

CHEMICAL REFINERY**Maximizing O&M Cost-Savings with an Anti-fouling and High Durability RO Membrane**

Product type: **Highest Rejection BWRO**
RO models: **LG BW 400 R G2**

Application:
Industrial Boiler Feed

Background

A continuous supply of high-purity boiler feedwater is critical for the stable operation of various industries. A multinational chemical company operating a refinery in Texas is an example that uses an Operation and Maintenance (O&M) firm to manage a containerized reverse osmosis (RO) system for boiler feedwater production for the refinery. The RO system consists of three skids in a 10:5:3 pressure vessel array with six elements per vessel. When one set of membranes is taken offline for cleaning, a second set is installed to ensure continuous service. The RO permeate is treated further via ion exchange before entering the boiler feed system.

O&M Strategy

In December 2020, as part of an ongoing focused improvement project, a parallel membrane study was conducted to assess the relative merits of three major RO membrane supplier products in the containerized RO skid. The focused improvement goals are listed in Table 1.

“Throughout the pilot study, LG BW 400 R G2 membranes have maintained their position at the top of all performance metrics. Combined with outstanding physical design attributes resulting in increased longevity and reduction in labor hours, LG BW 400 R G2 is our number one choice for replacement membranes, with hundreds installed within the last six months.”

Robert M, O&M Manager

Due to the adverse (extremely variable TDS and TSS) nature of the feedwater at this location, a significant portion of the O&M costs is allocated to the frequent cleaning, testing, and RO membrane replacement to meet or exceed water customer quality specifications. As a result, membrane robustness and performance stability were the key membrane properties evaluated, especially after frequent membrane cleanings. LG Water Solutions provided its highest rejection and anti-fouling membrane model, BW 400 R G2, tested against two equivalent competitor models (see Figure 1).

Membrane Pilot

The test membranes were loaded in three pressure vessels in the first stage of one skid. During cleanings, membranes

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in Set A are taken offline while Set B is installed to continue operation. When Set B requires cleaning, the newly cleaned Set A membranes are re-installed. The permeate production was set at 26.5 ±0.5 gpm for each pressure vessel at start-up and after each clean-in-place (CIP) cycle by adjusting individual permeate flow control valves. The permeate pressure after each pilot pressure vessel was also recorded. As per the requirements of the RO system, the test elements typically underwent an offsite cleaning every two weeks due to various organics and inorganics that led to a high fouling tendency of the feed water.

The CIP protocol is as follows:

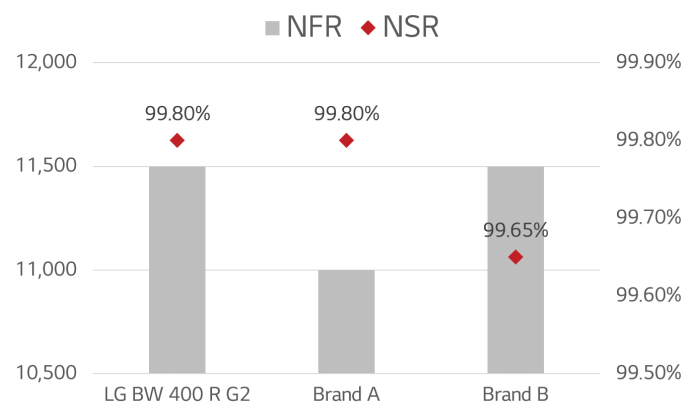
- Cleaning at 11.2 pH followed by 2.7 pH (+/- 0.2)
- Two hours at 95° F at each pH
- High-velocity cleaning using specific RO cleaning chemicals.

Table 1: O&M Improvement Project Goals

1. Increase time between membrane cleanings
2. Increase the membrane life cycle:
 - a. Decrease total number of membrane cleanings per membrane (equipment life improvement);
 - b. Reduce membrane early failure rate (damage/performance)
3. Improve water quality: decrease % rejection drop rate between membrane cleanings
4. Reduce labour hours associated with RO membrane changeouts

Figure 1: RO membrane specifications*
NFR = normalized flow rate / NSR = normalized salt rejection

*Based on manufacturer's data sheet



Results

When compared to other RO membrane models, the membrane study revealed the following about LG NanoH₂O™ RO membranes:

- LG BW 400 R G2 performed with less variation in normalized permeate flow (NPF) rate and its decline throughout numerous cleaning cycles over more than 15 cleanings in a period of nearly 14-months (see Figures 2A and 2B).
- After frequent cleanings, BW 400 R G2 in both sets produced the lowest normalized salt passage, while competitor membranes experienced a considerable increase (see Figures 3 and 4).

Using highly durable membranes can significantly extend the life cycle of a RO system by reducing membrane replacements caused by losses in permeability and salt rejection. The membrane study established the value and durability of LG BW 400 R G2 membranes in an industrial plant setting with high fouling conditions and frequent CIP requirements that commonly lead to quicker membrane performance loss over time.

Contact LG Water Solutions today to see how our RO membrane solutions can help improve your O&M strategy and Maximize Plant Uptime.

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Plant Uptime**

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