

4-3-16 (Lawrence mark-up)

Item number 14-909 BPV-VIII-1; Redundant Relief Valves

Proposal: Add new paragraph to Appendix M to with warnings on excess capacity

Appendix M-15 Pressure Relief System Excess Capacity

A Pressure Relief Valve (PRV) is generally available with a selection of fixed flow areas. The required flow area is identified (based upon the capacity rating of the pressure relief device to be used) and the next larger available area is selected. This larger area for the selected PRV gives assurance of adequate capacity and no additional sizing factor should be applied. Selection of a flow area greater than the next available size should be avoided because capacity in excess of required capacity may cause detrimental performance characteristics and other issues.

- A) Excess installed capacity may cause a PRV to cycle rapidly. This phenomenon is referred to as 'chatter' or 'flutter'. Other factors can cause or contribute to chatter but excess capacity alone may cause chatter.
- B) A chattering PRV does not flow its rated capacity and may lead to pressure in excess of allowable limits.
- C) A chattering PRV may cause system interactions such as vibration and shock loading which can become resonant. Resulting damage may be cumulative and may not be readily noticeable in early stages.

Where selection of the next largest available flow area results in PRV capacity significantly exceeding the required flow rate, specification of a restricted lift PRV is recommended.

There are two methods of handling differing causes of overpressure and flow requirements.

UG-125(c)(1), UG-134(a), and UG-134(b) address the use of multiple PRV's. One PRV is sized for typically the lower flow requirement, and the other PRV is sized to provide only the additional capacity required for worst-case total possible flow. The total capacity of the two PRV's should provide only the additional capacity provided in orifice selection in order not to grossly oversize the total capacity. In a worst-case relief requirement, the staggered set pressures ensure the first PRV is at or near full lift prior to the second PRV opening.

A single modulating pilot operated PRV is another method of addressing varying capacity requirements.

Installation of duplicate PRV's for the purpose of addressing concerns of operational readiness is good practice. In this case, one valve is locked out as an installed spare. Readiness and testing is facilitated. Opening both fully sized PRV's to the process results in more than two times excess capacity. Therefore this practice should be avoided due to the problems noted above. Operational readiness is not bettered with redundant, fully sized, on-line PRV's and may introduce unwanted consequences:

- A. Both valves are exposed to the same service conditions.
- B. Mean time between failure (MTBF) is halved. A PRV is a fail open device.
- C. PRV interaction becomes complicated and unpredictable increasing the probability of chattering and damage.
- D. If set points are staggered and one valve comes out of service, the other valve may have a setting higher than MAWP. This practice is not acceptable and set points must match the PRV nameplate.

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