Pretesting a Pressure Relief Valve

Purpose:
The purpose of a pretest is to determine if a Pressure Relief Valve (PRV) would have operated on demand within the set pressure tolerance limits of the code for the entire period it was in service.

What are pretest test results used for?
They are used to:
• create history;
• adjust the servicing and/or testing intervals of the PRVs;
• take corrective action, as necessary, to assure proper performance of the PRV (other than adjusting the service interval). For example, if a PRV did not operate within the set pressure tolerance limits or was found to be stuck closed due to corrosion products, a corrective action may be to install a rupture disc at the inlet or outlet, as the case may be, to prevent corrosion of the PRV’s internals or replace the PRV with the one whose materials will not corrode or reduce the corrosiveness of the process.

Testing options:

1. Pretest a PRV on the equipment that it is installed upon:
This is the best option because it incorporates testing with the same media and in the conditions that the PRV is supposed to operate under while in service. These conditions take into consideration the operating temperature, media, installation deficiencies, process damage to the internals of the PRV, external environmental damage, etc. The best time to conduct a pretest may be at the time the pressure equipment is coming off line.

   a. Pretesting by raising the system pressure:
   This closely simulates the conditions that a PRV may experience while in service and may provide for the best accuracy of the test results. This method should be used whenever it is practical and safe to do so.

   b. Pretesting by using an Assist Lift Device (ALD):
   An ALD may be employed to perform a pretest just before the pressure equipment upon which it is installed may be coming off line. A calibrated ALD, operated by a trained technician using a testing procedure that has consistently been proven to produce accurate results, may be the second best option for performing a Pretest.
2. Pretesting on a test equipment:

Test media:

The best media to pretest a PRV is the media in which it is intended to operate. This will provide the best accuracy of test results. This is possible only if a PRV is tested in the as installed conditions described in Section 1 of this article.

The second best media is the media that was used to set a PRV when it was last set. For example, if a steam service PRV was last set with steam, then it should be pretested with similar quality steam to maintain the media consistency. Even after the media consistency is maintained, other factors such as change in installation conditions, damage during transportation of the PRV to a test shop, loosening of the corrosion products from the internals which may have affected the opening of the PRV, cold testing, etc., will still apply and tend to reduce the accuracy of pretesting. The effect of all of the deficiencies noted herein is cumulative and therefore may cause significant variation in the test results. Changing the test media from steam to air will further reduce the accuracy of the pretest.

a. Test equipment installed at a plant site:
   This scenario applies to owner-users who are certified to set and service their own PRVs. These owners may pretest their PRVs using the in-house PRV service shop test equipment.

   If any owner has installed a test only facility, it may be used for pretesting PRVs. In this case, no Certificate of Authorization Permit is required from ABSA (provided the set points are not adjusted and seals are not broken).

   i. Testing by raising system pressure:
      A pretest may be conducted by mounting a PRV on a test vessel and raising the pressure until the PRV operates in accordance with its set pressure definition and within set pressure tolerance limits of an applicable ASME Code.

   ii. Testing by using an ALD:
      A pretest may be conducted by mounting a PRV on a test vessel and using an ALD to test for the relieving pressure in accordance with its set pressure definition and within set pressure tolerance limits.

b. Test equipment installed at a certified service shop:
   Same as 2(a) above.


**Interpretation of a Pretest:**

1. **If a PRV operates in accordance with its set pressure definition and within the set pressure tolerance limits of the code:**
   a. The results should be documented;
   b. Its history should be reviewed. If for the past few years pretest results have shown consistent operation in accordance with its set pressure definition and within the set pressure tolerance limits of the code, it may be a case for an increased service interval.

   **Example:**
   - An air service UV stamped PRV whose set pressure definition is ‘start to leak’ and is set at 100 psi, must leak one bubble between 97 and 103 psi when a pretest is performed.
   - A steam service UV stamped PRV whose set pressure definition is ‘pop’ and is set at 100 psi, must pop between 97 and 103 psi when a pretest is performed. This valve will simmer first, but the pressure must be increased until it pops. A simmer is not a pop.

2. **If a PRV does not operate in accordance with its set pressure definition and/or within the set pressure tolerance limits of the code:**
   a. The result should be documented;
   b. Its history should be reviewed. If the previous results were acceptable, the conditions of the current test should be reviewed to rule out any issues with the current test. If the current results are consistent with the historic results, a root cause analysis should be conducted to determine the persistent cause(s) of repeated failures. A reduction of the service interval is not always the answer. If for example:
   - it is found that the set point of a PRV is too close to the operating pressure, the valve may chatter and lose its setting and seat tightness over a period of time. In such a case, the operating differential as recommended by the NB-23 code should be tried;
   - if the spring of a PRV is corroded, it may have lost a part of the cross section to corrosion thus weakening the spring and causing the PRV to operate prematurely. In this case, the spring should be replaced instead of reducing the service interval.

   In some cases, a PRV may not have been set right at a service shop when it was serviced and set the last time.

   In some cases, both a change in the operating conditions and/or reduction of a service interval may be needed.
Misinterpretations:

1. **No pretest is required:**
   It has been brought to our attention by some PRV servicing shops that some owners do not require a pretest and therefore no pretest is ordered when they send the PRVs for servicing to a service shop.

   Note that a pretest is required in all cases per the requirements of the AB-506 and AB-524 documents. As an exception to this rule, a pretest may not be performed if a PRV is received in extremely fouled and dirty condition or is plugged.

2. **No pretest is required if a PRV is replaced or serviced every year:**
   We understand that some PRV servicing shops have made recommendation to owners to replace PRVs every year instead of pretesting.

   It may be noted that the replacement of a PRV does not eliminate the need of a pretest. If a pretest is not done, it is unknown if the PRV would have operated on demand within the set pressure tolerance limits of the code for the entire period it was in service.

Requirement documents and good engineering practices of interest:

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<th>Requirement documents</th>
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<tr>
<td>AB-506, 2009, Section 17.3</td>
<td>Requirement</td>
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<td>AB-524, 2014, Sections 3.3 and 3.6.8</td>
<td>Requirement</td>
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<tr>
<td>API-576, Section 6.2.9</td>
<td>Recommended practice for pretesting</td>
<td>Para 6.2.9.2-A PRV is required to operate within the CDTP tolerance limits; Para 6.2.9.3 leads us to the conclusion that in-situ pre-test may produce the best results.</td>
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<td>API-581, 2008, Section 7.1.5</td>
<td>Recommended practice</td>
<td>“Where a shop bench pre-pop test is performed, the resulting Pass/fail data is given the highest degree of confidence”.</td>
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<td>EPRI-Safety and Safety Relief Valve Maintenance Guide, 1996, TR-105872, Section 6.3.1</td>
<td>Recommended practice</td>
<td>“The most accurate method for testing the set pressure of a valve is to test it in the exact condition that it is required to function”. “Set pressure test should generally be performed as the operating system is coming off line”.</td>
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**Recommended practice**

The information included applies to testing in general.

- “Testing may be accomplished by the owner on the unit where the valve is installed or at a qualified test facility” [Part 2, Section 2.5.7(b)].
- “Tolerances specified for these operating requirements in the original Code of Construction shall be used to determine the acceptability of test results” [Part 2, Section 2.5.7(a)].
- Test medium requirements are specified in Part 2, Section 2.5.7(d).

| NB-23, 2011, Part 2, Section 2.5.7 and Part 3, Section 7.1.4.2. | Recommended practice | • “Testing may be accomplished by the owner on the unit where the valve is installed or at a qualified test facility” [Part 2, Section 2.5.7(b)].
• “Tolerances specified for these operating requirements in the original Code of Construction shall be used to determine the acceptability of test results” [Part 2, Section 2.5.7(a)].
• Test medium requirements are specified in Part 2, Section 2.5.7(d). |