Valve Deficiency Study :End User Experience

Meshari Al-Otaibi

Aramco Chief Representative, Italy

Objective

- Promote awareness of Saudi Aramco Valve Inspection Requirements & Equipment Deficiency Report concept among procured material's stakeholders

- Improve the quality of supplied valves to Saudi Aramco’s projects and operating facilities in order to mitigate the risk of failure and minimize the associated cost and time impact

Outlines

- Aramco Overseas Company Overview
- Valve Inspection Requirements
- What is the Equipment Deficiency Report?
- Statistics and analysis
- Examples of Defected Valves
- Aramco Support for valve manufacturers

Aramco Overseas Company Overview

Aramco Overseas Mission:

"To support the Saudi Aramco enterprise by providing optimal services and maximizing value"

where energy is opportunity™

QMD vision

Globally leading partner to Saudi Aramco through excellence service provisions

QMD Goal

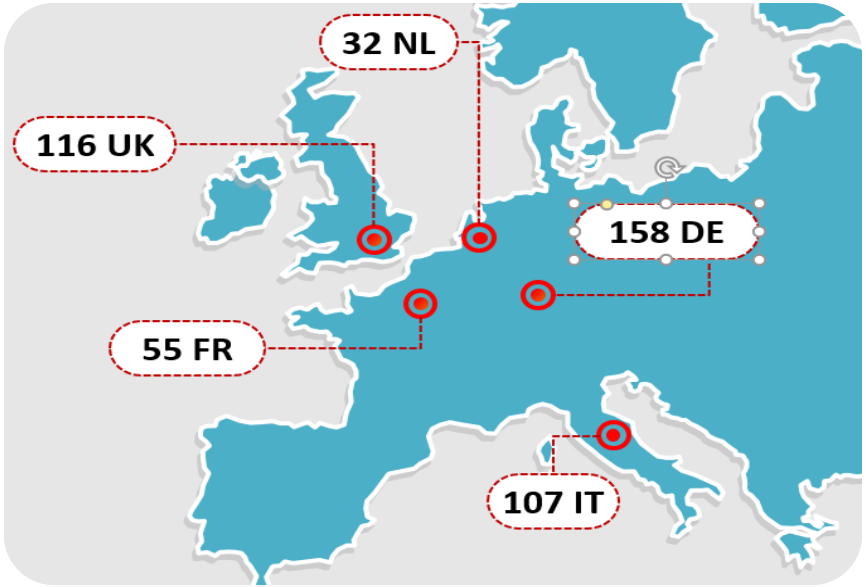
Fully compliant equipment delivered to Saudi Aramco (Zero Defects)

Global Presence

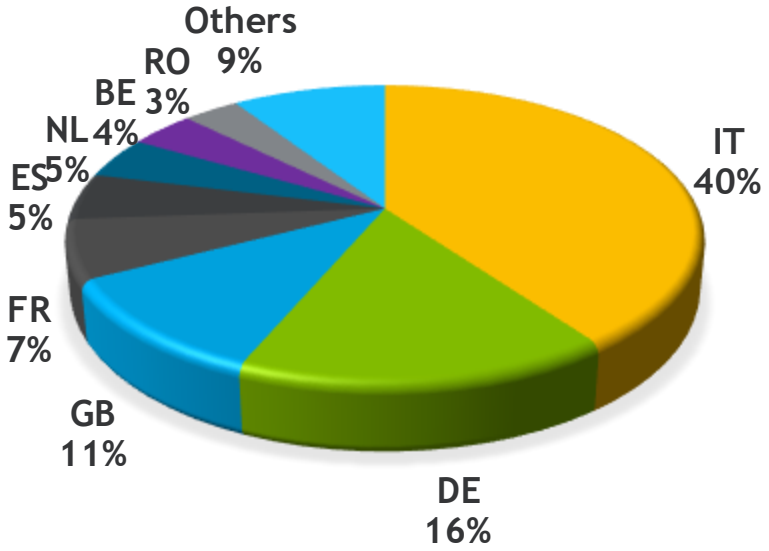
aramco

Figures & Facts

Top 5 Manufacturing Countries



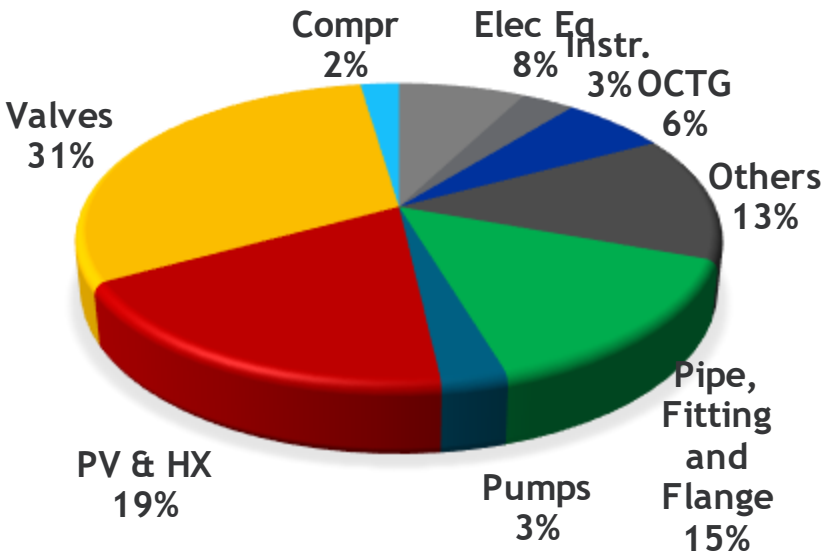
Business Volume per Country



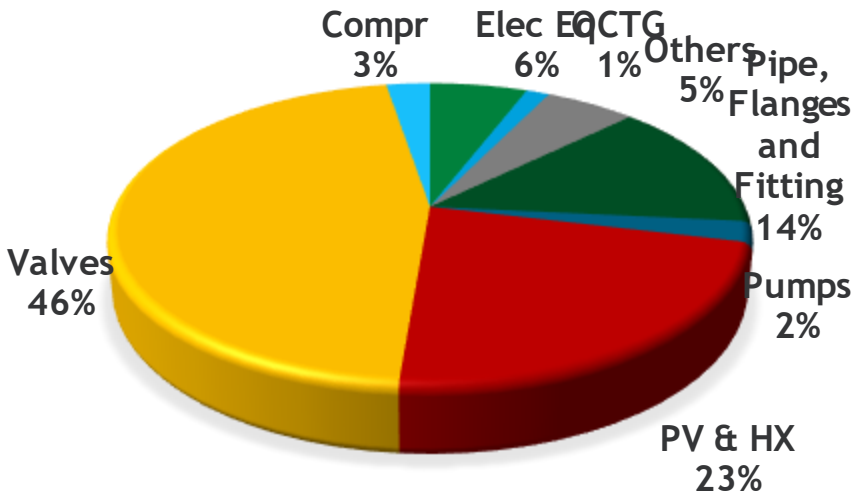
aramco

Figures & Facts

Material Purchased in Europe



Materials Purchased in Italy



aramco

Valves Inspection Requirements

Valves Inspection Requirements

Pre-Fabrication | **In-process inspection & test** | **Final Inspection & test**

Scope
Review and approval of manufacturer's quality documents

Main Activities
- Pre Inspection meeting (PIM)
- Review of Material Certification, Welding & NDT Requirements

aramco

Valves Inspection Requirements

Pre-Fabrication | **In-process inspection & test** | Final Inspection & test

Scope
Verification of intermediate manufacturing processes

Main Activities
- PMI
- Visual inspection (Castings & Forgings)
- NDT Testing (RT, PT MT or UT)

Note: For RT, PT MT , it's sampling requirements as per specification

aramco

Valves Inspection Requirements

Pre-Fabrication | In-process inspection & test | **Final Inspection & test**

Scope
Verification finished product before shipment

Main Activities
- Final Visual inspection
- Pressure testing
- Final painting
- Marking & preparation before shipment

aramco

What is Equipment Deficiency Report?

What is Equipment Deficiency Report (EDR) ?

Definition

Equipment Deficiency Report (EDR) is SAP report established in end of 2001,documenting purchased inspectable material received at site and found deficient due to manufacturing or transportation problem

Objective

To take effective corrective action & to ensure that reporting, investigation, and documentation of equipment deficiencies are handled consistently (SAEP-380 :Equipment Deficiency Report)

What is Equipment Deficiency Report?

Scope

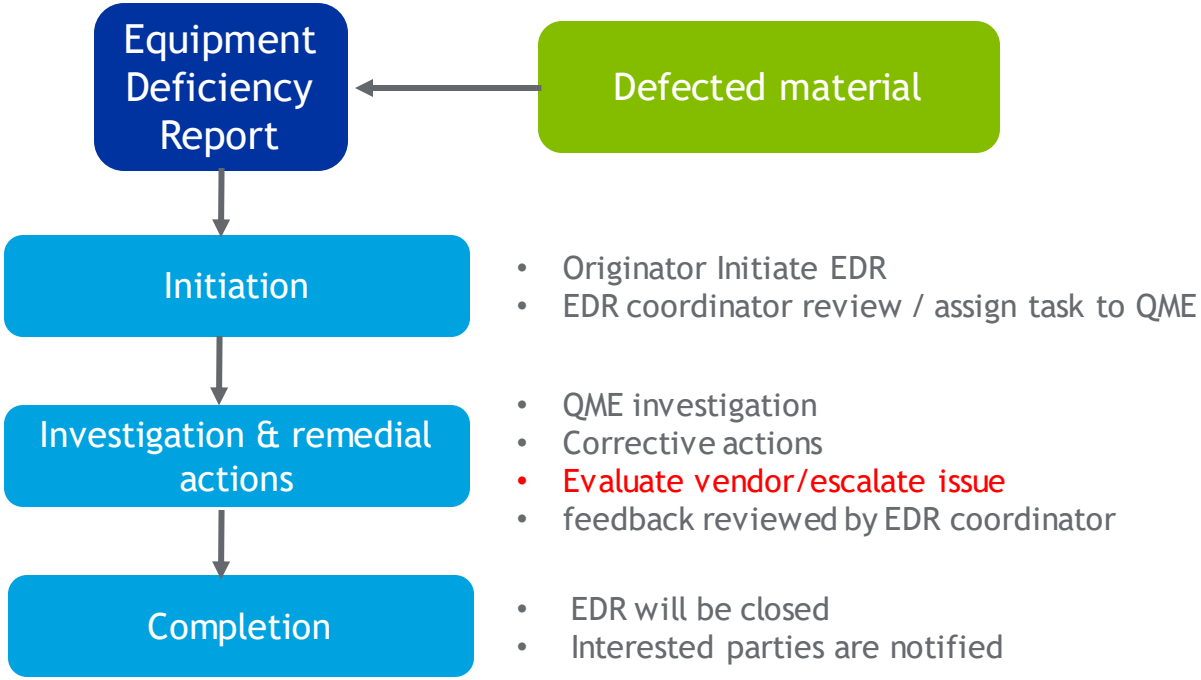
Purchased Inspectable material:

a. Arrived at site with deficiency(ies).
b. Failed prematurely after being put in service.

Advantages of Equipment Deficiency Report:

a. Report manufacturing deficiencies
b. Identify root cause(s)
c. Determine & implement corrective actions to avoid reoccurrence.
d. Measure and evaluate the effectiveness of the quality management system (manufacturers, inspection agency)
e. identify continual improvement of the quality management system

Equipment Deficiency Report Process



- Originator Initiate EDR
- EDR coordinator review / assign task to QME

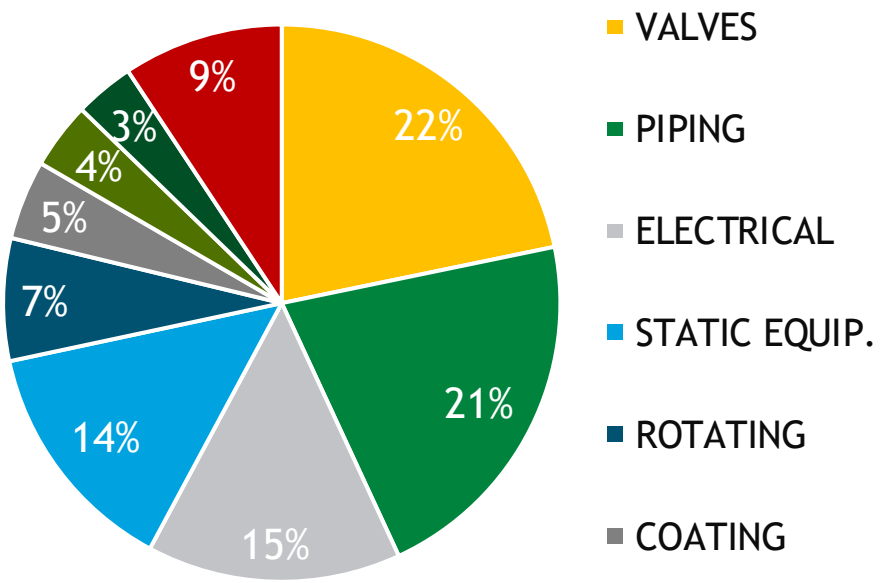
- QME investigation
- Corrective actions
- Evaluate vendor/escalate issue
- feedback reviewed by EDR coordinator

- EDR will be closed
- Interested parties are notified

EDR Statistics and Analysis

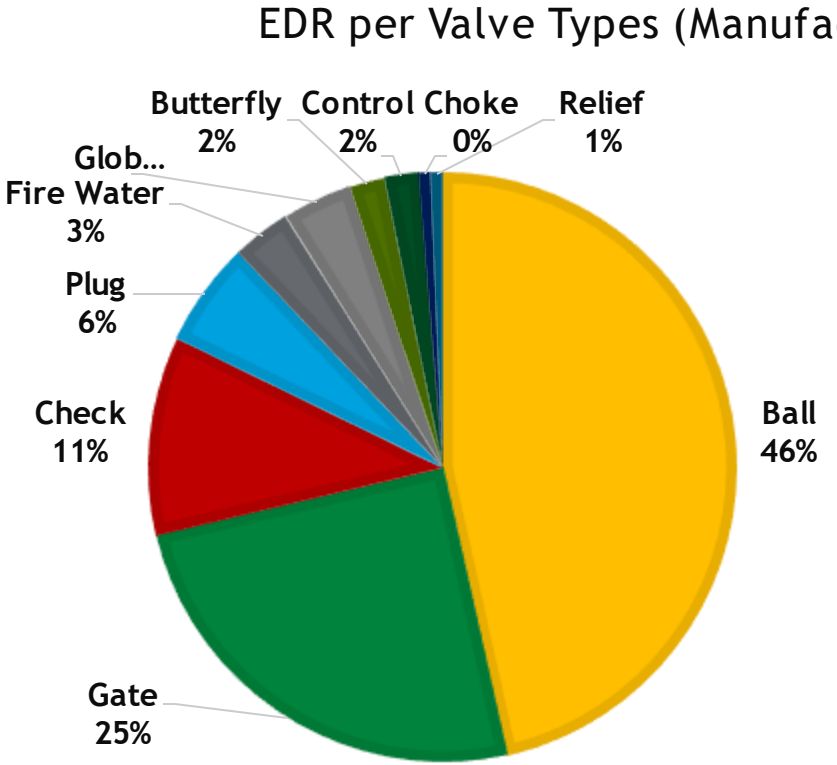
Data Collection

- All collected data retrieved from EDRs between 2007 to 2018
- Valve represent 22 % of total EDRs



OTHER*:structural steel, constructions, gaskets, HVAC, cranes

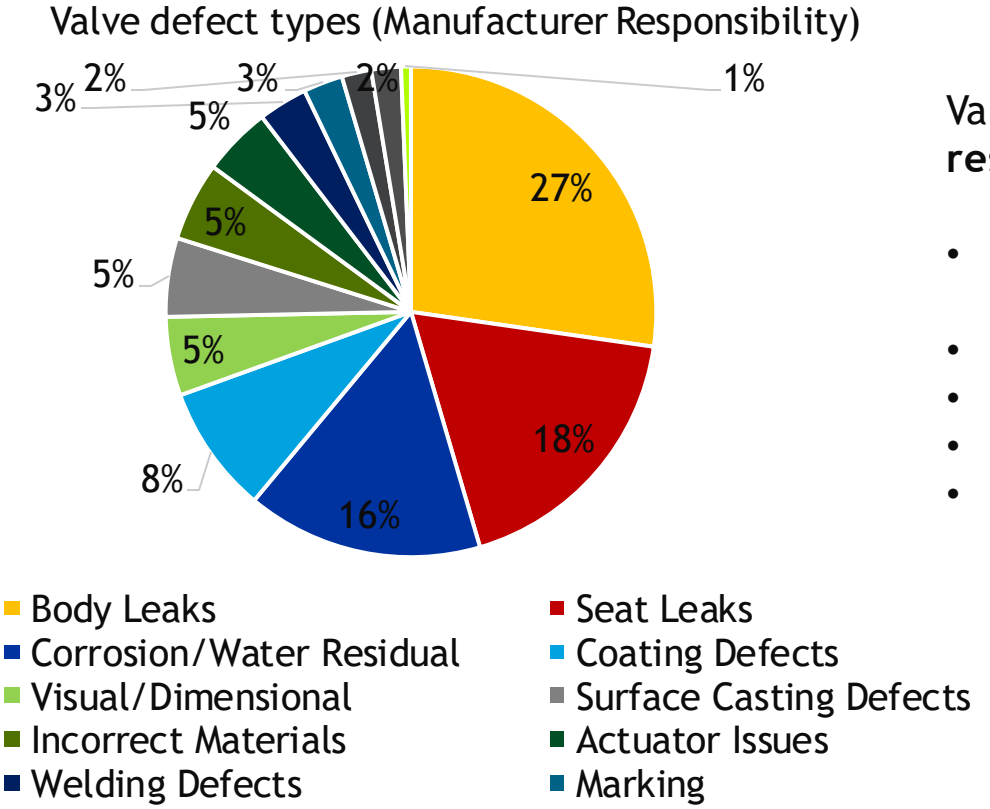
Valve EDR Statistics (2007-2018)



- EDR Distribution is aligned with supply distribution where Ball Valves cover most of supply of this commodity.
- Proportion of defective valves is higher in large sizes (NPS above 20) sizes against the number of supplied.

aramco

Valve EDR Statistics (2007-2018)



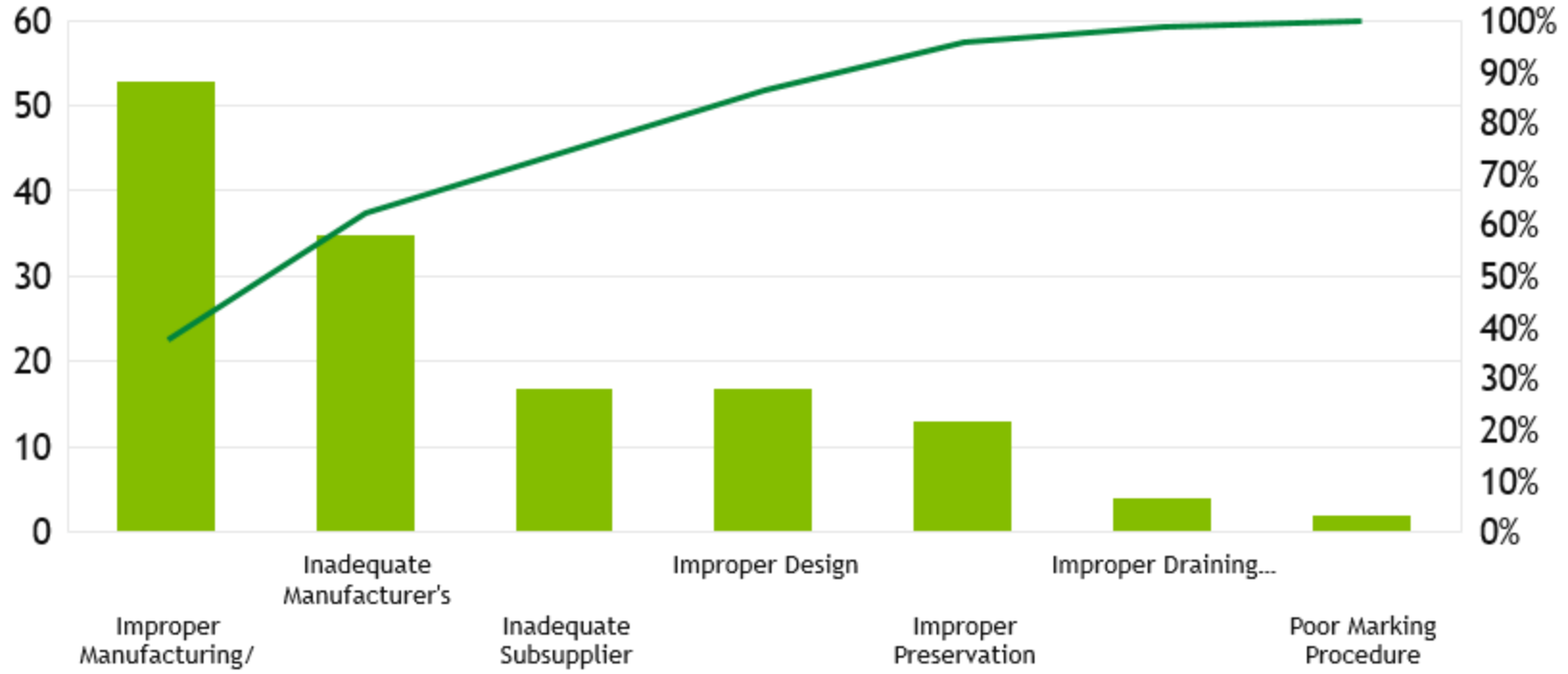
Valve EDRs attributed to **Manufacturer's responsibility** are due to:

- Improper Assembling / Manufacturing Procedure
- Improper Internal Inspection Process
- Improper Design
- Improper Sub Supplier Control
- Improper Draining and preservation Procedure

aramco

Valve EDR Statistics (2007-2018)

Pareto Analysis of Root Causes assessed on defective Valves (Manufacturer Responsibility)



aramco

Gaps Analysis & Recommendations

1. Unsatisfactory Vendor Manufacturing and Quality Control Processes performance
   - Introduce Statistical approach for Quality Control Processes (e.g. by using new statistics as p.p.m (part per million) for defective components or delivered defective valves)

2. Inconsistent approach among Vendors to qualify and manage sub-suppliers (Casting, W.O. and coating)
   - Implement guidelines for sub supplier qualification (e.g. enforce the use API 20A for casting sub supplier qualification)
   - Formalize processes to ensure sub supplier list are continually monitored and evaluated

3. Design and product validation not properly implemented by Vendor or not mandated by applicable Specs
   - Impose valve qualification tests for critical and or specific applications including pressure cycles, mechanical quality, tension, bending and thermal.

Recommendations before valves' shipment

The below actions to be taken at Manufacturer's shop before shipment :

1. Verify the tightness of safety cap or bleed plug screw. This shall be done by qualified inspector.
2. Ensure that the bonnet nuts are tightened properly by measuring the bolting tightness torque. Inspector shall check tightness torque against approved Drawings / Data Sheets.
3. Check the correct lubrication of bearings, operator and seats. Visual inspection shall be done by qualified inspector to ensure sufficient and correct lubrication is applied on bearings, operator and seats.
4. Check the Valves correct draining and drying after Hydrostatic Pressure Testing. This shall be done in accordance with applicable SAMSS and API Standards

Examples of Valve Defects

Fabrication / Assembly Defects

Valve external leakages from body sealing

Example

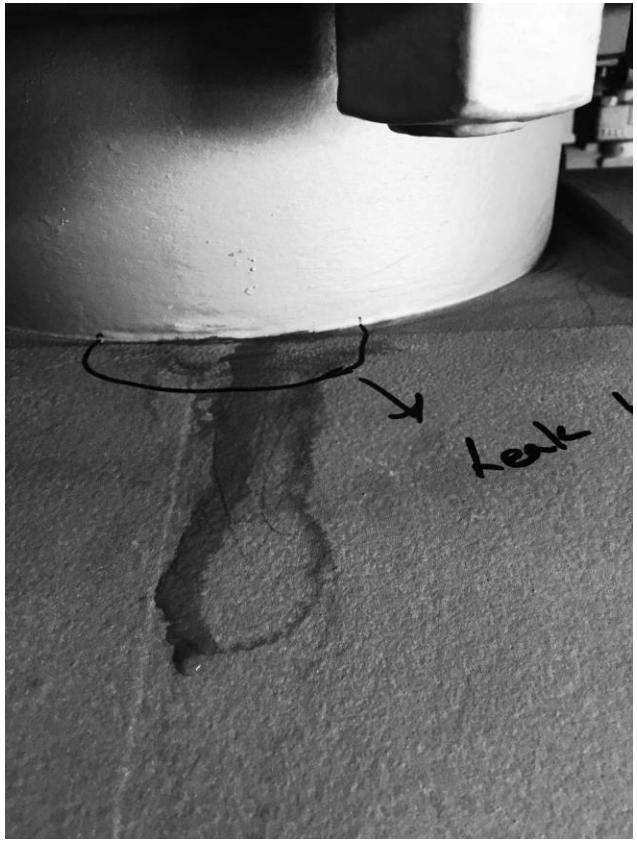
Leakages from body sealing found during on-site tests

Root Cause

Non-adequate assembly technique which compromised the integrity of gaskets

Corrective Actions

1. Emphasize the importance on proper handling of gaskets and protection of critical sealing areas by a clear Work Instructions which shall be available in the Work Shop.
2. Cleanliness of the work area to prevent risk of Foreign Object Debris during the final assembly.
3. Periodical training course for assembly technique.



aramco

Fabrication / Assembly Defects

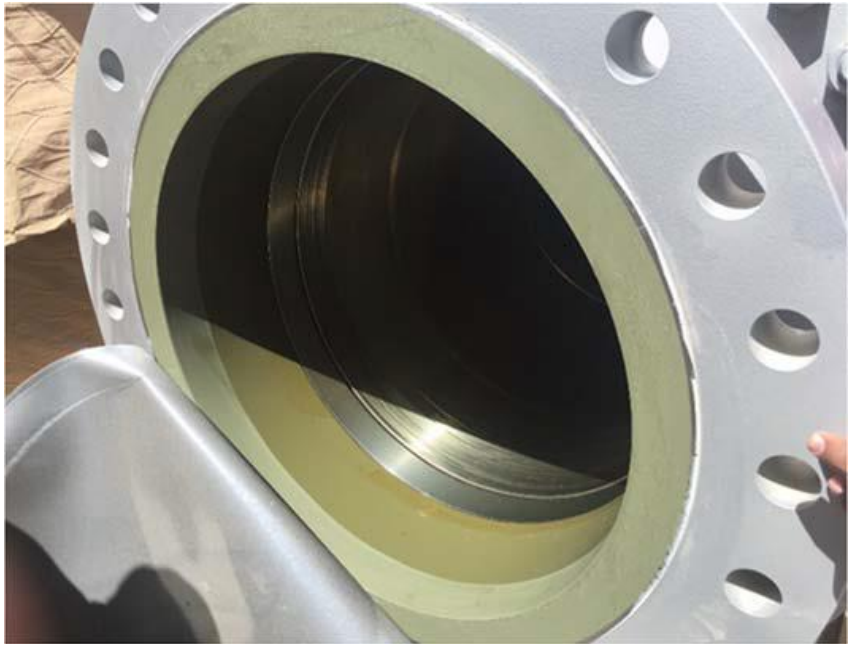
Valve external leakages from body sealing

Design / Engineering / Manufacturing

Failure to follow Company Standards/Customer Requirements

Example:

The manufacture extended the internal FBE coating on flange raised face (serration area) seating area in violation to SAES-H-002, Para 5.2.9



Root Cause:

Wrong “interpretation” to the standard requirements

Corrective Actions:

1. Emphasize the importance to “Determine” and “Review” the requirements for products by ensuring that all the applicable Standards are available in last up-dated edition and followed during the entire realization/manufacturing process.
2. Importance of communication with customer to obtain feedback, including eventual clarifications.

Inspection and NDE Defects

Defects on valve components

Example:

Leakages from casted body valve. Casting impurities classified as unacceptable identified during the following specific radiographic examination

Root Cause:

Defects on material / valve components not identified during the inspection stages (visual, NDT, and final inspections)

Corrective Actions:

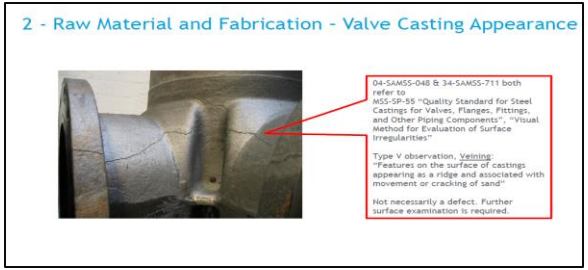
1. Implementation of monitoring and measurement activities at appropriate stages.
2. Validation and periodic revalidation of the processes.
3. Inspection on sub-contracted activities.

aramco

Aramco Support for Valve Manufacturers

AOC Support for Valve Manufacturers

- Conducted Valve Manufacturers Symposium in 2017
- Development of lesson learned for valves. Scope of Lesson Learned is share knowledge, avoid repetition of errors and ensure highest levels of compliance to the Company and Industry Standards.
- Conducting PO focus assessment during manufacturing/assembly.
- Liaison with Saudi Aramco Central Engineering (CSD) & Vendors to identify opportunities for optimizing and improving valve specifications



aramco

THANK YOU

aramco