

SJVN



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)**

**TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE
IN
POWER HOUSE CRANE 175/50/10T AND
TRANSFORMER CUM GIS HALL CRANE 50/10 T**

SPECIFICATION NO.: PE-TS-542-501-A201 Rev 0



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA**



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

**SPECIFICATION No:
PE-TS-542-501-A201**

SECTION

REV. 00

INDEX

SECTION	TITLE	PAGE NO.
IA	INTENT OF SPECIFICATION	1
IA	SPECIFIC TECHNICAL REQUIREMENT (MECHANICAL)	3
IA	QUALITY ASSURANCE AND INSPECTION REQUIREMENT	12
IA	CUSTOMER SPECIFICATION – GENERAL TECHNICAL SPECIFICATION	25
IA	CUSTOMER SPECIFICATION – PARTICULAR TECHNICAL SPECIFICATION	90
IA	ANNEXURES	
IA	-ANNEXURE I: MAKES OF SUB VENDOR ITEMS	164
IA	-ANNEXURE II: LIST OF MANDATORY SPARES	174
IA	-ANNEXURE III: LIST OF TOOLS AND TACKLES	174
IA	-ANNEXURE IV: COMPLIANCE DRAWINGS	
	-CRANE CLEARANCE DIAGRAM OF 2 NOS. 175/50T POWER HOUSE CRANE	176
	-CRANE CLEARANCE DIAGRAM OF 1 NO. 50/10T TRANSFORMER CUM GIS HALL CRANE	178
IA	-ANNEXURE V: DRAWING/ DOCUMENT SUBMISSION SCHEDULE	179
IA	-ANNEXURE VI: PACKING PROCEDURE	182
IA	-ANNEXURE VII: CHECK LIST FOR OPERATION & MAINTENANCE MANUAL	198
IB	SPECIFIC TECHNICAL REQUIREMENT (ELECTRICAL)- NOT USED	
IC	DATA SHEET	201
III	DOCUMENTS TO BE SUBMITTED ALONG WITH BID	221
III	COMPLIANCE CUM CONFIRMATION CERTIFICATE	222
III	PRE BID CLARIFICATION SCHEDULE	223



SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANES

SPECIFICATION No: PE-TS-542-501-A201

SECTION I

REV. 00

MAR 2026

1. SCOPE OF ENQUIRY / INTENT OF SPECIFICATION

- 1.1 This specification includes, but not limited to SUPPLY PART, SERVICE PART & MANDATORY SPARES comprising provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, preservation at site, installation, commissioning, performance testing, acceptance testing, training of Employer's personnel, Annual Maintenance Contract, handing over to employer and guarantee for **EOT cranes** for **POWER HOUSE AND TRANSFORMER CUM GIS HALL** complete with all auxiliaries, accessories, spare parts and warranting a trouble-free safe operation of the installation for project and package specified above complete with all accessories 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, erection & commissioning and load testing of the cranes and its accessories.**
- 1.3 It is not the intent to specify herein all the details of design and manufacture. 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.



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANES**

SPECIFICATION No: PE-TS-542-501-A201

SECTION I

REV. 00

MAR 2026

- 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. Further all checks and tests indicated in QAP as detailed in CUSTOMER SPECIFICATION and GENERAL TECHNICAL SPECIFICATION etc. have to be followed.



SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANES

SPECIFICATION No: PE-TS-542-501-A201

SECTION I

REV. 00

MAR 2026

SECTION I
SPECIFIC TECHNICAL REQUIREMENTS

SUB-SECTION IA: Specific Technical Requirements (Mechanical)

SUB-SECTION IB: Specific Technical Requirements (Electrical)

SUB-SECTION IC: Data Sheet-A



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANES**

SPECIFICATION No: PE-TS-542-501-A201

SECTION I

REV. 00

MAR 2026

**SECTION IA
SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)**



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANES**

SPECIFICATION No: PE-TS-542-501-A201

SECTION I

REV. 00

MAR 2026

1.0.0. SCOPE OF WORK

1.1.0. SCOPE OF SUPPLY

- 1.1.1. Equipment and services to be furnished by the bidder for the EOT CRANE with accessories as per the details given in the technical specification and data sheet A. Any equipment / accessories not specified in the specification but required to make the EOT crane complete for efficient & reliable operation shall also be under the bidder's scope of work.
- 1.1.2. Compliance with this specification shall not relieve the bidder of the responsibility of furnishing material and workmanship to meet the specified working/duty conditions.
- 1.1.3. A) Two (2) number 175/50T Double Girder EOT Cranes for Power House area shall include but not be limited to the following: -
- a. Bridge girders
 - b. End carriages with wheels
 - c. Crab (trolley)
 - d. Cross Travel & Long Travel drive arrangement
 - e. Operator's Cabin.
 - f. All electrical equipment including cables, junction box, VVVF drive, pendent, RRC, panels etc.
 - g. PVC insulated shrouded bus bar Cu conductor type DSL along with insert plates (fixing plates for DSL) to be mounted at RCC girder.
 - h. Earthing arrangement
 - i. Fill of lubricant till commissioning of crane
 - j. Painting of cranes and accessories
 - k. One (1) set of flexible power cable (Half the bay length +25 m) of suitable size as per load calculation for commissioning, testing & operation of EOT Crane till such time the DSL is charged.
 - l. Rail complete with sole plates, anchor bolts, clamps etc. including all accessories and end stopper to be mounted at RCC girder.
 - m. Maintenance tools & Tackles
 - n. Erection & Commissioning spares
 - o. Mandatory Spares
 - p. Main Isolating switch in enclosure at operating floor for incoming power supply from two boards.
 - q. Power cables from two nos. station supply boards (SSB) to the Main Isolating switch / Changeover.
 - r. One (1) no, 10 Tonnes monorail hoist supported below one side of the bridge girder of each power house EOT cranes (Location as per Crane clearance diagram) complete with electric controls, hoists, brakes, safety devices, fittings and connections and all necessary accessories.
 - s. One (1) set of equaliser beam, fittings, connections, electric controls and other accessories required when the cranes are operating in tandem.
 - t. One (1) set of fabricated steel stand for support of equaliser beams when beam are not in use.
 - u. One (1) set of cradle along with sling for load testing of cranes
- B) One (1) number 50/10TT Double Girder EOT Crane for **Transformer cum GIS** hall shall include but not be limited to the following: -
- a. Bridge girders
 - b. End carriages with wheels
 - c. Crab (trolley)



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANES**

SPECIFICATION No: PE-TS-542-501-A201

SECTION I

REV. 00

MAR 2026

- d. Cross Travel & Long Travel drive arrangement
- e. Operator's Cabin.
- f. All electrical equipment including cables, junction box, VVVF drive, pendent, RRC, panels etc.
- g. PVC insulated shrouded bus bar Cu conductor type DSL along with insert plates (fixing plates for DSL) to be mounted at RCC girder.
- h. Earthing arrangement
- i. Fill of lubricant till commissioning of crane
- j. Painting of cranes and accessories
- k. One (1) no. flexible power cable (Half the bay length +25 m) of suitable size as per load calculation for commissioning, testing & operation of EOT Crane till such time the DSL is charged.
- l. Rail complete with sole plates, anchor bolts, clamps etc. including all accessories and end stopper to be mounted at RCC girder.
- m. Maintenance tools & Tackles
- n. Erection & Commissioning spares
- o. Mandatory Spares
- p. Main Isolating switch in enclosure at operating floor for incoming power supply from two boards.
- q. Power cables from two nos. station supply boards (SSB) to the Main Isolating switch / Changeover.

1.1.4 Makes of Sub- Vendor Items

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

1.1.5 Maintenance Tools and Tackles

As per Annexure III, section-IA of this specification

1.1.6 Mandatory Spares

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-IA of this specification.

1.1.7 Painting & Colour Scheme

PAINTING shall be as per "Customer's specification" Volume: I-A, Clause no.- 1.9.3, Painting

1.1.8 Erection and Commissioning spares

The Bidder shall also supply erection & commissioning spares along with his main equipment 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 supply all equipment complete with initial fill of fluids, grease or lubricants, in drums / containers. Bidder shall supply minimum following spares

- i) Oil seal for each gear box 1 Set
- ii) Indicating Lamps 1 no. of each type 1 Set
- iii) Push Button 1 no. of each type 1 Set
- iv) Aux. contactor 1 no. of each size 1 Set
- v) Limit switches- 1 no. of each type 1 Set
- vi) Any other spare/s, as per experience of bidder 1 Set

Note:



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANES**

SPECIFICATION No: PE-TS-542-501-A201

SECTION I

REV. 00

MAR 2026

- a. Any spare, not quoted by bidder, but required during commissioning shall be supplied by bidder without any additional cost.
- b. One set means 100% requirement of one crane.
- 1.1.9 Any supplies to be done under warranty clause & any other clause of NIT, **GCC**, **SCC** as relevant to the package
- 1.1.10 Packing as per Annexure VI, forwarding and transportation to delivery address as per SCC.
- 1.2.0 **Services to be provided by the bidder**
- 1.2.1 Packing, forwarding, transportation and unloading at site.
- 1.2.2 Development of storage space including ward & watch of the equipment and handling at site.
- 1.2.3 **Unloading, storage and handling at site.**

The Bidder shall provide means for all unloading and reloading for all consignments of plant; both during transport to Site and on the Site. Consignments shall be unloaded immediately on arrival at Site. The Bidder is required to take the necessary steps in order to provide the carriage, special supporting structures for heavy loads, etc. The following parts shall be stored inside enclosed warehouses:

Bolts, pins, packing, tools, insulation materials, electrical parts with electrical devices attached, electric motors and excitation equipment, instruments, welding material and equipment, all small parts and all parts of the crane which already have been finally painted. If large parts are stored in the open air, they shall be provided with weather resistant and fire & resistant covers. Electrical parts, which are not packed in heavy duty polyethylene foil and those so packed, but whose packing has been damaged shall be kept in suitable places from the moment of storage to the moment of installation. All insulation materials which will be taken from the warehouse for installation and which are stored temporarily in the station shall be protected from weather or humidity. All the equipment shall be stored as per standard storage and preservation instructions etc. of the suppliers.
- 1.2.4 **Arranging test load at site**

Arrangement of test load at site shall be under bidder's scope of work. Test load shall be in the form of rolled steel, plates, girder, angle, concrete blocks, water balloons, sand bags etc suitable for the cradle and slings.

Load blocks for load testing of cranes at site shall be provided by PS- region approximate within 20kms from power house/ GIS hall (as per land availability) and handling of loads shall be under scope of crane supplier (including loading/unloading/transportation).

Cradle & Slings for Load Testing and its loading/unloading/transportation is under EOT Vendor Scope.
- 1.2.5 Erection and Commissioning of EOT cranes and all accessories.
- 1.2.6 Demonstration / Load test at bidder's Works and at Site.

Obtaining clearance and acceptance certificate from the concerned competent Authority after site test and as and when required as per Government Norms /Statutory body till the time of final handling over to Customer. Necessary fees/expenditure as required shall be borne by the supplier.
- 1.2.7 Training to Customer's Operation & Maintenance staff (as applicable).
- 1.2.8 Any service mentioned in GCC & SCC as relevant to the package.
- 1.2.9 Anchor bolt, insert plates to be supplied to site three (3) months from the date of LOA/ 15 days from the site intimation, whichever is earlier.
- 1.3.0 **Exclusions**

Supply feeder.
Space for storage & storage.
Civil work. However bidder shall coordinate with Civil agency during casting of gantry girder for proper alignment of anchor bolts , insert plates, sole plate etc to their satisfaction for further erection of rail and DSL.



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANES**

SPECIFICATION No: PE-TS-542-501-A201

SECTION I

REV. 00

MAR 2026

RCC Gantry girder.

Exclusion, if any, mentioned in GCC, SCC.

2.0.0 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-A of this specification.

3.0.0 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 in Sec III 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.

4.0.0 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. Refer clause 23.3.2, Chapter 23: EOT Cranes ED/TS/SDHEP/FEB-2024/R2 (Page 10 of 47) of customer specification.

4.1.0 Testing at Works

Refer section IA: QUALITY ASSURANCE AND INSPECTION REQUIREMENT.

4.2.0 Testing at Site

4.2.1 Completely assembled crane at site shall be check for misalignment of gears, shafts and other items. Following minimum tests shall be conducted on the crane at the site under supervision of bidder’s representative.

- i. Deflection test of bridge girder at rated load.
- ii. Load test and Overload test (running of CT and Hoisting mechanism at 125% of the rated load). Capability of crane to lift the overload 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

Note: The test shall be carried out with actual panels, RRC, Master controller etc.

5.0 Consumables

The Bidder’s scope includes requirements of consumables such as oils, lubricants including grease, servo fluids, gases and essential chemicals etc. till handing over. Consumption of all these consumables till handing over shall also be included in the scope of the Bidder. Bidder shall also supply a quantity of the full charge of each variety of lubricants, servo fluids, gases,



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANES**

SPECIFICATION No: PE-TS-542-501-A201

SECTION I

REV. 00

MAR 2026

chemicals etc. used which is expected to be utilized till handing over. This additional quantity shall be supplied in separate containers.

6.0 HEALTHINESS CHECK SERVICE

The scope of work is mentioned in quarterly and annual schedule. Any other checks as deemed necessary to ensure healthiness of the crane shall be performed. Detailed report along with repair, replacement of parts as required shall be submitted to BHEL after each visit, for further maintenance work by BHEL.

S. NO	EQUIPMENT/ITEM	SCOPE OF WORK	SCHEDULE
1.	Bridge and Trolley wheel assembly	Checking for wear, flat spots and cracks in flange. Ensure drive wheels are of the same diameter.	Quarterly
2.	Runway rail	Checking alignment and elevation of rail track. Check rail clamp, bolts, blocks etc.	Quarterly
3.	Machine Bolts	Checking all foundation bolts of Electrical and Mechanical equipment for tightness.	Quarterly
4.	Structural Bolts	Checking for tightness. They should also be checked after the first month of operation.	Quarterly
5.	Flexible Couplings	Checking pins and teeth for wear, cleaning and greasing	Quarterly
6.	Cross-shaft Plummer Blocks	Checking oil seals for cleaning.	Quarterly
7.	Trolley Collectors	Checking of cable trolleys / cabling / chain for connection of trolley wheels through entire length of span.	Quarterly
8.	Brakes	All Brake assembly will be checked for loose connection, earthing connection, linings for wear, leakages and adjustments to ensure brake is not rubbing the brake drum during operation. Checking for greasing pins and operation adjustment of brakes	Quarterly
9.	Resistor Connections	Checking, tightening connections at grid joints and at cable terminations.	Quarterly
10.	Radio remote controller, Master controller, Pendant	Checking of all connection at push buttons, master controllers contact tips, cams and terminals & functional checks.	Quarterly
11.	Panels	All Panels will be checked for loose connection and contactor contacts, components including VVFD's, DBR healthiness.	Quarterly
12.	Electrical Motors	All motion motors connection will be checked for loose contacts in terminal box loose crimping of wire lugs, loose contacts on slip ring assembly with carbon brush. Earthing connection with motor.	Quarterly
13.	Safety Switches	All limit switches will be checked for desired operation and limits. Emergency switches will be checked.	Quarterly
14.	Main Current collectors, LT DSL	Checking of worn collector shoes, sag in main runway wiring, ensuring contact is kept through entire	Quarterly



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANES**

SPECIFICATION No: PE-TS-542-501-A201

SECTION I

REV. 00

MAR 2026

		length runway properly.	
15.	Electrical connections	Checking throughout electrical equipment for loose connection such as selector switches, junction boxes, min isolator switch etc.	Quarterly
16.	Lubrication	All gear box and thrusters' oil level will be checked. All bearings, couplings' grease will be checked.	Quarterly
17.	Operational check of crane	Trolley will be checked for idle operation, for brake operation, limit switch operation & safety switch operation. All motor currents will be checked on no load. Check for abnormal sound /jerk during operation.	Quarterly
18.	Gear Boxes	Oil seals will be checked for replacement. Gear and pinion teeth will be checked. Grease/ Oil check.	Annually
19.	Motor	All motors' insulation test and meagre test will be carried out.	Annually
REQUIREMENTS FOR HANDING OVER OF CRANES			
1	Handing over of crane/s to End Customer, in smooth and working condition (after closing all punch points), signing of protocols for hand over shall be in bidder's scope. This shall be carried out within the Guarantee period for which bidder shall be informed.		
2	Any item/s, manpower & services required for closure of punch point and hand over shall be in bidder's scope. For item/s refer sl no 3 below.		
3	Unused Operation & Maintenance spares, as available, during closure of punch point to facilitate handing over of cranes shall be issued by BHEL to the bidder. However, bidder at their own discretion may also envisage suitable spares or additional quantity that may be required to facilitate handing over. For list of Operation & Maintenance spares being purchased from bidder by BHEL, as per below list.		

S. NO.	DESCRIPTION (OPERATION AND MAINTENANCE SPARES)	QUANTITY FOR 2 NOS. 175T CRANES	QUANTITY FOR 1 NO. 50T CRANE	UOM
1.	Gear Oil in sealed packets/containers.	40	20	litres
2.	Grease in sealed packets/containers.	40	20	kg
3.	Brake Oil in sealed packets/containers.	240	120	litres
4.	Cardium compounds in sealed packets/containers.	60	30	kg
5.	Brake shoes	2	1	Set
6.	Brake liners	2	1	Set
7.	Brake springs	2	1	Set
8.	Oil seal for gear box	2	1	Set
9.	Main & auxilliary contactors of each type and rating	1	1	Set
10.	Overload relays of each rating	1	1	Set
11.	Bearing for motors of each size and rating	2	1	Set
12.	Limit switch of each type and rating	2	1	Set
13.	Push button of each type and rating	1	1	Set
14.	Panel lights, indicating lamps etc	1	1	Set
15.	Main Isolating switch cum Changeover with box and lever	1	1	No.
16.	Fuse of each type and rating	1	1	Set
17.	MCB/MCCB of each type and rating	1	1	Set
18.	Under bridge and over bridge lights of each type and	1	1	Set



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANES**

SPECIFICATION No: PE-TS-542-501-A201

SECTION I

REV. 00

MAR 2026

	rating			
19.	Tags for cables, panels, JB's etc.	1	1	Set
20.	Master Controllers for all motions	1	1	Set
21.	Accessories i.e Rail clamps, alignments blocks, washers, springs, bolts etc. for rail fixing.	For approximately 3% of total rail length		
Note for Operation and maintenance Spares: -				
1.	Operation and maintenance spares shall be supplied in separate box/container clearly marked " O&M spares" with individual Machined Components/Assemblies/Equipment, Electrical & Electronic Components/Assemblies protected as per the packing defined in "Packing Requirement" of this specification.			
2.	Grease, lubricants, oils, compounds etc shall be supplied in such size of packets/containers so that they are opened and utilized in one application/use.			
3.	One (1) Set is defined as 100% requirement for one crane of each type.			
4.	Operation and maintenance spares shall be used for general/breakdown maintenance during operation and also during periodic healthiness check services (to be provided by crane vendor). Unused Operation & Maintenance spares, as available, during closure of punch point to facilitate handing over of cranes shall be issued by BHEL to the bidder. However, bidder at their own discretion may also envisage suitable spares or additional quantity that may be required to facilitate handing over.			



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

**SECTION IA
QUALITY ASSURANCE AND INSPECTION REQUIREMENT**



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

1.1.0. Inspection and Testing

Bidder shall submit Manufacturing Quality Plan (MQP) based on the guidelines given in the specification & MQP enclosed herein. Format shall be as agreed with Customer in line with Customer's specification in section IA of technical specification.

1.1.1. Inspection and testing at Manufacturer's works

Copy of approved documents with stamp and signature (one set) shall be available at the place of Inspection which shall be ensured by supplier.

Shop inspection and tests will include but not limited to the following –

STAGE INSPECTION

Stage inspection of various components of crane shall be guided by the MQP approved during detail engineering. Indicative MQP is attached in the specification. However, following shall be ensured and read in conjunction with relevant clause of MQP w.r.t. stage inspection:

- i. All test certificates shall be in original and legible. Photocopies certified by Mill/ manufacturer of raw material used, are acceptable.
- ii. For tensile testing of hooks/ forgings, samples shall be drawn from the full cross section of the shank diameter of hooks/ forgings Samples forged to reduced cross section for testing purposes is not acceptable. **Hooks shall be manufactured from Blooms, billets, rounds by forging with forging ratio of at least 3:1. Hooks manufactured from plates are not acceptable.**
- iii. Radiographs shall be inspected to a sensitivity of 2%.
- iv. Ultrasonic test on forgings and casting of critical components like cross head (hook suspension block), Hooks, Shafts, Axles, Gears, Wheels, Pulleys etc. Ultrasonic test on forgings shall be carried out as per norms given below. UT shall be carried out in Proof machined condition (single diameter/ Flat surface without steps, keyways, teeth cutting or other profile machining which can create difficulty in ultrasonic testing). Components shall be identified with Heat number and serial number by punching). Hardening operation shall be carried out prior to Ultrasonic testing.

Unacceptable defects in forgings are as given below:

1. Cracks, flakes, seams and laps
2. Defects giving indication larger than '4 (four) mm diameter equivalent flaw' except for wheels for which Defects giving indication larger than '6 (six) mm diameter equivalent flaw.'
3. Group of defects with maximum indication less than that from a 4 mm diameter equivalent flaw which cannot be separated at testing sensitivity if the back echo is reduced by 50% except for wheels for which Group of defects with maximum indication less than that from a 6 mm dia. equivalent flaw which cannot be separated at testing sensitivity if the back echo is reduced by 40%.



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

4. Defects giving indication of 2 to 4 mm dia. equivalent flaw, separated by a distance less than 4 (four) times the size of the larger of the adjacent flaws except for wheels for which Defects giving indication of 3 to 6 mm dia. Equivalent flaw, separated by a distance less than 4 (four) times the size of the larger of the adjacent flaws Ultrasonic test on Castings shall be carried out as per ASTM E 609.
- Wherever, the Quality plan calls for witness of Ultrasonic test by BHEL or BHEL's representative, the material shall be offered for UT in proof machined condition as stated above and hard stamping and subsequent stamp transferring by BHEL shall be followed at subsequent stages to ensure trace ability.
- v. Gear boxes shall be checked at No load for backlash, tooth contact, noise, temperature rise and vibration as per attached Procedure No. PEM (Q)/001.
- vi. Test certificates shall be furnished for verification of Type tests including environmental tests - for electrical and electro-mechanical items. If Type tests for items with similar / identical construction are not available, arrangement shall be made to conduct the same in the presence of BHEL/ Customer's representative (as required).
- vii. Acceptance and routine tests (HV and insulation) for all electrical and electro-mechanical components and system as per governing specification

FINAL INSPECTION OF CRANES- (TESTING OF CRANES AT SUPPLIER'S WORKS)

Cranes shall be completely assembled at manufacturer's works to check the misalignment of gears, shafts and other items. Gears shall be run idle for at least 4 (four) hours. Following minimum tests shall be conducted on the crane at the works of the manufacturer:

- a) Deflection test of bridge girder at rated load. Crane shall rest on centerline of LT wheels.
- b) Load test and Overload test (running of CT and Hoisting mechanism at 125% of the rated load). Capability of crane to lift the overload from mid-air shall be demonstrated.
- c) Electrical tests for brakes, panel, electrical equipment etc. as per IS - 3177
- d) All Other tests as per IS-3177.



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

**Procedure No. PEM (Q)/001
SHOP TEST PROCEDURE FOR GEAR BOX**

1.0.0	Scope: Acceptance Norms for Crane Gear Boxes
1.1.0	<p>This procedure lays down the Acceptance norms for the Gear boxes for EOT crane. This standard also covers vertical gear boxes.</p> <p>Reduction Gears shall be tested for reduction ratio, backlash & contact pattern. Gear Box shall also be subjected to No load run test to check for oil leakage, temp. rise, noise and vibration.</p>
2.0.0	The following dimensions shall be checked:
2.1.0	<ul style="list-style-type: none">i. Diameter and keyway dimensions of input and output shafts.ii. Projection of input and output shafts beyond foundation holes and Centre lines of gear box.iii. Centre distance between input and output shafts.iv. Centre Height.v. Distance between foundation holes with respect to center line of the output shaft and distance of foundation holes from center line of the gearbox.vi. Overall dimensions
3.0.0	Backlash
3.1.0	<p>The back lash shall be checked by dial gauge preferably (refer Figure –1). Lead wire may be also be used but final decision in case of dispute shall be taken by using dial gauge. The backlash shall be within the limits specified in the drawing. If the value of the backlash allowed is not specified in the drawing, the allowed backlash shall be a given in Table-1</p>
4.0.0	Area of Contact:
4.1.0	<p>Area of contact shall be taken by applying Prussian blue. The contact area shall be within the limits mentioned below (refer Figure –2)</p> <p>For final stage of Hoist gearing: h / H shall be more than 30% $(a - c) / b$ shall be more than 40%</p> <p>For all other gears: h / H shall be more than 40% $(a - c) / b$ shall be more than 50%</p>
5.0.0	Running Test
5.1.0	<p>1.1.1 The gear boxes shall be run under no-load condition at the rated speed for minimum four hours in each direction and the following are to be checked:</p> <ul style="list-style-type: none">i. All bolts at the joints remain tightii. All gear mesh lines are getting enough lubrication



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

	<ul style="list-style-type: none">iii. All bearings are getting enough lubricationiv. Bearing temperatures after running for four hours shall not exceed 50 deg. Centigrade or 15 deg. centigrade above ambient whichever is higher. Temperature shall be checked after every hour.v. Vibration : Maximum limit 125 microns (peak to peak)vi. Sound: The gearbox shall not emit unusual sound as obtained under conditions of hard meshing, high spots etc. Maximum sound level shall be 85 dBA at a distance of 1000mm and 91 dBA at a distance of 300 mm.vii. There shall be no Oil leakage at parting lines, bearing housings or inspection covers.
6.0.0	1.1.2 General
6.1.0	<p>1.1.3 In addition to the above specific points, the following general points shall be ensured:</p> <ul style="list-style-type: none">i. Inspection pockets are provided as required.ii. Gear box casings are provided with at least two fit bolts/dowels at the parting line.iii. Dip sticks with minimum / maximum level markings are provided.iv. Drain plugs are provided at convenient locations preferably at vertical wall of the housing.v. Breathers are provided.vi. Lifting lugs or eye bolts are provided as required.vii. Wherever bearings have splash lubrication, oil retainers are provided.viii. Gear boxes are painted as per specification outside and inside. Inside surfaces shall be painted with Oil proof paint.ix. In case of vertical gear boxes having more than two stage reduction, forced lubrication is also provided. <p>1.1.4 Name plate should provide information eg. Ratio, KW rating, Bearing details and manufacturers name.</p>



SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

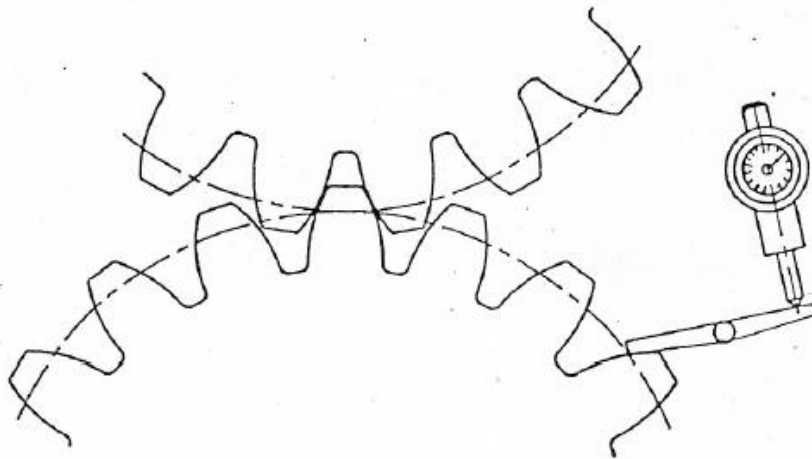


FIG.1 MEASUREMENT OF BACKLASH

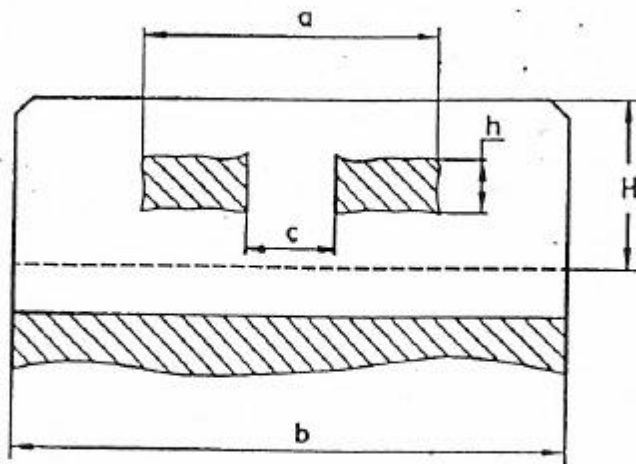


FIG.2 AREA OF CONTACT OF GEAR TEETH



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201


SECTION IA


REV. 00


MAR 2026


**TABLE 1
BACKLASH AND GEARING SPECIFIED BY MODULE
(Clause 3.1.0)**


Centre distance in mm		Tolerances in microns		
Above	Upto	Minimum	Maximum	
			For gears other than Drum gears	For Drum gears
			For all modules 1 to 50	For all modules 2.5 to 50
-	50	85	240	280
50	80	105	320	380
80	120	130	360	420
120	200	170	470	530
200	320	210	540	640
320	500	260	660	740
500	800	340	820	880
800	1250	420	970	1040
1250	2000	530	1200	1280
2000	3150	710	1500	1670
3150	5000	850	1810	1980


 Manufacturing Quality Assurance Test Requirements			
Project Name: Sunni Dam HEP 382 MW (5X73 MW + 1x17 MW)		Doc. No. QAI/SD/M/EM/EOT/02	Rev. No. 02
Item Description: EOT Crane for Power House & Transformer Hall		Issue Date: 29.02.2024	Pages : 03
Sr. No.	Component, Operation & Characteristics	Applicable Standard	Remarks
1	2	3	4
	EOT CRANE		
1	Incoming Material		
1.1	Steel plates (Box Girder, End carriage, Crab Frame, Bed frame, Load frame / cradle, Gear Box Casings).		
	Chemical Analysis & Mechanical Properties	TS/DRG/ REL.STD.	V
	UT of plates	TS/DRG/ REL.STD.	V
	Dimensional Check	TS/ DRG	V
	Material Identification & transfer stamping	TS /Manufacturer standard practice / REL. STD.	V
1.2	Casting/plate or Seamless Pipe for Rope Drum		
	Chemical Analysis & Mechanical Properties	TS/DRG/ REL.STD.	V
	Heat Treatment of Casting	TS/DRG/ REL.STD.	V
	UT and Micro Etching / Flattening	TS/DRG/ REL.STD.	V
	Dimensional Check	TS/ DRG	V
	Material Identification & transfer stamping	TS /Manufacturer standard practice / REL. STD.	V
1.3	Wheels		
	Chemical analysis & Mechanical Properties including hardness	TS/DRG/ Rel. Std.	V
	UT & DPT	TS/DRG/ Rel. Std.	V
	Dimensional Check	TS/DRG/ Rel. Std.	V
	Heat Treatment	TS/DRG/ Rel. Std.	V
1.4	Wire Rope, Slings		
	Identification & Grade	TS/DRG/ Rel. Std.	V
	Dimensional Check	TS/DRG/ Rel. Std.	V
	Check for twist, kinks, proper thimble end connection & splicing	TS/DRG/ Rel. Std.	V
	Braking Strength	TS/DRG/ Rel. Std.	V
1.5	Gears, pinions, shaft, coupling shaft & Axles		
	Chemical Composition & Mechanical Properties including Hardness	TS/ DRG/REL.STD	V
	Dimensional Check	TS/ DRG/REL.STD	V
	UT after proof machining	ASME Sec VIII & V	V
	DP Test on teeth, Bore & Tooth OD	ASME Sec VIII & V	V
	Heat Treatment	TS/ DRG/REL.STD	V
1.6	Bearings		
	Make & type	TS/DRG/ Rel. Std.	V
1.7	Lifting Hook and Block		
	Mechanical Properties on integral test bar Chemical analysis	TS/DRG/ REL.STD.	V
	Heat Treatment	TS/ DRG	V
	UT on raw material of Hook	TS/DRG/ Rel. Std.	V
	Forging operation of Hook	TS/DRG/ REL.STD.	V
	Proof Load Test	TS/DRG/ REL.STD.	W/V
	UT & MPI after proof load test (UT on shank portion only)	TS/DRG/ ASME Sec- VIII & V	W/V
	Material Identification	TS/DRG/ REL.STD.	V
1.8	Rails (CT rail as well as run way rails)		
	Chemical Composition & Mechanical Properties including Hardness	TS/DRG/ Rel. Std.	V
	Dimensional check	TS/DRG/ Rel. Std.	V
1.9	Pulleys, brake drums, coupling & other major steel casting & forging		
	Chemical Composition & Mechanical properties	TS/DRG/ Rel. Std.	V
	Hardness except pulleys	TS/DRG/ Rel. Std.	V
	Final Dimensional Check	TS/DRG/ Rel. Std.	V
	DPT in groove after machining of pulleys	TS/DRG/ Rel. Std.	V
1.10	Master controllers Radio Remote, Pendant Controller, if applicable		
	HV, IR, Functional tests	TS/DRG/ Rel. Std.	V
1.11	Brakes		
	Make, Type, Rating, Dia, Functional test/Routine test.	TS/DRG/ Rel. Std.	V
1.12	Resistance Box if applicable		
	IR Test & HV Test	TS/DRG/ Rel. Std.	V
	Temperature Rise	TS/DRG/ Rel. Std.	V
	Measurement of Resistance	TS/DRG/ Rel. Std.	V
	Verification of IP class	TS/DRG/ Rel. Std.	V
1.13	Power & Control Cables		
	Acceptance Test & Routine Test	TS/DRG/ Rel. Std.	V
1.14	Limit switch		
	HV, IR & Functional Check & Verification of IP class	TS/DRG/ Rel. Std.	V
1.15	Current collector arm, if applicable		
	Verification of make, Type, Rating and Dimensional conformity.	TS/DRG/ Rel. Std.	V

 Manufacturing Quality Assurance Test Requirements			
Project Name: Sunni Dam HEP 382 MW (5X73 MW + 1x17 MW)		Doc. No. QAI/SD/M/EM/EOT/02	Rev. No. 02
Item Description: EOT Crane for Power House & Transformer Hall		Issue Date: 29.02.2024	Pages : 03
Sr. No.	Component, Operation & Characteristics	Applicable Standard	Remarks
1	2	3	4
1.16	DSL guard, if applicable		
	Verification of make, Type, Rating and Dimensional conformity.	TS/DRG/ Rel. Std.	V
1.17	Sockets/Clamps for wire rope		
	Destructive tensile test in which rope shall fail first than the socket or joints	TS/DRG/Rel. Std.	V
1.18	Sole Plates & Clamps		
	Chemical composition and Mechanical Properties.	TS/DRG/Rel. Std.	V
	NDT & Dimensions.	TS/DRG/Rel. Std.	V
1.19	Electric Motors : Make, Rating, Routine Test, IP class, Type Test	TS/DRG/ Rel. Std.	V
1.20	Control Panel		
	Interlocking functional, IR, HV, Shoot thickness, cable laying, dressing, ferulling overall, Dimensions, painting shade, Panel surface finish, Paint thickness, adhesive test, component fixing, Degree of Protection by paper inserting method	TS/DRG/ Rel. Std.	V
1.21	Trailing Cable, Power Control Cable & DSL		
	Make, Type, Railing, Acceptance test, Routine test, insulation resistance values.	TS/DRG/ Rel. Std.	V
1.22	Transformer & VVVF Drives : Make, Rating, Routine Test.	TS/DRG/ Rel. Std.	V
1.23	SFU, MCCB, MCB, Contactors, DSL, Relays, Fuses		
	Make, Type, Rating Size, Functional, Continuity check	TS/DRG/ Rel. Std.	V
1.24	Anti Collision devices, cable gland, Lugs, Rectifier, indicating lamps, terminal blocks, load cell : Make, Type, Rating.	TS/DRG/ Rel. Std.	V
2	In process Inspection		
2.1	Welding		
2.1.1	WPS, PQR & WPQ	ASME Section IX	V
2.1.2	Root Run / Back Chipping	ASME Section VIII	V
2.1.3	Butt weld, if any, in Box Girder, End carriage, Crab Frame, Rope Drum, Gear Box Casing, Load Frames / Cradle		
	DP/MPI test after root run, RT, UT	ASME Section V & VIII/Rel. Std./DRG/TS	V
	DPT & MPI.	ASME Section V & VIII/Rel. Std./DRG/TS	W/V
2.1.4	Fillet Welds in Box Girder, End carriage, Crab Frame, Rope Drum, Gear Casing, Load Frames / Cradle.		
	NDT of all fillet weld joint as per drawing or MPI / DP of all fillet joints if it is not specified in drawing. NDT of inaccessible weld joints in Box Girder (before closing) shall be witnessed by SJVN.	ASME Section V & VIII/Rel. Std./DRG/TS	V
2.1.5	All weld joints: Visual Examination for final weld appearance, cracks, undercut, Excess reinforcement, burn through or excess penetration, root concavity , non-uniform width of fillet weld joint, distortion & misalignment.	ASME Section VIII & V/DRG	W / V
2.1.6	Stress relieving of assemblies /sub-assemblies / item (rope drum, gear box casing & rope drum) after welding as per DRG.	TS/ASME Section V&VIII/ DRG	V
2.1.7	Dimensional check of weld joints/ Weld size (Weld size shall be checked with universal weld gauge).	ASME Section VIII/DRG	W / V
2.1.8	Welding & welder records to be maintained for Box Girder, End carriage, Crab Frame, Rope Drum, Load Frames / Cradle in weld Log book.	Relevant standard ASME/IS/IEC	V
2.2	Machining: Machined Components		
	Visual examination	TS/DRG/ Rel. Std.	V
	Dimensional check	TS/DRG/ Rel. Std.	V
	Surface finish	TS/DRG/ Rel. Std.	V
	Material traceability control	TS/DRG/ Rel. Std.	V
2.3	Box Girder		
	Dimensional check including camber, verticality & bend	TS/ DRG/ Rel. Std.	W/V for girder before closing.
	Material Identification & transfer stamping	TS/DRG/ Rel. Std.	V
2.4	End carriage		
	Dimensional check	TS/DRG/ Rel. Std.	V
2.5	Rope Drum		
	Dimensional check	TS/DRG/ Rel. Std.	V
	DP test after machining	TS/DRG/ Rel. Std.	V
	Visual check for surface defects after machining	TS/DRG/ Rel. Std.	V
	Stress relieving after welding, if applicable	TS/ASME Section V&VIII/ DRG	V
2.6	Gear Box casing		
	Dimensional check	TS/DRG/ Rel. Std.	V
	Stress relieving after welding	TS/ASME Section V&VIII/ DRG	V

Manufacturing Quality Assurance Test Requirements				
	Project Name: Sunni Dam HEP 382 MW (5X73 MW + 1x17 MW)		Doc. No. QAI/SD/M/EM/EOT/02	Rev. No. 02
	Item Description: EOT Crane for Power House & Transformer Hall		Issue Date: 29.02.2024	Pages : 03
Sr. No.	Component, Operation & Characteristics	Applicable Standard	Remarks	
1	2	3	4	
2.7	Platforms, LT Frames, Hand Railings, Crab Assembly			
	Dimensional Check	TS/DRG/ Rel. Std.		V
2.8	Gear Box Assembly and Idle Running			
	Check for Oil Leakage	TS/DRG/ Rel. Std.		V
	Noise Level	TS/DRG/ Rel. Std.		V
	Backlash, Meshing of gear & pinions teeth	TS/DRG/ REL.STD.		V
	Rise in Temperature after 2 hrs of running	TS/DRG/ Rel. Std.		V
2.9	Brakes			
	Check for alignment, tightness and capacity	TS/DRG/ Rel. Std.		V
2.10.	Operator Cabin			
	Dimensional check	TS/DRG/ Rel. Std.		V
2.11	Bridge with LT			
	Dimensions, wheel level alignment	TS/DRG/ Rel. Std.		V
2.12	Crab assembly			
	Dimensions, wheel level alignment.	TS/DRG/ Rel. Std.		V
3	Final Inspection (Crane at Manufacturer's Works)			
	Overall inspection of crane, dimensions, Span, Diagonal Dimensions check, clearances, ratings, hook reaches, Equipment Layout on bridge platform, skewness, cambering of girder. Visual & Dimension check of Load frame / cradle. Visual & dimension check of slings.	TS/DRG/ Rel. Std.		W
	Electrical & Electronic Panels.	TS/DRG/ Rel. Std.		W
	Insulation Test on Electrical Components of Crane.	TS/DRG/ Rel. Std.		W
	No Load tests and load tests as per Technical Specification	TS/DRG/ Rel. Std.		W
	No load Running of Machinery for Direction & Speed, Check of working range.	TS/DRG/ Rel. Std.		W
	No load Test of Hoists, CT, LT, Speed & Current Measurement. Testing of fault panel functions, Test of emergency stop at no load.	TS/DRG/ Rel. Std.		W
	SWL test: Hoisting, Travel operation, Speed, Current & Deflection Measurement.	TS/DRG/ Rel. Std.		W
	Overload Test at 125% of SWL: Check for Hoisting operation only.	TS/DRG/ Rel. Std.		W
	Main & Auxiliary hoist lifting motion with test load of 100% and 125 % of rated load	TS/DRG/ Rel. Std.		W
	Simultaneous Operation of main and auxiliary Hoists.	TS/DRG/ Rel. Std.		W
	Braking Test.	TS/DRG/ Rel. Std.		W
	Functional check for emergency stop, limit switch operation & overload protection.	TS/DRG/ Rel. Std.		W
	Motor speed Check while lowering the rated load (should not exceed 105% of the synchronous speed)	TS/DRG/ Rel. Std.		W
	Oil leakage check in gear box.	TS/DRG/ Rel. Std.		W
	Visual inspection of Hook & accessible weld joints after load test.	TS/DRG/ Rel. Std.		W
	DP test of Hook & accessible weld joints after load test.	TS/DRG/ Rel. Std.		W
	Measurement of throat opening of hook after load test.	TS/DRG/ Rel. Std.		W
	Other tests as per Technical Specification			
	De-energized tests as per TS.	TS/DRG/ Rel. Std.		W
	Energized tests as per TS.	TS/DRG/ Rel. Std.		W
	Functional tests as per TS.	TS/DRG/ Rel. Std.		W
	Deflection tests as per TS.	TS/DRG/ Rel. Std.		W
4	Cleaning, Coating and Painting			
	Surface Preparation.	TS/ DRG		V
	Check for Paint thickness and adhesion test.	TS/ DRG		V
LEGENDS				
TS: TECHNICAL SPECIFICATION		REL. STD.: RELEVANT STANDARD		
W: CUSTOMER HOLD POINT (CHP)		DRG: DRAWING		
V: VERIFICATION OF REPORT/TEST CERTIFICATE				
NOTES				
1	Any test at any stage not covered in Quality Assurance Test Requirement (QATR), but part of technical specification of contract, shall also be carried out by Contractor/ firm without any financial implication on SJVN.			
2	QATR shall be read in conjunction with General Quality Assurance Requirement given as part of Technical Specification			
3	QATR shall be read in conjunction with QATR of Motor Starter Panel.			

 Manufacturing Quality Assurance Test Requirement			
Project Name: Sunni Dam HEP 382 MW (5X73 MW + 1x17 MW)		Doc. No. QAI/SD/M/EM/LB/02	Rev. No. 02
Item Description: Lifting Beam		Issue Date: 29.02.2024	Pages: 01
Sr. No.	Component, Operation & Characteristics	Applicable Standard	Remarks
1	2	3	4
1	In-coming Material for Lifting Beam structure, Lifting Lugs, Guide roller Pin etc.		
1.1	Casting/Forging/Steel Plates/Bars		
	Chemical Analysis, Mechanical Properties.	DRG / REL. STD.	V
	NDT (UT/MPI/DPT).	DRG / REL. STD.	V
	Heat Treatment (As applicable)	DRG / REL. STD.	V
	Material Identification & transfer stamping.	DRG / REL. STD.	V
2	In process Inspection		
2.1	Butt weld, if any (as per drawing)		
	DP/MPI test after root run weld.	DRG / REL. STD.	V
	RT shall be conducted as per approved drawing/Standard	DRG / REL. STD.	V
	UT, DPT & MPI shall be conducted.	DRG / REL. STD.	W/V
2.2	Fillet Welds (as per drawing)		
	NDT of all fillet weld joint as per drawing or MPI / DP of all fillet joints if it is not specified in drawing.	DRG / REL. STD.	V
	Material Traceability Control and transfer stamping (As applicable)	DRG / REL. STD.	V
	Stress relieving after welding, as applicable.	DRG / REL. STD.	V
3	Final Inspection		
3.1	Final assembly of Lifting Beam:		
	Dimensional Check, Visual Examination, Surface Finish, Deflection measurement, Engaging /de-engaging (Latching),Load Test & Over load Test as per relevant Standard and DP test of all accessible weld joints after the Load test.	DRG / REL. STD.	W
3.2	Cleaning, Coating and Painting		
	Surface Preparation, Coating & Painting	DRG / REL. STD.	V
	Adhesion, paint thickness	DRG / REL. STD.	V
LEGENDS			
W: CUSTOMER HOLD POINT (CHP)		DRG: DRAWING	
ER: EMPLOYER REQUIREMENTS.		REL. STD: RELEVANT STANDARD	
V: VERIFICATION OF RECORDS / REPORTS / TCs			
NOTES:			
1	Any test at any stage not covered in Quality Assurance Test Requirement (QATR), but part of employer requirements of contract, shall also be carried out by Contractor / firm without any financial implication on SJVN.		
2	QATR shall be read in conjunction with General Quality Assurance Requirement given as part of employer requirements.		

 Field Quality Assurance Test Requirements			
Project Name: Sunni Dam HEP 382 MW (5X73 MW + 1x17 MW)		Doc. No. QAI/SD/F/EM/EOT/02	Rev. No. 02
Item Description: EOT Crane for Power House & Transformer Hall		Issue Date: 29.02.2024	Pages: 02
Sr. No.	Component, Operation & Characteristics	Applicable Standard	Remarks
1	2	3	4
	EOT CRANE		
1	Receipt of Material		
	External conditions of Equipment free from Damages etc	Packing list/DRG/ Tech Spec.	W
	Number of packages in each Equipment and physical condition of each package	Packing list /DRG /Tech Spec.	W
2	Storage		
	Proper Placement of equipment as per the Instruction Manual.	All parts fully covered	W
	Ensure that no damage or rusting takes place during storage	All parts fully covered	W
	Ensure that all delicate Equipment are stored in protected area.	All parts fully covered	W
3	Pre-erection & erection check		
3.1	Site Welding		
	Joint preparation, edge preparation & root gap	DRG/TS/ASME V & VIII	W
	NDT	DRG/TS/ASME V & VIII	W
	Visual check	DRG/TS/ASME V & VIII	W
3.2	Embedments / Sole Plates		
	Installation/fixing of embedments as per drawing.	DRG/TS/Plant std	W
	Leveling & alignment before & after concreting.	DRG/TS/Plant std	W
3.3	Blockout		
	Check for visual, dimensions & Co-ordinates of block out	DRG/TS/Plant std	W
3.4	Gantry Girder level, diagonal, head room height, side clearance etc.	DRG/TS/Plant std	W
3.5	Rail		
	Centre distance measure at every 6 Mtr. Length.	DRG/TS/Plant std	W
	Measurement of Rail centre distance at every 6 mtr. Length, Diagonal, straightness of each rail.	DRG/TS/Plant std	W
	Verification of expansion gap within rail w.r.t. civil drawing.	DRG/TS/Plant std	W
	Tightening of rail clamps (LT Rail).	DRG/TS/Plant std	W
	Waviness of rail (horizontal and vertical planes).	DRG/TS/Plant std	W
3.6	Erection of end carriage		
	Free movement of wheel over rail.All wheels in contact with L.T.Rail.	DRG/TS/Plant std	W
3.7	Erection of girders & joint with end carriage / Bogie.		
	Matching of fastener holes for joint E/C & Girder for joining bogies with girder.	DRG/TS/Plant std	W
	Check span both drive and idle side.	DRG/TS/Plant std	W
	Check Diagonal Dist. Over L.T. Wheels.	DRG/TS/Plant std	W
3.8	Fixing crab on CT Rail (Girder Rails)		
	Alignment of CT mechanism.	DRG/TS/Plant std	W
	Alignment of MH & AH mechanism.	DRG/TS/Plant std	W
3.9	Rope Waving, Hook Block Fixing.		
	Free movement of hook, Head Room	DRG/TS/Plant std	W
3.10.	Electrification and cabling		
	Check L.T., C.T., Hoist Motions for proper electrical work.	DRG/TS/Plant std	W
3.11	Erection of DSL, if applicable		
	Check for straightness, level, alignment with respect to gantry rails, fixing arrangement, painting.	DRG/TS/Plant std	W
4	Pre-commissioning & commissioning check		
4.1	De-energized test		
	De-energized test shall be carried out as per TS.	TS/Drg./Rel. Std.	W
4.2	No Load Static Test		
	Checking of gears, bearings, couplings and rotating parts for proper oil level or lubrication and hydraulic brakes for brake fluid.	TS/Drg./Rel. Std.	W
	Checking of satisfactory operation and to determine if lamp fixture on each bridge walk way are operable and convenient for re-lamping.	TS/Drg./Rel. Std.	W
	Checking of the controller for each motion to ensure that hook and travel motions is in accordance with marked controller directions.	TS/Drg./Rel. Std.	W
	Overall inspection & verification of crane dimensions, clearances, hook reaches & other important items.	TS/Drg./Rel. Std.	W
	Verification of insulation resistance for electrical equipment and wiring circuits	TS/Drg./Rel. Std.	W
	Operational tests on each controller, switch, contactor, relay and other control devices including limit switches.	TS/Drg./Rel. Std./ Plant Std.	W
	Operational tests on all protective devices.	TS/Drg./Rel. Std./ Plant Std.	W
	Test for checking correctness of all circuits, interlocks, and sequences of operation.	TS/Drg./Rel. Std./ Plant Std.	W
	Check of drift point for smooth and effective operation.	TS/Drg./Rel. Std./ Plant Std.	W
	Tightness of nuts and bolts	TS/Drg./Rel. Std./ Plant Std.	W
	Measurement of throat opening of hook & checking w.r.t dimensions provided by supplier.	TS/Drg./Rel. Std./ Plant Std.	W
	Check all Brake setting.	TS/Drg./Rel. Std./ Plant Std.	W

 Field Quality Assurance Test Requirements			
Project Name: Sunni Dam HEP 382 MW (5X73 MW + 1x17 MW)		Doc. No. QAI/SD/F/EM/EOT/02	Rev. No. 02
Item Description: EOT Crane for Power House & Transformer Hall		Issue Date: 29.02.2024	Pages: 02
Sr. No.	Component, Operation & Characteristics	Applicable Standard	Remarks
1	2	3	4
	Check oil leakage in all gear Boxes.	TS/Drg./Rel. Std./ Plant Std.	W
4.3	No Load operation tests.		
	No Load operation tests shall be carried out as per technical Specification.	TS/Drg./Rel. Std.	W
	Measurement of speed and current for all motions. Emergency stop test (Switch off, emergency off).	TS/Drg./Rel. Std.	W
4.4	Load Test (at rated load).		
	Load test (at SWL) shall be carried out as per Technical Specification.	TS/Drg./Rel. Std.	W
	Measure speed and current for all motions.	TS/Drg./Rel. Std.	W
	Check effectiveness of brake and pad for main and aux. hoist (Braking Test)	TS/Drg./Rel. Std.	W
	Check all components for overheating.	TS/Drg./Rel. Std.	W
	Measurement of deflection at SWL.	TS/Drg./Rel. Std.	W
4.5	Over load Test		
	Over load test shall be carried out as per Technical Specification.	TS/Drg./Rel. Std.	W
	Check bridge structure for excessive deflection at 125% of rated load.	TS/Drg./Rel. Std.	W
	Braking test at overload.	TS/Drg./Rel. Std.	W
	Measurement of throat opening of hook.	TS/Drg./Rel. Std.	W
4.6	Commissioning		
	Check trouble Free running of crane Set right wherever any trouble.	TS/Drg./Rel. Std.	W
4.7	Tandem operation test for power house crane including anti-collision test.		
	Electrical & Mechanical interlock checking.	TS/Drg./Rel. Std.	W
	Movement checking with tandem beam.	TS/Drg./Rel. Std.	W
4.8	Performance test		
	Performance test shall be carried out as per TS.	TS/Drg./Rel. Std.	W
4.9	Load Frames / cradle		
	Tests on load frame / cradle shall be carried out as per TS.	TS/Drg./Rel. Std.	W
4.10.	Paint touch up: Paint applied all over crane parts.	TS/Drg./Rel. Std.	W
LEGENDS			
TS: TECHNICAL SPECIFICATION		REL. STD.: RELEVANT STANDARD	
V: VERIFICATION OF REPORTS/TCs		DRG: DRAWING	
W: CUSTOMER HOLD POINT (CHP)			
NOTES			
1	Any test at any stage not covered in Quality Assurance Test Requirement (QATR), but part of technical specification of contract, shall also be carried out by Contractor/ firm without any financial implication on SJVN.		
2	QATR shall be read in conjunction with General Quality Assurance Requirement given as part of Technical Specification.		



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-507-501-A201

SECTION IA

REV. 00

MAR 2026

**SUB-SECTION IA
CUSTOMER SPECIFICATION
(GENERAL TECHNICAL SPECIFICATION (GTS))**

INDEX

Sr. No.	CONTENTS
1.1	Site Specific Information
1.2	Reports of Studies
1.3	Water Sample Details
1.4	Operating Pattern of Plant
1.5	Intent of Specification
1.6	Codes and Standards
1.7	Project Completion Schedule
1.8	Electrical Works
1.9	Mechanical Works
1.10	Civil Works
1.11	Training of Engineers
1.12	Selection of Sub-Vendor
1.13	Tools and Spares
1.14	Erection, Testing, Commissioning and performance of Guarantee Tests

1.15	Consumables, oils and Lubricant
1.16	Type tests
1.17	Interface Management
1.18	Functional Guarantee Schedule
1.19	Submission of Drawings, Documents, Manual, software, Calculations, Safety Margin Details etc.
1.20	Quality Assurance Requirement for Electro-Mechanical Package
1.21	Safety
1.22	Earthing
1.23	Completeness of the specification
1.24	Packaging and Shipment
1.25	Final Clean Up
1.26	Working Hours
1.27	Draft Tube Profile for 73 MW Unit

1.28 Definition of Lot: #1 (inserted)

SECTION-1

GENERAL TECHNICAL SPECIFICATION

1.0 General

382 MW Sunni Dam Hydro Electric Project (*SDHEP*) is envisaged of Two Power Plants i.e., Main Power Plant ($4 \times 73 = 292$ MW) and Auxiliary Power Plant ($1 \times 73 + 1 \times 17 = 90$ MW) located in Single Underground Power House Cavern. Auxiliary Power Plant shall also be termed as Environmental Flow Plant (*e-Flow Plant*).

The 73 MW Unit of Main Plant and Auxiliary Plant is similar in every aspect. Accordingly, in order to simplify the Nomenclature, following terms shall be used in entire document (*instead of Main Plant unit or/and Auxiliary/e-flow Unit*): -

A) 73 MW Unit

B) 17 MW Unit

The salient feature of project is enclosed in **Annexure-I**.

Main Power Plant is envisaged as Peaking Run-of-River (*PRoR*) scheme with Storage capacity of 7.9 MCM on River Satluj. The Energy generated by Main Power Plant in 90% dependable hydro year is 987.84 MU (**Annexure-II**).

e-flow Plant is envisaged as Run-of -River (*RoR*) scheme corresponding to mandatory release of water as per **Table -1**. The Energy generated by e-flow Plant in 90% dependable hydro year is 393.93MU (**Annexure-III**).

Combined Energy generation from Main Power Plant and e-flow Plant in 90% dependable hydro year is 1381.77 MU.

Sr.No.	Season	e-Flows (Cumecs)	Remarks
1	Monsoon Period (June to Sept)	171.27	30% of average monsoon Flow of 90% dependable Hydro Year
2	Non-Monsoon-Non-Lean Period (Oct-Nov and April-May)	72.38	25% of average NM-NL flow of 90% dependable Hydro Year
3	Lean Period (Dec-March)	21.12	20% of average flow of 90% dependable Hydro Year

1.0.0 Rejection of Bid

Failing to visit of contractor expert Team or/and including Logistic vendor and non-submission of Logistic Survey Report along with bid as per clause 1.1.6 shall lead to rejection of Bid. All cost of



above visits & preparation of report shall be borne by Bidder. SJVN shall provide access to project site & interaction with Engineers.

1.0.1 Bidder to Inform themselves Fully

The bid document has been prepared in good faith and on best endeavor basis. The Bidders shall make independent enquiry and satisfy themselves with respect to all the required information, inputs, conditions and circumstances and factors that may have any effect on his Bid.

Once the Bidders have submitted their Bids, the Bidders shall be deemed to have inspected and examined the site conditions including but not limited to its surroundings, its geological condition and the adequacy of transport facilities to the site, the laws and regulations in force in India, the transportation facilities up to project site, its adequacy and conditions of roads, bridges, railway sidings, ports, etc. for unloading and/or transporting heavy pieces of material and has based its design, equipment size and fixed its price taking into account all such relevant conditions and also the risks, contingencies and other circumstances which may influence or affect the execution of EM Works.

Accordingly, each Bidder acknowledges that, on being selected as Successful Bidder, contractor shall not be relieved from any of its obligations under the Bid Document nor shall the contractor be entitled to any extension in Scheduled COD mentioned in this bid document or financial compensation for any reason whatsoever.

1.1 Site Specific Information

1.1.1 Project Name

- Project Title:.....Sunni Dam HEP
- Owner/ Employer:.....SJVN Ltd.

1.1.2 Location

The project is situated on Satluj River near Khaira Village, in Shimla and Mandi Districts of Himachal Pradesh. On the upstream of the project lies the under construction 210 MW LHEP-I of SJVN Ltd., which utilizes water discharged from the further upstream 412 MW Rampur Hydro Power Station. On the downstream of Sunni Dam Hydroelectric project lies the 800 MW Koldam HPS (*FRL 642 m*). The minimum tail water level of SDHEP is El. 647.5 m.

Latitude31°14'53"N

Longitude77°12'39"E

1.1.3 Climatic Condition

Maximum Ambient Temperature : 40°C

Minimum Ambient Temperature	:	0°C
Max. River Water Temperature	:	15°C
Minimum River Temperature	:	6 °C
Relative Humidity (during monsoons)	:	95% Maximum
	:	16 % (Minimum)
Average Annual Rainfall	:	1424.8 mm per annum
Wind zone	:	4
Thunder storm	:	Refer vulnerability Atlas of India

1.1.4 Seismic Zone

The project area lies in Seismic Zone-V. The site-specific design earthquake parameters are 0.50g (MCE) and 0.28g (DBE) for horizontal and 0.33g (MCE) and 0.19g (DBE) for the vertical ground motions. The horizontal and vertical Seismic Coefficients for project area is 0.24g and 0.16g respectively. The strong motion duration is estimated to be 8 sec and the total duration is 43 sec.

The Contractor shall design all equipment supplied under contract to satisfy above criteria. The equipment and each part of it shall be strong enough and sufficiently well assembled to resist total operating stresses resulting from forces during normal operation, abnormal condition and forces superimposed due to occurrence of earthquakes.

1.1.5 Transportation Route

The project site is located at about 145 km from the nearest railhead at Kalka in Haryana and can be approached by NH-5 followed by SH-13 and MDR-22 via Shimla, Naldhera and Chaba (main route for Major EM equipment). The nearest airport is at Jubbar Hati (Shimla) about 70 km from project site. The nearest international airport is located at Chandigarh at a distance of 170 km from the project site.

There are multiple alternative routes upto Project site through which minor EM equipments can be transported during emergencies/ exigencies. The illustrative routes are as below:

1. Shimla- Narkanda- Sainj- Luhri- Ogli- Khaira
2. Sunder Nagar- Tattapani- Sunni- Khaira
3. Shimla- Naldehra- Basantpur- Jalog- Ogli-Khaira

1.1.6 Transportation Limitation

It is mandatory for all prospective bidders to perform the Logistic Survey of Main route for transportation by expert team or/ and including logistic vendor based on the dimensions of EM equipments (*planned/Design by Bidder*) between Shimla to Khaira (*Project site*). It has been assumed that no constraints upto Shimla is foresighted as the transportation of EM equipments of upstream projects is transported without any difficulties. Bidder shall submit Logistic Survey Report along with Bid as per **Attachment -20**.

Logistic Survey of route NH-5 (Shimla) – SH-13 (*Dhali, Shimla to Sunni*) and MDR -22 (*Sunni to Khaira/project site*) is to be made on “as-is-where-is basis” and accordingly, designed EM equipment by segmentation/sectionalisation, orientation of shipment etc. Bidder shall submit the comprehensive list of ODC/ OWC based on their design considering segmentation in **Attachment – 21**.

Logistic route survey carried out by EM prospective bidder before NIT shall be deemed eligible and need not to submit **Attachment-20**. M/s Voith Hydro, M/s Andritz Hydro and M/s BHEL has performed the Logistic route survey and are enclosed in **Annexure- IV**.

1.1.6.1 Employer’s Responsibility

~~Widening of road/ Civil works related to transportation of EM equipment from Shimla-Dhali-Naldehra-Sunni-Chaba-Khaira shall be in Employer’s scope based on Equipment dimensions of ODC listed in Bid document.~~

Transportation limiting road dimensions are as below:-

Length (m) x Width (m) x Height (m)- 10x5x5*

* Height is taken from road level.

Bridge/Culvert Capacity – 40 R

1.1.6.2 Bidder’s Responsibility

~~Minor work (illustrative lists are: permit/ liaison with Administration/ handling of Electric & telecom poles, civil works like filling, temporary arrangement on bridge/ culvert etc.) for transportation of EM equipments along the route shall be in Bidders’ responsibility.~~

1.1.7 Other Logistics

The Contractor shall make his arrangement and establish all essential facilities such as site office, storage (enclosed & stockyard), communication system, internet facilities, contractor’s camp etc. for smooth and effective execution and monitoring of EM works at site at his own cost. In this regard, please refer **clause no. 1.0.1** and ITB provisions.

1.2 Reports of Studies

When plant is in operation (*Main Plant or/and e-Flow Plant*), mandatory e-flow signal shall be provided to MoEF &CC through the flow meters of machines. It is a direct method of measurement of flow.

The instrumentation for e-flow measurement is cover in respective chapter of Turbine and Control & Monitoring System Chapters.

1.4.3.2 Plant Shut Down Scenario

When plant is in shutdown (*Force outage or otherwise*), mandatory e-flow shall be routed through Dam spillways (*Upper-Level Spillway or Lower-Level Spillway or combination*).

The e-flow signal shall be derived from Level Sensors, Geometry of Spillways, Parameters of Spillways etc. The necessary program shall be developed in Dam LCB and tested during commissioning. It is an indirect method of measurement of flow.

The instrumentation for e-flow measurement is cover in respective chapter of Turbine and Control & Monitoring System Chapters.

1.4.4 Reservoir Sedimentation and Flushing

Reservoir sedimentation and Flushing study have been carried out on physical model study. The Reservoir shall act as desilting chamber.

The report is enclosed in *Annexure-VII*. The underwater component including cooling water system etc. shall be designed accordingly taking into the report's analysis/observations.

During operation of project, this report shall be taken as guide book/reference documents for planning/optimizing the generation from project site.

1.5. Intent of Specification

- 1.5.1** This specification is intended to cover the provision of labour, tools, plants, materials and performance of work necessary for the design, engineering, manufacture, quality assurance, quality control, shop assembly, shop testing, packaging & delivery at site including insurance, unloading, site storage and preservation, in plant transportation at site, erection / installation, testing, supervision, pre commissioning, successful commissioning, performance and acceptance testing, handing over to Employer and warranting trouble free operation as per the specifications/GCC/SCC of various components for Sunni Dam Hydro power project having six units (6) {73 MW (05 Nos) & 17 MW Unit (01 No)} consisting of generator & its auxiliaries, Francis turbine & its auxiliaries, Station Auxiliaries and accessories and as specified herein.

- 1.5.1.1** Scope of the work shall cover following activities and services in respect of all the equipment but not limited to following and works specified in various sections of this specification:

- i) Basic engineering of all equipment and equipment systems;

- ii) Detailed design of all the equipment and equipment system(s)
 - iii) Providing engineering drawings, data, instruction manuals, as built drawings and other information for purchaser's review / approval / records.
 - iv) Compliance with statutory requirements and obtaining clearances from statutory authorities, wherever required.
 - v) All corresponding parts of similar equipment of the generating units and other plant equipment shall be interchangeable with one another. The Bidders shall confirm the same in their Bids.
 - vi) The Bidder shall make his offer in consonance with the specified requirements. In case the bidder wishes to deviate from specifications in certain respects without affecting the basic functional requirements or stipulations he shall submit a complete and itemized list of such **deviations / departures** together with full particulars of the reasons for the departures, in schedule - VII enclosed for every section. The deviations shall be considered valid only in case the same have been accepted by the purchaser formally.
- In the absence of such acceptance, the plant offered shall be deemed to comply in every respect with these specifications.
- vii) The Purchaser or the Contractor may propose change in the specification of the equipment or quality thereof and if the parties agree upon any such changes the specification shall be modified accordingly.
 - viii) Complete manufacturing, quality assurance, quality control, shop assembly including shop testing.
 - ix) Packaging and transportation from the manufacturer's works to the site including Insurance, minor works during transportation of EM equipment as per GTS clause 1.1.6.2.
 - x) Receipt, movement to proper storage, storage, preservation and conservation of Equipment at the site, movement from storage area to interim/ final foundation location.
 - xi) Fabrication, pre-assembly, if any, erection / installation, testing, pre-commissioning and successful commissioning and putting into satisfactory operation all the equipment including successful completion of initial operation.
 - xii) Performance & acceptance testing after successful completion of initial operation.
 - xiii) Warranting trouble free operation as per the specifications/GCC/SCC

- xiv) Supply of mandatory spares as per schedule – III of each section ~~and furnishing list of recommended spares in schedule – IV of each section.~~
- xv) Supply of any other equipment including special tools and tackles, commissioning spares and services required for satisfactory completion of the project and operation and maintenance of the same.
- xvi) Training of purchaser’s personnel nominated by the purchaser during erection, testing and commissioning, and for operation and maintenance.
- xvii) Reconciliation with customs authorities, in case of imported equipments;
- xviii) Satisfactory conclusion of the contract.
- xix) All items and equipment though not specifically mentioned in the specification, but needed to complete the system to meet the intent of the specification shall be deemed to be included in the scope of the bidder.

It is not the intent to completely specify all details of design and construction, but only to lay down broad sizing and quality criteria for the major equipment and systems and it is expected that the equipments shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation up to the contractor’s guarantee in a specified manner acceptable to the purchaser.

Bidder has full freedom to add value in design & engineering consistent with Intent of Specification and Good Industry Practice.

Following sections / chapters have been considered in the E&M Works for the Project:-

Section No.	Description
Volume-I	
1.	General Technical Specification EOT Cranes & Lifting Devices
2A.	Turbine and Associated Auxiliaries
2B.	Hard Coating of Underwater components

25.	Ventilation & Air Conditioning System
26.	Elevators
27.	DG Sets
28.	Security and Surveillance System
29.	PA & Communication System
Volume-II	
30.	Tender Drawings
Volume-III	
31.	Schedules to be filled by bidder
Volume-IV	
32.	QAP/QATR

Note: - Technical specifications i.e. GTS, PTS, Schedules, QATRs and Tender drawings are intended to be correlative, complementary & mutually explanatory. These documents are required to be read as a whole. No interpretation of data, parameter or information to be made in an isolated manner.

1.5.1.2 Good Industry Practice

Successful Bidder shall have obligation to ensure Good Industry Practice during project execution at all times, more specifically when specific scope/provision is not mentioned but necessary for the satisfactory completion of scope of work. **It is therefore expected from bidder to study & examine whole bid document carefully and shall inform constraints/limitations/exclusions etc. during pre-bid stage to employer.**

“Good industry practice” means the exercise of that degree of skill, diligence, prudence and foresight that reasonably would be expected from the designer of Hydro Project facilities in accordance with best practice, methods and standards that are generally accepted internationally for hydro project facilities under condition comparable to those applicable to this project, consist with Laws, Regulation, codes etc. and taking into account factors such as (A) the use of appropriate hydro technology (B) Relative size, performance, age and technology of physical component (C) Safe, efficient and economic design, construction, commissioning, operation and maintenance of hydro project (D) Technical standards

1.6 Codes and Standards

Preference for latest IS standards for particular equipment / system shall be governed over ISO/IEC/ IEEE standards.

The design, manufacture and testing of the various equipment covered under this specification shall comply with the requirements of the latest edition of the relevant IEC/IS/IEEE/ISO standards at the time of signing of contract. ~~Preference for latest IEC standards for particular equipment / system shall be governed over IEEE/ IS/ ISO standards.~~

#1

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

Further rules, guide lines and standard laid down by International/ national agencies shall be applicable in this specification.

List of standards is attached at **Annexure-B (Illustrative only)**. Bidder to include/propose relevant Standards for design, manufactured and testing of EM equipment/component during detailed engineering consistent with **Intent of Specification**

1.6.1 System of Units

- (i) The SI system of Units has been used throughout these specifications and this system of units shall be used consequently throughout the duration of contract for all technical or contractual purposes.
- (ii) Following abbreviations/symbols shall be used in these specifications and other related contract documents.

Derived Quantity	Name	Symbols
Length	millimeter	mm
	centimeter	cm
	meter	m
	kilometer	km
Area	square millimeter	mm ²
	square centimeter	cm ²
	square meter	m ²
Volume	cubic meter	m ³
Mass	kilogram	kg
	Tonne/Ton	t
	Metric ton	MT
Density	ton per cubic meter	t/m ³

Stress	Newton per square millimeter	N/mm ²
	Kilo-Newton per square millimeter	kN/mm ²
Pressure	bar	bar
	Pascal	Pa
	Mega-Pascal	MPa
Time	Second	s
	Hour	hr
Rate of Flow	liters per second or minute	l/s, l/min
	Cubic meter per second	m ³ /s
	Cubic meter per minute	m ³ /min
Velocity	meter per second	m/s
Speed of rotation	revolution per minute	rpm
Temperature	degree Celsius	°C
Energy	Kilowatt hour	kWh
Slope	Vertical: horizontal	v:h
	Lump Sum	LS

1.6.2 Expenses for Witnessing of Testing, Training, Meeting etc.

It is expressly understood that employer shall bear all expenses for his engineers deputed for Training, Testing (*Type or/and Routine*), Model Testing and Meeting etc. in respect of Travelling (*to & fro from Head office/project office*), Boarding & lodging in India or Abroad.

1.7 Project Completion Schedule

Time for completion		
Sr. No	Activity	Duration in months from the effective date of Contract.

1.8.1.1 AC power

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

1.8.1.2 DC power

~~DC Systems, ungrounded, with earth fault detection 220V plus (+) 10% and minus (-) 20% for the supply of main control circuits for high and medium voltage switchgear, protection circuits and to other larger essentials loads.~~

~~Other voltage systems eventually needed, shall be from the above systems by means of dc/dc converters, inverters etc.~~

1.8.2 IP requirement

IP requirement shall be based on applicable National/ international standards and the same shall be finalized during detail engineering. However, the minimum requirement shall be as under or as specified in the particular technical specifications of various components:

- The cubicles and enclosures shall be of protection class IP 42 or higher according to their location.
- For outside installation and area which are humid, corrosive, and prone to dripping and/ or spray of water, the protection class of cubicles shall be IP 65.
- Cubicles housing electronic cards/modules such as of unit control boards/local control boards, digital governors, static excitation equipments shall be of protection class of IP 52.

*Wherever specific parameter is mentioned in different section, those clauses shall prevail.

1.8.3 Cabling & wiring

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

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

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

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

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

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

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

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

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

1.8.4 Power outlets

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

1.8.5 Terminal blocks

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

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

1.8.6 Protection requirement

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

1.8.7 Switches, Lamps & Instruments

General

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

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

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

Instruments and controls shall be located so that their dials, indicators and nameplates are clearly readable. Data for all instruments to be provided, including type, size, scale range, electrical ratings, nameplate and name of manufacturer, shall be furnished. Steel panels shall be provided for group mounting of the instruments. All instruments shall be of an approved type and shall match, insofar as practicable, the other instruments with which they are associated; their dial type, scaled markings and units, type of connection and mounting, shall be co-coordinated. All piping and tubing required for instruments shall be furnished and installed.

All instruments and control switches shall be furnished with necessary auxiliaries, i.e. resistors, shunts etc.

Control and Selector switches

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

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

Switches with shrouding of live parts and sealing of contacts against dust ingress

shall be provided.

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

Ammeter and voltmeter selector switches shall have four stay out position with adequate number of contacts for three phase 4 wire system. These shall have oval handles. Ammeter selector switches shall have make before break type contacts to prevent open circuiting of CT secondaries. Contacts of the switches shall be spring assisted and shall be of suitable material to give a long trouble-free service.

Push buttons

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

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

All push buttons shall be provided with integral escutcheon plates marked with its function.

The colour of the button shall be as follows:

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

Indicating and signaling lamps.

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

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

Lamps shall be provided with series resistors, preferably built-in the lamps assembly. The lamps shall have escutcheon plates marked with its function, wherever necessary.

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

by the application.

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

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

HRC Fuses

HRC-Fuses shall have visible operation indicators.

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

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

Indicating instruments and Meters

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

The instruments shall accurately measure and indicate the quantity under all conditions of operation with minimum instrument errors. Changes in ambient temperature within the range prevailing at site shall not affect the accuracy

Contact making instruments shall have contacts suitable for 240 V AC or 220 V DC circuits.

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

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

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

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

Integrating instruments

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

drawings.

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

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

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

Measuring converters

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

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

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

Accuracy class of the transducers shall be 0.5 or better.

Measuring transformers

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

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

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

All VTs shall have readily accessible HRC current limiting fuses on both primary and

secondary sides. The class of insulation should be E or better.

The parameter & rating of CTs & PTs are minimum requirement & tentative only. Contractor shall submit the calculations for selection of CT/PT for approval to purchaser.

Potential transformer secondary windings shall be rated $110 / \sqrt{3} V$

Current transformer secondary windings shall have a rated current of $1A / 5A$.

1.8.8 Nameplates and Labels

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

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

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

1.8.9 Motors

All electric motors for driving various equipments shall conform to relevant standards viz. IEC, BS or IS as applicable.

The motor rating, torque characteristics, speed etc. shall be selected to suit the duty requirements.

Type of starter shall be as per the system requirement and to be proposed by contractor during detailed engineering as per the Good Industry practices subjected to employers' approval. However, voltage drop during starting and steady state shall be less than 15% and 5% respectively.

~~The starter panel shall be placed in Field near to EM equipment/Component/System. The placement of Starter Module in SSB/UAB/SSSB/BSB etc. (if any) shall be subject to the approval of employer during detailed engineering.~~

The enclosure of each motor shall be of the type best suited for the service conditions of the motor.

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

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

Space heaters to avoid condensation shall also be provided.

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

1.8.10 Construction power

Arrangement/ availability of construction power on Chargeable basis if available and if construction power is not available, crane vendor to do their own arrangement regarding construction power) for Contractor's use for main works and their infrastructural facilities by PS- region.

1.8.11 Temporary Power and Lighting

~~The work relating to all temporary lighting and power facilities required for the installation work shall be carried out by the contractor under this contract and shall be included by the bidders in their offer. These temporary installations shall include cables, outlets, and conduits, supports, insulators, fuses, switches and other required materials.~~

~~The materials used for temporary facilities shall not be reused in any permanent installation. The work regarding removal of all temporary facilities from the plant premises, after the same have served the purpose, is also covered under the scope of these specifications.~~

1.8.12 Space heaters

Space heater shall be provided in the Distribution Boards, Control & Protection panels, Motor Control panels etc. The space heaters shall be suitable for continuous operation on

240V AC, 50 HZ single phase supply, and shall be automatically controlled by thermostats. Necessary isolating switches and fuses shall also be provided.

1.8.13 Auxiliary relay, contacts and devices

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

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

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

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

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

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

1.9. Mechanical Works

1.9.1 Materials selection

Materials shall be new and of high-grade quality, suitable for the purpose, free from defects and imperfections, and of the classifications and grade listed herein (**illustrative only**), or their equivalents subject to acceptance by the Owner.

Bidder shall submit/propose the material in consistent with **Intent of Specification** subject to the approval of employer during detailed engineering. Where specific material is listed in respective section shall always prevail over GTS provision

hereunder.

Material specifications, including grade or class shall be shown on the appropriate Contractor's detail drawings submitted for review. Materials not listed herein but equivalent in their basic properties may be used subject to the Owner's review of their acceptability.

S. No.	Material	Specification
1	Carbon-steel castings	DIN-1681, Steel castings for general use: quality specifications, grade GS-45 / GS-60 ASTM A27 Grade 65-35 GS-45/ GS-60/IS-1030/ASTM A216 Grade WCC,G 20 Mn5 as per DIN EN10293
2	Iron castings	DIN-1691, Gray iron castings for general use: quality specifications, grade GG-22 and GG-26.
3	Corrosion-resistant steel castings	DIN-17445, Stainless quality specifications type G-X 8 Cr Ni 13 (1.4008) and G-X 6 Cr Ni 18 9 (1.4308), For runners EN Grade:X4 CrNiMo 16-5-1 (Number 1.4418), EN Grade GX4 CrNiMo 16-5-1 (Number 1.4405) , ASTM A743 CA6Nm
4	Corrosion-resistant steel plate, bars, pipes	DIN-17440, Stainless steel: quality specifications: X 2 Cr Ni Mo 1810(1.4404) X2 Cr Ni Ti 1810 (1.4541) X10 Cr Ni Mo Ti 1810(1.4571) X22 Cr Ni 17 (1. 4057) DIN 2462 Seamless stainless steel pipes.
5	Hardened corrosion resistant steel	DIN-17440, Stainless steel: quality specifications X 10 Cr 13 (1.4006) hardened condition.
6	Carbon steel forging (turbine/ generator shaft,	DIN-17200, Quenched and tempered steels, Ck 35/Ck 45 ASTM A 668 Grade D.

	important parts)	
7	Carbon steel forging (pipe flanges, fittings etc.)	DIN-17100, Steels for general structural purposes: quality specifications grade RSt 37-2 / St 52-3.
8	Carbon steel plates (for low-stressed parts and piping)	DIN-17100, Steels for general structural purposes: quality specifications, grade St 37-2 (1.0116). ASTM A 283 Grade B., IS 2062, S235,S355 DIN EN 10025

9	Carbon steel plates (for important stress carrying parts)	DIN-17100, Steels for general structural purposes: quality specifications, grade ST52-3 (1.0841), normalized. ASTM A 287 Grade B., IS 2062, S235,S355 DIN EN 10025
10	Intermediate and high strength steels (for important stress carrying parts and structures under hydraulic pressure)	DIN-17102, weldable fine grain steels, normalized, grades TTStE. ASTM 514.
11	Bronze casting	DIN-1705, Bronze castings: quality specifications.
12	Bronze (for bolting)	DIN-17672, Rod, bar of wrought copper and copper alloys: mech. Properties non-leaded copper-zinc alloys with min. U.T.S of 370 N/mm ²
13	Copper Tube	DIN-1754, Tube of copper: seamless drawn, material type SFCu F30 according to DIN-17671.
14	Steel pipes	DIN-2448, Seamless steel tubes: dimensions and weights. DIN-2458, Welded steel tubes

		dimensions and weights. ASTM A53, API 5L , ASTM A 106
15	Steel pipe flanges and flanged fittings	Applicable DIN-standards for weld neck and slip-on flanges.
16	Bolts and fasteners	DIN-13, ISO metric screw threads from 1 to 300 mm diameter: selection for diameters and pitches. DIN-267, Fasteners and similar parts: technical specifications complete. Other applicable DIN standards.

All materials or parts used in the equipment shall be tested in conformity with the standards specified herein or other applicable standards approved by the Owner.

Certified Material Test Report for the materials of major/important components and/or materials for special application shall be furnished to the Owner as soon as possible after the tests are performed. Each test certificate shall identify the components for which the materials are used and shall contain all information necessary to verify compliance with the Contract Documents.

1.9.2 Welding & NDT

Where specific provision is listed in respective section shall always prevail over GTS provision hereunder.

1.9.2.1 Preparation of base material

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

1.9.2.2 WPS & WPQR

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

be submitted to the purchaser for review and record.

1.9.2.3 Welded construction and stress relieving

Weld-fabricated pressure-containing parts shall be designed, fabricated, stress relieved inspected and tested, unless otherwise specified, in accordance with ASME-VIII.

1.9.2.4 Non-Destructive Testing

Examination of Welds

Combination of NDT techniques i.e RT, UT, MPI, DPT shall be used to ensure the soundness of the weldments depending upon the requirement and geometry of the welds in accordance with the provisions of the ASME. The acceptance criteria for various NDT, NDT personnel shall be as per ASME-V/VIII/IX.

The Contractor's Drawings shall indicate the type and extent of non-destructive examination as it applies to each component or weld. Distinct notations shall be used on the drawings to differentiate shop and site welding.

Examination of Casting

All cast material including Turbine Runner etc. shall be given complete non-destructive examination including radiographic examination of the most critical areas. The Contractor shall submit Quality Sheets (Specification for inspection of steel casting for hydraulic machines), with his recommendation and specify special precautions to be taken of the casting of the turbine runner and other important casting components. The Quality Sheets submitted shall define the area and extent of the various non-destructive examinations to be performed on castings. The examination of castings shall be in accordance with the provisions of CCH-70.

Examination of Forging

Shafts, stems and coupling bolts made of forgings shall be given complete ultrasonic examination and other applicable non-destructive test, to determine that they are sound. Non-destructive examination of other forgings shall be in accordance with accepted good practice to assure their soundness. The structure of forgings shall be homogeneous and free from excessive non-metallic inclusions. An excessive concentration of impurities or separation of alloying elements at critical points in a forging will be a cause for its rejection.

1.9.2.5 Field welding

Filler material required for field-welded joints shall be furnished by the Contractor. The Contractor shall perform all welding work at site in accordance with the applicable WPS.

Only qualified welders shall be used for undertaking welding as per the applicable WPS. NDT shall be performed as per the approved drawings.

Preparation for field welding

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

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

1.9.3 Painting

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

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

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

Where specific provision is listed in respective section shall always prevail over GTS provision hereunder.

1.9.4 Galvanization

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

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

Where specific provision is listed in respective section shall always prevail over GTS provision hereunder.

1.9.5 Pumps

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

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

~~Where specific provision is listed in respective section shall always prevail over GTS provision hereunder.~~

1.9.6 Embedded parts, Anchor Bolts and Fasteners

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

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

Where specific provision is listed in respective section shall always prevail over GTS provision hereunder.

1.9.7 Pipes, valves, Bends, Flanges

Civil foundations for equipment of the generating units in Power House & Transformer Hall, Pot Head Yard, TRT, Dam and Intake, FF/CWS tanks area etc. and other plant & equipment (Trench for cables, hume pipes for road crossing, CW and FF tanks etc.) will be prepared/ provided by the Employer in accordance with the basic design data to be supplied by the Contractor.

However, the Contractor shall provide design data for foundations and install the inserts/embedment; support steels and/or components for foundation /supports purpose, shall perform minor civil work such as any chipping / leveling works, denting / painting etc. This shall be applicable to all section.

Civil fronts to EM equipment installation shall be provided free from hindrances/ restrictions as far as practicable. **All aspects related to access to Civil fronts for EM equipments is in Employer scope.**

1.11 Training of Engineers

The scope of work shall also include the training of engineers at the works of respective suppliers for the equipment / system specified herein:

- Turbine and Governor
- Generator and excitation system
- GIS
- Control & Protection System
- EOT Crane

Details of the training program are as under: -

Sr. No.	Equipment / System	Duration	No. of engineers
1.	Turbine	2 weeks	6
2	Governor	2 weeks	4
3	Generator	2 weeks	6
4	Excitation System	2 weeks	4
5	GIS	2 weeks	6
6	Control System	2 weeks	4
7	Protection System	2 weeks	4

8	EOT Crane*	2 weeks	6
---	------------	---------	---

* Contractor shall devise the training module for technicians for operation of EOT cranes during construction at site.

1.12 Selection of Sub-Vendor for Bought out items (BoI) and Bought out Services (BoS)

1.12.1 Sub-Vendor approval of BoI or/and BoS

• Pre-award Stage

~~The Bidders shall clearly and unambiguously identify and name the proposed sub-Vendors/sub-contractor at respective attachment of bid document for procurement of all major BoI or/and BoS including castings, forgings, semi-finished and finished components/equipments.~~

~~The list of proposed sub-vendors/sub-contractors shall be based on the Bidder Organisation's approved vendor selection/assessment policy. For this, a certificate shall be required to be submitted with the bid by the prospective bidder.~~

~~All prospective bidders being professional EPC contractors are expected to propose the comprehensive list in the respective attachment of bid document.~~

~~The proposed list of L-1 Bidder appended in respective attachment shall be jointly examined/evaluated (by Employer and L-1 Bidder), agreed and signed during pre-award meeting.~~

~~The jointly agreed and signed list of selected vendors is considered deemed approved and shall be the part of contract agreement.~~

• Post-award stage

~~During post award engineering, contractor shall have right to introduce any new sub-vendor {in addition to already approved vendors under clause 1.12.1(a)}. Introduction of new vendor at this stage shall be restricted to major BoI or/and BoS.~~

~~Contractor shall propose the Qualifying Requirement (QR) similar to main contract to Electrical Design of Employer and shall be finalized mutually.~~

17.	Illumination & Electrical Installation
18.	Elevators
19.	Submersible pumps for Drainage & Dewatering, flood dewatering system
20.	Pumps for cooling water System
21.	LP Compressed Air System
22.	Castings/Forgings for Runner and other Turbine Underwater components.
23.	PA Communication, Security & Surveillance
24.	Fabricators / Machinist
25.	Erection Agency
26.	Erection for Balance of Plant (BOP) items such as EOT Crane, Ventilation system, Fire Fighting System, PA & Communication and Security Surveillance System etc.

Remarks:

~~For the purpose of sub vendor selection, the EPC performed by sub-vendor for equipment/component/system/services as a whole shall only be considered as BoI or/and BoS. However, the contractor shall not be relieved from any contractual obligations as stipulated in the contract document.~~

~~During the performance of the contract, the employer shall have the Right to include any additional BoI or/and BoS to the above list. Any other BoI or/and BoS or their component/equipment's/system/services shall stands deemed approved.~~

1.13 Tools and Spares**1.13.1 Tools for Erection, Testing and Commissioning**

Contractor shall bring his own tools, devices, testing instruments/ equipment's to site in order to erect, install and commissioned the complete equipment delivered under this section.

These shall remain the property of the Contractor unless otherwise agreed to take over any / all of these at mutually agreed condition

1.13.2 Tools, Tackles and Instruments for O&M Purpose only.

These instruments shall be supplied as detailed under:

1.13.2.1 Tools for Annual Maintenance (Recommended)

Tools for Annual Maintenance (Capital maintenance in nature) of various components shall be listed by the contractor and shall be indicated in Schedule – VIII in the offer, wherever required to supply under different sections. However, finalization of these tools shall be done during detailed engineering in consultation with the suppliers in accordance with system requirement.

1.13.2.2 Tools for Mechanical workshop/Electrical Lab items

~~Tools for mechanical workshop/Electrical Lab items shall be supplied by the contractor as specified in Schedule – V.~~

1.13.3 Mandatory Spares

The bidder shall include and quote for mandatory spares in their bids listing items, their particulars, makes, unit rates, total prices, etc. List of mandatory spares identified is given at Schedule III of all sections. The bidders shall review this list and recommend any modification, additions and deletions with reason thereof. The spare parts shall be interchangeable with and shall be of the same or higher quality than the original component.

These spares shall be delivered on or before commissioning of first unit as listed in the time schedule of the contract.

Th tools/tackles/spares which are not covered in all relevant sections of technical specification shall be procured by Project Site, separately during O&M Stage, based on the system requirement.

1.13.4 Recommended Spares

~~In addition to the mandatory spare parts, the Contractor shall also provide a list of recommended spares for five (5) years of normal operation of the plant and indicate the list and total prices in relevant schedule. The list shall take into consideration the mandatory spares specified and should be independent of the list of the mandatory spares. The purchaser reserves the right to buy any or all of the recommended spares within warranty period.~~

~~Prices of recommended spares will not be used for evaluation of the bids. The price of these spares will remain valid upto execution of the contract. However, the Contractor shall be liable to provide necessary justification for the quoted prices for these spares as desired by the purchaser, if required.~~

1.14 Erection, Testing, Commissioning and performance of Guarantee Tests

1.14.1 Testing and inspection

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

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

The Bidders shall furnish schedule of the shop tests and inspections on materials and equipment.

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

Equipment on which tests and inspections have been duly witnessed and approved by the Purchaser may be dispatched by the Contractor.

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

Pressure Tests

~~Unless specifically mentioned otherwise in the Contract Documents, equipment, vessels and tanks under internal pressure during service shall be subject to hydrostatic pressure testing. The test pressure shall be 1.5 times the maximum design pressure of the respective equipment, vessel or tank.~~

~~The test pressure shall be applied for appropriate duration according to standards without showing leaks or drop in pressure.~~

Dimensional Checks and Visual Inspection

Dimensional checks shall be performed on all major parts, components and partial assemblies, especially when close tolerances and fits are involved (tolerance of shafts,

between stationary and moving parts, connecting dimensions for the assembly with other supplies, etc.). If the dimensional checks show discrepancies in measurement, which may affect the fit, assembly or dismantling of the respective part or component, the same have to be corrected correspondingly. Such correction or modification shall, however, in no way lead to sacrifices with respect to reliability of operation or inter-changeability, and shall be performed only after the agreement of the Owner has been obtained. If the correction or modification cannot be carried out in accordance with the terms mentioned above, the part or component concerned may be subject to rejection. Faulty machine parts or equipment shall by no means be delivered.

Functional Tests

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

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

1.14.2 Erection, commissioning & field tests

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

The Contractor shall submit the necessary data/information, layout and foundation/support drawings well in advance.

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

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

1.14.3 Installation procedure

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

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

1.14.4 Cable laying

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

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

1.14.5 Field inspection

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

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

1.14.6 Field tests

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

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

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

Any defects or leaks disclosed in the tests shall be duly mended/ repaired to meet the desired function and retested

All necessary materials and labour for performing all the above tests shall be provided by the Contractor.

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

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

1.14.7 Taking over of facilities

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

1.14.8 Operation acceptance

The operational acceptance by the Employer of the Facilities (or any part of the Facilities where the Contract provides for acceptance of the Facilities in parts), which certifies the Contractor’s fulfillment of the Contract in respect of Functional Guarantees of the Facilities (or the relevant part thereof) in accordance with the provisions of GCC / SCC.

1.15. Consumables, oils and Lubricant

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

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

Supply

The Contractor shall furnish the following:

- (i) Oil/Grease required for initial filling of all of the equipment. 10% additional of 01 unit of 73 MW.

- (ii) Gases for initial filling of all equipment supplied. 10 % additional quantity of 01 unit of 73 MW
- (iii) Flushing fluids to flush and clean all systems.

1.16. Type tests:

Type tests have been divided into following two categories:

(a) Category-I

The contractor shall carry out type tests listed under Category -I for the respective equipment. The charges for each of these type tests shall be indicated separately in the respective price schedules and the same shall be considered for the evaluation of the bids. The Type Testing Procedure document shall be prepared by Contractor and Approved by employer (Design Team) before six months of testing. Type Testing without approved procedure shall not be carried out and treated as null and void.

The structure of Type Testing procedure documents shall be prepared by Contractor and approved by Employer (Design Team) within six months of LoA.

(b) Category-II

The contractor shall only submit the certificates from Govt. approved labs/ accredited laboratories or in-house laboratories witnessed by third party preferably CPSU of the type tests listed under Category -II for the respective equipment which should have been carried out within last ten (10) years from the date of L2 Schedule or bid opening whichever is later. These reports should be for the tests conducted on the equipment similar (i.e. as per IEC / equivalent standards or Good Industry Practice) to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory (NABL approved or equivalent)/In-House witnessed by third party.

In case the contractor is not able to submit report of the type test(s) conducted within last ten (10) years or as per CEA guidelines from the date of L2 schedule or bid opening whichever is later, or in case the type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct the test without any financial implication to purchaser.

1.16A. Routine tests:

All Equipment/Component/System/Sub-system etc. of EM works shall be subjected to routine test as per requirement of specification/Standards/MQAP/FQAP.

The Routine Testing Procedure document shall be prepared by Contractor and Approved by employer (Quality Team) before six months of testing. Routine Testing without approved procedure shall not be carried out and treated as null and void.

Routine testing procedure document shall be of two type i.e. Testing on Equipment/component/system at Factory (MQAP) and Testing on Equipment/component/system at Project Site (FQAP)

The structure of Routine Testing procedure documents shall be prepared by Contractor and approved by Employer (Quality Team) within six months of LoA.

1.16B. Test on Similar Equipment:

Contractor shall be required to submit the Type Test report in Category -II for the equipment/component/system/sub-system of EM works as per specification. Type test report on similar equipment means as describe in IEC/Equivalent Standard or Good Industry Practice.

The “Similar Equipment” Procedure document shall be prepared by Contractor and Approved by employer (Design Team) before placement PO for BoI (Bought-out-items) or before engineering of In-house manufactured item. Acceptance of Type Test report on similar equipment without approved procedure shall not be carried out and treated as null and void.

The structure of Similar equipment procedure documents shall be prepared by Contractor and approved by Employer (Design Team) within six months of LoA.

1.17. Interface Management

The Bidder shall ensure the functional and physical compatibility of supply at each physical interface among various Sub-Vendor/ Manufacturers/ Vendors / other third-party interface such as Civil, Hydro Mechanical, Associated Transmission System (ATS) contractor etc. in order to ensure efficient, reliable and safe operation of the whole system/ Scheme.

- List of critical Interfaces (Illustrative only):
 1. Reference Survey Points/Setting Points (C/L, Elevation etc.) with Civil
 2. Turbine shaft & Generator shaft
 3. Bus Duct & Generator Phase Terminals
 4. Bus Duct & Generator Transformer
 5. GT & GIS

6. ACSR conductor to PHY Equipment
7. Spiral Inlet to Penstock (HM Works) Pot Head Yard Gantry to incoming/outgoing towers
8. Normalisation of transmission line connection with ATS Contractor for PHY-1 & PHY-2.
9. FODP/SDH with CMS & Protection
10. Employer Requirement of (Civil + HM) Contract attached as *Annexure-X*. (This annexure includes the inputs requirement for the EM Contractor for Civil and HM works.

The Contractor shall ensure co-ordination among various sub-vendor, to verify the continuity and the coherence between themselves. The Contractor shall also resolve all interfacing requirements among various sub-bidders for execution of the work as per scope of contract. Engineer-in-Charge shall provide necessary help for such co-ordinations with different sub-bidders (if chosen by Owner including penstock contractor).

The contractor shall provide compliance certification of interface management at design / engineering level of the concerned interface unit while submitting drawing / document of above interface activities.

The contractor shall provide compliance certification of interface management during erection, testing and commissioning stage of concerned interface to EIC or his authorized representative.

1.18. Functional Guarantee Schedule

The bidder has to provide the functional guaranteed value for the following equipments as per *Annexure - A* of GTS:-

1. Turbine
2. Generator
3. Generator Transformer

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

All drawings and documents shall be submitted to purchaser in hard form as well as in editable soft form (Word, Excel, Autocad, Revit, BIM etc.). Bidder shall submit Ten (5) number hard copies of the documents & drawings to purchaser for record after approval / review. However, during approval / review stage, two (2) number hard copies along with editable soft copy shall be submitted

1.19.1 Design memorandum

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

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

~~Protection co-ordination diagrams~~

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

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

~~Emergency shutdown diagram~~

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

~~Flow Charts~~

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

1.19.5 Manuals

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

Sr. No.	Manual Description	Time Schedule
1.	Storage and preservation manual	Before start of dispatch
2.	Safety manual	Before start of DT Erection of 1 st unit
3.	Erection Manual	Before start of DT Erection of 1 st unit
4.	Testing and commissioning manual	Before start of Testing & Commissioning of 1 st unit

5.	Operation manual	Before Commissioning of 1 st unit
6.	Maintenance manual	After commissioning of all units
7.	Long term storage manual for Generator Transformer	After commissioning of all units [#]
8.	Long term storage manual for boxed up component / equipment.	After commissioning of all units
9.	Repair process / procedure manual for equipment / system	After commissioning of all units
# In case of Long storage during transit or Project site, same shall be provided immediately and implemented for preservation.		

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

1.19.6 Drawing & Document Submission Schedule

Drawings & documents submission schedule of the EM package & tentative submission date shall be submitted to purchaser for approval within six (6) months from the date of Letter of award of contract. The list of drawings in the proposed schedule shall not be limited to the drawings/documents/ manual etc. covered under clause 1.19, the list as per **Annexure – C** of this section & the list covered under head “Drawings, Documents & Design Calculation” of each section.

Preliminary list of drawings have been prepared and appended at **Annexure – C**.

Categorization (approval/information/reference) including deletion/addition/modification of drawing list of **Annexure-C** shall be made by mutual consent between Contractor and Employer within six (6) months from LoA.

The categorization of drawing and their usage/application (iro of Inspection/NCR etc) during currency of contract shall be expressly brought out by Contractor consistent with the provision of contract document or Good Industry Practice and approved by Employer within six months of LoA.

In the event of conflict iro of categorization/addition/deletion, usage/application etc, the decision of Employer shall be final and binding to contractor.

1.19.7 3-D Drawing & Document

The layout drawing (*Plan, Section, Cable/piping/HVAC duct/CW&FF Piping etc. including their interfacing*) of Project shall compulsorily be developed on 3-D CAD model in addition to 2-D working drawings. The 2-D drawings shall be reviewed/updated periodically in the interval of six month initially and quarterly in Last Year of currency of the Contract.

Contractor shall submit 3-D drawings for Layout and major components in soft form.

1.19.8 Engineering Document Management (EDM) Software

Contractor shall develop robust yet simple software for document management (Design & Engineering) for submission, archiving/historian during the project execution.

The software shall mapped all drawing list with submission scheduling as per L-2 Schedule section wise/chapter wise compulsorily. It shall present various reports such as first submission pending, approval/acceptance pending, engineering progress etc. Report shall be exportable in pdf, excel etc.

Access shall be password protected. Contractor and Employer shall mutually agree upon the structure of EDM software within six months of LoA. In case of conflict, Employer's decision shall be final and binding.

At the end of project, As built drawing, document, calculation etc shall be handed over to employer in PDF. The Pdf document shall be indexed and hyper link based for each section wise/category wise.

1.19.8.1 Default on Development of EDM Software

Contractor shall develop and demonstrate the EDM software satisfaction to the Employer within Six (06) Month of LoA.

In the event of default i.e. Contractor is unable to develop and demonstrate the EDM software within stipulated timeline as above, employer shall develop and maintain the EDM software on the Risk & Cost of Contractor.

1.20 Quality Assurance Requirement for Electro-Mechanical Package

Refer QATR Document (Volume-IV)

1.21 Safety

1.21.1 Safety of personnel

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

1.21.2 Safety of operation

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

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

- plant control level,
- unit control level,
- functional control level, functional drive group level,
- Local drive level.

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

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

1.22 Earthing

1.22.1. Earthing in Power House Area, PHY-1 & PHY-2 and Dam Area

Employer shall be responsible for laying for Earthing Grid/Mat including provision of Risers in all floors, Yard of Power House area (Power House, PHY-1 & PHY-2 and TRT), Dam area, FF & CW tanks etc.

Contractor shall design and provide Two (02) no Earthing terminals for each equipment (whose earthing is compulsory as per regulation, technical requirement or/and safety requirement) of these specifications.

Contractor shall be responsible for connecting all EM equipment under this package of earthing terminals to Risers of Earthing Grid/Mat.

One (1) Lot of GI earth strip or GI wire or combination thereof various sizes as per requirement for earthing of electrical equipment (motors, panels, marshalling box, junction box, cable trays etc.) to main riser is in the scope of contractor.

SJVN is carrying out the Earthing design of the Project from M/s CPRI, Bengaluru and its report shall be shared with the successful contractor in due course of time.

1.23 Completeness of the specification

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

The completeness of specification shall be determined as per Good Industry Practice define in this specification.

1.24 Packaging and Shipment

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

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

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

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

1.25 Final Clean Up

- (i) Upon the completion of works, or any part of facilities has completed its functions, the contractor shall dismantle and demobilize all temporary facilities and remove all refuse, debris, objectionable material, and dress all areas in a clean and proper condition acceptable to the EIC or his authorized representative. All such areas, as far as possible, shall conform to the natural appearance of the landscape.
- (ii) No demobilization or removal of temporary facilities and equipment shall be made without the prior approval of the EIC or his authorized representative.

Annexure-B

List of Standards

S. No.		Standard name
a)	Turbine & auxiliaries	
i.	IEC 60193 storage pumps and pump turbines.	Hydraulic turbines, storage pumps and pump turbines - Model acceptance tests.
ii.	IEC 60609	Cavitation pitting evaluation in hydraulic turbines,
iii.	IEC 60041	Field acceptance tests to determine the hydraulic performance of hydraulic turbines, storage pumps and pump- turbines
iv.	IEC 60545	Guide for commissioning, operation and maintenance of hydraulic turbines.
b)	Governor	
i.	IEC 61362	Guide to specification of hydraulic turbine control systems
ii.	2 IEC 60308	International code for testing of speed governing systems for hydraulic turbines
iii.	3. IEEE 125	IEEE recommended practice for preparation of equipment specifications for speed-governing of hydraulic turbines intended to drive electric generators
c)	Generator	
i.	4722	Rotating electrical machine- specification
ii.	60034	Rotating electrical machine
d)	Static excitation system	
i.	IEC 60034-16	Excitation system for synchronous machine
ii.	IEEE 421-1 to 5	Excitation system
e)	Busduct	
i.	IS:8084-1976	Specifications for interconnecting bus bars for AC voltage above 1 KV and up to and including 36 KV.
ii.	ANSI C 37.20 (Std.27)	Standard of switchgear assembly including metal enclosed bus.

iii.	ANSI C 37.23-1987 (Std.298)	Calculating losses in IPB.
iv.	IS 3070-Part-III/IEC99-4	Lightning arrester. Metal oxide without gap.
v.	IS:3156/IEC 186	- Voltage transformers.
vi.	IS:2705/IEC 185	- Current transformers.
vii.	IS:226	- Structural Steel (Standard Quality).
viii.	IS:72	Galvanizing of steel structure.
ix.	IS:13947	Degree of Protection provided by enclosures for low voltage and control gears
x.	IEC 61869	Instrument Transformers.
xi.	IEC 60909	Short circuit current in 3 phase AC System.
xii.	IEC 60865	Short circuit current-calculation & effects.
xiii.	IS:5082	Wrought aluminum and alloy bars, rods, tubes and sections for electrical purposes.
xiv.	IS:2099	Bushing for alternating Voltage above 1000 V.
xv.	IS:11171	Earthing Transformer.
xvi.	IS:728	Methods for determining coating on galvanised articles.
xvii.	IS: 9921 (Part 1 to V)-1981	A.C. disconnectors(Isolators)and earthing switches for voltage above 1000V.
xviii.	IS: 9431	Porcelain Insulator.
xix.	IS: 11548 IEC: 129	Shunt capacitor for power system. A.C disconnectors& earthing switches
f)	Valves	
	N.A	
g)	Generator transformer	

i.	Power Transformer	IEC-60076
ii.	Fittings and accessories for power transformers	IS:3639 & IS: 554
iii.	Transformer bushings	IS:2099 & 3347/IEC-60137
iv.	Dimensions for porcelain transformer bushings	IS:3347
v.	Transformer oil	IEC-60296
vi.	Gas and oil operated relay	IS:3637
vii.	Heat exchangers	IS:6088
viii.	Motors	IS:325 and 996/IEC-34
ix.	Motor starters	IS:1822
x.	Oil pumps	IS:5120
xi.	Current transformers	IS:2705/IEC-61869-1&2
h)	GIS	
	<p>IEC 694 Common clauses for HV switchgear</p> <p>IEC 517 HV metal-enclosed switchgear above 72.5 kV</p> <p>IEC 56 Parts 1 to 6-AC High voltage circuit breakers</p> <p>IEC 129 AC disconnectors and earthing switches</p> <p>IEC 267 Guide to testing of circuit breakers</p> <p>IEC 185/186 Current and voltage transformers</p> <p>IEC Rec.376 SF6 Gas</p> <p>IEC Publ. Sec. 187, 192 earthquake 50A</p> <p>IEC 99-1 IEC TC 37 WG 4(194) IEC 9.4 Surge arrester</p> <p>IEC 137 Outdoor bushing</p> <p>IEC 270 Partial discharge measurement</p> <p>IEC 506 Switching impulse test on HV insulators.</p> <p>IEC 1128 – Alternating current disconnectors bus transfer current switching by disconnectors.</p> <p>17 c (Sec) 121, 17 c (Central Office) IEC 1259 Requirement for switching of bus charging current by disconnectors.</p> <p>IEC 1129 – AC earthing switches induced current switching.</p> <p>IEC-1259 Requirement for switching of bus charging current by disconnectors.</p> <p>IEC-1639 Direct connection between power transformers & SF6 GIS Current Transformers.</p> <p>IS -3156 Voltage Transformers</p> <p>IEC 480 – guide to the checking of SF6 taken for electrical equipments.</p> <p>IEC 427 – Synthetic testing of high voltage A.C. circuit breaker.</p> <p>IS 2705 – Protective Current Transformers for special (Part-IV) purpose application.</p> <p>NSI/IEEE – Guide for safety in A.C. sub-station (Std. 80-1986) grounding.</p>	

	IEC – 71 Insulation coordination.	
i)	Pothead yard	
i.	IEC 99-4	Metal Oxide Lighting arrestor without gap for AC System.
ii.	IEC-353	Line Traps.
iii.	IEC-358	Coupling capacitor & capacitor divider.
iv.	IS-3156	Capacitor voltage transformer.
v.	IS-5561	Electric power connectors.
vi.	IS-335	Insulating oil for transformers & switchgear.
vii.	IS-5621	Hollow insulation for use in electrical installation.
viii.	IS-1364 (Part I to V)	Hexagon head bolts, screw and nuts for product grade A & B.
ix.	IS-2633	Methods for testing uniformity of coating in Zn-coated articles.
x.	IS-802	Code of practice for use of structural steel for over head transmission tower.
xi.	IS-2629	Recommended practice for hot dip galvanising of iron & steel.
xii.	IS-2062	Specification for structural steel standard quality.
xiii.	IS-808	Specification for rolled steel beam, channel & angle section.
xiv.	IS-2016	Specification for plain washers.
xv.	IS-1367	Specification for hot dip galvanizing coating of fasteners.
xvi.	IS-7215	Specification for tolerances for fabrication of steel structures.
xvii.	IS-209	Specification for zinc.
xviii.	IS-6639	Specification for hexagon bolts & other fasteners.
xix.	IS-1573	Specification for galvanizing washers.
xx.	IS-2486	Specification for insulator fittings for overhead power lines.
xxi.	IS-731	Specification for porcelain insulator for overhead power line.
xxii.	IS-2099	Specification for bushings for A.C Voltage above 1000 V.
xxiii.	IEC-68	Environmental testing
xxiv.	IEC-129	AC Disconnectors and Earthing Switches
xxv.	IEC-137	Insulated bushings for alternating voltage above 1000V
xxvi.	IEC-185	Current Transformers
xxvii.	IEC-270	High voltage test techniques partial discharge
xxviii.	IEC-506	Switching Impulse Test on HV insulators
xxix.	IEC-1128	AC Disconnectors for line charging current switching
xxx.	IEC-1129	AC Earthing Switches induced current switching
xxxi.	IS-1364	Hexagon Head bolts, screw and Nuts for product Grade A and B (Part 1 to V)
xxxii.	IS-2705	Current Transformers

j)	Unit control system		
i.	IEC 60255	Electrical relays	
ii.	IEC 61850	Communication protocols for intelligent electronic devices	
iii.	IEC 60297	Dimension of mechanical structure of 19 inch series	
iv.	IEC 60326	Printed Boards	
v.	IEC 60446	Basic and safety principles for man-machine interface, marking and identification, identification of conductors by colours or numerals	
vi.	IEC 60478	Stabilized power supplies, DC output	
vii.	IEC 60625	Interface system for programmable measuring instruments	
viii.	IEC 61000	Electromagnetic compatibility for industrial process – measurement and control equipment	
ix.	IEC 61131	Programmable controllers	
x.	IEC 61158	Digital data communications for measurement and control – Field bus for use in industrial control systems	
xi.	ISO/IEC 8802	Information technology	
xii.	IEEE 1046	Application guide for distributed digital control and monitoring for power stations	
xiii.	IEC 60870-5	Tele-control equipment and systems	
xiv.	IEC 60793 Part 1	Optical Fibre- Measurement and test procedures	
xv.	IEC 60793 Part 2	Optical Fibre- Product specifications	
k)	Unit protection system		
i.	IEC 50(16)	International Electro Technical Vocabulary	
ii.	IEC -68-1	Environmental Testing	Part I
	(General & Guidance)		
iii.	IEC-255-1-00	Electrical Relays -All or nothing Electrical Relays	
iv.	IEC -255	Electrical Relays	
v.	Part 3	Single Input Energising Quantity Measuring Relays with Dependent or Independent Time	
vi.	Part 5	Insulation Tests	
vii.	Part 6	Measuring Relays with more than one Input Energising Quantity	
viii.	Part 7	Test and Measurement Procedures for Electromechanical all or nothing Relays	
ix.	Part 8	Thermal Electrical Relays	
x.	Part 10	Application of the IEC Quality Assessment System for Electronic Components for all or nothing Relays	
xi.	Part 11	Interruption to and Alternating Component (Ripple) in DC Auxiliary Energising Quantity of Measuring Relays	
xii.	Part 12	Directional Relays and Power Relays with Two Input Energising Quantities	
xiii.	Part 13	Biased (%) Differential Relays	

xiv.	Part 16 Impedance Measuring Relays
xv.	Part 21 Vibration, shock, Bump & Seismic Tests on Measuring Relays & Protection Equipment
xvi.	Part 22 Electrical Disturbance Tests for Measuring Relays & Protection Equipment IEC -255 Electrical Relays - Part 23 Contract Performance
xvii.	IEC -337 Control Switches & Low Voltage Switching Devices for Control & Auxiliary Circuits
xviii.	IEC 529/ DIN 40050 Degree of Protection provided by Enclosures (IP Code)
xix.	IEC 617/BS 3950 Electrical Protective Systems for A.C. Plant
xx.	BS: 4227 (Part-I) Relay Terminology
xxi.	BS 142 Electrical Protection Relays
xxii.	ASA C 5013 Electrical Relays
xxiii.	IS: 1885 Electro Technical Vocabulary
xxiv.	Part-IX Electrical Relays
xxv.	Part-X Electric Power System Protection
xxvi.	Part-XVIII Switch gear and Control Protection
xxvii.	IS: 3231 Specification for Electrical Relays for Power System Protection
xxviii.	IS: 3842 Application Guide for Electrical Relays for AC System
	Part-I Over Current Relays for Feeders and Transformers
	Part-IV Thermal Relays
	Part-V Distance Protection Relays
	Part- VI Power Relays
	Part- VII Frequency Relays
	Part-VIII Voltage Relays
	IS: 8686 Specification for Static Protective Relays
	IS: 12083 Special Requirements for Protection Relays
	IS:8686 Static Protective Relays
	IS:8686 Static Protective Relays
	IEC:255 Electric Relays
	(Part 1 to 19)
	IS:3231 - Electric relays for power system protection
	IS:2208 - HRC fuses
	IS:3842 - Applicable guide for electrical relays for A.C.
	(Part 1 to 10) system
	IS:1248 - Direct acting electrical indicating instruments
	IS:2419 - Dimensions for panel mounted indicating recording instruments
	IS:5834 - Electric Timer relays

	IS:722	- A.C. Electricity meters
D)	LV & MV Cables	
i.	IS-694	PVC insulated cables for working voltages up to and including 1100V.
ii.	IS-1554 (Part-I)	PVC insulated (heavy duty) electric cables for working voltages up to and including 1100V.
iii.	IS-1554 (Part-II)	PVC insulated (heavy duty) electric cables for working voltages from 3.3kV up to and including 11kV.
iv.	IS-3961	Recommended current ratings for cables
v.	IS-8130	Conductors for insulated electric cables and flexible cords.
vi.	IS-5831	PVC insulation and sheath of electric cables.
vii.	IS-6380	Specification of Elastomeric Insulation & Sheath of Electric Cables.
viii.	IS-7098 (Part-I & II)	Cross linked polyethylene insulated PVC sheathed cables for working voltages up to 33kV.
ix.	IS-3975	Mild steel wires, strips and tapes for armouring cables.
x.	IS-1753	Aluminium conductors for insulated cables.
xi.	IS-10418	Drums for electric cables
xii.	IS-10810 (Part 0 to 63)	Methods of test for cables
xiii.	IS-6474	Polyethylene insulation and sheath of electric cables.
xiv.	IS-5819	Recommended short circuit ratings of high voltage PVC cables.
xv.	IEC-60502	Power Cables with extruded insulation & their accessories for rated voltages 1kV to 30 kV
xvi.	IEC-540 & 540A	Test methods for insulation and sheaths of electric cables and cord.
xvii.	IEC-60332	Test on electric cables under fire conditions.
xviii.	IEC-60754	Test on gases evolved during combustion of electric cables.
xix.	IEC Hand Book for Temperature Index	Cable in fire regarding temperature Index Chapter-6.
m)	EOT Crane	
i.	IS-3177/BS:466	Code of Practice for Electric overhead traveling cranes and gantry cranes other than steel work crane
ii.	IS-807/BS:2573	Code of practice for design, manufacture, erection and testing (Structural portion) of cranes and hoists.
iii.	IS-5749/BS:3017	Forged Ramshorn hook.
iv.	IS-2266/BS:302	Specifications for steel wire ropes for general engineering

		purposes.
v.	IS-6938	Code of Practice for design of rope drum and chain hoists for hydraulic gates.
vi.	IS-325/BS:2960	Three phase induction motors.
vii.	IS-13947(Part 4/sec 1)	Contactors and motor starters – Electromechanical contactors & motor starter.
viii.	IS-2062	Steel for general structural purposes.
ix.	IS-3815 IS 15560	Point hooks with shanks for general engineering purpose.
x.	IS-1030	Carbon steel castings for general engineering purposes.
xi.	IS-1875	Carbon steel billets, bloom, slabs and bars for forgings.
xii.	IS-210	Grey Iron castings.
xiii.	IS-1363(Part 1,2,3)	Hexagon head bolts, screws & nuts of product grade C.
xiv.	IS-1364(Part 1,2,3,4,5)	Hexagon head bolts, screws & nuts of product grade A&B.
xv.	IS-4460 (Part 1,2,3)	Gears – spur & helical gears – calculation of load capacity.
xvi.	IS-800	Code of practice for general construction in steel.
xvii.	IS-2762	Wire rope slings and sling legs.
n)	DC BATTERY	
i.	IS-1652	Specification for stationary cells and batteries, Lead Acid type with plate positive plates.
ii.	IS-266	Specification for Sulphuric Acid
iii.	IS-2959	Specification of contactors for voltage not exceeding 1000V AC or 1200 V DC.
iv.	IS-8828	Specification for miniature Air break circuit breakers for voltage not exceeding 1000 volts.
v.	IS-2516 (Part-I & II/	Specification for alternating current circuit breakers.

	Section-I)	
vi.	IS-3136	Specification for Polycrystalline semi-conductor rectifier equipment.
vii.	IS:3395	Specification for monocrystalline semi-conductor rectifier cells & stakes.
viii.	IS-4540	Specification for monocrystalline semi-conductor rectifier assemblies and equipment.
ix.	IS-6071	Specification for synthetic separators for lead acid batteries.
x.	IS-1069	Specification for water of storage batteries
xi.	IS-1146	Specification for rubber and plastic containers for lead acid storage batteries.
xii.	IS-8320	General requirements and methods of tests for lead acid storage batteries.
xiii.	IS-1885 (Part-VIII)	Electrical Vocabulary – Secondary cells and batteries.
xiv.	IS-3116	Sealing compound for lead acid batteries.
xv.	IS-2147	Degree of protection for Cubicles.
xvi.	IS-1248	Meters and Instruments.
xvii.	IEC:51	Recommendation for direct acting indicating electrical measuring instruments and their accessories.
xviii.	IEC:157-1	Low Voltage Switchgear and Control gear – Contractors
xix.	IEC:158-1	Low Voltage Control gear
xx.	IEC:445	Identification of apparatus terminals and general rules for a uniform system of terminal marking, using an alpha – numeric notation
xxi.	IEC:478	Stabilized power supplies, DC output
xxii.	IEC:529	Classification of degree of protection provided by enclosure
xxiii.	IEC:896	Stationary lead acid batteries-general requirements and methods of Tests.
o)	UATs ,SATs & SSTs	
	IS 2026 (Part I to IV)	Specification for Power Transformer
	IS: 11171	Specification for dry type power transformers.
	IS-1271	Classification if insulating materials for relation to their stability in service
	IS-5	Colours for ready mixed paints and enamels.

	IS-226	Specification for structural steel.
	IS-144	Specification for painting of electrical equipments
	IS-694 and 1554/IEC-287	Specification for PVC insulated unarmoured low voltage power and control cables up-to 1100 V grade
	IS-2165 and IEC-71	Insulation co-ordination application guide
	S-4491	Steel casting of high magnetic permeability
	IEC-129 and IEC 1128 & 1129	Specifications for low voltage disconnectors earthing switches.
	IEC-287	Specifications for electrical cables and current ratings of cables.
	IEC-905	Loading guide of dry type power transformers
	IEC-1129	AC earthing induced current switching devices
	IS-2099	Specification for HV bushings.
	IS-3639	Specifications for fittings and accessories for power transformers.
	IS-2147	Degrees of protection provided by enclosures for LV switchgears and control gears.
	IS-2705	Specification for current transformers.
	IS-3347	Dimensions for porcelain transformer bushings
	IS-237	Specifications for bushings up to 1kV
	NEMA Standard	Average sound level of the transformers.
p)	415 V system	
i.	IS-13947-I(Part-I)	General requirement for switchgear and control gear for voltages not exceeding 1000 volts.
ii.	IS-13947(Part-II)	A.C. Circuit Breaker for voltages not exceeding 1000 volts
iii.	IS-13947(Part-IV)	Specification of A.C. contactors of voltages not exceeding

		1000V
iv.	IS-8623(Part I to III)	Specification for factory built assemblies of low voltage switchgear and control gear for voltage up to and including 1000 V AC and 1200 V DC.
v.	IS-2147/IEC-529	Degree of protection provided by enclosures for L.V. switchgear and control gear.
vi.	IS-2705/IEC-185 (Part I to IV)	Current transformers.
vii.	IS-3156/IEC-186 (Part I to IV)	Voltage transformers.
viii.	IS-3202	Code of practice for climate proofing of electrical equipment
ix.	IS-3231(Part I to III)	Specification for electrical relays.
x.	IS-1554	PVC insulated(heavy duty) electric cables for working voltages up to and including 1100 volts
xi.	IS-1255	Installation and maintenance of power cables up to and including 33kV rating
xii.	IS-1897	Copper strips
xiii.	IS-5	Colour shades
xiv.	IS-6875(Part I to III)	Push buttons & control switches
xv.	IS-4064	Heavy duty air break switches & fuses of voltages not exceeding 1000 volts
xvi.	IS-9224(Part-II)	H.R.C. cartridge fuse links up to 650 volts
xvii.	IS-9385(Part I to IV)	H.R.C. fuses
xviii.	Indian Electricity Rule,1956 (Latest Revision)	For electrical work
xix.	Indian Electricity Act 2003 for electrical works (Latest Revision) Section IV)	
xx.	IS-5578 & IS-11353	Marking and arrangement for switchgear bus bars, main contracts and auxiliary wiring
xxi.	IS-1248(Part I to IX)	Electrical indicating instruments
xxii.	IS-722(Part I to III)	A.C. electricity meters
xxiii.	IS-3072	Code of practice for installation and maintenance of switchgear
xxiv.	IS-10118	Code of practice for selection, installation and maintenance of switchgear and control gear
xxv.	IS-3043	Code of practice for earthing
xxvi.	IS-947-2	Low voltage switchgear and control gear and circuit breaker

xxvii.	IS-947-3	Low voltage switchgear and control gear – Load break switches, switch dis-connector and fuse combination units
xxviii.	IEC-947-4-1	Low voltage switchgear and control gear- Contractors and motor starters
xxix.	IEC-947-5-1	Low voltage switchgear and control gear - Electromechanical control devices (control switches)
xxx.	IEC-947-5-2	Low voltage switchgear and control gear- Proximity switches
xxxi.	IEC-947-6-1	Low voltage switchgear and control gear - Automatic system selector switches
xxxii.	IEC-439(I to III)	Low voltage switchgear and control gear assemblies and Requirement for type tested and partially type tested assemblies
xxiii.	DG sets	
xxiv.	IEC 60034	Rotating electrical machines
xxv.	IEC 60364-3	Electrical installation of buildings – Assessment of general characteristics
xxvi.	BS 5514	Reciprocating internal combustion engines
xxvii.	IS 8183	Bonded mineral wool
xxviii.	ISO 8528	Reciprocating IC engine driven alternating current generating sets
xxix.	DIN 6270	Internal Combustion Engines, Definitions of Output
xl.	IS 4722	Rotating Electrical Machines
xli.	IS: 8623	Panels
xlvi.	IS: 13497	Panels
xlvi.	IS: 10118	Panels
xliv.	IS: 5	Color for supply ready mixed paints and enamels
xlvi.	IS: 1248	Specifications for Direct Acting Indicating Instruments and their purposes.
xlvi.	IS: 10000	Methods for tests for internal combustion engine
xlvi.	IS: 10002	Specification for performance requirements for constant speed compression ignition (diesel) engine for general purposes (above 20 KW).
xlvi.	BS: 5000 (Part –III)	Rotating electrical machines of particular type of for particular applications. Generators to be driven by reciprocating internal combustion engine
xlvi.	IS: 15652 (2006)	Insulating mats for electrical purposes- specification.
q)	Ventilation system	
i.	IS 4720	Code of practice for ventilation of surface hydel power stations.
ii.	IS 3103	Installation, operation, testing and maintenance of ventilation

		system
iii.	IS 4894	Centrifugal fans
iv.	IS 2312	Propeller type AC ventilation fans
v.	IS 900	Induction motor installation
vi.	IS 659	Safety code for air conditioning.
vii.	IS 660	Safety code Mechanical refrigeration.
viii.	IS 655	Metal Air ducts
ix.	IS 325	Three phase induction motors.
x.	IS 5111	Measurement for testing refrigerant compressor.
xi.	IS 2825	Unfired pressure vessels.
xii.	IS 4503	Shell and tube type heat exchangers.
xiii.	ANSI B9.1	Safety code for mechanical refrigeration.
xiv.	IS 3069	Relating to Insulation material.
xv.	IS 4671	Expanded polystyrene for thermal insulation purposes.
xvi.		ASHRAE Handbook, Data and Guide Book.
xvii.	IS:1822	AC motor Starters of Voltage not exceeding 1000 V
xviii.	IS:4029	Guide for Testing of Three phase Induction Motor
xix.	IS:277	Specification for Galvanized Steel Sheets
xx.	IS:3588	Specification for Electric Axial flow Fans
xxi.	IS:7613	Air filters for Air Conditioners and Ventilation Tests
xxii.	IS:737	Specification for Wrought Aluminium or Aluminium Alloy Sheets and Strips
xxiii.	IS:661	Code of Practice for Insulation
xxiv.	IS – 2831	Methods of Test for Air Filters used in Air Conditioning and General Ventilation
xxv.	IS:3928	Sodium Flame Test for Air Filters (other than for air supply to IC Engines and compressors)
r)	Fire fighting system	
i)	General	
	NFPA 851	- Recommended practice for fire protection for hydroelectric generating plants.
	NFPA 72	- National Fire Alarm Code
	NFPA 70	- National Electrical Code
	NFPA 101	- Life Safety Code
	IS 1648	- Code of Practice for fire safety of buildings (General) fire fighting

		equipment and its maintenance
	IS 5571	- Selection of equipment in hazardous area
ii)	Fire Alarm & Detection System	
	IS 2189	- Code & Practice for Automatic fire alarm system
	IS 11360	- Specification for smoke detectors for use in Automatic electrical fire alarm system
	IS 2176	- Heat sensitive fire detectors
	IS 2148	- Specification for flame proof enclosure of electrical apparatus
	IS 694	- Copper conductor PVC insulated cables
	IS 3700	- Essential ratings & characteristics of semi-conductor devices
	IS 4237	- General requirement for switchgear & control gear
iii)	Water based fire protection system	
	NFPA 14	- Installation of standpipe and hose systems
	NFPA 15	- Water spray fixed system
	TAC document	- Recommendation for fire protection of transformers
	IS 3034	- Code of practice for fire safety of industrial buildings electrical generator & distributing station
	IS 1239	- M.S. tubular & other wrought steel Part I & II fittings
	IS 3589	- Specification for electrically welded steel pipes
	IS 952	- Fog nozzles for fire brigade use
	IS 3844	- Code of practice for installation of internal fire hydrants in multi-storeyed buildings
	IS 325	- 3 phase Induction motors

IS 780	-	Sluice valves for water work purposes
IS 3512	-	Specifications for spring check type reflux (non return) valve for water works purposes
IS 903	-	Specification for fire hose deliver couplings, branch pipes, nozzles
IS 7760	-	Specification for steel glass front cabinet
IS 901	-	Specifications for couplings double male and double female instantaneous pattern for fire fighting purpose
IS 5290	-	Specification for landing valve (internal hydrant)
IS 4927	-	Specification for unlined flax canvas hose for fire fighting
IS 884	-	Specification for first aid hose reel for fire fighting for fixed installation
IS 902	-	Suction hose compling for fire fighting purpose.
IS 554	-	Dimensions for pipe threads where pressure fight points are required on the treads.
IS 638	-	Sheet rubber jointing and rubber insertion jointing
IS 778	-	Gun- metal gate, globe and cheek valves for general purpose
IS 1822	-	Starter
IS 2379	-	Colour code for identification of pipe lines.
IS 2643	-	Dimensions of pipe threads for fastening purposes
IS 816	-	Code of practice for use of metal arc welding for general construction in mild steel.
IS 822	-	Code of practice for inspection of welds.
IS 5306	-	Code of practice for fire extinguishing installations and equipment on

	premises.	
iv)	Portable Fire Extinguishers	
	<p>NFPA 10 - Portable fire extinguishers</p> <p>IS 2190 - Code of practice for selection & maintenance of portable first aid fire extinguishers</p> <p>IS 933 - Specification for portable chemical fire extinguisher - Foam type</p> <p>IS 2878 - Specification for fire extinguisher - Carbon dioxide type</p> <p>NFPA 2001 - Standard on inert gas fire extinguishing system</p>	
s)	Illumination system	
i)	Lighting fixtures and accessories	
	IS: 1913	General and safety requirements for electric lighting fittings.
	IS: 4012	Dust proof electric lighting fittings.
	IS: 4013	Dust tight electric lighting fittings.
	IS: 1947	Specification for flood lights.
	IS: 1777	Industrial lighting fittings with metal reflectors.
	IS: 3287	Industrial lighting fittings with plastic reflectors.
	IS: 5077	Specification for decorative lighting outfits.
	IS: 2418	Tubular fluorescent lamps.
	IS: 1258	Specification for Bayonet lamp holder.
	IS: 3323	Bi-pin lamp holders for tubular fluorescent lamps.
	IS: 3324	Holder for starters for tubular fluorescent lamps.
	IS: 1534	Ballasts for use in fluorescent lighting fittings.
	IS: 13021	Electronic Ballasts for use in fluorescent lighting fittings.
	IS: 1569	Capacitors for tubular fluorescent, HPMV & HPSV lighting circuits.
	IS: 2215	Starter for fluorescent lamps.
	IS: 418	Tungsten filament general service electric lamps.
	IS: 3553	Watertight electric fittings.
	IS: 9974	HPSV Lamps specification.
	IS: 9900	HPMV Lamps specification.
	IS: 12948	TungstenHalogenLampsSpecification. (Non-vehicle)

	IS: 6616	Ballasts for HPM lamps.
	IS: 6665	Code of Practice for Industrial Lights.
	IS: 10322	Luminaries requirements (Part 1 to 5) (Sections 1 to 5).
ii)	Conduits and its accessories and junction boxes	
	IS: 1653	Rigid steel conduits for electrical wiring.
	IS: 3480	Flexible steel conduit for electrical wiring.
	IS: 2667	Fittings for rigid steel conduits for electrical wiring.
	IS: 3837	Accessories for steel conduits for electrical wiring.
	IS: 4649	Adaptors for flexible steel conduits.
	IS: 5133	Steel and cast iron boxes as enclosure for electrical accessories.
	IS: 2629	Hot dip galvanizing of iron and steel.
iii)	Lighting Panels	
	IS: 13947 (Part-I -1193)	Specification for low voltage switchgear and control gear.
	IEC: 947-I	Degree of protection of enclosed equipments (Annexure-C).
	IS: 8828	Miniature air-break circuit breakers for voltages not exceeding 1000 Volts.
	IS: 2959	AC Contactors of voltage not exceeding 1000 Volts.
	IS: 5	Colors for ready mixed paints and enamels.
	IS: 2551	Danger notice plates.
	IS: 9924 (Part-2)	HRC cartridge links for voltage above 650V.
	IS: 5082	Wrought aluminum and aluminum alloys hard rods, tubes and sections for electrical purposes.
	IS: 8623	Factory built assemblies of switchgear and control gear for voltage upto and including 1000V AC and 1200V AC.
	IS: 13947	AC circuit breaker of voltage not exceeding 1000 volts.
	IEC: 947-2	Low voltage switchgear & control-gear & circuit breaker.
iv)	Electrical Installation	
	IS: 1293	3 pin plugs.
	IS: 371	Ceiling roses.
	IS: 3854	Switches for domestic and other similar purposes.
	IS: 5216	Guide for safety procedures and practices in electrical works.
	IS: 732	Code of practice for Electrical wiring installations. (System voltage not exceeding 650 Volts)
	IS: 3043	Code of practice for earthing.
	IS: 1944	Code of practice for lighting of public thoroughfares.
	IS: 5571	Guide for selection of electrical equipment for hazardous areas.
	IS: 800	Code of practice for use of structural steel in general

		building construction.
	IS: 2633	Methods of testing uniformity of coating on zinc coated articles.
	IS: 6005	Code of practice for phosphating iron and steel.
	IS: 3646	Code of practice for Interior Illumination part I, II and III
t)PA & Communication system		
i.	IEC 60065	Audio, video and similar electronic apparatus- Safety requirements.
ii.	IS 10426	Specification for public address amplifier
iii.	IS 9304	Characteristics and method of measurement for sound system equipment.
u) Elevators		
i.	IS 14665 Electric traction lifts : Part 1	Guidelines for outline dimensions of passenger, goods, service and hospital lifts.
ii.	Part 2	Code of practice for installation, operation and maintenance
iii.	Section 1	Passenger and goods lifts.
iv.	Section 2	Service lifts.
v.	Part 3	Safety rules
vi.	Section 1	Passenger and goods lifts.
vii.	Section 2	Service lifts.
viii.	Part 4	Components
ix.	Section 1	Lift buffers
x.	Section 2	Lift guide rails and guide shoes
xi.	Section 3	Lift car frame, car, counter weight and suspension.
xii.	Section 4	Lift safety gears and governors.
xiii.	Section 5	Lift retiring cam
xiv.	Section 6	Lifts doors and locking devices and contacts.
xv.	Section 7	Lift machines and brakes.
xvi.	Section 8 Lift wire ropes.	Controller and operating devices for lifts.
xvii.	Section 9	
xviii.	Part 5	Inspection Manual
xix.	IS – 4691	Protection of motors from moisture
xx.	IS-325-1978	Specification for Three Phase Induction Motors (Rev IV)
xxi.	IS-732-1982	Code of practice for Electrical Wiring Installation (Revised)
xxii.	IS-2365	Steel wire Suspension Ropes for Lifts & Hoists
xxiii.	IS-3734	Dimensions of Worm Gearing
v)Security system		
i.	IEC 600065	Audio, video and similar electronic apparatus-Safety

		requirements.
ii.	IEC 60326	Printed Boards
iii.	IEC 60446	Basic and safety principles for man-machine interface, marking and identification, identification of conductors by colours or numerals.
iv.	IEC 60478	Stabilized power supplies, DC output.
v.	IEC 60870-5	Tele-control equipment and systems.

The Following Annexures can be accessed through the Google Drive link provided below:

SR. No.	TITLE	ANNEXURE NO.
1.	SALIENT FEATURES	I
2.	90% DEPENDABLE YEAR FOR 73 MW UNIT	II
3.	90% DEPENDABLE YEAR FOR 17 MW UNIT	III
4.	Logistic Survey Reports	IV
5.	Hydraulic Transient Study	V
6.	Petrography & Water Quality Sample	VI
7.	Sedimentation Data Report	VII
8.	L-2 Schedule of Civil+HM Contract	VIII
9.	EM Specified Activities	IX
10.	EMPLOYER REQUIREMENT (CIVIL+HM) CONTRACT	X
11.	Technical Note for Draft Tube profile	XI

https://drive.google.com/file/d/1v-Ks2smuni_NN0yHKNrHbZxk87jgwB1z/view?usp=sharing

If the bidder faces any problem while downloading above Annexures, bidder may contact in this regards through our email at elect.contracts@sjvn.nic.in .



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

**SUB-SECTION IA
CUSTOMER SPECIFICATION
(PARTICULAR TECHNICAL SPECIFICATION (PTS))**



SECTION-23

EOT CRANES

INDEX

Sr. No.	CONTENTS
23.1	SCOPE OF WORK
23.2	STANDARDS & REGULATIONS
23.3	PARAMETERS & GUARANTEES
23.4	DESIGN AND CONSTRUCTION
23.5	AUXILIARY SYSTEM AND MISCELLANEOUS COMPONENTS
23.6	DRAWINGS, DOCUMENTS AND DESIGN CALCULATIONS
23.7	SHOP ASSEMBLY, INSPECTION AND TESTS
23.8	PACKAGING, HANDLING AND SITE STORAGE
23.9	SITE INSTALLATION AND COMMISSIONING
23.10	TOOLS AND INSTRUMENTS
23.11	SPARE PARTS

CHAPTER-23

EOT CRANES

23.1 SCOPE OF WORK

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, engineering, manufacture, quality assurance, quality control, shop assembly, shop testing, packaging & delivery at site including insurance, unloading, site storage and preservation, in plant transportation at site, erection / installation, testing supervision, pre commissioning, successful commissioning, performance and acceptance testing, training of Employer's personnel, handing over and warrantee of EOT Cranes, as per the specifications hereunder, each complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work covered under this section shall be read in conjunction with General Technical specifications, Chapter-1.

Special Requirement:

All crane listed in this specification i.e. Power House and Transformer Hall/GIS shall be brought from same manufacture only unless it is explicitly proven (undertaking from manufacture & verified by employer with his source of information/physical visit to manufacture works) that same is not practical.

23.1 Detailed Scope of Work

The component/Equipment/system shall be design for Useful life of 40Years for Primary/Major equipment/component. Useful Life of Secondary/Electronic/Minor equipment/Component shall be as per Good Industry practice.

Provisions stipulated in whole document is meant to ensure quality, reliability, efficiency and safety of Equipment/component/system to be design, manufactured, Tested, erected and commissioned. The Bidders are recognized EM EPC contractors and are free to do value engineering based on Good Industry practice and it shall be established with supporting documents (certification from end utility/user in last six month for such value engineering).

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

A) 175/50/10 EOT crane for Power House (Indoor Application)

- i) Two (2) no., Indoor 175/50/10T [Main Hoist (MH)/Auxiliary Hoist (AH)/ Mono-Rail] Double Girder, Electric Over Head Travelling crane, complete with electric control panels (PLC based & VVVF Starter), Operator Cabin Control & Remote radio controls (RRC) for MH & AH and Pendant Control for Monorail, main and auxiliary hoists on a common trolley, brakes, safety devices, platform, ladders, fittings and connections and all necessary accessories and load cells.
- ii) One (1) equalizer beam, fittings, connections, electric control and other accessories required when the cranes are operating in tandem for lifting complete assembled rotor.
- iii) One (1) set of fabricated steel equalizer beam stand (s) for support when beam is not in use.

B) 50T/10T EOT Crane for Transformer Hall

- i) One (1) no., Indoor 50/10T [Main Hoist (MH)/Mono-Rail] Double Girder, Electric Over Head Traveling crane, complete with electric control panels (VVVF Starter), Operator Cabin Control & Remote radio controls (RRC) for MH and Pendant Control for Monorail, main and auxiliary hoists on a common trolley, brakes, safety devices, platform, ladders, fittings and connections and all necessary accessories and load cells.

C) Miscellaneous Items

- i) One (1) set of main runway rails with base plates, anchor bolts, rail clips, lock nut, end stops, limit switches, striker's plates, buffers etc. for each set of cranes.
- ii) One (1) set of bridge rails with rail clips, lock nut, end stops, limit switches, striker's plates, buffers etc. for each crane.
- iii) One (1) set of compact conductor bar (shrouded) down shop lead (DSL) with indication system for power supply system complete with metal enclosures, conductors, collector trolleys, all fittings and connections etc. for total runaway length of the crane as per tender drawings for each set of cranes.
- iv) Till the installation and commissioning of DSL temporary cable for erection testing commissioning and further operation of crane for installation work shall be arranged by the contractor at each location. Load testing of cranes at site including load arrangement (arrangement of steel plates or/and casting of concrete blocks etc.) and all logistics.
- v) Lubricating oil, grease and hydraulic brake fluid for first filling of all components with 100% reserve in non-returnable drums, for each crane.

- vi) One set of anti-collision sensors for detection of collision of bridge(s) and also with End Stoppers at far end on both sides.
- vii) Provision for Event Recording such as Operational Hours of various hoists, motor/gears etc through manual as well as PLC based system.
- viii) Suitable rating receptacles along with copper cable between DSL and receptacle for cranes at suitable location decided during detailed engineering.
- ix) Arrangement of Cradle, Load & Slings for performance of Load testing of EOT Crane at site.
- x) One (1) set of Nylon slings suitable for lifting stator segments (if applicable), 1 set of nylon sling for GT, 1 set for nylon sling for GIS, 1 sets of Nylon slings for runner, bearing brackets, shaft etc.

D) Control, monitoring and related items and services

Co-ordination and provision of necessary contacts and / or port for integration with plant SCADA system.

E) Common supplies and services

- i) Routine maintenance including supply of consumables, breakdown maintenance of EOT Cranes, supply of DSL as well as rails and provision of qualified operator (24X7) shall be in the scope of contractor upto handing over of the cranes.
- ii) Obtaining statutory clearance / license for radio remote control system.
- iii) Drawings, documents and design calculations as per clause 23.6.
- iv) Shop, assembly, inspection & tests as per clause no. 23.7.
- v) Packaging, handling and site storage as per clause no. 23.8.
- vi) Delivery, installation and commissioning as per clause no. 23.9.
- vii) Tools and instruments as per clause no. 23.10.
- viii) Spare parts as per clause no. 23.11
- ix) Field/touch-up painting including all painting materials as per GTS Clause 1.9.3.

F) Erection, testing & Commissioning devices

Contractor shall bring his own tools, devices, testing instruments/ equipment's to site in order to erect, install and commissioned the complete equipment delivered under this section. These shall remain the property of the Contractor unless otherwise agreed to take over any / all of these at mutually agreed condition

G) Civil Works

All Civil Works associated with this section/chapter shall be in the scope of Employer. However, Contractor to provide all design inputs, Drawings/Documents(wherever applicable), embedment's/inserts, foundation

bolt, base plate, brackets etc.

H) Mobile Crane/Hydra/Tower Crane /EOT Crane

The activity i.r.o. of erection, handling etc of this section/chapter shall be carried out by EM Contractor with his resources only.

I) Interface Activity

All aspect (supply & services as applicable) of interface activity within EM component (Generator, Turbine, GIS, GT etc.) or with third party i.e. Civil/HM (input related to Foundation/ Crane Beam /Cut outs/coordination with DT Gates layout etc.) shall be in scope of EM contractor. Above interfaces are illustrative in nature, Bidder to list out all such interface within six months of LoA for approval of Employer.

J) Completeness of System

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s) / Good Industry practices shall be in the scope of EM contractor.

Scope of work define herein are prepared for tender purpose only, Bidder are requested to examine carefully whole bid document and do value engineering and modify/delete/addition (if any) and submit in their bid document of such modification/deletion/addition etc. with full justification and same shall be consistent with Intent of Specification and other provision of contract that shall ensure Quality, Reliability, efficiency and safety of System.

Such items are to be listed out in respective attachment of Bidding document i.e. Schedule of Technical Deviations. Any deviation listed anywhere in submitted bid shall be treated as null and void.

K) Post award scope changes

Generally, post award engineering changes for scope(s) shall be avoided at first instant, however, if employer is satisfied with the findings/justification etc for such changes that is consistent with primary requirement i.e. ensuring improved quality, reliability, safety and obsolescence of technology etc., Technical acceptance shall be provided by Employer and such change(s) in scope shall not affect the overall schedule of project.

Every change in “Scope” shall be associated with financial implications and shall be determined as per the procedure of contract provisions.

Contractor to carry out the sizing of Main Hoisting Capacity of EOT Crane during detailed engineering subject to approval of employer. Final rating/sizing of Hoisting within $\pm 10\%$ as approved by employer shall be adopted without financial implication. Final Rating of Main Hoisting means combine rating

530 Ton (2 x 175 + 3x 50 + 3x 10).

However, Sizing/Final rating of Main Hoist approved beyond $\pm 10\%$ shall be adjusted financially (towards contractor or towards employer as the case may be). Unit price for adjustment shall be based on INR/ Ton and shall be equal to EOT Crane section price in LoA (Supply) in INR / 530 Ton.

23.2 STANDARDS & REGULATIONS

Please refer clause no. 1.6 of chapter 1 - GTS.

23.3 PARAMETERS & GUARANTEES

23.3.1 Specific Parameters and Layout Conditions

23.3.1.1 175/50/10 T EOT cranes for Power House

The Contractor shall supply 175/50/10 T (MH/AH/Monorail) capacity of crane to be installed in Power House for indoor application as per Tender Drawing. The MH, AH and monorail hoist of EOT crane shall be required for handling turbine components, generator, associated apparatus and other equipment during erection and O&M.

The MH shall be used to lift a complete generator rotor mass, Stator including lifting device. Other major component of Generator, Turbine etc shall be hoisted through AH. Monorail shall be used for lighter package of EM equipment's in Power House.

The main hook of the 2x175 T EOT crane shall have anti-sway arrangement.

Installation of the equipment shall be done by the Contractor at Site (exact location shall be intimated by Employer at the time of installation). Material/manpower required for such installation shall be arranged by the Contractor.

Technical literature of the equipment/components offered and as published by the original manufacturer of the component, shall be submitted.

23.3.1.2 Tandem operation of two cranes for heavy loads (for Power House Crane)

For handling generator-rotor with shaft or any other heavy equipments whose weights exceed the crane capacity, both the cranes will be used jointly and simultaneously for handling such equipment with the help of a special lifting beam to which both the hoists will be attached. The lifting beam has been specified to have in-built pins for attaching to the main hoists of the 2 cranes.

During joint (tandem) operation, both the cranes shall be coupled electrically and mechanically and all operations and controls of both the cranes shall be carried out by a single operator, common for both the cranes, from only one of the two crane control cabins. Suitable provisions in the design shall be made to enable and ensure that all operations and control of both the cranes shall be perfectly synchronized for all travel and hoisting motions.

The 2 cranes shall have provision for coupling mechanically and electrically with ease and reliability for this purpose. When operating in tandem the 2 cranes shall maintain horizontality of the lifting beam in all motions during such operation.

The lifting beam is covered as part of the supplies. The crane hook shall have pin and holes for attaching the lifting beam to the hoist. Coupling arrangement for lifting beam to rotor is covered in the scope of generator. However, interfaces shall be coordinated with the generator section.

The Contractor is responsible for all co-ordination.

23.3.1.3 50/10T EOT Crane for Transformer Hall

The Contractor shall supply 50/10 T (MH/Monorail) capacity of crane to be installed in transformer hall for indoor application as per Tender Drawing.

The crane design shall be coordinated with the Transformer design for capacity and other provisions in the cranes with respect to installation layouts. The contractor shall supply the required capacity of cranes if requirement is higher than 50T for Transformer Hall. The hooks shall have anti-sway arrangement.

23.3.2 RATING AND FUNCTIONAL CHARACTERISTICS

Rating and functional characteristics of all the components of the EOT Cranes shall be of latest state of the art. If the system components mentioned in the awarded contract becomes obsolete at the time of approval of General technical particulars during detail engineering, the Contractor shall offer the latest model without any extra cost to purchaser. The components of the system shall be selected taking the following requirements into consideration:

- Reliability of components and subsystems.
- Scalability of the system for future extensions.
- Availability of spares.
- Ease of maintenance.

Power House Cranes

The EOT cranes shall be designed for the following parameters/duties:

A.	Capacity (in Tonnes)		
i)	Main	175 T (capacity of each of two cranes)	
ii)	Auxiliary	50 T in each crane	
iii)	Monorail	10 T	
B.	Span (s)	Refer Crane clearance diagram attached	
C.	Normal speeds with full loads, in m/minute		
a)	Main hoist for loads up to 175T		
i)	Hoisting & lowering speed	0-1.0 m/min	
b)	Aux. hoist for loads up to 50T		
i)	Hoisting & lowering speed	0-3.0 m/min	
c)	Trolley Travel	0-10.0 m/min	
d)	Bridge Travel (long travel)	0-15.0 m/min	
D	Maximum acceleration/ deceleration of bridge travel & trolley travel.	0.2 m/sec ²	
E.	Crane hook vertical travel reach (Maximum feasible, to be finalized during detailed engineering)	Main Hook	Aux. Hook
i)	Between service bay floor EL-649.5 m to Crane Beam	Refer Crane clearance diagram attached	
ii)	Between service bay floor level to DT access/runner removal floor EL-631.0 m		
iii)	Total hook travel upto DT access/runner removal floor EL-631.0 m (To be fine-tuned as per system requirement)		
F.	Position of Hook from Rail C/L (mm) (to be finalized during detailed engineering)		
		Main Hook	Aux. Hook
i)	On Upstream side	As per the Crane Design and Layout Consideration	
ii)	On Downstream side		

G.	Position of centerline of Hook from End Walls (Maximum feasible, to be finalized during detailed engineering)	Main Hook (mm)	Aux. Hook (mm)	Mono rail hook (mm)
i)	From end walls –Crane (Preferably)	Refer Crane clearance diagram attached		
H.	Runway level and Travel lengths			
i)	Crane beam level	EL. 662 m		
ii)	Length of run way	Refer Crane clearance diagram attached		
iii)	Trolley travel length	Max. Feasible for specified crane span and hook reaches.		
I.	Distance from rail C/L to nearest side obstruction on			
i)	Up-stream	As per the Crane Design and Layout Consideration		
ii)	Down-stream			
J.	Distance from crane end to nearest side obstruction			
i)	Up-stream	500 mm		
ii)	Down-stream	500 mm		
K.	Monorail Hoist { Attached under Crane Girder (one per crane) }			
i)	Capacity	10 tonnes		
ii)	Hoist speed with full load	12 m/min		
iii)	Cross Travel speed with full load (along the bridge)	12 m/min.		
iv)	Vertical Lift of monorail hook			
a)	Between service bay floor <i>EL-649.5</i> m to Crane Beam	Refer Crane clearance diagram attached		
b)	Between service bay floor level to DT access/runner removal floor <i>EL-631.0</i> m	Refer Crane clearance diagram attached		
v)	Position of Hook from rail centre line			
a)	Upstream side	As per the Crane Design and Layout Consideration		
b)	Downstream side			
L	Means for Micro speed for Inching Motion for lifting hooks.	Step less, frequency converter speed control system		
M.	Factors of safety & Deflections:			
a)	Minimum Factors of safety for			

	Design	
i)	For structural members based on ultimate tensile strength	As per IS 807(Latest)
ii)	For ropes & slings, based on ultimate tensile strength	As per IS 807(Latest)
b)	Deflection limit of girder under safe working load plus dead loads.	As per latest IS standard of span with weight of crab in central position

B) Transformer Hall and GIS Cavern

The EOT crane shall be designed for the following parameters/duties:

Transformer Hall/GIS cavern		
A.	Capacity (in Tonnes)	
	Main	50 T
	Monorail Aux. Hoist	10T
B.	Span (s)	Refer Crane clearance diagram attached
C.	Length	Refer Crane clearance diagram attached
D.	Normal speeds & with full loads	
i)	Hoisting speed for hook hoist	3.0 m/min (WITH VFD)
ii)	Trolley Travel (Cross)	10.0 m/min (WITH VFD)
E.	Total Lift (with load)	16m
F.	Working Clearance required for crane movement/ maintenance from the centerline of rail up to nearest side obstruction	500 mm
G.	Maximum distance between bottom of gantry rail and the highest point of crane	As per the Crane Design and Layout Consideration
H.	Minimum Incremental movement (not greater than the given values)	
i)	Main Hoist	1.0mm
ii)	Bridge Travel	3.0mm
iii)	Trolley Travel	3.0mm
I.	Aux. Hoist	
i)	Capacity	10 tonnes
ii)	Hoist speed with full load	5 m/min (WITH VFD)
iii)	Cross Travel speed with full load (along the bridge)	12 m/min.

iv)	Vertical Lift of monorail hook	18 m
-----	--------------------------------	------

Note: The EOT Crane dimensions and hoisting capacity are tentative and shall be finalized at the detailed engineering stage for achieving optimization. The Contractor shall, however, co-ordinate the lifting requirement of machine components for erection with respect to the layout and dimension of powerhouse.

23.3.2 Performance Criteria and Guarantee

The electric overhead traveling (EOT) crane along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

The cranes shall be capable of raising, lowering, holding and transporting their rated loads without any damage to or excessive deflection of any component.

The following shall be maintained in the operation of the cranes, with all brakes adjusted and functioning correctly and hook carrying rated load. Minimum possible travel/incremental movement are given below:

- i. Main Hoist vertical movement 1.5 mm
- ii. Auxiliary Hoist vertical movement 1.5 mm
- iii. Bridge travel 3.0 mm
- iv. Trolley travel 3.0 mm
- v. Monorail travel 5.0 mm

The vertical deflection of crane girders caused by the rated load plus all dead load should not exceed the value as per latest IS of the crane span.

It is the responsibility of the Contractor to supply the equipment as per relevant standards and shall also guarantee the reliability and performance for the same to meet the provisions of contract.

23.3.4 Safety requirements

In the design of Crane, all safety regulations as applicable with Factory Acts, Indian Electricity rules or equivalent national / international rules etc. as prevailing in the country and the site of installation shall be taken into consideration and provided for. Correct vertical motion functioning shall be guaranteed within the above-mentioned ranges of expected frequency and supply voltage variation. In the event of extreme variation in supply voltage outside the expected limits defined in “Section 1 - General Technical

Specification”, there shall be total load control and measures shall be taken to place the handled equipment in a secure position. In the event of a loss of electrical supply, load control shall be ensured. Collisions of trolleys and pieces of equipment with buffers shall not endanger load control.

23.4 DESIGN AND CONSTRUCTION

23.4.1 General

The EOT crane shall conform to the requirements of the specification and installation arrangement shown in the relevant drawings appended with the specification.

- a) The crane shall be of indoor type, electrically driven (~~PLC based~~ and VVVF Starters), Cabin operated, RRC, single trolley, double girder, overhead traveling type the crane shall be M3 duty type and shall be designed in compliance with the latest versions of IS 807 and IS 3177 wherever requirements contained in the latest applicable IS are stricter than those contained herein, IS requirements shall govern.
- b) The crane shall be designed in accordance with requirement of these specifications including the limiting and/or mandatory dimensions shown on the specification drawings. The details shall be determined by the Contractor subject to customer’s approval
- c) Any design feature or detail not specified shall be in accordance with IS:807 & IS: 3177 or other approved standards which shall supplement these specifications.

Crane conforming to any other International or National Standards shall also be acceptable provided the crane satisfies fully the technical requirements and intents of these specification.

Suitable devices shall be provided for fixing the various equipments/panels to withstand the seismic events to prevent the movement of foundation. The necessary bolts for embedding in the concrete foundation would need to be supplied by the Contractor for this purpose. It shall be ensured that these special devices as well as bolts shall not be over stressed. The details of the devices used and its adequacy along with the supporting calculations shall be furnished by the Contractor and shall be subject to the purchaser’s approval. Seismic forces as per chapter no 1 shall also be considered for design of EOT Cranes.

23.4.2 Operator Cabins

Normally the operation of the crane (MH&AH) will be performed from driver's cabin suspended under the bridge. EOT crane operation shall be achieved through Programmable Logic Controller (PLC) with starter of all

motors by VVVF Drive (Variable Voltage Variable Frequency). Remote display of Load cell shall be installed below Operator Cabin.

Remote operation of crane shall also be possible through RRC.

The operator cages/cabins of the cranes shall be fitted on the upstream side preferably on the non adjacent girders. This arrangement will ensure that while operating the cranes (in tandem), the lifting beam shall not interfere with cages even when it is moved to extreme upstream sides.

The mono-rail hoists shall also be installed on the wall sides.

The crane on the service bay side of power house shall be designated as crane No.1. and crane from the unit no. 6 shall be designated as crane No.2.

23.4.3 Simultaneous Operation of Hoist (for Power House Crane)

The cranes will be required to handle hydro generating plant and machinery, for lighter equipment independently and for heavy equipment in tandem.

Normally one hoist would be operated at a time. It shall however be possible to change the position of the components from lying to vertical position using both the hoists, by manipulation of the hoisting and other movements as the case may be.

Normally one hoist (MH or AH or Monorail) would be operated at a time. It shall however be possible to change the position of the components/equipment's from lying to vertical position using combination of two hoists i.e. MH &AH or MH & Monorail or AH & Monorail, by manipulation of the hoisting and other movements as the case may be.

23.4.4 Loadings for Crane Design

The crane and runway rails shall be designed for combination of loads acting on them during operation or standstill as per the provisions of IS 3177 clause 7.3. Eccentricity of loading shall be taken into consideration in the design. The maximum stresses acting on the members of the crane and runway rails etc. shall not exceed the safe permissible stresses under any actual combination of loads.

23.4.4.1 Combination of Loadings on crane

1 Crane stationary/load being hoisted/ beginning to be hoisted

- a) Dead load + Live Load + Vertical Impact Load
- b) Dead load + forces caused by maximum or break down torque of the main hoist motor.

The resulting stresses not to exceed 90% (ninety percent) of the yield point (elastic limit) of the materials of the members subjected under the loading.

2 Crane in motion

- a) Dead load + live load + any one horizontal load viz lateral, longitudinal or specific design load.
- b) Dead load + braking load.
- c) Dead load + live load + any 2 (two) or more horizontal loads viz lateral, longitudinal or the specified design loads.

The resulting unit stresses due to loads shall not exceed the safe stresses by more than 35 (thirty five) percent.

3 Crane Stationary

Dead load + Earthquake load.

23.4.6 Performance/Quality of Operations

The crane shall be capable of raising, lowering, holding and transporting the rated load without any damage to or excessive deflection of any crane component.

The following tolerances shall be maintained in the operation of the crane:-

- a) Smooth control of vertical movement within 1 mm for loads up to Main hooks and 3 mm for aux hooks and 10 mm for hook carrying rated load at a time and hoist brakes properly adjusted for normal operation.
- b) Control of bridge and trolley motion to within 10 mm.
- c) The motor speed not to exceed 105% of the synchronous speed while lowering the rated load.
- d) The vertical deflection of the main girders caused by the rated load plus all dead loads not to exceed the value as per the latest IS of the crane span for all Cranes

23.4.7 Fabrication at Works Only

The cranes shall be completely fabricated in the contractor's workshop and no welds on main structures shall be allowed at site.

23.4.8 CONSTRUCTION DETAILS

23.4.8.1 Structural parts of crane

A Crane Bridge

- 1 The crane bridge, made of two girders as box type construction, reinforced with stiffening ribs, supported on end trucks, shall be designed to safely carry the full rated load without undue vertical or lateral deflection or vibration. The design shall ensure that girder vibrations are quickly dampened within 1 mm in 4 seconds.
- 2 The bridge shall be designed taking into consideration the specified transport and handling limits in regard to size and weight of packages. Accordingly, the bridge shall be sectionalized into suitable but minimum no. of sections within the transport constraints as also of field erection & handling.
- 3 The joints between the sections shall be spliced and shall be made by most appropriate method. Most appropriate design shall be adopted for the spliced joints between the sections.
- 4 Adequate No. of CO₂ gas cylinder of 4.5 Kg capacity each for fire extinguishing shall be provided on the bridge suitably located.

The bridge shall have the following provisions:-

- a) Welded end-stops of steel to act as stoppers for trolley/crane.
- b) Heavy rails for trolley supported centrally on girders held in place by rail clips locked in position to prevent creeping of rails.
- c) Large gusset and skew plates with interference fit bolts at girder ends to connect to the end trucks to maintain a square rigid structure secure against shock & vibration & skewing of crane on the track.
- d) Suitable no. of guide rollers for guiding trolley wheels on rail track.
- e) Supporting structure for mono-rail hoist underneath the bridge

girder.

- f) Access for inspection & maintenance of the 10-tonne mono-rail hoist.

B Trucks (End Carriages)

- 1 The trucks of box type construction with openings at each end for receiving the truck wheels shall be either cast, or weld fabricated, or bolted, or riveted structure of steel and shall have adequate strength and stiffness. Two end carriages will be provided on each end of the crane and will be connected with an equalizing beam to take care of any track variation and for equal load sharing.
- 2 The ends of the trucks shall be shaped to form a hood over the truck wheels extending beyond them to receive the track (rail) sweeps and bumpers. The trucks shall be arranged so that wear may be compensated in order to maintain the drive gear in proper mesh. The size of the journals shall be sufficient to carry the rated capacity load at specified speed without excessive heating during continuous operation.
- 3 Wheel assembly shall be so arranged that replacement of any wheel can be achieved from the side without undue difficulties. The wheel base shall not be less 4 m, as reckoned between centers of outer wheels. The end trucks shall be designed to contact end stops.
- 4 Each truck shall have
 - a) Double flanged rail wheels with bearings running on suitable axles, fracture props, buffer etc. for easy maintenance.
 - b) Suitable track sweeps at each end of trucks, effective in both directions of travel.
 - c) Guide rollers extending below the top of rail on both sides to prevent the trucks from leaving the rails.
 - d) Lugs to prevent a drop of not more than 25 mm in case of axle getting broken.
 - e) Resilient bumpers or spring loaded buffers on contact faces of

end stops.

- f) End stops at each end of runway rails, designed in such a way that they make contact with the face of the end truck and not the wheel.
 - g) Suitable pads on each truck for all wheels for jacking of the crane for changing truck wheels and bearings, to be so designed as not to interfere with the replacement of the truck wheels.
 - h) Lifting jib arrangement along with a lifting jack. Jack need not be of built-in type.
 - i) Hand holes with removable covers, in each closed compartment of end trucks to facilitate painting of the interior with a spray gun without major disassembly.
- 5 Arrangement for jacking the cross traverse wheels shall be similar to the one described here. The contractor shall furnish the technical details of jacks to be supplied.

C) **Wheels, Axles and Wheel Bearings**

1. **Wheels**

- a) The bridge shall be carried on sufficient number of wheel pair on each side as per latest IS 3177 suitably mounted on trucks and designed so as to distribute the load equally on truck beams & wheels. The wheels shall meet the following requirement
 - i) Double flanged type with treads machined and ground to size.
 - ii) Turned, bored and ground to true and uniform diameters concentrically.
 - iii) Made of forged steel and heat-treated or made of spheroidal cast and heat treated to HB-250 and steel should not contain more than 0.060 percent either of sulphur or phosphorus.

- iv) Equalized in pairs
 - v) Flanges tapered and radiused to prevent derailment.
 - vi) Tread width to have proper clearance and sufficient size to withstand maximum static and moving/ rolling loads.
 - vii) Bridge and trolley wheels to be identical for interchangeability.
- b) The design of the wheel truck assembly shall be such as would allow the wheels to adjust themselves to irregularities of the runway within allowable limits.

2 Wheel Axles

The wheel axles shall be as per the following

- a) Made of forged carbon or alloy steel.
- b) Accurately turned, grounded and polished at the fitting positions in the wheels.
- c) Suitable interference fit with the wheels
- d) Driving wheel axles to be keyed also in addition to interference fit

3 Wheel Axle Bearings

The wheel bearings which shall be interchangeable & easily removable shall comprise the following: -

- a) Bearing housings/journals fitted into truck bodies.
- b) Self-lubricated type bronze bearings accurately machined to fit into journals/seats in the truck bodies, and correctly bored for the axles, or
- c) Roller bearings with high pressure grease lubrication.

D) Trolley

The trolley shall be made as a welded frame of structural steel and shall be designed and fabricated in accordance with the following :-

- a) Provision of adequate bracing to withstand vertical, lateral and torsional strains.

- b) Properly machined to receive the drum, wheels, axles and motors for hoisting and cross travel.
- c) Provision of heavy duty roller bearings, for trolley wheels & winding drum, with bearing caps and fittings for pressure lubrication.
- d) Double end spring buffers at bottom of trolley frame on each side to engage stops at each end of the bridge.
- e) A provision to fit/receive a device to lift the heaviest parts of the trolley viz the drum and motors for maintenance without any external place for anchoring the hooks or need for any other device.

E Operator Cabin, Walkways, Ladders and Safety Guards

1 Operator Cabin	
The operation of the crane will be from driver's cabin suspended under the bridge and will house all the control equipment for the operation of the crane. The cabin of structural steel frame shall be designed and constructed in accordance with the following requirements :-	
a)	Enclosed type for indoor service, having adequate working space for operation & maintenance.
b)	Adequately braced to the crane so as not to sway, swing, or shake.
c)	Floor of steal plates securely connected to the frame and covered with matting.
d)	Located on the up stream side of the bridge of the crane, and suspended from their outside girders.
e)	Railing on all open sides, a ladder for access to the crane bridge walkway, a 5 kg CO ² portable fire extinguisher.
f)	A cut off switch near the cabin for disconnecting the incoming power supply before entering or leaving the cabin for operator safety.
g)	Foot operated rotary alarm gong at least 300 mm in diameter.
h)	Fan
2 Walkways and Ladders	
Ladders, platform, walkways, hand holds, etc., necessary to give safe access to any movement in the cage, bridge drive and trolley drive mechanisms and all other components of the crane needing inspection, maintenance and repair shall be provided. The walkways and ladders shall be as per the following requirements :-	

a)	Walkways to be of steel checkered plating for full bridge length, at same elevation as that of bridge attached but outside each girder. The width, clearance from drive units and head room are to be minimum 700, 500 and 2000 mm respectively.
b)	Steel ladders and stairs to have non-slip treads, not less than 600 mm wide between sides, preferably sloped forward, and provided with back safety guards in case height of ladders exceeds 3 meters.
c)	<p>Hand rails for walkways, platform, stairs, ladders, etc. shall be 1100 mm with an intermediate rail.</p> <p>Lifting Beam</p> <p>a) The lifting beam required for lifting generator rotor or/ and generator stator shall be supplied by the Contractor.</p> <p>b) Lifting beam is required for handling the generator rotor, generator stator or other parts having a weight as per Data Requirement sheet requiring the use of two cranes working together. The weight and dimensions of the lifting beam shall be within the transportation limitations. It shall have a rated capacity to be established by the Contractor to handle the generator rotor and generator stator. The lifting beam shall have in built pins for attaching to the main hoists of the two (2) cranes.</p> <p>c) All connections between the lifting beam and lifting devices/attachments for the generator rotor/station etc. shall be so arranged that when the lifting beam is attached to the main hoists of the cranes, the generator rotor/stator with the shaft shall remain in a vertical position and shall be free to turn upon its vertical axis. The horizontality of the beam shall be maintained when it is lowered or raised. Suitable roller type bearings shall be provided for the load support. The final lifting arrangement for the components requiring use of lifting beam etc. shall however be finalized in consultation with the generator manufacture. The lifting beam shall be provided with suitable arrangements (such as mercury limit switch) to check the horizontality of the beam when it is attached to the cranes. For this, balance indicator is to be provided on the lifting beam to show that the beam is horizontal at all times.</p> <p>d) The lifting beam with pins/slings shall be adequately designed for handling the rotor weight. The spacing of the lifting trunnions shall be finalized in consultation with the generator Contractor. The total length of the lifting beam shall be determined taking into</p>

	<p>consideration the shortest distance available between the two main hooks of the cranes when operating in tandem.</p> <p>e) Necessary drawings or lifting arrangement or stator and rotor along with attachments for lifting these items shall be supplied by the generator Contractor.</p>
<p>3 Safety Guards</p>	
<p>Appropriate & effective safety guards, encasements, and covers shall be provided for various rotating components and live electrical conductors of the crane as below.</p>	
a)	For gears, chain drives : encasements
b)	For revolving shafts & couplings: guards for full lengths.
c)	For sheaves of hook block and rope: guards to prevent trapping of hand and rope from dismounting from sheave grooves even if rope slackening develops.
d)	For opening in foot Walk floorings and other inspection platforms: Covers of lockable type.

23.4.9 Mechanical Equipment Details

23.4.9.1 Bridge Travel Mechanism (Long Travel)

- 1 This mechanism shall comprise of 4 (four) electric motors and totally enclosed speed reduction helical gear unit, 2 (two) for each end of the bridge, to drive the 4 (four) bridge wheels and shall ensure equal speed.
- 2 The gear motors shall be keyed directly to the extended wheel shaft.
- 3 The bridge motion shall be free from vibration, rocking etc. under all conditions of operations and the crane structure shall not have any tendency to get out of line.

23.4.9.2 Trolley Travel Mechanism (Cross Travel)

This mechanism shall comprise of electric motor preferably 2 for Cranes and totally enclosed speed reduction gear unit, 1 (one) for each end of trolley to drive two trolley wheels, designed to ensure equal speed and steady motion, free from vibrations and rocking.

23.4.9.3 **Hoisting Mechanism for Raising and Lowering of Loads**

The hoisting mechanism provided and mounted on the crane trolley shall comprise of Motors, Speed reduction gear units for normal speed, Drums, Brakes, Lifting tackles and hooks, hoisting ropes and slings as below.

1 **Hoist Drive For Normal Speed**

The hoist shall be driven by a motor through speed reduction gear unit for normal speed and shall be complete with brakes and retarding devices.

2 **Hoist Drive For Micro Speed (Inching)**

- a) Very slow, accurate and controlled operation will be required to place the generator rotor and other heavy equipments very gently. The hoist shall have such provision by means of stepless, frequency converter speed control system, enabling control of the vertical motion of the hoist within 1 mm.
- b) The inching operation shall work for both individual as well as for tandem operation of the 2 cranes.

4 **Winding Drum**

The winding drum shall be made of cast steel / rolled steel conforming to relevant IS. The winding drum shall have machined grooves to receive the full hoisting rope without overlapping and the drum shall be of such size that there will not be more than one layer of rope on the drum when the rope is in fully wound position and its length shall be such that each lead of rope has a minimum of two full turns on the drum when the hook is in its lowest position and one spare groove for each rope lead off the drum when the hook is at its highest position. The drums shall be designed to withstand the maximum compressive stresses and local bending stresses in the drum at the grooves when the rope is wound on.

5 **Lifting Tackles and Hooks**

- a) The lifting tackles shall consist of a safety type lower pulley block, hook, necessary sheaves and flexible steel wire rope. The lower block shall be a heavy steel housing to support the sheaves and hook for Cranes.

- b) Sheaves shall be made of cast steel and shall be machine grooved to a depth of not less than 1.5 (one and one half) times the diameter of the rope. The groove shall be finished smooth and shall be free from surface defects likely to injure the rope. The sheaves shall be provided with guards to retain the rope in grooves and other requirements of sheaves shall be as per approved relevant standards.
- c) The swiveling hook shall be of forged steel and mounted on ball thrust bearings and protective skirt shall be provided to enclose the bearings for power house cranes.
- d) The Main hook shall be of the Ramshorn type for e cranes . Auxiliary hooks for cranes shall be shank (single) type conforming to approved relevant standards.

6 Hoisting Ropes

The selection and sizing of hoisting ropes for main and auxiliary hoisting shall be design as per IS 2266 and calculation shall be approved by purchaser. The rope ends shall be anchored by clamps securely attached to the drum. The factor of safety for the hoisting ropes shall not be less than 6 (six). The rope system shall be equalized and arrangements entailing reverse bends shall be avoided as far as possible.

7 Mono-Rail Hoist

The mono-rail drum type hoist shall be installed underneath the non-adjacent girders of the two cranes which shall be electrically operated from the operator cabin of each crane both for hoisting and across travel having two speeds. The hoist shall be compact, dirt and dust proof. The travel wheels shall be machined. Gear reduction may be helical. High and low limits to lift shall be provided. The mono-rail shall be provided with end stops.

23.4.9..4

Brakes For Various Drives/Motors

1	The brakes for various motion drives shall be as per the FEM standards. The following type of brakes shall be provided for the various crane drives:	
	a)	Bridge Travel (Long Travel):

		i)	Main braking by means of VVVF Drive i.e. frequency speed control of motors down to 0 (VFD Frictionless Brake).
		ii)	DC electro-magnetic Disc/Shoe Brake (DC Type Brake)
		iii)	EH Thruster brakes (AC Type Brakes)
	b)	Trolley Travel (Cross Travel):	
		i)	Main braking by means of VVVF Drive i.e. frequency speed control of motors down to 0 (VFD Frictionless Brake).
		ii)	DC electro-magnetic Disc/Shoe Brake (DC Type Brake)
		iii)	EH Thruster brakes (AC Type Brakes)
	c)	Hoisting Motion:	
	i)	Main Hoist (MH)	
		a)	Main braking by means of VVVF Drive i.e. frequency speed control of motors down to 0 (VFD Frictionless Brake).
		b)	DC electro-magnetic Disc/Shoe Brake (DC Type Brake)
		c)	EH Thruster brakes (AC Type Brakes)
	ii)	Auxiliary Hoist (AH):-	
		a)	Main braking by means of frequency speed control of motors down to 0 (VFD frictionless brake).
		b)	Automatic DC electro-magnetic Disc/Shoe Brake (DC Type Brake)
		c)	EH Thruster brakes (AC Type Brake)

	d)	Mono rail hoist	
	i)	Hoisting motion	DC EM Disc brake
	ii)	Travel motion (along bridge)	DC EM Disc brake
2.	The electromagnetic brakes shall be of DC type complete with rectifier equipment to convert the available 240 V AC, 50 HZ supply. The electro-hydraulic thruster brakes shall be AC type.		
3.	The brakes system shall have the following provisions :-		
	a)	Locking device in the brake lever.	
	b)	Means for adjustment to compensate for wear of the shoes.	
	c)	Emergency stop push buttons.	
4.	All the brakes shall have adequate capacity. The brakes for hoisting when applied shall arrest the motion and sustain the load up to the test load at any position of the lift. Provision shall be made to control with safety the lowering of any load up to the test load.		
5.	Brakes in other motions shall be capable of bringing the relevant motions of the fully loaded crane safely to rest in the shortest possible time with least possible shock and shall arrest the motion under all other service conditions.		
6.	The various brakes shall be designed to independently exert, the torque equal to 1.5 times the full load torque of motors.		

23.4.9.5

Gears

The gears, and the gear trains for reduction of speeds of the motors for various motions of the crane shall be designed, manufactured/fabricated, and shall have the following provisions :-

a)	Spur and helical gears only to be used for speed reduction gearing. The tooth profiles to be carefully designed and machined.
----	---

b)	The gears having speeds higher than 500 rpm to be of helical teeth type with active contact area hardened to a depth of 0.2 to 0.3 mm.
c)	To be made of cast steel or wrought steel & designed for the specified crane duty.
d)	To be totally enclosed in oil tight gear cases of weld fabricated steel.
e)	Inspection covers on the top of the gear case for quick and easy inspection of gears and for adding oil in the case.
f)	Adequate breathing and drainage facilities on all gear cases shall be provided.
g)	Oil level indicator.
h)	Proper guards for gear in case not enclosed in gear cases.
i)	Markings of pitch line on all gears for facilitating erection.

23.4.9.6

Shaft

The shafts for various purposes shall be designed and made in accordance with the following :-

a)	Material- high tensile rolled steel.
b)	Shaft diameter to take into account the key slot & splints. Slot bottom to have proper rounding off.
c)	Designed with shoulders/raised portion for carrying & fitting of gears, pinions & other similar parts.
d)	Provision of fillets of ample radius at all changes in sections.
e)	Designed to limit shaft deflection to within 1/3000th of the span between bearings.

23.4.9.7 Bearings

The bearings for various purposes shall be designed and provided in accordance with the following :-

a)	Anti friction roller, ball or bush (sleeve) journal type as applicable for components as per sound practice.
b)	Bearings to be located close to the points of loading & to be designed so as to be easily replaceable type.
c)	Bearings at shaft ends, to be sealed appropriately so as to be drip proof in case of oil lubrication.
d)	In case of grease lubrication type, open ends of bearings to be appropriately sealed with grease retainers. e) Bearing number of each type of bearing used in EOT Crane shall be specified.

23.4.9.8 Lubrication Arrangement of Bearing, Journals, Ball & Roller Bearings

The arrangement shall comprise of the following :-

a)	Pressure lubrication system comprising gun for lubrication of all easily accessible grease type bearings provided with grease nipples.
b)	Centralized hand operated lubrication system comprising pump and grease pipelines of copper or brass for bearings not easily accessible- e.g. end carriage wheels. For reliability, distribution lines to be double lines for ensuring continuous lubrication in case one line gets choked.
c)	Provision of means to prevent development of excess lubrication pressure at the bearings.
d)	Gear trains to be lubricated by oil bath. Sleeve bearings to be oil lubricated.

e)	Initial lubrication of crane before handing over is contractor's responsibility which shall be done in the presence of Purchaser.
f)	Portable hand operated lubrication equipment viz. grease gun etc. to be included in the supply.
g)	Specification and details of lubricants, Indian standards or equivalents thereof shall be furnished by contractor.

23.4.9.9 Drip Pans And Covers

1.	All bearings and gear cases shall be made oil tight. Suitable drip pans shall be provided to collect oil and grease which may drip from bearings, gear cases and other components of the crane. In case drip proof arrangement is not possible, means for cleaning the drip pans shall be available.
2.	Dust covers shall be provided where necessary to protect sliding and rotating parts and to prevent dust from mixing with the lubricant.

23.4.9.10 Bumpers

Spring bumpers shall be attached to the bridge trucks and the trolley. The bridge shall have four bumpers one at each corner arranged to meet the crane stops squarely. The trolley shall have two spring bumpers on each side placed to ensure that the track stops squarely at the end of the stops. The bumpers shall consist of suitable resilient type capable to absorb the moving energy as per FEM standard.

These shall be fastened to the trucks and the trolley, and shall be capable of bringing the crane and the trolley to a gradual stop when travelling at rated speed in either direction, when the power supply is suddenly cut-off and thus, eliminate excessive stresses and damage to any part of the crane.

23.4.9.11 Holding Clamps Against Earthquake

As a safeguard against movement of the crane off the rails during an earthquake, suitable provision to contain the movement of the crane shall be made. Clamps to keep the crane in locked condition while not in operation shall be provided.

- b) Capacity Of ample capacity to withstand respective duties. Full load torque of motors to be higher than the maximum load torque.
- c) Type & Enclosures All motors should be squirrel cage type to suit 415 V AC, 3 phase, 50 HZ, 4 wire power supply system and be totally enclosed type with or without fan cooling arrangement. The motor shall be suitable for direct on line starting any hoisting/lowering rated load, even in event of frequency control system being out of order. Protection IP-54.
- d) Variation of voltage & Frequency (Steady State) Voltage \square 5%
Frequency: \square 3%
Any combination values of voltage & frequency variations up to above limits.
- e) Pull out torque Not less than 2.25 times the full load torque of motors at rated voltage and frequency.
- f) Insulation Class-F.
- g) Time Rating One hour for all motors.
- h) Temp. Rating Temperature rise not to exceed the limits in Table 1 of IS: 325-1970. Max. Temperatures rise at full load measured by resistance method shall not exceed 60 °C over the average ambient temp of 40 °C .
- i) Rated syn. speed To suit duty for various motions.
- j) Over speed with stand capacity 2.5 (Two and a half) times rated speed or 2000 rpm whichever is

lesser.

- k) Space heaters To be provided in case motor capacity is \leq 20 kW (To suit 240 V AC Supply).
- l) Motor Bearings Roller or ball type. Sealed to prevent grease leakage & entry of dust. Of ample strength to withstand heavy shocks & vibration to which subjected under all conditions of operation.
- m) Tests Type & routine test as per IS:325 - 1970. Copies of test reports to be furnished by the contractor.
- n) Temp. rise measurement By resistance method.
- o) Climate To be located indoor in tropical climate to be provided with protection against fungus, vermin's and corrosion.
- p) Terminal To be arranged such that terminals are easily accessible for inspection and maintenance. Natural ventilation is not to be restricted.
- q) General Sturdy and strong to withstand shocks and vibrations to which they get subjected.

2. Limit Switches

- a) For each type of crane Limit switches for hoisting motion shall be of spindle type while for bridge and trolley motions, these shall be of liver/roller and proximity type with maintained contacts. The number of limit switches shall be as under :-

Motion/ Travel	Travel	Raising	Lowering	Emergency 'up' limit
Each Main Hoist	-	1	1	1
Each Auxiliary Hoist	-	1	1	1
Bridge	2	(Two way self resetting type)		-
Trolley	2	(Two way self resetting type)		-
Monorail	2	1	1	1

- b) Type, contact rating and resetting of limit switches shall be totally enclosed type, 5 A at 240 V AC by reversing the controller.

The Gravity limit switch shall be of heavy duty type for fail safe operation

23.4.10.3 Electrical controls and protection for operation of cranes

General

For Power House Crane:

The cranes shall be provided with control gear located in the operator cabin from where it shall be normally operated by the operator. The control gear shall provide for:

- a) Individual independent control of the crane for all motions and various speeds up to normal speeds.

Transformer/GIS Hall Crane:

The crane shall be provided with control gear located in the operator cabin from where it shall be normally operated by the operator. The control gear shall control all motions and various speeds up to the normal speed.

Control Switches, Levers and Speed Controls

1. For individual independent control (start, stop and motor speed selection) of the cranes, lever type switches shall be provided.
2. The controls shall provide for torque and speed control of the various motors in following number of steps in both direction of motions:

	Hoisting	Long Travel	Cross Travel
a) Main Hoist Motor	Stepless	-	-
b) Bridge Travel	-	Stepless	-
c) Cross Travel	-	-	Stepless

3. The trolley travel controllers shall be provided with drift points in both directions of travel.

23.4.10.4 Speed Regulation

Speed regulation shall be accomplished utilizing a VVVF drive control system for all crane motions. The hoist and travel motions shall be provided with stepless speed-regulation from 5% to 100% of rated speed. Speed control shall be achieved by adjusting the frequency of the motor electrical supply using thyristors. (Combination of Power Rectifier Bridge and Inverter)

The maximum acceleration produced by the control system shall be independent of the rate of change of the control lever position. The speed in the first lowering position shall not exceed 5% of the synchronous hoist speed when lowering any load up to rated load. The speed in the first hoisting position when lifting any load up to 125% of rated hoist capacity shall not exceed 5% of the synchronous hoist speed.

23.4.10.6 Operation of Brakes

Whenever power supply to the various drive motors for various motions are cut OFF. The brakes shall be automatically and instantly applied. The brakes shall also be applied immediately in case of any over speed of the hoist motor in lowering direction.

23.4.10.7 Electrical Interlocks

1	The main circuit breaker (CB) for power supply to the crane shall have interlock providing circuit breaker to be able to be closed only when all the control lever switches for the various motors are in OFF positions. The interlock shall be so arranged that if the contactors for various motors/drives have failed to open, even though the control lever switches have been brought to the OFF positions, the circuit breaker will not close.
2	The master controller shall be provided with a thumb operated auxiliary switch so as to ensure the safety of personnel and equipment in case of loss of attention or death of the operator while operating the crane. The control circuit of the master controller shall be so arranged that all the controls during starting and subsequent operations shall be de-energized unless the thumb operated switch is kept in pressed position. During the operation also if the operator fails to keep it pressed, the power supply to the controls shall be disconnected.
3	The inter locking arrangement shall be such that during tandem operation of cranes, if the main circuit breaker of one crane trips, the circuit breaker of other crane shall also trip.
4	An isolator fitted on the crane bridge which cannot be operated from the floor shall be provided to prevent inadvertent operation of the crane from the floor from pendant switch while maintenance work is being carried out on the crane.

The controls shall have following provisions:-

- a) 3 pole 415 V AC, ACB with rupturing current not less than 20 kA.
- b) A master push button for complete emergency stop in the cabin at a convenient location for cranes
- c) A key operated electrical switch for the control circuit to prevent unauthorized operation and for the safety of maintenance and operation personnel.
- d) Indicating lamp to show that the control circuit is healthy.
- e) Indicating lamp for the main circuit breaker position (OFF or ON).

- f) The radio control push button station with proper indication.

23.4.10.8 Automatic Electrical Protection

The Electrical equipment and circuitry shall be provided with required automatic protection against various faults and mal-operations of the equipment as detailed below:

- a) Protective relays for protection against instantaneous over-current, over-load, single phasing and under voltage for all motors. The OC relay to be adjustable between 2 to 3 times the full load motor current.
- b) Protective relays of motors to trip the main power supply circuit breaker in case of their operation due to fault.
- c) Double pole fuse switches for control and protection of all motor circuits.
- d) Circuit breaker located in operator cabin of 3 pole, 415 V, A.C, totally enclosed type for power supply tapping from the main collectors, with interrupting capacity not less than 20 KA with short circuit, overload & under voltage trip devices and one shunt trip coil and prevention against single phasing, 3 timer relays.
- e) Protection against over speed of the hoist motors which shall cut off the power supply and apply the brakes in case any hoist motor speed increases to 105 % of the rated synchronous speed.
- f) Operation of any protective relays of motors shall trip the motor supply circuits by opening the primary contactors of the motors.
- g) An emergency push button shall be provided in the operator's cabin in all the cranes for emergency tripping. The push button shall be arranged as to immediately cut-off the main supply and apply all the brakes simultaneously irrespective of controller position.

23.4.10.9 Particulars of control gear for equipment

1 Motors

- a) Controls for various motors shall be full magnetic reversing type with definite time limit and frequency controlled acceleration devices for power house cranes.
- b) The motors speed changes may be provided by thyristor or static or magnetic method for cranes.
- c) Master switches for operation shall be vertical type lever handle design pointing in the actual direction of the performed motion when operated. They shall be labeled indicating directions of motion for which they are meant for cranes.

.2 Resistors

- a) All resistors shall be non-breakable, corrosion resistant crane duty, stainless type having low temperature coefficient. The resistor classification shall be in accordance with the National Electrical Manufacturer's Association (NEMA) standard, USA or the corresponding British Standard or any equivalent. The resistors shall be placed in accessible places outside the cages and in well ventilated non-combustible cabinets which will not emit flame.
- b) The resistor shall be of continuous duty for hoist motor. The resistors for bridge travel and trolley travel shall have at least 10 (ten) minute rating.
- c) The general arrangement of the resistors shall be such that a defective bank of elements or part thereof may be easily removed and replaced without being completely dismantled.
- d) Tapping shall be connected by copper rod or strap to an accessible terminal board at the base of each frame. Provision shall be made for making a connection to any grid of each resistor.

- e) The controllers and resistors for motors shall comply with BS: 587-1957. The contactors and starters shall conform to IS: 1822-1967 and IS: 2959-1965 and shall be continuously rated for 150% full load current of motor.

3. Circuit Breaker/Controllers

Each main supply circuit breaker or contactor shall have an interrupting capacity of not less than 40,000 amperes for higher rating cranes and 10,000 amperes for 10 T crane symmetrical at 415 volts. All switches, contactors, primary relays and primary circuits on the controller shall have a thermal capacity corresponding to 40,000 amperes for higher rating cranes for one second without injury and shall have a rating of at least 660 volts and capacity ratings in accordance with the British Standards or IEC. Allowable temperature rises shall be as prescribed in the Indian or other equivalent standards and based on an ambient temperature of 40 deg.C.

4. All switchgear control and protective equipment viz breakers, contactors, controller control switch, HRC fuses, relays, meters etc. shall be housed suitably in a cabinet placed in a manner convenient for operation and maintenance in the cabin. For wiring suitable terminal blocks complete and ready for making external connection shall be provided. The cabinet shall be tropicalized.

5. An emergency push button shall be provided in the cabins of cranes for Emergency Tripping. The push button shall be arranged as to immediately cut off the main supply & apply all brakes simultaneously.

23.4.10.10 Power supply tapping and other electrical arrangement

Collectors

The collectors shall be designed to reduce the sparking between collectors and conductors to the minimum. The minimum clearance between live parts and ground parts shall be 80 mm. The collector shall be suitably covered to avoid accidental contacts.

Trolley conductors

The trolley conductors shall be of PVC/TRS flexible trailing cable type of copper core and of suitable size. It shall be mounted on retracing support.

23.4.10.11 Compact Conductor Bar (Shrouded) Down Shop Leads (Main Runway Conductors)

1.	A safe, robust and compact down shop leads (DSL) system with suitable collectors using latest technology shall be provided for each crane location and length as specified in Parameters above. It shall consist of substantial rolled copper section conductors of adequate capacity shrouded in a rigid PVC cover. The copper bar section shall be supplied with connecting pins for proper joints. The hanger clamps for holding the down shop leads shall be plastic moulded standard interlocking snap-on type. The collectors shall be standard mount for use on straight bar system.
2.	The contractor shall verify and satisfy himself about the adequacy of leveling & grouting etc.

23.4.10.12 Wiring

All electrical wiring shall conform to IS: 1554 (part-I)- 1964 "PVC insulated (heavy duty) electric cables; for working voltage upto and including 1100 Volts". All conductors for primary power, lighting and control circuits shall be insulated for not less than 1100 volts and shall have standard moisture resisting double braid coverings. All conductors between the secondaries of the motor contactors and resistors shall have sufficient current carrying capacity in accordance with the standard specifications and shall be insulated with 1100 volts class asbestos, high temperature type tropical insulation with moisture resisting impregnation. The primary conductors to the motors shall have standard, continuous current carrying capacity of not less than 100% of the rated full load primary current of the motors. All control and lighting conductors shall be of copper and of suitable sizes. All the wiring shall be subject to approval of the Purchaser. All wiring shall be laid in hot dip galvanized metal conduits.

23.5 AUXILIARY SYSTEM AND MISCELLANEOUS COMPONENTS

23.5.1 Illumination and convenient outlets

The permanent AC illumination system on the crane shall consist of six 1000 watt highway beamed flood lighting units to illuminate uniformly the area under the crane. The Lux Level of flood lighting at Machine floor (EL 480m) shall be 200 Lux.

Sufficient and redundant LED based illumination should be provided in operator's cabin to illuminate uniformly the operator's cabin. A convenient outlet at each end of the bridge shall also be provided. The system shall be

supplied from 415 V AC crane power system through 415 V circuit breaker. A portable hand lamp with plug & 25 m long wire shall also be supplied by the Contractor.

23.5.2 Earthing

1.	The crane structure, motor frames and metal cases of all electrical equipment including metal conduits or cable armoring or guards shall be efficiently bonded to facilitate earthing as per latest edition of Indian Electricity Rules 1956 and latest edition of IS-3043.
2.	The contractor shall provide an earthing system to which all equipment under his scope of supply shall be interconnected. This system will in turn be connected by the Purchaser to the power house earth mat to be laid by the Purchaser.

23.5.3 Rails and other Miscellaneous Items

23.5.3.1 Runway Rails

1. One (1) set of runway rails complete with sole plates, anchor bolts, clamps etc. for the bridge travel shall be designed and supplied by the contractor.
2. The runway rails shall be CR-100 type or as per the mechanism size calculations submitted during detailed engineering for approval of purchaser.
3. The rails for bridge travel shall be laid on and fixed to the crane beam by means of anchor bolts etc. The contractor shall supply all the materials including embedded parts for fixing the bridge rails on the crane beam. The supervision and erection of embedded parts for crane rails shall be contractor's responsibility.
4. The rail section shall be selected to suit the crane and the load to be handled. The faces of the rail lengths shall be inclined at angle of 45 degrees to the length to provide oblique faces between rail lengths to prevent jerking of the crane bridge while crossing the gaps

23.5.3.2 Towing Equipment (For Power House Crane)

Provision shall be made on each crane so that either crane when loaded may be pushed or towed by the other. The coupling arrangement shall be adequate for the purpose and easy to operate.

23.5.3.3 Anti-collision devices (For Power House Crane)

Provision of suitable anti-collision devices to prevent the collision of the two cranes shall be made.

The anti-collision devices which may be of mechanical actuator-limit switch type or any other suitable type shall be installed on the cranes. Details of device shall be furnished.

23.5.3.2 End Stops

Suitable end stops shall be provided for the crane to be fixed either on the end wall faces or on crane beams. Load cell arrangement as given in the clause 15.12 of IS 3177 for all the cranes shall be provided.

23.6 DRAWINGS, DOCUMENTS AND DESIGN CALCULATIONS

After award of contract, the contractor shall furnish all drawings, documents, design calculations, data, manuals & other necessary literature, pertaining to equipment offered by them & so specified under various clauses, in accordance with requirements stipulated in “clause 1.19 of Section – 1 i.e. General Technical Specification (GTS)”. A comprehensive list of all such drawings/documents planned to be submitted for reference/approval shall be provided beforehand for approval of the purchaser as already explained in clause no. 1.19.6 of Section – 1 (GTS). The list of drawings & documents to be furnished for approval / reference shall not be limited to the following: -

- i. Drawings, documents, design calculations, literatures, manuals as listed in Annexure – C of Section -1 (GTS) referred under clause no. 1.19.6
- ii. Detailed quality assurance plan, giving complete specifications of the materials and specifications relating to inspection and testing of materials and finished components.
- iii. All drawings having bearing on civil.

- iv. foundations, equipments foundation details and loads
- v. Arrangement, installation, foundation, plan, section, detailing of main equipment and sub-assemblies including piping, control & instrumentation system.
- vi. All Electrical, Hydraulic & Control Drawings such as Electrical Panels OGA, Cable Block & Termination Diagram, Schematic Diagram, JB/MB/Kiosk Diagram etc. in respect of this section.
- vii. All manufacturing drawings not specifically covered under approval/reference category shall be submitted for record and facilitate inspection of the component in the shop and assembly at site.
- viii. Any other drawings, documents, design calculations, literatures, manuals etc. not covered anywhere in the specification, but required to be furnished for approval / reference of employer for suitability of design to fulfill the scope of work.

23.6.1 3-D Drawing & Documents

Refer GTS clause 1.19.7

23.7 SHOP ASSEMBLY, INSPECTION AND TESTS

23.7.1 Shop test

23.7.1.1 Testing of Crane Assembly

All the cranes shall be completely assembled, inspected, operated and tested in the shop. The crane shall be tested, both for hoisting and cross traverse motion. Travelling gear shall be run light to check shaft and gear alignments. The tests shall cover but shall not be limited to the following:-

- i. Overall inspection of crane, dimensions, spans, clearances, hook reaches and ratings.
- ii. Main hoist lifting motion with test load of 100% and 125% of rated load.
- iii. Auxiliary hoist lifting motion with test load of 100% and 125% of rated load
- iv. All other tests as mentioned below.

a) Part-I De-energized Tests

- i) Steel Structure
- ii) Bolts and Nuts.
- iii) Securing devices for all wire ropes.
- iv) Crane Cabin-Platform.
- v) Gangway.
- vi) Surface/Painting.
- vii) Boggies - Traveling Wheels.
- viii) All Main Hooks W / Housing and Safely Latch.
- ix) All aux Hooks W/Housing and Safety Latch.
- x) Bolts for all motors.
- xi) Inspection of spare parts.
- xii) Insulation tests of various drive motors.
- xiii) Air gap of brakes measurement.
- xiv) Examine wire ropes.
- xv) Inspect clean and oil all moving mechanical parts.
- xvi) Check oil level in hoists and traveling motors gearboxes and ‘top-up’.
- xvii) Check and grease rope guide und drums.
- xviii) Check and examine cable trolley, track system, moving and connection parts.
- xix) Check bus-bar suspension bolts, brackets and current collectors.
- xx) Check and examine all electrical control panel cables, connection terminals.
- xxi) Check and examine all contactor and thermal protection device
- xxii) Check cable glands and insulation of cables.
- xxiii) Setting on the control card (APC, exi. I/O comm.). if applicable
- xxiv) Clean up dust and oil.

b) Part-II Energized Tests

- i. Testing of the APC and exi. I/O boards, if applicable.
- ii. Testing of the digital inputs/outputs, if applicable
- iii. Testing of the analogue in puts, if applicable.
- iv. Testing or the control panel function.
- v. Testing of the lights.
- vi. Testing of the anti-condensation heaters.
- vii. Testing of the phase order of the 415 V AC.

c) Part-III Function Tests (No Load)

- i. Testing of the fault panel functions.
- ii. Simultaneous operation of main and aux. hoists.

- iii. Travel and hoisting operations.
- iv. Working range.
- v. Control of limit switches.
- vi. Test of emergency Slop.

d) Part-IV Deflection Test

- i) The deflection test shall be carried out with the safe working load at rest and with the trolley in a central position. The measurement shall not be taken at the first application of the load. The datum line for measuring the deflection should be obtained by placing the crab on the extreme end of the crane span with smaller hook approach. The vertical deflection caused by the safe working load and weight of crab in central position shall not exceed the limits specified in the relevant standards.
- e) Test certificates in respect of rail, sole plates, clamps etc.as per the relevant IS

23.7.2

Field test

All field tests including tests during installation. Pre-commissioning, commissioning, performance & field acceptance tests shall be conducted by the contractor, in presence of representatives of the employer.

Test on Rails

- i) Leveling and alignment of sole plates
- ii) Measurement of span, diagonally, straightness, waviness, (horizontal and vertical) as per approved drawings.

B No-Load Static Tests

- i) Checking of gears, bearings, couplings and rotating parts for proper oil level or lubrication and hydraulic brakes for brake fluid
- ii) Checking of the controller for each motion to ensure that hook and travel motions is in accordance with marked controller directions.
- iii) Checking of satisfactory operation and to determine if lamp fixtures on each bridge walkway are operable and convenient for relamping.
- iv) Measurement of throat openings of the hooks &, checking with respect to dimensions furnished by the supplier.
- v) Overall inspection & verification of crane dimensions, clearances, hook reaches & other important items.
- vi) Verification of insulation resistance for electrical equipment and wiring

circuits.

- vii) Operational tests on each controller, switch, contactor, relay and other control devices including limit switches.
- viii) Operational tests on all protective devices.
- ix) Tests for checking correctness of all circuits, interlocks and sequences of operation.

C No Load Operation Tests

- i) Each hoist will be run in both the hoisting and lowering direction for the full length of the hook lift until the limit switches stops travel. Both upper and lower limit switches will be checked for proper setting (for resulting hook elevation and amount of rope remaining on drum after switch stops travel) and operation. The additional liver travel limit switches will also be checked by temporarily by-passing the action of the normal upper limit switch. Each hoist will be checked to determine whether the hooks operate within the specified maximum speed ranges. At least two (2) complete raising and lowering operations will be made for EOT hoist at maximum speed. Proper alignment, quiet operation and any major tendency toward overheating of motors, hearings und gear drives will be checked. Hoist brakes will be checked to determine whether they are functioning properly.
- ii) All hook approaches, both the side approaches to the rails and the end approaches to the end walls, will be checked for conformance to approved shop drawings and the requirements of these specifications. The limit switches shall allow the specified hook approaches or better approaches.
- iii) The trolley will be run in each direction of travel for at least four (4) complete cycles of trolley travel to disclose any tendency towards noisy operation and misalignment at bearings, gearing or motor. The trolley shall be checked to determine whether the trolley travels at the required speed. The motion of the trolley upon setting the controller to the "off" position shall he checked to determine whether the travel brake correctly stops the trolley.
- iv) The bridge drive shall he run in both directions of travel for the full available length of runway. The test will consist of a check for quite operation as well as a check of both the electric and hydraulic brakes. The bridge shall be run at full speed in both directions to determine whether the drive operates within the specified maximum speed range.

The electric brake and drift points shall be checked for smooth and effective operation.

D Rated Load Tests

a) Hoist

- i) With each hoist loaded with its rated load to tests outlined under '*No-Load Operation Tests*' above shall be repeated except for the additional block-operated over travel limit switch operation need not be rechecked. The operation of the electric hoist brake shall be carefully checked. All components shall be checked for overheating, Operating speed on the maximum speed point shall be checked and recorded. The maximum lowering speed will be checked to ensure that it is not more than 125% of the no-load hoisting speed. The control system will be checked for proper operation. The first speed point shall be checked to ensure that it does not exceed 5% of the no-load hook speed in the lowering direction and 25% in either direction. The entire hoist shall be checked for overheating after completing the hoist and lowering cycle with the test load.

- ii) The loaded hoist shall be checked to determine whether the hoist control and the solenoid brake satisfactorily control the handling of the load. The hoist must demonstrate its ability to raise, lower and hold the rated load in any position.

b) Trolley Travel

The tests outlined in "No-Load Operation Test- iv)" above shall be repeated for the trolley with the hoists loaded with their rated load.

c) Bridge Travel

The tests outlined in "*No-Load Operation Tests- iv)*" above shall be repeated for the main hoist loaded with their rated load.

E) Overload Tests

a) Hoists

With each hoist loaded with 125% of rated load, the hoist will be checked to determine whether it can raise, lower or hold the overload in all speed positions without a drift. Each hoist will be checked to determine that the load shall not lower on any hoisting position. The throat openings of all hooks will be pre-measured and recorded after the overload test and compared to the initial measurements to be checked for deformation.

b) Bridge

The: bridge structure shall be checked for excessive deflection while loaded with 125% of their rated capacity with the trolley at the center of the crane span.

c) Travel

No trolley or bridge travel shall be required during overload tests.

F) Test Load Frames

a) The supplier shall design, submit shop drawing, manufacture and deliver suitable cradle or a test load frame and all required slings to be used for the rated load and overload tests on each of the cranes to be furnished. The test loads will be made up of steel test weights or any other suitable material and shall be arranged by the contractor including all logistics and transportation. Standard sizes of semi finished steel ingots or slabs can be used as test weights.

b) The crane shall be completely tested by contractor, including the rated load test and the overload test. Test load frames shall be used for all the Load test required such as the testing of the tangs of sister hooks and centre pin holes in sister hooks. The Crane shall have its hooks tangs tested first for the rated load test.

c) All pins or other devices for attaching the frames to the hooks and slings and other required accessories for all required tests shall be provided.

d) All structural components of the test load frames shall be cleaned before testing.

e) The following tests shall be carried at site in addition to the tests indicated above

A De-Energized Tests:

i) During commissioning at site

B Deflection Test

Deflection of girders with full loads on all crane to be determined using theodolite or other optical instrument after load has been applied for 15 minutes.

C Tandem operation test for Power house crane including anti-collision test.

- i) Electrical and mechanical interlock checking
- ii) Movement checking with tandem beam

23.7.4 Performance testing

After completion of commissioning tests and commissioning of respective cranes, these shall remain in the contractor's custody for erection activities till the commissioning of last generating unit. The contractor shall be responsible for maintenance (providing manpower, consumable, spares etc.) of EOT Cranes including rails and operator during this period.

The contractor shall make good any damages and do the capital maintenance of cranes at the time of commissioning of the last unit.

If nothing unusual is observed after capital maintenance, the test service period of seven days shall follow. During the test service period, the cranes must perform satisfactorily.

The contractor is responsible for the equipment during the test service and also for the way it is operated. However, Employers' personnel shall operate the equipment under the guidance during the test service period

During this test service period, the system / installations must perform satisfactorily & if any defects are observed, same shall be rectified by contractor without any financial implication to employer.

23.8 PACKAGING, HANDLING & SITE STORAGE

The contractor shall be liable for all packing, handling and site storage of all the equipment till the installation is handed over to the Engineer in charge.

23.9 SITE INSTALLATION AND COMMISSIONING

23.9.1 General

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

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

The Contractor shall supply sufficient number of erection and commissioning spare based on their experience so that erection, testing and commissioning work progresses smoothly and is not hampered for want of such spares. These spares shall be in addition to the spare parts described under clause "Spare Parts".

23.10 TOOLS AND INSTRUMENTS

~~The contractor shall supply the tools & instrument as per Schedule V.~~

23.11 SPARE PARTS

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

23.11.1 Mandatory Spare Parts

The Contractor shall supply the mandatory spare parts as per Schedule-III.

23.11.2 Recommended Spare Parts

~~The Contractor shall furnish the list of recommended spare parts at Schedule-IV.~~

SCHEDULES FOR EOT CRANES

INDEX

Schedule No.	Description
I	Schedule of requirements for Main Equipment
II	Schedule Of Data Requirement Sheet (To Be Filled By Bidder)
III	Schedule of requirement for Mandatory spares
IV	Schedule of Recommended spares
V	Schedule of Tools for Mechanical Workshop/Electrical Lab items
VI	Schedule of Type Tests, Model Test & Test & other test (Category-I)
VII	Schedule of Technical Deviation

SCHEDULE - I

SCHEDULE OF REQUIREMENTS for Main Equipment

S.NO.	Description	Quantity
1.	EOT Cranes as per Section- 23	Lot

SCHEDULE II

Schedule Of Data Requirement Sheet (To Be Filled by Bidder)

Part A

S.No.	Description	PH Crane		Transformer Hall/ GIS Hall Crane	
1.	Capacity (in Tons)				
a)	Main lifting hoist				
b)	Auxiliary hoist				
c)	Mono rail hoist				
2.	Span				
3.	Duty class of cranes				
a)	Hoist (Hoisting or lowering)				
i)	Normal speed				
ii)	Micro speed				
b)	Trolley Travel				
c)	Bridge Travel				
5.	Acceleration in long travel Motion.				
6.	Vertical Hook Reach/Travel of lifting hook.				
7.	Hook Reaches	U/S	D/S	U/S	D/S
a)	Crane 1				
b)	Crane 2				
8.	Nos. of wheel for				
a)	Bridge				
b)	Trolley				
9.	Minimum factor of safety for				

	i) Structure		
	ii) Rope		
10.	Number of motors for long travel		

Part B

Sr. No.	Description	PH Crane	T/F Hall Crane
1.	Name of the manufacturer		
2.	Type and class of crane		
3.	Standard to which crane conforms		
4.	Effective span (centre to centre of runway rails)		
5.	Weight of crane		
a)	Total weight of crane including electrical equipment & trolley.		
b)	Weight of each Bridge girder assembled and ready for erection		
c)	Total weight of Trolley including electrical equipments		
d)	Weight of each end carriage (Trucks) as assembled ready erection.		
6.	Full load speed (Mtrs/Min) for		
a)	Bridge travel		
b)	Trolley cross travel		
c)	Monorail travel		
d)	Hook Hoisting/Lowering at		

i)	Full load		
ii)	Half load		
iii)	No load		
iv)	10 T monorail hook		
7.	Minimum possible travel of		
a)	Bridge drive		
b)	Trolley drive		
c)	Monorail drive		
d)	Main lifting hoist		
e)	Monorail hoist		
8.	Distance from Machine hall floor to top of crane rail		
9.	Minimum working clearance required:		
a)	Between center of crane rail and the nearest side obstruction		
i)	Upstream side of Power House.		
ii)	Downstream side of Power House.		
b)	Between the top of crane and the lowest over-head obstruction		
10.	Terminal Position of		
a)	Main lifting hook from center of crane rails on the		

i)	Upstream side		
ii)	Downstream side		
b)	Monorail hook from the center edge of crane rail on the		
i)	Upstream side		
ii)	Downstream side		
c)	Main lifting hook from the inner edge of walls at the		
i)	Service bay end		
ii)	Power house end (Beyond Unit No.4)		
d)	Hook at maximum lift below top of crane rails of		
i)	Main hook		
ii)	Monorail hook		
11.	Operator's Cabin		
a)	Distance between center of crane rails to the cabin end wall nearer to the rails		
b)	Cabin width at the base		
c)	Base of cabin from top of crane rails		
d)	Size of cabin (LxBxH)		
12.	Crane Bridge		
a)	Type of main girders		

b)	Material		
c)	Details of construction		
d)	Slenderness ratio		
i)	Main compression members		
ii)	Bracing and secondary members		
iii)	Ratio of unsupported lengths of the horizontal protection of any riveted tension members to the least radius of gyration.		
iv)	Particulars of unit stresses assumed on various components		
13	End Truck		
a)	Type and number		
b)	Material		
c)	Details of construction.		
d)	Wheels per truck		
e)	Center to center distance of wheels		
f)	Maximum load excluding impact on traveling Wheels		
g)	Type of drive system		
14.	Trolley		
a)	Type		
b)	Material		

c)	Details of construction		
d)	No. of wheels		
15.	Wheels	Truck	Trolley
a)	Type		
b)	Total Number		
c)	No.of drive wheels		
d)	Diameter		
e)	Width		
f)	Material/chemical composition		
g)	Type of bearings		
h)	Name of manufacturer		
16.	Rails	Main Runway	Trolley Runway
a)	Section		
b)	Length		
c)	Weight/meter		
d)	Name of manufacturer		
17.	Winding Drum	Main Hoist	Main Hoist
a)	Material and type of construction		
b)	Diameter and length (mm)		
c)	Depth of grooves		
d)	Pitch diameter of rope grooves		



e)	Thickness of drum bottom of grooves		
f)	Crushing and bending stresses for hoist drums		
g)	Name of manufacturer		
18.	Sheaves	Main Hoist	Main Hoist
a)	Material		
b)	Groove diameter		
c)	Number of rope sheaves		
d)	Bearing arrangement		
e)	Name of manufacturer		
f)	Diameter of sheaves		
g)	No .of pulleys		
19.	Hoisting Ropes	Main Hoist	Main Hoist
a)	Construction		
b)	Diameter of rope		
c)	Number of falls		
d)	Minimum factor of safety		
e)	Quality of steel		
f)	Name of manufacturer		
20.	Crane hook and bottom blocks	Main Hoist	Main Hoist
a)	Type		

b)	Lifting capacity		
c)	Material		
d)	Bearing arrangement		
e)	Name of manufacturer		
21	Gears (Give details for each type)		
a)	Type of drive		
b)	Material		
c)	Type of lubrication		
d)	Type of enclosures		
e)	Name of manufacturer		
22.			
a)	Between motor and gear box		
b)	Between gear box and shaft		
23 (a)			
	Particulars of Motor	Cross Travel	
a)	Number		
b)	Type and manufacture		
c)	Voltage, phase & frequency		
d)	Rating in kW		
e)	Class of insulation		
f)	Rating in minutes of continuous operation		

g)	Speed in rpm		
h)	Starting torque		
i)	Break down torque		
j)	Locked rotor current		
k)	Max. temperature rise		
l)	Type of enclosures		
m)	Size		
23 (b)			
	Particulars of Motor	Cross Travel	
a)	Number		
b)	Type and manufacture		
c)	Voltage, phase & frequency		
d)	Rating in kW		
e)	Class of insulation		
f)	Rating in minutes of continuous operation		
g)	Speed in rpm		
h)	Starting torque		
i)	Break down torque		
j)	Locked rotor current		
k)	Max. temperature rise		
l)	Type of enclosures		
m)	Size		

23 (c)			
	Particulars of Motor	Cross Travel	
a)	Number		
b)	Type and manufacture		
c)	Voltage, phase & frequency		
d)	Rating in kW		
e)	Class of insulation		
f)	Rating in minutes of continuous operation		
g)	Speed in rpm		
h)	Starting torque		
i)	Break down torque		
j)	Locked rotor current		
k)	Max. temperature rise		
l)	Type of enclosures		
m)	Size		
24 (a)			
	Particulars of brakes	Trolley travel	
a)	Type of brakes used		
b)	Total number of brakes provided & their locations		
c)	Braking torque		

d)	Dynamic braking for lowering motion		
e)	Name of manufacturer		
24 (b)			
	Particulars of brakes	Trolley travel	
a)	Type of brakes used		
b)	Total number of brakes provided & their locations		
c)	Braking torque		
d)	Dynamic braking for lowering motion		
e)	Name of manufacturer		
24 (c)			
	Particulars of brakes	Trolley travel	
a)	Type of brakes used		
b)	Total number of brakes provided & their locations		
c)	Braking torque		
d)	Dynamic braking for lowering motion		
e)	Name of manufacturer		
25 (a)			
	Particulars		
a)	Number		
b)	Type & size		
c)	Material of contact		

d)	Current and voltage rating		
e)	Name of manufacturer		
25 (b)			
	Particulars		
a)	Number		
b)	Type & size		
c)	Material of contact		
d)	Current and voltage rating		
e)	Name of manufacturer		

25 (c)			
	Particulars		
a)	Number		
b)	Type & size		
c)	Material of contact		
d)	Current and voltage rating		
e)	Name of manufacturer		
26 (a)			
	Particular		
a)	Type of controller		
b)	Number of steps		
c)	Type of resistors		

d)	Continuous rating of resistors		
e)	Ohmic value		
f)	Name of manufacturer		
26 (b)			
	Particular		
a)	Type of controller		
b)	Number of steps		
c)	Type of resistors		
d)	Continuous rating of resistors		
e)	Ohmic value		
f)	Name of manufacturer		
26 (c)			
	Particular		
a)	Type of controller		
b)	Number of steps		
c)	Type of resistors		
d)	Continuous rating of resistors		
e)	Ohmic value		
f)	Name of manufacturer		
27 (a)			
	Particular		

a)	Type of conductors		
b)	Size		
c)	Current carrying capacity		
d)	Voltage drop		
e)	Type of collectors		
27 (b)			
	Particular		
a)	Type of conductors		
b)	Size		
c)	Current carrying capacity		
d)	Voltage drop		
e)	Type of collectors		
27 (c)			
	Particular		
a)	Type of conductors		
b)	Size		
c)	Current carrying capacity		
d)	Voltage drop		
e)	Type of collectors		
28.	Bearings		
	Details for different bearings		
29	Power supply requirements		

a)	Total load of one crane		
b)	Voltage		
30.	Protective Panel		
a)	Main conductor		
i)	Type		
ii)	Location		
iii)	Standard to which conforms		
iv)	Low voltage protection provided		
b)	Overload protection		
i)	Manufacturer		
ii)	Type		
iii)	Range of settings		
c)	Emergency push button		
i)	Manufacturer		
ii)	Location		
31.	Illumination		
a)	Illumination in cabin		
i)	Manufacturer		
ii)	Number and type of fixtures		
iii)	Voltage		
b)	Illumination of bridge		
i)	Manufacturer		

ii)	Number and type of fixtures		
iii)	Voltage		
c)	Portable hand lamp with wiring furnished		
d)	Supply transformer and all other accessories required included.		
32.	Particular of safety devices		
33.	Wiring		
a)	Type and size of cables used for power wiring		
b)	Type and size of cables used for control and aux. circuit wiring		
c)	Method of wiring		
34.	Standards adopted for		
a)	Materials		
i)	Structural steel		
ii)	Steel plate		
iii)	Cold finished steel		
iv)	Cast steel		
v)	Forged steel		
vi)	Cast iron		
vii)	Bronze		
viii)	Brass		
ix)	Bolts, nuts and stud		
x)	Other miscellaneous items		

b)	Equipment		
i)	Rope drum		
ii)	Sheaves		
iii)	Hooks		
iv)	Bearings		
v)	Couplings		
vi)	Gears		
vii)	Shaft		
viii)	Wheels		
ix)	Wire ropes		
x)	Keys and keyways		
xi)	Motors		
xii)	Resistors		
xiii)	Brakes		
xiv)	Switchgear		
35.	Minimum factor of safety for each major component		
36.	Tools and accessories supplied		
37	Heaviest package for shipment		
a)	Name		
b)	Weight		

c)	Dimension (l x b x h)		
38.	Largest package for shipment		
a)	Name		
b)	Weight		
c)	Dimension (l x b x h)		

Note:

- 1. For items not listed above but mentioned in the contract required to complete the system, contractor has to submit the performance/ compliance certificate before supply.**
- 2. The above parameters shall be filled by the bidders as per the available data. However, same shall be submitted by contractor during detailed engineering stage.**

SCHEDULE III

SCHEDULE OF MANDATORY SPARES

Sr. No.	Description of spares	Quantity	
		PH Crane	Transformer /GIS Hall Crane (50/10T)
1	Pair of brake shoe with lining for each size of brake used viz. D.C. operated E.M, or Hydraulic thruster operated.	2 Sets	1 Set
2	Pair of brake linings with rivets for each size of brake used.	2 Sets	1 Set
3	Main springs for each size of brake used.	2 Nos.	1 No. each
4	Brake coils for each size of brake used.	2 Sets	1 Sets
5	Thruster of each size used.	2 Nos.	1 No. each
6	Pair of oil seals for each gear box used on crane.	6 Sets	1 Sets
7	Contactors of each size used.	2 Sets	1 Sets
10	Overload relay for each motor.	2 Nos.	1 No.
11	3 No. fuse links of each sizes used on crane	2 Sets	1 Sets
13	Fuse links of each size used	1 Sets	1 Sets
14	LT Bearings	1 no.	1 no.
15	CT Bearings	1 no.	1 no.
16	Flood light illumination	1 no.	1 no.
17	Indication lamp of DSL	2 set	1 set
18	Auxiliary relay, contactor and timers	2 nos. each	1 nos. each
19	MCCB and fuses	1 set each	1 set each

Set means quantity required for one unit.

SCHEDULE - VII

SCHEDULE OF TECHNICAL DEVIATIONS

Sr. No.	Clause no.	Specified Requirement	Deviation	Reasons/ Justification
1.	2.	3.		

Bidder's Guarantee:

We guarantee that the above deviations in no way shall adversely affect the performance and other requirements of the equipment stipulated in the specifications.



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

**SECTION IA
ANNEXURES**



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

**ANNEXURE-I
MAKES OF SUB-VENDOR ITEMS**

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- MAHARASHTRA	(FOR LT MOTORS ONLY)



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		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		



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		ABB		
		BCH		
		SCHNEIDER (Earlier TELE MACHANIQUE)		
14.	TRANSFORMERS	INDCOIL		
		LOGICSTAT		
		KAPPA		
		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	



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		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	
		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	
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	



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		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 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	
		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	
21.	TRAILING CABLES	NICCO	KOLKATA	



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		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 INDUSTRIES LTD	GWALIOR	
		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	



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		TORRENT CABLES LTD	AHMEDABAD	
		THERMO CABLES LTD	HYDERABAD	
		TIRUPATI PLASTOMATICS PVT. LTD	JAIPUR	
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	
		SRIRAM CABLES PVT. LTD	NEW DELHI	
		TORRENT CABLES LTD	AHMEDABAD	
		UNIVERSAL CABLES LTD	SATNA	
24.	CABLE GLAND	COMMET		
		SUNIL&CO		
		ARUP ENGINEERING		
		JAINSON		
		DOWELL		
		ALLIED TRADERS & EXPORTERS	NOIDA	



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		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		
		ABB		
		SCHNEIDER		
32.	PANELS	OEM		
		RITTAL		
		PYROTECH		



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
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		
35.	VVVF	YASKAWA		
		ABB		
		SIEMENS		
		SCHNIEDER		
		FUJI ELECTRIC		
		MITSUBISHI ELECTRIC		
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 Motors only
		ELECON ENGINEERS		
		SHANTI GEARS		
		PBL*		
		NAW*		



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		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. BIDDER TO PROPOSE SUB VENDOR WITHIN 4 WEEKS OF PLACEMENT OF LOI. THEREAFTER NO REQUEST FOR ADDITIONAL SUB-VENDOR SHALL BE ENTERTAINED.
3. 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.



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

ANNEXURE-II MANDATORY SPARES

Mandatory spares list shall be as per “**Customer’s specification**” Volume IIB (PTS), SCHEDULE III Also refer unpriced bid. for the same.

ANNEXURE III - TOOLS & TACKLES

One (1) lot of 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) each pen hammer 1 lb. & 2 lb.
- e) One (1) set of Allen key set.
- f) One (1) feeler gauge set.
- g) One (1) oil can size 1 pint cap along with a funnel for oil filling.
- h) Fuse Puller
- i) Panel indicating lamp puller
- j) Two (2) set of Hydraulically operated jack of suitable Capacity
- k) Three (3) sets of Grease gun hand lever type
- l) Any other Tool/Tackle required for maintenance

Note:

1) 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.

2) Refer “Customer’s specification” Volume IIIA(GTS), Clause no. 3 (Spare Parts and Tools).



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

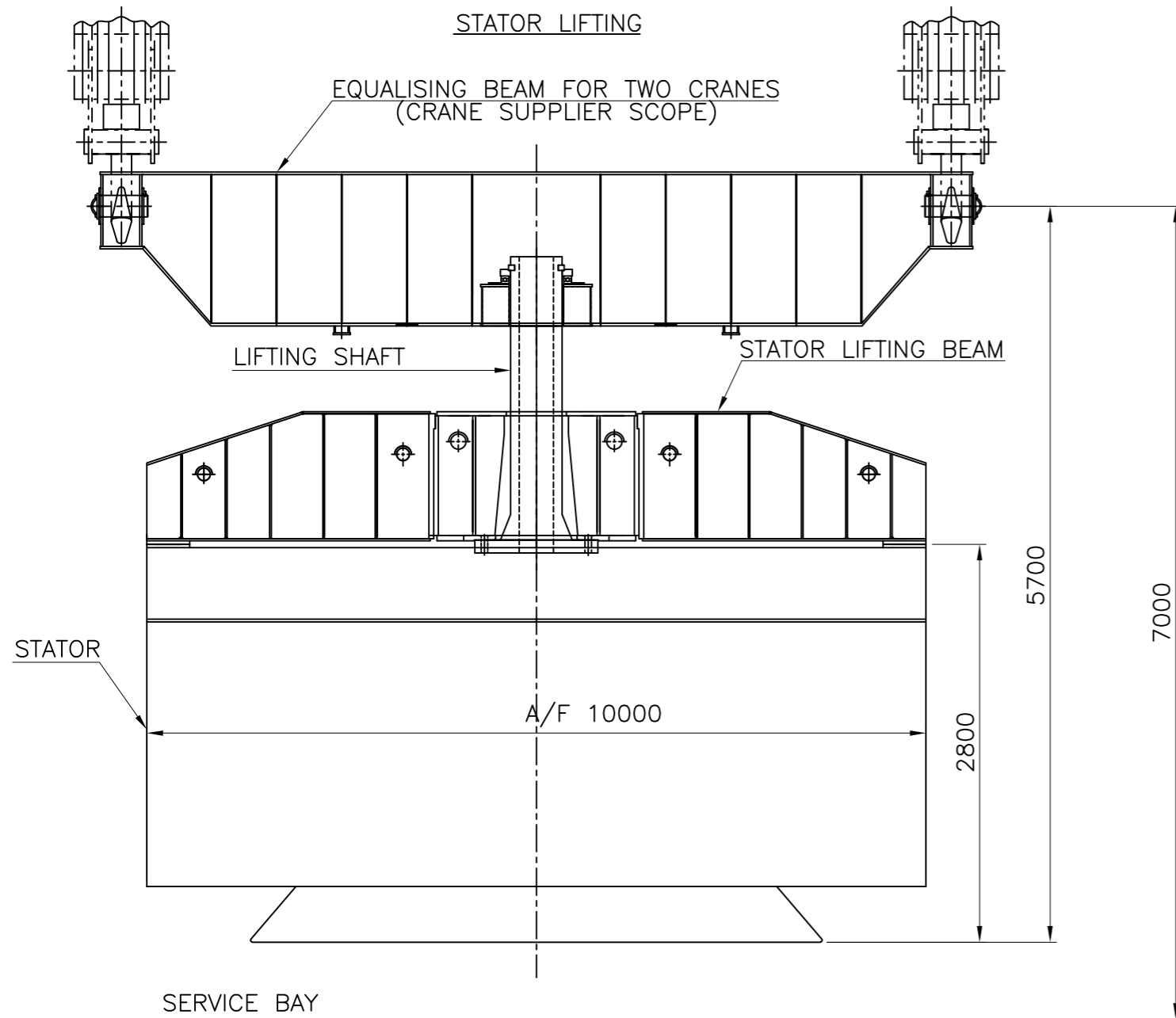
SECTION IA

REV. 00

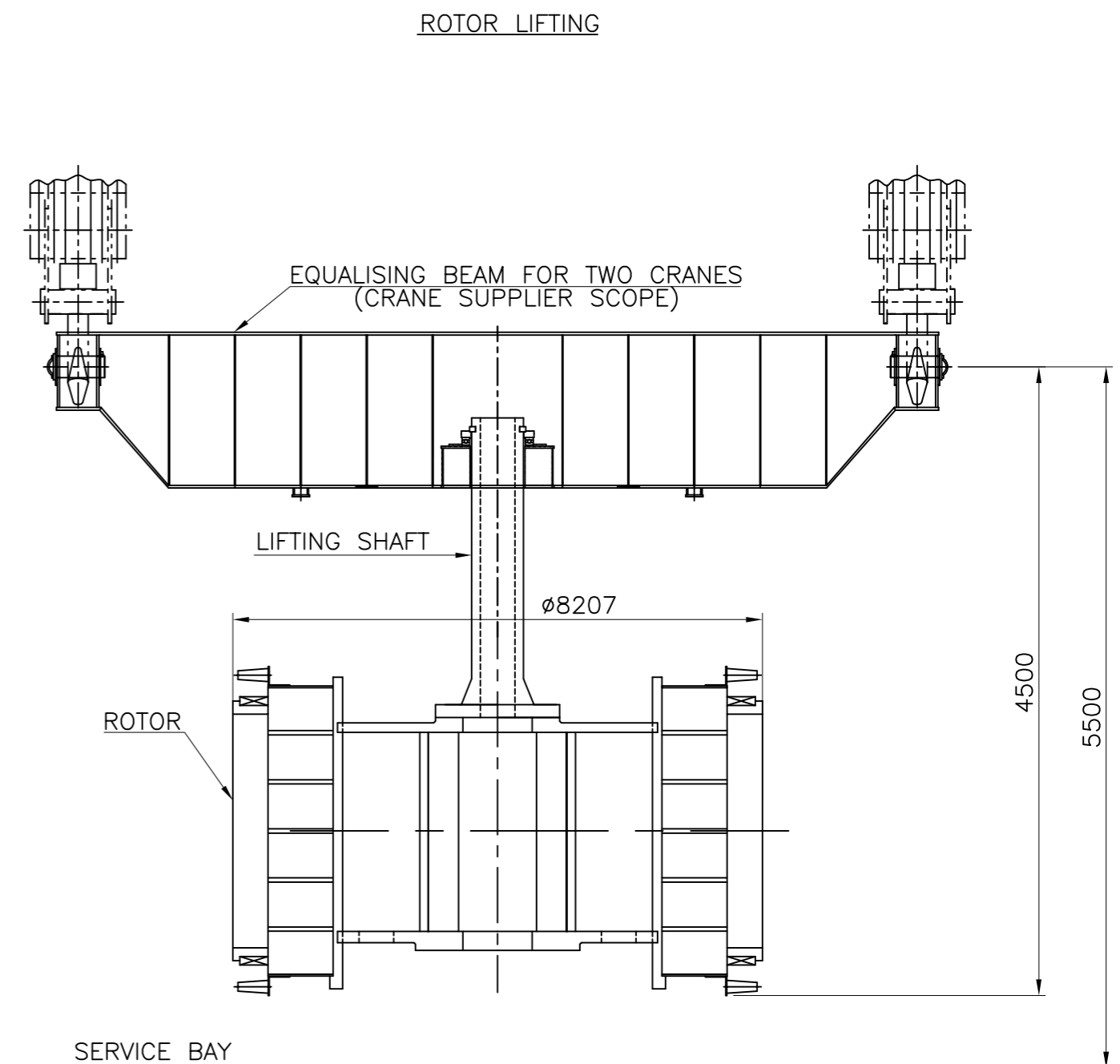
MAR 2026

ANNEXURE IV
COMPLIANCE DRAWINGS

ALL DIMENSIONS ARE IN mm.



TOTAL LIFTING WEIGHT OF WOUND STATOR ASSEMBLY = 170 T
(INCLUDING STATOR LIFTING BEAM AND LIFTING SHAFT)



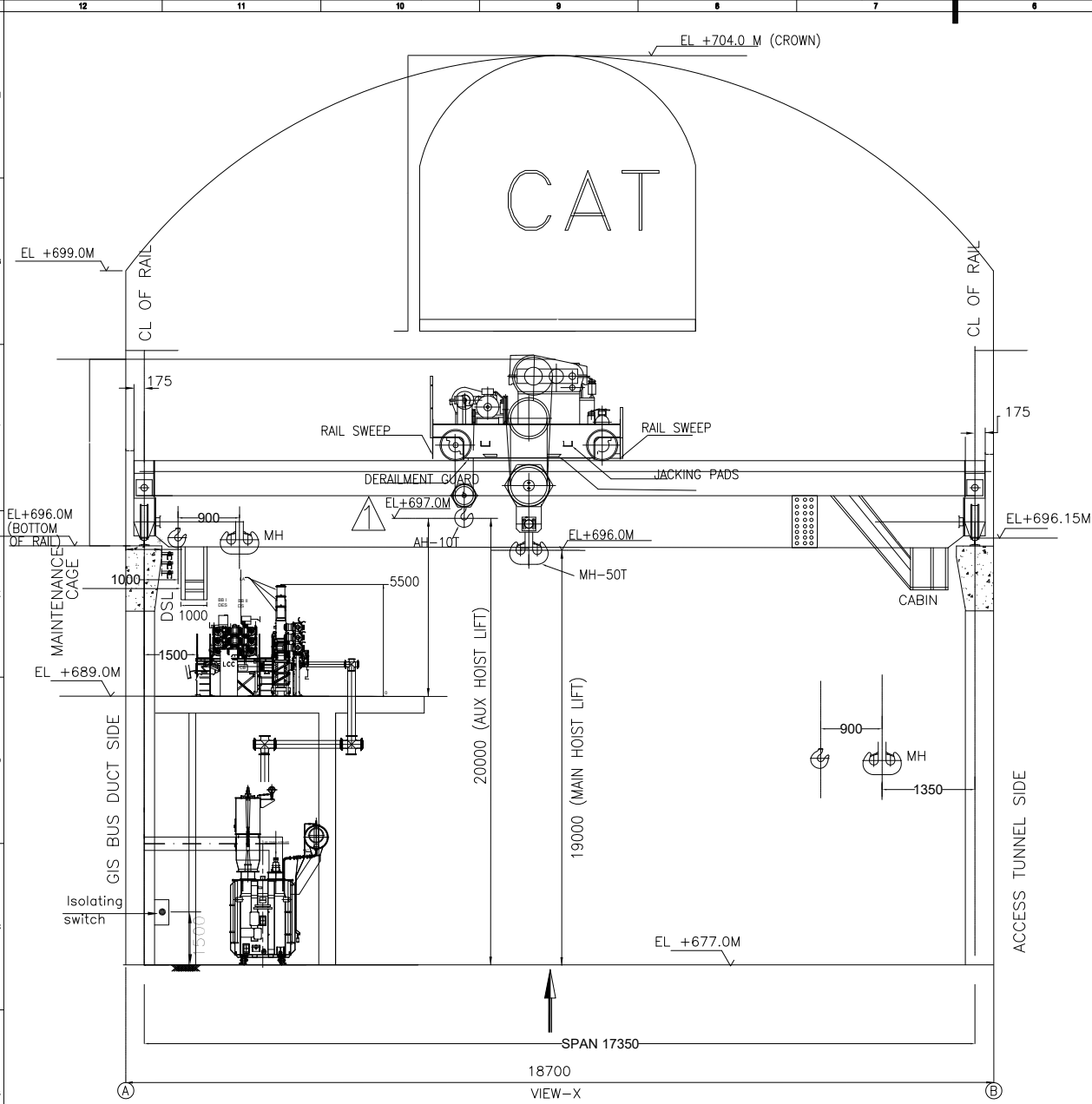
TOTAL LIFTING WEIGHT OF ROTOR ASSEMBLY = 220 T
(WITHOUT GENERATOR SHAFT INCLUDING LIFTING SHAFT)

NOTE:- THIS DRAWING IS FOR TENDER PURPOSES ONLY.

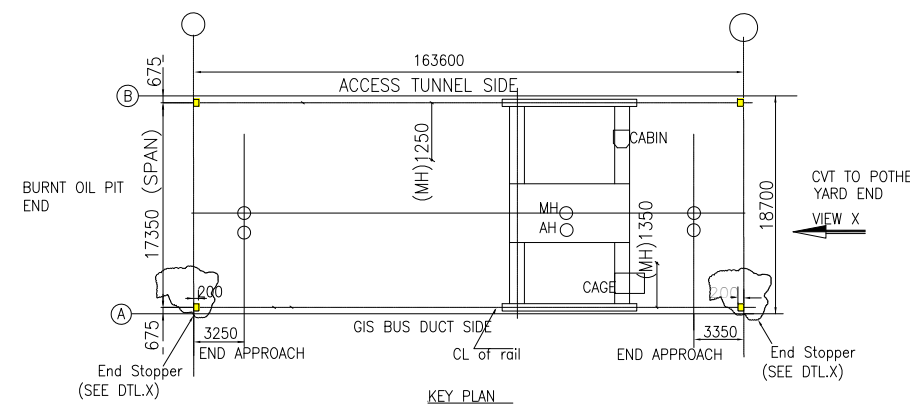
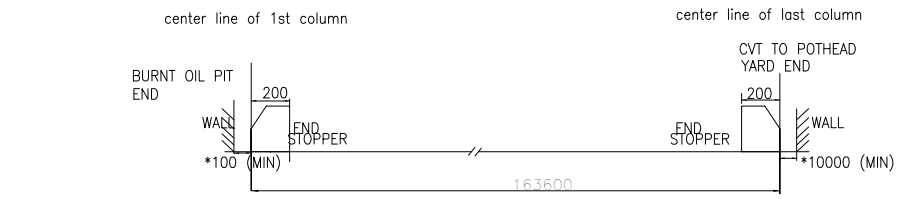


BHARAT HEAVY ELECTRICALS LIMITED.
BHOPAL

REVISION	DATE.						
CHECKED	APPD.	PROJECT/CUSTOMER SUNNI DAM HEP (5x73MW)/M/s SJVNL		NAME	SIGN.	DATE.	
		TITLE. LIFTING ARRGT. OF STATOR & ROTOR		DRAWN			
		DEPT. HGE	CODE. 403	SCALE NTS.	TECH.DOCU.NO. HGS-2266	CHECKED ILA YADAV	04.02.25
						APPD. R.GAJBHIYE	04.02.25



5.	LT SPEED/CREEP SPEED	15.0/Ajustable from min. to max. (M/Min)
4.	CT SPEED/CREEP SPEED	10.0/Ajustable from min. to max. (M/Min)
3.	AH HOISTING/CREEP SPEED	5.0/Ajustable from min. to max. (M/Min)
2.	MH HOISTING/CREEP SPEED	3.0/Ajustable from min. to max. (M/Min)
1.	DESIGN STANDARD	IS 3177 & IS 807
SL NO.	PARAMETER	VALUE

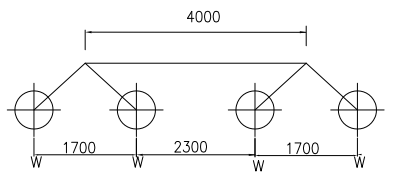


NOTES

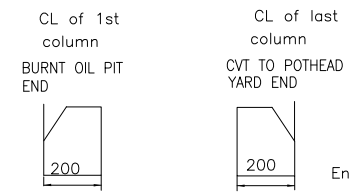
- DRAWING IS NOT TO THE SCALE.
- ALL DIMENSIONS ARE IN MM & ELEVATIONS IN METRES.
- DIMENSIONS MARKED WITH * TO BE CONFIRMED BY SJVN LTD/CIVIL CONTRACTOR.
- TRANSPORTATION LIMIT (LXBXH) - 10M X 5M X 5M
- CRANE WILL STOP AT 10M FROM CVT TO POTHEAD YARD END

REFERENCE DRAWINGS:

- 12000022657 (POWER HOUSE PLAN AT EL649.5M AND TRANSFORMER HALL AT EL677.00M)
- 12000022651 (CROSS SECTION POWER HOUSE- 73 KW)
- DIMENSIONS MARKED WITH * TO BE CONFIRMED BY SJVN LTD/CIVIL CONTRACTOR.



TENTATIVE LT WHEEL LOAD WITHOUT IMPACT(W) = 17.5T
 TENTATIVE LT WHEEL LOAD WITH IMPACT(W) = 20.65T



CRAB WEIGHT= 12T (APPROX.)
 CRANE WEIGHT= 37T (APPROX.)
 (INCLUDING CRAB)

PROJECT	SUNNI DAM HYDRO ELECTRIC PROJECT (5X73 MW + 1X17 MW)
CUSTOMER	SJVN LTD. (A JOINT VENTURE OF GOVT. OF INDIA & GOVT. OF H.P.)
CONSULTANT	

JOB NO.	542
STATUS	CONTRACT
DISTRIBUTION	

DEPT	DRY	NAME	SIGN	DATE
CHD	VVN	BHASKAR	-45	19.01.20
APPO	LJ	BHASKAR	-45	19.01.20

CRANE CLEARANCE DIAGRAM FOR TRANSFORMER HALL (50/10T CAP.)

REV	DATE	ALTD	CHD	APPO	REV	DATE	ALTD	CHD	APPO

SCALE: 1:100

SHEET 1 OF 1

PE-DG-542-501-A002



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

ANNEXURE-V

DRAWINGS/ DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT

The successful bidder shall submit the following drawings / documents during detail engineering for Customer's/Consultant's approval /information:

S.N.	BHEL drawing No.	Title	Schedule date of submission from date of LOI. (*in weeks)
PRIMARY DRAWINGS			
1	PE-V0-542-501-A201	Manufacturing Quality Plan along with sub vendor list for EOT crane	2
2	PE-V0-542-501-A204	Mechanism Sizing Calculation for Cranes	2
3	PE-V0-542-501-A205	General arrangement for EOT Crane with CT DSL details	2
4	PE-V0-542-501-A211	Main and Auxiliary hook block assembly with details of hook, nut and check plate For Cranes	2
5	PE-V0-542-501-A212	Structural calculations For EOT Crane (including structural calculation for crab structure)	3
SECONDARY DRAWINGS			
6	PE-V0-542-501-A206	Crab sub assembly for crane with CT wheel assembly	3
7	PE-V0-542-501-A208	General arrangement for PVC shrouded DSL for EOT crane	3
8	PE-V0-542-501-A210	Long travel Machinery Assembly with LT wheel assembly For EOT Crane	4
9	PE-V0-542-501-A216	Electrical equipment layout in cabin for cranes	
10	PE-V0-542-501-A217	Schematic circuit diagram of a) Protective panel, Main and lighting circuit & BOM b) Main hoist panel & BOM c) Aux. hoist panel & BOM d) Cross Traverse & BOM e) Long Traverse & BOM Including earthing diagram For EOT Crane including Crane Operational write up	5
11	PE-V0-542-501-A218	General Arrangement of a) Protective panel b) Main hoist panel c) Aux. Hoist Panel d) Cross Travel panel e) Long Traverse travel panel f) Pendent g) Remote Radio Control For EOT Crane	5
12	PE-V0-542-501-A219	Cable Sizing and cable schedule For Crane	6



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

13	PE-V0-542-501-A223	Mandatory spare parts list For EOT Crane	8
14	PE-V0-542-501-A224	Data requirement sheet as in Schedule II	3
15	PE-V0-542-501-A227	Data sheet of Crane with painting details	3
16	PE-V0-542-501-A228	Data sheet of motors for Cranes	5
17	PE-V0-542-501-A221	Type test certificate (for motors) For Crane	10
18	PE-V0-542-501-A232	Gantry Rail installation and Sole plate and Anchor bolt drawing for rail fixing details for cranes	3
19	PE-V0-542-501-A250	Crane lubrication drawing For EOT Crane	6
20	PE-V0-542-501-A251	Component wise weight schedule, lifting arrangement & safety arrangement	8
21	PE-V0-542-501-A214	O & M Manual For EOT Crane	9
22	PE-V0-542-501-A215	Erection Procedure documents along with all the drawings pertaining to this section (Erection Manual)	10

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.



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

- 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, 3etc.
- 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.



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

ANNEXURE VI – PACKING PROCEDURE

COMMON GUIDELINES FOR PACKING

1. GENERAL:

The Components/Assemblies need to be packed suitably to avoid physical damage & corrosion during transit & storage. This packing shall be suitable for different handling operations and for the adverse conditions during transportation and during indoor / outdoor storage of materials.

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. The Contractor shall be responsible for all loss or damage during transportation, handling and storage due to improper packing.

The identification marking indicating the name and address of the consignee shall be clearly marked in indelible ink on two opposite sides and top of each of the packages. In addition the Contractor shall include in the marking gross and net weight, outer dimension and cubic measurement.

Each package shall be accompanied by a packing note (in weather proof paper) quoting specifically the name of the Contractor, the number and date of contract and names of the office placing the contract, nomenclature of contents and Bill of Material.

2. TYPES OF PACKING:

The following 5 types of packing have been standardized for packing of General Components/ Assemblies.

- 1) 'OP' - Open Type.
- 2) 'PP' - Partially Packed.
- 3) 'CP' – Crate/Box Packing - Components/Equipment requiring physical protection.
- 4) 'CQ' - Case Packing – Machined Components-Small & Medium Components/ Assemblies/ Equipment which require corrosion & physical protection.
- 5) 'CR' - Case Packing – Electrical/Electronic Components/ Assemblies, which require special packing viz. Water Proof, Shock Proof etc...

3. DESCRIPTION OF TYPES OF PACKING:

The various types of packing, as standardized above, are described below.

3.1 'OP' - Open Type

In case, of components which are not affected by water & dust and do not require special protection, are generally not machined, shall be sent as open packages. However, these components may be sent in crates, wherever necessary.

3.2 'PP' - Partially Packed

Components which need special protection at selected portions only shall be despatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces should be protected with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film. All sharp corners and edges shall be protected by rubber mats to prevent damage to the polyethylene film.

3.3 'CP' - Crate Packing

Assemblies/Components which need only physical protection from the point of view of handling shall be despatched duly packed in crates.

3.4 'CQ' - Case Packing - Machined Components/Assemblies/Equipment

Small and medium sized components/assemblies/equipment due to size/weight and to avoid handling and pilferage problems shall be packed in Case/Containers. Wherever required adequate quantity of silica gel or VCI Powder/Tablets, packed in thin muslin cloth cotton bags shall be suitably placed. Small



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

machines/components of less weight shall be provided with suitable cushioning by Rubberised coir. The components inside the case shall be entirely covered with 100GSM (Colourless) Multi Layered Cross Laminated Polyethylene Film, wherever required. This may be prescribed for electronic parts/critical machined components/surfaces.

For mechanical product like valves where motors are separately securely wrapped in polyethylene, the requirement of individual component wrapping shall be exempted.

3.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies

Delicate components likely to be damaged e.g. Gauges, Instruments etc. are to be wrapped in waxed paper or polyethylene air bubble film and packed in cartons. Adequate quantity of Silica gel packed in cotton bags of 100grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with 100GSM (Colourless) Multi Layered Cross Laminated Polyethylene Film before being packed in the cases. VCI Powder/Tablets can be used as an alternative to Silica Gel.

Empty space in the cartons shall be filled with rubberized coir to get proper cushioning effect. The cartons shall be manufactured from corrugated Fiber Board.

4 PREPARATION OF PACKING CASES

4.1 DIMENSIONS:

- a) Thickness of planks for Front, rear, top and bottom sides and binding, jointing battens shall be 25/20mm +2/-3 mm as per applicable drawings of the respective units.
- b) Width of all planks including the tongue shall be more than 125mm and after planing it shall be minimum 100mm.
- c) Minimum number of planks shall be used for a shook.
- d) Horizontal, vertical, diagonal planks shall be given for binding (number of such planks depend on the dimension of panel).
- e) Width of binding planks shall be minimum 100mm.
- f) Distance between any 2 binding planks shall be less than 750mm.
- g) diagonal planks shall be used in between vertical binding planks when distance between inner to inner of vertical planks is more than 750mm
- h) Distance of the outer edges of these planks from the edge of case shall be less than 250mm.
- i) Diagonal planks are not required for top planks and width side, if the width of pallet is less than 750mm.

4.2 JOINTING OF PLANKS

Single length planks shall be used for cubicles whose overall length is less than 2400mm. For cubicles of length more than 2400mm, jointing is permitted. The jointing shall be done with one single or maximum of 2 planks of wood same as other planks of width 250 mm (minimum) with two rows of nails on either side of the joint in zigzag manner. From the joint along height side, it shall be of lap joint with overlap of at least the width of plank.

4.3 TONGUE AND GROOVE JOINTS

Two consecutive planks shall be joined by tongue and groove joint. Depth of tongue shall be 12+1 mm, thickness of tongue shall be 8 +1 mm. The groove dimensions shall be such that the tongue fits tightly into the groove to make a good joint. This type of joint can be done based on the product requirement wherever required.

4.4 PERMISSIBLE DEFECTS

Wood shall be free from knots, bows, visible sign of infection and any kind of decay caused by insects, fungus, etc.

End splits: Longest end splits at each end shall be measured and lengths added together. The added length shall not exceed 60mm per meter run of shook's. Wood pins shall be used to prevent further development of split.

Surface cracks: Surface cracks with a maximum depth of 3mm are permissible. A continuous crack of any depth all along the length is not allowed.



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

4.5 OTHER MATERIALS

4.5.1 NAILS

The dia. of the nails shall be 3.15mm. The length of the nails shall be 65mm wherever two planks of 25mm thickness are joined and 75mm wherever a 25mm planks is joined to a 50mm plank.

4.5.2 BLUE NAILS

These are used for nailing bituminized Kraft paper/hessian cloth to the planks. The length of the nails shall be 16mm.

4.5.3 HOOP IRON STRIPS

These are used for strapping the boxes. The width of the strips shall be 19+1mm and thickness 0.6+0.01mm. The material shall be free from rust.If sufficient nailing is done for bigger boxes, strapping need not be done.

4.5.4 CLIPS

These shall be used for strapping the hoop iron strips on the boxes.

4.5.5 BRACKETS

These brackets are used for nailing to the corners of cubicle boxes. The brackets shall be of mild steel of thickness min 2mm and width 25+1mm. The brackets shall be of "L" shape, the length of each side being 100+2mm. Two holes shall be provided towards the end of each side for screwing /nailing.

4.5.6 FASTENERS

Bolts, double nuts, spring washers will have to be used for packing of some special items like transformers, reactors, breakers, etc., to hold the job to the bottom plank of the box. The bolts, nuts, washers will be provided by the vendor. Drilling of holes will have to be done using contractor's tools.

4.5.7 MULTI LAYERED CROSS LAMINATED POLYTHELENE FILM

100GSM (Colourless) Multi Layered Cross Laminated Polythelene Film are used to make covers to the jobs individually. The cross lamination gives qualities of extra toughness, together with flexibility and lightness coupled with good weather resistance to ultra violet rays.

4.5.8 RUBBERISED COIR:

The rubberized coir is used as cushioning material. For the packing of loose items, items are to be arrested by using rubberized coir. For the packing of cubicles rubberized coir of thickness 25mm and width 75mm shall be used.

4.5.9 FOAM RUBBER / 'U' FOAM:

This is used for covering the delicate items. This material is provided by the vendor.

4.5.10 MARKING PLATE:

This shall be of anodized aluminium sheet. Size of the marking plate shall be maintained minimum of size as per the details specified in the Figure 4.

4.5.11 PACKING SLIP HOLDER:

This shall be of galvanized iron tinned sheet /Aluminium sheet

4.5.12 SILICA GEL:

Silical gel shall be used for such products only where moisture needs to be avoided.

4.5.13 COTTON BAGS:

These are used for holding silica gel. The bags shall have the following matter indicated on them:

BHEL-UNIT NAME PLACE -PINCODE
SILICA GEL -INDICATING TYPE
BLUE : -ACTIVE
ROSE : -REDUCED ACTIVITY



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

WHITE : -NO ACTIVITY. TO BE REPLACED WITH FRESH SILICA GEL

4.5.14 COTTON/ PLASTIC TAPE:

This is used for tying small items. And also to prevent vibrations of moving parts within the cubicles.

4.5.15 MARKING INK:

The ink used normally is black in color. In some special cases other color also will have to be used. The ink shall be non-fading/indelible and non-washable by water.

4.5.16 POLYETHYLENE BAGS:

These are to be used for keeping the Packing slips. The bag shall be of size 70mm X 100mm (minimum).

4.5.17 Hessian cloth, twine thread, paint will have to be used in packing certain items.

4.5.18 Mechanical Latching clamps:

For CLW Railway panels and similar Panels self-locking clamps can also be used on need basis in conjunction with or apart from regular bolt and nut fixing arrangement. For reusable boxes, these clamps provide easy locking and unlocking arrangement. These clamps will be made available from BHEL in some cases.

4.5.19 STICKERS

The following stickers to be put by the vendor on cubicles/Boxes after packing.

- 1) Case No sticker: 2 nos. Size 25.Cm x 0.45Cm
- 2) BHEL Monogram sticker: 1 no. Size 1.75Cm x 2.3Cm
- 3) Address sticker: 2 nos. Size 3.8Cm x 3.0Cm
- 4) Direction sticker "Front" & "Back" - 4 nos. Size 2.0Cm x 0.75Cm
- 5) Chain Mark Sticker: 4 Nos. Size – 3.0Cm x 0.75Cm
- 6) "Fragile" sticker: 2 Nos. Size. 2.1Cm x 1.5Cm
- 7) "DO NOT STACK" sticker - 2 Nos. Size 3.0Cm x 2.2Cm

In place of stickers, writing all the details legibly with paint shall be allowed & respective units may take decision accordingly.

5. PACKING OF CUBICLES:

5.1 The packing is to be done as per clause 4 in all respects.

5.2 The cubicles are already fixed on wooden pallets. Hence the contractor need not arrange the bottom pallets normally.

5.3 The cubicles will be of different sizes both width wise and lengthwise. The cubicles may be made up of single suite, 2 Suite, 3 Suite, 4 Suite, etc., The width of the cubicles generally varies from 400 mm to 1650mm. The length of the cubicle, generally varies from 1500 mm to 4800 mm. The height is normally 2430 mm. In some cases, the height may be less/more.

5.4 MULTI LAYER CROSS LAMINATED POLY FILM

The inner surface of 4 sides of shook's shall be nailed with Multi-layer cross laminated poly film (as per 4.5.7) using blue nails (as per 4.5.2) wherever 2 pieces of Cross laminated poly film are used, the joint shall have an overlap of minimum 20mm.

The inner surface of top cover shall be nailed with Multi-layer cross laminated poly film (as per 4.5.7). This sheet shall project outside on 4 sides by at least 100mm and shall be nailed properly on sides. Joining of sheets should have overlap of minimum 20mm.

The cubicles shall be covered with Multi-layer cross laminated poly film (as per 4.5.7).

5.5 SILICA GEL:

Silica gel (as per 4.5.12) packed in cotton bags shall be kept at different places inside the cubicle as per BHEL-



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

Unit directions. Each suit of cubicle shall be provided with 1 kg of Silica gel (for a 4 suit cubicle 4 kgs of Silica Gel to be used. The bag containing silica gel to be as per 4.5.13).

5.6 LOOSE PARTS:

Any loose parts in the cubicles shall be tied using cotton/ plastic tape. Wooden battens shall be provided wherever necessary.

5.7 WOODEN BATTENS:

In case of cubicle which are not rectangular in shape like control desks, sufficient number of wooden rafters/battens of proper size shall be provided to give strength to the package.

5.8 RUBBERISED COIR:

Gap between the cubicle and the case shall be filled with rubberized coir (as per 5.5.8) with distance between consecutive layers less than 500mm.

5.9 CLAMPING:

Packing shall be bound at edges by nailing M.S. Clamps / Brackets (as per 5.5.5). Each vertical edge shall have minimum 3 clamps. Top horizontal edges will have one clamp for every meter length of package. However, minimum 4 clamps shall be nailed at the top for any cubicle.

5.10 PACKING SLIP:

Packing slip kept in the polyethylene bag (As per 5.5.16) shall be placed in the box at appropriate place. In addition, one more packing slip covered in polyethylene cover and packing slip holder (as per 5.5.11) shall be nailed to front / rear of case.

5.11 MARKING PLATE:

One no. (As per 5.5.10) shall be nailed to the front side of the case.

5.12 CASE MOUNTING:

After complete packing, stencil marking of various details and marking of symbols shall be done as per BHEL instructions using indelible / non washable marking ink.

5.13 Different types (Typical) of Cubicles with sizes for Packing

1. Single suite cubicle - 900 x 950 x 2500
2. Two suite cubicle - 1650 x 950 x 2500
3. Three suite cubicle - 2400 x 950 x 2500
4. Four suite cubicle - 3150 x 950 x 2500
5. Regulation cub - 1300 x 1350 x 2500
6. Thy cub - 2870 x 1350 x 2500
7. VFD Cub - 3800 x 1550 x 2500

6 PACKING OF LOOSE ITEMS/SPARES

- 1) Shape of cases shall be square, rectangular with single gabled roof or with double gabled roof depending on the nature of the job to be packed. Construction shall be as per drawings enclosed. Only gable will be additional as required.
- 2) Wood with Tongue and Groove joint as per clause 4.3.
- 3) Width of planks shall be at least 100 mm. Width of binding planks (battens) shall be at least 75mm.
- 4) External surface of planks on front and rear shall be plane 100% (except bottom plank).
- 5) Inner surfaces of all 6 sides shall be lined with Multi Layered Cross Laminated Polythelene Film (as per clause 4.5.7) using blue nails.
- 6) Rubberized coir of minimum 25mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of box.



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

- 7) Internal packing: Items that go into the box shall be packed using 100GSM, (Colourless) Multi Layered Cross Laminated Polyethylene Film. Any space left between the job and the sides and the top of the box shall be filled with rubberized coir to get proper cushioning effect.
- 8) Certain items like transformers, reactors, breakers, etc., shall be bolted to the bottom of the box using bolts, nuts and washers.
- 9) Silica gel as per clause 4.5.12 held in cotton bags as per clause 4.5.13 shall be kept at proper places in the box.
- 10) Packing slip kept in polyethylene bag (clause 4.5.16) shall be placed in the box.
- 11) Marking plate as per clause 4.5.10 shall be nailed to side of the box.
- 12) Two numbers of hoop iron strips as per clause 4.5.3 shall be strapped tightly on the case using clips.
- 13) Stencil marking of various details and marking of various symbols shall be done as per BHEL instructions using indelible/non-washable marking ink.
- 14) Loose items to be kept inside the cubicle

- The components which are removed from cubicle for shipping purpose only, such as meters shall be kept inside the cubicle individually, kept in wooden box and tied firmly in bottom of Cubicle.

- Other items which are given loose in addition to cubicle shall be packed in separate boxes.

7 BOX SIZES

7.1 BOX SIZES

Table 1 – SPARES WOODEN BOX DETAILS

SNO	BOX	BOX SIZE	BOX Wt	Carrying Capacity
	TYPE	(in mm)	(in KG)	
1	A	800 X 200 X 200	15	
2	B	1500 X 200 X 200	22	
3	C	2000 X 200 X 200	27	
4	D	1100 X 200 X 200	15	
5	E	200 X 200 X 200	5	
6	F	320 X 250 X 260	13	
7	G	320 X 250 X 430	16	
8	H	430 X 370 X 430	23	
9	I	1100 X 400 X 400	45	
10	J	1500 X 500 X 400	65	
11	K	2000 X 500 X 400	93	
12	L	2500 X 500 X 400	88	
13	M	900 X 600 X 600	100	
14	N	3000 X 400 X 400	60	
15	P	600 X 500 X 400	35	
16	Q	710 X 630 X 600	90	
17	R	850 X 630 X 670	102	
18	S	1000 X 770 X 670	140	
19	T	2500 X 850 X 800	180	
20	U	1500 X 700 X 700	120	



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

21	W	1200X900X600	120	
22	Y	450 X 200 X 200	10	

Table 2 – WOODEN BOX DETAILS

BOX TYPE	BOX SIZE (in MM)	BOX Wt (in KG)	Carrying Capacity
1	320X250X260	10	
2	320X250X430	15	
3	430X370X430	25	
4	670X670X470	65	
5	720X630X600	75	
6	1000X770X660	100	
7	1100X430X670	80	
8	1200X1200X900	80	
9	1300X770X1050	155	
10	2500X850X800	225	
11	2000X1500X1200	305	
12	1850X1050X1250	260	
13	2000X800X800	180	
14	2600X1500X1600	470	
15	250X250X600	20	
16	250X250X880	30	
17	300X300X700	25	
18	380X380X880	45	
19	510X510X1400	60	
20	570X570X1400	80	
21	575X575X1875	105	
22	3600X1100X1100	390	
23	900X500X800	110	
24	2000X950X740	225	
25	1600X1120X700	220	
26	2500X2000X1200	490	
27	2900X1900X1400	525	
28	3000X1000X900	370	
29	3200X2200X950	450	
30	2150X1100X750	325	
31	2000X2000X700	130	
32	700X1200X1325	130	

TABLE 3 STEEL BOXES



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

S.NO.	TYPE	DIMENSION IN MM			WEIGHT	CARRYING CAPACITY (KGS)
		LENGTH	BREADTH	HEIGHT		
1	I	2480	1680	1500	339	4500
2	II	1200	900	600	61	2000
3	IIB	1800	850	950	115	2500
4	III	900	600	600	29	1000
5	IV	600	450	500	19	750
6	V	400	350	300	11	500

TYPICAL PATTERN OF WOODEN BOX

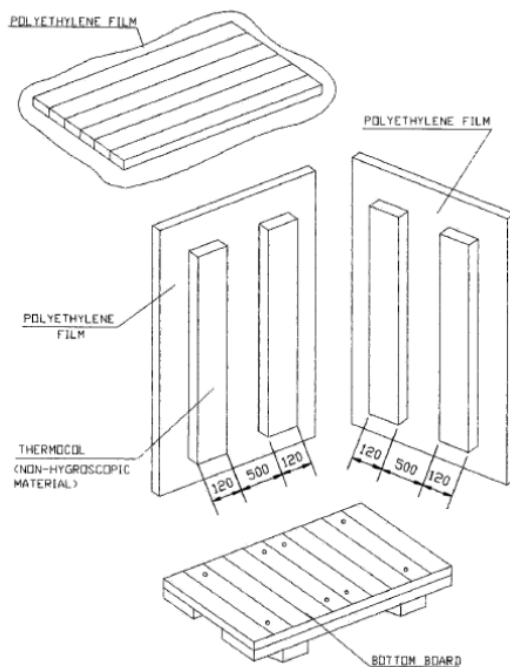
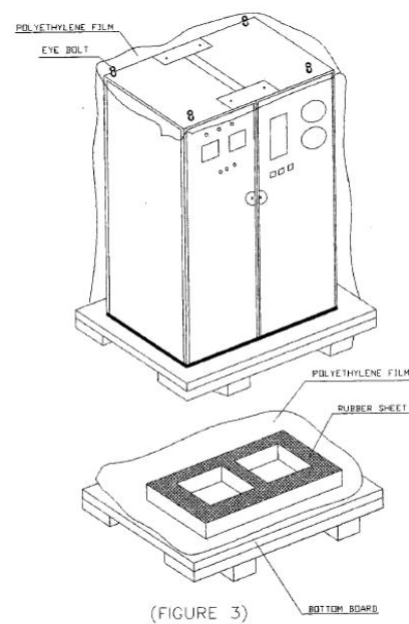


Figure 1



(FIGURE 3)

Figure 2

7.3 SEALED PACKING:

Components sub-assemblies and assemblies sensitive to climatic conditions shall be packed seal tight. All the openings of the sensitive components, sub-assemblies and assemblies shall be blanketed to prevent the ingress of dust and moisture. The components sub-assemblies and assemblies are completely covered with 2 layers of polyethylene sheet. All sharp corners and edges are to be protected by rubber mats to prevent the polyethylene sheet from damage. Top surface of the case shall be free from dents to prevent rain water pockets.

8 MARKINGS/STENCILINGS



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

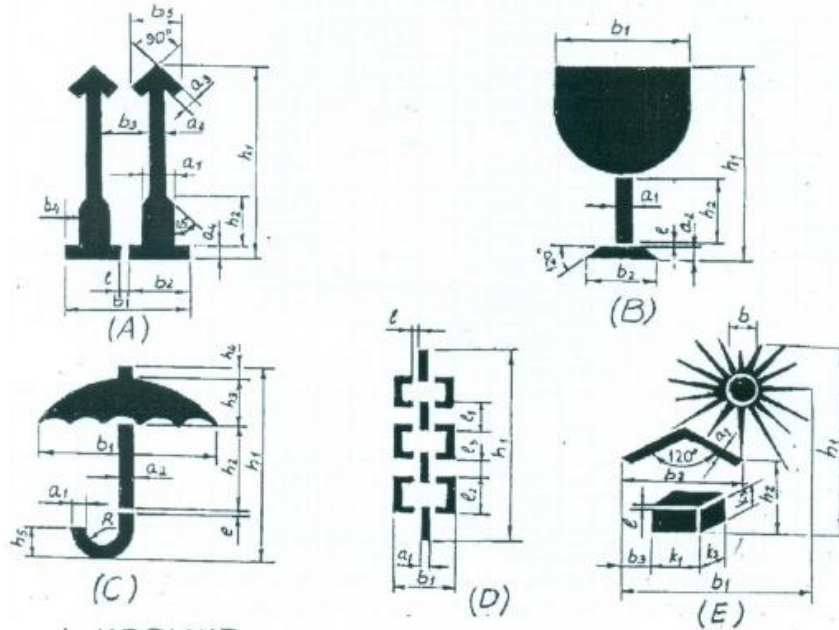
SECTION IA

REV. 00

MAR 2026

MARKINGS ON PACKING CASE S

1. THIS PLANT STANDARD PRESCRIBES THE VARIOUS CAUTION SIGNS AND OTHER MARKINGS ON PACKING CASES.
2. DIMENSIONS IN THE TABLE 1 SHALL BE USED FOR MAKING STENCILS ONLY.



- A. UPRIGHT
- B. FRAGILE
- C. PROTECTION FROM FALLING OR CONDENSING MOISTURE.
- D. SLINGING POSITION
- E. PROTECTION FROM DIRECT RADIATIONS.



Figure 3



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

DESIGN- ATION		DIMENSION IN MM																							
		a1	a2	a3	a4	b1	b2	b3	b4	b5	b	l	h1	h2	h3	h4	h5	k1	k2	k3	l1	l2	l3	R	
A	1	12	5	5	4	52	25	19	8	21		2	84	23											
	2	17	7	7	6	75	36	29	11	30		3	119	33											
	3	24	10	10	8	104	50	38	16	42		4	168	46											
	4	34	14	14	11	147	71	59	23	60		5	239	65											
B	1	5	5			50	33					2	84	25											
	2	7	7			71	47					3	119	36											
	3	10	10			100	66					4	168	50											
	4	14	14			142	94					5	239	71											
C	1	4	3			66						2	80	39	19	5	11							6	
	2	6	4			85						3	114	55	27	7	16							9	
	3	8	6			120						4	160	78	38	10	22							12	
	4	11	9			170						5	227	110	54	14	31							17	
D	1	6				30						4	148									30	30	10	
	2	9				42						5	209									42	42	14	
E	1	3				69	47	10			16	2	91	26				17	8	11					
	2	4				98	67	15			23	3	128	33				24	11	16					
	3	6				138	94	20			32	4	182	62				34	16	22					

Table 4

Black and Red Marking Ink to IS:1234 "Ink, Stencil, Oil Base, For Marking Porous Surfaces" or duplicating ink stencilling, oil base for marking porous surfaces.

All cases containing fragile items are to be stencilled with red marking and stencilling paint/ink

"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".

Besides the caution signs the product information's shall be stencilled of letters with 13mm to 50mm height. In case of consignment consists of more than one package, each package shall carry its package no as given in shipping list. All caution signs shall be stencilled in high quality full glossy out door finishing paint red in colour (AA56126). All other markings shall be carried out in black enamel.

Caution signs & other markings shall be stencilled on both the end shooks & the side shooks.

Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.

Note: In case the size of package is small for using the stencils, then hand written letters/figures shall be allowed.



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026


	BHEL – <unit> - <location> - <pin>				
CONSIGNEE					
MATERIAL					
CUSTOMER REF.				MO. NO.	
DESPATCH ADVISE NOTE NO				CASE NO	
DIMENSIONS(MM) L x B x H				NET WT -KGS	GROSS WT -KGS
SPECIAL INSTRUCTIONS	HANDLE WITH CARE - KEEP DRY DO NOT DROP - DO NOT TILT				

Figure 4 – TYPICAL MARKING PLATE (225 X 170)



Figure 5

Easy spares [Initial and O&M] Traceability and Identification at units and as well as at sites:

9 STANDARD METHOD OF PACKING
Table 5 - Standard Method of Packing

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
PRESSUE VESSELS								
TOWERS					O			
TANKS					O			
VESSELS					O			



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

GASKETS	O							
FASTENERS	O							
COVERS		O						
EXCHANGERS								
HEAT EXCHANGERS					O			
TUBE BUNDLE	O							
SHELL					O			
AIR FIN COOLERS					O			
COLOUMNS, MOTOR SUSPENSIONS, PLENUM CHAMBERS, SCREEN GUARDS, ETC					O			
BEARING BLOCKS	O							
FANS	O	O						
MOTORS	O							
GASKETS	O							
FASTENERS	O							
TEST FLANGES			O					
TEST RINGS			O					
COVERS			O					
CRYOGENIC VESSELS								
COLD CONVERTERS					O			
HORIZONTAL STORAGE TANKS					O			
TRANSPORTATION TANK					O			
COLD BOX					O			
DRYING UNIT					O			
DRYING BOTTLES					O			
MOISTURE SEPARATORS					O			
SILENCERS					O			
ONGC SKIDS					O			
VAPORISER		O						
SPECIAL PRODUCTS								
SI/VI PIPING		O						
CRO BIO CONTAINERS	O							
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
AIR BOTTLES	O							
TITANIUM BOTTLE	O							
WAR HEAD CONTAINER	O							
MISSILE CONTAINER	O							
FUEL CONTAINER	O							
AIR LOCK ASSEMBLY	O							
BOILER DRUMS					O			
BOILER ITEMS								
COILS			O					



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

ELECTRICAL INSTRUMENTATION								
MOTORS, PUMPS, COMPRESSORS, TURBINES	O							
SWITCH BOARDS, DISTRIBUTION BOARDS, STARTERS, JUNCTION BOXES		O						
INDICATORS, VIBRATOR SWITCHES	O							
CABLE BUNDLES, CABLE DRUMS					O			
CABLE TRAYS, CABLE RACKS, EARTHING MATERIAL		O						
OPERATIONAL SPARES	O							

10 PROCEDURE FOR HANDLING OF COMPONENTS

The purpose of this procedure is to protect the quality of the components/equipment while handling in various stages of manufacturing packing & despatching.

- 10.1 Adequate care shall be taken in handling the material, and components to avoid damage during receipts, storage issue manufacture & despatch operations.
- 10.2 Appropriate material handling equipment like fork lifters, cranes etc. shall be used where needed.
- 10.3 Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. shall be done carefully.
- 10.4 For critical items, where specified, special handling fixtures shall be used for lifting.
- 10.5 Slings and shackles used for lifting the components/equipment shall be checked for fitness and suitability before use.
- 10.6 Slings used on machined surfaces shall be suitably padded. No slings shall be used on journal surfaces.
- 10.7 Precision machined components like blades, catches, rollers etc. shall be lifted using suitable wooden pallets.

10.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH

Before loading/unloading a packing case from the carrier look for the following shipping instructions painted on the packing case.

- a) The markings showing the upright position.
- b) The markings showing the sling position
- c) Markings showing the fragile contents.
- d) Other required markings as per clause no.10

10.8.1 Appropriate cranes and slings should be used for different components/ cases. Slings should normally make an angle as minimum as possible (width wise) but in no case more than 15°.

10.8.2 Handling and lifting should be done without jerks or impacts.

10.8.3 Immediately after receipt of the goods, the packing should be examined all-round for any sign of damage.



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

If necessary, lift the cover or a number of boards of the case so as to make the contents visible. In the event of sealed packing being used the plastic sheeting should not be damaged. It is imperative that the packing material is restored in original condition after the inspection.

10.8.4 On receipt of the equipment it should be checked with the shipping list and missing or damage if any should be reported immediately. It is important to arrange for immediate examination to determine the extent of the damage, the cause of the damage and where applicable the person or persons responsible for the damage. According to general practice when transporting by railway or by road vehicle the carrier concerned should be immediately called upon (within specified periods) for jointly establishing a statement of the damage. This is essential as a basis for a subsequent claim and possible damage report to the insurance company.

10.8.5 Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.

10.8.6 Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

11 GENERAL GUIDELINES FOR ODC TRANSPORTATION/DESPATCH

Based on the Dimensions/Weight indicated in the Transportation Sketch, the type of Trailer is decided and indicated in the Tender Enquiry.

11.1 TRANSPORTATION:

1. LOW BED TRAILERS (LB 8):

Well Bed Length : 10000mm
Over Gooseneck : 13000mm
Width : 3000mm
Carrying Capacity : 40MT

2. LOW BED TRAILERS (LB 16):

Well Bed Length : 12000mm
Over Gooseneck : 16000mm
Width : 3000mm
Carrying Capacity : 75MT

3. TOW TYPE TRAILERS (WITH FRONT DOLLEY 16 TYRES): 12000MM length (for Exceptional equipment length: 30000mm and above)

Bigger Dia equipment are loaded in the Well with overhanging.

Smaller Dia equipment with excess length are loaded over Gooseneck with rear hanging.

The Vehicle Dimensions are defined above are only guidelines for selection based on actual Dimensions/Weight of the Consignment

11.2 PACKING:

For all ODCs, Wooden Saddles are cut to the diameter of equipment as per the Transportation Sketch.



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

Wooden Saddles	For Diameter up to 4000mm	For Diameter above 4000mm
Length:	1836/2743mm (6'0"/9'0")	3353mm (11'0")
Width:	300mm (1'0")	300mm (1'0")
Height:	Saddle + one/two wedges a top	Saddle + three/four wedges a top

Number of Saddles:	
Minimum	3 in case of Loading inside Well +1 when loaded on Gooseneck
Maximum:	4 in case of Loading inside Well +2 when loaded on Gooseneck

For Securing the equipment firmly on the Trailer, 19mm (3/4"), wire rope with 25mm (1") Heavy Duty Turn Buckles / BD Clamps are used as Lashing for the equipment.

12 GUIDELINES FOR HANDLING/LOADING/LASHING

- Jobs to be checked for complete painting before loading.
- Components to be lifted with Nylon belts. This protects painting, edges and attachments.
- All the components to be transported by putting inside the properly fabricated Crating
- Small components may fall down while transporting without closed crating and there are chances of missing of small parts. Hence, it is always better to transport small components in closed containers/crating. Loose to be being shipped in a closed crating.
- No component loaded over the crating.
- **LASHING:** Use Nylon belts only for lashing of all components. It prevents removal off painting and cut in the materials.



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

ANNEXURE-VII

Check List for Operation & Maintenance Manual

Project name :
 Project number :
 Package Name :
 PO reference :
 Document number :
 Revision number :

Sl.no. & Sections	Description	Tick (√) if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	Cover page				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address , Emergency Contact number				
1.5	Name and sign of prepared by , checked by & approved by				
1.6	Revision history with approval Details				
2	Index				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3	Description of Plant/System				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

4	Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5	Operation Guidelines for plant personal/user/operator				
5.1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5.2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5.3	Do's & Don't of the equipments.				
5.4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5.5	Parameters to be monitored with normal values and limiting values				
5.6	Trouble shooting with causes and remedial measures				
5.7	Routine operational checks, recommended logs & records				
5.8	Changeover schedule if more than one auxiliary for the same purpose is given				
5.9	Painting requirement and schedule				
5.10	Inspection, repair , Testing and calibration procedures				
6	Maintenance guidelines for plant personal				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IA

REV. 00

MAR 2026

6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7	Statutory and other specific requirements considerations.				
8	List of reference documents				
9	Binding as per requirement				

Checked by
Dealing Engineer

Key Resource Person

Section Head



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IC

REV. 00

MAR 2026

**SUB-SECTION IC
DATASHEET – A**



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IC

REV. 00

MAR 2026

Sr. No.		DESCRIPTION	TECHNICAL PARTICULARS	
1.0.0		General		
1.1.0		Basic Details		
	a.	EOT Crane	Double Girder EOT crane	
	b.	Location/Number/Capacity	Two (2) no.s Indoor 175/50T along with 1 no. 10T EH under one crane girder in Power House One (1) no. 50/10T in Transformer cum GIS Hall Crane	
1.2.0	a.	Design, fabrication and testing of the crane confirm to standard / code number	Mechanical and Electrical as per IS: 3177-2020 & Structure design in accordance to IS 807:2006 / IS 800:1984.	
	b.	Minimum thickness of Structural members	a) Load carrying members: 8 mm b) Tubes with both ends sealed: 4.9 mm (6 SWG) c) Tubes with unsealed ends: 8mm d) Chequered plates: 6 mm O/P e) Diaphragm/stiffner thickness - 8mm	
	c.	MAXIMUM SPAN/DEPTH RATIO FOR GIRDER:	i) For main compression members, the slenderness ratio shall not exceed 150. In case of other load carrying members and secondary members the slenderness ratio shall not exceed 240. ii) For girders, the following values of maximum span shall be governing: a) Plate girders & rolled beams: Slenderness ratio shall be less than 300 b) Box plate girders: Ratio of effective length of compression flange (l) to the width of flange of girder shall be 60 for welded girders.	
1.3.0		Crane classification	M3 (Mechanical, Structural and Electrical) as per IS: 3177-2020, IS: 807-2006 and 13834 (Part-5)-1993	
1.4.0		Suitable for outdoor or indoor duty	Indoor	
1.5.0		Capacity (T)	POWER HOUSE CRANE	TRANSFORMER CUM GIS HALL CRANE
	a.	MH (Main Hoist) SWL	175T	50T
	b.	AH (Aux Hoist) SWL	50T	10T
	c.	Monorail Electric Hoists (Attached under crane Girder (One per crane) SWL	10T	-
	d.	Over load test	125% of SWL (Safe Working Load)	
1.6.0		Span (Crane rail to rail distance)	Refer Crane Clearance Diagram Attached	
1.7.0		Hook Approaches	Refer Crane Clearance Diagram Attached	
1.8.0		Lift (hook reach from bottom most position to top most position)	Refer Crane Clearance Diagram Attached	
1.9.0		Crane Travel	Refer Crane Clearance Diagram Attached	



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IC

REV. 00

MAR 2026

1.10.0		Operation from	Cabin + Pendent Push Button+ Radio remote control	
2.0		CRANE PERFORMANCE		
2.1.0		Crane speed with full load	POWER HOUSE CRANE	TRANSFORMER CUM GIS HALL CRANE
	a.	Main Hoist (M/Min.)	0-1.0 (Thro. VFD)	0-3.0 (Thro. VFD)
	b.	Aux. Hoist (M/Min.)	0-3.0 (Thro. VFD)	0-5.0 (Thro. VFD)
	c.	Trolley (crab) travelling speed (CT motion) (M/Min.)	0-10.0 (Thro. VFD)	0-10.0 (Thro. VFD)
	d.	Bridge travelling speed (LT motion) (M/Min.)	0-15.0 (Thro. VFD)	0-15.0 (Thro. VFD)
	e	Monorail Hoisting speed (M/min)	12.0	NA
	f	Monorail Travel speed (M/min)	12.0	NA
	g	Maximum acceleration/ deceleration of bridge travel & trolley travel.	0.2 m/sec ²	
2.2.0		Hand Rail Pipes	32 mm NB medium duty pipes as per IS 1161 having top and bottom rail at height of 1100 mm and 600 mm and vertical post spacing not exceeding 1500 mm with provision of kick plate (100 mm high and 6mm thick)	
3.0.0		COMPONENT DETAILS		
3.1.0		Bridge girder		
	a.	Type & Quantity	Box type – 2 nos. Fusion welded. Material: Mild steel, grade 'B' of IS 2062	
	b.	Stress consideration	Following to be consider as per IS 807: Static load (dead load), loads due to working load multiplied by dynamic coefficient, two most unfavourable horizontal effects excluding buffer forces.All these loads must then be multiplied by amplifying coefficient	
	c.	Maximum Limit for Vertical Deflection	Rated load plus all dead loads not to exceed the value as per the latest IS of the crane span for all Cranes	
	d.	Type of connection to end carriage	By fitted bolts	
	e.	Camber	The girder shall be cambered by an amount equal to the maximum deflection due to dead load plus one half the live load and trolley.The bridge girder shall be given adequate camber to prevent sagging of the girder due to load. The camber shall be of such an angle that the girder becomes flat when the trolley moves on it while carrying full load.	
	f.	Nut & bolts	As per IS:1363, IS:1364 and IS:1367. High Tension Friction grip bolts as per IS: 3757. High Tension Friction grip nuts as per IS: 6623.	
	g	Splice joints	Girder sections to be joined by splice joint for girder length more than 10 meter.	



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IC

REV. 00

MAR 2026

3.2.0		Type of platform required on the bridge	Chequered plate platform 6mm thick over plain as per IS : 3502
	a.	Length	Full span length
	b.	Walkways	Access walkways of not less than 800 mm (clear) with hand railing of height of 1100 mm along the both side of bridge girder and cross over walkways.
	c.	Type of access from gantry girder level to crane bridge	Rung ladder at ends from gantry girder level walkway to crane bridges walkway
	d	Type of access to maintenance cage from crane bridges walkway	Rung ladder
	e	Type of access to Cabin from crane bridges walkway	By Staircase
	f	Provided at both ends	Yes
3.3.0		End carriage span (wheel base)	As per IS 807 (latest edition)
3.4.0		Trolley	The trolley frame shall be built up from heavy steel plates, angles and channels adequately braced to resist vertical, lateral and torsional strains, welded to form a rigid one piece frame. Alternatively, it may be of cast steel construction and should be covered by flooring as far as possible.
			On bottom of trolley frame, on each side a double spring bumper shall be provided to engage stops at each end of the bridge.
			800 mm (clear) with hand railing of height of 1100 mm along the cross over walkways on trolley.
	a.	Type	Fabricated
	b.	Method of fabrication	Fusion welded
	c.	Material	Mild steel, grade 'BR' of IS 2062
	d.	Other requirements	Upper pulley block shall be approachable for maintenance.
	e.	Whether jacking pads for lifting trolley provided or not	Yes
3.5.0		Rope drums	a) Drum will have minimum one spare groove when this hook is at its highest position. b) Rope will be of sufficient length so that drum has two full turns when hook is at the lowest position.
	a.	Material (Indicate IS)	Seamless pipe ASTM A 106 Gr. B or fabricated Fe410W IS 2062 Gr. B & stress relieved
	b.	Flange / flangeless	Flanged
	c.	Numbers provided	One for each hoist
	d.	Type of grooves	Identical Right hand and Left hand & other details shall be as per IS 3177:2020
3.6.0		Rope details	



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IC

REV. 00

MAR 2026

	a.	Construction	Extra flexible plough steel , 6 x 36 construction, Galvanised	
	b.	Standard conforming to	IS: 2266 (latest edition)	
	c.	Factor of safety	6 (minimum)	
	d.	Type of core	Steel/ Fibre	Steel/ Fibre
3.7.0		Sheaves details	1. Shall be machine grooved to a depth of not less than 1.5 (one and one half) times the diameter of the rope. 2. Guards shall be provided to retain the rope in grooves.	
	a.	Material	Fe410 WB IS 2062 Gr. B / CS Gr. 280-520 IS 1030 Design as per IS: 3177 (latest std.)	
	b.	Type of guards provided	Fabricated from rolled steel plate	
	c.	Diameter of equivalent sheaves in mm on root	Should not be less than 62% of calculated main sheave diameter	
3.8.0		COUPLINGS & SHAFTING		
3.8.1		Coupling details (between motor and gear box)	(for Main hoist, Aux hoist, Cross Travel and long travel)	
	a.	Type	Flexible geared type	
	b.	Guards and enclosures	Provided	
	c.	Coupling material and hardness	All couplings shall be of cast, wrought or from forged steel, tooth portion to be heat treated to hardness HB241-280	
3.8.2		Coupling details (between gear box and wheels)	Cross Travel (CT)	Long Travel (LT)
	a.	Type	Flexible geared type	
	b.	Guards and enclosures provided	Yes	
3.8.3		Coupling details (between gear box and rope drum)	Main hoist	Aux hoist
	a.	Type	Flexible geared type coupling housed within the drum	
	b.	Guards and enclosures provided	Yes	
3.8.4		Shafting (Output)	Cross Travel	Long Travel
	a.	Material	high tensile rolled steel.	
	b.	Arrangement of lubrication	Grease cups / Nipple	
	c.	Type of lubricant	Grease	
	d.	Factor of Safety	As per IS: 3177-2020	
	e.	Shaft deflection	Designed to limit shaft deflection to within 1/3000th of the span between bearings.	
3.9.0		Gear box details		
	a.	Type of mounting of gear box	Horizontal / Vertical	
	b.	Classification	Suitable for M3 duty	
	c.	Type of gears	For full speed: Helical / Spur For creep speed: Through VVVF drive	



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IC

REV. 00

MAR 2026

	d.	Type of lubrication (grease / splash / pump lubrication)	Splash Lubrication	
	e.	Difference in Gear and pinion hardness	Min 20 BHN	
	f.	Materials (gear/pinions)	cast steel or wrought steel & designed for the specified crane duty. Gears to be hardened, tempered & heat treated as per IS 4460	
	g.	Casings	Fabricated Fe 410w IS: 2062 Gr B & stress relieved	
	h.	Noise level	85 db	
	i.	Standard conforming to	IS: 4460 / AGMA	
	j.	Other requirement	The gears having speeds higher than 500 rpm to be of helical teeth type with active contact area hardened to a depth of 0.2 to 0.3 mm.	
3.10.0		Wheels details	Cross Travel	Long Travel
	a.	Material	C55Mn75	
	b.	Hardness	300 – 350 BHN	
	c.	Depth of hardness	10 mm (min)	
	d.	Process of hardening	Volume hardening	
	e.	Type	Double flanged and straight tread type	
	f.	Min.Numbers provided	4 nos.	8 nos.
	g.	Specification conforming to	IS: 3177-2020	
	h.	Arrangement of lubrication	Grease	
	i.	Other requirement	Bridge and trolley wheels shall be identical for interchangeability.	
3.11.0		Lifting hooks	POWER HOUSE CRANE	TRANSFORMER CUM GIS HALL CRANE
	a.	Type	MH- Ramshorn type as per IS 5749 AH- Ramshorn type as per IS 5749 Monorail hoist- Point hooks with shank as per IS 15560	MH- Ramshorn type as per IS 5749 AH- Point hooks with shank as per IS 15560
	b.	SWL (safe working load)	MH- 175T AH- 50T Monorail hoist- 10T	MH- 50T AH- 10T
	c.	Hook rating as per relevant IS	MH- 200T as per IS 5749 AH- 50T as per IS 5749 Monorail hoist- 10T as per IS 15560	MH-50T as per IS 5749 AH- 10T as per IS 15560
	d.	Hook can rotate	Yes	
	e.	Safety latch on hook provided	Yes	
	f.	Locking device on swivelling hook required or not	Provided	
	g.	Other Requirement	The swiveling hook shall be of forged steel and mounted on ball thrust bearings and protective skirt shall be provided to enclose the bearings for power house cranes.	
3.12.0		Buffers	Cross travel	Long travel



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IC

REV. 00

MAR 2026

	a.	Type	Spring loaded / hydraulic type rubber buffer To be designed to bring the loaded crane to rest from speed of 50% of the rated speed to a deceleration rate not exceeding 5m/s ²	
	b.	Numbers provided	4	4
	c.	Details of end stop	Mild steel, grade 'B' of IS 2062	
3.13.0		Brakes		
3.13.1		Hoist Motions	Main hoist	Aux hoist
	a.	Type of brake	AC Electro-Hydraulic Thruster operated + DC Electromagnetic	
	b.	Number provided per motor	1+1	1+1
	c.	Braking capacity (% of torque transmitted to the brake drum with full load.)	150%	150%
	d.	Material		
		· Brake liners	Ferrodo liners	
		· Drum	CS IS : 1030 / CL 4 IS : 1875	
		· Springs	As per manufacturers standard	
3.13.2		Travel Motions	CT	LT
	a.	Type of brake (ac / dc / thruster)	AC Electro-Hydraulic Thruster operated + DC Electromagnetic	
	b.	Number provided per motor	1+1	1+1
	c.	Braking capacity (% of motor rated torque before derating)	150%	150%
	d.	Material		
		· Brake liners	Ferrodo liners	
		· Drum	CS IS : 1030 / CL 4 IS : 1875	
		· Springs	As per manufacturers standard	
3.13.3		Other requirements for hoist and travel brakes	The brakes system shall have the following provisions:- a) Locking device in the brake lever. b) Means for adjustment to compensate for wear of the shoes. c) Emergency stop push buttons.	
3.13.4		Holding Clamps Against Earthquake	Shall be provided for all cranes to withstand the seismic events and earthquake.	
3.14.0		Motors		
	a.	Type	Three phase Squirrel Cage Induction motors to be operated from VFD system shall be suitable for speed range and torque without exceeding temperature rise limits as specified elsewhere in this specification. VFD shall be used to drive three (3) phase squirrel cage inverter duty Induction motor with VPI insulation (Resin poor) suitable for VFD application.Suitable for Inverter duty.	



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IC

REV. 00

MAR 2026

	b.	Design Codes & Standards	1 Three phase induction motors : IS15999, IEC:60034, IS: 12615, IS: 325 2 Single phase AC motors : IS:996, IEC:60034 3 Energy Efficient motors : IS 12615, IEC:60034-30 4 Crane duty motors : IS:3177, IS/IEC:60034 5 Designation of Methods of Cooling of Rotating Electrical Machines: IS 6362 6 Designation for types of construction and mounting arrangement of rotating electrical machines: IS 2253
	c.	Enclosure	TEFC
	d.	Numbers furnished	For Main hoist: 1 no. For aux hoist: 1 no. For Cross travel: 2 nos. For long travel: 2 nos.
	e.	Voltage, phase and frequency	415V \pm 10%, 3 Ph., 4 wire, 50 Hz, -5/+3 % Combined voltage & frequency variation \pm 10% absolute
	f.	Class of protection for motor including terminal box	IP – 54
	g.	Rated capacity (KW)	Motor nameplate rating at 40 deg C shall have Motor rating will be calculated keeping margin of at least 10% over the maximum power requirement in the duty condition specified.
	h.	Duration factor/duty	25 % CDF / S-4
	i.	Pull out torque	275% of full load torque
	j.	Class of insulation	Class- F. Temperature rise shall be restricted to limits corresponding to Class 'B' insulation
	k.	Number of starts/ hour	150 Starts / hr
	l.	Overload protection for motors provided	Yes
	m.	Space heater requirements	For motors of rating 20 KW and above. Separate terminal box for space heaters shall be provided.
3.15.0		Cradle	One(1) set of cradle (common for power house and transformer hall)
3.16.0		Drive system for hoisting	
	a.	Arrangement of drive from motor to rope drum (main)	Through geared coupling and gear box
	b.	Arrangement of drive from pony motor to rope drum (creep speed)	Creep speed through VVVF drive.
3.17.0		Bearings (for crane hook, Trolley wheels, rope drum, gear box or any other assembly)	
	a.	Type	Antifriction ball / roller bearings
	b.	Number provided for each	As per assembly requirements



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IC

REV. 00

MAR 2026

	c.	Method of lubrication	Centralised grease lubrication with hand operated grease pump for all bearings as per bidder's standard proven practice.
	d.	Bearing life	not less than 10,000 working hours
3.18.0		Rails	
	a.	Type / section	Rails sections as per IS: 3443. Joint to be butt-welded by thermit welding or fusion welding. Material grade- Grade 50 C12
	b.	Rails	CR-100
3.19.0		Power conductors (DSL)	
	a.	Voltage drop	Cable from main isolating switch (1.5M above operating floor) to motor terminal shall be so sized that the voltage drop does not exceed 3% of rated voltage at motor terminals.
	b.	Type	LT: PVC shrouded Cu conductor bus bar. CT: Flexible trailing cable mounting on retracting support (Festoon type) EPR insulated and CSP Sheathed type / Energy chain
	c.	Length	Suitable for bay length
	d.	Guard provided for DSL	Yes
3.20.0		Cables	
	a.	Power cables	1100V, IS: 1554 (part-I)- 1964 "PVC insulated (heavy duty), Min. size. 2.5 sq. mm
	b.	Control cables	1100V, IS: 1554 (part-I)- 1964 "PVC insulated (heavy duty), Min. size. 1.5 sq. mm
	c.	Trailing cable	1100 V Grade flexible trailing cable shall be tinned copper of Class – 5 of IS – 8130, heat resistant electrometric compound based on EPR insulation, inner sheath of heat resistant electrometric compound PCP sheath, nylon cord reinforcement and heat resistant, oil resistant and flame retardant heavy duty electrometric compound FRLS CSP outer sheath. Min. size. 2.5 sq. mm
	d.	Size	Cables shall be sized based on the following considerations: a) Rated current of the equipment b) Cable from MCC board to motor terminal shall be so sized that the voltage drop does not exceed 5% of rated voltage. c) Short circuit withstand capability Derating factors for various conditions of installations (variation in ambient temperature, grouping of cables) shall be considered while cable sizing.



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IC

REV. 00

MAR 2026

	e	CABLE TRAYS	<p>Cable trays shall be ladder/perforated type complete with matching fittings (like brackets, elbows, bends, reducers, tees, crosses, etc.) accessories (like side coupler plates, etc. and hardware (like bolts, nuts, washers, G.I. strap, hook etc.) as required. Cable tray shall be ladder type for power & control cables and perforated for instrumentation cables.</p> <p>Cable trays, fittings and accessories shall be fabricated out of rolled mild steel sheets free from flaws such as laminations, rolling marks, pitting etc. These (including hardware) shall be hot dip galvanized.</p> <p>Cable trays shall have standard width of 150 mm, 300 mm & 600 mm and standard lengths of 2.5 metre. Thickness of mild steel sheets used for fabrication of cable trays and fittings shall be 2 mm. The thickness of side coupler plates shall be 3 mm.</p> <p>Cable troughs shall be required for branching out few cables from main cable route. These shall be U-shaped, fabricated of mild steel sheets of thickness 2 mm and shall be hot dip galvanised. Troughs shall be standard width of 50mm & 75 mm with depth of 25 mm.</p>
	f	SUPPORT SYSTEM FOR CABLE TRAYS	<p>Cable supporting steel work for cable racks/cables shall comprise of various channel sections, cantilever arms, various brackets, clamps, floor plates, all hardwares such as lock washers, hexagon nuts, hexagon head bolt, support hooks, stud nuts, hexagon head screw, channel nut, channel nut with springs, fixing studs, etc. All steel components, accessories, fittings and hardware shall be hot dip galvanized. Cable tray support system shall be pre-fabricated out of single sheet. Support system for cable trays shall essentially comprise of the two components i.e. main support channel and cantilever arms. The main support channel shall be of two types : (i) C1:- having provision of supporting cable trays on one side and (ii) C2:-having provision of supporting cable trays on both sides. The main support channel and cantilever arms shall be fabricated out of 2.5 thick rolled steel sheet conforming to relevant IEC/Equivalent standard. Cantilever arms of 320 mm, 620mm and 750 mm in length are required.</p>
3.20.0		Operators cabin (for each crane)	Ergonomic design with glass on three sides for clear view of the working area.
	a.	Type of construction	Open Type
	b.	Area and minimum clear height	2500x1850 mm with a head room of 2000 mm
	c.	Operator's seat	Cushioned, Revolving type



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IC

REV. 00

MAR 2026

	d.	Warning gong	A foot operated electric warning horn of double bell type suitable for 240 V AC. of noise level 95 dB at 3.5 m. One brass gong suspended outside the Cabin and operated from inside.	
	e.	Alarm	A distinct type alarm with conspicuous warning lights on either side of the crane bridge to indicate overloading of crane.	
	f.	Position of controllers	In front/ side of operator's chair	
	g.	Ventilation	One no electric fan in cabin	
	h.	Other requirements	1. A cut off switch near the cabin for disconnecting the incoming power supply before entering or leaving the cabin for operator safety shall be provided. 2. Mat for cabin floor	
3.21.0		Limit switches qty		
	a.	Hoisting motion	Main hoist	Aux. Hoist
		Raising	1	1
		Lowering	1	1
		Emergency 'up' limit	1	1
	b.	Travel motion	Trolley (Cross) Travel	Bridge (Long) Travel
		Forward/Reverse	2/1 (one way/ two way lever type)	2/1 (one way/ two way lever type)
	c.	Material of contacts	Double break Silver Cadmium	
	d.	Control voltage / Enclosure	110 V/ IP 55	
	e.	Type, contact rating and resetting of limit switches	Totally enclosed type, 5 A at 240 V AC by reversing the controller.	
3.22.0		Isolating switch		
	a.	Main isolating cum changeover switch (01 no.), mushroom type emergency STOP push buttons : At center of bay length(to be decided during detail engineering). Additionally Two nos. isolating switch shall be provided at extreme ends of the bay length, at a distance of approximately 20 mtrs. From the centre line of first & last column for maintenance of the cranes.		
	b.	Power cable from switchgear to isolating switch at power house/ transformer hall shall be in vendor scope		
	c.	Motor starter shall be part of crane control panel.		
3.23.0		Protective Panel	Shall be Provided with isolating switch, power contactor control and indication to switch ON/OFF power to starter panels, control and lighting transformer, Indicating lamps to indicate the live condition of all three phases, main supply ON/OFF lamps on the door, internal illumination.	
	a.	Material	Cold Rolled Sheet steel 2 mm size,3mm for Gland Plate	
	b.	Numbers and location	One number located in cabin	
	c.	DOP	IP 54	
3.24.0		Control panel	Indicating lamps to indicate main supply ON/OFF lamps on the door of the panel. Each panel shall have internal illumination.	
	a.	Material	Cold Rolled Sheet steel 2 mm size,3mm for Gland Plate	



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IC

REV. 00

MAR 2026

	b.	Numbers and location	One each for MH, AH, CT and LT located on bridge platform with space heaters.
	c.	Degree of protection	IP 54
3.25.0		Master Controllers (Desk Type)	
	a.	Number of steps	Five speed control points in each direction of hoist motion. Four speed control points in each direction of bridge and trolley motion.
	b.	Voltage & current rating	415 V/10 A
	c.	Type	Heavy duty type having DOP IP54. Release of operators' hand from the controls shall stop motion and set brakes automatically.
	d.	Location	In cabin
3.26.0		Control for Hoists /CT/LT operations	Through separate Variable Voltage Variable frequency drive
	a.	Speed control	Thru' VVVF with minimum 6 pulse design
		Design margin	VFDS shall be sized for the specific application with a design margin of atleast 10% over the motor rating. The drive shall be rated to operate at a design ambient of 50°C
	b.	Starting torque of VVVF	Up to 400 % typical with/ without encoder
	c.	Starting current	Less than 150 % of rated torque.
	d.	Temperature	VVVF system shall be capable of withstanding up to 50 o C without derating.
	e.(i)	Other requirements for VFD	Necessary input & output devices to be provided to reduce harmonics, as per IEEE519, at supply side of the drive at the switchgear.DOL starter By pass arrangement.
	(ii)		The Variable frequency drive (VFD) system shall be of a modern proven design for similar applications in power plants/industry. The system shall be either Current Source Inverter (CSI) or Voltage Source Inverter (VSI) type with minimum 6 pulse with active frontend harmonic filter.
	(iii)		All necessary protections e.g., Input Phase Loss, Earth Fault, Over Voltage, Output Short Circuit, Load Loss, Input Transient Protection, overload etc to be provided.
3.27.0	a.	Contactors	AC 4 duty for reversing application. AC 3 duty for non-reversing application
	b.	Switches	AC 23 for motor application, AC 22 for other application.
	c.	Fuses	HRC
	d.	Overload relay	Temperature compensated bimetallic with single phasing preventor.
3.28.0		Power supply	415 V, 3 phase, 3 wire supply



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IC

REV. 00

MAR 2026

3.29.0		Cable glands	Cable shall be terminated using double compression type cable glands. Cable glands shall conform to BS:6121 and be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene and of tested quality.	
3.30.0		Cable Lugs	a) Power cables with aluminium conductor :Aluminium crimping type. b) Power cables with copper conductor : Copper crimping type. c) Control Cables : Copper pin type /Copper screw type	
3.31.0		Transformer	(Dry type, With Insulation Class B or Better)	
	a.	Quantity	2 X 100 % for control, 1 no for lighting & 1 no for hand lamp.	
	b.	Voltage Rating	Control 415/110V, Lighting 415/240V and hand lamp 415/24V.	
	c.	KVA rating	20% over loading to be considered while sizing the rating	
3.32.0		Illumination	POWER HOUSE CRANE	TRANSFORMER CUM GIS HALL CRANE
	a.	In cabin	Two 10W LED fixture, 2nos. 240V – 5A – 3 pin industrial socket. 15A/20A socket outlet shall be provided for A/C	Two 10W LED fixture, 2nos. 240V – 5A – 3 pin industrial socket. 15A/20A socket outlet shall be provided for A/C
	b.	Over Bridge	4 nos 40 W fluorescent with incandescent lamps and 4nos. 240V – 5A – 3 pin industrial socket	4 nos 40 W fluorescent with incandescent lamps and 4nos. 240V – 5A – 3 pin industrial socket
	c.	Under bridge	Six 1000 watt highway beamed flood lighting units The Lux Level of flood lighting shall be 200 Lux.	2 nos. 1000 watt highway beamed flood lighting units
	d.	For inspection of crane components	One (1) portable 9W LED type hand lamp with min. half span length flexible cable for inspection of crane components.	One (1) portable 9W LED type hand lamp with min. half span length flexible cable for inspection of crane components.
3.33.0		Fire Extinguisher	POWER HOUSE CRANE	TRANSFORMER CUM GIS HALL CRANE
	a.	Type and size	4.5 kg , CO2 type	4.5 kg , CO2 type
	b.	Location	One in cabin and Three on bridge	One in cabin and Three on bridge
3.34.0		Maintenance cage	Suitable inspection cages to accommodate two persons to facilitate inspection of down shop lead.	



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IC

REV. 00

MAR 2026

3.35.0		Mechanical overload protection (Load Cell with digital display)	To be provided for each cranes
3.35.1		Load cell specification	a) The load cell shall be of compression type and IP 68 protection.b) The power supply shall be 230V AC or 110 V AC 50Hz single phase.c) The load cell shall be placed in such a way that the load which is inert on the equalising pulley/bar is transferred to this load cell by a pivot assembly.d) The built-in crane weighing system should have local indicator., processor based type. LED display, IP 55 protection, shall be located on the control cabin of the crane.e) The built-in crane weighing system should have remote indicator, LED display type,minimum visibility range of 50 m, shall be located on the crane girder.t) The resolution shall be in the order of 5kg.g) The system shall have the provision of tripping the circuit in case of overloadingthe cranes and should serve on an additional overload safety device.To be provided for main hoist mode and aux hoist mode.Digital display of load should be clearly visible from operation floor.
3.36.0		RRC details	
	a.	RRC should be supplied with transmitter unit, receiver unit, encoder unit, decoder unit, interface panel, coupling system, battery unit and any other control gear if required.	
	b.	The equipment should be based upon the microprocessor based digital technology with almost nil hard wiring.	
	c.	The remote unit should communicate up to the distance of approximately 100 meters.	
	d.	The system has to integrate with the control system of crane, which operates at 110 V AC, Single phase.	
	e.	The remote unit should have transmitter which can be mounted on shoulder by suitable belt. Main controls can be of single joystick movement or double joystick movement type stepped control with spring return. The Micro control should be toggle switch type or push control type.	
	f.	Frequency allotment for radio remote unit from Govt. of India, Dept. of Telecommunication or any other agency shall be the responsibility of supplier.	
	g.	The transmitter and receiver unit should have its own frequency and address code with each system having its own security code so that one particular set becomes unique and there is no interference from any other remote unit device. A microprocessor should check all security codes. The processor should have its own watchdog circuit. The receiver FM band should be sufficiently narrow to allow only passing of desired frequency and valid command. Any error should shut down the system immediately.	
	h.	The remote unit should have safety key to prevent any unauthorized operation. All the crane operations should stop at once the communication breakdown occurs.	
	i.	On local unit (receiver side), the system should be provided with one selector switch so that EOT crane can be operated either from Operator cabin or radio remote unit.	
	j.	The receiver unit along with I/O interface unit should be able to bear the vibrations and shocks encountered in normal usage of EOT crane.	
	k.	The system should have very fast response time.	



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IC

REV. 00

MAR 2026

3.37.0	Pendent Push buttons station	Movable and retractable type. The pendent push button shall be provided with a lockable (with key) ON-OFF provision. Emergency stop, Power on-off with lamps, start, lights, main and creep speed for up & down, forward & reverse for Cross travel and long travel, alarm, selector switch (for mode of operation), glow type push buttons to be provided. Indicative marking for easy operation shall be provided. 1. Suitable for IP 55 protection 2. Ambient temp (-25 to 60 deg C) 3. Pendant cable shall be multicore EPR flexible. 4. PVC coated steel wire rope for pendant shall be 2 mm. 5. Fabricated from CRCA sheet.
3.38.0	Sweep	Sweep shall be attached to the end carriages and to the trolley to remove foreign materials from the rails.
3.39.0	Anti Collision device	Suitable anti-collision device of two cranes running on the same bay, along with stoppers at both the gable ends.
3.40.0	Lubrication	
	a.	Provisions shall be made for proper lubrication of all parts.
	b.	Pressure lubrication system comprising gun for lubrication of all easily accessible grease type bearings provided with grease nipples. Provision of means to prevent development of excess lubrication pressure at the bearings.
	c	The crane shall be provided with all necessary lubrication fittings.
	d	Lubricating points shall be located for easy and safe access without the necessity of removing guards or other parts. Lubrication lines shall be securely fastened to the cranes structure and shall be located to provide the maximum protection and so that ordinary repairs can be made without removing the lines.
	e	The crane shall be provided with a centralized lubrication system of reputed make with hand operated grease pump shall be provided for anti-friction bearings. This system shall be manually operated, complete with a manual pump, reservoir, supply lines, connectors, valves, and discharge lines to all bearings. System shall be centralized lubrication type with at least, one pump mounted on the trolley and one on each of the crane bridge with supply line for connection to all lubrication points. .
	f	Gear trains to be lubricated by oil bath. Sleeve bearings to be oil lubricated.
	g	Grease pipelines of copper or brass for bearings not easily accessible- e.g. end carriage wheels. For reliability, distribution lines to be double lines for ensuring continuous lubrication in case one line gets choked.
	h.	Initial lubrication of crane before handing over is BHEL responsibility which shall be done in the presence of SJVN
	i	Portable hand operated lubrication equipment viz. grease gun etc. shall be provided.
	j.	Suitable drip pans shall be provided to collect oil and grease which may drip from bearings, gear cases and other components of the crane. In case drip proof arrangement is not possible, means for cleaning the drip pans shall be available.
3.41.0	DSL phase indicating lamps	to be provided on both side of bay length and after isolation switches in maintenance bay.



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IC

REV. 00

MAR 2026

3.44.0	Consumables	The Bidder's scope includes requirements of consumables such as oils, lubricants including grease, servo fluids, cadmium compounds, gases and essential chemicals etc. First fill of all these consumables shall also be included in the scope of the Bidder.
3.45.00	Electrodes	Radiography quality, covered electrodes with heavy covering as per IS : 814 and relevant requirements of ASME Sec. IX and IIC. Bare Electrodes as per IS:7280 and flux wire combination as per IS : 3613.
3.46.00	Lifting beam (applicable for Power house cranes only)	One (1) equaliser beam, fittings, connections, electric controls and other accessories required when the cranes are operating in tandem for lifting rotor. One (1) set of fabricated steel equaliser beam stand(s) for support when beam is not in use.
Note:-		
1	No cast iron part shall be used except for electrical equipment. Similarly, no wood or other combustible material shall be used in any part of the crane.	
2	All motors on each crane shall be supplied through single contractor operated main switch; each motor shall be protected by a protective device of approved manufacturer. The protective device shall be arranged so that in the event of a fault the main contractor will open, isolating all motors and applying electro mechanical brakes.	
3	CONNECTIONS i) Unless otherwise specified, only welded joints shall be used. ii) Where welding is not practicable turned or fitted bolts shall be used. iii) Black bolt shall not be used in main structures and high tensile bolts shall not be used unless approved by the Purchaser. Bolts shall preferably be not used in tension. iv) Minimum number of turned and fitted bolts in connection shall not be less than two. v) Where bolts pass through sections having tapered flanges, tapered flats shall be welded to inside of the flanges. Tapered washers shall not be used. vi) Transverse fillet welds on load carrying members shall be avoided. If side fillets are used in end connections, the length of each side fillet should not be less than the edge distance between the fillets. vii) Butt welds on structural members under tensile stress shall be 100% checked by Radiographic examination. Bidder to confirm the no of radiography joints during the detailed engineering / with offer. Bidder to submit the radiography reports. viii) Splices shall be designed as per International code to resist one and half times the forces and moments to which it is subjected, but in no case it shall be less than 2/3rd of the effective strength of the material spliced except that splices in the webs of the plate girders shall be designed for full strength of the web in shear as well as bending. Thickness of splicing plate shall be ten percent more than that of the material spliced. Splices shall be proportioned and arranged, so that the gravity axis of the splices is in line with the gravity axis of the members to avoid eccentricity.	
4	Drain holes shall be provided in all places where water or oil is likely to collect.	
5	Trolley travel ends shall be curved upwards to stop the trolley smoothly and prevent it from leaving the rails in case of over travel at its maximum speed.	



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IC

REV. 00

MAR 2026

DATA SHEET-A FOR 10T ELECTRIC HOIST IN POWER HOUSE CRANE

S.N..	DESCRIPTION	TECHNICAL PARTICULARS
1	Type	Electric wire rope hoist
2	General Design & duty	As per IS: 3938 latest conforming to Class-2
3	Type of service	Indoor
4	Overload test	125% of SWL
5	Design Ambient temperature	40 deg C
6	Operating speed	Hoisting motion- 12 mpm CT motion- 12 mpm
7	Type of transmission	Through Electric motor and gearbox
8	Operation from	Pendent Push Button
9	Wire Rope	
9.1	Construction / core	Extra flexible plough steel, 6 x36 construction, (Steel / Fiber), Galvanised, Grade 1960 N/mm ² .
9.2	Code	IS:2266
9.3	Number of falls	Min. 4
9.4	Factor of safety	6
10	Load Hook and block	NORMALISED HOOK ONLY
10.1	Type of load hook	Shank type swiveling with safety latch and also with swivel lock pin.
10.2	Load hook Code	IS: 15560
10.3	Load hook Material	As per IS: 1875, minimum Class 3
10.4	Hook suspension	Thrust bearing
10.5	Material of block suspension	Fabricated from steel plate, Material: IS: 2062 grade A or B
11	Gear & pinion	
11.1	Type	Spur / Helical
11.2	Material	Gear: 16 Mn Cr 5 / 20 Mn Cr 5 / C40 / C50 / EN19 / EN24 / SAE 8620 / 16 Cr Ni 4 / 18 Ni Cr Mo5 / 39 Ni Cr. MO3 / 42 Cr MO4
11.3	Lubrication	Oil splash / grease lubricated
11.4	Bearing type	Antifriction Ball / Roller
12	Trolley drive	
12.1	Wheel	Single flanged
12.2	Wheel conform to (Std. / code)	IS: 3938
12.3	Wheel material	Cast, forged or rolled steel to be decided in detail engineering.
12.4	Bearing type	Antifriction Ball / Roller
12.5	Trolley type	Adjustable type to accommodate beams flange width. Actual beam size shall be confirmed during detail engineering before manufacturing clearance.
12.6	Hardness	200 BHN (max)
12.5	Type	Tapered/ Flat tread based on beam type, size of ISMB or NPB. Same is project specific and shall be confirmed during detail engineering
13	SHEAVE	



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IC

REV. 00

MAR 2026

13.1		Material	Fabricated from steel plate. IS: 2062 Gr. B / carbon steel casting as per IS 1030 or as per IS: 3938.	
13.2		Bearing type	Antifriction Ball / Roller	
14		BRAKES		
14.1		Type	For Hoisting & CT: DCEM/ACEM (fail to safe)	
14.2		Capacity	150 % of rated motor torque	
14.3		Number	One number for each motor.	
15		Lubrication	Oil splash/Grease lubrication	
16		Wheel	EN8/En9	
17		ROPE DRUM		
17.1		Material	Seamless steel pipe. ASTM A106 Gr A /B /ASTM 53 grade B; Fabricated from MS as per IS 2062 Gr A/B.	
17.2		Flange / Flangeless	Flanged	
17.3		Type of groove	RHO and LHO/LHO/RHO lay type to suit the layout requirement for nearest hook approaches.(Shall be decided during detail engineering).	
18		TYPE OF POWER SUPPLY TO HOIST	Shrouded Bus Bar (GI) Conductor Type DSL.	
19		MOTORS	HOIST & TROLLEY	
19.1		Type	Sq. Cage induction, TEFC, S4 duty, 40% CDF. Service class of motor shall be Class 2 as per IS:3938, to be informed on project to project basis.	
19.2		Number of start	150 starts / hr	
19.3		Voltage , Phase and Frequency	415V ± 10%, 3 phase, 50 Hz, 3 wire/ 4 wire shall be informed during detail engineering.	
19.4		Class of insulation	Class "F" and temperature rise limited to class "B" or 70°C	
19.5		Type of enclosure	TEFC	
19.6		Degree of protection provided for enclosure	IP-54	
19.7		Margin	The motor rating shall be arrived considering 10% margin over the maximum power requirement.	
20		LIMIT SWITCHES	Hoisting / lowering	Trolley
20.1		Type (project specific)	-Snap action, self-actuating type	Two/ one-way lever
			Rotary geared + gravity type	Two/ one-way lever
20.2		Construction	Shall be housed in robust metallic, oil and dust tight enclosure conforming to IP-65. At least 2 NO and 2 NC contacts shall be provided for each limit switch. Material of contact shall be high grade silver cadmium plated with high conductivity and non-corrosive type.	
		CONTROL PANEL (Hoist mounted).	* Fabricated from CRCA steel sheet min 2 mm thick.	
			* Degree of protection shall be IP 55.	
			* Power on indicating lamps shall be provided	
21			* Panel illumination lamps (LED type) operated by door switch.	
			* 2 nos earthing bolts on panel.	



**SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)
TECHNICAL SPECIFICATION FOR
DOUBLE GIRDER EOT CRANE**

SPECIFICATION No: PE-TS-542-501-A201

SECTION IC

REV. 00

MAR 2026

			* 20 % spares terminals (clip on type) shall be provided.
			* Power and control terminals (clip on type) shall be on separate channels.
			* Gland plate thickness shall be minimum 3mm.
			* Gland plate shall be double brass compression type.
22		Control Voltage (AC)	110 V
			Up /down / forward / Reverse push buttons (glow type). Indicative marking for easy operation shall be provided.
23		Pendent Push buttons station	1.Suitable for IP 55 protection
			2.Ambient temp (40 deg C)
			3.Suitable for upto: 1.5 X 14C cable entry.
			4.Pendant cable shall be multicore EPR flexible.
			5.PVC coated steel wire rope for pendant shall be 2 mm.
24		Power cables	1100V, IS: 1554 (part-I)- 1964 "PVC insulated (heavy duty), Min. size. 2.5 sq. mm
25		Control cable	1100V, IS: 1554 (part-I)- 1964 "PVC insulated (heavy duty), Min. size. 1.5 sq. mm
26		Control Transformer	Dry type, with insulation class B or better. Rating shall be minimum 20% over loading to be considered while sizing the rating.
27		Other requirements	1. Inching operation of hoist is to be through main hoist motor. 2. DSL phase indicating lamps (LED type) to be provided. 3. Pull out torque of motor at rated voltage shall be 275% of full load torque. Starting torque of motor at rated voltage shall be 225% of full load torque. 4. Earthing conductor size shall be minimum as follows a) Push buttons – 8 SWG GI wire b) Panel & motors – 25 x 3 mm GS flats 5. Bearing life shall be 20 years minimum or 10,000 working hours whichever is more. 6. Spring or rubber buffers shall be provided on the trolley



**TECHNICAL SPECIFICATION
DOUBLE GIRDER EOT CRANES
SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)**

PE-TS-542-501-A501

Rev. No. 00

Date : MAR 2026

SECTION – III

Sl no.	Description
1	DOCUMENTS TO BE SUBMITTED ALONG WITH THE BID
2	COMPLIANCE CUM CONFIRMATION CERTIFICATE
3	PRE-BID CLARIFICATION SCHEDULE



**TECHNICAL SPECIFICATION
DOUBLE GIRDER EOT CRANES
SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)**

PE-TS-542-501-A501

Rev. No. 00

Date : MAR 2026

DRAWINGS/ DOCUMENTS TO BE SUBMITTED WITH THE BID

- 1 Pre-qualification requirement (PQR) documents
- 2 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.
Or,
No deviation certificate
- 3 Un-priced copy of price format indicating quoted/ not quoted against each row / column.
- 4 Signed and stamped copy of Compliance cum Confirmation Certificate

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 ACCORDINGLY WILL NOT BE CONSIDERED FOR BID EVALUATION.



**TECHNICAL SPECIFICATION
DOUBLE GIRDER EOT CRANES
SUNNI DAM HYDRO ELECTRIC PROJECT
(5X73 MW + 1X17 MW)**

PE-TS-542-501-A501

Rev. No. 00

Date : MAR 2026

COMPLIANCE CUM CONFIRMATION CERTIFICATE

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

1	The scope of supply, technical details, construction features, design parameters 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.
2	Bidder shall submit Manufacturing Quality Plan(MQP) in the event of order based on the guidelines given in the specification & reference MQP enclosed therein. MQP will be subject to BHEL / CUSTOMER approval & customer hold points for inspection / testing and additional inspection requirement, if any shall be marked in the MQP 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.
3	All drawings/ data-sheets / calculations etc. submitted along with the offer shall not be taken cognizance off.
4	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 then same shall be resolved by the bidder with BHEL 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, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.
5	All sub vendors shall be subject to BHEL / CUSTOMER approval in the event of order.
6	Guarantee for plant /equipment shall be as per relevant clause of GCC /SCC /Other Commercial Terms & Conditions.
7	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. 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.
8	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.
9	As built drawings shall be submitted as and when required during the project execution.
10	That the bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering 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.
11	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 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.
12	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 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.

