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"Active corrosion in onshore and offshore pipelines is an increasing problem."

Integrity of Salvaged, Remanufactured and Repaired Control Valves

Part 2

by Bob Baker

Preface: The July/August 2006 issue of the IJ contained Part 1 on the integrity of salvaged, remanufactured and repaired control valves. This second part includes recommendations for the straightforward and efficient identification, abatement, and ongoing organizational awareness of potentially non-compliant control valves. To set the scene for Part 2 for those that might not have seen Part 1 or don't remember it, the introduction portion of this article reiterates the essential elements from Part 1.

Introduction

Depending on equipment age, repair history, application severity and other factors, salvaged/refurbished (aka "remanufactured") or repaired control valves may no longer meet a manufacturer's original specifications as designed in accordance with the ANSI/ASME B16.34 control valve standard, "Valves – Flanged, Threaded, and Welding End".[1]

This is the only available ANSI/ASME standard currently written for control valves; however its scope covers "new" valves. Thus, in the absence of a Standard for "used" control valves (i.e. to include salvaged/refurbished, remanufactured, or repaired) the issue of ensuring sustained integrity, through valve refurbishment to the manufacturer's design specifications as developed in accordance with the ASME standard, may be overlooked.

Control valve damage resulting from severe service applications is typically recognized by visual inspection and corrective action (assuming such repair actions appropriately return the valve to its original design specifications and dimensions). However, there are many process applications where gradual degradation of control valve surfaces or thickness may not be noticeably visible, possibly resulting in potential integrity failure (loss of containment) with potential injury or property damage.

So the questions that beg answering for "used" equipment such as salvaged, remanufactured, or repaired control valves are:

- "When new chemical plant and refinery projects require adherence to a control valve design standard such as ASME B16.34 to better ensure plant design safety and address regulatory requirements, then why wouldn't periodic inspection with adherence to the same standard be required during the operational life of a control valve?

- Is the process industry requiring inspection, verification and certified documentation of control valve design parameters that are critical for integrity and meeting piping system pressure class, specifically including certification of body wall thickness?

Unless companies have faced safety or regulatory issues with "used" control valves, they may overlook the need to ensure that reconditioned control valves (which, for the remainder of this article will include "used" control valves that have been salvaged/refurbished, remanufactured or repaired) meet all of the manufacturer's specifications as originally designed in accordance with the ASME standard.

Integrity of Salvaged, Remanufactured and Repaired Control Valves

Many individuals incorrectly perceive hydro-testing as the sole indication of control valve integrity. Upon reviewing the ASME B16.34 standard, one will find that hydro-testing is required, but another critical design element is additional wall thickness as addressed in B16.34 paragraph 6.1.7. This paragraph, titled "Additional Metal Thickness" references required additional wall thickness, determined by individual manufacturers, needed for additional stresses (due to valve shape, design contour, internal web, etc.) such as:

- Assembly loads
- Actuating (closing and opening) loads
- Shapes other than circular
- Stress concentrations

Process application and age have a major impact on a control valve's life-cycle and its integrity. Erosive applications have a greater impact on body wall thickness than the gradual, time-based effects of surface oxidation or corrosion. Thus, restoring and/or verifying critical valve design parameters such as wall thickness, is a critical element in maintaining a control valve's integrity.

Although standards have been developed to address these issues for the repair and refurbishment of "used" pressure vessels, they are still lacking for control valves. Until such standards exist for reconditioned control valves, end users may choose to strictly enforce supplier qualification requirements, demanding that suppliers provide inspection, verification and certified documentation services (such as signed certificates of conformance), ensuring that a suppliers' control valves meet all of the original valve manufacturer's design specifications.

To complicate the issue, there are numerous examples of third party claims that their salvaged or repaired control valves are equivalent to all OEM specifications.
Despite their claims, most third party salvagers or repairers simply do not have the information they need to guarantee the restoration of control valves to full compliance with original manufacturers' design and manufacturing specifications.

In cases where suppliers cannot certify back to all original specifications as designed to ASME B16.34 (including necessary minimum valve wall thicknesses) an end user can require suppliers to provide a notation indicating such non-compliance, on all written communications including quotation, specification and invoicing documents.

Such notations by non-qualified suppliers would provide the end user with visibility to the potential application of non-conforming control valves, and the appropriate MOC evaluations could be completed before any equipment installation. The intent is similar to the Fitness For Service evaluation process used to restore and re-certify the pedigree of a pressure vessel before applying it in a service for which the design basis of the vessel cannot be confirmed.

Addressing Potential Non-Compliance
Pressure integrity of piping systems and their components has continued to receive significant public scrutiny due to loss of containment incidents. The results of Process Safety Management (PSM) audits by OSHA have consistently demonstrated that mechanical integrity (MI) is a PSM element receiving a large number of citations at most facilities, and in some cases has been the last PSM element to be fully addressed due to its implementation difficulty.[2]

An obvious solution is to appropriately monitor piping system components such as control valves so that conditions potentially jeopardizing pressure integrity (mechanical integrity) can be identified and corrected, thus reducing the risk of a loss of containment incident.

Monitoring piping system components is especially critical when reconditioned control valves, unless re-certified back to all original design specifications per pressure class, may already have been exposed to years of corrosion due to prior process application and/or deficient maintenance practices.

As a result, it's key when using reconditioned control valves to address:

a) How can installed, potentially non-compliant reconditioned control valves, be identified and then abated?
b) What processes can be efficiently implemented to maintain compliance and to prevent introducing additional non-compliant, reconditioned control valves?

In collaboration with end users, some manufacturers and manufacturers' representatives have developed programs addressing these issues. This article outlines four major steps that end users could consider to develop and implement an action action.

- Assessing
- Verifying
- Abating
- Sustaining

Although these steps may look intimidating on paper, end users can reduce the required resource demands by collaboratively using supplier/service-provider resources to achieve these objectives.

1.0 **Assessing**

The first objective is to assess a site's installed base of reconditioned control valves and identify units suspected of being non-compliant with original OEM specifications as designed in accordance with ASME B16.34.

Although all reconditioned control valves should be assessed at some point in their life cycle, the following recommendations are probably best initially applied to valves installed in process units that are included in a site's PSM program (typically handling hazardous chemicals per OSHA 1910.119)[3] or the EPA's comparable Risk Management Program (RMP) Rule.[4]

Collaborate with supplier/service-providers whenever possible to perform the following steps:

1.1 Identify all suppliers and service-providers of reconditioned control valves by the end user's purchasing organization.

1.2 Individually qualify each supplier and service-provider (repair shop) on its ability to deliver reconditioned control valves to original manufacturer (OEM) specifications, including specific adherence to paragraph 6.1.7 and require:
- o Signed, written certification from each supplier and service-provider
- o Written OEM confirmation demonstrating that the supplier/repair shop is an authorized supplier/service-provider

1.3 For each non-qualifying supplier/service-provider in step 2, historical purchase and/or repair orders are pulled
- o Keep in mind that the time window of historical purchase records is at the discretion of the end user site
- o Ensure that the gag number and/or any other site-specific methods of control valve identification are logged
- o Include the stores inventory

1.4 Tag numbers from the step 1.3 list are reviewed against a list of the process units included in the site's PSM program
- o Optionally, this review could be expanded beyond those included in a PSM program
- o Typically one would include all control valve stores inventory unless control valves are specifically dedicated tag number replacements

1.5 The resulting list from step 1.4 is provided to qualified suppliers and/or service-providers identified in step 1.2 for subsequent use in field verification
- o If there is no site-qualified supplier/service-provider for a control valve brand, the brand's OEM-authorized service-provider should be involved.

2.0 **Verifying**

After completing the above assessment, field verification is recommended to confirm whether the identified reconditioned control valves are still installed. If so, all technical specifications of latest construction should be obtained.

Collaborate with supplier/service-providers wherever possible to perform the following steps:

2.1 Conduct a walk-down of the listed control valve tag numbers, including:
- o Those already installed
- o Those located in stores inventory

2.2 After confirming installation, obtain all as-built/as-installed technical specifications for each potentially suspect, reconditioned control valve.
- o From site engineering/maintenance documentation files or databases
- o From the last supplier or service-provider that handled a potentially suspect control valve

3.0 **Abating**

Once identified, potentially non-compliant reconditioned control valves can be scheduled for appropriate abatement either through day-day MRO (Maintenance, Repair, Other) maintenance procedures or during a turnaround. Scheduling and priority of abatement will be based on a variety of factors such as the potential risk of taking no action, valve criticality, valve accessibility, the time required to inspect and certify the valve, etc.

When making abatement decisions, collaborate with supplier/service-providers whenever possible to perform the following steps:

3.1 Identify site-based abatement direction, including risk assessment, priority, timing, work processes, etc.
- o Identify valves capable of immediate abatement during day-day maintenance
- o Identify valves where abatement must be deferred to a turnaround

3.2 Abatement would typically consist of full inspection of potentially non-compliant reconditioned control valves by a qualified supplier and/or service-provider. Ensure that the following steps are taken:
- o Documentation is provided certifying that valves continue to meet all of an OEM's original design specifications (specifically addressing ASME B16.34 paragraph 6.1.7)
- o Non-compliant valves are fully restored to original design specifications with accompanying COC (Certificate of Conformance) documentation
- o At a minimum, inspection and certification

should include:
- PMI (positive metal identification) of all metal components with a cross-check to required specifications
- Wall thickness measurement of all pressure containment elements with verification to original design specification requirements
- Dimensional tolerance and/or surface finish checks of all critical sealing surfaces, guide surfaces and trim stack heights
- Hydrotest of full assembly to ASME B16.34 requirements.

3.3 Recommended action plan would be to initially address stores inventory
- o Perform step 3.2 actions on potentially non-compliant reconditioned control valves
- o Benefit is that certified inventory could subsequently be installed in any plant area as appropriate to a process application's required control valve specifications.

3.4 Abatement of installed control valves would be the recommended next step in the action plan
- o Priority and timing per step 3.1 determinations
- o Plan execution could include the identification and use of certified stores inventory when duplicate replacements of installed valves are available
- o When certified inventory is not available, possible methods include:
  - Purchase one or two duplicate, certified replacement valves when there are multiple installations of the same valve type, specifications, etc.
  - Remove and replace the non-compliant valves with the purchased, certified valves
  - Send the removed, non-compliant valves to a qualified service-provider for inspection and certification
  - Use these certified valves for the next replacements
  - Continue such removal, certification, and replacement on a rotational basis.

4.0 **Sustaining**

To sustain compliance and prevent further use or future introduction of non-compliant reconditioned control valves, the importance of using compliant reconditioned valves and training on how to do so must be communicated to inspection, maintenance, engineering, and safety organizations. In addition, an ongoing certification program could be implemented with qualified service-providers whenever a control valve is removed from a piping system.

Training:

Training should ensure that staff fully understands applicable control valve codes and standards, OSHA 1910 and EPA regulatory requirements, purchasing department's supplier/service-provider qualification requirements, as well as the safety rationale supporting behind each.

Areas recommended for integration into a comprehensive control valve pressure integrity training program offered to new employees and used as an evergreen continuing education program to existing employees, could include:

4.1 Supplier/service-provider qualification requirements

4.2 Purchasing's list of qualified supplier/service-providers
- o Distribute a list of qualified supplier/service-providers to all site organizations involved in specifying or purchasing control valves

4.3 Document notation requirements of non-qualified supplier/service-providers (quotes, specifications, invoices)
- o Educate internal staff to ensure understanding of non-qualified supplier/service-provider policy
- o Individual responsibility to communicate policy to future supplier/service-providers

4.4 Increasing awareness of MOC evaluation requirements for non-compliant reconditioned control valves
- o Communicate the difference between legitimate replace-in-kind control valves that are certified to original OEM design specifications, versus "perceived" replace-in-kind control valves from non-qualified suppliers/service-providers claiming equivalency

4.5 Control valve pressure integrity program certification requirements (if implemented) with COC documentation
- o Abatement of existing, potentially non-compliant valves
- o Ongoing certification of valves during MRO activities
- o Turnarounds

Ongoing Control Valve Certification Program:

When a control valve requires removal and maintenance for some reason, it is an opportunity to provide a new "birth certificate" for the valve (i.e., appropriately inspected and certified that it continues to meet all original manufacturing design specifications.) This can be done whenever a valve is removed from the piping system and sent to a qualified

service-provider's shop.

This evergreen certification program decreases the potential for unexpected loss of containment (run to failure) and provides early awareness of any wall thickness deterioration. Future dates for inspection, replacement or corrective repair can be better identified as a result.

A structured certification program, via COC documentation addressing the various specifications outlined in this article, would be another way to demonstrate a site's commitment to its PSM or other safety programs.

Summary

In summary, industry awareness of the technical and/or safety compliance issues associated with reconditioned control valves should provide the impetus for chemical processors and refiners to develop appropriate corporate policies and guidance directing inspection, engineering, maintenance, and procurement assessments of potential safety and regulatory issues associated with this equipment.

Opportunity exists to directly assess the pressure integrity of piping system components like control valves, especially where salvaged, remanufactured, or repaired valves may be have significant age and may have been used in process applications that accelerate deterioration of wall thickness.

Such actions assist in creating a safe workplace and in demonstrating a proactive safety culture by reducing the probability of deficient salvaged or repaired equipment being the focal point of a future, potentially significant incident.

References:

[1] "Valves – Flanged, Threaded, and Welding End", The American Society of Mechanical Engineers, 2004

[2] "Repair Your Mechanical Integrity Program", Michael Hazzan, Acu-Tech, ChemicalProcessing.com, Nov 2005

[3] Regulations (Standards – 29 CFR) 1910.119: "Process safety management of highly hazardous chemicals"; U.S. Department of Labor, Occupational Safety & Health Administration

[4] Code of Federal Regulations 40 CFR Part 68.73: "Chemical Accident Prevention Provisions; Mechanical Integrity"; U.S. Environmental Protection Agency

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The views and opinions expressed herein are those of the author himself. The author is not speaking and does not purport to be speaking on behalf of any other company or organization.

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Biography

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Bob is a 1970 Aerospace Engineering graduate of Iowa State University, gaining process industry experience with Fisher Controls International, Rosemount,Inc., and John H. Carter Company. Prior to joining John H.Carter Company, his management responsibilities with Fisher Controls International included Director-North American Sales, Chemical Industry Business Manager, Power Industry Business Manager, and Control Valve Product Manager.

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