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Non-OEM parts—Buyer beware

What is the harm in wearing a knock-off Rolex watch? It looks the same, keeps time, and if no one inspects it too closely, appears impressive. How about wearing a name-brand replica pair of jeans, or perhaps a counterfeit pair of top-tier athletic shoes? That might create some discomfort and even a blister or two, but the cost savings may more than compensate.

Now, consider the ramifications of using non-OEM (original equipment manufacturer) airbags or brakes on your car. Would it be acceptable if passenger trains began using these types of parts to repair their braking systems? Suddenly, a non-OEM replacement part might be seen in a very different light.

In some industries, such as aviation, legal requirements cover service and repair situations, making it against the law to use non-OEM parts. The same types of regulations apply to the use of valves in some industrial applications, such as in safety systems; while most industrial applications for valves do not expressly prohibit the use of non-OEM parts, this certainly does not lessen the risk of their use.

All types of non-OEM parts present potential problems. Issues are not limited to poor performance and downtime due to failure, as civil lawsuits can result if personnel injury occurs due to failure of a sub-standard part. If a company loses its case in court due to the use of non-OEM parts, insurance rates will certainly rise, and future visits by adjusters will become more frequent and exacting.

Imagine non-OEM valve body components in 1500# service, as isolation valves for natural gas service, and even in a nuclear power plant. Each of these situations has the potential to create catastrophic damage and, in the worst-case scenario, injury to plant personnel.

A burgeoning problem. It is disconcerting that the scenarios posed above have actually occurred. Certainly, the world is awash in fake watches, name-brand clothes and designer shoes, but it is a less-publicized fact that non-OEM auto parts are common in every world market, with some countries estimating that 20% of car accidents stem from these substandard components. Despite laws prohibiting their use, at least one fatal airline crash was directly attributable to non-OEM engine mount bolts.

In a similar vein, non-OEM valves and valve components are invading various sectors of industry. In some cases, these components are used within a plant unknowingly, as some are marketed as the real thing and provided by a new supplier. In other cases, maintenance and procurement departments order the cheaper components in an attempt to save money or fill a pressing need. The problem is the number of non-OEM parts is growing explosively, and spotting them is becoming more difficult (FIG. 1).

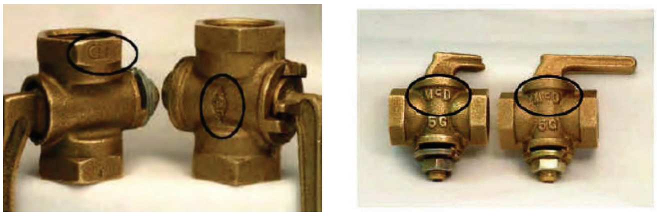

FIG. 1. The non-OEM gas valve on the left will not close properly. Other than some markings and a few dimensional variations, the part looks very similar to the authentic valve on the right. (Reprinted from Department of Energy's Counterfeit Training Manual.)

In the past, non-OEM parts may have been easier to spot, with parts that were wrapped in newspaper, labels that had misspelled words and prices that were significantly reduced. However, some non-OEM parts are now shipped in authentic packaging with fairly accurate equipment labels, and prices have been raised to make the part cost seem reasonable—although still attractive. It is certainly possible for a plant to pay nearly full price for a non-OEM part and not realize it was not genuine.

What are the critical differences? Non-OEM valve parts can look identical to their OEM counterparts. The color, dimensions and labeling may appear to be exactly the same. Some are openly marketed as a "direct replacement" for the original component, while others are presented as an authentic OEM part. What are the differences between an OEM and a non-OEM part? The answer, while not obvious, can be significant.

A parts replicator looks to fabricate a non-OEM part as cheaply as possible. The part itself must look the same, of course, and in that regard the replicator is usually fairly successful. They start with an OEM part, often used, and measure its dimensions. They then use a positive material identification (PMI) gun to scan the part and identify the alloy of construction (FIG. 2). Based on that data, the fabricator creates the replacement part, often painting it the same color and affixing a similar label. The part is then sold as a direct replacement, and in some cases, it is even packaged and marketed as an actual OEM part.

While the component may look identical, a more thorough examination can reveal a host of problems, starting with those seemingly simple dimension measurements. Any machining process involves a target dimension with an allowable manufacturing tolerance (FIG. 3, left). As long as the final dimensions fall within the allowable range, the part is considered "in specification" and released. This process works well for the OEM fabricator, which has designed the part, knows the fabrication tolerances, and has set that tolerance band to ensure the finished part will consistently fall within specification and perform as expected.

Despite their near identical appearance, non-OEM components are still likely to underperform, resulting in significant costs in terms of downtime, equipment damage and personnel hazards.

In contrast, the replicator has a single, and typically used, part that they measure to determine the target dimension. They then use that dimension as their new target and will fabricate parts in a tolerance around that measured value. The replicator does not know the OEM target dimension or the allowable tolerance, so the resulting parts will often fall outside OEM specifications, as shown on the right of FIG. 3. This can create significant performance issues when the component is placed into service.

FIG. 2. While a PMI gun can reveal some details regarding materials of construction, it does not provide a complete picture. Source: Emerson.

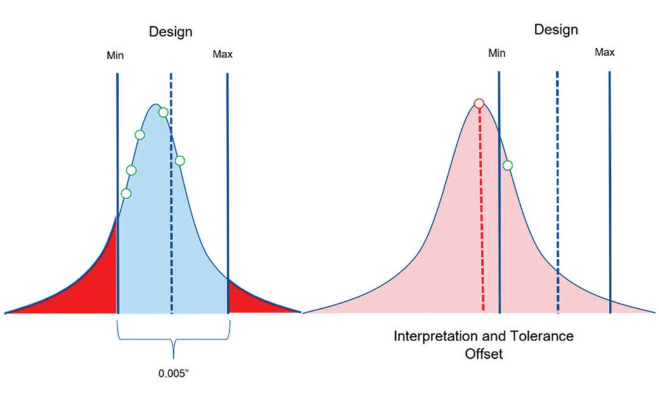

FIG. 3. The OEM part (left) is fabricated to a design dimension and falls within an allowable tolerance band. The non-OEM part (right) is based on a single dimension taken from a used part. The resulting dimensions will often fall outside the allowable OEM tolerance band. Source: Emerson.

Now consider the replica part's material of construction. The x-ray fluorescence analyzer in the PMI gun can identify the chemical composition and grade of the part, but that is only a small piece of a much broader specification. Every OEM part has detailed specifications for external coating materials and thickness, heat treatment, hardness and surface finish (TABLE 1).

These processes are carefully chosen to extend part life, minimize friction, manage specific stresses expected in normal operation, and perform as expected. The non-OEM part manufacturer has no way to determine any of this information from a PMI gun reading, so they finish the part until it "looks right," and then box it up for shipment to a hapless customer.

The difference in part performance can be significant. Hardness and surface finish impact the friction of the component as it moves, which can cause control valves to hunt around setpoint. The non-OEM parts also tend to gall and wear earlier, as well as leak and fail prematurely in cavitation or flashing conditions.

Additional value from OEM parts. The dimensions and material of construction obviously have a significant impact on the performance and service life of a valve component. However, another significant benefit is associated with OEM parts: the knowledge and expertise of the manufacturer itself.

A host of professional standards organizations are dedicated to maintaining the safety and reliability of process control valves, while ensuring the metallurgical fabrication techniques are the best available. Nearly every OEM control valve supplier has active representation on many of these standards committees, offering valuable knowledge and staying current on the latest industry developments.

That knowledge is translated into continuous improvements in the materials of construction and manufacturing techniques that are used to fabricate valve parts. Just as every product has a

TABLE 1. A PMI gun reading can indicate the specific material of construction, but it cannot determine the host of other material specifications, post-treatment and testing a typical valve part requires

Replication vs. OEM design: Materials

	ASTM A494	Fisher ASTM A494
Raw material control		x
Chemistry control	x	x
Heat qualification bend test		x
Liquid penetrant (LP) examination		x
Heat treat temperature control	x	x
Heat treat time control		x
Quench method control		x
PWHT major repairs		x
Weld filler control		x
Interpass temperature control		x
LP examination weld repairs		x

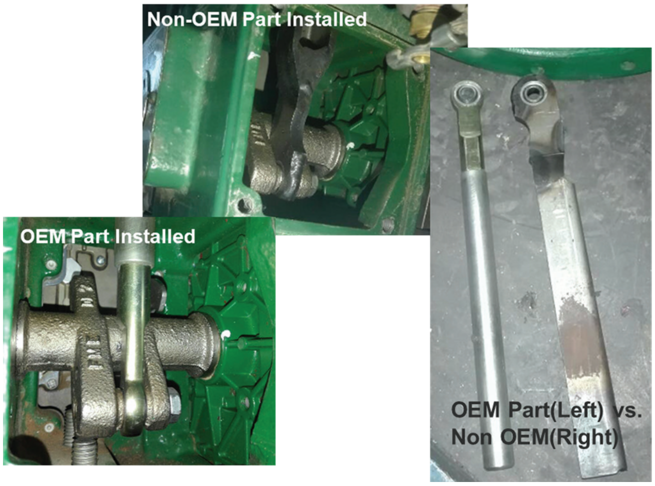

FIG. 4. An unauthorized valve repair shop decided to replace the actuator shaft assembly with a reverse engineered version (right). The non-OEM part dimensions were incorrect and kept the valve from fully closing, forcing an additional 24 hr of unplanned downtime. Source: Emerson.

lifecycle, so does every part. In some cases, the part remains the same throughout its lifecycle; in many other instances, the part is upgraded throughout its lifecycle, sometimes more than once.

An upgraded part may be quite different from the original part used in the original valve because it has often been redesigned to perform better and/or last longer than the original. When an OEM part is purchased, the user is taking advantage of this expertise and obtaining a part that reflects the most up-to-date knowledge available.

Another benefit of buying OEM parts is the opportunity to benefit from a vendor's extensive application and domain expertise. Process changes occur often, subjecting valve components to more difficult conditions than were originally considered in the original purchase. If a part fails prematurely, the OEM has the expertise to evaluate the part, determine why it failed and possibly offer an upgraded part better suited to the new conditions and requirements. Replicators will simply offer their best efforts at a duplicate (but not exact) replacement, which is destined to fail again soon.

Another valuable service provided by OEMs is the ability to quickly provide stocked parts anywhere in the world. In many cases, the part can be delivered within hours, with upgraded parts supplied as a matter of course.

The wages of non-OEM parts are serious incidents. Innumerable examples exist where non-OEM electronic, piping and valve components found their way into plants and caused serious damage and lost production. A few recent examples are detailed here.

A massive fire in India's Hazira gas plant forced the immediate shutdown of the plant's 30-MMm^{3}d capacity, blocked production from several gas fields, and curtailed 40% of a downstream user's supply. The cause of the fire was traced to a set of non-OEM gaskets and O-rings installed in a gas meter during refurbishment. The meter was returned to service and the meter seals failed shortly thereafter, sparking the blaze that forced the large gas processing plant out of production.

In another incident, an end user sent a control valve to an unauthorized repair facility for refurbishment. The valve was repaired, returned to the site and placed into service (**FIG. 4**). Upon startup, the valve immediately began leaking and forced the plant to shut down again to address the problem. Upon investigation, the plant determined that the shop had replaced the actuator shaft assembly with a non-OEM part that was not dimensionally correct and kept the control valve from fully closing, creating the leaks noticed at startup. Ultimately, the plant incurred an additional 24 hr of unexpected downtime due to minuscule savings on a part that could have been purchased from the OEM for $200 from stock at a nearby warehouse.

Steam desuperheaters are a critical application in many combined-cycle power stations, with downstream equipment and piping dependent on their performance to avoid significant damage. After an extended time in service, a set of desuperheaters was removed and sent to an authorized repair facility for refurbishment, with the plant purchasing the repair components and providing them to the service center.

The repair facility examined the non-OEM parts and noticed significant differences in the design. Further investigation revealed that the plant had purchased the "OEM" parts from a non-OEM supplier, and the replacement components were actually substandard. There is no way to know how these parts would have performed, but any deviation could have easily damaged downstream piping, warped boiler tubes and cost hundreds of thousands of dollars in equipment and downtime. The plant was unwilling to take the risk, so the non-OEM parts were returned and replaced with OEM parts, and the repaired desuperheaters were returned to service without incident.

Takeaways. The case studies presented here are just a small sample of the thousands of cases of non-OEM valve components encountered daily in industrial plants and facilities worldwide. Valve bodies have failed, internal seal components have quickly deteriorated, and control valves have leaked both internally and externally—all due to the use of non-OEM parts.

Eliminating this problem has become increasingly difficult because suppliers of substandard parts have stepped up their game. Non-OEM parts are no longer so easily recognized, with these parts packaged, priced and sold into non-OEM supply channels and marketed as authentic OEM parts. Despite their near identical appearance, these types of components are still likely to underperform, resulting in significant costs in terms of downtime, equipment damage and personnel hazards.

A repair savings of a few hundred dollars can easily result in an unplanned loss and equipment damage worth hundreds of thousands of dollars. Is that deal worth the risk? Certainly not when the results can include extended downtime, associated economic loss, equipment damage, environmental incidents, injury to personnel, civil lawsuits, increased insurance rates and long-lasting damage to a company's brand and reputation.

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