

**TELANGANA STATE POWER GENERATION  
CORPORATION LTD.**

4 X 270MW BHADRADRI TPS AT MANUGURU,  
KHAMMAM, TS

VOLUME IIB & III

TECHNICAL SPECIFICATION  
FOR  
SINGLE GIRDER CRANE

SPECIFICATION NO.: PE-TS-411-524-A001



BHARAT HEAVY ELECTRICALS LTD

POWER SECTOR PROJECT ENGINEERING MANAGEMENT  
PPEI, NOIDA-INDIA



**TECHNICAL SPECIFICATION FOR  
SINGLE GIRDER CRANE  
4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

INDEX

Rev 01 Date Oct 2015

**VOLUME – IIB**

SECTIONS	TITLE	Page no.
SECTION-A	INTENT OF SPECIFICATIONS	1
SECTION-B	PROJECT INFORMATION WITH WIND AND SEISMIC DESIGN CRITERIA	4
SECTION-C		
C1 -A	<b>SPECIFIC TECHNICAL REQUIREMENT</b> (Scope of supply & services, exclusion and terminal points etc.)	7
C1-B	GENERAL REQUIREMENT (General Technical Requirement, General conditions, Engineering services)	17
C1-C	FUNCTIONAL / PERFORMANCE / DEMONSTRATION GUARANTEE (AS APPLICABLE)	NA
C1-D	QUALITY ASSURANCE	91
C1-E	PAINTING SPECIFICATION	96
SECTION-C2	TECHNICAL SPECIFICATION (ELECTRICAL)	98
	<b><u>ANNEXURES</u></b>	
i)	ANNEXURE-I - MAKES OF SUB-VENDOR ITEMS	117
ii)	ANNEXURE-II -MANDATORY SPARE LIST	120
iii)	ANNEXURE-III – Check list for Operation and maintenance Manual	122
iv)	ANNEXURE-IV - Load/ Overload testing of EOT crane at manufacturer's works	125
v)	ANNEXURE-V - DRAWING / DOCUMENT DISTRIBUTION SCHEDULE	126
vi)	ANNEXURE-VI - Main Drawing list with schedule of submission	128
vii)	ANNEXURE-VII - Site Storage and preservation	NA
viii)	ANNEXURE-VIII - Input Drawing.	129
SECTION-D	<b>STANDARD TECHNICAL SPECIFICATION</b>	135

**VOLUME-III**

SECTIONS	TITLE	Page no.
1	List of documents to be submitted with bid	146
2	Compliance cum confirmation certificate	147
3	Pre Bid Clarification Schedule	148
4	Electrical load data	149
5	Suggestive price format	150
6	Deviation sheet (cost of withdrawal)	158

PEM-6666-0



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -A

Rev 01 Date Oct 2015

**SECTION-A**  
**INTENT OF SPECIFICATION**



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -A

Rev 01 Date Oct 2015

**SCOPE OF ENQUIRY**

- 1.1 The specification is intended to cover design, engineering, manufacturing, inspection and testing, painting, supply/ delivery duly packed at FOR site including Mandatory spares, erection & commissioning spares, maintenance tools & tackles, all accessories (isolating switch and power cable from isolating switch to DSL rails) including freight and handing over to the customer in line with drawings/ documents/ test procedures approved by BHEL/ Customer for single girder cranes as per scope list below.
- 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 of SINGLE GIRDER CRANE.**
- 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 Vol-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.



**TECHNICAL SPECIFICATION FOR  
SINGLE GIRDER CRANE  
4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -A

Rev 01 Date Oct 2015

- 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, Section - C shall prevail over section – D, however 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 TSEGENCO including their consultant as interpreted by BHEL in the relevant context. For details refer the relevant clause in GCC.

**Scope list:**

S No.	Area/Equipment Description	Type	Quantity (Nos.)	Capacity (T)	Span (m)	Lift (m)	Travel (m)
1	Air compressor house	U/S EOT	1	8T	10.5	4.5	44
2	Clarified water pump house water pump house	U/S EOT	1	5T	11	12	33
3	Raw water pump house water pump house	U/S EOT	1	5T	6	15	13
4	CWPH screens and gates handling	Semi gantry	2	8T	4.9	16.67	50
5	FUEL OIL PUMP HOUSE (Suitable for hazardous operation for hazardous area zone IIA/IIB)	U/S EOT	1	3T	7.5	12	15

PEM-6666-0



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -B

Rev 01 Date Oct 2015

**SECTION B**

**PROJECT INFORMATION 4X270 MW BHADRADRI TPS**



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -B

Rev 01 Date Oct 2015

**INTRODUCTION**

4x270 MW Bhadradi TPS is being set up by Telangana State Electricity Corporation Limited (TSGENCO) at Manuguru in the district of Khammam, Telangana, India.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on BHEL/Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

**APPROACH TO SITE**

**The distance from Manuguru to Major cities in state:** Hyderabad-345KM, Warangal-180km, Bhadrachalam-38km, Kothagudem-70km and Khammam-130km, Vijayawada-195km.

**District:** KHAMMAM

**State:** TELANGANA

**Nearest Airport:** The nearest airport is Vijayawada Airport but the most used airport is the Hyderabad International Airport.

**Nearest Railway Station:** Manuguru railway station is 10KM from nearby town. However Warangal/Vijaywada railway Station is major railway station near to Manuguru.

- |                                |  |
|--------------------------------|--|
| <b>1. Owner</b>                | TSGENCO  |
| <b>2. Owner Consultant</b>     | DESEIN PRIVATE LIMITED, NEW DELHI  |
| <b>3. Project Title</b>        | 4X270 MW Bhadradi TPS  |
| <b>4. Location</b>             | 16 Km from Manuguru Railway station  |
| <b>5. Nearest Railway Stn.</b> | Manuguru   |
| <b>6. Temperature</b>          |  |
| a.                             | Mean daily minimum ambient temperature during oldest month of the year=11.5 Deg.C  |
| b.                             | Mean daily minimum ambient temperature during hottest month of the year=45.1 Deg.C |
| <b>7. Rainfall</b>             |  |
|                                | Intensity of rainfall @ 80 mm/hr considering heaviest fall in 24 hrs               |
| <b>8. Wind Data</b>            |  |
| a.                             | Basic wind speed at 10m height <span style="float: right;">44 m/sec</span>         |
| b.                             | Wind pressure <span style="float: right;">As per IS: 875 Part III- 1987</span>     |



**TECHNICAL SPECIFICATION FOR  
SINGLE GIRDER CRANE  
4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -B

Rev 01 Date Oct 2015

**9. Seismic Zone**

Zone III as defined in IS:1893 (part-1)-2002 according to Indian Standard

Seismic Zoning Map

10.0	<b>Power Supply</b> The power supplies for distribution and auxiliaries shall be as under:	
	a) In plant generation	16.5kV $\pm 5\%$ , 3ph, 50Hz $\pm 5\%$ , high resistance earthed.
	b) MV distribution	6.6kV $\pm 10\%$ , 3ph, 3w, 50 Hz, + 5 % to - 5%, Medium Resistance grounding
	c) LT distribution	415V $\pm 10\%$ , 3ph, 3W, 50Hz + 5% to -5%, High Resistance Grounding for all plant area shall be provided.
	d) Motor rated 160kW and above 160kW	6.6kV $\pm 10\%$ , 3 ph, 3W, 50Hz +5% to -5%.
	e) Motor rated below 160kW and all motorized actuators.	415V $\pm 10\%$ , 3 ph, 3w, 50Hz +5% to -5%.
	f) For motors equal and below 30kW winding heating	24V AC $\pm 10\%$ , 50 Hz %, [to be generated in 415V switchgear by vendor]
	g) DC Motors	220V DC + 10% to - 15%, 2 wire ungrounded system
	h) Control supply for relay panel/ 6.6kV breakers/415V breakers and DC emergency lighting.	220V DC + 10% to - 15%, 2 wire ungrounded system
	i) UPS for instrumentation & Control system	240V AC $\pm 1\%$ , 1 ph, 50Hz $\pm 0.5\%$ 2 Wire AC system
	j) Control supply for 415V Motor contactors/AC Control circuits [to be generated in MCC /panel by vendor]	110V AC $\pm 10\%$ , 50Hz + 5% to -5%.
	k) Diesel Generator emergency supply	415V $\pm 10\%$ , 3ph, 3W, 50Hz +5% to -5%.
11.0	<b>Fault levels</b>	
	a) 400kV	40kA rms for 1 sec
	b) 6.6kV	40 kA rms for 1 sec.
	c) 415V	50 kA rms for 1 sec.

PEM-6666-0



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C1 A

Rev 01 Date Oct 2015

**VOLUME - IIB**

**SECTION – C1-A**

**SPECIFIC TECHNICAL REQUIREMENTS**



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C1 A

Rev 01 Date Oct 2015

**1.0.0 SCOPE OF WORK****1.1.0 SUPPLIES**

1.1.1 Equipment and services to be furnished by the bidder for the Single Girder EOT with accessories as per the details given in data sheet A. Any equipment / accessories not specified in the specification but required to make the crane units complete and efficient shall also be under the bidder's scope of work.

Each EOT crane shall include all necessary items but shall not be limited to the following: -

1. Bridge girder.
2. End carriages complete with wheels
3. Electric Hoist
4. CT / L T drive arrangement
5. Electrical equipments
6. PVC Shrouded Conductor Bus Bar Type DSL with accessories for entire bay length
7. Rail/ sq. bar (for semi gantry crane only)
8. Earthing arrangement.
9. Painting of crane.
10. First fill of lubricant.
11. O & M Manual, drawings and documents.
12. Main isolating switch and power cable from 1.5M above ground / operating floor to down shop lead.
13. Mandatory spares

**1.1.2 Maintenance Tools and Tackles**

A complete unused new set of 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 it can be easily identified for 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 specially protected against rusting in tropical climate and minimum the following shall be provided.

<b>S. No.</b>	<b>Description</b>	<b>Qty.</b>
1	Complete set of ring spanners (Indicate the sizes offered)	1 Set
2	Complete set of screwdrivers (Min. 6 nos. Indicate the sizes)	1 Set
3.	Adjustable Spanner	1 No.
4.	Insulated pliers	1 No.



**TECHNICAL SPECIFICATION FOR  
SINGLE GIRDER CRANE  
4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C1 A

Rev 01 Date Oct 2015

5	Wrench spanner	1 No.
6.	Grease Gun	1 No.
7.	Oil Gun	1 No.
8.	Hand Lamp	1 No.
9	Line tester	1 No.

Note: All maintenance tools & tackles are to be supplied in a tool box.

**1.1.3 Erection and commissioning spares:** The Bidder shall also supply erection & commissioning spares along with his main equipment as per annexure-A of price format, 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. The Purchaser shall retain the unutilized commissioning spares. Fill of lubricants, oil etc. shall also be supplied by the bidder (for details refer price format)

**1.1.4 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 and specially protected against rusting in tropical climate. The minimum requirement of mandatory spare parts is listed in Annexure –II, volume II-B of this specification.

**1.2.0 Services to be provided by the bidder**

1.2.1. Packing, forwarding and transportation to site.

1.2.2. Erection and commissioning procedure shall be submitted by successful bidder for carrying out the erection and commissioning at site by customer.

**1.3.0. Inspection and Testing**

**1.3.1. Inspection and testing at Manufacturer's works (In process)**

**A. Shop inspection and tests will include but not limited to the following -**

- i. Identification, co-relation and verification of material test certificates for the important components like girders, major load carrying components, hooks, gears, shafts, wheels, wire rope drum, wire rope, gear box etc. For other components supporting test certificates or random check tests shall be conducted / furnished.
- ii. Qualification of welder and welding procedure as per ASME section IX .
- iii. 100% radiography of tension zone & 25% radiography of compression zone on butt welds of load bearing members shall be carried out with acceptance norms as per ASME Sec VIII Div.1 UW 51. DP test of all butt welds shall be carried out as per ASTM E 165/ ASTM E 109 with acceptance norms as per ASME Sec VIII Div.1
- iv. For fillet welds visual inspection on all welds. Die- penetration test (DPT) for fillet welds in the load bearing members as per ASME-165/ASTME 109 and acceptance norm as per ASME section VIII Div. 1.



**TECHNICAL SPECIFICATION FOR  
SINGLE GIRDER CRANE  
4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C1 A

Rev 01 Date Oct 2015

- v. Ultrasonic test on forgings and casting of critical components like hook, shafts, axles, gears, wheels, pulleys, etc. Ultrasonic test for casting as per ASME Section III NB 2572 & for forging as per ASTM A388.

Unacceptable defects in forgings are as given below: -

1. Cracks, flaws, seams and laps.
  2. Defects giving indication larger than 4mm diameter equivalent flaw.
  3. Groups of defects with maximum indication less than that from a 4mm dia, equivalent flaw, which cannot be separated at testing sensitivity if the back echo is reduced by 50%.
  4. Defects giving indication of 2 to 4 mm diameter equivalent flaw separated by a distance less than 4 the size of the larger of the adjacent flaws.
- vi. PT/MT on component with surface hardening as per ASTM E -165 and ASTM E 138 respectively with no surface defects.
- vii. Gearbox trial run test as per AGMA standards.
- viii. Acceptance and routine tests (HV and insulation) for all electrical and electromechanical components and system as per governing specification
- ix. Functional and simulated operation test, sequencing, interlocks, safety, protection and alarm system. Test on CRANE / CRAB motors and other mechanical, electrical, electro-mechanical as per BHEL technical specification and or as per applicable code
- x. Cranes shall be completely assembled at manufacturers' works to check the misalignment of gears, shafts and other items. Gear box shall have the idle run for minimum two (2) hours.

**B. Testing At Works (Final)**

- i. Deflection test of bridge girder at rated load.
- ii. No load / load (SWL) / Over load test (running of CT & Hoisting mechanism at 125% of rated load.)
- iii. Electrical tests for brakes, panel, electrical equipment etc as per IS - 3177
- iv. Measurement of speed of CT & Hoisting (lowering & raising) at rated load.
- v. All Other tests as per IS-3177.

**Note: Refer Annexure-III, Section-C, Volume II-B for "Shop test Procedure for Load/Overload testing of EOT cranes at Manufacturer's Works.**

**1.3.2 Testing at site**

The following tests shall be carried out at site by **BHEL** as a part of Erection and Commissioning: -

- a) All the tests as mentioned against S.N. 1.3.1 (B) above, with actual hook and wire rope.
- b) Speed test at rated load for hoisting / CT and LT mechanism.
- c) Brake test and working of electric hoist.
- d) Any other test as per IS-3177-1999.



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C1 A

Rev 01 Date Oct 2015

The successful bidder shall furnish their recommended procedure for carrying out the Erection, Commissioning & testing at site as mentioned above. Any discrepancy found in original equipment during site testing, shall be set right at the expense of supplier.

**1.4.0 Surface preparation, painting & colour scheme**

Detailed painting procedure has been attached as Annexure IV , Section C, Volume IIB. Bidder shall follow the same.

**1.5.0. Drawing / design document for submission after award of contract**

Drawing/ design documents to be submitted as per list & submission schedule attached as Annexure-VI.

Any other design document/ drawing as required by customer/ BHEL shall be submitted by bidder during detail engineering without any implication.

**1.6.0 Number of drawing and documents for submission**

The number of prints / copies required for various drawing and documents are listed in Annexure –V, section-C, volume II-B of this specification.

**2.0.0. Works Excluded**

**2.1.0 Supply of steel gantry girders/ ISMB for crane travel**

**2.2.0 For EOT crane:**

The purchaser shall provide single point 415V, 3 phase, 4 wire and 50Hz power feeder at any point of the bay or in the middle of the bay as specified in the Data sheet A. Vendor shall provide main isolating switch at 1.5 M above the ground / operating floor level and cable required from isolating switch to DSL.

Any other supply required by the bidder shall be arranged by the bidder himself by using suitable transformer as per the specification.

**3.0.0. Deviations**

If the proposal submitted has got any deviation from the technical stipulations in the tender document, bidder shall tabulate the same in the appropriate “Schedule of Deviations” 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 indicate ‘NO DEVIATION’ in the deviation schedule.

**4.0.0. Make of Sub - Vendor items**

Make of bought out items will be as per Annexure-I, section C, volume II-B of the specification. No other make will be acceptable, until and unless specifically got approved by BHEL/Customer during



**TECHNICAL SPECIFICATION FOR  
SINGLE GIRDER CRANE  
4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C1 A

Rev 01 Date Oct 2015

detail engineering. Acceptance/non acceptance of same shall not have any impact on manufacturing & delivery schedule and on cost of crane.

**5.0.0 DOCUMENT TO BE FURNISHED BY BIDDER ALONG WITH THE OFFER**

As detailed in Annexure VII, Vol III.

**6.0.0 TECHNICAL DATA SHEET**

S.N.	Description	Technical Particulars
1.0.0	GENERAL	
1.1.0	Name of Manufacturer	
	a) EOT Crane	*
	b) Runway conductors	*
1.2.0	WEIGHT OF EQUIPMENTS	
	a) Crane weight (Kgs.)*	*
	b) Weight of DSL (Kgs.)*	*
1.3.0	Design, fabrication and testing of crane conform to standard / code	IS-3177 & 807 ( latest edition)
1.4.0	Number of cranes	As per scope list attached in Section A, Vol IIB
1.5.0	Crane Classification	Group M5 of IS: 3177 – 1999(latest edition) for structure and machinery.
1.6.0	Type of service	-----Indoor (Except crane for CWPH screens and gates which is outdoor duty crane)-----
1.7.0	Type of Crane	EOT (semi gantry for CWPH screens and gates)
1.8.0	Capacity (SWC)	As per scope list attached in Section A, Vol IIB
1.9.0	Span	As per crane clearance diagrams attached
1.10.0	Lift	As per crane clearance diagrams attached
1.11.0	Load test	As per IS: 3177
1.12.0	Over Load Test	(125% of rated capacity-SWC)
1.13.0	Crane structure	Fabricated from rolled section (Box section/ I- section)
1.14.0	Design ambient temperature	50 <sup>0</sup> C
1.15.0	End carriage	
1.15.2	Material	M.S. as per IS: 2062, GR A/B
1.16.0	Manufacturer	*
1.16.1	Main girder	
1.16.2	Type & Size	Fabricated or rolled section (Box section/ I- section)
1.16.3	Material	M.S. as per IS: 2062, GR A/B
1.16.4	Vertical Deflection	As per IS: 807
1.17.0	Manufacturer	As per Sub-vendor list
1.18.0	<b>Power supply</b>	415V ± 10 %, 3 phase , 4 wire , 50 Hz ±5 % variation. Combined voltage and frequency variation 10%.( Shall be arranged by BHEL at 1.5 m above floor level )
1.19.0	Control Supply	110V (Shall be arranged by vendor)
2.0.0	<b>CRANE PERFORMANCE</b>	
2.1.0	<b>Operation</b>	Electrical -- From floor by means of Pendant Push Button



**TECHNICAL SPECIFICATION FOR  
SINGLE GIRDER CRANE  
4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C1 A

Rev 01 Date Oct 2015

		controller suspended from panel		
2.2.0	<b>Crane speed with full load</b>	Full Speed (M/Min)	Creep Speed	
	a) Hoist (Full speed)	3 M/ Min.	NA	
	b) Cross travel (CT)	15.0 M/Min	NA	
	c) Longitudinal bridge travel (LT)	25.0 M / min.	NA	
2.3.0	<b>Hoisting Mechanism</b>	Gear		
2.4.0	<b>Type of power transmission</b>	Gear		
2.5.0	<b>WIRE ROPE</b>			
2.5.1	Make	As per Sub-vendor list		
2.5.2	Core / Construction	Steel core as per IS-2266 / 6 X 36		
2.5.3	Wire rope dia. (mm)	*		
2.5.4	Wire rope fall	*		
2.5.5	Material	Plough steel		
2.5.6	Tensile strength	160-180 Kg /mm <sup>2</sup>		
2.5.7	Min. Breaking load	*		
2.5.8	Conform to (Std. / code)	IS-2266		
2.5.9	Factor of safety	5.25		
2.6.0	<b>LOAD HOOK / HOOK BLOCK</b>			
2.6.1	Make	As per makes of BOI list		
2.6.2	Type of load hook	Plain shank, Trapezoidal section-forged as per IS: 15560, with safety latch.		
2.6.3	Material of load hook	As per IS 1875		
2.6.4	Type of Bearing of hook suspension	Thrust ball bearing		
2.6.5	Make of Bearing of hook suspension	*		
2.6.6	Type and Material of hook suspension.	M.S. Fabricated		
2.7.0	<b>ELECTRIC HOIST</b>			
2.7.1	Model No.	*		
2.7.2	Duty	Class II as per IS: 3938 ( latest edition)		
2.8.0	Type of DSL			
2.8.1	Long travel	PVC shrouded bus bar conductor type		
2.8.2	Cross traverse	Flexible cable with Taut wire / Festoon cable arrangement		
2.9.0	<b>MOTORS</b>	M.H.	C.T.	L.T.
2.9.1	Make	As per sub-vendor list		
2.9.2	Rating (KW)	*		
2.9.3	RPM	*		
2.9.4	Type	TEFC, Sq. cage induction type, S4 duty, 40% CDF		
2.9.5	Enclosure	IP-55		
2.9.6	Number of start	150 starts/Hr.		
2.9.7	Insulation	Class 'F' with temperature rise limited to class 'B'		
2.9.8	Margin	Maximum continuous motor ratings shall be 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.		



**TECHNICAL SPECIFICATION FOR  
SINGLE GIRDER CRANE  
4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C1 A

Rev 01 Date Oct 2015

2.9.9	Ambient Design temperature	50°C		
2.10.0	<b>LIMIT SWITCHES</b>			
2.10.1	Location	M.H.	C.T.	L.T.
2.10.2	Qty.	1+1	1	1
2.10.3	Type	Snap action	Two way lever	Two way lever
2.10.4	Method of actuation	Snap action	Shunt type	Shunt type
2.10.5	Material of contact	Silver Cadmium		
2.10.6	Make	As per make of BOI list		
2.10.7	Control Voltage	110V		
2.11.0	<b>Control panel</b>	A suitable control panel will be provided comprising of main contractor, motor contactor, single phase preventor with overload relays, transformer, fuses, MCCB's, etc. Rectifier panel for brake shall also be provided		
2.12.0	<b>BRAKES</b>			
2.12.1	Location	M.H.	C.T.	L.T.
2.12.2	Qty. / Motor	1	1	1
2.12.4	Type	All brakes will be DC Electro magnetic type		
2.12.5	Capacity	150% FLT	125% FLT	125% FLT
2.12.6	Size / rating	*		
2.12.7	Make	As per make of BOI list		
2.13.0	<b>GEAR (HOISTING, CT &amp; LT)</b>			
2.13.1	Make	As per make of BOI list		
2.13.2	Type	Spur / Helical		
2.13.3	Material	Gear: EN9/55C8/IS 2707 Gr 1 or 2/ 20 MnCR5		Pinion: EN 19/EN24/20MnCR5
2.13.4	Lubrication	Grease / Oil splash		
2.13.5	Reduction	*		
2.13.6	Bearing Make	*		
2.13.7	Bearing Type	Antifriction deep groove ball / roller bearing		
2.13.8	Hardness (BHN)	As per IS 3177 (Latest Edition)		
2.14.0	<b>WIRE ROPE DRUM</b>			
2.14.1	Material	As per IS 3938		
2.14.2	Diameter	*		
2.14.3	Length	*		
2.14.4	Type	Flanged		
2.14.5	Type of grooves	*		
2.15.0	<b>WHEELS</b>			
2.15.1	Location	C.T.	L.T.	
2.15.2	Diameter (mm)	*	*	
2.15.3	Qty	*	*	
2.15.4	Hardness	200 BHN ( Max.)	As per IS 3177.	
2.15.5	Material	Forged steel/EN 8/EN 9	Forged steel/EN 8/EN 9	
2.15.6	Bearing make			
2.15.7	Bearing Type	Antifriction deep groove ball bearing	Antifriction deep groove ball bearing	
2.15.8	Flange	Single	Single / double flanged	
2.15.8.1	Conform to IS	3177		
2.15.8.2	Wheel Base	*		



**TECHNICAL SPECIFICATION FOR  
SINGLE GIRDER CRANE  
4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C1 A

Rev 01 Date Oct 2015

2.16.0	<b>SHEEVE</b>	
2.16.1	Material	Cast steel
2.16.2	Groove dia/ O.D. .(mm)	*
2.16.3	Bearing make	As per make of BOI list
2.16.4	Bearing Type	Antifriction deep groove ball bearing
2.17.0	CONTROL PANEL	<ul style="list-style-type: none"> <li>* Fabricated from CRCA steel sheet min 2 mm thick.</li> <li>* Degree of protection shall be IP 55.</li> <li>* Power on indicating lamps shall be provided</li> <li>* Panel illumination lamps operated by door switch.</li> <li>* 2 nos earthing terminals on panel.</li> <li>* 20 % spares terminals ( clip on type) shall be provided.</li> <li>* Power and control terminals (clip on type) shall be on separate channels.</li> <li>* Gland plate thickness shall be minimum 3mm.</li> <li>* Gland plate shall be double brass compression type.</li> </ul>
2.17.1	Qty	One
2.17.2	Make	As per make of BOI list
2.17.3	Location	On the crane
2.17.4	Size	*
2.17.5	Thickness of sheet	2 mm
2.18.0	ISOLATING SWITCH	
2.18.1	Qty	One (1) no at 1.5 m from operating floor.
2.18.2	Make	As per sub-vendor list
2.18.3	Rating	*
2.19.0	PENDANT PUSH BUTTON	Up /down / forward / Reverse push buttons (glow type). Indicative marking for easy operation shall be provided. Emergency stop push button shall be provided.
2.20.0	Cables	Power Control
2.20.1	Make	As per Sub-vendor list
2.20.2	Material	Aluminum/ Copper
2.20.3	Type	FRLS PVC/ EPR
2.20.4	Dearing factor to be considered	YES YES
2.20.5	Voltage grade	1100V
2.21.0	END STOPPER (LT)	
2.21.1	Qty.	4 Nos.
2.21.2	Material	As per IS 2062
2.22.0	BUFFER	
2.22.1	Location	CT LT
2.22.2	Qty	Two Four
2.22.3	Material	Rubber/Spring Rubber/Spring
2.23.0	PAINTING	Refer painting specification as per section C1-E, Vol IIB

**SPECIAL HAZARDOUS AREA REQUIREMENT (For crane in FOPH)**

1. All wheels shall be provided with phosphor bronze type.
2. Any other mechanism where two non-lubricated parts mate, one of them shall be for non-ferrous material like phosphor bronze aluminum bronze.
3. All electrical components/ equipment shall meet the requirements of hazardous area & shall be explosion proof type.
4. Coupling guards shall be non-sparking (i.e. non-ferrous/non-metallic) type.
5. LT DSL shall be flexible trailing cable type.



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C1 A

Rev 01 Date Oct 2015

6. It is to be noted that cranes shall be suitable for hazardous area (i.e. Zone-2) for gas group IIA,IIB

**Note:**

- Bidder to confirm the compliance of technical details as mentioned against each item. Deviation, if any shall be brought out clearly.
- The bidder shall fill Technical details against each item marked (\*), during detailed engineering only.
- In case of discrepancy between the Data sheet and requirement given elsewhere in the technical specification, the more stringent of the two as per the interpretation of purchaser shall be applicable.

PEM-6666-0



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C1 B

Rev 01 Date Oct 2015

**VOLUME - IIB**

**SECTION – C1 B**

**GENERAL REQUIREMENT**

**CONTENT**

<b>CLAUSE NO.</b>	<b>DESCRIPTION</b>
1.00.00	CODES AND STANDARDS
2.00.00	RESPONSIBILITY FOR DESIGN
3.00.00	NAME PLATES (RATING PLATES)
4.00.00	SAFETY AND SECURITY
5.00.00	GUARDS
6.00.00	LOCATION AND LAYOUT REQUIREMENTS
7.00.00	OPERATION, MAINTENANCE AND AVAILABILITY CONSIDERATIONS
8.00.00	MATERIALS
9.00.00	LUBRICATION
10.00.00	LUBRICANTS & CONTROL FLUIDS
11.00.00	OPERATION AND MAINTENANCE
12.00.00	PLANT LIFE AND MODE OF OPERATION
13.00.00	PACKAGING & MARKING
14.00.00	PROTECTION
15.00.00	ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT
16.00.00	INSPECTION AND TESTING
17.00.00	TRAINING OF OWNER'S PERSONNEL
18.00.00	DEVIATIONS
	<b>ATTACHMENTS</b>
ANNEXURE-I	LIST OF STANDARDS FOR REFERENCE
ANNEXURE-II	CRITERIA FOR LAYOUT

## **GENERAL TECHNICAL REQUIREMENTS**

### **1.00.00 CODES AND STANDARDS**

1.01.00 Except where otherwise specified, the Plant shall comply with the appropriate Indian Standard or an agreed internationally accepted Standard Specification as listed in the annexure to this Section and mentioned in detailed specifications, each incorporating the latest revisions at the time of tendering. Where no internationally accepted standard is applicable, the Bidder shall give all particulars and details as necessary; to enable the Owner to identify all of the Plant in the same detail as would be possible had there been a Standard Specification.

1.02.00 Where the Bidder proposes alternative codes or standards he shall include in his tender one copy (in English) of each Standard Specification to which materials offered shall comply. In such case, the adopted alternative standard shall be equivalent or superior to the standards mentioned in the specification.

1.03.00 The plant will be designed in compliance with applicable National and International Codes and Standards such as ASME, ASTM, DIN, BS, IEC, IEEE, IS, etc. Wherever specified or required the Plant shall conform to various statutory regulations such as Indian Boiler Regulations, Indian Explosives Act, Indian Factories Act, Indian Electricity Act, Environmental Regulations, etc. Wherever required, approval for the plant supplied under the specification from statutory authorities shall be the responsibility of the Contractor.

1.04.00 In the event of any conflict between the codes and standards referred above, and the requirements of this specification, the requirements, which are more stringent, shall govern.

1.05.00 In case of any change of code, standards and regulations between the date of purchase order and the date the Contractor proceeds with manufacturing the Owner shall have the option to incorporate the changed requirements. It shall be the responsibility of the Contractor to advise Owner of the resulting effect.

1.06.00 Successful Bidder to furnish two (2) sets of latest of national/inter-national codes and standards to owner.

### **2.00.00 RESPONSIBILITY FOR DESIGN**

2.01.00 The Contractor shall assume full responsibility for the design of the whole and every portion of the Plant, whether or not the design work was undertaken specifically in relation to the Contract and whether or not the Contractor was directly involved in the design work.

- 
- 2.02.00 Notwithstanding the Owner's wish to receive improved technologies, a prime requirement is that all the systems and components proposed shall have been already adequately developed and shall have demonstrated good reliability under similar, or more arduous conditions elsewhere, at least for continuous 2 years in two different power station. Rev 01 Date Oct 2015
- 2.03.00 The successful bidder shall have to carry out surge analysis, BFP transient analysis and other transient condition studies as may be necessary and as required by the Owner as per proven engineering practice.
- 2.04.00 The Bid shall include a detailed discussion on the development status of, and the reasons for any changes made in proposed systems or components for the Plant, as compared with similar items previously supplied in other installations cited by the bidder as reference plants.
- 2.05.00 The Bidder may also make alternate offers, provided such offers are superior in his opinion in which case adequate technical information, operating feed back, etc. are to be enclosed with the offer, to enable the Owner to assess the superiority and reliability of the alternatives offered. In case of each alternative offer, its implications on the performance, guaranteed efficiency, auxiliary power consumptions, etc. shall be clearly brought out to the Owner to make an overall assessment. In any case, the base offer shall necessarily be in line with the specifications i.e. Base offer shall be as per the technical specifications and the same will be considered for techno-commercial evaluation.
- 3.00.00 **NAME PLATES (RATING PLATES)**
- 3.01.00 Instruction plates, name plates or labels shall be permanently attached to each main and auxiliary item of plant in a conspicuous position. These plates shall be engraved with the identifying name, type and manufacturers serial number, together with the loading conditions under which the item of plant has been designed to operate.
- 3.02.00 Items such as valves, etc. which are subject to hand operation, shall be provided with nameplates so constructed as to remain clearly legible throughout the life of the plant giving due consideration to the difficult climatic conditions to be encountered. Nameplates shall be securely mounted where they will not be obscured in service by insulation, cladding, actuators or other equipment. Direction of flow is also to be engraved.
- 3.03.00 All trade nameplates and labels shall be in English language. All measurements shall be in M.K.S. Units.
- 3.04.00 The size and location of nameplates shall be subject to Approval of the Engineer.
- 4.00.00 **SAFETY AND SECURITY**
- 4.01.00 The design shall incorporate every reasonable precaution and provision for the safety of all personnel and for the safety and security of all persons and

property. The design shall comply with  $\epsilon$  relating to safety. All structures and e Rev 01 Date Oct 2015 constructed to withstand every foreseeable static and dynamic loading condition, including loading under earthquake conditions, with an adequate margin of safety.

- 4.02.00 Ready and safe access with clear head room shall be provided to all parts of the plant for operation, inspection, cleaning and maintenance.
- 4.03.00 Escape routes and clear ways shall be provided to allow speedy evacuation of the plant in the event of fire or explosion, and the plant layout shall allow for ease of access to all parts of the Works by rescue and fire fighting teams. The plant layout shall be designed to localise and minimise the effects of any fire or explosion. The recommendations of NFPA, OSHA, and TAC etc. as necessary shall be followed in all respects.
- 4.04.00 The use of corrosive, explosive, toxic or otherwise hazardous materials shall be kept to a minimum during construction and the design of the plant shall minimise the requirement for such materials during operation and maintenance. Where such materials must be used, all necessary precautions shall be taken in the design, manufacture and layout of equipment to minimise the resulting hazard, and all equipment necessary for the protection and first-aid treatment of personnel in the event of accidents shall be provided. Particular attention is drawn to avoid the use of materials containing asbestos in any form.
- 5.00.00 **GUARDS**
- 5.01.00 Effective guards and fences must be provided to prevent injury to operators through accident or malpractice.
- 5.02.00 Mesh guards which allow visual inspection of equipment with the guard in place are generally preferable. The guards shall be constructed of mesh attached to a rigid framework of mild steel rod, tube, or angle and the whole galvanised to prevent loss of strength by rusting or corrosion. The guards shall be designed to facilitate removal and replacement during maintenance.
- 5.03.00 All drive belts, couplings, gears, sharp metallic edges and chains must be safely guarded. Any lubricating nipple requiring attention during normal running must be positioned where they can be reached without moving the guards.
- 5.04.00 Guards for couplings and rotating shafts shall be in accordance with BS 5304-1975 or similar approved standard. All rotating shafts and parts of shafts must be covered.
- 5.05.00 Suitable fencing shall be provided to enclose all openings or doorways used for the hoisting and lowering of machinery etc. This fencing must be securely fixed but quickly detachable when required. A secure hand hold must be provided on each side of the opening or doorway.

6.00.00 **LOCATION AND LAYOUT REQUIREMEN** Rev 01 Date Oct 2015

The majority of plant and equipment (excluding steam generator and some other auxiliaries) shall all be of indoor installation. A broad list of buildings housing such equipment is given elsewhere in this specification. Layout should facilitate access for operation-maintenance and inspection of any one or more equipment/components at a time without disturbing the operation or installation of rest of the plant. Further, Bidder should comply with the criteria given under the various equipment and system specifications as well as those stipulated in Annexure-II attached to this section.

Enclosed General Layout and other tender layout drawings show the location of major installations and auxiliary buildings. The Bidder shall try to retain these locations as far as practicable. The layout of equipment within the power house as shown in the tender drawings is indicative. The Bidder may, subject to Owner's approval alter the same to suit the space requirement of the equipment offered.

Bidder may give as an alternative his own preferred layout clearly indicating the advantages and other implications, if any. Such alternative will not be considered for evaluating the bid, but may be considered with the successful Bidder if Owner/Engineer finds the proposal more attractive in terms of techno-economic consideration.

While developing the layout of buildings the following criteria shall be given effect :

- a) The minimum width of clear access corridors around equipment shall be 1.2 meter.
- b) Each building shall have an identified vacant space for equipment unloading and maintenance and preferably a separate bay altogether in buildings housing heavy equipment. Provision for handling equipment by monorail hoist and/or overhead crane shall be made as specified.
- c) The minimum clear height available between two consecutive floor slabs shall not be less than five (5) meters. A clear head room of 2.5m shall be maintained between the floor and any overhead piping/ cables or other obstruction. Adequate provision for natural ventilation and illumination shall be made as per good engineering practices.
- d) There shall be at least two (2) nos. main access doors, one on either side of each building, of which one shall be minimum 3 meters wide with rolling shutters for equipment entry. For multistoried buildings, at least two (2) nos. regular staircases diagonally opposite to each other shall be provided connecting all the floors and roof. These minimum requirements shall be augmented as required depending on the floor area, statutory requirements and TAC recommendations.
- e) All buildings shall have provision for toilet and associated effluent discharge system together with facility for drinking water. The criteria for ventilation, fire protection and illumination of building spaces specified

---

elsewhere in this specification shall

Rev 01 Date Oct 2015

- f) All rail/road crossings for pipe/cable racks shall be done with minimum 8 meters headroom from top of rail/road to bottom of rack. Similarly top cover over underground pipes/cables shall be minimum one (1) meter. For other detail refer to Annexure-II.
- g) Cubicle for operating personnel shall be located at safe place near the equipment.
- h) Interplant cable routing will be on overhead cable trays on pipe cum cable trestle or on cable trestle except where approved by purchaser/consultant. In exceptional case, small stretch of outdoor run of interplant cable routing may be taken through cable trench only with the Employer's prior approval.
- i) Concept of various mechanical and electrical equipment location and building dimensions (including column-row spacing) as shown in Plot Plan/Floor Plan drawing are to be adhered to. Any departure from this suggestive layout is primarily not recommended.

#### 7.00.00 **OPERATION, MAINTENANCE & AVAILABILITY CONSIDERATIONS**

7.01.00 Equipment/works offered shall be designed for high availability, high reliability, low maintenance and ease of operation & maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability, availability, operability and ease of maintenance. He shall also furnish details of availability records in plants stated in his experience list.

7.02.00 Ample space for ease of operation and maintenance including equipment removal, tube bundle/cartridge/rotor pulling etc. shall be provided. All valves, gates, dampers and other devices shall be located and oriented in such a way that they are accessible from operating floor levels. Where this cannot be adhered to, platforms and walkways with access ladders shall be provided to facilitate operation and maintenance.

7.03.0 Motorised lifting devices, i.e. hoists, chain pulleys, jacks, etc. shall be provided for handling and carrying out maintenance of any equipment and/or part having weight in excess of 2000 Kg. Suitable beams, hooks etc. for this purpose shall be provided in the buildings.

No lifting arrangement is necessary for part having weight less than 500 Kg. Hoist shall be well protected by environment. Suitable painting and coating covering hoist at outdoor shall be provided.

Lifting devices like lifting tackles, slings, etc. to be connected to hook of the hoist/crane shall be provided by the Bidder for lifting the equipment, accessories covered under this specification.

7.04.00 All similar parts of the equipment shall be made to gauge and shall be interchangeable with and shall be made of same material and workmanship as the corresponding parts of the equipment. Where feasible common

components shall be employed in different applications to optimize the spares inventory and utilization. Rev 01 Date Oct 2015

8.00.00 **MATERIALS**

8.01.00 In selecting materials of construction of equipment, the Contractor shall pay particular attention to the atmospheric conditions existing at the Site and the nature of material/fluid handled. Wherever deviations are taken in respect of materials specified, the reasons shall be spelt out clearly in the proposal.

All materials shall be new, and shall be of the quality most suited to the proposed application.

8.02.00 In as far as is possible; materials shall be in accordance with Indian or international standard specifications and shall be used in accordance with Indian or international codes of practice. Where such standards or codes of practice are not available sufficient information shall be provided to allow the Owner to assess the suitability of the material for the particular application.

All materials used shall have performed lengthy satisfactory service in similar or more arduous conditions to those proposed by the Contractor.

8.03.00 All parts which could deteriorate or corrode under the influence of the atmospheric, meteorological or soil conditions at the Site, or under the influence of the working conditions shall be suitably and effectively protected so that such deterioration or corrosion is a minimum over the life of the plant.

9.00.00 **LUBRICATION**

9.01.00 Provision shall be made for suitable efficient lubrication where necessary to ensure smooth operation free from undue wear.

9.02.00 Non ferrous capillary tubing shall be used throughout.

9.03.00 Gear boxes and oil baths shall be provided with filling and drain plugs, both of adequate size. An approved means of oil indication including level switches and temperature indication shall be provided.

9.04.00 All high speed gears shall be oil bath lubricated. Low speed gears shall be lubricated by means of soft grease. Removable and accessible drip pans shall be provided to collect lubricant which may drop from operating parts.

9.05.00 All lubrication points shall be conveniently situated for maintenance purposes. It must be possible to carry out lubrication from a gangway or landing and without the removal of guarding or having to insert the hand into it. Where accessibility to a bearing for oiling purposes would be difficult a method of remote lubrication shall be fitted.

9.06.00 The Contractor shall supply grease gun equipment suitable to service each type of nipple fitted.

- 10.00.00      **LUBRICANTS AND CONTROL FLUIDS**      Rev 01 Date Oct 2015
- 10.01.00      The Contractor shall provide a detailed and comprehensive specification for all lubricating oils, greases and control fluids required for the entire plant. A sufficient supply of these shall be provided by the Contractor for initial commissioning, first fill and till COD of the unit.
- 10.02.00      The Contractor shall supply a detailed schedule giving the lubricant testing, cleaning and replacement procedures. All equipment and facilities necessary for the testing, cleaning and changing of lubricants and control fluids shall be provided. The Contractor shall endeavor to reduce the varieties and grades of required lubricants and control fluids to a minimum, matching them where possible to those already in use in the generating station in order to simplify procurement and minimise storage requirements. All lubricants and control fluids shall be of internationally recognised standards and shall be easily obtainable from a large number of Indian suppliers. Bidder shall also indicate the equivalent Indian Standard for the above for easy procurement in future.
- 10.03.00      No lubricant or control fluid shall have toxic or other harmful effects on personnel or on the environment.
- 11.00.00      **OPERATION AND MAINTENANCE**
- 11.01.00      The plant shall be designed and constructed so that operation and maintenance manpower requirements are minimised.
- The design and layout shall facilitate inspection, cleaning, maintenance and repair. The importance of continuity of operation is second only to that of safety.
- 11.02.00      Spare parts for equipment shall be interchangeable with the original components and, so far as possible, be of common design and manufacture.
- 11.03.00      All similar standard components/parts of similar standard equipment provided shall be interchangeable with one another. Further identical equipments shall be provided for similar duties so that the same are interchangeable with one another in totality and component wise.
- 11.04.00      All heavy parts (500 Kg and above) must be provided with a convenient arrangement for slinging and handling during erection and overhaul. Any item of plant normally stripped or lifted during periods of maintenance and weighing one tonne or above, shall be clearly marked with its weight.
- 11.05.00      On completion of commissioning, a complete set of tools for the maintenance of the entire plant shall be provided by the Contractor. This shall include all necessary spanners, special wrenches, extraction equipment and any special tools reasonably required by the Engineer. Tools used during erection and commissioning shall not be accepted except with the specific approval of the Engineer.
- 11.06.00      All equipment and major valves should be provided with adequate maintenance approach and facility.

---

 12.00.00 **PLANT LIFE AND MODE OF OPERATION** Rev 01 Date Oct 2015

The complete plant including all the equipment and systems individually and collectively shall be designed for continuous operation for an economic service life of thirty (30) years under the prevailing site conditions and for the type of duty intended.

The critical components of the Steam Generator, Turbine-Generator and Auxiliary equipment, the life of which is limited by time and temperature dependent mechanisms such as thermal stress, creep and low cycle fatigue, are to be designed considering expected (hot, warm and cold) start-up, shut-down and cyclic load variations.

The allowable stresses shall be reduced so that life expectancy to minimum 2,00,000 hours of operation can be achieved. The Bidder shall discuss this aspect in his technical proposal.

The unit would be operated on base load with cyclic load variation. The load variation is expected to be as per schedule depending on power demand.

The expected start-ups should be considered as minimum  
(Based on HPT metal temperature)

Cold start-up ( >72 hrs. shutdown)	:	6 per year
Warm start-up (between 10 to 72 hrs. of shutdown)	:	40 per year
Hot start-up (less than 10 hrs. shutdown)	:	160 per year

 13.00.00 **PACKAGING & MARKING**

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. While packing all the materials, the limitations from the point of view of availability of railway wagon sizes in India should be taken account of. The details of various wagons normally available with Indian Railways for transportation of heavy equipment shall be considered by the Bidder. The Contractor shall be responsible for all loss or damage during transportation, handling and storage due to improper packing.

As per the information available, the dimensions of OD consignment for transportation of the equipment by rail (if any equipment to be handled through rail transportation) are as below :

a)	Width of the Package (from centre-line of rails - 1.6 metres on both sides)	:	3.2 Meters
b)	Height of the package from rail top	:	4.47 Meters

The above indicates the dimensions which can be normally transported on the

wagons without infringement of the "moving gauge" duly authorised and approved by the Indian Railways. There may be difference between the "moving gauge" and the "fixed structure gauge" and consignments infringing the "moving gauge" can be moved after investigation regarding possible infringement with the fixed structures. As the critical fixed structures in each route are different, consignments infringing moving dimensions have to be individually investigated to select a route and also determine the restrictions under which such movement is to be carried out. Such routes selected or other mode of transport envisaged is to be clearly brought out in the proposal wherever transport of over dimensional equipment is involved.

Bidder to consider unloading of material delivered through rail transportation, at near by railway station/ site unloading siding. The subsequent transportation up to project work place shall be considered by road only. All unloading and handling equipment both at railway station siding and at project site shall be arranged by the Bidder. Necessary arrangement to be organized with the railway authority for such purpose shall also be under the scope of services of the Bidder. Bidder may consider entire material delivered up to site through rail transportation only.

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.

For imported equipment and material, suitable port facilities may be used in which case material may be transported from the port by tractor-trailer. Bidder may consider this aspect.

#### 14.00.00 **PROTECTION**

Equipment having antifriction or sleeve bearings shall be protected by weather-tight enclosures. Coated surfaces shall be protected against impact, abrasion, discoloration and other damages. Surfaces that are damaged shall be repainted.

Electrical equipment, controls and insulations shall be protected against moisture and water damages. All external gasket surfaces and flange faces, couplings, rotating equipment shafts, bearings and like items shall be thoroughly cleaned and coated with rust preventive compound as specified above and protected with suitable wood, metal or other substantial type covering to ensure their full protection. All exposed threaded parts shall be greased and protected with metallic or other substantial type protectors.

All piping, tubing and conduit connections on equipment and other equipment openings shall be closed with rough usage covers or plugs. Female threaded openings shall be closed with rough usage covers or forged steel plugs. The closures shall be taped to seal the interior of the equipment. Open ends of

pipings, tubing and conduit shall be sealed a Rev 01 Date Oct 2015

Returnable containers and special shipping devices shall be returned by the manufacturer's field representative at the Contractor's expense.

15.00.00 **ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT**

15.01.00 **Environment Protection**

The plant shall be designed for installation and operation in harmony with the surrounding environment and all measures of pollution control shall be ensured by the Bidder to restrict pollution from the liquid effluent and stack emission within the limits as given below with due consideration of Environment (Protection) Rules 1986 as amended till date.

In case the Ministry of Environment & Forest stipulate any other conditions not specified hereunder while clearing the project shall be complied with the plant by the contractor.

15.01.01 For Liquid Effluent

- a) Provision laid down in schedule-I for Thermal Power Plants and also in Schedule-VI. General Standards for discharge of Environmental pollutants Part-A : Effects of Environmental (protection) Rules 1986, as amended till date.
- b) Any specific requirement of State Pollution Authorities over and above the above stipulation.

15.01.02 For Air Emission

- a) Suspended Particulate Matter i.e. dust burden at chimney outlet - Maximum 50 mg/Nm<sup>3</sup> (with worst coal and one field out at TMCR).
- b) NO<sub>x</sub> - 365 ppm Max. or 750 mg/Nm<sup>3</sup> (Equivalent NO<sub>2</sub>).
- c) SO<sub>2</sub> - Concentration based standard 2000 mg/Nm<sup>3</sup>. Load based standard 0.2 metric tonne /MWe/day (for first 500 MW and 0.1 metric tonne/MWe/day for rest of the capacity above 500 MW)

In absence of Indian Standard for emission from power plants as on date, for certain gaseous effluents, the internationally accepted World Bank Standard is to be followed. Indian Standard for emission of power plants are under formulation. Should this standard is published before finalisation of the contract, the bidder has to comply the more stringent of the above norm or the new Indian Standard.

The bidder shall include in his scope all necessary equipment and measuring instruments to comply with above requirements. Location and accessibility of the instruments shall be properly coordinated.

15.02.00 **Noise Level Requirement**

Rev 01 Date Oct 2015

The plant will be designed, constructed and provided with suitable acoustic measures to ensure the noise level criteria as per the following stipulations.

- a) Maximum noise level shall not exceed 85 dB (A) when measured at 1.0M away from the noise emission source.
- b) Maximum noise level from its source within the premises shall not exceed 70 dB (A) as per Environment (Protection) Rules 1986, Schedule-III, 'Ambient Air Quality Standards' in respect of noise.
- c) Any statutory changes in stipulations regarding noise limitation that may occur in future according to State Pollution Control Board or Central pollution Control Board or Ministry of Environment & Forest regulation during tenure of the contract, the contractor shall comply with the requirement.

An exception will be made for the plant at startup operations and other big pressure reducing devices operating during emergency periods and for the safety valves.

16.00.00 **INSPECTION AND TESTING**

16.01.00 **Inspection and Tests during Manufacture**

16.01.01 The method and techniques to be used by the Contractor for the control of quality during manufacture of all plant and equipment shall be agreed with the Owner prior to the Award of Contract.

16.01.02 The Owner's general requirements with respect to quality control and the required shop tests are set out elsewhere in this specification.

16.01.03 Before any item of plant or equipment leaves its place of manufacture the Owner shall be given the option of witnessing inspections and tests for compliance with the specification and related standards.

16.01.04 Advance notice shall be given to the Owner as agreed in the Contract, prior to the stage of manufacture being reached, and the piece of plant must be held at this stage until the Owner has inspected the piece, or has advised in writing that inspection is waived. If having consulted the Owner and given reasonable notice in writing of the date on which the piece of plant will be available for inspection, the Owner does not attend the Contractor may proceed with manufacture having forwarded to the Owner duly certified copies of his own inspection and test results.

The Contractor shall forthwith forward to the engineer duly certified copies of the Test Certificates in six copies (one to the Purchaser and five to the Consulting Engineer) for approval. Distribution of six (6) copies of Test Certificates for approval will be two(2) copies to owner and four(4) copies to consultant. These four(4) copies will be further distributed by consultant after approval to owner, site and bidder. One copy will be retained with the

---

consultant for record purpose.

Rev 01 Date Oct 2015

Further, nine (9) copies of Shop Test Certificates shall be bound with Instruction Manuals referred to elsewhere. Distribution of nine (9) copies of Shop Test Certificates for approval will be Two (2) copies to owner, Three (3) copies to site, Two (2) copies to consultant, Two (2) copies to owner's library / record.

- 16.01.05 Under no circumstances any repair or welding of castings be carried out without the consent of the Owner's Engineer. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Engineer along with Defect Map.
- 16.01.06 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works.
- Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Contractor shall allow for trial assembly prior to despatch from place of manufacture.
- 16.01.07 All materials used for the manufacture of equipment covered under this specification shall be of tested quality. Relevant test certificates shall be made available to the Purchaser. The certificates shall include tests for mechanical properties and chemical analysis of representative material or any other test as required by approved QAP/ Material specification.
- 16.01.08 All pressure parts connected to pumping main shall be subjected to hydraulic testing at a pressure of 150% of shut-off head for a period not less than one hour. Other parts shall be tested for one and half times the maximum operating pressure or as required by design code of that part, for a period not less than one hour.
- 16.01.09 All necessary non-destructive examinations shall be performed to meet the applicable code requirements.
- 16.01.10 All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR as applicable. All welded joints for pressure parts shall be tested by liquid penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination magnafux and ultrasonic testing shall be employed wherever necessary/recommended by the applicable code. At least 10% of all major butt welding joints shall be radiographed.
- 16.01.11 Statutory payments in respect of IBR approvals including inspection for design and manufacturer of equipment shall be made by the Bidder. All payment for erection and testing at site (i.e. under IBR jurisdiction) shall also be made by the Bidder. In such case Contractor's scope shall also be extended to preparation of all necessary documents, co-ordination and follow-up with IBR authorities for above approval.
- 16.02.00 **Performance Tests at Site**

- 16.02.01 The full requirements for testing the sys  
Owner and the Bidder prior to Award of Rev 01 Date Oct 2015  
System shall be tested by the Contractor on site under normal operating conditions. The Contractor shall also ensure the correct performance of the System under abnormal conditions, i.e. the correct working of the various emergency and safety devices, interlocks, etc.
- 16.02.02 The Bidder shall provide complete details of his normal procedures for testing, for the quality of erection and for the performance of the erected plant. These tests shall include site pressure test on all erected pipe work to demonstrate the quality of the piping and the adequacy of joints made at site.
- 16.02.03 The Contractor shall furnish the quality procedures to be adopted for assuring quality from the receipt of material at site, during storage, erection, pre-commissioning to tests on completion and commissioning of the complete system/equipment.
- 16.03.00 For details of specific tests required on individual equipment refer to respective section of this specification.

**17.00.00 TRAINING OF OWNER'S PERSONNEL**

The Contractor shall extend all possible assistance and co-operation to the Purchaser regarding the transfer of technology and developing expertise in the area of engineering operation and maintenance of the Plant.

Number of man-days of training as mentioned below shall be included in his Tender.

**17.01.00 Training at Contractor's Premises**

The Contractor shall conduct training of sixty (60) engineers of the Owner on engineering, operation and maintenance of the Plant at the Contractor's or Associates or Sub-contractor's premises where adequate training facilities are available during the design and manufacturing stage of the Contractor.

The total man-months for training of engineers shall be maximum sixty (60), having following indicative break-up :

Discipline	No. of Engineers	No. of Man-month
Operation	20 heads	20
Maintenance Boiler, Turbine, Mechanical	20 heads	20
Electrical Maintenance	8 heads	4
Control & Instrumentation	8 heads	4
Maintenance Planning	4 heads	2
	-----	-----

60 heads  
----- Rev 01 Date Oct 2015

However, the details of the training programme will be discussed and finalised with the successful Bidder.

The training may also be arranged by the Contractor in any Plant where the equipment manufactured by the Contractor or his Associates is under installation, operation or testing to enable the trainees to become familiar with the equipment being furnished by the Contractor. All expenses inherently related to the training shall be borne by the Contractor and shall include but not limited to travel expenses (international and inland fares), lodging and per diem charges as well as medical insurance, instructors fee, programme and miscellaneous cost to be incurred during the training.

The training programme shall be adequate for the trainees to acquire the necessary expertise and competence in the area of engineering, operation and maintenance and as trainers for in-house technology transfer programme of the Purchaser.

The Contractor shall be responsible for the development of the Training Module and Programme Schedule which shall be submitted to the Purchaser for approval.

The components of the training modules shall include but not be limited to the training procedures/methodology, instructional materials such as audio visual materials, CDs and slides and manuals for each trainee.

Three (3) sets of the materials included in the training modules shall be handed over to the Purchaser upon completion of the training. An evaluation shall be jointly undertaken by the Contractor and the Purchaser's representative on the adequacy, appropriateness and relevance of the training and the programme effectiveness after the training. The training material shall be in English language only.

The content of the training programme shall include but not be limited to:

1. Coal fired thermal plant principles in management and practice for operators, technicians and maintenance personnel.
2. Plant operation and systems training for operators including simulator training as applicable.
3. Maintenance training programme covering electrical, mechanical and instrumentation and control.

Said training programme shall be submitted to the Purchaser for approval.

The timing of the training should be such that the participants will be conversant with sufficient know-how to participate in the pre-commissioning and commissioning tests of the Plant.

The Contractor shall provide qualified English speaking instructors and training

---

coordinator(s) during the tenure of the traini

Rev 01 Date Oct 2015

17.02.00 **Operation and Maintenance Training at Site**

The Contractor shall provide a comprehensive training programme related to design application, plant management, operation and maintenance, including trouble shooting, of the Contractor's supplied system and equipment at the Site starting from Start of Commissioning and thereafter up to the Final Acceptance of the first Unit.

The following instructors shall be at the Site continuously during the training :

- a) One (1) for Steam Generator and Auxiliaries ;
- b) One (1) for Turbine Generator and Auxiliaries ;
- c) One (1) for Electrical Works ;
- d) One (1) for Instrumentation and Control (Boiler and Auxiliaries) ;
- e) One (1) for Instrumentation and Control (Turbine and Auxiliaries).

17.03.00 **On-the-Job Training**

During the period of pre-commissioning, commissioning and trial operation, the Purchaser shall provide operation and maintenance personnel to assist the Contractor in the operation and maintenance of his supply and work under the direction of the Contractor for the purpose of on-the-job training.

The Purchaser shall have the right to send to the Site his employees later intended to operate and maintain the equipment supplied under this Contract. The Contractor shall, without additional cost, use his site staff to instruct these employees on the operation and maintenance of the equipment. All instructions shall be in the English language.

17.04.00 For detail C&I training refer to Volume-VI, Section-9.

18.00.00 **DEVIATIONS**

The Bidder is required to submit with his proposal in the relevant schedules a detail list of any and all deviations taken by him clearly without any ambiguity. In the absence of such a list it will be understood and agreed that the Bidder's proposal is based on strict conformance to this specification and no post-contract negotiations would be allowed in this regard.

Unless otherwise specifically indicated in the deviation list, it will be construed and agreed that details indicated in documents & drawings furnished by the Bidder along with the offer is in-line with the specification requirement.

**ANNEXURE-I**

Rev 01 Date Oct 2015

**LIST OF STANDARDS FOR REFERENCE**

- a) International Standards Organisation (ISO).
- b) International Electro-technical Commission (IEC).
- c) American Society of Mechanical Engineers (ASME).
- d) American National Standards Institute (ANSI).
- e) American Society for Testing and Materials (ASTM).
- f) American Institute of Steel Construction (AISC).
- g) American Welding Society (AWS).
- h) Architecture Institute of Japan (AIJ).
- i) National Fire Protection Association (NFPA).
- j) National Electrical Manufacturer's Association (NEMA).
- k) Japanese Electro-technical Committee (JEC).
- l) Institute of Electrical and Electronics Engineers (IEEE).
- m) Federal Occupational Safety and Health Regulations (OSHA).
- n) Instrument Society of America (ISA).
- o) National Electric Code (NEC).
- p) Heat Exchanger Institute (HEI).
- q) Tubular Exchanger Manufacturer's Association (TEMA).
- r) Hydraulic Institute (HIS).
- s) International Electro-Technical Commission (IEC) Publications.
- t) Power Test Code for Steam Turbines (PTC).
- u) Applicable German Standards (DIN).
- v) Applicable British Standards (BS).
- w) Applicable Japanese Standards (JIS).

- x) Electric Power Research Institute (EPRI). Rev 01 Date Oct 2015
- y) Standards of Manufacturer's Standardization Society (MSS).
- z) Bureau of Indian Standards Institution (BIS).
- aa) Indian Electricity Rules.
- bb) Indian Boiler Regulations (IBR).
- cc) Indian Explosives Act.
- dd) Indian Factories Act.
- ee) Tariff Advisory Committee (TAC) rules.
- ff) Emission regulation of Central Pollution Control Board (CPCB).
- gg) Pollution Control regulations of Dept. of Environment, Govt. of India
- hh) Central Board of Irrigation and Power (CBIP) Publications.
- ii) The Air Prevention and Control of Pollution Act.
- jj) The Environmental Protection Act
- kk) The Public Liability Insurance Act.
- ll) The Forest Conservation Act
- mm) The Wildlife protection Act.
- nn) The EIA Notification, 1994.
- oo) IS: 14665-Specification for Electric Traction Lift
- pp) Any other statutory Codes/Standards/Regulations

**ANNEXURE-II**

Rev 01 Date Oct 2015

**CRITERIA FOR LAYOUT**

## PLOT PLAN LAYOUT REQUIREMENTS

<b>ITEM</b>	<b>SPECIFICATION REQUIREMENT</b>
A. Site conditions to be considered	
1. Prevalent wind direction	See wind-rose in plot plan. Also refer Metrological Data.
B. Layout Requirements	
1. Maximum permissible slope in	
a) Rail track	1 in 400
b) Road	1 in 30
c) Sides of unpaved embankment	1 in 2
2. Required road width	
a) Main roads	As per Civil DBR
b) Auxiliary interconnections	
c) Road to the power house unloading bay :	
• Only for entry to the unloading bay	Yes
• To pass through the unloading bay	No
3. Required minimum horizontal distance between the nearest points of	
a) Plant boundary and the boundary of residential area	(Local municipality/factory rule)
b) Electrical transformer and any other building/facility	As per the Tariff Advisory Committee/ LPA Rules
c) Fire water supply installation and any building/facility subject to fire risk.	As per the Tariff Advisory Committee/ LPA Rules
d) Inflammable liquid (fuel oil, etc.) storage & handling installation and their fencing and other buildings/facilities.	Rules of the Indian Explosive (Indian Explosives Act) and Indian Petroleum Code

<b>ITEM</b>	Rev 01 Date Oct 2015
4. Required minimum vertical clearance	
a) Under pipes/cable racks at road crossings	8.0 Metres
b) Soil coverage over underground pipes	1.0 Metre (minimum)
5. Railway Wagon clearance	Rules of the Indian Railways
6. Minimum Clearance between any road edge and building/structure/ any fixed installation.	3 Metres
7. Required level, above the local developed grade level, of	
a) top of all roads	150 mm above FGL
b) all outdoor paved areas	100 mm above FGL
c) Temporary storage areas, workshops, offices, residence etc. required at the time of erection work.	Yes
d) Green belt around power plant area	As per environmental guidelines of MOEF, Govt. of India.

#### BUILDING/ EQUIPMENT LAYOUT REQUIREMENTS

- A. Minimum clear space required at all working and walking areas for operating & maintenance personnel
1. Horizontal, in all directions
    - a) Adjacent to any electrical equipment, electrical cables, running (rotating/reciprocating) equipment, safety valve or vent/drain pipe outlet, pipe/ equipment of surface temperature exceeding 60°C. 1200 mm
    - b) Adjacent to any other plant facilities (including walls/structures) 1000 mm
  2. Vertical (head-room clearance)
    - a) Under any pipe/equipment surface of temperature exceeding 60°C and any electrical cables or other electrical items. 2.5 Metre
    - b) Under any other plant facilities (including structures, pipes etc.) 2.5 Metre

<b>ITEM</b>	Rev 01 Date Oct 2015
3. For all areas where any equipment (including trucks, trolleys and other material handling equipment) will move or maneuver.	Minimum 500 mm clear in all direction from the outer edges of the equipment
4. Minimum clear hand space required for	
a) The application of thermal insulation	100 mm
b) Welding work	150 mm
c) Bolt tightening	150 mm
B. Floors, platforms, staircase, ladders, walls, doors & windows	
1. Statutory Requirement	As per the regulations of Tariff Advisory Committee, Indian National Building Code, Indian Factories Act, Local Municipal Rules, etc.
2. Operation & Maintenance Requirement	
a) Adequate floor space shall be kept to permit dismantling, temporary storing and in-situ maintenance of plant & equipment parts, satisfying the clear space requirements stated above. A separate unloading bay for such purpose is required.	Yes
b) Floors or fixed/portable platforms with stairs/ ladders shall be provided for easy approach to any plant item, including valves, instruments, etc. to be operated, observed and/or to be frequently (more than once a month) maintained.	Yes
3. Plinth level of all buildings, above the finished grade level	500 mm
4. Minimum access opening required (with rolling shutter) for transportation, wherever entry of truck for material handling is envisaged	3.5M wide x 4M high or, more depending upon the equipment size to be handled.

ITEM	Rev 01 Date Oct 2015
C. Other Maintenance Requirement	
1. Generator stator handling In case the Generator stator cannot be handled by the turbine house crane, all provisions for its overhauling, including the arrangement to slide the stator on the turbine house floor, the foundation work for stator jacking /lowering assembly, dismantling of building end walls/structures etc. shall be kept.	Yes
2. Maintenance of the internals/impellers of all important equipment, like boiler feed pumps, feed water heaters, Surface Condenser, fans of the boiler draft plant, Intake and circulating water pumps, cooling water pumps, coal mills, compressors, blowers, heat exchangers, fuel oil pumps, filters etc.	Shall be possible without disconnecting or dismantling any piping/ducting.
3. Overhauling and handling of the casings for the above items	Shall be possible without disturbing/dismantling any piping/ducting not directly connected to them.
4. Crane Approach	
Wherever required the unobstructed approach of the crane hook/other hoisting equipment hook to various plant & equipment shall be possible.	Yes
D. Central Control Room	
All electronic equipment other than those directly associated with control, operation or presentation of displays shall be mounted external to the control room in air conditioned control equipment room.	Yes
The bidder shall describe in his bid the proposed layout philosophy of the Central Control Room and Control Equipment Room and the arrangement of equipment best suited for the system offered by him and as per good ergonomically consideration.	
However, as a guide line, following features are given :	
a) False ceiling and false flooring shall be provided.	
b) Uniform height, colouring schemes for cabinets etc. shall be available.	

**ITEM**

Rev 01 Date Oct 2015

- c) The total area of floor space covered by Control Consoles/Panels in the Control Room shall not exceed 15% of floor area.
- d) No opening shall be provided from Boiler side.
- e) Two double leaf doors, suitably located for entering the Control room shall be provided with opening towards the turbine floor.
- f) Cable entry for the panels/consoles shall be from bottom and suitable openings shall be provided.
- g) The Control Room lighting shall be designed to provide a glare free uniform illumination. The level of illumination shall be minimum 400 LUX.
- h) Necessary Air Conditioning shall be provided for Central Control room, Control Equipment Room and SWAS room etc.
- i) Basic amenities like toilet, Tiffin rooms, wash basins, rest rooms etc. shall be provided near the Control Room.
- E. Toilet and drinking water facility

Required in all buildings and on all floors wherever operating personnel are to be deployed.

Rev 01 Date Oct 2015

## **PROJECT MANAGEMENT AND SITE SERVICES**

Rev 01 Date Oct 2015

## CONTENT

<b>CLAUSE NO.</b>	<b>DESCRIPTION</b>
1.00.00	PROJECT MANAGEMENT SERVICES
2.00.00	SITE SERVICES
3.00.00	PROJECT INFORMATION AND MANAGEMENT SYSTEM, INCLUDING DCOUMENT MANAGMENT SERVER (DMS)

## **PROJECT MANAGEMENT AND SITE SERVICES**

### **1.00.00 PROJECT MANAGEMENT SERVICES**

#### **1.01.00 Responsibility**

The Bidder shall identify a separate and independent project management team headed by a Project Manager for the execution of this project. Responsibilities of this project Management team shall cover the areas listed below :

- a) Planning and Monitoring
- b) Engineering Management
- c) Contracts Management
- d) Project Safety Management
- e) Quality Assurance, Inspection & Expediting
- f) Construction Management
- g) Spares Management
- h) Erection & Commissioning Management

Detailed responsibilities in the above areas are discussed below :

#### **1.02.00 Organisation**

##### **1.02.01 Headquarters**

The headquarters of the project management team shall be headed by a senior level executive designated as the Project Manager who shall be responsible to Owner for the execution of the project. He should have adequate financial power and authority to give decision.

Separately, designated leaders shall be identified for each of the areas mentioned under 1.01.00, who, in turn, will report to the Project Manager for all matters relative to this contract.

##### **1.02.02 Central Co-ordination Cell**

The central coordination cell shall have sufficient technical personnel to coordinate technical matters and to quickly resolve day to day queries or

---

references made by Owner and his Cons  
refer to his headquarters each time. Rev 01 Date Oct 2015

1.02.03 Site Organisation

The site should have a competent construction manager for all site operations with adequate financial power and sufficient level of authority to take site decisions. The organisation chart for site should indicate the various levels of experts to be posted for supervision in the various fields in civil construction, erection, commissioning etc.

1.02.04 Organisation Chart

The Bidder shall furnish a detailed organisation chart for the project management team, clearly identifying the key personnel in each of the areas mentioned at 1.01.00 above. The expected number of executives at different levels shall also be indicated, separately for headquarters, central coordination cell and site organisation.

1.03.00 **Implementation Schedule**

The schedule for the completion of the Project would be as follows :

As per project specific special condition of contract.

To achieve these targets, the Contractor shall furnish to the Owner, various schedules as defined below:

1.03.01 Engineering Schedules

These schedules shall cover various design submissions indicating different engineering activities to be performed. Such schedules shall be furnished by the Bidder for each and every plant/systems/ equipment item covered in the scope of this specification.

1.03.02 Manufacturing Schedule

The Contractor shall submit to the Engineer his manufacturing and delivery schedules for all equipment within thirty (30) days from the date of issue of the Letter of Intent (LOI). Such schedules shall be in line with the detailed network for all phases of the work of the Contractor. Such schedules shall be reviewed, updated and submitted to the Engineer, once in every two months thereafter, by the Contractor. Schedules shall also include the materials and equipment purchased from outside suppliers.

1.03.03 Erection Schedules Rev 01 Date Oct 2015

In order to achieve the overall completion schedule, the Contractor shall provide the Owner all the information covering erection sequence, testing and commissioning activities. These schedules may be based on the recommended erection procedures and will be subject to discussions/agreements with the Owner subsequent to the award of contract.

1.03.04 The successful Bidder shall have to provide all the above schedules (i.e. 1.03.01, 1.03.02 & 1.03.03) in a tabular form in addition to that in the form of L2 & L3 networks and these shall necessarily include information not limited to the earliest and latest dates for various activities/submissions and also any related constraints. However, the Bidder shall include in his proposal a Level-1 (L-1) network showing the major activities and various milestones to achieve the above mentioned completion schedule.

1.03.05 The Contractor shall provide the Owner the original disc/software for all such schedules alongwith requisite no. of copies (as required by the Owner) within an agreed time schedule. This time schedule will be agreed between Owner/Bidder at the time of award of contract. The Contractor's project management software shall be compatible with that of the Owner and the input data shall be furnished to the Owner in a manner compatible with Owner's project management software, SAP.

1.04.00 **Detailed Responsibilities**

## 1.04.01 Planning &amp; Monitoring

## a) Planning

The Bidder shall prepare a Master Network Schedule in the form of PERT network.

The network shall be prepared on a Work Breakdown Structure for the project which sub-divides the project into a set of manageable systems/sub-systems. The master network will identify milestones of key events for each system/package in the areas of engineering, procurement, manufacture and despatch and erection and commissioning. The master network shall represent the Level-I plan and will form the basis for development of detailed second and third tier execution plans. The master network shall conform to the overall schedule prescribed by Owner.

The master network should be submitted along with the bid which would be mutually discussed and finalised before the Award of Contract. This master network would clearly indicate the responsibility of the Bidder and project management team. This master network would form a part of the contract. The master network shall also identify a complete list of inputs to be furnished by the Owner which may be required for proper interfacing and tie-up. Scheduled dates for providing such inputs shall also be indicated, which will be mutually discussed and finalised.

b) Monitoring & Progress Reporting Rev 01 Date Oct 2015

The progress reports would be emanated every month, one from the head office of the Contractor and another from the site office. The progress report emanating from the head office should necessarily include the following sections:

- i) Report on key milestones.
- ii) Management summary indicating critical areas with details of actions initiated and effect of any on the project.
- iii) Action needing attention of the Owner/Consultant.
- iv) Detailed packagewise status of engineering submissions, quality plan submissions and approval, procurement manufacture and despatch.

The monthly report generated from the site office should necessarily include:

- i) Report on key milestones.
- ii) Management summary indicating critical areas with details of actions initiated and effect if any on the project.
- iii) Action needing attention of the Owner/Consultant.
- iv) This report would also cover the areas pertaining to the receipt of the equipment at the port, port clearance, transport, receipt at site, erection and commissioning.

In addition to the above, as the project execution progresses, the Contractor shall also be responsible for generating more frequent reports in the form of fax/e-mail information on progress in critical areas so that actions can be expedited. The exact format of the progress report shall be finalised after award of Contract.

1.04.02 Engineering Management

Based on the master network for the project (L-1) the Contractor will prepare an exhaustive list of engineering activities for the equipment/systems covered in his scope and a detailed programme of accomplishing the same within the time frame specified in the master network. This schedule will form the Level-2 (L-2) network for engineering activities.

Based on (L-2) network, the Contractor shall further develop the Level-3 (L-3) network for engineering activities which will indicate schedule for data availability, drawing release date and document submission dates.

Detailed (L-2) and (L-3) networks would be provided by the Contractor within two months from the date of award and finalised within one (1) month thereafter. Rev 01 Date Oct 2015

All such networks shall be provided in MS PROJECT software as well as in other format / software suitable to Owner.

The engineering management team should also co-ordinate all interface engineering activity between the Contractor and the equipment sub-vendors so as to ensure the correctness and completeness of related engineering documentation before the same is submitted to the Owner.

TSGENCO is implementing SAP ERP. Hence the bidder apart from submission of the hard copies shall upload all the documents, drawings etc. in soft format in the relevant C- folder environment (web based) and comply with the additional requirements, if any.

#### 1.04.03 Contracts Management

Based on the master network, the Contractor shall submit L-2 programmes of manufacture and despatch. In addition, the master network shall also include periods considered for site activities viz. erection, commissioning etc. These L-2 programmes would be submitted in 2 months time from the date of award of contract and finalised within one (1) month thereafter. The Contractor will also submit site mobilisation plan. This programme would be submitted at the time of finalisation of award of contract and agreed immediately thereafter so that immediate development of the various activities at site could take place.

The Contractor should also submit L-3 programmes for the manufacturing, despatch of the various items. These networks shall also show the customer hold points (CHP) which have to be cleared by Owner or their authorised representative(s) before further manufacture can take place. These L-3 programmes for the manufacture and despatch would clearly identify responsibilities of the Contractor, sub-Contractor and Owner. These networks shall be submitted within one (1) month of the date of finalisation of the various sub-contracts by the Contractor.

In case all the manufacture is being done by the Contractor then the L-2 programmes would be themselves amplified to cover details of the manufacture, inspection, clearance by Owner and despatch.

The Contractor shall also submit the programme for procurement of boughtout items, detailed shipping schedule and cash flow statement for Owner's approval.

#### 1.04.04 Quality Assurance, Inspection and Expediting

The Contractor shall submit the list of manufacturers/sub-vendors from whom the equipment are expected to be procured and the quality assurance plans thereof for the manufacture shall be approved by the QA group of Owner before the manufacture is commenced. The list of major suppliers would be submitted along with the bid and this shall be mutually discussed and approval will be given by the Owner during contract negotiation meeting prior

---

to placement of Letter of Intent. This a  
bidder. In the said list, Owner reserves t Rev 01 Date Oct 2015  
vendors of his own choice. Regarding the various other sub-vendors, the list  
would be submitted within six (6) months of the award of the contract that  
shall be scrutinized by the Owner to accord approval. In such list Owner  
reserves the right to include vendors of his own choice. No further vendor  
approval will be given after twelve (12) months. On the quality plans, the  
customer hold points will also be identified based on which Owner would give  
clearance for the manufacture to proceed further.

Quality assurance/Inspection group of Owner or its representative would  
issue a material despatch clearance certificate (MDCC) after the inspection  
clearance which will enable the Contractor to despatch the equipment and  
claim the payment. In the despatch programme, the Contractor shall indicate  
a schedule of estimated programme, tonnages specifically identifying various  
oversize dimensioned consignments (ODC). Further the Contractor will also  
be required to ensure at all stages of shipment that packing of all shipments  
despatched are suitable for ocean freight to India, handling at the port of  
entry, inland transportation and preservation at site upto erection. All  
despatch details & item lists shall be made available to both Owner & site  
immediately after shipping.

The Contractor shall also expedite all despatches from their own works/works  
of their sub-vendors, so as to match with the various activities mentioned at  
1.04.03 above.

#### 1.04.05 Construction Management

Based on the L-1 Master Network Programme, within two (2) months of the  
issue of Letter of Intent, the Contractor shall submit a programme of  
construction/ erection/ commissioning, either in continuation with the  
manufacture and despatch or separately for the implementation. These  
programmes would be amplified showing when the civil drawings shall be  
released by him and construction of civil works shall be completed by him to  
facilitate start of erection and subsequent activities and shall form the basis  
for site execution and detailed monitoring. The three monthly rolling  
programme with the first month's programme being tentative based on the  
site conditions would be prepared based on these L-3 programmes. The  
Contractor shall also be involved along with the Owner to tie up detailed  
resource mobilisation plan over the period of time of the contract matching  
with the performance targets.

The L-3 programme would be jointly finalised by the site in charge of the  
Contractor with the Owner's project coordinator as well as the site planning  
representative. The erection programme will also identify the sequential  
erectable tonnages that are required for various equipment which should be  
taken care of in the despatch programmes.

Erection and commissioning of the equipment shall also be done under the  
supervision of experts from the respective equipment/ system supplier.

#### 1.04.06 Spares Management

Alongwith the proposal for the plant and e  
submit proposals/schedule for the following Rev 01 Date Oct 2015

- a) Mandatory spares
- b) Recommended spares

While the award for mandatory spares will be finalised at the time of the award of contract, recommended spares will be finalised thereafter.

**1.05.00 Project Progress Review Meetings**

Keeping in mind the overall responsibility of the Contractor it is intended that periodic progress reviews on the entire activities of execution of the project will be held initially at least once in two (2) months at Hyderabad/site/ at the discretion of the Owner.. During peak period it may be held once in a month. These meetings will be attended by reasonably higher officials of the Contractor and their leading sub- contractors and will be used as a forum for discussing all areas where progress needs to be speeded up. Actions will be placed on the concerned agencies and decisions will be taken to expedite/speed up the progress. Minutes of such meetings will be issued reflecting the major discussions and decisions taken and circulated to all concerned for reference and action. The Contractor shall be further responsible for ensuring that suitable steps are taken to meet various targets decided upon such meetings.

In addition to the above, and to streamline the construction and erection at site, a suitable frequency and forum of periodic meetings between the Contractor and the Owner will be decided upon as part of erection coordination procedure. Site co-ordination meeting may be held on weekly basis.

**1.06.00 Owner's Consultant**

The Owner would appoint a consultant to assist him in some of the areas mentioned at 1.01.00 above. The details of interaction and procedures for coordination between Owner / Owner's Consultant and Contractor/ Contractor's project management team shall be finalised during contract negotiations.

**1.07.00 Commissioning Management**

**1.07.01** For commissioning of the various equipment/system covered under the scope of contract, Owner will form an organisation structure which may consist of the following committees. The Contractor shall nominate his representative on one or more of the committee as decided by the Owner:

- a) Steering Committee
- b) Commissioning Panel.
- c) Working Parties
- d) Testing Teams.

**1.07.02** Commissioning documents shall be prepared by the Contractor in the

following manner and submitted for Owner  
Rev 01 Date Oct 2015

a) Field Quality Plan

This document shall be prepared for the various equipment/ systems under commissioning and shall have the following objectives to fulfill and shall be submitted for Owner's approval at least six (6) months before their actual commissioning :

- i) Establish design data against which Plant Performance will be compared.
- ii) Set-out the testing objectives and proposals.
- iii) Define the documentation required.

b) Testing/Commissioning Schedule

These shall be prepared for the various equipment/systems under consideration and shall contain sections like detailed testing method, programme, safety, individual responsibility and results.

c) Standard Check Lists

Standard check lists are intended for use at the completion of erection to ensure correct erection, testing and to a limited extent operation for repetitive items.

1.07.03 Test Reports

After the completion of commissioning activity of equipment/ systems, the Contractor shall prepare the test reports which shall include all the relevant information related to various commissioning checks, tests carried out, any deviations/commissions noticed with respect to the intended design requirements, sequence of various commissioning activities as actually adopted vis-a-vis as recommended in the procedures, programme schedules achieved and any other such information as required. These test reports shall be submitted in requisite number of copies to the Owner and this should be duly signed jointly by the Owner/Consultant and the Contractor/Equipment supplier, who are involved during the commissioning activities.

2.00.00 **SITE SERVICES**

These services shall be rendered by the Bidder as part of the overall project management service. The services shall broadly include but not be limited to the following :

2.01.00 Arranging material despatch from the shop by rail/road and/or sea as applicable.

2.02.00 Monitoring movement of materials & follow-up as necessary with Railways, road transport, port clearance etc. from the time of despatch F.O.R. works/ F.O.B. port of shipment by Contractor till receipt of the same at site.

- 2.03.00 Unloading of materials at Railway Station, Rev 01 Date Oct 2015  
Road Transportation, transportation to site store, assessment of lost/damaged items in transit and arranging insurance claims and replacement of lost/damaged items. The Contractor shall submit to the Engineer a report detailing all the receipts during the week as well as storing, preservation of material at site.
- 2.04.00 Issuing materials from site store/open yard from time to time for erection as per the construction programme. The Contractor shall be the custodian of all the materials issued till the plant is officially taken over by the Owner after complete erection and successful trial run & commissioning.
- 2.05.00 Transportation of materials to their respective places of erection and erection of the complete plant & equipment as supplied under this specification.
- 2.06.00 Trial run and commissioning of individual equipment/sub-systems and the plant as a whole to the satisfaction of the Owner, including supply of temporary equipment & services for chemical cleaning, steam blowing as well as performance guarantee tests.

Apart from Boiler, proper chemical cleaning shall be carried out in following pipe lines/equipment before commissioning

- a) Deaerator
- b) Boiler feed suction, recirculation leak-off lines
- c) Boiler Feed discharge line by passing heaters
- d) Attemperation lines
- e) Condensate suction & discharge piping upto deaerator by passing the feed water heaters.
- f) Fuel oil lines.

Provision for preservation of individual equipment after trial run and commissioning e.g. Nitrogen blanketing etc. as necessary shall also be in the scope of the Bidder.

Safe disposal of effluent after chemical cleaning shall be done by the contractor.

- 2.07.00 Supply and application of the final paints and first fill lubricants on all the equipment to be erected under this specification. Supply of chemicals, lub oils and other consumables upto COD.
- 2.08.00 For the purpose of erection and commissioning the Contractor's scope of work shall include but not be limited to the following :
- 2.08.01 Deployment of all skilled and unskilled manpower required for erection, supervision of erection, watch & ward, commissioning and other services to

be rendered under this specification.

Rev 01 Date Oct 2015

- 2.08.02 Deployment of all erection tools & tackle, construction machinery, transportation vehicles and all other implements in adequate number and size, appropriate for the erection work to be handled under the scope of this specification.
- 2.08.03 Supply of all consumables, e.g. welding electrodes, cleaning agents, diesel oil, grease, lubricant etc. as well as materials required for temporary supports, scaffolding etc. as necessary for such erection work except those listed under exclusion elsewhere in this specification.
- 2.08.04 Construction of all civil/structural/architectural works, including construction of foundation for all equipment supplied as required, grouting of equipment on foundation after alignment, and all other incidental civil activities as detailed elsewhere.
- 2.08.05 All structural steel fabrication and erection work as detailed elsewhere in the specification.
- 2.08.06 Providing support services for the Contractor's erection staff e.g. construction of site offices, temporary stores, residential accommodation and transport to work site for erection personnel, insurance cover, watch & ward for security and safety of the materials under the Contractor's custody etc. as required.
- 2.08.07 Maintaining proper documentation of all the site activities undertaken by the Contractor as per the proforma mutually agreed with the Owner; submitting monthly progress reports as also any such document as and when desired by the Owner; taking approval of all statutory authorities e.g. Boiler Inspector, Factory Inspector, Inspector of Explosives, Electrical Inspector etc. for respective portions of work under the jurisdiction of such statutes or laws.
- 2.08.08 The Contractor shall provide 'Industrial Relations' unit and 'Medical' unit to take care of his erection staff and the Owner shall have no obligation in the regard.
- 2.08.09 The successful Bidder shall arrange for Tower cranes of adequate capacity for speedy erection activities.

2.09.00 **Site Organisation**

The Contractor shall maintain a site organisation of adequate strength in respect of manpower, construction machinery and other implements at all times for smooth execution of the contract. This organisation shall be reinforced from time to time, as required, to make up for slippages from the schedule without any commercial implication to the Owner. The site organisation shall be headed by a competent construction manager having sufficient authority to take decisions at site.

On award of contract, the Contractor shall submit to the Owner a site organisation chart indicating the various levels of experts to be deployed on the job. The Owner reserves the right to reject or approve the list of personnel

proposed by the Contractor. The pers  
 approved by the Owner, will have to be p Rev 01 Date Oct 2015  
 regard will not generally be permitted.

The Contractor shall also submit to the Owner for approval a list of construction equipment, erection tools, tackle etc. prior to commencement of site activities. These tools & tackle shall not be removed from site without written permission of the Owner.

**2.10.00 General Guidelines for Field Activities**

2.10.01 The Contractor shall execute the works in a professional manner so as to achieve the target schedule without any sacrifice on quality and maintaining highest standards of safety and cleanliness.

2.10.02 The Contractor shall co-operate with the Owner and other Contractors working in site and arrange to perform his work in a manner so as to minimise interference with other Contractors' works. The Owner's engineer shall be notified promptly of any defect in other Contractor's works that could affect the Contractor's work. If rescheduling of Contractor's work is requested by the Owner's engineer in the interest of overall site activities, the same shall be complied with by the Contractor. In all cases of controversy, the decision of the Owner shall be final and binding on the Contractor without any commercial implication.

2.10.03 The Engineer shall hold weekly meetings of all the Contractors working at Site at a time and a place to be designated by the Engineer. The Contractor shall attend such meetings and take notes of discussions during the meeting and the decisions of the Engineer and shall strictly adhere to those decisions in performing his Work. In addition to the above weekly meeting, Engineer may call for other meetings either with individual contractors or with selected number of contractors and in such a case the Contractor, if called will also attend such meetings.

2.10.04 Time is the essence of the Contract and the Contractor shall be responsible for performance of his Work in accordance with the specified construction schedule. If at any time the Contractor is falling behind the schedule, he shall take necessary action to make good of such delays by increasing his work force or by working overtime or otherwise accelerate the progress of the work to comply with the schedule and shall communicate such action in writing to the Engineer, satisfying that his action will compensate for the delay. The Contractor shall not be allowed any extra compensation for such action.

2.10.05 The Engineer shall however not be responsible for provision of additional labour and or materials or supply or any other services to the Contractor except for the co-ordination work between various Contractors as set out earlier.

2.10.06 The works under execution shall be open to inspection & supervision by the Owner's engineer at all times. The Contractor shall give reasonable notice to the Owner before covering up or otherwise placing beyond the reach of inspection any work in order that same may be verified, if so desired by the Owner.

- 2.10.07 Every effort shall be made to maintain the <sup>Rev 01 Date Oct 2015</sup> stringent supervision and inspection at every stage of execution. Manufacturer's instruction manual and guidelines on sequence of erection and precautions shall be strictly followed. Should any error or ambiguity be discovered in such documents, the same shall be brought to the notice of the Owner's engineer. Manufacturer's interpretation in such cases shall be binding on the Contractor.
- 2.10.08 The Contractor shall comply with all the rules and regulations of the local authorities, all statutory laws including Minimum Wages, Workmen Compensation etc. All registration and statutory inspection fees, if any, in respect of the work executed by the Contractor shall be to his account.
- 2.10.09 All the works such as cleaning, checking, leveling, blue matching, aligning, assembling, temporary erection for alignment, opening, dismantling of certain equipments for checking and cleaning, surface preparation, edge preparation, fabrication of tubes and pipes as per general engineering practice at site, cutting grinding, straightening, chamfering, filling, chipping, drilling, reaming, scrapping, shaping, fitting-up bolting/welding, etc., as may be applicable in such erection and are necessary to complete the work satisfactorily, are to be treated as incidental and the same shall be carried out by the Contractor as part of the work.
- 2.10.10 In case of any class of work for which there is no such specification as laid down in the contract such as, blue matching, welding of stainless steel parts, etc., the work shall be carried out in accordance with the instructions and requirements of the Engineer and as per the Standards.
- 2.10.11 It may sometimes be necessary to remove some of the erected structural members to facilitate erection of bigger/pre-assembled equipment. In such cases, the removal and re-erection of such members, which are essential, and if so agreed by the Engineer, will have to be done by the Contractor.
- 2.10.12 Attachment welding of necessary instrumentation tapping points, thermocouple pads, root valves, condensing vessels, flow nozzles and control valves etc., both for regular measurement and performance testing to be provided on equipment, its auxiliaries or pipelines covered within the scope of this tender, will also be the responsibility of the Contractor and the same will be done as per the instructions of Engineer. The erection and welding of all above items will be the Contractor's responsibility, even if :
- a) Product groups under which these items are re-leased are not covered in the scope of this tender.
  - b) Items are supplied by an agency other than the Contractor.
- 2.10.13 Preservation of all materials/equipment under custody of the Contractor during storage, pre-assembly & erection, commissioning etc., shall be the responsibility of the Contractor. All necessary preservatives and consumables like paints, etc., shall be arranged by the Contractor. Necessary touch up painting, periodic application of preservatives/paints on pressure parts/other equipment even after erection until completion of work shall be carried out by

the Contractor. The Contractor shall fabricate and carry out the acid cleaning of fabrications, service the lub. oil system, carry out the hydraulic test of oil coolers, etc. Rev 01 Date Oct 2015

- 2.10.14 It is responsibility of the Contractor to do the alignment etc. if necessary, repeatedly to satisfy Engineer, with all the necessary tools & tackle, manpower, etc. The alignment will be complete only when jointly certified so, by the Contractor's Engineer & Owner. Also the Contractor should ensure that the alignment is not disturbed afterwards.
- 2.10.15 Additional platforms for approaching different equipment as per site requirement, which may not be indicated in drawings, shall be fabricated and erected by the Contractor. The materials required for these works shall be supplied by the Contractor and he will have to fabricate them to suit the requirement.
- 2.10.16 Equipment and material which are wrongly installed shall be removed and reinstalled to comply with the design requirement at the Contractor's expense, to the satisfaction of the Owner/ Consultant.
- 2.10.17 Before erection of any equipment on a foundation, the Contractor shall check and undertake if necessary rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin, etc.
- 2.10.18 Assistance for calibrating/testing the power cylinders, valves, gauges, instruments, etc., and setting of actuators coming under various groups shall be provided by Contractor.
- 2.10.19 It shall be the responsibility of the Contractor to provide ladders on columns for initial works till such time stairways are completed. For this, the ladder should not be welded on the column and should be prefabricated clamping type. No temporary welding on any structural member is permitted except under special circumstances with the approval of Owner.
- 2.10.20 Structural materials required for the supporting/operating platforms required for the valves at various levels for the same operation of valves will be arranged by the Contractor.
- 2.11.00 **Safety**
- Safety and overall cleanliness of work site shall be given top priority.
- 2.11.01 The Contractor shall ensure the safety of all workmen, materials and equipment either belonging to him or to others working at site. He shall observe safety rules & codes applied by the Owner at site without exception.
- 2.11.02 The Contractor shall notify the Owner of his intention to bring to site any equipment or material which may create hazard. The Owner shall have the right to prescribe the conditions under which such equipment or material may be

handled and the Contractor shall adhere  
prohibit the use of any construction machinery Rev 01 Date Oct 2015  
unsafe. No claim for compensation due to such prohibition will be entertained by  
the Owner.

- 2.11.03 Storage of petroleum products & explosives for construction work shall be as per rules and regulation laid down in Petroleum Act, Explosive Act and Petroleum and Carbide of Calcium Manual. Approvals as necessary from Chief Inspector of Explosives or other statutory authorities shall be the responsibility of the Contractor.
- 2.11.04 The Contractor shall be responsible for safe storage of his and his sub-contractor's radioactive sources.
- 2.11.05 All requisite tests & inspection of handling equipment, lifting tools & tackle shall be done by the Contractor and certified copies shall be supplied to the Owner. Defective equipment shall be removed from service. Any equipment shall not be loaded in excess of its recommended safe working load.
- 2.11.06 All combustible waste and rubbish shall be collected and removed from the worksite at least once each day. Use of undercoated canvas paper, corrugated paper, fabricated carton, plastic or other flammable materials shall be restricted to the minimum and promptly removed.
- 2.11.07 The Contractor shall provide adequate number of fire protection equipment of the required types for his stores, office, temporary structures, labour colony etc. Personnel trained for fire-fighting shall be made available by the Contractor at site during the entire period of the Contract.
- 2.11.08 All electrical appliances used in the work shall be in good working condition and shall be properly earthed. No maintenance work shall be carried out on live equipment. The Contractor shall maintain adequate number of qualified electricians to maintain his temporary electrical installation.
- 2.11.09 All workmen of the Contractor working in construction site shall wear safety helmets, safety boots and safety belts. The Contractor shall take appropriate insurance cover against accidents for his workmen as well as third party.
- 2.11.10 All the worksites shall be provided with adequate lighting facilities e.g. flood lighting, hand lamps, area lighting etc. by the Contractor for proper working environment during night times.
- 2.11.11 All safety precautions shall be taken for welding and cutting operations as per IS-818.
- 2.11.12 All safety precautions shall be taken for foundation and other excavation marks as per IS-3764.
- 2.12.00 **Taking Delivery & Storage**
- 2.12.01 The Contractor shall arrange issue of all equipment and materials to be erected under the contract from the stores/open yard at site by signing on standard indent forms. After completion of work, detailed auditing of the

materials so issued shall be submitted to the Engineer for approval. Rev 01 Date Oct 2015

- 2.12.02 The Contractor shall arrange for proper and safe storage of materials till the same are taken over by the Owner as per terms of the contract. Manufacturer's instructions for preservation shall be strictly followed.
- 2.12.03 All empty containers, packing materials, gunny bags, transport frames and also surplus and unused materials reconciliation prior to completion of contract shall be the property of the Owner and returned to the Owner by the Contractor.
- 2.13.00 **Site Welding & Heat Treatment**
- 2.13.01 Welding shall be done in accordance with IS-813, IS-816, IS-9595 & other relevant IS/International standards and as per instructions of Contractor. Only those welders, who are qualified as per IS-817 for ordinary welds and as per IBR/ASME Section-IX for high pressure welds, shall be employed in the job.
- 2.13.02 All welders shall be tested and approved by Engineer before they are actually engaged on the work even though they may possess the requisite certificates. The Owner reserves the right to reject any welder without assigning any reason. The welder identification code as approved by the Engineer shall be stamped by the welder on each joint done by them. The Contractor will be responsible for the periodic renewal, re-testing of the welders as demanded by Owner.
- 2.13.03 The Engineer is entitled to stop Contractor's any welder from his work if his work is unsatisfactory for any technical reason or there is a high percentage of the rejection of joints welded by him, which in the opinion of Engineer will adversely affect the quality of welding even though the welder has earlier passed the tests. The welders having passed the tests do not relieve the Contractor from his contractual obligations, to check the performance of the welders.
- 2.13.04 All charges for testing of welders including destructive and non- destructive tests if conducted by Owner or by the inspection authority at site shall have to be borne by the Contractor. The necessary test materials and consumables will have to be arranged by the Contractor and all testing facility made available, as required.
- 2.13.05 All welded joints shall be subject to acceptance by Engineer. Inspection of welds shall be in accordance with IS-822 or equivalent code.
- 2.13.06 Preheating/post heating and stress relieving after welding are part of fabrication and erection work and shall be performed by the Contractor in accordance with the instruction of Engineer. Contractor shall arrange to supply heating equipment with automatic recording devices. Also the Contractor shall have to arrange for the labour, heating elements, thermocouples, compensating cables, insulation materials like mineral wools, asbestos cloth, ceramic beads, asbestos rope, etc. required for the heat-treatment and stress relieving works. During pre- heat/stress relieving operations, the temperature shall be measured at one or more points as required by attaching thermocouples and recorded on a continuous printing

type recorder. All the record graphs for th  
shall be got signed by the Engineer prior to Rev 01 Date Oct 2015  
and handed over to Engineer on completion. The graphs will be the property  
of Owner. The Contractor has to provide thermo-chalks temperature  
recorders, thermocouple attachments, units, graph sheets, etc. required for  
the job and maintain them in good condition.

- 2.13.07 All electrodes shall be baked and dried in the electric/electrode drying oven to the required temperature and for the period specified by the Engineer before they are used in erection work. The electrodes used shall be as per IS-814, IS-815, IS-1442, IS-7280 and other codes as applicable, and shall be of approved reputed manufacture. The electrodes shall meet the requirement of the pipe material. No electrode manufactured more than 12 months ago and the type covered under certificate issued after conducting tests more than 6 months ago shall be used. All electrodes shall be preserved at works and at site as per manufacturer's recommendations.
- 2.13.08 Oxy-acetylene flame or Exothermic chemical heating for stress relieving is not permitted. Heating shall be by means, of electric induction coil or electric resistance coil.
- 2.13.09 It may become necessary to adopt inter layer radiography/MPT/UT depending upon the site/technical requirement necessitating interruptions in continuation of the work and making necessary arrangement for carrying out the above work.
- 2.13.10 Gas tungsten arc welding process (TIG) shall be adopted for all root pass welds except for structural works until 4.75 mm thickness is deposited. Subsequent welding after root pass can be carried out by manual metal arc welding with coated electrodes. For pipes of thickness less than 6 mm the entire welding has to be carried out by TIG welding.
- Fillet weld shall be made by shielded metal arc process as per applicable codes.
- However, the Engineer will have the option of changing the method of welding as per site requirement. The method adopted for manual arc welding shall be weaving technique and the width of weaving shall not exceed 1.5 times of the dia. of the electrode.
- In case of deviation from welding process and electrodes, the Contractor shall take approval of the Owner prior to adoption of same.
- 2.13.11 The root pass for butt joints shall be such as to achieve full penetration with complete fusion of root edges.
- 2.13.12 Each pass shall be cleared and freed of slag before the next pass is deposited.
- 2.13.13 On completion of each run, craters, weld irregularities, slag etc. shall be removed by grinding or chipping.
- 2.13.14 Each layer of welding shall have an even and smooth appearance.

- 2.13.15 Welding sequence shall be adjusted in Rev 01 Date Oct 2015 welding shrinkage is minimised. Further any movement, shock or vibration during welding shall be avoided to prevent weld cracks.
- 2.13.16 Proper protection of welders and the work shall be taken during periods of rain. No welding shall be carried out when surface to be welded are wet from any cause.
- 2.13.17 Following will be stages of inspection during welding :
- a) Two pieces to be joined shall be individually checked for the weld edge preparation and profile dimensionally and to the template. Dye penetrant check shall be carried out on edge prepared surfaces at random. The percentage will depend upon on criticality as specified by Engineer.
  - b) Joint fit up will be a stage of inspection. Misalignment after fit up may vary from 0.3 mm to 1.6 mm depending on outside diameter and thickness.
  - c) All joints shall be offered for visual inspection after root run. Subsequent welding should be made only after the approval of root run.
- 2.13.18 All welded joints shall be painted with anti-corrosive paint immediately on completion of radiography and stress-relieving.
- 3.00.00 **PROJECT INFORMATION AND MANAGEMENT SYSTEM, INCLUDING DCOUMENT MANAGMENT SERVER (DMS)**
- 3.01.00 Contractor shall submit as part of its Work Scope detailed documentation as outlined in this section and / or required by the Technical Requirements. The content and format of the documentation to be submitted are subject to Owner's approval.
- 3.02.00 Contractor shall utilise a computer based system for control and management of project documentation. The system must be capable of producing customized reports and information on demand. This control system should have been successfully applied to similar projects and be familiar to the project control personnel selected. Contractor's detailed project documentation plan shall identify all documentation requirements for the project, the party responsible for production of the document, the basic content of the document and the required timing for issue. This plan shall include, but not be limited to the details of all Drawings to be produced, plant specification / definition documentation, equipment orders and manuals. The documentation identified shall be entered into the computer based control system The database thus created shall be capable of being sorted and

ordered on a variety of selected parameters  
description, responsible party, start date a Rev 01 Date Oct 2015  
update to be conducted only on those documents which are relevant.

3.03.00 Regular documentation control progress reports shall be prepared by the Contractor to record the status of documentation. In the event either Party or Engineer expresses concern with the content of such progress reports, the accuracy of progress reports, status of documentation production and other such matters, the concern will be identified to the Project Manager. Within five days of notification of this concern, the Project Manager will attend a meeting with relevant Owner Representatives and provide details of specific actions to be initiated to satisfactorily overcome the difficulties identified. It will be the Project Manager's responsibility to initiate whatever action is necessary to ensure that the production of documentation is completely in accordance with Project Information Management System (PIMS).

3.04.00 Within 90 days after Effective Date of Contract, the Contractor shall establish an integrated PIMS which will support the needs of Project and management, detail design and engineering, procurement, construction and operation, and maintenance.

PIMS shall utilise software which links various software and database programs to form a composite system. The typical scope of PIMS shall include, but not be limited to, the following:

- (a) Power plant systems and equipment data, from which Project specific flow diagrams, data sheets and other integrated data are derived. The Power plant systems and equipment data, from which Project specific flow diagrams, data sheets and other integrated data are derived. This data shall include, but not be limited to, the following:
  - (i) System descriptions and design requirements and design criteria
  - (ii) Equipment and material technical specifications for all engineering disciplines
- (b) Detail engineering data to create flow diagrams, plant arrangements, piping configurations, equipment layout and design, electrical and instrumentation systems, structures, and other systems. The software tool used shall be capable of manipulation and storage of plant layout and design information. The 3D model of the plant shall also contain details of the various components like pipe, structural steel work, etc., and relevant information shall be available on-line from relevant data base. Software shall be multi-user, multi-access nature allowing the designers of Contractor and major Sub-Contractors, if required, to work in interactive real time environment and software shall be capable of interference checking. The software shall allow access to different types of information held in the database. It shall estimate the type and quantity of materials required to build the plant and it shall be possible for such data to be taken off the system at any time.

---

(c) Construction data to monitor and manage control, scheduling and progress, quality operation, maintenance, training, and all other site functions. Rev 01 Date Oct 2015

(d) Plant design and construction records to provide data for safe and efficient maintenance and operation. Records to include may be maintenance schedule, man power tracking, tools, spare parts, and test equipment inventory, equipment list, drawing, control, technical specifications, and equipment instruction manuals.

3.05.00 The PIMS shall be installed in a distributed processing array system and operated through personal computer work stations at the Contractor's site office. A complete integrated system shall be implemented. This system shall be utilised by Contractor during the Project execution.

Rev 01 Date Oct 2015

## ENGINEERING SERVICES

## **CONTENT**

Rev 01 Date Oct 2015

<b>CLAUSE NO.</b>	<b>DESCRIPTION</b>
1.00.00	GENERAL
2.00.00	DESIGN COORDINATION MEETING
3.00.00	CO-OPERATION WITH OTHER CONTRACTORS AND CONSULTING ENGINEERS
4.00.00	GUIDELINES FOR ENGINEERING SERVICES
5.00.00	OPERATING MANUALS AND MAINTENANCE INSTRUCTIONS
6.00.00	PLANT HANDBOOK
7.00.00	CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVAL PROCEDURE
8.00.00	TENDER STAGE DOCUMENT SUBMISSION

### **ATTACHMENTS**

ANNEXURE-1	DISTRIBUTION SCHEDULE
------------	-----------------------

## **ENGINEERING SERVICES**

### **1.00.00 GENERAL**

1.01.00 As part of the overall project management activity, the Contractor shall be responsible for proper engineering and co-ordination of activities during various phases of execution of the contract. The Contractor shall identify a person, designated as Project Manager, with whom the Owner, the Consulting Engineer or the Review Consultant shall interact on matters related to engineering as well as execution of the contract. The Project Manager shall be the single-point contact person on behalf of the Contractor and shall be responsible for all engineering co-ordination. The Owner/Consultant/Review Consultant shall interact with the Project Manager only on all matters of co-ordination between the Owner and the Contractor or on matters involving the Contractor, his manufacturing units and sub-vendors. For the purpose of expediting the Owner or his representative may sometimes interact with the manufacturing units or sub-vendors of the contractors. However such interaction will not, under any circumstance, dilute the responsibility of the Contractor to provide a fully engineered and co-ordinated package under this contract.

1.02.00 On finalization of the contract, a procedure for exchange of engineering information will be mutually agreed and finalized between the Owner and the Contractor.

### **2.00.00 DESIGN COORDINATION MEETING**

The Contractor and his sub-vendors will be called upon to attend design co-ordination meetings with the Engineer, other Contractors and the Consultants of the Owner during the period of execution of contract. The Contractor including his sub-vendors shall attend such meetings at their own cost at Owner's or Consultant's office in Kolkata or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions.

### **3.00.00 CO-OPERATION WITH OTHER CONTRACTORS AND CONSULTING ENGINEERS**

The Contractor shall agree to cooperate with the Owner's other Contractors and Consulting Engineers and freely exchange with them such technical information as is necessary to obtain the most efficient and economical design and to avoid unnecessary duplication of efforts. The Engineer shall be provided with copies of all correspondences addressed by the Contractor to other Sub- contractors and Consulting Engineers in respect of such exchange of technical information.

- 4.00.00 **GUIDELINES FOR ENGINEERING SERV** Rev 01 Date Oct 2015
- 4.01.00 Prior to commencement of the engineering work as part of design submissions, all aspects of design viz., criteria for selection and sizing of all equipment and systems, design margins etc. including that for structural steel and civil work shall be outlined and these shall form the basis for the detailed engineering work.
- 4.02.00 Engineering work shall be performed on modern and proven concepts and internationally accepted good engineering practices but fully compatible with the Indian environments. Owner shall have the right to review and approve the engineering work by themselves and/or through consultant and ask for any clarifications and changes/modifications to the work performed by Contractor.
- 4.03.00 At any stage during the performance of assignment, the Contractor may be required to make certain changes/modification/improvements in design/drawing/other documents which are applicable to 800 MW Unit, which in the opinion of the Owner could result in better improved design, layout, operability, plant availability, maintainability, reliability or economy of the plant and its systems/sub-systems in view of revised and more accurate information/data available at a later date(s) or feedback(s) received during execution / operation of similar units. Such changes / modifications/improvements required could be identified by Owner and/or consultant and mutually discussed. Owner requires the Bidder to incorporate such action in the subject assignment appropriately without any additional cost liability and time implication to the Owner and same shall be within the responsibilities and scope of the Contractor.
- 4.04.00 During the course of review of detailed engineering stages, it may be essential in the opinion of Owner to obtain certain classified data for review purposes only. In case Owner so desires, the Bidder shall submit such data to Owner.
- 4.05.00 During the course of review of detailed engineering, it may be essential in Owner's opinion to obtain data and information on similar equipment and plants engineered by the Bidder. In case Owner so desires the Bidder shall submit such data and information to the Owner.
- 4.06.00 It is not the intent to give details of every single task covered in the total engineering work to be carried out by Contractor, however, all engineering work required for the satisfactory completion of the plant/systems as specified shall be carried out by the Contractor. Broadly, the following are the minimum requirements in respect of scope of major items of work:
- 4.06.01 Preparation, updating and finalisation of scheme drawings, control and interlock diagrams, detailed and fully dimensioned layout drawings (plant layout and equipment layout detailed plan, elevation and cross-sectional drawings at different elevations / floor levels) covering all mechanical, electrical, C&I, civil and structural items, equipment, systems and facilities. Drawings and Schedules prepared by the Contractor from time to time, as detailed designs are developed, shall be submitted for Owner's / Consultant's

approval before the work is taken up. F  
drawings and schedules shall not be consi Rev 01 Date Oct 2015

- 4.06.02 Preparation of detailed technical specifications including data sheets, tender drawings and bill of material for all bought out items, as also finalisation of corresponding sub-contractors.
  - 4.06.03 Review of sub-contractor's data, drawings, design calculations, schedules, bill of materials, instruction manuals etc. for all equipment, before forwarding them to Owner/Consultant for approval.
  - 4.06.04 Preparation of civil construction drawings for all equipment showing foundation details and full details regarding equipment loads, floor openings, details of embedments etc. required for preparation of civil construction drawings and also as referred at relevant sections of Scope, Terminal Points & Exclusions. These documents shall be preceded by appropriate design calculations, static and dynamic analysis as necessary.
  - 4.06.05 Preparation and finalisation of process piping and instrumentation diagrams and schematics, complete in all respects for all systems/packages of the power plant.
  - 4.06.06 Preparation of consolidated schedules and bills of materials, including line numbers, tag numbers, source of supply, service conditions, specifications, materials, types and connections details, quantities for items of the plant including dampers, steam traps, strainers, instrumentations, ducting.
  - 4.06.07 Sizing of all piping and equipment as per the stipulated design criteria; carrying out of flexibility analysis/dynamic analysis as necessary; hangers & support engineering.
  - 4.06.08 Final revision of all documents including preparation and compilation of Instruction Manuals for installation, commissioning, operation and maintenance for all equipment and systems. Refer clause 5.00.00 for the specific requirement in this regard.
  - 4.06.09 Certification and submission of final as-built drawings for all areas.
  - 4.06.10 Preparation and compilation of all drawings, schedules and instructions which may be required at site, whether separately mentioned or not.
  - 4.06.11 All erection and assembly drawings which may be required at site.
  - 4.06.12 For all bought out item packages, the Contractor shall provide complete material / component list along with detail specification, drawings, component part no. etc. during detail engineering stage prior to final approval. Such approved drawing/document shall be made available at site in adequate number prior to commencement of work. Moreover, such document/drawing shall be provided in soft form (CD)
  - 4.06.13 Preparation of necessary documentation, design calculations etc. required for submission to statutory authorities like IBR, Chief Electric Inspector, Factory Inspector etc.
-

Rev 01 Date Oct 2015

5.00.00 **OPERATING MANUALS AND MAINTENANCE INSTRUCTIONS**

5.01.00 The Contractor shall provide at least six (6) months before the time of commissioning and before taking over of the plant and equipment, all necessary maintenance manuals and operating instructions. The instruction manual shall be submitted in the form of one (1) soft copy in CD and 15 hard copies as per distribution schedule (Annexure-1).

5.02.00 The information provided, which shall be contained in loose leaf stiff backed covers, shall include :

- a) A complete inventory of all main items of plant, with identification details.
- b) Service manuals for all plant and equipment giving full descriptions of the main items and auxiliary items such as power packs, hydraulic equipment, actuators, lubricating pumps, etc.
- c) A separate electrical manual covering items such as switchgear, cabling, instrumentation, controls, cabling layouts and wiring diagrams.
- d) A schedule of recommendations for routine maintenance of all electrical and mechanical equipment, recommended inspection point, information on detection, cause and rectifications of troubles & faults.
- e) A lubrication schedule with all necessary drawings diagrams to identify the lubrication points.
- f) Manufacturer's literature.

5.03.00 The instruction manual shall be subject to the approval of Owner.

6.00.00 **PLANT HANDBOOK**

The Contractor shall submit to the Engineer, a preliminary plant handbook preferably in A-4 size sheets which shall contain the design and performance data of various plant, equipment and systems covering the complete project including single line flow diagrams, within twenty four (24) months from the date of his acceptance of the Letter of Intent. The final plant handbook complete in all respects shall be submitted by the Contractor six (6) months before start-up and commissioning activities. The plant handbook shall be submitted as per distribution schedule.

7.00.00 **CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVAL PROCEDURE**

7.01.00 Within fifteen (15) days to one month of issue of Letter of Intent (LOI) by the Owner, the Contractor shall furnish a schedule of drawings and design

document to be submitted by him to t  
against each document. Rev 01 Date Oct 2015

The documents shall be divided into two categories : a) for approval and b) for information/further engineering and co-ordination by the Owner.

In preparing this schedule, the Contractor shall allow two (2) weeks from date of receipt for review and comments by the Owner/Engineer for each submission of a document.

This document submission schedule shall require approval by the Owner/Engineer.

7.02.00 All contract documents shall be marked, without fail, with the name of the Owner, the Project, the specification title and number and the unit designation.

All dimensions shall be in metric units.

All notes, markings etc. shall be in English.

7.03.00 Documents/Drawings, submitted during tender stage, shall be revalidated or revised as required and submitted as certified contract document for approval / information of the Owner/Engineer.

7.04.00 Unless specified otherwise, the following categories of documents/drawings would require approval of the Owner/Engineer:

- a) List of sub-vendors (from Owner only)
- b) System scheme and instrumentation diagrams
- c) Design basis justifying selection of equipment & process parameters where not specified in the Contract
- d) Equipment data sheets and general arrangement drawings
- e) Materials of construction
- f) Layout drawings.
- g) Operation logic diagrams.
- h) Typical control circuit.
- i) Drawings of Instrumentation and control.

7.05.00 Unless specified otherwise, the following categories of documents/ drawings would be treated for information/further engineering by the Owner/Engineer. The Contractor shall, however, incorporate all additional information and clarifications in these documents / drawings as and when desired by the Owner/Engineer.

- a) Equipment foundation drawings. Rev 01 Date Oct 2015
- b) Equipment cross-section drawings, product literature etc. which are of proprietary nature.
- c) Predicted performance curves of equipment.
- d) Various bills of quantity, schedules etc.
- e) Piping fabrication drawings, isometrics etc.
- f) Panel wiring diagrams.
- g) Instruction/Operation manuals.
- h) Service manuals and trouble shooting guide for C & I system including field instruments.
- i) Cable schedule and interconnection chart.
- j) Drive/feederwise control scheme showing all external interfaces.

In essence, the Contractor is solely responsible for corrections and adequacy of design & engineering for documents under this category.

7.06.00

Upon review, the Owner/Engineer shall put his remarks and one of the following action stamps on the drawing/document:

- a) A - Drawing submitted as approved, proceed with fabrication
- b) B - Drawing approved subject to comments noted, proceed with fabrication, considering our comments. Correct as necessary and resubmit for record.
- c) C - See attached memo.
- d) D - Correct your original drawing incorporating our comments and resubmit for approval.
- e) E - Information furnished is noted.
- f) F - Prints not enclosed

For action stamps in category (c) & (d), documents must be resubmitted for review by the Owner/Engineer. For action stamp in category (b), further review by Owner/Engineer would not be necessary provided the Contractor agrees & incorporates the comments made on the document.

Except for action stamp under category (c) & (d), the Contractor can proceed with manufacturing and other sequential activities for those areas of a drawing/document which do not have any review comment by the Owner/Engineer.

The Owner/Engineer may accord approval of one submission of a document till he/she has been fully complied with. The Contractor shall be responsible for delay in such cases and no extension of time shall ordinarily be allowed on such grounds. Approval of contract documents by the Owner/Engineer shall not relieve the Contractor of his responsibility for any errors and fulfillment of contract requirements. Rev 01 Date Oct 2015

The Contractor's work shall be in strict accordance with the finally approved drawings and no deviation shall be permitted without written approval of the Owner/Engineer.

- 7.07.00 Except key plan/general yard plan, any layout drawing requiring scrutiny shall not be drawn to a scale less than 1:50.
- 7.08.00 For review by the Consulting Engineer, the Contractor shall furnish soft copies of drawings & documents and three (3) prints of each drawing/document. Two (2) prints of such submission shall also be sent to the Owner. After review, comment/approval will be sent to the Contractor. Upon action under category (a) or (e), the Contractor shall directly distribute the documents to the various offices of the Owner and other agencies in number of copies as specified in the contract document. Such distribution copies shall be marked with the reference and date of the letter by which the Owner/Engineer has accorded his final approval. Penal action shall be taken against the Contractor for any unauthorised revision in the drawings so distributed from the drawings approved by the Owner/Engineer. The contractor shall furnish three (3) CDs of all as built/final drawings for Owner/Consultant site.
- 7.09.00 In case of contradiction between the stipulations above and those stated elsewhere in the specification, the stipulations herein shall prevail.

**ANNEXURE-1**

**DISTRIBUTION SCHEDULE**

S. No	Description	TSGENCO										Consultant		Equipment Vendor	Remarks
		Director Projects	Director Technical	CE/Civil Thermal Projects Hyd.	CE/ TPC-I, Hyd	CE/ O&M/	SE/ Civil	SE/E&M /	DE Constr.	HYD	BTPS				
A	<b>Letter Of Intent or Contract Documents</b>	1	1	1	S	1	2	2	1	1	1	2			
B	<b>Vendor Drawings</b>														
1.	Preliminary	1	1	1	2	1	1	2	2	12	1	S			
2.	Return preliminary with comments	-	-	1	2	1	1	1	1	S	1	1			
3.	Final and any revision thereof														
	a. Civil	1	1	6+1T	1	1	6+1T	1	1	2+1T	1	S			
	b. E&M	1	1	1	6+1T	1	1	6+1T	1	2+1T	1	S			
C.	<b>Design Drawings</b>														
1.	Preliminary														
	a. Civil	1	1	2	1	1	2	1	1	4	1	S			
	b. E&M	1	1	1	2	1	1	2	1	4	1	S			
2.	Released for construction														
	a. Civil	1	1	2	1	1	6	1	1	1	1	S			
	b. E&M	1	1	1	1	2	1	6	1	1	1	S			
3.	Return marked 'As built'														
	a. Civil	-	-	1	-	-	1	-	-	1	1	S			
	b. E&M	-	-	-	1	-	-	1	-	1	1	S			
4.	As built drawings														
	a. Civil	-	-	1+1T	-	2+1T	5+1T	-	1	1+1T	-	S			
	b. E&M	-	-	1	2+1T	2+1T	-	5+1T	1+1T	1+1T	-	S			

Rev 01 Date Oct 2015

S. No	Description	TSGENCO										Consultant		Equipment Vendor	Remarks	
		Director Projects	Director Technical	CE/Civil Thermal Projects Hyd.	CE/ TPC-I, Hyd	CE/ O&M/	SE/ Civil	SE/E&M /	DE Constr.	HYD	BTPS					
D	Progress Report Monthly															
1.	Equipment vendor	1	1	1	2	1	1	2	1	1	1	1	1	S		
2.	Consultant	1	1	2	2	1	1	2	1	S	1	1	1	Nil		
E	Test & Inspection Reports															
1.	Equipment manufacturer															
a.	Civil	1	1	1	2	1	1	1	1	11	1	1	1	S		
b.	E&M	1	1	-	2	1	-	1	1	11	1	1	1	S		
2.	Consultant	1	1	-	2	1	-	1	-	S	-	1	1	-		
F	Instruction Manuals/Data Books															
1.	Equipment manufacturer															
a.	Civil	1	1	1+1T	1	1	6+1T	1	1	2+1T	1	1	1	S		
b.	E&M	1	1	-	3+1T	1	-	6+1T	2	3+1T	1	1	1	S		
2.	Consultant	1	1	-	10+1T	1	-	15+1T	-	S	1	1	1	Nil		
G	Consultant	1	1	1	8+1T	1	1	2	1	1	1	1	1	S		
H	Design Calculations	1	1	1	8+1T	1	1	2	1	1	1	1	1	S		
I	Final consulting Engineering Report	1	1	1	10	1	1	2	1	S	1	1	1	Nil		

Rev 01 Date Oct 2015

S – Source, T – Transparency & Soft Copy on CD,

TSGENCO : Telangana State Power Generation Corporation Limited  
 Director, Projects, Hyd : Director/ Projects, TSGENCO, Viduyt Soudha, Hyderabad – 500 082

Rev 01 Date Oct 2015

## **QUALITY ASSURANCE REQUIREMENTS**

## CONTENT

<b>CLAUSE NO.</b>	<b>DESCRIPTION</b>
1.00.00	QUALITY ASSURANCE PROGRAMME
2.00.00	GENERAL REQUIREMENTS QUALITY ASSURANCE
3.00.00	QUALITY ASSURANCE DOCUMENTS
4.00.00	INSPECTION, TESTING & INSPECTION CERTIFICATES

### **ATTACHMENTS**

ANNEXURE-I	FORMAT OF QUALITY ASSURANCE PROGRAMME
ANNEXURE-II	FIELD WELDING SCHEDULE

## **QUALITY ASSURANCE REQUIREMENTS**

### **1.00.00 QUALITY ASSURANCE PROGRAMME**

1.01.00 To ensure that the equipment and services under the scope of Contract whether manufactured or performed within the Contractor's works or at his Sub-contractor's premises or at the Owner's site or at any other place or work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Owner/Authorised representative after discussions before the award of contract. A quality assurance programme of the Contractor shall generally cover the following :

- a) His organisation structure for the management and implementation of the proposed quality assurance programme.
- b) Documentation control system.
- c) Qualification data for Bidder's key personnel.
- d) The procedure for purchase of materials, parts, components and selection of Sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.
- e) System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.
- f) Control of non-conforming items and system for corrective actions.
- g) Inspection and test procedure both for manufacture and all site related works.
- h) Control of calibration and testing of measuring and testing equipments.
- i) System for quality audit.
- j) System for indication and appraisal of inspection status.
- k) System for authorising release of manufactured product to the Owner.
- l) System for handling storage and delivery.
- m) System for maintenance of records.

- n) Furnishing of quality plans for Rev 01 Date Oct 2015 detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per format enclosed at Annexure-I to this section for Owners approval
- o) Internal standards, if referred in the quality plans shall generally be compatible with National / International standards and shall be mentioned in the quality plans. Alternatively bidder shall furnish extracts of the internal standards detailing out acceptance norm for the product / material.

2.00.00 **GENERAL REQUIREMENTS - QUALITY ASSURANCE**

2.01.00 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the Contractor for some of the major items is given in the respective technical specification. This is however, not intended to form a comprehensive programme as it is the Contractor's responsibility to draw up and implement such programme duly approved by the Owner/Consultant. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder, separately in the format attached at Annexure-I and will be submitted to Owner/Authorised representative for approval. Schedule of finalisation of such quality plans will be finalised before award.

Contractor shall furnish list of Manufacturing Quality Plans of major equipments indicating proposed inspection categorisation indicating items that will be offered for Owner's inspection etc and the Field Quality Plans

2.02.00 Manufacturing Quality Plan for all the major equipment will detail out their respective important components, their in-process various tests/inspection & final inspection / tests, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's Quality Control organization. The relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing are to be comprehensibly documented by Contractor.

Manufacturing Quality Plan for all major equipments/ items will be approved by owner. In these approved quality plans, Owner / Authorised representative shall identify customer hold points (CHP), test / checks which shall be carried out in presence of the Owners Engineer or his authorised representative and beyond which the work shall not proceed without consent of Owner / Authorised representative in writing. Inspection/ Test reports are to be submitted to owner as specified in final approved Manufacturing Quality Plans.

2.03.00 Field Quality Plans / Procedures for all field activities shall be submitted to

---

owner for review / approval. These Quality Plans shall be submitted to the Owner for review and approval. Rev 01 Date Oct 2015  
 for all equipment, the quality practices and procedures shall be approved by the Contractor's site Quality Control organisation, during various stages of site activities from receipt of materials/ equipment at site.

- 2.04.00 The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality plans and reference documents/standards etc. will be subject to Owner's approval without which manufacture shall not proceed. These approved documents shall form a part of the contract. In these approved quality plans, Owner/Authorised representative shall identify customer hold points (CHP), test/checks which shall be carried out in presence of the Owners Engineer or his authorised representative and beyond which the work will not proceed without consent of Owner/Authorised representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and major deviations in the form of Non Conformity Report shall be referred to Owner/Authorised representative for approval and dispositioning.
- 2.05.00 No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of all previous tests/inspections by Owner's Engineer/ Authorised representative for "CHP" and "W" points marked in quality plans , and duly authorised for despatch by issuance of Material Despatch Clearance Certificate (MDCC). For items which is not under owner's inspection the contractor shall apply for despatch clearance (MDCC) from owner by submitting their internal inspection reports and quality records
- 2.06.00 All materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report. These certificates and reports shall indicate the sheet serial numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it.
- 2.07.00 Castings and forgings used for construction shall be of tested quality. Details of results of chemical analysis, heat treatment record, mechanical property test results shall be furnished.
- 2.08.00 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section - IX (latest edition) or other International equivalent standard acceptable to the Owner.

All brazers, welders etc. employed on any part of the contract at Contractor's/ Sub-Contractor's works or at site shall be qualified as per ASME Section-IX (latest edition) or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner / his authorised representative or owner approved Third Party Inspection Agency(TPIA). Previously qualified WPS & PQR shall be acceptable if witnessed by owner's approved TPIA.

For welding of pressure parts and high pressure piping coming under IBR purview, the requirements of IBR shall also be complied with.

- 2.09.00 All non-destructive examination (NDT) shall be carried out in accordance with LIST OF STANDARDS FOR REFERENCE. Rev 01 Date Oct 2015
- The NDT operator shall be qualified as per SNT-TC-IA (of American Society of non-destructive examination). Results of NDT for the list major equipments / items identified for owner's inspection shall be properly recorded and submitted for review and approval. Other items not covered under owner's inspection, contractor shall review and approve the NDT results and such reports shall be submitted to owner in the final documentation of the items / equipments
- 2.10.00 All the sub-vendors proposed by the Contractor for procurement of major bought out items including castings, forgings, semi-finished and finished components/equipment list of which shall be drawn up by the Contractor and finalised with the Owner shall be subject to Owner's approval. Quality Plans of the successful vendors shall be discussed, finalised and approved by the Owner/Authorised representative and form part of the Purchase Order between the Contractor and the Vendor.
- 2.11.00 All the purchase specifications for the major bought-out items, list of which shall be drawn up by the Contractor and finalised with the Owner shall be furnished to the Owner for comments and subsequent approval before orders are placed.
- Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-vendor's quality management and control activities. The Contractor shall provide all necessary assistance to enable the Owner carry out such audit and surveillance.
- Quality audit/approval of the results of tests and inspection will not prejudice the right of the Owner to reject equipment not giving the desired performance after erection and shall not in no way limit the liabilities and responsibilities of the Contractor in earning satisfactory performance of equipment as per specification.
- 2.12.00 Quality requirements for main equipment shall equally apply for spares and replacement items.
- 2.13.00 Repair/rectification procedures to be adopted to make any job acceptable shall be subject to the approval of the Owner.
- 2.14.00 For quality assurance of all civil works refer to the specifications for civil works.
- 3.00.00 **QUALITY ASSURANCE DOCUMENTS**
- 3.01.00 The Contractor shall be required to submit two (2) copies and two (2) sets of microfilms / CDs of the following Quality Assurance documents within three (3) weeks after despatch of the equipment:
- a) Material mill test reports on components as specified by the specification.

- b) The inspection plan with verification sketches, if used and inspection and testing points in the inspection plan were performed satisfactorily. Rev 01 Date Oct 2015
- c) Non-destructive examination results /reports including radiography interpretation reports.
- d) Factory tests results for testing required as per applicable codes and standards referred in the specification.
- e) Welder identification list listing welder's and welding operator's qualification procedure and welding identification symbols.
- f) Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
- g) Stress relief time temperature charts.
- h) Inspection reports duly signed by QA personnel of the Owner and Contractor for the agreed inspection hold points. During the course of inspection, the following will also be recorded :
  - i) When some important repair work is involved to make the job acceptable.
  - ii) The repair work remains part of the accepted product quality.
- i) Letter of conformity certifying that the requirement is in compliance with finalised specification requirements.

4.00.00 **INSPECTION, TESTING AND INSPECTION CERTIFICATES**

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

4.02.00 The Contractor shall give the Owner's Engineer/ Authorized Inspector twenty one (21) days written notice for "CHP" / "W" points of any material being ready for testing by owner' engineer / Authorized inspector. Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Engineer/ Inspector, unless the witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date on which the equipment is notified as being ready for test/inspection. If owner's Engineer / Authorised Inspector fail to attend the inspection, next mutually convenient date for test shall be agreed with Contractor. Contractor shall, in

---

no case proceed with the test without or unless the witnessing is officially waived Rev 01 Date Oct 2015

with the test. Contractor shall forthwith forward duly certified completed test report and a product quality certificate in six (6) copies to owner upon completion of such test.

- 4.03.00 The Engineer or Inspector shall within fifteen (15) days from the date of Inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract / QAP or other approved quality documents. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall confirm in writing to the Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the contract / QAP or other approved quality documents.
- 4.04.00 When the factory tests have been completed at the Contractor's or sub-contractor's works, the Engineer/Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests excluding the test completion date subject to submission of all certified documents related to the test, If the tests are not witnessed by the Engineer/Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Engineer/Inspector. Failure of the owner's Engineer/Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests, or the issue of the certificates shall not bind the Owner to accept the equipment should it, on further tests after erection be found not to comply with the contract / QAP or other approved quality documents.
- 4.05.00 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the owner's Engineer/Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contract / QAP or other approved quality documents. Contractor and shall give facilities to the owner's Engineer/ Inspector or to his authorised representative to accomplish testing.
- 4.06.00 To facilitate advance planning of inspection in addition to giving inspection notice as per Clause 4.02.00, the Contractor shall furnish quarterly inspection programme indicating proposed schedule dates of inspection at customer hold point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.

**LIST OF STANDARDS FOR RE** Rev 01 Date Oct 2015

- a) International Standards Organisation (ISO).
- b) International Electro-technical Commission (IEC).
- c) American Society of Mechanical Engineers(ASME)
- d) American National Standards Institute (ANSI).
- e) American Society for Testing and Materials (ASTM).
- f) American Institute of Steel Construction (AISC).
- g) American Welding Society (AWS).
- h) Architecture Institute of Japan (AIJ).
- i) National Fire Protection Association (NFPA).
- j) National Electrical Manufacturer's Association (NEMA).
- k) Japanese Electro-technical Committee (JEC).
- l) Institute of Electrical and Electronics Engineers (IEEE).
- m) Federal Occupational Safety and Health Regulations (OSHA).
- n) Instrument Society of America (ISA).
- o) National Electric Code (NEC).
- p) Heat Exchanger Institute (HEI).
- q) Tubular Exchanger Manufacturer's Association (TEMA).
- r) Hydraulic Institute (HIS).
- s) International Electro-Technical Commission Publications.
- t) Power Test Code for Steam Turbines (PTC).
- u) Applicable German Standards (DIN).
- v) Applicable British Standards (BS).
- w) Applicable Japanese Standards (JIS).
- x) Electric Power Research Institute (EPRI).
- y) Standards of Manufacturer's Standardization Society (MSS)

- 
- z) Bureau of Indian Standards Institution (BIS) Rev 01 Date Oct 2015
  - aa) Indian Electricity Rules.
  - bb) Indian Boiler Regulations (IBR).
  - cc) Indian Explosives Act.
  - dd) Indian Factories Act.
  - ee) Tariff Advisory Committee (TAC) rules.
  - ff) Emission regulation of Central Pollution Control Board (CPCB).
  - gg) Pollution Control regulations of Dept. of Environment, Govt. of India
  - hh) Central Board of Irrigation and Power (CBIP) Publications

**ANNEXURE-I  
FORMAT OF QUALITY ASSURANCE PROGRAMME**

<b>VENDOR'S LOGO , NAME &amp; ADDRESS</b>	<b>MANUFACTURING QUALITY ASSURANCE PLAN</b>				<b>DOC NO:</b> XXXXX-CAL-QAP-M-0001
<b>CLIENT :</b>	<b>ITEM :</b>				<b>REV NO :</b> 0 1 2 3 4
<b>PROJECT :</b>	<b>LOCATION :</b>				<b>DATE :</b>
<b>VENDOR :</b>	<b>REFERENCE PURCHASE ORDER NO. &amp; DT :</b>				
<b>SUB VENDOR :</b>	<b>REFERENCE APPROVED DATA SHEET :</b>				
	<b>REFERENCE APPROVED DRAWING. NO. :</b>				
<b>ABBREVIATIONS :</b>	<b>GENERAL REMARKS</b>				
QAP - QUALITY ASSURANCE PLAN, CR - CRITICAL, MA - MAJOR, MI - MINOR SPEC - SPECIFICATION, TC - TEST CERTIFICATES P - PERFORM W - WITNESS V - VERIFY CHP - CUSTOMER HOLD POINT	<b>AGENCY :</b> 1 - PROJECT AUTHORITY 2 - SUPPLIER 3 - SUB-SUPPLIER 4 - MANUFACTURER 5 - THIRD PARTY INSPECTION AGENCY  <b>MATL - MATERIAL,</b> <b>APP - APPROVED,</b> <b>DWG - DRAWING,</b> <b>SUPL - SUPPLIER,</b> <b>PROC - PROCEDURE</b>				1 THE ITEMS WHICH ARE FALLING UNDER ANY STATUTORY AUTHORITY'S (LIKE I.B.R. ETC.) SCOPE SHALL BE SUBJECTED TO THAT STATUTORY AUTHORITY'S INSPECTION CLEARANCE.
<b>NOTES:</b>	1. EXACT MATERIAL / PROCESS / INSPECTION / TESTS FOLLOWED BY THE MANUFACTURER SHALL BE SPECIFIED 2. EXACT REFERENCE DOCUMENT/ACCEPTANCE STANDARD SHALL BE SPECIFIED 3. IN CASE SPECIFIED ACCEPTANCE STANDARD / NORMS IS OTHER THAN NATIONAL / INTERNATIONAL STANDARDS STANDARD / COPY OF THE ACCEPTANCE NORMS FOLLOWED BY THE MANUFACTURER SHALL BE SUBMITTED FOR REVIEW RECORD 4 FINAL INSPECTION DOSSIER SHALL BE PREPARED BY MANUFACTURER & SHALL BE ENDORSED BY INSPECTION AGENCY				Rev 01 Date Oct 2015
<b>Revision</b>	<b>Prepared by</b>	<b>Checked by</b>	<b>Approvec</b>		
<b>DATE</b>	R0	R1	R2	R0	R1
			R2		R2



**ANNEXURE-II**

**FIELD WELDING SCHEDULE**

PROJECT : FWS NO :  
 CONTRACTOR : REV NO. :  
 PACKAGE : FIELD WELDING CODE :  
 SYSTEM : PAGE NO. :

SI No.	Drawing No. for Weld Locations & Identification mark	Description of parts to be welded	Material specification	Dimensions	Process of Welding	Type of Weld	Electrode Filler Specification	WPS No.	Minimum Pre-heat Temperature	Heat Treatment Temperature [Holding Time in secs]	NDT Method	NDT Specification Number	Acceptance Norm Ref.	Remarks
--------	--	-----------------------------------	------------------------	------------	--------------------	--------------	--------------------------------	---------	------------------------------	---	------------	--------------------------	----------------------	---------

Rev 01 Date Oct 2015

The Field Welding Schedule should be submitted for :

- 0 Pressure Parts
- 0 Tanks/Vessels
- 0 Piping
- 0 Heavy/Important Structural Steel
- 0 Heat Exchangers
- 0 Bus Ducts

Rev 01 Date Oct 2015

**REQUIREMENTS OF SPARES, TOOLS & TACKLE,  
LUBRICANTS/OIL/CONSUMABLES**

Rev 01 Date Oct 2015

## CONTENT

<b>CLAUSE NO.</b>	<b>DESCRIPTION</b>
1.00.00	TOOLS AND TACKLE
2.00.00	SPARES
	<b>ATTACHMENT</b>
ANNEXURE-I	MANDATORY SPARE LIST

Rev 01 Date Oct 2015

**REQUIREMENTS OF SPARES, TOOLS & TACKLE,  
LUBRICANTS/OIL/CONSUMABLES****1.00.00 TOOLS & TACKLE**

The Contractor shall supply with the equipment one complete set of special tools and tackle as required for the erection, assembly, dismantling & maintenance of the equipment. These special tools will also include special material handling equipment, jigs & fixtures for maintenance and calibration/readjustment, checking & measurement aids etc. A list of such tools & tackle shall be submitted by the Bidder along with the offer. Detailed description of each tools/tackle, its function along with the equipment/part for which it is meant for and the price of each tools/tackle shall also be indicated in the offer. These tools & tackle shall be separately packed and sent to site before the first unit commissioning. The Bidder shall also ensure that these tools are not used for erection purpose.

**2.00.00 SPARES****2.01.00 General**

The Bidder shall indicate and include in his scope of supply all the necessary start-up, commissioning and recommended spares in addition to mandatory spares as specified elsewhere in the specification. The Owner reserves the right to buy any or all mandatory and recommended spares. The Contractor shall also state for each item of spares both mandatory and recommended, the normal expected service life.

2.01.01 All spares supplied under this contract shall be strictly interchangeable with the parts for which they are intended to replace. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site, e.g. small items shall be packed in sealed transparent plastic bags with dessicator packs as necessary.

2.01.02 Each spare part shall be clearly marked or labelled on the outside of the packing with the description. When more than one spare part is packed in a single case, a general description of the contents shall be shown on the outside and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.

2.01.03 All cases, containers or other packages are liable to be opened for examination as may be considered necessary by the Engineer.

2.01.04 All mandatory spares shall be delivered to site within one to three months prior to the scheduled date of the trial operation of the plant. However, they shall not be despatched before the despatch of the associated main equipment.

2.01.05 The Bidder shall also guarantee supply c Rev 01 Date Oct 2015 based on manufacturer's drawings on special order from the Purchaser for 30 years after commissioning of the plant.

2.02.00 **Recommended Spares**

2.02.01 The Contractor shall provide a list of recommended spares giving unit prices and total prices for 2 years of normal operation of the plant for spares of indigenous origin, and for 5 years of normal operation for spares of non-indigenous origin. This list shall take into consideration the mandatory spares specified elsewhere in the specification and should be a separate list.

2.02.02 The price of recommended spares will not be used for the evaluation of bids. The price of these spares shall remain valid for a period as specified elsewhere in the specification from the date of Award of the Contract. Where the recommended spares are the same as mandatory spares, the prices shall be the same. The prices of any recommended spares, which are not common with mandatory spares, shall be subject to review by the Owner, and shall be finalised after mutual discussion.

2.03.00 **Start-up Commissioning Spares**

2.03.01 Start-up commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares used until the plant is handed over to the Owner shall come under this category. Said spares, properly marked, shall be supplied together with the main equipment and shall be used by the Contractor, if needed, during erection & commissioning stage. All such spares which remain unused till issuance of Taking Over Certificate by the Owner, along with an equipment-wise quantitative consumption report shall be returned to the Owner during time of handover. The list of commissioning spares to be brought by the Contractor to ensure smooth commissioning of the plant shall be subject to the Engineer's approval.

2.03.02 The Contractor shall submit a complete BBU list inclusive of recommended, mandatory, initial start-up and commissioning spares. Costs of the above spares, which are consumed before the handing-over of the plant, shall be deemed to have been included in the lump sum proposal price of the package, and the Contractor shall have no claim on this account to the Owner.

2.04.00 **Mandatory Spare Parts**

2.04.01 The Owner considers some of the spares are essential for running the equipment irrespective of whether they are included in the list of recommended spares by the Bidder as mentioned above.

Since the components involved can not be foreseen at the bidding stage, only

---

broad requirements of the Owner in this r  
bidder shall include his proposal, on the ba: Rev 01 Date Oct 2015  
of all components and the quantity, unit prices & total price thereof, offered as  
mandatory spares for each and every equipment. This list shall be separate  
from the list of recommended spares and shall be used for bid evaluation  
purposes. Any clarification in this respect may be obtained by the Bidder at the  
pre-bidding stage.

- 2.04.02 The mandatory spares should be supplied to the Owner at least one month  
before the trial run. The despatch programme is subject to approval of the  
Owner/Consultant after award of contract.

PEM-6666-0



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B


SECTION -C1 D

Rev 01 Date Oct 2015

**VOLUME - IIB**


**SECTION – C1 D**


**QUALITY ASSURANCE**

MANUFACTURER'S NAME & ADDRESS		MANUFACTURING QUALITY PLAN					PROJECT: 4X270 MW BHADRADRI		
 MANUFACTURER'S NAME & ADDRESS ITEM: SINGLE GIRDER EOT CRANES CAPACITY: - UPTO 10T		REV	Rev 00	Page 1 of 5		Acceptance Norms	PACKAGE: Single Girder EOT Crane		
		DATE			Reference Document	7	8	BHEL NO: PE-V0-STD-524-A100	
S.NO.	Component & Operation	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Format of Record	CONTRACTOR: BHEL	
1	2	4	5	6	7	8	9	10	
3		4		5		6		11	
3		4		5		6		11	
<b>FOR EOT CRANE</b>									
<b>1.0 RECEIVING INSPECTION</b>									
1.1	Structural-Plates/R SJ for Main Girders, End Carriages Trolley, Pulley, Gearbox housing, rope drum (if fabricated) etc.	Major	Lab Analysis	100%	IS:2062 Gr. A or B / As per approved G.A.		MTC / Lab Report	P V V	
1.2	Rope Drum (Seamless Pipe)	Major	Lab Analysis	1/pipe	Approved drg/DS ASTM A106 Gr A or B		Lab Report	P V V	
	Flattening & Acid etching Test Surface defect	Major	Mech test Visual	1/pipe 100%	no cracks, pitting, rusting, damage ,etc		I.R.	P V V	
1.3	Gears, pinions, shafts, axles & wheels (#)	Major	Lab Analysis	1/lot	Relevant IS/appd drg		MTC	P V V	
		Major	UT	100%	ASTM A388/NOTE 1		I.R	P V V	# If wheel, gears, pinions, shafts & axle diameter / thickness is equal to or more than 50 mm UT . . . e carried out, ref pance norm at (UT of hook) tc
1.4	Hook	Major	Lab Analysis	100%	IS: 15560 Related Std. As per appd. Drg./data sheet		MTC	V V V	
		Major	UT on shank portion only	100%	ASTM A388 / ASME Sec VIII Divn 2 - NOTE:1		UT report	P V V	
1.5	Wire Rope	Major	Review of TC Measurement	100%	IS: 2266 Appd G A drg		Mfr's TC QCR	P V V	
		Major	Measurement	100%	Appd G A drg			P V V	

Rev 01 Date Oct 2015


<b>LEGEND: CLASS A: Critical, B: Major, C: Minor</b> ** M: MANUFACTURER / SUB-CONTRACTOR D: Records for Data Fold C: CONTRACTOR /NOMINATED INSPECTION AGENCY, ND: NDT LAB N: Customer R: Test / Dim Report, IR-Inspection Report INDICATE "P" PERFORMS, "W" WITNESS, MTC: Mfr's Test Cert. "V" VERIFICATION, ALC: Approved Laboratory Certificate, QCR: Quality Control Report		DOC. NO.:
MANUFACTURER NAME & SIGNATURE	CONTRACTOR	
		NAME & SIGN OF APPROVING AUTHORITY & SEAL Page 92 of 158

MANUFACTURER'S NAME & ADDRESS		MANUFACTURING QUALITY PLAN					PROJECT: 4X270 MW BHADRADRI					
 MANUFACTURER'S NAME & ADDRESS ITEM: SINGLE GIRDER EOT CRANES CAPACITY: - UPTO 10T		REV			Rev 00		PACKAGE: Single Girder EOT Crane					
		DATE			Page 2 of 5		BHEL NO: PE-V0-STD-524-A100					
Component & Operation		Reference Document			Acceptance Norms		CONTRACTOR: BHEL					
S.NO.	Characteristics	Class	Type of check	Quantum of check	Appd drg./DS/Tech spec/Rel IS	I.R	Format of Record	Agency	Remark			
1	2	3	4	5	6	7	8	9	10			
1.6	1.7	1.8	1.9	2	2.1	2.2	2.3	11				
1	Motors & cables. Brakes	Make/Type/Rating/ Routine test Make/ type / rating/ HV/IR functional test	Major	Visual / Measurement	100%	Appd drg./DS/Tech spec/Rel IS	I.R	STC	P	V	V	For motor, ref. Note 2
1.7	Sheaves	Mech	Major	Tensile & Hardness	1/lot	Approved Drg / Mfg drg		MTC	P	V	V	
1.8	Limit switch, SFU, Relays, MCB, Fuses, Push buttons Etc Control transformer	Make/Type/Rating/ Functional /continuity input/output	Major	Review of TC	100%	Appd drg./DS/Scheme ./Manu.Std		QCR Routine TC/CO C of mfrg	V	V	V	
1.9	DSL	Make , type, rating, Dimension.	Major	Review of TC	100%	Appd drg./DS/Scheme / Manu.Std		QCR Routine TC/CO C of mfrg.	V	V	V	
2	<b>INPROCESS- INSPECTION</b>											
2.1	WPS,PQR & WPQ	Verification of approval				WPS,PQR & WPQ			P	V	V	IN CASE OF NTPC/ LLOYDS / EIL / TPL QUALIF ELDERS AVAILA REQUA WELDE REQUIT
2.2	Assembled gear box	No load run test backlash & contact pattern, noise, vibration & oil temp rise ( for oil lubricid)	Major	Performance	100%	Apprvd drg./DS/Mfg std Noise 85dba max, vibration 75 mi- crons max, oil temp rise – 30 °C above ambient max			P	V	V	Rev 01 Date Oct 2015
2.3	Welding of end carriage, Main Girder, Trolley , rope drum ( if fabricated) etc.,	DPT of Welds(all)  RT of Butt weld	Major  Major	LPI  RT	100% on butt&10% on fillet 100%/10%	ASTM E165 or Eq. / No crack or linear indication  ASME Sec.VIII,Div.1, UW 51/52		I.R.  RT film & report	P  P	V  V	V  V	or Butt i & 25% in 100% d for drum  @RT-(c weld in compre: RT on b fabricat
		<b>LEGEND: CLASS A: Critical, B: Major, C: Minor</b>		DOC. NO.:								
		** M: MANUFACTURER / SUB-CONTRACTOR C: CONTRACTOR /NOMINATED INSPECTION AGENCY, ND: NDT LAB N: Customer R: Test / Dim Report, IR-Inspection Report INDICATE "P" PERFORMS, "W" WITNESS, MTC: Mfr's Test Cert. "V" VERIFICATION, ALC: Approved Laboratory Certificate, QCR: Quality Control Report										
MANUFACTURER NAME & SIGNATURE		CONTRACTOR										
												NAME & SIGN OF APPROVING AUTHORITY & SEA Page 93 of 158

MANUFACTURER'S NAME & ADDRESS		MANUFACTURING QUALITY PLAN					PROJECT: 4X270 MW BHADRADRI			
 MANUFACTURER'S NAME & ADDRESS ITEM: SINGLE GIRDER EOT CRANES CAPACITY: - UPTO 10T		REV	Rev 00	Reference Document		Acceptance Norms	Format of Record	Agency	Remark	
		DATE	Page 3 of 5	7	8	9	D M C N	10	11	
S.NO.	Component & Operation	Characteristics	Class	Type of check	Quantum of check					
1	2	3	4	5	6	7	8	9	10	
2.4	Hook	Dimension Proof Load NDT after proof load	Major	Measurement Load Test	100%	Mfr's drg / Related Std. As per appd. Drg./data sheet/ IS: 15560	QCR	QCR	P V	
2.5	Gears, pinions, shafts, axles & wheels	Hardness Surface Defect (after machining)	Major	MPI/LPI	100%	ASTME 165 or Eq. / No crack or linear indication	I.R.		P V	
3	<b>FINAL INSPECTION</b>									
3.1	Overall dimensions	Dimensions (span) level, alignment	Critical	Measurement	100%	Approved Drg/ Data sheet ASTM E-165 No linear indication	MTC		P V	
3.2a	Assembled Crane along with individual control panel & pendant station	Current & speed for Cross Travel & Hoisting, interlocking sequencing, inching operation, Limit switch operation	Critical	Measure /Verify	100%	Appd GA drg & IS: 3177/IS:3938	I.R.		P W	FUNCTIONAL CHECK OF PENDENT & PANEL FOR SPECIFIC CRANE
3.2b	Overload test at 125% of SWL	Deflection at SWL Holding capacity of brakes	Critical	Measurement Lifting from mid Air	100%	Appd GA drg & IS: 3177/IS:3938/ Appd data sheet	I.R.		P W	
3.3	Control Panel & Pendant station	1. Make/type/rating of BOIs. 2.IR-HV functional & interlocks 3.DOP by paper insertion for panel	Major	Visual, Operational & Functional Measurement do	100%	Approved drawing / Data sheet  Paper should not go easily.	I.R.		P W	ircuit at l circuit at er & with 500V acceptance ega Ohm.

Rev 01 Date Oct 2015

<b>LEGEND: CLASS A: Critical, B: Major, C: Minor</b> ** M: MANUFACTURER / SUB-CONTRACTOR D: Records for Data Fold C: CONTRACTOR /NOMINATED INSPECTION AGENCY, ND: NDT LAB N: Customer R: Test / Dim Report, IR-Inspection Report INDICATE "P" PERFORMS, "W" WITNESS, MTC: Mfr's Test Cert. "V" VERIFICATION, ALC: Approved Laboratory Certificate, QCR: Quality Control Report		DOC. NO.:
MANUFACTURER NAME & SIGNATURE	CONTRACTOR	

MANUFACTURER'S NAME & ADDRESS		MANUFACTURING QUALITY PLAN				PROJECT: 4X270 MW BHADRADRI				
 ITEM: SINGLE GIRDER EOT CRANES CAPACITY: - UPTO 10T		REV	Rev 00	PACKAGE: Single Girder EOT Crane		BHEL NO: PE-V0-STD-524-A100		CONTRACTOR: BHEL		
		DATE	Page 4 of 5	Reference Document	7	Acceptance Norms	8	Format of Record	9	
S.NO.	Component & Operation	Characteristics	Class	Type of check	Quantum of check	Agency	Remark			
1	2	3	4	5	6	7	8	9	10	
3.4	Painting	Examination – shade	Minor	Visual & measurement	100%	Customer's / Approved Painting Procedure		P	V	-
		Dry Film Thickness	Major	Measurement	Sample			P	V	-

NOTE1:\*\*\* When back wall echo is set to 100% in sound area then,

a) defect echo shall not exceed 20%

b) Back echo shall be minimum 80% in any area

Note 2:- Less than 30 KW. Acceptance of motor less than 30 KW is based on COC of the manufacturer & the contractor confirming as follows : It is hereby confirmed that the above mentioned motor/motors was/were manufactured taking care of customer specific requirement regarding ambient temp, voltage & frequency variation, hot start, pull out torque, starti KVA/KW, temp rise, distance between center of stud and gland plate and tested in accordance with approved drawing/data sheet.

Rev 01 Date Oct 2015

		DOC. NO.:	
		LEGEND: CLASS A: Critical, B: Major, C: Minor	
		** M: MANUFACTURER / SUB-CONTRACTOR D: Records for Data Fold	
		C: CONTRACTOR /NOMINATED INSPECTION AGENCY, ND: NDT LAB	
		N: Customer R: Test / Dim Report, IR-Inspection Report	
		INDICATE "P" PERFORMS, "W" WITNESS, MTC: Mfr's Test Cert.	
		"V" VERIFICATION, ALC: Approved Laboratory Certificate,	
		QCR: Quality Control Report	
MANUFACTURER	CONTRACTOR		
NAME & SIGNATURE			
		NAME & SIGN OF APPROVING AUTHORITY & SEAL	
		Page 95 of 158	

PEM-6666-0



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C1 E

Rev 01 Date Oct 2015

**VOLUME - IIB**

**SECTION – C1 E**

**PAINTING SPECIFICATION**



**TECHNICAL SPECIFICATION FOR  
SINGLE GIRDER CRANE  
4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C1 E

Rev 01 Date Oct 2015

**A) Structural**

**Surface preparation** : De greasing and Mechanical cleaning with wire brush or hand tool. (SA 1/ ST 2 / ST 3 as applicable)

**Primer** : Red oxide Zinc phosphate (Alkyd medium)- 2 coat ,  
DFT 35  $\mu$  per coat.

**Finish Coat** : Synthetic enamel (Alkyd medium) as per IS: 2932- 2 coats,  
DFT 35  $\mu$  per coat.

**Total DFT** : 140 $\mu$

**B) Electrical /Control Panel**

**Surface preparation:** Seven tank process

**Primer** : Red Oxide Zinc phosphate (Alkyd medium)- 2 coat , Minimum DFT 35  $\mu$  per coat.

**Finish Coat** : Synthetic enamel (Alkyd medium) as per IS: 2932- 2 coats, Minimum DFT 35  $\mu$  per coat.

**Total DFT** : 140  $\mu$

**COLOR SHADE FOR CRANE**

S. No	Item Description	Color Shade	Remarks
1	Crane Structure	Golden yellow, shade 356 as per IS-5	
2	Bottom block assembly	Golden yellow, shade 356 as per IS-5	With black strip
3	Hooks	Golden yellow, shade 356 as per IS-5	With 100 mm wide black zebra strip
4	End carriage sweep	Golden yellow, shade 356 as per IS-5	With black strip
5	Panels and motors	Color shade for Control panels shall be Opaline green for exterior and semi glossy white for interior	

PEM-6666-0



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C2

Rev 01 Date Oct 2015

**VOLUME - IIB**

**SECTION – C2**

**TECHNICAL SPECIFICATION  
(ELECTRICAL)**

REV: 00 DATE: 18.03.2015

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGE: SINGLE GIRDER EOT CRANE

PROJECT : 4 X 270 MW BHADRADRI TPS

SCOPE OF VENDOR: SUPPLY

<u>S. NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&amp;C</u>	<u>REMARKS</u>
1	Isolating Switch	Vendor	BHEL	BHEL will provide one number 415 V(3ph, 4W) supply feeder only up to isolating switches for cranes/hoists. Any other voltage level (AC/DC) required will be derived by the vendor. Motor starter shall be part of crane/ hoist control panel.
2	Power cables, control cables, screened control cables and any special cables (if required) between equipment supplied by vendor.	Vendor	BHEL	Cable from supply feeder to isolating switch shall be in BHEL scope.
3	Cabling material (cable trays, accessories, cable tray supporting system, conduits etc).	Vendor	BHEL	
4	Equipment Earthing	BHEL	BHEL	All equipment metallic enclosures / frames, metal structure etc. shall be grounded at two points each to the nearest grounding points / risers provided by BHEL
5	Motors	Vendor	BHEL	
6	Cable glands and lugs for equipment supplied by vendor	Vendor	BHEL	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tin copper lugs for power & control cables.
7	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Rev 01 Date Oct 2015 Cable listing for Control and Instrumentation Cab enclosed excel format shall be submitted by vendor during detailed engineering stage.
8	Equipment layout drawings	Vendor	-	
9	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.



**ELECTRICAL EQUIPMENT SPECIFICATION  
FOR  
CRANES & HOISTS**

SPECIFICATION NO.
VOLUME NO. : <b>II-B</b>
SECTION : <b>C</b>

Rev 01 Date Oct 2015

115

**4X270MW BHADRADRI TPS**

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for **EOT crane**
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “ both end equipment in vendor’s scope”shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

**2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:**

Refer “Electrical Scope between BHEL and Vendor”.

**3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID**

3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.

3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

**4.0 List of enclosures :**



**ELECTRICAL EQUIPMENT SPECIFICATION  
FOR  
CRANES & HOISTS**

SPECIFICATION NO.

VOLUME NO. : **II-B**

SECTION : **C**

115

Rev 01 Date Oct 2015

**4X270MW BHADRADRI TPS**

- a) Electrical scope between BHEL & vendor (Annexure –I)
- b) Standard BHEL specification for motors.
- c) Datasheets(A&C) & quality plan for motors.
- d) Electrical Load data format (Annexure –II)
- e) BHEL cable listing format (Annexure –III)
- f) Explanatory notes for cable routing



**GENERAL TECHNICAL REQUIREMENTS**

SPECIFICATION NO.  
PE-SS-999-506-E101

**FOR**

VOLUME NO. : **II-B**

**LV MOTORS**

SECTION : **D**

Rev 01 Date Oct 2015

**GENERAL TECHNICAL REQUIREMENTS**

**FOR**

**LV MOTORS**

**SPECIFICATION NO.: PE-SS-999-506-E101 Rev 00**

<b>TITLE :</b> <b>GENERAL TECHNICAL REQUIREMENTS</b>  <b>FOR</b>  <b>LV MOTORS</b>	<b>SPECIFICATION NO.</b> PE-SS-999-506-E101
	<b>VOLUME NO. : II-B</b>
	<b>SECTION : D</b>
Rev 01 Date Oct 2015	

**1.0 INTENT OF SPECIFICATION**

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer's work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

**2.0 CODES AND STANDARDS**

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

- |           |  |
|-----------|--|
| IS:325    | Three phase Induction motors   |
| IS : 900  | Code of practice for installation and maintenance of induction motors  |
| IS: 996   | Single phase small AC and universal motors   |
| IS: 4722  | Rotating Electrical machines   |
| IS: 4691  | Degree of Protection provided by enclosures for rotating electrical machines                                 |
| IS: 4728  | Terminal marking and direction of rotation rotating electrical machines                                      |
| IS: 1231  | Dimensions of three phase foot mounted induction motors  |
| IS: 8789  | Values of performance characteristics for three phase induction motors                                       |
| IS: 13555 | Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment |
| IS: 2148  | Flame proof enclosures for electrical appliance  |
| IS: 5571  | Guide for selection of electrical equipment for hazardous areas  |
| IS: 12824 | Type of duty and classes of rating assigned  |
| IS: 12802 | Temperature rise measurement of rotating electrical machines   |
| IS: 12065 | Permissible limits of noise level for rotating electrical machines   |
| IS: 12075 | Mechanical vibration of rotating electrical machines   |

In case of imported motors, motors as per IEC-34 shall also be acceptable.

**3.0 DESIGN REQUIREMENTS**

3.1 Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2 Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information  
 Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

**3.3 Starting Requirements**

3.3.1 Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

3.3.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.

TITLE : <b>GENERAL TECHNICAL REQUIREMENTS</b>  <b>FOR</b>  <b>LV MOTORS</b>	SPECIFICATION NO. PE-SS-999-506-E101
	VOLUME NO. : <b>II-B</b>
	SECTION : <b>D</b>
Rev 01 Date Oct 2015	

The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.

3.3.3 The following frequency of starts shall apply

- i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.
- ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)
- iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor

#### 3.4 **Running Requirements**

3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.

3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.

#### 3.5 **Stress During bus Transfer**

3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.

3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.

3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.

#### 4.0 **CONSTRUCTIONAL FEATURES**

4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy

4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.

Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled

4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.

TITLE : <b>GENERAL TECHNICAL REQUIREMENTS</b>  <b>FOR</b>  <b>LV MOTORS</b>	SPECIFICATION NO. PE-SS-999-506-E101
	VOLUME NO. : <b>II-B</b>
	SECTION : <b>D</b>
Rev 01 Date Oct 2015	

- 4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.
- 4.5. Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.
- 4.6. In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.  
In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.
- 4.7. **Terminals and Terminal Boxes**
- 4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.  
  
Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".
- 4.7.2 Unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.
- 4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or V W & V respectively.
- 4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.
- 4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.
- 4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.
- 4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.
- 4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.
- 4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.
- 4.8 Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.

<b>TITLE :</b> <b>GENERAL TECHNICAL REQUIREMENTS</b>  <b>FOR</b>  <b>LV MOTORS</b>	<b>SPECIFICATION NO.</b> PE-SS-999-506-E101
	<b>VOLUME NO. :</b> <b>II-B</b>
	<b>SECTION :</b> <b>D</b>
Rev 01 Date Oct 2015	

**4.9 General**

- 4.9.1 Motors provided for similar drives shall be interchangeable.
- 4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.
- 4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.
- 4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.
- 4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.
- 4.9.6 Name plate with all particulars as per IS: 325 shall be provided
- 4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.

**5.0 INSPECTION AND TESTING**

- 5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.
- 5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.
- 5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.
- 5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.

**6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT**

- a) OGA drawing showing the position of terminal boxes, earthing connections etc.
- b) Arrangement drawing of terminal boxes.
- c) Characteristic curves:  
*(To be given for motor above 55 kW unless otherwise specified in Data Sheet).*
  - i) Current vs. time at rated voltage and minimum starting voltage.
  - ii) Speed vs. time at rated voltage and minimum starting voltage.
  - iii) Torque vs. speed at rated voltage and minimum voltage.  
 For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.
  - iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.

**Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.**

1. For the purpose of clarity, it may please be noted that the information given in regard to the cables to be routed through WinPath as per the system elaborated Rev 01 Date Oct 2015 : the term "Cable Schedule" applies to the cable list with routing information added after routing has been carried out.
2. The cable list shall be entered as an MS Excel file in the format as per enclosed template EXT\_CAB\_SCH\_FORMAT.XLS. No blank lines, special characters, header, footer, lines, etc. shall be introduced in the file. No changes shall be made in the title line (first line) of the template.
3. The field properties shall be as under:
  - a. UNITCABLENO: A/N, up to sixteen (16) characters; each cable shall have its own unique, unduplicated cable number. In case this rule is violated, the cable cannot be taken up for routing.
  - b. FROM: A/N, up to sixty (60) characters; the "From" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
  - c. TO: A/N, up to sixty (60) characters; the "To" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
  - d. PURPOSE: A/N, up to sixty (60) characters; the purpose (i.e. power cable/ indication/ measurement, etc.) to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
  - e. REMARKS: A/N, up to forty (40) characters; Any information pertinent to routing to be specified here (e.g., cable number of the cable redundant to the cable number being entered). Information in excess of 40 characters will be truncated after 40 characters.
  - f. CABLESIZE: A/N, 7 characters exactly as per the codes indicated below shall be specified here. The program cannot route cables described in any other way/ format.
  - g. PATHCABLENO: Field reserved for utilization by the program. User shall not enter any information here.
4. One list shall be prepared for each system/ equipment (i.e., separate and unique cable lists shall be prepared for each system).
5. The cables shall be described as per the scheme listed below:

A	NN	A	NNN
Cable	No. of cores	Cable code	Cable size
Voltage	(e.g. 01,03,3H, 07)	(See C below)	(e.g. 035,185,2.5, 0.5)
Code (see B below)			

**(A) SYSTEM VOLTAGE CODES:**

(ac) A = 11KV, B = 6.6KV, C = 3.3KV, D = 415V, E = 240V, F = 110V  
 (dc) G = 220V, H = 110V, J = 48V, K = +24V, L = -24V

**(B) CABLE VOLTAGE CODES:**

A = 11KV (Power cables)

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

B = 6.6KV (Power cables)

C = 3.3KV (Power cables)

D = 1.1KV (LV & DC system power & control cables)

E = 0.6KV (0.5 sq. mm. Control cables)

Rev 01 Date Oct 2015

(C) CABLE CODES

PVC Copper

A = Armoured FRLS

C = unarmoured FRLS

B = Armoured Non-FRLS

D = Unarmoured Non-FRLS

PVC Aluminium

E = Armoured FRLS

G = unarmoured FRLS

F = Armoured Non-FRLS

H = Unarmoured Non-FRLS

XLPE Copper

J = Armoured FRLS

L = unarmoured FRLS

K = Armoured Non-FRLS

M = Unarmoured Non-FRLS

XLPE Aluminium

N = Armoured FRLS

Q = unarmoured FRLS

P = Armoured Non-FRLS

R = Unarmoured Non-FRLS

S = FIRE SURVIVAL CABLES

T = TOUGH RUBBER SHEATH

U = OVERALL SCREENED

V = PAIRED OVERALL SCREENED

W = PAIRED INDIVIDUAL SCREENED

Y = COMPENSATING CABLES

I = PRE-FABRICATED CABLES

Z = JELLY FILLED CABLES



TITLE

**LV MOTORS****DATA SHEET-A****4 X 270 MW BHADRADRI | TPS**

SPECIFICATION NO.

VOLUME II R

Rev 01 Date Oct 2015

REV NO. DATE 18.03.15

SHEET 1 OF 2

1.0	Design ambient temperature	:	50 °C
2.0	Maximum acceptable kW rating of LV motor	:	160KW *
3.0	Installation (Indoors/ Outdoors)	:	As required
4.0	Details of supply system		
a)	Rated voltage (with variation)	:	415V ± 10%
b)	Rated frequency (with variation)	:	50 Hz + 3 % to - 5%
c)	Combined voltage & freq. variation	:	10% (sum of absolute values)
d)	System fault level at rated voltage	:	50 kA for 1 sec
e)	Short time rating for terminal boxes		
o	110 kW and above (Breaker Controlled)	:	50 KA for 0.20 sec..
o	Below 110 kW (Contactor Controlled)	:	50 KA protected by HRC fuse
f)	LV System grounding	:	Solidly
5.0	Class of insulation	:	Class 'F', with temp rise limited to class B.
6.0	Minimum voltage for starting (As percentage of rated voltage)	:	(a) 85% below 110KW (b) 80% from 110KW to 160KW (c) 85% above 160KW to 1000KW (d) 80% from 1001 KW to 4000KW (e) 75% > 4000KW
7.0	Power cables data	:	Shall be given during detailed engg.
8.0	Earth Conductor Size & Material	:	As per attached Datasheet of Earthing.
9.0	Space heater supply	:	240 V, 1ϕ, 50 Hz (for motors above 30 Kw)
10.0	Rating up to which Single phase motor	:	Acceptable below 0.20 kW
11.0	Locked rotor current		
a)	Limit as percentage of FLC	:	As per IS 12615*
12.0	Flame-proof motor		
a)	Enclosure suitable (As per IS: 2148)	:	As per requirement
b)	Classification of Hazardous area (As per IS: 5572 part-I)	:	As per requirement
13.0	Makes	:	BHEL/ Customer approval
14.0	Paint shade	:	Shall be given during detailed engg
15.0	Degree Of protection for motor/ terminal box	:	IP 54/ IP 55



TITLE

## LV MOTORS

### DATA SHEET-A

**4 X 270 MW BHADRADRI**

**TPS**

SPECIFICATION NO.

VOLUME IIR

Rev 01 Date Oct 2015

REV NO. DATE 18.03.15

SHEET 1 OF 2

\* Continuous duty LT motors up to 160 KW Output rating (at 50 deg.C ambient temperature), shall be High efficiency (IE2) as per IEC: 60034-30/ IS:12615

#### 16.0 TESTING

##### 16.1 Type Tests

For LT Motors above 55kW, type test reports for type tests as per IS: 325/ IS: 12615 conducted on equipment similar to those proposed to be supplied and carried out within last five years from the date of bid opening shall be submitted. However, if such reports are not available, one motor of each type shall be subjected to type tests for free of cost.

##### 16.2 Routine Tests

All motors shall be subjected to routine tests as per IS: 325/ IS: 12615 in the presence of customer or customer representative.

	<b>TITLE</b>  <b>MOTOR</b>  <b>DATA SHEET - C</b>	<b>SPECIFICATION NO.</b>  Rev 01 Date Oct 2015 <hr/> <b>REV NO. 00 DATE 18.03.15</b> <b>SHEET 1 OF 2</b>
--	---	--

S. No.	Description	Data to be filled by successful bidder
<b>A.</b>	<b>General</b>	
1	Manufacturer & country of origin	
2	Motor type	
3	Type of starting	
4	Name of the equipment driven by motor & Quantity	
5	Maximum Power requirement of driven equipment	
6	Rated speed of Driven Equipment	
7	Design ambient temperature	
<b>B.</b>	<b>Design and Performance Data</b>	
1	Frame size & type designation	
2	Type of duty	
3	Rated Voltage	
4	Permissible variation for	
5	a) Voltage	
6	b) Frequency	
7	c) Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)	
9	Synchronous speed & Rated slip	
10	Minimum permissible starting voltage	
11	Starting time in sec with mechanism coupled	
12	a) At rated voltage	
13	b) At min starting voltage	
14	Locked rotor current as percentage of FLC (including IS tolerance)	
15	Torque	
	a) Starting	
	b) Maximum	
16	Permissible temp rise at rated output over ambient temp & method	
17	Noise level at 1.0 m (dB)	
18	Amplitude of vibration	
19	Efficiency & P.F. at rated voltage & frequency	
	a) At 100% load	
	c) At 75% load	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			


	<b>TITLE</b>  <b>MOTOR</b>  <b>DATA SHEET - C</b>	<b>SPECIFICATION NO.</b>  Rev 01 Date Oct 2015 ----- <b>REV NO. 00 DATE 18.03.15</b> <b>SHEET 2 OF 2</b>
--	---	---

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
<b>C.</b>	<b>Constructional Features</b>	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level ( kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i) Zone	O / I / II
	ii) Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
<b>D.</b>	<b>Characteristic curves/ drawings</b> (To be enclosed for motors of rating $\geq 55KW$ )	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

CUSTOMER : TSGENCO		PROJECT		SPECIFICATION :							
BIDDER/ VENDOR		TITLE		NUMBER :							
SYSTEM		QUALITY PLAN		SPECIFICATION TITLE							
CAT.		ITEM AC ELECT. MOTORS BELOW 55KW (LV)		SECTION							
TYPE/ METHOD OF CHECK		ACCEPTANCE NORM		AGENCY							
EXTENT OF CHECK		DOCUMENT		P W V							
3		7		10							
4		8		11							
5		9		REMARKS							
6		10		VOLUME III							
7		11									
1	2	3	4	5	6	7	8	9	10	11	
1.0	ASSEMBLY	1.WORKMANSHIP 2.DIMENSIONS 3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUF'S SPEC MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC. 2.OVERALL DIMENSIONS & ORIENTATION	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1	NOTE -1 & NOTE-3
			MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	NOTE -1 & NOTE-3
BHEL		PARTICULARS		BIDDER/VENDOR							
		NAME									
		SIGNATURE									

Rev 01 Date Oct 2015

		<b>QUALITY PLAN</b> SHEET 2 OF 2		<b>CUSTOMER : TSGENCO</b>		<b>PROJECT</b> TITLE : <b>4X270MW BHADRADRI TPS</b> <b>CRANES &amp; HOISTS</b>		SPECIFICATION : NUMBER : SPECIFICATION : TITLE :			
SL. NO.	COMPONENT/OPERATION CHARACTERISTICS CHECK	BIDDER/ VENDOR SYSTEM	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS	
1	2	3	4	5	6	7	8	9	P	W	V
1	3.NAMEPLATE DETAILS	IMA	4	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-
NOTES: <ol style="list-style-type: none"> <li>1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON</li> <li>2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.</li> <li>3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.</li> </ol>											
<u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)  P. PERFORM W. WITNESS V. VERIFY											
Rev 01 Date Oct 2015											
<b>BHEL</b>		<b>PARTICULARS</b>		<b>BIDDER/VENDOR</b>							
		<b>NAME</b>									
		<b>SIGNATURE</b>									
		<b>DATE</b>									
				<b>BIDDER'S/VENDORS COM</b>							
				<b>SEAL</b>							

PEM-6666-0



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C

Rev 01 Date Oct 2015

**VOLUME - IIB**

**ANNEXURES**



**TECHNICAL SPECIFICATION FOR  
SINGLE GIRDER CRANE  
4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C

Rev 01 Date Oct 2015

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

S.NO.	ITEM	STANDARD MAKES	REMARKS
1	STEEL	SAIL /TISCO / JINDAL/ ESSAR	
2	HOOKS	Steel Forging & Engg. Co., Kolkata/ SIMRITI FORGING/ Karachiwala (up to 25T)	
3	GEAR COUPLINGS	ALLIANCE / FLEX-TRANS (formerly known as HICLIFF) / OEM / NUTECH/ SAHARA	
4	WIRE ROPE	USHA MARTIN / FORT WILLIAMS/ Bharat Wire Ropes.	
5	BEARINGS	SKF/ FAG/ TATA / NBC	
6	MOTORS	SIEMENS / NGEF (up to 15KW) / CROMPTON / KIRLOSKAR / BHARAT BIJLI / MARATHON/ ABB/LHP	
7	BRAKES	ELECTROMAG /SPEED-O- CONTROL / BCH (for DCEM Brakes only) / Kakku	
8	CONTACTOR	SIEMENS / L&T /SCHNEIDER (Earlier TELE MECHANIQUE) / BCH	
9	OVER LOAD RELAYS	SIEMENS / L&T / ABB / SCHNEIDER (Earlier TELE MACHANIQUE )	
10	HRC FUSES	SIEMENS / L&T/ ENGLISH ELECTRIC / GE Power / Eaton (Bussmann)/ABB	
11	ISOLATING SWITCH	SIEMENS/ L&T/ CONTROL & SWITCH GEAR/ABB	
12	SWITCH FUSE UNITS	SIEMENS/ L&T/ CONTROL & SWITCH GEAR/ ABB	
13	TIME DELAY RELAYS	SIEMENS/ L&T/ ABB/ BCH/ SCHNEIDER (Earlier TELE MACHANIQUE )	
14	TRANSFORMERS	INDCOIL / LOGICSTAT/ KAPPA / AUTOMATIC ELECTRIC / PRECISE ELECTRICALS / SILKAAN ELECTRIC MFG. CO. LTD. / SOUTHERN ELECTRIC/NEC	
15	CABLE LUGS (HEAVY DUTY)	DOWELLS / UML ENGINEERS, KOLKATA / JAINSON	
16	CABLES		



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C

Rev 01 Date Oct 2015

a)	PVC Power Cables	APAR INDUSTRIES LTD., CORDS CABLE INDUSTRIES LTD., Diamond Power Infrastructure Ltd, GOYOLENE FIBRES (INDIA) PVT.LTD, GOVIND CABLE INDUSTRIES, GUPTA POWER INFRASTRUCTURE LIMITED,, Havells India Limited, KEI INDUSTRIES LTD., KRISHNA ELECTRICAL INDUSTRIES LTD., KEC INTERNATIONAL LIMITED, MANSFIELD CABLES COMPANY LTD., NICCO CORPORATION LTD., PARAMOUNT COMMUNICATIONS LTD., POLYCAB WIRES PVT. LTD., RADIANT CORPORATION PRIVATE LIMITED, RAVIN CABLES LIMITED, SUYOG ELECTRICALS LTD., SRIRAM CABLES PVT. LTD., Scot Innovation Wires and Cables Pvt. Ltd., Sam Cables & Conductors (P) Ltd., THERMO CABLES LTD.,	
b)	PVC Control cables	Advance Cable Technologies (P) Ltd., APAR INDUSTRIES LTD., CMI LTD., CORDS CABLE INDUSTRIES LTD., CRYSTAL CABLE INDUSTRIES LTD, DELTON CABLES LTD, Diamond Power Infrastructure Ltd, ELKAY TELELINKS LTD, GEMSCAB INDUSTRIES LTD., GOVIND CABLE INDUSTRIES, GUPTA POWER INFRASTRUCTURE LIMITED,, Havells India Limited, Incom Cables (P) Ltd.,KEI INDUSTRIES LTD., KRISHNA ELECTRICAL INDUSTRIES LTD., KEC INTERNATIONAL LIMITED, MANSFIELD CABLES COMPANY LTD., NICCO CORPORATION LTD., PARAMOUNT COMMUNICATIONS LTD., POLYCAB WIRES PVT. LTD., RAVIN CABLES LIMITED, SUYOG ELECTRICALS LTD., SPECIAL CABLES PVT. LTD, Scot Innovation Wires and Cables Pvt. Ltd., Sam Cables & Conductors (P) Ltd., SPM POWER & TELECOM PVT. LTD,TORRENT CABLES LTD., THERMO CABLES LTD., TIRUPATI PLASTOMATICS PVT. LTD., UNIVERSAL CABLES LTD.	
c)	Trailing Cables	Nicco / Universal / Incab / ICL / KEI/ APAR INDUSTRIES LTD/ CMI LTD/ KEI INDUSTRIES LTD./ SUYOG ELECTRICALS LTD.	
d)	XLPE Power Cables	APAR INDUSTRIES LTD., CORDS CABLE INDUSTRIES LTD., CRYSTAL CABLE INDUSTRIES LTD, Diamond Power Infrastructure Ltd, GEMSCAB INDUSTRIES LTD., GOVIND CABLE INDUSTRIES, GUPTA POWER INFRASTRUCTURE LIMITED,, Havells India Limited, KEI INDUSTRIES LTD., KRISHNA ELECTRICAL INDUSTRIES LTD., KEC INTERNATIONAL LIMITED, MANSFIELD CABLES COMPANY LTD., PARAMOUNT COMMUNICATIONS LTD., POLYCAB WIRES PVT. LTD., RAVIN CABLES LIMITED, SUYOG ELECTRICALS LTD., SPECIAL CABLES PVT. LTD, Scot Innovation Wires and Cables Pvt. Ltd., SRIRAM CABLES PVT. LTD.,TORRENT CABLES LTD., THERMO CABLES LTD., TIRUPATI PLASTOMATICS PVT. LTD.,	



**TECHNICAL SPECIFICATION FOR  
SINGLE GIRDER CRANE  
4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C

Rev 01 Date Oct 2015

e)	XLPE Control cables	APAR INDUSTRIES LTD., CABLE CORPORATION OF INDIA LTD., CRYSTAL CABLE INDUSTRIES LTD., Diamond Power Infrastructure Ltd, GEMSCAB INDUSTRIES LTD., Havells India Limited, KEI INDUSTRIES LTD., KRISHNA ELECTRICAL INDUSTRIES LTD., KEC INTERNATIONAL LIMITED, PARAMOUNT COMMUNICATIONS LTD., POLYCAB WIRES PVT. LTD., RADIANT CORPORATION PRIVATE LIMITED, RAVIN CABLES LIMITED, SUYOG ELECTRICALS LTD., SRIRAM CABLES PVT. LTD., TORRENT CABLES LTD., UNIVERSAL CABLES LTD.	
17	Cable gland	COMMET / SUNIL&CO./ ARUP ENGINEERING / JAINSON / DOWELL	
18	PUSH BUTTONS	SIEMENS / L&T / BCH / Schneider	
19	Limit Switches	Speed-o-control / Electromag	
20	Pendent Push button station	OEM	
21	Indicating Lamps	Tecknic / BCH / Siemens / Standard	
22	MCB	MDS / Indo Copp / Standard / Siemens / L&T/ ABB/ Schneider	
23	Panels	OEM / RITTAL / PYROTECH	
24	Resistance boxes	Enapros / OEM	
25	VVVF	YASKAWA/ ABB / SIEMENS/ SCHNIEDER/ FUJI ELECTRIC/ MITSUBISHI ELECTRIC	
26	Shrouded DSL	Susheel/ Stromag	
27	LOAD CELL	IPA, Sartorius	
28	GEAR BOX	OEM/ ELECON ENGINEERS/ SHANTI GEARS/ PBL*/ NAW*/ NORD*/ SEW*/ BONGFILIOLI*	* = Applicable for Geared Motors only
29	RAIL	JSPL / SAIL	

**Note:**

1. Make is indicative, subject to customer's / consultant approval during detail engineering. Acceptance/non acceptance of same shall not have any impact on manufacturing, delivery schedule and on cost of the crane/s.



**TECHNICAL SPECIFICATION FOR  
SINGLE GIRDER CRANE  
4X270 MW BHADRADRI TPS  
ANNEXURE -II**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C

Rev 01 Date Oct 2015

**MANDATORY SPARES FOR SINGLE GIRDER CRANE**

<b>1</b>	<b>Single girder crane</b>	
1.1	One set consisting of 2 nos. bearing for:	
	a) CT wheel	1 set
	b) LT wheel	1 set
1.2	One set consisting of 2 nos. brake linings with rivets for :	
	a) MH brake	1 set
	b) AH brake	1 set
	c) CT brake	1 set
	d) LT brake	2 sets
	e) MH creep brake	1 set
	f) AH creep brake	1 set
1.3	One set consisting of 2 nos. brake shoes with lining for :	
	a) MH brake	1 set
	b) AH brake	1 set
	c) CT brake	1 set
	d) LT brake	2 sets
	e) MH creep brake	1 set
	f) AH creep brake	1 set
1.4	One set consisting of 6 nos. carbon brushes for :	
	a) MH motor	1 set
	b) AH motor	1 set
	c) CT motor	1 set
	d) LT motor	2 sets
1.5	One set consisting of 3 nos. brush holders for :	
	a) MH motor	1 set
	b) AH motor	1 set
	c) CT motor	1 set
	d) LT motor	2 sets
1.6	Fixed and moving contacts for each type of contactor	1 set
1.7	No volt coil for each type of contactor	1 set
1.8	Overload relay for	
	a) MH motor	1 No.
	b) AH motor	1 No.
	c) CT motor	1 No.
	d) LT motor	2 Nos.
1.9	Motor bearings	
	a) MH	2 Nos.
	b) AH	2 Nos.
	c) CT	2 Nos.
	d) LT	4 Nos.
1.10	Bearing for	
	a) MH Main Pulley	2 Nos
	b) MH Eq. Pulley	2 Nos
	c) AH Main pulley	2 Nos
	d) AH Eq. Pulley	2 Nos
<b>2</b>	<b>Electrical Items</b>	



**TECHNICAL SPECIFICATION FOR  
SINGLE GIRDER CRANE  
4X270 MW BHADRADRI TPS  
ANNEXURE -II**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C

Rev 01 Date Oct 2015

2.1	415 Volt Motor (Upto 30 KW Rating)	
a	Driving End & Non-Driving End Bearing	3 Set for each type and rating of Motor
b	Cooling Fan	2 Nos. for each type and rating of Motor
c	Motor Terminal Block	5 Nos. for each type and rating of Motor
d	Complete Set of Coupling	1 Set of each application
<b>3</b>	<b>C&amp;I Items</b>	
a	PLC	NA
b	Back-up panel mounted devices (Selector switches/ Push buttons/ Indicators etc.	5% of installed capacity
c	Lamps/ LEDs	10% of the total quantity
d	Blank Tiles	10% of installed capacity
e	MCBs	10% of each type & rating
f	Fuses/ Fuse holder	10% of each type & rating

**Note:**

1. "One (1) set of each type & size" is defined as 100% requirement for one crane for the entire cranes of similar size & capacity. If two (2) cranes are of same capacity, the total quantity for both cranes shall be 100% quantity required for one crane.
2. 100% of total population of each type, size and rating is defined as 100% requirement for one crane.



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**  
**ANNEXURE -III**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C

Rev 01 Date Oct 2015

### Check List for Operation & Maintenance Manual

1	Project name	:
2	Project number	:
3	Package Name	:
4	PO reference	:
5	Document number	:
6	Revision number	:

Sl.no. & Sections	Description	Tick (√) if included in Manual			Remarks
		Yes	No	Not Applicable	
<b>1.</b>	<b>Cover page</b>				
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				
<b>2.0</b>	<b>Index</b>				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
<b>3.0</b>	<b>Description of Plant/System</b>				
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				
<b>4.0</b>	<b>Commissioning Activities (if not covered in separate document i.e. erection manual,</b>				



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**  
**ANNEXURE -III**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C

Rev 01 Date Oct 2015

	<b>commissioning manual)</b>				
<b>4.1</b>	Pre-Commissioning Checks				
<b>4.2</b>	handling of items at site				
<b>4.3</b>	Storage at site				
<b>4.4</b>	Unpacking & Installation procedure				
<b>5.0</b>	<b>Operation Guidelines for plant personal/user/operator</b>				
<b>5.1</b>	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.				
<b>5.2</b>	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.				
<b>5.3</b>	Do's & Don't of the equipments.				
<b>5.4</b>	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
<b>5.5</b>	Parameters to be monitored with normal values and limiting values				
<b>5.6</b>	Trouble shooting with causes and remedial measures				
<b>5.7</b>	Routine operational checks, recommended logs & records				
<b>5.8</b>	Changeover schedule if more than one auxiliary for the same purpose is given				
<b>5.9</b>	Painting requirement and schedule				
<b>5.10</b>	Inspection, repair , Testing and calibration procedures				
<b>6.0</b>	<b>Maintenance guidelines for plant personal</b>				
<b>6.1</b>	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
<b>6.2</b>	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.				
<b>6.3</b>	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to				



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**  
**ANNEXURE -III**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C

Rev 01 Date Oct 2015

	be given				
<b>6.4</b>	Long term maintenance schedules especially for structural, foundations etc.				
<b>6.5</b>	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.				
<b>6.6</b>	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
<b>6.7</b>	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
<b>6.8</b>	List of mandatory and recommended spare parts list				
<b>6.9</b>	Tentative Lead time required for ordering of spares from the equipment supplier				
<b>6.10</b>	Guarantee and warranty clauses				
<b>7.0</b>	<b>Statutory and other specific requirements considerations.</b>				
<b>8.0</b>	<b>List of reference documents</b>				
<b>9.0</b>	<b>Binding as per requirement</b>				

Checked by  
Dealing Engineer

Key Resource Person

Section Head



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**  
**ANNEXURE -IV**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -C

Rev 01 Date Oct 2015

**ANNEXURE IV**

**Procedure for Load/Overload testing of Single Girder EOT crane at Manufacturer's Works**

**Objective:** To demonstrate final NO load / Load / Overload / Deflection / Functional tests of assembled Crane for the purpose of acceptance in line with IS 3177.

**Basic Assumptions / Inputs for testing at Works:**

- Actual job hook shall be used for load / overload tests for hoisting.
- Actual wire ropes shall be used for load / overload testing.
- Shop cables can be used for temporary power supply for the purpose of showing various functional tests at shop.
- Interlock and limit switch operation check will be shown for hoisting and CT motion.

**Procedure for Load / Overload testing:**

- The cranes shall be tested for no load and load /overload test at works generally in conformance with the IS – 3177 (1999). Specifically with respect to the load / overload testing of crane, the following tests as per the outlined procedures shall be done at works.
- Deflection of the girder will be measured at SWL when the trolley with load is at the middle of the girder.
- No load and full load current of the motors will be measured to verify whether it is as per the approved data sheet of the motor. Resistors in the circuit will be checked for any overheating of the element.
- The load will be gradually raised to 125 percent of the rated capacity (SWL) with actual hook. The load will be lifted upward to about 1 meter height above its support and stop again. Check for any undue drift in the load. If load drifts, check the adjustment of brakes and repeat the above procedure. Then lower the load to rest on support/ground.
- For checking the cross travel, raise the load up to one (1) meter height above supports and then move the trolley with load about one (1) meter in either direction of the bridge. Then lower the load to rest on support/ground.
- Creep speed motions shall be checked over a distance of about 500 mm.

**Note: Complete No load / load / over load tests in line with IS-3177-1999 shall also be done by BHEL after erection of EOT crane at site.**

**ANNEXURE-V**  
**DISTRIBUTION SCHEDULE**

S. No	Description	TSGENCO										Consultant		Equipment Vendor	Remarks
		Director Projects	Director Technical	CE/Civil Thermal Projects Hyd.	CE/ TPC-I, Hyd	CE/ O&M/	SE/ Civil	SE/E&M /	DE Constr.	HYD	BTPS				
A	<b>Letter Of Intent or Contract Documents</b>	1	1	1	S	1	2	2	1	1	1	1	2		
B	<b>Vendor Drawings</b>														
1.	Preliminary	1	1	1	2	1	1	2	2	12	1	-	S		
2.	Return preliminary with comments	-	-	1	2	1	1	1	1	S	1	-	1		
3.	Final and any revision thereof														
	a. Civil	1	1	6+1T	1	1	6+1T	1	1	2+1T	1	1	S		
	b. E&M	1	1	1	6+1T	1	1	6+1T	1	2+1T	1	1	S		
C.	<b>Design Drawings</b>														
1.	Preliminary														
	a. Civil	1	1	2	1	1	2	1	1	4	1	1	S		
	b. E&M	1	1	1	2	1	1	2	1	4	1	1	S		
2.	Released for construction														
	a. Civil	1	1	2	1	1	6	1	1	1	1	2	S		
	b. E&M	1	1	1	1	2	1	6	1	1	1	2	S		
3.	Return marked 'As built'														
	a. Civil	-	-	1	-	-	1	-	-	1	1	S	1		
	b. E&M	-	-	-	1	-	-	1	-	1	1	S	1		
4.	As built drawings														
	a. Civil	-	-	1+1T	-	2+1T	5+1T	-	1	1+1T	-	1	S		
	b. E&M	-	-	1	2+1T	2+1T	-	5+1T	1+1T	1+1T	-	1	S		

Rev 01 Date Oct 2015

S. No	Description	TSGENCO										Consultant		Equipment Vendor	Remarks		
		Director Projects	Director Technical	CE/Civil Thermal Projects Hyd.	CE/ TPC-I, Hyd	CE/ O&M/	SE/ Civil	SE/E&M /	DE Constr.	HYD	BTPS						
D	Progress Report Monthly																
1.	Equipment vendor	1	1	1	2	1	1	2	1	1	1	1	1	1	S		
2.	Consultant	1	1	2	2	1	1	2	1	S	1	1	1	1	Nil		
E	Test & Inspection Reports																
1.	Equipment manufacturer																
	a. Civil	1	1	1	2	1	1	1	1	11	1	1	1	1	S		
	b. E&M	1	1	-	2	1	-	1	1	11	1	1	1	1	S		
2.	Consultant	1	1	-	2	1	-	1	1	S	-	1	1	1	-		
F	Instruction Manuals/Data Books																
1.	Equipment manufacturer																
	a. Civil	1	1	1+1T	1	1	6+1T	1	1	2+1T	1	1	1	1	S		
	b. E&M	1	1	-	3+1T	1	-	6+1T	2	3+1T	1	1	1	1	S		
2.	Consultant	1	1	-	10+1T	1	-	15+1T	-	S	1	1	1	1	Nil		
G	Consultant	1	1	1	8+1T	1	1	2	1	1	1	1	1	1	S		
H	Design Calculations	1	1	1	8+1T	1	1	2	1	1	1	1	1	1	S		
I	Final consulting Engineering Report	1	1	1	10	1	1	2	1	S	1	1	1	1	Nil		

Rev 01 Date Oct 2015

S – Source, T – Transparency & Soft Copy on CD,

TSGENCO : Telangana State Power Generation Corporation Limited  
 Director, Projects, Hyd : Director/ Projects, TSGENCO, Vidyut Soudha, Hyderabad – 500 082



**TECHNICAL SPECIFICATION FOR  
SINGLE GIRDER CRANE  
4X270 MW BHADRADRI TPS  
ANNEXURE-VI**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II B

SECTION -C

REV Rev 01 Date Oct 2015

**A: DRAWINGS/ DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT**

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

Sl. No.	BHEL DRG.NO	DRAWING TITLE	SUBMISSION SCHEDULE - WEEK NUMBER FROM DATE OF P.O
1	PE-V0-411-524-A100	Manufacturing Quality Plan with sub vendor list	2
2	PE-V0-411-524-A101	Data sheet of Single Girder Crane with painting details	2
3	PE-V0-411-524-A102	G.A. of Single Girder CRANE with CT DSL arrangement	2
4	PE-V0-411-524-A103	Mechanism Sizing Calculation	2
5	PE-V0-411-524-A104	G.A. drg of Hoist with trolley wheel and bottom block assembly	3
6	PE-V0-411-524-A106	General arrangement for LT DSL for Single Girder crane	3
7	PE-V0-411-524-A107	Schematic Circuit Diagram for following a) Main Protective panel & BOM b) Main hoist panel & BOM c) Cross Traverse and Long Travel panel & BOM d) Pendent and earthing.	3
8	PE-V0-411-524-A108	Long travel Machinery Assembly with LT wheel assembly	4
9	PE-V0-411-524-A110	General arrangement of panel & pendent push button	4
10	PE-V0-411-524-A111	Cable sizing calculation and schedule.	3
11	PE-V0-411-524-A112	O & M Manual	8
12	PE-V0-411-524-A113	Mandatory spare parts list	6

Note:

- > VENDOR SHALL RESUBMIT THE REVISED DRAWINGS WITHIN 7 DAYS OF RECIEPT OF COMMENTS.
- > INCOMPLETE DRAWINGS/DOCUMENTS SHALL NOT BE TREATED AS SUBMITTED.
- > MANUFACTURING SHALL BE STARTED ON RECIEPT OF CAT II APPROVED DRAWINGS.

**B: DOCUMENT MANAGEMENT SYSTEM**

- 1.0 Bidder to note that BHEL reserves the right for drawing/document submission through web based Document Management System. Bidder would be provided access to the DMS for drawing/document approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.
- Internet explorer version – Minimum Internet Explorer 7.
  - Internet speed – 2 mbps (Minimum preferred).
  - Pop ups from our external DMS IP (124.124.36.198) should not be blocked.
  - Vendor's Internal proxy setting should not block DMS application's link (<http://124.124.36.198/wrenchwebaccess/login.aspx>).



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II B

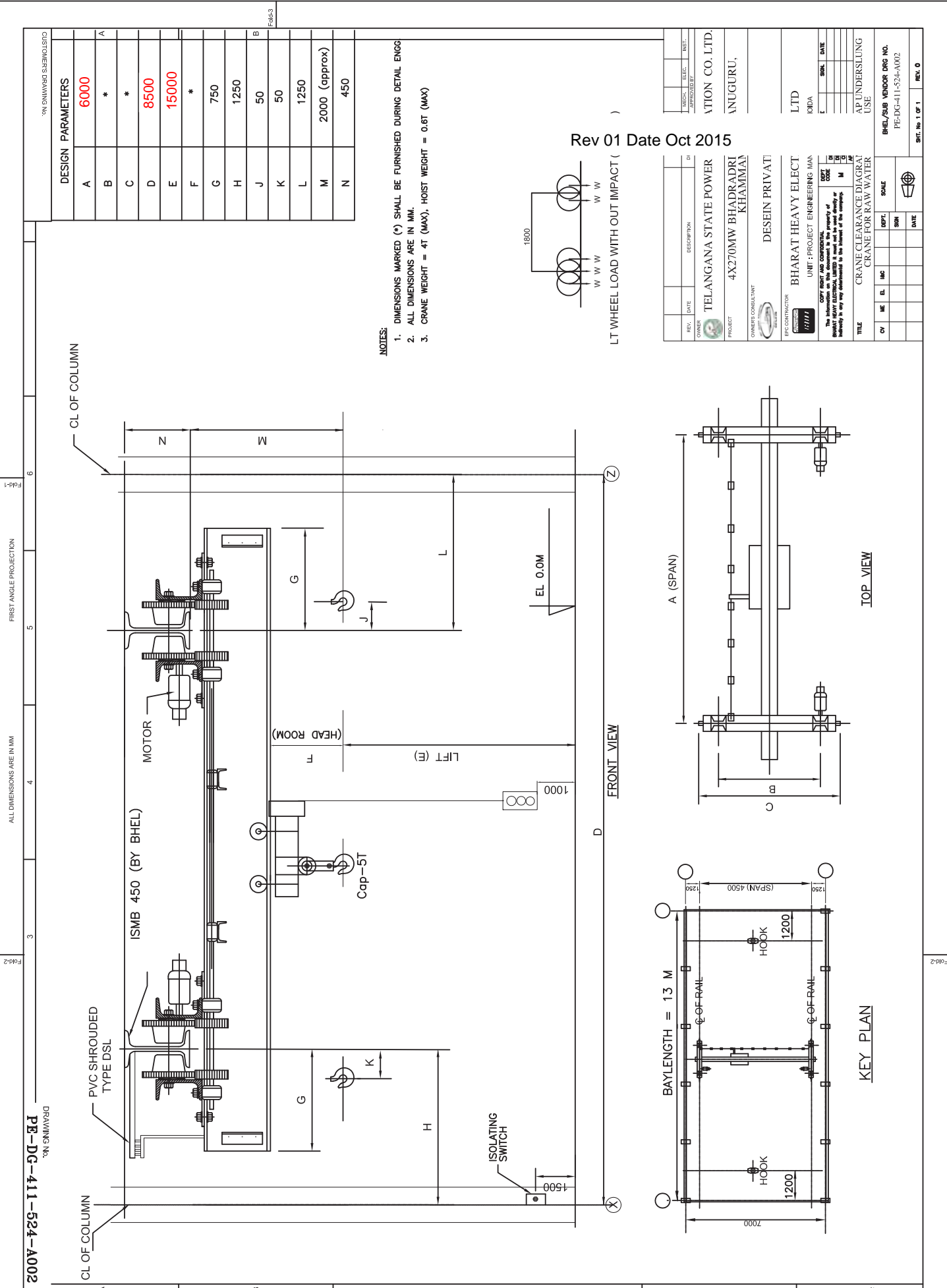
SECTION -C

REV      Rev 01 Date Oct 2015

**ANNEXURE - VIII**  
**INPUT DRAWING**



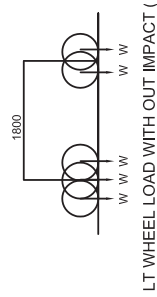
COPY RIGHT AND CONFIDENTIAL  
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED  
 It must not be used, decayed or indirectly in any way detrimental to the interest of the company.



DESIGN PARAMETERS	
A	6000
B	*
C	*
D	8500
E	15000
F	*
G	750
H	1250
J	50
K	50
L	1250
M	2000 (approx)
N	450

- NOTES:
1. DIMENSIONS MARKED (\*) SHALL BE FURNISHED DURING DETAIL ENGG
  2. ALL DIMENSIONS ARE IN MM.
  3. CRANE WEIGHT = 4T (MAX). HOIST WEIGHT = 0.6T (MAX)

Rev 01 Date Oct 2015



REV.	DATE	DESCRIPTION	BY	CHKD

OWNER: TELANGANA STATE POWER  
 PROJECT: 4X270MW BHADRADRI KHAMMAN  
 OWNER'S CONSULTANT: DESEIN PRIVATI  
 EPC CONTRACTOR: BHARAT HEAVY ELECT  
 UNIT: PROJECT ENGINEERING MAN  
 COPY RIGHT HAS RESERVED  
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used, decayed or indirectly in any way detrimental to the interest of the company.

DATE	SCALE

TITLE: CRANE CLEARANCE DIAGRAM FOR RAW WATER  
 CRANE FOR RAW WATER

CV	ME	EL	INC	DEPT.	SNR	DATE

BHEL/SUB VENDOR DRS NO. PE-DG-411-524-A002  
 AP UNDERSLUNG USE  
 LTD  
 BHEL  
 DATE

2002-411-524-A002  
 DRAWING No. PE-DG-411-524-A002  
 ALL DIMENSIONS ARE IN MM  
 FIRST ANGLE PROJECTION  
 CUSTOMER'S DRAWING No.

Fig-3  
 Fig-2  
 Fig-3





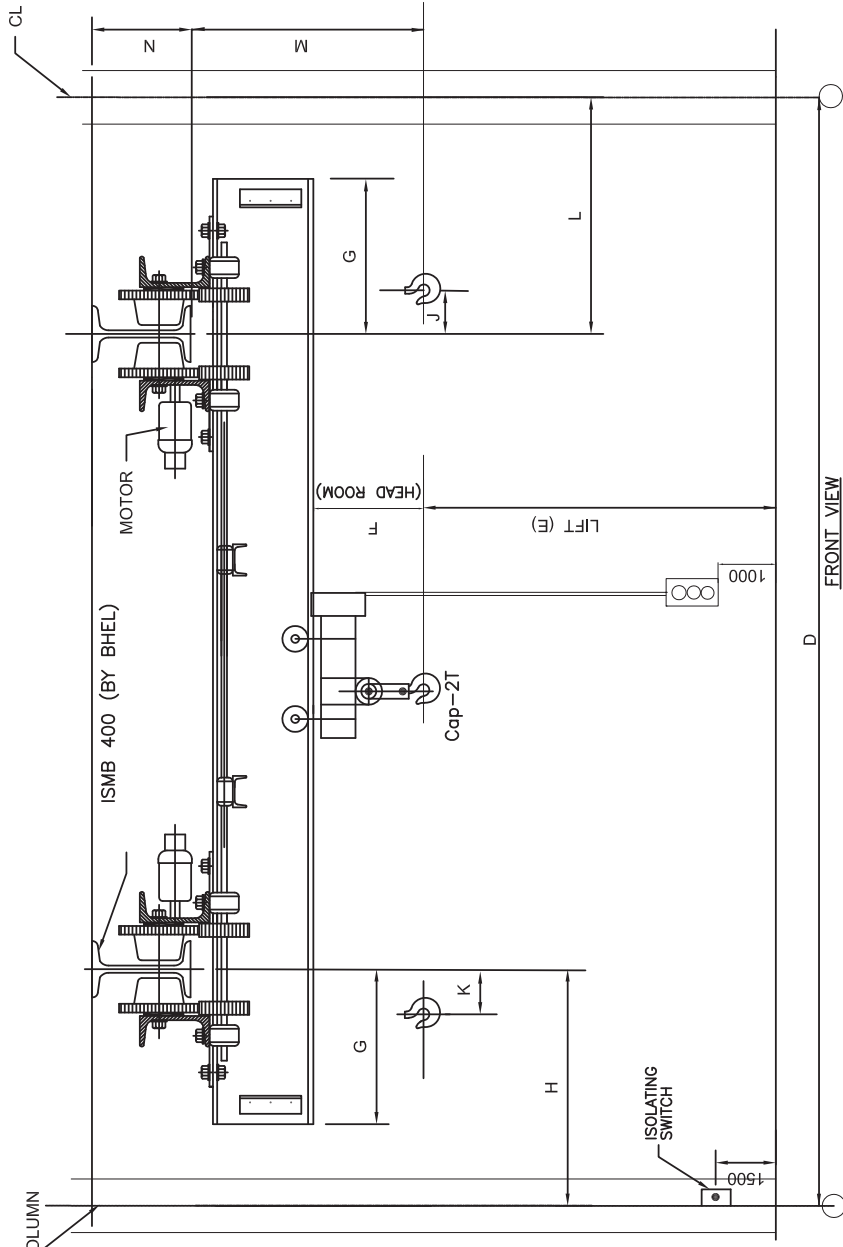
COPY RIGHT AND CONFIDENTIAL  
 The information on the document is the property of BHARAT HEAVY ELECTRICALS LIMITED  
 It must not be used directly or indirectly in any way detrimental to the interest of the company.

CUSTOMER'S DRAWING No.	
DESIGN PARAMETERS	
A	7500
B	*
C	*
D	10000
E	12000
F	*
G	750
H	1250
J	50
K	50
L	1250
M	1500 (approx)
N	400

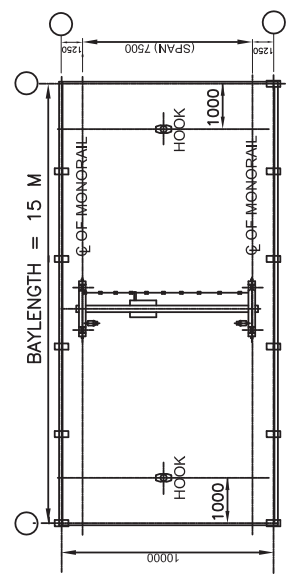
Fig-3

CL OF COLUMN

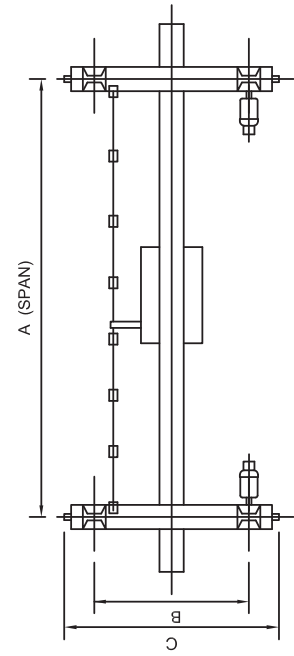
CL OF COLUMN



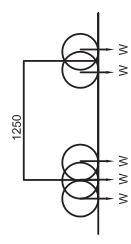
FRONT VIEW



KEY PLAN



TOP VIEW



LT WHEEL LOAD WITH OUT IMPACT ( )

NOTES:

1. DIMENSIONS MARKED (\*) SHALL BE FURNISHED DURING DETAIL ENGG
2. ALL DIMENSIONS ARE IN MM.
3. CRANE WEIGHT = 2.5 T (MAX), HOIST WEIGHT = 0.5T (MAX)
4. CRANE SHALL BE SUITABLE FOR HAZAROUS AREA
5. LT DSL SHALL BE FLEXIBLE TRAILING CABLE TYPE.

Rev 01 Date Oct 2015

REV.	DATE	DESCRIPTION	BY
OWNER		TELANGANA STATE POWER	
PROJECT		4X270MW BHADRADRI KHAMMAN	
DRAWN		DESEIN PRIVATI	
CHECKED		BHARAT HEAVY ELECT	
UNIT		PROJECT ENGINEERING MAN	
DATE			
SCALE			
THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT IS TO BE USED ONLY FOR THE PROJECT AND NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM.			
TITLE: CRANE CLEARANCE DIAGRAM CRANE FOR FC			
CV	ME	EL	INC
DATE	DATE	DATE	DATE
BHEL/SUB VENDOR DRS NO. PE-DG-411-524-A005			
SHEET No 1 OF 1 REV. 0			

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM

DRAWING No.  
**PE-DG-411-524-A005**

Fig-3

PEM-6666-0



**4X270 MW BHADRADRI TPS**  
**SINGLE GIRDER CRANE**  
**STANDARD TECHNICAL SPECIFICATION**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -D

Rev 01 Date Oct 2015

**VOLUME - IIB**

**SECTION – D**

**STANDARD TECHNICAL REQUIREMENTS**



**4X270 MW BHADRADRI TPS**  
**SINGLE GIRDER CRANE**  
**STANDARD TECHNICAL SPECIFICATION**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -D

Rev 01 Date Oct 2015

**SINGLE GIRDER EOT CRANE****1.0.0 SCOPE**

This specification covers the design, material, manufacture, assembly, inspection and testing at manufacturer works for single girder EOT crane. The equipment shall include all the accessories required for the trouble free operation.

The crane shall be complete with trolley and truck, wheels and axles, Drive mechanisms, Hoisting Drums, Brakes, Creep Speed Arrangement, and Lifting tackles, Buffers, Electric Motors, Controls, Switch Board and cabling, horns, warning lights, Limit switches etc. Any item not mentioned herein but required to make the system complete for the satisfactory performance of the crane shall also be included.

**2.0.0 CODES AND STANDARDS**

The equipment to be supplied under this specification shall conform to the following codes and standards (latest revisions) unless otherwise specified hereinafter.

- |    |                  |   |
|----|------------------|---|
| a) | IS 807           | Codes of Practice for Design, Manufacture, Erection and Testing (Structural Portion) of cranes and hoists |
| b) | IS: 3177         | Code of Practice for Design of Overhead Travelling Cranes and Gantry Cranes other than steel work cranes  |
| c) | IS: 2266         | Specification for steel wire ropes for general Engineering purposes.                                      |
| d) | IS: 4029         | Guide for testing induction motor (for temperature rise)  |
| e) | IS: 15560        | Steel hooks for standard shank design   |
| f) | IS: 1554 Part I  | PVC insulated (Heavy-duty) electric cables for working voltages up to and including 1100 volts.           |
| g) | IS: 325          | Three phase induction motors.   |
| h) | IS: 900          | Code of practice for installation and maintenance of induction motors                                     |
| i) | IS: 694 (Part-I) | Copper conductors PVC insulated cables for voltage up to 1000 V.  |
| k) | IS: 434 (Pt I)   | Copper conductors rubber insulated cables for voltage up to 1000V.  |
| m) | IS: 691          | Flexible trailing cables rubber insulated.  |
| n) | IS 3043          | Code of practice Earthing.  |



**4X270 MW BHADRADRI TPS**  
**SINGLE GIRDER CRANE**  
**STANDARD TECHNICAL SPECIFICATION**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -D

Rev 01 Date Oct 2015

- |    |          |  |
|----|----------|--|
| o) | IS: 3938 | Electric Wire Rope Hoists.   |
| p) | IS: 2147 | Degree of protection provided by enclosures for Low voltage switchgear and control gear. |
| q) | IS: 1544 | Polyethylene insulated PVC sheathed cables.  |

**Indian electricity rules - 1956.**

In the event of any conflict between the specification and standards mentioned above, the specification shall govern.

**3.0.0 SINGLE GIRDER EOT CRANE**

**3.1.0 DESIGN REQUIREMENTS**

3.1.1 The crane shall be designed in accordance with the latest edition of IS-3177/IS-807 & hoist block shall be as per IS-3938 and any other standard as referred there in and subject to any modification and requirement as specified herein after.

Class of crane mechanism shall correspond to that of the crane requirement and as specified elsewhere.

3.1.2 Safety devices should be provided with all equipment/parts covered under this specification.

3.1.3 Parts requiring replacement or lubrication shall easily be accessible without dismantling the other equipment or structures. All electrical cables shall be laid to comply with recognized standards and purchaser's requirements.

3.1.4 For welded construction such as bridge girders, end carriages, rope drum, gearboxes etc; steel shall be conforming to IS-2062 quality.

3.1.5 No cast iron part shall be used on the crane.

3.1.6 Guard shall be provided on crane to prevent the hoist ropes coming in contact with down shop leads. Guards of an approved design, which will push forward or off the track any object such as a person foot or arm, placed across it. Guards shall be attached to each end of the end carriages. Suitable guards shall be provided to revolving shafts, coupling etc.

3.1.7 All cables shall be clamped individually. All trailing cables shall be clamped with PVC or non-metallic clamp.

3.1.8 All wheels, couplings, open gear etc. shall be provided with covers.

3.1.9 All bolts except those with locknut shall be provided with grip lock nuts or spring washers.

3.1.10 Fasteners for pedestal blocks, motors, gearboxes etc. shall be easily removable from the top. Studs shall not be used as fasteners for mechanical items except for fixing covers.

3.1.11 Defects in the material like fractures, cracks, blowholes, pitting etc. are not allowed. Rectification of any such flaw is permissible only with the approval of the purchaser.



**4X270 MW BHADRADRI TPS**  
**SINGLE GIRDER CRANE**  
**STANDARD TECHNICAL SPECIFICATION**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -D

Rev 01 Date Oct 2015

3.1.12 All parts of the crane shall be thoroughly cleaned of mill scales, rust or foreign matter and then painted as per the specification requirements

3.1.13 The crane shall be manufactured as per the tolerances specified below

- |    |  |  |
|----|--|--|
| a) | Span over LT wheels                                | ± 3mm  |
| b) | Diagonal on wheels                                 | ± 3mm  |
| c) | Long travel wheel alignment                        | ± 1mm  |
| d) | Tilt of wheels or balancer axle                    | ±1/1000mm(horizontal and vertical)                     |
| e) | Permissible variation in Speeds at full notch with | rated load, voltage and frequency shall be as follows. |
|    | i) Travelling and traversing                       | ±10%   |
|    | ii) Hoisting Lowering                              | ±10%   |

3.1.14 Proper allowance shall be made for impact and wear in the design of the crane and in no case shall the factor of safety in any part be less than six (6), as per IS: 3177 based on the ultimate strength of the materials used at design duty.

### **3.2.0 STRUCTURAL DETAILS**

3.2.1 Crane structure shall be designed in accordance with the latest edition of IS-807 after taking the following additions/deviations as applicable.

- 3.2.1.1 Black bolts shall not be used in the main structure of the crane. The calculated strength of other bolted joints in structural members shall not be less than net strength of member plus 25%.
- 3.2.1.2 The calculated strength of riveted joint or joints made by friction grip bolts in structure members shall be not less than the calculated net strength of the member.
- 3.2.1.3 Bolts used in shear shall be fitted in to reamed hole.
- 3.2.1.4 Transverse filled welding on load carrying member shall be avoided.
- 3.2.1.5 All butt welds on structural members subjected to tensile stress shall be X - rayed.
- 3.2.1.6 Fillet welding on load carrying members shall be avoided.
- 3.2.1.7 Plates, angles and other rolled section used in the load bearing members of the structure shall not be less than 6mm thick.
- 3.2.1.8 The cranes working out door or in corrosive environment, an allowance of 1.5 mm shall be added to the calculated thickness.
- 3.2.1.9 Minimum thickness of chequered plates for platform shall be over 5mm over plain. Chequered plates shall not be considered for strength calculations of load carrying member.
- 3.1.1.10 The material of construction of the major components shall be as specified in the specification/data sheet. Manufacturer are however free to use alternate material material which are superior for the intended service. But in all the cases, prior concurrence of the purchaser is must.



**4X270 MW BHADRADRI TPS**  
**SINGLE GIRDER CRANE**  
**STANDARD TECHNICAL SPECIFICATION**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -D

Rev 01 Date Oct 2015

**3.2.2 Girder / Beam**

3.2.2.1 The girder / beam shall consist of a box construction with double web plate girders or lattice girders and shall be of adequate strength to withstand the rolling loads and other stresses it is subjected to. The design of the girder shall be in accordance with latest edition of IS- 807 with the following deletion / addition as applicable.

3.2.2.2 Minimum deflection of the bridge girder with safe working load shall not exceed 1/800 of span. 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.

**3.2.3 End carriage**

End carriages shall be fabricated from rolled steel section or plates or as the case may be. End carriage shall be of ample strength to resist all stresses likely to be imposed on them under service conditions including collision with other cranes or stops.

**3.3.0 MECHANICAL****3.3.1 Rope drums**

Rope drums shall be of mild steel plate fabricated or of cast steel. All fabricated rope drums shall be stress relieved. The drum shall be so designed to take full length of hoisting rope in single layers. The end of the rope shall be anchored to the drum in such a way that the charger is readily accessible. Each rope shall have not less than two (2). Full turns on the drum when the hook is at lowest position not taking into consideration the turns covered by the rope in charge. There shall be one spare groove for each rope lead when the hook is at the highest position. Each rope end shall be clamped with minimum two clamping wedges with at least two bolts on each clamping arrangement.

The pitch diameter of the drum shall be as per IS -3177 or as specified elsewhere. The depth of the groove shall not be less than 0.35 times the rope diameter. Each rope shall be clamped to drum with two clamp wedges with at least two numbers of bolts on each clamping arrangement.

**3.3.2 Hoist ropes**

Ropes of steel core as specified in Data Sheet – A/B shall be of right hand lay, of 6x36 construction of best plough steel having minimum tensile strength as 160-180 kg/mm<sup>2</sup>. Left hand lay wire ropes shall not be used (Reverse bend ropes shall be avoided as far as possible).

**3.3.3 Rope sheaves**

Sheaves shall be of cast steel. All sheaves shall be identical, however, exception may be made for equalizer sheave. Sheave groove shall be ground finished for getting increase rope life. Equalizer sheave shall be arranged to turn and swivel in order to maintain rope alignment under all circumstances.

**3.3.4 Wheels**



**4X270 MW BHADRADRI TPS**  
**SINGLE GIRDER CRANE**  
**STANDARD TECHNICAL SPECIFICATION**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -D

Rev 01 Date Oct 2015

LT wheels shall be double flanged with tread to suit the rail. The wheels shall be capable of taking up misalignment in span as specified. Solid wheel shall either be of forged steel or as specified. The wheel shall be with hardness of BHN 300-350. Contact stresses between wheels and rails should be within permissible limits.

**3.3.5 Buffer**

Each End carriage shall be provided with buffer as per data sheet 'A'. Buffers should be so located that removal is not required while changing wheels or bogies. Buffers shall have sufficient tension on energy absorption capacity to bring the unloaded crane to rest from the speed of 50% of the rated speed to zero speed.

**3.3.6 LT drive**

One pair of wheels in each end carriage shall be driven by motor through reduction gear.

**3.3.7 CT drive**

The CT mechanism of the electric hoist shall consist of 2pairs of wheels which shall be driven by motor through reduction gear.

**3.3.8. Gearing**

Spur and helical gearing shall normally be used for all motions. Worms and bevel gears shall not be used. First high-speed reduction shall be through helical gears. All gears shall be hardened and tempered and of alloy steel with machine cut teeth. Surface hardening of teeth is not acceptable. Gear teeth shall preferably be cut in metric module system. Gears shall be designed to meet requirement of crane duty as per IS: 3177. The ratings of gears shall be established as per IS: 4660.

**3.3.9 Gear Box**

3.3.9.1 All gears shall be completely covered and enclosed in oil tight casing & sealed with gasket.

3.3.9.2 The gearboxes shall be of mild steel or cast steel. All fabricated gearboxes shall be stress relieved.

**3.3.10 Bearing**

3.3.10.1 Ball and roller antifriction bearing of FAG, SKF, NBC, NORMA make shall be used throughout, except where specified otherwise. Rated life of ball and roller bearing shall be not less than total working life as per relevant codes. Life of bearing shall be calculated in accordance with manufacturers recommendations.

3.3.10.2 Provision shall be made for service lubrication of all bearings. Bearing enclosures shall be designed as far as possible to exclude dirt and prevent oil leakage.

**3.3.11. Couplings**

3.3.11.1 Motor shafts shall be connected to gear box input extension shafts through flexible gear coupling. Solid coupling shall be used for connecting intermediate lengths of long travel shafts, if applicable.

**3.3.12 Lifting hook**



**4X270 MW BHADRADRI TPS**  
**SINGLE GIRDER CRANE**  
**STANDARD TECHNICAL SPECIFICATION**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -D

Rev 01 Date Oct 2015

Standard hooks shall be used unless otherwise specified. These hooks shall conform to the latest edition of IS 15560 as specified in the data sheet "A".

**3.3.13 Brakes**

Selection and design of brakes shall be such as to meet the requirement. Electro mechanical brakes shall be provided for each motions. Brakes shall be designed to suit 150% FLT of motor for the hoist motion and 125 % FLT of motor for LT/CT motion. Brakes shall be provided as specified in Data Sheet 'A'

**3.4.0 ELECTRICAL**

3.4.1 The scope of supply shall cover all electrical equipments comprising from Main isolating switch, down shop leads, trolley conductors, current collectors etc.

3.4.1.1 Main isolating Switch fuse unit shall be provided at 1.5M above the operating floor level at one end of bay length or in the middle as specified in the data sheet A. Supply of cable from switch to down shop leads shall be included in the bidder's scope of work.. The switch shall be provided with Power ON Red indication lamp.

3.4.1.2 Run way conductors (Down shop leads) shrouded conductor as specified in the data sheet A shall have four conductors. One of the conductors shall be connected to earth grid for earthing connections of all electrical equipments on the crane and shall be connected to suitable collecting gear of earth conductor. Voltage drop across the down shop leads shall be less than 2%. Maintenance cradle for DSL shall be provided on crane if asked in Data Sheet 'A'. Sufficient allowance of min. 10% for wear & tear shall be considered while sizing the conductor. The runway conductors shall be supported on brackets and insulators.

3.4.1.3 The current collectors shall be of adequate current carrying capacity and shall maintain adequate contact pressure. Spacing between current collectors shall be such as to provide sufficient quenching area for sparks coming out of collectors surface. The collector system per conductor shall be top-running type having spring loaded CI/carbon metallic shoes to maintain adequate contact pressure.

3.4.1.4 The cable, supplying power to crane trolley / electric hoist shall be flexible trailing cable as per IS-9968 Part I (latest edition) and mounted on retracting supports (festoon type)

**3.4.2 DRIVE MOTORS**

3.4.2.1 Crane motors shall be totally enclosed, fan cooled and as per data sheet 'A'. The break down torque of the motors shall not be less than 225 percent of the full load torque with rated voltage and frequency applied and pull out torque shall not be less than 250% of the rated full load torque of motor.

3.4.2.2 Ambient correction factors as well as voltage /frequency correction factors depending upon the ambient temperature and voltage /frequency variation shall be applied to derate the motors. The minimum margin of 15% or as specified in the section C of specification shall be considered over the



**4X270 MW BHADRADRI TPS**  
**SINGLE GIRDER CRANE**  
**STANDARD TECHNICAL SPECIFICATION**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -D

Rev 01 Date Oct 2015

calculated rating of the motor. The protection class of the motors shall be as per data sheet A. Motors shall be tested at manufacturers works in accordance with IS-325/as per agreed Quality plan & Reports shall be submitted for approval. Motors shall comply with the requirement of IS-325-1978 or as per the motor specification if enclosed here with.

- 3.4.2.3 All the motors shall be provided with lifting lugs, two earth terminals of adequate size to accept the earthing conductors shall be provided at diametrically opposite points unless specifically designed For higher speeds, motors shall be capable of withstanding 2.5 times the rated speed.

### 3.4.3 Limit Switch

The hoist mechanism of the crane shall be provided with rotary type limit switch to open the control circuit and in order to prevent the crane hook from over hoisting and over lowering. One gravity type back-up limit switch of hand-reset type shall be provided. This switch shall operate in the event of failure of main limit switch if called for in data sheet "A".

Lever operated limit switches shall be provided at both ends of longitude travel and cross traverse. These limit switches shall be self reset type.

### 3.4.4 Protective Panel / Controls

- 3.4.4.1 The electrical protective panel shall be a cubicle fabricated from 2 mm thick sheet steel with lockable-hinged door. It shall be dust and vermin proof with degree of protection as IP-55 or as specified in data sheet A. All the equipment inside the panel shall have permanent identification. The panels shall be front connected type with front-hinged door for access to wiring and terminals. Engraved nameplate shall be furnished for all panels and also for the equipments and devices mounted there on. The following minimum equipments shall be provided.

- a) One triple pole air break type main contactor with thermal overload relay.
- b) One triple pole main line connecting/disconnecting switch.
- c) Switch fuse unit with D.O.L. starter for each motion.
- d) Thermal overload relay for each drive. It shall be ambient temperature compensated and adjustable type.
- e) Contactors, timer and auxiliary contactors.
- f) Control transformer with fuses.
- g) Indicating lamps to indicate the live condition of all three phases.
- h) Other equipments as per supplier's standard practice. Air break contactors shall conform to category AC-4 duty. The contactor drop off voltage shall be between 45-50% of rated voltage.
- i) All internal wiring shall be identified with numbering ferrules at both ends as per the relevant wiring diagram.

### 3.4.5 Pendent Push button station



**4X270 MW BHADRADRI TPS**  
**SINGLE GIRDER CRANE**  
**STANDARD TECHNICAL SPECIFICATION**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -D

Rev 01 Date Oct 2015

It shall be suspended by wire rope to prevent pull on the cables. The following minimum push buttons key operated type.

- a) Main "ON", "OFF" push button key operated and lockable in "OFF" position.  
This push button will operate the main contactor.
- b) Hoist and lower directions. (2Nos.)
- c) Trolley travels both directions. (2 Nos.)
- d) Bridge travels both directions. (2 Nos.)
- e) Inching speed for hoisting & lowering
- f) Inching speed for bridge motion.
- g) Inching speed for trolley motion.
- h) Creep speeds
- i) Emergency stop push button (mushroom type).
- j) Alarm bell push button.

#### 3.4.6 Grounding

- 3.4.6.1 The crane structure, motor frame and all other electrical equipments shall be grounded in accordance with the Indian Electricity Rules. The connections from Crane Bridge to 4th conductor of down shop leads shall be by means of current collector.
- 3.4.6.2 The equipment fed by flexible cables shall be grounded by means of fourth core provided in the flexible trailing cable. Pendant push button station shall be earthed separately.
- 3.4.6.3 Red warning light 3 Nos. shall be provided at both ends of the gantry girder to indicate the aliveness of DSL.

#### 3.4.7 WIRING SYSTEM

- a) The supplier shall furnish all power, control and auxiliary circuit wiring of the equipment and the panel located on the trolley or bridge.
- b) The wiring shall be complete in all respect to ensure the proper functioning of the equipment.
- c) Power wiring to any motor shall be done with 1100V grade Cu conductor, PVC insulated / armoured / FRLS cable of suitable sizes as specified in Data Sheet A.
- d) For selecting the cable rating, cable for power wiring, consideration shall be given to the motor duty, ambient temperature grouping and disposition of the cables voltage drop etc.
- e) All control and auxiliary external circuit wiring shall be done with PVC insulated FRLS type 2.5mm stranded copper conductor.
- f) Armoured cables or un-armoured running through the flexible conduits may be used for power wiring / control and auxiliary circuit wiring shall run through flexible conduits.
- g) Each motor shall be wired independently. Power and control wiring shall be effectively separated.



**4X270 MW BHADRADRI TPS**  
**SINGLE GIRDER CRANE**  
**STANDARD TECHNICAL SPECIFICATION**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME II - B

SECTION -D

Rev 01 Date Oct 2015

- h) Each wire shall be identified at both ends with wire designation in accordance with circuit wiring diagram.
- i) All wire termination to the panels shall be provided with clamp type connections screw. Type terminals with screw directly impinging on conductors are not acceptable.
- j) Multi-way terminal blocks complete with screw nut, washer and marking strips shall be furnished for terminating the panel wiring and outgoing.
- k) Not more than two wires shall be connected to any terminal on either side of terminal block. If necessary number of terminals shall be jumped together to provide the wiring points
- l) Each terminal block shall be marked with designation in accordance with conductors wiring diagram.

**4.0.0 LOAD INDICATION:**

The crane shall have a permanent inscription of English on each side, readily visible from the ground level, stating the safe working loads in tonnes, year of manufacture, crane serial number and manufacturer's name.

PEM-6666-0



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME III

Rev 01 Date Oct 2015

**VOLUME - III**



**TECHNICAL SPECIFICATION FOR**  
**SINGLE GIRDER CRANE**  
**4X270 MW BHADRADRI TPS**

SPECIFICATION NO. PE-TS-411-524-A001

VOLUME III

Rev 01 Date Oct 2015

**DRAWINGS / DOCUMENTS TO BE SUBMITTED WITH THE BID**

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

- a) Signed & stamped Electrical load list
- b) Deviation schedule with reference to specific clauses of the specification along with reason for such deviation or No deviation in the format given under Vol.-III
- c) Un priced copy of price format indicating quoted/ not quoted against each row/column
- d) Copy of pre-bid clarifications, if any, duly signed & stamped
- e) Signed/ Stamped copy of Compliance cum Confirmation Certificate (Vol.-III)

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.



TITLE:  
**TECHNICAL SPECIFICATION FOR  
SINGLE GIRDER CRANE  
4X270 MW BHADRADRI TPS  
COMPLIANCE CUM CONFIRMATION  
CERTIFICATE**

SPEC. NO.: PE-TS-411-524-A001  
VOLUME: III  
SECTION:  
REV. NO. 0  
Date: July 2015

**COMPLIANCE CUM CONFIRMATION CERTIFICATE**

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

- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions other than those mentioned under "exclusion" in section C and those resolved as per 'Schedule of Deviations', if applicable, with regard to same.
- b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'.
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CUSTOMER approval & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This shall be within the contracted price with no extra implications to BHEL after award of the contract.
- d) All drawings/ data-sheets/ calculations etc. submitted along with the offer shall be considered for reference only, same shall be subject to BHEL/ CUSTOMER approval in the event of order.
- e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified/ intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements 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.

- f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.
- g) All sub vendors shall be subject to BHEL/ CUSTOMER approval in the event of order.
- h) Guarantee for plant /equipment shall be as per relevant clause of GCC /SCC /Other Commercial Terms & Conditions.
- i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price and within purview of the tender specification even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities.
- j) 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.
- k) As built drawings shall be submitted as and when required during the project execution.
- l) 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.



LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONT ROL CODE	REMA LOAD RKS No.	VERIFICATI ON FROM MOTOR DATASHEET (Y/N)	KKS NO	
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	Nos						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

ANNEXURE-II

AIR COMPRESSOR HOUSE (8T)		8 kW	S	1	0	D S	N I	A												
CLARIFIED WATER PUMP HOUSE (5T)		6 kW	S	1	0	D S	N I	A												
RAW WATER PUMP HOUSE (5T)		6 kW	S	1	0	D S	N I	A												
CWPH SCREENS AND GATES HANDLING (8T)		8 kW	S	2	0	D S	N I	A												
FUEL OIL PUMP HOUSE (2T)		3 kW	S	1	0	D S	N I	A												

NB: Bidder to confirm the load data. No increase in load data is acceptable after award of contract.

NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL) / CUSTOMER  
 2. ABBREVIATIONS : \* VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V  
 \*\*: FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTOR CONTROLLED)

<b>LOAD DATA (ELECTRICAL)</b>	JOB NO.	411	ORIGINATING AGENCY	PEM (ELECTRICAL)
	PROJECT TITLE	4X270MW BHADRADRI TPS	NAME	DATA FILLED UP ON
	SYSTEM	Single girder crane	SIGN.	DATA ENTERED ON
	DEPTT. / SECTION	MAX	SHEET 1 OF 1	REV. 00

PRICE FORMAT					Rev 00		
4X270 MW BHADRADRI TPS (Single Girder Crane)							
Sl.No	DESCRIPTION OF EQUIPMENT / ITEM	QTY	Ex-works price	ED with Cess @	CST / VAT	FREIGHT	ALL PRICES IN Rs Total F.O.R PRICE
1	2	3	4	5	6	7	8 =4+5+ 6 + 7
A.0.0	Total lumpsum firm price inclusive of all taxes duties and other levies as applicable for design, engineering, manufacturing, inspection and testing, painting supply/delivery duly packed at FOR site (4X270 MW BHADRADRI) including mandatory spares, Erection and commissioning spares, maintenance tools and tackles, all accessories (isolating switch and Power Cable from isolating switch to DSL) for 8.0 T capacity Single Girder underslung EOT Crane of 10.5 m span, 4.5 m lift and 44 m baylength for AIR COMPRESSOR BULIDING as per total scope defined in technical specification PE-TS-411-524-A001 taking into account all clarifications, confirmations and agreements till date.	1 no.					
B.0.0	Total lumpsum firm price inclusive of all taxes duties and other levies as applicable for design, engineering, manufacturing, inspection and testing, painting supply/delivery duly packed at FOR site (4X270 MW BHADRADRI) including mandatory spares, Erection and commissioning spares, maintenance tools and tackles, all accessories (isolating switch and Power Cable from isolating switch to DSL) for 5.0 T capacity Single Girder underslung EOT Crane of 7.0 m span, 16 m lift and 13 m baylength for RAW WATER PUMP HOUSE as per total scope defined in technical specification PE-TS-411-524-A001 taking into account all clarifications, confirmations and agreements till date.	1 no.					
C.0.0	Total lumpsum firm price inclusive of all taxes duties and other levies as applicable for design, engineering, manufacturing, inspection and testing, painting supply/delivery duly packed at FOR site (4X270 MW BHADRADRI) including mandatory spares, Erection and commissioning spares, maintenance tools and tackles, all accessories (isolating switch and Power Cable from isolating switch to DSL) for 5.0 T capacity Single Girder underslung EOT Crane of 11.0 m span, 12.0 m lift and 33 m baylength for CLARIFIED WATER PUMP HOUSE as per total scope defined in technical specification PE-TS-411-524-A001 taking into account all clarifications, confirmations and agreements till date.	1 no.					
D.0.0	Total lumpsum firm price inclusive of all taxes duties and other levies as applicable for design, engineering, manufacturing, inspection and testing, painting supply/delivery duly packed at FOR site (4X270 MW BHADRADRI) including mandatory spares, Erection and commissioning spares, maintenance tools and tackles, all accessories (isolating switch and Power Cable from isolating switch to DSL) for 8.0 T capacity Single Girder semi gantry crane of 4.9 m span, 16.67 m lift and 50 m baylength for CWPH screens and gates as per total scope defined in technical specification PE-TS-411-524-A001 taking into account all clarifications, confirmations and agreements till date.	2 nos.					
E.0.0	Total lumpsum firm price inclusive of all taxes duties and other levies as applicable for design, engineering, manufacturing, inspection and testing, painting supply/delivery duly packed at FOR site (4X270 MW BHADRADRI) including mandatory spares, Erection and commissioning spares, maintenance tools and tackles, all accessories (isolating switch and Power Cable from isolating switch to trailing cable) for 3.0 T capacity Single Girder underslung EOT Crane of 7.5 m span, 12.0 m lift and 15 m baylength for FOPH (suitable for hazardous area) as per total scope defined in technical specification PE-TS-411-524-A001 taking into account all clarifications, confirmations and agreements till date.	1 no.					
F.0.0	Total lumpsum firm price inclusive of all taxes duties and other levies as applicable for commissioning spares as per Annexure A	5 set					
G.0.0	Total lumpsum firm price inclusive of all taxes duties and other levies as applicable for Maintenance tools and tackles as per Annexure B	8 set					
H.0.0	Total lumpsum firm price inclusive of all taxes duties and other levies as applicable for Mandatory spares (Break up is as per Annexure II, III, IV, V)	1 Lot					
I.0.0	total (A.0.0 to H.0.0)						
<b>NOTES</b>							
I	Bidder to note that total price indicated above at J.0.0 shall be considered for evaluation and hence should be complete in all respect for the full scope defined and considering all terms and conditions agreed.						
II	Total Lumpsum price in column-8 of J.0.0 should match with summation of total prices as in [Column (8) of 6.0 of Annexure I +Column (8) of A.0 of Annexure A + Column (8) of (D) of Annexure B + Column (8) of A.0 of Annexure II+ Column (8) of A.0 of Annexure III + Column (8) of A.0 of Annexure IV + Column (8) of A.0 of Annexure V ]						
III	Any item not included in the price quoted above and shown separately will not be taken cognizance of and the offer shall be liable for rejection.						

PRICE FORMAT (MAIN SUPPLY)						ANNEXURE-I	
4X270 MW BHADRADRI TPS (Single Girder Crane)							
Sl.No	DESCRIPTION OF EQUIPMENT / ITEM	QTY	Ex-works price	ED with Cess @	CST / VAT	FREIGHT	ALL PRICES IN Rs Total F.O.R PRICE
1	2	3	4	5	6	7	8 =4+5+ 6 + 7
<b>1.00</b>	<b>Break - up of Prices given in clause A.0.0 of Main price format</b>						
1.1	Total lumpsum price of 8T capacity single girder EOT crane of 10.5 M span, 4.5 m lift with all accessories for <b>AIR COMPRESSOR HOUSE</b>	1 no					
1.2	Lump sum firm price for PVC Shrouded bus bar type DSL for 44 m baylength complete with all accessories.	for 44 m of bay length					
1.3	Lump sum firm price for one (1) lot power cable from isolating switch to DSL including isolating switch and all accessories	One lot					
<b>2.00</b>	<b>Break - up of Prices given in clause B.0.0 of Main price format</b>						
2.1	Total lumpsum price of 5.0 T capacity Single Girder underslung EOT Crane of 6.0 m span, 15 m lift with all accessories for <b>RAW WATER PUMP HOUSE</b>	1 no					
2.2	Lump sum firm price for PVC Shrouded bus bar type DSL for 13 m baylength complete with all accessories.	for 13 m of bay length					
2.3	Lump sum firm price for one (1) lot power cable from isolating switch to DSL including isolating switch and all accessories	One lot					
<b>3.00</b>	<b>Break - up of Prices given in clause C.0.0 of Main price format</b>						
3.1	Total lumpsum price of 5.0 T capacity Single Girder underslung EOT Crane of 11.0 m span, 12 m lift with all accessories for <b>CLARIFIED WATER PUMP HOUSE</b>	1 no					
3.2	Lump sum firm price for PVC Shrouded bus bar type DSL for 33 m baylength complete with all accessories.	for 33 m of bay length					
3.3	Lump sum firm price for one (1) lot power cable from isolating switch to DSL including isolating switch and all accessories	One lot					
<b>4.00</b>	<b>Break - up of Prices given in clause D.0.0 of Main price format</b>						
4.1	Total lumpsum price of 8.0 T capacity Single Girder Semi Gantry Crane of 4.9 m span, 16.67 m lift with all accessories for <b>CWPH screens and gates handling</b>	2 no					
4.2	Lump sum firm price for PVC Shrouded bus bar type DSL for 50 m baylength complete with all accessories.	2 sets for 50 m of bay length					
4.3	Lump sum firm price for one (1) lot power cable from isolating switch to DSL including isolating switch and all accessories	2 lot					
4.4	Lump sum firm price for sq. bar for 50 m baylength complete with all accessories.	2 sets for 50 m of bay length					
<b>5.00</b>	<b>Break - up of Prices given in clause E.0.0 of Main price format</b>						
5.1	Total lumpsum price of 3.0 T capacity Single Girder Underslung EOT Crane of 7.5 m span, 12.0 m lift with all accessories for <b>FOPH (Suitable for hazardous area)</b>	1 no					
5.2	Lump sum firm price for flexible trailing cable for 15 m baylength complete with all accessories.	for 15 m of bay length					
5.3	Lump sum firm price for one (1) lot power cable from isolating switch to trailing cable including isolating switch and all accessories	One lot					
<b>6.0.0</b>	Total (1.0.0 to 5.0.0)						
NOTE	1.0 Bidder to note that there shall be no implication for change in lift and/or span upto 1000 mm. 2.0 Any variation in length of DSL due to change in bay length will be adjusted based on unit rates arrived from 1.2.0, 2.2.0, 3.2.0, 4.2.0, 5.2.0 above						
	Date: _____						
	Bidder's / bidder's representative signature						Company Seal

ANNEXURE-A							
4X270 MW BHADRADRI TPS (Single Girder Crane)							
LIST OF COMMISSIONING SPARES							
S.No.	Item	Quantity	Total ex-works price	ED including CESS	CST/VAT	FREIGHT	Total
1	2	3	4	5	6	7	8=4+5+6+7
<b>A)</b>	EOT crane of 8T capacity	3 SET					
a	Overload Relay						
b	Limit Switch						
c	Fuse Link						
	Total of A.						
<b>B)</b>	EOT crane of 5T capacity	2 SET					
a	Overload Relay						
b	Limit Switch						
c	Fuse Link						
	Total of B.						
<b>C)</b>	EOT crane of 3T capacity	1 SET					
a	Overload Relay						
b	Limit Switch						
c	Fuse Link						
	Total of C.						
	Total (D) (A+B+C)						
Note:	"One (1) Set" is defined as 100% requirement for one crane for the entire cranes of similar size & capacity.						
	Date: _____	Bidder's / bidder's representative signature					
		Company Seal					

4X270 MW BHADRADRI TPS (Single Girder Crane)							ANNEXURE-B
List of Maintenance Tools & Tackles							
Sl.no	Description	Unit	Total ex-works price	ED with Cess	CST /VAT	FREIGHT	Total
1	2	3	4	5	6	7	8=4+5+6+7
1	Complete set of ring spanners(Indicate sizes)	6 Set					
2	Complete set of screwdrivers (Min 6 nos , indicate size)	6 Set					
3	Adjustable Spanner	6 No.					
4	Insulated plier	6 No.					
5	Wrench spanner	6 No.					
6	Grease Gun	6 No.					
7	Oil Gun.	6 No.					
8	Hand Lamp.	6 No.					
9	Line tester	6 No.					
A	TOTAL						
<b>Note: - The tools shall be supplied in one no. new tool box</b>							
Date: _____							Company Seal

4X270 MW BHADRADRI TPS (Single Girder Crane)							Annexure II
PRICE SCHEDULE FOR MANDATORY SPARES OF 8T SINGLE GIRDER UNDERSLUNG EOT CRANE							
S. No	DESCRIPTION OF EQUIPMENT / ITEM	Qty	Total Ex-works price (Rs.)	ED including cess	VAT/CST as applicable (Rs.)	Freight	TOTAL F.O.R. Site Price (Rs.)
1	2	3	4	5	6	7	8
1.1	<b>One set consisting of 2 nos. bearing for:</b>						
	a) CT wheel	1 set					
	b) LT wheel	1 set					
1.2	One set consisting of 2 nos. brake linings with rivets for :						
	a) MH brake	1 set					
	b) AH brake	1 set					
	c) CT brake	1 set					
	d) LT brake	2 sets					
	e) MH creep brake	1 set					
	f) AH creep brake	1 set					
1.3	One set consisting of 2 nos. brake shoes with lining for :						
	a) MH brake	1 set					
	b) AH brake	1 set					
	c) CT brake	1 set					
	d) LT brake	2 sets					
	e) MH creep brake	1 set					
	f) AH creep brake	1 set					
1.4	One set consisting of 6 nos. carbon brushes for :						
	a) MH motor	1 set					
	b) AH motor	1 set					
	c) CT motor	1 set					
	d) LT motor	2 sets					
1.5	One set consisting of 3 nos. brush holders for :						
	a) MH motor	1 set					
	b) AH motor	1 set					
	c) CT motor	1 set					
	d) LT motor	2 sets					
1.6	Fixed and moving contacts for each type of contactor	1 set					
1.7	No volt coil for each type of contactor	1 set					
1.8	Overload relay for						
	a) MH motor	1 No.					
	b) AH motor	1 No.					
	c) CT motor	1 No.					
	d) LT motor	2 Nos.					
1.9	Motor bearings						
	a) MH	2 Nos.					
	b) AH	2 Nos.					
	c) CT	2 Nos.					
	d) LT	4 Nos.					
1.1	Bearing for						
	a) MH Main Pulley	2 Nos					
	b) MH Eq. Pulley	2 Nos					
	c) AH Main pulley	2 Nos					
	d) AH Eq. Pulley	2 Nos					
2	Electrical Items						
2.1	415 Volt Motor (Upto 30 KW Rating)						
a	Driving End & Non-Driving End Bearing	3 Set for each type and rating of Motor					
b	Cooling Fan	2 Nos. for each type and rating of Motor					
c	Motor Terminal Block	5 Nos. for each type and rating of Motor					
d	Complete Set of Coupling	1 Set of each application					
3	<b>C&amp;I Items</b>						
a	PLC	NA					
b	Back-up panel mounted devices (Selector switches/ Push buttons/ Indicators etc.	5% of installed capacity					
c	Lamps/ LEDs	10% of the total quantity					
d	Blank Tiles	10% of installed capacity					
e	MCBs	10% of each type & rating					
f	Fuses/ Fuse holder	10% of each type & rating					
<b>A.0.0</b>	<b>Total (sl no. 1 to 3)</b>						
1	The lists of spares indicated are for the type equipment generally used in thermal power plants. If the design or type of equipment proposed by the bidder is different, then the bidder shall suit the spares list according to the type of equipment. However, the numbers or quantity of spares, indicated shall not be reduced.						
2	All essential spares shall be supplied as per the requirement of the specifications. In case any spare indicated in the specification is not applicable for particular equipment then suitable applicable alternate spare have been offered / shall be supplied without any financial implication.						
3	Any change or variation in equipment or systems during detailed engineering stage which would cause changes / variations in the essential spares quantity, shall be supplied by Vendor without any commercial implications						
4	For quantities indicated in percentage, fractions are to be rounded-off to next higher integer.						
5	Any item which is "not applicable" in the above list and is found to be "applicable" at a later date shall be supplied by the Vendor without any extra cost.						
6	If any of the items of spares/tools & tackles ordered is found to be not applicable during detailed engineering stage/execution stage, the contractor will have to supply alternative items of spares/tools & tackles. The alternative items of spares/tools & tackles are to be mutually agreed between the PURCHASER and VENDOR						

4X270 MW BHADRADRI TPS (Single Girder Crane)							Annexure III
PRICE SCHEDULE FOR MANDATORY SPARES OF 8T SINGLE GIRDER SEMI GANTRY CRANE							
S. No	DESCRIPTION OF EQUIPMENT / ITEM	Qty	Total Ex-works price (Rs.)	ED including cess	VAT/CST as applicable (Rs.)	Freight	TOTAL F.O.R. Site Price (Rs.)
1	2	3	4	5	6	7	8
1.1	<b>One set consisting of 2 nos. bearing for:</b>						
	a) CT wheel	1 set					
	b) LT wheel	1 set					
1.2	One set consisting of 2 nos. brake linings with rivets for :						
	a) MH brake	1 set					
	b) AH brake	1 set					
	c) CT brake	1 set					
	d) LT brake	2 sets					
	e) MH creep brake	1 set					
	f) AH creep brake	1 set					
1.3	One set consisting of 2 nos. brake shoes with lining for :						
	a) MH brake	1 set					
	b) AH brake	1 set					
	c) CT brake	1 set					
	d) LT brake	2 sets					
	e) MH creep brake	1 set					
	f) AH creep brake	1 set					
1.4	One set consisting of 6 nos. carbon brushes for :						
	a) MH motor	1 set					
	b) AH motor	1 set					
	c) CT motor	1 set					
	d) LT motor	2 sets					
1.5	One set consisting of 3 nos. brush holders for :						
	a) MH motor	1 set					
	b) AH motor	1 set					
	c) CT motor	1 set					
	d) LT motor	2 sets					
1.6	Fixed and moving contacts for each type of contactor	1 set					
1.7	No volt coil for each type of contactor	1 set					
1.8	Overload relay for						
	a) MH motor	1 No.					
	b) AH motor	1 No.					
	c) CT motor	1 No.					
	d) LT motor	2 Nos.					
1.9	Motor bearings						
	a) MH	2 Nos.					
	b) AH	2 Nos.					
	c) CT	2 Nos.					
	d) LT	4 Nos.					
1.1	Bearing for						
	a) MH Main Pulley	2 Nos					
	b) MH Eq. Pulley	2 Nos					
	c) AH Main pulley	2 Nos					
	d) AH Eq. Pulley	2 Nos					
2	Electrical Items						
2.1	415 Volt Motor (Upto 30 KW Rating)						
a	Driving End & Non-Driving End Bearing	3 Set for each type and rating of Motor					
b	Cooling Fan	2 Nos. for each type and rating of Motor					
c	Motor Terminal Block	5 Nos. for each type and rating of Motor					
d	Complete Set of Coupling	1 Set of each application					
3	<b>C&amp;I Items</b>						
a	PLC	NA					
b	Back-up panel mounted devices (Selector switches/ Push buttons/ Indicators etc.	5% of installed capacity					
c	Lamps/ LEDs	10% of the total quantity					
d	Blank Tiles	10% of installed capacity					
e	MCBs	10% of each type & rating					
f	Fuses/ Fuse holder	10% of each type & rating					
<b>A.0.0</b>	<b>Total (sl no. 1 to 3)</b>						
1	The lists of spares indicated are for the type equipment generally used in thermal power plants. If the design or type of equipment proposed by the bidder is different, then the bidder shall suit the spares list according to the type of equipment. However, the numbers or quantity of spares, indicated shall not be reduced.						
2	All essential spares shall be supplied as per the requirement of the specifications. In case any spare indicated in the specification is not applicable for particular equipment then suitable applicable alternate spare have been offered / shall be supplied without any financial implication.						
3	Any change or variation in equipment or systems during detailed engineering stage which would cause changes / variations in the essential spares quantity, shall be supplied by Vendor without any commercial implications						
4	For quantities indicated in percentage, fractions are to be rounded-off to next higher integer.						
5	Any item which is "not applicable" in the above list and is found to be "applicable" at a later date shall be supplied by the Vendor without any extra cost.						
6	If any of the items of spares/tools & tackles ordered is found to be not applicable during detailed engineering stage/execution stage, the contractor will have to supply alternative items of spares/tools & tackles. The alternative items of spares/tools & tackles are to be mutually agreed between the PURCHASER and VENDOR						

		4X270 MW BHADRADRI TPS (Single Girder Crane)			Annexure IV		
PRICE SCHEDULE FOR MANDATORY SPARES OF 5T SINGLE GIRDER UNDERSLUNG CRANE							
S. No	DESCRIPTION OF EQUIPMENT / ITEM	Qty	Total Ex-works price (Rs.)	ED including cess	VAT/CST as applicable (Rs.)	Freight	TOTAL F.O.R. Site Price (Rs.)
1	2	3	4	5	6	7	8
1.1	<b>One set consisting of 2 nos. bearing for:</b>						
	a) CT wheel	1 set					
	b) LT wheel	1 set					
1.2	One set consisting of 2 nos. brake linings with rivets for :						
	a) MH brake	1 set					
	b) AH brake	1 set					
	c) CT brake	1 set					
	d) LT brake	2 sets					
	e) MH creep brake	1 set					
	f) AH creep brake	1 set					
1.3	One set consisting of 2 nos. brake shoes with lining for :						
	a) MH brake	1 set					
	b) AH brake	1 set					
	c) CT brake	1 set					
	d) LT brake	2 sets					
	e) MH creep brake	1 set					
	f) AH creep brake	1 set					
1.4	One set consisting of 6 nos. carbon brushes for :						
	a) MH motor	1 set					
	b) AH motor	1 set					
	c) CT motor	1 set					
	d) LT motor	2 sets					
1.5	One set consisting of 3 nos. brush holders for :						
	a) MH motor	1 set					
	b) AH motor	1 set					
	c) CT motor	1 set					
	d) LT motor	2 sets					
1.6	Fixed and moving contacts for each type of contactor	1 set					
1.7	No volt coil for each type of contactor	1 set					
1.8	Overload relay for						
	a) MH motor	1 No.					
	b) AH motor	1 No.					
	c) CT motor	1 No.					
	d) LT motor	2 Nos.					
1.9	Motor bearings						
	a) MH	2 Nos.					
	b) AH	2 Nos.					
	c) CT	2 Nos.					
	d) LT	4 Nos.					
1.1	Bearing for						
	a) MH Main Pulley	2 Nos					
	b) MH Eq. Pulley	2 Nos					
	c) AH Main pulley	2 Nos					
	d) AH Eq. Pulley	2 Nos					
2	Electrical Items						
2.1	415 Volt Motor (Upto 30 KW Rating)						
a	Driving End & Non-Driving End Bearing	3 Set for each type and rating of Motor					
b	Cooling Fan	2 Nos. for each type and rating of Motor					
c	Motor Terminal Block	5 Nos. for each type and rating of Motor					
d	Complete Set of Coupling	1 Set of each application					
3	<b>C&amp;I Items</b>						
a	PLC	NA					
b	Back-up panel mounted devices (Selector switches/ Push buttons/ Indicators etc.	5% of installed capacity					
c	Lamps/ LEDs	10% of the total quantity					
d	Blank Tiles	10% of installed capacity					
e	MCBs	10% of each type & rating					
f	Fuses/ Fuse holder	10% of each type & rating					
<b>A.0.0</b>	<b>Total (sl no. 1 to 3)</b>						
1	The lists of spares indicated are for the type equipment generally used in thermal power plants. If the design or type of equipment proposed by the bidder is different, then the bidder shall suit the spares list according to the type of equipment. However, the numbers or quantity of spares, indicated shall not be reduced.						
2	All essential spares shall be supplied as per the requirement of the specifications. In case any spare indicated in the specification is not applicable for particular equipment then suitable applicable alternate spare have been offered / shall be supplied without any financial implication.						
3	Any change or variation in equipment or systems during detailed engineering stage which would cause changes / variations in the essential spares quantity, shall be supplied by Vendor without any commercial implications						
4	For quantities indicated in percentage, fractions are to be rounded-off to next higher integer.						
5	Any item which is "not applicable" in the above list and is found to be "applicable" at a later date shall be supplied by the Vendor without any extra cost.						
6	If any of the items of spares/tools & tackles ordered is found to be not applicable during detailed engineering stage/execution stage, the contractor will have to supply alternative items of spares/tools & tackles. The alternative items of spares/tools & tackles are to be mutually agreed between the PURCHASER and VENDOR						

4X270 MW BHADRADRI TPS (Single Girder Crane)						Annexure V	
PRICE SCHEDULE FOR MANDATORY SPARES OF 3T SINGLE GIRDER UNDERSLUNG CRANE							
S. No	DESCRIPTION OF EQUIPMENT / ITEM	Qty	Total Ex-works price (Rs.)	ED including cess	VAT/CST as applicable (Rs.)	Freight	TOTAL F.O.R. Site Price (Rs.)
1	2	3	4	5	6	7	8
1.1	One set consisting of 2 nos. bearing for:						
	a) CT wheel	1 set					
	b) LT wheel	1 set					
1.2	One set consisting of 2 nos. brake linings with rivets for :						
	a) MH brake	1 set					
	b) AH brake	1 set					
	c) CT brake	1 set					
	d) LT brake	2 sets					
	e) MH creep brake	1 set					
	f) AH creep brake	1 set					
1.3	One set consisting of 2 nos. brake shoes with lining for :						
	a) MH brake	1 set					
	b) AH brake	1 set					
	c) CT brake	1 set					
	d) LT brake	2 sets					
	e) MH creep brake	1 set					
	f) AH creep brake	1 set					
1.4	One set consisting of 6 nos. carbon brushes for :						
	a) MH motor	1 set					
	b) AH motor	1 set					
	c) CT motor	1 set					
	d) LT motor	2 sets					
1.5	One set consisting of 3 nos. brush holders for :						
	a) MH motor	1 set					
	b) AH motor	1 set					
	c) CT motor	1 set					
	d) LT motor	2 sets					
1.6	Fixed and moving contacts for each type of contactor	1 set					
1.7	No volt coil for each type of contactor	1 set					
1.8	Overload relay for						
	a) MH motor	1 No.					
	b) AH motor	1 No.					
	c) CT motor	1 No.					
	d) LT motor	2 Nos.					
1.9	Motor bearings						
	a) MH	2 Nos.					
	b) AH	2 Nos.					
	c) CT	2 Nos.					
	d) LT	4 Nos.					
1.1	Bearing for						
	a) MH Main Pulley	2 Nos					
	b) MH Eq. Pulley	2 Nos					
	c) AH Main pulley	2 Nos					
	d) AH Eq. Pulley	2 Nos					
2	Electrical Items						
2.1	415 Volt Motor (Upto 30 KW Rating)						
a	Driving End & Non-Driving End Bearing	3 Set for each type and rating of Motor					
b	Cooling Fan	2 Nos. for each type and rating of Motor					
c	Motor Terminal Block	5 Nos. for each type and rating of Motor					
d	Complete Set of Coupling	1 Set of each application					
3	C&I Items						
a	PLC	NA					
b	Back-up panel mounted devices (Selector switches/ Push buttons/ Indicators etc.	5% of installed capacity					
c	Lamps/ LEDs	10% of the total quantity					
d	Blank Tiles	10% of installed capacity					
e	MCBs	10% of each type & rating					
f	Fuses/ Fuse holder	10% of each type & rating					
A.0.0	Total (sl no. 1 to 3)						
1	The lists of spares indicated are for the type equipment generally used in thermal power plants. If the design or type of equipment proposed by the bidder is different, then the bidder shall suit the spares list according to the type of equipment. However, the numbers or quantity of spares, indicated shall not be reduced.						
2	All essential spares shall be supplied as per the requirement of the specifications. In case any spare indicated in the specification is not applicable for particular equipment then suitable applicable alternate spare have been offered / shall be supplied without any financial implication.						
3	Any change or variation in equipment or systems during detailed engineering stage which would cause changes / variations in the essential spares quantity, shall be supplied by Vendor without any commercial implications						
4	For quantities indicated in percentage, fractions are to be rounded-off to next higher integer.						
5	Any item which is "not applicable" in the above list and is found to be "applicable" at a later date shall be supplied by the Vendor without any extra cost.						
6	If any of the items of spares/tools & tackles ordered is found to be not applicable during detailed engineering stage/execution stage, the contractor will have to supply alternative items of spares/tools & tackles. The alternative items of spares/tools & tackles are to be mutually agreed between the PURCHASER and VENDOR						

