Case History

FILMTEC™ BW30-400/34*i* Elements

Help to Reduce Costs by Increasing Normalized Permeate Flow and Reducing Pressure Drop

Dow
Water Solutions

Site Information

Location: Midwest Utility, USA
Purpose: Evaluate elements with 34-mil feed spacer
Time in Operation: Since April 2005
Comparative Performance: Elements with the 34-mil feed spacer:

- Increase normalized permeate flow
- Reduce pressure drop
- Require less frequent cleaning
- Reduce costs

Installation of FILMTEC™ BW30-400/34*i* elements with a 34-mil feed spacer helped a Midwest generating station reduce operating costs by increasing normalized permeate flow and reducing pressure drop. *iLEC*™ technology eliminated the need for multiple sliding interconnector seals between adjacent membrane elements.

Introduction

This Midwest generating station supplies electricity and steam to the industry, businesses, and homes of a city in Iowa. The reverse osmosis (RO) feed water is taken from surface water from the city of Cedar Rapids. Although the conventional FILMTEC™ BW30-400 elements installed in 2001 performed well, fouling became a problem because of the issues commonly associated with the fouling tendencies of surface water. A planned plant upgrade in 2005 offered the opportunity to evaluate two new improvements: a 34-mil feed spacer and *iLEC*™. In April 2005, FILMTEC BW30-400/34*i* elements featuring a 34-mil feed spacer and *iLEC* technology were installed to compare performance with a new set of standard FILMTEC BW30-400 elements with a 28-mil feed spacer installed on an adjacent train.

Benefits of 34-mil Feed Spacer

The function of the feed spacer is to provide an area for the feed water to pass from the feed to the concentrate end of the element. It also provides turbulent flow against the membrane surface, which helps prevent fouling and concentration polarization. It has been frequently observed that wider feed spacers enable more turbulence and more effective membrane cleaning. Additionally, the flow dynamics and increased turbulence provided by the 34-mil feed spacer is more effective at preventing foulants from attaching to the membrane surface. FILMTEC™ BW30-400/34*i* elements use the same 34-mil feed spacer as FILMTEC BW30-365 elements.

Benefits of *iLEC*™ Technology

iLEC™ technology eliminates the need for multiple sliding seals between adjacent membrane elements, reducing the number of sealing surfaces per connection to a single, axially compressed o-ring. The result is reduced permeate pressure drop and a high-integrity, leak-tight seal that will not require lubrication or other maintenance during the life of the element.

Elements using *iLEC* technology are installed in minutes with a level of effort comparable to that associated with standard interconnectors. Customers have reported that loading a pressure vessel with *iLEC* technology takes approximately 30 percent less time compared to loading a pressure vessel with conventional elements.

Plant Design

Feed water for the plant is taken from surface water from the city of Cedar Rapids, Iowa. The feed water total dissolved solids (TDS) is approximately 220 mg/L. Pretreatment of the RO system consists of multimedia filtration, 5-µm cartridge filters, sodium bisulfite, and antiscalant.

The RO plant consists of three RO units. Each unit is designed to produce 400 gpm (91 m^3/h) permeate at 80 percent recovery. The configuration of each RO unit is identical, consisting of two stages with 11:5 pressure vessel configuration. Each pressure vessel contains six membrane elements. Two RO units are equipped with FILMTEC BW30-400 membrane elements (RO B); one RO unit is equipped with FILMTEC BW30-400/34*i* membrane elements (RO A). The permeate is used for boiler feed water and steam.

Plant Performance

The new installation began operation in April 2005. There are a number of performance advantages with the train using the 34-mil feed spacer. Differential pressure drop for the elements with the 34-mil feed spacer is about 30 percent to 60 percent that of the elements with the 28-mil feed spacer (Figure 1 on next page). In addition, permeate flow rate (Figure 2 on next page) is about 5 percent higher, while salt passage (Figure 3 on last page) is slightly lower. The train with elements using the 34-mil feed spacer also requires less frequent cleaning than the train with the 28-mil feed spacer. The cost savings due to lower feed pressure alone is estimated to be more than $100 per element over a three-year operating life with the BW30-400/34*i* elements, compared to standard BW30-400 elements.

The customer preferred to eliminate the acid addition because of safety and handling reasons. In August 2005, after discussions with Dow Water Solutions technical personnel, the customer eliminated acidification and increased antiscalant dose rate. The salt passage of the membrane elements was reduced by more than 50 percent by operating at pH 8.1 compared to operating at pH 6.4, resulting in higher purity water. Figure 3 shows the effect of feed water pH on the salt passage.

Figure 1. Comparison of differential pressure for elements with 34-mil feed spacer or 28-mil feed spacer.

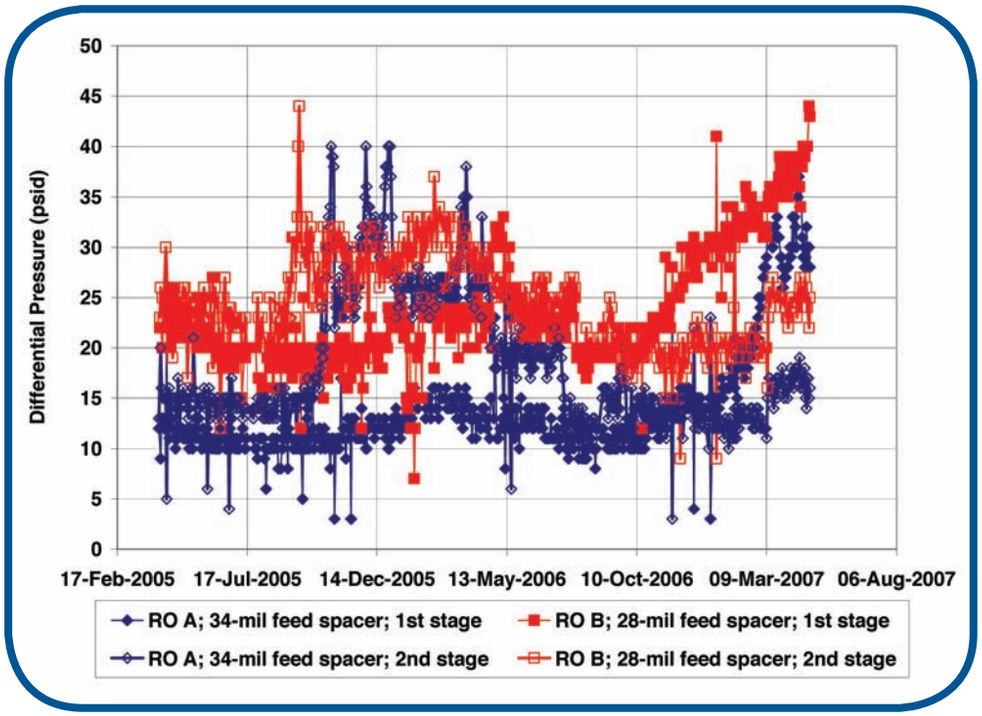


Figure 2. Comparison of normalized flow for elements with 34-mil feed spacer or 28-mil feed spacer.

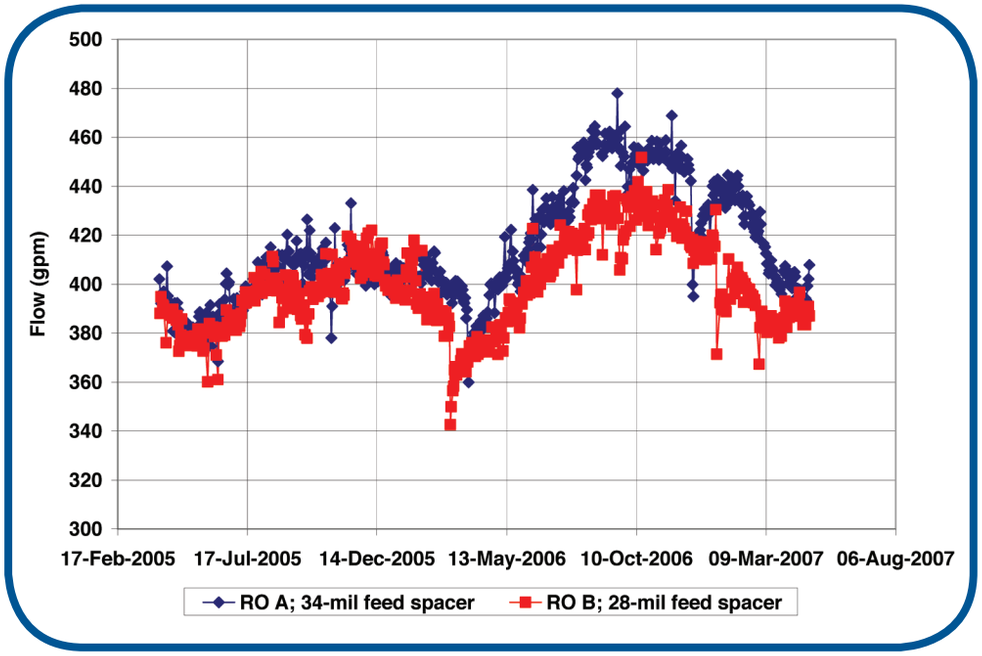
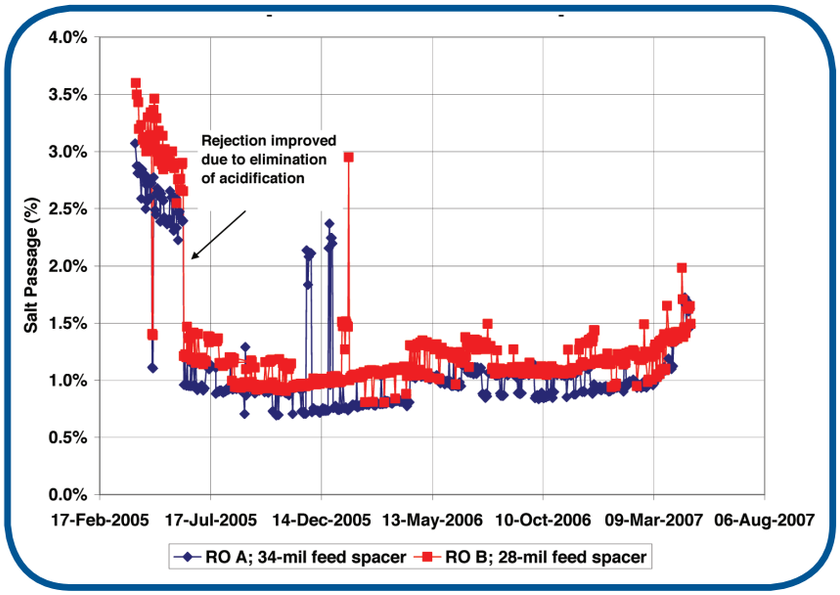


Figure 3. Comparison of salt passage for elements with 34-mil feed spacer or 28-mil feed spacer.



Conclusions

Through two years of operation, FILMTEC™ BW30-400/34*i* elements with 34-mil feed spacer and *iLEC*™ technology required less frequent cleaning than equivalent elements using a 28-mil feed spacer (FILMTEC BW30-400) and showed 30 percent to 60 percent lower pressure drop. Normalized permeate flow increased by 5 percent while maintaining a slightly better salt rejection. In addition, eliminating acidification resulted in rejection improvement of the RO system. All of this has resulted in savings because of less chemical consumption in the operation of the downstream mixed-bed ion exchange beds. Estimated overall operating cost reduction due to the lower feed pressure alone is more than $100 per element over a three-year operating life.

For More Information

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