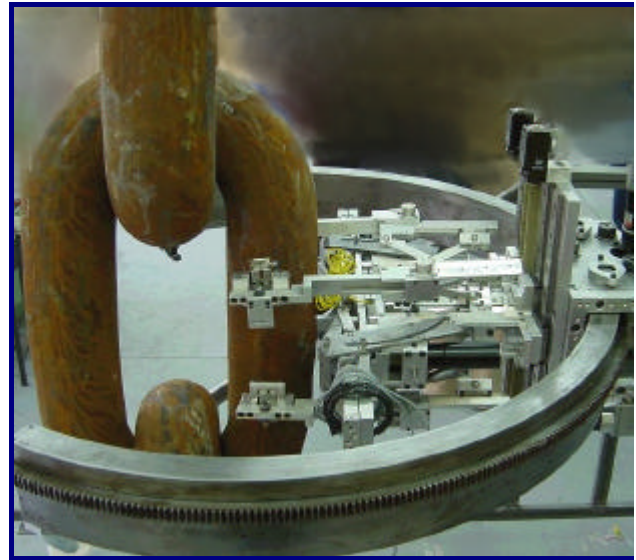


PRODUCT HIGHLIGHTS

- Fully Automatic inspection of welded area in chain links from 110 to 185 mm Ø.
- Inspection time: 1-2 minutes per link.
- Special ultrasonic transducer assembly enhances detection of inner weld defects.
- Software tools include storage, management and hardcopy reports of calibration, reference blocks, and links inspected.
- Connectivity to factory computer network via FTP client on Ethernet.
- Based on ULTRASEN® modular ultrasound data processor architecture.



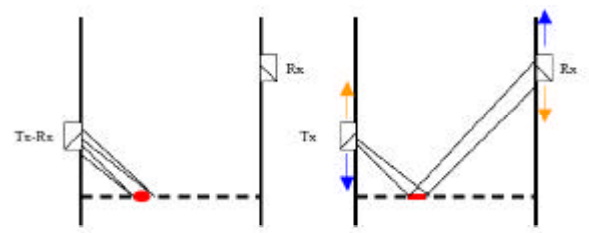
PRODUCT DESCRIPTION

The extreme environmental and mechanical stress conditions to which mooring chains used in shipping and offshore oil platforms are subjected during their operational life call for strict observance of demanding quality standards during their manufacturing process, so as to assure their continued performance. In studless chains, each link is constructed from a single steel bar which is curved and joint end-to-end through a Flash Butt Welding process which leads to a concentration of manufacturing flaws in the soldered area.

ULTRASEN-CHILI is an automatic ultrasound inspection system specifically designed to inspect welded sections of chain links with diameters between 110 and 185 mm.

Ultrasonic transducer assembly

The system includes two two-transducer subsets, operating above and below the welded section of the inspected link with water film coupling. Each of the two transducers within each subset is used to perform standard pulse-echo inspection. Additionally, each subset of transducers works in transmission-reception mode, enabling detection of internal flaws parallel to the welded section, undetectable in a conventional, single transducer, inspection.



ULTRASEN-CHILI Inspection strategy

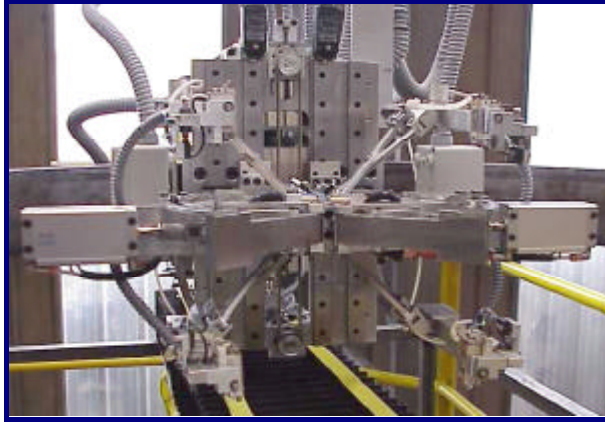
Mechanical subsystem

It runs the two transducer subsets along the inspected link, following a pattern that guarantees scanning of 100% of the welded section of each link, regardless of its diameter.

Ultrasonic processor and control module

Based on proprietary *ULTRASEN⁰* architecture, it carries out the following tasks:

- Generating the trigger pulses for the ultrasonic transducers.
- Synchronising signal acquisition to transducer position over the inspected link.
- Real time ultrasonic data acquisition and signal processing.

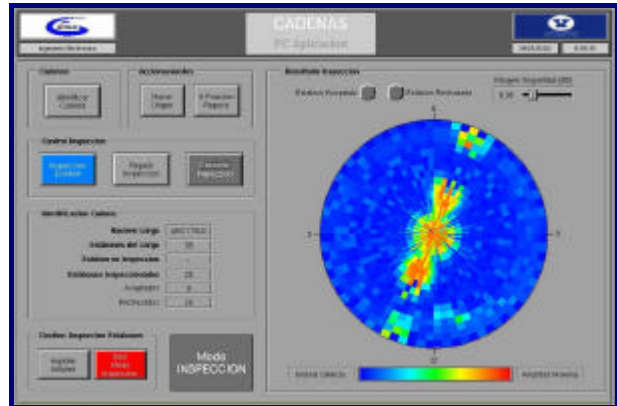


Inspection Robot

Processing computer

Host to the Human-Machine Interface (HMI), which displays real time inspection results in a C-Scan image format. Additionally, it provides acoustic and optical alarms of link acceptance or rejection. Furthermore, the HMI includes tools to store, transfer and review the results of previous inspections and calibrations.

Thereby, the inspector has access to a database with information relative to links already inspected. This application has been developed using Linux Red Hat 6.1, running on an industrial computer built in the system mainframe.



HMI: Display of inspection results

TECHNICAL CHARACTERISTICS

• Inspection technique:	Pulse-echo system, with water film coupling
• Number of channels:	6 channels, implemented with 4 transducers (see product description)
• Transducer type:	2.25 MHz, 12.5 mm Ø, Angle beam at 45°
• Link diameter range:	110 to 185 mm.
• Inspection rate:	1 to 2 minutes per link, depending on diameter
• PRF:	Up to 10 pulses per mm, measured over the link generatrix
• Differential transducer gain and delay compensation range:	Independently programmable 0 to 40 dB gain for each channel. Independently programmable delay for each channel up to 320 mm.
• Digital Filters:	Real-time Digital Signal Processing Tools using dedicated FPGA
• Distance - Amplitude compensation curve (DAC):	Fully programmable, 0 to 40dB gain in 256 steps.
• Excitation pulse amplitude:	Adjustable up to -350V.
• Excitation pulse width:	Up to 350 ns programmable in 12.5 ns steps.
• Depth (TOF) resolution:	0.1 mm
• Connectivity to factory computer network:	Via FTP client on eEthernet