

White Paper

# Control Valve Sourcing Has Gone Global... Should You Care?



# Control Valve Sourcing Has Gone Global... Should You Care?

Global sourcing is “business as usual” in today’s control valve marketplace in which the practice of combining assorted components from various resources around the world is the rule, not the exception.

## **Should this be a concern for a valve user?**

When dealing with a major valve manufacturer like Emerson, the answer is “no”.

There shouldn’t be any room for doubt when the manufacturer has multiple checks and balances in place that focus on product quality to ensure that valves operate as designed, need minimal maintenance, perform safely, and operate within environmental regulations.

Yet, despite such efforts by the manufacturer, a valve user may have remaining questions about global valve sourcing that most often center on the integrity of the core components of any valve—its castings—and their country of origin.

## Meeting Expectations

Emerson has a long-standing commitment to providing control valves that meet its customers’ performance criteria.

To fulfill that responsibility, Emerson maintains relationships with world-class foundries that can meet or exceed performance requirements in terms of conformity to material specifications, ability to cast complex components, casting quality, delivery integrity, and consistency.

The following provides a brief overview of the requirements and processes that Emerson has established and follows in the procurement and use of castings.

## Quality Specification Brings Global Assurance

Emerson enforces a comprehensive quality specification for their control valves that must be met by suppliers of pressure-containing and structural metal castings.

The quality specification includes more than a dozen requirements that apply to the following areas:

- Vendor Qualification
- Welding Procedures
- Marking
- Inspection and Testing
- Tryout and Sample Castings
- Production Castings
- Certification of Compliance

## Vendor Qualification

Emerson’s supply chain uses a rigorous qualification process when selecting a vendor. The process thoroughly investigates a potential supplier’s ability to meet material specifications, applicable international codes and standards, as well as specific valve requirements.

In the instance of castings, a foundry is considered “qualified” when it passes a critical evaluation by Emerson engineers. The foundry must demonstrate a record of qualification by a third-party inspection agency (ISO 9001:2000, ASME, A2LA, PED). It must pass a review of its quality program as well as Emerson-conducted, on-site audits of the foundry’s processes and procedures such as welding, heat treatment, and non-destructive examination. Additional proof of performance is determined by analysis of tryout castings to verify that the castings meet valve specifications.

## Welding Procedures

Welding is used during the production and upgrading of castings, such as when radiographic examination is required. Emerson has established welding requirements stating that procedures and welder qualifications must meet ASME Section IX or EN ISO 15614-1 and ISO 9606-1 (qualification) standards.

Similarly, each lot of weld filler must comply with ASME/AWS chemical analysis specifications. In Europe, compliance must be to EN499. Use of weld filler with “typical chemistry certification” is not allowed by Emerson’s weld requirements.

## Markings that Identify

Valve body castings have markings that identify the foundry that poured the casting and indicate the heat code. Material identification is also typically shown on the body casting, such as WCC, CF8M, CN7M and others.

## The Higher Cost of NDT

Nondestructive testing (NDT) of valve body castings not only adds cost, but also extends delivery time. Unless absolutely required, you can avoid the NDT “add-ons” by specifying standard valve constructions.

The following table provides examples of the added cost and time.

Requiring these NDT processes:	To this valve construction:	Adds this amount to net pricing:	Extends delivery by:
MT/PT	4”, CL600 globe valve	\$655	12 weeks
RT/UT	6”, CL1500 globe valve	\$5,248	20 weeks
RT/UT & MT/PT	20”, CL150 butterfly valve	\$6,017	20 weeks
MT = Magnetic Particle Testing PT = Liquid Penetrant Testing RT = Radiographic Testing UT = Ultrasonic Testing			

## Inspection and Testing



*Figure 1: Pressure-retaining components of a valve are subjected to hydrostatic testing to evaluate the parts' integrity. Visible leakage or seepage through a casting means automatic rejection.*

Emerson technicians conduct both visual inspections and mechanical tests on pressure-retaining castings.

As-cast external and internal surfaces are inspected visually for unacceptable irregularities, including hot tears and cracks, shrink, sand inclusions, veining, and rat tails.

Mechanical testing involves a hydrostatic pressure test to confirm the leak tightness of a valve's pressure-retaining parts, including the body and bonnet castings. The test procedure involves a fixture that closes off cavities that would be pressurized in service and then subjects the component to the hydrostatic shell test pressure appropriate for the valve body material and class.

ASME B16.34 sets out the hydrostatic test pressure to use for steel and alloy valves. It is calculated by multiplying the 38°C (100°F) working pressure by 1.5 and rounding to the next higher 25 psig increment.

Any visually-detectable weeping or leaking through the pressure boundary walls that are part of the valve assembly is a mandatory cause for rejection.

## Meeting Material Requirements

At Emerson, valve casting integrity (or quality) begins with specifications that call not only for premium materials, but also for the materials that work best in the intended applications. These application requirements include strength and ductility as well as resistance to certain factors, including the makeup of the controlled fluid, operating temperature, and flow velocity.

For instance, chemical composition must be controlled precisely to achieve an alloy's intended performance level.

Carbon steel castings for valves intended for use in oil and gas applications meet NACE SP0472 recommendations that chemical composition be controlled to less than 0.43% carbon equivalency. The lower carbon content improves weldability and reduces the potential for stress cracking by hydrogen sulfide typical in oil and gas production and processing applications.

Another example of materials tied to a specific application include those for upstream oil and gas production. Many of these applications occur in the arctic regions of Russia and Canada. For this service, castings are ASME SA 352 Grade LCC while forgings meet ASME SA 350 Grade LF2.

Many products with global use now comply with dual material specifications that meet both ASME and European standards. For example, steel castings are specified and certified to both ASME SA216 Grade WCC and EN 10213 Grade 1.0619.

Emerson often adds their own stringent requirements such as the heat treating of high nickel alloys, tighter chemical composition, or special welding procedures.

## High-Nickel Alloys: Composition and Quality Beyond Conventional Specifications

In the past, Emerson has supplemented conventional ASTM and ASME specifications to achieve the enhanced corrosion-resistance levels and high temperature capabilities provided by the high-nickel alloys. This is now accomplished by the new ASTM specification A990, which addresses both material composition and quality.

When a casting is to be CW2M or CN3MCu, the melt must be either AOD<sup>2</sup> or VOD-refined or AOD/VOD-refined ingots. Gates and risers from heats poured of this material cannot be reused without going through the AOD or VOD process again. Use of scrap material is prohibited.

### Visual Inspection

Valve castings are visually inspected for compliance with MSS SP 55.

## Weld Repairs

Random sand and slag inclusions may require weld repair for cosmetic reasons. In these instances, the weld procedure and welder both are qualified as delineated on page 4.

## Heat Treatment

Alloy M35-1 can be used in the as-welded condition, while CW2M and CN3MCu castings require solution heat treating following all foundry weld repairs. CW2M is solution-annealed at 2250°F (1232°C) for one hour per inch of thickness and is then water quenched. CN3MCu undergoes the same solution-annealing process at a minimum of 2050°F (1120°C).

## Non-Destructive Testing

Radiography is used as a monitoring tool. ASTM A990 Class C requires radiography of the first casting off of each pattern. The acceptance criteria is Level 3 for categories A, B and C. For categories D through G, no cracking, hot tears, or inserts are allowed as specified in ASTM A990.

*Note: Argon-oxygen-decarburization (AOD) and vacuum-oxygen-decarburization (VOD) refining offers the close control that is critical for high-nickel alloy castings. Molten metal is poured from the melting furnace into a refractory-lined vessel that allows the introduction of argon, oxygen, nitrogen either individually or in combination. This provides simultaneous decarburization ( $C < 0.015\%$ ), deoxidization, desulphurization ( $S < 0.01\%$ ), degassing and reduction of metallic oxides in the slag. The result is a cleaner and more uniform molten metal, with 8 castings that boast high impact toughness and good weldability.*

## Qualifying a Foundry as a Source of High-Nickel Alloy Castings

High-nickel alloy castings provide improved performance in corrosive services and elevated temperatures. However, if high-nickel castings are improperly prepared, they can pose major problems, including poor integrity, poor weldability, and lower than expected corrosion resistance. A systematic foundry qualification process can be followed to avoid these casting difficulties.



*Figure 2: In foundry evaluation, a casting is filled with weld filler, then sliced to yield a bar for bend testing.*

As a first step in the qualification process, the prospective foundry prepares a weldability test plate as illustrated above.

The plate configuration meets ASTM Material Specification A990. It proves difficult to cast because of the difference in cross-section between the base of the weld cavity (in the center) and the overall 1-inch thickness of the plate.

The cavity of the poured plate is then filled with a matching composition weld material. The welder and procedure for this step meet the standards outlined in Section IX of the ASME Boiler and Pressure Vessel Code.

Test bars (3/8-inch thick) are cut from the plate and bent over a 1-1/2-inch mandrel per ASTM A990 into a U-shape.

The bars are examined closely for cracking along the weld heat-affected zone, casting grain boundaries, or dendrite boundaries. Failure to meet quality standards will result in the disqualification of the foundry from further consideration.

Casting patterns must be dedicated solely to high-nickel alloy service. Use of carbon steel or a stainless steel pattern is unacceptable due to differences in solidification properties. While the shrinkage rates are only slightly different, the gates, risers, and other accessories vary considerably.

Once the dedicated pattern equipment has been secured, try-out castings are poured for each pattern-alloy combination. The castings are then radiographed. The intent is to reveal any inherent casting defects—such as shrinkage—that need to be eliminated by modifying the pattern rigging.

---

## CASE IN POINT:

### Foundry Qualification and Long-Term Affiliation Yield Quality Results



*What began over ten years ago as an exploratory visit by Emerson procurement and manufacturing specialists to a major foundry resource in China, followed by an extensive qualification process, is today delivering high quality valve body and bonnet castings to Fisher valve manufacturing sites.*

*To help ensure the quality of the castings it produces, the Chinese foundry has implemented international standards and has obtained German TUV and CE certifications, Norway DNV certification, German Lloyd's GL certification and American ABS certification, and has passed international quality system certifications of ISO 9001 and QS-9000. The foundry has been awarded Gold Medals three times consecutively in the Beijing International Casting, Forging and Industrial Boiler Expo. It has twice received an Excellent Supplier award from Emerson.*

---

## Casting Integrity—the Proof is in the Product

Emerson's guiding principle of designing and building valves for safety and reliability extends across all facets of product development, manufacturing and delivery.

Following this principle means that cast components, regardless of country origin, must meet Emerson standards and requirements—and therefore, customer specifications and expectations.

To that end, the process of identifying, qualifying, and auditing foundries is ongoing, with long-term business relationships and quality product being the ultimate goals. The success of these efforts is proven by Emerson valve castings that serve process control needs within a wide number of industries and a vast number of applications where attention to safety and reliability is key.

## Visit Fisher.com to learn more or find an Emerson sales representative near you.



<http://www.Facebook.com/FisherValves>



<http://www.YouTube.com/user/FisherControlValve>



<http://www.Twitter.com/FisherValves>



<http://www.Linkedin.com/groups/Fisher-3941826>

© 2017, 2023 Fisher Controls International LLC. All rights reserved.

Fisher is a mark owned by one of the companies in the Emerson business unit of Emerson Electric Co. Emerson and the Emerson logo are trademarks and service marks of Emerson Electric Co. All other marks are the property of their respective owners.

The contents of this publication are presented for informational purposes only, and while every effort has been made to ensure their accuracy, they are not to be construed as warranties or guarantees, express or implied, regarding the products or services described herein or their use or applicability. All sales are governed by our terms and conditions, which are available upon request. We reserve the right to modify or improve the designs or specifications of such products at any time without notice. Neither Emerson, nor any of its affiliated entities assume responsibility for the selection, use, or maintenance of any product. Responsibility for proper selection, use, and maintenance of any product remains solely with the purchaser and end user. D351598X012 / Aug23

### Emerson

Marshalltown, Iowa 50158 USA  
Sorocaba, 18087 Brazil  
Cernay, 68700 France  
Dubai, United Arab Emirates  
Singapore 128461 Singapore  
[www.Fisher.com](http://www.Fisher.com)