1.3.19. TESTING OF HEXAGONAL AND OTHER EDGE PROFILED MATERIALS BY USING ULTRASONIC PHASED ARRAY PROBES ARRANGED ANNULARLY

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Many manufacturers of semi-finished goods produce hexagonal, square and other profiles, as well as standard round bars. There is a requirement for an easy and fast method of ultrasonic testing of such profiled bars. The technologically advanced ROWA phased-array system uses curved probes concentrically arranged around round bars and these create virtual probes to achieve a special sound beam to allow the testing of bars of other profiles in the same line. The complete process requires only electronic adjustment of the system to the profile of the bar. As a result, various profiles can be tested in the same conveyor line with short change-over times.

Currently angle shaped bar material (e.g. square / hexagon / rectangle) is tested to detect core flaws by using e.g. ROWA (phased array type) and ROB (rotating single crystal) testing machines. Those machines employ circular moving sound fields for ultrasonic testing (ROWA electronic moved – ROB mechanic moved).

With round bar material the ultrasonic testing with these machines is able to perform full body testing by both normal beam (core flaws) and angle beam method (surface and sub-surface flaws).

In profiled bar material, the ROWA system is currently able to test in repeatable way only the core area by normal beam method.

To enlarge the ROWA (phased array type) test performance from only center core area testing the following procedure shall be used:

During the test process, the test specimen bar material (e.g. square / hexagon / rectangle) is moved in linear direction through a circular phased array device e.g. ROWA mechanics in a way that the flat surface areas always remain precisely in the same geometric orientation to the circular orientated phased array probes. The geometric orientation of the specimen's flat surface areas in reference to the position of each of the phase array single elements is detected by ultrasonic signals. This is the basis of an accurate focal law calculation. A numerical algorithm is used based on the Fermat principle.

This algorithm calculates the needed focal laws to provide a sound beam orientated perpendicularly to the specimen's flat area for every virtual phased array aperture of the circular array probe arrangement. For each virtual probe there is an individual focal law setting. So flaws parallel to the flat area are detectable in a repeatable way and in a significantly increased volume fraction.

First test results and experiences will be discussed.