"Safety and Regulatory Compliance of Reconditioned Equipment"

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Responding to challenges of seemingly unending reductions in capital and maintenance budgets, the process industry has increasingly turned toward the purchase of lower cost, recycled equipment including salvaged control valves and instrumentation. Although it may be acceptable from a functional perspective, depending on equipment age, repair history, application severity and other factors, this "reconditioned" equipment may be out of compliance with safety standards, or with manufacturer's specifications as originally designed to applicable industry codes, for safe use in hazardous locations.

If the use of these devices does not meet an original equipment manufacturer's technical specifications for the process application, there are possible implications with respect to the Process Safety Information and Mechanical Integrity elements of OSHA's Process Safety Management (PSM) Standard (29 CFR 1910.119) [1] and EPA's Risk Management Program Rule (RMP) (40 CFR 68) [2]. Another possible implication exists with respect to OSHA's Hazardous (Classified) Locations Standard (29 CFR 1910.307) [3].

This manuscript describes the issues and offers recommendations buyers can use to increase their confidence that salvaged, remanufactured, refurbished or new-surplus equipment meets plant design safety standards and regulatory requirements.

Investigations into process plant explosions and fires have resulted in regulatory and investigative agencies issuing reports, fines and recommendations. Plant managers are responsible for assessing whether their site programs are adequately addressing safety requirements, yet the potential issues associated with reconditioned and new surplus equipment may not be known and/or included in such assessments. Two issues are:

- Mechanical integrity of piping system components such as control valves
- Maintaining hazardous (classified) location approvals of electrical/electronic equipment

Potential equipment or compliance problems may arise when purchases are made from third party salvagers who recondition and resell used control valves and/or used and new surplus instrumentation. These third party sellers often do not have access to the original manufacturer's specifications and standards used during new product design of process instrumentation and control valves. Yet the following common marketing claims may confuse industry:

- "meet or exceed factory specifications"
- "meet and even exceed OEM testing standards"
- "remanufactured to like new"
- "fully reconditioned to OEM specifications"
- "remanufactured to original manufacturers' specifications and tolerances"

Despite these claims, salvagers often do not have the information needed to guarantee the restoration of equipment to full compliance with an original manufacturer's design attributes.

The question that begs answering is: "when standards and approvals are required to better ensure the safety of new equipment when introduced into the marketplace, why would not the same requirements be required whenever such products are salvaged, refurbished, reconditioned, remanufactured or repaired over their life cycle?"

Most original equipment manufacturers (OEM) of process instrumentation can offer solutions to assist plants in identifying and abating potential safety-related risks and regulatory non-compliance. In addition, implementing recommended solutions may potentially lower rates for property, liability and business-interruption insurance while simultaneously increasing reliability and process uptime.

This manuscript's information on used and new surplus control valves and instrumentation should:

- Assist plant management and technicians in identifying their chemical processing units' potential regulatory non-compliance issues

- Help maintenance, operations and engineering recognize a potential need for more frequent implementation of management of change (MOC) evaluation processes for reconditioned equipment that may visually look like replacement-in-kind, but may not be technically equivalent to be considered as an acceptable replacement-in-kind.

DEFINITIONS

To avoid confusion, the following terminology will be used in the context of this discussion.

Reconditioned refers to any form of *salvaged, refurbished or remanufactured* equipment. Unlike an end user repairing its own control valves or instruments, transfer of equipment ownership has typically taken place during a reconditioning process with limited, if any, traceability associated with the equipment's prior application, environmental conditions, handling, maintenance history, use of OEM parts during repairs, etc.

New-Surplus refers to *unused* current or obsolete equipment, which:

- May or may not still be in the original packaging
- May have aged significantly since being purchased and inventoried by an end user, or by a third party salvager / distributor not authorized by the OEM
- May have been previously installed, calibrated and subsequently removed and repackaged without a plant or process unit being started up
- May have had multiple ownership transfers without having actually been used

More traceability typically exists for new-surplus equipment than for reconditioned equipment, but it is still usually limited. More specifically, for new-surplus electrical or electronic instruments subjected to the scenarios outlined in the bullets above, the opportunity exists for unknown changes or hidden damage to occur during the typically lengthy time and extensive handling between original manufacture and subsequent resale.

MECHANICAL INTEGRITY (MI)

Mechanical integrity refers to the ability of equipment to maintain its original design integrity over its entire life cycle (i.e, to resist the loss of containment of chemical processes throughout operational and design maximum process pressures and temperatures). Loss of containment not only presents potential onsite safety issues, but also potential offsite health/safety and environmental issues, especially if a released hazardous process is carried beyond the confines of the plant site.

The mechanical integrity (MI) element of the PSM Standard[1] and RMP Rule[2] may apply in several ways to the use of reconditioned control valves:

- Paragraphs 1910.119(j)(1)(ii) and 68.73(a)(2) include valves when applying mechanical integrity to process equipment: "Piping systems (including piping components such as valves)"

- Paragraphs 1910.119(j)(4)(ii) and 68.73(d)(2) cover inspection and testing: "Inspection and testing procedures must follow recognized and generally accepted good engineering practices"

- Paragraphs 1910.119(j)(6)(i) and 68.73(f)(1) include quality assurance: “In the construction of new plants and equipment, the employer shall assure that equipment as it is fabricated is suitable for the process application for which they will be used”

With respect to the “information pertaining to the equipment in the process”, these standards apply in the following ways:

- Paragraphs 1910.119(d)(3)(i)(F) and 68.65(d)(1)(vi) include: “Design codes and standards employed”

- Paragraphs 1910.119(d)(3)(ii) and 68.65(d)(2) state that: “The employer shall document that equipment complies with recognized and generally accepted good engineering practices.”

Since the PSM Standard and RMP Rule require that equipment covered by the regulation be suitable for the existing process application, and that the equipment design, operation, and maintenance must conform to recognized and generally accepted good engineering practices, a detailed assessment of reconditioned piping system components, such as control valves, would be beneficial any time the valves are applied in PSM and RMP-covered processes. These assessments could include:

- Verification that control valves, when purchased after reconditioning, continue to meet all OEM design specifications as designed in accordance with the appropriate ASME pressure class standard.
- Similarly, verification that existing control valves, when repaired, continue to meet all design specifications in accordance with the appropriate ASME pressure class standard.

Development and execution of assessments better prevents potential loss of equipment integrity and loss of containment (LOC) of toxic and flammable materials.

Market Background

Historically (early 1990’s), the market for salvaged/reconditioned control valves originated in shallow water offshore and onshore oil and gas facilities. However, over the last few years the installation of this reconditioned process equipment has significantly expanded into onshore chemical process and refining facilities due to declining maintenance budgets and financial pressure on small, locally engineered capital projects.

The closing of many chemical, paper, and other industrial processing facilities, built during the hey-day construction period of the 1970’s through the 1990’s feeds this phenomenon with recycled equipment of varying ages and quality. So along with the typical worn-out valves regularly recycled from plant boneyards, suppliers and/or service providers now often have an ample supply of salvaged control valves to recondition and resell.

Subsequent to reconditioning, these control valve assemblies are often repainted to look like new, and often *still bear the original nameplate applied when manufactured new, or contain a salvager's re-applied nameplate that is marked or stamped with valve ratings that infer continued compliance with the valve's originally designed pressure class.* But does a potentially aged, reconditioned valve still comply with, and has it been recertified to, all of the OEM's specifications as originally designed in accordance with the ASME standard?

Standards Background

As with any piping component, a control valve is a pressure-retaining device. Control valves are designed by the original manufacturer in accordance with the ASME B16.34 standard, to ensure integrity for the appropriately designed pressure class and compliance with the designed piping system pressure class when installed. The ASME B16.34 standard is the recognized and generally accepted good engineering practice for new control valves.

An important, but often overlooked, element of valve design, as referenced in ASME B16.34 paragraph 6.1.7 is "Additional Metal Thickness."[4] Unlike cylindrical shapes such as piping, additional wall thickness is designed into valve bodies and bonnets in order to handle the additional stresses occurring from:

- 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 and/or corrosive applications have a greater impact on body wall thickness than the gradual, time-based effects of surface oxidation (steel castings).

Thus, sustaining the design parameters referenced by ASMBE B16.34 paragraph 6.1.7 is a critical element in maintaining a control valve's pressure integrity. If a designed, minimum wall thickness is required for new control valves off the assembly line, why wouldn't they continue to be required for a reconditioned control valve?

Many individuals incorrectly perceive hydrotesting as the sole indication of control valve integrity. Upon reviewing ASME B16.34, one will find that a shell test (hydrotest) is required, but is an additional element in meeting design specifications in accordance with the B16.34 standard, specifically paragraph 6.1.7.

Gary Icenogle, retired Engineering Department Manager of a major global manufacturer of process equipment including valves, was consulted about the standard's wall thickness and hydrotest (shell test) requirements. Icenogle gained an in-depth understanding of B16.34 during his 28 year membership on ASME B16.34 Subcommittee N, beginning in 1971 when appointed to American National Standards Committee B16 / Subcommittee 15 (subsequently renamed Subcommittee N). So he was extensively involved in the Subcommittee's ongoing development and revisions of the B16.34 standard as we know it today.

Icenogle:

"When ascertaining the pressure containment integrity of a valve, the appropriate data and application of the data is critical. With the exception of repair entities associated with the valve OEM, the typical source of wall thickness data and shell test requirements would be the ASME B16.34 standard, which gives valve design requirements to meet a specific pressure-temperature rating. It addresses minimum wall requirements as well as pressure testing requirements per pressure Class.

A sophisticated salvager, remanufacturer, refurbisher or non-OEM repair shop may measure a salvaged valve's wall thickness and compare it to the required minimum wall thickness of ASME B16.34 Table 3 or the thickness calculated per the equations of Appendix VI. These entities' assumption is that if their measured wall thickness is greater than the table or calculated value, then the valve is capable of the pressure ratings for that valve size and pressure Class.

However, this is an incomplete application of the B16.34 standard that produces a potentially significant safety risk, since the minimum wall thickness described in paragraph 6.1.1 "*Wall Thickness"* and listed in Table 3 and Appendix VI are ONLY for cylindrical shapes. Other than bar stock bodies, most control valves are by no means cylindrical throughout, other than at their inlets and outlets. By using only Table 3 and/or the equations, a salvager will have ignored the exception paragraphs identified in paragraph 6.1.1 and detailed in paragraph 6.1.7 "*Additional Metal Thickness*."

The purpose of the shell test, typically referred to within the industry as a "hydrostatic test" or "hydrotest", is to ensure that the pressure boundary is capable of containing pressure in a static condition (as the term "hydrostatic test" implies). In other words, the shell test is performed to identify whether the pressure boundary has any material defects that could allow the fluid contained within the valve to leak to atmosphere. *However, the shell test is not intended to be the sole requirement that defines the pressure containing capability of a valve.*

The requirements within ASME B16.34 for a valve's pressure rating are to have adequate wall thickness per paragraph 6.1 *and* to pass the appropriate shell test of 1.5 times the rated maximum cold working pressure per paragraph 7.1. *Neither of these, if one is done without the other, will ensure that the pressure boundary is adequate to maintain a valve's original design pressure rating.* Both are required, along with meeting the rest of the standard."

Equivalency Claims

The equivalency claims often made by third party reconditioners have incorrectly advanced industry perceptions that their reconditioned control valves are always equivalent to new control valve specifications. But there is evidence indicating otherwise.

A major OEM maintains a measurements database of used valve body wall thickness (valves obtained from the plant demolition market and/or end user bone-piles), documenting the number of such valves required to be scrapped or requiring body wall restoration. Without access to manufacturer specifications, third parties may not identify such deficiencies and some reconditioned valves, which would potentially require de-rating of their pressure/temperature capability, may unknowingly be installed in piping systems where the valve's pressure class rating is no longer compatible.

Again, logic would indicate that an old used control valve body would need similar wall thickness as a new valve. And with the significant retirement and demolition of plant assets, a salvaged, reconditioned valve may already be in excess of 20 years old. Thus, *an end user should consider including the certification of control valve body wall thickness as an integral part of its mechanical integrity program,* especially when implementation could increase plant safety and demonstrate ongoing plant compliance to regulatory standards, but could also simultaneously increase operational reliability.

The obvious solution for a mechanical integrity program is to have reconditioned or repaired control valves individually certified that they continue to meet the original manufacturer's specifications as designed to ASME B16.34. This can be accomplished by specifically requiring the measurement, verification and certification of wall thickness and performing the appropriate hydrotest.

These additional requirements could easily be incorporated into a plant's maintenance and turnaround specifications for repaired or reconditioned control valves. An OEM or OEM-authorized facility can measure wall thicknesses with available non-destructive testing technology, and then compare the results to the latest revision of the OEM's casting drawings.

The ability to meet such a specification already exists today with most OEMs, with minor additional time required for measurement, testing and issuing a certificate of conformance (COC). This is similar to the Fitness For Service evaluation process that is used to restore and re-certify a pressure vessel before application in a service for which the design basis of the vessel cannot be confirmed.

Importance

Loss of equipment integrity presents potential safety, property and environmental issues. The results of PSM audits by OSHA have consistently demonstrated that 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. And, often the Mechanical Integrity element of PSM has been a difficult element for many facilities to implement.[5]

In a recent case, the U.S. Chemical Safety Board (CSB) raised issues about a site's mechanical integrity programs for equipment, where one of its incidents involved a valve. Review of other OSHA citations reveals cases addressing mechanical integrity of other types of equipment. Some of these citations were classified as "egregious willful violations" or as "willful violations" with each violation accompanied by a significant fine.

Assessment of fines should be considered, but the potential financial impact from civil actions arising from a serious incident resulting in personal injury or death could potentially far exceed the investment required to meet regulatory standards..

HAZARDOUS (CLASSIFIED) LOCATIONS

Similar to the situation with reconditioned control valves, over the last several years there has been an increasing number of reconditioned and new-surplus electronic instruments installed in process plant hazardous (classified) locations.

Reconditioned instruments are also usually repainted to look like new. Further, these instruments usually have the original manufacturer nameplate left on, or it is reattached following reconditioning work*.* When this is done with an instrument having a nameplate with a NRTL Approved certification mark on it, and the reconditioned or new surplus instrument is sold by a supplier or service provider whose facility is not NRTL approved and audited, there is typically a misperception by both supplier and end user that the reconditioned instrument is still NRTL Approved.

But in this type of situation, a major NRTL *considers the instrument no longer compliant with the standards it originally certified the equipment to and thus would not be compliant to OSHA requirements for use in a hazardous (classified) location.*

And with the end user bearing the responsibility, once in use, for an instrument's continued compliance with applicable codes and standards, it is critical that no "changes" have unknowingly been made to the equipment after it has left an NRTL approved supplier and/or service-provider facility. [6]

Regulatory Background

The NRTL program is a part of OSHA's Directorate of Science, Technology and Medicine.[7] For purposes of meeting the NRTL product-approval requirements in OSHA standards, e.g., those under Subpart S of 29 CFR Part 1910, OSHA only accepts equipment or products approved by one of its listed NRTLs. One can access OSHA Web pages for information on each NRTL's scope of recognition, or contact OSHA or the NRTL for additional information at www.OSHA.gov.

OSHA's NRTL Program recognizes private sector organizations as NRTLs, and OSHA accreditation signifies that an organization has met the necessary qualifications specified in the regulations. The NRTL determines that specific equipment and materials ("products") meet consensus-based standards of safety to provide assurance, required by OSHA, that these products are safe for use in the U.S. workplace.

The hazardous locations standard, 29 CFR (OSHA)1910.307, regulates the use of electrical equipment and wiring in hazardous locations which are classified depending on the properties of the flammable vapors, liquids or gases or combustible dusts or fibers which may be present therein, and the likelihood that combustible concentrations or quantities are present.[3]

Pursuant to 29 CFR 1910.307(b): "Electrical installations: Equipment, wiring methods and installations of equipment in hazardous (classified) locations shall be" [3] either:

- "Intrinsically safe"
- "Approved for the hazardous location"
- "Safe for the hazardous location"

Using NRTL approved instrumentation is the most common and efficient method for an employer to reliably demonstrate that electrical instrumentation, intended for use in hazardous (classified) locations, meets the 1910.307 standard requirements. As stated in 29 CFR 1910.307(b)(i): "Equipment shall be approved not only for the class of location but also for the ignitable or combustible properties of the specific gas, vapor, dust or fiber that will be present." [3] This corresponds with the first two preceding bullets, with the NRTL performing the appropriate equipment testing and certification, audits and approves manufacturing and repair facilities, and then authorizes approved facilities to apply the NRTL's approval mark.

Electrical classification is also included within the PSM Standard[1] and RMP Rule[2], as noted in paragraphs 1910.119(d)(3)(i)(C) and 68.65(d)(1)(iii): "Electrical classification"

Published OSHA interpretations note that the employer must be able to demonstrate that the equipment will provide protection from the hazards arising from the combustibility and flammability of vapors, liquids, gases, dusts or fibers. The National Electrical Code, NFPA 70, contains guidelines for determining the type and design of equipment and installations which will meet this requirement. One method for an employer to demonstrate that equipment used in hazardous (classified) locations meets the requirements of the standard is to use equipment that is certified as intrinsically safe and approved for the hazardous (classified) location (29 CFR 1910.307(b).[8]

Distinguishing Between Compliant and Potentially Non-Compliant Instruments

As noted earlier, a purchaser may have an erroneous perception of whether a reconditioned or new-surplus instrument is still NRTL approved, i.e. is still compliant to the standards which the NRTL certified it to, and free from "changes" unknowingly made to the equipment after it has left an NRTL approved supplier and/or service-provider facility.

FM Approvals, an OSHA accredited NRTL, has recently communicated that such "change" can include equipment that is repaired, where repair also includes refurbished, remanufactured, reconditioned, salvaged, and new surplus. FM Approvals defines repair as "Work performed to the unit that would bring it back to its original condition approved by FM Approvals", i.e. reconfirming product compliance with appropriate standards as FM Approvals originally certified it to. [6]

Earlier, FM Approvals had specifically communicated its position regarding reconditioned and new-surplus instruments that were originally approved for use in hazardous (classified) locations at the time of OEM manufacture:

> "It is FM Approvals' position that only the original manufacturer of the Approved product or an FM Approved remanufacturer whose facilities are part of the FM Approvals follow-up audit program, can remanufacture a product and reissue the FM Approvals certification mark. Any suggestion, practice or inference to the contrary is wrong and must cease."

> Further: “Any salvaged, remanufactured or new surplus electrical instrument cannot be labeled or relabeled as FM Approved for use in a classified hazardous location unless the refurbishing/new surplus supplier entity is audited and approved by FM Approvals, LLC, for that specific type of instrument.”
>
> “Absent the above being met, the device can carry the FM Approvals certification ONLY if the product has been resubmitted and approval granted by FM Approvals. Failure to follow these guidelines will invalidate the FM Approvals certifications. In such instances the FM Approvals certification mark shall be permanently removed from the product (including the nameplate).” [9]

The FM Approval mark is a statement of conformity that a product is in compliance with defined standards at the time the product leaves the manufacturing and/or repair facilities that have been approved and audited by FM Approvals. [6]

As noted, the certification mark and nameplate should be removed unless the supplier/service-provider is an FM Approved facility, i.e. has been approved and audited by FM Approvals. For third party and end user facilities, such approval and auditing is to FM Class Standard 3606 for specific product brands and models. [6]

Maintaining Safety and Regulatory Compliance

Safety and regulatory compliance may be jeopardized if end users cannot distinguish between compliant and potentially noncompliant devices. [6] Thus the recommendation that end users, who have responsibility for continued compliance with applicable codes and standards, need to fully qualify their product and repair service vendors as described later in this article.

The use of a reconditioned or new-surplus instrument purchased from a non-qualified vendor would require a MOC for installation and use in a hazardous (classified) location, since product compliance would not be reconfirmed with the appropriate standards FM Approvals originally certified it to. This raises a question about the probability that such a MOC process would be pursued for a noncompliant instrument. An alternate solution may be to have the process unit re-classified; however this may or may not be possible.

One may question the inclusion of new-surplus devices that were originally labeled by the OEM with the FM Approved certification mark. The issue is traceability since the typical origins of new-surplus instruments range from aged or obsolete unused inventory to instruments removed from units that may have been constructed but never started up. During the possible multiple transfers (resale) of new-surplus equipment there is limited, if any, knowledge and traceability of problems a device may have encountered that would unknowingly result in a “change”, due to possible exposure to:

- Damage during prior installation and removal
- Overpowering during calibration and/or performance checks
- Inadequate re-packaging or damage during repacking
- Inadequate storage conditions
- Any other hidden handling or shipping damage

Importance

Currently, the presence of erroneously marked NRTL approved products in the marketplace is resulting in potentially significant numbers of noncompliant instruments being unknowingly installed, annually, into hazardous (classified) locations.

The issue appears to be exacerbated by a lack of industry awareness. As such, education, trade journal articles, published safety alerts, and symposium presentations are increasingly important.

Noncompliant instruments are potential ignition sources creating additional potential exposure to safety risks and regulatory citations. Even though there is no confirmation that incidents have directly resulted from the use of noncompliant instruments, the combination of situations required to cause an incident could very well occur. In a recent investigation, OSHA issued citations on the use of non-approved electrical equipment with each violation considered “willful” and accompanied by a fine and with the aggregate fines totaling several million dollars.

The risk of being a potential ignition source is one of the reasons there are OSHA requirements for the use of electrical and electronic equipment in hazardous locations. Although the subject of this article is not a treatment of how risks are realized, an important reminder is that a simultaneous combination of events can create an incident even though never experienced previously. At times, users cite their experience with salvaged instruments as having never given them a problem. However, safety experts typically concur that as the number of installed non-approved instruments increases, there is increased opportunity of such a combination of events occurring.

Industry is familiar with the “swiss cheese” or “light & disc” illustrations of this, where appropriate instrument electrical classification is an element of protection. Figures 1 and 2 illustrate situational risk by using discs with holes, representing layers of protection methods.[10] Any single disc (protection method) can keep the light source from penetrating through the entire box (Figure 1). If all of the holes in the discs become aligned, representing a combination of abnormal situations and failures occurring simultaneously, the light will shine through, representing an “incident”.

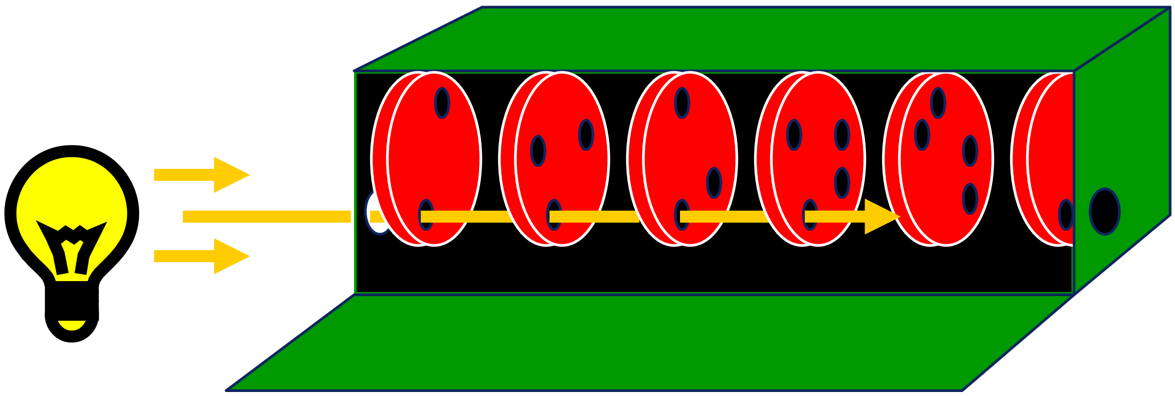

Figure 1.

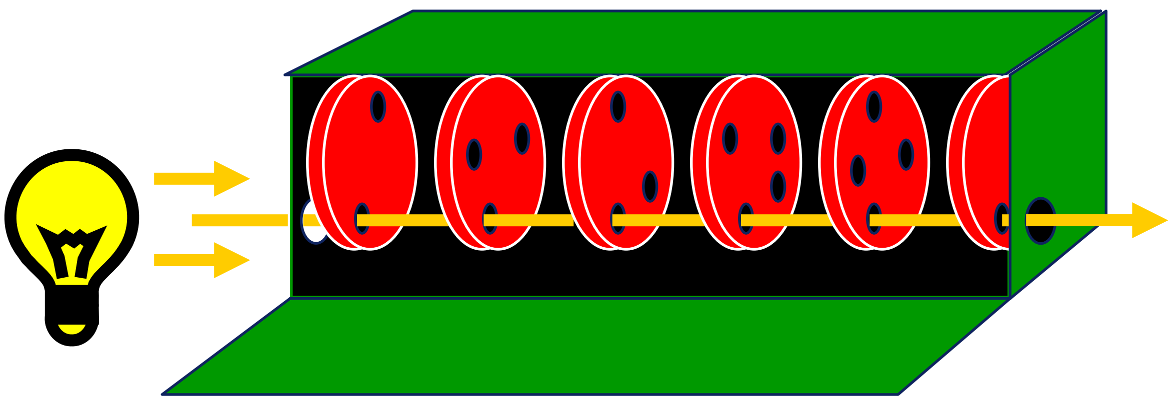

Figure 2.

Incident investigations have identified the occurrence of this type of situational concept, such as reports where prior start-ups had experienced similar abnormal situations and failures, but never the exact combination that resulted in an incident, until it finally occurred.

MITIGATING RISK

Again, the potential safety and regulatory compliance risks associated with the use of reconditioned equipment include:

- Loss of control valve containment (pressure integrity)
- Noncompliant instrumentation used in hazardous (classified) locations (not NRTL Approved)

So what can chemical processors do to help mitigate these?

Vendor qualification and technical awareness is critical, requiring initial education of all plant personnel associated with the specification, purchase, inspection or repair of reconditioned and new-surplus equipment. Further, ever-changing organizational structure and new personnel requires a sustained education program, including ongoing emphasis at safety meetings. End user issuance of specific corporate policy and guidance could be an effective method to appropriately emphasize and establish requirements for purchasing reconditioned equipment.

Vendor Qualification

Implementation and strict enforcement of three critical supplier qualification requirements can increase confidence in meeting safety and regulatory requirements when purchasing reconditioned control valves and instrumentation, or new-surplus instrumentation.

With appropriate documentation on file, such records can be valuable in discussions with insurance carriers or trade and regulatory organization safety audits.

Suggested Qualification Requirements

Note: Per prior definition, "reconditioned" includes salvaged, refurbished, and remanufactured.

1. For reconditioned or new surplus electrical/electronic instrumentation required to be compliant to OSHA 1910.307 per your plant's hazardous area classifications, require:
    - Signed NRTL authored documentation from your supplier and/or service providers of reconditioned and new-surplus instrumentation to include:
        - Certification that a supplier and/or service provider <u>facility is approved and audited</u> by the NRTL for the specific brands and models
        - Scheduled dates for the NRTL's follow-up audits of the facility
        - Results and status pursuant to the follow-up audits
    - That for any supplier/service provider whose facility <u>is not approved and audited</u> by the NRTL for the specific brands and models
        - Commitment, in writing, to remove any OEM nameplate containing a NRTL certification mark or at a minimum, completely remove the NRTL certification mark from the nameplate

2. For better evidence of control valve pressure integrity addressing plant safety and PSM and RMP Rule regulatory requirements, require:

- Signed documentation from your supplier and/or service providers of reconditioned or repaired control valves to include:
  - Certification of their ability to conform to all of an OEM's original specifications as designed to ASME B16.34, specifically including conformance to design requirements for additional metal thickness, as referenced by paragraph 6.1.7.
  - Certificate of Conformance documents for each control valve, upon request, certifying that a supplier's and/or service provider's reconditioned or repaired control valves meet all OEM specifications, with specific reference that body walls meet thickness specifications as designed to ASME B16.34 including paragraph 6.1.7 and are shell tested in accordance with section 7.1.

3. For any supplier and/or service provider incapable of complying with any of the above, require:
   - Notation of noncompliance on all correspondence including:
     - Specification documents
     - Quotations submitted
     - Packing lists
     - Invoices

   Note: Requiring noncompliance notations on correspondence increases site visibility to any anticipated application of non-compliant control valves or instrumentation, with an objective of triggering an appropriate MOC evaluation before installation of the equipment.

Beyond these first steps some manufacturers, in collaboration with end users, have developed programs addressing these pressure integrity and NRTL approval issues without significantly impacting an end user's personnel requirements.

Resulting work processes typically involve assessing and identifying existing, potentially non-compliant devices, developing appropriate abatement processes and sustaining compliance awareness through training. The following guidelines are presented in general terms without detailing specific execution steps since execution is often dependent upon site maintenance practices, equipment criticality and access, management appetite for risk, etc.

Suggested Work Processes

Work processes may include:

- Assessment and identification
  - Existence of potentially noncompliant instrumentation installed in hazardous (classified) locations
  - Existence of reconditioned control valves not having certified pressure integrity via body wall measurements

- Abatement
  - Instrument recertification performed by an NRTL approved and audited facility
  - Abatement executed via day-day or turnaround maintenance work processes
  - Control valve pressure integrity inspection and restoration (when required) that is compliant to all OEM specifications with individual control valve certification documentation via a Certificate of Compliance (COC).

- Sustaining
  - Implementation and enforcement of vendor qualification requirements to better prevent introduction or re-introduction of noncompliant equipment
  - Initial and ongoing communication and training of all potential safety and regulatory compliance issues and site prevention policies
  - Communication and training to include employees having any degree of involvement in the engineering, specification, purchase or inspection of reconditioned or new-surplus control valves and instrumentation.

OEM facilities that supply new and/or remanufactured instruments are typically audited and approved by the major NRTLs. Also, OEMs typically have authorized service centers with the technology, training, work processes, and access to intellectual property necessary to appropriately assess and certify compliance of reconditioned and repaired control valves to original OEM design specifications.

Summation

During the last few years there has been an increasing number of potentially noncompliant reconditioned control valves and instrumentation, as well as noncompliant new surplus instrumentation, being introduced into all types of chemical process industries and the refining industry. Depending upon variables such as equipment age, repair history, application risk, etc., this reconditioned or new surplus equipment may no longer be compliant with safety standards or to an OEM's original design specifications with respect to pressure retaining capability or safe use in hazardous locations.

Industry awareness of the technical and/or safety compliance issues associated with reconditioned equipment should provide the impetus for chemical processors and refiners to develop appropriate corporate policies and guidance directing inspection, engineering, operations, maintenance and procurement assessment of potential safety and regulatory issues.

Going forward, stringent supplier qualification can be a straightforward and efficient preventive solution. For suspect equipment that is already installed, identification and appropriate abatement processes may be needed.

Such actions assist in creating a safe workplace and can demonstrate a proactive safety culture by reducing the probability of deficient reconditioned or new surplus equipment being the focal point of a future, potentially significant incident.

References:

1. U.S. Department of Labor, Occupational Safety & Health Administration Regulations; Standard 29 CFR 1910.119*:* "Process safety management of highly hazardous chemicals"

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5. Hazan, Michael (2006), "Why is Mechanical Integrity So Tough?", AIChE 21st Annual CCPS International Conference

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9. Martell, Robert (2004) Assistant Vice-President and Director of Approvals, FM Approvals,LLC

10. U.S. Department of Labor, Occupational Safety & Health Administration Regulations; Standard 29 CFR 1910.119*:* "Process safety management of highly hazardous chemicals"

11. U.S. Environmental Protection Agency, Code of Federal Regulations 40 CFR Part 68.73: *"Chemical Accident Prevention Provisions; Mechanical Integrity";*

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