

УДК 620.179.16

COMPARATIVE ANALYSIS OF PHASED ARRAY ULTRASONIC TESTING  
METHOD AND TIME OF FLIGHT DIFFRACTION METHOD

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At present, the significance of non-destructive testing (NTD) of welds of various industrial facilities is great, which leads to increased use of ultrasonic testing. The main methods of ultrasonic testing are phased array ultrasonic testing (PAUT) and time of flight diffraction method (TOFD).

Phased array ultrasonic testing is the most effective method for detecting defects in welded joints and base metal.

The principle of ultrasonic testing is based on the ability of the beam to be reflected from a defect in the test material. The result of traditional ultrasonography is displayed as an A-scan. The phased array method is a set of A-scans converted into an S-scan, which helps visualize the structure of the material.

The time of flight diffraction method was developed in the early 1970s by the team of Dr. Maurice Silk.

The physical basis of the time of flight diffraction method is the interaction of the edges of the defect with ultrasonic waves. The presence of the defect in the material is determined by the analysis of transverse and longitudinal waves. In this case, the basis for assessing the parameters of the defect is the time of signal passage and its reception.

The TOFD method is more sensitive to some defects such as plane cracks.

After comparing phased array ultrasonic testing and time of flight diffraction method the following conclusions can be drawn:

1. With the TOFD method, the defect detection accuracy ranges from  $\pm 1$  mm to  $\pm 0.3$  mm upon repeated examination.

2. In TOFD method, the measurement of parameters is based on travel time of signals and is independent of signal amplitude, whereas with phased array method the measurement of parameters is based on the change in signal amplitude.

3. With the TOFD method, the ability to detect defects does not depend on their spatial location.

4. There is a possibility to generate different input angles of a signal by a transducer, which greatly increases the area being tested and the scanning speed.

5. TOFD method can be used to test flat surfaces or surfaces with a small curvature, whereas the phased array method is more suitable for testing complex shapes.

Thus, the use of these two methods depends on the object being tested and the required parameters.