

First Line

USER GUIDE

FRP Pressure Vessels

8 Inch | Side Entry | Low pressure

Models: R80-300S / R80-450S



Certifications

First Line Pressure Vessels are designed and manufactured in accordance with the American Society of Mechanical Engineers (ASME) Section X Boiler and Pressure Vessel Code, and are complemented by certifications including NSF, CE, ISO, and SGS, meeting the requirements for use as membrane element housings.



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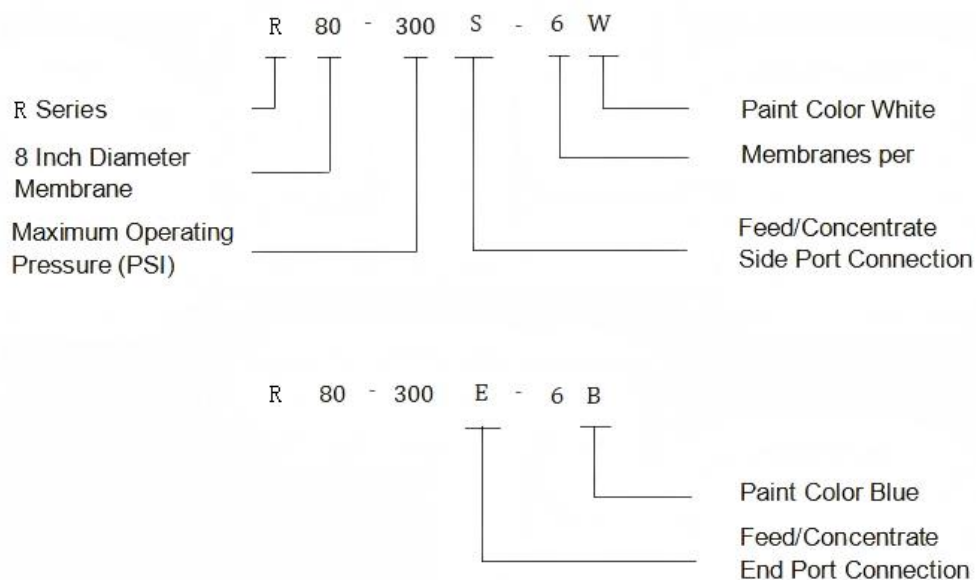
Section 1: General Product Description

First Line pressure vessels are engineered to provide safe, reliable operation throughout their service life when properly installed, operated, and maintained. Each vessel undergoes rigorous inspection and hydrostatic testing prior to shipment to ensure compliance with design specifications and safety standards.

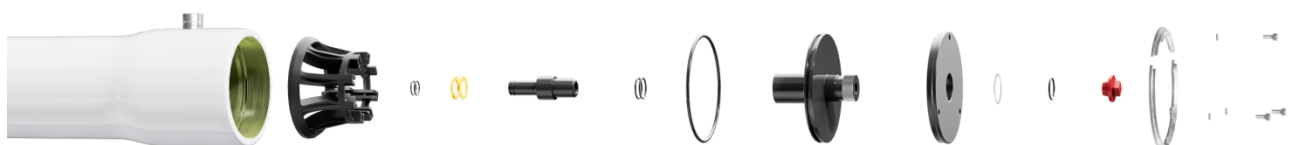
1.1 Product Identification

For identification, the FRP pressure vessel's model is on the End Cap and its serial number is inside the shell end.

Model Description



3D End Cap Assembly View



1.2 Operating Specifications

- **R80-300S Design Pressure:** 300 PSI / 2.1 MPa / 21 Bar
- **R80-4500S Design Pressure:** 450 PSI / 3.1 MPa / 31 Bar
- **Maximum Permeate Pressure:** 125 PSI / 0.86 MPa / 8.6 Bar
- **Minimum Operating Temperature:** 20°F / -7°C
- **Maximum Operating Temperature:** 120°F / 49°C
- **Factory Test Pressure:** 1.1 × Design Pressure
- **Operating pH Range:** 3 – 11
- **Cleaning pH Range:** 2 – 12 (maximum 30 minutes exposure)

1.3 Intended Use & Safety Precautions

- **Pressure Limits:** Do not exceed the design pressure of the specific model.
- **Vacuum Conditions:** Avoid vacuum conditions; install vacuum breakers if necessary.
- **Membrane Compatibility:** Designed for standard 8-inch nominal diameter spiral-wound elements.
- **Installation Hardware:** Ensure element adapters are installed at both ends before operation.
- **Vessel Expansion:** Allow for axial and radial expansion during pressurization. Do not over-tighten support straps/saddles.
- **Non-Load Bearing:** Vessels must not support other system components. All connections must be flexible and non-load bearing.
- **Alignment:** Align side ports with system manifolds. Misalignment can cause stress concentration and failure.
- **Overpressure Protection:** Install appropriate safety devices in the system.
- **Regular Inspection:** Periodically inspect end cap and side port for corrosion or damage.
- **Thrust Ring:** Must be installed at the downstream end of the vessel.
- **Pressure Relief:** Always relieve system pressure before performing any maintenance.
- **Permeate Port Connection:** Do not over-tighten permeate port fittings. One turn past hand-tight is typically sufficient.

- **Chemical Exposure:** Operate within specified pH ranges. Flush with permeate water before extended shutdowns.
- **Environmental Protection:** Do not install vessels under direct sunlight or in corrosive environments.
- **Membrane Support:** Minimize membrane movement by proper shimming during installation.
- **Warranty Notice:** Failure to follow these instructions may void the warranty and result in vessel failure.

Section 2: Installation

1. Review engineering drawings for dimensions and technical requirements.
2. Design and fabricate support racks according to drawings, ensuring independent support for vessels and manifolds.
3. Inspect vessel integrity, focusing on inner surfaces and Feed/Concentrate port sealing areas.
4. Allow sufficient clearance at both ends for membrane installation/removal.
5. Mount vessel on provided saddles at specified span locations.
6. Connect to manifolds, minimizing misalignment (refer to Section3).
7. Install strap assemblies; torque screws to 3–5 N·m. Do not over-tighten.
8. Assemble end Caps (refer to Section4).
9. Install membrane elements (refer to Section5).
10. Install thrust ring at downstream end.
11. Close the vessel (refer to Section6).
12. Connect permeate port manifolds.
13. Perform pre-operation inspection using Appendix I checklist.
14. Pressurize and commission system.

CAUTION

The vessel expands under pressure. The strap assemblies must not be over-tightened, as this can induce excessive compressive stress and cause damage.

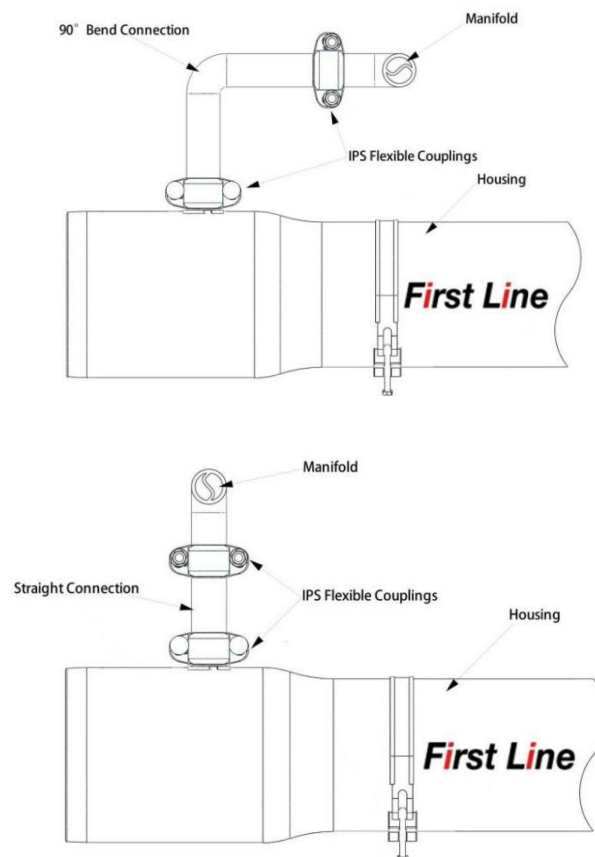
Section 3: Piping Connections

3.1 Permeate Port Connections

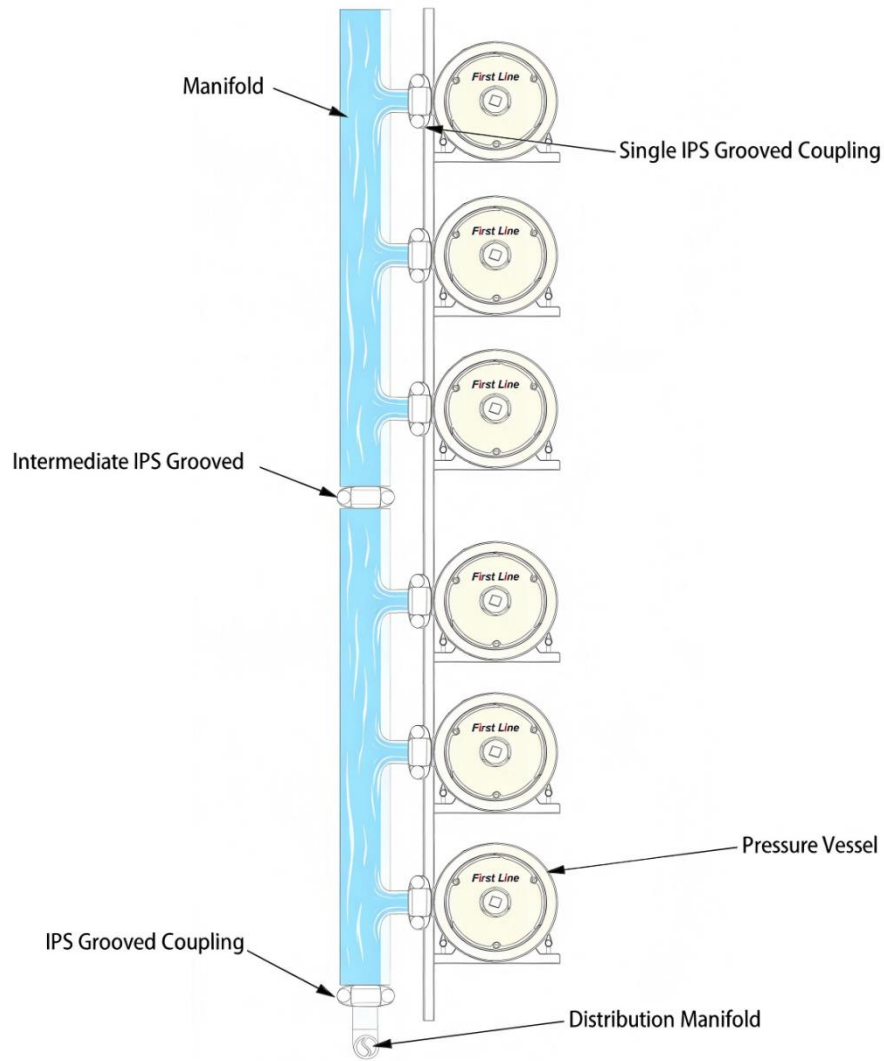
- Use flexible connections (e.g., U-shaped tubing with flexible connectors) to absorb vibration and movement.
- Provide independent support for permeate piping; do not use permeate ports as supports.

3.2 Feed/Concentrate Port Connections

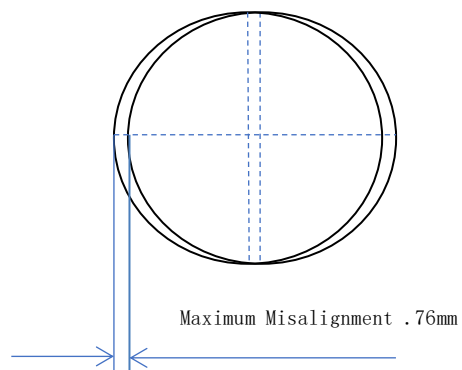
- Use flexible grooved couplings (IPS type).
- Do not rigidly connect manifolds directly to vessel ports.
- Support all manifolds independently.
- Allow manifold span to exceed vessel span to accommodate pressure-induced growth.
- Recommended: Use two IPS flexible couplings with a pipe section between vessel and manifold for optimal flexibility



- Acceptable: Single IPS coupling connection requires precise alignment.



- Alignment tolerance: Maximum 0.76 mm misalignment in any direction



- Ensure couplings can be hand-tightened without excessive force.

Section 4: Maintenance Guide

4.1 Preventive Maintenance

- **End Caps:** Regularly clean salt/corrosion deposits. Inspect for deterioration.
- **Side Ports:** Check for leaks. Inspect couplings for corrosion. Keep areas dry.
- Schedule maintenance based on operating conditions and manufacturer recommendations.

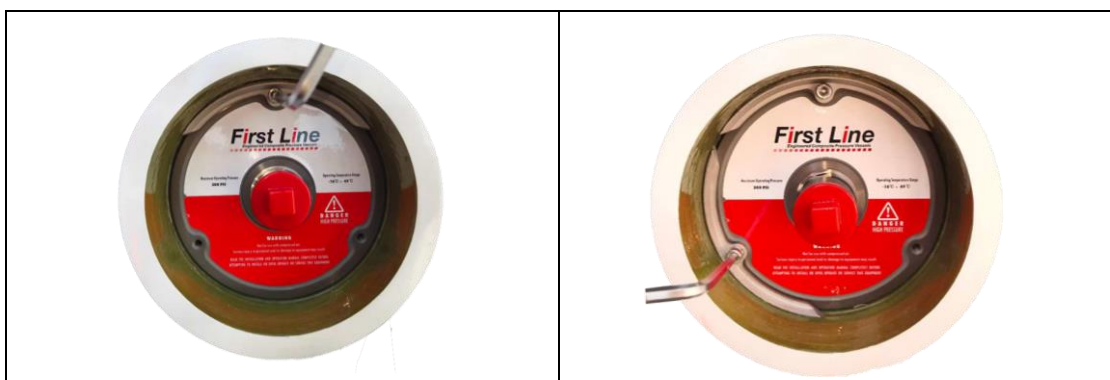
WARNING

Thoroughly review this section before any service work.

Do not proceed until the system is fully shut down and the vessel is confirmed to be at zero pressure.

4.2 Opening the Vessel

1. Shut down system and relieve all pressure.
2. Disconnect permeate port piping carefully.
3. Inspect end cap for corrosion/damage.
4. Remove locking kit segment screws with hex wrench.



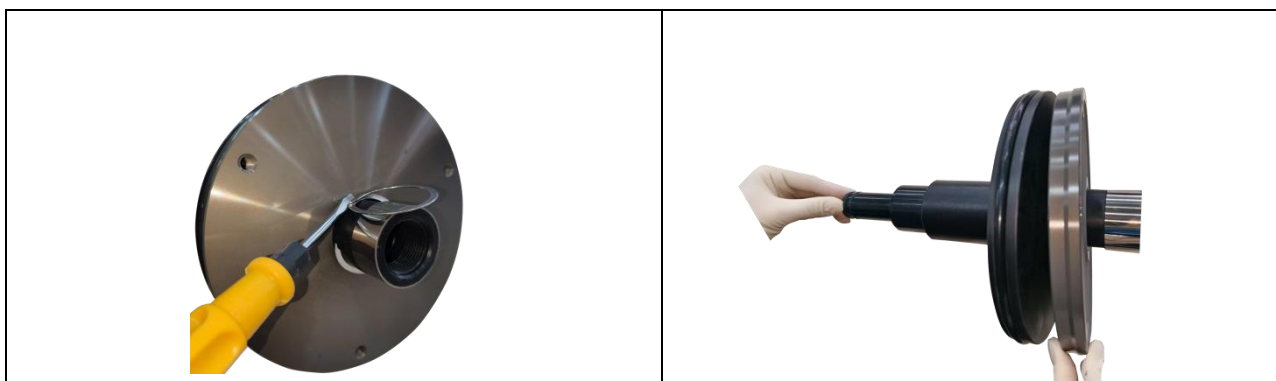
5. Remove end cap using First Line removal tool or approved alternative method.

First Line Removal Tools



4.3 Head Disassembly

1. Remove permeate port locknut (left-hand thread – turn clockwise to loosen).
2. Separate bearing plate from sealing plate.



3. Remove adapter and seals from permeate port.
4. Remove seals from permeate port and sealing plate.



Exploded View of End Cap Assembly



CAUTION

Carefully remove the seals to avoid damaging the sealing surfaces.

It is recommended to replace all used seals with new ones.

4.4 Head Assembly Cleaning and Inspection

- **Metallic Parts (bearing plate, locking kit segments, screws):** Clean with mild dishwashing liquid solution, remove deposits with non-abrasive tools. Rinse, dry, and inspect for coating damage or structural defects.
- **Non-Metallic Parts (sealing plate, permeate port, adapter, seals):** Clean, rinse, dry, and inspect for cracks, wear, or deformation.

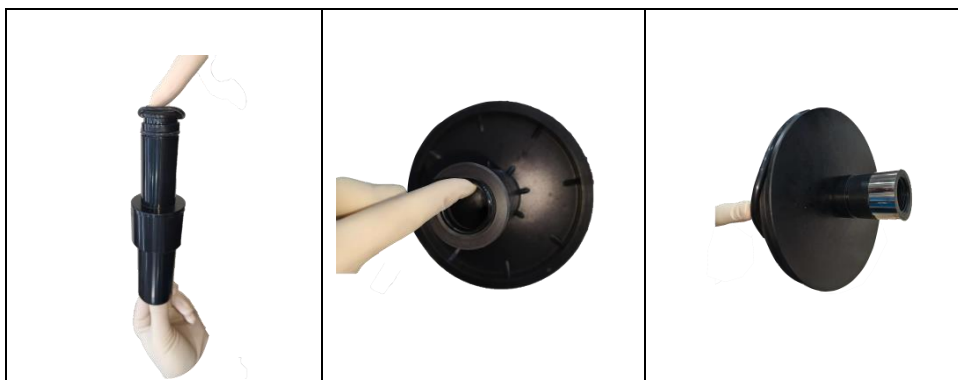
CAUTION

Replace all seals during reassembly.

Do not attempt repairs on FRP components without consulting First Line. In the event of **chemical reaction problems** (e.g., cracks or discoloration) on the vessel or components, notify First Line immediately at: support@firstline.com.cn.

4.5 Head Assembly

1. Lubricate and install all seals using approved lubricant (e.g., glycerin).



2. Assemble sealing plate and bearing plate.
3. Install permeate port locknut (left-hand thread – turn counterclockwise to tighten).
4. Install adapter.
5. Install head O-ring into sealing plate groove.



Assembled End Cap



CAUTION

Always use **new seals** coated with glycerin lubricant for any head assembly or reassembly. **Do not** attempt repairs on FRP components without consulting First Line. In the event of **chemical reaction problems** (e.g., cracks or discoloration) on the vessel or components, notify First Line immediately at: support@firstline.com.cn.

Section 5: Loading/Replacing Membrane Elements

1. Ensure zero pressure in vessel.
2. Open vessel per Section 4.2.
3. Remove thrust ring (downstream end).
4. Remove adapters from both ends.
5. Clean vessel interior.
6. Unload membranes in direction of flow (from concentrate end).
7. Clean and inspect vessel interior and Feed/Concentrate ports.



300PSI/450PSI

8. Install downstream head with thrust ring.



Lubricate vessel interior and membrane seals with 1:1 glycerin/water solution.

9. Load membranes from feed end, using interconnectors as required.
10. Ensure final membrane seats properly against thrust ring.

Section 6: Closing the Vessel

Take care to prevent scratching the inner surface of the vessel during membrane element removal or installation.

Thoroughly **read** this section before closing the vessel.

Never install corroded or damaged parts.

Ensure all closure steps are fully complete before pressurization.

Failure to follow these instructions may lead to catastrophic failure.

1. Verify head assembly is complete (Section 4.5).
2. Confirm membranes are properly loaded.
3. Inspect vessel interior and sealing grooves.
4. Check Feed/Concentrate port condition.
5. **Shimming (if required):** Measure gap between adaptor and permeate port; add 2 mm shims as needed to prevent membrane movement.
6. Install upstream head with lubricated O-ring.
7. Install the permeate port plug (equipped with a seal). Hand-tighten only. Do not use tools or exceed hand-tight force.
8. Install locking kit segments; torque screws to 10 N·m.



9. Reconnect piping per Section 3.
10. Complete Pre-Running Checklist (Appendix I).

Section 7: Handling and Storage

7.1 Vessel Handling Precautions

- Never drop or impact vessel.
- Use protective padding during movement.
- Do not lift by ports or piping.
- Avoid scratching interior surface.
- Do not climb on or stack heavy items on vessel.
- Damaged vessels must not be used.

7.2 Storage Requirements

- Store in original packaging.
- Temperature: 20° F /-7°C to +120° F /49°C
- Humidity: 40%–70% RH.
- Light: Below 100 Lux.
- Stack height: Maximum 3 units.
- Store separately from other products.

Section 8: Troubleshooting and Solutions

8.1 Locking Kit Segment Issues

- **Stuck screws:** Apply penetrating fluid (WD-40/LPS-1). Tap gently.
- **Damaged screws:** Cut with angle grinder, drill out remainder, re-tap threads (M8).

8.2 Head Issues

- **Leaks:** Check seal condition, pH/temperature exposure. Replace seals.
- **Damaged components:** Replace sealing plate, permeate port, or bearing plate as needed.

8.3 Vessel Issues

- **Seal surface scratches:** Light scratches – polish with 600-grit wet sandpaper. Deep damage – consult First Line.
- **Cracks/corrosion:** Check pH exposure. Replace vessel if structural layer is affected.
- **Body damage:** Minor damage can be repaired with epoxy/fiberglass. Major damage requires vessel replacement.

8.4 Feed/Concentrate Port Issues

- **Leaks:** Replace seals or ports. Ensure proper alignment with manifolds.
- **Installation:** Lubricate seals, insert port from inside vessel, secure with retaining ring.

8.5 Low Permeate Quality

- **Damaged adaptor seals:** Replace seals.
- **Membrane movement:** Add shims to eliminate gap (seeSection6.1).

Section 9: Service Guide

CAUTION

Avoid damaging the bearing plate, vessel, and permeate port during cutting. **Wear a helmet and mask** for personal protection. **Should leakage occur** at the Feed or Concentrate port, please contact First Line. **To prevent damage** to the vessel's inner surface from falling Feed/Concentrate ports, place soft mats inside prior to removal.

Avoid scratching the inner surface of the vessel's side holes during Feed/Concentrate port installation.

First Line provides:

- **One-year warranty** on materials and workmanship under normal use.
- **Lifetime technical support.**
- **Response time:** Within 8 hours for inquiries.
- **On-site support:** Available within 48 hours if required.

Exclusions:

- Damage from improper transport, installation, operation, or maintenance.
- Operation outside specified parameters.
- Altered documentation or missing certificates.

Contact:

Phone: +34 678 42 01 32

Email: customer.care@firstline-global.com.

Website: www.firstline-global.com

Appendix I: Pre-Running Checklist

Appendix II: Maintenance Checklist

Appendix III: Engineering Drawings (Contact First Line for latest versions)

Appendix IV: First Line Limited Warranty (See attached terms and conditions)

Appendix I

Pre- Running Check List

Drawing No.	Pressure rating	Vessel No.
Name	Items	Status
Membrane elements	Membrane elements are loaded as specified.	YES ☐ NO ☐
	The adaptor is installed as specified.	YES ☐ NO ☐
	The thrust ring is installed as specified.	YES ☐ NO ☐
Pressure Vessel	All components are clean and in sound condition.	YES ☐ NO ☐
	The vessel is installed and secured as specified.	YES ☐ NO ☐
	The head is assembled as specified.	YES ☐ NO ☐
	The locking kit segments are installed as specified.	YES ☐ NO ☐
	The pressure gauge on the closed vessel reads the	YES ☐ NO ☐
Piping Connections	Piping is connected as specified without stress	YES ☐ NO ☐
	All piping components are in sound condition.	YES ☐ NO ☐

Installation staff:_____

Installation date:_____

Inspector:_____

Inspection date:_____

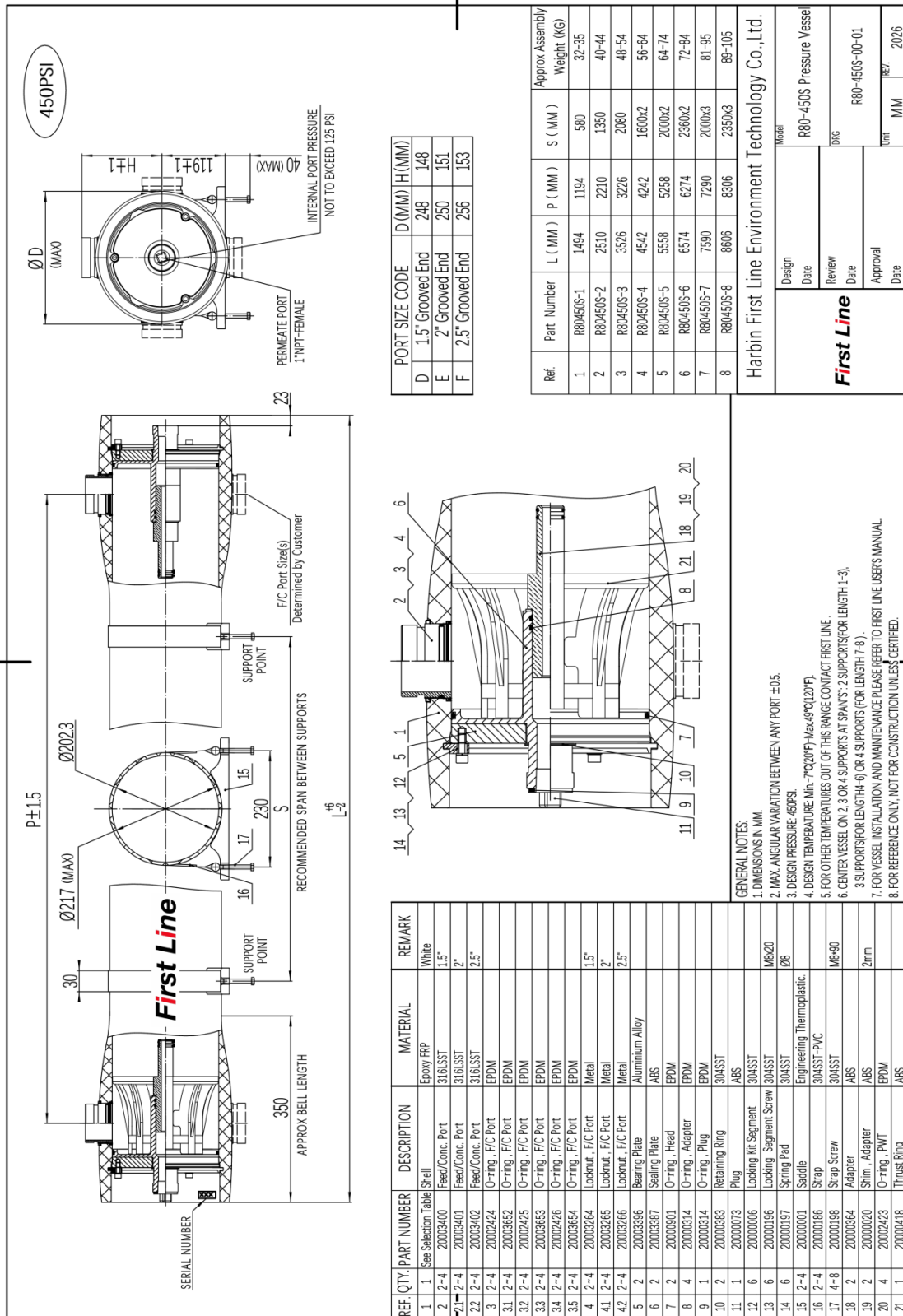
Appendix II

Maintenance Check List

Name		Vessel No.	
Pressure rating		Work pressure	
Running time		Times of maintenance	
Item	Status	Treatment	
Corrosion	YES? NO?		
Deterioration	YES? NO?		
Damage	YES? NO?		
Leakage	YES? NO?		

Inspector: _____ Maintenance staff: _____

Inspection date: _____ Maintenance date: _____



REF. QTY.	PART NUMBER	DESCRIPTION	MATERIAL	REMARK
1	1	See Selection Table	Shell	White
2	2-4	Feed/Conc. Port	316L SST	1.5"
21	2-4	Feed/Conc. Port	316L SST	2"
22	2-4	Feed/Conc. Port	316L SST	2.5"
3	2-4	O-ring, F/C Port	EPDM	
31	2-4	O-ring, F/C Port	EPDM	
32	2-4	O-ring, F/C Port	EPDM	
33	2-4	O-ring, F/C Port	EPDM	
34	2-4	O-ring, F/C Port	EPDM	
35	2-4	O-ring, F/C Port	EPDM	
4	2-4	Locknut, F/C Port	Metal	1.5"
41	2-4	Locknut, F/C Port	Metal	2"
42	2-4	Locknut, F/C Port	Metal	2.5"
5	2	Bearing Plate	Aluminum Alloy	
6	2	Sealing Plate	ABS	
7	2	O-ring, Head	EPDM	
8	4	O-ring, Adapter	EPDM	
9	1	O-ring, Plug	EPDM	
10	2	Retaining Ring	304 SST	
11	1	Plug	ABS	
12	6	Locking Kit Segment	304 SST	
13	6	Locking Segment Screw	304 SST	M8x20
14	6	Spring Pad	304 SST	Ø8
15	2-4	Saddle	Engineering Thermoplastic	
16	2-4	Strap	304 SST-PVC	
17	4-8	Strap Screw	304 SST	M8x90
18	2	Adapter	ABS	
19	2	Shim, Adapter	ABS	2mm
20	4	O-ring, PWT	EPDM	
21	1	Thrust Ring	ABS	

Design Date		Model	
Review Date		R80-450S Pressure Vessel	
Approval Date		Dwg	
		R80-450S-00-01	
		Unit	
		MM	
		Rev.	
		2026	

Harbin First Line Environment Technology Co., Ltd.

First Line

Appendix IV

FIRST LINE LIMITED WARRANTY

Harbin First Line Environment Technology Co., Ltd (hereinafter called "First Line") RO vessels (the "Product") are warranted to the original purchaser (the "Customer") under normal use and if installed, operated and maintained in accordance with applicable User Guides to be free of defects in material and/or workmanship for a period of (18) months from date of manufacture subject to the following. Any replacement Product or Part will be warranted only for the remainder of the original warranty period or thirty (30) days, whichever is longer.

Exclusions from this Limited Warranty

The warranty shall be void if:

1. Defects are not reported during the warranty period.
2. The Product is subject to accident, damage, incorrect installation, mishandling, abuse, misuse, negligence or accident by any other party.
3. Problems caused by modification or alteration.
4. Chemical exposure or acts of nature.
5. Any item manufactured by other companies.
6. Wear on replaceable components under normal conditions – seals are excluded from this warranty.

Procedure for Obtaining Warranty Performance

First Line reserves the right to determine if a reported defect is a breach of this warranty. This may require, at First Line's discretion, one or more of the following:

1. An inspection or test of the Product and/or the system in which it was installed by an First Line representative the customer is responsible for arranging access to the Product.
2. An inspection or test of the product and/or the system in which it was installed by the Customer.
3. An inspection or test of the product and/or the system in which it was installed by third party inspector appointed by First Line.
4. Return of the Product to First Line's factory for inspection or testing. This is not a statement of limitations for warranty performance and First Line reserves the right to conduct warranty performance outside of the items shown.

If the Product is found by First Line to be defective under the terms of this warranty, First Line will perform one of the following at its option:

1. Supply a substantially similar replacement part based on FOB factory terms.
2. Conduct a field repair of the Product.
3. Issue a credit for the original cost of the Products. This is not a statement of limitations for warranty performance and First Line reserves the right to conduct warranty performance outside of the items shown.

Products returned to First Line for inspection or testing must be shipped freight prepaid at the Customer's expense. If a breach of warranty is confirmed, First Line will bear all costs related to the inspection and testing. If the Product failure is found to be caused by cause other than breach of warranty, all costs related to the inspection and testing of the Product will be borne by the Customer. This includes per day fee and all related travel expenses.

All reported defects must be submitted to First Line in writing.