DAMODAR VALLEY CORPORATION (DVC)

PANCHET HYDEL STATION
RM&U OF UNIT # 1

TECHNICAL SPECIFICATION FOR RENOVATION WORK FOR 1 NO. 2X112.5T/2X25T POWER HOUSE DOUBLE GIRDER EOT CRANE

SPECIFICATION NO.: PE-TS-495-501-A001 Rev 0

BHARAT HEAVY ELECTRICALS LIMITED

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT

NOIDA, INDIA

INDEX

PROJECT INFORMATION

01.00 PREAMBLE

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.

~~The Technical Specification (**Volume-II, III & IV**) shall be read in conjunction with the Commercial Specification (**Volume- I)** of Tender Document. Volume-II of Technical Specification deals with the Technical Specification for Mechanical and Civil works whereas as Volume-III deals with Technical Specification for Electrical and C&I work. This Technical specification also describes dismantling of Turbine, Generator, electrics and all equipment, renovation of embedded parts, supply, erection, testing commissioning and demonstration of Performance Guarantee of Turbine generator, governing system, excitation system, other auxiliaries for Turnkey Installation of Unit # 1 of Panchet Hydel Station of DVC in Dhanbad District of Jharkhand.~~

01.01 Location details

Panchet Hydel Station is a dam toe power house located at the toe of Panchet reservoir on the river Damodar near the border of Dhanbad and Purulia districts of Jharkhand and West Bengal respectively. Panchet Hydel Station is approx 10 KM from Kumardubi Railway station and 25 KM from Asansol Railway station, West Bengal. The site is approx 50 KM from Dhanbad, Jharkhand. Longitude and Latitude of site location are as follows:

Longitude : 86°44' E
Latitude : 23°40' N

SECTION I
SPECIFIC TECHNICAL REQUIREMENTS

1. INTENT OF SPECIFICATION

1.1 This specification includes, but not limited to 'Supply part' & 'Service part' comprising of provision of all labour, plant , materials and performance of all work necessary for assessment of the existing crane, reverse engineering , site measurements on existing structures & equipment in order to determine site limitations & constraints, dismantling , detail design and engineering, manufacturing, testing, quality assurance, quality control, shop assembly, shop testing, transportation, delivery of all equipment's required for refurbishment including power cables, design, manufacturing, testing and supply of lifting beam, NDT services, storage of items & preservation, erection, testing and commissioning including performance testing, field acceptance test, training of employer's personnel, handing over and guarantee(as per relevant clauses of NIT, SCC & GCC), complete with accessories, spare parts and warranting a trouble free safe operation of the installation as per requirement given in NIT for refurbishment of **1 no. DOUBLE GIRDER EOT CRANE for POWER HOUSE (consisting of 2 nos. crabs, each having 1 no. 112.5T Main hoist and 1 no. 25T Aux hoist)** for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order.

1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. **Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the contractor of the responsibility of providing such facilities to complete the supply and services of the cranes and its accessories.**

1.3 It is not the intent to specify herein all the details. However, the equipment 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 who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.

1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.

1.5 The general term and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.

1.6 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Section-III of the specification **within 10 days of receipt of tender documents.** In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

1.7 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.

1.8 Deviations, if any, should be very clearly brought out clause by clause in the enclosed deviation schedule along with cost of withdrawal; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification. If no cost of withdrawal is given against the deviation, it will be presumed that deviation can be withdrawn without any cost to BHEL/its customer.

1.9 In the event of any conflict between the requirements of two clauses of this specification documents or requirements of different codes and standards specified, more stringent requirement as per the interpretation of the owner shall apply.

1.10 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.

1.11 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder /vendor and Customer/ Purchaser/Employer will mean BHEL and /or customer including their consultant as interpreted by BHEL in the relevant context. For details refer the relevant clause in GCC.

1.12 Quality plan for reference is included in this specification to enable the bidder to understand the extent of inspection and testing requirements to execute this job. The successful bidder has to follow the quality plan's minimum requirement during manufacturing and testing.

1.13 Bidder shall visit site and satisfy himself of all details including facilities at site before quoting for the equipment and services. No claim on this account shall be admissible in this regard.

Note:

Bidder to note that BHEL reserves the right for drawing/document submission through web based Document Management System. Bidder would be provided access to the DMS for drawing/document approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.

- Internet explorer version – Minimum Internet Explorer 7.
- Internet speed – 2 mbps (Minimum preferred).
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked.
- Vendor's internal proxy setting should not block DMS application's link (https://www.bhelpem.com/WrenchWeb/

1.0.0. SCOPE OF WORK

1.1.0 Scope shall covers the provision of all labour, plant , materials and performance of all work necessary for assessment of existing cranes, reverse engineering , site measurements on existing structures & equipment in order to determine site limitations & constraints, dismantling , detail design and engineering, manufacturing, testing, quality assurance, quality control, shop assembly, shop testing, transportation, delivery of all equipment's required for refurbishment, erection, testing and commissioning including performance testing, field acceptance test, training, handing over to the Employer and guarantee(as per relevant clauses of NIT, SCC & GCC), complete with accessories, spare parts and warranting a trouble free safe operation of the installation.

1.1.1 Equipment and services to be furnished by the bidder for the refurbishment of EOT CRANE of Power House with accessories as per the details given along with design, manufacturing and supply and testing of lifting beam. Any equipment / accessories not specified but required for refurbishment of the EOT cranes for efficient operation shall also be under the bidder's scope of work.

DESCRIPTION OF EXISTING CRANES

SN.	Description	Details as per Contract Specification
1	Capacity	2x112.5T Double Girder EOT crane for Power house
1.1	Main hoist	2 nos., 112.5T
1.2	Aux hoist	2 nos., 25T
2	Number of crabs	2 numbers (each consists of 112.5T Main hoist and 25T Aux hoist)
3	Duty	Indoor
4	Number of Cranes	One (1) no.
5	Span	19.812 m
6	Main Hoist Speed	1.25 m/min
7	Aux Hoist Speed	5 m/min
8	CT Speed	8 m/min
9	LT speed	12.5 m/min
10	Lift	21.488 m lift for MH and 30.48m for AH motion
11	Gantry Girder	RCC
12	Baylength	53.1665 m baylength
13	LT wheels	16 nos. (800mm dia)
14	CT wheels	4 nos for each crab (630mm dia)
15	Tandem operation of both crabs	Yes, provision of tandem operation for hoisting and CT motion both is given in existing crane by cabin. One selector switch has been provided for individual/tandem operation for hoisting motion and CT motion each.
16	Make/ commissioning year	M/s. LITROSTROZE, Yugoslavia / 1959
17	Ambient Temperature	50°C
18	Motor Details (Slip ring motors)	
18.1	Main hoist Motor	
	Qty	2 Nos.
	Make	**Siemens Schuckert**
	KW	43
	Voltage	400
	Current	88A
18.2	Aux hoist Motor	
	Qty	2 Nos.

	Make	**Siemens Schuckert**
	KW	31
	Voltage	400
	Current	88A
18.3	Cross travel Motor	
	Qty	2 Nos.
	Make	**Siemens Schuckert**
	KW	4.2
	Voltage	400
	Current	8.8A
18.4	Long travel Motor	
	Qty	1 Nos.
	Make	**Siemens Schuckert**
	KW	7.2
	Voltage	400
	Current	20A

1.1.2 Scope of supply: The scope of supply for refurbishment work for the crane shall include the following: The rating of components to be replaced shall be of at least minimum rating of the particular items installed at site.

1. Dismantling and replacement of old control & power panels, resistance boxes, rotary switches, MCCBs, limit switches etc.
2. Supply, Installation, testing & commissioning of new rotary switches, grid resistance box and Master controller with complete wiring for Main hoist-1 & 2, Aux. hoist-1&2, long travel, cross travel- 1&2.
3. Supply, Erection, testing & commissioning of new control & power panels consisting of over load relays, power & control contactor, single phase preventer, timer, switch fuse unit, etc. with complete wiring for Main hoist-1&2, Aux. hoist-1 & 2, long travel, cross travel- 1&2.
4. Supply, Erection, testing & commissioning of new limit switches of suitable rating and grade with complete wiring for Main hoist-1&2, Aux. hoist-1&2, long travel, cross travel-1&2.
5. Making arrangement for parallel operation (for hoisting and cross travel motion) of 2 nos. of main hoists, inching operation of the drives, remote operation of the Crane with dropdown control switch complete in all respect with testing & commissioning.
6. Making arrangement for remote operation of the Crane with dropdown control switch complete in all respect along with operation from Operator's cabin with testing & commissioning. Pendant control to be provided for existing crane.
7. Complete servicing & overhauling with replacement of bearings, varnishing, carbon brush, etc. in respect of 1 no. long travel motor, 2 nos CT motor, 2 nos. main hoist motor and 2 nos. of aux. hoist motor with testing and trial run of the motors. Replacement of bearings, line shaft bearing and gears (if damaged) along with oil seals, bushes are also included in the works.
8. Supply, Erection of festoon arrangement with "I" section, pulley train, chain link, flexible copper cable of adequate size to feed electric supply to crab/trolley along with both side terminal boxes in place of all existing bus bar arrangement for cross travel. Dismantling of bare conductor is also a part of job.
9. Dismantling of old power & control cables and installation & termination of new cable of required rating and grade.
10. Supply, installation of new fan, siren with switch & emergency switch in operator cabin of EOT Crane including all cabling and auxiliaries etc .
11. Supply, installation of spot lights with fixtures and lighting arrangement including all cabling and auxiliaries etc in other areas for sufficient illumination in the crane. All under

bridge lights, over bridge lights and cabin lights shall be replaced with LED lights. Rating of lights shall be as given below:

a) 125W LED lights for under bridge
b) 40 W LED lights for over bridge
c) 10 W LED lights for cabin.

12. Supply, Installation of minimum 200A Switch fuse unit with enclosure and termination after dismantling of existing old main switch, complete in all respect.
13. Supply, laying & termination of 3.5CX185 Sqmm AL PVC armoured cable between Switch fuse unit & DSL after dismantling of existing old cable.
14. Replacement of power conductors (down shop and/or trolley and bridge). PVC shrouded bus bar (Cu) DSL for long travel and flexible trailing cable/ Energy chain type for cross travel to be provided. All fixing arrangement of DSL is in bidder's scope.
15. Checking and Repairing of existing earthling system of EOT crane.
16. Complete servicing & overhauling of Long Travel Gear Box, main hoist gear boxes, auxiliary hoist gear boxes and cross travel gear boxes.
17. Checking the condition of all guide wheels for any defect and any other abnormality. If any defect & abnormality observed, submission of report for needful corrections required.
18. Checking and repairing of Levelling and alignment of both the long travel rails.
19. Dismantling of old braking system and supply & installation of new braking arrangement for main hoist-1&2, auxiliary hoist -1 & 2 long travel and Cross travel-1&2.
20. Supply and replacement of Lubrication oil of all gears and moving parts of crane. (Servo system 150, Make-IOC) for all the gear box.
21. Supply, installation & replacement of complete wire rope for 2 nos. main hoist (112.5 Ton each), 2 nos. of auxiliary hoist (25 Ton each) as per IS 2266.
22. Components i.e fuses/relays/contactors etc inside all panels shall be replaced
23. Replacement of control and power wiring or conductor and collector systems. All cables shall be copper of minimum 2.5 sq mm.
24. Refurbishment of end stopper.
25. Load testing of crane for maximum safe working load shall be done by bidder as per IS 3177 at site through an authorized agency,recognized by Chief Inspector of Factories,Govt. of Jharkhand.
26. Painting of complete crane including girders after cleaning the complete surface with suitable cleaner shall be done. (refer painting schedule).
27. Make of various items to be replaced shall be as per Annexure I: Makes of sub vendor items.
28. Testing and commissioning of the total system after servicing / overhauling / replacement of damaged equipment/components in the presence representative of DVC.
29. Design, manufacturing and supply of 225T capacity 1. no. Lifting beam (with 1 no. 250T Ramshorn hook as per IS 5749 and thrust bearing for hook) for tandem operation of both the crabs of crane (refer Stator rotor handling arrangement drawing). Total weight of lifting beam and hook should not exceed 7T.
30. Slings for Rotor and stator lifting (refer Stator rotor handling arrangement drawing)
31. Supply of (150m) power cable (XLPE insulated armoured stranded copper conductor incoming power cable, 1.1 KV Grade as per IS 7098 Part 1;1988) from crane feeder (from Unit Auxiliary Board) to Switch Fuse Unit (provided at operating floor of power house) of crane. Cable from Unit Auxiliary Board to motor terminal shall be so sized that the voltage drop does not exceed 5% of rated voltage.
32. NDT scope as per Annexure VI, Section IA of technical specification.

1.1.3 **Mandatory Spares**

Spares listed in Annexure II are to be supplied only for the parts replaced/ refurbished by the contractor as per applicability from the indicated list.

A complete unused and new set of Mandatory Spare parts shall be supplied. Each part shall be stamped so as to be identified, easy for it use. The items supplied shall be of the best

quality. The requirement of mandatory spare parts is listed in Annexure –II Section-I of this specification.

1.1.4 **Erection & Commissioning spares; Maintenance Tools and Tackles**

The Bidder shall supply erection & commissioning spares, Maintenance Tools and Tackles as per his experience, for replacement of damaged or unserviceable parts during the execution of the project at site, to avoid delay in the project schedule. This shall form part of the main equipment supply. Oil and grease required for first filling along with ten (10%) percent excess quantity. The bidder shall deliver to the Owner all equipment complete with initial fill of fluids, grease or lubricants, in drums / containers. Bidder shall supply minimum following.

1.1.5 Any supplies to be done under guarantee clause & any other clause of **NIT, GCC, SCC** as relevant to the package.

1.167 Forwarding and transportation to delivery address as per SCC.

Note:

a. Any item, not quoted by bidder, but required during refurbishment work of EOT cranes shall be supplied by bidder without any additional cost to purchaser.

1.2.0 Services to be provided by the bidder

a) Assessment of existing cranes at site and report submission for approval before starting refurbishment activity.

b) Dismantling of cranes/crane parts at site as per requirement.

c) All activities associated with replacement/renovation/refurbishment of crane equipments as described above in scope of supply.

d) Handling equipment such as mobile crane, hydra crane, fork lift etc. required for dismantling or refurbishment, loading, unloading, assembly and erection of refurbished crane shall be in bidder's scope.

e) Erection and commissioning.

f) Load testing at site.

g) Open space is available at site near power house which may be used for storage.

Unloading, watch and ward shall be in bidder's scope. Refurbishment work can be done in service bay of power house.

h) Packing, forwarding, transportation and handling at site.

i) Handling and disposal of scraps to the area identified by BHEL/Customer at site.

j) Obtaining clearance and acceptance certificate from the concerned competent authority after site test. Necessary fees/expenditure as required shall be borne by the bidder.

k) Training at site during refurbishment work for operation and maintenance.

l) Any certification / license from statutory authority required for installation & putting the crane into service.

n) Electricity, water facility for Refurbishment of cranes will be provided by Erection subcontractor/ Customer on chargeable basis at single point.

o) Any services to be done under warranty clause & any other clause of NIT, GCC, SCC as relevant to the package.

p) Successful commissioning, load test of crane at site and closure of all punch points after commissioning shall be considered as acceptance for final handing over of the crane to M/s DVC

2.0.0. **Works Excluded**

2.1.0 Refurbishment/ replacement of existing crane structure i.e. bridge girder, operator's cabin, end carriage.

OTHER REQUIREMENTS:

3.0.0. Drawing and documents submission schedule along with number of prints.

Drawing and documents submission schedule along with number of prints / copies required for various drawing and documents are listed in Annexure –V, section I of this specification.

4.0.0. Deviations

If the offer submitted has got any deviation from the technical stipulations in the tender document, bidder shall tabulate the same in the format of “Cost of withdrawal of deviation” attached with GCC and furnishing full particular of such deviations. Deviations are to be furnished with mention to specific clause number (reasons / explanations for such deviations shall be furnished). Notes / comments etc. is not acceptable. If there are no deviations from the tender document, bidder shall mention “NO DEVIATION’ in cost of withdrawal of deviation format.

5.0.0. Makes of Sub - Vendor items

Makes of bought out items as per Annexure-I, section I of the specification is for reference only. Sub vendor list shall be subject to Customer’s approval and same shall not have any impact on manufacturing, delivery schedule and cost of the crane.

6.0.0 Renovation/replacement of cranes parts are to be inline with IS 3177. Further design, selection of components, material etc. is to conform to IS 3177 in line with details mentioned in tender specification elsewhere.

7.0.0. Performance Test requirement

EOT crane along with its drives, controls and other accessories shall be checked for the rated capacity against the rated speed of motions and for the service conditions specified. The bidder shall have the full responsibility for the safe and efficient operation of the crane with associated accessories as a single unit. If the site performance tests indicate the failure of any of the components to achieve the desired performance, the deficiency shall be made good at bidder’s cost. Performance test shall be carried out each time after the rectification

/modification is carried out. Performance test of the crane shall include load tests and speeds in various motions at site.

Testing at site

Completely assembled crane at site shall be check for misalignment of gears, shafts and other items. For load test the heaviest assembly during assembling of TG components/ equipment's shall be used for load testing and the deflection of the bridge.

i. Vertical deflection test shall be conducted for the crane at the site.

ii. Existing crane structure shall be cleaned and painted.

ii. Capability of crane to lift the load from mid-air shall be demonstrated. Electrical tests for brakes, panel, electrical equipment etc. as per IS – 3177.

iii. Speed test at rated load for hoisting, CT and LT mechanism.

iv. Brake test.

v. Any other test as per IS-3177

The test shall be carried out with actual panel, etc.

8.0.0 Testing at works for sub assembly and bought out items.

Quality plans at Section I have been enclosed with this specification to enable the bidder to understand the extent of inspection and testing requirements applicable for all the items which shall be replaced.

QUALITY ASSURANCE REQUIREMENTS

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	MANUFACTURING QUALITY PLAN			SPEC. NO: PE-TS-495-501-A001	DATE: 12.07.2022
		CUSTOMER: DVC			QP NO.: PE-V0-495-501-A301	DATE:
		PROJECT: PANCHET HYDEL STATION RM&U OF UNIT # 1			PO NO.:	DATE:
		ITEM: RENOVATION WORK FOR 1 NO. 2X112.5T/2X25T POWER HOUSE DOUBLE GIRDER EOT CRANE	SYSTEM: EOT CRANES		SECTION:	SHEET 1 OF 5

SL NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			10
					M	C/N				D	M	C	N	
1.0	**MATERIAL:**													
1.1	Brake Drums	1. Chemical & Physical	Major	Chemical & Physical	100%	-	APPD. DRG. / DATA SHEET	APPD. DRG. / DATA SHEET	TC	√	P	V	V	
		2.NDT	Major	U.T (only boss area)	100%	-	ASME Sec.V,article-23,SA-609	SA - 609 , Level - II	NDT Report	√	P	V	V	For UT procedure refer Note 4
2.0	**BOUGHT OUT ITEMS**													
2.1	Wire Rope & slings	Visual & Breaking Strength	Major	Type, grade, breaking strength &visual , Diameter	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	Mill T.C.	√	P	V	V	
3.0	**ELECTRICAL ITEMS**													
3.1	Transformer (Control transformer, Light transformer etc.)	Make , Rating	Major	Visual	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	IR	√	P	V	V	
		Routine Test	Major	Doc. Review	100%	-	Mfg. Catalogue	Mfg. Standard	TC	√	P	V	V	
3.2	SFU , MCCB , MCB , CONTRACTORS , DSL, RELAYS , FUSES , RESISTENCE BOX,HOOTER, DBR, PUSH BUTTONS, indicating instruments , junction box, Limit Switches	Make / Rating / Type / Size	Major	Visual	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	IR	√	P	V	V	
		Functional / Continuity Check	Major	Operational	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	IR / COC	√	P	V	V	
3.3	Brakes	Make, Type ,Rating	Major	Measurement	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	TC		P	V	V	
		IR, HV, Functional Test	Major	Measurement	100%	-	MFG. STD.	MFG. STD.	TC	√	P	V	V	
3.4	Cables (Power / Control / Trailing / Flexible)	Make, Type, Size	Major	Visual	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	TC	√	P	V	V	
		Routine Test	Major	Measurement	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	TC	√	P	V	V	
3.5	Radio Remote, Master Controller, Pendent Station, Switches	Make / Rating / Type / Functional	Major	Visual	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	TC / COC	√	P	V	V	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:			Checked by:		
Reviewed by:			Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

THIS IS PART OF TECHNICAL SPECIFICATION NO.: PE-TS-495-501-A001 Rev 0

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	MANUFACTURING QUALITY PLAN			SPEC. NO: PE-TS-495-501-A001	DATE: 12.07.2022
		CUSTOMER: DVC			QP NO.: PE-V0-495-501-A301	DATE:
		PROJECT: PANCHET HYDEL STATION RM&U OF UNIT # 1			PO NO.:	DATE:
		ITEM: RENOVATION WORK FOR 1 NO. 2X112.5T/2X25T POWER HOUSE DOUBLE GIRDER EOT CRANE	SYSTEM: EOT CRANES		SECTION:	SHEET 2 OF 5

SL NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			10
					M	C/N				D	M	C	N	
3.6	Anti - Collision Device , Cable Gland & lugs , Rectifier ,Lamps, Load cell, Illumination and Earthing material	Make / Type	Major	Visual	100%	-	APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	TC/ COC		P	V	V	
4.0	**OTHER BOUGHT OUR ITEMS**													
4.1	Bearings	Type & Size	Major	Verification	100%	-	Appd.drg./ Mfr's catalogue	Appd.drg./ Mfr's catalogue	TC / IR / COC	√	P	V	V	
4.2	Tools and tackles	Verification of type size / rating	Major	Verification	100%	-	As per PO / BBU	APPD DRG / DATA SHEET	TC / COC	√	P	V	V	
4.3	Hook for Lifting beam	i) Chemical Composition , Heat treatment , Mechanical properties on integral test bar.	Major	Chemical , Heat treatment & Tensile , % Elongation.	100%	100%	IS : 1875	IS : 1875	Test Certificate , HT Chart & Inspection report	√	P	V	V	
		ii) UT on raw material of Hook	Major	UT	100%	100%	ASTM A 388	UT Procedure, ASTM A 388		√	P	V	V	
		iii) Forging operation of hook	Major	Visual	100%	100%	IS:5749 / IS:15560	IS:5749 / IS:15560		√	P	V	V	
		iv) Proof Load Test	Major	Mechanical	100%	100%	IS:5749 / IS:15560	IS:5749 / IS:15560		√	P	W	W	
		v) UT & MPI after proof load test.	Major	UT & MPI	100%	100%	ASME Sec. V / SE 709	UT Procedure & Annexure V		√	P	W	W	
		vi) identification Punch (By BHEL or Customer, after proof load & NDT Witness.	Major	Visual	100%	100%	---------	-------		√	P	W	W	CHP - Customer Hold Point.
4.4	Spares (Mandatory / recommended spare / commissioning spares)	Verification of make, type, size , rating	Major	Review Of Internal Inspection Reports / Mfr's TC / COC	100%	-	Approved Spare List	APPD DRG / DATA SHEET	IR / COC	√	P	V	V	
5.0	**IN PROCESS INSPECTION OF MACHINED COMPONENTS**													
5.1	Brake Drums	1.Visual & dimension	Major	verification	100%	-	Mfg. Drg	Mfg. Drg	I.R.	√	P	V	V	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:			Checked by:		
Reviewed by:			Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
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Approved by:			

THIS IS PART OF TECHNICAL SPECIFICATION NO.: PE-TS-495-501-A001 Rev 0

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	MANUFACTURING QUALITY PLAN							SPEC. NO: PE-TS-495-501-A001					DATE: 12.07.2022
		CUSTOMER: DVC							QP NO.: PE-V0-495-501-A301					DATE:
		PROJECT: PANCHET HYDEL STATION RM&U OF UNIT # 1							PO NO.:					DATE:
		ITEM: RENOVATION WORK FOR 1 NO. 2X112.5T/2X25T POWER HOUSE DOUBLE GIRDER EOT CRANE					SYSTEM: EOT CRANES		SECTION:					SHEET 3 OF 5

SL NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9		**			10
					M	C/N				D	M	C	N	
		2. NDT	Major	DPT after machining	100%	-	ASME - Sec. V	NO RELEVANT INDICATION	NDT Report	√	P	V	V	
5.2	DSL Guard	Dimensional	Major	Dimension	100%	-	Mfg. Drg.	Mfg. Drg.	I.R.	√	P	V	V	
5.3	Hooks for main hoists and aux hoist for crane at site	UT & MPI after load test of crane.	Major	UT & MPI	100%	100%	ASME Sec. V / SE 709	UT Procedure m ASME Sec. V / SE 709	I.R.	√	P	W	W	
6.0	**FINAL INSPECTION**													
6.1	CONTROL PANEL	Identification of all Elect. Components, Cable laying / Dressing/ Feruling /Terminations Dimensional, Functional , HV, IR, interlocks, Protection DOP	Major	Visual, dimensional, Operational & Functional Check , HV,IR, Painting	100%	100%	IS:3177 / APPD DRG / DATA SHEET	IS:3177 / APPD DRG / DATA SHEET	I.R	√	P	W	W	Refer Note 27
		Paint Shade/ Thk/ Adhesion	Major	Visual / DFT Check	100%		APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	TC	√	P	V	V	Refer Note 28
6.2	EOT crane assembly with control panel, Master Controller / Remote Controller Pendent Station (At Site)	Visual & dimensional	Major	Dimensional ,Span, Diagonal & Wheel Base Dimension, LT Stopper Dimension	100%	100%	IS 3177 / APPD DRG / DATA SHEET	IS 3177 / APPD DRG / DATA SHEET	I.R.	√	P	W	W	Refer Note 29

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:			Checked by:		
Reviewed by:			Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	MANUFACTURING QUALITY PLAN			SPEC. NO: PE-TS-495-501-A001	DATE: 12.07.2022
		CUSTOMER: DVC			QP NO.: PE-V0-495-501-A301	DATE:
		PROJECT: PANCHET HYDEL STATION RM&U OF UNIT # 1			PO NO.:	DATE:
		ITEM: RENOVATION WORK FOR 1 NO. 2X112.5T/2X25T POWER HOUSE DOUBLE GIRDER EOT CRANE		SYSTEM: EOT CRANES	SECTION:	SHEET 4 OF 5

SL NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			10
					M	C/N				D	M	C	N	
		Operational	Major	(1) Speed & Current Measurement at No Load for Hoist & CT/LT motion (2) Speed & Current measurement at SWL of Hoist & CT & LT motion (3) Deflection test (4) Operation Check of Brake at SWL (5) Interlock & Functional test	100%	100%	APPD DRG / DATA SHEET / IS 3177	APPD DRG / DATA SHEET / IS 3177	I.R.	√	P	W	W	Refer Note 30
7.0	Cleaning & painting	Paint Shade / DFT	Major	Visual , DFT Check	100%		APPD DRG / DATA SHEET	APPD DRG / DATA SHEET	IR	√	P	W	V	
8.0	Review of QA documentation						As per approved QAP			V	V	V	V	
9.0	Packing of components	Packing Soundness	Major	Visual	100%	100%	APPD DRG / DATA SHEET /Packing specification	APPD DRG / DATA SHEET /Packing specification	IR	√	P	W	V	Refer Note 6

NOTES:

1) Original TCs / Photocopies certified in original by mill shall be furnished for review. Test In absence of correlated TCs Check test shall be carried out from each plate/ bar for above 10 mm thk., certificates shall be offered for review at the time of stage inspection of components / assembly. Supplier shall ensure that pitted material is not used.
2) Blank
3) Performance of electrical & control devices along with the interlocks, protection & sequence to be checked after crane assembly at works.
4) Blank.
5) Following to be noted for packing:
   a) Packing shall be suitable for storage at site in tropical climate conditions.
   b) Blank.
   c) Photographs of items duly placed inside the box just before the final packing and photographs of the box just before dispatch to be sent to BHEL purchase group for review before issuing MDCC.
6) In case of foreign supplier, all test certificates shall be furnished by the supplier, duly witnessed/verified by supplier's TPI.
7) The latest revisions/year of issue of all the standard indicated in the QP shall be referred.

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:			Checked by:		
Reviewed by:			Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	MANUFACTURING QUALITY PLAN						SPEC. NO: PE-TS-495-501-A001				DATE: 12.07.2022
		CUSTOMER: DVC						QP NO.: PE-V0-495-501-A301				DATE:
		PROJECT: PANCHET HYDEL STATION RM&U OF UNIT # 1						PO NO.:				DATE:
		ITEM: RENOVATION WORK FOR 1 NO. 2X112.5T/2X25T POWER HOUSE DOUBLE GIRDER EOT CRANE			SYSTEM: EOT CRANES			SECTION:				SHEET 5 OF 5

SL NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N			*	**			
									D	M	C	N	
1	2	3	4	5	6		7	8	9				10

8) Blank.
9) Blank.
10) The heat no. /plate identification no. shall be transferred on all major cut pieces of the MS plate for proper correlation, cutting plan of each plate shall be maintained for proper traceability.
11) Welder no. shall be punched near butt weld joints, the welding plan of each fabricated item shall be maintained.
12) In absence of co-related TC, check testing shall be witnessed on samples selected by Main contractor.
13) Co-related Mill TC inclusive of UT will be reviewed by BHEL/CUSTOMER, In absence of UT conformance in Mill TC, then UT will be witnessed by BHEL. For UT procedure refer Note 4.
14) Mech. Properties against H.T condition if applicable against respective Material standard/Grade. Hardness test report review after applicable Q & T condition.
15) Blank
16) Blank.
17) Blank.
18) Blank.
19) Blank.
20) Identification by BHEL/Customer
21) Blank
22) Welder/procedure qualification will be witnessed by Customer/ BHEL as per appd. WPS. In case the BHEL/NTPC/Lloyds /any other renowned approving agency already available, and doing the job, requalification is not required.
23) Blank.
24) Blank
25) BlankR.
26) Noise Max.85 db at 1 mtr. & 30^0 C temp. rise at ambient. Witness for Noise & vibration measurement during the final inspection
27) HV at 2.5 KV AC for power ckt at 2 KV for control ckt, DOP by paper insertion method. BOI as per CUSTOMER Approved Makes. Will be Checked at the time of Final Inspection.
28) 7 Tank Pretreatment before Painting.
29) Crane Should be Operable by RRC & PPB (Pendant push button) meant for that Crane only.
30) Functional & Interlock test to be checked as per approved Electrical Schematic drawing.

LEGENDS:
*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **C**: BHEL/ THIRD PARTY INSPECTION AGENCY, **N**: DVC,
P: PERFORM, **W**: WITNESS, **V:** VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI**: MINOR, **CR:** CRITICAL. **H** - Hold point

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:			Checked by:		
Reviewed by:			Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

	MANUFACTURER NAME & ADDRESS	MANUFACTURING QUALITY PLAN		TECHNICAL SPECIFICATION: PE-TS-495-501-A001
		ITEM: LIFTING BEAM ASSEMBLY FOR FOR 1 NO. 2X112.5T/2X25T POWER HOUSE DOUBLE GIRDER EOT CRANE **W.O.NO**:	BHEL DOC. NO. : REV : DATE :	PROJECT : PANCHET HYDEL STATION RM&U OF UNIT # 1 CLIENT : BHARAT HEAVY ELECTRICAL LTD.

SR. NO.	COMPONENT & OPERATIONS	CHARACTERISTIC	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	D	10			11
1)	**For Lifting beam (Lower & Upper Lifting Beam)**									**M**	**C**	**S**	
i)	Material	Chem. & Phy.	Major	Co-relation with T.C. Check test in absence of T.C.	1/heat/batch	Drg. / Tech. Spec. / IS:2062:2006 , GR-BR, (E250) , AMD.1 ,2009	Drg. / Tech. Spec. / IS:2062:2006 , GR-BR, (E250) , AMD.1 ,2009	MTC	✓	P	R	R	
		NDT	Major	U.T	100%	ASTM A 435	ASTM A 435	I.R	✓	P	R	R	UT on 25 mm & above thick plate
ii)	Weld set up	Dimensional conformity	Major	Measurement	100% for butt weld joint	Component drawing	Component drawing	I.R	-	P	-	-	
iii)	Pins for Slings & Hooks	Chem. & Phy.	Major	Co-relation with T.C. Check test in absence of T.C.	100%	Mfg.drg/EN-9(070M55) / BS - 970-1983	Mfg.drg/EN-9(070M55) / BS - 970-1983	I.R	✓	P	R	R	
		NDT	Major	U.T	100%	ASTM A 388	ASTM A 388	I.R	✓	P	R	R	IF DIA >= 50mm UT to be Applicable.
iv)	Wire rope	Make, construction , breaking strength	Major	Visul corelation with TC	100%	IS:2266 / As Per Drg.	IS:2266 / As Per Drg.	MTC	✓	P	R	R	
2)	**Welding**												
i)	WPS , WPQ & PQR	Welding parameters	Major	Review of earlier appd. WPS/WPQ/ PQR records	100%	ASME SEC IX	ASME SEC IX	WPS/WPQ/ PQR records as per ASME SEC - IX format	✓	P	R	R	WPS already approved by LIOYDS/NTPC/NPCIL shall be valid. In case NTPC/BARC/NPCIL/ IRS/TPL/LIOYDS qualified welders already available & doing the same job regularly, re-qualification is not required. Alternatively welder qualified by above agences will be utilised.
ii)	Back chipping	Surface defects	Major	DPT	100%	ASME Sec.V	ASME - Sec. VIII Div 1 Appen.-8	-		P	R	-	

LEGEND:
RECORDS IDENTIFIED WITH 'TICK (✓) SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION
"M" MANUFACTURER/ SUBCONTRACTOR
"C" CONTRACTOR (BHEL)
"S" CUSTOMER
INDICATE "P" PERFORM, "W" WITNESS AND "V" VERIFICATION AS APPROPRIATE.
" CHP" SHALL IDENTIFIED IN COLUMN " N "
NOTE: ITEMS NOT COVERED IN MQP, MAY BE CLEARED ON BASIS OF "CERTIFICATE OF CONFIRMANCE"

MANUFACTURER	CONTRACTOR (BHEL)	FOR CUSTOMER USE			
SIGNATURE			REVIEWED BY	APPROVED BY	APPROVAL SEAL

	MANUFACTURER NAME & ADDRESS	MANUFACTURING QUALITY PLAN		TECHNICAL SPECIFICATION: PE-TS-495-501-A001
		ITEM: LIFTING BEAM ASSEMBLY FOR FOR 1 NO. 2X112.5T/2X25T POWER HOUSE DOUBLE GIRDER EOT CRANE **W.O.NO**:	BHEL DOC. NO. : REV : DATE :	PROJECT : PANCHET HYDEL STATION RM&U OF UNIT # 1 CLIENT : BHARAT HEAVY ELECTRICAL LTD.

SR. NO.	COMPONENT & OPERATIONS	CHARACTERISTIC	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
										M	C	S	
1	2	3	4	5	6	7	8	9	D	10			11
a)	Butt-Weld	Weld Quality	Critical	RT	100% in tension & 25% in compression	ASME SEC VIII	ASME SEC VIII Clause UW - 51	RT report & Film	✓	P	R	R	Review of radiography report
			Major	DPT	100%	ASME Sec.V	ASME SEC VIII Appnd. 8	I.R	✓	P	R	R	
b)	Fillet Weld	Surface defect & size	Major	Visual	100%	Component Drawing	Component Drawing	I.R	✓	P	R		
			Major	DPT	10% at random	ASME Sec.V	ASME Sec. VIII	I.R	✓	P	**W**	R	W - At the time of final Inspection of Lifting beam
iii)	Inspection of Fabricated Lifting Beam	Visual & dimensional	Major	Dimensional & measurement	100%	Individual component drawing	Individual component drawing	I.R	✓	P	R	R	
3)	Final assembly of Lifting beam	Visual & Dimensional	Major	Visual & Dimensional check	100%	GA Drawing of lifting beam / IS 3177 / Tech-Specification.	GA Drawing of lifting beam / IS 3177 / Tech-Specification.	I.R	✓	P	**W**	**W**	CHP (AT WORKS)
4)	Review of QA Documents	-	-	-	-	-	As per approved QAP	-	-	R	R	R	
5)	Load test at Mfg. Works	Visual	Major	Visual	100%	Appd drawing / Load test procedure	Appd drawing / Load test procedure	I.R	✓	P	**W**	**W**	
		Deflection test at SWL	Major	Measurement	100%			I.R	✓	P	**W**	**W**	
		Overload test at (1.25 x SWL)	Major	Visual	100%			I.R	✓	P	**W**	**W**	

		LEGEND: RECORDS IDENTIFIED WITH 'TICK (✓) SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION "M" MANUFACTURER/ SUBCONTRACTOR "C" CONTRACTOR (BHEL) "S" CUSTOMER INDICATE "P" PERFORM, "W" WITNESS AND "V" VERIFICATION AS APPROPRIATE. " CHP" SHALL IDENTIFIED IN COLUMN " N " NOTE: ITEMS NOT COVERED IN MQP, MAY BE CLEARED ON BASIS OF "CERTIFICATE OF CONFIRMANCE"	**FOR CUSTOMER USE**	
MANUFACTURER	CONTRACTOR (BHEL)			
SIGNATURE			**REVIEWED BY**	**APPROVED BY** / **APPROVAL SEAL**

SECTION I
CUSTOMER SPECIFICATION

GENERAL TECHNICAL RULES

(AS PER APPLICABILITY OF SCOPE DEFINED IN SECTION IA)

04.00 GENERAL TECHNICAL RULES:

04.01 Introduction

This part of the specification describes the general technical rules to be followed while carrying out the work of Unit # 1 with installation of new up-rated Turbine Generator of Panchet Hydel Station. The technical requirement for electrical and instrumentation works are described in Volume - III of the Tender Specification.

The purpose of this 'General Technical Rules' is to provide the tenderer with certain general information on the location and conditions existing at site and to lay down common guidelines and specifications which Tenderer shall follow in designing the plant and execution of work. Adherence to the 'General Technical Rules' shall, however, not relieve tenderer of his responsibility regarding type, quality of materials, workmanship and requirement as specified by the Purchaser/Consultant under 'Technical Specifications' 'Invitation to Tender' and 'Draft Contract'.

Tenderer shall satisfy himself regarding the site conditions and other relevant matters by visiting site. It is desirable, for compelling reasons, to deviate from these instructions; tenderer is required to obtain prior approval from the Purchaser/Consultant.

All equipment to be supplied and/or engineering services and technical services to be rendered shall be manufactured/executed in accordance with the best trade/ engineering practices judged by the established standards and as given in the Technical Specification. Wherever the codes are not mentioned, the best international standards to be approved by the Purchaser/Consultant shall be followed.

Any supplies and services which might have not been specifically mentioned in the Technical Specification, but are necessary for efficient and smooth operation and maintenance of the work under Indian conditions, unless expressly excluded from the scope of supplies and services shall be supplied/provided by Tenderer without any extra cost to the Purchaser/Consultant.

04.02 Plant and Equipment

a. General

The selection, design and manufacture/fabrication of plant and equipment shall be suitable for the intended service and duty conditions and ensure maximum interchangeability of components and least maintenance. The unit shall be complete in all respect.

All the equipment, technological structures, pipes, valves, fittings, etc shall be subjected to inspection and testing as per accepted national or international standards and practices. All the components shall be subjected to inspection and testing as per standard practices of the manufacturer prior to offering them for inspection by the Purchaser/Consultant/his authorized representative.

All equipment shall be complete with approved safety devices, wherever a potential hazard to personnel and/ or equipment exists. There shall be adequate provision for safe access of personnel to and around the equipment for operational and maintenance functions.

All equipment shall be complete in all respect including all accessories essential for proper installation, operation and maintenance irrespective of whether such items are specifically mentioned in the specifications or not.

All working parts shall be arranged for convenience of operation, inspection, lubrication and ease of repair and replacement of parts and sub- assemblies with minimum downtime.

Suitable working platforms, walkways, hand railing, cross over, ladders, lifting tackle and tools required for the above shall be provided.

The fabrication and assembly areas shall be kept clean and free from contamination. During assembly of major components, a polythene covering shall be maintained in position to prevent ingress of dirt, grease, etc from overhead cranes or other equipment.

During fabrication, equipment, pipes, etc shall be kept sealed to the extent possible to avoid entry of foreign matter and contamination by dirt.

Piping shall be degreased after fabrication and maintained sealed until the end is presented for welding or jointing.

All equipment will be visually inspected in the presence of an inspector immediately before closure. A system of physical identification and accountability will be used to account for all tools, test equipment, shipping blanks and other items used during assembly to obviate the possibility of their being left inside vessels or equipment.

On completion of manufacture, each pressure vessel shall be pressure tested at room temperature at site/ manufacturing works in accordance with the appropriate code. On completion of construction/erection at site, the entire assembly shall be leak tested as above.

b. Design Considerations

Life of the Electro-mechanical generating equipment i.e., turbine, generator, transformers, auxiliaries, etc. shall not be less than forty (40) years

The Unit shall be designed for unconstrained operation over maximum net head and minimum net head and full range of ambient and other environmental conditions.
The turbine settings shall be as available and indicated in Chapter-6 of this Volume.
Speed rise, pressure rise, run away speed shall be governed by the limits specified in relevant IS.
Chemical analysis of water and data including the petro graphic analysis shall be taken into consideration while designing the turbine and other auxiliary equipment susceptible to abrasive effects of silt. Suitable materials, protective coatings and painting shall be provided to resist silt abrasion as per site conditions.

The operation of the Unit shall be smooth and quiet. The noise level shall not be more than 90 dBA at a distance of 1metre from any equipment.

c. Layout Considerations

Layout of equipment shall be developed considering the proper utilisation of space and functional requirements. The equipment layout shall be compact so as to economise use of materials.

Maintenance facilities shall be provided as required for assembly, disassembly and handling during maintenance of all equipment and auxiliaries.

d. ~~Operating Capability of the Generating Unit~~

~~The Unit shall be capable of giving the rated output continuously as specified by the manufacturer at the rated design head and rated discharge and shall be capable of operating between the minimum and maximum head specified in this specification (Vol II) and ambient temperature at site specified.~~

~~The maximum continuous over load capacity of the unit at the generator terminals during the high head conditions or high discharge conditions or both as guaranteed by the manufacturer shall be based on the hydraulic parameter of the station~~

~~The Unit and associated auxiliaries shall be suitable for continuous operation without any restriction within a frequency range of -5% to +3% (47.5Hz to 51.5 Hz). All the equipment driven by the electric motors shall give their rated performance even at a power supply frequency of 47.5 Hz.~~

~~Provision shall be made for starting the Unit in auto mode up to synchronisation by a single command and loading of the unit to full load quickly. The design of the equipment and control system shall permit participation of the unit in auto frequency control mode.~~

~~The Unit and all its associated auxiliaries shall be designed for trouble free operation up to maximum rating of the unit for complete range of operation for active power and reactive power output~~

~~The redundancy in the Unit auxiliaries and station equipment shall be provided so that the generating unit continue to operate even in the event of outage of a part of the auxiliary system.~~

04.03 Manufacturing and fabrication

a. General

All forgings, castings and structural materials shall conform to the relevant BIS/International standards/ equivalent ASTM/EN/DIN.

Special non-ferrous materials required for manufacturing parts subject to heavy pressure, severe working conditions, and/or requiring high tensile strength, toughness and resistance to corrosion shall be used.

Bronze used for manufacturing parts such as bearings, shall preferably be forged or centrifugally cast.

b. Working Stresses

For rotating parts the unit stresses due to run away speed of turbine shall not exceed two third of the yield strength of the material of construction.

Stresses for other materials will be as per OEM standard conforming to relevant standard.

04.03.01 Bearings

All parts subject to reciprocal motion and rubbing against other parts shall be provided with bronze or other suitable liners to minimise wear. The liners shall conform to IS;318 or as detailed against the particular equipment capable of being adjusted to compensate for wear. All rotating parts supported on frames shall have proper bearings depending upon speed, torque, load condition, etc.

04.03.02 Machine frames and bases

All machine bases shall be designed for maximum strength and rigidity consistent with good design.

Base plates shall be of welded steel construction. Those shall be designed with sufficient depth and stiffness to ensure rigidity of assembly.

If bases are made of two or more parts to make up height, locating pins shall be provided. Machined bolts shall be used in drilled and reamed holes for connecting the parts.

The machine frames shall have suitable eye bolts or hooks in requisite numbers for lifting purposes during erection and maintenance.

04.03.03 Nuts, Bolts, Studs and Washers

Machining and manufacturing of all the nuts, bolts, studs and washers shall conform to International Standards.

Nuts and bolts for pressure parts shall be of the best quality steel. Nuts, bolts and studs shall be of materials most suitable for the service operating conditions and designed to ensure the stresses arising in normal operation. For bolts used in critical areas the tenderer shall provide the following details:

i) Allowable elongation
ii) Recommended torque

Fitted bolts shall be a close fit in the reamed holes they occupy, and shall be marked in a conspicuous position to ensure correct assembly.

The threaded portion of any bolt or stud shall not project more than 1.5 threads above the surface of its mating nut.

Where practicable the use of slotted head screws shall be avoided in machinery component assemblies, hexagon socket screws being preferred.

04.03.03 Steel Forging

The tenderer shall supply a list of all important forgings and draw up material specification for each one. Copies of this list and specifications shall be supplied to the Purchaser/Consultant for his use. In each case the quality and inspection requirements shall be clearly stated.

Whenever possible steel forgings shall be in accordance with the requirements of IS/ International Standards. Forgings shall be free from cracks externally or internally, extensive non-metallic inclusions and surface defects. Tenderer shall carry out non-

destructive testing of forgings during machining to verify that no unacceptable defects are present.

Repairs by welding or other means shall not be undertaken on forgings at any stage of the production cycle.

Each forging shall be suitably branded with an identification number which shall be transferred throughout all final machining stages. The identification number shall be marked on all documents and test certificates relative to the forging.

04.04. Castings

a. General

All castings shall be homogeneous, free of shrinkage, under sizing, porosity or voids welding, filling, interlocking or plugging of defective parts shall be done with the approval of Purchaser/Consultant in writing. All repairs shall be subjected to non- destructive examination after heat treatment.

b. Steel Castings

The Tenderer shall prepare material purchasing specifications for all important castings. Each document shall indicate fully the quality and inspection requirements for the component casting covered. Copies of the Specification shall be issued to Purchaser/Consultant for his use.

Castings may be repaired by welding provided written approval of the Purchaser/Consultant is obtained in advance. The Tenderer shall submit drawings, sketches or photographs showing the location and principal dimensions of the defects together with the proposed weld repair procedure.

Only welders who have passed an appropriate qualification test shall be employed on the repair of castings. All repairs shall be carried out by the metal arc process.

Ultrasonic inspection shall be applied to all important castings to locate the extent of sub-surface defects and to check the wall thickness.

All castings shall be identified by stamped, or cast-on reference marks which shall be entered on all relevant documents and test certificates.

Purchaser/Consultant may require that certain castings shall be examined using radiographic inspection to locate the extent of sub- surface defects and to check the wall thickness.

c. Cast Iron Castings

Cast iron shall not be used for any part of equipment which is in tension or which is subjected to impact.

~~**d. Aluminium Bronze Castings**~~

~~The Tenderer shall prepare material purchasing specifications for all important aluminum bronze castings. Each document shall indicate fully the quality and inspection requirements for the component casting covered. Copies of the Specification shall be issued to the Purchaser/Consultant for his use. The inspection and quality requirements shall include an analysis of each cast, mechanical testing of test bars from each cast, pressure testing, penetrant flaw detection and radiographic examination of selected critical areas.~~

04.05 Hydraulic system

Hydraulic systems required for various units referred herein generally cover the following: Hydraulic fluid reservoir, pumps of various kinds, valves, accumulators, Hydraulic cylinders, oil coolers, Hydraulic motors, various accessories such as filter, strainers, hydraulic pipe work, fittings, flexible hose supporter for equipment, sealing devices, instruments for indicating, recording and integration of various parameters such as pressure, temperature, velocity etc., control devices for manual and automatic operation of the system, safety devices and alarms for abnormal operating condition, interlocks for sequencing and safe operation.
Hydraulic fluids shall be used on the basis of proven performance, operating condition, operating costs and easy availability.

The Hydraulic power system shall be suitable in every way for the service intended and shall be oriented forwards maximum interchangeability of component and minimising maintenance.

Hydraulic systems shall have filters at various points with adequate capacity and necessary filtration rating so as to keep the hydraulic fluid within permissible limits of contamination to achieve maximum life of the components.

Each hydraulic circuit shall be designed to minimize surge pressures, etc.

The hydraulic system shall be designed taking into account the maximum pressure encountered. Also, one must ensure while designing the system that the components of hydraulic systems are compatible with the hydraulic fluid selected at operating condition in the plant and under atmospheric conditions prevalent at Panchet Hydel Station. First fill of the hydraulic shall be in tender scope.

The hydraulic units will be of standard make.

04.06 Lubrication

Tenderer shall provide for proper lubrication systems for all moving parts of the equipment supplied.

All oil lubrication systems shall preferably be of circulating type complete with oil reservoir, pumps with motors, filter pressure vessels, pressure regulators, heat exchangers, oil heater, temperature controllers etc., flow switches, level switches, pressure gauges, pressure switches, temperature gauges, oil flow indicators, etc. The oil tanks shall have adequate capacity so as the return oil de-aerates, gives away heat picked up from lubricating points before again being pumped.

Wherever there is chance of water ingress into the oil lubrication system, the provision for water detection/removal shall be provided.

The selection/design and construction shall be suitable in every way for the service intended and shall be oriented towards maximising interchange- ability of components and minimising maintenance.

04.07 Optimization of Indian supplies & services

The Tenderer shall make all efforts to optimize the supplies and services from Indian sources and shall, however, ensure that the performance of the plant and equipment are achieved as envisaged in the Technical Specification.

04.08 Pumps

Centrifugal pumps shall be provided unless technical or strong economic reasons dictate that a positive displacement, either rotary or reciprocating is more appropriate.

~~04.09 Valves~~

~~a. General~~

~~All valves shall be suitable for the service conditions under which they are required to operate. The design, construction and choice of material shall take into account all operational requirements.~~

~~Parallel slide, butterfly or gate valves may be used for air, water services, and sluice valves for low head applications.~~

~~Any valve which is designed for unidirectional flow shall have an arrow embossed or cast on the valve body clearly indicating the required flow direction. All the valves provided with hand wheel/lever shall be clearly marked with "OPEN" and "CLOSED" positions and an arrow to indicate the direction of opening/closing.~~

~~Gate, globe, butterfly and non-return valves shall be provided with bypass arrangement as per applicable standards. Bypass arrangement may be integral with the valve or connected between pipes.~~

~~All valves, unless otherwise approved or specified, shall be of the external rising spindle type. Where desirable to protect the spindle against ingress of dirt, or where the position of the valve may create a hazard to operators when the spindle is extended, suitable spindle covers shall be provided. The spindles and operating gear of all valves for use outdoors shall have weather and dust proof protection.~~

~~Tenderer shall provide all necessary facilities in the pipe system for carrying out the requirements of item (b) including and temporary pipe work, valves and supports.~~

~~04.10.04~~ **~~Traps, Drains and Vents~~**

~~Tenderer shall provide all traps, drains and vents which are called for in this specification or which are necessary for plant operation, line or plant filling.~~

~~Drains and vents from different systems, or parts of systems operating at widely differing pressures, shall not be interconnected. At highest point for~~ vent and lowest point for drain should be provided to avoid the water hammering.

04.11 Welding General Requirements

a. General

All welding shall conform to the relevant National or International Standard Specification as agreed by the Purchaser/Consultant.

b. Welding Equipment

Any welding equipment which in the opinion of the Purchaser/Consultant, unsuitable or unsatisfactory for the service for which it is being used, shall be replaced by Tenderer without any time implication.

The absence of comment by the Purchaser/Consultant shall not be taken as approval for any equipment.

c. Weld Procedure Documents

Complete and full detailed weld procedure documents shall be kept and these shall be made available to the Purchaser/Consultant on request.

Prior to the commencement of the welding the Tenderer shall submit to the Purchaser/Consultant for approval the welding procedures to be used in the fabrication of the relevant sections of work.

d. Welders Qualification Tests

All welders shall be qualified for the work and shall hold current welders qualification certificates in accordance with National Standards.

Records showing the date and result of the qualification tests performed by each welder and weld operator together with the identification number assigned to him shall be available for scrutiny by the Purchaser/Consultant.

e. **Welding Inspection**

i. **Quality Requirements for Welds**

All welds subjected to non-destructive tests shall be entirely free from cracks or crack like defects, lack of root fusion, lack of sidewall fusion, root burn through or tailed pores. The standard for porosity and slag inclusions will be as indicated in the agreed standards for design and welding.

ii. **Visual Weld Inspection**

Each weld shall be subjected to a stringent visual inspection and shall be free from undercut, cracks, porosity and other surface imperfections.

Fillet welds shall be checked for dimensional tolerance and from using a fillet weld gauge. Fillet welds should be slightly concave in form and each leg of the weld shall have equal length.

iii. **Non-Destructive Examination**

All non-destructive examinations shall be supervised by a fully qualified and experienced specialist appointed by the Tenderer. Individual operators in each of the respective techniques shall be qualified and trained in the respective subject.

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

iv **Weld Repairs**

The Purchaser/Consultant's approval shall be obtained prior to commencement of any repair or rectification work.

Weld repairs shall be made to the same procedure as for the original weld. All tests shall be repeated after the repair has been completed.

v. Mandatory Inspections

All transmission welds between dissimilar materials, such as high alloy steel to carbon steel, or non-ferrous materials to steels, shall be subjected to 100% ultrasonic examination or crack detection wherever practicable. In addition, all butt welds between dissimilar materials shall be subjected to 100% radiographic examination.

All welds in ferritic alloy steels, e.g., having a carbon equivalent value in excess of 0.40%, and high yield-strength steels, e.g. having yield strength greater than 300 MPa, shall be subjected to 100% ultrasonic examination and crack detection wherever possible. In addition, all butt welds in these materials shall be subjected to 100% radiographic examination.

04.12 Noise and Vibration

a. **Noise**

Maximum noise level tolerable in work areas shall be within the applicable limit. As per applicable code & standard. The equipment and the services shall be designed such that limits are not exceeded. Tenderer shall indicate the maximum noise level guaranteed for each equipment/system with detailed description of noise control measures adopted, if any.

b. **Vibration and Balance**

Plant shall be designed and constructed to operate without vibration in so far as the nature of the works will permit. Where vibration must be expected this shall be reduced to the minimum which can be achieved by good design and careful balancing in the case of rotating plant.

The amplitude of vibration of rotating plant when measured on the bearing housings under steady state conditions at the designed operating speeds shall conform to IEC 34-14 (1982) or equivalent International Codes.

04.13 Scaffolding, Stairway and Ladders

Where safe and easy plant operation and maintenance cannot be arranged from provided floor levels, Tenderer shall supply and erect all platform galleries, stairways, access ways and ladders necessary for providing the required safe and easy access to the plant items. Tenderer shall ensure that the whole of the access ways are of uniform design and pattern throughout the Works. Where access is required for operation then standard design stairways must be provided, but if infrequent access for maintenance only is required then vertical ladders will be considered.

04.14 Safety Guards

All moving parts, shafts, couplings, flywheels, bare conductors and hot or cold surfaces shall be adequately and securely guarded in accordance with the prescribed legislation and to the Engineer's approval so as to afford complete safety to all personnel.

04.15 Special Tools and Tackles

The following tools and appliance shall be supplied under this tender for use by the Purchaser.

a) One set of all special tools and tackles including testing, calibrating and measuring instruments required for assembly, disassembly and maintenance of all equipments/ systems covered under the scope of the contractor shall be supplied by the Contractor. These shall not be used for erection/ commissioning purposes and shall be in an unused and new condition, when they are handed over to the purchaser/owner. A list of such special tools and tackles shall be submitted along with the offer.

Supply of all instrumentation measuring devices etc. (both test grades as well as standard) needed for conductance of demonstration / commissioning/ performance guarantee test. The instrumentation specifically brought by the contractor for the purpose of various PG testing alone, can be taken by the contractor after conductance of the PG tests.

b) One set of special lifting and handling appliances required for the normal maintenance of unit # 1.

Each tool or appliance is to be clearly marked with its size and/or purpose.

The tools and appliance supplied shall not be used for erection purposes by Tenderer and shall be handed over in new condition.

The exception to this is the special lifting and stud tensioning equipment which may be used provided that when it is handed over to the Purchaser it has not been subjected to more than normal wear and is still fully suitable for its intended use. In case of doubt, the Purchaser will require the tenderer to replace the worn appliances. Copies of certified test certificates for lifting appliance must be handed over at the Taking over Date.

Each set of tools and appliance under category (a) shall be suitably arranged in fitted boxes of mild steel construction, the number of boxes being determined in relation to the layout of the plant and equipment in question. If the weight of any box and its contents should be such that it cannot conveniently be carried. It shall be supported on steerable rubber-tyred wheels.

Each cabinet and box shall be painted, fitted with lock and clearly marked in white letters with the name of the item of equipment for which the tolls and appliance contained are intended.

Suitable storage racks shall be provided for all portable lifting tackle in this contract. Suitable lifting lugs, ears or eye bolts, or tapped holes for lifting rings shall be provided on all equipment items where the weight exceeds 15 kg.

All lifting tackle shall be stamped with unique identification number and safe working load. A test certificate from an approved Authority shall be supplied for each item of lifting tackle.

The tenderer shall provide a schedule of all lifting tackle and tools and appliance

being supplied for the approval of the owner engineer/consultant.

The tenderer shall provide all runway beams, trolley, chain blocks, special slings etc. necessary for the safe and efficient handling and maintenance of the works. The tools and appliance with the appropriate storage racks, cabinet and boxes shall be handed over the Purchaser at the time of taking over.

Where the tenderer includes site erection any special tools or appliance required solely for erection (but not for maintenance) shall be provided by the tenderer for own use and shall remain the property of the tenderer.

04.16 Painting

a. **General**

The primers & finishing paints will conform to latest Indian Standard or equivalent international standards. There shall be of approved quality and shade.

General precautions for painting such as preparation of surfaces, application of paints, inspection and testing etc. will be as per relevant clause of IS:1477 (Part I & II) and shall be followed, wherever possible.

General compatibility between primer and finishing paints recommended by the paint manufacturer, supplying these paints shall be followed.

General compatibility between successive coats must be ensured.
Unless otherwise specified, the general colour scheme for finishing coats for different types of equipment and pipelines as per requirement of the Purchaser/Consultant are to be followed. The colour schemes, however, may be changed, if necessary, by the Purchaser/Consultant at any stage before the start of the painting of the equipment.

b. Painting instructions

In general, unless otherwise specified, all plant and equipment & pipelines will be given one coat of antirust primer, lacquers, etc. at the supplier's works after completing surface

preparation to remove grease, rust, scales and other foreign materials. The second coat of antirust primer will be applied immediately after erection after completing requisite surface preparation) followed by two coats of finishing paint of approved quality & shade.

Technological structures, crane girders & other structures shall be given one coat of primer during manufacturer & one coat of primer after erection followed by two coats of finishing paint.

For equipment where original colour as per supplier's practice is desired, both primer & finishing coats will be applied at supplier's works before dispatch of equipment.

Structures embedded in concrete shall have no shop painting applied. The portion of the column that is to be embedded in concrete shall be given a coat of portland cement slurry after thoroughly cleaning the surfaces from mill scale, grease & oil immediately after fabrication.

The portion of the structures embedded underground shall be given two coats of red lead graphite primer at shop and finished with two coats of bituminous black paint of approved quality.

Machined/plain surfaces shall be coated with white lead and tallow before dispatch or before being put into open air & covered with gunny cloth.

Surfaces to be site welded shall have no shop paint applied within 100mm of welding zone. After site welding normal painting application will be followed.

Areas which become in-accessible after assembly shall be painted before assembly.
Cables & other electrical accessories shall have adequate antirust protection. Chequered plates shall be given primer coats only.
The phosphate coated surface shall have one coat of baking based and two coats of finished paint of amino alkyd resin stone enamel.
External surface of pipe fittings shall be thoroughly cleaned by wire brushing and given two coats of red oxide zinc chromate primer at supplier's works & two coats of final synthetic enamel paint after erection.

The equipment which is to be dispatched in knocked down condition and require assembling at site shall be given two coats of rust and corrosion preventive primer and one coat of synthetic enamel paint of approved quality and shade. After assembly at site, such equipment shall be given one final coat of synthetic enamel paint.

The equipment which can be sent as a single block unit duly shop assembled, shall be given full application of paint i.e. two primer coats of rust and corrosion preventive primer and two finish coats of paint of approved quality and shade as per relevant Indian Standards/equivalent international standards.

All painting shall be carried out by brushing or roller application with prior permission of the Purchaser/Consultant.

All metal parts not accessible for painting shall be made of rust and corrosion resisting materials. Interiors of equipment will be suitably quoted with anti-rust compounds.
The fasteners shall not be painted. These will be dispatched with application of anti-rust compound.
Any special painting requirement indicated on Tenderer's drawings by the Purchaser/Consultant during approval stage shall be binding.

c. Surface preparation and environmental conditions

All surfaces to be painted shall be thoroughly cleaned of dirt, grease, rust & mill scale. Removal of rust & scale shall be by hand brushing, power driven wire brushes or by sand blasting, as the surface condition/service condition warrants.

The paint shall be applied on the metallic cleaned surface after it is perfectly dry but not later than 3 hours after cleaning of the surfaces. Reasonable time gap should be allowed between any two consecutive coats of primer or finishing coats.

Surfaces coming in contact with acid & acidic fumes alkalis, soda, detergents etc shall be cleaned thoroughly to get complete metallic surface as per IS;1477 Part I & II or BS 4232-1967. After sand blasting the surface shall be cleaned with cotton rags, soaked in

benzene, to remove fine rust, grease, etc. No sand blasted surface shall be exposed to weather for more than 3 hours.

The choice of primer & finishing paint will depend on the environmental condition to which the plant & equipment and pipelines are exposed to.

Paints are to be applied on dry surface only under agreeable weather conditions. Painting in damp & foggy weather conditions will not be permitted.

For a selected primer the method of surface treatment best suited for that primer & suggestion of paint manufacturer shall be obtained and followed.

Zinc rich primer paints which have been exposed for a long time before the finishing coat is applied shall be washed down thoroughly to remove soluble zinc salt deposit.
The recommendation of paint manufacturer shall be forwarded to the Purchaser/Consultant for approval.

d. Primer paint

In general, two coats of primer paints conforming to relevant Indian Standard or equivalent international standards shall be applied on all unmachined surfaces, except noted otherwise.
Where equipment is to be finish painted for dispatch, both coats will be applied before finishing coats at supplier's works.

Where equipment warrants finishing coat after erection, one coat will be applied just after manufacture at supplier's works and the second coat just after erection at site after surface cleaning.

Equipment on which primer coat has been damaged due to prolonged exposition at site, final erection or transport, shall be given two coats of primer at site before applying finishing coats. Before applying paint the surface will be thoroughly cleaned by sand paper.
The primer applied should be compatible in quality and colour schemes with the subsequent finishing coats.

Unless stated otherwise, the following primer paints shall be used depending upon the exposition and environmental condition to which the plant & equipment, structures & pipelines are exposed to :

- Aluminium zinc oxide - conforming to IS;2931
- Red oxide zinc chromate - conforming to IS;2074
- Heat resistant aluminium primer paint - conforming to IS:161
- Air drying chemical resistant paint
- Epoxy resin paint (cold cured) -
- Poly urethene paint
- Chlorinated rubber based conforming to DEF-1402, Ministry of Defence

e. Finishing paint

Two coats of finishing paint compatible with the primer and conforming to relevant Indian Standard or equivalent international standards shall be applied on all unmachined surfaces unless mentioned otherwise.

Unless noted otherwise, the following finishing paints will be applied on plant & equipment, structure & pipelines depending upon the exposition and environmental conditions to which the plant & equipment, structures & pipelines are on subjected to:

- Synthetic enamel conforming to IS;2932 exterior type
- Epoxy based finishing paint -
- Heat resistant silicon based Aluminium paint IS:161

The finishing paint shall be of approved colour. The undercoat shall have different tinge to distinguish from the finishing paint.

The surfaces of the equipment on which finishing coats of paint has been damaged due

to prolonged exposition at Tenderer's work, erection site, during transport, storage or final erection shall be thoroughly cleaned & touched up with the same paint as applied previously.

f. Thickness of coat of paint

A single coat of paint when dry should have a thickness of 25 to 30 microns (0.025 to 0.030 mm) or 1 mil to 1.25 mils.

Total thickness of 4 coats (2 primer coats + 2 finishing coats) should have thickness of 100 to 125 microns (0.100 to 0.125 mm) or 4 to 5 mils.

In case of bituminous aluminium gilsonite based paint 3 coats are to be applied. The total thickness of 3 coats will be not less than 100 microns (0.100 mm) or 4 mils.

Immediately following the award of the Contract, the Tenderer shall submit the names of the proposed paint supplier and applicator together with a quality assurance program for approval. All paints for one section shall be provided by one manufacturer and preferably shall be manufactured in one country to ensure compatibility.

04.17 Coding Scheme

A coding scheme for identifying the drawings, plant and equipment, structures, spares and shipping documents shall be adopted by Tenderer.

a. **Coding scheme for drawings**

A ten (10) digit drawing numbering scheme is proposed for all the plant and equipment/spares to be supplied. The scheme will be cleared by the Purchaser/Consultant.

b. **Coding scheme for plant and equipment/ spares (Equipment identification number)**

Eight (8) digit coding scheme is proposed for all such items of supply. The first 3 digits conform to the shop complex, next 3 represent the equipment number. Suffixes of 2 digits may be used at the end of six digits, wherever necessary. (Identification number presently

used by plant people shall also be given for easy identification number).

c. **Shipping code for plant and equipment/spares**

The various items of plant units which arrive at site in packages have to be stored at proper areas/stores so that they can be retrieved easily and also to ensure the completeness of supply proper storing of the packages have to be done without opening the packages. As such, the boxes/packages have to be marked so that the contents may be easily identified for proper storage and easy retrieval.

Shipping code will comprise:

- Code number assigned to Tenderer
- Code number of equipment
- Package SN/total number of packages

d. **Colour scheme for plant & equipment**

Purchaser/Consultant will indicate the colour scheme to be followed during painting of the plant and equipment. This as well as the equipment identification number will be indicated by the Purchaser/Consultant soon after the Tenderer submits the list of plant and equipment along with GA drawings.

04.18 Erection, testing & commissioning of plant and equipment and pipelines

a. **General**

Tenderer, amongst other things, shall be responsible for renovation of the plant equipment to be reused and erection of plant and equipment, fluid system, electrics, auxiliaries, etc. as per the scope of supply within the design limit as given in the Technical Specification.

Tenderer shall delivery of the equipment and transport the same to his store/erection site, maintain his own stores for the storage of equipment and all related documents and records and finally transport the equipment to site for erection. Tenderer shall take an erection-cum-storage insurance policy covering all the risks including third party liabilities for equipment as well as human life. All security arrangements also shall be made by Tenderer.

Tenderer shall unpack the cases and do visual checking against physical damages of equipment and do cleaning of the equipment before start of erection.

Tenderer shall be responsible for proper and neat storage and also undertake conservation of all consignments including damaged boxes. During storage of equipment, Tenderer shall take into account deterioration and carry out the re-conservation of the complete equipment/parts/supplies as may be necessary as per the Storage Instructions of the Manufacturer of equipment/components. Tenderer shall also supply the consumables required for such re-conservation/conservation work and repair/replace parts required thereof for the proper functioning of the equipment after erection and commissioning.

Damage/shortage of the equipment/component during transit/transfer/storage, shall be made good by Tenderer without loss of time so as not to upset the agreed erection and commissioning schedule and at no extra cost to the Purchaser/Consultant. Delay on account of settlement of insurance claims by Tenderer shall not be taken into cognizance by the Purchaser/Consultant.
Tenderer shall be liable to make good any damage to existing equipment and/or facilities caused by Tenderer's personnel. In case any existing equipment or facility is required to be dismantled for erection of the new equipment, the same shall be restored at no extra cost to the Purchaser/Consultant.

Equipment will be installed on the existing civil foundation provided by the Purchaser. However, if any deficiency is noticed in the quality of concreting, dimensions, center-lines, levels, locations, etc of the foundation or anchors bolts or other embedments, the same will be rectified by Tenderer at no extra cost. Chipping/ rectification of the equipment for proper erection, alignment, etc. shall be done by Tenderer. Chipping/dressing of the foundation with air or air and water jet prior to placing the equipment will also be carried out by Tenderer.

Tenderer shall lay and maintain properly all the temporary supply lines at the erection site for temporary power, water, and air connections required for erection purposes, from the points earmarked by the Purchaser/Consultant for this purpose.

Tenderer shall provide all necessary construction tools, compressors, small hand tools, instruments, all commissioning instruments, welding equipment, service bolts, nuts, jigs and fixtures, winches, alignment tools, precision levels etc. and other equipment which may be required for carrying out the erection work efficiently within the time schedule. Unless otherwise specified, the above construction materials shall be the property of the Tenderer after the erection work is over. Special tools & tackles obtained by the Purchaser/Consultant with the equipment will, however, be the property of the Purchaser/Consultant.

Tenderer shall provide all temporary ladders, scaffolding materials, platforms, supports and other necessary facilities required for handling, erection and visual inspection of supplies at the point of installation and shall also provide necessary packing plates, wedges, shims, leveling screws, etc. required for erection of plant and equipment.

Tenderer shall provide erection consumables like oxygen and acetylene gas, welding rods, solder lugs, oil, grease, kerosene, cotton waste, etc. required for erection of plant and equipment.

Tenderer shall erect and maintain his own site offices, main stores and site temporary stores as required for the work and arrange for maintaining in neat manner the area placed at his disposal.

Tenderer shall provide sufficient fencing, notice boards and lights to protect and warn others as may be considered necessary by the Purchaser/Consultant.

On placement of order, the Tenderer shall provide his scheme for mobilisation with bar chart indicating clearly the resources, of erection machinery man-power and machinery proposed to be deployed to ensure timely completion of work and quality of workmanship.

The plant and equipment will be erected as per the instructions of the manufacturers/suppliers and under the supervision of the supervisory personnel, to be deputed by the Tenderer at site. Tenderer shall also undertake rectification work on account of manufacturing defects, required for proper erection and assembly which can

be done at site only according to site condition.

Tenderer shall align, level, couple and securely fix all equipment, steel structures and accessories in accordance with drawings and/or instructions.

All precision survey instruments including leveling instruments shall be arranged by the Tenderer.

Tenderer shall supply materials and carry out flushing and first filling of oil and lubricants, grease, chemicals and as required till successful commissioning.

Laying and termination of cables, bus bars, bus ducts and earthing shall be done by Tenderer.

Installation and connection of all pipings and fittings from the headers termination points to the equipment and inter-connection of all service lines within the design limit after the main headers/termination points shall be Tenderer's responsibility.

Tenderer shall check electrical connections to individual items.

Tenderer shall be responsible for calibration of all the instruments used at site.

Tenderer shall be responsible for checking the correctness of erection of mechanical equipment, auxiliary systems, electrical equipment, other equipment, etc. as per the specification and relevant drawings.

Tenderer shall arrange all facilities at site to undertake radiographic testing and stress relieving of butt welded pipe joints, as required.

Tenderer shall be responsible for the management of erection work with proper and adequate supervision for ensuring progress of erection work and quality of workmanship.

Tenderer shall deploy required number of supervisory, skilled, unskilled and auxiliary labor as required, for the erection work and comply with such reasonable instructions of

the Purchaser/Consultant in the interest of satisfactory progress and completion of the work according to the schedule.

Tenderer shall be responsible for total commissioning of the Plant including mechanical run, commissioning and demonstration of Performance Guarantee Parameters.

Tenderer shall organise the work in a manner that other work at site is not impeded and the workmen therein not endangered. He shall arrange temporary access at site, if required, for the erection work.

Tenderer shall intimate the Purchaser/Consultant/ concerned Plant authorities in writing well in advance about the requirement of shut down of any of the existing units/facilities for inter-connection/ incorporation of additional facilities. The shut down period shall be mutually discussed and finalised. The work to be undertaken during the shut down period shall be planned meticulously by the Tenderer to reduce the shut down period to the minimum.

Tenderer shall make temporary arrangement for maintaining the continuity of the services/ facilities before commencement of the diversion of existing service lines wherever shut down is not possible, without any extra cost to the Purchaser/Consultant.

Tenderer shall return to the Purchaser/Consultant all crates, packing cases and packing materials and all returnable supplies belonging to the Purchaser/Consultant at a place designated by the Purchaser/Consultant at the erection site in the conditions these exist during and after erection work is completed.

The tests/checks to be conducted during erection by the Tenderer shall be as per the manufacturer's instructions. The Tenderer shall attend to the rectification of erection defects, if any, expeditiously. The Tenderer shall arrange all testing instruments for such testing at site.

Tenderer shall carry out final painting including supply of paint of the plant & equipment and pipelines, etc. erected as per the instructions of the Purchaser/Consultant.

Grouting of the equipment on the foundations with shrinkkomp /ferro grout shall be the responsibility of the Tenderer.

Tenderer shall indicate to the Purchaser/Consultant well in advance the requirement of services such as electric power, water, EOT crane, etc. required during construction/erection period.

Tenderer will arrange for the staying facilities of his working personnel.
All safety, health and pollution control measures, as required to be adopted as per the Statutory Regulations and the Safety Codes for projects issued along with the tender documents otherwise required or implied by statutory regulations or practices, shall be strictly followed by the Tenderer during the execution of the Contract. The Tenderer shall set up a suitable safety organisation of his own at site in this regard.
The Tenderer shall comply with all Statutory Rules & Regulations with respect to the employment of labour at site including payment of minimum wages as per Govt. rules, deduction of employees contribution to Provident Funds, depositing the same along with Tenderer's contribution to the Provident Fund Commissioner, Employees State Insurance and other statutory deductions/obligations.
At the end of the work the Tenderer shall remove all such temporary structures put up by him and hand over the site to the Purchaser/Consultant in neat and tidy manner.

09.19 Supervision of erection, testing, commissioning and performance guarantee tests

Tenderer shall depute at site engineer/ specialists from various disciplines for the supervision of entire renovation works, erection, testing trial run, commissioning and performance guarantee tests of the plant and equipment under his scope of work engineers/specialists from various disciplines. The above mentioned engineers/specialists shall supervise the erection, testing, commissioning and conducting of performance guarantee tests of the plant and equipment with their auxiliaries so as to establish to the Purchaser/Consultant that the guarantees as stipulated by the Purchaser/Consultant and agreed by Tenderer are fully met.

The Purchaser/Consultant may place his engineers of respective disciplines to witness successive steps adopted in successful erection, testing, commissioning and performance guarantee tests.
For mechanical completion, erection, testing, commissioning and performance guarantee tests refer other section of this tender specification.

04.20 Contract Terminal Points

Tenderer's responsibility for making connections shall be as follows unless otherwise stated in the Specification:

a) Where pipe work and ducting supplied under this Contract connects the equipment already existing or supplied by the Purchaser, the connection shall be made under this contract.

b) This contract includes the terminating and connecting up all cables, which are supplied under this Contract except where noted.

c) All associated existing cabling not included in the Contract will be checked and tested under the supervision of the Purchaser/Consultant but it will be the responsibility of the Tenderer under this Contract to assist the Purchaser/Consultant in re-checking all final connections and to ensure the subsequent satisfactory operation of the equipment.

Tenderer shall be deemed not to have fulfilled his obligation insofar as the commissioning of the plant in concerned until complete end-to-end tests have been carried out to the satisfaction of the Purchaser/Consultant.

04.11 CABLES

04.11.01 Cable Specification

Types of cables of following grades and general specifications shall be used taking into consideration the application requirements. All cables shall have FRLS (Fire Retardant Low Smoke) PVC compound for inner and outer sheath.

~~**Type 1 : 11 kV (UE) XLPE Cables**~~

~~11 kV (UE) heavy duty power cable, 3 core, with compact circular stranded (rm/V) Aluminium conductor with extruded conductor shielding of semiconducting material, XLPE insulated, with insulation shielding over individual cores consisting of extruded semi-conducting compound followed by lapped semi conducting material and copper tape, cores~~
~~stranded together with a holding tape provided with a common covering of extruded inner sheath, galvanised steel wire armoured and FRLS PVC outer sheath of type ST2 compound as per IS : 7098 (Pt II) 1973 as ammended upto date. Copper screen shall be suitable to carry 1 kA E/F current for one second.~~

~~**Type 2 :**~~
~~1.1 kV, heavy duty power cable multicore with standard sector shaped (sm) or with compact circular stranded (rm/V) or circular stranded (rm) Aluminium conductors as applicable, XLPE insulated type A suitable for 70 deg. C. operation, core stranded together provided with a common covering of FRLS PVC inner sheath of type ST1 PVC compound, galvanised round steel armoured and FRLS PVC outer sheathed of type ST1 PVC compound conforming to IS:1554 (Part I) - 1976, as ammended upto date.~~

Type 3 :

1.1kV circular stranded (rm) annealed copper conductor, PVC/XLPE insulated of type A PVC compound suitable for 70 deg.C operation,as per IS:5831 - 1970, cores stranded together provided with a common covering of PVC inner sheath, galvanised steel armoured and overall FRLS PVC sheathed of type ST1 PVC compound and multi-core to IS : 1554 (Part-I) - 1976,

04.11.02 Cable Selection

- In general, cables for LT drives shall be selected as per Annexure-I, however, size and type of cables for specific applications shall be selected giving due consideration for the following:

- Thermal heating effect/permissible current carrying capacity.

- Voltage drop

- Short time current/overload requirement

- Protection system grading and short circuit current carrying capacity.

- Ambient conditions

- Cable grouping factors

In selection of the cable following ambient conditions shall be taken into account.

Cables laid directly in ground in single way ducts or pipes buried underground.

- Thermal resistivity of soil : 150 deg.C cm/W

- Soil temperature : 40 deg.C

- Depth of laying (to the highest point of cable or grade cables and top surfaces of ducts) : 75 cm for 1.1kV 90 cm for HT cables

- Horizontal formation axial : 15 cm in case of spacing cables laid directly in ground in a group and approximately touching in case of single way ducts or pipes.

Cables laid in free air/in conduits in free air.

Ambient air temperature : 40 Deg.C & As specified for the respective shops.

Cables laid in ventilated ducts/gallery

Ambient air temperature : 40 Deg.C.

The minimum cross sectional area for HT power cables shall be 185 sq.mm.

The minimum cross-sectional area of the cables used in LT power circuits shall be 6 sqmm per core if with aluminium conductor or 4 sqmm per core if with copper conductor. Maximum cable size shall be 185 sq mm for motors and 240 sqmm for incomers to MCCs, PCCs etc.

For power supply to moving mechanisms subject to vibrations, flexible copper cables preferably single core should be used. In these cases, a separate core should be provided for earthing. Cables used for circuits of tachogenerators, brakes, solenoids, field windings

and secondary windings of measuring transformers shall be copper conductor with cross-sectional area not less than 2.5 sqmm per core. All control cables shall have copper stranded conductors except for mobile and portable equipment where control cables shall be of flexible type. Copper cables shall be used for all cranes/hoists.

For control circuits, PVC insulated and FRLS PVC sheathed multicore cables with copper conductors having a minimum cross-sectional area of 2.5 sqmm per core shall be used. The number of cores may be standardized as 2,3,4,5,7,10,14,19,24.Each core of control cable with 7 core and above shall be numbered at every 1 meter intervals.

In multi-core control cables, the following minimum reserve cores shall be kept at the engineering stage:

Upto 7 cores	-	One reserve core
10 cores	-	Two reserve cores
14,19 & 24 cores	-	Three reserve cores

Sequential length marking shall be provided in outer sheath of all power and control cables.

Standard drum length for all types of power and control cables shall be offered.

ISI marking at every meter of cable length shall be provided.

Cores of multi-core control cables shall be serially numbered.

For all cables, extra length of 2 metres will be left before jointing.

Additional Tests on cable

To prove the fire retardent low smoke characteristics, the following additional tests shall be conducted at works on any size of each type of cable namely, H.T/ power, L.T. power, control and instrumentation cables.

Oxygen index test as per ASTM D 2863. Minimum value of Oxygen index shall be 30.

Flammability tests on finished cable as per the requirements of IEEE-383 and IEC-332-1.

Smoke generation by inner/outer sheath fire as per ASTM D 2843. The cables shall meet the requirements of light transmission of minium 40% after the test.

04.11.03 Cable termination & joints

Following type of cable termination and joints shall be used for XLPE cables in indoor and outdoor applications :

1. Tapex type
2. Heat shrinkable type
3. Pre moulded push on type

Tapex type system :

The stress grading material shall be wrapped around the cable core, over lapping the edge of the outer conducting layer. The tape layer shall fuse together to form a compact rubber body around the stress grading material and cable core and thereby excert an active pressure on cable.

Heat Shrinkable type system :

The stress control and grading wherever necessary shall be by means of semi conducting heat shrinkable tubing. Environmental sealing between heat shrinakable material and cable surfaces shall be achieved by using hot melted sealants or adhesives. Where such sealents or adhesives shall be exposed to high electrical stress, same shall be track resistant type.

Premoulded Push On type system :

Premoulded refers to moulded Ethylene Propylene Diene monomer rubber components. Sealing between the premoulded push on material and cable surface shall be achieved by semi conducting pad which has cold flow properties.

The termination and straight joints for HT/LT cables shall be supplied in kit form. The kit shall include all insulating and sealing material apart from conductors fittings and consumable items. Necessary devices required for termination and joints shall be provided.

~~**04.12 MISCELLANEOUS**~~

~~**04.12.01 Illumination**~~

~~1.0~~ ~~**General**~~

~~The lighting system inside and outside power house units are designed based on the desired minimum illumination levels recommended by IS and the practices followed in industries, architectural arrangement, building dimensions including mounting height, environmental considerations, ease of maintenance and reliability of the lighting distribution network.~~

LT XLPE FRLS Power Cable

Attributes/ Characteristics Item/Components/ Sub System/Assembly	Make, Type, Rating& T.C	Dimension/Surface finish	Mechanical properties	Chemical Compostion	Spark Test (as applicable)	Electrical Properties	Hot Set Test(XLPE)	Lay length & Sequence	Armourcoverage,cross over, looseness,gap between two wires	Sequential marking/surface finish/cable length	T.S. & elongation before and after ageing on outer sheath & insulation	Thermal stability on outer sheath	Anti rodent and anti termite properties of outer sheath and anti rodent coating on wooden drums	Constructional requirement feature as per approved technical specification	Routine & Acceptance test as approved QAP	FRLS Tests
Aluminium (IS-8130)(Conductor)	Y	Y	Y	Y		Y										
XLPE Compound (IS-7098 Part-II)(Insulation)	Y		Y			Y					Y					
PVC Compound(IS-5831) -Inner Sheath	Y		Y								Y					
FRLS PVC Compound(IS-5831,IEC-754 Part-1,ASTM-D2843,ASTM-2863)(Outer sheath)	Y		Y								Y	Y				Y
Armoure wire/Strip	Y	Y	Y													
Insulated Core		Y			Y		Y					Y				

Laid up core		Y						Y									
Inner sheath(PVC-ST2 IS:5831/84)		Y															
Armouring		Y							Y								
Outer sheath(PVC-ST2 IS:5831/84)		Y								Y	Y	Y	Y	Y		Y	
Power Cable-Finished(IS-7098 Part-I), IS-5831,ASTM D-2843/IS-10810(Part-58),ASTM-2863,IEC 754 Part-1),SS 4241475,Flammability test IEC-332 Part-3	Y	Y				Y			Y	Y	Y	Y		Y	Y	Y	
Wooden Drum(IS-10418)/Steel Drum		Y											Y				

Notes:
1)This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the practice and procedures along with relevant supporting documents.
2)Make of all major brought out items will be subject to DVC approval.

ROUTINE TESTS	**Following routine tests shall be carried out on each drum of finished cables for all types (PVC / XLPE insulated) & sizes.**		
1	Conductor Resistance test		
2	High voltage test		
ACCEPTANCE TESTS **Following Acceptance tests shall be carried out on each size of each type (PVC / XLPE insulated) of cables, in the offered lot.**			
A) For Conductor (as per sampling plan mentioned in IS: 1554 / 7098)			
	1)	Annealing test (Copper)	
	2)	Tensile Test (Aluminium)	
	3)	Wrapping Test (Aluminium)	
	4)	Resistance test	
B) For Armour Wires / Formed Wires (If applicable) (as per sampling plan mentioned in IS: 1554 / 7098)			
	1.	Measurement of Dimensions	
	2.	Tensile Tests	
	3.	Elongation Test	
	4.	Torsion Test For Round wires only	
	5.	Wrapping Test	
	6.	Resistance Test	
	7.	Mass of Zinc coating test For G S wires / Formed wires only	
	8.	Uniformity of Zinc coating For G S wires / Formed wires only	
	9.	Adhesion test For G S wires / Formed wires only	
	10.	Freedom from surface defects	
C) For PVC / XLPE insulation & PVC Sheath (as per sampling plan mentioned in IS: 1554 / 7098)			
	1.	Test for thickness	
	2.	Tensile strength & Elongation before ageing (for tests after ageing see “D”)	
	3.	Hot set test (For XLPE insulation)	

D)Ageing Test				
	Criteria	**Condition**	**Test Requirements**	**Remarks**
PVC insulation & outer sheath:	Samples as per relevant IS, from each size of cables in the offered lot, shall be tested for tensile strength & elongation (Before ageing). **Tensile & elongation testing shall preferably be done with a computerized machine.** The values will be compared with corresponding values mentioned in the Type Test report accepted by OWNER. These values of Tensile Strength & Elongation (before ageing) should be within +/ -15% of the corresponding values of Type Test report. (Please note that test values should be more than the minimum values indicated in relevant standard).	All sizes which meet the criteria	The size which has maximum negative deviation from type test report values will be put on Accelerated ageing test. The Samples shall be aged in air oven at temperature of 130ºc+/-2ºc for 5 hours and tested for TS & elongation. Acceptance norms shall be as per IS.	In case the size does not meet the requirement in accelerated ageing test **then all sizes (which had met the criteria) will be put on ageing test as per IS.**
		Sizes which do not meet the criteria	Every size will be put on ageing test as per IS.	
XLPE insulation	Samples as per relevant IS, from each size of cables in the offered lot, will be put on ageing test as per IS.			
E) Following tests will be carried out on completed cables as per IS on each size of each type (PVC / XLPE insulated)				
	1.	Insulation resistance test (Volume resistivity method)		
	2.	High voltage test		
F) Following tests shall be carried out on only one size of offered lot (comprising of all sizes & types)				
	1.	Thermal stability test on PVC insulation and outer sheath		
	2.	Oxygen index test on outer sheath		
	3.	Smoke density rating test on outer sheath		
	4.	Acid gas generation test on outer sheath		
G) Flammability test as per IEC 60332 - Part- 3 (Category- B) on completed cables as per following sampling plan:				
		This test will be carried out using composite sampling i.e. irrespective of size; cables of one particular type (i.e. armoured PVC insulated, unarmoured PVC insulated, armoured XLPE insulated, unarmoured XLPE insulated) will be bunched together, as per calculations in line with the IEC. All sizes of PVC & XLPE insulated, armoured & unarmoured cables shall be covered. For one particular type, cables with OD less than or equal to 30 mm shall be		

		clubbed together in touching formation while cables with OD greater than 30 mm shall be clubbed together leaving a gap equal to OD of cable having least diameter. Cable OD shall be taken as nominal overall diameter as per OWNER approved datasheet.
H) Following tests shall be carried on one length of each size of each type (PVC / XLPE insulated) of offered lot:		
	1.	Constructional / dimensional check, surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires, Sequential marking, drum / Batch (outer sheath extrusion batch) number marking on sheath
	2.	Measurement of Eccentricity & Ovality.

13.00 LIST OF PREFERED MAKES

PREAMBLE

This document "PREFERRED MAKES OF EQUIPMENT AND SUPPLIES" is a part of the tender specification for RM&U of Unit#1 of Panchet Hydel Station of DVC at Panchet.

The makes of various equipment and supplies in respect of imported/indigenous equipment/components/materials are listed out in this document. It is essential that the equipment/component/materials to be supplied from imported/indigenous sources by the Tenderer will be of any one of the makes listed against that particular equipment/ component/material in this document. In case of any contradiction in respect of 'Preferred Makes' indicated in this document with the preferred makes indicated in any other tender document, the one indicated in this document shall prevail.

In case the Tenderer/ Contractor intends to substitute any particular make of equipment / components/ materials by a make other than that listed in this document, the Tenderer shall clearly bring out the same in his tender along with justification and indicate the alternative makes offered by him. It will be prerogative of the Purchaser to accept or reject the alternative makes so offered.

a. Mechanical

Sl. No.	EQUIPMENT	Preferred Makes
1.	Horizontal Centrifugal Pumps	Kirloskar Brothers, KSB, Beacon Weir, Khimline, Jyoti, Sintech, Mather & Platt,
2.	Vertical Turbine Pumps	Kirloskar Brothers, Mather & Platt, WPIL, Jyoti, Sintech, Flowserve
3.	Vertical Wet Pit Type Pumps	SU Motors, Kishore Pumps, Kirloskar, Brothers, KSB , Sintech, Mather & Platt, Flowserve.
4.	Submersible Pumps	KSB, SU Motors, Kirloskar Brothers, Kishore Pumps, Darling, Beacon Weir
5.	Slurry Pump	Akay, Sam Engg., MBE, KBL, KSB Pumps, WARMAN. Sintech
6.	Dosing Pump	Shapo Tools, Asia LMI (Madras), Positive Metering Pumps, Toshniwal, Milton Roy India.

~~Sl. No.~~	~~EQUIPMENT~~	~~Preferred Makes~~
		~~Ingersoll Rand~~
~~44.~~	~~Pressure Vessel & Tanks~~	~~Beekay Engg., BHPV, ISGEC, Kaveri Engg., TSL, Lloyds Steel, Mukand, Parkair Engg., Grasim Industries, Anup Thermal System, Texmaco, SV Tank, Grasim Industries, Hyderfuel Industries.~~
~~45.~~	~~Trap & Strainer for Compressed Air & Steam~~	~~Uniklinger, ESCO, JNM, Dryton Greaves, F(Mazda,AIRA EURO AUTOMATION PVT LT~~

b. Electrical.

Sl. No.	EQUIPMENT	Preferred Makes
1.	HV BUSDUCT	ECC (KOLKATA)/ STAR DRIVE NOW KGS ENGINEERING LIMITED (CHENNAI)/ ENPRO (CHENNAI)/ BEST & CROMPTON/ SIEMENS/ BHEL/ CONTROL & SWITCHGEAR
2.	ISOLATING SWITCH	DP / A BOND STRAND / ESWARI/ GE/ SIEMENS/ L&T
3.	LT TRANSFORMER	BBL/CGL/ALSTOM/ C/EMCO// INDCOIL / VOLTAMP/TR
4.	CURRENT TRANSFORMER	AE /ABB/ JYOTI / KAPPA / WSI/INDCOIL
5.	POTENTIAL TRANSFORMER	AE /ABB/ JYOTI / KAPPA / WSI / INDCOIL
6.	LIGHTNING ARRESTOR	ELPRO / W.S INDUSTRIES LTD / OBLUM INDUSTRIES LTD /RAYCHEM/ SCHNEIDER (AREVA) / SIEMENS AG
7.	415V SWITCHGEAR & MCC	L&T / SIEMENS / CONTROL & SWITCHGEAR /GE (ALSTHOM) / SCHNEIDER

Sl. No.	EQUIPMENT	Preferred Makes
8.	MOTOR CONTROL CENTRES	SIEMENS/BCH/GE-POWER / L&T / C&S/ECC/ SWITCHING CCIRCUIT/ HCE/TECHNOCRATS/TECHNO-COMMERCE/SEN & SINGH/M K Engineers/ POWER & PROTECTION/ SCHNEIDER
9.	LT CIRCUIT BREAKER	SIEMENS/BCH/ DISTRIBUTION BOARD GE(ALSTHOM)/ L&T/ C&S/ SCHNEIDER
9.	BATTERY CHARGER	HBL-NIFE(SABNIFE)/ CHHABI ELECTRICALS /DEBIKAY/CALDYNE / AMAR RAJA/ HCE
10.	UPS	SIEMENS/HIREL/ EMERSON/GE / DB POWER CONTROL
11.	SOLID STATE ANNUNCIATOR	APLAB/ L&T/ ELECMECH/ PROCON/ MINILEC
12.	NUMERICAL PROTECTION RELAYS FOR LT SYSTEM	SIEMENS/ ABB/ AREVA/ SCHNEIDER / L&T(MM30)/ ASIDA
13	NUMERICAL PROTECTION RELAYS FOR HT SYSTEM	AREVA / SIEMENS / ABB / L&T
14.	PROTECTIVE RELAYS	AREVA/SEIMENS/ABB/ER
15.	AUXILIARY RELAYS	AREVA/ EASUN/ ABB/ L&T/ GE/ SCHNEIDER/ SIEMENS BCH/ ROCKWELL
16.	AMMETER/VOLTMETER/ VARMETER/WATTMETER	AEP/ IMP/ MECO AE/GEC// L&T
17	VOLTAGE/ POWER/ CURRENT/ FREQUENCY/ ENERGY TRANSDUCER	ABB/ AEP/ SIEMENS/ ELSTER / ADEPT
18.	INDICATING LAMP/ TECHNIK/	SIEMENS/ VAISHNO/(CLUSTER LED TYPE) /BINAY/ J-AUER

Sl. No.	EQUIPMENT	Preferred Makes
19.	HOOTER/ BUZZER/ BELL	GETCO/ KHERAJ/ EDISON/ KAKKU
20.	HT CABLES	RPG/ UNIVERSAL/ CCI/ NICCO/ TORRENT CABLES/ INDUSTRIAL/ INCAB/ CRYSTAL/ UNIFLEX / ASIAN / CRYSTAL
21.	LT CABLES	RPG/ UNIVERSAL/ CCI/ NICCO/ TORRENT CABLES / INCAB/ CRYSTAL/ UNIFLEX/ POLYCAB/ FINECAB/ INCAB/ RADIANT/ KEI
22.	CONTROL CABLE	RPG/ UNIVERSAL/ CCI/ NICCO/ TORRENT CABLES/ INDUSTRIAL/ INCAB/ CRYSTAL/ UNIFLEX/ POLYCAB/ FINECAB/ INCAB/ RADIANT/ KEI/ SPECIAL/ DELTON/ CORDS/ CAPCAB
23.	LOCAL PUSH BUTTONNS	SIEMENS/ L&T/ BCH/ BHEL/ C&S/ TECHNOCRAT/ B&C/ MEDITRON/ ELECTRO FABRIC/ HCE/ SEN & SINGH /TECHNO COMMERCE/ SWITCHING CIRCUIT/ VIJAY SWITCHGEAR.
24.	Lighting fittings (SV/MV/MH/FLUROESCEN	PHILIPS/ GE/ BAJAJ/ CGL/ WIPRO/ FLOROCRAFT
25.	HT CABLE JOINTING KITS TERMINATION KITS	RAYCHEM/3M / DENSONS/ M – SEAL
26.	CONTACTORS	SIEMENS / ALSTHOM / L&T / CGL / SCHINDIR/BCH/ABB
27.	HT HRC FUSES	AREVA/ DP/ S&S/ COPPER- BUSSMAN
28.	LT FUSE	SIEMENS / STANDARD (INDO ASIAN) / ABB / GE POWER/ ESWARAN
29.	Temperature Scanner	JYOTI/APLAB/SYNTECH/ MASIBUS
30.	MCCB	SCHNEIDER (MG)/ L&T/ ABB/ SIEMENS/ GE POWER/ CONTROL / CONTROL & SWITCHGEAR / BCH /MDS(LEGRAND)
31.	Miniature Circuit Breaker	SIEMENS/ L&T/ GE POWER CONTROL/SCHNEIDER (PROTEC / MG)/ STANDARD/INDOASIAN/ HAVELLS/ MDS (LEGRAND)/ ABB

Sl. No.	EQUIPMENT	Preferred Makes
32.	LT squirrel cage Motor	ABB/ BHARAT BIJLEE/ CGL/ KEC/ LAXMI HYDRAULICS PVT LTD./ MARATHON/SIEMENS/ ELGI/ JYOTI/WEG
33.	TERMINAL BLOCK	EPCC/ ELMEX/ PHOENIX CONTACT/ CONNECT WELL/ ESSEN DEINKI/ WAGO/ LAPP/ S&S/ HANSEL
34.	CONTROL SWITCH	SIEMENS / KAYCEE / AREVA / L&T / VAISHNO / C&S
35.	LIMIT SWITCH	AG SYSTEMS/JAY BALAJI/ TECHNOCRATS / JAYSHREE
36.	MIMIC PANELS & ANNUNCIATION PANELS	L&T / ADVANI OERLIKON / GE POWER CONTROL/ BHEL/ BCH/ TRANSRECT/ MINLEC/ TIRUPATI ELECTRONICS/ ADVANCE POWER CONTOL/ CONTROL DEVICES

c. Control & Instrumentation.(C&I)

Sl. No.	Equipment	Preferred Makes
1.	PLC	• Rockwell Automation Control Logix L73 • GE Fanuc PAC Rx3i • Siemens S7-400H series • ABB 800XA • Schneider(Quantum) or better
2.	DCS	• Yokogawa Centum VP • ABB Simphony Harmony • Honeywell Experion Pks • BHEL METSO DNA • Emersion Ovation
3.	Transmitters (Pressure, Flow & Level)	• YOKOGAWA INDIA LTD., EMERSON., HONEYWELL LTD, FUJI
4.	Digital indicators	• YOKOGAWA LTD.,MASIBUS

Sl. No.	Equipment	Preferred Makes
		ELECTRONICS, RANUTROL LTD.
5.	Pressure/ Temperature Gauges	• WAIKA, WAREE , GIC , A.N. Instruments pvt. LTD, Forbes marshall.
6.	RTDs & Thermocouples	• General instruments, Industrial instrumentation, Instrumentation LTD, Nagman sensors, Toshniwal brothers.
7.	Temperature transmitter	• YOKOGAWA LTD, EMERSON., HONEYWELL LTD.
8.	Digital scanner	• JYOTI, LECTROTEK, PROCON, MASIBUS.
9.	Power cables	• Cable corporation of India ltd., Universal cables ltd., Fort Gloster Industries LTD., Asian cables ltd, Finolex cables ltd., KEI.
10.	Instrumentation screened cables	• Thermopad, Finolex cables ltd., Toshniwal cables, Delton cables, KEI,MEM, Asian cables, Universal Cables.
11.	Compensating cables	• Toshniwal cables, General Instruments, Uday Raj, KEI.
12.	Orifice / Flow nozzle	• Engineering Specialities (pvt) ltd., Micro Precission, GIC
13.	PC	• HP, DELL, COMPAQ
14.	Ethernet switch	• CISCO, SIEMENS.
15.	Control valve	• IL, MIL, Fisher-Xomox, Uniflow, Demla
16.	Pressure switch	• WIKA, SWITZER, WAREE, ORION, INDFOSS
17.	Flow switch	• TRAC, CHEMTROL, D.K.INSTRUMENTATION, LEVCON

QUALITY CONTROL, INSPECTION & TESTING OF PLANT / EQUIPMENT

9.0 QUALITY CONTROL, INSPECTION & TESTING OF PLANT / EQUIPMENT

1.00.00 QUALITY ASSURANCE PROGRAMME

To ensure that the equipment and services under the scope of contract whether manufactured or performed within the Contractor's works or at his sub-contractor's premises or at the owner's site or at any other place of work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Owner / authorised representative after discussions. The QA programme shall be generally in line with ISO-9001/ISO-14001.

1.01.01 a quality assurance programme of the contractor shall generally cover the following:

a) His organisation structure for the management and implementation of the proposed quality assurance programme.

b) Quality System Manual.

c) Design Control System.

d) Documentation Control System.

e) Qualification data for Bidder's key Personnel.

f) The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.

g) System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.

h) Control of non-conforming items and system for corrective actions.

i) Inspection and test procedure both for manufacture and field activities.

j) Control of calibration and testing of measuring testing equipment.

k) System for Quality Audits.

l) System for indication and appraisal of inspection status.

m) System for authorising release of manufactured product to the Employer.

n) System for handling storage and delivery

o) System for maintenance of records, and

p) Furnishing of quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component.

q) Finalising categorization plan for each items during approval of Engineering Document.

2.00.00 **GENERAL REQUIREMENTS - QUALITY ASSURANCE**

2.01.00 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the contractor for some of the major items is given in dashboard form. This is, however, not intended to form a comprehensive programme as it is the contractor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder and will be submitted to Employer for approval.

2.02.00 Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's/ Sub-contractor's/ sub-supplier's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Manufacturing Quality Plan shall be submitted in addition to hard copy, for review and approval. After approval the same shall be submitted in compiled form on CD-ROM.

2.03.00 Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's "Site Quality Control Organisation", during various stages of site activities starting from receipt of materials/equipment at site. Submission of the Field Quality Plans and accordingly approval of the same by the Employer is to be done as per the approved schedule.

2.04.00 The Bidder shall also furnish copies of the reference documents/plant standards/ acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality Plans and reference documents/standards etc. will be subject to Employer's approval without which manufacturer shall not proceed. These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer or his authorised representative and beyond which the work will not proceed without consent of Employer in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer along with technical justification for approval and dispositioning.

2.05.00 The contractor shall have suitable Field Quality Organization with adequate manpower at Employer's site, to effectively implement the Field Quality Plan (FQP) for site activities. The FQA setup shall be in place before the start of site activities.

2.06.00 No material shall be despatched from the manufacturer's works before the same is accepted, subsequent to pre-despatch final inspection based on approved QAPs & Inspection Categorization Plan and verification of records of all previous tests/inspections by Employer/Authorised representative and duly authorised for despatch by issuance of Material Despatch Clearance Certificate (MDCC).

2.07.00 All material used for equipment manufacture shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties, chemical analysis shall be recorded on certificates. Tests shall be carried out as per applicable material standards and/or agreed details.

2.08.00 The Contractor shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the sub-contractor proposed by the Contractor for procurement of major bought out items including semi-finished and finished components/equipment etc., list of which shall be drawn up by the Contractor and finalised with the Employer, shall be subject to Employer's approval. The contractor's proposal shall include vendor's facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc.

along with his own technical evaluation for identified sub-contractors enclosed and shall be submitted to the Employer for approval within the period agreed at the time of pre-awards discussion and identified in "DR" category prior to any procurement. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.

2.09.00 For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Employer, the contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the sub-contractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc. Such quality plans of the successful vendors shall be finalised with the Employer and such approved Quality Plans shall form a part of the purchase order/contract between the Contractor and sub-contractor.

2.10.00 The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractor's and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials arts and equipment. Contractor shall carry out all tests/inspection required to establish that the items/equipment conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.

The stage inspection / final inspection will be carried out by manufacturer's representatives, contractor , DVC as per approved MQP.

2.11.00 **Test Certificates & Documents**

For each of the items being manufactured as per approved QAP, following test certificates and documents as applicable for each of the equipment in requisite copies including original duly endorsed by the manufacturer & successful tenderer with appropriate linkage to project, purchase order and acceptance criteria etc. shall be submitted to the consultant / purchaser.

- Raw material identification, physical & chemical test certificates as applicable for all materials used to manufacture the equipment.
- WPS, PQR & WPQ documents as per applicable code.
- Detail of stage-wise inspection & rectification records for fabricated items, castings, forgings & machined articles.
- Control dimension chart with record of alignment, squareness, etc.
- Manufacturer's material and performance/ relevant test certificates for all brought-out items.
- Details of Heat Treatment & Stress relieving chart as per specification.
- Non-destructive Test report as per respective code carried out by NABL accredited lab.
- Static / Dynamic Balancing Certificates for rotating components / machines.
- Hardness Test Certificate
- Pressure / leakage test certificate.
- Performance Test Certificates for all characteristics.
- Routine / Type Test / Calibration / Acceptance / Special Tests (Type Test etc.) certificates for electrical / power electronics / automation / instrumentation.

2.12.00 for all modular spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.

2.13.00 Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.

2.14.00 **Environmental Stress Screening**

All solid state electronic system / equipment / sub assembly shall be free from infant mortile components. For establishing the compliance to this requirement, the contractor / sub – contractor should meet the following.

1) The Contractor / Sub – contractor shall furnish the established procedure being followed for eliminating infant mortile components. The necessary details as required under this clause shall be furnished at the stage of QP finalization.

or

In case the Contractor / Sub – contractor do not have any established procedure to eliminate infant mortile components then two or 10% whichever is less, most densely populated Panels shall be tested for Elevated Temperature Cycle Test as per the following procedure.

1. Elevated Temperature Test Cycle

During the elevated temperature test which shall be for 48 hours, the ambient temperature shall be maintained at 50°C. The equipment shall be interconnected with devices and kept under energized conditions so as to repeatedly perform all operations it is expected to perform in actual service with load on various components being equal to those which will be experienced in actual service.

During the elevated temperature test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components/modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature at 50° C.

In case of any failure during the test cycle, the further course of action should be mutually discussed for demonstrating the intent of the above requirement.

2) **Burn in Test Cycle**

The test shall be conducted on all the panels fully assembled and wired including the panels having undergone the above mentioned elevated temperature test.
The period of Burn in Test Cycle shall be 120 hrs and process shall be similar to the elevated temperature test as above except that the temperature shall be reduced to the ambient temperature prevalent at that time.

During the above tests, the process I/O and other load on the system shall be simulated by simulated inputs and in the case of control systems; the process which is to be controlled shall also be simulated. Testing of individual components or modules shall not be acceptable.

During the Burn in Test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature.

The Contractor / Sub-contractor shall carry out routine test on 100% item at contractor / sub-contractor's works. The quantum of check / test for routine & acceptance test by employer shall be generally as per criteria / sampling plan defined in referred standards/ technical specification. Wherever standards/ technical specifications have not been mentioned quantum of check / test for routine / acceptance test shall be as agreed during finalization of Manufacturing Quality Plan on mutually agreed basis.

3.00.00 QUALITY ASSURANCE DOCUMENTS

3.01.00 The Contractor shall be required to submit the QA Documentation in two hard copies and two CD ROMs, as identified in respective quality plan with tick (√) mark.

Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document.

The QA Documentation file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing.

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

3.02.00 Typical contents of QA Documentation are as below:-

a) Quality Plan
b) Inspection Categorization Plan

c) Material mill test reports on components as specified by the specification and approved Quality Plans.

d) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.

e) All the accepted Non-conformance Reports (Major/Minor)/deviation, including complete technical details / repair procedure).

f) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points.Certificate of Conformance (COC) wherever applicable.

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

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

(a) If the result of the review carried out by the Engineer/Inspector is satisfactory, the Engineer/Inspector shall stamp the quality document (or applicable section) for release.

(b) If the quality document is unsatisfactory, the Supplier shall endeavour to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Engineer/Inspector.

(c) If a decision is made for despatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time, the supplier shall immediately, upon shipment of the equipment, send a copy of the quality document review status signed by the Supplier Representative to the Engineer/Inspector and

notify of the committed date for the completion of all outstanding actions & submission. The Engineer/Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the despatch of equipment

TRANSMISSION OF QA DOCUMENTATION

3.05.00 On release of QA Documentation by Engineer/Inspector, one set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Project Site of Employer.

3.06.00 Material Dispatch Clearance Certificate (MDCC) will be issued by DVC, after inspection and receipt of all necessary approved engineering documents, all the relevant TCs along with the request letter for issuance of MDCC from the main Contractor.

4.00.00 INSPECTION, TESTING AND INSPECTION CERTIFICATES

4.01.00 The word 'Inspector' shall mean the Engineer and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.

4.02.00 The Engineer or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Engineer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.

4.03.00 The Contractor shall give the Engineer /Inspector fifteen (15) working days (within India) and/or forty five (45) working days (outside India) written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector's. The Engineer /Inspector, unless the witnessing of the tests is virtually waived and confirmed in writing, will attend such tests within (15) working days (within India) and/or forty five (45) working days (outside India) of the date on which the equipment is noticed as being ready for test/inspection failing which the contractor may proceed with test which shall be deemed to have been made in the inspector's presence and he shall forthwith forward to the inspector duly certified copies of test reports in two (2) copies.

4.04.00 During raising Inspection Call, Contractor has to submit the approved engineering documents, approved MQP and other necessary documentation as per the approved documents/ NIT, failing to which the Inspection Call will not be accepted.

4.05.00 In all cases where the contract provides for tests whether at the premises or

works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the

4.06.00 Engineer /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Engineer /Inspector or to his authorised representative to accomplish testing.

The inspection by Engineer / Inspector 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 contract.

4.07.00 To facilitate advance planning of inspection in addition to giving inspection notice the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.

4.08.00 All inspection, measuring and test equipment used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by DVC. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipment in the presence of Engineer / Inspector

5.00.00 **GENERAL REQUIREMENTS**

The equipment and work performed shall be subject to shop and site test as per Owner's approved quality assurance plan.

Hydrostatic and pneumatic tests shall be performed on all pipes, tubing and systems and shall conform to ANSI B31.1.

All instrument piping/ tubing shall be hydrostatically tested upon completion of erection. The test pressure shall be 1.5 times the maximum process pressure. The test shall be performed either with the testing of associated process piping or without the associated process piping (by closing the root valve. In both the cases the instrument shall be isolated by closing the shutoff valve).

All air headers & branch pipes shall be air tested by pressure decay method as per ANSI B31.1. Flexible hoses and short signal tubing shall be tested at normal pressure for leakage. Long signal tubing shall be tested by charging each tube with air at 2 kg/ sq. cm. through a bubbler sight glass.

(a) SHOP TESTS

Shop tests shall include all tests to be carried out at Contractor's works, at works of his sub-contractor and at works where raw material supplied from manufacture of equipment is manufactured. Testing requirement of major equipment over and above the respective code/standard requirements are given elsewhere in this specification.

(b) SITE TESTS

The Contractor shall prepare and submit detailed field quality plans in the format prescribed by owner setting out the quality practice and procedures to be adopted by him for assuring quality for eachequipment of material at this specification from the receipt of material at site, during storage erection, pre commissioning to final

commissioning of the system. These procedures shall necessarily include all checks/tests conducted at site for preservation, assembly, alignment, positioning of the equipment, foundation preparation, welding/bolting, non-destructive examination, hydraulic test, running test, performance test etc. The Contractor shall also furnish detailed quality procedure proposed by him for storage, preservation, painting, hydraulic test, air/gas tightness test etc. as applicable to the Employer. The same shall be discussed and finalised with the employer during detailed engineering stage.

6.00.00 **General Requirements**

I. The contractor shall furnish the type test reports of all type tests as per relevant standards and codes as well as other specific tests indicated in this specification. A list of such tests is given for various equipment in this specification titled 'Type Test Requirement' mentioned elsewhere in this specification. For the balance equipment, type tests may be conducted as per by relevant standard where applicable or if required by mutual agreement between contractor and Employer. Detail shall be finalized during detail engineering.

II. Submission of type test results and certificate shall be acceptable provided.

(a) The same has been carried out by the bidder/ sub-vendor on exactly the same model /rating of equipment.

(b) There has been no change in the components from the offered Equipment & tested equipment.

(c) The test has been carried out as per the latest standards along with amendments as on the date of bid opening.

(d) Type test report is not more than five (5) years old.

(e) Type tests shall be carried out from CPRI/ National Test House/ NABL accredited laboratories only.

7.00.01 **TYPE TEST REQUIREMENTS**

I. In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the bidder within the quoted price and no extra cost will be payable by the purchaser on this account.

II. The Type test certificates for all the items shall be reviewed and approved by the Employer or his authorized representative.

III. The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion.

IV. For the type tests to be conducted, contractor shall submit detailed test procedure for approval by purchaser. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable), recording of different parameters, interval of recording precautions to be taken etc. for the tests to be carried out.

7.00.02 **Special Requirement for Solid State Equipment/ Systems**

The minimum type tests reports, over and above the requirements of above clause which are to be submitted for each of the major C&I systems shall be as indicated below:

7.00.03 **Surge Protections for Solid State Equipment/ Systems**

I. All solid state systems/ equipment shall be able to withstand the electrical noise and surges as encountered in actual service conditions and inherent in a power plant. All the solid state systems/ equipment shall be provided with all required protections that needs the surge withstand capability as defined in ANSI 37.90a/ IEEE-472. Hence, all front end cards which receive external signals like analog input & output modules, binary input & output modules etc. including power supply, data highway and data links shall be provided with protections that meets the surge withstand capability as defined in ANSI 37.90a/ IEEE-472. Complete details of the features incorporated in electronics systems to meet this requirement, the relevant tests carried out, the test certificates etc. shall be submitted along with the proposal. As an alternative to above, suitable class of IEC-255-4 which is equivalent to ANSI 37.90a/ IEEE-472 may also be adopted for SWC test.

II. Dry heat test as per IEC-68-2-2.

III. Damp heat test as per IEC-68-3.

IV. Vibration test as per IEC-68-2-6.

V. Electrostatic discharge tests as per IEC 801-2 or equivalent.

VI. Radio frequency immunity test as per IEC 801-6 or equivalent.

VII. Electromagnetic immunity as per IEC 801-3 or equivalent.

Test listed at item no. v), vi), vii) above are applicable for front end cards only as defined under item i) above.

QA MECHANICAL

9.13. QUALITY ASSURANCE

DASH BOARD FOR MECHANICAL ITEMS

SN	Tests/Checks	Material Test	WPS/ WQS/PQR	DPT/MPI	Ultrasonic Test	Radiographic Test	PWHT	Assembly / Fit up	Dimensions	Hydraulic	Pneumatic Test	Balancing	Functional/operational	Performance Test	Other Tests	All Tests as per relevant Std
1	Pipes & Fittings	Y[a]							Y	Y[5]						Y
2	Diaphragm Valves	Y[a]							Y	Y[5]			Y		Y[6]	Y
3a	Cast Butterfly Valves	Y[a]		Y[3]	Y[b]			Y	Y	Y[5]			Y		Y[7]	Y
3b	Fabricated Butterfly	Y[a]	Y	Y[3]	Y[12]	Y[12]	Y[12]	Y	Y	Y[5]			Y		Y[7]	Y
4	Gate/ Globe/ Check Valves	Y[a]		Y[3]	Y[b]			Y	Y	Y[5]	Y		Y		Y[8]	Y
5	Dual Plate Check	Y[a]		Y[3]	Y[b]			Y	Y	Y[5]	Y		Y		Y[4]	Y
6	Plug / Ball Valves	Y[a]		Y[3]	Y[b]			Y	Y	Y[5]	Y		Y			Y
7	Rolled & Welded Pipes	Y[a]	Y	Y[3]		Y[1]			Y	Y[20]						
8	Coating & Wrapping of	Y[a]							Y							Y[2]
9	Strainers	Y[a]		Y[3]					Y	Y[20]					Y[9]	
10	Rubber Expansion Joints	Y[a]						Y	Y	Y[10]					Y[11]	
11	Site Welding		Y	Y[3]		Y[1]				Y[20]						
12	Compressors/ Blowers	Y[a]		Y[3]	Y[b]			Y	Y	Y[20]		Y		Y[18]	Y[19]	Y
13	Atmospheric Storage Tanks/Mixing Tanks	Y[a]	Y	Y[3]				Y	Y	Y[20]					Y[13]	Y
14	Pressure vessels /Air Receiver & Heat exchangers	Y[a]	Y	Y[3]		Y[21]	Y[22]	Y	Y	Y[20]					Y[23]	Y
15	Air Drying Plant	Y[a]	Y	Y[3]		Y[21]	Y[22]	Y	Y	Y[20]	Y		Y		Y[24]	
16	Fans	Y[a]		Y[3]	Y[b]			Y	Y			Y		Y	Y[14]	Y

	NOTES
Y	To apply
a	One per heat/heat treatment batch/lot.
b	For shaft/spindles/forgings diameter ≥ 50 mm & Plate thickness ≥ 16 mm

1	Weld Joints not subjected to hydraulic test shall be subjected to 100% RT.
2	Tests for primer and enamel / Coal Tar Tapes as per AWWA-C-203 / IS 15557
3	On machined surfaces of castings/shaft/spindles/forgings. DPT/MPI on root run (after back gouging/chipping – as applicable) for 100% and on finish butt & fillet welds for 10%.
4	Dry Cycle Test on Dual Plate Check valve spring for one lakh (10^5) Cycles shall be carried out as a type test.
5	Valves shall be tested for Body, seat & back seat leakage as applicable. Hydraulic test pressure shall be as per relevant standard. & shall be done as per relevant standard. Seat Leakage Test for Actuator Operated Valves, shall be done with by closing the valves with actuator. Valves shall be offered for hydro test in unpainted condition
6	Tests on rubber diaphragm such as hardness, bleed resistance test, rubber to fabric bond, flex test & type test for 50,000 cycles shall be carried out.
7	In addition to Body & seat hydrotest, disc-strength shall be carried out as per relevant standard
8	Blue matching for metal-seated valves, Wear travel for gate valves, pneumatic seat leakage test & reduced pressure test for check valves shall be done as per relevant standard. Maximum allowable vacuum loss is 0.5 mm of Hg absolute for valves to be tested for vacuum operation for internal pressure 25 mm of Hg absolute for a period of 15 minutes
9	Pressure drop across the strainer for each type and size as a special test shall be carried out
10	During hydraulic and vacuum tests in 3 positions, the change in the circumference of arch should not be more than 1.5%. 24 hrs after the test permanent set in dimension should not exceed 0.5%.
11	Tests on rubber for tensile, elongation, hardness, hydraulic stability check as per ASTM D 471, ozone resistance test as per ASTM D 1149, ageing test and adhesion strength of rubber to fabric & rubber to metal shall be carried out.
12	a) For fabricated butterfly valves: UT as per ASTM A-435 on plates for body and disc shall be carried out. b) 100% RT as per ASTM, Section-VIII, Division-I, on butt joins of body and disc c) Post Weld Heat Treatment (PWHT) as per ASME, Section-VIII, Division-I on butt joints of body and disc of thickness above 30mm shall be carried out.
13	Rubber Lining Mix shall be subjected to Bleed Resistance Test on mould sample. Adhesion Test, Spark Test and Hardness Test for the Rubber lined jobs shall also be conducted.
14	All fans shall be subjected to run test and Vibration, noise, temperature rise, and current drawn shall be measured during the run test. Performance test of one fan of each type and size shall be carried out as per applicable standard for air flow, static pressure, speed, Efficiency, power consumption.
15	In case of diaphragm/plunger, only proven material shall be used and certificate in this regard shall be submitted for review.
16	All pumps to be performance tested as per Hydraulic Institute Standard/Relevant standard. Performance test to include check for noise, vibration level and bearing temperature rise.
17	Pumps shall be tested at 200% of pump rated head or at 150% of pump shut-off head whichever is higher for 30 min duration.
18	Performance testing of each compressor/ Blower / Vacuum Pump shall be carried out at shop as per BS-1571/ IS: 5456 /ISO 1217/ Pneurop 6612/ equivalent as applicable. Noise & vibration shall also be measured during performance testing.
19	For Compressors capacity control and operation of safety valves shall be checked during inspection at shop
20	Pressure retaining parts shall be hydraulic tested. Hydraulic test pressure shall be as per applicable std / 1.5 x design pressure or 2 x working pressure whichever is higher for 30 minutes duration. Atmospheric tanks shall be water fill tested
21	RT on weld joints shall be as per respective code requirements. Heat Treatment of the Tank/Vessel shall be done as per fabrication code requirement.
22	Dished ends shall be stress relieved as per relevant code. However, dished ends welds (if manufactured by using welded plates) shall be subjected to 100% RT and stress relieved.
23	Tube to tube sheet joints of heat exchanger shall be subject to mock up test. Coolers/heat exchanger shall be hydro tested on tube side and shell side
24	Refrigerant compressors shall be tested as per relevant std and certification from manufacturer for the same shall be submitted. Due point measurement & function of auto drain trap shall also be carried out.
25	Concentricity/ centering & Axial Run out Shall also be measured

~~1.08.00 PIPING, VALVE AND SPECIALITIES~~

~~1.08.01 Shop Tests~~

~~a) All pipes and fittings shall be tested as per applicable code.~~

~~b) DPT of pipe welds (in case of rolled and welded pipes only) shall be carried out for root and finished welds.~~

~~c) All strainers shall be subjected to Hydraulic pressure test for leakage and Pressure drop v/s Flow for each type and size.~~

~~d) All valves shall be hydraulically tested for body, seat and back seat (if applicable) as per relevant standard. Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure.~~

~~e) Valves shall be offered for hydro test in unpainted condition.~~

~~f) Functional checks of the valves for smooth opening and closing shall also be done.~~

~~g) Anti-corrosive protection shall be tested as per applicable code.~~

~~1.09.00 FOAM SYSTEM :~~

~~1.09.01 Shop Test~~

~~a) For tanks , pipes, fittings, valves and specification refer respective section of the specifications.~~

~~b) System shall meet test requirements as specified in TAC / UL / FM / NFPA etc.~~

~~1.10.00 PORTABLE & MOBILE FIRE EXTINGUISHERS~~

~~1.10.01 Shop Test~~

~~a) All Fire Extinguishers shall be tested as per relevant standard.~~

~~b) Performance / function test shall be carried out on sampling basis as per relevant code /standard~~.

1.11.00 **EOT/HOT Crane**

a) Chain pulley Blocks shall be tested as per IS: 3832.

b) Electrical wire rope hoists shall be tested as per IS : 3938

c) Following NDT requirements shall be met :

(i) 100% RT of Butt welds in tension and 10% RT of butt welds in compression.

(ii) DP at random on all weld mentals.

d) Deflection, load, overload & travel check on EOT/ HOT crane assembly shall be carried out as per IS:3177.

~~1.12.00 **SITE TESTS :**~~

~~a) **Fire Extinguishers :**~~

~~A performance demonstration test at site of five (5) percent or one (1) number, whichever is higher , of each type and capacity of the extinguisher shall be carried out by the contractor. All consumables and replaceable items require for this test would be supplied by the contractor without any extra cost to employer.~~

~~b) **Foam System :**~~

~~(i) The operation of the foam generation shall be demonstrated by the vendor after installation either in the tank to be protected or in the dyke area.~~

~~(ii) Any other equipment found necessary for the demonstration of the above testing like portable foam water monitor hose etc. shall be provided by the contractor during testing.~~

~~c) **Piping Protection :**~~

~~(i) Thickness , Holiday by spark test, Adhesion test shall be carried out as per relevant standard.~~

~~(ii) Complete piping shall be Hydro pressure tested,at 1.5 X DP or 2 X MWP whichever is higher , before protection.~~

~~d) **Welding of Pipes :**~~

~~(i) ERW Black / rolled welded~~

~~100% DPT on root of butt and finish weld of butt and fillet.~~

~~RT on 10% randomly selected joints shall be carried out (for underground piping).~~

~~(ii) **GI Pipes**~~

~~Welding on GI Pipes in general shall not be done. Welding of GI Pipes, if permitted by design , (butt / socket / fillet weld) shall be done strictly as per approved drawing and procedure approved by DVC / MECON.~~

SECTION IA
ANNEXURES

ANNEXURE-I

MAKES OF SUB-VENDOR ITEMS

1. Bought out items listed in the Customer's specification (TS VOL II Section-A Chap-13)shall be followed for make of various items to be replaced. In case of vendors or items not appearing in the preferred makes list, prior approval from M/s DVC shall be sought by furnishing the credentials of the vendors before proceeding.
2. The items / makes indicated below but not covered at "TS VOL II Section-A Chap-13" of Customer's Specification for makes as proposed by bidder shall be put up for Customer's approval during detailed engineering stage without any commercial & delivery implication to BHEL.
3. Bidder to propose sub vendor within 4 weeks of placement of LOI, thereafter no request for additional sub-vendor shall be entertained.
4. The inspection category will be finalized after award of contract during detailed engineering. Same will be adhered by the bidder without any commercial and delivery implication to BHEL

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	STEEL	SAIL		
		TISCO		
		JINDAL		
		ESSAR		
2.	HOOKS	STEEL FORGING & ENGG. CO.,	KOLKATA	
		SIMRITI FORGING		
		KARACHIWALA		UP TO 25T CAPACITY
3.	GEAR COUPLINGS	ALLIANCE		
		FLEX-TRANS (formerly known as HICLIFF)		
		SAHARA		
		NUTECH		
		OEM		
4.	WIRE ROPE	USHA MARTIN		
		FORT WILLIAMS		
		BHARAT WIRE ROPES		
5.	BEARINGS	SKF		
		FAG		
		TATA		
		NBC		
6.	MOTORS	SIEMENS		
		NGEF (up to 15KW)		
		CROMPTON GEAVES		
		KIRLOSKAR ELECTRIC CO LTD.		
		BHARAT BIJLI		
		MARATHON		
		ABB		
		GE-POWER	CHENNAI	(FOR LT MOTORS ONLY)
		LAXMI HYDRAULICS PVT. LTD	SOLAPUR-	(FOR LT MOTORS ONLY)

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
			MAHARASHTRA	
		RAJINDRA ELECT INDUSTRIES		(FOR LT MOTORS ONLY)
7.	BRAKES	ELECTROMAG		
		SPEED-O- CONTROL		
		BCH		FOR DCEM BRAKES ONLY
		KAKKU		
		PATHE		
8.	CONTACTOR	SIEMENS		
		L&T		
		SCHNEIDER (Earlier TELE MECHANIQUE)		
		BCH		
9.	OVER LOAD RELAYS	SIEMENS		
		L&T		
		ABB		
		SCHNEIDER (Earlier TELE MACHANIQUE)		
10.	HRC FUSES	SIEMENS		
		L&T		
		ENGLISH ELECTRIC		
		GE POWER		
		EATON (BUSSMANN)		
		ABB		
11.	ISOLATING SWITCH	SIEMENS		
		L&T		
		CONTROL & SWITCH GEAR		
		ABB		
12.	SWITCH FUSE UNITS	SIEMENS		
		L&T		
		CONTROL & SWITCH GEAR	-	
		ABB		
13.	TIME DELAY RELAYS	SIEMENS		
		L&T		
		ABB		
		BCH		
		SCHNEIDER (Earlier TELE MACHANIQUE)		
14.	TRANSFORMERS	INDCOIL		
		LOGICSTAT		
		KAPPA		

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		AUTOMATIC ELECTRIC		
		PRECISE ELECTRICALS		
		SILKAAN ELECTRIC MFG. CO. LTD.		
		SOUTHERN ELECTRIC		
		NEC		
15.	BULB & FLOURESCENT TUBES/FITTINGS	PHILIPS		
		BAJAJ		
		CROMPTON		
16.	CABLE LUGS (HEAVY DUTY)	DOWELLS		
		UML ENGINEERS	KOLKATA	
		JAINSON		
17.	HOOTERS	BEACON		
		OSC		
		TARGET		
		KHERAJ		
18.	LIGHTING SWITCHES	ANCHOR		
		ELLORA		
		BAJAJ		
		PHILIPS		
19.	PVC POWER CABLES	APAR INDUSTRIES LTD.	MUMBAI	
		CORDS CABLE INDUSTRIES LTD.	NEW DELHI	
		DIAMOND POWER INFRASTRUCTURE LTD	VADODARA	
		GOYOLENE FIBRES (INDIA) PVT.LTD	MUMBAI	
		GOVIND CABLE INDUSTRIES	KOLKATA	
		GUPTA POWER INFRASTRUCTURE LIMITED	BHUBNESWAR	
		HAVELLS INDIA LIMITED	NOIDA	
		KEI INDUSTRIES LTD.	NEW DELHI	
		KRISHNA ELECTRICAL INDUSTRIES LTD	GWALIOR	
		KEC INTERNATIONAL LIMITED	MUMBAI	
		MANSFIELD CABLES COMPANY LTD.	NOIDA	
		NICCO CORPORATION LTD.	KOLKATA	
		PARAMOUNT COMMUNICATIONS LTD.	NEW DELHI	
		POLYCAB WIRES PVT. LTD.	MUMBAI	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		RADIANT CORPORATION PRIVATE LIMITED	HYDERABAD	
		RAVIN CABLES LIMITED	MUMBAI	
		SUYOG ELECTRICALS LTD.	VADODARA	
		SRIRAM CABLES PVT. LTD.	NEW DELHI	
		SCOT INNOVATION WIRES AND CABLES PVT. LTD.	SOLAN	
		SAM CABLES & CONDUCTORS (P) LTD	UDHAM SINGH NAGAR	
		THERMO CABLES LTD	HYDERABAD	
		M/s Lapp		
		M/s Furukawa		
		M/s Torrent		
		M/s Universal		
		M/s RPG		
20.	PVC CONTROL CABLES	ADVANCE CABLE TECHNOLOGIES (P) LTD	BANGALORE	
		APAR INDUSTRIES LTD., CMI LTD	MUMBAI	
		CMI LIMITED	FARIDABAD	
		CORDS CABLE INDUSTRIES LTD	NEW DELHI	
		CRYSTAL CABLE INDUSTRIES LTD	KOLKATA	
		DELTON CABLES LTD	NEW DELHI	
		DIAMOND POWER INFRASTRUCTURE LTD	VADODARA	
		ELKAY TELELINKS LTD	NEW DELHI	
		GEMSCAB INDUSTRIES LTD	NEW DELHI	
		GOVIND CABLE INDUSTRIES	KOLKATA	
		GUPTA POWER INFRASTRUCTURE LIMITED	BHUBNESWAR	
		HAVELLS INDIA LIMITED	NOIDA	
		INCOM CABLES (P) LTD	NEW DELHI	
		KEI INDUSTRIES LTD	NEW DELHI	
		KRISHNA ELECTRICAL INDUSTRIES LTD	GWALIOR	
		KEC INTERNATIONAL LIMITED	MUMBAI	
		MANSFIELD CABLES COMPANY LTD	NOIDA	
		NICCO CORPORATION LTD	KOLKATA	
		PARAMOUNT COMMUNICATIONS	NEW DELHI	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		LTD		
		POLYCAB WIRES PVT. LTD	MUMBAI	
		RAVIN CABLES LIMITED	MUMBAI	
		SUYOG ELECTRICALS LTD	VADODARA	
		SPECIAL CABLES PVT. LTD	NEW DELHI	
		SCOT INNOVATION WIRES AND CABLES PVT. LTD	SOLAN	
		SAM CABLES & CONDUCTORS (P) LTD	UDHAM SINGH NAGAR	
		SPM POWER & TELECOM PVT. LTD	HYDERABAD	
		TORRENT CABLES LTD	AHMEDABAD	
		THERMO CABLES LTD	HYDERABAD	
		TIRUPATI PLASTOMATICS PVT. LTD	JAIPUR	
		UNIVERSAL CABLES LTD	SATNA	
		M/s Lapp		
		M/s Furukawa		
		M/s RPG		
21.	TRAILING CABLES	NICCO	KOLKATA	
		UNIVERSAL	SATNA	
		INCAB		
		ICL	NEW DELHI	
		APAR INDUSTRIES LTD	MUMBAI	
		CMI LTD	FARIDABAD	
		KEI INDUSTRIES LTD	NEW DELHI	
		SUYOG ELECTRICALS LTD	VADODARA	
22.	XLPE POWER CABLES	APAR INDUSTRIES LTD	MUMBAI	
		CORDS CABLE INDUSTRIES LTD	NEW DELHI	
		CRYSTAL CABLE INDUSTRIES LTD	KOLKATA	
		DIAMOND POWER INFRASTRUCTURE LTD	VADODARA	
		GEMSCAB INDUSTRIES LTD	NEW DELHI	
		GOVIND CABLE INDUSTRIES	KOLKATA	
		GUPTA POWER INFRASTRUCTURE LIMITED	BHUBNESWAR	
		HAVELLS INDIA LIMITED	NOIDA	
		KEI INDUSTRIES LTD	NEW DELHI	
		KRISHNA ELECTRICAL	GWALIOR	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		INDUSTRIES LTD		
		KEC INTERNATIONAL LIMITED	MUMBAI	
		MANSFIELD CABLES COMPANY LTD	NOIDA	
		PARAMOUNT COMMUNICATIONS LTD	NEW DELHI	
		POLYCAB WIRES PVT. LTD	MUMBAI	
		RAVIN CABLES LIMITED	MUMBAI	
		SUYOG ELECTRICALS LTD	VADODARA	
		SPECIAL CABLES PVT. LTD	NEW DELHI	
		SCOT INNOVATION WIRES AND CABLES PVT. LTD	SOLAN	
		SRIRAM CABLES PVT. LTD	NEW DELHI	
		TORRENT CABLES LTD	AHMEDABAD	
		THERMO CABLES LTD	HYDERABAD	
		TIRUPATI PLASTOMATICS PVT. LTD	JAIPUR	
		M/s Lapp		
		M/s Furukawa		
		M/s RPG		
23.	XLPE CONTROL CABLES	APAR INDUSTRIES LTD	MUMBAI	
		CABLE CORPORATION OF INDIA LTD	MUMBAI	
		CRYSTAL CABLE INDUSTRIES LTD	KOLKATA	
		DIAMOND POWER INFRASTRUCTURE LTD	VADODARA	
		GEMSCAB INDUSTRIES LTD	NEW DELHI	
		HAVELLS INDIA LIMITED	NOIDA	
		KEI INDUSTRIES LTD	NEW DELHI	
		KRISHNA ELECTRICAL INDUSTRIES LTD	GWALIOR	
		KEC INTERNATIONAL LIMITED	MUMBAI	
		PARAMOUNT COMMUNICATIONS LTD	NEW DELHI	
		POLYCAB WIRES PVT. LTD	MUMBAI	
		RADIANT CORPORATION PRIVATE LIMITED	HYDERABAD	
		RAVIN CABLES LIMITED	MUMBAI	
		SUYOG ELECTRICALS LTD	VADODARA	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		SRIRAM CABLES PVT. LTD	NEW DELHI	
		TORRENT CABLES LTD	AHMEDABAD	
		UNIVERSAL CABLES LTD	SATNA	
		M/s Lapp		
		M/s Furukawa		
		M/s RPG		
24.	CABLE GLAND	COMMET		
		SUNIL&CO		
		ARUP ENGINEERING		
		JAINSON		
		DOWELL		
		ALLIED TRADERS & EXPORTERS	NOIDA	
		BALIGA LIGHTING EQPT.PVT.LTD.	CHENNAI	
		ELECTROMAC INDUSTRIES	MUMBAI	
		INCAB	KOLKATA	
25.	PUSH BUTTONS	SIEMENS		
		L&T		
		BCH		
		SCHNEIDER		
26.	LIMIT SWITCHES	SPEED-O-CONTROL		
		ELECTROMAG		
27.	MASTER CONTROLLER	SPEED-O-CONTROL		
		ELECTROMAG		
28.	SAFETY SWITCHES	ALSTOM		
		L&T		
		SIEMENS		
29.	PENDENT PUSH BUTTON STATION	OEM		
30.	INDICATING LAMPS	TECKNIC		
		BCH		
		SIEMENS		
		STANDARD		
31.	MCB	MDS		
		INDO COPP		
		STANDARD		
		SIEMENS		
		L&T		

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		ABB		
		SCHNEIDER		
32.	PANELS	Instrumentation Ltd		
		RITTAL		
		PYROTECH		
		Hoffman		
33.	RESISTANCE BOXES	ENAPROS		
		OEM		
34.	FIRE EXTINGUISHERS	ASKA EQUIPMENTS LTD.		
		ASHOKA ENGINEERING COMPANY		
		KANADIA FYR FYTER PVT. LTD		
		NITIN FIRE PROTECTION INDUSTRIES LTD		
		NEW ENGINEERING CORPORATION		
		SAFEX FIRE SERVICES LTD		
		UNITED FIRE EQUIPMENTS PVT. LTD		
		ZENITH FIRE SERVICES (INDIA) PVT LTD		
		M/s Ceasefire		
		M/s Steelage Minimax		
		M/s Siemens		
35.	VVVF	Yokogawa		
		ABB		
		SIEMENS		
		SCHNIEDER		
		FUJI ELECTRIC		
		MITSUBISHI ELECTRIC		
		CGL		
36.	SHROUDED DSL	SUSHEEL		
		STROMAG		
37.	ANTI COLLISION DEVICE	ELECTRONIC SWITCHES INDIA		
38.	LOAD CELL	IPA		
		SARTORIUS		
39.	RRC	ACROPOLIS ENGINEERING	-	
		SNT CONTROLS	-	
40.	GEAR BOX	OEM		* = Applicable for Geared

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		ELECON ENGINEERS		Motors only
		SHANTI GEARS		
		PBL*		
		NAW*		
		NORD*		
		SEW*		
		BONGFILIOLI*		
41.	RAIL	JSPL		
		SAIL		

NOTE:

1. THE SUB VENDOR LIST ABOVE IS INDICATIVE ONLY AND IS SUBJECT TO BHEL AND CUSTOMER APPROVAL DURING DETAILED ENGINEERING STAGE WITHOUT ANY COMMERCIAL & DELIVERY IMPLICATION TO BHEL.
2. MAKE OF ITEMS/EQUIPMENTS USED IN ORIGINAL CRANES ARE ALSO ACCEPTABLE.
3. BIDDER TO PROPOSE SUB VENDOR WITHIN 4 WEEKS OF PLACEMENT OF LOI. THEREAFTER NO REQUEST FOR ADDITIONAL SUB-VENDOR SHALL BE ENTERTAINED.
4. THE INSPECTION CATEGORY WILL BE FINALISED AFTER AWARD OF CONTRACT DURING DETAILED ENGINEERING. HOWEVER THE SAME WILL BE ADHERED BY THE BIDDER WITHOUT ANY COMMERCIAL AND DELIVERY IMPLICATION TO BHEL/ CUSTOMER.

ANNEXURE-II LIST OF MANDATORY SPARES

A) Local Instrument

i) 10 % of each type of Push buttons, indicating lamps, colour caps, limit switches & control station for each type.

ii) 10% or minimum 1 nos of each instrument not covered in the list but used in the system

B) AC Motors

i. Valve drive - 1 of each type
ii. Bearings - 3 set of each type
iii. Fans - 3 nos. each type

Note:-

1. Spares listed in Annexure II are to be supplied only for the parts replaced/ refurbished by the contractor as per applicability from the indicated list.
2. Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc. these shall cover all the items supplied. replaced and installed during refurbishment.
3. In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed in the above list.
4. Any item which is quoted as “not applicable” in the above list and is found to be “applicable” at a later date shall be supplied by the Bidder without any commercial implications. The Bidder shall note that if there in any change/ variation in equipment/ system during detail engineering which causes any change/ variation in the essential spares quantity, the same shall be supplied without any commercial implications. The price indicated for the mandatory spares shall be considered for the purpose of evaluation.
5. Mandatory spares shall not be dispatched before dispatch of corresponding main equipment. The spares shall be treated and packed for a long storage under the climatic condition prevailing at site.
6. All spares supplied under this contract shall be strictly interchangeable with parts for which they are intended for replacements.
7. Each spare shall be clearly marked and labeled on the outside of the packing with its description. When more than one spare part is packed in single case, a general description of the contents shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification. The spare shall be treated and properly packed for long term storage.

ANNEXURE III - TOOLS & TACKLES

Following unused new set of special purpose tools, tackles and accessories along with detailed instructions and maintenance manual for the crane shall be supplied. Each tool and wrench shall be stamped so as to be identified, easy for its use. The tools shall be supplied in steel toolbox and with a copy of instruction manual. The items supplied shall be of the best quality and minimum the following shall be provided.

a) One (1) set of wrench spanner having sockets.
b) One (1) set of sliding bar for socket wrench.
c) One (1) torque wrench
d) One (1) set of Allen key set.
e) One (1) grease and oil gun.
f) One (1) hydraulically operated jack of suitable capacity for CT & LT wheels.
g) Any other if required
h) One (1) tool box with lock and double keys.

Note: - One set of tool and tackles with O&M manual in the toolbox shall be supplied. Further in addition to above mentioned items, if any other items is required for maintenance of crane, the same shall also be included as a part of maintenance tools by the bidder.

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ANNEXURE IV

PAINTING SPECIFICATION

1. Painting of crane before erection at site:

Surface preparation: All surfaces to be painted shall be thoroughly cleaned of dirt, grease, rust & mill scale. Removal of rust & scale shall be by hand brushing, power driven wire brushes.

Primer : Either of Aluminum zinc oxide / Red oxide zinc chromate/ Epoxy resin paint (cold cured) as per manufacturer's standard. 2 coat, DFT 25-30 µm per coat.

Finish Coat : Either of Synthetic enamel /Epoxy based finishing paint as per manufacturer's standard.
2 coat, DFT 25-30 µm per coat.

Total DFT : 100µ-125µ

2. Painting for components such as panels, electrical parts, motors etc. shall be as per as per manufacture's standard.
3. Colour Shade:

SL. No.	Item Description	Colour Shade	Remarks
1	Crane Structure & lifting beam	Golden Yellow shade 356 as per IS-5	Colour band-Black
2	Trolley and hook	Crimson shade 540 as per IS-5	
3	Motors	As per manufacturer's standard	
4	Control Panels	Light Gray as per IS-5	

ANNEXURE-V

DRAWINGS/ DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT

1.0.0 Following documents shall be submitted for the above refurbishment scope during detail engineering after placement of order on BHEL's vendor.
Sizing /selection of crane parts requiring renovation/ replacement shall be as per IS 3177.

Legend: A- Approval, I – Information

BASIC ENGINEERING DRAWINGS/DOCUMENT

S. No.	BHEL drawing No.	Title	No. of days for submission from date of LOI.	CATEGORY
1	PE-V0-495-501-A501	Manufacturing Quality Plan (as applicable) with sub vendor list for Power house crane	28	A
2	PE-V1-495-501-A504	Mechanism Sizing Calculation (for applicable items) for Power house cranes	28	A
3	PE-V0-495-501-A505	General arrangement drawing of crane	28	A
4	PE-V0-495-501-A508	General arrangement for PVC shrouded DSL.	35	I
5	PE-V0-495-501-A517	Schematic circuit diagram	35	I
6	PE-V0-495-501-A518	General Arrangement of panels (for component arrangement and pendant details	35	I
7	PE-V0-495-501-A519	Cable Sizing and cable schedule	35	I
8	PE-V0-495-501-A521	Mandatory spare parts list	42	A
9	PE-V0-495-501-A522	Data sheet for replaced items 2x112.5T/2.25T Power house crane	35	A
10	PE-V0-495-501-A534	Crane assessment report before refurbishment of cranes	21	I
11	PE-V0-495-501-A514	Catalogues/Data sheet/Lubrication Schedule/Packing and storage guidelines for replaced parts	42	I
12	PE-V0-495-501-A523	Manufacturing Quality Plan for Lifting beam	35	I
13	PE-V0-495-501-A524	GA drawing and structural calculation for Lifting beam and slings	35	I
14	PE-V0-495-501-A524	NDT reports for 2x112.5T/2.25T Power house crane	21	I

Notes:

1. The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. While some of the drawings indicated above may not be applicable, some additional drawings may also be required based on scope of work.
2. Drawings shall be prepared in Auto-Cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.
3. Only manual calculation with authentic supporting literature (e.g. extracts of hand Book/ standard/codes) shall be acceptable. All design calculations and drawings shall be in SI system only.

4. Bidder to note that all values/dimensions/elevations etc. without supporting back up data adopted/assumed by the successful bidder (during contract stage) in the design calculation/drawings shall be taken by the customer/owner to be correct unless they are stipulated in the specification. Any problem arising later in this regard shall be made good by the successful bidder at his cost and no extension of time shall be granted for the same.
5. All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.:-

   a) All drawings and documents shall indicate the list of all reference drawings including general arrangement.

   b) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view; all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.

   c) Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.

   d) All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating all major components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.

   e) Drawings/ documents to be submitted for purchasers review/ approval shall be under Revision A, B, C… etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3 ….etc.

   f) Drawings and documents not covered above but required to check safety of machines/ system, shall be submitted during detailed engineering stage without any commercial implication.

   g) All drawings shall include "B.O.M" and indicate quantity, material of construction, make along with IS/BS No., Technical parameters, dimensions, hardness, machining symbol and tolerance, requirement of radiography and hydraulic tests, painting details, elevation, side view, plan, skin section and blow-up view for clarity.

   h) All drawings shall be prepared as per BHEL's title block and shall bear BHEL's drawing No.

   i) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.

   j) Bidder to follow the following the drawing submission schedule:

      i. 1st submission of drawings as per the submission schedule.

      ii. Every revised submission incorporating comments – within 7 days.

   k) Bidder to submit revised drawings complete in all respects incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.

ANNEXURE-VI

NDT SCOPE

NDT (Non Destructive Testing) of existing Power house EOT crane is to be conducted by bidder as per attached NDT conducting Plan for any defects/cracks through approved ASNT level-II NDT engineer/agency by bidder. After conducting of NDT bidder need to submit report to customer/consultant for review of the same. All manpower, calibrated instruments/equipments /facilities, consumables and facility for approach to various parts of crane to carry out NDT shall be in bidder's scope.

Bidder to conduct the NDT and submit the NDT report to BHEL within 21 days from date of LOI/LOA placement.

With NDT report, bidder to submit the details on any defect found and recommended corrective action to refurbish/replace the defected item.

Note: Refurbishment/replacement of defected items as per recommendation of bidder **shall NOT be in bidder's scope**.

	NDT CONDUCTING AGENCY NAME & ADDRESS M/S	NDT CONDUCTING PLAN	DVC DOC NO.: 2201-121-QVGP-A001	DATE: 27-06-2022
		PROJECT: 1x46 MW Panchet HEP (RMU)	BHEL DOC NO. PE-DC-495-501-A001	
		CUSTOMER: DVC	REV 04	
		ITEM: 1 NO. 2X112.5T POWER HOUSE D/G EOT CRANE — SYSTEM: RMU OF EOT CRANE		SHEET 1 OF 2

SL NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	CLASS	TYPE OF CHECK	*QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9		**			10
1.0 NDT TO BE CONDUCTED FOR FOLLOWING LOAD BEARING AREAS														
1	Pulley , Brake drum	NDT	Major	U.T (boss area & groove area)	50%	50%	ASME Sec.V,article-23,SA-609 FOR CASTING & ASTM A 388 FOR FORGING	SA - 609 , Level – II FOR CASTING & UT PROCD. FOR FORGING	NDT Report	√	P	V	V	For UT procedure refer Note 2
2	Rope Drum	DP test on fillet weld & Dimension	Major	DP test on fillet weld & Dimension	50%	50%	ASME SEC VIII Div -1 / Mfg. Drg.	NO RELEVANT INDICATION	NDT Report	√	P	W	V	
		NDT	Major	U.T if seamless rope drum (on ungrooved area only)	50%	50%	ASTM E 213	ASTM E 213	NDT Report	√	P	W	V	For UT procedure refer Note 2
		NDT	Major	DPT on Butt Weld (if applicable)	50%	50%	ASTM E165	No Relevant Indications	I.R	√	P	W	V	
		NDT	Major	DP test on Groove	50%	50%	IS: 3658-1981 / ASME - Sec. V	NO RELEVANT INDICATION	NDT Report	√	P	W	V	Cleaning to be done with wire mesh grinder before testing
3	Hook	NDT	Major	U.T & MPI	100%	10%	ASTM A 388-2007 / ASTM E 709-2007	ASTM A 388-2007 / ASTM E 709-2007	NDT Report	√	P	W	V	UT only shank portion Refer Note 6
4	Pinions, Gear	NDT	Major	DPT on teeth	50%	50%	IS:3658-1981 / ASME - Sec. V	NO CRACKS & LINEAR INDICATION	NDT Report	√	P	V	V	
		NDT	Major	UT on teeth	50%	50%	ASTM A 388-2007	ASTM A 388-2007	NDT Report	√	P	V	V	
5	Wheels		Major	DPT & UT on tread portion only	50%	50%	ASTM E165 / ASTM A 388-2007	No Relevant Indications	I.R	√	P	V	V	50% on each wheel
6.1	Fillet Weld (Girder ,End-carriage, Trolley & Fabricated Rope drum, if applicable, lifting beam)	NDT	Major	DPT/MPI on Fillet Weld	10%	10%	ASME - Sec. V ASTM E 709-2007	ASME SEC. VIII , Div-1 , Append. – 8 ASTM E 709-2007	NDT Report	√	P	V	V	
6.2	Butt Weld	NDT	Major	UT	25%	25%	ASTM A 388-2007	ASTM A 388-2007	NDT Report	√	P	W	V	

SUPPLIER			BHEL			FOR CUSTOMER REVIEW & APPROVAL		
NDT CONDUCTING AGENCY			QUALITY			Doc No:		
	Sign & Date	Name		Sign & Date	Name		Sign & Date	Name
Prepared by:			Reviewed by:			Approved by:		

	NDT CONDUCTING AGENCY NAME & ADDRESS M/S	NDT CONDUCTING PLAN	DVC DOC NO.: 2201-121-QVGP-A001	DATE: 27-06-2022
		PROJECT: 1x46 MW Panchet HEP (RMU)	BHEL DOC NO. PE-DC-495-501-A001	
		CUSTOMER: DVC	REV 04	
		ITEM: 1 NO. 2X112.5T POWER HOUSE D/G EOT CRANE — SYSTEM: RMU OF EOT CRANE		SHEET 2 OF 2

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	*QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9		**			10
	(Girder ,End-carriage, Trolley & Fabricated Rope drum, if applicable, lifting beam,)			DPT	10%	10%	ASTM E165	No Relevant Indications	I.R	√	P	W	V	
7	CT rails	NDT	Major	UT	At 10 nos. locations * (5 nos. on each girder),		ASTM A 388-2007	ASTM A 388-2007	NDT Report	√	P	V	V	*Locations shall be decided mutually
8	LT rails	NDT	Major	UT	10%*	10%*	ASTM A 388-2007	ASTM A 388-2007	NDT Report	√	P	V	V	*Locations shall be decided mutually

NOTES:

1) X-Ray to be taken for thickness upto 19 mm and Gamma Ray for thickness above 19 mm. If Gamma Ray is used for lower thickness slow speed film like D2 or equivalent which gives enough readable and interpretable film quality to be used for clarity. All NDT shall be carried out by Qualified Level II personnel.
2) Vendor's UT Procedure from NDT Level II to be submitted to BHEL for approval. The BHEL approved NDT Procedures shall be submitted to DVC for Information and reference.
3) For MH Hook, UT in proof machined condition and AH Hook in grinding condition. For UT procedure refer Note 2.
4) NDT shall be carried out for all load bearing area as covered in this documents.
5) Quantum of check indicated is maximum and it may vary depending upon accessibility and approach available at site. However, if the failure is observed during the NDT checking the Quantum of Check shall be increased from the maximum indicated Quantum of check on mutual agreement basis and as per the direction of DVC Engineer in Charge.\
6) NDT of hook shall be done again after refurbishment and load test of the crane by BHEL's crane RMU vendor.

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
** **M**: NDT CONDUCTING AGENCY, **C**: BHEL/ THIRD PARTY INSPECTION AGENCY, **N**: CUSTOMER (DVC),
P: PERFORM, **W**: WITNESS, **V:** VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI**: MINOR, **CR:** CRITICAL. **H** - Hold point

SUPPLIER			BHEL			FOR CUSTOMER REVIEW & APPROVAL		
NDT CONDUCTING AGENCY			QUALITY			Doc No:		
	Sign & Date	Name		Sign & Date	Name		Sign & Date	Name
Prepared by:			Reviewed by:			Approved by:		

SECTION III

DRAWINGS / DOCUMENTS TO BE SUBMITTED WITH THE BID

Bidder shall submit the following drawings / documents along with their bid:

a) Deviation schedule with reference to specific clauses of the specification along with reason for such deviation in the 'Deviation Schedule' (Cost of withdrawal) format as attached in GCC.

b) Un-priced copy of price format indicating quoted/ not quoted against each row/column

c) Copy of pre-bid clarifications/ amendment/ corrigendum issued by BHEL, if any, duly signed & stamped

d) Signed/ Stamped copy of Compliance cum Confirmation Certificate

e) Facility for manufacturing and load testing of Lifting beam (225T): Supporting documents related to availability of manufacturing facility, dead loads and testing facility are to be furnished. In case similar testing has been conducted previously at the facility, report of same can also be submitted to substantiate.

OFFER WILL BE CONSIDERED AS INCOMPLETE IN ABSENCE OF ANY OF ABOVE DOCUMENTS. DOCUMENT OTHER THAN ABOVE, IF ANY, SUBMITTED WITH THE OFFER WILL NOT FORM PART OF CONTRACT AND WILL NOT BE CONSIDERED FOR BID EVALUATION.

PRE-BID CLARIFICATION SCHEDULE

S. NO.	SECTION/CLAUSE/PAGE NO.	STATEMENT OF THE REFERRED CLAUSE	CLARIFICATION REQUIRED

The bidder hereby clarifies that above mentioned are the only clarifications required on the technical specification for the subject package.

Signature: _____

Name: _____

Designation: _____

Company: _____

Date: _____

Company Seal

COMPLIANCE-CUM-CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing / stamping this compliance certificate (every sheet) and furnish same with the offer.

a) The scope of supply, technical details, construction features, design parameters, refurbishment requirements etc. shall be as per technical specification & there are no exclusions, other than those mentioned under "exclusion and those resolved as per 'Schedule of Deviations', with regard to same.

b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'.

c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL / CUSTOMER approval & customer hold points for inspection / testing shall be marked in the QP at the contract stage. Inspection / testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This is within the contracted price without any extra implications to BHEL after award of the contract.

d) All drawings/ data-sheets / calculations etc. submitted along with the offer, if not sought/required for bid evaluation shall not be taken cognizance off.

e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified / intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements, the same shall be resolved by the bidder during the pre-bid discussions, otherwise BHEL/Customer's decision shall be binding on the bidder, whenever the deficiency is pointed out.

   For components where materials are not specified, the same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same are deemed to be included in the base price.

g) All sub-vendors shall be subject to BHEL / CUSTOMER approval in the event of order.

h) Guarantee/Warranty for plant/equipment shall be as per relevant clause of GCC / SCC / other Commercial Terms & Conditions.

i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break-up, approved drawing or approved Bill of quantities within the scope of work as tender specification. This clause will apply in case during site commissioning, additional requirements emerges due to customer and / or consultant's comments. No extra claims shall be put on this account.

j) Schedule of drawings/documents/quality plans submission, comment incorporation & approval shall be as stipulated elsewhere in the specification. The successful bidder shall depute his design personnel to BHEL's / Customer's / Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.

k) As-built drawings shall be submitted as and when required during the project execution.

l) The bidder has not tampered with this compliance-cum-confirmation certificate and if at any stage any tampering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

m) Successful bidder shall furnish detailed erection/installation manual for each of the equipment supplied under this contract as per the schedule of submission of documents and well before the scheduled erection of the equipment / component concerned.

n) Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and shall require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

o) In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.

DRAWINGS OF EXISTING CRANES AND OTHER REFERENCE DRAWINGS

14A/1

PHPS/Cr.-3
18. 11. 58
EDON-7/12/2-(U)-6405
dk 8. 11. 58

Performances:

Capacity, bridge ____ 125 tons
trolley main hook ____ 112.5 tons
aux. hook ____ 25 tons
Span (between centres of rails) ____ 19810 mm
Total lift main hook ____ 21.685 m
aux. hook ____ 30.460 m
Speeds, main hoist ____ 4.1 m/min
aux. hoist ____ 16.4 m/min
cross travel ____ 16.4 m/min
long travelling ____ 41 m/min
Max. crane wheel load (without impact increase) 31 tons of 224 kN
Control: magnetic control from the cab
Current supply: ____ 400 volts, 50 cy, 3 phase
Schedule, wiring diagram see drawing N° 94140
Drawing of track rail basement ____ N° 96757

TITOVI ZAVODI LITOSTROJ LJUBLJANA

B VIII/1958

General arrangement

E.O.T.C. 2×(112.5+25) tons 93155

1:50

Sketch of max. wheel loads

(in tons)

Downstream side

Upstream side

Flow sheet

Remark 1):
Clearance of min 100 mm (4") is necessary because of spring buffer deformation.
In case of operation fail, the crane must be stopped in the position where the distance is 0".
(Lower position of the hook)

Drawing cancels and is cancelled by drawing N° 93075

This drawing is the property of TITOVI ZAVODI LITOSTROJ LJUBLJANA and may not be reproduced or given to any third party without our written permission.

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN "mm")

DRG. NO. 1-200-00-219 52 REV. 00

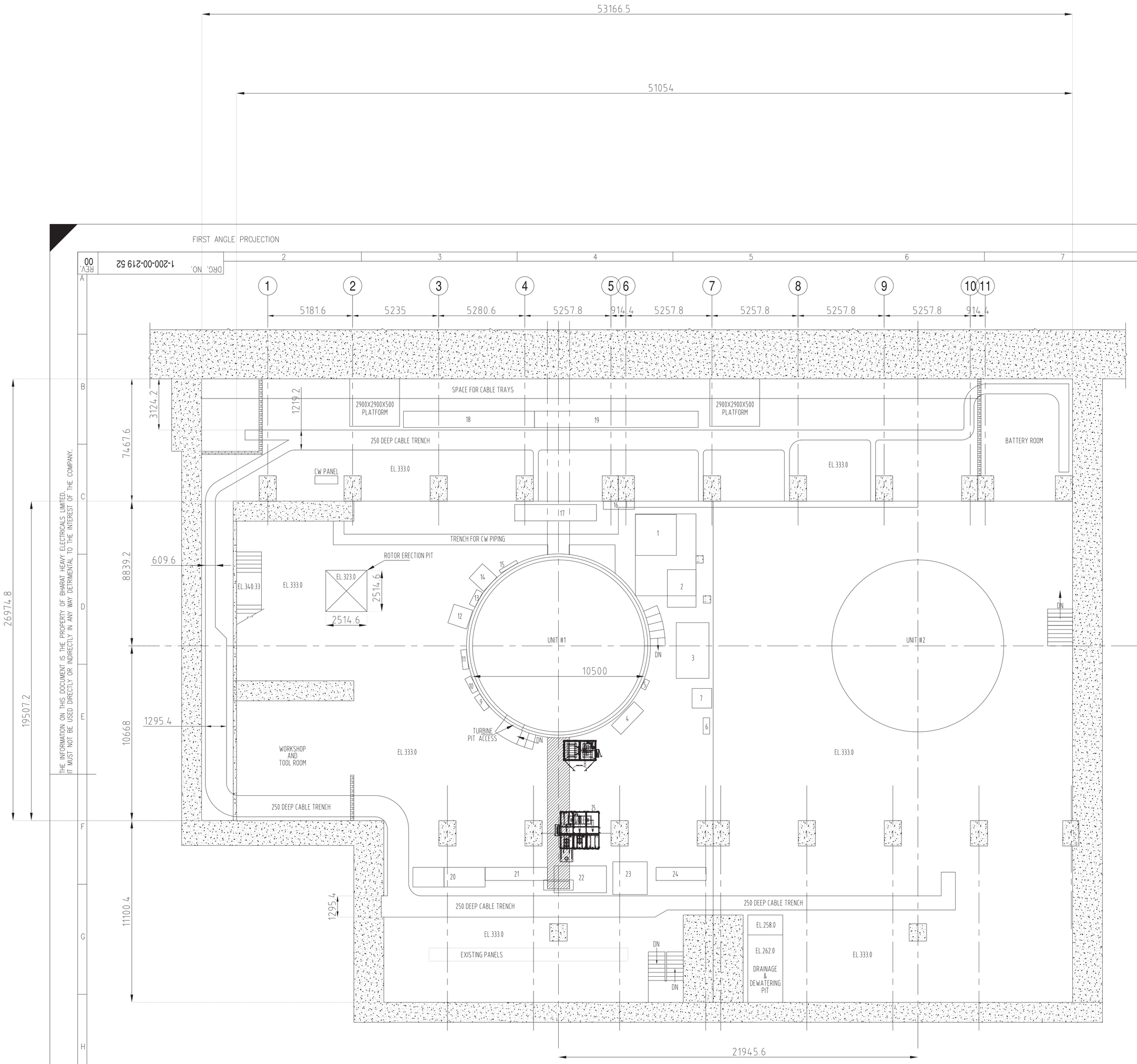


TABLE FOR DIMENSION OF EQUIPMENTS(TENTATIVE)								
ITEM NO	DESCRIPTION	WIDTH	DEPTH	HEIGHT	QTY./UNIT	TOTAL QTY	WT. (KG)	SUPPLYING UNIT
1	PP SET	2500	2500	2300	1	1	-	HPE GOV
2	PISTON TYPE PRESSURE ACCUMULATOR	1750	2300	2400	1	1	-	HPE GOV
3	N2 BOTTLE BANK	3400	2000	1800	1	1	-	HPE GOV
4	H.S LUBRICATION SYSTEM	2000	800	800	1	1	-	HGE
5	H.S LUB. STARTER PANEL(AC)	1000	400	1400	1	1	-	HPE ELEC
6	H.S LUB. STARTER PANEL(DC)	1000	400	1400	1	1	-	HPE ELEC
7	MOTORISED POWER PACK	1200	1200	1800	1	1	-	HGE
8	NG CUBICLE	2000	1250	2100	1	1	-	RUDRAPUR
9	TOP COVER DRAINAGE PUMP STARTER PANEL	1000	400	1400	1	1	-	HPE ELEC
10	GENERATOR SPACE HEATER PANEL	1000	400	1200	1	1	-	HPE ELEC
11	BRAKE & JACK PANEL	1100	350	1200	1	1		HGE
12	CARBON DUST COLLECTOR(CDC)	1200	1200	2300	1	1	-	HGE
13	CDC & BDC STARTER PANEL	1000	400	1200	1	1	-	HPE ELEC
14	BRAKE DUST COLLECTOR(BDC)	1200	1200	2300	1	1	-	HGE
15	MARSHALLING BOX	1500	200	1200	1	1	-	HGE
16	STARTER PANEL FOR PP SET	1900	500	2200	1	1	-	HPE ELEC
17	CO2 FIRE FIGHTING SYSTEM FOR GEN.	5000	1000	2300	1	1	-	HBE GOV
18	UAB	8000	1000	2600	1	1	-	HPE GOVC.
19	SAB	11000	800	2600	1	1	-	HPE ELEC.
20	EXCITATION PANELS	4410	1200	2295	1	1	-	EDN
21	UCB	3804	800	2300	1	1	-	EDN
22	GDS	2800	1640	3200	1	1	-	SWGR
23	ET	3000	1500	2295	1	1	-	JHANSI
24	LCB FOR COMMON SERVICES	3804	800	2300	1	1	-	EDN
25	LAVT	2400	2250	1900	1	1	-	RUDRAPUR

PLAN AT EL 333.0 ft

NOTES:
1. ALL ELEVATIONS ARE IN FEET AND DIMENSIONS IN MM.

REV.	DATE	ALTERED / CHECKED / APPROVED	ZONE

ADDITIONAL INFORMATION

STATUS OF DRAWING: U

DISTRIBUTION OF PRINTS

	NAME	SIGN	DATE	NO. OF VAR.
DRWN	B.SINGH		23.07.22	
CHKD	B.SINGH		23.07.22	
APPD	R.SINGH		23.07.22	

SUB-SUPPLIER / VENDOR

PROJECT	2X40 MW PANCHET HEP (R&M)
CUSTOMER	DVC LTD.
CONSULTANT	-
DVC DWG NO	2203 121 P V M F 002
CONTRACTOR	भारत हेवी इलेक्ट्रिकल्स लिमिटेड, भोपाल Bharat Heavy Electricals Limited, Bhopal

DEPT HSE | CODE 415 | UNTOL. DIMS. GR. | ANGLE | SCALE -- | WEIGHT(kg) | REF.TO ASSY.DRG. | ITEM NO. | NO.OF ITEMS

TITLE: STATION LAYOUT PLAN AT EL 333 FT

DRAWING NO. 1-200-00-219 52 | REV. 00

SHEET NO. 01 | NO. OF SHEETS. 01

A1 SIZE

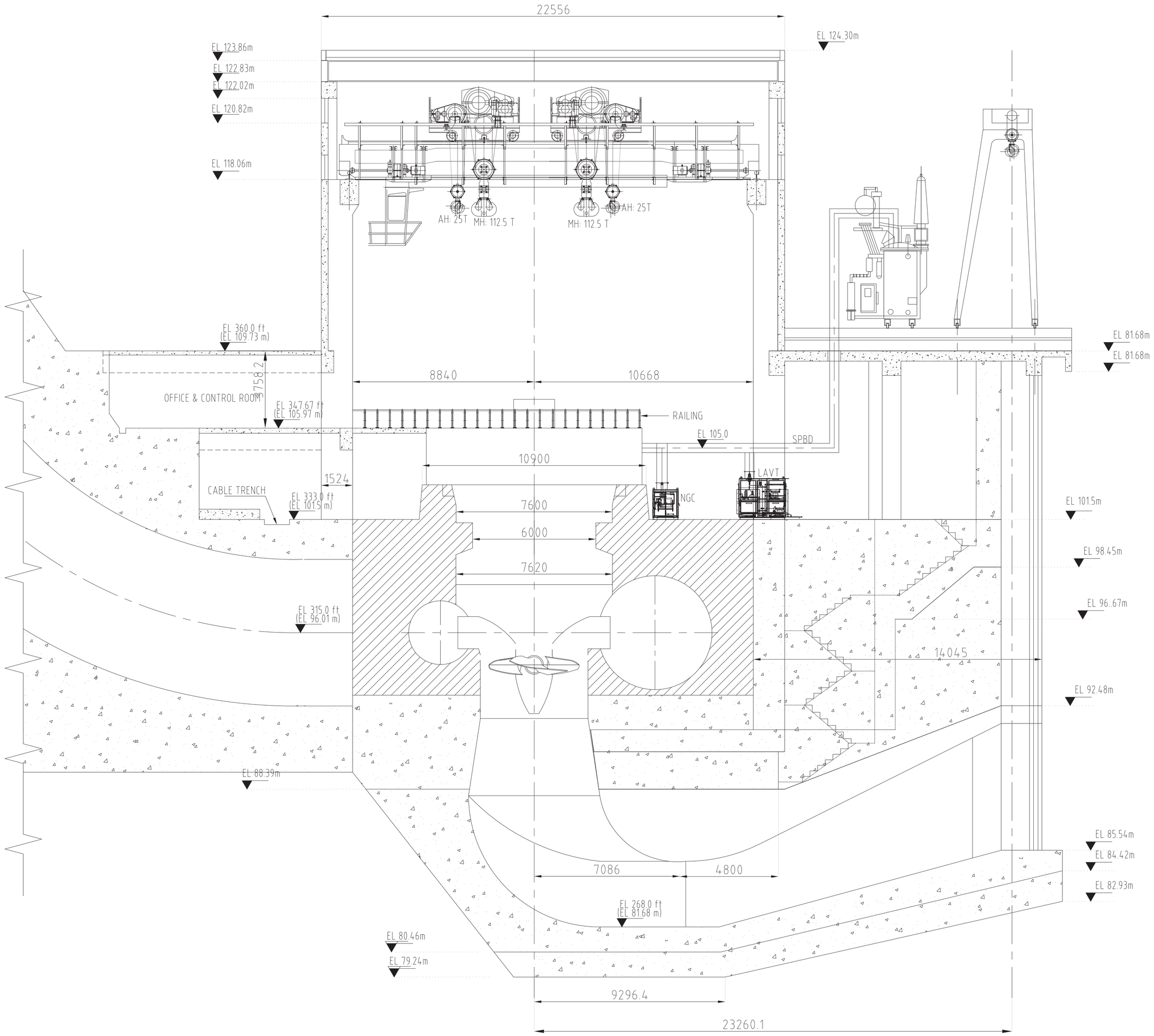
REF. DRG. NO. | SIGN. & DATE | INVENTORY NO.

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN "mm")

DRG. NO. 1 200 00 204 52

REV. 06



NOTES:

1. ALL ELEVATIONS ARE IN FEET AND DIMENSIONS IN MM.

REV.	DATE	ALTERED / CHECKED / APPROVED		REV.	DATE	ALTERED / CHECKED / APPROVED		REV.	DATE	ALTERED / CHECKED / APPROVED		REV.	DATE	ALTERED / CHECKED / APPROVED		REV.	DATE	ALTERED / CHECKED / APPROVED		REV.	DATE	ALTERED / CHECKED / APPROVED	
ZONE				ZONE				ZONE				ZONE				ZONE				ZONE			

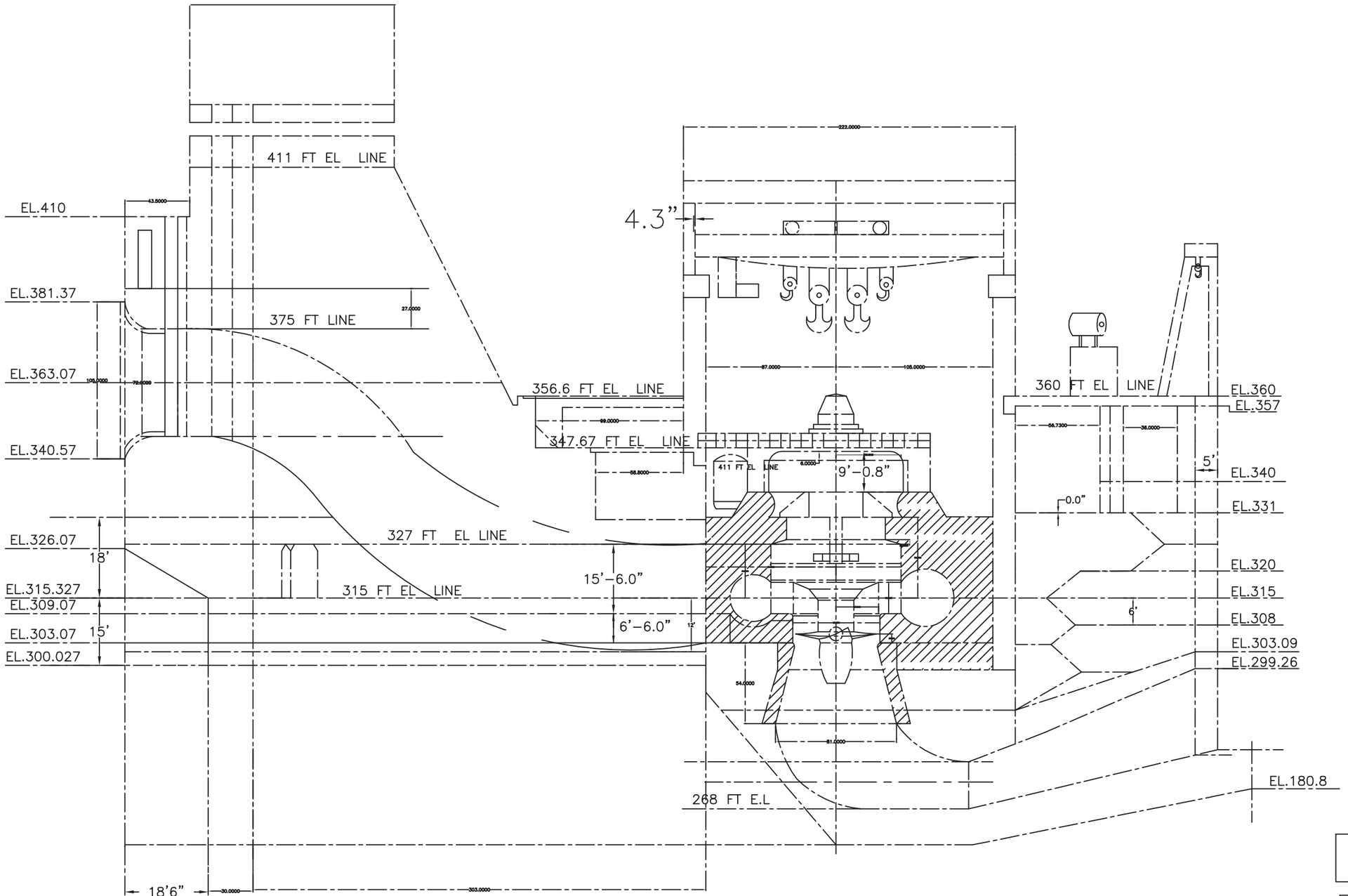
ADDITIONAL INFORMATION		PROJECT	2X40 MW PANCHET HEP (R&M)		
STATUS OF DRAWING	U	CUSTOMER	DVC LTD.		
DISTRIBUTION OF PRINTS		CONSULTANT	-		
		DVC DWG NO	2201 121 P V M F 001		
	NAME / SIGN / DATE / NO. OF VAR.	CONTRACTOR	भारत हेवी इलेक्ट्रिकल्स लिमिटेड, भोपाल Bharat Heavy Electricals Limited, Bhopal		
DRWN	B SINGH / 23.07.22				
CHKD	B SINGH / 23.07.22				
APPD	R SINGH / 23.07.22				
SUB-SUPPLIER / VENDOR		DEPT HSE / CODE 415	UNTOL. DIMS. GR.	ANGLE	SCALE 1:80 / WEIGHT(kg) / REF.TO ASSY.DRG. / ITEM NO. / NO.OF ITEMS
		TITLE	POWER HOUSE CROSS SECTION	DRAWING NO. 1-200-00-219 51	REV. 00
				SHEET NO. 01	NO. OF SHEETS. 01

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

REF. DRG. NO. / SIGN. & DATE / INVENTORY NO.

A1 SIZE

THIS IS PART OF TECHNICAL SPECIFICATION NO.: PE-TS-495-501-A001 Rev 0



TENDER PURPOSE ONLY

DAMODAR VALLEY CORPORATION (DVC)

मैकॉन लिमिटेड

MECON LIMITED

NOTES:-

1. ALL DIMENSIONS & LEVELS ARE IN METRES AND ONLY FIGURED DIMENSIONS SHALL BE FOLLOWED.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DRG. NO. MEC/11/11/Q670/DE/RF/35/7421 SHEET 2 OF 2.

REV/SEC	GL.& T.	M.H. SEC.	B.F.	S.M.S.
	CONCURRED BY			

REV.NO.	DATE	ZONE	DESCRIPTION	BY	VERIFIED
			REVISIONS		

REFERENCES — DRG. NO.

SECTION	PP&EE
LOCATION	RANCHI
DESIGNED	A CHATTERJEE
DRAWN	SATISH
CHECKED AND VERIFIED	J K SINGH
APPROVED	
SIG.	
DATE	

PANCHET HYDEL STATION

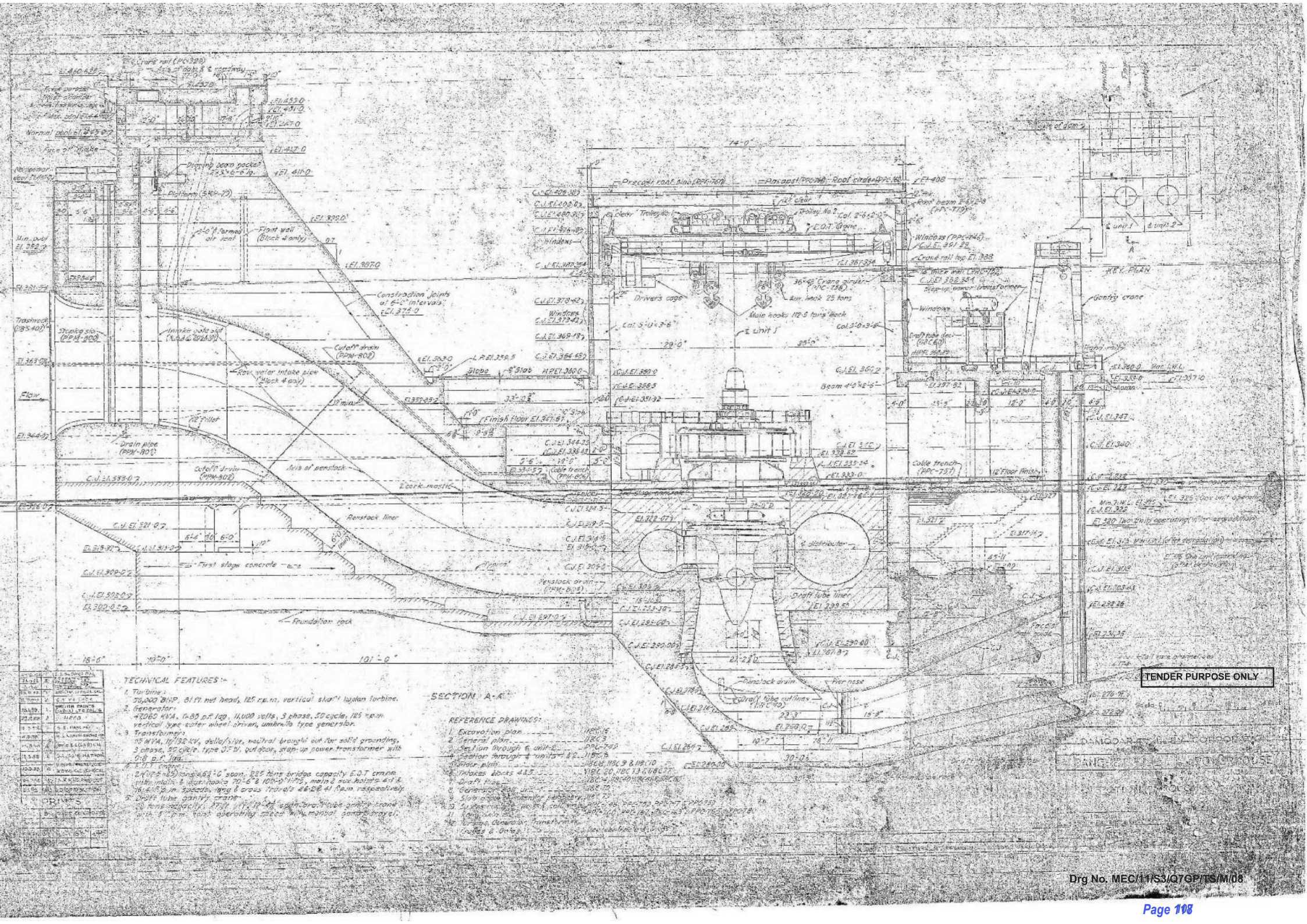
CROSS SECTION DRAWING OF UNIT#1

SCALE:- NTS.

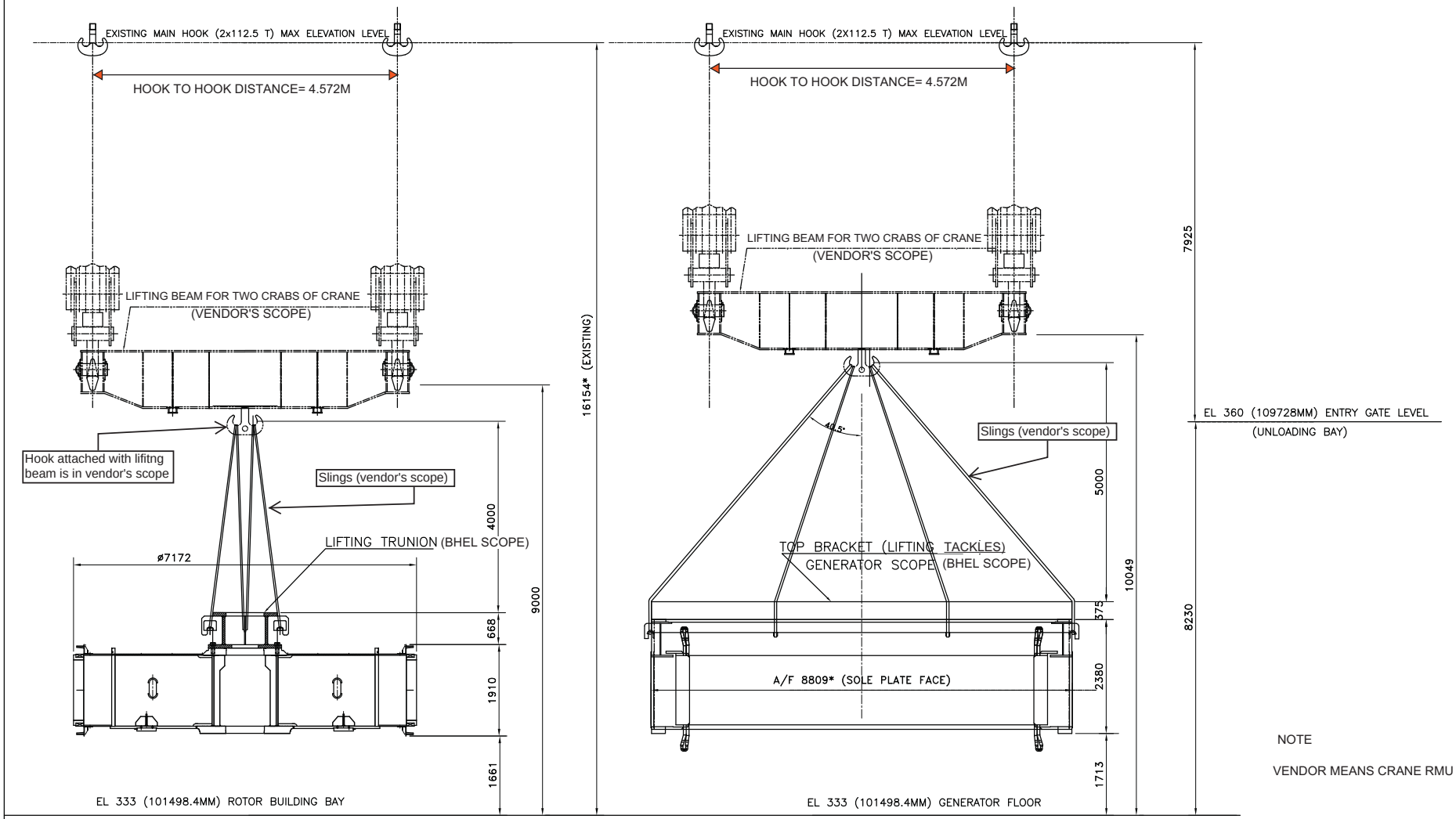
DRG.No.MEC/S3/11/Q76P/TS/M/01

SHEET 1 OF 1

REV. 0


TECHNICAL FEATURES :-
1. Turbine :
30,000 BHP, 81 ft. net head, 125 r.p.m, vertical shaft Kaplan turbine.
2. Generator :
42000 KVA, 0.85 p.f. lag, 11,000 volts, 3 phase, 50 cycle, 125 r.p.m vertical type outer wheel driven, umbrella type generator.
3. Transformers :
125 MVA, 11/132 KV, delta/star, neutral brought out for solid grounding, 3 phase, 50 cycle, type O.F.W. out door, step-up power transformer with 0.8 p.f. lag.
4. E.O.T. Crane :
2 x (125 + 25) tons, 63'-0" span, 225 tons bridge capacity E.O.T crane with main & auxiliary hooks 70 & 100 tons lifting, main & aux. hoists 6 & 16 r.p.m. speeds, long & cross travels 26 & 8 r.p.m. respectively.
5. Draft tube gantry crane :
25 tons capacity, 27'-0" span double girder gantry crane with 5 r.p.m. hoist operating speed with manual control travel.
SECTION A-A
REFERENCE DRAWINGS :
1. Excavation plan
2. General plan
3. Section through 6 unit-6
4. Section through 4 units + P.C.
5. Rotor plan
6. Intakes blocks 4 & 5
7. Draft tube
8. General
9. Slab
10. Superstructure
11. Turbine, Generator, Transformers
Drg No. MEC/11/S3/Q7GP/TS/M/08
TENDER PURPOSE ONLY
DAMODAR VALLEY CORPORATION
PANCHET HILL PROJECT
KEY PLAN
PRINTS

ALL DIMENSIONS ARE IN mm.



NOTE

VENDOR MEANS CRANE RMU VENDOR

ROTOR LIFTING

WEIGHT (EXCL. SHAFT) = 215 T (APPROX)

WOUND STATOR LIFTING

WEIGHT (INCL. LIFTING TACKLES)= 130 T (APPROX)

SLINGS DETAILS (VENDOR'S SCOPE)

1. **Slings for Rotor lifting (4 point lifting):** 4 nos. slings, 60mm dia, loop ended type, 6x36 construction, fibre core as per IS 2266, 2 nos of fall per slings
2. **Slings for Generator lifting (6 point lifting):** 6 nos. slings, 44mm dia, loop ended type, 6x36 construction, fibre core as per IS 2266, 2 nos of fall per slings

BHARAT HEAVY ELECTRICALS LIMITED.
BHOPAL/

		NAME	SIGN.	DATE.
PROJECT /CUSTOMER. PANCHET HEP(1x46MW)/DVC	DRAWN			
/TITLE. STATOR AND ROTOR HANDLING ARRANGEMENT	CHECKED	VG		26.07.22
DEPT. HGE / CODE. 403 / SCALE. NTS. / SKETCH HG-001	APPD.	DKC		26.07.22

THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-495-501-A001

PHOTOGRAPHS OF
EXISTING CRANES FOR REFERENCE

LITOSTROJ

SAFE WORKING LOAD

225 TONS BRIDGE

112,5 TONS MAIN HOOK

25 TONS AUXILIARY HOOK


Tested OK
01.10.12.2013


ISOLATION
SWITCH


LITOSTROJ
225
112,5
25


AUTION
400 VOLTS
হাশিয়ার
৪০০ ভোল্ট
সাবধান
৪০০ ভোল্ট

LT END STOPPER

CT PLATFORM
AND PANELS

INSIDE CABIN

INSIDE CABIN

INSIDE CABIN