Pressure Relief Device Inspection

Review of NBIC Part 2, par. 2.5

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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?
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
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
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?
Device Data – Valve Seals

• 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
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
What’s wrong here?
Installation Condition
Installation Condition

• Rupture disk installation under PRV
• No pressure on gage
Installation Condition

Isolation valves

- Not permitted for boilers or hot water heaters
- May be permitted in some pressure vessel applications
  - ASME Code Appendix M requirements
  - $\text{??}$
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
P1000425.mov
P1000428.mov
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
Testing and Operational Inspection

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
• 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 2.2)

1. Valve Type
2. Set pressure
3. Object being protected
4. Object MAWP
5. Set pressure LT or equal to MAWP: Yes ___ No ___
6. Set pressure seal intact
7. Adjusting ring(s) seal intact
8. Seals match mfg. / repair / test nameplate? Yes ___ No ___
9. Inspection done with valve: Installed Removed
10. Evidence valve is leaking
11. Connections (bolting) tight
12. Evidence of rust or corrosion
13. Body drain open
14. Test gag
15. Bonnet vented for bellows
16. Inlet pipe GT or equal to valve inlet size
17. Outlet pipe GT or equal to valve outlet size
18. Drain pipe open
19. Binding of inlet or outlet piping
20. Discharge pipe support OK
21. Discharge to safe location
22. Isolation valve(s) used?
23. Inlet pipe and valve inlet deposits?
24. Outlet pipe and valve outlet deposits?
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!