



BHOPAL

R & M JOB FOR BOP OF GND TPS
UNIT 3 TO 4 STAGE II (2x 110 MW) FOR PSEB

TECHNICAL SPECIFICATION FOR
MISCELLANEOUS MECHANICAL WORKS

PDX 05 385
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REV.6

TECHNICAL SPECIFICATION FOR MISCELLANEOUS MECHANICAL WORKS



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	EXHIBITS	
	1. PIPING LAYOUT OF COMPRESSED AIR SYSTEM Dwg. No. - 1-726-04-25-009	
	2. P & ID Compressed Air System Dwg. No. - 1-726-04-25-015	
	3. GA of Emergency Cooling Water Tank Dwg. No. - 2-726-29-25-005	
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01.00.00	INTENT OF SPECIFICATION		
01.01.00	This specification is intended for supply, transportation to site, unloading at site, storage, erection, testing and commissioning of mechanical systems, electrical, instrumentation and control as given under scope of work (Item 2.00.00). The overall project synopsis is given in Annexure-I.		
01.02.00	Any item / equipment not specifically mentioned in the contract but required for completeness and safe / normal operation of the listed equipment system, are deemed to be included in the contract without any commercial implication. During the contract execution any ambiguity / contradiction / difference of opinion arising will be interpreted by the purchaser / his consultant and his decision shall be binding on the contractor.		
02.00.00	SCOPE OF SUPPLY AND SERVICES		
	(Manufacture, testing at works, supply, transportation to site, receipt, storage & handling at site dismantling, erection, testing, and commissioning)		
02.01.00	Sump Pump Package		
02.01.01	Two (2) Nos. Gate Valve of size 50 NB class 150 [#] . Along with companion flanges, nuts bolts, washer and gaskets etc. Existing Valve, Companion Flange etc. to be dismantled and sent to store.		
02.01.02	Two (2) Nos. Gate Valve of size 100 NB class 150 [#] . Along with companion flanges, nuts bolts, washer and gaskets etc. Existing Valve, Companion Flange etc. to be dismantled and sent to store.		
02.01.03	Two (2) Nos. NRV of size 50 NB class 150 [#] . Along with companion flanges, nuts bolts, washer and gaskets etc. Existing Valve, Companion Flange etc. to be dismantled and sent to store.		
02.01.04	Two (2) Nos. NRV of size 100 NB class 150 [#] . Along with companion flanges, nuts bolts, washer and gaskets etc. Existing Valve, Companion Flange etc. to be dismantled and sent to store.		
02.01.05	Four (4) Nos. Pressure gauge of range 0-5 Kg / cm ² for discharge pipe of sump pumps.		
02.02.00	Compressed Air System Package		
02.02.01	Complete Instrument air piping inside compressor room and yard piping with fittings and supports as per BOM attached as Annexure-III.		
02.02.02	Complete cooling water piping inside compressor room, yard piping with fittings and supports from existing BCW header near BCW Pumps of Unit 3 and 4 for Instrument Compressor of #3 and # 4 respectively and Conveying air Compressors as per BOM attached as annexure-III.		
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02.02.03	Valves as per BOM attached as Annexure -II.		
02.02.04	One (1) No. Chain Pulley block of 2T capacity for Dryer. Specification is attached as Annexure – VI.		
02.02.05	One (1) No. Monorail type Electric Hoist with traveling trolley of 3 Tons capacity. Specification is attached as Annexure – V. Traveling Trolley shall be common for Electric Hoist as well as Chain pulley Block.		
02.02.06	Approx 90 Meters long monorail.		
02.03.00	Emergency Cooling Water Tank Package		
02.03.01	Design, engineering, testing, transportation & Delivery of Material F.O.R. site, storage and handling at site, fabrication & performance testing at site, erection and commissioning of One (1) no. Emergency cooling water storage tank of capacity 25 M ³ along with fittings. Existing tank of same capacity will be replaced with this new tank. The manufacturer has to design the new tank with a view to use existing foundations. The existing foundation details is given in attached Drawing No. 2-726-29-25-005. Specification is attached as annexure VII.		
02.03.02	One (1) No. Float type (external cage type) level switch for Emergency cooling water tank.		
02.03.03	Two (2) Nos. level gauges (Tubular type) for Emergency cooling water tank.		
2.04.00	Air conditioners & Exhaust Fans in Compressor House (Refer Enclosure – I).		
03.00.00	SCOPE OF SERVICES OF ITEM SUPPLIED BY OTHER (Receipt, storage and handling at site, dismantling, erection, commissioning and testing)		
03.01.00	Sump Pumps		
03.01.01	Two (2) Nos. sump pump having discharge capacity 35 M3/hr and head 10 MWC with drive motor.		
03.01.02	Two (2) Nos. sump pump having discharge capacity 150 M3/hr and head 15 MWC with drive motor		
03.02.00	Compressed Air System		
03.02.01	Four (4) Nos. compressors with motors, Four (4) Nos. air drying plants, Four (4) Nos. receivers, control panels and instruments including impulse piping and control cabling.		
03.03.00	Butter Fly Valve		
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03.03.01	Five (5) Nos. 1200 NB double flanged motor actuator operated Butter fly valve.		
03.03.02	One (1) No. 1600 NB double flanged motor actuator operated Butter fly valve.		
03.04.00	CW PUMPS Storage and Handling of Five (5) Nos. CW Pumps impeller		
03.05.00	Stop log Gates and Trash Screen for Cooling Tower		
03.05.01	Eight (08) Nos. Stop Log Gates each weighing approx. 2.5 T		
03.05.02	1st set of Four (04) Nos. of Trash Screen each weighing approx. 2.0 T		
03.05.03	2 nd set of Four (04) Nos. of Trash screens each weighing approx. 2.0 T.		
03.05.04	Hoisting Equipment for Hoisting of Stop Log Gates and Trash Screens. Hoisting equipment will be common for Stop Log Gates as well as Trash Screens (chain pulley blocks to be supplied by others)		
03.05.05	Fabrication of structures for hoisting equipments of Stop Log Gates and Trash Screens (Approx. 20 T).		
04.00.00	DATA REQUIREMENT		
04.01.00	Information To Be Furnished Along With The Bid <ul style="list-style-type: none"> a) Sub-vendor list for bought out items b) Filled in enclosed technical Data Sheet c) Manufacturer's catalogue on valves 		
04.02.00	Technical Data & Information To Be Submitted After Award of Contract After finalization of the Contract, the Contractor shall submit various drawings and data for review of Purchaser/Consultants and afterwards for final distribution. The various drawings and data to be furnished shall include the following <ul style="list-style-type: none"> A) Hydrostatic test certificates for pipes & valves. B) System wise erection drawing Isometric Drawing for each system. <ul style="list-style-type: none"> a) Fabrication details. b) Design code. c) Design / working condition. 		
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<p>d) BOM with specification and weight of each item.</p> <p>e) Shop and site welding schedule indicating welding details in tabular form viz.</p> <p>(i) Location and identifications of welds, (ii) Welding procedure, (iii) Type of weld, (iv) Parent metal (v) Edge preparation details (vi) Electrode make, Type and size (vii) Quantity of weld deposition (viii) Pre and post weld heat treatment requirements (ix) Test including NDT (x) Position in which is to be done.</p> <p>f) Specification of electrodes for site welds.</p> <p>g) Erection notes.</p> <p>h) Support location.</p> <p>i) Drain pockets; vent stubs, pressure and temperature stubs.</p> <p>j) Quality plan detailing out schedule of test and inspection.</p> <p>k) Filled up Valve and Pump data sheet.</p> <p>l) Details of surface preparation and final protective paint proposed (primer and finish paint specifications, colour, number of coats and total thickness)</p> <p>m) Flow direction</p> <p>n) Shop and site weld identification.</p> <p>o) Equipment and other drawing reference.</p> <p>p) Orientation of valve spindle and orientation of flange bolt.</p> <p>q) Pipe lay out in isometric form showing the pipe/ equipment / fitting dimensions, reference with columns, welding gaps, valves etc.</p> <p>r) As built Drawing.</p> <p>s) Individual support drawings for each pipe hanger / support / anchor and shall submit for approval along with design calculations.</p> <p>The support drawings shall show the following details:</p> <p>i) Location of support</p> <p>ii) Arrangement of hangers / supports showing all components.</p> <p>iii) Design and hydraulic loads at the support points.</p> <p>iv) Movement in three directions.</p>		
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05.00.00	<p>v) Reference of Isometric Drawings on which the supports appears.</p> <p>vi) System wise summary sheet shall be prepared for hangers required for that system and it shall give the following details.</p> <p style="padding-left: 40px;">Hanger number, type, quantity and Drawing number</p> <p style="padding-left: 40px;">Painting, testing and inspection details.</p> <p>t) Final approved documents Category A shall be submitted in Six (6) paper copies and two CDs in word / Excel / Auto cad formats.</p>		
	QUALITY ASSURANCE, INSEPCTION AND TESTING		
05.01.00	<p>Quality Control Surveillance</p> <p>The plant/equipment to be supplied under this specification shall have assured quality and workmanship. The Bidder in his proposal shall submit his Quality Assurance Plan and Field Quality Plan (as per enclosed format) containing quality assurance programme and quality assurance documents for Purchaser's approval. The Contractor shall be bound to conduct all stage inspections on various equipment/material during manufacturing process in accordance with the approved copy of this document. Purchaser shall have the right to carry out Quality Audit and Quality Surveillance by witnessing any or all such tests to be carried out at Contractor's / Sub—Contractor's works as and when desired. The procedure applicable to Contractor's works will also apply to the works of his sub contractors. For items coming under the purview of any Indian Statutory Regulation during the course of manufacture, all stage inspections and tests shall be witnessed by an inspecting authority recognized under the statutory regulation. A list of all sub-vendors is to be forwarded to the Purchaser for approval prior to the placement of sub-contract. All technical details shall be sent to Purchaser for approval prior to placement of orders on sub-vendors.</p> <p>These audit/surveillance/approvals shall not however relieve the manufacturer of their responsibility of the Quality Assurance of their product and overall guarantee and responsibility shall wholly lie with the Bidder.</p> <p>Tests/inspections shall be carried out during and after the completion of manufacture of different components and assembly as applicable in accordance with relevant codes and standards. Test Certificates for all such tests/inspections shall be made available to the Purchaser for approval.</p> <p>Purchaser or his authorized representative shall have his full access to witness any or all tests/inspections to be carried out at manufacturer's shop. In case, the job is sub-contracted, it will be Contractor's responsibility to make all arrangements so that Purchaser or his authorized representative can attend such tests at Sub-Contractor's premises.</p> <p>After installation, the equipment/system shall be tested and commissioned at site to Purchaser's full satisfaction.</p>		
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05.02.00	Testing		
05.02.01	Tests at Manufacturer's Works <p>a) The manufacturer shall conduct all tests required to ensure that the equipment conforms to the specifications stipulated herein and in conformance with applicable codes. However, specific tests as mentioned against different equipment in other sections of this volume must be conducted.</p> <p>b) The particulars of the proposed tests and the procedure for the tests and inspection by purchaser shall be submitted along with offer which will be subject to approval before conducting the tests.</p> <p>c) All materials, casting and forging shall be of tested quality and test certificates shall be made available to the Purchaser.</p>		
05.02.02	Test at Site <p>After erection at site, the equipment/systems will be operated at site to show satisfactory performance as required by the applicable clause of the specification. During these tests, if any equipment/system fails to perform to the fullest satisfaction of purchaser then the same will be rectified /replaced, without any extra cost, by contractor</p>		
06.00.00	ERECTION AND INSTALLATION		
06.01.00	The installation work shall comply with the latest applicable standards, regulations, electricity rules, and safety codes relevant to the location where the installation is being carried out.		
06.02.00	Erection Activities:- <p>The work shall include but not limited to:-</p> <ul style="list-style-type: none"> - Shifting of materials from stores to erection site. - Cleaning and assembling equipment for erection. - Taking over of fronts, checking with respect to civil drawings for foundations. - Chipping of foundation wherever necessary. - Placing of equipments on foundation with bolts in position, leveling, grouting. - Checking of embedded pipe spools in position as per piping layout drawings. - Placing of pipe spools and fittings, valves in position as per piping drawings with temporary supports and tack welding. - Checking of embedded plates for piping supports. - Final welding of piping joints, NDT as per specification. - Erection of pipe supports from building structures / floors. 		
06.03.00	Cleaning, surface, preparation, corrosion protection and painting of all piping and structures as required. Touchup painting of factory supplied equipment.		
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06.04.00	Providing all necessary platform, stairs, ladders etc. for operation & maintenance of equipment / systems, if required		
06.05.00	Arranging all temporary supply of special aids for erection, commissioning etc. like scaffolding, cranes, etc. including operating personnel.		
06.06.00	Provide all labour, necessary erection equipment, temporary site facilities, temporary connection to power supply, water supply etc. for erection, tests, tests on completion required for the fulfillment of the contractor's duties in connection with the works.		
06.07.00	Arrange & deliver power, fuel, water, waste water discharge etc. during construction, erection, startup and testing and pay for construction power & water.		
06.08.00	Apply for all permits & get authorities approval for all actions, which require approval or permit.		
06.09.00	Co-ordination with approval agencies on plant interface areas.		
06.10.00	Carry out testing, tests on completion of the plant and equipment applicable.		
06.11.00	Provide inputs to all documents required including AS BUILT DRAWINGS.		
06.12.00	Any other supplies and services in connection with or related to the works so far as the necessity for providing the same is specified in or reasonably to be inferred from the contract and / or required for the completion of the project.		
06.13.00	All dismantled/left-over parts shall be transported to stores within the plant boundary.		
07.00.00	SITE DETAILS		
	Refer Annexure I enclosed entitled "PROJECT INFORMATION".		
07.01.00	Construction Power Source The Purchaser will make all endeavour to assist the contractor for obtaining construction power at one point on chargeable basis. Contractor shall clearly mention normal, peak & minimum power required along with timings. Power supply by owner will be on chargeable basis However if the construction power is not available, the contractor has to make his own arrangement such as mobile DG sets. Power supply and electrical power distribution from the one point to the construction site are within the Contractor's scope of supply.		
07.02.00	Construction Water Source		
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	<p>The construction water will be arranged by the purchaser at one point near the power plant boundary. Distribution inside for working area will have to be arranged by contractor. Water will be available on free of cost basis, vendor to indicate quantity at bid time.</p>		
07.03.00	<p>Construction Communications</p> <p>Any communication system which the Contractor might need is within the scope of the Contractor's supply.</p>		
07.04.00	<p>Access To Construction Site</p> <p>Transportation will have to be via existing road and roads constructed by the Owner.</p>		
07.05.00	<p>Site Safety & Security</p> <p>It's Contractor's duty to organize and constitute a safety system for providing protection to installation work, contracting material storage, warehouse, field office, accommodation, etc within the Contractor's scope of supply and services.</p> <p>Security Guards shall also be provided by Contractor for his equipment / works.</p> <p>The Contractor is responsible for the storage of material and the upkeep of equipment at the working site. There shall be fencing for temporary storage and material storing yard with security personnel on duty day and night.</p> <p>Contractor's scope includes the organization of a managing system and a group of full-time personnel to ensure safe execution of construction and installation.</p>		
07.06.00	<p>Field Safety and Health Organization</p> <p>According to both, local safety and health regulations, Contractor's field safety organization shall provide necessary tools, documentation and other measures especially with respect to controlling of dangerous goods, protection technology of potential fire sources and medical service.</p> <p>Contractor shall be in charge of examining field safety under the control of a field safety member, who shall report to Project Safety Manager.</p>		
07.07.00	<p>Cleaning On Site</p> <p>Contractor shall be responsible to keep the construction site clean and remove any waste material or hazardous waste to an appropriate waste disposal site approved by authorities in a safe and orderly manner.</p>		
07.08.00	<p>Lay Down and Construction Office Facilities</p> <p>Space for temporary site office, store etc. will be made available for contractor's lay down, and construction. Contractor shall construct the above facilities, buildings at his own cost.</p>		
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08.00.00	<p>After completion of the project the contractor should demolish & remove the debris & handover the clean site in good condition. Space for labour hutments shall be provided outside the plant boundary.</p>		
	<p>INSPECTION AND TESTING</p> <p>This section contains general requirements for inspection of material, parts, equipment and workmanship of the plant for site fabricated items, assembly and erection, upon completion and commissioning to demonstrate compliance with specification, codes and standards to ensure overall reliability of plant operation and performance.</p> <p>The Purchaser and / or Purchasers' Engineer shall, at any time, be allowed free and ready access to the Contractor's premises and those of his suppliers as well as to the site installation and the Contractor has to make the plant items available for the purpose of inspecting the specified equipment components and obtaining information as to the progress of the work. Failure on the part of Purchaser, at this or any other time, to discover or reject materials or work which do not meet specified requirements shall not be deemed as acceptance thereof nor a waiver of defects therein.</p> <p>The approval of the Purchaser shall not prejudice the right to reject equipment if it does not give complete satisfaction in service.</p> <p>The Contractor has primary responsibility for ensuring the quality of items of equipment supplied & erected under the contract and remains accountable when erection is subcontracted. It is therefore a requirement of the specification that work is only subcontracted to companies with effective quality control organizations and that the Contractor monitors the performance of these by the attendance at tests of experienced inspectors employed by the Contractor. The Contractor shall, at the appropriate time, prove that his material and / or equipment comply with all the requirements of this Section, such proof being the successful completion of tests and inspections. Certified routine test and type test certificates shall be submitted for each item of equipment, where applicable.</p> <p>The Contractor shall provide all necessary means for execution of inspection and testing, according to the requirements.</p> <p>All materials, components and equipment supplied & erected under the contract shall be subject to inspection by the Purchaser, his representative or his authorized Agency should they so require during erection and after completion. Inspection by an approved independent agency shall also apply when required by the Purchaser. The inspection and tests shall include but shall not be limited to the requirements of this section of the specification.</p> <p>The type and extent of inspection of items shall be in accordance with the relevant manufacturer / International / Indian Standards and other standards approved by the Purchaser, supplemented or amended by the requirements of this section of the specification or as specified elsewhere in the specification.</p>		
09.00.00	<p>QUALITY ASSURANCE & CONTROL</p>		
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09.01.00	Welding The Contractor shall submit to the Purchaser on request the following documented proposals prior to commencement of welding: <ul style="list-style-type: none"> Welding procedure specifications with qualification records and valid welders certificates. Pre / Post-weld heat treatment procedures where applicable. Inspection schedule including quality requirements. Non-destructive testing procedures. Standard weld repair procedures. All welders employed on items of plant for this contract must be qualified.		
09.01.01	Welding Procedure Specifications Welding procedure specifications shall include the following information: <ol style="list-style-type: none"> Procedure reference number. Application Specification or type of materials to be joined. Range of material thickness and pipe diameters to which the procedure applies. Welding processes Welding position Sizes and brand names of consumables Minimum preheat and maximum interpass temperatures Deposition sequence (including approximate number of runs) with welding current parameters and progression speed. Post-weld heat treatment (if applicable). 		
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09.01.02	<p>Welding procedures shall be qualified in accordance with the requirements of the construction code / specification for the item of plant concerned.</p> <p>Welder Performance</p> <p>Welders shall be qualified in accordance with the requirements of the construction code / specification for the item of plant concerned for all types / positions of welding they may perform. The Purchaser may at his discretion accept the records of previously conducted performance qualification tests. If in the opinion of the Purchaser further qualification tests are required these shall be conducted at Contractor's expense.</p> <p>Records showing the date and results of the qualification tests performed by each welder together with his identification number shall be available at the work place for examination by the Owner's Engineers.</p> <p>A system of positively identifying the work of each welder shall be maintained, and any welder whose work is the subject of multiple rejections shall be required to undergo a prequalification test. Any welder failing the retest may, at the discretion of the Purchaser, be disqualified from further welding on items under this Contract.</p>		
09.01.03	<p>Post-weld Heat Treatment</p> <p>Welded fabrications shall be stress-relieved through post-weld heat treatment wherever applicable as per codes.</p>		
09.01.04	<p>Quality Requirement for Welds</p> <p>All welds shall be visually examined and shall be of smooth contour, free from cracks, undercut and other significant defects. Wherever possible the interior of tubes etc. shall be examined, using a suitable optical device where necessary.</p> <p>The physical properties of the welds produced by electrodes recommended for the welding of a partial on base metal shall not be lower than the minimum values specified for the base metal.</p>		
09.01.05	<p>Weld Repairs</p> <p>Unacceptable defects observed by visual examination or indicated by non-destructive testing shall be completely removed by chipping or thermal gouging and grinding. The resulting excavation shall be crack-detected prior to re-welding.</p> <p>One or more standard weld repair procedures shall be submitted to the purchaser for approval before fabrication commences.</p>		
09.01.06	<p>Non-destructive Examination Practice</p> <p>Welds shall be non-destructively examined to the extent specified in the clause 06.00.00 above.</p>		
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09.02.00	<p>Procedures outlining the proposed non-destructive testing practice based on recognized techniques shall be submitted to the Purchaser on request for approval prior to commencement of fabrication.</p> <p>If necessary welds shall be ground prior to examination.</p> <p>Radiographic Examination</p> <p>10% radiography shall be carried out on all welding and welding of repaired welds.</p> <p>Standard X-ray techniques shall be used. The sensitivity of radiographic films shall be 2% or less as indicated by the image quality indicator for density grade between 2 and 3.</p> <p>Inspection and Testing During Erection at Site And Prior To Test On Completion</p> <p>Contractor shall submit Field Quality Plan, in the attached format for all inspection and tests to be conducted during erection of equipment / piping.</p> <p>The Tenderer shall submit with their offer procedures that they intend to use in the field to review the quality of work accomplished by the site personnel, so as to comply with the requirements of this section of the specification.</p> <p>The Contractor's scope of delivery includes all site test and inspection expenses, e.g. all labour, materials, water, electricity, consumables, chemicals and stores as well as the instruments and apparatus required to perform such tests efficiently. The Contractor is responsible for and shall include in his delivery all safety measures such as barriers, warning signs etc. required for inspection and testing while erection is in progress and all interruption of work in this connection shall be at his expense.</p> <p>The Contractor is responsible for ensuring that safe procedures are adopted for the use, handling and storage of radioactive sources and an inventory of all sources supplied to the site shall be maintained.</p> <p>All instruments and apparatus used for site inspection and testing shall be subject to the Purchaser's approval and at his discretion.</p> <p>During the erection of all mechanical, electrical and control equipment the Contractor shall make the plant items available at any reasonable time for inspection by the Purchaser if so required.</p> <p>To assist the Purchaser and his representatives in their review of the quality of the work being performed, the contractor's senior field representative shall provide the Purchaser with a schedule of the specific areas and items of work that will be performed during each work week. The list shall be presented to the Purchaser prior to the start of work on a day agreed by the Purchaser. All work that is executed prior to such notification shall, at the Purchaser's option, be subject to removal and replacement by the Contractor at his expense.</p>		
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09.02.01	<p>In particular, the Contractor has to mark on his implementation schedule all stages of erection or commissioning which are subject to the Purchaser's acceptance and to notify one week in advance when such inspection for acceptance becomes due. The stages subject to acceptance shall include but not be limited to the items indicated in this specification.</p> <p>Additional testing requested by the Purchaser shall be performed promptly and no claim for consequent delay or disruption of work shall be considered.</p>		
	<p>Erection and Pre-commissioning checks</p> <p>Purchaser's written approval of completed work stages and pre-commissioning checks shall be obtained before continuing with erection and should it be necessary to dismantle subsequently erected parts in order to gain access for inspection or rectification, this shall be at the Contractor's expense and no claim by the Contractor for delay shall be considered.</p> <p>Erection and pre-commissioning checklist prepared and maintained by the Contractor shall be countersigned by the Owner's Engineer after the satisfactory completion of each part of the plant. On satisfactory completion of erection for a group of works, the Purchaser will issue a "Mechanical Completion Certificate" which is a prerequisite for approval to commence commissioning of an item of plant.</p> <p>Copies of site erection inspection document files for items of plant or systems shall be distributed prior to pre-commissioning.</p>		
	<p>09.02.02 Pressure Testing</p> <p>Unless otherwise specified pressure tests shall be made on:</p> <ul style="list-style-type: none"> Pressure items that have not been pressure tested in the manufacturer's works. Site-made welds and other forms of joint on pressure items. <p>Tests shall be made after erection and completion of piping up to a suitable stop valve before painting.</p> <p>Prior to pressurizing a line, it shall be flushed with the medium to be used for testing at a flow rate at least twice that for the system in operation.</p>		
09.02.03	<p>Hydrostatic Testing</p> <p>Test pressures shall be in accordance with the applicable construction standard; if none is specified then the test pressure shall be 1.5 times the design pressure.</p> <p>The following shall not be fitted until after the pressure test:</p> <ul style="list-style-type: none"> Items which could restrict filling, venting or draining (e.g. orifice plates, flow nozzles etc.). 		
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09.02.04	<ul style="list-style-type: none"> Items that could be damaged by the test or by debris in the water (e.g. control valves etc.). <p>Adequate drying and cleaning of items to prevent deterioration shall be carried out in appropriate cases following testing.</p> <p>Pneumatic Testing</p> <p>The Contractor shall propose pneumatic testing in cases where hydraulic testing is impractical or undesirable. Safety precautions, test pressures / duration and degree of prior non-destructive examination of the subject items shall be agreed with the Purchaser.</p> <p>Items Exempted from Pressure Testing</p> <p>The following items shall not be subject to pressure testing at site:</p> <ul style="list-style-type: none"> Compressors, Pumps. Strainers and filter elements. Pressure relief valves. Piping that in operation discharges to atmosphere Equipment lined with non-metallic material. Locally mounted pressure gauges, where the test pressure would exceed the scale ranges. Other equipment as agreed with the Purchaser. 		
09.03.00	<p>Alignment of Rotating Equipment</p> <p>The correct alignment of equipment which is to be coupled on site installation with other rotating parts (e.g. motors, reduction gears etc.) shall be demonstrated by the Contractor to the satisfaction of the Owner's Engineer. The alignment results shall be entered into an appropriate alignment report sheet which shall be counter-signed by the Purchaser's and the Contractor's representatives.</p>		
09.04.00	<p>Additional Testing / Pre-Commissioning Checks</p> <p>After completion of erection, non-destructive and pressure testing as appropriate, further tests including pre-commissioning function trials shall be made on individual items of equipment and their alarm and shut-down systems to satisfy the Owner's Engineer that the plant may be safely commissioned.</p> <p>Pre-commissioning checks on mechanical equipment shall include:</p> <ul style="list-style-type: none"> Individual pre-commissioning runs (test runs) of all rotating equipment such as pumps, compressors, etc. 		
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10.00.00	<ul style="list-style-type: none">Functional tests to the mechanical equipment, alarm and tripping systems. <p>Additionally pre-commissioning checks for electrical and I&C equipment shall be carried out.</p> <p>COMMISSIONING PERIOD</p> <p>Following shall be submitted by contractor before start of commissioning activity:-</p> <ul style="list-style-type: none">An organization chart of proposed commissioning team with bio-data of key personnel. <p>The manufacturer's installation / commissioning engineer shall be present at site wherever required during critical erection and mechanical completion commissioning activities of all the equipments and systems at all critical phase of execution.</p> <p>After erection work and pre-commissioning checks of individual equipment have been completed the Contractor shall apply to the PURCHASER's representative for permission to commence the commissioning period. This is the period in which the plant shall be prepared, operated and adjusted to obtain specified performance so as to ensure an undisturbed subsequent test on completion of the entire plant or units of the plant which may be operated independently of each other.</p> <p>Preconditions for permission being granted are the issue of the "Mechanical Completion Certificate" and the approved commissioning program containing schedules of procedures.</p> <p>The contractor shall give sufficient detail in his commissioning program to satisfy the Purchaser that:</p> <ul style="list-style-type: none">The sequence and duration of the proposed activities are logical, realistic and in accordance with safety and permit regulations in force on the site.The commissioning of any item of plant would not interrupt the normal operation of any previously commissioned items. <p>Commissioning Activities</p> <p>Commissioning shall be performed in accordance with the manufacturer's standards, Indian Standards & practice. The correct functioning of the plant and the performance obtained should comply with the contract requirements and be proved for individual sections of the plant.</p> <p>On completion of each commissioning activity to the satisfaction of the Owner's Engineer, the commissioning schedule shall be signed and dated by the Contractor and countersigned by the Owner's Engineer.</p>		
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11.00.00 L.P.PIPING SPECIFICATION

11.01.00 All the piping systems and equipment supplied under this package shall be designed to operate without replacement and with normal maintenance for a plant service life of 30 years, and shall withstand the operating parameter fluctuations and cycling which can be normally expected during this period.

11.02.00 For all L.P. piping system covered under this specification, sizing and system design shall be to the requirements of relevant codes and standard indicated elsewhere. In addition to this, requirements of any statutory code as applicable shall also be taken into consideration.

11.03.00 Inside diameters of piping shall be calculated for the flow requirements of various systems. The velocities for calculating the inside diameters shall be limited to the following:

A. Water Application

Water Velocity in m/sec.

Pipe Size	Below 50 mm	50-150 mm	200 mm & above
(a) Pump suction	-----	1.2-1.5	1.2-1.8
(b) Pump discharge And recirculation	1.2-1.8	1.8-2.4	2.1-2.5
(c) Header	-----	1.5-2.4	2.1-2.4

Pipe line under gravity flow shall be restricted to a flow velocity of 1 m/sec generally. Channels under gravity flow shall be sized for a maximum flow velocity of 0.5 m/sec.

WILLIAM & HAZEN formula shall be used for calculating the friction loss in piping systems with the following "C" value:

(i)	Carbon steel pipe	100
(ii)	C.I. Pipe / Ductile Iron	100

For calculating the required pump head for pump selection, at least 10% margin shall be taken over the pipe friction losses and static head shall be calculated from the minimum water level of the tank/sump/reservoir from which the pumps draw water.

B. Compressed Air Application

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Compressed Air up to 15 m/sec.

- 11.04.00 The pipes shall be sized for the worst (i.e. maximum flow, temp. and pressure values) operating conditions.
- 11.05.00 Based on the inside diameter so established, thickness calculation shall be made as per ANSI B 31.1 OD and thickness of pipes shall than be selected as per ANSI B 36.10/IS-1239 Heavy grade/IS-3589 as the case may be.
- 11.06.00 Corrosion allowance of 1.6 mm will be added to the calculated thickness being considered.
- 11.07.00 Bend thinning allowance / manufacturing allowance etc. shall be as per the requirement of the design code provision.
- 11.08.00 All high points in piping system shall be provided with vents along with valves. All low points shall be provided with drains along with valves. Drain lines shall be adequately sized so as to clear condensate in the lines. Material for drain and vent lines shall be compatible with that of the parent pipe material.
- 11.09.00 Material of construction for pipes carrying various fluids shall be as specified elsewhere.
- 11.10.00 Compressed air pipe work shall be adequately drained to prevent internal moisture accumulation and moisture traps shall be provided at strategic locations in the piping systems.
- 11.11.00 Depending upon the size and system pressure, joints in compressed air pipe work shall be screwed or flanged. The flange shall be welded with the parent pipe at shop and shall be hot dip galvanized before dispatch to site.
- 11.12.00 Threaded joints shall be provided with Teflon sealant tapes.
- 11.13.00 Following types of valves shall be used for the system / service indicated.

System	Types of Valves					
	Butterfly	Gate	Globe	Check	Ball	Plug
Water	x	x	x	x	x	
Air		x	x	x	x	
Drains & Vents		x	x	x		



- 11.14.00 Recirculation pipes along with valves, break-down orifices etc. shall be provided for important pumping. The recirculation pipe shall be sized for minimum 30% design flow of single pump operation or the recommended flow of the pump manufacturer.

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12.00.00	TECHNICAL SPECIFICATION		
12.01.00	General <p>Specific technical requirements of low pressure piping and fittings have been covered under this sub-section. It includes details pertaining to design and material of construction, cleaning/surface preparation application of primer and painting on over ground piping. It also includes detailed technical requirement of laying underground / buried piping including water proofing / anti corrosive protection. It also covers design, engineering, manufacturing, fabrication, details of valves, specialties, piping hangers/supports, tanks etc.</p>		
12.01.01	Pipes and fittings <p>All low pressure piping systems shall be capable of withstanding the maximum pressure in the corresponding lines at the relevant temperatures. However, the minimum thickness as specified in the following clauses and or respective codes for pipes and fittings shall be adhered to. The bidder shall furnish the pipe sizing/ thickness calculation as per the criteria mentioned above under LP piping equipment sizing criteria of this Technical Specification.</p> <p>Supporting arrangement of piping systems shall be properly designed for systems where hydraulic shocks and pressure surges may arise in the system during operation. Bidder should provide necessary protective arrangement like anchor blocks/anchor bolt etc. for the safeguard of the piping systems under above mentioned conditions. The requirement will be, however, worked out by the contractor and he will submit the detailed drawings for thrust/anchor block to the Employer. External, and internal, attachments to piping shall be designed so as not to cause flattening of pipes and excessive localized bending stresses.</p> <p>Bends, loops, off sets, expansion or flexible joints shall be used as required in order to prevent overstressing the piping system and to provide adequate flexibility. Flexibility analysis (using software packages such as Caesar-II etc.) shall be carried out for sufficiently long piping (straight run more than 300M).</p> <p>Wherever Bidder's piping coming under this specification, terminates at an equipments or terminal point not included in this specification, the reaction and the thermal movement imposed by bidder's piping on equipment terminal point shall be within limits to be approved by the Employer.</p> <p>The hot lines shall be supported with flexible connections to permit axial and lateral movements. Flexibility analysis shall be carried out for pipelines which have considerable straight run as indicated above and necessary loops/expansion joint etc. shall be provided as may be necessary depending on layout.</p>		
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Piping and fittings shall be manufactured by an approved manufacturer of repute. They should be truly cylindrical of clear internal diameter, of uniform thickness, smooth and strong, free from dents, cracks and holes and other defects.

For rubber lined ERW pipes, beads shall be removed.

At all intersection joints, it is Bidder's responsibility to design and provide suitable reinforcements as per the applicable codes and standards.

For large size pipes/ducts at high point and bends / change of direction of flow, air release valves shall be provided. Sizing criteria for air release valves shall be generally on the basis of valve size to pipe diameter ratio of 1:8. Requirement shall be decided as per relevant code.

Transient analysis / surge analysis where ever specified and required shall be conducted in order to determine the location, number and size of the Air-Release valve on certain long distance/high volume piping systems, if applicable within the scope of work of the package.

12.01.02

Material

Alternate materials offered by Bidder against those specified shall either be equal to or superior to those specified. The responsibility for establishing equality or superiority of the alternate materials offered rests entirely with the Bidder and any standard code required for establishing the same shall be in English language.

No extra credit would be given to offers containing materials superior to those specified. Likewise no extra credit would be given to offers containing pipe thickness more than specified.

All materials shall be new and procured directly from the manufacturers. Materials procured from traders or stockiest are not acceptable.

All materials shall be certified by proper material test certificates. All material test certificates shall carry proper heat number or other acceptable references to enable identification of the certificate that certifies the material.

Material of construction for pipes carrying various fluids shall be as follows:

1	Raw water, clarified water and service water.	ASTM A-36/ASTM A-53 type 'E' Gr.B/IS-3589 Gr.410/ IS-1239 Heavy.
2	Instrument air & plant air	ASTM A-53 type 'E' Gr.B galvanized / IS 1239 heavy galvanized/IS 3589 Gr.410 galvanised to IS-4736 or equivalent.

In water lines, pipes up to 150mm NB shall conform to ANSI B36.10 and minimum selected thickness shall not be less than IS: 1239 Grade Heavy

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Pipes of above 150mm NB shall be to AWWA-C200/ANSI B 36.10/ASTM A-53/IS 3589. Pipe to be fabricated by the bidder shall be rolled and butt welded from plates conforming to ASTM A-53 type 'E' Gr.B/IS 2062 Gr.B.

Instrument air, Plant (service) air lines shall be to ASTM A 53 type E grade B/ANSI B 36.10/IS 3589/IS 1239 Heavy (in case thickness calculated is more than Gr.Heavy, ANSI B 36.10 schedule numbers shall be followed) and galvanized to IS 4736 or any equivalent internationally reputed standard. The material of the pipes shall be to ASTM A 53 Type 'E' Gr., B/IS 1239 Gr. Heavy. The fittings shall be either same as parent material or malleable iron to IS-1879 (galvanized).

Spiral welded pipes as per API-5L/IS-3589 are also acceptable for pipe of size above 150 NB. However minimum thickness of the pipes shall be as elaborated in above clauses.

12.01.03

Piping layout

Piping shall be grouped together where practicable and routed to present a neat appearance.

Piping routing shall be such as to provide sufficient clearance for removal and maintenance of equipment, easy access to valves, instruments and other accessories. The piping shall not encroach on the withdrawal space of various equipments.

Over head piping shall have a normal minimum vertical clearance of 2.5 meters above walkways and working areas and 8M above roadways/railways. When several pipe lines are laid parallel, flanged joints must be staggered. Welded and flanged joints should as far as possible be located at one third span from supports. If the support is situated right under the welded joints this joint must be reinforced with a strap. Flanged and welded joints must be avoided in the middle of the span. Valves should be located in such a manner so as to ensure their convenient operation from the floor or the nearest platform.

Pipe lines of NB 50 size and below are regarded as field run piping. It is Bidder's responsibility to plan suitable layouts for these system insitu. Bidder shall prepare drawings indicating the layout of field run pipe work. These drawings shall be approved by Project Manager to the installation of the field run pipe work. Based on these approved layouts the Bidder shall prepare the BOQ of field run-pipes and submit to Employer for approval.

All piping shall be routed so as to avoid interference with other pipes and their hangers and supports, electrical cable trays, ventilation ducting, structural members, equipment etc. Adequate clearance shall be ensured with respect to the above to accommodate insulation and pipe movements, if any.



Piping shall generally be routed above ground but where specifically indicated/approved by the Project Manager the pipes may be arranged in trenches or buried. Pipes at working temperature above the ambient shall however not be buried.



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12.01.04	<p>Sufficient up stream and down stream lengths shall be provided for flow measuring devices, control valves and other specialties.</p> <p>All local instruments shall be located on pipe lines as to render them observable from the nearest available platforms.</p> <p>Openings provided in the wall for pipelines must be closed with bricks and mortar with 10-12 mm clearance between brick work and pipe after taking care of insulation and thermal movement, if any. The clear space must be filled with felt or asbestos or approved filling compound.</p>		
	<p>Slope / Drains and Vents</p> <p>Suitable slope shall be provided for all pipelines towards drain points. It is Bidder responsibility to identify the requirements of drains and vents, and supply the necessary pipe work, valves, fittings, hangers and supports etc. In addition to the system requirement all low points in the pipelines shall be provided with suitable draining arrangement and all high points shall be provided with vent connections where air or gas pockets may occur. Vent for use during hydrostatic test shall be plugged after the completion of the test. Vent shall not be less than 15mm size. Drains shall be provided at low points and at pockets in piping such that complete drainage of all systems is possible. Drain shall not be less than 15mm for line size up to 150mm, not less than 20mm up to 300mm and not less than 25mm for 350mm to 600mm pipes and not less than 50mm for 600mm and above pipes.</p> <p>Air piping shall be sloped so that any part of the system can be drained through the shut-off drain valve or drain plugs.</p>		
	<p>Pipe Joints</p> <p>In general all water lines 65mm Nb and above, are to be joined generally by butt welding except the locations where valves/fittings are to be installed with flanged connections and 50mm and below by socket welding unless mentioned otherwise specifically. All air lines shall be of screwed connection and rubber lined pipes of flanged connections.</p>		
12.01.06	<p>Screwed</p> <p>(a) Threading of pipes shall be carried out after bending, heat treatment etc. if not possible, threading may be done prior to these operations but proper care should be taken to protect them from damage. Threads shall be to ANSI B 2.1 (taper) NPT/IS:554 unless specified otherwise.</p> <p>(b) Galvanized pipe shall generally be joined by screwing into sockets. The exposed threaded portion on the outside of the pipes shall be given a zinc silicate coating. Galvanized pipes shall not be joined by welding. Screwed ends of GI pipes shall be thoroughly cleaned and painted with mixture of red and white lead before jointing. For galvanized pipe sizes of 150 mm NB and above, either screw & socket jointing or flanged jointing shall be employed. However, the bidder shall ensure the galvanized pipe joints do not fail during hydro test.</p>		
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12.01.07	<p>(c) Teflon taps shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be reamed and all chips shall be removed. Screwed flanges shall be attached by screwing the pipe through the flange and the pipe and flange shall be refaced accurately</p> <p>Welded</p> <p>For making up welded joints (butt weld or socket weld) the welding shall be performed by manual shielded metal arc process in accordance with the requirements specified elsewhere in the spec. Any welder employed for carrying butt welding shall be qualified as per ASME section IX for the type of joints he is going to weld. Jointing by butt weld, or socket weld shall depend upon the respective piping material specifications.</p>		
12.01.08	<p>Flanged</p> <p>(a) All rubber lined pipes shall be flanged joined. Flanged connections for other pipes are to be kept to the minimum and used only for connections to vessel, equipments, flanged valves and other fittings like strainer/traps/orifices etc. for ease of connection and maintenance etc.</p> <p>(b) All flanged valves intended for installation on steel piping system, shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class stated in their respective piping material specification.</p> <p>(c) Drilling on flanges of flanged valves must correspond to the drilling of flanges on the piping system on which the valves are installed.</p>		
12.01.09	<p>Bends /Elbows/Mitre bends/Tees/Reducers & other fittings</p> <p>Unless otherwise specified elbows shall be of long radius type.</p> <p>For pipe sizes up to 65 Nb, long radius forged elbows or seamless pipe bends shall be used. Pipe bends, if used, shall be cold bent to a radius measured to the centre line of pipe of 3 to 5 times the pipe diameter.</p> <p>For steel pipes 80 Nb and above, seamless long radius forged elbows shall be used. For pipe size 350 Nb and above mitre bends may be used for all pipes except rubber lined pipes. The bend radius shall be 1 ½ times the nominal pipe diameter. 90 Deg. Bends (mitre) shall be in 4 pieces (3 cuts) and 45 deg. Mitre bends shall be in 3 pieces 22 ½ deg. Fabrication of mitre bends shall be as detailed in BS 2633/BS 534.</p> <p>Mitre bends are not acceptable in case of rubber lined mild steel pipes.</p> <p>For pipe fittings such as reduces and tees, the material shall be to ASTM-A-234 Gr. WPB up to 300 NB. For pipe reducers and tees above 300 Nb, the fittings may be fabricated</p>		
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12.01.10	<p>conforming to parent pipe material. Provision of compensation pads shall be kept as per ANSI B 31.1. The fitting shall conform to the dimensional standard of ANSI b-16.9.</p> <p>However, for pipes up to 150 NB, pipe fittings may be supplied with material and dimension conforming to IS 1239 in case parent pipes also conform to IS 1239.</p> <p>For pipes, above 1200 NB, reducer and tees shall be to dimensional standard of AWWA-C-208.</p>		
	<p>Flanges</p> <p>Flanges shall be slip on type. Welding of flanges in tension is not permitted.</p> <p>All flanges and flanged drilling shall be to ANSI B 16.5/BS 4504 of relevant pressure/temperature class. Flanges shall be fabricated from steel plates conforming to ASTM A 105/IS 2062 Gr.B.</p>		
	<p>Specific technical requirement of laying buried pipe with anti corrosive treatment</p> <p>The pipe in general shall be laid with top of the pipe minimum 1.0 (one) meter below finished general ground level.</p>		
	<p>Trenching</p> <p>(a) The trench shall be cut true to the line and level and shall follow the gradient of the pipeline. The width of the trench shall be sufficient to give free working space on each side of the pipe. Trenches shall conform to IS 5822.</p> <p>(b) Free access shall be provided for the welding of the circumferential joints by increasing the width and depth of the trench at these points. There should be no obstruction to the welder from any side so that good welded joints are obtained.</p> <p>(c) The free working space shall conform to IS:5822. The trench shall be excavated so as to provide minimum cover of 1000mm between the top of the pipe and finished grade.</p> <p>(d) Prior to lowering and laying pipe in any trench, the Bidder shall backfill and compact the bottom of the trench or excavation in accordance with IS:5822 to provide an acceptable bed for placing the pipe.</p> <p>(e) Coating and wrapping shall be done as under</p>		
12.01.13	<p>Preparation and cleaning of piping</p> <p>(a) The pipeline shall be thoroughly cleaned of all rust, grease, dirt, weld scales and weld burrs etc. moisture or other foreign matter by power cleaning method such as sand blasting, power tool cleaning, etc. Grease or heavy oil shall be removed by washing with a volatile solvent such as gasoline. Kerosene will not be permitted for cleaning.</p>		
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12.01.04	<p>This cleaning operation shall be immediately followed by priming with the mechanical priming machine.</p> <p>(b) Certain inaccessible portions of the pipe line (which otherwise not possible to be cleaned by power cleaning methods) may be scrubbed manually with a stiff wire brush and scrapped where necessary.</p> <p>(c) The cleaning and priming operation shall be carried out at site. The entire pipe length shall be cleaned but the ends of the pipes shall be left without coating for a distance of 230 mm for joints, which shall be coated manually at site after laying, welding and testing the pipe.</p> <p>(d) On the internal surface for pipes 1000 Nb and above, a coat of primer followed by a hot coal-tar enamel or coal air epoxy painting (cold) shall be applied.</p>		
	<p>Coating and wrapping</p> <p>(a) Burried piping shall be coated and wrapped, as per specification, after completion of welded and /or flanged connections, and after completion and approval of Hydro testing. Materials to be used for coating and wrapping of underground pipelines are:</p> <p>(1) coating primer (coal tar primer)</p> <p>(2) Coating enamel (coal tar enamel)</p> <p>(3) Wrapping materials.</p> <p>(b) All primer/coating/wrapping materials and methods of application shall conform to IS:10221 except asphalt/bitumen material. Materials (primer/coating/wrapping) as per AWWA-C-203 are also acceptable.</p> <p>(c) Protective coating shall consist of coal tar primer, coal tar enamel coating, glass fibre tissue inner wrap followed by coal tar impregnated glass fibre or craft paper outer wrap or finish coat.</p> <p>(d) Number of coats and wraps, minimum thickness for each layer of application shall be as per IS-10221. Number of coats and wraps shall be decided based on soil corrosivity / resistivity as indicated in IS-10221. Soil data for this purpose shall be collected by the Contractor, if required.</p> <p>(e) Total thickness of completed coating shall not be less than 4.0 mm.</p> <p>(f) Alternatively, the anti-corrosive protection can consist of anti-corrosive protection Coal-tar tapes. Material and application of tapes shall conform to AWWA-C-203. These tapes shall be applied hot over the cold coal tar primer. The total thickness of the finished protective coating shall be 4 mm minimum</p>		
12.01.15	<p>Trench bed preparation and back filling (Remove the bold)</p>		
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	<p>Prior to lowering and laying pipe in any excavated trench, the bottom of the trench may require to be back filled and compacted (or as the case may be) to provide an acceptable bed for placing the pipe. Bed preparation in general shall be as per IS:5822.</p> <p>Bed preparation and back filling of excavated trenches for buried pipes depend on type of soil. Soil types are classified into 3 categories:</p> <p>(a) Rocky Soil.</p> <p>(b) Sandy / silty soil (including non-expansive clay).</p> <p>(c) Expansive soil (including water logged / marshy soil).</p>		
12.01.16	<p>Laying of galvanized steel (GI) pipes</p> <p>All the joints shall be screwed or flanged. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing. Treaded portion on either side of the socket joint shall be applied with Zinc silicate paste.</p> <p>All the provisions for trenching / bed preparation / laying the pipe application of primer/coating/wrapping with tapes/back filling etc. as indicated for "laying of buried piping" and "anti corrosive protection for buried piping" are applicable for buried galvanized steel (GI) pipes also.</p>		
12.01.17	<p>Cleaning, Flushing and Blow Out</p> <p>All piping shall be cleaned by the contractor before and after erection to remove grease, dirt, dust, scale and welding slag.</p> <p>Before erection all pipe work, assemblies, sub-assemblies, fittings and components, etc. shall be thoroughly cleaned internally and externally by blast cleaning or by power driven wire brush and followed by air blowing. The brushes shall be of the same or similar material as the metal being cleaned.</p> <p>After erection, all water lines shall be mass flushed with water. The cleaning velocities in water lines shall be 1.2-1.5 times the operating velocities in the pipelines.</p> <p>All compressed air pipe work shall be cleaned by blowing compressed air.</p>		
12.01.18	<p>Surface preparation and painting</p> <p>Pipes shall be cleaned both internally and externally thoroughly by blast cleaning or power tool cleaning method as indicated above. In case of oil piping, cleaning will have to be done by pickling. No painting is required on galvanized pipe surface or galvanized steel surface. However, necessary colour banding for identification as per colour code shall be done. External surface of piping shall be cleaned and prepared as indicated in the painting schedule below:</p>		
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12.01.19	<p>Primer painting</p> <p>After the surface is prepared in a manner acceptable to the Project Manager two coats of red oxide (zinc chromate) primer conforming to IS-2074 or equivalent BS shall be applied. Primer shall be applied by brushing to ensure a continuous film without holidays. Primer shall be immediately applied without any time lag after the surface preparation.</p> <p>Any equipment which has been given the shop coat of primer shall be carefully examined after its erection in the field and shall be treated with a touch up coat of red oxide primer wherever the shop coat has been abraded, removed or damaged during transit/erection, or defaced during welding.</p>		
12.01.20	<p>Finish Painting</p> <p>(a) Paint to be used shall be synthetic enamel paint conforming to IS-2932 or equivalent. The manufacturer of paints and colour/shade shall be as approved by the Project Manager.</p> <p>(b) Finish paintings shall be carried out in three coats consisting of one under coat and two finishing coats.</p> <p>(c) The primed surface shall be cleaned of dust/dirt/grease etc. without scratching or in any way damaging the primer coat. Over this dry surface an optimum coat of under coating of synthetic enamel shall be applied. The under coat shall be allowed to dry.</p> <p>(d) Paint shall be applied by brushing. It shall be ensured that brush marks are minimum and the requirements of workmanship is as specified in IS-1477.</p> <p>(e) Paint used shall be stirred frequently to keep the pigment in suspension. Paint shall be of the ready mixed type in original sealed containers as packed by the paint manufacturer. No thinners shall be permitted.</p> <p>(f) No painting shall be done in frost/foggy weather or when the humidity is high to cause condensation on the surface to be painted.</p> <p>(g) The dry film thickness (DFT) after the painting shall not be less than 150 microns.</p>		
12.01.21	<p>Other requirements</p> <p>(a) Paint manufacturer's instructions shall be followed in method of application, handling, drying time etc.</p> <p>(b) The colour of the finish paint shall be as per approved colour coding scheme.</p> <p>(c) If finish paint was applied in shop, one coat of finish paint shall be applied at site.</p>		
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	<p>(d) Protection of other surfaces adjacent to the surface being painted is the responsibility of the Contractor.</p> <p>(e) The dry film thickness of the finish paint shall not be less than 0.15 mm.</p> <p>(f) All painting materials such as paints, varnishes, primer, solvents, thinners shall be supplied by the Contractor. All the services, tools etc. required for preparation / cleaning and painting shall be provided by the Contractor. The Contractor shall be required to estimate the quantity of painting material required.</p>		
12.01.22	<p>Colour code for identification</p> <p>The pipes shall be colour painted / banded for identification as per the colour coding scheme of employer. These sheets shall be furnished during detail engineering stage to the bidder and shall be generally as per IS-9404.</p>		
12.01.23	<p>Specification for hangers and supports</p> <p>All supports and parts shall conform to the requirement of power piping code ANSI B 31.1 or approved equipment.</p> <p>While designing supports for rubber lined pipes special consideration should be given. Any kind of welding on these pipes is not allowed after rubber lining.</p> <p>Hanger for piping 65mm Nb and larger and all spring support assemblies regardless of size shall be completely engineered in conformance with the provision of power piping code ANSI B 31.1.</p> <p>Hangers, saddles, supports etc. shall be capable of carrying the sum of all concurrently acting loads and shall be fabricated from plates / pipes sections conforming to ASTM A 53 / IS:2062/IS:226/or equivalent. They shall be designed to provide the required supporting effects and allow pipe line movements as necessary. The structural steel work shall be as per IS: 800 / BS: 4360. Insulation protection saddles shall be used at support point of all insulated piping.</p> <p>The support shall be so interspaced as to minimize sagging of the pipes and to keep them within permissible limits where pipes are full with the conveying media.</p> <p>The maximum spans of the supports of straight lengths shall not exceed the recommended values indicated in ANSI B 31.1.</p> <p>All pipe supports shall be designed to provide an absolute minimum head room of 2.5 m from floor in passages / walkways.</p> <p>At all sliding surfaces of supports Contractor shall provide suitable arrangement to minimize sliding friction.</p>		
12.01.24	<p>Design/Construction/Material Particulars of Gate/ Globe/ Check Valves</p>		
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- (a) All valves shall be suitable for the service conditions i.e. flow, temperature and pressure, at which they are required to operate.
- (b) The valves as well as all accessories shall be designed for easy disassembly and maintenance.
- (c) Valves to be installed outside shall be required to have the stem properly protected against atmospheric corrosion.
- (d) All rising stem valves shall be provided with back seat to permit repacking (of glands) with valves in operation. All valves shall preferably be of outside screw and yoke type.
- (e) All valves shall be closed by rotating the hand wheel in the clockwise direction when looking at the face of the hand wheel. In case where the hand wheel is not directly attached to the valve spindle suitable gearing shall be introduced.
- (f) All valves shall have indicators or direction clearly marked on the hand-wheel so that the valves opening/ closing can be readily determined.
- (g) Gate/ sluice valves shall be used for isolation of flow. Gate valve shall be provided with the following accessories in addition to the standards items:
 - 1) Hand wheel
 - 2) Draining arrangement wherever required.
- (h) Globe valves shall be used for regulation purpose. They shall be provided with hand wheel, position indicator, draining arrangement (wherever required) and arrow indicating flow direction.
- (i) Check valves shall be used for non-return service. They shall be swing. Check type or double door (Dual plate) check type with a permanent arrow inscription on the valve body indicating the fluid flow direction. In long distance pipes lines with possibility of surge-occurrence, dual plate check valves are preferable for its spring controlled opening/ closing of flaps/ doors against flow reversals.
- (j) All gate and globe valves shall be provided with back seating arrangement to enable on line changing of gland packing.
- (k) All gate and globe valves shall be rising stem type.
- (l) All valves shall be provided with embossed name plate giving details such as tag number, type, size etc.
- (m) Necessary small platforms for facilitating easy valve operation shall be provided by the bidder wherever necessary in consultation with project manager within the bid price at no extra cost to Owner



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12.01.25	<p>(n) All valves except those with rising steams, shall be provided with continuous mechanical position indicators; rising steam valves shall have only visual indication through plastic/metallic steam cover.</p> <p>(o) For CI gate, globe and check valves standards, standards, thickness mentioned in the valves standards, thickness mentioned in IS-1538 for fitting shall be applicable.</p> <p>Valve Codes & Standards</p> <p>The design, material, construction, manufacture, inspection, testing and performance of valves shall comply with all currently applicable statues, regulations and safety codes in the locality where the valves will be installed. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be constructed to relieve the Bidder of his responsibility. Valves in general shall conform to the requirements of the following standards.</p>																											
	12.01.26	<p>Standards and Codes</p> <table><tr><td>BS-5155</td><td>Cast iron and carbon steel butterfly valves for general purpose.</td></tr><tr><td>IS-778</td><td>Gun-metal gate, globe and check and gate valves for general purpose.</td></tr><tr><td>BS-5154</td><td>Copper alloy globe/glob stops and checks and gate valves for general purpose.</td></tr><tr><td>IS-780</td><td>Sluice valve for water works purpose (50-300 mm size)</td></tr><tr><td>IS 5150</td><td>Cast iron wedge and double disc gate for general purpose.</td></tr><tr><td>BS-5152</td><td>Specification for cast iron globe valves.</td></tr><tr><td>BS-5153</td><td>Cast iron check valves for general purpose.</td></tr><tr><td>IS- 5312</td><td>Swing check type reflux (non –return) Valves.</td></tr><tr><td>ANSI B 16.34</td><td>Standard for valves.</td></tr><tr><td>API- 594</td><td>Standard for Dual – Check Valves.</td></tr><tr><td>API-600</td><td>Steel gate valves.</td></tr><tr><td>ANSI-B-16.10</td><td>Valves face to face and other relevant dimension</td></tr><tr><td>API- 598</td><td>Valves inspection test.</td></tr></table>		BS-5155	Cast iron and carbon steel butterfly valves for general purpose.	IS-778	Gun-metal gate, globe and check and gate valves for general purpose.	BS-5154	Copper alloy globe/glob stops and checks and gate valves for general purpose.	IS-780	Sluice valve for water works purpose (50-300 mm size)	IS 5150	Cast iron wedge and double disc gate for general purpose.	BS-5152	Specification for cast iron globe valves.	BS-5153	Cast iron check valves for general purpose.	IS- 5312	Swing check type reflux (non –return) Valves.	ANSI B 16.34	Standard for valves.	API- 594	Standard for Dual – Check Valves.	API-600	Steel gate valves.	ANSI-B-16.10	Valves face to face and other relevant dimension	API- 598
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ANSI-B-16.10	Valves face to face and other relevant dimension																											
API- 598	Valves inspection test.																											
12.01.27	<p>End Connections</p>																											
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12.01.28	<p>The end connections, shall comply with the following:</p> <p>Socket welding (EW) – ANSI B 16.11</p> <p>Butt Welding (BW) – ANSI 16.25.</p> <p>Threaded (SC) – ANSI B 2.1</p> <p>Flanged (FL) – ANSI B 16.5 & AWWA-C 207 (STEEL flanges), ANSI B 16.1 (cast Iron flanges)</p> <p>All cast iron body valves (gate, globe and non-return) shall have flanged end confection, (screwed ends for cast iron</p> <p>All steel and stainless steel body valves of sizes 65 mm and above shall have flanged or socket welded ends. Compatibility of welding between valve body material and connecting pipe material is a pre- requisite in case of butt- welded joints.</p> <p>All flanged end valves /specialties. Shall be furnished along with matching counter flanges, flanges, fasteners, gaskets etc .as required to complete the joints.</p>		
	<p>Check Valves</p> <p>Check valves shall comply with the following characteristics:</p> <p>(a) For bore greater than 2” the valves must be swing check type or dual plate check type suitable for installation in all positions (vertical and horizontal);</p> <p>(b) For bore smaller than or equal to 2”the valves must be of the piston type to be installed, In horizontal position.</p> <p>(c) In the case of swing check valves, the body seat shall be inclined at such an angle from the vertical as will facilitate closing and prevent chatter.</p> <p>Drilling on flanges of flanged valves must correspond to the drilling on flanges of the piping system on which the valves are to be installed.</p> <p>All flanged valves intended for installation in steel piping systems shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class.</p> <p>Counter flanges to be installed on air pipes shall be screwed- on type irrespective of size.</p>		
12.01.29	<p>Globe Valves</p> <p>The globe valves shall have the following characteristics:</p> <p>Straight conveyed flow.</p>		
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12.01.30	Right angle preferably, the valves shall be of vertical stem type.	
	Globe Valves shall preferably have radiused or spherical seating and discs shall be free to revolve on the spindle.	
	The pressure shall preferably be under the disc of the valve. However, globe valves, with pressure over the disc shall also be accepted provided (i) no possibility exists that flow from above the disc can remove either the disc from stem or component from disc (ii) manual globe valves can easily be operated by hand. If the fluid load on the top of the disc is higher than 40-60 KN, bypass valve shall be provided which permits the downstream system to be pressurized before the globe valve is opened.	
	Globe valves with NB smaller than or equal to 2" shall be of the integral type. Valves of this type shall be so as to permit the easiest disassembly of the internals (stem and disc.)	
	For the regulating valves with regulating plug & parabolic outlines disc type is preferred.	
	All motorized globe valve with regulating plug for which indication of percentage (%) opening are required in the control room shall be provided with necessary position transmitter.	
	Gate valves	
	All gate valves shall be of the full- way type. And when in the full open position the bore of the valves shall not be constricted by any of the gate.	
	Gate valves shall be of the solid/ elastic or articulated wedge disc and rising stem type.	
	12.01.31	Material of construction (gate/globe/check valve)
	The material shall generally comply with the following:	
	(a) Cast Steel Valves	
	Body & bonnet	ASTM A 216 Gr. WCB/ ASTM A 105
	Disc for non-return valves	ASTM A 216 Gr. WCB/ ASTM A 105
	Trim.	ASTM A 182 Gr. F6
	(b) Stainless Steel Valves	
	Body & Bonnet	ASTM A 351 Gr. CF 8M/ ASTM A 182 Gr. 304
	Disc	-do-
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Trim. ASTM 182 Gr. F. 316

(c) Cast Iron Valves

Body & Bonnet BS 1452 Gr. 14 / IS-210 Gr.
FG 260

Seating surfaces and rings 13% chromium steel

Disc for non-return valves BS 1452 Gr. 14/IS-210 Gr FG
260

Hinge pin for non-return valves 13% chromium steel

Back Seat 13% chromium steel

(d) Gun Metal Valves

Body and Bonnet IS 318 Gr. 2/Equipment
Standard

Trim. -do-

(e) Cast iron body valves shall have stainless steel stem and seat.

(f) Material for counter flanges shall be the same as for the pipings.

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ANNEXURE-I: PROJECT INFORMATION

- 1.0 OWNER : Punjab State Electricity Board
Guru Nanak Dev Thermal Plant Bathinda
(Punjab State), India
- 2.0 CONSULTANT : TCE Consulting Engineers Limited
AT THE TIME OF INITIAL 73/1, St. Mark's Road
DESIGN, ENGINEERING, Bangalore – 560 001.
ERECTION & COMMISSIONING
- 3.0 PROJECT : Guru Nanak Dev Thermal Plant
2 x 110MW -Unit Nos. 3 & 4 – Stage II
R & M Project
- 4.0 LOCATION : At Bathinda, Punjab State, India.
- 5.0 NEAREST AIRPORT : Delhi
- 6.0 ROAD APPROACH : Accessible by road from Bathinda
- 7.0 NEAREST RAILWAY STATION : Bathinda
- 8.0 NEAREST PORT : Mumbai
- 9.0 ALTITUDE : About 213 M above mean sea level.
- 10.0 SEISMIC ZONE : Zone – as per Indian Standard IS:1893
(Current Issue)
- 11.0 RAINFALL : 1200 mm (Maximum rainfall occurs during
(ANNUAL TOTAL MEAN) June to September)
- 12.0 AMBIENT AIR TEMPERATURE
- a) Maximum dry bulb : 45.0 Deg. C
- b) Minimum dry bulb : 2.0 Deg. C
- c) Reference temperature for : (+) 50 Deg. C
design of electrical
equipment / devices
- 13.0 RELATIVE HUMIDITY
- a) Maximum : 80%
- b) Minimum : 20%

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- c) Relative humidity for : (+) 100%
design of equipment /
devices

14.0 CLIMATIC CONDITION : Hot, dry and dusty but healthy climate.

15.0 TROPICALISATION : All equipment supplied against this specification shall be given tropical and fungicidal treatment in view of the severe climatic conditions prevailing at site as described above.

16.0 WIND DATA

16.1 a) Wind load as per IS 875
(Part-3) 1987

- i) Basic wind speed : 50 km/hr.
b) Prevailing wind direction : Tending South

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ANNEXURE-II: BILL OF MATERIAL FOR VALVES


INSTRUMENT AIR LINE						
A.	Sl.No.	Description	Size (NB)	Operation	Specification	Qty. (nos.)
	1.	Gate Valve (Normally open)	125	Manual	Body ASTM A 216 Gr. WCB, 150 #, flanged to ANSI 16.5	10
	2.	Gate Valve (Normally Close)	125	Manual	Body ASTM A 216 Gr. WCB, 150 #, flanged to ANSI 16.5	4
	3.	Gate Valve (Normally Close) for interconnection of Unit # 3 and Unit # 4	80	Manual	Body ASTM A 216 Gr. WCB, 150 #, flanged to ANSI 16.5	1
B.	COOLING WATER LINE					
	1.	Gate Valve	150	Manual	Body ASTM A 216 Gr. WCB, 150 #, flanged to ANSI 16.5	5
	2.	Gate Valve	100	Manual	Body ASTM A 216 Gr. WCB, 150 #, flanged to ANSI 16.5	4
	3.	Gate Valve	65	Manual	Body ASTM A 216 Gr. WCB, 150 #, flanged to ANSI 16.5	16
	4.	Gate Valve	65	Solenoid	Body ASTM A 216 Gr. WCB, 150 #, flanged to ANSI 16.5	4
	5.	Globe Valve	100	Manual	Body ASTM A 216 Gr. WCB, 150 #, flanged to ANSI 16.5	4
	6.	Globe Valve	65	Manual	Body ASTM A 216 Gr. WCB, 150 #, flanged to ANSI 16.5	16
	7.	Globe Valve	15	Manual	Body ASTM A 105 150 #, flanged to ANSI 16.5.5	4

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<div>INSTRUMENTS IN COOLING WATER LINE</div>					
C.					
1.	Slight Glass	65 NB			12
2.	Pressure Gauge with root valve and impulse tubing, pressure stub etc.	100 NB		Range 0-10 Kg / sq. cm (g)	8
3.	Temperature gauge along with thermo well, temperature stub etc.	100 NB		Range 0 -100 °C	4
4.	Temperature gauge along with thermo well, temperature stub etc.	65 NB		Range 0 -100 °C	4
5.	Temperature switch	65 NB		Range 0 -100 °C	8

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ANNEXURE-III : BILL OF MATERIAL FOR PIPES & FITTINGS

BILL OF MATERIAL OF INSTRUMENT AIR SYSTEM

Sl. No.	Description	Specification	Qty.
1.	Pipe (G.I.)	125 NB, CS, IS : 1239 (H)	100 meters.
2.	Pipe (G.I.)	80 NB, CS, IS : 1239 (H)	470 Meters.
3.	Impulse Piping	15 NB copper tube	120 meters
4.	Elbow 90° (G.I.)	125 NB, CS to ASTM A 234 Gr. WPB	45 nos.
5.	Elbow 90° (G.I.)	80 NB, CS to ASTM A 234 Gr. WPB	32 nos.
6.	Equal Tee 90 ° (G.I.)	125 NB, CS to ASTM A 234 Gr. WPB	4 nos.
7.	Equal Tee 90 ° (G.I.)	80 NB, CS to ASTM A 234 Gr. WPB	10 nos.
8.	Flange (G.I.)	125 NB, Class 150#, ASTM A 216 Gr. WCB, ASME B 16.5	16 nos.
9.	Flange (G.I.)	80 NB, Class 150#, ASTM A 216 Gr. WCB, ASME B 16.5	25 nos.
10.	Blind Flange (G.I.)	80 NB, Class 150#, ASTM A 216 Gr. WCB, ASME B 16.5	05 nos.
11.	Pipe supports material like angles, channels, hangers, etc.	Various	3.0 T

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BHOPAL

**R & M JOB FOR BOP OF GND TPS
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BILL OF MATERIAL OF COOLING WATER PIPE FOR COMPRESSOR

1.	Pipe	150 NB, CS, IS : 1239 (H)	360 Meters.
2.	Pipe	100 NB, CS, IS : 1239 (H)	110 Meters.
3.	Pipe	65 NB, CS, IS : 1239 (H)	115 Meters.
4.	Pipe	15 NB, CS, IS : 1239 (H)	30 Meters
5.	Equal Elbow 90°	150 NB, CS to ASTM A 234 Gr. WPB	15 nos.
6.	Equal Elbow 90°	100 NB, CS to ASTM A 234 Gr. WPB	8 nos.
7.	Equal Elbow 90°	65 NB, CS to ASTM A 234 Gr. WPB	36 nos.
8.	Equal Tee 90 °	150 NB, CS to ASTM A 234 Gr. WPB	01 nos.
9.	Reducing Tee	150 X 150 X 100, CS to ASTM A 234 Gr. WPB	04 nos.
10.	Reducing Tee	100 X 100 X 65, CS to ASTM A 234 Gr. WPB	12 nos.
11.	Reducer	80 X 65, CS to ASTM A 234 Gr. WPB	8 nos.
12..	Flanges	150 NB, Class 150#, ASTM A 216 Gr. WCB , ASME B 16.5	11 nos.
13.	Flanges	100 NB, Class 150#, ASTM A 216 Gr. WCB , ASME B 16.5	15 nos.
14.	Flanges	80 NB, Class 150#, ASTM A 216 Gr. WCB , ASME B 16.5	8 nos.
15.	Flanges	65 NB, Class 150#, ASTM A 216 Gr. WCB , ASME B 16.5	75 nos.
16.	Flanges	15 NB, Class 150#, ASTM A 105 Gr. 1, ASME B 16.5	8 nos.
17.	Blind Flanges	150 NB, Class 150#, ASTM A 216 Gr. WCB , ASME B 16.5	01 nos.
18.	Blind Flanges	100 NB, Class 150#, ASTM A 216 Gr. WCB , ASME B 16.5	05 nos.
19.	Pipe supports material like angles, channels, hangers, etc.	Various	5.0 T

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ANNEXURE-IV – DATA SHEETS
(CHECK VALVES FOR DISCHARGE PIPE OF SUMP PUMP)

Type	Check
Size	50 NB for sump pump of capacity 35 M ³ / hr and 100 NB for sump pump of capacity 150 M ³ / hr
Type	Swing Type
Rating	150 [#]
End Details	Flanged to ANSI B 16.5
TYPE OF CONSTRUCTION	
Cover	Bolted
Wedge / DISC	Solid
Body Seat	Renewable
Back Seating Arrangement	provided
MATERIAL OF CONSTRUCTION	
Body & Bonnet / Cover	ASTM A 216 GR. WCB
Trim / DISC	ASTM A 216 GR. WCB
Body Seat	13 % Cr. S.S AISI 410
Disc Seat	13 % Cr. S.S deposited
Hinge	ASTM A 216 GR. WCB
Hinge pin	13 % Cr. S.S AISI 410
Lock nut	13 % Cr. S.S AISI 410
Gasket	Spiral Wound AISI-304 with asbestos/C.A.F
Studs & Nuts	A 193 GR.B7 A 194 GR.2H

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GATE VALVES FOR DISCHARGE PIPE OF SUMP PUMP

Type	Gate
Size	50 NB for sump pump of capacity 35 M ³ / hr and 100 NB for sump pump of capacity 150 M ³ / hr
Type	Rising Spindle
Rating	Class 150
End Details	Flanged to ANSI B 16.5 Class # 150

TYPE OF CONSTRUCTION

Stem	O&S – Y type
Bonnet	Bolted
Wedge / DISC	Solid
Body Seat	Provided
Back Seating Arrangement	Renewable

MATERIAL OF CONSTRUCTION

Body	ASTM A 216 GR WCB
Body Seat	13% Cr. Stainless Steel AISI 410
Bonnet	ASTM A 216 GR WCB
Wedge	13% Cr. S.S Deposited
Wedge seat	13% Cr. S.S Deposited
Back Seat	13% Cr. S.S AISI-410
Gland	13% Cr. Stainless Steel AISI 410
Yoke	ASTM A 216 GR.WCB
Stem	13% Cr. S.S AISI-410
Studs & Nuts	A 193 GR.B7 A 194 GR.2H
Gasket	Spiral Wound AISI-304 with Asbestos/C.A.F

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Type	Gate
Service	As per BOM
Size	80 NB
Type	Rising Spindle
Rating	As per BOM
End Details	Flanged to ANSI B 16.5
TYPE OF CONSTRUCTION	
Stem	O&S – Y type
Bonnet	Bolted
Wedge / DISC	Solid
Body Seat	Provided
Back Seating Arrangement	Renewable
MATERIAL OF CONSTRUCTION	
Body	ASTM A 216 GR WCB
Body Seat	13% Cr. Stainless Steel AISI 410
Bonnet	ASTM A 216 GR WCB
Wedge	13% Cr. S.S Deposited
Wedge seat	13% Cr. S.S Deposited
Back Seat	13% Cr. S.S AISI-410
Gland	13% Cr. Stainless Steel AISI 410
Yoke	ASTM A 216 GR.WCB
Stem	13% Cr. S.S AISI-410
Studs & Nuts	A 193 GR.B7 A 194 GR.2H
Gasket	Spiral Wound AISI-304 with Asbestos/C.A.F

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DATA SHEET FOR GLOBE VALVE

Type	Globe
Service	As per BOM
Size	As per BOM
Type	Rising Spindle
Rating	As per BOM
End Details	Flanged to ANSI B 16.5
TYPE OF CONSTRUCTION	
Stem	O&S – Y type
Bonnet	Bolted
Wedge / DISC	Solid
Body Seat	Provided
Back Seating Arrangement	Renewable
MATERIAL OF CONSTRUCTION	
Body	ASTM A 105 / ASTM A 216 (as per BOM)
Stem	13% Cr. S.S AISI 410
Bonnet / Cover	ASTM A105 / ASTM A 216 (as per BOM)
Trim / DISC	13% Chrome Steel.
Body Seat	13% Chrome steel to AISI-410
Gland	13% Cr. S.S AISI 410
Gland Packing	Graphite Asbestos / PTFE
Studs & Nuts	A 193 GR.B7 A 194 GR.2H
Gasket	Spiral Wound AISI-304 with Asbestos/C.A.F

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DATA SHEET FOR FLOAT TYPE LEVEL SWITCH (EXTERNAL CAGE TYPE)

01.	Type	:	External cage float operated. Magnetically coupled.
02.	Float Material	:	AISI-316 stainless steel
03.	Other wetted parts	:	AISI-316 stainless steel
04.	External Cage	:	Carbon steel / Stainless steel as per process requirements. Welded type / flanged construction. Cage pressure rating shall equal or exceed the rating of the main vessel.
05.	External cage mounting	:	Side – Side with drain valve.
06.	External cage connection	:	25 NB socket weld to vessel or RF flanged.
07.	Switch housing	:	Epoxy coated die-cast aluminum alloy with neoprene gasket conforming to IP-65. (Explosion proof for NEC Class-1, Division 1 area).
08.	Type of switch configuration	:	2 SPDT (two nos.) Snap acting magnetically operated hermetically sealed.
09.	Contact rating	:	5A, 240VAC / 0.5A, 220V DC
10.	Accessories	:	a) Counter flange, nuts & bolts, suitable gasket etc.
			b) Steel globe type drain valve.
			c) ¾ “ ET cable gland
			d) Stainless steel alpha-numeric engraved for service and tag.
11.	Preferred feature		Switch operating point marked on cage
12.	Float Length		400 mm

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DATA SHEET FOR LEVEL GAUGES

01.	Type	:	Tubular
02.	Glass	:	Toughened Borosilicate. Resistant to mechanical & Thermal Shocks.
03.	Protection	:	MS guard rods
04	Packing	:	PTFE
05.	Pressure Rating	:	Twice the maximum working pressure
06.	Temperature Rating	:	60 Deg. C.
07	Process connection	:	Flanged
08	Accessories	:	Auto shut off Ball check valves of SS 304/ 316 body & trim, gaskets, companion flanges, bolts & nuts etc.

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ANNEXURE – V - MONORAIL ELECTRIC HOISTS WITH TRAVELLING TROLLEY

01.00.00

GENERAL

This specification covers the design, material, construction features, manufacture, assembly, inspection and testing for monorail hoists with traveling trolley.

02.00.00

CODES AND STANDARDS

The equipment to be supplied under this specification shall conform to the following codes and standards unless otherwise specified hereafter:

A	IS:807:1976	:	Code of Practice for design, manufacture, erection and testing (structural portion) of cranes and hoists.
B	IS:2266	:	Specification for steel wire ropes for general engineering purposes.
C	IS:3815	:	Steel hooks for standard shank design.
D	IS:325	:	Three phase induction motors.
E	IS:900	:	Code of practice for installation and maintenance of induction motors.
F	IS:4237	:	General requirement of switchgear and control gear for voltage not exceeding 1000 volts.
G	IS:4047	:	Heavy duty air break switches and fuses for voltage not exceeding 1000 V.
H	IS:434 (Pt 1)	:	Copper conductors rubber insulated cables.
I	IS:1596	:	Polyethylene insulated PVC sheathed cables.
L	IS:3043	:	Code of practice for earthing.
M	IS:3938	:	Electric wire rope hoists.
N	IS:694 (Pt 1)	:	Copper conductor PVC insulated cables for voltages up to 1000V.



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



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		TECHNICAL SPECIFICATION FOR MISCELLANEOUS MECHANICAL WORKS	REV. 6
03.00.00	MONORAIL ELECTRIC HOISTS WITH TRAVELLING TROLLEY		
03.01.00	Design Criteria		
03.01.01	General Technical Requirements		
	The hoists shall be of robust design. The hoist motion shall be electrically operated and cross travel motions may be electrically operated/hand operated as specified in data sheet.		
	The trolley shall be suitable for wide variation of beam sizes and bidder shall indicate the size of beam.		
	The hoists shall conform to class of duty as specified in data sheet – A.		
	The hoists shall be of modular construction complete with drive motors, rope drum, gear boxes, electrical control panel, traveling trolley and brakes.		
	The design shall be such that the distance between the bottom of the runway and highest position of hook (head room) shall be minimum so that maximum lift is obtained.		
03.01.02	Mechanical Equipment		
	The drum shall be designed to withstand crushing and bending stresses imposed by wire rope. The drum shall preferably be of mild steel/cast steel and stress relieved in case of fabricated drum. The drum shall have machined grooves and working surfaces shall accurately receive the wire rope in single layer when hook is in highest position.		
	Wire rope.		
	The wire rope shall be 6 x 36 or 6 x 37 construction with fibre/steel core as called for in data sheet-A. The minimum factor of safety shall be as per data sheet A. The rope sheaves and load block shall be forged steel/cast steel.		
	Hooks		
	Hooks shall be of heavy duty, forged type supported on thrust bearing and free swiveling type.		
	Gearing		
	Gears shall be helical/spur type cut from alloy steel duly heat-treated. All gears shall preferably be totally enclosed. In case of fabricated gear boxes, stress relieving shall be done. The gear box shall be complete with oil filling, draining and lifting arrangement.		
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	<p>Bearing</p> <p>All bearings shall be anti-friction ball/roller type and of SKF/FAG or equivalent Indian make.</p> <p>Shafts and Keys</p> <p>All shaft and keys shall be made of carbon steel. Keys and key ways shall conform to relevant Indian Standards.</p> <p>Lubrication</p> <p>Provision shall be made for lubrication of all moving parts and bearings. Lubricating nipples and adopters shall be easily accessible. All hoist gearing shall be enclosed and provided with means for ample lubrication.</p> <p>Friction drives</p> <p>They shall be capable of transmitting a torque of 50 percent greater than the torque transmitted when the hoist is lifting its safe working load applied as a direct pull on the drum at the appropriate speed.</p> <p>Trolley Wheels</p> <p>Material of the wheel shall be forged/cast steel/high grade cast iron.</p> <p>Wheels shall be provided with anti-friction bearings.</p> <p>Hand Chain and Wheel</p> <p>In case of hand operated trolley the hand chain shall be butt welded, calibrated, pitched and polished and shall conform to IS:2429(Part II) grade 30. The length of chain and link dimensions shall be as per IS:3832.</p> <p>Hand chain wheel shall be made of heavy duty malleable castings and shall be designed to ensure effective operation of the chain.</p> <p>All un-machined surfaces shall be cleaned thoroughly by wire brushing to remove dirt, grit and dust etc. and shall be painted with one prime coat and two finish coats as per data sheet – A.</p> <p>03.01.03 Electrical Equipments:</p> <p>a) Control panel</p> <p>The control panel for feeding the hoist & trolley motors shall be from control panel provided by the manufacturer.</p>		
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<p>b) Motors</p> <p>All crane motors shall be totally enclosed fan cooled squirrel cage induction type with class-F insulation limited to temperature rise of Class-B and suitable for heavy duty reversible crane service with duty rating as per data sheet A. The starting torque of motor shall not be less than 2.75 times the rated torque and pull out torque shall not be less than 250% of the rated full load torque. Motor enclosures shall confirm to IP-55 degree of protection starting current shall not exceed six time the full load current. The cranes shall be furnished complete with all electrical equipment, accessories (like drive motors, electrically operated brakes, controllers, registers, conductors, protection & operating devices, cables, current conductors etc.</p> <p>Ambient correction factor as well as voltage/frequency correction factors depending upon the temperature and voltage/frequency variation shall be applied to derate the motors. The minimum margin of 15% over the calculated rating KW/HP of the motor shall be available. The protection class of the motors shall be as per data sheet A. The motors shall be tested at manufacturer's work in accordance with IS:325 and test reports shall be submitted for purchaser's approval prior to dispatch.</p> <p>Terminal box shall be split type with removable cover with access to connections of robust type and have ample room for terminating the internal and external connections.</p> <p>The bearings of the motor shall be ball/roller type housed in capsules fitted in the shield.</p> <p>Bearings shall be provided with proper re-greasing nipples and relief holes.</p> <p>Motors above 25 kg weight shall be provided with lifting lugs. Two earth terminals of adequate size to accept the earthing conductor shall be provided diametrically opposite points.</p> <p>The following technical particulars shall be furnished for approval.</p> <div><p>Motor data as per technical data sheet.</p><p>Torque V/S speed characteristic curves for motor.</p><p>Starting torque V/S starting time characteristic curve.</p><p>Starting current V/S time characteristic curve.</p><p>Thermal withstand curve (Hot & Cold).</p></div> <p>c) Limit Switch</p> <p>Limit switches shall be totally enclosed type IP-55. The hoisting motion shall be provided with rotary type limit switches to open the control circuit of hoist in order to prevent the crane hook from over hoisting and over lowering. One gravity type back up limit switch of hand reset type shall be provided to operate in the event of failure of the main limit switch. Lever operated limit switch shall be provided at both the ends of trolley travel. These limit switches shall be self reset type and spring failure within limit switch shall not render it inoperative.</p>		
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<div>d) Main disconnect MCCB (Isolator)</div> <div><div>i) Main disconnect unit shall be MCCB with adjustable short circuit release, metal clad, IP-55 enclosure. The switch shall be 3 pole load brake type and double compressor type brass glands and tinned copper lugs shall be supplied.</div><div>ii) Switch shall be provided with “Power ON” red indication lamp and shall be suitably located so that it can be manually operated from the operating floor. It shall have pad locking arrangement in ‘OFF’ position.</div></div> <div>Brakes</div> <div>Hoist motion shall be provided with two brakes. One of the brakes shall be electro hydraulic thruster and other electro magnetic type. The design shall be such that braking action in the off position and release with current are provided.</div> <div>Trolley travel shall be provided with electro-magnetic brake.</div> <div>The brake shall be effective in both directions. All brakes shall apply automatically when power supply fails or when the main contactor is in ‘off’ position or emergency push button is operated.</div> <div>Pendent push button station</div> <div>The pendent push button station shall be robust and heavy duty type. It shall be suspended by wire rope to prevent pull on cables. The following minimum push buttons shall be provided.</div> <div>Main ON/OFF push button, key operated and lockable in ‘off’ position. This push button will operate the main contactor.</div> <div><div>Hoisting and lowering push buttons (2 Nos.)</div><div>Trolley push buttons for each direction (2 Nos.), if motorized trolley is specified</div><div>Inching speed for hoist/lower push button.</div><div>Emergency stop push button.</div><div>Alarm bell push button.</div></div> <div>Cross traverse power conductor</div> <div>For trolley travel, flexible trailing cable system mounted on retracting supporting system shall be preferred. The conductors shall consist of insulated conductor cables with permanent termination on hoist machinery.</div> <div>Earthing</div> <div>The hoist structure, motor frames and metal enclosures of all electrical equipments shall be effectively grounded in accordance with Indian electricity rules. Pendent push button station shall be earthed separately.</div>		
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Wiring

The supplier shall furnish all power control and auxiliary circuit wiring of the equipment and panels located in the trolley and bridge.

The wiring shall be complete in all respect to ensure the proper functioning of the equipment.

Power wiring to any motor shall be done with 1100 V grade aluminium conductor FRLS PVC insulated armoured cables of suitable sizes.

For selecting the rating of the cable for power wiring, consideration shall be given to the duty of the motor, ambient temp, grouping and disposition of the cables, voltage drop etc.

All control and auxiliary circuit wiring shall be done with PVC insulated, 2.5 mm² stranded copper conductor.

Armoured cables or unarmoured cables running through the flexible conduits may be used for power wiring. Control and auxiliary circuit wiring shall run through flexible conduit.

Each motor shall be wired up independently. Power and control wiring shall be effectively separated.

Each wire shall be identified at both ends with wire designation in accordance with circuit wiring diagram.

All wire terminations to the panels shall be provided with clamp type connectors. Screw type terminals with screw directly impinging on conductors are not acceptable.

Multiway terminal blocks complete with screw, nut, washer and marking strips shall be furnished for terminating the panel wiring and outgoing cable.

Cable from isolator to control panels & motors shall be included in the scope.

Not more than two wires shall be connected to any terminal on either side of terminal block. If necessary number of terminals shall be jumpered together to provide the wiring point.

Each terminal block shall be marked with designation in accordance with conductor's wiring diagram.

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DATA SHEET FOR MONORAIL ELECTRIC HOIST

1.	Type	Electric Hoist with Manual operated Traveling trolley
2.	Capacity	3 Tone
3.	No. and location of Hoists	One (1) No. of 3T capacity in Compressor House
4.	Duty Class	II as per IS:3938
5.	Type of trolley.	Manually operated
6.	Type of Rope	
	a. Construction	6x37 with Fibre core of best plough steel having tensile strength of 160-180 kg/cm ²
	b. Type of core	Fibre
	c. Factor of safety	6
7.	Operating speed	
	Hoisting(If required)	3.0 m/min
	Hoisting creep	NA
	Trolley	10.0 m/min
8.	Method of achieving creep speed (If applicable)	NA
9.	Total lift required	7 M
10	Cross Travel	40
11	Height of bottom of mono rail beam from operating floor	Approx 6 M
12.	Motor	High starting torque, crane duty
	Type	TEFC squirrel cage induction motor as per IS:325
	a. Duty/Rating	25% CDF, 16-25 cycles/hour, S4
	b. No. of starts/hr.	150
	c. Degree of protection	IP 54
	d. Class of insulation	F limited to temperature rise of class-B.
13	Painting	
	Colour of finish coat	Later

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ANNEXURE- VI – CHAIN PULLEY BLOCKS

01.00.00

GENERAL

This specification covers the design, manufacture, assembly, Inspection and testing at manufacturer's and/or his sub-contractor's works of hand operated chain pulley blocks.

02.00.00

CODES AND STANDARDS

The design, manufacture, inspection and testing and performance of hand operated chain pulley blocks shall conform to the latest editions of the following standards:-

IS:3832	Specification for hand operated chain pulley block
IS:807	Code of Practice for design, manufacture, erection and testing (structural portion) of cranes and hoists.
IS:3109 (Part II)	Calibrated load chain for pulley blocks and other lifting appliances.
IS:2429 (Part II)	Calibrated load chain for Pulley blocks and other lifting appliances.
IS:4460	Method for rating of machine cut spur and helical gears.
Material specification	IS or approved equal

03.00.00

TECHNICAL REQUIREMENT

03.01.00

Chain Pulley Block

03.01.01

Frame

Frame shall be robust in design and of welded construction.

The frame shall be selected in such a way that head room requirement is minimum.

03.01.02

Chains

The load chain shall be electrically welded, accurately calibrated, pitched and polished conforming to IS: 3109 (Part II) grade 40/IS:6216 Grade 80 as specified in data sheet 'A'.

The hand chain shall also be electrically welded, calibrated, pitched and polished and shall conform to IS: 2429 (Part II) grade 30. The length of chain and link dimension shall be as per IS: 3832.



The forged hook properly heat treated shall be so designed that it shall be free to swivel in the loaded conditions without twisting the load chain. The hook shall conform to IS: 3815.

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03.01.03	Brakes Brakes shall be of screw friction disc type self actuating or any other approved type as per manufacturer's standard practice. Brake capacity shall be ample and materials used shall not get affected by humid atmosphere. The brake shall prevent self lowering of load and sustain load in all working positions.		
03.01.04	Wheel The load chain wheel shall be made of heavy duty malleable casting and shall be designed to ensure, effective operation of the chain. Load chain wheel shall be mounted on two ball bearings. Hand chain wheel shall be made from malleable casting/pressed sheet steel. The idler wheel shall be so shaped as to avoid the twisting of the chain when passing round.		
03.01.05	Other components The hand chain wheel shall be provided with flanges.		
03.01.06	Monorail trolleys All other components of chain pulley block such as anchorage, guide etc. shall be designed and provided as per IS: 3832.		
04.00.00	INSPECTION AND TESTING Monorail trolleys shall be provided if called for in the enclosed Data Sheet – A. Monorail trolley frame shall be of heavy section rolled steel, held together by bolts. Wheels shall be of high grade cast iron mounted on ball bearings. Axles and shafts shall be of carbon steel and accurately machined and suitably supported. The trolley shall be suitable for variations in I section beams. The trolley shall be geared travel type.		
	The hand chain required for trolley travel shall be as per clause 03.01.01. of this specification.		
	Hand chain wheel shall be as per clause 03.01.03 of this specification.		
	INSPECTION AND TESTING All materials to manufacturer chain pulley blocks shall be of tested quality and test certificates for the same shall be furnished by the bidder. Each chain pulley block shall be tested for proof load and operational test as per IS: 3832.		
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DATA SHEET FOR CHAIN PULLEY BLOCK



1.	Type	Manually operating chain Pulley block with manually operated Traveling Trolley
2.	Capacity	2 T
3.	Duty Class	As per IS:3832
4.	No. and location	One (1) Nos. 2 T capacity for Dryer in New Compressor House
5.	Lift in meters	7 m in new compressor house
6.	Type of suspension	Chain pulley block suspended with Trolley. Trolley will move on monorail beam
7.	Head Room (distance from operating floor to bottom of mono rail beam	For 2 T capacity: 7 m
8.	Type of gear in chain pulley block	Spur or worm/worm Wheel
8.	Type of bearing	Anti friction bearing as per IS:3832
9.	Grade of load Chain	Load Chain – IS:3109 (Part II)/JS62168 grade 80 Hand chain – IS:2429 (Part-II)/Grade 30
10.	Type of Trolley	Geared travel type
11.	Painting	Later



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ANNEXURE – VII- EMERGENCY COOLING WATER TANK		
01.00.00	INTENT OF SPECIFICATION	
	<p>This Specification presents the general description; technical requirements and scope of supply and services of Emergency Cooling water Tank.</p> <p>Equipment and services to be furnished in accordance with this specification shall include design, engineering, manufacture, painting and corrosion protection, inspection and testing in accordance with the requirements, data sheets, conditions, Annexure, drawings, etc. as stated in this specification.</p>	
02.00.00	CODES AND STANDARDS	
	<p>The design, manufacture and performance of tank shall comply with all currently applicable statutes, regulations and safety codes in the locality where it is to be installed. The equipment shall conform to latest edition of applicable Indian standards or their equivalent standards. Nothing in this specification shall be construed to relieve the vendor of this responsibility.</p>	
03.00.00	FEATURES OF CONSTRUCTION	
03.01.00	Storage Tank	
	<p>The tank will be of mild steel welded construction and will be designed to withstand satisfactorily the internal forces due to the liquid this tank have to hold as specified and external forces due to wind and seismic forces without deformation or undue strain.</p> <p>Tank will be designed for the capacities, dimensions and working conditions as specified in DATA SHEET enclosed in clause 04.00.00. This tank will be provided with all necessary connections as required. The design of tank will be such as to allow easy inspection, cleaning and repair. Due consideration will be given to wind loading and adequate stiffening will be provided to prevent failure of tank due to buckling when it is empty.</p> <p>Vessel seams shall be so positioned that they do not pass through vessel connections.</p> <p>The inside seam should be ground smooth, suitable for application of corrosion resistant primer. Except where otherwise indicated in the specification, if the stiffening of shell and/ or roof is necessary, tank will be stiffened from outside.</p> <p>Flange faces of all nozzles shall be machined and squared with the vessel centre line. The material for flange shall be of ASTM A 105/ IS-2062 Gr .B.</p> <p>Roof and supporting structures shall be designed to support dead load plus a uniform live load of not less than 150 kg/m² of projected area.</p>	
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	<p>The tank shall be designed to have all courses truly vertical. Adequate distance between vertical joints in adjacent courses shall be taken so that the distortion is reduced to minimum.</p> <p>When removing temporary attachments from shell plates, care should be taken that parent plate is not damaged. Holes in plate work to assist in fabrication / erection should be avoided as far as possible. The location of holes and method of filling shall be indicated in the fabrication drawing. Any projection of metal shall be chipped and ground flush with the plate surface .The plate shall not be gouged or torn in process of removing lugs.</p> <p>In the construction of shell every care shall be taken to minimize distortion due to welding or any other reason.</p> <p>Manholes shall be provided for easy access in to the Vessels. The size shall be minimum 500 mm and will be with cover plate, nuts, bolts etc. to ensure leak tightness at the test pressure.</p> <p>Tank shall be complete with ladder and fittings like drain connection, overflow connection, tank inlet and outlet covers, level gauge glass, fittings with isolation cocks and protection covers, tank vent connection etc all complete with needed accessories for the completeness of the tank.</p> <p>Nozzles/Neck pipes from tank body shall be adequately compensated with suitable reinforcement pad as per relevant design code.</p> <p>03.02.00 Alignment</p> <p>Plates to be joined by butt welding shall be matched accurately. Misalignment in completed vertical joints shall not exceed 10% of the plate thickness or 1.5 mm for plates of 20 mm thick and under, whichever is larger.</p> <p>In completed horizontal butt joints, the upper plate shall not project beyond the face of the lower plate at any point by more than 20% of the upper plate thickness with a maximum of 3 mm for plate thickness exceeding 8 mm except that for plate thickness 8 mm and under , the maximum shall be 1.5 mm.</p> <p>Tank shall be properly constructed ensuring perfect vertical alignment with 5 mm. local bulging and / or depressions at any location of tank shall not be permitted.</p> <p>03.03.00 Corrosion Allowance and protection</p> <p>Corrosion allowance as per code requirement shall be considered for calculating the plate thickness of tank irrespective of whether a protective internal lining / coating is provided or not.</p> <p>Wherever corrosion allowance has not been specifically mentioned in code/Std., a minimum of 1.6 mm shall be considered over and above the calculated minimum thickness of plate.</p>		
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	<p>Painting shall be done as per attached painting specification in Annexure I</p> <p>03.04.00 Welding</p> <p>Tank and other attachments shall be welded as per IS-816 and the qualification of welder should be as specified in IS-7310</p> <p>Welding sequence shall be so adopted that distortion due to welding shrinkage shall be minimum. Welding procedure specification shall be submitted for Owner's approval giving details of material, welding position, sequence, type of electrode used, pre-heat & post weld requirement etc as per the code of construction. Brand name of electrodes to be used with proper classification (e.g. E 6013) shall be as per Owner's approval.</p> <p>Welding shall not be carried out when the surface is wet and during periods of rain and high winds unless the welder and the work are properly shielded which should meet the approval of the purchaser.</p> <p>Inspection of all welds shall be carried out in accordance with the governing code of construction. All material used by the purchaser such as electrodes, gaskets , bolts, nuts etc shall be conforming to relevant standards of repute and approved by the purchaser prior to use.</p> <p>All openings in tank plate shall be well reinforced in approved manner by adding pad plates of adequate size and / or structural sections.</p> <p>03.05.00 Access Ladder</p> <p>Access ladder for rectangular tank shall be provided for access to the tank roof. It shall be steel fabricated having minimum 450 mm width. Ladder stringers shall be heavy steel flats or angle section. All rungs shall be minimum 20 mm Dia rods spaced at not more than 300 mm center to center. Access ladder's stringers shall be widely spaced at top for free access to the tank roof.</p> <p>Unless otherwise specified, for all flanged connections vendor shall furnish suitable counter flanges and necessary nuts, bolts and gaskets materials.</p> <p>Unless otherwise specified bolts and nuts shall be hexagonal head conforming to IS-1367</p> <p>Gaskets shall be 3 mm thick full face rubber or CAF. On completion of hydraulic test / water fill test, contractor shall replace the gaskets used during testing at his own cost.</p> <p>The tank shall be suitably stiffened. Suitable lifting lugs are to be provided on the Tank.</p>		
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03.06.00 Repair Of Leaks

All leaks detected during testing shall be repaired to the satisfaction of the purchaser and on completion retested for leakage as per approved procedure.

In the joints between roof plates only, pin hole leaks may be repaired by mechanical caulking. However, where there is any indication of considerable porosity, the leaks shall be sealed by laying down an additional layer of weld over the porous sections.

In all other joints, whether between shell plates or bottom plates or both, leak shall be repaired only welding and if necessary, after first cutting out the defective part.

When the tank is filled with water for testing, defects in the shell joints shall be repaired with the water level at least 300 mm below the joint being repaired.

03.07.00 Nozzle Schedule

Nozzle schedule shall be as per enclosed Drawing No. 2-726-29-25-005

03.08.00 Specification for Painting Requirement

For Storage Tank			
	Internal	External	Underneath
Surface Preparation	Degreasing & surface preparation to SA 2.5	Degreasing and Mechanical cleaning to St2	Blast clean to SA 2.5
Primer	1 Coat of epoxy resin based Zinc phosphate high build primer (2 pack), DFT 50 – 70 microns	2 coats of red oxide Zinc chromate (IS 2074) of 25-35 microns DFT each coat.	1 Coat of high build coal tar epoxy suitably pigmented (2 pack), DFT : 80-100 microns
Finish	2 Coats of solvent free epoxy paint, DFT – 35 microns each	2 Coats of synthetic enamel (IS: 2932) of 20 – 25 microns DFT each coat.	N>A
Total DFT	120 – 140 microns	90 – 120 microns	80 – 100 microns

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DATA SHEET

To be read in conjunction with Enclosed Tank Drawing

Sl.No.	Description	Data
(i)	Quantity	One (1)
(ii)	Capacity	25 M ³
(iii)	Design Standard	ASME section – VIII Div.I
(iv)	Design Pressure	Atmospheric
(v)	Design Temperature	Ambient
(vi)	Hydro test pressure	2 Kg/cm ² (g)
(vii)	Shape	Rectangular
(viii)	Base plate thickness	12 MM (Minimum)
(ix)	Side wall thickness	10 MM (minimum)
(x)	Size	
(a)	Length	4.8 M
(b)	Width	2.5 M
(c)	Height	2.2 M
(xi)	Material of Construction	
(a)	Tank	IS: 2062
(b)	Nozzle	IS 1239 (H) Part I and IS 3589 for size 150 NB & below and 200 NB & above respectively
(c)	Bolt and Nut	IS 1367 - 1967
(d)	Flange	ASTM A 105 / IS 2062 Gr.B

05.00.00

WARRANTY

Tank shall be warranties valid for One (01) year from the date of taking over by the owner.

06.00.00

QUALITY ASSURANCE, INSPECTION AND TESTING

06.01.00

Quality Control Surveillance



The plant/equipment to be supplied under this specification shall have assured quality and workmanship. The Bidder in his proposal shall submit his Quality Assurance Plan as per attached format containing quality assurance program and quality assurance documents for Purchaser's approval. The Contractor shall be bound to conduct all stage inspections on various equipment/material during manufacturing process in accordance with the approved copy of this document. Purchaser shall have the right to carry out Quality Audit and Quality Surveillance by witnessing any or all such tests to be carried out at Contractor's / Sub—Contractor's works as and when desired. The procedure applicable to Contractor's works will also apply to the works of his sub


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	<p>contractors. For items coming under the purview of any Indian Statutory Regulation during the course of manufacture, all stage inspections and tests shall be witnessed by an inspecting authority recognized under the statutory regulation. A list of all sub-vendors is to be forwarded to the Purchaser for approval prior to the placement of sub-contract. All technical details shall be sent to Purchaser for approval prior to placement of orders on sub-vendors.</p> <p>These audit/surveillance/approvals shall not however relieve the manufacturer of their responsibility of the Quality Assurance of their product and overall guarantee and responsibility shall wholly lie with the Bidder.</p> <p>Tests/inspections shall be carried out during and after the completion of manufacture of different components and assembly as applicable in accordance with relevant codes and standards. Test Certificates for all such tests/inspections shall be made available to the Purchaser for approval.</p> <p>Purchaser or his authorized representative shall have his full access to witness any or all tests/inspections to be carried out at manufacturer's shop. In case, the job is sub-contracted, it will be Contractor's responsibility to make all arrangements so that Purchaser or his authorized representative can attend such tests at Sub-Contractor's premises.</p> <p>After installation, the equipment/system shall be tested and commissioned at site to Purchaser's full satisfaction.</p> <p>07.00.00 TESTING</p> <p>07.01.00 Tests at Manufacturer's Works</p> <p>The supplier shall provide inspection to establish and maintain quality of workmanship in his works and that of his subcontractors to ensure the mechanical accuracy of components, compliance with drawings identity and acceptability of all materials, parts and equipment. He shall conduct all tests required to ensure that the equipment and material furnished shall conform to requirements of the acceptable codes. All tests and test procedure proposed by manufacturer shall be submitted to the purchaser for their prior approval.</p> <p>All materials used for manufacture of the equipment under this specification shall be of tested quality. Relevant test certificates shall be made available to the purchaser before the final shop inspection. In case the relevant correlating test certificates are not available, the supplier shall arrange to carry out the necessary tests required by codes at his own cost.</p> <p>Alloy cast iron and cast steel components shall be tested for both physical and chemical properties in absence of purchaser's representatives. Test bears shall be either integral or taken from the same ladle of material as the casting they represent.</p>		
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07.02.00	<p>Test at Site</p> <p>The scope of testing and inspection for pressure vessel covered in this specification shall generally comprise of the following:</p> <p>Examination and approval of fabrication drawings to ensure that design, materials and fabrication details meet requirement of code and specifications. Purchaser will review these drawings for interface problems and conformity with the general arrangement drawings and accord their approval.</p> <p>Examination of materials of construction and identification with material test certificates.</p> <p>Ensuring the relevant weld procedure and welder qualification tests are in accordance with stipulated code requirements.</p> <p>Inspection during fabrication at appropriate stages including fit ups.</p> <p>For all butt welds, the root run and final run shall be subjected to dye penetrate or magnetic particle inspection. For all fillet welds the final run shall be subjected to dye penetrate / magnetic particle examination.</p> <p>Examination of radiographs including radiographic techniques, supervision of other non - destructive tests and heat treatment procedure as required by codes and specifications.</p> <p>Examination of internal cleanliness before final closure.</p> <p>Dimensional examination of completed vessel including axis marking, proof marking , match marking etc.</p> <p>Witnessing of hydrostatic, pneumatic or vacuum tests or special tests as required by the code and specification. In case of hydrostatic tests, the test pressure must be kept for a minimum of two hours.</p> <p>Witnessing cleanliness, preservation, packing and marking.</p> <p>Stamping of vessel and issue of certificates.</p>		
08.00.00	DATA REQUIREMENT		
08.01.00	<p>Information to be furnished along with the Bid and during contract stage</p> <p>a) Sub-vendor list for bought out items</p> <p>b) Filled in enclosed technical Data Sheet</p> <p>c) Tank fabrication drawing and design calculation</p>		
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01.00.00	<p>ANNEXURE - VIII: EXHAUST FAN & AC FOR COMPRESSOR HOUSE</p> <p>Intent of Specification</p> <p>This Specification presents the general description, basic design and performance requirements, broad scope of supply, packing, inland transport, testing at site for Fans and AC systems in compressor house. The overall Project Information has been attached as Annexure-I to this specification.</p> <p>Equipment, systems and services to be furnished in accordance with this specification shall include design, engineering, manufacture painting and corrosion protection, inspection and testing at manufacture's works, packing, inland transport, accordance with the requirements, conditions, Annexures, drawings, etc. as stated in this specification. The equipment shall, in general, conform to relevant IS/ASME/ANSI/BS/ISO codes. The vendors for the bought out items shall be approved by the Owner.</p> <p>02.00.00 SCOPE OF SUPPLY AND SERVICES</p> <p>Design, manufacture, testing at shop, forwarding, transportation to site of following equipment.</p> <p>02.01.00 Eleven (11) Nos. axial flow type exhaust fans with motor, each of 5000 M³/hr capacity, static pressure 10 MMWC for Compressor House.</p> <p>02.02.00 Three (03) Nos. axial flow type fans with motor, each of capacity 1500 M³/hr, static pressure 10 MWC for MCC room in new compressor house.</p> <p>02.03.00 Two (02) Nos. Air cooled Non Duct able Split type AC of capacity 4 TR each (1W + 1S) for control panel in compressor House.</p> <p>02.04.00 Common Supply and Services</p> <p>In addition to the scope of supply detailed out above, Bidder shall also provide the following, as necessary and applicable unless otherwise excluded specifically.</p> <ul style="list-style-type: none"> i) Supply of consumables, lubricants, oils, greases, etc. for initial fill, cleaning, refill and topping up. ii) Foundation bolts and clamps, rings, all erection items etc for fans for fixing in wall, foundation bolts for air handling unit. iii) All relevant drawings, data and instruction manual for MCC. iv) Submission of Quality Assurance Plan (QAP), FQP indicating testing and inspection of all equipment before shipment at manufacturing works. 		
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	<p>v) Packing, transportation to site and insurance.</p> <p>vi) Trial run, performance testing and handling over the plant to the Owner including supply of temporary instruments and tools/tackle for performance testing/erection as required.</p> <p>vii) Complying and obtaining the statutory requirements, if any, as per the defined scope of work.</p> <p>viii) List of recommended spare for commissioning and maintenance for three year trouble free operation.</p> <p>ix) Construction power & water will be provided by BHEL/Customer on chargeable basis.</p> <p>x) In case local push button is provided by the bidder as per scope, all power & control cable from local push button station to equipment shall be supplied by the bidder</p>		
03.00.00	EXCLUSION		
03.01.00	MCC, Power & control cables.		
03.02.00	Civil foundation, wall openings for supply and exhaust fans.		
04.00.00	Technical requirement		
04.01.00	Fans		
04.01.01	Codes and Standards <p>The design, manufacture and performance of equipment shall comply with all currently applicable statues, regulations and safety codes in the locality where it is to be installed. The equipment shall conform to latest edition of applicable Indian Standards or their equivalent standards. Nothing in this specification shall be construed to relieve the bidder of this responsibility. In particular the equipment shall conform to the latest editions of the following standards.</p> <p>a) IS: 3588 : Electric Axial Flow fans</p> <p>b) BS: 848 : Method of performance</p>		
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04.01.02	<p>c) AMCA Publication 99 : Standard Handbook</p> <p>d) AMCA standard 210 : Test Code for air moving devices</p> <p>Design and Construction of Axial flow fans</p> <p>The enclosed data sheet gives the necessary technical data for axial fans.</p> <p>a) Casing</p> <p>i) The axial flow fan casing shall be of heavy gauge sheet construction, properly reinforced for rigidity and shall be complete with suitable supports. Sheet shall be spray or hot dip galvanized. Access doors with suitable locking arrangement shall be provided in the casing for easy access to the motor and impeller.</p> <p>ii) Suitable motor brackets designed for rigid mounting of motors, shall be provided for fans</p> <p>b) Impeller</p> <p>The axial flow fan impeller shall be of high efficiency aerofoil design. The blades shall be mounted on a streamlined hub and the impeller shall be mounted directly on the motor shaft. Impeller shall be in one piece however, fabricated blades will be acceptable up to 450 mm impeller diameter. Final assembled fan motor unit shall be statically and dynamically balanced.</p> <p>c) Bearings:</p> <p>The fan bearing may be ball, roller or sleeve bearings of self-aligning heavy duty type with adequate capacity and life. Bearings shall be oil/grease lubricated and provided with fittings for lubrication from outside and shall be located in easily accessible position to facilitate maintenance.</p> <p>d) Base Plate and Vibration Isolators</p> <p>Base plate and vibration isolators, which may be double deflection rubber in shear or rubber in compression type or spring type shall be provided. With each fan rubber bushes, washers wherever needed for vibration isolator in sufficient nos. shall be included, as required, to ensure isolation of foundation from vibration of equipment.</p> <p>e) Inlet cones and Guards</p> <p>Axial fan inlet cone shall be spun to have a smooth finish. Galvanized 25 mm square bird screen shall be provided at the inlet.</p> <p>f) Cowl</p>		
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Rain protection cowls (outside) shall be designed to suit wall exhausters/supply fans for protecting fans from rain. The cowls shall be provided with bird screen of heavy gauge expanded metal netting.

g) Speed

The speed of axial flow fans shall not exceed 960 RPM for impeller dia exceeding 450 mm and shall not be greater than 1440 with impeller dia less than 450 mm.

h) Motors

Drive motors shall be of totally enclosed type, suitable for horizontal/vertical mounting as applicable and shall comply with the requirements of the specifications furnished elsewhere for motors.

i) Accessories

Accessories as specified in Data Sheets and as required for satisfactory trouble free & safe operation of fans shall be provided. For axial fans, necessary rain protection cowl, adjustable damper, vibration isolators, bird screens etc. shall be provided.

04.01.03

Data Sheet for Exhaust Fan

1.0	Designation		Exhaust Fan
1.1	Number Required		11 Nos. of capacity 5000 M ³ /hr and 3 Nos. of 1500 M ³ /hr
3.0	Service		Continuous
4.0	Location		At Walls of Compressor House
5.0	Type		Axial Flow Fan
6.0	Capacity : Normal	M ³ /hr	5000 and 1500
7.0	Gas to be handled		Air
8.0	Material of construction		
9.1	Casing		MS TO IS 2062
9.2	Impeller		Cast AL. (A-6M/IS 617)
10.0	Accessories required		
10.1	Neoprene rubber pads		Yes
10.2	Supporting frame for mounting		Yes
10.3	Louvered shutter		No
10.4	Cowl with bird screen/bird screen		Outlet/inlet
10.5	Inlet cone or bell & outlet cone		No
10.6	Guards		No
10.7	Damper		No

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11.0	Tests		
11.1	Free delivery test		Yes
11.2	Performance test at specified duty point		Yes
12.0	Motor Data		By bidder

04.02.00 AIR CONDITIONING SYSTEM

04.02.01 General

The Air conditioning system shall be designed to maintain temperature of 24 +/- 1 deg Celsius with a Relative humidity of 50 +/- 5 percent. The maximum out side temperature to be considered for the design of Air conditioning system should be 50 degree Celsius.

The Air cooled Non Duct able split Air conditioners shall consist of Indoor and out door unit

The unit shall be completed with multiple sealed refrigerant compressors, condensing unit with propeller fans, refrigerant piping & controls, micro processor based control panel etc. The units shall be connected to Ceiling mounted Indoor unit located in suitably insulated area.

Suitable heating units shall be provided to maintain the dry bulb temperature and relative humidity of the control room and the office during winter season.

Temperature of the air conditioned space shall be controlled to a pre set value by sensing return air temperature and subsequently regulating the ON/OFF sequencing of compressors of respective units.

04.02.02 CONDENSING UNITS

Each condensing unit shall be complete with multiple semi hermetic scroll compressors, air cooled aluminum finned copper tube condenser with propeller fan, refrigerant piping, controls, microprocessor based control panel etc. to form a factory finished compact unit. The unit shall be designed for continuous running and provided with R 134 A refrigerant.

Condenser shall be aluminum finned copper tube air cooled type. It shall be complete with hot gas inlet, liquid outlet, safety valve etc.

04.02.03 INDOOR UNITS



The Indoor Unit shall comprise of rough filter, evaporator coil (finned coil), evaporator fan, fan motor, all assembled together in a single sheet metal casing and compiled



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04.02.04	<p>with interconnecting refrigerant piping, refrigerant controls, safety devices, operating controls etc.</p> <p>Refrigerant is circulated inside the finned Evaporator coil to the out side unit and then back to the indoor unit. The fan pulls or pushes air around the outer surface of the coil inside the indoor unit, taking warm air from the room and injecting cooled air in to the room in summer.</p> <p>The refrigerant has no direct contact with air. So the heat of the room air is transferred in to the refrigerant in the indoor unit. The indoor unit is ceiling mounted unit.</p> <p>Evaporators shall be of direct expansion or flooded type as required and designed for the specified duty. Tubes shall not be less than 13 mm inside diameter. Tubes shall be adequately supported to prevent tube vibration.</p> <p>The evaporator shall be complete with the following accessories, depending on type of system offered.</p> <ul style="list-style-type: none"> • Evaporation pressure gauge • Relief valve or Rupture disc purge, drain valve and necessary shut off valves. • Refrigerant charging connection with valve. • Refrigerant inlet and outlet connection with necessary shut off valves, and liquid refrigerant level indicator. • Anti freeze-up thermostat fitted into proper water passage. • Flow switch • Any other standard accessories necessary with the equipment. <p>Both the Indoor unit and Out door unit will be factory fabricated. Vendor shall also bring out in their tender clearly, the manufacturing techniques employed and finishes provided to meet the service condition involved.</p> <p>A.C. UNIT CONTROL & SAFETY DEVICES</p> <ol style="list-style-type: none"> 1. Compressor shall be provided with safety against high discharge pressure, low suction pressure and oil pressure failure. 2. Compressor shall be stopped automatically in case of condenser air flow failure. 3. Compressor shall be provided with multi step temp. Indicator cum controller. In case of fall in room temperature below pre set temperature, the unit capacity to fall automatically by compressor ON/OFF control to match the cooling load and vice versa. 4. Compressor shall be interlocked with condenser fans. 5. Fault shall be indicated with audio visual signal. On acknowledgement of signal the hooter shall be stopped and visual signal to continue till it is rectified. 6. The unit shall start automatically in case of restoration of the electric power supply. 		
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04.02.05	GRILLES/DIFFUSERS/LOUVERS All the grilles, diffusers and louvers shall be made out of extruded aluminum sections finished with powder coating of approved shade all supply air grilles and diffusers shall be provided with aluminum powder coated volume control dampers. Louvers shall be gravity type.																															
04.02.06	ELECTRICAL EQUIPMENT (a) General Separate control boxes for control of each air conditioning units complete with protective, control & indicating devices shall be provided. (b) Control System Electrical control system shall be complete with all components, auxiliary relays and connectors and wiring for controls and interlocking for 240V, Single Phase, 50 HZ AC supply.																															
04.02.07	Standard and Specifications The design, manufacture and performance of equipment shall comply with all currently applicable statues, regulations and safety codes in the locality where it is to be installed. The equipment shall conform to latest edition of applicable Indian Standards or their equivalent standards. Nothing in this specification shall be construed to relieve the bidder of this responsibility. <table><tr><td>a)</td><td>IS: 5111</td><td>Code of practice and measurement procedure for testing of refrigerant compressor</td></tr><tr><td>b)</td><td>IS: 2501</td><td>Copper tubes for general engineering purposes</td></tr><tr><td>c)</td><td>IS: 1239</td><td>Mild steel tubes, tubulars & other wrought steel fittings.</td></tr><tr><td>d)</td><td>IS: 277</td><td>Galvanised steel sheet specification</td></tr><tr><td>e)</td><td>IS: 737</td><td>Wrought aluminium and alloy sheet and strip for general engineering purpose</td></tr><tr><td>f)</td><td>IS: 702</td><td>Specification of industrial Bitumen</td></tr><tr><td>g)</td><td>IS: 3396 / ASTM C-518</td><td>Method of test for volume and surface resistivity of electrical insulating material</td></tr><tr><td>h)</td><td>BS: 6540/ASHRAE-52-76</td><td>Method of testing efficiency of fine filter</td></tr><tr><td>i)</td><td>IS: 1737</td><td>Material for the filter frame</td></tr><tr><td>j)</td><td>BS: 6549/ASHRAE-52-76</td><td>Method of testing efficiency of fine filter</td></tr></table>		a)	IS: 5111	Code of practice and measurement procedure for testing of refrigerant compressor	b)	IS: 2501	Copper tubes for general engineering purposes	c)	IS: 1239	Mild steel tubes, tubulars & other wrought steel fittings.	d)	IS: 277	Galvanised steel sheet specification	e)	IS: 737	Wrought aluminium and alloy sheet and strip for general engineering purpose	f)	IS: 702	Specification of industrial Bitumen	g)	IS: 3396 / ASTM C-518	Method of test for volume and surface resistivity of electrical insulating material	h)	BS: 6540/ASHRAE-52-76	Method of testing efficiency of fine filter	i)	IS: 1737	Material for the filter frame	j)	BS: 6549/ASHRAE-52-76	Method of testing efficiency of fine filter
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05.00.00	WARRANTY All the newly supplied and installed items/equipment has warranties valid for One (1) year from the date of taking over by the Owner.	
06.00.00	QUALITY ASSURANCE, INSPECTION & TESTING	
06.01.00	Quality Control Surveillance The plant/equipment to be supplied under this specification shall have assured quality and workmanship. The Bidder in his proposal shall submit his Quality Assurance Plan and Field Quality Plan (as per enclosed format) containing quality assurance programme and quality assurance documents for Purchaser's approval. The Contractor shall be bound to conduct all stage inspections on various equipment/material during manufacturing process in accordance with the approved copy of this document. Purchaser shall have the right to carry out Quality Audit and Quality Surveillance by witnessing any or all such tests to be carried out at Contractor's / Sub—Contractor's works as and when desired. The procedure applicable to Contractor's works will also apply to the works of his sub contractors. For items coming under the purview of any Indian Statutory Regulation during the course of manufacture, all stage inspections and tests shall be witnessed by an inspecting authority recognized under the statutory regulation. A list of all sub-vendors is to be forwarded to the Purchaser for approval prior to the placement of sub-contract. All technical details shall be sent to Purchaser for approval prior to placement of orders on sub-vendors. These audit/surveillance/approvals shall not however relieve the manufacturer of their responsibility of the Quality Assurance of their product and overall guarantee and responsibility shall wholly lie with the Bidder. Tests/inspections shall be carried out during and after the completion of manufacture of different components and assembly as applicable in accordance with relevant codes and standards. Test Certificates for all such tests/inspections shall be made available to the Purchaser for approval. Purchaser or his authorised representative shall have his full access to witness any or all tests/inspections to be carried out at manufacturer's shop. In case, the job is sub-contracted, it will be Contractor's responsibility to make all arrangements so that Purchaser or his authorized representative can attend such tests at Sub-Contractor's premises. After installation, the equipment/system shall be tested and commissioned at site to Purchaser's full satisfaction.	
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06.02.00 06.02.01	<p>Testing Tests at Manufacturer's Works</p> <p>a) The manufacturer shall conduct all tests required to ensure that the equipment conforms to the specifications stipulated herein and in conformance with applicable codes. However, specific tests as mentioned against different equipment in other sections of this volume must be conducted.</p> <p>b) The particulars of the proposed tests and the procedure for the tests shall be submitted along with offer which will be subject to approval before conducting the tests.</p> <p>c) All materials, casting and forging shall be of tested quality and test certificates shall be made available to the Purchaser.</p> <p>06.02.02 Test at Site</p> <p>After erection at site, the Ventilation fans will be operated at site to show satisfactory performance as required by the applicable clause of the specification. During these tests, if any equipment/system fails to perform to the fullest satisfaction of purchaser then the same will be rectified /replaced, without any extra cost, by contractor.</p>		
07.00.00	GUARANTEES AND PERFORMANCE TESTING		
07.01.00	<p>Guarantees Following parameters for the fans shall be guaranteed by the Bidder:-</p> <ul style="list-style-type: none"> • Fan capacity • Fan static pressure • Noise level • Power consumption • Cooling Capacity of the AC equipment • Inside Room Condition (Temperature and Humidity) 		
07.02.00	<p>Performance / Acceptance Tests</p> <p>After completion of commissioning of the fan and AC equipment, performance test shall be carried out in accordance with a mutually agreed upon procedure.</p> <p>In case any of the equipment is not meeting agreed parameter defined in Cl.07.01.00 after performance testing, bidder shall rectify/replace the fan to meet the guarantee requirement.</p>		
08.00.00	DRAWING, DATA AND INFORMATION		
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- a) The scope of services shall include all engineering services required, but not limited to general arrangement and sectional drawings, fan opening size & height for civil works, general arrangement drawing foundation /fixing details, filled-up data sheets, guarantee schedule, technical literature. Quality Assurance Plan and Field Quality Plan etc to be submitted along with Bid as per the enclosed format. Format for the Stage Inspection Report (SIR) shall be submitted along with the bid.
- b) Operation and maintenance manual shall be submitted after award of contract.
- c) The documents in a) above shall be submitted after award of contract also.

09.00.00

DATA REQUIREMENT

09.01.00

DATA SHEET FOR EXHAUST FAN

1	Fans details		
2	Manufacturer		
3	Model No.		
4	Impeller Diameter	mm	
5	Impeller speed	RPM	
6	Capacity	M ³ /hr	
7	Static pressure	mmwc	
8	Shaft power	watts	
9	Motor rating	KW	
10	Fan efficiency	%	
11	Bearings		
a)	Make & Type		
b)	Manufacturer's Designation		
12	Material of all parts as per specification	Yes/No	
13	Weight of fan	Kg	

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09.02.00

AC System

14	Noise level	dB	
15	Performance curve enclosed	Yes/No	
16	Wall opening size (DIA)	mm	

1	Modal	
2	Quantity	
3	Refrigerant	
4	Compressor	
5	Power consumption	
6	COP	
7	Air volume indoor unit	
8	Technical data (indoor unit)	
9	Sound level	
10	Net dimensions	
11	Net weight	

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ANNEXURE - IX: MANPOWER SERVICES & MATERIAL SHIFTING

A: PROVIDING MANPOWER SERVICES

Sl. No.	Classification	Qty. in man-days
01	Typist cum clerk / PC operator / Office Asst.	800
02	Security guard / Cook / Office Boy / Helper, etc.	800

B: MATERIAL SHIFTING AND RE-STACKING

Sl. No.	Description	Weight in MT
01	Material shifting from existing stored place and restacking in new storage area within the plant premises (1.5 km range) – Mechanical	100
02	Material shifting from existing stored place and restacking in new storage area within the plant premises (1.5 km range) – Electrical	300

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ANNEXURE – X

MAKES OF MATERIAL /EQUIPMENT

S. No.	ITEM	MAKE
1.	Steel plates	SAIL, Tata steel, Essar steel, Jindal Vijaynagar steel (JVSL), RINL
2.	Steel structurals	SAIL, Tata steel, Essar steel, Jindal Vijaynagar steel (JVSL), RINL
3.	Pipes - carbon steel seamless	Maharashtra Seamless, Mahalaxmi Seamless, Tata steel, Indian Seamless metal tubes
4.	Pipes - Stainless steel seamless	Tata Steel / Indian Seamless /Maharashtra Seamless / Saw pipes/ Remi steels/ Choksi tubes
5.	Pipes - ERW	Tata steel, Zenith, Jindal
6.	Pipe fittings, tubes	Reputed vendors with prior approval of BHEL
7.	Tube fittings	Hyd air engineering Pvt. Ltd., Mumbai Excel hydro-pneumatics (P) Ltd., Mumbai
8.	Butterfly valve	Alfa Laval Saunders (I) Ltd., Fouress Engg. (I) Pvt. Ltd., Leader Valves Ltd., Levcon Valves Ltd., BDK Valves, Audco India
9.	Ball valve	Alfa Laval Saunders (I) Ltd., Fouress Engg. (I) Pvt. Ltd., Leader Valves Ltd., Levcon Valves Ltd., BDK Valves, Audco India
10.	Check valve	Fouress Engg. (I) Pvt. Ltd., Leader Valves Ltd., Levcon Valves Ltd., BDK Valves, Intervalve (I) Ltd.
11.	Shut off valve	Hydair Engg., Lonavala, Multimetal Industries, Baroda, Swagelok, Parker, IVI control Pvt. Ltd., Mumbai
12.	Pressure gauge	Bells controls Ltd., J N Marshal (P) Ltd., Manometer (I) Ltd., Pressure and temperature controls, New Scientific repairs trading Co.
13.	Temperature gauge	Bells controls Ltd., J N Marshal (P) Ltd., Manometer (I) Ltd., Pressure and temperature controls, New Scientific repairs trading Co., H Guru

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14.	Anchor fasteners	Fisher , Hilti
15.	Air Conditioner	Voltas, Carrier, Blue Star, Hitachi
16.	Exhaust Fans	SK Systems Pvt Ltd, Air Link Engineers Pvt Ltd, Air Control Chemical Engineers Co. Ltd, Mumbai.
17.	Chain Pulley Block	Hercules Hoist Ltd, Pulin Brothers, Standard Materials Agencies, Solid Tackles, Toubro Ferguson India Ltd, Tractel Tirfor Engineers Pvt Ltd.
18.	Electric Hoist	Power build, Consolidated Hoist, Armsel, Dynamic Cranes.

Note:

1. If the contractor has to use any other make other than listed above, he shall take written approval from BHEL 15 days in advance before procurement of material. Necessary catalogues / documents shall be submitted in support.

No material shall be dispatched to site without approval of material test certificates by BHEL unless such inspection is waived in writing by BHEL

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ANNEXURE - XI: DATA SHEETS (To be filled by Bidder)
(CHECK VALVES)

Type	Check
Service	
Size	
Type	
Rating	
End Details	
TYPE OF CONSTRUCTION	
Cover	
Wedge / DISC	
Body Seat	
Back Seating Arrangement	
MATERIAL OF CONSTRUCTION	
Body & Bonnet / Cover	
Trim / DISC	
Body Seat	
Disc Seat	
Hinge	
Hinge pin	
Lock nut	
Gasket	
Studs & Nuts	

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DATA SHEET GATE VALVES

Type	Gate
Service	
Size	
Type	
Rating	
End Details	
TYPE OF CONSTRUCTION	
Stem	
Bonnet	
Wedge / DISC	
Body Seat	
Back Seating Arrangement	
MATERIAL OF CONSTRUCTION	
Body	
Body Seat	
Bonnet	
Wedge	
Wedge seat	
Back Seat	
Gland	
Yoke	
Stem	
Studs & Nuts	
Gasket	

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DATA SHEET FOR GLOBE VALVE

Type	Globe
Service	
Size	
Type	
Rating	
End Details	
TYPE OF CONSTRUCTION	
Stem	
Bonnet	
Wedge / DISC	
Body Seat	
Back Seating Arrangement	
MATERIAL OF CONSTRUCTION	
Body	
Stem	
Bonnet / Cover	
Trim / DISC	
Body Seat	
Gland	
Gland Packing	
Studs & Nuts	
Gasket	

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DATA SHEET FOR MONORAIL HOIST WITH TRAVELLING TROLLEY

Sl.No.	Description	Data
A	ELECTRIC MONORAIL HOIST WITH TRAVELLING TROLLEY	
1.	Capacity in Kgs	
2	Duty Class	
3	No. and location	
4	Lift in meters	
5	Hoisting speed	
6	Trolley traveling speed	
7	Specification of wire rope	
8	Type of rope	
9	Type of suspension	
10	Head Room	
11	Type of bearing	
12	Distance between bottom of monorail beam and operating floor level	
13	Type of trolley	
14	Painting	
15.	Brakes Type/No.	

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DATA SHEET FOR CHAIN PULLEY BLOCK

1.	Type	
2.	Capacity	
3.	Duty Class	
4.	No. and location	
5.	Lift in meters	
6.	Type of suspension	
7.	Head Room (distance from operating floor to bottom of mono rail beam	
8.	Type of gear in chain pulley block	
8.	Type of bearing	
9.	Grade of load Chain	
10.	Type of Trolley	
11.	Painting	

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DATA SHEET FOR EMERGENCY COOLING WATER TANK

1. DESIGN DATA

Code/Standard

Wind pressure

Corrosion Allowance

mm

Radiography

Longitudinal joint efficiency

%

Testing (Hydrotesting)

Capacity

M³

Nos. required

Type

2. MATERIAL SPECIFICATION

Shell, bottom, roof

Flange <= 40 NB

Nozzle from pipe

Nozzle from plate

Gasket

Bolting for flanges

Bolting for structures

Structures

Internals

Paintings

3. ACCESSORIES REQUIRED

Ladder

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Earth connection / Earthing bosses		
Breather valve		
Gauge hatch with cover		
Type of foundation		

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ANNEXURE-XII: LIST OF DEVIATIONS (TECHNICAL)

Name of Firm : _____

Signature of Bidder : _____

Name of Bidder : _____

Designation : _____

Date : _____

Seal of the Company

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ANNEXURE-XIII: LIST OF INSTALLATIONS

S. No.	Purchaser	Location	Customer's PO No. & Date	Year of putting into operation	Details of works executed	Capacity of Plant commissioned
(1)	(2)	(3)	(4)	(5)	(6)	(7)

Name of Firm : _____

Signature of Bidder : _____

Name of Bidder : _____

Designation : _____

Date : _____


Seal of Company


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ANNEXURE-XIV: FIELD QUALITY PLAN								
		FIELD QUALITY PLAN		PROJECT: 2X110 MW, GNDP TPS				
ITEM Miscellaneous Mechanical Works SUB:		FQP NO: REV: 0 DATE: PAGE: 1 OF 1		PACKAGE: CONTRACT NO. CONTRACTOR:				
SL. NO.	CHARACTERISTICS / ITEMS	TYPE OF CHECK	INSTRUMENT	CLASS	QUANTUM / FREQUENCY OF CHECK	REF. DOC. AND ACCEPTANCE STANDARD	FORMAT OF RECORDS	REMARKS
1	2	3	4	5	6	7	8	9
MANUFACTURER/ SUBCONTRACTOR	CONTRACTOR	Miscellaneous Mechanical Work				FOR BHEL USE	DOC. NO. PDX -11-023, REV: 0	
SIGNATURE						REVIEWED BY	NAME AND SIGN OF APPROVING AUTHORITY AND SEAL	

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QUALITY PLAN

LEGEND: P: Performed By, W-Witness By TS-Technical Standard
M: Manufacturer V: Verify IR: Inspection Report
IR-Inspection Report, BR-balancing Report
IC: Test Certificate

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ANNEXURE-XVI: PAINTING REQUIREMENT – GENERAL ENVIRONMENT									
1. For General Atmosphere (Non Coastal)									
Item Description		Surface Preparation Grade/Surface Profile	Primer Coat		Intermediate Coat		Finish Coat		Total DFT in Microns
			Primer Paint	No. of Coats	DFT in microns	Interm ediate Paint	No. of Coats	DFT in micron s	
Various type of Equipment, Valves etc. (Temp. upto 90 Deg. C)		Degreasing and Mech. Cleaning to (St2/St3 as applicable)	HB Zinc Phosphate (alkyd medium)	2	35 - 45 per coat	--	--	20 - 25 per coat	110-140
Piping/Structurals /Vessels, etc. (Temp. upto 90 Deg. C)		Degreasing and Mech. Cleaning to (St2/St3 as applicable)	Red oxide zinc chromate as per IS:2074 (alkyd medium)	2	25 - 35 per coat	--	--	20 - 25 per coat	110-145
Equipment with temp. up to 250 Deg. C		Degreasing and Mech. Cleaning to (St2/St3 as applicable)	Heat resistant Al - Paint	2	20 per coat	--	--	20 per coat	80
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TractebelEngineering		suez							

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Equipment in corrosive areas like CPU (regeneration)/PT P/DMP area etc. Dosing Skid etc.		Blast clean to Sa 2.5	Epoxy resin based zinc phosphate primer	1	35-50 per coat	Epoxy based MIO pigmented paint	1	50 per coat	Polyamide cured Epoxy finish coat	2	25-35 per coat	135-170



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ANNEXURE – XVII VENDOR LIST

Sr.	Description	Vendor Name
1.	Steel plates	SAIL, Tata steel, Essar steel, Jindal Vijaynagar steel (JVSL) , RINL
2.	Steel structural	SAIL, Tata steel, Essar steel, Jindal Vijaynagar steel (JVSL) , RINL
3.	Pipes - carbon steel seamless	Maharashtra Seamless, Mahalaxmi Seamless, Tata steel, Indian Seamless metal tubes
4.	Pipes - stainless steel seamless	Tata Steel / Indian Seamless /Maharashtra Seamless / Saw pipes/ Remi steels/ Choksi tubes
5.	Pipes - ERW	Tata steel, Zenith, Jindal
6.	Pipe fittings, tubes	Reputed vendors with prior approval of BHEL
7.	Tube fittings	Hyd air engineering Pvt. Ltd., Mumbai Excel hydro-pneumatics (P) Ltd., Mumbai
8.	Butterfly valve	Alfa Laval Saunders (I) Ltd., Fouress Engg. (I) Pvt. Ltd., Leader Valves Ltd., Levcon Valves Ltd., BDK Valves, Audco India
9.	Ball valve	Alfa Laval Saunders (I) Ltd., Fouress Engg. (I) Pvt. Ltd., Leader Valves Ltd., Levcon Valves Ltd., BDK Valves, Audco India

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Sr.	Description	Vendor Name
10.	Check valve	Fouress Engg. (I) Pvt. Ltd., Leader Valves Ltd., Levcon Valves Ltd., BDK Valves, Intervale (I) Ltd.
11.	Shut off valve	Hydair Engg., Lonavala, Multimetal Industries, Baroda, Swagelok , Parker, IVI control Pvt. Ltd., Mumbai
14.	Anchor fasteners	Fisher , Hilti
1.	Air Filter/ Regulator	Norgren, Schrader Scovil Duncan Ltd, SMC
2.	Safety Valves	Spirax Marshall Leader
3.	Pressure Reducing Valve	Tyco Sanmar Rico Arca
4.	Needle Valve	BIC Technomatic
5.	Compensating Cable	General Instruments Toshniwal Industries Pvt. Ltd Cords Cable
6.	DP Gauges	A N Instruments Switzer Instruments
		Pyroelectric

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Sr.	Description	Vendor Name
		Waaree Instruments
7.	DP Switches	Barksdale
		Switzer Instruments
		Beta BV
8.	DP Transmitter /Pressure Transmitter	Honeywell Automation India Ltd
		Rosemount (Emerson)
		Yokogawa
9.	Flow Glasses	Eureka
		General Instruments
		Levcon
10.	Indicating LEDs/ Illuminated Pushbuttons	English Electric Company of India Ltd
		Siemens
		Honeywell
11.	Level Gauges	Norvik Yarway
		Levcon
		Technomatic (I) Pvt. Ltd
12.	Level Switches	Levcon
		Besta AG
		Soletron Mobrey
13.	Pressure Gauge	General Instruments
		A N Instruments

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Sr.	Description	Vendor Name
		Waree
14.	Pressure Switches	Indfoss
		Switzer
		Mennsman Rexroth
15.	Push Button	Siemens
16.	Bar graph indicators	Yokogawa
		Masibus
17.	RTD	Detriv Instrumentation
		General Instruments
		Pyroelectric Instruments
18.	SOV	ASCO
		ROTEX
		HERION
19.	Temperature Gauges	General Instruments
		Pyroelectric Instruments
		Pyrotech
		Wika
20.	Temperature Switches	Indfoss
		Switzer Instruments
		General Instruments
21.	Control switches	ABB

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Sr.	Description	Vendor Name
		GEC Alstom
		Siemens
22.	Junction Boxes and FTCs	Pyrotech, Udaipur
		ICA
		Baliga
23.	Instrumentation Cables	Cords cable
		Delton cable
		Poly cab
		Finolex
24.	Control Panels	Rittal
		ICA
		Pyrotech, Udaipur
25.	Wiring termination accessories	WAGO
		Phoenix
26.	Thermowells	General Instruments
		Pyroelectric
		Detriv Instruments
27.	Limit Switches	Cuttler-Hammer
		SIEMENS
28.	Annunciation System	Procon
		ILK

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Sr.	Description	Vendor Name
		Rochester
		Ronan
		Hathaway
29.	Motors	Kirloskar Electric Co. Ltd.
		ABB
		Crompton Greaves
		Siemens
		GE
		Alstom

Note:

2. If the contractor has to use any other make other than listed above, he shall take written approval from BHEL 15 days in advance before procurement of material. Necessary catalogues / documents shall be submitted in support.
3. No material shall be dispatched to site without approval of material test certificates by BHEL unless such inspection is waived in writing by BHEL

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