4.4.9. CALCULATION AND DESIGNING OF UNIVERSAL TRANSDUCERS FOR THE ULTRASONIC CONTROL OF WELDED JOINT CONNECTIONS OF POLYETHYLENE PIPES

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Application of the wide nomenclature of polyethylene pipes for replacement steel and l lying of new pipelines, problems of durability and tightness of welded butt connections of pipelines, and also absence of means of non-destructive testing quality assurance of welded connections required elaboration of home ultrasonic transducer, providing solution of the problem of reliability of pipelines.

The analysis spent by authors, has shown that the most suitable piezoelectric transducers (PT) for quality assurance of welded joint connections of polyethylene pipes are PT type "DUET" and "TANDEM", distinguishing by high values of sensitivity in ratio signal/noise.

For calculation of parameters inclined separately-combined PT type "DUET" the scheme resulted on fig. 1 has been used. It is easy to show that the corner of a turn of a radiator and receiver PT in vertical plane δ_1 is equal

$$\delta_1 = 2\arcsin\frac{a+\frac{b}{2}\cos\frac{\delta}{2}+c\sin\frac{\delta}{2}}{R}, \qquad (1),$$

where a – distance between the nearest tops of dihedral corners of prisms of a radiator and the receiver; b – width of a prism of a radiator and the receiver; c – a radiator and receiver arrow; R – pipe radius; δ – a corner of a turn of a radiator and the receiver in a horizontal plane.

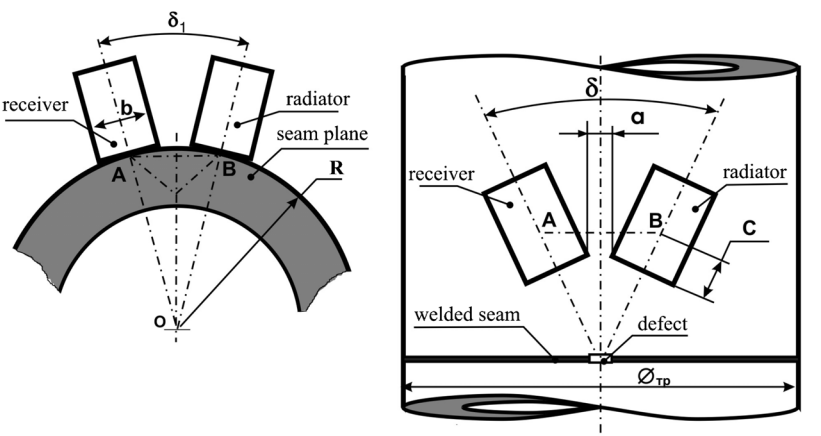

Fig. 1. The scheme of arrangement PT on a pipes

The formula (1) and other considerations assumed as basis of PT calculation of the type “DUET”, providing control quality of welded joint connections of polyethylene pipes in diameter from 50 mm to 325 mm and thickness from 2.9 mm to 25.4 mm.

The state metrological tests 19 types PT of “Priz-D8”, certification PT and their entering into the state registry have confirmed a correctness of the formula (1) for calculation such PT.

For solution of methodical questions of quality control of welded joint connections of polyethylene pipes using PT of the type “Priz-D8” were taken experimentally dependences of amplitude reflected from defect of the echo-impulse from moving PT along formed pipe relative to near $A = f(L_{бл})$ and distant $A = f(L_{дал})$ defects.

The analysis of the received dependences has shown that PT “Priz-D8” provide detection of the defects equivalent to diameter of 0.8 mm and more in welded joint connections of polyethylene pipes depending on their thickness and diameter on frequencies 1.8 and 1.25 MHz. Besides, the recommendations have been received about disposition of PT relative to welded joint connections in order to secure its control for one turn round a pipe.

Experience of exploitation of a considerable quantity of standard sizes PT of the type “Priz-D8” has led to necessity of working out universal PT of one-two types, solving problems of the control of welded connections of pipes.

The modified prisms of this PT are connected to the case by low-sited hinges, allowing their working surfaces to self-install themselves on a surface of any pipe in diameter from 30 mm to indefinitely (i.e. it is possible to supervise welding of pipes and flat sheets).

Acoustic parameters are improved at the expense of reduction of influence of errors of cylindric surfaces of a pipe, displacement of a line of a contact relative to an acoustic axis of prisms.

Updating of prisms and possibility of their change, application on the case of standard sockets, replacement of some PT by one universal raises competitiveness of this variant.