



SPECIFICATION FOR
RO MEMBRANE PRESSURE VESSELS

SPEC.NO.ROS:6213
REV.: 01

**BHARAT HEAVY ELECTRICALS LIMITED,
RANIPET- 632 406**

**TECHNICAL SPECIFICATION
FOR
RO MEMBRANE PRESURE VESSELS (1st Pass RO)
MAITREE - 2 x 660 MW**

01	28.06.18	<i>A. M. Pandey</i> IMRL	SAV <i>Shrey</i>	MN <i>M. K. Hanuman</i>	Revised based on finalized RO skid arrangement
00	07.05.18	IMRL	SAV	MN	Fresh issue
Rev.No	Date	Prepared	Checked	Approved	Remarks

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1.0 SCOPE OF SUPPLY

The intent of this specification is to cover Design, Engineering, Manufacturing, shop testing & supply **of RO membrane Pressure Vessels for 1st Pass RO System (SWRO).**

The scope shall fully cover the requirement of the Design Criteria and Technical requirement of this specification. The scope shall include but not limited to the following:

- a) Pressure vessels suitable for housing of RO membranes. Each pressure vessel shall consists of following
 - Pressure vessel with end cap assembly - 1 set
 - Interconnectors with 'O' rings - 1 set
 - Support saddles & SS316 Holding strips - 3 set
 - b) The manufacturer shall provide one set of special tools for assistance in assembly / disassembly of membrane elements, removal of end cap assembly from the vessel, membrane permeate probing etc. These shall include Rubber Mallet, Nose pliers, channel lock pliers, Permeate Probing set & 'O' ring lubricant etc., along with the main supply.
 - c) Commissioning spares - 1 set
 - d) Recommended spares for 3 years O & M (optional). - 1 set
- 1.1 Items though not mentioned, but needed to make the system complete as stipulated under these specifications are also to be furnished unless otherwise specifically excluded.
 - 1.2 In case of any deviation, the Bidder shall indicate the same, clause by clause in the deviation schedule. In the absence of the same it will be construed that the bid confirms strictly to the specification.
 - 1.3 The inspection at bidder's / Sub vendor's work before dispatch of all equipment shall be carried out as per agreed QAP. The inspection at bidder's work before dispatch shall be carried out by BHEL / BHEL Authorized agency / Customer / Jointly by Customer & BHEL before dispatch.
 - 1.4 The order of priority of this specification is as follows:
 - Technical requirement / Equipment Specification,
 - General design requirements
 - 1.5 The material shall be dispatched to stores department- BHEL / BAP / Ranipet, Tamil Nadu. The quality plan (QAP) formats will be given by the customer after ordering

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2.0 EQUIPMENT SPECIFICATION:

2.1 GENERAL

- 1) Equipment : Pressure Vessel & Accessories
- 2) Application : To house RO Membranes
- 3) Surrounding : Dusty, humid atmosphere
- 4) Installation : Indoor
- 5) Ambient Temperature : 50 Deg.C

2.2 TECHNICAL SPECIFICATION:

- 1) Make / Model : Bidder to specify
- 2) Material of construction : FRP
- 3) Vessel Size : To house spiral wound RO-membranes of
Size: 8" dia. x 40" length each
- 4) No. of elements per vessel : 7
- 5) Pressure Rating : 1000 psi
- 6) Design pressure : 1000 psi
- 7) Test pressure : As per design code (ASME SEC - X un coded).
- 8) Burst Pressure : As per design code
- 9) Quantity required : 270 Sets (total)

Variant-I : 135 sets, Variant-II : 135 sets



10)

Sl. no	Type of port	Variant-I (135 sets)	Variant-II (135 sets)
A	Feed port (per vessel)		
	-Port orientation(side port)	2 Nos	1 No
	-Port size with IPS grooved end	2 ½ "	2 ½ "
	-MOC	Duplex Stainless Steel 2205 or equivalent	Duplex Stainless Steel 2205 or equivalent
B	Brine port (per vessel)		
	-Port orientation(side port)	2 Nos	1 No
	-Port size with IPS grooved end	2 ½ "	2 ½ "
	-MOC	Duplex Stainless Steel 2205 or equivalent	Duplex Stainless Steel 2205 or equivalent

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Note: For Variant-II, feed port & brine port shall be in the same side & same plane.

11) Permeate port (for all variants):

	- Port orientation : End port – 2 Nos. per vessel
	- Port size : 1” or 1 ½ “ with IPS Grooved End – bidder to specify
	- MOC : Engineering thermoplastic.

13) Water TDS / Chloride : 27000 / 15000 ppm

3.0 General

The equipment supplied shall be guaranteed for a minimum period of 12 (twelve) months from the date of successful commissioning of the plant (or) 18 months from the date of receipt of all materials at site, whichever is earlier. The date of receipt of last item at site will be reckoned for this purpose.

Any part which proves defective either in design, materials / and / or manufacture within the above guarantee period shall be replaced at free of cost to the owner at site and the provision of this clause shall apply to the portions of the plant so replaced or renewed until the expiration of the guarantee period or from the date of replacement which ever is later.

4.0 SPARES

4.1 Commissioning Spares:

The bidder shall provide the list of commissioning spares and it shall be delivered along with the main supply well in time before the start-up & commissioning of the plant. The commissioning spares list is indicated in this section.

Over and above of the list provided, if any additional items are required for trouble free commissioning of the equipment / system shall also be included in the list. The price for the commissioning spares shall be included in the main supply and the list shall be provided along with the bid, this price will be included for bid evaluation. Any unutilized commissioning spares shall be handed over to the Customer

Sl.No	Item Description	Qty.	Remarks
1	Adapter seal 'O' ring	50 Nos	
2	End cap assembly	5 Nos	
3	Thrust cone	5 Nos	

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4	Membrane Seal for Adapter ('O' Ring)	50 Nos	
5	Head Seal	20 Nos	
6	Any other specific requirement		Bidder to include

4.2 Recommended Spares for 3 Years O&M:

The bidder shall provide the list of recommended O&M spares for the first three (3) years of normal operation along with price details as per the format in **Annexure-2**. Customer reserves the right to buy any of the recommended spares as considered necessary by them during later stage. The price of recommended spares will not be considered for bid evaluation.

The prices of recommended spares shall be consistent with those of the Initial spares. The validity of prices for these spares shall be up to 1 year from the date of handing over & taking over of the plant.

5.0 DOCUMENTATION:

The documentation during bid and post order stage shall meet the following requirements.

1. All documents and drawing shall be submitted in English
2. Hard copies of all documents and drawings during bid stage to be submitted in duplicate.
3. Hard copies of all documents for approval shall be submitted in triplicate.
4. Hard copies of all final documents, drawings, manual etc., shall be submitted in bound folder in duplicate.
5. Soft copies of all final documents in MS word / MS office in the form of CD –1 set
6. Soft copies of all final calculations in MS excel/ MS office in the form of CD–1set
7. Soft copies of all final drawings in Auto Cad, latest version in the form of CD-1set

5.1 DOCUMENTS ALONG WITH BID:

The following drawings / documents are to be enclosed along with the bid for scrutiny.

1. A technical write-up giving detail of capacities and GA drawing
2. Filled up data sheets as called in the specification – **Annexure -1**
3. Typical Quality Plan.
4. Deviation schedule duly filled, if any –**Annexure – 3**.
5. Un priced commercial offer on the scope of supply
6. Un priced commercial offer for the recommended spares list

Note:

In case of any deviation, the Bidder shall indicate the deviation, clause by clause in the deviation format attached in **Annexure - 3**. If there is no deviation "NIL"

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statement shall be furnished. In the absence of the non-attachment of this **Annexure-3**, it will be construed that the bid confirms strictly to the specification.

5.2 DOCUMENTS AFTER ORDER

The following documents / Drawings and data to be furnished for BHEL / customer approval / information

Phase-I (for approval) within 2 weeks from the date of purchase order receipt:

1. Technical Write-up and design basis
2. GA drawings, detailed assembly & cross sectional drawings with bill of materials of Pressure vessel
3. Dully filled up datasheets for approval as per **Annexure – 1**

Phase-II (For information & review) within 4 weeks from the date of order receipt

1. Erection Manual indicating
 - a. Assembly, erection / installation instructions of equipment.
 - b. Field quality checks
2. Operation and maintenance manual.

Note:

Bidder to confirm in their offer that these details called in 5.2 will be provided. The documents under Phase-II shall be submitted before dispatch.

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Annexure - 1

EQUIPMENT DATA SHEET

RO PRESSURE VESSELS :

- 1) Make :
- 2) Model :
- 3) Material of construction
 - Pressure vessel :
 - End Plate :
 - End adapters :
 - Interconnector :
 - Holding strips :
 - Support saddle :
 - O rings :
 - Feed & Brine port :
 - Permeate port :
- 4) Quantity of pressure vessels offered set :
- 5) Pressure rating psi :
- 6) Design Pressure psi :
- 7) Test pressure psi :
- 8) Burst Pressure psi :
- 9) Port size / Orientation
 - Feed : /
 - Brine : /
 - Permeate : /
- 10) Port Victaulic Groove Style
 - Feed :
 - Brine :
 - Permeate :
- 11) Empty weight Kgs :
- 12) Filled weight Kgs :
- 13) Shipment weight Kgs :
- 14) Vessel Drawing No. :

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Annexure – 2

LIST OF RECOMMENDED SPARES

Sl. No.	Description of the Equipment	Description of Spares	Quantity	Price

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ANNEXURE-3

TECHNICAL DEVIATIONS

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