLENOID VALVE	ROTEX AVCON	BARODA MUMBAI	
13	MICROPROCESSOR BASED FIRE ALARM PANEL, DETECTORS & OTHER ALARM DEVICES	SCHRACK SECONET ESSER HONEYWELL AUTRONICA EST (EDWARD SIGNATURE SERIES) NOTIFIER BOSCH SIMPLEX	AUSTRIA GERMANY NORWAY USA FRANCE GERMANY USA	UL/FM/VDS APPROVED
14	CAST IRON GATE VALVE / BUTTERFLY VALVE	SHAH BHOGILAL JETHALAL & BROTHERS KALPANA VALVES MFG. CO. PVT. LTD. NEWAGE FIRE FIGHTING CO. LTD H SARKAR & COMPANY VENUS PUMP & ENGINEERING WORKS G.M. DALUI AND SONS PVT. LTD. KAMLA VALVES & ENGINEERING LEVCON VALVES PVT. LTD. FLUIDLINE VLAVES COMPANT PVT. LTD. A.V. VALVES LTD. ATAM VALVES PVT. LTD. LEADER VALVES LTD. CRESCENT VALVES MFG. CO. PVT. LTD. MICON VALVES (I) PVT. LTD. HAWA VALVES (INDIA) PVT. LTD. FLOSTEER ENGINEERS PVT. LTD.	AHMEDABAD KOLKATA SURENDRA NAGAR KOLKATA KOLKATA	ISI MARKED
15	AIR RELEASE VALVE	H SARKAR & COMPANY LEADER KALPANA VALVES MFG. CO. PVT. LTD. VENUS PUMP & ENGINEERING WORKS WINCO NEWAGE FIRE FIGHTING CO. LTD.	KOLKATA JALLANDAR KOLKATA KOLKATA AHMEDABAD SURENDRA NAGAR	
16	PRESSURE GAUGE	AN INSTRUMENTS H GURU MANOMETER FORBES MARSHALL (HYD) NEWAGE FIRE FIGHTING CO. LTD.	KOLKATA KOLKATA THANE HYDERABAD SURENDRA NAGAR	

767269/2022/TBG-TB ENG SR

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 28 of 29

17	PRESSURE SWITCH	INDFOS SWITZER SOR INC. DRESSER INDUSTRIES INC. NEWAGE FIRE FIGHTING CO. LTD.	GHAZIABAD CHENNAI USA USA SURENDRA NAGAR	
18	PAINT	SHALIMAR ASIAN PAINTS BERGER		
19	POWER & CONTROL CABLE	NICCO TORRENT POLYCAB DELTON PARAMOUNT		ISI MARKED
20	OPTICAL FIBER CABLE	FINOLEX POLYCAB		ISI MARKED
20	FIRE EXTINGUISHER	KANEX SAFEX		ISI MARKED



CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)

CONSULTANT: SJVN LTD.

PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL

TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM

TB-405-552-002

Rev. 00

Page | 29 of 29

ANNEXURE-'C'**Cable Sizes being procured by BHEL for Sub-Station****Control Cable**

Sno	Description
1	4cX6sq.mm Cu/HRPVC
2	4cX4sq.mm Cu/HRPVC
3	2CX2.5sq.mm Cu/HRPVC
4	5cX2.5sq.mm Cu/HRPVC
5	10cX2.5sq.mm Cu/HRPVC
6	14cX2.5sq.mm Cu/HRPVC
7	19cX2.5sq.mm Cu/HRPVC

Power Cable

<u>Sno</u>	<u>Description</u>
1	4CX4 mm2 Al/PVC
2	2CX6 mm2 Al/PVC
3	2Cx16 mm2 Al/PVC
4	4CX16 mm2 Al/PVC
5	3.5CX70 mm2 Al/PVC
6	3.5CX35 mm2 Al/PVC
7	3.5CX95 mm2 Al/PVC
8	1Cx70 Cu/XLPE
9	1CX400 mm2 Al/XLPE

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 1 of 13

SECTION-2 CUSTOMER EQUIPMENT SPECIFICATION

2.1. SCOPE OF WORK

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, engineering, manufacture, quality assurance, quality control, shop assembly, shop testing, packaging & delivery at site including insurance, unloading, site storage and preservation, in plant transportation at site, erection / installation, testing supervision, pre commissioning, successful commissioning, performance and acceptance testing, handing over to Employer and warrantee for two years of Fire Fighting System as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation. The scope of work covered under this section shall be read in conjunction with Section-1.

Unloading, storage at site and preservation, erection / installation, commissioning shall be in purchaser's scope, however **Supervision of Erection Testing & commissioning shall be in contractor's scope.*

2.1.1. Detailed Scope of Work

The scope of work shall be a comprehensive functional system complete in every respect including but not be limited to following

2.1.1.1. Main Scope

A. Fire Detection System

- i) One (1) Set of Fire alarm and detection system consisting of microprocessor based main fire alarm panel.
- ii) One (1) set of smoke detectors, heat detectors, QB detectors, manual pull stations, audio/visual combination devices.
- iii) One (1) set of air sampling smoke detection system for control room, HT Room and Control & Protection room in GIS Building complete with sampling pipe network, detectors, detector control assembly chart recorder/data log output, remote annunciation display panel, spares and tools etc., as described in the detailed specification.
- iv) One (1) set of LHS cable system complete with all associated accessories for all cable trays GIS building.
- v) One (1) set of cabling for various smoke/fire/heat detection systems, control signaling & monitoring system, auxiliary supply for complete fire detection and protection system.

B. Fire protection System

- i) Automatic High Velocity Water Spray system for fire protection of three (3) nos. of Shunt Reactor.
- ii) Medium velocity water sprays system for cable tunnel, cable rack / cable highway in covered trench and cable spreader room.
- iii) One (1) set of manual fire hydrant system complete with piping, pressure reducers, accessories, valves, hose pipes, triple purpose branch pipes fitted with nozzles and quick coupling ends and emulsifier branch pipe with fog type nozzles, steel hose boxes, first aid hose reels, spares & tools, suitable number

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 2 of 13

of deration valves(automatic/manual), drain valves at strategic locations etc., in switchyard as described in detailed specification.

- iv) The piping from tap off point to farthest point of fire protection systems, valves, strainers, accessories, pressure reducers, supports, at strategic locations etc. as described in detailed specification.
- v) Automatic inert gas fire extinguishing system for control room, HT Room and Control & Protection room in GIS Control Building complete with inert gas cylinders, manifolds, pressure reducing devices, cylinder valves, directional valves, pipes, discharge nozzles, bracket supports, hangers and such other fittings as necessary for the complete installation of the system.

2.1.1.2. Miscellaneous components and auxiliary system

2.1.1.2.1 Portable Fire extinguishers

- i) One (1) set of Portable and mobile type chemical fire extinguishers of carbon dioxide, foam, dry powder to be decided during detailed engineering.
- ii) One (1) set of sand and water buckets at necessary locations as required as per NFPA/National guidelines.

2.1.1.2.2. Safety Devices

- i) One (1) set of Safety kits comprising of safety masks, first aid box, artificial breathing apparatus, resuscitators etc. complete as per NFPA/Equivalent Standards. The kits are required to be placed in Control room, Switchyard.
- ii) A Lot of fluorescent directional signals to direct the personnel trapped inside to the escape route and stair cases to be decided during detailed engineering.
- iii) Any of the equipment not specifically mentioned but needed to make the system complete as per design and engineering of the system by the supplier as per recommendations of NFPA or any statutory body and good engineering practice shall be treated as though included, supplied and erected unless specifically excluded elsewhere without any financial implication. The system should be designed as per the requirements of NFPA. Design calculations are required to be submitted along with the bid. It will be preferable if the state of art equipment is used for fire detection & protection.
- iv) All major civil works like foundations, hume pipes for road crossing, pedestal etc. shall be in the scope of customer. However, contractor shall supply design calculations, drawings etc. for the above work. Minor civil works like chipping, supply of materials like inserts, clamping, channels, hangers, brackets, supports etc. to be provided by the purchaser for entire fire protection system.
- v) The bidder shall ensure a visit of statutory body's authorized representative is arranged at the conception stage, intermediate stage and at the finalization stage, so as to have the overall design as per NFPA guidelines. If required, necessary for clearance or approval of drawing/design of entire system from any statutory body shall be arranged by the Contractor.

2.1.1.3. Control, monitoring and related items and services

Coordination and provision of necessary contacts and/ or ports of the field detectors, audio/visuals devices, MCPs, repeater panel with main Fire Protection panel, Fire protection panel for integration with the plant SCADA system.

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 3 of 13

2.1.1.4. Common supplies and services

- i) Drawings, documents and design calculations.
- ii) Shop, assembly, inspection & tests.
- iii) Packaging, handling and site storage.
- iv) Delivery, installation and commissioning.
- v) Tools and instruments.
- vi) Spare parts
- vii) Field/touch-up painting including all painting materials.

2.1.1.5. Completeness of System

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s)/best international practices.

2.2. STANDARDS & REGULATIONS

The design, manufacture and testing of the various equipment covered under this specification shall comply with the requirements of the latest edition of the relevant IEC/IS/IEEE/ISO standards only. Preference for latest IEC standards for particular equipment / system shall be governed over IEEE/ IS/ ISO standards. Further rules, guide lines and standard laid down by international/ national agency shall be applicable in this specification.

The relevant abstract (in soft / hard copy) of all referred standards shall be provided free of cost during engineering stage for facilitating review/ approval of submitted drawing/documents.

2.3. PARAMETERS AND GUARANTEES

2.3.1. Special design & Layout Condition

2.3.1.2. System requirement

The fire-fighting system shall have smoke sensors, temperature detector bulbs, deluge valves, water sprinkler system, piping, fittings, fire hoses, portable fire extinguishers, control panels etc. to complete the system.

The fire-fighting system shall have suitable extinguishing media, installations and control of fixed systems and extinguishing equipment with suitable fire detectors, alarm and signaling systems with signal initiation, transmission, notification and annunciation along with other items required to complete the system in all respect.

2.3.1.3. Fire detection, alarm and supervision

The fire alarm and detection system shall be a completely supervised fire alarm reporting system, which shall be activated into the alarm mode by the activation of any of the alarm initiating devices in the event of fire. The system shall remain in the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal. All the connections necessary for making the system functional shall be in accordance with relevant NFPA Standards.

Each fire alarm system shall consist of one central unit receiving the signals from the detectors grouped in lines for each supervised area separately. The supervised area shall be same or part of the corresponding fire-fighting zone defined.

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 4 of 13

All alarms coming from the detectors shall be line wise transmitted to the main fire alarm panel for each respective supervised area/zone/sector. The alarms of this system shall be transferred first to the pertaining panels of the respective area/zone/sector for activating the fire suppression systems and then be transferred to the main fire alarm panel for each line. In parallel, each line shall be printed out on a fire alarm printer and indicated at the main mimic control panel.

Smoke detection system, Excitation cubicles, control rooms, computer and communication rooms and offices shall be provided with adequate smoke detection system for the earliest possible warning of a potential fire in incipient stage.

Cable spreading area including cable trays shall also be provided with necessary smoke detectors.

Suitable interfaces shall be provided for supervision of the real time data through plant SCADA. Provision for multiple alarm levels of at least three (3) levels with programmable relays shall be made.

2.3.1.4. Special design considerations

- i) A looped conduit system shall be provided so that if the conduit and all the conductors get severed at any point, the initiating device circuit, signal line circuit and notification appliance circuit shall remain functional.
- ii) The implementation of the communication technology for fire signaling system shall be such to compensate for any failure to communicate a signal by eliminating the risk of missing even a single fire alarm signal.
- iii) Addressable system in the control panel shall be advanced microcomputer based system.
- iv) The time delay between the activation of an initiating device and the automatic activation of a local fire safety function shall not exceed ten (10) seconds.
- v) Detectors shall be located at strategic position and arranged in zones (as per relevant International Standards) to facilitate proper indication of fire location, transmission of audio-visual signals to fire control panels and actuation of the appropriate fire-fighting system.
- vi) Detectors installed in concealed areas shall have suitable visual indication in a visibly located area. Smoke detectors shall not be installed until construction is essentially complete and the building thoroughly cleaned.
- vii) All the systems and equipment of the fire-fighting system shall be tested and installed in accordance with the relevant standards and specifications.
- viii) The equipment and all its components shall be corrosion resistant and all the system devices/ components shall be located and mounted so that accidental operation or failure is not caused by vibration or jarring.
- ix) The Contractor shall coordinate with the Ventilation and air conditioning Contractor for designing the ventilation system providing necessary means and pressure to evacuate smoke and toxic particles from the place of origin to the outdoors in a manner that it does not interfere with the operation of plant and to allow for emergency access and exits.
- x) Necessary smoke and heat venting shall be planned for areas identified by fire risk evaluation, carried out by the Contractor, where either the heat or smoke or both shall be vented from its place of origin

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 5 of 13

directly to the outdoors. The Contractor shall ensure the necessary co-ordination with ventilation contractor for the same to ensure proper functioning in emergency situations.

2.3.2. Rating and Functional Characteristics

The system and equipment shall be designed, built, tested and installed to the latest revisions of the applicable NFPA standards.

2.3.3. Performance Criteria and Guarantee

The fire-fighting system along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. It is the responsibility of the Contractor to supply the equipment as per guaranteed technical particulars and shall also guarantee the reliability and performance.

These shall include at least the following:

- i) Performance of deluge indicating coverage,
- ii) Flow rates at various locations,
- iii) Pressure at fire hydrants.

2.4. DESIGN AND CONSTRUCTION

2.4.1. Fire alarm, supervision and signaling system

2.4.1.1. Fire detection, alarm and supervision

The fire alarm and detection system shall be a completely supervised fire alarm reporting system, which shall be activated into the alarm mode by the activation of any of the alarm initiating devices in the event of fire. The system shall remain in the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal.

All alarms coming from the detectors shall be line wise transmitted to the main fire alarm panel. The alarms of the system shall be transferred first to the respective panels for activating the fire suppression systems. In parallel, each line shall be printed out on a fire alarm printer and indicated at the main mimic panel.

2.4.1.2. Power supplies

Fire alarm systems shall be provided with at least two independent and reliable power supplies, one primary and one secondary (standby), each of which shall be of adequate capacity for the application and performance of the fire alarm system. The Contractor shall coordinate with the plant DC system manufacturer in designing and supplying the necessary cables, connections, interfaces etc. for the secondary power supply of the fire alarm panel. The Contractor shall fully ensure that the changeover from primary supply to secondary supply and vice-versa shall be fully automatic without affecting the transmission of signal via the fire reporting system upon operation of the initiating device.

2.4.1.3. Fire alarm control panels

The fire alarm control panel shall provide automatic, supervised, multi zone detection and alarm system. Each fire alarm panel shall be of modular type, installed in a mounted steel cabinet with hinged door and cylindrical lock. The panels shall be clean, uncluttered and orderly assembled containing all necessary operating and supervising elements/ components, using a solid state technique. The start-up shall be automatic after restoration of power either primary or secondary. Signals and LEDs/LCDs together with

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 6 of 13

visual annunciation shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system as an integral part of the control panel with suitable identification.

The operational features of the modules shall have at least the following. Other additional features required to make the system fully functional shall also be incorporated in accordance with relevant standards.

1. Monitoring electrical supervision of different circuits viz. initiating device circuits, circuits used for supervisory signal services viz. sprinkler water-flow, water level indicators etc.
2. Monitoring electrical supervision of power supply, transmitter tripping circuit integrity etc.
3. Trouble buzzer and trouble LEDs/LCDs against any fault due to loss of power supply, single break, open, or ground fault condition, panel fault and panel door open etc. impeding the normal functioning of the system,
4. Evacuation alarm signal switch and transmitter disconnect switch
5. Confirmation or verification of all smoke and heat detectors
6. Monitoring and control of fire sprinkler system, release of deluge system and other fire extinguishing system
7. Control panels and field panels shall have suitable software programme enabling expansion and modification of the system without replacement of hardware or firmware viz addition or deletion of zones etc.
8. Suitable number of signals shall be provided in the fire control panel to shut of the air handling unit and air conditioning dampers/louvers of each zone/complete system of ventilation network

An alarm condition in the circuit which shall automatically annunciate in the mimic and shall have at least the following functions to make the system fully functional. These alarms shall also be printed out.

- i) Transmission of signals to the plant SCADA system
- ii) Transmission of signal to the station security and surveillance system
- iii) Transmission of signal over the telephonic fire reporting system
- iv) Visual indication of the alarm device on the fire panel control panel display
- v) Continuous operation and sounding of alarm notification appliances as per the applicable standards
- vi) Operation of smoke control system and de-activation of air handling units in the alarmed area
- vii) Automatic discharge of the respective fire suppression system with maximum 15 seconds delay for deluge system and 30 seconds for wet pipe system.

Provision of necessary contacts/ports for control, monitoring, and supervision and alarm functions shall be made in the fire alarm control panels for duplicating these functions in plant SCADA system.

Unacknowledged alarm signals shall not be interrupted if a fault on a fire detector circuit or a signaling line circuit occurs while there is an alarm condition on that circuit.

Fire alarms, supervisory signals and trouble signals shall be distinctively and descriptively annunciated Signs and evacuation signals for deluge areas, the warning signs and releasing signs according to applicable codes may be installed. Fluorescent type exit and evacuation route signs shall be installed throughout the plant.

2.4.1.4. Automatic fire detectors

The detectors spacing and rating shall be in accordance with the applicable standards/codes and shall have UL approval. The smoke detectors shall be designed with minimised effect of environmental conditions like air velocity, altitude, humidity, temperature, colour of smoke, electrical and mechanical influences like abnormal pressure or vibration and the influence of aerosols and any particulate matter. It shall be plug-in type with detector base containing terminals for making connections. The detectors shall be assembled and

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 7 of 13

engineered for flush or surface ceiling mounting with a standard outlet box. Provision of visual indication of detector's alarm condition shall be visible from a distance of six (6) m and visually different from indications of other conditions. The openings of the smoke entry shall be at least thirty (30) mm below the ceiling level assumed to be smooth and flat.

1. Ionization detectors: Ionization type smoke detectors shall be of dual chamber type responsive to both visible and invisible particles of combustion.
A pilot light shall indicate the alarm status of the detectors.
2. Photo-electric detectors: Photo-electric detectors shall have an obscuration rate in accordance with suitable standards. Detectors shall not initiate alarm during failure of its LED light source.
3. Thermal detectors: Thermal/ heat detectors shall be designed to operate when the rate of temperature rise at the detectors exceeds a predetermined value irrespective of the actual temperature. It shall be possible to reset detectors after attending the alarm.

Any other suitable type detectors required can be acceptable subject to acceptance during detailed engineering.

2.4.1.5. Manual pull stations

The manual pull stations shall preferably be located at access ways within a distance of 1.5 m from the exit doorway opening at each exit on each floor and distance to the nearest pull station measured horizontally on the same floor shall normally not to exceed 50 m. The coded manual pull station shall produce at least three (3) repetitions of the coded signal, with each repetition to consist of at least three impulses. The lever of the manual pull stations shall get locked after manual activation till it is reset. The front colour of the station shall be fire red with white inscription as per relevant standards.

2.4.1.6. Fire alarm printing

Fire alarms printing shall be printed in the alarm printer installed in the Central control room.

2.4.1.7. Fire alarm bus interface

Signals going to the alarm printer shall also be transferred to the main data logger via a bus coupler system in the sequence they occur. The signals shall be stored in the main data logger for at least one year, shall be reachable via the bus system from the common visual display unit, and be printed out through alarm/ event printer on request.

2.4.1.8. Fire telephone

An emergency fire telephone system shall be installed throughout the plant based on a two-way communication system connecting the individual locations with the central control room. Contractor to interface Fire Alarm Panel with the Public Addressable System of mail plant.

2.4.1.9. Notification devices

If an alarm in a fire zone occurs, electric hooters/bells/horns/ speakers, light or text splays providing audible, tactile, or visible outputs or any combination thereof shall be actuated. The number of these items shall be sufficient to alert the complete zone. These devices shall have separate screw terminal for each conductor and the sounders/audible appliances shall generate sound in the range of 500-1000Hz different from the equipments and other devices provided in the area and in the building.

Visual notification appliances shall conform to the applicable standards and shall be surface mounted.

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 8 of 13

2.4.1.10. Air Sampling Smoke Detection System

The system shall include but not be limited to the following:

1. Sampling Pipe Network
2. Detector
3. Filter
4. Aspirating Fan
5. Detector Control Assembly
6. Chart Recorder/Data Log Output
7. Digital Communication Port
8. Remote Annunciator Display Panel
9. Power Supplies

Each detection system shall have the capacity to analyze samples of air taken from up to 20,000 sq .ft. of floor area and detector shall be capable of continuous sampling of air from sampling ports located as defined by NFPA72, shall provide very early smoke pre-alarm and alarm levels and shall report any fault on the unit by a general fault output relay.

Digital Communication Port of the system shall comply with RS232 Protocol.

The common detector fault relay contacts shall be connected into the appropriate alarm indicating zone on the fire alarm panel in such a way that the detector fault or air flow fault would register a trouble signal on the alarm indicating zone and a common trouble signal on the Fire Alarm Control Panel(FACP).

Air Sampling Network Calculations shall be provided from a registered Computerized sampling pipe aspiration modeling program. The detailed calculations shall also be given.

2.4.1.11. Linear Heat Sensing Cable Module

Each linear heat sensing (LHS) cable control module shall be designed to achieve the following:-

- i) To receive signals from each circuit of LHS cable connected to the control module.
- ii) To supervise each Linear heat sensing (LHS) cable circuit.
- iii) To process the signals and display the alarm/trouble condition on graphic annunciation panel to be supplied with each LHS cable control module. The graphic annunciation panel shall indicate the line mimic diagram of the LHS cables connected to the particular control modules and the cable initiating the alarm signal.
- iv) To report the cable control module conditions to the Main FACP. Output signals from the LHS cable, control module shall be compatible with reception system in Main FACP.

The LHS cable control module shall be associated with Digital alarm point locator with 16 zones scanner to give information about the affected LHS cable provided and the distance of the point at which the fault is initiated.

2.4.1.12. Cables

The cable shall be FRLS and screened cables shall be provided wherever necessary to ensure satisfactory operation of the system.

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 9 of 13

The FRLS cables shall be of 1100V grade, 85 deg.C. rating stranded copper conductor, HRPVC insulations, cores laid up, overall screened with aluminized mylar tape with tinned copper drain wire, extruded FRLS HRPVC inner sheath, round wire/strip armor as per IS 1554 & as specified in the specification and extruded FRLS HRPVC overall sheath. The size of cable shall be decided during detailed engineering based on the laying conditions.

2.4.2. Fire Protection System

2.4.2.1. Hydrant systems and hose reels

Fire hydrants and its components shall be designed and installed in conformity to relevant code/standards.

Hose reels with shut-off nozzle shall preferably be installed in recesses so that they do not form obstruction on a route of escape and shall be located in accessible positions at each floor level adjacent to exits in corridors on exit routes. A tapping of 20mm dia. shall be taken from water hydrants for water supply to hose reels.

Each hose reel shall be provided with nozzle with shut-off arrangement, stop valve, hose reel, hub with sides, pressure gauge etc. as per IS: 884. It shall be swinging (180 degree) wall mounting type. The length of the hose shall be 30 m having diameter 20 N.B. Material of the hose reel shall be made of rubber conforming to IS: 444. Material of nozzle shall be as per IS: 8090.

The spacing of hydrants shall be in accordance to the relevant national/international standards. The space requirement, location, maximum overall size, component case, water supply for hose reels, materials, appliances etc. shall be in accordance with relevant standards. The hose stations shall be so positioned so that two streams can be directed to any location.

2.4.2.2. Water sprinkler and spray systems

Each of the high velocity water spray system shall consist of a deluge valve, pressure switches, distribution piping, nozzles, thermal/heat detectors and a deluge panel. The deluge panel shall provide a connection point from the deluge system to the powerhouse annunciation and detection system, as well as transferring the signal from the heat detectors to the electrically operated deluge valve.

Each deluge system shall consist of an electrically monitored isolating valve; normal dry/wet distribution piping, flow/ pressure switch and bulb type monitoring system which automatically gets activated at a rated temperature.

Each sprinkler system shall consist of an electrically monitored isolating valve; normal wet distribution piping flow/ pressure switch and glass type sprinklers which automatically get activated at a rated temperature.

All automatic sprinklers shall have temperature-sensitive sealing. The type, size and design of each sprinkler installation used in the system shall be appropriate to the hazards covered by the installation. All exposed metalwork in systems shall be efficiently earthed to prevent the metalwork becoming electrically charged. The temperature rating of a sprinkler shall not be less than 30°C greater than the highest expected ambient temperature of the location.

Sprinklers shall be suitably coated with corrosion-resistant material. The system design and equipment shall be in accordance with relevant standards. All sprinklers etc. shall be UL approved make.

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 10 of 13

2.4.2.3. Headers and piping

The fire header and piping shall be looped and of sufficient size to supply the flow requirements at any point in the loop considering the most direct path to be out of service. Fluid velocity in the main header, sub headers and branch pipes shall normally not exceed 2.5 m/s. Pipe sizes shall also be designed to accommodate any future expansion/ water demands.

The piping network shall be designed in such a way by using valves, strainer, and filters etc. for providing 100% redundancy supply for the sectionalized / fire zone in firefighting system. Painting of pipes shall be fire resistant in the required location such as transformer hall, reactor area etc.

Suitable Mechanical protection shall be provided for the pipes passing through public places in the project area as per statutory requirement.

2.4.2.4. Inert Gas System (Inert Gas as Per NFPA-2001)

It may be noted that Inert Gas System to be provided shall meet the requirements of NFPA-2001 (1996). Hence anything specified as mandatory in NFPA-2001, although not mentioned in this specification shall form part of total specification/scope of the work for the job to be executed. The type of gas shall be IG-541.

The centralized system shall be designed to protect the largest risk or the total risk in particular area.

The quantity of gas provide shall be sufficient for the risk protected (largest or total as defined) in each area with 100% standby for areas where a centralized system is specified. The inert gas suppression system shall be designed separately for each area. The system for every individual area shall have its own storage, distribution piping, nozzles, fire alarm, detection and actuation system, etc.

Both primary and standby supply shall be permanently connected to the distribution piping through manifold and arranged for easy and auto changeover.

In case the system is designed for the largest risk and there are several risks varying in size in particular area, the system shall permit use of required number of cylinders for any individual risk involved so that the concentration of gas in that risk does not exceed 43%.

The agent discharge shall be substantially completed in a nominal 60 seconds, or a shorter time. The measured discharge time is considered to be the time when the measuring device starts to record reduction of oxygen until the design oxygen reduction level is achieved.

2.5. AUXILIARY SYSTEM AND MISCELLANEOUS COMPONENTS

2.5.1. Portable fire extinguishers

The type and number of portable fire extinguishers shall be determined on the basis of classification of fires anticipated in the area, the construction and occupancy of the individual property, ambient-temperature conditions etc.

2.6. DRAWINGS, DOCUMENTS AND DESIGN CALCULATIONS

After award of contract, the contractor shall furnish all drawings, documents, design calculations, data, manuals & other necessary literature, pertaining to equipment offered by them & so specified under various clauses. A comprehensive list of all such drawings/documents planned to be submitted for reference/approval shall be provided beforehand for approval of the customer.

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 11 of 13

The list of drawings & documents to be furnished for approval / reference shall not be limited to the following:-

- i) Drawings, documents, design calculations literatures, manuals etc.
- ii) Drawings, documents, design calculations, literatures, manuals
- iii) Detailed quality assurance plan, giving complete specifications of the materials and specifications relating to inspection and testing of materials and finished components.
- iv) All drawings having bearing on civil foundations, equipments foundation details and loads.
- v) Arrangement, installation, foundation, plan, section, detailing of main equipment and sub-assemblies including piping, control & instrumentation system.
- vi) All Electrical, Hydraulic & Control Drawings such as Electrical Panels OGA, Cable Block & Termination Diagram, Schematic Diagram, JB/MB/Kiosk Diagram etc. in respect of this section.
- vii) All manufacturing drawings not specifically covered under approval/reference category shall be submitted for record and facilitate inspection of the component in the shop and assembly at site.

Any other drawings, documents, design calculations, literatures, manuals etc. not covered anywhere in the specification, but required to be furnished for approval / reference of employer for suitability of design to fulfill the scope of work.

2.7. SHOP ASSEMBLY, INSPECTION AND TESTS

2.7.1. Shop Tests

The motors, pipes, valves, deluge system, sprinkler system, strainers, inert gas system portable type extinguishers, automatic and manual detectors, control system, etc. to be supplied shall be tested as per relevant IEC/IS/NFPA/other Indian/international standards. These shall include at least the following:

- Verification of motor characteristics/ performance including material of the casing, shaft etc.,
- Verification of performance of suppression system, detectors of all types including aspirator type smoke detectors, notification devices, control system etc. for the specification intended,

Data sheet of all items for approval wherever applicable.

2.7.2. Routine tests

These shall at least include the following:

- Routine tests on all the types of motors, air sampling network, filters, all types of detectors, pipes, valves including deluge valves, portable type fire extinguishers, inert gas system etc. as per relevant Indian/ international standards,
- Control system equipment/ components shall be tested in accordance with applicable Indian/international standards including insulation tests

2.7.3. Type tests

Type tests shall verify that motors, filters, all types of pipes, valves and fittings including deluge valves, all type of detectors, control system components including panels perform satisfactorily at the rating assigned. The equipments/ system components proposed according to this specification shall be type tested at typical units in accordance with the relevant Indian/ international standards.

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 12 of 13

2.7.4. Field Tests

All field tests including tests during installation, pre-commissioning, commissioning, performance and field acceptance tests shall be conducted by the Contractor, in the presence of representative of the Employer.

The field tests shall be in accordance with, but not limited to, NFPA Standards. If the system shall be tested in sections, the same applies for each section. Any defects or leaks disclosed in the tests shall be duly mended/ repaired to meet the desired function.

Procedure to be adopted for conducting the operational, pre- commissioning, commissioning, performance and field acceptance tests shall be submitted well in advance, at least six (6) months before start of relevant testing, for approval of the Employer.

2.7.5. Tests during installation and pre commissioning

The tests at site should at least include the following. The tests for the piping system shall be completed prior to installation of the equipment in the pipes:

- Hydrostatic pressure tests of the whole piping system,
- Pressure-flow tests on water distribution system and supplies,
- Leakage test,
- Test for value of insulation as per relevant Indian/ international standards,
- Test for sensitivity range of all types of sensors/detectors,
- Calibration of the aspirator/ air sampling type smoke detectors and other detectors,
- Circuits and equipments shall be properly protected against the possibility of induced transients,
- The power supply shall be equipped with locking mechanism and marked in red with proper identification,
- Before installation all system components shall be checked for cleanliness and after installation, the systems shall be effectively flushed out with clean water and filled up for testing before the nozzles and discharge horns are fitted.

2.7.6. Commissioning tests

Functions that shall be initiated or controlled during a fire alarm condition and shall have, but shall not be limited to, the following operations in accordance with relevant safety and installation codes/standards:

- Verification of performance of suppression system, detectors of all types including aspirator type smoke detectors, notification devices, control system etc. for the specification intended,
- Elevator operation/recall,
- Operation of exit doors and release of fire and smoke dampers,
- Monitoring and initiation of self-contained automatic fire extinguishing systems and equipment,
- Control of GIS HVAC equipment to provide smoke control,
- Control of process, data processing and similar equipment as necessary during fire alarm conditions.

The power plant fire alarm system must be in any case, ready for operation prior to the commissioning of the first generating unit.

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC) CONSULTANT: SJVN LTD. PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	TB-405-552-002
		Rev. 00
		Page 13 of 13

2.7.7. Performance testing

After completion of commissioning tests and commissioning of complete system, the test service period of thirty (30) days shall follow before taking over. During this test service period, the system / installations must perform satisfactorily & if any defects are observed, same shall be rectified by contractor without any financial implication to employer.

2.8. PACKAGING, HANDLING AND SITE STORAGE

The Contractor shall pack all the consignment in sea worthy packaging strong enough to withstand rough handling during transit. Machine surface shall be suitably protected against scratches, corrosion, shocks, impact etc.

Packages shall be suitably and distinctly identified for type of handling and kind of storage.

2.9. SPARE PARTS

The spare parts mentioned here under are meant for use by the Employer during operation and maintenance stage and shall not be used as erection spares required during installation.

2.9.1. Mandatory Spare Parts

The Contractor shall supply the mandatory spare parts as per **Section-1**.

2.9.2. Recommended Spare Parts

The Contractor shall furnish the list of recommended spare parts at **Schedule-4 of Section-5**.



SECTION- 3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

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, equipment and services covered under other sections of tender documents 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 prevail.

3.1. PROJECT DETAILS

Name of the Project:	4x225MW, Arun-3 HEP, Nepal
Name of the Customer:	SAPDC
Name of Consultant :	SJVN

SJVN Arun-3 Power Development Company (P) Ltd. (SAPDC), a company promoted by SJVN Ltd., as a single shareholder company in Nepal having its registered office at Lokanthali, Kathmandu, Nepal has signed Project Development Agreement with Government of Nepal to plan, promote, organize & execute Arun-3 Hydroelectric Project (900 MW) in Sankhuwasabha District. of Nepal.

The bid prepared by the Bidder and all correspondence and documents related to the bid exchanged by the Bidder and the consultant/owner shall be written in the English, provided that any printed literature furnished by the Bidder may be written in another language, as long as such literature is accompanied by a translation in English, in which case, for purposes of interpretation of the bid, the translation shall govern.

3.2. Location & Land Availability:

The proposed project site is located at a distance of 50 km from Khandbari, the headquarters of Sankhuwa sabha District of Nepal. It is at about 240 km from Biratnagar and about 740 km from Kathmandu. The location details of the proposed project site are as indicated below:

- Latitude 27°30'N – 27° -35'N
- Longitude 87° -12'E – 88°-20'E
- Distance from Tumlingtar (domestic airport) town is.....About 68 km
- Distance of Kathmandu (international airport) from Tumlingtar.....About 660.km

3.3. Climatic Condition

Average max temp: 30° C

Average Minimum Temp: 20° C

Maximum river water temperature: 25°C

Minimum river water temperature: 10°C

Ambient Temperature for the Equipment: 40° C



3.4. Seismic Zone

The equipment shall be designed for operation in seismic zone IV for earthquake resistance. The equipment and each part of it shall be strong enough and sufficiently well connected to resist total operating stresses resulting from forces in normal operation, abnormal condition and forces superimposed due to occurrence of earthquakes of intensity which cause a ground acceleration of 0.16 g in vertical direction and 0.24 g in the other horizontal directions.

3.5. Transportation

Unless otherwise specified in the **Specification**, responsibility for arranging transportation of plant and equipment lies with the Contractor. The Contractor shall at its own risk and expense transport all plant and equipment to a destination specified in bid document. The contractor shall transport the contracted plant and equipment/ supplies through registered common carriers only.

The nearest major airport is at Kathmandu which is at a distance of 740km from Project Site Biratnagar is connected to Kathmandu by Road.

The major nearest seaport for the trans-shipment of heavy equipment to Nepal is Kolkata.

Other sea ports for imported equipment would be Mumbai or Chennai as convenient. The two sea ports Mumbai & Chennai are connected to Kolkata and Jogbani by rail as well as roads.

Railway transport is available from Kolkata and other locations of Indian Cities to the Nepal-India border only. The broad gauge line from Kolkata ends at Jogbani, Bihar. All rail freight for Nepal has to be unloaded there. The distance of Kolkata by rail route is about 800 km. From Jogbani, the road distance to the projects sites via Biratnagar is about 300km.

Road access to Arun-3 project from Kolkata to Jogbani is 600km; from Biratnagar to Project Area via Hile is 300km. Total distance to project area from Kolkata is 900km. Alternative route could be from Kolkata to Raxaul which is 800km, further from Birganj to Dhalkebar to Hile to Project Area which is 450km. Total distance Kolkata to Project Area is 1250km.

Local transportation, insurance and other services incidental to the delivery of facilities to be supplied from Employer's country (Schedule- 2 Items) shall be quoted separately.

3.6. Transport Limitation

The transport limitation by road from Jogbani to the project site is the governing factor for determining permissible package size and weight.

The existing roads allow the transport of the packages of the following size and weight. Size (in mm) (l x b x h) - 9700 x 6000 x 6000*

Weight (Tonnes) - 70R

Heaviest package to be transported with suitable number of axle for safe transportation of consignment for 70R bridge capacity.

* Height from the ground.



3.7. Salient features of Project

The salient features of Arun-3 HEP are as follows:

A. POWER HOUSE COMPLEX

- | | |
|-------------------------------|------------------------------------|
| i. Power House Cavern | Underground on Left bank |
| ii. Installed capacity | 900 MW |
| iii. No. of units | 4 |
| iv. Unit Capacity | 225 MW |
| v. Size of Power House Cavern | 179.50m (L) x 22.5m (W) x 49.5m(H) |

B. UNDERGROUND TRANSFORMER CAVERN

- | | |
|----------------------------|---|
| i. Size | 146.14m (L) x 16 m(W)x 23m(H) |
| ii. Transformer Type | Single Phase |
| iii. Number and rating | 13 nos. (including 1 spare),
15.75/420/ $\sqrt{3}$ kV, 50Hz, 92MVA |
| iv. Transformer Hall level | El. 552 m |

C. Switchyard & Transmission

- | | |
|-------------------------|---|
| i. Type of Switching | Gas Insulated Substation and Pothead Yard |
| ii. Size | 207m (L) x 106m (W) |
| iii. Switchyard level | El. 557 m |
| iv. Transmission System | 400kV Arun III HEP – Muzzafarpur via
Dhalkebar D/c Quad Moose
Lines with LILO of both circuits at
Dhalkebar 400/220kV substation |

3.7.1. SYSTEM PARAMETERS

1	Continuous current carrying capacity (rms) at 40° C ambient temperature.	2000A (min)
2	Short time current carrying Capacity	50kA for 1sec
3	Voltage	400KV/420kV (rms) (Nom/Max)
4	Frequency	50Hz
5	System neutral earthing	Effectively earthed
6	Insulation Level	
a	One minute Dry Power frequency Withstand Voltage (kV rms)	630
b	One minute Wet power frequency Withstand Voltage (rms)	630
7	Switching Impulse withstand(250/2500 microsec.) voltage (kV peak)	1050
8	Impulse Withstand Voltage of arrester housing with 1.2/50 micro sec wave.	1425 kVp
9	Creepage distance	25 (mm/kV)
10	Radio Interference voltage at 320kV	As per CEA guidelines



3.7.2. AUXILIARY POWER SUPPLY

3.7.2.1. AC power

Three-phase system with grounded neutral for feeding three-phase and one-phase consumers (connected between phase and neutral), 415/240V $\pm$ 10% and 50Hz, -5% to +3 %. All motors and other electrical apparatus should be designed to work continuously under, -5% to +3 % frequency variation and $\pm$ 10% voltage variation.

3.7.2.2. DC power

DC Systems, ungrounded, with earth fault detection 220V plus (+) 10% and minus (-) 20% for the supply of main control circuits for high and medium voltage switchgear, protection circuits and to other larger essentials loads. Other voltage systems eventually needed, shall be generated from the above systems by means of dc/dc converters, inverters etc.

3.7.2.3. Deleted

3.7.2.4. Cabling & wiring

Wiring within cubicles and equipment enclosures shall conform to requirements of this section unless otherwise specified. Control wiring shall be single / stranded copper subjected to prior approval by purchaser during detailed engineering and shall not be smaller than 2.5 Sq. mm, except as otherwise agreed by the purchaser.

All Distribution Boards, Control & Protection panels, Motor Control control panels etc. shall be supplied completely wired internally up to the terminal blocks ready to receive purchaser control cable.

All inter cubicle and inter panel wiring and connections between panels of same Distribution Board, Control & Protection panels, Motor Control panels including all bus wiring for AC and DC supplies shall be provided by the tenderer.

Larger size wiring shall be used where needed for the current carrying capacity requirements.

Cables shall have at least 1000 V PVC insulation except for 220V DC and telemetering or communication system equipment for which 650V and 300 V ratings respectively are acceptable.

For current and potential transformer secondary circuits the minimum cross section of the conductors shall not be less than 4.0 Sq. mm.

Wiring shall terminate at terminal blocks at one side only. Where tap connections are required, they shall be made on terminal blocks. Wiring shall be neatly arranged and laid in wire ways accessible from the front door.

Engraved core identification ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire.

Each cubical shall be provided with an earthing bar (PE) of sufficient cross section carrying any possible fault current without undue heating. All metallic parts of the cubicle not forming part of the live circuits, all instrument transformer terminals to be earthed and other earthing terminals as well as all cable screens and PE-wires shall be connected to the earthing bar.



3.7.2.5. Power outlets

Power outlet for utilities such as electric drills, welding equipment etc., shall be provided in all floors of the powerhouse to enable repair and maintenance works to be done locally/ in-situ.

3.7.2.6. Terminal blocks

The terminal blocks shall be located to allow a neat and easy connection work and shall be safely accessible while the equipment is in service. Control circuits and power circuits shall be completely separated by use of divided or separate terminal blocks. Power terminal blocks shall be rated in accordance with applicable standards, and shall be provided with covers.

Terminal blocks shall be 1100V grade and have continuous rating to carry the maximum expected current on the terminals.

Terminal blocks 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 such 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.

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/PT flexible circuits	Minimum of two of 2.5 sq. mm copper
All CT/ PT Circuits flexible	Minimum of 2 nos. of 6 sq. mm copper

The arrangements shall be made 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.

Wherever duplication of a terminal block is necessary it shall be achieved by solid bonding links.

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.

There shall be minimum clearance of 250 mm 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.



3.7.2.7. Protection requirement

For short circuit and overload protection of power and control circuits, air circuit breakers, moulded case circuit breakers or MCBs shall be used. Outlets from AC (and DC) distribution panels are protected in their respective panels.

3.7.2.8. Switches, Lamps & Instruments

General

Control switches, indicating lamps and instruments shall be arranged so that all parts are readily accessible for servicing without the necessity to remove other devices, terminal blocks or excessive amount of wiring.

All control switches and indicating devices mounted in cabinets and enclosures shall be visible with the doors closed.

Identification nameplates shall be provided for all control switches, indicating instruments and lamps, in accordance with clause "Nameplates".

Instruments and controls shall be located so that their dials, indicators and nameplates are clearly readable. Data for all instruments to be provided, including type, size, scale range, electrical ratings, nameplate and name of manufacturer, shall be furnished. Steel panels shall be provided for group mounting of the instruments.

All instruments shall be of an approved type and shall match, insofar as practicable, the other instruments with which they are associated; their dial type, scaled markings and units, type of connection and mounting, shall be co-coordinated. All piping and tubing required for instruments shall be furnished and installed. All instruments and control switches shall be furnished with necessary auxiliaries, i.e. resistors, shunts etc.

3.7.2.9. Control and Selector switches

The switches and push buttons shall be provided with ample contact ratings, suitable cam or block arrangements necessary for the control functions on 230 V AC or 220V DC circuits. The control switches used in mimic diagrams shall be of discrepancy type with built in lamp indication.

Control and Selector switches shall be rotary type with escutcheon plates clearly marked to show the function and positions. The switches shall be of sturdy construction suitable for mounting on panel front.

Switches with shrouding of live parts and sealing of contacts against dust ingress shall be provided.

Circuit breaker control switches shall have three positions and shall be spring return to "NEUTRAL" from "CLOSE" and "TRIP" positions and shall have pistol grip handles. They shall have at least two (2) contacts closing in close position, and two (2) contacts closing in trip position unless specified otherwise.

Ammeter and voltmeter selector switches shall have four stay out position with adequate number of contacts for three phase 4 wire system. These shall have oval handles. Ammeter selector switches shall have make before break type contacts to prevent open circuiting of CT secondaries. Contacts of



the switches shall be spring assisted and shall be of suitable material to give a long trouble free service.

3.7.2.10. Push buttons

Push-buttons shall be of spring return, push to actuate type. Their contacts shall be rated to make, continuously carry and break 10A at 230V AC and 0.5A at 220V DC.

All push buttons shall have one normally open and one normally closed contact, unless specified otherwise. The contact faces shall be of silver or silver alloy.

All push buttons shall be provided with integral escutcheon plates marked with its function. The colour of the button shall be as follows:

- Green : Breaker Close
- Red : Breaker Open
- Black : For overload reset

3.7.2.11. Indicating and signaling lamps

Each indicating and signaling lamp shall have a removable cap, which can be inscribed with wording and shall not be affected with the heat of the lamp.

Indicating lamps are preferably of LED type & low watt consumption and shall be replaceable from the front of the panel. The indicating and signaling lamps shall be of the same size and type.

Lamps shall be provided with series resistors, preferably built-in the lamps assembly.

The lamps shall have escutcheon plates marked with its function, wherever necessary.

Lamps shall have translucent lamp-covers of the following colours, as warranted by the application.

- Red : ACB's/MCCB's close
- Green : ACB's/MCCB's open
- White : Auto trip
- Amber : For all healthy conditions e.g. control supply
- Voilet : Circuit breaker spring charged
- Blue : For all alarm conditions (e.g. overload) Also for "SERVICE" & "TEST" positions indicators

Indication lamps should be located just above the associated push buttons/control switches. All indicating lamps shall be suitable for continuous operation at 90% to 110% of their rated voltage.

3.7.2.12. HRC Fuses

HRC-Fuses shall have visible operation indicators.

HRC-Fuses shall be mounted on fuses carriers, which are mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type of bases. In such cases one set of insulated fuse pulling handles shall be supplied with each switchgear.

HRC-Fuse rating shall be chosen by the tenderer depending upon the circuit requirements.



3.7.2.13. Indicating instruments and Meters

Instruments mounted on panels, shall be of the semi flush type back connected, matching pattern, shape, and of approved finish to present neat and fitting appearance consistent with functional requirements Mechanical quantity measuring instruments which are directly mounted on equipment shall have circular dials and shall be properly supported and guarded against accidental injury/breakage. These shall be placed in convenient locations.

The instruments shall accurately measure and indicate the quantity under all conditions of operation with minimum instrument errors. Changes in ambient temperature within the range prevailing at site shall not affect the accuracy Contact making instruments shall have contacts suitable for 240 V AC or 220 V DC circuits.

The reading scales on the dials shall be in metric units only and range shall be such that the normal operating values of the quantities are indicated in the middle 3rd of the scale. The dials pointer etc. shall be designed to facilitate accurate reading by minimizing parallax and glare from instrument window and by providing clear bold dial markings. The size of dial and length of the scales of the indicating instruments shall be large enough to suit the requirements. The scale plates of panel mounted indicating instruments shall have a permanent white mat finish with black graduations and the pointer shall also be of the black colour. Instruments mounted on panels shall be of flush type and shall be back connected. All instruments on a switchgear panel shall be of matching pattern, shape and finish so as to present a pleasing appearance consistent with the functional requirements.

All instruments shall conform to relevant International or national applicable standards. These shall be subjected to tests prior to dispatch. The instruments shall be shock, vibration and moisture proof. The electrical instruments shall withstand dielectric test of 2000 V RMS to ground for one (1) minute as per standards.

The coils of electrical instruments shall be designed for continuous operation at 110% of the full load current at instrument potential. The coil rating of the measuring instruments shall be coordinated with those of the associated instrument transformers (i.e. CTs, PTs, etc.) by the supplier. The VA burden of the instruments shall be as low as possible. The meters shall be of the first grade in respect of accuracy classification.

Energy meter shall be suitable for 3-phase, 4-wire unbalanced system and shall comply generally with the relevant standard. All instruments shall be tested in accordance with the requirements of relevant standards.

3.7.2.14. Integrating instruments

The Wh and VARh meters shall be of the semi-flush-mounted type. Each meter shall be connected to terminal blocks suitable for opening and short-circuiting for testing purposes. The meter cases shall be dust-tight and with removable covers. The meters shall be three-phase, three element, equipped with an impulse contact mechanism, potential free for remote metering purposes, and shall be suitable for continuous operation from secondary of potential transformers and from secondary of current transformers, with transformer ratios and connections indicated on the contract drawings.

The meters shall be provided with primary-rated, direct reading registers, with five or more digits and a suitable multiplier. The meters for the outgoing lines shall be of the two-way type and all meters shall have mechanism to prevent negative registration.



The meters shall have built in over-voltage protection and isolation according to IEC Publication 60521. The tolerance ambient temperature range of the meters shall be 0 to 45 degrees C.

The protection class of the Wh meters shall be 0.2 and the VARh meters 0.2 according to IEC Publication 60687.

3.7.2.15. Measuring converters

The converters shall be suitable for direct connection to the secondary circuits of the potential and current transformers used, or other sensors, each as they apply. The converters shall be static type, having all accessories to provide an output signal of 4-20 mA, filtered DC.

For the measuring converters the following minimum requirements shall be fulfilled:

Current transducers shall be single-phase, of accuracy class 0.5 or better. Voltage transducers shall be single-phase of accuracy class 0.5 or better. W and VAR transducers shall be two elements, three-phase. Accuracy class of the transducers shall be 0.5 or better.

3.7.2.16. Measuring transformers

All current and voltage transformers shall be completely encapsulated cast resin insulated type suitable for continuous operation at the temperature prevailing inside the switchgear enclosure, when the distribution board is operating at its rated condition and the outside ambient temperature is 40 deg.C.

All instrument transformers shall be able to withstand the thermal and mechanical stresses resulting from the maximum short circuit and momentary current ratings of the associated switchgear.

All instrument transformer shall have clear indelible polarity markings. All secondary terminals shall be wired to a separate terminal on an accessible terminal block where star-point formation and earthing shall be done.

All VTs shall have readily accessible HRC current limiting fuses on both primary and secondary sides. The class of insulation should be E or better.

The parameter & rating of CTs & PTs are minimum requirement & tentative only. Contactor shall submit the calculations for selection of CT/PT for approval to purchaser. Potential transformer secondary windings shall be rated 110 / $\sqrt{3}$ V Current transformer secondary windings shall have a rated current of 1A / 5A.

3.7.2.17. Nameplates and Labels

Each major and auxiliary item of equipment shall have a nameplate permanently affixed thereto, or as directed, showing in a legible and durable manner the serial number, name and address of the manufacture, rated capacity, speed, electrical characteristics, and other significant information, as applicable.

The module identification plate shall clearly give the feeder number and feeder designation wherever applicable. For single front switchboards, similar panel and board identification labels shall be provided at the rear also.



All name plates shall be of non rusting metal or 3-ply lamincoid with white engraved lettering on black back-ground, inscriptions and lettering sizes shall be as per their standard practice. Suitable plastic sticker labels shall be provided for easy identification of all equipment, located inside the panel/module. These labels shall be positioned so as to be clearly visible and shall give the device number, as mentioned in the module wiring drawings.

3.7.2.18. Motors

All electric motors for driving various equipment shall conform to relevant standards viz. IEC, BS or IS as applicable. The motor rating, torque characteristics, speed etc. shall be selected to suit the duty requirements.

Type of starter for motors shall be duly approved by the purchaser during detailed engineering. The detailed design calculation for selection of type of starters is to be submitted for approval. The priority for type of starters shall be in the following order:

1. Variable frequency drive
2. Soft starter
3. Star delta/ auto –transformer
4. Direct on-line starter

The enclosure of each motor shall be of the type best suited for the service conditions of the motor. The motor insulation shall be resistant to moisture, oil or oil vapor and the motors in general shall be so designed as to suit the tropical climate. Varnished cambric or glass insulation class F shall be used for connection from the windings to the terminals.

The terminal box shall be closed conduit box type conveniently located, and shall have means for terminating the external wiring for outdoor use. The motor terminals shall be of the stud type totally enclosed. Eye bolts or lugs shall be provided for lifting.

Space heaters to avoid condensation shall also be provided. Special type of motors, not adequately covered by these specifications, shall be offered for any special application, but these shall be subject to the approval of purchaser.

3.7.2.19. Space heaters

Space heater shall be provided in the Distribution Boards, Control & Protection panels, Motor Control panels etc. The space heaters shall be suitable for continuous operation on 240V AC, 50 HZ single phase supply, and shall be automatically controlled by thermostats. Necessary isolating switches and fuses shall also be provided.

3.7.2.20. Auxiliary relay, contacts and devices

All relays and timers in protective circuits shall be flush mounted on panel front with connections from the inside. They shall have transparent dust tight covers removable from the front. All protective relays shall have a draw out construction for easy replacement from the front. They shall either have built-in test facilities, or shall be provided with necessary test blocks and test switches located immediately below each relay. The auxiliary relays and timers may be furnished in non-draw out cases.

All AC auxiliary relays shall be suitable for operation with VTs and CTs secondaries.



DC auxiliary relays shall be designed for 220V DC unless otherwise specified and shall operate satisfactorily between 80% and 110% of the rated voltage. Relays shall have adequate thermal capacity for continuous operation in circuits in which they are used.

All protective relays and timers shall have at least two potentially free output contacts. Relays shall have contacts as required for protection schemes. Contacts of relays and timers shall be silver faced and shall have a spring action. Adequate number of terminals shall be available on the relay cases for applicable relaying schemes.

Suitable number of auxiliary contacts or auxiliary relays shall be provided with each VCB's / ACB's for indication, remote indication, annunciation and automatic changeover and interlocking scheme.

All protective relays, auxiliary relays and timers shall be provided with hand reset operation indicators (flag) for analysing the cause of operation.

3.7.2.21. Welding & NDT

Preparation of base material

Members to be joined by welding may be cut to shape and size by mechanical means such as shearing, machining, grinding, or by gas or arc cutting, to suit the conditions. Edges shall be shaped according to ASME requirements. Design of welded joints and selection of weld filler metal shall be in accordance with approved standards and shall allow thorough penetration and good fusion of the weld with the base metal. The edges of surfaces to be welded shall be sound metal free of visible defects such as laminations or defects caused by cutting operation at least 30 mm back from the edge of the weld, and free from rust, oil, grease, and other foreign matter.

The establishment of welding procedures, welder's qualifications shall conform to the requirements of the ASME Boiler and Pressure Vessel Code Section VIII and IX. The approved copy of the WPS & WPQR in accordance with the ASME requirements shall be submitted to the purchaser for review and record.

3.7.2.22. Field welding

Filler material required for field-welded joints shall be furnished by the Contractor. The Contractor shall perform all welding work at site in accordance with the applicable WPS. Only qualified welders shall be used for undertaking welding as per the applicable WPS. NDT shall be performed as per the approved drawings.

Preparation for field welding

All cutting, chamfering, and other shaping of metals necessary for the field connection shall be done as far as possible in the shop. Adequate temporary bolted field connections shall be provided to hold the assemblies rigidly and in proper alignment during shop and field assembly.

To ensure proper alignment during field erection, a minimum of two dowels shall be provided for each field connection between subassemblies. The holes shall be drilled and the dowels fitted at shop assembly after the subassemblies have been satisfactorily aligned. All stipulations for welding, structural work and other, shall be applied to fieldwork as well as to shop work, except where otherwise stated.



3.7.2.23. Painting

All the equipment furnished and installed by the Contractor shall be completely painted for final use, with the exception of those parts or surfaces that are expressly designated as unpainted. Surfaces to be painted shall receive the preparatory treatment and required number of coats. The Contractor shall perform all painting work in the shop, before shipment, followed by a final coat of paint at site after installation as per the standard procedure.

All materials, supplies, and articles furnished shall be the standard products of recognized reputable manufacturers. Colour schedule of equipment supplied shall be finalized during detailed design stage.

3.7.2.24. Galvanization

All materials to be galvanized shall be of the full dimensions shown or specified and all punching, cutting, drilling, screw tapping and the removal of burrs shall be completed before the galvanizing process commences. All galvanizing shall be done by the hot dip process with smelter, not less than ninety eight percent (98%) of which must be pure zinc. No alternative process shall be used without the approval of the purchaser. No components shall be galvanized which are likely to come into subsequent contact with oil. Bolts shall be completely galvanized including the threads, but the threads shall be left uncoated in the case of nuts.

The zinc coating shall be uniform, clean, smooth and as free from spangle as possible. In the case of component parts, the zinc coating shall weigh not less than 0.6 kg/m² over the area covered and be not less than 0.09mm in thickness. All galvanizing shall comply with the requirements of the relevant ASTM standards/Indian Standards. All galvanized parts shall be protected from injury to the zinc coating due to differential aeration and abrasion during the period of transit, storage and erection. Damaged areas of the coating shall be touched up with an approved zinc dust paint or other approved flake metallic compound.

3.7.2.25. Pumps

All pumps forming part of the generating units and other plant and equipment shall be of high performance requisite type (viz. centrifugal, rotary etc.) and rating, of reputed make, and shall be directly coupled to their driving motors. The pumps shall be of self-priming type and with proper sealing systems and protection.

The materials of construction of pumps in general shall suit the service conditions. The materials of construction of the pumps handling water, such as drainage & dewatering pumps, turbine top cover drainage pumps etc. shall be resistant to abrasive effects of silt in such water. The pumps shall operate quietly without undue noise and vibration in their full operating range of head and flow. They shall be easy to maintain.

3.7.2.26. Embedded parts, Anchor Bolts and Fasteners

All embedded anchor bolts, rods, pipes, welding plates and support plates shall be provided by contractor. Anchor bolts shall consist of a threaded steel rod installed inside a pipe sleeve to provide lateral adjustment after the sleeve is embedded. The threaded end of the rod shall be provided with two steel nuts and two steel washers to permit leveling and anchoring the equipment prior to grouting.

Approved types of expansion or chemical anchors shall be used where practicable for small equipment.



3.7.2.27. Rust Prevention and Protection during Transit:-

Bright steel parts including all machined surfaces shall be given a thick coat of tar or tallow or any other approved rust resisting paint in plain colour to prevent rusting during shipment and transport.

3.7.2.28. Civil Works

Civil foundations for equipment of the generating units and other plant and equipment will be prepared by the Purchaser in accordance with the basic design data to be supplied by the Contractor.

The Contractor shall provide design for foundations and install the concrete inserts/embedment; support steels and/or components for foundation /supports purpose, shall do any chipping / levelling works, denting / painting etc.

3.7.3. Erection, Testing, Commissioning and performance of Guarantee Tests

3.7.3.1. Testing and inspection

Materials used for construction of major & important sub-assemblies shall be thoroughly shop tested and inspected by the Contractor at his own expense prior to dispatch. Shop test shall comprise of routine test & type tests.

The shop tests and inspections shall be as spelt out in individual equipment specifications as dealt in succeeding sections but shall not be limited to the same. Any other tests and inspection not specifically listed but are otherwise considered essential and advisable shall also be conducted.

The Bidders shall furnish schedule of the shop tests and inspections on materials and equipment. Important tests/inspections shall be subject to witness by the purchaser for which the Contractor shall give sufficient advance notice. In case purchaser is unable to witness shop tests/inspections, the Contractor shall be so intimated and the tests/inspections may then be carried out in the absence of the Purchaser.

Equipment on which tests and inspections have been duly witnessed and approved by the Purchaser may be dispatched by the Contractor. Equipment on which tests and inspections have not been witnessed by the purchaser shall be dispatched only after the shop tests and inspection Certificates have been approved by the Purchaser.

3.7.3.2. Dimensional Checks and Visual Inspection

Dimensional checks shall be performed on all major parts, components and partial assemblies, especially when close tolerances and fits are involved (tolerance of shafts, between stationary and moving parts, connecting dimensions for the assembly with other supplies, etc.). If the dimensional checks show discrepancies in measurement, which may affect the fit, assembly or dismantling of the respective part or component, the same have to be corrected correspondingly. Such correction or modification shall, however, in no way lead to sacrifices with respect to reliability of operation or interchangeability, and shall be performed only after the agreement of the Owner has been obtained. If the correction or modification cannot be carried out in accordance with the terms mentioned above, the part or component concerned may be subject to rejection. Faulty machine parts or equipment shall by no means be delivered.



3.7.3.3. Functional Tests

Functional tests on partial assemblies and/or complete assemblies shall be carried out as much as possible already in the manufacturer's workshops. Such tests shall be performed as far as possible under operation-like conditions.

When requested by the Owner, the functional tests shall be repeated until full proof has been obtained that the functioning of the assemblies will comply with the requirements of the Contract Documents.

3.7.3.4. Erection, commissioning & field tests

The Contractor has to do all the work related to assembly, erection, testing and commissioning complete in all respects. All necessary tools, plants, labour, materials including consumables for performing installation, testing and pre-commissioning shall be provided by the Contractor.

The Contractor shall submit the necessary data/information, layout and foundation/support drawings well in advance. The Contractor shall provide and install the concrete inserts/embedment, support steels and/or components for foundation/supports purpose as per approved erection drawings and coordinate the activities with civil contractors to keep his activities in synchronism with civil work. All installation for foundation shall be verified and accepted by the Engineer.

The Contractor shall use anchor fasteners for installation of piping, fixtures, mountings, conduits, cabling, panels etc. Minor Chipping of concrete is permitted. However, taking support from reinforcement bars shall not be allowed.

3.7.3.5. Installation procedure

The Contractor shall submit six copies of all detailed programs and the procedures to be adopted for erection / installation, testing and commissioning well in advance, before start of erection activities/ installation.

The installation procedure shall also have a section "site quality assurance plan" containing erection data sheets / site protocols for various components. These sheets should specify site measurements/ inspections required to be made for ensuring proper installation.

3.7.3.6. Cable laying

Wiring between equipment enclosures shall be made with cables, laid in trenches and/or cable trays and in cable conduits. The Contractor shall submit for review to the Engineer a cable route layout-showing location of trenches, conduits and trays. All material for cable laying such as cable trays supports and fastening material shall be furnished and placed by the Contractor. Cables shall be properly fastened and marked where they enter enclosures by either cable clamps or nipples.

Cables in horizontal cable trays shall be fastened properly with clamps or plastic strips. Power and control cables shall be placed in separate trays or conduits. Cables shall be clearly marked at each terminal point and appropriate intermediate locations as per Standard.

Conduits shall be of heavy gauge rigid steel, hot-dip galvanized, cut square reamed, threaded and screwed tight at all joints.

Conduit entrances to pull boxes and switches shall have double lock nuts & insulating bushings. No running thread shall be used.



Flexible metallic conduit shall be used for connection to equipment, which are subject to vibration, and also for connection to level/limit/pressure switches.

3.7.3.7. Field inspection

The Contractor shall permit Engineer to perform inspections of the assembly which will include a complete verification of the assembly of all parts as to their levels, clearances, pertinent fits, alignments and quality of workmanship. The field supervisor of the Contractor shall provide Engineer with three (3) copies of all the clearances, tolerances and data of all pertinent fits, alignments and levels, so that the latter may repeat the Contractor's measurement, if desired.

Unless otherwise specified, any rejection based on the inspection will be reported to Contractor within fifteen (15) days.

3.7.3.8. Field tests

All field tests including tests during installation, pre-commissioning, commissioning, performance and field acceptance tests shall be conducted by the Contractor, in the presence of representative of the Employer. Procedure to be adopted for conducting these tests shall be submitted well in advance, before start of relevant testing, for approval of the Employer.

The equipment / system shall be deemed to be commissioned and ready for trial run only after successful operation for a test service period specified in sub clause "Performance Testing". In the event of any failure this period shall be repeated for any number of times till the successful operation as described above is achieved.

All test equipment and instruments shall be furnished by the Contractor and will remain the Contractor's property after the fulfillment of all field tests.

Any defects or leaks disclosed in the tests shall be duly mended/ repaired to meet the desired function and retested. All necessary materials and labour for performing all the above tests shall be provided by the Contractor.

The Contractor shall prepare written test certificates in a form agreed upon by the Contractor and Employer of all tests results and hand them over to the Employer in due time.

The design, location and approval tests of anchoring rings for the fixing of lifting apparatus necessary for assembly and dismantling of equipment and plant accessories shall be the responsibility of the Contractor.

3.7.3.9. Taking over of facilities

Taking over" means that the Facilities (or a specific part thereof where specified) have been completed operationally and structurally and put in a tight and clean condition, and that all work in respect of pre-commissioning of the Facilities or such specific part thereof has been completed and commissioning has been attained as per Technical Specifications. The contractor shall make formal request for taking over the facility to the EIC.

3.7.3.10. Operation acceptance

The operational acceptance by the Employer of the Facilities (or any part of the Facilities where the Contract provides for acceptance of the Facilities in parts), which certifies the Contractor's fulfillment



of the Contract in respect of Functional Guarantees of the Facilities (or the relevant part thereof) in accordance with the provisions of Specification.

3.7.3.11. Consumables, oils and Lubricant

The Contractor shall deliver to the Owner all equipment complete with initial fill of fluids, grease or lubricants, transformer oil, Nitrogen, SF6 gas and other used gases in non returnable drums / containers and replace any quantity used up or lost during installation and testing.

The oil used for the lubrication and oil pressure systems for the turbine, governor, shutoff valve and generator shall be preferably of the same type.

Supply

The Contractor shall furnish the following:

- (i) All oil for initial filling of all equipment supplied, plus additional oil equivalent to the first filling requirement of one unit.
- (ii) Grease if required for initial filling of all of the equipment, plus 10% additional.
- (iii) Gases for initial filling of all equipment supplied, plus 10 % additional quantity.
- (iv) Flushing fluids to flush and clean all systems.

3.7.3.12. Deleted:

3.7.3.13. Submission of Drawings, Documents, Manual, software, Calculations, Safety Margin Details etc.

All drawings and documents shall be submitted to purchaser in hard form as well as in editable soft form. Bidder shall submit Ten (10) number hard copies of the documents & drawings to purchaser for reference / review / approval. A comprehensive list of all such drawings/documents planned to be submitted for reference/approval shall be provided beforehand to the purchaser.

Loading drawings

For all larger pieces of Works which, due to their dimensions and/or weight and transport limitations, will require special means for their transportation, the Contractor shall submit binding loading drawings indicating dimensions, weights, etc., of the respective pieces of Works and the necessary trailer for its transportation to the site.

Foundation drawings

If a piece of works requires its own foundation or needs a special area for installation, the contractor shall submit drawings indicating all pertinent dimensions, static and dynamic loads, etc. They shall include all essential details required for proper design and construction of the foundations and/or buildings.

In addition, they shall include openings, sleeves, slopes and the arrangement of any supporting structure, i.e. base-frames or other steel constructions for permanent fixing or erection purposes.

If conduits are to be installed in the foundations, the relevant information such as diameter, length, and purpose shall be indicated on the drawings.



Arrangement drawings

All arrangement drawings shall be drawn to scale. The General Arrangement Drawings shall show the physical arrangement of Works (constructions, machines, complete switchgears, control panels, instrument cubicles, etc.), civil constructions (buildings, rooms, foundations, ducts, etc.) and reserved areas (for pipes, cables, lines, etc.) in relation to each other and to agreed co-ordinates and boundaries. Such drawings shall be prepared for the whole plot, for separate plots and for each building (building, hall, room, ducts and trenches, etc.).

Outline drawings

The Outline Drawing shall show all elements and the main dimensions of individual components where necessary in plan view, cross-section, side and top views. If reasonably possible such dimensions can be shown on Arrangement Drawings.

Design drawings

The Design Drawings shall include the shop drawings, assembly drawings, erection drawings, piping diagrams and piping arrangement drawings, etc., showing the dimensions, design and data of all constructions, apparatus and Works to be furnished under this Contract. The drawings shall - where applicable - substantially conform to the Contract Drawings and shall show:

- 3-D Assembly drawings for major components in hard and soft form.
- Details of manufacturing and treatment of major single work pieces specially manufactured for this Contract
- Assembly of the Works in plan and elevation with main dimensions Sub-assembly of the principal components of the Works with overall dimensions, adjustment and clearance tolerances, numbers of corresponding detail drawings
- Sub-assemblies in which the Contractor proposes to ship the Works
- All necessary details of the parts connecting to the Works supplied by others
- Location and sizes of auxiliary connections for oil, grease, water, air, electrical power etc.
- Location and size of the instruments and accessories provided
- Methods of lubrication and sealing
- Instructions for heat treatment, pressure tests, surface preparation and anticorrosive protection
- Full details of parts for which adjustment is provided or which are subject to wear
- Method and sequence of installation, field joints, erection and lifting devices, jacks, grout plugs, anchoring details, etc., if not shown on foundation drawings.

Installation drawings

The construction, mechanical, electrical and I & C Installation Drawings shall provide detailed information on the disposition of the various items of a system (e.g. lighting fixtures, socket outlets, connection boxes, transmitters, actuators, loudspeakers, telephones, pipes, valves, pumps, compressors, etc.) and of the piping and wiring respectively included in the installation or assembly. They shall be based on dimension drawings of cubicles, rooms, buildings or areas containing the Works.



Diagrams

Single-line diagrams

This is a simplified diagram of the essential electrical Works and their interconnections. Each circuit shall be represented by a single line only. It shall contain all required technical information of the Works represented, e.g. voltage, current, capacity, shortcircuit level, ratios, voltage variations, positive and zero sequence impedances, measuring transformer and protection relay indices, interlocking, kind of switch drive, code designation, etc. as applicable.

Circuit diagrams

The Circuit Diagrams shall show the power circuits in all the phases with the main apparatus as well as the pilot circuits (measuring and control circuits). It shall show in full the functioning of part or all installations, Works or circuits with all required technical details.

Block diagrams

The Block Diagrams shall be used to show in a simplified manner the main inter - relationships between the elements of a system by means of symbols, block symbols and pictures without necessarily showing all the connections. The symbols used for the individual kinds of components, e.g. servomotors, computing modules, etc., shall clearly be explained on the diagram or on an attached legend.

Logic diagrams

The Logic or Functional Diagrams shall be used for representation of logic and sequence controls and interlocking by showing only binary logic elements and their effect on the various process equipment disregarding their electrical realisation. Logic function elements (AND, OR, NOR, NAND, STORAGE, etc.) shall be used for processing and combining binary signals.

Terminal diagrams

Such diagrams shall be prepared for any type of terminal box, marshalling rack, control cubicle, switchboard, etc., and shall show the terminals (properly numbered) and the internal and/or external conductors (wires or cables) connected to them.

The terminal diagram of each individual switchboard, terminal box, panel, etc., shall contain, but not be limited to the following information:

Protection co-ordination diagrams

These diagrams shall show in a graphical manner separately for each power supply circuit:

- A simplified single-line diagram of the circuit with technical data of all instrument transformers and relays
- Co-ordinated tripping curves of related protection devices
- Setting of the protection devices.

Emergency shutdown diagram

This diagram shall show the sequential steps and interdependencies during emergency closure.



Flow Charts

Flow charts shall be used for representing sequence of events for start / stop / shut down of the machine including associated equipment and auxiliaries.

Manuals

The following manuals covering all equipment of EM works shall be supplied as per the time schedule in both editable soft and hard form:-

Sr.No.	Manual Description
1.	Storage and preservation manual
2.	Safety manual
3.	Erection Manual
4.	Testing and commissioning manual
5.	Operation manual
6.	Maintenance manual
7.	Long term storage manual for Generator Transformer
8.	Long term storage manual for boxed up component / equipment.
9.	Repair process / procedure manual for equipment / system

As built drawing to be provided incorporating changes made during erection, testing and commissioning.

Drawing & Document Submission Schedule

Drawings & documents submission schedule of the EM package with the categorization (i.e. Approval / reference) & tentative submission date shall be submitted to purchaser.

Preliminary list of drawings under various categories have been prepared and appended at Section 1 of the Technical Specification.

3.8. DRAWINGS & DOCUMENTS TO BE SUBMITTED BY THE SUCCESSFUL BIDDER AFTER AWARD OF CONTRACT

One set of soft copies of all the approved drawings, documents including as built drawings shall be furnished by the Bidder to the Owner / Consultant in compact discs.

White prints or other non-reproducible drawings can be mailed folded. Blue prints shall generally not be used.

All drawings, prepared by the Bidder shall be as per IS: 696. Supplier's standard drawings are exempted from the above size limitation, unless his "standard" includes drawings of very large size or length. There shall be sufficient reference notes on the drawings to permit identification of all the drawings which are required for a proper understanding.

Bills of material and drawings shall be cross-referenced for easy identification.

All drawings shall be dimensioned in the metric system. Where drawings are usually made in the British (or other) system, they shall also have metric system dimensions in parentheses or below dimension line. Titles and written notations shall be in English. If the original is in another language it shall carry English translation. The translations will appear immediately on the drawings. Attached lists of translated words shall not be accepted.



Drawings and bills of material shall be identified by a numbering system to be mutually agreed later on. Any additional identification numbers or symbols that the Bidder selects to use for his own purposes are permissible so long as Owner's number is the prime means of identification.

The scale of the drawing shall be shown clearly in the title block of the drawing. Wherever possible, scales of drawings shall be:-

1:1	1 : 2.5	1 : 5	1 : 10	1 : 20	1 : 25
1:50	1 : 100	1 : 200	1 : 300	1 : 500	
1:1000	1 : 2000	1 : 5000			

All reproducible must be made from original drawings.

All revised drawing shall clearly indicate the number, date and subject to each revision. All the revisions carried out in the drawings shall be clearly identified and marked.

Drawing list shall be kept up-to-date, incorporating all new additions, cancellations and changes, and will be reissued periodically with Progress Report.

General arrangement drawings shall be submitted for approval to the Owner/ Consultant prior to the commencement of detail engineering by the Bidder. These drawings shall show to scale all major equipment including electrical equipment and building outlines and overall dimensions as well as tie-in dimensions and clearances shall be clearly indicated. Approved arrangement drawings shall be used as basis for design and preparation of detail drawing to be prepared by the Bidder. The Bidder shall furnish all the necessary drawings, data etc., of the plant/equipment with appropriate "Status" stamp in adequate no. of copies as indicated below:

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
			Prints	Prints	CDs
1	Drawings and Data Sheets	1	6	10	-
2	Drawings "As Built "	-	-	10	-
3	Type Test Reports	1	6	10	02
4	Erection Manuals	-	6	10	-
5	Operation and Maintenance Manuals	-	6	10	-
6	Manufacturing Quality Plan	1	6	10	-
7	Field Quality Plan	1	6	10	-
8	Inspection Test Reports	-	-	10	-

All instruction manuals / O&M Manual/"as built drawing": 10 copies each

3.8.1.1. QUALITY ASSURANCE PROGRAMME

The Bidder shall follow Quality Assurance Programme to ensure that the equipment and services under the scope of contract whether manufactured or performed at the Bidder's works or at his sub-vendor's premises or at the SAPDC's site or at any other place of work are in accordance with the technical specifications. Such programme shall be outlined by the Bidder and be submitted along with



the bid. The QA programme shall be generally in line with IS/ISO- 9001 and generally cover the following:

- ORGANISATION STRUCTURE FOR THE MANAGEMENT AND IMPLEMENTATION OF THE
- PROPOSED QUALITY ASSURANCE PROGRAMME
- QUALITY SYSTEM MANUAL
- DESIGN CONTROL SYSTEMS
- DOCUMENTATION AND DATA CONTROL SYSTEMS
- QUALIFICATION/EXPERIENCE OF BIDDER'S KEY PERSONNEL.
- PROCEDURE FOR PURCHASE OF MATERIAL, PARTS, COMPONENTS AND SELECTION OF SUB-VENDOR'S SERVICES INCLUDING VENDOR ANALYSIS, SOURCE INSPECTION, INCOMING RAW-MATERIAL INSPECTION, VERIFICATION OF MATERIALS PURCHASED, ETC.
- SYSTEM FOR SHOP MANUFACTURING AND SITE ERECTION CONTROLS INCLUDING PROCESS, FABRICATION AND ASSEMBLY.
- CONTROL OF NON-CONFORMING ITEMS AND SYSTEM FOR CORRECTIVE ACTIONS AND
- RESOLUTION OF DEVIATIONS.
- CONTROL OF CALIBRATION AND TESTING OF MEASURING / TESTING EQUIPMENT.
- SYSTEM FOR QUALITY AUDITS.
- SYSTEM FOR IDENTIFICATION AND APPRAISAL OF INSPECTION STATUS.
- SYSTEM FOR AUTHORISING RELEASE OF MANUFACTURED PRODUCT TO THE PURCHASER.
- SYSTEM FOR TRANSPORTATION /DELIVERY, HANDLING, STORAGE AND PRESERVATION.
- SYSTEM FOR MAINTENANCE OF RECORDS.

GENERAL REQUIREMENTS - QUALITY ASSURANCE

All materials, components and equipment covered under scope and its technical specifications shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme agreed mutually.

Minimum Quality Assurance Test Requirement (QATR) to be followed during Manufacturing and Field erection indicating requirement of various tests / inspections, on major equipment / items, to be carried out as stipulated in technical specification and standards mentioned therein, are attached hereto and are part of bidding documents.

Clarification, if any, on these quality assurance test requirement, raised by bidder shall be discussed and resolved during pre-bid meeting.

After the award of contract, the contractor shall submit the detailed Manufacturing & Field Quality Assurance Plans for complete equipment / material during detailed engineering in the format attached hereto (format of quality plan F-060-02 issue 2.0 rev. 01, Total 1 Page) for approval and acceptance by SAPDC/Consultant in line with technical specification, Quality Assurance – General & Test Requirements and detailed engineering.

Manufacturing Quality Assurance Plans shall detail out for all the components and equipment & various tests/inspection, to be carried out in conformity with relevant latest IEC/IS/ISO etc, quality practices and procedures to be followed by Contractor's / Subvendor's Quality Control Organization, the relevant reference documents, standards and acceptance norms etc. during all stages of material procurement, manufacture, assembly and final testing / factory acceptance tests.



The Field Quality Assurance Plans shall detail out the various tests/inspection to be carried out in conformity with relevant latest IEC/IS/ISO, quality practices and procedures etc. to be followed by the contractor's / sub-contractor's site Quality Control Organisation during various stages of site activities from receipt of material/equipment at site till final commissioning/ acceptance/handover.

All major items/ equipment/ components to be manufactured in house as well as procured from sub-vendors (Bought out Items, BOI) to be listed in the bid. Bidder shall submit Quality Assurance Plan submission schedule in the bid for above listed items in attached Format (duly filled in the format F-060-05 Issue 2.0 Rev. 00, Total 1 Page) in line with L2 Schedule.

For components / equipment / Bought out Items procured by the contractor for the purpose of the contract, the Contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the sub-vendors.

The quality plans called for from the sub-vendors shall detail out, during the various stages of manufacture and installation, the quality practices and procedures followed by the sub-vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc.

Such quality plans of the successful sub-vendors shall be finalized with the SAPDC/Consultant in line with requirement mentioned above and such approved Quality Plans shall form a part of the purchase order/contract between the contractor and his sub-vendor.

Within three weeks of the release of the purchase orders /contracts for such bought out items /components, a copy of the same without price details but together with the detailed purchase specifications and other related documents such as data sheet, drawings, quality plans and delivery conditions shall be furnished to the SAPDC/Consultant by contractor along with a report of the Purchase Orders placed, on the monthly basis, so far for the contract.

The Quality Plans shall be submitted on electronic media e.g. CD or E-mail in addition to hard copy, for review and approval of SAPDC/Consultant. After approval, the same shall be submitted in compiled form on CD-ROM by contractor.

For all spares, replacement items and additional similar items, the quality requirements/Quality Plans as agreed for the main equipment supply shall be applicable.

All material of construction shall be as per technical specification / approved drawings / GTP.

Contractor's Plant internal standards must be traceable to acceptable International / National standards & salient points of difference (if any) shall be clearly stated with submission of plant standards. The contractor shall furnish copies of reference documents, plant standards, acceptance norms, test and inspection procedure etc. as referred in Quality Plans along with Quality Plan to SAPDC/Consultant. These Quality Plans and reference documents/standards etc. will be subject to approval of SAPDC without which manufacturer shall not proceed. These documents shall form a part of the contract.

Tests on components and sub-assemblies shall be carried out at various stages of manufacturing, till the product undergoes the final tests in conformity with the relevant standards.

The Customer Hold Points (CHPs), identified in approved quality plan, i.e. testing checks which shall be carried out in the presence of the SAPDC, beyond which the work will not proceed without written consent of SAPDC's authorized representative.



The contractor / sub-vendor shall carry out routine test on 100% items at his works. The quantum of check / test for routine and acceptance test by SAPDC/Consultant shall be generally as per criteria / sampling plan defined in referred standards. Wherever standards have not been mentioned, quantum of check / test for routine / acceptance test shall be as agreed during detailed engineering.

The quantum of check when specified in percentage (%) / sampling basis shall be treated as per lot per sub-vendor. When the quantum of check is indicated to in whole no., then same quantum of check shall be applicable to each sub-vendor supplying the same equipment.

For sub-vendors identified during pre-award stage for submission of vendor details/ credentials (category "DR"), contractor shall submit documents in format F-060-01 after placement of award in the manner as specified as under prior to any procurement and within a month after placement of award or a period as agreed at the time of pre-award discussions.

The proposed sub-vendors should be registered vendors of the bidder and must have proven experience for successful operation for similar equipment / items / processes as mentioned elsewhere in technical specification.

Before assigning any portion of work to the sub-vendor, other than one specified and duly accepted in the contract, the contractor will take prior approval of BHEL/SAPDC.

Normally no request for change of sub-vendors or inclusion shall be entertained by SAPDC. But in exceptional circumstances, if the request for change of sub-vendors or inclusion is found reasonable and justified, then the same shall be entertained and the decision of SAPDC in this respect shall be final and binding. The time consumed for the change / inclusion of sub-vendors shall not be excluded from the stipulated time of the completion of the contract. This change shall not relieve the contractor from the responsibility to complete the work within stipulated time in any manner.

The contractor's proposal shall include sub-vendor's facilities established at the respective works, the process capability, process stabilization, Q.C. system followed, experience list etc. along with his own technical evaluation of sub-vendor. (Format F- 060-01 issue 2.0 rev. 01, Supplier / Sub-vendor Assessment Sheet, Total 14 pages).

However, whenever felt necessary, sub-vendor assessment will also be carried out by SAPDC/Consultant in accordance with the above procedure and by factory visits; for existing/proposed vendors/sub-vendors. This approval shall not relieve the contractor from any obligation, duty or responsibility under the contract & SAPDC shall not be responsible for any complications arising between the contractor and his subcontractor(s) / sub-vendor (s) and / or any other liabilities.

SAPDC/Consultant reserves the right to carry out quality audit and quality surveillance of the system and procedures of the contractor / or their sub-vendor. The contractor shall provide all necessary assistance to enable SAPDC/Consultant to carry out such details & surveillance including Quality Manuals, if required by SAPDC/Consultant.

All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirement of ASME section-VIII/IX or other International equivalent standard acceptable to SAPDC/Consultant. All welding/brazing procedures shall be submitted to SAPDC/Consultant/BHEL for review / verification prior to carrying out the welding/brazing. However, wherever required by the SAPDC/Consultant, tests shall be conducted in presence of SAPDC's authorized representative.



All Brazers, Welders and welding operators employed on any part of the contract either in Contractor/his sub-vendor's works or at site or elsewhere shall be qualified as per ASME section-VIII/IX or other equivalent International Standards acceptable to SAPDC/Consultant.

Unless otherwise proven and specifically agreed with SAPDC/Consultant, welding of dissimilar material and high alloy materials shall be carried out at shop only.

All non-destructive examination shall be performed in accordance with written procedures as per International Standards. The NDT operator shall be qualified as per SNT-TC-IA (of the American or Indian Society of non-destructive examination). NDT shall be recorded in a report, which include detail of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of correlation of the test report with the job.

All material used for equipment manufacture including castings and forgings, etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties; chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details.

Contractor shall submit Field Welding Schedule for field welding activities like field welding location, numbers, welding procedure to be used, requirements, codes and NDT requirement along with all supporting documents, like welding procedures, heat treatment procedures, NDT procedures, etc. to SAPDC/Consultant for review at least ninety days before schedule start of erection work at site.

Any other statutory requirements as applicable for the equipment / systems shall also be complied with.

The inspection calls (duly filled in the format F-060-06 Issue 2.0 Rev. 00, total 1 Page) shall be placed at least 06 weeks in advance for overseas inspections excluding India and 15 days in advance for inspections within India and Nepal.

Before submitting the inspection call to SAPDC for witnessing the Customer Hold Points (CHP's) and/or requesting SAPDC for issuance of Material Dispatch Clearance Certificate (MDCC) based on Test Certificate (TC) review / Certificate of Conformance (COC), the contractor shall ensure that all Drawings / documents / GTP / technical data sheet, relevant to respective CHP / MDCC requirement, has been duly approved /accepted / noted by SAPDC.

Contractor shall ensure readiness of offered equipment by all means, before raising such call to SAPDC to attend CHP inspections. In case, SAPDC engineer (s) on reaching at a place of inspection found that material is not ready for inspection due to whatsoever reason, the complete inspection expenditure of SAPDC engineer(s) as per actual shall be chargeable to the contractor.

Only calibrated testing & measuring instruments shall be used while performing tests during manufacturing and erection, testing & commissioning at site by the contractor. Copy of the calibration certificates will be submitted to SAPDC/Consultant by the contractor during inspection as an evidence.

Non-conformities observed during manufacturing, shop testing, handling, packaging, transportation, storage, preservation, erection, testing & commissioning are required to be intimated by the contractor (Format for reporting, F-060-04 issue 2.0 rev 01, Total 5 pages). The acceptance/rejection of the non-conformities will be at the discretion of SAPDC.



Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the acceptance of SAPDC. Action taken in accordance with decision of disposal of non-conformity for repair / rework / modification of the item / equipment and to prevent re-occurrence. The corrective and preventive action may involve modification of item / equipment, change in procedure and system etc. to achieve quality improvement at all stages and levels.

Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the SAPDC to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings etc.

No material shall be dispatched from the manufacturer's works before the same is duly accepted, subsequent to pre dispatch/final inspection including verification of records of all previous tests/inspection by SAPDC and duly authorised for Dispatch by issuance of Material Dispatch Clearance Certificate (MDCC).

The test reports of type tests conducted as per contract, in line with requirement stipulated in the technical specification / quality plan should be got accepted from SAPDC/Consultant before final inspection / issuance of MDCC.

All materials used or supplied shall be accompanied by valid and approved material certificates and tests and inspection reports. These certificates and reports shall indicate the heat numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it to ensure physical correlation and traceability of material vis-a-vis test certificate. Such identification no. shall remain same and verifiable for all stages of manufacturing and installation.

3.8.1.2. QA DOCUMENTATION

The contractor shall be required to submit the QA Documentation in two hard copies and two CD ROMs, as identified in respective quality plan.

Each QA Documentation shall have a project specific Cover Sheet bearing name and identification number of equipment including index of its contents with page control on each document. The QA Documentation file shall be progressively completed by the Contractor/sub-vendor to allow regular reviews by all parties during the manufacturing.

The final quality document will be compiled and issued at the final assembly place of equipment before despatch. However, CD-ROM may be issued not later than three weeks.

Before dispatch / commissioning of any equipment, the Contractor shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The Contractor will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.

The contractor shall be required to submit copies of the following quality assurance documents in original duly reviewed and accepted by contractor along with the request letter for issuance of MDCC (Material Dispatch Clearance Certificate):

- QUALITY PLAN CHECK LIST.
- MATERIAL MILL TEST REPORTS ON COMPONENTS AS SPECIFIED IN QUALITY PLAN.



- SKETCHES AND DRAWINGS USED FOR INDICATING THE METHOD OF TRACEABILITY OF THE
- RADIOGRAPHS TO THE LOCATION ON THE EQUIPMENT.
- NON-DESTRUCTIVE EXAMINATION RESULTS REPORTS INCLUDING INTERPRETATION REPORTS.
- CALIBRATION CERTIFICATE OF ALL METERS & MEASURING INSTRUMENTS PROPOSED TO
- BE SUPPLIED AS PART OF RELEVANT BILLING BREAKUP ITEM.
- ROUTINE TEST REPORTS FOR TESTING REQUIRED AS PER APPLICABLE CODES AND
- STANDARDS REFERRED IN THE SPECIFICATIONS.
- INSPECTION REPORTS DULY SIGNED BY AUTHORIZED REPRESENTATIVE OF SAPDC AND
- CONTRACTOR FOR THE AGREED CUSTOMER HOLD POINTS.
- ALL THE ACCEPTED DEVIATIONS SHALL BE INCLUDED WITH COMPLETE TECHNICAL DETAILS.
- LIST OF BALANCE POINTS IF ANY.
- CERTIFICATES IN RESPECT OF CALIBRATION, WELDERS & BRAZERS QUALIFICATION ETC.
- COPY OF ALL REFERENCE DRAWINGS AND REFERENCE TECHNICAL DOCUMENTS
- ACCEPTANCE OF TYPE TEST REPORTS BY SAPDC/CONSULTANT.

Similarly, the Contractor shall be required to submit two sets (two hard copies and two CD ROMs), containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/procedures, within 2 weeks after commissioning of individual system.

On release of QA Documentation by Inspector, one set of quality document shall be forwarded to Consultant and other set to SAPDC. For the particular case of phased deliveries, the complete quality document to the SAPDC/Consultant shall be issued not later than 3 weeks after the date of the last delivery of equipment.

ASSOCIATED DOCUMENTS / FORMATS

- F-060-01 VENDOR / SUB-VENDOR ASSESSMENT SHEET
- F-060-02 QUALITY PLAN SUBMISSION BY CONTRACTOR
- F-060-04 NON-CONFORMANCE REPORT (NCR)
- F-060-06 INSPECTION CALL REQUEST

3.8.1.3. Safety

Safety of personnel

All equipment and services provided under this contract shall abide by international standards commonly accepted in the hydroelectric utility industry for safety of personnel whether involved with operation or maintenance.

Safety of operation

All equipment and services provided under this contract shall abide by commonly accepted standards for safety of operation.

The various system and sub-systems supplied under this contract shall be designed to follow and operate under a clear hierarchical structure:

- Plant control level,
- Unit control level,



- Functional control level, functional drive group level,
- Local drive level.

Each hierarchical control level shall perform its specific tasks and always depend on the subordinate lower control levels. In general, should a higher control level failure occur, the lower control level shall not be affected and shall be able to control the power plant with full safety.

The Contractor shall accordingly build into the "Electrical & Mechanical System" adequate levels of autonomy, independence, redundancy and functional distribution to insure that safety is maintained at all times.

3.8.1.4. Earthing

Earthing terminals for equipment of these specifications shall form part of equipment supplies. The contractor shall connect the earthing conductors to these terminals as required.

Risers from earthing bus shall be in the scope of purchaser. However, extension from these risers to the equipment shall be in the scope of supplier in the Power House, Transformer Hall, Switchyard and Butterfly Valve House.

However, overall earthing arrangement required for HT panel, LT panel, DG set, motor & motor control panels etc. at isolated location such as Dam Site, TRT Outfall area and Surge Shaft either by pit earthing or counter poise etc. shall be in the scope of supplier including civil works, design, material supply (for main earthing risers, interconnection, charcoal, salt, Bentonite etc.), erection, testing & commissioning etc.

A copper ground bus, sized to carry maximum short circuit current, shall run along the entire length of panel structure and shall have terminal connector at each end for connection to station ground grid (50 X 6 mm G.I. flat).

Tests

Each panel shall be completely assembled, wired, adjusted and tested at the factory prior to shipment. The test shall include wiring continuity tests, insulation tests and functional tests to ensure satisfactory operation and control of individual equipment.

Special Cables

Special cables for specific purpose, as required, shall be supplied and installed by the Bidder.

3.8.1.5. Completeness of the specification

Any fittings, accessories, equipment or any other things required for successful commissioning of Arun-III Hydro Electric Project, though may not have been specifically mentioned in the specification but are usually necessary for the completeness of the equipment shall be deemed to be included in the specification and shall be supplied by the contractor without any extra cost to the Employer.

3.8.1.6. Packaging and Shipment

The Contractor shall provide such packing of the Goods as it is required to prevent their damage or deterioration during transit to their final destination as indicated in the Contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme



temperatures, salt and precipitation during transit and open storage. Packing case size and weights shall take into consideration, where appropriate, the remoteness of the final destination of Goods and the absence of heavy handling facilities at all points in transit.

The packing, marking and documentation within and outside the packages shall comply strictly with such special requirements as shall be expressly provided for in the Contract and, subject to any subsequent instruction ordered by the Employer consistent with the requirements of the Contract.

After unpacking of Goods the packing material shall become the property of Employer

The contractor shall wrap, pack and crate all plant included in the work or part thereof, suitable for shipment to a tropical location, facilitating proper handling and protection from damage in rail, truck, ocean or air shipment as applicable. An approved drying agent, such as Silica Gel, shall be packed in containers or packages holding plant which may be adversely affected by moisture or excessive humidity.

All packing crates shall be clearly marked before shipping to indicate the contract number, shipping address, volume, weight, name, number and unit number of the contents, slinging and weight bearing points.

All plant parts shall be marked to facilitate erection. Each packing crate shall contain a packing list in a waterproof envelope. Parts shall be described and also identified by their numbered marking in the packing list.

Three copies of the packing list shall be forwarded to the purchaser prior to dispatch. The ownership of packaging materials shall be of Employer. All wooden packaging crates and steel support structures shall be dumped to the designated area within 5kms of the power house as per the direction of Engineer in charge.

The supplier shall be entirely responsible for the insurance, shipment, handling and transportation.

The equipment shall not be dispatched by the Bidder from the place of manufacture to the site until the dispatch instructions are issued by the Owner.

3.8.1.7. PACKAGING, HANDLING AND SITE STORAGE

The Contractor shall pack all the consignment in sea worthy packaging strong enough to withstand rough handling during transit. Machine surface shall be suitably protected against scratches, corrosion, shocks, impact etc. Packages shall be suitably and distinctly identified for type of handling and kind of storage.

Electronic equipment shall be packaged, shipped and stored in anti-static packing. All packages shall be stored indoor. Packages containing electronic equipment shall be stored in humidity controlled environment.

The Bidder shall indicate the number of packages of consignment together with the size (L x W x H) and weight for transporting the equipment in the Bidding Document.



3.9. SPECIAL INSTRUCTIONS TO BIDDERS

General

The Bidder shall base the equipment design on the information given in this specification. The equipment shall be complete in all respects. Any item which is not specifically mentioned herein but found essential for safe and efficient operation and maintenance and satisfactory performance of the system shall be deemed to have been included in the scope of the Bidder. It shall be presumed that the Bidder has studied the site, all the drawings, tender documents and is fully aware of the scope of work involved and the site conditions prevailing.

3.10. Codes and Standards

- a) All equipment, systems and works covered under this specification shall comply, in all respect, with requirements of applicable latest statutes and that of latest editions of codes and standards. Latest regulations and safety & environmental requirements as applicable in India / state of installation shall also be complied with.
- b) All codes and standards mentioned shall mean as relevant and applicable to a particular equipment / system.
- c) All other codes/standards not covered in Section 1 / Section 2 but required for the plant and system offered shall also be referred / followed by the Bidder. The Bidder, along with the bid, shall submit a comprehensive list of codes and standards to be followed for various equipment / system.
- d) In all cases where IBR does not govern, German, American, British, ISO or other international standards established to be equivalent or superior to the codes specified are also acceptable. In the event of any conflict between the requirements of equivalent codes and standards and the requirements of Indian standards / regulations, the latter will govern unless specified otherwise in the specifications.
- e) The Bidder shall be responsible to be in possession of all the specified Codes / Standards and ensure reference to the same before submitting the offer/ bid.
- f) Mandatory codes / local regulations to be followed for safety, design, fabrication and operation of the switchyard shall be, followed:
- g) If the equipment supplied does not conform to the codes and standards mentioned in this specification, but is manufactured to the Bidder's own standard, developed as a result of his experience, is also acceptable provided the same is found to be superior to the above mentioned codes and standards. The Bidder shall identify such equipment and shall also present sufficient data to the Owner / Consultant to support his design and to establish the superiority. The design may be accepted by Owner/ his Consultants only if the Purchase / his consultant is satisfied that sufficient experience exists with the design proposed.
- h) Design not meeting the stipulations of the codes and standards will not be acceptable.
- i) Apart from various codes and standards mentioned in Section 1/2, the Manufacturer shall comply with other requirements of codes and standards mentioned in this Specification for detailed design, manufacture, testing, erection, construction etc.



Control System	IEEE – 122 , 1992
Metering / Dosing pumps	API 675 – 1987 (Positive displacement pumps – controlled volume) API 676 – 1987 (Positive displacement pumps – Rotary).
Centrifugal pumps	API 610 – 1990, ASME PTC 8.2 – 1965
Gear Box	API 613 – 1993 & AGMA 420 & 421
Coupling	API 671 – 1993
Structural	IS 1893 – 1991, IS 875-1992 & IS 800 – 1991
Pressure Vessel	ASME Sec. VIII, Div. 1 – 1995
Piping	ANSI B 31.1-1995 / 31.3 – 1993, IBR
Valve	API
Instrument	ISA, API
Electrical	As per specification attached & relevant
	IS/IEC
Tanks	API 650- 1993
Electrodes	AWS, IS
Painting	IS Standards
Performances Tests	
Overload test of crane and hoists	IS 3177

3.11. Deviations and Assumptions

Bidders requested to carefully examine and understand the specifications and seek clarifications, if required, to ensure that they have understood the specifications. The Bidder's offer should not carry any sections like clarifications, interpretations and/or assumptions. In the event of conflict between the Technical Specifications and the condition of contract, the requirements as indicated in the technical specification shall govern, unless confirmed otherwise by the Owner in writing before the award of contract, based on written request from the bidder for such a clarification.

In the event of conflict between requirements of any two clauses of the specification documents, the more stringent requirements shall apply, unless otherwise confirmed by the Owner in writing before the award of this contract, based on a written request from the Bidder for such clarification.

The Bidders are advised that while making their Bid Proposals and quoting prices, all terms and conditions of bidding documents may appropriately be taken into consideration. Bidders are required to furnish a certificate indicating their full compliance to the terms and conditions of the bidding documents.

3.12. Limit of Contract

Equipment furnished shall be complete in all respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/ or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions. All similar standard components/ parts of similar standard equipment provided shall be interchangeable with one another.

This review by the Owner's Engineer / Consultant may not indicate a thorough review of all dimensions, quantities and details of the equipment, materials, any devices or items indicative of the accuracy of the information submitted. This review and/ or approval by the Engineer shall not be



construed by the Bidder, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements specified under these specifications and documents.

3.13. Latent Defects

Notwithstanding the issue of the Take Over Certificate, the Contractor shall be responsible for making good with all possible speed any Latent Defect in any Works /equipment of the plant which appears at any time before the expiry of defect liability period. And shall remedy such defect at its own cost and expense. The latent defect liability period shall be a minimum of 5 years from the end of defect liability period. The defects to which this applies are defects in design, materials or workmanship or defects arising from any act or omission of the Contractor done or omitted prior to Take-over of the portion of the Plant affected by the defects or during the Warranty Period which a reasonable examination at the end of the Warranty Period would not have disclosed.

3.14. Defect Liability

The Contractor warrants that all the facilities or any part thereof are new, unused, and of the most recent or current models, and that they incorporate all recent improvements in design and materials, unless provided otherwise in the Contract.

The Contractor further warrants that the Plant and equipment shall be free from defects arising from any act or omission of the Contractor or arising from design, materials, and workmanship, under normal use in the conditions prevailing in the

If during the Defect Liability Period any defect should be found in the design, engineering, materials and workmanship of the Plant and equipment supplied or part thereof, the Contractor shall promptly, in consultation and agreement with the Employer regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise make good (as the Contractor shall, at its discretion, determine) such defect as well as any damage to the Facilities caused by such defect. The Contractor shall not be responsible for the repair, replacement or making good of any defect or of any damage to the Facilities arising out of or resulting from any of the following causes:

- (a) Improper operation or maintenance of the Plant and equipment by the Employer
- (b) Operation of the Facilities outside specifications provided in the Contract
- (c) Normal wear and tear.

3.15. Completion Schedule

The Bidder shall submit Time Bar chart indicating completion date of major activities such as submission of design data / calculations and drawings for approval, manufacturing of components / units, supply, inspection etc. without which the Tender shall not be considered. Time Bar Chart furnished shall afterwards form part of the contract and cannot be altered arbitrarily except Force Majeure conditions as may be agreed with the Owner.

3.16. Drawings & Documents for Owner's use and Archives

The Bidder shall submit all final drawings, documents, manuals for Owner's use and for reference / record required during course of operation and maintenance of the plant. Numbers of copies and their form (hard copy, electronic form, reproducible) to be submitted and the details of the documents, drawings, manual etc. to be furnished by the Bidder are described elsewhere in the specification.



Drawings, documents, calculation, data & Information to be submitted by the Bidder along with the offer:

Technical Data to be submitted with the Tender

- 1) List of performance tests proposed by the Bidder to demonstrate the guaranteed parameters for generator and other electrical equipment.
- 2) Specific energy consumption.
- 3) Type test certificates for major categories of equipment, issued by independent testing authority.
- 4) Guaranteed Technical Parameters.
- 5) Technical catalogues.
- 6) Manufacturing Quality Plan

Operation & Maintenance Manuals

Instruction manuals, presenting the basic categories of information for the operating and/or maintenance personnel, as detailed herein below shall be furnished by Bidder.

The instruction manuals shall present the following basic categories of information in particular complete and comprehensive manner and prepared for the use by operating and/or maintenance personnel.

- i. Instructions for initial commissioning, short duration and long duration shut down.
- ii. Instruction for operation, routine inspection and maintenance including preventive maintenance.
- iii. Recommendation for inspection points, method of inspection and period of inspection.
- iv. Information on detection, cause and rectification of troubles and faults.
- v. Instructions on normal repairs and overhaul.
- vi. Complete parts list with proper and complete identification (Tag nos./Serial nos. as shown in the respective approved drawings) and ordering information for all replaceable parts. The identification details of equivalent and alternative makes for these spare parts which are not manufacturer's own product shall also be listed.
- vii. List of all special tools and tackle & spares and instructions for use of such tools and tackle & spares.
- viii. One complete set of as built drawings of the entire systems.
- ix. The information shall be organized in a logical and orderly sequence. A general description of equipment including significant technical characteristics shall be included to familiarize operating and maintenance personnel with the equipment. Such description and technical characteristics shall not differ from the approved data.
- x. Necessary drawings, curves and other illustrations shall be included or copies of appropriate approved drawings shall be bound in the manuals. Tests, adjustment and calibration information, as appropriate, shall be included. Safety and other warning notices and installation, maintenance and operating cautions shall be emphasized.
- xi. Write-up, figures, part list etc., shall be clearly legible. The manuals shall be prepared on good quality paper securely bound in durable folders.
- xii. The instruction manuals shall be subject to Consultant's approval in the same fashion as that for drawings.
- xiii. Instruction manual shall give step by step procedure for Erection, testing and commissioning
- xiv. Operation, Maintenance and Repair Instruction manual shall also contain:
- xv. List of spare parts with ordering specifications and manufacturer's catalogues



- xvi. List of consumables, lubricants, chemicals with specifications, brand names and annual consumption figures.
- xvii. Drawings relevant for erection, operation, maintenance and repair of the equipment.
- xviii. Procedure for ordering spares.
- xix. Maintenance Manual shall also include:
- xx. Diagnostic trouble shooting / fault location charts
- xxi. Tests for checking of proper functioning.

Drawings / documents for approval

Quality Control & Quality Assurance plan.

G.A. and Cross Sectional drawings of all equipment indicating weights, material of construction, bill of material, dimension, specification etc.

Final design calculations and assumptions.

Actual performance data and characteristic curves based on the testing at site.

Technical specification of all equipment, motors, for all system and all other accessories.

Final list of drawings.

As built drawings.

Miscellaneous

- i. General arrangement and cross sectional drawings of all major components with bill of material.
- ii. Foundation drawings, load data & design calculation for all equipment.
- iii. Erection drawings for all equipment and structures showing complete erection details.
- iv. Engineering and design calculations of installations and units.
- v. QAPs
- vi. Detailed procedures of shop testing of all the items applicable shall be submitted to the Owner/ Consultant for approval before conducting tests.
- vii. Following shop test certificates/test curves/data, shall be furnished.
 - Materials and components test certificates.
 - Performance test results and characteristic curves of all fans, pumps, and electric drive motors etc.
 - Non-destructive test results as applicable.
 - Reports and test certificates of shop tests.
 - Type test & routine test certificates.
- viii. Detailed quality assurance program along with quality plan shall be submitted.

Following data shall be furnished:-

- a) Technical data of all the plant, equipment, drive motors, instruments, panels, etc. shall be furnished.



b) Following lists/tables / write ups shall be furnished, complete with tag nos. and brief specification. Proper numbering system as approved by Consultant/Owner shall be adopted.

- i) Instrument schedule (with service, range, make of instrument).
- ii) Flow element schedule.
- iii) Valve schedule.
- iv) Pipe schedule.
- v) Cable schedule (Power & Control).
- vi) Schedule of actuators (electric/pneumatic)

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.

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.

3.17. Workmanship and Quality Control

All moving parts of equipment, which can conceivably cause injury to the operator and otherwise authorized personnel within the vicinity of working area shall be suitably guarded and warning displays shall be put at prominent places.

The Bidder shall clearly indicate and identify the plans and procedures, which shall be followed in the design, manufacture and installation of plant and equipment to control and assure to the Owner of the desired quality.

FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistance varnish shall be applied on 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 interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

3.17.1. Equipment Mounting

All instruments, switches etc. mounted on the front face of the panels shall be of flush type.

All equipment shall be so mounted that removal and replacement may be accomplished individually without interruption of service to others.

All equipment inside the panel shall be so located that their terminals and adjustments are readily accessible for inspection and maintenance. Adequate ventilation shall be provided in enclosed panel.



CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)

TB-405-552-002

CONSULTANT: SJVN LTD.

Rev. 00

PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL

Page | 35 of 35

TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM

Each of the LV switchboards shall be designed for 1.1 times the required rating as a spare capacity. Further all LV Switchboard shall be provided with 20 % spare modules of each rating and type of module.

3.18. Title Block :

Project	4x225MW Arun-3 (HEP), Nepal			
Customer	SJVN Arun-3 Power Development Company (P) Ltd. (SAPDC)			
Consultant	 SJVN Ltd			
	BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP NOIDA		Name	Sign
		Drawn		
		Checked		
		Approved		
Title	Drawing Number :			Rev

-----XXXX-----

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 1 of 2

SECTION-4 LIST OF DRAWINGS & DOCUMENTS

In this section Technical Datasheets (TDS) of various equipment/items and system drawings that are required to be generated is furnished herewith. The list furnished here is tentative and additional documents may be required during detailed engineering.

I. Datasheets for following Equipment:

1. MS & GI Pipes, Pipe Fittings and Wrapping & Coating
2. Hydrant Valve
3. Gate Valve
4. Deluge Valve
5. Butterfly Valve
6. Air Release Valve
7. Solenoid Valve
8. Hose Box
9. Hose Pipe
10. Branch Pipe
11. Y Strainer
12. QB Detector
13. HVW Spray Nozzles
14. MVW Spray Nozzles
15. Pressure Switch
16. Pressure Gauge
17. Fire Extinguishers
18. Components of IGES
19. Multisensor Detectors
20. Heat Detector
21. Beam Detector Set
22. Air Sampling Detector Set
23. Hooter
24. Response Indicator
25. Manual Call Point
26. IO Modules
27. LHS Cable
28. Detection Cable
29. FO Cable
30. Exit Sign
31. Fire Alarm Panel

II. Drawings:

1. P&ID of Hydrant & Spray System
2. P&ID of HVWS & MVWS System
3. Fire Water Piping Layout for Switchyard area
4. Hydraulic Calculation of Hydrant System
5. HVW Spray System for Reactors - Plan, Elevation, Side View & Isometric View
6. Hydraulic Calculation for HVWS System for Reactor
7. MVW Spray System for Cable Trench Room - Plan, Elevation, Side View & Isometric View
8. Hydraulic Calculation for MVWS System for Cable Trench Room
9. G.A. & Wiring Diagram for DVLCP

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 2 of 2

10. P&ID of Inert Gas Extinguishing System
11. Piping Layout of IGES
12. Isometric View of IGES Piping
13. Schematic of Fire Detection & Alarm System
14. FDA Layout for GIS Building
15. FDA Layout for Switchyard Control Building
16. LHS Layout of Cable Trench Room
17. Distribution of Extinguisher inside GIS Control Room building
18. Erection Procedure documents along with all the drawings pertaining to this section (Erection Manual).
19. O&M Manual for Fire Protection System
20. O & M Manual for Fire Detection & Alarm System

III. BOQ – Fire Fighting System alongwith Mandatory Spares

IV. For Reference:

1. Cable Schedule and Cable Layout for complete Fire-Fighting System for Control Cable, Power Cable and FO Cable.
2. List of I/O for Fire Alarm Panel Interface with Main Plant FAP, SCADA and Public Addressable System.



CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)

TB-405-552-002

CONSULTANT: SJVN LTD.

Rev. 00

PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL

Page | 1 of 21

TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM

SECTION-5 ENCLOSURES TO SPECIFICATION

SCHEDULES TO BE FILLED UP BY THE BIDDER

- Schedule 1: Schedule of Deviations
- Schedule 2: Details of contact persons (technical & commercial)
- Schedule 3: Schedule of Guaranteed Technical Particulars
- Schedule 4: Schedule of Recommended Spares
- Schedule 5: Enclosures to Specification



CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)

TB-405-552-002

CONSULTANT: SJVN LTD.

Rev. 00

PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL

Page | 2 of 21

TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM

SCHEDULE-1**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: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 3 of 21

SCHEDULE-2

DETAILS OF CONTACT PERSON BOTH TECHNICAL AND COMMERCIAL

Name

Address for correspondence

Phone No.

Fax No.

Email

Place:

Signature of the authorized representative of Bidder

Name-----

Date:

Designation-----

Company seal -----

Note: Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 4 of 21

SCHEDULE-3

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS

(TO BE FILLED IN BY THE BIDDER)

1. FIRE ALARM CONTROL PANEL

- i) Make & Model No.
- ii) manufacturer
- iii) DC supply supervision available
- iv) Number of historical event logs
- v) Zone selectable alarm verification
- vi) Voice communication
- vii) LCD display size
- viii) Field programmable
- ix) No. of operator Access levels
- x) On board trouble diagnostics available
- xi) Trouble silence reminders
- xii) RS-232 output for printer of VDU

2. LINEAR HEAT SENSING CABLE CONTROL MODULE

- i) Linear heat sensing cable control module
 - a) Manufacturer
 - b) Standard
 - c) Model No.
 - d) Length cable monitor by each circuit
 - e) Capacity of zones
- ii) Zone Alarm assembly
 - a) Manufacturer
 - b) Whether ISO-9002 company
 - c) No. of zones provided

3. INERT GAS RELEASE PANELS

- i) Make & Model No.
- ii) No. of initiating device circuit
- iii) No. of supervisory zone
- iv) No. of releasing circuit
- v) Auxiliary power output available
- vi) Trouble buzzer available
- vii) Manual release switch available

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 5 of 21

- viii) Standby UPS sizing
- ix) Are the circuits power limited?
- x) Is transient protection available
- xi) Pre-discharge/discharge times available
- xii) Type of solenoid compatibility
- xiii) Diagnostic indicators available

4. HEAT DETECTOR

Rate compensated type Rate of rise/fixed temperature type

- i) Manufacturer
- ii) Type & Model No.
- iii) Addressable means (dip switch/software)
- iv) Sensitivity
- v) Operating temperature Range
- vi) Humidity Range
- vii) Whether detector automatically resets after actuation
- viii) Area covered by single Detector
- ix) Electrical Rating
- x) Type of Contacts
- xi) Whether detector approved by FOC/FM/UL/TAC

5. QUARTZ BULB DETECTOR

- i) Manufacturer
- ii) Type
- iii) Sensitivity range
- iv) Temperature Range
- v) Humidity range
- vi) Material of detector body

6. MULTI-SENSOR SMOKE DETECTOR

- i) Manufacturer
- ii) Type
- iii) Code/Specification
- iv) Sensitivity range
- v) Temperature Range
- vi) Humidity range
- vii) Air velocity
- viii) Plug-in type Detector if provided
- ix) No. of terminals on detector on mounting base

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 6 of 21

- x) Area covered by single detector
- xi) Operating voltage
- xii) Inbuilt indicating lamp to indicate operation of the detector provided
- xiii) Whether Detector is disposable after useful life without prior approval of DAE
- xiv) Material of detector body
- xv) Whether Detector is approved by UL/FOC/TAC?

7. LONG RANGE BEAM SMOKE DETECTOR

- i) Make and model No.
- ii) Whether manufacturer is ISO 9002 company
- iii) Addresable means (Dip switch/software)
- iv) Sensor type
- v) Maximum range between transmitter/receiver
- vi) Number of sensitivity ranges
- vii) Does it have both Form-A & Form-C Contacts
- viii) Does it have built in power supervision
- ix) Automatic signal synchronization available
- x) Automatic environmental compensation available
- xi) Operating temperature

8. LINEAR HEAT SENSING CABLE

- i) Manufacturer
- ii) Type
- iii)
 - a. Fusion temperature deg.C
 - b. No. of splices per loop
 - c. Response time
 - d. Max. fused length for alarm
 - e. Bend radius
 - f. Operating temperatures(From-To) deg.C
 - g. Electrical parameters:
 - i. Voltage V
 - ii. Standby current mA
 - iii. Alarm current mA
 - h. Signal and wiring format
 - i. Wiring format
 - ii. Trouble
 - iii. Alarm
 - iv. Reset

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	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 7 of 21

9. MANUAL PULL STATIONS

- i) Manufacturer
- ii) Total numbers offered
- iii) Type
- iv) Whether furnished detailed write-up illustrative catalogue on the manual call points
- v) Whether Manual call points approved by the Regional Committee of the Tariff Advisory Committee/NFPA

10. AUDIO/VISUAL COMBINATION DEVICE

- i) Make & model No.
- ii) Light output
- iii) Flash rate
- iv) Voltage requirement

11. PRESSURE SWITCH

- i) Manufacture
- ii) Type
- iii) Number
- iv) Set point
- v) Whether set point adjustable over range (if yes, indicate range)
- vi) Mounting style
- vii) Enclosure
- viii) Conduit connection
- ix) Body rating
- x) Flange material
- xi) Contact Number - NO & NC
- xii) Contact Rating:
 - a. A.C.
 - b. D.C.
- xiii)
 - a. Differential
 - b. Accuracy
 - c. Repeatability
 - d. Hysteresis
- xiv) Enclosure class

12. AIR SAMPLING SMOKE DETECTION SYSTEM

- a) Air Sampling Network Control panel
 - i) Make & Model No.
 - ii) Whether manufacturer is ISO 9002 company

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 8 of 21

- iii) Field programmable
 - iv) Provision of automatic detection calibration
 - v) High/low settings for air flow suppression
 - vi) Detector supervision
- b) Smoke Detector Assembly
 - i) Make & Model No. of detector
 - ii) Range and obscuration level
 - iii) Particulars of filter
- c) Sampling Pipe Network
 - i) Size of pipe
 - ii) Length of pipe
 - iii) Interval between sampling points

13. PIPING AND FITTINGS, VALVES AND SPECIALITIES, EXPANSION JOINTS

13.1. Pipe and Fittings:

- i) Codes & standards for design fabrication and erection
- ii) Codes & standards for testing and inspection
- iii) Applicable codes/standard for
 - a) Qualification of welding procedure and welder/ welding operators
 - b) Shop & site welding
 - c) Edge preparation
 - I. For butt weld end
 - II. For socket weld end
 - III. For screwed end
- iv) Pipes
 - a) Manufacturer
 - b) Manufacturing process
 - c) Type of construction (Seamless/ERW)
 - d) Material of construction (Indicate code/standard)
 - e) Type of joints
 - I. For size 65 mm NB & above
 - II. For size 50mm NB & below
 - f) Design pressure kg/sq. cm.
 - g) Design temperature oC
- v) Fittings
 - a) Manufacturer
 - b) Manufacturing process
 - c) Type of construction
 - d) Type of joints

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 9 of 21

I. For size 65 mm NB & above

II. For size 50mm NB & below

vi) Flanges

- a) Manufacturer
- b) Material standard
- c) Type
- d) Standard
- e) Gasket

vii) a) Welding process

b) Type and make of welding

viii) Hydrostatic test pressure Kg/Sq.cm

a) At shop

b) At site after erection

ix) All equipment and temporary piping for hydro testing furnished

x) Minimum duration of Hydrostatic test(Minute)

a) For shop test

b) For site test

xi) Type of rust inhibitor given before shipment

xii) Outside painting for Over ground/Trench Pipes

a) Type and make of primer

b) Type and make of paint

c) Type of surface preparation before use of paint

xiii) Painting and protective coating of piping as per specification furnished

xiv) Complete bill of quantity of piping and fitting

13.2. Valves

Gate Valves

Globe

Check

above 50mm

valves

valves

- i) Manufacturer
- ii) Valve standard
- iii) Type
- iv) Material of construction
- v) Frictional losses(m) in equivalent length
- vi) Body
- vii) Bonnet
- viii) Wedge/disc
- ix) Plug/Ball
- x) Seating surface
- xi) Hinge Pin

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 10 of 21

- xii) Stem
- xiii) Back seat
- xiv) Hand wheel
- xv) Bolts
- xvi) Nuts
- xvii) Gasket
- xviii) Gland Packing
- xix) Counter Flange
- xx) End connection standard
 - a) Flanged
 - b) Butt welded
 - c) Socket welded
 - d) Screwed
- xxi) Testing standard
- xxii) Whether manufacturer's catalogue furnished
- xxiii) Valves Bill of Quantities

13.3. Expansion Joints

- i) Number, size, type and pressure testing (a separate list may be enclosed if necessary).
- ii) Code/Standard
- iii) Material of Construction
 - a) Body (indicate hardness)
 - b) Inner Tube (indicate hardness)
 - c) Stretcher bolt assembly
 - d) Pressure relief device
 - e) De-aeration Device
- iv) Flange drilling standard
- v) Whether approved by the Regional Committee of the Tariff Advisory Committee/NFPA

14. ISOLATING VALVE (QUICK OPENING TYPE)

- i) Manufacturer
- ii) Size
- iii) Type
- iv) Code
- v) Pressure Class
- vi) End Connection
- vii) Material of Construction:
 - a) Body
 - b) Seat

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 11 of 21

- c) Disc
- d) Shaft
- e) Shaft Seal
- viii) Test Pressure
 - a) Body
 - b) Seat
- ix) Mode of operation

15. DELUGE VALVE

- i) a) Manufacturer
 - b) Whether manufacturing company holds ISO 9002
- ii) Type
- iii) Size
- iv) Code/Standard
- v) Is the valve external resetting type?
- vi) Material of construction:
 - a) Body
 - b) Valve internal
 - c) Discharge Clapper facing
- vii) Principal components provided:
 - a) Body assembly
 - b) Diaphragm
 - i. Diaphragm
 - ii. Retainer
 - iii. Cover
 - c) Clapper assembly
 - i. Clapper
 - ii. Clapper assembly
 - iii. Retainer
 - iv. Hinge pin
 - d) Clapper catch
- viii) Can the valve accommodate dry pilot, wet pilot & electric actuation trim?
- ix) Frictional losses(m) in equivalent length
 - 100 NB size
 - 150 NB size
- x) Water motor gong
 - i. Type
 - ii. Mounting
 - iii. Material of construction

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 12 of 21

- a) Gong
- b) All external parts
- c) Motor housing
- xi) Strainer
- xii) Flow test & drain valve
- xiii) Priming line & priming valve
- xiv) Check valve
- xv) Drip check
- xvi) Up stream/down stream side isolating valve and bypass valve
- xvii) Drip cup
- xviii) Manual over riding facility
- xix) Alarm test valve
- xx) Drain valve
- xxi) Pressure switch
- xxii) Emergency trip valve
- xxiii) End connections
- xxiv) Is Deluge valve approved by TAC?
- xxv) Working Pressure
- xxvi) Testing Pressure:
 - a) Body
 - b) Seat
- xxvii) Whether all the accessories of the deluge valve as specified in Specification are provided?

16. NOZZLES FOR MEDIUM/HIGH VELOCITY WATER SPRAY SYSTEM

- i) Manufacturer
- ii) Type
- iii) Material of construction
- iv) Flow capacity cu.m/hr. at rated pressure (May be furnished in the form of a curve: capacity Vs pressure) size wise
- v) Minimum required pressure at projected inlet for proper formation of spray kg/sq.cm.
- vi) Range(meter) and effective coverage (square meter) of each projector size wise at the minimum acceptable pressure
- vii) Hydro Static test pressure (kg/sq.cm)
- viii) Whether nozzles approved by the regional committee of the Tariff Advisory Committee/NFPA
- ix) Maximum allowable pressure of nozzles inlet
- x) K factor lpm/_/bar
- xi) Orifice size
- xii) Nozzle spray angles

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	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 13 of 21

17. HYDRANT VALVES

- i) Type
- ii) Code/Standard
- iii) Working Pressure
- iv) Test Pressure
- v) Flow test as per Specification
- vi) Material of construction:
 - a) Column pipe
 - b) Body
 - c) Stop valve
 - d) Spindle
 - e) Hand wheel
 - f) Washer gasket etc.
 - g) Bonnet
 - h) Gland out
 - i) Seat
 - j) Quick coupling connection
 - k) Spring
 - l) Cap with chain
 - m) Orifice plate
- vii) Minimum acceptable pressure at inlet of stand post for hydrant valves
- viii) Whether Accepted by TAC/NFPA quality

18. HOSE PIPE

- i) Manufacturer
- ii) Type
- iii) Code/Standard
- iv) Material of Hose
- v) Material of Coupling
- vi) Change in size of hose due to pressure build up
 - a) Diameter(mm)
 - b) Extension in length(%)
- vii) Maximum friction loss in 30m length (kg/cm)
- viii) Size & length
- ix) Working pressure
- x) Testing pressure
- xi) Burst pressure
- xii) Coil diameter 30m length
- xiii) Weight gm/m

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 14 of 21

- xiv) General Constitution
- xv) End fittings (quick coupling end)
- xvi) Hose fixing with quick coupling arrangement
- xvii) Whether hose pipes - approved by TAC

19. BRANCH PIPES AND NOZZLES

- i) Manufacturer
- ii) Type
- iii) Code/specification
- iv) Working pressure
- v) Test pressure
- vi) Material of construction
 - a) Branch pipe
 - b) Nozzle
- vii) Whether branch pipe & nozzle approved by TAC

20. FIRE HOSE CABINET

- i) Overall size of the cabinet
- ii) Material
- iii) Contents of the cabinet
- iv) Whether handle & locking arrangement provided
- v) Fixing details
- vi) Quality

21. INERT GAS SYSTEM

- i) Type of System Normal Charging Pressure
- ii) Design code/standard to Which Design /Manufacturer/ Testing conforms
 - a) Name of Inert gas
 - b) Chemical composition of Inert gas
- iii) System designed to protect the Largest or total risk in the area as Specified
 - a) Centralized for (List the area)
 - b) Modular for (List the area)
- iv) Design Concentration
 - a) Amount of gas required (attached separate sheet If required) (List out gas supplied, number of cylinders, etc. for working And standby requirements, Risk-wise).
- v) Inert Gas Cylinder Details
 - a) Manufacturer
 - b) Design Code
 - c) Capacity in Litres /Kg

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 15 of 21

- d) Gas Holding Cap. Kg.
- e) Total number supplied
 - i. For Central
 - ii. For Modular
 (This must be correlated With 4(a) above)
- f) Approving Agency FM/UL/ LPC/VDS/TAC (This must Be acceptable to TAC)
- g) Approved by CCE
- h) Working pressure (kg/cm²)
- i) Design pressure (kg/cm²)
- j) Dimension of Cylinder Dia x Length x thickness
- vi) Pipes, Valves and Fittings
 - a) Manufacture
 - i. Pipes
 - ii. Fittings
 - iii. Valves
 - b) Material of Construction
 - i. Pipes
 - ii. Fittings
 - iii. Valves
 - c) Design Code
 - i. Pipes
 - ii. Fittings
 - iii. Valves
 - d) Type of joints
 - e) Hydraulic test pressure of Manifold/supply lines (kg/cm²)
 - f) Directional Valve
 - i. Make and type
 - ii. Material of construction
 - iii. Test pressure(kg/cm²)
 - iv. Approved by FM/UL/VDS/ LPC/TAC (Yes/No)
 - g) Discharge Nozzles
 - i. Manufacturer and type
 - ii. Material of construction
 - iii. Number supplies
 - iv. Approved by FM/UL/VDS/ LPC/TAC (Yes/No)
 - h) Pressure Gauge
 - i. Make
 - ii. Pressure Range
 - iii. Approved by FM/UL/VDS/ LPC/TAC (Yes/No)

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 16 of 21

- i) Pressure Reducer
 - i. Make
 - ii. Approved by FM/UL/VDS/ LPC/TAC (Yes/No)
- j) Cylinder Valve
 - i. Make
 - ii. Approved by FM/UL/VDS/ LPC/TAC (Yes/No)
- k) Cylinder Valve Actuator
 - i. Make
 - ii. Approved by FM/UL/VDS/ LPC/TAC (Yes/No)
- vii) Painting and colouring of pipeline Nozzles, Cylinder supports included (two coat of red oxide and two coat Of synthetic enamel)
- viii) Operating Devices:
 - a) Signal from the inert gas control Panel for shuttering off the air Handling unit and damper closing.
 - b) Detectors:
 - i. Manufacturer
 - ii. Type
 - iii. Detectors guarded against false alarm (Yes/No)
 - iv. Detectors approved by FM/UL/ VDS/LPC/TAC (Yes/No)
 - c) Push Button Station:
 - i. Type
 - ii. Manufacturer
 - iii. Model, numbers offered
 - iv. Overall dimensions
 - d) Control Cables:
 - i. Manufacturer
 - ii. Code/Standard
 - iii. Type
 - iv. Size
 - v. Rating
- ix) Main Control Panel:
 - a) Manufacturer
 - b) Mounting Details
 - c) Number of Entries
 - d) Sheet Thickness
 - e) Cable Entry
 - f) Total head load predicted for air conditioning
 - g) No. of AC/DC feeders and their rating
- x) Additional requirements for Control Panel

	CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)	TB-405-552-002
	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 17 of 21

- a) Whether housing all the necessary printed card circuits, board cards, relays indicating lamps, push buttons, switches etc. for the efficient operation of the system (Yes/No)
- b) Input power supply requirement for operation of panel+AC/DC Volts
- c) Panel Signal Voltage AC/DC Volts
- d) Type/APM capacity
- e) Interconnecting cabling between Battery and panel
 - i. Power supply unit incorporated in the panel (Yes/No)
 - ii. Audiovisual alarm on panel Provided for battery low Conditions (Yes/No)
- f) Change over from AC main supply to standby power supply fully Automatic in either direction (Yes/No)
- g) Regulated supply for detectors Provided in the panel (Yes/No)
- h) Dual red lamps windows provided for fire conditions in each zone (Yes/No)
- i) Dual yellow lamps windows Provided for fault conditions in each zone (Yes/No)
- j) Following push buttons provided:
 - i. Alarm accept
 - ii. Reset
 - iii. Test (Yes/No)
- k) Audio visual indication for AC Supply failure provided (Yes/No)
- l) Pilot lamp for system "ON" supply failure provided (Yes/No)
- m) Dial tone hooter for fire/fault alarm provided and range of the same
- n) Painting (External/Internal)
- xi) Material of construction selected in accordance with NFPA-2001 (Yes/No)
- xii) Inspection and Testing:
 - a) Visual inspection of installed system and hazard area
 - b) Check of labeling of devices
 - c) Check of mechanical tightness of pipe and associated equipment
 - d) Non-destructive operation tests for All devices included
 - e) Test with inert gas (one no. cylinder)

22. PORTABLE EXTINGUISHERS

	DCP	CO2	CO2
	Type	Type	Type
	5 kgs	9 Litres	4.5 Litres
i) Capacity			
ii) Test pressure of cylinder/hose			
iii) Fitting used			
iv) Material of hose nozzle and discharge horn			
v) Maximum discharge time(sec.)			

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	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 18 of 21

vi) Type and material of valve/ operating head

vii) Whether handling bracket supplied

Wheeled portable	Hand portable	Wheeled
CO2	foam	portable
Type	Type	Type
22.5 kgs	9 Litres	22.5 kgs

i) Capacity

ii) Test pressure of cylinder/hose

iii) Fitting used

iv) Material of hose nozzle and discharge horn

v) Maximum discharge time(sec.)

vi) Type and material of valve/ operating head

vii) Whether handling bracket supplied

23. PAINTS

i) Manufacturer

ii) Design Standard

iii) Quantity offered

iv) Fire rating minutes

v) Material of composition

vi) Whether furnished detailed write-up/ illustrative catalogue on the paints

vii) Whether Paints approved by under writers Laboratories/Fire Office Committee/Factor Manual

viii) Whether paint approved by the Regional Committee/NFPA

24. A.C. AUXILIARY POWER REQUIREMENT

i) Main FACP

ii) Repeater alarm panels

iii) Linear heat sensing cable control panels

iv) Release panels

v) Total power requirement	3 phase	Single phase	220V
at single point location	AC	AC	DC
to be provided by Purchaser			

25. SAFETY KIT

i) Manufacturer

ii) Type

iii) Specification

iv) Equipment included

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	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 19 of 21

26. FLOURESCENT PAINT

- i) Manufacturer
- ii) Specification
- iii) Colour

Place:

Signature of the authorized representative of Bidder

Name-----

Date:

Designation-----

Company seal -----



CLIENT: SJVN ARUN-III POWER DEVELOPMENT COMPANY (P) LTD. (SAPDC)

TB-405-552-002

CONSULTANT: SJVN LTD.

Rev. 00

PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL

Page | 20 of 21

TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM

SCHEDULE-4**SCHEDULE OF RECOMMENDED SPARES**

S.No.	Description	Quantity

Place:

Signature of the authorized representative of Bidder

Name-----

Date:

Designation-----

Company seal -----

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	CONSULTANT: SJVN LTD.	Rev. 00
	PROJECT: 4x225MW ARUN-III, HYDRO ELECTRIC PROJECT, NEPAL TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM	Page 21 of 21

SCHEDULE –5

ENCLOSURES TO SPECIFICATION

ANNEXURES

1. Manufacturing Quality Test Assurance Requirements
2. Field Quality Test Assurance Requirements
3. Export worthy Packing
4. Quality and Inspection Formats

DRAWINGS

1. *Conceptual Layout of CRP Room in Switchgear Building of 400kV Switchyard of Arun 3 HEP - TB-3-405-316-021-Rev06*
2. *400kV GIS Layout (Plan, Section & Isometric View) – TB-405-317-10-2-Rev02.*
3. *Electrical Layout Plan and Section of 4x225MW of Arun-3 HEP – TB-3405-316-001-Rev07*
4. *Combined OGA – 3 469 00 01992-Rev00.*
5. *P&ID of Fire Hydrant & Spray System – PY-DP-1-M110-8661-01*
6. *Schematic Diagram for Fire Detection & Alarm System – PY-FL-3-M110-8663-01*

	MANUFACTURING QUALITY ASSURANCE TEST REQUIREMENT		
	Project Name: ARUN III HEP (4X225 MW)	DOC.NO.QAI/A/M/EM/FFS/01	REV. NO. 02
	ITEM DESCRIPTION: FIRE FIGHTING SYSTEM	Issue Date: 30.05.17	PAGES: 02
SR. NO.	CHARACTERISTICS	APPLICABLE STANDARD	REMARKS
1	2	3	4
1.0.	Fire Fighting System		
1.1	Each component of Fire Detection, Fire Protection & Monitoring System as well as supplier of major item/component should be listed by UL/FM etc and also meet the requirement of NFPA/UL/FM etc.	DRG. / Rel. Std. / TS	V
1.2	Storage cylinders/container with all accessories. All piping , valves, fitting & nozzle shall be subject to all test as per the design code to which they are supplied and also meet the requirement of UL/FM/NFPA etc.	DRG. / Rel. Std. / TS	V
2.0.	Pump & Motor Set		
2.1	Incoming Material of Impellar, Casing & Shaft Material		
2.1.1	Chemical Composition ,Mechanical Properties & Hydrostatic Pressure Test of Casing	DRG. / Rel. Std. / TS	V
2.1.2	MPI/DP test of machined surface of casing, shaft, impellar and on weld of fabricated part	DRG. / Rel. Std. / TS	V
2.1.3	UT on Pump Shaft (for dia 50mm & above), impeller & Casing	DRG. / Rel. Std. / TS	V
2.1.4	Static & Dynamic Balancing of Impellar	DRG. / Rel. Std. / TS	
2.2	Motor for Pump		
2.2.1	Make, Type ,Rating , Routine Test and Type Test	DRG. / Rel. Std. / TS	V
2.3	Motor Pump Set		
2.3.1	Make, model & Type of Pump and performance Test on Pump & Motor set. Measurement of rate of flow, Head, Power input, Speed & Efficiency, NPSH, Noise & Vibration	DRG. / Rel. Std. / TS	W
3.0.	Pipes & Pipe Fitting ,Valves, Strainer & Accessories(For Hydrant / MVWS/ HVWS System / Pump to Main Tank/ Inert Gas System)		
3.1	Pipe & Pipe Fittings		
3.1.1	Class , Duty, Dimension / Size ,WPS & WPQR (As applicable), NDT of Welds of pipe (In case of rolled & welded pipes) and Hydro Test	DRG. / Rel. Std. / TS	V
3.2	Strainer		
3.2.1	Dimension, Hydraulic Pressure Test and Leakage Test & Pressure Drop V/s Flow for each type & size	DRG. / Rel. Std. / TS	V
3.2.2	Operation & functional checks	DRG. / Rel. Std. / TS	V
3.3	Valves		
3.3.1	Hydraulic test for body, seat & back seat (If applicabe as per standard), check valve shall be tested for leak tightness test at 25 % of specified seat test pressure for all type & size of valve	DRG. / Rel. Std. / TS	W/V
3.3.2	Operational & Functional Checks for all type & size of valves for smooth opening & closing operation	DRG. / Rel. Std. / TS	W/V
3.3.3	Capacity test/flow test on hydrant valves as per std.	DRG. / Rel. Std. / TS	W
3.3.4	Performance test/functional test on deluge valve in HVWS/ MVWS System	DRG. / Rel. Std. / TS	W
3.3.5	Dielectric /IR test, actuation test on Solenoid Valve	DRG. / Rel. Std. / TS	W
3.4	All pipe, fitting, valve etc. shall be checked for anti corrosion	DRG. / Rel. Std. / TS	V
3.5	Paint & Thickness as per applicable standard	DRG. / Rel. Std. / TS	W/V
4.0.	Hose Reel, Hose Pipe with Coupling & Branch Pipe with Nozzle for Hydrant System		
4.1.1	Dimension/Size , Hydro Test & Performance Test (As applicable)	DRG. / Rel. Std. / TS	W
4.1.2	Tests as per chapter 6 of NFPA 1961	DRG. / Rel. Std./ TS/NFPA 1961	V
4.1.3	Check of Abrasion Resistance,Heat Resistance, Repeated Bending, Alternating Pressure & Moisture Resistance Test (As applicable)	DRG. / Rel. Std./ TS/NFPA 1961	W
4.2	Hose Box		
4.2.1	Dimensional Check	DRG. / Rel. Std. / TS	V
5.0.	Spary Nozzle (For MVWS + HVWS System)		

767269/2022/TBG-TB_ENG_SR

SR. NO.	CHARACTERISTICS	APPLICABLE STANDARD	REMARKS
1	2	3	4
5.1	Dimension/Size, Spray Pattern, angle of spray , K-factor, Flow Test and Rough Handling Test	DRG. / Rel. Std. / TS/NFPA 1964	W
6.0.	Fire Sensing Device, Actuation System,Fire Alarm System & Indicators for Complete Fire Protection System		
6.1	All type of Detectors ,Actuators, Fire Sensing Devices , notification devicesAlarm/Indicators of entire system shall be tested as per relevant standard	DRG. / Rel. Std. / TS	W/V
7.0.	Manual Pull Station, Monitor Module & Control Module		
7.1	Make, Model,Type,Dimensional Check, Routine test and Operational & Functional Check	DRG. / Rel. Std. / TS	V
7.2	UL/FM Approval	DRG. / Rel. Std. / TS	V
8.0.	Air Sampling System (Detector, Piping, Capillary Sampling Point and Panel)		
8.1	Routine, Acceptance & Performance Test	DRG. / Rel. Std. / TS	V
8.2	UL/FM Approval	DRG. / Rel. Std. / TS	V
8.3	Calibration of aspirator/air sampling type smoke detectors & oher detectors.	DRG. / Rel. Std. / TS	V
9.0.	Linear Heat Sensing (LHS) Cable		
9.1	Make, Model,Type,Rating and Class	DRG. / Rel. Std. / TS	V
9.2	Electrical & Mechanical Functional Test	DRG. / Rel. Std. / TS	V
9.3	Measurement of loop resistance & acceptance test	DRG. / Rel. Std. / TS	V
9.4	UL/FM Approval	DRG. / Rel. Std. / TS	V
10.0.	FACP Panel/ Mimic panel and other Panels		
10.1	Visual, General arrangement, BOM, Layout of System, Dimension, Thickness, Alignment, Component rating, make, type,wiring (with colour code),HV/IR Test, Heating & Lighting System, Functional & Operational Check , Protection & Checking of Interlocks	DRG. / Rel. Std. / TS	W
10.2	Verification of Degree of Protection (IP Class)	DRG. / Rel. Std. / TS	V
10.3	Checking of Paint Shade & Paint Thickness and Adhesion Test	DRG. / Rel. Std. / TS	W
11.0.	Fire Extinguisher and Cylinder of all type		
11.1	Make, Serial number,Dimension / Size, Fill density, weight, leakage test , Capacity Check etc on each cylinder. Performance & Routine Test as per applicable Standard , Hydro Test on all cylinders and Burst Test one Cylinder per lot.	DRG. / Rel. Std. / TS	V
11.2	Check for anti corrosive treatment & paint	DRG. / Rel. Std. / TS	V
11.3	All cylinder shall meet the statutory requirement of approval/acceptance by CCOE/ PESO in duly listed in (FM/UL/VDS/LPC) as per country of origin	DRG. / Rel. Std. / TS	V
12.0.	Cable		
12.1	Routine & Acceptance Test as per relevant standard	DRG. / Rel. Std. / TS	V
13.0.	Instruments, Gauges for complete system		
13.1	Make, Model, Type, Functional/Operational Check ,Callibration Report and Contact Rating	DRG. / Rel. Std. / TS	V
LEGENDS			
W: CUSTOMER HOLD POINT (CHP)		DRG: DRAWING	
TS: TECHNICAL SPECIFICATION		REL. STD: RELEVANT STANDARD	
V: VERIFICATION OF RECORDS / REPORTS / TC			
NOTES:			
1	Any test at any stage not covered in Quality Assurance Test Requirement (QATR), but part of technical specification of contract, shall also be carried out by Contractor / firm.		
2	QATR shall be read in conjunction with General Quality Assurance Requirement given as part of Technical Specification.		

	FIELD QUALITY ASSURANCE TEST REQUIREMENT		
	PROJECT NAME: ARUN III HEP (4X225 MW)	DOC.NO.QAI/A/F/EM/FFS/01	REV. NO. 02
	ITEM DESCRIPTION: FIRE FIGHTING SYSTEM	ISSUE DATE: 30.05.17	PAGES: 02
SR. NO.	CHARACTERISTICS	APPLICABLE STANDARD	REMARKS
1	2	3	4
1	Receipt of Material		
1.1	External conditions of Equipment free from Damages etc	Packing list /Drawings /TS	W*
1.2	Number of packages in each Equipment and physical condition of each package	Packing list /Drawings /TS	W*
2.0.	Storage		
2.1	Proper Placement of equipment as per the Instruction Manual.	All parts fully covered	W*
2.2	Ensure that no damage or rusting takes place during storage	All parts fully covered	W*
2.3	Ensure that all delicate Equipment are stored in protected area.	All parts fully covered	W*
3.0.	Pre-erection check		
3.1	Embedments/Concrete Insert		
3.1.1	Installation/fixing of embedments/Inserts as per drawing	DRG/TS/Plant std	W*
3.1.2	Check for alignment & level before & after concreting	DRG/TS/Plant std	W*
3.2	Blockout		
3.2.1	Check for visual, dimensions & Co-ordinates of block out	DRG/TS/Plant std	W*
4.0.	Erection & Pre-Commissioning Checks		
4.1	Laying of Pipes and jointing with fitting and flanges & welding	DRG/TS/Plant std/NFPA	W*
4.1.1	Installation & verification of pipe layout as per the approved drawing	DRG/TS/Plant std/NFPA	W*
4.1.2	WPS ,PQR & WPQR	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	V
4.1.3	Physical verification with critical view-Root gap linearity	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	V
4.1.4	100% DPT on root of Butt and finish weld of Butt & Fillet joint.	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	W*
4.1.5	RT on 10% random selected joint shall be carried out	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	W*
4.1.6	Welding on GI Pipe in general shall not be done. If, permitted by Design (Butt/Socket/Fillet Weld) shall be done as per approved drawing with proper removal of Zinc before welding and use of paint after welding. 100 % DP shall be done after welding	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	W*
4.1.7	Internal cleaning/flushing of pipeline after installation but before assembling with other associated component/devices	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	W*
4.2	Levelling & alignment	DRG/TS/Plant std/NFPA	W*
4.2.1	Hydrostatic Testing and Leakage Test of complete pipe line after installation as per NFPA/TAC requirement and pressure flow test on water distribution system & supplies for hydrant system/ MVWS & HVWS	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	W*
4.2.2	Pressure Test & Mechanical Tightness Test for complete pipe line after installation as per NFPA 2001 for Inert Gas System	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	W*
4.3	Primer & paint on welded pipeline complete with fitting & flanges for HVWS, MVWS & Inert Gas System	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	W*
4.4	Installation and verification of layout / location and fitment of all type of component/devices/instruments/panel as per approved drawings & NFPA requirement	DRG/TS/Plant std/NFPA	W*
4.5	Test for sensitivity range of all type of sensors / detectors	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	W*
4.6	Check for protection against possibility of induced transients	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	W*
4.7	Operational & functional test of fire pumps	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	W*
4.8	Operational & functional test of components, sub-assemblies, auxiliaries i.e. Detector of all type, suppression system,notification devices,valves including deluge valve etc.	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	W*
4.9	Testing, Setting and calibration of instrument & gauges for complete system and aspirator/air sampling type smoke detector & other detectors	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	W*
4.10.	All Panel including FACP Panel, Mimic Panel & for Air Sampling System etc.		

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SR. NO.	CHARACTERISTICS	APPLICABLE STANDARD	REMARKS
1	2	3	4
4.10.1	Verification of correctness of inter-pannel wiring/ Cabling, Fencing, dressing, routing, bunching, continuity check, colour coding and earthing	As per drawing	W*
4.10.2	Check for cable termination, tightness & phase sequence of incoming supply	As per drawing	W*
4.10.3	Insulation resistance & HV test	DRG. / Rel. Std / TS/NFPA	W*
4.10.4	Functional test on all AC & DC circuit including heating, Lighting, Fan & thermostat	Approved GTP/Tech. Spec./Drg	W*
4.10.5	Operational & functional test including control logic field test to prove control logic scheme for operation & interlocks of system components including Interfacing with plant SCADA, annunciation & suppression system	DRG/Manufacturer Plant standard/NFPA	W*
4.11	Cable Laying		
4.11.1	Continuity , IR & HV	DRG/Manufacturer Plant standard/NFPA	W*
4.12	Cable Tray		
4.12.1	Dimensional check of racks & trays, support & spacing between trays,earthing of rack & trays	DRG/Manufacturer Plant standard/NFPA	W*
4.13	LHS Cable		
4.13.1	Visual check for sharp bend , physical damage and check integrity of installation	DRG/Manufacturer Plant standard/NFPA	W*
4.13.2	Alignment and layout as per drawing & ensure adequate support to prevent sagging	DRG/Manufacturer Plant standard/NFPA	W*
4.14	Complete Air Sampling System		
4.14.1	Visual Check, Functional Test	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	W*
4.14.2	Fault Simulation Test for each detection unit circuit	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	W*
4.14.3	Sensitivity Setting and checking of all alarm signal	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	W*
4.15	Performance cum functional test for complete system including Fire alarm Detection System,Hydrant , HVWS and MVWS System & Inert Gas System	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	W*
4.15	Portable Fire Extinguisher		
4.15.1	A performance demonstration test at site of 5% or one no. extinguisher whichever is higher , of each type & capacity of extinguisher shall be carried out by contractor. All consumable and replaceable item required for the contracts without any extra cost to SAPDC.	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	W*
4.17	Check for labeling of devices for proper designations, instructions and hazard area as per approved drawings & NFPA requirements	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	W*
5.0.	Commissioning Test as per TS	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol/NFPA	W*
6.0.	Performance Test as per TS	DRG. / Rel. Std / TS/ Erection & Commissioning Protocol	W*
LEGENDS			
W: CUSTOMER HOLD POINT (CHP)		DRG: DRAWING	
TS: TECHNICAL SPECIFICATION		REL. STD: RELEVANT STANDARD	
V: VERIFICATION OF RECORDS / REPORTS / TC		W*: WITNESS BY SAPDC / MAIN CONTRACTOR	
NOTES:			
1	Any test at any stage not covered in Quality Assurance Test Requirement (QATR), but part of technical specification of contract, shall also be carried out by Contractor / firm.		
2	QATR shall be read in conjunction with General Quality Assurance Requirement given as part of Technical Specification.		
3	Responsibility for witnessing (W*) at site shall be decided mutually at the time of finalisation of FQAP as per the criticality of test.		

Annexure F - Export-Worthy Packing

1.0 SCOPE:

For export jobs, sea worthy packing capable of performing all necessary functions like prevention of damage to the contents, sufficient to support frequent handling and lengthy periods of outdoor storage in adverse weather conditions are required. Workmanship and material used shall meet the technical requirements and be in accordance with best commercial export packing practices. Vendor shall be responsible for the packing, however, it shall meet the minimum requirements specified herein. Equivalent or better packing methods may be deployed subject to approval of the purchaser. Vendor shall submit the packing procedure for its equipment for purchaser's approval during detailed engineering.

2.0 TECHNICAL SPECIFICATION OF WOOD:

The wood shall be Fir, Chir, Silver Oak (Grevillea Robusta) or chemically treated mango with moisture content not exceeding 50 %. The wood shall have flexural & compressive strength, stiffness, shock absorption and nail retention properties. The wood shall be free from common defects such as warp, bone, twist, knot, cracks, splits, end splits, bend, visible sign of infection and any kind of decay caused by insects, fungus etc. Surface cracks with a maximum depth of 3 mm are permissible. A continuous crack of any depth all along the length is not allowed.

The wood shall be chemically treated to provide protection against deterioration due to fungi and attack by termites, borers, marine organism and any other kind of infection. It shall be treated only after final processing like cutting, planing, joint grooving etc.

3.0 TYPE, DESIGN & DIMENSION OF WOODEN PACKING CASES:

3.1.1 PACKING OF EQUIPMENTS:

Various mechanical, electrical and C&I equipment e.g. pumps, motors, equipment skids, heat exchangers, control panels, switch gears, transformers etc. shall be wrapped in weather proof packing and then secured in wooden packing cases. The construction of wooden packing cases shall be as per details given below and also in figures 1 to 11.

3.1.1 BOTTOM FRAME:

The construction of bottom frame shall be as per fig. 2. The number of slides/runners for bottom frames shall be selected depending upon the weight and overall dimension of the load to be carried. The equipment shall be secured by fixing their base frame/plate with the help of bolt & nuts etc to the bottom frame of the wooden packing cases. The equipment not provided with the base frame/plate like

cylindrical vessels etc. to be secured to the bottom frame of the wooden case with 'C' clamps fabricated from steel channels/angle irons.

3.1.2 TOP FRAME:

The construction of top frame shall be as per fig. 3.

3.1.3 END PANELS:

The dimensions of the end and lateral panels shall be calculated according to overall dimensions of the items to be packed.

Diagonal braces shall be used for packing cases having height exceeding 500 mm. Detail of bracing shall be as per figure 5 to 8.

3.1.4 SLING PLATE:

To facilitate lifting of cases, longitudinal under slide boards shall be fixed. To avoid damage to the box while lifting sling plates shall be provided. Refer fig. 11.

3.1.5 ANGLE IRON CLEATS :

Angle iron cleats shall be used for strengthening the joints as indicated in fig. 10.

3.1.6 OTHER REQUIREMENTS:

The thickness of planks for top, bottom, side and end panels shall be at least 25 mm. Planks used for this purpose shall be joined with each other by tongue & groove joint. The groove dimension shall be such that tongue fits tightly into groove to make good joint.

Runners/slides, traverse bars etc. shall be of single length i.e. without any joint. Planks for sheathing, diagonal bracing etc shall also be of single length upto 2400 mm. For sizes larger than 2400 mm, proper jointing is permitted for planks for sheathing and diagonal bracing.

Each equipment to be individually covered with double polyethylene petticoat. Sheet thickness of polyethylene sheet shall not be less than 0.175 mm (175 microns). The sealing shall be such so as not to allow moisture inside.

The inner surface of 4 sides of shooks shall be nailed with bituminised water proof kraft paper. Wherever 2 pieces of kraft paper are used, the joint shall have an overlap of minimum 20mm.

All the inner sides of the box shall be nailed with bitumen coated hessian polyethylene kraft paper. For top frame it shall project on all sides by 100mm and shall be nailed on sides. Wherever 2 pieces of kraft paper are used, the joint shall have an overlap of minimum 20mm.

For delicate equipment like control panels, switchgears etc suitable cushioning material like rubberized coir shall be provided on their bottom support. The thickness of coir shall be 50 mm (minimum) and width 100 mm (minimum).

For control panels and switchgears, the gap between the panel and casing shall be filled with rubberized coir with distance between consecutive supports less than 500 mm (ref fig 15). For other equipment suitable support from sides of the casing to be provided.

Switchgear cubicles, control panels and control desks shall be packed and shipped in separate convenient sections. The components e.g. circuit breakers relays and instruments etc. which are removed from panels for shipping purpose shall be separately packed and shipped as per packing instructions in clause 3.2.

Packing case for control panels & switchgear panels shall be finally covered with GI sheet of minimum thickness of 0.4 mm.

Packing cases shall be bound at edges by nailing MS clamps/brackets at sufficient intervals. Further, heavier boxes shall be strapped with 'C' clamps (ref fig 4) fabricated from steel channels/angles and lighter boxes shall be strapped with hoop iron strips.

3.1.7 ALTERNATIVE PACKING CASES FOR CONTROL PANELS AND SWITCHGEARS

If required, for control and switchgear panels, construction of wooden packing cases may be provided as per fig 14 & 15 and as detailed below:

Thickness of planks for all sides, binding and jointing battens shall be atleast 25 mm. Width of planks shall be at least 125mm and that of binding and jointing planks shall be at least 100 mm.

Top frame shall be suitable so that it does not collapse due to sandwiching between slings while lifting. Longitudinal and traverse bars for the bottom wooden pallet to be suitably selected.

Diagonal bracings shall be as per clause 3.1.3 and All other requirements shall be as per clauses 3.1.4 to 3.1.6.

3.2 PACKING OF LOOSE ITEMS:

Loose mechanical, electrical and C&I items eg valves, fittings, pressure/temperature gauges/switches, circuit breakers, relays etc shall be individually wrapped using polyethylene sheets/U foam/thermocole sheets/air bubbled sheets depending upon the item and then packed in wooden boxes. The left out spaces and top of the boxes shall be filled with rubberized coir to get proper cushioning effect. Special attention is to be paid to relays, instruments etc for arresting the movement of their operating mechanisms during transportation.

The construction of wooden packing case shall be as per clause 3.1 retaining its all features concerning strength of box. The construction of wooden packing case for loose electrical and C&I items shall be as per fig. 16.

Inner surface of 6 sides of the box shall be lined with Bitumen coated hessian polyethylene kraft paper. Rubberized coir of min. 25 mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of the box.

Loose items such as Galvanised Steel Structure, Cable support racks, Cable Trays and GI Pipes etc. shall be individually wrapped using polyethylene sheets and further lots may be wrapped in Bitumen coated hessian cloth.

4.0 MOISTURE ABSORBER:

Silica gel is used for this purpose to protect contents over sufficiently long time from corrosion. Silica gel shall be of indicating type conforming to IS-304-1979 packed in cotton bags placed at different positions inside the packing for absorbing moisture and shall not come directly into contact with the equipment / material inside the package. The quantity of silica gel shall be enough for storage period of one (1) year, however, it shall not be less than 4 gms per litre volume of case subject to minimum of 400 gms per case.

5.0 INDICATION MARKS ON THE BOXES:

Markings shall be provided on the boxes indicating position of boxes for handling, storage and nature of consignment. For guidelines refer figure 12. The ink used for this purpose as well as for marking despatch instruction shall be indelible/nonwashable marking ink.

6.0 DESPATCH DETAILS:

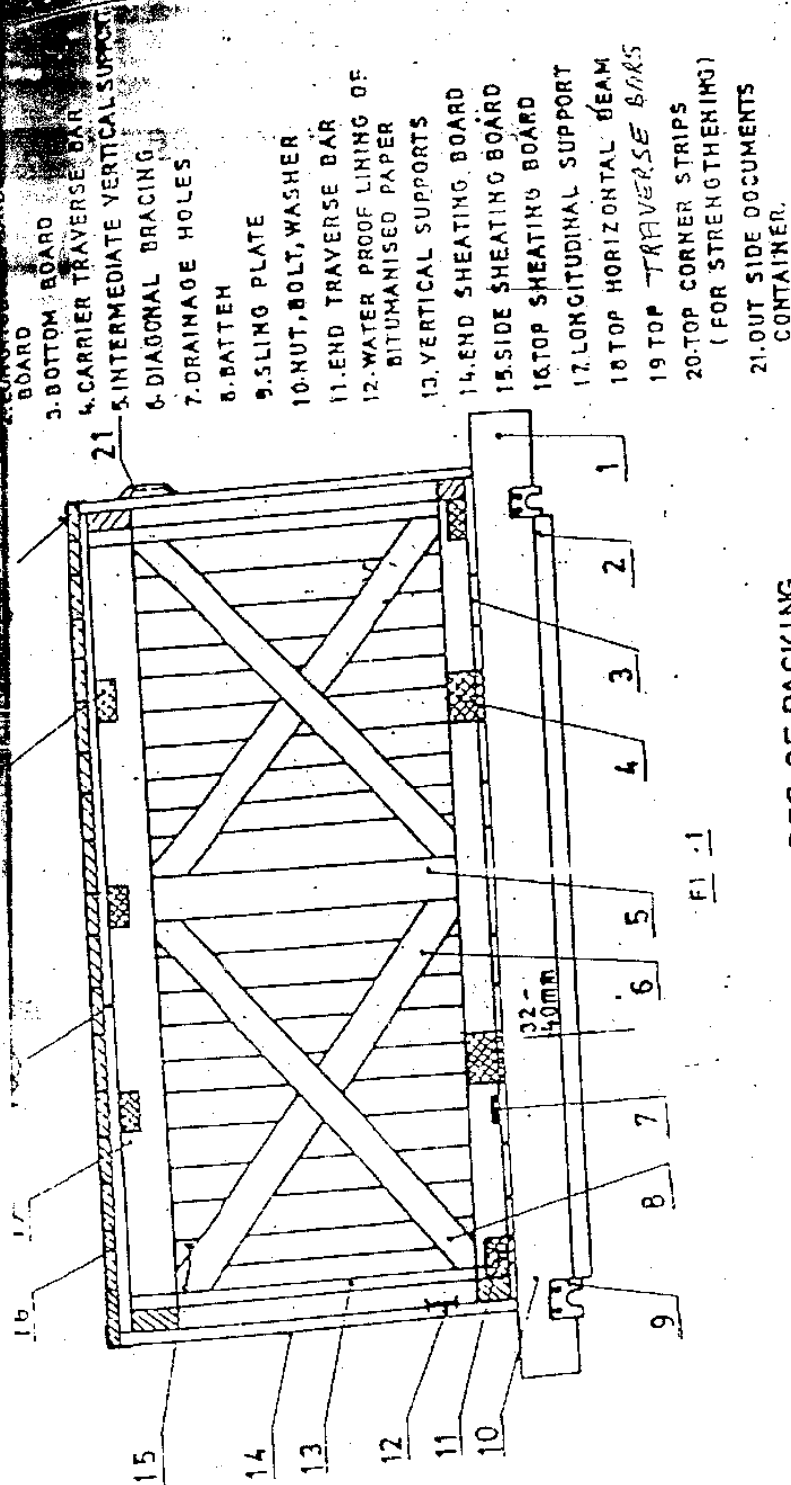
External front and rear sides of the boxes to be planed for writing instructions.

Dispatch details such as consignor/consignee address, contract and case details, country of origin , port of delivery, stacking instructions shall be written on one of the side of boxes. An anodised aluminium plate shall be provided on one side of the boxes.

One copy of packing slip wrapped in polyethylene bag covered with aluminium packing slip holder to be nailed on the external surface of the box. One more copy of the packing slip wrapped in polyethylene bag to be kept inside the box at the prominent place.

7.0 INSPECTION:

There shall be a Customer Hold Point (CHP) for inspection of final assembly of packing. During above inspection, the records for Chemical Treatment shall be reviewed.



EC 009

BOTTOM FRAME ARRANGEMENTS

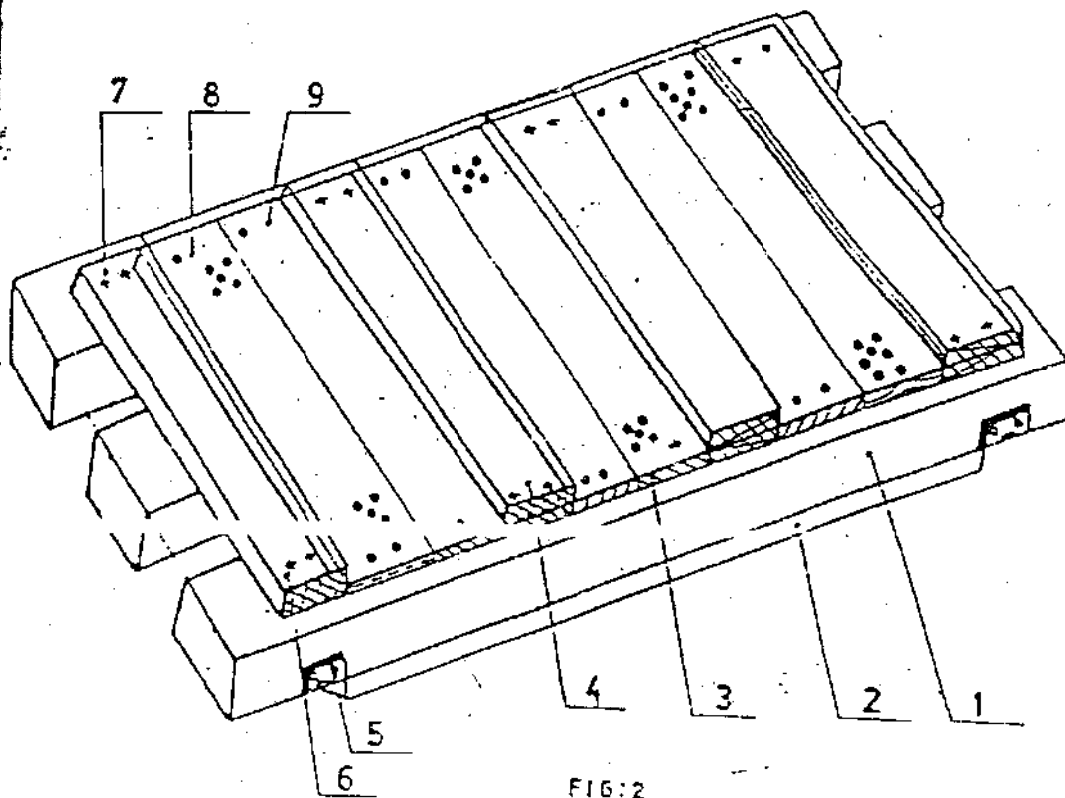


FIG:2

Nos. of slides : Minimum 2 Nos.

For length more than 1800 mm or
load more than 1000 kg, Nos. of
slides shall be minimum 3 Nos.

For dimensions of slides, refer Table 1

Cross section of end traverse bar; 100 X 100 mm
(minimum)

1. SLIDE
2. UNDER SLIDE BOARD
3. BOTTOM BOARD
4. CARRIER TRAVERSE BAR
5. SLING PLATE
6. TRAVERSE BAR
7. BOLT, NUT & WASHER
8. DRAINAGE HOLES
9. NAILS

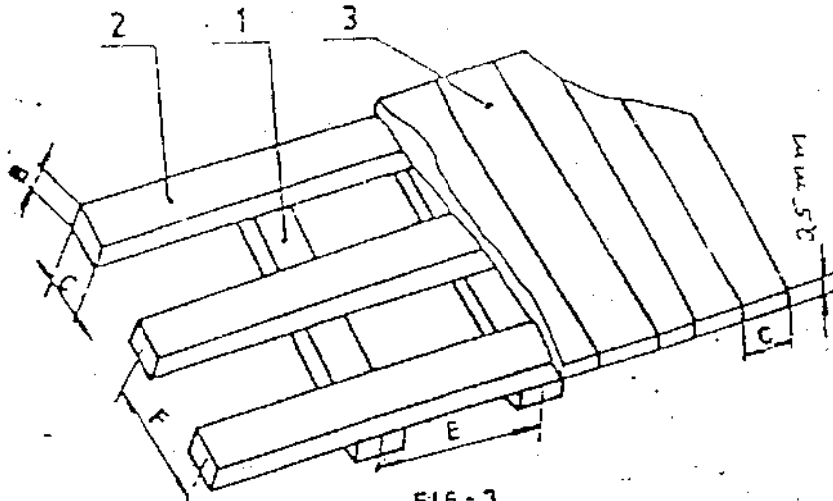
TOP FRAME ARRANGEMENT

FIG-3

Dim F : 700 to 1000 mm
 Dim E : 500 to 900 mm
 B x C : 30 x 100 mm.

- 1 - Traverse Bars
- 2 - Horizontal Scans
- 3 - Top Board

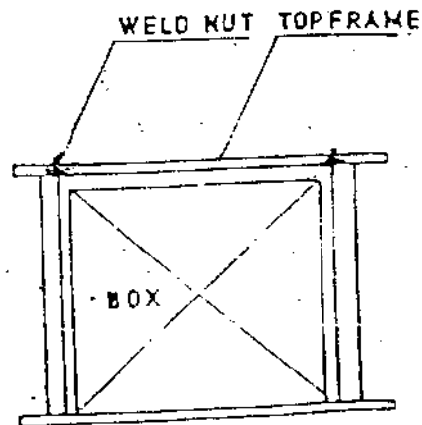
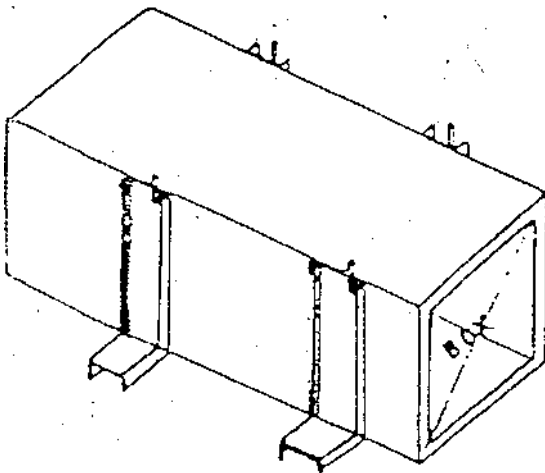
ARRANGEMENT OF C-CLAMPS AROUND CASES

FIG-4

ARRANGEMENT OF DIAGONAL BRACING AND HORIZONTAL SUPPORT

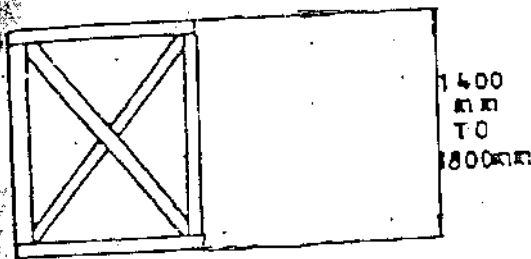


FIG: 6

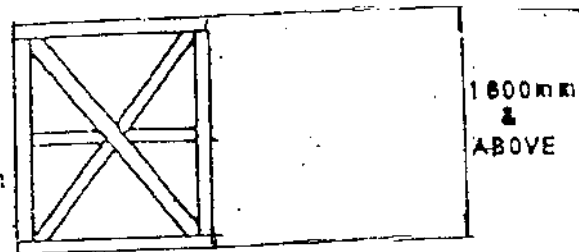


FIG: 8

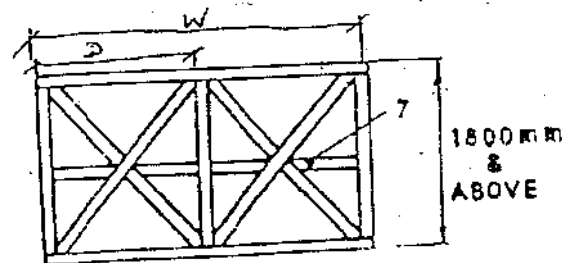


FIG: 9

7- Middle Horizontal Support

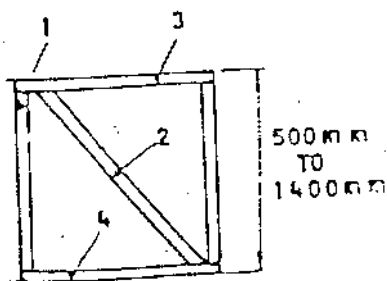


FIG: 5

- 1- Vertical Support
- 2- Diagonal Bracing
- 3- Upper Horizontal Support
- 4- Lower Horizontal Support

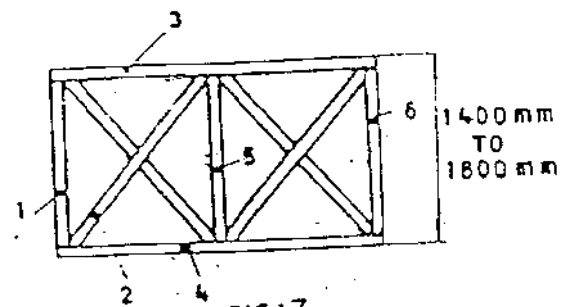
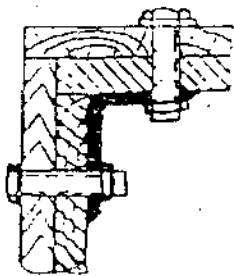
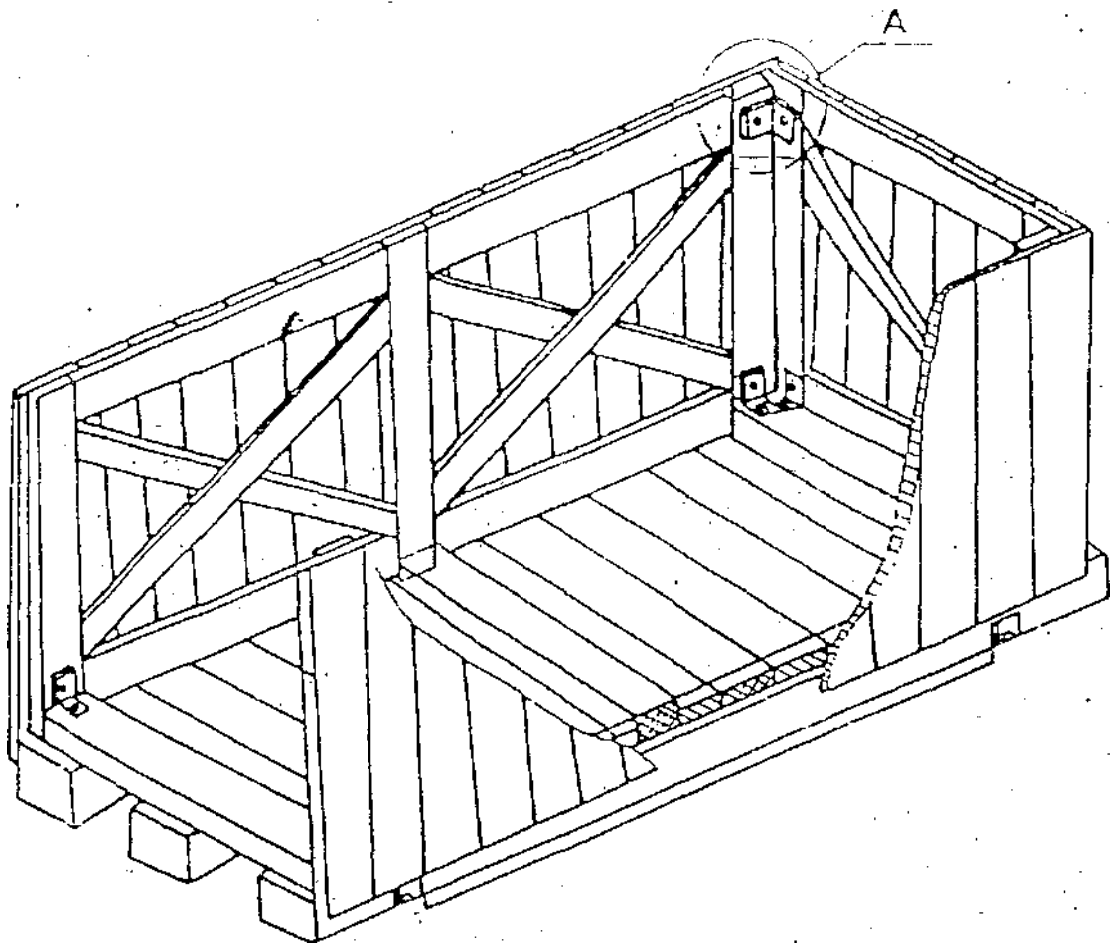


FIG: 7

- 1, 5, 6 - Vertical Support
- 2 - Diagonal Bracing
- 3 - Upper Horizontal Support
- 4 - Lower Horizontal Support

The dimensions of various items shall be as Table-2

ARRANGEMENT OF PACKING CASE



DETAIL-A

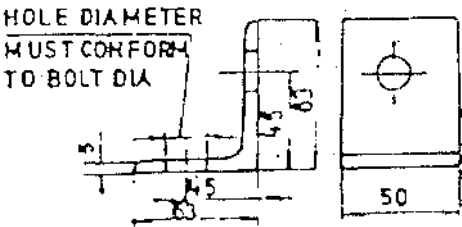


FIG 1D

ARRANGEMENT OF SLING - PLATE ON
CASES

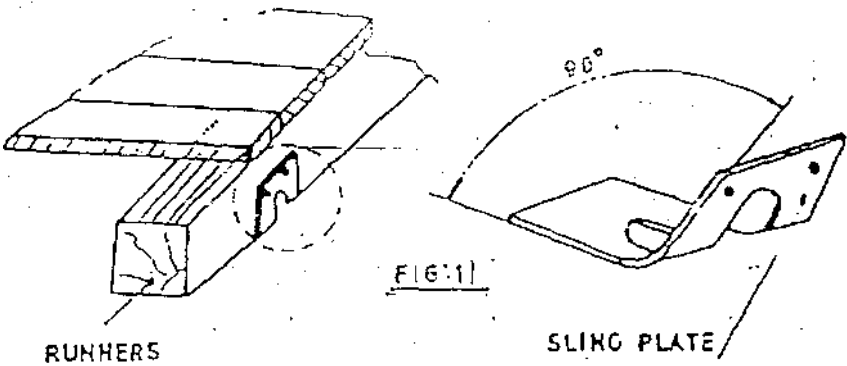


Table 1

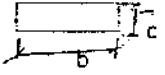
load	Length of Slides						
	600	800	1000	1200	1300	1500	2000
	Cross Section $b \times c$ 						
500	50 x 100	50 x 100	50 x 100	50 x 100	75 x 100	75 x 100	100 x 100
800	50 x 100	50 x 100	75 x 100	75 x 100	75 x 100	75 x 100	100 x 100
1000	75 x 100	75 x 100	75 x 100	100 x 100	100 x 100	100 x 110	100 x 150
1500	75 x 100	75 x 100	100 x 100	100 x 100	100 x 100	100 x 150	100 x 150
2000	75 x 100	100 x 100	100 x 100	100 x 150	100 x 150	100 x 150	150 x 150
2500	75 x 100	100 x 100	100 x 150	100 x 150	100 x 150	150 x 150	150 x 150
3000	100 x 100	100 x 150	150 x 150	150 x 150	150 x 150	150 x 150	

Table 2

End and side Panels	Width of the panel W	Distance between longitudinal support DIM 'D'						
		600	800	1000	1200	1400	1600	1800
		Cross section (b : c)					Item 1 to 7	
Fig 5 to	600 to 1200	30 x 100	30 x 100	30 x 100	30 x 130	30 x 130	30 x 130	30 x 130
	1201 to 1600	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130
	1601 to 2000	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130
Fig 9	2001 to 3000	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	30 x 130	40 x 150
	3001 to 4000	30 x 130	30 x 130	40 x 150	40 x 150	40 x 150	40 x 150	40 x 150

INDICATION MARKS ON CASES

SL. NO.	INDICATION MARK	MEANING
1		TOP SIDE
2		KEEP AWAY FROM HEAT
3		SLINGING POSITION
4		FRAGILE MATERIAL. TO BE HANDLED WITH CARE
5		CENTRE OF GRAVITY
6		KEEP DRY

BHEL-PEM-DELHI-INDIA			
CONSIGNEE			
MATERIAL		MO. NO.	
CUSTOMER REF.		CASE NO.	
DESPATCH ADVICE NOTE NO.	NET WT -KGS	GROSS WT -KGS	
DIMENSIONS(MM) LXBXH			
SPECIAL INSTRUCTIONS		HANDLE WITH CARE - KEEP DRY DO NOT DROP - DO NOT TILT	

FIG-13: MARKING PLATE.

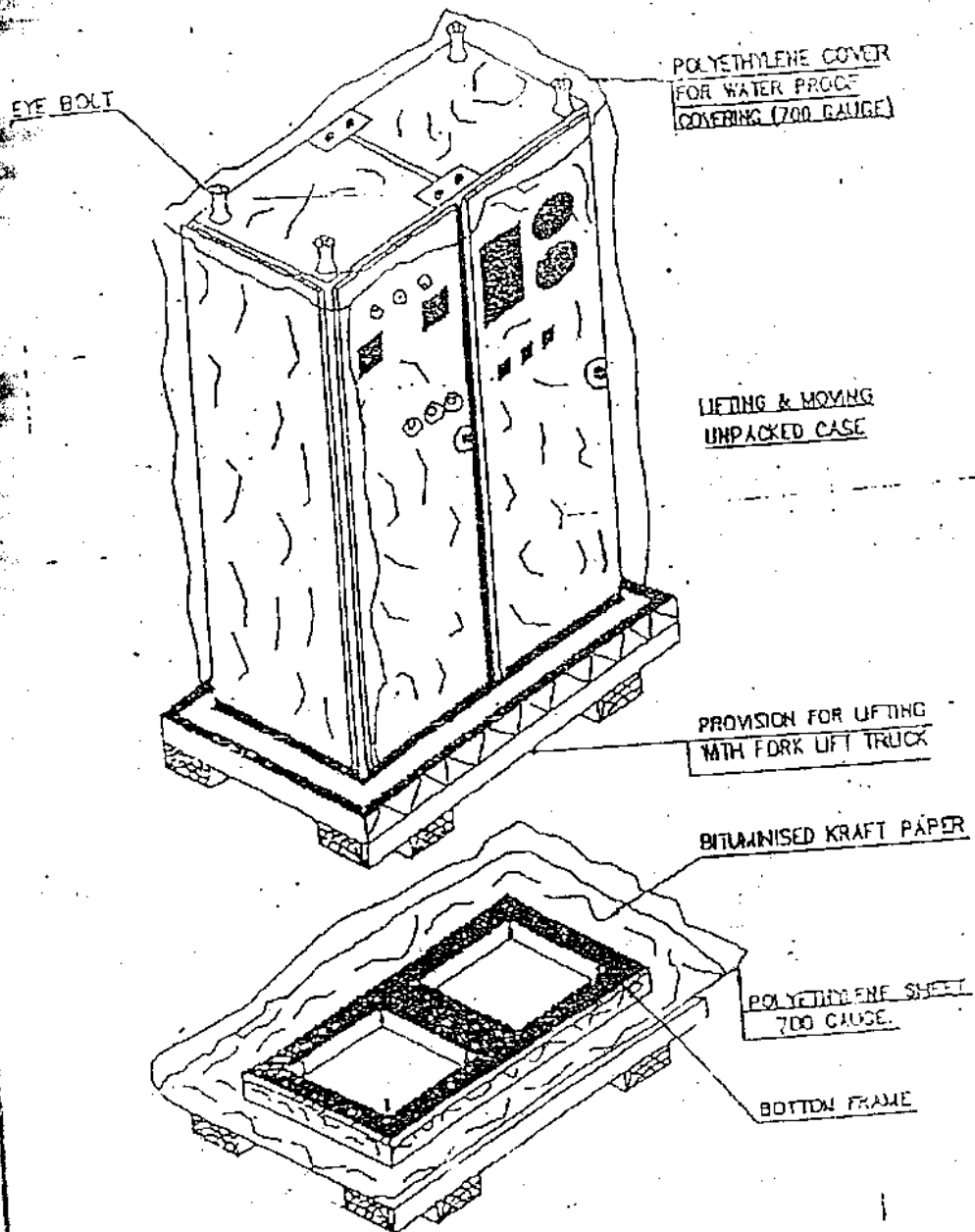


FIGURE-14

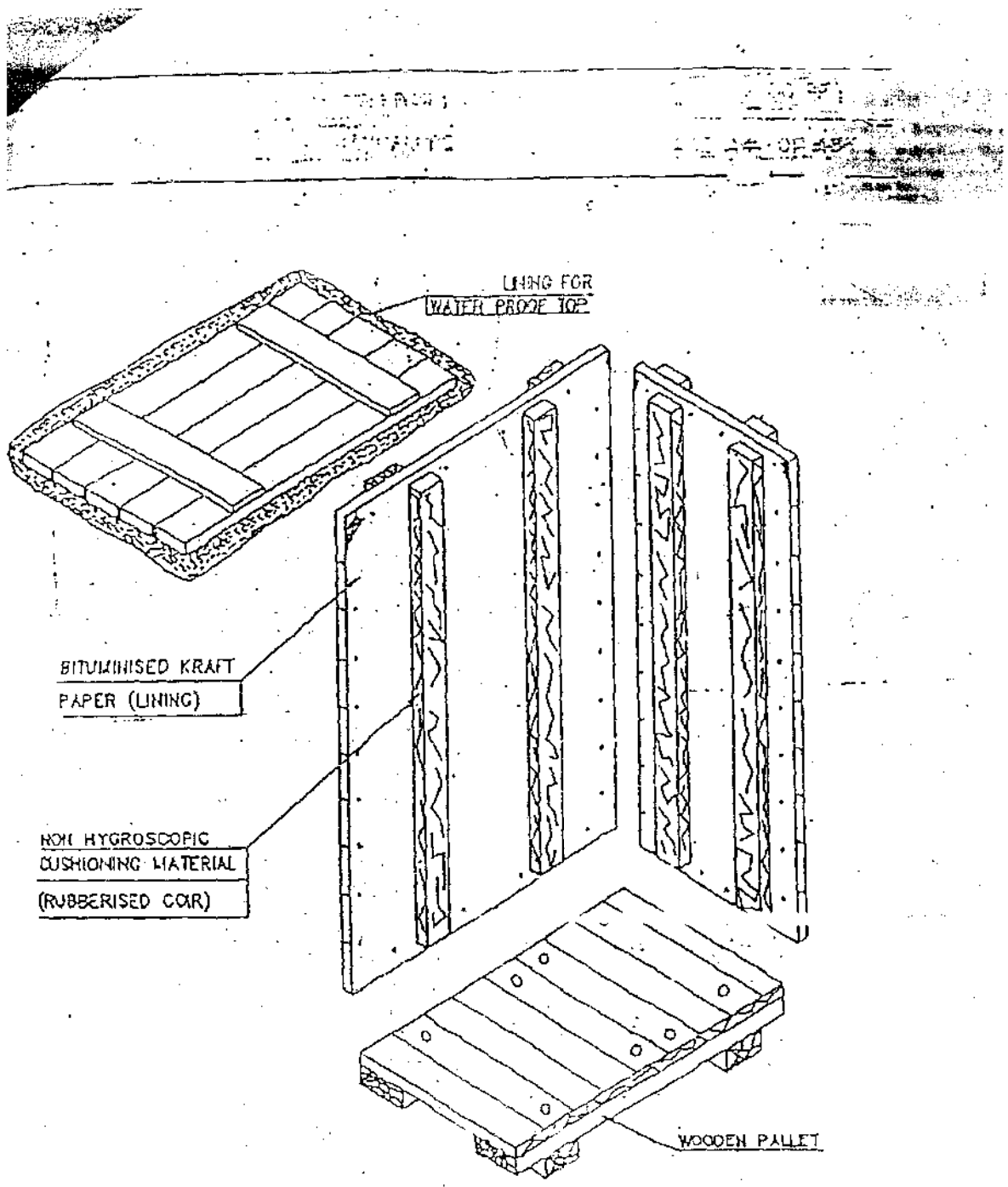


FIGURE-15

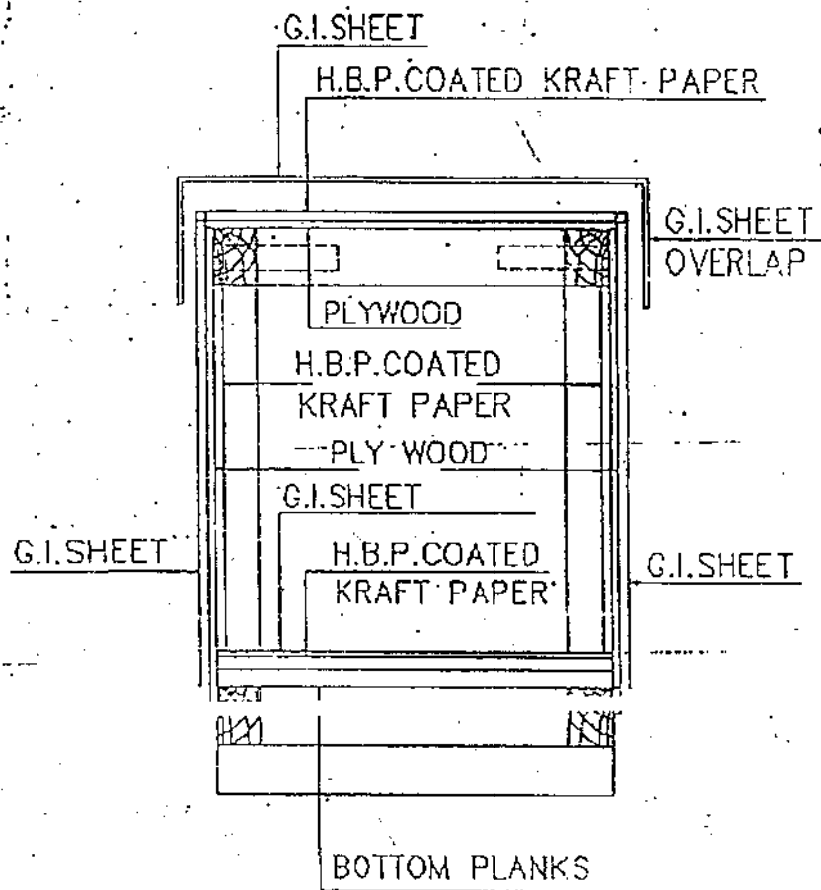


FIG-16 : CLOSED PACKING CASE WITH G.I.SHEET
SHOWING LAYERS OF PACKING MATERIALS.

Annexure –E

QA&I Formats

	SJVN	FORM NO.: F-060-01 PAGE: 1 of 14 ISSUE: 2.0 REV. 01 DATE: 30/06/2016
	FORM	

VENDOR / SUB-VENDOR ASSESSMENT SHEET

TO BE FILLED-IN BY SUPPLIER / SUB-VENDOR

NAME OF SUPPLIER / SUB-VENDOR IN FULL					
		REGISTERED OFFICE		FACTORY / WORKS	
ADDRESS					
TELEPHONE NO.					
FAX NO.					
EMAIL ID					
PERSON(S) TO BE CONTACTED (NAME & DESIGNATION & MOBILE NO.)					
WEEKLY OFF					
SHIFT WORKING		Type of Company (Pl. Tick)		Type of Industry (Pl. Tick)	
OFFICE	WORKS	Pvt. Ltd	Public Ltd.	MSME	Large Scale
ONE	ONE	☐	☐	☐	☐
☐	☐	Proprietary	Partnership	Govt.	Contractor
TWO	TWO	☐	☐	☐	☐
☐	☐	Public Sector			
THREE	THREE	☐			
☐	☐				

	SJVN	FORM NO.: F-060-01 PAGE: 2 of 14 ISSUE: 2.0 REV. 01 DATE: 30/06/2016
	FORM	

Sr. No.	Items / Services / Process for which Approval is desired for	Rating / Size & Type	Applicable Standards IS/DIN/BS/IEC Etc.

REGISTRATION DETAILS

PAN / TAN NO.	CENTRAL SALES TAX REG. NO.	STATE SALES TAX / TIN NO.	EXCISE DUTY REGISTRATION NO.
ENCISE CONTROL CODE NO.	SERVICE TAX REG. NO.	CATEGORY OF INDUSTRY	REGISTRATION NO. & VALIDITY DATE
		Micro ☐	
		Small ☐	
		Medium ☐	
		Large ☐	

ARUN-III HEP

	SJVN	FORM NO.: F-060-01 PAGE: 3 of 14 ISSUE: 2.0 REV. 01 DATE: 30/06/2016
	FORM	

A. ORGANISATIONAL SOUNDNESS						
Sr. No.	DESCRIPTION		DETAILS TO BE FURNISHED			
1.	Nature of Business (Strike whichever is not applicable)		Manufacturing Unit / Engineering Consultant / Agents / Distributors / Stockists / Dealers / Traders / Indian Subsidiary / EPC contractor / Channel Partner (Attach authorization certificate of principal) / Erection contractor / Other			
2#	Year of commencement of Business / Factory Establishment					
3.	Year of Commencement of Manufacture / Services					
4.	Total Area/Covered Area in Sq. m.		Total Area	Covered Area		
5.	Electric Power-Connected Load					
6#	Electric Power Standby Load & System					
7.	Details of Directors					
Sr. No.	Name	Designation	Qualification	Experience		
8.	Details of Employees					
Please attach copy of Company's Organization Chart (For Unit)						
Division Status	Graduate		Diploma	Skilled	Un-Skilled	Remarks
	Technical	Non-Technical				
Production						
Engineering & Quality Control						
Administration & Other Supporting activities.						

	SJVN	FORM NO.: F-060-01 PAGE: 4 of 14 ISSUE: 2.0 REV. 01 DATE: 30/06/2016
	FORM	

9. Brief Details of Product and Manufacturing Capability					
Sr. No.	Item & Material	Description (Type, Size Rating)	Annual Production for Last Three Years		
			I	II	III
10.#	Details of Foreign or Indigenous Collaborator				
Sr. No.	Product	Name & Address of Collaborator	Collaboration		
			Scope	Year	Valid up to
11#	Have your product been type tested by any external agency? If so, give details				
Sr. No.	Product	Test (Size / Type & class	Test Report No.	Next Due date	

ARUN-III HEP

	SJVN	FORM NO.: F-060-01 PAGE: 5 of 14 ISSUE: 2.0 REV. 01 DATE: 30/06/2016
	FORM	

12.#	Have you been approved by any Statutory agency / third party agency like LLOYD, ASME, NTPC, PGCIL, EIL, Railways etc. ? If so, indicate details and enclose copies of approval letters				
Sr. No.	Item / Material / Service / Process	Description (Size, Type & Class)	Agency	Date of approval	Next Due date
13.#	Indicate Approval / Certification by National / International Standards / Agencies applicable for the subject product.				
Sr. No.	Product	Codes / Standards	License No. & Date		
14.#	Reference List (Experience in Particular Type of Equipment / Service / Process). Please indicate since how many years similar type of item / equipment / service / process provided (please furnish documentary evidence).				
Sr. No.	Item / Material / Service / Process	Type & Capacity / Rating	Customer (End User with Address)	Date of Supply / Service provided	Under Operation since year / Month
#Note: Please furnish the performance feedback certificate for proposed item / equipment / process / service form end user in line with requirement stipulated in Technical Specification.					

	SJVN	FORM NO.: F-060-01 PAGE: 6 of 14 ISSUE: 2.0 REV. 01 DATE: 30/06/2016
	FORM	

15.#	Business Commenced with SAPDC/SJVN in past				
Sr. No.	Year	Name of Department / Project Dealt with	Item Supplied / Services Offered.		
16.A#	Machinery, Instrument & other Equipment Specific to Process & Product Facilities / service				
Sr. No.	Description of Machine	Capacity & Nos.	Location Shop	Make	Year of Manufg.
16.B#	Other General Facilities				
Sr. No.	Description of Machine	Capacity & Nos.	Location Shop	Make	Year of Manufg.
i	Material Handling Mobile Crane Fork Lift Over Head Cranes				
ii	Metal Cutting &				

ARUN-III HEP

	SJVN		FORM NO.: F-060-01		
	FORM		PAGE: 7 of 14 ISSUE: 2.0 REV. 01 DATE: 30/06/2016		

	Bending				
iii	Casting				
iv	Forging				
v	Fabrication				
vi	Welding				
vii	Machining				
viii	Heat Treatment				
ix	Sheet Metal				
x	Fettling & Cleaning, Sand Blasting, Shot Blasting & Pickling				
xi	Painting				
xii	Metal Coating				
xiii	Protection before packing				
xiv	Packing				
xv	Other				
17.#	If In-House Manufacturing Facilities not available, inform source of manufacturing details along with their facilities and experience				
Sr. No.	Process outsourced	Name of the company	Description of machine / Equipment	Remarks	
18. A#	Facilities for In-house Testing & Inspection				
Sr. No.	Description	Capacity & Nos.	Make & Year of Mfg.	Calibration Status	Approval Qualification

	SJVN		FORM NO.: F-060-01			
	FORM		PAGE: 8 of 14 ISSUE: 2.0 REV. 01 DATE: 30/06/2016			

18. B#	If In-house testing facilities are not available, indicate source of testing with relevant details.				
Sr. No.	Source of Testing	Description	Capacity & Nos.	Make & Year of Mfg.	Calibration Status
Note: In case of outsourcing of major testing such as NDT, Electrical & Mechanical testing, no marks will be awarded. However, material composition testing by chemical method from NABL Lab shall not attract negative marking.					
18 C #	Details of any Government Laboratory facility available in area				
	Product related testing facility (type / Performance / Routine / Acceptance Test)				
19	Sources of Raw Material and Bought out Items				
Sr. No.	Description of Raw Material / Bought Out Items			Source	
20 #	Storage Area Availability				
	Storage for finished goods (Open / Close)				
	Raw Material storage and identification				

	SJVN	FORM NO.: F-060-01 PAGE: 9 of 14 ISSUE: 2.0 REV. 01 DATE: 30/06/2016		
	FORM			
21 #	Do you have in-house Design / R&D departments?			
22 #	Details of pending legal issues on contractual aspects with customers, if any.			
23 #	Please furnish details of Labour problems in the last three years, if any?			
B. FINANCIAL SOUNDNESS OF ORGANIZATION				
Financial Information for last Three Years (Please furnish copy of annual report)				
Sr. No.	Parameters	Year 20	Year 20	Year 20
1#	Please furnish annual turnover of the company. Growth in annual turnover w.r.t. previous years (%)			
2#	Please furnish Profit before tax (PBT) of the company. Growth in PBT w.r.t. previous years (%)			
3#	Please indicate the net worth (Net current assets – Net current liabilities) of the company?			
4#	Whether the vendor has been referred to BIFR / NCLT / any other similar Govt. agency.			
5#	Whether the supplier is a potentially sick company.			
6	Please mention current order book position, as on date in terms of Value and time			
C. QUALITY SYSTEM				
Sr. No.	DESCRIPTION	Sub-vendor response (along with supporting document)		
1*	Are you an ISO 9001 company? If yes, please furnish the certificate and what is your quality policy?			
2*	Is the company an ISO 14000 approved?			
3#	Is the company an OHSAS approved?			
4*	Have your company won any Quality award like Rajeev Gandhi National Quality Award, DMC Ramkrishna Bajaj National Quality Award, Golden Peacock National Quality Award etc? If yes provide documentary evidence.			
5*	Have you received appreciation letter from your customer. Please provide evidence.			
6	To whom your Q.C./Q.A. Chief reports to? (Please furnish your organization structure)			
7*	If you have a written quality control manual/procedure, then please furnish the same.			

	SJVN	FORM NO.: F-060-01 PAGE: 10 of 14 ISSUE: 2.0 REV. 01 DATE: 30/06/2016	
	FORM		
7 (i) *	Incoming Material Control System (Furnish a copy of system and organization)		
7 (ii) *	Process Control: Are written procedure defining stage wise operations and functions on shop floor established and followed? (Furnish copy of work instruction and record of process control parameter)		
7 (iii) *	Manufacturing/Testing Procedure Qualification & Personnel Qualification (Procedure qualification specification & Record of personnel qualification (PQR) to be submitted).		
7 (IV) *	Are written Quality Control Instruction sheets prepared & properly used? (Please furnish evidence)		
7 (V) #	Are records generated during inspection maintained & available for review? (Please furnish evidence)		
7 (VI) *	Are quality control checks / procedure adequate to maintain desired quality level right from the incoming stage to final stage? Please furnish copy of such control checks / procedure.		
8 #	Documentation Control		
8 (i)	Does a system for clear and precise stipulation of responsibilities for documentation issue & change control exists?		
8 (ii)	Are changes made in writing?		
9*	Control of Inspection, measuring and testing equipment		
9 (i)	Are necessary gauges, testing and measuring equipment's, available and used?		
9 (ii)	Are testing and measuring equipment properly maintained?		
9 (iii)	Is recorded control on calibration of equipment available?		
10*	System of Identification & Traceability of materials, tools, jigs, fixtures & processed components, etc. (Copy of procedure to be submitted).		
11*	System of Storage / Preservation / Painting and Packing (copy of Procedure to be submitted)		
12*	Do you have written procedure for disposing off the non-conformities? If yes, please furnish the copy of the same also furnish three copies of NCR & CAPA.		
13*	Safety measures (Submit copy of safety system & record of accidents for last two years)		
14#	What type of Sampling Inspection Plan is used in your factory/company? Please furnish details.		
15	How good are you in keeping your dispatch commitments? Please give details of last ten deliveries stating details as below (Provide documentary evidence) Within delivery period:		

	SJVN	FORM NO.: F-060-01 PAGE: 11 of 14 ISSUE: 2.0 REV. 01 DATE: 30/06/2016
	FORM	

	Delayed but accepted by user: Delayed but accepted with penalty:	
16 [#]	Have you ever been de-listed or put in under temporary suspension by any customer / contractor.	
D. AFTER SALES SERVICE		
Sr. NO.	DESCRIPTION	Sub-vendor response (along with supporting document)
1 [#]	For overcoming product deficiencies what are the analytical methods used at Customer's premises?	
2 [#]	What is the strength of your "after-sales service" team?	
3 [#]	What is the response time after receiving complaints from the customers? Provide evidence.	
4 [#]	Customer complaints handling system (Submit list of customer complaints & status for the last three years) Please furnish complete list of complaints attended to during last one year.	
5 [#]	How do you keep your "after-sales service" team updated?	
6 [#]	Provide certificate from 02 customers (end user) for satisfactory after sales services.	

Declaration by Director/ Partner/ Proprietor

I declare that the information furnished above and attached documents are correct to the best of my knowledge. I undertake to inform you at the earliest any change(s) in the details mentioned above.

Signature and Date

Name & Designation

	SJVN	FORM NO.: F-060-01 PAGE: 12 of 14 ISSUE: 2.0 REV. 01 DATE: 30/06/2016
	FORM	

TO BE FILLED BY MAIN CONTRACTOR FOR SUB-VENDOR (MC)

Sr. No.	Parameters	Supplier response (along with supporting document)
1	Name and address of sub-vendor:	
2 (a)	Type of equipment / item / process / service for which approval is sought:	
2 (b)	Details of equipment / item / process / service for which approval is sought (i.e. Rating, capacity, type, size, weight, etc.):	
3	Experience of main contractor with sub-vendor:	
(a) [#]	Since how many years sub-vendor is registered with you for proposed type of equipment / item / process / services (furnish documentary evidence):	
4 [#]	Whether sub-vendor is meeting the qualification criteria indicated in the technical specification (furnish documentary evidence).	
5 [#]	Sub-vendor rating as per contractor's internal procedure in the scale 0-10 or 0-100% (furnish documentary evidence).	
6 [#]	Any dispute of main contractor with vendor during execution of last 05 contracts.	
7 [#]	Have you ever de-listed or put in temporary suspension the proposed sub-vendor? If yes, please provide the reason for same.	
8	Please indicate the reason for re-approving / re-listing the sub-vendor.	

I declare that the information furnished by Sub-vendor has been verified and found in order / minor changes which have been marked and initialed on this form itself / observed the following discrepancies.

(Signature & Designation)

ARUN-III HEP

	SJVN	FORM NO.: F-060-01 PAGE: 13 of 14 ISSUE: 2.0 REV. 01 DATE: 30/06/2016
	FORM	

**GUIDELINES TO SUPPLIERS FOR FILLING-UP VENDOR/SUPPLIER
REGISTRATION FORM**

- All columns are to be filled up properly in the space provided for. Wherever it is not applicable / not available, please mention "Not Applicable" / "Not Available". All pages of the form are to be signed along with seal by the authorized signatory.
- A separate sheet may be attached if the space provided is insufficient or additional information is to be given, Please put proper identification tag on the separately attached sheet.
- Any information / clarification required by SAPDC/ Consultant during evaluation must be given expeditiously.
- Please ensure that all required enclosures are attached with the filled up Vendor Registration Form.
- Marks shall be awarded on the basis of documentary evidences submitted by Vendor / sub-vendor wherever called in vendor / sub-vendor assessment form.
- Incomplete or incorrect forms will be rejected.
- Please fill up the check list given below and send along with the vendor registration forms to SAPDC/Consultant.
- In case any information found incorrect / false, the vendor shall be rejected / de-listed at any stage.
- Information with # marks is score able.
- Accepting or rejecting a vendor is sole discretion of SAPDC.
- Product catalogue / manual for the proposed item / equipment / process / service, if available, shall be submitted alongwith other documents.

	SJVN	FORM NO.: F-060-01 PAGE: 14 of 14 ISSUE: 2.0 REV. 01 DATE: 30/06/2016
	FORM	

Furnish following information/Documents:-

Sr. No.	Description	Yes / No	Page No / Annexure
1	Latest audited annual account.		
2	Balance Sheet.		
3	Valid Income Tax Clearance Certificate.		
4	Details of Pending Arbitration cases.		
5	Details of pending disputes with Statutory Authorities.		
6	Organization chart		
7	Copy of Performance certificate (minimum 03)		
8	Copy of minimum three (03) completion certificates of similar work / service.		
9	Letter of approval from ASME / NTPC/ EIL / Railway / Lloyds / Power Grid etc. if any.		
10	ISO: 9001 certificate		
11	Quality Manual		
12	ISO: 14000 certificate		
13	OHSAS, ISO 18000 certificate		
14	Experience list		
15	Type test report & approval certificate		
16	Product Approval certificate from national / international agency.		
17	Quality award certificate		
18	Process and Personnel qualification certificates		
19	Copy of registration / enlistment with reputed / large organizations		
20	Detail of existing clients and details such as address, contact number and mail address.		
21	List of works / projects of similar nature executed with documentary evidences of works executed in last 02 years.		
22	Other documents mentioned elsewhere in vendor / sub-vendor assessment form.		

(Signature & Designation)

ARUN-III HEP

	SJVN	FORM NO.: F-080-02 PAGE: 1 of 1 ISSUE: 2.0 REV. 01 DATE: 30/06/2016
	FORM	

	PROJECT NAME (MW)			MANUFACTURING / FIELD QUALITY ASSURANCE PLAN				CONTRACTOR NAME, ADDRESS & LOGO		
	ITEM DESCRIPTION			SUB-ITEM	QAP NO.	REV. NO	ISSUE DATE	SUB-CONTRACTOR NAME, ADDRESS & LOGO		
SR. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK M/C S	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY M C S	REMARKS
1	2	3	4	5	6	7	8	9	10	11
LEGENDS										
M	MANUFACTURER		C	CONTRACTOR		S	SAPDC LTD.			
P	PERFORM		V	VERIFICATION OF RECORDS		W	WITNESS / CHP			
IR	INSPECTION REPORT		DRG	DRAWING		CHP	CUSTOMER HOLD POINT			
MA	MAJOR		MD	MINOR		CR	CRITICAL			
ME	MEASUREMENT		NDT	NON DESTRUCTIVE TESTING		HT	HEAT TREATMENT			
TR1	CERTIFICATE OF COMPLIANCE TO TS/STANDARD REQUIREMENT WITHOUT ANY CHECK LIST OF TESTS CARRIED OUT.		TR2	CERTIFICATE OF COMPLIANCE TO TS/STANDARD REQUIREMENT WITH CHECK LIST OF TESTS CARRIED OUT.		TR3	TEST REPORT/TEST CERTIFICATE WITH TEST RESULTS BASED ON SPECIFIC INSPECTION & TESTING AT MANUFACTURER FACILITY/NABL APPROVED LAB.			
NOTE: QAP SHALL BE READ IN CONJUNCTION WITH QUALITY ASSURANCE REQUIREMENT GIVEN AS PART OF TECHNICAL SPECIFICATION.										
MANUFACTURER / SUB-CONTRACTOR:			CONTRACTOR:		FOR SAPDC USE:		REFERENCE DOC NO. OF SJVN:			
PREPARED BY:		REVIEWED BY		REVIEWED & RECOMMENDED BY		REVIEWED BY		RECOMMENDED BY		APPROVED BY
NAME, DESIGNATION & SIGNATURE		NAME, DESIGNATION & SIGNATURE		NAME, DESIGNATION & SIGNATURE		NAME & SIGNATURE		NAME & SIGNATURE		SIGNATURE & SEAL

Prepared By:	Reviewed By:	Approved By:
		Process Owner

	SJVN	FORM NO.: F-060-04 PAGE: 1 of 5 ISSUE: 2.0 REV. 01 DATE: 28/06/2016
	FORM	

NON-CONFORMITY REPORT FOR MANUFACTURING, TRANSPORTATION, STORAGE & ERECTION STAGES		FOR SAPDC USE ONLY NC NO. Date: PAGE 1 of 5
PART-A (Proposal of Disposition of Non Conformity) Please read instructions carefully before filling up the form and attach separate sheet wherever required.		
Contract No.	CATEGORY OF NON CONFORMITY (Please refer instruction no.1&Tick appropriate)	
Package Unit No.		
Supplier/ Contractor	MAJOR ☐	
Sub-Vendor	MINOR ☐	
Place of Manufacture		
DETAILS ITEM DESCRIPTION: _____ IDENTIFICATION NO. _____ RANGE/SIZE/TYPE: _____ QUALITY PLAN NO.: _____ & CLAUSE NO. _____ STAGE OF NON-CONFORMITY ☐ DESIGN (A) /RAW MATERIAL (B) /ASSEMBLY (C) / IN PROCESS (D)-Specify _____/ TESTING (E)/ STORAGE (F) /HANDLING & TRANSPORTATION (G) /ERECTION & COMMISSIONING (H) /ANY OTHER (I) (SPECIFY) _____		
NON CONFORMITY-DESCRIPTION WITH CAUSE (Attach Relevant Drawings/ Details): 		
PROPOSED DISPOSITION WITH JUSTIFICATION(For Correction): (Note: Attach Details including design calculation)		Disposition Code ☐

	SJVN	FORM NO.: F-060-04 PAGE: 2 of 5 ISSUE: 2.0 REV. 01 DATE: 28/06/2016
	FORM	

NON-CONFORMITY REPORT FOR MANUFACTURING, TRANSPORTATION, STORAGE & ERECTION STAGES		FOR SAPDC USE ONLY NC NO. Date: PAGE 2 of 5
STEPS TO PREVENT RECCURANCE (For Corrective Action): 		
ENCLOSURE SUBMITTED BY CONTRACTOR:- ☐ DRAWINGS/ DETAILS ☐ INSPECTION REPORT ☐ ROOT CAUSE ANALYSIS ☐ PROCEDURE OF DISPOSAL OF NCR ☐ ANY OTHER (Please specify) _____		
DATE	NAME & DESIGN	SIG.OF CONTRACTOR
FINAL DISPOSITIONING BY SAPDC INCHARGE of RIO or FQA (In case of Minor) SAPDC (In case of Major)		SEAL Disposition Code ☐
DATE	NAME & DESIG.	SIGNATURE

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	SJVN	FORM NO.: F-060-04 PAGE: 3 of 5 ISSUE: 2.0
	FORM	REV. 01 DATE: 28/06/2016

NON-CONFORMITY REPORT FOR MANUFACTURING, TRANSPORTATION, STORAGE & ERECTION STAGES		FOR SAPDC USE ONLY NC NO. Date: PAGE 3 of 5
FOR SAPDC INTERNAL USE ONLY		
RECOMMENDATION of INCHARGE of RIO or FQA (In case of Major)/ CONCERNED SAPDC 's INSPECTION/ SITE ENGINEER (In case of Minor)		Disposition Code
DATE	NAME & DESIG.	SIGNATURE
RECOMMENDATION OF SAPDC CONCERNED ENGINEER		Disposition Code
DATE	NAME & DESIG.	SIGNATURE
GROUP HEAD		
DATE	NAME & DESIG.	SIGNATURE
RECOMMENDATION OF SAPDC (FOR MAJOR CATEGORY) (Comments of Engineering / Others deptt as applicable to be considered)		
DATE	NAME & DESIG.	SIGNATURE

	SJVN	FORM NO.: F-060-04 PAGE: 4 of 5 ISSUE: 2.0
	FORM	REV. 01 DATE: 28/06/2016

NON-CONFORMITY REPORT FOR MANUFACTURING, TRANSPORTATION, STORAGE & ERECTION STAGES		FOR SAPDC USE ONLY NC NO. Date: PAGE 4 of 5
PART B (Verification of Corrections of Non-Conformity) (Filled after Completion of corrections of Non-Conformity)		
ACTION TAKEN BY SUPPLIER/ CONTRACTOR (Attach Report of verification)		
DATE	NAME & DESIGN	SIG.OF SUPPLIER/ CONTRACTOR
VERIFICATION BY SAPDC'S SITE ENGINEER/ INSPECTION ENGINEER		
DATE	NAME & DESIG.	SIGNATURE
IN-CHARGE of RIO/ FQA		
DATE	NAME & DESIG.	SIGNATURE
COMMENTS OF SAPDC ENGINEER		
DATE	NAME & DESIG.	SIGNATURE
GROUP HEAD		
DATE	NAME & DESIG.	SIGNATURE
HOD		
DATE	NAME & DESIG.	SIGNATURE
HOD		
DATE	NAME & DESIG.	SIGNATURE
HOD		

ARUN-III HEP

	SJVN	FORM NO.: F-060-04
	FORM	PAGE: 5 of 5 ISSUE: 2.0 REV: 01 DATE: 28/06/2016

NON-CONFORMITY REPORT FOR MANUFACTURING, TRANSPORTATION, STORAGE & ERECTION STAGES	FOR SAPDC USE ONLY
	NC NO.
	Date:
	PAGE 5 of 5

INSTRUCTIONS 1. 'MAJOR' NONCONFORMITY IS DEFINED AS DEPARTURE FROM SPECIFICATION WHICH AFFECTS PERFORMANCE RELIABILITY. SAFETY INTERCHANGEABILITY. ERECTION, COMMISSIONING OR WORKING LIFE ALL OTHER NON-CONFORMITIES SHALL BE TREATED AS CATEGORY 'MINOR'. 2. ACCEPTANCE OF DISPOSITIONED NON-CONFORMANCE IS WITHOUT PREJUDICE TO SAPDC RIGHT TO CLAIM COMMERCIAL REBATE AND DOES NOT ABSOLVE CONTRACTUAL OBLIGATIONS. 3. OBTAINING APPROVAL OF STATUTORY AUTHORITY IF ANY W.R.T. ABOVE NON CONFORMANCE IS THE RESPONSIBILITY OF SUPPLIER/ CONTRACTOR. 4. DISPOSITIONING OF THIS NON-CONFORMANCE IS FOR THIS SPECIFIC CASE ONLY AND NOT TO BE REGARDED AS PRECEDENCE. 5. DISPOSITION CODE THE NON-CONFORMANCE SHALL BE DISPOSITIONED AS UNDER BY SAPDC AND SUPPLIER. (GIVE CODE AT APPROPRIATE BOXES):- (01) NC-REJECTED (02) NC- CONDITIONALLY ACCEPTED (SPECIFY CONDITION) (03) NC-ACCEPTED AS-IT-IS (04) NC-ACCEPTED WITH REPAIR. 6. NC NUMBER - THIS NO. SHALL BE ALLOTTED BY SAPDC AND SHALL HAVE SAPDC PROJECT NAME, PACKAGE, FOLLOWED BY RUNNING SERIAL NO. & ENTER TO NC REPORT BY RIO/ FQA/ CQAL
--

RESPONSIBILITIES OF CONTRACTOR 1. ASCERTAIN EXACT NATURE OF NON-CONFORMANCE AND ALONGWITH SUPPORTING DRAWING OF ITEMS/ EQUIPMENT ETC WITH WHICH NON-CONFORMANCE EXISTS. 2. IDENTIFY THE CAUSE OF NON CONFORMITY. 3. DECIDE ON CODE OF DISPOSING. 4. FINALISE THE CAUSE OF NON-CONFORMITY AND PROPOSE CORRECTIVE ACTION. 5. ENSURE AND CERTIFY THAT THE PRODUCT QUALITY PERFORMANCE, RELIABILITY AND WORKING LIFE IS NOT AFFECTED FOR MINOR NON-CONFORMITIES AND QUANTIFY THE EXTENT TO WHICH IT IS AFFECTED IN THE CASE OF CATEGORY 'MAJOR' NON-CONFORMITIES. 6. IMPLEMENT AGREED CORRECTIVE ACTION IN A TIME BOUND PROGRAMME AND PROVIDE FEEDBACK AS PER PART-B OF THE FORMAT

RESPONSIBILITIES OF RIO/ FQA 1. IDENTIFY THE PRODUCT APPROPRIATELY. 2. ANALYSE THE CAUSE OF NON-CONFORMITY AND PROPOSE RECOMMENDATION
--

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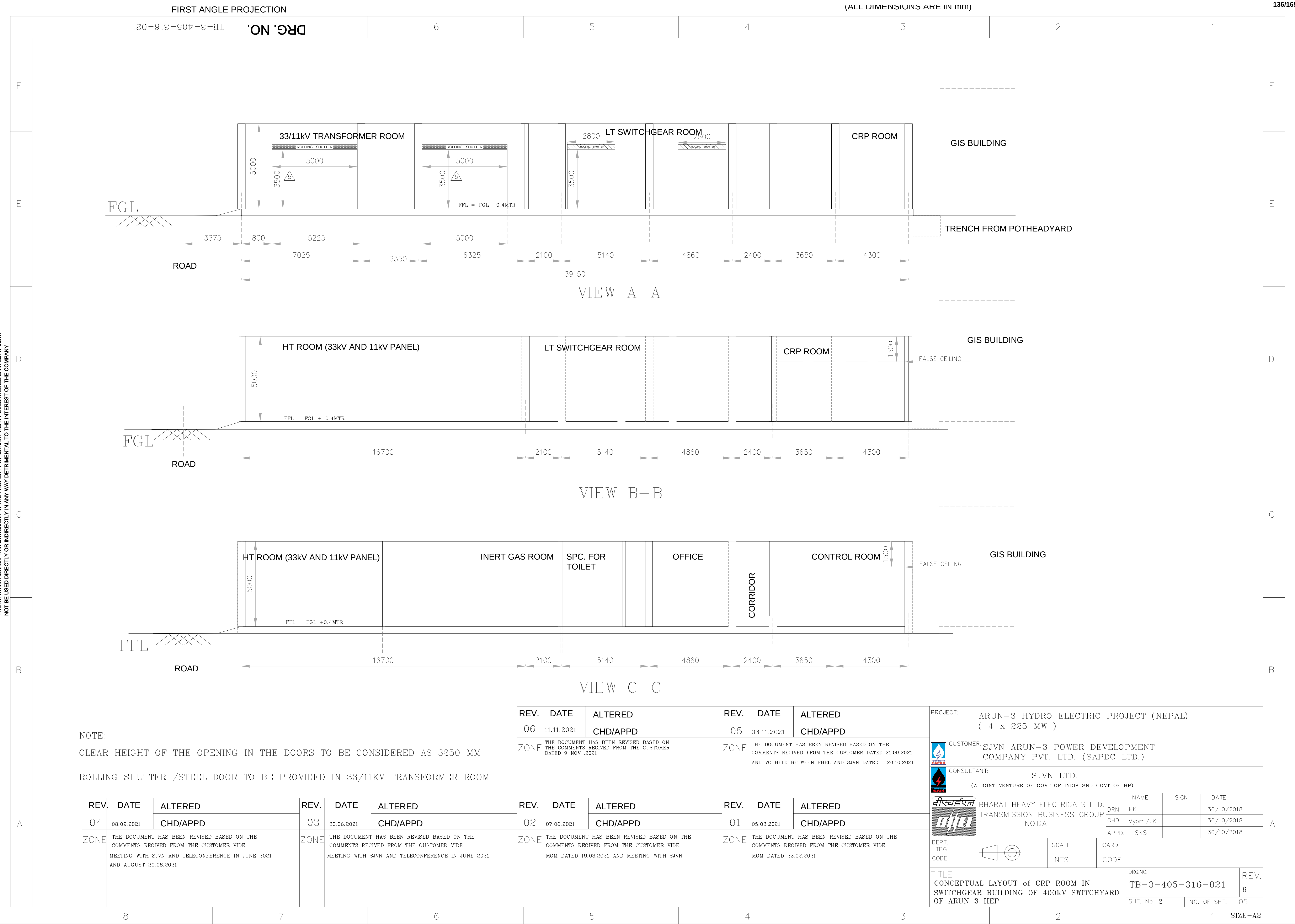
	SJVN	FORM NO.: F-060-06
	FORM	PAGE: 1 of 1 ISSUE: 2.0 REV. 00 DATE: 30/06/2016

INSPECTION CALL REQUEST

Inspection Call No.		Date:				
Project:		Contract No. :				
Contractor/Supplier's Name & Address:		Sub-vendor/Sub-Supplier's Name & Address:				
Contact Person:		Contact Person:				
Telephone/Mobile No.:		Telephone/Mobile No.:				
Fax No.		Fax No.				
email ID:		email ID:				
Details of Equipment with Unit No.:						
Sr. No.	Equipment/Item Description and Sr. No.	Unit No.	BBU Ref.	QAP No. & Rev. No.	Relevant QAP Clause No.	Approved Drawing No. & Rev. No.
Status of Type Tests		Approved / Not Approved / Not Applicable		Place of Inspection:		
Proposed date of Inspection:				Anticipated Working Days Required		
Status of internal inspection by Vendor/sub-vendor		Completed		In-progress	Yet to be done	
Tentative date of completion of internal inspection in case inspection is in-progress/yet to be done:						
Note: Readiness status is to be submitted separately after completion of internal inspection by Manufacturer.						

Date:
Place:

Signature
Name
Designation
Department
Company

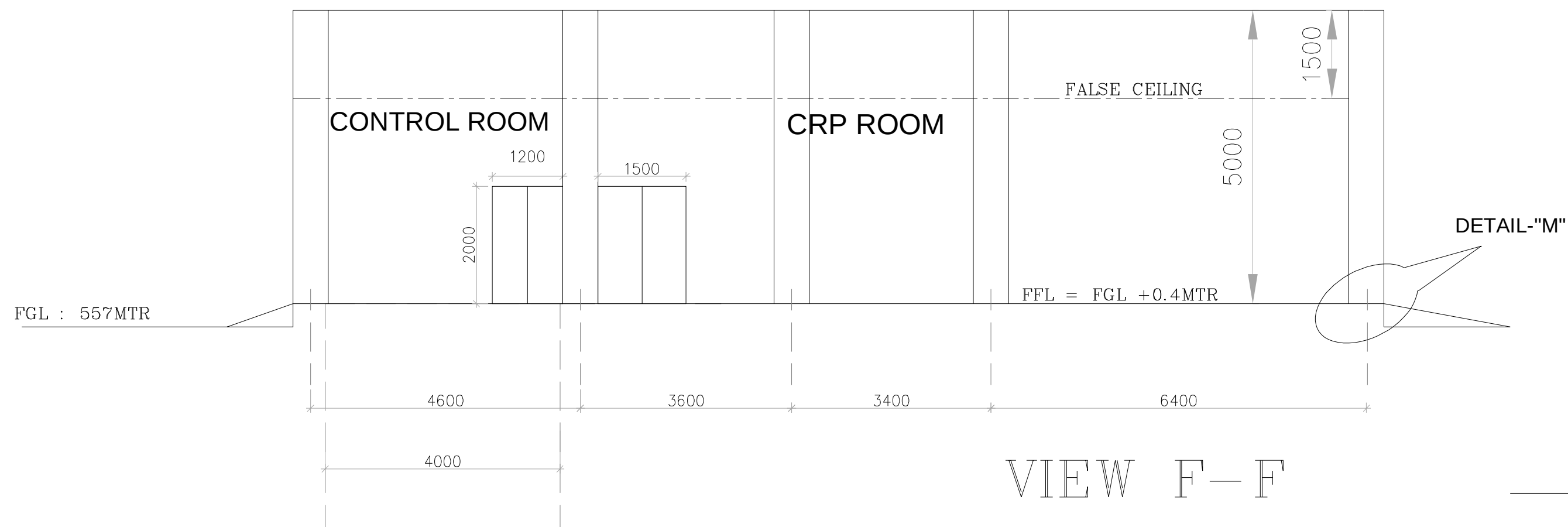
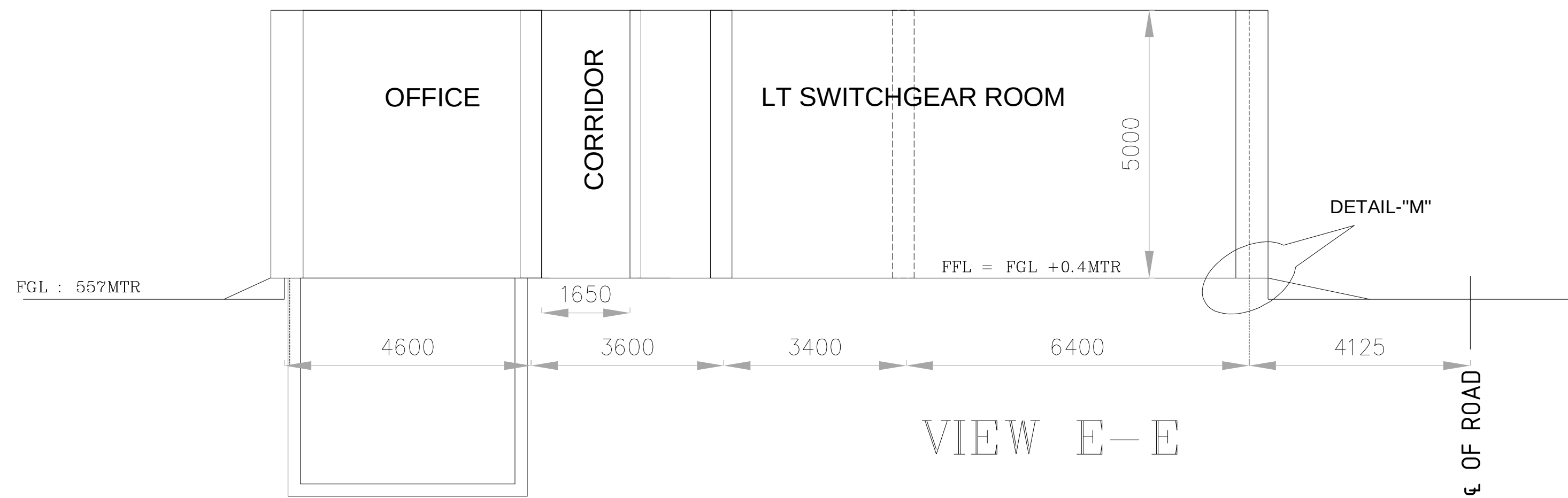
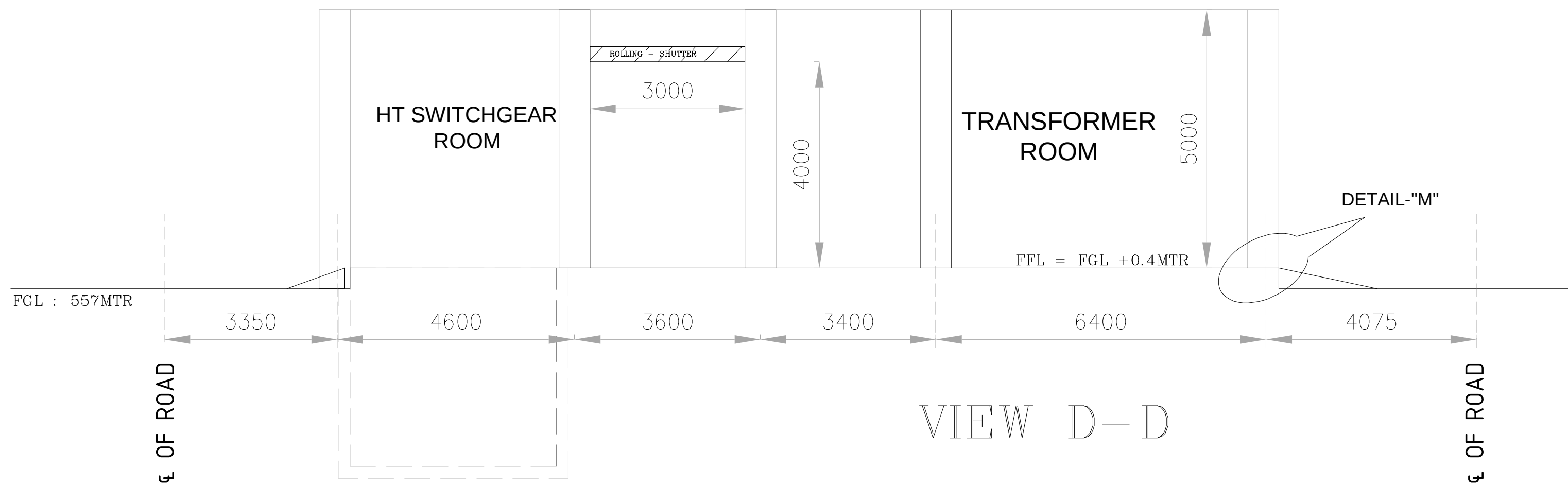


THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY

(ALL DIMENSIONS ARE IN INCH)

FIRST ANGLE PROJECTION

DRG. NO. TB-3-405-316-021



Panel References :

A	<u>Transformer Room</u>	
1	Transformer 33kV/11kV -A	1 Nos
2	Transformer 33kV/11kV -B	1 Nos
B	HT Panel Room	
3	33kV Panels - 13.0m x 3.50m x 2.50m - dwg no : 3 521 00 5 6540	1 Nos
4	11kV Panels - 5.74m x 2.35m x 2.70m - dwg no : 3 521 00 5 6517	1 Nos
B	<u>LT Panel Room</u>	
5	ACDB - 7.36m x 0.9m x 2.8m (tentative)	1 Nos
6	DCDB - 5.00m x 0.9m x 2.8m (tentative)	1 Nos
7	MLDB - 3.30m x 0.9m x 2.8m (tentative)	1 Nos
8	ELDB - 1.60m x 0.9m x 2.8m (tentative)	1 Nos
9	AC-PDB - 1.80m x 0.9m x 2.8m (tentative)	1 Nos
10	VENTILLATION-PDB - 1.80m x 0.9m x 2.8m (tentative)	1 Nos
C	<u>CRP Room</u>	
11	400kV Side Generator Transformer	1 Nos
12	400kV Line Reactor-1 (Panel A)	1 Nos
13	400kV Line Reactor-1 (Panel B)	1 Nos
14	400kV Line Dhalkebar-1 (Panel A)	1 Nos
15	400kV Line Dhalkebar-1 (Panel B)	1 Nos
16	400kV Side Generator Transformer	1 Nos
17	400kV Line Dhalkebar-2 (Panel A)	1 Nos
18	400kV Line Dhalkebar-2 (Panel B)	1 Nos
19	400kV Line Reactor-2 (Panel A)	1 Nos
20	400kV Line Reactor-2 (Panel B)	1 Nos
21	400kV Bus Coupler -2 (Panel B)	1 Nos
22	400kV Bus Reactor (Panel A)	1 Nos
23	400kV Bus Reactor (Panel B)	1 Nos
24	400kV Side GT	1 Nos
25	400kV Side GT	1 Nos
26	400kV Bus Bar	1 Nos
27	400kV Bus Bar	1 Nos
28	LCB - 3.0m x 0.8m x 2.5m - DWG NO : 3 694 00 00 836 Rev 02	1 Nos
29	PLCC/FOTE (SAPDC/SJVN Supply) - 0.75 m x 0.75 m x 2.2m (tentati	2 Nos
30	METERING PANEL - 0.75 m x 0.75 m x 2.2m	2 Nos
31	FUTURE PANEL - 0.75 m x 0.75 m x 2.2m	10 Nos

NOTES:-

1. ALL DIMENSION ARE IN MM UNLESS OTHERWISE NOTED.
2. HEIGHT OF ROOMS SHOWN IN SECTION IS CLEAR HEIGHT FROM BEAMS TO FFL.
3. ELEVATION SHOWN ABOVE IS FOR INDICATION OF HEIGHTS ONLY.
4. CABLE ENTRY FOR ALL PANELS SHALL BE THROUGH BOTTOM.
5. SIZE AND NUMBER OF PANELS INDICATED HERE ARE TENTATIVE AND SUBJECT CHANGES.
6. TRENCH SECTION SHALL BE PART OF DRAWING OF INDOOR TRENCH LAYOUT.
7. EDGE PROTECTION TO BE PROVIDED AT THE EDGE OF FLOOR CUTOUT AND CABLE TRENCH.
8. ALL THE PVC PIPE OPENINGS SERVING AS THE CONDUIT SHALL BE SEALED WITH A SEALANT AFTER CABLE LAYING.

DRAWING REFERENCE:-

1. 33KV POTHEADYARD SWITCHBOARD - 3 521 00 5 6540
2. 11KV POTHEADYARD SWITCHBOARD - 3 521 00 5 6517
3. OGA OF LCB OF 400KV SWITCHYARD - 3 694 00 00836 r2
4. OGA OF LCB OF 400KV SWITCHYARD - 3 694 00 00836 r2
5. OGA OF 400KV SWITCHYARD RELAY PANEL - 25610051715
6. OGA OF 33/11KV 3150KVA TRANSFORMER - DWG NO :34730052489

												PROJECT: ARUN-3 HYDRO ELECTRIC PROJECT (NEPAL) (4 x 225 MW)		
												CUSTOMER: SJVN ARUN-3 POWER DEVELOPMENT COMPANY PVT. LTD. (SAPDC LTD.)		
												CONSULTANT: SJVN LTD. (A JOINT VENTURE OF GOVT OF INDIA AND GOVT OF HP)		
												BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP NOIDA		
												NAME SIGN. DATE		
												DRN. PK 30/10/2018		
												CHD. Vyom/JK 30/10/2018		
												APPD. SKS 30/10/2018		
												DEPT. TBG CODE		
												SCALE NTS		
												CARD CODE		
												TITLE		
												CONCEPTUAL LAYOUT of CRP ROOM IN SWITCHGEAR BUILDING OF 400kV SWITCHYARD OF ARUN 3 HEP		
												DRG.NO. TB-3-405-316-021		
												REV. 6		
												SHT. No 3 NO. OF SHT. 05		

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FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN MM)

138/165

767

DRG. NO. TB-3-405-021

6

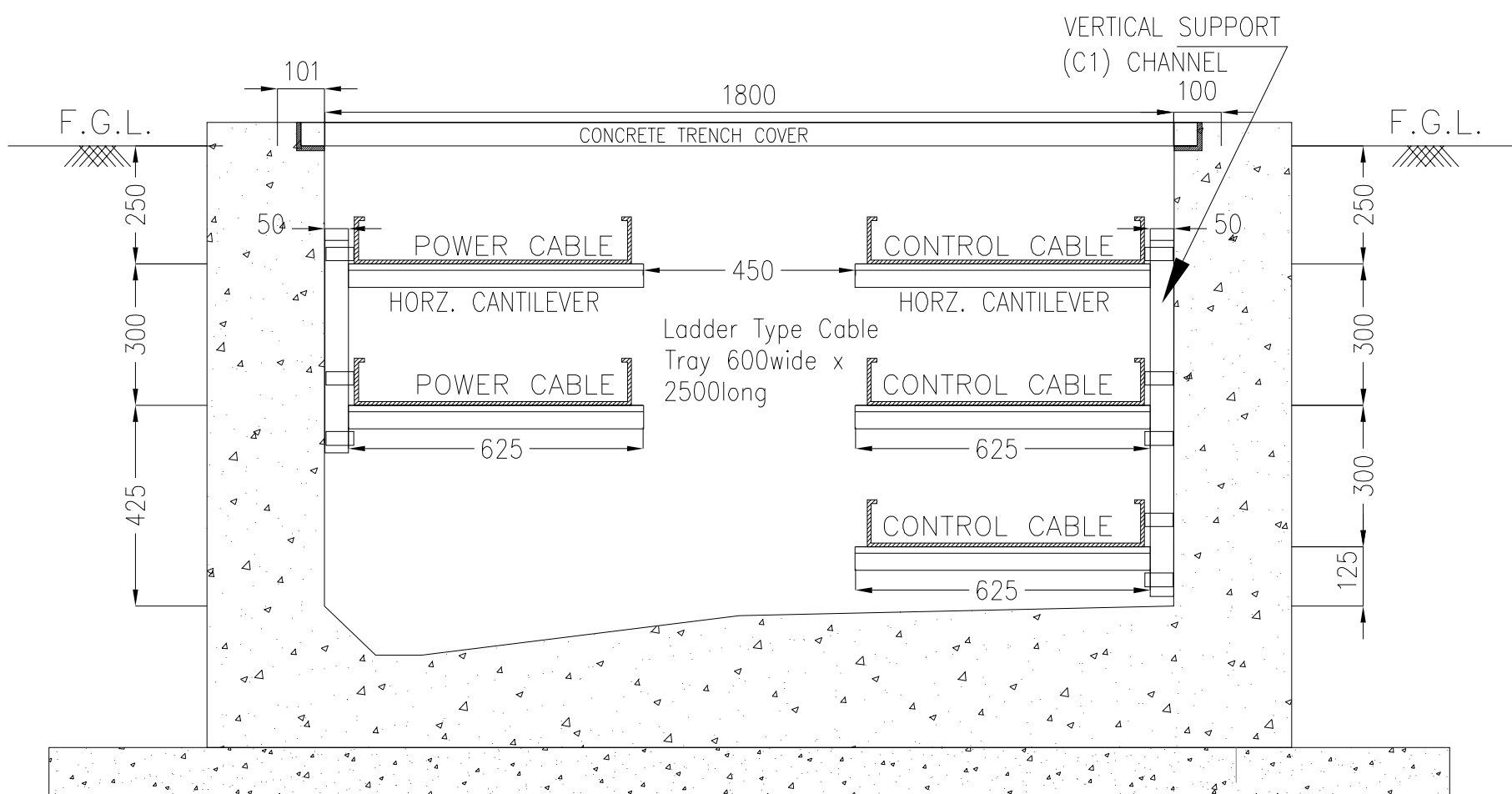
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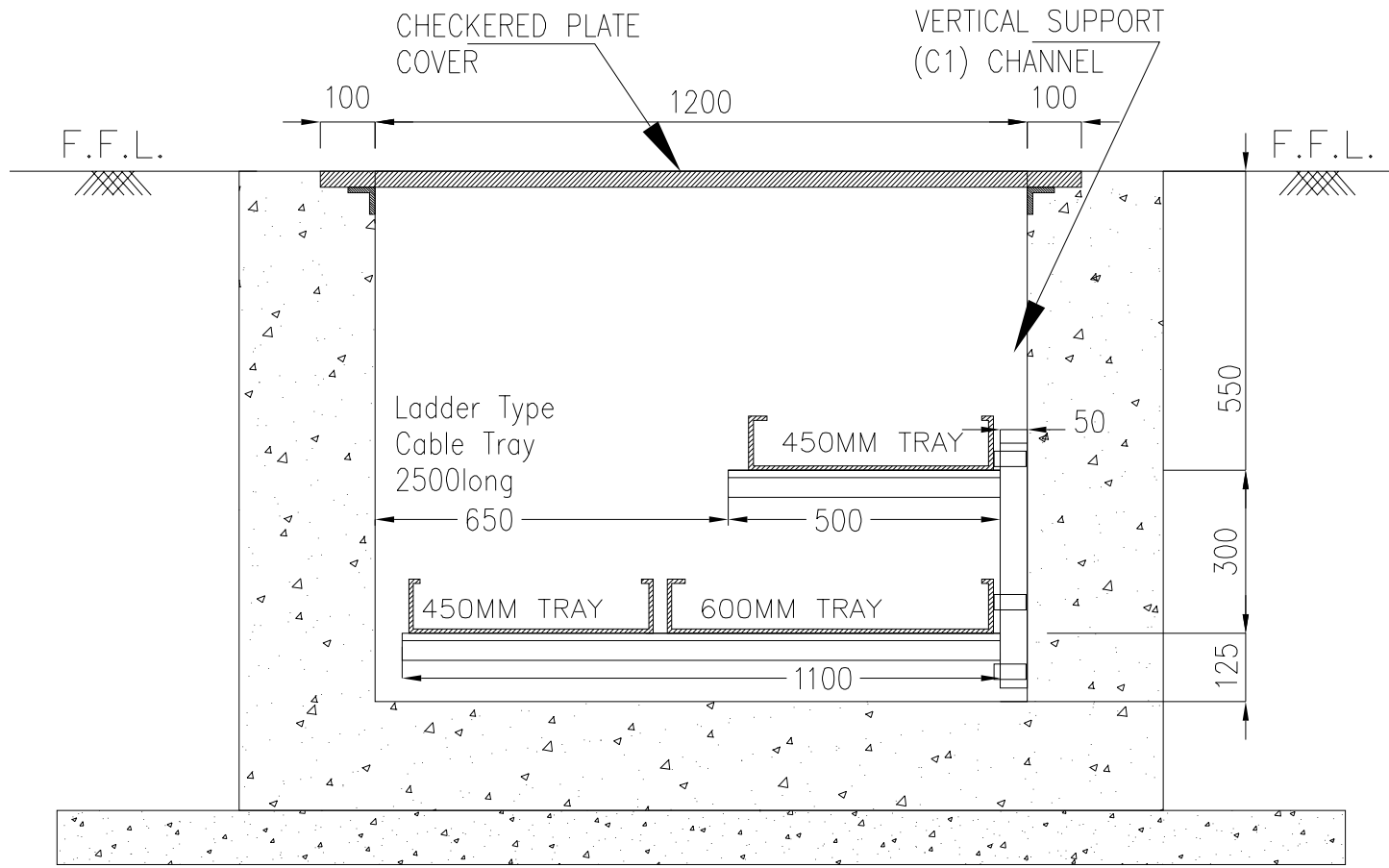
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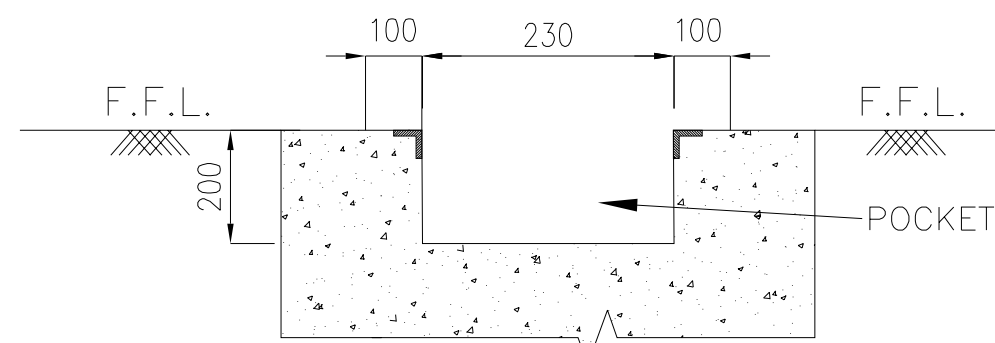
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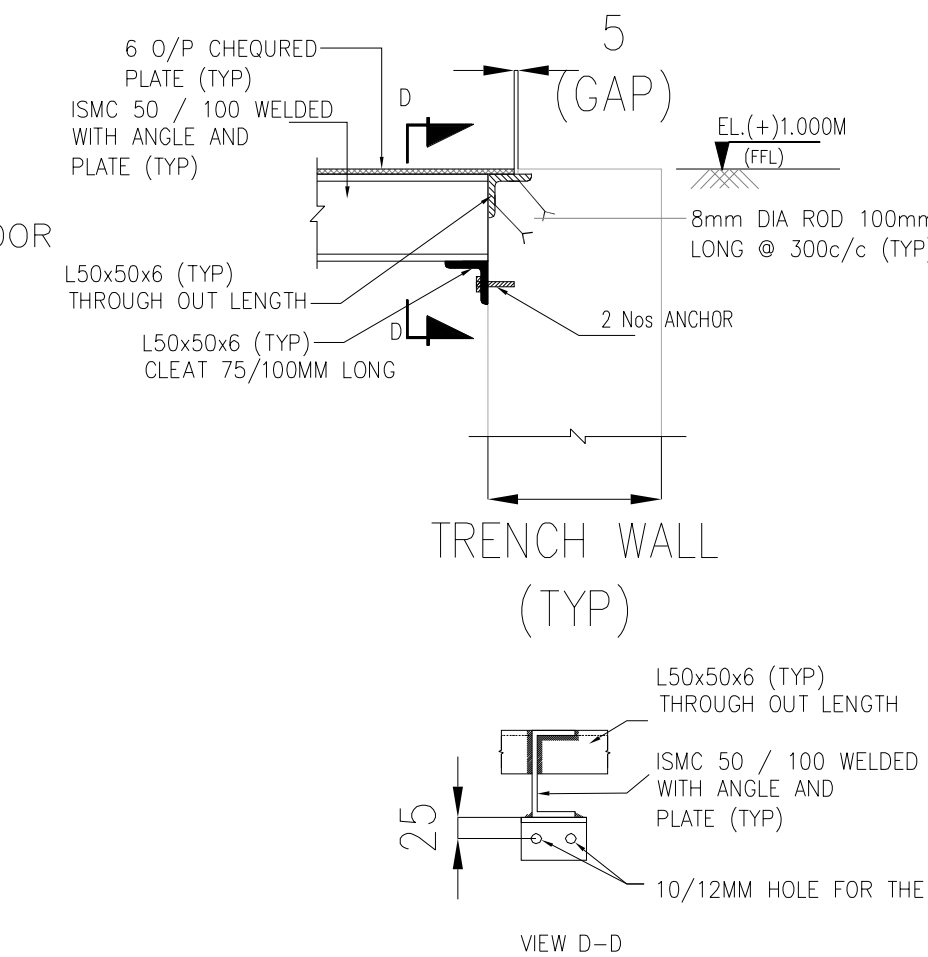
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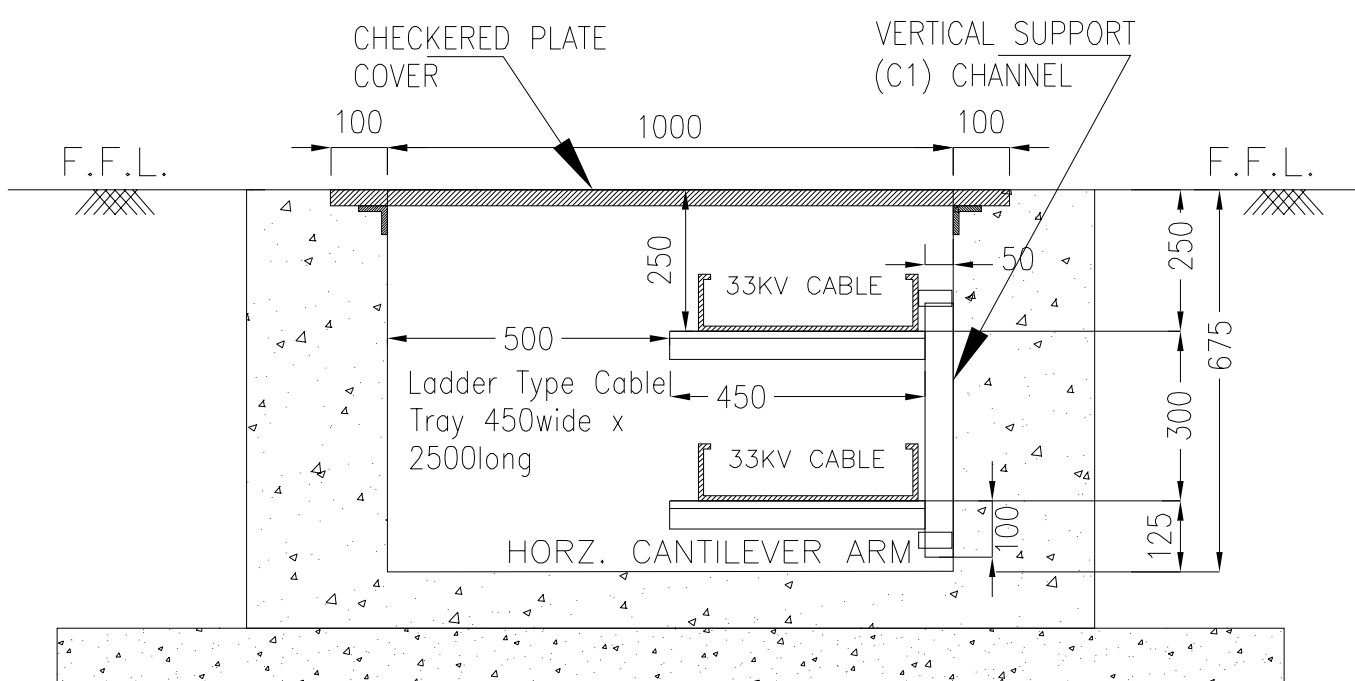
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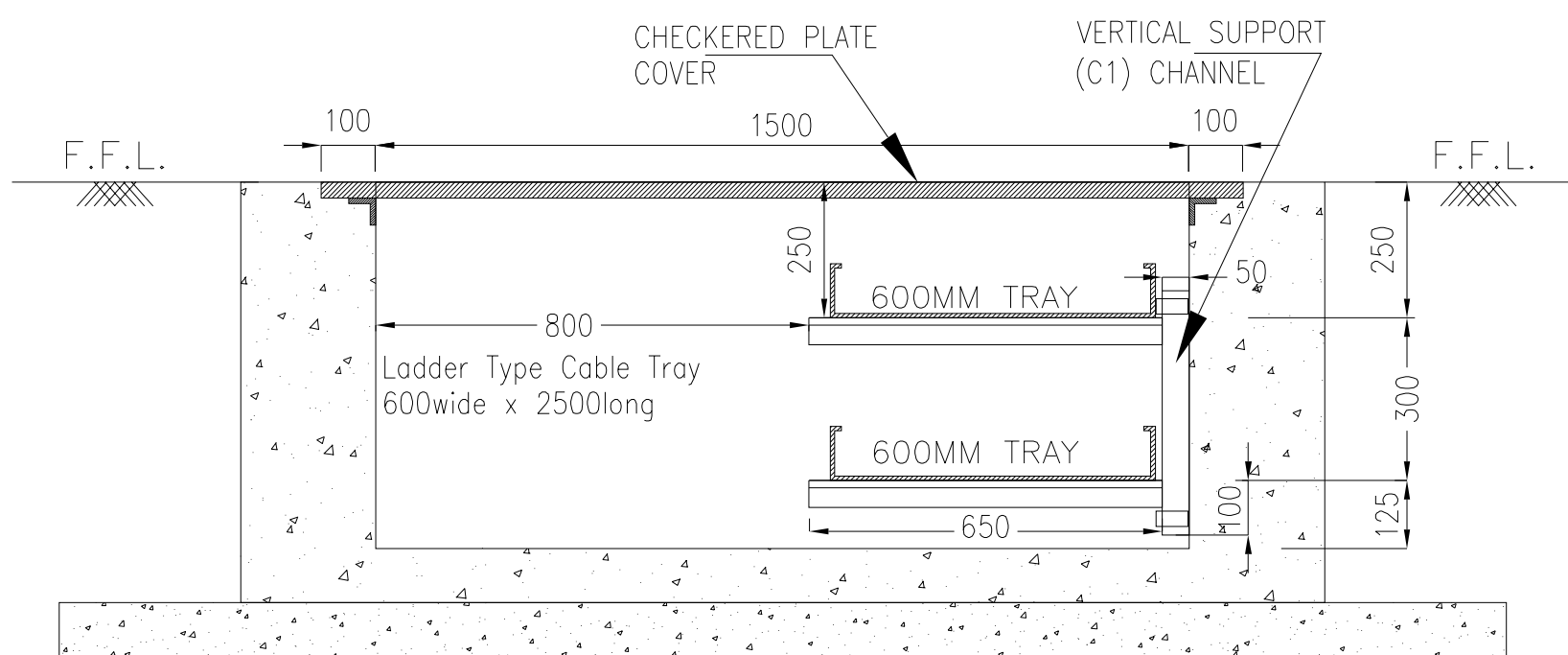
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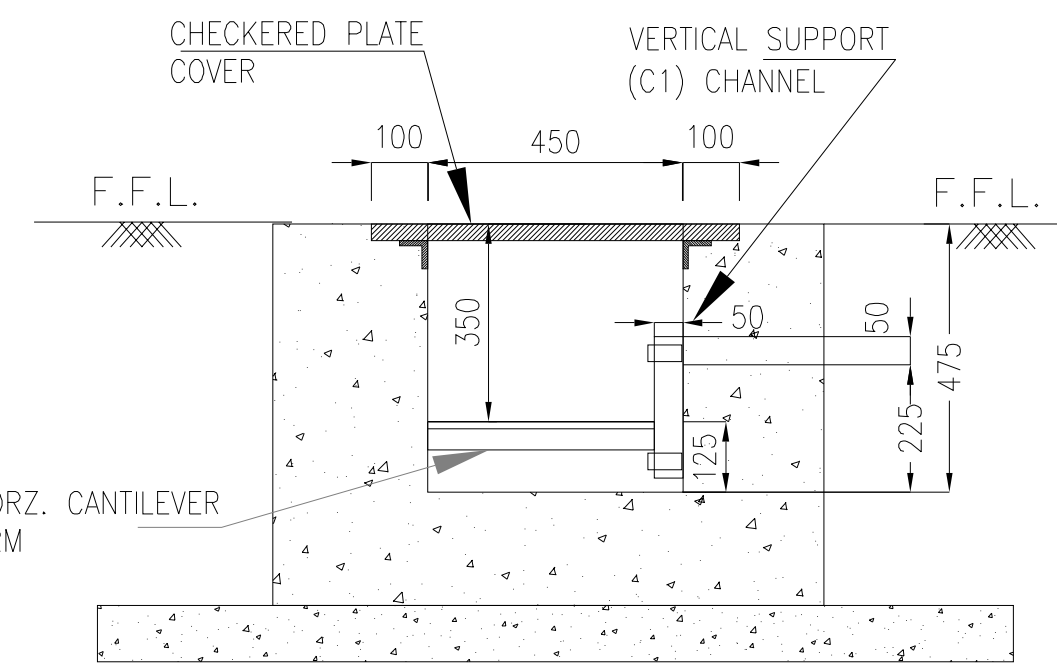
TRENCH WALL (TYP)



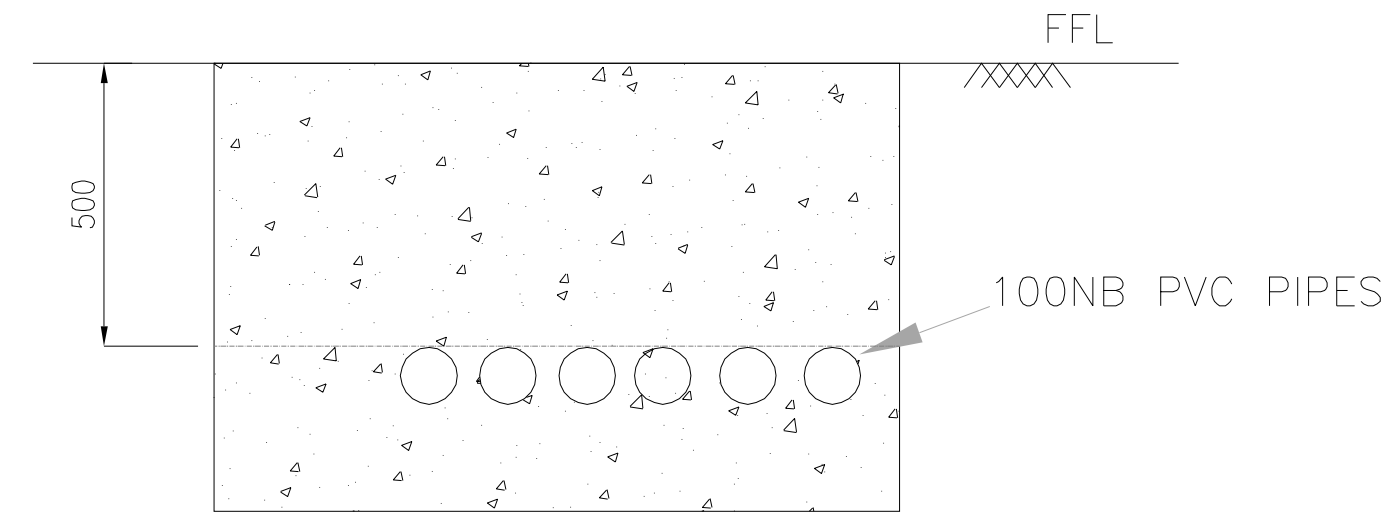
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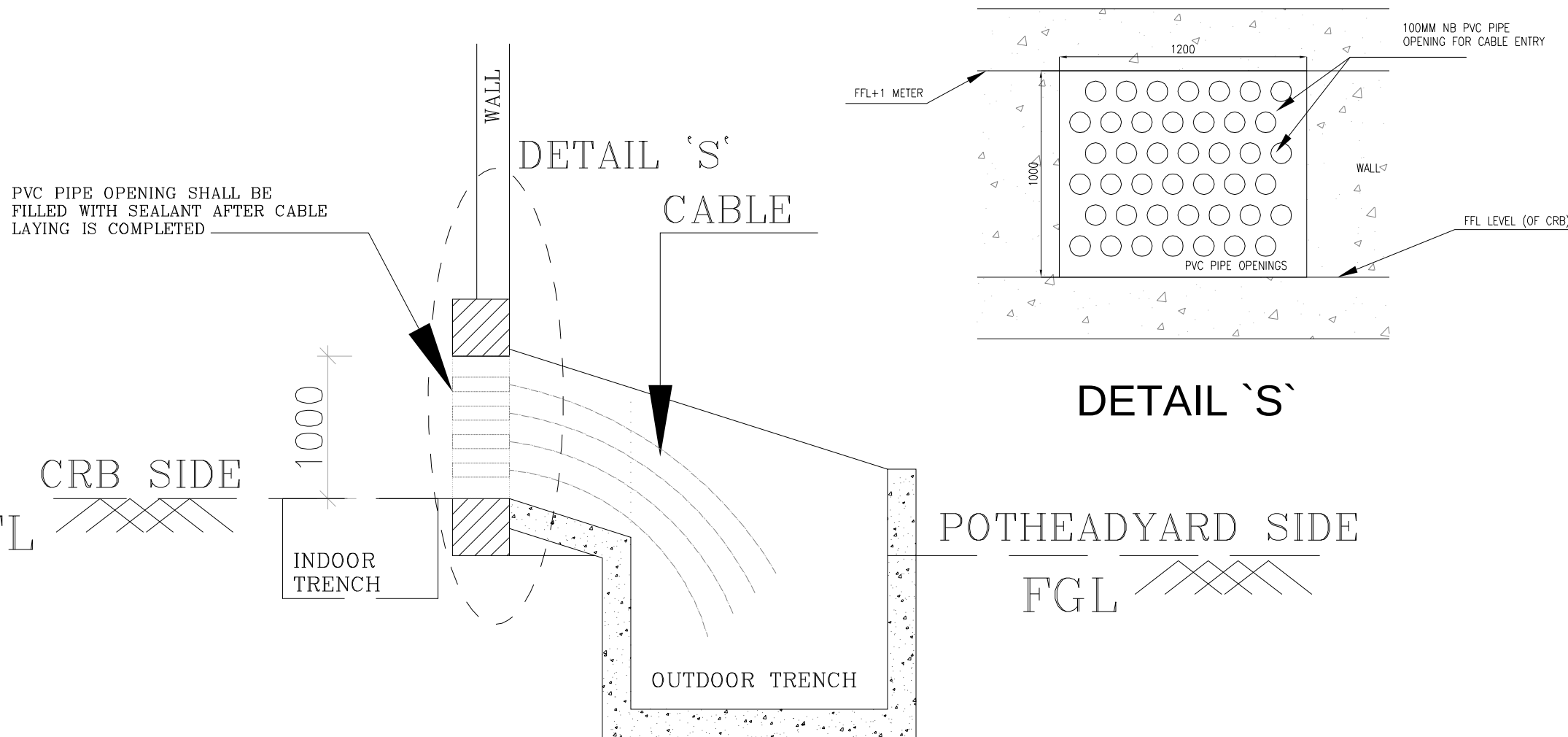
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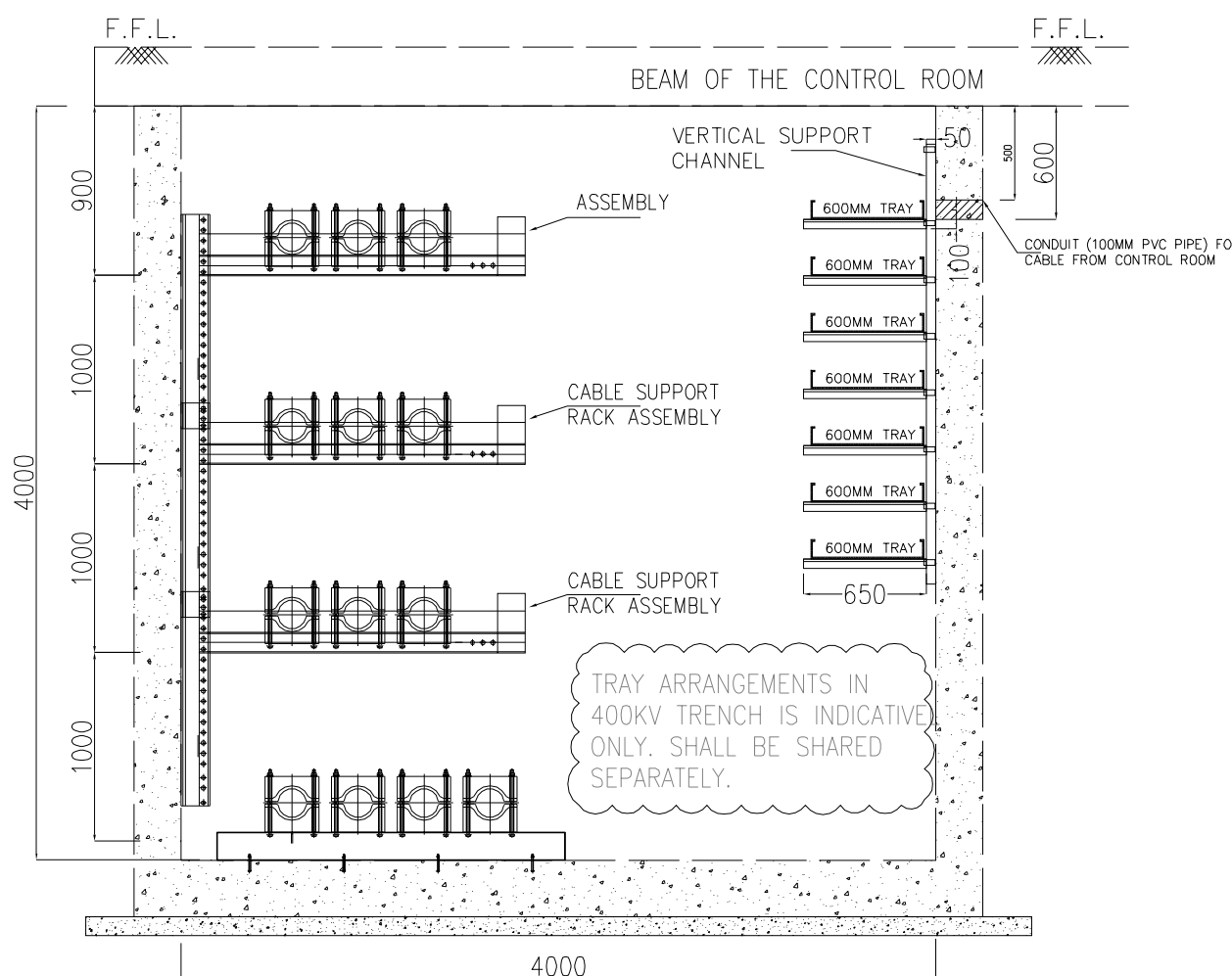
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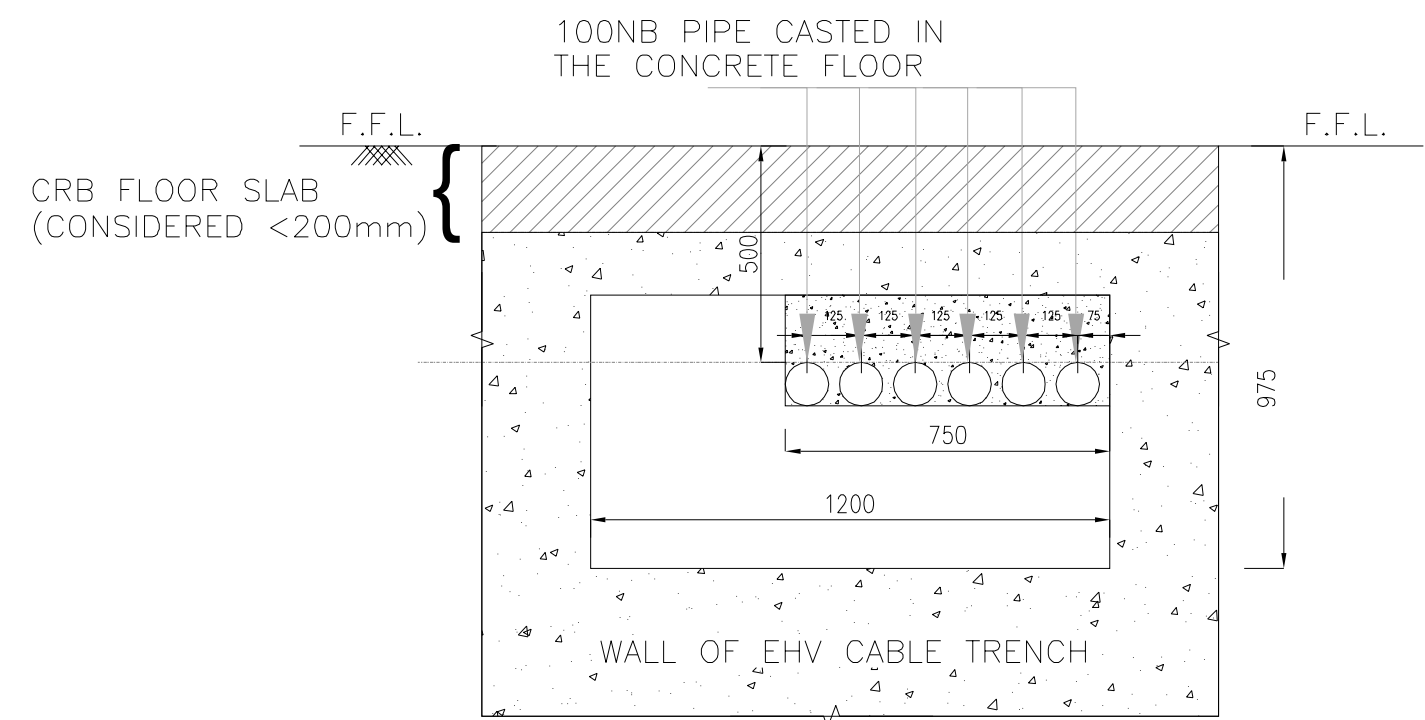
DETAIL Q



DETAIL 'S'



TRAY ARRANGEMENTS IN 400KV TRENCH IS INDICATIVE ONLY. SHALL BE SHARED SEPARATELY.



DETAIL-P

DETAIL-"M"
TYPICAL CABLE ENTRY ARRANGEMENT INTO CRP ROOM (FOR ALL TYPE OF ENTRY)

REV.	DATE	ALTERED	REV.	DATE	ALTERED
04	08.09.2021	CHD/APPD	03	30.06.2021	CHD/APPD
ZONE	THE DOCUMENT HAS BEEN REVISED BASED ON THE COMMENTS RECIVED FROM THE CUSTOMER VIDE MEETING WITH SJVN AND TELECONFERENCE IN JUNE 2021 AND AUGUST 20.08.2021		ZONE	THE DOCUMENT HAS BEEN REVISED BASED ON THE COMMENTS RECIVED FROM THE CUSTOMER VIDE MEETING WITH SJVN AND TELECONFERENCE IN JUNE 2021	

REV.	DATE	ALTERED	REV.	DATE	ALTERED
06	11.11.2021	CHD/APPD	05	03.11.2021	CHD/APPD
ZONE	THE DOCUMENT HAS BEEN REVISED BASED ON THE COMMENTS RECIVED FROM THE CUSTOMER DATED 9 NOV .2021		ZONE	THE DOCUMENT HAS BEEN REVISED BASED ON THE COMMENTS RECIVED FROM THE CUSTOMER DATED 21.09.2021 AND VC HELD BETWEEN BHEL AND SJVN DATED : 26.10.2021	
REV.	DATE	ALTERED	REV.	DATE	ALTERED
02	07.06.2021	CHD/APPD	01	05.03.2021	CHD/APPD
ZONE	THE DOCUMENT HAS BEEN REVISED BASED ON THE COMMENTS RECIVED FROM THE CUSTOMER VIDE MOM DATED 19.03.2021 AND MEETING WITH SJVN		ZONE	THE DOCUMENT HAS BEEN REVISED BASED ON THE COMMENTS RECIVED FROM THE CUSTOMER VIDE MOM DATED 23.02.2021	

PROJECT:		ARUN-3 HYDRO ELECTRIC PROJECT (NEPAL) (4 x 225 MW)			
CUSTOMER:		SJVN ARUN-3 POWER DEVELOPMENT COMPANY PVT. LTD. (SAPDC LTD.)			
CONSULTANT:		SJVN LTD. (A JOINT VENTURE OF GOVT OF INDIA SMD GOVT OF HP)			
BHEL		NAME	SIGN.	DATE	
DEPT. TBG		DRN.	PK	30/10/2018	
CODE		CHD.	Vyom/JK	30/10/2018	
		APPD.	SKS	30/10/2018	
TITLE		CONCEPTUAL LAYOUT of CRP ROOM IN SWITCHGEAR BUILDING OF 400KV SWITCHYARD OF ARUN 3 HEP		DRG.NO.	REV.
				TB-3-405-316-021	6
		SHT. No 4	NO. OF SHT. 05		

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SIZE-A2

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FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN MM)

139/165

767

DRG. NO. TB-3-405-316-021

6

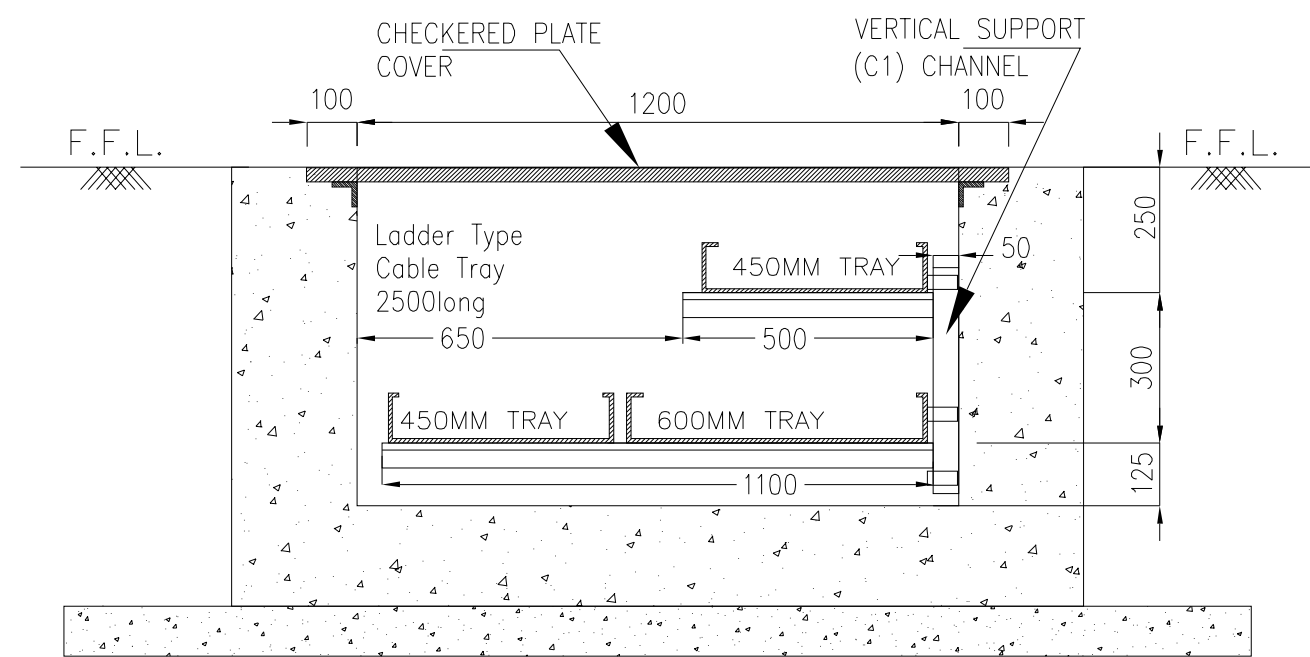
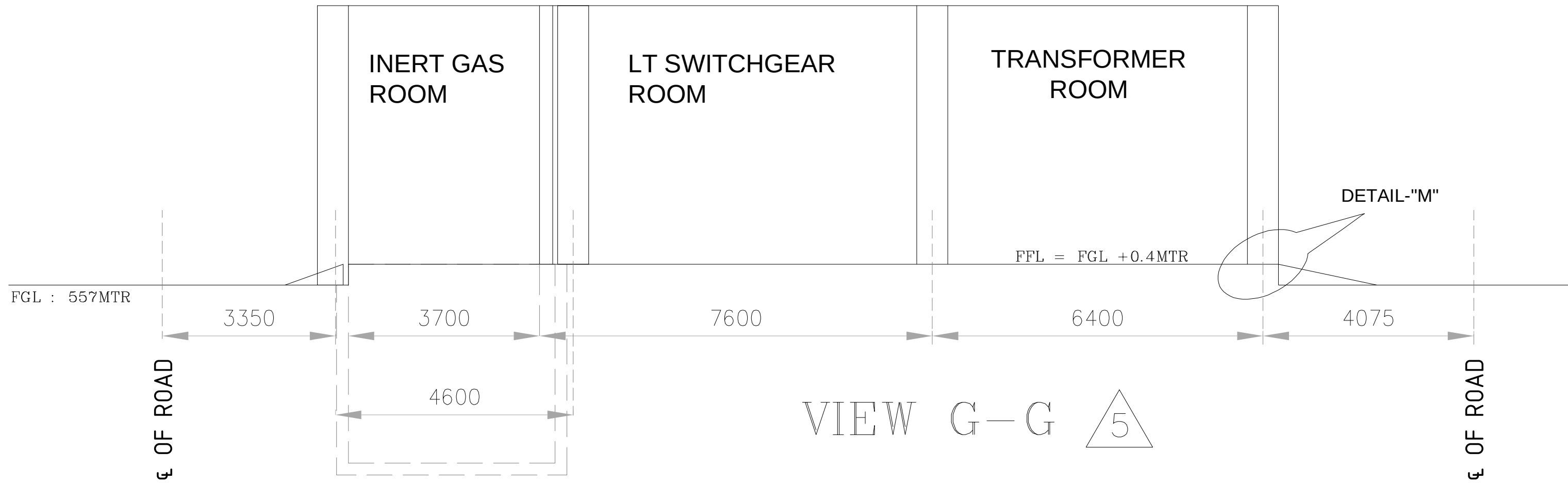
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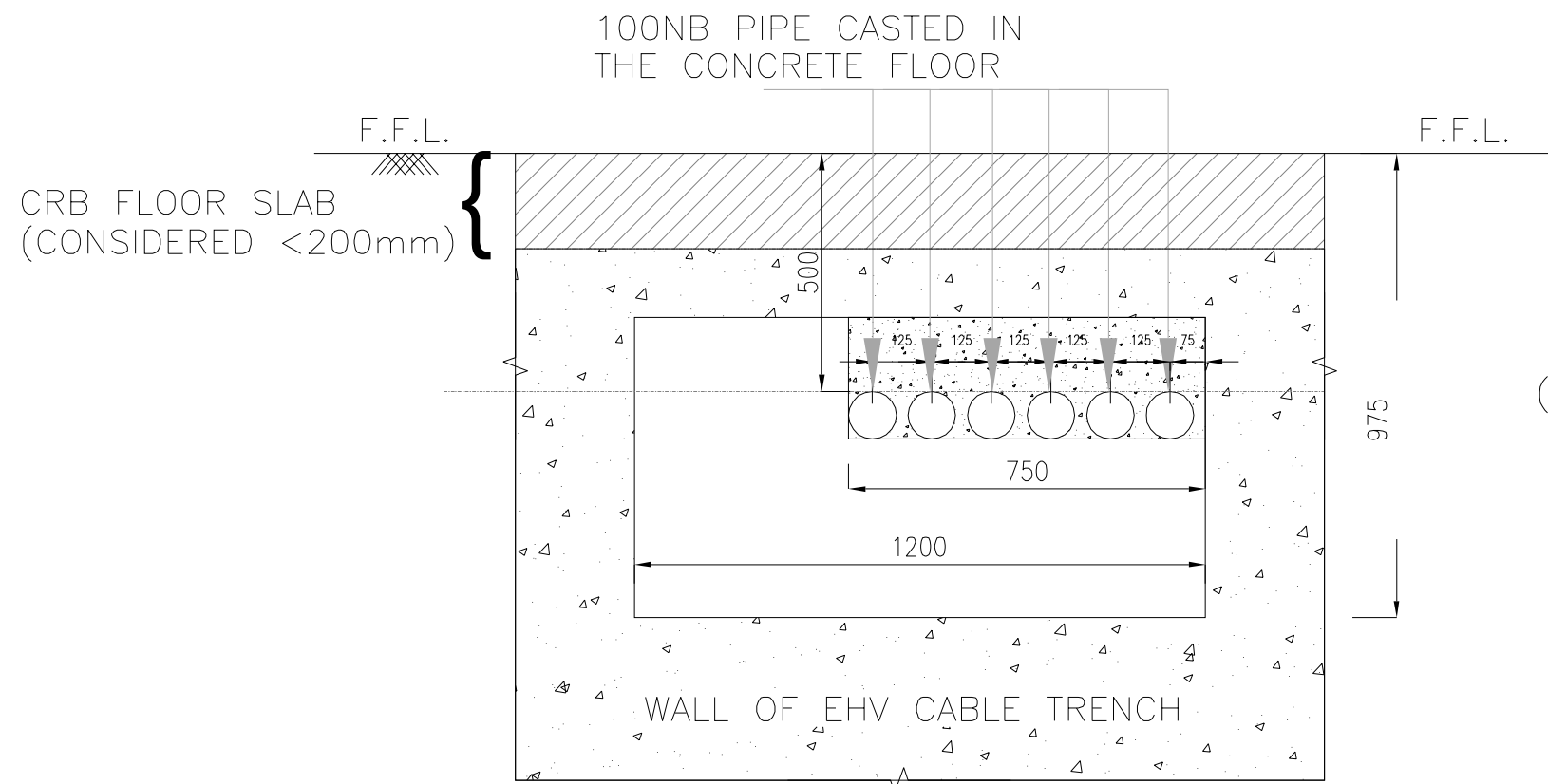
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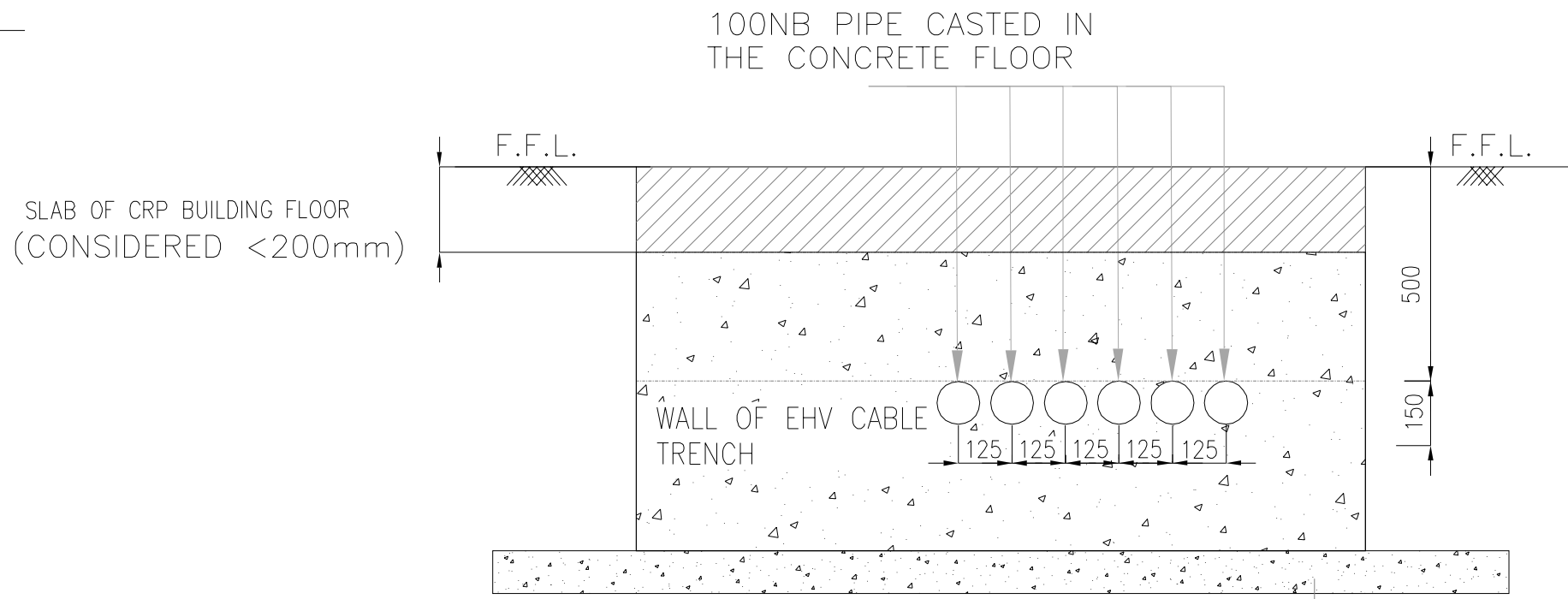
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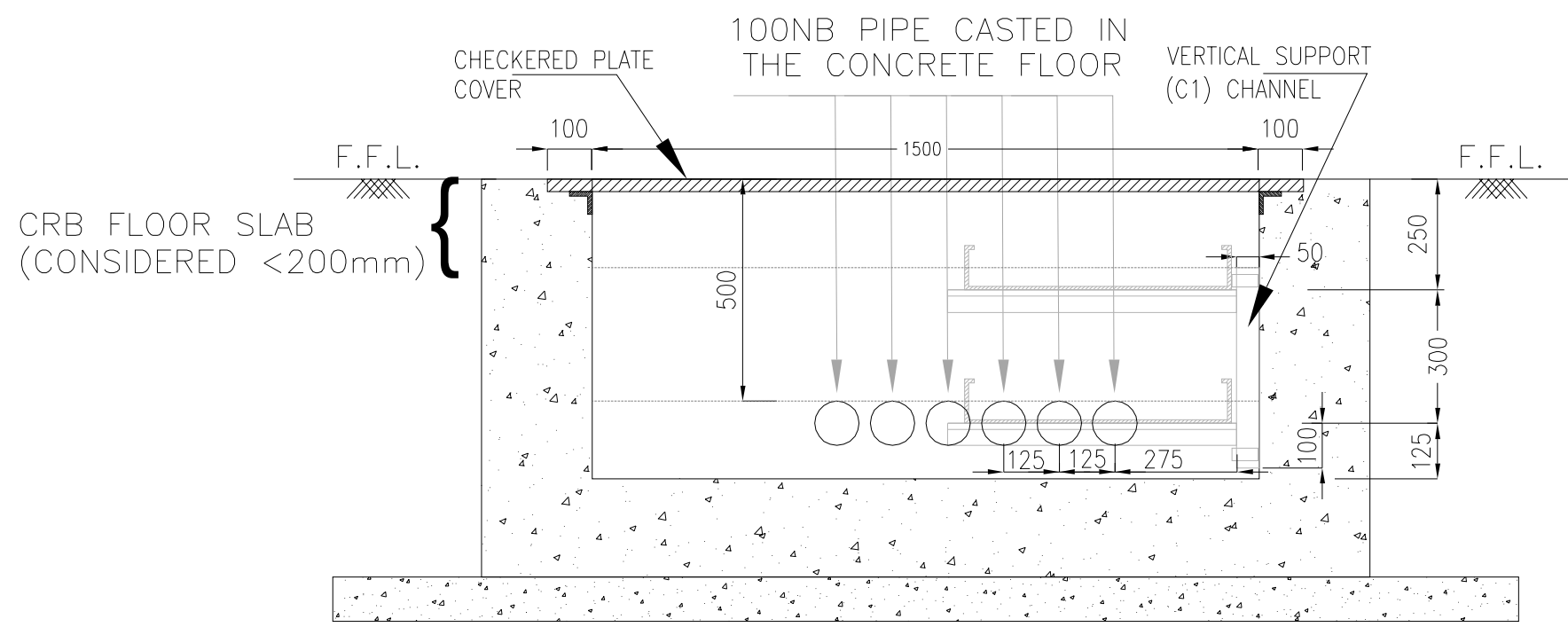
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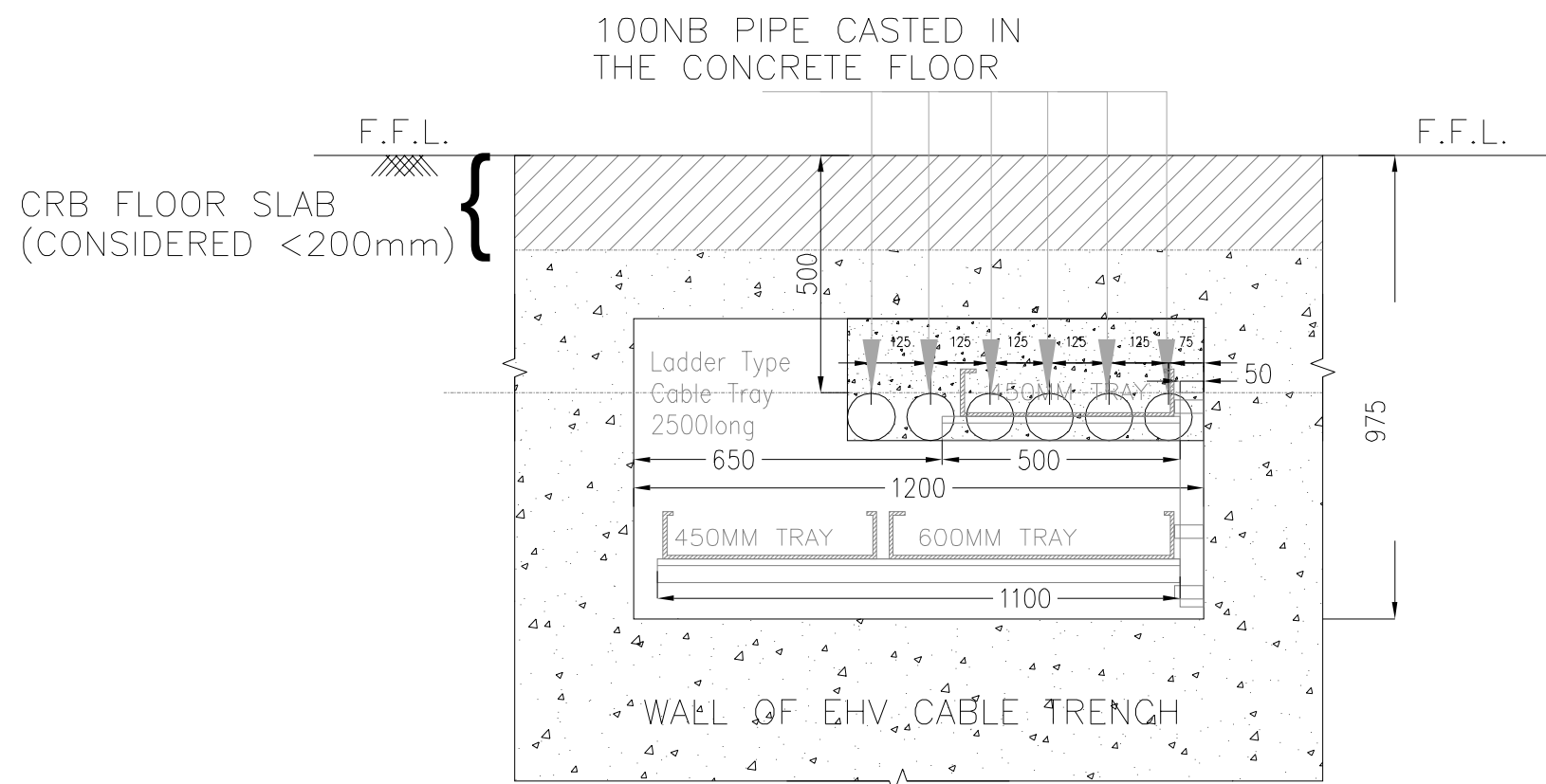
DETAIL-P1



DETAIL-Q1



DETAIL-Q2



DETAIL-P2

REV.	DATE	ALTERED	REV.	DATE	ALTERED
04	08.09.2021	CHD/APPD	03	30.06.2021	CHD/APPD
ZONE	THE DOCUMENT HAS BEEN REVISED BASED ON THE COMMENTS RECIVED FROM THE CUSTOMER VIDE MEETING WITH SJVN AND TELECONFERENCE IN JUNE 2021 AND AUGUST 20.08.2021		ZONE	THE DOCUMENT HAS BEEN REVISED BASED ON THE COMMENTS RECIVED FROM THE CUSTOMER VIDE MEETING WITH SJVN AND TELECONFERENCE IN JUNE 2021	

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ZONE	THE DOCUMENT HAS BEEN REVISED BASED ON THE COMMENTS RECIVED FROM THE CUSTOMER DATED 9 NOV .2021		ZONE	THE DOCUMENT HAS BEEN REVISED BASED ON THE COMMENTS RECIVED FROM THE CUSTOMER DATED 21.09.2021 AND VC HELD BETWEEN BHEL AND SJVN DATED : 26.10.2021	
REV.	DATE	ALTERED	REV.	DATE	ALTERED
02	07.06.2021	CHD/APPD	01	05.03.2021	CHD/APPD
ZONE	THE DOCUMENT HAS BEEN REVISED BASED ON THE COMMENTS RECIVED FROM THE CUSTOMER VIDE MOM DATED 19.03.2021 AND MEETING WITH SJVN		ZONE	THE DOCUMENT HAS BEEN REVISED BASED ON THE COMMENTS RECIVED FROM THE CUSTOMER VIDE MOM DATED 23.02.2021	

PROJECT:

ARUN-3 HYDRO ELECTRIC PROJECT (NEPAL)
(4 x 225 MW)



CUSTOMER: SJVN ARUN-3 POWER DEVELOPMENT
COMPANY PVT. LTD. (SAPDC LTD.)



CONSULTANT: SJVN LTD.
(A JOINT VENTURE OF GOVT OF INDIA AND GOVT OF HP)



BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

	NAME	SIGN.	DATE
DRN.	PK		30/10/2018
CHD.	Vyom/JK		30/10/2018
APPD.	SKS		30/10/2018

DEPT. TBG		SCALE	CARD
CODE		NTS	CODE

TITLE	DRG.NO.	REV.
CONCEPTUAL LAYOUT of CRP ROOM IN SWITCHGEAR BUILDING OF 400KV SWITCHYARD OF ARUN 3 HEP	TB-3-405-316-021	6
	SHT. No 5	NO. OF SHT. 05

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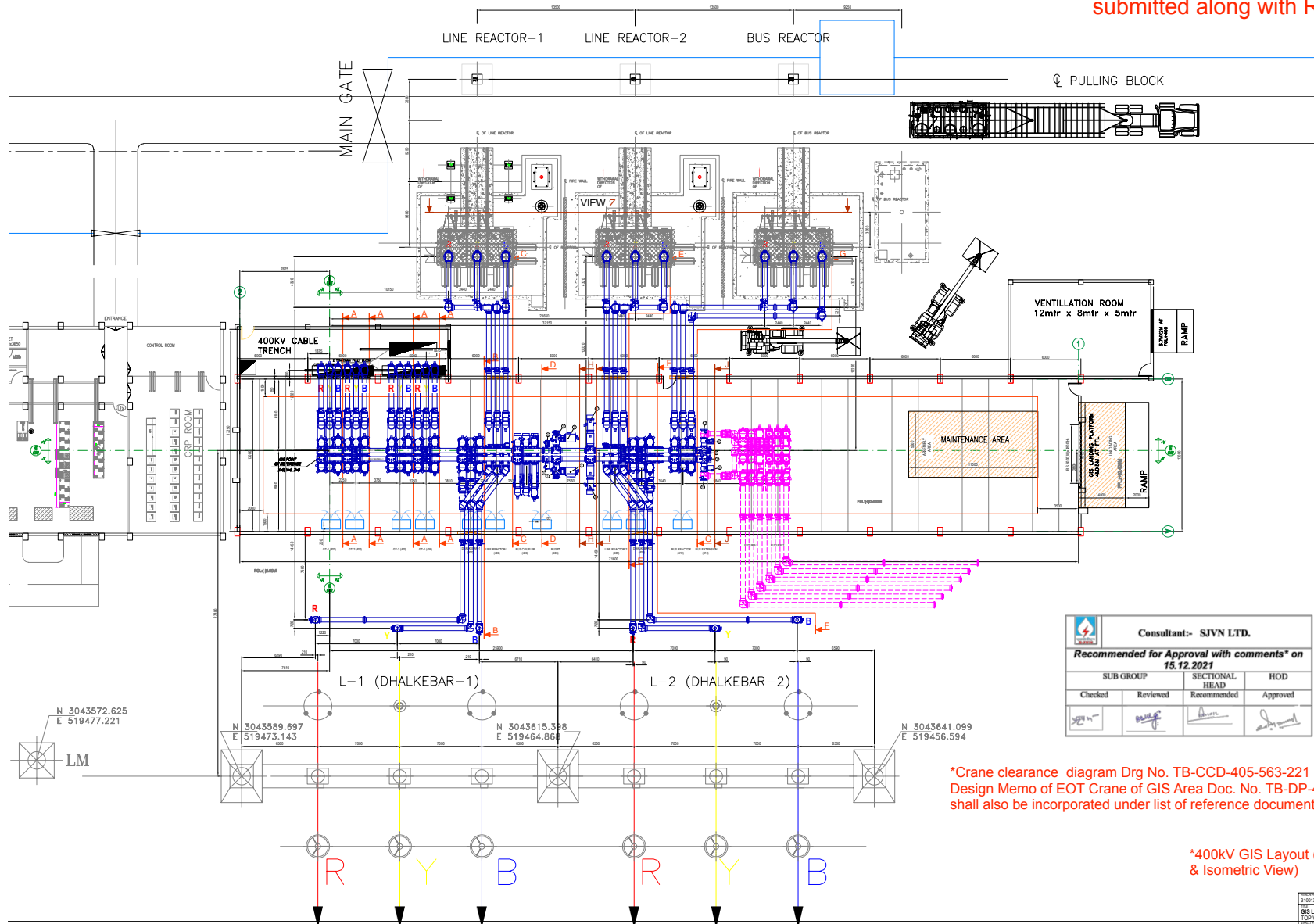
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SIZE-A2

* The document is approved with comments:-

1. Drawing shall be reviewed after placement of PO of 400kV XLPE Vendor & finalisation of HV bushing of Reactor at respective interface location.
2. Reactor placement shall be reviewed after approval of revised Switchyard Layout incorporating proposed reactor placement.
3. For interface management, please refer BHEL reply vide CRS no. 1HYG900079-2-CRS dated 10.12.21 submitted along with Rev.02 of GIS Layout on 13.12.21.



एनवेलीएन अरुन-3 पावर डेवलपमेंट कंपनी प्रा. लि.
SJVN Arun-3 Power Development Company Pvt. Ltd.
(एनवेलीएन अरुन-3 पावर डेवलपमेंट कंपनी प्रा. लि. का पूर्णतः स्वतंत्र सहायक उपक्रम है।)
100 करोड़ रुपये का पूंजीगत निवेश
800 MW Arun-3 Hybrid Power Project
Page No. 11/06/08/070

Category: **Approval with comments**

Approved by Consultant: *[Signature]*

Reviewed: ☒ Yes ☐ No

Recommended: ☒ Yes ☐ No

Approved: ☒ Yes ☐ No

GIS (SCOPE OF SUPPLY) _____

GIS (FUTURE) _____

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. CIVIL DETAILS (DOORS / STAIRS / LAND STEEL STRUCTURE) ON THIS DRAWING ARE FOR INFORMATION ONLY. FOR DETAILS REFER TO RELEVANT DRAWINGS.
3. BHEL SHOULD INFORM ABB ABOUT OTHER INSTALLATION SUCH AS AIR CONDITIONING, LIGHTING PANELS, ETC. IN GIS HALL IN ORDER TO AVOID COLLISION WITH GIS / GIS SUPPORT STRUCTURES.
4. MARK DIMENSIONS ARE YET TO BE CONFIRMED BY BHEL TEAM.

LEGEND

- 1 - CIRCUIT BREAKER
- 2 - DISCONNECTOR
- 3 - DISCONNECTOR & EARTHING SWITCH
- 4 - HIGH SPEED EARTHING SWITCH
- 5 - CURRENT TRANSFORMER
- 6 - VOLT TRANSFORMER
- 7 - SURGE ARRESTER
- 8 - SF6 TO AIR BUSHING
- 9 - CABLE END BOX
- 10 - TRANSFORMER CONNECTION
- 11 - LOCAL CONTROL CUBICLE (LCC)
- 12 - EXTENSION MODULE

REFERENCE DOCUMENTS

Document Title	ABB Doc. No.	CLIENT Doc. No.
PROJECT SPECIFIC GIS PARAMETERS	HYG900079-2	TB-405-317-10-3
SLD	HYG900079-1	TB-405-317-10-1
CIVIL WORK REQUIREMENTS	HYG900079-3	TB-405-317-10-10
400KV SLD		TB-405-317-10-1
SWITCHYARD LAYOUT		TB-405-317-10-1
SLD (GT HALL)	HYG900079-1	TB-405-317-10-10
GIS LAYOUT (GT HALL)	HYG900079-2	TB-405-317-10-10

Consultant:- SJVN LTD.

Recommended for Approval with comments* on 15.12.2021

SUB GROUP	SECTIONAL HEAD		HOD
	Checked	Reviewed	
	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>

BASE DESIGN

*Crane clearance diagram Drg No. TB-CCD-405-563-221 annexed with Design Memo of EOT Crane of GIS Area Doc. No. TB-DP-405-563-221 shall also be incorporated under list of reference documents.

*400kV GIS Layout (Plan, Section & Isometric View)

PROJECT: ARUN-3 HYBRID ELECTRIC POWER PROJECT (NEPAL) (4x225 MW)

CLIENT: SJVN ARUN-3 POWER DEVELOPMENT COMPANY (P) LTD.

CONSULTANT: SJVN LTD.

CONTRACTOR: BHEL HEAVY ELECTRICALS LTD.

SUB CONTRACTOR: HITACHI ENERGY INDIA LTD.

TITLE: ELECTRICAL LAYOUT PLAN AND SECTION OF 4x225MW OF ARUN-3 HEP

DWG NO: TB-405-317-10-2

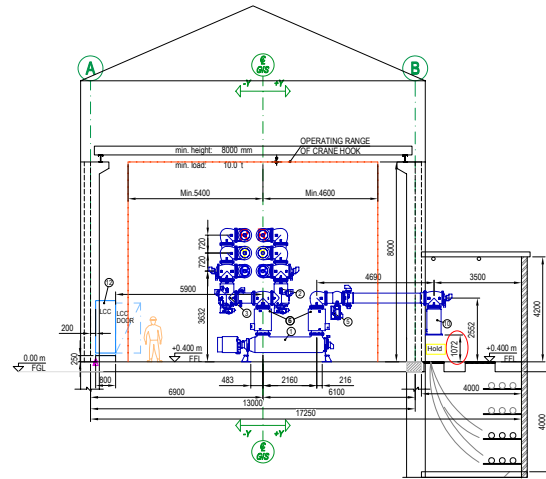
REV. 02

DATE: 08.12.2021

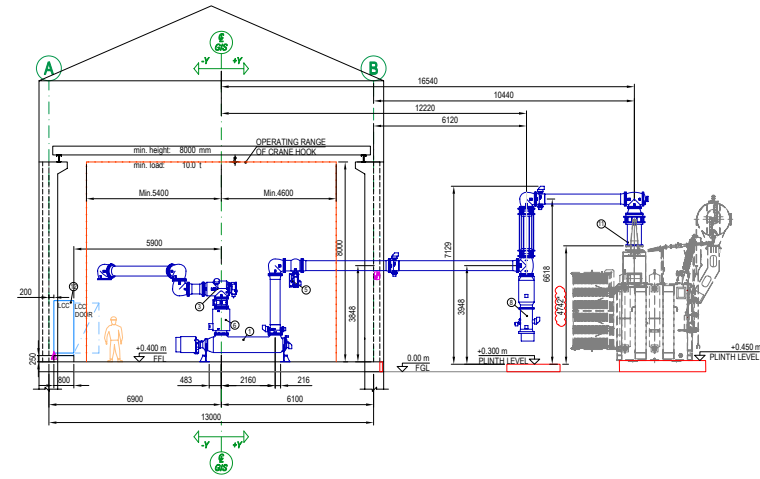
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CHECKED: [Signature]

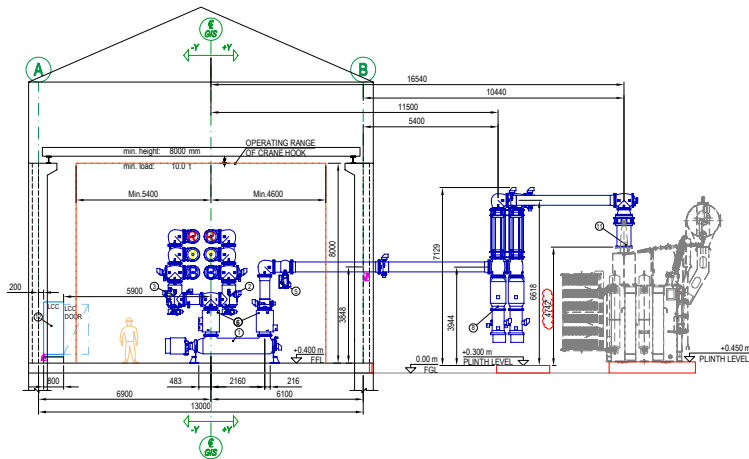
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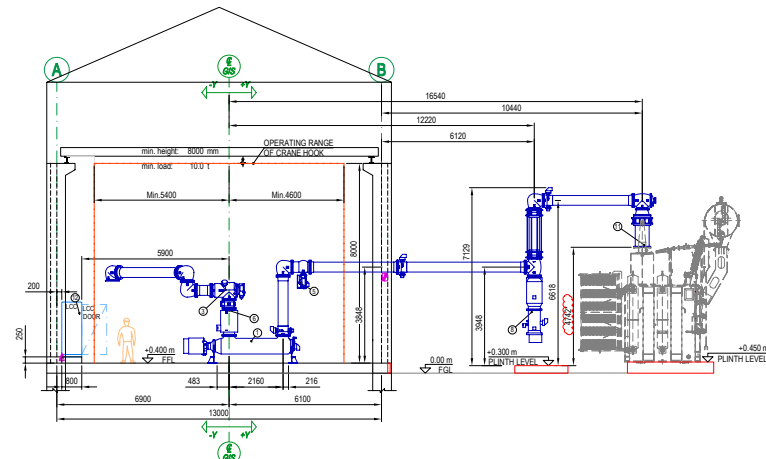
SECTION A-A (GT -1/GT -2/GT -3/GT -4)



SECTION C-C (LINE REACTOR -1)

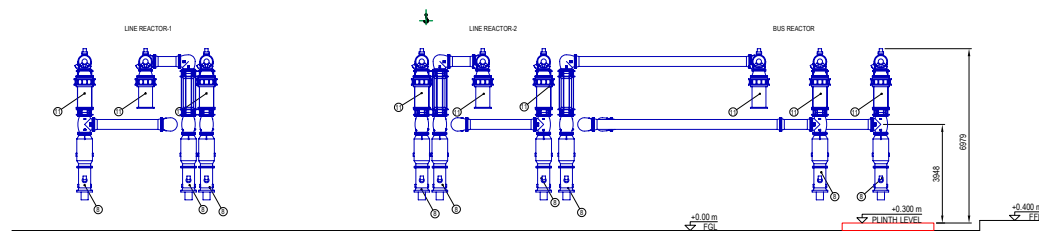


SECTION G-G (BUS REACTOR)



SECTION E-E (LINE REACTOR-2)

VIEW Z



GIS (SCOPE OF SUPPLY) ————
 GIS (FUTURE) - - - - -

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. CIVIL DETAILS (DOORS / STAIRS / LAND STEEL STRUCTURE ON THIS DRAWING ARE FOR INFORMATION ONLY. FOR DETAILS REFER TO RELEVANT DRAWINGS.
3. (BHEL) SHOULD INFORM ABB ABOUT OTHER INSTALLATION (SUCH AS AIR CONDITIONING, LIGHTING PANELS, ETC) IN GIS HALL, IN ORDER TO AVOID COLLISION WITH GIS / GIS SUPPORT STRUCTURES.
4. * MARK DIMENSIONS ARE YET TO BE CONFIRMED BY BHEL TEAM.

LEGEND

1 - CIRCUIT BREAKER
2 - DISCONNECTOR
3 - DISCONNECTOR & EARTHING SWITCH
4 - HIGH SPEED EARTHING SWITCH
5 - CURRENT TRANSFORMER
6 - VOLTAGE TRANSFORMER
7 - SURGE ARRESTER
8 - SF6 TO AIR BUILDING
9 - CABLE END BOX
10 - TRANSFORMER CONNECTION
11 - LOCAL CONTROL CUBICLE (LCC)
12 - EXTENSION MODULE

REFERENCE DOCUMENTS

Document Title	ABB Doc. No.	CLIENT Doc. No.
PROJECT SPECIFIC GIS PARAMETERS	HYG000079-6	TB-405-317-10-3
SLD	HYG000079-7	TB-405-317-10-1
CIVIL WORK REQUIREMENTS	HYG000079-3	TB-405-317-10-10
400KV SLD	-	TB-405-317-10-1
SWITCHGEAR LAYOUT	HYG000080-1	TB-405-317-10-2
GIS LAYOUT (GT HALL)	HYG000080-2	TB-405-317-10-2

BASE DESIGN

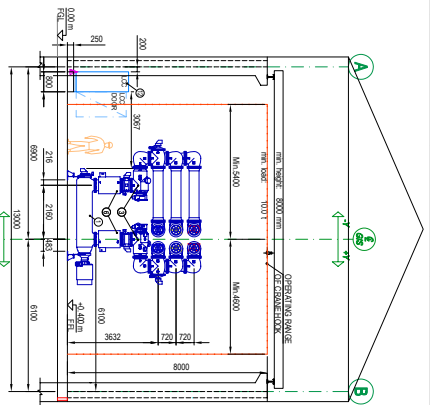
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AC	20.12.2021	DEBASISH M	MODIFIED AS PER CUSTOMER COMMENTS
AB	20.12.2021	DEBASISH M	MODIFIED AS PER CUSTOMER COMMENTS
AA	14.12.2021	DEBASISH M	FIRST ISSUE

PROJECT	ARUN-3 HYDRO ELECTRIC POWER PROJECT (NTPAL)
CUSTOMER	SAVN ARUN-3 POWER DEVELOPMENT COMPANY (P) LTD.
CONTRACTOR	SAVN LTD.
DESIGNER	HITACHI ENERGY INDIA LTD.
REVISION	HITACHI ENERGY INDIA LTD.

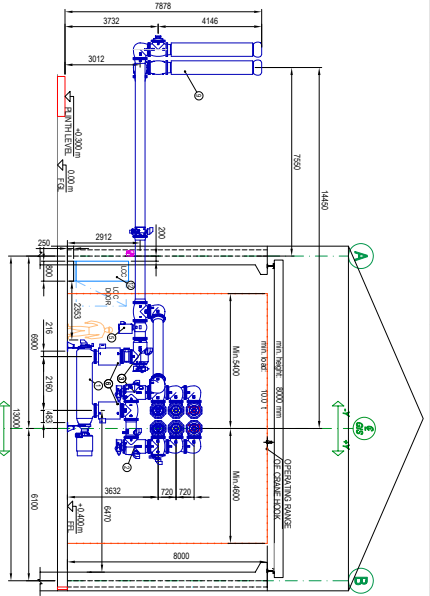
REV.	DATE	BY	CHK.	APP.
01	08.12.2021	Debasish M	Debasish M	Debasish M
02	08.12.2021	Debasish M	Debasish M	Debasish M

*400kV GIS Layout (Plan, Section & Isometric View)

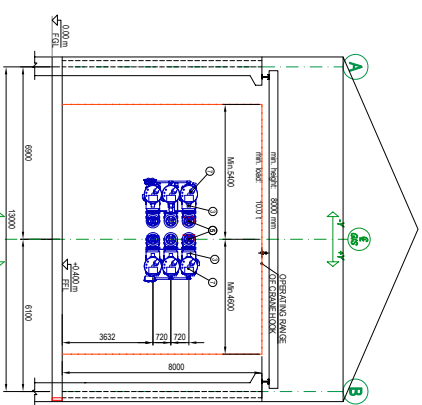
PROJECT	ARUN-3 HYDRO ELECTRIC POWER PROJECT (NTPAL)
CUSTOMER	SAVN ARUN-3 POWER DEVELOPMENT COMPANY (P) LTD.
CONTRACTOR	SAVN LTD.
DESIGNER	HITACHI ENERGY INDIA LTD.
REVISION	HITACHI ENERGY INDIA LTD.



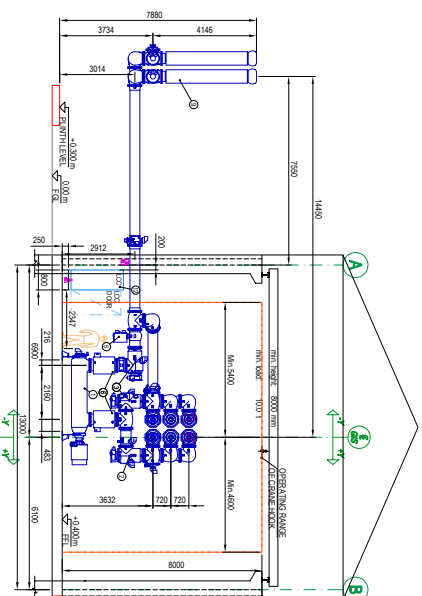
SECTION D-D (BUS COUPLER)



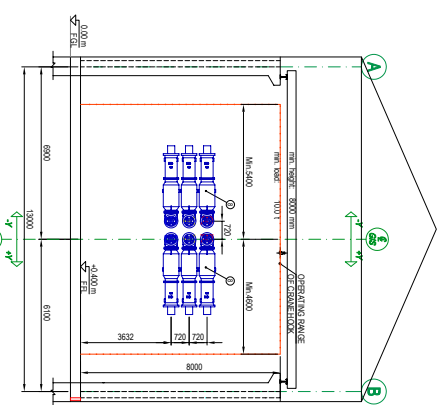
SECTION B-B (DHALKEBAR-1)



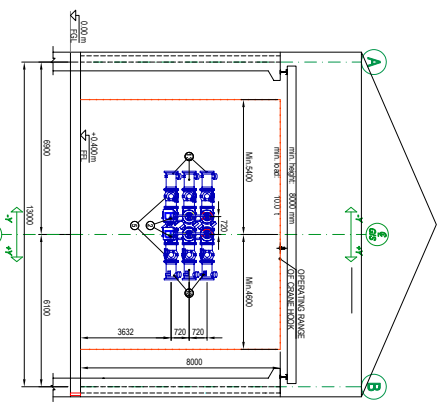
SECTION H-H (BUS PT)



SECTION F-F (DHALKEBAR-2)



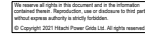
SECTION I-I (BUSBAR LA)



SECTION J-J (BUS EXTENSION)

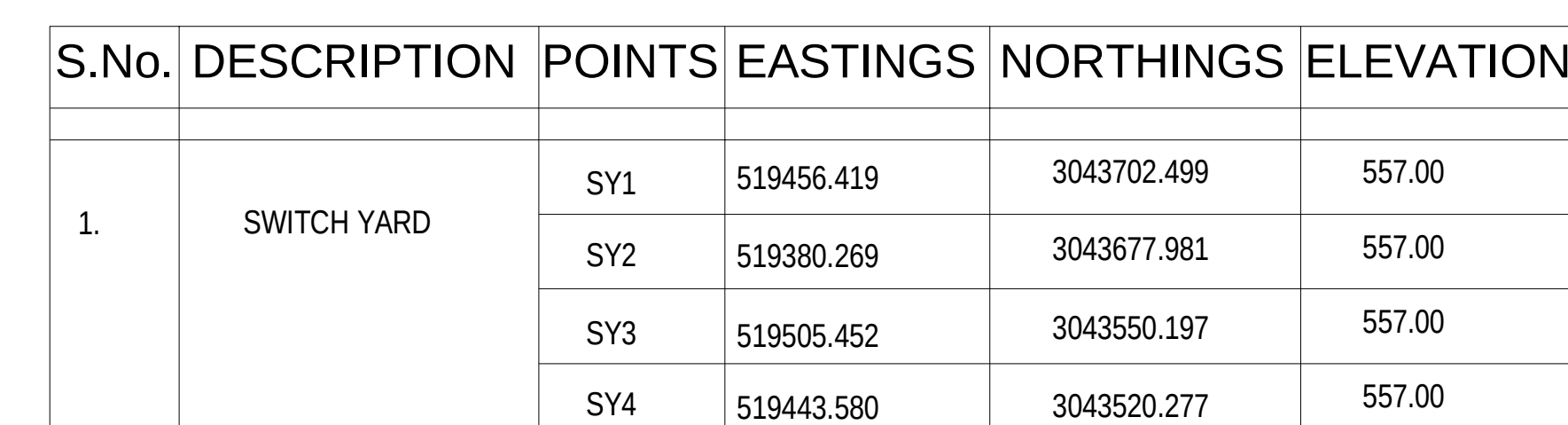
*400kV GIS Layout (Plan, Section & Isometric View)

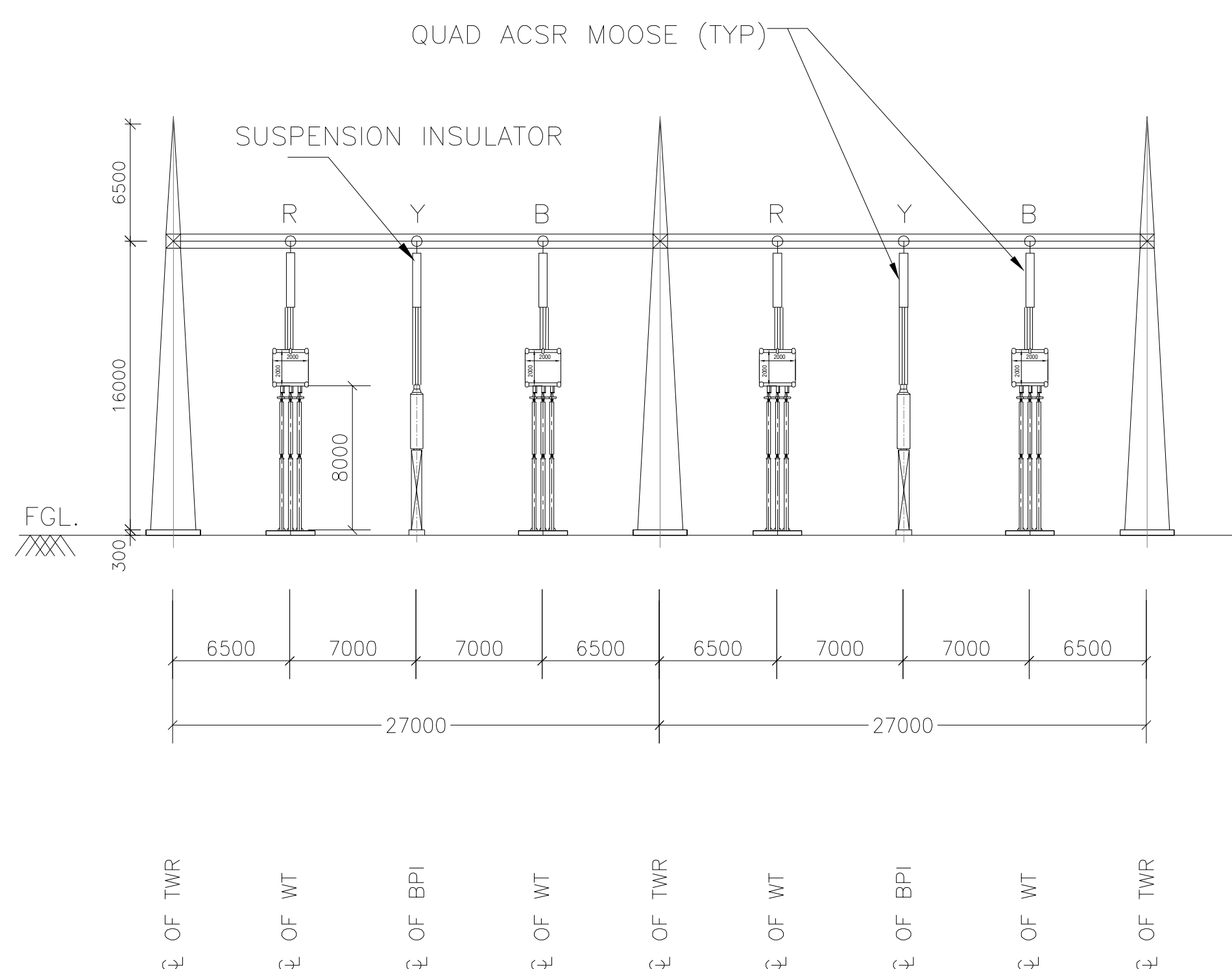
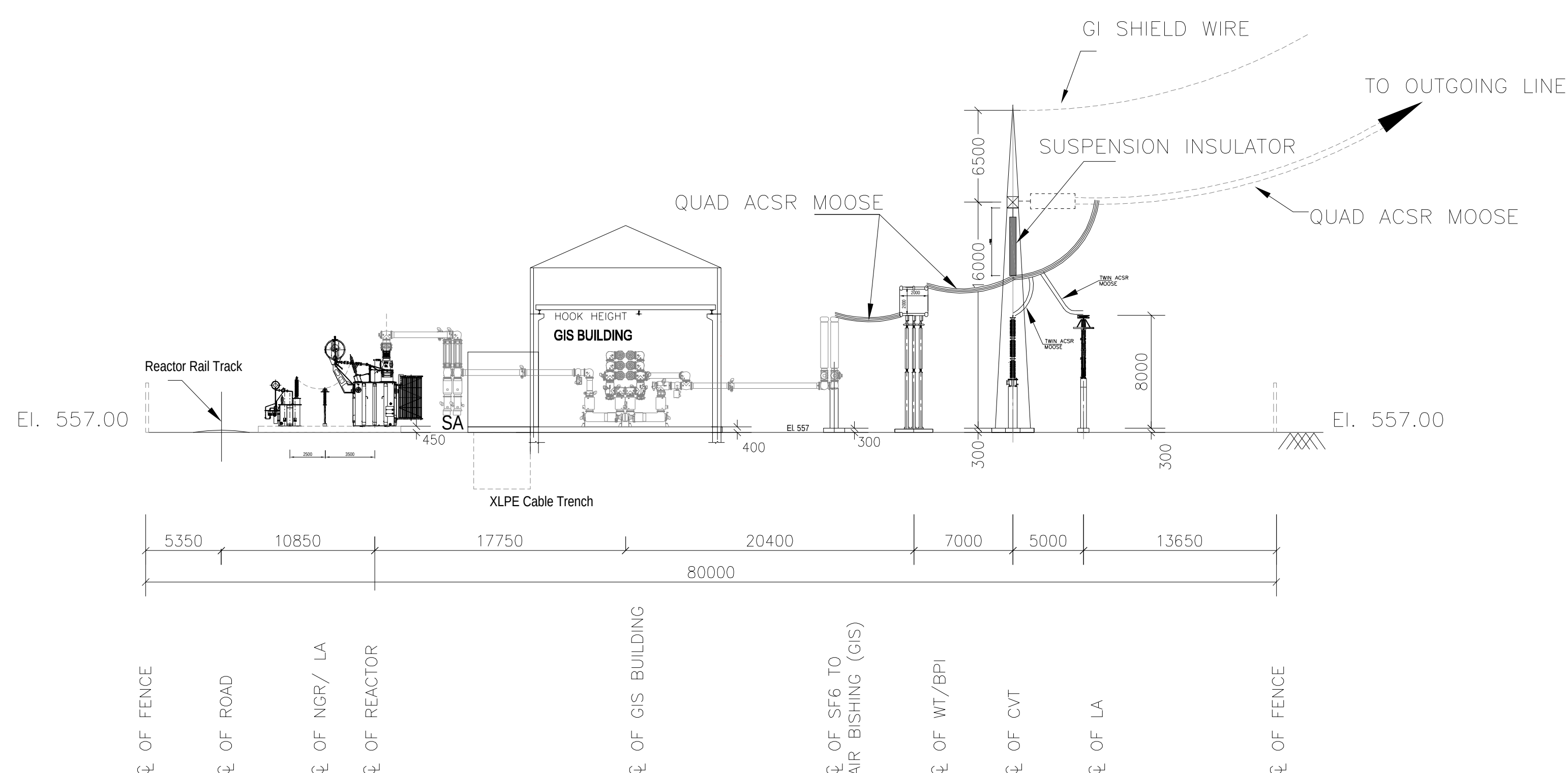
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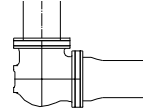
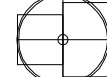
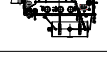
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SIZE-A2



<u>MINIMUM CLEARANCE TABLE</u>	<u>400kV</u>
PHASE TO PHASE (PP) (mm)	4000
PHASE TO EARTH (PE) (mm)	3500
SECTION CLEARANCE (SC) (mm)	6500
HEIGHT OF CONDUCTOR CENTRE LINE OF FIRST LEVEL (MIN.) MM. (FROM PLINTH LEVEL)	8000
GROUND CLEARANCE TO NEAREST PART NOT AT EARTH POTENTIAL OF AN INSULATOR SUPPORTING LIVE CONDUCTOR	2550
CREEPAGE DISTANCE (mm/kV)	25

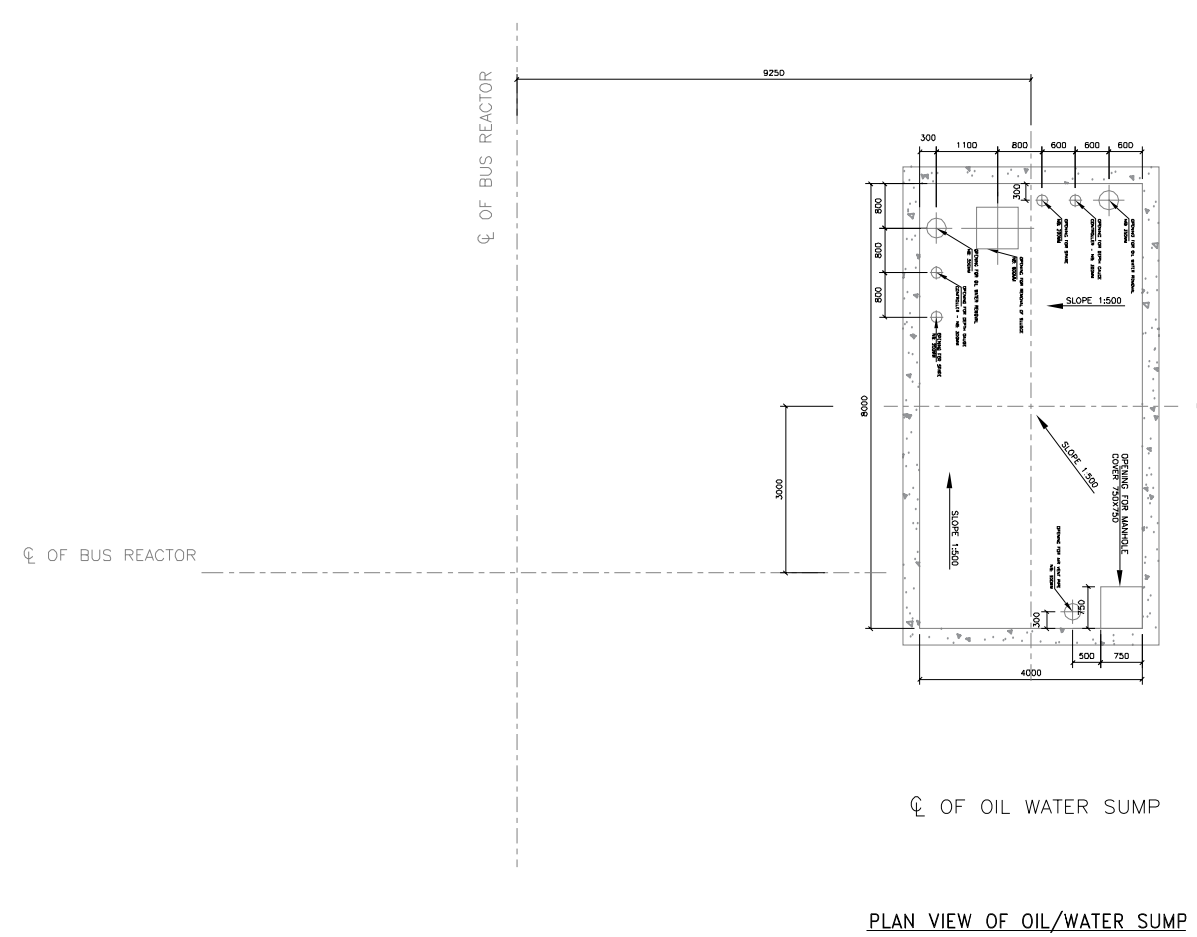
CONDUCTOR SIZE DETAILS		
EQUIPMENT INTERCONNECTION	400 KV	QUAD 'MOOSE' CONDUCTOR
CONNECTION DROPS	400 KV	QUAD 'MOOSE' CONDUCTOR TWIN 'MOOSE' CONDUCTOR ON CVT AND SURGE ARRESTER

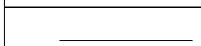
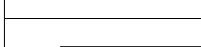
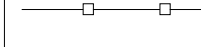
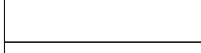
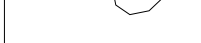
BILL OF QUANTITY OUTDOOR EQUIPMENT:-			
S.NO.	DESCRIPTION	SYMBOL	QUANTITY (NOS.)
1	420 kV INDOOR GIS		01
2	420 KV, 1-ph SF6 TO AIR BUSHING		06
3	420kV, 1-ph CVT		06
4	336kV, 1-ph SURGE ARRESTER		06
5	420kV, 8 KN , 1-ph, BUS POST INSULATOR		02
6	WAVE TRAP		04
7	400KV,80MVAR REACTOR (BHEL MAKE)		03
8	NGR (BHEL MAKE)		02
9	120kV, 1-ph SURGE ARRESTER FOR NGR		2

CO-ORDINATES & ELEVATIONS OF IMPORTANT POINTS

CO-ORDINATES & ELEVATIONS OF IMPORTANT POINTS						
S.No	DESCRIPTION	POINTS	EASTINGS	NORTHINGS	INVERT ELEVATION	REMARKS
1.	SWITCH YARD	SY1	519456.419	3043702.499	557.00	FINISHED LEVEL
		SY2	519380.269	3043677.981	557.00	-DO-
		SY3	519505.452	3043550.197	557.00	-DO-
		SY4	519443.580	3043530.277	557.00	-DO-

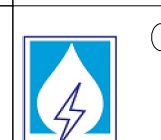
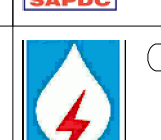
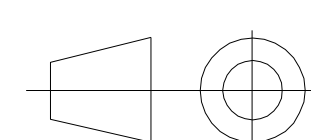
SCOPE OF CUSTOMER		
ITEM NO.	DESCRIPTION	QTY.
01	GRATING IN LINE REACTOR AREA	2 LOT
02	GRATING IN BUS REACTOR AREA	1 LOT
03	PULLING BLOCK	6 NOS
04	FENCE	1 LOT
05	GRAVEL	1 LOT

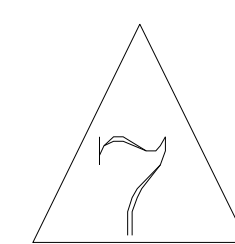


LEGEND TABLE:-	
	 400kV TENSION INSULATOR NOT IN BHEL'S SCOPE  QUAD MOOSE ACSR CONDUCTOR  TWIN MOOSE ACSR  SHIELD WIRE  FENCE (NOT IN SCOPE OF BHEL)  CONNECTION TO QUAD ACSR MOOSE CONDUCTOR  PROPOSED SCOPE  EXISTING/FUTURE SCOPE (NOT IN TBG SCOPE)  GIB (GAS INSULATED BUS DUCT)  TOWER WITH PEAK  LM (LIGHTNING MAST)  ENTRY GATE (NOT IN BHEL SCOPE)

<u>SYSTEM PARAMETERS</u>	
<u>NOTES:-</u>	
1. RATED VOLTAGE	: 400KV
2. HIGHEST SYSTEM VOLTAGE	: 420KV
3. SYSTEM VOLTAGE VARIATION	: -5% to +5%
4. RATED FREQUENCY	: 50 Hz, ±3%
5. INSULATION LEVELS FOR 400KV CIRCUIT BREAKERS AND DISCONNECTING SWITCHES	
5A. RATED ONE MINUTE POWER FREQUENCY WITHSTAND VOLTAGE BETWEEN LIVE TERMINAL AND EARTH	: 650 KV RMS (GIS) 630 KV RMS FOR POETHEAD YARD EQUIPMENTS
5B. RATED LIGHTNING IMPULSE WITHSTAND VOLTAGE	A) ± 1425 KVP (ACROSS FROM LIVE TERMINALS AND EARTH). B) ± 1665 KVP IMPULSE ON ONE TERMINAL AND OTHER TERMINAL EARTHED (ACROSS ISOLATING DISTANCE).
5C. RATED SWITCHING IMPULSE WITHSTAND VOLTAGE	: 1050 KVP (PHASE TO EARTH) 1425 KVP (PHASE TO PHASE)
6. RATED SHORT TIME WITHSTAND CURRENT CAPACITY:	50 KA/SEC. RMS
7. SYSTEM NEUTRAL EARTHING	: EFFECTIVELY EARTHED
8. AC AUX. SUPPLY	: 415V, 3PH, 4 WIRE (+10% TO -10%) : 240V, 1PH, 2 WIRE (+10% TO -10%)
9. CONTROL VOLTAGE	: 220V DC, 2 WIRE, +10% TO -20%
11. GIS BUS CONFIGURATION	: DOUBLE BUSBAR, 400 kV, 2500A, 50KA FOR 1S
12. ALL EQUIPMENT SHALL BE RATED FOR 50 DEG CENTIGRADE AMBIENT AND OUTDOOR INSTALLATION.	

1. ALL DIMENSIONS ARE IN MM, UNLESS OTHERWISE SPECIFIED.
2. MINIMUM CLEARANCE TABLE
(a) PHASE TO PHASE = 4000 MM.
(b) PHASE TO EARTH = 3500 MM.
(c) SECTIONAL CLEARANCE = 6500 MM
3. REMARK FOR 400KV GIS IN POTHEAD YARD: PLEASE REFER DRAWING # TB-405-317-10-02 (1HYG900079-2) 400KV GIS LAYOUT (PLAN, SECTION & ISOMETRIC VIEW) FOR RELATIVE SPACING & DIMENSIONS OF GIS ASSEMBLY, GAS INSULATED BUS DUCT, SF6 TO AIR BUSHING ETC. THIS DRAWING INDICATE REFERENCE AXIS OF GIS ASSEMBLY.
4. LEVELS FOR SWITCHYARD ARE AS PER Revised Switchyard Layout - Sketch - Drg No. SJVN/ED/Arun-III/EM-2017-04
5. ELEVATION OF SWITCHYARD AREA = 557.00 M.
6. SYSTEM NOMINAL VOLTAGE = 400KV.
7. SYSTEM HIGHEST VOLTAGE = 420KV.
8. DOUBLE BUS-BAR SCHEME WITH BUS-COUPLER HAS BEEN ADOPTED IN GIS.
9. CONDUCTOR FOR 400KV SYSTEM WILL BE QUAD/TWIN MOOSE.
10. ALL STRUCTURE/CONDUCTOR HEIGHTS ARE ABOVE PLINTH LEVEL. PLINTH LEVEL = 300 MM ABOVE F.G.L.
11. ALL FLEXIBLE CONNECTIONS ARE WITH QUAD MOOSE/TWIN ACSR MOOSE CONDUCTOR WITH 450 MM SPACING.
12. LOCATION OF WAVE TRAPS ARE INDICATIVE ONLY AND THE EXACT LOCATION WILL BE BASED ON PLCC REQUIREMENT. THE FDN. DESIGN SHALL BE PROVIDED BY BHEL.
13. GIS/BUS DUCT LAYOUT IS TENTATIVE AND SHALL BE FINALIZED AFTER VENDOR FINALIZATION OF GIS.
14. SWITCHGEAR ROOM AND GIS BUILDING LAYOUT SHALL BE SUBMITTED SEPARATELY.
15. THE SCOPE OF BHEL SHALL BE LIMITED TO POINT OF CONNECTION OF OUTGOING LINE AT THE DEAD END GANTRY.
16. THE DETAIL OF THE CABLE TERMINATION ON GT AND CABLE SUPPORT SYSTEM SHALL BE ADDED IN SUCCESSIVE REVISIONS.
17. ROADS, FENCE AND GATE IS NOT IN BHEL'S SCOPE.
18. OUTGOING STRINGING OF LINE CONDUCTOR & SHIELD WIRE ARE NOT IN BHEL SCOPE BUT CONNECTION OF EQUIPMENT TOWARDS LINE SIDE SHALL BE DONE BY BHEL..
19. CONSTRUCTION OF FIRE RESISTANT WALL BETWEEN 400KV REACTOR UNITS ARE NOT IN BHEL SCOPE.
20. PHASE SEQUENCE IS INDICATIVE & IT SHALL BE VERIFIED AT SITE DURING EXECUTION.
21. THE DIMENSION OF THE XLPE CABLE TRENCH IS TENTATIVE AND SHALL BE FINALISED IN LINE WITH THE CABLE LAYING PHILOSOPHY OF THE EHV XLPE CABLE SUPPLIER.
22. THE SWITCHGEAR BUILDING LAYOUT SHALL BE FURNISHED AS A SEPARATE DRAWING.
- DETAILS OF CABLE TRENCH - ROAD CROSSING ARRANGEMENT SHALL BE SHOWN IN CABLE TRENCH LAYOUT.
23. FOUNDATION WORKS TO BE UNDERTAKEN BY EMPLOYER. HOWEVER, BHEL SHALL BE RESPONSIBLE FOR DESIGNING AND SUPPLYING DRAWINGS AND MATERIALS SUCH AS INSERT, EMBEDMENTS, BOLTS FOR FOUNDATION.
24. REACTOR, UNLOADING AND HANDLING AT SITE SHALL BE ARRANGED BY BHEL.
25. REFER SOAK PIT DESIGN FOR THE DETAILS OF THE SOAK PIT.
26. REFER TO THE CONCEPTUAL DRAWING OF THE CONTROL ROOM BUILDING FOR THE CONTROL ROOM BUILDING DETAIL.
27. SCOPE: GRAVEL AND THE GRATING IN THE REACTOR PIT SHALL BE IN THE SUPPLY SCOPE OF THE END CUSTOMER.
28. THE ACTUAL COORDINATES OF THE DG AND THE BOT SHALL BE FINALISED BY THE END CUSTOMER.
29. LOCATION OF WORKSHOP & 33KV T/L IS INDICATIVE. EXACT LOCATION TO BE FINALISED BY SAPDC AS PER SITE CONDITION.

REV. 07	DATE 18/11/21	ALTERED CHD/APPD	REV. 06	DATE 22/06/21	ALTERED CHD/APPD	REV. 05	DATE 28/05/21	ALTERED CHD/APPD	ADDITIONAL INFORMATION : WO NO. :			PROJECT: ARUN-3 HYDRO ELECTRIC PROJECT (NEPAL) (4 x 225 MW)						
ZONE	CURRENT REVISION INCORPORATES CHANGES AS PER EMAIL DATED 14 JUNE 2021 AND 5TH JULY 2021 FROM M/S SJVN		ZONE	CURRENT REVISION INCORPORATES CHANGES AS PER EMAIL DATED 14 JUNE 2021 FROM M/S SJVN		ZONE	CURRENT REVISION INCORPORATES SOAK PIT AS PER SOAK PIT DOCUMENT REV-04 (TB-405-316-018)		STATUS OF DRAWING :				CUSTOMER: SJVN ARUN-3 POWER DEVELOPMENT COMPANY PVT. LTD. (SAPDC LTD.)					
									DISTRIBUTION OF PRINTS :				CONSULTANT: SJVN LTD. (A JOINT VENTURE OF GOVT OF INDIA AND GOVT OF HP)					
REV. 04	DATE 20/10/20	ALTERED CHD/APPD	REV. 03	DATE 10/03/20	ALTERED CHD/APPD	REV. 02	DATE 07/06/19	ALTERED CHD/APPD	REV. 01	DATE 30/03/19	ALTERED CHD/APPD		BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP NOIDA			NAME	SIGN.	DATE
												DRN.	PK			30/10/2018		
												CHD.	Vyom/VK			30/10/2018		
												APPD.	SKS			30/10/2018		
ZONE	1. DETAILS OF THE REACTOR AND REACTOR CUM NGR AREA INCLUDED. 2. DISTANCE BETWEEN THE REACTORS OPTIMISED. 3. REPRESENTATION OF THE REACTOR UNLOADING INCLUDED.		ZONE	1. Building for Ventilation Room is now limited for catering to the requirement of GIS.		ZONE	1.Building for Inert Gas System included. 2.Common Ventilation Room for Power House and GIS Building included. 3.Cable Trench shown for the CAT to Switchyard. 4. The Layout of the Tranformer Cavern shall be part of shown in "Cross Section and Plan of Transformer Cavern - 1 200 00 20558. 5. Comments marked on Rev-01 incorporated.		ZONE	Revised Switchyard Layout - Sketch - Drg No. SJVN/ED/Arun-III/EM-2017-04			DEPT. TBG CODE		SCALE NTS	CARD CODE		
												TITLE ELECTRICAL LAYOUT PLAN AND SECTION OF 4x225MW OF ARUN-3 HEP			DRG.NO. TB-3-405-316-001		REV. 07	
												SHT. No 02		NO. OF SHT. 04				



ADDITIONAL INFORMATION :
WO NO. :
STATUS OF DRAWING :
DISTRIBUTION OF PRINTS :

(ALL DIMENSIONS ARE IN mm)

FIRST ANGLE PROJECTION

TB-3-405-316-001

DRG. NO.

6

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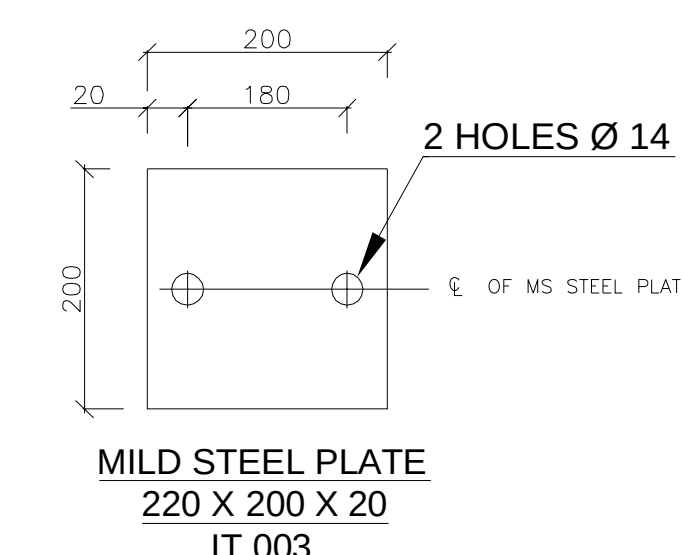
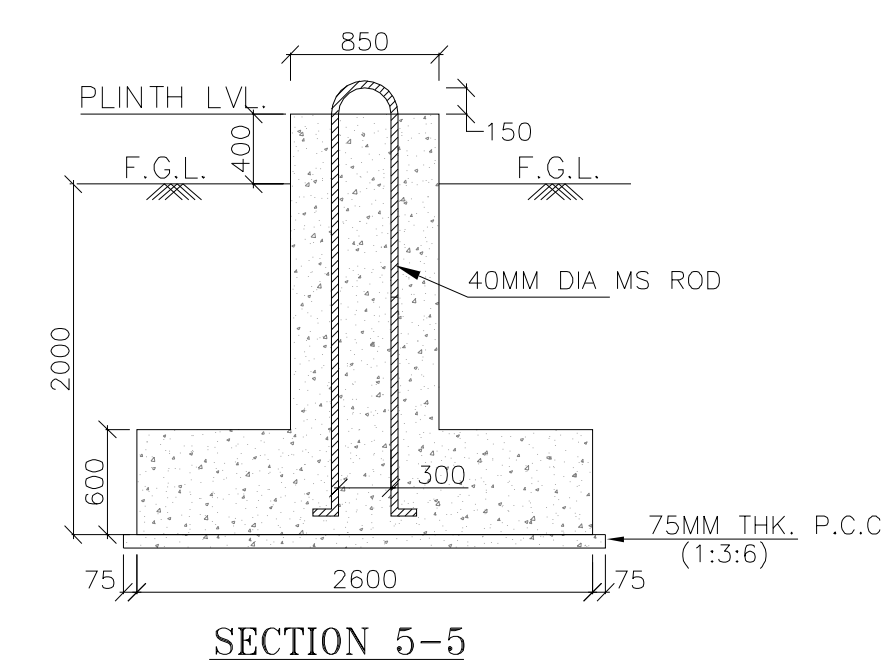
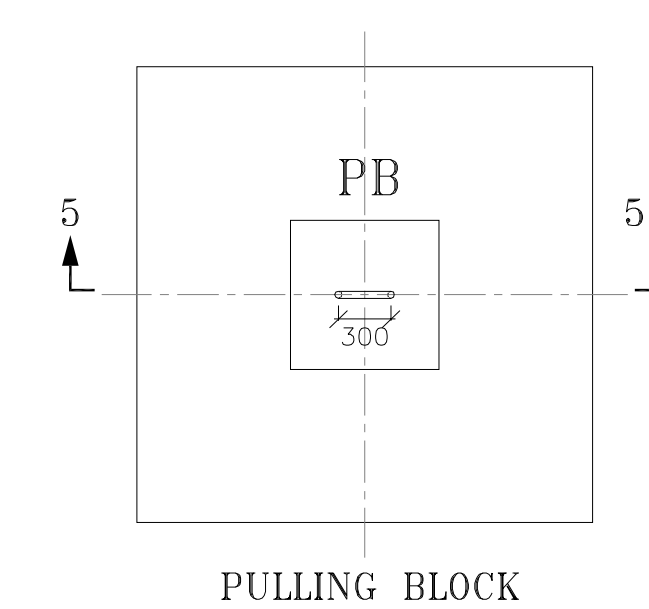
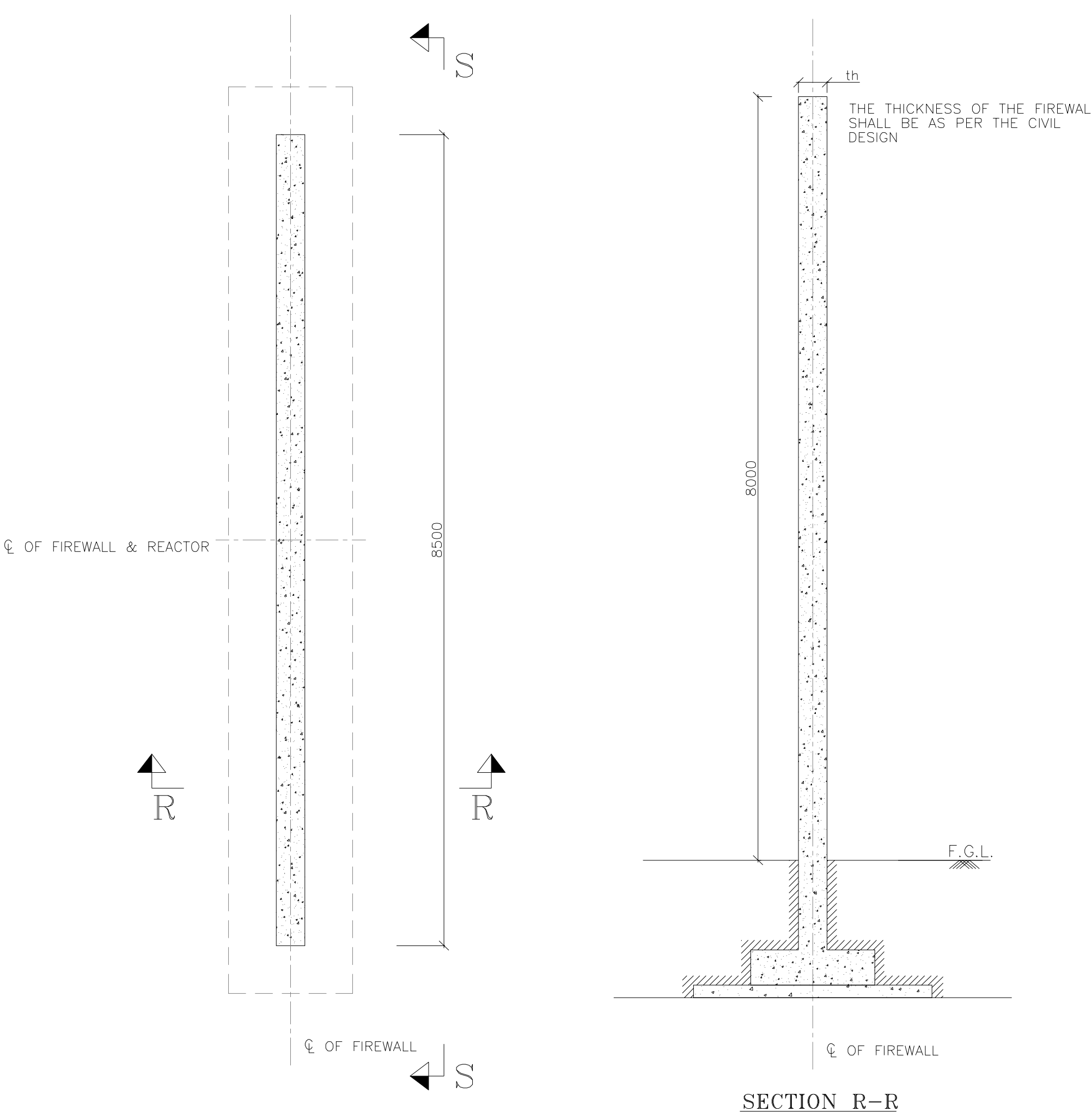
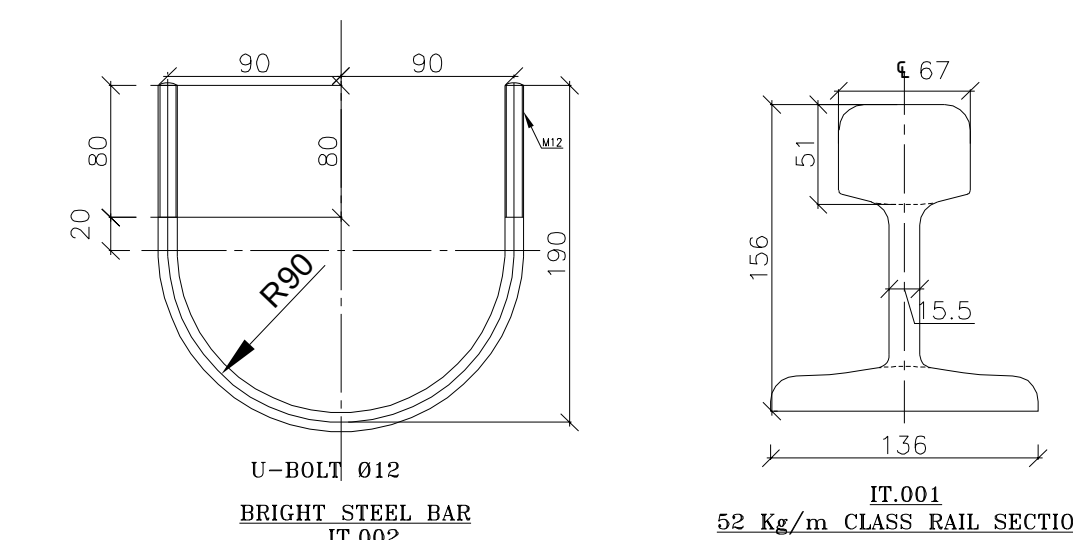
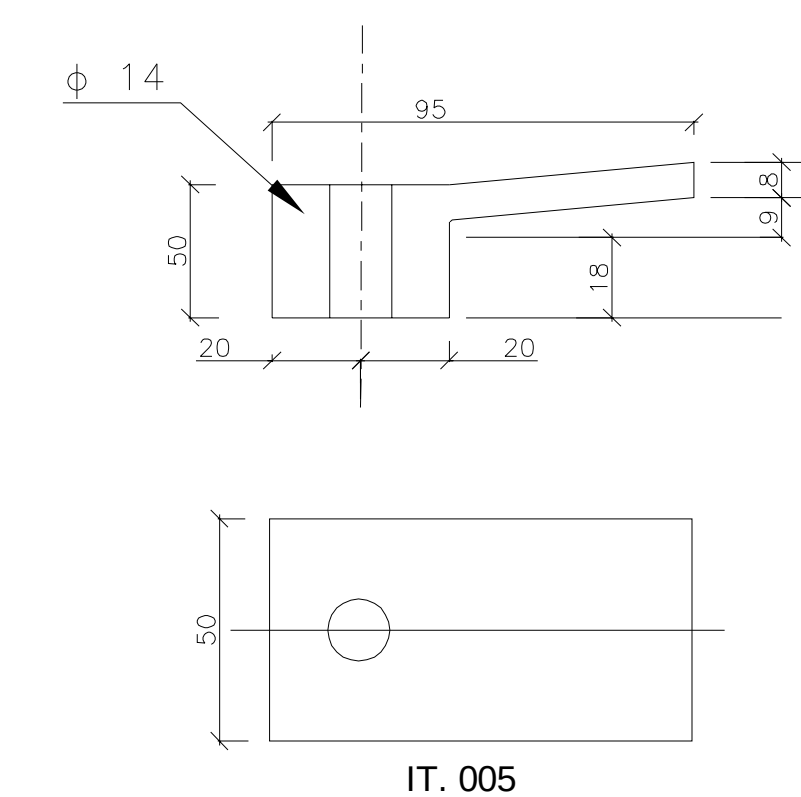
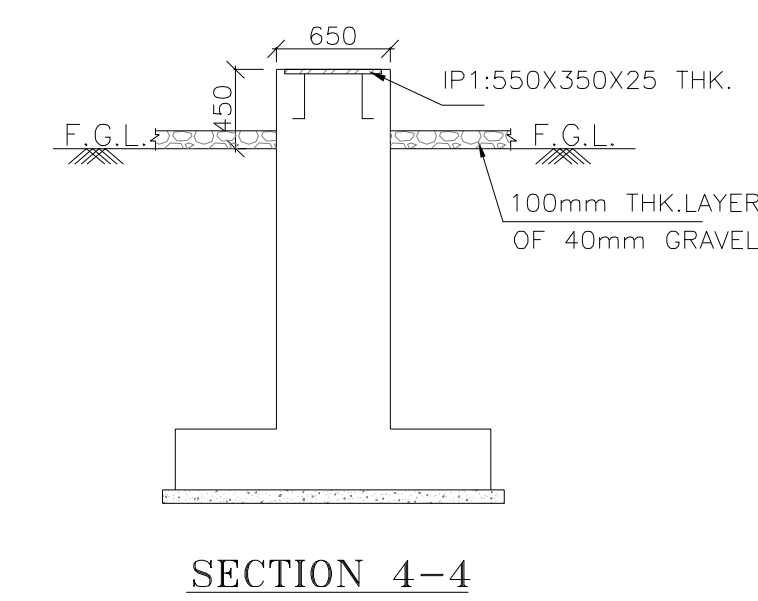
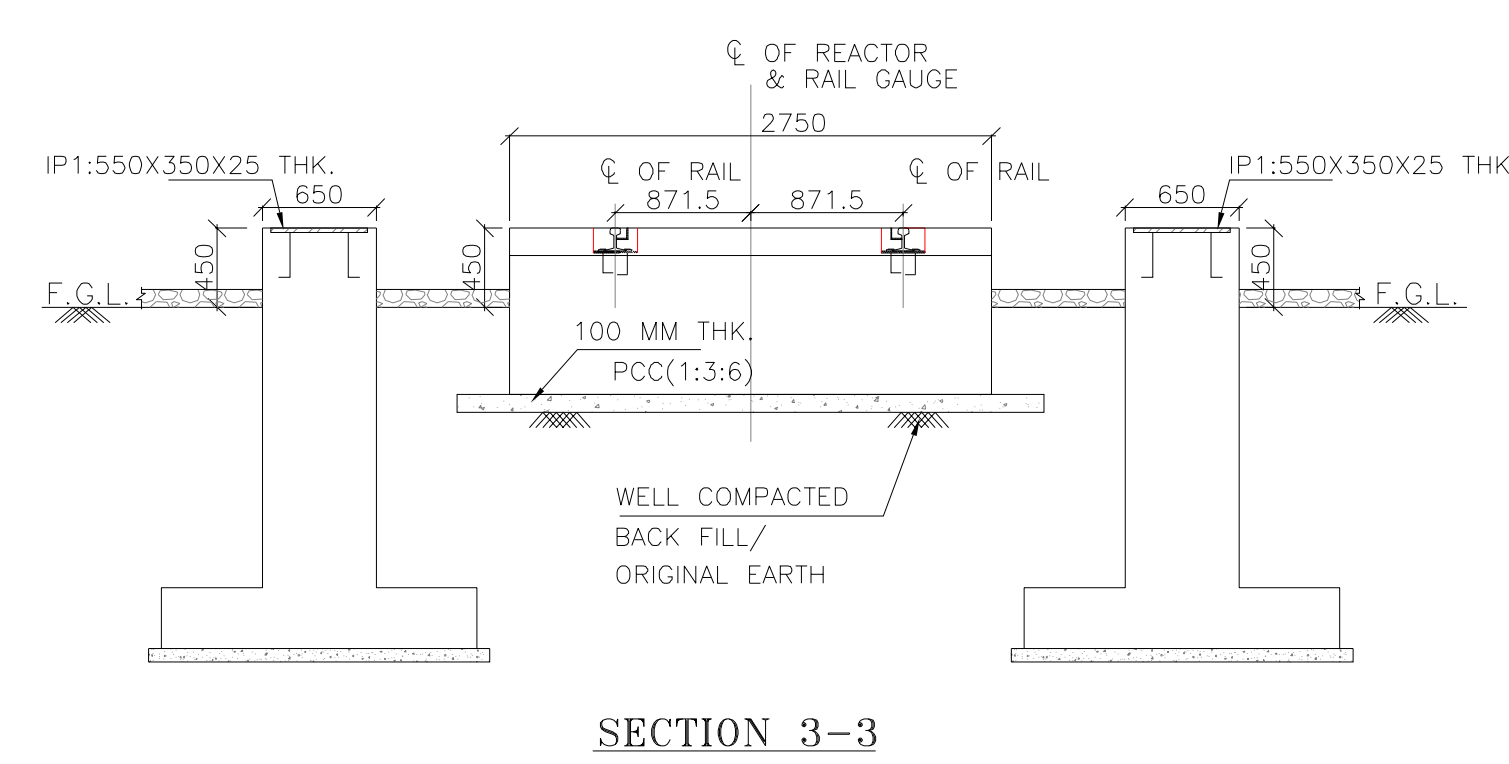
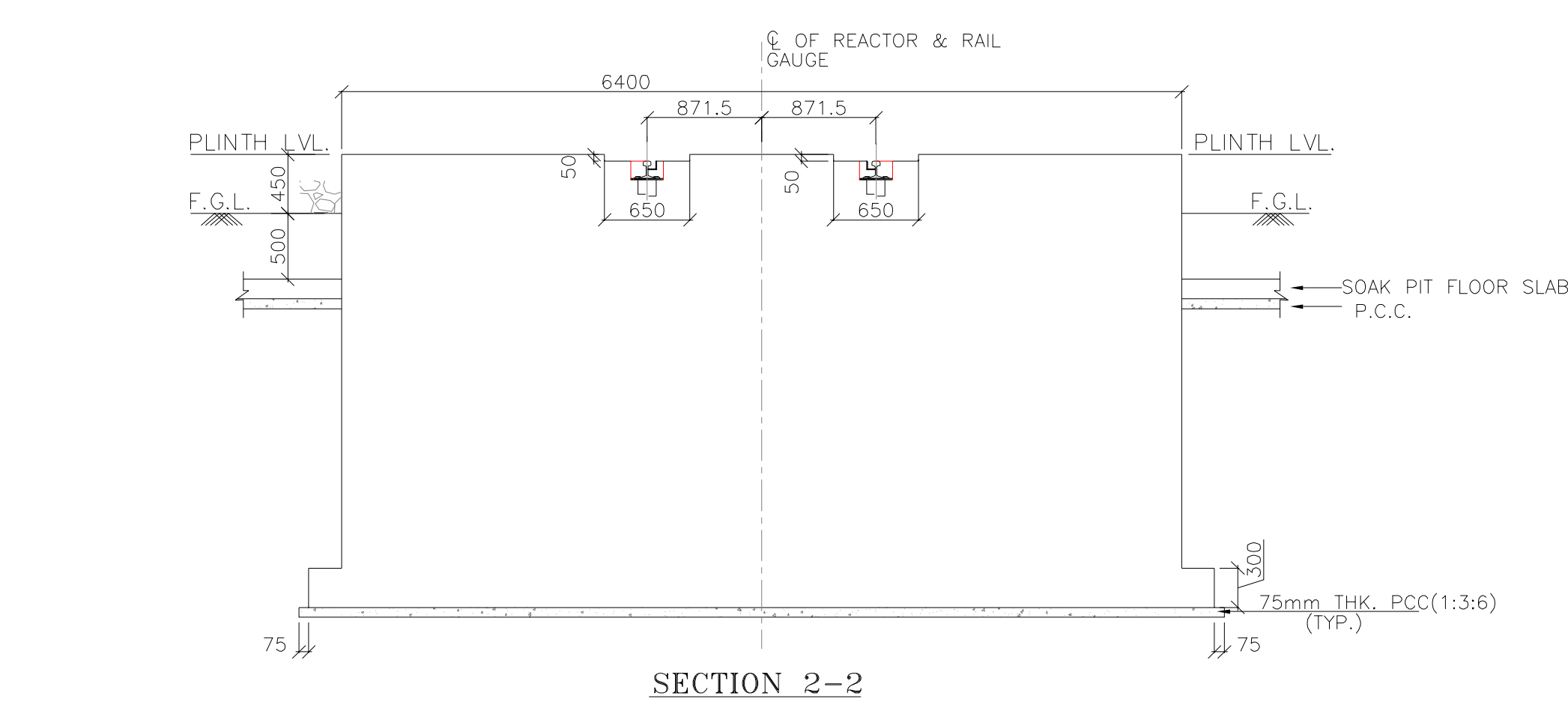
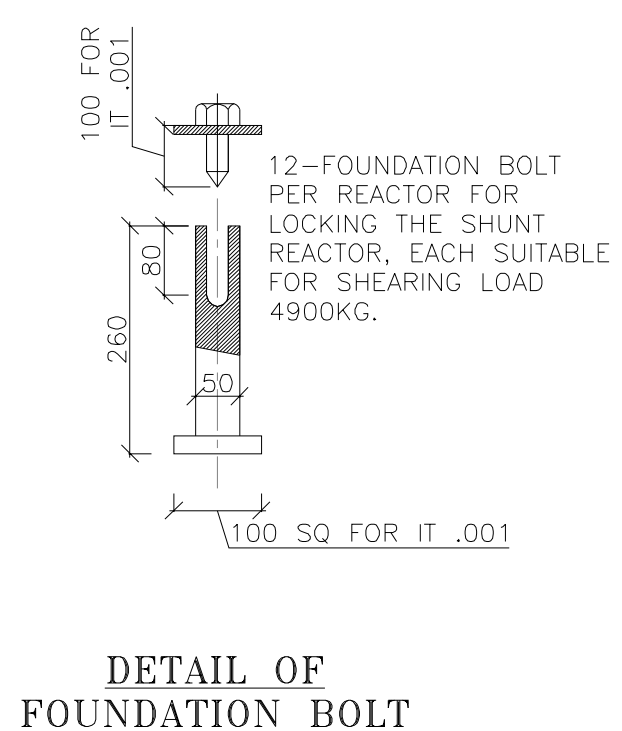
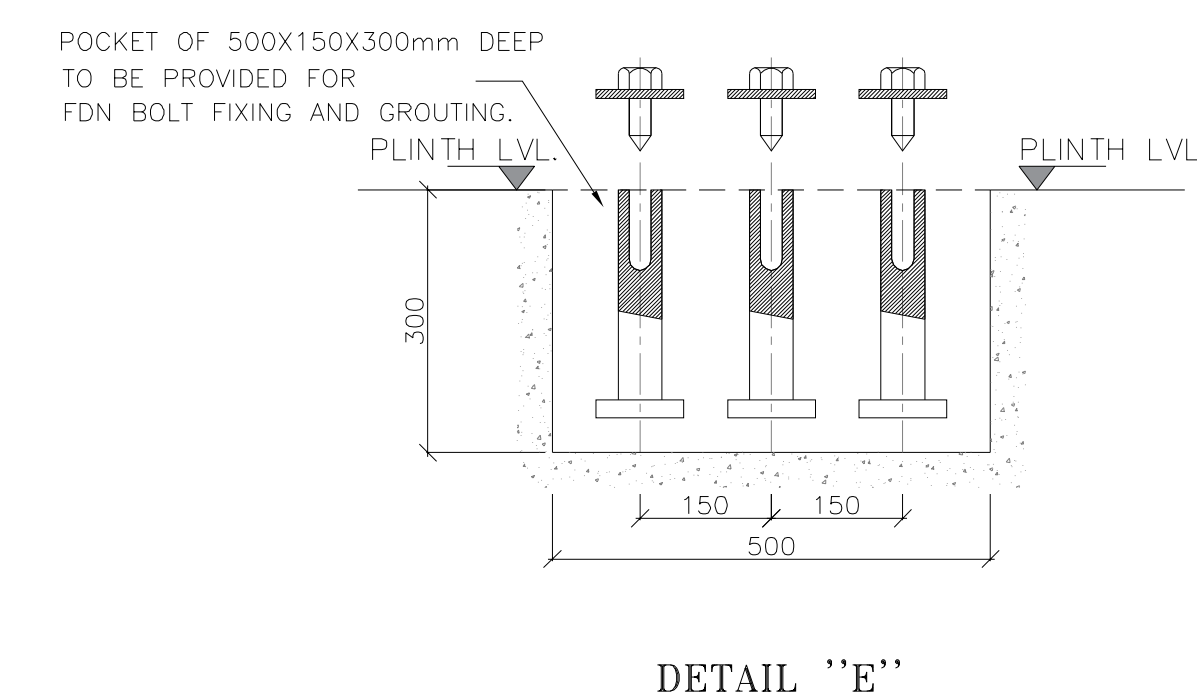
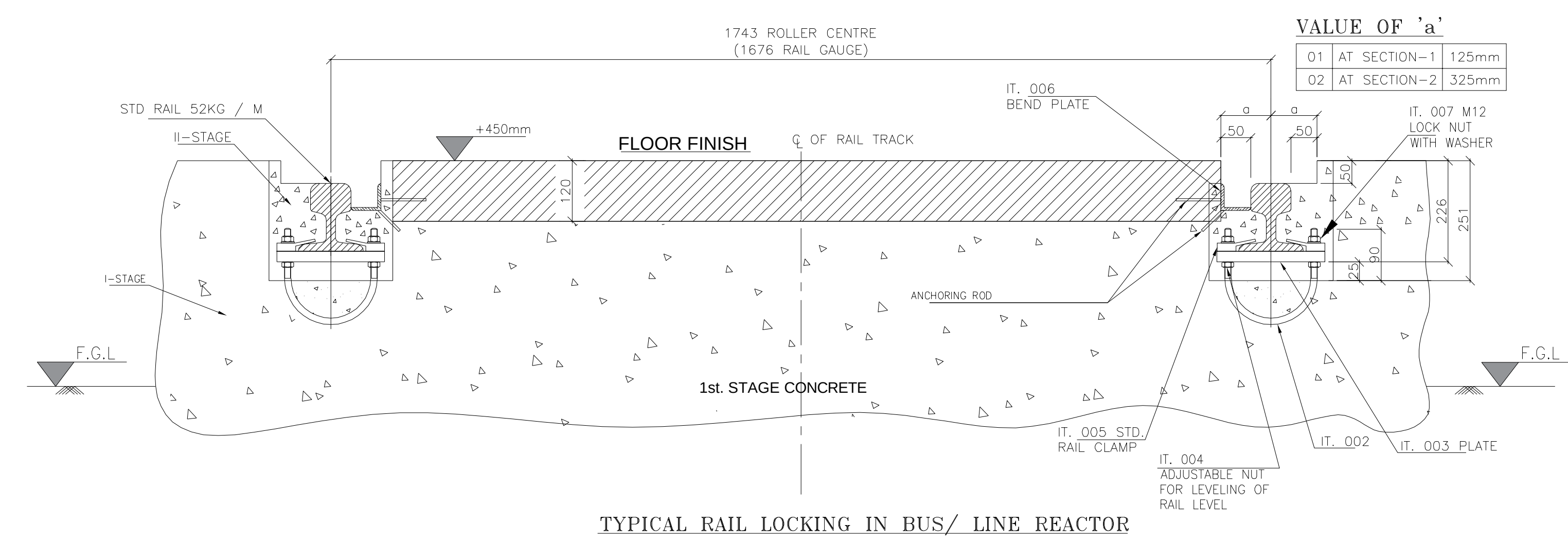
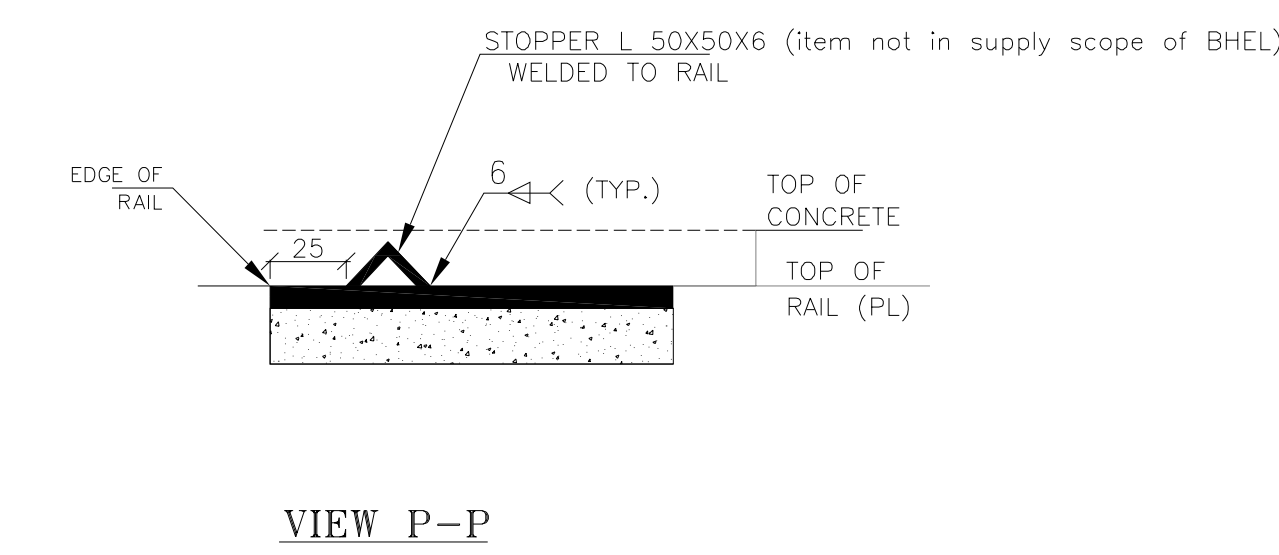
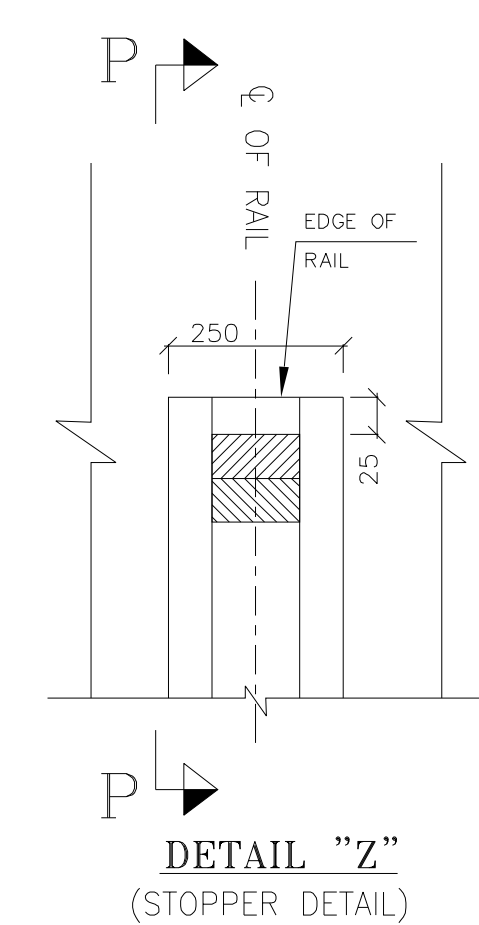
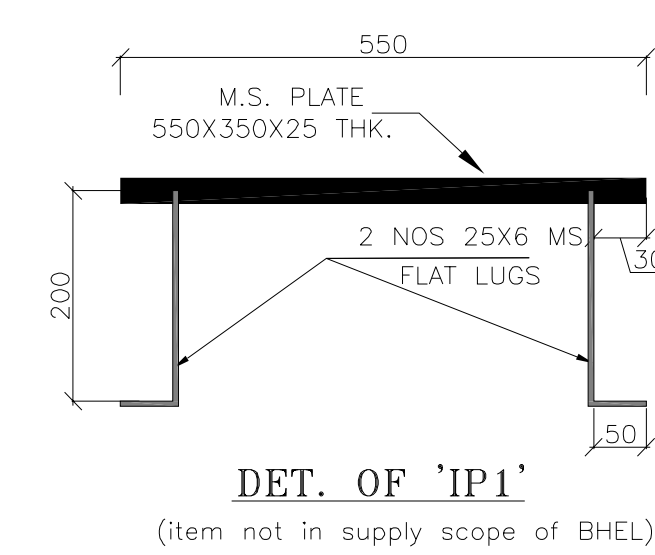
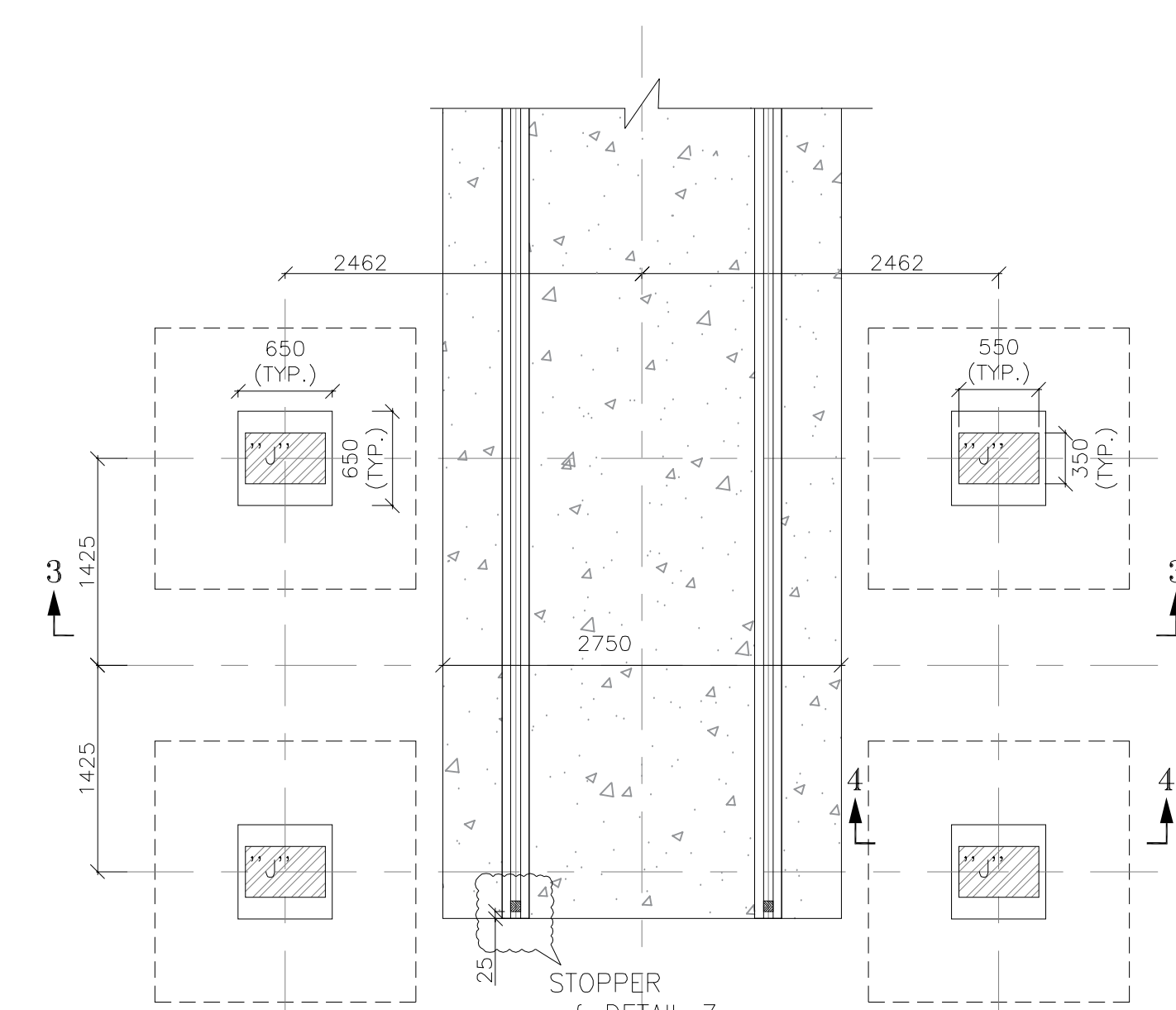
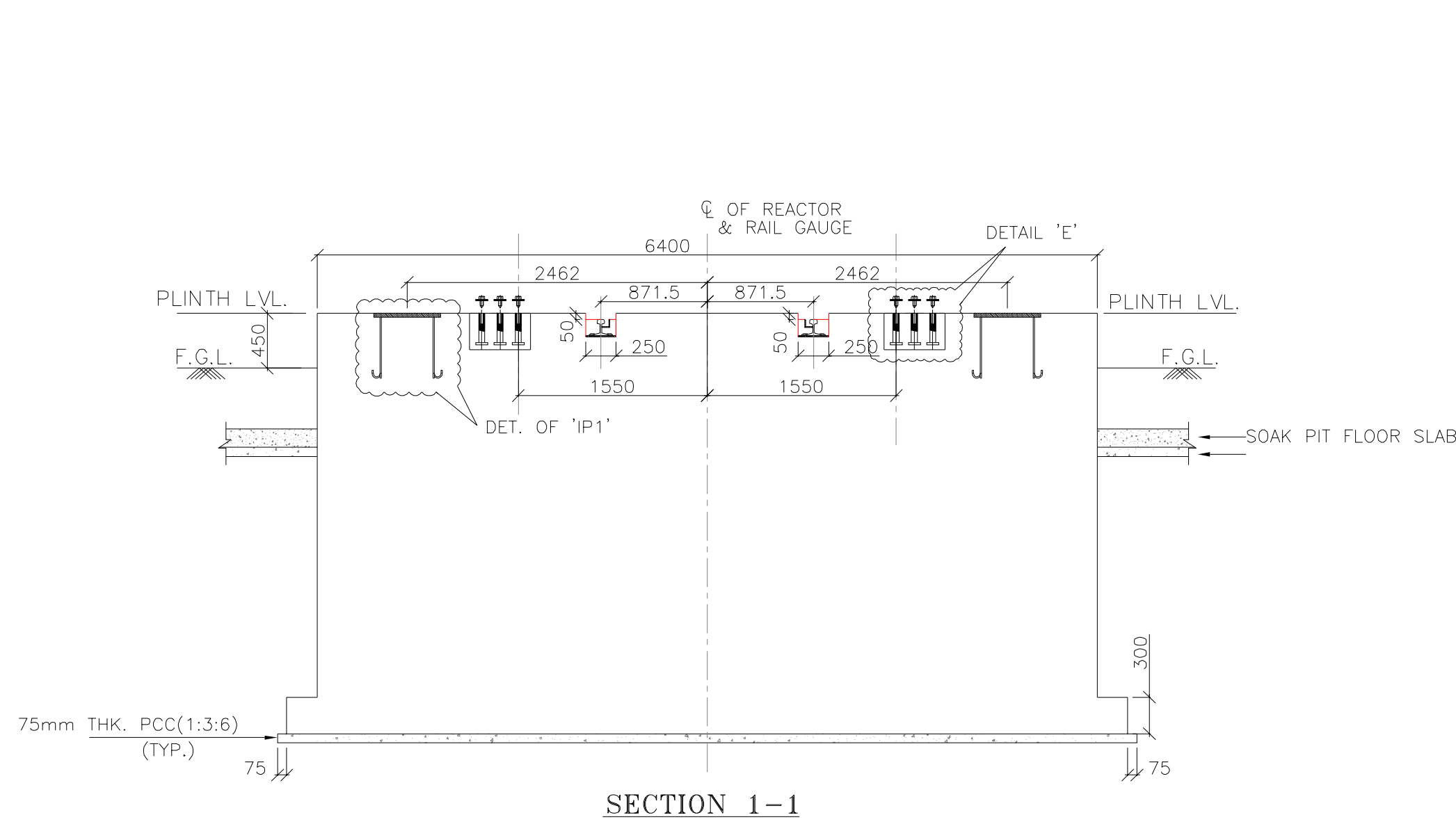


TABLE-A (BOM FOR RAIL FIXING ITEM) SCOPE OF
BHEL-BHOPAL

ITEM NO.	DESCRIPTION	QTY.
01	RAIL	60 METER
02	U BOLT FOR RAIL FIXING	124 NOS.
03	PLATE MS (220 x 200 X 20 MM)	124 NOS.
04	ADJUSTABLE NUT M12	248 NOS.
05	RAIL CLAMP	248 NOS.
06	BEND PLATE WITH ANCHORED ROD (50 x 50, 5mm)	62 METER
07	LOCK NUT M12 WITH WASHER	248 NOS.

PROJECT:	ARUN-3 HYDRO ELECTRIC PROJECT (NEPAL) (4 x 225 MW)
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CUSTOMER: SJVN ARUN-3 POWER DEVELOPMENT
COMPANY PVT. LTD. (SAPDC LTD.)

CONSULTANT: **SJVN LTD.**
(A JOINT VENTURE OF GOVT OF INDIA AND GOVT OF HP)

ADDITIONAL INFORMATION :
WO NO. :

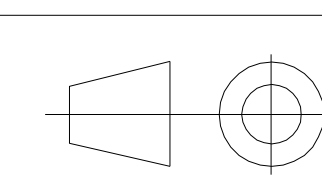
STATUS OF DRAWING :

DISTRIBUTION OF PRINTS :



BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

DEPT.
TBG
CODE



SCALE
NTS

CARD
CODE

TITLE	ELECTRICAL LAYOUT PLAN AND SECTION OF 4x225MW OF ARUN-3 HEP
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DRG.NO. TB-3-405-316-001	REV. 07
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DRG.NO. TB-3-405-316-001	REV. 07
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SIZE-A2

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REF.DRG.NO. 34690001594

SIGN.DATE

INVENTORY NO.

DRG. NO. 3 469 00 01992

102

103

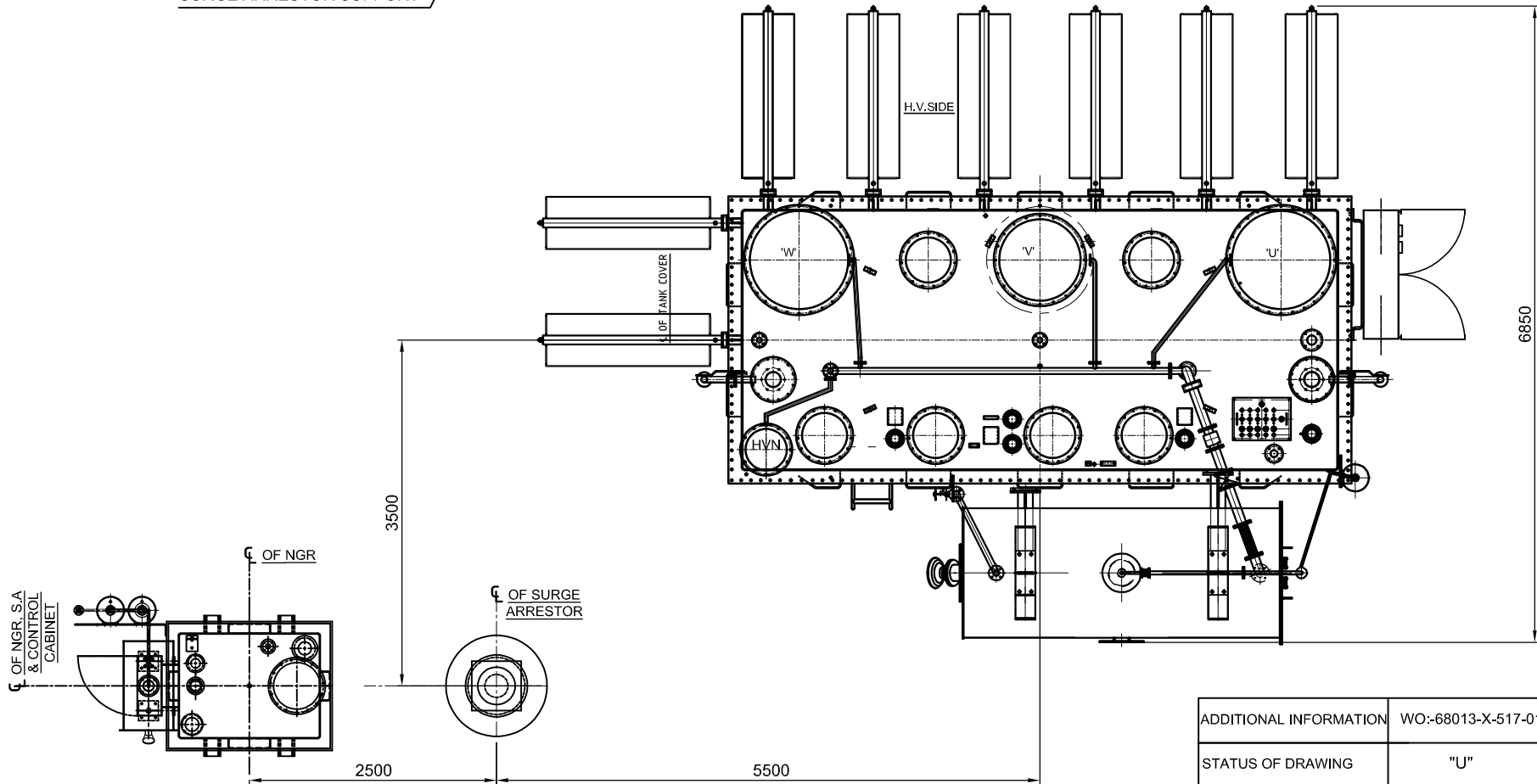
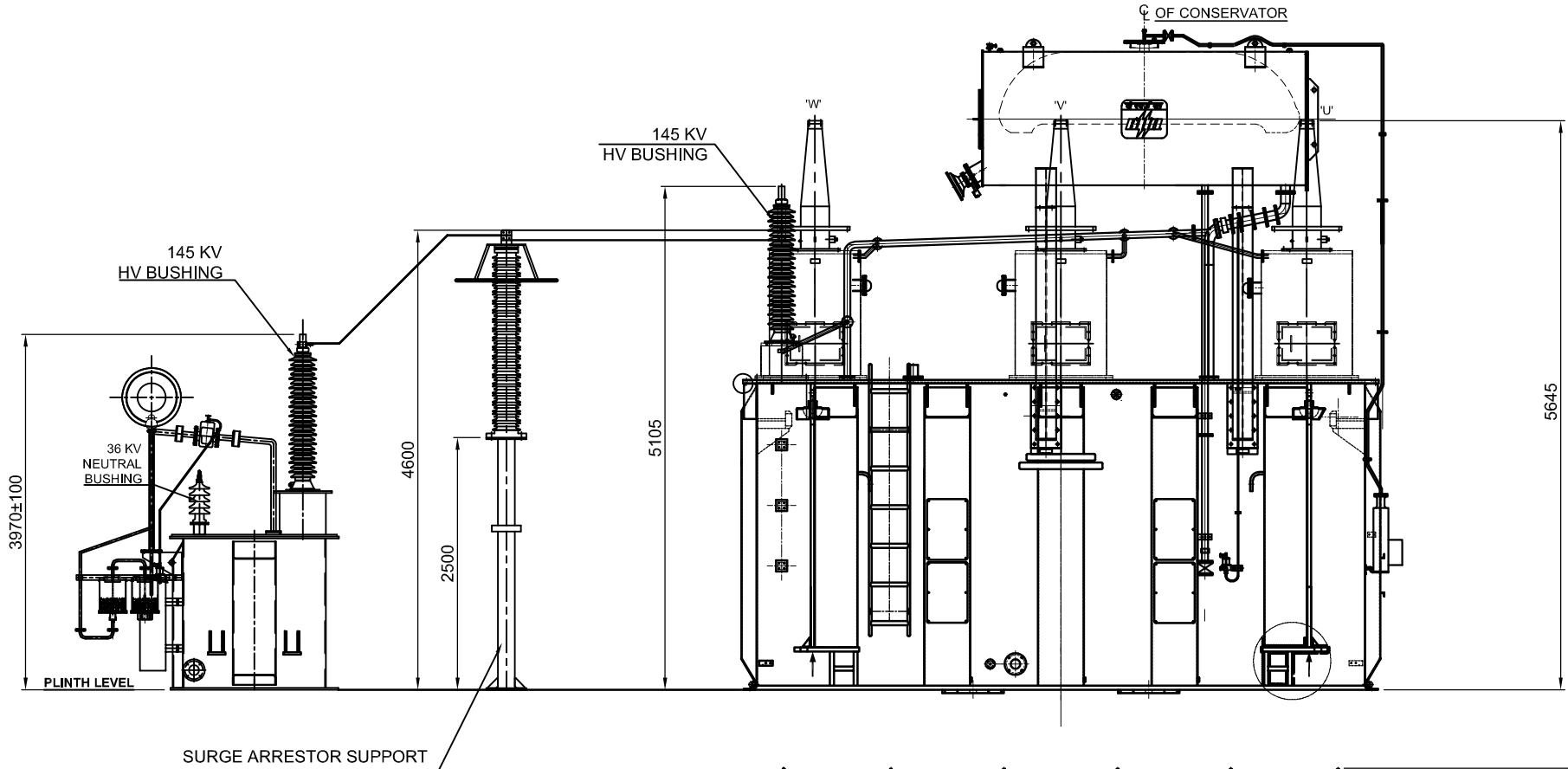
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एसजेवीएन अरुण-३ पावर डेवलपमेण्ट कम्पनी प्रा. लि.

SJVN Arun-3 Power Development Company Pvt. Ltd.

(एसजेवीएनको पूर्ण स्वामित्व भएको कम्पनी)

(A wholly owned company of SJVN)

९०० मेगावाट अरुण-३ जलविद्युत आयोजना

900 MW Arun-3 Hydro Electric Project

Regd. No.: 11150669079

Recommended by Consultant	To be Issued to Contractor		
	Category: APPROVAL		
	Status: Approved Dated: 23.07.2020		
☒ Yes ☐ No	Reviewed	Recommended	Approved

- NOTE :-
- THIS DRAWING REPRESENTS RESPECTIVE POSITION OF SHUNT REACTOR. NEUTRAL GROUNDING REACTOR AND SURGE ARRESTOR FOR DETAIL OF DIMENSIONS REFER RESPECTIVE DRAWING

Consultant: - SJVN LTD.

Recommended for Approval on 20.07.2020

SUB GROUP		SECTIONAL HEAD	HOD
Checked	Reviewed		
		On Leave	

ADDITIONAL INFORMATION	WO:-68013-X-517-01	PROJECT	ARUN-3 HYDRO ELECTRIC PROJECT, NEPAL (4X225MW)			
STATUS OF DRAWING	"U"	CUSTOMER	SJVN ARUN-3 POWER DEVELOPMENT COMPANY PVT.LTD.(SAPDC LTD)			
DISTRIBUTION OF PRINTS	TRE-1, TRM-3	CONSULTANT	SJVN LTD. (A JOINT VENTURE OF GOVT OF INDIA AND GOVT OF HP)			
		TYPE OF PRODUCT	80 MVAR, 420KV, 3-PHASE, SHUNT REACTOR			
		भारत हेवी इलेक्ट्रिकल्स लिमिटेड भोपाल		NAME	SIGN	DATE
		BHARAT HEAVY ELECTRICALS LTD. BHOPAL		DRN.	MKP	26.07.19
DEPT	CODE	SCALE	WEIGHT(kg)	CHD.	KD/JS	26.07.19
TRE	406	COMP.SCALE-1:1	-----	APPD.	KD/JS	26.07.19
		COMBINED OGA		DRG. NO.	3 469 00 01992	REV. 00
				SHEET	01 OF 01	

Manish

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GENERAL DIMENSIONAL LIMITS, FITS & TOLERANCES AS PER HY0230261

INVENTORY NO

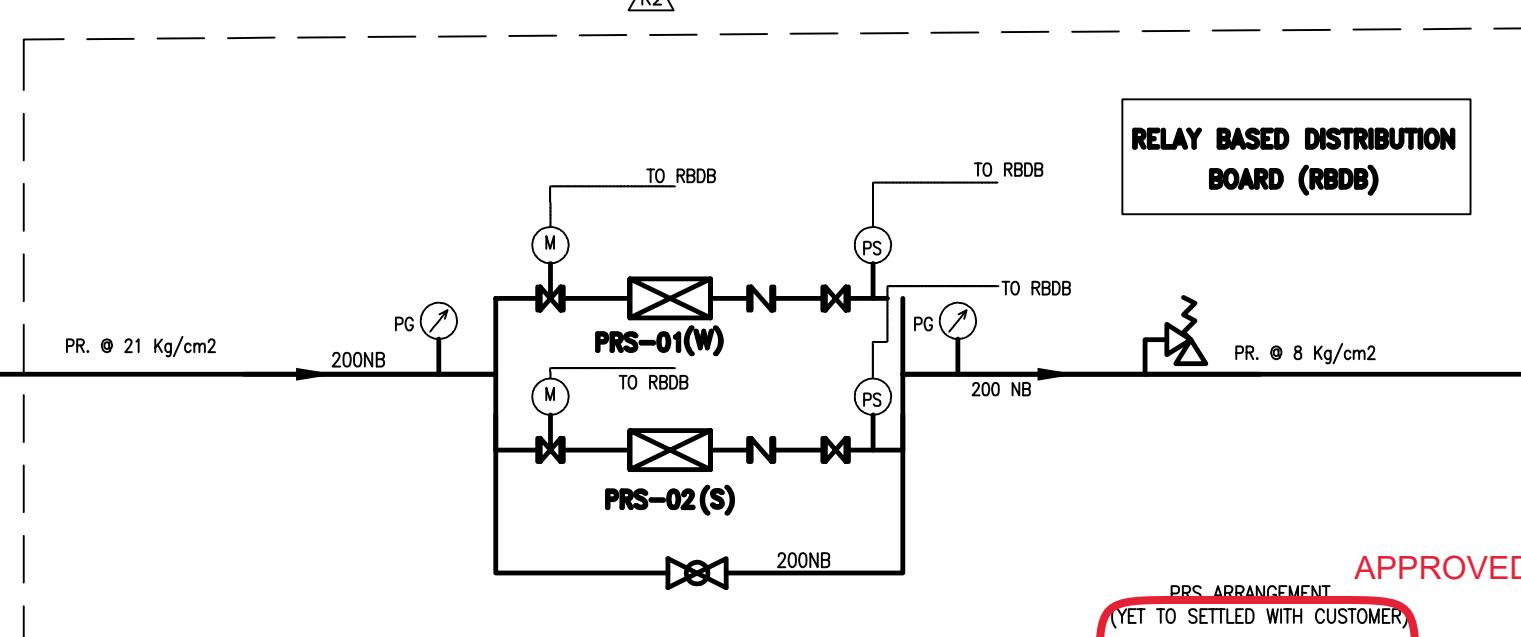
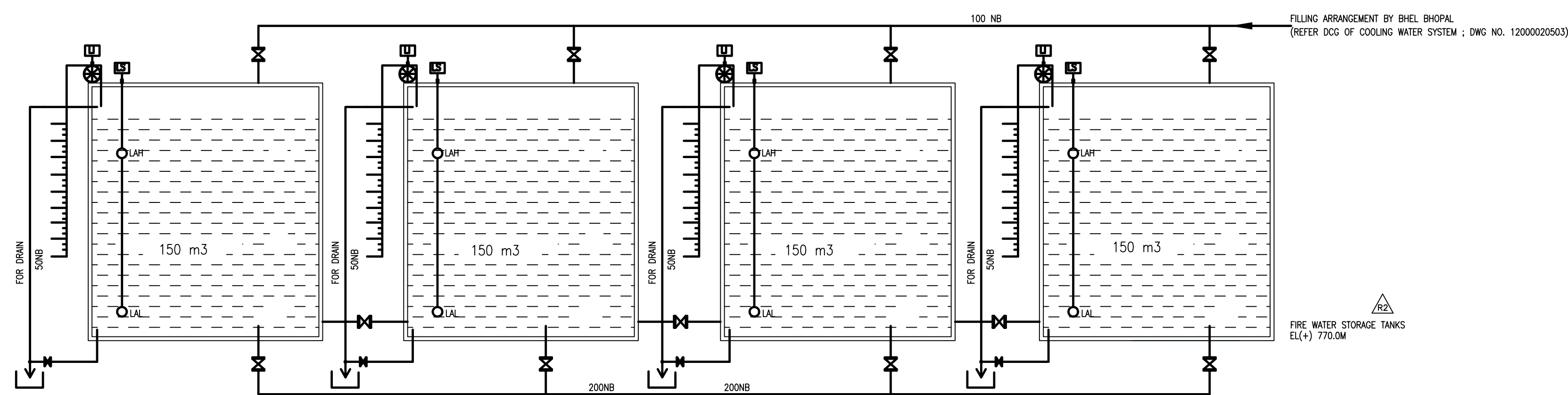
SIGN. AND DATE

REF. DRG. NO.

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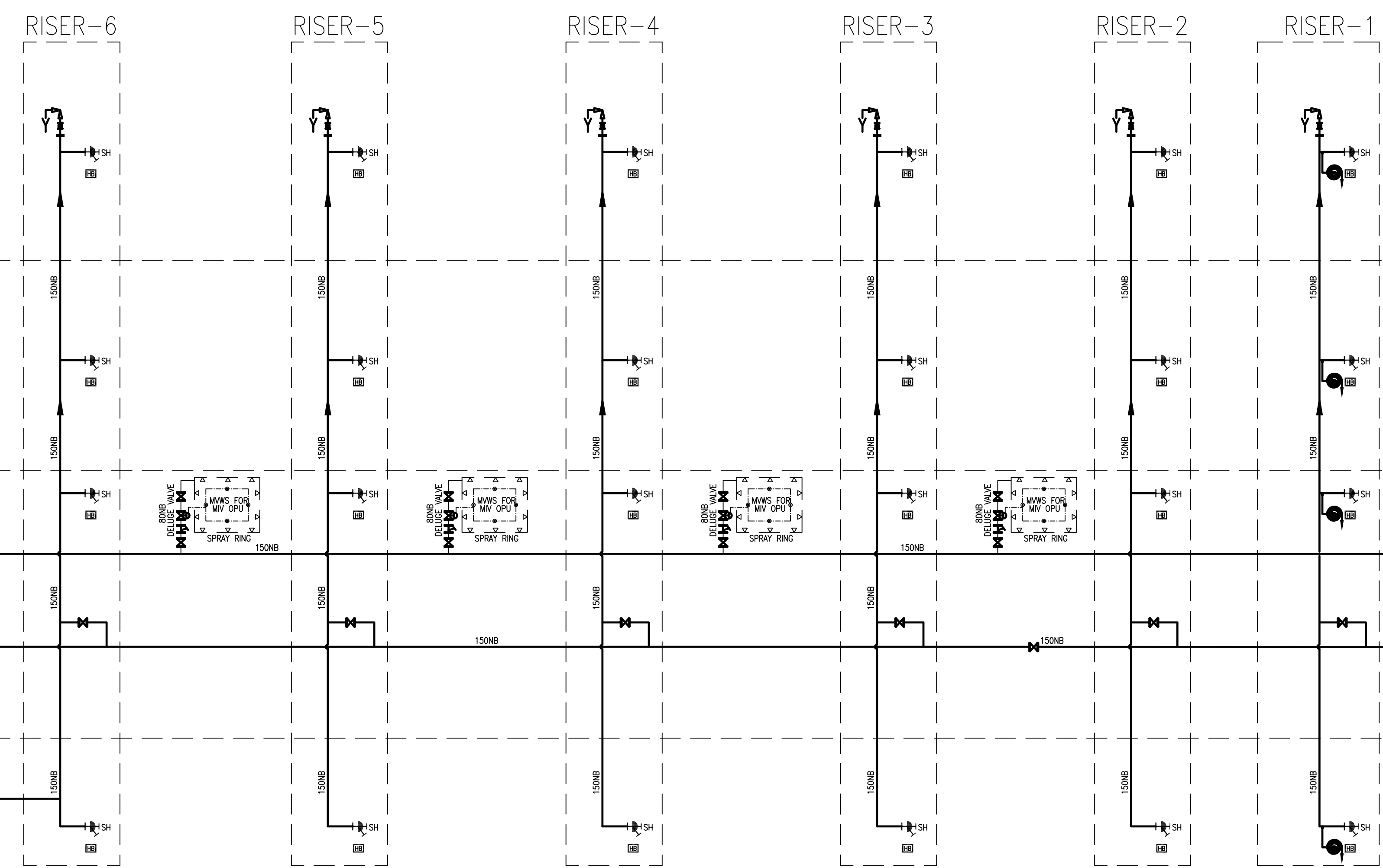
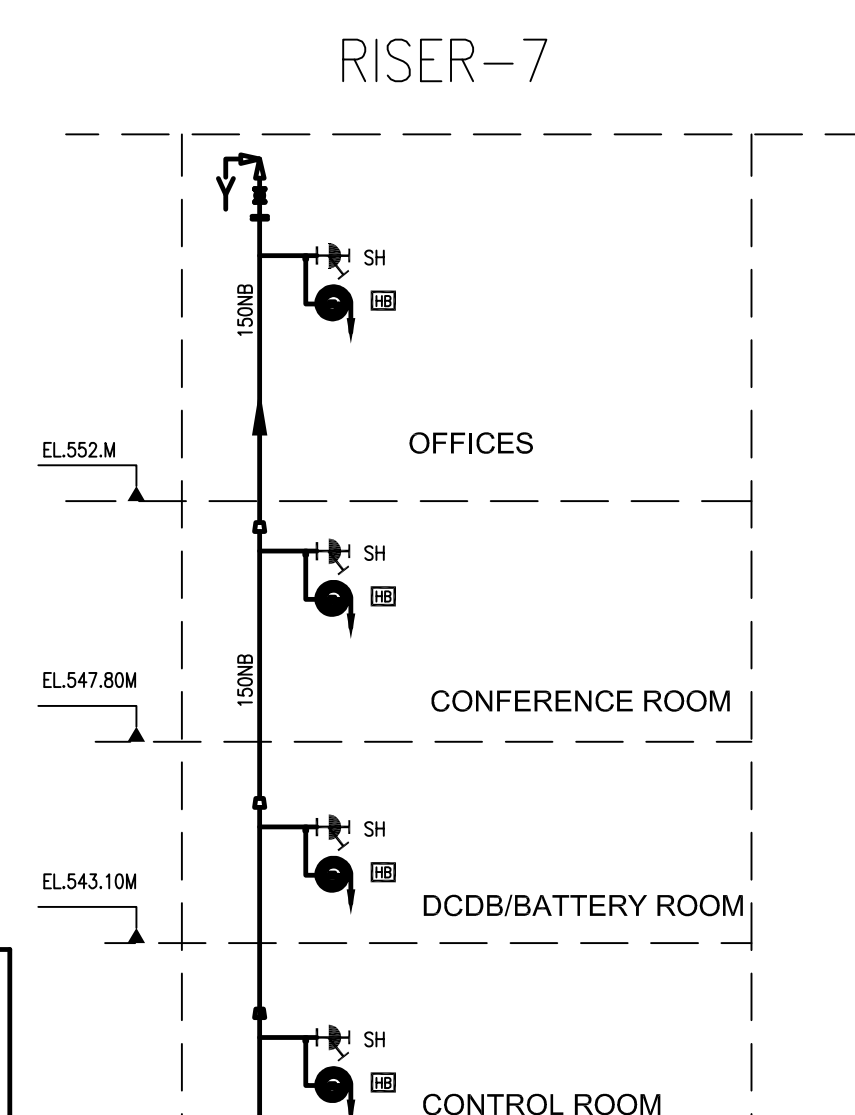
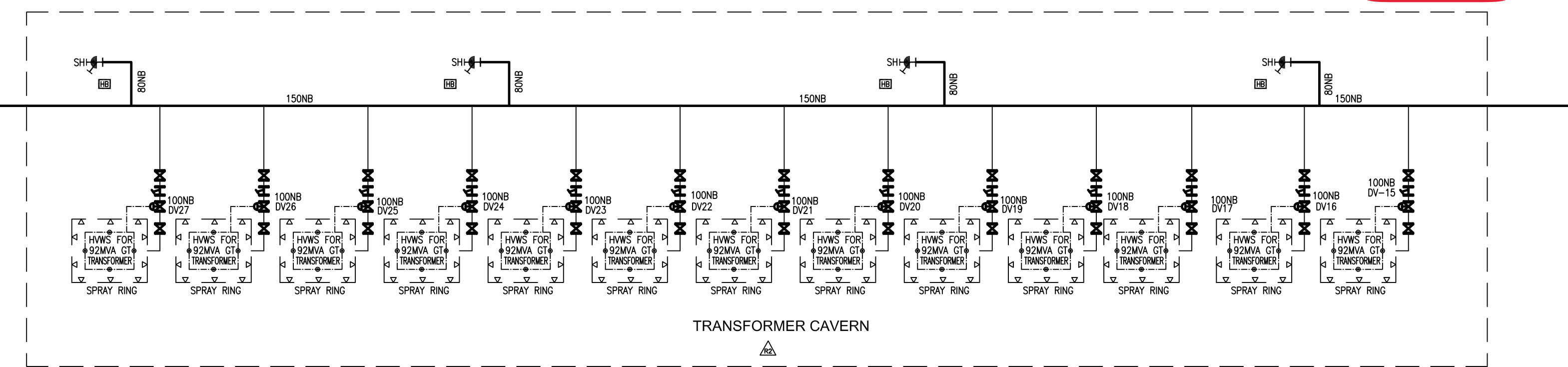
DRG. NO. PYDP1M11086101

SH. OF



REVISION APPROVED
YET TO SETTLE WITH CUSTOMER
Deleted

SWITCHYARD AREA

TAP-OFF FOR SWITCHYARD AREA
EL(+): 557.0M

EL.552 M

EL.539 M

EL.534 M

EL.529 M

EL.520.5 M

Consultant: - SJVN LTD.			
Recommended for Approval on 06.01.2021			
SUB GROUP		SECTIONAL HEAD	HOD
Checked	Reviewed	Recommended	Approved
<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>

एसजेवीएन अरुण-3 पावर डवलपमेंट कंपनी प्रा. लि. SJVN Arun-3 Power Development Company Pvt. Ltd. (एक सार्वजनिक क्षेत्र का उपक्रम है) (A wholly owned subsidiary of SJVN) 900 मेगावाट अरुण-3 जलविद्युत परियोजना 900 MW Arun-3 Hydro Power Project Project No. 111086101			
To be Issued to Contractor			
Category: APPROVAL			
Approved by Consultant	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>
☒ Yes ☐ No	Reviewed	Recommended	Approved

* BHEL shall arrange review of P & ID for hydrant and spray system by an expert / agency after completion of 90% of engineering.

NOTES

- THE SYSTEM IS DESIGNED AS PER TAC RULES.
- ALL PIPE SIZES ARE IN MM AND NOMINAL DIA ONLY.
- HOSE BOX SHALL BE PROVIDED NEAR EACH LANDING/HYDRANT VALVE. EACH HOSE BOX SHALL CONTAIN 15 M LONG HOSES ALONG WITH BRANCH PIPE & NOZZLES.
- SIZES OF DELUGE VALVES AND ISOLATION VALVES SHALL BE FINALIZED DURING DETAIL ENGINEERING DRAWING.
- ALL QUANTITIES SHOWN ARE INDICATIVE AND SHALL BE AS PER SITE REQUIREMENT.
- ARRANGEMENT OF OVERHEAD TANK SHALL BE AS PER "POWER HOUSE COOLING WATER SYSTEM" DWG. NO. SJVN/ED/ARUN-III/EM-2017-06
- THE OVERHEAD TANK FIRE WATER TANKS ARE EXCLUDED FROM BHEL SCOPE AND SHALL BE PROVIDED BY OTHERS. HOWEVER INTERCONNECTING PIPES AND VALVES, INSTRUMENTS SHALL BE PROVIDED BHEL.

CUSTOMER		SJVN ARUN-3 POWER DEVELOPMENT COMPANY PVT. LTD. (SAPDC)			
PROJECT		4 x 225MW ARUN-3 HYDRO ELECTRIC PROJECT (NEPAL)			
CONSULTANT		SJVN LTD.			
BHARAT HEAVY ELECTRICALS LTD. HYDERABAD PROJECT ENGG & SYSTEMS DIVISION		NAME	SIGN.	DATE	NO. OF VAR.
		DRN. HARISH	-SD-	30.01.19	N.A.
		CHD. KAMAL	-SD-	30.01.19	N.A.
		APPD. PC SEKHAR	-SD-	30.01.19	N.A.
DEPT. PED	UNTO. GR.	DIMS. GR.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.
CODE 450			N.T.S	N.A.	N.A.
TITLE		P&ID OF FIRE HYDRANT AND SPRAY SYSTEM			
CARD CODE		DRG. NO.	REV.	DATE	NO. OF ITEMS
NA		PYDP1M11086101	02		
		CUST. DRG. NO.			
		SHT. No 01	No. of SHT. 01	SIZE - A1	

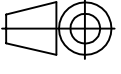
THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY

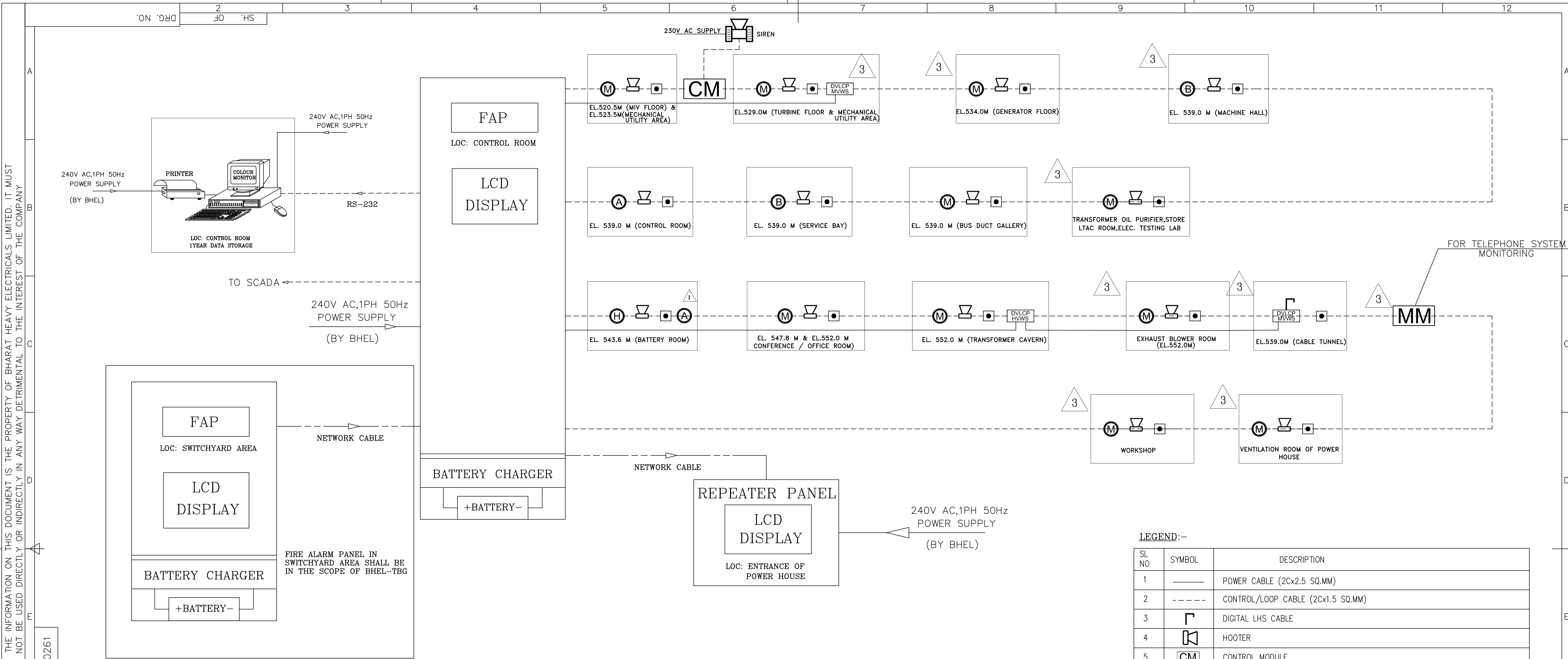
GENERAL DIMENSIONAL LIMITS, FITS & TOLERANCES AS PER HY0230261

INVENTORY NO	SIGN. AND DATE	REF. DRG. NO.	COMPUTER FILE NAME

ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE
CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD			CHD/APPD		

PS-1 : PRESSURE SWITCH IN DISCHARGE LINE
PS-2 : PRESSURE SWITCH IN DETECTION LINE
LHS : LINEAR HEAT SENSING CABLE
SOV : SOLENOID VALVE

CUSTOMER	SJVN ARUN-3 POWER DEVELOPMENT COMPANY PVT. LTD. (SAPDC)												
PROJECT	4 x 225MW ARUN-3 HYDRO ELECTRIC PROJECT (NEPAL)												
CONSULTANT	SJVN LTD. (AJOINT VENTURE OF GOVT. OF INDIA & GOVT. OF HP)												
	BHARAT HEAVY ELECTRICALS LTD. HYDERABAD PROJECT ENGG & SYSTEMS DIVISION					NAME	SIGN.	DATE	NO.OF VAR.				
	DRN.	RAVITEJA —SD—				22.01.19		N.A.					
	CHD.	PRASHANT —SD—				22.01.19							
					APPD.	K. GUNJAN —SD—		22.01.19					
DEPT. PED CODE 450	UNTOL. DIMS. OR 9/11/1		SCALE N.T.S	WEIGHT (KG) N.A.	REF. TO ASSY. DRG. N.A.			ITEM NO. N.A.	NO.OF ITEMS N.A.				
TITLE SCHEMATIC DIAGRAM OF FIRE DETECTION & ALARM SYSTEM					CARD CODE NA	DRG. NO. PY-PL-3-M110-8663-01 CUST. DRG. NO.			REV. 03				
10		11			SHT. No 01		No. of SHT. 02		SIZE - A3				
					12								



SL NO	SYMBOL	DESCRIPTION
1	—	POWER CABLE (2Cx2.5 SQ.MM)
2	----	CONTROL/LOOP CABLE (2Cx1.5 SQ.MM)
3	┐	DIGITAL LHS CABLE
4	⬇	HOOTER
5	CM	CONTROL MODULE
6	MM	MONITOR MODULE (INPUT MODULE)
7	■	MANUAL CALL POINT
8	M	MULTISENSOR DETECTOR
9	M ^{sp}	MULTISENSOR DETECTOR WITH RESPONSE INDICATOR (ABOVE FALSE CEILING)
10	A	ASPIRATION DETECTOR
11	B	BEAM DETECTOR
12	H	HEAT DETECTOR
13	FAP	FIRE ALARM PANEL
14	DVLCP	DELUGE VALVE LOCAL CONTROL PANEL (FOR HVWS/MVWS)

