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All materials used shall have performed lengthy satisfactory service in similar or more arduous conditions to those proposed by the Contractor.		
8.3	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.	
9.0	<u>LUBRICATION</u>	
9.1	Provision shall be made for suitable efficient lubrication where necessary to ensure smooth operation free from undue wear.	
9.2	Non ferrous capillary tubing shall be used throughout.	
9.3	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.	
9.4	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.	
9.5	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.	
9.6	The Contractor shall supply grease gun equipment suitable to service each type of nipple fitted.	
10.0	<u>LUBRICANTS AND CONTROL FLUIDS</u>	
10.1	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 unit.	

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10.2	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 recognized 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.	
10.3	No lubricant or control fluid shall have toxic or other harmful effects on personnel or on the environment.	
11.0	<u>OPERATION AND MAINTENANCE</u>	
11.1	The plant shall be designed and constructed so that operation and maintenance manpower requirements are minimized. The design and layout shall facilitate inspection, cleaning, maintenance and repair. The importance of continuity of operation is second only to that of safety.	
11.2	Spare parts for equipment shall be interchangeable with the original components and, so far as possible, be of common design and manufacture.	
11.3	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.	
11.4	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.	

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11.5	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.													
11.6	All equipment and major valves should be provided with adequate maintenance approach and facility.													
12.0	<u>PLANT LIFE AND MODE OF OPERATION</u> 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 major equipments like 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 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 units shall also be suitable for two shift operation, if required. The expected start-ups should be considered as minimum (Based on HPT metal temperature) <table><tr><td>(a)</td><td>Cold start-up (>50 hrs. shutdown)</td><td>:</td><td>20 per year</td></tr><tr><td>(b)</td><td>Warm start-up (between 10 to 50 hrs. of shutdown)</td><td>:</td><td>40 per year</td></tr><tr><td>(c)</td><td>Hot start-up (Less than 10 hrs. shutdown)</td><td>:</td><td>180 per year</td></tr></table> The allowable stresses shall be so selected so that life expectancy to minimum 2,00,000 hours of operation can be achieved. The Bidder shall		(a)	Cold start-up (>50 hrs. shutdown)	:	20 per year	(b)	Warm start-up (between 10 to 50 hrs. of shutdown)	:	40 per year	(c)	Hot start-up (Less than 10 hrs. shutdown)	:	180 per year
(a)	Cold start-up (>50 hrs. shutdown)	:	20 per year											
(b)	Warm start-up (between 10 to 50 hrs. of shutdown)	:	40 per year											
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discuss this aspect in his technical proposal.

13.0 **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 shall be taken into account. Bidder shall consider the details of various wagons normally available with Indian Railways for transportation of heavy equipment. 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 : 3.2 Meters
metres on both sides)
- (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". This is however not indicative of the consignment which can be carried out with infringement of "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 shall 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

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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.

Specification of Packaging and Marking has been described in detail in Volume I: General Condition of Contract of the Specification.

14.0 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

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openings shall be closed with forged steel plugs. The closures shall be taped to seal the interior of the equipment. Open ends of piping, tubing and conduit shall be sealed and taped. Returnable containers and special shipping devices shall be returned by the manufacturer's field representative at the Contractor's expense.		
15.0	<u>PAINTING</u>	
15.1	<u>GENERAL</u>	
All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. Surfaces not easily accessible after shop assembly shall be treated before-hand and protected for life of the equipment. Surfaces to be finish painted after installation shall be shop painted with at least two (2) coats of primer. Steel surfaces, which are not to be painted, shall be coated with suitable rust preventive compound subject to the approval of the Owner. All paints shall be used in accordance with the manufacturer's instructions. No thinners or other substance shall be added to the coating material without the approval of the Engineer. The quality and vendor of the paints shall require approval of the Owner. All paints, when applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects. All primers shall be well marked into the surface, particularly in areas where pitting is evident, and the first priming coat shall be applied as soon as possible after cleaning, within four hours maximum. The paint shall be applied by brush, roller or airless spray, according to the manufacturer's instructions. Spray painting shall be carried out by operators trained and thoroughly experienced in the use of the equipment. If the drying interval between successive coats, which should not exceed one week, has been so long as to endanger the adhesion of the following coat, the paint already applied shall be lightly rubbed down with fine abrasive paper before putting on the next coat. Paint spraying on large surfaces shall not normally be done indoors, except with the approval of the Engineer. Spray guns shall not be used outdoors in		

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windy weather or near unprotected surfaces of a contrasting colour and under no circumstances shall spray guns be used where spray may be carried into or onto exposed electrical equipment. Paint containers shall not be opened until required and the paint shall be mechanically mixed thoroughly before use, and agitated occasionally during use. Electrical equipment shall be shop finished with one or more coats of primer and two coats of high-grade oil resistant enamel. The interior of all panels' cabinets and enclosures shall be finished with gloss white enamel. The Contractor shall furnish sufficient touch-up paint for one complete finish coat on all exterior factory surfaces of each item of equipment. The touch-up paint shall be of the same type and colour as the factory applied paint and shall be carefully packed to avoid damage during shipment. Complete painting instructions shall be furnished. The Contractor shall select shop primer for steel and iron surfaces, which will have a continuous operating temperature below 35°C, in accordance to the relevant standard. Special high temperature primer shall be used on surface exposed to operating temperature above 35°C. The Owner/Engineer shall submit the colour scheme during execution of contract for approval.		
15.2	<u>PREPARATION</u> Oil and grease shall be removed from the surface by washing with a suitable detergent, rinsing with clean water, and drying. Surfaces to be shot blasted shall be cleaned to Swedish Standard SA 2.5 or equivalent, and all dust remaining after cleaning shall be removed. The priming coat shall be applied without delay.	
15.3	<u>DAMAGED PAINTWORK</u> Any damaged paintwork shall be made good as follows:	

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15.3.1	The damaged area, together with an area extending 25 mm around its boundary, shall be cleaned down to bare metal.	
15.3.2	A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50 mm around the perimeter of the original damage.	
15.3.3	The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before and after priming	
15.4	<u>PAINTING SYSTEMS</u> The requirements for the Dry Film Thickness (DFT) of paint and the materials to be used shall be as stated below, unless otherwise specified elsewhere in this specification.	
15.4.1	Surfaces subject to Weathering All surfaces shall have a minimum of four coats of paint made up as follows: (a) Primer coat : 35 micron DFT (b) Tie coat : 35 micron DFT (c) Finishing coat (Two Nos.) : 35 micron DFT per coat (d) The total minimum DFT : 140 micron	
15.4.2	Surfaces Inside Buildings All surfaces shall have a minimum of three coats of paint made up as follows: (a) Primer coat : 35 micron DFT (b) Tie coat : 35 micron DFT (c) Finishing coat (Two Nos.) : 25 micron DFT per coat (d) The total minimum DFT : 120 micron	

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The Contractor shall select the type and colour of primer & finish coat after approval by the Owner. For detail painting on building & structural steel elements, please refer Volume VI / A & B of this specification. 16.0 <u>COLOUR CO-ORDINATION & FINISH</u> 16.1 Exterior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and with the surrounding landscape. 16.2 Interior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and which will be conducive to; the comfort, well-being and high productivity of the operators. Operating plant and services provided shall be colour coded for ease of identification. 16.3 All finishes shall be durable and as far as possible maintenance free. Finishes shall be easily cleaned. 16.4 Final colours and finishes shall be to the Approval of the Engineer. 17.0 <u>ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT</u> 17.1 <u>ENVIRONMENT PROTECTION</u> 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 stipulates any other conditions not specified hereunder while clearing the project, same shall be complied with by the Contractor.		

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17.1.1 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 17.1.2 For Air Emission (a) Suspended Particulate Matter i.e. dust burden at Chimney outlet - Maximum 50 mg/Nm³ (with worst coal and one field out). (b) NO_x : 365 ppm (maximum) or 750 mg/Nm³ (Equivalent NO₂). (c) SO₂ : As per prevailing Indian/ World Bank standards 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. 17.2 <u>NOISE LEVEL REQUIREMENT</u> The plant shall be designed, constructed and provided with suitable acoustic measures to ensure the noise level criteria as per the following stipulations. 17.2.1 Maximum noise level shall not exceed 85 dB (A) when measured at 1.0 M away from the noise emission source. 17.2.2 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. 17.2.3 Any statutory changes in stipulations regarding noise limitation that may occur in future according to Maharashtra Pollution Control Board or Central Pollution Control Board or Ministry of Environment & Forest regulation		

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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.		
18.0	<u>INSPECTION AND TESTING</u>	
18.1	<u>GENERAL:</u>	
18.1.1	An indicative list of Inspection and testing requirements for each package has been given for equipments across various volumes of this specification. Bidder shall note that these testing and inspections listed herein are the minimum requirements as perceived by the Owner; the bidder shall consider this only as a general guidance and is not meant to be exhaustive. The bidder shall consider requisite testing and inspections across the equipments / systems forming the proposed power plant unit based on his own experience and in line with the current industry practices for identically rated power plant for the technology under consideration. The comprehensive list of tests considered for each of the equipment/ systems shall be furnished as part of the bid.	
18.2	<u>INSPECTION AND TESTS DURING MANUFACTURE</u>	
18.2.1	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.	
18.2.2	The Owner's general requirements with respect to quality control and the required shop tests are set out elsewhere in this Specification.	
18.2.3	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.	
18.2.4	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	

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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 six (6) copies of the Test Certificates. 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. 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. 18.2.5 Under no circumstances any repair or welding of castings shall be carried out without the consent of the Engineer. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Engineer. 18.2.6 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. 18.2.7 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 Owner. The certificates shall include tests for mechanical properties and chemical analysis of representative material. 18.2.8 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		

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hour. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than one hour. 18.2.9 All necessary non-destructive examinations shall be performed to meet the applicable code requirements. 18.2.10 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, magnuflux 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. 18.2.11 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 Maharashtra 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. 18.3 <u>PERFORMANCE TESTS AT SITE</u> 18.3.1 The full requirements for testing the system shall be agreed between the Owner and the Bidder prior to Award of Contract. The completely erected 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. 18.3.2 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. 18.3.3 The Contractor shall furnish the quality procedures to be adopted for assuring quality from the receipt of material at site, during storage, erection,		

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pre-commissioning to tests on completion and commissioning of the complete system/equipment.

18.4 For details of specific tests required on individual equipment, refer to respective section of this specification.

19.0 TRAINING OF OWNER'S PERSONNEL

The Contractor shall extend all possible assistance and co-operation to the Owner 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 Tender.

19.1 TRAINING AT CONTRACTOR'S PREMISES

The Contractor shall conduct training of Thirty (30) 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 Contract.

The total man-months for training of engineers shall be maximum Thirty (30), having following indicative break-up:

	Discipline	Number of Engineers	Number of Man-month
(a)	Operation	10 heads	10
(b)	Maintenance (Boiler & Turbine)	10 heads	10
(c)	Electrical Maintenance	4 heads	4
(d)	Control & Instrumentation	4 heads	4
(e)	Maintenance Planning	2 heads	2
		30 heads	30

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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 Owner.

The Contractor shall be responsible for the development of the Training Module and Programme Schedule, which shall be submitted to the Owner 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 Owner upon completion of the training. An evaluation shall be jointly undertaken by the Contractor and the Owner'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:

- (a) Coal fired thermal plant principles in management and practice for operators, technicians and maintenance personnel.

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(b) Plant operation and systems training for operators including simulator training as applicable. (c) Maintenance training programme covering electrical, mechanical and instrumentation and control. Said training programme shall be submitted to the Owner 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 training programme. 19.2 <u>OPERATION AND MAINTENANCE TRAINING AT SITE</u> 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 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). Instructors shall also be available for Coal handling Plant, Ash Handling Plant, Water Treatment Plant and other specific areas as per requirement.		

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19.3 ON-THE-JOB TRAINING

During the period of pre-commissioning, commissioning and trial operation, the Owner 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 Owner 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.

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LIST OF STANDARDS FOR REFERENCE

ANNEXURE – A

- | | |
|------|---|
| 1.0 | International Standards Organisation (ISO) |
| 2.0 | International Electro-technical Commission (IEC) |
| 3.0 | American Society of Mechanical Engineers (ASME) |
| 4.0 | American National Standards Institute (ANSI) |
| 5.0 | American Society for Testing and Materials (ASTM) |
| 6.0 | American Institute of Steel Construction (AISC) |
| 7.0 | American Welding Society (AWS) |
| 8.0 | Architecture Institute of Japan (AIJ) |
| 9.0 | National Fire Protection Association (NFPA) |
| 10.0 | National Electrical Manufacturer's Association (NEMA) |
| 11.0 | Japanese Electro-technical Committee (JEC) |
| 12.0 | Institute of Electrical and Electronics Engineers (IEEE) |
| 13.0 | Federal Occupational Safety and Health Regulations (OSHA) |
| 14.0 | Instrument Society of America (ISA) |
| 15.0 | National Electric Code (NEC) |
| 16.0 | Heat Exchanger Institute (HEI) |
| 17.0 | Tubular Exchanger Manufacturer's Association (TEMA) |

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18.0	Hydraulic Institute (HIS)	
19.0	International Electro-Technical Commission (IEC) Publications	
20.0	Power Test Code for Steam Turbines (PTC)	
21.0	Applicable German Standards (DIN)	
22.0	Applicable British Standards (BS)	
23.0	Applicable Japanese Standards (JIS)	
24.0	Electric Power Research Institute (EPRI)	
25.0	Standards of Manufacturer's Standardization Society (MSS)	
26.0	Bureau of Indian Standards (BIS)	
27.0	Indian Electricity Rules	
28.0	Indian Boiler Regulations (IBR)	
29.0	Indian Explosives Act	
30.0	Indian Factories Act	
31.0	Tariff Advisory Committee (TAC) rules	
32.0	Emission regulation of Central Pollution Control Board (CPCB)	
33.0	Pollution Control regulations of Dept. of Environment, Govt. of India	
34.0	Central Board of Irrigation and Power (CBIP) Publications	
35.0	The Air Prevention and Control of Pollution Act	
36.0	The Environmental Protection Act	
37.0	The Public Liability Insurance Act	

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38.0 The Forest Conservation Act 39.0 The Wildlife protection Act 40.0 The EIA Notification, 1994 41.0 IS: 14665-Specification for Electric Traction Lift 42.0 Any other statutory Codes/Standards/Regulation		

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<u>CRITERIA FOR LAYOUT</u> <u>ANNEXURE – B</u>		
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
1.0	<u>SITE CONDITIONS TO BE CONSIDERED</u>	
1.1	Prevalent wind direction during summer (for deciding cooling tower orientation)	See wind-rose in plot plan.
1.2	Prevalent wind direction (s) during dry seasons (for deciding the location of coal stock pile and ash dump/unloading areas, minimising the pollution effect due to dust)	See wind-rose in plot plan.
1.3	Location of	
1.3.1	Raw Water intake point	As shown in Plot Plan
1.3.2	Plant drainage outfall point (s)	In Existing Drainage/Effluent treatment Plant
1.3.3	Railway entries & exits	As shown in Plot Plan
1.3.4	Road entries & exits	As shown in Plot Plan
1.3.5	Electrical power transmission grid system	As shown in Plot Plan
1.3.6	Preferred / selected ash dump area	Velhala nearly 10 Km from the site
1.3.7	Nearest residential area	Existing Colony

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<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>	
2.0	<u>LAYOUT REQUIREMENTS</u>		
2.1	<u>MAXIMUM PERMISSIBLE SLOPE IN</u>		
2.1.1	Rail track	1 in 400	
2.1.2	Road	1 in 30	
2.1.3	Sides of unpaved embankment	1 in 2	
2.2	<u>REQUIRED ROAD WIDTH</u>		
2.2.1	Main roads	14.00 Metres with 1.0 m wide shoulders on either side for outer roads on western and eastern side and 7 meters with 1.5 m wide shoulders for other two sides of power block.	
2.2.2	Auxiliary interconnections	Minimum 4 Metres without shoulders on either side and shall vary upto 7 m subject to availability of space. For carriage way, 5 Metre wide with 0.5 Metre shoulders and 7.0 Mtre wide with 1.5 Metre shoulders.	
2.2.3	Road to the power house unloading bay		
(a)	Only for entry to the unloading bay	Yes	
(b)	To pass through the unloading bay	No	

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<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
2.3	Required minimum horizontal distance between the nearest points of	
2.3.1	Plant boundary and the boundary of residential area	(Local municipality/factory rule)
2.3.2	Electrical transformer and any other	As per the Tariff Advisory Committee Rules
2.3.3	Fire water supply installation and any building / facility subject to fire risk.	As per the Tariff Advisory Committee Rules
2.3.4	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
2.4	Required minimum vertical clearance	
2.4.1	Under pipes/cable racks at road crossings	8.0 Metres
2.4.2	Soil coverage over underground pipes	1.0 Metre (minimum)
2.4.3	Pipe/Cable trench	Not Acceptable
2.5	Railway Wagon clearance	Rules of the Indian Railways
2.6	Minimum Clearance between any road edge and building/ structure / any fixed installation	3 Metres
2.7	Required level, above the local developed grade level, of	

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2.7.1	Top of all roads	150 mm	
2.7.2	All outdoor paved areas	150 mm	
2.8	Temporary storage areas, workshops, offices, residence etc. required at the time of erection work.	Yes	
2.9	Green belt around power plant area	As per environmental guidelines of MOEF, Govt. of India.	

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<u>BUILDING/ EQUIPMENT LAYOUT REQUIREMENTS</u> <u>ANNEXURE – C</u>		
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
1.0	Minimum clear space required at all working and walking areas for operating & maintenance personnel	
1.1	<u>HORIZONTAL, IN ALL DIRECTIONS</u>	
1.1.1	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
1.1.2	Adjacent to any other plant facilities (including walls / structures)	1000 mm
1.2	<u>VERTICAL</u> (head-room clearance)	
1.2.1	Under any pipe / equipment surface of temperature exceeding 60°C and any electrical cables or other electrical items.	2.0 Metre
1.2.2	Under any other plant facilities (including structures, pipes etc.)	2.0 Metre

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1.3	For all areas where any equipment (including trucks, trolleys and other material handling equipment) move or manoeuvre.	Minimum 500 mm clear in all direction from the outer edges of the equipment
1.4	Minimum clear hand space required for	
1.4.1	The application of thermal insulation	100 mm
1.4.2	Welding work	150 mm
1.4.3	Bolt tightening	150 mm
2.0	<u>FLOORS, PLATFORMS, STAIRCASE, LADDERS, WALLS, DOORS & WINDOWS</u>	
2.1	Statutory Requirement	As per the regulations of Tariff Advisory Committee, Indian National Building Code, Indian Factories Act, Local Municipal Rules, etc.
2.2	<u>OPERATION & MAINTENANCE REQUIREMENT</u>	
2.2.1	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

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2.2.2	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
2.3	Minimum access opening required (with rolling shutter) transportation,	3.5 M wide x 4 M high or wherever entry of truck, for material depending upon the envisaged equipment size to be handled.
2.4	Plinth level of all buildings, above the local developed for power house building.	300 mm
3.0	<u>OTHER MAINTENANCE REQUIREMENT</u>	
3.1	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

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3.2	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, Air Compressors, Blowers, Heat Exchangers, Fuel Oil Pumps, Filters etc.	Shall be possible without disconnecting or dismantling any piping/ducting.
3.3	Overhauling and handling of the casings for the above items	Shall be possible without disturbing / dismantling any piping / ducting not directly connected to them.
3.4	Crane Approach Wherever required, the unobstructed approach of the crane hook / other hoisting equipment hook to various plant & equipment shall be possible.	Yes
4.0	<u>CENTRAL CONTROL ROOM</u> 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

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5.0	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.		
5.1	However, as a guide line, following features are given:		
5.1.1	False ceiling and false flooring shall be provided.		
5.1.2	Uniform height, colouring schemes for cabinets etc. shall be available.		
5.1.3	The total area of floor space covered by Control Consoles/Panels in the Control Room shall not exceed 15% of floor area.		
5.1.4	No opening shall be provided from Boiler side.		
5.1.5	Two double leaf doors, suitably located for entering the Control room shall be provided with opening towards the turbine floor.		
5.1.6	Cable entry for the panels/consoles shall be from bottom and suitable openings shall be provided.		

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5.1.7	The Control Room lighting shall be designed to provide a glare free uniform illumination. The level of illumination shall be minimum 400 LUX.		
5.1.8	Necessary Air Conditioning shall be provided for Central Control room, Control Equipment Room and SWAS room etc.		
5.1.9	Basic amenities like toilet, Tiffin rooms, wash basins, rest rooms etc. shall be provided near the Control Room.		
6.0	Toilet and drinking water facility	Required in all buildings and on all floors wherever operating personnel are to be deployed.	

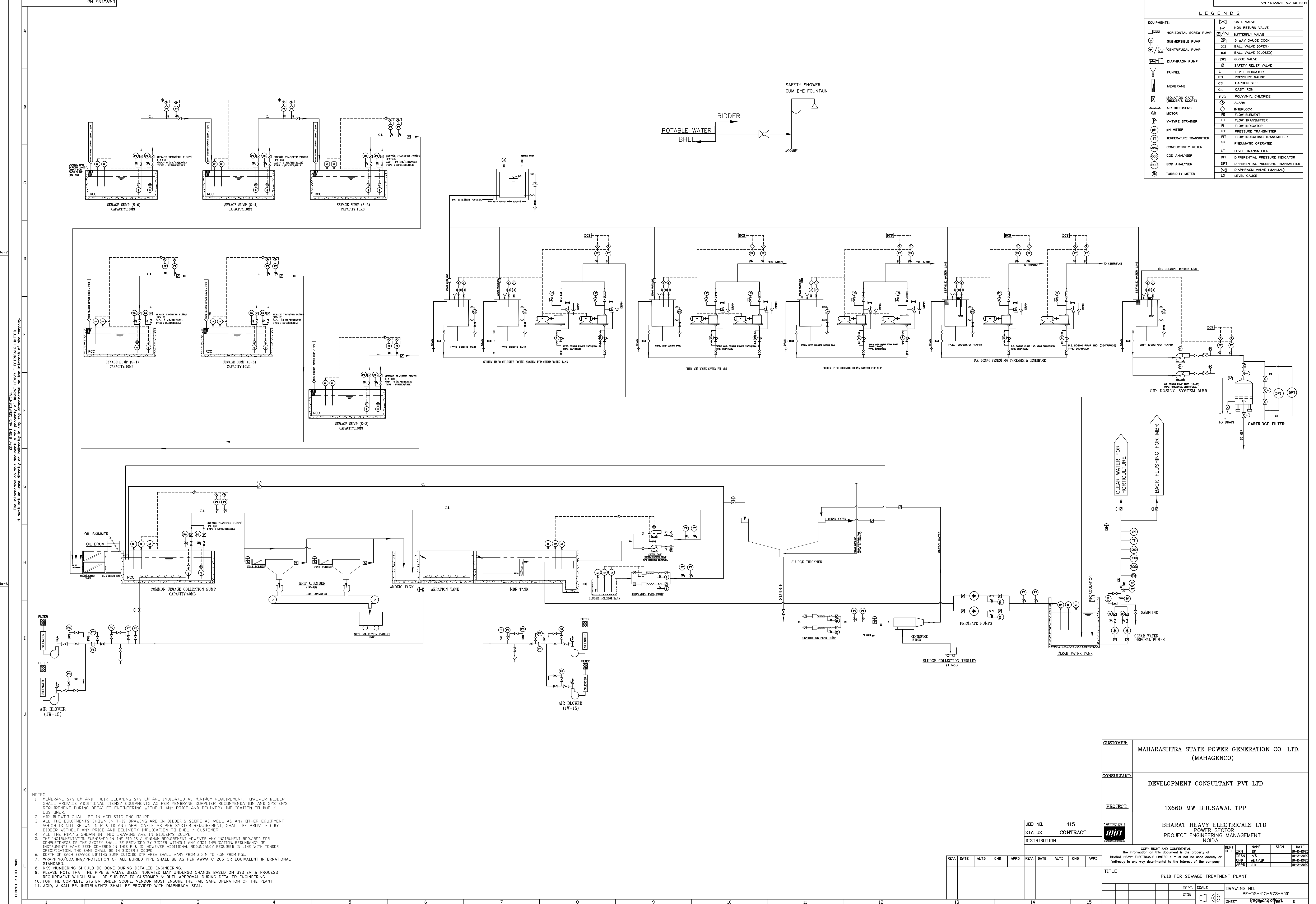
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<u>SPECIFIC LAYOUT CONSIDERATIONS</u> <u>ANNEXURE-D</u> While developing the layouts, the following major layout parameters shall be ensured, as a minimum:		
<u>SR.NO.</u>	<u>PARAMETER</u>	<u>REQUIREMENTS</u>
1.0	AB bay, BC & CD bay widths	36.0 M, 12.0 M & 12.0M
2.0	Arrangement of TG set	Longitudinal
3.0	Floor levels in AB bay	0.0 M, 9.0 M, 17.0 M
4.0	Floor levels in B-C bay	0.0 M, 9.0 M, 17.0 M 24.0M, 28.0 M 32.8 M, 38.0 M
5.0	Level of operating floor	17.0 M
6.0	Level of mezzanine floor	9.0 M
7.0	HT/LT Switchgear and MCC location	HT Switchgear at 3.5 M and LT Switchgear & MCC at 12.0 M in AB bay
8.0	Area of unloading bays	750 sq. M
9.0	Lay down Area (Minimum on operating floor) with EOT Crane approach	750 sq. M.
10.0	Minimum clear working space around the equipment	1200 mm
11.0	Location of Deaerator	In BC bay at EL. 38.0 M

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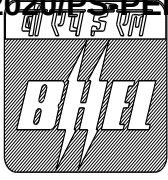
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<u>SR.NO.</u>	<u>PARAMETER</u>	<u>REQUIREMENTS</u>	
12.0	Location of Heaters	HP Heaters/LP Heaters at Operating Floor/ Mezzanine Floor respectively in B-C Bay.	
13.0	Location of BFP	TDBFP at Operating Floor and MDBFP at Ground Floor in AB Bay.	
14.0	Location of Boiler MCC	At 28.0 M in BC bay	
15.0	Clear Head room within Main plant Building for pipes, structures & cable trays, ducts etc.	2.5 M	
16.0	Number of Fire Escape staircases in the main plant with fire doors at each landing	Minimum Four (4)	
17.0	Minimum width of all staircases landings	1500 mm	
18.0	Passenger Elevators	One (min)	
19.0	Clear approach width in front and rear of ESP	10 M (Height = 8 M)	
20.0	Head Room for pipe/cables trestles at rail, road crossing	8.0 M	
21.0	Minimum straight length in Flue gas duct at ESP outlet for Opacity meters.	As required for accurate dust measurement within the battery limits.	
22.0	Elevation of ID Ducts entering Chimney	12.75 M (Min.) (Bottom of steel)	

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CUSTOMER:	MAHARASHTRA STATE POWER GENERATION CO. LTD. (MAHAGENCO)								
CONSULTANT:	DEVELOPMENT CONSULTANT PVT LTD								
PROJECT:	1X660 MW BHUSAWAL TPP								
STATUS:	CONTRACT								
DISTRIBUTION:									
JOB NO.	415								
DEPT. CODE	DESN BK								
CHD	VS								
APPD	MS/JIP								
APPD	SB								
REVISIONS:									
REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD
TITLE: P&ID FOR SEWAGE TREATMENT PLANT									
DEPT. SCALE: DRAWING NO. PE-DG-415-673-A001									
SHEET 24 OF 24									

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	TITLE :		SPECIFICATION NO. PE-TS-415-673-A001	
	1 X 660 MW BHUSAWAL THERMAL POWER PROJECT		SECTION: I	
	TECHNICAL SPECIFICATION FOR SEWAGE TREATMENT PLANT		SUB-SECTION: IA	
			REV. No. 00	DATE :

DATASHEET-A FOR SEWAGE TREATMENT PLANT

SL.No.	DESCRIPTION	PARAMETERS
1.0	Capacity of STP, Operating Hours	40 m ³ / day or 40 KLD, 24 HOURS
2.0	SEWAGE SUMPS (OUTSIDE STP AREA)	
2.1	Sewage sump S1, S2, S3, S4, S5, and S6	Minimum effective capacities as per P&ID of sewage treatment plant.
2.2	MOC	RCC
2.3	Type	Covered at top, below ground
2.4	Accessories	Coarse bar screen (Two no. (1W+1S), MOC: SS316) at each sump location.
2.5	SEWAGE PUMP	
2.5.1	Type	Submersible grinder type
2.5.2	Quantity per sump	2 X 100 %
2.5.3	Capacity	As per P & ID of Sewage Treatment plant
2.5.4	MOC casing	Cast Iron
2.5.5	MOC impeller	Stainless Steel AISI 304
2.5.6	MOC shaft	SS 410
2.5.7	Handling arrangement	Suitable handling arrangement shall be provided by bidder in each sewage sump.
3.0	INLET CHAMBER	
3.1	Quantity	One (1)
3.2	MOC	RCC
3.3	Type	Below ground
3.4	Capacity	As per system requirement
3.5	Isolation gates	Two nos. shall be provided by bidder at the outlet
4.0	COARSE SCREEN	
4.1	Quantity	Two (2) (1W+1S)
4.2	MOC	SS316
4.3	Type	Below ground
4.4	Capacity	As per system requirement
4.5	Isolation gates	Two nos. shall be provided by bidder at the outlet
5.0	OIL & GREASE TRAP	
5.1	Quantity	One (1)
5.2	Capacity	As per system requirement
5.3	Oil drum	Two nos each 500 litre effective, FRP/HDPE
5.4	Oil skimmer	One number, drum type.
6.0	COMMON SEWAGE COLLECTION SUMP	
6.1	Quantity	One(1)
6.2	MOC	RCC
6.3	Type	Below ground
6.4	Effective Capacity	As per P & ID of Sewage Treatment plant
7.0	SEWAGE TRANSFER PUMPS	
7.1	Type	Submersible grinder type
7.2	Quantity	2 x 100 %

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7.3	Capacity	As per system requirement
7.4	MOC casing	Cast Iron
7.5	MOC impeller	Stainless Steel AISI 304
7.6	MOC shaft	SS 410
7.7	Handling arrangement	Suitable handling arrangement shall be provided by bidder.
8.0	FINE SCREEN	
8.1	Quantity	Two (2) (1W+1S)
8.2	MOC	SS316
8.3	Type	Above ground
8.4	Capacity	As per system requirement
9.0	GRIT CHAMBER	
9.1	Quantity	Two (2) (1W+1S)
9.2	MOC	RCC with conical bottom, above ground
9.3	Capacity	As per system requirement
9.4	Mechanism	One no. in each, MS with FRP coating with washing system/ mechanism.
9.5	Belt conveyor	One no. automatic electrically driven
9.6	Grit collection trolley	Two nos each 500litre effective, FRP/HDPE
10.0	ANOXIC TANK	
10.1	Quantity	One(1)
10.2	MOC	RCC, above ground
10.3	Capacity	As per system requirement
11.0	AERATION TANK	
11.1	Quantity	One (1)
11.2	MOC	RCC
11.3	Type	Above ground
11.4	Capacity	As per system requirement
12.0	MBR TANK AND MBR	
12.1	MBR TANK	
12.1.1	Quantity	One (1) 1x100%
12.1.2	MOC	RCC
12.1.3	Capacity	As per system requirement
12.1.4	Type	Above ground
12.2	MEMBRANE BIO REACTOR	
12.2.1	Streams	One (1)
12.2.2	No of trains/ stages per MBR stream	As per supplier recommendation
12.2.3	Type of membrane	Ultrafiltration hollow supported fibre/ flat sheet/ approved equivalent
12.2.4	No of modules per cassette	As per supplier recommendation
12.2.5	Diameter of membrane	As per supplier recommendation
12.2.6	Length of the membrane (mm)	As per supplier recommendation
12.2.7	Filtration area per cassette (m2)	As per supplier recommendation
12.2.8	Flow direction	Outside in

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1 X 660 MW BHUSAWAL THERMAL POWER PROJECT

TECHNICAL SPECIFICATION FOR SEWAGE TREATMENT PLANT

SPECIFICATION NO. PE-TS-415-673-A001

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12.2.9	MOC	
12.2.9.1	Frame	SS-316
12.2.9.2	Membrane	PVDF/ polyethylene.
12.2.10	Overall Recovery	90 %
13.0	AIR BLOWER	
13.1	Type	Twin lobe rotary
13.2	Quantity	Two (2) Nos. (1W+1S) common for aeration tank & Common sewage collection sump. Two (2) Nos. (1W+1S) for membranes.
13.3	Capacity and head	To suit system requirement
13.4	MOC casing	CI
13.5	Side plates / gear cover	CI
13.6	Impeller	SS 304
13.7	Diffuser	EPDM/Silicone
14.0	PERMEATE PUMPS	
14.1	Type	Horizontal centrifugal
14.2	Quantity	Two (2) Nos. (1W+1S)
14.3	Capacity	To suit system requirement
14.4	MOC Casing	CI
14.5	MOC Casing Impeller / shaft / shaft sleeve	SS316/ SS410
14.6	Other fasteners	CS
14.7	Base plate / mounting plate	MS
15.0	ANOXIC TANK RECIRCULATION PUMP	
15.1	Type	Horizontal centrifugal
15.2	Quantity	Two (2) Nos. (1W+1S)
15.3	Capacity	To suit system requirement
15.4	MOC Casing	CI
15.5	MOC Casing Impeller / shaft / shaft sleeve	SS316/ SS410
15.6	Other fasteners	CS
15.7	Base plate / mounting plate	MS
16.0	SLUDGE HOLDING TANK	
16.1	Quantity	One (1)
16.2	MOC	RCC
16.3	Capacity	24 hours
16.4	Type	Below ground
17.0	THICKENER	
17.1	Number	One (1), above ground
17.2	Capacity	As per system requirement.
17.3	MOC	MS FRP
18.0	THICKENER FEED PUMP	
18.1	Type	Horizontal Screw
18.2	Quantity	Two (2) Nos. (1W+1S)
18.3	Capacity	To suit system requirement

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18.4	MOC Casing	CI
18.5	MOC shaft / Rotor	Stainless Steel AISI 316
18.6	MOC stator	Stainless Steel AISI 316
18.7	Other fasteners	CS
18.8	Base plate / mounting plate	MS
19.0	CENTRIFUGE FEED PUMP	
19.1	Type	Horizontal Screw
19.2	Quantity	Two (2) Nos. (1W+1S)
19.3	Capacity	To suit system requirement
19.4	MOC Casing	CI
19.5	MOC shaft / Rotor	Stainless Steel AISI 316
19.6	MOC stator	Stainless Steel AISI 316
19.7	Other fasteners	CS
19.8	Base plate / mounting plate	MS
20.0	CENTRIFUGE	
20.1	Quantity	One (1)
20.2	Type	Variable differential speed control type
20.3	Capacity	To suit system requirement
20.4	MOC	
20.5	• Bowl & scrapper material	SS-316
20.6	• All wetted parts	SS-316
20.7	Lining material of scrapper bowl	Tiles/as per supplier's recommendation
20.8	Sludge collection trolley	One no. 500 litre effective, FRP/HDPE
21.0	CLEAR WATER TANK	
21.1	Quantity	One (1), above ground
21.2	MOC	RCC
21.3	Effective Capacity	40 m3
22.0	CLEAR WATER DISPOSAL PUMP	
22.1	Type	Horizontal centrifugal
22.2	Quantity	Two (2) Nos. (1W+1S)
22.3	Capacity	10 m3/ hr.
22.4	MOC Casing	CI
22.5	MOC Casing Impeller/ shaft/ shaft sleeve	SS316 / SS410/ SS410
22.6	Other fasteners	CS
22.7	Base plate / mounting plate	MS
23.0	OVERHEAD SERVICE WATER STORAGE TANK	
23.1	Quantity	1 Number, above ground
23.2	MOC	HDPE/ FRP
23.3	Effective Capacity	Minimum 1 m3 or Service water requirement for chemical preparation, flushing of pumps, sludge & chemical lines, along with overall 20% margin whichever is higher.

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23.4	Supporting arrangement at ground level	Structural steel support shall be provided by bidder. Height of support shall be considered by bidder as per process requirement.
24.0	HYPO (NaOCL) DOSING SYSTEM FOR CLEAR WATER TANK	
24.1	HYPO DOSING TANK	
24.1.1	Quantity	Two (2) No. (1W+1S)
24.1.2	MOC	FRP
24.1.3	Capacity each	Adequate to hold the quantity required for 12 hours of operation plus 20% margin.
24.2	HYPO DOSING PUMPS	
24.2.1	Number	Two (2) Number [1W+1S]
24.2.2	Type of Pump	Positive displacement and hydraulic diaphragm type with stroke adjustment.
24.2.3	Location	Outdoor
24.2.4	Service	To dose hypo solution to the Clear water tank
24.2.5	Duty	Continuous
24.2.6	Suction Condition	Flooded
24.2.7	Rated Capacity, m3/ hr.	100 % requirement at full load condition of the plant
24.2.8	Design Temperature, 0C	50
24.2.9	Range of Operation (%)	10 – 100
24.2.10	Pump Speed, (RPM)	1500
24.2.11	Material of construction	
24.2.11.1	Crank case	EN8
24.2.11.2	Valve and valve housing	PP
24.2.11.3	Plunger	PP
24.2.11.4	Diaphragm	PTFE
24.2.11.5	Worm Shaft	EN-8
24.2.11.6	Type of drive	Electrical Motor
24.2.11.7	Other fasteners	MS plated
24.2.11.8	Base plate / mounting plate	MS Epoxy painted
25.0	HYPO (NaOCl) DOSING SYSTEM FOR MBR	
25.1	Quantity, MOC and Capacity	One no., MOC FRP of minimum 500 Litre
25.2	Capacity	As per requirement or minimum 500 liter
25.3	HYPO DOSING PUMPS FOR MBR	
25.3.1	Number	Two (2) Number [1W+1S]
25.3.2	Type of Pump	Positive displacement and hydraulic diaphragm type with stroke adjustment.
25.3.3	Location	Outdoor
25.3.4	Service	To dose hypo solution to the Clear water tank
25.3.5	Duty	Continuous
25.3.6	Suction Condition	Flooded
25.3.7	Rated Capacity, m3/ hr.	100 % requirement at full load condition of the plant
25.3.8	Design Temperature, 0C	50
25.3.9	Range of Operation (%)	10 – 100

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25.3.10	Pump Speed, (RPM)	1500
25.3.11	Material of construction	
25.3.11.1	Crank case	EN8
25.3.11.2	Valve and valve housing	PP
25.3.11.3	Plunger	PP
25.3.11.4	Diaphragm	PTFE
25.3.11.5	Worm Shaft	EN-8
25.3.11.6	Type of drive	Electrical Motor
25.3.11.7	Other fasteners	MS plated
25.3.11.8	Base plate / mounting plate	MS Epoxy painted
26.0	CITRIC ACID DOSING SYSTEM FOR MBR	
26.1	Quantity, MOC and Capacity	One no. MOC FRP of minimum 500 Litre
26.2	Capacity	As per requirement or minimum 500 liter
26.3	CITRIC ACID DOSING PUMPS	
26.3.1	Number	Two (2) Number [1W+1S]
26.3.2	Type of Pump	Positive displacement and hydraulic diaphragm type with stroke adjustment.
26.3.3	Location	Outdoor
26.3.4	Service	To dose hypo solution to the Clear water tank
26.3.5	Duty	Continuous
26.3.6	Suction Condition	Flooded
26.3.7	Rated Capacity, m3/ hr.	100 % requirement at full load condition of the plant
26.3.8	Design Temperature, 0C	50
26.3.9	Range of Operation (%)	10 – 100
26.3.10	Pump Speed, (RPM)	1500
26.3.11	Material of construction	
26.3.11.1	Crank case	EN8
26.3.11.2	Valve and valve housing	PP
26.3.11.3	Plunger	PP
26.3.11.4	Diaphragm	PTFE
26.3.11.5	Worm Shaft	EN-8
26.3.11.6	Type of drive	Electrical Motor
26.3.11.7	Other fasteners	MS plated
26.3.11.8	Base plate / mounting plate	MS Epoxy painted
27.0	POLYELECTROLYTE DOSING SYSTEM FOR CENTRIFUGE (Dosing rate=20 ppm), THICKNER (Dosing Rate=5 ppm)	
27.1	PE DOSING TANKS	
27.1.1	Numbers required	One (1) No.
27.1.2	Type	Vertical rectangular with flat bottom
27.1.3	Effective capacity of tank, m ³	Adequate to hold the quantity required for 24 hours of simultaneous operation of thickener and centrifuge plus 20% margin.
27.1.4	Design Pressure, Kg/sq. cm (g)	Atmospheric
27.1.5	Design Temperature, 0C	60
27.1.6	Material of Construction	FRP/HDPE

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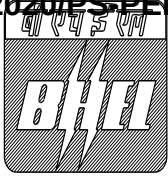
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27.1.7	Agitator along with drive motor and all other accessories	
	• Number	One (1)
	• Material of Construction	SS 304
27.1.8	Dissolving Basket	
	• Number	One (1)
	• Material of Construction	SS 304
27.2	PE DOSING PUMPS	
27.2.1	Number	Two (2) Number (1W+1S) i.e. one pump shall cater dosing to thickener and centrifuge simultaneously and another pump is common stand by.
27.2.2	Description for each Pump	
27.2.3	Type of Pump	Positive displacement and hydraulic diaphragm type with stroke adjustment.
27.2.4	Location	Outdoor
27.2.5	Fluid to be handled	0.1 % w/w PE Solution.
27.2.6	Service	To dose PE solution to Centrifuge and Thickener
27.2.7	Duty	Continuous
27.2.8	Suction Condition	Flooded
27.2.9	Rated Capacity, m ³ / hr.	100 % requirement at full load condition of Centrifuge and Thickener
27.2.10	Design Temperature, °C	60
27.2.11	Range of Operation (%)	10 – 100
27.2.12	Pump Speed, (RPM)	1500
27.2.13	Material of construction	
	• All wetted parts	SS-304
	• Diaphragm	PTFE
27.2.14	Type of drive	Electrical Motor
28.0	CIP DOSING SYSTEM	
28.1	CIP DOSING TANK	One (1) no.
28.1.1	Capacity	As per requirement
28.1.2	Agitator	One (1) no. Motor driven with reduction gear unit.
28.1.3	Accessories	SS 316 Dissolving basket, vent, overflow & drain connection with required valves as well as the feed funnel at top of the tank to feed the solution to tank.
28.1.4	Cartridge Filter	One (1) no.
28.2	CIP DOSING PUMP	Two (2) Number (1W+1S)., MOC: PP, Horizontal centrifugal type
29.0	PIPING (Refer Sub Section IIA also)	
29.1	Sewage transfer piping	CI as per IS 1536, Heavy Grade
29.2	Chemical piping	HDPE, ISO4427/ DIN-8074/ D2239/ D3350 (PE 100 Grade) 150 class/ PN 10 minimum
30.0	VALVES (Refer Sub Section IIA also)	
30.1	Diaphragm Valve	Body: CI Bonnet: CI (sealed Type)

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		Compressor: SS 304 Stem: AISI 410 Diaphragm: Neoprene rubber 65+/-5 Shore A/ Back butyl 65 +/- 5 Shore A. Lining: Ebonite Lined to 3.0 mm THK. (up to 80NB) & 4.0 mm THK. (Above 80 NB) Hardness: 90 TO 100 Shore A Hand wheel MOC : SG IRON
31.0	ISOLATION GATES	
31.1	Quantity	4 (four)
31.2	MOC	MSEP

Note: All Valve, piping, fitting, and instrument shall be of minimum PN 10/ 150 class rating.

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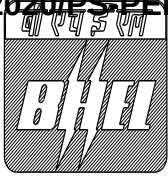
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TECHNICAL DATA SHEET-A FOR ELECTRIC HOIST

Sr. No.	DESCRIPTION	TECHNICAL PARTICULARS
		Electric hoist with electrically operated trolley
1	Design, duty, fabrication and testing of the crane confirm to standard / code number	As per IS: 3938 (latest edition), Class-II duty
2	Area of installation, quantity, rated capacity (Safe Working Load) of cranes	As per Annexure A
3	Margin	The crane/hoist capacity shall be selected considering 25% margin over the weight of heaviest component/ equipment to be handled.
4	Overload Test	125% of Rated capacity (Safe Working Load)
5	Deflection test of crane	NA
6	Operation from	Pendant station - It shall locate the push buttons for controlling the various motions of the crane and shall be hung from the crane trolley to a height of approximately 1 metre above the operating floor
7	Design Ambient temperature	50° C
8	PERFORMANCE	
8.1	Crane speed with full load	
8.1.1	Main hoist	3
8.1.2	Trolley travel (CT)	15
8.1.3	Longitudinal bridge travel (LT)	NA
8.2.1	Acceleration values	NA
8.2.2		CT motion (trolley travel) as per IS: 3938
9	Lift in Metres	The lifting rope shall be of sufficient length to permit the main hook to reach the zero level.
9.1	Main Hoist	Shall be suitable as per approved layout
9.2	Hook Approaches	To suit the lifting requirement.
	COMPONENT DETAILS	
10	Trolley	
10.1	Type	Fabricated steel / Cast steel
10.2	Material	Rolled structural steel with side plates extended beyond wheel flanges to protect wheels. Material of construction as per IS: 2062 (Grade A/B).
10.3	Whether jacking pads for lifting trolley provided or not	Yes
11	Rope drums	
11.1	Material (Indicate IS)	Cast steel or mild steel.
11.2	Flange / flangeless	Flanged
11.3	Numbers provided	One
11.4	Type of grooves	Machined grooved identical Right hand and Left hand of proper shape for the rope used. Additional grooves shall be provided as per IS 3177/3938 in rope drum
12	Rope details	

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12.1	Construction / Core	The wire ropes shall be of suitable diameter as per Suppliers design of crane. The rope shall confirm to I.S. 1835, 1804 and 2266. The rope shall be parallel right hand lay having 6 x 37 constructions with hemp core. However, this should be in relation with Drum diameter as per IS: 3177. The rope selection procedure shall be as per IS 3177 cl. no. 8.3.2.
12.2	Tensile designation (Rope Grade)	1770 or 1960 (in N/sq. mm)
12.3	Factor of safety	Not less than 5
13	Sheaves details	
13.1	Material	The sheaves (Pulleys) shall be of carbon steel casting having chemical and mechanical properties as per IS: 1030 (Class 11).
13.2	Type of guards provided	Fabricated from Sheet steel
14	Gear box details	
14.1		Forged steel as per IS 3938
14.2	Hoist Motion / Cross Travel	
14.2.1	Type of mounting of gear box	Horizontal / Vertical
14.2.2	Classification	Suitable for M5 duty
14.2.3	Type of gears	Spur / Helical, hardened and tempered with machine cut teeth
14.2.4	Type of lubrication	Oil splash/ grease lubricated
14.2.5	Hardness (BHN) – gear	568+/-20BHN for alloy steel.
14.2.6	Hardness (BHN) – pinion	568+/-20BHN for alloy steel.
14.2.7	Difference in Gear and pinion hardness	Min 20 BHN
14.2.8	Materials (gear/pinions)	Gears shall be of cast or forged steel and pinions shall be forged steel and shall be machine cut. Gear and pinion teeth shall be treated for resistance to wear.
14.2.9	Casings	Fabricated steel gear boxes which shall be dust proof and firmly sealed to prevent oil leakages. Gearboxes shall have covers split horizontally and arranged such that top half can be removed for inspection. The gear boxes shall be fitted with bolted type machined inspection covers.
14.2.10	Noise level	85 db
14.2.11	Standard conforming to	IS: 4460
15	Wheels details	Cross Tavel
15.1	Material	EN-8/9
15.2	Hardness	IS: 3938. Max hardness 200 BHN
15.3	Type	Wheels in trolley unit travel shall be single flanged with straight / taper/ barrel shaped tread to suit the monorail.
15.4	Numbers provided	As per manufacturer's standard.
15.5	Specification conforming to	IS: 3938
15.6	Arrangement of lubrication	Grease
16	Lifting hooks	
16.1	Type	Plain shank trapezoidal section

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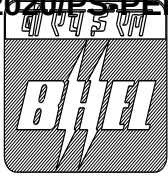
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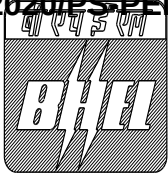
16.2	Safe lifting capacity	As per Safe Working Load
16.3	Material	Solid, forged, heat treated alloy steel/ carbon steel of rugged construction as per IS:15560
16.4	Standard conforming to	IS: 15560
16.5	Hook can swivel	Yes
16.6	Safety latch on hook provided	Yes
16.7	Locking device on swivelling hook	Provided
16.8	Hook suspension	Ball or roller thrust bearing
17	Buffers	Cross Travel
17.1	Type	Spring or rubber buffers shall be provided on the trolley
17.2	Numbers provided	4
17.3	Details of end stop	NA
18	Brakes	
18.1		Hoist Motion / Cross Travel
18.2	Type of brake (ac / dc)	DCEM/ ACEM disc type (fail to safety)
18.3	Number provided per motor	1
18.4	Braking capacity (% of full load torque)	150% / 125%
19	Drive system for hoisting	
19.1	Arrangement of drive from motor to rope drum (main)	Through geared steel coupling and gear box
20	Bearings	Hook / Trolley wheels / Rope drum / Gear box / Sheave / Any other assembly
20.1	Type	Antifriction ball / roller bearings
20.2	Lubrication	Grease lubrication
20.3	Bearing life	10,000 working hours.
21	Bridge girder	
21.1	Type & Quantity	NA
21.2	Vertical Deflection and Camber	NA
21.3	Type of connection to end carriage	NA
21.4	End carriage span material	NA
22	Motors	
22.1	Hoist Motions	MH / CT
22.2	Type	Motor shall be rated for duty S4, CDF 40% and 150 starts per hour. Service class of motor shall be "M8" as per IS: 3177. Conditions given in IS:3938 for hoist motor shall be followed.
22.3	Enclosure	TEFC
22.4	Numbers furnished	One
22.5	Voltage, phase and frequency	Suitable for rated frequency of 50Hz with a voltage variation of $\pm 10\%$ and frequency variation of $\pm 5\%$ occurring separately or combined voltage and frequency variation of 10%.

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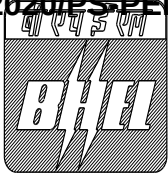
22.6	Class of protection	IP-55
22.7	Margin	Motor ratings shall be calculated keeping margin of at least 25% over the maximum power requirement. Further, the hoist motors shall be rated to lift 125% of the design load on the hook at the rated speed.
22.8	Class of insulation	All motors shall be totally enclosed, fan cooled type, having class-B stator insulation and class-F rotor insulation for slip ring motors & class-B insulation for squirrel cage motor with temperature rise limited to class-B operation in all cases.
22.9	Overload protection for motors provided	One main electro-magnetic contactor together with magnetic overload relay (hand reset) for each motor circuit shall be housed in the protection panel. The operation of overload relay shall interrupt the main magnetic contactor. Adequate short circuit protection shall be provided for main and individual circuits.
23.10	Space heater requirements	Not required
24	Limit switches	Main Hoist / Cross Travel
24.1	In hoisting motion	Each hoist shall be provided with 2 limit switches. 1. A screw type limit switch with self-resetting features which will act in case of over hoisting. 2. A gravity operated hand reset type limit switch as a back-up protection against over-hoist
24.2	In CT/LT motion	Track type limit switches shall be provided on the trolley to prevent over travelling in either direction
24.3	Material of contacts	Double break Silver Cadmium
24.4	Control voltage	110V
24.5	Construction	The limit switches shall be housed in robust metallic oil and dust tight enclosure conforming to IP:65. At least 2 NO and 2 NC contacts shall be provided for each limit switch.
25	Power conductors (DSL)	Shrouded GI type runway conductor.
25.1	Type	CT travel : PVC shrouded GI conductor bus bar
25.2	Size	Shall be sized with a margin of 10% over load requirement. Voltage drop at motor terminal shall be limited to 3% at extreme positions of cranes. Protective cover over DSL shall be provided.
25.3	Length	Suitable for entire bay length.

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26	Isolation switch & Control Panel	Isolation switch shall be provided at operating floor. Protective and control panels shall have IP-54 gasketed enclosure, fabricated from sheet steel, minimum 2 mm thick, suitably reinforced to provide structural rigidity. The panels shall be front connected type with front hinged door for access to wiring and terminals. Engraved name plates shall be furnished for all panels and also for the equipment and device mounted thereon. All panels shall be factory wired and terminated on suitable terminal blocks for external cable connection. All internal wiring shall be identified with numbering ferrules at both ends as per relevant wiring diagram. Terminal blocks shall have 20% spare terminals. Control wiring shall be carried out with 1100 Volt grade flexible, heat resistant, insulated switchboard wires with minimum 2.5 sq.mm stranded copper conductor. Each panel shall have internal illumination with fluorescent lamp and thermostat controlled space heater, suitable for operation on 240V I-ph 50Hz supply. Lamps and heater circuits shall have individual ON-OFF switches.
26.1	Material & size	Rolled sheet steel 2mm size
26.2	DOP	IP 55
26.3	Qty	1 no. per hoist
27	Control for Hoisting operations	
27.1	Creep speed	NA
27.2	Starting torque of VVVF	NA
27.3	Starting current	NA
27.4	Temperature	NA
28	Cable	Power / Control / Trailing
28.1	Type	The wiring shall be done with 1100 V grade PVC insulated stranded aluminum conductor cable of suitable size not less than 2.5 mm ² nominal equivalent copper area of cross-section. All control and auxiliary circuit wiring shall be done with 1100 V g grade PVC insulated, 2.5 mm ² stranded copper conductor. Control wire terminations to the panels shall be made with compression type connectors. Multiway terminal blocks shall be furnished for terminating panel wiring and outgoing cable.
28.2	Voltage drop	Cable from main isolating switch (1.5M above operating floor) to motor terminal shall be so sized that the voltage drop does not exceed 3% of rated voltage with cranes at extreme position.
29	Earthing	Crane structures, motor frames and metal cases of all electrical equipment including metal conduit and cable guards shall be effectively earthed. Electrical system shall be designed for a fault level of 50 kA. Earthing system adopted shall be type TN-CS.
29.1	Material of earthing	G.I / Copper
30	Contactors	AC 4 duty for reversing application. AC 3 duty for non - reversing application.
31	Switches	AC 23 for motor application, AC 22 for other application.
32	Fuses	HRC
33	Power supply	

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34	Transformer	Dry type, with insulation class B or better.
34.1	Quantity	3 X 100 % for control
34.2	Voltage Rating	Control 415/110V
34.3	KVA rating	Min. 20% over loading to be considered while sizing the rating

DATA SHEET-A FOR MANUAL HOIST (CHAIN PULLEY BLOCK)

Sr. No.	DESCRIPTION	TECHNICAL PARTICULARS
1	Type	Hand operated chain pulley blocks. Chain pulley blocks shall be with or without the travelling trolley depending upon the layout requirement and intended use.
2	Area of installation	As per Annexure A
3	Design	IS: 3832
4	Duty Class as per IS:3832	Class -II
5	Hoisting Mechanism	Through endless chains
5.1	Type	Hand operated gear transmission
5.2	Type of gear	Spur
5.3	Load Chain	
5.3.1	Type	Link type
5.3.2	Material	Alloy steel (grade 40) as per IS 3109 (part-II)
5.4	Hand Chain	
5.4.1	Type	Link type
5.4.2	Material	Mild steel (grade 30) as per IS 2429 (Part I)
5.5	Load Hook & Hook Block	
5.5.1	Type of load hook	Plain shank- Trapezoidal section
5.5.2	Load hooks conforms to (Std./Code)/ Material	IS: 15560/ Forged steel
5.5.3	Type of hook suspension	Swivelling type fitted with a locking device.
5.5.4	Type of make of bearing of hook suspension	Thrust ball bearing
5.6	Gears	
5.6.1	Type	Spur
5.6.2	Material	Alloy steel / carbon steel
5.6.3	Type of bearing used	Antifriction ball bearing / Roller
5.7	Pinions	
5.7.1	Type of bearing used	Antifriction ball bearing / Roller
5.8	Sprockets	
5.8.1	Type of bearings used	Antifriction ball bearing / Roller
5.8.2	Method of lubrications Used	
5.8.2.1	Bearings	Grease
5.8.2.2	Gearing & Pinions	Grease
5.8.2.3	Sprockets	Grease
5.8.3	Brakes	
5.8.3.1	Type	Screw and friction disc type
5.8.3.2		Chain pulley block shall be fitted with an automatic mechanical ratchet and pawl arrangement to prevent self- lowering of load.
6	Trolley & Bridge Drive	Through endless chains
6.1	Trolley	
6.1.1	Type	Geared (Manually operated)

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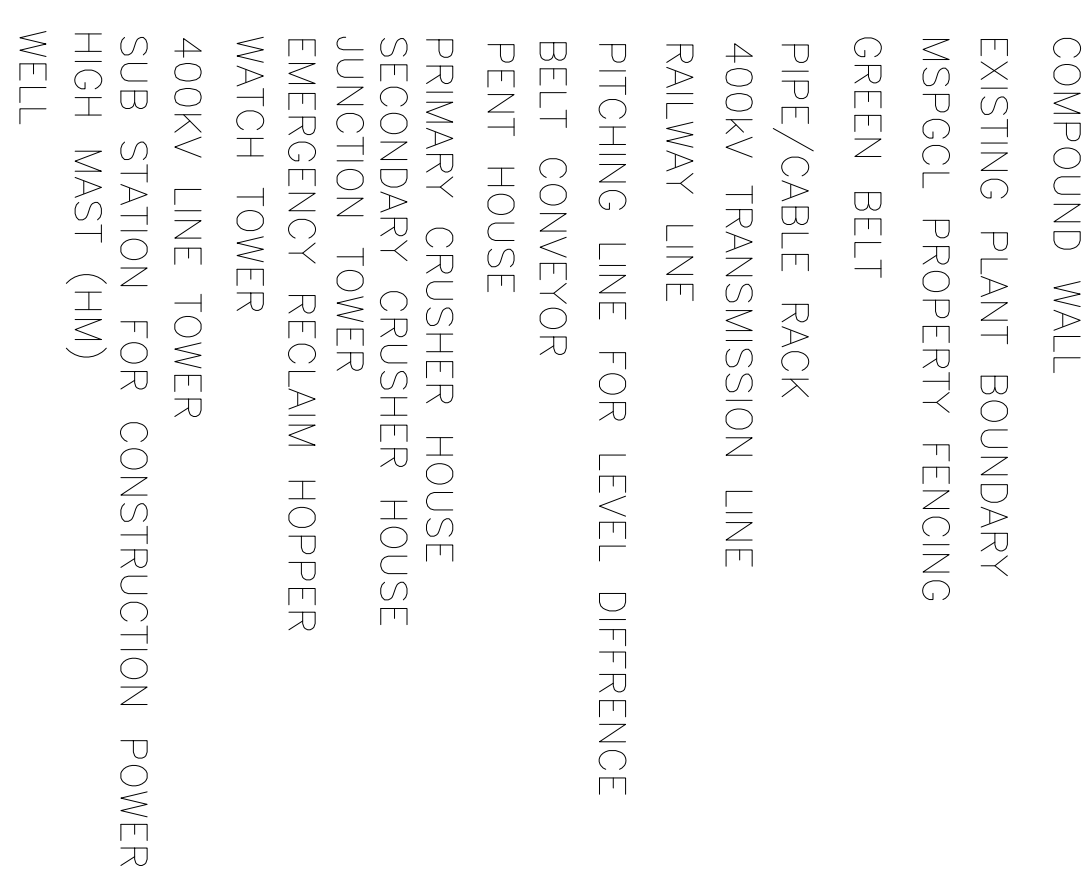
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6.1.2	Material of frame	Rolled structural steel (IS:2062 Grade A or B)
6.2	Drive Chain	
6.2.1	Type	Link type
6.2.2	Material	Steel Gr.30
6.2.3	Wheel	
6.2.3.1	Number of pairs of wheel in each trolley/bridge	Two/four
6.2.3.2	Flange	Wheels in trolley unit travel shall be single flanged with straight / taper/ barrel shaped tread to suit the monorail.
6.2.3.3	Wheel material	Wheels should be preferably of forged steel construction
6.2.3.4	Type of bearings need	Antifriction
6.3	Gears	
6.3.1	Type	Spur / helical
6.3.2	Material	Alloy/ Carbon steel
6.3.3	Type of bearings used	Antifriction
6.4	Method of lubrication for	
6.4.1	Bearings	Grease
6.4.2	Sprockets	Grease
6.5	Load chain wheel	
6.5.1	Material	SG iron / Steel casting / Pressed sheet steel.
6.6	Hand chain wheel	
6.6.1	Material	SG iron / Steel casting / Pressed sheet steel / Gray iron casting
7	Hoisting and trolley travel effort	As per IS 3832



FACILITY	DESCRIPTION OF FACILITIES	SIZES (m ²)
1.0	POWER BLOCK AREA	
	1.1 TO BUILDING	1139.448
	1.2 ROILER	124.5
	1.3 ROILER ROOM, EQUIPMENT ROOM/USE	624.5
	1.4 F/D/PA PANS	2 No. Each
	1.5 F/D/PA	2 No. Each
	1.6 F/D/PA	2 No. Each
	1.7 PER CONTROL ROOM	8
	1.8 D/PANS	2
	1.9 SPACE FOR F/D (BETTER FACILITY No. 10)	—
	1.10 W/FLR SLOD	7,546.0
	1.11 AIR COMPRESSOR BUILDING/AIR EFFECT	16,448
	1.12 COAL PILE	—
	1.13 CONDENSATE STORAGE TANK	281.5
	1.14 CONDENSATE STORAGE TANK PUMP HOUSE	281.5
	1.15 DE BUILDING/IN W/FLR SLOD	224.6
	2.0	ELECTRICAL FACILITIES
2.1 GENERATOR TRANSFORMER		—
2.2 TRANSFORMER		—
2.3 UNIT TRANSFORMER		—
2.4 UNIT TRANSFORMER		—
2.5 STATION AUXILIARY TRANSFORMER		—
2.6 STATION AUXILIARY TRANSFORMER		—
2.7 STATION AUXILIARY TRANSFORMER		—
3.0 WATER SYSTEM		400,350
3.1 RAW WATER & FINE WATER STORAGE TANK		119,492
3.2 RAW WATER PUMP HOUSE		56,465
3.3 FINE WATER PUMP HOUSE		2,000
3.4 RAW WATER CUMULATOR (PER PLANT)		—
3.5 NON-DM WATER CUMULATOR (PER PLANT)		—
3.6 NON-DM WATER CUMULATOR (PER PLANT)		—
3.7 GREASEY FLEASOMER (NON DM WATER) (PER PLANT)		—
3.8 FILTER WATER TANK & PUMP HOUSE (FOR DM)		244.0
3.9 CHARGED WATER TANK & PUMP HOUSE (NON DM)	65,270	
3.10 CHEMICAL HOSE/TEST & CONTROL ROOM	151,635	
3.11 D/D COOLING TOWER	41,132	
3.12 W/FLR SLOD	115,285	
3.13 COAL PILE	—	
3.14 DM WATER STORAGE TANK/USE AREA (C/S SYSTEM)	46,500	
3.15 DM WATER STORAGE TANK/USE AREA (C/S SYSTEM)	412	
3.16 NON-DM WATER STORAGE TANK (DM PLANT)	12,100	
3.17 NON-DM WATER STORAGE TANK (DM PLANT)	12,100	
3.18 ACID/ALKALI STORAGE AREA	208	
3.19 RAW WATER WASTING POND	14,145	
3.20 CHEMICAL HOSE/TEST & CONTROL ROOM	30,020	
3.21 CHEMICAL HOSE/TEST & CONTROL ROOM	40,350	
3.22 PREP. PREPARATION BUILDING	40,350	
4.0	COAL HANDLING PLANT (CS SCOPE)	
	4.1 W/FLR SLOD	—
	4.2 W/FLR SLOD	—
	4.3 CRUSHER HOUSE	39,530
	4.4 CRUSHER HOUSE	39,530
	4.5 CRUSHER HOUSE	39,530
	4.6 CRUSHER HOUSE	39,530
	4.7 CRUSHER HOUSE	39,530
	4.8 CRUSHER HOUSE	39,530
	4.9 CRUSHER HOUSE	39,530
	4.10 CRUSHER HOUSE	39,530
	4.11 CRUSHER HOUSE	39,530
	4.12 CRUSHER HOUSE	39,530
	4.13 CRUSHER HOUSE	39,530
	4.14 CRUSHER HOUSE	39,530
	4.15 CRUSHER HOUSE	39,530
	4.16 CRUSHER HOUSE	39,530
5.0	ASH HANDLING PLANT (CS SCOPE)	
	5.1 W/FLR SLOD	—
	5.2 W/FLR SLOD	—
	5.3 W/FLR SLOD	—
	5.4 W/FLR SLOD	—
	5.5 W/FLR SLOD	—
	5.6 W/FLR SLOD	—
	5.7 W/FLR SLOD	—
	5.8 W/FLR SLOD	—
	5.9 W/FLR SLOD	—
	5.10 W/FLR SLOD	—
	5.11 W/FLR SLOD	—
	5.12 W/FLR SLOD	—
	5.13 W/FLR SLOD	—
	5.14 W/FLR SLOD	—
	5.15 W/FLR SLOD	—
	5.16 W/FLR SLOD	—
6.0	FUEL OIL SYSTEM	
	6.1 FUEL OIL TRANSFER PUMP HOUSE	9,424.5
	6.2 FUEL OIL TRANSFER PUMP HOUSE	9,424.5
	6.3 FUEL OIL TRANSFER PUMP HOUSE	9,424.5
	6.4 FUEL OIL TRANSFER PUMP HOUSE	9,424.5
	6.5 FUEL OIL TRANSFER PUMP HOUSE	9,424.5
	6.6 FUEL OIL TRANSFER PUMP HOUSE	9,424.5
	6.7 FUEL OIL TRANSFER PUMP HOUSE	9,424.5
	6.8 FUEL OIL TRANSFER PUMP HOUSE	9,424.5
	6.9 FUEL OIL TRANSFER PUMP HOUSE	9,424.5
	6.10 FUEL OIL TRANSFER PUMP HOUSE	9,424.5
	6.11 FUEL OIL TRANSFER PUMP HOUSE	9,424.5
	6.12 FUEL OIL TRANSFER PUMP HOUSE	9,424.5
	6.13 FUEL OIL TRANSFER PUMP HOUSE	9,424.5
	6.14 FUEL OIL TRANSFER PUMP HOUSE	9,424.5
	6.15 FUEL OIL TRANSFER PUMP HOUSE	9,424.5
	6.16 FUEL OIL TRANSFER PUMP HOUSE	9,424.5
7.0	EFFLUENT TREATMENT PLANT	
	7.1 W/FLR SLOD	—
	7.2 W/FLR SLOD	—
	7.3 W/FLR SLOD	—

1. ALL DIMENSIONS ARE IN MM AND ALL ELEVATIONS ARE IN METERS. THE GRIDS AND CO-ORDINATES ARE SHOWN IN METERS.
2. BUILDINGS OUTER LINES SHOWN ARE COLUMNS GRID LINES.
3. ALL ELEVATIONS ARE REFERRED TO PLOWERS FINISHED GROUND FLOOR
4. ELEVATION ± 0.000 WHICH CORRESPONDS TO RL(+1209.0M).
5. HIGH FLOOD LEVEL RL+198.20M
6. PROPOSED RCC BOX CULVERTS SHALL BE AS PER INDIA RAILWAY STANDARD.
7. RAILWAY LAYOUT IS INDICATIVE AND THE SAME SHALL BE PROVIDED AS PER RAILWAY'S APPROVAL.
8. EXISTING FIRE STATION OF 2-x200MM UNITS SHALL BE FOR 1660MM.
9. CO-ORDINATES OF EXISTING FIRE STATION S/E1710 & N/525.6, SIZE 20.3Mx10M
10. LAYOUT/SIZE OF VARIOUS EQUIPMENTS/FACILITIES IS TENTATIVE ONLY AND SHALL BE FINALIZED DURING DETAIL ENGINEERING.

OWNER  MAHARASHTRA STATE POWER GENERATION CO. LTD.
 MAHARASHTRA
 CONSULTANT  DEVELOPMENT CONSULTANTS PVT. LTD.
 CONSULTING ENGINEERS
 VASHI, NAVI MUMBAI

JOB NO.	415	PROJECT				
STATUS	CONTRACT					
DISTRIBUTION						
			1x660 MW BHUSAWAL TPS UNIT-6			

REV	DATE	ALTD	CHD	APPD
03	16.11.19	BS	AMT	PM
1.	PLOT PLAN REVISED AS PER CUSTOMER COMMENTS DTD. 04.09.18.			
2.	DRAWING IS UPDATED IN GENERAL.			

DATE	ALTD	CHD	APPD
24.07.18	AK -sd/	AMT-sd/	PM -sd/

PLOT PLAN REVISED AS PER CUSTOMER
OBSERVATION VIDE MAIL DTD:21.06.2018

	PROJECT ENGINEERING MANAGEMENT	-	UD24 AM	-93/	130
		CHD	RP	-54/	190
title	NORDA		APFD LU	-44/	130
		PLOT PLAN			

PROGRESSIVE COPY DATED 03.01.2020C

REFERENCE DRAWINGS:

1. CUSTOMER PLOT PLAN (GENERAL LAYOUT,

2. PLOT PLAN BOUNDARY MARKING

PE-189-GA-101-REV.09
DC/253-NEW-001/REV.0
(189-MAHAGENCO-05/R0

(189-MAHAGENCO-05/RO

51.80/2020/PS-PEM-MAX

	TITLE.		SPECIFICATION NO. PE-TS-415-673-A001	
	1X660 MW BHUSAWAL THERMAL POWER STATION UNIT -6		SECTION : I	
	TECHNICAL SPECIFICATION FOR SEWAGE TREATMENT PLANT		SUB-SECTION: IB	
			REV. NO. 00	DATE :

SECTION – I
SPECIFIC TECHNICAL REQUIREMENTS
SUB-SECTION IB - Specific Technical Requirements (Electrical)

	ELECTRICAL EQUIPMENT SPECIFICATION FOR STP PLANT	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION: C
		REV NO. : 00 DATE: 12/02/2020
		SHEET: 1 OF 1

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- 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 STP PLANT SYSTEM.
- 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 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/quality assurance requirements stipulated. In line with this, the bidder shall furnish two signed and stamped copies of the following:

- a) A copy of this sheet “Electrical Equipment Specification for STP Plant Package and sheet Electrical scope between BHEL and Vendor” with bidder’s signature and company stamp.
- b) Electrical load requirement in the load data format.

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:

- a) Electrical scope between BHEL & vendor
- b) Technical specification for motors DG/BSL U-6/2011/T-1
- c) Datasheets along with Annexure-I
- d) Conduit & Pipes specification & constructional details of cables.
- e) Quality plan for motors.
- f) Electrical Load data format (Annexure –II)
- g) BHEL cable listing format (Annexure –III)

5180/2020/PS-PEM-MAX



LV MOTORS DATA SHEET-A

1X660 MW BHUSAWAL TPP

SPECIFICATION NO.

VOLUME II B

SECTION

D

REV NO. 00

DATE 12.02.2020

SHEET 1

OF 1

- | | | | |
|------|---|---|---|
| 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 $\pm$ 10% |
| b) | Rated frequency (with variation) | : | 50 Hz (+5% and -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 90 kW and upto 160kW (Breaker controlled) | : | 50 KA for 1 sec. |
| | o Below 90 kW (SFU + Contactor controlled) | : | 50 KA protected by fuse for 0.2 sec |
| f) | LV System grounding | : | Effectively grounded |
| 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) | : | 80% of rated voltage |
| 7.0 | Power cables data | : | Shall be given during Detailed engg |
| 8.0 | Earth Conductor Size & Material | : | Shall be given during Detailed engg |
| 9.0 | Space heater supply | : | 240 V, 1 ϕ , 50 Hz |
| 10.0 | Rating up to which Single phase motor | : | Acceptable below 0.20 kW |
| 11.0 | Additional tests | : | As per QP and customer motor spec |
| 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 | : | As per ANNEXURE-I |
| 14.0 | Paint shade | : | RAL 7032 |
| 15.0 | Degree of Protection of enclosure (motors): | : | INDOOR IP-55
OUTDOOR IPW-55 |
| 16.0 | Energy efficiency | : | IE3 as per IS:12615: 2011 |

❖ Also detail Customer spec. for Motors to be referred as enclosed with spec.

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1.0 <u>SCOPE</u> 1.1 This section covers the general requirements of the drive motors for power station auxiliary equipment. 1.2 Motors shall be furnished in accordance with both this general specification and the accompanying driven equipment specification. 1.3 In case of any discrepancy, the driven equipment specification shall govern etc. 2.0 <u>STANDARDS</u> 2.1 All motors shall conform to the latest applicable IS, IEC and CBIP Standards/ Publications except when otherwise stated herein or in the driven equipment specification. 2.2 Major standards, which shall be followed, are listed below other applicable Indian Standards for any component part even if not covered in the listed standards shall also be followed (a) IS-325 (b) IS-12615 (c) IEC-34 3.0 <u>SERVICE CONDITIONS</u> 3.1 The motors will be installed in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash canopy to be provided to all outdoor install motors. 3.2 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the annexure to this specification.		

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3.3	For motor installed outdoor and exposed to direct sunrays, the effect of solar heat shall be considered in the determination of the design ambient temperature	
4.0	<u>TYPE AND RATING</u>	
4.1	<u>A.C. MOTORS</u>	
4.1.1	Motors shall be general purpose, constant speed, squirrel cage, three phase, induction type.	
4.1.2	All motors shall be rated for continuous duty. They shall also be suitable for long period of inactivity.	
4.1.3	The motor name-plate rating at 50°C shall have at least 10% margin over the input power requirement of the driven HT equipment at rated duty point unless stated otherwise in driven equipment specification or in general electrical specification.	
4.1.4	The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating, pull up, break down and full load torques are available for the intended service.	
4.1.5	All LT motors used in this project are proposed to be energy efficient type suitable for EFF1 efficiency rating.	
4.1.6	The motor name plate rating shall have at least 10% margin over the input power requirement of the HT driven equipment and 15% for LT driven equipments at rated duty point.	
4.1.7	Motors located in hazardous area shall be flame proof type.	
4.2	<u>D.C. MOTORS</u>	
4.2.1	D.C. Motor provided for emergency service shall be shunt/compound wound type.	
4.2.2	Motor shall be sized for operation with fixed resistance starter for maximum reliability.	

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4.2.3	Starter panel complete with all accessories shall be included in the scope of supply.	
4.3	For equipment installed outdoor and exposed to direct sun rays, the effect of solar heat shall be considered in determining the design ambient temperature.	
5.0	<u>PERFORMANCE</u>	
5.1	<u>RUNNING REQUIREMENTS</u>	
5.1.1	Motor shall run continuously at rated output over the entire range of voltage and frequency variations as given in the annexure.	
5.1.2	The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.	
5.1.3	The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.	
5.1.4	Motor shall not be stalled if the supply voltage drops to 70% of the rated voltage for 2 seconds duration.	
5.2	<u>STARTING REQUIREMENTS</u>	
	Motor shall be designed for direct online starting at full voltage. Starting current shall not exceed 6 times full load current for all auxiliaries except boiler feed pump where the starting current shall be limited to 4.5 times. No further tolerances are applicable on starting current specified above for HT motors	
5.2.1	The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage	
5.2.2	Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminal except BFP motor. In case of BFP motor, it shall	

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be 75% rated voltage. Minimum starting requirement for mill motor (double cage) shall be 85% rated voltage at motor terminals.		
5.2.3	Motor shall be capable of three equally spread starts per hour, two starts in quick succession from cold condition and one restart from hot condition. Cranking motor shall be capable of six equally spread starts per hour, three starts in quick succession from cold condition and one restart from hot condition. The coal conveyor and crusher motors shall be suitable for 3 consecutive hot starts with maximum 20 starts per day. Pump motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with shaft rotating at 125% rated speed in reverse direction.	
5.2.4	HT pump motors shall be suitable to start with forward rotation.	
5.2.5	The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage	
5.3	<u>STRESS DURING BUS TRANSFER.</u>	
5.3.1	The motor may be subjected to sudden application of 150% rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.	
5.3.2	The motor shall be designed to withstand any torsional and/or high current stresses, which may result, without experiencing any deterioration in the normal life and performance characteristics.	
5.4	<u>LOCKED ROTOR WITHSTAND TIME</u>	
5.4.1	The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 seconds for motors up to 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time.	

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5.4.2	Starting time mentioned above is at minimum permissible voltage of 80% rated voltage.	
5.4.3	Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting utilizing motor rated capacity	
6.0	<u>SPECIFIC REQUIREMENTS</u>	
6.1	<u>ENCLOSURE</u>	
6.1.1	All indoor motor enclosures shall conform to the degree of protection IP-55 unless otherwise specified and outdoor motor enclosure shall conform to degree of IPW-55. Motor for outdoor or semi-outdoor service shall be of weather-proof construction.	
6.1.2	For hazardous area approved type of increased safety enclosure shall be furnished.	
6.2	<u>COOLING</u>	
6.2.1	The motor shall be self ventilated type, either totally enclosed fan cooled (TEFC) or closed air circuit air-cooled (CACA).	
6.2.2	In case water cooling is required for very large motors, prior approval of the customer is to be obtained before proceeding ahead with design & manufacture.	
6.3	<u>WINDING AND INSULATION</u>	
6.3.1	All insulated winding shall be of copper.	
6.3.2	All motors shall have class F insulation but limited to class B temperature rise.	
6.3.3	Windings shall be impregnated to make them non-hygroscopic and oil resistant.	

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6.4	<u>TROPICAL PROTECTION</u>	
6.4.1	All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.	
6.4.2	All fittings and hardware shall be corrosion resistant.	
6.5	<u>BEARINGS</u>	
6.5.1	Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application.	
6.5.2	Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred.	
6.5.3	Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.	
6.5.4	Sleeve bearings shall be split type, ring oiled, with permanently aligned, close running shaft sleeves.	
6.5.5	Grease lubricated bearings shall be prelubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication.	
6.5.6	Oiled bearing shall have an integral self cooled oil reservoir with oil ring inspection ports, oil sight glass with oil level marked for standstill and running conditions and oil fill and drain plugs.	
6.5.7	Forced lubricated or water cooled bearing shall not be used without prior approval of Owner.	
6.5.8	Lubricant shall not deteriorate under all service conditions. The lubricant shall be limited to normally available types with IOC equivalent.	
6.5.9	Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.	

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6.6	<u>NOISE & VIBRATION</u>	
6.6.1	The noise level shall be as per statutory acceptance (IS/IEC).	
6.6.2	The peak amplitude of the vibration shall be within IS/IEC specified limits.	
6.7	<u>MOTOR TERMINAL BOX</u>	
6.7.1	Motor terminal box shall be phase segregated (PSTB) type and located in accordance with Indian Standards clearing the motor base- plate/ foundation.	
6.7.2	Terminal box shall be capable of being turned 360 Deg. in steps of 180 Deg. For HT motors and 90 Deg. for LT motors unless otherwise approved.	
6.7.3	The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor.	
6.7.4	The terminal box shall have sufficient space inside for termination/connection of XLPE insulated armoured aluminium cables.	
6.7.5	Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame.	
6.7.6	The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.	
6.7.7	The terminal box shall be capable of withstanding maximum system fault current for duration of 0.25 sec.	
6.7.8	For 11kV and 3.3kV motor, the terminal box shall be phase-segregated type. The neutral leads shall be brought out in a separate terminal box (not necessarily phase segregated type) with shorting links for star connection.	
6.7.9	Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used.	
6.7.10	The gland plate for single core cable shall be non-magnetic type.	

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6.7.11 Due to any reason, if the terminal box is found to be not suitable for the approved cable size for either HT/LT motors, then the bidder shall arrange necessary adopter box to facilitate the termination of cables. The adopter box shall be of the same short circuit rating and specifications as the main terminal box. The adopter box shall be located as near as possible to the main terminal box. The interconnecting cabling between adopter box and main terminal box along with providing suitable cable glands and termination kits as applicable shall also be done by the bidder. 6.8 <u>GROUNDING</u> 6.8.1 The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GS bolts and washer 6.8.2 The grounding connection shall be suitable for accommodation of ground conductors as follows : Motor above 90 kW : 75 x 10 mm GS Flat Motor above 30 kW up to 90 kW : 50 x 6 mm GS Flat Motor above 5 kW up to 30 kW : 25 x 6 mm GS Flat Motor up to 5 kW : 8 SWG GS Wire 6.8.3 The cable terminal box shall have a separate grounding pad 6.9 <u>RATING PLATE</u> In addition to the minimum information required by IS, the following information shall be shown on motor rating plate: (a) Temperature rise in Deg.C under rated condition and method of measurement. (b) Degree of protection.		

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(c) Bearing identification no. and recommended lubricant. (d) Location of insulated bearings. 6.10 <u>CONSTRUCTION</u> 6.10.1 Stator Core The Stator Core Lamination shall be made of high-grade silicon/magnetic steel sheet varnished on both sides and pressed to form rigid core. 6.10.2 Rotor The rotor construction shall be such that in case of dislodging of the rotor bar from the end ring, it should not come out and hit the stator core/stator winding and damage. 7.0 <u>ACCESSORIES</u> 7.1 <u>GENERAL</u> Accessories shall be furnished, as listed below, or if otherwise required by driven equipment specification or application 7.2 <u>SPACE HEATER</u> 7.2.1 Motor of rating 30 kW and above shall be provided with space heaters, suitably located for easy removal or replacement. 7.2.2 The space heater shall be rated 240 V, 1 phase 50 Hz and sized to maintain the motor internal temperature above dew point when the motor is idle. 7.3 <u>TEMPERATURE DETECTORS</u> 7.3.1 All 11kV and 3.3kV motors shall be provided with twelve (12) nos. Simplex type winding temperature detectors, four (4) nos. per phase.		

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7.3.2	11kV and 3.3kV motor bearing shall be provided with duplex type temperature detectors.	
7.3.3	The temperature detector mentioned above shall be resistance type, 3 wire, platinum wound, 100 Ohms at 0°C.	
7.3.4	Leads of all simplex type motor winding RTDS and motor bearing RTDS shall be wired up to respective switchgear metering & protection compartment. From which one set of RTDS will be connected to numerical protection relay and another set shall be kept free for DCS connectivity.	
7.3.5	Five numbers of Temperature detectors / thermistors shall be provided for L.T. Motors above 90 kW (3 nos. Winding temperatures & 2 nos. bearing temperatures).	
7.4	<u>INDICATOR/SWITCH</u>	
7.4.1	Dial type local indicator with alarm contacts shall be provided for the following :	
	(a) 11kV and 3.3kV motor bearing temperature	
	(b) Hot and cold air temperature of the closed air circuit for CACA and CACW motor	
7.4.2	Flow switches shall be provided for monitoring cooling water flow of CACW motor and oil flow of forced lubrication bearing, if used.	
7.4.3	Alarm switch contact rating shall be minimum 0.5 A at 220V D.C. and 5A at 240V A.C.	
7.5	<u>CURRENT TRANSFORMER FOR DIFFERENTIAL PROTECTION</u>	
7.5.1	Motor 1000 KW and above shall be provided with three differential current transformers mounted over the neutral leads within the enclosure. Loose 3 nos. CT for mounting on switchgear side shall be in bidder's scope.	

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7.5.2	The arrangement shall be such as to permit easy access for C.T. testing and replacement. Current transformer characteristics shall match Owner's requirements to be intimated later.	
7.6	<u>ACCESSORY TERMINAL BOX</u>	
7.6.1	All accessory equipment such as space heater, temperature detector, current transformers etc., shall be wired to and terminated in terminal boxes, separate from and independent of motor (power) terminal box.	
7.6.2	Accessory terminal box shall be complete with double compression brass glands and pressure type terminals to suit cable connections.	
7.7	<u>DRAIN PLUG</u>	
	Motor shall have drain plugs so located that they will drain the water, resulting from the condensation or other causes from all pockets of the motor casing.	
7.8	<u>LIFTING PROVISIONS</u>	
	Motor weighing 25 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.	
7.9	<u>DOWEL PINS</u>	
	The motor shall be designed to permit easy access for drilling holes through motor feet or mounting flange for installation of dowel pins after assembling the motor and driven equipment.	
7.10	<u>PAINTING</u>	
	Motor including fan shall be painted with corrosion proof paints of colour shade (RAL-7032).	
8.0	<u>TESTS</u>	
8.1	<u>ROUTINE AND TYPE TEST:</u>	

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Tests are to be conducted for HT and LT motors 60kW and above in presence of Mahagenco representative and contractor as per IS: 325 and required copies of test certificates are to be furnished for approval and despatch clearance. In addition, following tests shall have to be carried out on the motors in presence of MAHAGENCO representative & contractor on LT & HT motors. For Motors below 60kW type and routine test conducted as per IS325 shall be witnessed by contractor and test certificate shall be submitted for review of Mahagenco & Dispatch clearance								
8.1.1 <u>FOR HT MOTORS:</u> (a) Impulse test by 1.2 / 50 micro sec. On sample coil of Stator winding insulation as type test as per IEC-671/IS 14422,1995 test voltages as under <table><tr><td>Voltage rating of motor</td><td>Impulse Test Voltage</td></tr><tr><td>3.3 kV</td><td>: 18 kV peak</td></tr><tr><td>11 kV</td><td>: 49 kV peak</td></tr></table> (b) Tan delta, charging current and dielectric loss measurements on each phase of motor stator winding as routine test (c) Polarization Index Test as per IS:7816 as routine test (d) Tan delta measurement on coils (e) Surge withstand test for inter turn insulation. (f) Test to diagnose rotor bar failure during manufacture. Tests indicated at (d), (e), (f) shall be carried out during manufacture of the coils and shall be furnished for verification .			Voltage rating of motor	Impulse Test Voltage	3.3 kV	: 18 kV peak	11 kV	: 49 kV peak
Voltage rating of motor	Impulse Test Voltage							
3.3 kV	: 18 kV peak							
11 kV	: 49 kV peak							
8.1.2 <u>FOR HT & LT MOTORS:</u> (a) Test for suitability of IP55/ IPW– 55 as per IS 4691 as type test. Type test certificate for first numeral shall be acceptable in lieu to test,								

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provided the test motor is identical to motor being supplied. Second numeral test shall be carried out on one motor of each type and rating. (b) Fault Withstand Test for main terminal box as type test. Type test certificate shall be acceptable, if the test is conducted on exactly identical terminal box within last three years. (c) Test for noise level as routine test. (d) Test for vibration as routine test. (e) Overspeed test as type test. 8.2 <u>TEST WITNESS:</u> Test shall be performed in presence of Owner/Purchaser's representative so desired by the Owner/Purchaser. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.		

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<u>AC & DC MOTOR</u>			
SR. NO.	ITEM	UNIT	
1.0	<u>AUXILIARY POWER SUPPLY</u>		
1.1	<u>H.T. SUPPLY</u>		
	11kV, 3Ø, 3W, 50 Hz non-effectively earthed		Motors rated 1000 kW and above
	Fault level 44 kA symm		
	3.3kV, 3Ø, 3W, 50 Hz, non-effectively earthed		Motors above 160 kW and below 1000kW
	Fault level 40 kA symm		
1.2	<u>L.T. SUPPLY</u>		
	415V, 3Ø, 3W, 50 Hz effectively earthed		Motors below and including 160kW
	Fault level 50 kA symm		
	240V, 1Ø, 2W, 50 Hz effectively earthed		Lighting, space heating, A.C. control & protective devices
1.3	<u>D.C. SUPPLY</u>		
	220V, 2W, unearthed		D.C. alarm, control & protective devices
	Fault level 25* kA.		
	Indicative only, the actual value will be decided by the Bidder, after substantiating the same by calculation		
2.0	<u>RANGE OF VARIATION</u>		

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SR. NO.	ITEM	UNIT	
2.1	<u>A.C. SUPPLY:</u>		
	Voltage		± 10%
	Frequency		± 5%
	Combined Voltage & frequency		± 10% (absolute sum)
	During starting of large motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance		
2.2	<u>D.C. SUPPLY</u>		
	Voltage		198 to 240 Volt

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ANNEXURE III

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ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR**PACKAGE: ST PLANT****SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT****PROJECT: 1 X 660MW BHUSAWAL TPP**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	1. 415 V AC (3 Phase, 4 Wire) /240 V AC supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor. 2. Interposing relays (RE 302 of Jyoti make or equivalent), if required for PLC and microprocessor based systems, shall be provided by BHEL in MCCs. Requirement of these relays shall be furnished by vendor during detailed engineering stage.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL BHEL BHEL	BHEL Vendor BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Junction box for control & instrumentation cable	Vendor	Vendor	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc.	Vendor	Vendor	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
6	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
7	Cable glands ,lugs and bimetallic strip for equipment supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
8	Conduit and conduit accessories for cabling between equipments supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR**PACKAGE: ST PLANT****SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT****PROJECT: 1 X 660MW BHUSAWAL TPP**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
10	Equipment grounding & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
15	Any other equipment/material/service required for completeness of system but not specified above (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable (excluding power cables) in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Electrical Equipment & cable tray layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish Electrical equipment layout & cable tray layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Cabling arrangement of the same (wherever overhead cable trays, trenches, cable ducts, conduits etc.) shall be decided during contract stage. Electrical equipment layout & cable tray layout drawing shall be subjected to BHEL/ customer approval without any commercial implications to BHEL.
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. In case the requirement of Junction Box arises on account of Power Cable size mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.
4. Vendor shall indicate location of Electronic Earth pit in their Civil assignment drawing.

REV: 00 DATE:

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

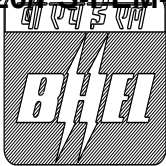
PACKAGE: ELECTRIC HOIST FOR STP

PROJECT 1X660 MW BHUSAWAL TPS UNIT-6

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

<u>S. NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	Isolating Switch	Vendor	Vendor	BHEL will provide one number 415 V(3ph, 3W) supply feeder only up to isolating switches for cranes. Any other voltage level (AC/DC) required will be derived by the vendor. Motor starter shall be part of crane control panel.
2	Power cables, control cables, screened control cables and any special cables (if required) between equipment supplied by vendor.	Vendor	Vendor	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	Vendor	
4	Equipment Earthing	Vendor	Vendor	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	Vendor	
6	Cable glands and lugs for equipment supplied by vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned 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	- - -	Cable listing for Control and Instrumentation Cable in 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.

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	TITLE: 1X660 MW BHUSAWAL THERMAL POWER STATION UNIT -6	SPECIFICATION NO. PE-TS-415-673- A001	
		SECTION : I	
	TECHNICAL SPECIFICATION FOR SEWAGE TREATMENT PLANT	SUB-SECTION: IC	
		REV. NO. 00	DATE :

SECTION – I
SPECIFIC TECHNICAL REQUIREMENTS
SUB-SECTION IC - Specific Technical Requirements (C&I)

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION: C&I
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
GENERAL REQUIREMENT 1.0 Bidder shall provide complete and independent control & instrumentation system with all accessories, auxiliaries and associated equipment for the safe, efficient and reliable operation of auxiliary systems. 2.0. The quantity of instruments for auxiliary system shall be as per tender P & ID, wherever provided, for the respective system as a minimum for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P&ID. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any price implication. 3.0 Measuring instruments/equipment and subsystems offered by the bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Further all the instruments shall be of proven reliability, accuracy, and acceptable international standards and shall be subject to employer's approval. All instrumentation equipment and accessories under this specification shall be furnished as per technical specification, ranges, makes/ numbers as approved by the employer' during detail engineering. 4.0 The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold and all the other accessories required for mounting/ erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments; sensors, switches etc. for external connection including spare contacts shall be wired out to suitably located junction boxes. 5.0 In case of any contradiction most stringent clause/condition shall prevail.		

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION: C&I
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
SPECIFIC TECHNICAL REQUIREMENTS (C&I): 1) The control of STP shall be through DCS based control system (in BHEL scope). The operation and control philosophy of STP has been elaborated in separate section in the specification. The DCS panel along with OWS, EWS, printers (in BHEL scope) shall be located in Local Control Room. 2) Bidder shall provide Local control panel at different locations for above said system. This local panel shall comprise of lamps, 'START' push button, 'STOP' push button along with 'ON/OFF/TRIP' indication, local/remote indication & Local annunciation for local operation. The pumps, motorized valves, control valves etc. shall be operated from Lamp /Pushbuttons, selector switches etc. located on the Local Control panel. Integral type hardware annunciation system shall be provided at the top of the panel for alarm monitoring. Bidder to provide oil tank, pump, Sump etc. level, pressure, temperature indications on the Local Control Panel. 3) All electrical actuators shall be integral type. 4) The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements (to be decided by BHEL/customer) among them are to be complied with. 5) The solenoid valves shall have limit switches for open/close feedback. 6) Interface of MCC, HT SWGR, Actuators, solenoid drives, control valves etc. with DCS based control system shall be as per Drive Control Philosophy attached in the specification. 7) All the instruments/drives shall be terminated on JBs/Panels in field. JBs/Panels shall be in Bidder's scope. No. of junction boxes shall be sufficient and positioned in the field to minimize (max 12-15 meter) local cabling and trunk cable. 8) RTD's shall be of duplex type. Both the elements of duplex temperature sensors shall be terminated to junction boxes. Temperature measurement shall have upscale / down scale drive to protect from process upset in case of sensor failure.		

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION: C&I
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
9) Each pneumatic device requiring air supply and intended for field mounting shall include a filter regulator air set with gauge, to owner's approval. 10) Primary sensor redundancy for Control/measurement shall be decided as per following general criteria: - Critical controls and respective measurements- Triple redundant. - Non-critical but important control & measurements- Dual redundant. - Only measurement- No redundancy. 11) Scope of Instrumentation cables (Screened Control Cables), shall be as per Electrical Cable scope matrix in Electrical portion of specification. Any cable in Bidder's scope shall be as per specification. Fiber optic cables are excluded from bidder's scope. 12) Redundant 230 VAC UPS feeders shall be provided by BHEL at a single point. Further distribution to various instruments/analyzers/local panel etc. shall be in Bidder's scope. Bidder to include necessary power distribution board (ACDB) (as per details attached elsewhere in this specification) in his scope. Any power supply other than the above, if required by any instrument/device, has to be derived by the Bidder from the above supply and all necessary hardware for the same shall be in bidder's scope. Bidder to furnish UPS power requirement along with the bid. 13) Bidder to furnish electrical load/UPS load data during detailed engineering 14) All cables terminated in the terminal block, power distribution scheme instruments shall be ferruled. Ferruling shall be double cross ferruling (i.e.) source and destination addresses shall be marked on both sides of the tube ferruling 15) Bidder to comply with codes and standards as mentioned in the specification. 16) Instrument installation shall be as per the attached "Standard Hook-up diagram of instrument." 17) Bidder shall provide erection hardware as per installation drawings. 18) Bidder to provide mandatory spares as per mandatory spares list attached elsewhere in specification. 19) Bidder to perform tests of C&I items/instruments/systems as per Quality plans/type test attached in the specification.		

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION: C&I
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
20) All local gauges, transmitters and switches shall be mounted on suitable enclosures, racks subject to owner's approval. All transmitters shall be HART compatible. 21) All weather canopy is to be provided for instruments in open to protect the instrument/electronics from rain/ sunlight etc. 22) All field instruments enclosure shall be IP65 local panel/cabinet enclosure shall be IP 55, unless otherwise specified. 23) Diaphragm seal shall be provided with Instruments having contact with corrosive media. 24) Analysers such as Sodium Analyser and Silica Analyser, etc if applicable, shall be Multi Channel Type. 25) Bidder to delegate /depute their persons/experts as per BHEL/owner/consultants' requirement without any additional cost at site during commissioning. 26) Bidder must offer general tools and tackles and special calibration instruments required during start-up, trial run, operation and maintenance of the system. 27) The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL. 28) Any part/module of the C&I system which are not listed under recommended spares shall be deemed as having life expectancy not less than the expected life of the plant i.e. 30 years. 29) Instrument ranges shall be selected to have the normal reading, preferably between 50% and 70% of full scale for linear parameters and 70% to 80% for flow measurements. Deviation indicators shall have the null position at mid-scale. The normal operating parameter shall be identified with a clear green mark. 30) Important signals to be identified during detailed engineering and same shall be hardwired to DM plant control room. 31) Bidder's presence is required for 3 Man days (Excluding travel time) at EDN Bangalore during FAT of DDCMIS for certifying correctness & completeness of implementation of Control logic. Intimation to be attained		

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	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION: C&I
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
FAT shall be informed in 2 days' advance. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope. 32) The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL.		

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