

RANDOM EXAMINATION

Prepared by
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Random Examination

Expectations, Guidelines and Methodology

1. Scope

- 1.1. Codes and specifications often require that welds be subjected to spot or random radiography, ultrasonic or other examination methods. The purpose of this standard is to:
 - 1.1.1. Examine the expectations, effectiveness and limitations of random examination.
 - 1.1.2. Identify common industry practices and methods for specifying random examination.
 - 1.1.3. Provide guidance in establishing and defining the size of a lot to be subjected to random examination, focusing on the ASME B31.3 use of the terms “lot” and “kind of item.”

2. Definitions

- 2.1. Commonly used extents of examination are defined as follows:
 - 2.1.1. **Random examination:** complete examination of a percentage of a specified kind of item in a designated lot of piping
 - 2.1.2. **Spot examination:** a specified partial examination of a weld or specified group of welds (e.g. 1 six inch spot in each 50 feet of weld by a particular welder)
 - 2.1.3. **Random spot examination:** a specified partial examination of a percentage of a specified kind of item in a designated lot of piping
 - 2.1.4. This standard uses the term “random examination” to represent all examination methods such as radiography and ultrasonic or other examination that may be used in order to avoid excessive repetition of these inspection method names throughout this standard.

3. Expectations, effectiveness and limitations of random examination

- 3.1. Random examination of welds in a piping system will not ensure that all the welds in that system will be of the same quality level as the welds that were examined. For example, if 10

welds in a piping system containing 100 welds are examined and accepted using random radiography, the remaining 90 welds may contain rejectable flaws that would have been disclosed if additional welds had been radiographed. If all rejectable weld flaws must be eliminated from a given piping system, then examination of 100% of the welds in that system must be performed¹. More simply put, to insure that welds are free of rejectable flaws, 100% of those welds must be examined, repaired as necessary and then reexamined.

- 3.2. Random examination of welds is an effective quality control tool when properly implemented.
 - 3.2.1. When random examination is used to check the quality of the welder’s work, that examination provides feedback to the welder showing that the work is or is not satisfactory. If the work is not satisfactory, the welder and/or the welding supervisor can take corrective steps to improve weld quality in subsequent work; such steps can include the full range of changes from increased attention, to initial fit-up, to replacement of the welder. This will improve the quality of subsequent welds.
 - 3.2.2. For this process to work properly, it is critical that examinations be made, (and timely feedback provided to the welder), contemporaneously with the work being done. The sooner the welder learns that his weld requires repair, the sooner he can take corrective action.

¹ See ASME B31.3 para. 344.1.3, footnote 3 and ASME section VIII Div 1, UW-52 footnote.

|Denotes Revision

4. Specifying Random Examination

- 4.1. The method and extent of examination and acceptance criteria to be applied must be clearly defined in the standard or specification and be agreed upon prior to the start of work. This is standard industry practice that is well established in various welding standards such as the ASME B31 Code for Pressure Piping, ASME Section VIII, Unfired Pressure Vessels, and the AWS D1.1, Structural Welding Code - Steel. For example, ASME B31.1, paragraph 136.3.1, specifies:

“The degree of examination and the acceptance standards beyond the requirements of this Code shall be a matter of prior agreement between the manufacturer, fabricator or erector and the Owner.”

- 4.2. When performing random examination, the method of examination (e.g., radiography in accordance with ASME Section V, Article 2) and the acceptance criteria (e.g., ASME B31.1, paragraph 136.4.5) are straightforward and simple to define in the contract documents.
- 4.3. When random examination is specified, the extent of random examination must be clearly defined in the contract documents. Random examination can be applied to:
- 4.3.1. Circumferential butt and miter welds on a project.
 - 4.3.2. Circumferential butt and miter welds within specific line classes or systems on a project,
 - 4.3.3. Circumferential butt and miter welds within particular parts of systems (e.g., high-pressure parts of a steam system)
 - 4.3.4. Circumferential butt and miter welds in specific locations (e.g., piping inside buildings)
 - 4.3.5. Other schemes that satisfy the Owner or his engineer.
 - 4.3.6. Volumetric examination is not normally applied to nozzle or branch connection welds or to fillet welds.
- 4.4. When the purchaser wishes to impose additional random examination, and the applicable code does not specify random examination, the following is recommended for inclusion in the purchaser's specification:

“Random Radiography and acceptance criteria shall be in accordance with the requirements of ASME B31.3, paragraph 341.4.1(b). Acceptance criteria shall be in accordance with Table 341.3.2, Normal Fluid Service, with progressive sampling in accordance with paragraph 341.3.4.”

5. Defining Random Examination when ASME B31.3 is applicable

- 5.1. The following are important points to recognize when ASME B31.3, Process Piping, is the applicable Code.
- 5.1.1. For Normal Fluid Service piping, Paragraph 341.4.1(b) requires that not less than 5% of circumferential butt and miter groove welds be examined fully by random radiography or by random ultrasonic examination. Normal Fluid Service is the applicable fluid service category unless another Fluid Service Category (e.g., Category D, Category M, Severe cyclic, etc) or a greater extent of examination is specified for a system by the engineer in the contract documents.
 - 5.1.1.1. Random Examination is to be performed on a lot basis. Once the percentage of welds in a lot are examined and accepted and the welds representing the work of each welder in that lot have been examined and accepted, all remaining welds in that lot (i.e., those that were not examined) are Code-acceptable provided they are visually acceptable and pass hydrostatic testing. See paragraph 341.3.1.
 - 5.1.1.2. Since B31.3 places responsibility for performing examination on the Fabricator or Contractor who is doing the welding, lot selection is the prerogative of the Fabricator or Contractor in the absence of arrangements in which a lot is established by contract. B31.3 recognizes that lot selection can be a source of dispute and suggests² that the quantity or extent of a designated lot should be established by agreement between the contracting parties before the start of work. See Section 6 for various methods of defining a lot.

² See paragraph 344.1.3, footnote 2.

