



BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

TRANSMISSION BUSINESS GROUP

SEC - 142, NOIDA

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TYPE OF DOC.	TECHNICAL SPECIFICATION			NAME	AJ	TDT	SKS	
TITLE FIRE PROTECTION AND DETECTION SYSTEM				SIGN				
				DATE	06.08.19	06.08.19	06.08.19	
				GROUP	TBEM			
CUSTOMER	UP POWER TRANSMISSION CORPORATION LTD. (UPPTCL)							
PROJECT	EXTENSION OF 765/400kV S/S, BARA TPS, (U.P.)							
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TECHNICAL QUALIFYING CRITERIA (TQR) FOR BIDDERS

Fire Detection and Protection System:

The bidder should have designed, supplied, tested, erected and commissioned at least one number fire protection system of each type described in (i), (ii), (iii) and (iv) below in installations such as power plants, substations, refineries, fertilizer plants or other industrial or commercial installations. Such systems must have been designed to the recommendations of Tariff Advisory Committee of India or any other international reputed authority like (FOC, London or NFPA, USA etc.) executed during last ten (10) years and should have been in successful operation (#) for at least 2 (two) years as on the date of bid opening (02.03.2019).

- i) HVW Spray System
- ii) Hydrant System
- iii) Portable Fire Extinguishers
- iv) Fire Detection and Alarm System

In case bidder himself do not meet the requirement of design, he can engage a consultant(s) who must have designed the above system, which must be in successful operation for at least two years as on the date of bid opening (02.03.2019).

In support of the above credentials, the bidder should submit copy of Purchase order along with performance certificate from customer.

(#) Successful operation means certificate issued by the Customer/ end user certifying the operation without any adverse remark.

Only Bidders qualifying TQR requirements will be made technically acceptable for further bid evaluation activity.

SECTION 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

1.0.0 INTENT OF SPECIFICATION

- 1.1.0 This specification is intended to specify the requirements for design, engineering, manufacture, assembly, stage testing, inspection, testing before supply, packing, forwarding, transportation at site, complete erection of all equipment and accessories, testing of the system, trial run, commissioning of the system, final painting and carrying out acceptance test of Fire Fighting System along with its accessories and auxiliary equipment / instruments etc. at UPPTCL Bara site as mentioned in this section and in various other sections of this specification for **400/220kV Bara S/S of Uttar Pradesh Power Transmission Corporation Limited (UPPTCL)**.
- 1.2.0 The system shall be designed, erected & commissioned in accordance with **TAC/ NFPA** guidelines.
- 1.3.0 Requirements pertaining to type, make, quality, testing & inspection of equipment as laid down in various clauses of CUSTOMER Specification, enclosed in Section 2, shall be full & final. In the event of any contradiction w.r.t. other sections of this specification, technical requirements of Section 1 & 2 shall prevail.
- 1.4.0 The Bidder shall be deemed to have understood completely all the tender drawings and documents and quoted accordingly.
- 1.5.0 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respect 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/their judgment is not in full accordance with the specifications.
- 1.6.0 The Bidder to note carefully that 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.
- 1.7.0 The **contract** shall be on **Unit Rate Basis** for the package. In case of change in the input after placement of order the additions / deletions to the scope shall be settled on the basis of unit rates agreed between the Purchaser and Contractor.
- 1.8.0 *During contract stage, quantities of various items of BOQ may vary to any extent and same rates will be applicable so far the resultant variation in total contract value is within $\pm 30\%$. Variations beyond $\pm 30\%$ shall be negotiated mutually.*
- 1.9.0 The term **Customer** shall refer to **UPPTCL**, '**Purchaser**' shall refer to **BHEL** and the term '**Contractor**' shall refer to the **successful Bidder**.
- 1.10.0 There shall preferably be no deviation on technical specification. The bidder shall sign and stamp the "Certificate for No Deviation" enclosed in Schedule-2, Section-5 towards confirmation. ***Deviations in any other form including clarifications / assumptions / observations, input data in the GTP etc will not be considered and it will be construed that the bid conforms strictly to the specification.***

2.0.0 TYPE OF FIRE PROTECTION REQUIRED

- i) Hydrant system for switchyard viz., Auto Transformers, all around switchyard to cover entire surface area.
- ii) HVW spray system for: 3x500 MVA Auto Transformers
 - 500MVA, 765/400/33kV Auto Transformer (Single Phase) – 3 Nos.

(OGA of 500MVA Transformer (BHEL make) is enclosed to this spec. for reference and estimation purpose.)

iii) Conventional fire detection & alarm system

OR

Addressable Fire detection & alarm system

*Type of Fire detection & alarm system will be decided during detailed engineering and only one type of system, either conventional or addressable will be intimated.

iv) Capacity and qty. of fire extinguishers are given in scope of supply Cl. No. 4.1.0. These extinguishers shall be installed in Transformer area. Distribution of these shall be finalized during detailed engineering.

3.0.0 DESIGN CRITERIA

3.0.1 The equipment offered shall comply with the relevant Indian Standards. The equipment conforming to any other approved international standards shall meet the requirement called for in the latest revision of relevant Indian Standard or shall be superior. The Deluge valves, HVW spray nozzles & quartzoid bulb detectors shall have the approval of any of the following agencies;

- a. UL of USA.
- b. F M of USA
- c. LPCB of UK or
- d. VDs of Germany

3.0.2 Ordinary Hazard occupancy shall be considered for hydrant protection.

3.0.3 All the requirements regarding supplies, provisions of control, interlocks, indications, annunciations, alarms etc, stipulated in various clauses of customer specification (Section 2) shall be satisfied by the contractor in totality.

3.0.4 It is contractor's responsibility to prepare the standard HVW spray drawing of Transformers and get approval on the same from customer which is a normal practice in any sub-station project.

3.0.5 Interfacing Requirement

Fire signals of HVW spray system shall be annunciated in Fire alarm panel in control room.

There should be provision for remote actuation of HVWS system through deluge valve local control panel.

However, cable laying and termination scope to wire these fire signals from equipment to control room lies with the contractor.

4.0.0 SCOPE OF SUPPLIES & SERVICES

The requirements mentioned under this clause are provisional and final quantity will be decided after detailed engineering stage:

4.1.0 SCOPE OF SUPPLY

Complete supply consists of following heads:

Sr. No.	System	Areas Covered
1.	Hydrant System	a) Auto Transformers b) Switchyard Area

2.	HVW Spray System	3 Nos. of 500 MVA, 765/400/33 kV, 1-phase Autotransformer
3.	Conventional Fire Detection and alarm System OR Addressable Fire Detection and alarm System	For HVWS System of Transformer
4.	Fire Extinguishers as per customer technical specification attached to section-2.	Manual 25 Kg DCP type
5.	Civil	RCC Pedestals for above ground piping Deluge valve housings Pylon supports for HVW spray system
6.	Electricals	As per Customer Specification attached under section-2.
7.	Erection, Testing & commissioning	For complete fire fighting system as per specification.

Besides, the Bidder shall take a note of the following while preparing his offer:

- a. Water shall be tapped off from the pipeline about 100 mtrs. from the transformers.
- b. Power & Control cables for fire protection system 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 choose their cables from the available sizes only and necessary modifications in their equipment for termination of these cables shall be made by contractor.
- c. Since laying & termination of all power & control cables is in contractor's scope, supply of cable accessories such as lugs, glands, cable tags & markers etc. shall be included by the bidders in their offers alongwith supply of cable for fire detection and alarm system.
- d. Fire detection cable shall be of armoured type when the same is running in outdoor trenches.
- e. Either addressable (microprocessor based) fire alarm panel will be provided or conventional (zone card based) fire alarm will be provided after finalization by end client during detailed engineering stage.
- f. Contractor shall interface fire alarm panel to be located in switchyard control building with existing fire alarm panel located in main plant control room to annunciate vital fire signals of switchyard in main plant.
- g. 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.
- h. 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 and earthing of firefighting equipments shall be done by contractor.
- i. Road, Rail crossing of fire water piping shall be through RCC Hume pipes duly covered with coating and wrapping as per specification. Contractors shall supply and lay these hume pipes.
- j. All pylons required for transformer shall be anchored to soak pit base slab of individual transformer, paved area outside soak pit, etc. using anchor fasteners of adequate capacity. Subsequent to fixing the pylons, lower part of pylon which would be within filled up gravel portion shall be encased with concrete by Contractor for corrosion protection.
- k. Contractor shall submit valid Type test report for approval by BHEL/UPPTCL. Fresh type test of equipment is not envisaged. It is presumed that equipment offered are duly type tested.

Type Test Certificate for degree of protection shall be submitted for the following:

1. Deluge Valve local control panel
2. All other electrical panels in control room 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 and delivery implication to BHEL. The final decision for accepting/ rejecting of type test report shall be of customer. Hence contractor must ensure that panel manufacturer has valid report before ordering.

- l. Contractor shall choose make of materials from list enclosed in Annexure-M to this section. However final applicable make is subject to ultimate customer approval. Bidder can provide any other make that is not included in the list only if it is acceptable to ultimate customer without any cost implication to BHEL. Ultimate client may ask for any make not mentioned of the list below and the same shall be binding on the contractor without any commercial implication.
- m. **Bidder should decide the pipe size of header to take care of requirement of hydrant and spray for transformer based on the hydraulic calculation and consider the same in his offer. There shall not be any price implication to BHEL/customer due to change of any pipe/valve size during detailed engineering.**
- n. **While making his Bid, Bidder should check the requirements carefully.**
- o. Any spares required for commissioning purpose shall be supplied by the contractor without any cost implication.

4.2.0 SCOPE OF SERVICES

4.2.1 Erection, Testing & Commissioning (ETC) requirements

- a) The scope of ETC shall include receipt of material at site, safe storage of material, handling of equipment/ material at site, erection of equipment /material at site including fabrication, equipment and system testing, commissioning of the entire system at site.
- b) Erection of pipe pylon supports, with pipe hangers and other pipe supports corresponding to HVW Spray system.
- c) Painting of aboveground piping (for hydrant system & HVW spray system in the pump house & switchyard), pipe pylon supports etc. as per customer specification.
- d) Land excavation, laying of underground piping for hydrant/ spray system with wrapping & coating & backfilling shall be done by contractor.
- e) Laying and termination of power and control cables for the equipment under the scope this specification.
- f) Laying & fixing of cable trays on walls or elsewhere if applicable.
- g) All the installations in the switchyard shall be properly earthed by the contractor to the nearest earthmat riser of the Owner / Purchaser.
- h) The contractor shall arrange all machinery -tools & tackles and consumables required for erection of the system.
- i) Contractor shall ensure that sufficient quantity of commissioning spares is made available for timely completion of commissioning of the system. The contractor shall furnish a list of commissioning spares that will be brought by him. The unused commissioning spares shall be returnable to the Contractor.
- j) Conducting Performance Guarantee tests to the satisfaction of Customer/ Purchaser.
- k) 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.

- l) After completion of erection and commissioning of the system, the contractor shall train site engineers of Purchaser/Owner so that they are fully conversant with both electrical and mechanical part of the package.
- m) The contractor shall furnish the operation and maintenance manual specifically compiled for each of the sub-stations. The draft O&M manual shall be submitted within 20 weeks after award of contract. The O&M manual shall contain the following information:
 - i) Description of the system and equipment with design particulars
 - ii) Instruction for erection.
 - iii) Instruction for operation, maintenance and repair.
 - iv) Recommended inspection practices and inspection schedule.
 - v) Ordering information for all replaceable parts
 - vi) Recommendation for type of lubricants and frequency of lubrication.

4.2.2 Civil Works

The following shall be in the scope of Contractor:

- a) Construction of RCC pedestals to support the above ground piping for hydrant & spray system and for pylon supports of HVW spray system outside sump pit, wherever required.
- b) Construction of housing for deluge valve and painting the same on outside & inside. The housing shall have RCC roof.
- c) Minor civil works such as grouting, filling up of crevices/ cut outs etc during installation of equipment shall also be in contractor's scope. Any other damage caused to civil works during ETC work of the equipment/system shall be made good to the original finish by the Contractor at no extra cost to the Purchaser.

4.2.3 Inspection & Testing

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

5.0.0 EXCLUSIONS

- 5.1.0 Supply of power & control cables for the system except for fire detection & alarm system which shall be supplied by contractor.**
- 5.2.0 Supply of necessary cable trays for laying power and control cables, wherever required.**
- 5.3.0 Supply of GI flat for earthing of equipments is free issue item to contractor. However, earthing of all firefighting equipment shall be done by contractor.**
- 5.4.0 Receipt, Unloading & Storage of various supply items.**

6.0.0 HANDING & TAKING OVER

It is the responsibility of the Contractor to run and maintain the plant till it is handed over to the owner. Contractor shall assist purchaser to hand over the plant to owner.

7.0.0 UTILITIES AVAILABLE

The contractor shall have to make his own arrangements for electricity distribution to various locations for their works including proper switches / fuse units, distribution boards, cables, poles etc. to ensure safety of employees, workmen and equipment. If required, the contractor shall employ DG Set operated equipment in addition to electrically operated ones to ensure timely completion of work.

8.0.0 VARIOUS HEADS TO BE QUOTED FOR

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

Sl. No.	Item Description	Qty	Unit	Ex-Work Rate	Total Ex-works	ETC rate	Total ETC
A	Hydrant System						
1	Pipe - 200 NB	74	m				
2	Pipe - 150 NB	400	m				
3	Pipe - 100 NB	10	m				
4	Pipe - 80 NB	25	m				
5	Isolation Gate Valve - 100 NB	1	Nos.				
6	Isolation Gate Valve - 150 NB	1	Nos.				
7	Single headed Hydrant Valve	3	Nos.				
8	Hydrant Fire Hose (15 m)	6	Nos.				
9	Branch Pipe with Nozzle	3	Nos.				
10	Fire Hose Cabinet with accessories	3	Nos.				
B	Portable Extinguishers - DCP Type-25 Kg	2	Nos.				
C	HVWS for 500 MVA Transformers (1-phase) (3Nos.)						
1	Deluge Valve 150 NB	3	Nos.				
2	Strainer 150 NB	3	Nos.				
3	Gate valve 150 NB	9	Nos.				
4	Pressure switch	6	Nos.				
5	Spray Nozzle	342	Nos.				
6	Quartzoid Bulb Detector	186	Nos.				
7	Solenoid Valve	3	Nos.				
8	Deluge Valve Local Control Panel	3	Nos.				
9	GI Pipe - 150 NB	54	m				

10	GI Pipe - 100 NB	162	m				
11	GI Pipe - 80 NB	135	m				
12	GI Pipe - 65 NB	291	m				
13	GI Pipe - 50 NB	15	m				
14	GI Pipe - 40 NB	126	m				
15	GI Pipe - 32NB	12	m				
16	GI Pipe - 25 NB	72	m				
17	MS Pipe, B-Class - 80 NB	420	m				
18	Pipe - 25 NB – Detection Line	570	m				
D	Fire Alarm And Detection System						
1	Conventional Fire Alarm cum Annunciation Panel	1	No.				
2	Addressable Fire Alarm Panel	1	No.				
3	Manual Call point	2	No.				
4	Screened FRLS detection cable	1500	m				

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

- f) 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.

ANNEXURE- 'A'

Cable Sizes being procured by BHEL for Sub-Station

Sl. No.	Item Description	Length (Mtrs)	Remark
1	2Cx2.5 sq. mm. control cable		Bidder to furnish the quantity required against the applicable cable size.
2	5Cx2.5 sq. mm. control cable		
3	7Cx2.5 sq. mm. control cable		
4	10Cx2.5 sq. mm. control cable		
5	2Cx6 sq. mm. control cable		
6	4Cx6 sq. mm. control cable		
7	5Cx2.5 sq. mm. screened control cable		
8	10Cx2.5 sq. mm. screened control cable		
9	2Cx6 sq. mm. screened control cable		
10	4Cx6 sq. mm. screened control cable		
11	LV single phase conductor power cable (630 sq. mm. Al)		

Equipments/Items for Fire Protection System

ANNEXURE-M

SI No	Item Name	Vendor Name
1	Pumps	Mather And Platt Pumps Ltd, Kolhapur/KBL,Pune/Flowmore, Ghaziabad/KSB Pumps, Pune
2	Diesel Engine	Greaves Cotton/Kirloskar
3	Gate Valve & Check Valve	Kalpna Valves, Howrah/H Sarker and Company Valves Pvt Ltd, Howrah/VENUS Valves Manufacturing Co,Howrah/Levcon/Advance Valve, Una
4	VALVES (HYDRANT) AND ACCESSORIES	SHAH BHOGILAL, Ahmedabad/SUKAN, Ahmedabad
5	Deluge Valve	HD Fire, Jalgaon/FLOW-TEK VALVES AND CONTROLS INC, Ahmedabad
6	MS and GI Pipes	Jindal, Gahziabad/Surya/AS per COV
7	Stariners (Y Type & Basket Type)	Jaypee Industries, Faridabad/GUJARAT OTOFILT,Ahmedabad/Grandprix/Venus Pumps, Howrah
8	QB Detector	HD Fire,Thane/ACE Turnkey,Mumbai/Spray Safe,UK/Tyco
9	Heat & Smoke Detector	APOLLO,UK/PYROTONICS SYSTEM SENSOR,USA/Nittan,UK/Tyco
10	HV Nozzel	HD Fire, Thane
11	RESPONSE INDICATORS / HOOTERS/BREAK GLASS UNITS	MATHS, Thane/MEHTA & ASSOCIATES, Ahmedabad/
12	Butterfly Valve	Kalpna Valves, Howrah/H Sarker and Company Valves Pvt Ltd, Howrah/Leader,Jalandhar/Advance Valve, Una
13	Pressure Switch	FIBEG , Mumbai/SWITZER, Ghaziabad/DELAVEL TURBINES,Germany/DANFOSS,Chennai/INDFOSS INDUSTRIES, Gahziabad/Trafag
14	MS SECTIONS:- FLATES/ANGLES/CHANNELS/PLATES	POWERGRID approved sources
15	Air Vessel	Anu Designers & fabricators, Ahmedabad/TEMASME VESELEX, Noida/Rattan Industries, Bokaro/Heat Fabs,Pune
16	Electrical Panels	POWERGRID approved sources as per COV
17	Hose Pipes	Newage, Surendernagar/Chhatariya Rubber & Chemical Industries, Gujarat/JAYASHREE
18	Fire Alaram Zonal Panels	Agni Instruments, Okhla/ECD/ Apollo, UK/Daksha, Uttarakhand
19	Fire Extinguisher	safex Fire, Mumbai/KANADIA FYR FYTER PVT.LTD, Bhavnagar/Minimax/Zenith
20	Level Switch and Indicator	Sigma Instruments, Mumbai/Levcon
21	Hose Box	SHAH BHOGILAL, Ahmedabad/TECHNICO (INDIA) PVT LTD, Kolkata
22	Branch Pipe	SHAH BHOGILAL, Ahmedabad

Project: Extension of 765/400kV S/S, Bara TPS, (U.P.)

TB-407-552-033

Customer: Uttar Pradesh Power Transmission Corporation Ltd.

Rev-0

Contractor: Bharat Heavy Electricals Ltd.

TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM

23	Pressure Guage	Gauges Bourdon (I) Pvt. Ltd, Panvel/Fiebeg/H Guru
24	Motor	Siemens/ABB/CGL/Bharat Bijlee/Kirloskar
25	Air Compressor	KGK/ELGI/INGERSOL Rand
26	Battery	POWERGRID approved sources as per COV
27	Solenoid Valve	Avcon/Rotex
28	RESPONSE INDICATORS / HOOTERS/BREAK GLASS UNITS	M.C.ENGINEERING/MATHS /MEHTA & ASSOCIATES FIRE /TECHNICO (INDIA) PVT LTD/Agni Instruments, Okhla
Any sub vendor already approved by POWERGRID and not appearing in this list can be informed to Corporate, QA&I Department with relevant documents/evidence as a proof of POWERGRID approval. On review of these documents and if, necessary after audit/ re-assessment, their name may be considered for inclusion in this list.		

M/s NewAge Fire Fighting Co. Ltd. , Surendranagar Gujarat is approved for Fire protection System item Viz Landing Valve , Branch pipe with Nozzle , Fire Hose and Hose Box for POWERGRID Projects

29. Addressable Fire alarm panels - Autronica, Norway/ Shrack/ Simplex.

SECTION - 2

EQUIPMENT SPECIFICATION

TECHNICAL SPECIFICATION FOR FIRE PROTECTION SYSTEM

1 FIRE PROTECTION SYSTEM

1.1 General

This Specification outlines the standard Technical Requirements applicable to the design, manufacture, and installation and testing of the Fire Protection System in the 765/400kV Bara TPS substation Extn. by the Uttar Pradesh Power Transmission Corporation Ltd. (UPPTCL), Uttar Pradesh, India.

The intent of this specification is to describe the overall requirements of the fire detection and protection system for the substation. The system design and equipment shall conform in all respects to high standard of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in a manner acceptable to the Engineer. The system design shall also conform to TAC/IS/NFPA standards.

Ambient temperature for design of all equipment shall be considered as 50°C.

The Contractor shall ensure that the equipment procured under this specification shall be compatible with the Project requirements.

The Contractor shall prepare and present the required documents for Engineer's review as described later in this document or elsewhere in the Contract documents.

The equipment covered in this specification is broadly classified as follows:

- High Velocity Water Spray System for Autotransformers
- Manual Dry Chemical Fire Extinguishers for transformers
- Fire Protection Distribution System and Hydrants for Switchyard Extension
- Fire Detection and Alarm System for Substation Extension
- AC Supply, Control and Annunciator Panels

This technical specification shall be read in conjunction with the General Technical Requirements and the Scope of Work.

2 TECHNICAL DATA SCHEDULES**2.1 High Velocity Water Spray System for Autotransformers**

TECHNICAL DATA SCHEDULE HIGH VELOCITY WATER SPRAY SYSTEM FOR AUTOTRANSFORMERS CODE NO: 5101				
ITEM	DESCRIPTION	UNITS	REQUIRED	GUARANTEED
1.0	<i>Manufacturer</i>			
1.1	Model	-	-	
1.2	Type	-	-	
1.3	Country of origin	-	-	
2.0	<i>Nominal characteristics</i>			
2.1	Design flow rate	L/minute.	-	
2.2	Design time for water spray	hrs	1/2	
2.3	Number of nozzles	No.	-	
2.4	Size of nozzles	mm	-	
2.5	Number of fire detectors by loop	No.	-	
2.6	Deluge valve size	mm	-	
2.7	Fire detection System (wet/Air detection)		-	
3.0	<i>Control Panel</i>			
3.1	Height	mm	-	
3.2	Width	mm	-	
3.3	Depth	mm	-	
3.4	System diagram		To be enclosed with tender	
4.0	<i>Miscellaneous</i>			
4.1	Piping	-	As per Contractor design	
4.2	Air vessels	-	As per Contractor design	
4.3	Instruments	-	As per Contractor design	
4.4	Other items/specialities	-	As per Contractor design	
5.0	<i>Standards</i>	-	TAC/IS	
6.0	<i>Quality control</i>	-	ISO 9001	
7.0	<i>Installation</i>	-	Outdoor – Refer to existing 765kV Bara TPS S/S documents for Environmental Conditions	416

2.2 Manual Dry Chemical Fire Extinguishers for Transformer

TECHNICAL DATA SCHEDULE MANUAL DRY CHEMICAL FIRE EXTINGUISHERS FOR TRANSFORMER CODE NO: 5107				
ITEM	DESCRIPTION	UNITS	REQUIRED	GUARANTEED
1.0	Manufacturer			
1.1	Model	-	-	
1.2	Type	-	Hand Held	
1.3	Country of origin	-	-	
2.0	Nominal characteristics			
2.1	Type of extinguisher agent	-	-	
2.2	Rating	-	6kg & 25kg	
	Quantity		As per TAC guidelines	
2.3	Classification	-	-	
2.4	Capacity	kg	-	
2.5	Horizontal range	m	-	
2.6	Discharge time	Sec	-	
3.0	Weight and Dimensions			
3.1	Weight	kg	-	
3.2	Dimensions			
3.2.1	Height	mm	-	
3.2.2	Width	mm	-	
3.2.3	Depth	mm	-	
4.0	Standards	-	TAC/IS	
5.0	Quality control	-	ISO 9001	
6.0	Installation	-	Outdoor – Refer to existing 765kV Bara TPS S/S documents for Environmental Conditions	

2.3 Fire Protection Distribution System and Hydrants for Extension Switchyard

TECHNICAL DATA SCHEDULE FIRE PROTECTION DISTRIBUTION SYSTEM AND HYDRANTS FOR SWITCHYARD CODE NO: 5111				
ITEM	DESCRIPTION	UNITS	REQUIRED	GUARANTEED
1.0	<i>Manufacturer</i>			
1.1	Model	-	-	
1.2	Type	-	-	
1.3	Country of origin	-	-	
2.0	<i>Nominal characteristics</i>			
2.1	Hydrant			
2.1.1	Number of hydrants	No.	As per TAC guidelines	
2.1.2	Size of hydrant	mm	-	
2.1.3	Pressure rating	kPa	-	
2.1.4	Size of main valve opening	mm	-	
2.2	Hoses			
2.2.1	Number per hydrant	No.	2	
2.2.2	Type	-	-	
2.2.3	Length	m	15	
2.2.4	Loop piping size	mm	-	
2.2.5	Main pipe size	mm	-	
2.2.6	Post indicating valve number	-	-	
2.2.7	Piping			
	- Material	-		
	- Grade	-		
	- Pressure rating	kPa		
3.0	<i>Miscellaneous</i>			
3.1	Air vessels	-	As per Contractor design	
3.2	Instruments	-	As per Contractor design	
3.3	Other items/specialities	-	As per Contractor design	
5.0	<i>Standards</i>	-	TAC/IS	
6.0	<i>Quality control</i>	-	ISO 9001	
7.0	<i>Installation</i>	-	Outdoor – Refer to existing 765kV Bara TPS S/S documents for Environmental Conditions	

2.4 Fire Detection and Alarm System for Substation

TECHNICAL DATA SCHEDULE CONTROL AND ANNUNCIATOR PANEL CODE NO: 5115				
ITEM	DESCRIPTION	UNITS	REQUIRED	GUARANTEED
1.0	Manufacturer			
1.1	Model	-	-	
1.2	Type	-	-	
2.0	Nominal characteristics			
2.1	Nominal AC voltage	V	240	
2.2	Nominal DC voltage	V	220	
2.3	Internal wiring ratings	V	1100	
2.4	Terminal block rating	V	650	
2.5	Heat detectors	-	Yes	
	- Type	-		
	- Alarm current	-		
	- Standby current	-		
	- Voltage range	-		
	- Sensitivity setting	-		
	- Thermal setting	-		
	- Weight	-		
	- Dimensions	-		
2.6	Smoke detectors	-	Yes	
	- Type	-		
	- Alarm current	-		
	- Standby current	-		
	- Voltage range	-		
	- Sensitivity setting	-		
	- Thermal setting	-		
	- Weight	-		
	- Dimensions	-		
2.7	Data printer	-	Yes	
2.8	Manual fire alarm stations	-	Yes	
2.9	Visual alarm devices	-	Yes	
2.11	Audible alarm devices	-	Yes	
3.0	Test reports			
3.1	Type test reports	-	To be enclosed with tender	
3.1	Site tests	-	As per the	419

Project: Extension of 765/400kV S/S, Bara TPS, (U.P.)

TB-407-552-033

Customer: Uttar Pradesh Power Transmission Corporation Ltd.

Rev-0

Contractor: Bharat Heavy Electricals Ltd.

TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM

TECHNICAL DATA SCHEDULE CONTROL AND ANNUNCIATOR PANEL CODE NO: 5115				
ITEM	DESCRIPTION	UNITS	REQUIRED	GUARANTEED
			Complementary Technical Req.	
4.0	<i>Standards</i>	-	TAC/IS	
5.0	<i>Quality control</i>	-	ISO 9001	
6.0	<i>Installation</i>	-	Outdoor – Refer to existing 765kV Bara TPS S/S documents for Environmental Conditions	

2.5 Control and Annunciator Panel

TECHNICAL DATA SCHEDULE CONTROL AND ANNUNCIATOR PANEL CODE NO: 5116				
ITEM	DESCRIPTION	UNITS	REQUIRED	GUARANTEED
1.0	Manufacturer			
1.1	Model	-	-	
1.2	Type	-	-	
1.3	Country of origin	-	-	
2.0	Nominal characteristics			
2.1	Nominal AC voltage	V	240	
2.2	Nominal DC voltage	V	220	
2.3	Internal wiring ratings	V	1100	
2.4	Terminal block rating	V	650	
2.5	Annunciation system	-	Yes	
3.0	Weight and Dimensions			
3.1	Weight	kg	-	
3.2	Dimensions			
3.2.1	Height	mm	-	
3.2.2	Width	mm	-	
3.2.3	Depth	mm	-	
4.0	Test reports			
4.1	Type test reports	-	To be enclosed with tender	
4.1	Site tests	-	As per the Complementary Technical Req.	
5.0	Standards	-	TAC/IS	
6.0	Quality control	-	ISO 9001	
7.0	Installation	-	Outdoor – Refer to existing 765kV Bara TPS S/S documents for Environmental Conditions	

3 CODES AND STANDARDS

The latest revisions of the following Codes and Standards shall be applicable for the equipment/material covered in this Specification. In case of conflict, the manufacturer may propose equipment/material conforming to one group of Industry Codes and Standards quoted hereunder without jeopardizing the requirement of this specification:

NFPA	National Fire Protection Association
IS	Indian Standards
BS	British Standards
ASTM	American Society for Testing and Materials
ASME	American Society of Mechanical Engineers
DIN	“Deutsches Institut für Normung” German Institute for Standardization
API	American Petroleum Institute Standards
ISO	International Organization for Standardization
TAC	Tariff Advisory Committee of India
	Hydraulic Institute Standards

4 COMPLEMENTARY TECHNICAL REQUIREMENTS

4.1 Scope of Work

The scope of works includes all equipment and material to make the fire protection system functional in every aspects including but not limited to high velocity water spray system (water sprinkler systems), fire hydrants, manual fire extinguishers, control and annunciation panels, fire detection and alarm system for substation buildings, complete earthwork (i.e. excavation, backfilling, etc.) for the entire buried piping system, valve pits and pipe supports for buried, entrenched and over ground piping system. The contractor has to extend the existing fire protection system already installed at the substation. High velocity water spray system for the transformers under the present scope of work, shall be provided by the contractor.

The substation buildings have been provided with the Fire Extinguishers and Fire Detection and Alarm System.

It is the Contractor responsibility to supply and install the complete fire-fighting system for the extension of substation in accordance with the relevant international standards and as per the project requirements.

The equipment offered shall comply with the relevant Indian Standards. The equipment conforming to any other approved international standards shall meet the requirement called for in the latest revision of relevant Indian Standard or shall be superior.

This specification describes and specifies the fire protection system for the HV substation at Bara TPS Extension, complete in all respects. The overall scope at the substation is described in the following sections. The overall scope of work given below describes only the major electrical equipment requirements, which gives an overall assessment in the context of fire protection systems requirements at Bara TPS Extension substation.

4.1.1 Description of 765kV Bara TPS Extension Substation

The switchyards will connect and incorporate the following main equipment:

- One (1) 1500MVA, 765/400kV ICT bank of 3 single phase unit will interconnect the 765kV to the 400kV switchyard;
- Design and Construction Requirements

4.1.2 High Velocity Water (H.V.W) Spray System

A. General Requirements

High velocity water spray type fire protection essentially consists of a network of projectors and an array of heat detectors around the Transformer to be protected. On operation of one or more of heat detectors, water under pressure is directed to the projector network through a Deluge valve from the pipe network laid for this system. This shall be provided for transformers in 765kV/400kV substation.

For the purpose of the design it shall be assumed that only one (1) transformer will be on fire.

The Electrical clearance between the Emulsifier system pipe work and live parts of the protected equipment shall not be less than the values given below:

- 765kV bushing 4900 mm
- 420 kV bushing 3500 mm
- 145 kV bushing 1300 mm

Minimum water pressure available at the farthest and/or highest nozzle (H.V.W. spray system) on the equipment protected shall be 3.5kg/cm²g. However, water pressure available at any projector shall not exceed 5.00kg/cm²g. Water shall be applied at a rate of 10.2 L/min/m² of the surface area of the entire transformer including radiator, conservator, etc. (including bottom surface for transformer).

B. Deluge Valve

The deluge valve shall be water pressure operated manual reset type. The deluge valve shall be closed watertight when water pressure in the heat detector pipe work is healthy and the entire pipe work shall be charged with water under pressure up to the inlet of the Deluge valve. On fall of water pressure due to opening of one or more heat detectors, the valve shall open and water shall rush to the spray water network through the open Deluge valve. The valves shall be manually reset to initial position after completion of operation. Each Deluge Valve shall be provided with a water motor gong which shall sound an alarm when water after passing through the Deluge valve, is tapped through the water motor.

Each deluge valve shall be provided with a local panel, which will enable manual electrical operation of the valve. In addition to this, each valve shall be provided with local operation latch.

Test valves shall simulate the operation of deluge valves and shall be of quick opening type. The general construction shall conform to requirements given in under Section 4.5 "Piping, Valves and Specialities".

C. High Velocity Spray Nozzles (Projectors)

High velocity spray system shall be designed and installed to discharge water in the form of a conical spray consisting of droplets of water travelling at high velocity, which shall strike the burning surface with sufficient impact to ensure the formation of an emulsion. At the same time the spray shall efficiently cut off oxygen supply and provide sufficient cooling.

Minimum set point of the heat detectors used in the H.V.W. spray system shall be 79°C. The optimum rating shall, however, be selected by the Contractor, keeping in mind the maximum and minimum temperature attained at site.

4.1.3 Fire Protection Distribution System and Hydrants for Switchyard and Buildings

Fire protection distribution system for switchyard essentially consists of water hydrants and a large network of pipes, both underground and over ground which feeds pressurized water to a number of deluge valves, hydrant valves. The hydrant valves shall be located at strategic locations near buildings, transformers. Hosepipes of suitable length and fitted with standard accessories like branch pipes, nozzles etc., shall be kept in hose boxes. In case of emergency, these hoses shall be coupled to the respective hydrant valves through instantaneous couplings and jet of water is directed on the equipment on fire. The hydrants shall be provided at the following locations, as generally shown on the layout drawings as well at the other locations to cover complete switchyard area:

- Autotransformers

- Indoor and outdoor stores
- All around switchyard to cover entire surface area

A warning plate shall be placed near the hydrant points for the transformers and the pumps to clearly indicate that water shall be sprayed only after ensuring that the power to the switchyard equipment, transformers which is on fire is switched off and there are no live parts within 20 meters of distance from the personnel using the hydrant.

The most remote hydrant with two 63 mm (2 1/2") hose connections should have a flow not less than 1920 L/min at a minimum residual pressure of 4.5 kg/cm².

4.1.4 Fire Detection System

A. Conventional Fire Detection System

Suitable fire detection system shall be provided for all High Velocity Water Spray System. The operation of any of the fire detectors/ manual call point should result in the following:

- A visual signal exhibited in the annunciation panels indicating the area where the fire is detected.
- An audible alarm sounded in the panel, and
- An external audible alarm sounded in the building, location of which shall be decided during detailed engineering
- If the zone comprises of more than one room, a visual signal shall be exhibited on the outer wall of each room.

Each zone shall be provided with two zone cards in the panel so that system will remain healthy even if one of the cards becomes defective.

Manual call points (Break glass Alarm Stations) shall be provided at strategic locations. All cabling shall be done through concealed conduits.

4.1.5 Manual Fire Extinguishers

2 numbers of manual fire extinguishers of Dry chemical types shall be provided in suitable locations in the buildings. These extinguishers will be used during the early phases of fire to prevent its spread and costly damage.

4.1.6 Instrumentation and Control System

A. General Requirements

All instruments like pressure indicators, differential pressure indicators, pressure switches, level indicators, level switches, temperature indicators, alarms and all other instruments and panels as indicated in the specification and drawings and those needed for safe and efficient operation of the whole system shall be furnished according to the requirements stated instruments section.

B. Control Panel

Individual local control panel for each transformer deluge system shall be provided. This panel shall contain push buttons with indicating lamps for spray ON/OFF operation in the valve operation circuit. Push buttons shall be concealed behind glass covers, which shall be broken to operate the buttons. Provision shall be made in the panel for the field signal for the annunciations such as spray ON and fire in the transformer. A signal for spray ON shall also be provided in the control room fire alarm panel for event logger.

C. Annunciation Panels

Following annunciations shall be provided.

Sl.No.	Description	Number
1.	Fire in Transformer	1 for each equipment
2.	Deluge system operating for Transformer	1 for each equipment
3.	Fire in smoke detection system zone	1
4.	Fire/Fault	1+1(duplicate) for each zone as applicable
5.	Spares	10

Each annunciation panel shall be provided with a hooter.

Indication for fault in respective areas shall also be provided. Each annunciation window shall exhibit 'FIRE' and 'FAULT' conditions separately.

B. Addressable Fire Detection System

- a) Fire Alarm Panel of analogue addressable type shall be dedicated to Switchyard control building which shall evaluate the signals received from the detectors, transmit the fire or trouble alarms (audio-visual) to prearranged points, supervise and monitor the complete fire detection circuits and initiate the shutdown of air-conditioning equipments.
- b) The fire alarm panel shall be designed to include all the standard features and shall also accommodate programmed activation of various interlocks with fire protection system and other associated systems and programmed activation of sequence of events to be carried out in case of fire in any particular protective area.
- c) All the circuits from the detectors to the panels and the circuits from the panels to the actuating devices shall be closed loop type and shall be supervised for open and short circuiting.
- d) Facilities shall be provided on the fire alarm panel for simulating fire conditions, sensitivity adjustment, isolation of detectors etc. from the panel.
- e) Fire alarm control panel shall have filters to ignore false alarm and increase sensitivity to real fire from sensors and provision for automatic re-calibration of sensitivity levels of over/ under sensitive detectors. The sensitivity of each detector should be automatically raised if detectors are gradually polluted due to dust and dirt entering inside the detector. If detectors are more polluted the control panel shall give a warning. The trouble report shall indicate the location of device requiring service.
- f) All devices shall be individually identifiable for its type, its zone location, and alarm set value, alarm and trouble indication by a unique alpha numerical label.

4.2 Piping, Valves and Specialities

This section covers the design, manufacture and erection of piping, valves and specialities.

4.2.1 General Requirements

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

- Plain run of piping, bends, elbows, tees, branches, laterals, crosses, reducing unions, couplings, caps, expansion joints, flanges, blank flanges, thrust blocks, anchors, hangers, supports, saddles, shoes, vibration dampeners, sampling connections, hume pipes, etc.
- Gaskets, ring joints, backing rings, jointing material etc. as required. Also all welding electrodes and welding consumables including special ones, if any

- Instrument tapping connections, stubs, etc.
- Gate and globe valves to start/stop and regulate flow and swing check valves for one directional flow. Fire protection valves shall be of UL listed.
- Basket strainers and Y-type strainers
- Bolts, nuts, fasteners as required for interconnecting piping, valves and fittings as well as for terminal points. For pipe connections into Engineer's R.C.C. works, Bidder will furnish all inserts
- Painting, anti-corrosive coatings etc. inside and outside pipes and equipment. Adequate number of air release valves shall be provided at the highest points in the piping system to vent any trapped air in the system.

4.2.2 Design & Construction

Material of construction of various pipes shall be as follows:

A. Buried Pipes

Mild steel black pipes as per IS: 1239, Part-I medium grade (for pipes of sizes 150 NB and below) or IS: 3589, Fe 410 grade (for pipes of sizes 200 NB and above) suitably lagged on the outside to prevent soil corrosion, as specified elsewhere.

B. Overground Pipes normally full of water

Mild steel black pipes as per IS: 1239, Part-I medium grade (for pipes for sizes 150 NB and below) or IS: 3589, Fe 410 grade (for pipes of sizes 200 NB and above).

C. Overground pipes normally empty, but periodic charge of water and for detector line for H.V.W. System.

Mild steel galvanized pipes as per IS: 1239, Part-I medium grade (for pipes of sizes 150 NB and below) or IS: 3589, Fe 410 grade (for pipes of sizes 200 NB and above).

All fittings to be used in connection with steel pipe lines up to a size of 80 mm shall be as per IS:1239. Part-II Mild steel tubulars and other wrought steel pipe fittings, heavy grade. Fittings with sizes above 80 mm up to 150 mm shall be fabricated from IS:1239 Heavy grade pipes or steel plates having thickness not less than those of IS:1239 Part-I Heavy grade pipes. Fittings with sizes above 150 mm shall be fabricated from IS: 3589 Class-2 pipes. All fitting used in GI piping shall be threaded type. Welding shall not be permitted on GI piping.

Pipelines carrying water, air etc. should be sized on the basis of following values of allowable velocities based on the rated capacity of the pumps:

Service Description	Velocity (m/sec)		
	Pipe Size		
	Below 50 mm	50-150 mm	200 mm & upwards
(a) Pump suction		1.2-1.5	1.2-2.0
(b) Pump discharge	1.2-1.8	1.8-2.4	2.1-2.5
(c) Header	—	1.5-2.4	2.1-2.4
(d) Compressed air below 2 kg/cm ² g	15-20	20-30	25-35
(e) Compressed air 2 kg/cm ² g and above	20-30	25-40	35-45

For steel pipeline, welded construction should be adopted unless specified otherwise.

All piping system shall be capable of withstanding the maximum pressure arising from any condition of operation and testing including water hammer effects.

Gate/sluice valve will be used for isolation of flow in pipe lines and shall be as per IS:778/BS-5150 (for size up to 40 mm), IS:780 (for sizes above 40 mm and up to 300 mm) and IS:2906 (for sizes above 300 mm). Valves shall be of rising spindle type. PN 1.6 class valves shall be provided.

Gate Valves shall be provided with the following:

- Hand wheel
- Position indicator
- Draining arrangement of valve seat
- Locking facility (where necessary)

Gate valves shall be provided with back seating bush to facilitate gland removal during full open condition.

Globe valves shall be provided with contoured plug to facilitate regulation and control of flow. All other requirements should generally follow those of gate valve.

Non-return valves shall be swing check type. Valves will have a permanent "arrow" inscription on its body to indicate direction of flow of the fluid. These valves shall generally conform to IS:5312.

Whenever any valve is found to be so located that it cannot be approached manually from the nearest floor/gallery/platform hand-wheel with floor stand or chain operator shall be provided for the same.

Valves below 50 mm size shall have screwed ends while those of 50 mm and higher sizes shall have flanged connections.

4.2.3 Y-type On-line Strainer

Body shall be constructed of mild steel as per IS: 2062 (tested quality). Strainer wires shall be of stainless steel AISI: 316, 30 SWG, 30 mesh.

Blowing arrangement shall be provided with removable plug at the outlet. Screen open area shall be at least 4 times pipe cross-sectional area at inlet.

4.2.4 Hydrant Valve (Outdoor)

The general arrangement of outdoor stand post assembly, consisting of a column pipe and a hydrant valve with a quick coupling end shall be as per TAC requirement. Materials of construction shall be as follows:

(a) Column pipe M.S. IS: 1239 med. grade

(b) Hydrant Valve:

i. Body	Gun metal
ii. Trim	Leaded tin bronze as per IS: 318, Grade-2
iii. Hand Wheel	Cast Iron as per IS: 210, Grade-20
iv. Washer, gasket, etc.	Rubber as per IS: 638
v. Quick coupling connection	Leaded tin bronze as per IS: 318, Grade-2
vi. Spring	Phosphor Bronze as per IS: 7608.
vii. Cap and chain	Leaded tin bronze as per IS: 318, Grade-2

The general design of hydrant valve shall conform to IS: 5290.

4.2.5 Hoses, Nozzles, Branch pipes and Hose boxes

(a) Hose pipes shall be of unlined flax canvas/reinforced rubber-lined canvas construction as per IS:4927/type A of IS:636 with nominal size of 63 mm (2 1/2") and lengths of 15 metres or 7.5 metres. All hoses shall be ISI marked.

(b) Hosepipes shall be capable of withstanding an internal water pressure of not less than 35 kg/cm² without bursting. It must also withstand a working pressure of 8.5 kg/cm² without undue leakage or sweating.

(c) Each hose shall be fitted with instantaneous spring lock type couplings at both ends. Hose shall be fixed to the coupling ends by copper rivets and the joint shall be reinforced by 1.5 mm galvanized mild steel wires and leather bands.

(d) Branch pipes shall be constructed of copper and have rings of leaded tin bronze (as per IS:318 Grade-2) at both ends. One end of the branch pipe will receive the quick coupling while the nozzles will be fixed to the other end.

(e) Nozzles shall be constructed of leaded tin bronze as per IS:318, Grade-2.

(f) Suitable spanners of approved design shall be provided in adequate numbers for easy assembly and dismantling of various components like branch pipes, nozzles, quick coupling ends etc.

(g) Hose pipes fitted with quick coupling ends, branch pipes, nozzles spanner etc. will be kept in a hose box, which will be located near point of use. The furnished design must meet the approval of Tariff Advisory Committee.

(h) All instantaneous couplings shall be of identical design (both male and female) so that anyone can be interchanged with another. One male, female combination shall get locked in by mere pushing of the two halves together but will provide leak tightness at a pressure of 8 kg/cm² of water. Designs employing screwing or turning to have engagement shall not be accepted.

4.2.6 Fabrication & Erection

The Contractor shall fabricate all the pipework strictly in accordance with the related approved drawings.

4.2.7 End Preparation

(a) For steel pipes, end preparation for butt-welding shall be done by machining.

(b) Socket weld end preparation shall be sawing/machining.

(c) For tees, laterals, mitre bends, and other irregular details cutting templates shall be used for accurate cut.

4.2.8 Pipe Joints

(a) In general, pipes having sizes over 50 mm shall be joined by butt-welding. Pipes having 50 mm size or less shall be joined by socket welding/screwed connections. Galvanised pipes of all sizes shall have screwed joints. No welding shall be permitted on GI pipes. Screwed joints shall have tapered threads and shall be assured of leak tightness without using any sealing compound.

(b) Flanged joints shall be used for connections to vessels, equipment, flanged valves and also on suitable straight lengths of pipe line of strategic points to facilitate erection and subsequent maintenance work.

4.2.9 Overground Piping

(a) Piping to be laid overground shall be supported on pipe rack/supports. Rack/supports details shall have to be approved by the Engineer.

(b) Surface of overground pipes shall be thoroughly cleaned of mill scale, rust etc. by wire brushing. Thereafter one (1) coat of red lead primer shall be applied. Finally two (2) coats of synthetic enamel paint of approved colour shall be applied.

4.2.10 Buried Pipe Lines

(a) Pipes to be buried underground shall be provided with protection against soil corrosion by coating and wrapping with two coats of coal tar hot enamel paint and two wraps of reinforced fibre glass tissue. The total thickness of coating and wrapping shall not be less than 3 mm. Alternatively corrosion resistant tapes can also be used for protection of pipes against corrosion.

(b) Coating and wrapping shall be in line with IS: 10221.

(c) Buried pipelines shall be laid with the top of pipe one meter below ground level.

(d) At site, during erection, all coated and wrapped pipes shall be tested with approved Holiday detector equipment with a positive signaling device to indicate any fault hole breaks or conductive particle in the protective coating.

4.2.11 General Instruction for Piping Design and Construction

While erecting field run pipes, the contractor shall check, the accessibility of valves, instrument tapping points, and maintain minimum headroom requirement and other necessary clearance from the adjoining work areas.

Modification of prefabricated pipes, if any, shall have to be carried out by the Contractor at no extra charge to the Employer.

4.2.12 Welding

i. Welding shall be done by qualified welders only.

ii. Before welding, the ends shall be cleaned by wire brushing, filing or machine grinding. Each weld-run shall be cleaned of slag before the next run is deposited.

iii. Welding at any joint shall be completed uninterrupted. If this cannot be followed for some reason, the weld shall be insulated for slow and uniform cooling.

iv. Welding shall be done by manual oxyacetylene or manual shielded metal arc process. Automatic or semi-automatic welding processes may be done only with the specific approval of Engineer.

v. As far as possible welding shall be carried out in flat position. If not possible, welding shall be done in a position as close to flat position as possible.

vi. No backing ring shall be used for circumferential butt welds.

vii. Welding carried out in ambient temperature of 5°C or below shall be heat-treated.

viii. Tack welding for the alignment of pipe joints shall be done only by qualified welders. Since tack welds form part of final welding, they shall be executed carefully and shall be free from defects. Defective welds shall be removed prior to the welding of joints. Electrodes size for tack welding shall be selected depending upon the root opening.

ix. Tacks should be equally spaced as follows:

- For 65 NB and smaller pipes: 2 tacks
- For 80 NB to 300 NB pipes: 4 tacks
- For 350 NB and larger pipes: 6 tacks

x. Root run shall be made with respective electrodes/filler wires. The size of the electrodes/filler wires shall not be greater than 3.25mm (10 SWG) and should preferably be 2.3mm (12 SWG). Welding shall be done with direct current values recommended by the electrode manufacturers.

xi. Upward technique shall be adopted for welding pipes in horizontally fixed position. For pipes with wall thickness less than 3mm, oxyacetylene welding is recommended.

xii. The root run of butt joints shall be such as to achieve full penetration with the complete fusion of root edges. The weld projection shall not exceed 3mm inside the pipe.

xiii. On completion of each run craters, weld irregularities, slag, etc. shall be removed by grinding or chipping.

xiv. Fillet welds shall be made by shielded metal arc process regardless of thickness and class of piping. Electrode size shall not exceed 10 SWG (3.25mm). At least two runs shall be made on socket weld joints.

4.3 Heat Detectors/Fire Detectors and Spray Nozzles

4.3.1 Codes and Standards

All equipment supplied shall conform to internationally accepted codes and standards. All equipment offered by Bidders should be TAC approved or have been in use in installations, which have been approved by TAC.

4.3.2 Heat Detectors, Quartzoid bulb type (Used in HVW spray system)

(a) Heat detectors shall be of any approved and tested type. Fusible chemical pellet type heat detectors are however not acceptable.

(b) Temperature rating of the heat detector shall be selected by the Bidder taking into consideration the environment in which the detectors shall operate. Minimum set point shall, however, be 79°C.

(c) Heat detectors shall be guaranteed to function properly without any maintenance work for a period of not less than (25) twenty-five years.

(d) The heat detectors must be approved by the Tariff Advisory Committee, India or FOC, London or a reputed international authority.

(e) The heat detectors shall be mounted on a pipe network charged with water at suitable pressure. On receipt of heat from fire, the heat detector will release the water pressure from the network. This drop in water pressure will actuate the Deluge valve.

4.3.3 HVW Spray Nozzles (Projectors)

High velocity water spray system shall be designed and installed to discharge water in the form of a conical spray consisting of droplets of water travelling at high velocity, which shall strike the burning surface with sufficient impact to ensure the formation of an emulsion. At the same time the spray shall efficiently cut off oxygen supply and provide sufficient cooling. Integral non-ferrous strainers shall be provided in the projectors ahead of the orifice to arrest higher size particle, which are not allowed to pass through the projectors. Material of construction of projector shall be in line with TAC/NFPA requirements.

4.4 Manual Fire Extinguishers for Buildings

4.4.1 General Requirements

This specification lays down the requirement regarding fire extinguishers of the following types:

- Dry Chemical Type

All the extinguishers offered by the Bidder shall be of reputed make and should have been approved by Tariff Advisory Committee of India or any other international authorities like FOC-London/NFPAUSA. All extinguishers shall be ISI marked.

The quantity of each type of the above-mentioned extinguishers shall be as per TAC guidelines.

4.4.2 Design and Construction

All the manual extinguishers shall be of freestanding type and shall be capable of discharging freely and completely in upright position. All extinguishers shall be supplied with initial charge and accessories as required.

Each extinguisher shall have the instructions for operating the extinguishers on its body itself. Manual type extinguishers shall be provided with suitable clamps for mounting on walls or columns.

4.4.3 Performance Guarantee

The Contractor shall guarantee all equipment supplied by him against any defect due to faulty design, material and workmanship. The equipment shall be guaranteed to operate satisfactorily at the rated conditions at site.

4.4.4 Painting

Each fire extinguisher shall be painted with durable enamel paint of fire red colour conforming to relevant Indian Standards.

4.5 Instruments

4.5.1 General Requirements

All field-mounted instruments shall be weather and dust tight, suitable for use under ambient conditions prevalent in the subject plant. All field-mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance can be achieved.

4.5.2 Local Instruments, Pressure/Combination/Differential Gauges & Switches

The pressure sensing elements shall be continuous 'C' bourdon type.

The sensing elements for all gauges/switches shall be properly aged and factory tested to remove all residual stresses. They shall be able to withstand at least twice the full-scale pressure/vacuum without any damage or permanent deformation.

For all instruments, connection between the pressure sensing element and socket shall be braced or hard soldered.

Gauges shall be of 150mm diameter dial with die-cast aluminium, stoved enamel black finish case, aluminium screwed ring and clear plastic crystal cover glass. Upper range pointer limit stop for all gauges shall be provided.

All gauges shall be with stainless steel bourdon having rotary geared stainless steel movements. All gauges shall have micrometer type zero adjuster. All gauges shall have 1/2-inch NPT bottom connection.

Weatherproof type construction shall be provided for all gauges. This type of construction shall be fully dust tight, drip tight, weather resistant and splash proof with anti-corrosive painting conforming to NEMA-4.

Neoprene safety diaphragm shall be provided on the back of the instruments casing for pressure gauges of ranges 0-10 kg/cm² and above.

Scales shall be concentric, white with black lettering and shall be in metric units. Accuracy shall be + 1.0 percent of full range or better. Scale range shall be selected so that normal process pressure is approximately 75 percent of full-scale reading.

All instruments shall conform to IS:3624-966. All instruments shall be provided with 3 way gauge isolation valve or cock. Union nut, nipple and tail pipe shall be provided wherever required.

Switch element contact shall have two (2) NO and two (2) NC contacts rated for 240 Volts, 10 Amperes AC or 110/220 Volts, 5 Amperes DC. Actuation set point shall be adjustable throughout the range. ON-OFF differential (difference between switch actuation and de-actuation pressures) shall be adjustable. Adjustable range shall be suitable for switch application.

Switches shall be sealed diaphragm, piston actuated type with snap action switch element. Diaphragm shall be of 316 SS. Necessary accessories shall be furnished.

4.5.3 Timers

The timers shall be electro-mechanical type with adjustable delay on pick-up or reset as required.

Each timer shall have two pairs of contacts in required combination of NO and NC.

4.5.8 Solenoid Valves

The body of the valves shall be forged brass or stainless steel.

The coil shall be continuous duty, epoxy moulded type Class-F, suitable for high temperature operation.

The enclosure shall be watertight, dust-tight and shall conform to NEMA-4 Standard.

The valves shall be suitable for mounting in any position.

4.5.9 Switches, Lamps, Meters Etc.

All electrical components on the panel namely push buttons, switches, lamps, meters etc. shall meet the requirements of Section 4.9 "Instruments".

All local instruments shall be inspected by Engineer as per the agreed quality plan.

4.6 Control & Annunciation Panels

4.6.1 General Requirements

The equipment specified herein is required for controlling, metering, monitoring and indication of electrical systems of the plant offered.

The selection and design of all the equipment shall be so as to ensure reliable and safe operation of the plant and shall be subjected to the approval of the Engineer.

The reference ambient temperature outside the panel shall be taken as 50°C and relative humidity 100%.

4.6.2 Equipment to be Furnished

Control & annunciation panels shall be furnished complete with all accessories and wiring for safe and trouble free operation of the plant.

4.6.3 Constructional Details

The panel frames shall be fabricated using suitable mild steel structural sections or pressed and shaped cold-rolled sheet steel of thickness not less than 2.5mm. Frames shall be enclosed in coldrolled sheet steel of thickness not less than 1.6mm. Stiffeners shall be provided wherever necessary.

Freestanding type panels shall be provided with hinged door with locking arrangement. The access doors, cutest and covers shall be equipped with neoprene/synthetic rubber all around and the latches sufficiently strong to hold them in alignment when closed. The panels to be installed outdoor or semi outdoor shall have a degree of protection of IP:55 and those installed indoor shall have a degree of protection of IP:52 as per IS:2147.

If a panel consists of a number of panels, each panel should be mounted side by side and bolted together to form a compact unit, when two panels meet, the joints shall be smooth, close fittings and un-obstructive.

Removable eyebolt or lifting lugs shall be provided on all panels to facilitate easy lifting.

The heights of all operating equipment on the panel shall be between 800 mm to 1600 mm from the finished floor level. If the control panel height is small then it should be mounted on a separate support so that the operating height of the equipment comes within the above limit. The proper supporting arrangement shall be provided by the Contractor.

Cable entries to the panel may be from bottom or top. The cable entry required will be intimated to the successful Bidder. A suitable removable gland plate of 3mm thick shall be mounted not less than 200mm above the floor level.

All equipment mounted on the front face of the panels shall be flush or semi-flush type. All equipment shall be so located that their terminal and adjustment are readily accessible for inspection or maintenance and their removal and replacement can be done without interruption of service to other equipment. The Contractor shall submit the panel general arrangement drawings clearly bringing out internal mounting details, dimensions of equipment, clearance between the equipment and the edges of the panel, for approval.

4.6.4 Name Plates and Labels

Each panel shall be provided with prominent, engraved identification plates for all front mounted equipment. Panel identification nameplate shall be provided at front and rear as required.

All nameplates shall be of non-rusting metal or 3-ply lamicold, with white engraved lettering on black background. Inscription and lettering sizes shall be subjected to Employer's approval.

Suitable plastic sticker labels shall be provided for easy identification of all equipment located inside the panel. These labels shall be positioned so as to be clearly visible and shall give the device number, as mentioned in the wiring drawings.

4.6.5 AC/DC Power Supply

The AC supply shall be from the main switchgears. The Contractor shall make for his own arrangements for providing these power supplies to different panels.

The Contractor shall provide suitable isolating switch fuse unit in the control panel for receiving the incoming AC supply. Fuse and link shall be provided for isolating of individual circuit without disturbing other circuits.

4.6.6 Wiring

All inter panel wiring and connections between panels (if there is group of panels) including all bus wiring for AC & DC supplies shall be provided by the Contractor.

All internal wiring shall be carried out with 1100 V grade, single core, 1.5 square mm or larger stranded copper wires having colour-coded PVC insulation. CT circuits shall be wired with 2.5 square mm copper wires, otherwise similar to the above.

Extra-flexible wire shall be used for wiring to devices mounted on moving parts such as doors. Spare contacts of auxiliary relays, timers and switches shall be wired out to the terminal blocks as required by the Engineer at the time of detailed engineering.

4.6.7 Terminal Blocks

Terminal Blocks shall be of 650 V grade, rated for 10 Amps and in one-piece moulding. It shall be complete with insulating barriers, clip-on-type terminals, and identification strips. Marking on terminal strip shall correspond to the terminal numbering on wiring diagrams. It shall be similar to 'Elmex-Standard' type terminals.

Terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal block. The terminal blocks shall have at least 20% spare terminals.

4.6.8 Grounding

A continuous copper bus 25x3mm size shall be provided along the bottom of the each panel structure. It shall run continuously throughout the length of the panel and shall have provision at both ends for connection to the station grounding grid (25x6mm MS Flat).

4.6.9 Space Heater and Lighting

Space heaters shall be provided in the panels for preventing harmful moisture condensation. The space heaters shall be suitable for continuous operation on 240V AC, 50 Hz, single phase supply and shall be automatically controlled by thermostat. Necessary isolating switches and fuses shall also be provided.

Freestanding panel shall have a 240V AC, plug point and a fluorescent light operated by door switch.

4.6.10 Control and Selector Switches

Control and selector switches shall be of rotary type, with escutcheon plates clearly marked to show the function and positions.

Control/selector switches shall be spring return or stay put type as per the requirements. Handles of control/selector switches shall be black in colour. Shape and type of handles shall be to the approval of the Employer.

The contact ratings shall be at least the following:

- | | |
|-----------------------------------|-----------------------------|
| - Make and carry continuously | 10 Amperes |
| - Breaking current at 220/110V DC | 1 Ampere (Inductive) |
| - Breaking current at 220/110V DC | 5 Amperes at 0.3 PF lagging |

4.6.11 Push Buttons

Push buttons shall be spring return, push to actuate type and rated to continuously carry and break 10A at 240V AC and 0.5A (Inductive) at 220/110V DC. The push buttons shall have at least 1 NO and 1 NC contact. All 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 buttons shall be as follows:

- | | |
|---------|---|
| - Green | For motor START, Breaker CLOSE, valve/damper OPEN |
| - Red | For motor TRIP, Breaker OPEN, valve/damper CLOSE |

- Black For all annunciation functions, overload reset and miscellaneous

Red push buttons shall always be located to the left of green push buttons. In case of clinker grinder etc. the push buttons would be black-red-green from left to right.

4.6.12 Indicating Lamps

Indicating lamps shall be of the panel mounting, filament type and of low watt consumption. 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.

Lamp shall have translucent lamp covers of the following colours:

- Red For motor OFF, Valve/damper OPEN, Breaker CLOSED.

- Green For motor ON, Valve/damper CLOSED, Breaker OPEN.

- White For motor AUTO-TRIP.

- Blue For all healthy conditions (e.g. control supply, lub oil pressure and also for spring charged).

- Amber For all ALARM conditions (e.g. pressure low, overload and also for 'service' and 'Test' position indication).

Bulbs and lamps covers shall be easily replaceable from the front of the panel.

Indicating lamps should be located directly above the associated push button/control switches. Red lamps shall variably be located to the right of the green lamp. In case a white lamp is also provided, it shall be placed between the red and green lamps. Blue and amber lamps should normally be located above the red and green lamps.

4.6.13 Fuses

All fuses shall be of HRC cartridge plug-in-type and shall be of suitable rating, depending upon circuit requirements.

All fuses shall be mounted on fuse carriers, which shall be mounted on fuse-bases.

4.6.14 Contactors

Contactors shall be of air break, electromagnetic type rated as per requirement. These shall be of utilization category AC 3 as per IS:2959.

Operating coils of AC contactors shall be of 240V AC or 220/110V DC as required. AC contactors shall operate satisfactorily between 85% and 110% of the rated voltage. The Contactor shall not drop out at 70% of the rated voltage.

DC contactors shall have a coil voltage of 220/110V DC and shall be suitable for satisfactory continuous operation at 80% to 110% of the rated voltage.

4.6.15 Relays and Timers

All auxiliary relays & timers shall be of proven design and of reputed make. Contacts of relays and timers shall be of solid silver or silver cadmium oxide or solid silver faced. Timers shall have the provision to adjust the delay on pick-up or reset as required. All relays and timers shall have at least two NO and two NC contacts.

All relays and timers shall be suitable for 240V AC and 220/110V DC as required. DC relays shall operate satisfactorily between 70% and 110% and AC relays shall be suitable for voltage variation between 80% and 110%.

4.6.16 Indication Instruments

All indicating and integrating meters shall be flush mounted on panel front. The instruments shall be of at least 96 mm square size with 90-degree scales and shall have an accuracy class of 2.0 or better. The covers and cases of instruments and meters shall provide a dust and vermin proof construction.

All instruments shall be compensated for temperature errors and factory calibrated to directly read the primary quantities. Means shall be provided for zero adjustment removing or dismantling the instruments.

All instruments shall have white dials with black numerals and lettering. Black knife-edge pointer with parallax free dials will be preferred.

4.6.17 Annunciation System

The annunciation system shall be complete with all necessary relays, flashers and other accessories required for the proper operation of the equipment and shall be completely solid state. The control circuit shall be mounted on plug-in type glass epoxy printed circuit boards. Audible alarms for the system shall be mounted inside the panel. One set of acknowledge, test and reset push buttons shall be mounted on the panel.

Indications shall be engraved on Acrylic inscription plate window and shall be visible clearly when the indication lamp is lighted (black letters on white background). Each window shall be provided with two lamps.

Audible horn shall sound when a trouble contact operates and shall continue to sound until the acknowledge button is pressed.

Indication lamps shall flash when trouble contact operates and shall continue flashing until acknowledge button is pressed.

After acknowledge button is pressed, the horn and flashing shall stop but the indication lamp shall remain lighted.

After trouble is cleared indication lamps shall be ready and shall go off only when reset. Silencing the horn in conjunction with one trouble contact shall not stop and horn sounding if another trouble contact operates.

When test button is pressed, all lamps shall flash and horn shall sound. Annunciator systems shall operate on 220/110V DC systems.

The annunciation system shall include alarm for AC control system failure (working on DC supply), DC supply failure (working on AC supply) and test facilities for these alarms.

The Contractor shall also provide additional annunciations if desired by the Employer during Vendor drawing review stage and for such additional annunciations no extra charges shall be claimed by the Contractor, if the number of such additions are within 10% of the number stipulated in this specification.

20% spare windows shall be provided on the panel.

4.6.18 Painting

All sheet steel work shall be pre-treated, in tanks, in accordance with IS:6005, degreasing shall be done by alkaline cleaning. Dust and scale shall be removed by pickling; the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate coating shall be "Class-C" as specified in IS:6005. The phosphated surfaces shall be rinsed and passivated prior to application of stoved lead oxide primer coating. After primer application, two coats of finishing synthetic enamel paint on

panels shall be applied. Electrostatic painting shall also be acceptable. Finishing paint on panels shall be shade 631 (light grey) of IS:5 unless required otherwise by the Engineer. The inside of the panels shall be glossy white. Each coat of finishing shall be properly stoved. The paint thickness shall not be less than 50 microns. Finished parts shall be coated by peelable compo and by spraying method to protect the finished surface from scratches, grease, dirt and oily spots during testing, transportation handling and erection.

4.8 Shop Testing and Inspection

4.8.1 General Requirements

The manufacturer shall conduct all tests required to ensure that the equipment furnished conform to the requirements of this specification and are in compliance with the requirements of applicable Codes and Standards.

4.8.2 Shop Tests

Shop tests of all major equipment piping, valves and specialties, pressure and storage vessels, MCC, electrical panels, controls, instrumentation etc. shall be conducted as specified in this specification and as per applicable standards/codes.

Shop tests shall include all tests to be carried out at Contractor's works and at works where raw materials supplied for manufacture of equipment are fabricated. The tests to be carried out shall include but not be limited to the tests described as follows:

- Materials analysis and testing.
- Hydrostatic pressure test of all pressure parts, piping, etc.
- Dimensional and visual check.
- Balancing test of rotating components.
- Response characteristics of heat/smoke detectors.
- Performance characteristics of H.V.W. spray nozzles (projectors).
- Temperature rating test on heat detectors.
- Flow rate and operational test on flow control valves.
- Operational test of alarm valve (water-motor gang).
- Calibration tests on instruments and tests on control panel.
- Destruction/burst tests on 2% or minimum one (1) number of hoses and manual type fire extinguishers for each type as applicable. Any fraction number shall be counted as next higher integer.
- Performance test on fire extinguishers as required in the code.

In the absence of any Code/Standard, equipment shall be tested as per mutually agreed procedure between the Supplier and the Engineer.

A comprehensive visual and functional check for panels would be conducted and will include a thorough check up of panel dimensions, material of construction, panel finish, compliance with tubing and wiring specifications, quality of workmanship, proper tagging & locations of instruments/accessories. The wiring check shall be complete point to point ring out and check for agreement with installation drawings and equipment vendor prints of the complete system and an inspection of all field connection terminals and levelling. All test certificates and reports shall be submitted to the Engineer for approval.

The Engineer's shall be given full access to all tests. The manufacturer shall inform the Engineer allowing adequate time so that, if the Engineer so desires, he himself or his representatives can witness the test.

4.8.3 Site Tests

The site tests to be carried out shall include but not be limited to the tests described as follows:

- All piping and valves, after installation will be tested hydraulically at pressure of 1.5 times that of the maximum attainable pressure in the system to check against leak tightness
- All manually operated valves/gates shall be operated throughout 100% of the travel and these should function without any trouble whatsoever, to the satisfaction of the Engineer
- Painting shall be checked by dry type thickness gauges
- Visual check on all structural components, welding, painting etc. and if doubt arises, these will be tested again.
- All test instruments and equipment shall be furnished by the Contractor to the satisfaction of the Engineer
- Operation of the automatic flow control valve by operating the test valve and remote operating of the solenoid valve
- Operation of entire annunciation system

After erection at site, the complete H.V.W. spray protection and hydrant system shall be subject to tests to show satisfactory performance for which detailed procedure shall be submitted for Engineer's approval.

All the detectors installed shall be tested for actuation by bringing a suitable source of heat/smoke near the detector and creating a stream of hot air/ smoke over the detector. The exact procedure of this test shall be provided by the successful Bidder for Engineer's approval.

4.8.4 Piping, Valves and Specialities Tests

A. Pipes

Mechanical and chemical tests shall be performed as required in the codes/standards. All pipes shall be subjected to hydrostatic tests as required in the codes/standards. A 10% spot Radiography test on welds of buried pipes shall be carried out in accordance with Article 2 of Section V of the ASME Boiler and Pressure Vessel Code.

B. Valves

Mechanical and chemical tests shall be conducted on materials of the valve as required in the codes/standards. All valves shall be tested hydrostatically for the seat as well as required in the code/standards for a period of ten minutes. Air test shall be conducted to detect seat leakage. Visual check on the valve and simple operational test in which the valve will be operated thrice from full open to full close condition. No repair work on CI valve body, bonnet or wedge shall be allowed.

C. Strainers

Mechanical and chemical tests shall be conducted on materials of the strainer. Strainers shall be subjected to a hydrostatic test pressure of 1.5 times the design pressure or 10 kg/cm²g whichever is higher for a period of one hour. Pressure drop test on one strainer of each size/type shall be conducted.

D. Hydrant valves

The stand post assembly along with the hydrant valve (valve being open and outlet closed) shall be pressure tested at a hydrostatic pressure of 21 kg/cm²g to detect any leakage through defects of casting. Flow test shall be conducted on the hydrant valves at a pressure of 7 kg/cm²g and the flow through the valve shall not be less than 900 litres/min. Leak tightness test of the valve seat shall be conducted at a hydrostatic test pressure of 14 kg/cm²g.

E. Hoses, Nozzles, Branch Pipes and Hose Boxes

Unlined flax/reinforced rubber-lined canvas hoses shall be tested hydrostatically. Following tests shall be included as per IS:4927/IS:636.

- Percolation test
- Pressure test at 21 kg/cm²g
- Burst test at 32 kg/cm²g (minimum)

The branch pipe, coupling and nozzles shall be subjected to a hydrostatic test pressure of 21 kg/cm²g to detect any leakage through defects of casting. Dimensional checks shall be made on the hose boxes and nozzle spanners.

4.8.5 Heat Detectors/Fire Detectors and Spray Nozzles Tests

The heat detectors shall be type tested, in accordance with relevant standards.

4.8.6 Manual Fire Extinguishers Tests

Particulars of shop tests and procedure shall be submitted to the Engineer before hand for his approval. A performance demonstration test at site of five (5) percent or one (1) number whichever is higher, of the extinguishers shall be carried out by the Contractor. All consumable and replaceable items required for this test would be supplied by the Contractor, without any extra cost to Engineer. Performance testing of extinguisher shall be in line of applicable Indian Standards. In case where no Indian Standard is applicable for a particular type of extinguisher, the method of testing shall be mutually discussed and agreed to before placement of order for the extinguishers.

4.8.7 Control & Annunciation Panels Tests**A. Factory Tests**

The following factory tests shall be carried out:

- Compliance with approved drawings, data and specification
- Visual check for workmanship
- Wiring continuity and functional checks
- Calibration of instruments, relays and metres wherever required by inspector
- HV test
- Insulation resistance measurement before and after HV test
- Testing to observe compliance to degree of protection as per IS -2147 (latest version).

B. Annunciation System Tests

The Contractor shall carry out following annunciation tests:

- The Fire detection and annunciation panel shall be tested as per BS: 3116 Part-IV
- The Annunciation System shall be routine tested.

SECTION - 3

PROJECT DETAILS & GENERAL TECHNICAL REQUIREMENTS

1.0 GENERAL

This section stipulates the General Technical Requirements (GTR) under the Contract and will form an integral part of the Technical Specification. The provisions under this section are intended to supplement general requirements for the materials, equipments and services covered under respective equipment sections and are not exclusive. However, in case of conflict between the requirement specified in this section and requirements specified under respective equipment sections, the requirements specified under respective sections shall hold good.

It is not the intent to specify completely in technical specifications of equipments/materials all details of the design and construction of equipment. However, the equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation. BHEL/UPPCL will interpret the meaning of drawing and specification and shall have the power to reject any work or material which in his judgement is not in accordance therewith. The equipment offered shall be complete with all components necessary for its effective and trouble free operation. Such components shall be deemed to be within the scope of Bidder's supply, irrespective of whether these are specifically brought out in this specification and/or commercial order or not.

UPTCL procures all the equipment and materials for substations, keeping into consideration the interchangeability and future extension of substation. All equipment and materials to be supplied shall conform to the UPTCL's current Bid specifications for similar equipment and materials.

2.0 COMPLETENESS OF EQUIPMENTS

2.1 Equipments furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories specified &/or 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 Technical Specifications. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the substation unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost. All similar standard components/ parts of similar standard equipment provided, shall be interchangeable with one another.

2.2 The Bidder shall supply type tested (including special test as per technical specification) equipments and materials. The test reports/details shall be furnished by the Bidder in the bid. In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes or due to noncompliance with the requirement stipulated in the Technical Specification and/or IEC/136IS, same, shall be carried out without any additional cost implication to the Purchaser. The Purchaser reserves the right to get any or all type tests conducted/ repeated. The reports for all type tests and additional type tests as per technical specification furnished by the Bidder shall be of the tests conducted within last 05(five) years prior to the date of bid opening (02.03.19). The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO/ IEC Guide 25/ 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by UPPTCL or representative authorized by UPPTCL or Utility or representative of accredited test lab or reputed consultant.

3.0 STANDARDS

3.1 Except as modified by this Bid specification, all material and equipment shall conform to the requirement of the latest editions of relevant ISS/ IEC and other applicable standards. The equipments/ works shall be designed, engineered, manufactured, built, tested and commissioned shall be carried out in accordance with the Acts, Rules, Laws and Regulations in force in India.

3.2 In addition to meeting the specific requirements called for in the respective sections of the Technical Specification, the equipment shall also conform to the general requirement of the relevant standards which shall form an integral part of the specification. When the specific requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.

3.3 In the event of the Bidder offering equipment conforming to standards other than ISS/ IES standards, which ensure equivalent or better performance than that specified in the standards, the salient point of comparison between the standards adopted and relevant ISS/ IEC standards shall be indicated clearly in the proposal, along with English language version of such standard or relevant extract of the same. The equipment conforming to standards other than IS/IEC shall be subject to Purchaser's approval.

3.4 The standards mentioned in the respective equipment specifications are not mutually exclusive or complete in themselves. The equipment &/or work shall also conform to any other applicable standard, even if not specifically mentioned in these specifications.

3.5 Should the Bidder wish to depart from the provisions of the specifications, either on accounts of manufacturing practices or for any other reason, he shall clearly mention the departure and submit complete justification supported by information, drawings etc. as will enable to assess the suitability of equipment(s) offered. In the event of the Bidder's specifications, drawings, forms and tables etc. being found to disagree with the requirement of the Bid specifications at any stage, Bid specifications shall be binding, unless the departures have been duly approved in writing by the Purchaser.

4.0 PROJECT DATA

i.	Location	UTTAR PRADESH
ii.	Altitude	not exceeding 1000 Meters
iii.	Climatic Conditions	
(a)	Design maximum ambient Air Temperature	50 deg. C
(b)	Minimum ambient air temperature in shade	0 deg. C
(c)	Relative Humidity	100%Max.
(d)	Wind Load	195 Kg./ Sq.m.
(e)	Seismic Level	0.3 g
(f) I	soceraunic Level	50days/ year
(g)	Average annual rain fall	1200 mm
(h)	Hot and humid tropical Climate conducive to rust and fungus growth	

5.0 SYSTEM PARTICULARS

(i)	Rated System voltage	800kV, 420 kV, 245kV, 145kV, 36kV
(ii)	System frequency	50 Hz, This may vary by $\pm 5\%$
(iii)	Number of phases	Three

- (iv) Neutral Effectively Earthed
- (v) **Auxiliary power supply:-**
Auxiliary electrical equipment shall be suitable for operation on the following supply system:
- | | |
|--|--|
| (a) Power device (Like drive motors) | 400V, 3Phase, 4Wire 50Hz
Effectively earthed AC system. |
| (b) Lighting fixtures, space heaters, fractional Horse Power motors and control devices. | 250V, 2wire, 50Hz,
AC supply with one point grounded. |
| (c) DC alarm, Control and Protective | 2wire ungrounded DC supplies |
- Devices from sub-station batteries as under
- | | |
|---------------------|---------------------|
| (i) 765kV S/S | : 220V DC |
| (ii) 400 kV S/S | : 220V DC |
| (iii) 220/132kV S/S | : 110V DC |
| (iv) Communication | : 48 V DC equipment |

The above supply voltage is subject to variation as follows:

All devices must be suitable for a continuous operation over the entire range of voltage variations:

- | | |
|---------|---|
| (i) AC | Voltage may vary by $\pm 10\%$.
Frequency by $\pm 5\%$
Combined Voltage & frequency by $\pm 10\%$. |
| (ii) DC | a) 220 V may vary between 187 & 242 V
b) 110 V may vary between 93 & 121 V
c) 48 V may vary between 41 & 53 V |

6.0 SYSTEM PARAMETERS

The following system parameters shall prevail:

Sl. No.	Description of Parameters	765 kV System	400 kV System	33 kV System
1.	Nominal system voltage	765kV	400kV	33kV
2.	Maximum operating voltage of the system(rms)	800kV	420kV	36kV
3.	Rated frequency	50Hz	50Hz	50Hz
4.	No. of phase	3	3	3
5.	Rated short time current	40/50 kA for 1 Sec	40/50 kA for 1 Sec	25 kA for 3 sec
6.	Dry and wet one minute power frequency withstand voltage	830 kV	680 kV	70 kV
7.	Full wave impulse withstand voltage (1.2/50 microsec.)	2100 kVp	1550 kVp	170 kVp
8.	Corona extinction voltage	508kV	320 kV	--
9.	Max. Radio interference voltage for frequency between 0.5 MHz and 2 MHz	2500 micro-volt at 508 kV rms	1000 micro-volt at 266 kV rms	--
10.	Minimum total creepage 25mm/kV	20000 mm	10500 mm	1300 mm
11.	Min. clearances			

	Phase to phase	7600mm (for Conductor configuration) 9400mm (for rod -Conductor configuration)	4000mm (for Conductor configuration) 4200mm (for rod -Conductor configuration)	320 mm
	Phase to earth	4900mm (for Conductor structure) 6400mm (for rod- structure)	3500 mm	320 mm
	Sectional clearances	10300 mm	6500 mm	3000 mm
12.	System neutral earthing	Effectively Earthed	Effectively Earthed	Effectively Earthed

7.0 SERVICES TO BE PERFORMED BY THE EQUIPMENT

All equipments shall perform satisfactorily under various electrical, electromechanical and meteorological conditions of the installation site. All equipment shall be able to withstand all external and internal mechanical thermal and electromechanical forces due to various factors like wind load temperature variation, ice & snow (wherever applicable) short circuit etc for the equipment. The Bidder shall design the various forces which the terminal connectors of the equipment are required to withstand. All outdoor EHV equipments except marshalling kiosks shall be suitable for hot line washing. To facilitate erection of equipment, all items to be assembled at site shall be "match marked".

10.0 COLOUR SCHEME AND CODES FOR PIPE SERVICE

The Bidder shall propose a colour scheme for the those equipments/ items for which the colour scheme has not been specified in the specification. For the approval of purchaser. The decision of Purchaser shall be final. The scheme shall include.

Finishing colour of Indoor equipment.

Finishing colour of Outdoor equipment.

Finish colour of all cubicles.

Finishing colour of various auxiliary system equipment including piping

Finishing colour of various building items.

All steel structures, plates etc. shall be painted with non-corrosive paint with a suitable primer. It may be noted that normally all electrical equipments in switchyard are painted with shade 631 of IS-5.

11.0 MATERIAL/ WORKMANSHIP

11.1 General Requirement

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

The design of the works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each

component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill their required function. In general screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from the Purchaser.

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

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

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

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

A cast iron or welded steel base plate shall be provided for all rotating equipment which are to be installed on a concrete base unless otherwise agreed to by the Purchaser. Each base plate shall support the unit and its drive assembly, shall be of design with pads for anchoring the units and shall have a raised up all around and shall have threaded in air connections, of so required.

11.2 PROVISIONS FOR EXPOSURE TO HOT AND HUMID CLIMATE

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

12.0 Void

13.0 FUNGI STATIC VARNISH

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

14.0 Void

15.0 DEGREE OF PROTECTION

The enclosures of the Control Cabinets, junction boxes and Marshalling Boxes, panels etc. to be installed shall be provided with degree of protection as detailed here under:

b) Installed out door: IP-55

d) Installed indoor in air conditioned area: IP-31

f) Installed in covered area: IP -52

h) Installed indoor in non-air-conditioned area where possibility of entry of water is limited: IP-41

j) For LT Switchgear (AC & DC distribution Boards): IP-52

The degree of protection shall be in accordance with: 13947 (Part-I)/ IEC-60947 (Part-I)/ IS 12063 / IEC-60529. Type test report for degree of protection test, on each type of the box shall be submitted for approval.

16.0 RATING PLATES, NAME PLATES AND LABELS

Each main and auxiliary item of substation is to have permanently attached to it in a conspicuous position a rating plate of non-corrosive material upon which is to be engraved manufacturer's name, year of manufacture, equipment name, type or serial number together with details of the loading conditions under which the item of substation in question has been designed to operate, and such diagram plates as may be required by the Purchaser. The rating plate of each equipment shall be according to IEC requirement.

All such nameplates, instructions plates, rating plates CB, CT, VT, SA, Isolators and Relay & Protection panels equipments shall be bilingual with Hindi inscription first followed by English. Alternatively two separate plates one with Hindi and the other with English inscriptions may be provided.

17.0 FIRST FILL OF CONSUMABLES, OIL AND LUBRICANTS

All the first fill of consumables such as oils, lubricants, filling compounds, touch up paints, soldering/brazing material for all copper piping of circuit breakers and essential chemicals etc. which will be required to put the equipment, covered under the scope of the specifications, into successful operation, shall be furnished by the Bidder unless specifically excluded under the exclusions in these specifications and documents.

18.0 PACKAGING AND PROTECTION

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. The Bidder shall also submit packing details/associated drawing for any equipment/material, to facilitate the Purchaser to repack any equipment/material at a later date. The Bidder shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Bidder.

All coated surfaces shall be protected against abrasion, impact, discoloration and any other

damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner.

19.0 SURFACE FINISH

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

All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or otherwise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified.

The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling. All external painting shall be as per shade No. 631 of IS: 5.

20.0 HOT DIP GALVANISING

All ferrous parts including all sizes of nuts, bolts, plain and spring washers, support channels, structures, shall be hot dip galvanized conforming to latest version of IS: 2629 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electro-galvanized. Minimum weight of zinc coating shall be 610 gm/ sq.mm and minimum thickness of coating shall be 85 microns for all items thicker than 6 mm. For items lower than 6mm thickness, requirement of coating shall be as per relevant ASTM. For surface which shall be embedded in concrete, the zinc coating shall be 610 gm/sq. m minimum.

The galvanized surfaces shall have a continuous and uniform thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth and shall be free from defects like discolored patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surface, flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection. After galvanizing, no drilling or welding shall be performed on the galvanized parts of the equipment excepting that nuts may be threaded after galvanizing. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization.

Galvanised material must be transported properly to ensure that galvanized surfaces are not damaged during transit. Application of zinc rich paint at site shall not be allowed.

21.0 PROTECTIVE GUARDS

Suitable guards shall be provided for protection of personnel on all exposed rotation and/of moving machine parts. All such guards with necessary spares and accessories shall be designed for easy installation and removal for maintenance purpose.

22.0 TOOLS AND TACKLES

The Bidder shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dis-assembly and maintenance of the equipment. However, these tools and tackles shall be separately packed and brought on to site.

23.0 CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES AND MARSHALLING BOXES FOR OUTDOOR EQUIPMENT

23.1 All types of boxes, cabinets etc. shall generally conform to and be tested in accordance with IS-5039/ IS-8623, IEC-60439, as applicable, and the clauses given below.

23.2 Control cabinets, junction boxes, marshalling boxes and terminal boxes shall be made of sheet steel or aluminum enclosure and shall be dust, water and vermin proof. Sheet steel used shall be at least 2.0 mm thick cold rolled or 2.5 mm hot rolled. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. In case of aluminum enclosed box, the thickness of aluminum shall be such that it provides adequate rigidity and long life as comparable with sheet steel of specified thickness.

23.3 Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements. A canopy and sealing arrangements for operating rods shall be provided in marshalling boxes/ Control cabinets to prevent ingress of rain water.

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

23.5 All doors, removable covers and plates shall be provided gasket all around with suitably profiled EPDM/Neoprene gaskets. The gasket shall be tested in accordance with approved quality plan, IS:11149 and IS:3400. The quality of gasket shall be such that it does not get damaged/cracked during 10(ten) years of operation of the equipment or its major overhaul whichever is earlier. All gasketed surfaces shall be smooth straight and reinforced if necessary to minimize distortion and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters, the screen shall be fine wire mesh made of brass.

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

23.7 A 240V, single phase, 50 Hz, 15 amp AC plug and socket shall be provided in the cabinet with ON-OFF switch for connection of hand lamps. Plug and socket shall be of industrial grade.

23.8 For illumination, a 20 Watts fluorescent tube or 15 watts CFL/LED bulb shall be provided. The switching of the fittings shall be controlled by the door switch. For junction boxes of smaller sizes such as lighting junction box, manual operated earth switch mechanism box etc., plug socket, heater and illumination is not required to be provided.

23.9 All control switches shall be of rotary type. Toggle piano switches shall not be accepted.

23.10 Positive earthing of the cabinet shall be ensured by providing two separate earthing pads. The earth wire/ strip shall be terminated on to the earthing pad and secured by the use of self etching washer. Earthing of hinged door shall be done by using a separate earth wire.

23.11 The bay marshalling kiosks shall be provided with danger plate and a diagram showing the numbering/connection/ earthing by pasting the same on the inside of the door.

23.12 a) The following routine tests along with the routine tests as per IS: 5039 shall also be conducted.

- Check for wiring
- Visual and dimension check

b) The enclosure of bay marshalling kiosk, junction box, terminal box shall be type tested for IP-55 as per IS: 13947. After IP-55 test, 2.5 kVrms for 1 (one) minute, insulation resistance and functional test should be conducted.

23.13 Auxiliary Switches

All the auxiliary switches shall be fully type tested as per relevant IS. The following type test reports on auxiliary switches shall be submitted:

- (a) Electrical endurance test - A minimum of 2000 operation for 2A D. C. with a time constant greater than or equal to 20 millisecond with a subsequent examination of mV drop/visual defects/temperature rise test.
- (b) Mechanical endurance test. A minimum of 1,00,000 operations with a subsequent checking of contact pressure test/visual examination.
- (c) Heat run test on contacts.
- (d) IR/HV test etc.

24.0 TERMINAL BLOCKS AND WIRING

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

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

24.3 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.

24.4 The terminals 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.

24.5 The conducting part in contact with cable shall preferably be tinned or silver plated, however Nickel plated copper or zinc plated steel shall also be acceptable.

24.6 The terminal blocks shall be of extensible design.

24.7 The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

24.8 The terminal blocks shall be fully enclosed with removable covers of transparent, non-deterioration 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.

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

- a) All circuits except CT circuits Minimum of 2 nos. of 2.5 sq. mm copper flexible
- b) All CT circuits Minimum of 4 nos. of 2.5 sq.mm copper flexible

24.10 The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live.

24.11 At least 20% spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminal rows.

24.12 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.

24.13 The Bidder shall furnish all wire, conduits and terminals for the necessary interphase electrical connections (where applicable) as well as between phases and common terminal boxes or control cabinets.

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

27.5 TESTING AND COMMISSIONING

The Bidder shall conduct following tests along with list of instruments and calibration certificates to the Purchaser. If any additional test is required the same shall be conducted without any extra cost to the Purchaser.

- (a) Insulation resistance.
- (b) Phase sequence and proper direction of rotation.
- (c) Any motor operating incorrectly shall be checked to determine the cause and the conditions corrected.

28 DOCUMENTATION

The successful Tenderer or Bidder shall provide the following technical information:

- General outline drawings of all major equipment
- Estimated works programme (Bar Chart)
- Completed technical data schedules
- Type Test Reports
- Quality assurance and quality control programme and organization
- Complete set of catalogues

The following additional information shall be provided before proceeding with the manufacturing, or during the manufacturing period:

- Schedule of engineering documents including drawings
- Assembly drawings, list of materials including spare parts and tools, cabling diagrams, etc.
- Instruction and service manuals
- Paint samples, if requested by UPTCL
- Test reports and certificates
- Shop inspection and testing program
- Packing drawings, if requested by UPTCL
- Marking models, if requested by UPTCL
- List of test required for commissioning
- Detailed procedure for installation
- Detailed procedure for commissioning
- Works programme and schedule (bar-chart)
- Progress report of manufacturing

The Bidder is responsible for any discrepancies, errors or omissions in the submittals whether these have been reviewed by the UPTCL or not, provided that such discrepancies, errors and omissions are not due to inaccurate information or particulars furnished in writing by the UPTCL to the Bidder. All reports or drawings must be provided in the SI unit system.

28.1 Drawings

The successful Tenderer or Bidder shall prepare and submit for review of the UPTCL, the drawings indicated in this document. The drawings must be A1 format (841 x 594 mm), A3 (420 x 297 mm) or A4 (297 x 210 mm) format and include in the lower right-hand corner, a title block as indicated in section-1.

The successful Tenderer or Bidder shall submit, one (1) Autocad computer file on a CD-ROM Disk and by E-mail, plus four (4) paper copies of each of the drawings to the UPTCL. The copies marked by the UPTCL will be returned to the Bidder, at the latest, 30 days after presentation of these drawings. The corrected drawings will be submitted once more, following the same procedure, if necessary.

An updated Autocad computer file, plus six (6) paper copies of the final version of the drawings, must be submitted by the Bidder, at the latest one (1) month before delivery of the purchased equipment.

28.1.1 Outline and Foundation Drawings

Outline drawings must be provided to scale including dimensions, weight, reaction for design of foundations, centre of gravity for transportation and installation, in plan view, elevation, section and foundation plan including blockouts embedded parts.

Design briefs and detailed drawings must be presented for all metallic structures and supports of the substation equipment. Nameplates, to scale, must indicate test results from the factory, serial number, weight mass, etc. When available, catalogues references and codes must be indicated on the drawings.

28.1.2 Assembly Drawings

A bill of material must be provided with all assembly drawings.

Every device or apparatus must be identified using a numerical or alphanumeric system

corresponding to the one used for the respective diagram. The identification will be in accordance with the ANSI C37.2 standards. The terminal blocks must be identified on the drawing as they are on the equipment itself. Every terminal block of a panel or cabinet must be identified with the number indicating the panel or cabinet it belongs to, the terminal strip identification followed by a number starting with 1 for the first terminal and finishing with the number of the last terminal from top to bottom or left to right. The Bidder shall arrange and identify the terminal blocks for exclusive use of Purchaser as show on enclosed drawing specific to each equipment. The Bidder must comply with this requirement.

The UPTCL will not accept any deviation nor will assume any cost resulting from drawing changes or modifications of wiring or cabling resulting from changes caused or originated by the Bidder. Wires originating from a device or terminal block shall be tagged at both ends with identification of remote end device terminal number using the symbols previously mentioned. Every cabinet or panel will be provided with a wiring drawing where all the devices are shown.

28.2 Technical Data Schedules

The Tenderer must fill out completely and attach to his proposal the Technical Data Schedules included in the technical specification of the equipment. The data shall include the values guaranteed by the Bidder. If any data cannot be furnished at tender stage, Bidder shall assign reasons and shall confirm to provide the same at engineering stage for approval.

The Bidder shall guarantee that the equipment and the works are in accordance with all the requirements of the present specification including the data from the Technical Data Schedules. The Technical Specifications for equipment represent different types and/or ratings under a single data schedule. Bidder shall however submit the data schedule for each type and/or rating of the equipment required for the project.

28.3 Instruction Manuals

Service and maintenance manuals including sequence of operation manuals must describe in details, the procedures and the operation instructions for the equipment and the measuring devices. The assembly method, commissioning guide, adjustment, operation and disassembly of every component, system or machine, must be described and illustrated in details. The manuals must include as well a troubleshooting procedure to locate rapidly the defective part. For preventive maintenance purposes, a list of verification point visual marking and measurements will be included. The frequency of inspections and maintenance of every component shall be described in the manuals.

The Bidder shall submit manuals that are clear, fully detailed and easily understood to ensure the appropriate operation and maintenance of the equipment.

The manuals shall include a copy of the "as built" drawings, the list of spare parts and a list of all the pieces of every component or item that makes up the equipment. The latter must include the Bidder identification, the manufacturing codes and the instructions to order the pieces. The manual shall also include an updated copy of the Technical Data Schedules of the equipment, as supplied. The Bidder shall submit the instruction and service manual for UPTCL's review at least one month before shop testing.

The Bidder shall include in every manual a copy of the tests performed on the equipment and all the accessories, and the corresponding results.

The Bidder shall provide for every apparatus, six (6) technical manuals, two (2) of which shall be properly wrapped and placed inside the cabinets, panels or control kiosks at time of delivery. In the case where there is no room for manuals, the two manuals shall be well placed and packed in a wooden crate.

28.4 Language

All technical documents such as: calculation schedules, curves, maintenance and service manuals, quality assurance control program report, plant tests and manufacturing schedule, drawings, nameplates and instructions manuals shall be presented by the Bidder to the UPTCL, shall be in the English language.

29 QUALITY CONTROL PROGRAMME

29.1 Programme

In general terms, the manufacturing quality programme shall be in compliance with ISO 9002 or later standards. The UPTCL reserves the right to verify the document pertaining to the manufacturer's quality assurance programme, as well as the application of the same in the manufacturing plant.

In general, the assembly of all the equipment components shall be carried out in the manufacturer's workshops so that it shall possible to perform inspections, tests, etc. that will ensure a subsequent satisfactory operation. The exceptions to this rule will only be possible upon UPTCL's consent.

The UPTCL's authorized representatives shall have the right of access to the plant and to inspect and verify the quality of materials used in the manufacturing process.

The manufacturer of each major equipment shall submit Quality Assurance Programme (QAP) for the manufacturing and testing of equipment along with the drawings to UPTCL.

29.2 Plant Tests

The materials and all the equipment shall be tested as per the prescriptions of this specification. The tests shall be performed by the Bidder and certified by the authorized representative of the UPTCL.

All the required tests must be performed in order to confirm that the materials and the equipment comply with these specifications, and to allow the UPTCL to detect any material or manufacturing defects.

The results of all the tests shall be marked down in the reports containing all the necessary information to enable verification of compliance with the present specification. The test certificates shall be written in English and shall show the results and real conditions of the tests performed the circuits, oscillogrammes, environmental conditions, nameplate drawings with measured values, graphs, etc.

No later than two (2) weeks after having performed the tests, the Bidder shall submit to the UPTCL, four (4) copies of the report of all tests as a bound document. The test reports shall indicate the tests performed, instruments used, names of test personnel and provide the witness's signature as applicable. The report must also include a description of any failure that occurred while performing the plant tests, even if the test resumed after the failure.

The tests are meant to verify and determine the characteristics of the equipment. Normally, type tests shall be performed on one (1) apparatus of each type and with different technical characteristics. If type tests have been performed on identical apparatus, within a period not exceeding 5 years from 02.03.19, the results may be accepted. The routine tests are intended to

reveal any defective material or manufacture non-conformity and shall be performed on all equipment supplied.

The units to be assembled in the plant (panels, cabinets, control cabinets) shall be assembled, wired, adjusted and tested in the plant, as much as possible, under the same service conditions that will prevail at the site of installation, to ensure the accuracy of the wiring and the correct operation of the equipment.

The UPTCL reserves the right to be present at any of the tests.

The equipment to be tested must be totally assembled for an inspection before the tests. The Bidder must submit to the UPTCL a detailed program of tests for review, at least one month before the tests take place. The Bidder shall inform the UPTCL in writing, at least 30 days in advance, of the date of the tests.

29.3 Stage Inspection Programme

UPTCL and/or his representative will conduct routine and/or periodic inspection of the works and material in the manufacturing of the major equipment and construction sites in various stages of the Project. The Bidder shall provide facilities and access to the UPTCL and/or his representative to inspect the workmanship and the quality of the material, manufacturing process and the installation. The Bidder shall advise the UPTCL in writing the schedule of any such routine and/or periodic inspection. The Bidder shall attach a copy of the completed inspection checklist or final/in-process inspection report by the Bidder's QA/QC UPTCL/inspector on every inspection request submitted to the UPTCL. The Bidder's QA/QC UPTCL/inspector shall ensure that the items for inspection covered by the Bidder's "Inspection Request" are ready prior to inspection by the UPTCL and/or his representative.

30 NAMEPLATES, LABELS AND RATING PLATES

The equipment shall be fitted with nameplates and indication plates, which must be manufactured of non-corrodible stainless steel or aluminium, with a minimum thickness of 1 mm engraved black letters on a light background, and shall be fixed to the apparatus with non-busting screws.

A rating plate shall be attached to each major and auxiliary item of equipment supplied. This plate shall be permanently engraved with the designed full load ratings, serial number, type number, date of manufacture, and other identification deemed necessary. Where required by the UPTCL, diagram plates shall also be supplied.

A nameplate shall be provided to identify the equipment supplied. The identifying inscription shall be approved by the UPTCL or conform to that designated in the appropriate sections of this Specification. Devices shall be identified by nameplates on both front and rear of all desks, panels, cubicles, etc.

Labels shall be manufactured of non-hygroscopic material with engraving of a contrasting colour or alternatively, for indoor use, of laminated plastic material with lettering engraved. The lettering should be black against white background. The materials used shall be non-fading, non-aging type, suitable for tropical conditions.

All apparatus, motors, control gear and all panels and the apparatus contained therein, shall be labelled, indicating where necessary, their purpose and the "ON" and "OFF" positions. Upon request by the UPTCL during the approval of Nameplates and Labels, some inscriptions shall be in Hindi language.

SECTION 4

LIST OF DOCUMENTS

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

The list furnished here is tentative and additional documents may be required during detailed engineering.

DOC. NO.	TECHNICAL DATA SHEET
TB-DS-407-552-01	TDS OF PIPES & PIPE FITTINGS
TB-DS-407-552-02	TDS OF GATE VALVES (RISING SPINDLE)
TB-DS-407-552-03	TDS OF `Y' STRAINER
TB-DS-407-552-04	TDS OF DELUGE VALVE.
TB-DS-407-552-05	TDS OF DIAPHRAGM TYPE PRESSURE SWITCH.
TB-DS-407-552-06	TDS OF SOLENOID VALVES
TB-DS-407-552-07	TDS OF QB DETECTOR
TB-DS-407-552-08	TDS OF HVWS NOZZLE.
TB-DS-407-552-09	TDS OF CONTROL CABLE FOR FIRE ALARM SYSTEM
TB-DS-407-552-10	TDS OF DRY CHEMICAL TYPE PORTABLE EXTINGUISHER
TB-DS-407-552-11	TDS OF CONTROL AND ANNUNCIATOR PANEL
TB-DS-407-552-12	TDS OF HYDRANT SYSTEM
TB-DS-407-552-13	BOQ - FPS

- Following drawings shall be followed for supply installation by the bidders:

DRG. NO.	DRAWINGS
TB-DG-407-552-01	PIPING LAYOUT OF AUTOMATIC HVW SPRAY SYSTEM FOR ICT 1,2&3
TB-DG-407-552-02	ISOMETRIC LAYOUT OF AUTOMATIC HVW SPRAY SYSTEM
TB-DG-407-552-03	NODAL DIAG. OF AUTOMATIC HVW SPRAY SYSTEM
TB-DG-407-552-04	P & I Diagram
TB-DS-407-552-05	Fire Alarm & Detection system

Project: Extension of 765/400kV S/S, Bara TPS, (U.P.)

TB-407-552-033

Customer: Uttar Pradesh Power Transmission Corporation Ltd.

Rev-0

Contractor: Bharat Heavy Electricals Ltd.

TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM

SCHEDULES AND ENCLOSURES

SECTION- 5

ENCLOSURES TO SPECIFICATION

SCHEDULES TO BE FILLED UP BY THE BIDDER

- Schedule 1 **Schedule of Makes of Equipment**
- Schedule 2 **Schedules of Deviations**
- Schedule 3 **Schedule of past experience and qualifying requirements**
- Schedule 4 **Schedule of performance certificates**
- Schedule 5 **Schedule of type test and special tests**
- Schedule 6 **Details of contact persons (Technical & Commercial)**
- Schedule 7 **Enclosures to Specification**

ANNEXURE-A Drawings

Project: Extension of 765/400kV S/S, Bara TPS, (U.P.)

TB-407-552-033

Customer: Uttar Pradesh Power Transmission Corporation Ltd.

Rev-0

Contractor: Bharat Heavy Electricals Ltd.

TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM

SCHEDULE-1

MAKES OF IMPORTANT ITEMS / COMPONENTS OF EQUIPMENTS AND THEIR DETAILS

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

Place

Signature of the authorized representative of Bidder

Name -----

Date

Designation-----

Company seal-----

SCHEDULE-2**SCHEDULE OF TECHNICAL DEVIATION**

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

Section	Clause No. / Page No.	Statement of deviation/ Variations/Exceptions
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- 1) In case, this schedule is not submitted, it will be presumed that the equipment /material to be supplied under this contract is 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-----

Project: Extension of 765/400kV S/S, Bara TPS, (U.P.)

TB-407-552-033

Customer: Uttar Pradesh Power Transmission Corporation Ltd.

Rev-0

Contractor: Bharat Heavy Electricals Ltd.

TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM

SCHEDULE – 3

SCHEDULE OF PAST EXPERIENCE AND QUALIFYING REQUIREMENT

Following is the list of earlier orders executed by us for supply of equipment / material of Similar nature over the last past five years:

S.No.	Item	Brief rating	Qty	customer	Date of order	Date of supply	Order value
-------	------	--------------	-----	----------	------------------	-------------------	----------------

Place

Signature of the authorized representative of Bidder

Date

Name-----

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.

Project: Extension of 765/400kV S/S, Bara TPS, (U.P.)

TB-407-552-033

Customer: Uttar Pradesh Power Transmission Corporation Ltd.

Rev-0

Contractor: Bharat Heavy Electricals Ltd.

TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM

SCHEDULE – 4

SCHEDULE OF PERFORMANCE CERTIFICATE

Bidder shall furnish the performance certificate of the similar equipment having
The following details:

S.No.	Item	Brief rating	Qty	Customer	Date of supply
-------	------	--------------	-----	----------	-------------------

Place

Signature of the authorized representative of Bidder

Date

Name-----

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.

SCHEDULE-5**SCHEDULE OF TYPE TESTS AND SPECIAL TESTS**

The following type tests and special tests as called for in the Specification shall be conducted (all type tests / special tests as mentioned in the relevant clauses of the Specification shall be listed here):

Sl no.	Cl.no. / page no. of specification	Details of test	Lab in which to be conducted
		A. Type Tests	
		1.	
		2.	
		B. Routine Tests	
		1.	
		2.	
		C. Site Tests	
		1.	
		2.	
		D. Special Tests (specified)	
		1.	
		2.	
		E. Other tests at works / site recommended by the Bidder	
		1.	
		2.	

NOTE:

- 1) Details have to be furnished on cables as well as accessories, each separately.
- 2) **NO PRICE SHALL BE FURNISHED IN THIS FORMAT.**

Place

Signature of the authorized representative of Bidder

Name-----

Date

Designation-----

Company seal-----

Project: Extension of 765/400kV S/S, Bara TPS, (U.P.)

TB-407-552-033

Customer: Uttar Pradesh Power Transmission Corporation Ltd.

Rev-0

Contractor: Bharat Heavy Electricals Ltd.

TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM

SCHEDULE-6

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

Date

Name-----

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.

Project: Extension of 765/400kV S/S, Bara TPS, (U.P.)

TB-407-552-033

Customer: Uttar Pradesh Power Transmission Corporation Ltd.

Rev-0

Contractor: Bharat Heavy Electricals Ltd.

TECHNICAL SPECIFICATION FOR FIRE FIGHTING SYSTEM

SCHEDULE –7

ENCLOSURES TO SPECIFICATION

DRAWINGS

1. LAYOUT PAN AND SECTION OF 765/400KV BARA EXTENSION

DRG. NO. TB-1-407-316-002

2. CABLE TRENCH LAYOUT OF 765/400KV BARA EXTENSION

DRG. NO. TB-1-407-316-003

3. OGA of Transformer

DRG. NO. 3 498 00 00051

2. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.
3. ALL 400KV BARS AND STRUNG BUSES ARE PROTECTED FROM 7/3.66 GALVANISED STEEL WIRE IN LINE WITH EXISTING LAYOUT.
4. ALL FOUNDATION DRAWINGS OF TOWER "TH" & "LJ" AND BEAM "CA" & "CB" SHALL BE USED FOR MANUFACTURING & SUPPLY OF THE SAME IN THIS EXTENSION PROJECT.
5. BEING A EXTENSION PROJECT, STRUCTURE LOADING DIAGRAM IS NOT REQUIRED. HOWEVER, THE LOADING INFORMATION OF EXISTING STRUCTURE SHALL BE PROVIDED IN THE EXISTING LAYOUT INFORMATION PURPOSE.
6. EXISTING FOUNDATION DRAWINGS OF TOWER "TH" & "LJ" SHALL BE USED FOR FOUNDATIONS OF SAME TOWERS IN THIS EXTENSION PROJECT.
7. ALL 750KV EQUIPMENTS STRUCTURE SHALL BE LATTICE TYPE IN LINE WITH EXISTING LAYOUT.
8. ALL 400KV EQUIPMENTS STRUCTURE SHALL BE PIPE TYPE EXCEPT FOR CB & 66/33KV IN LINE WITH EXISTING LAYOUT.
9. THE TOP OF THE BOLT OF BPI (COMING IN ICT AREA) FOUNDATION SHALL BE LOWER BY 150MM THAN THE TOP OF THE RAIL, THIS IS TO FACILITATE THE REMOVAL OF BPI STRUCTURE DURING ICT TO BE TAKEN OUT OF THE RAIL.
10. SEPARATE DRAWING SHALL BE REFERRED FOR ERECTION KEY DIAGRAM, OUTDOOR TRENCH LAYOUT, FIRE FIGHTING SYSTEM AND EQUIPMENT EARTHING.
11. ALL EQUIPMENTS SHALL BE IDENTIFIED WITH REFERENCE TO THE EXISTING LAYOUT. HOWEVER, CENTRE LINE OF MAJOR EQUIPMENTS LIKE CB, ISOLATOR, CT & ICT TO BE MATCHED WITH EXISTING EQUIPMENTS AND PHASE SEQUENCE TO BE CHECKED BEFORE STARTING OF FOUNDATION & ERECTION WORK AT SITE.
12. EXISTING RELAY WASH SHALL NOT BE TOWARDS ICT SIDE/ANY EQUIPMENT KEPT NEAR LIGHTNING ARRESTER.
13. EXISTING ROAD AND DRAIN SHALL BE USED FOR THIS EXTENSION PROJECT.
14. EXISTING RELAY WASH CONTAINING OF 2 BAYS SHALL BE EXTENDED UPON BHEL "B" PHASE ICT. HOWEVER, BHEL ICT SHALL MOVE ON 2 RAILS.
15. ERECTION OF 400KV Gantry REQUIRE DISMANTLING OF EXISTING 1 NO. LIGHTING MAST. THE SAME IS IN LINE WITH EXISTING LAYOUT.
16. PLEASE REFER DETAILING OF 785/400KV ICT AREA FOR AUXILIARY BUS (NEUTRAL AND TERTIARY) OF CB BUSK LOCATION SHALL BE MARKED IN OUTDOOR TRENCH LAYOUT.
17. EXISTING OUTDOOR TRENCH LAYOUT SHALL BE IDENTIFIED ON SWITCHYARD GATEWAY.

S.No.	DESCRIPTION OF PARAMETER	785kV SYSTEM	400kV SYSTEM
1	HIGHEST SYSTEM VOLTAGE	800kV	420kV
2	NORMAL SYSTEM VOLTAGE	785kV	400kV
3	RATED FREQUENCY	50Hz	50Hz
4	NO. OF PHASES	3	3
	RATED INSULATION LEVELS		
	1) FULL WAVE LIGHTNING IMPULSE WITHSTAND VOLTAGE (1.2/50microsec.)	±2100kV	±1550kV
5	2) WAVELENGTH IMPULSE VOLTAGE (250/2500microsec.) DRY & WET	±1550kV	±1050kV
	3) ONE MINUTE POWER FREQUENCY DRY WITHSTAND VOLTAGE (rms)	830kV	630kV
6	CORONA EXTINCTION VOLTAGE	508kV	320kV
7	MAX. RADIO INTERFERENCE VOLTAGE LEVEL AT 500 mtrs. (FOR 700 KV & AT 250 KV. (rms). FOR 400KV.	2500 micro volts	1000 micro volts
8	RATED SHORT CIRCUIT CURRENT FOR 1 SEC. DURATION	40KA	50KA
9	EQUIPMENTS CURRENT RATING	2000A	2500A/ 3150A
10	SYSTEMS NEUTRAL EARTHING	EFFECT. FARTED	EFFECT. FARTED

This detailed technical drawing illustrates the layout of a power plant, likely a steam turbine generator set. The diagram shows the arrangement of major components such as the boiler, condenser, feedwater pumps, and the main steam turbine. It includes extensive piping networks for water and steam circulation. Structural elements like foundations, supports, and walkways are also depicted. Key features include:

- Equipment Layout:** Various pieces of machinery are shown with their respective dimensions and positions.
- Piping System:** A complex network of pipes connects different parts of the system, with flow directions indicated by arrows.
- Structural Details:** Foundations, supports, and structural frames are clearly marked.
- Dimensions and Annotations:** Numerous numerical values specify distances, heights, and component sizes. Labels like "TH", "GA", and "CB" identify specific areas or components.
- Legend:** A legend at the top right lists symbols used throughout the drawing, such as "OF 70000 RPM", "OF 60000 RPM", etc., indicating different types of equipment or materials.

S.NO.	REL. OF QTY.	SYMBOL	QTY.
1	785K, 2000A, 40KA FOR 1 SEC, 3PH KNEE TYPE ISOLATOR WITH TWO EARTH SWITCH		01
2	6244K, 20KA, 1-PH, METAL OXIDE GAPLESS TYPE SURGE ARRESTER		03
3	785K, 10AH BUS POST INSULATOR (SOLID CORE PORCELAIN TYPE)		03
4	400KV, 3150A, 50KA FOR 1 SEC, 3PH, SFS CIRCUIT BREAKER WITHOUT OR WITH CSD		02
5	400KV, 2500A, 50KA FOR 1 SEC, 3PH HCB ISOLATOR WITH ONE EARTH SWITCH		05
6	400KV, 2500A, 50KA FOR 1 SEC, 3PH HCB ISOLATOR WITH TWO EARTH SWITCH		01
7	400KV, 5-CORE, 1PH, CURRENT TRANSFORMER		06
8	3384K, 20KA, 1-PH, METAL OXIDE GAPLESS TYPE SURGE ARRESTER		03
9	400KV, 10AH BUS POST INSULATOR (SOLID CORE PORCELAIN TYPE)		53
10	686K, 6AH BUS POST INSULATOR (SOLID CORE PORCELAIN TYPE)		61
11	5000MA, 785/400/33KV 1-PT ICH KT		03

CONDUCTOR & STRAPPING DETAILS			
SL.NO.	DESCRIPTION	755K ^Y	400K ^T 565K ^T
1.	JACKBUS	----	----
2.	DROPPERS/ JUMPERS	QUAD AAC BULL CONDUCTOR WITH 450MM SUB-CONDUCTOR SPACING	QUAD BERSIMS ACSR CONDUCTOR WITH 450MM SUB-CONDUCTOR SPACING
3.	EQUIPMENT INTERCONNECTION	4.5" IPS AL. TUBE (120mm OD, 12MM THICK)/QUAD AAC BULL CONDUCTOR WITH 450MM SPACING	4" IPS AL. TUBE (114.2mm OD, 8.51MM THICK)/QUAD ACSR BERSIMS CONDUCTOR WITH 450MM SPACING
4.	ENTWIRE INTERCONNECTION	7/3.66mm GI WIRE (10.96mm DIA)	7/3.66mm GI WIRE (10.96mm DIA) -----

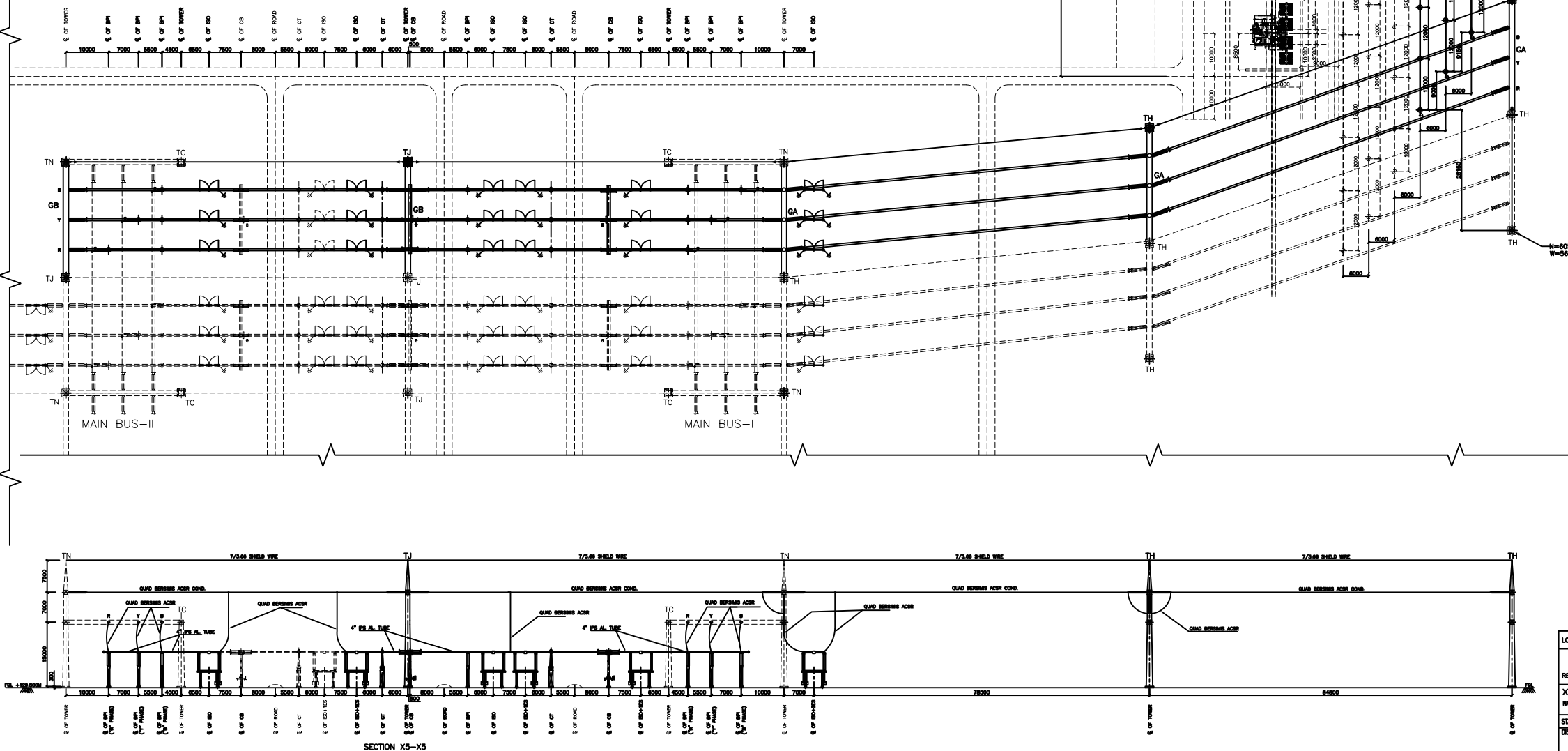
S/No.	DESCRIPTION	765kV SYSTEM	400kV SYSTEM
1.	PHASE TO PHASE FOR CONDUCTOR-CONDUCTOR CONFIGURATION FOR ROD-CONDUCTOR CONFIGURATION	7600mm 9400mm	4000mm 4200mm
2.	PHASE TO EARTH FOR CONDUCTOR-CONDUCTOR STRUCTURE FOR ROD-CONDUCTOR CONFIGURATION	4900mm 5400mm	3500mm
3.	SECTIONAL CLEARANCE	10300mm	6500mm
4.	MIN HEIGHT OF EQPMT BUS CENTRE LINE ABOVE PLINTH LEVEL	+14000mm	+8000mm
5.	HEIGHT OF PLINTH ABOVE FINISHED GROUND LEVEL	300mm	300mm

DISC INSULATOR DATA:-			
SL.NO.	DESCRIPTION	765kV	400kV
01	ELECTROMECHANICAL STRENGTH	210KN	210KN
02	SIZE	305X170MM	305X170MM
03	CREEPAGE DIATANCE	460MM	460MM

BEAM/ TOWER TYPE	SPAN/ HEIGHT (METER)	QTY. (NOS.)
GA	27	03
GB	27	02
IJ	22.0+7.5	01
TH	22.0+7.5	02

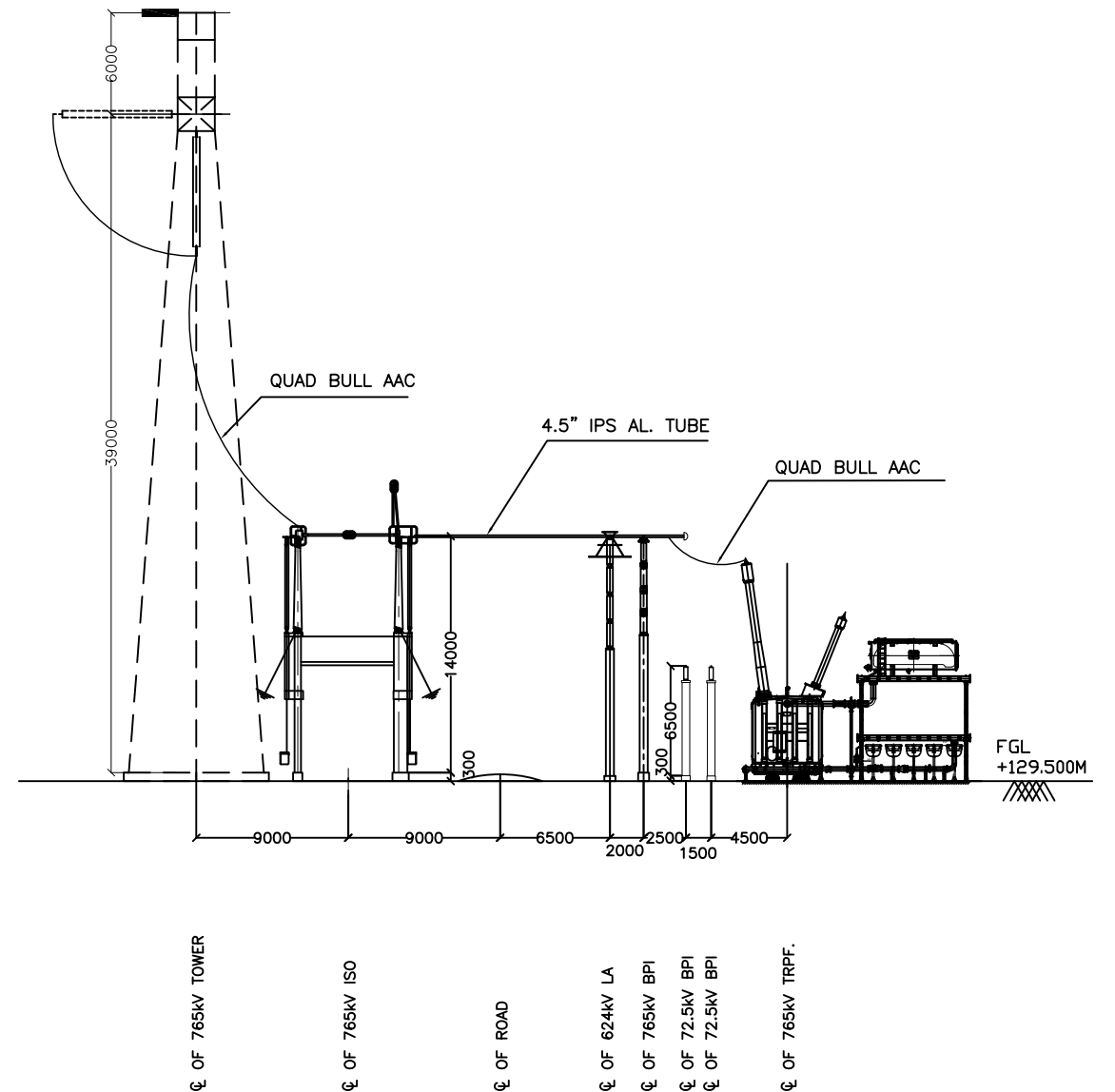
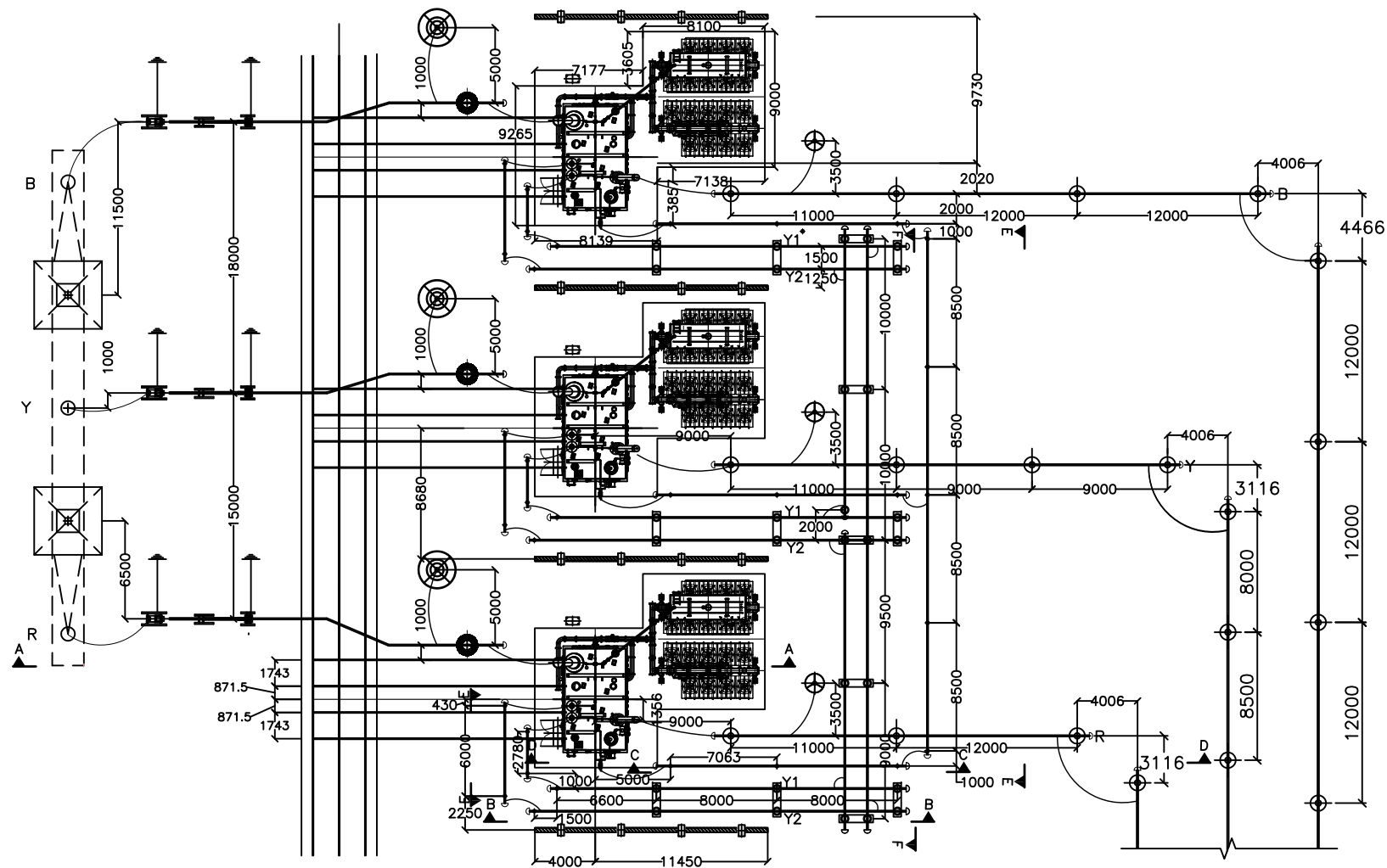
	PRESENT BHEL SCOPE
	EXISTING SCOPE/CUSTOMER SCOPE
	TENSION STRING INSULATOR
	SUSPENSION STRING INSULATOR
	SHIELD WIRE
	COLUMN WITH PEAK
	CORONA END BELL

Conductor/Shield Wire per Phase	Normal Tension Per Phase (kg)	S/C Tension Per Phase(kg)	Separation Between Spacers (meters)	Remarks
QUAD ACSR BERSIMIS MAX SPAN=88000 mm	4000	5100	4.0 m	Without or With Max. +/-30 deg deviation
SHIELD WIRE	800 with +/-30° deviation	Not Applicable	Not Applicable	Without or With Max. +/-30 deg deviation

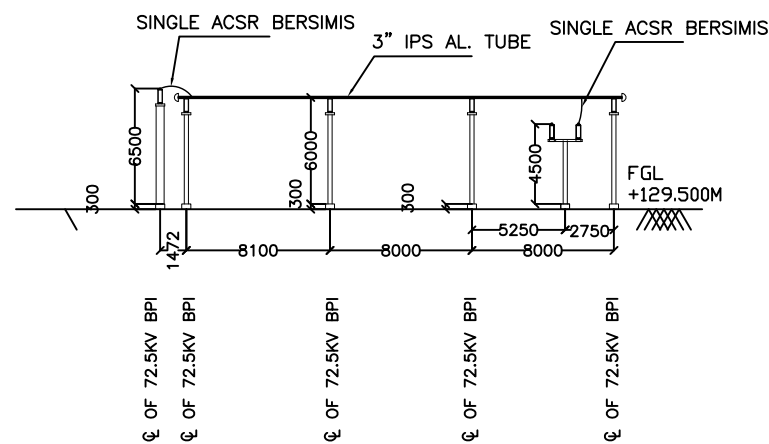


LOT NO.					121/ESD-785vk/13/Bara/Vol-I Dated 08.03.2019									
REFERENCE DRG. NO.					400VK SWITCHYARD LAYOUT PLAN & SECTIONS (DRG. NO. 01221S-E-SY-SY-EL-001 SHEET 3 OF 3) 785VK SWITCHYARD LAYOUT- 785VK AREA FOUNDATION LAYOUT (DRG. NO. 01221A-E-SY-ST-SY-EL-1023 SHEET 3 OF 3)									
xzkgd@ffkstuk dk					uke									
NAME OF CUSTOMER/PROJECT					EXTENSION OF 765/400V S/S Bara TPS U.P. UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED									
STATUS OF DRAWING														
DISTRIBUTION OF RIGHTS					 Hkkir gshon bpsid Bharat Heavy Electricals Ltd. TRANSMISSION PROJECTS DIVISION									
REV	DATE	ALTERED BY	CHECKED BY	APPROVED BY	Scale	Sheet No.	Total Sheet	Drawn By	Checked By	Approved By	Date			
01	08.07.10	CHANDU	HKS	SURENDRA	1:1000	04/2	04/2	CHANDU	HKS	SURENDRA	08/03/19			
ZONE					REVISION IN LINE WITH 785/400VK ICT DRAWING							M.B.E.-DRAWING NO. TB-1-407-316-002 02		

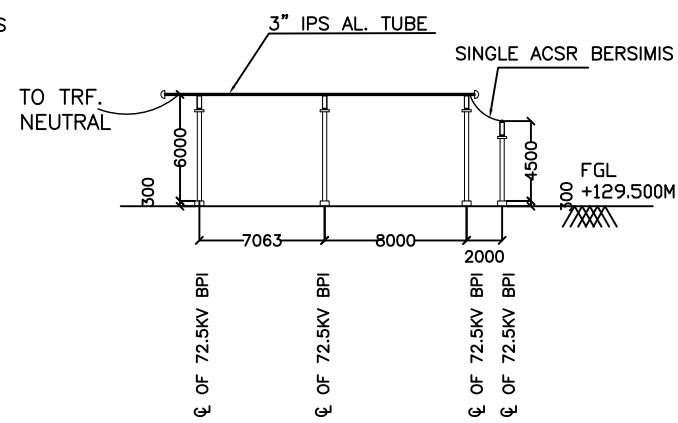
				TRANSMISSION PROJECTS DIVISION							
REV.	DATE	ALTERED	PK	REV.	DATE	ALTERED	PK	for/bk DEPT. TECH		w/qr / SCALE 1:1000	dWG dwtl CARD CODE
00	24.07.19	CHECKED	NR	01	05.07.19	CHECKED	NR	APPROVED			
		APPROVED	SSS/AB			APPROVED	SSS/AB	CODE 422			
ZONE				ZONE				1/4 TITLE			
REVISED FOR ELECTRICAL CLEARANCE FROM 765KV LA & BP1				REVISED IN LINE WITH 765/400KV ICT DRAWING				LAYOUT PLAN & SECTION OF 765/400KV BARA EXTENSION			



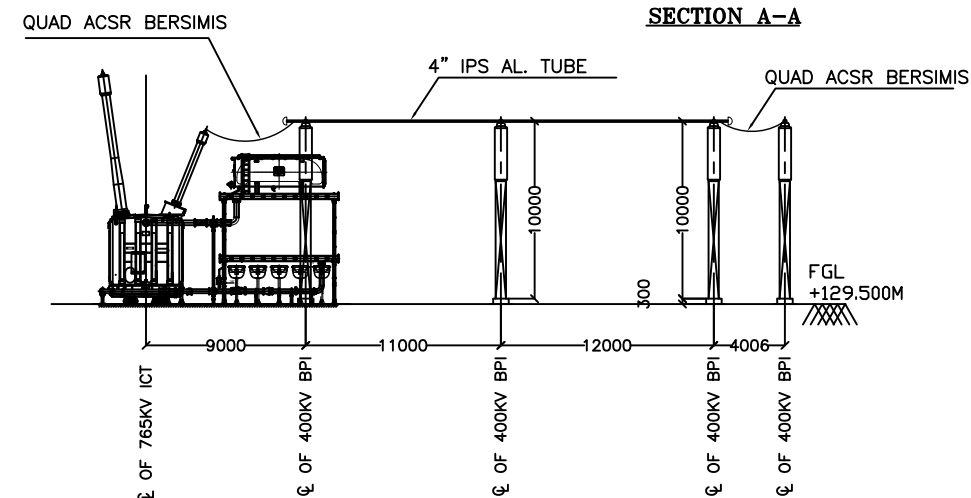
SECTION A-A



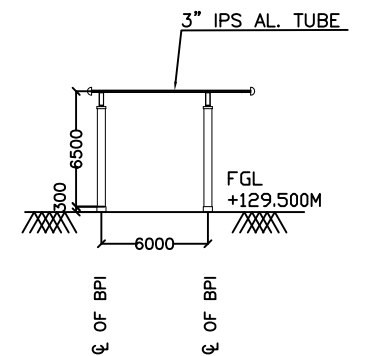
SECTION B-B



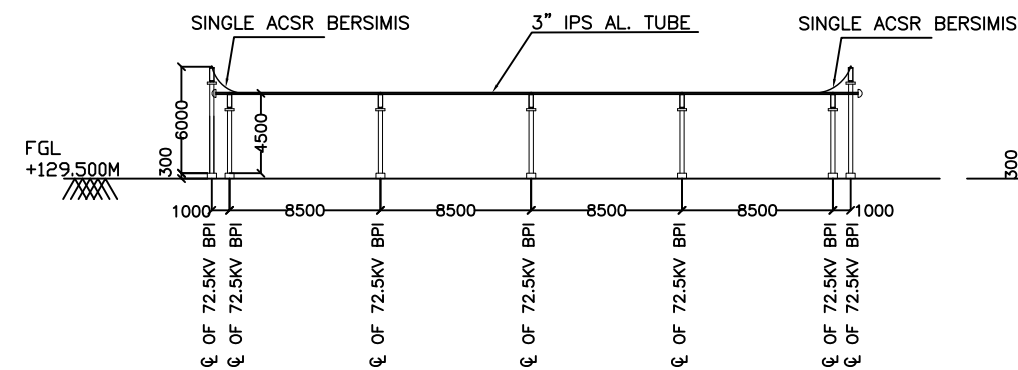
SECTION C-C



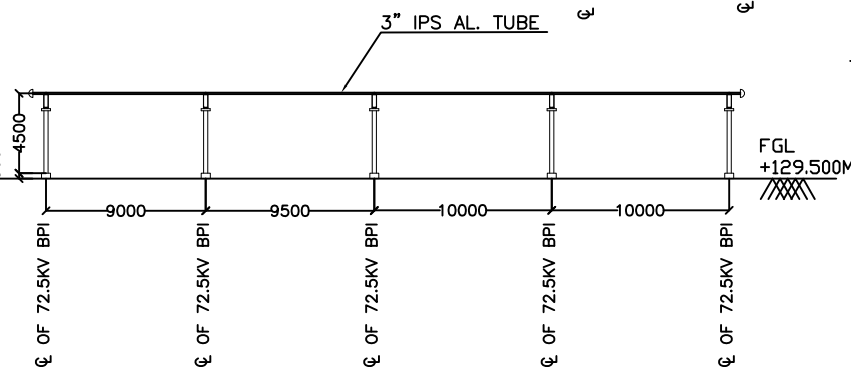
SECTION D-D



SECTION E-E



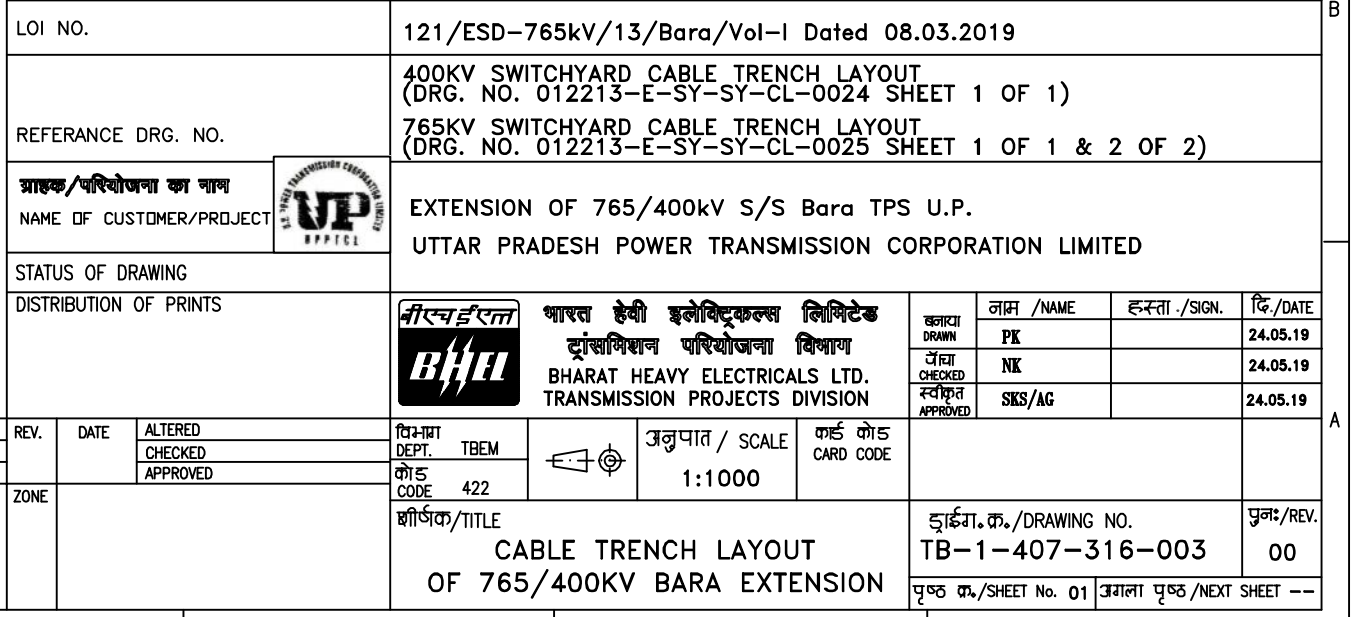
SECTION F-F

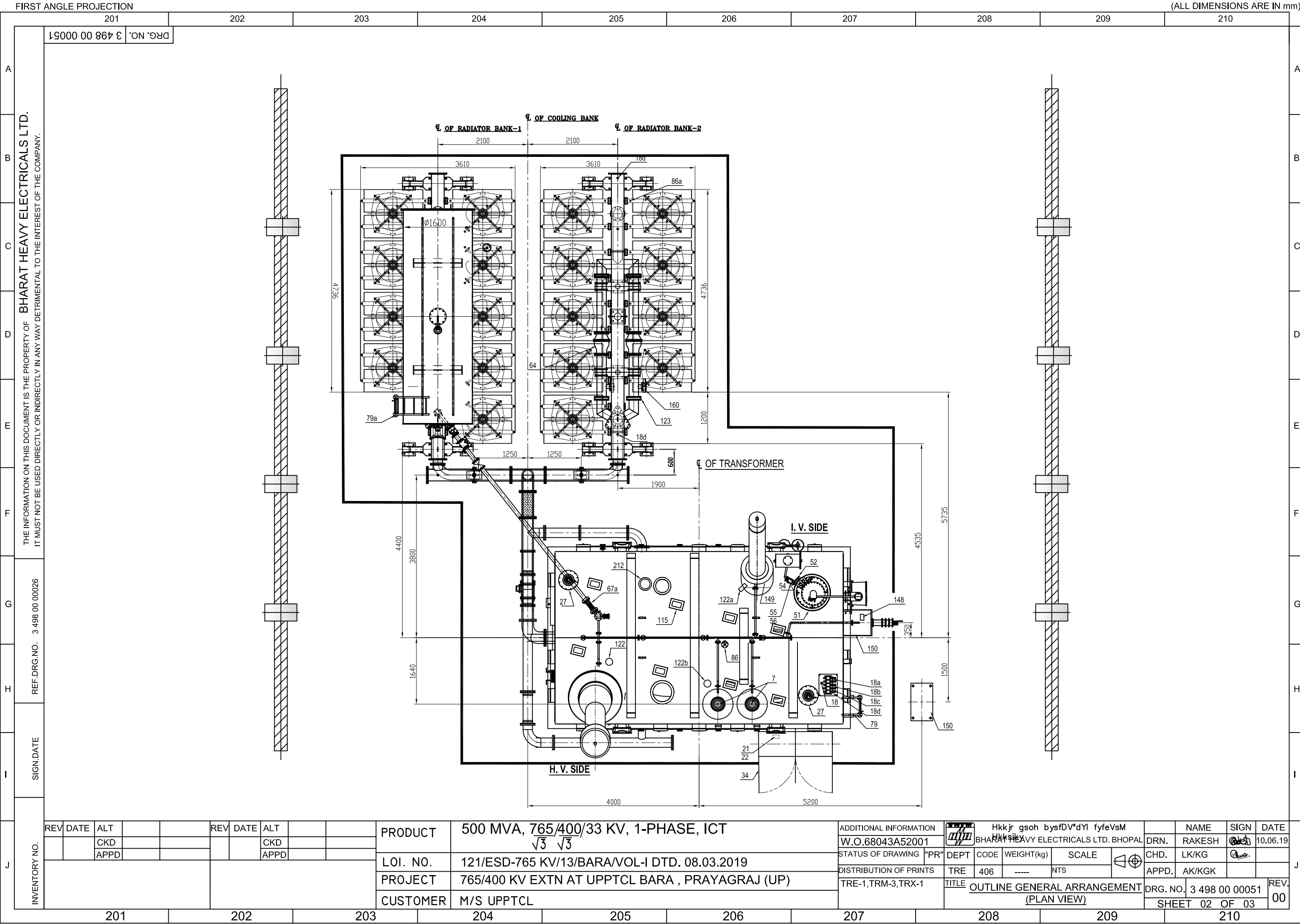


SECTION G-G

REV.	DATE	ALTERED	PK
02	24.07.19	CHECKED	NK
		APPROVED	SKS/AG
ZONE	REVISED FOR ELECTRICAL CLEARANCE FROM 765KV LA & BP		

LOI NO.		121/ESD-785kV/13/Bara/Vol-I Dated 08.03.2019	
REFERENCE DRG. NO.		400KV SWITCHYARD LAYOUT PLAN & SECTIONS (DRG. NO. 012213-E-SY-SY-EL-001 SHEET 3 OF 3) 785KV SWITCHYARD LAYOUT- 785KV AREA FOUNDATION LAYOUT (DRG. NO. 012213-C-SY-ST-FL-1-1025 SHEET 5 OF 5)	
xzkgd@fj;ks tuk dk		EXTENSION OF 765/400KV S/S BARA TPS U.P.	
NAME OF CUSTOMER/PROJECT		UTTAR PRADESH POWER TRANSMISSION CORPORATION LIMITED	
STATUS OF DRAWING			
DISTRIBUTION OF PRINTS		 Hkkx gsoh bysifj Hkkafe ku ifj kku BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION	
REV.	DATE	ALTERED REASON	10/07/19 08/07/19 08/07/19
ZONE		1:1000 100%	08/07/19 08/07/19
DETAILING OF 765/400KV ICT AREA		TB-2-407-316-005 02	





INVENTORY NO.	2
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REV	DATE	ALT		REV	DATE	ALT			PRODUCT	500 MVA, 765/400/33 KV, 1-PHASE, ICT	ADDITIONAL INFORMATION	 Hkkjr gsoh bysfDV*dYl fyfeVsM BHARTI HEAVY ELECTRICALS LTD. BHOPAL		NAME	SIGN	DATE		
		CKD				CKD				$\sqrt{3} \sqrt{3}$	W.O.68043A52001		DRN.	RAKESH		10.06.19		
		APPD				APPD			LOI. NO.	121/ESD-765 KV/13/BARA/VOL-I DTD. 08.03.2019	STATUS OF DRAWING "PR"	DEPT	CODE	WEIGHT(kg)	SCALE			
									PROJECT	765/400 KV EXTN AT UPPTCL BARA , PRAYAGRAJ (UP)	DISTRIBUTION OF PRINTS	TRE	406	----	NTS	APPD.	AK/KGK	
									CUSTOMER	M/S UPPTCL	TRE-1,TRM-3,TRX-1	TITLE	OUTLINE GENERAL ARRANGEMENT (ELEVATION VIEW)			DRG. NO.	3 498 00 00051	REV
																SHEET 01 OF 03	00	

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

REF.DRG.NO. 3 498 00 00026

SIGN.DATE

INVENTORY NO.

REV	DATE	ALT			REV	DATE	ALT		
		CKD					CKD		
		APPD					APPD		

PRODUCT	500 MVA, 765/400/33 KV, 1-PHASE, ICT $\sqrt{3} \sqrt{3}$
LOI. NO.	121/ESD-765 KV/13/BARA/VOL-I DTD. 08.03.2019
PROJECT	765/400 KV EXTN AT UPPTCL BARA , PRAYAGRAJ (UP)
CUSTOMER	M/S UPPTCL

ADDITIONAL INFORMATION				Hkkjr gsoh bysfDV*dYl fyfeVsM				NAME	SIGN	DATE
W.O.68043A52001				BHARAT HEAVY ELECTRICALS LTD. BHOPAL				DRN.	RAKESH	10.06.19
STATUS OF DRAWING "PR"				DEPT	CODE	WEIGHT(kg)	SCALE	CHD.	LK/KG	
DISTRIBUTION OF PRINTS				TRE	406	-----	NTS	APPD.	AK/KGK	
TRE-1,TRM-3,TRX-1				TITLE				DRG. NO. 3 498 00 00051		REV. 00
				OUTLINE GENERAL ARRANGEMENT (END VIEW)				SHEET 03 OF 03		

