

Seven things you must know before selecting solenoid valves for your reverse osmosis system

*by Anne-Sophie Kedad-Chambareau,
Product Marketing Manager, ASCO
Roy Bogert, Senior Product Engineer, ASCO
David Park, Senior Product Engineer, ASCO*



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Introduction

Membrane-based reverse osmosis (RO) filtration systems offer valuable service in a wide variety of industrial and commercial settings. They purify water, improve taste, and provide savings in food and beverage processing; increase energy efficiency in boilers; and supply a range of other benefits in applications from water jet cutting, vehicle washing, and humidification to restaurant and grocery use.

One important component of these systems, typically used at several critical points, is the *solenoid valve*. Design engineers working for original equipment manufacturers (OEMs) face multiple options — and issues — when selecting these complex, highly engineered devices for their systems.

Beyond the usual considerations of correct sizing and wattage, experienced designers are aware that many current models may exhibit worrisome performance problems, as well as difficulties relating to certifications, availability, ease of assembly, and support, among others.

Fortunately, valve technologies are now available that avoid many or all of these problems, while providing significant benefits for OEM and end user alike. This report guides designers and specifiers in choosing the right valve to make a major positive impact on budgets, equipment life, and time to market.

1 What you must know about the valve you select

Does it have the proper certifications?

OEMs must accommodate new regulations in many parts of the world, including those specifying the use of lead-free products and more. For instance, most current U.S. plumbing codes and state drinking water regulations demand that RO equipment for potable water applications meets NSF 61-G leachate and lead-free requirements.



However, regulations and their means of adoption have been changing with relative rapidity, leaving many OEMs confused — and concerned. Caution is advisable. In specifying composite valves for these RO systems, pay close attention to how prospective vendors state their products' certification status.

Some don't mention NSF certification at all. Likely conclusion: the given product does not possess it. This should be a red flag. It could legally preclude use of an OEM's RO system incorporating the vendor's valve in certain North American localities such as in California or Vermont. Furthermore, S. 3874, the "Reduction of Lead in Drinking Water Act," will be effective in January 2014 all across the USA. This act modifies the Safe Drinking Water Act (amended in 1986), that defines "lead free" with regard to pipes, pipe fittings, plumbing fittings and fixtures. Other vendors may claim their product "complies" with a certain standard. However, untested and uncertified compliance does the OEM little good in jurisdictions that may require the certification itself. Design engineers should look for valves that possess all the certifications necessary for your intended application. For example, the new 212 Series composite valves from ASCO are tested and certified by NSF International (accredited by ANSI and the Standards Council of Canada) for all applicable ratings. Valves suitable for applications such as water jet cutting, vehicle washing, boilers, and humidification systems are tested and certified to NSF 372 (weighted average lead content for lead-free applications using industrial purified water). For potable water applications such as food and beverage processing and restaurant steamers, relevant models are tested and certified to NSF 61 Annex G (for drinking water leachate requirements, and low lead content) and NSF 169 (for special-purpose food equipment and devices). They're also tested and certified to NSF 42 for drinking water treatment units — aesthetic effects.

2 Will it be available when needed?

Most OEM designers must depend more and more on the ready availability of composite valves for their RO systems. Today's lean manufacturing methodologies demand it, as do the lower work-in-process inventory requirements now common in OEM operations.

But just when it's become more important than ever, availability has proved an Achilles heel for a number of composite valve vendors. Their response to ongoing doldrums in the world economy has included cuts in staffing and limits in their own inventories of materials and components — all efforts to reduce capital requirements. Unfortunately, these measures often result in long lead times and uncertain scheduling for their customers, threatening your assembly target dates, or prolonging plant downtimes.

When evaluating valve makers, designers and purchasing managers must take a good look at availability. Does the supplier have established quick-shipment programs? Do



the programs cover your locality? Are the composite valves you want — as well as other products you might buy from the same company — included in those programs? What lead times and delivery schedules do they claim? Each vendor with such a program tracks its on-time percentages; ask about its record of meeting shipment dates for those commitments.

3 Is it reliable?

Certain other characteristics must also be carefully considered when selecting composite valves for RO applications. They can have a real impact on product reliability, maintenance costs, and service life.

Unfortunately, it's not uncommon for some composite valves used for these applications to leak — even after only a few thousand operating cycles. This issue may be caused simply by poor connection system design (see next section). However, it can also be due to out-of-spec pressure or thermal stress on the connection or other parts of the valve.

Some vendors offer composite valves that simply aren't designed or rated for the higher pressures and temperatures inherent in some RO system applications. The vendor may or may not consider these limits when selling the valve. Ultimately, it behooves the designer to make sure the valve's ratings are adequate for the job.

Passing the test

Headquartered in Gurnee, Illinois, Corrigan Corporation of America is a leading U.S. manufacturer of high-quality systems for produce misting, humidity, and water filtration. To avoid corrosion, water inlet control on its three major product lines — including the HyperSoft reverse osmosis system — is performed by a composite-bodied solenoid valve.

"For years, we had unbelievable supply problems with this valve type," recalls Paul Jones, Corrigan's vice president of engineering. "Moldings would leak, or plunger assemblies would fail, or the wrong product would be shipped, or the maker would miss our deadline."

"We grabbed the chance to beta test the new ASCO composite valve," says Mike

Corrigan, president and CEO. "It can take the pressure. We're operating up to 70 psi. In addition, the valve has the NSF rating. Corrigan systems are NSF-certified, and it's very important that our valves also have that certification. Health departments and plumbing inspectors throughout North America recognize NSF and never have an issue with our equipment. And the valves are proven reliable up to 1 million cycles. We love that. We're seeing maybe 100,000 cycles per year. So our equipment will last longer than the whole grocery case," Corrigan said.

"We've had on-time delivery since the composite valve launched. I'd say we've put in 700 of them already. And every valve out there has performed," he said.



As a protective measure, many designers choose valves with ratings that slightly exceed levels expected in applying a given piece of equipment. The high points for this category would currently be represented by the ASCO composite valves available in ½-inch and ¾-inch line sizes, with durable thermoplastic bodies rated for pressures to 150 psi and temperatures to 180° F.

4 Can it connect easily and securely?

Frankly, connections can be a major concern when specifying composite valves for RO work. Many design engineers report frustration with valves utilizing traditional NPT and solvent bond connections, for example. These may require considerable trouble and expense in equipment design, installation, and assembly. (See next section.)

The logical alternative would be quick-connect valves. But experience has left many designers uneasy about the security of various quick-connect solutions available to date. Simply put, they can leak.

Fortunately, designers now have a better choice. Ongoing development efforts have produced a new type of quick-connect technology. ASCO's patent pending FasN™ universal connection system, introduced on its newest composite valves, provides an innovative turn-and-lock solution. Like other quick-connect systems, it's said to maximize ease and speed. But unlike some previous systems, it also prevents leaks.

FasN-equipped valves can be used with all three types of standard valve-to-pipe end connections: threaded pipe types with NPT thread; CTS or PEX tubing with turn-and-lock; and PVC with solvent bond. With all three types, users report highly secure, no-leak connections. So designers previously wary of such connections can now specify a quick-connect solution without worry.

5 Is it easy and economical to design and install?

Several situations can make integration of valve components into purified water and reverse osmosis filtration systems especially difficult and time-consuming.

Often, desired performance characteristics are maximized by using, for example, PEX tubing in one part of an RO system, and PVC or copper (CTS) tubing in another part. However, this requires the design, specification, purchase, assembly, and installation of custom fittings or adapters, at the place or places where components of differing types or materials must come together. When multiple such situations exist in a single piece of equipment, or in cases where OEMs must turn out high volumes of such equipment, added costs and lost time can be substantial.



Another issue may arise where composite valves threaded for NPT connection must be assembled or installed. The concern here: cracking.

When a piping assembly is put together, the valve is screwed onto the pipe with a given torque or pressure, to the tightness required for a good seal. However, this procedure usually will not leave the valve aligned correctly, for instance in an upright position, for proper mounting. So the valve must then be further rotated into its final position.

Problem: this further tightens the valve. With brass or stainless steel valve bodies, such overtightening does no harm. But depending on the degree of rotation involved, the thermoplastic threads of composite models may easily split or crack under the increased strain — ruining the entire valve. This cracking may only be evident when the system is pressurized (worst case: in the field), after which the entire component must be disassembled and replaced.

(Note that some models include stops to prevent overtightening. However, this presents assemblers with almost equally aggravating problems: they must then search for some other point in the system that can be tightened to compensate.)

In critical assemblies using composite valves, then, cautious engineers must often go to the trouble and expense of specifying two extra parts per valve, adding unions to each end.

Where the latest-technology connections are used, both these problems are resolved. For instance, ASCO composite valves with FasN connectors are proving to have the industry's greatest design flexibility, most rapid assembly, and lowest cost. They're currently the only models on the market equipped with three possible varieties of union coupling on each end — even on NPT-threaded models. So piping and valves of disparate

Connecting to savings

Especially in a high-production OEM environment, cost differences can be substantial when using newer technology versus conventional solutions. Example: ASCO composite valves with FasN connections demonstrate a measured labor savings of 35 seconds per valve, plus much greater materials savings depending on which type

of extra fitting or adapter would otherwise be required. Assuming 1000 RO units turned out per year, with 3 valves per unit, a study comparing FasN connection to NPT-threaded valves on PVC piping calculated savings of \$15,790 per year. Another — versus NPT-threaded valves on PEX tubing — showed savings of \$40,930 per year!



types and materials may be connected quickly and easily, with fewer piping accommodations and no custom fittings or adapters. Additionally, each NPT end coupling can be screwed onto the pipe with the required torque for a proper seal. The valve is then rotated freely to the proper position, and the union joint quickly and easily secured.

6 Is it available in both normally closed and normally open versions?

Even leading vendors may offer composite valves only in normally closed versions. This can force OEM designers to make unwelcome equipment compromises. For example, they may have to purchase expensive diverter valves to compensate for this lack of normally open models.

Look for a vendor that offers both normally open and normally closed composite solenoid valve versions. This can furnish needed design speed and flexibility, while simplifying sourcing with fewer part numbers to keep in stock.

It may even save money. Some customers buy a normally open plus a normally closed valve and wire them in series, gaining the functionality of a diverter valve for less cost.

7 Does it come with the right support?

When selecting your valves for an RO system, don't stop at hardware characteristics. Evaluate potential buys also on the level of support their vendors can offer.

Some suppliers put more energy and resources than their competitors into maintaining the quality of their support. Other vendors have spotty coverage due to basic geographical disadvantages. With North American customers, for example, products made by Asian or European manufacturers naturally face greater logistical challenges. Customers may find it takes considerable time to get answers, technical fixes, and onsite service or training.

Essentially

- The solenoid valve is more important than you might think to the success of a reverse osmosis filtration system.
- Valves are not created equal when it comes to issues such as availability, connection and installation, or reliable performance without leaks.
- Fortunately, some newly improved valve technologies can save trouble, time, and costs.



Additionally, satisfactory support should now extend beyond phone calls and site visits. The Web has greatly expanded support possibilities for companies that choose to use them. Does the prospective valve vendor's Web site provide good technical information on the product in question? Does it include specification assistance with sizing and application issues? How about 3-D engineering drawings and similar enriched content?

For maximum effectiveness, favor vendors with global technical and application support capabilities as well as extensive Web presences. Then investigate how well a given vendor provides local support in your area.

Conclusion

Conventional composite valves have presented several challenges to specifiers and designers. These have ranged from business concerns including availability and support to technological issues and connection drawbacks.

However, some vendors, using new composite valve technologies, can offer notable benefits when improved valves are specified for membrane-based filtration functionality in reverse osmosis systems. These advantages include up-to-date certifications; ready availability; high reliability even in challenging applications; quick, secure connection; ease of use and ensured savings in design, assembly, and installation; a choice of open and closed versions; and comprehensive, resource-rich support. For the OEM, they all add up to greater cost savings, longer ensured equipment life, and shorter time to market. Compare widely and evaluate carefully. You can find a composite solenoid valve that offers the right reliability and performance for your equipment's unique application.



Global contacts

www.ascovalve.com

ASCO

Location

World headquarters (U.S.A.)

Canada

Australia

Brazil

Mexico

France

Germany

United Kingdom

China

Singapore

Japan

Phone

(1) 800-972-ASCO (2726)

(1) 519-758-2700

(61) 2-9-451-7077

(55) 11-4208-1700

(52) 55-3640-0200

(33) 1-47-14-32-00

(49) 7237-9960

(44) 1695-713600

(852) 2-343-8580

(65) 6556-1100

(81) 798-65-6361

E-mail

info-valve@asco.com



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