



**BHEL-ISG
BENGALURU**

5X800 MW TSGENCO YADADRI TPS

**TECHNICAL ENQUIRY SPECIFICATION FOR CLARIFIER
SYSTEM**

**DOCUMENT
NUMBER
IS-4-ES-699-300-
M005**



5x800 MW YADADRI THERMAL POWER STATION, TELANGANA

**TECHNICAL ENQUIRY SPECIFICATION
OF
CLARIFIER PACKAGE FOR ASH HANDLING SYSTEM**



**BHARAT HEAVY ELECTRICALS LIMITED
INDUSTRIAL SYSTEMS GROUP
BANGALORE**

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1.0 PROJECT INFORMATION:


The specification has been prepared for supply of conventional type clarifier for ash water recovery system for **TSGENCO 5X800 MW Yadadri TPS, Telangana** for which **TCS, Bangalore** is the consultant for the customer **TSGENCO**. BHEL is the principal contractor who is responsible for the establishment of the power project for 5X800 MW Yadadri TPS. **Industrial Systems Group (ISG)** of BHEL located at Bengaluru will be executing the Ash Slurry Disposal System of TSGENCO 5X800 MW Yadadri TPS. Project information for TSGENCO 5X800 MW Yadadri TPS is as per enclosed Annexure-I (Sheet 1 & 2).

2.0 SCOPE OF SUPPLY:

The scope of supply and works includes design, engineering, manufacture, supply, assembly & testing at shop, inspection at manufacturer's work, painting of item/ equipment's, packing, delivery at site including commissioning spares (including chemicals for a requirement of 15 days), mandatory spares & and supervision of commissioning/ PG test of 4 nos conventional type clarifier (2 nos in plant area of Capacity-1450m³/hr for BA Overflow water and coal settling pond water, 2 nos in dyke area of capacity 2280 m³/hr for ash water recovered from ash dyke). Bidder to note that clarifier plant shall be a complete system which shall include associated mechanical, electrical, control & instrumentation items/ equipment's. Bidder's commissioning experts shall be required to make visit to site for pre-commissioning and commissioning (as required by BHEL) for system integration with the ash handling without any cost implication to BHEL. Bidder's scope also includes deputing their experts or their sub-vendor's experts for any issue reported during guarantee/warranty period of the items supplied by them without any cost implication to BHEL. Apart from above works specified, if any other visit along with mandays of their experts or their sub-vendor's experts as desired by BHEL shall be payable by BHEL as per the price quoted by bidder in the price format which shall be valid till end of the contract.

Broad scope of supply has been listed below for all four (4) no conventional type clarifier:

1. All Equipments, Pipes, Valves, Instruments shown in the tender flow diagram shall be provided by Bidder. All valves, instrumentations & accessories for parshall flume with stilling chamber and flash mixer chamber.
2. Flash Mixer Agitator with Motor, Gear Box, Base Frame & Accessories
3. All valves, instrumentations & accessories for flash mixer with motorized stirrer (SS) .
4. Paddle Flocculator with Motor, Gear Box, Base Frame & Accessories
5. Clarifier bridge assembly with galvanized gratings, required motors, valves, piping, instruments/devices etc.
6. Central Bearing with Base Plate for Clarifier Bridge
7. End Carriage Arrangement Wheel, Motor, Gear Box and Accessories
8. Sludge disposal system from clarifier with piping, valves, instruments/devices upto sludge collection pit.
9. RCC alum dosing tanks (civil & structural work by BHEL) with motorized stirrer, flushing arrangement, instrumentation, valves, fittings and piping for alum upto the stilling chamber/parshall flume for plant area clarifier and dyke area clarifier.

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10. RCC polyelectrolyte tanks (civil & structural work by BHEL) with motorized stirrer, flushing arrangement, instruments/devices, valves, fittings and piping upto the stilling chamber/ parshall flume for plant area clarifier and dyke area clarifier.
11. SS Dissolving Basket for Alum & Poly Solution
12. Clarified water overhead storage tank (PVC) with float type valve, overflow arrangement, level indicator etc.
13. Clarifier Inlet Line isolation valve
14. Pipe Sleeves in various tanks, equipment foundation bolts, nuts & washers for the pumps, motors and agitators.
15. MS Pipe from Drop Chamber of Flash Mixer to Clarifier with flange
16. Wrapping & Coating Material of underground pipes
17. Staircase, Ladder, Grating, Handrail etc.
18. Local Power cum Control Panel (located on Clarifier Bridge) for drives located on the bridge assembly.
19. All piping, valves, instruments as required for the system completion.
20. Chemicals specified elsewhere in this specification for a requirement of 15 days
21. Miscellaneous items like field mounted instruments, hardware items like flanges with nuts, bolts, foundation bolts, pipe sleeves, gaskets & washers, canopy for outdoor motors, etc. as required.
22. Clarifier system shall contain all items/ equipments/ instruments/ accessories including but not limited to what are indicated in BHEL flow diagram for ash water recovery system.
23. All other things are also included in scope of supply as specified in other part of the specification and technical details.

Note: Items and accessories which are not mentioned specifically but are essential for sound performance of the system shall be supplied by bidder without any cost implication to BHEL.

3.0 ELECTRICAL SCOPE DEMARCATION:

The Details of electrical scope of work, electrical equipment specifications & electrical equipment's vendors are attached as per **Annexure-A, Annexure-B & Annexure-C** respectively.

4.0 CIVIL SCOPE DEMARCATION:



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S. No	Job/Area	Responsibility for Design & Drawing	Responsibility & Scope of Supply
i)	Clarifier, Parshall flume, Sludge pit, Chemical House, RCC tank, foundation for equipments, pipe/cable trenches, access/maintenance platforms inside/outside building, walkways, monorail beam for hoists, including reinforcement steel, cement, handrails, gratings, acid resistant tiles for chemical dosing tank & storage area.	Clarifier package Mechanical Vendor	BHEL-ISG
ii)	Complete Clarifier bridge with handrails, gratings, staircase, ladder, drives, Alum/PE agitators, Flash mixers, valves, filed instruments etc.	Clarifier package Mechanical Vendor	Clarifier package Mechanical Vendor
iii)	Pipe Sleeves, monorail hoists, Puddle Joints, Overflow Pipes, Vent Pipes for tanks and sumps, foundation bolts, nuts, SS-dissolving basket and all other embedding components etc.	Clarifier package Mechanical Vendor	Clarifier package Mechanical Vendor

5.0 SPECIFICATION FOR CLARIFIER:

A. Conventional type clarifier sizing (Plant Area):

1. The following design parameters shall be selected for sizing of clarifier:

- | | |
|--|--|
| i) BAOF Water Quality (design value) | : 1000 ppm. |
| ii) Minimum Particle size of Ash | : 30 microns |
| iii) Clarifier Outlet water quality (design value) | : 100 ppm. |
| iv) Surface overflow rate | : 1.5 m ³ /hr/m ² (max.) |
| v) Detention time in flocculation zone | : 30 min |
| vi) Detention time in clarifier zone | : 150 min |
| vii) Alum & PE storage area considered | : 15 days. |
| viii) Alum (Al ₂ So ₄) ₃ dosage rate | : 70 ppm. |
| ix) PE dosage rate | : 1 ppm. |
| x) Alum preparation tank capacity (2nos.) | : 12 hrs. |
| xi) PE preparation tank capacity (2nos.) | : 12 hrs. |
| xii) Stilling Chamber Capacity | : 1 Min. |
| xiii) Flash Mixer | : 1 Min. |
| xiii) Sludge Quantity Assumed in Input Water | : 2-3% |

2. A stilling chamber cum Parshall Flume cum Flash mixer shall be provided. The stilling chamber shall receive water from BAOF pump, Coal Settling Pond.

3. Motorized stirrer shall be provided in flash mixer for mixing of chemicals.

4. The clear water outflow from clarifier shall flow by gravity to ash water tank.

1	BA overflow (m ³ /hr) (During BA evacuation, BA overflow shall not be there) (5unitsx BAOF 690 m ³ /hr.x 6hrs =20700m ³ /8hrs =2587.5m ³ /hr)	2588
2	Water from Coal Settling Pond (m ³ /hr)-350 m ³ /hr intermittent	175
3	Total inflow to clarifier (m ³ /hr)	2762.5
4	No. of Clarifier Provided	2
5	Required Capacity of Clarifier (2762.5/2=1381.25 m ³ /hr)	1381.25



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6	Selected Clarifier (m ³ /hr)	1450
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B. Conventional type clarifier sizing (Dyke Area):

1. The following design parameters shall be selected for sizing of clarifier:
 - i) Water Quality from Ash Dyke (design value) : 600 ppm.
 - ii) Clarifier Outlet water quality (design value) : 100 ppm.
 - iii) Surface overflow rate : 1.5 m³/hr/m² (max.)
 - iv) Detention time in flocculation zone : 30 min
 - v) Detention time in clarifier zone : 150 min
 - vi) Alum, lime & PE storage area considered : 15 days.
 - vii) Alum (Al₂SO₄)₃ dosage rate : 70 ppm.
 - viii) PE dosage rate : 1 ppm.
 - ix) Alum preparation tank capacity (2nos.) : 12 hrs.
 - x) PE preparation tank capacity (2nos.) : 12 hrs.
 - xi) Stilling Chamber Capacity : 1 Min.
 - xii) Flash Mixer : 1 Min.
 - xiii) Sludge Quantity Assumed in Input Water : 2-3%
2. A stilling chamber cum Parshall Flume cum Flash mixer shall be provided. The stilling chamber shall receive water from recovery water pumps.
3. Motorized stirrer shall be provided in flash mixer for mixing of chemicals.
4. The clear water outflow from clarifier shall flow by gravity to recycle water tank.

1	Recovered water inflow (m ³ /hr)	4560
2	Nos. of Clarifier provided	2
3	Total inflow to individual clarifier (m ³ /hr)	2280
4	Selected Clarifier (m³/hr.)	2280

However, The Bidder shall take note that the "Constituent water" types vary considerably in regard to the particulate matter sizes, densities, their settling properties and concentration thereof.

Additional Note:

- a) It shall be possible to overload the clarifier System by 20% without affecting the outlet quantity.
- b) All the valves, gates, shutters etc. used in this plant shall be rising spindle type and general materials & constructions as per relevant AWWA/IS/BS etc. Instrument isolation Ball valves shall be of SS-316. Valves at flushing line in Alum soln. tank shall be of Diaphragm type having ebonite lining with adequate hardness.
- c) Agitator wetted parts for Alum & Poly electrolyte shall be of SS-316. Dosing Box will be of SS-304.
- d) All valves used in "Sludge" service shall have draining/flushing arrangement at valve seat.
- e) All nuts, bolts, washers etc. in underwater and corrosive/erosive application shall be of SS-316.
- f) All "Sludge" service pipes shall have flushing facilities.
- g) The sludge draining system shall be continuously operating type.
- h) All structural members, equipment working underwater shall be suitably protected from rusting, corrosion and erosion. It is presumed that the materials shall be basically stainless steel and other proven materials of construction.
- i) For all pipes handling lime and sludge, only flanged piping shall be used and pipe sizes shall not be less than 80 mm NB. All such pipes shall receive suitable slope during erection if it is gravity flow. 'Tees' shall be provided instead of 'bends' and 'crosses' shall be provided instead of 'tees' - all remaining faces kept blanked off for flushing purpose.



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- j) Required Chemical House shall be a two-storied construction – having Chemical store facility in the ground floor and all solution preparation facilities on the first floor.
- k) All mechanical stirrers shall be of Stainless-Steel Construction, electrically driven and proven in design.
- l) Suitable access ladder, platform, staircase, walkway (1000 mm wide), hand railings shall be provided for approach to all the equipment of the system.
- m) All lifting tackles, manual/electric hoists etc. for maintenance and day to-day operation shall be provided.

6.0 TERMINAL POINT:

As per Enclosed Flow Diagram.

7.0 TECHNICAL INPUTS TO BE FURNISHED ALONG WITH OFFER:

Following documents are to be necessarily enclosed for Conventional type of clarifier by the Bidder as a part of the Offer:

- a) GA of clarifier, chemical house dimensions, chemical agitators, sludge sumps indicating the make of the bought-out items.
- b) Bill of materials.
- c) Technical Data Sheet of clarifier, chemical agitators, sludge pumps etc.
- d) Signed copy of all the pages of enquiry specification.
- e) The list of tools in the Tool Kit for erection, assembly, dismantling, operation and maintenance of the clarifier and its associated equipments.
- f) Bidder to specify the design standard followed for design of clarifier and also specify the equivalent Indian Standard/ MOC for foreign standards
- g) Motor Drive list.

8.0 LIST OF DRAWINGS/ DOCUMENTS TO BE FURNISHED AFTER PLACEMENT OF LOI.:

- 8.1 Detailed Sizing calculations of clarifier, clarifier bridge, sludge pumps, chemical agitators, flocculator paddles, various motor sizing, stilling chamber, parshall flume, flash mixer etc. for approval.
- 8.2 Mechanical GA drawings & Data Sheet with BOQ for approval.
- 8.3 Mechanical GA drawings of Chemical House & Data Sheet with BOQ for approval.
- 8.4 Sectional assembly drawings complete with bill of material and its part numbers for approval.
- 8.5 Manufacturer's QAP for approval.
- 8.6 Load data inputs of the equipments and system for the civil & structural and electrical design for information
- 8.7 Civil drawings based on the approved Mechanical Drawings as per L2 plan from the date of award of contract.
- 8.8 The Bidder shall provide Design details and complete Design documents of substructure, superstructure and other relevant civil drawings of the system.
- 8.9 The bidder shall provide the Bill of Quantities (BOQ) of Structural material required for various structures and also the reinforcement steel required in advance so that the employer can plan and supply the structural and reinforcement steel in stages. Each drawing shall contain required section-wise/size-wise structural steel quantity/RCC Quantity/Reinforcement quantity
- 8.10 Civil Task drawings indicating various equipment loadings, supporting arrangement and floor loads shall be submitted along with design calculations. Soft copies of all STAAD input



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files, design excel sheets & compliance reports etc. shall be submitted along with the design calculations for all the revisions.

- 8.11 PG test procedure and field quality plan for approval.
- 8.12 Operational and maintenance manual for information.
- 8.13 Lubrication schedule for information.
- 8.14 Painting Schedule for approval.
- 8.15 Any other relevant document which may be felt necessary during execution of Contract.
- 8.16 Successful bidder shall submit all the above with proper BHEL provided title block within a week of receipt of LOI. Bidder's LD on account of delay on submission and revised submission of these documents/drawings shall not be entertained.

9.0 OPERATION & MAINTENANCE MANUAL:

O & M manual shall contain the following:

9.1	Principle of operation of the equipment
9.2	Details of preventive/repair maintenance for equipment and accessories used.
9.3	Details about the general specifications, design capacities of equipment and their function.
9.4	Equipment Bidder's address, telephone nos., contacts person details to be furnished.
9.5	Required Dismantling devices, tools etc.
9.6	List of DO's and DO NOT's.
9.7	Test certificates.
9.8	All drawings
9.9	Erection Procedure
9.10	Write-up, description and illustrative pamphlets on various components of the elevator and its control, interlock and safety devices.
9.11	Proper procedures & sequence of operation.
9.12	Details of consumable.

Note:

- 1. All manual shall be supplied in proper bound books or in folders, preferably in A4 size.
- 2. The volume and section number shall be intimated by the Bidder.
- 3. Bidder will submit the regular progress reports for self-manufacturing & their bought-out item's equipment ordering / manufacturing status, drgs status once in fifteen days.
- 4. Bidder shall directly send O&M Manuals to BHEL-ISG HQ as per distribution schedule given in this specification with covering letter copy to Project Manager, BHEL-ISG, Bengaluru. BHEL Project Manager shall co-ordinate and ensure submission to Customer/customer's Consultant for the equipment's as per BHEL standard practice.

10.0 COMMISSIONING SPARES :

Bidder shall supply the chemical required for operation of Clarifier system for 15 days as commissioning spare. The chemical shall be supplied as per intimation to the bidder by BHEL. Besides BHEL considered commissioning spares, bidder shall furnish the list of spares which bidder feels are vital for commissioning of clarifier plant.



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11.0 MANDATORY SPARES :

A	Mechanical	
A.1	Valve (including solenoid valve)	30% of total executed quantity or minimum 6 nos of total quantity used in each size and type
A.2	Coil for solenoid valve	30% of total executed quantity or minimum 6 nos of total quantity used in each size and type
A.3	Agitator Blade	4 nos of each size and type
A.4	Pipes	20% of total executed quantity in each size and type

B	ELECTRICAL AND C&I		
B.1	415 Volt Motor (Upto 30KW Rating)		
B.1.1	Driving End & Non-Driving End Bearing	6	Set for each type and rating of Motor
B.1.2	Cooling Fan	4	No. for each type and rating of Motor
B.1.3	Motor Terminal Block	10	No. for each type and rating of Motor
B.1.4	Complete Set of Coupling	2	Set for each Application
B.2	Field Instruments (as applicable)		
B.2.1	Transmitters/ Gauges/Switches etc. along with relevant accessories	20	% of total (or at least 4), for each type along with accessories (whichever is higher).
B.2.2	Temperature Element (RTD/Thermocouple) with thermowell	20	% (or Minimum 10 nos.)of each type , range and immersion length (whichever is higher)
B.2.3	Sensor /valves/dampers	2	no. each for each type, model & range
B.3	Control Panel		
B.3.1	Push Button		
B.3.1.1	Complete assembly	5	Nos for each colour
B.3.1.2	Contact Element (1NO + 1NC) Block	20	Nos.
B.3.2	Selector Switch	10	Nos. for each type and rating



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B.3.3	Meter (Analog or Digital)		
B.3.3.1	Ammeter	10%	% for each type and range or minimum one (1) no. whichever is more
B.3.3.2	Voltmeter	10%	% for each type and range or minimum one (1) no. whichever is more
B.3.4	Indicating Lamps complete assembly	10	Nos. for each Colour and type
B.3.5	Mimic Lamps	10	Nos. for each Colour and type
B.3.6	MCB	2	2Nos. for each type and rating
B.3.7	Door Limit Switch	2	Nos.
B.3.8	Annunciation system		
B.3.8.1	Lamp Box with Facia & Lamps (LED type)	25	Nos.
B.3.8.2	Hooter	1	No.
B.3.8.3	Each type of PCB (for non-PLC driven system)	1	No.

12.0 PAINTING:

Painting of Clarifier system as per approved painting schedule. Supply of paint as per approved painting schedule for the clarifier system is in Bidder scope.

13.0 INSPECTION & TESTING:

1. All Quality plans shall be submitted in soft copy for BHEL/Customer/customer's Consultant approval.
2. Bidder shall give 15 days' advance written notice of equipment being ready for testing. Such tests shall be to bidder's account. The customer/Inspector, unless the witnessing of the tests is virtually waived, will attend such tests within 15 days of the date on which the equipment is notified as being ready.
3. Type & routine test report / certificates shall include details of standard to which the tests are performed, test parameters, acceptance criteria, test set up etc. used during the testing along with the test piece details/rating and the detailed test record and final test result.
4. All inspection, measuring and test equipment used by the contractor shall be calibrated periodically. Bidder shall maintain all relevant records of periodic calibration, instrument identification, and shall provide for inspection by bidder wherever asked specifically; bidder shall calibrate measuring / testing equipment in the presence of employer.
5. The details of the checks to be carried out for various components (MQP) are to be submitted within one month from the date of Purchase order by bidder for customer approval.
6. Bidder shall maintain strict quality norms and standards for Bought out/ self-manufactured items through its wide network of quality departments throughout the country who carryout



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stage and final inspection of the product as per quality standards agreed by engineering/quality specialists

7. All bought out items shall be as per TSGENCO approved Vendor List.
8. After completion of inspection the material will be treated as cleared for dispatch by BHEL/Customer/customer's Consultant inspector, if inspection is OK as observed by Inspection Engineers.
9. Training of Customer personnel at equipment manufacturer's factory premises and O&M training at site, as per equipment manufacturer's standard training modules, is also in the scope of bidder.

14.0 TOOLS & TACKLE: -

The bidder shall supply with the equipment **two complete set** of special tools and tackle as required for the erection, assembly, dismantling & maintenance of the equipment. These special tools will also include special material handling equipment, jigs & fixtures for maintenance and calibration/ readjustment, checking & measurement aids etc. A list of such tools & tackle shall be submitted by the Bidder along with the offer.

15.0 DISTRIBUTION OF DRGS/ DOCUMENT DURING DETAIL ENGINEERING:

- a) Distribution of drawings/ documents
 - i) For Approval and Information category drgs :
Initial submission –Soft copy (AutoCAD version and Pdf version)
Commented copies back to the sender- Soft copy (Pdf version)
Resubmission of revised drg – Soft copy (AutoCAD version and Pdf version).
 - ii) Erection Drgs: Soft Copy
 - iii) Final approved Drgs– 6 copies,
 - iv) Instruction Manuals / O & M Manuals
6 hard bound copies to BHEL HQ and soft copy also.
 - v) Test Certificates: Soft copies to BHEL HQ
- b) Considering the criticality of the project requirement, all out efforts shall be made to re-submit the drawings / documents as early as possible.
- c) Final distribution of copies of all Category 1 approved drawings/documents shall be submitted by successful Bidder to BHEL / Customer / customer's Consultant as per distribution schedule given above.

16.0 DRAWINGS ATTACHED:

1. ANNEXURE – 01 Project information
2. ANNEXURE - 02 Layout of Ash Handling System
3. ANNEXURE – 03 Ash Handling Specification
4. ANNEXURE- 04 Painting Specifications (14 sheets).
5. ANNEXURE-05-Flow Diagram
6. ANNEXURE – 06 (HSE Manual)
7. ANNEXURE-07-CHEMICAL HOUSE (PLANT AREA)
8. ANNEXURE-08-CHEMICAL HOUSE (DYKE AREA)
9. ANNEXURE-A,B&C (ELECTRICAL AND C&I)