



*Flowserve – Anchor Darling  
1/2” – 2” Small Valve Product Line*

# 1/2" – 2" Small Valve Product Line

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## Problem

Low cost, small-bore valves that have a very high life-cycle cost due to performance problems such as packing and seat leakage.

## Solution

Flowserve Anchor-Darling small-bore valves that are specifically designed for ALARA programs and long term, low overall cost.

## Introduction - 1/2"-2" Small Valves

Generally, the primary factor in selecting a specific small valve design is the initial purchase price. However, this initial outlay represents only a small percentage of the valve's total life cycle costs. In actuality, on-site installation and removal costs of small valves easily exceed the valve purchase price and therefore must become a prime consideration in the overall selection of a specific valve design. When a valve must be removed because of leakage or poor performance prior to its expected service life, these on-site costs become an even larger percentage of that valve's total life cycle costs. Consider the following costs, over and above the initial purchase price, associated with the replacement of a small valve due to premature failure:

- Work package development and planning
- Protective clothing/ALARA/QA concerns
- Disruption to system
- Removal of pipe insulation

- Maintenance/Disassembly to repair valve, if possible
- Cutting the problem valve from the line, if necessary
- Welding/prepping piping spool piece for new valve
- Installing new valve (upstream and downstream welds)
- Radiography of welds, if required
- Reinstallation of piping and valve insulation
- Disposal of contaminated waste
- Unnecessary inventory requirements

All of these factors make the initial price of a small valve insignificant if that valve fails prematurely. There is an alternative that can reduce these total life cycle costs: choosing a rugged, dependable, high-quality small valve product line from a supplier dedicated to the nuclear industry, the first time—every time.

## The Flowserve Product Range

As a major manufacturer of ASME Section III Nuclear valves 1/2" and larger, Flowserve Anchor/Darling Valves offers the most complete line of small valves developed specifically for nuclear service. Our small valve designs provide for lower total life cycle costs by addressing the primary concerns of the nuclear industry, including reliable operations, positive sealing, ease of maintenance and ALARA considerations. All valves are produced in the U.S.A. to ISO 9001 and 10CFR50 App. B quality programs and are available to ASME Section III Class 1, 2, 3, or

ANSI B16.34 requirements.

Flowserve's extensive small valve line includes the following product selections, many of which are available from stock in carbon steel (SA216-WCB) or stainless steel (SA351-CF8M) materials:

## Globe Valves

1/2"-2" 1878 Series Y-Pattern Globe Valves  
1/2"-2" 1878 Series T-Pattern Globe Valves  
1/4"-2" 1878 Series T-Pattern Instrument Needle Valves  
1/2"-2" 800 Series T-Globe Valves

## Gate Valves

1/2"-2" 1888 Series Double-disc Gate Valves  
1/2"-2" 1888 Series Parallel-slide Gate Valves  
1/2"-2" 800 Series Split-wedge Gate Valves

## Check Valves

1/2"-2" 1878 Series T-Pattern Piston Check Valves  
1/2"-2" 1878 Series Y-Pattern Piston Check Valves  
1/2"-2" 1878 Series Swing Check Valves  
1/2"-2" 800 Series T-Pattern Piston Check Valves  
1/2"-2" In-Line Check Valves (Class 150-1500)

## Ball Valves

1/2"-2" Three-piece Ball Valves (Class 150-600)  
3"-4" Three-piece Ball Valves (Class 150-300)

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Variations from these standard product selections are available, including options such as special materials, mountings for motor actuators and air actuators, and bellows seal configurations.

## Design Features

We developed our small valves to solve problems. Our standard designs reflect significant industry analysis and product research and development. In applications where competitor designs have faltered, our small valves incorporate various design features that enhance overall performance, extend service life, and lower overall life cycle costs. These features specifically target deficiencies existing in competitor designs, which have led to costly valve problems, including those explained in the sections below:

## Seat Leakage

Tight sealing capability—the most important function of a valve. Most, if not all, of our competitors have valve designs with integral seating surfaces and stem-guided disc-to-seat contact. This type of design, though less expensive to manufacture, does not provide maximum sealing integrity. Valves with stem-guided, integral seat designs, when coupled with marginal body strength and rigidity, cannot withstand the test of time under installed conditions. Bottom line—they leak. The Flowserve small valve line features a

separate, solid, hardened seat ring that is fully shouldered into a machined body pocket and high-temperature nickel-brazed into place. This rugged seating surface can be lapped in service, extending the valve's useful life.

The discs, similarly constructed of solid hardened materials, are fully body-guided. Smooth internal finishes and tight design tolerances give our valves the best possible disc-to-seat contact and sealing integrity.

Flowserve has put significant development effort and resources into enhancing the valve's critical sealing function. The result—valve designs with superior sealing performance.

## Bonnet Leaks

External leakage—one of the most noticeable and frustrating valve problems. Many of our competitors have bolted bonnet joints with only four studs. This design increases the likelihood that flange rotation will occur, resulting in external bonnet leakage.

Flowserve's small valve product line does not feature any bolted bonnet joint with fewer than six studs, ensuring sufficient bolt load for joint integrity. In addition, most of our small valve designs are available with ADVanseal pressure-seal bonnet joints. This design incorporates our unique die-molded graphite gasket, which creates an extremely tight seal and eliminates external bonnet leakage. Our 1878 Globe Valve design incorporates a unique bonnetless design, with all internals removed directly through the stuffing box.

This one-piece body design completely eliminates bonnet joint problems while providing for greater ease of maintenance.

## Packing Leaks

Again—frustrating and costly external leakage. Most competitors' valves experience packing leaks due in part to poorly designed or non-existent backseats. Without a proper backseating surface, packing leaks result, causing energy loss, potential corrosion of external parts, and contamination where system fluids are radioactive. This design flaw and others, including marginally designed stems and gland bolts, produce the leading causes of packing leaks. In contrast, the Flowserve non-rotating stem design aids in packing longevity.

Our small valve product line features fully machined backseats that mate properly with the stem to protect the packing from service pressure when the valve is fully opened. We also employ oversized, rugged stems for added rigidity and oversized gland bolts for positive loading. These design features greatly extend packing life and improve sealing performance.

## Body Designs

Inadequate body design forms the root cause of distortion due to piping stress and flow-induced turbulence. Our competitors' valves often incorporate marginally designed forged bodies.

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A large volume forging process does not allow for smooth flow transition nor does it provide for the consistent material properties required for the most critical valve component—the body. Marginal design leads to increased flexibility and additional piping stresses.

Flowserve's small valve product line utilizes rugged valve bodies produced from investment castings, providing for uniform material properties, superior finishes, and tighter tolerances than traditional forged or sand cast processes. This precision, "lost wax" casting process produces unmachined flow passages that are smooth and contoured to allow for superior flow profiles and reduced flow turbulence. Our investment cast bodies also have extra strength at the body inlet and outlet areas, thus eliminating piping stress concerns. We are extremely proud of our valve body design and investment casting process.

## Spare Parts

In evaluating small valves, the cost, fit-up, and performance of spare parts—even the need for spare parts themselves—must be considered.

Frequent requirements for spare part items such as stems, discs, glands, bolting, and other critical components indicate the existence of marginal, poor quality valve designs.

## Experience and Confidence

Flowserve's small valve product line has been proven—in service. We developed our 1878 and 1888 product lines specifically for nuclear primary systems. These valve lines have been in service at operating plants for over ten years with excellent performance results.

The design of 800 series valves is based on our modification to correct difficulties with other manufacturers' gate valves for BWR control rod drive systems. Our design was based on providing a new stem and disc assembly to be installed in the existing body. The unique split wedge with the half ball and socket solved the leakage problems that BWRs had been experiencing. Since 1986, we have provided over 4,000 of these assemblies.

The principle design of our 800 series gate and globe valves is taken directly from our experience and success with the BWR application.

## Conclusion: Small Valves and Total Life Cycle Costs

After considering all of the facets that go into the design, manufacture, purchase, and installation of small valves, it becomes apparent that the initial purchase price of the valve is only a small part to a much larger story. In order to determine if the price paid is truly the lowest price, it is necessary to evaluate the overall value received. Total life cycle costs, while initially difficult to quantify and evaluate, eventually tell the true story of the total price paid for a particular valve.

The topics discussed here, including removal and installation costs, product range and quality, design features, manufacturing methods, and overall experience and confidence are critical issues to consider in selecting a particular design. Upon a thorough evaluation of these parameters, it is evident that the Flowserve small valve product line is unmatched in the nuclear industry. Bottom line—our products perform in service and provide the lowest life cycle costs!



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For more information about Flowserve Corporation, contact [www.Flowserve.com](http://www.Flowserve.com) or call USA 1-800-225-6989

**Flowserve Corporation**  
**Flow Control Division**  
Edward & Anchor/Darling Valves  
1900 South Saunders St  
Raleigh, NC 27603 USA

**Toll – Free Telephone Service**  
(U.S. and Canada)  
Day: 1-800-225-6989

**After Hours Customer Service**  
1-800-543-3927

**U.S. Sales Office**  
Phone: 919-832-0525  
Fax: 919-831-3369

**Website:**  
[www.Flowserve.com](http://www.Flowserve.com)