Pressure Relief Device Inspection

Review of NBIC Part 2, par. 2.5

Prepared by: J. F. Ball, P. E.
Updated November 2016
Purpose of Pressure Relief Devices

• Last line of defense against overpressure condition
• Overpressure could lead to failure of the boiler or pressure vessel (PRI)
• Protection for both persons and property
• PRDs are not designed as pressure control devices!
Keys to In-service Inspection

- Safety considerations
- Pressure relief device and PRI data
- Device condition
- Installation condition
- Testing and Operational Inspection
Safety Considerations

• High pressure discharge may have considerable energy released
• High temperatures may be involved (steam)
• High levels of noise encountered during testing
PRI Data

First look at application and PRI nameplate

• Determine MAWP and design temperature
• Determine steaming capacity or heating surface for boilers
• What is the service fluid?
Device Data

Correct Code Stamp for application

- Power and heating boilers
- Low pressure steam heating boilers, hot water heating boilers, hot water heaters
- Unfired pressure vessel service
ASME Certification Mark with Designator

- New ASME Certification Mark
- Replaced previous Code stamps after 2013
- “Designator” gives service
- V, HV, UV, or UD for pressure relief devices
Device Data – Set Pressure

Inspect pressure relief device nameplate data

- Set pressure for single device cannot exceed MAWP

- Set pressure of high set device where multiple devices are installed may exceed MAWP
  - +3% for Section I boilers
  - +5% for heating boilers
  - +5% for pressure vessels
  - +10% for pressure vessel fire case

- Section I valves must have spread less than 10%
Device Data

Repair plate could change data on original plate
Device Data

Valve may also have “test only” nameplate

- Will show date of test
- Responsible party
- Gives traceability if valve reset
Missing Nameplates

2013 ASME Code, Section I, Appendix III included “CRITERIA FOR REAPPLICATION OF A CERTIFICATION MARK”

• Not practically written for pressure relief valves
• NBIC Part 3, par. 5.12.5 includes provisions for duplicate nameplates (must be done along with VR repair)
• Includes “Sec.I” instead of Code stamp
Device Data - Capacity

• For boilers, combined valve capacity must exceed maximum designed steaming capacity
• NBIC Part 1, Table 2.9.1.3 gives calculation method when heating area is used (need to know boiler fuel)
Device Data - capacity

Compare valve capacity in BTU/Hr to burner input for heating boilers

• Has burner or fuel been changed?
• Valve seals must have correct identification
• Valve seal identification must match other information on the valve
  • OEM seal
  • Repair company seal should match repair nameplate
  • Seal may match “test only” nameplate
Device Condition

• Seals intact
• Bolting tight and no bolts missing
• Deposits or material buildup
• Damaged or missing parts
Device Condition

Small valves may be permanently sealed (what’s wrong here?)
Device Condition

- Valve should not be leaking
- Drain hole not clogged or plugged
Device Condition

- Bellows valve bonnet vent not plugged
- No leakage through bonnet vent
Device Condition

No test gag!
Installation Condition

- No reduced inlet or outlet pipe sizes
- Drain piping open
- Piping should not be binding on valve
- Piping should not be supported by valve
- Discharge hazards to personnel
Typical ASME Section I Safety Valve Installation
Installation Condition

What’s wrong here?
Installation Condition
Installation Condition

- Rupture disk installation under PRV
- No pressure on gage
Isolation valves

- Not permitted for boilers or hot water heaters
- May be permitted in some pressure vessel applications
  - ASME Code Appendix M requirements
  - Jurisdiction must approve
Installation Condition

Change-over valves
Testing and Operational Inspection

- Does the valve actually work?
- Lift lever test
  - At least it’s not stuck shut...
  - Test at 75% of set pressure for boiler or pressure vessel valves
  - Section IV valves can be checked without pressure
  - Section VIII: Test lever required for valves for steam, air, and hot water over 140 deg. F.
Testing and Operational Inspection

• Rope can be tied to lever for personnel safety

• Assure rope does not affect valve

• Allow valve to “snap” shut
Testing and Operational Inspection

• Set pressure test
  • Set pressure within Code tolerance
  • Valve should not be leaking
• Full pressure test on unit (not accumulation test)
• Remove valve and check on test stand
Lift assist devices sometimes used to check valve on-line without a full pop test
Testing and Operational Inspection

• Corrective Action
  • Remove system from service if valve is stuck shut! (+16%)

• Out of set pressure tolerance (NBIC Part 2, par. 2.5.7 g))
  • “Minor” adjustment = 2x set tolerance
  • Must be done by qualified organization
  • “Major” adjustment indicates a repair is needed
What is a Qualified Organization?

- NBIC defines a “qualified organization” as an “organization accredited by the National Board”
- Could be National Board VR or T/O certified organization
- Part 3, Supplement S7.10 gives outline of requirements for potential Jurisdictional acceptance
Recommended Test Frequencies

• Jurisdictional Rules
• NBIC recommendations
  • Boilers less than 400 psi – manual test every 6 months, annual pressure test
  • Boilers greater than 400 psi – Pressure test every three years
  • High temp. hot water boilers – annual pressure test
  • Low pressure boilers (15 psi) – manual test quarterly, annual pressure test before heating season
Recommended Test Frequencies

- Hot water heating boilers – manual test quarterly, annual pressure test before heating season
- Hot water heating boilers – manual test quarterly, annual pressure test before heating season
- Water heaters – manual test every 2 months (replace if defective)
Recommended Test Frequencies

Pressure Vessel and Piping Applications

• To determine inspection frequency, the vessel contents, system operation, and previous inspection history must be reviewed

• Steam – annually

• Air, clean dry gasses – every 3 years

• PRV with rupture disk – 5 years

• Propane, refrigerant – 5 years

• All others – Per Inspection History
Sample Inspection Checklist

Sample Inspection Checklist for Pressure Relief Devices
(Based on NBIC Part 2, Section 2.5)

1. Valve Type ___________________________
2. Set pressure _________________________
3. Object being protected __________________ Code Section _____________
4. Object MAWP _________________________
5. Set pressure LT or equal to MAWP: Yes ___ No ___

6. Set pressure seal intact Yes ___ No ___
7. Adjusting ring(s) seal intact Yes ___ No ___ N/A
8. Seals match mfg. / repair / test nameplate? Yes ___ No ___
9. Inspection done with valve: Installed ___ Removed ___
10. Evidence valve is leaking Yes ___ No ___

11. Connections (bolting) tight Yes ___ No ___
12. Evidence of rust or corrosion Yes ___ No ___
13. Body drain open Yes ___ No ___
14. Test gag Yes ___ No ___
15. Bonnet vented for bellows Yes ___ No ___ N/A

16. Inlet pipe GT or equal to valve inlet size Yes ___ No ___ N/A
17. Outlet pipe GT or equal to valve outlet size Yes ___ No ___ N/A
18. Drain pipe open Yes ___ No ___
19. Binding of inlet or outlet piping Yes ___ No ___
20. Discharge pipe support OK Yes ___ No ___

21. Discharge to safe location Yes ___ No ___
22. Isolation valve(s) used? Yes ___ No ___
23. Inlet pipe and valve inlet deposits? Yes ___ No ___ N/A
24. Outlet pipe and valve outlet deposits? Yes ___ No ___ N/A
25. Test method: Pop test ___ Lift lever check ___


27. Seat leakage: Acceptable: _______, Not acceptable ___

Comments: ____________________________________________________________

Inspected by: ___________________________ Date ________________________

Corrective actions required/ taken:

____________________________________________________________________

Corrective actions completed by: ___________________________ Date ________
Final Exam (outlet piping)
Final Exam

What’s wrong with this installation?
Conclusions

• Pressure relief devices are important to safe system operation
• Inspections must be done to assure devices are installed and functioning properly

THANK YOU!