

Step Change Safety Alert Template



Alert Title

Gas Leak from Actuated Ball Valve Trunnion

What leaked and where from? E.g.: "Lube oil leak from compressor system open vent"

Incident Date

26/03/2014

The date on which the incident occurred, not when this form was completed

Location Type

Offshore Fixed Production Platform

E.g. Floating/Fixed Production, Drill Rig, Vessel, etc.

Specific Equipment Involved

Actuated, 16" 300# trunnion mounted ball valve in 25Cr Super Duplex Stainless Steel. Trunnion fixed externally to ball valve body with capscrews. Plant Tag Number SDV-11379

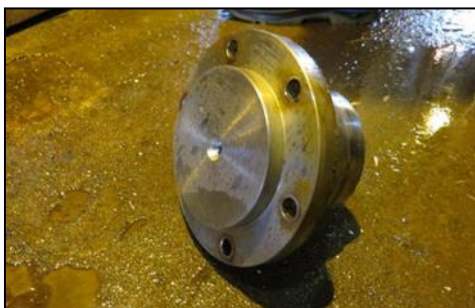
Give as much detail as possible about the equipment involved

Description of What Happened

During start-up of the platform HP Compressor, pressure was being equalised across the inlet valve SDV-11379 (via a 2" bypass valve). SDV-11379 was in the closed position.

During the pressure equalisation across SDV-11379, a loud bang was heard and smell of gas reported by operators at site. The operators immediately vacated the scene and the plant was shut down and depressurised in a controlled manner.

During investigation of the scene, the trunnion from SDV-11379 was found to have parted from the valve body causing a loss of containment. The trunnion, installed in the 6 o'clock position approximately 1 metre from the deck, was projected vertically downwards. The trunnion bounced off some scaffold boards underneath the valve and then struck a 2" cooling medium pipe, before coming to rest circa 1.7 metres from the valve.



The investigation of the valve found that the six of six trunnion fixing cap screws remained screwed into the valve body but all cap screw heads had separated from the cap screw (at the shoulder). Five out of the six cap screw heads were recovered from the deck within a ten metre radius of the valve.



Note that the valve was visually inspected in November 2013 with no faults reported and all capscrews witnessed to be present.

Be as detailed as possible. Give equipment history and approximate time(s) of actions/occurrences related to the incident

Cause of Incident

The SDV-11379 trunnion cap screws were recovered from the site and sent for a full metallurgical analysis.

Review of the general arrangement drawing and material specification originally supplied with the valve revealed the cap screws to have been specified as ASTM A320 B8 Class 1 (304 Stainless Steel).

Visual inspection of the cap screw fractures revealed extensive corrosion product covering the fracture faces with the exception of a small corrosion free region on one cap screw. Chemical analysis of the failed cap screws determined the composition to match UNS S30430 stainless steel. Metallurgical examination of the cap screws confirmed the presence of cracking characteristic of chloride induced stress corrosion cracking (SCC) in six out of six capscrews. The corrosion free region noted on one cap screw exhibited no signs of chloride SCC.



It is concluded that the cap screws failed due to chloride induced stress corrosion cracking, with the final capscrew failing in tensile overload due to the pressure force exerted on the trunnion during pressure equalisation across the valve. The total failure of the trunnion cap screws allowed the valve trunnion to be projected under line pressure from the valve.

During the investigation, it was confirmed that the valve was not subject to pressure in excess of the Process design pressure.

The valve is installed in a gas compression module with deluge coverage, increasing exposure to a chloride environment. Process design temperature for the valve is 130°C. The valve has been in service for circa 21 years. The trunnion is located at the bottom of the valve (6 o'clock position), allowing water to travel down the valve body, under the trunnion flange and collect in the recess within the trunnion bolt holes around the cap screw shanks.

Build from OIR/12 checklist

Incident Consequences

The consequences of this incident were the projection of the trunnion (10.9kg) and cap screw heads from the valve body and the subsequent loss of containment.

Include the release itself and any subsequent emergency actions/dangerous occurrences

Lessons Learned

- Installation specifications should take into account possible modes of failure and specify materials to mitigate the risk of occurrence
- An appropriate inspection technique/strategy should be in place which takes into account possible modes of failure during operation

Include a few bullet points clarifying what was learned from the incident

Recommendations/Actions

- Undertake a review of asset valve populations to identify those valves potentially at risk from Chloride induced SCC considering valve; operating temperature; design and materials of construction; location and potential for chlorides environment.
- Replace trunnion cap screws of valves potentially at risk with cap screws not susceptible to Chloride induced stress corrosion cracking
- Review company material / valve specifications and revise as required to recognise failure mode and specify materials accordingly
- Develop and implement a Long Term Strategy for valve cap screw inspection and replacement
- Review and revise the asset ALE strategy based upon learning from this incident

Include a few bullet points stating any recommendations/actions that will be made/taken as a result of the lessons learned

Contact Details (Optional)

If you would like your submission to be anonymous, leave this section blank