TOFD PRO System

CEN/TS 14751:2004 Compliant

EN 5836:2000 Compliant

ULTRACON SERVICE®

www.ndt.com.ua

PURPOSE

TOFD PRO System is intended for mechanized testing of welded joints using Time-of-Flight Diffraction (TOFD) technique. The System assures the solution of the following tasks - testing the welded joints of:

- flat objects;
- tubes of medium and large diameters (with min. outer diameter of 600 mm);
- spherical and cylindrical oil and gas tanks (with min. diameter of 10 m).

General appearance of TOFD PRO system

CONFIGURATIONS OF TESTED WELDED JOINTS:

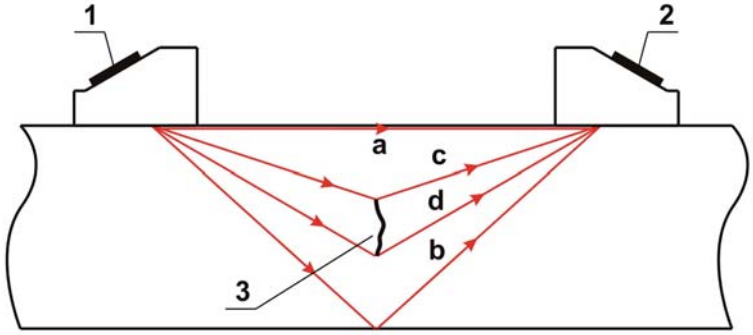
- profile types: CRC-Evans, single J groove weld, single V groove weld, double V groove weld, x-welds, etc.;
- conventional wall thickness: from 6 mm (0.25 inch) to 50 mm (2 inch) and more;
- tube and plate material: standard carbon steels.

TOFD TECHNIQUE DESCRIPTION, FEATURES AND COMPLIANCE WITH STANDARDS

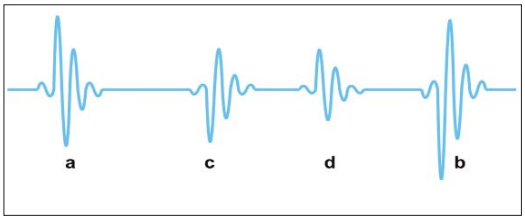
Time of Flight Diffraction (TOFD) technique is based on diffraction of ultrasonic waves from the tips of discontinuities. TOFD technique is performed by means of two probes operating in a separate mode.

The TOFD PRO System assures:

Testing scheme by TOFD technique



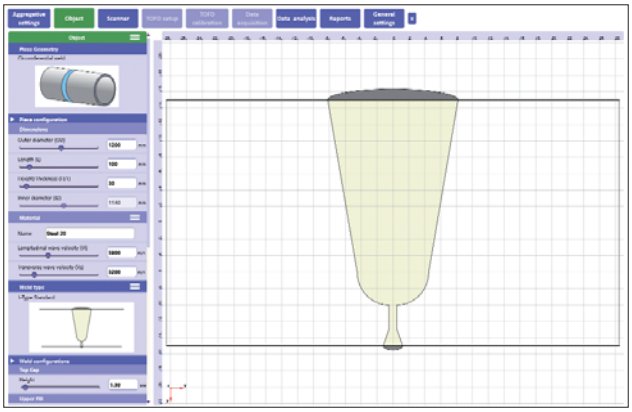
Displaying the signals on A-scan



1 - transmitter;
2 - receiver;
3 - internal crack;
a- lateral wave;
b- back wall echo;
c- diffracted signal from the top tip;
d- diffracted signal from the bottom tip.

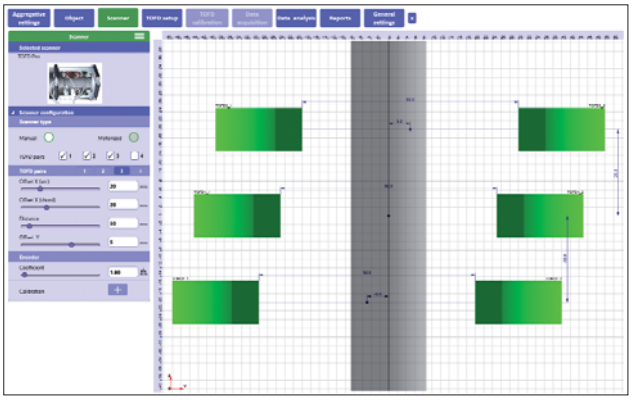
- Testing with the application of two TOFD probes according to standards CEN/TS 14751:2004, ENV 583-6:2000 Non-destructive testing. Time of Flight diffraction technique as a method for defect detection and sizing.
- Detection of defects of various orientation (longitudinal, transverse), precise determination of a depth and length of defects, high sensitivity from its corner position.
- Testing scheme fully covers the groove area and the whole volume of a welded joint.
- Testing the whole volume of the welded joint per one scanning cycle.

THE SYSTEM SOFTWARE INCLUDES THE FOLLOWING PAGES (MODULES):



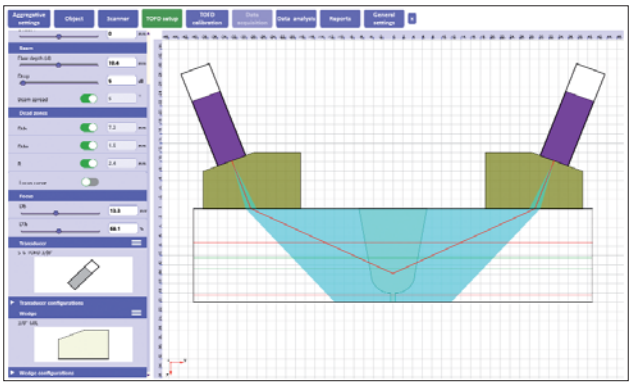
The “Object” page ensures:

- selecting the test object geometry and setting up its geometrical dimensions;
- selecting the type of test object material;
- selecting the type of a weld bevel and setting up all geometrical dimensions.



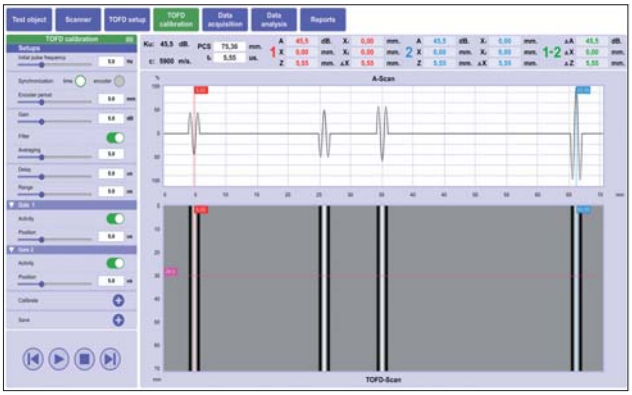
The “Scanner” page ensures:

- selecting the scanner;
- setting up the scanner type: manual, motor-operated;
- setting up the spatial position of TOFD-transducers pair relative to the origin of the coordinate system;
- using of up to 4 TOFD transducer pairs;
- carrying out the encoder calibration.



The “TOFD setup” page ensures:

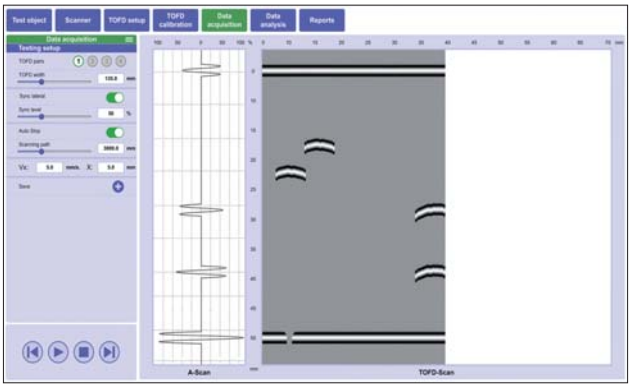
- selecting the type of TOFD probes, TOFD wedges, operating set up of their parameters;
- setting up the PCS - the distance between the index points of TOFD transducers and their shift relative to the welded joint axis;
- calculation and graphic plotting of the following parameters when using the TOFD Calculator:
  - Spatial resolution (R);
  - Scanning-surface dead zone (D_{ds});
  - Backwall dead zone (D_{dw});
  - Locus curve;
  - Beam Spread.



TOFD calibration

The “TOFD calibration” page ensures:

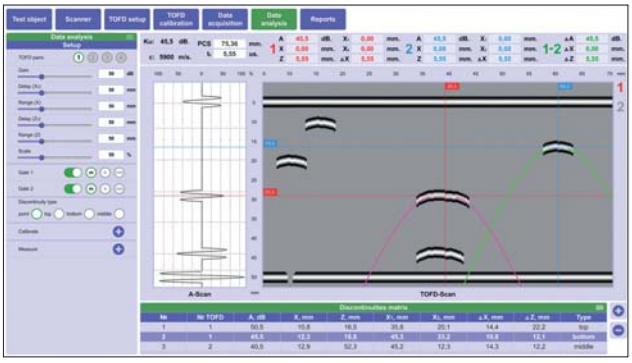
- setting up the testing parameters for TOFD;
- carrying out the real-time TOFD calibration by saved data;
- real-time check up of reflectors detection in calibration block;
- generating the parameters matrix of calibration block reflectors;
- saving the calibration results.



Data acquisition

The “Data acquisition” page ensures:

- data display in a form of A-Scan toget-her with TOFD-Scan during the testing process;
- carrying out the testing and data acquisition with an auto stop of a testing mode by a distance predetermined by the operator;
- displaying the current scanner position (the coordinate along the scanning path) and the scanning speed;
- data synchronization during the testing process by lateral wave;
- considering the scanning direction and capability to perform the confirming testing of regions with the loss of acoustic coupling;
- saving the testing results.



Data analysis

The “Data analysis” page ensures:

- review and analysis of saved data in a form of A-Scans and TOFD-Scans;
- quick and detailed analysis of testing results while using two measuring gates (type: simple, hyperbolic, hyperbolic manual);
- discontinuities detected by TOFD shall be characterized by at least:
  – their position in the object (X and Y coordinates);
  – their length ($\mathrm{D}X$);
  – their depth and height (Z, $\mathrm{D}Z$);
  – their type, limited to: “top-surface breaking”, “bottom-surface breaking” or “inner”.
- generating the defects table and its saving.

The "Reports" page ensures:

- generating the reports according to the requirements of Regulatory Documentation CEN/TS 14751:2004, ENV 583-6:2000;
- approval of report forms with the customer when necessary.

The software is designed for ease of use, flexibility and scalability, and is oriented for a touchscreen operation.

The user interface is optimized for the accelerated learning process and improving the efficiency of use.

TOFD PRO SYSTEM COMPOSITION

INDUSTRIAL NOTEBOOK OR TABLET AND SOFTWARE

Shockproof industrial notebook/tablet with installed Microsoft Windows and special software for TOFD setup, data acquisition, analysis and reporting.

DATA ACQUISITION TOFD UNIT

The System may contain of up to 4 data acquisition TOFD units.

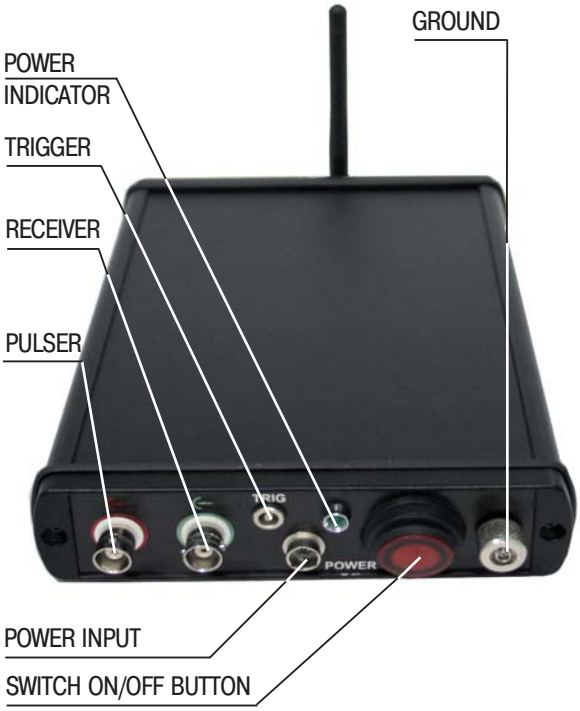
Ultrasonic unit ensures data acquisition and transmission in real-time mode via Ethernet-interface to industrial notebook or tablet.

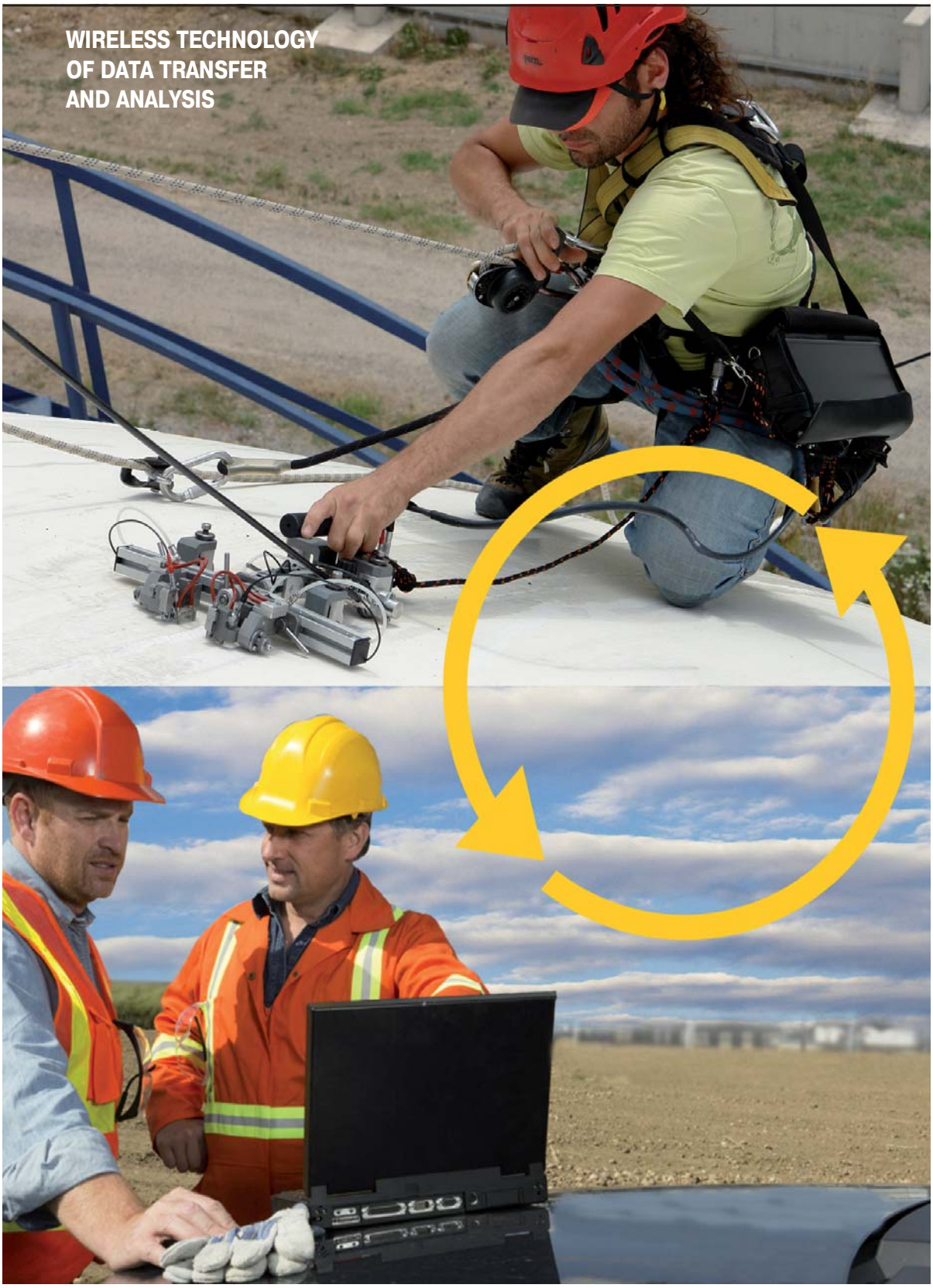
Unit case is made of shock-proof material.

COUPLANT-FEED UNIT

Couplant is supplied to the scanner with motorized pump and magnetic valve.
Couplant feed control is carried out with regulating valve set on the scanner.

MULTI-CHANNEL ULTRASONIC FLAW DETECTOR OKO-22M-UT TOFD



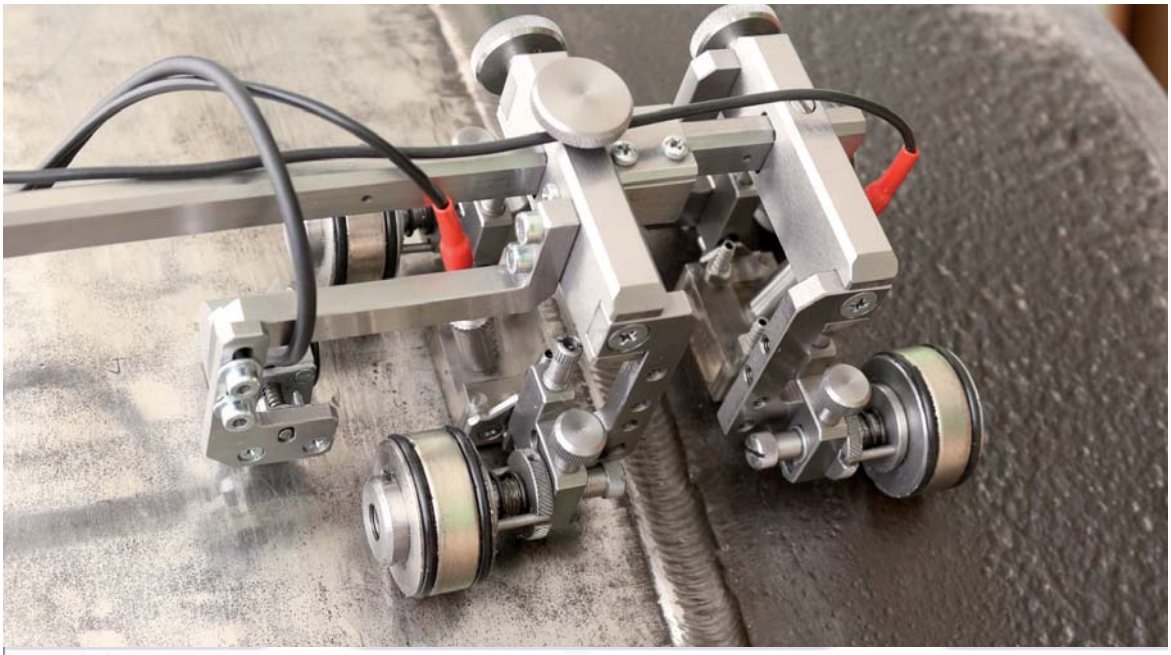

WIRELESS TECHNOLOGY
OF DATA TRANSFER
AND ANALYSIS

TOFD SCANNERS

Due to the various production tasks, there is a need in specified testing techniques mechanization. Considering this, PROMPRYLAD LLC has designed a series of scanning devices allowing to solve the express-testing tasks of local welds of flat objects and pipes, to carry out both laboratory researches and testing of operated objects in various industries, to provide high-efficiency testing of ring, longitudinal welded joints of pipelines. Next will be, considered various types of scanners and advantages of their use in the control of various objects.

TOFD 1.10 Lite SCANNER

TOFD 1.10 Lite ultrasonic scanning device is intended for manual testing of welded joints of flat surfaces and large diameter pipes. The scanner can be operated in two directions: along and across the welded joint. The main advantages while operating **TOFD 1.10 Lite** scanner are the wide range of applications: ensuring the testing of welded joints of flat objects and pipes with minimal diameter of 300 mm and thickness from 6 to 75 mm; small size and dimensions of the scanning device allows to ensure the testing mobility and simplicity of welded joints testing.

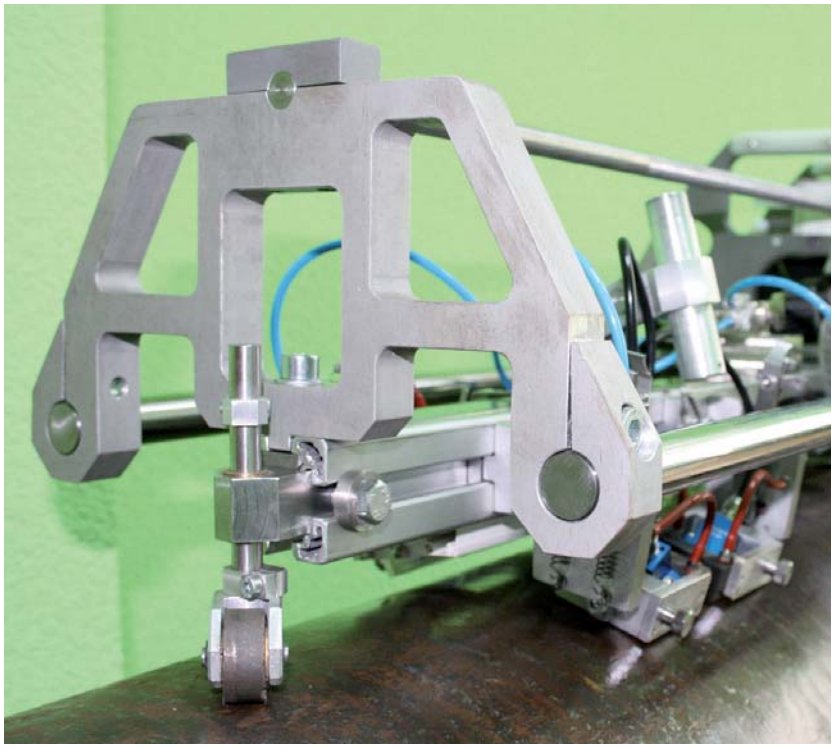


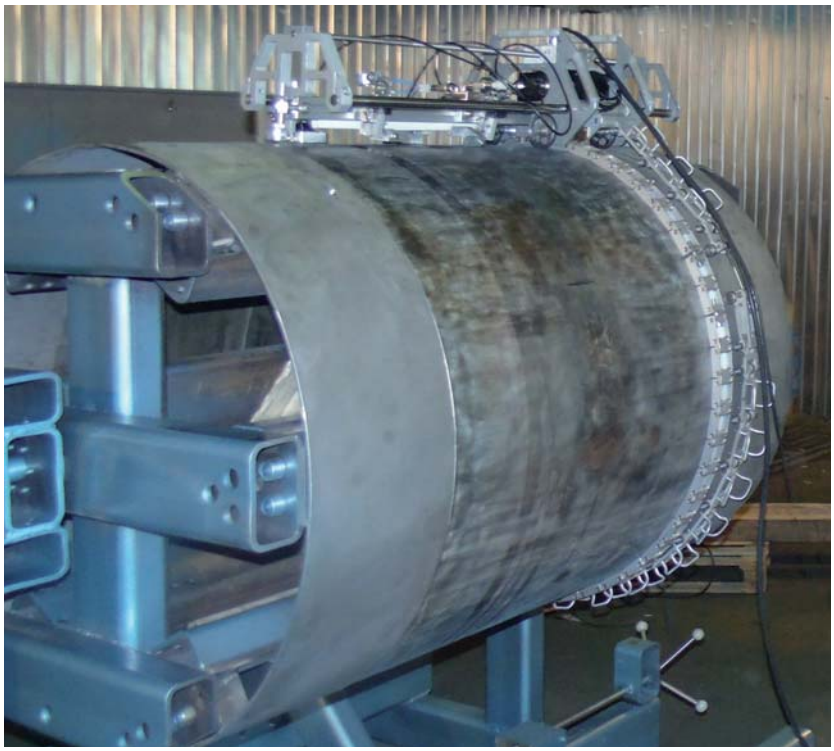
TOFD 2.10 Dragonfly

TOFD 2.10 Dragonfly scanning device has a wide range of applications: testing of welded joints of flat surfaces, longitudinal and ring welded joints of pipes with minimal outer diameter 600 mm and thickness from 6 to 75 mm. The scanner provides the possibility of detailing of defects length due to the longitudinal and transverse scanner movement relative to the welded joint, as well as operation simplicity due to the magnetic wheels system, ensuring the complete hold and easy movement along the pipe. Special-purpose suspension of TOFD probe of **TOFD 2.10 Dragonfly** and organized supply of couplant directly under each probe ensures qualitative acoustic contact between the probe and the surface of the testing object. Additionally it is possible to expand the scanner capabilities, due to the modular structure and composition with the suspension to implement the testing schemes “Duet” and “Tandem”.

TOFD ScTC-M

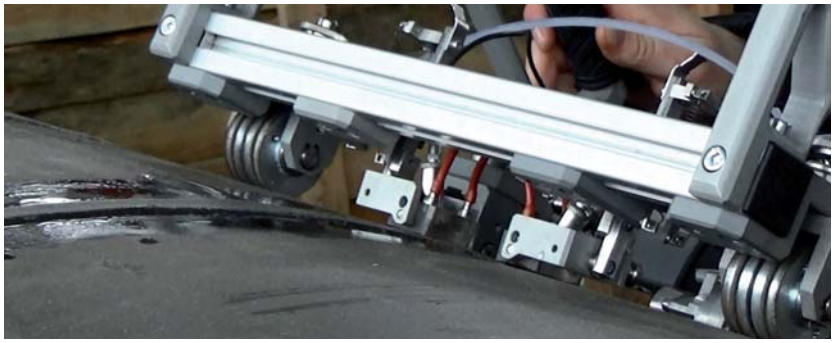
TOFD ScTC-M scanning device is implemented in two versions (mechanized and motorized). Using the scanner the ring welded joints of solid and longitudinal welded pipes with the diameter from 320 to 1600 mm and wall thickness from 8 to 75 mm. This scanning device is equipped with a stepping mechanism allowing to carry out scanning in flat surfaces with a step from 1 mm.

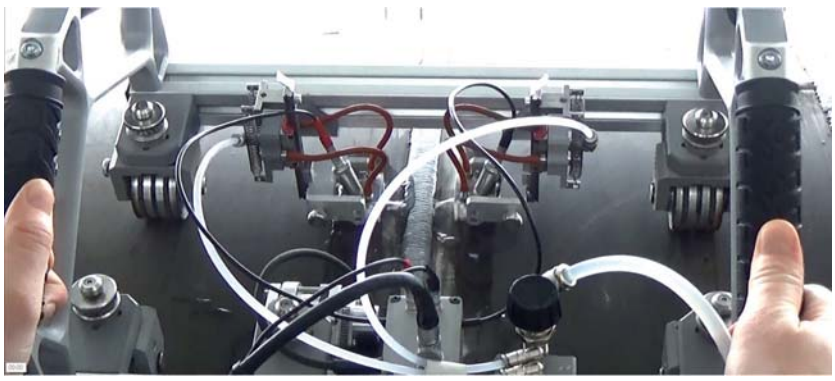




TOFD 2.11 PRO

TOFD 2.11 PRO scanner is the best decision for testing of the ring welded joints of solid and longitudinal welded pipes and boilers with the diameter from 600 to 6000 mm and wall thickness from 8 to 75 mm and flat surface object such as plates, oil and gas tanks. This scanning device is able to install up to four pairs of TOFD probes, respectively, and control thick objects.





TOFD UNIT SPECIFICATIONS

- Ultrasonic transducers connector _____2 (Lemo)
- A/D converter _____10 bit (100 MHz)
- Initial pulse _____ 50 – 400 V
- Gain _____ 110 dB
- Rectification _____full wave, + half wave, - half wave _____and radio frequency
- Bandwidth _____ 0.2 - 27 MHz
- Encoder _____ 2- axis encoder line
- PRF _____15 - 2000 Hz
- Real-time averaging _____1, 2, 4, 8, 16, 32, 64
- Maximum scanning velocity _____100 mm/s
- Operating temperature range _____from minus 20 °C to plus 50 °C

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