

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 153 of 555
in Quality Plans along with Quality Plans. These Quality plans and reference documents/standards etc shall be subject to Owner's approval without which manufacture shall not proceed. These approved documents shall form a part of the contract. In these approved quality plans, Owner/ Authorised representative shall identify Customer Hold Points (CHP), test/ checks which shall be carried out in presence of the Owner's Engineer or his authorised representative and beyond which the work will not proceed without consent of Owner/Authorised representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Owner/Authorised representative for approval and disposal. 2.5 No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of all previous tests/inspections by Owner's Engineer/Authorised representative and duly authorised for despatch issuance of Material Despatch Clearance Certificate (MDCC). 2.6 All materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report. These certificates and reports shall indicate the sheet numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it. 2.7 Castings and forgings used for construction shall be of tested quality. Details of results of chemical analysis, heat treatment record and mechanical property test results shall be furnished. 2.8 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section-IX/BS-4870 or other International equivalent standard acceptable to the Owner. All brazers, welders etc employed on any part of the contract at Contractor's / Sub-Contractor's works or at site shall be qualified as per ASME Section-IX or BS- 4871 or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner/his authorised representative.		

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 154 of 555
For welding of pressure parts and high pressure piping, the requirements of IBR shall also be complied with.		
2.9	All Non-Destructive Tests (NDT) shall be carried out in accordance with approved International Standard. The NDT operator shall be qualified as per SNT-TC-IA (of American Society of non- destructive examination). Results of NDT shall be properly recorded and submitted for approval.	
2.10	List of all the sub-vendors proposed by the Contractor for procurement of major bought out items including castings, forgings, semi-finished and finished components/ equipment shall be drawn up by the Contractor and finalised with the Owner. Such list shall be subject to Owner's approval. Quality Plans of the successful vendors shall be discussed, finalised and approved by the Owner/Authorised representative and form part of the Purchase Order between the Contractor and the Vendor.	
2.11	All the purchase specifications for the major bought-out items, list of which shall be drawn up by the Contractor and finalised with the Owner shall be furnished to the Owner for comments and subsequent approval before orders are placed. Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-vendor's quality management and control activities. The Contractor shall provide all necessary assistance to enable the Owner carry out such audit and surveillance. Quality audit/approval of the results of tests and inspection will not prejudice the right of the Owner to reject equipment not giving the desired performance after erection and shall not in no way limit the liabilities and responsibilities of the Contractor in earning satisfactory performance of equipment as per specification.	
2.12	Quality requirements for main equipment shall equally apply for spares and replacement items.	
2.13	Repair/rectification procedures to be adopted to make any job acceptable shall be subject to the approval of the Owner.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 155 of 555
2.14	For quality assurance of all civil works refer to the specifications for civil works.	
3.0	<u>QUALITY ASSURANCE DOCUMENTS</u>	
3.1	The Contractor shall be required to submit two (2) copies and two (2) sets of softcopies in the form of CD of the following Quality Assurance documents within three (3) weeks after despatch of the equipment :	
3.1.1	Material mill test reports on components as specified by the specification.	
3.1.2	The inspection plan with verification, inspection plan check points, verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.	
3.1.3	Non-destructive examination results/reports including radiography interpretation reports.	
3.1.4	Factory tests results for testing required as per applicable codes and standards referred in the specification.	
3.1.5	Welder identification list incorporating welder's and welding operator's qualification procedure and welding identification symbols.	
3.1.6	Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.	
3.1.7	Stress relief time temperature charts.	
3.1.8	Inspection reports duly signed by QA personnel of the Owner and Contractor for the agreed inspection hold points. During the course of inspection, the following shall also be recorded :	
	(a) When some important repair work is involved to make the job acceptable.	
	(b) The repair work remains part of the accepted product quality.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 156 of 555
3.2	Letter of conformity certifying that the requirement is in compliance with finalised specification requirements.	
4.0	<u>INSPECTION, TESTING AND INSPECTION CERTIFICATES</u>	
4.1	The Engineer, his duly authorised representative and/or an outside inspection agency acting on behalf of the Owner shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Engineer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.	
4.2	The Contractor shall give the Engineer/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Engineer/Inspector, unless the witnessing of the tests is virtually waived, shall attend such tests within fifteen (15) days of the date on which the equipment is notified as being ready for test/inspection failing which the Contractor may proceed with test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector duly certified Six (6) copies of test reports.	
4.3	The Engineer or Inspector shall within fifteen (15) days from the date of Inspection as defined herein give notice in writing to the Contractor, on any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall confirm in writing to the Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.	
4.4	When the factory tests have been completed at the Contractor's or sub-contractor's works, the Engineer/Inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Engineer/ Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Engineer/Inspector. Failure of the Engineer/ Inspector to issue such a	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 157 of 555
certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Owner to accept the equipment should it, on further tests after erection be found not to comply with the contract. 4.5 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Engineer/ Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Engineer/ Inspector or to his authorised representative to accomplish testing. 4.6 To facilitate advance planning of inspection in addition to giving inspection notice, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at customer hold point and final inspection stages. Updated quarterly inspection plans shall be made for each three consecutive months and shall be furnished before beginning of each calendar month.		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6 /2011 /T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 158 of 555

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.				Volume: II	
	BID SPECIFICATION NO.: DG/BSL U-6 /2011 /T-1				Section – 7	
	REV: R0	MASTER SPECIFICATIONS				Page 159 of 555

FORMAT OF QUALITY ASSURANCE PROGRAMME

ANNEXURE – A

Name of Company/ Contractor		NAME OF CONTRACT PACKAGE			QUALITY PLAN FOR							
		Package No. : _____			QP No. : _____ Date _____							
		Contractor : _____			Rev. No.: _____ Date _____							
Sl. No.	Component & Operation	Characteristics	Class	Type of Check	Quantum of Check	Reference Document	Acceptance Norm	Format of Record	Agency	Remark		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6 /2011 /T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 160 of 555

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.		MAHARASHTRA STATE POWER GENERATION CO. LTD.										Volume: II			
		BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1										Section – 7			
REV: R0		MASTER SPECIFICATIONS												Page 161 of 555	
PROJECT : FWS NO CONTRACTOR : REV NO. PACKAGE : FIELD WELDING CODE SYSTEM : PAGE NO. FIELD WELDING SCHEDULE ANNEXURE – B															
SI No	Drawing No. for Weld Locations & Identification mark	Description of parts to be welded	Material specification	Dimensions	Process of Welding	Type of Weld	Electrode Filler Specification	WPS No.	Minimum Preheat Temperature	Heat Treatment Temperature [Holding Time in secs]	NDT Method Quantum	NDT Specification Number	Acceptance Norm Ref.	Remarks	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6 /2011 /T-1		Section – 7
REV: R0	MASTER SPECIFICATIONS		Page 162 of 555
The Field Welding schedule shall be submitted for: (a) Pressure Parts (b) Tanks/Vessels (c) Piping (d) Heavy/Important Structural Steel (e) Heat Exchangers (f) Bus Ducts			

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	
REV: R0	COMPRESSED AIR, AIR-CONDITIONING & VENTILATION SYSTEMS	Page 54 of 171

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	
REV: R0	COMPRESSED AIR, AIR-CONDITIONING & VENTILATION SYSTEMS	Page 55 of 171

1.0 INSPECTION AND TESTING REQUIREMENTS

1.1 GENERAL :

The testing and inspections listed herein are the minimum requirements as perceived by the Owner; the bidder shall consider this only as a general guidance and is not meant to be exhaustive. The bidder shall consider requisite testing and inspections across the equipments/systems forming the proposed power plant unit based on his own experience and in line with the current industry practices for identically rated power plant for the technology under consideration. The comprehensive list of tests considered for each of the equipment/systems shall be furnished as part of the bid.

1.2 The Contractor shall carry out the following specific tests and inspections to ensure that the equipment furnished shall conform to the requirements of this section and in accordance with relevant codes and standards.

1.3 Material identification of compression chambers, rotor, rotor shaft, suction and delivery valves constituting the compressors and all parts of intercoolers, after coolers, moisture separators, air receivers, air dryers, hot cranes, strainers, filters, all interconnecting air and water piping with valves and all other parts and accessories that could not spelt out in this clause.

1.4 Hydrostatic testing of compressor, intercoolers, after coolers, moisture separators, air receivers, strainers, filters, all interconnecting air and water piping with valves and all other applicable pressure parts that could not be spelt out in this clause. Hydrostatic testing shall be carried out at 150% of the design pressure for at least one (1) hour, unless contradicted by the relevant test code.

1.5 Testing of all drive motors and control panels in the compressed air system shall be as outlined under Volume-IV of this specification.

1.6 Performance Test (Shop Test):

1.6.1 Performance test on the compressors shall be carried out in accordance with ISO: 1217/eq.. The test shall also include demonstration of loading and unloading mechanism (Capacity control) and operation of safety valves.

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	
REV: R0	COMPRESSED AIR, AIR-CONDITIONING & VENTILATION SYSTEMS	Page 56 of 171
1.6.2	Power consumption at motor input terminal at rated capacity as well as at fully unloaded condition of the compressor shall be measured.	
1.6.3	Vibration and noise level measurement will be done during shop performance test & P.G. Test at site.	
1.6.4	Test shall be carried out on all compressors with contract drive motor at Works.	
1.6.5	Clearance on Type test requirements from Employer's Engineer Shall be reviewed prior to final clearance.	
1.7	Specific test to be carried out on each system:	
1.7.1	Air compressors	
1.7.1.1	All pressure parts shall be hydraulically tested at not less than 150% of design pressure prior to painting and lining, if applicable. The test pressure will be maintained for 30 minutes.	
1.7.1.2	All other parts including inter-connecting piping's shall be hydraulically tested wherever possible, as per relevant codes.	
1.7.1.3	Ultrasonic testing shall be carried out on all forgings and shafts (if dia. $\geq$ 50 mm) viz. Crank shaft, connecting rod, piston rod, etc. MPI/DP test will be done on machined areas of the above components.	
1.7.1.4	Screws shall be subjected to DP testing.	
1.7.1.5	During assembly all clearances and alignments shall also be checked and recorded.	
1.7.1.6	Dynamic balancing of all rotating components and assembly of each air compressor including all drive motors in the compressed air system.	
1.7.1.7	Type test/Routine tests for all the air compressors as per IS-5456. All performance tests for compressors shall be carried out with actual motor being furnished. Routine tests shall include the following tests and measurements:	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	
REV: R0	COMPRESSED AIR, AIR-CONDITIONING & VENTILATION SYSTEMS	Page 57 of 171
(a) Capacity (Free Air delivery) (b) Speed (c) Specific power consumption (d) Volumetric and overall efficiency of machine (e) Test of loading and unloading mechanism (f) Any other test deemed necessary for the system 1.7.2 Intake air filter & silencer Tests for capacity, pressure drop and efficiency of each Intake Air Filter with silencer shall be as per Manufacturer's standard. These tests shall be conducted along with performance testing of each compressor. 1.7.3 Air receiver, Heat exchangers, Moisture separator, Air drying plant: 1.7.3.1 Each finished vessel shall be hydraulically tested to 150% of the design pressure for duration of 30 minutes. 1.7.3.2 NDT on weld joints shall be as per respective code requirements or the minimum as specified below: (a) 100 % DPT on root run of butt welds. (b) 100% DPT on all finished butt welds and fillet welds (c) 100% RT on butt welds which shall include all T-joints. Radiography shall be done by gamma radiation. (d) Dished ends if made in two pieces shall have their longitudinal seams weld 100% Radiographed. 1.7.3.3 Tube-to-Tube sheet joint of the heat exchangers shall be subject to Mock-up test as per the relevant standards.		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-G
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	
REV: R0	COMPRESSED AIR, AIR-CONDITIONING & VENTILATION SYSTEMS	Page 58 of 171
1.7.3.4 Reactivation blowers shall be tested for FAD, temp. rise, noise & vibration. Rotating parts shall be dynamically balanced. 1.7.3.5 Completely assembled ADP shall be pneumatically tested at design pressure for a duration of 5 minutes. Functional and sequential operation testing of the completely assembled ADP shall be demonstrated at shop. Other accessories shall be tested as per relevant code and sections. Dew point measurement shall be done at site. 1.7.3.6 Dew Point tests to be carried out on each Air Drying Plant. 1.8 Any other test deemed necessary for the system. 1.9 ADP PG Test shall be carried out as per ISO 7183 or equivalent code.		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 143 of 158

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 144 of 158

1.0 GENERAL

The testing and inspections listed herein are the minimum requirements as perceived by the owner; the bidder shall consider this only as a general guidance and is not meant to be exhaustive. The bidder shall consider requisite testing and inspections across the equipments/systems forming the proposed power plant unit based on his own experience and in line with the current industry practices for identically rated power plant for the technology under consideration and relevant codes and standards. The comprehensive list of tests considered for each of the equipment/systems shall be furnished as part of the bid.

2.0 H.P.PIPING FOR STEAM GENERATOR, TURBINE AND AUX.

2.1 TESTING OF PIPING AT WORKS

2.1.1 Piping & fittings:

2.1.1.1 All raw materials used shall have co-related mill test certificate meeting mandatory and supplementary checks of material specification.

2.1.1.2 Raw material of all forged/formed fittings shall be ultrasonically tested. All mother pipes used for fitting shall either be ultrasonically tested or hydraulic tested. Forged fittings shall be ultrasonically tested and formed fittings shall be MPI tested.

2.1.1.3 All pipe lengths shall be subjected to 100% ultrasonic examination or hydraulic tests and UT/RT on longitudinal welds at the tube mill.

2.1.1.4 Welded and cast fittings if any shall be subjected to suitable NDT as per applicable standards. However, 100% RT shall be carried out on alloy steel fittings and on carbon steel fittings for use above 71 bar design conditions.

2.1.1.5 The edge preparation for shop and site welds in stainless steel /alloy steel shall be subjected to a dye penetrate check.

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 145 of 158
2.1.1.6 Thickness of pipe bend shall be checked by ultrasonic or other acceptable methods on sample basis for high pressure applications. Outer surface of bends shall be subjected to magnetic particle examination/LPI. The tests shall be done before fabrication on the piping system and results submitted to Owner/Engineer for approval. 2.1.1.7 Non-destructive examination of welds shall be carried out after post weld heat treatment, if any. 2.1.1.8 For welds in P91, X20 & X22 materials, induction type of heating shall be deployed for heat treatment or heat treatment can be carried out in furnace. 2.1.1.9 Non-destructive examination of welds shall be carried out in accordance with the relevant design/manufacturing codes. However, as a minimum, the following requirements shall be met. Further statutory requirement, wherever applicable shall also be complied with. (a) Temperature > 400 Deg, C and/Or pressure exceeding 71 bar. (i) 100% RT/UT on butt welds and full penetration branch welds. (ii) 100% MPE. (b) Temperature > 175 Deg, C upto 400 Deg. C and/or pressure exceeding 17 bar and upto 71 bar. (i) 100% RT/UT on butt welds and full penetration branch welds for pipe dia more than 100 NB. (ii) 10% RT/UT on butt welds and full penetration branch for pipe dia upto 100NB. (iii) 100% MPE. (c) 100% UT & 100% MPI on all butt welds of P 91 and X22 UT shall be carried out by digital recorded type. Wherever SR/PWHT is envisaged, above NDTs shall be after SR/PWHT.		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 146 of 158
2.1.1.10 For all other pipes not covered above, shall be subjected 100% MPE/ DPT in case of under ground pipes and 10% MPE/DPT in case of piping above the ground. Further, 10% of butt welds of underground piping shall be subjected to RT. 2.1.1.11 Hardness survey of welds shall be carried out on alloy steel/stainless steel piping (100% Hardness survey of welds on P91, X20 & X22 material grade piping) and 3% hardness survey on welds of other alloy steel). 2.1.1.12 Testing of piping at works All piping shall be subjected to the hydrostatic test pressure at shop as required by the IBR or any other applicable standards. Test pressure shall however be not less than the following: Test Pressure $= 1.5 \times \frac{\text{Allowable Stress at Room Temperature}}{\text{Allowable Stress at Design Temperature}} \times \text{Design Pressure}$ The Contractor shall guarantee his work as capable of withstanding such hydrostatic tests and consent to repair or replace at his expense any item, which fails to pass such tests at site. Hydrostatic test of all pipes coming under IBR shall be offered for witnessing by the representative of the Inspecting Authority recognised by IBR. 2.1.2 Hangers & Supports: (a) All raw materials used shall have co-related mill test certificate meeting mandatory checks of material specification. (b) Completed springs shall be tested for Scragging Test & Load vs Deflection Test and for dia. > 25mm MPI shall be carried out. (c) Each constant load and spring support shall be tested before delivery to ensure that the variation in support capacity provided through the specified ranges (i.e. the difference in load between hot conditions and		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 147 of 158
cold condition) does not exceed 6 percent for constant load supports and 20 percent for variable spring supports. (d) Butt Welds shall be tested for UT and fillet welds shall be tested for MPI. (e) Turn buckle/pipe clamps/Hangers of thickness > 25mm shall be checked by MPI/DPT on bent portion. 2.1.3 Assembled Hangers shall be checked for Variation in deflection and Travel vs Load test and shall meet the requirements of data sheet. 2.1.4 Thermal Insulation & Lagging, Cladding: (a) Light resign bound mineral wool: LRB mattresses of Rockwool/Glass wool from approved manufacturing sources confirming to 8183, tested as per relevant clauses of IS 3144 and shall meet the requirements of data sheet. Wire mesh of diameter 0.71 mm (min.) as per data sheet shall only be used. (b) Lagging & Cladding: Aluminium sheeting confirming to ASTM B-203-1060 temper H14 from reputed manufacturer meeting the requirements of data sheet. 2.1.5 Valves: (a) All materials shall be of tested quality and the contractor shall submit the relevant material test certificate for the approval of Owner/Consultant. (b) All Valves and Specialties as well as counter flanges to be used in steam service shall have IBR certification marked on them and IBR certificates in appropriate pro-forma shall be submitted. (c) Pressure retaining parts of valves shall be subjected to (min.) NDT as per Table 1.		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 148 of 158
(d) Hardened/stellitted valve disc and seat are to be subjected to LPI and hardness check. (e) Color matching of valve disc/plug and seat shall be carried out to ensure min. 80% contact and no through passage. (f) Hydraulic pressure test and seat leak test shall be carried out as per ANSI 16.34/IBR. (g) Air seat leak test shall be carried out as per applicable Standards/Codes. (h) Functional testing shall be carried out on each valve to check the following as per the approved valve data sheet (i) Smooth operation (ii) Valve travel, closing and opening time. (iii) Current drawn by actuators. (i) Springs for safety valves shall be tested with suitable NDT and for spring rate. (j) Gate valves shall be subjected to shop tests in accordance with API-598 including the high-pressure closure test. Globe valves shall be tested in accordance with BS-1873 and check valves in accordance with BS-1868. (k) All gaskets used for test shall be of the same material and design as specified for the finished product. (l) Each relief valve shall be subjected to hydrostatic test, seat pressure test, seat leakage test and test for relieving capacity. The valve body test pressure shall be at least twice the set pressure. The seat test pressure shall be at least equal to the set pressure. During this test, the valve seat shall be demonstrated to be watertight for a period of at least two (2) minutes.		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 149 of 158
2.1.6 Strainers and Traps (a) All strainers shall be subjected to hydrostatic test. The test pressure shall be twice the design pressure. (b) All steam traps shall be subjected to hydrostatic test at twice the design pressure. IBR certification shall be furnished for all steam traps. 2.2 <u>TESTS AT SITE</u> Contractor shall carry out tests at site to prove to the Owner that the equipment of the plant complies with requirements stipulated and is erected in accordance with requirements. Before the plant is put on trial run, the Contractor will be required to conduct tests to demonstrate to the Owner that each item of the plant is capable of correctly performing the functions for which it was specified. These tests may be conducted concurrently with those required under commissioning sequence. Tests required shall in general be as follows: 2.2.1 All piping, valves and specialties after installation, shall be tested hydraulically at a pressure, one half times that of the maximum attainable pressure in the system or two (2) times the design pressure whichever is higher, to check against leak tightness. 2.2.2 All manually operated valves/gates shall be operated throughout 100% of the travel and these should function without any trouble whatsoever. 2.2.3 Visual check on all structural components, welding, painting etc and if doubt arises, these shall be tested again. 2.2.4 All test instruments and equipment shall be furnished by the Bidder to the satisfaction of the Owner. 2.2.5 Checks on electrical items as mentioned in relevant electrical specification. 2.3 <u>PRE-COMMISSIONING TESTING</u> 2.3.1 Alignment Test		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 150 of 158
After completion of erection and before start-up, alignment test shall be carried out to check levelling, clearance, eccentricity etc. Measurement will be witnessed and acceptance will be certified by the Engineer. 2.3.2 Heat Treatment - All necessary preheating, post heating and stress relieving operation of welds/fabricated items are part of the erection work in accordance with relevant regulations and standard. All required supervising staff for heat treatment and stress relieving works shall be arranged. Heat treatment may be required to be carried out at any time during day and night to ensure the continuity of the progress. Supervising staff shall be arranged accordingly. All data such as heating temperature, heating rate, sparking time, maximum temperature during heat treatment shall be properly recorded. All the data recorded during heat treatment shall be the property of the Owner. 2.3.3 Radiography Test Radiography tests of all field-welded joints coming under IBR shall be carried, the acceptability standard of which shall be as per IBR. For other field welded joints, radiography or other NDT methods shall be employed as per ASME or equivalent. All radiography shall be carried out in presence of a competent supervisor and his certificate of identification of the films of the radiographs shall be given invariably in all cases. The repair work shall be suggested immediately after detection of the defective zone to the complete satisfaction of the Engineer. Regarding acceptance of the joints, decision of the Engineer shall be final. All X-ray films of joints radiographed at site shall become the property of the Owner. Following optional non-destructive tests after completion of erection of all piping and equipment shall be carried out: (a) Ultrasonic test per weld joint		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 151 of 158
(b) Hardness test for 10% weld joints for each system of piping and/or as specified in the approved Field Quality Plan (FQP).		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.			Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1			
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION			Page 152 of 158
TABLE-1				
Valve size NB in mm	ANSI Class upto 300	ANSI Class above 300 upto 600	ANSI Class above 600 below 900	ANSI Class 900 & above & below 4500
Less than 50	Visual	Visual	Visual	MPI
50 & above but below 100	Visual	Visual	MPI	MPI & RT (on 10% of valves on 100% area)
100 & above but less than 300	Visual	MPI	MPI & RT (on 10% of valves on change of section & weld ends)	MPI & RT (on 100% area)
300 and above	MPI	MPI	MPI & RT (on change of sections & weld ends)	MPI, RT on 100% area)

CONSULTANT : PROCON ENGINEERS

 MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: III-F														
		BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1														
REV: R0		PIPING, SPECIALTIES & THERMAL INSULATION										Page 153 of 158				
3.0 LOW PRESSURE PIPING SYSTEM (INCLUDES LARGE DIA CW PIPE)																
Tests/Check	Items / Components	Material Test	DPT/MPI	Ultrasonic Test	WPS/ WQS/PQR	Balancing	Hydraulic / Water Fill Test	Pneumatic Test	Assembly Fit up	Dimensions	Functional/ operational Test	Performance Test	Other Tests	All Tests as per relevant Std	Adhesion/Spark Tests	REMARKS
3.1	Pipes & Fittings and Metered Bends	Y ^a	Y ^b		Y		Y									
3.2	Diaphragm Valves	Y ^a					Y ⁵			Y				Y ⁶		
3.3	Butterfly Valves (Low Pressure)															
(a)	Cast Butterfly Valves															
	i. Body (Cast)	Y ^a	Y ^b				Y		Y	Y	Y		Y ⁷			
	ii. Disc (Cast)	Y ^a	Y ^b													
	iii. Shaft	Y ^a	Y	Y ^c												

CONSULTANT : PROCON ENGINEERS

		MAHARASHTRA STATE POWER GENERATION CO. LTD.										Volume: III-F			
		BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1													
REV: R0		PIPING, SPECIALTIES & THERMAL INSULATION										Page 154 of 158			
(b)	Fabricated Butterfly Valves														R e f N o t e 1 4
3.4	Gate/ Globe/ Swing Check Valves	Y ^a	Y ^b	Y ^c			Y ⁵	Y	Y				Y ⁸		
3.5	Dual Plate Check Valves	Y ^a	Y ^b	Y ^c			Y	Y	Y				Y ⁴		
3.6	Rolled & Welded Pipes	Y ^a	Y ³		Y		Y ¹			Y					
3.7	Coating & Wrapping of Pipes	Y ²											Y ²		
3.8	Strainers	Y ^a	Y ^b				Y						Y ¹ ₁		
3.9	Rubber Expansion Joints	Y ^a					Y ¹²		Y	Y			Y ¹ ₃		
3.10	Rubber Lining of Pipes	Y ^a	Y ^b		Y		Y			Y			Y ⁹	Y	
3.11	Hangers & Supports	Y ^a						Y							
3.12	Fasteners	Y ^a		Y _b				Y							
3.13	Site Welding		Y ¹		Y		Y								
<u>Notes:</u>															

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 155 of 158
1. Weld Joints not subjected to hydraulic test shall be subjected to 100% RT. 2. Spark Test, Adhesion Test and Material Test for primer and enameled & Coal Tar Tapes shall be as per AWWA-C-203-91. 3. DPT on route run and after back gouging and on finish welds. 4. Dry Cycle Test (Spring Cycle Test) for one lac Cycles shall be carried out as a type test. 5. Seat Leakage Test for Actuator Operated Valves, shall be done with by closing the valves with actuator. 6. Tests on rubber parts per batch of rubber mix such as hardness, adhesion, spark test, bleed test and flex test on diaphragm, type test for diaphragm for 50,000 cycles. 7. Hydraulic Test of Body, Seat and disc-strength shall be carried out in accordance with AWWA-C-504 in presence of owner's representatives. Actuator operated valves shall be checked for Seat Leakage by closing the valves with actuator. Seat Leakage Test shall be carried out in both directions. 8. Blue matching, wear travel for gates, valves, pneumatic seat leakage, reduced pressure test for check valves shall be done as per relevant standard. Maximum allowable vacuum loss is 0.5 mm of Hg abs. for valves to be tested for vacuum operation for internal pressure 25 mm of Hg abs. for a period of 15 minutes. 9. Hardness, Bleeding Test and Ozone resistance test shall be done on rubber material. 10. 2% of welds shall be subjected to DPT. 11. Pressure drop across the strainer for each type and size as a special test shall be carried out. 12. During hydraulic and vacuum tests at 25 mm Hg (abs) in 3 positions, the change in the circumference of arch should not be more than 1.5%. 24 hrs after the test, permanent set in dimension should not exceed 0.5%.		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 156 of 158
13. Tests on rubber for tensile, elongation, hardness, hydraulic stability check as per ASTM D 471, ozone resistance test as per ASTM D 1149, aging test and adhesion strength of rubber to fabric, rubber to metal adhesion shall be carried out. 14. For fabricated butterfly valves: UT as per ASTM A-435 on plate material for body and disc. 100% RT as per ASTM, Section-VIII, Division-I, on butt joints of body and disc and post weld heat treatment as per ASME, Section-VIII, Division-I on butt joints of body and disc of thickness above 30mm shall be carried out in addition to other tests indicated for cast butter fly valves. (a) One per heat/heat treatment batch/lot. (b) On machined surfaces only for castings and on finished butt welds. (c) For shaft/spindles > or = 50 mm. 4.0 <u>THERMAL INSULATION</u> 4.1 The Contractor shall furnish test certificates from any one of the independent authorities listed below or any other reputed body subject to Purchase's/Consultant's prior approval for all the tests as mentioned later. (a) National Test House - Calcutta/Bombay (b) Central Glass & Ceramic Research Institute, Calcutta (c) National Metallurgical Laboratory, Jamshedpur (d) Central Mechanical Engineering Research Institute, Durgapur (e) National Physical Laboratory, Delhi (f) Central Building Research Institute, Roorke, U.P. (g) Any other internationally reputed Test House. 4.2 The Contractor shall carry out all the tests according to IS: 8183/3144 or according to any other internationally accepted standards. The tests shall be		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F																															
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1																																
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 157 of 158																															
done on representative samples drawn from the insulating material supplied under this section of specification. All the tests mentioned in IS: 3144 shall be carried out for establishing various chemical and physical properties (as mentioned below) in accordance with the procedure laid down therein. Owner shall have the right to witness any or all of the tests conducted by the contractor at the shop or laboratory. Following shall be met by testing as per relevant clauses of IS: 3144. <table><tr><td>(a)</td><td>Shot content</td><td>5% by weight (max.), size of any shot not to exceed 5 mm in diameter</td></tr><tr><td>(b)</td><td>Weight gain by moisture Absorption</td><td>2% (max.)</td></tr><tr><td>(c)</td><td>Sulphur Content</td><td>Not exceeding 0.6%</td></tr><tr><td>(d)</td><td>Alkalinity as Percentage of Na₂O</td><td>Not exceeding 0.6%</td></tr><tr><td>(e)</td><td>Maximum oil content</td><td>Not exceeding 0.3% by weight</td></tr><tr><td>(f)</td><td>Total carbon content</td><td>Not exceeding 0.3% by weight</td></tr><tr><td>(g)</td><td>Settlement</td><td>Nil (When tested as per Cl. 21.1 & 21.2 of IS:3144)</td></tr><tr><td>(h)</td><td>Handability</td><td>Fully handable, without any lump formation and disintegration of material</td></tr><tr><td>(i)</td><td>Loss of weight after</td><td>Not exceeding 5% by weight combustibility test</td></tr></table> 4.3 The Bidder shall furnish the following test reports along with the offer: <table><tr><td>(a)</td><td>Thermal conductivity of the insulating material at various mean temperatures.</td></tr><tr><td>(b)</td><td>Retention of binder at elevated temperature</td></tr></table>			(a)	Shot content	5% by weight (max.), size of any shot not to exceed 5 mm in diameter	(b)	Weight gain by moisture Absorption	2% (max.)	(c)	Sulphur Content	Not exceeding 0.6%	(d)	Alkalinity as Percentage of Na ₂ O	Not exceeding 0.6%	(e)	Maximum oil content	Not exceeding 0.3% by weight	(f)	Total carbon content	Not exceeding 0.3% by weight	(g)	Settlement	Nil (When tested as per Cl. 21.1 & 21.2 of IS:3144)	(h)	Handability	Fully handable, without any lump formation and disintegration of material	(i)	Loss of weight after	Not exceeding 5% by weight combustibility test	(a)	Thermal conductivity of the insulating material at various mean temperatures.	(b)	Retention of binder at elevated temperature
(a)	Shot content	5% by weight (max.), size of any shot not to exceed 5 mm in diameter																															
(b)	Weight gain by moisture Absorption	2% (max.)																															
(c)	Sulphur Content	Not exceeding 0.6%																															
(d)	Alkalinity as Percentage of Na ₂ O	Not exceeding 0.6%																															
(e)	Maximum oil content	Not exceeding 0.3% by weight																															
(f)	Total carbon content	Not exceeding 0.3% by weight																															
(g)	Settlement	Nil (When tested as per Cl. 21.1 & 21.2 of IS:3144)																															
(h)	Handability	Fully handable, without any lump formation and disintegration of material																															
(i)	Loss of weight after	Not exceeding 5% by weight combustibility test																															
(a)	Thermal conductivity of the insulating material at various mean temperatures.																																
(b)	Retention of binder at elevated temperature																																

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 158 of 158
(c) All other tests as per IS: 9842/8183. 4.4 The Contractor shall guarantee that if, on actual measurement, the specified maximum insulation surface temperatures are exceeded and the contractor shall either replace the insulation with a superior material or provide additional insulation thickness at no extra cost.		

CONSULTANT : PROCON ENGINEERS

1X660 MW BHUSAWAL TPP UNIT 6

COMPRESSED AIR SYSTEM

SECTION - IA

ANNEXURE - I

(SUB- VENDOR LIST)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
NOIDA-INDIA



COMPRESSED AIR SYSTEM
LIST OF MAKES OF SUB-VENDOR ITEMS

LIST OF MAKES OF SUB-VENDOR ITEMS

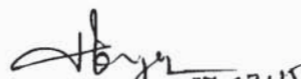

07.07.15
(Harish Kumar)
PEM-MACX



SUB VENDOR LIST & INSPECTION CATEGORISATION (ANNEXURE- II)

COMPRESSED AIR SYSTEM

SL No	Item	QP / Insp.Cat	Proposed Subvendor	Place of Manufacturer	Technical Limit	Remarks
1	AIR DRYING PLANT (HOC TYPE)	I	ACIL	BELGIUM	ROTARY DRUM	Testing at Atlas Copco Works Pune
			MELLCON	Delhi	Twin Tower type	
			DELAIR	Gurgaon	Twin Tower type	
			SUMMITS	Coimbtore	Twin Tower type	
			Shakot	Noida	Twin Tower type	
2	AIR DRYING PLANT (REFRIGERANT TYPE)	I	ACIL	BELGIUM		
			MELLCON	Delhi		
			DELAIR	Gurgaon		
			SUMMITS	Coimbtore		
			Shakot	Noida		
			Savroe	Germany		
			MTA	Italy		
			Dominic Hunter	U.K		
3	MS/GI Pipes –ERW IS 1239 / IS 3589	III	SAIL	Rourkela		1) Quantity < 200 meters Assorted sizes) 2) Material will be accepted on the basis of Main contractor COC supported by manufacturer TC as per relevant Code. In addition to above main contractor will certify availability of correlated identification marks on pipe wrt Manf TC and will also certify that pipes are free from rust
			Jindal	Ghaziabad/Hissar	upto 350NB	
			Surya Roshni	Bahadurgarh	upto 400 NB	
			Tata IS 1239 Pipes	Jamshedpur	upto 150NB	
			Maharashtra seamless IS 3589	Raigad	200 to 500 NB	
			PSL	Chennai/Vizag/Kutch/Daman	Spiral Weld SAW as per IS 3589	
			Lalit Profile	Thane	Spiral Weld SAW as per IS 3589	
			Samshi Pipes Industries	Vadodara	Spiral Weld SAW as per IS 3589	
			Mukut Pipes	Rajpura	Longitudinal SAW (Single side weld) as per IS 3589	
			Indus Tubes	G B Nagar	Upto 300 NB ERW Pipes as per IS 1239/3589	
			Mann Ind	Indore	Spiral Weld SAW as per IS 3589	
			Surendra Engg	Rajpura	Spiral Weld SAW as per IS 3589	


 07.07.15
 (Harish Kumar)

CAS SUB-VENDOR LIST.xls

SL No	Item	QP / Insp.Cat	Proposed Subvendor	Place of Manufacturer	Technical Limit	Remarks
			Pratibha Pipes & Structure Pvt Ltd	Thane	Spiral Weld SAW as per IS 3589	
			JCO Gas Pipe	Chindwara	Spiral Weld SAW as per IS 3589	
			Nukat Tanks and Vessels	Tarapur	Longitudinal SAW (Single side weld) as per IS 3589	
			DADU Pipes	Sikandrabad	Upto 300 NB ERW Pipes as per IS 1239/3589	
			Good Luck Tubes	Sikandrabad	Upto 300 NB	
			Advance Steel Tubes	Sahibabad	Upto 300 NB	
			APL APPOLO Tubes	Sikandrabad	Upto 300 NB	
			Hi Tech Pipes	Sikandrabad	Upto 300 NB	
			Ratnamani	Kutch/Ahmedabad/Chhatral	Upto 400 NB ERW Pipes as per IS 3589 and SAW as per IS 3589	
			Welspun	Anjar/Bharuch	Upto 400 NB ERW Pipes as per IS 1239/3589 and SAW as per IS 3589	
4	Forged/Formed fittings	III	EBY	Taloja		
			Siddarth & Gautam	Faridabad		
			Pipefit	Baroda		
			MS Fittings	Kolkata		
			Tube Products	Baroda		
			Bharat Forge	Pune		
			NL Hazra	Kolkata		
5	Ball Valve	I	Precision Engg	Nasik	upto 400NB 150 class	
			Microfinish Valves Ltd	Hubli		
			Weir BDK engg Industries	NEW DELHI		
			Flow chem. Industries	Ahemdabad	upto 50 NB 800 Class: 350NB 150 class	
			Audco	Chennai		
			Akay India	Hubli	upto 50NB 800 class	
			A V Valves	Agra		
			Asian Industrial valves & Instruments Ltd.	Chennai		
			ATAM Valves	Jalandhar	(1) BALL VALVES: FCS/FSS - 1/2" to 2" #800 & CCS/CSS - 2.1/2" to 4" # 150 (2) BALL VALVES: GUN METAL VALVES SIZE 15 NB TO 80 NB - UPTO PN16.0	
			GM ENGINEERING	Rajkot		
			Hawa Valves (India) Pvt. Ltd.	Navi Mumbai	Size up to 2" & #800 with MOC as FCS & FSS and for size from 65 NB to 150 NB & #150 with MOC as CCS and CSS.	


 07.07.15
 (Harish Kumar)

CAS SUB-VENDOR LIST.xls

SL No	Item	QP / Insp.Cat	Proposed Subvendor	Place of Manufacturer	Technical Limit	Remarks
			INTERVALVE (INDIA) LTD.	Pune	Steel ball Valves upto 50NB, #800 and 65NB to 150NB. #150	
			NILON VALVES PRIVATE LIMITED	Ahmedabad		
			LEADER VALVES LTD.	Jalandhar	CAST STEEL UPTO 200 MM, CLASS 150/300.	
			DEMBLA VALVES LTD.	Thane		
			SURYA VALVES AND INSTRUMENTS MFG CO.	Chennai	FOR CARBON STEEL/STAINLESS STEEL UPTO SIZE 200NB.	
			UNIFLOW	Chennai		
			VALTECH INDUSTRIES	Mumbai	FORGED CARBON & ALLOY STEEL BALL VALVES ,SCREWED TYPE BALL VALVES RATING 800 , SIZES UPTO 50 & CC& ALLOY STEEL BALL VALVES RATING 150 , SIZES 65 TO 200 FLANGED TYPE.	
			VAAS AUTOMATION	NEW DELHI		
			Belgaum Aqua Valve	Belgaum		
6	CS/FS Gate/Globe/Check valves	III	Fouress	Mumbai/ Aurangabad		
			Weir BDK	NEW DELHI		
			L & T Valves	Coimbatore/ Kancheepuram		
			Leader	Jullundhar		
			KSB	Coimbatore		
			A V Valves	Agra		
			ATAM Valves	Jalandhar	(1) Carbon Steel Gate Valves & non return valves: 15 NB to 50 NB (#800) & 65 NB to 300 NB (#150) (2) Carbon Steel Globe Valves: 15 NB to 50 NB (#800) & 65 NB to 200 NB (#150)	
			Fluidline valves	Ghaziabad		
			GM ENGINEERING	Rajkot		
			INTERVALVE (INDIA) LTD.	Pune	a) Steel Gate Valves: upto 50NB, #800 and 65NB to 150NB, #150 b) Steel Globe Valves: upto 50NB, #800 and 65NB to 100NB, #150 c) Supplier not registered for NR Valves	
			Niton Valves	Mumbai		
			NSSL Ltd.	Nagpur		
			Steel Strong valves Ltd.	Navi Mumbai		


 07.07.15
 (Harish Kumar)

CAS SUB-VENDOR LIST.xls

SL No	Item	QP / Insp.Cat	Proposed Subvendor	Place of Manufacturer	Technical Limit	Remarks
			VENUS PUMPS AND ENGG. WORKS	Kolkata	CC/CSS-GATE-BBT-upto600NB CL upto300,GATE-PSBT upto250NB CL 1500,GLV-BBT-upto300NB CL upto600,SCNRV-BBT-upto600NB CL upto150,SCNRV-BBT-upto300NB CL 300,SCNRV-PSBT-upto150NB CL upto900	
			VALTECH INDUSTRIES	Mumbai	CAST CARBON & ALLOY STEEL - VALVE/RATING/SIZE- GV/150/900,GV/300/400, GV/600/300, GV/GLV/NRV/900/250, GLV/300/300,GLV/150/350/ , SCNRV/150/700, SCNRV/300/350, SCNRV/600/250.	
			V K Valves Ltd.	Jalandhar		
			KBL	Kondhapuri		
			KBL	Kondhapuri		
7	Butterfly Valve	II	Fouress	Bangalore		
			Audco	Chennai		
			Weir BDK	NEW DELHI		
			Tyco	Halol		
			Inter Valve	Pune		
			Advance Valves	Noida		
			Fluidline valves	Ghaziabad		
			Instrumentation Ltd.	Palakkad		
			R and D Multiples (Metal Cast) Pvt. Ltd.	Mumbai		
			SURYA VALVES AND INSTRUMENTS MFG CO.	Chennai	FOR CI , CCS & CSS UPTO SIZE 750 NB.	
			PENTAIR VALVES AND CONTROLS INDIA PRIVATE LIMITED	Navi Mumbai		
			UPADHAYA VALVES MANUFACTURERS PRIVATE LIMITED,	Kolkata	MOC-Cast Iron, size from 65 NB to 350 NB having rating of PN10 as per BS EN 593.	
			VENUS PUMPS AND ENGG. WORKS	Kolkata		


 07.07.15
 (Harish Kumar)

CAS SUB-VENDOR LIST.xls

SL No	Item	QP / Insp.Cat	Proposed Subvendor	Place of Manufacturer	Technical Limit	Remarks
8	Air Receiver	I	Integrated Engineers	Mumbai		
			Diamond Fabricators	Pune		
			Parkaire	Delhi		
			Temasme Vesselex	Noida		
			United Engineering Works	Nasik		
9	Safety Relief Valve	III	LEADER	JALANDHAR		
			SPIRAX MARSHALL	PUNE		
			FISCHER SANMAR	CHENNAI		
10	Pr./Vacuum/Dp Gauges	III	Auxitrol	U.K		
			Switzer (for DP gauge)	Chennai		
			Budenburg	U.K		
			A.N.Instruments	Kolkata		
			Bells Control	Kolkata		
			Manometer India	Mumbai		
			H Guru Industries	Kolkata		
			Ashcroft India	Kalol		
			General Inst.	Mumbai/Goa		
			Gluck India	Mumbai		
			BOSE PANDA INSTRUMENTS PVT.LTD.	Kolkata		
			Forbs Marshall	Hyderabad		
			Gauge Bourdon	Mumbai		
			H Guru Instruments	Bangalore		
			Baumer Technologies	Mumbai		
11	Pr./Vacuum/DP.switch	III	Barton Inst.system	USA		* If the total Quantity is <= 10, then inspection category III. However, manufacturer TC to be submitted
			Indfoss	Ghaziabad		
			SOR	USA		
			Dressor	USA		
			Delta control	UK		
			Trafag	Ranipet		
			GiC(Gauges Bourdon)	Parvel		
			ASHCROFT INDIA PVT LTD.	USA/GERMANY		
			Switzer	Chennai		
12	Temperature Gauge	III	Budenburg	U.K		
			A.N.Instruments	Kolkata		
			Bells Control	Kolkata		
			H Guru Industries	Kolkata		
			General Inst.	Mumbai/Goa		
			H Guru Instruments	Bangalore		
			Forbs Marshall	Hyderabad		
			Goa Instruments	Goa		
			Goa Thermostatics Instruments Pvt. Ltd.	Goa		
			Gauge Bourdon	Mumbai		
			Baumer Technologies	Mumbai		

Harish
07.07.15
(Harish Kumar)

SL No	Item	QP / Insp.Cat	Proposed Subvendor	Place of Manufacturer	Technical Limit	Remarks
			Ashcroft India	Kalol		
13	Transmitters (PT, TT, DPT, LT)	II	ABB	Faridabad	PRESSURE TRANSMITTER, DP TRANSMITTER and TEMP TRANSMITTER	* If the total Quantity is <= 10, then inspection category III. However, manufacturer TC to be submitted
			Yokogawa	Bangalore		
			Emerson	Mumbai		
			(ABB) -2600T series	Faridabad/Italy		
			Pune Techrol Pvt. Ltd.	Pune	Only for capacitance Type Level Transmitter	
			SIEMENS LIMITED	Mumbai		
			SMART INSTRUMENTS LTD, BRAZIL	Mumbai	LD-301 & T-301 TRANSMITTER FROM M/S SMART EQUIPMENTS BRAZIL.	
			SBEM PVT. LTD.	Pune	Only for capacitance Type Level Transmitter	
			TOSHNIWAL INDUSTRIES PVT. LTD.,	Ajmer		
			V. AUTOMAT & INSTRUMENTS (P) LTD.	NEW DELHI	a)DISPLACEMENT TYPE TRANSMITTERS. b)PRESSURE AND DP TRANSMITTERS	
			Honeywell Automation	NEW DELHI		
			Fuji	Japan		
			NIVO CONTROLS PVT. LTD.	Indore	For Capacitance type only	
			Moore Industries International Inc.	CALIFORNIA, USA	Indian Associate - Chemtrol	
			Endress + Hauser (India) Pvt. Ltd.,	NEW DELHI	TEMP TRANSMITTER ONLY	
14	HT Motor for Air compressor	I	CGL	Mandideep	Upto 1600 KW, 6.6 KV; Upto 1310 KW, 11 KV	
			Marathon Electric	Kolkata	Upto 6.6 KV, 750 KW	
			BHEL	Bhopal		
			SIEMENS	Germany		
			Hyosung	Korea		
			Hyundai	Korea		
15	Flow Switch	III	Switzer	Chennai		
			Levecon	Kolkata		
			DK Instruments	Kolkata		
			Delta	UK		
			ITT Barton	USA		
16	Temp Sensor	III	Pyro Electric	Mumbai		
			Detriv	Mumbai		
17	Flow Indicator	III	Sigma	Mumbai		
			Eureca	Pune		
18	Auto Drain Trap	III	Pennant	Pune		
			Forbes Marshall	Pune		
19	Dew point meter	III	GE Sensing	Ireland		

07.07.15
(Harish Kumar)

SL No	Item	QP / Insp.Cat	Proposed Subvendor	Place of Manufacturer	Technical Limit	Remarks
			Michell Instruments	UK		
			XENTAUR	USA		
			Shaw	UK		
20	Flow Meter / Rota Meter	III	Trac	Hyderabad		
			Eureca	Pune	Rota Meter only	
			Flow Star Engg.	Faridabad	Rota Meter only	
			Flow Tech instruments	Vadodara	Rota Meter only	
			Instruments Engineers Pvt. Ltd.	Hyderabad	Rota Meter only	
			Scientific Devices (Bombay) Pvt. Ltd.	Mumbai	Rota Meter only	
			Emerson Process Management	singapore	Vortex Type	
			ABB Ltd.	India	Vortex Type	
			Krohne Marshall Pvt. Ltd.	India	Vortex Type	
			Endress + Hauser (I) Pvt. Ltd.	India	Vortex Type	
			Yokogawa Electric Corporation (other than high temp & h2 services)	japan	Vortex Type	
			Krohne Messtechnik GmbH & Co. Kg	Germany	Vortex Type	
21	Level Indicator/ Gauge	III	Flow Star	Faridabad		
			Scientific Devices	Mumbai		
			Gauges Bourden	Parvel		
			SBEM	Pune		
			Pune Techtrol	Pune		
			Levcon	Kolkata		
			Sigma	Mumbai		
			V-Automat	New Delhi		
22	Solenoid Valve	III	DK Instruments	Kolkata		
			HERION	GERMANY/ ITALY		
			ROTEX AUTOMATION LTD.	V V NAGAR/ BARODA		
			ASCO	CHENNAI		
			JEFFERSON	ARGENTINA		
23	Cable trays (max 300 meters)	III	AVCON	MUMBAI		
			INAR PROFILE	ANNAKAPALLI		
			ANAND UDYOG	THANE		
			MJ ENGG.	DELHI		
			INDIANA	MUMBAI		Galvanizing. At Karmatara
			TECHNO ENGG	CHANDIGARH		
			JAMUNA METAL	DELHI		


 7/7/15
 Harish Kumar

SL No	Item	QP / Insp.Cat	Proposed Subvendor	Place of Manufacturer	Technical Limit	Remarks
			INDUSTRIAL PERFORATION	KOLKATA		Galvanizing at Unistar
			VATCO	MUMBAI		Galvanizing At Sigma Mumbai
24	Cable Glands	III	SUNIL & COMPANY	KOLKATA		
			ARUP ENGG	KOLKATA		
			COMMET	MUMBAI		
			QUALITY PRECISION	KOLKATA		
25	Cable Lugs	III	DOWELLS	MUMBAI		
			CHETNA ENGG	NASIK		
			3D	VALSAD		
26	DC LEAD ACID/Ni-CD BATTERY	III	AMCO SAFT INDIA LTD	BANGALORE	Ni-Cd batteries only	
			EXIDE INDUSTRIES LTD	NEW DELHI	Lead Acid batteries only.	
			HBL POWER SYSTEMS LTD	Hyderabad	Ni/Cd and TUBULAR TYPE for Lead acid	
			HOPPECKE BATTERIEN GMBH & CO.KG,	Germany		
27	DC Battery Charger (for PLC Panel)	III	AMARA RAJA POWER SYSTEMS LIMITED	Tirupati		
			CHHABI ELECTRICALS PVT.LTD.	Jalgaon		
			CHLORIDE POWER SYSTEMS & SOLUTIONS LIMITED	Kolkata		
			DUBAS ENGG PVT LTD	BANGALORE		
			HBL POWER SYSTEMS	Hyderabad		
			JEMA ENERGY	Spain	For Static SCR Type Full Wave fully Control type	
			MASS-TECH CONTROLS PVT.LTD.	Mumbai		
			STATCON POWER CONTROLS LTD	Noida		
28	INSTRUMENT FITTINGS	III	AURA INCORPORATED	NEW DELHI		
			Astec Valves & Fittings Pvt. Ltd.,	Mumbai		
			Arya Crafts & Engineering Pvt. Ltd.	Mumbai		
			Comfit & Valve Pvt. Ltd.	Nandasan-Gujarat		
			FLUIDFIT ENGINEERS PVT. LTD.	Mumbai		
			Fluid Controls Pvt. Ltd.	Mumbai		
			HP VALVES & FITTINGS INDIA PVT. LTD.	Chennai		
			PRECISION ENGINEERING INDUSTRIES	Mumbai		
			Panam Engineers,	Mumbai		
			Perfect Instrumentation Control (India) Pvt. Ltd.	Mumbai		
			VIKAS INDUSTRIAL PRODUCTS	Noida		
29	SS Pipes	III	REMI	Mumbai		
			Ratmani	Ahmedabad		
			Apex Tubes	Behror		
			Choksi	Ahmedabad		
30	UPS	III	HITACHI-HIREL	Gandhinagar		
			APC	Bangalore		
			Delta	Gurgaon		
			Emerson	Mumbai		
			DB Power	Pune		
			Aplab	Mumbai		

Handwritten signature and date:
 27/11/15
 Harish Kumar

SL No	Item	QP / Insp.Cat	Proposed Subvendor	Place of Manufacturer	Technical Limit	Remarks
31	OWS/PC	III	HP/Compaq /Dell/HCL/IBM/Lenovo			
32	Printer	III	HP/Cannon/Epson/Xerox/IBM /Lexmark			
33	PLC Based Panels	I	SIEMENS	Nasik		
			SCHNEIDER	Nasik		
			ROCKWELL	Sahibabad		
			GE Intelligent Platform	BANGALORE		
			Honeywell Automation India Limited ,	Pune		
			ABB	Bangalore		
34	Fibre Optic Cable	III	Birta Ericsson	Rewa		
			Finolex	Pune/Goa		
			Aksh Fibre	Bhiwadi		
35	Junction Box	III	AJMERA INDUSTRIAL &	Mumbai	For galvanised & FRP Junction	
			FLEXPRO ELECTRICALS	Navsari, Gujarat	Metal type Junction boxes only	
			K.S.INSTRUMENTS	Bangalore		
			SUCHITRA INDUSTRIES	Bangalore		
			Shrenik & Company,	Ahemdabad		
36	PAINTS	III	Asian Paints (I) Ltd.	Mumbai		
			Berger Paints India Ltd	Delhi		
			Goodlass Nerolac	Mumbai		
			Jenson & Nicholson (I) Ltd	Gurgaon		
			CDC carboline (I) Ltd.	Delhi		
			Shalimar Paints Ltd.	Gurgaon		
			Addison Paints Ltd	Chennai		
			Grand Polycoat	Mumbai		
			Bombay Paints	Mumbai		
			Jotun Paints	Pune		
			Hemple Paints	Singapore		

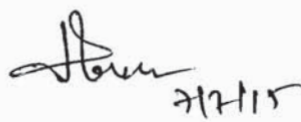
NOTES:

1) INSP CAT I : FOR THOSE ITEMS THE QUALITY PLANS ARE APPROVED BY CUSTOMER AND FINAL ACCEPTANCE WILL BE ON PHYSICAL INSPECTION WITNESS BY BHEL & CUSTOMER.

2) INSP CAT II : FOR THOSE ITEMS THE QUALITY PLANS ARE APPROVED BY CUSTOMER. HOWEVER NO PHYSICAL INSPECTION WILL BE DONE BY BHEL / CUSTOMER. THE FINAL ACCEPTANCE BY BHEL / CUSTOMER SHALL BE ON THE BASIS OF REVIEW OF DOCUMENTS AS PER QP.

3) INSP CAT III : FOR THOSE ITEMS FINAL ACCEPTANCE BY BHEL / CUSTOMER BASED ON BIDDER'S COC.

4) THE ABOVE SUB VENDOR LIST IS INDICATIVE ONLY AND IS SUBJECT TO APPROVAL/ACCEPTANCE BY CUSTOMER/BHEL . BIDDER TO PROPOSE HIS SUB VENDOR LIST WITH BACK UP DOCUMENTS (EXPERIENCE LIST, END USER CERTIFICATE AS APPLICABLE) WHICH WILL SUBJECT TO BHEL AND CUSTOMER APPROVAL DURING DETAILED ENGINEERING STAGE WITHOUT ANY TECHNICAL , COMMERCIAL AND DELIVERY IMPLICATION TO BHEL/CUSTOMER.


 7/7/15
 (Harish Kumar)

1X660 MW BHUSAWAL TPP UNIT 6

COMPRESSED AIR SYSTEM

SECTION – IA

ANNEXURE - II

(DRWG/DOC DISTRIBUTION SCHEDULE)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
NOIDA-INDIA

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 137 of 555

1.0 GENERAL

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

2.0 DESIGN COORDINATION MEETING

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

3.0 GUIDELINES FOR ENGINEERING SERVICES

- 3.1 Prior to commencement of the engineering work as part of design submissions, all aspects of design viz criteria for selection and sizing of all equipment and systems, design margins etc including that for structural steel

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 138 of 555
and civil work shall be outlined and these shall form the basis for the detailed engineering work. 3.2 Engineering work shall be performed on modern and proven concepts and internationally accepted good engineering practices but fully compatible with the Indian environments. Owner shall have the right to review and approve the engineering work by themselves and/or through consultant and ask for any clarifications and changes/modifications to the work performed by Contractor. 3.3 At any stage during the performance of assignment, the Contractor may be required to make certain changes/modification/improvements in design/drawing/other documents which are applicable to any unit of 660 MW individually or severally, which in the opinion of the Owner could result in better improved design, layout, operability, plant availability, maintainability, reliability or economy of the plant and its systems/sub-systems in view of revised and more accurate information/data available at a later date (s) or feedback (s) received during execution/operation of similar units. Such changes/modifications/improvements required could be identified by Owner and/or consultant and mutually discussed. Owner requires the Bidder to incorporate such action in the subject assignment appropriately without any additional cost liability and time implication to the Owner and same shall be within the responsibilities and scope of the Contractor. 3.4 During the course of review of detailed engineering stages, it may be essential in the opinion of Owner to obtain certain classified data for review purposes only. In case Owner so desires, the Bidder shall submit such data to Owner. 3.5 During the course of review of detailed engineering, it may be essential in Owner's opinion to obtain data and information on similar equipment and plants engineered by the Bidder. In case Owner so desires, the Bidder shall submit such data and information to the Owner. 3.6 It is not the intent to give details of every single task covered in the total engineering work to be carried out by Contractor, however, all engineering work required for the satisfactory completion of the plant/systems as		

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 139 of 555
specified shall be carried out by the Contractor. Broadly, the following are the minimum requirements in respect of scope of major items of work:		
4.6.1	Preparation, updating and finalisation of scheme drawings, control and interlock diagrams, detailed and fully dimensioned layout drawings (plant layout and equipment layout detailed plan, elevation and cross-sectional drawings at different elevations/ floor levels) covering all mechanical, electrical, C&I, civil and structural items, equipment, systems and facilities. Drawings and Schedules prepared by the Contractor from time to time, as detailed designs are developed, shall be submitted for Owner's/ Consultant's approval before the work is taken up. Revisions, corrections, additions to drawings and schedules shall not be considered to change the scope of work.	
4.6.2	Preparation of detailed technical specifications including data sheets, tender drawings and bill of material for all bought out items and also finalisation of corresponding sub-contractors.	
4.6.3	Review of sub-contractor's data, drawings, design calculations, schedules, bill of materials, instruction manuals etc. for all equipment, before forwarding them to Owner /Consultant for approval.	
4.6.4	Preparation of civil construction drawings for all equipment showing foundation details and full details regarding equipment loads, floor openings, details of embedments etc required for preparation of civil construction drawings and also as referred at relevant sections of Scope, Terminal Points & Exclusions. These documents shall be preceded by appropriate design calculations, static and dynamic analysis, as necessary.	
4.6.5	Preparation and finalisation of process piping and instrumentation diagrams and schematics, complete in all respects for all systems/packages of the power plant.	
4.6.6	Preparation of consolidated schedules and bills of materials, including line numbers, tag numbers, source of supply, service conditions, specifications, materials, types and connections details, quantities for items of the plant including dampers, steam traps, strainers, instrumentations, ducting.	
4.6.7	Sizing of all piping and equipment as per the stipulated design criteria, carrying out the flexibility analysis/dynamic analysis as necessary, hangers & support engineering.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 140 of 555
4.6.8	Final revision of all documents including preparation and compilation of Instruction Manuals for installation, commissioning, operation and maintenance for all equipment and systems. Refer clause 5.0 for the specific requirement in this regard.	
4.6.9	Certification and submission of final as-built drawings for all areas.	
4.6.10	Preparation and compilation of all drawings, schedules and instructions which may be required at site, whether separately mentioned or not.	
4.6.11	All erection and assembly drawings which may be required at site.	
4.6.12	For all bought out item packages, the Contractor shall provide complete material/ component list along with detail specification, drawings, component part number etc during detail engineering stage prior to final approval. Such approved drawing / document shall be made available at site in adequate number prior to commencement of work. Moreover, such document/ drawing shall be provided in soft form (CD).	
4.6.13	Preparation of necessary documentation, design calculations etc required for submission to statutory authorities like IBR, Chief Electric Inspector etc.	
4.0	<u>OPERATING MANUALS AND MAINTENANCE INSTRUCTIONS</u>	
4.1	The Contractor shall provide all necessary maintenance manuals and operating instructions at least six (6) months before the time of commissioning and before taking over of the plant and equipment. The instruction manual shall be submitted in the form of one (1) soft copy in CD and 15 hard copies.	
4.2	The information provided, which shall be contained in loose leaf stiff backed covers, shall include :	
4.2.1	A complete inventory of all main items of plant, with identification details.	
4.2.2	Service manuals for all plant and equipment giving full descriptions of the main items and auxiliary items such as power packs, hydraulic equipment, actuators, lubricating pumps etc.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 141 of 555
4.2.3	A separate electrical manual covering items such as switchgear, cabling, instrumentation, controls, cabling layouts and wiring diagrams.	
4.2.4	A schedule of recommendations for routine maintenance of all electrical and mechanical equipment, recommended inspection point, information on detection, cause and rectifications of troubles & faults.	
4.2.5	A lubrication schedule with all necessary drawings, diagrams to identify the lubrication points.	
4.2.6	Manufacturer's literature.	
4.3	The instruction manual shall be subject to the approval of Owner.	
4.4	The contractor shall submit the complete equipment list. The list shall be updated every three (3) months.	
5.0	<u>PLANT HANDBOOK</u> The Contractor shall submit to the Engineer, a preliminary plant handbook preferably in A-4 size sheets which shall contain the design and performance data of various plant, equipment and systems, covering the complete project including single line flow diagrams, within twenty four (24) months from the date of his acceptance of the Letter of Award. The final plant handbook complete in all respects shall be submitted by the Contractor six (6) months before start-up and commissioning activities. The plant handbook shall be submitted in the form of two (2) soft copy in CD/DVD (one to Owner and one to Consultant) and twenty five (25) hard copies in decent bound forms.	
6.0	<u>CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVAL PROCEDURE</u>	
6.1	Within fifteen (15) days of issue of Letter of Award (LOA) by the Owner, the Contractor shall furnish a schedule of drawings and design document to be submitted by him to the Owner/Engineer indicating dates against each document. The documents shall be divided into two categories:	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 142 of 555
(a) for approval and (b) for information/further engineering and co-ordination by the Owner. This document submission schedule shall require approval by the Owner/Engineer. 6.2 All contract documents shall be marked, without fail, with the name of the Owner, the Project, the specification title and number and the unit designation. All dimensions shall be in metric units. All notes, markings etc. shall be in English. 6.3 Documents/Drawings, submitted during tender stage, shall be revalidated or revised as required and submitted as certified contract document for approval/information of the Owner/Engineer. 6.4 Unless specified otherwise, the following categories of documents/drawings would require approval of the Owner/Consultant: 6.4.1 List of sub-vendors (from Owner only) 6.4.2 System scheme and instrumentation diagrams 6.4.3 Design basis justifying selection of equipment & process parameters where not specified in the Contract 6.4.4 Equipment data sheets and general arrangement drawings 6.4.5 Predicted performance curves of equipment** 6.4.6 Materials of construction 6.4.7 Layout drawings		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 143 of 555
6.4.8	Operation logic diagrams	
6.4.9	Typical control circuit	
6.4.10	Drawings of Instrumentation and Control	
6.4.11	Any deviation from contract (by Owner)	
	** For all critical equipments (boiler and turbine auxiliaries etc), submission of this data shall be mandatory for approval of equipment data sheets / GA drawings.	
6.5	Unless specified otherwise, the following categories of documents/ drawings would be treated for information/further engineering by the Owner/Engineer. The Contractor shall, however, incorporate all additional information and clarifications in these documents/ drawings as and when desired by the Owner/Engineer.	
6.5.1	Equipment foundation drawings	
6.5.2	Equipment cross-section drawings, product literature etc which are of proprietary nature	
6.5.3	Various bills of quantity, schedules etc	
6.5.4	Piping fabrication drawings, isometrics etc	
6.5.5	Panel wiring diagrams	
6.5.6	Instruction/Operation manuals	
6.5.7	Service manuals and troubleshooting guide for C & I system including field instruments	
6.5.8	Cable schedule and interconnection chart	
6.5.9	Drive/feeder wise control scheme showing all external interfaces.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 144 of 555
In essence, the Contractor is solely responsible for corrections and adequacy of design & engineering for documents under this category. 6.6 Upon review, the Owner/Engineer shall put his remarks and one of the following action stamps on the drawing/document: 6.6.1 Approved 6.6.2 Approved except as noted, forward final drawing 6.6.3 Approved except as noted, resubmission required 6.6.4 Disapproved 6.6.5 For information/reference only For action stamps in category (c) & (d), documents must be resubmitted for review by the Owner / Engineer. For action stamp in category (b), further review by Owner / Engineer would not be necessary provided the Contractor agrees & incorporates the minor comments made on the document. Except for action stamp under category (c) & (d), the Contractor can proceed with manufacturing and other sequential activities for those areas of a drawing/document which do not have any review comment by the Owner/Engineer. The Owner/Engineer may accord approval in category (c) or (d) in more than one submission of a document till he is satisfied that the intent of the specification has been fully complied with. The Contractor shall be responsible for delay in such cases and no extension of time shall ordinarily be allowed on such grounds. Approval of contract documents by the Owner/Engineer shall not relieve the Contractor of his responsibility for any errors and fulfillment of contract requirements. The Contractor's work shall be in strict accordance with the finally approved drawings and no deviation shall be permitted without written approval of the Owner/Engineer.		

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 145 of 555
6.7	Except key plan/general yard plan, any layout drawing requiring scrutiny shall not be drawn to a scale less than 1:50.	
6.8	For review by the Consulting Engineer, the Contractor shall furnish three (3) prints of each drawing. Two (2) prints of such submission shall also be sent to the Owner. After review, one (1) stamped print will be returned to the Contractor. Upon action under category (a) or (e), the Contractor shall directly distribute the documents to the various offices of the Owner and other agencies in number of copies as specified in the contract document. Such distribution copies shall be marked with the reference and date of the letter by which the Owner/Engineer has accorded his final approval. Penal action shall be taken against the Contractor for any unauthorised revision in the drawings so distributed from the drawings approved by the Owner/Engineer. The contractor shall furnish three (3) CD's of all as built/final drawings for Owner / Consultant site.	
6.9	In case of contradiction between the stipulations above and those stated elsewhere in the specification, the stipulations herein shall prevail.	
6.10	For details of documentation for Civil, Structural and Architectural works, Volume VI may be referred.	
7.0	<u>TENDER STAGE DOCUMENT SUBMISSION</u>	
8.1	The Bidder shall submit along with his bid all documents/drawings as requested in respective specifications. The documents shall include but not be limited to the following:	
8.1.1	All Bid proposal sheets duly filled up. (The data mentioned in Bid proposal sheets is minimum required only. The Bidder shall submit the additional data asked for at any later stage).	
8.1.2	Detailed experience list and financial resources of the prime bidder, his collaborators/ associates in this bid as well as the sub-vendors proposed.	
8.1.3	Scheme drawings indicating scope of supply and service as offered by the Bidder indicating clearly exclusions, if any.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 6
REV: R0	MASTER SPECIFICATIONS	Page 146 of 555
8.1.4 List of terminal points of the package offered together with quality and quantity of various input (i.e. water, air, electricity etc.) as required from the Owner at such interfaces. 8.1.5 Equipment GA, Layout, Design Calculations, interlock and other write-up, catalogues/ literature etc as required for clear understanding of the bid submitted. 8.1.6 L-1 network indicating target dates for intermediate milestones and final commissioning of equipment supplied. This network shall be supplemented by a detailed write-up on proposal procedure of project implementation, deployment schedule for Key personnel with their bio-data, schedule of construction machinery etc. 8.1.7 List of suppliers for all bought out items.		

CONSULTANT : PROCON ENGINEERS

1X660 MW BHUSAWAL TPP UNIT 6

COMPRESSED AIR SYSTEM

SECTION – IA

ANNEXURE - III

(MDL WITH SUBMISSION SCHEDULE)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
NOIDA-INDIA

MDL FOR CAS PACKAGE FOR 1X660 MW BHUSAWAL TPP UNIT 6

Section IA, Annexure III

S. N.	DRAWING NO.	DRAWING TITLE	PURPOSE	SCHEDULED SUBMISSION, DAYS FROM LOI DATE	RESUBMISSION AFTER INCORPORATING COMMENTS (IN DAYS)
1	PE-V0-415-555-A023	PG TEST PROCEDURE FOR COMPRESSED AIR SYSTEM	A-CUST	75	10
2	PE-V0-415-555-A029	SUB-VENDOR LIST WITH INSPECTION CATEGORISATION PLAN FOR COMPRESSED AIR SYSTEM	A-CUST	15	10
3	PE-V0-415-555-A002	QUALITY PLAN OF AIR DRYING PLANT FOR COMPRESSED AIR SYSTEM	A-CUST	21	10
4	PE-V0-415-555-A013	GA DRAWING OF MOTOR FOR COMPRESSED AIR SYSTEM		30	10
5	PE-V0-415-555-A020	ELECTRICAL & INTERNAL WIRING DIAGRAM FOR COMPRESSOR PANEL FOR COMPRESSED AIR SYSTEM.	A-CUST	21	10
6	PE-V0-415-555-A018	P&I DIAGRAM OF COMPRESSED AIR SYSTEM WITHIN COMPRESSOR HOUSE	A-CUST	21	10
7	PE-V0-415-555-A003	QUALITY PLAN OF AIR RECEIVER FOR COMPRESSED AIR SYSTEM	A-CUST	24	10
8	PE-V0-415-555-A011	GA DRAWING OF INSTRUMENT & SERVICE AIR COMPRESSOR	A-CUST	21	10
9	PE-V0-415-555-I003	I/O LIST OF COMPRESSED AIR SYSTEM	I-CUST	56	10
10	PE-V0-415-555-A014	GA DRAWING OF AIR RECEIVER FOR COMPRESSED AIR SYSTEM	A-CUST	25	10
11	PE-V0-415-555-A015	COMPRESSOR HOUSE LAYOUT	A-CUST	30	10
12	PE-V0-415-555-A007	TDS & CHARACTERISTIC CURVES OF MOTOR FOR COMPRESSED AIR SYSTEM		30	10
13	PE-V0-415-555-A008	TDS & GA OF VALVES FOR COMPRESSED AIR SYSTEM	A-CUST	42	10
14	PE-V0-415-555-A012	GA DRAWING OF AIR DRYER FOR COMPRESSED AIR SYSTEM	A-CUST	21	10
15	PE-V0-415-555-A017	P&I DIAGRAM OF AIR DRYER FOR COMPRESSED AIR SYSTEM	A-CUST	21	10
16	PE-V0-415-555-A010	TDS OF INSTRUMENTS FOR COMPRESSED AIR SYSTEM	A-CUST	42	10
17	PE-V0-415-555-A019	OPERATION & CONTROL PHILOSOPHY OF COMPRESSED AIR SYSTEM	A-CUST	60	10
18	PE-V0-415-555-A001	QUALITY PLAN OF AIR COMPRESSOR FOR COMPRESSED AIR SYSTEM	A-CUST	21	10
19	PE-V0-415-555-A027	QUALITY PLAN OF BROUGHT OUT ITEMS (BOI) FOR COMPRESSED AIR SYSTEM	A-CUST	42	10
20	PE-V0-415-555-A004	QUALITY PLAN OF MOTOR FOR COMPRESSED AIR SYSTEM		30	10
21	PE-V0-415-555-A006	TDS OF AIR DRYING PLANT FOR COMPRESSED AIR SYSTEM	A-CUST	21	10
22	PE-V0-415-555-A024	O&M MANUAL-COMP AIR SYSTEM	A-CUST	90	10
23	PE-V0-415-555-A016	P & I DIAGRAM OF AIR COMPRESSOR FOR COMPRESSED AIR SYSTEM	A-CUST	21	10
24	PE-V0-415-555-A005	TDS OF INSTRUMENT AIR & SERVICE AIR COMPRESSORS	A-CUST	21	10
25	PE-V0-415-555-I002	CABLE SCHEDULE FOR COMPRESSED AIR SYSTEM	I-G-P	60	10

NOTES

- The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. While some of the drawings indicated above may not be applicable, some additional drawings may also be required based on scope of work.
- Drawings shall be prepared in Auto-Cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.
- Only manual calculation with authentic supporting literature (e.g. extracts of hand Book/ standard/codes) shall be acceptable. All design calculations and drawings shall be in SI system only.
- All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.:-
 - All drawings and documents shall indicate the list of all reference drawings including general arrangement.
 - All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view; all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.
 - Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.
 - All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating all major components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.
 - Drawings/ documents to be submitted for purchasers review/ approval shall be under Revision A, B, C... etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3etc.
 - Drawings and documents not covered above but required to check safety of machines/ system, shall be submitted during detailed engineering stage without any commercial implication.
 - All drawings shall include "B.O.M" and indicate quantity, material of construction, make along with IS/BS No., Technical parameters, dimensions, hardness, machining symbol and tolerance, requirement of radiography and hydraulic tests, painting details, elevation, side view, plan, skin section and blow-up view for clarity.

- h) All drawings shall be prepared as per BHEL's title block and shall bear BHEL's drawing No.
- i) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.
- j) Bidder to follow the following the drawing submission schedule:
- k) 1st submission of drawings from date of LOI as per the submission schedule.
- l) Every revised submission incorporating comments – within 7 days.
- m) Bidder to submit revised drawings complete in all respects incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.
5. Bidder to note that during detailed engineering, drwg/doc will be submitted through web based document management system in addition to hard copies to be submitted as per drawing/document distribution schedule. Procedure for the same shall be informed after award of contract.
6. *I-G-P stands for ' internal generation purpose'.

1X660 MW BHUSAWAL TPP UNIT 6

COMPRESSED AIR SYSTEM

SECTION – IA

ANNEXURE - IV

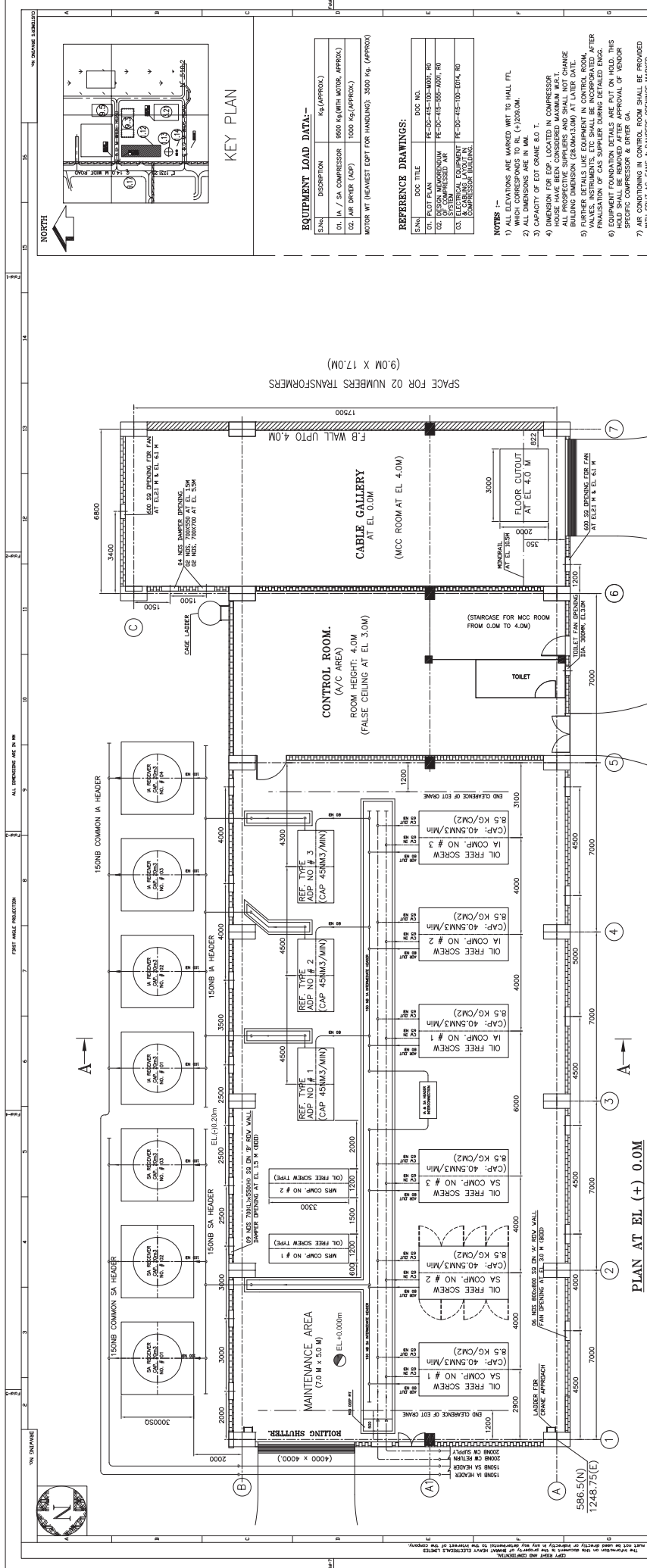
(INPUT DRAWINGS OF TENDER)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
NOIDA-INDIA

List of Drawings, for tender estimation purpose only, enclosed with the technical specification

SNO	DESCRIPTION	DRG NO
1	PLOT PLAN	PE-DG-415-100-M001
2	COMPRESSOR HOUSE LAYOUT	PE-V0-415-555-A015
3	CW / ACW SYSTEM PID	PE-DG-415-165-N001
4	PID FOR COMPRESSED AIR SYSTEM (BHEL)	PE-DG-415-555-A001
5	PROCESS FLOW DIAGRAM: CAS (CUSTOMER)	PE-189-PF-229, ISSUE P2



1X660 MW BHUSAWAL TPP UNIT 6

COMPRESSED AIR SYSTEM

SECTION – IA

ANNEXURE - V

(MANDATORY SPARES LIST)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
NOIDA-INDIA

LIST OF MANDATORY SPARES		Section IA, Annexure V
		Rev No: 0
		Date of issue: 22.02.2019
NAME OF PROJECT:		1 x 660 MW BHUSAWAL TPP UNIT 6
NAME OF PACKAGE:		COMPRESSED AIR SYSTEM
TECHNICAL SPECIFICATION:		PE-TS-415-555-A001
S. No.	DESCRIPTION	Quantity for each type of equipment / instrument
1.1	SCREW COMPRESSOR	
1.1.1	HP STAGES OF COMPRESSORS	
a	HP element	2 Sets
b	Packing set	8 Sets
c	Axial thrust bearing	4 Sets
d	Labyrinth oil seal or radial seals or double acting seals	8 Sets
e	Bearing for male & female rotors (DE & NDE)	2 Lot (02 each per Lot)
f	Timing gears	2 Nos
g	Suction & Discharge valve	2 Lot (02 each per Lot)
1.1.2	LP STAGES OF COMPRESSORS	
a	LP element	2 Sets
b	Graphitic ring shaft seals for compressor chamber or	8 Sets
c	Packing set	8 Sets
d	Axial thrust bearing	4 Sets
e	Bearing for male & female rotors (DE & NDE)	2 Lot (02 each per Lot)
f	Timing gears	2 Nos
g	Suction & Discharge valve	2 Lot (02 each per Lot)
1.1.3	Main Bearing	2 Lot (02 each per Lot)
1.1.4	Set up gear / pinoin	2 Nos
1.1.5	Air intake filter element with gaskets	16 Nos
1.1.6	Oil filter element with gasket and seals	16 Nos
1.1.7	Safety valve springs & gaskets	8 Nos
1.1.8	One set of inbuilt automatic drain valve	8 Sets
1.1.9	Gearcase breather filter element	2 Nos
1.1.10	Drain Valve Kit	2 Nos
1.1.11	COMPRESSORS COOLERS	
a	Gaskets & seals for inter cooler and after cooler	8 Nos
b	Inter cooler drain check valve	2 Nos
1.1.12	OIL PUMP / MOTOR	
a	Oil pump complete assembly	2 Nos
b	Pump impeller / rotor with shaft	2 Nos
c	Set of bearings	4 Sets
d	Oil pump motor bearing	4 Nos
1.1.13	SHAFT DRIVEN OIL PUMP	
a	Drive gear with shaft	2 Nos
b	Driven gear with shaft	2 Nos
1.1.14	Drain tap elements	8 Nos
1.1.15	Moisture tap elements	8 Nos
1.1.16	Oil cooler gaskets and seals	8 Nos
1.1.17	Seal washer	4 Nos
1.1.18	Mass flow meter	2 Nos
1.1.19	AIR DRYING PLANT	
a	Pre filter element (ceramic candle)	2 Nos
b	After filter element (ceramic candle)	2 Nos
c	Heater element (if required)	2 Nos
d	Blower bearing (if required)	2 Nos

LIST OF MANDATORY SPARES		Section IA, Annexure V
		Rev No: 0
		Date of issue: 22.02.2019
NAME OF PROJECT:		1 x 660 MW BHUSAWAL TPP UNIT 6
NAME OF PACKAGE:		COMPRESSED AIR SYSTEM
TECHNICAL SPECIFICATION:		PE-TS-415-555-A001
S. No.	DESCRIPTION	Quantity for each type of equipment / instrument
e	Blower motor bearing (if required)	2 Nos
f	Valve actuators	2 Nos
g	Inlet and outlet valve for dryers	1 Set
h	Automatic drain valve (No air loss type)	1 Set
i	Expansion valves	1 Set
j	Filter Dryer	1 Set
k	Air cooler condenser fan	1 Set
2.0.0	415V MOTORS	
(a)	Terminal plates for motors upto 30kw for each rating	1 Lot (1 no. For each type & rating of Motor)
(b)	Terminal plates for motors above 30kw for each rating	1 Lot (1 no. For each type & rating of Motor)
(c)	Heaters	1 Lot (1 set For each type & rating of Motor)
(d)	Greasing arrangements	1 Lot (1 set For each type & rating of Motor)
(e)	Motor of each type and rating	1 Lot (10% of the installed quantity or minimum 1 number whichever is higher)
(f)	Bearings (DE and NDE)	1 Lot (1 set For each type & rating of Motor)
(g)	End shield cover driving and non driving end	1 Lot (1 set For each type & rating of Motor)
(h)	Cooling fan	1 Lot (1 set For each type & rating of Motor)
(i)	Motor terminal block	1 Lot (1 set For each type & rating of Motor)
(j)	Complete set of coupling	1 Lot (1 set For each type & rating of Motor)
3.0.0	CABLES AND CONNECTORS	
a	System bus cable with connectors	1 Lot (02 nos of each type and length whichever is more)
b	I/O bus cable with connectors for remote I/O units	1 Lot (02 nos of each type and length whichever is more)
c	Fiber optic patch cords	1 10% of each type of total nos. used in the system or minimum 2 nos. of each type, whichever is more
d	Fiber optic cables	1 Lot (250 meters of each type)
e	Other cables (viz. coaxial cables UTP cables etc) as applicable	1 Lot (250 meters for each type and rating)
4.0.0 a	Power supply modules & power packs for control rating, system.	1 Lot (10% or 2 nos. of each type model and rating whichever is more)
4.0.0 b	Intelligent UPS for workstation server, PCs	1 Lot (2 no. of each size and rating)
5.0.0	Electronic modules of each type and model for control system including all type of cards like I/O cards,	1 Lot (10% or 2 nos. of each type model and rating whichever is more)
5.0.1	Function controller and control module	1 Lot (10% of each type of total nos. used in the system or minimum 2 nos. of each type, whichever is more)
5.0.2	Process I/O cards (AI, AO, DI, DO, RID/TC cards) and drive modules	1 Lot (10% of each type of total nos. used in the system or minimum 2 nos. of each type, whichever is more)
5.0.3	All other types of electronic modules like communication modules, modules for data highway,	1 Lot (10 % of each type of total nos. used in the system or minimum 2 nos. of each type, whichever is more)
5.0.4	Pulse input card	1 Lot (10% of total use or 4 nos. of each type and rating whichever is more)
5.0.5	LIU Unit	1 Lot (10% of total quantity used for each type and model or 2 no. whichever is more)
5.0.6	Trans-receiver (optical to UTP converter)	1 Lot (10% of total quantity used for each type and model or 2 no. whichever is more)
5.0.7	I/O & processor module chassis (rack)	1 Lot (1 no of each type)
5.0.8	Terminal block	1 Lot (10% of total quantity used for each type and rating)
5.0.9	Blank CD / DVD	50 Nos

LIST OF MANDATORY SPARES		Section IA, Annexure V
		Rev No: 0
		Date of issue: 22.02.2019
NAME OF PROJECT:		1 x 660 MW BHUSAWAL TPP UNIT 6
NAME OF PACKAGE:		COMPRESSED AIR SYSTEM
TECHNICAL SPECIFICATION:		PE-TS-415-555-A001
S. No.	DESCRIPTION	Quantity for each type of equipment / instrument
5.0.10	Tonner for colour laser printer	1 Lot (10 no. of each colour other than black & 20 no. of black tanner for each type of laser printer model)
5.0.11	MCBs	1 Lot (1 no of each type and rating)
5.0.12	Complete set of operator work station	1 No
6.0.0	Bus coupler / interface hard ware	1 Lot (10% or 2 nos. of each type and model whichever is more)
7.0.0	Relays, interposing relays	1 Lot (10% or 2 nos. of each type and model whichever is more)
8.0.0	PCs	1 Lot (2 no of each type & model.)
9.0.0	Batteries used for battery backup of RAMs	1 Lot (10% or 2 nos. of each type and model whichever is more)
10.0.0	Fuses	1 Lot (100% of each type and rating)
11.0.0	Cooling fan for power supply	1 Lot (10% or 2 nos. of each type and model whichever is more)
12	MEASURING INSTRUMENTS	
12.1	ELECTRONIC TRANSMITTERS	
(a)	Transmitters of all types, ranges and model no. (for the measurement of	1 Lot (10% or 2 no. of each type and model, whichever is more)
(b)	Electronic cards / PCB's for each type and model and model of transmitters	1 Lot (10% or 5 nos. of each type, whichever is more)
12.2	TEMPERATURE ELEMENTS	
(a)	RIDs of each type & length	1 Lot (10% or 2 nos. whichever is more)
(b)	Thermocouples of each type like K-type, R-type, metal etc and length	1 Lot (10% or 2 nos. whichever is more)
(c)	Thermowell for T / C & RIDs	1 Lot (10% or 1 no. of each type, rating, length used in the system whichever is more)
(d)	Process actuated switch devices Including all types of pressure, differential pressure, flow, temperature,	1 Lot (10% or 1 no. of each type and model whichever is more)
12.3	INDICATORS / RECORDERS	
(a)	Digital Indicators of each model, type & range (including relevant digital indicators of electrical	1 Lot (10% or 2 nos. min. whichever is more)
(b)	Vertical Indicators of each type & model.	1 Lot (5% or 1 no. of each model whichever is more)
(c)	Recorders for each type and model	1 Lot (5% or 1 no. whichever is more.)
(d)	Consumables for continuous recorders Charts Ink capsules	1 Lot (25 rolls per recorder/ 25 nos per recorder / 20 nos. per recorder / Ink Pads / Pens.)
(e)	Consumables for multi point recorders: (i) Charts (ii) Ink pad (iii) Print mechanism / print head assembly.	1 Lot (i) 5 nos per recorder. (ii) 5 nos per recorder. (iii) 25 rools per recorder / 25 nos per recorder / 20 nos per recorder / Ink Pads / Pens.
12.4	Level transmitters (displacer type)	
(a)	Electronic cards / PCB's of level transmitters	1 Lot (10% of total quantity used or 1 for each type/rating whichever is more)
(b)	Level transmitters	1 Lot (10% of total quantity used or 1 for each type/rating whichever is more)
(c)	Electronic water level indicator	1 Lot (10% or 2 nos. min. whichever is more)
(d)	PD type flow transmitters	1 Lot (10% of total quantity used or 1 for each type/rating whichever is more)
12.5	SWITCHES	
(a)	Switches (Pressure, DP, Level, Flow, temperature etc)	1 Lot (10% of each type of total nos. used in the system or minimum 1 no. of each type, model & range
12.6	Rotameter	1 Lot (10% of each type of total nos. used in the system or minimum 2 no. of each type, model & range
12.7	Solenoid Valve	1 Lot (10% of each type of total nos. used in the system or minimum 2 no. of each type, model & range

LIST OF MANDATORY SPARES		Section IA, Annexure V
		Rev No: 0
		Date of issue: 22.02.2019
NAME OF PROJECT:		1 x 660 MW BHUSAWAL TPP UNIT 6
NAME OF PACKAGE:		COMPRESSED AIR SYSTEM
TECHNICAL SPECIFICATION:		PE-TS-415-555-A001
S. No.	DESCRIPTION	Quantity for each type of equipment / instrument
(a)	Assembly	1 Lot (10% of total quantity used or minimum 2 no. of each type whichever is more)
(b)	Coil	1 Lot (10% of total quantity used or 5 no. whichever is more)
12.8	E/P Converter	1 Lot (10% of each type of total nos. used in the system or minimum 2 no. of each type, model & range
13	PROCESS CONNECTION PIPING (for impulse plpmg /tubing, sampling piping/ tubing	
13.1	Valves of all types and models	1 Lot (10% or 2 no. of each type, class, size and model whichever is more.)
13.2	2 way, 3way, Sway valve manifolds	1 Lot (10% or 2 no. of each type, class size and model whichever is more.)
13.3	Fittings	1 Lot (10 nos. of each type)
13.4	Purge meters	1 Lot (10 % of each model or 2 Nos. whichever is more)
13.5	Filter regulators	1 Lot (10% of each model or 2 Nos. whichever is more)
13.6	Impulse pipe & tubing of all type	1 Lot (20 mtrs each type & size)
13.7	Impulse line root valve	1 Lot (10% of total quantity used or 4 no. whichever is more for each type and rating of each size)
13.8	SS tube	1 Lot (40 mtrs of each type/ size)
13.9	Fitting for SS tube	1 Lot (40 nos of each type/ size)
14	INSTRUMENTATION CABLE, INTERNAL WIRING AND ELECTRICAL FIELD	
14.1	Pre fabricated cable of each type	1 Lot (10% of installed quantity)
14.2	Pre fabricated cable connector	1 Lot (10% or 1no. of each type and model whichever is more.)
14.3	Other cables	1 Lot (10% of each type, pair and size of actual installed quantity)
15	ELECTRICAL ACTUATORS	
15.1	Actuators	1 Lot (10% or 1 no. of each type, model and rating, whichever is more.)
15.2	Power unit for modulating actuator	1 Lot (10% or 2 nos. of each type, whichever is more.)
15.3	DC-DC unit/power pack units	1 Lot (10% or 2 nos. of each type, whichever is more.)
15.4	Electronic cards	1 Lot (10% or 5 nos. of each type, whichever is more)
15.5	Brake assembly	1 Lot (10% or 2 nos. of each type, whichever is more .)
15.6	Brake coils	1 Lot (10% or 2 nos. of each type whichever is more.)
15.7	Position feed back transmitters	1 Lot (10% or 2 nos. of each type whichever is more.)
15.8	Control Unit	1 Lot (10% or 2 nos. of each type whichever is more.)
15.9	Torque and limit switch assembly of each unit	1 Lot (10% or 2 nos. of each type whichever is more.)
15.10	O-ring	1 Set of each size
15.11	Motor	1 No. of each type & rating
15.12	Auxiliary contact	1 Lot (10% of total quantity used or 2 nos. whichever is more for each type and rating of each size)
15.13	Seal Kit	1 Set of each type & size
16.00	Microprocessor / PLC system integrated with Compressor panel.	1 Complete set.

LIST OF MANDATORY SPARES		Section IA, Annexure V
		Rev No: 0
		Date of issue: 22.02.2019
NAME OF PROJECT:		1 x 660 MW BHUSAWAL TPP UNIT 6
NAME OF PACKAGE:		COMPRESSED AIR SYSTEM
TECHNICAL SPECIFICATION:		PE-TS-415-555-A001
S. No.	DESCRIPTION	Quantity for each type of equipment / instrument

Note:

i) Mandatory spares listed above is bare minimum requirement. In case any additional mandatory spares requirement is covered elsewhere in the tender specification apart from specified above, same shall be deemed to have been covered in bidders scope of supply.

ii) Wherever the quantity is mentioned as percentage, it shall mean percentage of total population of that item in package/system unless specified otherwise, and the fraction will be rounded off to the next higher whole number.

iii) Wherever set is mentioned, one set of the spares of that item shall be for complete replacement of that particular item for one equipment.

iv) Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item.

v) BHEL reserves the right to buy any or all the mandatory spares parts.

1X660 MW BHUSAWAL TPP UNIT 6

COMPRESSED AIR SYSTEM

SECTION – IA

ANNEXURE - VI

(COOLING WATER ANALYSIS)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
NOIDA-INDIA

COOLING WATER ANALYSIS			
<u>SR. NO.</u>	<u>PARAMETERS</u>	<u>UNITS</u>	<u>VALUES</u>
1.0	pH		8.0 – 8.5
2.0	Temperature	°C	22 - 30
3.0	Conductivity	µS/cm	6500
4.0	Colour	Hazen Units	Not Available
5.0	Odour		Not Available
6.0	Taste		Not Available
7.0	TDS	ppm	4350
8.0	P-Alkalinity as CaCO ₃	ppm	Nil
9.0	M-Alkalinity as CaCO ₃	ppm	2000
10.0	T – Alkalinity as CaCO ₃	ppm	2000
11.0	Organic Matter as KMnO ₄	ppm	50
12.0	Iron (as Fe)	ppm	1
13.0	Turbidity (NTU)	ppm	40
14.0	CATIONS		
	(a) Ca as CaCO ₃	ppm	1475
	(b) Mg as CaCO ₃	ppm	385
	(c) Na as CaCO ₃	ppm	1015

<u>SR. NO.</u>	<u>PARAMETERS</u>	<u>UNITS</u>	<u>VALUES</u>
	(d) K as CaCO ₃	ppm	50
	Total Cation	ppm	2925
15.0	ANIONS		
	(a) HCO ₃ as CaCO ₃	ppm	2000
	(b) Chlorides	ppm	745
	(c) SO ₄ as CaCO ₃	ppm	165
	(d) Fluoride as CaCO ₃	ppm	5
	(e) Nitrate as NO ₃	ppm	10
	Total Anion	ppm	2925
16.0	Ammonia	ppm	Absent - Traces
17.0	Silica Colloidal (as SiO ₂)	ppm	< 1 (can be present in summer)
18.0	Silica Non - Colloidal (as SiO ₂)	ppm	180
19.0	Free Chlorine	ppm	Nil
20.0	Total Suspended Solids	ppm	25
21.0	Carbonates as CaCO ₃	ppm	Not Available
22.0	Boron	ppm	Not Available
23.0	Oil & Grease	ppm	Not Available



**1X660 MW BHUSAWAL TPP # 6
COMPRESSED AIR SYSTEM
TECHNICAL SPECIFICATION
(ELECTRICAL PORTION)**

SPECIFICATION No: PE-TS-415-555-A001

SECTION : IB

REV. 01

DATE: 30.01.2020

SHEET: 1 OF 1

**SECTION: IB
TECHNICAL SPECIFICATION (ELECTRICAL PORTION)**



TITLE : ELECTRICAL EQUIPMENT SPECIFICATION FOR COMPRESSED AIR SYSTEM 1 X 660MW BHUSAWAL TPS UNIT-6	SPECIFICATION NO.
	VOLUME NO. : II-B
	SECTION : I
	REV NO. : 00 DATE :
	SHEET : 1 OF 2

1.0 **EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:**

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for Compressed Air system.
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “ both end equipment in vendor’s scope”shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.
- k) Technical requirements shall be as per specifications listed in Clause 4.1, 4.2, 4.3, 4.4,4.5, 4.6, 4.7, 4.8 & 4.9 below.

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

Refer “Electrical Scope between BHEL and Vendor”.

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

- 3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.
- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc. is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 **List of enclosures:**

- 4.1) Electrical scope between BHEL & vendor (Annexure –I)
- 4.2) Electrical Load data format (Annexure –II)
- 4.3) BHEL cable listing format and guidelines for cable listing (Annexure –III)
- 4.4) Sub vendor list for motors (Annexure-IV)

बीएसईएल 	TITLE : ELECTRICAL EQUIPMENT SPECIFICATION FOR COMPRESSED AIR SYSTEM 1 X 660MW BHUSAVAL TPS UNIT-6	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION : I
		REV NO. : 00 DATE :
		SHEET : 2 OF 2
4.5) Datasheet of motors 4.6) Quality plan of motors 4.7) Technical specification for motors 4.8) Technical specification for LT switchgear 4.9) Technical specification for cabling		

225 of 527