

## Ultrasonic Examination in Lieu of Radiographic Examination for ASME Sections I & VIII Division 1 & 2

Ultrasonic Examination (UT) is a permitted volumetric examination method in lieu of the required Radiographic Examination (RT) of ASME Boiler and Pressure Vessel Code, Sections I, VIII Division 1 and VIII Division 2. It is important to note that for all three code books, the permitted ultrasonic examinations are restricted to Time of Flight Diffraction (TOFD) and Phased Array (PAUT) with computer based data acquisition and analysis abilities using automatic or semi-automatic equipment that is **mechanically mounted and guided** on the examination surface. Manual straight beam UT, manual angle beam UT and manual Phased Array (PAUT) are not permitted as substitute techniques when using UT in place of required RT. Listed below are the requirements for Sections I and VIII Division 1 & 2.

### Section I

Section I permits UT in place of RT by utilizing Code Cases 2235, 2816, or by using PW-52.1. Code Cases 2235 and 2816 utilize fracture mechanics based acceptance criteria, while PW-52.1 references Section V, Article 4, Mandatory Appendix VII, which uses workmanship based acceptance criteria.

While the acceptance criteria are different, in all three cases, the use of TOFD or PAUT using equipment mechanically mounted and guided on the examination surface either through automatic or semiautomatic means is required.

Code Case 2235-13 paragraph (d) requires UT to be performed using a “device employing automatic computer based data acquisition”. Code Case 2816 has the similar requirement in paragraph (d). PW-52.1 states that UT shall be in accordance with Section V, Article 4, Mandatory Appendix VII. Mandatory Appendix VII paragraph VII-431 states that ultrasonic examination is to be performed, “using a system employing automated or semi-automated scanning with computer based data acquisition and analysis abilities”. Semi-automated and automated are defined terms within Section V, Article 1, Mandatory Appendix I and are listed below for convenience.

*Semi-automated ultrasonic examination (SAUT):* a technique of ultrasonic examination performed with equipment and search units that are mechanically mounted and guided, manually assisted (driven), and which may be manually adjusted by the technician. The equipment used to perform the examination is capable of recording the ultrasonic response data, including the scanning positions, by means of integral encoding devices such that imaging of the acquired data can be performed.

*Automated ultrasonic examinations (AUT):* a technique of ultrasonic examination performed with the equipment and search units that are mechanically mounted and guided, remotely operated, and motor-controlled (driven) without adjustments by the technician. The equipment used to



perform the examination is capable of recording the ultrasonic response data, including the scanning positions, by means of integral encoding devices such that imaging of the acquired data can be performed.

As a result, manual UT is not permitted for use as the primary technique for Section I Code examinations with the exception of PW-44.7.3 examinations of bimetallic tubing when clad strength is included.

### **Section VIII Division 1&2**

Section VIII Divisions 1 and 2 likewise permit UT in lieu of the required RT. Section VIII Division 1, UW-51(a)(4) states that this UT must meet the requirements of Section VIII Division 2, paragraph 7.5.5. As a result, a Certificate Holder performing UT as permitted in UW-51(a)(4), needs to have access to a Section VIII Division 2 code book. UW-51(a)(4) further references Section V, Article 4, Mandatory Appendix VIII, which utilizes fracture mechanics based acceptance criteria in conjunction with Mandatory Appendix IX.

Mandatory Appendix VIII, paragraph VIII-431 requires that ultrasonic examination must be performed, "using a system employing automated or semi-automated scanning with computer based data acquisition and analysis abilities". Semi-automated and automated were previously defined above are defined terms, while equipment with computer based data acquisition and analysis abilities is either TOFD or PAUT.

There are some specific allowances in Section VIII Division 1 to use manual UT in accordance with Mandatory Appendix 12, such as for the final closure seam examination. Section VIII Division 2, paragraph 7.5.4 also permits manual UT examinations on Type 7, and 8 joints in some instances. These allowances for using manual UT should not be confused with the requirements for using UT in lieu of RT.