BHEL	BHARAT HEAVY ELECTRICALS LIMITED (A GOVT OF INDIA UNDERTAKING)	Flue Gas Desulphurization Group-FGD, Boiler Auxiliary Plant (BAP), Ranipet

TECHNICAL SPECIFICATION FOR MIST ELIMINATORS

SPECIFICATION NO	:	**FGD:ME:R01**
BUYER (EPC)	:	**BHEL, BAP Ranipet**
APPLICATION	:	**WET LIMESTONE FGD**

REV	Date	Description	Prepared	Checked	Approved
01	01-12-2020	Clause 12, Annexure-III revised	Jyotish Kumar Patel	Shanmuga Sundaram S	V.Kesavan
00	15-06-2020	Fresh issue	-Sd- Jyotish Kumar Patel	-Sd- Shanmuga Sundaram S	-Sd- V.Kesavan

CONTENTS

DOCUMENTS TO BE SUBMITTED ALONG WITH THE BID

Sl. No.	Description	No of copies With proposal
1.	Documents for meeting the Qualification Requirement	1
2.	Reference plant list (as per Annexure-I)	1
3.	Compliance to Specification – Duly signed and stamped by the bidder	1
4.	Data Sheet for Mist Eliminator(as per Annexure-II)	1
5.	General arrangement and the cross-sectional drawing of the Mist Eliminator & its accessories.	1
6.	Schedule of Guarantee (as per Annexure-III)	1
7.	Deviation list (as per Annexure-IV)	
8.	Performance characteristic curves of Mist Eliminator	1
9.	Washing System data calculation sheet and Washing sequence	1
10.	Utility List & Required Pump Capacity	1
11.	Mandatory spares list.	1
12.	Start-up, Erection and commissioning spares list.	1
13.	Recommended Spares List for 3 Year's Normal Operation	1
14.	Proforma Packing List	1
15.	Approximate weight of each skid	1
16.	Support beam details and loading data	1
17.	Sub-Vendor List	1
18.	Scope of Supply	1
19.	Quality Plan	1
20.	List of Special Tools	1
21.	Delivery Schedule	1
22.	Droplet Measurement procedure	1
23.	WPS & PQR arrangement	1
24.	Man-holes, Viewing Ports, Sampling ports & Wash Pipe flange location & details	1
25.	Catalogue	1
26.	Terminal Point details	1
27.	Bill of Materials along with material and codes	1

DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT:

Sl. No.	Description	No of copies After award of contract	Delivery Time
1.	General arrangement and the cross-sectional drawing of the Mist Eliminator & its accessories.	1	2 weeks after contract
2.	Isometric (3D) Drawing of the Mist Eliminator & it accessories	1	1 month after award
3.	Data Sheet for Mist Eliminator	1	2 weeks after contract
4.	Performance characteristic curves of Mist Eliminator	1	2 weeks after contract
5.	Washing system data calculation sheet , Washing sequence.	1	2 weeks after contract
6.	Utility List & Required Pump Capacity	1	2 weeks after contract
7.	Support beam drawing & loading data	2	2 weeks after contract
8.	Strength & performance Calculation	1	2 weeks after contract
9.	Mandatory spares list.	1	2 weeks after contract
10.	Erection and commissioning spares list.	1	2 weeks after contract
11.	Recommended Spares List for 3 Year's Normal Operation	1	2 weeks after contract
12.	Special tools list	1	2 months after contract
13.	Inspection and Test Procedure	1	1 month after contract
14.	Installation and assembly procedure	1	4 months after contract
15.	Inspection and Test Procedure	1	1 month after contract
16.	Quality Plan	4	1 month after contract
17.	Inspection & Test record	1	In 2 weeks after test
18.	Inspection Certificate	1	In 2 weeks after test
19.	Material Test Certificates	2	In 2 weeks after test
20.	Sub vendors List	1	2 weeks after contract
21.	Manufacturing Schedule	1	2 weeks after contract
22.	Progress report	1	Every month
23.	Proforma Packing List	1	2 months prior to shipping

Sl. No.	Description	No of copies After award of contract	Delivery Time
24.	Approximate weight of each skid	1	2 months after contract
25.	Material Test Certificates	2	In 2 weeks after test
26.	Pre Commissioning Check List	2	4 months after contract
27.	Droplet Measurement procedure	2	1 month after contract
28.	WPS & PQR	2	2 weeks after contract
29.	Catalogue	2	2 weeks after contract
30.	Operation and Maintenance Manual Cleaning and repair procedure	• 10 hardcopies and 5 electronic copies in English	4 months after contract

1.0 APPLICABLE CODES & REGULATIONS

The design and materials shall conform to the requirements of applicable codes and regulations of the latest edition. The design, manufacture, installation and testing of the Mist Eliminator shall follow the latest applicable Indian/International (AISI / ASME/EN/Japanese) Standards.

2.0 INTENT OF SPECIFICATION

This specification covers the minimum requirements for the complete design, material, manufacturing, shop inspection, testing at the manufacturer's works, supervision of erection & commissioning and performance testing of Mist Eliminators along with accessories which is to be furnished in the Flue Gas Desulphurization plant of Coal fired Power Plants. The following points may be noted.

a. Bidder shall assume full unit responsibility for the entire equipment assembly and make all possible efforts to comply strictly with the requirements of this specification and other specifications/attachments to inquiry/order.

b. In case, deviations are considered essential by the Bidder (after exhausting all possible efforts), the same shall be separately listed in the Bidder's proposal under separate section, titled as "List of Deviations/Exceptions to the Enquiry Document (**Annexure-IV**)". In case of NIL deviation, bidder has to specify "NIL Deviation" in Annexure-IV.

c. Any deviation, not listed under the above section, even if reflected in any other portion of the proposal, shall not be considered applicable.

d. No deviation or exception shall be permitted without the written approval of the purchaser.

e. Compliance to this specification shall not relieve the Bidder of the responsibility of furnishing equipment and accessories/auxiliaries of proper design, materials and workmanship to meet the specified start up and operating conditions.

f. In case, the Bidder considers requirement of additional instrumentation, controls, safety devices and any other accessories/auxiliaries essential for safe and satisfactory operation of the equipment, the same shall be recommended along with reasons in a separate section and include the same in scope of supply.

g. All accessories, items of work, though not indicated but required to make the system complete for its safe, efficient, reliable and trouble free operation and maintenance shall also be in supplier's scope unless specifically excluded.

3.0 PROVENNESS CRITERIA:

"Bidder should have previous experience of design, manufacture, supply, erection and commissioning / supervised erection & commissioning of the Mist Eliminators for Wet Limestone based FGD system for at least one (1) no. 500/ MW or higher capacity pulverized coal fired power plant such that respective equipment(s) should have been in successful operation for a period not less than One (1) year prior to Part-I (Techno-commercial) bid opening date**"**

The Bidder shall offer only proven design which meets the Provenness criteria indicated above. Necessary document evidences (PO copy/ GAD or Datasheet for the reference plant/Performance certificate from end user for the reference plant) for qualification shall be submitted along with the bid. If bidder doesn't meet the specified provenness criteria, their offer is liable for rejection.

4.0 SCOPE OF SUPPLY

Scope for the bidders shall include Design, Supply, Testing and Supervision of Erection & Commissioning.

Design: Includes basic engineering, detail engineering, preparation and submission of engineering drawings/calculations/datasheets/quality assurance documents/field quality plans, storage instructions commissioning procedures, operation & maintenance manuals, performance guarantee test procedures and assisting BHEL in obtaining time bound approval from END CUSTOMER.

The following items shall be Bidder's scope of design

- Performance Calculation
- Basic Design
- Detail Fabrication Drawings
- Support Beam Drawing and Loading data for Absorber Design
- Strength Calculation
- Documents for Fabrication, Inspection, Installation, Shipment and Erection & Maintenance works at site.

Supply: Includes manufacturing/fabrication, shop floor testing, stage inspections, final inspections, painting & packing.

Supervision of Erection & commissioning: Includes supervision of erection& Commissioning at site.

Performance testing: Includes outlet Mist Concentration measurement at site as per VDI Norm

Supplier's scope shall cover complete Mist Eliminator unit including sub-systems, start-up spares and special tools (typically) as given below. The scope of supply for Mist Eliminators shall include but not limited to the following:

Sl. No	Scope
1.	Mist Eliminator complete with
	i. Mist Eliminator modules/panels with end stopper plate for all the stages.
	ii. Flushing pipes with spray nozzles and flange for the front and back wash for all the stages.
	iii. Horizontal member for pipe support with mounting clamps for pipe.
	iv. Vertical member (Leg support- L angle) from the main beam to horizontal pipe support
	v. Inverted U-Clamp (Hanger type) for mounting bottom wash pipe support.
	vi. Pad Plate at the end of the leg support
	vii. All fasteners required for pipe support members , Mist Eliminator panels, etc.
	viii. Fasteners (made of Galvanised steel) and gaskets for the flanges outside absorber as per the drawing
	ix. Any blanking plate, if required, shall be provided by bidder.
	x. 3% of Hardware and gaskets supplied shall be provided as erection spares. Any other erection/commissioning spares deemed necessary by the vendor shall be supplied
	xi. Startup Spares as applicable
	xii. Special tools & tackles as applicable
	xiii. Mandatory spares as per requirement
	xiv. Painting and Rust Prevention during shipment and construction
	xv. Export packing and Inland Transportation
	xvi. Supervision of Erection & commissioning at site
	xvii. Residual droplet content measurement at site using VDI Norm 3679.
	xviii. Installation, operation and maintenance manuals
	xix. Any other items required for completeness of the equipment except the items covered in the exclusions.

Bidder shall refer to the drawing enclosed with this specification. Buyer will provide the details of the structures inside/outside absorber after placement of order and Mist Eliminator system shall be designed suitably considering the structures.

4.1	DESIGN AND CONSTRUCTION FEATURES
1.	To separate the entrained droplets, mist eliminators are installed above the absorber spraying zone. Mist Eliminators offered shall be designed, installed, tested and operated so that high availability and high droplet removal efficiency is guaranteed.

2.	The residual droplet content shall be measured according to applicable clauses in VDI Norm 3679.
3.	**Material grade** for Mist Eliminator chosen by the bidder shall be field proven in previous installation for the corrosive and erosive condition prevailing inside FGD absorber. The No of stages of ME shall be as per Annexure" Selection parameter for Mist Eliminator".
4.	Provision shall be made for continuous washing of both ends all the stages except the back wash of the last stage. Wash water arrangement shall also be provided at the back end of the last stage of Mist Eliminators and it is meant for maintenance or during shutdown condition(i.e. back wash of the last stage is designed for intermittent washing).
5.	The Mist Eliminator washing system shall be designed for cyclic washing of different sections. Pneumatically operated valves required for cyclic washing will be provided by the buyer. Platforms for accessing the automatic valves for the spray system will be provided by BHEL.
6.	Entrained Slurry shall be collected by Mist Eliminators downstream of the slurry spray system to avoid carryover of slurry to the Stack.
7.	The ME system shall be equipped with washing and drain provisions, where drains are directed into the absorber. Washing provisions shall include external and internal piping systems with replaceable nozzles, complete with all piping.
8.	The Material of construction for the Mist Eliminator Wash Pipe header shall be as per "Annexure- Selection parameters for Mist Eliminator". The material chosen by the bidder shall be proven and Mist Eliminator vendor shall have experience for the same
9.	Ease of replace-ability and placement of the mist eliminator on maintenance platforms is an important requirement.
10	The ME shall be designed to allow for efficient cleaning in process.
11	Test ports will be provided by the buyer in the downstream of the mist eliminator to enable performance testing. Test ports location shall be recommended by the Mist Eliminator vendor and shall be as per ASME PTC-40.
12	The mist eliminator system shall be capable of withstanding high velocity spray water jets typically employed during manual cleanings. The ME shall be constructed in individual cells. The design shall safely avoid ME vibration and/or humming. The individual cells shall be sized so that no more than two maintenance personnel are needed to handle them manually when they are fully scaled or plugged, and the cells shall be capable of passing through the access doors for the mist elimination section.
13	Easy access for placement and replacement of the mist eliminator shall be incorporated in the design of the mist eliminator arrangement and the absorber vessel. Vendor shall provide recommendations for the same.

14	Walkways will be provided by the Buyer. However, Size and location of Manholes which are required for installation and replacement of each segment of the Mist Eliminator shall be recommended by the Mist Eliminator vendor.
15	The headroom shall have a height of more than 2200 mm.
16	The mist eliminator support beams shall be designed to act as maintenance walkways approximately 300 mm wide and shall allow for a minimum 500 Kg/m2 load. The support beam/walkways shall provide personnel access to all mist eliminator modules, wash headers and wash nozzles. The support beam will be provided by the buyer. However, bidder shall ensure the design of ME system in such a way that there is place to walk on the beam.
17	Adequate number of viewing ports with flushing devices connected to automatically operating washing system will be provided by the buyer at following locations: (i) Upstream of 1st stage (ii) Between 1st and 2nd stage (iii) Downstream of 2nd stage. (iv) Downstream of 3rd stage (in case of Three stage ME) Regular flushing will be done in a defined time sequence. Viewing ports locations shall be recommended by the ME vendor.
18	Internal supports for mist eliminator sections, etc. shall be designed to withstand the flooded weight of the supported section.
19	All internal piping support members for mist eliminator and flushing system shall be provided as per Annexure" Selection parameter for Mist Eliminator".
20	The material used for washing nozzles shall be field proven in previous installations.
21	All fasteners provided for the ME and wash pipe supports shall be as per Annexure" Selection parameter for Mist Eliminator".
22	The Mist eliminators and its supporting structure shall be designed to carry sufficient load during maintenance.
23	The formation of agglomeration, deposition & caking shall be avoided. For mist eliminators the bidder shall submit a cleaning procedure including the required safety measures as part of the inspection concept.
24	Detailed washing procedure for the mist eliminator shall be submitted such as • Minimum washing water pressure (MPa) • Minimum Flow rate (m3/hr) • Washing time schedule and sequence • Nozzle type • No of spray nozzles • Size of header pipes • Valve list
25	Mist Eliminator Panel's support shall be designed in consideration of dirty condition of the Mist Eliminator. Design Load of the Mist Eliminator shall be as follows, Mist Eliminator's weight including eliminated liquid weight plus max. allowable pressure

	drop of the mist eliminator.
26	The thickness of the Mist Eliminator shall be as per vendor's proven practice. Vendor shall specify the thickness in their offer.
27	The spacers to link each panel for restricting the gap between the panels shall be supplied.
28	Blade surface shall be capable of supporting 225 kg of concentrated load, as might be experienced during inspection, while fully plugged with solids. Provide anchors, Fasteners, spacers and supports shall be provided by bidder to securely hold Mist Eliminator and prevent shifting during operation
29	The beam and the outer ring for supporting the Mist Eliminator will be provided by the buyer. All other supports for Wash Pipes shall be taken from the main beam or outer ring supports. Pipe support shall not be taken from Absorber Casing and such arrangements involving support from the casing will not be accepted.

5.0 GENERAL REQUIREMENTS:

S.No	Description
1.	Descriptions in the drawings, in the documents, and in the displays shall be in English
2.	The equipment shall be designed to withstand the corrosive and moist environment in which these are proposed to operate.
3.	Suitable drain connections shall be provided.
4.	The equipment shall be suitable for stable continuous operation.
5.	Limit of connection: The buyer (BHEL) has an intention to minimize interface for utilities as much as possible. The bidder shall consider this requirement in the planning stage of layout for the equipment. The bidder shall provide the header piping for utilities and branch piping to each nozzle. Terminal points for all utilities shall be located at Absorber wall edge at Mist Eliminator elevation. The bidder shall specify all terminal points with tie-in number in the P&ID and submit it in the proposal to confirm the scope of supply.
6.	Service life: Entire equipment except wearing parts shall be designed and fabricated for a minimum service life of 30 years of operation or 200,000 full load operating hours whichever is longer.
7.	Corrosion allowance: Corrosion allowance for entire equipment shall be in accordance

S.No	Description
	with latest applicable international standard.
8.	Unless otherwise specified , flanges shall be in accordance with ANSI B16.5 Class 150
9.	Name plate: Nameplate shall be provided indicating the item number and service name. Name plates shall be of 304 Stainless steel plate and placed at a readily visible location. Nameplate of main equipment shall have enough information, which will be confirmed during engineering phase.
10.	Unless otherwise specified, all equipment items where the weight exceeds 15 kg shall be provided with suitable lifting lugs, ears or ring bolts or tapped holes for lifting rings. Minimum shock factor for lifting lugs shall be minimum 2.0. The position of lifting lugs and reference dimension shall be shown on GA and/or outline drawings. NDT shall be conducted for lifting lugs. When any spreader bars are required for lifting and laydown, the bidder shall provide spreader bar with equipment.
11.	Equipment shall be fabricated as much as practical to minimize erection at the site.
12.	Washing headers support and its clamping arrangement along with fasteners shall be provided by the bidder.
13.	If the Mist eliminator is in the resonance condition or any vibration problems occur, the bidder shall solve the problems in a timely manner.
14.	Bidder shall provide the mating flanges with the necessary gaskets.
15.	All the surfaces of the carbon steel (if any) should be rust prevented before shipment for the period of at least 12 months for storage and construction.
16.	The list of all Bought out items with makes and country of origin to be mentioned along with offer to be submitted.
17.	Quality Plan to be submitted along with the offer.
18.	During entire period of the project, the bidders shall strictly follow and adhere to the guidelines for effective Health & Safety Management. Supply of safety gears/PPE for bidder's/bidder's sub vendor personnel deputed at site for Supervision of E&C, etc. shall be in bidder's scope.
19.	Cost towards the participation in discussions/meetings, providing technical assistance during technical discussions/meetings with customer for approval of drawing/documents etc. TA/DA, boarding and lodging to attend these meetings shall be borne by the bidder and shall be inclusive in supply portion.
20.	Material of construction for all equipment/components shall be subject to BHEL/END CUSTOMER/END CUSTOMER's consultant approval during detail engineering. Accordingly bidder shall consider MOC for all equipment/component as per best engineering practice, global standard and global references.

S.No	Description
21.	Bidder to provide sub vendor list and Bidder shall strictly adhere to BHEL/END CUSTOMER approved vendor list.
22.	The modalities of inspection (Stage, Final, In-process) shall be finalized during detail engineering after submission of quality assurance plan (QAP). It shall be reviewed by the END CUSTOMER/END CUSTOMER's consultant and BHEL. Bidder shall follow the procedures of inspection as per the approved QAP. Bidder has to submit the following documents along with inspection call and if any other documents required as per approved QAP. - Raw material inspection certificate - Internal test reports - Statutory certificates as required. - All inspection & testing shall be carried out based on the following documents: a. Relevant Standards b. Specifications c. Approved drawings d. Data Sheets e. Calibration certificate for all the measuring instruments f. Bidder should also coordinate in getting the MDCC's (Material Dispatch clearance certificate) and all types of IC's (Inspection Certificates) from the customer/customer's consultant along with BHEL.
23.	Any shim plates for erection of equipment / item at site shall be in the scope of bidder.
24.	During detail engineering, bidder to strictly adhere to BHEL/END CUSTOMER/END CUSTOMER's consultant drawing formats, document numbering, quality plan & FQP formats
25.	The identification and numbering of equipment, systems, items, etc. of supply, as well as of all documents and drawings shall be in accordance with the VGB guideline RDS-PP (Reference Designation System for Power Plants - KKS system).
26.	Complete detail engineering drawings, calculations, selection of components etc. shall be reviewed & subject to approval of BHEL/END CUSTOMER/END CUSTOMER's consultant during detail engineering
27.	Bidder shall furnish necessary inputs & drawings of all equipment in editable Auto CAD/ MS-Word /Excel format.
28.	During detail engineering, successful bidder shall ensure flow of drawings/documents as per schedule. Any comments from BHEL/END CUSTOMER/END CUSTOMER's consultant should be addressed timely by the bidder.

S.No	Description
29.	Bidder to note that list above is not exhaustive and any work /items required for completing the smooth operation and ensuring satisfactory running of the machines till final hand over to the end user shall also be in the scope of the bidder.
30.	Bidder shall submit the signed and stamped copy of all the pages which constitutes this technical enquiry specification signed by authorized signatory and clearly mentioning each clause under following two categories to avoid any ambiguity in scope understanding & the scope division along with technical offer. a. "Accepted without deviation and considered in scope of work" b. "Not considered in scope of work".
6.0	**PACKING AND FORWARDING**
1.	Proper packing to be ensured. **Indigenous Supply:** The equipment shall be wrapped in polythene bags & packed in a strong rigid wooden crate. Rain water should not enter into the equipment during storage in the outer yard of power plant. Imported Supply: All imported supply (supplies from outside India) should be packed as per Sea worthy packing specification no. **PE-TS-888-100-A001**. All imported items should have Sea worthy packing. Liberal packing materials and struts shall be provided to arrest rolling and to protect from transit damages
2.	Cardboard containers shall be enclosed in a solid wooden container
3.	Equipment and process materials shall be packed and semi-knocked down, to the extent possible, to facilitate handling and storage and to protect bearings and other machine surfaces from oxidation. Each container, box, crate or bundle shall be reinforced with steel strapping in such a manner that breaking of one strap will not cause complete failure of packaging. The packing shall be of best standard to withstand rough handling and to provide suitable protection from tropical weather while in transit and while awaiting erection at the site.
4.	Equipment and materials in wooden cases or crates shall be properly cushioned to withstand the abuse of handling, transportation and storage. Packing shall include preservatives suitable to tropical conditions. All machine surfaces and bearings shall be coated with oxidation preventive compounds. All parts subject to damage when in contact with water shall be coated with suitable grease and wrapped in heavy asphalt or tar impregnated paper.
5.	Crates and packing material used for shipping will become the property of owner.(END CUSTOMER)
6.	Packing (tare) shall be part of the equipment cost and shall not be subject to return. The packing should ensure integrity and cohesiveness of each delivery batch of equipment during transportation. In case of equipment assemblies and unit's delivery in the

S.No	Description
	packing of glass, plastics or paper the specification of packing with the material and weight characteristics are to be indicated.
7.	Each package should have the following inscriptions and signs stenciled with an indelible ink legibly and clearly: a. Destination b. Package Number c. Gross and Net Weight d. Dimensions e. Lifting places f. Handling marks and the following delivery marking
8.	Each package or shipping units shall be clearly marked or stenciled on at least two sides as follows. **BHEL SITE OFFICE,** ***"ADRESS OF THE PROJECT SITE AS PER ENQUIRY/ PO "*** **INDIA** In addition, each package or shipping unit shall have the symbol painted in red on at least two sides of the package, covering one fourth of the area of the side.
9.	Each part of the equipment which is to be shipped as a separate piece or smaller parts packed within the same case shall be legibly marked to show the unit of which it is part, and match marked to show its relative position in the unit, to facilitate assembly in the field. Unit marks and match marks shall be made with steel stamps and with paint.
10.	Each case shall contain a packing list showing the detailed contents of the package. When any technical documents are supplied together with the shipment of materials no single package shall contain more than one set of such documents. Shipping papers shall clearly indicate in which packages the technical documents are contained.
11.	The case number shall be written in the form of a fraction, the numerator of which is the serial number of the case and the denominator the total number of case in which a complete unit of equipment is packed.
12.	Wherever necessary besides usual inscriptions the cases shall bear special indication such as "Top", "Do not turn over", "Care" , "Keep Dry" etc. as well as indication of the center of gravity (with red vertical lines) and places for attaching slings (with chain marks)
13.	Marking for Safe handling: To ensure safe handling, packing case shall be marked to show the following: a. Upright position

S.No	Description
	b. Sling position and center of Gravity position c. Storage category d. Fragile components (to be marked properly with a clear warning for safe handling
14.	Each crate or package is to contain a packing list in a waterproof envelope. All items are to be clearly marked for easy identification against the packing List. All cases, packages etc. are to be clearly marked on the outside to indicate the total weight where the weight is bearing and the correct position of the slings are to bear an identification mark relating them to the appropriate shipping documents. All stencil marks on the outside of cases are either to be made in waterproof material or protected by shellac or varnish to prevent obliteration in transit.
15.	**The packing slip shall contain the following information: -** Customer name, Name of the equipment, Purchase Order number with Date, Address of the delivery site, Name and Address of the Sender, Serial Number of Mist Eliminator & accessories, BHEL item Code, Gross Weight and Net weight of Supplied items.
16.	Prior to transport from manufacturer's work to destination, components of the unit shall be completely cleaned to remove any foreign particles. Flange faces and other machined surfaces shall be protected by an easily removable rust preventive coating followed by suitable wrapping.
17.	All necessary painting, corrosion protection & preservation measures shall be taken as specified in painting schedule. Supplier shall consider the coastal environment zone which is defined as "very severe" during final finishing/shipping.
18.	Successful bidder shall furnish the detail packing /shipment box details with information like packing box size, type of packing, weight of each consignment, sequence no. of dispatch, no. of consignment for each deliverable item against each billing break up units/ billable blocks. Without these details the BBU shall not be approved during detail engineering. Also, complete billing break-up with above mentioned details shall be submitted within 10days of LOI.
19.	All items/equipment shall be dispatched in properly packed condition (i.e. no item shall be dispatched in loose condition such that it becomes difficult to store/identify its location at site at a later stage).
20.	Cases which cannot be marked as above shall have metal tags with the necessary markings on them. The metal tags shall be securely attached to the packages with strong steel binding wire. Each piece, Skid, Case or package shipped separately shall be labelled or tagged properly.

S.No	Description
7.0	**SUPERVISION OF ERECTION AND COMMISSIONING**
	ERECTION
1.	The erection of Mist Eliminator and washing system will be done by buyer as per Erection Manual and check List provided by the bidder. However, the bidder shall make one visit per Mist Eliminator System/Absorber for the supervision of erection and commissioning.
2.	There will be one visit for each Mist Eliminator system or Absorber. Total No of Visit shall be as per Enquiry/PO. The bidder will be informed well in advance for the visit. No of days required supervision shall be as per enquiry/PO.
3.	TA/DA, Travel expenses, boarding and lodging shall be borne by the bidder and shall be inclusive in supervision portion.
8.0	**DROPLET MEASUREMENT/PERFORMANCE TESTING AT SITE**
1.	Bidder has to measure residual droplet at Mist eliminator outlet as per approved procedure for all the Mist Eliminators at site . The bidder will be informed well in advance for conducting the performance test (droplet measurement).
2.	Bidder has to complete the test for all the units as per enquiry/PO. TA/DA, travel expense, boarding and lodging, cost for bringing the testing kit to site shall be borne by the bidder and shall be included in the performance testing charges.
9.0	**EXCLUSION**
	The following work associated with the Mist Eliminator will be by BHEL: a. Mist Eliminator Wash Pumps b. Piping from ME Wash pumps to Absorber wall at Mist eliminator elevation. c. Pneumatic operated valves d. Support beams and outer ring inside the casing to support the ME e. Absorber casing and Nozzles.
10.0	**INSPECTION AND TESTING**
	The General inspection requirements to be considered are as below:
1.	Bidder shall furnish written copies of shop production, fabrication and quality test procedures and drawings for review by BHEL/END CUSTOMER prior to manufacture. Inspection of above mentioned tests by BHEL representative at bidder's works is

S.No	Description
	envisaged.
2.	The Bidder shall furnish performance test procedure along with measurement standard. The procedure will be reviewed and approved by the BHEL/END CUSTOMER.
3.	Final inspection and release by the BHEL/END CUSTOMER is a mandatory requirement unless specially waived.
4.	Acceptance tolerance of actual versus guaranteed performance for Droplet removal efficiency and Pressure drop shall be as per applicable standard.
5.	Mist Eliminator shall not be released for shipment, until shop tests data have been approved by Owner.
6.	Bidder should furnish performance guarantee as per applicable standard guarantee for the design, manufacture, material and safe operation of the equipments.
7.	BHEL/END CUSTOMER shall witness the test at Bidder's works and a notice of minimum three (3) weeks shall be given for attending the inspection.
8.	Bidder to arrange all calibrated gauges, Instruments during inspection.
9.	Bidder to arrange Instruments and all accessories for the measurement at site as per applicable clauses VDI Norm 3679.
10.	The performance test & droplet measurement may be carried out at site for Guarantee conditions and shall be converted to the design condition.
11.0	**SPARES,TOOLS & TACKLES**
11.1	**START UP & COMMISSIONING SPARES**
	Start-up & Commissioning Spares shall be part of the main supply of the Mist Eliminator & sub system. Start-up & commissioning spares are those spares which may be required during the start- up and commissioning of the equipment/system. The following startup/erection & commissioning spares shall be supplied by bidder along with main supply free of cost: All hardware's and gasket – 3% In addition to the above, any other spares required for Start-up and commissioning deemed necessary by the bidder shall be supplied. The spares must be available at site before the equipments are energized.
11.2	**RECOMMENDED SPARES**
	Bidders shall also furnish the **R**ecommended spares list along with the offer required for 3 years of normal operation of the plant and should be should be independent of the list of the mandatory spares. Prices of recommended spares will not be used for evaluation of the bids. The price of these spares will remain valid up to 6 months after placement of Notification of Award for the main equipment.

S.No	Description
11.3	**MANDATORY SPARES:**
	Bidder to quote for the mandatory spares as per enquiry/PO. Bidder shall quote for the "Mandatory spares", and it will be considered for L1 evaluation. Mandatory spare items shall be handed over separately and shall not be mixed with the supply of the main equipment parts. Spares shall not be dispatched before dispatch of corresponding main equipments. The mandatory spares shall be clearly identifiable and suitable tagging shall be made by the bidder. All spares supplied under this contract shall be strictly inter-changeable with the parts for which they are intended for replacements. All the mandatory spares shall be manufactured as per same specification and quality plan of the main supply. Mandatory spares will be in percentage of main supply. However while quoting, vendor to indicate quantity in numbers against percentage for each type. If derived quantity of mandatory spares is in fraction, then next higher side whole number has to be considered. In the event of ordering, PO will be released on rate per number basis, for the above firm quantity only. However, the price of Mandatory spare prices shall be kept valid for minimum 2 years from the date of dispatch of the of mandatory spares, to enable BHEL to place order further orders, if any, in case of additional requirement. The quantity of additional order may be less than or equal to the mandatory spares quantity indicated in the tender.
11.4	**SPECIAL TOOLS & TACKLES:**
	Any special tools & tackles required for the entire equipment to disassemble, assemble or maintain the units, they shall be included in the quotation and furnished as part of the initial supply. List of special tools & tackles shall be decided by bidder as per his proven practice. When special tools are provided, they shall be packaged in separate, boxes with lugs and marked as "Special Tools for (tag / item number)."Each tool shall be stamped or tagged to indicate its intended usage. Levers and eye bolts for the removal of parts to be serviced shall be submitted with special tools.
12.0	**PERFORMANCE GUARANTEE**
R01	All performance tests for Mist Eliminators shall be carried out in accordance with any latest international codes/standards. 1) The mist eliminator outlet droplet content shall be guaranteed as follows at absorber outlet measured over a period of 24 hrs continuous operation. a) ≤ 20 mg/Nm3 (in case of 3 stage Mist Eliminator) b) ≤ 50 mg/Nm3 (in case of 2 stage Mist Eliminator) 2) Mist outlet-droplet content shall be measured as per applicable clauses in VDI Norm 3679 and the Contractor shall carry out the tests as per the test procedure approved by the Employer. 3) Bidder shall furnish Performance guarantee for the design, manufacture, material,

S.No	Description
	safe and trouble-free operation of the Mist Eliminator and its accessories 4) Maximum Pressure drop across M/E at Design Point condition (as per "Selection parameter for Mist Eliminator") is to be guaranteed. It shall be measured at Guarantee point conditions in site and shall be converted to the design condition. 5) The Bidder shall ensure a design of the equipment to achieve an average target availability of 98% for 120 days and average target availability of 95% for 1 year 6) In the event that the performance test is unsuccessful in meeting performance guarantees, bidder shall take necessary remedial action at his cost and the performance test shall be repeated.
13.0	**WARRANTY:**
1.	The Bidder shall warrant that the equipments/items shall be free from defects in the design, engineering, materials and workmanship of the Plant and Equipment supplied and of the work executed. The Warranty period shall be 24 months from the date of supply or 18 months from the date of commissioning, whichever first occurs. If during the Defect Liability Period any defect should be found in the design, engineering, materials and workmanship of the Plant and Equipment supplied or of the work executed by the Bidder, the Bidder shall promptly, in consultation and agreement with BHEL regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise make good (as the Bidder shall, at its discretion, determine) such defect as well as any damage to the Facilities caused by such defect.
2.	In case of failure of the equipment to meet the guarantee, END CUSTOMER/BHEL reserves the right to reject the equipment. However, END CUSTOMER/BHEL reserves the right to use the equipment until new equipment supplied by bidder meets the guaranteed requirement .
14.0	**TRAINING**
	Successful bidder shall provide comprehensive training for END CUSTOMER/BHEL Engineering, O&M, Erection & Commissioning staffs at site covering all aspects of the ME system - Operation & Maintenance, Troubleshooting, cleaning procedure etc.
15.0	**CONFLICT**
	Bidder's equipment shall be designed for and shall meet the service, performance and minimum level of quality requirements specified. Bidder shall be solely responsible for advising End customer in writing of any conflicts between the specifications and Bidder's design, including performance and levels of quality. Bidder agrees that its obligations, liabilities and warranties shall not be diminished or extinguished due to its meeting the requirements of the Specification.

S.No	Description
16.0	**DOCUMENTATION**
	DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT
	List of Drawings or documents to be submitted after award of contract is enlisted. Drawings that are reviewed by the END CUSTOMER/ BHEL will be returned to bidder with a transmittal letter with any comments and / or questions marked on the drawings or noted in the letter. All comments and questions must be resolved before a resubmission of drawings / documents. If the design has not developed enough to resolve some of the comments or questions, bidder shall place a "hold" on those items or areas of design. END CUSTOMER/ BHEL reserves the right to return drawings unprocessed to bidder if there exists any evidence that bidder has not acknowledged all comments and questions. All necessary GA drawings, sections, sub-assembly drawings, specifications of main and sub components and necessary set of operation & maintenance manual as asked by END CUSTOMER must be furnished by bidder in soft and hard copy forms. For all documents softcopy format shall be searchable pdf, however in addition all drawings, diagrams like P&IDS shall be supplied in ACAD or other editable format and all lists in Excel format. Further break up of technical documents will be discussed during finalization of the purchase contract. Unless agreed otherwise, Ten (10) hard copies and five (05) sets of electronic copies of all documents are to be submitted in the English language. Electronic Copies shall be submitted in primary original data format (e.g. DOC, XLS, DWG) as well as in a printable non-proprietary document format (e.g. PDF). Especially P&IDs shall be submitted as DWG files and PDF files. Bidder to ensure submission of hard copies as per END CUSTOMER requirement for all engineering drg/doc and for all subsequent revisions along with a soft copy through email to concerned project team. However all the engineering related information shall be furnished in soft form to BHEL.

17.0 ANNEXURES

ANNEXURE – I

a) REFERENCE LIST as per format shown below. (at least One (1) reference plant details)

S. No.	Project Name , Customer & Plant capacity	Coal fired Yes/No	Wet Limestone Based FGD Yes/No	Model	Flue gas flow Nm^3/hr	Size	Outlet Mist Concentration mg/Nm^3	Year of Commg	Qty

NOTE: Performance certificate (End user feedback) or Unpriced PO or contract copy is required for 1 No Reference plant meeting the qualification requirement

SIGNATURE OF BIDDER ----------

NAME ----------

DESIGNATION ----------

ANNEXURE – II- TECHNICAL DATA SHEET

Enquiry No: _____ Project: _____

Sl. No	Description			Data		
1.0	**GENERAL**					
	a. Buyer		:	BHEL-Ranipet		
	b. Project		:			
	c. End Customer		:			
	d. Location		:			
	e. Service		:	Continuous		
	f. Installation		:	In-door		
	g. Total number of Mist Eliminators and Accessories (No of sets)		:	-Bidder to Provide-		
2.0	**MANUFACTURER DETAILS**					
	a. Model		:	-Bidder to Provide-		
	b. Type		:	-Bidder to Provide-		
	c. No of stages		:	-Bidder to Provide-		
	d. Vane type for Coarse & Fine separators		:	-Bidder to Provide-		
	e. Pitch details for Coarse & Fine separators		:	-Bidder to Provide-		
	f. Weight data		:	-Bidder to Provide-		
	g. Flushing system details		:	-Bidder to Provide-		
	(i) Nozzle Details:			1st stage	2nd stage	3rd stage (if applicable)
	Type of Nozzle					
	Spray angle					
	Size					
	Thread					
	Flow rate					
	Nominal size					
	(ii) No of nozzles for upstream wash					
	(iii) No of nozzles for downstream wash					
3.0	**OPERATING CONDITION**		**:**	**“Refer Selection parameters for Mist Eliminator”**		
4.0	**PERFORMANCE DATA**					
	a. Face Velocity	m/s	:	Bidder to Provide		
	b. Pressure Drop	hPa(G)	:	Bidder to Provide		
	c. Limit Drop Size	Micron	:	Bidder to Provide		
	d. Temperature resistance of ME System	Deg C	:	“Shall be as per Selection parameters for Mist Eliminator”		

	e. Performance curves (i) Pressure Drop Vs Gas Velocity (ii) Outlet Mist Load vs Gas Velocity (iii) Limit Drop Size vs Gas Velocity (iv) Collection Efficiency vs Drop Size	:	Bidder to Provide
	f. Washing sequence & Valve List	:	Bidder shall submit the washing sequence with detailed write up
	g. Utility list & required Pump Capacity	:	Bidder to Provide
5.0	**MATERIALS**		
	a. ME Panel	:	Bidder to Provide
	b. Washing Pipe	:	Bidder to Provide
	c. Wash Pipe Supports		Bidder to Provide
	d. Washing Nozzles	:	Bidder to Provide
	e. Hardwares	:	Bidder to Provide

7. 0 WASHING ARRANGEMENT

7.1	**Washing water condition**	
a.	Flow rate - Average	Bidder to provide
b.	Flow rate – Instantaneous Allowable Max	"Shall be as per Mist Eliminator Selection Parameters for the project"
c.	Feed Pressure (at inlet flange of ME Wash header)	"As per tender specification"
d.	Spray pipe level from ME Panel	< 700 mm

7.2	**Washing Method**						
		First Stage		Second Stage		Third stage (if applicable)	
		Front Surface	Back Surface	Front Surface	Back Surface	Front Surface	Back Surface
a.	Total Washing Area m^2						
b.	No of divided sections						
c.	Washing Water Source						
d.	Washing Water Average Flow rate m^3/h	*	*	*	*	*	*
e.	Instantaneous Max Water Flow rate m3/h	*	*	*	*	*	*

f.	Duration of One washing for One Divided Section Sec	*	*	*	*	*	*
g.	Time of One washing Cycle (min)	*	*	*	*	*	*
h.	* Bidder to fill the value						
i.	Note: Last/Final stage back surface washing - only for Maintenance						

SIGNATURE OF BIDDER ----------

NAME ----------

DESIGNATION ----------

ANNEXURE III- SCHEDULE OF GUARANTEES

Enquiry No: _____ Project: _____

Sl. No	Description			Data
1. R01	Mist eliminator outlet droplet content at absorber outlet measured over a period of 24 hrs continuous operation. (in case of three stage ME)*	mg/Nm^3	:	≤ 20 mg/Nm3
R01	Mist eliminator outlet droplet content at absorber outlet measured over a period of 24 hrs continuous operation. (in case of two stage ME)*			≤ 50 mg/Nm3
2.	Total Pressure drop across M/E at design point condition (in case of three stage ME)	mmwc(G)	:	< 20 mm WC
	Total Pressure drop across M/E at design point condition (in case of two stage ME)	mmwc(G)		< 15 mm WC
3.	Equipment Availability (%) Equipment Availability for 120 days Equipment Availability for 1 year	 % %	 : :	 Bidder to Provide Bidder to Provide

*Strike off whichever is not applicable

SIGNATURE OF BIDDER ----------

NAME ----------

DESIGNATION ----------

ANNEXURE – IV- LIST OF DEVIATIONS/EXCEPTIONS TO THE ENQUIRY DOCUMENT

Enquiry No: _____ **Project: _____**

Sl No	Clause No	Page No	Description of Deviation

Note: Enlarge the table to incorporate items. In case of NIL deviation, bidder has to specify “NIL Deviation”.

SIGNATURE OF BIDDER ----------

NAME ----------

DESIGNATION ----------

REF: MISTEL:BHILAI:R01

TECHNICAL INFORMATION OF MIST ELIMINATOR FOR NSPCL BHILAI 2X250 MW

A. TECHNICAL INFORMATION

Sl. No.	Description	Requirement	
1.	**End Customer**	NSPCL (NTPC-SAIL Power Corporation Limited)	
2.	**Project Name**	Bhilai 2X250 MW	
3.	**Location**	District Durg, Bhilai (East) , Chattisgarh State, India	
4.	**Type**	Three stage chevron type (First Stage shall be Flat or Roof Type, Second and Third stages shall be Diamond/Roof type)	
5.	**Material of construction of Mist Eliminator**		
i.	ME Panel	Polysulfone (Or) Super austenitic stainless steel (254 SMO)	
ii.	Washing Pipe	a)Glass fiber reinforced plastics (or) b) Polypropylene or PVC is also acceptable for mist eliminator wash headers provided vendor has proven experience for the same.(Previous reference & Documentary evidence should be submitted with the offer) R01	
iii.	Wash Pipe Supports	Shall be lined with min 2mm thk Alloy 59/C276 or entire Material in Alloy 59/C276	
iv.	Washing Nozzles	PVDF or PP as per bidder's proven practice	
v.	Hardware inside absorber	a) Alloy 59/ C276 for load bearing applications b) All metallic fasteners provided shall be of Alloy 59/C276 c) For pipe clamps, C276 Bolt, C276 Nut, C276 washer and C276 spring washer to be provided	
vi.	Enclosure Plate	Same as that of ME Panel if it is part of Mist Eliminator (or) C276 material.	
v.	ME Panel	Polysulfone (Or) Super austenitic stainless steel (254 SMO)	
6.	**Quantity**		
i.	Quantity of Mist Eliminators for Unit-1,2	2 sets (1 set for each unit) 1 set means Complete Mist Eliminators, Washing systems and accessories	
7.	**Parameters**		
vi.	Gas flow	Vertical	
vii.	Casing Dimension	Length : 7900 mm	Width : 13900 mm
viii.	Design Pressure of Mist Eliminator Panel	660 mmH_2O (G)	

Customer / Plant: NTPC BHILAI (2x250MW)								
Cont. No. : G211, G212	Rev. 00		Rev. 01		Rev. 02		Rev. 03	
	Sign	Date	Sign	Date	Sign	Date	Sign	Date
Engineer : VV	-sd-	20.03.20	-sd-	03.12.20				
Reviewer : PNR/ACR	-sd-	20.03.20	-sd-	03.12.20				
Approver : RSB	-sd-	20.03.20	-sd-	03.12.20				

TECHNICAL INFORMATION OF MIST ELIMINATOR FOR NSPCL BHILAI 2X250 MW

Sl. No.	Description	Requirement	
ix.	Max Allowable Pressure drop across Mist Eliminator element	20 mmH_2O (G) at Design point	
x.	Design Temperature	• 70 Deg C (Continuous) • 80 – 90 Deg C (30 minutes) • 90 – 100 Deg C (5 min)	
8.	**Gas condition at ME Inlet**	**Guarantee Point**	**Design Point**
i.	Gas Flow Rate (Nm^3/s-wet)	308	352
ii.	Gas Flow Rate (m^3/s-wet)	371	429
iii.	Gas Temperature (Deg C)	57.2	61.1
iv.	Density (kg/m^3)	1.044	1.018
v.	Operating Pressure at Mist Eliminator inlet (mm H_2O (G))	48	60
vi.	Gas Flow Distribution	+ or - 20%	
9.	**Gas Composition at ME Inlet**		
i.	SO_2 (Vol%-wet)	0.0071	0.0069
ii.	H_2O (Vol%-wet)	17.08	20.47
iii.	O_2 (Vol%-wet)	5.72	5.48
iv.	CO_2 (Vol%-wet)	10.19	9.78
v.	N_2 (Vol%-wet)	67.0	64.26
vi.	HCl (ppm-wet)	<3	<3
vii.	HF (ppm-wet)	<1	<1
vii.	Dust (mg/Nm^3-wet)	<50	<200
10.	Gypsum Slurry Density(t/m3)	1213	1213
11.	**Entrained Mist Condition:**		
i.	Mist Concentration at Inlet –at Guarantee & Design Point	200 g/Nm^3-dry	
ii.	Mist Concentration at Outlet –at Guarantee & Design Point	≤20 mg/Nm^3	

12.	**Mist Composition**	
i.	Solid	30 wt.%
ii.	Cl^-	19000 ppm
iii.	Mg^{2+}	7570 ppm
iv.	Ca^{2+}	1170 ppm
v.	Na^+	1240 ppm
vi.	SO_4^{2-}	8055 ppm

Customer / Plant: NTPC BHILAI (2x250MW)								
Cont. No. : G211, G212	Rev. 00		Rev. 01		Rev. 02		Rev. 03	
	Sign	Date	Sign	Date	Sign	Date	Sign	Date
Engineer : VV	-sd-	20.03.20	-sd-	03.12.20				
Reviewer : PNR/ACR	-sd-	20.03.20	-sd-	03.12.20				
Approver : RSB	-sd-	20.03.20	-sd-	03.12.20				

TECHNICAL INFORMATION OF MIST ELIMINATOR FOR NSPCL BHILAI 2X250 MW

B. WASHING ARRANGEMENT

1.1 Washing water condition		
a.	Flow rate - Average	13.77 m^3/hr *1)
b.	Flow rate at M/E Inlet – Instantaneous Allowable Max	96 m^3/hr
c.	Flow rate at M/E Inlet – Instantaneous Min	80 m^3/hr
d.	Feed Pressure (at inlet flange of ME Wash header)	0.2 MPa (Max)
e.	Spray Nozzle –Top washing	90 °, Full Cone(vendor shall decide based on proven practice)
f.	Spray Nozzle –Bottom washing	120 °, Full Cone(vendor shall decide based on proven practice)
g.	Spray pipe level from ME Panel	< 700 mm

*1) Vendor shall decide

Customer / Plant: NTPC BHILAI (2x250MW)								
Cont. No. : G211, G212	Rev. 00		Rev. 01		Rev. 02		Rev. 03	
	Sign	Date	Sign	Date	Sign	Date	Sign	Date
Engineer : VV	-sd-	20.03.20	-sd-	03.12.20				
Reviewer : PNR/ACR	-sd-	20.03.20	-sd-	03.12.20				
Approver : RSB	-sd-	20.03.20	-sd-	03.12.20				

TECHNICAL INFORMATION OF MIST ELIMINATOR FOR NSPCL BHILAI 2X250 MW

C. WATER ANALYSIS

Process water is envisaged for Mist Eliminator washing. Process water analysis is provided below.

S.no	Constituents	Unit	PROCESS WATER
1.	Calcium as $CaCO_3$	ppm	190
2.	Magnesium as $CaCO_3$	ppm	121
3.	Chlorides as $CaCO_3$	ppm	110
4.	Sulphate as $CaCO_3$	ppm	93.5
5.	Alkalinity as $CaCO_3$	Ppm	297
6.	Iron as fe	ppm	0.55
7.	Total silica	ppm	38.5
8.	pH		7.5
9.	Turbidity	NTU	11

Customer / Plant: NTPC BHILAI (2x250MW)								
Cont. No. : G211, G212	Rev. 00		Rev. 01		Rev. 02		Rev. 03	
	Sign	Date	Sign	Date	Sign	Date	Sign	Date
Engineer : VV	-sd-	20.03.20	-sd-	03.12.20				
Reviewer : PNR/ACR	-sd-	20.03.20	-sd-	03.12.20				
Approver : RSB	-sd-	20.03.20	-sd-	03.12.20				

TECHNICAL INFORMATION OF MIST ELIMINATOR FOR NSPCL BHILAI 2X250 MW

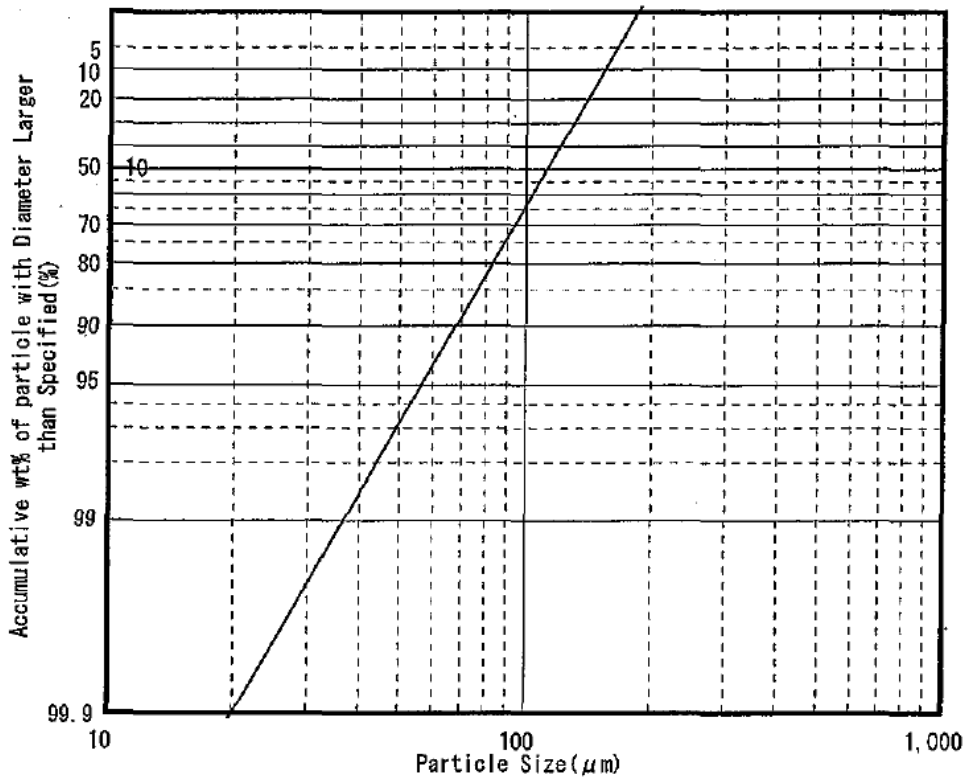
D. MIST PARTICLE SIZE DISTRIBUTION

a. Bidder shall note there is a tie beam located at the centre line of Absorber (Bidder shall refer to Note 01 :A in the typical drawing enclosed). This tie beam has to be used as Mist Eliminator beam.

b. Overall wash arrangement shall be as per the drawing (typical) enclosed. R01

The Mist Particle Size Distribution shall be as per below fig

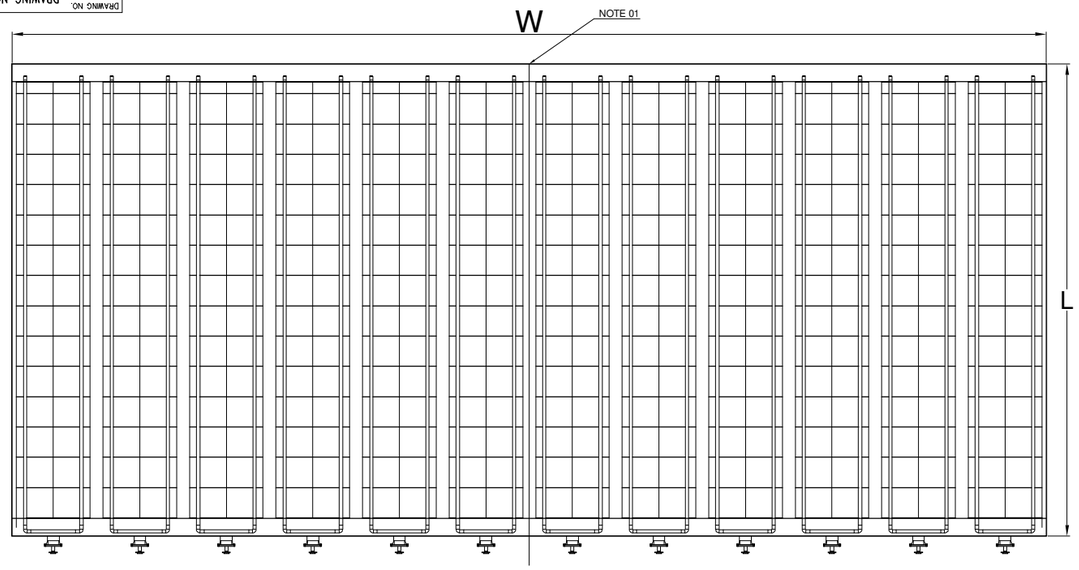
Fig. 2 Mist Particle Size Distribution(EXPECTED VALUE)

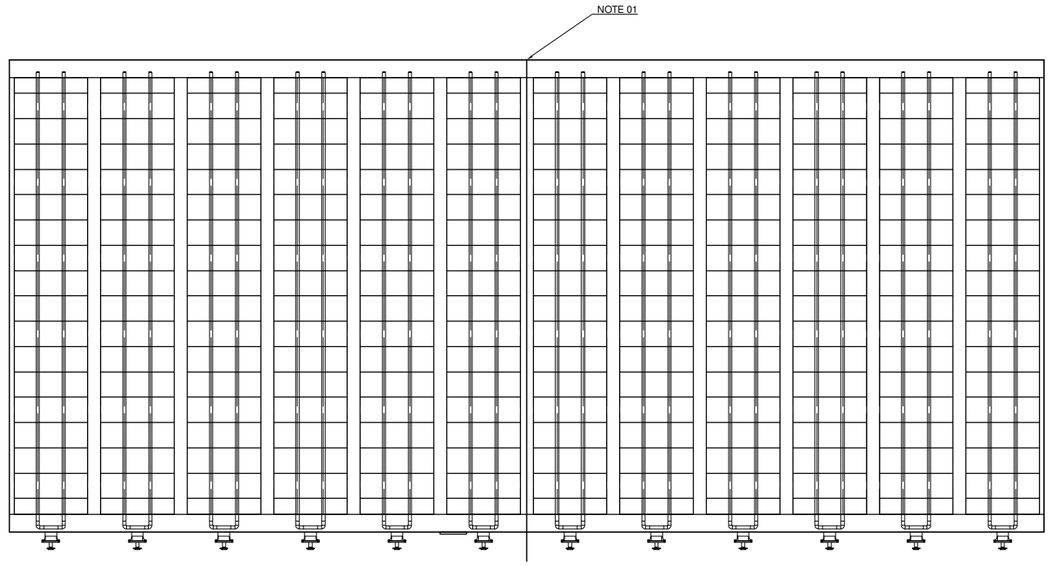


Customer / Plant: NTPC BHILAI (2x250MW)								
Cont. No. : G211, G212	Rev. 00		Rev. 01		Rev. 02		Rev. 03	
	Sign	Date	Sign	Date	Sign	Date	Sign	Date
Engineer : VV	-sd-	20.03.20	-sd-	03.12.20				
Reviewer : PNR/ACR	-sd-	20.03.20	-sd-	03.12.20				
Approver : RSB	-sd-	20.03.20	-sd-	03.12.20				

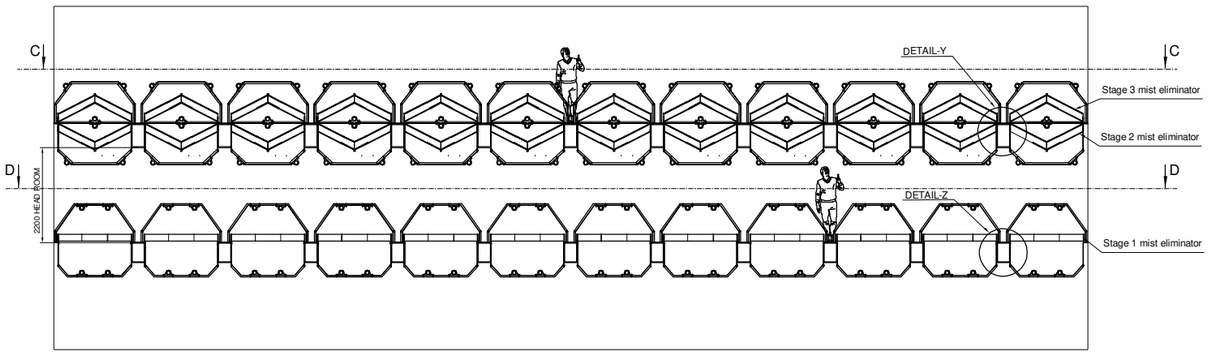
DRAWING NO.

All dimensions are in millimeters

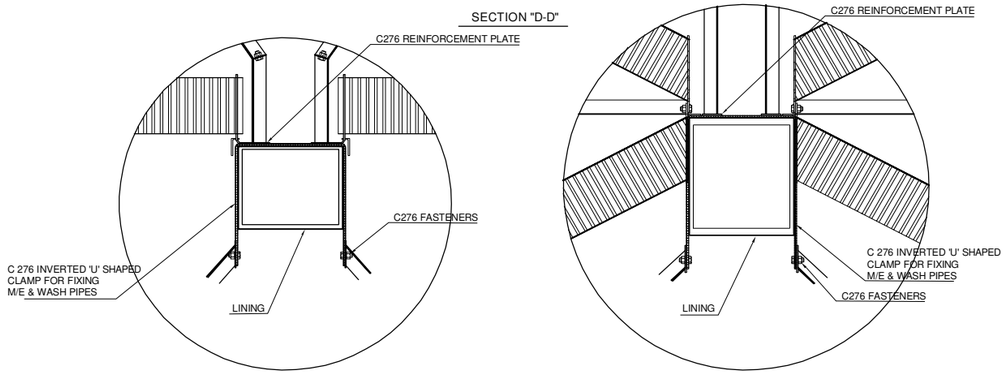




SECTION "C-C"

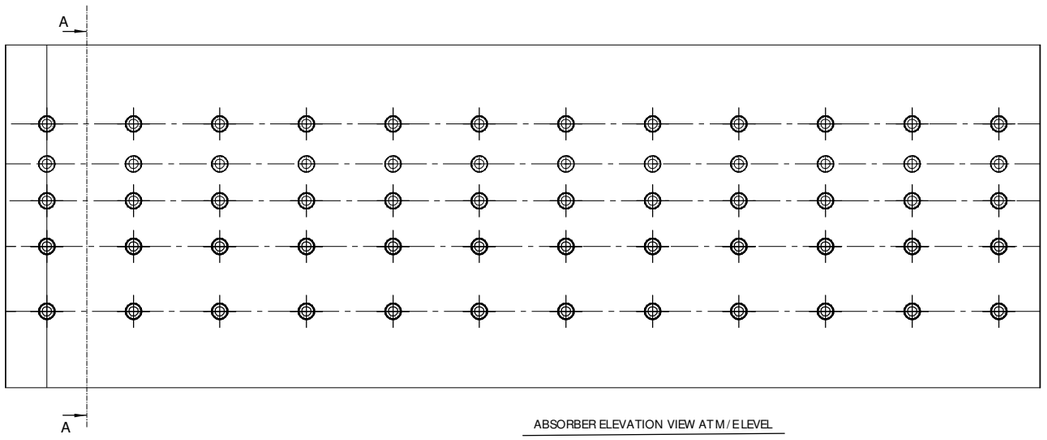


SECTION "D-D"

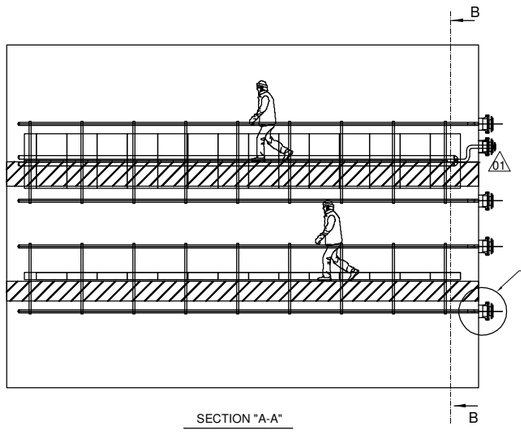


DETAIL-Z

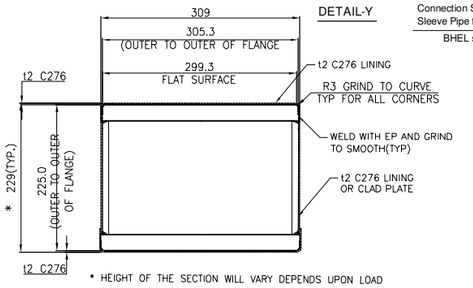
SECTION "B-B"



ABSORBER ELEVATION VIEW AT M/E LEVEL



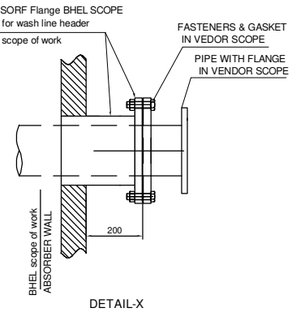
SECTION "A-A"



DETAIL-Y

* HEIGHT OF THE SECTION WILL VARY DEPENDS UPON LOAD

ME SUPPORT BEAMS 01



DETAIL-X

THE FOLLOWING ITEMS ARE IN VENDOR SCOPE:

a) MIST ELIMINATOR MODULE WITH END STOPPER PLATE FOR ALL THE STAGES
b) FLUSHING PIPES WITH SPRAY NOZZLES AND FLANGE FOR THE FRONT AND BACK WASH FOR ALL THE STAGES
c) HORIZONTAL MEMBER FOR PIPE SUPPORT WITH MOUNTING CLAMP FOR PIPE
d) VERTICAL MEMBER (LEG SUPPORT- L ANGLE) FROM THE MAIN BEAM TO HORIZONTAL PIPE SUPPORT
e) INVERTED U-CLAMP (HANGER TYPE) FOR MOUNTING BOTTOM WASH PIPE SUPPORT
f) PAD PLATE AT THE END OF THE LEG SUPPORT
g) ALL FASTENERS (MADE OF C-276) FOR SUPPORT MEMBERS/LOAD BEARING MEMBER INSIDE ABSORBER
h) FASTENERS/GASKETS FOR THE FLANGES OUTSIDE ABSORBER AS PER THE DRAWING
i) ANY BLANKING PLATE, IF REQUIRED, SHALL BE PROVIDED

NOTE 01:

A) WHEN W <= 22.9 M , CENTRAL BEAM AT "W/2 LOCATION" IS MANDATORY AND ITS LOCATION CANNOT BE DISTURBED TO ACCOMMODATE M/E.
B) WHEN W>22.9 M CENTRAL BEAM IS NOT APPLICABLE. INSTEAD TWO BEAMS ONE ON EITHER SIDE AT A DISTANCE OF 4 TO 4.6 M AWAY FROM THE CENTRE LINE. THESE TWO BEAMS ARE MANDATORY AND ITS LOCATION CANNOT BE DISTURBED TO ACCOMMODATE M/E. EXACT LOCATION OF BEAMS WILL BE INFORMED DURING DETAILED ENGINEERING.
01 C) M/E SUPPORT BEAM ARE IN BHEL SCOPE AND DETAILS ARE GIVEN. ONLY THE DEPTH OF THE SUPPORT BEAM WILL BE VARIED AS PER THE LOADING DETAILS. VENDOR'S ME DESIGN SHALL BE ABLE ACHIEVE THE WALKWAY REQUIREMENT OF 300 MM WIDE CONSIDERING THE BEAM DETAILS GIVEN IN THE DRAWING. THE WIDTH OF THE M / E BEAM CANNOT BE MODIFIED AND ANY ADDITIONAL SUPPORT REQUIRED TO ACHIEVE WALKWAY OF 300 MM HAS TO BE PROVIDED BY VENDOR.
D) BHEL'S SCOPE IS M / E SUPPORT BEAM AND THE OUTER RING SUPPORT. THE MAXIMUM WIDTH OF THE SUPPORT RING SHALL BE 300 MM . ANY OTHER ITEMS LIKE ENCLOSURE PLATES/ BLANKING PLATES ,IF REQUIRED, SHALL BE IN THE SCOPE OF M / E VENDOR.

BHEL WILL PROVIDE ONLY THE MAIN SUPPORT BEAM AND OUTER RING SUPPORT FOR THE MIST ELIMINATOR. ALL SUPPORTS FOR PIPE SHALL BE TAKEN FROM THE MAIN SUPPORT BEAM / OUTER RING .

PIPE SUPPORTS SHALL NOT BE TAKEN FROM ABSORBER CASING.

1st STAGE MAY BE WITH ROOF TYPE/ FLAT.

2nd & 3rd STAGE HAS TO BE DIAMOND (AS PER DRAWING).

NOZZLE LOCATION ON 'W' SIDE ONLY.

REV	DATE	ALTERED / CHECKED
01		BEAM DETAILS UPDATED, NOTE ADDED

TYPE OF PRODUCT
OR NAME OF
CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LTD.
UNIT: BOILER AUXILIARIES PLANT
RANIPET – 632 406.

	NAME	SIGN	DATE	NO.OF VAR.
DRN	SR		15-06-20	
CHD	SHANMUGA			-
APPD	V KESAVAN			

DEPT	GRADE OF UNTOL. DIM	SCALE	WEIGHT (KG)	REF. TO ASSY/OLD DRG.	ITEM NO	NO. OF ITEMS
FCD		N.T.S	-	-	-	-
CODE 9789						

TITLE: TYPICAL ARRANGEMENT OF M/E

CARD CODE: U 01

DRAWING NO.: SKETCH M/E 01

REV: 01

Size A0

01	03-12-2020	Generally revised, Drg revised (revisions are highlighted)	-sd-	-sd-	-sd-
			Kabilash KM	Manoj KT	Balaji RS
00	15-05-2020	Fresh Release	-sd-	-sd-	-sd-
			Kabilash KM	Manoj KT	Balaji RS
REV	**DATE**	**DESCRIPTION**	**Prepared**	**Checked**	**Approved**

Sl. No	**Description**	**Requirement**	
1.	**End Customer**	MAHAGENCO	
2.	**Project Name**	Bhusawal 1X660 MW	
3.	**Location**	Bhusawal, Jalgaon Dist, Maharashtra State, India.	
4.	**Type**	Two stage chevron type (flat type)	
5.	**Quantity**		
	Quantity of Mist Eliminators for	1 set (1 set means Complete Mist Eliminators, Washing systems and accessories).	
6.	**MOC**		
	ME Panel	FRP	
	Washing Pipe	FRP	
	Wash Pipe Supports	FRP	
	Washing Nozzles	PVDF or PP as per bidder's proven practice	
	Hardware inside absorber	a) Alloy 59/ C276 for load bearing applications b) All metallic fasteners provided shall be of Alloy 59/C276 c) For pipe clamps, C276 Bolt, C276 Nut, C276 washer and C276 spring washer to be provided	
7.	**Parameters**		
i.	Gas flow	Vertical	
ii.	Casing Dimension	Length : 9900 mm	Width : 21900 mm
iii.	Design Pressure of Mist Eliminator Panel	660 mmH_2O (G)	
iv.	Max Allowable Pressure drop across Mist Eliminator element	15 mmH_2O (G) at Design point 12 mmH_2O (G) at Guarantee point	
v.	Design Temperature	▪ 70 Deg C (Continuous) ▪ 80 – 90 Deg C (30 minutes) ▪ 90 – 110 Deg C (5 min)	
8.	**Gas condition at ME Inlet**	**Guarantee Point**	**Design Point**
i.	Gas Flow Rate (Nm^3/s-wet)	628.1003	700.3001

Sl. No	**Description**	**Requirement**	
ii.	Gas Flow Rate (m^3/s-wet)	752.2133	839.2807
iii.	Gas Temperature (Deg C)	54.0	54.2
iv.	Density (kg/m^3)	1.07035	1.06876
v.	Operating Pressure at Mist Eliminator inlet (mm H_2O (G))	70	80
vi.	Gas Flow Distribution	+ or - 20%	
9.	**Gas Composition at ME Inlet**		
i.	SO_2 (Vol%-wet)	0.0028	0.0028
ii.	H_2O (Vol%-wet)	14.5062	14.6711
iii.	O_2 (Vol%-wet)	4.5218	4.5266
iv.	CO_2 (Vol%-wet)	12.3177	12.2816
v.	N_2 (Vol%-wet)	68.6511	68.5175
vi.	HCl (ppm-Dry)	<2	<2
vii.	HF (ppm-Dry)	<1	<1
viii.	Dust (mg/Nm^3-wet)	<50	<200
10.	**Gypsum Slurry Density (t/m3)**	1.204	1.202
11.	**Entrained Mist Condition:**		
i.	Mist Concentration at Inlet –at Guarantee & Design Point	200 g/Nm^3-dry	
ii.	Mist Concentration at Outlet –at Guarantee & Design Point	≤50 mg/Nm^3 R01	
12.	**Mist Composition**		
i.	Solid	30 wt.%	
ii.	Cl^-	6294.01 ppm	
iii.	Mg^{2+}	6033.88 ppm	
iv.	Ca^{2+}	479.12 ppm	
v.	Na^+	1416.2544 ppm	
vi.	SO_4^{2-}	18296.81 ppm	

1.1 WASHING ARRANGEMENT

I.	**Washing water condition**	
a.	Flow rate - Average	27.4 m^3/hr *1)
b.	Flow rate at M/E Inlet – Instantaneous Allowable Max	120 m^3/hr
c.	Flow rate at M/E Inlet – Instantaneous Min	100 m^3/hr
d.	Feed Pressure (at inlet flange of ME Wash header)	0.2 MPa (Max)
e.	Spray Nozzle –Top washing	90 °, Full Cone
f.	Spray Nozzle –Bottom washing	120 °, Full Cone

g.	Spray pipe level from ME Panel	< 700 mm					
II.	**Washing Method**						
		First Stage			Second Stage		
		Front Surface		Back Surface	Front Surface		Back Surface
a.	Total Washing Area m^2	9.9 x 21.9		9.9 x 21.9	9.9 x 21.9		9.9 x 21.9
b.	Washing Water Source	Refer Clause 1.2					
c.	Washing Water Average Flow rate m^3/h	*	*	*	*		
d.	Instantaneous Max Water Flow rate m3/h	*	*	*	*		
e.	Duration of One washing for One Divided Section Sec	*	*	*	*		
f.	Time of One washing Cycle (min)	*	*	*	*		
	*Washing method shall be confirmed by the vendor. ** Only for Maintenance *1) shall be finalized by vendor						

1.2 WATER ANALYSIS

Process water characteristic envisaged for Mist Eliminator washing is given below.

CW / ACW QUALITY

The water quality of CW / ACW water is mentioned below.

Sl.No	Description	Unit	Value
1.	Calcium as CaCO3	Mg/l	240
2.	Magnesium as CaCO3	Mg/l	120
3.	Sodium & Potassium as CaCO3	Mg/l	252/33
4.	Bicarbonates as CaCO3	Mg/l	220
5.	Chloride as CaCO3	Mg/l	140
6.	Sulphate as CaCO3	Mg/l	50
7.	Carbonate as CaCO3	Mg/l	80
8.	Silica as SiO2	Mg/l	48
9.	Iron as Fe	Mg/l	0.16
10.	pH value	-	8.85
11.	Turbidity	NTU	2.2

CW-Cooling water
ACW- Auxiliary cooling water

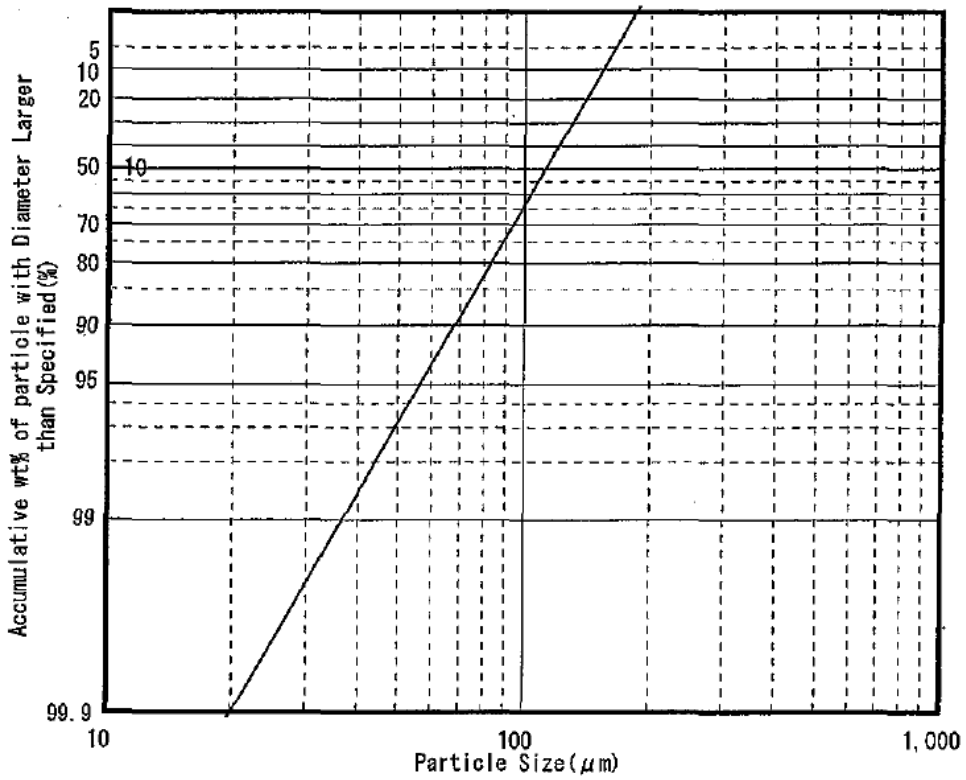
1.3 MIST ELIMINATOR ARRANGEMENT AND MIST PARTICLE SIZE DISTRIBUTION:

a) Bidder shall note that there is column connecting tie beam which will be coming inside the absorber at the centre line at the Mist Eliminator beam levels. This beam has to be used as one of the ME support beam (please refer to Note 01:A in the enclosed reference drawing).

R01

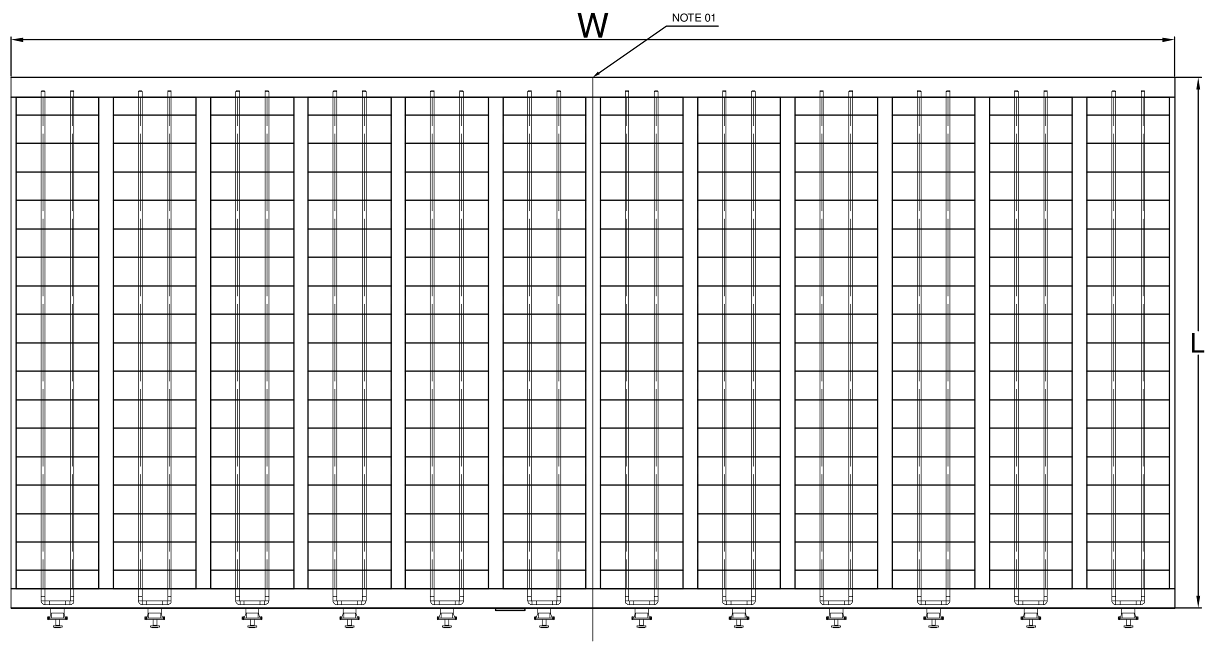
b) Overall wash arrangement shall be as per the drawing (typical) enclosed:

Fig. 2 Mist Particle Size Distribution(EXPECTED VALUE)

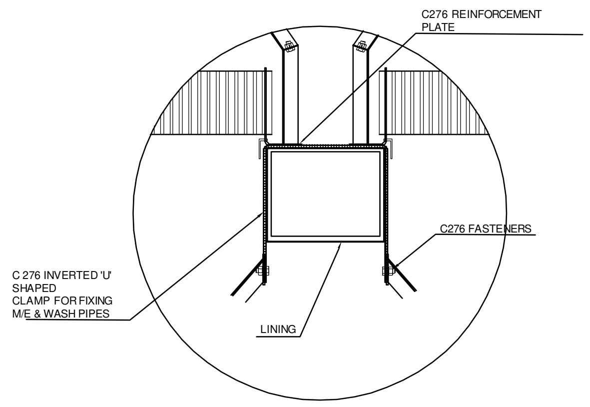


DRAWING NO. 2-FW-215-03631

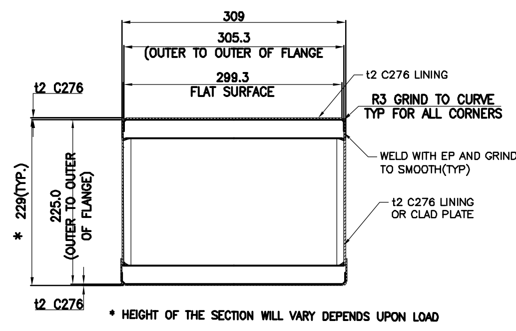
All dimensions are in millimeters



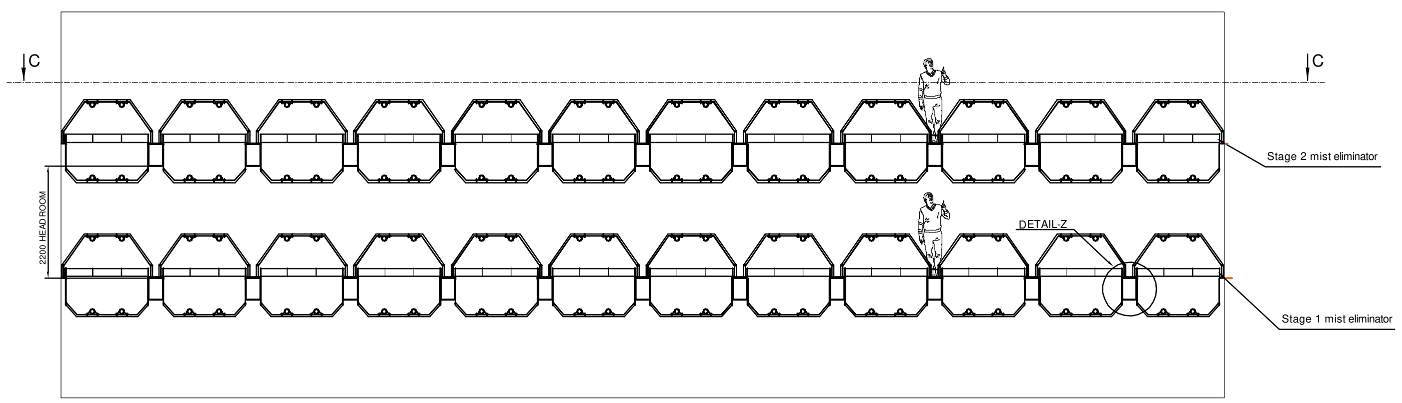
SECTION "C-C"



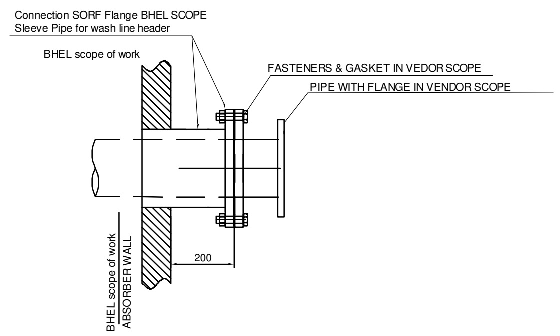
DETAIL-Z



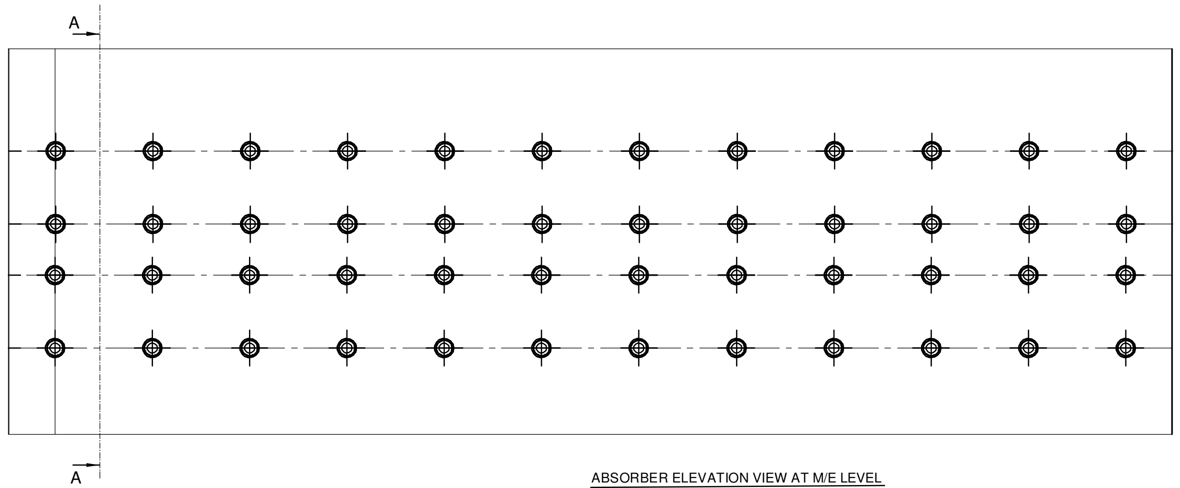
ME SUPPORT BEAMS 01



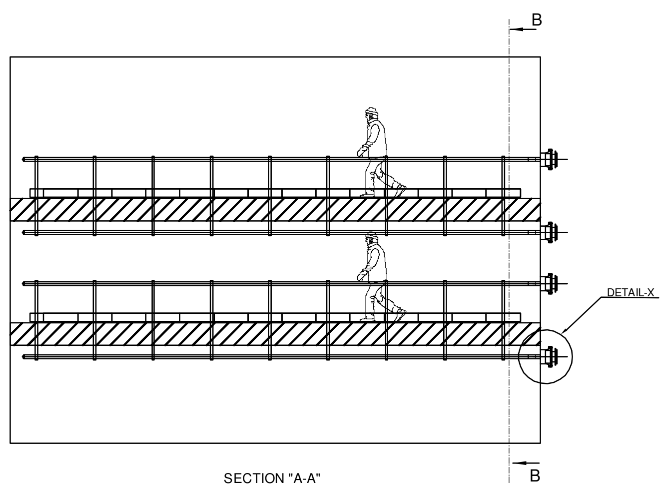
SECTION "B-B"



DETAIL-X



ABSORBER ELEVATION VIEW AT M/E LEVEL



SECTION "A-A"

THE FOLLOWING ITEMS ARE IN VENDOR SCOPE:

a) MIST ELIMINATOR MODULE WITH END STOPPER PLATE FOR ALL THE STAGES
b) FLUSHING PIPES WITH SPRAY NOZZLES AND FLANGE FOR THE FRONT AND BACK WASH FOR ALL THE STAGES
c) HORIZONTAL MEMBER FOR PIPE SUPPORT WITH MOUNTING CLAMP FOR PIPE
d) VERTICAL MEMBER (LEG SUPPORT- L ANGLE) FROM THE MAIN BEAM TO HORIZONTAL PIPE SUPPORT
e) INVERTED U-CLAMP (HANGER TYPE) FOR MOUNTING BOTTOM WASH PIPE SUPPORT
f) PAD PLATE AT THE END OF THE LEG SUPPORT
g) ALL FASTENERS (MADE OF C-276) FOR SUPPORT MEMBERS/LOAD BEARING MEMBER INSIDE ABSORBER
h) FASTENERS/GASKETS FOR THE FLANGES OUTSIDE ABSORBER AS PER THE DRAWING
i) ANY ENCLOSURE PLATE, IF REQUIRED, SHALL BE PROVIDED

BHEL WILL PROVIDE ONLY THE MAIN SUPPORT BEAM AND OUTER RING SUPPORT FOR THE MIST ELIMINATOR. ALL SUPPORTS FOR PIPE SHALL BE TAKEN FROM THE MAIN SUPPORT BEAM / OUTER RING.

PIPE SUPPORTS SHALL NOT BE TAKEN FROM ABSORBER CASING.

1st STAGE & 2ND STAGE SHALL BE FLAT TYPE.

NOZZLE LOCATION ON 'W' SIDE ONLY.

NOTE 01:

A) WHEN W <= 22.9 M , CENTRAL BEAM AT "W/2 LOCATION" IS MANDATORY AND ITS LOCATION CANNOT BE DISTURBED TO ACCOMMODATE M/E.

B) WHEN W>22.9 M CENTRAL BEAM IS NOT APPLICABLE, INSTEAD TWO BEAMS ONE ON EITHER SIDE AT A DISTANCE OF 4 TO 4.6 M AWAY FROM THE CENTRE LINE, THESE TWO BEAMS ARE MANDATORY AND ITS LOCATION CANNOT BE DISTURBED TO ACCOMMODATE M/E. EXACT LOCATION OF BEAMS WILL BE INFORMED DURING DETAILED ENGINEERING.

01 C) M/E SUPPORT BEAM ARE IN BHEL SCOPE AND DETAILS ARE GIVEN. ONLY THE DEPTH OF THE SUPPORT BEAM WILL BE VARIED AS PER THE LOADING DETAILS. VENDOR'S ME DESIGN SHALL BE ABLE ACHIEVE THE WALKWAY REQUIREMENT OF 300 MM WIDE CONSIDERING THE BEAM DETAILS GIVEN IN THE DRAWING. THE WIDTH OF THE M/E BEAM CANNOT BE MODIFIED AND ANY ADDITIONAL SUPPORT REQUIRED TO ACHIEVE WALKWAY OF 300 MM HAS TO BE PROVIDED BY VENDOR.

D) BHEL'S SCOPE IS M/E SUPPORT BEAM AND THE OUTER RING SUPPORT. THE MAXIMUM WIDTH OF THE SUPPORT RING SHALL BE 300 MM. ANY OTHER ITEMS LIKE ENCLOSURE PLATES/BLANKING PLATES, IF REQUIRED, SHALL BE IN THE SCOPE OF M/E VENDOR.

REV	DATE	ALTERED / CHECKED
01		BEAM DETAILS UPDATED, NOTE ADDED

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LTD.,
UNIT: BOILER AUXILIARIES PLANT.
RANIPET – 632 406.

	NAME	SIGN	DATE	NO.OF VAR.
DRN	SRI		15-06-20	–
CHD	SHANMUGA			
APPD	V KESAVAN			

DEPT	GRADE OF UNTOL.DIM	SCALE	WEIGHT (KG).	REF. TO ASSY/OLD DRG.	ITEM NO.	NO. OF ITEMS
FGD / CODE 9780	—	N.T.S	–	–	–	–

TITLE	CARD CODE	DRAWING NO.	REV
TYPICAL ARRANGEMENT OF M/E (2 STAGE FLAT TYPE)	U 01	2-FW-215-03631	01

Size A0

01	03-12-2020	Clasue 6(ii) revised, Drawing revised	-sd- Abhishek Kumar	-sd- P Naveen Reddy
00	11-03-2020	Fresh Release	-sd- Abhishek Kumar	-sd- P Naveen Reddy
REV	**DATE**	**DESCRIPTION**	**Prepared**	**Checked & Approved**

1.0 TECHNICAL INFORMATION

Sl. No.	**Description**	**Requirement**	
1.	**End Customer**	NTPC is setting up the project for Bhartiya Rail Bijlee Company Ltd.(BRBCL)	
2.	**Project Name**	BRBCL NABINAGAR 4X250 MW	
3.	**Location**	Nabinagar, Aurangabad Dist,Bihar State, India	
4.	**Type**	Three stage chevron type (First Stage shall be Flat or Roof Type, Second and Third stages shall be Diamond/Roof type)	
5.	**Quantity**		
i.	Quantity of Mist Eliminators for Unit-1,2,3,4	4 sets (1 set for each unit) 1 set means Complete Mist Eliminators, Washing with supports.	
6.	**MOC**		
i.	ME Panel	Polysulfone (Or) Super austenitic stainless steel (254 SMO)	
ii.	Washing Pipe	a)Glass fiber reinforced plastics (or) b) Polypropylene or PVC is also acceptable for mist eliminator wash headers provided vendor has proven experience for the same.(Previous reference & Documentary evidence should be submitted with the offer) R01	
iii.	Wash Pipe Supports	Shall be lined with min 2mm thk Alloy 59/C276 or entire Material in Alloy 59/C276	
iv.	Washing Nozzles	PVDF or PP as per bidder's proven practice	
v.	Hardware inside absorber	a) Alloy 59/ C276 for load bearing applications b) All metallic fasteners provided shall be of Alloy 59/C276 c) For pipe clamps, C276 Bolt, C276 Nut, C276 washer and C276 spring washer to be provided	
vi.	Enclosure Plate	Same as that of ME Panel if it is part of Mist Eliminator (or) C276 material.	
7.	**Parameters**		
i.	Gas flow	Vertical	
ii.	Casing Dimension	Length : 7900 mm	Width:13900 mm
iii.	Design Pressure of Mist Eliminator Panel	660 mmH_2O (G)	

Sl. No.	Description	Requirement	
iv.	Max Allowable Pressure drop across Mist Eliminator element	20 mmH_2O (G) at Design point 16 mmH_2O (G) at Guarantee point	
v.	Design Temperature	• 70 Deg C (Continuous) • 80 – 90 Deg C (30 minutes) • 90 – 110 Deg C (5 min)	
8.	**Gas condition at ME Inlet**	**Guarantee Point**	**Design Point**
i.	Gas Flow Rate (Nm^3/s-wet)	298.40	329.60
ii.	Gas Flow Rate (m^3/s-wet)	361.54	403.96
iii.	Gas Temperature (Deg C)	57.8	61.6
iv.	Density (kg/m^3)	1.03177	1.00502
v.	Operating Pressure at Mist Eliminator inlet (mm H_2O (G))	56	77
vi.	Gas Flow Distribution	+ or - 20%	
9.	**Gas Composition at ME Inlet**		
i.	SO_2 (Vol%-wet)	0.0021	0.0020
ii.	H_2O (Vol%-wet)	17.57	20.98
iii.	O_2 (Vol%-wet)	5.92	5.67
iv.	CO_2 (Vol%-wet)	9.44	9.05
v.	N_2 (Vol%-wet)	67.06	64.3
vi.	HCl (ppm-Dry)	<2	<2
vii.	HF (ppm-Dry)	<1	<1
viii.	Dust (mg/Nm^3-wet)	<50	<200
10.	**Gypsum Slurry Density (t/m3)**	1.212	1.210
11.	**Entrained Mist Condition:**		
i.	Mist Concentration at Inlet –at Guarantee & Design Point	200 g/Nm^3-dry	
ii.	Mist Concentration at Outlet –at Guarantee & Design Point	≤20 mg/Nm^3	
12.	**Mist Composition**		
i.	Solid	30 wt.%	
ii.	Cl^-	18383.4 ppm	
iii.	Mg^{2+}	7956.0 ppm	
iv.	Ca^{2+}	824.12 ppm	
v.	Na^+	2340.32 ppm	
vi.	SO_4^{2-}	12267.0 ppm	

1.1 WASHING ARRANGEMENT

I.	**Washing water condition**	
a.	Flow rate - Average	13.77 m^3/hr *1)
b.	Flow rate at M/E Inlet – Instantaneous Allowable Max	96 m^3/hr
c.	Flow rate at M/E Inlet – Instantaneous Min	80 m^3/hr
d.	Feed Pressure (at inlet flange of ME Wash header)	0.2 MPa (Max)
e.	Spray Nozzle –Top washing	90 °, Full Cone(recommended)
f.	Spray Nozzle –Bottom washing	120 °, Full Cone(recommended)
g.	Spray pipe level from ME Panel	< 700 mm

1.2 WATER ANALYSIS

Process water is envisaged for Mist Eliminator washing. Process water analysis is provided below.

S.No	Constituent	As	mg/l (except pH & turbidity)
1.	Calcium	$CaCO_3$	131
2.	Magnesium	$CaCO_3$	52
3.	Sodium + Potassium	$CaCO_3$	65
4.	Total Cations	$CaCO_3$	248
5.	Chloride	$CaCO_3$	20
6.	Sulphate	$CaCO_3$	93
7.	Nitrate	$CaCO_3$	10
8.	Alkalinity	$CaCO_3$	125
9.	Total Anions	$CaCO_3$	248
10.	Iron(total)	Fe	0.3
11.	Total Silica	SiO_2	22
12.	pH value	---	7.0-8.2
13.	Turbidity	NTU	10

Note: Clarified water is used for CW system as make up & the CW system is expected to operate at about 5.0 – 5.5 Cycles of Concentration (COC) with suitable chemical treatment program using acid, scale & corrosion inhibitor dozing. As CW blow down water is tapped from CW system, the water quality of CW blow down shall accordingly be arrived by the bidder.

- Water Quality shall be arrived by the bidder considering the COC – 5.5

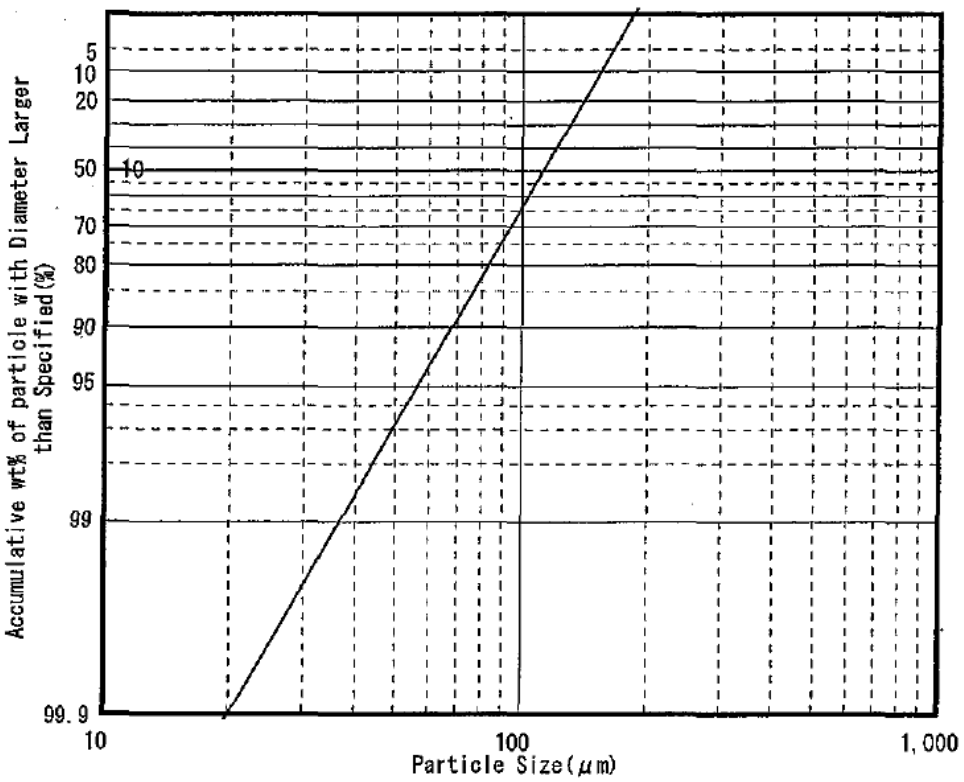
1.3 MIST PARTICLE SIZE DISTRIBUTION:

a) Bidder shall note there is a tie beam located at the centre line of Absorber (Bidder shall refer to Note 01 :A in the typical drawing enclosed). This tie beam is fixed and it has to be used as Mist Eliminator support beam**.** R01

b) Overall wash arrangement shall be as per the drawing (typical) enclosed.

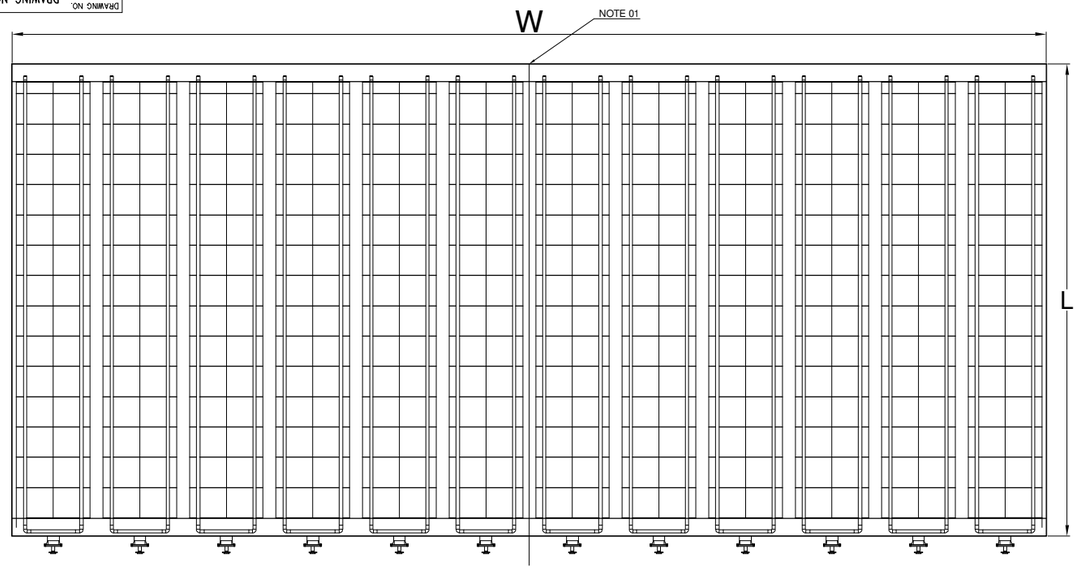
The Mist Particle Size Distribution shall be as per below fig

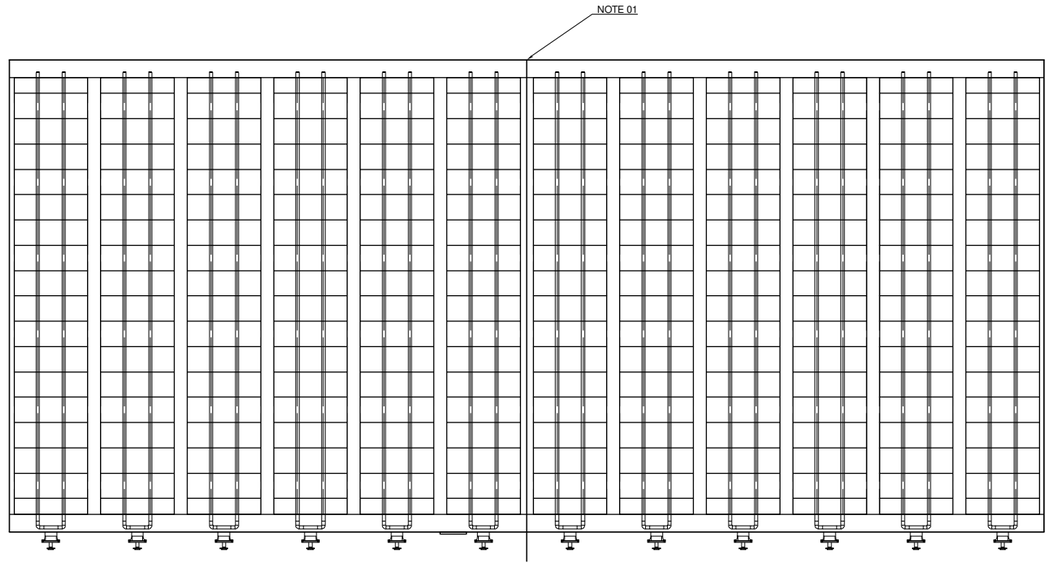
Fig. 2 Mist Particle Size Distribution(EXPECTED VALUE)



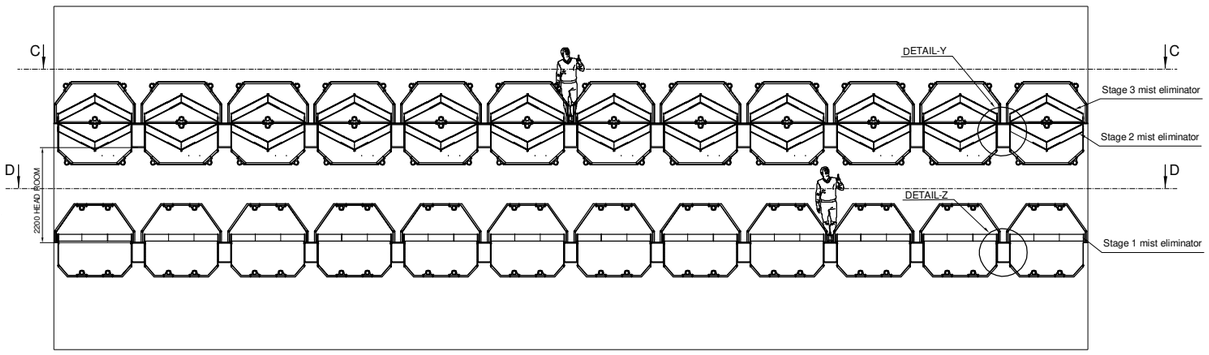
DRAWING NO.

All dimensions are in millimeters

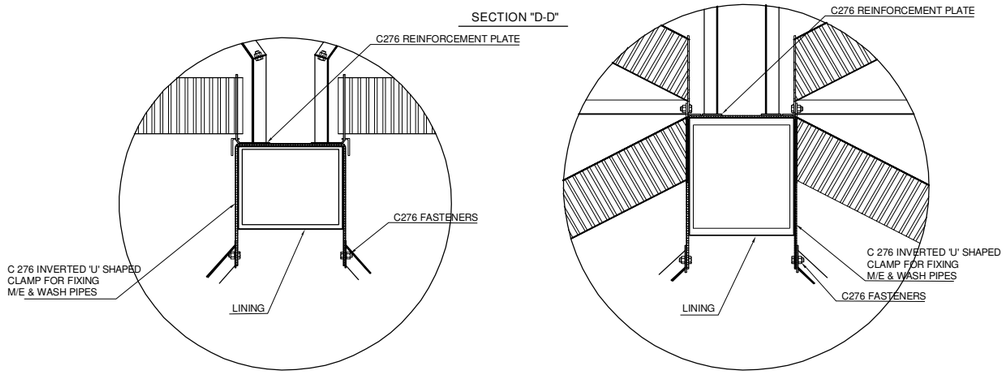




SECTION "C-C"

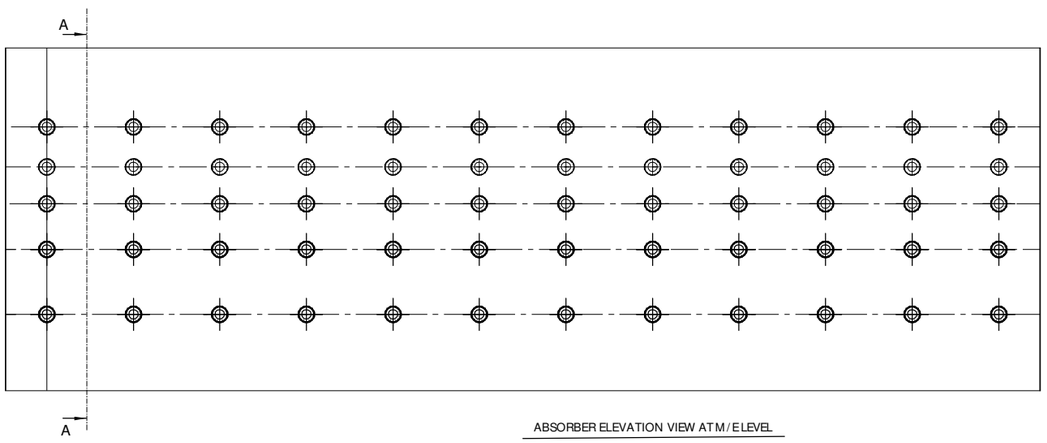


SECTION "D-D"

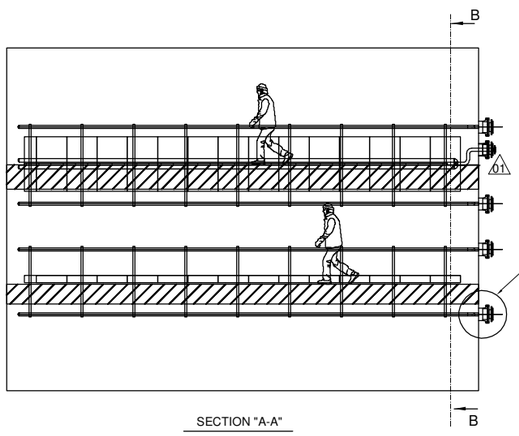


DETAIL-Z

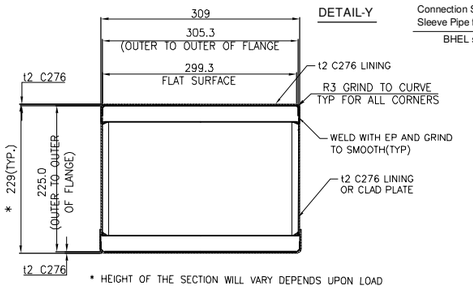
SECTION "B-B"



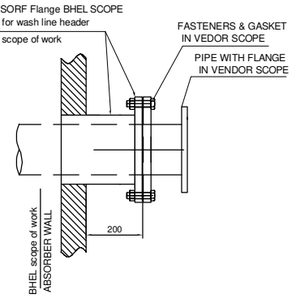
ABSORBER ELEVATION VIEW AT M/E LEVEL



SECTION "A-A"



DETAIL-Y



DETAIL-X

* HEIGHT OF THE SECTION WILL VARY DEPENDS UPON LOAD

ME SUPPORT BEAMS 01

THE FOLLOWING ITEMS ARE IN VENDOR SCOPE:

a) MIST ELIMINATOR MODULE WITH END STOPPER PLATE FOR ALL THE STAGES
b) FLUSHING PIPES WITH SPRAY NOZZLES AND FLANGE FOR THE FRONT AND BACK WASH FOR ALL THE STAGES
c) HORIZONTAL MEMBER FOR PIPE SUPPORT WITH MOUNTING CLAMP FOR PIPE
d) VERTICAL MEMBER (LEG SUPPORT- L ANGLE) FROM THE MAIN BEAM TO HORIZONTAL PIPE SUPPORT
e) INVERTED U-CLAMP (HANGER TYPE) FOR MOUNTING BOTTOM WASH PIPE SUPPORT
f) PAD PLATE AT THE END OF THE LEG SUPPORT
g) ALL FASTENERS (MADE OF C-276) FOR SUPPORT MEMBERS/LOAD BEARING MEMBER INSIDE ABSORBER
h) FASTENERS/GASKETS FOR THE FLANGES OUTSIDE ABSORBER AS PER THE DRAWING
i) ANY BLANKING PLATE, IF REQUIRED, SHALL BE PROVIDED

NOTE 01:

A) WHEN W <= 22.9 M , CENTRAL BEAM AT "W/2 LOCATION" IS MANDATORY AND ITS LOCATION CANNOT BE DISTURBED TO ACCOMMODATE M/E.
B) WHEN W>22.9 M CENTRAL BEAM IS NOT APPLICABLE. INSTEAD TWO BEAMS ONE ON EITHER SIDE AT A DISTANCE OF 4 TO 4.6 M AWAY FROM THE CENTRE LINE. THESE TWO BEAMS ARE MANDATORY AND ITS LOCATION CANNOT BE DISTURBED TO ACCOMMODATE M/E. EXACT LOCATION OF BEAMS WILL BE INFORMED DURING DETAILED ENGINEERING.
01 C) M/E SUPPORT BEAM ARE IN BHEL SCOPE AND DETAILS ARE GIVEN. ONLY THE DEPTH OF THE SUPPORT BEAM WILL BE VARIED AS PER THE LOADING DETAILS. VENDOR'S ME DESIGN SHALL BE ABLE ACHIEVE THE WALKWAY REQUIREMENT OF 900 MM WIDE CONSIDERING THE BEAM DETAILS GIVEN IN THE DRAWING. THE WIDTH OF THE M / E BEAM CANNOT BE MODIFIED AND ANY ADDITIONAL SUPPORT REQUIRED TO ACHIEVE WALKWAY OF 300 MM HAS TO BE PROVIDED BY VENDOR.
D) BHEL'S SCOPE IS M/E SUPPORT BEAM AND THE OUTER RING SUPPORT. THE MAXIMUM WIDTH OF THE SUPPORT RING SHALL BE 300 MM , ANY OTHER ITEMS LIKE ENCLOSURE PLATES/ BLANKING PLATES ,IF REQUIRED, SHALL BE IN THE SCOPE OF M/E VENDOR.

BHEL WILL PROVIDE ONLY THE MAIN SUPPORT BEAM AND OUTER RING SUPPORT FOR THE MIST ELIMINATOR. ALL SUPPORTS FOR PIPE SHALL BE TAKEN FROM THE MAIN SUPPORT BEAM / OUTER RING .

PIPE SUPPORTS SHALL NOT BE TAKEN FROM ABSORBER CASING.

1st STAGE MAY BE WITH ROOF TYPE/ FLAT.

2nd & 3rd STAGE HAS TO BE DIAMOND (AS PER DRAWING).

NOZZLE LOCATION ON 'W' SIDE ONLY.

REV	DATE	ALTERED / CHECKED
01		BEAM DETAILS UPDATED, NOTE ADDED

TYPE OF PRODUCT
OR NAME OF
CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LTD.,
UNIT: BOILER AUXILIARIES PLANT
RANIPET – 632 406.

	NAME	SIGN	DATE	NO.OF VAR.
DRN	SR		15-06-20	
CHD	SHANMUGA			-
APPD	V KESAVAN			

DEPT	GRADE OF UNTOL. DIM	SCALE	WEIGHT (KG)	REF. TO ASSY/OLD DRG.	ITEM NO	NO. OF ITEMS
FCD		N.T.S	-	-	-	-
CODE 9789						

TITLE	CARD CODE	DRAWING NO.	REV.
TYPICAL ARRANGEMENT OF M/E	U 01	SKETCH M/E 01	01

Size A0

REF:MISTEL:NNG660:R01

TECHNICAL INFORMATION OF MIST ELIMINATOR FOR NABINAGAR 3X660MW

			-sd-	-sd-
01	03-12-2020	Drawing revised	Kabilash K M	P Naveen Reddy
			-sd-	-sd-
00	31-03-2020	Fresh Release	Kabilash K M	P Naveen Reddy
REV	**DATE**	**DESCRIPTION**	**Prepared**	**Checked & Approved**

1.0 TECHNICAL INFORMATION

Sl. No.	**Description**	**Requirement**	
1.	**End Customer**	NTPC	
2.	**Project Name**	Nabinagar STPP 3X660 MW	
3.	**Location**	Nabinagar, Aurangabad District, Bihar State, India.	
4.	**Type**	Three stage chevron type (First Stage shall be Flat or Roof Type, Second and Third stages shall be Diamond/Roof type)	
5.	**Quantity**		
i.	Quantity of Mist Eliminators for Unit-1,2,3	3 sets (1 set for each unit) 1 set means Complete Mist Eliminators, Washing systems and accessories.	
6.	**MOC**		
i.	ME Panel	Polysulfone (Or) Super austenitic stainless steel (254 SMO)	
ii.	Washing Pipe	a) Glass fiber reinforced plastics b) Polypropylene or PVC is also acceptable provided bidder has proven experience for the same. Supporting documents to be produced.	
iii.	Wash Pipe Supports	Shall be lined with min 2mm thk Alloy 59/C276 or entire Material in Alloy 59/C276	
iv.	Washing Nozzles	PVDF or PP as per bidder's proven practice	
v.	Hardware inside absorber	a) Alloy 59/ C276 for load bearing applications b) All metallic fasteners provided shall be of Alloy 59/C276 c) For pipe clamps, C276 Bolt, C276 Nut, C276 washer and C276 spring washer to be provided.	
vi.	Enclosure Plate	Same as that of ME Panel if it is part of Mist Eliminator (or) C276 material.	
7.	**Parameters**		
i.	Gas flow	Vertical	
ii.	Casing Dimension	Length : 10900 mm	Width : 23900 mm

Sl. No.	Description	Requirement	
iii.	Design Pressure of Mist Eliminator Panel	660 mmH_2O (G)	
iv.	Max Allowable Pressure drop across Mist Eliminator element	20 mmH_2O (G) at Design point 16 mmH_2O (G) at Guarantee point	
v.	Design Temperature	• 70 Deg C (Continuous) • 80 – 90 Deg C (30 minutes) • 90 – 110 Deg C (5 min)	
8.	**Gas condition at ME Inlet**	**Guarantee Point**	**Design Point**
i.	Gas Flow Rate (Nm^3/s-wet)	734.62	814.95
ii.	Gas Flow Rate (m^3/s-wet)	891.04	1000.1
iii.	Gas Temperature (Deg C)	58.2	62.1
iv.	Density (kg/m^3)	1.02907	1.00164
v.	Operating Pressure at Mist Eliminator inlet (mm H_2O (G))	45	64
vi.	Gas Flow Distribution	+ or - 20%	
9.	**Gas Composition at ME Inlet**		
i.	SO_2 (Vol%-wet)	0.0021	0.0020
ii.	H_2O (Vol%-wet)	17.87	21.40
iii.	O_2 (Vol%-wet)	5.89	5.64
iv.	CO_2 (Vol%-wet)	9.36	8.96
v.	N_2 (Vol%-wet)	66.87	64.0
vi.	HCl (ppm-Dry)	<2	<2
vii.	HF (ppm-Dry)	<1	<1
viii.	Dust (mg/Nm^3-wet)	<50	<200
10.	**Gypsum Slurry Density (t/m3)**	1.212	1.216
11.	**Entrained Mist Condition:**		
i.	Mist Concentration at Inlet –at Guarantee & Design Point	200 g/Nm^3-dry	
ii.	Mist Concentration at Outlet –at Guarantee & Design Point	≤20 mg/Nm^3	
12.	**Mist Composition**		
i.	Solid	30 wt.%	
ii.	Cl^-	22116 ppm	
iii.	Mg^{2+}	10189 ppm	
iv.	Ca^{2+}	728.28 ppm	
v.	Na^+	3003.03 ppm	
vi.	SO_4^{2-}	16453.95 ppm	

1.1 WASHING ARRANGEMENT

I.	**Washing water condition**	
a.	Flow rate - Average	32.1 m^3/hr *1)
b.	Flow rate at M/E Inlet – Instantaneous Allowable Max	120 m^3/hr
c.	Flow rate at M/E Inlet – Instantaneous Min	100 m^3/hr
d.	Feed Pressure (at inlet flange of ME Wash header)	0.2 MPa (Max)
e.	Spray Nozzle –Top washing	90 °, Full Cone
f.	Spray Nozzle –Bottom washing	120 °, Full Cone
g.	Spray pipe level from ME Panel	< 700 mm

*1) shall be finalized by vendor

1.2 WATER ANALYSIS

Process water is envisaged for Mist Eliminator washing. Process water analysis is provided below:

S.no	Constituents	**Unit**	**PROCESS WATER**
1.	Calcium as $CaCO_3$	ppm	720.5
2.	Magnesium as $CaCO_3$	ppm	286
3.	Sodium as $CaCO_3$	ppm	357.5
4.	Potassium as $CaCO_3$	ppm	1364
5.	Iron as fe	ppm	110
6.	Total alkalinity as $CaCO_3$	ppm	511.5
7.	Chlorides as $CaCO_3$	ppm	55
8.	Sulphate as $CaCO_3$	ppm	687.5
9.	Silica	ppm	1364
10.	pH	-	7.0-8.2
11.	Turbidity	NTU	10

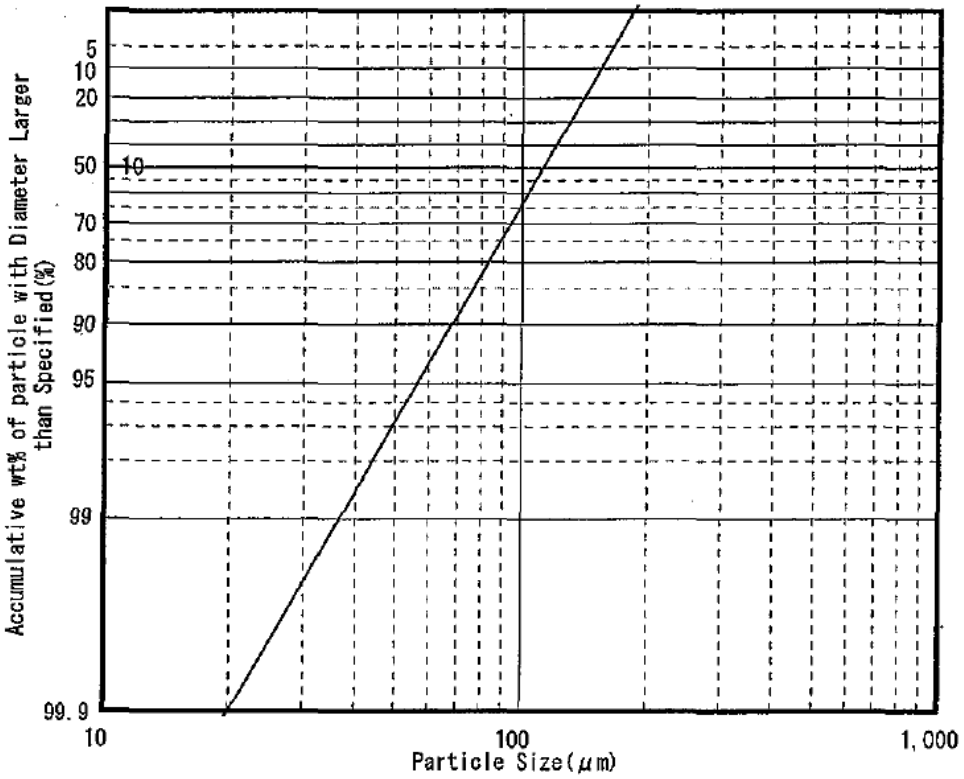
1.3 MIST ELIMINATOR ARRANGEMENT AND MIST PARTICLE SIZE DISTRIBUTION:

a) Bidder shall note that there are two column tie beams located inside the absorber and separated by 8000 mm. Beams are located on either side of centre line at a distance of 4000 mm from the centre line (Bidder shall refer to Note 01 :B in the typical drawing enclosed). These two tie beams have to be used as Mist Eliminator support beams**.**

b) Overall wash arrangement shall be as per the drawing (typical) enclosed. Bidder shall decide the spray washing arrangement accordingly.

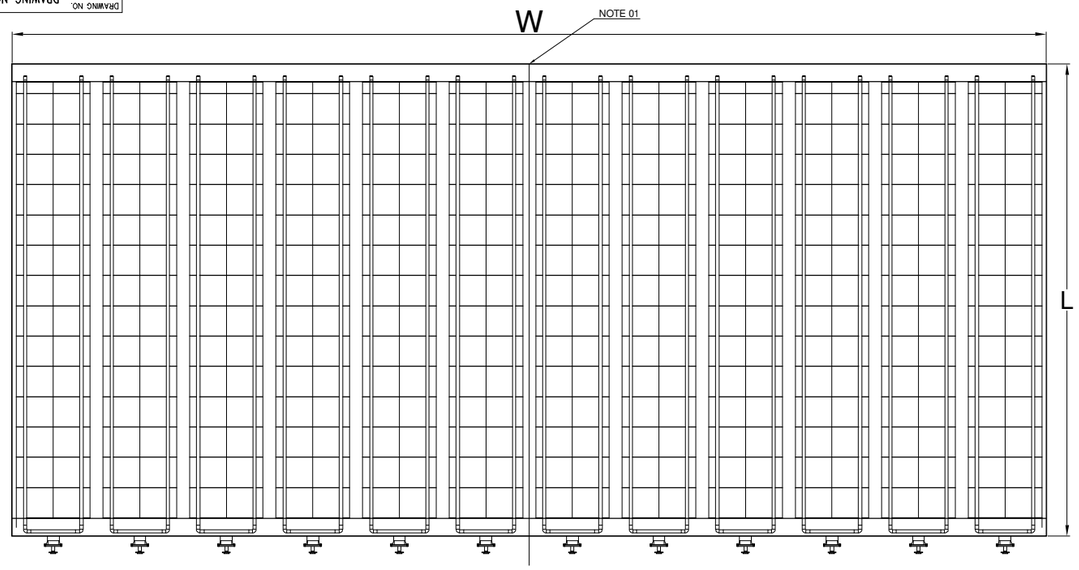
The Mist Particle Size Distribution shall be as per below fig

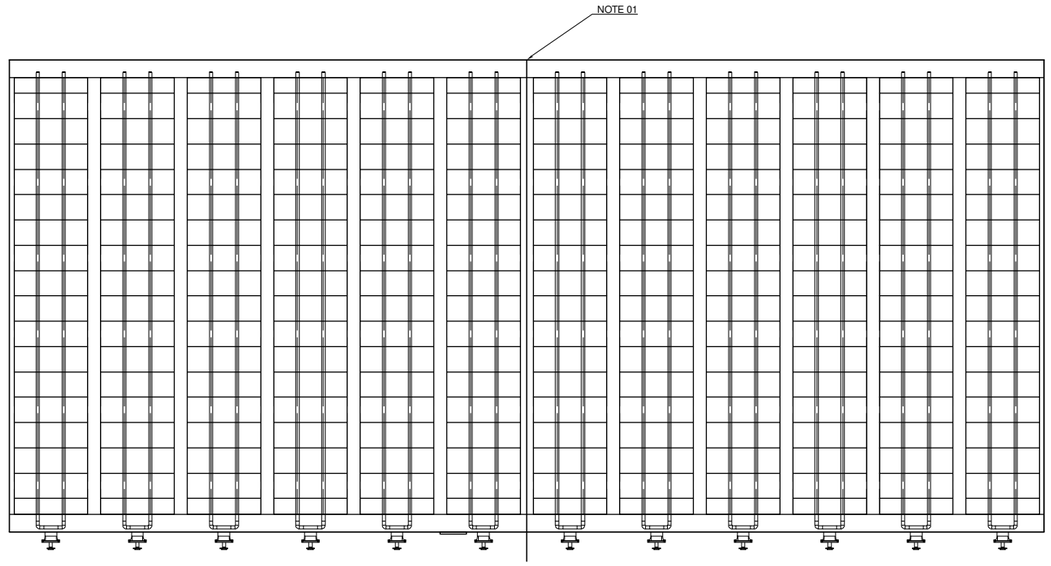
Fig. 2 Mist Particle Size Distribution(EXPECTED VALUE)



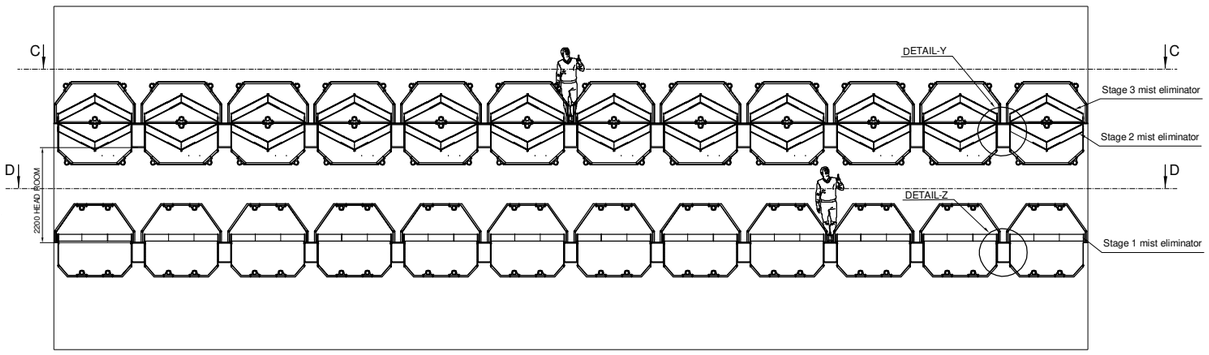
DRAWING NO.

All dimensions are in millimeters

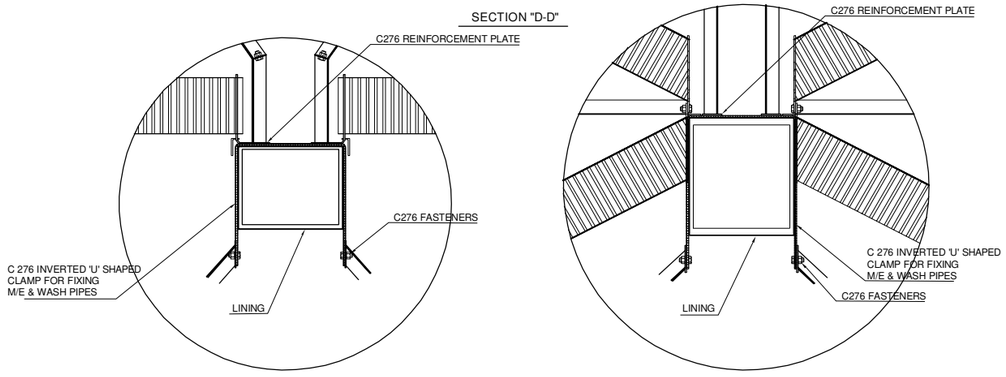




SECTION "C-C"

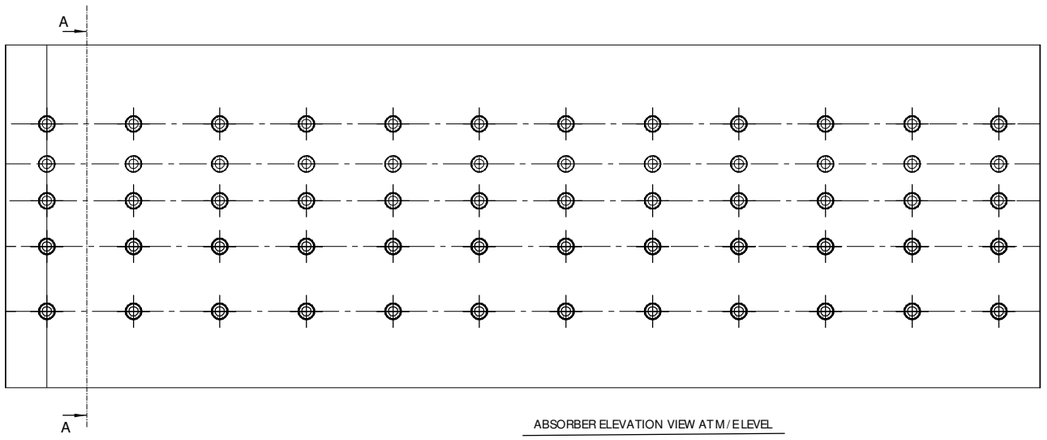


SECTION "D-D"

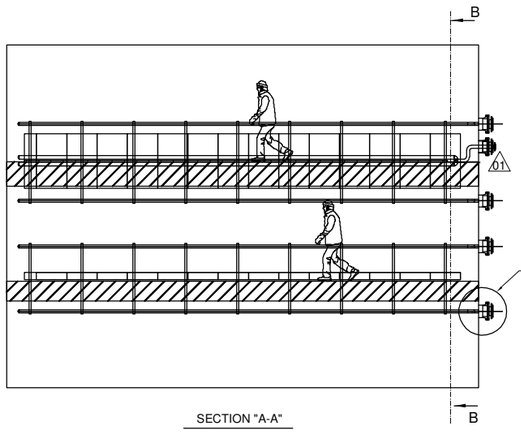


DETAIL-Z

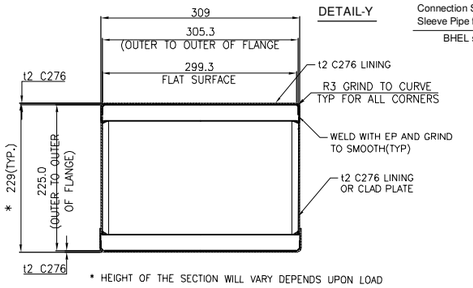
SECTION "B-B"



ABSORBER ELEVATION VIEW AT M/E LEVEL



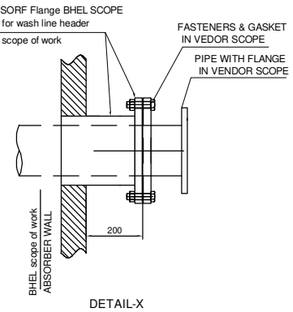
SECTION "A-A"



DETAIL-Y

* HEIGHT OF THE SECTION WILL VARY DEPENDS UPON LOAD

ME SUPPORT BEAMS 01



DETAIL-X

THE FOLLOWING ITEMS ARE IN VENDOR SCOPE:

a) MIST ELIMINATOR MODULE WITH END STOPPER PLATE FOR ALL THE STAGES
b) FLUSHING PIPES WITH SPRAY NOZZLES AND FLANGE FOR THE FRONT AND BACK WASH FOR ALL THE STAGES
c) HORIZONTAL MEMBER FOR PIPE SUPPORT WITH MOUNTING CLAMP FOR PIPE
d) VERTICAL MEMBER (LEG SUPPORT- L ANGLE) FROM THE MAIN BEAM TO HORIZONTAL PIPE SUPPORT
e) INVERTED U-CLAMP (HANGER TYPE) FOR MOUNTING BOTTOM WASH PIPE SUPPORT
f) PAD PLATE AT THE END OF THE LEG SUPPORT
g) ALL FASTENERS (MADE OF C-276) FOR SUPPORT MEMBERS/LOAD BEARING MEMBER INSIDE ABSORBER
h) FASTENERS/GASKETS FOR THE FLANGES OUTSIDE ABSORBER AS PER THE DRAWING
i) ANY BLANKING PLATE, IF REQUIRED, SHALL BE PROVIDED

NOTE 01:

A) WHEN W <= 22.9 M , CENTRAL BEAM AT "W/2 LOCATION" IS MANDATORY AND ITS LOCATION CANNOT BE DISTURBED TO ACCOMMODATE M/E.
B) WHEN W>22.9 M CENTRAL BEAM IS NOT APPLICABLE. INSTEAD TWO BEAMS ONE ON EITHER SIDE AT A DISTANCE OF 4 TO 4.6 M AWAY FROM THE CENTRE LINE. THESE TWO BEAMS ARE MANDATORY AND ITS LOCATION CANNOT BE DISTURBED TO ACCOMMODATE M/E. EXACT LOCATION OF BEAMS WILL BE INFORMED DURING DETAILED ENGINEERING.
01 C) M/E SUPPORT BEAM ARE IN BHEL SCOPE AND DETAILS ARE GIVEN. ONLY THE DEPTH OF THE SUPPORT BEAM WILL BE VARIED AS PER THE LOADING DETAILS. VENDOR'S ME DESIGN SHALL BE ABLE ACHIEVE THE WALKWAY REQUIREMENT OF 300 MM WIDE CONSIDERING THE BEAM DETAILS GIVEN IN THE DRAWING. THE WIDTH OF THE M / E BEAM CANNOT BE MODIFIED AND ANY ADDITIONAL SUPPORT REQUIRED TO ACHIEVE WALKWAY OF 300 MM HAS TO BE PROVIDED BY VENDOR.
D) BHEL'S SCOPE IS M / E SUPPORT BEAM AND THE OUTER RING SUPPORT. THE MAXIMUM WIDTH OF THE SUPPORT RING SHALL BE 300 MM . ANY OTHER ITEMS LIKE ENCLOSURE PLATES/ BLANKING PLATES ,IF REQUIRED, SHALL BE IN THE SCOPE OF M / E VENDOR.

BHEL WILL PROVIDE ONLY THE MAIN SUPPORT BEAM AND OUTER RING SUPPORT FOR THE MIST ELIMINATOR. ALL SUPPORTS FOR PIPE SHALL BE TAKEN FROM THE MAIN SUPPORT BEAM / OUTER RING .

PIPE SUPPORTS SHALL NOT BE TAKEN FROM ABSORBER CASING.

1st STAGE MAY BE WITH ROOF TYPE/ FLAT.

2nd & 3rd STAGE HAS TO BE DIAMOND (AS PER DRAWING).

NOZZLE LOCATION ON 'W' SIDE ONLY.

REV	DATE	ALTERED / CHECKED
01		BEAM DETAILS UPDATED, NOTE ADDED

TYPE OF PRODUCT
OR NAME OF
CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LTD.
UNIT: BOILER AUXILIARIES PLANT
RANIPET – 632 406.

	NAME	SIGN	DATE	NO.OF VAR.
DRN	SR		15-06-20	
CHD	SHANMUGA			-
APPD	V KESAVAN			

DEPT	GRADE OF UNTOL. DIM	SCALE	WEIGHT (KG)	REF. TO ASSY/OLD DRG.	ITEM NO	NO. OF ITEMS
FCD		N.T.S	-	-	-	-
CODE 9789						

TITLE: TYPICAL ARRANGEMENT OF M/E

CARD CODE: U 01

DRAWING NO.: SKETCH M/E 01

REV: 01

Size A0

01	01-12-2020	Drawing revised	-sd- Yuvaraj R	-sd- P Naveen Reddy
00	13-03-2020	Fresh Release	-sd- Yuvaraj R	-sd- P Naveen Reddy
REV	**DATE**	**DESCRIPTION**	**Prepared**	**Checked & Approved**

1.0 TECHNICAL INFORMATION

Sl. No.	Description	Requirement	
1.	**End Customer**	NTPC Limited	
2.	**Project Name**	Patratu Super Thermal Power Station Expansion Phase-I 3x800 MW	
3.	**Location**	Patratu, Ramgarh District, Jharkhand	
4.	**Type**	Three stage chevron type (First Stage shall be Flat or Roof Type, Second and Third stages shall be Diamond/Roof type)	
5.	**Quantity**		
i.	Quantity of Mist Eliminators for Unit-1,2,3	3 sets (1 set for each unit) 1 set means Complete Mist Eliminators, Washing systems and accessories.	
6.	**MOC**		
i.	ME Panel	Polysulfone (Or) Super austenitic stainless steel (254 SMO)	
ii.	Washing Pipe	FRP with corrosion and erosion resistant in the inner and outer side (Silicon Carbide coating on FRP surface exposed to slurry)	
iii.	Wash Pipe Supports	Shall be lined with min 2mm thk Alloy 59/C276 or entire Material in Alloy 59/C276	
iv.	Washing Nozzles	PVDF or PP as per bidder's proven practice	
v.	Hardware inside absorber	a) Alloy 59/ C276 for load bearing applications b) All metallic fasteners provided shall be of Alloy 59/C276 c) For pipe clamps, C276 Bolt, C276 Nut, C276 washer and C276 spring washer to be provided	
vi.	Enclosure Plate	Same as that of ME Panel if it is part of Mist Eliminator (or) C276 material.	
7.	**Parameters**		
i.	Gas flow	Vertical	
ii.	Casing Dimension	Length : 9900 mm	Width : 31900 mm
iii.	Design Pressure of Mist Eliminator Panel	660 mmH_2O (G)	
iv.	Max Allowable Pressure drop across Mist Eliminator element	20 mmH_2O (G) at Design point	
v.	Design Temperature	• 70 Deg C (Continuous)	

Sl. No.	Description	Requirement	
		• 80 – 90 Deg C (30 minutes) • 90 – 100 Deg C (5 min)	
8.	**Gas condition at ME Inlet**	**Guarantee Point**	**Design Point**
i.	Gas Flow Rate (Nm^3/s-wet)	943	1034
ii.	Gas Flow Rate (m^3/s-wet)	1143	1261
iii.	Gas Temperature (Deg C)	58.1	62.1
iv.	Density (kg/m^3)	1.03149	1.00296
v.	Operating Pressure at Mist Eliminator inlet (mm H_2O (G))	47	60
vi.	Gas Flow Distribution	+ or - 20%	
9.	**Gas Composition at ME Inlet**		
i.	SO_2 (Vol%-wet)	0.0021	0.0023
ii.	H_2O (Vol%-wet)	17.80	21.45
iii.	O_2 (Vol%-wet)	5.91	5.65
iv.	CO_2 (Vol%-wet)	9.67	9.25
v.	N_2 (Vol%-wet)	66.61	63.66
vi.	HCl (ppm-wet)	<3	<3
vii.	HF (ppm-wet)	<1	<1
viii.	Dust (mg/Nm^3-wet)	<50	<200
10.	**Gypsum Slurry Density (t/m3)**	1.176	1.177
11.	**Entrained Mist Condition:**		
i.	Mist Concentration at Inlet –at Guarantee & Design Point	200 g/Nm^3-dry	
ii.	Mist Concentration at Outlet –at Guarantee & Design Point	≤20 mg/Nm^3	
12.	**Mist Composition**		
i.	Solid	25 wt.%	
ii.	Cl^-	21950 ppm	
iii.	Mg^{2+}	4330 ppm	
iv.	Ca^{2+}	5790 ppm	
v.	Na^+	240 ppm	
vi.	SO_4^{2-}	1450 ppm	

1.1 WASHING ARRANGEMENT

I.	**Washing water condition**	
a.	Flow rate - Average	40 m^3/hr *1)
b.	Flow rate at M/E Inlet – Instantaneous Allowable Max	120 m^3/hr
c.	Flow rate at M/E Inlet – Instantaneous Min	100 m^3/hr
d.	Feed Pressure (at inlet flange of ME Wash header)	0.2 MPa (Max)
e.	Spray Nozzle –Top washing	90 °, Full Cone
f.	Spray Nozzle –Bottom washing	120 °, Full Cone
g.	Spray pipe level from ME Panel	< 700 mm

II.	**Washing Method**						
		First Stage		Second Stage		Third Stage	
		Front Surface	Back Surface	Front Surface	Back Surface	Front Surface	Back Surface
a.	Total Washing Area m^2	9.9 x 31.9	9.9 x 31.9	9.9 x 31.9	9.9 x 31.9	9.9 x 31.9	9.9 x 31.9
b.	Washing Water Source	Refer Clause 1.2					
c.	Washing Water Average Flow rate m^3/h	*	*	*	*	*	**
d.	Instantaneous Max Water Flow rate m3/h	*	*	*	*	*	**
e.	Duration of One washing for One Divided Section Sec	*	*	*	*	*	**
f.	Time of One washing Cycle (min)	*	*	*	*	*	**
	*Washing method shall be confirmed by the vendor. ** Only for Maintenance *1) shall be finalized by vendor						

1.2 WATER ANALYSIS

Process water is envisaged for Mist Eliminator washing. Process water analysis is provided below:

S.no	Constituents	**Unit**	**PROCESS WATER**
1.	Calcium as $CaCO_3$	ppm	105
2.	Magnesium as $CaCO_3$	ppm	81
3.	Sodium as $CaCO_3$	ppm	70
4.	Potassium as $CaCO_3$	ppm	7
5.	Iron as fe	ppm	0.5
6.	Total alkalinity as $CaCO_3$	ppm	180
7.	Chlorides as $CaCO_3$	ppm	60
8.	Sulphate as $CaCO_3$	ppm	23
9.	Silica	ppm	17
10.	pH	-	7.0-7.8
11.	Turbidity	NTU	10

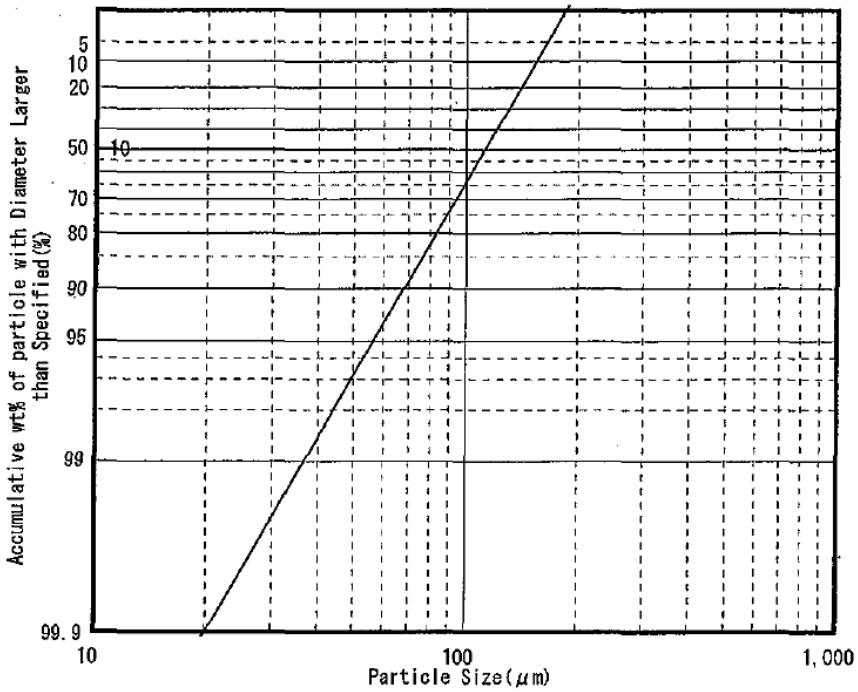
1.3 MIST ELIMINATOR ARRAGMENT AND MIST PARTICLE SIZE DISTRIBUTION:

a) Bidder shall note that there are two column tie beams located inside the absorber and separated by 11058mm. Beams are located on either side of centre line at a distance of 5529 mm from the centre line (Bidder shall refer to Note 01 :B in the typical drawing enclosed). These two tie beams have to be used as Mist Eliminator Support beams**.**

b) Overall wash arrangement shall be as per the drawing (typical) enclosed:

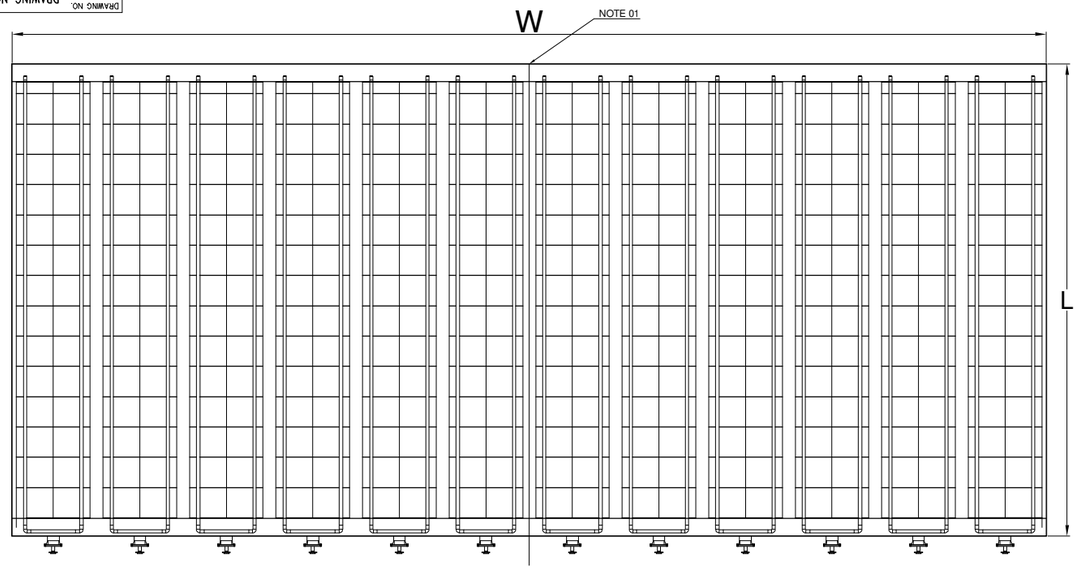
The Mist Particle Size Distribution shall be as per below fig

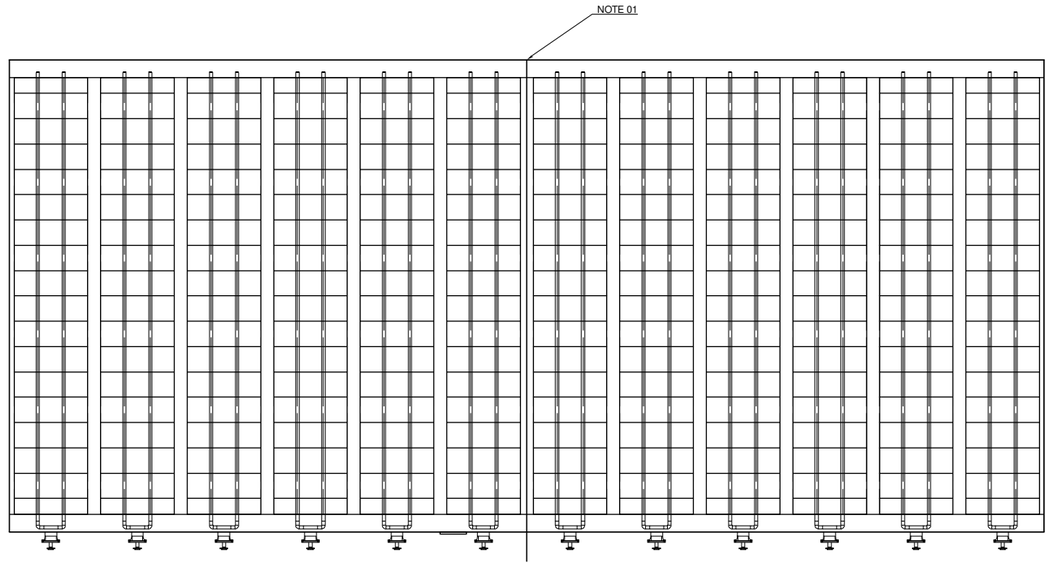
Fig. 2 Mist Particle Size Distribution(EXPECTED VALUE)



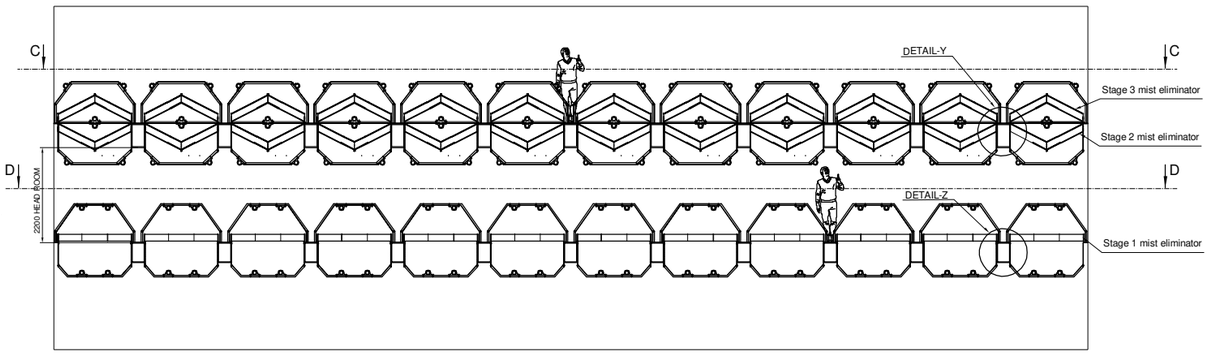
DRAWING NO.

All dimensions are in millimeters

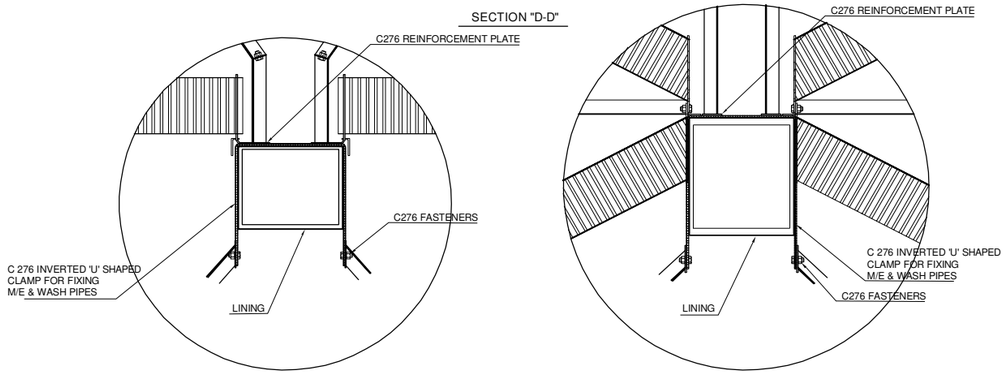




SECTION "C-C"

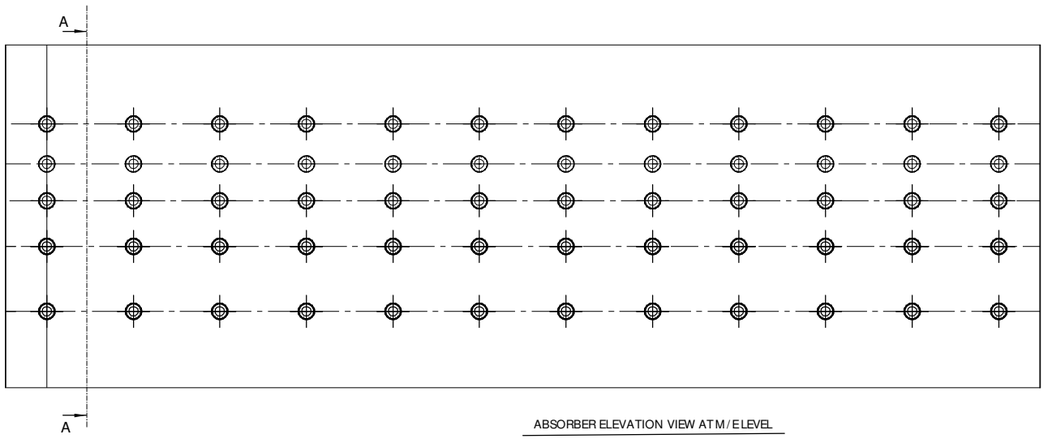


SECTION "D-D"

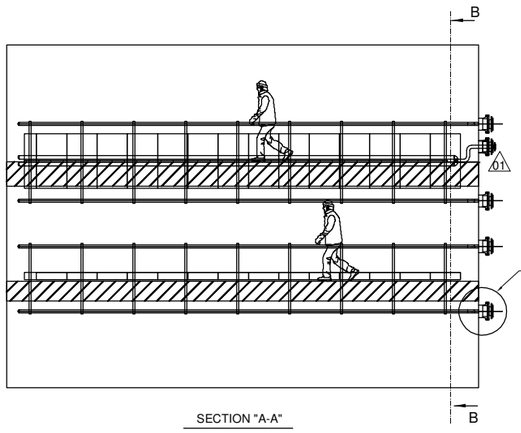


DETAIL-Z

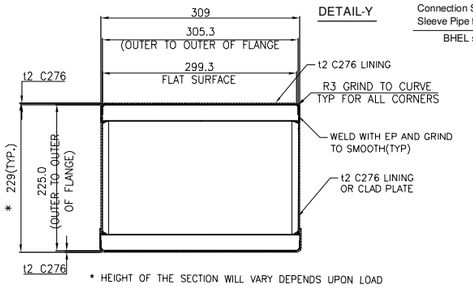
SECTION "B-B"



ABSORBER ELEVATION VIEW AT M/E LEVEL



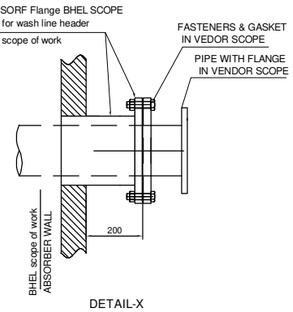
SECTION "A-A"



DETAIL-Y

* HEIGHT OF THE SECTION WILL VARY DEPENDS UPON LOAD

ME SUPPORT BEAMS 01



DETAIL-X

THE FOLLOWING ITEMS ARE IN VENDOR SCOPE:

a) MIST ELIMINATOR MODULE WITH END STOPPER PLATE FOR ALL THE STAGES
b) FLUSHING PIPES WITH SPRAY NOZZLES AND FLANGE FOR THE FRONT AND BACK WASH FOR ALL THE STAGES
c) HORIZONTAL MEMBER FOR PIPE SUPPORT WITH MOUNTING CLAMP FOR PIPE
d) VERTICAL MEMBER (LEG SUPPORT- L ANGLE) FROM THE MAIN BEAM TO HORIZONTAL PIPE SUPPORT
e) INVERTED U-CLAMP (HANGER TYPE) FOR MOUNTING BOTTOM WASH PIPE SUPPORT
f) PAD PLATE AT THE END OF THE LEG SUPPORT
g) ALL FASTENERS (MADE OF C-276) FOR SUPPORT MEMBERS/LOAD BEARING MEMBER INSIDE ABSORBER
h) FASTENERS/GASKETS FOR THE FLANGES OUTSIDE ABSORBER AS PER THE DRAWING
i) ANY BLANKING PLATE, IF REQUIRED, SHALL BE PROVIDED

NOTE 01:

A) WHEN W <= 22.9 M , CENTRAL BEAM AT "W/2 LOCATION" IS MANDATORY AND ITS LOCATION CANNOT BE DISTURBED TO ACCOMMODATE M/E.
B) WHEN W>22.9 M CENTRAL BEAM IS NOT APPLICABLE. INSTEAD TWO BEAMS ONE ON EITHER SIDE AT A DISTANCE OF 4 TO 4.6 M AWAY FROM THE CENTRE LINE. THESE TWO BEAMS ARE MANDATORY AND ITS LOCATION CANNOT BE DISTURBED TO ACCOMMODATE M/E. EXACT LOCATION OF BEAMS WILL BE INFORMED DURING DETAILED ENGINEERING.
01 C) M/E SUPPORT BEAM ARE IN BHEL SCOPE AND DETAILS ARE GIVEN. ONLY THE DEPTH OF THE SUPPORT BEAM WILL BE VARIED AS PER THE LOADING DETAILS. VENDOR'S ME DESIGN SHALL BE ABLE ACHIEVE THE WALKWAY REQUIREMENT OF 300 MM WIDE CONSIDERING THE BEAM DETAILS GIVEN IN THE DRAWING. THE WIDTH OF THE M / E BEAM CANNOT BE MODIFIED AND ANY ADDITIONAL SUPPORT REQUIRED TO ACHIEVE WALKWAY OF 300 MM HAS TO BE PROVIDED BY VENDOR.
D) BHEL'S SCOPE IS M / E SUPPORT BEAM AND THE OUTER RING SUPPORT. THE MAXIMUM WIDTH OF THE SUPPORT RING SHALL BE 300 MM . ANY OTHER ITEMS LIKE ENCLOSURE PLATES/ BLANKING PLATES ,IF REQUIRED, SHALL BE IN THE SCOPE OF M / E VENDOR.

BHEL WILL PROVIDE ONLY THE MAIN SUPPORT BEAM AND OUTER RING SUPPORT FOR THE MIST ELIMINATOR. ALL SUPPORTS FOR PIPE SHALL BE TAKEN FROM THE MAIN SUPPORT BEAM / OUTER RING .

PIPE SUPPORTS SHALL NOT BE TAKEN FROM ABSORBER CASING.

1st STAGE MAY BE WITH ROOF TYPE/ FLAT.

2nd & 3rd STAGE HAS TO BE DIAMOND (AS PER DRAWING).

NOZZLE LOCATION ON 'W' SIDE ONLY.

REV	DATE	ALTERED / CHECKED
01		BEAM DETAILS UPDATED, NOTE ADDED

TYPE OF PRODUCT
OR NAME OF
CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LTD.
UNIT: BOILER AUXILIARIES PLANT
RANIPET – 632 406.

	NAME	SIGN	DATE	NO.OF VAR.
DRN	SR		15-06-20	
CHD	SHANMUGA			-
APPD	V KESAVAN			

DEPT	GRADE OF UNTOL. DIM	SCALE	WEIGHT (KG)	REF. TO ASSY/OLD DRG.	ITEM NO	NO. OF ITEMS
FCD		N.T.S	-	-	-	-
CODE 9789						

TITLE: TYPICAL ARRANGEMENT OF M/E

CARD CODE: U 01

DRAWING NO.: SKETCH M/E 01

REV: 01

Size A0

MIST ELIMINATOR DATA SHEET

REF: MISTEL:RAMAGUNDAM:R00

A. TECHNICAL INFORMATION FOR RAMAGUNDAM ST-I (3X200MW)

Sl. No.	Description	Requirement	
1.	**End Customer**	NTPC Limited	
2.	**Project Name**	Ramagundam Stage-I 3X200 MW	
3.	**Location**	Ramagundam, Pedapalli Dist, Telengana State.	
4.	**Type**	Three stage chevron type (First Stage shall be Flat or Roof Type, Second and Third stages shall be Diamond/Roof type)	
5.	**Material of construction of Mist Eliminator**		
i.	ME Panel(entire ME module)	Polysulfone (Or) Super austenitic stainless steel (254 SMO)	
ii.	Washing Pipe	Glass fibre reinforced plastics (or) Polypropylene or PVC is also acceptable provided bidder has proven experience for the same. Supporting documents to be produced.	
iii.	Wash Pipe Supports	Alloy 59/C276	
iv.	Washing Nozzles	PVDF or PP as per bidder's proven practice.	
v.	Hardware inside absorber	a) Alloy 59/ C276 for load bearing applications b) All metallic fasteners provided shall be of Alloy 59/C276 c) For pipe clamps, C276 Bolt, C276 Nut, C276 washer and C276 spring washer to be provided.	
vi.	Enclosure Plate	Same as that of ME Panel if it is part of Mist Eliminator (or) C276 material.	
6.	**Quantity**		
i.	Quantity of Mist Eliminators for Abosrber – 1 (common for 3X200MW)	1 sets 1 set means Complete Mist Eliminators, Washing systems and accessories	
7.	**Parameters**		
i.	Gas flow	Vertical	
ii.	Casing Dimension	Length : 10900 mm	Width : 26900 mm
iii.	Design Pressure of Mist Eliminator Panel	660 mmH_2O (G)	
iv.	Max Allowable Pressure drop across Mist Eliminator element	20 mmH2O (G) at Design point 14 mmH2O (G) at Guarantee point	
v.	Design Temperature	• 70 Deg C (Continuous) • 80 – 90 Deg C (30 minutes) • 90 – 100 Deg C (5 min)	
8.	**Gas condition at ME Inlet**	**Guarantee Point**	**Design Point**
i.	Gas Flow Rate (Nm^3/s-wet)	825	960

Customer / Plant: NTPC RAMAGUNDAM STG I & II (3x200 MW + 3x500MW)								
Cont. No. : G208,209,210 & G509,510,511	Rev. 00		Rev. 01		Rev. 02		Rev. 03	
	Sign	Date	Sign	Date	Sign	Date	Sign	Date
Engineer : PR	-sd-	18.07.2020						
Reviewer : PNR/ACR	-sd-	18.07.2020						
Approver : RSB	-sd-	18.07.2020						

MIST ELIMINATOR DATA SHEET

REF: MISTEL:RAMAGUNDAM:R00

Sl. No.	Description	Requirement	
ii.	Gas Flow Rate (m^3/s-wet)	999	1176
iii.	Gas Temperature (Deg C)	57.5	61.4
iv.	Density (kg/m^3)	1.0362	1.0092
v.	Operating Pressure at Mist Eliminator inlet (mm H_2O (G))	48	60
vi.	Gas Flow Distribution	+ or - 20%	
9.	**Gas Composition at ME Inlet**		
i.	SO_2 (Vol%-wet)	0.0053	0.0051
ii.	H_2O (Vol%-wet)	17.35	20.76
iii.	O_2 (Vol%-wet)	5.91	5.66
iv.	CO_2 (Vol%-wet)	9.90	9.50
v.	N_2 (Vol%-wet)	66.83	64.07
vi.	HCl (ppm-wet)	<3	<3
vii.	HF (ppm-wet)	<1	<1
viii.	Dust (mg/Nm^3-wet)	<50	<200
10.	**Gypsum slurry density (t/m3)**	1213	1216
11.	**Entrained Mist Condition:**		
i.	Mist Concentration at Inlet –at Guarantee & Design Point	200 g/Nm^3-dry	
ii.	Mist Concentration at Outlet –at Guarantee & Design Point	≤20 mg/Nm^3	

12.	**Mist Composition**	
i.	Solid	30 wt.%
ii.	Cl^-	28000 ppm
iii.	Mg^{2+}	9731 ppm
iv.	Ca^{2+}	1657 ppm
v.	Na^+	2146 ppm
vi.	SO_4^{2-}	6879 ppm

B. WASHING ARRANGEMENT

1.1 Washing water condition		
i.	Flow rate - Average	36.08 m^3/hr *1)
ii.	Flow rate at M/E Inlet – Instantaneous	120 m3/hr (max) 100 m3/hr (min)
iii.	Feed Pressure (at inlet flange of ME Wash header)	0.2 MPa (Max)
iv.	Spray Nozzle –Top washing	90 °, Full Cone

Customer / Plant: NTPC RAMAGUNDAM STG I & II (3x200 MW + 3x500MW)								
Cont. No. : G208,209,210 & G509,510,511	Rev. 00		Rev. 01		Rev. 02		Rev. 03	
	Sign	Date	Sign	Date	Sign	Date	Sign	Date
Engineer : PR	-sd-	18.07.2020						
Reviewer : PNR/ACR	-sd-	18.07.2020						
Approver : RSB	-sd-	18.07.2020						

v.	Spray Nozzle –Bottom washing	120 °, Full Cone
vi.	Spray pipe level from ME Panel	< 700 mm

1.2 Washing Method

		First Stage		Second Stage		Third Stage	
		Front Surface	Back Surface	Front Surface	Back Surface	Front Surface	Back Surface
i.	Total Washing Area m^2	10.9x26.9	10.9x26.9	10.9x26.9	10.9x26.9	10.9x26.9	10.9x26.9
ii.	Washing Water Source	Refer Clause E					
iii.	Washing Water Average Flow rate m^3/h	*	*	*	*	*	**
iv.	Instantaneous Max Water Flow rate m3/h	*	*	*	*	*	**
v.	Duration of One washing for One Divided Section Sec	*	*	*	*	*	**
vi.	Time of One washing Cycle (min)	*	*	*	*	*	**
	*Washing method shall be confirmed by the vendor. ** Only for Maintenance *1) shall be finalized by vendor						

Customer / Plant: NTPC RAMAGUNDAM STG I & II (3x200 MW + 3x500MW)								
Cont. No. : G208,209,210 & G509,510,511	Rev. 00		Rev. 01		Rev. 02		Rev. 03	
	Sign	Date	Sign	Date	Sign	Date	Sign	Date
Engineer : PR	-sd-	18.07.2020						
Reviewer : PNR/ACR	-sd-	18.07.2020						
Approver : RSB	-sd-	18.07.2020						

MIST ELIMINATOR DATA SHEET

REF: MISTEL:RAMAGUNDAM:R00

C. **TECHNICAL INFORMATION FOR RAMAGUNDAM ST-II (3X500MW)**

Sl. No.	Description	Requirement	
1.	**End Customer**	NTPC Limited	
2.	**Project Name**	Ramagundam Stage-II 3X500 MW	
3.	**Location**	Ramagundam, Pedapalli Dist, Telengana State.	
4.	**Type**	Three stage chevron type (First Stage shall be Flat or Roof Type, Second and Third stages shall be Diamond/Roof type)	
5.	**Material of construction of Mist Eliminator**		
vii.	ME Panel(entire ME module)	Polysulfone (Or) Super austenitic stainless steel (254 SMO)	
viii.	Washing Pipe	Glass fibre reinforced plastics (or) Polypropylene or PVC is also acceptable provided bidder has proven experience for the same. Supporting documents to be produced.	
ix.	Wash Pipe Supports	Alloy 59/C276	
x.	Washing Nozzles	PVDF or PP as per bidder's proven practice.	
xi.	Hardware inside absorber	a) Alloy 59/ C276 for load bearing applications b) All metallic fasteners provided shall be of Alloy 59/C276 c) For pipe clamps, C276 Bolt, C276 Nut, C276 washer and C276 spring washer to be provided.	
xii.	Enclosure Plate	Same as that of ME Panel if it is part of Mist Eliminator (or) C276 material.	
6.	**Quantity**		
i.	Quantity of Mist Eliminators for Abosrber – 4,5 & 6 (3X500MW)	3 sets (1 set for each unit) 1 set means Complete Mist Eliminators, Washing systems and accessories	
7.	**Parameters**		
i.	Gas flow	Vertical	
ii.	Casing Dimension	Length : 9900 mm	Width : 20400 mm
iii.	Design Pressure of Mist Eliminator Panel	660 mmH_2O (G)	
iv.	Max Allowable Pressure drop across Mist Eliminator element	20 mmH_2O (G) at Design point 16 mmH_2O (G) at Guarantee point	
v.	Design Temperature	• 70 Deg C (Continuous) • 80 – 90 Deg C (30 minutes) • 90 – 100 Deg C (5 min)	
8.	**Gas condition at ME Inlet**	**Guarantee Point**	**Design Point**
i.	Gas Flow Rate (Nm^3/s-wet)	602	661

Customer / Plant: NTPC RAMAGUNDAM STG I & II (3x200 MW + 3x500MW)								
Cont. No. : G208,209,210 & G509,510,511	Rev. 00		Rev. 01		Rev. 02		Rev. 03	
	Sign	Date	Sign	Date	Sign	Date	Sign	Date
Engineer : PR	-sd-	18.07.2020						
Reviewer : PNR/ACR	-sd-	18.07.2020						
Approver : RSB	-sd-	18.07.2020						

MIST ELIMINATOR DATA SHEET

REF: MISTEL:RAMAGUNDAM:R00

Sl. No.	Description	Requirement	
ii.	Gas Flow Rate (m^3/s-wet)	729	810
iii.	Gas Temperature (Deg C)	57.6	61.4
iv.	Density (kg/m^3)	1.036	1.009
v.	Operating Pressure at Mist Eliminator inlet (mm H_2O (G))	48	60
vi.	Gas Flow Distribution	+ or - 20%	
9.	**Gas Composition at ME Inlet**		
i.	SO_2 (Vol%-wet)	0.0027	0.0025
ii.	H_2O (Vol%-wet)	17.37	20.78
iii.	O_2 (Vol%-wet)	5.90	5.65
iv.	CO_2 (Vol%-wet)	9.91	9.51
v.	N_2 (Vol%-wet)	66.81	64.06
vi.	HCl (ppm-wet)	<3	<3
vii.	HF (ppm-wet)	<1	<1
viii.	Dust (mg/Nm^3-wet)	<50	<200
10.	Gypsum Slurry Density(t/m3)	1.210	1.212
10.	**Entrained Mist Condition:**		
i.	Mist Concentration at Inlet –at Guarantee & Design Point	200 g/Nm^3-dry	
ii.	Mist Concentration at Outlet –at Guarantee & Design Point	≤20 mg/Nm^3	
iii.	Gypsum slurry density- at design point	1212 kg/m3	
iv.	Gypsum slurry density- at guarantee point	1210 kg/m3	

11.	**Mist Composition**	
vii.	Solid	30 wt.%
viii.	Cl^-	26000 ppm
ix.	Mg^{2+}	8323 ppm
x.	Ca^{2+}	1462 ppm
xi.	Na^+	1793 ppm
xii.	SO_4^{2-}	6995 ppm

Customer / Plant: NTPC RAMAGUNDAM STG I & II (3x200 MW + 3x500MW)								
Cont. No. : G208,209,210 & G509,510,511	Rev. 00		Rev. 01		Rev. 02		Rev. 03	
	Sign	Date	Sign	Date	Sign	Date	Sign	Date
Engineer : PR	-sd-	18.07.2020						
Reviewer : PNR/ACR	-sd-	18.07.2020						
Approver : RSB	-sd-	18.07.2020						

REF: MISTEL:RAMAGUNDAM:R00

D. WASHING ARRANGEMENT:

1.1 Washing water condition		
i.	Flow rate - Average	25.83 m^3/hr *1)
ii.	Flow rate at M/E Inlet – Instantaneous Min	120 m3/hr (max) 100 m3/hr (min)
iii.	Feed Pressure (at inlet flange of ME Wash header)	0.2 MPa (Max)
iv.	Spray Nozzle –Top washing	90 °, Full Cone
v.	Spray Nozzle –Bottom washing	120 °, Full Cone
vi.	Spray pipe level from ME Panel	< 700 mm

1.2 Washing Method								
		First Stage		Second Stage		Third Stage		
		Front Surface	Back Surface	Front Surface	Back Surface	Front Surface	Back Surface	
i.	Total Washing Area m^2	9.9x20.4	9.9x20.4	9.9x20.4	9.9x20.4	9.9x20.4	9.9x20.4	
ii.	Washing Water Source	Refer Clause E						
iii.	Washing Water Average Flow rate m^3/h	*	*	*	*	*	**	
iv.	Instantaneous Max Water Flow rate m3/h	*	*	*	*	*	**	
v.	Duration of One washing for One Divided Section Sec	*	*	*	*	*	**	
vi.	Time of One washing Cycle (min)	*	*	*	*	*	**	
	*Washing method shall be confirmed by the vendor. ** Only for Maintenance *1) shall be finalized by vendor							

Customer / Plant: NTPC RAMAGUNDAM STG I & II (3x200 MW + 3x500MW)								
Cont. No. : G208,209,210 & G509,510,511	Rev. 00		Rev. 01		Rev. 02		Rev. 03	
	Sign	Date	Sign	Date	Sign	Date	Sign	Date
Engineer : PR	-sd-	18.07.2020						
Reviewer : PNR/ACR	-sd-	18.07.2020						
Approver : RSB	-sd-	18.07.2020						

E. WATER ANALYSIS

Process water is envisaged for Mist Eliminator washing. Process water analysis is provided below.

WATER ANALYSIS

Sl. No.	Constituent	as	mg/Litre
A)	**COOLING WATER ANALYSIS /CW BLOW DOWN WATER ANALYSIS**		
1.	Calcium	$CaCO_3$	316
2.	Magnesium	$CaCO_3$	292
3.	Sodium	$CaCO_3$	260
4.	Potassium	$CaCO_3$	24
5.	Total Cations	$CaCO_3$	892
6.	M-Alkalnaity	$CaCO_3$	120
7.	P-Alkalinity	$CaCO_3$	0
8.	Nitrate $CaCO_3$	$CaCO_3$	8.8
9.	Chloride	$CaCO_3$	252
10.	Sulphate	$CaCO_3$	160
11.	Total Anions	$CaCO_3$	892
12.	Silica	SiO_2	60
13.	Iron	Fe	0.48
14.	pH Value	-	6.5-6.9
15.	Turbidity	NTU	6
16.	Total Dissolved solids	$CaCO_3$	980
17.	Organic matter (Oxygen absorbed from Acid Permanganate in 4 Hrs.)	mg/l	0.1

Customer / Plant: NTPC RAMAGUNDAM STG I & II (3x200 MW + 3x500MW)								
Cont. No. : G208,209,210 & G509,510,511	Rev. 00		Rev. 01		Rev. 02		Rev. 03	
	Sign	Date	Sign	Date	Sign	Date	Sign	Date
Engineer : PR	-sd-	18.07.2020						
Reviewer : PNR/ACR	-sd-	18.07.2020						
Approver : RSB	-sd-	18.07.2020						

F. MIST ELIMINATOR ARRANGEMENT AND MIST PARTICLE SIZE DISTRIBUTION

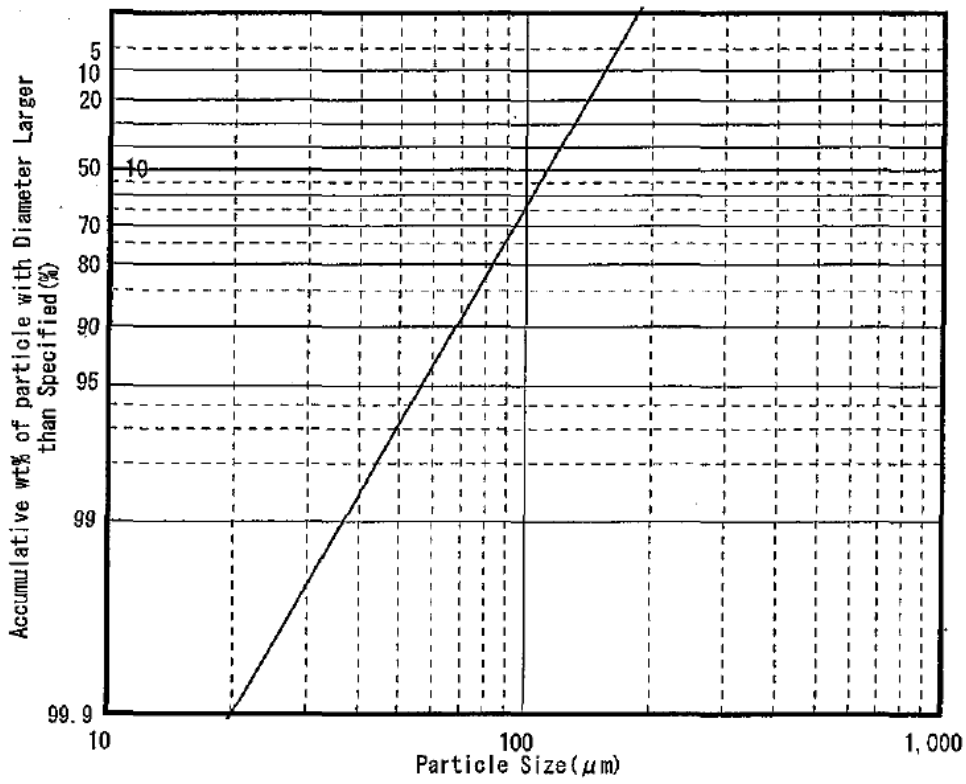
i. The following tie beams are located inside Absorber:

a) For Ramagundam Stage-I, there is only one Absorber(common absorber for all three units) of size 10900 mm Length X 26900 mm Width. Bidder shall note that there are two column tie beams located inside the absorber and separated by 8000 mm. Beams are located on either side of centre line at a distance of 4000 mm from the centre line (Bidder shall refer to Note 01 in the typical drawing enclosed). These two tie beams have to be used as Mist Eliminator support beams**.**

b) For Ramagundam Stage-ii, there are three absorbers (one for each unit) and the size of the Absorber is 9900 mm Length X 20400 mm Width. Bidder shall note that there is a column tie beam located at the centre of the absorber(Bidder shall refer to Note 01 in the typical drawing enclosed) and the same has to be used as Mist Eliminator support beams

ii. Overall spray washing arrangement shall be as per the drawing (typical) enclosed. Spray arrangement shall be designed considering the water flow rate mentioned above.

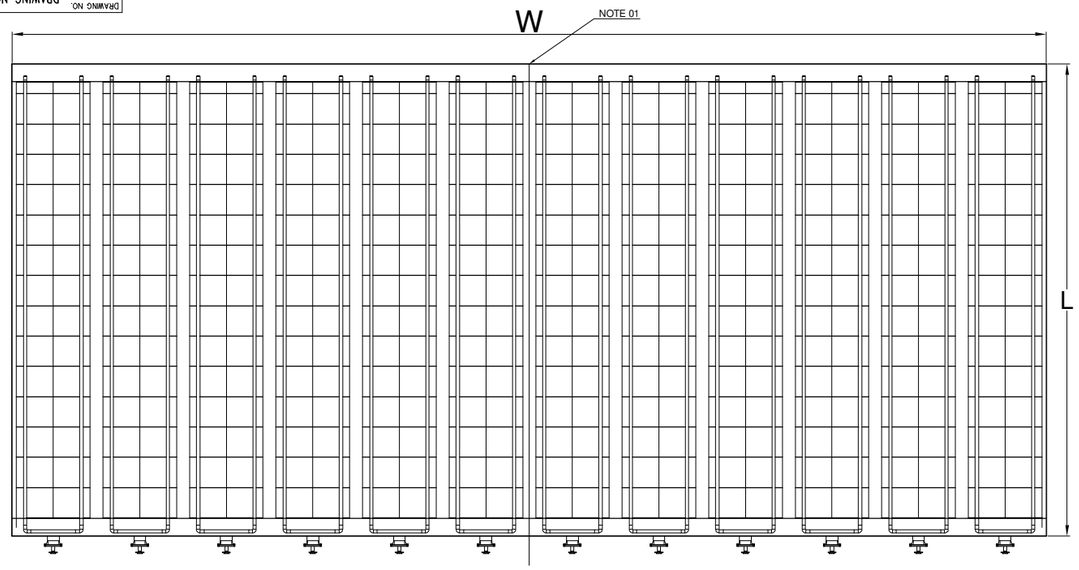
Fig. 2 Mist Particle Size Distribution(EXPECTED VALUE)

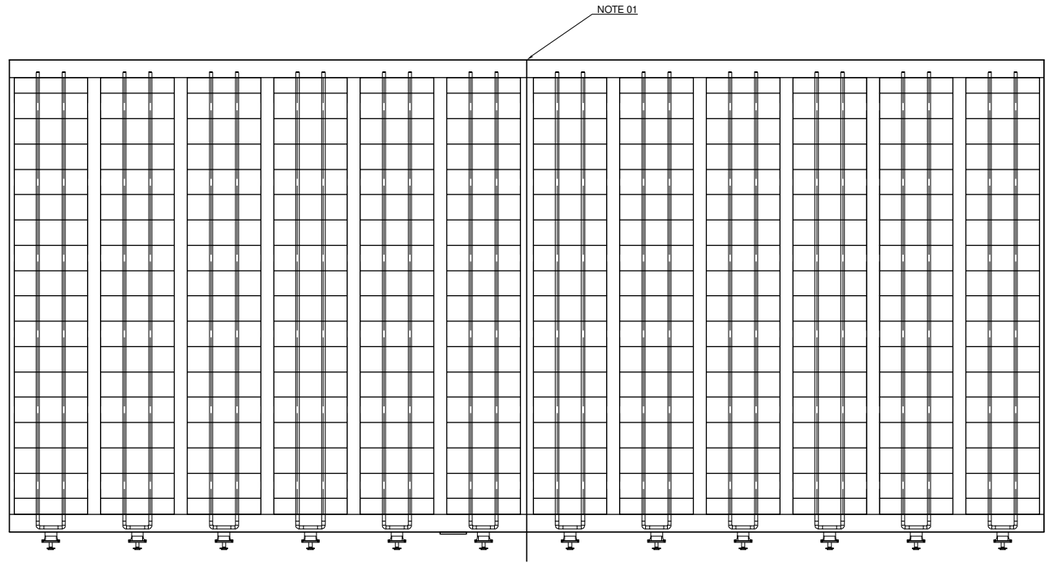


Customer / Plant: NTPC RAMAGUNDAM STG I & II (3x200 MW + 3x500MW)								
Cont. No. : G208,209,210 & G509,510,511	Rev. 00		Rev. 01		Rev. 02		Rev. 03	
	Sign	Date	Sign	Date	Sign	Date	Sign	Date
Engineer : PR	-sd-	18.07.2020						
Reviewer : PNR/ACR	-sd-	18.07.2020						
Approver : RSB	-sd-	18.07.2020						

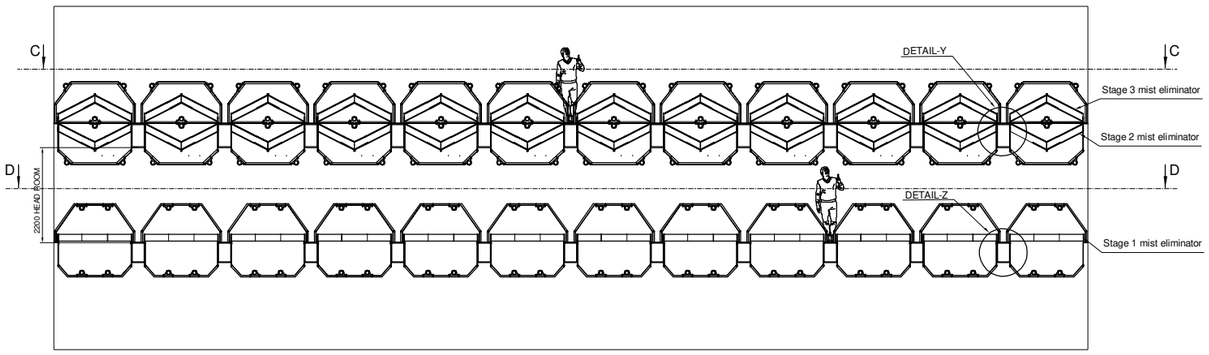
DRAWING NO.

All dimensions are in millimeters

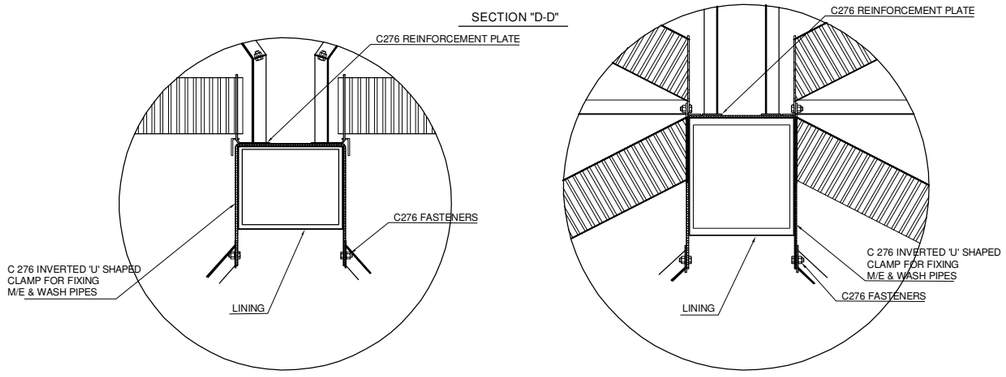




SECTION "C-C"

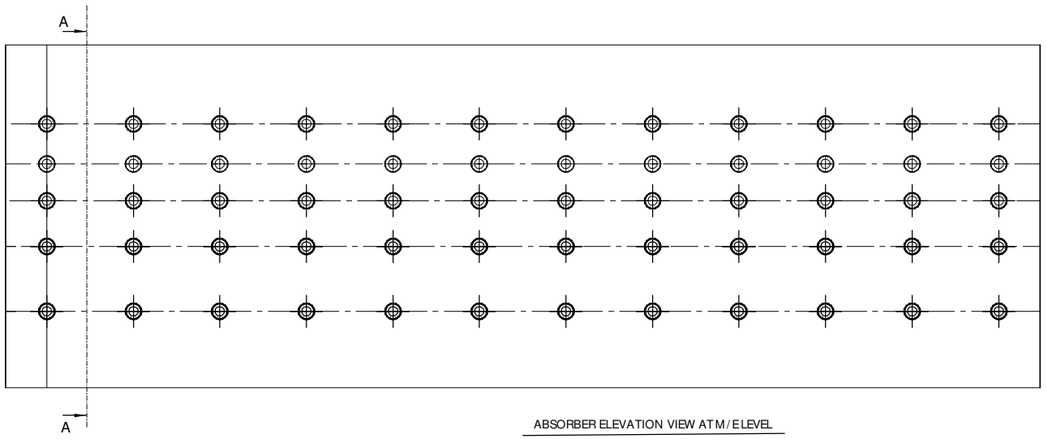


SECTION "D-D"

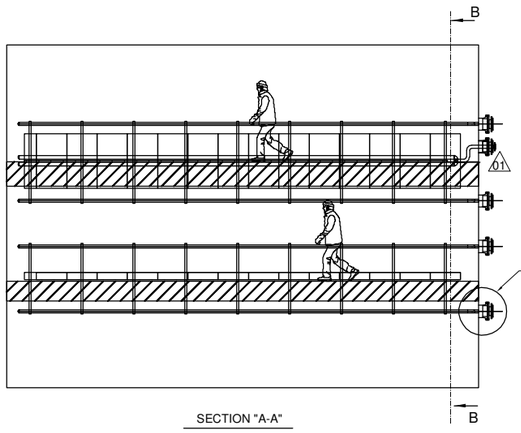


DETAIL-Z

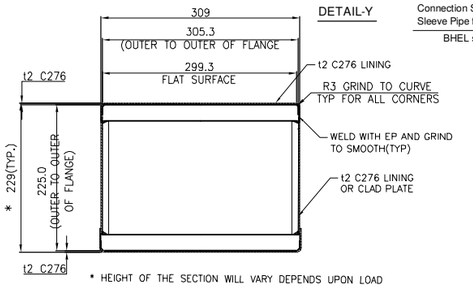
SECTION "B-B"



ABSORBER ELEVATION VIEW AT M/E LEVEL



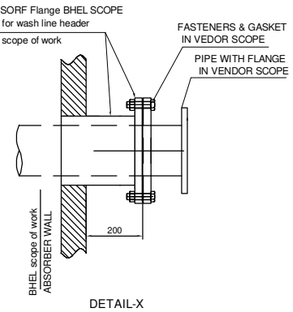
SECTION "A-A"



DETAIL-Y

* HEIGHT OF THE SECTION WILL VARY DEPENDS UPON LOAD

ME SUPPORT BEAMS 01



DETAIL-X

THE FOLLOWING ITEMS ARE IN VENDOR SCOPE:

a) MIST ELIMINATOR MODULE WITH END STOPPER PLATE FOR ALL THE STAGES
b) FLUSHING PIPES WITH SPRAY NOZZLES AND FLANGE FOR THE FRONT AND BACK WASH FOR ALL THE STAGES
c) HORIZONTAL MEMBER FOR PIPE SUPPORT WITH MOUNTING CLAMP FOR PIPE
d) VERTICAL MEMBER (LEG SUPPORT- L ANGLE) FROM THE MAIN BEAM TO HORIZONTAL PIPE SUPPORT
e) INVERTED U-CLAMP (HANGER TYPE) FOR MOUNTING BOTTOM WASH PIPE SUPPORT
f) PAD PLATE AT THE END OF THE LEG SUPPORT
g) ALL FASTENERS (MADE OF C-276) FOR SUPPORT MEMBERS/LOAD BEARING MEMBER INSIDE ABSORBER
h) FASTENERS/GASKETS FOR THE FLANGES OUTSIDE ABSORBER AS PER THE DRAWING
i) ANY BLANKING PLATE, IF REQUIRED, SHALL BE PROVIDED

NOTE 01:

A) WHEN W <= 22.9 M , CENTRAL BEAM AT "W/2 LOCATION" IS MANDATORY AND ITS LOCATION CANNOT BE DISTURBED TO ACCOMMODATE M/E.
B) WHEN W>22.9 M CENTRAL BEAM IS NOT APPLICABLE. INSTEAD TWO BEAMS ONE ON EITHER SIDE AT A DISTANCE OF 4 TO 4.6 M AWAY FROM THE CENTRE LINE. THESE TWO BEAMS ARE MANDATORY AND ITS LOCATION CANNOT BE DISTURBED TO ACCOMMODATE M/E. EXACT LOCATION OF BEAMS WILL BE INFORMED DURING DETAILED ENGINEERING.
01 C) M/E SUPPORT BEAM ARE IN BHEL SCOPE AND DETAILS ARE GIVEN. ONLY THE DEPTH OF THE SUPPORT BEAM WILL BE VARIED AS PER THE LOADING DETAILS. VENDOR'S ME DESIGN SHALL BE ABLE ACHIEVE THE WALKWAY REQUIREMENT OF 300 MM WIDE CONSIDERING THE BEAM DETAILS GIVEN IN THE DRAWING. THE WIDTH OF THE M / E BEAM CANNOT BE MODIFIED AND ANY ADDITIONAL SUPPORT REQUIRED TO ACHIEVE WALKWAY OF 300 MM HAS TO BE PROVIDED BY VENDOR.
D) BHEL'S SCOPE IS M / E SUPPORT BEAM AND THE OUTER RING SUPPORT. THE MAXIMUM WIDTH OF THE SUPPORT RING SHALL BE 300 MM . ANY OTHER ITEMS LIKE ENCLOSURE PLATES/ BLANKING PLATES ,IF REQUIRED, SHALL BE IN THE SCOPE OF M / E VENDOR.

BHEL WILL PROVIDE ONLY THE MAIN SUPPORT BEAM AND OUTER RING SUPPORT FOR THE MIST ELIMINATOR. ALL SUPPORTS FOR PIPE SHALL BE TAKEN FROM THE MAIN SUPPORT BEAM / OUTER RING .

PIPE SUPPORTS SHALL NOT BE TAKEN FROM ABSORBER CASING.

1st STAGE MAY BE WITH ROOF TYPE/ FLAT.

2nd & 3rd STAGE HAS TO BE DIAMOND (AS PER DRAWING).

NOZZLE LOCATION ON 'W' SIDE ONLY.

REV	DATE	ALTERED / CHECKED
01		BEAM DETAILS UPDATED, NOTE ADDED

TYPE OF PRODUCT
OR NAME OF
CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LTD.
UNIT: BOILER AUXILIARIES PLANT
RANIPET – 632 406.

	NAME	SIGN	DATE	NO.OF VAR.
DRN	SR		15-06-20	
CHD	SHANMUGA			-
APPD	V KESAVAN			

DEPT	GRADE OF UNTOL. DIM	SCALE	WEIGHT (KG)	REF. TO ASSY/OLD DRG.	ITEM NO	NO. OF ITEMS
FCD		N.T.S	-	-	-	-
CODE 9789						

TITLE: TYPICAL ARRANGEMENT OF M/E

CARD CODE: U 01

DRAWING NO.: SKETCH M/E 01

REV: 01

Size A0

Ranipet	MANUFACTURER'S NAME & ADDRESS BHEL/ BHEL APPROVED SOURCE	**STANDARD QUALITY PLAN** **ITEM:** MIST ELIMINATOR WASHING SYSTEM **SUB SYSTEM:** MIST ELIMINATOTR	**QP. NO.:** MIST ELIMINATOR :742 **Rev No. :**00 **Date:** 27.04.2020 **Page** 1 of 2	PROJECT: AS PER PO.

SL NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK 6		REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD		Agency			REMAR KS
											M	B	C	
1	2	3	4	5	M	B/C	7	8	9	D	10			11
1.0	**RAW MATERIAL**													
1.1	Inspection of incoming Material		Major	Verification of MTC	100%	100%	Manufacturer's Test Certificates	Test certificates.	√		P	V	-	
1.2	Inspection of semi-finished goods(plates, profiles, pipes, nozzles etc.	Visual & Dimension	Major	Visual & Dimension	Each Heat	Each Heat	Approved Drawing / P.O.	Test certificates.	√		P	V	-	
2.0	**IN PROCESS INSPECTION**													
2.2	Inspection of parts and profiles after cutting (profile, plates etc.)	Visual & Dimension	Critical	Visual & Dimension	Random	Random	Approved Drawing / P.O.	Inspection Report	√		P	V	-	
3.0	**FINAL INSPECTIONN AND DOCUMETATION**													
3.1	Final Dimensional Inspection of all items	Visual & Dimension	Major	Visual & Dimension	Single module of each type	Single module of each type	Approved Drawing / P.O.	Inspection Report	√		P *	W	-	

M – Manufacturer / Subcontractor,
B - BHEL /BHEL Authorized Inspection Agency,
C - Customer, P - perform,
V - Verification of reports
W - Witness, TC - Test certificate
"D" – Record, identified with tick (√) shall be essentially included by Supplier in QA documentation.

Prepared by	Reviewed by	Approved by
Sanjib Pandit (AE/QA)	Rakesh Kumar Madhu (Dy Manager / QA)	K C Gandhiparimalam (DGM/QA)

Ranipet	MANUFACTURER'S NAME & ADDRESS BHEL/ BHEL APPROVED SOURCE	**STANDARD QUALITY PLAN** **ITEM:** MIST ELIMINATOR WASHING SYSTEM **SUB SYSTEM:** MIST ELIMINATOTR	**QP. NO.:** MIST ELIMINATOR :742 **Rev No. :**00 **Date:** 27.04.2020 **Page** 2 of 2	PROJECT: AS PER PO.

SL NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK 6		REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD		Agency M	Agency B	Agency C	REMAR KS
1	2	3	4	5	M	B/C	7	8	9	D	10			11
4.1	Review of Final Documentation	Inspection Reports & test certificates, Quality	Major	Visual & Verification	100%	100%	Drawing / P.O.	QC Dossier	√		P	V	-	

Note: * 100% by manufacturer / supplier.

a. Latest version of standards & Specification shall be applied.
b. Materials shall be procured in compliance to Functional Technical Specification.
c. Gauges and measuring instruments with valid calibration only shall be used.
d. Inspection / Inspection wavier / approval by BHEL does not absolve Supplier's responsibility for conformity of the specification as per the terms of PO.
e. BHEL /BHEL Authorized representatives shall have the right to witness the necessary inspection and testing of goods mentioned in the PO.
f. In case of Vendor Drawing & Datasheet, it needs approval by BHEL Engineering.
g. This QP shall be read along with relevant PO, BHEL Specification/Drawing/Approved Datasheet.

.

Record of revision

Rev no	Date	Description
00	27.04.2020	Original Issue – First submission

M – Manufacturer / Subcontractor,
B - BHEL /BHEL Authorized Inspection Agency,
C - Customer, P - perform,
V - Verification of reports
W - Witness, TC - Test certificate
"D" – Record, identified with tick (√) shall be essentially included by Supplier in QA documentation.

Prepared by	Reviewed by	Approved by
Sanjib Pandit (AE/QA)	Rakesh Kumar Madhu (Dy Manager / QA)	K C Gandhiparimalam (DGM/QA)

Annexure Q - Enquiry no: 3800980E		**Date:** 25-03-2021
Sl.No	**BHEL / Customer Requirement**	##Specific confirmations by the manufacture
1	**Quality Plan Requirement:**	
1a	MQP (Manuafcutering Quality Plan) shall be submitted in attached format for BHEL/Customer review & approval. Typical MQP is attached for indicative purposes for guidance & use.	
1b	MQP shall invaribly cover w.r.t Inward inspection including on Raw materail Procurement, In process and Final inspection in elaborated way/details.	
1c	Bidder shall also to give specific confirmation that on need basis, their competent officials shall visit to BHEL/customer for finalization of Quality plan including test procedure/methodology during preaward / post award approval / detailed engineering in the event of an order.	
1d	No deviation on BHEL/Customer approved MQP is acceptable.	
1e	Bidder shall agree to submit all cross referred documents other than codes/standrads to BHEL/Customer/Consultant.	
2	**Important Notes shall be included in MQP :** (a) Latest revision of Standard s & Specification shall apply. Only International Standards are applicable. Indian & Chinese Standards are not applicable. (b) Materials shall be procured in compliance to Functional Technical Specification. (c) Inspection shall be in compliance with Approved Quality Control Procedure for the Product. (d) NDT shall be carried out by Qualified Personnel with compliance to Approved NDT Procedures and Acceptance Norms, as per ASME Section V. (e) Gauges and measuring Instruments, with valid calibration only shall be used. (f) Cleaning and Painting of products shall be carried out as per Approved Painting Schedule. (g) Finished Products shall be packed to comply with Approved Packing Schedule. (h) Welding shall be carried out by Qualified Personnel with compliance to Approved NDT Procedures and Acceptance Norms, as per ASME Section V.	
3	**Domestic / Inland Inspection** will be carried out by BHEL/BHEL apointed Third Party Inspection Agency (TPIA) / Customer/Customer Apointed Inspection Agency/Consulatnat. This is applicable for all Stage inspection and Final Inspection identified as "W" - Witness or "CHP" - Customer Hold Point as per customer approved Quality Plan/ Technical specification / Approved Drawing/ Approved Data sheet / Scheme / PID / PFD / SLD (Process Instrumentaion Diagram / Process Flow Diagram / Single Line Diagram) etc (As applicable). **"The inspection charges at actuals incurred by BHEL will be loaded to compare with foreign suppliers".**	
4	**Inspection Agency for Foreign Bidders and also for Indian Bidder but importing from Forgign Sources**: (1) Any one of the fllowing Third Party Inspection Agency (TPIA) shall be appointed by the bidder and same shall be furnished by the bidder in techno commercial bid itself. (2) The details of TPIA with contact details like Name of the official, Phone no, Email id shall also to be submitted during pre/post award. However **cost for such inspection agency shall be borne by the bidder only. Inspection charges for such inspection agency shall be indicated separately so that if BHEL/Customer is undertaking the inspection by on their own , then these charges non claimable by the bidder.** **List of TPIA** (1). M/s Bureau Veritas, (2). M/s TUV-Nord, (3). M/s TUV-SUD, (4). M/s TUV Rheinland, (5). M/s Lloyds Register, (6). M/s SGS, (7). M/s Germanischer Lloyds, (8). M/s QUEST, (9). M/s Certification Engineers International, (10). M/s Intertek, (11). M/s IR Class Systems and Solutions, (12). M/s DNV, (13). M/s Fichtner, (14). M/s ABS Inspection Services.	
5	**Stage Inspection during manufacturing Process :** Stage Inspection during manufacturing shall be carried out as per approved quality plan and all necessary documents shall be provided for review,verification and clearanace for further processing. This inspection call shall be given well in advance (atleast 2 weeks before) to TPI/Bidder's own inspection agency to avoid delay in the manufacturing processes.	
6	**Inspection before despatch for domestic supplier :** Inspection before despatch at supplier's works shall be carried out by BHEL/BHEL appointed Inspection agency. Inspection shall be done as per approved Quality plan/ Technical specification/ Approved Drawing/ Approved Data sheet .	

Sl.No	BHEL / Customer Requirement	##Specific confirmations by the manufacture
7	**Inspection at Forign Source/Supplier:** (a) As in sl no: 3. shall be ensured without fail, (b) No materail / items shall be despatched without getting the written communication from BHEL / Customer inspection carried out by BHEL/BHEL apointed Third Party Inspection Agency (TPIA) / Customer/Customer Apointed Inspection Agency/Consulatnat. This is applicable for all Stage inspection and Final Inspection identified as "W" - Witness or "CHP" - Customer Hold Point as per customer approved Quality Plan/ Technical specification / Approved Drawing/ Approved Data sheet / Scheme / PID / PFD / SLD (Process Instrumentaion Diagram / Process Flow Diagram / Single Line Diagram) etc (As applicable). (c) Inspection before despatch at supplier's works shall be carried out by bidder appointed inspection agencies having international presence at vendors and or vendor's sub vendor works. Inspection shall be done as per approved Quality plan/ Technical specification/ Approved Drawing/ Approved Data sheet by TPIA mentioned in Sl no: 03 at supplier's cost.	
8	**Painting** shall be done strictely as per BHEL/Customer approved painting schedule / scheme only. Paint Thickness / Paint shade shall be ensured as per BHEL / Customer approved painting schedule / specification / data sheet etc. No deviation is acceptable unless otherwise accepted by BHEL/Customer in writing. Any conflict if any among BHEL / Customer approved painting schedule / Spec / data sheet etc shall be brought to the notice to BHEL well in adavnce before proceding including the BOI being procured for assy / skid like motors etc	
9	Specific conformation for document package in the event of an order (2 Hard copies & soft copy in PDF file) is to be given containing the following with proper linkages (i) Index Sheet, (ii) MQP/RQP/Endorsemment Sheet (As applicable), (iii) TCs identfied by BHEL/ Customer for record for "CHP" / "W" and Verification portion ("V") as given in approved QP, (iv) Final inspection report + TC including Chemical + Mechnaical + HT + NDT etc, (v) Third party Inspection report + TC, (vi) Customer CHP/ MDCC, (vii) Type test / Performance Test reports conducted, (viii) Type test / Performance Test approval/ clearance obtained from BHEL/Customer, (ix) BOM with As Build Drgs with actual make / rating used with BHEL/customer approved drawings.	
10	**Packing / Seaworthy Packing** shall be as per BHEL Packing schedule / approved drg / sketch. This shall be ensured to take care tarnsit / handling / transhipment in Road / Sea / Air. Photographs are to be submitted for BHEL review before despatching the material as per contract conditions.	
10	**Packing** shall be as per BHEL Packing schedule / approved drg / sketch. This shall be ensured to take care tarnsit / handling / transhipment in Road / Sea / Air. Photographs are to be submitted for BHEL review before despatching the material as per contract conditions.	
11	**Outsourcing of test facilities:** Bidder shall ensure all the testing facilities in house. However If any of the test facilities are not available with successful bidder, then bidder shall ensure the same at NABL accreadted third party lab / Govt / Govt Lab for major testing such as NDT, Electrical & Mechanical testing.	
12	**Important Note:** No deviation on the above requirement 01 to 11 is acceptable w.r.t Quality Requirement and those offers not meeting these specific customer requirement is liable for rejection and hence the bidder shall submit all the required documentary evidances in the offer itself.	
13	## Necessorily to be filled up by the bidder at the time of offer itself otherwise the offer may not be considered w.r.t Quality Requirement being customer specific requirement.	