

2017-G: Gas leak from bolt tightening with wrong torque

A gas detector gave an alarm at 10 per cent lower explosion limit (LEL) during normal operation. The area operator, who was already nearby, was ordered by the control room operator to check and report back. Soon afterwards, the leak was tracked to a flow meter on a gas injection well. The control room operator then began to close the wing valve towards the well, while the area operator manually closed the valve towards the gas manifold and opened two manual valves towards the blowdown/equalising system to drain the gas to the flare system. Meanwhile, the relevant detector had given a high-high alarm (20 per cent LEL). That activated ignition source disconnection in the area and started up the fire-extinguishing pumps in case deluge was required. As equipment was closed off towards the well, two further gas detectors gave high-high alarms. That initiated automatic emergency shutdown (ESD 2) of the process plant, an alarm announcement over the PA system and initiation of deluge mixed with foam. A total of five gas detectors registered more than 10 per cent LEL, with four registering over 20 per cent LEL. The leak has subsequently been estimated at 0.16 kilograms per second. It occurred because the bolts lost pretensioning owing to creep in a teflon gasket after the wrong torque had been applied when tightening them.

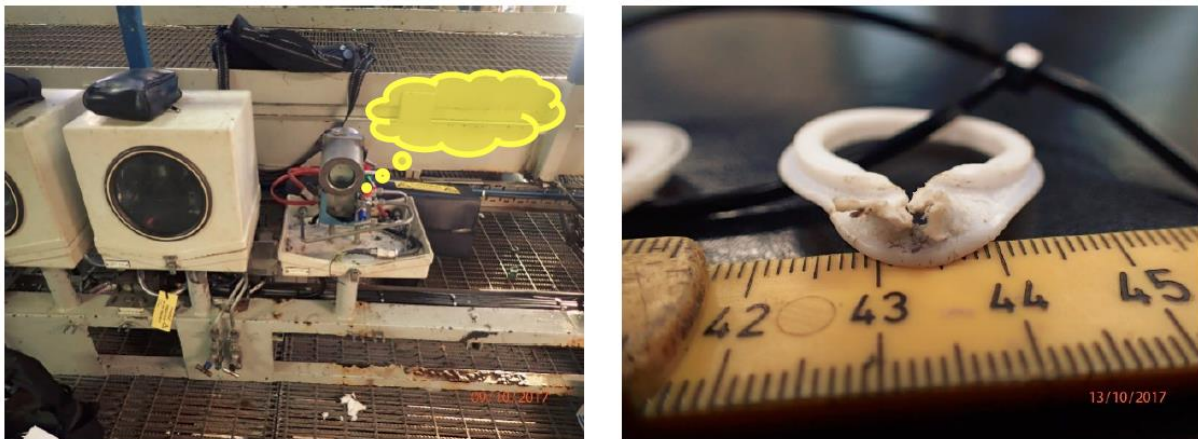


Figure 1 Left: the leak site. Right: deformed gasket.

Causes

Direct cause:

- The bolts lost pretensioning because of creep (cold flow) in a teflon gasket after the wrong torque had been applied when tightening them.

Underlying causes

- Using torque wrenches with this equipment was not normal practice for automation technicians
- The importance of using torque wrenches had not been appreciated by this discipline on board
- A description of the tightening method was difficult to find in the user manual for the instrument (176 pages), and the torque value for the relevant bolts was not mentioned in the quick installation guide
- Taking a course on bolt tightening, gaskets and use of torque wrenches was not established practice for automation technicians
- No expertise requirements for bolt tightening and seals were specified in governing documents
- Follow-up of measures in the wake of similar incidents on other installations in 2014-15 has been inadequate. After a leak in 2015, measures which should have applied to all automation technicians were directed only at a sub-group which works on fiscal metering equipment

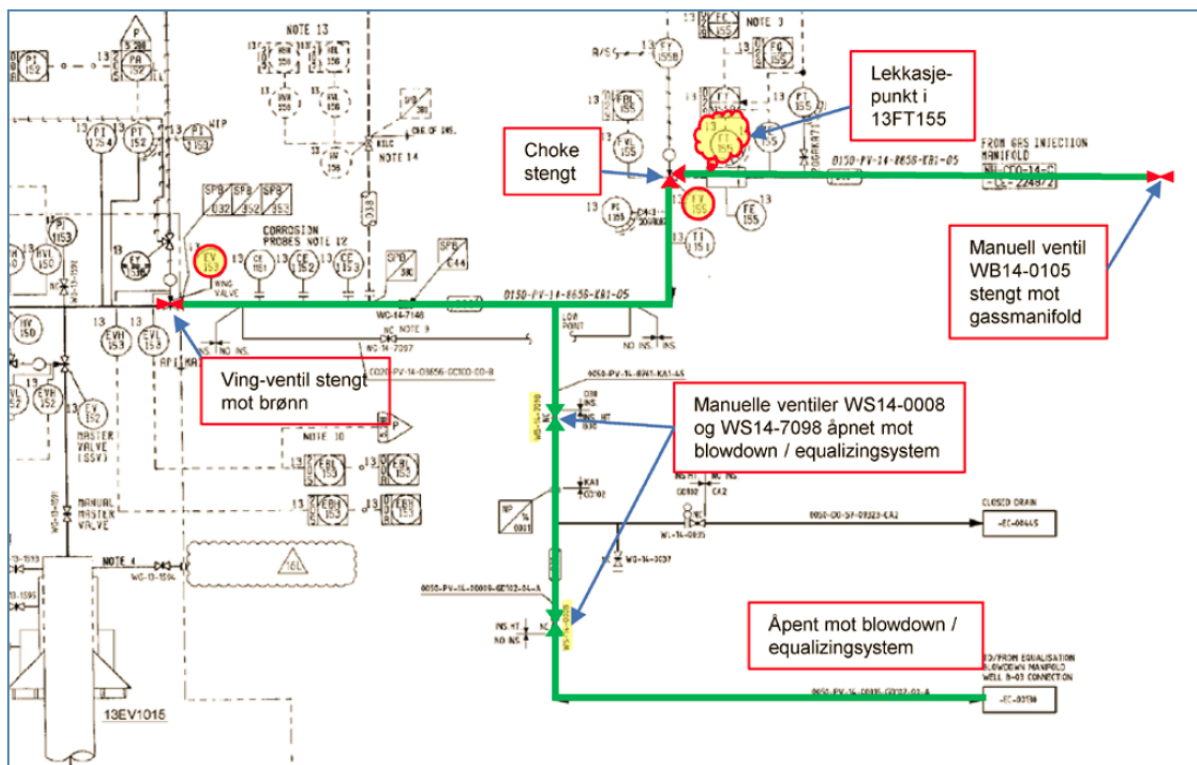


Figure 2 P&ID which shows the leak point and the valves closed (red) and opened (green) to restrict the leak.

Lessons learnt and recommendations

- Correct tightening of bolts
 - If bolts are to be tightened on instrument systems, include a qualified mechanic until automation technicians have acquired the correct expertise
 - Inform all automation technicians about the need to tighten bolts on valve blocks with the correct torque to ensure that gaskets do not give rise to leaks over time
 - Update checksheets for instruments
- More appropriate title for the work process on instrument tubing and fittings
 - Change the name of the relevant procedure from “work on instrument tubing and fittings” to “work on instrument tubing, fittings, valve blocks and other connections”
- Extend automation-technician expertise to include the use of torque wrenches for bolt tightening
 - Expand the content of course curricula to include the importance of the correct tightening torque on gaskets, use of torque tools and additional tightening after a few hours to compensate for cold flow. This expertise requirement should also apply when suppliers carry out work on instruments, both on land and offshore
- Assess review of instruments already installed
 - Each unit should conduct a review of instruments installed in hydrocarbon gas systems with teflon gaskets where it is not possible to confirm that bolts have been tightened using the necessary torque specified in the supplier’s recommendations