Multiple third party inspection: boon or bane for the valve industry

VALVE FAILURES HAVE RESULTED IN CATASTROPHIC INCIDENTS SUCH AS IN THE DEEP WATER HORIZON RIG, BUNCEFIELD OIL STORAGE DEPOT AND JAIPUR OIL DEPOT. THE IMPACT OF THESE INCIDENTS INCLUDE LOSS OF LIFE, APART FROM THE MONETARY LOSS AND THE DAMAGE CAUSED TO THE ENVIRONMENT. SUCH INCIDENTS HAVE RESULTED IN TIGHTENING OF SPECIFICATIONS AND INTRODUCTION OF STRINGENT INSPECTION AND TESTING AT THE VALVE MANUFACTURERS' END. IN THE VALVE INDUSTRY TODAY, CERTAIN END-USERS STRONGLY BELIEVE IN THE VALVE MANUFACTURERS' INTERNAL QUALITY CONTROL MEASURES AND DO NOT HAVE ANY ADDITIONAL INSPECTIONS IN THE MANUFACTURING STAGE WHILE CERTAIN OTHER END-USERS BELIEVE IN STAGE INTERVENTION/INSPECTION DURING MANUFACTURING TO ENSURE COMPLIANCE. WHILE BOTH STRATEGIES HAVE THEIR MERITS & DEMERITS, IT IS IMPORTANT THAT WE AVOID DUPLICATION OF INSPECTIONS/MULTIPLE INSPECTIONS ETC. WITHOUT COMPROMISING ON THE QUALITY, COST & LEAD TIME.

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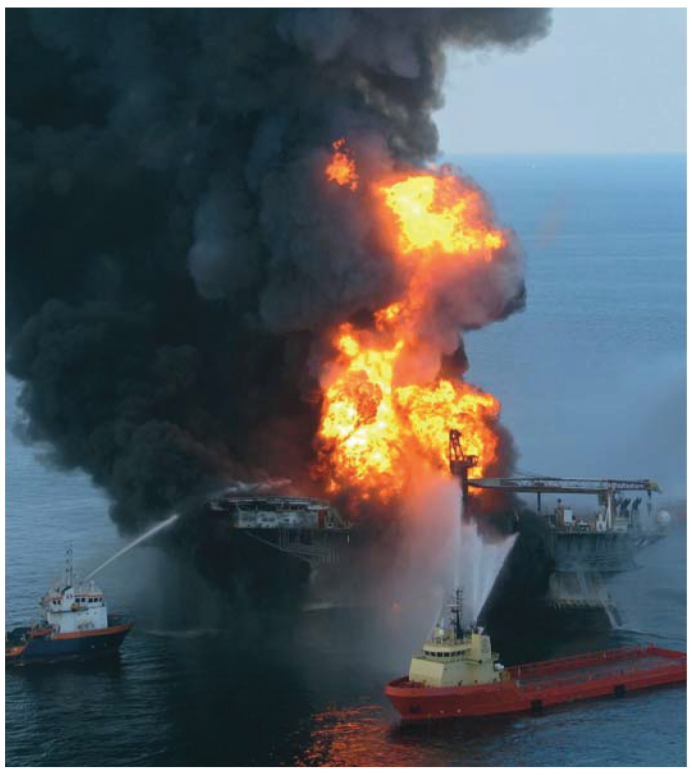

Background

With oil prices where they are at, there is immense pressure on end-users to cut costs in the supply chain in existing projects or to defer investment in new projects. This has led to identification of new suppliers from emerging markets previously unbeknownst to end-users. Consequently, with the intention of improving valve reliability and to alleviate the problems associated with a low cost supplier route, requirements are amplified in valve specifications and the scope of valve inspection is expanded to cover the entire gamut of valve operations. The implementation of increased and multiple inspection scope, however, is done globally and even the well-established manufacturers have to deal with the new norm. The over-specified controls and inspection points have a direct impact on the cost and delivery of the valves.

Valve inspection and testing: then and now

Valve inspection and testing is an important function in the valve industry in the eyes of an end-user as it assures them that valves purchased are fully meeting the specification and conform to the relevant product standard and statutory laws. Valve inspection and testing encompasses all stages in the production of the industrial valves and is done against approved drawings, purchase order specifications, relevant API/ISO standards such as API 598 or ISO 5208. A few decades ago, an end user would engage a third party inspection (TPI) agency to witness the final hydro testing of standard valves at the manufacturer facility and witness qualification testing as well as production testing for valves meant for critical applications.

The current scenario is far different as stage inspection checkpoints are specified by many of the end-users/EPCs with an objective to ensure flawless startup of the plant and to avoid any operational issues that may affect the HSE performance of the plant. Table 1 shows the inspection points for valves then and now.

Does it really add value? Yes, and No!

The number of inspection checkpoints has increased multifold from only hydrotesting in the 80's to five to six checkpoints by 2000 to approximately fifteen checkpoints now. While inspection is indispensable, some of the checkpoints are superfluous and act as speed bumps more than anything. Let us look at pros & cons of the current scenario:

- With multiple inspection checkpoints, one could argue that product quality could be monitored better by pointing out non-conformances, if any. *However, what is more important is the nature of the non-conformance – technical or trivial, intent/ basis of the non-conformance - sensationalism or pragmatism.*
- Every paragraph in valve standards such as API 600 or API 623 is not written with an "unless otherwise agreed" wording and hence on non-technical and technical issues, it is important to understand the intent of the standard while doing the inspection and take a judicious call. A few examples are:
  1. MSS SP-55 for example provides 60 reference photographs for surface imperfections that are intended for general use for any 4" x 5" area. But the intent of the standards is not to compare these photos with those taken on a smart phone with 5X resolution and zoomed to accentuate the defects.
  2. API 600 provides guidelines for stem projection in handwheel operated gate valves. The same was extended to gear operated valves by an inspector and several valves were put on hold citing non-conformance. Here, the intent of the standard is that there should be enough thread engagement after a few years in service (wear travel) in HW operated valves. However, gear operated valves are sized such that operator torque/thrust capacity is much more than the valve torque and hence the threaded bush length will be longer to suit the maximum torque/thrust requirement of the operator though there may be no stem thread projecting beyond the bush.

Table 1.

Inspection stages	Inspection	1980s	2000s	Now
Raw material	Foundry audit/approval		✓	✓
	Surveillance witness of body/bonnet by TPI			✓
	Prototype RT review/production RT review		✓	✓
	TPI witness 3.2 – Chemical/mechanical/HT for body/bonnet/trim			✓
	WPS/PQR fresh approval		✓	✓
In process Inspection	Raw material inspection body/bonnet/connector – Visual /NDE/dimensional inspection witness			✓
	Machined components DP (BW end, overlay) and overlay/hardness		✓	✓
	Surveillance monitoring –Pre-assembly inspection for high end MOC (PMI on body, bonnet, trim components and fasteners, disc, seat ring, fasteners			✓
Testing Inspection	Hydro testing witness	✓	✓	✓
	Special testing witness like cryogenic test/FE test/ Vacuum		✓	✓
Final inspection	Blasting & painting inspection/pre-packing inspection			✓
	Packing inspection			✓
	Documents –3.1/3.2 certification for body/bonnet		✓	✓
	Documents –2.2 certification for trim components, fasteners			✓
	Helium test, hardness, PMI, DP/MP reports			✓

Valves internally tested OK lined up for hydrotest offering to TPI.

- Castings are subjected to relevant NDE & visual inspection per the valve manufacturer's Technical Delivery Conditions (TDC) at the foundry and checked again during receipt inspection at the manufacturer's facility. There's no value addition *when these components are again offered to TPI as raw material offering (RMO)* except that it increases the throughput time and impacts the delivery period. This is applicable for the mandatory tests as per API 598 that are also conducted twice – once by the manufacturer and once for the TPI when tests are done on 100% of the lot quantity instead of on a sample % lot.
- Valve manufacturers have to deal with multiple TPI agencies for a single order, handle end-user surveillance inspection of EPC appointed inspector and statutory inspection bodies. This results in conflicts and creates a logistics nightmare of coordinating multiple agencies. Manufacturers also have to plan for additional resources like capacity with test stands, dedicated space for storing valve components meant for inspection and people.

Castings lined up for TPI.

How established valve manufacturers ensure product reliability

An established valve manufacturer has an elaborate quality system administered across the value chain. Compliance to the below requirements ensures process & product reliability

a. *Quality Management System:* Typically, a well established valve manufacturer will have a quality management system evolved around ISO 9001, API Spec Q1, and have an apex quality manual, followed by detailed procedures covering all the functions to meet the quality requirements and maintain the documents/ records stored over a period of years.

b. *API Monogram:* When a manufacturer is qualified for API Spec Q1 quality system and API Monogram for products manufactured to standards such as API 6D, API 600, API 609 etc. it is an assurance that products manufactured are in full compliance to the requirement of the product standard in terms of design, manufacturing, selection of materials for shell, trim components, testing and marking requirement. Such audits are conducted by API appointed inspectors and based on the outcome of audit, an API monogram license can be obtained/retained or suspended.

c. *Qualification of Process & Product in an independent lab:* API RP 591, Process valve qualification procedure, is a recommended practice (RP) that provides recommendations for evaluation of a manufacturer's valve construction and quality management system. The tests conducted on randomly selected valves range from radiography tests on castings, strength tests to mechanical and metallurgical tests. API 624/API 641 Fugitive emissions tests and API 607 fire safe tests are product qualification tests that prove the valve design.

d. *Independent design examination:* PED Module B1 covers design examination certification where the appointed third party agency would review technical construction files with design calculation, drawing, ESR, risk and other relevant documents for the products in compliance to the PED 2014/68/EU directive. Alternatively, the end-users themselves can review design calculations, drawings and if required witness prototype tests.

e. *Accepted Manufacturers' list:* The AML as it is more commonly referred to contains manufacturers who have been evaluated i.e. these manufacturers have been successfully used on several projects in the recent past and have proven themselves. The AML process in itself would comprise points a to d mentioned above and additionally include factory audits and a list of approved sub-suppliers.

Conclusion:

- While it is important that valves, which are pressure vessels, are inspected and tested at the manufacturer's end to ensure compliance to codes, standards and end-user specification, there is a need to revisit the scope of inspection to avoid the stop-start on the shop floor.
- The valve manufacturer is solely responsible for the product quality and performance and no amount of inspection absolves the manufacturer in case of any failure in service.
- All tests and inspections notwithstanding, if valves are wrongly selected, are not stored properly at the site and not commissioned with adequate precautions, the valve performance would be hampered nullifying all the effort, time and money spent on additional inspections.

About the authors

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