The latest development from GE's Inspection Technologies business is a turnkey solution for full body inspection of tubes using Phased Array Technology on a long portal. The scanning system detects longitudinal, transverse and oblique (±45°) flaws on the internal and external surfaces of seamless tubes, measures the wall thickness and eccentricity and checks for lamination defects. The use of the Phased Array technique allows a flexible design of the scanning system. The size of the virtual probes, the track pitch on the surface, the overlap of the sound fields as well as the beam angle for the transversal flaw detection can simply be optimized by adjusting the electronic settings.

**Technical Specifications**

**Typical Data of Test Objects**
- Tube Diameter*: 60 - 500 mm
- Wall Thickness: 3 - 50 mm
- Tube Length: 6 - 15 m
- Rational Speed: max. 100 rpm
- Circumferential Speed: up to 2.2 m/s
- Pitch: max. 120 mm / revolution

* other dimensions on request

**Test Specifications**
- DIN EN 10246 –6, -7, -14
- EN ISO 10893 – 8, -10, -12
- API –5 CT, 5 L, 5 D
- Other Specifications on Request

**System Performance**
- Longitudinal and transverse flaw test
- Oblique flaw test (11°, 22°, 33°, 45°, 67°)
- Optional: Oblique test ±45° gapless
- Lamination test
- Wall thickness and eccentricity measurements
- Signal to noise ratio (SNR) > 18dB typical
- Steering and paintbrush in 1 cycle
- Example tube cycle time: 40-90 sec.

(*valid for tube OD 114-406mm, length 14 m, 2 carriage layout)

Scan the QR code with your smartphone or go to https://www.youtube.com/watch?v=DCbsasWZkFw to see a video and learn more

Double carriage overview
Paint-Brush

The key procedure to detect longitudinal and oblique defects with high throughput is the Paint Brush method, which allows the detection of oblique flaws of -45º to +45º without gap. With this method, all elements of a phased array probe are fired simultaneously.

The received individual signals are stored and then evaluated in a special pattern (Sub-Cycles) related to the different sound transmission angles (time delayed receiving of sound energy). High speed signal processing techniques combined with this procedure ensures a stable coupling condition and minimizes the extent of untested tube ends. Coupling of the probe is carried out via a water delay path and is monitored for more than one revolution, remains in the same position. Each probe is individually positioned onto the surface and, after completing the inspection, the tube is removed from the test position and the paths of both test carriages are pre-programmed. The inspection is carried out with an overlap range of the tubes is achieved by the design of the probe holders and wear shoes. After all probes are placed on the tube, the carriage will be accelerated to its test speed. On reaching the tube end, the carriage will slow down and finally stop. Before the probes are lifted off in sequence, the spin roller block station and sentenced, according to the test classification. The equipment performs data processing and evaluation of the measurements and transfer of the data to a line PC, where it can be correlated with a customer's production control system.

The fast and safe coupling for the total rotational speed range of the tubes is achieved by the design of the probe holders and wear shoes. After all probes are placed on the tube, the carriage will be accelerated to its test speed. On reaching the tube end, the carriage will slow down and finally stop. Before the probes are lifted off in sequence, each probe remains in the end position for 1-2 revolutions, to ensure an untested end as short as possible. As soon as all probes are lifted, the test carriage moves directly back to the start position.

When a defect has been detected, it is possible to reverse the test carriage to repeat the test of the relevant area.

For high throughput requirements, the portal can be equipped with two carriages. In this case the test start position and the paths of both test carriages are pre-programmed. The inspection is carried out with an overlap in the middle section of the tube and the inspection lines are precisely inter-locked. This ensures a complete scanning of the tube by the two test carriages.

After completing the inspection, the tube is removed from the spin roller blocks and sentenced, according to the test classification. The equipment performs data processing and evaluation of the measurements and transfer of the data to a line PC, where it can be correlated with a customer's production control system.

Scanning Techniques

The tubes are inspected with a scanning system, which is mounted on a carriage above the tube. During scan, the carriage moves along the tube axis, while the tube is rotated on a spin roller block station. The carriage is equipped with gimbal-mounted probe holders, each with one Phased Array probe.

At the beginning of the test procedure, the complete probe holder mechanics will be lowered into the test position. Each probe is individually positioned onto the surface and, for more than one revolution, remains in the same position. This procedure ensures a stable coupling condition and minimizes the extent of untested tube ends. Coupling of the probe is carried out via a water delay path and is monitored during the whole inspection.

For each color the flaw types individual protection are supplied via this pipeline during the probe placement on the tube surface. For ensuring a quick coupling through pneumatic the probe individually on the tube surface and the hole in a special pattern (Sub-Cycles) related to the different sound transmission angles (time delayed receiving of sound energy).