

	TECHNICAL SPECIFICATION FOR CO2 DOSING SYSTEM - EVAPORATOR, HEADERS & DIFFUSER	SPEC. No.: ROS 6391
		REV: 00

BHARAT HEAVY ELECTRICALS LIMITED,
RANIPET- 632 406.

TECHNICAL SPECIFICATION

For

CO2 DOSING SYSTEM - EVAPORATOR, HEADERS & DIFFUSER

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1.0 SCOPE OF SUPPLY

I. The intent of this specification is to cover design, engineering, manufacturing, shop testing and hydro testing of the CO₂ dosing system. The scope shall include but not limited to the following.

- a) Design and engineering of Centralized electric CO₂ gas heater (sized up to 25 kg/hr) on common manifold outlet.
- b) 5 + 5 CO₂ cylinder manifold (two banks of 5 cylinders each) with isolation valves, NRVs and common header.
- c) Stainless steel braided PTFE hose assemblies for cylinder–manifold connections, suitable for CO₂ service.
- d) Centralized high capacity pressure regulator with valves, gauges and fittings for dosing into 200 NB line.
- e) Standard accessories, supports and fittings necessary for proper functioning of the manifold and dosing system.

Note: Scheme and general details of CO₂ dosing system. Drg No. **3-WT-000-01602** attached to this specification.

II. Installation of all the equipment at site, commissioning and trial operation of the system at site.

2.0 PROJECT INFORMATION

- | | | |
|---|------------------|--|
| A | 1. Owner | : Tamil Nadu Generation & Distribution Corporation Limited |
| | 2. Project Title | : Ennore 2 x 660 MW STPP |
| | 3. Location | : Chennai |

3.0 TECHNICAL SPECIFICATION – MECHANICAL

The CO₂ manifold system is designed to receive CO₂ from cylinders, atmospheric evaporating and reducing it to lower pressure through Cold Reduction Station. In the given configuration, gaseous CO₂ is taken through the manifold system delivering CO₂ to the assembly. At this stage, a pressure reduction device adjusts the pressure of CO₂ gas to the desired level for delivery into the CO₂ gas injector. This water shall then be returned to the main flow to correct the pH of main supply or CO₂ gas is injected directly into water through special type of injector.

CO₂ is transported in liquid phase in cylinders but it is used in the gaseous state for water applications. CO₂ is evaporated and expanded to lower pressure for use and, in this

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expansion operation cooling occurs which can choke the entire system with dry ice, resulting in pressure oscillation and CO₂ losses.

4.0 EQUIPMENT SPECIFICATIONS

4.1 Centralized Electric CO₂ Gas heater (sized up to 25 kg/hr)

A Vaporizer/Evaporator with heavy-duty electric heater is provided to vaporize the liquid CO₂ to gaseous state as per requirement. Vapour/Evaporator heater is provided to heat CO₂ gas and delivers gas at a stable, controlled temperature to the 200 NB process line, eliminating icing issues on the downstream header during normal operation.

Vaporizer/Evaporator system shall contain the following.

1. Insulated Oil container with pipe coil, electric heater and thermostat.
2. Panel box contains
 - a. Miniature Circuit Breaker (MCB)
 - b. Temperature indicating lamp
 - c. Power on/off indicator

4.2 SKID FRAME.

A skid shall be fabricated with MS channel and angles as per the approved drawing with good engineering practice. Two MS skid shall be provided by bidder suitable to assemble 10 nos. each of CO₂ cylinders with capacity of 40 kg each. The cylinder's elevation and space between cylinders shall be suitably designed to facilitate easy operation for flow adjustment, valve operation, maintenance and loading etc.

Lifting hook arrangement shall also be provided.

4.3 Cylinder manifold with controlled withdrawal per cylinder

Cylinders shall be connected to a common stainless-steel manifold through individual flexible braided PTFE hoses suitable for CO₂ service.

The manifold and valve arrangement shall be designed so that the withdrawal rate from any single cylinder does not exceed approximately 10 kg/hr, thereby preventing excessive cooling, internal dry-ice formation, and bottom shell icing.

4.4 Braided PTFE flexible hose assemblies

Stainless Steel braided PTFE hoses, shall be suitable for high-pressure, low-temperature CO₂ applications.

These hoses shall have excellent chemical resistance, wide temperature tolerance, and improved safety, thereby minimizing external icing and ensuring long hose life in water treatment environments.

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4.5 Centralised high-capacity pressure regulator for dosing control

A single high-capacity regulator shall be provided downstream of the heater to regulate CO₂ pressure and maintain the required dosing range of 12–25 kg/hr into the remineralisation system.

Centralised regulation ensures stable flow control to the process while maintaining cylinder withdrawal within safe limits and improving overall system reliability.

4.6. DIFFUSER

For mixing of CO₂ with water inside the main pipeline. This diffuser shall be installed in a commoner header connected to the Remin vessel feed. Refer attached drawing.

Technical Details:

- | | | |
|---------------------------|---|---|
| 1. Length of the diffuser | : | 180 mm (max) to fix into the 200 NB pipe. |
| 2. Rating | : | 5 micron |
| 3. MOC | : | Compatible to CO ₂ application. |
| 4. End connection | : | Terminated with threaded connection (BSP-F) |

4.4. VALVES

All Valves will be SS316 / Brass MOC suitable for CO₂ application.

4.5. PIPING SYSTEM.

All the interconnecting pipes shall be industrial grade to suite the system Design/operating pressure.

CO₂ transfer pipe line from Cylinder to diffuser system shall be of 1" (DN 25) size with MOC SS316.

The distance of discharge piping from the skid to the process line (dosing point) will be as per the enclosed drawing.

ALL FLANGE DRILLING SHALL CONFIRM TO ANSI B-16.5, CLASS 150.

4.6 Dosage Rates

Sl. No.	Project	Reminrelisation Feed Pump Flow (M3/hr)	Reminrelisation Feed Pump Head (m)	Dosage (ppm)	Dosage Rate (Kg/hr)
1.0	Ennore	420	20	51	(12-25)

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4.7 TERMINAL POINTS

Scope and terminal point details are indicated in the enclosed drawings, Scheme and general details of CO2 dosing system. Drg No. **3-WT-000-01602**.

- a) Outlet of Cylinders (From Manifold) to the diffusers.
- b) Requirement of piping, valves, external supports, etc. for the following lines shall be provided by the vendor.

Note: Refer attached drawing for the details.

4.8 OTHER REQUIREMENTS

- a. All the interconnecting piping shall be SS316 industrial grade Schedule 80.
- b. The pipe size shall be minimum of dia. ½" or 1" as applicable
- c. All mounting fasteners : SS 316
(Flanges, tank, pump etc.)
- d. Foundation Bolts : SS 316

Items though not mentioned but needed to make the system complete in all respects as stipulated under these specifications are also to be supplied unless otherwise specifically excluded.

5.0 DESIGN AND CONSTRUCTION FEATURES

The following consideration shall be made during the design / selection of valves for the CO2 dosing System.

1. Bidder to select suitable material of construction for the valves based on the system requirement.
2. The end connection for the valves shall be of flanged type as per **ANSI B16.5, 150 class**.
3. Pressure rating of valves shall be as per system requirement.
4. Max. operating pressure in process water line is 3 bar
5. The painting shall be to suit the sea shore, humid, dusty and corrosive environment.
6. Suitable check valve arrangement to handle the CO2 gas and to prevent the back flow from the process water line.
7. The Material of Construction of the body and disc of check valve shall be SS 316.

6.0 INSPECTION

By BHEL's inspector or BHEL's authorized representative at Vendor's works.

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Technical Deviation format

Annexure-1

Sl. No	Section No.	Clause No.	Page / No.	Specification	Statement of Deviations/ variations	Reason for Deviation

7.0 Erection, Commissioning and trail run.

The scope of Erection and Commissioning of systems comprises of collection of materials and equipment from site stores, transportation to erection spot, erection of complete system including site fabrication if any, stage clearance, testing, commissioning and trail operation of the system and further handling over of these systems.

The equipment after inspection at manufacturer's works shall be transported to BHEL site and shall be delivered to the BHEL stores as in supply specification. Unloading of the materials at Site stores & storing of the materials is in BHEL-PSSR's scope. The applicable materials shall be drawn from BHEL stores as per the relevant procedure. The equipment shall be erected sequentially and shall be interconnected with the applicable piping and valve system. Necessary Hydro testing of piping shall also be carried out. All the dummy flanges etc. required for it are under the scope of bidder.