TECHNICAL PRE QUALIFICATION REQUIREMENT

Name of Project :- **1 X 46 MW PANCHET HYDEL POWER STATION (RM&U)**
Name of Customer :- **DAMODAR VALLEY CORPORATION (DVC)**
Name of Item :- **FIRE PROTECTION SYSTEM FOR Switchyard Area**

TECHNICAL PRE QUALIFICATION REQUIREMENT
1. The bidder should have designed, supplied, erected, tested & commissioned at least one number fire protection system of each type described in (a) & (b) below in installations such as power plants, sub-stations, electricity boards, refineries, fertilizer plants or other industrial or commercial installations during the last 15 years as on bid opening date of this tender. a) High Velocity Water (HVW) Spray for transformer rating of minimum 20MVA b) Fire Hydrant system 2. The supplied fire-protection system should be in successful operation for at least 01(one) year in last 15 years as on scheduled date of bid opening of BHEL tender.

SUPPORTING DOCUMENTS TO BE ATTACHED		
Sr	**Required Criteria**	**Supporting Documents to be submitted by bidder along with technical bid**
1	Supply	Copy of POs/Material receipt certificate at site, etc.
2	Successful operation	Successful operation means certificate issued by the Customer certifying the operation without any adverse remark.

Notes (General points):

1. Consideration of offer shall be subject to customer's approval of bidder's, if applicable.

2. Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self- attested English translated document should also be submitted.

3. Notwithstanding anything stated above, BHEL reserves the right to assess the capabilities and capacity of the bidder to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL.

4. After satisfactory fulfilment of all the above criteria / requirement, offer shall be considered for further evaluation as per NIT and all the other terms of the tender.

भारत हैवी ईलैक्ट्रिकल्स लिमिटेड

BHARAT HEAVY ELECTRICALS LIMITED

पारेषण व्यापार अभियांत्रिकी प्रबंधन

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

प्रलेख संख्या DOC. No	**TB-420-552-01**	Rev. No.	**0**		**बनाया/** Prepared	**जांचा/** Checked	**स्वीकृती/** Approved
TYPE/ **प्रकार** OF DOC.	**TECHNICAL SPECIFICATION**			**हस्ता**. / SIGN			
TITLE/ **शीर्षक**	**FIRE FIGHTING SYSTEM (SWITCHYARD AREA)**			**नाम** / NAME	**TDT**	**TDT**	**VK**
				दिनांक/ DATE	**04.11.22**	**04.11.22**	**04.11.22**
				समूह/GROUP	**TBEM**		
ग्राहक/ CUSTOMER	**DAMODAR VALLEY CORPORATION (DVC)**						
परियोजना/ PROJECT	**1 X 46 MW PANCHET HYDEL POWER STATION (RM&U)**						

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Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS

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SECTION 1

INTENT, SYSTEM REQUIREMENT, DESIGN CRITERIA AND SCOPE

1.0 INTENT OF SPECIFICATION

1.0.0 This specification is intended to cover following activity and service in respect of all the equipment of the **Fire Protection System to be provided for switchyard and the Power transformers located in switchyard area of 1x46MW, Hydel Power Station at Panchet.**

i) Detailed design of all the equipment and equipment system(s).
ii) Complete manufacturing including shop testing.
iii) Providing engineering data, drawings, and O & M manuals as per specified format etc. for owners/purchaser's review, approval and records.
iv) Packing and transportation from the manufacturer's works to the site.
v) Receipt and verification of materials received at site.
vi) Fabrication, pre-assembly, if any, erection testing and putting into satisfactory operation all the equipment including successful completion of trial operation.
vii) Performance and Guarantee tests after successful completion of trial operation.

1.0.1 The requirements specified under SECTION 2, SECTION 3, SECTION 4 & SECTION 5 of the specification shall be considered as part of this section. In the event of any conflict between the various sections/sub-sections of this specification, SECTION 1 shall prevail. *DVC Technical specification is attached with SECTION 2 & shall be referred strictly. Requirements of the same regarding system specification shall be provided by the contractor without any deviation.*

1.0.2 It is not the intent to specify herein all the details of design and manufacture. However, the equipment and the system shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to Purchaser/ Owner, who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material, which in his judgment is not in full accordance herewith.

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

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

1.0.5 **Deviation:** There shall preferably be no deviation on technical specification. The bidder shall sign and stamp the "Certificate for No Deviation" enclosed in Schedule-2, Section-5 towards confirmation. Except for these deviations/variations covered under Deviation Schedules which are accepted by the Purchaser before the award of the Contract, it will be the responsibility of the Bidder to fully meet the intent and the requirements of the specification within the quoted price. *Deviations in any other form including clarifications / assumptions / etc will not be considered and it will be construed that the bid conforms strictly to the specification*.

1.0.6 The Bidder to note carefully that the parameters, estimated capacities of equipment indicated and the tender drawings in the specification are only for the guidance of the Bidder. The system shall be designed as per relevant standards/ codes and exact capacities and quantities are to be estimated by the Bidder. All such estimations and design calculations shall be submitted for Purchaser's approval.

1.0.7 It is the responsibility of the successful Bidder to obtain necessary approval/ clearance from statutory organizations wherever applicable for the equipment/ systems under the scope specified.

1.0.8 The term **'Owner'** appearing in this specification shall refer to **Damodar Valley Corporation (DVC)**, the term **'Consultant'** shall refer to **MECON,** the term **'Purchaser'** shall refer to **BHEL** and the term **'Contractor'** shall refer to the **successful Bidder.**

2.0 FIRE FIGHTING REQUIREMENTS FOR VARIOUS AREAS

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

System	Areas Protected
HVW Spray System	10 MVA Transformer (1 no.) 20 MVA Transformer (1 no.) 31.5 MVA Transformer (1 no.)
Hydrant System	Switchyard area

3.0 SYSTEM REQUIREMENT & DESIGN PHILOSOPHY

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

3.1 Protection System (HVW Spray System)

HVW Spray system is envisaged for 3 Nos. transformers located in the switchyard area.

Codes and standards:

- NFPA 15 - Standard for Water Spray Fixed Systems for Fire Protection
- Rules for Water Spray System of TAC

American Society for Testing and Materials (ASTM):

- A 105 (Standard Specification for Carbon Steel Forgings for Piping Applications)

- A 234 (Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service)
- A 182 (Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service)

Indian Standards (IS):

- IS 1239 (Steel Tubes, Tubulars and Other Wrought Steel Fittings - Specification - Part 1 : Steel Tubes)
- IS 3589 Gr 410 (Steel Pipes for Water and Sewage (168.3 to 2540 mm Outside Diameter)
- IS 4736 (Specification for Hot-dip Zinc Coatings on Mild Steel Tubes)
- IS 15337 (Coal Tar Based Anticorrosion Tape for Protection of Underground Mild Steel Pipelines)
- IS 14846 (Sluice Valve for Water Works Purposes, 50 to 1200 mm Size)
- IS 210 (Grey Iron Castings)
- IS 2871 (Specification for branch pipe, universal for firefighting purposes)

A. General

i. One no. tap-off point for Hydrant points & HVW spray system of 200NB size along with a gate valve will be provided as indicated in Plan layout enclosed. This tap-off point will be provided by the purchaser.

ii. ***OGA for 10 MVA transformer provided with this specification is not from transformer OEM. Drawing of similar rating of transformer of a different make has been provided. Dimensions of the actual existing 10 MVA transformer at Panchet was measured manually and the same has been marked in this drawing, hence the indicated dimensions are approximate.***

iii. ***Switchyard layout provided has been prepared as per measurement done on google map platform, contractor must visit the site for site survey and shall start with layout engineering with actual measured dimensions at site.***

iv. System shall be pressurized continuously to normal working pressure up to the Deluge valves.

v. Spray system shall consist of spray mains tapped from the main fire water header present outside switchyard area, Deluge valve, Isolation valves, Y-type strainer, spray nozzles/ projectors, spray nozzles piping network, detection system, instrumentation, junction boxes, cables etc.

vi. In order to design the system, a minimum pressure of 8 kg/cm^2 (g) shall be made available at the tap-off location by owner for spray header. The system is designed considering 8 kg/cm^2 (g) pressure at Tap-off points.

vii. Construction of Deluge valve housing & RCC pedestals shall be in bidder's scope of works.

B. Design Criteria

i. HVW spray system shall be designed as per Section -3 of rules for water spray systems (TAC).

ii. The system for HVW spray system shall consist of water supply system, suitable number of spray nozzles, deluge valve, quartzoid bulb detectors, strainers, pipes and necessary valves.

iii. Minimum running water pressure at any projector/spray nozzle will not be less than 3.5 Kg/ sq.cm and not greater than 5.0 kg/ sq.cm. The velocity in feed pipes shall not be more than 10m/s as per cl. No. 3.2.3.6.2.7 of TAC manual for Spray System.

iv. The density of spray system shall be 10.2 lpm/sqm as per the rules of water spray system of Tariff Advisory Committee (TAC).

v. An isolation valve shall be provided at upstream & downstream of each of the deluge valve. The size shall be same as that of the deluge valve. Manual operated bypass valve (butterfly valve) in case of malfunction of deluge valve shall be provided for each deluge valve.

vi. A strainer ('Y' type) shall be provided at upstream of deluge valve. Strainer wire shall be SS (AISI 316), 18 SWG, and 30 mesh. Strainer area shall be at least 4 times the pipe cross-section at the pipe inlet, pressure drop across strainer in clean condition shall not exceed 1.0 kg/cm^2 at design flow of deluge valve.

vii. Limit switch (open & close) for Deluge valves shall be provided for upstream & downstream isolation valve. Water motor gong shall form part of accessories to be provided with deluge valve.

viii. Pressure gauges at both upstream and downstream of deluge valves, and in the detector pipe network shall be provided. Pressure gauge shall be integral part of Deluge Valve.

ix. Pressure switches shall be provided in spray and detector piping to exhibit "FIRE" and "SPRAY ON" annunciations and as well as for interlock.

x. The detection in HVWS system is through heat sensing detectors of fusible type (Quartzoid Bulb). In the event of fire, the surrounding temperature increases. As the surrounding temperature reaches the rated temperature of QB detector, the detector bulb bursts and allows water in detection line to flow out. This creates a pressure drop in the detection line. The pressure drop in detection line will open the deluge valve and water starts projecting out from the spray nozzles.

xi. Wet type pipe detection shall be provided for actuating the Deluge system. QB detectors are set at 79ºC. At the preset temperature the detector burst and release the pressure with the detector piping network around the reactor & actuating the flow of water across Deluge Valve.

xii. The water supply to HVWS system will be controlled by wet pilot type deluge valve which will be operated hydraulically and is normally closed by water pressure. Water for deluge valves shall be supplied from spray header. Gate Valves shall be provided for each deluge valve on upstream and downstream. Y- Strainer shall be provided at upstream of each deluge valve.

xiii. Pipe structure for pylon support around transformer shall be fixed to the ground level with the help of Anchor fasteners. The structure will be in two pieces with a flanged joint at around Zero level above chequered plate. Pipe size for pylon, size of Anchor fasteners etc. shall be adequate for the support to provide sufficient rigidity against vibration & load during operation.

xiv. Sprayers/ projectors/ nozzles shall be arranged in the form of a ring around transformers and number of such rings/ tiers shall be decided considering maximum gap between two (2) consecutive tiers of rings shall be as per TAC. The distance of the deluge valves from the

protected area / plant / equipment shall be 6 m. (min.) in line with TAC manual.

xv. The horizontal and vertical distances between the projectors shall be maintained in such a way that their spray patterns intersect on the surface of the Transformer.

xvi. All Spray pipe mains/ pipelines shall be routed aboveground on RCC pedestals with coating and wrapping as per specification. Road, Rail or pipe trench crossing shall be through RCC Hume pipes duly covered with coating and wrapping as per specification. Hume pipe for road crossing shall be NP3 class and that for rail crossing shall be NP4. Underground pipe shall be provided with coating and wrapping as per specification and IS: 10221 /TAC norms.

xvii. As per the modern practice of fire detection system, all Deluge Valves (DV's) will be networked to Microprocessor based analogue addressable Fire Alarm Panel. *Fire alarm panel is excluded from the scope of the contractor, however networking of deluge valve system with main fire alarm panel i.e. MFAP located in main powerhouse control building shall be in scope of the contractor*.

xviii. Local control panel for deluge valves shall be provided. Remote actuation of the deluge valve from control room shall be provided through monitor module & control relay module present in local control panel for deluge valve. These modules shall be treated and an integral part of DVLCP and bidders shall quote in tender BOQ accordingly. Cabling of DVLCP with MFAP shall be done by the contractor.

xix. Facility for manual initiation of deluge valves locally, through hand operations (manually by operating the push button) shall also be provided.

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

xxi. There may be requirement of both 2C x 1.5 sq.mm & 2C x 2.5 sq.mm cable sizes w.r.t cable quantity mentioned in the tender BOQ, contractor shall quote accordingly.

xxii. **Deluge valve housing room**

For DV open to atmosphere, there will be Masonry enclosure all around the deluge valve along with M.S Grill door. All related civil/structural work required for the enclosure shall be provided by the contractor. Deluge valve housing shall be of RCC roof.

3.2 Hydrant System

a. Hydrant systems for the switchyard area shall be tapped off from main header from where tapping for spray system has been allocated. Tap-off point will be of 200 NB size along with a gate valve will be provided by the purchaser as indicated in the switchyard layout drawing provided with this specification. These tap-off points will be provided by the purchaser. Maximum water pressure at the tap-off point will be 8.0 Kg/ cm^2 (approx.).

b. **Hydrant system is designed for Ordinary Hazard Classification.** This system is in accordance with the clause no 7.6 of the FP manual of TAC.

c. A hydrant ring shall be formed around the switchyard. Isolation gate valves shall be provided in the ring main so that a portion of the loop can be taken out for maintenance without any loss of system in the balance part. Hydrants valves shall be provided in the switchyard fire water piping

network as per requirement inline with TAC guidelines.

d. The Hydrant System of fire protection shall consist of mainly aboveground pipe that will feed water to a number of hydrants valves in switchyard area. However wherever necessary underground piping shall also be done by the contractor.

e. System shall be designed in a way so that minimum terminal pressure of 3.5 kg/cm^2 can be maintained at the farthest/remotest hydrant point of the switchyard. The velocity of flow of water is generally not exceeding 5.0 m/sec in Hydrant system header.

f. All the outdoor and indoor hydrants shall be provided with a front glass type hose box carrying 2 nos. 15 mtrs hose along with branch pipe coupling and nozzle.

g. All hydrant pipe ring mains/ pipe lines shall be routed aboveground on RCC pedestals. Road, Rail or pipe trench crossing shall be through RCC Hume pipes duly covered with coating and wrapping as per specification. Hume pipe for road crossing shall be NP3 class and that for rail crossing shall be NP4.

3.2.1.0 Specific Data

i) All hydrant valves shall be of single headed, oblique type with 75 mm flanged inlet and 63mm outlet.

Hose cabinet - The hose cabinet shall be fabricated out of fiber reinforced plastic (thickness 2.5 mm) of size 750 mm x 600 mm x 250 mm. The top shall have pressed edge slightly projecting outside to prevent water (while cleaning etc.) from entering the cabinet. The cabinet shall be fitted with glass fronted door. The door shall be provided with a knob and a lock with duplicated key on the body of the door with a glass cover. The glass of the key box shall be easily replicable. Suitable hooks, etc., shall be provided in the cabinet to hold the hose reels etc. mentioned above.

3.3 MATERIAL OF CONSTRUCTION (MOC) OF MAJOR EQUIPMENTS

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

SL. NO.	ITEM	MOC
i.	Fire Water Pipes	Mild steel, Black, ERW to IS: 1239 Part-1 Heavy grade (for pipes of sizes 150NB and below) & IS: 3589 ERW Black, min. 6 mm wall thickness for sizes 200 NB and above.
ii.	Fire Water Pipes (Downstream of Deluge valve)	MS ERW Galvanized to IS:1239, Part-1, Heavy grade; Galvanized as per IS: 4736
iii	Gate Valves	C.I as per IS 14846, FG260
iv	Y Strainer	Body: MS as per IS: 2062, Wire Mesh of SS 316 with18 SWG
v.	HVWS Nozzle	SS 304
vi	QBD	Bronze (ASTM B145 Class-5A Ni-leaded gun metal) with chromium plating
vii	Deluge Valve	Cast Iron IS:210 Gr. FG 260

viii.	Hydrant Valve	As per IS:5290 Type-A, SS 304
ix.	Branch Pipe	As per IS:903, SS 304
x.	Hose Pipe	Reinforced Rubber Lined Fire Hose as per IS 636, Type – A
xi.	Hose Cabinet	Fiber reinforced plastic
xii.	Air Release Valve	Gun Metal as per IS 318
xiii.	Flanges	Fabricated from Plate conforming to IS: 2062 Gr. A
xiv	Fittings	IS: 1239, Part-II

3.4 Spares

Following mandatory spares items shall be provided:

Sl. No.	Item	Qty.
1.	HVWS Spray Nozzles	15 Nos.
2.	QB Detectors	20% of total installed qty.

❖ ***There is no BOQ item available in price schedule for above spares, hence bidder shall consider price of the above items distributed among the items available in the respective priced BOQ in the tender while preparing his offer.***

3.5 Commissioning Spares

Contractor shall ensure availability of such spares along with the main equipment as per equipment manufacturer's recommendations. The list of such recommended spares shall be provided along with the offer.

4.0 SCOPE OF SUPPLY & SERVICES

4.1. Exact requirements shall be worked out during detailed engineering after award of contract. The scope of the work under the contract shall be deemed to include all such items, which although not specifically mentioned in the bid documents and/or in the bidder's proposal, but are required to make the equipment/system complete for its safe, efficient, reliable and trouble free operation.

4.2. Bidders shall consider makes for various equipments as per Annexure A, which shall be **subjected to owner's approval** during design engineering stage. Price implication to BHEL later on account of non-acceptance of proposed vendors by Owner shall not be considered.

4.3. Bidder shall also consider the following while quoting for the system:

i) 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 (2C x 1.5/ 2.5 sq.mm or higher size, FRLS, twisted pair, armoured Cu cable) for fire detection and alarm system.

ii) Necessary conduits for laying of cables as per specification requirements shall be included by the bidders in their offers and the same shall be supplied and laid by the contractor.

iii) Earthing of all installations shall be done by the contractor.

iv) Bidder shall ensure that sufficient quantities of commissioning spares are made available for timely commissioning of the system. The bidder shall furnish a list of commissioning spares that will be brought by him.

v) The contractor shall lay the aboveground piping required for spray system and hydrant system. RCC pedestals shall be provided by contractor. RCC pedestals for Pylon supports fixing to be provided by contractor for HVWS.

vi) Pipe size for pylon, size of Anchor fasteners etc. shall be adequate for the support to provide sufficient rigidity against vibration & load during operation. The whole arrangement shall be in bidder's scope. The contractor shall justify adequacy of design during engineering.

vii) Conducting performance guarantee tests as per approved procedure to the satisfaction of Owner / Purchaser and handing over an operational system to the owner. Procedure for performance guarantee test shall be submitted by contractor for customer review and approval.

viii) Contractor shall submit valid Type test report for approval by owner. Fresh type test of equipment is not envisaged. It is presumed that equipment offered is duly type tested.

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

4.4. Scope of Services

A. Erection, Testing & Commissioning (ETC) requirements

i) The scope of ETC shall include receipt of material at site, handling of equipment/ material at site, erection of equipment /material at site including fabrication, equipment and system testing, commissioning of the entire system, conducting performance guarantee tests to the satisfaction of Owner / Purchaser and final handing over to the owner of the entire system. ***Scope regarding unloading & storage of materials at site is excluded from contractor scope of works and the same shall be done by BHEL.***

ii) Furnishing technical calculations in support of equipment selection or sizing as and when required.

iii) Dye Penetrant Test, Ultra Sonic Examination, Radiography; Magnetic crack detection shall be carried out in accordance with standards.

iv) Painting of the pipes, equipments, FPS items shall be as per Annexure-B to Sec-1 of this specification.

B. With Other Electrical System

i) Preparations of cable interconnection diagram for equipment supplied under this contract. Termination details shall also be furnished in the said interconnection table.

ii) Laying & Termination of Power/ control cables/ FO Cables for the equipment under the scope of this specification. Bidders shall include all cable accessories like lugs, glands, cable tags, markers etc in their respective bids. Cabling of DVLCP with MFAP shall be done by the contractor.

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

C. With Civil System

i) Providing location of pipes crossing the road/ rail & trenches, supply & laying of adequately sized Hume pipes.

D. All machinery tools & tackles and consumables required for erection/testing / commissioning of the system shall be arranged by the Bidder.

E. Minor modifications, alterations in system installation as per customer's specific requirements shall be done without any extra cost to purchaser.

F. Bidders to ensure that sufficient quantity of spares are made available for timely completion of commissioning of the system. The bidder shall furnish a list of commissioning spares that will be brought by him. The unused commissioning spares shall be returnable to the bidder.

i) Obtaining, "As Built" certification from purchaser or owner on applicable drawings. Completing documentation as per specification requirement.

ii) Obtaining customer's written acceptance of satisfactory completion of job. (Acceptance of PG + handing over of system and mandatory spares).

iii) Any other service not explicitly illustrated herein but which may be required to complete the system with its desired functionality or in the spirit of contract shall also deemed to be under the scope of bidder.

G. Civil Works

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

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

i) Construction of DV housing as per specification shall be in scope of the contractor.

ii) Construction of RCC pedestals for aboveground piping and PCC/ RCC pedestal for pylon supports shall be in scope of the contractor.

5.0 OPERATION & MAINTENANCE (O&M) MANUAL

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

a. Description of the system and equipment with design particulars.
b. Instruction for erection.
c. Instruction for operation, maintenance and repair.
d. Recommended inspection practices and inspection schedule.
e. Ordering information for all replaceable parts.
f. Recommendation for type of lubricants and frequency of lubrication.

6.0 Handing & Taking Over

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

during the period shall be rectified by the contractor without any price implication to BHEL. Also suitable PG tests shall be conducted by the contractor to show the achievement of guaranteed parameters in line with the requirements of specification/ standards/ codes and to the satisfaction of Purchaser/ Owner.

7.0 Inspection & Testing

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

8.0 Various Heads to be quoted for

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

Sl No.	Item Description	Unit	Qty
1	MS PIPE 200NB	MTR	75
2	MS PIPE 150NB (HEAVY GRADE)	MTR	300
3	MS PIPE 100NB (HEAVY GRADE)	MTR	45
4	MS PIPE 80NB (HEAVY GRADE)	MTR	17
5	MS PIPE 25NB (HEAVY GRADE)	MTR	277
6	WRAPING & COATING MATERIAL	SQMTR	10
7	GI PIPE 100NB (HEAVY GRADE)	MTR	71
8	GI PIPE 80NB (HEAVY GRADE)	MTR	5
9	GI PIPE 65NB (HEAVY GRADE)	MTR	93
10	GI PIPE 50NB (HEAVY GRADE)	MTR	159
11	GI PIPE 40NB (HEAVY GRADE)	MTR	40
12	GI PIPE 32NB (HEAVY GRADE)	MTR	74
13	GI PIPE 25NB (HEAVY GRADE)	MTR	140
14	PYLON PIPE-80 NB	MTR	210
15	PYLON PIPE-50 NB	MTR	60
16	GATE VALVE 150NB	NO	3
17	GATE VALVE 100NB	NO	6
18	BUTTERFLY VALVE - 100NB	NO	3
19	DELUGE VALVE - 100NB	NO	3
20	Y-TYPE STRAINER - 100NB	NO	3
21	Q.B DETECTOR	NO	163
22	HVW SPRAY NOZZLE	NO	194
23	LOCAL CONTROL PANEL FOR DELUGE VALVE	NO	3
24	PRESSURE SWITCH	NO	6
25	LIMIT SWITCH	NO	3
26	PRESSURE GAUGE	NO	6
27	SOLENOID VALVE	NO	3
28	CABLE FOR HVWS WIRING WITH FDAS	MTR	900
29	SINGLE HEADED HYDRANT VALVE	NO	7
30	HOSE PIPE - 15M LONG	NO	14

31	BRANCH PIPE WITH NOZZLE	NO	7
32	HOSE BOX	NO	7
33	RCC PEDESTALS FOR PIPE ROUTING	NO	90

- **GENERAL CONDITIONS OF CONTRACT FOR THE PRCED BOQ OF THE TENDER**

a) *Price of items like pipe fittings, structure, MS plates, hume pipe, modules & hardware items etc. shall be considered along with price of the respective pipes/ or any other items in the tender BOQ or price schedule.*

b) *3 Nos. DV housings has to be constructed and spares listed under Cl. No. 3.4 of this section has to be provided by the contractor, bidder shall consider cost of the same distributed among the tender BOQ items while quoting in their offer.*

c) The equipments and services to be furnished under this contract are detailed here under Cl. No. 8.0 of this section is for reference. Bidders shall work out the actual requirement based on the building & switchyard layout enclosed with this specification during detailed engg. stage.

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

e) 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.

f) 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.

g) *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.*

h) 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.*

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

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

k) Bidders shall consider makes for various equipments as per Annexure A, which shall be subjected to Owner's approval during design engineering stage. Price implication to BHEL later on account of non-acceptance of proposed vendors by Owner shall not be considered.

l) Drawings attached with this specification are preliminary & are not exhaustive in nature. These drawings may get revised during detail engineering. All other inputs required for engineering of

the Fire fighting system will be furnished to the bidder during detail engineering stage, as and when the same is available with BHEL. Bidder to note that they shall not be eligible to raise any extra claim on account of revision of input drawings or any other input drawings during detail engineering stage.

***ANNEXURE- A TO SECTION-1**

9.0 Sub-Vendor List

Bidder shall choose make of materials from list enclosed in Annexure-A to this section. This list is only indicative, final applicable make is subject to end customer approval without any additional commercial implication to BHEL.

***SUB-VENDOR LIST FOR FIRE FIGHTING SYSTEM**

S.N.	ITEMS	APPROVED SUB-VENDOR
2	STRAINERS (Y-TYPE & BASKET TYPE)	SAROJNI ENTERPRISES FILTRATION ENGRS. OTOKLIN SUPERFLOW TRIVENI
3	FITTINGS & FLANGES	JINDAL BST STEWARDS LLOYD TUBE BENDS INDIA MS FITTINGS SHIVANANDA NOMAAN EBY INDUSTRIES
4	STEEL STRUCTURAL MATERIALS	SAIL Tata Steel Ltd., RINL, Jindal Steel & Power Ltd. JSW Steel Ltd
5	WELDING ROD	ESSAB Ferro Speed plus D&H Norma
6	MS/ GI PIPE	SAIL TATA JINDAL MAN

		SAW WELSPUN PRAKASH PSL MSL ITC BST AJANTA PRAKASH TUBES ZENITH GUJRAT STEEL TUBES KALINGA MAHARASHTRA SEAMLESS LTD.
7	FIRE HOSES	NEWAGE SUKAN
8	DELUGE VALVES	HD FIRE KIDDE INDIA GRINELL TYCO TOTAL WHALTE
9	SPRAY NOZZLE/ QB DETECTORS	RELIABLE ASCO LAXMI SPRINKLER. GRINELL TYCO SPRAY SAFE NEWAGE SURENDRANAGAR HD FIRE
11	SOLENOID VALVE	SEITZ ROTEX NORGREN SCHRADER AVCON ASCO
13	COATING & WRAPPING MATERIAL/TAPE	MP TAR PRODUCTS RUSTECH
14	GATE VALVE	KIRLOSKAR BROTHERS STEAM & MINING

		IVPL NASIK BDK FOURESS HAWA ENGINEERS, AHMEDABAD AUDCO DEZURIC TIFLIN SAKHI INTERNATIONAL
15	BATTERY	EXIDE INDUSTRIES LTD. AMAR RAJA BATTERIES LTD HBL POWER SYSTEMS LTD
16	AIR RELEASE VALVE	IVPL
1	PRESSURE GAUGE	AN INSTRUMENTS, H GURU, MANOMETER FORBES MARSHALL (HYD), WIKA ASHCROFT, GAUGES BOURDEN WAAREE INSTRUMENTS, TIWAC
18	PRESSURE SWITCH	INDFOS, SWITZER, ORION, ROTAREX, WIKA GAUGES BOURDEN, WAAREE INSTRUMENTS
19	PAINT	ICI Asian Berger
20	FIRE ALARM AND COMMN. CABLE	RPG, UNIVERSAL, CCI,NICCO, TORRENT CORDS CABLE, INCAB, CRYSTAL, UNIFLEX DELTON, POLYCAB, FINECAB, RADIANT CAPCAB, SPECIAL KEI INDUSTRIES LIMITED
21	FIRE EXTINGUISHER	KANADIA FYR FYTER PVT LTD ZENITH DEFLAME(INDIA) GUNNEBO (INDIA)
22	FIRE HYDRANTS	NEW AGE INDUSTRIES, STEELAGE INDUSTRIES, ASCO, STRUMECH, VIJAY FIRE, ZENITH
23	HOSES	AEROFLEX, MARKWEL, SENIOR FLEXONICS, INALSA, TEKSONS
24	RCC PIPES, FITTINGS	SUR INDUSTRIAL PIPES, HIND CERAMICS, INDIAN HUME PIPES, DAYA CUNCRCHING

***Final applicable make is subject to DVC final approval without any additional implication to BHEL.**

	ANNEXURE-B to BHEL TECHNICAL SPECIFICATION				
PAINTING SCHEDULE FOR FIRE PROTECTION SYSTEM					
1. Paint requirement For Over-ground (GI Pipe) pipes normally empty but periodically charged with water .					
SL No	Name of the item	Type	Number of coat	DFT of each layer in micron	Remark
1	Primer	Etch Primer	2	6	
2	Final Paint	Synthetic Enamel paint conforming to IS 2932.	2	25	Shade: Fire Red (IS: 5) Shade no. 536
		Total DFT in micron		62	
	Note: Surface preparation shall be done either by manually or by any other approved method.				
2. Paints for external surfaces protection of piping / fittings/ Structural steel, etc. (Carbon steel /Mild Steel) to be installed indoor and outdoor.					
SL No	Name of the item	Type	Number of coat	DFT of each layer in micron	Remark
1	Primer	Red oxide zinc chromate primer to IS 2074	2	25	
2	Final Paint	Synthetic Enamel paint conforming to IS 2932.	2	25	Shade: Fire Red (IS: 5) Shade no. 536
		Total DFT in micron		100	
3. Paints for Deluge Valves, Hydrant valves, Hose Boxes etc. and painting of all equipments / components of Fire detection & Protection system shall be as per manufacturer's standard practice.					
4. Paints for Fire Water Tanks, Internal Coating					
SL No	Name of the item	Type	Number of coat	DFT of each layer in micron	Remark
1	Primer	Red oxide zinc chromate primer to IS 2074	1	25	
2	Final Paint	Epoxy based finishing paint	3	25	Shade: Fire Red (IS: 5) Shade no. 536
		Total DFT in micron		100	
5. Paints for Fire Water Tanks, External Coating					
SL No	Name of the item	Type	Number of coat	DFT of each layer in micron	Remark
1	Primer	Red oxide zinc chromate primer to IS 2074	1	25	
2	Final Paint	Chlorinated rubber paint	3	25	Shade: Fire Red (IS: 5) Shade no. 536
		Total DFT in micron		100	
6. Paints for Fire Water Tanks, Outside surface of bottom plate resting on ground					
SL No	Name of the item	Type	Number of coat	DFT of each layer in micron	Remark
1	Primer	Red oxide zinc chromate primer to IS 2074	1	25	
2	Final Paint	Coal-tar epoxy based paint	3	25	Shade: Fire Red (IS: 5) Shade no. 536
		Total DFT in micron		100	
Note:					
1	The surfaces of stainless steel, Gunmetal, brass, bronze and non-metallic components shall not be applied with any painting				
2	Surface preparation shall be done by means of Degreasing and Mech. Cleaning with wire brushing/hand tool.				

SECTION 2

EQUIPMENT SPECIFICATION

Refer the enclosed end client –DVC specification (Ch-06 at Vol-II, Sec-A of Technical Specification) for Fire Protection System provided as Annexure to this section 2.

All the requirements pertaining to scope, type, make, quality, testing & inspection of equipments, provisions of control, interlocks, indications, annunciations, alarms etc, as laid down in various clauses of this specification shall be satisfied by the contractor in totality.

This Annexure contains requirements applicable for main power house of the job too, however contractor shall refer to the clauses for the scope applicable for Switchyard portion only as a part of this tender.

ANNEXURE TO SEC-2 OF TECHNICAL SPECIFICATION

06.08 FIRE PROTECTION FACILITIES

General

The scope of work covers design, engineering, manufacture/fabrication, shop testing, assembly, packing, supply, transportation to site, comprehensive insurance, ~~unloading~~, unpacking, ~~storage at site,~~ site handling, fabrication, erection as per approved drawings, painting, commissioning, performance guarantee testing, approval from the competent authority & handing over of complete Fire protection system, sub-systems and integrated systems as described including fulfillment of guarantee of all the system and integrated system required for Panchet Hydel Station.

Obtaining tariff advisory committee (TAC') approval for the complete fire protection system at the design stage and at completion stage (stage wise as well as final)

The fire protection system includes the following:-

a. Fire Hydrant system consisting of internal as well as external hydrants for the Power house.

b. Automatic High Velocity Water Spray (HVWS) system complete in all respects and related accessories including electrics for two (2) nos generator transformer 60 MVA transformer each and three nos power transformer of capacity 31.5MVA, 20MVA and 10MVA located at switch yard. Apart that HVWS facilities for lub oil system of the turbine to be provided.

c. ~~Microprocessor based Fire detection and Alarm system for Control room & QBD detectors for Transformer area.~~

~~d. Portable fire extinguishers at suitable location in and around power house. Electrical room & control room etc.~~

e. Piping, valves, Pressure switch, Pressure gauge, alarm etc.

f. All civil & structural works including DV housing etc. during the erection of above system.

g. All associated electrical & Control and instrumentation facilities.

h. Erection, testing, commissioning, PG and warranty for the complete fire protection system including commissioning spares as required.

i. All the requirements of TAC for complete FPS shall be incorporated by tenderer in their scope irrespective of whether the details are describe in specification and/or shown in the drawing or not.

j. Compliance with statutory requirements and obtaining clearances from statutory authorities, wherever required. Reconciliation with customs authorities (if required), as required.

k. All equipment/system components (including detectors etc) shall have approval from one of the followings:

i) Underwriters Laboratories (UL) of USA.

ii) FM of USA.

iii) Vds.

The scope of work and services to be rendered by Tenderer for supply and installation of fire protection systems shall include but shall not be limited to the following activities.

Miscellaneous materials and services shall include but not limited to the following:

a) All piping integral to and/or between any equipment furnished under this specification, except as otherwise specified.
b) Coupling guards for all exposed shafts and couplings.
c) Necessary control panels and electrics.
d) Foundation bolts, base plates, thrust blocks, duck-foot bends, matching flange, supporting materials and shims.
e) All necessary instruments, power and control wiring integral to an equipment furnished under this specification. This shall include terminal blocks and integral wiring to these terminal blocks for equipment requiring external connection.
f) Earthing strips of all panels & other fire fighting equipments supply be the Tenderer shall be connected to the nearest earthing ring available at site.
g) Digging of under ground trenches, laying of cables, laying of Slab/ bricks over the cable routes, back filling of trench and leveling earth if required.
h) GI pipes/ conduits and other accessories wherever required for laying of cables.
i) Other erection materials like cable supporting structures, channel, brackets, clamps and other hardware materials, as required, for laying of cables.
j) All erection accessories, consumables and miscellaneous materials, though not specifically indicated in this specification, but actually required for completing the job in all respects.
k) All necessary isolation valves, fittings at tapping points and branch pipes.

l) Erection, testing and commissioning materials inclusive of measuring/ testing equipment.
m) Initial fill of gas and other fire extinguisher media (including quantity required for PG test) and demonstration. The quantity requirement for PG test will be taken by the Tenderer from within the supply made under BOQ. However the used up quantity is to be replaced by the Tenderer free of cost.
n) Valve chambers for all isolation for all isolation valves.
o) Housing chambers for all isolation valves.
p) Housing for deluge valves.
q) All unforeseen items (items not envisaged in schedule of quantity) required to complete the fire protection system.

List of main components involved in the fire protection systems as given in the specification are indicative only. Successful tenderer shall supply and erect the material as per the actual requirement. The quantities of such material shall be decided during detailed engineering and shall be supplied accordingly. Tenderer shall therefore base the offer on his own assessment. No extra price/ claim shall be entertained later during detailed engineering.

civil works pertaining to underground buried pipelines such as excavation, laying, backfilling, compacting, construction of valve chambers, manholes, laying of encasing pipes below roads shall also be in the scope of the Tenderer as a part of pipe laying. In case group of pipes are crossing road, RCC culverts to be provided below the roads and the same are included in the scope of the Tenderer.

All civil and structural works required for completeness of fire protection systems and also those which may not have been described but required for TAC approval shall be under Tenderer's scope.

Any other facilities to complete the plant as per system requirement of CEA/ TAC/ other statuary authority requirement within the defined battery limits.

06.08.01 TECHNICAL SPECIFICATION FOR PORTABLE FIRE EXTINGUISHER

a. General

~~Various units of Hydel Power Plant shall be protected by Portable Fire Extinguishers as first aid firefighting facility. Portable fire extinguishers of different type and capacity shall be supplied and erected at various plant premises.~~

The distribution of extinguishers in terms of their numbers and types shall be done in accordance with IS 2190 (latest edition). All the areas of the power house shall be covered with fire fighting facilities including remote installation. In any case every room shall have portable fire extinguisher facility.

b. Material of Construction

All the fire extinguishers shall be of welded construction except Carbon-dioxide type. In case of Carbon-dioxide extinguishers, the cylinders shall be of cold drawn seamless steel. Riveted joints will not be acceptable.

All the extinguishers shall bear metallic parts viz. unions, caps, inner containers etc. as per IS.

All the extinguishers shall be treated with lead-tin alloy for anti-rust, anti-corrosive treatment by electrolytic process or by dip coating process as per IS.

All extinguishers shall be supplied along with the wall brackets/fasteners for wall mounted extinguishers. All the parts shall have IS approval. All the extinguishers shall bear IS marking on their body.

c. Erection

All wall mounted portable extinguishers shall be supplied with mountings accessories and installed along the columns/walls near entry/exit at a height of approximately 1200 mm from the finished floor level.

Wherever extinguishers are required to be installed on the steel columns of the building, the welding of the supporting fixture to columns shall be done with prior approval.

d. Technical Parameters of CO_2 Extinguisher

S.N.	Parameter	Description
1.	Make	As per approved vendor list
2.	Design Standard	IS 15683 (2018).
3.	Quantity	As per IS, during detailed engineering.
4.	Rating	21B
5.	Performance	
	Capacity	4.5 kg
	Class of Occupancy	Group C & D
	Class of Risk Fire	HH
	Working Temperature	(-) 30^{O}C to (+) 55^{O}C
	Cylinder Test Pressure	250 kg/cm^2
	Filling Tolerance	+/- 5% by mass
	Minimum effective discharge time	8 second (minimum)
	Bulk Range Discharge	2m (minimum)
6.	Construction Feature	
	Dome & Dish	Concave
	Filling Density	0.667 max
	Design & Construction of Valve	As per IS: 3224
	Design & Construction of Cylinder	Seamless as per IS: 7285
	Gas Storage Pressure	50 kg/cm^2 (approx..)
	Seal & Temper Indicator	Provided
	Safety Release	Provided
7.	Material of Construction	As per IS:2878-2004
8.	Painting	First Coats: 2 coats of red oxide primer Outside Coats: 2 coats of red oxide primer and 2 coats of synthetic enamel paint Finish Coat: Fire Red (IS: 5) Shade no. 536
9.	Marking	IS:15683-2018
10.	Inspection & Testing	Verification of Test certificates from approved test houses at site by purchaser inspection team
11.	Approval	BIS

e. Technical Parameters of DCP Extinguisher

S.N.	Parameter	Description
1.	Make	As per approved vendor list
2.	Design Standard	IS 15683 (2018).
3.	Quantity	As per IS, during detailed engineering
4.	Performance	
	Capacity	6 kg
	Class of Occupancy	Group C & D
	Class of Risk Fire	HH
	Working Temperature	(-) 30^{O}C to (+) 55^{O}C
	Cylinder Test Pressure	35 kg/cm^2

	~~Filling Tolerance~~	~~+/- 5% by mass~~
	~~Minimum effective discharge time~~	~~8 second (minimum)~~
	~~Bulk Range Discharge~~	~~2m (minimum)~~
~~5.~~	~~Material of Construction~~	~~As per IS: 2171-1999~~
~~6.~~	~~Painting~~	~~First Coats: 2 coats of red oxide primer Outside Coats: 2 coats of red oxide primer and 2 coats of synthetic enamel paint Finish Coat: Fire Red (IS: 5) Shade no. 536~~
~~7.~~	~~Marking~~	~~IS:15683-2018~~
~~8.~~	~~Inspection & Testing~~	~~Verification of Test certificates from approved test houses at site by purchaser inspection team~~
~~9.~~	~~Approval~~	~~BIS~~

~~NOTE: If during detailing, other capacity and type of portable fire extinguishers need to be provided, the same shall be in the scope of Tenderer without any cost implications~~.

06.08.02 TECHNICAL SPECIFICATION OF HIGH VELOCITY WATER SPRAY SYSTEM

a. General

The proposed RM&U of Panchet Hydel Station Unit #1 has number of transformers containing large quantity of oil which is prone to fire.

In order to protect the transformer from fire, it is proposed to provide high velocity water spray system

Sl. No.	Equipment Name	Make	Ratings	Elevation of the Transformer(approx)			Location of the Transformer
				Length (mm)	Width (mm)	Height (mm)	
~~1~~	~~Generator transformer# 1 (GT#1)~~	~~BHEL, Bhopal~~	~~60 MVA, 11/138 KV (Ynd1)~~	~~5300~~	~~4250~~	~~6100±50~~	~~Outside the Power House, on Concrete Deck over the Tail Race.~~
~~2~~	~~Generator Transformer# 2 (GT#2)~~	~~TRF~~	~~60 MVA, 11/138 KV (Ynd1)~~	~~7820~~	~~4000~~	~~6425~~	~~Outside the Power House, on Concrete Deck over the Tail Race~~.
3	Power Transformer (TR#1)	TELK	20 MVA, 132/33 KV (Ynd1)	6000	3000	5000	Switch-Yard
4	Power Transformer (TR#2)	TELK	31.5 MVA, 132/33 KV (Ynd1)	7300	4300	5500	Switch-Yard
5	Power Transformer (TR#3)	NGEF	‘10MVA	4800	4500	5000)	Switch-Yard
~~6~~	~~Turbine lub oil system~~	~~As per new oil system envisaged by the tenderer~~					~~Machine hall~~

xxii. Description of the System

High velocity water spray system envisaged is a special fixed pipe system connected to a reliable supply of adequate quantity of water and equipped with spray nozzles (projectors) for specific water discharge and impingement over the surface or area to be protected. The piping system is to be connected to the water supply through an automatically actuated valve (deluge valve) which can initiate flow of water. Deluge valves for the spray system are to be actuated by an automatic detection system which in the case of transformers consists of quartzoid bulb detectors mounted around the protected area. The detectors are to be mounted on an independent pipeline charged with pressurized water. In case of fire, the heat sensing bulb (detector) shatters at about 75-80^{o}C temperature creating a drop in water pressure in the detector line thereby opening the deluge valve and allowing water to rush into the system. Deluge valves shall also to be operated using solenoid valve from remote in manual mode as well as in auto mode. Transformers and lub oil system protected by HVWS system shall be provided with quartzoid bulb type detector. There will be provision for manual operation of the system also by operating quick opening valves of each Deluge valve (By pass valve).

xxiii. Principles of the HVWS System

The HVWS system applies water in the form of a conical spray consisting of droplets of water traveling at high velocity. Three stages of extinguishing are to be carried out in the system, viz. emulsification, cooling and smothering thus enabling the system to be extremely effective.

xxiv. Emulsification

Droplets of water traveling at high velocity bombard the surface of the oil to form an emulsion of oil and water that will not support combustion. The effect of this emulsion is to convert a flammable liquid into one that will not burn. The emulsion thus formed is not of a stable character as after few minutes when the water is shut-off, the oil starts separating from the water, leaving the oil unimpaired. The water thus separated is drained out.

xxv. Cooling and Smothering

The rate of burning of a flammable liquid depends upon the rate at which vapour is formed from the surface of the liquid and the supply of air or oxygen to support combustion. When a flammable liquid burns, the rate of vapourisation increases until the fire reaches a maximum rate of burning making the surface of the liquid near to boiling point.

The HVWS System, when forcing an emulsion, intersperses cold water with the oil, thus cooling it and reducing the rate of vapourisation and in addition, prevents further escape of the flammable vapour. While the water droplets are passing through the flame zone, some of the water is formed into steam. This dilutes the air or oxygen feeding the fire and creates a smothering effect.

xxvi. Main Components of the System

The HVWS System shall be provided with the following major components:

a. Water Supply at high Pressure at Tapping Point
b. Deluge Valve
c. Y-type Strainers
d. Arrangement of Spray Nozzles
e. Arrangement of Detectors/ Quartzoid Bulb
f. Pipes, fittings and fixtures
g. Pressure gauges, pressure switches and solenoid valves
h. Main control panels, Local Control Panels and cables
i. Deluge Valve housing
j. Isolation / butterfly valve as a bypass system to each deluge valve
k. Water motor gong and drain valves
l. Piping for draining water from DV to the nearest existing drain.

a. Water Supply

Water shall be made available from the pump house proposed under this package. This pump house is at around 350 m from the transformers to be protected with HVWS system. The supply and laying of spray header shall be in the scope of successful tenderer.

b. Automatic Deluge Valve

This shall be basically a hydraulically operated valve. Normally the clack shall be in closed condition owing to equal pressure in the upper and lower chamber of the deluge valve. The upper chamber of the DV shall be pressurised with water tapped from the header. In case of fire, main fire alarm panel of respective area sends signal to solenoid valve of the deluge valve of the zone under fire. On actuation of solenoid valve or manual release valve, pressurised water in the upper chamber of the DV shall get released to the atmosphere and clack shall open due to hydraulic thrust by the pressurised water from below the clack. Once the clack opens, the pressurised water shall be sprayed into the risk through the Deluge Valve and spray nozzles.

Isolating valves shall be provided before and after deluge valves to facilitate the testing and maintenance of the system.

c. Y- type Strainer for Deluge Valve Assembly

'Y' type strainers are to be provided on the inlet side to the deluge valve assembly. This strainer shall be provided to segregate foreign materials which are deemed to be harmful for effective operation of the HVWS System. These strainers shall be so designed that prolonged use up to one year without cleaning the strainer will not hamper effective operation of the system. The material of construction of the strainer shall be carbon steel and it will bear TAC/IS approval

d. Arrangement of High Velocity Water Spray Nozzles (Projector)

High Velocity Water Spray Nozzles shall be installed all around the transformer in such a manner that each portion of the transformer is covered and water is sprayed uniformly. The number, spacing and discharge angles of these nozzles shall be designed to give effective coverage with an economical discharge of water to minimize the extent of damage on the equipment. The nozzles (projectors) shall be provided with integral strainer to arrest any foreign matter passing through them along with water. The nozzle (projector) shall be installed in and around the transformer.
The positioning of nozzles shall be such to protect all surfaces of the transformers and to give discharge rate of system not less than 10 lpm/m2.

e. Arrangements of Quartzoid Bulb Detectors

Quartzoid bulb detectors shall be provided as heat sensing element for the HVWS System for transformers. Detectors shall be placed at the top and sides of the transformer where maximum temperature rise is expected due to convection currents. The detectors are to be mounted on independent pipe line. The heat sensing detector bulbs should shatter at about 75-80^{o}C in case of fire, creating a drop in the water pressure in the detector pipe line.

f. Arrangements of Detectors:

For actuation of HVWS system in auto mode fire detectors (which are part of fire detection and alarm system) shall be used in oil cellar / Hydraulic cellar. The detectors have been described in detail in respective chapter of this specification.

g. Pipe, fittings etc.

M. S. black ERW pipes as per IS-1239, Part – 1 heavy grade (for pipes of sizes 150 mm NB or below) and IS-3589 ERW Black, min. 6mm wall thickness for sizes 200 mm NB and above.

h. Pressure gauges, pressure switches and solenoid valves

All pressure gauges, pressure switches and solenoid valves shall be connected with a three-way valve.

The solenoid operated valve shall be a 24 V DC operated valve which will get energized on receipt of fire signal from the respective zone of the main fire alarm panel. The status of its function (open / close) shall be indicated in the main fire alarm control panel. In case the solenoid valve fails to open within a stipulated time period, the corresponding signal shall appear in the main control panel.
There shall be a pressure switch on the outlet side of the deluge valve to indicate opening of the deluge valve in the main control panel.

i. Main Fire Alarm Panel (MFAP)

j. An Isolation / butterfly valve as a bypass system to each deluge valve shall be provided.

Operation of the System

Complete transformer shall be considered as one zone. Proposed water header shall be kept pressurized up to deluge valve. The Q.B. detector line shall be pressurized with the help of water, tapped from the header itself. Deluge valve clack is kept in horizontal position in normal condition due to balanced hydraulic pressure on two sides of the clack (Top and bottom).

Normal Condition

In normal condition, when there is no fire and system is kept in automatic mode, any leakage of water from the system will cause pressure drop in the water line. This leakage shall be compensated by the operation of jockey pump so that line pressure which is maintained at 5.5 Kg/cm^2.

Fire Condition

In case of transformer fire, temperature will rise all around the transformer. On reaching a predetermined temperature (generally 30°C above ambient temperature) quartzoid bulb detectors, which are installed on pressurised water line (water for which is tapped from the main header itself), will shatter. As the bulb shatters, water in the detector line gets released through the detector openings and water pressure in detection line drops rapidly. When pressure reaches a predetermined low level, pressure switch installed on the detection line actuates and sends signal to the main fire alarm panel (MFAP). This in turn actuates the solenoid valve of the deluge valve and water starts flowing through the deluge valve assembly and finally sprayed on the protected area / premises through the spray nozzles (projectors).

Design Criteria

The High Velocity Water Spray System shall be designed as per the stipulation of TAC rules on the subject as well as NFPA's guidelines.

Following minimum salient parameters shall be followed for the design of the system. However, any other equipment/ item/component required for completeness of the system and for successful operation is in the tenderer's scope of work.

i. Water application rate @ 10.2 lpm/m^2 of the surface area of the entire transformer including bottom surface, radiators and conservator tank etc. and of the surface area of the oil tanks, oil facility/ oil cellars/oil premises/ hydraulic rooms.

ii. The system shall be so hydraulically designed that the pressure at the hydraulically most remote projector in the network shall not be less than 3.5 bars for outdoor transformers and 2.8 bars for indoor transformer and maximum pressure 5 bar for both.

iii. Water velocity in Fire water pipes shall be as per TAC recommendation. However, Velocity of water thru' pipelines at pump's suction and discharge shall be limited to 1.2 M/sec. to 1.5 M/sec and 2.1 M/sec to 2.5 M/sec respectably.

iv. The header shall be laid in underground in RCC trench from individual deluge valve to ring main of transformer.

v. Quartzoid bulb detectors shall be installed in two/three rings one at top and another at bottom and third in the middle if required around the protected area. Maximum spacing between detectors shall be 2.5 m.

vi. Projectors shall be installed in rings encircling the protected area. One ring shall be provided at the top and subsequently rings for every 3 m from top to bottom shall be provided.

vii. Detectors around the transformer and lub oil tanks to be considered – 2/3 rows (top & bottom/middle).

viii. Distance between transformer surface and pipe shall not exceed 1000 mm.

ix. Distance between transformer surface and projector nozzle shall be kept between 500 mm to 800 mm.

x. Distance between transformer surface and detector shall be within 300 mm.

xi. Max. Distance of detectors from flange of oil pipe shall be 300 mm.

xii. Distance between detectors shall not exceed 2.5m

xiii. No. of transformer considered under fire at a time (largest) – One.

xiv. Proper drainage system and adequate dewatering pumps shall be in the scope of tenderer.

xv. Chrome plated nozzles shall be arranged in the form of ring to all transformers and nos. of such rings/tiers shall be decided considering maximum gaps between two (2) consecutive tier of rings as 2.5 M.The distance of the deluge valves from the transformers shall be approx. 10 metres.

xvi. The horizontal and vertical distances between the Projectors/Nozzles shall be maintained in such a way that their spray patterns intersect on the surface of the Transformer.

Equipment Specification

a. Deluge Valve Assembly

Deluge valve assembly functions on differential pressure operation allowing quick opening of the valve and thereby rush of water to the protection system. The valve consists of inlet, outlet and priming chamber. The inlet and outlet chambers are separated from the priming chamber by the valve chamber and a diaphragm. In the 'Set' position, pressure is applied to the priming chamber through a restricted prime line. The pressure is trapped in the priming chamber and holds the clapper on the seat due to the differential design. In the 'Set' position the clapper separates the inlet from the outlet keeping the system piping dry. When the pressure is released from priming chamber, the clapper moves and allows the inlet water supply to flow through the outlet and to the fire extinguishing system.

The deluge valve under reference shall be a control valve assembly which will operate on receipt of fire signal from the fire alarm control panel. It will consist of solenoid operated discharge valve capable of operating at the voltage that of the FDA system. Emergency Manual override facility at local and at MFAP shall be provided for actuating the valve in case the automatic operation fails.

The deluge valve assembly will consist mainly of the following:

- Isolation valves
- Inline strainer
- Deluge valve proper
- Actuator/pilot assembly
- Drain valve
- Pressure gauges
- Solenoid valve
- Pressure switches
- Water motor alarm shall be provided for hydraulically operated Deluge valve.

The deluge valve shall be of resetting type, taking minimum time for resetting. The deluge valve shall have UL&TAC approval.

b. Technical Parameters

Deluge		
Size	-	100/150 NB
Operating Pressure	-	10 Kg/cm^2
Hydraulic Test Pressure	-	25 Kg/cm^2
Material of Construction	-	
Body, cover	-	C.I – IS : 210 Gr. FG 260
Seat, Clapper, Clamp, Clamp ring etc	-	Bronze - IS : 318 LTB-II
Seat rubber	-	Neoprene
Diaphragm	-	Neoprene
Approval	-	UL/FM & TAC

c. **HVWS Nozzles (Projectors)**

Water spray nozzles (projectors) for the HVWS system shall be of suitable orifice size and varying discharge angles to cover fully all the area supposed to be protected. The nozzles (Projectors) shall be of Stainless Steel. The nozzles shall be normally open type, Spray nozzles (projectors) shall bear UL&TAC approvals.

Discharge angle : 60 degrees to 150 degrees.
Body: SS-304
Insert: SS-304

d. **Y Strainer**

Y type strainer shall be provided on the inlet side of each deluge valve assembly. The strainer shall prevent deposition of foreign particles in the valves and thereby malfunctioning of control valves. The material of construction of the strainer shall be gun metal and it will bear TAC/IS approval.

1.	Type	:	'Y' Type
2.	Sizes	:	80 NB,100 NB, 150 NB
3.	Fluid Handled	:	Water
4.	Pressure Drop	:	0.5 MWC in 100% Clean, 1.0 MWC in 50% Choked
5.	End connection	:	Flanged and drilled to IS 6392 TABLE 17
6.	Free staining area	:	Minimum times pipe cross section
7.	Material of Construction		
7.1	Body	:	IS: 2062 (tested quality).
7.2	Cover	:	MS to IS:2062
7.3	Strainer wires	:	SS 316 wire mesh with 18 BWG
7.4	Mesh	:	Stainless Steel 30 MESH
7.5	Gasket	:	Compressed Asbestos
8.	Drain Size	:	1/2" NPT Plug
9.	Design Pressure	:	10 Kg / Cm2
10.	Hydraulic Test Pressure	:	15 Kg/cm2

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.

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

e. **Solenoid Operated Valve**

The solenoid operated valve shall be a 24 VD.C operated valve which will get energized on receipt of fire signal from the respective zone of the main fire alarm panel. The status of its function (open/close) shall be indicated in the main fire alarm control panel. In case the solenoid valve fails to open within a stipulated time period, the corresponding signal shall appear in the main control panel as well as local control panel.

There shall be a pressure switch on the outlet side of the deluge valve to indicate opening of the deluge valve in the main control panel.

Technical Parameters

Valve size	:	½ inch
Fluid application	:	Water
Working line pressure range	:	0-12 Kg/cm2
Operating voltage	:	24V DC
Operating condition	:	NC
Position feedback required	:	Yes
Enclosure Protection	:	IP 65 & Ex. Proof
Working action	:	Direct acting
Rating	:	Continuous
Material of construction	:	SS 316
Mounting	:	On line
Coil Insulation	:	H/F
Process connection	:	½ inch NPT
Gland material	:	Ni plated brass
Provision of manual override	:	Yes

f. **Detectors:**

For actuation, Quartzoid Bulb Detectors for transformer shall be used.

g. Quartzoid bulb detector:

The Q.B. detectors shall bear TAC/UL approval and shall have a temperature rating of minimum 79 degree centigrade. However the Tenderer shall take into account the temperature at which they shall operate.

Technical Parameter:

Type	:	Frangible bulb
Operating temperature	:	79 ^{o}C
Working pressure	:	3.5 Kg/Cm^2 (g) minimum
Material of construction		
Frame	:	Bronze (ASTM B145 class-5A Ni-leaded gun metal) with chromium plating
Bulb	:	Glass filled with heat sensitive coloured liquid
Deflector	:	Brass (Ni-chromium plating)
Cap	:	Copper (Ni-chromium plating)

h. **Pipes & Fittings**

Pipes and pipe fittings in general shall comply with the requirements of BIS codes / International Codes.

The complete piping layout required for the HVWS system shall be done in accordance with various requirements of TAC fire protection manual and relevant IS codes.

Piping layout must follow good engineering practice. Proper attention shall be given to obtain full functional requirement of piping system with a layout which provides

sufficient clearance for other equipment and other personnel and easy access for operation and maintenance.

All piping shall be complete in all respects and shall consist of necessary valves, fittings, supports, air release and drain valves and other accessories. The air release and drain valves shall be provided at high and low points respectively. Each of the branch connection taken from the network shall be provided with an isolation valve.

i. **Gate Valves**

Valves shall be provided on pipe work for stopping and starting of flow, controlling flow rate, diverting flow, preventing back flow, controlling pressure, relieving pressure and for venting and draining of pipelines etc.

Valve selection shall be made based on the following considerations:

- Suitability of valve materials in regard of properties of fluids, temperature, pressure, erosion and shock.
- Valve size.
- Main function of the valve (viz. throttling, stop, permitting flow in one direction, diverting flow, relieving pressure etc.)
- Friction head losses.
- Ease of operation, i.e. method of actuation-closing time.
- Maintenance considerations.

The valves to be provided shall include but not limited to the following:

- Isolation valves on the main header at various locations.
- Gate valves in the branch pipes from header to DV and from DV to the served area.
- NRV on all pipelines requiring unidirectional flow only.
- Quick opening safety shut off valves.
- Manual drain valves.
- Pressure control valves.- These shall be installed in the pipeline in order to fulfill the pressure requirement at projectors .
- Bypass butterfly valve for all DVs for manual opening

j. **Pipe Supports and Fixtures**

Necessary pipe supports & fixture, pipe thrust block or pipe bridge to run the pipes overhead/underground or in the pipe trench as the case may be, shall be included in the scope of the tenderer. The tenderer shall study the location of protected premises and their auxiliary equipment and accordingly plan the pipe routing and the location of spray nozzles, deluge valves and manually operated valves. At places, where no supports/trenches are available the tenderer shall consider dedicated supports required for the pipe lines/spray nozzles etc. for the HVWS system.

Spacing of supports shall be as per TAC guidelines.

k. **Deluge valve housing rooms**

For DV open to atmosphere, there will be Masonry enclosure all around the deluge valve along with M.S Grill door. All related civil/structural work required for the enclosure shall be provided by the Tenderer. M.S grill shall be made from expanded metal sheets as per IS: 412-1975 (latest revision). Short-way and long-way of the grill/mesh will be 40mm & 75 mm respectively. Width and thickness of the mesh shall be 3.25mm and 1.60 mm respectively. Deluge valve housing shall be of RCC roof. DV located inside the plant premises under roof/ceiling shall be provided with structural frame with fence with grill door without any roof.

Electrical System Requirements

Equipment such as Local control panels, MFAP and cables will conform to the requirements specified in sections.

Following panels for HVWS systems will be provided:

i. Local Control Panels for deluge valves and other accessories where all necessary interlocks, relays, pressure switches, indicating lamps are wired. These panels will be located at suitable location. Necessary interlocks with MFAP will also be provided. The LCP shall consist of control & monitor module which will be interfaced with the microprocessor based FDA panel/ panels

ii. Annunciation for HVWS system will be made available in the respective area MFAP as well as in the fire-fighting pump house. For fire-fighting pump house separate annunciation panel shall be provided.

List of Control Signals

Following signals and control shall be required on the Main fire alarm control panel and at local deluge valve panel from each of the deluge valve.

1. Fire alarm signal from each Zone/premises through the actuation of pressure switch located on the detection line near to Deluge valve (DV) – very-very low water pressure (in case of actual fire)
2. Low pressure indication in Main header line.
3. Deluge valve / solenoid valve fail to open after command to solenoid valve incase of fire from each zone/premises.
4. Audio-visual alarm from DV to know that it has operated with actuation of pressure switch located on the delivery side of each Deluge valve
5. ON/OFF command to operate solenoid valve of DV at water line from main fire alarm panel as well as from local DV panel.
6. 24V DC power shall be provided for solenoid valves from the FDA system.
7. 24V DC Power failure alarm /Trip alarm
8. 24V DC Battery low alarm

Local Control Panel

The fire alarm local DV panel shall be provided with minimum following facilities

- Power On (Indication)
- Very Low water Pressure (fire signal)
- DV operated
- Solenoid fail to open signal
- Electronics Hooter
- Switch for power On/Off
- Push Button (Break Glass Type)- to operate solenoid valve of Deluge valve
- Acknowledge switch for Alarm accept

However all Signals shall be exchanged to MFAP through Local Panel.

Solenoid Operated Valve

The solenoid operated valve shall be a 24 V DC operated valve which will get Energized on receipt of power supply from the respective zone of the main fire alarm panel. The status of its function (open/close) shall be indicated in the main fire alarm control panel. In case the solenoid valve fails to open within a stipulated time period, the corresponding signal shall appear in the main control panel.

There shall be a pressure switch on the outlet side of the deluge valve to indicate opening of the deluge valve in the main control panel.

Hooter

Hooter shall be connected in each zone internally as well as externally. External hooters may be clubbed together with respect to common entry/exit point of view for cable areas. Annunciation in the hooters shall be as per programme through panel.

Layout Requirements

The layout of detector piping, lay out of spray piping, sprayers, etc. will be strictly in compliance with TAC especially with regard to clearances from various transformers. Complete civil works for the HVWS system area / premises covering excavation and back filling for laying the underground piping, brick masonry chambers with cast iron covers for outdoor isolation valves, pipe supports, excavation and back filling for all road crossings provision of Hume pipes for protection of pipes and finish to original grade are included in the scope of tenderer.

06.08.03 Fire Detection & Alarm System (FDA)

Fire Detection and Alarm System (FDA) will be intelligent addressable microprocessor based automatic system. The Intelligent Addressable Microprocessor based Automatic Fire Detection and Alarm system will be software controlled automatic system and will provide necessary programmed activities and various controls. The system shall consist of central processing units, man machine interface, communication system, microprocessor based fire alarm control panels, TFT monitor, printer Addressable Intelligent Automatic sensors and Interface unit as applicable.

Fire alarm control panel shall function as communication interface between Central Processing Unit and sensors and controlled devices. Addressable Intelligent type microprocessor based Detectors / Manual Pull Stations and required field devices in the various areas shall be connected to fire alarm control panels by class A wiring to the loop module.

In all the electrical premises Intelligent addressable type microprocessor based photo-electric detector in double configuration / rate of rise-cum- fixed type heat detectors shall be provided as applicable. Siren/hooter shall be mounted on suitable support. There will be interlocks to shut off the exhaust fans and simultaneous tripping of A/C and ventilation system.

Scope of work

The scope of work includes design, engineering, supply, erection, testing, commissioning, performance tests and handing over of intelligent addressable type Fire Detection and Alarm system for various premises of the project as mentioned in Table-1.

TABLE-1

LIST OF ELECTRICAL ROOMS

Sl. No.	Description	False ceiling	Type of System
1.	Cable Gallery and Unit Aux. Board, LAVT. NGTR, Service Aux. Board	No	Addressable Automatic Fire Detection and Alarm (FDA) system and Passive Fire Protection including fire extinguisher
2.	Control Room	Yes	FDA system with Fire extinguisher
3.	UAT	No	Fire Extinguisher
4.	Battery & Battery charger room	No	FDA system including Fire Extinguisher
5.	office room	yes	FDA system with Fire Extinguisher
6.	All other areas including above areas	No	Fire Extinguishers

06.09 WATER SYSTEM FOR FIRE FIGHTING

06.09.01 Scope of work

The scope of work shall include design, engineering, fabrication, manufacturing, assembly & supply, erection/ construction/ laying, commissioning, testing & performance guarantee tests etc of plant & equipment and piping etc of complete water supply facilities including, technological structures, piping support structures etc. required for fire fighting hydrants system as specified in this chapter and subject to Purchaser's approval, complete in all respect on turnkey basis.

The scope of work shall include the following activities:-

i) Design, engineering, manufacture/ fabrication, assembly, shop testing, painting, packing sequential delivery for site, ~~unloading~~, unpacking, ~~storage~~ at site, preparation & submission of all drawings for civil, mechanical, structural, piping, construction & erection drawings, construction & erection as per approved drawings, site-testing, painting, commissioning and fulfillment of guarantee performance of the water based fire-fighting system, for the HVWS System for ~~2 nos of 60MVA Generator Transformer (GT# 1 & 2)~~ , 3 nos of power Transformer of 20MVA, 31.5MVA & 10MVA in switchyard. Apart that HVWS system for lub oil system to be provided

ii) Supply of pipeline supports, anchor blocks, R.C.C. pedestals etc. for on-ground pipelines.

iii) Supply of all technical literature, drawings & documents, general arrangement drawings, assembly & sub-assembly drawings of all the plant & equipment, construction & erection drawings, as-built drawings, operation & maintenance manuals, manufacturing drawings, etc.

iv) Submission of all drawings at (iii) above, design calculations, data sheets for various equipments, pipeline sizing calculation and for approval of Purchaser/ Consultant and finalizing the same as per approval of Purchaser/ Consultant. The approval of the same however does not absolve the Tenderer from his responsibilities.

v) Supply of commissioning spares & consumables; a list there of shall be submitted by the Tenderer.

vi) Tenderer shall submit an itemized price-list of two years operation and maintenance spares.

vii) Supply of special tools, tackles for construction, erection operation and repair & maintenance of the plant & equipment.

viii) All necessary connections for hook-up with Purchaser's system at battery limits.

ix) Supply of erection, testing & commissioning equipment and material.

x) Piping network flushing fluids, chemicals & consumables.

xi) First fill of oils, lubricants, filter media, resins, chemicals reagents and other consumables.

xii) Inspection and performance testing of individual equipment and system as a whole.

xiii) Participation in design conference with the Purchaser & Consultant as and when called for.

The Tenderer's scope covers make up feed water system from existing river source to water reservoir via negative suction pumps shed and fire fighting pipe line from Fire Fighting Pump House (FFPH) to both Transformer areas and HVWS System.

Water supply system/ sub-systems shall be complete in all respects and any equipment or material not specifically mentioned herein, but required for safe, efficient & smooth operation and guaranteed performance of the plant shall be deemed to be included under the scope of work of the Tenderer.

~~06.09.02 Battery Limit~~

~~Make Up-Feed Water from River source to Reservoir:~~

~~Industrial quality water for firefighting system will be made available from nearby existing river water canal. The water from river canal will be supplied to propose Reservoir two nos each of approx capacity of 400 cum (minimum) with the help of negative suction pumps (1 working+1 standby) located at Pump Shed near to river source. In order of~~

proper suction of water from river canal and to avoid turbulence of river flow, local sump shall be constructed at river canal bed near the suction end of negative suction pumps.

Fire-fighting water

Fire Fighting Pump House (FFPH) will be constructed adjacent to water reservoir. FFPH shall consist of pumps such as, Electrical Driven Pump (171m3/hr- Qty- 2Nos), Diesel Driven Pump (171m3/hr- 1 stand by), Jockey Pump(10m3/hr, 1W+1S) and Drain Pumps. Pump delivery pressure will be 7.0 kg/cm² and minimum pressure required at remotest hydrant is 3.5 kg/cm². It is proposed to provide piping network fire fighting hydrant system at requisite pressure for HVWS system and to two nos of 60 MVA Generator Transformers (GT#1& 2) which are located at 100m (approx) from proposed FFPH and to three nos of Power Transformers in switchyard of 20, 31.5 & 10MVA which are located at 350m approx from proposed FFPH and lub oil system of the proposed turbine located in the machine hall.

The fire-fighting water requirement & head at take over point shall be finalized during engineering duly corroborated by back-up calculation to be submitted by the Tenderer and approved by the Purchaser / Consultant.

06.09.03 Specification and description of work

Water System Facilities:

Water system shall in general include the following facilities:-

a) Feeding water from existing river source to proposed Water Reservoir.
b) Water based fire-fighting system.
c) Interplant pipelines.

a) Feeding Water from existing River source to proposed Water Reservoir

Water in River canal will be available at an average level 2-3m from water bed, continuously during monsoon season for months July to October. And during non monsoon season, 1.5-1.8m (approx) level of water from river bed will be available

only in peak hours (Morning & Evening). Water will be pumped from existing river source with help of negative suction pumps and Strainer.

Pump Shed Structure shall be located in between river source and water reservoir. 1.0T CPB shall be provided at the pump shed for handling of pumps.

Tenderer shall provide makeup feed water lines from river source to water reservoir through negative suction pump shed and fire-fighting water lines from FFPH through isolation gate valves to the proposed systems for fire-fighting water requirement for the both the Transformer area.

b) Water based Fire-Fighting System

To cater to the needs of water based fire-fighting system, Fire Fighting Pump House (FFPH) shall be constructed beside Reservoir. FFPH shall consist of 2 nos of Electrical Driven Pump(171m3/hr), Diesel Engine Driven Pump (171m3/hr- 1 stand by), Jockey Pump(10m3/hr, 1W+1S) and Drain Pumps of adequate capacity. Pump head is considered to be 88m water column and minimum pressure required at remotest hydrant is 3.5 kg/cm². It is proposed to provide fire fighting piping network and hydrant system at requisite pressure for HVWS system for 2 ~~Nos of 60MVA Generator Transformer (GT#1- 60MVA & GT#2- 60MVA) which is located at 100m (approx) from proposed FFPH and~~ 3 nos of Power Transformers in switchyard of 20, 31.5 & 10 MVA which are located at 350m approx from proposed FFPH and lub oil system of the proposed turbine located in the machine hall.

i. The following specification of work shall be considered:-

   a. Category at hazard : ordinary (as per TAC)
   b. Yard hydrants : at 45 m intervals
   c. Min. pressure at highest/ remotest landing valve:3.5 kg/cm^2 (g)
   d. Pump Head: 88m water column

ii. Two nos. of 15 m long hose (RRL) as per IS 636 shall be provided for each external hydrant. These will be kept in hose box (fabric-reinforced plastic) along with branch pipe, nozzle (20mm bore size), spanner etc.

iii. All the hydrant valves, branch pipe, nozzles shall be of stainless steel

iv. The water based fire fighting system shall be designed, supplied & erected in line with the NFPA-20, FM. UL, TAC requirement. The details of the MVWS system have been dealt with separately.

c) Interplant Pipelines

Fire-fighting water network will be provided from FFPH to HVWS system ~~for 2 nos of 60MVA Generator Transformer GT#1 & 2~~ , 3 Nos of 20MVA, 31.5MVA and 10MVA of Power Transformer TR#1, TR#2 and TR#3 respectively in switchyard and and lub oil system of the proposed turbine located in the machine hall.

Water lines shall generally be laid over ground, preferably on civil pedestals.

d) ~~Fire Water Storage Tanks :~~

~~Two numbers each of 50% capacity fire water storage tanks shall be provided by the tenderer. The fire water storage tanks shall be vertical cylindrical steel tanks (as per IS 2062). The effective capacity (between High Level of fire water tanks and minimum low level of the tank above the suction pump line of the pump) of each of the fire water storage tank shall not be less the 400 Cu. M. Tenderer shall interconnect the same to each of the fire water tank through individual motorised/pneumatic operated isolation valve. It shall be ensured that this connection is only used during emergency by providing leak proof valves and the same shall be normally kept locked. The internal coating of three coats of epoxy painting over one coat of suitable primer and external coating of three coats of chlorinated rubber paint over one coat of suitable prime be provided for the fire water tanks. The outside surface of bottom plate resting on ground shall provided with three coats of coal tar epoxy based paint over a coat of primer. The discharge pipe each of the tank shall be interconnected through isolation valve. From the discharge headers, individual suction lines with isolation valve & strainer shall be provided for each of the pump. Each tank shall be provided with Level indicators, level transmitters. The instrumentation and control shall include annunciations of low level, very low level, high level, automatic opening of make up water connection at low level, closure of valves at high level automatic opening of make up water connection at low level, closure of valves at high level etc as per system requirement~~ .

~~06.09.04 Design Criteria~~

~~06.09.05 Pump House~~

~~The layout of the various equipment inside the pump house shall be designed by the tenderer keeping in view the safety of the personnel, accessibility of equipment and space for maintenance.~~

~~The Pump house shall be of civil construction, closed on all sides and shall be provided with minimum two entries. One of the entries shall be provided with rolling shutters having space provision of truck entry. Each pump house shall be provided with office room and toilet facilities with drinking water provision. Equipment layout including design load data, equipment foundation size, layout of pump house, details of electrics, cable layout etc shall be furnished by the Tenderer.~~

~~Structural platform with ladder shall be provided so that the valves can be easily accessible for operation and maintenance.~~

~~The reservoir(Sump) shall be designed as per the standard of Hydraulic Institute. Sump model tests shall be conducted, if necessary. The reservoir shall be compartmentalized in a way to facilitate maintenance of any of the pumps' suction valve while ensuring running of all working pumps along with one reserve pump ready to operate compartments with provisions to divert the entire flow from the cooling tower/ settling tank to either of the compartments when one of the compartments is under repair/maintenance. Sluice gates shall be provided for isolation of the compartments. The suction chambers / sump shall be provided with drain and overflow connections leading to the nearest storm water drain.~~

~~The pump house shall be provided with proper ventilation, electrics, illumination, instrumentation, telecommunication, wall clock and hoisting and handling equipment.~~

All the controls for the recirculation system and cooling tower shall be provided and the control panel shall depict the working condition of various units.

The electrics of the pump house shall be designed as per the specification given in the relevant chapter.

2T capacity Manual hoist to be provided at the pump house for handling of pumps.

The pump house shall be provided with suitable ventilation facilities.

The pump house shall be provided with necessary illumination facilities along with portable lamps.

All pumphouses shall have a welding transformer and two (02) nos of 24V transformers for head lamps.

The pumphouses shall be provided with a DN15 tapping of compressed air for service requirements. The compressed air shall be tapped from the existing plant network with due appurtenances viz- isolation valves at source and consumption point, strainers and moisture traps etc.

The scheme of make up water supply shall ensure maintenance of normal water level in the sump and prevent wastage through overflow. Level switch shall be provided in the sump which will actuate motor/solenoid operated gate valve on make up water line to the sump in order to maintain water level within a desired range. A bypass make up water line with float valve shall also be provided into the sump with isolating facilities. .

The pump house shall be provided with adequate drainage facilities with necessary side slope, channels, etc. leading to drainage sump of suitable capacity.

The pump house reservoir shall be provided with low level alarm and the pumps shall be provided with dry running protection.

Total no. of pumps for a particular group shall be selected in the following manners.

Final arrangement shall be decided by the Purchaser / Consultant during detailed engineering stage on case to case basis. In case of drainage pumps, there will be one reserve pump for one working pump.
Each pump shall be complete in all respects comprising the following:

Each pump shall have independent suction. The delivery line of each pump shall be connected to the main header with isolating header gate valves for isolating pumps' delivery valves; in case of space constraints butterfly valves may be used with Purchaser's / Consultant's approval. The following flow velocities shall be maintained for the pump suction and delivery branches.

Pipe Diameter	Suction side	Delivery side
Upto DN 150 mm	0.6 to 1.0	0.9 to 1.5 m/s
DN 200 mm to 450 mm	0.8 to 1.2 m/s	1.2 to 1.5 m/s
DN 500 mm to 1200 mm	1.0 to 1.2 m/s	1.5 to 2.2 m/s
Above 1200 mm	1.5 to 2.0 m/s	2.2 to 2.5 m/s

Each pump shall be provided with a Gate Valve on the suction side and a non-return valve and Gate Valve on the delivery side.

Each pump shall be provided with local indication of pressure on suction side and local indication and signaling of pressure on delivery side

Header shall be provided with suitable number of alves for isolating and maintenance purpose.

Header shall be provided with local indication of pressure and indication, recording and signaling of flow and temperature, which shall be depicted on the panel of the control room.

For drainage pumps two nos HSC, non-clog, self-priming centrifugal pumps of capacity
25 m3/h and adequate head with foot valve shall be provided. The pumps shall not be of mono-block design. The drainage pumps shall operate automatically based on water levels in the sump. The characteristics of the prime mover shall be same as described under the main pumps.

Dismantling / Rubber Expansion joints near the pumps on both suction and delivery lines and compensators on the main header shall be provided wherever necessary.

The pipe network and valves within the pump house shall be adequately supported so as to avoid undue stress on the pumps.

Minimum clear gap to be kept between equipment to equipment/ pipe should be 1000 mm, between equipment to wall should be 2000mm and between valves to wall should be1000 mm. If height of the equipment is more than 1m minimum gap should be not less than the height of the equipment.

Pump House Operation Philosophy

The following interlocks shall be provided, as applicable, in the operation of all the pumps, such that for the starting of any of the pumps:

- The level of the liquid in the pump house basin is higher than the low level,
- All the pumps shall be tripped when the low-low level is reached.

06.09.06 DESIGN CRITERIA FOR FIRE WATER PUMPS –

a. HORIZONTAL CENTRIFUGAL PUMPS:

All the pumps provided in the pump house shall be horizontal centrifugal type with flooded suction. For drainage pumps HSC, non-clog, self-priming centrifugal pumps of capacity 25 m3/h and adequate head with foot valve shall be provided. The pumps shall not be of mono-block design. As far as

practicable, pumps of reputed indigenous makes shall be preferred. Pumps shall be HSC SSSD type.

Pumps feeding water from river source to proposed reservoir will be negative suction head pumps. Negative Suction head pumps shall also be provided with foot Valves. However, in Fire Water Pump House all the other pumps shall be in positive suction.

Horizontal centrifugal fire water pump (electric driven) shall be connected to alternate power supply. The horizontal pumps shall be mounted on a common base plate with the motor and shall be directly coupled to the motor thorough a flexible coupling without any gear reducer.

The centrifugal pumps shall be suitable for discharging not less than 150% of the rated capacity at a head of not less than 65% of the rated head. The Shut off head shall not exceed 120% of the rated head.

The horizontal centrifugal pumps will be designed, manufactured and tested as per IS:1520-1980, IS:5120-1977 R.A.1991, IS:9137-1978 R.A.1993 or as per international standards acceptable to the Purchaser / Consultant and will be suitable for the required duty conditions and capacities.

The pumps and their auxiliary equipment shall be suitable for the required duty conditions and shall be designed and constructed for continuous duty at full load.

The centrifugal pumps shall be suitable for a capacity range of 25% to 125% of duty point capacity

The motor capacity shall have a margin over its BHP absorbed at the pump shaft at duty point and the margin shall be 25% for motors of rating upto 15kW, 20% for motors of rating 18.5kW to 160kW and 15% for motors of rating 200kW and above. The above margin shall be in addition to

temperature derating.

The pumps of kW rating more than 250 kW shall be of synchronous speed 1000 rpm/750 rpm. For pumps less than 250 kW motor rating, rpm shall not be more than 1500 (drive motor shall be 4 pole motor) unless otherwise specified.

The equipment and auxiliaries shall be designed for quick and economical maintenance. The equipment shall be easily dismantable without disturbing the suction and delivery pipe connections.

The equipment design shall incorporate provisions for reduction in noise level.

The rotating elements of the pumps shall be checked for critical speed in bending as well as in torsion. The critical speeds shall be at least 30% away from the normal speeds for units with flexible shafts and at least 20% away from the maximum operating speed in case of stiff shafts.

All passages inside the pump casing and impellers, which may be inaccessible to machining, shall be ground to a smooth finish as far as practicable.

The direction of rotation shall be clearly marked either by incorporating it on the casing or by separate metal plate arrow securely fitted to the casing.

- The head – Vs – discharge characteristics of the pump shall be continuously rising form the duty point to the shut off point without any zone of instability. The required duty range for a pump shall be on the stable portion of its head capacity curve close to the best efficiency point. The head developed at the best efficiency point shall be close to the required differential pressure so that throttling is not required at pump discharge. The power vs discharge characteristics shall be non-overloading type. The shut off head shall be minimum 20% /15 mWC (whichever is more) than the rated head of the pump.

- The pump flow rating shall have 10% margin over the process flow value.

- Pump motor shall be selected in such a way that tripping of a working pump will not result in run-out condition and overloading of running pump-motor.

- The pump shall be so selected and installed that the available NPSH is not lower than the required NPSH even in the most adverse operating conditions.

- The pump shall be of proven make and design having material of construction which is the best of its kind for the particular application and shall be manufactured using

best engineering practices under strict quality control. Each pump shall be tested as per the standards stipulated elsewhere in this document. The test shall include hydrostatic test, static and dynamic balancing tests, performance tests material tests and motor routine tests.

- The pump shaft and bearing shall be adequately sized to take the unbalanced forced due to mal-operation. The pump gland shall ensure proper sealing without excessive tightening of the packing. Proper cooling and flushing arrangement for the gland shall be provided wherever required.

- All moving parts of the pump shall be adequately guarded to prevent any injury to operating personnel.

- Pumps shall be designed and installed keeping in view the easy accessibility of its parts for maintenance. All end suction pumps shall be of back-pull-out design and shall be provided with spacer coupling of adequate length.

- Mechanical seals shall be provided at all pumps envisaged for closed loop circuit as specified by the Purchaser/Consultant during detailed engineering. .

- Minimum no. of standby pump shall be provided for each group of clear water pumps and drainage pumps as specified in the design criteria for pump house. The group of Pumps for scale water or other abrasive slurries shall be provided with at least two standby units. Special abrasion resistant material shall be used for these pumps and the design shall allow easy replacement of parts subject to wear and tear.

- An isolating valve shall be provided on the suction line of each pump and another isolating valve together with a non return valve shall be provided at the delivery line of each pump. Pressure gauges shall be provided at the suction and delivery flange of each pump.

- The suction pipeline shall be laid at a constant down ward slope from pump centre line to the suction chamber. Reducers used in the line shall be eccentric type to keep the top of the suction line straight.
- Each pump shall be provided with adequate safety interlocks including overload and dry running protection.

- Dismantling joints shall be provided on the delivery side of large size pumps to facilitate quick maintenance, wherever required.

- All pumps shall be provided with suitable lifting attachments and each pump installation shall have suitable handling facilities.

- A clear minimum gap of 800 mm shall be maintained between the pump and the adjacent piping, other equipment or structures for proper movement. In case the height of the top most part of the pump from the working floor is more than 1.0 m, the minimum clearance shall be increased to 1000 mm.

- The details of pumps should match with the drive motors throughout the working life of these equipments and to meet operational requirement. Working hour meter shall be provided on control panels to monitor conditions and subsequent ageing/ reduced efficiency, etc.

- Vibration readings, etc. of new installation shall be supplied.

- Pumps shall be installed and commissioned as per manufacturer's instructions. A continuous running for 72 hours shall be required before final acceptance is given to the pumping installation.

b. MATERIAL OF CONSTRUCTION FOR PUMPS

HORIZONTAL CENTRIFUGAL PUMPS:

Sl	**ITEM**	**MATERIAL**
a)	Casing	CI IS: 210 FG260
b)	Impeller	CF8
c)	Shaft	En8 /
d)	Shaft sleeve	SS410
e)	Wearing rings	CI FG 220 / CF8
f)	Shims & packings	Brass IS: 442
g)	Neck ring	CI FG 260 / CF8
h)	Lantern ring	CI FG
i)	Gland	CI FG
j)	Bearing end cover	CI FG
k)	Bearing Housing	CI FG
l)	Coupling Pump & motor	CI FG
m)	'O' rings	Nitrile Rubber
n)	Sleeve nuts	SS
o)	Cowl nuts	SS41
p)	Base plate	MS Fabricated

The above MOC is for guidance, MOC of all pumps will be subjected to Purchaser's /Consultant's approval during detailed engineering.

c. DIESEL ENGINE FOR PUMPSET

General

- The diesel engine shall be complete with all standard accessories, battery sets, battery charger, instruments & control panel, base frame etc.

- The diesel engine shall be compression ignition mechanical direct injection type, capable of being started by a battery powered electric starter motor, and shall accept full load within 15 seconds from the receipt of signal to start.

- The diesel engine shall be natural aspirated, super charged or turbo charged and either air or water cooled. In case of charge air cooling by means of a belt driven fan or of a belt driven auxiliary water pump, there shall be multiple belts such that half the belts should be capable of driving the fan or pump.

- The diesel engine shall be capable of operating continuously (24 hours) on full load.

- The diesel engine shall be provided with an automatically adjustable governor to control the engine speed with 10% of its rated speed, under any condition of load up to the full load rating. The governor shall be set to maintain rated pump speed at maximum pump load.

- The diesel engine shall be provided within in built tachometer to indicate the speed of the engine in rpm.

- Any manual device fitted to the engine, which could prevent the engine starting, shall return automatically to the normal position.

- Engines after correction for altitude and ambient temperature shall

have bare engine horsepower rating of 10% in excess of maximum horse power required to drive the pump at its duty point.

- The coupling between the engine and the pump shall allow each unit to be removed without disturbing the other.

Cooling System

- The engine shall be cooled by water from the discharge of the pump (takes off prior to the pump discharge valve) direct into the engine cylinder jackets via a pressure reducing device to limit the applied pressure to a safe value as specified by the engine manufacturer. The outlet connection from this system shall be terminated at least 150 mm above the engine water outlet pipe and be directed into an open tundish so that the discharge water is visible.

- The discharge from the engine shall be collected and drained into the nearest drainage channel.

Air Filtration

The air intake system ensures sufficient clean air to the engine. It shall incorporate the suction air filter, which shall be of oil bath type to supply clean air to the engine.

Exhaust System

The hot exhaust gases shall be let off with suitable system. All the hot parts located at the working level shall be insulated. The exhaust system shall include:

- Exhaust manifold

- Silencer: The exhaust gas shall be let off through suitable silencer. The total back pressure shall not exceed the engine manufacturer's recommendation. Sufficient length of straight pipe shall be provided

after the exhaust silencer to leave the gases at sufficient height above the engine and outside the engine room.

- Expansion joint in SS construction to reduce the forces and moment likely to be transmitted on the engine frame.

Fuel System

- Fuel for the engine shall be high speed diesel oil as per IS : 1460 – 1974.
- Fuel tank and fuel feed pipe shall be provided for the engine.
- The fuel tank shall have the capacity sufficient enough to allow the running of the engine at full load for 3 hours.
- The fuel tank shall be of welded steel construction. The tank shall be mounted above the engine fuel pump to give gravity feed. The tank shall be fitted with a level gauge calibrated in liters, filling in and cleaning hand holes, drain cocks, self supporting from and connection to the engine fuel oil system.
- Valves in the fuel feed pipe between the fuel tank and the engine shall be placed adjacent to the tank and they shall be located in open position. Plastic tubing shall not be used.
- A duplex filter to suitable capacity shall be provided for the fuel feed pipe between the fuel tank and fuel pump.
- Suitable sludge and sediment trap shall be provided for the fuel feeding system.
- The fuel tanks shall be supplied with hand pump for tapping the fuel tank from oil barrel.

Lubricating System

The lubrication system shall be self contained with the following equipment.

- Sump: To store sufficient lube oil for circulation, suitable sump shall be located in the engine.
- Pump: Suitable pump for forced lubrication.
- Filter
- Lubricating oil cooler
- Interconnecting piping & tubes in seamless construction.

Starting System

The engine shall be capable of manual starting by electric starter motor. Since the pump driven by the diesel engine is not required to run continuously for long period and the operation will not be frequent, special features shall be built in the engine to allow it to start within a very short period, even if it has been remained idle for a considerable long period.

The engine shall be designed in such a way that is shall be started by one operator, if necessary, without any preliminary heating of the combustion chamber. All controls/mechanism, which has to be operated in the starting process, will be within easy reach of the operator.

Automatic cranking shall be effected by a battery driven 24V DC motor having high starting torque to have adequate ampere hour capacity to provide the starting power for the diesel engine. A control panel for starting of the engine through battery to be provided. Engine START/STOP/TEST buttons shall be provided on control panel. The battery capacity shall be adequate for ten (10) Consecutive starts without recharging with a cold engine under full compression.

The battery shall be used exclusively for starting the diesel engine and kept

fully charged all the time. Arrangement for both trickle and booster charge shall be provided. However, when the engine starts or is running, provision shall be kept to ensure that the charger is automatically disconnected and the battery is charged by the engine dynamo. At no times it should happen that the battery gets disconnected and is not available to start the engine.

The charger shall give constant D.C output voltage irrespective of incoming voltage variation specified. The charger shall be with fully controlled bridge circuit with diodes.

Governing System

The governor shall be fitted with a speed control device, which will control the speed under all conditions of load.

The governor shall offer the following features:

Engine should be provided with an adjustable governor capable of regulating engine speed within a range of 10% between shut off and maximum load condition of the pump. The governor shall be set to maintain rated pump speed at maximum pump load. Engine shall be provided with an over speed shutdown device. It shall be arranged to shut down the engine at a speed approximately 20% above rated engine speed and for manual reset, such that the automatic engine controller will continue to show an over-speed signal, until the device is manually reset to normal operating position.

The governor shall be capable of operating without external power supply.

Foundation Frame

Suitable foundation frame with foundation bolts & nuts shall be provided.

~~**Instruments**~~

~~The equipment shall be provided with necessary instruments to check the working of the engine continuously. The following instruments shall be minimum which will be provided and the same shall be fixed on a common instrumentation panel mounted directly on the engine base frame:~~

- ~~Lubricating oil temperature indicator.~~
- ~~Lubricating oil pressure indicator.~~
- ~~Cooling water inlet temperature indicator.~~
- ~~Cooling water outlet temperature indicator.~~
- ~~Speed cum hour meter.~~

~~The pressure and temperature gauges shall be of reputed make. The following protections annunciation also shall be provided.~~

~~a. High cooling water outlet temperature~~
~~b. Low lubricating oil pressure~~

~~Any other instrument, control and protection equipment required for the safe operation of the engine shall also be provided.~~

~~All the pressure gauges, pressure transmitter, pressure switches etc. where viscous fluid enters inside the instruments shall be provided with diaphragm sealed flanged process connection with flanged isolation valves.~~

06.09.07 DESIGN CRITERIA FOR VALVES:

Flow control /isolating valves, drain valves, air release valves and Compensators, wherever necessary, shall be provided for the complete in-shop pipe network.

All valves shall be suitable for service conditions i.e. quality of fluid, flow

temperature and pressure under which they are required to operate.

Valves shall be provided on pipe network for isolation of pipe section and equipment, control of pressure and flow, venting, draining etc. They shall be suitable located considering ease of operation and maintenance.
All valves shall be provided with hand wheel and position indictor. The face of each hand wheel shall be clearly marked with words “Open” and “Shut” with arrows adjacent to indicate the direction of rotation.

Valves shall be provided with suitable extension spindle and head stock assembly wherever required. In case gears or bevel system are used , these shall be of cast steel or suitable grade cast iron with machine cut teeth

Non-return valves shall be Dual Plate zip check type and shall have a permanent “Arrow” inscription on its body to indicate direction of flow.

Larger size valves shall be provided with by pass and drain arrangement.

Float operated valve shall be preferably be right angled pattern complete with ball float, level and other accessories.

Butterfly valves shall be of quotable flanged, tight shut of design with angular travel of 90 deg. from open to shut off position.

Specifications for valves

A) Specification for sluice valves- Manual Operated

1.	Type	Rising spindle type sluice valves for water works
2.	Body & Cover	CS ASTM A216 Gr WCB
3.	Disc	ASTM A216 Gr WCB Face ring 13% Cr steel
4.	Body seat ring	13% Cr. Steel
5.	Handwheel	CI, IS: 210 FG 260
6.	Pin	Stainless Steel, AISI-410
7.	Stem	SS, IS: 6603, 12 Cr 13 04 Cr 18 Ni 10
8.	Gaskets	Neoprene rubber
9.	Gland packing	Rubber
10.	Gear	Alloy Steel, IS: 1570, 40Ni2Cr1MO28Gr B

11	Gear housing	Cast Steel, IS: 1030, 230-450 W
12	Pinion & pinion shaft	SS, IS: 6603
13.	End connections	Flanged to be drilled as per IS:6392-1971 (RA 1998) relevant
14.	Pressure rating	As per system requirement, minimum PN =1.0 N/mm2
15.	Manufacturing Standard	IS-14846-2000/ equivalent international standard
16.	Hydro static testing	As per manufacturing / testing standard
17	Test certificates	Required for material/hydro test
18.	Service	Water
19	Max. operating temp	100 Deg ^{O}C
20.	Type of operation	Upto DN300- Manual Beyond DN350 - Gear operated
21.	Operation	Manual / Pneumatic(As and where specifically mentioned)

B) Specification for ball valve / Full bore / 2 Way / 3 Way

1	Type	three piece, full bore, floating ball, PTFE seated
2	Body, Cover & Gland	CS as per ASTM A216 WCB
3	Ball	SS (ASTM A 351, Gr. CF 8M) with PTFE impregnated,
4	Stem	AISI 316
5	Fasteners	HT, SS 304 only
6	Gland Packing	35% Carbon Filled PTFE/ Graphite
7	End connection	Socket welded / Flanged
8	Pressure rating	As per system requirement, minimum PN = 1.0 N/mm2
9	Manufacturing Standard	BS 5353/API 599
10	Test certificates	Required for material/hydro test
11	Service	water
12	Max. operating temp	100 Deg ^{O}C
13) Remarks- Socket weld connection with nipple pipe of 100mm welded on all openings		

C) Specification for air release valve

Air release valves shall be cast iron, single large orifice type, with flanged ends. Air release valve shall conform to IS: 14845-2000.

1	Type	Air release valves shall be cast iron, type S1 & S2 upto diameter 50 mm and type DS1 above diameter 50 mm and upto diameter 200 mm IS: 14845-2000.
2	Body	CI FG 210 as per IS:210
3	Body seat ring	Gun metal IS:318 LTB-2
3	Float	Timber core with vulcanite/ rubber coating
4	Disc	Gun metal IS:318 LTB-2
5	Stem	SS, IS: 6603, 04Cr17
6	Disc nut	Gun metal IS:318 LTB-2
7	Bolts/studs, nuts	Carbon steel IS:1367
8	Gland	CI FG 200 as per IS:210
9	Gland packing	Graphite asbestos/ jute/ hemp
10	Air release nipple	Gun metal IS:318 LTB-2
11	Gasket	Compressed asbestos Fiber 3 mm thick
12	Rubber ball	Vulcanite Ebonite
13	End connection	Screwed up-to DN40 and flanged for DN50 &
14	Pressure rating	As per system requirement, minimum PN = 1.0
15	Test pressure	As per manufacturing / testing standard

D) SPECIFICATION FOR COMPANION FLANGES

1	Type	Raised face plate flanges, Slip-on, welded, plate fabricated, machined finish.
2	Dimensional Standard	As per IS-6392-1971(RA'88), PN=1.6 /1.0 N/mm2 as per valve rating, Table-17/11, drilled off centre, RF.
3	Material	C.S as per IS-2062 -1992 GR.A.
	Note: Valve flanges and matching flanges shall be drilled as per IS:6392-1971 (RA'1988), table 17 for PN 1.6.	

E) Motor specifications

1	Make & Type	ABB/NGEF/BHARAT BIJLEE/KEC/ APPROVED & 3 PHASE,4 WIRE, SQUIRREL CAGE, INDUCTION MOTOR
2	Supply Conditions	415 V AC + 10%, 50 C/S + 3% -6%
3	Control Voltage	240 V

4	Protection	IP-65
5	Enclosure	TEFC
6	Duty Condition	S2, 30 MINUTES
7	Class of Insulation	'F' Temperature rise limited to class-B
8	No. of Starts/hr Allowed	60
9	Design Performance	As per IS:325-1996
10	Breakdown Torque	Minimum 2.5 TFL or higher

F) Specification for cast steel dual plate zip check valve

1	Type	Dual Plate Zip Check Valve
2	Body	ASTM A 216 Grade WCB
3	Plate	ASTM A 351 Gr. CF8 M (SS 316)
4	Stop Pin	AISI SS 410
5	Hinge pin	AISI SS 410
6	Spring	INCONNEL
7	Retainer	CF8M (SS 316)
8	Body Bearing	AISI SS 316
9	Plate Bearing	AISI SS 316
10	Spring Bearing	AISI SS 316
11	Eye Bolt	Carbon Steel
12	Body Seal	EPDM
13	Plate Seal	Integral
14	Body Test Pressure	450 psi (g)
15	Seat Test Pressure	320 psi (g) (Max.) / 285 psi (g) (Mini)
16	Design Standard	API 594
17	Dimensions	As per API 594
18	Testing	As per API 598
19	Special features required	1. Arrow indicating the flow direction. 2.Embossed name plate giving details of tag No. size, etc.
20	End Connections	• Wafer type upto DN200mm, • Flanged ends for size DN250 and above.
21	Service	Water

G) Specification for ball float valve

1	Type	Single - beat type with balancing piston
2	Body/Cover/Gland/Piston	Cast iron Gr 200 as per IS 210-1993
3	Seat ring/valve guide	IS 318 Gr 2
4	Pilot valve seat/face cap/spindle	IS 318 Gr 2
5	Links	M.S. cadmium plated
6	Face ring/piston cups	Leather
7	Lever	M.S.
8	Float	Tinned copper

9	Pressure rating	As per system requirement, minimum PN = 1.0
10	End connections	Flanged end, IS:6392-1971(RA'88) 50 mm and above . Screwed end upto 40 mm. Threading as per IS: 554/BSP Thread.
11	Hydrostatic testing	As per manufacturing / testing standard
12	Service	Makeup/Drinking/fire/ service water .

Design criteria for sluice gates

06.09.08 EQUIPMENT SPECIFICATION

Sluice gates shall be supplied as per IS: 3042-1965. Gear box arrangement shall be of open type for small size and closed type for sizes above 400mm size.

All assembly bolts/ studs, nuts, anchor, bolts and washers are acceptable in stainless steel construction to AISI: 304/ AISI: 410.

Sealing of single face is acceptable. Accordingly, leakage test shall be performed to ensure committed leakage for seating head only applied for unseating side.

Item Nos. of all the gates shall be punched on the gate (at an easily identifiable place) before dispatch.

a. DATA FOR DESIGN OF SLUICE GATES

i) Type of Mounting : Wall mounted type with head stock. Headstock shall have geared handle for operation.

ii) Spindle type: Rising Spindle.

iii) Design code: Sluice gates shall be generally as per IS: 3042; 1965 (Reaffirmed 1998). Wedges shall be provided on the sides to ensure maximum water tightness.

MATERIAL OF CONSTRUCTION

Sl No.	Compo nents	Material
1.	Gate frame, shutter	Stainless steel , ASTM A276 Gr A, AISI:316
2.	Resilient rubber seal	Neoprene rubber
3.	Rubber seal retianer bar	Stainless steel , ASTM A276 Gr A, AISI:316

4.	Seat facing/ sealing face	Naval brass IS291, Gr 2
5.	Stem & hinge–pin	Stainless steel , ASTM A276 Gr A, AISI:316
6.	Coupling	Cast iron, IS210, FG260
7.	Operating nut/stem nut	Leaded tin bronze, IS318, LTB2
8.	Headstock, stemguide bracket stopnut	Cast iron, IS210, FG260
9.	Fasteners & studs	Stainless steel , ASTM A276 Gr A, AISI:316
10.	Anchor bots	Stainless steel , ASTM A276 Gr A, AISI:316
11.	Yoke	Mild steel IS2062, GrA
12.	Hand wheel	M S

b. **DESIGN CRITERIA FOR PIPE WORK**

The term pipe work referred herein generally cover pipes, fittings (such as bends, tees, reducers, plugs, nipples, sockets, unions, flanges, crosses etc.), valves of various types

and functions (such as gate, globe butterfly, plug, ball check, diaphragm, electrically operated, pressure reducing valves, etc.) strainers, filters, hoses, hose couplings hose clamps, hose nozzles, fire hydrant assemblies, pipe supports, corrosion protection etc.

Pipe work is intended to convey fluids such as different qualities of water and industrial effluents.

The pipe work shall be designed, manufactured, assembled and tested as per the latest standards, codes and recommendations of the Bureau of Indian Standards, ANSI, ASTM, AWWA, or other equivalent international standards. Pipe work shall be complete in all respects including all accessories essential for proper installation, operation and maintenance, even though such items are not specifically mentioned in the specification.

Piping system shall be designed with high degree of reliability so that the systems perform the duty of fluid handling without any failure under all conditions of plant operation.

Piping layout must follow good engineering practice. Proper attention shall be given to obtain full functional requirement of the piping system with a layout which provides sufficient clearance for other equipment and operating personnel, easy access for operation and maintenance, convenient supporting points and neat appearance.

Complete design of piping system shall be subject to approval by the Owner/ Consultant.

The design shall take into account the effect of internal/ external pressure, thermal expansion, self weight of piping, support reactions, surge and water hammer, earthquake and wing effects at site, corrosion and erosion etc. and any other effects dictated by good engineering practices

Each consumer in a circulating system shall be provided with double header. Each header shall be provided with suitable number of valves for isolating and maintenance purpose. The delivery valves of the pumps should be able to be isolated for maintenance by means of header valves without affecting the availability of other pumps. The Piping systems shall not impose undue forces on equipment terminals.

Mild steel pipelines shall be used in general for water supply facilities Material of pipes selected shall be indicated by the Tenderer in the offer and the same will be subject to Purchaser's/ Consultant's approval.

Pipelines shall be generally laid over ground on the civil trestles, All openings in the piping shall be kept effectively closed until assembled in the system to avoid foreign matter entering into the system.

As far as possible all the pipelines shall be laid together along the piping corridor. The piping corridor shall be parallel to and by the side of roads.

The entire pipe network shall be provided with manually operated valves for

isolation/controlling purpose.

The pipe network shall be provided with air release valves at high points and drain valves at the lower points.

Pipeline passing under or through equipment foundations or walls of buildings or any other inaccessible structure shall be provided with steel encasing pipes for easy insertion and removal.

All the pressure pipes shall be laid with a nominal slope and the gravity network with slope of self-cleaning velocities.

Continuous welding MS pipes shall be used for water supply facilities.

Except where otherwise specified, all piping shall have butt welded connections with a minimum of flanged joints for connections to equipment. Branches shall in general, be formed by welding.

Provision shall be made for branches for cleaning and flushing of pipelines wherever necessary.

Manholes shall be provided in the gravity pipe networks and the distance between two manholes shall be 30m depending upon the pipe size.

Compensators shall be provided on the over-ground pipe network to take care of thermal expansion. Compensators to be provided will conform to relevant IS/ IPSS.

Wherever over-ground pipelines are crossing roads and railway tracks, they shall be laid on pipe bridges to provide the necessary clearance for the traffic movement. This should take in to account the various type of vehicles likely to move in the plant.

Valves provided on the over-ground pipe network shall be provided with steel structural platforms and access ladders.

Walkable platforms with necessary hand rails shall be provided by the side of overhead slime troughs and open gravity network, wherever necessary.

Provision shall be made for support of piping which may be disconnected during maintenance work. All large pipes and all long pipes shall have at least two supports each arranged in such a way that any length of piping or valve may be removed without any additional supports being required.

Pipe supports shall be capable of supporting the pipelines under all conditions of operation.

Air release valves shall be provided at the highest points of each sector of the pipeline and drainage valves shall be provided at the lowest points of each sector of the pipeline.

In case a number of pipes are crossing road or track, these pipes shall be laid in a reinforced concrete culvert having easy access.

Wherever gravity drainage of premises is not feasible, suitable drainage pit shall be provided for collection of drain and stray effluents. Minimum two drainage pumps as specified above shall be provided for automatic operation based on the drainage pit water level. The level control equipment for automatic operation shall consist of the following :

a) level indication,
b) low level to stop the pump(s),
c) high level to start the first pump,
d) high-high level to start the second pump,
e) high-high-high level for alarm annunciation

06.09.09 Fire Hydrant

Landing valve/ yard hydrant shall be as per IS: 5290, Type-A.

The hose cabinet shall be fabricated out of fiber reinforced plastic (thickness 2.5 mm) of size 750 mm x 600 mm x 250 mm. The top shall have pressed edge slightly projecting outside to prevent water (while cleaning etc.) from entering the cabinet. The cabinet shall be fitted with glass fronted door. The door shall be provided with a knob and a lock with duplicated key on the body of the door with a glass cover. The glass of the key box shall be easily replicable. Suitable hooks, etc, shall be provided in the cabinet to hold the hose reels etc. mentioned above. Suitable wall mounting bracket shall be provided with the cabinet. The Tenderer shall provide a fully dimensioned general arrangement drawing indicating materials of construction, relevant specifications, etc.

General specification of Hydrants to be provided by the Tenderer is given below. However, the quantities of all the items will be provided by the Tenderer as per requirement and approval of Purchaser/Consultant without any price implication.

Each hydrant shall be provided with 15m long delivery hose (Type B IS636) with SS coupling and accessories.

Sl. No.	IS no.	Description	Quantity
A.	**YARD HYDRANT**		
1.	IS:5290 Type-A (1993)	Fire hydrant (landing valves) single outlet oblique type of 75mm flanged inlet, 63mm outlet with hand wheel, Instantaneous bronze female coupling at outlet and blank cap.(Stainless Steel)	-do-

Sl. No.	IS no.	Description	Quantity
2.	IS:6392 Table-18 (1971 R.A.1988)	MS matching flange DN 80 (Slip-on type)with bolts, nuts & gaskets for the above hydrants	-do-
3.		Hose cabinet with glass front (suitable for outdoor installation, One number Hose box for each landing valve to keep 15 m long hoses (2 Nos.), branch pipe, nozzle and spanner)consisting of the following	
a)	IS:636 Type-B (1988) & IS:903 (1984 R.A.-1990)	Reinforced rubberised fabric lined flexible canvas hose of 15m length having 63mm dia, each fitted (as per IS:1648 -1961) with instantaneous male Coupling at one end and female Coupling at the other end including intermediate coupling for joining 1x15m long hose.	-do-
b)	IS:903 (1984 R.A.1990)	One branch pipe (Stainless Steel)	-do-
c)	-do-	One 25mm nozzle (Stainless Steel)	-do-
d)	-do-	One nozzle spanner (Stainless Steel)	-do-

06.09.10 Standards

~~Sl. No.~~	~~Standard~~	~~Equipment~~
~~1~~	~~IS:1520 : 1980~~	~~Horizontal centrifugal pumps for clear, cold & fresh water~~
~~2~~	~~IS:5120: 1977 RA91~~	~~Technical requirement for roto dynamic special purpose pumps~~
~~3~~	~~IS:9137 1978 RA93~~	~~Code of acceptance tests for centrifugal, mixed flow and axial pumps~~

Sl. No.	Standard	Equipment
4	BS 5351	Steel ball valves
5	IS 780:1984 (RA 1990)	Sluice valves for water works
6	IS 2906:1984(RA 1990)	Sluice valves for water works DN 350 to 1200
7	IS 4038:1986(RA 1990)	Foot valves
8	BS 5158 / AWWA C504	CI & carbon steel plug valve for general purpose
9	IPSS-1-06-019	Air release valve
10	IPSS-1-06-001	Foot valves
11	IS 1239(Partl) :1990	Mild steel tubes & fittings
12	IS 1239(PartII):1992	Mild steel fitting
13	ANSI B 31.1	Code for pressure piping
14	ANSI B 16.9	Butt welded fittings
15	ANSI B 16.11	Forged steel fittings : Socket welded & threaded
16	IS 3589:1991	Electrically welded steel pipes for water, gas, and sewerage (DN 200 to 2000 mm)
17	IS 5504:1969(RA 1990)	Spiral welded pipes
18	IS 6392:1971(RA 1988)	Steel pipe flanges for water, oil, steam etc.
19	IS 2712:1979 RA94 BS 2815	Specification for compressed asbestos fiber jointing

06.09.11 Erection, Testing and Commissioning

i. The erection of all plant and equipment shall be carried out according to the latest engineering practices and according to the drawings, specifications, Instructions etc. duly approved by the Purchaser/Consultant.

ii. The welding work should be carried out as per the approved WPS and PQR.

iii. The Tenderer shall supply all required manpower, tools and related equipment, all hoisting equipment, all necessary scaffoldings, all necessary transporting equipment, consumables. Construction and erection materials, petrol, diesel oil, kerosene, solvents, sealing compound, tapes, brazing and soldering materials, welding and brazing gases, erection bolts, nuts and packing sheets/compounds, temporary supports, wooden blocks, spacers, templates, jute and cotton wastes, sand/emery paper etc. as required for the satisfactory completion of work.

iv. On completion of the work, the Tenderer shall remove and dispose off all rubbish and other unsightly materials caused by his working to a distance of five kilometer from the proposed project including MV System units or as directed by the Purchaser and thereby leaving the premises in good, clean, safe and operable condition.

v. Before giving call for final inspection, all the documents shall be furnished to the Purchaser. The record of manufacturing details, inspection and tests carried out by the successful Tenderer shall be made available to the final inspecting authority. However, approval and final inspection at the manufacturing works shall not relieve the successful Tenderer of responsibility of replacing at his cost any defective part/material which may be detected by the purchaser during erection and commissioning or guarantee period.

vi. All materials required for fabrication, construction, testing and inspection shall be supplied by the Tenderer. No material shall be free issue to the Tenderer.

vii. No equipment or part item shall be dispatched without final inspection and issuance of inspection certificate.

viii. All equipment, assemblies, sub-assemblies shall be shop tested as per relevant standards and the test certificates shall be submitted by the supplier.

SECTION 3

PROJECT DETAILS AND GENERAL TECHNICAL REQUIREMENT

1. General

1. This section stipulates the general technical requirements under the contract and will form integral part of the technical specification.

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

2. Project Details

Panchet reservoir is one of the four multi-purpose reservoirs included for construction in the first phase by Damodar Valley Corporation (DVC). It was constructed across the Damodar River at Panchet in Dhanbad district of Jharkhand state and was opened in the year 1959.

The Station has an installed capacity of generating 80 MW power with two (2) generating units of 40 MW each. The hydel power station started in 1959 with one unit of 40 MW (Unit # 1).

The second unit of 40 MW (Unit # 2) was commissioned in 1991, Unit # 1 of Panchet Hydel Station has outlived its service life and is operating at de-rated capacity. As such, M/s DVC decided to renovate, modernized and up-rate the Unit # 1.

Sl. No.	Description	Particulars
1	Customer	Damodar Valley Corporation
2	Consultant	MECON Ltd.
3	Project	1x 46 MW (RMU) Panchet HPS
4	Project location	At border of Dhanbad and Purulia districts of Jharkhand and West Bengal Kumardubi Railway station: 10 Km (approx.) Asansol Railway station: 25 Km (approx.) Dhanbad: 50 Km (approx.)
5	Transport facilities	Connected by road, rail with other parts of the country.

3. Instruction to Bidders

1. The bidders shall submit the technical requirements, data and information as per the technical specifications provided in the bid documents.
2. The bidders shall furnish catalogues, engineering data, technical information, design document, drawings etc fully in conformity with the technical specification.

3. It is recognised that the contractor may have standardised on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to the owner. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously; All deviations from the specification shall be clearly brought out in the respective schedule of deviations. Any discrepancy between the specification and the catalogues or the bid, if not clearly brought out in the schedule, will not be considered as valid deviation.
4. Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the technical specifications unless include in the list of exclusions. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the switchyard shall be deemed to be included in the scope of the specification. All similar standard components/parts of similar standard equipment provided, shall be inter changeable with one another.
5. Unless brought out clearly in the respective schedule of deviations, it will be considered that, the bid proposal scrupulously confirms compliance to the specification. The bidder must bring out all the deviations in the bid proposal.
6. In case there is a discrepancy between the data offered equipment and catalogue furnished, and unless the deviations are brought out clearly in the Technical Deviation Schedule, the equipment will be deemed to conform compliance to the specification scrupulously.

4. Standards

1. The works covered by the specification shall be designed, engineered, manufactured, built tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.
2. The equipment to be furnished under this specification shall conform to latest issue with all amendments of standard specified of this section as well as under respective Sections/Chapters of the specification.
3. In addition to meeting the specific requirement called for in the respective sections of the Technical Specification, the equipment shall also conform to the general requirement of the relevant standards and shall form an internal part of the specification.
4. The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intend to complement each other.
5. The Contractor shall also note that list of standards presented in this specification is not complete. Wherever necessary the list of standards shall of the specification shall take precedence.
6. When the specific requirements stipulated in the specification exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.
7. Other internationally accepted standards which ensure equivalent or better performance than that specified in the standards referred shall also be accepted.
8. In case governing standards for the equipment is different from IS or IEC, the salient points of difference shall be clearly brought out in deviation sheets along with English language version of standard or relevant shall be subject to Owner's approval.
9. Indicative List of Standards and Specifications General Standards Indian Electricity Rules shall be as per Annexure- A.

5. Services to be performed by the Equipment being furnished

1. The 220/33 kV system is being designed to limit the switching surge over voltage and the power frequency over voltage within limits of IEC. The equipment furnished under this specification shall perform all its functions and operate satisfactorily without showing undue strain, re-strike etc. under such over voltage conditions and in system where line lengths would extend up to 200 km.

2. All equipment shall also perform satisfactorily under various Electro-mechanical and meteorological conditions of the site of installation.
3. All the Equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, short circuit etc for the equipment.
4. The bidder shall design the various forces for terminal connectors of the equipment are required to withstand.
5. The equipment shall also comply to the following:
   - All outdoor EHV equipment shall be suitable for hot line washing.
   - To facilitate erection of equipment, all items to be assembled as site shall be "match marked". All piping, if any between equipment control cabinet operating mechanism to marshalling box of the equipment shall bear proper identification to facilitate the connection at site.

6. Engineering Data

1. The furnishing of engineering data by the Contractor shall be in accordance with the schedule for each set of equipment as specified in the technical specifications.
2. The review of these data by the owner will cover only general conformance of the data to the specifications and documents, interfaces with the equipment provided under the specifications, external connections and of the dimensions which might affect substation layout. This review by the owner may not indicate a thorough review of all dimensions, quantities and accuracy of the information submitted. This review and/or approval by the owner shall not be considered by the Contractor, as limiting any of his responsibilities and liabilities for mistakes and deviation from the requirements, specified under these specifications and documents.
3. All engineering data submitted by the Contractor after final process including review and approval by the owner shall from part of the Contract Document and the entire works performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the owner in Writing.
4. LIST OF DOCUMENTS

   4.1 The bidder must furnish a detailed list of drawings/documents along with the bid proposal which he intends to submit to the owner after awarded of the contract.

   4.2 The supplier shall necessarily submit all the drawings/ documents unless anything is waived. The supplier shall submit required sets of drawings/design documents/test reports as may be required for the approval of the owner.

   4.3 All engineering data submitted by the Contractor after final process including review and approval by the Owner shall from part of the Contract Document and the entire works performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the owner in Writing.

5. DRAWINGS

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

5.2 Each drawing submitted by the Contractor shall be clearly marked with the name of the Owner, the unit designation, the specifications title, the specification number and the name of the Project. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

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

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

5.5 APPROVAL PROCEDURE

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Owner would be discussed and finalised at the time of award. The supplier shall also submit six (6) copies of all drawings/design documents/test report for approval of the Owner.

NOTE: The contractor may please note that all resubmission must incorporate all comments given in the submission by the Owner failing which the submission of documents is likely to be returned.

5.6 The drawing which are required to be referred frequently during execution should be submitted on cloth lined paper.

5.7 OTHER REQUIREMENTS OF DOCUMENTATION

5.7.1 One set of soft copy of all drawings, manual, catalogues to be submitted along with 6 sets of hardcopies during submission of as built documents.

5.7.2 6 copies of instruction/operation manuals for complete project shall also be furnished. The instruction Manuals shall contain full details of drawing of all equipment being supplied under this contract, their exploded diagrams with complete instruction for storage, handing, erection, commissioning, testing, operation, trouble shooting, servicing and overhauling procedures.

5.7.3 If after the commissioning and initial operation of the substation, the instruction manuals require any modifications/additions/changes, the same shall be incorporated and the updated final instruction manual in the form of one (1) reproducible original and twelve (12) copies shall be submitted by the Contractor to the Owner.

The Contractor shall furnish to the Owners, twelve (12) sets of spare part catalogue.

5.8 TITLE BLOCK

Title block for project shall be as follows,

Customer:	Damodar Valley Corporation
Consultant:	MECON Ltd.
Contractor:	Bharat Heavy Electricals Ltd.
Project:	1x 46 MW (RMU) Panchet HPS

7. Colour Scheme and Codes

1. The contractor shall propose parts a colour scheme for those equipment/ Items for which the colour scheme has not been specified in the specification, for the approval of Owner. The decision of Owner shall be final. The scheme shall include,

- Finishing colour of Indoor equipment.

- Finishing colour of Outdoor equipment.
- Finishing colour of all cubicals.
- Finishing colour of various auxiliary system equipment including piping.
- Finishing colour of various building items.

2. All steel structures, plates etc shall be hot dip galvanised or painted with noncorrosive paint on a suitable primer as per the provisions of the respective Section. It may be noted that normally all Owner's electrical equipment in Owner's switchyard are painted with shade 631 of IS-5 and Owner will prefer to follow the same for this project also. All the indoor cubicles shall be of same colour scheme and for other miscellaneous items colour scheme will be approved by the Owner.

8. Material/ Workmanship

1. GENERAL REQUIREMENTS

1.1 Where the specification does not contain characteristics with reference to workmanship, equipment, materials and component 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 the best engineering practice and suitable for the purpose for which they are intended.

1.2 The equipment must be new, of highest grade, the best quality of their kind, to best engineering practice and latest state of ardent in accordance with purpose for which they are intended and to ensure satisfactory performance throughout the service life.

1.3 In case where the equipment, material or components are indicated in the specification as "similar" to any special standard, the Owner shall decide upon the question of similarly. When required by the specification or required by the Owner the supplier shall submit, for approval, all the information concerning the material or components supplied, installed or used without such approval shall run the risk of subsequent rejection, it being understood that the cost as well as the time delay associated with the rejection shall be borne by the Supplier.

1.4 The design of the work shall be such that installation, future expansions, replacement and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements and shall be used throughout the design. All joints and fastenings shall be devised; constructed and documented so that the component part shall be accurately positioned and retained to fulfil 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 Owner.

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

1.6 All material and equipment shall be. installed in strict accordance with the manufacturer's recommendation(s). The erection procedure must be approved by the OEM and erection completion shall be certified by OEM for satisfactory completion. The commissioning of all major equipment as recommended by Engineer in-charge.

1.7 Only first-class work in accordance with the best modern practice will be accepted. Installation shall be constructed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouping, levelling, aligning, coupling of or bolting down to previously installed equipment bases/ foundation, performing the alignment check and final adjusting prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances and instruction 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 purpose. The spare equipment(s) shall be installed at designated location and tested for healthiness.

1.8 The Supplier 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 purpose shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Supplier shall apply all operational lubricants to the equipment installed by him.

1.9 All oil, grease and other consumable used in the Works/Equipment shall be purchased in India unless the Supplier 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 Owner in establishing equivalent India make and Indian supplier. The same shall be applicable to other consumable too.

1.10 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 Owner. Each base plate shall support the units 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, if so required.

2. PROVISION FOR EXPOSURE TO HOT 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 favourable to the growth of fungi and mildew. The indoor equipment located in non- air conditioned areas shall also be same type.

2.1 SPACE HEATERS

2.1.1 The heater shall be suitable for continuous operation at 240 V as supply voltage. On-off switch and fuse shall be provided.

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

2.1.3 The heaters shall be suitably designed to prevent any contact between the heater wire and the air and shall consist of coiled resistance wire centred in a metal sheath and completely encased in a highly compacted powder of magnesium oxide or other material having equal heat conducting and electrical insulation properties, or they shall consist of resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and the air. Alternately, they shall consist of a resistance wire mounted into a tubular ceramic body and embedded in vitreous gale. The surface temperature of the heater shall be restricted wire is wound on a tubular ceramic body and embedded in vitreous glaze. The surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments.

2.2 FUNGISTATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied to parts which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part

where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

2.3 VENTILATION OPENING

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass or galvanized steel to prevent the entry if insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

2.4 DEGREE OF PROTECTION

The enclosures of the control cabinets, junction boxes and marshalling boxes to be installed shall provide degree of protection as detailed here under:

a) Installed outdoor: IP 55

b) Installed indoor in air conditioned area: IP31

c) Installed in covered area: IP 52

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

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

The above requirement is indicative only. Requirements as provided in respective technical specification shall prevail.

9. Rating Plates, Name Plates and Labels

1. Each main and auxiliary item of substation is to be 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 condition under which the item of substation in question has been designed to operate, and such diagram plates as may be required by the Owner. The rating plates of each equipment shall be according to IEC requirement.
2. All such nameplates instruction plates, rating plates shall be bilingual with Hindi inscription first followed by English. Alternatively, two separate plates one with Hindi and the other English Instruction may be provided.

10. First Fill of Consumable, Oil and Lubricant

All the first fill consumable such as SF6, AC refrigerant, oil, lubricant, 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 supplied by the Contractor unless specification excluded under the exclusions in these specifications and documents.

11. Design Improvements

1. The bidder may note that the equipment offered by him in the bid only shall be acceptable, however, the Purchaser or the Supplier may propose changes in the specification of the equipment or quality thereof and if the parties agreed upon any such changes, the specification shall be modified accordingly.
2. If any such agreed upon change is such that if affects the price. and schedule of completion, the parties shall agree in writing as to the extent of any change in the price and/or schedule of the

completion before the contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.

12. Quality Assurance Programme

1. To ensure that the equipment and services under the scope of this contract whether manufactured or performed within the contractor's Work or at his Subcontractor's premises or at the Owner's site or at any other place of work are in accordance with the specification, the Contractor shall adopt suitable quality assurance programme to control such activities at all points necessary.

   Such programme shall be outlined by the contractor and shall be finally accepted by the Owner after discussions before award of contract. A quality assurance programme of the contractor shall be generally covered the following,

   a) His Organization structure for the management and implementation of the proposed quality assurance programme.
   b) Qualification data for bidder's key personnel.
   c) Documentation control System.
   d) The procedure for purchases of material, parts components and selection of subcontractor’s services including vendor analysis, source, inspection, incoming raw material inspection, verification of material purchases etc.
   e) System for shop manufacturing and, site erection control including process controls and fabrication and assembly control.
   f) Control and non-conforming items and system for corrective actions.
   g) Inspection and test procedure both for manufacture and field activities.
   h) Control of calibration and testing of measuring instruments and field activities.
   i) System for indication and appraisal of inspection status.
   j) System for quality audits.
   k) System for authorising release of manufactured product to the Purchaser.
   l) System for maintenance of records.
   m) System for handling storage and delivery. and
   n) A quality plan detailing out the specific quality control measures and procedures adopted for controlling the quality characteristics relevant to each item of equipment furnished and/or services ordered.

   The Owner or his duly authorised representative reserves the right to carry out quality audit and quality surveillance of the system and procedure of the Contractor/his vendor's quality management and control activities.

2. QUALITY ASSURANCE DOCUMENTS

   The contractor shall be required to submit the following quality Assurance Documents within three weeks after despatch of the equipment.

   All Non-destructive Examination procedures, stress relief and weld repair procedure actually used during fabrication and report including radiography interpretation reports.

   Welder identification list, listing welder’s and welding operator qualification procedure and welding identification symbols.

   Welder and Welding operator qualification certificate.

   Raw material test reports on components as specified by the specification and for agreed to in the quality plan.

   Stress relief time temperature chart/oil impregnation tile temperature chart.

Factory test results for testing required as per applicable codes/ mutually agreed quality plan/standards referred in the technical specification.

The quality plan with verification of various customer inspection points(CAP) as mutually agreed and methods used to verify the inspection and testing points in the quality plan were performed satisfactory.

13. Inspection, Testing and Inspection Certificate

1. The Owner his duly authorised representative and/or outside inspection agency acting on behalf of the Owner shall have at all reasonable times free access to the Contractor's premises or Works and shall have the power at all reasonable times to inspect and examine the material and the Workmanship of the Works during its manufacture or erection and if part of the works during its manufacturing or erection and if the part of works being manufactured or assembled at other premises or works, the contractor shall obtain for the Engineer and for his duly authorised representative permission to inspect as if the work were manufactured or assembled on the Contractor own premises or works, Inspection may be made at any stage of manufacture, despatch or at site at the option of the Owner and equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.
2. All equipment being supplied shall conform to type tests and shall be subject to routine tests in accordance with relevant standards.
3. The Contractor shall give the Owner/Inspector thirty (30) days written notice of any material being ready for testing along with work test certificate. Such tests shall be to the Contractor's account. The Owner unless witnessing of the tests is virtually waived, will attend such tests with thirty (30) days of the date of which the equipment is notified as being ready for tests/inspection, the contractor must ensure TPI for all inspections in line with tender documents.
4. The Owner or Inspector shall, within fifteen (15) days from the date of inspection as defined here in give notice in writing to the contractor, of any objection to any drawings and all any equipment and workmanship which in his opinion is not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either made the modifications that may be necessary to meet the said objections or shall confirm in writing to the Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the Contract.
5. When the, factory tests have been completed at the Contractor's or Subcontractor's Works the Owner/Inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests. The completion of these tests or the issue of the certificate shall not bind the Owner to accept the equipment should, it, on further tests after erection be found not to comply with the Contract. The equipment shall be dispatched to site only after approval of test reports and issuance of dispatch clearances in approved by the Owner.
6. In all cases where the Contract provides for tests whether at the premises or at the works of the contractor or of any Sub-Contractor. The Contractor except where otherwise specified shall provide free of charge such items as labour, material electrically, field water, stores, apparatus and instruments as may be reasonably demanded by the Owner/Inspector or his authorized representative to carry out effectively such tests of the equipment in accordance with the contractor and shall give facilities to the Owner/ inspector or to his authorised representative to accomplish testing.
7. The inspection by Owner and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed quality assurance programme forming a part of the contractors.
8. The Owner will have the right of having at his own expenses any other test(s) of Reasonable nature carried out at Contractor premises or at site of in any other place in addition of aforesaid type and routine tests, to satisfy that the materials comply with the specification.

9. The Owner reserves the right for getting any field tests conducted on the completely assembled equipment at site.

14. Tests

1. CHARGING

On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Owner and the Contractor for correctness and completeness of installation and acceptability for charging, leading to initial pre-commissioning tests at site. The list of pre-commissioning tests to be performed are given in section-7 and shall be included in the Contractor's quality assurance programme.

2. COMMISSIONING TESTS

2.1 The available instrumentation and control equipment will be used during such tests shall calibrated. However un-measurable parameters shall be taken into account in a reasonable manner by the Owner for the requirement of these tests. The tests will be conducted at the specified load points and as near the specified cycle condition as practicable. The Owner will apply proper corrections in calculation, to take into account conditions which do not correspond to the specified condition.

2.2 Any special equipment, tools and tackles required for the successful completion of the Commissioning Tests shall be provided by the Contractor, free of cost.

2.3 The specified tests to be conducted on equipment have been brought out in the respective chapters of the technical specification.

2.4 The Contractor shall be responsible for obtaining statutory clearances from the concerned authorities for commissioning the equipment and the switchyard. However, necessary fee shall be paid by Owner.

15. Packing and Shipping

All the equipment shall be suitably protected, coated, covered or boxes and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. While packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken account. The Contractor shall be responsible for any loss or damage during transportation, handling due to improper packing. Owner takes no responsibility of the wagons.

16. Protection

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves and pilings 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.

17. Painting and Finishing of Metal Surfaces

1. GENERAL

All metal surfaces shall be subjected to treatment for anti-corrosion protection. All ferrous surfaces for external use shall be hot-dip galvanized after fabrication. High tensile steel nuts and bolts and spring washers shall be electro-galvanized to service condition. All steel conductors including those used for earthing/grounding (above ground level) shall also be galvanized according to IS: 2629.

2. HOT DIP GALVANIZING

2.1 The minimum weight of the zinc coating shall be 610g/sq.m and minimum thickness of

coating shall be 85 microns for all items thicker than 6mm. For items lower than 6mm thickness requirement of coating thickness shall be as per relevant ASTM.

2.2 The galvanized surfaces shall consist of a continuous and uniform thick coating of zinc, firmly adhering to the surface of steel; The finished surfaces shall be clean and smooth and shall be free from defects liked is colour patches, are spots, unevenness of coating, plate which is loosely attached to the steel globules, spiky deposits, blistered surface, flaking or peeling off, etc. The presence of any of these defects notices on visual or microscopic inspection shall render the material liable to rejection.

2.3 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.

2.4 The galvanized steel shall be subjected to six one minute dips in copper sulphate solution as per IS-2633.

2.5 Sharp edges with radii less than 2.5mm shall be able to withstand four immersions of the standard price test. All other coating shall withstand six immersions. The following galvanizing tests should essentially be performed as per relevant Indian Standards.

- Coating
- Uniformity of zinc
- Adhesion test
- Mass of Zinc

2.6 Galvanized 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.

3. PAINTING

3.1 All sheet steel work shall be digressed, pickled, phosphated in accordance with the IS-6005 "code of practice for phosphating iron and sheet". All surfaces which will not be easily accessible after shop assembly shall beforehand to be treated and protected for the life of the equipment. The surface which are to be finished painted after installation, shall be shop painted with at least two coats of primer. Oil, grease, dirt and swart shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.

3.2 After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and over drying. The phosphate coating shall be sealed with application of two coats may be "flash dried" while the second coat shall be stoved.

3.3 After application of the primer, two coats of finishing synthetic enamel paint shall be applied, each coat followed by stoving. The second finishing coat shall be applied after inspection of first coat of painting.

3.4 The exterior colour of the paint shall be as per shade No.:631 of IS-5 and inside shall be glossy white. Each coat of primer and finishing paint shall be of slightly different shade to enable inspection of the painting. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipment.

3.5 In case the bidder proposes to follow his own standard surface finish and protection

procedures or any other established painting procedures, like electrostatic painting etc. the procedure shall be submitted along with the bids for Owner's review & approval.

18. Handling, Storing and Installation

1. In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the Owner or his representative, the contractor shall, erect, install, wire test and place into commercial use all the electrical equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square and properly aligned and oriented. Commercial use of switchyard equipment means completion of all site tests specified and energisation at rated voltage.
2. Contractor may engage manufacturer's engineer to supervise the unloading, transportation to site, storing and erection. The contractor shall engage the manufacturer’s Engineer’s for testing and commissioning of the various equipment being procured by them separately. Contractor shall transport, erect, test and commission the equipment as per instructions of the manufacturer's supervisory Engineer(s)/ as per Manufacturer’s approved process and shall extend full cooperation to them.
3. In case of any doubt or misunderstanding as to the correct interpretation of manufacture's drawing or instruction, necessary clarifications shall be obtained from the Owner/ Manufacturer. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawing/instructions correctly.
4. Where assemblies are supplied in more than one section, Contractor shall make all necessary mechanical and electrical connections between section including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected during testing and commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the Contractor at his own expense.
5. Supplier shall be responsible for examining all the shipment and notify the Owner immediately of any damage, shortage, discrepancy etc. for the purpose of Owner's information only. The supplier shall submit to the Owner every week a report detailing all the receipts for any shortages or damages in transit, handling and/or erection of the equipment at Site. Any demurrage, wharf age and other such charges claimed by the transporters, railways etc. shall be to the account of the Supplier.
6. The Contractor shall be fully responsible for the equipment material unit the same is handed over to the Owner in an operating condition after commissioning. Contractor shall be responsible for the maintenance of the equipment material during as well as after erection unit taken over by Owner, as well as protection of the same against theft, element of nature, corrosion, damages etc.
7. The words 'erection' and 'installation' used in the specification are synonymous.

SECTION 4
LIST OF DRAWINGS AND 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.

Sl. No	BHEL_DRG_NO	DVC DRG NO.	MDL_DRG_TITLE
1	TB-DS-556-552-01	3201-116-P-V-M-Y-001	TDS For FPS Items [Pipe & fittings/ Hydrant Valve/ Branch pipe with nozzle/ Hose box/ Gate Valve/ Wrapping Coating/ Deluge Valve/ Y-Strainer/Pressure gauge & Pressure Switch]
2	TB-DS-556-552-02	3201-116-P-V-M-Y-002	TDS for control & power cables
3	TB-DG-556-552-03	3201-116-P-V-M-B-003	Drg. for DVLCP
4	TB-DG-556-552-04	3201-116-P-V-M-C-004	Schematic For Fire Protection system of Switchyard
5	TB-DG-556-552-05	3201-116-P-V-M-P-005	Fire Water Piping Layout for the Switchyard
6	TB-DG-556-552-06	3201-116-P-V-M-P-006	HVW Spray System for 31.5 MVA Transformer - Plan, Elevation Side View & Isometric with Hyd. calc. (3 Sheets)
7	TB-DG-556-552-07	3201-116-P-V-M-P-007	HVW Spray System for 20 MVA Transformer - Plan, Elevation Side View & Isometric with Hyd. calc. (3 Sheets)
8	TB-DG-556-552-08	3201-116-P-V-M-P-008	HVW Spray System for 10 MVA Transformer - Plan, Elevation Side View & Isometric with Hyd. calc. (3 Sheets)
9	TB-BQ-556-552-09	3201-116-P-V-M-W-0009	BOQ – Firefighting system

SECTION 5
ENCLOSURES TO THE SPECIFICATION

SCHEDULES TO BE FILLED UP BY THE BIDDER

Schedule 1 **Schedule of makes of Equipments**

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

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

1) In case, this schedule is not submitted, it will be presumed that the equipment /material to be supplied under this contract are deemed to be in compliance with the specification.

2) If there is NIL deviation, even then the format to be filled as **NIL DEVIATION**

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

Place

Date

Signature of the authorized representative of Bidder

Name ----------

Designation----------

Company seal----------

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

Name----------

Date

Designation----------

Company seal ----------

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

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

Date

Signature of the authorized representative of Bidder

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.	Clause no/ page no of Specification	Details of test	Lab in which to be conducted	Whether test to be conducted free or on chargeable basis. Mention 'FREE' or 'CHARGEABLE'	If charges per test have been quoted for in the price bid. YES / NO
		A. Type Tests			
		1.			
		2.			
		B. Routine Tests			**DO NOT**
		1.			**MENTION**
		2.			**ANY PRICE**
		C. Site Tests			**IN THIS**
		1.			**COLUMN**
		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

Date

Signature of the authorized representative of Bidder

Name----------

Designation----------

Company seal----------

SCHEDULE-6

DETAILS OF CONTACT PERSON BOTH TECHNICAL AND COMMERCIAL

Name

Address for correspondence

Phone No.

Fax No.

Email

Place

Date

Signature of the authorized representative of Bidder

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 –7

ENCLOSURES TO SPECIFICATION

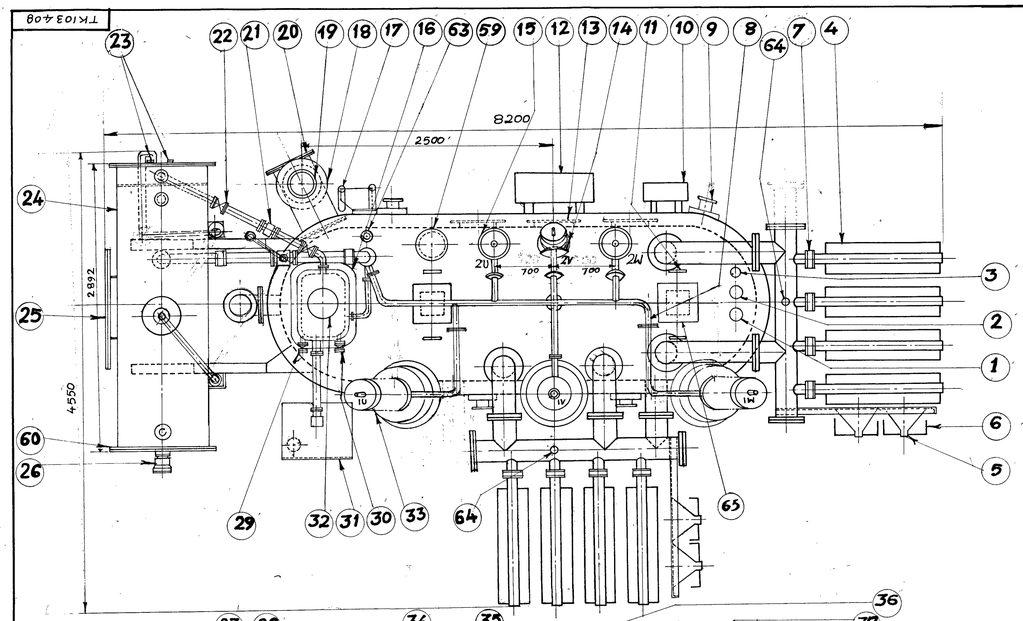
DRAWINGS ENCLOSED

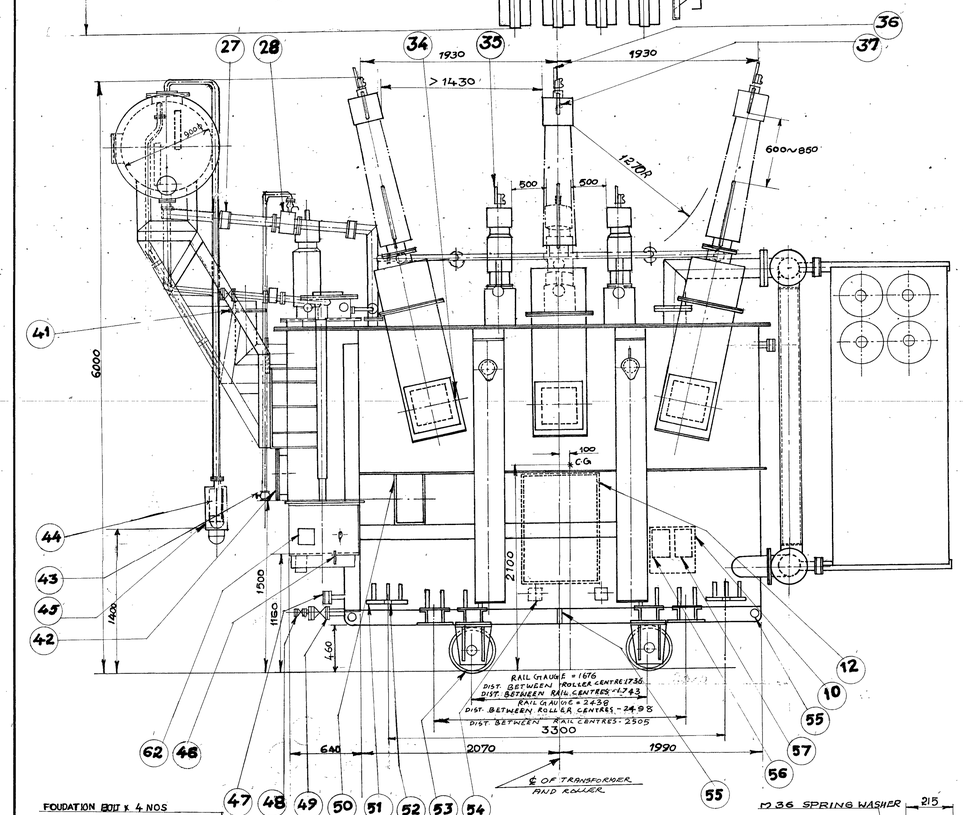
1. PLOT PLAN CUM SWITCHYARD PLAN LAYOUT (1 SHEET)
2. OGA FOR 10 MVA TRANSFORMER (1 SHEET)
3. OGA FOR 20 MVA TRANSFORMER (1 SHEET)

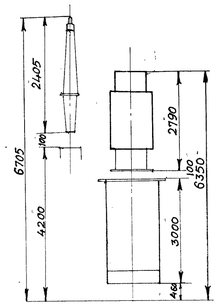
   DRG NO. TK103510
4. OGA FOR 31.5 MVA TRANSFORMER (1 SHEET)

   DRG NO. TK103408

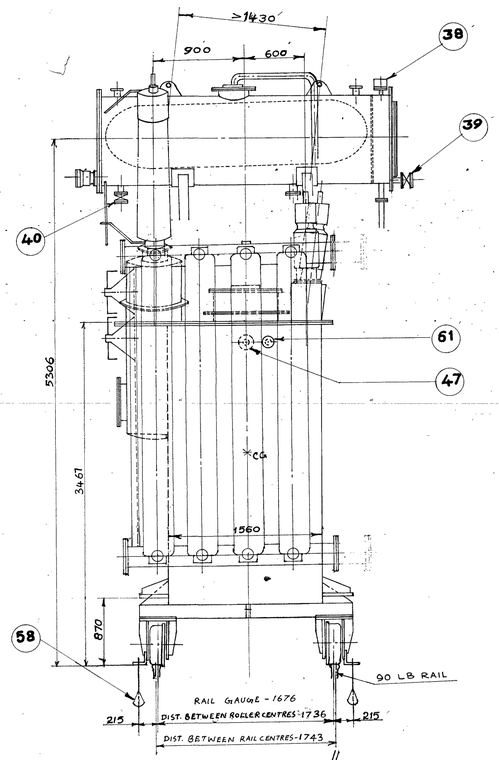
TK103408

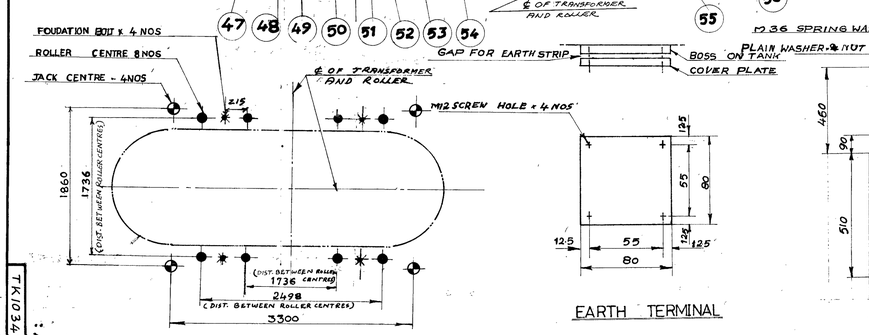






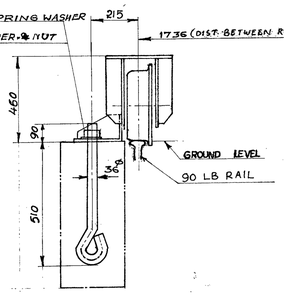
LIFTING HT: OF INT. BODY & HV BUSHING



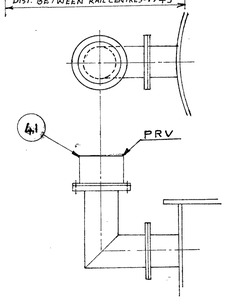


FODNDATION DETAILS

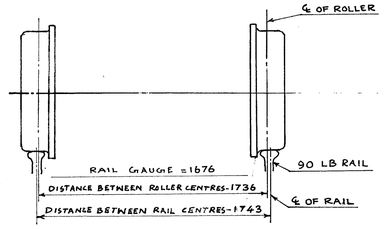
EARTH TERMINAL



DETAILS OF ROLLER FOUNDATION



PRESSURE RELIEF VALVE



REVALIDATED

CHD	JS	01.07.94
APPD	[illegible]	01.07.94

SPECIFICATIONS :-

CUSTOMER	: DAMODAR VALLEY CORPORATION
CAPACITY	: 31.5 MVA, 50Hz., 3-PHASE
VOLTAGE CLASS	: 132 kV/ 34.5kV, LI: 550/170
CONNECTION	: STAR / DELTA
COOLING	: ONAN / ONAF
VECTOR GROUP	: YN d1

SCHEDDLE OF WEIGHT

INTERNAL BODY (APPROX.)	:	33,000 kg
TANK & PARTS (APPROX.)	:	16,500 kg
OIL - 14000 L (APPROX.)	:	12,500 kg
TRANSPORTATION WEIGHT	:	42,000 kg
TOTAL WEIGHT (APPROX.)	:	60,000 kg
MAX. LOAD/JACK	:	20,000 kg
MAX. LOAD/ROLLER	:	20,000 kg

NOTE:-

1. WHILE COORDINATING WITH CIVIL WORKS PROVIDE AN ALLOWANCE OF ±5% IN WEIGHT AND ±3% IN DIMENSIONS.
2. THE FOUNDATION SHALL BE DESIGNED BY THE PURCHASER TO SUIT THE SOIL CONDITIONS.

R1	⚠1	CUSTOMER'S COMMENTS ADDED	13-3-90
R2	⚠2	" "	14-5-90
R3	⚠3	" "	16-7-90
R4	⚠4	" "	9-11-90
R5	⚠5	" "	24-1-91

TK103408

PART NO.	DESCRIPTION	QNTY
1	SENSING BULB FOR WTI	1 NO
2	SENSING BULB FOR OTI	1 NO
3	THERMO METER POCKET	1 NO
4	RADIATOR CTR/ EXOTHERM	8 NOS
5	COOLING FAN (18") GEC / CROMPTON	8 NOS
6	WIRE GAURD FOR COOLING FAN	8 NOS
7	SHUT OFF VALVE FOR RADIATOR (BUTTERFLY) 3"	16 NOS
8	AIR RELEASE PIPES	—
9	LIFTING HOOK FOR COMPLETE TRANSFORMER	4 NOS
10	MARSHALLING KIOSK	1 NO
11	LIFTING HOOK FOR UPPER TANK COVER	4 NOS
12	COOLER CONTROL CUBICLE	1 NO
13	HAND HOLE FOR LV CONNECTION	3 NOS
14	WTI BCT TERMINAL BOX	1 NO
15	52KV 800A LV BUSHING TELK	3 NOS
16	ON LOAD TAP CHANGER YB2, 66kv, TELK	1 NO
17	LADDER WITH SAFTY DEVICE	1 NO
18	HAND HOLE FOR HV-N CONNECTION	1 NO
19	52kv, 800A HV-N BUSHING TELK	1 NO
20	HV-N BCT TERMINAL BOX	1 NO
21	3B BUCHHOLZ RELAY FOR OLTC (I&C MAKE)	1 NO
22	ISOLATING VALVE FOR OLTC CONSERVATOR (1")	2 NOS
23	PLAIN OIL LEVEL GADGE FOR OLTC CONSERVATOR	2 NOS
24	CONSERVATOR (AT MS SEAL TYPE)	1 NO
25	TELK' MONOGRAM	1 NO
26	MAGNETIC OIL LEVEL GAUGE 150mm (SUKRUT)	1 NO
27	ISOLATING VALVE FOR TRF. CONSERVATOR 3"	2 NOS
28	3B BUCHHOLZ RELAY FOR T-RF (I & C MAKE)	1 NO
29	FILLING VALVE FOR OLTC 1"	1 NO
30	FILTER VALVE FOR OLTC 1"	1 NO
31	DRIVING MECHANISM OF OLTC	1 NO
32	EXPLOSION VENT FOR OLTC - DIAPHRAGM TYPE	1 NO
33	145kv, 800A HV BUSHING TELK	3 NOS
34	HAND HOLE FOR HV CONNECTION	3 NOS
35	LV TERMINL CONNECTOR NUTAN / MILIND	3 NOS
36	HV TERMINL CONNECTOR NUTAN / MILIND	3 NOS
37	ARCIN HORN FOR HV BUSHING	3 SET
38	GAS VENT	1 NO
39	DRAIN VALVE FOR OLTC CONSERVATOR 1½"	1 NO
40	DRAIN VALVE FOR TRF. CONSERVATOR 1"	1 NO
41	PRESSURE RELIEF VALVE SUKRUT	1 NO
42	MAN HOLE FOR OLTC CONNECTION	2 NOS
43	GAS TESTING COCK	1 NO
44	SILICAGEL BREATHER FOR OLTC CONSERVATOR - ANUSEN	1 NO
45	SILICAGEL BREATHER TELK	1 NO
46	OPERATING HANDLE FOR OLTC DH	1 NO
47	FILTER VALVE 2"	2 NOS
48	SAMPLING VALVE ½"	1 NO
49	DRAIN VALVE (4")	1 NO
50	RATING AND CONNECTION DIAGRAM PLATE	1 NO
51	JACK BOSS	4 NOS
52	JACK BOSS NAME PLATE	4 NOS
53	BI- DIRECTIONAL FLANGED ROLLER (400 ϕ)	4 NOS
54	EARTH - TERMINAL	2 NOS
55	PULLING EYE	4 NOS
56	WINDIG TEMPERATURE INDICATOR (PERFECT CONTROLS)	1 NO
57	OIL TEMPERATURE INDICATOR	1 NO
58	FOUNDATION BOLT	4 SET
59	INSPECTION COVER (Core dclamp to tank earthing)	1 NO
60	END COVER FOR MAIN CONSERVATOR	1 NO
61	UPPER SAMPLING VALVE 15 mm	1 NO
62	LOCAL TAP POSITION INDICATOR OF OLTC	1 NO
63	AIR RELASE VALVE 15mm	1 NO
64	AIR RELASE PLUG	2 NOS
⚠4 65	VIBERATION PREVENTOR BOSS	2 NOS

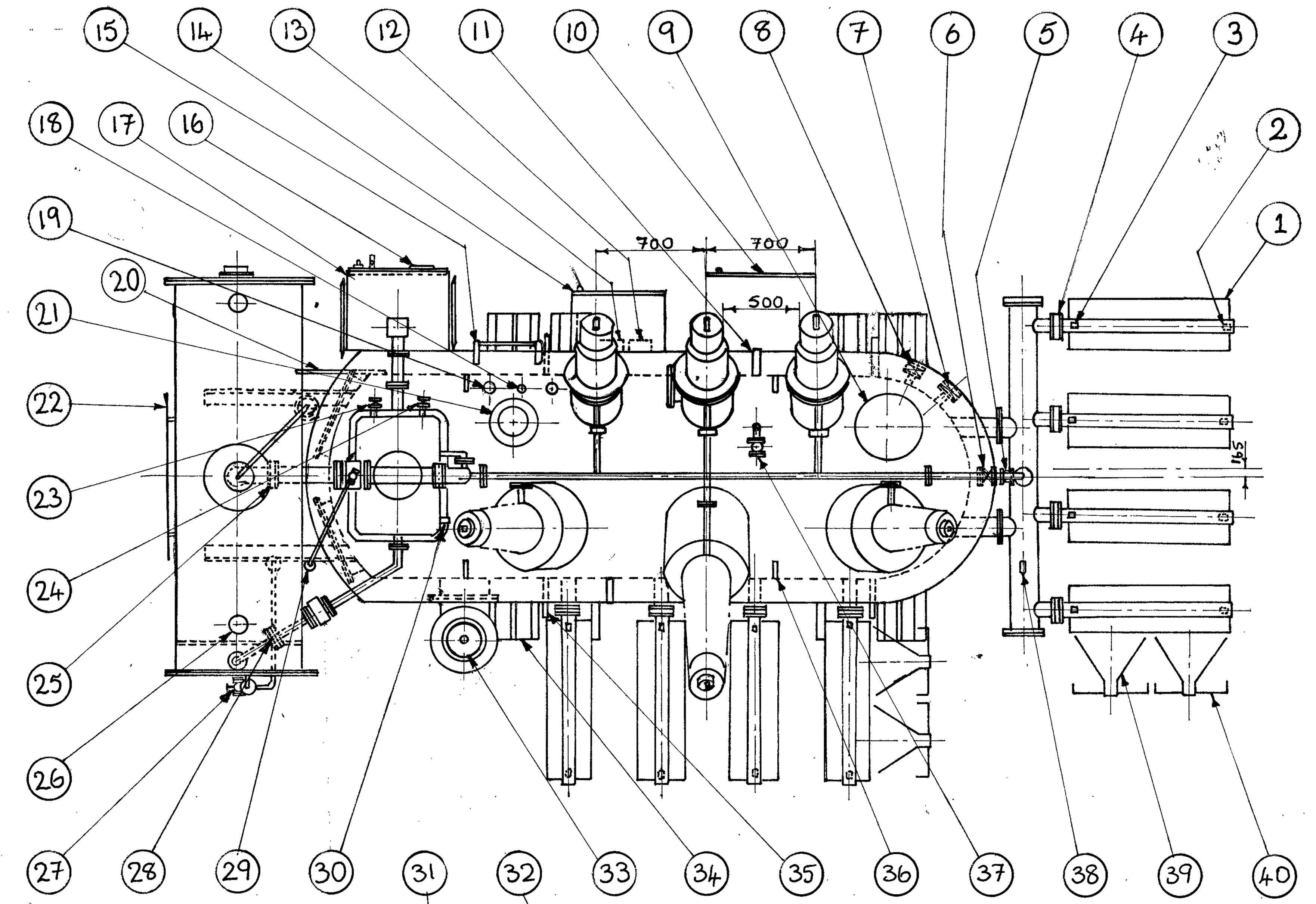
CUSTOMER : DAMODAR VALLEY CORPORATION

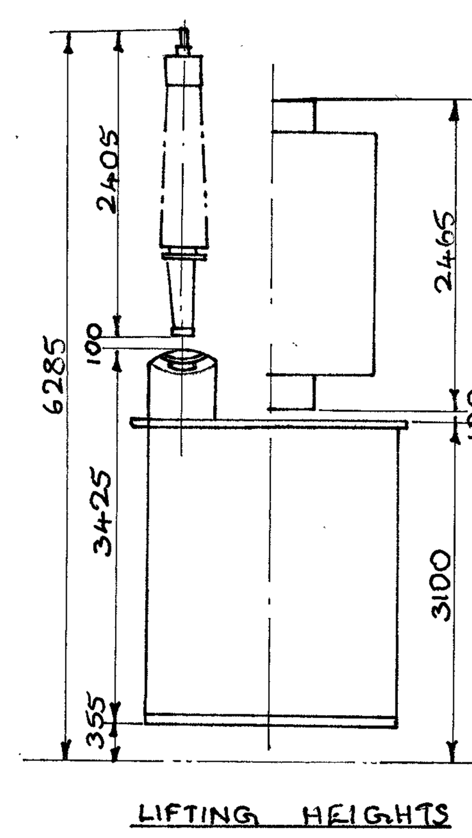
PO: NO: : PE- SPEC -553/14 DATED 15-11-1988

ALL DIMENSIONS ARE IN MM	STATUS OF DPG.		
ABDU	2-12-89		
CHANDR	14-8-90		
GP		TELK	TITLE GENERAL OUTLINE ARRANGEMENT OF DVC 31.5MVA TFR.
MVK			R3 4.1.1 TK 103408

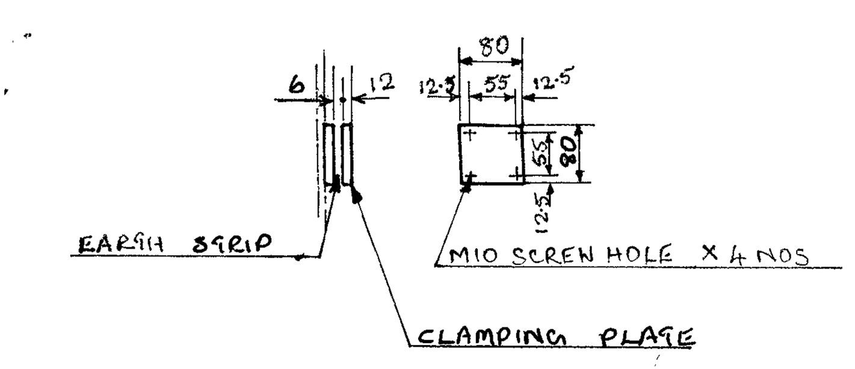
△ OLTC CONSERVATOR DRAIN VALVE CORRECTED. T.C.V. 24-1-91.

REVALIDATED
CHD 25 01.07.94
APPD 01.07.94

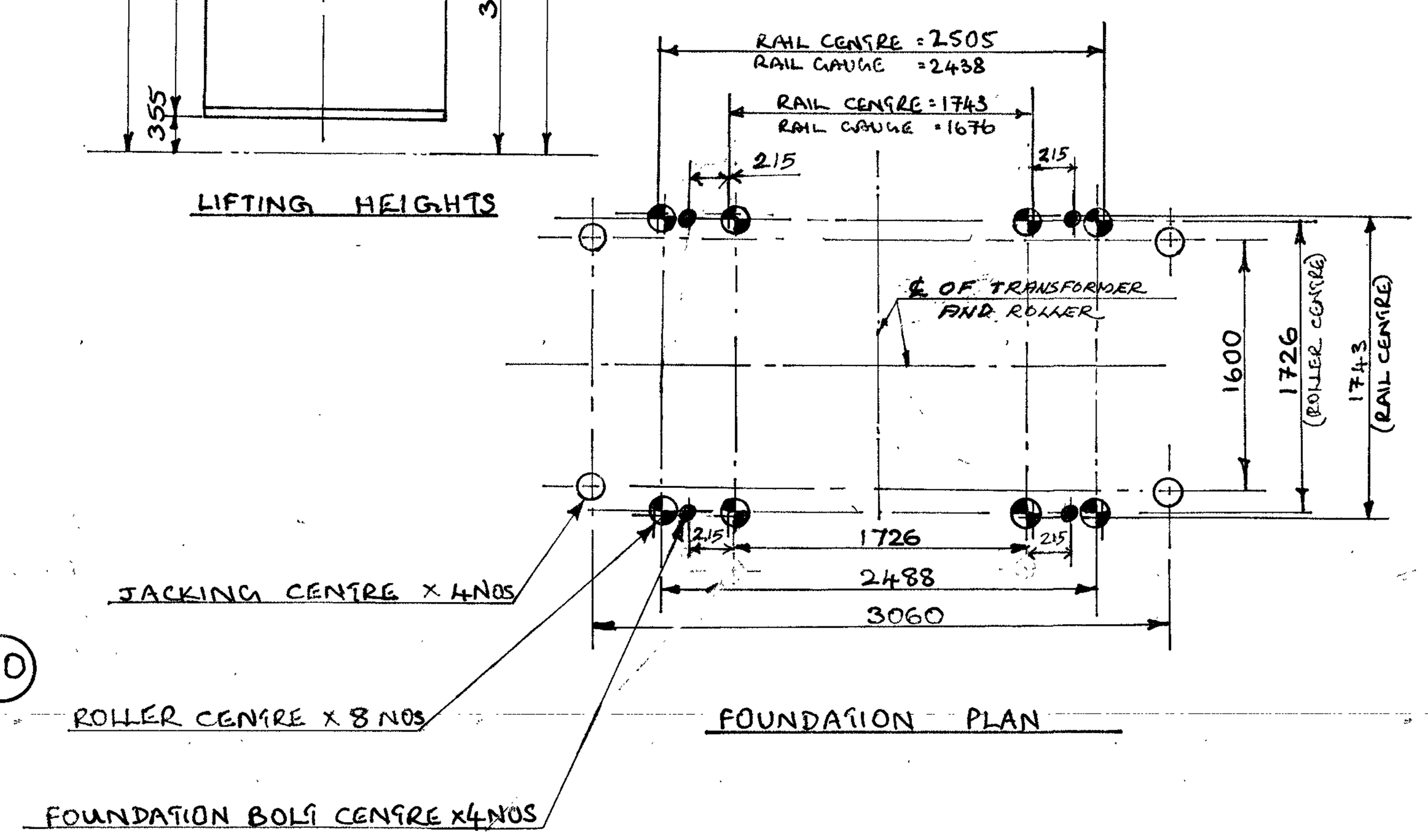




LIFTING HEIGHTS



EARTH TERMINAL



FOUNDATION PLAN

SPECIFICATIONS

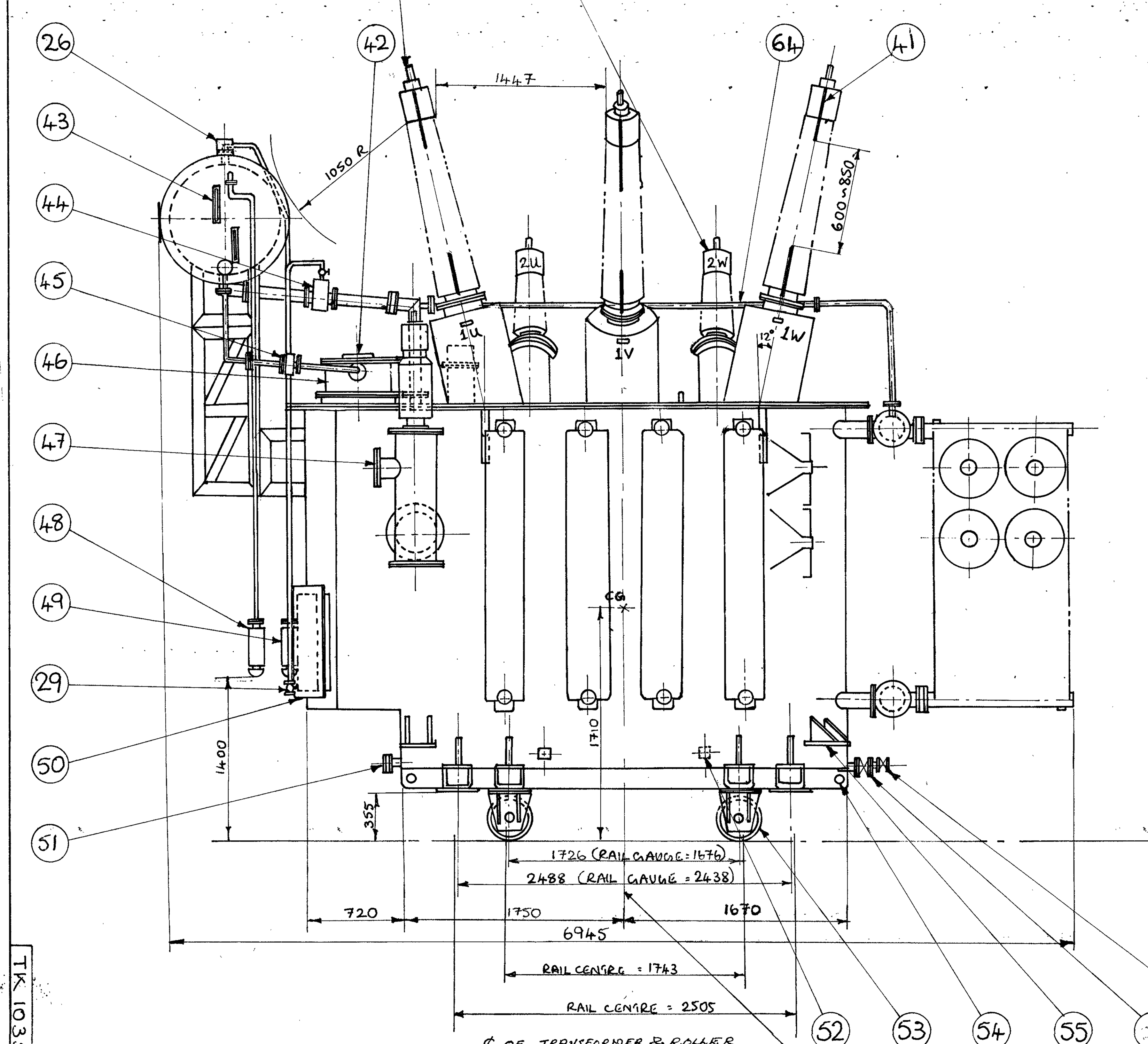
CUSTOMER	: DAMODAR VALLEY CORPORATION
CAPACITY	: 12000/20000 KVA
ORDER NO	: PE-SPEC-553/14 DTD: 15.11.1989
HV	: 132 KV, 550 LI, 230 AC
LV	: 34.5 KV, 170 LI, 70 AC
COOLING	: ONAN/ONAF
CONNECTION	: 3 PHASE, STAR/DELTA

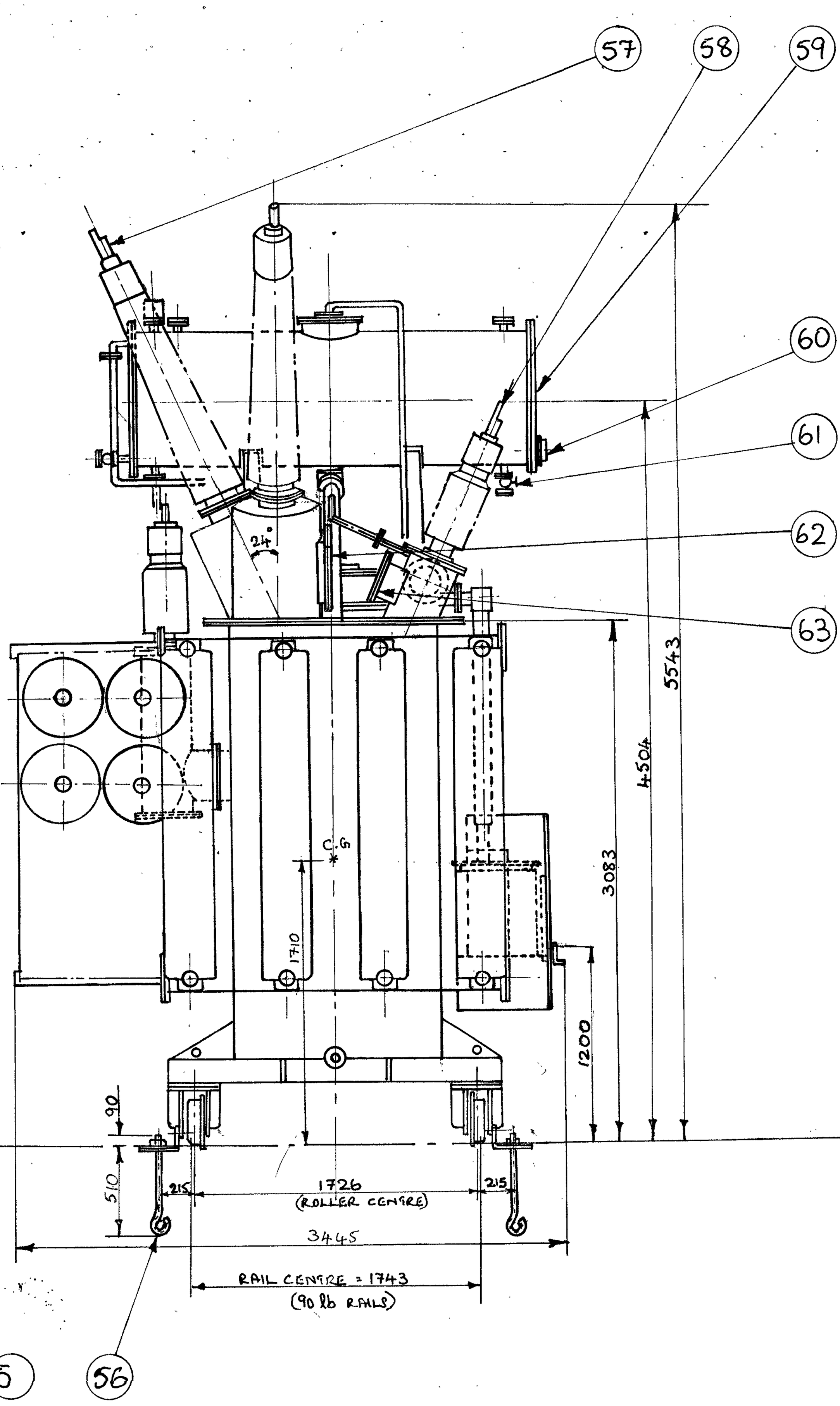
NOTE

1. FOUNDATION SHALL BE DESIGNED AND ARRANGED BY THE CUSTOMER TO SUIT THE LOAD, DEPENDING ON THE CONDITION OF THE SOIL.
2. WHILE COORDINATING WITH CIVIL WORKS, ALLOW A TOLERANCE OF ± 5% IN WEIGHTS AND ± 3% IN DIMENSIONS.

WEIGHT SCHEDULE

1. INTERNAL BODY (APPROX) : 19000 kg
2. TANK AND PARTS (APPROX) : 12500 kg
3. OIL (10000 l) (APPROX) : 8900 kg
4. TOTAL WEIGHT (APPROX) : 40400 kg
5. TRANSPORTATION WT (N2 FILLED) : 28000 kg
6. MAX. LOAD PER ROLLER/JACK : 14000 kg





NO	DESCRIPTION	QTY
1	RADIATORS (CTR/EXOTHERM MAKE)	8 NOS
2	RADIATOR DRAIN PLUG	8 NOS
3	AIR RELEASE PLUG	8 NOS
4	RADIATOR VALVES (80 mm)	16 NOS
5	LOWER SAMPLING VALVE (15 mm)	1 NO
6	DRAIN VALVE (80 mm)	1 NO
7	UPPER FILTER VALVE (50 mm)	1 NO
8	UPPER SAMPLING VALVE (15 mm)	1 NO
9	INSPECTION COVER FOR INTERNAL BODY EARTHING	1 NO
10	COOLER CONTROL CUBICLE (TELK MAKE)	1 NO
11	BAND EARTHING STRIP	2 NOS
12	WINDING TEMP. INDICATOR (PERFECT INSTRUMENTS MAKE)	1 NO
13	OIL TEMPERATURE INDICATOR (PERFECT INSTRUMENTS MAKE)	1 NO
14	MARSHALLING KIOSK (TELK MAKE)	1 NO
15	LADDER WITH SAFETY DEVICE	1 NO
16	TAP POSITION INDICATOR	1 NO
17	DRIVING MECHANISM FOR OLTC (TELK MAKE)	1 NO
18	ALCOHOLIC THERMOMETER POCKET	1 NO
19	WTI/OTI SENSING BULB POCKET	2 NOS
20	RATING AND CONNECTION DIAGRAM PLATE	1 NO
21	PRESSURE RELIEF DEVICE (SUKRUT MAKE)	1 NO
22	TELK MONOGRAM	1 NO
23	FILTER VALVE FOR OLTC (25 mm)	1 NO
24	FILLING VALVE FOR OLTC (25 mm)	1 NO
25	ISOLATING VALVE FOR MAIN CONSERVATOR (80 mm)	2 NOS
26	GAS VENT	1 NO
△ 27	DRAIN VALVE FOR OLTC CONSERVATOR (15 mm)	1 NO
28	ISOLATING VALVE FOR OLTC CONSERVATOR (25 mm)	1 NO
29	GAS TESTING COCK	1 NO
30	OLTC TO TANK EARTHING STRIP	2 NOS
31	145 KV HV BUSHING (TELK MAKE)	3 NOS
32	52 KV LV BUSHING (TELK MAKE)	3 NOS
33	52 KV HVN BUSHING (TELK MAKE)	1 NO
34	ROLLER SUPPORTS	8 NOS
35	LIFTING HOOK FOR TRANSFORMER	4 NOS
36	LIFTING HOOK FOR TANK COVER	4 NOS
37	AIR RELEASE VALVE	1 NO
38	AIR RELEASE PLUG	1 NO
39	18" COOLING FANS (GEC/CROMPTON MAKE)	8 NOS
40	WIRE GUARD FOR FANS	8 NOS
41	ARCING HORNS FOR HV BUSHINGS (TELK MAKE)	3 NOS
42	DIAPHRAGM TYPE EXPLOSION VENT FOR OLTC	1 NO
43	PLAIN OIL LEVEL GAUGE	2 NOS
44	3" BUCHOLZ RELAY - MAIN (I&C MAKE)	1 NO
45	1" BUCHOLZ RELAY - OLTC (I&C MAKE)	1 NO
46	YB2, 66 KV CLASS OLTC (TELK MAKE)	1 NO
47	BCT TERMINAL BOX	2 NOS
48	SILICAGEL BREATHER FOR OLTC CONSERVATOR (ANUSEN)	1 NO
49	SILICAGEL BREATHER FOR MAIN CONSERVATOR (TELK)	1 NO
50	MANHOLE COVER FOR OLTC CONNECTION	2 NOS
51	LOWER FILTER VALVE (50 mm)	1 NO
52	EARTH TERMINAL	2 NOS
53	300φ ROLLER ASSEMBLY	4 NOS
54	PULLING EYE	8 NOS
55	JACKING PAD	4 NOS
56	FOUNDATION BOLT	4 NOS
57	TERMINAL CONNECTOR FOR HV BUSHING	3 NOS
58	TERMINAL CONNECTOR FOR LV BUSHING	3 NOS
59	800φ ATMOSEAL TYPE CONSERVATOR (PRONAL)	1 NO
60	MAGNETIC OIL LEVEL GAUGE (SUKRUT MAKE)	1 NO
61	DRAIN VALVE FOR MAIN CONSERVATOR (25 mm)	1 NO
62	HAND HOLE FOR HV CONNECTION	3 NOS
63	HAND HOLE FOR LV CONNECTION	3 NOS
64	AIR EQUALISER PIPE	1 NO

ALL DIMENSIONS ARE IN mm UNITS

DRN.	GUSTIN	26.12.89
TRD.	LALU	13.7.90
CHD.	GUSTIN	13.7.90
CHD.	GP	
APPD.	MVK	

MO NO: 120297

TITLE: GENERAL OUTLINE ARRANGEMENT (DVC20)

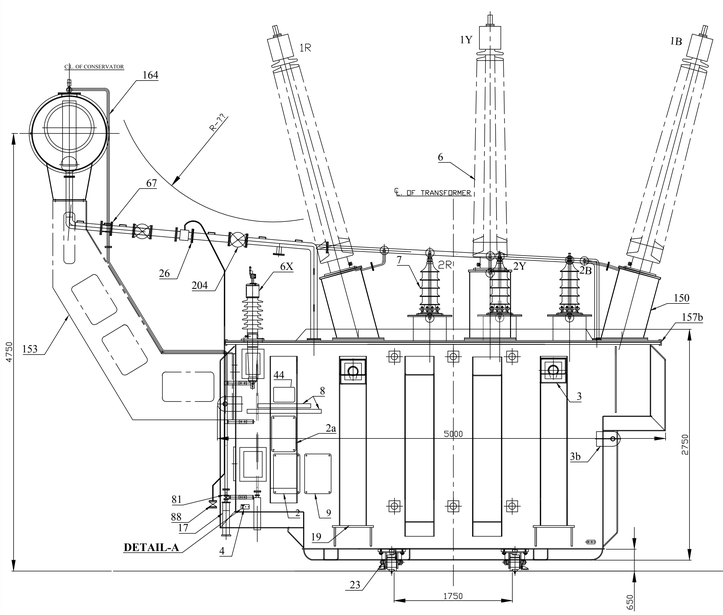
TELK ANGAMALLY KERALA INDIA

TK 103510

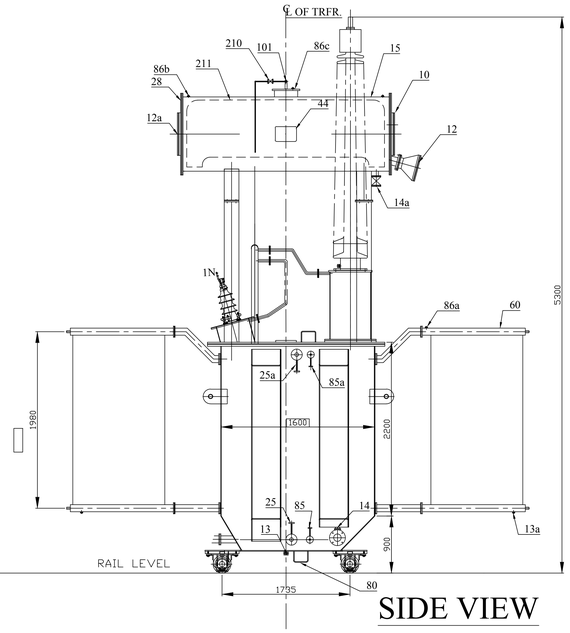
FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN mm

DRG. NO. 0 458 00 50 123



ELEVATION VIEW

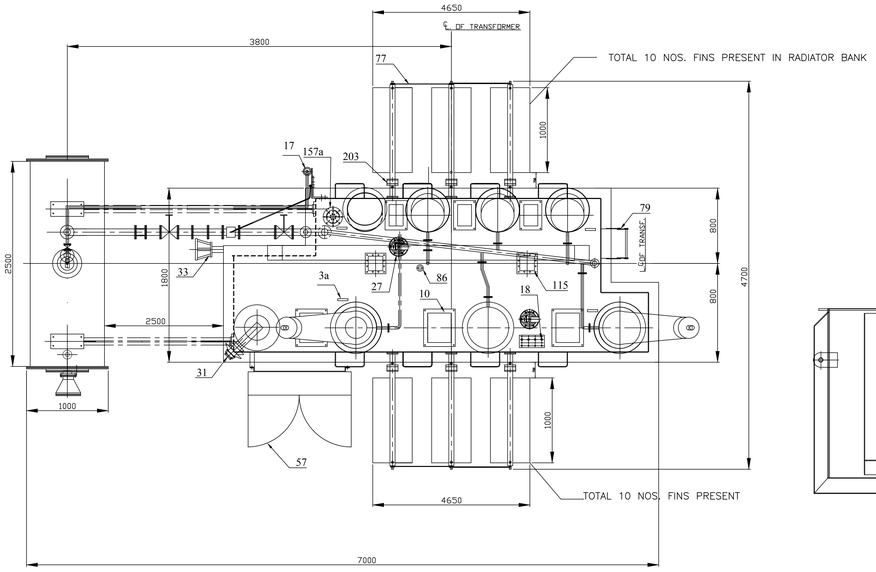


SIDE VIEW

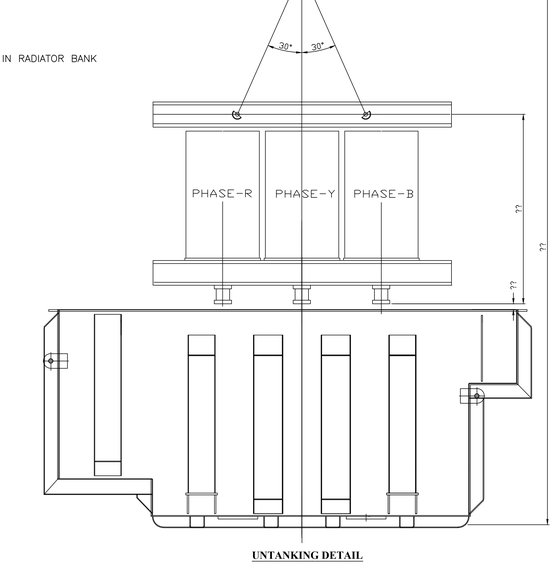
ITEM NO.	DESCRIPTION	QTY.
60	RADIATORS	06NOS.
67	FLEXIBLE JOINT 80 N.B.	01NO.
72	CT TERMINAL BOARD FOR CTS.	04NOS.
77	RADIATOR TIE BAR	12NOS.
79	LADDER WITH SAFETY FLAP	01NO.
80	SKID BASE	01NO.
81	VALVE (15 NB) FOR BREATHER.	02NOS.
85	SAMPLING VALVE (15 NB) ON BOTTOM TANK	01 NO.
85a	SAMPLING VALVE (15 NB) ON TOP TANK	01 NO.
86	AIR RELEASE VALVE (15 NB) ON COVER	01NO.
86a	AIR RELEASE PLUG ON RADIATORS, 3/4" BSP	12NOS.
86b	AIR RELEASE PLUGES (3/4" BSP) ON MAIN CONSERVATOR	02NOS.
86c	AIR RELEASE PLUG (1/4" BSP) ON MAIN CONSERVATOR	01NO.
88	BUCHHOLZ RELEASE COCK (6 NB) WITH 6 N.B. PIPE	01NO.
101	PRESSURE GAUGE ON MAIN CONSERVATOR	01NO.
115	HOLE FOR CLAMPING CORE AND COIL TO TANK COVER	02NOS.
150	HV TURRET (DETACHABLE)	03NOS.
151	LV TURRET (DETACHABLE)	03NO
153	CONSERVATOR SUPPORT FOR MAIN CONSERVATOR	02NOS.
157a	EARTHING CONNECTION BETWEEN CORE TO END FRAME & END FRAME TO TANK	01NO.
157b	EARTHING CONNECTION BETWEEN TOP TANK TO TANK COVER	02NOS.
164	BREATHER PIPE (15 N.B.)	02NOS.
203	RADIATOR VALVE (80 NB BUTTERFLY)	12NOS.
204	CONSERVATOR VALVE (80 NB FOR MAIN CONS.)	02NOS
210	VALVE (15 NB) FOR BREATHER CONNECTION ON MAIN CONSERVATOR	01NO.
211	FLEXIBLE SEPERATOR (AIR CELL) INSIDE MAIN CONSERVATOR	01NO.

TABLE OF FITTINGS

ITEM NO.	DESCRIPTION	QTY.
2	COMBINED RATING & DIAGRAM PLATE (ENGLISH)	01NO
2a	VALVE SCHEDULE PLATE (ENGLISH)	01NO.
3	LIFTING BOLARD	04NOS
3a	LIFTINGS LUGS FOR COVER	04NOS.
3b	LASHING LUGS	04NOS.
4	EARTHING TERMINAL	02NOS.
6	H.V. LINE TERMINALS 245 KV, 800 AMP.	03NOS.
6x	H.V. NEUTRAL TERMINAL 36 KV, 630 AMP.	01NO.
7	L.V. & LVN LINE TERMINAL 52 KV, 800 AMPS.	04NOS.
8	NAME PLATE (ENGLISH & HINDI)	02NOS.
9	OIL FILLING INSTRUCTION PLATE	01NO.
10	INSPECTION COVERS	10NOS.
12	MAGNETIC OIL GAUGE (WITH LOW OIL LEVEL ALARM)	01NO.
12a	PRISMATIC OIL GAUGE MAIN CONSERVATOR	02NO.
13	DRAIN PLUG 1"BSP	01NO.
13a	DRAIN PLUG 1/4"BSP FOR RADIATOR.	12NOS.
14	DRAIN VALVE ON TANK (100 NB. GATE VALVE)	01NO.
14a	DRAIN VALVE ON MAIN CONSERVATOR (25 NB. GATE VALVE)	01NO.
15	OIL CONSERVATOR AIR CELL TYPE	01NO.
17	DEHYDRATING BREATHER FOR MAIN CONSERVATOR	02NOS.
18	THERMOMETER POCKETS (WITH ALCOHAL THERMOMETER) ON TANK COVER.	02NOS
19	JACKING LUGS	04NOS.
21	OIL TEMPERATURE INDICATOR + RTD	01+01NO.
22	WINDING TEMPERATURE INDICATOR + RTD	02+02NO.
23	FLANGED BI-DIRECTIONAL ø 320 ROLLER WITH STOPPER ARRGT.	04NOS.
25	FILTER VALVE ON BOTTOM TANK (50 NB.)	1 NO
25a	FILTER VALVE ON TOP TANK (50 NB.)	1 NO
26	BUCHHOLZ RELAY (80NB)	01NO.
27	PRESSURE RELIEF VALVE	02NOS.
28	END COVER FOR MAIN CONSERVATOR	01NO.
31	36 KV POST INSULATOR (FOR HVN GROUNDING)	02NOS.
33	OFF CIRCUIT TAP SWITCH OPERATING HANDLE (WITH LIMIT SWITCH,LOCKING ARRGT., TAP POSITION INDICATOR)	01NO.
44	BILINGUAL COMPANY'S MONOGRAM (ON TANK & MAIN CONSERVATOR)	01NO.
57	MARSHALLING BOX	01NO.



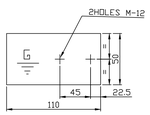
PLAN VIEW



UNTANKING DETAIL

NOTES:-

1. DIMENSIONS MARKED THUS ▭ ARE OVER ALL SHIPPING DIMENSIONS EXCLUSIVE OF PACKING.
2. PVC, SWA, PVC ARMOURED CABLE WIRING UPTO MARSHALLING BOX ARE SUPPLIED BY BHEL, BUT NOT SHOWN IN THIS DRG. FOR CLARITY.
3. FOUNDATION BOLTS, NUTS & WASHERS ETC. ARE SUPPLIED BY BHEL.
4. OUT SIDE PAINTING SHALL BE EPOXY PAINT TO SHADE RAL-7035.
5. ALL BOLTS NUTS EXPOSED TO WEATHER SHALL BE OF HOT DIP GALVANISED.
6. FINAL WEIGHTS SHALL BE CALCULATED AFTER COMPLENTION OF MANUFACTURING DRGS.
7. ALL VALVES SHELL BE GUN METAL.
8. ZINC SPTAYING OF TANK BOTTOM (THICKNESS-100 MICROMETER).



DETAIL-A

DIRECTION OF WITHDRAWAL

ADDITIONAL INFORMATION

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: 10 MVA ONAN COOLED STATION TRANSFORMER

M/S:-DVC

NGEF MAKE

	NAME	SIGN.	DATE
DRN.			
CKD.			
APPD.			

NO. OF VAR. 00

REV.	DATE	ALTERED / CHECKED / APPROVED

DEPT / CODE | UNTOL. DIMS. GR. | SCALE 1:1 | WEIGHT (K.G.) NA | REF. TO ASSY. DRG. NA | ITEM NO. NA | NO. OF ITEM NA

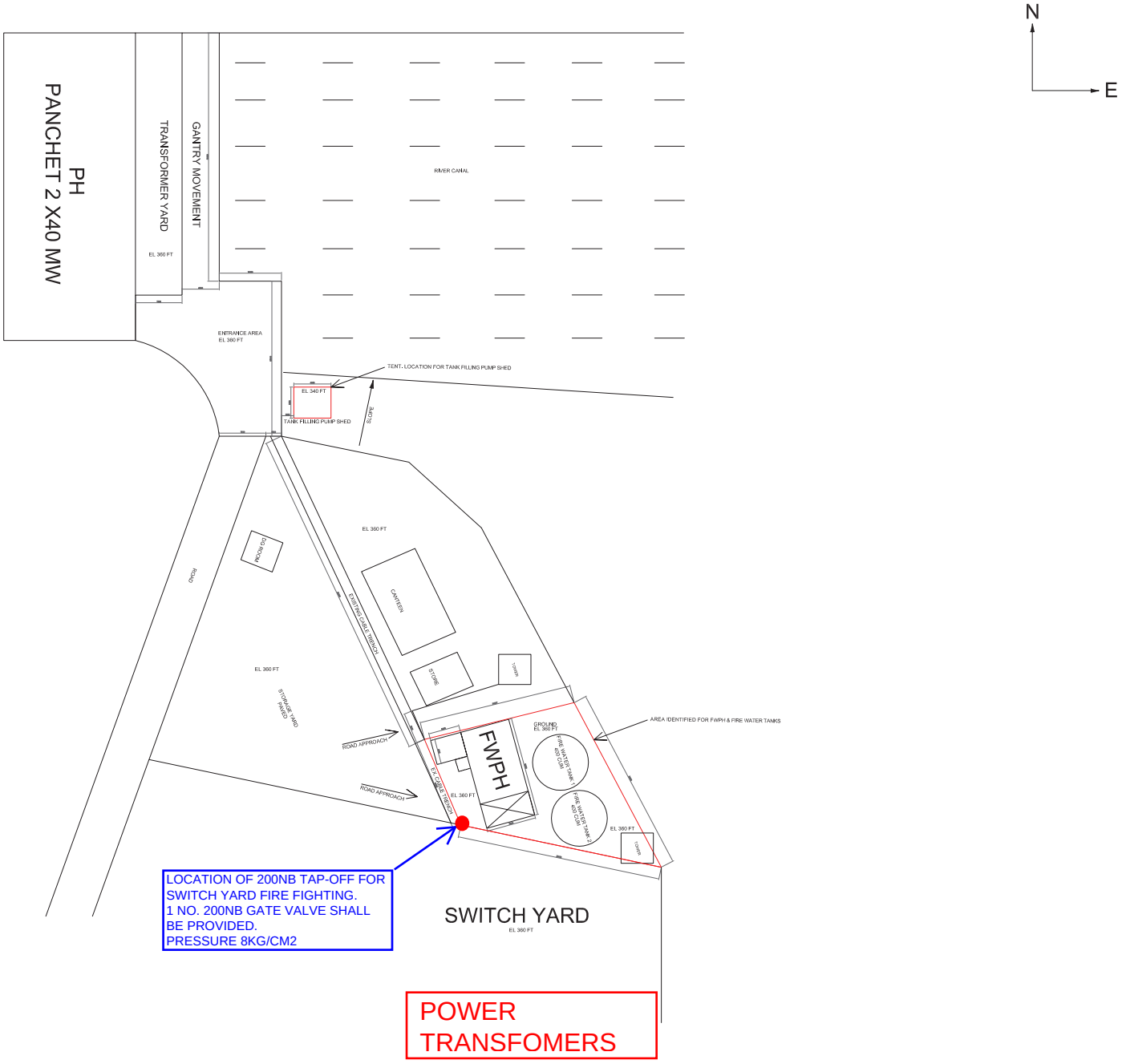
TITLE: OUT LINE GENERAL ARRANGEMENT

DRAWING NO. | REV. 02

SHT. NO. 01 | NO. OF SHT. 01

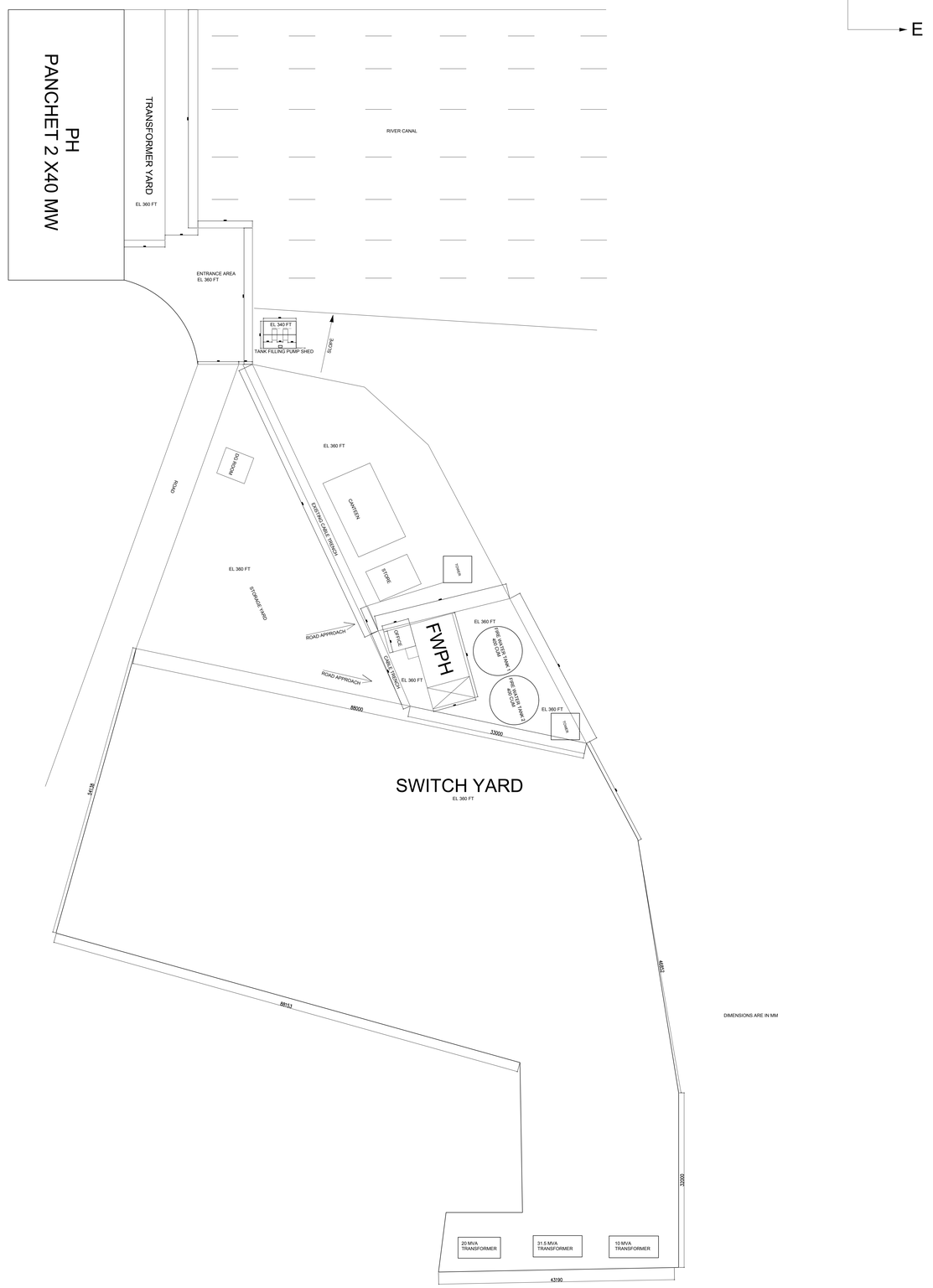
REF. DRG. NO. | SIGN AND DATE | INVENTORY NO.

A0 SIZE



TENTATIVE SKETCH OF MAJOR BUILDINGS/LOCATIONS

DIMENSIONS ARE IN MM



DIMENSIONS ARE IN MM


Rating
Hours
All filters
Search this area
Sign in
Damodar River
Purulia - Chirkunda Rd
Damodar River
JHARKHAND
WEST BENGAL
LOCATION OF 200NB TAP-OFF FOR SWITCHYARD FIRE FIGHTING
Panchet Hill Hydel Power Station
SWITCHYARD AREA
Sarbari - Panchet Rd
DVC water treatment plant
POWER TRANSFORMERS
Layers
Google
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