

AIR COOLED CONDENSER PACKAGE

				नाम NAME	नामांक एवं हस्ताक्षर SIGNATURE & DATE
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समर्पण सूची संख्या को अधिकृतित करता है		PRODUCT PURCHASE SPECIFICATION	
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स्वाधिकार एवं गोपनीय इस प्रलेख में दी गई सुचना भारत हेतु एलेक्ट्रिकल की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी को सरुह प्रयोग, ओ कि सम्पत्ति के हित में हानिकारक हो न किया जाय ।			
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समर्पण सूची संख्या INVENTORY NO.		समर्पण सूची संख्या INVENTORY NO.	
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सामग्री सूची संख्या को INVENTORY NO.	Technical Specification Air Cooled Condenser (ACC) Package				
सामग्री सूची संख्या को INVENTORY NO.	I. Intent of Specification Bidder shall be responsible for providing the complete engineering, design, drawings, supply of all material equipment, fabrication, assembly, pre-shipment testing at manufacturer's works, proper packing for transportation, delivery at plant site, supervision of unloading & storage, supervision of erection and commissioning and complete performance testing as specified / or otherwise which are required to complete the job under these specifications. If BHEL find during the discussions that the package offered is not absolutely complete and not in line with their requirement as specified by them, the bidder shall agree to comply with the requirement of BHEL without any extra commercial implication and completion schedule. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. I.1 Scope of The Proposal The scope of the proposal for Air Cooled Condenser package for Patratu 3X800MW Project shall completely cover the following activities and services in respect of all the equipment(s) specified and covered under the specifications including handing over to the owner a complete Air Cooled Condenser. - Detailed design and engineering of all the equipment and systems - Complete manufacture including shop testing of bidders scope of supply items. - All equipment modules shall be complete with all necessary interconnecting pipe work, valves, instruments and electrical wiring for control. The components of the package shall be arranged in a compact and orderly manner to ensure good access for operation, maintenance and repair. Piping interfaces shall terminate at with a pipe flange. - Supervision of Erection and commissioning of complete ACC (only for unit 1). Supervision may be taken for Unit 2 & 3 based on daily basis as optional, if required. - Project activities scheduling, monthly progress report. - Quality assurance planning, control and documentation. - Providing engineering data, drawings (including Auto-CAD), equipment sizing, thermal, mechanical, hydraulic calculations and performance data, specification, instruction manual, as-built drawings, erection and commissioning drawings - documents, civil assignment drawings, layout drawings - documents, O & M manuals etc. for Purchaser's / Owner's approval. Bidder shall provide complete civil design and documents for BHEL / NTPC review and approval. - Seaworthy Packing and transportation - Bidder to note that supporting structure of ACC shall be RCC only. - Reliability tests and performance and guarantee tests including the tests for performance demonstration after successful completion of trial operation; - Furnishing of spares				
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SUPERSEDES INVENTORY NO. सामग्री सूची संख्या को प्रतिस्थापित करता है		xii. Satisfactory conclusion of the Contract xiii. Other services: a. 3-D model of complete package together with all necessary piping, valves, fittings, supports, pumps and drives etc. b. First fill of all lubricants, servo-fluids and chemicals. The consumption during the trial operation and final filling/topping up after the trial operation shall also be included in the bidder's scope. c. Two set of all special tools and tackles for maintenance of all the equipment/system. d. Necessary paints, primers and painting of all equipment for the protection and color codes for identification as specified elsewhere in the specification. e. Type tests as per specification. f. Training of BHEL personals and Owner's personnel / Customer as per requirement specified. g. Learning module as per the requirement specified.					
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company		Notes: i. In the specification Owner/ Engineer/ Customer referred is M/s NTPC, Purchaser / Employer referred is M/s BHEL, and Contractor/Supplier/Vendor referred is Bidder. The Bidder shall be responsible for providing all material, equipment and services, specified or otherwise which are required to complete the project and fulfill the intent of ensuring operability, maintainability and the reliability of the complete work covered under this specification. It is not the intent to specify completely herein, all aspects of design and construction equipment. Nevertheless, the equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation, in a manner acceptable to Purchaser/Owner. ii. All concrete work, electrical, Air conditioning and ventilation, Staircase, Passenger Elevators and Firefighting system are excluded from scope of work. These are in BHEL scope. Interface between Bidders supply & BHEL scope issues shall be resolved during detail engineering. iii. 2 no. elevators for erection purpose for 3 units as per specification are in bidder scope of supplies. Erection and commissioning of this elevator is in bidder scope. iv. The requirement mentioned in this specification is minimum, for completeness, bidder shall be responsible to meet the requirements specified in referred specifications/ standards. v. Complete design of steam ducts , all pipings are in Bidders scope as specified in annexure IV.1-1 however, Manufacturing and supply of steam ducts and piping are in BHEL scope of supply .Bidder to furnish the detailed manufacturing drawings including					
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SUPERSEDES INVENTORY NO.		II. Project Information					
समर्पित सूची संख्या को अधिकृत करता है		i. Location and Approach, Meteorological Data etc as per Annexure-II-1 ii. Plant Configuration (a) LP Turbine shall be one exhaust casing with single flow to ACC. (b) For normal make up to the power cycle, DM water shall be added in the condensate storage tank through the cycle makeup control station. The makeup station shall have suitable control valves for normal and emergency makeup with required isolation and motorized bypass valves. The Cycle makeup pumps shall supply the makeup water. (c) The condensate to regenerative cycle shall be through Condensate Extraction Pump (CEP) discharge at specified flow and pressure value. Recirculation line for CEP and its control shall be done through DCS and provision of connection in condensate tank shall be provided. (d) Cooling water for heat exchanger of Air Evacuation system shall be provided. Cooling water temperature is specified in the specification. Bidder to indicate the cooling water flow required. (e) Instrument Air line for instruments shall be provided. The air flow value required by Bidder has to be as specified. (f) There shall be 2 nos of LP exhaust opening and 2 nos of auxiliary turbine exhaust opening for sizing of the air evacuation system . (g) For Air evacuation pump selection, volume other than ACC shall be considered as 2200m3					
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स्वत्वाधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी एलेक्ट्रिकल लि. की सम्पत्ति है। इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, ओर कि सम्पत्ति के हित में हानिकारक हो न किया जाए।							
दिनांक एवं हस्ताक्षर SIGN & DATE		i. The Performance / Acceptance test shall be carried out as per the agreed procedure. The PG test procedure including demonstration tests shall be submitted within 90 days of the date of Notification of Award and finalization of the PG test procedure shall be done within 180 days from the date of Notification of Award. After the conductance of Performance test, the contractor shall submit the test evaluation report of Performance test results to Employer promptly but not later than one month from the date of conductance of Performance test. However, preliminary test reports shall be submitted to the Employer after completing each test run. The PG test procedures shall be submitted for equipment / system & subsystem under Contractor's scope for all Guarantees under category I, II & III as mentioned below, as per latest International codes / standard including correction curves, meeting the specification requirements along with sample calculations & detailed activity plan of preparation (including test instrumentation), conductance and evaluation of Guarantees. j. The contractor shall submit for Employer's approval the detailed Performance Test procedure containing the following: i. Object of the test. ii. Various guaranteed parameters & tests as per contract. iii. Method of conductance of test and test code. iv. Duration of test, frequency of readings & number of test runs. v. Method of calculation. vi. Correction curves. vii. Instrument list consisting of range, accuracy, least count, and location of instruments. viii. Scheme showing measurement points. ix. Sample calculation. x. Acceptance criteria. xi. Any other information required for conducting the test. k. In case during performance guarantee tests it is found that the equipment/system has failed to meet the guarantees, the Contractor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the Employer and re-conduct the performance guarantee test(s) with Employer's consent. However, if the specified performance guarantee(s) are still not met but are achieved within the Acceptable Shortfall Limit specified at clause III.2 of this subsection, Employer will accept the equipment/system/plant after levying liquidated damages as per clause III.2 of this sub-section. If, however, the demonstrated guarantee(s) continue to be more than the stipulated Acceptable Shortfall Limit, even after the above modifications/replacements within ninety (90) days or a reasonable period allowed by the Employer, after the tests have been completed, the Employer will have the right to either of the following:					
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समग्री सूची संख्या को अधिकृत करता है		III.1.2 Performance Guarantee Tests : a. Cat-1 i) ACC should be designed for guaranteed back pressure of 160 mmHg (abs) (parameters as per annexure IV.3-1) with 5% margin on design steam flow measured at 300 mm downstream of 1st welding joint of turbine exhaust at Hotbox at valve wide open (VWO) 3 % make-up (MU) Condition considering pressure drop in Hot Box / ETD as per clause IV.3.5. ii) Guaranteed Power consumption of all unit Auxiliaries required for continuous unit operation measured at motor terminal at the condition i) above. b. Cat-2 Not Applicable. c. Cat-3: i) Noise level shall not exceed 85 dBA at distance of 1.0 m horizontally from the nearest surface of any equipment / machine and at a height of 1.5 M above the floor level elevation. Noise measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with a calibrated integrating sound level meter meeting the requirement of IEC 61672-1 and IEC 61672-2 (latest edition). Minimum 6 points around each equipment shall be covered for measurement. Additional measurement points shall be considered based on the applicable standards and the size of the equipment. The measurement shall be done with slow response on the A - weighting scale. The average of A-weighted sound pressure level measurements expressed in decibels to a reference of 0.0002 micro bar shall not exceed the guaranteed value. Corrections for background noise shall be considered in line with the applicable standards. All the necessary data for determining these corrections, in line with the applicable standards, shall be collected during the tests. ii) BHEL and Bidder to jointly demonstrate to NTPC that Air Leakage to ACC shall not exceed 50% of design value taken for sizing of Vacuum Pumps. iii) Design of air Cooling Section to cool Air and Vapour mixture to at least 4.17 deg C below saturation temperature corresponding to Suction Pressure. Correction curves for establishing the capacity at site conditions shall also be furnished. iv) The capacity of each vacuum pump in free dry air under standard conditions at a condenser pressure of 25.4 mm Hg (abs) and sub cooled to 4.17 deg.C below			
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समय सीमा अधिकारिता		III.2 Liquidity Damages:															
समय सीमा अधिकारिता		<table><tr><th>PARAMETER</th><th>Rate of Liquidity Damage</th><th>Acceptable Short Fall with LD</th></tr><tr><td>1.For Deficiency in Condenser Back Pressure 160 mmHg abs, (in case actual pressure drop inside hot box is different from the value provided by BHEL, suitable correction shall be applicable.) at condition mentioned at clause III.1.2 sl.no. (a)(i).</td><td>\$ 375,632 per 1 mm Hg increase in Condenser Pressure</td><td>(+) 2.5% of 160 mm Hg condenser pressure</td></tr><tr><td>2.For increase in guaranteed auxiliary power consumption for unit auxiliaries as per clause III.1.2 sl.no. (a)(i) & ii)</td><td>US \$ 3,025 /- (US Dollar Three Thousand Twenty Five only) per 1 KW increase in Auxiliary power consumption</td><td>(+)1% of the guaranteed value.</td></tr></table>				PARAMETER	Rate of Liquidity Damage	Acceptable Short Fall with LD	1.For Deficiency in Condenser Back Pressure 160 mmHg abs, (in case actual pressure drop inside hot box is different from the value provided by BHEL, suitable correction shall be applicable.) at condition mentioned at clause III.1.2 sl.no. (a)(i).	\$ 375,632 per 1 mm Hg increase in Condenser Pressure	(+) 2.5% of 160 mm Hg condenser pressure	2.For increase in guaranteed auxiliary power consumption for unit auxiliaries as per clause III.1.2 sl.no. (a)(i) & ii)	US \$ 3,025 /- (US Dollar Three Thousand Twenty Five only) per 1 KW increase in Auxiliary power consumption	(+)1% of the guaranteed value.			
PARAMETER	Rate of Liquidity Damage	Acceptable Short Fall with LD															
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2.For increase in guaranteed auxiliary power consumption for unit auxiliaries as per clause III.1.2 sl.no. (a)(i) & ii)	US \$ 3,025 /- (US Dollar Three Thousand Twenty Five only) per 1 KW increase in Auxiliary power consumption	(+)1% of the guaranteed value.															
समय सीमा अधिकारिता		GUARANTEED AUXILIARY POWER CONSUMPTION The total guaranteed auxiliary power consumption (Pau) at condition mentioned at clause III.1.2 sl.no. (a)(i). is to be calculated as below: Pau = Sum (Pu) Pau = Guaranteed ACC Auxiliary Power Consumption. Pu = Power consumed by each auxiliary of the ACC under test. The power consumed by each auxiliary shall be measured at the motor terminal end. Bidder shall provide the suitable power meter at the time of the test. While guaranteeing the auxiliary power consumption the bidder shall necessarily include all continuously operating unit auxiliaries. The auxiliaries to be considered shall include but not limited to the following: a) Motor for ACC fans b) Drain Pumps c) Vacuum Pump motors (holding) d) Other equipment which are deemed to be seen as consuming electricity. Bidder to furnish the value for each auxiliary in the total guaranteed auxiliary power consumption value.															
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III.2.1 Performance Guarantee Acceptance Test:

Condenser back pressure Acceptance Test shall be carried out as per ASME PTC 30.1.

Corrections available for Condenser Back pressure:

- Correction for variation of Ambient Air Temperature.
- Correction for variation in Wind speed.
- Correction for Heat Load.

During PG test the base value for correction in steam flow / Heat Load shall be based on value calculated by adding 5% margin on design steam flow.

TEST REPORTS

The Contractor shall prepare test reports in which the methods followed, instrument readings, graphs, observations, final results obtained, etc. shall be recorded.

Four (4) hard copies and 2 soft copies on CD –ROM of each test report shall be submitted to Employer for Approval. Formats for functional guarantee test as per Annexure-III-1 to be submitted by Bidder along with commercial offer.

Test Interruptions

In the event of a test interruption resulting from an Event of Force Majeure or Employer- Caused-Delay, the interrupted Performance Test must be started again and test data that were collected during the interrupted test must be ignored.

Performance Guarantee/ Acceptance Tests on the equipment's / systems not covered in this Sub-section shall be carried out as per the procedure/ test codes/ specified in respective detailed specifications/ Sub-sections.

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समय सीमा एवं मूल्यांकन SIGN & DATE		IV. MECHANICAL IV.1 Scope of supplies Scope of supplies for mechanical equipment(s): Broad Scope of supplies, erection and commissioning of various equipment forming mechanical system shall be as per attached ANNEXURE-IV.1-1. Vendor to furnish the signed and stamped copy of same along with the bid. All equipment(s) in bidder's scope shall be complete in all respects with all applicable and necessary accessories such as: i. Anchor/ foundation bolts. ii. Base plates/frames. iii. Supporting steel work. iv. Enclosure/weather canopies, required for outdoor installed equipment details to be given along with offer. v. Integral galleries, walkways, ladders/stairs and platforms including interconnecting platforms required for access during erection, operation and maintenance for all equipment, piping, valves etc. covered in the scope. vi. Hand rails, kick plates, gratings. vii. Integral hangers and supports for piping, cable trays etc. viii. Integral piping and headers. ix. Isolating, check and regulating valves and their actuators. x. Safety and relief valves with silencers. xi. Bearing, gearing, couplings, belt drives. xii. All fittings, hardware and fasteners. xiii. Drive motors and integral electrical system. xiv. Cable racks, trays, support for the complete system as per relevant project specification. xv. Sampling probes and connectors. xvi. Integral control and instrumentation. xvii. Lubricating and cooling system, if required. - xviii. Expansion and maintenance joints. xix. Inspection ports, manholes. xx. Gaskets, glands, sealing arrangements etc. xxi. Integral ducting and dampers. xxii. Filling connections and cleaning lines. - xxiii. Protective covers and guards. xxiv. Danger boards and signs. xxv. Name plates, rating plates and labels. xxvi. Counter flanges, Nuts, Bolts, Gaskets, Washers etc. - xxvii. Pipe trestles, racks, sleepers as per requirements - xxviii. Handling and lifting requirements for maintenance of the equipment(s) installed. xxix. Erection elevator.			
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समर्पित सूची संख्या INVENTORY NO.		IV.2.3Tube Bundles i. Bundles: A bundle shall consist of multiple finned tubes (Single row type only) welded into the tube sheets at either end. The finned tubes shall be arranged in a sloping A-frame type installation, from the main steam header to the condensate collection system. There are two types of bundles: first and second stage condensing bundles as per HEI. ii. First Stage Bundle - These bundles are to be connected to the steam header at the top and condensate header at the bottom. Condensate is also collected within the condensate header and drained. The first stage bundles typically condense 60-90% of the total steam through the ACC. iii. Second Stage Bundle - The second stage bundles condense the remaining steam and collect non-condensable gases. Non-condensable gases are to be extracted by the air removal system. 10-40% of total area provided shall be provided for second stage bundle. IV.2.4Fan, Motor and Gear Box This equipment includes the complete fan assemblies, comprised of blades, hub, and seal disks to provide optimum efficiencies over the expected range of ambient temperatures and fan speed modulation. Fan systems shall be equipped with inlet bell rings to improve the entering airflow characteristics upstream of the fan. Wind wall to avoid air –recirculation shall be provided all round at fan deck. Fan bell shall be designed to cater higher cross wind speeds. Gearboxes shall be designed for continuous service. Axial flow fans, installed at ACC deck level shall be driven by single speed electric motors along with coupling, coupling guard and complete lubricating oil system. Suitable arrangement shall be provided to improve the entering airflow characteristics upstream of the fan. Each fan or gearbox shall be fitted with vibration detection devices (vibration transmitter) arranged to trip the fan due to high vibration. Each fan and gearbox assembly shall be fitted with devices to prevent reverse rotation, if applicable. Selection of fans and speed reducer shall be as per HEI. IV.2.5Semi-Automatic Tube cleaning system Fin tube cleaning system of semi-automatic type as per HEI is to be provided. The fin tube bundles shall be cleaned using high pressure water. IV.2.6Condensate Extraction pumps, Recirculation valve and Piping (Not included in the scope of supply of Bidder) 3 x 50% capacity motor driven condensate extraction pumps for each unit along with all accessories, drives, suction strainers, associated piping, and valves, flow elements with flow			
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समय सीमा संचालन को अधिकृत करता है		transmitter and indicators, instrumentation and control etc. Including one number canister drainage pump per station shall be provided. It will be located away from the condensate storage tank (CST) of ACC.		Page 17 of 124	
समय सीमा संचालन को अधिकृत करता है		IV.2.7 DM Make-up lines with control valve and piping. (Not in Bidder's scope) DM water Make-up lines along with control valve and piping shall be in BHEL scope. IV.2.8 Air Evacuation system Each unit shall consist of 2x100% vacuum pumps(minimum 40SCFM, 68m3/hr capacity) for holding operation with all accessories and instrumentation for condenser air evacuation. One (01) or two (02) start up hogging vacuum pump per unit with capacity not be less than 1050scfm (1784 cu.m per hour) under standard conditions i.e. 760 mm of Hg (abs) and 21.1 deg C at 10 inch (254 mm) of Hg (abs) shall be provided. All three /four pumps running together should be able to bring condenser pressure from atmospheric pressure to 10 inch of Hg (abs) within 30 minutes. Handling arrangement for pumps as specified in the specification shall be provided by Bidder. IV.2.9 Access Walkways, ladders / stairs and platforms including interconnecting platforms required for access for all equipment, piping, valves etc. for area marked shall be supplied by successful bidder IV.2.10 Handling systems All systems required to remove, convey across the ACC, lower to grade, and replace/maintain mechanical equipment fall into the general category of hoists, davits, and monorails. Such equipment will be permanently mounted, with removable panels at intermediate and end walls to convey equipment through and out of the ACC. IV.2.11 Mandatory spares IV.2.12 Start up and commissioning spares as per requirements Bidder shall supply all start up and commissioning spares required for initial operation till the equipment is declared by the Owner as having satisfactorily completed the trial operation. The scope shall minimum include the following commissioning spares as below - Sufficient quantity of gasket, O rings, seals and other soft parts - One set of calibrated pressure gauge, temperature gauge - One set of coupling for pump motor (each type) - One set of filter elements - Test rig for resetting of relief valve, pressure gauge, temperature gauge etc. at site			
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SUPERSEDES INVENTORY NO.	IV.2.20 Drawings and documentation Drawings and documentation including Erection drawings, civil assignment drawings, erection and commissioning instructions, operation and maintenance manual etc.			
सामग्री सूची संख्या को अधिकतम करता है	IV.3 Design Criteria for Air Cooled Condenser			
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company	IV.3.1 The Air Cooled Condenser shall be designed to achieve Condenser Pressure of 160 mm Hg (abs) measured at 300mm downstream of 1st welding joint of turbine exhaust at Hotbox under Valve wide open (VWO) 3% make up (MU) condition (design parameters as per Annexure IV.3-1) with 5% margin on design steam flow at ambient air temperature of 38°C considering pressure drop in Hot Box / ETD as per clause IV.3.5. The Air cooled condenser (ACC) shall be designed, manufactured and tested to requirements of the HEI for Air Cooled Condenser, ASME VIII Div-1, TEMA and to standards wherever specified in the specification, requirements as per HEI shall prevail in case of similar requirement specified. Manufactures standard and proven practice shall be followed where HEI for Air Cooled Condenser or standards as specified does not specify design, manufacturing and testing criteria.			
	IV.3.2 Bidder to furnish thermal calculation for required area as per HEI and the total pressure drop from steam entering the horizontal duct to steam entering the tube bundle with calculation.			
स्थायिकता एवं गोपनीयता इस प्रलेख में दी गई सुचना भारत हेवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, ओ कि सम्पत्ति के हित में हानिकारक हो न किया जाए।	IV.3.3 The equipment and auxiliaries shall be suitable for continuous operation in the frequency range of 47.5 Hz to 51.5 Hz.			
	IV.3.4 Input Data/ Design data shall be as per ANNEXURE-IV.3-1 for Guaranteed back pressure and guaranteed Auxiliary power consumption.			
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INVENTORY NO.	IV.3.6 The ACC is to be designed to sustain and operate in all climatic conditions as per project data specified in section-II of specification, max./min. ambient temperature and			
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सामग्री सूची संख्या को INVENTORY NO.	effects of wind excess as per allowable limit mentioned in ASME PTC 30.1, without damage. Air Cooled Condenser fans shall supply winds homogeneously whatever are the main wind orientations. The design of the ACC shall be based on proven design practices and the supplier shall indicate the provision made for wind effects on the performance of the ACC. ACC shall be designed for wind velocity: 5m/s (any direction). IV.3.7 The Air Cooled Condenser shall be designed for entire plant life of 30 years with high efficiency and reliability. The ACC shall be designed taking into account the environmental conditions & the seismic condition. IV.3.8 Under all the operating conditions, while passing the required steam flows as per the relevant heat balances, the condenser should be able to accept the entire steam without increasing the exhaust hood temperature and condenser pressure beyond the maximum permissible value. The ACC shall be capable of condensing the steam flows under the following, but not limited to conditions: a) The whole of the steam from the steam turbine under Turbine at VWO + 3% makeup and all normal operating conditions, and at specified design ambient air temperature. b) Attemperated steam flow from the steam bypass systems under transient operation (start-up, shutdown, unit trip) (Input data at HP-LP bypass condition shall be as per annexure IV.3-7). c) In addition, this system shall be able to meet the operation under various operating conditions (including operations in winter, summer, at different loads, upon unit start/stop, bypass operation of steam turbine, etc) as specified in specification. Bidder to ensure provision of suitable feature to control the fluctuation in steam turbine back pressure due to low load operation. Bidder to provide control philosophy adopted for safe and reliable operation of ACC under all operating conditions. IV.3.9 Water, steam properties functions shall be as per IAPWS-IF97. IV.3.10 The inlet to each fan shall be protected with a screen capable of preventing objects/foreign materials. IV.3.11 All components of the condenser system and the auxiliaries shall be designed for full vacuum and the entire system shall be vacuum tight. As higher pressures above atmospheric pressure may occur, the system shall be equally designed for 0.5 bar internal over pressure. The design temperature shall be 121 deg C. IV.3.12 ASME PTC 30.1 should be followed for reporting thermal performance characteristics of mechanical draft air-cooled steam condensers (ACC) operating under vacuum conditions. The condenser vacuum shall be measured with a vacuum grid utilizing ASME basket tips. The grid is fitted at 300 mm downstream of LP turbine exhaust connection. Bidder shall provide all necessary blanking arrangement for leakage testing.				
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SUPERSEDES INVENTORY NO.	IV.3.13 The design of the condenser shall avoid condensate sub-cooling under all operating conditions including part load as per HEI. The condensate temperature inside condensate tank shall not be below the temperature indicated in Input data as per clause IV.3.4. Air removal section to cool the air and vapor mixture to at least 4.17 deg C below steam saturation temperature at the effective suction pressure. Connections to air evacuation pumps shall be made at this section. Condenser to be designed for minimum air leakage and under normal operating conditions, the air leakage in the condenser not to exceed more than 50% of design value taken for sizing of vacuum pumps. The same shall be demonstrated at site under actual operating condition failing which bidder shall carryout necessary modifications. IV.3.14 Maximum oxygen content of condensate at the outlet of condensate storage tank shall be 0.015 cc/litre as per HEI. To achieve the same proper deaeration system for make-up water and condensate shall be provided. Bidder to provide the detailed write-up for the same in its proposal. DM Make-up water parameters to be considered is as below: a. DM make up flow – 3% of Main Steam flow (Maximum steam flow is 2567T/hr) b. Oxygen content in DM Make up 7 TO 8 PPM. IV.3.15 Components shall be designed for outdoor location or placed in open shed except drain tank/pot. All Drain pumps shall be located outside the TG building. IV.3.16 Plant shall comply with an agreed internationally accepted standard specification. IV.3.17 The components of the system shall be complete with all necessary interconnecting pipe work, valves, gauges and electrical wiring for control. The components of the package shall be arranged in a compact and orderly manner to ensure good access for operation, maintenance and repair. Piping interfaces shall terminate at the edge of the module with pipe flange. IV.3.18 All high points in the piping system shall be provided with vents. All low points shall be provided with drains. IV.3.19 No damaging due to vibration during normal, abnormal and transient conditions and during turbine trip from full load to HP-LP bypass operation, feed heaters out of operation, VWO condition, 100% load and start-up condition etc. Bidder to ensure satisfactory operation under above operating conditions. IV.3.20 The acceptable sound pressure level shall be as per clause III.1.2 c. If the noise fails to reach the requirements when or after the ACC system is put into operation, the Bidder shall adjust or replace the equipment free of charge in time until the noise reaches the requirements. IV.3.21 The Bidder shall consider that there shall be no resonance occurring with fan group, which is caused by the rotating fan, ACC platform and support system and endangers the safety of the system and structure under various operating conditions. The Bidder				
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इस प्रलेख में दी गई सुचना भारत हेवी इलेक्ट्रिकल लिमिटेड की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, जो कि सम्पत्ति के हित में हानिकारक हो न किया जाए।

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सममती सूची संख्या INVENTORY NO.		shall consider taking control means or other measures to avoid occurrence of above situation in the design. Bidder to furnish the calculations during detail engineering.			
सममती सूची संख्या INVENTORY NO.		IV.3.22 Suitable supports, anchors, hangers, saddles, clamps etc. shall be provided for the piping system covered in the scope of the specification. The supports shall be so interspaced as to minimize sagging of the pipes and to keep it within permissible limits at operating conditions.			
सममती सूची संख्या INVENTORY NO.		IV.3.23 ACC shall be connected to each other at fan deck level for movement from one unit to another unit. The walking platform all around the ACC shall be minimum 2m wide.			
सममती सूची संख्या INVENTORY NO.		IV.3.24 Wherever required expansion loops shall be provided in order to restrict end forces and movements.			
सममती सूची संख्या INVENTORY NO.		IV.3.25 Fan motor shall be single speed motor with a provision of ON/OFF. Fans for Air cooled condenser shall be provided with automatic algorithm for switching ON/OFF based on load, ambient temperature and condenser pressure in order to optimize Aux power consumption. Vendor to provide supporting document to verify this requirement.			
सममती सूची संख्या INVENTORY NO.		IV.3.26 All pipes shall be supplied with relevant test certificates.			
सममती सूची संख्या INVENTORY NO.		IV.3.27 All statutory requirements including safe distances between various facilities as per applicable rules/ acts/ laws are to be met. Provision of rupture devices shall be as per latest HEI.			
सममती सूची संख्या INVENTORY NO.		IV.3.28 The inspection port should be designed for ease of accessibility with leakage proof features while in operation Tools for inspection ports to be provided.			
सममती सूची संख्या INVENTORY NO.		IV.3.29 Outdoor support shall be provided for sliding movement of pipe over the support. All steel sliding support faces shall be covered with Teflon plates fitted with counter sunk screws on both top and bottom sliding faces of support.			
सममती सूची संख्या INVENTORY NO.		IV.3.30 Bidder shall provide performance curve alongwith the Bid to indicate losses and gains in ACC performance as the ambient air temperature rises and falls from the contract guarantee value. Bidder to furnish the thermal, mechanical and hydraulic calculation as per relevant standards during detail engineering for approval.			
सममती सूची संख्या INVENTORY NO.		Following characteristic curves of ACC shall be provided: i. Heat Load Vs ACC Back Pressure for entire range of ambient temperature. ii. Heat Load Vs ACC Back pressure under different operating conditions(VWO, TMCR, HP-LP Bypass operation, House load operation etc.) iii. ACC Back pressure Vs Fan power under design Heat Load at different ambient air temperature.			
सममती सूची संख्या INVENTORY NO.		IV.3.31 The type tests shall be carried out in presence of the Employer's representative, for which minimum 45 days' notice shall be given by the Contractor. The Contractor shall obtain the Employer's approval for the type test procedure before conducting the type			
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SUPERSEDES INVENTORY NO.	IV.4 Detailed Technical Specification Mechanical Components IV.4.1 Turbine Exhaust Device / Exhaust transition Device (ETD) / Hot Box (Not in Bidder's Scope of supplies) IV.4.1.1 Purpose of exhaust transition device is to carry the LP turbine load, guide to exhaust flow into horizontal steam duct, transfer of force and moments and compensation of thermal movement and transmission device from rectangular turbine flange to circular Air Cooler Condenser duct flange. The exhaust transition Device for Air Cooled Condenser shall consist of following: (a) Welded connection to LP turbine. (b) Fabricated carbon steel structure with inner parts. (c) Welded Connection to Horizontal Steam Duct. (d) Connection provision for TDBFT exhaust (2 no.), LP Heater 1, Steam by Pass and vents. (e) Foundation and Bearing Supports for the exhaust Box. IV.4.1.2 The ETD shall be designed for full vacuum and internal pressure of 0.5 bar. IV.4.1.3 The ETD shall be connected via welded joint with LP Outer casing, No bellow is allowed in the ETD. No drain / condensate are allowed inside ETD. IV.4.1.4 The ETD shall rests on a bearing system on the foundation. IV.4.1.5 Terminal points for ETD shall be as per Annexure- IV.4-1. IV.4.2 Exhaust steam pipeline system IV.4.2.1 The exhaust steam pipeline system refers to the pipelines (Towards A-row) between outlet of ETD / HotBox as described under clause IV.4.1 under LP cylinder of steam turbine (Terminal point as per Annexure IV.4-1) and steam distributing pipes connected to each row of ACCs as well as sliding/fixed supports, spring supports/hangers, expansion compensator, associated isolating valves and overhaul lifting facilities (if required), pressure relief valve, insulation (if required), drain pipe, etc. IV.4.2.2 The pipeline system is required to be tight, connection between pipelines is required to be made by welding, there shall be provided(if applicable) with baffle plate inside the bend at the curved section, there shall be provisions to prevent shock caused by external factors or internal factors and compensate thermal expansion of compensating pipeline in the pipeline system, external surface of the piping shall be treated for corrosion protection, and a description of internal surface purging, flushing and corrosion protection of the pipeline shall be given before the pipeline system is put into operation and after it is shut down. The maximum steam side velocities in the duct at the inlet of tubes shall be per latest HEI.				
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SUPERSEDES INVENTORY NO.	IV.4.2.3 The layout, elevation and requirement of the exhaust duct system shall be made suitable as per the drawing no ANNEXURE-IV.4-1. The clear space between the TG columns is 9800mm, bidder to select the size of duct suitably. IV.4.2.4 The Bidder shall indicate the number of pressure relief valves or rupture discs equipped for ACC system. Exhaust steam volume, diameter, set pressure and installation position of each pressure relief valve or rupture disc to be furnish in Bid. The rupture disc to be designed as per maximum steam flow of 2891T/hr. IV.4.2.5 Main Steam Ducting IV.4.2.5.1 The ducting carrying steam between the connection at ETD / Hot Box and the ACC shall be of welded steel construction as per HEI, arranged in conjunction with the ACC tube arrangement to ensure proper distribution of steam over the whole of the parallel flow tube banks, so as to prevent the stagnation of steam at any point. The ducting from the steam turbine shall be designed with suitable turning vanes to prevent internal erosion, if required. IV.4.2.5.2 The ducting shall be of adequate size to reduce the pressure drop along the length of the steam path to a practical minimum. Guide vanes shall be used within large diameter bends in the ducting. The ducting shall be stiffened and supported to ensure that it remains tight and free from distortion at all pressures and stresses to which it may be subjected during transport, handling and operation. Special precautions shall be taken to ensure that the completed ducting is free from distortion due to welding or any other cause. Suitable provision in the form of flexible joints, bellows and sliding feet shall be made to allow thermal expansion of the ducting over the full range between minimum ambient air temperature and the maximum steam temperature condition. IV.4.2.5.3 Internal silencers or baffle plates shall be provided in the steam duct to reduce the noise levels within the steam duct, if required. To meet the requirements of allowed noise levels additional noise attenuation/heat insulation cladding is required then this shall be taken into consideration in the design of the ACC cooling capacity. IV.4.2.5.4 The main duct is also designed to provide connection points. Location of the connections shall be finalised at the stage of Detailed Engineering. IV.4.2.5.5 Any exhaust duct drainage shall be by means of gravity rather than a pumped system to the drains collecting vessel. IV.4.2.5.6 Access by means of hinged and bolted manhole doors shall be provided for the internal inspection of the steam ducting. Each external manhole shall have a permanent external access ladder and work platform, internal access shall also be provided where necessary. The number and positions of manholes shall take into account the blockage of baffle plates at the turn inside the duct and convenience in replacing the seal rings at both sides of the isolating valve (if any). All staircases shall have resting and landing platform preferably for every 5m height.				
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स्वाधिकार एवं गोपनीय

इस प्रलेख में दी गई सुचना भारत हेवी एलेक्ट्रिकल लिमिटेड की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, ओ कि सम्पत्ति के हित में हानिकारक हो न किया जाए।

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समय सीमा के अनुसार अधिकतम करता है		IV.4.2.5.7 The exhaust steam duct shall have sufficient strength and rigidity and reasonable duct supports/hangers shall be provided in the design to ensure stability of the duct system. The exhaust steam duct shall satisfy max. thrust and moment value which the outlet of ETD / HotBox of steam turbine is able to withstand. The permitted value of allowable forces and moments shall be as per Annexure IV.4-10.			
समय सीमा के अनुसार अधिकतम करता है		IV.4.2.5.8 The ASME basket arrangement for measurement of vacuum for performance testing shall be provided in the Hot Box /ETD by BHEL at the location as specified elsewhere for performance guarantee, also the same arrangement to be provided by Bidder at inlet of ACC duct at nearest possible point from hotbox connection to measure the pressure. The calibrated pressure gauges to be provided by Bidder at both locations during performance testing.			
समय सीमा के अनुसार अधिकतम करता है		IV.4.2.5.9 Motorized Butterfly valves (sectionalizing valves) to isolate each street on steam side, condensate side & vacuum side of ACC for maintenance of individual A frame tube bundles without Unit trip and capability of ACC to operate in cold weather conditions and low load conditions as per HEI without formation of Dead Zone to be provided. The valves shall meet the requirement as specified in Annexure-IV.4-7. Type test of these valves shall be conducted as specified in the Annexure-IV.4-7.			
समय सीमा के अनुसार अधिकतम करता है		IV.4.2.6 Steam Distribution Manifold The steam distribution manifold shall be provided between the main steam duct and the steam headers as per HEI. This manifold shall include vertical ducts also known as risers. The risers shall have arrangement to accommodate the thermal expansion. This manifold should not be routed at ground level and should be bracket supported from fan deck structure. No support from ground is allowed since transformers are placed below manifold.			
समय सीमा के अनुसार अधिकतम करता है		IV.4.2.7 Steam Header The steam header shall be provided to convey steam between the manifolds and the bundles of an ACC row. Arrangement may also be required in the steam header to accommodate thermal expansion.			
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SUPERSEDES INVENTORY NO.	IV.4.2.8 Design Data to be considered for Exhaust steam pipeline system:				
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	ii. Design standard		HEI (latest edition), ASME		
	iii. Corrosion allowance		As per HEI (latest edition) for ACC		
	iv. Design Temperature		121 Deg C		
	v. Painting		As per section IV.5		
	vi. Insulation		Refer section IV.4.21		
	Bidder shall note that painting requirement are only indicative and bidder shall submit the detailed painting procedure and scheme and these painting specification shall be subject to approval of BHEL/ NTPC.				
IV.4.3 Drain tank (drain pot) and drain pumps package and associated condensate pipeline (supply is in BHEL scope)					
IV.4.3.1 The water condensed through Duct of ACC, ETD / HotBox and drains from Flash tanks etc. is collected through condensate pipeline (design of interconnecting piping is also in Bidder's scope however supply is in BHEL scope) and flows by gravity into external drain tank/pot placed below ETD/ HotBox and Main steam duct. A condensate blowdown port shall be provided at appropriate position on the condensate pipeline so as to discharge the blowdown water during hot cleaning prior to system startup. The Bidder to provide thermal insulation as per specification (if required) of condensate pipeline according to its own technical characteristics and measures to prevent pipeline shock due to steam (gas) hammer inside the condensate pipe.					
IV.4.3.2 External drain tank/pot provided for the drains from Flash tanks, condensate formed in the Hot Box, main duct and other process drains, the drain pot capacity shall be sized for at least Five minutes between the low and high operating level using the maximum continuous condensate flow rate as per annexure-IV.3-1, entering the drain pot. List of connections shall be finalized at the time of detailed engineering.					
IV.4.3.3 Drain tank/pot material shall be as per ASTM A285 Gr. C or equivalent. The responsibility for establishing equality or superiority of the alternate materials offered					
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IV.4.3.14 The pumps shall be designed for maximum continuous operation conditions at grid frequencies between 47.5 – 51.5 Hz. IV.4.3.15 Lifting/ Handling arrangement as per specification for drain pumps shall be provided by Bidder. IV.4.3.16 STRAINERS AT DRAIN PUMP SUCTION IV.4.3.16.1 Strainer body simplex and cylindrical type IV.4.3.16.2 The clear area of strainer to be Five times the inlet cross sectional area of the connecting piping. IV.4.3.16.3 Strainer to be constructed of 16 gauge perforated stainless steel (304 grade) and lined with stainless steel (316 grade) screen.																																			
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समर्पण सूची संख्या INVENTORY NO.		IV.4.3.16.4 At design flow and clean condition, Pressure drop not to exceed 0.1 Kg/cm2. At design flow and 50% clogged condition, Pressure drop not to exceed 0.15 kg/cm2. IV.4.3.17 The pumps shall operate satisfactorily when delivering varying quantities from minimum to maximum flow at all possible operating conditions. IV.4.4 Tube Bundles IV.4.4.1 Heat Exchanger of Air Cooled Condenser shall be comprised of finned tube bundles arranged on A-frame structure. A bundle shall consist of finned tubes, only Single Row Tube design shall be acceptable, the details of tube to tube sheet joint shall be furnished by Bidder at the time of detailed engineering. Connections are of welded type. IV.4.4.2 The total finned-tube system needs to accommodate expansion and contraction with changes in thermal loads. Cooling fins shall be designed to withstand the cleaning water jet pressure. IV.4.4.3 Materials of construction for tubes shall be Aluminum clad (from outside) carbon steel plates. The thickness of the aluminum layer on the CS base tube plate shall not be less than 50µm; the total thickness of this clad plate shall not be less than 1.5mm. Base tube shall be finned with aluminum or Aluminum alloy fins brazed to the tubes, the fin thickness after manufacturing of tube bundle shall be more than or equal to 0.25mm. IV.4.4.4 The process of cladding shall be high pressure rolling of the aluminium and carbon steel strips which are compressed to form a bond. Pre-treatment of strips and heat treatment of bond shall be ensured. Bidder to indicate the list of sub-vendors and manufacturing process for the aluminum clad carbon steel strips alongwith the Bid. IV.4.4.5 Base tube formed shall be cleaned prior to fin brazing. IV.4.4.6 The weld location on the base tube of the single-row flat tube shall be provided with anticorrosion treatment (if required) and the base tube weld shall ensure 30 years service life. IV.4.4.7 The finned tubes shall be designed for the full vacuum and internal pressure of 0.5 bar(g). IV.4.4.8 Air Tightness test of each tube bundle shall be carried out at a pressure as per ASME Sec VIII Div. 1 i.e. minimum 1.1 times of design pressure. Alternatively, vacuum drop test on the tube bundle shall be conducted as per approved procedure.			
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समर्पण संख्या को अधिकृत किया जाता है		IV.4.4.9 Type test for performance (Heat transfer coefficient) of tube bundles using scaled down model or full size model of type offered for this project shall be conduct which shall be witnessed by BHEL. Procedure shall be submitted by Bidder for BHEL approval.	
समर्पण संख्या को अधिकृत किया जाता है		IV.4.4.10 The design shall prevent the formation of overcooled or dead zones in the ACC. The Bidder shall state tube dimensions and material in its proposal.	
समर्पण संख्या को अधिकृत किया जाता है		IV.4.4.11 The Bidder shall provide details of the method of attaching tubing to the steam supply headers and condensate collectors and of attaching fins to the tubing, together with details of materials employed, differences in fin spacing, etc at the time of offer.	
समर्पण संख्या को अधिकृत किया जाता है		IV.4.4.12 A movable access ladder/work platform shall be provided for accessing the steam supply header manholes and instrumentation without the requirement to erect scaffolding.	
समर्पण संख्या को अधिकृत किया जाता है		IV.4.5 Cooling air system The complete cooling air system (fan assembly, motor and gearbox) will operate outdoors and shall be able to adapt to the natural environment of the region where the plant site is located. The fan shall adopt axial-flow fan and shall be equipped with supporting bridge, air-guide duct, grid guard, etc. Fan motor shall be supplied as per the details specified elsewhere in the specification. The complete cooling air system consists of the following main elements: • Multi-bladed fan mounted on fan hubs • Speed reduction gear box • Electric motor • Fan bell / Fan ring • Fan protection screen • Instrumentation and All necessary accessories. Each cooling air condenser cell shall be separated by a wall and arrangement shall be made such that all main components of separate cell shall be lifted via hoist and beam for maintenance.	
समर्पण संख्या को अधिकृत किया जाता है		IV.4.5.1 FAN:	
समर्पण संख्या को अधिकृत किया जाता है		IV.4.5.1.1 Fan shall be axial. Minimum no. of fan blades for an individual fan shall be five (05).	
समर्पण संख्या को अधिकृत किया जाता है		IV.4.5.1.2 Complete fan assemblies comprised of blades, hub and seal disks to provide optimum efficiencies over the expected range of ambient temperature. Suitable arrangement shall be provided to improve the entering airflow characteristics upstream of the fan.	
समर्पण संख्या को अधिकृत किया जाता है		IV.4.5.1.3 The Bidder shall verify that the fans and the ACC will perform in minimum and maximum density inlet air environments, including those associated with warm weather conditions, plus a recirculation allowance.	
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समर्पण संख्या को अधिकृत करता है		IV.4.5.2 GEAR BOX: IV.4.5.2.1 The gearbox matched with the fan shall be of parallel vertical shaft helical gear type, the design service factor or application factor shall not be less than 2.0 according to the rotating speed on the motor nameplate rating. IV.4.5.2.2 Gearbox shall be designed as per AGMA. IV.4.5.2.3 Gearbox to operate for 100,000 hours before major repair or replacement. Reverse fan rotation is not foreseen. All the bearings in the gearbox shall be designed for a life of 100,000 hours. IV.4.5.2.4 Gearboxes shall be equipped with a means of simple access for filling and servicing of lubricating oil. IV.4.5.2.5 The lube oil pump shall be provided. The lubrication of the gear shall be guaranteed over the entire speed range including wind milling of the fan. IV.4.5.2.6 Expected gear lubrication Oil temperature, initial grade of oil viscosity, any other lubrication recommendation including filled in lubrication schedule shall be given by bidder during detailed engineering. IV.4.5.2.7 Bidder shall furnish detail dimensional drawing showing overall dimensions; shaft C.L. Dimensions, mounting dimensions etc during detail engineering. IV.4.5.2.8 The gear box housing shall have provision for mounting of flanged mounted motor. The motor end shaft of gear box shall be sized suitable for taking loads at starting and operative conditions. IV.4.5.2.9 The fan end shaft shall be sized suitable for taking fan loads during starting and operative conditions. IV.4.5.2.10 Calculation for Input/ Output shaft diameter and selection of bearing shall be submitted to BHEL during detail engineering. IV.4.5.2.11 Input /Output shaft shall be parallel type. IV.4.5.2.12 The bearing-design shall incorporate seals to prevent the loss of lubricant and entry of foreign materials. IV.4.5.2.13 The shaft diameter shall confirm to bearing sizes. IV.4.5.2.14 The shaft stresses shall not exceed the value given in AGMA standard 6001-C. The shaft shall have key seats per ANSI -B17.1. IV.4.5.2.15 Bidder to provide fan vibration sensor along with transmitters for vibration measurement and control.			
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स्वत्वाधिकार एवं गोपनीयता इस दस्तावेज में दी गई सूचना भारत हेवी इलेक्ट्रिकल लिमिटेड की सम्पत्ति है। इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी प्रकार का उपयोग, जो कि सम्पत्ति के हित में हानिकारक हो न किया जाए।	IV.4.6.8 Maximum oxygen content of condensate at the outlet of condensate storage tank shall be 0.015 cc/litre as per HEI. To achieve the same proper deaeration system for make-up water and condensate shall be provided. Bidder to provide the detailed write-up for the same in its proposal. Make up water details as below: DM Make-up flow-3% of Main steam flow (max. steam flow is 2567T/hr) Oxygen content in DM Make-up 7 to 8 ppm. IV.4.6.9 Provision of large box type screening structure with anti-vortex baffling at each CST connection to suction of condensate pumps to be provided by Bidder. IV.4.7 Piping, valves, Fittings and accessories IV.4.7.1 The design, fabrication, assembly and testing of pipes, fittings, flanges, piping components etc. shall generally conform to the requirements of ASME/ ANSI B 31.1. IV.4.7.2 This includes complete piping system along with valves, fittings and accessories for the entire system. IV.4.7.3 The specification of piping, valves and fittings shall be as per Annexure-IV.4-7. IV.4.7.4 Valves shall be installed in accessible position otherwise suitable operating platform/valve operating mechanisms shall be provided for access to the valves. IV.4.7.5 Wherever required for safety purpose, locking devices shall be furnished with the valves. IV.4.7.6 Wherever ASTM 106 Gr. B/Gr. C or A - 105 material are used the maximum carbon content shall be limited to 0.30% (Max.). IV.4.7.7 All piping shall be provided with vents at the highest point and drains at the lowest points. The drain valves shall be provided with threaded plugs. IV.4.7.8 Suitable support, hanger, anchor, saddles, clamps etc. shall be provided for the piping system. The entire piping system shall be effectively earthed. IV.4.7.9 Adequate provision for allowing smooth movement due to thermal expansion shall be provided. Suitable slope shall be given in all pipelines towards drain point. IV.4.7.10 All drains and vents shall be provided with isolating valves. IV.4.7.11 Standard pipes, fittings and connecting pieces shall be acid pickled, neutralized, passivated or blasted on the inside, cleaned (the abrasive material removed), primed on the outside and fitted with end caps prior to supply by bidder. The inside surface of the pipe material must be minimum comply with the requirements of Rust Level C as per ISO 8501. This means a steel surface from which scale has rusted away or can be scraped off but which has only the initial signs of pitting visible to the naked eye.If				
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		IV.4.8 Valves The specification of valves shall be as per Annexure-IV.4-7. Design and supply of all Valves are in Bidder's scope.					
समर्पित सूची संख्या को अधिकृत करता है		IV.4.9 Name plates / identification tags Name plates / identification tags shall be stainless steel. Labels and Name plates of all equipment shall be in English. Annexure-IV.4-8 shall be followed.					
		IV.4.10 Air Evacuation package IV.4.10.1 Provision of 2X100% air evacuation pumps for holding operation per unit along with all accessories and instrumentation. One (01) or two (02) start up hogging vacuum pump per unit with suitable capacity under standard conditions i.e. 760 mm of Hg. (abs) and 21.1 deg. C) at 10 inch (254 mm) of Hg (abs) shall be provided. All other requirements shall be as per specification HE 57016 at Annexure IV.4-6. Reference P&ID shall be as per annexure-IV.4-11. IV.4.10.2 Single/ two stage liquid ring type with both stages(if two stages pumps provided) mounted on a common shaft IV.4.10.3 Each pump and its accessories shall be mounted on common steel base plate. Pump shall be connected to motor by flexible coupling IV.4.10.4 Heat Exchangers shall be shell and tube type, alternatively-plate type heat exchangers with SS 316 plates and 20% area margin on plates also acceptable. IV.4.10.5 Material of tube-stainless steel type 316 and material of shell and tube plates as M.S. type ASTM-A285 Gr. C properly coated. IV.4.10.6 For U-tube type : Removable tube bundle provision. IV.4.10.7 Provision of air ejector (if required) for abnormal operation and selection of suitable compression ratio for air ejector IV.4.10.8 Handling arrangement for pumps (holding & hogging) as per specification shall be provided by Bidder. IV.4.10.9 The stand-by pump (holding) shall cut in automatically in case running pump fails or when condenser pressure falls back to a preset value					
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SUPERSEDES INVENTORY NO.	IV.4.10.10 No cavitation under all operating conditions without air ejector. IV.4.10.11 Noise levels should not exceed limitations as specified in Section of General Technical Requirements and vibration levels shall be Zone A of ISO 10816. IV.4.10.12 Pumps (holding) shall be sized as per latest HEI requirements. Capacity of each pump(holding) in free dry air at standard condition with condenser operating at design pressure of 1 inch (25.4 mm) of Hg (abs) and sub cooled to 4.17 degC below temperature corresponding to absolute suction pressure shall not be less than 40 scfm (68 cu.m per hour under standard condition i.e 760 mm of Hg (abs) and 21.1 deg. C) . IV.4.10.13 The capacity of each pump (holding& hogging) during hogging shall not be less than 1050 scfm (1784 cu.m/per hour) under standard conditions i.e. 760 mm of Hg. (abs) and 21.1 deg. C) at 10 inch (254 mm) of Hg (abs). IV.4.10.14 All three/ four pumps (2X100% Holding+ 01/02 Hogging pump) running together should be able to bring condenser pressure from atmospheric pressure to 10 inch of Hg (abs) within 30 minutes. In case two hoggers, identical hoggers to be offered. IV.4.10.15 Type test for Cavitation and Wet air test for each type of vacuum pump (Holding & hogging) as detailed in specification HE 57016 at Annexure IV.4-6. IV.4.10.16 Motor requirements as per Sec-V- Electrical shall supersedes the requirements specified in HE57016 (Annexure-IV.4-6). IV.4.10.17 The quality of water for vacuum pump shall be clarified water (auxiliary cooling water) and chloride (as CaCO3) content shall be 125 ppm. IV.4.11 Condensate extraction pumps (Not in Bidder's scope of supplies) IV.4.12 Pipe racks, pipe trestles The pipes in ACC area shall be routed on trestle at a height of about 8.0 m bottom of steel(B.O.S.). The pipes routed above ground on trestles shall have minimum clearance of 8.0m bottom of steel(B.O.S.). at road crossings. Structures shall be designed for the most critical combinations of dead loads, imposed loads, equipment loads, crane loads, piping loads (static and dynamic), wind loads, seismic loads and temperature loads. In addition, loads and forces developed due to differential settlement shall also be considered. IV.4.13 Access IV.4.13.1 General – Access refers to all stairways, platforms, ladders, manways, etc. to safely access, inspect, maintain, and operate the ACC.				
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SUPERSEDES INVENTORY NO.	IV.4.13.2 Recommended Access Type and Locations: a. Staircase and Elevator(04 Nos for 3Units) shall be in BHEL scope. Loading due to common Frame and structure of staircase and elevator on ACC structure shall be informed during detailed engineering. Further the all ACC units shall be interconnected with each other by providing suitable platform & structure. b. Grating platforms connecting the ACC cells and accessing the mechanical equipment. c. Minimum 2m wide Walkway around the ACC perimeter at the tube-bundle condensate collection level d. Access to steam duct rupture disc and any valve that may require manual operation e. Access to instrumentation and sensor locations, including all permanent and temporary test wells or ports f. Hinged doorways with full seals for access to each end of a street. g. Provision to be provided by Bidder for exit / access at fan deck for safety of personals to work at peak temperatures (above 65 deg C) at the perimeter of ACC tube bundles walkway. h. Rolling staircase for access to upper surfaces of tube bundles and cleaning spray nozzles. IV.4.13.3 All stairways, catwalks, and platforms will be equipped with kick plates and handrails as well as intermediate piping and base plates. IV.4.14 Handling systems (EOT crane, Monorail and Hoist) IV.4.14.1 Suitable EOT Crane/HOT crane/monorail beams with hoists/chain pulley blocks of adequate capacity to meet the maintenance requirements are to be provided by the Bidders for handling equipments in ACC package. IV.4.14.2 Monorail Beams – This includes a full run of monorail along the length of any entire “street,” i.e., along each condensing run. It shall be designed to suspend and convey the weight of a fan blade bundle, fan hub, fan motor, or gearbox. The beams will have sufficient overhang on one end of the ACC to raise or lower removed or replacement assemblies to and from grade to the fan elevation level. IV.4.14.3 EOT crane, Monorail Trolley and Hoist – The monorail trolley and hoist, include a movable roller-type assembly and electric hoist with movable operating panel and cable to run the length of a condensate run or street. This scope shall include all items / devices needed to comply with the requirements indicated Annexure IV.4-2.				
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		Bidder to indicate the quantity of cleaning water as per Annexure IV.8-3. The quality of cleaning water is the clarified water as per Annexure II-1 (expected clarified water analysis) and offer ACC shall be suitable for same.					
		IV.4.15.2 Design Requirements and Data					
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		The rig shall be fitted with monorail and caster wheel in order to move the rig along the complete length of Condenser Street. Cleaning can either be done during shutdown or during operation of the ACC.					
		IV.4.16 EXPANSION JOINTS					
SIGN & DATE		IV.4.16.1 Metallic expansion joints are to be used for Main duct, risers, steam distribution manifold or piping etc.					
		IV.4.16.2 METALLIC EXPANSION JOINTS					
		IV.4.16.2.1 The design, material, construction, manufacture, inspection, testing and performance of the expansion joints shall comply with the currently applicable requirement of EJMA, Boiler and Pressure Vessel Code Section III, ANSI B-31.1 and all statutes, regulations and safety codes.					
INVENTORY NO.		IV.4.16.2.2 The bellow shall be hydraulically or roll formed from perfect cylinders of single ply, 304 grade stainless steel. It shall have internal sleeves of the same material as the bellows and installed with sufficient clearance to allow full rated deflection					
		IV.4.16.2.3 Type test of Metallic Expansion joints					
		IV.4.16.2.3.1 Following tests (Type tests) shall be carried out for metallic expansion joints as per the procedures given in EJMA. Each type shall be witnessed by BHEL. For large size bellow (> 3500NB) the type test may be conducted on scaled down model.					
		a. Life Cycle Test: the number of test cycles shall be minimum 10,000 cycles					
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SUPERSEDES INVENTORY NO.	b. Meridional yield-rupture testing c. Squirm testing				
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COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company	IV.4.17 Hangers and Supports IV.4.17.1 General				
स्वीकृति एवं गैरगोपनीय इस प्रलेख में दी गई सूचना भारत हेवी एलेक्ट्रिकल लिमिटेड की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, ओर कि सम्पत्ति के हित में हानिकारक हो न किया जाए।	a. Design and manufacture of hangers / supports shall conform to requirements as detailed in the Annexure IV.4-7. b. The bidder shall design and detail all piping hangers and supports, restraints, guides, stops, snubbers, anchors, dampers etc. including pipe attachment, tie rods, clamps, devices, structural attachments, pipe attachments etc. the bidder's design documents (drawings and calculations) shall be submitted for BHEL/ Owner's review. c. Hangers & supports/ restraint shall be designed such that they do not become disengaged due to normal piping movements/ vibrations during operation. d. The axis of all supports shall be concentric with the neutral axis of the structural steel members as far as possible. Eccentric attachment shall be made only with Owner's / BHEL approval. Supports from brackets to steel framing, supports from bracing will normally not to be permitted. e. Generally where horizontal piping movements exceeds 25mm, the hanger and structural attachments shall be offset in the cold position in such a manner that the hanger rod is vertical in operating conditions.				
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समर्पित सूची संख्या को अधिकृत करता है SUPERSEDES INVENTORY NO.		ग. Spring hangers shall be adjusted to the cold position before shipment and blocked in that position. The cold and hot position shall be clearly marked on the travel indicator scales. ह. All spring hangers shall be locked before performing the pneumatic test. The locking shall be removed before the line is placed under operation. i. NTPC specification as per Annexure- IV.4-7 shall be read in conjunction with above requirement. IV.4.20 Restraints and Anchors अ. All anchors shall be designed for direct rigid fastening to the structural steel member. ब. Anchors, guides and restraints shall be capable of withstanding the forces & moments due to thermal expansion and dynamic effect. IV.4.21 Erection Elevators IV.4.21.1 Two numbers (2) Elevators/ Lift (tool and tackle) for all three units, meant for human movement during erection & commissioning phase shall be in Bidder's scope of supply which shall need to be supplied first so that it can be installed and commissioned by BHEL prior to start mechanical erection works. The Elevators shall be Rack and Pinion type Service Elevator/Lift (tool and tackle) having maximum Load carrying capacity of 1000Kg. Speed of Lift should be approx. 25 Mtr/ Minute. Maximum travel should be upto Fan deck level. Drive unit of the lift should be equipped with 415 V AC Squirrel Cage Induction Motor, Reduction Gear, Drive Pinion and Over Speed Governing system. Motor should have Electromagnetic brake. In the event of power failure, brake will be operated and the Lift will be stopped. Lift should have a safety device to avert over speed. IV.4.21.2 Complete erection, testing and commissioning including all testing and commissioning materials, consumables and other tools and tackles required for erection is in Bidder's scope. IV.4.21.3 To obtain necessary local administration permits / approvals and make arrangements for inspection and tests required thereby. IV.4.22 Thermal Insulation Specification for thermal insulation shall conform to the requirements as per Annexure IV.4-9. IV.4.23 Spares IV.4.23.1 Mandatory Spare Parts अ) The contract shall include in this scope the supply of mandatory spares for all three units of ACC as per Annexure-IV.4-13 including mandatory spares for C&I items. Bidder to indicate Price of each item.			
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SUPERSEDES INVENTORY NO.		b) In addition to above, bidder to furnish the list of mandatory spares as essential based on his experience along with the price of each item.					
समर्पित सूची संख्या को अधिकृत किया जाता है		IV.4.23.2 Recommended Spare Parts In addition to the mandatory spare parts, the bidder is required to submit, as part of the contract, a complete list of recommended spare parts for the equipment supplied, based on his experience and according to the selected design and operation, which are essential for a plant operation of ten (10) years. The BHEL/ employer is free to order these recommended spare parts at any time.					
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company		IV.4.23.3 General Requirement for Spare Parts All spare parts shall be handed over to the employer piece by piece corrosion-protected and sealed air tight in transparent heavy duty plastic. The individual spare parts must be labeled with an identification number, easily legible from the outside. The contractor shall follow a system of designing and tagging each and every spare part for ease of store keeping. Any spare parts furnished by the bidder in connection with the works under the contract shall be guaranteed to be free of manufacturing defects and shall upon any failure occurring within the Guarantee period (24 months) from their incorporation into the works, be replaced without cost to the employer. All spare parts must be prepared and protected for long term storage to preclude damage during this period. The storage requirements shall be submitted to the employer.					
		IV.4.23.4 Long term Availability of Spares The bidder shall generate the long term availability of spares to the employer for the full life of the equipment covered under the contract. The bidder shall generate that before going out of production of spare parts of the equipment covered under the contract, he shall give the employer at least twelve (12) month advance notice so that the employer may order his bulk requirement of spares, if he so desires. The same provision shall also be applicable to the subcontractors. Further, in case of discontinuance of manufacturer of any spares by the bidder or his subcontractor, the bidder shall provide the employer, two years in advance, with full manufacturing drawing, material specification and technical information required by the employer for the purpose of manufacturer of such items. Further, in case of discontinuance of supply of the spares by the bidder or his subcontractor, the bidder shall provide the employer with full information for replacement of such spares with other equivalent makes, if so required by the employer. The bidder shall provide the employer with a "directory" of his subcontractors giving the addresses and other particulars of his subcontractors. The employer, if he so desires, shall has the right to procure the spares directly from subcontractor.					
		IV.4.23.5 Start Up and Commissioning Spares Bidder shall supply all commissioning and start-up spares required for initial operation till the system is declared by Owner as having satisfactorily completed the Trial Operation. The supplier					
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समर्पित सूची संख्या को अधिकृतित करता है SUPERSEDES INVENTORY NO.		shall furnish a list of all such spares within 60 days from the date of letter of award and such list shall be reviewed by the purchaser / Owner and mutually agreed to. However, such review and agreement will not absolve Supplier of his responsibility to supply all commissioning spares so that initial operations do not suffer for want of such spares. IV.4.24 Tools and Tackles IV.4.24.1 Tools The bidder shall inform within this contract all necessary general and special tools required for the dismantling, maintenance and adjustment testing of the supplied equipment. Special Tools and equipment for a major inspection shall be included as well. The contract price shall include supply of Two (2) new set of special maintenance / inspection tools. All tools shall be stored in appropriate boxes, except large parts. Shipment containers shall be suitable for permanent storage of tools by the employer. The boxes and container shall become property of the employer after the project will be finalized. The tools shall be new and unused. IV.4.25 Air Conditioning and Ventilation (BHEL Scope) Bidder to furnish following details along with technical Bid: 1. Heat dissipation Data as per Annexure IV.4-14 for reference IV.4.26 Consumables & Chemicals IV.4.26.1 List of Consumables and Chemicals The bidder shall furnish, at the time of and as a condition for provisional acceptance, a complete tabulated list of consumables for all lubricants and any other consumables and/or chemicals required for all equipment furnished by him, showing all locations where consumables/ chemicals are required, the type of consumables/ chemicals, the quantity for one refill and any special tool / means / procedure required for such refill and shall be in scope of supply of Bidder. The lubricants and consumables/ chemicals list shall include the following data as minimum a. Specification of oil, including make, type, viscosity and special characteristics that may be required such as viscosity number, flash point, fire point etc. b. Specification of all other consumables / chemicals c. Quantity of lubricants, grease and other consumables required initially and Quantity of all lubricants, grease and other consumables/chemicals required for two years operation.			
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SUPERSEDES INVENTORY NO.		समर्पित सूची संख्या को अधिकृत किया जाता है		IV.5 General Requirements for Painting This specification defines the requirements for painting, surface preparation, as well as the application of protective coatings for structural steel, equipment, piping, tanks etc. for the entire plant. Surface Preparation and Painting shall be done as per Annexure-IV.5-1. The engineer shall, at all times, have access to the works in order to inspect surface preparation or application of work in progress in the workshop as well as on site. Shall any work or product be found to be defective or not in compliance with the specification, correction or replacement shall be made by the contractor at his costs. The contractor shall bear the full responsibility for the application of coatings, applied by him on surfaces, primed or painted by others. All coatings proposed for oil tanks shall be certified by an approved independent institute. Parts which cannot be coated and which are very sensitive to atmospheric exposure shall be efficiently packed for storage. The inside of equipment and machinery shall be cleaned thoroughly at works and before transportation all holes and access openings shall be efficiently sealed in order to prevent infiltration of dirt and humidity IV.6 Fabrication of structural steel work, walkways, stairways, intermediate landings, gratings and handrails and Ducts IV.6.1 Bidder shall supply pre-fabricated (shop fabricated) bolted structural steel materials for all structures including fan deck supporting structure, stair, exhaust duct supporting structures, erection elevator structures, pipe sleepers, pipe trestles, pipe racks in ready to erect condition. Only site erection and touch-up painting shall be performed at site. All the workmanship and finish shall be of the best quality and shall conform to the best approved method of fabrication. All materials shall be finished straight and shall be machined true and square as per applicable standard. All holes and edges shall be free of burrs. Shearing and chipping shall be neatly and accurately done and all portions of work exposed to view shall be neatly finished. Bidder shall inform the list of applicable standards for design, engineering and fabrication of structural steel in their technical offer inline with specification requirement. IV.6.2 Bolts, nuts, washers and other fastening material shall be shipped separately and applied suitable protective coating. All bolts, nuts and washers shall conform to the relevant national or international standards. IV.6.3 All stairways and intermediate landings shall be fabricated as a complete unit and shall include grating treads, landings, hangers, brackets, struts, clips, bracings etc. as necessary along with structural steel framings. The usual span of gratings will not generally exceed 1.5 meters. Handrails shall be provided on open sides of platforms, stairways and walkways. Handrails shall be of standard weight steel pipe of flush			
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स्वाधिकार एवं गोपनीय		इस प्रारूप में दी गई सुचना भारत हेवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, ओ कि सम्पत्ति के हित में हानिकारक हो न किया जाए।					
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समर्पित सूची संख्या INVENTORY NO.		welded constructions, ground smooth using 32 mm nominal bore medium class pipe provided with double rail, top rail about 1 meter above platform level and pipe posts spaced not more than 1.5 meters apart. IV.6.4 All structural steelworks including hand railings, gratings etc. shall have shop painting as well as final painting. IV.6.5 All steel structures shall be fabricated in factory, transported and erected at site. All factory fabricated structures shall have bolted field connections. Ducts may be fabricated and welded at site. All factory fabricated structures shall have bolted field connections. IV.6.6 Material of construction Structural Steel (including embedded Steel) shall be straight, sound, free from twists, cracks,flaw, laminations and all other defects. Structural steel shall comprise of mild steel, medium strength steel and high tensile steel as specified below. ASTM or International make for Structural steel are acceptable subject to the following: IV.6.6.1 Mechanical properties and Chemical composition of steel shall comply with the requirements of IS 2062, the values of different parameters of Mechanical properties shall be within the permissible ranges / values specified in IS 2062. Also, Chemical composition %age of Elements like C, Mn, S, P, Si & other elements and Carbon Equivalent of steel shall comply with the requirements of IS 2062. IV.6.6.2 Specific steel making / refining processes and Testing requirements shall be as per below: IV.6.6.2.1 Mild steel: i. Rolled sections shall be of grade designation E250, Quality A/BR, Semi-killed/ killed conforming to IS 2062. All steel plates shall be of grade designation E250, Quality BR (fully killed), conforming to IS 2062 and shall pass the impact test value at room temperature. Plates beyond 12mm thickness and up to 40mm thickness shall be normalized rolled. Plates beyond 40mm thickness shall be vacuum degassed & furnace normalised and shall also be 100% ultrasonically tested as per ASTM – A578 level B-S2. ii. Pipes shall conform to IS: 1161 (Hand rails only). iii. Hollow (square and rectangular) steel sections shall be hot formed conforming to IS:4923 and shall be of minimum Grade Yst 240. Minimum thickness of hollow section shall be 4mm. iv. Chequered plate shall conform to IS 3502 and shall be minimum 6 mm thick excluding projection. Steel for chequered plate shall conform to grade E250A semi-killed of IS: 2062 or equivalent grade conforming to ASTM & BS standards only			
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SUPERSEDES INVENTORY NO.		IV.7.1.5 All materials used or supplied shall be accompanied by valid and approved materials certificate tests and inspection report. These documents should be correlated with the supply having suitable identifications as per applicable standards/ codes. IV.7.1.6 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME B & PV code Section-IX or other International equivalent standard acceptable to the Purchaser/Owner. IV.7.1.7 All welding/brazing procedures shall be submitted to the Purchaser/Owner or its authorized representative for approval prior to carrying out the welding/ brazing. IV.7.1.8 All brazers, welders and welding operators employed on any part of the contract either in Contractor's/his Sub-Contractors works or at site or elsewhere shall be qualified as per ASME B & PV Code Section IX or other equivalent International Standards acceptable to the Purchaser/Owner. IV.7.1.9 Test results of qualification tests and specimen testing shall be furnished to the Purchaser/Owner for approval. However where required by the Purchaser/Owner, tests shall be conducted in presence of Purchaser/Owner/Authorised representative. IV.7.1.10 Latest statutory/regulatory requirements wherever applicable shall be followed. IV.7.1.11 All gas cut weld edge preparations on alloy steels/stainless steels shall be examined by MPI/DPT. IV.7.1.12 All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes. IV.7.1.13 All non-destructive examination shall be performed in accordance with written procedures (as per International standard). The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report which includes details of procedure, equipment used, result evaluation, job data, identification of personnel employed and details of co-relations the test report with the job. IV.7.1.14 All the sub-vendors proposed by the bidder for procurement of major bought out items, list of which shall be as per Document no. HXE/SK/90345/3, if required by purchaser/ owner, the bidder has to submit vendor details like their manufacturing and testing facilities, past experience, technical leaflets/ catalogue to demonstrate proven capabilities to supply the required item. Such vendor approval shall not relieve the Contractor from any obligation, duty or responsibility under the contract. IV.7.1.15 Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Purchaser/Owner/authorized representative.					
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स्वाधिकार एवं गोपनीय

इस प्रलेख में दी गई सुचना भारत हेवी एलेक्ट्रिकल लिमिटेड की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, जो कि सम्पत्ति के हित में हानिकारक हो न किया जाए।

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समर्पित सूची संख्या को अधिकृत किया जाता है		IV.7.1.17 Bidder shall carry out test at site to prove to the Owner that each equipment of the system complies with requirements stipulated and is erected in accordance with requirement as specified in the specification. Field quality plan to be submitted by bidder. Before the plant is put to conduct trial to demonstrate to the employer that each item of the plant is capable of correctly performing the functions for which it was specified. These trials may be conducted concurrently with those required under commissioning sequence.			
समर्पित सूची संख्या को अधिकृत किया जाता है		IV.7.1.18 UT shall be carried out for raw material thickness $\geq 40\text{mm}$ at plates, bars, forgings etc.			
समर्पित सूची संख्या को अधिकृत किया जाता है		IV.7.2 Major items to be covered in detail in Quality Plan are listed below along with minimum checks to be covered.			
समर्पित सूची संख्या को अधिकृत किया जाता है		IV.7.2.1 DRAIN PUMPS			
समर्पित सूची संख्या को अधिकृत किया जाता है		a. Material tests as per specification requirements.			
समर्पित सूची संख्या को अधिकृत किया जाता है		b. Dimensional check of all the component parts including surface finish, axial and radial runout of shaft etc. during manufacture and assembly.			
समर्पित सूची संख्या को अधिकृत किया जाता है		c. Non-destructive examination as follows:			
समर्पित सूची संख्या को अधिकृत किया जाता है		i. Impeller/wear ring/ shaft sleeve/Casing/ diffuser: MPI/DPT.			
समर्पित सूची संख्या को अधिकृत किया जाता है		ii. Shaft, Couplings and other active components: UT and DPT.			
समर्पित सूची संख्या को अधिकृत किया जाता है		iii. Fabricated Pump components: Dye penetration test on weld.			
समर्पित सूची संख्या को अधिकृत किया जाता है		d. Hydro-test of pump casing shall be done as per approved drawing/standard.			
समर्पित सूची संख्या को अधिकृत किया जाता है		e. Dynamic balancing as per ISO-1940, Gr 6.3 of assembled rotor.			
समर्पित सूची संख्या को अधिकृत किया जाता है		f. Performance test as per Hydraulic Institute Standards and approved data sheet over entire operating range at rated speed, including vibration and noise measurement.			
समर्पित सूची संख्या को अधिकृत किया जाता है		g. Type test of NPSH (R) of drain pump to be carried out and same shall be witnessed by BHEL.			
समर्पित सूची संख्या को अधिकृत किया जाता है		h. SITE TEST: Tests shall be carried out to ensure satisfactory parallel operation, vibration and noise level tests shall also be performed.			
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समर्पण संख्या को अधिकृत करता है		IV.7.2.2 FABRICATION OF PRESSURE PARTS (DUCT, ELBOW, CONDENSATE TANK & DRAIN POT)(design in bidders scope and supply in BHEL scope) a. DPT/MPI on all welds shall be carried out as per ASME/equivalent agreed standard. b. Edge preparation for welds to be carried out at site shall be checked by DPT/ magnetic particle inspection method before dispatch. c. All welds shall be visually examined. Radiographic examination of 10% of butt welds shall be carried out as per ASME/equivalent agreed standard. Same shall be applied for site welds. d. In case of fabricated flanges, welds shall be checked by 100% radiographic/ ultrasonic and 100% magnetic particle inspection methods to ensure freedom from internal and surface defects. e. Plates greater than 40 mm thick shall be ultrasonically tested as per ASTM A 435 or equivalent. f. Drain pot and condensate tank shall be hydraulically tested at 1.3 times the design pressure. g. Leak tightness test to be carried out as per HEI. h. Vendor to incorporate these testing requirements in specification which is to be provided to BHEL for procurement of raw material.															
स्वाधिकार एवं गोपनीय		IV.7.2.3 STRAINERS/FILTERS a. Check for mesh size shall be carried out. b. Suitable NDT shall be carried on body and cover to ensure freedom from defects as per agreed norms. c. Strainer body shall be subjected to hydraulic test at 1.3 times the design pressure. d. Pressure drop tests shall be carried out at rated flow to demonstrate, pressure drop in clean conditions, clogged conditions and filter characteristics.															
निष्कर्ष एवं तिथि SIGN & DATE		IV.7.2.4 RUPTURE DISC a. Test certificates of raw material for disc and safety head shall be tested as per applicable material standards and shall be tested for internal defects as per relevant code. b. Burst testing of Disc shall be done as per approved drawing/ standard. (1 no. per lot)															
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समर्पण संख्या INVENTORY NO.		IV.7.2.5 EXPANSION BELLOW	
समर्पण संख्या INVENTORY NO.		a. Test certificates of raw material for end pipe and bellow shall be tested as per applicable material standards and shall be tested for internal defects as per relevant code.	
समर्पण संख्या INVENTORY NO.		b. 100% DPT of longitudinal butt weld joints of bellow before forming and 100% MPE/ DPT after forming shall be done as per ASME Sec V.	
समर्पण संख्या INVENTORY NO.		c. All welds shall be subjected to 100% magnetic particle/dye penetrant check and butt welds shall be subjected to 100% radiographic testing.	
समर्पण संख्या INVENTORY NO.		d. Hydraulic pressure test shall be carried out on each pipe and expansion bellow.	
समर्पण संख्या INVENTORY NO.		e. All the bellows subjected to vacuum service shall be subjected to vacuum test.	
समर्पण संख्या INVENTORY NO.		f. Rubber expansion joints (if applicable) shall be tested as detailed in Annexure-IV.7-3.	
समर्पण संख्या INVENTORY NO.		g. The bellows shall be subjected to movement test to establish suitability to perform satisfactorily in site conditions. During this test spring rate shall also be measured.	
समर्पण संख्या INVENTORY NO.		h. Type test (life cycle test, meridional yield rupture and squirm test) to be carried out on prototype bellow as per EJMA as per cl IV.4.16.	
समर्पण संख्या INVENTORY NO.		IV.7.2.6 PIPING	
समर्पण संख्या INVENTORY NO.		Piping system shall be tested as per the requirement specified in Annexure-IV.7-3.	
समर्पण संख्या INVENTORY NO.		IV.7.2.7 TUBE BUNDLES	
समर्पण संख्या INVENTORY NO.		a. Test certificates of raw material for tube sheet, tubes, header, fins etc shall be tested as per applicable material standards and shall be tested for internal defects as per relevant code.	
समर्पण संख्या INVENTORY NO.		b. Finned tubes shall be dimensionally checked and tested as per approved drawing and manufacture's standard.	
समर्पण संख्या INVENTORY NO.		c. Tube to tube sheet joint mock-up shall be done as per ASME Sec VIII Div1/approved drg.	
समर्पण संख्या INVENTORY NO.		d. 100% DPT Tube to tube sheet welding as per agreed norms.	
समर्पण संख्या INVENTORY NO.		e. 100% Air tightness test of tube bundles at a pressure of 1.1 times the design internal pressure or vacuum drop test shall be conducted.	
समर्पण संख्या INVENTORY NO.		f. 100% DPT of Header pipe with tube sheet fit-up shall be done as per approved drawing.	
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समग्री सूची संख्या को अधिकृत करता है		g. Type test of tube bundle to be carried out as per section IV.4. IV.7.2.8 FAN a. Test certificates of raw material for hub, disc and blades shall be tested as per applicable material standards and shall be tested for internal defects as per relevant code. b. Blades and fan hub shall be balanced as per section IV.4.5.1. c. Blade track variation, tip clearance shall be checked as per approved drawing. d. In case of fabrication of hub and blades by welding, the weld joint shall be 100% RT tested as per agreed norms. e. Type test of fan performance shall be carried out as per section IV.4.5.1. f. Ultrasonic test shall be carried out on shaft material dia ≥40mm. g. Moment weight (proof load) test on blades shall be checked. h. Assembly fit-up and balancing shall be checked either at manufacturing shop or at site. IV.7.2.9 GEAR BOX a. Test certificates of raw material for casing, pinion, input shaft, output shaft and gear wheel shall be furnished as per applicable material standards. b. Kerosene Leak test of Gear Box casing shall be done as per approved drg. c. Heat Treatment of Gears, pinions and shaft shall be done as per manufacturer's standard for checking the HT cycle verification, hardness, case hardening depth etc. to be furnished. d. Performance test at no load for smooth running, gear ratio, noise level etc. as per procedure. Test of first Gear box shall be witnessed by BHEL. Procedure of performance testing is to be submitted to BHEL. e. Gear box shall be tested for no load run test for 4 hours. IV.7.2.10 SPRING ASSEMBLY (IF REQUIRED) a. Static load testing of the springs shall be carried out and spring characteristics shall be drawn and verified.					
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SUPERSEDES INVENTORY NO.		b. Surface defect test shall be carried out on all the springs after coiling and heat treatment. c. Surface cleaning shall be checked prior to painting and check for thickness of painting shall be carried out. IV.7.2.11 Hangers and Supports Hanger and support shall be tested as per the requirement specified in Annexure-IV.7-3. IV.7.2.12 VALVES AND FLANGES a. The testing of conventional valves shall be as per Annexure-IV.7-3. b. Testing requirement for control valves shall be as per ANSI B 16.31. c. Functional test on control valves shall include check for hysteresis, opening & closing time and correct action on loss of supply. Functional test on stop valve shall include check for stroking time, limit switch setting etc. These tests shall be carried out alongwith respective actuators and accessories. d. Type test for discharge coefficient, relieving capacity and pressure drop co-efficient as applicable shall be carried out. Report of same shall be furnished. e. Flanges shall be forged or made from single plates as far as possible. For flanges 50 mm and above in thickness ultrasonic testing shall be carried out on plates as per ASTM A-435/ A 435 M-90. In case of forged flanges, ultrasonic testing shall be carried out as per ASTM E-388. f. Flanges shall be completely stress relieved after welding in accordance with specified codes. g. In case of fabricated flanges, all welds shall be subjected to 100% radiographic examination after rough machining. Sealing welds after back gouging and final run of welded joints shall be subjected to magnetic particle dye penetrant examination. IV.7.2.13 Structural steel like columns, girder, beams and truss etc. a. Standard Quality plan for structural steel fabrication and erection for applicable areas shall be as per Annexure-IV.7-2. Vendor to prepare the quality plan inline with same and shall be furnished for review to purchaser. b. Steel plates / sections to be used shall be tested for chemical and mechanical properties as per relevant specification and shall be supplied with mill test certificates. c. Plates of 40 mm thickness and above shall be subjected to ultrasonic test as per ASTM 578 level B-52 or equivalent to check the presence of laminations if any.					
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समग्री सूची संख्या को अधिकृतित करता है		d. Steel shall be free from pitting, scaling and rusting. e. If the rolled sections and plates are bent or distorted, bend / distortion shall normally be removed by the cold treatment. Straightening under hot stage shall be resorted only under specific permission from BHEL. f. During cutting if any rolling defects viz. laminations, cracks etc. are observed, the plates shall be checked by ultrasonic test as per AWS D 1.1. Plates with such defects are not to be used. g. Steel plates of different specification grade and type shall be stacked separately. h. Steel of IS: 2062 Gr E250 quality A shall be given distinctive identification mark. IV.7.2.14 Nuts, Bolts etc. a. Bolts, nuts and other hardware shall comply with the requirements of relevant code and shall bear manufacturer's trade mark and give identification as per IS standard or equivalent. b. Bolts and nuts of well-known manufacturer are only acceptable with manufacturer's test certificates. However, in case supplier is not able to produce the manufacturer's test certificate, the same can be inspected only after satisfactory testing as per IS 1367 or equivalent international standard. For the purpose of these tests the inspecting officer shall select at random samples for each test out of each consignment of 1000 nos. or less and instruct the supplier to carry out the tests in his presence. Cost of testing shall be borne by the bidder. IV.7.2.15 Fin Tube Cleaning System The testing shall be carried out as per standard and proven practice of Bidder and same shall be included in quality plan as per Annexure IV.7-1. IV.7.2.16 EOT cranes and Hoist The testing requirement shall as per Annexure IV.7-4. IV.7.2.17 Air Evacuation System The testing requirement shall as per Annexure IV.4-6. IV.7.2.18 Thermal Insulation The testing requirement shall as per Annexure IV.7-3. IV.7.2.19 Final Inspection at shop a. Dimensional check shall be done as per fabrication drawings.			
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SUPERSEDES INVENTORY NO.				b. Marking of holes for fitments or connections and hole sizes shall be checked. c. Painting, preservation and packing. IV.7.2.20 Inspection during fabrication and erection a. All components / members/ items shall be checked for dimensional tolerances, alignment, and orientation during fabrication and erection as per drg. b. The tolerance on dimensions for fabrication and erection shall be as per standards IS 7215 / IS 12843 or equivalent. c. All weld seams shall be subjected to magnetic particle examination. At least 10% of butt welds shall be subjected to radiographic examination. Acceptance criteria of welds shall be as per AWS D1.1 d. Care shall be taken in assembly of sections and correctness of alignment and fit up shall be checked. Site welding shall be carried out as per the procedure approved by the Project Manager. e. Pneumatic test of Duct and Tube Bundle assembly for leak tightness as per HEI to be carried out. f. Testing and inspection shall be as per approved FQP. IV.8 List of Referred Standards <table><tr><td>1.</td><td>IEC 651</td></tr><tr><td>2.</td><td>BS 5969</td></tr><tr><td>3.</td><td>IS 9779</td></tr><tr><td>4.</td><td>IS 3177</td></tr><tr><td>5.</td><td>HIS</td></tr><tr><td>6.</td><td>BS 5352-1981</td></tr><tr><td>7.</td><td>BS 6755</td></tr><tr><td>8.</td><td>ANSI/ASME B16.10</td></tr><tr><td>9.</td><td>AISI316</td></tr><tr><td>10.</td><td>DIN 3230</td></tr><tr><td>11.</td><td>BS 6755</td></tr><tr><td>12.</td><td>TSTE 355 N</td></tr><tr><td>13.</td><td>EJMA</td></tr><tr><td>14.</td><td>ANSI B-31.1</td></tr><tr><td>15.</td><td>MSS-SP-89</td></tr><tr><td>16.</td><td>ASME Sec IX</td></tr><tr><td>17.</td><td>SNT TC-IA</td></tr><tr><td>18.</td><td>ISO 1940</td></tr><tr><td>19.</td><td>SA-UT</td></tr><tr><td>20.</td><td>ASTM-A-435/A435M-90</td></tr><tr><td>21.</td><td>ASTM-388</td></tr></table>				1.	IEC 651	2.	BS 5969	3.	IS 9779	4.	IS 3177	5.	HIS	6.	BS 5352-1981	7.	BS 6755	8.	ANSI/ASME B16.10	9.	AISI316	10.	DIN 3230	11.	BS 6755	12.	TSTE 355 N	13.	EJMA	14.	ANSI B-31.1	15.	MSS-SP-89	16.	ASME Sec IX	17.	SNT TC-IA	18.	ISO 1940	19.	SA-UT	20.	ASTM-A-435/A435M-90	21.	ASTM-388
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PRODUCT PURCHASE SPECIFICATION

**SUPERSEDES
INVENTORY NO.**

मामग्री सूची संख्या को
अधिक्रमित करता है

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स्वत्वाधिकार एवं गीपनीय

इस प्रलेख में दी गई सूचना भारत हेवी एलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाय।

दिनांक एवं हस्ताक्षर

सामग्री सूची संख्या
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|-----|---------------------|
| 22. | IS1367 |
| 23. | ANSI D1.1 |
| 24. | IS 7215 |
| 25. | IS12843 |
| 26. | HEI for ACC |
| 27. | HE57016 |
| 28. | TEMA |
| 29. | IAPWS-IF97 |
| 30. | ASME PTC 30.1 |
| 31. | ANSI/ASME 31.1 |
| 32. | ISO 8501 |
| 33. | SA 105M-95 B Gr II |
| 34. | ASTM-216GrWCB |
| 35. | ASHARE |
| 36. | AGMA |
| 37. | IS: 800 |
| 38. | ASTM A105 |
| 39. | ASTM A285 Gr. C |
| 40. | ASTM A234 WPB |
| 41. | ASTM A193B7/A1942H |
| 42. | DIN 1944 |
| 43. | AFBMA-9 or AFBMA-11 |
| 44. | AGMA 6001-C |
| 45. | ANSI- B17.1 |

IV.9 Documents / Information to be furnished with Technical Offer for mechanical equipment

1. Bidder shall confirm total compliance to the specification without any deviation from the technical / quality assurance requirements stipulated. Duly signed and stamped "No deviation certificate" to be furnished. For any deviations, a list with details along with cost of withdrawal shall be enclosed, BHEL reserves the right to accept or reject any such deviations.
2. Technical Offer to be furnished in three (3) copies with drawings duly signed and stamped.
3. Write up and filled up data sheets as per Annexure-IV.8-4.
4. Filled up Annexure IV.8- 2 & 3.
5. Layout drawings of condensate tank, Vacuum Pump, drain pump.
6. G.A. drawings of ACC with location mentioned for CST, drain pump, drain pot, Vacuum Pump (holding and hogging), Cleaning Pump and tank, elevator, staircase etc. inline with Annexure-IV.3-2.
7. P&ID of the complete system.
8. Performance curve for ACC as per clause IV.3.30 for design case (160 mm Hg)
9. Details of RCC columns like number, spacing, elevation, size etc along with BOQ as per loading criteria HXE/SK/90345/2 to be furnished with price/ commercial bid.
10. Value of Guaranteed Auxiliary power consumption to be furnished. The input parameters shall be as per Annexure-IV.3-1.
11. Tube drawing with fin dimensional details.
12. Write-up on deaeration of make-up and condensate..
13. Process of manufacturing Aluminium clad steel strips for Single row tube.

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IV.10 Documents / Information to be furnished after award of contract Successful bidder shall submit the drawings / documents / information as per agreed "Engineering Information Submission Schedule", the schedule should include the following minimum drawings / information - List of MDL documents as per Annexure- IV.10-1. - Drawings with details of size and capacity including erection and construction drawings - Loading details, Civil drgs - Pipework details at the limit of supply - Instruction manuals - O&M Manuals					
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- Erection manuals - Commissioning procedure - Storage instructions at site 3 original copies (1 for BHEL and 2 for NTPC) of Latest HEI of Air cooled condenser. The documentation that shall be provided by the Contractor is indicated in the various sections of specification. This documentation shall include but not be limited to the following: - Arrangement and detail drawings (Foundation loading details, supporting details, allowable forces and moments at the supports etc). - Complete layout of drain tank/pot with associated pumps, piping details and pit invert level. - General arrangement drawing with details of weight and dimension of the equipment/ skids. - Piping isometric, composite layout and fabrication drawings (Auto-CAD version). - Piping engineering diagrams, pipe and fittings schedules, valve schedules, hanger and support schedules, insulation schedules. - Technical data sheets for all bought out and manufactured items. Contractor shall use the Employer's specifications as a base for placement of orders on their sub vendors. - Detailed design calculations for ACC, individual components, system, piping etc. - Transient, hydraulic and thermal stress analysis of piping and system wherever applicable & input and output data alongwith stress analysis isometrics showing nodes. - Characteristic Curves of fans/ Performance Correction Curves. Hydraulic, Thermal & Mechanical design calculations. - Tube to tubesheet joint and Tube and tube bundle drg. - List of connections on steam duct, drain pot and condensate tank with elevation, location, size etc. - Type test reports, insulation co-ordination study report. - After final acceptance of individual equipment / system by the Employer, the Contractor will update all original drawings and documents for the equipment / system to "as built" conditions and same shall be submitted in number of copies as agreed. - Catalogues / brochures of the various equipments. - Completed data sheets with list of equipment, valve list, pipe schedule, feeder load list as per the format provided at detailed engineering stage. - Production plan with material supply dates, detailed schedule from the start of production covering design, supply, supervision of erection and commissioning. - Information for Civil works (Civil design documents, Foundation loads comprising complete breakup of all the loads and STAAD input file for structure) , allowable building tolerances, Setting -out plans etc.) - Calculations (strength, sound etc.) - Welding and production plan - Inspection plan - Material list and certification - Detailed erection instructions - Detailed operating and maintenance instructions - Parts list with material identification - List of special tools - Despatch details					
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SUPERSEDES INVENTORY NO.	V. ELECTRICAL (BHEL Scope)(except motors, Terminal point is at motor terminal) V.1 SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL i. Bidder shall furnish all AC as well as DC loads required for the system at different voltage levels (eg. 415V AC, 240 V AC, 220 V DC etc.) of all types, such as motor feeders, supply feeders in format (Annexure-V.1-2). V.2 DOCUMENTS TO BE SUBMITTED ALONG WITH BID a. Electrical load requirement in the load data format (for HT & LT motors). b. Maximum Continuous Load per unit to be furnished at design point and 60% BMCR condition. c. Layout of ACC system showing location of PMCC/MCC & drives. V.2.1 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. V.3 LIST OF ENCLOSURES V.3.1 Specification for Motors, Annexure-V.1-4. V.3.2 Specification for LT power cables Annexure V.1-8 V.3.3 Specification for LT control cables Annexure V.1-9 V.3.4 V.3.5 Specification for Instrumentation and power supply cables, Annexure-V.1-10. V.3.6 Quality assurance of following V.3.6.1 LT power cable, Annexure-V.1-12. V.3.6.2 LT control cable, Annexure-V.1-13 V.3.6.3 Motors, Annexure-V.1-15. V.3.6.4 Instrumentation cable, Annexure-V.1-17 V.3.7Data sheet of following V.3.7.1 Motors, Annexure-V.1-19 V.3.7.2 LT power cables, Annexure-V.1-22 V.3.7.3 LT control cables, Annexure-V.1-23 V.3.8List of documents after award of contract Annexure-V.1-27 V.3.9Load data format , Annexure-V.1-2.				
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SUPERSEDES INVENTORY NO.		V.4 Bidder to furnish following at the time of detail engineering:- 1) Quantity of Local push button station for motors. 2) All size and quantity of All Power & control cables and screen control cable for complete ACC incase of either both ends or single end. 3) size and quantity of Any special type of cable like compensating cable, co-axial cable, pre fab cable, micc cable, FO cable. 4) Tonnage and quantity of Cabling material (cable trays, accessoiries , cable tray suporting structure, conduits, marshling boxes, JB) for comleete ACC. 5) Quantity of Illumination system including distribution board & lighting cable (Power supply to distribution board) and aviation lighting. 6) SLD and suggestive layout of ACC switchgear room. 7) No of drives to be connected to Local DCS for ACC.					
समर्पित सूची संख्या को अधिकृत करता है		COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company					
समर्पित सूची संख्या को अधिकृत करता है		स्वाधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी एलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी को सरह प्रयोग, ओ कि सम्पत्ति के हित में हानिकारक हो न किया जाए।					
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SUPERSEDES INVENTORY NO.		VI. CONTROL & INSTRUMENTATION					
समर्पित सूची संख्या को अधिकृत करता है		VI.1 GENERAL SPECIFICATIONS					
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company.		AIR COOLED CONDENSOR (ACC) and its associated equipments shall be designed for safe and efficient operation under all operating regimes in the Power Plant. All necessary instrumentation, field devices, Junction Box etc. shall be provided to make the system complete. Monitoring and control shall be carried out through BHEL supplied Distributed Control System (DCS). However, complete engineering of ACC system for operation shall be carried out by Vendor and logics, schematics etc. for operation, monitoring and control shall be furnished to BHEL for realisation in DCS.					
		VI.1.1 SCOPE OF SUPPLY					
स्वाधिकार एवं गोपनीय इस प्रलेख में दी गई सुचना भारत हेवी एलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी को प्रयोग, ओ कि सम्पत्ति के हित में हानिकारक हो न किया जाए।		1. Instruments for ACC system : 1 SET					
		2. Instrument Junction Boxes : 1 SET					
SIGN & DATE		3. Instrument Cables upto JB's : As required					
		4. Cable Trays, Routing and Accessories upto : As required					
SIGN & DATE		5. Process Connection & Piping : 1 SET					
		6. Local Instruments Racks (LIRs) : 1 SET					
SIGN & DATE		7. Instrumentation cables, ordinary cables, screen control cables between equipments supplied by vendor					
		8. Instrumentation cable, ordinary cables, screened control cables upto Junction Box (Terminal point- BHEL will provide instrumentation cable from JB to Local ACC control room.)					
SIGN & DATE		9. Any special type of cable like compensating, Co-axial, prefab, MICC and fiber optical upto JB.					
		The control system for the AIR COOLED CONDENSOR shall be DCS based which shall be provided by BHEL. However, complete engineering, logics, I/O list, Alarm list, Drive list etc. for ACC system design shall be provided by Vendor in BHEL format which will be discussed during detailed engineering.					
SIGN & DATE		Make of various equipments/items in the scope of bidder shall strictly be subject to approval of the owner during detailed engineering stage without any commercial implications.					
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SUPERSEDES INVENTORY NO.		VI.1.2 ELECTRIC POWER 415 V, 3-phase AC feeder shall be provided to the Vendor. Any other special power supply like 24VDC, 110 VDC or 220 VDC and any UPS supply shall be arranged by the Vendor itself. VI.1.3 UNIT OF MEASUREMENT Flow: Liquid: m3/hr Steam: T/hr Gas & Vapours: Nm3/hr Pressure Gauge: Bar (g) Vacuum: Bar (abs.): mm of H2O (abs.) Temperature: °C Level: % VI.2 SYSTEM DESIGN VI.2.1 GENERAL The work shall be consistent with modern power plant practices and shall be in compliance with all applicable codes, standards, guides, statutory regulations and safety requirements in force. It is to be noted that where equipment or system for the generating units are described, it shall be understood that the quantities described are to be provided per unit basis, i.e., identical sets to be furnished by the Contractor for each of the units unless specifically indicated otherwise. VI.2.2 REDUNDANCY CRITERIAL OF SENSORS Redundancy of components and systems shall be dictated by safety considerations in critical applications and also the availability criteria of the control system. Triple redundancy of sensors and transmitters shall be provided for critical control /Protection applications. Double redundancy shall be provided for less critical control & interlock and single sensor/transmitters for alarm & monitoring purpose. Separate Cables are to be provided for dual/triple redundant instruments used for protection. VI.2.2.1 TRIPLE MEASUREMENT SCHEME Triple measurement scheme for analog/binary inputs employing three independent transmitters					
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समय सीमा संख्या को अधिकृत करता है SUPERSEDES INVENTORY NO.		connected to separate tapping points shall be employed for the most critical measurements. Triple sensors shall be provided for Instruments required for auto starting of pumps or pump tripping due to very low level of water.															
समय सीमा संख्या को अधिकृत करता है SUPERSEDES INVENTORY NO.		VI.2.2.2 DUAL MEASUREMENT SCHEME For other binary and analog inputs required for modulating control, protection and interlock purpose of other equipment etc., minimum dual sensors shall be provided. Dual measurement scheme for analog inputs employing															
समय सीमा संख्या को अधिकृत करता है SUPERSEDES INVENTORY NO.		VI.3 WIRING TERMINATION AND ACCESSORIES All the cables are to be treated with anti-rodent treatment.															
समय सीमा संख्या को अधिकृत करता है SUPERSEDES INVENTORY NO.		VI.3.1 INSTRUMENTATION AND CONTROL CABLES All instrumentation cables shall be twisted & shielded, PVC insulated & sheathed with FRLS properties. All necessary laying & termination accessories, hardware, sub trays , main trays etc. for meeting requirements specified shall be supplied by the contractor on as required basis. Separate cables are to be provided for dual / triple redundant instruments used for protection of Unit and HT drives. These cables are also to be laid in separate routes to the extent feasible. Cables for Instruments upto the Junction Box shall be in vendor scope.															
समय सीमा संख्या को अधिकृत करता है SUPERSEDES INVENTORY NO.		VI.3.2 JUNCTION BOXES <table><tr><td colspan="2">JUNCTION BOX</td></tr><tr><td>No. of ways</td><td>12/24/36/48/64 with 20 % spares terminals</td></tr><tr><td>Material and thickness</td><td>4mm thick Fiberglass Reinforced Polyester/2 mm CRCA steel sheet.</td></tr><tr><td>Type</td><td>Screwed at all four corners for door</td></tr><tr><td>Colour</td><td>RAL7035</td></tr><tr><td>Degree of Protection</td><td>IP55</td></tr></table>				JUNCTION BOX		No. of ways	12/24/36/48/64 with 20 % spares terminals	Material and thickness	4mm thick Fiberglass Reinforced Polyester/2 mm CRCA steel sheet.	Type	Screwed at all four corners for door	Colour	RAL7035	Degree of Protection	IP55
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SUPERSEDES INVENTORY NO.		VI.3.3 TERMINAL BLOCKS Terminal blocks shall be clip-on type equipped with corrosion resistant washer cage clamp terminals. Terminal blocks design shall include a white fibre marking strip with clear plastic hinged terminal covers. Alternate arrangement shall be subject to BHEL's approval. Bidder shall supply all cable glands required for glanding the above mentioned cables at field Junction Boxes. All cable glands shall be of anodised aluminium alloy or of nickel-plated brass and they shall be double compression type suitable for armoured cables. The brackets, bolts, nuts, screws, glands required for erection shall be of Stainless Steel and included in Bidders scope of supply. VI.3.4 CONDUITS All rigid conduits, couplings and elbows shall be hot dipped galvanised rigid mild steel in accordance with IS: 9537 Part-I and Part-II. The conduit internal and external surface shall have continuous zinc coating with an overcoat of transparent enamel lacker or zinc chromate. Flexible conduit shall be heat resistant lead coated galvanised steel with water leak, fire and rust proof protected. Conduits from each Junction Box upto & inside to local ACC control Room shall also be in Bidders scope. VI.3.5 CABLE TRAYS/ROUTING All cables/tubes shall run on cable trays. These cable trays shall be made out of galvanised MS and shall be of sheet steel of 2.5 mm thick. Suitable cable clamps shall be supplied for binding the cables / tubes at every 500 mm. A minimum distance of 400 mm shall be kept between instrument / signal cables and power cables.					
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SUPERSEDES INVENTORY NO.		VI.3.6 SPECIFICATION OF INSTRUMENTATION CABLE					
समर्थन सूची संख्या को अतिरिक्त करता है		VI.3.6.1 COMMON REQUIREMENTS					
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		Operating Voltage		225 V (peak value)			
		Codes and standard		All instrumentation cables shall comply with VDE 0815, VDE 0207, Part 4, Part 5, Part 6, VDE 0816, VDE 0472, SEN 4241475, ANSI MC 96.1, IS-8784, IS-10810 (latest editions) and their amendments read along with this specification.			
		Continuous operation suitability		At 70 deg. C for all types of cables			
		Marking		a. Progressive automatic on-line sequential marking of length in meters to be provided at every one meter on outer sheath. b. Marking to read 'FRLS' to be provided at every 5 meters on outer sheath. c. Durable marking at intervals not exceeding 625 mm shall include manufacturer's name, insulation material, conductor's size, number of pairs, voltage rating, type of cable, year of manufacturer to be provided on outer sheath.			
		Allowable Tolerance on overall diameter		+/- 2 mm (maximum) over the declared value in data sheet			
		Variation in diameter		Not more than 1.0 mm throughout the length of cable.			
		Ovality at any cross- section		Not more than 1.0 mm			
		Colour		The outer sheath shall be of blue colour.			
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SUPERSEDES INVENTORY NO.		TABLE A: CABLE TERMINATION TO BE FOLLOWED					
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		FROM (A)	TO (B)	END A	END B		
		Valves/dampers drives (Integral Junction box)	Local group JB	Plug in connector	Post mount cage clamp type.	G	
		Transmitters, Process Actuated switches mounted in LIE/LIR	Local Junction box	Plug in connector	Cage clamp (Rail mount) type.	F,G	
		RTD heads	Local junction box	Plug in connector	Cage clamp (Rail mount) type.	F	
		RTD	Temperature transmitter	Plug in connector	Screwed, Cage clamp type	F	
		Local Junction box, Temperature Transmitter, Int. Junction box of LIE/ LIR/ MCC/SWGR	Group JB	Cage clamp (Rail mount) type.	Cage clamp (Rail mount) type.	F,G	
Notes		1 Normally 10% spare cores shall be provided when the numbers of pairs of cables are more than four pairs. 2 For analog signals, individual pair shielding & overall shielding & for Binary signals, only overall shielding of instrumentation cables shall be provided.					
VI.3.8		INSTRUMENTATION CABLE INSTALLATION AND ROUTING					
स्वाधिकार एवं गोपनीय इस प्रलेख में दी गई सुचना भारत हेवी एलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, ओ कि कमर्श के लिए में हानिकारक हो न किया जाए।		Cables shall be segregated as per IEEE Std.-422. In vertically stacked trays, the higher voltage cable shall be in higher position and instrumentation cable shall be in bottom tier of the tray stack. The distance between instrumentation cables and those of other system shall be as follows: From 11 kV/6.6 kV/3.3 kV tray system - 914 mm From 415V tray system - 610 mm From control cable tray system 305 mm					
		Cables shall terminate in the enclosure through cable glands. All cable glands shall be properly gasketed. Sealing (to prevent ingress of dust entry and propagation of fire) shall be provided for all floor slots used for cable entrance.					
		All cables shall be identified by tag. Nos. provided at both the ends as well as at an interval of 5 meters.					
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समग्री सूची संख्या को अधिकृत करता है		PRODUCT PURCHASE SPECIFICATION	
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समग्री सूची संख्या को अधिकृत करता है		VI.3.9 CABLE LAYING AND ACCESSORIES	
समग्री सूची संख्या को अधिकृत करता है		1. Cables shall be laid strictly in line with cable schedule.	
समग्री सूची संख्या को अधिकृत करता है		2. Identification tags cables: Indelible tags to be provided at all terminations, on both sides of wall or floor crossing, on each conduit/duct/pipe entry/exit, and at every 20 m in cable trench/tray.	
समग्री सूची संख्या को अधिकृत करता है		3. Cable tray numbering and marking: To be provided at every 10m and at each end of cable way & branch connection.	
समग्री सूची संख्या को अधिकृत करता है		4. Joints for less than 250 Meters run of cable shall not be permitted.	
समग्री सूची संख्या को अधिकृत करता है		5. Buried cable protection With concrete slabs; Route markers at every 20 Meters along the route & at every bend.	
समग्री सूची संख्या को अधिकृत करता है		VI.4 SPECIFICATION OF FIELD INSTRUMENTS	
समग्री सूची संख्या को अधिकृत करता है		VI.4.1 GENERAL	
समग्री सूची संख्या को अधिकृत करता है		The contractor shall provide electronic transmitters, control valves and analysers with HART protocol for maintenance, diagnostics and record keeping.	
समग्री सूची संख्या को अधिकृत करता है		All the primary Instruments like Microprocessor based transmitters including temperature transmitters employing HART protocol, RTDs, Ultrasonic flow Transmitter / Impact Head type flow elements for CW flow, transducers, Ultrasonic / Guided Radar type level transmitters, Pressure/Diff. Pressure/Temperature/Flow/Level transmitters & Gauges, Flow Sensing Elements(Orifice Plates, Flow Nozzles, Impact Head Type Elements, Coriolis Type Flow Measuring System etc.) , Ultrasonic Flow Transmitters , positive displacement type flow transmitters , Magnetic Flow meter, Vibration sensors, key phasor, etc. shall be provided on as required basis meeting functional redundancy, available and reliability requirements.	
समग्री सूची संख्या को अधिकृत करता है		For temperature elements including bearing / winding temp of motors / pumps temperature transmitters shall be provided, with philosophy as defined below:	
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समग्री सूची संख्या को अधिकृत करता है		जांचकर्ता CHECKED BY	

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SUPERSEDES INVENTORY NO. समझी सूची संख्या को अधिकृत करना है।			
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company		i) Rail mounted/ Rack mounted (Dual input Field mounted temperature transmitters)/Field Bus Compatible temperature transmitters for temperature elements (for all the temperature elements being procured by the contractor) are to be provided by the contractor. ii) Contractor shall provide at least one dual input transmitter for temperature measurements being used in trip/protection/major interlock of Major auxiliaries. Eg. when three/two temperature measurement points are being used to for monitoring one bearing temperature, both elements of one duplex temperature element is to be connected to one dual input temperature transmitter. iii) Remaining temperature transmitters are to be Single Input DIN rail mounting type, mounted in JB's. Contractor shall provide enclosures/racks for mounting the dual-input TTs on as required. basis. The number of Temperature Transmitters in enclosures/ racks and the internal arrangement of the same shall be subject to Employer's approval during detailed engineering The Bidder shall furnish all instrumentation control equipment and accessories as per technical specifications, ranges, makes and model numbers approved by the Owner during detailed engineering. When more than one device utilizes the same measurement or control signal, the transmitter or other signal source shall be equipped to provide all signal requirements without affecting the accuracy. All instruments, devices and accessories furnished by the Bidder as per this specification shall be designed and constructed to perform normally and meet all guarantee when subjected to the environmental and service conditions. The necessary root valves, impulse piping, drain cocks, gauge zeroing cocks, valve manifolds and all other accessories required for mounting/erection of all local field instruments shall be provided by Bidder as per approved hook up drawings. All field instruments shall be weatherproof, drip tight, dust tight and splash proof suitable for use under outdoor ambient conditions prevalent in the subject plant. All field-mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance is achieved. The enclosures of all electronic instruments shall conform to IP-65 unless otherwise specified (Explosion proof for NEC class 1, Division 1 area) and an anti-corrosive paint shall be applied to the field mounted enclosures / instruments. Following minimum requirement of field instruments shall be fulfilled by Bidder (whichever	
स्वत्वधिकार एवं गोपनीयता इस प्रयोग में की गई सुचना भारत भारती परमाणुशक्ति की सम्पत्ति है इसका प्रसारण एवं उपयोग रूप से किसी भी तरह प्रयोग, जो कि समझी के हित में हो निषिद्ध है। अथ ।			
दिनांक एवं हस्ताक्षर SIGN & DATE			
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सामग्री सूची संख्या INVENTORY NO.	18. Fan speed for VFD: Fan motor speed status shall be monitored for each individual fan via feedback from the Motor Control Centre in case of VFD supplied Fan system. 19. Valve positions of automated valves: The valve position of each automated valve within the ACC should be monitored via the limit switches or valve positioners. 20. For measuring Ambient air pressure, temperature and wind speed, adequate instruments shall be provided. 21. 2 nos. conductivity transmitters for measuring condensate conductivity in CST shall be provided. Bidder to provide the supporting documents describing the standard philosophy of various instrumentations provided in ACC system; example, for Fan vibration measurement, for oil pressure and temperature measurement in gear box etc. Bidder may refer tender PID of further instrument details. The type/quantity of instruments shall be subjected to NTPC/BHEL approval and without any commercial implication. Field switches will be micro switch type with auto reset. Switches will have NO and NC contacts. Switch contacts shall be snap acting, SPDT, hermetically sealed, potential-free with a minimum contact rating of 240 V AC, 5A. The instrumentation and control equipment shall have high electro-magnetic and radio frequency interference Immunity and shall not be affected by portable radio transmitters operated in the vicinity of the equipment. Any limitations shall be stated. All transmitters, switches etc. shall be suitable grouped together and mounted inside Local Instrument Racks (LIRs) or Local Instrument Enclosures (LIEs). LIEs shall be of minimum IP55. LIRs/LIEs complete with all fittings, mountings and accessories etc. are to be provided by contractor as on required basis.				
सामग्री सूची संख्या INVENTORY NO.	VI.4.2 TEMPERATURE MEASUREMENTS Temperature gauges and elements shall be provided with SS316 tapered thermowells capable of withstanding the greatest shocks and vibrations that can be imposed upon them in the system piping without deterioration. RTDs shall be of duplex, 4 wire type made with 100 ohm platinum resistance elements.				
निष्कर्ष एवं दिनांक SIGN & DATE	VI.4.3 PRESSURE MEASUREMENTS Pressure transmitters shall be with integral mounted two valve manifolds up to line pressure of 40 bar. Above 40 bar the pressure instruments shall be supplied with adaptor flanges. All pressure transmitters will be capable of withstanding their body rating conditions without				
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समर्पित सूची संख्या को अधिकृत करता है		VI.4.4 LEVEL MEASUREMENTS Differential pressure transmitters shall be used in general. Float and tape type level transmitters shall be used for big storage tanks. The accuracy shall be better than 0.04% or better.					
समर्पित सूची संख्या को अधिकृत करता है		Displacer type level transmitters wherever used shall be 24V DC powered, with isolated 4-20 mA DC output signals. Displacer type level transmitter shall be of torque tube type. The accuracy shall be better than 05.					
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स्वाधिकार एवं गोपनीय इस दस्तावेज में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह का प्रयोग, जो कि सम्पत्ति के हित में हो सके, वर्जित है।		VI.4.6 CONTROL VALVE ACCESSORIES AND DEVICES Refer Annexure VI.III for details. Hand Held Calibrator shall be provided as per Annexure VI.III The type of valve whether pneumatic or motorised (ON/OFF or itching or regulating duty) shall be reviewed based on the functional requirement of the system and shall be subjected to BHEL/NTPC approval.					
SIGN & DATE		The following accessory equipment shall be provided for control valves(as applicable):					
SIGN & DATE		VI.4.6.1 AIR LOCKS: Air locks shall be designed to shut off the diaphragm loading airline if the supply air pressure to the associated pilot or Positioner fails. Air locks shall be of the automatic reset type and shall be furnished with alarms.					
SIGN & DATE		VI.4.6.2 HAND WHEELS: Hand Wheels shall be provided. Hand wheels shall be side mounted unless specified to be top mounted. However the mounting shall be as decided during engineering to offer maximum accessibility.					
SIGN & DATE		VI.4.6.3 LIMIT SWITCHES: Valves shall be provided with limit switches. Switches shall have not less than two normally open and two normally closed contacts in both open and close directions. Electrical rating of the limit switch contacts shall be 240V AC, 5 amps or 220V DC, 0.5 amps. The enclosures of the limit					
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समग्री सूची संख्या को अधिकृत करता है		For further details, refer Annexure VI.I					
समग्री सूची संख्या को अधिकृत करता है		VI.4.6.10 VIBRATION SENSORS					
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company		Eddy current / piezoelectric type transducers shall be used. The sensors shall be either velocity or accelerometer type. However, the finally selected sensor type shall also depend on recommendation of the equipment manufacturer & suitable for application requirement which shall be finalised during detail engineering and without any extra price. Transducers shall be furnished in weatherproof housing suitable for field conditions.					
स्वाधिकार एवं गोपनीय इस प्रारूप में दी गई सुचना भारत हेवी एलेक्ट्रिकल लिमिटेड की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, ओ कि सम्पत्ति के हित में हानिकारक हो न किया जाए।		VI.4.7 MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)					
SIGN & DATE		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 instruments shall be of proven reliability, accuracy, and repeatability requiring a minimum of maintenance and shall comply with the acceptable international standards and shall be subject to Employer's approval.					
SIGN & DATE		Every panel-mounted instrument requiring power supply shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.					
SIGN & DATE		All transmitters, sensors, and switches, Gauges for parameters like pressure, temperature, level, flow etc. as required for the safe and efficient operation and maintenance as well as for operator and management information (including all computation) of equipment in the system under the scope of specification shall be provided on as required basis with in quoted lump sum price. The Contractor shall furnish all Instrumentation / Control equipment & accessories under this specification as per technical specification, ranges, makes & model as approved by the Employer during detailed engineering.					
SIGN & DATE		The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments shall be furnished, even if not specifically asked for, as on required basis. The contacts of equipment mounted instruments, sensors, switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg./sq.cm.					
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SUPERSEDES INVENTORY NO.		VI.4.7.1 SPECIFICATION FOR ELECTRONIC TRANSMITTERS FOR PRESSURE, DIFF. PRESS AND DP BASED FLOW , LEVEL MEASUREMENTS <table><thead><tr><th>FEATURES</th><th>MINIMUM REQUIREMENTS</th></tr></thead><tbody><tr><td>Type of Transmitter</td><td>Microprocessor based 2 wire type, Hart protocol compatible</td></tr><tr><td>Accuracy</td><td>± 0.1% of calibrated span</td></tr><tr><td>Output signal range</td><td>4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol)</td></tr><tr><td>Turn down ratio</td><td>10:1 for vacuum/very low pressure applications. 5:1 for very high pressure application 30:1 for other applications</td></tr><tr><td>Stability</td><td>± 0.1% of calibrated span for six months for Ranges up to and including 70 Kg/cm². ± 0.25% of calibrated span for six months for Ranges more than 70 Kg/cm² (g)</td></tr><tr><td>Zero and span drift</td><td>+/- 0.015% per deg. C at max span. +/-0.11% per deg. C at min. Span</td></tr><tr><td>Load impedance</td><td>500 ohm (min.)</td></tr><tr><td>Housing</td><td>Weather proof as per IP-55 with durable corrosion resistant coating</td></tr><tr><td>Over Pressure</td><td>150% of max. Operating pressure</td></tr><tr><td>Connection (Electrical)</td><td>Plug and socket type</td></tr><tr><td>Process connection</td><td>1/2 inch NPT (F)</td></tr><tr><td>Span and Zero</td><td>Continuous, tamper proof, Remote as well as adjustability manual from instrument with zero suppression and elevation facility.</td></tr></tbody></table>						FEATURES	MINIMUM REQUIREMENTS	Type of Transmitter	Microprocessor based 2 wire type, Hart protocol compatible	Accuracy	± 0.1% of calibrated span	Output signal range	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol)	Turn down ratio	10:1 for vacuum/very low pressure applications. 5:1 for very high pressure application 30:1 for other applications	Stability	± 0.1% of calibrated span for six months for Ranges up to and including 70 Kg/cm ² . ± 0.25% of calibrated span for six months for Ranges more than 70 Kg/cm ² (g)	Zero and span drift	+/- 0.015% per deg. C at max span. +/-0.11% per deg. C at min. Span	Load impedance	500 ohm (min.)	Housing	Weather proof as per IP-55 with durable corrosion resistant coating	Over Pressure	150% of max. Operating pressure	Connection (Electrical)	Plug and socket type	Process connection	1/2 inch NPT (F)	Span and Zero	Continuous, tamper proof, Remote as well as adjustability manual from instrument with zero suppression and elevation facility.
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SUPERSEDES INVENTORY NO.		समर्थी सूची संख्या को अधिकृत करता है		<table><tr><td>Accessories</td><td>2 valve manifold for absolute & Gauge pressure transmitters, 3-valve manifold for vacuum pressure transmitters & where DP transmitters are being used for pressure measurement and 5 valve manifold for DP/Level/Flow applicable. -For hazardous area, explosions proof enclosure as described in NEC article 500</td></tr><tr><td>Diagnostics</td><td>Self-Indicating feature</td></tr><tr><td>Power supply</td><td>24V DC ± 10%.</td></tr><tr><td>Adjustment/ calibration/ maintenance</td><td>From hand held calibrator/centralized PC based system (as applicable).</td></tr></table> Note: For primary air/ secondary air/flue gas applications, DP type transmitters shall be provided for pressure measurement. LVDT type is not acceptable. Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application. VI.4.7.2 GUIDED WAVE RADAR TYPE LEVEL TRANSMITTER <table><tr><td colspan="2">Guided wave radar type level transmitters shall be provided for level measurements of the vessel under vacuum or low pressure applications.</td></tr><tr><td>Type</td><td>Guided wave Radar</td></tr><tr><td>Principle</td><td>TDR (Time domain reflectometry)</td></tr><tr><td>Probe Type& Material</td><td>Coaxial, SS316/316L. If required, probe shall be suitable for overfill prevention.</td></tr><tr><td>Signal o/p</td><td>4-20mA with HART signal suitable for overfill prevention.</td></tr><tr><td>Display</td><td>Integral</td></tr><tr><td>Power supply</td><td>24 VDC</td></tr><tr><td>Accuracy</td><td>5mm</td></tr></table>				Accessories	2 valve manifold for absolute & Gauge pressure transmitters, 3-valve manifold for vacuum pressure transmitters & where DP transmitters are being used for pressure measurement and 5 valve manifold for DP/Level/Flow applicable. -For hazardous area, explosions proof enclosure as described in NEC article 500	Diagnostics	Self-Indicating feature	Power supply	24V DC ± 10%.	Adjustment/ calibration/ maintenance	From hand held calibrator/centralized PC based system (as applicable).	Guided wave radar type level transmitters shall be provided for level measurements of the vessel under vacuum or low pressure applications.		Type	Guided wave Radar	Principle	TDR (Time domain reflectometry)	Probe Type& Material	Coaxial, SS316/316L. If required, probe shall be suitable for overfill prevention.	Signal o/p	4-20mA with HART signal suitable for overfill prevention.	Display	Integral	Power supply	24 VDC	Accuracy	5mm
Accessories	2 valve manifold for absolute & Gauge pressure transmitters, 3-valve manifold for vacuum pressure transmitters & where DP transmitters are being used for pressure measurement and 5 valve manifold for DP/Level/Flow applicable. -For hazardous area, explosions proof enclosure as described in NEC article 500																														
Diagnostics	Self-Indicating feature																														
Power supply	24V DC ± 10%.																														
Adjustment/ calibration/ maintenance	From hand held calibrator/centralized PC based system (as applicable).																														
Guided wave radar type level transmitters shall be provided for level measurements of the vessel under vacuum or low pressure applications.																															
Type	Guided wave Radar																														
Principle	TDR (Time domain reflectometry)																														
Probe Type& Material	Coaxial, SS316/316L. If required, probe shall be suitable for overfill prevention.																														
Signal o/p	4-20mA with HART signal suitable for overfill prevention.																														
Display	Integral																														
Power supply	24 VDC																														
Accuracy	5mm																														
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स्वाधिकार एवं गोपनीय		इस प्रलेख में दी गई सुचना भारत हेवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, ओर कि सम्पत्ति के हित में हानिकारक हो न किया जाए।																													
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समर्पण संख्या को अधिकृत करता है SUPERSEDES INVENTORY NO.		2) Four wire type transmitters can also be provided for applications where 2- wire transmitter has some technical limitations, subject to employer's approval during detailed engineering stage. However, in such cases isolated 4-20 mA DC (analog) output shall be provided. Power supply required for such transmitters shall be 240V AC / 24V DC. 3) For applications where transmitter location is not accessible, the transmitter shall have separate sensor unit and electronic unit for such applications. It shall be possible to mount the electronic unit at accessible location. VI.4.7.4 HART Hand Held calibrator Hand held calibrator shall be provided for adjustment/calibration/maintenance of the HART compatible transmitters. The hand held calibrator shall be suitable for all types of transmitters supplied in the package. If one type of hand held type calibrator is not suitable for communicating with all types of transmitters then separate hand held calibrator will be provided for that specific type of transmitter. VI.4.7.5 RESISTANCE TEMPERATURE DETECTOR (RTD) <table><tr><td>Feature</td><td>Essential/Minimum Requirements</td></tr><tr><td>Type of RTD</td><td>Four wire, Pt-100 (100 Ohms resistance at zero degree Centigrade).</td></tr><tr><td>No. of element</td><td>Duplex</td></tr><tr><td>Housing/Head</td><td>IP-65/Diecast Aluminium. Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable). Plug in connectors are to be provided for external signal cable connection</td></tr><tr><td>Sheathing of RTD</td><td>Metal sheathed, ceramic packed</td></tr><tr><td>Calibration and accuracy</td><td>As per IEC-751/DIN-43760 Class-A for RTD</td></tr><tr><td>Characteristic</td><td>Linear with respect to temp, within $\pm 1/2$ percent of top range value</td></tr><tr><td>Accessories</td><td>Thermo well (as specified below) and shall be spring loaded for positive contacts with the well</td></tr><tr><td>Standard</td><td>IEC-751/ DIN-43760 for RTD and ASME PTC-19.3 for Thermo-well.</td></tr></table>				Feature	Essential/Minimum Requirements	Type of RTD	Four wire, Pt-100 (100 Ohms resistance at zero degree Centigrade).	No. of element	Duplex	Housing/Head	IP-65/Diecast Aluminium. Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable). Plug in connectors are to be provided for external signal cable connection	Sheathing of RTD	Metal sheathed, ceramic packed	Calibration and accuracy	As per IEC-751/DIN-43760 Class-A for RTD	Characteristic	Linear with respect to temp, within $\pm 1/2$ percent of top range value	Accessories	Thermo well (as specified below) and shall be spring loaded for positive contacts with the well	Standard	IEC-751/ DIN-43760 for RTD and ASME PTC-19.3 for Thermo-well.
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SUPERSEDES INVENTORY NO. सामग्री सूची संख्या को अधिकृत करता है	NOTES: 1) The specifications for RTDs of winding/ bearings of motor/pump, can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However the type of RTD shall be Pt100.																																																																				
VI.4.7.6 PROCESS ACTUATED SWITCHES																																																																					
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VI.4.7.7 TEMPERATURE TRANSMITTER

Following types of 2-wire temperature transmitter (directly powered from 4-20mA input cards of DCS) shall be provided by contractor. The temperature transmitter shall be fully compatible with RTDs being provided by the contractor as well as Employer.

a. Single Input Head mounted Temperature Transmitter

These shall be suitable for mounting in the head of temperature element itself. The protection class of head of thermo well along with its plug-in connector shall be min. IP65.

b. Single Input DIN-rail mounted Temperature Transmitter

These shall be suitable for mounting on DIN-rails in JBs. These temperature transmitters shall be the ones which are especially designed for DIN-rail mounting with IP 20 protection class. These shall have terminals for input/output provided on front side when mounted on DIN-rail.

Head mounted temperature transmitter with clamps to make it suitable for DIN-rail mounting shall not be acceptable under this category.

c. Dual-input Temperature Transmitter With Indicator:

These shall be suitable for mounting on pipes/ support. Indicator shall be provided with these transmitters. These transmitters shall have bump less change over facility to second sensor in case first sensor fails .This change-over is to be alarmed. Protection class shall be IP65 minimum.

d. Common requirements for each of the above type of temperature transmitters.

Output	2-wire (power supply from input card of Control system) with 4-20mA output with superimposed HART protocol signal.
Input	Same transmitter shall be capable to handle Pt-100 RTD, Thermocouples –K&R types (input type to be selectable at site through HART terminal)
Isolation	min. 500 V AC
EMC compatibility	as per EN 61326
Operating ambient temperature	0 to 85 deg. C (without indicator) 0 to 70 deg. C (with indicator)

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समर्पण संख्या को अधिकृत करता है		<table><tr><td>Power supply</td><td>Compatible with input module of Control System.</td></tr><tr><td>Accessories</td><td>Mounting arrangements including clamps etc.</td></tr></table>				Power supply	Compatible with input module of Control System.	Accessories	Mounting arrangements including clamps etc.								
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समर्पण संख्या को अधिकृत करता है		VI.4.7.8 CONDUCTIVITY TRANSMITTER a) Applicable standard :- ASME PTC 19.11-1970 b) Type: Removable type (withdrawable with sealing valve) c) Analyser /Monitors:- Electronic (Microprocessor based) indicating type with multi range facility (Single Channel). d) Material : i) Cell Epoxy resin/SS316 ii) Electrode:- Platinised/SS316 iii) Analyser body :- Carbon steel/Aluminium/Polycarbonate e) Monitor output 2 x 4-20 mA D.C. Output load : 500O f) Power supply 240V, AC, 50 Hz from UPS g) Accuracy < + 1% of full scale span h) Stability + 1% of full scale per month non-cumulative i) Repeatability + 0.3% of span j) Response time < 5 seconds (90% of full scale) k) Annunciation contacts from monitors:- i) Number :- 2 SPDT ii) Type Snap action micro switch iii)Rating 5 amp, 240 V, 0.2 Amp, 220V DC l) Electrical :- Half (1/2) inch NPT (F) SCRD / Plug in Type. m) Accessories i) Automatic temperature compensation in the range 0-100 degC ii) Other accessories as required iii) Adequate length of cables for connecting coils to monitors iv) Sample rate set valves v) Alarm settings and Alarm indications on monitor. vi) Auto Calibration, Comprehensive diagnostic and alarm features. n) Other particulars:- Cell shall be suitable for maximum pressure of 7 kg/cm2 and maximum temp. of 100 degC															
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समग्री सूची संख्या को अधिकतम करता है		VI.5.1 GENERAL DESIGN CRITERIA Instrument process tubing and instrument air tubing to be designed in accordance with the instrument tubing line specifications. All instruments, process connections, including isolation valves and associated devices, shall be located in easily accessible locations for maintenance, calibration and replacement. All maintenance, calibration and replacement operations on a given device must be possible without interruption of service to adjacent equipment. Refer Annexure VI.V for further details. Instrument mounting height shall 1.5m above equipment base or platform. Instrument tubing installations are designed in accordance with ANSI B31.1, "Power Piping".					
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company		VI.5.2 PRESSURE PARTS The material of thermowell depends upon the process condition. One isolating valve is provided for pressure/level measurements up to 40 Kg/sq.cm (a) and two isolating valves shall be provided for pressure /Level measurements above 40 Kg/sq.cm (a). In addition one number three way valve is provided for local pressure measurement. Pressure test pockets on steam lines shall be provided with condensing loop.					
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सामग्री सूची संख्या को अधिकृत करता है	❖ Instrument sensing lines are grouped together as much as practical to benefit from the use of common support members and to present a finished installation that is routed in a neat and orderly manner. Care is exercised to assure that spacing between adjacent tubes in the same group is maintained uniform and that tubes do not cross under or over one another at any point. Changes in direction of tubing is done by the use of tube bends and not tube fittings.				
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company	❖ Compression tube fittings are used in low pressure process systems. Socket weld tube fittings are used in high pressure process systems. A single blow down valve or double blow down valves (if the process root valves are doubled) shall be installed to the sensing lines of all pressure transmitters that are tapped off liquid or steam process systems. These valves shall be located at the instrument and may be brought together to the header. The maximum process temperature for all transmitters shall be limited to 80°C. To dissipate the excess heat, a minimum of 1 meter of tubing for each 30°C of excess heat shall be installed to isolate the process media from the instrument. An additional isolation valve shall be used at the instrument for isolation of those instruments without valve manifolds.				
	❖ The following points shall be taken care by Vendor: - ACC Vendor to provide tapping for Specific Conductivity Analyzers (Left and Right side) on the condensate Tank. - Instruments for Drain pot Level Control shall be provided by Vendor.				
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SIGNATURE SIGN & DATE	VI.7 SPARES Pl. refer to the mandatory spares section for Mandatory, recommended and commissioning spares mentioned elsewhere in the ACC specification The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares and recommended spares and indicate these in the relevant schedules of the Bid Form and Price Schedules. The general requirements pertaining to the supply of these spares is given below:-				
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VI.7.1 MANDATORY SPARES (a) The list of mandatory spares considered essential by the Employer is indicated in Annexure IV.4-13. The bidder shall indicate the prices for each and every item (except for items not applicable to the bidders design) in the 'Schedule of mandatory Spares' whether or not he considers it necessary for the Employer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The bidder shall furnish the population per unit of each item in the Bid Forms and Price Schedules. Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item. (b) The Employer reserves the right to buy any or all the mandatory spares parts. (c) The prices of mandatory spares indicated by the Bidder in the Bid Proposal sheets shall be used for bid evaluation purposes. (d) All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipments. (e) Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise. VI.7.2 RECOMMENDED SPARES (a) In addition to the spare parts mentioned above, the contractor shall also provide a list of recommended spares for 3 years of normal operation of the plant and indicate the list and total prices in relevant schedule of the Bid Form and Price Schedules. This list shall take into consideration the mandatory spares specified in this Section and should be independent of the list of the mandatory spares. The Employer reserves the right to buy any or all of the recommended spares. The recommended spares shall be delivered at project site at least two months before the scheduled date of initial operation of first unit. However, the spares shall not be dispatched before the dispatch of the main equipment. (b) Price of recommended spares will not be used for evaluation of the bids. The price of these spares will remain valid upto 6 months after placement of Notification of Award for the main equipment. However, the Contractor shall be liable to provide necessary justification for the quoted prices for these spares as desired by the Employer.					
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SUPERSEDES INVENTORY NO.		VI.7.3 START-UP & COMMISSIONING SPARES Start-up and commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares used till the plant is handed over to the employer shall come under this category. The Contractor shall provide for an adequate stock of such start up and commissioning spares to be brought by him to the site for the plant erection and commissioning. They must be available at site before the equipments are energized. The unused spares, if any, should be removed from there only after the issue of Taking Over certificate. All start up spares which remain unused at the time shall remain the property of the Contractor.					
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company	सामग्री सूची संख्या को अधिकारित करता है	a) The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares and recommended spares and indicate these in the relevant schedules of the Bid Form and Price Schedules. The general requirements pertaining to the supply of these spars is given below. b) The Contractor shall indicate the service expectancy period for the spares parts (both mandatory and recommended) under normal operating conditions before replacement is necessary. c) All spares supplied under this contract shall be strictly inter-changeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desecrator packs as necessary. d) All the spares (both recommended and mandatory) shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan. e) The contractor will provide Employer with cross-sectional drawings, catalogues, assembly drawings and other relevant documents so as to enable the Employer to identify and finalise order for recommended spares. f) Each spares part shall be clearly marked or labelled on the outside of the packing with its description. When more than one spares part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification. g) All cases, containers or other packages are to be opened for such examination as may be considered necessary by the Employer. h) The contractor will provide the Employer with all the addresses and particulars of his sub suppliers while placing the order on vendors for items/components/equipments covered					
स्वीकृति एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी एलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी को सरुद्ध प्रयोग, ओ कि सम्पत्ति के हित में हानिकारक हो न किया जाए।							
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SUPERSEDES INVENTORY NO.		under the contract and will further ensure with his vendors that the Employer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors. i) The Contractor shall warrant that all spares supplied will be new and in accordance with the contract Documents and will be free from defects in design, material and workmanship. j) In addition to the recommended spares listed by the contractor, if the employer further identifies certain particular items of spares, the contractor shall submit the prices and delivery quotation for such spares within 30 days of receipt of such request with a validity period of 6 months for consideration by the Employer and placement of order for additional spares if the Employer so desires. k) The Contractor shall guarantee the long term availability of spares to the Employer for the full life of the equipment covered under the contract. The Contractor shall guarantee that before going out of production of spares parts of the equipment covered under the Contract, he shall give the Employer at least 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to sub-contractors. Further, in case of discontinuance of manufacture of any spares by the Contractor and/or his sub-contractors, Contractor will provide the Employers, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equivalent makes required by the Employer for the purpose of manufacture/procurement of such items. l) The bidder to provide datasheets/assembly drawings of the manufacturer/ any other relevant document showing Bill of Material(s), Make, Model Number, Part Number etc. through which the mandatory spares to be supplied can be uniquely identified. This would facilitate the Employer to assign a unique code to each of the mandatory spare. The bidder shall extend all necessary assistance in this regard. VI.7.4 CONTROL & INSTRUMENTATION MANDATORY SPARES- FOR AIR COOLED CONDENSOR (REFER ANNEXURE-IV.4-13) VI.7.4.1 GENERAL NOTE: 1. Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the total population of the item in the station (project), unless specified otherwise and the fraction will be rounded off to the next higher whole number. 2. Wherever the quantities have been indicated for each type, size,					
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COPYRIGHT AND CONFIDENTIAL		VI.8 TESTS AND TEST REPORTS All routine tests shall be carried out at Manufacturer's works in presence of Owner or his representative. Type test certificates for similar equipment supplied by the Bidder shall be submitted. Refer Annexure VI.VII for details. In case type test certificate for similar equipment is not available, the same shall be conducted in presence of Owner or his representative if Owner so desires. Routine tests shall be carried out on all equipment supplied as per relevant standards. The cost of all tests, packing, freight and insurance charges of any transportation including any repeat tests shall be borne by the Bidder. This also applies to tests and inspections carried out at the Sub-Vendor's works. Before any equipment / plant is packed or dispatched from the Vendor's or his SUB-Vendor's works, all tests called for shall be carried out in the presence of the Owner's representative.					
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सामग्री सूची संख्या को अधिकृत करता है SUPERSEDES INVENTORY NO.	VI.9 DOCUMENTATION Bidder shall furnish following drawings/ documents/ information for the entire ACC system and its associated accessories along with bid for review of Owner / Owner's Engineer. The Control and Instrumentation engineering shall include the following as a minimum. a) Preparation of basic logic / loop diagrams, I/O list, Drive list, instrument list , write ups by the OEM's for ACC system. b) Engineering of Process connection and piping, Control valves , FAN control etc. c) Instrumentation, cable engineering including preparation of interconnection cable diagram, cable schedule etc. VI.9.1 Data and Documents to be furnished along with the Bid ❖ Technical Particular Sheets of each hardware / instrument offered with complete bill of materials and related detailed technical literature, coding procedure etc. ❖ Submission of General Arrangement drawings of instrumentation system /equipments ❖ Suggested Closed Loop and Open Loop Control Diagrams along with write-up ❖ Functional group philosophy for sequential logic control. ❖ Lists of maintenance and calibration test, spare parts (erection / commissioning & recommended), special tools & tackle, training proposal. ❖ Power supply requirements including power supply load requirements in KVA.				
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इस प्रलेख में दी गई सूचना भारत हेवी एलेक्ट्रिकल लिमिटेड की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, ओ कि कमर्श के लिए में हानिकारक हो न किया जाए।

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❖ List of deviation from Specification document. ❖ Bidder clause wise acceptance/non-acceptance to C&I checklist. ❖ Design philosophy, Control write-up of C&I systems. ❖ List of Mandatory, Recommended, Start-up and Commissioning spares. ❖ PC & MCC Layout. ❖ Bidder to furnish Electrical & Instrumentation Interface with MCC & DCS diagram. ❖ Bidders to furnish drive Control Philosophy for VFD drive (if applicable). ❖ Bidder shall furnish the diagram of VFD interface with DCS. ❖ Bidder shall furnish P&ID of ACC and its auxiliary system.					
VI.9.2 Data and Documents to be furnished after awarding of contract ❖ Final version of P&I Drawings, all other drawings and data submitted along with the proposal. ❖ Detail dimensional drawings of various equipment, components / sub-assemblies. ❖ Instrument and Electric Actuator datasheets for all bought outs as per ISA format ❖ Interconnection block schematics and architecture drawing for complete C&I equipment. ❖ GA drawings of instrumentation equipments like control valves, panels etc. ❖ Instrument Installation drawings of Instruments like transmitters, gauges, switches for pressure, flow, level, temperature measurement. ❖ Design philosophy, Control write-up of C&I systems. ❖ Instrument loop schematics, Logic & protection diagrams. ❖ Interconnection & wiring schematics between various instruments and sub-assemblies. ❖ Proposed mimics, various displays and logs with menu and format. Flow chart for auto control loops. Logic flow sheets / Boolean diagram for open loop controls, Sequential control logics for Functional group for sequential logic control ❖ Control valve & Safety Relief Valve sizing calculations and dimensional drawings.					
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SUPERSEDES INVENTORY NO.		❖ Operation and maintenance manuals for instruments and accessories. ❖ Complete analog, binary drive list, I/O list, SOE list. ❖ Hardware and soft link Signal (in BHEL format) exchange list. ❖ Complete Instrument Schedule, Annunciation list, I&C load list, Control valve schedule, JB schedule, Rack schedule etc. ❖ Technical manuals and catalogues for the offered make & model of field instruments and associated accessories. ❖ Weight of each equipment to be supplied. ❖ Bidder's names and model numbers for offered bought out items. ❖ Quality Assurance Plan (QAP) & Inspection and Test Procedure. ❖ Calibration test & quality assurance test procedure and test certificates. ❖ Tapping point details. ❖ Instrumentation Layouts such as JB/ Rack/ Tray /Instrument location drawing etc. ❖ Instrument air distribution scheme & Total air requirement list. ❖ Electrical load list for UPS & Non UPS supply of instrumentation equipments and panels ❖ Cable Schedule and interconnection diagram. ❖ Spare parts list, Laboratory Instrument list, test & calibration report, special tools & tackle list. ❖ "As Built" status drawings. ❖ Submission of O&M manuals and documentation. ❖ List of all measuring instruments required for performance testing. ❖ List of Mandatory, Recommended, Start-up and Commissioning spares.					
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सामग्री सूची संख्या INVENTORY NO.	2. Operating sequence, interlocks and protection for ACC drives shall be programmed in BHEL's DCS. Bidder shall furnish Logic diagram and write-up for successful operation of the system. All sequential, interlocks & protection shall be clearly brought out in the logic diagram and write-up. 3. 24V Interfacing relays are to be supplied by vendor mounted in the Vendor MCC for operation of ACC drives. 24V commands shall be given from DCS to these relays for operation of same which will be discussed during detailed engineering. 4. All Motors above 110 KW shall be breaker operated and interfaced with the DCS as per Control philosophy mentioned in Annexure VI.10.1. 5. It is proposed that BHEL DCS cabinets shall be housed in AC environment near ACC field to reduce large cabling distance and communicate to CCR through fiber optic cables for remote control 6. Cabling distance from JB to local cabinet shall be furnished by bidder for estimation for instrumentations cables for DCS use 7. Signal exchange between DCS & drives shall be furnished as per drive control philosophy VI.11 Drive Control Philosophy VI.11.1 DCS INTERFACE FOR UNIDIRECTIONAL HT DRIVE / LT BREAKER CONTROL DRIVE (Signal Exchange has been envisaged between DCS and switchgear/Drives) a. Start Command DO 1 b. Stop Command DO 1 c. ON Feedback DI 1 d. OFF Feedback DI 1 e. Switchgear Disturbance (Overload relay operated/control supply fail/Emergency LPBS top)DI 1 f. Electrical Trip (Motor Protection Relay) DI 1 g. Switchgear Available (breaker in service position, switchgear in remote & breaker spring charged) DI 1 h. Pump / Fan bearing (DE & NDE) temperature measurement RTD 2 i. Motor Bearing (DE & NDE) temperature measurement RTD 2 j. Motor Winding temperature measurement RTD 6 k. Pump / Fan bearing Vibration measurement – DE & NDE (X & Y direction) AI4				
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समर्पण संख्या को अधिकृत करता है		d. Switchgear/MCC Available (switchgear/MCC in remote) DI 1 e. Open limit switch feedback DI 1 f. Close limit switch feedback DI 1 g. Open Torque switch feedback DI 1 h. Close Torque switch feedback DI 1 i. Position Transmitter (For inching type Drive) AI 1 j. Current input (> 30 KW rating) AI 1 VI.11.5 DCS INTERFACE FOR SOLENOID DRIVE (Single coil) a. Energise or De-Energise DO 1 b. Open limit switch feedback DI 1 c. Close limit switch feedback DI 1 VI.11.6 DCS INTERFACE FOR SOLENOID DRIVE (Double coil) a. Energise DO 1 b. De-Energise DO 1 c. Open limit switch feedback DI 1 d. Close limit switch feedback DI 1 VI.11.7 DCS INTERFACE FOR PNEUMATIC DRIVE a. Command to I/P converter (Smart Positioner) AO 1 b. Position Transmitter (Smart Positioner) AI 1 c. Open limit switch feedback DI 1 d. Close limit switch feedback DI 1 e. Command to Solenoid valve DO 1(Wherever applicable) NOTE: - 1. I/O counts for applicable drives with backup operation from backup panel i.e. ILPBs and A/M stations shall also be considered in addition to above I/O counts. Refer Annexure VI.VII for interfacing Drawings. Refer Annexure VI.IV for Drive Control Philosophy for Breaker operated Motor. VI.12 QUALITY ASSURANCE OF C& I BASES SYSTEM Refer ANNEXURE VI.II for information.			
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समर्पित सूची संख्या को अधिकृत करता है		VII.1 The Scope of Work: Civil & Structural					
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company		ACC is envisaged to be supported on hollow circular columns spaced at twice the spacing between Centreline of Fans in both directions. The fans are supported on Structural Steel Truss above RC Columns i.e. from top of RC Column to fan deck. The end one row of fan is supported on Structural steel framework as cantilever structural steel truss supported arrangement and this may extend on both sides of ACC in either direction depending upon number of fan modules in ACC of each Unit. The Scope of work under ACC Bidder shall be as follows: (a) Design, fabricate and supply to BHEL site, complete Structural Steel work over RC Columns for ACC fan deck as per NTPC specification. Erection of structural steel work shall be carried out by BHEL. All the necessary hardware's including HSFG bolts, nuts, washers as per approved detail drawing shall be supplied by bidder along with Structure. Fabrication shall be done complete as per specification. Blast Cleaning of surface, Shop painting with primer and all coats including Finish coat as per specification shall be done by bidder and material supplied with required packing/protection against damage. Final touch-up shall be done by BHEL at site. However, any damage in material/painting supplied by bidder has to be made good by bidder at no extra cost to BHEL. (b) Construction of Civil foundation and RC Columns including top RCC slab over hollow column shall be done by BHEL. However, design of RC columns and Top slab over RCC column shall be done by ACC bidders along with their ACC supporting super structure at fan deck level and structure above it. Cost of RC Column & Top slab over RCC column shall form part of bid evaluation as per document HXE/SK/10829/2. (c) Design, fabricate and supply to BHEL site, complete Structural Steel work for Elevator Structure from top of foundation pedestals at El(-)1.20m to machine room, machine room floors, structural covering etc. complete. Design & engineering of Lift pit for elevator and other RCC works like machine room floor etc. shall be carried out by bidder, but construction of RCC works shall be carried out by BHEL. (d) Design, fabricate and supply to BHEL site, complete Structural Steel work for Stair case for ACC from top of foundation pedestals at El(-)1.20m to top of stair/mumpty complete along with Erection of structural steel staircase and construction of staircase foundation shall be in BHEL scope of work. (e) Design, fabricate and supply to BHEL site complete Structural Steel work for Duct supporting Structure for raising ACC duct. Erection of duct support structure shall be carried out by BHEL. The ACC Duct supporting arrangement at an elevated level					
		स्वाधिकार एवं गोपनीय इस प्रलेख में दी गई सुचना भारत हेवी एलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, ओ कि सम्पत्ति के हित में हानिकारक हो न किया जाए।					
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SUPERSEDES INVENTORY NO.	सामग्री सूची संख्या को अधिकृत करता है	(d) Dynamic analysis check of superstructure for fan operations to be provided for typical ACC. (e) Design criteria, Wind Loading calculations, Earthquake loading, thermal loading, etc. with frame analysis of entire Structure and RCC column & Top RCC slab over hollow circular column. (f) Layout drawings of Beam Plan for the Structure, Stage Plan of Structure, Sectional elevation of Supporting Steel Structure / RCC Structure, Plan & Elevation of Elevator Supporting Structure, Plan & Elevation of ACC Duct Supporting Structure, Plan & Elevation of Duct Evacuation Pit, Support on TG raft for Duct/ Hot Box. (g) Design of ACC structural anchors/embedment & connections of fan deck structure to top of RCC Column. (h) Detail drawing of ACC Supporting Structural beams & frames with their bolted connection detail design & drawing, fabrication & assembly drawings (Auto-CAD format), anchors/connection to RC Columns. Detail design & drawing of RC hollow Columns & top slab , Duct supporting frames & foundations, Duct evacuation Pit, Erection Elevator Structure, Condensate tank supporting structure and all other equipment supporting structures & foundations, etc.									
COPYRIGHT AND CONFIDENTIAL The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company	सामग्री सूची संख्या को अधिकृत करता है	VII.3 All design and drawings submitted by Bidders at detailed engineering stage has to be got approved by NTPC & BHEL as per owner's requirement. The approved design and drawing will be treated as final design & drawing for construction. VII.4 Drawing submission schedule shall be considered as per attached specification provided by NTPC refer Annexure VII-1.(page 2-4 of 340) VII.5 Design of ACC supporting structure shall be considered as per attached specification provided by NTPC refer Annexure VII-1. (page 89-90 of 340) VII.6 Load cases, load combinations, design factors and design standard shall be considered as per NTPC specification refer Annexure VII-1. (page 90-106 of 340) VII.7 Painting and corrosion protection schedule shall be considered as per attached specification provided by NTPC refer Annexure VII-1. VII.8 Grade of concrete for hollow circular column shall be M30 and reinforcement, types of formwork, fabrication and welding details shall be considered as per attached specification provided by NTPC refer Annexure VII-1. (page 177-196,122-137 of 340) VII.9 Deck sheet, Roofing & cladding details shall be considered as per attached specification provided by NTPC refer Annexure VII-1. VII.10 Thermal Loads: Ambient thermal load in addition to Equipment thermal load & Climatological Data shall be considered as per specification provided by NTPC refer Annexure VII-1.									
दिनांक एवं हस्ताक्षर SIGN & DATE	स्वत्वधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत भारती एलेक्ट्रिकल्स की सम्पत्ति है, इसका प्रयोग एवं प्रसारण के बिना की जाने वाली प्रतियों को किन्हीं भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाय।										
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				4 Instrumentation and Control Field JB			
				4.1 Cable, cabling material and JB Field JB			
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IX. Layout and safety considerations IX.1 Layout Considerations IX.1.1 General a. The constraint and details of area for layout for ACC is as per Annexure-IV.3-2. The location of various facilities/ buildings as marked on this drawing is only tentative and the exact location shall be finalised during the detailed engineering stage. b. The finished floor level at ground level of the TG building shall be designated at EL.0.0M and shall be 500mm above the finished ground level (FGL) off-site area. The finished floor level for various areas / facilities shall be as follows :- i. FFL of Main Plant Building El.. 0.00M ii. Top of paving for Transformer Yard and ACC area El. (-)0.10M iii. FFL of offsite buildings 500 mm above FGL of respective area. c. The pipes in ACC area shall be routed on trestle at a height of about 8.0m bottom of steel (B.O.S.). The pipes/ cables routed over ground on trestles shall have minimum clearance of 8.0 m bottom of steel (B.O.S.) at road crossing. For cables/pipes routing of the system engineered by Purchaser/ Owner, space provision in bridges, trestle/cable conduit may be required and these shall be finalised during detailed engineering stage. Structural steel above concrete pedestals and pipe racks to maintain the requisite pipe elevation and slope are to be provided by bidder as per requirement. d. Each equipment room, if provided, shall be provided with alternate exits in case of fire/accidents as per requirements of factory act and TAC. IX.1.2 Equipment Layout While developing the layouts, bidder must give due considerations to the following requirements: a. All equipment except, drain tank/pot shall be placed in an open shed. b. Adequate numbers of stairs (minimum width 1200mm) and platforms shall be provided at suitable locations to provide easy & effective approach to various equipment, valves and any other equipment requiring manual operation or maintenance during plant running. c. Clear headroom of 2.5 m are to be maintained during pipe, cable routings. Clear walkways in congested areas are to be maintained. d. Insulation of equipments/ piping for personnel protection are to be provided if the temperature exceeds 60 deg C. e. A clear passage (walkway) of about 2000 mm width shall be provided from one end to the other end. f. Electrical equipment such as switch gears, panels and control panel shall be housed in separate rooms for each ACC unit. Dimension of electrical and control room shall be finalized during detailed engineering. g. Bidder to furnish the detailed erection strategy along with the bid for major equipments.					
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समर्पित सूची संख्या INVENTORY NO.		h. Bidder's shall prepare the detailed layout indicating the location of all major equipments. The layout shall be furnished along with the bids submitted by the bidder.			
समर्पित सूची संख्या को अधिकृतित करता है		IX.2 Safety Requirements IX.2.1 The layout of various equipment shall permit sufficient lay down area for all the parts/ components to enable carrying out maintenance and overhauling operations without any restrictions and without any hindrance to the operating personnel of other units. IX.2.2 Provision of handling arrangement of equipment by suitable capacity mono-rail crane for carrying out maintenance and overhauling shall be considered while developing the layout. IX.2.3 Corrosion protection measures for concrete reinforcement and structural steel members against aggressive ground condition and environment shall be provided, if required. IX.2.4 Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts. All such guards shall be designed for easy installation and removal for maintenance purpose.			
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स्वाधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी एलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी को सरह प्रयोग, ओ कि सम्पत्ति के हित में हानिकारक हो न किया जाए।		विनाक एवं हस्ताक्षर SIGN & DATE			
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समर्पित सूची संख्या INVENTORY NO.		X. Erection and Commissioning Supervision of Erection and commissioning of complete ACC to be provided by Bidder. Bidder will submit all erection and commissioning drawings, documents, manuals and procedures etc. X.1 Scope and conditions X.1.1 Erection and Commissioning of Unit-1 Condenser shall be carried out under total supervision of supplier. Duration of Unit-1 erection & commissioning supervision shall be tentatively of 21 months. Depending upon requirement, BHEL shall obtain supervision of Supplier for Unit-2 & 3 E&C work. Daily basis rate should be quoted by the supplier for such optional supervision. Bidder to inform all the essential inspection / hold points where performance parameters are effected due to erection and commissioning for unit 2 &3. X.1.2 Facilities to be provided by BHEL for the Supervising Engineers - Free furnished Bachelor accommodation will be provided by BHEL for four Supervising engineers at their Colony / Guest House being built at site. BHEL shall also provide Vehicle for movement of Supervising engineers free of any charges. Any facility required over and above shall have to be arranged by the supplier within their quoted price. X.1.3 BHEL shall erect and commission the ACC under direct supervision of the supplier. Supplier's engineers need to be actively associated in all the critical checks and log-sheet / Protocol need to be signed by all concerned before proceeding further. X.1.4 On the job training need to be imparted to BHEL personals for erection and commissioning for a total duration of 75 man-days at a site where erection and commissioning work of similar / comparable A.C.C is under progress. This training need to be given after 6 months from placement of order. This is in addition to training covered under section XIV.1 of specification. Bidder to include same in its offer. X.1.5 BHEL shall be the custodian of materials at site and unloading and storage shall be in BHEL scope. Bidder to provide supervision of the arriving material at site. Bidder to indicate the open and closed storage space required along with the bid for items of 1 unit. X.1.6 All the dummy flanges, gasket (if required) during hydro testing, pneumatic leakage testing are to be supplied by the bidder. X.1.7 PG test is the responsibility of vendor for all the three units , all the instrument etc. during PG test are to be provided by them. Necessary supporting manpower shall be provided by the BHEL. X.1.8 All the supporting structures should be of bolted configuration. All required Fasteners are also in scope of supply of Bidder.			
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X.1.9 All the erectable tonnage need to be supplied by the vendor in fabricated condition. For large diameter Duct greater than 3 meters, fabrication is allowed at site and rolled section welded with their stiffeners and with edge preparation to be dispatched in maximum 3 number circumferential parts each of minimum 1.5 meters length. For duct diameter equal to or less than 3 meters, the length of parts shall be minimum 7.0 meters except make-up pieces. X.1.10 All the material need to be supplied with Primer and finished coat. Only touch-up of painting shall be done after erection. X.1.11 Individual equipment's performance need to be demonstrated by the supplier as per the technical specification / contract data sheet during commissioning / post commissioning phase. X.1.12 Equipment performance parameters of Rotating Auxiliaries like Vibration, Bearing Temperature etc. need to be retained well within acceptable limit specified in the specification and supplier should be solely responsible for this. X.1.13 Foundation items / Inserts meant for supports etc. need to be despatched well before commencement of Civil works. X.1.14 Contract for ACC Civil works would be awarded by BHEL based on the BOQ / inputs received from the Supplier and this input need to be provided within 1 month of placing order. X.1.15 Supplier's Engineer needs to be associated during checking of final foundation before undertaking ACC erection. X.1.16 All the Civil construction drawing need to be made available within 2 months of placing order. X.1.17 Preliminary Erection Manual of Air Cooled Condenser need to be submitted within 3 months of placing order and final shall be furnished in 6 months of placing the order. X.1.18 Final Erection Field Quality Plan need to be submitted in 6 months time of placement of order. X.1.19 All detailed erection Drawings, P&IDs and SLDs need to be made available within 6 months of placing order. However, General arrangement drawing, ACC Thermal calculation, ACC Data sheet, ACC performance curves and P&ID's need to be submitted by the supplier within 1 months of placing order. X.1.20 Preliminary Field erection welding schedule to be supplied by the vendor within 3 months of placing order and final in 6 months. Welding Schedule should clearly specify the type of electrodes to be used as per AWS specification. Pre-heat / Post-weld heat treatment and NDT requirement should be clearly specified in the Field Welding Schedule. X.1.21 Commissioning and O&M Manuals need to be submitted well before stating the commissioning process. X.1.22 NTPC specification as per Annexure-X-1 shall be followed in conjunction with requirement specified herein where ever erection and commissioning of equipment(s) is in Bidder's scope. X.1.23 All weld seams shall be subjected to DPT/MPI. At least 10% of butt welds shall be subjected to radiographic examination. X.1.24 All duct sections shall be supplied in maximum 3 parts to reduce site welding. The Y or T section of steam distribution header may be supplied in max. 4 parts.							
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X.2 General (Erection) While preparing these manuals, bidder shall take note of the following guidelines in general - During condenser assembly, care shall be taken in the assembly, and the correctness of alignment need to be checked in a manner acceptable to the Employer prior to stitch welding. With stitch welding over, and on clearance of final alignment by the Employer, final welding shall be done by 'seam method' so as to ensure a minimum deformation of the welded parts. Only approved welders shall perform such welding operation. All the weld seams shall be properly ground and subjected to non-destructive examination. At least 10% of butt welded seams shall be subjected to radiographic examination. - The Fan drive assembly (Motor, Gear Box, and Fan) shall be checked for orientation, alignment, direction of rotation, fan blade pitch angel, tip clearance as per drawing. - Drain pump shall be checked for orientation, alignment, direction of rotation as per drg. - Erection of A- frames shall be checked for orientation, alignment, elevation, verticality, straightness as per drg. - Erection of tube bundles shall be checked for elevation, position, alignment as per drg. - Erection of ducting shall be checked for orientation, elevation, alignment, verticality, straightness as per drg. - The Bidder shall indicate all tests for the systems as included in this specification including valves, fitting, specialties, hangers, supports and other accessories in accordance with and true to the lines and elevations as indicated in his "Issued for Construction" drawings. - Erection procedure shall include welding, bolting, preheating, stress relieving, cleaning and painting of the piping systems as specified in this specification. Non destructive examination, stress relieving, heat treatment, pneumatic testing, hydrostatic testing, steam blowing, air blowing and chemical cleaning of piping systems to be mentioned as per the relevant clauses of this specification. - The Bidder shall also indicate the requirements to fabricate, erect and dismantle all temporary piping and equipment as required for chemical cleaning, water flushing, pneumatic testing, hydro testing and vacuum testing of pipelines and provision all vents and drains as required for these operations. Drain and vent valves shall be supplied by bidder. - Where flow nozzles, orifices and other piping appurtenances are to be installed only after steam blowing / chemical cleaning operation, the Bidder shall design the pipeline without cutting it short. After the completion of steam blowing/ chemical cleaning, cut spool pieces of required length shall be installed on the components as required to render the piping system complete. - Where cold pulls are envisaged the Bidder shall develop cold pull procedures specific to the requirements of that system and submit the same for BHEL/ Owner's.							
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SUPERSEDES INVENTORY NO.		X.3 Erection Instructions - All pipes of sizes 65 mm NB and above shall generally be shop fabricated and delivered to site in pre-fabricated conditions. - All pipes of size 50 mm NB and below shall be regarded as field run. The bidder shall prepare the layouts for these lines in situ and submit the isometric drawings, showing the layout. - All pipelines shall be given proper slope towards the drain points such that the slope is maintained in both hot and cold conditions. - The Bidder shall keep provision for erection of all instrument connections upto and including the piping root valves. - Provision for correct orientation of all valves, specialties; instrument stubs etc. and all valves are easily accessible to maintenance and operation to be kept. - Yard piping layout along with erection drawings are to be submitted by bidder. For field run piping, the Bidder shall take into account the following - Piping shall be routed to avoid interferences with other pipes, hangers, structures, equipment, electrical trays, ventilation ducts etc., with sufficient clearance to accommodate thermal insulation and /or piping movements as required. - The pipe routing shall also provide sufficient clearance for removal and maintenance of equipment, easy access to valves, instruments and other accessories. The piping shall not encroach on the withdraw space of the various equipments. - Piping shall be grouped together where practicable and routed to present a neat appearance. The routing shall generally be above ground but where specifically approved by the owner, pipes may be arranged in trenches. - Clear headroom of not less than 2.5 meters above walkways, platforms and other working areas and not less than 8.0 meters bottom of steel (B.O.S.) above roadways shall be provided unless otherwise approved by the owner. - Tap offs on main lines for the field run piping shall be suitably located by the Bidder to suite the layout prepared by him. - The Bidder shall supply auxiliary steel required in its scope of supply. - Field run piping shall be erected only after completion of erection of all other piping system, structures and equipment unless otherwise approved/ directed by the BHEL. - The initial setting on all hangers and supports and clearances on restraints and limit stops shall correspond to the cold values, all readings after completion of welding, cold pulling where required and application of insulation and carry out readjustment as necessary. - Provision for behavior checking of all hangers, supports, restraints etc. during the initial stages of plant operation to be kept. When the unit has attained its rated load and all piping systems have attained their rated temperatures, all load conditions, hangers and snubber deflections and clearances at restraints/ limits stops are to be logged.					
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SUPERSEDES INVENTORY NO.		XII. Field Quality Requirement during Erection, commissioning, Start-up, Trial operation and Performance Tests XII.1 Erection The bidder shall submit to the BHEL/ Owner field welding schedule for field welding activities. The field welding schedule shall be submitted to the Purchaser/Owner along with all supporting procedures, like welding procedures, heat treatment procedures, NDT procedures etc., Bidder shall submit the procedure of performance test to be conducted on their supply as per requirements of this specification to BHEL. The minimum number of tests should be included to demonstrate the design requirements as stipulated in the specification. The Bidder during trial operation and performance testing shall also perform vibration testing to determine the base line of performance of all rotating equipment pertaining to his system. The Bidder shall be responsible for the operation of his system during the period commencing with start-up and extending through trial operation and all performance tests. Bidder shall include cost incurred during demonstration tests, performance test and trial operation and supply of special devices in their offer. XII.2 Commissioning Commissioning of the power plant will be carried out stepwise. Before starting test runs, with the entire plant the individual systems with their components must be tested and commissioned carefully. All necessary commissioning steps are to be performed according to the corresponding commissioning procedure which is to be prepared in advance. The results of these commissioning activities are to be documented properly too. Bidder shall prepare a comprehensive commissioning program for the system including commissioning instructions, commissioning checklists, logic diagrams etc. All pre-commissioning tests & activities as required for successful running of the equipment or as mentioned in the technical specification elsewhere shall be performed by the contractor. The system specific commissioning programmes shall include 1.0 System inspection 2.0 Cleaning 3.0 Pressure test/ leak test 4.0 Electrical commissioning activities 5.0 Interlock checks 6.0 Components test 7.0 System specific process test as per approved commissioning procedure 8.0 Records of commissioning results and handed over to the purchaser/ Owner.																	
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SUPERSEDES INVENTORY NO.		XII.3 Commissioning Clearance Certificate This document is prepared when commissioning of the system has been completed. It confirms that all the tests required for safe operation have been completed and that the system concerned is available for plant operation. XII.4 Start up and initial operation Following the satisfactory completion of the inspection and checking of complete system, the same will be started up and placed in initial operation with cycle operation of respective steam turbine. The time consumed in start up and initial operation shall be considered as a part of the erection and installation period. Upon completion of system checking/tests and as a part of commissioning of facilities, complete plant/facilities shall be put on initial operation. The Contractor shall supervise all the commissioning tests and undertake commissioning activities pertaining to all equipments including Electrical & C&I equipment/systems not specifically brought out above but are within the scope of work and facilities being supplied by the Contractor and follow the guidelines indicated above or elsewhere in specifications. XII.5 Trial operation The Bidder will be responsible for running a trial operation period at the site for his system during the trial operation of each steam turbine generating unit and module along with respective individual systems including all auxiliaries and controls. Each steam turbine generating unit and module shall operate not less than fourteen (14) days out of which at least seventy two (72) hours shall be continuous operation on full load in the automatic position of the control system. The fourteen days of automatic position shall consist of operation in increasing, decreasing as well as steady load conditions. The duration provided is indicative only. XII.6 Performance and Guarantee tests Complete PG testing of all the three units is in Bidder scope. During performance and guarantee tests being conducted as per Owner's requirements, Bidder of this system shall remain present throughout the period even if this system is not directly involved in performance and guarantee tests of steam turbine. XII.7 Taking Over The Owner shall issue to the Bidder a Taking Over Certificate as a proof of the final acceptance of the equipment after successful completion of all the tests to be performed at site during operation of the plant.					
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समर्पण सूची संख्या INVENTORY NO.		XIII. Performance and Guarantee Test for the System After completion of the erection, commissioning and trial operation, bidder shall demonstrate the following XIII.1 Guarantees and Performance Parameters XIII.1.1 The bidder shall guarantee that the equipment offered shall meet the ratings and performance requirements stipulated for various equipment / system covered in these specifications. XIII.1.2 Erection and Commissioning site test report comply with the design standard / agreed site commissioning procedure. XIII.1.3 Bidder shall conduct the entire site test for the system etc. as per commissioning procedure.			
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SUPERSEDES INVENTORY NO.		XIV. Other Services XIV.1 Training The scope of service under training of purchaser and Owner engineers shall include a training module covering the areas of Product design, Engineering, manufacturing and O&M. Such training should cover the following areas as a minimum in order to enable these personnel to individually take the responsibility in a manner acceptable to the purchaser and Owner. The scope of services under training shall also necessarily include training of Purchaser and Owner Engineering personnel covering a training module as indicated in Annexure – XIV.1-1. This shall cover all disciplines viz, Mechanical, Electrical, C&I etc. and shall include all the related areas like Design familiarization, training on product design features and product design software of major equipment and systems, engineering, manufacturing, training on operating features of equipment, plant visits and visits to manufacturer's works, exposure to various kinds of problems which may be encountered in fabrication, manufacturing erection, welding etc. Bidder shall furnish in his offer, details of training module(s) covering above requirements which shall be subject to purchaser's/ owner's approval. Consolidated training period included above [i.e. Annexure – XIV.1-1 for Product design, Engineering and O&M] is indicative only. Purchaser reserves the right to re-appropriate the training period between O&M and engineering depending upon the details of training module proposed by the Bidder. Exact details, extent of training and the training schedule shall be finalized based on the Bidder's proposal within two (2) months from placement of award. In all the above cases, wherever the training of purchaser's/ owner's personnel is arranged at the works / design offices of the manufacturer's it shall be noted that the lodging and boarding of the purchaser / Owner personnel shall be at the cost of Bidder. The Bidder shall make all necessary arrangements towards the same. XIV.2 3-D modeling All the plant layouts shall be made in computerised 3D modelling system. Contractor shall progressively provide an integrated, intelligent and editable 3-D model of entire ACC package scope (including all facilities) made using rule-based, data centric 3D Design software (3 nos) that should accept 3D data from heterogeneous systems with equipment drawings, data sheets, intelligent P&ID correlated with intelligent 3D Model (Intelligent P&ID creation software – 3 nos),, BOQ, schematics, logic diagrams (Instrumentation and Electrical Design software – 3nos each), test reports and quality plan, etc. attached to the respective equipment / systems in the 3D model. 3-D model shall be submitted for employer's review for concurrent engineering at regular interval, as and when desired by employer. BHEL shall inform the details of software to be used for 3-D modelling at detailed engineering. BHEL shall be using IPDS which is based on Intergraph's Smart Plant using SPPID, SPEL, SPI, SP Foundation, SP 3D etc with the capability of importing models from source like PDS,					
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XV. Project Monitoring Schedule All activities of ACC package has to be completed within schedule . The indicative project schedule is attached as per Annxure-XV-2.Bidder to provide the project schedule along with the Bid. XV.1 Engineering Information Submission Schedule Prior to the award of contract, a detailed engineering information submission schedule shall be tied up with the purchaser / owner. For this, the bidder shall furnish a detailed list along with the proposed submission schedule and it shall be tied up for engineering data/ drawings/ information for all bought out items and manufacturing items. The information shall be categorised into the following parts. - Information that shall be submitted for the approval of the purchaser/ owner before proceeding further, and - Information that would be submitted for Purchasers/ owners information only. The schedule should allow adequate time for proper review and incorporation of changes/ modifications, if any, to meet the contract without affecting the equipment delivery schedule and overall project schedule. The early submission of drawings and data is as important as the manufacture and delivery of equipment and hardware and this shall be considered while determining the overall performance and progress. XV.2 Engineering Progress and Exception Report The Bidder shall submit every month an Engineering Progress & Exception Report giving the status of each engineering information including: - A list of drawings/ engineering information which remains unapproved for more than four (4) weeks after the date of first submission. Should any drawing remain unapproved for more than four (4) weeks after it's first submission, this shall be brought out in the monthly Engineering Progress and Exception Report with reasons thereof. - Drawings, which are not submitted as per agreed schedule. The draft format for this report shall be furnished to the purchaser/ owner within four (4) weeks of the award of contract, which shall be discussed and finalised with the purchaser/ owner. XV.3 Manufacturing Schedule - The supplier shall submit, within 30 days after the date of Notice of award of Contract, PERT network covering various key phases of the work such as design, procurement, manufacturing, shipment, erection, commissioning, and interface facilities to be provided by Bidder. Such schedules shall be reviewed, up-dated and submitted to the purchaser/ owner, once every two (2) months by the bidder. The schedule shall also include the materials and equipment purchased from outside supplies.					
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समग्री सूची संख्या को अधिकृत करना है		XV.4 Documents, data and drawings to be furnished by Bidder i. The supplier shall submit a detailed engineering documents, data and drawing submission schedule including the minimum documents as specified in the sections of this specification, clearly identifying the Category of submission i.e. for review, information, approval etc. within the period after award of contract as mutually agreed. The scope of review and approval shall also be mutually agreed. ii. Each document, submitted by the supplier shall be in English and marked with the name of OWNER, unit and equipment/system designation and the name of the project. iii. No. of prints, microfilms and reproducible to be submitted for review/approval/final submission shall be mutually agreed prior to award of Contract. iv. Tentative Number of Copies of drawings and documents to be submitted shall be as per Annexure -XV-1. Final number shall be communicated during detailed engineering.			
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समर्पित सूची संख्या को अधिकृत किया जाता है		XVI. PACKAGING AND TRANSPORTATION All the equipments 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 limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. The Contractor shall ascertain the availability of Railway wagon sizes from the Indian Railways or any other agency concerned in India well before effecting despatch of equipment. Before despatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site works like grinding, welding, cutting & preassembly to bare minimum. The Employer's Inspector shall have right to insist for completion of works in shops before despatch of materials for transportation. Bidder shall provide following during detail engineering: (i) Bidder shall submit the details and method of seaworthy packing of various equipment in order to prevent damage or deterioration during transit, handling and storage at site till the time of erection for BHEL review / approval. (ii) Bidder shall provide detailed package list with reference to part number of erection drawings for ease of correlation at site.					
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समग्री सूची संख्या को अधिकतम करना है		3. Electrical	
समग्री सूची संख्या को अधिकतम करना है		3. Electrical	
समग्री सूची संख्या को अधिकतम करना है		3	

