

SUB-SECTION– E-05

LOW PRESSURE PIPING

LOW PRESSURE PIPING/STATION PIPING

PIPES, FITTINGS, BENDS, VALVES, COATING-WRAPPING, STRAINERS EXPANSION, JOINTS, TANKS, FASTENERS, LINING ETC.

| | Tests/Check Items / Components | Material Test | DPT/MPI / RT | Ultrasonic Test | WPS/ WQS/PQR | Hydraulic / Water Fill Test | Pneumatic Test | Assembly Fit up | Dimensions | Functional/operational Test | Other Tests | All Tests as per relevant Std | REMARKS |
|--|--|----------------|-----------------|-----------------|--------------|---|----------------|-----------------|------------|-----------------------------|-----------------------|-------------------------------|--------------------------|
| | | | | | | | | | | | | | |
| 1 | Pipes & Pipe Fittings | Y ^a | Y ^b | | | Y ¹ | | | Y | | | Y | |
| 2 | Diaphragm Valves | Y ^a | | | | Y ⁵ | | | Y | | Y ⁶ | | |
| 3A | Cast Butterfly Valves (Low Pressure) | | | | | Y | | Y | Y | Y | Y ⁷ | | |
| | Body | Y ^a | Y ^b | | | | | | | | | | |
| | Disc | Y ^a | Y ^b | | | | | | | | | | |
| | Shaft | Y ^a | Y | Y ^c | | | | | | | | | |
| 3B | Fabricated Butterfly Valves | REFER NOTE 14 | | | | | | | | | | | |
| 4 | Gate/ Globe/Swing Check / Ball Valves | Y ^a | Y ^b | Y ^c | | Y ⁵ | Y | Y | Y | Y | Y ⁸ | | |
| 5 | Dual Plate Check Valves | Y ^a | Y ^b | Y ^c | | Y | Y | Y | Y | Y | Y ⁴ | | |
| 6 | Rolled & Welded Pipes and Mitre Bends | Y ^a | Y ³ | | Y | Y ³ | | | Y | | Y ^{3&15} | Y | |
| 7 | Coating & Wrapping of Pipes | Y ² | | | | | | | | | Y ² | | |
| 8 | Tanks & Vessels | Y ^a | Y ^b | | Y | Y | | | Y | | Y ¹⁶ | | |
| 9 | Strainers | Y ^a | Y ^b | | Y # | Y | | | | | Y ¹¹ | | #For Fabricated Strainer |
| 10 | Rubber Expansion Joints | Y ^a | | | | Y ¹² | | Y | Y | | Y ¹³ | | |
| 11 | Internal Lining of Pipes | Y ^a | | | | | | | Y | | Y ⁹ | | |
| 12 | Site Welding | | Y ¹⁰ | | Y | Y | | | | | | | |
| NOTES (MEANING OF SUPERSCRIPTS) | | | | | | | | | | | | | |
| a | One per heat/heat treatment batch/lot. | | | | | | | | | | | | |
| b | On machined surfaces only for castings and on butt welds. | | | | | | | | | | | | |
| c | For shaft/spindles > or = 40 mm | | | | | | | | | | | | |
| 1 | 100% Hydraulic test shall be carried out. Weld joints not subjected to hydraulic test due to some unavoidable reasons, shall be subjected to 100% RT/PAUT. | | | | | | | | | | | | |
| 2 | Spark Test, Adhesion Test and Material Test for primer and enameled & Coal Tar Tapes as per AWWA-C-203-91/ IS-10221 & IS 15337 as applicable. | | | | | | | | | | | | |
| 3 | Followings are the testing requirements for fabrication of pipes at site | | | | | | | | | | | | |
| | TESTS | | | | | QUANTUM OF CHECKS | | | | | | | |
| | WPS, PQR, Welder Qualification Test | | | | | 100% Welders and WPS shall be qualified as per ASME- section IX | | | | | | | |
| | DPT on root run | | | | | 100% for pipes up to 1200 mm diameter | | | | | | | |
| | DPT after back gauging | | | | | 100% for pipes above 1200 mm diameter | | | | | | | |
| | RT / UT by (TOFD/PAUT) Technique | | | | | 5% (100% of T Joints) | | | | | | | |

LOW PRESSURE PIPING/STATION PIPING


| | | |
|----|---|--|
| | DPT on finished butt weld joints | 10% |
| | Hydraulic Test | 100%, 1.5 times the design pressure or 2 times the working-pressure whichever is higher. |
| 4 | Dry Cycle Test on Dual Plate Check valve spring for one lakh Cycles shall be carried out as a type test. If Dry Cycle test carried out earlier for same material & diameter, Test report shall be reviewed. | |
| 5 | Seat Leakage Test for Actuator Operated Valves, shall be done with by closing the valves with actuator. | |
| 6 | Tests on rubber parts shall be conducted per batch of rubber mix for tensile, Elongation, hardness, adhesion, spark test, bleed resistance test. In addition, type test for 50,000 cycles of each type of diaphragm shall also be conducted. | |
| 7 | Hydraulic Test of Body, Seat and disc-strength shall be carried out in accordance with governing design standard in presence of owner / owner's representatives. Actuator operated valves shall be checked for Seat Leakage by closing the valves with actuator. For Proof of Design Test refer respective chapters of engineering portion in the technical specification. | |
| 8 | Blue matching, wear travel for gates, valves, pneumatic seat leakage, and 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. Fire safe test for ball valve shall be done wherever specified. In case of already carried out, the test report shall be submitted for review and acceptance by owner / owner's representatives. Valves shall be offered for hydro test in unpainted condition. | |
| 9 | Tensile, Elongation, Hardness, Specific Gravity, Lining Thickness, Humidity Check, Pipe temperature check, Adhesion Test and Holiday Detection Test etc as per applicable standard shall be done for all lining material and application. | |
| 10 | 10% of welds (Root and finished welds) shall be subjected to DPT. (100% DPT for compressed air line and boiler & deaerator fill line.). | |
| 11 | Pressure drop across the strainer for each type and size as a special test shall be carried out. In case of already carried out, the test report shall be submitted for review and acceptance by owner / owner's representatives. | |
| 12 | During hydraulic and vacuum tests at 25mm 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%. | |
| 13 | Tests on rubber for tensile, elongation, hardness, hydraulic stability check as per ASTM D 471, ozone resistance test as per ASTM D 1149/IS 3400 Part 20 aging test and adhesion strength of rubber to fabric, rubber to metal adhesion shall be carried out. | |
| 14 | In addition of all tests as indicated for Cast Butterfly valve being applicable for fabricated butterfly valves, following test shall be done for Fabricated Butterfly Valve: <ol style="list-style-type: none"> UT as per ASTM A-435/IS 11630 & IS 4225 on plate material for body and disc shall be carried out for plate thickness 25mm and above. 100% RT and DPT as per ASTM, Section-VIII, Division-I, on butt joins of body and disc. 10% DPT on other welds shall be done. Post weld heat treatment as per ASME, Section-VIII, Division-I on butt joints of body and disc. Welders and WPS shall be qualified as per ASME- section IX | |
| 15 | Maximum number of segments in segmental flanges shall be four (04) only. All butt weld joints in the segmental flanges shall be examined by RT/UT. Segmental flanges exceeding 37.5 mm thickness shall be stress relieved as per norms of ASME Section VIII after welding. | |
| 16 | For pressure vessel welds RT shall be done as per design code requirements. | |


All Valves shall be offered for inspection in unpainted condition.


No repair welding is permitted on Cast Iron / Alloy Cast Iron Castings.


SUB-SECTION– E-08

STEAM TURBINE & AUXILIARIES


| CLAUSE NO. | QUALITY ASSURANCE  | | |
|--|--|---|-----------------|
| 1.00.00 | STEAM TURBINE & INTEGRAL AUXILIARIES | | |
| | GENERAL REQUIREMENTS | | |
| | <p>Refer QA & I portion of General Technical conditions of technical specification.</p> <p>(a) Shop Tests</p> <p>Shop tests shall include all tests to be carried out at Contractor's works, at works of his sub-contractor and at works where raw material is manufactured for equipment. Testing requirement of major equipment over and above the respective code/standard requirements are given for ST & Aux. including Condenser, HP Bypass System & Vibration Isolating System.</p> <p>(b) Site Tests</p> <p>The Contractor shall prepare and submit detailed field quality plans in the format prescribed by NTPC setting out the quality practice and procedures to be adopted by him for assuring quality for each equipment of material at this specification from the receipt of material at site, during storage erection, pre-commissioning to final commissioning of the plant. However, the bidder may furnish the quality plans in his standard formats provided such quality plans contain the details required as per format enclosed as Annexure-II. These procedures shall necessarily include all checks/tests conducted at site for preservation, assembly, alignment, positioning of the equipment, foundation preparation, welding/bolting heat treatment, non-destructive examination, hydraulic test, running test, performance test etc. The Contractor shall also furnish detailed quality procedure proposed by him for storage, preservation, painting, acid cleaning, alkali boil out, steam blowing, hydraulic test air/gas tightness test etc. to the Employer. The same shall be discussed and finalised with the Employer and six numbers of such finalised copies shall be submitted.</p> | | |
| 1.01.00 | STEAM TURBINE AND ASSOCIATED EQUIPMENT | | |
| 1.01.01 | <p>High Pressure Cast Steel Enclosures:</p> <p>High pressure Cast Steel Enclosures (for example High pressure and Intermediate Pressure Inner and Outer Cylinders, Steam Chests and liner, Steam Inlet Pipes, nozzle boxes etc.).</p> <p>(1) Test pieces fully representative of the material and condition of the casting shall be made available at OEMs works to enable the properties of material to be determined.</p> | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES | Page 1 of 26 |


| CLAUSE NO. | QUALITY ASSURANCE  | | |
|--|--|--|-----------------|
| | <p>Creep requirements:</p> <ul style="list-style-type: none"> a) Steels chosen for design metal temperatures less than 400°C are exempt from creep /stress rupture testing. b) Steels chosen for design metal temperatures between 400°C to 540°C AND having less than 3% chromium, shall require 5 years performance feed back experience in the absence of which, creep rupture test will be required to be carried out for maximum test duration of 1000 hrs/mutually agreed parameters for NTPC approval. c) Steels chosen for design metal temperatures above 540°C AND/OR having more than 3% chromium, shall require 10 years performance feed back experience OR adequate stress rupture data, in the absence of which, creep rupture test will be required to be carried out for maximum test duration of 1000 hrs/mutually agreed parameters for NTPC approval. d) Unspecified alloying elements shall be controlled as per the applicable standard. <ul style="list-style-type: none"> (2) Each casting shall be subjected to magnetic particle examination on the entire inner and outer surfaces after heat treatment. (3) Each casting shall be subjected to a 100% examination for internal flaws by ultrasonic/ radiographic method after heat treatment and suitable preparation. (4) Cast enclosure shall be subjected to a hydraulic pressure test based on established practice of manufacturer unless there is a geometrical constraint for doing hydro test. Bidder to furnish their practice in this regard for Employer's approval. (5) Excavated area of all the defects shall be subjected to MPI/DPI to ensure excavation up to sound area. All the areas repaired/upgraded by welding shall be examined by UT, RT (where UT results cannot be analyzed correctly) and MPI. Sketches/reports of location of repair and reports of NDT carried out on repaired areas shall be submitted along with certificates. Hardness survey shall be carried out on the repaired area. (6) Where stub pipes and transition pieces are welded to the main body of an enclosure the following shall be carried out: <ul style="list-style-type: none"> (i) Radiographic examination or Ultrasonic testing and Magnetic particle or dye penetrant examination of weld preparation. | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES | Page 2 of 26 |


| CLAUSE NO. | QUALITY ASSURANCE  | | | |
|--|---|---|--|---|
| 1.01.02 | <div> <div>(ii) Magnetic particle examination of finished welds after stress relief.</div> <div>(iii) Radiographic or ultrasonic examination of finished welds.</div> <div>(iv) Before despatch to site, the site weld preparations on the stub pipes and transition pieces shall be subjected to 100% RT/UT and magnetic particle examination / Dye penetration test.</div> <div>(v) Hardness survey on the weld joint, HAZ and parent material.</div> <div>(7) Wall thickness measurement by ultrasonic for critical and highly stressed zones of the casting shall be carried out.</div> <div>(8) Colour matching of castings by putting two halves together or feeler gauge tightness check from outside to ensure required contact area and joint tightness shall be carried out.</div> </div> | | | |
| | <div> <div>Low Pressure Enclosure (Fabricated)</div> <div> <div>(a) Where welds are made by chipping and grinding back to the first side weld before completing the weld from second side, a magnetic particle or dye penetrant examination of the chipped area shall be carried out.</div> <div>(b) Bidder to furnish their practice regarding stress relieving of the fabricated enclosures for Employer's approval.</div> <div>(c) Bidder to furnish their standard practice regarding NDT on welds for Employer's approval, however following are minimum NDT requirements:</div> <div> <div>Butt welds10% RT or UT and 10% MPE/DP test</div> <div>Fillet welds10% MPE/DPT</div> <div>Nozzle welds10% MPE/DPT</div> <div>Lifting lug & other load bearing fillet welds100% MPE/DPT</div> <div>Site weld edge preparations10% MPE/DPT</div> </div> <div>(d) Bidder to furnish his proven practice for hydraulic pressure tests. If it is not their practice, the justification for not carrying out hydraulic test shall be furnished for Employer's approval.</div> </div> </div> | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES Page 3 of 26 |


| CLAUSE NO. | QUALITY ASSURANCE  | | |
|--|---|--|-----------------|
| 1.01.03 | <p>(e) Feeler gauge tightness check from inside and outside to ensure required joint tightness shall be carried out.</p> <p>Rotors</p> <p>(a) Forgings</p> <p>Rotor forgings (monoblock and/or discs), Impulse Wheel & Nozzle Box and coupling forgings :</p> <p>(1) Fully representative tangential or radial test pieces shall be provided at each end of the body, at each shaft end and radial test piece from the trepanned core (when a core is trepanned) respectively to determine mechanical properties including impact, brinell hardness etc. and tests for notch toughness i.e. FATT (both transition temperature and room temperature impact values).</p> <p>(2) Creep requirements:</p> <p>a) Steels chosen for design metal temperatures less than 400°C are exempt from creep /stress rupture testing.</p> <p>b) Steels chosen for design metal temperatures between 400°C to 540°C AND having less than 3% chromium, shall require 5 years performance feed back experience in the absence of which, creep rupture test will be required to be carried out for maximum test duration of 1000 hrs/mutually agreed parameters for NTPC approval.</p> <p>c) Steels chosen for design metal temperatures above 540°C AND/OR having more than 3% chromium, shall require 10 years performance feed back experience OR adequate stress rupture data, in the absence of which, creep rupture test will be required to be carried out for maximum test duration of 1000 hrs/mutually agreed parameters for NTPC approval.</p> <p>d) Unspecified alloying elements shall be controlled as per the applicable standard.</p> <p>(3) Heat treatment should be carried out in such a way so as to ensure minimum residual stress in the rotor. Residual stress measurement will be carried out.</p> <p>(4) Each forging shall be subjected to a 100% ultrasonic examination. Normal probes and angular probes with different probe angles shall be used for thorough examination to ensure complete soundness of the forging.</p> | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES | Page 4 of 26 |


| CLAUSE NO. | QUALITY ASSURANCE | | | <div>एनटीपीसी NTPC</div> |
|--|--|---|--|------------------------------|
| | <p>Supplier should furnish the proposal, alongwith scanning plan and probe angles to be used, for Employer's approval.</p> <p>(5) When a rotor forging is bored, a visual and magnetic particle examination of the bore shall be carried out.</p> <p>(6) Thermal stability tests shall be carried out on HP and IP rotor forgings to ensure the thermal stability of the rotors in service and at over speed.</p> <p>(7) Following tests shall be carried out on the rotor welds:</p> <p>(i) Ultrasonic examination with normal and angular probes of the weld to ensure complete coverage and freedom from harmful defects.</p> <p>(ii) Run out of rotor before and after welding</p> <p>(iii) MPE on finish welds.</p> <p>(iv) Hardness survey on the welds.</p> <p>(v) Stress relieve annealing.</p> <p>(vi) Test reports of filler material used.</p> <p>(vii) Dimensional record of weld preparation.</p> <p>(8) Dimensional Examination of the rotor blade grooves and other important dimensions to be carried out to ensure the conformance to drawing dimensions, Log sheets/records shall be prepared for all important dimensions.</p> <p>(b) Complete Rotors</p> <p>(1) Axial & radial run-outs and surface finish checks shall be carried out before and after blading and after over speed tests.</p> <p>(2) Check for clearance between rotor groove and blade at the root in line with manufacturer's standard and proven practice being followed.</p> <p>(3) Rotors shall be dynamically balanced at rated speed.</p> <p>(4) An over speed test shall be carried out during which the rotor shall withstand an over speed of 125% for two continuous minutes. If bidder's practice is different from as stated above, then same shall be furnished to Employer's</p> | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES | Page 5 of 26 |


| CLAUSE NO. | QUALITY ASSURANCE  | | | |
|--|--|---|--|---|
| 1.01.04 | <p>approval. During this test vibration measurement and analysis shall be carried out.</p> <p>(5) After blading, rotor stages with free standing blades over 225 mm of active length are to be given standing vibration tests to determine natural frequencies in various vibration modes to ensure that the ranges are outside operating frequencies and to check correct fitment of blades. The modes to be tested are: Bucket group tangentials, wheel axials and group axials.</p> <p>(6) In case, impulse stage and or blade discs are fitted on the rotor, fit up between such disc and rotor to be checked up before and after over speed.</p> <p>(7) Lock blade lift after the over speed, if applicable based on manufacturer's standard design & practice shall be checked and record for same shall be maintained.</p> | | | |
| | <p>Stator & Rotor Blades and Shroud Bands</p> <p>(a) Fully representative test pieces shall be made available at OEMs works to enable mechanical properties of the material to be determined. In case of blades machined from bar stock, mechanical tests shall be carried out on the hardest and softest specimens of each heat treatment batch. Hardness test will be carried out on 100% basis.</p> <p>(b) Creep requirements shall be similar as applicable for High Pressure cast steel enclosures.</p> <p>(c) Each bar stock for machining blades and forging shall be subjected to 100% ultrasonic examination.</p> <p>(d) When erosion shielded, the erosion shield and blade joint shall be radiographed. In case of flame and laser hardening MPI shall be done.</p> <p>(e) Dye penetrant checks shall be made on the erosion shield and blade joint in manufacture prior to fitting to the wheel and after over speed tests.</p> <p>(f) Magnetic particle inspection or dye-penetrant examination (when MPI is not applicable) shall be carried out on finish machined blade profile, roots and shrouds.</p> <p>(g) All moving blades of over 225mm active length are to be moment weighed and assembled on shaft in a prescribed sequence to ensure optimum balancing of rotor.</p> | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES Page 6 of 26 |


| CLAUSE NO. | QUALITY ASSURANCE  | | | |
|---|---|--|--|---|
| 1.01.05 | <p>(h) Natural frequencies of the L.P Turbine blades shall be determined before mounting on rotors to ensure that the same are outside operating frequency range.</p> <p>(i) Shroud bands after punching and after riveting shall be subjected to 100% DPT to ensure freedom from harmful surface defects.</p> <p>(j) In case of cast blades, following testing shall be done:-</p> <ol style="list-style-type: none"> (1) Chemical analysis/Mechanical testing per heat/heat treatment batch. (2) Rough machined/finish machined blade surface shall be subjected to MPI/DPT respectively. (3) -RT/UT on blades as per supplier standard practice. (4) Before starting mass productions, following technological tests shall be carried out on the first lot of 10 to 15 blades:- <ol style="list-style-type: none"> (i) 100% radiography and 100% MPI on blades (ii) 100% hardness testing. (iii) Mechanical testing and metallurgical testing. (iv) Weld repair shall not be permitted unless prior approval of Employer is obtained. <p>In case of repair is allowed, manufacturer shall submit WPS/PQR and defectogram for Employer's approval before welding. After weld repair, RT shall be carried out on repaired area.</p> | | | |
| | <p>Diaphragms</p> <p>(a) Welded and fabricated Diaphragms</p> <ol style="list-style-type: none"> (1) Concentricity checks shall be carried out on finally machined diaphragms to ensure that there are no negative overlaps between guide and moving blades. (2) 10% Ultrasonic examination and 10% magnetic particle examination / dye penetration examination shall be carried out on finished, stress relieved and machined welds <p>(b) Cast/Forged/Machined Diaphragms</p> <ol style="list-style-type: none"> (1) Details of the results of the tests conducted to determine mechanical properties together with chemical analysis, metallographic/ metallurgical examination, and heat | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES <p>Page 7 of 26</p> |


| CLAUSE NO. | QUALITY ASSURANCE  | | | |
|--|---|--|-----------------|--|
| 1.01.06 | <p>treatment procedures recommended and actually followed shall be recorded on certificates.</p> <p>(2) Concentricity, flatness, blade drop and area checks shall be carried out on finally machined diaphragms to ensure that there are no negative overlaps between guide and moving blades and port wall. Finish shall be to Project Manager's approval.</p> <p>(3) A 100% ultrasonic examination shall be carried out on diaphragm materials. Blade junction areas with the side walls shall be checked by magnetic particle or dye penetrant testing.</p> <p>(c) Colour matching of all the diaphragms by putting two halves together or feeler gauge tightness check shall be carried out.</p> <p>Stop, Control and bypass valves, actuators/servo-motors and steam strainers</p> <p>(a) Test pieces shall be made available at OEMs works to enable the mechanical properties of valve bodies, bonnets, valve disc and seat, and valve spindle material to be determined.</p> <p>Test Creep requirements:</p> <p>i. Steels chosen for design metal temperatures less than 400°C are exempt from creep /stress rupture testing.</p> <p>ii. Steels chosen for design metal temperatures between 400°C to 540°C AND having less than 3% chromium, shall require 5 years performance feed back experience in the absence of which, creep rupture test will be required to be carried out for maximum test duration of 1000 hrs/ mutually agreed parameters for NTPC approval.</p> <p>iii. Steels chosen for design metal temperatures above 540°C AND/OR having more than 3% chromium, shall require 10 years performance feed back experience OR adequate stress rupture data, in the absence of which, creep rupture test will be required to be carried out for maximum test duration of 1000 hrs/mutually agreed parameters for NTPC approval.</p> <p>Unspecified alloying elements shall be controlled as per the applicable standard.</p> <p>(b) Dye penetrant checks shall be carried out on stellited components in finish ground or honed condition. For nitrided areas DPT will be carried out in case of doubt during visual inspection. Hardness</p> | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES | Page 8 of 26 | |


| CLAUSE NO. | QUALITY ASSURANCE | | |  |
|--|---|---|--|---|
| 1.01.07 | <p>check shall be carried out to ensure required hardness on test sample.</p> <p>(c) Valve body and bonnet castings/forgings shall be subjected to 100% radiography or 100% ultrasonic examination. Body and bonnet shall also be subjected to 100% magnetic particle examination on entire surface. All pressure containing welds in body and bonnet shall be subjected to 100% RT/UT and MPI examination.</p> <p>(d) Wall thickness of the body and bonnet after finish machining shall be measured by ultrasonic method and valve seat bore shall be checked for size and concentricity.</p> <p>(e) Bar stock for valve stem shall be subjected to ultrasonic examination and finish machined stem shall be subjected to magnetic particle/Dye penetrant examination.</p> <p>(f) Each valve body and bonnet shall be hydraulically tested at minimum 1.5 times the maximum working pressure after applying temperature corrections.</p> <p>(g) All the actuating cylinders/servomotors shall be performance tested.</p> <p>(h) Performance testing shall be carried out on valve operators/actuators to check functional requirements like trip closing and opening time, valve lift and hysteresis.</p> <p>(i) Colour matching of the valve disc and seat to ensure the required contact area is to be carried out.</p> | | | |
| | <p>Cast and Forged Steel Components such as LP casing, in case of cast design, inlet & extraction/exhaust connections, shaft seal covers and rings, governor shaft, breach nut, threaded ring, angle ring, U-ring, servomotor parts such as body, piston, cover, yokes; turning gear casing and other items which are not specifically covered elsewhere</p> <p>(a) Results of tests conducted to determine mechanical properties, chemical analysis, metallurgical/ metallographic examination for nodular cast iron, if any and heat treatment procedures recommended and actually followed shall be recorded on certificates.</p> <p>(b) Each pressure containing enclosure shall be subjected to a hydraulic pressure test at 1.5 times the design pressure.</p> <p>(c) Each casting/forging shall be subjected to suitable non-destructive examination by Radiographic or ultrasonic and magnetic particle or dye penetrant examination methods to ensure freedom from harmful defects.</p> | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES | Page 9 of 26 |


| CLAUSE NO. | QUALITY ASSURANCE |  |
|--|--|---|
| 1.01.08 | <p>Bolts and nuts for pressure Retaining enclosures and Rotor Couplings</p> <ul style="list-style-type: none"> (a) Bar stock greater than or equal to 50 mm in diameter for bolts shall be subjected to ultra- sonic examination. (b) Finish machined bolts (Joint Bolts & Coupling Bolts) shall be subjected to magnetic particle examination /DPT for surface defect examination. (c) Coupling bolts and nuts shall be suitably identified after weight control checks. | |
| 1.01.09 | <p>Governing and Protection System Equipment such as Electro-hydraulic Controller, Hydraulic Amplifier, Hydraulic Controller, Electro hydraulic Convertors, Hydraulic Convertors, Hydraulic Speed Governor, Trip Devices etc.</p> <ul style="list-style-type: none"> (a) All pressure retaining parts shall be subjected to hydraulic testing. (b) All the major castings/forgings shall be subjected to suitable NDT methods depending upon their application and criticality to ensure the freedom from harmful defects. (c) All the main assemblies and sub-assemblies shall be subjected to functional test. (d) All butt welds shall be subjected to minimum 10% RT/UT and all fillet and corner welds shall be subjected to MPI/DPT. (e) All control equipment shall be subjected to rig testing, if it is not possible to test it on the steam turbine light run. The purpose of rig testing shall be as far as practical to prove that the functioning of the control equipment is in accordance with the approved design. (f) Nitrided and stellited components will be subjected to DPT and hardness check shall be carried out on test sample. | |
| 1.01.10 | <p>Inspection of Completed Turbine</p> <p>The steam turbine shall be assembled in the manufacturer's works to such an extent that a thorough inspection can be carried out. The purpose of this inspection will be to ensure that the fit between mating components is correct and that all clearances are in accordance with the design requirement. Contractor will prepare the checklist in this regard and submit the same for Employer's approval. However, minimum clearances which are required to be checked and records to be maintained during assembly of Inner Casing - Rotor, Inner Casing - Outer Casing, Rotor - Outer Casing, Gland Steam Housing - Shaft - Casing etc.</p> | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES |
| | | Page 10 of 26 |


| CLAUSE NO. | QUALITY ASSURANCE | | |  |
|--|--|---|--|---|
| | <p>and shroud diameters, axial distances for shroud bands for casings, clearance between shaft seal casings and shaft seal rings, radial and axial blade clearance in blading section, axial and radial alignment of rotor in respect of shaft seals, alignment of overspeed governor etc. by actual assembly. However, if the Bidder's standard practice provides for verifying the clearances by any other method, such as, computer aided assembly, the same is acceptable, in case the bidder is having experience for similar or higher rating turbine. This is indicative check only. However, the details shall be finalised during QP finalisation stage.</p> <p>These check lists shall be designed so that a comparison can be made between the design clearances, the clearances measured during works assembly, and those measured during the site turbine build. The vendor shall state, in his proposal, whether or not it is his practice to carry out no load works running tests on the steam turbine. If not carried out, the vendor shall give details of their normal works practice in order to verify compliance with the design of the steam turbine control and emergency control equipment.</p> | | | |
| 1.02.00 | AUXILIARIES OF STEAM TURBINE | | | |
| 1.02.01 | Bearing Pedestals and Bearings | | | |
| | (a) Cast Pedestals & Housing | | | |
| | Leakage tests shall be conducted on pedestals. | | | |
| | (b) Fabricated Pedestals & Housing | | | |
| | (1) Leakage test shall be conducted on pedestals. | | | |
| | (2) 10% weld shall be checked after stress relieving by magnetic particle test or DPT and minimum 10% of the butt welds will be checked by RT or UT. | | | |
| | (c) Bearings shell | | | |
| | (1) The shell and castings\forgings shall be subjected to suitable non destructive examination like RT\UT & MPI as applicable. | | | |
| | (2) Colour matching of the shells by putting two halves together or feeler gauge tightness checks from inside and outside to ensure required contact area and joint tightness shall be carried out. | | | |
| | (3) The fabricated /cast shell shall be subjected to hydraulic pressure test / water fill test as applicable. | | | |
| | (4) Chemical analysis of white metal shall be carried out. The effectiveness of the white metal adhesion shall be checked | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES | Page 11 of 26 |


| CLAUSE NO. | QUALITY ASSURANCE | | |  |
|--|---|---|--|---|
| | <p>(4) The complete purifier shall be tested at manufacturer's works for capacity, mechanical running sequential operation and interlocks, moisture content(if not covered under Type Test clause of technical specification), vapour tightness, vibration, noise level, quality improvements etc.</p> <p>(c) REFER RELEVANT CLAUSES OF THE SPECIFICATION FOR OTHER ITEMS SUCH AS PIPING, HEAT EXCHANGERS, VALVES, FILTERS, BLOWERS / EXHAUSTERS ETC IN THIS SYSTEM.</p> | | | |
| 1.03.00 | CONDENSERS FOR MAIN TURBINE AND DRIVE TURBINE:- | | | |
| 1.03.01 | WATER COOLED CONDENSERS FOR MAIN TURBINE AND DRIVE TURBINE (IF OFFERED) | | | |
| | (A) SHELL, HOTWELL, WATER BOXES, DOORS AND TUBESHEETS | | | |
| | <p>(a) All welds shall be visually examined. Radiographic examination of 10% of butt welds shall be carried out. However, for vacuum containing welds, R.T. on at least 10% of each butt weld shall be carried out. Surface defect examination by magnetic particle inspection or equivalent test method shall be carried out for minimum 10% weldments. This shall apply to site welds also.</p> <p>(b) All edge preparations shall be examined for surface defects. Edge preparation for welds to be carried out at site shall be checked by magnetic particle inspection/Dye penetrant examination method before despatch.</p> <p>(c) In case of fabricated flanges, welds shall be checked by 100% radiographic/ultrasonic and 100% magnetic particle inspection methods to ensure freedom from internal and surface defects.</p> <p>(d) To ensure dimensional control of condenser, parts\sub assemblies shall be trial assembled at shop. BIDDER shall furnish his proposal in this regard, which will be subject to Employer's approval. The extent/need for trial Assembly of various parts of Condenser / sub assemblies like Water Box, Water Chamber, Hotwell, Main Tube plate and support plate, its alignment and trial insertion of few tubes etc. shall be as per Manufacturers standard established practices. Such established practices shall be furnished to NTPC during finalization of quality plan.</p> <p>(e) Bidder to furnish his practice regarding stress relieving of the water boxes and water chambers.</p> | | | |
| | (B) TUBES Condenser Tubes shall be tested as per the requirements of relevant codes and standards. | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES | Page 13 of 26 |


| CLAUSE NO. | QUALITY ASSURANCE  | | | |
|--|--|---|--|--|
| 1.03.02 | <p>AIR COOLED CONDENSERS FOR MAIN TURBINE AND DRIVE TURBINE (IF OFFERED)</p> <p>(A) FABRICATION OF CONDENSER AND ACCESSORIES</p> <p>(a) All welds shall be visually examined. Radiographic examination of 10% of butt welds shall be carried out. However, for vacuum containing welds, R.T on at least 10% of each butt weld shall be carried out. Surface defect examination by magnetic particle inspection or equivalent test method shall be carried out for minimum 10% weldments. This shall apply to site welds also.</p> <p>(b) All edge preparations shall be examined for surface defects. Edge preparation for welds to be carried out at site shall be checked by magnetic particle inspection/Dye penetrant examination method before despatch.</p> <p>(c) In case of fabricated flanges, welds shall be checked by 100% radiographic/ultrasonic and 100% magnetic particle inspection methods to ensure freedom from internal and surface defects.</p> <p>(B) FAN</p> <p>(a) Ultrasonic Test shall be carried out on shaft material diameter ≥ 40 mm.</p> <p>(b) Fan hub and fan blade shall be tested as per relevant material code requirement and shall be tested for internal defects as per relevant code.</p> <p>(c) Moment weight test on blades, blade track variation, tip clearance shall be checked.</p> <p>(d) In case of fabrication of hub and blades by welding, the weld joint shall be tested by RT.</p> <p>(e) Assembly fit up and balancing shall be checked.</p> <p>(C) GEAR BOX</p> <p>(a) Gear box shall be tested as per relevant standard for performance, noise, vibration etc.</p> <p>(b) Gear box shall be tested for no load run test for 4 hours.</p> <p>(D) MOTOR</p> <p>The respective specification covered elsewhere is to be referred.</p> <p>(E) PIPING</p> <p>(a) All piping joint shall be tested for 10% RT/UT. IBR code regulations 1950 shall be ensured for IBR piping and relevant original IBR certificates shall be furnished.</p> <p>(F) TUBES</p> <p>(a) Condenser tubes/finned tubes shall be tested as per the requirements of relevant codes and standards.</p> | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES Page 14 of 26 |


| CLAUSE NO. | QUALITY ASSURANCE  | | |
|--|---|---|------------------|
| 1.03.03 | Steam Throw Off Device (If Offered) <ul style="list-style-type: none"> (a) Edge preparations shall be examined for surface defects by MPI/DPT. 10% radiographic or ultrasonic examination shall be carried out for all weldments. (b) Welds shall be subjected to surface defect examination by 10% magnetic particle/dye penetrant examination. | | |
| 1.03.04 | SPRING ASSEMBLY (If Offered) <ul style="list-style-type: none"> (a) Static load testing of the springs shall be carried out and spring characteristics shall be drawn and verified. (b) Surface defect test shall be carried out on all the springs after coiling and heat treatment. (c) Surface cleaning shall be checked prior to painting and check for thickness of painting shall be carried out. | | |
| 1.04.00 | Condenser Air Evacuation System For Main Turbine Condenser And Drive Turbine Condenser | | |
| 1.04.01 | Pumps <ul style="list-style-type: none"> (a) Vacuum pump shafts shall be subjected to ultrasonic test. After finish machining, shaft shall be subjected to magnetic particle examination/dye penetration test. (b) Pump casings and impellers shall be subjected to magnetic particle/dye penetration test. Finished pump rotor shall be subjected to dynamic balancing. (c) Pump casings shall be subjected to hydraulic test at 1.5 times the shut off pressure or twice the maximum operating pressure, whichever is higher. (d) Each pump shall be tested at supplier's works at full speed and load conditions to demonstrate successful operation and performance in accordance with the design requirements. (e) Supplier shall demonstrate by carrying out visual cavitation test that pump will be operating under all operating condition including blank off condition without cavitation. (f) REFER RELEVANT CLAUSES OF THE SPECIFICATION FOR OTHER ITEMS SUCH AS HEAT EXCHANGERS, FILTERS, PIPING, VALVES, ETC. IN THIS SYSTEM. | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES | Page 15 of 26 |


| CLAUSE NO. | QUALITY ASSURANCE | | |  |
|--|--|--|------------------|---|
| 1.04.02 | The complete package shall be subjected to hydraulic pressure and leakage test and shop tested to check interlocks and functional requirements. The one complete unit shall also be subjected to demonstrate successful operation and performance testing, with saturated air conditions at condenser design vacuum point as well as vacuum pump design point with total minimum three points. The test should be conducted with the respective motors to be supplied. The test shall include check for vibration and noise level. | | | |
| 1.05.00 | FEED WATER HEATERS, DRAIN COOLERS, GLAND STEAM CONDNSER, HEAT EXCHANGERS & PRESSURE VESSELS/ STORAGE TANKS | | | |
| 1.05.01 | All raw materials used shall have co-related mill test certificate meeting mandatory and supplementary checks of material specification. | | | |
| 1.05.02 | Material for Tube plates shall be ultrasonically tested. Finished plates shall be subjected to suitable NDT. For claddd plates, bonding shall be checked by UT. Vendor shall furnish their practice regarding manufacturing & NDT for supply of claddd plates for Employer's review. Drilled Tube plates shall be checked for ovality of holes, ligaments, surface finish etc. | | | |
| 1.05.03 | Dished ends shall be subjected to 100% MPI and RT/UT on welded joints. Knuckle portion shall be checked by MPI for surface defects and thinning shall be checked by UT. | | | |
| 1.05.04 | Butt Welded / Full penetration joints shall be checked by suitable RT / UT. Fillet welds shall be checked by MPI / DPT. | | | |
| 1.05.05 | Tubes shall be tested as per the relevant codes / specification / standards. | | | |
| 1.05.06 | Before tubes expansion in the tube sheets, the mock-up test for expansions shall be carried out, in case not done earlier. Torque setting of expander shall be based on mock up tests. Joints shall be checked for tube thinning. | | | |
| 1.05.07 | Completed assemblies shall be pressure tested with working-fluid/ hydraulically/ pneumatically. The heat exchangers shall be tested on both tube side and shell side. After hydro test, the heat exchangers shall be suitably dried and nitrogen capped. Atmospheric tanks shall be tested for leakage by water fill test for at least 12 hrs. | | | |
| 1.06.00 | PIPING, BELLOWS AND THERMAL INSULATION FOR TURBINE & AUX SYSTEMS | | | |
| 1.06.01 | Piping and Fittings (a) All raw materials used shall have co-related mill test certificate meeting mandatory and supplementary checks (as required to | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES | Page 16 of 26 | |


| CLAUSE NO. | QUALITY ASSURANCE  | | |
|--|---|--|------------------|
| | <p>meet statutory requirement and elsewhere asked in the specification) of material specification.</p> <p>(b) All pipe lengths shall be subjected to 100% ultrasonic examination or hydraulic tests and UT/RT on longitudinal welds at the tube mill.</p> <p>(c) All mother pipes used for fittings shall be subjected to a hydraulic test or an ultrasonic test at the tube mill. Raw material of all forged fittings shall be ultrasonically tested. Forged fittings shall be ultrasonically tested.</p> <p>(d) Welded and cast fittings, if any, shall be subjected to suitable NDT as per applicable standards. However, as a minimum 100% RT shall be carried out on all alloy steel fittings and on carbon steel fittings for use above 71 bar design conditions.</p> <p>(e) The edge preparation for shop and site welds shall be checked by MPI/LPI however edge preparation in stainless steel alloy/ steel shall be subjected to a Dye penetrant check.</p> <p>(f) Thickness of pipe bends 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.</p> <p>(g) Non-destructive examination of welds shall be carried out after post weld heat treatment, if any.</p> <p>(h) 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 (except for oil piping). Further statutory requirement, wherever applicable shall also be complied with.</p> <p>(1) Temperature > 400⁰C And / Or pressure exceeding 71 bar.</p> <p>(i) 100% RT/UT on butt welds and full penetration branch welds.</p> <p>(ii) 100% MPE.</p> <p>(2) Temperature > 175⁰C up to 400⁰C AND / OR pressure exceeding 17 bar and up to 71 bar.</p> <p>(i) 100% RT / UT on butt welds and full penetration branch welds for pipe dia more than 100 NB.</p> <p>(ii) 10% RT / UT on butt welds and full penetration branch welds for pipe dia up to 100 NB.</p> <p>(iii) 100% MPE.</p> | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES | Page 17 of 26 |


| CLAUSE NO. | QUALITY ASSURANCE  | | | |
|--|---|--|------------------|--|
| 1.06.02 | <p>(3) Wherever SR/PWHT is envisaged, above NDTs shall be after SR/PWHT.</p> <p>(4) For all other pipes not covered above (except oil piping), 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.</p> <p>(5) 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 pipings).</p> <p>(6) For welds in P91, X20 & X22 materials, only induction type of heating shall be deployed for heat treatment.</p> <p>(i) Oil piping shall be subjected to following NDT.</p> <p>(1) Butt welds of Oil piping shall be subjected to 10% RT and 10% DP Test. For Jacking oil lines 100% RT & 100% DPT shall be carried out on butt welds.</p> <p>(2) Fillet welds with load transfer shall be subjected to 100% MPE/DPT and fillet welds without load transfer shall be subjected to 10% MPE/DPT.</p> <p>(j) Rubber lined pipes shall be hydraulically tested before rubber lining. All rubber lining is to be subjected to following tests as per IS-4682 part-I or acceptable equivalent:</p> <p>(1) Adhesion test</p> <p>(2) Check for resistance to bleeding</p> <p>(3) Measurement of thickness</p> <p>(4) Shore hardness test</p> <p>(5) Visual examination and spark test at 5 KV/mm of thickness.</p> <p>Metallic Expansion Bellows</p> <p>(a) Hydraulic pressure test shall be carried out on each pipe and expansion bellow.</p> <p>(b) Longitudinal butt weld on bellow shall be subjected to suitable NDT examination before forming, and after forming MPE / DP test shall be carried out.</p> | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES | Page 18 of 26 | |

| CLAUSE NO. | QUALITY ASSURANCE  | | | |
|---|--|--|--|--|
| 1.06.03 | <p>(c) All welds shall be subjected to 100% magnetic particle/dye penetrant check and butt welds shall be subjected to 100% radiographic testing.</p> <p>(d) All the bellows subjected to vacuum service shall be subjected to vacuum test.</p> <p>(e) The bellows shall be subjected to movement test to establish suitability to perform satisfactorily in site conditions. During this test spring rate shall also be measured.</p> <p>(f) Life cycle test, meridional yield rupture test and squirm test to be carried out on a prototype/expansion bellow as per Sec.D clause 3.2 of standards of Expansion joint Manufacturer Association (EJMA). In case these tests have already been accepted by NTPC on a prototype expansion bellow, as defined in Sec.D Clause 3.2 of Expansion Joints Manufacturers Association (EJMA) test reports may be furnished by manufacturer for consideration and approval of Employer.</p> | | | |
| | <p>Rubber Expansion Joint</p> <p>(a) Rubber compound test slab after vulcanising shall be tested for tensile strength, elongation and shore hardness. Tests on rubber compound shall also include hydro stability test as per ASTM D-3137 and ozone resistance test as per ASTM D- 380.</p> <p>(b) Fabric strength of synthetic fibre for reinforcement shall be checked, and test for rubber to fabric adhesion as per IS: 3400/ASTM D- 413, rubber to metal adhesion as per IS 3100/ASTM D-429 shall be carried out.</p> <p>(c) All expansion joints in assembled condition shall be subjected to vacuum test at 730 mm Hg below atmospheric pressure under conditions to ensure its suitability to withstand deflection in each axial transverse and longitudinal direction. Duration of test shall be of minimum 10 minutes.</p> <p>(d) All bare bellows shall be subjected to hydraulic pressure test in normal condition at 1.5 times the design pressure for duration of 30 minutes. Additionally, all bare bellows shall be subjected to deflection tests under pressure, pressure being raised from zero to the design value in regular steps and deflection measured at each step.</p> <p>(e) All expansion joints in assembled condition along with control rod assembly shall be subjected to deflection test under design pressure. The details of test procedure shall be subjected to approval by Project Manager.</p> | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES <div> Page 19 of 26 </div> |


| CLAUSE NO. | QUALITY ASSURANCE  | | | |
|--|--|---|--|--|
| 1.06.04 | <p>(f) Either during the hydraulic test or during the vacuum test, change in circumference at the top position of the arch shall not exceed 1.5% of measured circumference at normal position.</p> <p>(g) Twenty Four (24) hours after the above tests, the permanent set (variation in dimensions with respect to its original dimension) shall be measured and recorded. The permanent set shall not be more than 0.5%.</p> <p>(h) Life cycle test shall be carried out on bellows of each type, design and size. In case these tests have already been accepted by NTPC in earlier projects for the same type / size / design, test certificate for the same may be furnished for approval of Employer.</p> | | | |
| | THERMAL INSULATION | | | |
| | <p>(a) For mineral wool insulation, testing shall be carried out as per relevant standard.</p> <p>(b) For sprayed mineral wool, testing shall be carried out as per relevant standard.</p> <p>(c) Thermal conductivity (k value) shall generally be measured in line with relevant standard.</p> | | | |
| | Hangers and Supports | | | |
| 1.06.05 | <p>(a) Forged components such as clevis, turnbuckle, eye- bolts, coupling etc. will be subjected to material testing, hardness, MPE, proof load test etc.</p> <p>(b) Dampers with viscous fluids will be checked for viscosity of liquid used, damping resistance of the damper, stiffness of the damper etc.</p> <p>(c) Springs used for variable constant load and spring hangers shall be checked for chemical, mechanical and spring rate tests.</p> <p>(d) Complete variable and constant load spring cage will be subjected to performance test and load/deflection test. Calibration of spring cages shall be done at shop.</p> | | | |
| 1.07.00 | VALVES | | | |
| 1.07.01 | Inspection and testing requirements for valves other than extraction line valves and butterfly valves shall be as follows:- | | | |
| | <p>(a) Pressure retaining parts of valves shall be subjected to NDT as per Table 1.</p> | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES Page 20 of 26 |


| CLAUSE NO. | QUALITY ASSURANCE |  | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|---|---|--|--------------------------------------|---|-----------------|--------|--------|--------|-----|--------------------------------|--------|--------|-----|--|--|--------|-----|---|----------------------------|---------|-----|-----|----------|-------------|--|
| | <p>(b) Bar stock/forging above 40mm diameter for valve trim shall be subjected to UT.</p> <p>(c) Hardened/stellitted valve disc and seat are to be subjected to LPI and hardness check (on test sample).</p> <p>(d) Colour matching of valve disc/plug and seat shall be carried out to ensure contact.</p> <p>(e) Hydraulic pressure test and seat leak test shall be carried out as per ANSI 16.34.</p> <p>(f) Air seat leak test shall be carried out as per applicable Standards/Codes.</p> <p>(g) Functional testing shall be carried out on each valve to check the following as per the approved valve data sheet:</p> <div><p>(1) Smooth operation</p><p>(2) Valve travel, closing and opening time.</p><p>(3) Current drawn by actuators..</p></div> <p>(h) Springs for safety valves shall be tested with suitable NDT and for spring rate.</p> <p>(i) Safety and safety relief valves shall be tested for performance.</p> <p>TABLE-1 NDT REQUIREMENTS FOR PRESSURE RETAINING COMPONENTS OF VALVES</p> <table><tr><th>Valve size NB in mm</th><th>ANSI Class upto 300</th><th>ANSI Class above 300 upto 600</th><th>ANSI Class above 600 below 900</th><th>ANSI Class 900 & above & below 4500</th></tr><tr><td>Less than 50</td><td>Visual</td><td>Visual</td><td>Visual</td><td>MPI</td></tr><tr><td>50 & above but below 100</td><td>Visual</td><td>Visual</td><td>MPI</td><td>MPI & RT (on 10% of valves on 100% area)</td></tr><tr><td>100 & above but less than 300</td><td>Visual</td><td>MPI</td><td>MPI & RT (on 10% of valves on change of section & weld ends)</td><td>MPI & RT (on 100% area)</td></tr><tr><td>300 and</td><td>MPI</td><td>MPI</td><td>MPI & RT</td><td>MPI, RT (on</td></tr></table> | 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 | MPI | MPI | MPI & RT | MPI, RT (on | |
| 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 | MPI | MPI | MPI & RT | MPI, RT (on | | | | | | | | | | | | | | | | | | | | | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES | Page 21 of 26 | | | | | | | | | | | | | | | | | | | | | | | | |

| CLAUSE NO. | QUALITY ASSURANCE  | | | |
|--|---|---|-------------------------------------|--|
| 1.07.02 | above | | (on change of sections & weld ends) | 100% area) |
| | <p>Note:</p> <p>(i) For body and bonnet forgings UT with MPI may be adopted in place of RT. For austenitic steel MPI may be replaced by LPI.</p> <p>(ii) Weld Edge Preparation shall be subjected to MPI/LPI</p> <p>Extraction Line Valves</p> <p>(a) Surface crack examination and hardness check (on test sample) shall be carried out on all hard faced/stellited surfaces, if any.</p> <p>(b) As a minimum requirement of castings for all valves on cold reheat and extraction lines shall be subjected to 100% MPI on all areas and RT on Butt Weld ends and change of Section. For forgings minimum requirement shall be 100% UT and 100% MPI.</p> <p>(c) Bar stock for valves stem shall be subjected to UT. Finish machined valve stem shall be subjected to magnetic particle examination/dye penetration test.</p> <p>(d) Wall thickness measurement by ultrasonic for critical and highly stressed zones of the casting/forging shall be carried out.</p> <p>(e) Colour matching of the valve disc and seat to ensure required contact area shall be carried out.</p> <p>(f) Hydraulic pressure tests shall be carried out on each valve to check body and bonnet strength. Seat leakage and back seat leakage test (wherever applicable) shall be carried out. Air seat leakage test shall also be carried out. Minimum test requirements of pressure shall be as per ANSI B 16.34.</p> <p>(g) Functional testing shall be carried out on each valve to check for freedom of movement, adherence to clearance, opening/ closing etc.</p> | | | |
| 1.07.03 | <p>Butterfly valves</p> <p>(a) Valve disc shall be checked for surface and sub-surface defects by magnetic particle examination.</p> <p>(b) Stubs and driving shafts shall be tested for internal defects by ultrasonic method.</p> <p>(c) Dye penetration test shall be carried out on shafts, seat rings etc.</p> | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES Page 22 of 26 |

| CLAUSE NO. | QUALITY ASSURANCE | | |  |
|--|--|---|--|---|
| | <div>(d) Test samples for rubber seal shall be subjected to tensile and hardness test for vulcanising and after ageing. Hydraulic stability test and ozone crack resistance tests also be carried out.</div> <div>(e) Valve shall be subjected to hydraulic pressure test for body and air seat leakage tests as per AWWA-C504/IS 13095.</div> <div>(f) Proof of design tests for valves and actuator shall be carried out as per AWWA-C504/IS 13095. In case the test has already been carried out on previous supplies, the contractor may submit the test certification of same for approval of Project Manager.</div> <div>(g) After complete assembly each valve with actuator will be subjected to performance test by opening and closing the valve from fully closed to fully open position and the reverse, under no flow for at least 25 cycles to check.<div>(1) Smooth uninterrupted movement of valve.</div><div>(2) Closing and opening time.</div><div>(3) Current drawn by actuator.</div><div>(4) Operation of tripping switch and position indicator.</div></div> <div>(h) After assembly, one valve of each size with respective actuator shall be shop operated over the full range of movement in both the directions, with the body subjected to the full hydrostatic pressure conditions, to demonstrate that the unit is in working order without any leakage through the joints and torque switches/clutches, limit switches are operating satisfactorily. During the test, hand wheel operation, opening/closing time and current drawn shall also be checked.</div> | | | |
| 1.08.00 | MISC. ITEMS / EQUIPMENTS | | | |
| 1.08.01 | FILTERS / STRAINERS | | | |
| | <div>(a) Filters / strainers shall be tested as per the requirements of relevant codes / standards.</div> <div>(b) Filters / strainer shall be performance tested for pressure drop, flow, particle size. If performance test is earlier established, then records shall be reviewed.</div> | | | |
| 1.08.02 | BLOWERS/ EXHAUSTERS | | | |
| | <div>(a) Rotors shall be dynamically balanced. Leakage tests (if applicable) shall be carried out.</div> | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES | Page 23 of 26 |


| CLAUSE NO. | QUALITY ASSURANCE | | | <div>एनटीपीसी NTPC</div> |
|--|--|---|--|------------------------------|
| | (b) Performance tests including noise and vibration tests shall be carried out as per relevant standards / codes. | | | |
| 1.08.03 | LP CHEMICAL DOSING SYSTEM | | | |
| | (a) Pumps of chemical doing system shall be performance tested as per relevant international codes. | | | |
| | (b) In case of diaphragm type of pumps, the life cycle test shall be done on pumps. If this test is already conducted for same model in earlier projects of NTPC, then TCs for same shall be reviewed. | | | |
| | (c) Dosing skid shall be subjected to leakage test and functional test. | | | |
| 1.09.00 | Electrical and Control & Instrumentation: | | | |
| | Refer Electrical and Control & Instrumentation Sections of QA&I specification. | | | |
| 1.10.00 | SITE TEST: | | | |
| | Quality requirements for site activities shall be as a minimum, those specified for corresponding shop activities. | | | |
| 1.10.01 | Hydraulic Test of Pressure Parts: | | | |
| | On completion of erection of pressure parts of each steam turbine generator, the unit with its fittings and mountings in position coming under purview of IBR shall be subjected to hydraulic test pressure in accordance with requirement of Indian Boiler Regulations. Water used for hydraulic test shall be made alkaline by addition of suitable chemical. After the test, all parts shall be drained and suitably preserved. | | | |
| 1.10.02 | Condenser Assembly- Water Cooled (If Offered): | | | |
| | (a) If the condenser sections calls for site assembly, care shall be taken in assembly of sections and correctness of alignment and fit up shall be checked. Site welding shall be carried out as per the procedure approved by the Project Manager. | | | |
| | (b) All weld seams shall be subjected to DPT/MPI. At least 10% of butt welds shall be subjected to radiographic examination. | | | |
| | (c) All welds between condenser neck and LP turbine shall be subjected to 100% radiographic and magnetic particle examination. | | | |
| | (d) Condenser tubes shall be visually examined for dents, mechanical damages or any other defects prior to insertion. Both tube ends | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES | Page 24 of 26 |


| CLAUSE NO. | QUALITY ASSURANCE  | | | |
|--|--|--|------------------|--|
| 1.10.03 | <p>shall be thoroughly cleaned to a length of 100mm to remove oil, grease etc. and shall be checked for freedom from burrs prior to insertion.</p> <p>(e) Tube expansion shall be carried out by electronic automatic torque control expanding unit, which shall be calibrated before use. Tube wall thinning and length of expansion shall be controlled and recorded.</p> <p>(f) Hydrostatic testing of condenser steam space shall be carried out after connecting all the pipes with the condenser along with condenser vacuum systems by filling the steam space with water 300mm above final joint of condenser exhaust neck to the turbine. The level of hydraulic test shall be selected such that all the field welding joints are covered in the test. Any leakage detected shall be rectified immediately.</p> <p>(g) Condenser water boxes shall be tested hydraulically at a minimum test pressure of 1.3 times the design pressure.</p> <p>Condenser Assembly-Air Cooled (If Offered):</p> <p>(a) If the condenser sections calls for site assembly, care shall be taken in assembly of sections and correctness of alignment and fit up shall be checked. Site welding shall be carried out as per the procedure approved by the Project Manager.</p> <p>(b) All weld seams shall be subjected to DPT/MPI. At least 10% of butt welds shall be subjected to radiographic examination.</p> <p>(c) All welds between condenser hot box and LP turbine shall be subjected to 100% radiographic and magnetic particle examination.</p> <p>(d) Condenser tube bundles shall be visually examined for dents, mechanical damages or any other defects prior to insertion. Both tube ends shall be thoroughly cleaned to a length of 100mm to remove oil, grease etc. and shall be checked for freedom from burrs prior to insertion.</p> <p>(e) Water Fill test / Hydrostatic testing / pneumatic test as applicable for condenser hot box space, tube bundle with header and associated parts of ACC shall be carried out after connecting all the pipes along with condenser vacuum systems such that all the field welding joints are covered in the test. Any leakage detected shall be rectified immediately.</p> <p>(f) Performance test (including flow, pressure, noise, vibration and alignment etc.) of Fan/Compressor as applicable shall be tested at site.</p> | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES | Page 25 of 26 | |

| CLAUSE NO. | QUALITY ASSURANCE  | | | |
|--|---|--|------------------|--|
| 1.10.04 | <p>TURBINE ASSEMBLY</p> <p>Bidder shall clearly indicate the extent of assembly to be carried out at site. Accordingly, bidder shall submit elaborate erection and assembly inspection programme of turbine for Employer's approval.</p> | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-8 STEAM TURBINE & INTEGRAL AUXILIARIES | Page 26 of 26 | |

SUB-SECTION– E-09

CONDENSER ONLINE TUBE CLEANING SYSTEM

| CLAUSE NO. | QUALITY ASSURANCE | | |  |
|--|---|---|---------------------------|---|
| 1.00.00 | CONDENSER ON LOAD TUBE CLEANING SYSTEM/DEBRIS FILTER FOR MAIN TURBINE CONDENSER AND DRIVE TURBINE CONDENSER (IF OFFERED) | | | |
| 1.01.00 | General Requirements Refer QA & I portion of General Technical conditions of technical specification. | | | |
| 1.01.01 | Ball Recirculation Pump (a) All rotating parts shall be dynamically balanced. (b) Pump casing shall be subjected to hydraulic test at 1.5 times the shut off head or twice the maximum working pressure whichever is higher. (c) Complete pump assembly shall be subjected to shop performance test at supplier's works. | | | |
| 1.01.02 | Ball Sorter / Fabricated Body (housing) (a) In the case of fabricated design, all butt welds shall be subjected to 10% radiographic/ultrasonic examination. All welds shall be examined by 10% magnetic particle testing method to ensure freedom from surface and sub-surface defects. (b) Body shall be subjected to hydraulic pressure test at 1.5 times the design pressure. (c) Performance test shall be carried out on ball sorter assembly. | | | |
| 1.01.03 | Strainer (a) Strainer mesh shall be checked for chemical composition and mesh size. (b) Strainer body shall be subjected to hydraulic pressure test at 1.5 times the design pressure. (c) Strainer assembly shall be checked for its function. | | | |
| 1.01.04 | The complete system and the individual equipment shall be subjected to performance testing at Site to demonstrate successful operation and performance to meet the design conditions. The tests shall also include hydraulic test, function test, check for interlocks and sequential operation. Site test shall also include test to establish pressure drop across the strainer section, proper functioning of DELTA-P system. | | | |
| 1.01.05 | Piping and Fittings Piping and fabricated fittings shall be subjected to following NDT. | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-9 COLTCS | Page 1 of 2 |

| CLAUSE NO. | QUALITY ASSURANCE | | |  |
|--|---|---|---------------------------|---|
| | <p>(a) Butt welds of piping shall be subjected to 10% RT and 10% DP Test. Butt welds of Segmental flanges shall be checked by 100% RT and DPT.</p> <p>(b) Fillet welds with load transfer shall be subjected to 100% MPE/DPT and fillet welds without load transfer shall be subjected to 10% MPE/DPT.</p> <p>Wrought/ forged fittings shall be tested as per relevant code/ specification/ standard.</p> | | | |
| 1.01.06 | Coating / lining | | | |
| 1.01.07 | Coating shall be checked for DFT and adhesion. Further, Contractor shall furnish his practice for testing of coating to ensure the uniformity and freedom from pinholes. | | | |
| 1.01.08 | Rubber lined items shall be hydraulically tested before rubber lining. All rubber lining is to be subjected to following tests as per IS-4682 part-I or acceptable equivalent: | | | |
| | <p>(a) Adhesion test</p> <p>(b) Check for resistance to bleeding</p> <p>(c) Measurement of thickness</p> <p>(d) Shore hardness test</p> <p>(e) Visual examination and spark test at 5 kv/mm of thickness.</p> | | | |
| 1.01.09 | VALVES | | | |
| | Conventional gate/ globe/ check/ ball valves shall be tested as per relevant standard. | | | |
| 1.02.00 | ELECTRICAL AND CONTROL & INSTRUMENTATION: Refer Electrical and Control & Instrumentation Sections of QA&I specification. | | | |
| | SITE TEST: Quality requirements for site activities shall be as a minimum, those specified for corresponding shop activities. | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | SUB-SECTION-E-9 COLTCS | Page 2 of 2 |

SUB-SECTION– E-10

CONDENSATE EXTRACTION PUMPS

CONDENSATE EXTRACTION PUMP

1.00.00 CONDENSATE EXTRACTION PUMPS

| INPROCESS TESTS | | | | | | | | | | | | | FINAL TESTS | | | | |
|-------------------------------|-------------------|------------------|----------------|---------|------|----------------|----------------|----------------|-----------|----------------|------------------|---------------|--|----------------|----------------|----------------|-----------------|
| Tests Item/ Description | Chemical Analysis | Mechanical Prop. | Heat Treatment | Run out | U.T. | R.T. | D.P.T. | M.P.I. | Balancing | Hyd. Test | Inclusion Rating | Pressure Drop | Performance Test | NPSH Test | Vibration | Noise | Strip Down Test |
| | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. | 16. | 17. |
| Pump Casing | Y | Y ^① | - | - | - | - | Y | - | - | Y | - | | | | | | |
| Suction Bell | Y | Y ^① | - | - | - | - | Y | - | - | - | - | | | | | | |
| Shaft | Y | Y ^① | Y | Y | Y | - | Y ^⑨ | Y ^⑨ | - | - | Y | | | | | | |
| Impeller | Y | Y ^① | Y | - | - | - | Y | - | Y | - | - | | | | | | |
| Rotor | - | - | - | Y | - | - | - | - | | - | - | | | | | | |
| Fabricated Items | Y | Y ^① | - | - | - | Y ^② | Y | - | - | Y ^③ | - | | | | | | |
| Strainer | | | | | | | | | | | | | | | | | |
| a) Body | Y | Y | - | - | - | - | Y* | - | - | Y | - | - | | | | | |
| b) Assembly | - | - | - | - | - | - | - | - | - | - | - | Y** | | | | | |
| CEP | | | | | | | | | | | | | Y ^④ | Y ^⑤ | Y ^⑥ | Y ^⑦ | Y ^⑧ |
| Elect Items | | | | | | | | | | | | | Tests as per relevant portion of specification | | | | |

- ① Chemical/ Mechanical shall be one per heat/HT batch.
- ② 10% Random on Butt Welds
- ③ ☐ Pressure Containing Parts.
- ④ ☐ Performance Test on each Condensate Extraction Pump to determine the characteristic curve (Head, Capacity, Efficiency & Power) at Design Speed and to ensure Compliance with design requirements specified in the specification. Measurements shall be carried out at 0%, 25%, 50%, 65%, 80%, 100% and 125% of design flow with cold water.
- ⑤ NPSH (R) test shall be carried out on one Condensate Extraction Pump using cold water at pump flows of 25%, 50%, 80%, 100% and 125% of Design Flow at Design Speed. This shall be done at 3% head break by Suction Throttling Procedure / varying suction pressure.
- ⑥ Vibration on all Condensate Extraction Pumps shall be measured in transverse, Horizontal and Vertical Direction at all measuring points.
- ⑦ Noise Level on each Condensate Extraction pump shall be measured at a distance of 1.5 meter above floor level in elevation and 1 mtr horizontally from the nearest surface of the equipment as per HIS. The measurement shall be taken at six points around the equipment for each flow condition.
- ⑧ One Condensate Extraction Pump shall be dismantled for visual inspection after completion of performance test and NPSH Test. For other Pumps strip down test shall be conducted only in case abnormal performance such as Excessive Vibration, High noise, high bearing temperature etc. is observed during performance test.
- (9) DPT / MPI shall be carried out on Shaft.

TABLE CONT'D ON NEXT PAGE

CONDENSATE EXTRACTION PUMPS

Note:

- 1) Quantum of In-Process Checks/ Tests is 100% until & unless specified otherwise.
- 2) Shop tests shall be conducted with softest Quality Water.
- 3) Bidder shall furnish details of proposed test procedures including test lay out, type and level of accuracy of instruments, sample calculation etc.
- 4) Tests shall be done in accordance with latest edition of Hydraulic Institute standard.
- 5) Tested Pump parameters shall be within following tolerances.

| | |
|---------------------|--|
| At design head : | + 10% of design capacity |
| At design capacity: | + 5% of design head (Under 152.4 meter) |
| | +3 % of design head (for 152.4meter and above) |
- * In case of fabricated construction.
- ** One per type and size.
Results must show no minus tolerance with regard to flow and head.
No minus tolerance on efficiency or positive tolerance on power input at motor terminals shall be allowed.

SUB-SECTION– E-11

POWER CYCLE HEATERS & DEAERATOR

POWER CYCLE HEATERS & DE-AERATOR

1.00.00 DEAERATORS:

| Components / Activity | | Tests/ Checks | Chemical Analysis | Mech. Properties | Impact | Hardness | Flattening | Flaring | UT | RT | MPI | DPT | Eddy Current | Air Leak Test | SR | HT | Hydraulic | Pneumatic | Dimensions | WPS/PQR/WQR/App. Performance test | Mock up Test |
|-----------------------|---|---------------|-------------------|------------------|--------|----------|------------|---------|------------------|------------------|------------------|------------------|--------------|---------------|------------------|----|-----------|-----------|------------------|-----------------------------------|--------------|
| 1 | Shell & Dished End | | Y | Y | Y | | | | Y ^(a) | | Y ^(g) | | | | Y ^(a) | | | | Y ^(e) | | |
| 2 | Fabrication/ Welding | | | | | | | | | | | | | | Y | | | | Y | | |
| a) | Edge Preparation/ Fillet Weld | | | | | | | | | | Y ^(b) | Y ^(b) | | | | | | | | | |
| b) | Butt Joints/ Branch Welding | | | | | | | | Y ^(c) | Y ^(c) | Y | Y | | | Y | | | | Y ^(d) | Y | |
| 3 | Complete Deaerator | | | | | | | | | | | | | | | | Y | | Y | | |
| 4 | Safety & Safety Relief Valve & other valves | | Y | Y | | | | | Y ^(f) | Y ^(f) | Y ^(f) | Y ^(f) | | | | | Y | | Y ^(h) | | |

2.00.00

HEATERS:

| Tests/ Checks Components / Activity | | Chemical Analysis | Mech. Properties | Impact | Hardness | Flattening | Flaring | UT | RT | MPI | DPT | Eddy Current | Air Leak Test | SR | HT | Hydraulic | Pneumatic | Dimension | WPS/PQR/WQR/App. Performance test | Mock up Test |
|--|------------------------------|-------------------|------------------|--------|----------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|---------------|------------------|------------------|------------------|-----------|------------------|-----------------------------------|--------------|
| 1 | Tube Sheet | | | | | | | | | | | | | | | | | | | Y |
| | a Forging | Y | Y | | | | | Y | | Y | | | | | Y | | | Y ⁽ⁱ⁾ | | |
| | b Plates | Y | Y | Y | | | | Y | | | Y | | | | | | | Y ⁽ⁱ⁾ | | |
| | c Cladding | | | | | | | Y | | | Y | | | Y | | | | Y ^(j) | | |
| 2 | Shell Plates | Y | Y | Y | | | | Y | | | | | | | | | | | | |
| 3 | Feed Nozzle Manhole forging | Y | Y | | | Y ^(k) | | Y ^(l) | | | | Y ^(k) | | Y ⁽ⁱ⁾ | | | | Y | | |
| 4 | Welding / Fabrication | | | | | | | | | | | | | | | | | | | |
| | a Weld Edge Preparation | | | | | | | | | Y ^(b) | Y ^(b) | | | | | | | | | |
| | b Back Chipping | | | | | | | | | Y ^(b) | Y ^(b) | | | | | | | | | |
| | c Weld Joints | | | | | | | | | | | | | | | | | | | |
| | (i) Butt | | | | | | | Y ^(c) | Y ^(c) | Y | Y | | | | Y | | | Y | Y | |
| | (ii) Fillet | | | | | | | | | Y | Y | | | | Y | | | Y | Y | |
| | (iii) Nozzle / Branch | | | | | | | Y ^(c) | Y ^(c) | Y | Y | | | | Y | | | Y | Y | |
| | (iv) Tube to tube sheet | | | | | | | | | | Y | | Y | | | Y | | | | |
| 5 | Dished End & Hemi Head | Y | Y | Y | | | | Y ^(a) | | Y ^(b) | Y ^(b) | | | Y | | | | Y ^(e) | | |
| 6 | Tubes | Y | Y | | | Y ^(q) | Y ^(q) | | | | | Y | | | Y ⁽ⁿ⁾ | Y | | Y | | |
| 7 | Tube expansion in tube sheet | | | | | | | | | | | | | | | | | Y ^(o) | | |
| 8 | Complete Heater | | | | | | | | | | | | | | | Y ^(p) | | Y | | |

3.00.00 REMARKS FOR DEAERATORS AND HEATERS:

- | | |
|---|--|
| (a) After forming of plates. For dished end and Hemi head. | (h) Including— Seat leakage |
| (b) DPT may be used as an alternate to MPI. | — Relieving |
| (c) UT/RT to be decided according to configuration/accessibility. | Capacity-popping test at set and blow down pressure |
| (d) (i) For plates | (i) Include ovality of holes, surface finish and size of holes. |
| (ii) For welding | (j) For cladding bond and cladding thickness during bond check and after drilling |
| (iii) For wall thickness | (k) For feed nozzle (pipes) |
| (e) Including wall thickness | (l) For forgings |
| (f) (i) 100% RT/UT shall be carried out on bodies, bonnets, nozzle and stem of valves of HP heater. | (n) After bending also |
| (ii) 100% DPT/MPI on machined surfaces of valve body, bonnet, stem, disc & springs. | (o) Dimension to include wall thinning |
| (g) Outer surface (Dished end Knuckle Portion) | (p) Both tube and shell side. After Hydro test drying and nitrogen filling to be done. |
| | (q) As per the code. |
- For HP Heaters & Gland steam coolers the statutory requirements (if applicable) to be ensured as per IBR latest regulations and the certificates in original to be furnished as per IBR regulations.**

Note :

- (1) Sampling plan shall be as per relevant Governing/plant standard and shall be subject to mutual agreement during MQP finalization.
- (2) Chem./Mech. shall be One/ per heat or HT batch.

SUB-SECTION– E-12

BOILER FEED PUMPS

1.00.00

BOILER FEED PUMPS

BOILER FEED PUMP

| INPROCESS TESTS | | | | | | | | | | | | | | | |
|--|-------------------|------------------|----------------|---------|------|------|----------------|----------------|-----------|----------|-----------|------------------|----------------|------------|---|
| Tests Item/ Description | Chemical Analysis | Mechanical Prop. | Heat Treatment | Run out | U.T. | R.T. | D.P.T. | M.P.I. | Balancing | F.A.T.T. | Hyd. Test | Inclusion Rating | Pr. Drop | Dimensions | Remarks |
| | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | |
| (A) BFP + BOOSTER PUMP | | | | | | | | | | | | | | | |
| i.) Barrel Casing | Y | Y ^① | Y | - | Y | - | - | Y | - | - | Y | - | - | - | ① Chemical/ Mechanical shall be one per heat/HT batch # On BFP Impeller as per ASTM 446 Level 2 *** In case of Fabricated Construction ② One per type and size. + Type of NDE & quantum of check shall be as per relevant code & pressure class ++ Include body & seat leakage test and functional test Note: Quantum of Checks/ Tests is 100% untill & unless specified otherwise. |
| ii.) Discharge Branch | Y | Y ^① | Y | - | Y | - | - | Y | - | - | Y | - | - | - | |
| iii.) Casing Cover | Y | Y ^① | Y | - | Y | - | - | Y | - | - | Y | - | - | - | |
| iv.) Suction Branch | Y | Y ^① | Y | - | - | - | Y | - | - | - | Y | - | - | - | |
| v.) Diffuser | Y | Y ^① | Y | - | - | - | Y | - | - | - | - | - | - | - | |
| vi.) Ring Section | Y | Y ^① | Y | - | Y | - | Y | - | - | - | - | - | - | - | |
| vii.) Impeller | Y | Y ^① | Y | - | - | Y# | Y | - | Y | - | - | - | - | - | |
| viii.) Shaft | Y | Y ^① | Y | - | Y | - | Y | Y | - | - | - | Y | - | Y | |
| ix.) Rotor | - | - | - | Y | - | - | - | - | Y | - | - | - | - | - | |
| (B) STRAINER | | | | | | | | | | | | | | | |
| i.) Body | Y | Y | - | - | - | - | Y*** | - | - | - | Y | - | - | - | |
| ii.) Assembly | - | - | - | - | - | - | - | - | - | - | - | - | Y ^② | - | |
| (C) Gear Box AND Hydraulic coupling | | | | | | | | | | | | | | | |
| i.) Gear | Y | Y ^① | Y | - | Y | - | Y ⁹ | Y ⁹ | - | - | - | - | - | - | |
| ii.) Pinions | Y | Y ^① | Y | - | Y | - | Y ⁹ | Y ⁹ | - | - | - | - | - | - | |
| iii.) Shaft | Y | Y ^① | Y | - | Y | - | Y ⁹ | Y ⁹ | - | - | - | - | - | - | |
| iv.) Casing | Y | Y ^① | - | - | - | - | - | - | - | - | Y | - | - | - | |
| v.) Wheels | Y | Y ^① | Y | - | Y | - | Y ⁹ | Y ⁹ | - | - | - | - | - | - | |
| vi.) Assembled Rotating Component | - | - | - | - | - | - | - | - | Y | - | - | - | - | Y | |
| (D) RECIRCULATION VALVE | Y | Y ^① | Y | - | Y+ | - | Y+ | Y+ | - | - | Y++ | - | - | Y | |
| | | | | | | | | | | | | | | | |

| FINAL TESTS | | | | | | | | | | | | |
|----------------------|---|-----------|-----------|-----------|--------------------|--------------|-------------|-------------------|-----------------|----------------|-------------|---------|
| Item/ Description | Performance Test | NPSH Test | Vibration | Noise | Pressure Pulsation | Axial thrust | Dry Running | Visual Cavitation | Strip Down Test | Mech. Run test | Other Tests | REMARKS |
| | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | |
| BFP | ① Y | ② Y | ③(a) Y | ③(b) Y | ③(c) Y | ③(c) Y | ④ Y | ⑤ Y | ⑥ Y | Y | Y | |
| Booster Pump | ① Y | ② Y | ③(a) Y | ③(b) Y | - | - | ④ Y | - | ⑥ Y | - | Y | |
| Gear Box | ⑦ Y | - | Y | Y | - | - | - | - | - | ⑧ Y | | |
| HYD Coupling | - | - | - | - | - | - | - | - | - | ⑧ Y | Y | |
| | | | | | | | | | | | | |
| Drive turbine | Tests as per relevant portion of specification including Note-6 | | | | | | | | | | | |

- ① (a) Performance Tests on each Boiler Feed Pump to determine the characteristic curve (Head, Capacity, Efficiency & Power) at Design Speed and to ensure compliance with design requirements specified in the specification. Measurement shall be carried out at 10%, 25%, 50%, 65%, 80%, 100% & 125% of Design Flow with loop water at design temperature. Performance Test at other specified Conditions shall be carried out on all Boiler Feed Pumps at their respective Speeds at design temperature.
- (b) Performance Test on each Booster Pump to determine the characteristic curve (Head, Capacity, Efficiency & Power) at Design Speed and to ensure Compliance with design requirements specified in the specification. Measurements shall be carried out at 0%, 25%, 50%, 65%, 80%, 100% and 125% of design flow with cold water.
- ② NPSH (R) test shall be carried out on one Boiler Feed Pump and one booster pump using cold water at pump flows of 25%, 50%, 80%, 100% and 125% of Design Flow at Design Speed. This shall be done at 3% head break by Suction Throttling Procedure.
- ③ (a) Vibration on all Boiler Feed Pumps and Booster Pumps shall be measured in transverse, Horizontal and Vertical Direction at all measuring points.
- (b) Noise Level on each Boiler Feed Pump and Booster Pump shall be measured at a distance of 1.5 meter above floor level in elevation and 1 mtr horizontally from the nearest surface of the equipment as per HIS. The measurement shall be taken at six points around the equipment for each flow condition.
- (c) Pressure Pulsation and Axial Thrust Measurement shall be carried out on one Boiler Feed Pump at all measuring points. Pressure Pulsation shall be measured at suction as well as at discharge in the operating range.
- ④ Dry running withstand capability shall be demonstrated and established on one Boiler Feed Pump and its corresponding booster pump. Feed pump shall be capable of

accepting complete loss of water and must be capable of being shut down in a controlled manner and brought down to rest after being tripped from design condition with simultaneous closure of suction valve. To demonstrate the capability during shop testing, suction valve actuation should be fast in order to ensure operation during vapour phase. Pump shall then be restarted and bring it back to design condition.

- ⑤ Deleted
- ⑥ Complete Strip Down of Boiler Feed Pump which under goes Performance Test, NPSH Test, Dry Run Test, etc. shall be done in order to check problems like Internal Rubbing Damage, Excessive Wear etc. One Booster Pump shall be dismantled for visual inspection after completion of performance test and NPSH Test. For other Pumps strip down test shall be conducted only in case abnormal performance such as Excessive Vibration, High noise, high bearing temperature etc. is observed during performance test.
- ⑦ Full load full speed/back to back locked rotor torque test for one gearbox.
- ⑧ Smooth operation, vibration, noise and temperature rise check on all equipment.
- (9) BFP + Booster Pump , Gear Box AND Hydraulic coupling (In Process Tests): DPT /MPI shall be carried out on Gear, Pinion, Shaft & Wheel.

Note:

- 1) Shop tests shall be conducted with soft Quality Water.
- 2) Bidder shall furnish details of proposed test procedures including test lay out, type and level of accuracy of instruments, sample calculation etc.
- 3) Tests shall be done in accordance with latest edition of Hydraulic Institute Standard, USA.
- 4) Tested Pump parameters shall be within following tolerances.

| | |
|----------------------|---|
| At design head: | + 10% of design capacity |
| At design capacity : | + 5% of design head (Under 152.4meter) |
| | + 3% of design head (for 152.4 meter and above) |

Results must show no minus tolerance with regard to flow and head.

No minus tolerance on efficiency or positive tolerance on power input at motor terminals shall be allowed.
- 5) It is preferred to carry out performance, NPSH(R) and Dry Running tests of the Boiler Feed Pump at design speed. However, in case of any constraint of manufacturer to carry out the above tests at design speed, the testing of pump at reduced speed as per HIS guidelines may be proposed to Owner for review and approval.
- 6) No Load Mechanical Run Test shall be carried out as per API-612.
In case MRT is not the standard practice of the bidder, the following tests are to be carried out at shop to establish that the Drive Turbine is in compliance with the design:
 - a) Run out checking of the complete Rotor before & after over speed test.
 - b) High Speed Balancing at rated speed of the complete rotor.
 - c) Over speed Test as per manufacturer's proven practice, however the

minimum over speed shall be 1% more than that of tripping value of the drive turbine.

- d) The vibrations measured during high speed balancing and over speed shall be within the range of operating values as per manufacturer's standard.
- e) The bladed rotor shall be run continuously at the maximum continuous speed for duration as per manufacturer's standard.
- f) Visual inspection of the Bladed Rotor after over speeding for any abnormality.
- g) Verification of radial & axial clearances between moving parts (Bladed Rotor) and stationary parts (Casing) by actual placement of Rotor in the Casing.

SUB-SECTION– E-13

RAW WATER SYSTEM

RAW WATER PIPING

PIPES, FITTINGS, BENDS, VALVES, COATING-WRAPPING, STRAINERS EXPANSION, JOINTS, TANKS, FASTENERS, LINING ETC.

| | Tests/Check Items / Components | Material Test | DPT/MPI / RT | Ultrasonic Test | WPS/WQS/PQR | Hydraulic / Water Fill Test | Pneumatic Test | Assembly Fit up | Dimensions | Functional/operational Test | Other Tests | All Tests as per relevant Std | REMARKS |
|---|--|---|-----------------|-----------------|-------------|-----------------------------|----------------|-----------------|------------|-----------------------------|-----------------------|-------------------------------|--------------------------|
| 1 | Pipes & Pipe Fittings | Y ^a | Y ^b | | | Y ¹ | | | Y | | | Y | |
| 2 | Diaphragm Valves | Y ^a | | | | Y ⁵ | | | Y | | Y ⁶ | | |
| 3A | Cast Butterfly Valves (Low Pressure) | | | | | Y | | Y | Y | Y | Y ⁷ | | |
| | Body | Y ^a | Y ^b | | | | | | | | | | |
| | Disc | Y ^a | Y ^b | | | | | | | | | | |
| | Shaft | Y ^a | Y | Y ^c | | | | | | | | | |
| 3B | Fabricated Butterfly Valves | REFER NOTE 14 | | | | | | | | | | | |
| 4 | Gate/ Globe/Swing Check / Ball Valves | Y ^a | Y ^b | Y ^c | | Y ⁵ | Y | Y | Y | Y | Y ⁸ | | |
| 5 | Dual Plate Check Valves | Y ^a | Y ^b | Y ^c | | Y | Y | Y | Y | Y | Y ⁴ | | |
| 6 | Rolled & Welded Pipes and Mitre Bends | Y ^a | Y ³ | | Y | Y ³ | | | Y | | Y ^{3&15} | Y | |
| 7 | Coating & Wrapping of Pipes | Y ² | | | | | | | | | Y ² | | |
| 8 | Tanks & Vessels | Y ^a | Y ^b | | Y | Y | | | Y | | Y ¹⁶ | | |
| 9 | Strainers | Y ^a | Y ^b | | Y # | Y | | | | | Y ¹¹ | | #For Fabricated Strainer |
| 10 | Rubber Expansion Joints | Y ^a | | | | Y ¹² | | Y | Y | | Y ¹³ | | |
| 11 | Internal Lining of Pipes | Y ^a | | | | | | | Y | | Y ⁹ | | |
| 12 | Site Welding | | Y ¹⁰ | | Y | Y | | | | | | | |
| NOTES (MEANING OF SUPERSSCRIPTS) | | | | | | | | | | | | | |
| a | One per heat/heat treatment batch/lot. | | | | | | | | | | | | |
| b | On machined surfaces only for castings and on butt welds. | | | | | | | | | | | | |
| c | For shaft/spindles > or = 40 mm | | | | | | | | | | | | |
| 1 | 100% Hydraulic test shall be carried out. Weld joints not subjected to hydraulic test due to some unavoidable reasons, shall be subjected to 100% RT/PAUT. | | | | | | | | | | | | |
| 2 | Spark Test, Adhesion Test and Material Test for primer and enameled & Coal Tar Tapes as per AWWA-C-203-91/ IS-10221 & IS 15337 as applicable. | | | | | | | | | | | | |
| 3 | Followings are the testing requirements for fabrication of pipes at site | | | | | | | | | | | | |
| | TESTS | QUANTUM OF CHECKS | | | | | | | | | | | |
| | WPS, PQR, Welder Qualification Test | 100% Welders and WPS shall be qualified as per ASME- section IX | | | | | | | | | | | |
| | DPT on root run | 100% for pipes up to 1200 mm diameter | | | | | | | | | | | |
| | DPT after back gauging | 100% for pipes above 1200 mm diameter | | | | | | | | | | | |
| | RT / UT by (TOFD/PAUT) Technique | 5% (100% of T Joints) | | | | | | | | | | | |

| | | | |
|--|---|--|--------------|
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATIONS SECTION-VI, PART – B BID Doc NO- | SUB SECTION-E-13 RAW WATER (MECHANICAL) | Page 1 of 12 |
|--|---|--|--------------|

| | | |
|----|--|--|
| | DPT on finished butt weld joints | 10% |
| | Hydraulic Test | 100%, 1.5 times the design pressure or 2 times the working-pressure whichever is higher. |
| 4 | Dry Cycle Test on Dual Plate Check valve spring for one lakh Cycles shall be carried out as a type test. If Dry Cycle test carried out earlier for same material & diameter, Test report shall be reviewed. | |
| 5 | Seat Leakage Test for Actuator Operated Valves, shall be done with by closing the valves with actuator. | |
| 6 | Tests on rubber parts shall be conducted per batch of rubber mix for tensile, Elongation, hardness, adhesion, spark test, bleed resistance test. In addition, type test for 50,000 cycles of each type of diaphragm shall also be conducted. | |
| 7 | Hydraulic Test of Body, Seat and disc-strength shall be carried out in accordance with governing design standard in presence of owner / owner's representatives. Actuator operated valves shall be checked for Seat Leakage by closing the valves with actuator. For Proof of Design Test refer respective chapters of engineering portion in the technical specification. | |
| 8 | Blue matching, wear travel for gates, valves, pneumatic seat leakage, and 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. Fire safe test for ball valve shall be done wherever specified. In case of already carried out, the test report shall be submitted for review and acceptance by owner / owner's representatives. Valves shall be offered for hydro test in unpainted condition. | |
| 9 | Tensile, Elongation, Hardness, Specific Gravity, Lining Thickness, Humidity Check, Pipe temperature check, Adhesion Test and Holiday Detection Test etc as per applicable standard shall be done for all lining material and application. | |
| 10 | 10% of welds (Root and finished welds) shall be subjected to DPT. (100% DPT for compressed air line and boiler & deaerator fill line.). | |
| 11 | Pressure drop across the strainer for each type and size as a special test shall be carried out. In case of already carried out, the test report shall be submitted for review and acceptance by owner / owner's representatives. | |
| 12 | During hydraulic and vacuum tests at 25mm 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%. | |
| 13 | Tests on rubber for tensile, elongation, hardness, hydraulic stability check as per ASTM D 471, ozone resistance test as per ASTM D 1149/IS 3400 Part 20 aging test and adhesion strength of rubber to fabric, rubber to metal adhesion shall be carried out. | |
| 14 | In addition of all tests as indicated for Cast Butterfly valve being applicable for fabricated butterfly valves, following test shall be done for Fabricated Butterfly Valve: <ul style="list-style-type: none"> a. UT as per ASTM A-435/IS 11630 & IS 4225 on plate material for body and disc shall be carried out for plate thickness 25mm and above. b. 100% RT and DPT as per ASTM, Section-VIII, Division-I, on butt joints of body and disc. 10% DPT on other welds shall be done. c. Post weld heat treatment as per ASME, Section-VIII, Division-I on butt joints of body and disc. d. Welders and WPS shall be qualified as per ASME- section IX | |
| 15 | Maximum number of segments in segmental flanges shall be four (04) only. All butt weld joints in the segmental flanges shall be examined by RT/UT. Segmental flanges exceeding 37.5 mm thickness shall be stress relieved as per norms of ASME Section VIII after welding. | |
| 16 | For pressure vessel welds RT shall be done as per design code requirements. | |

All Valves shall be offered for inspection in unpainted condition.

No repair welding is permitted on Cast Iron / Alloy Cast Iron Castings.

| | | | |
|---|--|--|---------------------|
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATIONS SECTION-VI, PART – B BID Doc NO- | SUB SECTION-E-13 RAW WATER (MECHANICAL) | Page 2 of 12 |
|---|--|--|---------------------|

RAW WATER SYSTEM EQUIPMENT

| Tests/Check Items / Components | | Material Test | DPT/MPI | Ultrasonic test | RT | Balancing | Hydraulic / Water Fill test | Pneumatic Test | Assembly/ fit up | Dimensions | Functional/operational Test | Performance Test | Other Test | All Test as per relevant Std/ Approved Data Sheets | Remarks |
|-----------------------------------|---|--|----------------|-----------------|----------------|-----------|-----------------------------|----------------|------------------|------------|-----------------------------|------------------|-----------------|---|---------|
| A. | VT PUMPS & CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL), SUMP PUMPS, SUBMERSIBLE PUMPS, DRAINAGE PUMP | | | | | | | | Y ¹ | Y | | Y ² | | | |
| 1 | Shaft | Y ^a | Y ^b | Y ^c | | Y | | | | Y | | | | | |
| 2 | Impeller | Y ^a | Y ^b | | Y ³ | Y | | | | | | | Y ^d | | |
| 3 | Suction Bell / Bowl Castings/ Inserts | Y ^a | Y ^b | | | | Y | | | Y | | | Y ⁶ | | |
| 4 | Discharge Head / Column Pipes / Distance Piece/Base Plate | Y ^a | Y ^b | Y ^c | Y ⁴ | | Y | | Y | | | | | | |
| 5 | Companion Flanges | Y ^a | Y ^b | Y ^c | Y ⁵ | | | | Y | | | | | | |
| 5 | Thrust Bearing (Tilting Pad type) | Y ^a | Y | Y | | | | | Y | Y | | | | Y | |
| B. | RE JOINTS | Y ^a | | | | | Y ¹⁰ | | Y | Y | | | Y ¹¹ | | |
| C. | CRANES & HOISTS | REFER BELOW FOR QA CHECKS ON EOT CRANES AND HOISTS | | | | | | | | | | | | | |
| E. | VENTILATION FANS | | | | | | | | | Y | | Y | | Y | |
| 1) | Hub/Blades/Casing /Impeller | Y | Y | | | Y | | | | | | | | | |
| 2) | Shaft | Y ^a | Y | Y ^c | | | | | | | | | | | |
| 3) | Pre/Fine Filters | | | | | | | | | | | | Y ¹⁴ | | |

Notes:

| | |
|----------|--|
| a | One per Heat/ Heat Treatment Batch/ Lot. |
| b | On machined surfaces only for Castings / Forgings and on Welds of Fabricated Components. |
| c | For Shaft diameter. ≥ 50 mm and for plate thickness ≥ 25 mm |

| | | | |
|---|--|--|---------------------|
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATIONS SECTION-VI, PART – B BID Doc NO- | SUB SECTION-E-13 RAW WATER (MECHANICAL) | Page 3 of 12 |
|---|--|--|---------------------|

| | |
|-----------|--|
| d | Inter Grannular Corrosion (IGC) Test shall be carried out on SS Castings. |
| 1 | Trial assembly of all Vertical Turbine Pump components with Column Pipes, Discharge Head, and Motor Stool shall be carried at shop. |
| 2 | Performance testing of Pumps shall be carried out at shop, as per HIS standard to determine Head & Flow Characteristics. |
| 3 | In case of pump impellers, Radiographic Examination shall be conducted as per ASTM E186/446 with Severity Level 2 for Gas porosity, Level 3 for Sand, Slag and Shrinkage. Cracks, Inserts and Mottling are not acceptable. Radiographic Examination should cover Vanes, Vane Junctions, Full Radial depth of Hub & other accessible areas of the rest of the Impeller. |
| 4 | Random 10% RT to be conducted on butt welds for Thk ≥ 10 mm & ≤ 25 mm and 100% RT to be conducted on butt welds for Thk > 25 mm (RT may be replaced by Ultrasonic Test due to constraint if any.) Stress relieving shall be carried out as per norms of ASME Section VIII. |
| 5 | Segmental Flanges exceeding 37.5 mm thickness shall be stress relieved after welding. All butt weld joints in segmental flange shall be examined by Radiographic Test. (RT may be replaced by Ultrasonic Test due to constraint if any.) Maximum number of segments shall be 4 only. |
| 6 | No repair welding is permitted on Cast Iron / Alloy Cast Iron Castings. |
| 7 | Hydraulic Test of Body, Seat and Disc strength shall be carried out in accordance with latest edition of AWWA C-504. Actuator operated Valves shall be checked for Seat Leakage by closing the Valve with Job Actuator. Seat Leakage test shall be carried out in both directions. |
| 8 | For Proof of Design Test refer respective chapters of engineering portion in the technical specification. |
| 9 | For Butterfly Valves of Fabricated construction (Sizes 600mm and above), butt Welds of thickness 20mm & above shall be subjected to 100% Radiography and Components shall undergo stress relieving. |
| 10 | During Hydraulic & Vacuum test at 30 mm Hg absolute in 3 different positions, the change in Circumference of the Arch should not be more than 1.5%. Permanent Set, after 24 hours of the test, should not exceed 0.5% of Arch. |
| 11 | Tests on Rubber for Tensile, Elongation, Hardness, Hydraulic Stability as per ASTM D-471, Ozone Resistance test as per ASTM D-1149, Aging test, Adhesion strength of Rubber to Fabric and Rubber to Metal shall be carried out. |
| 14 | Type / Routine tests as per requirements of BS-6540/ ASHRAE-52-76 for Dust arrestance shall be carried out. |

EOT CRANES AND HOIST

1.00.00 HOOKS

All Tests including Proof Load Test as per relevant IS shall be carried out. MPI / DPT shall be done after proof load test.

2.00.00 STEEL CASTINGS

DPT on machined surface shall be carried out.

3.00.00 GIRDERS, END CARRIAGE, CRAB, GEAR BOX AND ROPE DRUM

UT shall be carried out on plates of thickness 25 mm and above as per ASTM A 435
NDT requirements on weldments shall be as follows

- | | | |
|------|---------------------------|--------------------|
| i. | Butt Welds in Tension | 100% RT & 100% DPT |
| ii. | Butt Welds in Compression | 10% RT & 100% DPT |
| iii. | Butt Welds in Rope Drum | 100% RT & 100% DPT |
| iv. | Fillet Welds | 10% DPT |

4.00.00 FORGINGS (Wheels, Gears, Pinions, Axles, Hooks, & Hooks Trunion)

All forgings greater than or equal to 50 mm diameter or thickness shall be subjected to ultrasonic testing (UT).

DPT / MPI shall be carried out after hard-facing and machining.

Hardness and Case depth shall be measured

5.00.00 WIRE ROPES

Wire ropes shall be tested as per relevant standard.

6.00.00 REDUCTION GEARS

Reduction Gears shall be tested for reduction ratio, backlash and contact pattern.

Gear box shall be subjected to No – load run test for 4 hours to check for oil leakage, temperature rise, noise and vibration.

7.00.00 Chemical and Mechanical test of all components as per relevant material specification shall be carried out.

8.00.00 COMPLETE CRANE

The crane shall be completely assembled at shop for final testing.

All tests as per IS 3177 shall be carried out at shop.

9.00.00 HOISTS

All Electric Hoist shall be tested as per IS 3938 and chain pulley blocks shall be tested as per IS 3832.

LAYING/ERECTION OF PIPES

(1) Followings are the Quality Assurance Requirements for laying of 3 LPE Coated MS Pipes

A RECEIPT OF ITEMS AT SITE

Check for completeness of supply and visual check for damage of followings after receipt at site:

- i. 3 LPE Coated MS Pipes, fittings, flanges, couplings, bolts and nuts, fasteners, plugs, sleeves etc.
- ii. Welding electrodes, filler rods & wires, gases like oxygen, acetylene, argon, carbon di-oxide, propane etc.
- iii. X-ray & gamma ray equipment, dye penetrants, RT films,
- iv. Epoxy Primer, Paint, Heat Shrinkable Sleeve, Coating and wrapping material

B STORAGE

Check for proper storage of following items as per manufacturer recommendations / storage guideline

- i. 3 LPE Coated MS Pipes, fittings, flanges, couplings, bolts and nuts, fasteners, plugs, sleeves etc.
- ii. Welding electrodes, filler rods & wires, gases like oxygen, acetylene, argon, carbon di-oxide, propane etc.
- iii. X-ray & gamma ray equipment, dye penetrants, RT films.
- iv. Epoxy Primer, Paint, Heat Shrinkable Sleeve, Coating and wrapping material

C Following checks shall be carried out during Laying of 3LPE Pipes

- i. Ensure proper alignment & fit up
- ii. Ensure correct joining of pipes
- iii. Ensure installation of supports (as applicable)
- iv. Hydraulic Test of section and complete pipeline as per Engg technical specification requirements.

| | | | |
|---|--|--|---------------------|
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATIONS SECTION-VI, PART – B BID Doc NO- | SUB SECTION-E-13 RAW WATER (MECHANICAL) | Page 6 of 12 |
|---|--|--|---------------------|

D JOINING OF 3 LPE COATED MS PIPES AT SITE BY WELDING

Following checks shall be carried out during joining of 3 LPE coated MS pipes at site by welding

- i. Dimensional conformity
- ii. Tolerance OD/ Ovality
- iii. Ensure proper alignment of pipes, Edge preparation and joint fit up
- iv. Ensure Tack weld by qualified welder and provision of internal bracing to keep in proper shape
- v. WPS, PQR & WPQ (welder performance qualification) tests prior to welding
- vi. Check for surface defects after welding (visual)
- vii. 100% DPT on root run/ after back gauging/ grinding of butt weld as applicable
- viii. 10% DPT on fillet weld
- ix. 10% DPT on finished butt welds
- x. 5% RT/ 5% UT by TOFD/PAUT techniques on those butt weld joints which can be 100% hydro tested.
- xi. 100% RT / 100% UT by TOFD/PAUT technique of the butt weld joints of pipeline shall be carried out which cannot be Hydro tested.

E WRAPPING & COATING OF HEAT SHRINKABLE SLEEVE, PROCEDURE QUALIFICATION TEST

Following checks shall be carried out during Procedure Qualification Test (PQT) of application (wrapping and coating) of Heat Shrinkable Sleeve as well as during regular work (Wrapping & Coating) of Heat Shrinkable Sleeve after PQT

- i. Before start of work, ensure followings
 - a. Use of correct raw material i.e. epoxy primer, wrap around heat shrinkable sleeve of NTPC acceptable make & grade.

| | | | |
|---|--|--|---------------------|
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATIONS SECTION-VI, PART – B BID Doc NO- | SUB SECTION-E-13 RAW WATER (MECHANICAL) | Page 7 of 12 |
|---|--|--|---------------------|

- b. The applicator agency deployed for the work shall have adequate experience and approved by NTPC.

- c. All the butt weld joints shall have acceptable NDT (RT/UT & DPT) and Hydraulic test records.
 - ii. Ensure proper cleaning and Surface preparation of butt weld joints & adjoining pipe surface as per approved procedure complying with relevant clauses of Specification.
 - iii. Finished Surface - Visual Examination, Measurement of Surface Roughness, Profile, dust contamination
 - iv. Ensure compliance of correct time interval between blasts cleaned ready pipe & coating.
 - v. Ensure use of correct size of Wrap around heat shrinkable sleeve on each joint
 - vi. Ensure adequate pre – heating of pipe
 - vii. Ensure application of correct epoxy primer (check make, grade, date of manufacturing, date of expiry) immediately after preheating
 - viii. Visual Examination & Wet film thickness measurement after epoxy primer coat
 - ix. Ensure application of wrap around heat shrinkable sleeve entirely around the pipe when the epoxy is still wet.
 - x. Ensure proper heat duration / temperature during application of heat on wrap around heat shrinkable sleeve
 - xi. Finished coat
 - a. Visual examination,
 - b. Measurement of coat thickness (on pipe body and on weld bead),
 - c. Holiday Test
 - d. Peel – off test
 - e. Overlap Test

| | | | |
|---|--|--|---------------------|
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATIONS SECTION-VI, PART – B BID Doc NO- | SUB SECTION-E-13 RAW WATER (MECHANICAL) | Page 8 of 12 |
|---|--|--|---------------------|

(2) Followings are the Quality Assurance Requirements for laying/erection of MS Pipes

A RECEIPT OF ITEMS AT SITE

Check for completeness of supply and visual check for damage of followings after receipt at site:

- i. MS Pipes, fittings, flanges, couplings, bolts and nuts, fasteners, plugs, sleeves etc.
- ii. Welding electrodes, filler rods & wires, gases like oxygen, acetylene, argon, carbon di-oxide, propane etc.
- iii. X-ray & gamma ray equipment, dye penetrants, RT films, Epoxy Primer, Paint, Coating and wrapping material

B STORAGE

Check for proper storage of following items as per manufacturer recommendations / storage guideline

- i. MS Pipes, fittings, flanges, couplings, bolts and nuts, fasteners, plugs, sleeves etc.
- ii. Welding electrodes, filler rods & wires, gases like oxygen, acetylene, argon, carbon di-oxide, propane etc.
- iii. X-ray & gamma ray equipment, dye penetrants, RT films.
- iv. Epoxy Primer, Paint, Coating and wrapping material

C Following checks shall be carried out during Laying of MS Pipes

- i. Ensure proper alignment & fit up
- ii. Ensure correct joining of pipes
- iii. Ensure installation of supports (as applicable)

| | | | |
|---|--|--|---------------------|
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATIONS SECTION-VI, PART – B BID Doc NO- | SUB SECTION E-E-13 RAW WATER (MECHANICAL) | Page 9 of 12 |
|---|--|--|---------------------|

- iv. Hydraulic Test of section and complete pipeline as per Engg technical specification requirements.

D JOINING OF MS PIPES AT SITE BY WELDING

Following checks shall be carried out during joining of MS pipes at site by welding

- i. Dimensional conformity
- ii. Tolerance OD/ Ovality
- iii. Ensure proper alignment of pipes, Edge preparation and joint fit up
- iv. Ensure Tack weld by qualified welder and provision of internal bracing to keep in proper shape
- v. WPS, PQR & WPQ (welder performance qualification) tests prior to welding
- vi. Check for surface defects after welding (visual)
- vii. 100% DPT on root run/ after back gauging/ grinding of butt weld as applicable.
- viii. 10% DPT on fillet weld
- ix. 10% DPT on finished butt welds
- x. 5% RT/ 5% UT by TOFD/PAUT techniques on those butt weld joints which can be 100% hydro tested.
- xi. 100% RT / 100% UT by TOFD/PAUT technique of the butt weld joints of pipeline shall be carried out which cannot be Hydro tested.

E CHECKS ON PAINTING OF OVERGROUND MS PIPES

- i. Before start of work, ensure followings

| | | | |
|---|--|--|----------------------|
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATIONS SECTION-VI, PART – B BID Doc NO- | SUB SECTION-E-13 RAW WATER (MECHANICAL) | Page 10 of 12 |
|---|--|--|----------------------|

- a. Use of correct raw material i.e. primer, paint of NTPC acceptable make & grade.
- b. All the butt weld joints shall have acceptable NDT (RT/UT & DPT) and Hydraulic test records.
- ii. Ensure proper cleaning and Surface preparation of butt weld joints & complete pipe surface as per approved procedure complying to relevant clauses of Specification.
- iii. Finished Surface - Visual Examination, Measurement of Surface Roughness, Profile, dust contamination
- iv. Ensure compliance of correct time interval between blast cleaned ready pipe & coating / painting
- v. Ensure application of correct primer, paint (check make, grade, date of manufacturing, date of expiry)
- xii. Visual Examination & Wet film thickness measurement after primer coat, paint coats
- xiii. Finished coat
 - a. Visual examination,
 - b. Measurement of coat thickness (on pipe body and on weld bead),

(3) Followings are the Quality Assurance Requirements for laying of DI pipes

A RECEIPT OF ITEMS AT SITE

Check for completeness of supply and visual check for damage of followings after receipt at site:

DI Pipes, DI Pipes fittings, flanges, couplings, bolts and nuts, fasteners, plugs, sleeves etc.

B STORAGE

Check for proper storage of following items as per manufacturer recommendations / storage manual

DI Pipes, DI Pipes fittings, flanges, couplings, bolts and nuts, fasteners, plugs, sleeves etc.

C LAYING OF DI PIPES

Following checks shall be carried out during Laying of DI Pipes

- v. Ensure proper alignment & fit up
- vi. Ensure correct joining of pipes
- vii. Ensure installation of supports (as applicable)


| | | | |
|---|--|--|----------------------|
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATIONS SECTION-VI, PART – B BID Doc NO- | SUB SECTION-E-13 RAW WATER (MECHANICAL) | Page 11 of 12 |
|---|--|--|----------------------|

- viii. Hydraulic Test of section and complete pipeline as per Engg technical specification requirements.

| | | | |
|---|--|--|----------------------|
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATIONS SECTION-VI, PART – B BID Doc NO- | SUB SECTION-E-13 RAW WATER (MECHANICAL) | Page 12 of 12 |
|---|--|--|----------------------|


SUB-SECTION– E-15

EQUIPMENT COOLING WATER SYSTEM

| CLAUSE NO. | | QUALITY ASSURANCE | | | | | | | | | | |
|--|------------------------------------|---|--|----------------|-----------------|----------------------------|----------------|---|------------------------|----------------|----------------|------------------|
| | |  | | | | | | | | | | |
| | | EQUIPMENT COOLING WATER SYSTEM | | | | | | | | | | |
| | TEST / CHECKS | | | | | | | | | | | |
| | ITEM / COMPONENTS | Material Test | WPS/PQR/Welder Qualification | DPT/MPI | Assembly Fit Up | Visual & Dimensional Check | UT | RT | Hydraulic / Water Fill | Balancing | Type Test | Performance Test |
| A | PLATE TYPE HEAT EXCHANGER | | Y | Y ³ | Y | Y | | | Y | | | |
| A.1 | Heat Transfer Plates | Y ¹ | | Y ² | | Y | | | | | | Y ⁷ |
| A.2 | Gaskets | Y | | | | Y | | | | | | |
| A.3 | Cover Plates (Front & Rear) | Y ¹ | | | | Y | Y ⁵ | | | | | |
| A.4 | Tie Rods | Y ¹ | | Y ⁴ | | | Y ⁶ | | | | | |
| B | HORIZONTAL CENTRIFUGAL PUMP | | | | Y | Y | | | | | | Y ¹⁰ |
| B.1 | Casing | Y ¹ | | Y ⁴ | | Y | | | Y ⁸ | | | |
| B.2 | Impeller | Y ¹ | | Y ⁴ | | Y | | | | Y ⁹ | | |
| B.3 | Shaft | Y ¹ | | Y | | Y | Y ⁶ | | | Y ⁹ | | |
| NOTES 1 One per heat / HT batch 2 DP Test shall be conducted for 10% of the lot of HT plates. However, in case of any defect, entire lot shall be tested and only defect free plates shall be accepted. 3 100% DP Test shall be conducted on butt welds and 10% DPT on fillet weld after final run. 4 100% DPT shall be carried out on machined surfaces. 5 UT shall be done on plates with thickness >40 mm and for pressure parts plates 25 mm or above. 6 UT shall be done on shaft / tie rod with diameter 40 mm or above. 7 After pressing each HT plate shall be subjected to either of the following tests, as per Manufacturer Practice a) Light Box Test b) Vacuum Test c) Air Chamber Test 8 All pressure retaining parts shall be hydrostatically tested at 200% of pump rated head or 150% of shut – off head, whichever is higher, for at least 30 minutes. No leakage is allowed. 9 Static and Dynamic Balancing shall be carried out on complete rotor assembly. 10 All pumps shall be tested at rated speed, for head, flow capacity, efficiency and power consumption for the entire operating range i.e. from shut off head to maximum flow. A minimum of 7 readings shall be taken to plot the curve, with one reading at design flow. Testing standard shall be HIS (Hydraulic Institute Standard) of USA. Performance test shall be carried out with contract motor, wherever Liquidated Damages are to be ascertained based on performance test at shop. 11. For pipes, fittings, valves & RE joints refer QA chapters of LP Piping. | | | | | | | | | | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | | TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC.NO.: | | | | | SUB-SECTION –E-15 EQUIPMENT COOLING WATER SYSTEM (Mech) | | | Page 1 of 1 | |

SUB-SECTION– E-16

EOT CRANES AND HOISTS

| CLAUSE NO. | QUALITY ASSURANCE |  |
|---|--|--|
| | <p align="center">Shop Test for T.G.Hall EOT Cranes, Other Cranes & Hoist</p> <p>1.0 HOOKS</p> <p>1.01 ALL TESTS INCLUDING PROOF LOAD TEST AS PER RELEVANT IS/BS/DIN SHALL BE CARRIED OUT.</p> <p>1.02 MPI/DPT SHALL BE CARRIED OUT AFTER PROOF LOAD TEST.</p> <p>2.0 STEEL CASTING</p> <p>2.01 DPT ON MACHINED SURFACE SHALL BE CARRIED OUT.</p> <p>3.0 GIRDERS, END CARRIAGE, CRAB, GEAR BOX AND ROPE DRUM</p> <p>3.01 THE PLATES OF THICKNESS 25MM AND ABOVE SHALL BE ULTRASONICALLY TESTED.</p> <p>3.02 NDT REQUIREMENTS ON WELDMENTS SHALL BE AS FOLLOWS:</p> <p>a) BUTT WELDS IN TENSION:- 100% RT AND 100% DPT</p> <p>b) BUTT WELDS IN COMPRESSION:- 10% RT AND 100% DPT</p> <p>c) BUTT WELDS IN ROPE DRUM:- 100% RT AND 100% DPT</p> <p>d) FILLET WELDS:- RANDOM 10% DPT</p> <p>4.0 FORGING (WHEEL, GEARS, PINIONS, AXLE, HOOKS & HOOK TRUNION)</p> <p>4.01 ALL FORGINGS GREATER THAN OR EQUAL TO 50 MM DIAMETER OR THICKNESS SHALL BE SUBJECTED TO ULTRASONIC TESTING.</p> <p>4.02 DPT/MPI SHALL BE DONE AFTER HARDFACING AND MACHINING.</p> <p>5.0 WIRE ROPE SHALL BE TESTED AS PER RELEVANT STANDARD.</p> <p>6.0 REDUCTION GEARS SHALL BE TESTED FOR REDUCTION RATIO, BACKLASH & CONTACT PATTERN. GEAR BOX SHALL BE SUBJECTED TO NO-LOAD RUN TEST TO CHECK FOR OIL LEAKAGE, TEMPERATURE RISE, NOISE AND VIBRATION.</p> <p>7.0 THE CRANES SHALL BE COMPLETELY ASSEMBLED AT SHOP FOR FINAL TESTING. ALL TESTS FOR DIMENSION, DEFLECTION, LOAD, OVERLOAD, HOISTING MOTION, CROSS TRAVEL ETC. AS PER IS-3177 SHALL BE CARRIED OUT AT SHOP.</p> <p>8.0 ALL ELECTRIC HOISTS SHALL BE TESTED AS PER IS-3938 AND CHAIN PULLEY BLOCKS SHALL BE TESTED AS PER IS-3832.</p> <p>9.0 <u>LIFTING BEAM:</u></p> <p>9.01 THE PLATES OF THICKNESS 25MM AND ABOVE SHALL BE ULTRASONICALLY TESTED.</p> | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO | E-16 TURBINE HALL EOT CRANE, OTHER CRANES & HOISTS |
| | | Page 1 of 2 |

| CLAUSE NO. | QUALITY ASSURANCE | एनटीपीसी NTPC | |
|---|--|--|----------------|
| 9.02 | <p>NDT REQUIREMENTS ON WELDMENTS SHALL BE AS FOLLOWS:</p> <p>e) BUTT WELDS IN TENSION:- 100% RT AND 100% DPT</p> <p>f) BUTT WELDS IN COMPRESSION:- 10% RT AND 100% DPT</p> <p>g) FILLET WELDS:- RANDOM 10% DPT</p> | | |
| 9.03 | ALL FORGINGS GREATER THAN OR EQUAL TO 50 MM DIAMETER OR THICKNESS SHALL BE SUBJECTED TO ULTRASONIC TESTING. | | |
| 9.04 | DPT/MPI SHALL BE DONE AFTER MACHINING. | | |
| 9.05 | Lifting Beam will be subjected to overload testing at @1.25 X SWL of Lifting Beam at manufacturer works. | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO | E-16 TURBINE HALL EOT CRANE, OTHER CRANES & HOISTS | Page 2 of 2 |

SUB-SECTION– E-22

CW PUMP

| Tests/Check Items / Components | | Material Test | DPT/MPI | Ultrasonic test | RT | Balancing | Hydraulic / Water Fill test | Pneumatic Test | Assembly/ fit up | Dimensions | Functional/operational Test | Performance Test | Other Test | All Test as per relevant Std/ Approved Data Sheets | Remarks |
|--|--|--|----------------|-----------------|----------------|-----------|-----------------------------|---|------------------|------------|-----------------------------|------------------|-----------------|---|---------|
| A. | CW PUMPS, VT PUMPS & CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL), SUMP PUMPS, SUBMERSIBLE PUMPS, DRAINAGE PUMP | | | | | | | | Y ¹ | Y | | Y ² | | | |
| 1 | Shaft | Y ^a | Y ^b | Y ^c | | Y | | | | Y | | | | | |
| 2 | Impeller | Y ^a | Y ^b | | Y ³ | Y | | | | | | | Y ^d | | |
| 3 | Suction Bell / Bowl Castings/ Inserts | Y ^a | Y ^b | | | | Y | | | Y | | | Y ⁶ | | |
| 4 | Discharge Head / Column Pipes / Distance Piece/Base Plate | Y ^a | Y ^b | Y ^c | Y ⁴ | | Y | | Y | | | | | | |
| 5 | Companion Flanges | Y ^a | Y ^b | Y ^c | Y ⁵ | | | | Y | | | | | | |
| 5 | Thrust Bearing (Tilting Pad type) | Y ^a | Y | Y | | | | | Y | Y | | | | Y | |
| B. | BUTTERFLY VALVES | | | | | | Y ⁷ | | Y | Y | Y | | Y ⁸ | Y | |
| 1 | Body & Disc (Cast) | Y ^a | Y ^b | | | | | | | | | | | | |
| 2 | Body & Disc (fabricated) | Y ^a | Y ^b | Y ^c | | | | | | | | | Y ⁹ | | |
| 3 | Shaft | Y ^a | Y ^b | Y ^c | | | | | | | | | | | |
| 4 | EH Actuators | Y ^a | Y | | | | Y | Y | Y | | Y | | | | |
| C. | RE JOINTS | Y ^a | | | | | Y ¹⁰ | | Y | Y | | | Y ¹¹ | | |
| D. | R & W PIPES | Y ^a | REFER NOTE 13 | | | | | | | | | | | | |
| E. | CRANES & HOISTS | REFER BELOW FOR QA CHECKS ON EOT CRANES AND HOISTS | | | | | | | | | | | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATIONS SECTION VI, PART- B Bid Doc. No.: | | | | | | SUB-SECTION E-22 CW SYSTEM EQUIPMENT | | | | | | Page 1 of 5 | |

| | | | | | | | | | | | | | | | |
|-----------|---|----------------|----------------|----------------|--|---|-----------------|--|---|---|---|---|-----------------|---|--|
| F. | VENTILATION FANS | | | | | | | | | Y | | Y | | Y | |
| 1) | Hub/Blades/Casing /Impeller | Y | Y | | | Y | | | | | | | | | |
| 2) | Shaft | Y ^a | Y | Y ^c | | | | | | | | | | | |
| 3) | Pre/Fine Filters | | | | | | | | | | | | Y ¹⁴ | | |
| H. | GATE, GLOBE, CHECK VALVES, PIPINGS, & SPECIALITIES | Y ^a | Y ^b | Y ^c | | | Y ¹⁵ | | Y | Y | Y | Y | Y ¹⁵ | Y | |

Notes:

| | |
|----------|---|
| a | One per Heat/ Heat Treatment Batch/ Lot. |
| b | On machined surfaces only for Castings / Forgings and on Welds of Fabricated Components. |
| c | For Shaft diameter. ≥ 50 mm and for plate thickness ≥ 25 mm |
| d | Inter Granular Corrosion (IGC) Test shall be carried out on SS Castings. |
| 1 | Trial assembly of all Vertical Turbine Pump components with Column Pipes, Discharge Head, and Motor Stool shall be carried at shop. |
| 2 | Performance testing of Pumps shall be carried out at shop, as per HIS standard to determine Head & Flow Characteristics. |
| 3 | In case of CW pump impellers, Radiographic Examination shall be conducted as per ASTM E186/446 with Severity Level 2 for Gas porosity, Level 3 for Sand, Slag and Shrinkage. Cracks, Inserts and Mottling are not acceptable. Radiographic Examination should cover Vanes, Vane Junctions, Full Radial depth of Hub & other accessible areas of the rest of the Impeller. |
| 4 | Random 10% RT to be conducted on butt welds for Thk ≥ 10 mm & ≤ 25 mm and 100% RT to be conducted on butt welds for Thk > 25 mm (RT may be replaced by Ultrasonic Test due to constraint if any.) Stress relieving shall be carried out as per norms of ASME Section VIII. |
| 5 | Segmental Flanges exceeding 37.5 mm thickness shall be stress relieved after welding. All butt weld joints in segmental flange shall be examined by Radiographic Test. (RT may be replaced by Ultrasonic Test due to constraint if any.) Maximum number of segments shall be 4 only. |
| 6 | No repair welding is permitted on Cast Iron / Alloy Cast Iron Castings. |
| 7 | Hydraulic Test of Body, Seat and Disc strength shall be carried out in accordance with latest edition of AWWA C-504. Actuator operated Valves shall be checked for Seat Leakage by closing the Valve with Job Actuator. Seat Leakage test shall be carried out in both directions. |
| 8 | For Proof of Design Test refer respective chapters of engineering portion in the technical specification. |
| 9 | For Butterfly Valves of Fabricated construction (Sizes 600mm and above), butt Welds of thickness 20mm & above shall be subjected to 100% Radiography and Components shall undergo stress relieving. |

| | | |
|-----------|--|---|
| 10 | During Hydraulic & Vacuum test at 30 mm Hg absolute in 3 different positions, the change in Circumference of the Arch should not be more than 1.5%. Permanent Set, after 24 hours of the test, should not exceed 0.5% of Arch. | |
| 11 | Tests on Rubber for Tensile, Elongation, Hardness, Hydraulic Stability as per ASTM D-471, Ozone Resistance test as per IS:3400 Part 20, Aging test, Adhesion strength of Rubber to Fabric and Rubber to Metal shall be carried out. | |
| 12 | Smooth operation and Leakage test shall be carried out at site. | |
| 13 | Followings are the testing requirements for fabrication of pipes at site | |
| | Tests | Quantum of Check |
| | WPS, PQR, Welder Qualification Test | 100% |
| | DPT on root run | 100% for pipes up to 1200 mm diameter |
| | DPT after back gauging | 100% for pipes above 1200 mm diameter |
| | RT/ UT by TOFD Technique/PAUT | 5% |
| | DPT on finished butt weld joints | 10% |
| | Hydraulic Test | 100%, 1.5 times the design pressure or 2 times the working pressure which ever is higher. |
| | Note:- After erection, the complete piping system shall be tested at 1.5 times, the design pressure or two times the maximum working pressure whichever greater. No leakage/seepage is acceptable. Butt weld joints which would not be hydro-tested shall be subjected to 100% RT test/ 100% UT by TOFD /PAUT Technique. | |
| 14 | Type / Routine tests as per requirements of BS-6540/ ASHRAE-52-76 for Dust arrestance shall be carried out. | |
| 15 | <ul style="list-style-type: none"> a. All pipes and fittings shall be tested as per applicable code. b. All strainers shall be subjected to Hydraulic pressure test for leakage. c. All valves shall be hydraulically tested for body, seat and back-seat (if applicable) as per relevant standard. Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure. d. Valves shall be offered for hydro test in unpainted condition. e. Functional checks of the valves for smooth opening and closing shall also be done. f. Anti-corrosive protection shall be tested as per applicable code. | |

EOT CRANES AND HOIST

1.00.00 HOOKS

All Tests including Proof Load Test as per relevant IS shall be carried out. MPI / DPT shall be done after proof load test.

2.00.00 STEEL CASTINGS

DPT on machined surface shall be carried out.

3.00.00 GIRDERS, END CARRIAGE, CRAB, GEAR BOX AND ROPE DRUM

UT shall be carried out on plates of thickness 25 mm and above as per ASTM A 435 /IS:11630 & IS: 4225

NDT requirements on weldments shall be as follows

- | | | |
|------|---------------------------|--------------------|
| i. | Butt Welds in Tension | 100% RT & 100% DPT |
| ii. | Butt Welds in Compression | 10% RT & 100% DPT |
| iii. | Butt Welds in Rope Drum | 100% RT & 100% DPT |
| iv. | Fillet Welds | 10% DPT |

4.00.00 FORGINGS (Wheels, Gears, Pinions, Axles, Hooks, & Hooks Trunion)

All forgings greater than or equal to 50 mm diameter or thickness shall be subjected to ultrasonic testing (UT).

DPT / MPI shall be carried out after hard-facing and machining. Hardness and Case depth shall be measured

5.00.00 WIRE ROPES

Wire ropes shall be tested as per relevant standard.

6.00.00 REDUCTION GEARS

Reduction Gears shall be tested for reduction ratio, backlash and contact pattern. Gear box shall be subjected to No – load run test for 4 hours to check for oil leakage, temperature rise, noise and vibration.

7.00.00 Chemical and Mechanical test of all components as per relevant material specification shall be carried out.

| | | | |
|---|---|--|------------------------|
| <p>SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE</p> | <p>TECHNICAL SPECIFICATIONS SECTION VI, PART- B Bid Doc. No.:</p> | <p>SUB-SECTION E-22 CW SYSTEM EQUIPMENT</p> | <p>Page 4 of 5</p> |
|---|---|--|------------------------|

8.00.00 COMPLETE CRANE


The crane shall be completely assembled at shop for final testing. All tests as per IS 3177 shall be carried out at shop.


9.00.00 HOISTS

All Electric Hoist shall be tested as per IS 3938 and chain pulley blocks shall be tested as per IS 3832.


SUB-SECTION– E-24

FIRE PROTECTION SYSTEM

| CLAUSE NO. | TECHNICAL REQUIREMENTS | | |  |
|--|---|--|---|---|
| 1.00.00 | FIRE DETECTION & PROTECTION SYSTEM | | | |
| 9.01.00 | HYDRANT SYSTEM: Shop Tests | | | |
| 1..01 | Hydrant Valve: | | | |
| | a) All valves shall be hydro tested for body and seat. | | | |
| | b) Capacity test / flow test shall be done as per relevant standard. | | | |
| 1..02 | Water Monitor, Hoses, Branch Pipes, Couplings and Nozzles: | | | |
| | a) All tests including hydraulic test shall be done as per relevant Indian / International standard. | | | |
| 1..03 | For Pumps, Diesel Engine, refer the requirements are indicated separately. | | | |
| 9.01.00 | HIGH / MEDIUM VELOCITY WATER SPRAY & SPRINKLER SYSTEM: Shop Tests | | | |
| 1..01 | For Pipes, Fittings, Valves and specialties, requirements are indicated separately. | | | |
| 1..02 | Deluge Valves, Alarm Valves and Spray Sprinkler Nozzles | | | |
| | a) All valves shall be hydro tested for body and seat. | | | |
| | b) Performance test / functional test of 'Deluge Valves', 'Alarm Valves' and 'Spray Nozzles' shall be carried out. | | | |
| 1..03 | Detectors: All 'Detectors' shall be tested as per relevant Indian / International Standards. Detectors shall also meet the requirements of UL / FM / LPC/VDS etc. | | | |
| 9.01.00 | HORIZONTAL CENTRIFUGAL PUMP: | | | |
| 1..01 | SHOP TESTS | | | |
| | (a.) UT on Pump Shaft (>= 50mm dia) and MPI / DPT on Pump Shaft and Impeller shall be carried out. | | | |
| | (b.) All rotating components of the pumps shall be statically and dynamically balanced as per IS: 21940 Gr. 6.3 or better. | | | |
| | (c.) Hydraulic test shall be conducted on pump casing with water at 1.5 times the shut off pressure or twice the rated pressure whichever is higher for a minimum duration of 30 minutes. | | | |
| | (d.) Performance test and Standard Running test: | | | |
| | (1.) All the pumps shall be tested in the manufacturer's works for capacity, efficiency, head and brake horsepower. Pump shall be | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO | SUB SECTION E-24 Fire Detection & Protection System | Page 1 of 4 |

| CLAUSE NO. | TECHNICAL REQUIREMENTS | | |  |
|--|--|--|---|---|
| | <p>given running test over the entire operating range covering the shut off head to the maximum flow. The duration of test shall be minimum one hour. A minimum of five readings approximately equidistant shall be taken for plotting the curves with one point at design flow. Testing of pump shall be in accordance with stipulations oh Hydraulic Institute Standard (HIS) and / or as per applicable Indian Standard or equivalent. Tolerance of parameters shall be as per HIS.</p> <p>(2.) The test shall be conducted at the rated speed preferably with the type tested contract drive motor being furnished. However, in case of any limitation test bed motor duly calibrated can also be used.</p> <p>(3.) Noise and vibration shall be measured.</p> <p>(4.) Pumps shall be subjected to strip down examination visually to check for mechanical damages after testing at shop in case abnormal noise level / vibration performance are observed during the shop test.</p> | | | |
| 9.01.00 | COMPRESSION IGNITION DIESEL ENGINE | | | |
| 1..01 | Shop Tests: | | | |
| | <p>a) All pressure parts shall be subjected to hydraulic pressure tests at 1.5 times the design pressure.</p> <p>b) All Diesel engine shall be performance tests as per relevant IS / equivalent code.</p> | | | |
| 1..02 | Performance Test : | | | |
| | <p>Performance test of diesel engine shall be carried out as per BS-5514 to determine the rated power and specific fuel consumption and governor's function.</p> <p>Performance test of engine in shop shall be done with actual job accessories for minimum four hours (three hours for full load and one hour for over load at 110% of full load). All the engine parameters like RPM, inlet airs temp and pressure, water inlet and outlet temp. And pressure, lub. Oil pressure, fuel consumption, ambient condition shall be measured and recorded for every half an hour. No positive tolerance shall be allowed on the specific fuel consumption (contractor to specify in the offer.)</p> | | | |
| 9.01.00 | STORAGE VESSELS: Shop Test | | | |
| 1..01 | Atmospheric Tank | | | |
| | <p>(a.) All weld joints shall be DP Tested and complete tanks shall be water fill tested.</p> | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO | SUB SECTION E-24 Fire Detection & Protection System | Page 2 of 4 |

| CLAUSE NO. | TECHNICAL REQUIREMENTS | | | <div>एनटीपीसी NTPC</div> |
|--|---|--|---|------------------------------|
| | <div>(b.) All atmospheric storage tanks fabricated and erected at site shall be subjected to all tests (Hydro, NDT, and Vacuum) according to design code as applicable.</div> | | | |
| 1.06.00 | PIPING, VALVE AND SPECIALITIES | | | |
| 1.06.01 | SHOP TESTS | | | |
| | <div>(a.) All pipes and fittings shall be tested as per applicable code.</div> <div>(b.) DPT of pipe welds (in case of rolled and welded pipes only) shall be carried out for root and finished welds.</div> <div>(c.) All strainers shall be subjected to hydraulic pressure test for leakage and Pressure drop v/s Flow for each type and size.</div> <div>(d.) All valves shall be hydraulically tested for body, seat and back seat (if applicable) as per relevant standard. Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure.</div> <div>(e.) Valves shall be offered for hydro test in unpainted condition.</div> <div>(f.) Functional checks of the valves for smooth opening and closing shall also be done.</div> <div>(g.) Anti-corrosive protection shall be tested as per applicable code.</div> | | | |
| 1.07.00 | PORTABLE & MOBILE FIRE EXTINGUISHERS | | | |
| 1.07.01 | SHOP TEST | | | |
| | <div>(a.) All fire extinguishers shall be tested as per relevant standard.</div> <div>(b.) Performance / function test shall be carried out on sampling basis as per relevant code / standard.</div> | | | |
| 1.08.00 | EOT Crane | | | |
| | <div>a) Chain pulley Blocks shall be tested as per IS: 3832.</div> <div>b) Electrical wire rope hoists shall be tested as per IS : 3938</div> <div>c) Following NDT requirements shall be met:<div><div>(i) 100% RT of Butt welds in tension and 10% RT of butt welds in compression.</div><div>(ii) DP at random on all weldments.</div></div></div> | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO | SUB SECTION E-24 Fire Detection & Protection System | Page 3 of 4 |

| CLAUSE NO. | TECHNICAL REQUIREMENTS | | |  |
|--|---|--|---|---|
| 1.09.00 | c) Deflection, load, overload & travel check on EOT crane assembly shall be carried out as per IS: 3177. | | | |
| | SITE TESTS: a) Fire Extinguishers: A performance demonstration test at site of five (5) percent or one (1) number, whichever is higher, of each type and capacity of the extinguisher shall be carried out by the contractor. All consumables and replaceable items require for the contractor without any extra cost to employer would supply this test would be supplied by the Contractor without any extra cost to employer. b) Piping Protection: (1.) Thickness, Holiday by spark test, Adhesion test shall be carried out as per relevant standard. (2.) Complete piping shall be Hydro pressure tested, at 1.5 X DP or 2 X MWP whichever is higher, before protection. (c.) Welding of Pipes: (1.) ERW Black / rolled welded: 100% DPT on root of butt and finish weld of butt and fillet. RT on 10% randomly selected joints shall be carried out (for underground piping). (2.) GI Pipes Welding on GI Pipes in general shall not be done. Welding of GI Pipes, if permitted by design, (butt / socket / fillet weld) shall be done strictly as per approved drawing and procedure approved by NTPC Engineering. For all such welds 100% DP test and random 1% RT shall be done. | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO | SUB SECTION E-24 Fire Detection & Protection System | Page 4 of 4 |

SUB-SECTION– E-28

GENERATOR AND AUXILIARIES

CLAUSE NO.

QUALITY ASSURANCE

GENERATORS & AUXILIARIES.**PROCESS CHECK FOR STATIC PARTS GENERATOR / EXCITOR**

| ITEM/ COMPONENTS /PROCESS | Visual & dimension | Chem. Prop. (raw material) | Heat treatment | Mech. Prop. (raw material as applicable) | Impact. (raw material) | Hydraulic test | Pneumatic test | RT/UT (10% for butt weld) | MPI/DPT (All welds of trunnion & base plate, sample on other) | Relative permeability * | Ferrite content | DIN 43760, IS 2848, 7358 | DIN 48124 |
|--|--------------------|----------------------------|----------------|--|------------------------|----------------|----------------|---------------------------|---|-------------------------|-----------------|--------------------------|-----------|
| Sheet and Fabrication | Y | Y | Y | Y | Y | Y1 | Y1 | Y | Y | | | | |
| -END shield | | | | | | | | | | | | | |
| -Stator casing | Y | Y | Y | Y | Y | Y1 | Y1 | Y | Y | | | | |
| -Bushing boxes | Y | Y | Y | Y | Y | Y1 | Y1 | Y | Y | | | | |
| -Terminal plates | Y | Y | Y | Y | Y | Y1 | Y1 | | Y | | | | |
| -Manhole and covers | Y | Y | Y | Y | Y | Y1 | Y1 | | Y | | | | |
| -Trunnions | Y | Y | Y | Y | Y | | | Y | Y | | | | |
| Core bar | Y | Y | | Y | | | | | | | | | |
| Press ring | Y | Y | | Y | | | | | Y | | | | |
| Core bolt (insulated) | Y | Y | | Y | | | | Y | Y | | | | |
| Gaskets | Y | | | Y | | | | | | | | | |
| Bearing and Hydrogen Seals | Y | Y | | Y | | | | Y2 | | | | | |
| Terminal Bushing | | | | | | | | | | | | | Y |
| RTD/ Thermocouple | | | | | | | | | | | | Y | |
| Additional checks for | | | | | | | | | | Y | | | |
| -Nonmagnetic Components | | | | | | | | | | | | | |
| -Nonmagnetic Components welding | | | | | | | | | | | Y | | |
| Y-Test applicable, Y1-For Hydrogen cooled machine, Y2-UT on Babbitt for bearing, * - As per OEM standard practice. | | | | | | | | | | | | | |
| Note: 1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. 2. All generators shall be assembled at works and shall be tested to verify/ensure design and workman ship in accordance with IEC-34, VDE 0530, IEEE 115, IEEE 43. The manufacturer shall submit detailed test procedure which clearly specify test set up, instruments to be used, acceptance norms (wherever applicable) recording of different parameter, interval of recording, precautions etc. 3. Cooler, control panel and other auxiliaries (as applicable) to be suitably tested as per tests covered in the specification. 4. Test requirements of primary water system, seal oil system and Hydrogen cooling system shall be as per tests specified for similar items under respective tables covered in this section. | | | | | | | | | | | | | |

**GENERATORS & AUXILIARIES
PROCESS CHECK FOR CORE GENERATOR/EXCITOR**

| TESTS ITEM/ COMPONENTS / PROCESS | Specific loss before and after ageing | Magnetization | Anisotropy of losses | Stacking factor | Burr level | chem., elect., viscosity cure time, solid content, dielectric properties | Dimension & surface (uniformity of varnish coat) | Spot weld check |
|---|--|---|---------------------------------------|--|-----------------------------|--|--|-----------------|
| Core lamination | Y | Y | Y | Y | | | Y | |
| After punching Insulated core Laminations | | | | | Y | | Y | |
| Check for varnish | | | | | | Y | | |
| Ventilation Stamping | | | | | | | | Y |
| Core assembly | | | | | | | Y | |
| TESTS ITEM/ COMPONENTS / PROCESS | Process check including Heating & pressure application | Insulation test of insulated core tension bolt & core bar | Functional check of ventilation ducts | Hot spot at rated flux density by infra-red camera & ELCID * | Location of temp. detectors | Iron loss at rated flux density | | |
| CORE assembly (additional Checks for Generator) | Y | Y | Y | Y | Y | Y | | |

Y-Test applicable

*** In case of any constraint of manufacturer to carry out the test at rated flux, testing at reduced flux as per manufacturer guidelines to be proposed to Owner for review & approval.**

**GENERATORS & AUXILIARIES
PROCESS CHECK FOR CORE GENERATOR/EXCITOR**

| ITEM/ COMPONENTS / PROCESS | Winding copper and connecting bus bars | Insulated conductor | Insulation material | Manufacturing Winding bar & phase bar | Winding laying | Water supply hoses | Winding support ring | Connection between bars | wound stator |
|---|---|------------------------|---------------------|---|----------------|-----------------------|-------------------------|----------------------------|--------------|
| TESTS | | | | | | | | | |
| Support arrangement | | | | | Y | Y | | | |
| Type test reports for similar type of bars for heating cycle test, thermal stability test @ | | | | Y | | | | | |
| Slot wedge tightness & radial movement | | | | | | | | | Y |
| Thermal shock test Baroscopic Examination of brazed water box | | | | Y1 | | | | | |
| Inter strand Insulation test | | | | Y | | | | Y2 | |
| Dielectric test at elevated and room temp. | | Y | | | | | | | |
| Vibration fatigue * | | | | | | Y | | | |
| Magnetic permeability of metallic parts | | | | | | Y | | | |
| Reactance of stator winding | | | | | | | | | Y |
| Corona protection resistance | | | | Y | | | | | |
| Partial Discharge test | | | | Y# | | | | | |
| Tan delta and delta, tan delta Up to 1.2 un | | | | Y | | | | | Y |
| Check on RTD + location winding | | | | | Y | | | | |
| Helium leak test & PR. test | | | | Y | | Y | | | |
| Flow test | | | | Y1 | | | | | Y1 |
| Process check | | | | Y | Y | | | | |
| X-Ray of Water box | | | | Y1 | | | | | |
| Brazing procedure | | | | Y | | | | Y | |
| Physical prop. | | | Y | | | | Y | | |
| Electric test | | | Y | Y | Y | | | | |
| Dimension/visual | | Y | Y | Y | Y | Y | Y | | |
| Dielectric test | | Y | | Y | Y | Y | | | |
| Flexibility of bending temp. | | Y | | | | | | | |
| Insulation adhesion | | Y | | | | | | | |
| Eddy current & pr. Test | Y1 | | | | | | | | |
| Metallography prop. | Y | | | | | | | | |
| Resistivity/Resistance | Y | | | | | | | | |
| Chem. prop (sample) | Y | | Y | | | Y | Y | | |
| Mech. prop (sample) | Y | | Y | | | Y | | | |

Y - Test Applicable, Y1- Applicable for hollow conductor, * As per manufacturer established practice, Y2: Not applicable for connection between bars through contact-sleeve (lug), Y#: OEM practice shall be followed, @: Type test reports for similar type of bars for heating cycle test, thermal stability test, and voltage endurance test manufactured from same works from which bars are to be sourced is acceptable if conducted within 5 years of bid opening.

| CLAUSE NO. | QUALITY ASSURANCE | | | | | | | | | | | |
|---|----------------------------|-----------------------|--|--------------------|------------------------|-------------------------|--|--|--|---|--|------------------------|
| <div>एनटीपीसी NTPC</div> | | | | | | | | | | | | |
| GENERATORS & AUXILIARIES | | | | | | | | | | | | |
| PROCESS CHECK FOR ROTOR AND ASSEMBLY (GENERATOR/EXCITOR) | | | | | | | | | | | | |
| TESTS | Rep. sample tensile stress | Rep. sample 0.2 limit | Rep. sample elongation | Hardness on Sample | Impact check on sample | Rep. sample Chem. prop. | NDTT, FATT (as applicable) | Process check including heat treatment (as applicable) | Ultrasonic test/RT (at suppliers work and after preliminary machining) | Sulphur Prints Check (Depending on proneness) | Flux carrying capacity / Magnetic prop * | Boroscopic Examination |
| ITEM/ COMPONENTS / PROCESS | | | | | | | | | | | | |
| Rotor forging & slip ring shaft | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Rotor end retaining ring, locking ring & Slip ring forgings, diode wheel | Y | Y | Y | | Y | Y | | Y | Y | | | |
| Rotor wedges, damper Wedges. | Y | | Y | | | Y | | Y | Y | | | |
| Rotor winding copper CC-bolts & D-leads | Y | | Y | | | Y | | Y | | | | |
| Rotor slot boxes/ insulating material | | | | | | Y | | | | | | |
| Coil manufacture | | | | | | | | | | | | |
| Rotor winding | | | | | | | | Y | | | | |
| Winding connection studs & assembly | | | | | | | | | | | | |
| Complete rotor | | | | | | | | Y | | | | |
| Test on completed rotor at various speed up to rated speed | | | | | | | | | | | | |
| Test on completed rotor before & after over speed | | | | | | | | | | | | |
| Fan hubs/blades | | | | | | Y | | Y | Y | | | |
| GENERATOR assembly | | | | | | | | | | | | |
| Diode wheel Assembly | | | | | | | | | | | | |
| Permanent magnet | | | | | Y | | | | | | Y | |
| EXCITER assembly | | | | | | | | | | | | |
| Y- Test Applicable * Not applicable for slip ring shaft of SEE | | | | | | | | | | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | | TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC NO.: | | | | SUB-SECTION- E28 GENERATOR AND AUXILIARIES REV- 13 | | | | PAGE 4 OF 9 | |

GENERATORS & AUXILIARIES

PROCESS CHECK FOR ROTOR AND ASSEMBLY (GENERATOR/EXCITOR)

| TESTS ITEM/ COMPONENTS /PROCESS | MPI/DP/NDT test | Visual/Dimension/Cleanlines | Adhesion, thickness of Coat on silver plating If applicable | Electrical conductivity and Oxygen content | Mech. test on sample | Electrical test (Σ) | Resistance measurement | Vent hole blockage | Helium leak test for Hydrogen cooled M/C | Inter turn test | Dielectric test |
|--|-----------------|-----------------------------|---|---|----------------------|------------------------------|------------------------|--------------------|---|-----------------|-----------------|
| Rotor forging & slip ring shaft | Y | Y | | | | | | | | | |
| Rotor end retaining ring & cover, locking ring & Slip ring forgings, diode wheel | Y | | Y | | | | | | | | |
| Rotor winding copper, rotor wedges, damper Wedges, CC-bolts & D-leads | Y | | Y | Y1 | | Y | | | | | |
| Rotor slot boxes/insulating material | | | | | Y | Y | | | | | |
| Coil manufacture | | Y | | | | | | | | | |
| Rotor winding | Y | Y | | | | Y | | Y | | Y | Y |
| Winding connection studs & assembly | Y | | | | Y | | | | Y | | Y |
| Complete rotor | | | | | | | Y | | | | Y |
| Test on completed rotor at various speed up to rated speed | | | | | | | | | | Y | Y |
| Test on completed rotor before & after overspeed | | Y | | | | | Y | | | Y | Y |
| Fan hubs/blades | Y | Y | | | | | | | | | |
| GENERATOR assembly | | Y | | | | | | | | | |
| Diode wheel Assembly | | Y | | | | | | | | | |
| Permanent magnet | | Y | | | Y | | | | | | |
| EXCITOR assembly | | Y | | | | | | | | | |

Y-Test Applicable , Y1: Oxygen content applicable for Rotor winding copper & D Lead,
 Σ NOTE- Dielectric test & conductivity test etc. as applicable

GENERATORS & AUXILIARIES

PROCESS CHECK FOR ROTOR AND ASSEMBLY (GENERATOR/EXCITOR)

| TESTS ITEM/ COMPONENTS /PROCESS | Insulation Resistance | PI | Radial run out/alignment | Impedance measurement/ RSO (repetitive surge oscillograph) | Dynamic balancing ISO 5406, 2372, 1940 | Over speed test (120%) for 2 minute | Axial run out | Metallography examination * | Torque on joint bolts | Fitting and locking of Balancing weights | Brazer and brazing procedure |
|--|-----------------------|----|--------------------------|--|---|--|---------------|-----------------------------|-----------------------|--|------------------------------|
| Rotor forging & slip ring shaft | | | | | | | | Y | | | |
| Rotor end retaining ring & cover, locking ring & Slip ring forgings, diode wheel | | | | | | | | | | | |
| CC-bolts | | | | | | | | | Y | | |
| Rotor slot boxes/ insulating material | | | | | | | | | | | |
| Coil manufacture | | | | | | | | | | | Y |
| Rotor winding | | | | | | | | | | | Y |
| Winding connection studs & assembly | Y | | | | | | | | | | |
| Complete rotor | Y | | Y | Y | Y | Y | | | Y | | |
| Test on completed rotor at various speed up to rated speed | | | | Y | | | | | | | |
| Test on completed rotor before & after overspeed | Y | | Y | Y | | | | | | | |
| Fan hubs/blades | | | | | | | | | | Y | |
| GENERATOR assembly | Y | Y | Y | | | | Y | | Y | Y | Y |
| Diode wheel Assembly | | | Y | | | | Y | | Y | Y | |
| Permanent magnet | | | | | | | | | | | |
| EXCITOR assembly | | | Y | | | | | | Y | Y | |

Y-Test applicable * - As per OEM standard practice.

GENERATORS & AUXILIARIES

ADDITIONAL CHECK FOR EXCITOR

| ITEM/ COMPONENTS /PROCESS | TESTS | Routine Test as per applicable std | As per IEC-76 / Applicable std | Pole parallelism & polarity | Mech. chem. & Magnetic prop. (as applicable) | Functional check | Insulation resistance | IEEE/ANSI-C37.18 Or IEC 60947-2 | As per applicable standards | As per specification | Dimensional and visual |
|---|-------|------------------------------------|--------------------------------|-----------------------------|--|------------------|-----------------------|---------------------------------|-----------------------------|----------------------|------------------------|
| Fuse diode & filter Circuit | | Y | | | | | | | | | Y |
| Aux. Transformer (if applicable) | | | Y | | | | | | | | |
| Carbon brush holder & housing | | | | | Y | Y | | | | Y | Y |
| Cable | | | | | | | | | | Y | |
| PMG & Exciter stator | | | | Y | Y | | Y | | | | |
| Bandaging wire | | | | | Y | | | | | | |
| Field discharge resistor | | | | | | Y | | | | | |
| Bearing, exciter armature field, axis coil, RTD | | | | | | | Y | | | | |
| Excitation Transformer | | | Y | | | | | | | | |
| Thyristors | | | | | | | | | | Y | |
| Field breaker | | | | | | Y | | Y | | | |
| Bus duct AC/DC | | | | | | | | | Y | | |
| Voltage Regulator | | | | | | | | | | Y | |
| Carbon brush | | | | | Y | Y | | | | Y | Y |

Y - Test applicable

GENERATOR AND AUXILIARIES**FINAL ACCEPTANCE TEST GENERATOR/EXCITOR**

| ITEM/ COMPONENTS /PROCESS | TESTS | Works run test on generator to be conducted on first unit of each rating per contract to establish the performance characteristics / designated attributes | On total winding/phase at interval of 0.2 U _n for generator | Condition after dismantling (after works run test) | Works test on brush less exciter | PMG works test | Full load for PMG & converter assembly | Converter assembly for SEE | Static excitation system |
|---|-------|--|--|--|----------------------------------|----------------|--|----------------------------|--------------------------|
| | | | | | | | | | |
| Partial Discharge | | Y | | | | | | | |
| Visual and dimension | | Y | | | | | | | |
| Vibration Measurement | | Y | | | | | | | |
| Winding Overhang | | | | Y | | | | | |
| Seal Ring. Liners | | | | Y | | | | | |
| Bearing oil catcher | | | | Y | | | | | |
| Rotor journal | | | | Y | | | | | |
| Tan delta, delta tan delta | | Y | Y | | | | | | |
| Capacitance measurement | | Y | Y | | | | | | |
| RTD, BTD Check | | Y | | | | | | | |
| HV test (except electronic circuit) | | Y | | | Y | Y | | Y | Y |
| Shaft voltage | | Y | | | | | | | |
| Phase seq. voltage | | Y | | | | Y | | | |
| Polarization index | | Y | | | | | | | |
| Insulation resistance | | Y | | | Y | Y | | Y | Y |
| Efficiency By separation of Losses | | Y | | | | | | | |
| Steady state reactance's | | Y | | | | | | | |
| Record Aux. parameters | | Y | | | | | | | |
| SCC | | Y | | | | | | | |
| OCC | | Y | | | Y | Y | | | |
| Voltage regulation | | | | | | Y | | | |
| Function check | | | | | | | | Y | Y |
| Heat run test | | Y | | | Y | Y | Y | | |
| Rotor impedance at various speeds in steps of 200 rpm | | Y | | | | | | | |
| Resistance measurement | | Y | | | Y | Y | | | |
| Gas tightness for Hydrogen cooled M/C | | Y | | | | | | | |

Y – Test Applicable

GENERATORS & AUXILIARIES**FINAL ACCEPTANCE TEST GENERATOR/EXCITOR**

| ITEM/ COMPONENTS /PROCESS | TESTS | | | | | | | | | |
|----------------------------------|--------------------|------------------|-----------------------|---------|----------------------|--|----------------|----------------------|--------------------|-------------------|
| | Seal rings, liners | Winding Overhang | Vibration measurement | No load | Load characteristics | Characteristics of search coil, quad, axis | Ripple content | As per specification | Visual & dimension | Partial discharge |
| Works test on brush less exciter | | | Y | Y | Y | Y | | | Y | |
| PMG works test | | | | Y | Y | | | | | |
| Static excitation system | | | | | | | Y | Y | Y | |

Y - Test Applicable

SUB-SECTION– E-42

MOTORS

MOTOR

| TESTS/CHECKS TEMS/COMPONENTS | Visual | Dimensional | Make/Type/Rating /General Physical Inspection | Mech/Chem. Properties | NDT /DP/MPI/UT | Metallography | Electrical Characteristics | Welding/Brazing(WPS/PQR) | Heat Treatment | Magnetic Characteristics | Hydraulic/Leak/Pressure Test | Thermal Characteristics | Run out | Dynamic Balancing | Routine & Acceptance tests as per IS-4722 /IS- 9283/IS 2148/IEC60034/IEC 60079-I/ IS- 12615 | vibration | Over speed | Tan delta, shaft voltage & polarization index test | Paint shade, thickness & adhesion |
|---|--------|-------------|--|-----------------------|----------------|---------------|----------------------------|--------------------------|----------------|--------------------------|------------------------------|-------------------------|---------|-------------------|--|-----------|------------|---|-----------------------------------|
| Plates for stator frame, end shield, spider etc. | Y | Y | Y | Y | Y | | | | Y | | | | | | | | | | |
| Shaft | Y | Y | Y | Y | Y | Y | | | Y | | | | | | | | | | |
| Magnetic Material | Y | Y | Y | Y | | | Y | | | Y | | Y | | | | | | | |
| Rotor Copper/Aluminium | Y | Y | Y | Y | | | Y | | Y | | | | | | | | | | |
| Stator copper | Y | Y | Y | Y | | | Y | | Y | | | Y | | | | | | | |
| SC Ring | Y | Y | Y | Y | Y | | Y | Y | Y | | | | | | | | | | |
| Insulating Material | Y | | Y | Y | | | Y | | | | | Y | | | | | | | |
| Tubes, for Cooler | Y | Y | Y | Y | Y | | | | Y | | Y | | | | | | | | |
| Sleeve Bearing | Y | Y | Y | Y | Y | | | | Y | | Y | | | | | | | | |
| Stator/Rotor, Exciter Coils | Y | Y | Y | | | | Y | Y | | | | | | | | | | | |
| Castings, stator frame, terminal box and bearing housing etc. | Y | Y | Y | Y | Y | | | Y | | | | | | | | | | | |
| Fabrication & machining of stator, rotor, terminal box | Y | Y | | | Y | | | Y | Y | | | | | | | | | | |
| Wound stator | Y | Y | | | | | Y | Y | | | | | | | | | | | |
| Wound Exciter | Y | Y | | | | | Y | Y | | | | | | | | | | | |
| Rotor complete | Y | Y | | | | | Y | | | | | | Y | Y | | | | | |
| Exciter, Stator, Rotor, Terminal Box assembly | Y | Y | | | | | Y | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|--|--|--|--|--|--|--|--|--|--|---|---|---|----|---|
| Accessories, RTD, BTD, CT, Space heater, antifriction bearing, gaskets etc. | Y | Y | Y | | | | | | | | | | | | | | | |
| Complete Motor | Y | Y | Y | | | | | | | | | | | Y | Y | Y | Y1 | Y |

Note:

- The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, following methodology to be followed for Inspection Categorization:

Note for LT Motor:

i) Motor rating up to 50 KW: Inspection CAT- III : Acceptance of Motor up to 50 KW is based on COC of the Manufacturer and Main Contractor confirming as follows:

“It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage frequency variation, hot s KVA/KW, temperature rise, distance between center of stud gland plate and tested in accordance with approved drawing /data sheets.”

ii) Motor rating above 50 KW & less than 75 KW: Inspection CAT- II as per NTPC approved MQP: Acceptance of Motor rating above 50 KW & less than 75 KW is based on NTPC rev report as per IS:12615 - 2018 (including latest revision) duly witnessed by main contractor along with COC of the Manufacturer and Main Contractor confirming as follows:

“It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage frequency variation, hot s KVA/KW, temperature rise, distance between center of stud gland plate, space heater and tested in accordance with approved drawing /data sheets.”

iii) Motor rating 75 KW & above: Inspection CAT-I: As per NTPC approved MQP.

2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard

3. Makes of major bought out items for HT motors will be subject to NTPC approval.

4. Y1 = for HT Motor / Machines only.

5. For LT Motors, stator core stack length & grade, no load loss and winding resistance w.r.t. type tested motor for IE2/IE3 shall be checked/verified in addition to Compliance of relevant standard IS:12615/IEC requirement. In case actual results are not within the tolerance limit as declared by manufacturer during QP submission, the motor shall be subjected to efficiency test.

| | | | | |
|--|---------------|---|---|-------------|
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | BID DOC. NO.: | TECHNICAL SPECIFICATION SECTION – VI | PART - B SUB-SECTION-VI E42- MOTORS | Page 2 of 2 |
|--|---------------|---|---|-------------|

SUB-SECTION– E-46

DIESEL GENERATOR SET

DIESEL GENERATOR SET

| DIESEL ENGINE | | | | | | | | | | | |
|---|---------------|--------|------------------------------------|-----------|---------------------------|--------------|-----------|---------------------------|---|--|---|
| TESTS/CHECKS | | | | | | | | | | | |
| ITEMS/COMPONENTS | Material Test | DP/MPI | UT(On forging and piston Bonding) | Balancing | Hydraulic/water fill test | Assy./fit up | Dimension | Functional/Operation test | Performance test as per BS-5514/or equivalent IS/ISO- Standard including Governing Test for 3 hours at full load and one hr at 10% overload | Fuel consumption, rated power measurement, rated speed | All other tests(if applicable) as per Spec./ relevant standard |
| Crank shaft | Y | Y | Y | Y | | | | | | | |
| Cylinder blocks/heads | Y | | | | Y | | | | | | |
| Liner/ Radiator | Y | | | | Y | | | | | | |
| Rotating/moving parts other than crank shaft | Y | Y | | | | | | | | | |
| Piston | Y | Y | Y | | | | | | | | |
| Diesel Engine | | | | | | Y | Y | Y | Y | Y | Y |
| <p>Note: 1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents in line in case required as per agreement with NTPC.</p> <p>2. Make of all major BOIs will be subject to NTPC approval.</p> | | | | | | | | | | | |
| ALTERNATOR | | | | | | | | | | | |

| ITEMS/COMPONENTS | TESTS/CHECKS | | | | | | | | | | | | | | | | | |
|---|--------------|-------------|---|-----------------------|----------------|---------------|----------------------------|---------------------------|----------------|--------------------------|------------------------------|-------------------------|---------|-------------------|---------------------------|-----------|------------|--|
| | Visual | Dimensional | Make/Type/Rating/TC/General Physical Inspection | Mech/Chem. Properties | NDT /DP/MPI/UT | Metallography | Electrical Characteristics | Welding/Brazing (WPS/PQR) | Heat Treatment | Magnetic Characteristics | Hydraulic/Leak/Pressure Test | Thermal Characteristics | Run out | Dynamic Balancing | All tests as per IS--4722 | vibration | Over speed | Tan delta, shaft voltage & polarization index test |
| Plates for stator frame, end shield, spider etc. | Y | Y | Y | Y | | | | | Y | | | | | | | | | |
| Shaft | Y | Y | Y | Y | Y | Y | | | Y | | | | | | | | | |
| Magnetic Material | Y | Y | Y | Y | Y | | Y | | | Y | | Y | | | | | | |
| Rotor Copper/Aluminum | Y | Y | Y | Y | | Y | Y | | Y | | | | | | | | | |
| Stator copper | Y | Y | Y | Y | | | Y | | Y | | | Y | | | | | | |
| SC Ring | Y | Y | Y | Y | Y | Y | Y | Y | Y | | | | | | | | | |
| Insulating Material | Y | | Y | Y | | | Y | | | | | Y | | | | | | |
| Tubes for Cooler | Y | Y | Y | Y | Y | | | | Y | | Y | | | | | | | |
| Sleeve Bearing | Y | Y | Y | Y | Y | | | | Y | | Y | | | | | | | |
| Stator/Rotor, Exciter Coils | Y | Y | Y | | | | Y | Y | | | | | | | | | | |
| Castings, stator frame, terminal box and bearing housing etc. | Y | Y | Y | Y | Y | | | Y | | | | | | | | | | |
| Fabrication & machining of stator, rotor, terminal box | Y | Y | | | Y | | | | Y | | | | | | | | | |

ALTERNATOR

| | | | |
|--|--|----------------------------|-------------|
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO : | SUB SECTION E46- DG SET | Page 2 of 4 |
|--|--|----------------------------|-------------|

| TESTS/CHECKS ITEMS/COMPONENTS | Visual | Dimensional | Make/Type/Rating/TC/General Physical Inspection | Mech/Chem. Properties | NDT /DP/MPI/UT | Metallography | Electrical Characteristics | Welding/Brazing(WPS/PQR) | Heat Treatment | Magnetic Characteristics | Hydraulic/Leak/Pressure Test | Thermal Characteristics | Run out | Dynamic Balancing | All Routine tests as per IS-/IS-4722 | vibration | Over speed | Tan delta, shaft voltage & polarisation index test |
|--|--------|-------------|---|-----------------------|----------------|---------------|----------------------------|--------------------------|----------------|--------------------------|------------------------------|-------------------------|---------|-------------------|--------------------------------------|-----------|------------|--|
| Wound stator | Y | Y | | | | | Y | Y | | | | | | | | | | |
| Wound Exciter | Y | Y | | | | | Y | Y | | | | | | | | | | |
| Rotor complete | Y | Y | | | | | Y | | | | | | Y | Y | | | | |
| Exciter, Stator, Rotor, Terminal Box assembly | Y | Y | | | | | Y | | | | | | | | | | | |
| Accessories, RTD, BTD,CT,AVR. Brushes, Diodes,Space heater, antifriction bearing, cable glands, lugs, gaskets etc. | Y | Y | Y | | | | | | | | | | | | | | | |
| Alternator (IS 4722) | Y | Y | Y | | | | | | | | | | | | Y | Y | Y | Y1 |
| <p>Note:1 . his is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and Procedure along with relevant supporting documents during QP finalisation.</p> <p>2. Make of all major BOIs will be subject to NTPC approval.</p> <p>Y1= for HT Machines only.</p> | | | | | | | | | | | | | | | | | | |

FINAL ASSEMBLY

| TESTS/CHECKS ITEMS/COMPONENTS | | | | | | | | | | |
|--|---------------|-----------|-----------------|---------------|--------------------|------------------------------|------------------|----------------------------------|---|------------------------|
| | Material Test | Dimension | WPS/PQR/Welding | NDT/DP/MPI/UT | Check completeness | Hydraulic/Leak/Pressure test | Functional Tests | All routine test as per Spec/ IS | No load test for 5 min & partial load for one hour of the DG set assembly | Clearances & Alignment |
| Base frame | Y | Y | Y | Y | Y | | | | | |
| Fuel Tank | Y | Y | Y | Y | Y | Y | | | | |
| Battery | | | | | | | | Y | | |
| Battery Charger | | | | | | | | Y | | |
| Control Panel | | | | | | | | Y | | |
| Assembled DG Set | | Y | | | Y | | Y | | Y | Y |
| <p>NOTES:</p> <ol style="list-style-type: none"> This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents during finalization of QP. Make of all major Bought Out Items will be subject to NTPC approval. | | | | | | | | | | |

SUB-SECTION– E-56

ELECTRICAL ACTUATOR

| CLAUSE NO. | QUALITY ASSURANCE | | | | | | | | | | | | | <div>एनडीपीसी NTPC</div> |
|--|--|---|---|---|---|---|---|---|---|---|---|-------------|---|------------------------------|
| | ELECTRICAL ACTUATOR WITH INTEGRAL STARTER | | | | | | | | | | | | | |
| | Test/Attributes Characteristics ITEM/ COPONENT/ SUB SYSTEM ASSEMBLY/ TESTING | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| ELECTRICAL ACTUATOR with Integral Starter , Non-Intrusive Electrical Actuator (EN15714-2) | | | | | | | | | | | | | | |
| Motor | Y | Y | Y | Y | Y | | | | | | | | | |
| Final Testing | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | |
| <div>Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the practices and procedure adopted along with relevant supporting documents.</div> <div>- SIL 2 certificate if applicable</div> <div>® - Routine Test (A) - Acceptance Test Y - Test applicable</div> | | | | | | | | | | | | | | |
| SINGRAULI SUPER THERMAL POWER PROJECT STAGE-III (2X800 MW) EPC PACKAGE | | | | TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: | | | | SUB-SECTION-E-56 Electrical Actuator with Integral Starter | | | | PAGE 1 OF 1 | | |

SUB-SECTION– E-57

PROCESS, CONNECTION & PIPING